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TPE

58 Categories

71.5% Complete

The Preparedness Encyclopedia

Version: 11.00

By Fluidic Ice

Released: 20 June 2025

For the latest version see: www.fluidicice.com/TPE

The Preparedness Encyclopedia is a comprehensive and portable collection of crucial information designed exclusively to assist in your survival from any catastrophe that may arise and to help in the rebuilding of society afterwards.

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fluidicice.com/TPE

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Prelude

Preliminary statements and how to best utilize this sheet

"Healthy discontent is the prelude to progress."
Mahatma Gandhi

Introduction

Fluidic Ice here, and thanks for downloading *The Preparedness Encyclopedia* ! (TPE) (Pronounced "Teepee")

I'm an enthusiast minimalist prepper who began this journey in 2017 after seeing the current state of the world and where we're headed. I've gained most of my knowledge upon researching material for this document which I started to compile to be able to organize what I was learning about preparedness into one offline PDF readable on my phone. It has grown tremendously and I eventually decided to release it to the public.

This manual contains everything you should ever need to survive a disaster or the end of the world as we know it, and includes everything from Prepping Tips, Shelter Building, Weapon Guides, Food Preservation, Survival Tips, an Entire Novel, Games, Maps, Language Conversions and everything in between.

If you're new to prepping I recommend heading to the INTRODUCTION section for the official start of the document.

Throughout the creation of this guide I've spent countless weeks designing, compiling, writing, editing and disseminating the information found here which I consider to be a living document and have been actively updating and removing sections that are no longer of use or outdated. It will always be uploaded to my website (www.fluidicice.com/TPE) every year or so and with new updates and amend sections that require it. Occasionally I will release a 'silent' update which I won't post on social websites such as Reddit, therefore I recommend signing up to the TPE mailing list to get notified of new releases. (I will only email you upon new releases of TPE)

Almost all of the content has been written by a human, there is very little Artificial Intelligence (AI) text that has been used straight in this document, at most I would say 5% has been used. Even then, the text is highly vetted, checked and often edited prior to adding.
My goal in preparedness is to have 90% knowledge and 10% gear due to being part minimalist - thus the more I fill in here - the less I need to carry into the field. Living in Australia, my spelling and units may be different to your own, however the imperial conversions should be beside all values. Alternatively you can convert them yourself using the ADDENDUM > Conversions section. There may also be slight differences in information due to living in a different part of the world for details such as local stores, laws and restrictions. This guide was inspired by and is formatted similar to Wikipedia, the SAS Survival Guide and the U.S. Military Guides.

The guide should contain absolutely everything preparedness related and I challenge you to search (Ctrl+F) for something! If you search from the top of the document for a term like "Hurricane" it may take a while to find what you want due to the numerous reference to it throughout the guide. Therefore I recommend going to the likeliest category that would contain it - in this case "Natural Disasters", and search from there. If it's not in the guide and doesn't have a placeholder section, let me know and I'll add it. Below in the "Reader Tips" section are a few important things to help you read the guide.

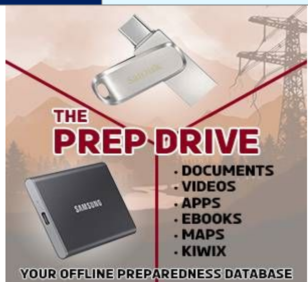
I aim to keep the size of TPE under 100mb if possible, but this may change based on future requirements. PDF versions may be slightly larger than the Excel formats but should run infinitely faster. This guide is designed to replace the internet when it goes down permanently or replace it temporarily for those situations where you can't get a signal. However I recommend you use it in conjunction with my 'Prep Drive' - a preparedness USB that contains everything I wanted on this document but couldn't due to size constraints. See scroll down for info on the Drive.

The guide was developed in Microsoft Excel, originally in a format with information in each cell, but over time has been migrated to an easier to read, or "word" style format where cells have been merged and the font size increased to remove unused space and allow easier reading on mobile devices. Rows without much (or any) information are to be filled in later, but they have been inserted so I won't forget what to add as I often come up with ideas while compiling other sections. I created TPE in excel to: Be different; To automate a lot of functions; to stop Microsoft Words annoying 'reflowing' of text and textboxes; and to give the document a very unique feel.

If hope you will find the information in this document useful in any situation you're faced with and may God will be with you throughout any disaster. TPE contains some Christian references for those sections that relate, so if you're seeking answers on 'what comes next', or millions of people vanish from the earth - take a look at the RELIGION > Christianity and MASS DESTRUCTION > The Rapture sections. I consider these an alternative to advertising throughout TPE in the hopes that it will save eternal lives. Just keep it in mind, and if it occurs come back and read it.

Support

Share TPE Share TPE to any friends, family and fellow preppers who could use it, because it may save their life in a disaster! Shares on social media sites are highly valued too.	**Donate** Your donations go a long way to producing this guide. If you can spare a dime, it will help me to continue producing great content for free and lighten the load of server costs. **https://fluidicice.com/TPE**	**Review** You could also post a video reviewing discussing TPE. After it's posted email me the link via my website so I can fix any problems pointed out.	**Purchase a Prep Drive** See Below



Prep Drive

Your Offline Preparedness Database

Are you concerned with the way the world is heading and would like a huge database of preparedness related content to help you survive **when** the internet goes down?

Prep Drive is a customisable USB which is packed full of free to use disaster preparedness documents, gear lists, survival apps, prepper eBooks, maps of your region, safety data, Kiwix files and videos from around the web. It's essentially a MUCH more detailed TPE. Just select the size of the Drive you need and then load it up with your choice of data to use on both your PC or Android phone on the go. Don't be caught off-guard.
For more info, see https://fluidicice.com/prepdrive

TPE Versions	The version number before the dot (**7**.14) is the public release version and the second number (7.**14**) is the daily iteration number for my use which acts as a failsafe against corruption - which has happened multiple times.
PDF Version	Runs extremely fast on mobile devices. Read only. This version is recommended. File Size: ~68 Mb
Excel Version	Includes hyperlinks around the sheet, external URLS for additional information and formulas. Reading and editing on Pc is recommended due to its size. It runs SLOWLY on older mobile devices. Donate $5 or more to receive this version via email. When resaving the excel document it will also create a backup version in the same location as a safeguard. File Size: ~47.1 Mb - Head to my website to donate www.fluidicice.com/TPE and click on the shop link at the top.
Mailing List	If you would like to be updated when I release a new version of TPE, sign up to the mailing list. Just head to **https://www.fluidicice.com/tpe** and scroll down to the Mailing List section and enter your email. I will only email you on the release of a new TPE version so there could be many months between emails.
External Backups	For off-site backups of TPE and my other content, see: **https://www.fluidicice.com/backups** or directly at: ● **Google Drive:** www.drive.google.com/drive/folders/1KVzoaRSuHUQl8Zj-mXPYIJ0iEi14PZc3 ● **Box:** http://app.box.com/s/jplaw5euljmybbzqk02m0o3g4y2hcm84 ● **Dropbox:** www.dropbox.com/sh/ljd2itt9tztzm1z/AADNRiWtvTr1zZ1nBVQbkkl3a

Statistics

	Sheet Creation Date	Number of Categories	Completion Percent	Number of Rows	Columns	Total Cells	Total Hours Editing	Average Editing Time Per Day	Avg Time Editing Each Cell	Avg Rows per Page
Overview	1 July 2017 (2909 Days Ago)	58	71.5%	48799	17	829,583	2711.06h (112.96 Days)	0.93 Hours	11.76 Seconds	25.1

	Number of Pictures	Total Picture Size	Average Picture Size	Avg Word Count Per Row	Approx Number of Words
Content	2,466 (Last Update v11.0)	34.1 Mb	13.8 Kb	85	4.15 Million

1 Reader Tips

This guide was built around the idea that it will be read prior to a disaster but will be referred to again when one occurs. However there will be a lot of people who are likely to glance at it a little, store it on their phone and only read it when they need it, which is risky. Skills need to be learnt and mastered over time as you're much more likely to survive with prior training and knowledge. However it's always better to have information than not having anything at all. I wish you the best in times of disaster and hope this guide helps you through it.

You can read the PDF in any PDF reader on Pc or Mobile, or you can read the .XLSX file in Microsoft Excel or Google Sheets. Some PDF readers such as Adobe Pro DC render the lines in the spreadsheet extra bold when zoomed out which makes the spreadsheet look 'dirty'. To fix this open DC and go: Edit > Preferences > Page Display, and Un-tick "Enhance Thin Lines".

These are the recommended programs and apps to read TPE.

$ = Purchase Required
* = Free, but there's in-app purchases OR there's a purchasable version too

Pc / Desktop / Laptop
- Adobe Reader (Free)
- Foxit PDF Reader (Free)
- Adobe Pro DC ($) (May alter look)
- Microsoft 365 (Free & Paid plans)
- Microsoft Excel 2010 ($) (Excel File)
- Google Sheets (Free)

Android (Google, Samsung, etc)
- ReadEra (4.9 ☆) Free
- Xodo PDF Reader (4.8 ☆) Free
- Lithium (4.6 ☆) Free*
- WPS Office (4.6 ☆) Free
- Firefox (4.6 ☆) Free
- Acrobat PDF Viewer (4.6 ☆) Free

iOS (Apple)
- Documents By Readdle (4.6 ☆) Free*
- PDF Expert 7 (4.6 ☆) Free*
- iBooks (4.5 ☆) Free
- Adobe Acrobat Reader (4.5 ☆) Free*
- PDFelement (4.4 ☆) Free

Searching

The best way to find what you're looking for would be by going to a section related to the topic you want information on in the 'Contents' section. Alternatively you can use find (Ctrl + F) on Pc or by using the search/find option on mobile devices to find what you're after such as "Evapotranspiration" or "Schmutzdecke".

PRELUDE | Reader Tips

Other Tips	● Coloured cells always have a purpose, such as drawing attention to an important fact or for displaying a mentioned colour. ● The number in the top left of every category is the percentage that section is complete. ## = 100%. ● Tables may have a hashed background to set them apart from the rest of the sheet and the make them easier to read. ● Very little text is coloured due to a problem when rendering the PDF which may 'bleed' the colour to random nearby text. ● Most category references will be in full capitals, such as: PREPAREDNESS and WATER to help distinguish them from other text.

For additional tips on reading and fine-tuning this document see the 'MAINTENANCE > Additional Reader Tips' section right at the bottom of TPE.

Other Tips

PRELUDE | Reader Tips | Other Tips

E-Reader Tips
Besides a phone and tablet, this guide can be read on an E-reader device which consumes much less power than regular devices which could prove effective in a grid down situation. I'm still researching ways to make it easier to read on these types of devices but if you find a section that's difficult to read on an e-reader, please let me know. I now own an E-reader and will be testing TPE on it when I get the time, however you should note that areas with dark backgrounds such as the answers in the ENTERTAINMENT section may not render correctly on e-readers.

Printing	I absolutely DO NOT recommend printing this document in its entirety for environmental reasons and the massive page count, but the best way to print the excel version is on the right. You can print certain sections by highlighting what you want to print by choosing "Print Selection" under the print menu. Otherwise on the PDF version you can find the range you want to print and input that into the print menu. (e.g. pages 52-78) *The print page counts are correct as at version 10.00.*	**Printing - A4 Portrait** ● Print Entire Workbook ● A4 Page ● Portrait ● All Margins = 0.6 ● Fit All Columns to One Page (Slightly Small Font) ~**1,958 Total Pages**	**Printing - A4 Landscape** ● Print Entire Workbook ● A4 Page ● Landscape ● All Margins = 0.6 ● Fit All Columns to One Page (Typical Sized Font) ~**4,053 Total Pages**
Disclaimers	● To the best of my knowledge, the information contained herein is accurate and reliable as of the date of publication; ● I do not assume any liability whatsoever for the accuracy and completeness of the information. ● You should not solely rely on any information contained in this article in life or death scenarios. Always trust your instincts as there's no one-size formula for survival. ● No donations can be refunded, but are greatly appreciated as it has taken many years to create this encyclopedia. ● The information contained within is not meant as medical or financial advice and should not be accepted as such. ● Most of the information is my own knowledge or an adaption of source information. However it's possible that some information found herein is directly copied from other sources. In that case, all credit goes to the original owners. I'm unable to vet all the work others send me to add to the document but I will re-word content, remove pictures or use alternative sources if required. ● The information found within this document is for educational purposes only. I'm not responsible for the malicious misuse of any information in this article. *I hope that this document will be beneficial to you in times of need. If it is, let me know when the disaster is over.*		

Contents

Page numbers, hyperlinks and descriptions of the categories

"This is the beginning of anything you want."
Unknown

1 Categories

This section contains every category in this guide including a short description and the percentage completed. Some categories have examples below them to help you find what you're looking for quicker. The following are hyperlinks to the categories.

There are 58 categories and 2332 pages in this document.

Preparedness Basics

Food and Health

Food	85% Complete	Types and the shelf life of foods, and the best foods to stock.
Field Dressing	10% Complete	How to bleed, skin, gut and prepare wild game.
Cooking	47% Complete	Cooking all types of food and food preservation methods.
Recipes	42% Complete	Step-by-step guides to cooking in the wild or homestead.
Health	80% Complete	How to keep fit, clean and healthy.

Medicine and Healing

Medical	95% Complete	General medical routines, tips and advice. Eg: Blood Groups, Triage, Medical Supplies, Body Systems and Quitting Addictions.
Medication	95% Complete	Comprehensive information on medications for treating illnesses.
Illness	100% Complete	Common illnesses and how to treat them. Eg: Radiation Sickness, Parasitic Infections, Bacterial Infections, Viral Infections, Fungal Infections, Altitude Sickness, Poisoning and Chemical illnesses.
Injury	97% Complete	Common types of injuries and how to treat them. Eg: Surface Wounds, Internal Injuries, Open Wounds, Avulsions, Burns, Anaphylaxis, Heat Stroke, Hypothermia, Motion Sickness, Asphyxiation, Drowning, Carbon Monoxide Poisoning, Bites, Childbirth and Toothaches.
Emotional	95% Complete	Recovering from emotional problems and signs to look out for. Eg: Depression, Anxiety, Stress, Confidence, Relaxation, Dementia, Grief, New Parents and Body Image.
Natural Remedies	94% Complete	Natural remedies and how to utilize raw healing plants.

Disaster Preparedness

Natural Disasters	97% Complete	Preparing for and surviving any natural disasters. Eg: Landslides, Avalanche, Earthquake, Sinkhole, Volcano, Flood, Tsunami, Blizzard, Hurricane, Drought, Thunderstorm, Heatwave, Cold Wave, Tornado, Wildfire, Meteorite and Solar Flare.
Man-Made Disasters	77% Complete	Surviving any man-made disasters you may encounter. Eg: Chemical Spills, Dam Failure, Power Failure, Nuclear Accidents, Pandemics, Zombie Apocalypse, Riots, Protests, War, Economic Collapse, Hyperinflation, Overpopulation, Famine, Terrorism and Cyber Attacks.
Personal Disasters	36% Complete	Disasters that can happen to you and your family personally. Eg: House Fire, Car Crash, Plane Crash, Theft, Mugging, Illness & Injury, Bankruptcy, Physical Abuse, Sexual Abuse, Past Trauma, Family Deaths, Separation, Displacement and Addiction.
Disaster Triggers	93% Complete	Any adverse effects that may be triggered from disasters.
Mass Destruction	98% Complete	Disasters that could end life on entire continents or earth completely. Eg: Supervolcano, Nuclear War, EMPs, Artificial Intelligence Uprising, Solar Flare, Gamma-Ray Burst, Large Asteroids, Alien Invasion and Biblical Disasters.

Modern Conveniences

Electricity	88% Complete	Power generation, schematics and battery types. Eg: Power Usage, Fuses, Solar, Dynamo, The Grid, Batteries, Componentry, Repairs and Schematics.
Light	94% Complete	Generating light and understanding lighting. Eg: Measurement, Colour, Sources, Light Operation, Luminescence, Beacon, Concealment and Darkness.
Fuel	76% Complete	All types of fuels from solid to liquid to gas and its effectiveness.

Modern Conveniences

Transport	70% Complete	How to use any air, sea or land transportation.
Geography	95% Complete	Locations around the world and the risks associated with them.
Locations	95% Complete	Details the survival uses of modern buildings & vehicles.
Communication	87% Complete	Any form of contact from radio to smoke signals and chalk markings.

Population and People

Population	35% Complete	Details on prepper circles, gangs and surviving with others.
Economy	25% Complete	Storing valuables, precious metals and maintaining a portfolio.
Religion	99% Complete	Details on religions, quotes and ethics. Eg: Christianity, Islam, Hinduism, Buddhism, Sikhism, Judaism, Atheism, Quotes and Ethics.
Language	68% Complete	Foreign alphabets and translations of words and phrases. Eg: Arabic, Chinese, French, German, Hindi, Italian, Japanese, Korean, Portuguese, Russian, Spanish and Phrase Translations.
Entertainment	99% Complete	An endless source of enjoyment during disasters. Eg: Card Games, Board Games, Puzzles, Brain Teasers, Riddles, Facts, Electronic Games, Stories and Poetry.

Skills and Crafting

Skills	71% Complete	Skills one should possess prior to a disaster and how to train them.
Crafting	25% Complete	Projects and crafting ideas for your home or campsite. Eg: Crafting Furniture, Clothing, Soap, Sewing & Knitting, Whittling, Woodworking, Blacksmithing, Fletching and Glass Crafts.
Knots	97% Complete	Tying knots and using rope skills like rappelling
Materials	71% Complete	Uses and types of materials such as wood, metal and plastic. Eg: Periodic Table, Chemistry, Alternative Uses, Woods, Metals, Polymers, Glass and Dangerous Goods.
Leadership	20% Complete	How to lead your family, small group or town post-disaster. Eg: Self Leadership, Family Leadership, Group Leadership, Town Leadership, Town Law, Discipline and Jobs.
Homesteading	32% Complete	Creating a sustainable lifestyle in a self-sufficient off-grid home.

Resource Harvesting

Gardening	71% Complete	How to grow any type of food, herbs and flowers. Eg: Gardening Methods, Soil, Seed Banks, Growing Vegetables, Fruit, Herbs, Spices and Nuts, Growing in-edible plants, Permaculture and Pests & Diseases.
Hunting	7% Complete	How to track, hunt and trap any type of animal.
Fishing	85% Complete	Fishing tips for any style, weather condition or region.
Plants	90% Complete	Identification tips for plants to determine its uses and edibility. Eg: Plant Identification, Tree Identification, Plant Nutrition, Foraging and the Edibility Test.

Animals	55% Complete	Animal tracks, types, poisonous creatures and edibility.
Animal Husbandry	15% Complete	Raising and sustaining animals for food or companionship.
Meteorology	78% Complete	Types of weather, clouds, planets and space phenomena. Eg: Weather Benefits, The Atmosphere, The Solar System, Clouds, Earth's Cycles and Weather Phenomenon.

Protection

Weapons	50% Complete	Information, tips and handling of modern weapons.
Offence	12% Complete	Using weapons, crafting your own and hand to hand combat. Eg: Unarmed, Kung-Fu, Krav Maga, Hand Weapons, Sword & Knife Offence, Blunt Weapons, Slings, Bows and Crossbows, Fire Based Weapons, Explosives, Improvised Weapons and Verbal Offence.
Defence	33% Complete	Self defence from attackers, animals and pests. Eg: Non Lethal, Unarmed, Bladed Defence, Armour, Insect Defence, Shelter Reinforcement, Bullet Defence, Military Defence, Verbal Defence, Safety and Security.
Warfare	70% Complete	The components and aim of large scale warfare. Eg: Army Personnel, Army Hierarchy, Intelligence Agencies, War Materiel such as Battleships, Submarines, Jet Fighters and Tanks, Electronic Warfare, Space Warfare, Traps & Explosives and War Targets.
Security	48% Complete	Camouflage, infiltration and awareness tips. Eg: Security, Surveillance, Hacking, Lockpicking, Camouflage, Stealth Camping, Concealment, Military Tactics, Tracking, Evasion, Infiltration and Awareness.

Maintenance and Tools

Prelude	100% Complete	Preliminary statements and how to best utilize this sheet.
Contents	100% Complete	Page numbers, hyperlinks and descriptions of the categories.
Addendum	75% Complete	A selection of additional information to compliment TPE. Eg: Preparedness Media, Conversions, Dictionary.
Maintenance	100% Complete	Document updates, user tips, credits and FAQs.

2 Shortcuts

These are hyperlinks to the most common questions relating to preparedness and survival. If you're looking for a specific category such as 'Water' have a look at the categories section below to check if there's a heading for it already.

Common Questions

How can I find something I'm looking for?	Use 'Ctrl + F' to search on PCs, or use the built-in search/find feature on mobile devices.			
How do I start prepping?	Read the 'Introduction' section:			INTRODUCTION
How do I start a bug out bag?	Read the 'Introduction' and 'Gear' sections:		INTRODUCTION	GEAR
What gear should I buy?	Read the 'Gear' section:			GEAR
Should I bug out?	Read the 'Preparedness > Bugging In & Out' sections:			PREPAREDNESS
How can I learn about different disasters?	Read these sections:	NATURAL DISASTERS	MAN-MADE DISASTERS	PERSONAL DISASTERS
What skills should I learn?	Read the 'Skills' section:			SKILLS
How can I be a grey man?	Read the 'Security > Grey Man' section:			SECURITY
How can I monitor disasters around the planet?	Read the 'Preparedness > Situation Monitoring' section:			PREPAREDNESS
Where should I go during a disaster?	Have a look at the 'Locations' and 'Geography' sections:		LOCATIONS	GEOGRAPHY
Where can I find other preparedness resources?	Have a look at the 'Addendum > Media' section:			ADDENDUM

How can I start a homestead?	Read the 'Homesteading' and 'Animal Husbandry' sections:	HOMESTEADING	ANIMAL HUSBANDRY
What do I do after a car/plane crash?	Read the 'Disaster Recovery > Personal Disasters' section:		PERSONAL DISASTERS
Is this edible?	Read the 'Plants' and 'Food' sections:	PLANTS	FOOD
How can I get clean water?	Read the 'Water' section:		WATER
How can I get food?	Read the 'Food', 'Cooking', 'Fishing', 'Hunting' and 'Gardening' categories:	FOOD	COOKING
		FISHING	HUNTING
How can I defend myself?	Read the 'Weapons' and 'Defence' sections:	WEAPONS	DEFENCE
I'm lost.	Read the 'Navigation' and 'Geography' sections.	NAVIGATION	GEOGRAPHY
I can't understand someone.	Use the 'Language' section to translate foreign words and phrases.		LANGUAGE
I'm sick!	Read the 'Illness' and 'Medical' sections:	ILLNESS	MEDICAL
I'm injured!	Read the 'Injury' and 'Medical' sections:	INJURY	MEDICAL
I'm depressed.	Read the 'Emotional' section:		EMOTIONAL
I'm bored.	Read, and play games in the 'Entertainment' section:		ENTERTAINMENT
People have vanished!	Read the 'Mass Destruction > The Rapture' section:		MASS DESTRUCTION
Why is the world going insane?	Read the 'Christianity' section:		RELIGION
How can I support you?	You can donate on my website:	**https://www.fluidicice.com/tpe**	

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Introduction

An introduction to preparedness and related categories

"A smile is always the best form of introduction."
Sanam Sri

Introduction

This section is designed to get you started on the path of preparedness if you aren't sure where to begin. It includes descriptions of the essentials of preparedness and how each category can be used to your benefit.

Purpose	The aim of INTRODUCTION is to give those with little-to-no experience with prepping a solid foundational knowledge about what it's all about and how they can get started. It lightly covers all the basics such as survival, planning, gear, fire, water, food and shelter as well as many of the skills involved. After this it dives into steps you can take to begin your preparedness journey to become more self-sufficient and ready for whatever may come your way. If you're proficient with preparedness and already know the basics, I recommend you skip this section.
Lost?	• If you're already adept at prepping I recommend starting at the PREPAREDNESS section. • If you're looking for a collection of preparedness websites, books, blogs, videos and podcasts, see the ADDENDUM > Media section. • For a list of terms you may not know, see the ADDENDUM > Dictionary section.

Contents

1 Preparedness

Preparedness refers to a set of actions that are taken as precautionary measures in the face of potential disasters. Whether that means it's a personal disaster such as a job loss or a loved one's death, or a global event such as a meteor impacting earth.

Preparedness also involves mitigation strategies to reduce the impact of a disaster to your daily routine such as having solar power and batteries in case the grid fails. With at least some electricity during an outage you reduce your dependency on others while somewhat going about your typical day. There's a lot to comprehend relating to preparedness so this should be your first section to read after this introduction.

"Preparedness refers to a set of actions that are taken as precautionary measures in the face of potential disasters."

Why Prepare?

John stretched contentedly on his couch, remote in hand, ready for a relaxing evening of whatever reality TV gem awaited him. He flicked on the television, a soft hum filling the living room, but his comfortable sigh caught in his throat. The screen, instead of showcasing domestic dramas or celebrity antics, blared with chaotic, wind-whipped scenes. A reporter, barely audible over a furious roar, battled against an unseen force, her words swallowed by the maelstrom. The graphic beneath her face screamed "CATEGORY 5 HURRICANE MAKES LANDFALL IN CUBA."

John, a man who scoffed at preppers and their doomsday scenarios, felt a chill that had nothing to do with his air conditioning. He stared, wide-eyed and suddenly very small, at the raw, terrifying power of nature unfolding just a few hundred miles from his own oblivious, seemingly secure world. A strange, uneasy sense of security washed over him, a relief that he was safe and sound here in Minnesota, far from hurricane territory.

While John sat in stunned disbelief, a few miles away, Angela watched the same terrifying images flickering across her screen but with a sense of comfort, mingled with genuine empathy for those in Cuba. She glanced around her cozy living room, her gaze lingering on the pantry door, knowing the shelves within were stacked high with dehydrated meals, canned goods, and water purification tablets – enough to sustain her family for months. Her meticulously packed bug-out bags and INCH (I'm Never Coming Home) bags leaned against the wall of her spare room, ready at a moment's notice.

A quick peek out the window confirmed that she was comfortably prepared: the emergency generator sat securely in the shed, next to neatly stacked jerrycans of fuel. In the distance, the familiar glint of the lake offered another resource. Angela sighed, a quiet sense of readiness settling over her amidst the unfolding chaos on the television.

Not only are preppers perpetually ready for any disaster, with resources and supplies stocked up, but they actively try to further their knowledge through experience and practise. A good way to accomplish this is by researching disasters that have previously occurred in your area while looking for ways to mitigate any risks that occurred because of it. Ask yourself why you want to prep.

● Is it to help protect and feed your family in times of disaster?
● Do you not like the way the world is headed?
● Do you want the peace of mind and knowledge that comes with being prepared?
● Do you not trust the current system or government in place?
● Or do you just want to be more self-reliant without being dependant on anyone else?

Any of these reasons are perfect to get you started - as long as you have a goal in mind and a bit of spare cash.

Unfortunately many people today don't worry or care about disasters until they're right on the doorstep. They naively believe everything will be fine and that the shops will always be open. This lack of judgement is what causes panic buying and a lack of resources in the first place, because the majority of people who are unprepared do their regular shop, compounded by those who buy a few extra items and finally those who buy insane amounts of the staple ingredients stripping the shelves clean and attempting to become 'instant preppers'. The obvious difference with preppers is the timing of the purchases.

Prepping is a choice that occurs before disaster

You can't expect to simply 'buy' your way into becoming a prepper. You'll be lacking all the essential skills required to make the best use of the gear and food you have. This type of individual will likely: fumble with their water filter, they'll have to read the instructions on their headlamp before they can use it, they'll make mistakes when bugging out and most importantly they won't know what to do when their resources run out.

Prepping is a choice that occurs **before** disaster. They purchase supplies when a disaster is the furthest thing on peoples mind and the shops are stocked full of everything imaginable, not to mention they can wait to get items on sale to pay even less. However this doesn't stop those who are unprepared for a disaster labelling preppers as selfish hoarders when a disaster DOES occur. This is just spiteful jealousy talking as anyone has the opportunity to be a prepper, but most people choose to enjoy life in the moment rather than worry about the future and an event which 'might' not happen. The difference between these people is that preppers spend time, money and effort getting ready over many years with the knowledge that there will always be another disaster.

In a disaster, anyone who's unprepared, whether that's a family member, a friend or a stranger may even try to forcefully take what preppers owns if the situation gets bad enough, therefore the need to defend oneself with force (or the threat of force) if required. But keep in mind that they're still human and have families to feed, so some preppers take the time to create mini survival kits for friends, family and neighbors to help appease their utter unpreparedness in the moment.

In many ways non preppers are prepared for all sorts of situations. The only reason why someone would buy home and contents insurance or car insurance is the chance that it may burn down, be stolen or destroyed in any freak accident. The difference here is that preppers are insuring their own life by taking control back fromthe external entities such as the government and utility companies. Some other ways that the general population prepares is by buying food for the week or putting away spare money for emergencies. Preppers just take the everyday concepts of preparation and push the boundaries even further, such storing food for a year or converting their spare cash to gold and silver to use for bartering and as a hedge against inflation and economic crashes.

Another way to look at it is that we're only 3 meals away from anarchy. Three meals because generally shops only have a 3 days supply of food for their local populations, and if this runs out or there's a disaster, it puts a strain on any nearby shops who have to compensate for it. However during disasters this chain reaction keeps proliferating outwards until the desire for food or the ability to get to the shop drops.

For example if a major earthquake in central U.S.A. cuts off the roads between the east and west, shops won't be able to restock their supplies. In response people will start to panic, rushing down to the shops loading up their car with as much food and water as they can carry which will further destabilize the delicate "Just In Time" methodology of shop deliveries. As shops run out of essentials people will begin travelling further and further just to get a meal and eventually some of them **will** become violent over a can of food. This is exactly the situation preppers try to avoid by planning ahead and having food, water, medication, weapons and more on hand. We try to look ahead at all the possibilities for interruption to our daily routine and reduce dependencies to outside companies and organisations whether it's food, gas, fuel, electricity, internet or even entertainment.

People often cite a lack of money as a reason for being unprepared or unable to prep, this is largely inaccurate as you can slowly build a stockpile of food even if you buy 1 additional long life item per shopping trip. Due to the relative rarity of disasters you can achieve quite a large supply by doing this over many years... because eventually a disaster will hit your area. The only reason why you wouldn't be able to prep is if you have a debilitating health condition or you're living on the streets and don't have an income. Start a prepping fund or bank account and slowly put money into it to help pay for the resources you, and your family need to survive. The rest of this document will help you to get started on this journey and will guide you on the best purchases to make.

If you're getting started with prepping you might not have someone available to offer support and answer your questions when you become stuck or you aren't sure of how to proceed next. This is where the internet comes in. You can find endless knowledge on websites, YouTube, podcasts, blogs and so much more. To get started I recommend taking a look at YouTube, typing in any questions you have and getting answers instantly. If you want recommendations on channels and websites take a look at the MEDIA section in this guide where I outline a lot of the highest rated content producers for preparedness. It's not as fun to prep alone, so if you find yourself needing some interaction with other preppers try looking up some prepping forums or even better some prepping events and take a friend along. You should always be careful when meeting people on the internet, particularly when you prep because there's always the chance they're after your money, supplies or your life. Therefore prepping is a hushed kind of hobby - not because people will think you're crazy, but because all those who aren't prepared will come knocking down your door during a disaster if they (even family members) know you have food and supplies when they don't.

Prepping is best done in a family situation where everyone can learn and prep together which makes it so much more enjoyable. Unfortunately there's a lot of people who begin prepping without a spouse on their side, and some who are even against it. As much as they offer their reasoning for prepping, their partner simply can't see a plausible future in which the earth comes to a cataclysmic end. It's not their fault, everyone is different and has different priorities in life. One thing that is certain however, is that once a person has gone through a disaster without being prepared, they will absolutely be prepared from then on.

We're dependant on so many complex systems in our fragile society, most of which we forget even exist such as the on-time arrival of food trucks, the power grid, fuel trucks and gas stations, water purification grid and the garbage removal trucks. If you're prepping correctly you should be becoming less reliant on these government assets and more self-reliant every day. If the water system fails you should have a way to acquire water from the surrounds or have it stored up in your house. If the rubbish trucks stop coming you should either be consuming a small amount of waste or have a way to deal with it hygienically to avoid illnesses.

I challenge you to begin prepping today if you aren't already, because the more people that are prepared - the less panic and chaos there will be during disasters. Not only will you be able to sustain yourself and your family through periods of hardship but the peace of mind is unbelievable as you know that you'll have a hot meal no matter the circumstances.

Firstly an explanation of the tools and helpful categories within this guide.
There's a few categories that don't directly apply to preparedness but still may help you navigating this document including: PRELUDE, CONTENTS and ADDENDUM These either give you additional information about TPE or help you in finding what you're looking for.

It only takes the threat of losing <u>anything</u> for people to panic buy <u>everything</u>

PREPAREDNESS	The primary category for preparedness containing bugging in, bugging out, preparing for a disaster and rehearsals.
PRELUDE	An introduction to The Preparedness Encyclopedia contains useful reader tips.
CONTENTS	A list of every category in TPE and a short description on each one.
INTRODUCTION	Outlines the practise of preparedness in a simple manner including first steps to take for those just getting started.
ADDENDUM	A selection of extra content included with TPE such as a dictionary, other preparedness websites and conversions.
MAINTENANCE	Additional usage tips, version control, credits and FAQs.

2 Survival Essentials

The rusty Cessna rattled like a tin can in a tumble dryer, its single propeller slicing through the humid Indonesian air. Below, emerald islands dotted a turquoise canvas, a postcard-perfect view that was doing little to calm my nerves. This was our summer getaway "budget" air tour, and every creak and groan of the ancient plane fortified the idea that I should have reached a little deeper into my pockets. My two friends, Sarah and Ben were strapped in behind me, equally mesmerized and mildly terrified. Beside them, two other passengers, a man and a woman in crisp, albeit rumpled, business attire, sat with serious expressions, their gazes fixed on the vast expanse outside, looking every bit like they were evaluating a new market.

Suddenly, a strangled gasp ripped through the cockpit. Our pilot, a man whose girth seemed to defy the Cessna's modest dimensions, slumped forward, his face a ghastly shade of purple. A terrifying thud echoed as his head hit the instrument panel. My heart hammered against my ribs. He was gone. A heart attack. Mid-flight.

Panic clawed at my throat, but years of watching aviation documentaries kicked in. "Okay, okay, deep breaths," I muttered, hands already gripping the yoke. The ground was rushing up, a dizzying blur of green and blue. "Sarah, Ben, we have a problem!" I yelled, my voice hoarse. Their stunned faces in the rearview mirror confirmed they understood. "He's gone. I need to land this thing."

My eyes darted, searching for anything flat, anything stable. Then I saw it – a thin, sandy strip of beach stretching along the edge of a small, uninhabited island. It was our only shot. I wrestled with the controls which were partially impeded by the sheer mass of the pilot, while the Cessna bucked and swayed like a drunken bird. The ground raced towards us, and I yanked back on the yoke, praying for a miracle.

The impact was brutal. A screech of tortured metal, the sickening crunch of collapsing structure. We skidded, bounced, and finally ground to a halt in a shower of sand, the plane skewed at an impossible angle. Silence, deafening and absolute, followed the chaos.

I fumbled with my seatbelt, my body aching. "Everyone okay?" I croaked, turning around. Sarah was pale but her eyes were wide and focused. Ben, however, was slumped against the fuselage, a dark stain rapidly spreading across his side. "Oh god," Sarah whispered, her voice trembling. "Ben... he's bleeding bad." His breathing was shallow, his eyes glazed with shock and pain. The landing gear was shattered, a wing twisted into an unrecognizable mess. Our pilot was dead. Ben was bleeding, badly. We were marooned on a remote island, the vast ocean stretching around us, and a growing dread told me that without immediate help, Ben's life would drain away with every crimson drop.

We've likely all played these kinds of games growing up, choosing only one type of food or movie that you would survive the rest of your life on. Unfortunately reality is much more ominous, with possible injuries, deaths, the fear of an unknown piece of land and what it contains, the real threat of dying with every decision and the lack of almost every resource needed for survival. This is where the survival category comes in handy, containing information on surviving in some of earth's most hostile environments such as deserts, forests and the arctic as well as tips on the usefulness of various terrains and weather phenomena local to each region.

If you're interested in what you need to do in the scenario above I recommend taking a look at the "PERSONAL DISASTERS > Disaster Recovery" section which contains a step by step procedure of the actions you should consider taking. As a side project I recommend watching 'Cast Away' starring Tom Hanks who is stuck on a tropical island and has to survive and return to civilization.

SURVIVAL	A category that contains tips on outdoor survival in various continents, climates and terrains.
PERSONAL DISASTERS	This category contains a step by step guide on how to proceed in a survival situation such as a plane crash, a car crash or becoming lost etc.

Survival can be distilled down to a few key requirements for staying alive: Hope, Air, Shelter, Water, Food and Company.

Hope
You can only survive 3 seconds without hope. This is arguably the most important one as people simply won't be able to see the good in staying alive anymore and will give up trying to survive. On the other hand you often hear about people who are up against such profound odds that they shouldn't have survived their ordeal. These people have such strong hope that they would even cut their own limbs off to free themselves to continue living. Your source of hope could be seeing family members again, religion, getting old and dying naturally or even just surviving this disaster.

ENTERTAINMENT	Contains a huge array of entertainment and games to keep your mind occupied and sharp if you're stuck with nothing else to do.
EMOTIONAL	Lists the most common emotional problems one can expect in a life and how to handle them.
MEDICAL	General medical tips such as wound care and blood type compatibility.
ILLNESS	Contains most illnesses that can befall you including those that impact airway.
RELIGION	If you're feeling without hope read some Bible passages or famous quotes to lift your spirits.

Air
It takes about 3 minutes without air before you either suffocate or drown. This is your number one priority in a survival situation and will come to the front of your mind as soon as the air supply is cut off, such as when diving underwater for too long. Occasionally you won't even realise you're lacking air, such as using a generator indoors which slowly fills the room with carbon monoxide causing you to feel nauseous and eventually pass out.

Shelter
You can last about 3 hours without shelter in extreme conditions such as snow or blizzards. This makes seeking shelter essential in those or similar circumstances such as bear country. In fairer climates shelter isn't as necessary early on but it's still worth looking for a shelter early on in case of surprises. It can protect you from the elements like heat, cold, wind, rain and snow as well as from dangerous creatures and camouflage from prying eyes such as other humans who wish to cause you harm and assist in giving you a good nights sleep through the comfort and perceived protection they provide. You should be well versed in creating your own wilderness shelters from any sourced materials as this will be a huge advantage in any survival situation.

SHELTER	This is the primary category for shelter featuring every type of shelter from a stick teepee to a nuclear bunker.
HOMESTEADING	How to create and maintain your own homestead.
KNOTS	Contains all the most useful type of knots for survival and construction situations and how to tie them.

Water
As you probably know you can survive around 3 days without water. However this is reduced considerably if you're performing heavy work or sweating profusely under a hot sun. Water is a necessity for life and can luckily be found almost everywhere on earth, even if deserts if you know where to look. Knowing how to find water when it doesn't seem like there's any and understanding the fundamentals of purifying it with makeshift materials is essential to living off the land and surviving any kind of disaster.

WATER	A section dedicated to locating, acquiring, filtering and storing water.

Food
It takes about 3 weeks to die of starvation. This may seem like a long time but over the duration your body will slowly break down and begin consuming itself for energy. Food should only be consumed if you have an ample supply of water as it takes a lot to digest it. Knowing how to source your own food from the wild either by hunting or growing it are great skills every survivalist or prepper should invest in.

If you aren't planning on sourcing your own, you should invest in a stockpile of various long life and shelf stable foods to cover any future disasters for extended periods. Some people rely on their ability to forage food from the wild as they travel around. This could be highly dangerous when there's a lack of food as a lot of people will be starving and will seek any way to acquire it. There's also the possibility of wild food not growing due to a flood, drought or other environment destroying disaster.

FOOD	Contains a list of most known foods with details on each one including their shelf life in the air, fridge and freezer.
COOKING	Different ways of cooking food whether in the outback or a modern kitchen.
RECIPES	Features lots of food, drink and entrée recipes designed to be cooked in the wild or the kitchen.
HEALTH	How to stay fit, healthy, and clean under any circumstances.
FIELD DRESSING	Outlines which creatures and animals are edible and how to prepare them for cooking.
GARDENING	How to grow your own foods from fruit to vegetables to nuts.
PLANTS	Identifying edible plants and food in the wild and how to harvest them correctly.
FISHING	Different fishing techniques and the best times and seasons to catch fish.
HUNTING	How to set up different traps for the situation to help catch or kill any sized creatures.

Company
The timeframe varies and may not apply for everyone, but it generally takes 3 months without company until you start to go insane. This may seem like one you can live without, but once you've gone through the toughest experience of your life and it feels like there's nobody left on earth you will start to crave company and contact of some sort or another whether it's an animal or human. We are social creatures and require contact to thrive whether or not you're introverted or extroverted.

POPULATION	Outlines the different types of countries, people, circles, gangs etc that are present in the world today.

On the Tv series 'Alone' the majority of participants had great survival skills and could potentially last indefinitely out in the wild, but the real killer after so many weeks solo was the need for human interaction which is often the primary reason they tapped out. Company could include talking to animals, AI such as chatbots or NPCs and spiritual company such as chatting to God.

If you would like to continue the plane crash scenario above, below is a list of items that you have with you, can find on the island or could salvage from the plane which would be beneficial in a survival scenario. How would you use them to survive?

From the Plane Fuselage/Cockpit
● Shelter: The intact part of the fuselage offers immediate protection from sun, rain, and wind. It can be insulated with other materials.
● Signaling: The large, metallic surface can be reflective, used to flash signals to aircraft. The bright colours of the plane (if any) can increase visibility.
● Water Collection: Tarps or large sections of metal can be angled to collect rainwater.
● Tools: Any remaining tools in the cockpit or cargo hold (e.g., wrenches, screwdrivers, fire extinguisher, small axe, first aid kit if present).
● Wiring/Cables: Can be used for cordage, snares, or electrical ignitions if carefully handled (though unlikely to be useful for power).
● Plexiglass/Windows: Can be broken to create sharp edges for cutting, or possibly used as a solar still component.
● Insulation: Found within the walls and ceiling of the plane, this can be pulled out and used for warmth, padding, or fire-starting tinder.
● Fuel (Jet Fuel/AvGas): Extremely Dangerous, but can be used as a fire accelerant.
● Batteries: If intact, they could potentially power small devices or provide a spark for fire starting.
● Metal Sheeting/Panels: Can be cut or torn to make tools, containers, or additional reflective signal panels.
● Rubber Hoses/Piping: Might be usable for siphoning water or as rudimentary cordage.

Plane Seats
● Cushions/Padding: Excellent for insulation from the ground or for comfortable bedding materials.
● Fabric: Can be torn into strips for bandages, cordage or rags.
● Metal Frames: Can be bent or broken to create makeshift tools, splints, or anchors.
● Seatbelts: Strong webbing for cordage, lashing, or tourniquets. The buckles can be used as heavy-duty clips.

Wing & Landing Gear (damaged)
● Metal Sections: Large reflective surfaces for signaling, or can be broken down for smaller metal pieces.
● Fuel Tanks (if any remaining): Again, handle fuel with extreme caution.
● Wiring/Piping: Similar to fuselage components.
● Metal Poles/Struts: Can be used as digging tools, splints, or supports for a lean-to.
● Rubber Tires: Can be cut to make shoe soles, or burned for smoke signals (toxic).

From the Pilot's Body/Uniform/Briefcase
● Fabric: Can be torn into strips for bandages, rags, or cordage. Layers provide warmth.
● Buttons/Zippers: Small metal parts for various uses (e.g., fishing hooks if resourceful).
● Shoes/Boots: Durable footwear if they fit someone.
● Paper/Documents: Can be used as tinder for fire starting, or for leaving notes.
● Pens/Pencils: For writing messages.
● Any food/water: Crucial if present.
● Maps/Charts: Potentially useful for identifying location or nearby islands.
● Electronics (phone, tablet, radio): Could potentially be charged or used for signaling if functional. Even if dead, the batteries may provide a spark.
● Tools (multi-tool, knife): Invaluable if the pilot had a personal survival kit.
● Medication: Potentially life-saving if you know the medication, but use extreme caution with unknown meds.

From Passengers
● Layers: Provide insulation against cold nights or sun protection during the day.
● Fabric: Can be torn for bandages (especially cotton or linen), rags, or strips for cordage.
● Socks: Can be used as filters, makeshift gloves, or water pre-filters.
● Shoes/Belts: Can provide durable materials.
● Business Attire: While not ideal for wilderness, suits can be layered for warmth. Ties can be used as makeshift rope or tourniquets. Shirts can be torn into bandages.

Backpacks/Luggage
● Bags themselves: Can be used for carrying water, food, or gear.
● Contents: Any personal items inside:
● Water Bottles/Food: Immediate sustenance.
● First Aid Kits: Critical in any disaster scenario.
● Knives/Multi-tools: Invaluable for cutting, prying, and general utility.
● Flashlights/Headlamps: Essential for night operations.
● Lighters/Matches: Fire starting.
● Sunscreen/Insect Repellent: Protection from environmental hazards.
● Any medications: Especially if any party members have chronic conditions.
● Glasses/Mirrors: For signaling or starting fire.
● Pens/Paper: For communication or journaling.
● Plastic Bags/Tarps: For water collection, shelter, or waterproofing.
● Ropes/Cordage (e.g., shoelaces, paracord bracelets): Multi-purpose.
● Electronics (phones, power banks): For emergency calls, light, or signal.
● Watches & Jewelry: Timekeeping, possibly a reflective surface.

From the Natural Environment (Island & Beach)
● Sand: For signaling (drawing a large SOS), fire pit insulation, or as a abrasive cleaner.
● Driftwood/Fallen Trees: For fire wood, shelter construction, or tools.
● Leaves/Foliage: For shelter insulation, bedding, or tinder (if dry).
● Vines/Plant Fibers: For cordage or lashing.
● Rocks: For fire pits, tools (if sharp-edged), marking, or as weights.
● Shells: Can be used as makeshift cutting tools or containers.
● Seawater (for distillation): Cannot be drunk directly, but can be desalinized using a solar still or boiling with condensation capture.
● Freshwater (if available): Streams, rainwater collected in natural depressions.
● Edible Plants/Fish/Shellfish: (Requires knowledge and careful identification to avoid toxicity).

3 Planning

Once you understand the basics of staying alive you should look at the most common disaster scenarios that could affect your area and work on a plan to minimise the impact to you. Begin by planning your bug-in scenario such as under what circumstances or disasters you will be bugging in and how to proceed. Read the Preparedness section on how to develop this plan in adequate detail and scope as it contains a lot of points people tend to forget about. Next work on your bug-out routes for those situations where it's not safe to stay in your home. Be sure to have backup routes in case some have been blocked by the disaster. People often have plans utilising multiple types of personal transportation such as a car, bike and hiking in those situations where one of them or both of them fails. These plans will be a lifesaver when a disaster is right around the corner as your mind will be far from easy and you'll be much more likely to forget important steps.

A couple of other plans that will be of benefit are; food and water rationing plans, contingency plans, a disaster probability plan, medical emergency plans and an extended disaster plan. These plans can be used to further plan for any eventualities or surprises that may come your way. Contingency plans should be made alongside your primary bug-in and bug-out plans in case the situation turns and you are either forced out of the home or redirected to another route. An example of each is the knowledge that your house will be flooded within 24 hours and you must leave, or an earthquake fracture which has torn a huge gap in the road, forcing you to find an alternate route to the other side.

Recommended Plans
- Bug Out Plans
- Bug In Plans
- Contingency Plans
- Disaster Probability Plans
- Food/Water Rationing Plans
- Medical Emergency Plans
- Extended Disaster Plans

Considerations
- Type of Disaster
- Number of people in your party
- Distance to your BOL
- Amount of Gear Carried
- Age of Party Members

Plan Type	Description
Grab List	An accessible list telling you exactly what to grab in a bug-out situation, as your mind will be overworked.
Bug-Out Plan	A plan to tell members of the party where to meet, the destination and a few alternate routes to get there.
Bug-In Plans	A detailed plan of how the bug-in should proceed and what to do in different scenarios.
Contingency Plans	Backup plans in case a disaster destroys your primary bug-out location or your means of getting there.
Disaster Probability Plans	A plan outlining the probabilities of different disasters and how to proceed during each of them.
Rationing Plans	When a disaster strikes this plan should be implemented quickly to prolong the life of your food and water.
Medical Emergency Plans	Plans to do if a member of the party is critically injured or needs medication when bugging in or out.
Extended Disaster Plan	This describes what to do if a disaster is prolonged far longer than you expected and your supplies are low.
Safety Plan	This plan is used to "baby proof" your house for an incoming disaster to help prevent injuries.

Planning isn't just confined to pen and paper. You should rehearse any plans you have to ensure they work as they should and it gives you a chance to shore up any weaknesses you find while implementing it. While rehearsing a bug out plan you may discover your small car can't handle the muddy mountain road conditions during heavy rain but it was fine in your previous rehearsal when it wasn't raining. You should always expect the unexpected as well because chances are your real bug out won't go the way you planned it. In the Preparedness category I've created a list of unexpected conditions that could potentially affect you whether you chose to bug in or out. During any practise scenario I recommend rolling the dice every so often to see what complications you get, and trying to survive with it.

4 Gear

The next step is to put together all the tools and equipment you'll need when implementing your Bug-Out scenario - otherwise known as creating a BOB (Bug-Out Bag). This is a bag designed to get you to a BOL (Bug-Out Location) within 3 days which should provide much more security and protection from the current disaster. The BOB is the most basic of preparedness assets, you can also work on more advanced bags such as INCH (I'm Never Coming Home) bags which are aimed at living off the land for extended worldwide disasters.

GEAR	Up to date tips on what gear to carry in your bags and details on why they should be carried. Includes an example Bug Out Bag item list.

This is the section people often start with and go crazy on by filling their bags to the brim with tons of gear they believe will help them survive in a disaster. This is due to: a) The ease of buying things and the false sense of progress is gives, and b) people tend to think that "stuff" will save them in a disaster with little effort on their part, which couldn't be further from the truth. They often miss the planning steps discussed above and believe they will "wing it" and head for the mountains in a disaster. What do you think will happen if everyone does that?

Gear - Steps to Take
- Put together a BOB
- Practise using your gear
- Try carrying your BOB long distances and see if you can handle it

Firstly you should only buy gear which provides an essential function for survival such as a knife or rope and possibly an item that makes surviving a little easier such as a book of crosswords or toilet paper. Secondly you should know your equipment inside and out by using it outside of a disaster scenario so you know how to use it without the added stress of a disaster on top. Your gear should also be based around your personal requirements, climate, country and state.

An example being that you're more likely to need water acquisition methods in humid environments than somewhere with snow. Likewise if you live in a country with gun restrictions, this will surely impact the means of self defence you carry. The gear sections contains a list of basic items you should consider carrying with you. From there you can branch out into the other items you require for your situation.

Gear List

This is an example list of BOB gear that preppers typically carry. Some of the items provide a critical function to surviving and others used in different situations based on your climate. Carrying pouches for groupings of gear aren't listed but it's recommended to have a few to be able to sort your items out so they aren't scattered all over the bag. Keep in mind this is a Bug Out Bag which should only have enough supplies to get you to a more permanent destination within three days or 72 hours.

Water
- 1x 1L Metal Water Bottle
- 1x 1L Folding Bottle
- 15-30x Water Purification Tablets
- 1-2x Unlubricated Condoms
- 1x Small Water Filter (Sawyer, Katadyn, MSR)

Food & Cooking
- 3-6x Meals
- 3-5x Energy/Hiking Bars
- 1x Stove
- 1x Fuel
- 1x Cooking Pot
- 0-1x Cup
- 1x Utensils
- 1x Scrubber

Clothing
- 1x Lightweight Clothes
- 1x Warm Clothes
- 1x Rain Poncho
- 1x Walking Boots
- 2x Underwear
- 1x Hat
- 1x Gloves
- 1x Shemagh
- 1x Eyewear
- 2x Pairs of Socks

Shelter
- 1x Shelter
- 1x Ground Pad
- 1x Sleeping Bag
- 1x Groundsheet
- 1x Wool Blanket

You should only buy a backpack once you have the gear you want to put inside. Purchasing the bag first is a common mistake as it could be too small for everything you require or too big causing you to fill up every nook and cranny with nice, but unnecessary gear. Make sure you're able to lift the bag as well or it will be useless when you're bugging out. A good standard for calculating the ideal weight of your BOB is: Your Weight ÷ 3. No bag which will be carried on your back should weigh more than 35kgs (66 pounds).

There's so much more to your gear than just having a list with no explanations for each item, what they can be used for and why it's worth its weight in your backpack.

Each of these items is described in much more detail in the Gear section with explanations on why it's necessary, the cost, size differences, recommended brands and alternative uses.

For a list of gear in the other preparedness bags, see the GEAR section.

Hygiene ● 1x Hand Sanitizer ● 1x Pack Towel ● 1x Toilet Paper ● 1x Toothbrush ● 1x Med. Toothpaste ● ?x Feminine Products	**Medical** ● 1x First Aid Kit ● 10x Isopropyl Wipes ● 5g Potassium Permanganate ● 30x Band-Aids ● 6x Butterfly Sutures ● 10x Wound Dressings ● 2-3x Surgical Blades ● 1x Clotting Powder ● 60g Oral Rehydration Salts (ORS) or (3 Packets) ● 3x Needles (S, M, L)	**Medication** ● 10x Analgesics (Panadol, Asprin, Nurofen) ● 8x Intestinal Sedatives (Imodium, Lomotil) ● 6x Antihistamines (Benadryl, Polaramine) ● 4x Anti-Malaria Tablet ● 30x Antibiotics (Penicillin, Amoxycilin) ● 3x Iosat (Radiation Tablets)	**Tools** ● 1x Knife ● 1x Multitool ● 1x Flexible Saw ● 1x Pen & Book (in a waterproof zip-lock bag)
Light & Fire ● 1x Flint Rod & Striker ● 1x BIC Lighter ● 1x Headlamp ● 2-3x Batteries ● 1x Candle ● 1x Fresnel Lens ● 1-2x Tritium Light ● 1x Torch ● 0-3x Glowstick	**Communication & Navigation** ● 1x Mobile Phone ● 1x Charger Cable ● 1x Compass ● 2x Local Map ● 1x Map Case ● 5x Signal Flares ● 1x Radio ● 1x Solar Panel (15-30W) ● 1x Power Bank (10K mAh) ● 1x Whistle ● 1x Binoculars	**Self Defence** ● 1x Weapon ● 25-50 Rounds Ammo ● 1x 50ml Insect Repellent	**Misc** ● 1x Backpack ● $300-$500 USD Cash ● 1x Brew Kit ● 0-10oz Barterable Coins ● 20m Thread ● 50m Fishing Line ● 5x Hooks ● 5x Small Sinkers ● 1x1m Latex Tubing ● 1x N95 Face Mask ● ID Documents ● 1 Deck of Playing Cards ● 1-2 Morale Boosters

It's always good to have redundancy of the essential items in your kit such as water, fire and medical gear. Fire can be achieved with a match, lighter or a lens. However did you know that you can use a clear spherical bag of water to start a fire instead of a lens? It's also lighter and smaller and provides the additional function of storing and purifying water. Purification, because a bag of water when placed in direct sunlight for 5-7 hours will kill the bacteria, viruses and protozoa in it. This is known as SODIS (SOlar DISinfection). When deciding on equipment to add to your BOB ask yourself what functions this item provides and try to think about any other useful ways it can be utilized.

Most people add way too many items into their BOB when they first start prepping, but this is a step everyone must take to learn what they need and don't need. The key here is to get out into the wild and find out what items you use the most and try to eliminate the ones you don't use or only use once. It's better to have an item you don't need when you're starting out rather than finding you desperately need something when you're in a disaster situation.

Disaster can happen at any time so ensure you're packed and ready to leave at a moments notice.	Your BOB should essentially be a living, breathing asset where you monitor the numbers and expiry dates of items inside, keeping them fresh or "rotated" and in a perpetually ready state in the event of a sudden disaster. There's no use "borrowing" an item from it and then having to hunt it down when disaster strikes, or worse - forgetting to put it back in. Some people keep their bag on them at all times and in the car when they're at work so they're able to make it home quickly, living solely off those supplies. Disaster can happen at any time so ensure you're packed and ready to leave at a moments notice.

Starting a BOB

You're probably wondering which of the above items would be best to purchase first if you're tight on cash with a disaster looming. This section guides you on your first 15 purchases for your Bug-Out Bag which fulfill the basic requirements of survival in the wild. This list doesn't include items under $20 which can be picked up for relatively cheap such as paracord. Therefore there are differences between this list and the "Top 10 Survival Items" list.

The 'Recommended Buys' below are my own thoughts on the products and may even be something I own. They are not sponsored in any way.

$** = Below Average **$$** = Average Price **$$$ = Above Average

Water Bottle	First you need a way to obtain, store and purify water. I recommend a stainless steel or titanium, single-walled water bottle. A bottle which is metal and single-walled allows you to boil water inside it, which takes care of the water purification and water storage aspects of survival. This should only cost between $20-$50 to buy but can reach up to $100 for titanium. You want to pick one which can easily stack with a pot too!	**Recommended Buys** ● Klean Kanteen 1182ml Bottle $$ ● Keith Titanium 1.8L Canteen $$$ ● Grayl Geopress $$$
Water Filter	Besides boiling water in your bottle you should have a simpler method of purifying it on the go. This is where a high quality water filter comes in. It's recommended, but not essential to buy a filter which also removes viruses, but this comes at a higher cost and they often take up more space. These can cost you between $30 to $500.	**Recommended Buys** ● Sawyer Mini $ ● Kayadyn Pocket Water Filter $$$ ● MSR Guardian $$$ ● Survivor Filter Pro $$
Knife	A water bottle and a knife are two of the most essential items if you're lost and trying to return to civilization again. You can use it to defend yourself, baton wood, build a shelter, hunt with, feather wood, start a fire, signal for help, gut animals and so much more. Don't cheap out on your knife because it will be used daily in any survival situation. You should pay between $100 to $300 for a fixed-blade, full tang knife.	**Recommended Buys** ● KA-BAR Becker BK2 $$ ● Schrade SCHF57 $ ● Fallkniven A1 $$$ ● KA-BAR USMC Knife $$
Shelter	Since it's more frequent to bug-out than bug-in during disasters you'll want a comfortable shelter which is light and portable. Ideally it should weigh less than 2kgs (4.4lbs) and is easily attachable to your backpack. You have the choice between a tent, swag, bivy or hammock depending on what you prefer. Don't cheap out on your shelter or it may fail you when you need it most and you certainly don't want a wet sleeping bag in the middle of the night. Set aside $200-$1,000 for a lightweight shelter of hard-wearing fabric.	**Recommended Buys** ● Snugpak Ionosphere $$ ● Marmot Tungsten Ultralight $$$ ● Carinthia Observer $$$ ● The North Face VE 25 $$$
Sleeping Bag	Sure, you could get by without a sleeping bag while you bug out if you're in a warm climate, but with a disaster occurring do you really want to risk a good night's sleep in favour of saving a bit of weight and money?	**Recommended Buys** ● Sea to Summit Trek II $$$ ● Snugpak Softie Elite 3 $$ ● Coleman 0°F Mummy $

Mattress	You won't get much sleep lying on the cold, hard ground. Thankfully there's lightweight portable mattresses which you can either blow up or leave to self-inflate over a few minutes.	**Recommended Buys** • KLYMIT Static V $ • Sleepingo Camping Pad $ • HiHiker Camping Pad $ • Sea to Summit Sleeping Mat $$ • Sea to Summit Comfort Deluxe $$$
Groundsheet	This sheet can be used to protect your tent from punctures, provide additional shelter configurations, collect rain, store water, build a solar still and more. Throw in about 30m (100ft) of paracord with it and you can do almost anything.	**Recommended Buys** • Tarp/Canvas $ • Tyvek Sheet $$ • Cuben Fiber $$$
Food	Next on the essentials list is food. Generally you only want 3 days worth of food in your BOB which should be enough to get you to your destination. You have quite a range of tasty options available today, in the form of MREs, ration bars, canned meals and freeze-dried meals. Freeze-dried meals are generally the best option because of how light they are, but if there isn't any water on your route then pick something that contains the water already.	**Recommended Buys** • Mountain House (USA) $$ • Backpackers Pantry (USA) $$ • Back Country Cuisine (AUS) $$ • Campers Pantry (AUS) $$
Camping Stove	You will probably need to cook while bugging out, and with today's technology you can have a hot meal within a few minutes. You can either heat water and pour it into a freeze-dried meal or heat the food directly. Alternatively you can buy a chemical heating bag which does the same for a fraction of the weight - although they are one use only. There's also many other methods you can cook with, but these are either messy or complicated to utilize. Don't forget the fuel if you opt for a gas stove.	**Recommended Buys** • BRS 3000-T $ • MSR Pocket Rocket 2 $$ • SOTO WindMaster $$ • Flameless Heater Bag $
Cooking Pot	If you're going to be eating food from a tin or packet you'll probably need to put it into something to heat up. That's where the pot comes in handy. Not only can you cook food in it but it can boil water, be used to brew coffee and more. Therefore I recommend getting one which fits snugly around your water bottle. Add a spork or any other cutlery you want to finish it off.	**Recommended Buys** • Stanley Adventure Cook Set 24oz $ • Toaks Titanium 750ml Pot $$
Torch	You're probably going to need some form of light during your bug-out and this is where a torch or headlamp comes in. They come in all shapes and sizes and have a lot of useful features, but all you need is something weather resistant and provides a decent amount of light for up to 3 nights. If you want to go stealth, get a light with a red LED on it as well as a white light. Don't forget the spare batteries!	**Recommended Buys** • Olight H2R (2300 lm) $$ • Olight i3E EOS (90 lm) $ • Black Diamond Spot 325 $$ • Olight X7R Marauder (12k lm) $$$
Radio	You probably won't have a mobile signal during a large scale disaster which is where a radio comes in. These can be small in size and may even already be built-in to your phone. I recommend one which has either a dynamo handle or solar panels and acts as a power bank from which you can charge your other devices.	**Recommended Buys** • RunningSnail Emergency Radio $ • FosPower Emergency Radio $ • Kaito KA500 $$
Map, Compass & Plans	Since you'll be travelling to your Bug-Out Location (BOL) during a potentially environment-altering disaster it's best to have a printed map and a compass so you can alter your course, if for some reason you can't use your original route. You should also print your Bug-Out Plan so you have it ready in your pack in zero hour.	**Recommended Buys** • Printed Local Maps $ • Silva Explorer 2.0 $
Medical Kit	This isn't technically one item, but as a kit it's an invaluable asset during any disaster because you're much more likely to injure yourself, or be injured during a disaster. You can either purchase a pre-packed kit or choose the bag and items yourself for a custom setup. See above for the recommended contents of this medical kit, or the GEAR section if you want a full spec-sheet of each item.	**Recommended Buys** • Build one yourself, or buy from a reputable company
Backpack	You should buy your backpack once you have the items you want to store inside it so you don't buy one that's too big and try to stuff it full of gear. Look for a backpack suited to your frame and which can hold up to about 1/3 of your body weight.	**Recommended Buys** • Granite Gear Crown2 $$ • Paratus 3-Day Operator's Pack $$ • Eberlestock 79 Skycrane II $$$ • Maxpedition Falcon 2 $$

Prepping at Home

This section will help you get started on 15 of the items you should be stockpiling if you're planning on bugging in through any disasters, or if you just want to be more self-sufficient.

Water	At minimum you should store barrels and bottles of water inside your home to safeguard against a cut water supply. The next step up would be to add some water tanks to your house allowing you to collect rainwater. But the ideal solution is that you would live next to a body of water which you can pump up to your house. Don't forget the filtration system if you collect rainwater or pump from a body of water.
Food	You should aim for at least a month of food per person to begin with and slowly add on from there. This will give you a strong foundation to continue prepping on as you focus on some other categories. Your pantry should be built off long life, staple ingredients such as rice, pasta, flour, sugar, potatos, onions, salt, honey, garlic, crackers, lentils, chickpeas, beans, grains, starches, herbs, spices, nuts, milk, sauces and canned foods. Beyond the kitchen you should have an established garden and everything required for the maintenance of it such as seeds, mulch, fertilizer, pots and tools.
Guns & Bullets	It's better to have one gun with a ton of bullets than lots of different guns with only a selection of bullets for each one. Better yet, choose guns which use the same bullets but have different functions. A good place to start is by researching .22 caliber bullets and 5.56 NATO bullets.

Medical Gear	You can never have enough medical supplies, especially in any disaster due to the chance of requiring any form of medical aid going up dramatically. Cover all the basics such as bandaids, bandages, thermal blankets and antiseptics. The next step up is the trauma gear such as torniquets, blood clotting powder, scalpels, chest seals, suture kit and staple kit. If you have more money to spend go for the hospital grade equipment such as a defibrilator, ventilator, drip machine, patient monitor, blood pressure meter, EKG machine, stretchers, anesthesia machines, nebulizer, patient lifters. For a complete list of medical gear see the GEAR section.
Medication	Medication is another very important one to consider. Stockpile lots of the basics such as Paracetamol (Panadol), Ibuprofen (Nurofen), Loperamide (Imodium) and Fexofenadine (Telfast). If you can, obtain a few different types of antibiotics because they may save your life in the future. You should consider any special medical requirements you or your family requires such as epi-pens and insulin and how you will acquire them and store them for the long term.
Barter/Spare Items	There's always going to be some people who either aren't prepared or have something you want, this is where barterable items can come in handy. These should be set apart from your own stocks and shouldn't be counted when you 'stocktake' your own items. They are used to give to others in need such as family and friends or to trade for something you really need. Barter items also include gold and silver coins which could become currency again if the economy fails.
Candles	When electricity isn't available you'll be sent back to the dark ages without a form of light, this is where candles will be extremely helpful. Not only will they provide a decent amount of light per candle, but they can provide warmth and a sense of hope and possibly a fire to cook over if you have enough of them. Look for the candles which burn the longest, these typically are about 2.5cm (1 in) wide and don't leave a wax 'shell' behind.
Hygiene Products	Generally the hygiene of people slips during any form of disaster which opens the door to some scary diseases. However this is easily countered with a well stocked hygiene cupboard which could include: hand sanitiser, toilet paper, cloths & towels, a working tap, toothbrushes & toothpaste, kitchen sprays, disinfectant, hand soap, a bucket shower and feminine hygiene products.
Fuel	If you're stuck at home for long periods you'll need fuel to power everything. Firstly wood is important as a source of fuel and for house repairs as discussed below. Petrol should be stored to help generate electricity and to keep your car running if it's necessary to travel. Finally gas fuel will provide a source of heat and flames to cook on if you don't have electricity anymore.
Hardware Supplies	Hardware supplies are essential to stock up on. You don't know what kind of disaster may hit your house, whether it's a flood, earthquake or hurricane, but if you stock up on wood, planks, rope, duct tape, screws & nails you know that you'll be able to fix most of the damage.
Clothing & Fabrics	Fabrics are great for repairing any clothing which may be damaged over time - if you're in it for the long haul. They can also be fashioned into other needs such as curtains or keep you warm during an exceptionally cold blizzard. Spare clothing is also important to keep because your clothes will certainly take a beating during any disaster. Mattresses are another great product to have a couple of spares of. They can be used for sleeping on, baterting or for protection during hurricanes.
Solar Panels & Batteries	Batteries are critical in any disaster to help you power your devices. I recommend stocking up on AAA, AA, C, D, 9v, and maybe a car battery or two. Power Banks are ideal to keep mobiles and tablets operational. Deep Cycle Marine batteries can also be extremely useful when combined with a solar setup to be able to power multiple electronics or even a small household. If you have a lot to spend, go for a large scale solar setup with a power bank to fulfill most your electrical needs.
Electronics	Even if the power goes out, electronics such as mobile phones, tablets, torches, radios, CB radios, fans, LED lights and portable solar panels are still essential in daily life since our dependence on them has grown. Even if you don't use them, they can be traded to people who are without for something else you need. If you're electrically minded you should keep a box of electric bits and pieces so you're able to repair electronics that break down.
Knowledge	Start a library on every preparedness, survival and homesteading book imaginable. You can use this to expand your knowledge and broaden your horizons if for example society goes back to the dark ages and you need to know how to blacksmith or forage. They can also provide a source of entertainment, so don't forget the novels and childrens books if you have kids.
Morale Items	If you're going to hunker down inside your house for long periods of time you're going to need something to keep entertained with. Morale items could be board games, card games, tv shows, music, video games, puzzles or books. Find out what each person enjoys the most and have a customised variety for each of them.

Terms

There are quite a lot of prepper terms you may see throughout this document which you may not understand such as: BOB, WROL and TEOTWAWKI. A complete list can be found in the 'ADDENDUM > Dictionary' category but a few of the more popular ones are to the right.	**BO** = Bug Out **BI** = Bug In **BOB** = Bug Out Bag **BIB** = Bug In Bag **BOL** = Bug Out Location **BOP** = Bug Out Plan **BOV** = Bug Out Vehicle **SHTF** = S*** (or Stuff) Hits The Fan **WROL** = Without Rule Of Law **BSTS** = Better Safe Than Sorry **GOOD** = Get Out Of Dodge	**EDC** = Every Day Carry (Kit) **CCW** = Concealed Carry Weapon **EMP** = ElectroMagnetic Pulse **EOD** = End Of Days **FAK** = First Aid Kit **IFAK** = Individual First Aid Kit **PFAK** = Personal First Aid Kit **JIC** = Just In Case **MRE** = Meal Ready to Eat **NBC** = Nuclear Biological Chemical **TPTB** = The Powers That Be	**PSK** = Personal Survival Kit **GHB** = Get Home Bag **INCH** = I'm Not Coming Home (Bag) **TEOTWAWKI** = The End Of The World As We Know IT

Term Descriptions

These are the terms you may come across throughout this document. Learn them now so you don't have to keep coming back to them. There are more definitions in the ADDENDUM section.

- **Bug Out Bag:** A simple backpack or bag of survival items that you have ready to go when you need to bug out. Your bug out bag should consist of basic items that will allow you to survive for at least three days.
- **Bug Out Location:** A designated location outside of the danger zone that you bug out too.
- **Bug Out Vehicle:** A vehicle that is large enough to transport you, your family, and your supplies, and can also go off-road in case roads are blocked.
- **Bugging In:** Refers to staying at home during a disaster.
- **Bugging Out:** Refers to evacuating your home during a disaster, either by your own choice or because you are ordered to.
- **Alpha Strategy:** Storing extra supplies for the purposes of trade or personal use in a disaster.
- **Ballistic Wampum:** Ammunition stored for disaster preparedness purposes.
- **Big Berkey:** A family water filtration system that can remove harmful bacteria and toxins from water.
- **Doomer:** Somebody who believes disaster is coming and chaos will ensue. These are hardcore preppers.
- **Electromagnetic Pulse:** A weapon that when detonated in the atmosphere would knock out all electronics within a certain radius.
- **Faraday Cage:** An improvised device that can shield the electronic items inside from an EMP attack or solar flare.
- **Food Insurance:** Refers to the food stockpile you have in your home.
- **Gamma Lid:** An airtight lid that is used for plastic containers that are food grade.
- **Potable Water:** Water which is safe to consume.
- **Get Home Bag:** A small backpack of survival items that you keep in your vehicle should you need to abandon your car and try to get home during an urban disaster.
- **Grid Down:** Means the power grid has gone down, likely as a result of an EMP.
- **Larder:** Typically refers to a pantry, but can also be used to refer to any place where you store food for survival and disaster-related purposes.
- **Mylar Bags:** Bags that are used to provide a barrier between stored survival food and sunlight.
- **Pollyanna:** Somebody who denies that a major disaster will ever occur.
- **Preppers:** People who prepare for disaster by storing food, supplies and learning survival skills.
- **Rendezvous Point:** A pre-determined location where you meet up with your survival group before continuing to your designated bug out location.
- **Rule of Threes:** You can live for three minutes without oxygen, three hours without shelter in harsh environments, three days without water, and three weeks without food.
- **Sheeple:** Refers to people who are largely unprepared for a disaster and will follow the rest of the crowd.
- **Solar Oven:** A cardboard box lined with aluminium foil to bake food using the sun's energy.
- **Survival Cache:** A collection of survival items that you bury or hide at a location away from your home.
- **Two is One, One is None:** Always have a second piece of kit with a redundant function in case the first one fails.

5 Skills

After you start equipping your person and your BOB with some items, the next step is to develop your skills in preparedness and survival. It's no good to have 'the best' gear sitting all clean and untouched in a bag somewhere. What if it breaks on the first use? Or it was defective when you bought it but didn't test it? What if it doesn't do what you expected?

Take time out on the weekend to go into the wild and try to survive with only what you have in your backpack, this will also give you an idea of what you might be missing but you're also so close to home that it's no big deal if you forget something. There's a huge range of skills which are essential to surviving alone and quite a lot which are just beneficial to know. Some of the most important ones to practise are listed here:

Essential Skills
- Fire Lighting
- Water Purification
- Stealth and Observation
- Living off the Land
- Navigation
- Understanding Climates
- Shooting/Self Defence
- Medical Skills

Valued Skills	Valued Skills	Other Skills	
• Shelter Building • Using Natural Resources • Meteorology • Knot Tying	• Fishing • Hunting • Trapping • Gardening • Cooking	• Weaving • House Construction/Repairs • Electrical Maintenance • Blacksmithing	A great way to start is by picking a skill and trying to master it over the course of a week. Each week is a new skill and you'll progress quickly if you continually use it on your outdoor trips as well.

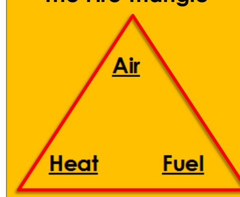
SKILLS	Skills one should possess prior to SHTF and how to train them

6 Fire

Fire is the single most important tool in the wild. With it you can cook food, purify water, provide heat, signal for help, scare predators and so much more. You should have at least 3 different ways to start a fire in your BOB such as a fresnel lens a lighter and a flint rod. To get started with fire lighting you should know the basic principles of the fire triangle. The three sides are: Air, Heat and Fuel. If you remove any one of these the fire will go out, therefore you need all three to start one as well. The best practice when learning fire lighting is to know how to extinguish them first, just in case it takes off too rapidly.

To extinguish a fire you must remove one or multiple sides of the fire triangle. This can be done by reducing the heat with water or a chemical compound such as that found in fire extinguishers. Removing the air (oxygen) from the fire by means of sealing it in an airtight area - just like a candle burning in a small space. Or by taking away the fuel source such as the logs or liquid fuel.

The Fire Triangle



INTRODUCTION Fire

Fire Lighting Methods ● Bow Drill ● Flint & Steel ● Matches ● Lighter ● Solar ● Electricity ● Chemical	To light a fire the first thing you'll need is a form of fine tinder to help catch a spark or flame. You can find a variety of natural tinders in the wild such as dusted tree bark, cats tails, leaves, cotton plants etc, but the easiest to use tinders are manufactured. Tissues, cotton balls, dryer lint and flammable liquids such as alcohol, petrol, diesel and kerosene make excellent tinders which only require a spark to ignite in most circumstances. It's recommended to have a small amount of this in a fire lighting kit to use when you aren't able to find natural materials.	**Skills to Learn** ● Extinguishing Fires ● Know the fire triangle ● Practise lighting with multiple different methods and tinders ● Wild Tinder Identification

Besides tinder you'll require kindling which are pieces of larger material - typically sticks, which give the fire more of a body to help sustain it longer. Sticks and pinecones are perfect for this as they are small enough to catch fire with a small flame yet will burn longer than tinders providing a stepping point to burning the larger materials. Finally you'll need fuel for your fire once your kindling is burning well. Logs with a diameter of 3cm and greater are the ideal choice for fuel as they are readily available in a forest and can easily be cut down to size. Be sure that the tinder, kindling and fuels are all bone dry as they won't light if there's any moisture in them. Also don't use green or fresh branches as they won't light either.

Once you have the required fuels and a lighting source for a fire there's a few important safety checks you should make before attempting to light a fire. Check that the climate and terrain is in favour of a fire. You won't get very far if it's about to pour down with rain or start snowing. Wind is also your enemy when attempting to light a fire as it will easily blow out small flames, or alternatively, encourage an established fire to spread rapidly. Have a bottle of water handy in case the fire starts to get out of control and clear out all the leaves within a 2m (6.7ft) radius before lighting it.

FIRE	Methods for starting fires, types of tinder and fire starters
FUEL	All types of fuels from solid to liquid or gas and its effectiveness

Make sure you have enough fuel to complete whatever goal you have in mind. It's better to have too much fuel than run out half way and have to restart the fire again. The final check you should make is that you won't be detected. Generally in bug out situations you don't want anyone knowing you're in the area and a fire is the easiest way people can detect you whether it's by the flicker of the campfire, the smoke rising above the trees or the smell of food coming from your camp. Sometimes having a fire is essential such as in the winter months or when water needs purifying. Fortunately there's a few ways you can have a "stealth fire", but these are mentioned in more detail in the Fire section.

Fire Lighting	To light a fire, first make a nest shaped dome with your semi-finest tinder and put the finest shaving inside it. Put this nest next to a teepee shaped bunch of kindling so that when the fire catches onto the tinder you can slide it under the kindling so it heats and climbs the sticks. You don't need the tinder if you're using a modern fire starter brick as these burn long enough to catch the kindling on fire and can also take a spark from flint to light. You should have the main fuel (logs) nearby so you can place them onto the kindling once it's burning well. Alternatively you can make another teepee from the larger sticks and logs so you can simply slide the kindling nest under it so you don't crush the fire accidentally.

When you're finished with the fire it's critical that you extinguish it - the last thing you want in an emergency is a forest fire on your tail. Embers can burn for days under a collapsed fire and if stirred up by the wind can easily trigger a forest fire under the right conditions. Water, dirt and mud are readily found in nature and are perfect for putting out fires, simply mix them together until the flames and embers die out.

7 Shelter

Having a shelter provides protection from elements and insects, keeps you warm and gives you a sense of security when you're laying there snug and ready for a good night's sleep. With today's technology comes amazing new leaps in fabrics and light weight poles allowing for compact, light, stealthy, yet durable shelters which can be set up within a few minutes. Choosing one is no easy task but it really depends on the situations it will be put into. If you know that it has to stand up to wild weather then go with a canvas swag which is highly puncture and tear proof. Needing something to keep the swarms of mosquitoes out? Go with something that's lightweight and has a very fine mesh.

SHELTER	Types of shelters, building survival shelters and shelter strengths

What if a situation arises in which you couldn't make it home to retrieve your BOB before you left? Or if you don't fancy lugging a shelter across the country on your back? You can easily build your own temporary shelter out of sourced materials or a naturally occurring feature such as a rock. You just need to know a bit of basic construction and know a few knots. I recommend you study the Shelter category for a variety of different shelters you can construct, including using natural resources such as fallen logs and rock formations which can easily be converted into shelters.	**Makeshift Shelters** ● Lean-To ● Snow Cave ● Tarp Hammock ● Bough Bed ● Leaf Hut

Shelters aren't just confined to makeshift shelters, tents, and swags but encompass any form of shelter from the elements whether that's a house, car or bus stop. These types of shelters can be used to take cover from a varying array of disasters or even just the harsh sun on a summers day and is much safer than attempting to wait it out with the elements bearing down on you. A good example is being trapped in your car during a snowstorm. You shouldn't leave the safety of even a fragile shelter such as a car in search of a house if you don't know the area and are unable to see very far. Being an enclosed space your body heat will generally remain in that space rather than being taken away by the wind.

8 Water

Water is one of the most crucial resources in a survival situation. It takes only a few hours before you can begin to feel the effects of lack of water in warm or humid conditions. In any survival condition it is vital to know how to find, filter, purify and store water. There are so many techniques that can be used to produce safe drinking water that you can do it in your home right now. A few ways are: Using bleach, distillation, filtering through cloth, chlorine tablets, filtering through charcoal, using SODIS (SOlar DISinfection) with an old plastic bottle, evapotranspiration and more. Keep in mind though, that not all techniques are equal, and water filtration is **not** the same as water purification. Filtration involves the removing of sediment and particles from water and Purification is the killing or removal of bacteria, protozoa and viruses from the water.

Natural Water Sources ● Rain ● Lakes ● Ocean ● Evapotranspiration ● Dew Collection ● Fog Harvesting ● Animals ● Plants ● Solar Still	The first thing you'll need to do is source some water. You should be able to find water nearly everywhere on earth if you look for it. These are a variety of ways water can be found in nature and around the home. Most of these methods require purification before being able to drink it, but can be utilized in an emergency. For more information on how each type can be purified see the Water section. There are a few exclusions to what kinds of water can be purified, these include: Water which contains heavy metals, water which contains dissolved pharmaceutical drugs and water which contains chemicals like cleaning solutions and factory waste water.	**Urban Water Sources** ● Taps ● Toilets ● Hot Water System ● Water Pipes ● Air Conditioners ● Fish Tank ● Cars ● Water Towers ● Fire Hydrants
Filtration Techniques ● Makeshift Water Filter ● Bank Filtration ● Carbon Filtering ● Activated Charcoal Filtering ● Sedimentation ● Coagulation	To turn water found in the environment into **potable** water (water safe to drink), it must go through a series of techniques to remove sediment, particulate and contaminants. The first step is a water filter which remove sediment in the water, whether visible or not. Sediment could be anything from stones, leaves, bugs, dirt and dust to hair. It's recommended to remove this prior to progressing to the next step of purification due to the chance of particulate becoming trapped in purification filters or even greatly reducing the purification effectiveness. An example is UV purification where the light can't shine through any solid material and therefore won't kill the bacteria on the particulate. Some techniques just require a handheld filter and others require an entire desalination plant. Similarly some can filter out salt but most of them aren't able to, so be sure to match the filter with the type of landscape you'll be living in.	**Purification Techniques** ● Manufactured Filters ● Slow Sand Filter ● Boiling ● Distillation ● Solar Pasteurisation ● SODIS ● Chlorination ● Electrolytic Purification ● UV Light ● Reverse Osmosis ● Ozonation ● Copper/Silver Ionization ● Solar Desalination
WATER	The WATER section is dedicated to locating, acquiring, filtering and storing water.	

9 Threats

In any survival situation, threats can come from a multitude of sources. Understanding and anticipating these threats is crucial for preparedness and increasing your chances of survival. They can generally be categorized as environmental, biological, and human-related.

Weather Extremes	**Heat:** Dehydration, heatstroke, sunburn, exhaustion. **Cold:** Hypothermia, frostbite, exposure. **Wind:** Wind chill, exposure, blowing debris, damage to shelter. **Rain/Snow/Ice:** Hypothermia, limited visibility, slippery terrain, flooding, avalanches. **Storms:** Thunderstorms (lightning), blizzards, hurricanes/cyclones (strong winds, flooding, storm surge), tornadoes (destructive winds).
Natural Disasters	**Floods:** Drowning, rapid current, contamination of water sources, loss of supplies. **Drought:** Lack of water, desiccation, increased fire risk. **Wildfires/Bushfires:** Burns, smoke inhalation, rapid spread, destruction of resources, limited escape routes. **Earthquakes:** Structural collapse, landslides, tsunamis (if coastal), aftershocks. **Volcanic Eruptions:** Ashfall, lava flows, lahars (mudslides), toxic gases. **Landslides/Mudslides:** Burial, crushing injuries, blocking routes. **Tsunamis:** Massive waves, drowning, widespread destruction.
Terrain & Geographical Hazards	**Rough Terrain:** Falls, sprains, fractures, getting lost. **Elevation:** Altitude sickness, thinner air. **Water Bodies:** Drowning, strong currents, hypothermia, hazards (e.g., submerged obstacles). **Quicksand/Bogs:** Entrapment, exposure. **Avalanches:** Burial, trauma. **Caves/Crevasses:** Falls, getting lost, hypothermia.
Animals	**Predators:** Attacks from large carnivores. **Venomous Creatures:** Bites/stings from snakes, spiders, scorpions, jellyfish, centipedes, certain insects (e.g., bees, wasps if allergic), marine life (stonefish, cone snails, blue-ringed octopus in Indonesia/Australia). **Aggressive Animals:** Attacks from non-predatory but aggressive animals (wild boar, monkeys, territorial birds, some herbivores like moose if provoked). **Insects:** Mosquitoes (malaria, dengue, Zika, chikungunya), ticks (Lyme disease, tick-borne encephalitis), fleas (plague), flies (various diseases, maggots).
Plants	**Poisonous Plants:** Ingestion (causing illness, organ damage, death), skin contact (rashes, burns, blisters). **Irritating Plants:** Thorns, sharp edges causing cuts and punctures.
Microorganisms & Disease	**Waterborne Pathogens:** Bacteria, viruses, parasites causing dysentery, cholera, giardia (from contaminated water). **Foodborne Illnesses:** From spoiled or improperly prepared food. **Wound Infections:** Bacteria entering open wounds, leading to sepsis, gangrene. **Respiratory Illnesses:** From exposure to cold or smoke. **Pre-existing Medical Conditions:** Exacerbation of chronic diseases (diabetes, heart conditions), lack of medication. **Pandemics/Epidemics:** Widespread infectious diseases.
Direct Conflict/Violence	**Hostile Individuals/Groups:** Robbery, assault, violence from desperate or malicious people. **Marauders/Looters:** Especially in collapsed societal scenarios. **Kidnapping/Hostage Situations**
Disaster Proliferation	This is when a current disaster situation becomes worse. For example in the cessna crash, the fuel tank could explode at a random time after the crash landing.
Accidents & Errors	**Poor Judgement/Panic:** Making rash decisions, freezing, or taking unnecessary risks. **Lack of Knowledge/Skills:** Inability to perform essential survival tasks. **Exhaustion/Fatigue:** Leading to errors, impaired judgment, reduced physical capability. **Exposure to Toxic Substances:** From industrial accidents, chemical spills, or improperly handled materials (e.g., plane fuel in your scenario). **Explosions/Fires (man-made):** From industrial incidents, intentional acts, or faulty equipment.

INTRODUCTION Threats

Psychological Threats	**Panic/Fear:** Hindering rational thought and action. **Anxiety/Stress:** Leading to poor decision-making, physical and mental breakdown. **Loneliness/Isolation:** Especially in long-term scenarios. **Hopelessness/Despair:** Loss of will to survive. **Group Dynamics:** Conflict within the group, lack of leadership, infighting.
Infrastructure Failure	**Power Outages:** Loss of light, heat/cooling, communication, refrigeration. **Communication Breakdown:** Inability to contact help or loved ones. **Supply Chain Collapse:** Lack of food, water, medicine, fuel. **Transportation System Failure:** Roads, bridges, airports unusable.

To continue the cessna crash scenario, below are some examples of the different threats that are prominent after the crash and others that you will likely encounter on the island.

Short Term Threats
● Severe Injury & Blood Loss (Ben): This is the most pressing and life-threatening concern. Without rapid and effective first aid to stop bleeding and treat shock, Ben's chances of survival are extremely low.
● Pilot's Death: While not a direct threat to the survivors, it creates a critical vacuum in terms of navigation, expertise, and any pre-existing emergency procedures or equipment the pilot might have known about or carried. It also presents a psychological shock.
● Shock (Sarah & other passengers): The extreme trauma of the crash can induce physical and psychological shock, impairing judgment, reducing ability to act, and worsening physical conditions.
● Aircraft Fire/Explosion: Though the initial impact might not have caused one, ruptured fuel lines, damaged electrical wiring, and hot engine components always pose a risk of fire or explosion immediately after a crash, especially with AvGas (highly volatile).
● Lack of Medical Supplies: The absence of a readily accessible and well-stocked first aid kit, or trained medical personnel, exacerbates Ben's injury.
● Debris Hazards: Sharp metal, glass, and other broken components from the plane pose immediate risks of cuts, punctures, and falls around the crash site.

Medium Term Threats
● Dehydration: Without a reliable source of fresh water, especially in a tropical climate, dehydration will quickly become critical. This will be exacerbated by Ben's blood loss.
● Sun/Heatstroke: Intense tropical sun can quickly lead to severe sunburn, heat exhaustion, and heatstroke.
● Rain/Humidity: Heavy tropical downpours can lead to hypothermia even in warm air, and the high humidity can make drying clothes difficult, increasing risk of fungal infections.
● Lack of Shelter: While the plane offers some immediate shelter, it's damaged. Without proper protection from sun, rain, and insects, the survivors are vulnerable.
● Infection: Ben's open wound is highly susceptible to infection from bacteria, fungi, and insect larvae (e.g., fly strike) in the tropical environment, leading to sepsis if untreated.
● Mosquitoes: High risk of diseases like Dengue, Malaria, Zika, especially at dusk and dawn. This is a very significant threat in Indonesia.
● Dangerous Animals: Venomous Snakes, Crocodiles, Wild Boar, Monkeys, Komodo Dragons, Monitor Lizards, Jellyfish, Sharks and Octopuses.

● Scorpions/Centipedes: Painful stings/bites, potentially causing severe reactions.
● Other Insects: Biting ants, flies, etc., causing discomfort and potential secondary infections.
● Marine Hazards: If exploring the coast for resources (saltwater crocodiles in estuaries, venomous marine life like stonefish, cone snails, jellyfish).
● Lack of Communication/Signaling: Without working electronics or effective signaling methods, the chances of being found are low. The ELT is critical.
● Starvation: While less immediate than water, without a food source, energy levels will rapidly decline, impacting ability to work, think, and heal.
● Psychological Deterioration: The trauma, isolation, fear, and discomfort can lead to panic, despair, conflict within the group, and impaired decision-making. The death of the pilot and the severity of Ben's injury will amplify this.
● Lack of Tools/Resources: Without basic tools (knife, fire starter, container), essential survival tasks like water purification, fire making, and shelter building become extremely difficult.
● Lack of Footwear Protection: Walking barefoot or in flimsy shoes on rough, hot, or sharp terrain (coral, rocks, debris) can lead to foot injuries, hindering mobility and increasing infection risk.

Long Term Threats
● Chronic Dehydration/Malnutrition: Leading to severe health degradation.
● Persistent Infection: Untreated or poorly treated wounds will likely lead to systemic infection.
● Resource Depletion: If they rely solely on salvaged items, these will eventually run out.
● Environmental Degradation of Supplies: Salvaged items (e.g., food, electronics) degrading due to heat, humidity, and pests.
● Loss of Hope/Motivation: Critical for psychological survival.
● Long-term Animal Encounters: Increased likelihood of dangerous encounters as survivors must range further for resources.
● Lack of Medical Expertise: Inability to diagnose or treat long-term illnesses or complex injuries.
● Search & Rescue Ceasing: If no signal is received, formal SAR operations will eventually be called off.

ANIMALS	Contains a fairly comprehensive list of different animals, both safe and dangerous, and how to deal with them.
PLANTS	This section is about different types of plants, both edible and toxic and the ways they can be used.

Preparedness

Being prepared for disasters and developing bug-out/in plans

"It wasn't raining when Noah built the ark."
Howard Ruff

Introduction

Survivalism, preppers or prepping is a movement of individuals or groups who are actively preparing for emergencies, including possible disruptions in social or political order, on scales from local to international. Survivalists often acquire emergency medical and self-defence training, stockpile food and water, prepare to become self-sufficient, and build structures that may help them survive a catastrophe.

Common preparations include the creation of a defendable retreat, haven, or bug out location (BOL) in addition to the stockpiling of food, water, clothing, seeds, weapons, agricultural equipment, and medical supplies. This section contains the fundamentals of being prepared and should link most of the other topics together.

Purpose	The aim of PREPAREDNESS is to help you come to grips with the real nature of being prepared in a world where the unexpected can happen at any moment. It starts by looking at the basic preparedness topics such as fire, water, shelter and food and then dives deeper into creating your own personalised bug-out plan, tips on rehearsing that plan and assessing any vulnerabilities you may have. It then looks into how you can monitor the world around you until one of these disasters occurs. We then get to the main section about what to do in the midst of a disaster, the considerations to take into account and the decisions to make such as bugging-in or out. The category comes to a close with some real world tips given by those with a tangible experience of disasters.
Lost?	● If you're new to prepping, I recommend reading the INTRODUCTION section first. ● If you want a list of preparedness resources, head to the ADDENDUM > Media section. ● For tips on leading your preparedness group, see the LEADERSHIP section. ● For information on keeping a positive state of mind, see the EMOTIONAL section. ● For a list of skills related to prepping, see the SKILLS section. ● If you want a bigger list of the terms of preparedness, see the ADDENDUM > Dictionary > Preparedness section.

Contents

1 Preparedness

"The superior man, when resting in safety, does not forget that danger may come.
When in a state of security he does not forget the possibility of ruin.
When all is orderly, he does not forget that disorder may come.
Thus his person is not endangered, and his States and all their clans are preserved."
Confucius

What is Prepping?	Prepping or being prepared is the conscious act of making preparations for unforseen events, disasters or catastrophes. It generally involves stocking up on the essential requirements for sustaining life such as water, food, shelter, medical etc. It is also for helping the prepper become more confident in their abilities and practising skills often for a range of different scenarios. There are many different levels of being prepared from having a simple backpack with gear to an underground bunker stocked full of resources.

What Prepping Isn't
Preppers aren't scared or worried of the future but rather prepared for anything that could arise from it, much like how students prepare for an exam rather than simply hoping they pass. In most circumstances as Gandalf puts it: "You Shall Not Pass!". Most preppers don't want disasters to strike even though their stockpiles of food, water and resources could dictate otherwise. They would rather have it and not need it. Conspiracy theories are sometimes closely linked with prepping such as preparing for aliens, the rapture, a yellowstone eruption, a pole shift or an economic reset, however this is often not the case for most preppers. Preppers deal in chances and work on mitigating them, such as a prepper in Hollywood where the chance of an earthquake is higher than any other natural disaster. So they would primarily prep for earthquakes and civil unrest. However one should always be ready for any disaster that may arise and your gear should be multi-purposed.

At the far end of the prepping spectrum are the die-hard preppers who have quit their jobs to dedicate their lives to being prepared and fitting out shipping containers and rooms full of guns. Most preppers are much more conservative and operate below the radar as the less people know they prep - the better. Prepping isn't simply having a lot of food, water, guns and vehicles primed and ready to go when you need, but equal parts gear and knowledge acquisition. The more knowledge and survival skills you have, the less gear you'll need.

FEMA recommends having a stock of three days worth of food and water in your pantry for your family. This doesn't automatically make you a prepper as you're lacking the entire preparedness mindset, the Bug-Out aspect and the survival knowledge. Prepping extends past the time your food reserves run out to encompass alternative ways to get food, water, electricity and even fuel. Below are the rules of threes showing how long you are likely to live without each basic need:

3 Seconds **without Hope**	Without hope you've got no reason to live, keep your family in mind and how you're going to feed them.
3 Minutes **without Air**	Within a few seconds without air you will begin to seek ways to get air. Ensure you have a clean oxygenated supply.
3 Hours **without Shelter**	In harsh conditions you've only got about three hours to live. Make sure you're at a safe temperature and are protected from weather and animals.
3 Days **without Water**	3L of water a day is recommended to keep you working at peak efficiency. Water must be free of contaminants and bacteria and easily acquired.
3 Weeks **without Food**	One of the lowest requirements for surviving but required nevertheless. At least one meal a day or 5,000Kj is recommended.
3 Months **without Company**	Without any form of company it will feel like there's no point to living since you can't share your experiences with anyone. One can literally go insane without interaction with another human or even animal. Watch the Tv show 'Alone' for examples.

Odds

Preparedness is about being prepared no matter the odds, because eventually it will happen. Below are the different odds of various events that could happen to anybody. Some of them you can prepare for and others you just have to hope they don't occur in your lifetime. Others seem so trivial or unlikely that you would never think you could die from that - such as a bee sting.

Wining the U.S. Lotto 1:292,000,000	**Being Dealt a Royal Flush** 1:649,740	**Being Killed by a Shark** 1:8,000,000	**Hit by Satellite Debris** 1:21,000,000,000,000	**Slipping & dying in the Shower** 1:2,232	**Tornado Destroys House** 1:10,000,000 / Year
Being Murdered 1:18,000	**Win an Academy Award** 1:11,500	**Meteor Hitting Your House** 1:182,138,880,000,000	**Dying From Any Injury** 1:1,820	**Dying from Assault** 1:16,421	**Hurricane Hits Miami** 1:25 / Year
Dying from a Fall 1:20,666	**Struck By Lightning** 1:576,000	**Killed by Asteroid** 1:74,817,414	**Death via Legal Execution** 1:127,717	**Injury from Fireworks** 1:19,556	**Dating a Millionaire** 1:216
Being Killed Next Year 1:69	**Killed By Lightning** 1:576,000	**Becoming President** 1:10,000,000	**Dying in Airplane Accident** 1:354,319	**Dying From Self Harm** 1:9,380	**Getting a Hole in One** 1:5,000
Dying from Car Accident 1:18,585	**Dying in an Explosion** 1:107,787	**Earth Asteroid Collision Within 100 Years** 1:5,000	**Dying from Exposure to Forces of Nature** 1:225,107	**Dying From Food Poisoning** 1:3,000,000	**Being an Astronaut** 1:13,200,000
Dying from Venomous Animal 1:3,441,325	**Having a Stroke** 1:6	**Getting a Flat Tyre** 1:5 / Year	**God Existing** 2:3 (Calculated by a Scientist)	**Dying from Heart Disease** 1:3	**Solar Flare (Carrington Sized)** 1:8,3 / 10 Years
Being Assaulted 1:60 / Year	**Being In A Car Accident** 1:18 / Year	**Car Broken Into/Stolen** 1:150 / Year	**Assaulted with Weapon** 1:277 / Year	**Getting Mugged** 1:500 / Year	**A Household Fire** 1:5 / Year
Getting Breast Cancer 1:9	**House Burglary** 1:38 / Year	**Developing Cancer** 1:2	**Dying in a Cataclysmic Storm** 1:27,925	**Dying Choking on Food** 1:2,482	**Dying from Wasp/Bee Stings** 1:46,744

Preparedness Levels

This is a classification of all preppers and gives a general idea of how prepared they are, what skills are known and their commitment to prepping. A lot of assumptions are made such as the amount of space the person has and that they have a job.

Level 0 (Sheeple)	Technically a prepper, but someone who doesn't participate in disaster preparedness at all. These are just ordinary people living their lives. At most they have three days of food in the pantry for power outages or strong storms.	• 0-3 Days Food & Water • No BOB & Supplies • No Preparedness Experience • 95-100% Grid Reliance
Level 1 (Wannabe Prepper)	A person who has been impacted by a disaster, TV series or other media and thought prepping is a good idea and they decide to take a few minor steps and stock a few extra items. At this stage they either fall away from prepping or pursue more information. Generally this stage is about reading, watching and understanding what preparedness is.	• 0-7 Days Food & Water • No BOB & Supplies • No Preparedness Experience • 95-100% Grid Reliance
Level 2 (Beginner Prepper)	Someone who has a weeks or so worth of food, a BOB and some action plans for disasters. People at this level are starting to get serious and often just buy, buy, buy to fill their BOB and pantry.	• 7-14 Days Food & Water • Limited BOB & Supplies • Little Preparedness Experience • 85% Grid Reliance
Level 3 (Prepper)	This type of person is becoming quite invested in being prepared for disasters with a BOB, skills and knowledge in survivalism and a month to 4 months worth of food and water per person. Usually people at this stage overfill their BOBs and generally have some simple plans for bugging out.	• 1-4 Months Food & Water • Decent BOB & Supplies • Little Preparedness Experience • 70% Grid Reliance
Level 4 (Confident Prepper)	This stage marks an increase in food and water again to around 6 months per person and they are looking into alternative bug out plans and may have a vehicle for it. They look at items critically and only keep what they need. People usually start to spread out into alternative bags such as INCH bags and GH bags. These people spend a lot of their free time preparing.	• 2-6 Months Food & Water • Decent BOB & Supplies • Decent Preparedness Experience • 60% Grid Reliance
Level 5 (Hardcore Prepper)	Preppers at level 5 have usually branched out into a working prepper pantry where they use the items they are stocking and replenish every week, have a complete lightweight BOB and extensive plans for bugging out in multiple types of disasters. They still have a job but spend most of their free time preparing.	• 3-8 Months Food & Water • Professional BOB & Supplies • Adept Preparedness Experience • 35% Grid Reliance
Level 6 (Devoted Prepper)	These people spend almost all of their free time prepping and have extensive knowledge about most aspects of preparedness. They have a stockpile of food and water from 6m-1y per person and are slowly consuming it and adding to it. They may have a plot of land and a building for a BOL stocked with some food but they definitely have multiple plans to GOOD in a SHTF situation.	• 6 Months to Infinite Food & Water • Exceptional BOB & Supplies • Expert Preparedness Experience • 0-15% Grid Reliance
Level 7 (Doomsday Prepper)	An extremely prepared person who devotes every waking second to prepping, they often have a job related to prepping or have quit their job to pursue it full time. They have many years worth of food per person, vast amounts of experience and often have bunkers or BOLs filled with supplies and often have family drills for SHTF situations.	• Infinite Food & Water • Flawless BOB & Supplies • Master Preparedness Experience • 0-5% Grid Reliance

Types of Preppers

These are the different classes of preppers you may encounter on your preparedness journey. You may fit into one class perfectly or be split up over a few different ones to help shore up some of the weaknesses. Some you want to avoid and others you should aspire to, but they all have their advantages and disadvantages.

The Sheeple (Non-Prepper)	A person who doesn't prep but can be considered a prepper at level 0. They believe that no large scale disasters will happen to them and that electricity, food and water will generally always be available on demand.	**Pros** • Less worry and stress • They save a ton of money • A swift death	**Cons** • Thirst/Hunger • Limited skills, knowledge & gear • Potential death during disasters • May have to join a gang to survive in times of complete disaster
The Hoarder	A prepper who simply stockpiles supplies such as weapons, food and water, neglecting most other things.	**Pros** • Tons of supplies • Ability to share their supplies with others • May be able to barter their supplies	**Cons** • Requires constant stockpile rotation • Limited skills • Limited knowledge • A theft target • Costly
The Accidental Prepper	People with a natural tendency to be prepared such as INTJs and related personality types. They often prep short term and for multiple scenarios without realizing it.	**Pros** • Wise in general • Prudent thinkers and planners • 'Accidentally' ready for disaster	**Cons** • Not prepared for long term disasters • Not prepared for 'rare' disasters • Limited, or no bug-out plans
The Typical Prepper	Someone with a BOB, a Bug out Plan, a stockpile for a few months and home defences. They watch other preppers online, buy useful preps and take actions to shore up their preparedness skills.	**Pros** • Solid baseline for preppers • Knowledge of a lot of preparedness skills • Keen interest in survival	**Cons** • Still a way to go to learn all the essential skills required • May suffer from prepper burnout after realizing they are only beginning • May lose interest in prepping • May find it hard to spend money on prepping vs entertainment items

The Survivalist	These preppers have honed bushcraft skills and can live off the land if the situation calls for it. They can find wild edibles, craft shelters and purify water with only what they have around them. They are often solo but this helps to greatly increase their stealth and speed up their journey.	**Pros** ● Can survive in the woods ● Plant/Animal Identification ● Medicinal plant experience ● Natural plant remedies ● Stealthy when solo	**Cons** ● Loneliness ● No stocks of food ● Plans to only bug out ● No comforts of home ● May not survive in a widespread, nature killing disaster
The Homesteader	They own a house, land and usually a farming plot and animals for self sufficiency. They are self sustainable and can grow, manufacture and recycle what they need at home.	**Pros** ● General homestead skills ● Surrounded by family ● Can save money ● Self sufficient ● Not dependant on civilization ● Ample storage space ● Can produce what they require	**Cons** ● Costly to set up ● Large area of land to protect ● Hard work to maintain ● Not inclined to bug out ● Crops can easily be stolen/destroyed ● Cold winters can eradicate their food source ● May not have access to news
The Self-Defence Prepper	In good shape, knows hand to hand combat and is concerned about smaller daily disasters. They have, or are in the armed forces and have military experience.	**Pros** ● Very fit ● Can protect themselves ● Great at stealth ● Great at teamwork ● Knowledgeable about combat	**Cons** ● Lacks preps and stockpiles ● Weak against guns ● May not trust others
The Minimalist	They keep their stockpile to a minimum and focuses on skills to further reduce the weight of their pack. They may drill holes in their toothbrush…	**Pros** ● Spends less money on fewer items ● Great skills ● Light and fast travel ● Knowledge replaces gear ● Can leave their old life easily	**Cons** ● Spends MUCH more money on ultralightweight gear ● Lack of gear when bugging-in ● May spend a lot of money on their quest for knowledge
The Know-It-All	Gains knowledge about prepping but doesn't do much to actually prepare. They can spend hours watching YouTube videos getting ideas but rarely puts any of them into action.	**Pros** ● Good knowledge on prepping ● Can lead others ● Can assist others	**Cons** ● Unprepared ● Few items ● Needs real world experience
The Economist	Focused on protecting their wealth via precious metals and stockpiles for barter in SHTF. They may also aim to profit from a disaster by bartering essentials for precious metals to sell afterwards.	**Pros** ● Can barter what they need if SHTF without stocking up on anything ● Only have to worry about stocking up on one type of resource.	**Cons** ● Neglects other preparedness areas such as knowledge and skills ● They rely on the fact that metals and tradables can be used as money and that people will be honourable
The Doomsday Prepper	Prepared for a complete global collapse for an extended period of time. They are often armed to the teeth and occasionally have a heavily fortified castle, bunker or BOL.	**Pros** ● Prepared for anything ● Comprehensive bug out plans ● Huge stockpiles ● Lots of time to prep ● Rehearses often ● Completely off-grid	**Cons** ● Costs an absolute fortune ● Often seen as paranoid ● Ridiculed ● Fixated on prepping and not enjoying life ● May quit their job to prep
The Tactical Prepper	Sees the world from a tactical perspective. They have likely been in the army and have planned very carefully for disasters and an attack on their home. They acquire a lot of tactical preps and focus on defence and stealth.	**Pros** ● Good defence from technology ● Has detailed Topographic maps and other military equipment ● Tactical Gear ● Can survive harsh environments ● Has some survival knowledge	**Cons** ● May be too tactical ● May not trust people
The Religious Prepper	Committed to their religion and often focuses on religious disasters such as the rapture and armageddon. They generally have goodwill to everyone else and will assist others in need.	**Pros** ● Community and shared beliefs ● Cares for others ● May share resources ● Won't take the lives of others ● Excellent sense of community	**Cons** ● Narrow view of potential disasters ● May be taken advantage of due to their goodwill ● May run out of supplies quickly
The Gun Enthusiast	A prepper who focuses on guns and weapons training. They have multiple guns and explosives and a variety of other weapons stockpiled. Generally they will stay and defend their land at all costs.	**Pros** ● Great gun skills ● Has a ton of ammo stockpiled ● Great marksmanship ● Advanced tactics ● May be able to make their own ammo	**Cons** ● Often ignores other skills ● May become looters when they run out of supplies ● May kill others unnecessarily
The Getaway Prepper	A prepper who will leave their usual home in the face of any danger. They have a BOL with extensive detailed plans to reach it no matter the scenario. A BOV is at the ready at all times.	**Pros** ● Always ready if they need to bug out ● Usually physically fit ● Not attached to physical possessions	**Cons** ● BOL may be looted or destroyed ● Bug in may be more beneficial ● Few supplies at home ● Weather may not permit leaving home

PREPAREDNESS Prepping Introduction Types of Preppers

The Defensive Prepper	Believes in defending their home and has taken the necessary steps to stay inside no matter what type of disaster they may face.	**Pros** ● Extensive stockpiles ● Plenty of weapons for defence ● They know their surroundings well ● They can set up strong home defences and booby traps	**Cons** ● May not have a BOL ● Possible death if the disaster is heading towards them ● No supplies if they are forced to leave ● Expensive to prep for a hurricane
The Fearful Prepper	A prepper who expects something bad to happen every day and sees the negative in the world. They check the news daily or hourly. They could possibly be into conspiracy theories.	**Pros** ● Keeps an eye out on the news ● First to know any breaking news and therefore can bug out quickly ● Can see the driving forces behind the world	**Cons** ● Puts life on hold to prep and doesn't plan for a regular life ● Always worried about disaster or embraces it and wants it to happen ● Can't see the good in the world
The Compassionate Prepper	A person who preps for the good of mankind, stocking up on knowledge, resources and skills solely to help others in disasters.	**Pros** ● Shares resources ● Helps those in need ● Builds great relationships ● Often great leaders	**Cons** ● May be taken advantage of ● May run out of resources quickly ● May be attacked or mugged

PREPAREDNESS Prepping Introduction Prepping

Prepping Deficiencies

PREPAREDNESS Prepping Introduction Prepping Deficiencies

Becoming a complacent prepper is one of the pitfalls of prepping. The following will discuss a few reasons we can become complacent and how to prevent them.

No Urgency	When things are going well we may tend to overlook the fact that anything bad could ever happen to us. We just have to turn on the news to see how much of a delusion this could be, especially today. Just because things are going well in your corner of the globe doesn't mean the violence on the other side can't affect us.
Expecting Disaster	A lot of preppers are so ready and expectant for a disaster to occur that they actively want one to happen in the back of their mind so they can finally use their preps. They spend so long researching disasters and looking at the worst of humanity that they forget to enjoy life and have fun while the going is easy. Don't forget to take time and enjoy the world around you while it's intact.
Ebb and Flow	There's a natural cycle between hard times and times when a disaster is the last thing on your mind. Sometimes we have to look past the best times and keep on prepping, as well as not becoming fearful if the worst looks like it will happen.
Attention to Detail	Always keep in mind the big picture as well as the small things such as remembering to have breakfast. You won't be very effective without keeping yourself running smoothly. In a similar way keep checking the basics of preparedness to ensure you aren't missing a critical area, or forgot you borrowed your gas stove when camping and forgot to put it back.
Self Interest	Preppers can get so caught up preparing for themselves and their family that they forget there will be a lot of other people such as friends and family who won't be prepared in a disaster. When one does strike, these people will be looking to anyone and everyone on how to proceed in these tough situations. Without any assistance they may have to resort to theft and violence to be able to stay alive which is the last thing you need from your neighbours and friends. Besides preparing for ourselves we should think about putting together a small collection of gear for our neighbours, friends and family. Not only will this help ease their survival situation, but it could turn a potential threat in a disaster into an ally. You could include long life food, water purification equipment, a torch with spare batteries or candles, some firelighters, a radio, a Bible as well as a few survival guides both on a USB or physically printed. You don't even have to make contact with them on your way to bug-out, just drop it off at their door, ring their doorbell and then bug-out.
The Easy Life	We've had such an easy life compared to the other periods of time and regions where nearly everyone sees death, violence and theft daily. Very few of us have lived through a world war or any war for that matter and with other countries boosting their arsenal we should stop being complacent and prepare like these events will happen. Although America is beginning to wake up from this easy-going lifestyle lately with a potential downfall of their entire constitution in the future.
Crying Wolf	Often we're sure a collapse is imminent or it looks like a disastrous cyclone is heading right for you but then dissipates before anything happening. After these events we can often question our preps and ask ourselves "Is this really necessary?". We should always remain steadfast in prepping and can't change our minds because of false warnings. But when you've let your guard down is potentially when disaster could happen, and then you would wish you never did.
Local Disasters	We often focus on the large scale world-changing disasters and end-times scenarios but tend to focus less on the common local disasters such as job loss, financial difficulty or the loss of a family member. We can't lose sight of preparing for the smaller things life can throw at us when we tend to only focus on the large scale disasters.
Situational Awareness	Throughout our often mundane lives are fixed patterns of repeated actions which we often automate because we do them so often. This generally happens at work when we have fixed tasks to complete over and over again and sometimes we take these actions home with us. We often don't pay attention to our surroundings during these times as it's a normal, dull day, but keeping an active mind will ensure our situational awareness is always active and alert for any trouble coming our way.
Health	We can easily become complacent about our health which may slip out of our control when we aren't taking note of what we're putting into our bodies or how much exercise we're getting. This will definitely affect our ability to survive in SHTF when the time does arise, and a person with poor health will be a risk to their prepping group and themselves.
Overconfidence	When you're sitting on a mountain of preps, months of food and enough guns to arm a small country. You may feel the need to sit back and survey the mighty empire you've constructed and become overconfident with your prepping. You may think you know it all, but I can guarantee there's always more you can learn and more research to undertake to improve your skills. Often the more you learn about preparedness the more your BOB changes. Don't let your number of possessions halt your prepping or your desire to learn.

Normalcy Bias

The normalcy bias is a mental condition which individuals experience when facing a disaster. It causes people to become vulnerable to approaching danger as they underestimate both the possibility of a disaster and its potentially dangerous impact. This often results in situations where people fail to prepare for a disaster, and that failure can be catastrophic on a state or national scale. It is a mental condition that convinces a person that since it has never happened before, it can't happen. Or "it won't happen to me." After all, this is America. We are special; however, we are not immune from natural or manmade disasters.

These are statements made those blinded by normalcy bias:
- "But that could never happen to us."
- "But, it can't last forever.
- "Well, government officials will never let it get so bad that we run out of food and water."

When God warned Noah that bad weather was coming and the earth would be inundated, he followed God's instructions that involved long term planning. And many years of hard work. He was ready when the rain began. While a global flood had never happened before, Noah thought it best to prepare for it. The normalcy bias killed everyone but Noah and his family.

There are four deadly stages of denial:
1. It won't happen.
2. If it does happen, it won't happen to me.
3. If it does happen to me, it won't be that bad.
4. If it does happen to me, and it's bad, there's nothing I can do to stop it anyway.

Are you living in normalcy bias that could end up killing you or your family? It is better to prepare and not need it than to not prepare and need it. Hope is not a plan and the state of the world will sooner or later wake you up from any optimism or wishful thinking you may be having.

Prepper Burnout

The following are signs of prepper burnout. Prepper burnout is the becoming frustrated, tired or wanting to give up prepping for various reasons.

Sign 1	They only read pessimistic new articles and ignore an encouraging outlook.
Sign 2	They don't see the beauty or pleasure in daily life, being focused on the end.
Sign 3	They spend all their money on securing goods and nothing for themselves or their entertainment.
Sign 4	They visit preparedness websites daily which can slowly reduce their optimism and outlook.

These are some simple ideas on how you can fix prepper burnout if you see it occurring.

Resolution 1	Realize that the world ending tomorrow is possible but not very likely.
Resolution 2	View prepping as a hobby and the skills you gain through it. Hobbies should be worked on in your free time and generally aren't thought about every second of every day.
Resolution 3	Find a healthy balance between prepping and enjoying life.
Resolution 4	Focus on buying food and gear you will use in daily life and which won't be just stored on a shelf.
Resolution 5	Take a break and focus on other activities or a skill that has links to prepping such as archery.

2 Prepping Basics

Prepping categories are the areas of preparedness that every prepper should embrace and have a plan for such as shelter, fire, food, fitness, medical, skills etc. This section outlines the basic supplies you'll need, how to best use them and how many you need to stock up on. For more information on any of the sections mentioned below, see the corresponding section(s).

Water Preparedness

Water is one of the most vital preps you can have due to the human body being unable to survive longer than 3 days without water. There are a few types of water shortages in disasters which are: Polluted water, low pressure and no water. Low pressure water may be able to be used for a short time before it stops coming out all together, but the others should never be used. For more information on water, water collection and water storage, see the WATER section.

What Type?
For bugging in you will want to store either pre-bottled water or tap water which has been treated to extend its storage life. For bugging out assuming you will have access to water on the route - you should bring a water filter and a backup, plus twice as much water as you think you will need for reaching your destination if there's no water along the way.

How Much?
Water is used for a wide range of applications like drinking, bathing, washing dishes and making meals. There isn't a magic number that you can reach where your water needs are sorted because everyone's situation is different. Take into account the availability of water around your area because you may be able to utilize it. Depending on the situation you may want water for flushing down the toilet if the taps aren't working. The average person uses about 50L of water per day if they have conservation in mind, so extrapolate and work out how much you will need for your party, adding about 15% just in case. For extended disasters you will want a good quality water filter which is sized on your parties size.

Water Requirements
- Number of People
- Age of People
- Bathing Needs
- Washing Req's

Food Preparedness

Besides water, food is another essential for surviving long periods of time. Be sure you have more than you think you'll need. Depending if you're planning on bugging in or out determines what type of food you should pack. The lightest foods such as freeze-dried ones are best for backpacking while canned foods are easier to prepare but weigh much more. Packaged foods have wastage which can be compressed down to a tiny size whereas cans are metal and will still take a fair amount of space after consumption.

You won't know what type of disaster is likely to hit you so you should be prepared with enough food to last at least a month. You could also grow your own food if you have the skills and space to do so. You will also need to keep your plants safe from desperate people and animals. For additional information about foods and food types see the FOOD section.

Shelter Preparedness

You're likely to only last about 3 hours in extreme weather, but having a shelter can shield you from the worst of it. To learn more about shelters and constructing shelters see the SHELTER section.

Household Preparedness	Your house is the strongest shelter you're likely to have, unless you own a bunker. You can make fortifications to it during a SHTF situation to boost your defence. Houses however stick out fairly well if they aren't in a suburb and can't often be camouflaged to prevent being a target for thieves, gangs etc.
Bug Out Shelters	Having a bug-out shelter can give you a huge boost over having to create your own from logs and leaves in an emergency situation. Modern tents or bivys are fast to set up, can be camouflaged and best of all can be dismantled quickly if there are threats in the area. Choose a correct shelter which is situational for your environment such as a four-season tent if you have large snowfalls or one with a lot of ventilation if it's a humid climate.

Fire Preparedness

Fire can be a lifesaver in many situations, but particularly in cold environments. Knowing how to start fires from the gear you have available and the resources around you is a vital skill you need for bugging out. Fire is essential for outdoor survival and if you would like to learn more see the FIRE section.

Fire Lighting	Having a variety of fire lighting tools and knowing how they work should be one of the first skills you learn. Understanding what a ferrorod and match can and can't light will assist in lighting fires. For example you can't light paper with a piezo ignition system, but gas is easily lit by it.
Tinders	Knowing what tinders are best for your chosen lighting method are basic skills needed for lighting fires.
Extinguishing Fires	Extinguishing fires is just as important as lighting them just in case they get out of hand because starting a forest fire will only worsen the current disaster.

Self Defence Preparedness

Protecting yourself and your family from being robbed is another essential skill because you'll basically be a walking Wal-Mart if you bug out on foot. Know how to wield, use and reload offensive and defensive weapons to help protect yourself and your gear. Self Defence is vital in a SHTF situation. For more information see the OFFENCE, DEFENCE and WEAPONS sections.

Non Lethal	Knowing how to protect yourself without lethal force can be situationally useful if you wish to only escape. Each life is precious no matter their past and what they may be currently doing, so knowing when to take a life or spare one is vital.
Lethal	Lethal force is necessary sometimes to protect yourself and your family from those who wish you harm. They may be wanting to kill you and take your gear or simply kill you for the fun of it, so you should know how to handle a gun if your country allows them. Taking a life can be hard on anyone so be sure you are making the right decision for your safety.
Defence Plans	Defence ranges from fortifications to your house, personal defence while hiking and even defence against mosquitos and snakes. Know what to do in each of the situations beforehand or you may be likely to make a mistake which could cost you dearly.

Medical Preparedness

There is likely going to be some injuries during any type of disaster and medical skills can go a long way to help save your life. For more information on medicine, illnesses and injuries see the corresponding MEDICAL section.

Medical Knowledge	Have at least a basic understanding of medical practices such as CPR, administering bandages and first aid. Ensure a few party members understand and can perform basic medical procedures in case the "physician" of your party is the one sick.
Medical Skills	Having medical skills and prior experience can be a life-saver. There's little use having knowledge without having put that knowledge to good use. Practise bandaging people, administering IVs, injecting epinephrine and wrapping triangular slings.
Medical Supplies	Put together a medical kit for a range of injuries and illnesses and keep tabs of when they all expire - replacing them when you need to. If a medical utensil or bandage is set to expire soon use it for your own personal learning experience and put it on yourself so you know how it works (if it's safe to do so). Applies to items such as Israeli bandages which may seem quite tricky to apply when in a real bleeding situation.
Medication	Medication will be hard to find in a SHTF situation so be sure to stock up constantly as they expire. Keep track of what you bought, how much and when they expire so you can replace them soon before. They should be stored correctly in a temperature controlled environment and should be kept away from heat, light and air.

Skills & Knowledge

It's no good to have to rely on a spreadsheet when you're actually faced with a disaster. This is where knowledge and practise comes in handy. For a list of skills and descriptions one should possess prior to SHTF, see the SKILLS section.

Know Your Gear	Learn and play with your gear BEFORE the need to use it arises. You should be proficient in every piece of your kit and know the perks and problems of each item. Without learning about your gear you may have a faulty item and it could break the first time you try to use it in a survival situation.
Hone Your Skills	You may already understand how to use an item, but when you push it's capabilities is when you really come to grips with what it can do. Have you tried using your gas canister in freezing temperatures? You may find it stops working until you warm it up. Choose a piece of gear per week and put it through its paces; for example a knife - the most crucial piece of kit. Use it to baton logs, chop trees, whittle, cut paracord, strike flint, gut meat etc. You will learn very quickly what it can and can't do. Get out into the wild - or your backyard when you can and get to know the ins and outs of everything in your BOB - from the compass to the gas stove.

Plans

You should have unique plans for almost any type of disaster that could come your way, from hurricanes to airborne viruses and even a UFO invasion. For additional information on stealth, tactics, camouflage, stealth camping and more, see the SECURITY section.

Bug Out Plans	A physical plan of what routes and actions you will take in a disaster where bugging out is your best option. Without such as plan you might as well be unprepared and will be caught off-guard and cut off from help. Street plans and maps, backup plans, bottleneck points, high population areas etc.
Bug In Plans	Just because you're bugging in during a certain disaster doesn't mean you don't need a plan. You aren't likely to be home when a disaster happens so the first step is to write a plan to get you and your family safely back home. You then need to secure your house from whatever disaster may be approaching such as blocking all vents and airflow if it's a pandemic or boarding up the windows and taping the glass if it's a hurricane.
Contingency Plans	It's extremely likely you will come across challenges and obstacles during disasters so be sure to have backup plans. What if the roads are blocked and you can't drive home from work during the start of a major disaster? What if a family member is in hospital when riots break out and moving them may kill them?
Situational Awareness	Knowing what's happening around you at all times isn't just a fictional Jason Bourne skill. You should train your mind to always know the exits, be able to read body language, interpret signs and see danger before it occurs. You should also know what's going on in the world at all times so you can be ahead of the curve when large scale or man-made disasters approach.

Physical Preparedness

You should be physically prepared at all times in case you're required to bug out over long distances at short notice, particularly if you have to escape on foot.

Physical Stress	During a bug out your body will often be pushed to its limits - especially if you're on foot and have a bag packed to the brim of gear. Know your limits prior to a disaster and try to strength your body by getting accustomed to your bug out route and the weight of your pack.
Change Stress	If you're used to a familiar routine it will certainly be a shock if you have to drop that life and bug in or out, even if you have ample supplies. This occurs particularly if you have a desk job and a fairly sedentary life which will make it tough to adapt to the requirements of long distance hiking.
Sleep Stress	Your body will be used to waking up at a certain time and getting a good amount of sleep per night. However you may need to stay up all night peeking out the window to ensure your continued survival. To minimize the impact it could have on your sleep try to keep as much of your old sleeping patterns as you can, setting night watches can help you sleep more securely. You could change your sleeping routine entirely such as sleeping during the day while you have the night watch, that way there will be people awake at all times of the day. The LEADERSHIP section has more tips on night watches.

Mental Preparedness

It's not enough to simply be materialistically or physically prepared but mentally prepared for anything that may happen.

Change Fatigue	You may still be in a pre-disaster state of mind and have to adapt to a changed way of thinking when the worst happens. The mind will have to go from a "Safe" state to a "Warning" state due to the increase of unpredictability of people during any disaster.
Entertainment Preparedness	If you're stuck in the same location for weeks or months at a time you will need something to keep your mind entertained. If you're bored I recommend taking a look at the ENTERTAINMENT section in this guide.
Kids Stress	Having kids is stressful enough but they could become unbearable if cooped up in a room for weeks at a time so being prepared kid-wise is vital. Have some entertainment for them like games, cards, books or handheld digital devices.
Emotional Preparedness	There's bound to be uncertainty in your mind during any form of disaster which is affecting or could affect your family. Be sure to have - and to stick with your bug in/out plan and act on it before things get worse. During the disaster you could lose a close friend or family member which will make it extremely tough to maintain emotional stability over this period. Your decision making may decline substantially and could cause you to have an accident - further risking lives.

Information Preparedness

Information preparedness is a collection of documentation, certificates, passports, maps, bug-in/out plans and guides like TPE all stored in one easily accessible location or USB for quick retrieval. You absolutely don't want to have to go looking for your passport at the last minute if you don't know where it is. Some people don't want to let the past go and will often want to keep memorabilia such as family photos. It's better to scan these and have them on a USB stick already in your BOB rather than having too many physical photos or grabbing them on the way out the door. See the "Important Documents" section under GEAR for more information.

Spiritual Preparedness

What's the point of prepping for survival if you're eventually going to die one day anyway? Chances are, you're probably going to be facing some tough disasters and other trials throughout life, so you need to stand firm in your faith because you may not survive the next disaster. How certain are you that there IS, or ISN'T something after this life?

Religion often is a vital aspect of what makes us who we are, so hold firm in your faith and pack a small Bible, cross or other item which will help you in any disaster. If you haven't thought much about religion but are interested and wondering if there is a God, take a look at the RELIGION section.

Spiritual Items
- Bible
- Cross
- Digital Bible
- Traditional Food
- Pendant/Necklace

3 Prepping Goals

These are preparedness goals of various types to help you start out on your preparedness journey. The aim is to get you off the ground and more prepared every week for an entire year. A Year till a Year. That's what this preparedness plan will help you achieve. This means that after a year after starting this plan, you will have enough resources, skills and knowledge to survive a whole year (for one person) if the worst does happen. Of course, if you have the time and money or other people you are prepping for, you could double or triple the recommendations in this guide to reach your goals quicker, or set additional goals you would like to achieve.

Each week has a theme and goals for Gear, Knowledge and Skills. It's assumed you start at week 1 with no prepping knowledge whatsoever. This section could also be used as a 'recommended reading' guide for TPE as it refers to every other section. The words in capitals refer to the categories throughout this guide. Not all the purchases below should go into the Bug-Out Bag (BOB), some (such as bulk amounts of batteries) should be stored in the house for future use.

Preparedness Goals Month 1

Week 1 Focus: Water Filter	Week 2 Focus: Food Stores	Week 3 Focus: Backpack	Week 4 Focus: Planning
Gear ☐ Buy a water filter (e.g. Sawyer Mini) ☐ Buy a cheap headlamp & btty's ☐ Buy 3-4 canned meals next shop. ☐ Buy a 20L/5gal+ water container. ☐ Buy a crate of water bottles	**Gear** ☐ Buy 10-12 canned meals ☐ Buy another 20L/5gal+ water jug ☐ Buy a portable stove & gas ☐ Buy a mini camping pot for the stove to cook your canned food	**Gear** ☐ Buy the SAS Survival Handbook ☐ Buy 6 canned meals ☐ Buy a backpack to put your gear ☐ Go through the BOB list in GEAR and buy <u>cheap</u> items from each category to stock it with. (<$5-10ea)	**Gear** ☐ Buy a USB for prepping. Ideally one that can plug into a phone and a PC (double-ended). Search 'Fluidicice Prep Drive'. ☐ Buy 6 canned meals ☐ Add clothes to your BOB
Knowledge ☐ Read the INTRODUCTION ☐ Read the WATER category ☐ Start a list of all your gear and update it every week.	**Knowledge** ☐ Read through PREPAREDNESS ☐ Read the FOOD category ☐ Research your region's highest disaster risks & make a list of them.	**Knowledge** ☐ Read through the SAS Handbook ☐ Read through the GEAR section. ☐ Create a list of the gear in your BOB & keep it updated	**Knowledge** ☐ Download emergency information, documents and PDF's for your local area & put on USB. ☐ Find your local emergency no's
Skills ☐ Set up your water filter. ☐ Test your water filter at home. ☐ Test your water filter outside. ☐ Fill the water container.	**Skills** ☐ Write the purchase date on all your cans from this point on. ☐ Fill the water container. ☐ Cook up a canned meal on your stove.	**Skills** ☐ Create your personalised disaster plans in the PREPAREDNESS > Disaster Preparedness section ☐ Discuss the plans with the family ☐ Practise with the gear your bought	**Skills** ☐ Make a list of your valuables to grab during bugging-out. ☐ Print copies of your important documents and store in your BOB. ☐ Put your important documents on a 'prepping' USB.
Prep Tracker Water: 2 Days & 3 Years Filtered Food: 1 Day	**Prep Tracker** Water: 3 Days & 3 Years Filtered Food: 5 Days	**Prep Tracker** Water: 3 Days & 3 Years Filtered Food: 7 Days	**Prep Tracker** Water: 3 Days & 3 Years Filtered Food: 9 Days

Preparedness Goals Month 2

Week 5 Focus: Shelter	Week 6 Focus: Communication	Week 7 Focus: First Aid	Week 8 Focus: Get Home Bag
Gear ☐ Buy a tent ☐ Buy a mattress ☐ Buy a sleeping bag ☐ Buy a tarp ☐ Buy 2x 20L/5gal+ water containers ☐ Buy 6 canned meals	**Gear** ☐ Buy a portable AM/FM radio ☐ Buy a CB radio (2 is preferred) ☐ Buy a loud whistle ☐ Buy a signalling mirror ☐ Buy 6 canned meals	**Gear** ☐ Buy or build a basic first aid kit ☐ Buy bulk OTC medications. (Aspirin, Paracet, Imodium, Ibuprof) ☐ Buy "The Survival Medicine Handbook" ☐ Buy 6 canned meals	**Gear** ☐ Buy a small Get Home backpack ☐ Go through the GH list in GEAR and buy <u>cheap</u> items from each category to stock it with. (<$5-10ea) ☐ Buy 6 canned meals ☐ Buy another 20L/5gal+ water jug
Knowledge ☐ Read the SHELTER section ☐ Learn the different types of tents ☐ Learn about the different types of mattresses and sleeping bags	**Knowledge** ☐ Learn how to use the AM/FM radio's advanced features ☐ Learn how to use the CB radio(s) ☐ Read the COMMUNICATION sect.	**Knowledge** ☐ Learn CPR and DRSABCD. ☐ Read through "The Survival Medicine Handbook". ☐ Learn the items in your medic kit.	**Knowledge** ☐ Learn what a Get Home bag is and how you can best stock it with the items you need most. ☐ Read the Get Home GEAR list
Skills ☐ Set up your tent in the backyard twice. See how fast you can do it. ☐ Go camping at a nearby site for a night to test the gear. ☐ List what items you needed and ones you didn't use at all.	**Skills** ☐ Learn how to use the radio's advanced features ☐ Learn how to use the CB radio ☐ Use the mirror and whistle to communicate to a friend.	**Skills** ☐ Take a CPR course. ☐ Try using some of the items in your First Aid kit. ☐ Practise bandaging and treating various ailments.	**Skills** ☐ Try all the gear in your Get Home kit so you know how it all works. ☐ Try walking for an hour with your bag and see if it's light enough. ☐ Work out your routes home.
Prep Tracker Water: 5 Days & 3 Years Filtered Food: 11 Days	**Prep Tracker** Water: 5 Days & 3 Years Filtered Food: 13 Days	**Prep Tracker** Water: 5 Days & 3 Years Filtered Food: 15 Days	**Prep Tracker** Water: 6 Days & 6 Years Filtered Food: 17 Days

Preparedness Goals Month 3

Week 9 Focus: Electrical	**Week 10** Focus: Self-Defence	**Week 11** Focus: Food Preservation	**Week 12** Focus: Fitness
Gear ☐ Buy a quality & bright torch ☐ Buy lots of batteries for the torch ☐ Buy a solar blanket/mat with USBs ☐ Buy a power bank for your phone ☐ Buy 6 canned meals	**Gear** ☐ Purchase a way to defend yourself. (Gun, Bow, Sword, Taser, Bear Spray & Ammo for it) ☐ Buy 6 canned meals	**Gear** ☐ Buy the equipment needed in the skills section to preserve 7 days worth of food. Mylar bagging rice and beans is fairly cheap and easy. ☐ Buy another 20L/5gal+ water jug	**Gear** ☐ Buy some gear that will help you get into your chosen activity, but avoid activities that are costly to get into. You're only getting a feel for it and may swap to another activity if you hate the first one.
Knowledge ☐ Read the ELECTRICITY section. ☐ Learn how to use your solar blanket. ☐ Learn how to use the power bank	**Knowledge** ☐ Learn about your weapon, how to safely use it, dissasamble it and maintain it properly. ☐ Read through OFFENCE	**Knowledge** ☐ Read through the FOOD PRESERVATION section ☐ Thoroughly research the method.	**Knowledge** ☐ Read the HEALTH section.
Skills ☐ Test the solar blanket and power bank together to create a device recharging system. Avoid getting the power bank too hot.	**Skills** ☐ Take an instructor led course on your weapon (if applicable). ☐ Practise/Train with your weapon. ☐ Safely practise with the unloaded weapon around the house/yard.	**Skills** ☐ Find a food preservation method you want to try (canning, drying, mylar bagging) ☐ Try your hand at preserving a weeks worth of food with your chosen method.	**Skills** ☐ Start and continue a weekly fitness regime like jogging, soccer, pilates, walking etc.
Prep Tracker Water: 6 Days & 6 Years Filtered Food: 19 Days	**Prep Tracker** Water: 6 Days & 6 Years Filtered Food: 21 Days	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 28 Days	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 28 Days Recurring: Fitness

Preparedness Goals Month 4

Week 13 Focus: Gardening	**Week 14** Focus: Protection	**Week 15** Focus: Hygiene	**Week 16** Focus: Stealth
Gear ☐ Buy the equipment, tools, seeds or seedlings needed to grow your chosen vegetable. ☐ Buy 6 canned meals ☐ Preserve another 7 days of food.	**Gear** ☐ Buy items that you can use to secure your home. (Window dowel, gate locks, security cameras, spotlights, fire extinguishers, door bolts, etc)	**Gear** ☐ Buy a camping toilet. ☐ Buy toilet paper or an alternative. ☐ Buy lots of bin bags. ☐ Buy cleaning supplies. ☐ Buy Calcium Hypochlorite (CH). ☐ Buy 6 canned meals	**Gear** ☐ Ensure you have 'Grey Man' clothes and backpack. ☐ Buy a faraday bag for your EDC digital devices. ☐ Buy 6 canned meals
Knowledge ☐ Choose a veg you want to grow and thoroughly research it. Microgreens are great to start with. ☐ Read the GARDENING section.	**Knowledge** ☐ Read the DEFENCE category. ☐ Create a home evacuation plan ☐ Watch videos on the channel "Active Self Protection".	**Knowledge** ☐ Research the best ways to deal with rubbish and toilet waste. ☐ Research CH as it is dangerous. ☐ Read the HYGIENE section.	**Knowledge** ☐ Read the SECURITY section. ☐ Learn how digital devices can be tracked by governments.
Skills ☐ Plant and maintain your veges daily and eat them if they are successful. ☐ Continue to research and improve on your growing technique.	**Skills** ☐ Learn situational awareness and avoid using your phone in public ☐ Learn a martial art if you have the ability and the funds.	**Skills** ☐ Find someone who is also getting started with prepping to aid your progress either locally or online. Don't share how many preps you have.	**Skills** ☐ Try camping stealthily (legally) with your BOB and avoid being detected, or start in your backyard. ☐ Make a list of items you used and those you didn't need.
Prep Tracker Water: 7 Days & 6 Years Filtered Food: 35 Days + Garden Recurring: Fitness, Garden	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 37 Days + Garden Recurring: Fitness, Garden	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 37 Days + Garden Recurring: Fitness, Garden	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 37 Days + Garden Recurring: Fitness, Garden

Preparedness Goals Month 5

Week 17 Focus: Teamwork	**Week 18** Focus: Medical Supplies	**Week 19** Focus: Fire	**Week 20** Focus: Construction
Gear ☐ Buy some cheap preps for giving to the neighbours during a disaster. (Headlamp & btty's, water, food) ☐ Buy a second water filter (better quality than the first if possible) ☐ Buy 6 canned meals	**Gear** ☐ Buy a bag for a large First Aid kit ☐ Buy the items to stock the First Aid kit, as per the book below. (Bandages, gauze, saline, tools, creams, prescribed meds, splints, ice packs, tape, pins, antiseptics)	**Gear** ☐ Buy a flint and steel (if you don't) ☐ Buy 20-100 BIC lighters ☐ Buy a portable camping stove and gas cans ☐ Buy 7 canned meals	**Gear** ☐ Buy a tarpaulin (if you don't) ☐ Buy some paracord ☐ Buy a WaterBOB but don't fill it unless you anticipate a disaster, or you don't need the bath.
Knowledge ☐ Get to know your neighbours & exchange numbers with them. ☐ Learn your local surroundings, paths, plants, shortcuts, buildings.	**Knowledge** ☐ Read through the 'Medical Supplies' section in "The Survival Medicine Handbook". ☐ Brush up on the rest of the book.	**Knowledge** ☐ Read the FIRE section ☐ Learn about the danger of fire ☐ Learn how to use fire extinguishers ☐ Learn about Carbon Monoxide	**Knowledge** ☐ Study various kinds of knots that can be used with shelters. ☐ Read the CRAFTING section
Skills ☐ Find someone who is also getting started with prepping to aid your progress either locally or online. Don't share how many preps you have.	**Skills** ☐ Try bandaging a family member ☐ Practise cleaning a wound ☐ Practise dealing with choking ☐ Practise making an arm sling ☐ Practise splinting a break ☐ Learn how to use a tourniquet.	**Skills** ☐ Try and create fire using three different methods of your choice. ☐ Try making fire with flint & steel ☐ Cook a canned meal on your gas stove (using one of your older cans)	**Skills** ☐ Craft a shelter of your choosing from sticks and a tarp and sleep the night in it. ☐ Try feathering a stick with a knife ☐ Start a fire and cook over the open flames.
Prep Tracker Water: 7 Days & 6 Years Filtered Food: 38 Days + Garden Recurring: Fitness, Garden	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 38 Days + Garden Recurring: Fitness, Garden	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 40 Days + Garden Recurring: Fitness, Garden	**Prep Tracker** Water: 7 Days & 6 Years Filtered Food: 40 Days + Garden Recurring: Fitness, Garden

Preparedness Goals Month 6

Week 21 Focus: Household Power	Week 22 Focus: Planning	Week 23 Focus:	Week 24 Focus:
Gear ☐ Buy a battery power station ☐	**Gear** ☐ ☐ ☐	**Gear** ☐ ☐ ☐ ☐	**Gear** ☐ ☐ ☐ ☐
Knowledge ☐ Learn how to use the power station and all its useful features ☐ Read the 'ELECTRICITY > Batteries' section	**Knowledge** ☐ ☐ ☐	**Knowledge** ☐ ☐ ☐	**Knowledge** ☐ ☐ ☐
Skills ☐ ☐ ☐ ☐	**Skills** ☐ Review the plans you made back in week 4 and update them based on your new knowledge ☐	**Skills** ☐ ☐ ☐ ☐	**Skills** ☐ ☐ ☐ ☐
Prep Tracker Water: Food:	**Prep Tracker** Water: Food:	**Prep Tracker** Water: Food:	**Prep Tracker** Water: Food:

Preparedness Goals Month 7

Preparedness Goals Month 8

Preparedness Goals Month 9

Preparedness Goals Month 10

Preparedness Goals Month 11

Preparedness Goals Month 12

Preparedness Goals Year 1

Week 49 Focus:	Week 50 Focus:	Week 51 Focus:	Week 52 Focus:
Gear ☐ ☐ ☐ ☐	**Gear** ☐ ☐ ☐ ☐	**Gear** ☐ ☐ ☐ ☐	**Gear** ☐ ☐ ☐ ☐
Knowledge ☐ ☐ ☐	**Knowledge** ☐ ☐ ☐	**Knowledge** ☐ ☐ ☐	**Knowledge** ☐ ☐ ☐
Skills ☐ ☐ ☐ ☐	**Skills** ☐ ☐ ☐ ☐	**Skills** ☐ ☐ ☐ ☐	**Skills** ☐ ☐ ☐ ☐
Prep Tracker Water: Food:	**Prep Tracker** Water: Food:	**Prep Tracker** Water: Food:	**Prep Tracker** Water: Food:

By now, you should be well prepared for any disaster that comes your way by combining your Gear, Knowledge and Skills that you have gained throughout this course.

4 Disaster Preparedness

These are templates for disaster-specific preparedness plans. Use them as a baseline to draw up your own plans based on your own circumstances.

Disaster Plan Template

This disaster plan is a blank template for you to fill in your own information. There are examples below if you want to see them filled out. The template can work for almost any disaster but will need to be modified slightly since some disasters have pre-warning and others occur instantly. I recommend you create disaster plans for the ones that occur most frequently in your area. Here is a list to help you get started:

Wildfire	Flood	Power Loss	Heatwave	Storm	Civil Unrest
Fuel Shortage	Drought	Hurricane / Cyclone	Resource Deficiency	Chemical Leak	Radiation Leak
Tsunami	Earthquake	Volcano	Landslide	Blizzard	Avalanche

Below are a also couple of tags which can be swapped out on different disasters based on their risk and damage.

The Disaster Chance:	No Chance	Low Chance	Med Chance	High Chance	Extr. Chance
The Disaster Damage:	No Damage	Low Damage	Mod Damage	High Damage	Extr. Damage

The start of the disaster plan template.

____________ Disaster Plan

DISASTERNAME	Situation:		
Icon	Disaster Plan For: Causes: Risk Season: Plan: Risks: Disaster Initiation: May Trigger:		
Chance Damage / Risk	Chance and Damage of this Event		
Disaster Severity	Level 1	Level 2	Level 3
At-Risk Groups:	• •	• •	
Preventative Measures:	•	•	
Pre-Disaster Maintenance (No Disaster Expected)	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐

Away From Home Plan

	_____ Watch in Effect	_____ Warning in Effect	_____ Evacuation in Effect
Away From Home (Action Plan)			

Shelter At Home Plan

Priority 1 (Imminent Evac)	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐
Priority 2 (Likely Evac)	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐
Priority 3 (Possible Evac)	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐
During the Disaster	• • •	• • •	• • •
Monitor News	• • •	• • •	
Shelter Evac Point	My Nearest Shelter Evacuation Point is: ________________________________		

Evacuation Plan

Evacuate When…	•

Aim			
Evacuate	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Location	1. Bug-Out Location 1 Ph: ☐ I will attempt to travel here	2. Bug-Out Location 2 Ph: ☐ I will attempt to travel here	3. Bug-Out Location 3 Ph: ☐ I will attempt to travel here
Routes	☐ Route 1 ☐ Route 2	☐ Route 1 ☐ Route 2	☐ Route 1 ☐ Route 2
Safety	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Route Hazards	• •	• •	• •
Route Blocked			

Plan Last Updated: 2024-09-23

This is the end of the disaster plan template.

Example Disaster Plans

This is a completed example of the disaster plan template above. The plan starts and ends where the red hashed background is. These documents are designed to be printed as a one-pager and be as simple to follow as possible.

Earthquake Disaster Plan Example

This is an example of an earthquake disaster plan. You will note that there are quite a few differences between this and the wildfire plan since they are fairly different natural disasters, but overall you should adjust the plan to suit your own needs.

Earthquake Disaster Plan

EARTHQUAKE	Situation: An earthquake which has caused damage to the building.
	Disaster Plan For: Brendale, BRISBANE, QLD
	Causes: Plate Movement, Solar Events, Large Explosions.
	Risk Season: No typical risk season but they may coincide with solar maximums.
	After-Plan: Shelter in place if the house is still sturdy.
	Disaster Risks: Falling Objects, Collapsing House, Landslides, Volcano, House Fires, No Water/Power/Sewage, Blocked Roads.
	Disaster Spontaneity: Instantly with little to no warning.
	May Trigger: Landslides, Avalanches, Volcanic Eruption, Power Outages, Water Outages, Gas Outages, House Fires, Food Shortages.
Low Chance High Damage	**Chance and Damage of this Event** Brisbane does not sit near any major plate boundaries therefore the chance is extremely low for an earthquake above magnitude 5. The destruction caused could potentially be devastating if a strong (mag 6+) earthquake strikes locally.

At-Risk Groups:	• The Elderly - They may not be able to take shelter. • Children - May not know what to do during an earthquake. • People with asthma - Due to the dust that would be disturbed.	• High-Rise Dwellers - Taller buildings are more at risk of falling. • City Dwellers - Lack of resources, taller buildings, more people.	
Preventative Measures:	• Bolted large pieces of furniture to the wall.	• The house has been reinforced against earthquakes	
Pre-Disaster Maintenance	☐ Secure loose items which could fall ☐ Protect glass preps from falling (Jars) ☐ Know the safest places in the house	☐ Ensure everyone knows the plan ☐ ☐	☐ ☐ ☐

Away From Home Plan

Earthquake Warning	Post-Earthquake
Contact the household and start the preparedness earthquake plan. Let them know your plans.	Attempt to make contact with the household. Try to return home, noting that there could be significant damage or blocked roads along the way. Members at home should initiate the shelter at home plan.

Shelter At Home Plan

Imminent Disaster	☐ Notify household members of the potential earthquake	☐ Get everyone to a safe room or safe position	☐ Alert/text others of the earthquake	☐ Cut the power / blow out any candles	☐

Response 1 (Post-Disaster)	☐ Assess your current health ☐ Assess the health of household members ☐ Keep open a pathway to escape quickly (chock the doors) ☐ Assess the building damage - Leave if the building is unsafe ☐ Secure loose items in preparation for aftershocks	☐ Put on a mask if there is dust debis ☐ Turn off the electricity ☐ Turn off the gas ☐ Clean up the most dangerous hazards ☐ Assess the need to stay vs leaving
Response 2 (Post-Disaster)	☐ Assess the mental state of household members ☐ Put on shoes (if there is broken glass or other hazards) ☐ Check on the neighbours (Assist in health related issues) ☐ (No power after 1 day) Prepare the generator ☐ Fill water containers & bath with water	☐ Prepare the fire extinguishers ☐ ☐ ☐ ☐

Response 3 (Post-Disaster)	☐ Initiate conservation of resources ☐ Begin eating the spoilable food first ☐ (24H no power) Begin cooking the meats in the fridge ☐ ☐		☐ ☐ ☐ ☐ ☐
Conditional Tasks	☐ (No Power) Initiate the no-power disaster plan ☐ (Power) Charge the power stations/power banks ☐ (Water Leaks) Turn off the water - after filling containers/bath	☐ ☐ ☐	☐ ☐ ☐
During the Disaster	• Keep an eye on the structural stability • Listen to the radio for updates •	• • •	• • •
Monitor the News	• • •	• • •	
Shelter Evac Point	My Nearest Shelter Evacuation Point is: ________________________________	Use a shelter if your house is structurally unsound or has been destroyed.	

Evacuation Plan

Evacuate When...	• The destruction of the house is too great and there is a clear evacuation route. • The house is unstable.		
Aim	To leave the dangerous building to stay in a stable building. Bug-out could last to a few months depending on building repairs.		
⚠ Evacuate	☐ Ensure all members are in the car ☐ Ensure all gear is packed ☐ Bring tree moving/chopping devices ☐ Turn off water/gas/electricity if it isn't already ☐ Lock up what you can of the house	☐ Notify the neighbours ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Location	1. Luke's House Ph: ☐ I will attempt to travel here	2. Dad's House Ph: ☐ I will attempt to travel here	3. Bug-Out Location 3 Ph: ☐ I will attempt to travel here
Routes	☐ Via Samford (40m) ☐ Via Logan (40m)	☐ Via The Gap ☐ Via Strathpine	☐ Route 1 ☐ Route 2
Safety	☐ Are the traffic lights out? ☐ ☐	☐ Are the traffic lights out? ☐ ☐	☐ Are the traffic lights out? ☐ ☐
Route Hazards	• •	• •	• •
Route Blocked	If a route is blocked, attempt to travel via an alternative route. If all alternatives are blocked, change the destination or survive outside the home if it's unstable.		

Plan Last Updated: 2024-09-23

Wildfire Disaster Plan Example

This is an example of a wildfire disaster plan. You will note that there are quite a few differences between this and the earthquake plan since they are fairly different natural disasters.

Wildfire Disaster Plan

WILDFIRE

Situation: An approaching wildfire which will likely reach the house.

Disaster Plan For: Toowoomba, QLD
Causes: Naturally Ignited Fire, Backburning, Arson.
Risk Season: July, August, September, October, November, December, January, February. (8 months)
Plan: Early evacuation recommended in most cases, especially if mandated to evacuate.
Disaster Risks: Flames, heat, lack of oxygen, smoke & ash particulate, explosions, low visibility, water outage, gas & electrical outage.
Disaster Spontaneity: Fires can begin and spread rapidly if the conditions are optimal.
May Trigger: Power Outages, Water Outages, Gas Outages, Food Shortages.

High Chance
High Damage

Chance and Damage of this Event
The mountainous terrain, steep slopes, multiple tall trees and thick scrub surrounding the house are condusive to wildfires spreading rapidly. There is bushland in fairly close proximity to the home. If the nearby trees are alight, there is a high chance that the house could catch on fire.

At-Risk Groups:	• Those surrounded by bushland • Individuals with Asthma	• People living remotely •	
Preventative Measures:	• Cleared the trees and bushes within 20m of the house.	•	
Pre-Disaster Maintenance	☐ Store wood away from house ☐ Ensure hoses reach everywhere ☐ Replace flyscreens with steel ones	☐ Clear gutters of debris ☐ Trim low lying branches ☐ Trim bushes leading to the house	☐ Clear fallen leaves ☐ ☐

Away From Home Plan

Fire Watch in Effect	Fire Warning in Effect	Fire Evacuation in Effect
Contact the members at home, who should begin preparing the house for the fire and start packing for a possible evacuation. Return home to help pack.	Contact the members at home, who should begin preparing the house for the fire and start packing for a likely evacuation. Return home to help pack if there is time.	Contact the members at home, let them know they should evacuate after packing the essentials and meet you at the chosen destination.

Shelter At Home Plan

Prepare 1 (Essential Tasks)	☐ Pack the cars for evac (Reversed In) ☐ Clear debris around house ☐ Centralise flammables ☐ Fill drinking water containers ☐ Shut & seal all windows/doors ☐ Don heat-resistant shoes (if possible)	☐ Ready particle gas masks ☐ Don protective clothing ☐ Inform the fire brigade ☐ Turn off the Gas ☐ Turn off the Electricity ☐ Pack the Flexi Blue Protection Bag	☐ ☐ ☐ ☐ ☐ ☐
Prepare 2 (Important Tasks)	☐ Seal car vents & gaps ☐ Prepare pets for evac ☐ Fill the bath/sink/buckets ☐ Ready the garden hoses ☐ Shave face(s) ready for mask ☐	☐ Prepare fire extinguishers ☐ Remove curtains ☐ Move furniture from windows ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐
Prepare 3 (Regular Tasks)	☐ Waterproof Evac Gear ☐ Soak the grass/ground ☐ Point LPG relief valves away ☐ Plug downpipes & fill with water ☐ Mow the lawn ☐	☐ Keep a ladder for roof access ☐ Service the car, ensure it works ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐

During the Disaster	• Monitor the Radio/TV updates (below) • Inspect the whole house every 10m. • Track the fire's progress on a map.	• Stay inside, away from windows. • Visually check the fire every 15 mins. • Stay hydrated.	• • •
Monitor News	• Tv Stations • Radio Stations • News Websites	• https://www.qfes.qld.gov.au/Current-Incidents • •	
Shelter Evac Point	My Nearest Shelter Evacuation Point is: __________________________________	If you chose to shelter in your properly prepared home but still need to evacuate but are unable to leave because the routes are now blocked, you should flee to the nearby evac point such as a lake, river, burnt ground or concrete bunker.	

Evacuation Plan

Evacuate When…	• Ordered to evacuate. • You deem it necessary and the roads are still clear. If some members of the household are away and you need to evacuate, text the others the Bug-Out Location.		
Aim	To avoid the flames entirely, or to avoid the particulate if it's causing health issues. Bug-out could last up to a few weeks.		
Evacuate	☐ Ensure all members are in the car ☐ Ensure all gear is packed ☐ Have fire-mitigation devices ready ☐ Put on particle gas masks (if needed) ☐ Recirculate Car Air	☐ Check driving visibility ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Location	1. Luke's House Ph: ☐ I will attempt to travel here	2. Dad's House Ph: ☐ I will attempt to travel here	3. Casper's House Ph: ☐ I will attempt to travel here
Routes	☐ Via Samford (15m) ☐ Via Logan (25m)	☐ Via The Gap (35m) ☐ Via Strathpine (40m)	☐ Via Richmond (1h 5m) ☐ Via Fernvale (1h 15m)
Safety	☐ Are the traffic lights out? ☐ ☐	☐ Are the traffic lights out? ☐ ☐	☐ Are the traffic lights out? ☐ ☐
Route Hazards	• •	• •	• •
Route Blocked	If a route is blocked, attempt to travel via an alternative route. If all alternatives are blocked, change the destination.		

Plan Last Updated: 2024-09-23

This is the end of the disaster plans. These plans are available on my Prep Drive in a much better looking format as I had to condense the versions you see to conform to the layout of TPE.

5 Advanced Planning

When **S**tuff (or S***) **H**its **T**he **F**an it's indicative of a large scale event occurring which preppers see as a potential bug-out event. So planning for a SHTF scenario is the plan that you will utilize when one of these disastrous scenarios takes place. Having this plan ready before a disaster breaks out is essential: to keep your mind focused on what you need to do when you're worried beyond belief; to cover multiple scenarios so you're ready for anything; and to cover alternative routes and backup plans if things go wrong.

Keep the plans sealed with your bug out bag in a secure and waterproof location, ensuring everyone knows where to find it when needed. You should have secure digital versions as well which are easily accessible on an external USB so they can't be hacked and used against you. If you're the type of person who is worried easy and paranoid about people finding out about your preps you can design the bug out plans on a permanently offline computer.

Planning	Plan your bug out routes well before any incident and keep it updated as roads and circumstances change. Ensure multiple routes to reach your destination in varying disaster scenarios. Calculate how many people you need to feed for how long and prep for that goal. Research the bug out destination for natural threats and nearby towns as well as visibility from the sky and surrounding bush colour/type for camo. Store hidden underground caches along various routes to your bug out location to restock from if you are looted or run out of supplies. Know your area thoroughly and exactly where you stored any caches as the terrain may change from time to time.

Plan Template

The following will be a template for a bug in/out plan with 2 redundancy routes.

Overview

Below is an example of a bug out plan. The first section with the white background gives details about the coloured section to the right. All information, locations and names are made up except for the map which are real locations. Any coloured background section to the right is a part of the bug out document, so ignore any white background cells which break up the colour. Or you can look for the full-length header below stating where the document starts and ends.

PLAN TEMPLATE - DOCUMENT START

Operation Name
The operation name is the identifying name of the plan/mission, often with a specific disaster in mind such as a world war. The name generally has something to do with the disaster.

"Operation Jericho"
O@H2500RB16004

Bugging Out Parameters
You may like to include a number of parameters to assist in giving detailed flexible plans without divulging any information via the phone. As long as you have a legend for what each character means you'll have no problem creating a code for others. It's best to keep the parameters to less than 10 characters or it may become cumbersome to say and there's more chance that the letters and positions may be mixed up.

Operation Jericho (It could relate to an ancient battle or war)
"O @H 2500 RB 1600 4" (The codename of the operation)
↑ 4 = Party Members (The number of members who are part of this operation)
↑ 1600 = Leave Time (24h) (In this case it's 4pm)
↑ R = Route Name. B = Bulbasaur - the codename of the grassland route discussed further below.
↑ 2500 = Meeting Time (24h) (In this case it's meet ASAP - since 2500 hours doesn't exist.)
↑ @H = Home. The location for the meeting point. You could pre-specify any location as long as it's in the document everyone has.
↑ O = Bug Out, It could also be 'I' for Bug In.

Bugging In Parameters
Bugging in parameters will be slightly different to the above because you won't need a route.

Operation El-Dorado (Remember not to relate the codename to any real aspects of the operation)
"I @H 0815 RN 1000 4" (The codename of the operation)
↑ 4 = Party Members (The number of members who are part of this operation)
↑ 1000 = Leave Time (24h) (In this case it's 10am)
↑ RN = Route Name. N = None, since we're bugging in.
↑ 0815 = Meeting Time (24h) (In this case it's 8:15 am)
↑ @H = Home. The location for the meeting point.
↑ I = Bug In.

It would be best to create your own operational coding system so that nobody outside the plan can understand what you mean. Organise the letters and number however you wish, but try not to make it too long because the chance for errors grows. When you tell someone the code you should use the NATO Phonetic Alphabet to help avoid discrepancies. A complete list of important information to convey in the codename via parameters can be found below:

Parameter	Description
Operation Name	You can have a lot of different operations with different names for various disasters that may arise.
Bugging In/Out?	Lets your party know if they're bugging in or out.
Meeting Time	Lets your party know the time to meet to discuss further plans or prepare to bug out. You could use ! as 'right now'.
Meeting Destination	Lets your party know the destination to meet to discuss plans further.
Leave Time	(Bugging Out) Lets your party know the time which they will be leaving.
Destination	(Bugging Out) Lets the party know which destination they will be heading to.
Meeting Route	(Bugging Out) The route which the party will be taking. Example: @B (For Bulbasaur)
!	A modifier which goes on the start of an operation which means, this plan is highly time sensitive. Example: !OPB41600
Leave Without	This can be used to tell a segment of your party to leave ASAP and that you will all rendezvous at the destination.

Plan Designer / Leader
The name of the party leader and designer of the plan. This person will also be the deciding factor on whether or not to initiate the plan. 2IC is the 'second in command'.

Plan Designer: Fluidic Ice
Plan Leader: Fluidic Ice
2IC: Julia Styles

Natural Disaster Type
Worldwide Nuclear War

Destination
Station Homestead

Party
1. Luke Styles (29) (Father)
2. Julia Styles (27) (Mother)
3. Lily Styles (8) Diabetic
4. John Styles (5)

Bug-Out Triangle
75% Speed
25% Supplies
0% Safety

The aim is to get out of the major cities and away from civilization as soon as possible while taking whatever you can.

Disaster Type: This is the type of disaster that this plan is designed for. It can however be adapted for other scenarios through the use of parameters. It's best to have a few different disaster scenarios as the effects - and your plans could vary wildly and are wholly dependant on which one occurs.

Destination: The chosen destination for this operation.
Party: The names and ages of everyone in the party.
Bug-Out Triangle: Your chosen route preference between speed, supplies or safety.

Objectives The objectives that should have been fulfilled on completion of the mission.	**Primary Objectives** • Reach the bug-out location with the family and the supplies needed to survive for 6 months	**Secondary Objectives** • Retrieve weapons from cache #12 • Refill water at Wilson's Well if required	**Tertiary Objectives** • None

These include stops for refuelling, toilet breaks or to dig up caches etc and any other objectives that may be of benefit to complete but aren't necessary. There should be a primary objective at the minimum and secondary objectives which don't need to be completed. Tertiary objectives may come in which are very minor and will only give a small boost to something. At all costs the primary objective must be completed and should be outlined in detail what should be accomplished. At minimum you would want all your party members to reach the BOL alive and in good health with your vehicles in good condition and everyone in high spirits.

	Name (Callsign)	Role	Age & Gender	Contact	Strengths	Weaknesses	Armed	BOB Weight & Items	Medical Conditions
Details about the party members including fields such as: Role, Name, Callsign, Age, Gender, Mobile, Work, Strengths, Weaknesses, etc…	**Member 1** **Luke Styles (Fluidic Ice)**	Party Leader	Age: 29 Gender: Male	**Home** (00) 0000 0000 **Mobile** 00-0000-0000 **Work** 0000-0000	• Strategy • Tactics • Preparedness	• No Weapons Training	No	15 Kg • Shelter • Food • Cash	None
Add any information you feel is necessary to know about your party members so you can quickly refer back to it.	**Member 2** **Julia Styles (Hashbrown)**	Second in Command	Age: 27 Gender: Female	**Home** (00) 0000 0000 **Mobile** 00-0000-0000 **Work** 0000-0000	• Cooking • Fire Lighting	• Firearms • Stealth	No	11 Kg • Shelter • Food • Water Purification	Hayfever
	Member 3 **Lily Styles (Booklet)**	Child	Age: 8 Gender: Female	N/A	• Reading	• Child	No	3 Kg • Entertainment • Water • Food	Diabetic
	Member 4 **John Styles (Scooby)**	Child	Age: 5 Gender: Male	N/A	• Tiny Size	• Child • Loud • Low Strength	No	None • N/A	None

Rendezvous Point: The point where everyone in your party will meet up when the mission is activated.	**Rendezvous Point** Meet at 123 Oak Street, Fakeville, MT. **Rendezvous Time** Meet 1 hour (or less) after the communication which initiated the plan.	**Destination** 331 Bugout Road, Preparednessland, 24410 **Route Choice** M = Mountainous G = Grassland O = Oceanside	**Specialist Bags** P = Pandemic V = Volcanic H = Hurricane **Initiation** Anyone can initiate this plan via discussion with the party leader.

Rendezvous Time: The time that everyone should be at the meeting location to leave for the BOL. Party members should aim for that time or earlier or risk being left behind if time is of the essence.
Destination: The destination or destinations of the BOL or site which are considered generally safe. There may be a pre-destination which is a semi-safe location where the party stops to wait for others who were left behind. This lets people escape the traffic of the city while not abandoning their companions.
Route Choice: The selection of the route based on the leaders decision of hazards along each and possible blockages.
Specialist Bags: If you have multiple bags packed ready to go you can name the type of equipment you need for this situation such as the pandemic bag. Example bags are as follows: Nuclear Bag, Pandemic Bag, Wet Bag, Cold Bag etc. Each bag can have a letter related to it so it's easier to specify which bags you need without discussing it over the phone.
Initiation: Details on how to set this plan into motion if you feel the need to bug-out. Anyone in the party can start this process but ultimately the leader will be the decision maker. Generally the initiation will involve talking to the party leader on the phone and mentioning your worries or the reasons to bug out now.

The Bug-Out triangle lets you prioritize one corner but then the other two will be reduced.

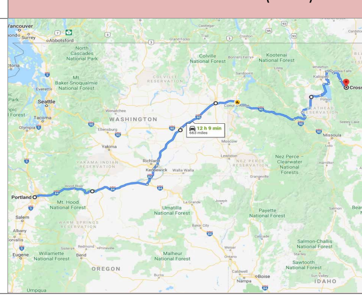
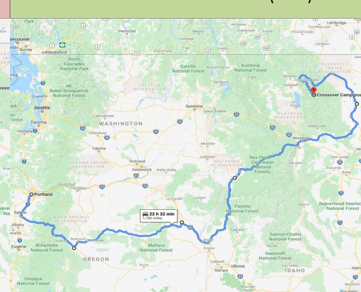
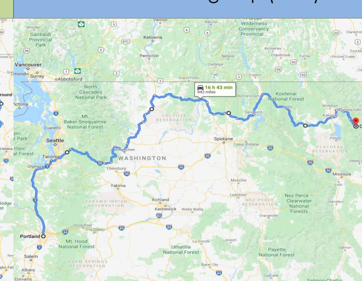
Bug-Out Triangle
• Speed
• Supplies
• Safety

Each route could have a different priority such as safety or speed, so take note of which corner of the triangle this route is. The bug-out triangle is explained further down in the Bug Out Planning section.

*Sheet Continued Below - Just follow along with the coloured sections ignoring full sized rows which give additional information.

Route Planning

This section is split into routes after the main section which are shown by different colours. Multiple routes ensure a redundancy plan in case one of them is blocked. Darkened headings under the row on the left represent that each heading is repeated for each route planned.

The name and type of the routes. You can codename each route for stealth and to use with the operation name as discussed above.	**Mountainous Route (Primary Route)** Quick Route Codename: Geodude (or G)	**Grassland Route (Secondary Route)** Safe Route Codename: Bulbasaur (or B)	**Oceanside Route (Tertiary Route)** Wilderness Route Codename: Magikarp (or M)
A satellite or Google map of the route, showing the separate legs and any notable features like hazards. I recommend creating the map in an app such as Alpine Quest then create a screenshot and using that as a printed map. This isn't the only map of the route that should be relied upon you should have an offline digital map as well.			

Maps should be as highly detailed as possible and it's worth having a separate map for each route as well as each stage of each route to show the smaller sections in higher detail. The maps above are screenshots from Google Maps which are a great program to use to calculate your route. Note: These maps are fictional bug-out routes, I selected them because they vaguely match the route names.

The directions of the route from the starting point to the destination. Include street names, visible landmarks and what you'll see if you've gone the wrong way.	**Route Description** A rocky and mountainous route which is picked for its small countryside villages and few major roads. The roads are slower and there's a chance of debris on the roads but bugging out early should counter this.	**Route Description** A generally easy going and flat route with a few farm houses and small villages along the way. The road is wide, straight and very fast but the roads are often occupied by large semi-trailers making deliveries to larger towns.	**Route Description** A seaside route going through a few minor cities and avoiding major ones. There are a lot of people living along this route but this will be mostly eliminated by bugging out early.
This breaks each route down into 3-5 checkpoints and has a little written about each leg of the journey.	**General Directions** **1.** Leave the city on the M3 and follow for 80kms, **2.** Turn onto Mountain Court and follow for 117kms, **3.** Merge onto Dire St and continue for 203kms, **4.** Go down Country Lane for 23kms, **5.** Disembark and continue on foot NNE for 2km.	**General Directions** **1.** Leave the city on the M3 and follow for 30kms, **2.** Take the rocky road exit and follow for 50kms, **3.** Turn onto the country expressway and follow for 306kms, **4.** Go down Country Lane for 23kms, **5.** Disembark and continue on foot NNE for 2km.	**General Directions** **1.** Leave the city on the M1 and follow for 85kms, **2.** Follow the Seaside View Road for 247kms, **3.** Go down Bullock Road for 62kms, **4.** Disembark and continue on foot NW for 3km.
Route Distance The distance the route is in total and each section of the leg. **Route Travel Time** The total estimated travel time for the route.	**Total Route Distance** **427 km** **Total Route Travel Time** **7h 35m**	**Total Route Distance** **411 km** **Total Route Travel Time** **7h 03m**	**Total Route Distance** **397 km** **Total Route Travel Time** **7h 57m**
Stages These are the different stages in this route with the estimated travel times between each of them factoring in stops. Add as many stages as you have.	**5 Stages** 1: City - 80km, 1h 40m 2: Outskirts - 120km, 2h 10m 3: Forest - 200km, 2h 40m 4: Lane - 23km, 0h 40m 5: Hiking - 2km, 0h 25m	**5 Stages** 1: City - 30km, 1h 00m 2. Rocky - 50km, 1h 10m 3. Country - 306km, 3h 50m 4. Lane - 23km, 0h 45m 5. Hiking - 2km, 0h 18m	**4 Stages** 1: City - 85km, 2h 10m 2: Seaside - 247km, 5h 30m 3: Inland - 62km, 0h 55m 4: Hiking - 3km, 0h 22m
Stops A list of all the possible places you can stop on this particular route for driver swaps, toilet breaks etc. Ensure the location is scouted out prior to adding it as it may be home to a hidden array of dangers such as animals or homes.	**Stops** 1. Andale City - Fuel/Toilet 2. Lewis Park - Toilet 3. Crow Lookout - Toilet 4. Dan's Well - Toilet	**Stops** 1. Andale City - Fuel/Toilet 2. Lambdas Farm - Toilet 3. Point Cape - Toilet 4. Dan's Well - Toilet	**Stops** 1. Muldave - Fuel/Toilet 2. Anchor Rest - Toilet 3. Yum Cha Lookout - Toilet 4. Lone Pine - Toilet
Route Speed Posted speed limits generally aren't a problem when SHTF, however if you bug out early there's a good chance police will still be in force.	**Route Speed** Average - 65k/h Minimum - 40k/h Maximum -110k/h	**Route Speed** Average - 85k/h Minimum - 60k/h Maximum -120k/h	**Route Speed** Average - 60k/h Minimum - 40k/h Maximum -110k/h
Transport A list of the transport forms used in the bug-out including points where transport is swapped from car > bike > hiking for example. ● Type of Transport ● Fuel Tank Size ● Km/Tank ● Seating Arrangements ● Gear in the Vehicle	**Route Transportation** ● Car - 425 km ● Walking - 2 km	**Route Transportation** ● Car - 409 km ● Walking - 2 km	**Route Transportation** ● Car - 394 km ● Walking - 3 km
Advantages Advantages to choosing this route such as speed or lack of population. **Disadvantages** Any disadvantages on this route like mostly uphill or slower speed limits. Disadvantages are not hazards, try to keep them separate.	**Route Advantages** ● Very Few People/Houses ● Few Towns ● Little Traffic **Route Disadvantages** ● Mountainous ● Slow Around Corners ● Longer Travel Time	**Route Advantages** ● Flat Landscape ● Safest Route ● Small Travel Time **Route Disadvantages** ● Easily Visible from Sky ● Few Trees ● Police Patrols	**Route Advantages** ● Ocean Views ● Fresh Air ● Flat Roads ● Fastest Route **Route Disadvantages** ● Populated ● Larger Villages ● More Traffic ● Low Lying Areas
Hazards A detailed description of the hazards found on the route such as slippery slopes, unstable trees and high population areas. Mark the hazards on the map with a small symbol wherever they may occur. Other hazards may include low lying land, falling rocks, avalanche prone areas, military bases and sharp cliffs.	**Route Hazards** ● Falling Rocks ● Narrow Roads ● No Guard Rails ● Slippery When Wet	**Route Hazards** ● Wild Animals ● Motorbike Gangs Nearby ● Big Trucks	**Route Hazards** ● Flooding ● Gangs ● Military Bases

Other Considerations The following are a few other idea you could mark on the map for each leg. • Lit/Unlit roads • Low-lying Roads • Flood Plains • Open Areas • Planted Forest • Total Traffic Lights • Major Roads • Traffic Prone Roads	**Other Considerations** • 8 Traffic Light Sets • Few Street Lights • 2 Bridges	**Other Considerations** • 7 Traffic Light Sets • Dirt Roads • 1 Bridge	**Other Considerations** • 12 Traffic Light Sets • Roads Lit Well • 5 Bridges • 2 Pedestrian Crossings
Further Considerations **Traffic Lights:** The number of traffic lights on the route - which could greatly affect the time taken to bug-out. **Major Roads:** Major roads in the country will often be the first to be clogged with traffic so take note if any of your routes use these roads and for how many kilometres. List how many km's on major roads are included on this route.			
Stages			
	Stage 1 - City Stage	**Stage 1 - City Stage**	**Stage 1 - City Stage**
Distance The total distance of this stage. **Travel Time** The ETA for this stage with the specified vehicles.	**Stage 1 Distance** 80km **Stage 1 Travel Time** 1h 40m	**Stage 1 Distance** 30km **Stage 1 Travel Time** 1h 00m	**Stage 1 Distance** 85km **Stage 1 Travel Time** 2h 10m
Stage Hazards A list of any and all potential hazards on that route. **Transportation** Shows the changes in transportation on this route (if any), such as if you swap between a car, bike or on foot prior to reaching the next stage or your destination.	**Stage 1 Hazards** • Blocked Roads • Extreme Traffic • No Traffic Light Power • Riots **Stage 1 Transport** Car	**Stage 1 Hazards** • Blocked Roads • Extreme Traffic • No Traffic Light Power • Riots **Stage 1 Transport** Car	**Stage 1 Hazards** • Blocked Roads • Extreme Traffic • No Traffic Light Power • Riots **Stage 1 Transport** Car
Detailed Directions These are GPS styled directions detailing exactly which roads to take on this route. If you aren't using roads for your bug out route you should use GPS coordinates instead.	**Stage 1 Detailed Directions** Leave the house and turn left onto Alpine Street and follow for 400m. Turn right onto Blueberry Street and continue for 2km. Turn right onto Narraway Street continuing for 2.6km then merge onto the M3 and continue for 75km.	**Stage 1 Detailed Directions** Leave the house and turn left onto Alpine Street and follow for 400m. Turn right onto Blueberry Street and continue for 2km. Turn right onto Narraway Street continuing for 2.6km then merge onto the M3 and continue for 25km.	**Stage 1 Detailed Directions** Leave the house and turn left onto Alpine Street and follow for 400m. Turn right onto Blueberry Street and continue for 7km. Turn left onto Bean Road continuing for 10.6km then merge onto the M1 and continue for 67km.
Tips List any tips for the route that may help your journey such as locations of toilets, water fountains, landmarks etc.	**Stage 1 Tips** • Ensure the toilet won't be needed until the first stop.	**Stage 1 Tips** • Ensure the toilet won't be needed until the first stop.	**Stage 1 Tips** • Ensure the toilet won't be needed until the first stop.
	Stage 2 - Outskirts Stage	**Stage 2 - Rocky Stage**	**Stage 2 - Seaside Stage**
The majority of the routes shouldn't overlap but having the final stage overlap should be fine.	**Stage 2 Distance** 117km **Stage 2 Travel Time** 2h 10m	**Stage 2 Distance** 50km **Stage 2 Travel Time** 1h 10m	**Stage 2 Distance** 247km **Stage 2 Travel Time** 5h 30m
List all hazards that may occur during travel on this stage no matter how unlikely. You can also rate them according to risk or occurrence chance.	**Stage 2 Hazards** • Rocks on the Road • Winding Roads • Fallen Branches **Stage 2 Transport** Car	**Stage 2 Hazards** • Rocks on the Road • Muddy when Wet **Stage 2 Transport** Car	**Stage 2 Hazards** No hazards **Stage 2 Transport** Car
	Stage 2 Detailed Directions Look for the #117 Exit "Standale Road" and follow for 33kms, Merge onto Mountain Court and follow for 84kms.	**Stage 2 Detailed Directions** Take the rocky road exit and follow for 50kms. There's a restroom right before the turn off for country expressway.	**Stage 2 Detailed Directions** Merge onto Seaside View Road for 244kms and follow through multiple cities. Turn left onto Dolphin Esp. and 1km down look for the public toilets. On completion follow Dolphin Esp. for 2km before merging onto Bullock Road.
Add as many extra "Tip" rows as necessary for the stage.	**Stage 2 Tips** • The exit to Standale Road can easily be missed, watch for it.	**Stage 2 Tips** • One lane crossing bridge low to the water 40kms into the road.	**Stage 2 Tips** • The toilets are for public use and are locked up after 7pm nightly. Look for a stone brick building with a navy colorbond roof.
	Stage 3 - Forest Stage	**Stage 3 - Country Stage**	**Stage 3 - Inland Stage**

	Stage 3 Distance 203km **Stage 3 Travel Time** 2h 40m	**Stage 3 Distance** 306km **Stage 3 Travel Time** 3h 50m	**Stage 3 Distance** 62km **Stage 3 Travel Time** 0h 55m
	Stage 3 Hazards ● Fallen Branches ● Rocks on the Road **Stage 3 Transport** Car	**Stage 3 Hazards** ● Wild Animals on Road ● No Lighting **Stage 3 Transport** Car	**Stage 3 Hazards** ● Few refuelling points ● Rocks on the Road **Stage 3 Transport** Car
	Stage 3 Detailed Directions Watch for and merge onto Dire St and continue for 203kms. There's a fuel point first thing on this road to the left for refuelling.	**Stage 3 Detailed Directions** Turn left onto the country expressway and follow for 206 kms. Then turn onto Twin Oak Road and continue for 100 kms watching out for Country Lane.	**Stage 3 Detailed Directions** Go down Bullock Road for 62kms. This road has no lighting and half of it is dirt making travel slower. Look for the shelter at the end of the road to park the car in.
	Stage 3 Tips ● The refuel point is the last stage you can get fuel at so be sure to stop and fill the spare tanks if necessary. ● Country lane is a small road easily missed if you're not keeping an eye out for it.	**Stage 3 Tips** ● Country lane is a small road easily missed if you're not keeping an eye out for it. ● A few stop shelters along country expressway for toilet breaks if required.	**Stage 3 Tips** ● None
	Stage 4 - Lane Stage	**Stage 4 - Lane Stage**	**Stage 4 - Hiking Stage**
	Stage 4 Distance 23km **Stage 4 Travel Time** 0h 40m	**Stage 4 Distance** 23km **Stage 4 Travel Time** 0h 45m	**Stage 4 Distance** 3km **Stage 4 Travel Time** 0h 22m
	Stage 4 Hazards ● Rocks on Road ● Fallen Trees **Stage 4 Transport** Car	**Stage 4 Hazards** ● Rocks on Road ● Fallen Trees **Stage 4 Transport** Car	**Stage 4 Hazards** ● Tiredness ● Slippery Hill ● Hypothermia if Snowy **Stage 4 Transport** Hiking
	Stage 4 Detailed Directions Follow the signs for Country Lane and follow for 23kms. The majority of the road is dirt and care needs to be taken.	**Stage 4 Detailed Directions** Follow the signs for Country Lane and follow for 23kms. The majority of the road is dirt and care needs to be taken.	**Stage 4 Detailed Directions** After parking and camouflaging the car, head east until you find the cul-der-sac signifying end of country lane which is about 1km away and marked by a car shelter. Then head towards the hill to the North. In 400m you will exit the tree line and the house to the NE on another larger hill. Head towards the house using the log crossing to the north.
	Stage 4 Tips ● This road has no lighting and loose stones so care needs to be taken. ● There's 3 cattle grids on Country Lane.	**Stage 4 Tips** ● This road has no lighting and loose stones so care needs to be taken. ● There's 3 cattle grids on Country Lane.	**Stage 4 Tips** ● Ensure the car is camouflaged well so it's not stolen as easily if it's needed again. ● On arrival take note to proceed slowly and observe the cabin 30m prior to entering to ensure it's safe.
	Stage 5 - Hiking Stage	**Stage 5 - Hiking Stage**	
	Stage 5 Distance 2km **Stage 5 Travel Time** 0h 25m	**Stage 5 Distance** 2km **Stage 5 Travel Time** 0h 18m	
	Stage 5 Hazards ● Tiredness ● Hypothermia if Rainy or Snowy **Stage 5 Transport** Hiking	**Stage 5 Hazards** ● Tiredness ● Hypothermia if Rainy or Snowy **Stage 5 Transport** Hiking	
	Stage 5 Detailed Directions After parking the car head towards the hill to the North. In 400m you will exit the tree line and see the house to the NE on another larger hill. Head towards the house avoiding the small river by using the log crossing to the north.	**Stage 5 Detailed Directions** After parking the car head towards the hill to the North. In 400m you will exit the tree line and see the house to the NE on another larger hill. Head towards the house avoiding the small river by using the log crossing to the north.	

If you want to break your routes down into further stages you can add more below.	**Stage 5 Tips** ● On arrival take note to proceed slowly and observe the cabin 30m prior to entering to ensure it's safe.	**Stage 5 Tips** ● On arrival take note to proceed slowly and observe the cabin 30m prior to entering to ensure it's safe.	
	Arrival		
Arrival The procedures and actions to take upon arrival of your destination.	☐ **Check Perimeter** Do not enter the house immediately but spread the party out and monitor the area for about 30m to ensure it's safe. ☐ **Check Exterior** With your party, approach the house from all sides at once and check for any damage. ☐ **Check Interior** Someone may be hidden inside so check each room thoroughly for intruders. ☐ **Unpack** It may take a few trips to get your gear from the car to the house if you over-packed per person. Go slow and take care not to injure yourself.		

Checklists

These are some recommended checklists to have on your bug-out plan to ensure you're ready for the journey. Tick the box off once you've completed the item or cross it out with a line if it's not applicable. Here are the other symbols in the set if you are re-creating this sheet elsewhere: ☐☒☑. (https://fsymbols.com/signs/tick/)

	Packing Checklist		
Packing Checklist (Checklist of items to bring outside of a bag) Have a checklist of the items that should be packed for the trip.	**Packing Checklist** ☐ Party Members ☐ Bug-Out Bags ☐ Trip Food/Water ☐ Medical Kit ☐ SCAR Bags if Required	☐ Weapons/Ammo ☐ Medication ☐ Bug Out Plans ☐ GPS / Navigation ☐ Paper Maps ☐ Pets	
	Car Checklist		
Car Checklist (Checklist to ensure the car is ready) Ensure the car is ready to go with fuel, fluids and disaster precautions added such as air vents taped or snow chains on.	**Car Checklist** ☐ Car Packed ☐ Fuel Tank Full ☐ Spare Fuel ☐ Air Vents Taped Closed ☐ Spare Tyre ☐ Oil Level ☐ Coolant Fluid	☐ Washer Fluid ☐ Tyre Pressure (+Spare) ☐ Brake Fluid ☐ Clutch Fluid ☐ Power Steering Fluid ☐ Oil Filter Check ☐ Air Filter Check ☐ Tyre Wear Level	☐ Lighting Check ☐ Indicator Check ☐ Fuse Check ☐ Wiper Blade Check ☐ Fire Extinguisher/Blanket ☐ Box of Caltrops
	House Bug In Checklist		
House Bug In Checklist (How to prepare the house for your bug in)	**Bug In Checklist** ☐ Store water in containers ☐ Tape up windows ☐ Board up unused Doors ☐ Seal Light Leaks ☐ Seal Air Gaps	☐ Set up night watches ☐ Turn off Gas ☐ Charge Electronics ☐ Loose Item Removal ☐ Designate a bunker room ☐ Ration Supplies	☐ Adapt Electrical Circuit
	House Bug Out Checklist		
House Bug Out Checklist (How to prepare the house for your departure)	**Bug Out Checklist** ☐ Windows Locked/Barricaded ☐ Doors Locked/Barricaded ☐ Water Off ☐ Electricity Off ☐ Gas Off	☐ Valuables Hidden ☐ Toilets Clean ☐ Unplug Electronics ☐ Discard Rubbish ☐ Eat Perishable Food ☐ Loose Item Removal	
	Bike Checklist		
Bike Checklist (Checklist to ensure the bike is ready)	**Bike Checklist** ☐ Tyres Pumped ☐ Trailer Attached ☐ Phone/GPS Holder ☐ Spare Tyre ☐ Tyre Patch Kit	☐ Spare Chain ☐ Maintenance Tools ☐ Bottle Holder ☐ Bags Packed ☐ Side Bags ☐ Brakes Tested	☐ Air Pump ☐ Full Water Bottles ☐ Helmet ☐ Bike Lock & Chain
	Hiking Checklist		
Hiking Checklist (Checklist to ensure you are ready for the hike)	**Hiking Checklist** ☐ Shoe Condition Adequate ☐ Adjusted & Fitted Backpack ☐ Hiking Pole ☐ Tied Laces ☐ Full Water Bottles	☐ Bag Weight Acceptable ☐ Correct Clothing for Weather / Season	

Procedure

A written plan of how you hope to proceed when disaster strikes.

	Step 1 - Initiation

	Initiation To initiate the plan in a time of urgency or discuss the prospect of bugging out/in contact the developer of the plan.	**Contact** Attempt to communicate with all other adult participants involved in the plan and explain which plan is being initiated and why. Use a code if required to keep others from knowing what you're doing. Make sure you know the route they will take to return home in case something happens along the way.	**No Contact** If no contact is available proceed with the plan but wait before leaving for the destination. Not having communications should be a sure sign to start preparing.
	Step 2 - Packing		
Packing Time The estimated time it will take to pack the vehicle with the supplies needed to bug-out	**At Home** Those already at the rendezvous point will begin packing the BOBs into the car and complete the pre-leave checks.	**Charging** Ensure your devices are charged up in the time you've got before leaving.	**Lock Up** Lock the house and bring any loose items in the back yard inside if there's time spare. The nature of the disaster will specify what has to be done.
	Step 3 - Monitor		
	Keep the news on and take note of any changes in the situation. Use multiple news sources in case there's bias in some of them. Use the changing information and what you currently know to update the plan on the fly to avoid obstacles or slowdowns. Your plan may change entirely from bugging out to bugging in due to weather based scenarios, so check the news every 15 minutes.		
	Step 4 - Leave		
	Leave If all party members have made it to the rendezvous location in time and the vehicle is packed, leave for the destination according to the plan.		
	No Show In certain situations it may be needed to leave for the destination without someone. If this occurs be sure to leave them instructions on when you left, the route you took and leave some supplies for them to make it. If contact has been made and the agreed time to leave has arrived: 1. Attempt contact again 2. Wait ~30m longer 3. Leave a note of the time you left and the route number taken, then leave. Only leave if your plan has contingency plans for no shows and what action plan to proceed with.		
	No Show - Contact Made / Known Route If the starting location of the person missing was known consider the possibility of driving along their route and keep and eye open.		

PLAN TEMPLATE - DOCUMENT END

Combined Planning

This section involves planning for anything that can be applied to both bugging in or out.

Team Bonding	A team that intimately knows each other is less susceptible to fights when the situation gets tough. Knowing how different members react to different scenarios as well as how they react with each other is an import factor in diffusing conflict. If everyone has slept in a crowded room with each other previously, it will be a lot less startling to discover that someone snores badly when the situation is already tough, and gives people the opportunity to plan ahead and bring ear buds.	
Leadership	Establishing a leader is essential to keep the decisions to one person who has had training in preparedness. Although people may rebel against the leader they always have the decision to leave the party and go their own way. As a prepper you should be leading the party if you feel up to the part. You could however delegate the tough-talk and strength to someone else who takes your advice and guidance wholeheartedly. For more information, see the LEADERSHIP category.	
Disputes	There are always going to be disputes and personality clashes in an apocalyptic scenario. It's how they are handled that will determine what comes out of them. Trying to keep everyone happy, optimistic and with high morale is essential for a seamless team and it will make the whole SHTF scenario a little easier. The best way to resolve conflict is splitting the difference, unless extenuating circumstances mean someone should get more than the other person. Disputes should never be settled by sacrificing food and other supplies to one person, or any other means which would decrease the survivability of the team.	**Dispute Outcomes** • Win / Win • Win / Lose • Lose / Win • Lose / Lose
Party Leavers	If an individual or individuals leave the party to go off for themselves they could take insider knowledge of how many people, resources and guns you have with you as well as your future plans. This can be a huge threat to your safety as they could return with other survivors they've teamed up with to take what you have. It's recommended you immediately change your location, route and tactics in this event to throw them off the scent.	
Knowledge	Ensure everyone knows the plan well including the supplies being brought, the redundancy plans and any failsafe's. If everyone knows how to use the tools in the BOBs then anyone can purify water, cook food and use gas stoves. Basic medical knowledge should also be shared among the group such as applying bandages and slings as well as any specialized medications that any party members require like an epinephrine auto injector. At least 20% of your party should have some form of advanced medical training in areas such as CPR, what to do in choking, dislocation, burns, breaks and drowning situations. The leader should always play their cards close to their chest and avoid telling people things they don't need to know, such as hidden caches. If the leader keeps details to themselves and they are robbed at gunpoint by their own party members, they still have the ability to survive by making it to a cache and plan from there.	

Bug In Planning

Helping you plan for bugging in and what preparations are required to have ready when the time arises. As always you shouldn't rely on a plan to always bugging in no matter what. Every situation should be weighed up and decided on when the time comes.

Supplies Duration	You should have a rough estimate as to how long the disaster should last, if it's longer than 6 months it may be recommended to bug out after that time. Ensure you have a supply cache that will last you at least the length of your estimated bug-in period plus 50%.	
Ration Plan	Even if you believe you have enough supplies to outlast a disaster you could be wrong and may perish from lack of food or water if the disaster prolongs itself. Develop a ration plan and stick to it, taking into account people's age, gender, strength, illnesses and medication requirements.	**Items to Ration** ● Water ● Food ● Ammunition ● Electricity ● Energy ● Time
House Reinforcements	It's wise to have a collection of planks, nails and a hammer handy if you need to block off access to certain areas. Duct tape will help to prevent shattered glass from showering your floors. Move heavier items behind access points such as doors and windows to make it hard to intruders to enter. Charge all your batteries so you're ready when the power goes out. Ensure your generator won't cause carbon monoxide poisoning and won't be stolen.	
Defensive Weapons	Your weapons should be primed and ready for use any point in time, but exercise caution around them. SHTF is not the time for shooting practice so keep quiet and avoid attracting attention.	
Day/Night Watch	Start a day and night watch as early as possible and get into a routine of checking the perimeter without showing yourself. For more information see the SECURITY section.	

Bug Out Planning

Helping you plan for bugging out and what preparations are required to have ready when the time arises. As always you shouldn't rely on a plan to always bugging out no matter what. Every situation should be weighed up and decided on when the time comes.

Route Planning

Choosing a route can be difficult as it's hard to gauge from a map what dangers you may encounter along the way. It's best to choose three different routes each primarily based in on of the features below.

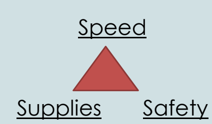
Safe Route	A route which has few natural hazards such as slippery roads, falling rocks, flooding or a lack of guard rails on mountain passes.
Uncrowded Route	A route which is as free of as much population as possible such as houses, cities, suburbs, or likely places people will gather.
Clear Route	A route which will have the least likely number of obstructions such as flooded roads, downed trees, mud/rock/snowslides etc.
Fastest Route	The route which will take the least amount of time at any time of the day, assuming there's no traffic or blockages.
Evasion Route	A route which is calculated on the day to avoid a certain new element such as an area infected with a virus or radiation. It also gives you the element of surprise against anyone attempting to ambush people.
Stealth Route	A route where you try to stay out of sight from as many people as possible, using the small country roads and avoiding all cities and towns. The route should be generally surrounded by vegetation and you should be difficult to spot from the ground and air. There's more likely to be road blockages on this route due to the number of trees etc hiding you from view.

Bug-Out Triangle

The Bug-Out triangle lets you prioritize what's most important to you when bugging out. You can choose one point on the triangle to specialize in, however you can't focus on them all. This applies to all modes of bug out transport from driving to hiking. You can however find a balance between them all so that you don't specialize in any one of them primarily.

If you want to go for ultimate speed when bugging out you will either need fewer supplies or compromise safety which can lead to injury. If you want a ton of supplies then your speed will be ultimately sacrificed and due to being weighed down, your safety will also be reduced. And finally safety, everyone knows speed can kill and if you're on foot, fewer items will let you keep your footing easier and won't put your centre of gravity off.

Bug-Out Triangle



Some reasons for choosing **Speed** are:
- There's a disaster rapidly approaching and you want to get out of its path as fast as possible.
- You want to leave town before other people realize they should leave too.
- The roads will be closed, flooded or destroyed in the near future.

Some reasons for choosing **Supplies** are:
- You're leaving town permanently. (I'm Never Coming Home)
- You don't know how long you will be away from home.
- There's no or few supplies where you're going.

Some reasons for choosing **Safety** are:
- The route is dangerous, wet, snowy or is an unknown route.
- You have to stay under the radar to avoid being detected.
- You're likely to be injured if you continue at a regular pace.

Sometimes it may be necessary to change your tactics part way through a bug-out. For example if you started with Speed but come across an icy part of the road, you will have to prioritize Safety and slow down or risk sliding off the road. Another example would be if you chose Supplies but due to the change in course of a disaster you need to get to your bug out location faster, therefore you may have to drop some gear to be able to lighten the load and quicken the pace.

Gear Grabbing

PREPAREDNESS Advanced Planning Bug-Out Planning Gear Grabbing

Essential Gear

In general your BOB should be packed and ready to grab and go at a moments notice, however there's a few reasons why some items won't always be stored in the bag. Some of the below items are stored in containers and therefore require a key. You do NOT want to waste time searching for a key to your safe or weapons locker in an emergency because it could cost you your life. Ensure you either have your keys on you at all times or you know exactly where they are and can easily get to them without going through multiple security barriers.

Borrowed Items	If you're the type to borrow items from your pack when you go camping or hiking you should be sure to return them immediately afterwards.
On Display	Some items such as family pictures will be displayed on mantles and desks, so be sure you know where they are and grab them before you go if you want them. An alternative is to have digital versions or duplicates in your pack.
Refrigerated Items	Medicines and drugs should be stored at a cooler ambient temperature, therefore you should only grab these at the last minute to maximise their life.
Valuables	You may have a separate location for your valuables such as a safe or they could be diversified around your home or work office, or even perhaps a safety deposit box.
SCAR Bags	You may have specific bags for this type of emergency stored around the house, in addition to your primary BOB like pandemic medical gear.
Weapons	Weapons are generally stored in special containers to ensure their compliance with the law, therefore you have to remember to grab them before you leave.
Volatiles	Volatiles are items which have to be stored separately from general living quarters due to the hazard they pose to general safety. These kinds of items can include: Gas Canisters, Fuel (Petrol, Diesel, LPG) and dangerous chemicals such as kerosene, calcium hypochlorite (used in water purification) and Shellite.

Unessential Gear

Before you need to bug-out there may be a bit of spare time to grab a few extra items around your home, particularly if you're never coming back. The following list provides ideas on the most important non-essential items.

Digital Records	Computer hard drives and other storage media could prove useful if you aren't ever coming home and you rely on your files. There may also be personal files on them which shouldn't get into the hands of anyone else.
Memories	Photographs, memorabilia, personal items etc can provide a vital function in keeping up morale.
Important Documents	Leaving any important documents (such as your birth certificate) in your home could end in a stolen identity. You should either bring these documents with you, including copies or burn them - in the case of copies.
Spares	Grab any spare pantry snacks, food, water, gas canisters, batteries and candles you have around your home if you're bugging out via car and have some spare time.

PREPAREDNESS Advanced Planning Pet Pet Bug Out

Pet Bug Out

The best way to protect your family from the effects of a disaster is to have a disaster plan. If you are a pet owner, that plan must include your pets. Being prepared can save their life. Different disasters require different responses. But whether the disaster is a hurricane or a hazardous spill, you may have to evacuate your home. In the event of a disaster, if you must evacuate, the most important thing you can do to protect your pets is to evacuate them, too. Leaving pets behind, even if you try to create a safe place for them, is likely to result in their being injured, lost, or worse. So prepare now for the day when you and your pets may have to leave your home.

Pet Safe Place	Remember that Red Cross disaster shelters cannot accept pets because of states' health and safety regulations and other considerations. Service animals who assist people with disabilities are the only animals allowed in Red Cross shelters. It may be difficult, if not impossible, to find shelter for your animals in the midst of a disaster, so plan ahead. Do not wait until disaster strikes to do your research.

Contact hotels and motels outside your immediate area to check policies on accepting pets and restrictions on number, size, and species. Ask if "no pet" policies could be waived in an emergency. Keep a list of "pet friendly" places, including phone numbers, with other disaster information and supplies. If you have notice of an impending disaster, call ahead for reservations. Ask friends, relatives, or others outside the affected area whether they could shelter your animals.

If you have more than one pet, they may be more comfortable if kept together, but be prepared to house them separately. Prepare a list of boarding facilities and veterinarians who could shelter animals in an emergency; include 24-hour phone numbers. Ask local animal shelters if they provide emergency shelter or foster care for pets in a disaster. Animal shelters may be overburdened caring for the animals they already have as well as those displaced by a disaster, so this should be your last resort.

Pet Disaster Supplies Kit	Whether you are away from home for a day or a week, you'll need essential supplies. Keep items in an accessible place and store them in sturdy containers that can be carried easily (duffel bags, covered trash containers, etc.). Your pet disaster supplies kit should include:	● Medications and medical records (stored in a waterproof container) and a first aid kit ● Sturdy leashes, harnesses, and/or carriers to transport pets safely and ensure that your animals can't escape ● Current photos of your pets in case they get lost ● Food, potable water, bowls, cat litter/pan, and can opener ● Information on feeding schedules, medical conditions, behaviour problems, and the name and number of your veterinarian ● Pet beds and toys, if easily transportable

Know What To Do	Often, warnings are issued hours, even days, in advance. At the first hint of disaster, act to protect your pet. Call ahead to confirm emergency shelter arrangements for you and your pets. Check to be sure your pet disaster supplies are ready to take at a moment's notice. Bring all pets into the house so that you won't have to search for them if you have to leave in a hurry. Make sure all dogs and cats are wearing collars and securely fastened, up-to-date identification. Attach the phone number and address of your temporary shelter, if you know it, or of a friend or relative outside the disaster area. You can buy temporary tags or put adhesive tape on the back of your pet's ID tag, adding information with an indelible pen.

Tips	You may not be home when the evacuation order comes. Find out if a trusted neighbour would be willing to take your pets and meet you at a prearranged location. This person should be comfortable with your pets, know where your animals are likely to be, know where your pet disaster supplies kit is kept, and have a key to your home. If you use a pet sitting service, they may be available to help, but discuss the possibility well in advance. Planning and preparation will enable you to evacuate with your pets quickly and safely. But bear in mind that animals react differently under stress. Outside your home and in the car, keep dogs securely leashed. Transport cats in carriers. Don't leave animals unattended anywhere they can run off. The most trustworthy pets may panic, hide, try to escape, or even bite or scratch. And, when you return home, give your pets time to settle back into their routines. Consult your veterinarian if any behaviour problems persist.

Pet Evacuation

Take your pets with you. Many people mistakenly leave their companion animals behind when they evacuate during an emergency, thinking their pet's instincts will prevent them from being harmed. Nothing could be farther from the truth. Companion animals depend on us for their survival, much as children do.

- Take your supplies with you. At evacuation sites, you should have, or be able to readily obtain, food, water, veterinary care, handling equipment, and generators if necessary.
- Photograph your pet. Carry a photo of your pet for identification purposes.
- Transport your pet safely. Use secure pet carriers and keep your pet on a leash or in a harness.
- Find a pet-friendly hotel. Because most emergency shelters do not admit pets, call hotels in a safe location and ask if you can bring your pet. If the hotel has a no-pets policy, ask the manager if the hotel can waive the policy during the disaster.
- Carry a list of emergency telephone numbers with you. This should include your veterinarian, local animal control, local animal shelters, the Red Cross, and any other individual or group you might need to contact during the disaster.

- Foster your pet. If you and your pet cannot stay together, call friends, family members, veterinarians, or boarding kennels in a safe area to arrange safe foster care.
- Have supplies on hand. Be sure to pack a week's worth of food, water, medication, cat litter, or any other supplies your pet needs on a regular basis.
- Plan your evacuation and leave in plenty of time. Do not wait until the last minute to evacuate. When rescue officials come to your door, they may not allow you to take your pets with you.
- Evacuate animals as soon as possible. Be ready to leave once the evacuation is ordered.
- Set up safe transportation. Make sure that you have available trucks, trailers, or other vehicles suitable for transporting farm animals or arrange to have experienced animal handlers and drivers to transport them.

- Arrange your evacuation route in advance.
- Arrange for a place to house your animals.
- Plan an alternate evacuation route. Alternate routes should be mapped out in case the planned route becomes inaccessible.
- Work with the state department of agriculture. If your animals cannot be evacuated, your state department of agriculture can provide on-farm oversight.
- Identify your pet. Securely fasten a current identification tag to your pet's collar. If you face evacuation, it is a good idea to attach to the collar the phone number of a friend or family member who is well out of disaster range. That way, anyone who finds your pet will be able to reach a person who knows how to contact you.

Other Pet Evacuation Tips	**Birds** Birds should be transported in a secure travel cage or carrier. In cold weather, wrap a blanket over the carrier and warm up the car before placing birds inside. During warm weather, carry a plant mister to mist the birds' feathers periodically. Do not put water inside the carrier during transport. Provide a few slices of fresh fruits and vegetables with high water content. Have a photo for identification and leg bands. If the carrier does not have a perch, line it with paper towels and change them frequently. Try to keep the carrier in a quiet area. Do not let the birds out of the cage or carrier.	**Reptiles** Snakes can be transported in a pillowcase but they must be transferred to more secure housing when they reach the evacuation site. If your snakes require frequent feedings, carry food with you. Take a water bowl large enough for soaking as well as a heating pad. When transporting house lizards, follow the same directions as for birds.	**Pocket Pets** Small mammals (hamsters, rabbits, gerbils, etc.) should be transported in secure carriers suitable for maintaining the animals while sheltered. Take bedding materials, food bowls, and water bottles.

If you must evacuate, do not leave your animals behind. Evacuate them to a prearranged safe location if they cannot stay with your during the evacuation period. If there is a possibility that disaster may strike while you are out of the house, there are precautions you can take to increase your pets' chances of survival, but they are not a substitute for evacuating with your pets.

6 Rehearsals

It's not enough to simply have a plan and route selected for disasters. You need to practice the plan as if it were real and throw in some random situations you didn't expect. This section covers the forms of rehearsals you should participate in and how to simulate random problems you may encounter along the way. You can be the controller of these random factors or you can get an external party to tell you what happens so there's no bias. You should take notes throughout the simulation to improve your plan for next time and adapt to any circumstances should they happen in the real situation.

Rehearsing Tips

Rehearse bug out plans for multiple disaster scenarios and have contingency plans in case of accidents. Keep rehearsing any skills you know, practice makes perfect and if you don't use it you lose it. Act as if any situation is real and that your life depends on getting everything right.

Complications	Different circumstances that can be applied to your bug-in/out at any time which you have to work around. The below rehearsal complications can be just thrown into any bug in or bug out situation at any point in time.
Scenarios	A whole scenario is given to you which you have to enact and then work through

How to Play

The situations below are possible events that could happen during a disaster. It only specifies the problem, you have to find a solution to it yourself. If you don't find a solution you should predict what would happen as a result from that and adapt to the situation. Ideally you will want to roll a new scenario every 2-3 hours to keep you on your toes and to represent a scenario where multiple things can go wrong.

So if you're doing an overnight adventure from 8am to 8pm the next day you would have rolled at 11am, 2pm, 5pm, 8pm, 11pm, *Break while asleep*, 8am, 11am, etc.

You could even roll the dice to see how many half-hours or full hours before the next event.
1 = 30 mins and 6 = 3 hours

Equipment ● 1 x 6 Sided Dice ● This Spreadsheet	**Rolling** Roll a 6-sided dice once to find the row you will look at. Roll again twice, adding the numbers together then minus 1. Your roll will be between 1-11 and corresponds with a cell in the row you rolled. Where column G=1 and Q=12.	The complications vary from minor alterations of your plan to severe events which can completely alter the outcome. The severity is shown via the cell number colour. Complications can be timed every x hours or happen whenever you decide (or the game master decides) on rolling one.

Roll Severity The roll severity is how much this complication will affect you.	**Minor (Green)** Small deviations	**Major (Orange)** Quite sizable deviations from the plan	**Severe (Red)** Huge deviations from the plan

Cumulative
The complications are cumulative so if your party is split up and you have previously rolled downed mobile networks, you can't simply ring them to find out where they are. There may be some that contradict each other such as a drought and heavy rain, so just go along with it and see what happens.

Difficulty Level
You can choose what level of complication severity you want to rehearse with, as the higher rows are tougher situations. If you're just starting out set a number and minus it from the row roll every time to reduce the overall row.

If you roll a row 5 and you want 2 levels easier you will read from row 3 instead of 5. You then roll the row number of the complication.

Injuries
If a simulated injury is sustained you should apply medication to the injury and not use that limb if necessary. Do not actually take medication for any simulated ailment but pretend that supply is now gone and put it in an area for consumed items. If you die it's probably best to stay away from those alive to maintain the simulation.

Have Fun
The most important factor in this is that you learn something from the simulation and have fun while doing so, if possible get some friends to be the "game master" to coordinate attacks every so often so the participants can focus on surviving.

Dice Rolls

The following is how to read and act on the information from one of the cells you rolled. Some cells have dice roll numbers at the bottom of them which provide a slightly different outcome to what is mentioned above. Some cells are dependant on your current situation and what action you take after the event. Depending on what you choose to do in that scenario, a different outcome will take place. Other cells require you to keep rolling the dice every x hours to see if an effect will take place. If a cell says "Cumulative Effect" and you roll a 3, you have to do all of the effects from 1-3.

If you don't have a dice, see the ENTERTAINMENT section for a simulated die.

Dice Rolls	**2,4,6:** Do this action if you roll any of the numbers listed.	**1-4**: Do this action if you roll any of those numbers (inclusive). So 1,2,3 or 4.	**Odd**: 1, 3, 5 **Even**: 2, 4, 6	**(3) or (1,2,6)**: Roll for each person in the party, and if the number matches any in the brackets then do the action for that person.

There are some cells which take affect on certain people in your party, depending on how many are with you. You want to assign rolls to each person so you know who it affects. Then roll the dice and apply the affect on whoever was rolled. For an odd number of people you don't have to have the same chance for everyone. You can also have a blank number where nobody is affected.	**Number of People** **1:** 1-6 or 1-3 etc. **2:** 1-3, 4-6 **3:** 1-2, 3-4, 5-6 **4:** 1-2, 3-4, 5, 6 **5:** 1, 2, 3, 4, 5 **6:** 1, 2, 3, 4, 5, 6 **7+:** (2 Rolls) 2-3, 3-4, 5-6, 7-8, 9-10, 11, 12	***Action*** This signifies when the action should be decided on and taken in relation to the dice rolls. It is either before the dice rolls or after the dice rolls. If there's no action marker then you do the action after rolling the dice.

Bug-In Rehearsals

These are the bug-in rehearsal scenarios.

Inside a House

Bug-In	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Bug-In Complications Row 1	**Cell 1** You see your neighbour run past your window and knock on your door seemingly panicked and making a commotion. 1-2: It's a distraction while their buddies stealthily try to enter through the back door. 3-4: They've seen a violent gang down road approaching your location and came to warn you. If you roll a 1,3 or 6 they will attempt to loot your house. 5-6: They are crazed and lunge at you with a concealed knife if you open the door.	**Cell 2** It's raining heavily and any outdoor firewood gets damp. You notice a small leak in the roof in another part of the house which has formed a small puddle on the floor. Dripping once per 2 seconds. Without patching the leak will double in output every hour.	**Cell 3** Your mains gas supply and bottled gas canisters - including camping gas has run out.	**Cell 4** The water supply to your house is knocked out and you can only get a few drips per minute.	**Cell 5** The sewage system is clogged and the toilet now contains floating faeces.	**Cell 6** A party member has accidentally burnt themselves and a large portion of their torso. They can't use their left arm.	**Cell 7** There's a solar flare which is blocking all wireless signals such as: TV, radio, GPS, wifi, 3G, 4G etc. 2 way radios still work with their range down to 1/3rd. All grid electricity is knocked out permanently.	**Cell 8** A water pipe bursts in the bathroom and soaks through any toilet paper and fabric in those rooms rendering them useless.	**Cell 9** The sky is covered in thick cloud rendering solar panels useless for weeks on end.	**Cell 10** There's a FEMA truck nearby giving out food and water to the line of people waiting. Your unfriendly neighbours notice you aren't in the line and wonder why.	**Cell 11** Some of your party (or kids) are extremely bored just sitting and waiting with nothing to do as it's too dangerous to leave the house. They begin to get restless and start making noise.

Bug-In Complications Row 2	**Cell 1** A lightning strike hits your power line inlet and kills the power permanently disabling anything plugged into the wall outlets.	**Cell 2** Your supply of wood and hexamine tablets has been exhausted.	**Cell 3** You realize all the current batteries in your torches are dead.	**Cell 4** Some of your party are divided and are adamant they want to leave the house as it's too dangerous to stay.	**Cell 5** Your diesel/petrol and other liquid fuel supplies are now depleted.	**Cell 6** There's a pandemic in your area and any gaps in your framing will possibly let in the contagious virus. Trips outside will surely infect anyone without proper protection.	**Cell 7** During the nights thieves are stealing your crops, livestock and anything else not tied down.	**Cell 8** An EMP knocks out the power to your house via a surge in the grid and fries any electronics connected to the wall socket. As it was quite a distance away the EMP doesn't affect anything not plugged in to the wall.	**Cell 9** It begins to snow heavily, freezing water mains and external water sources.	**Cell 10** Your gas grid pressure is extremely low, making it impossible to use.	**Cell 11** A screaming young child in your party is drawing unwanted attention from outside.
Bug-In Complications Row 3	**Cell 1** One of your party members has an infected cut on their leg they failed to show you earlier and are now clammy and cold.	**Cell 2** A blizzard hits your house and freezes all water pipes, and external water tanks. The snow is 3ft deep making it impossible to open outward swinging doors for 48 hours. Your power is knocked out and most outdoor plants die.	**Cell 3** The temperature is 37.5°C (100°F) outside and 95% humidity. There are bushfires approaching the area slowly filling the air with increasingly more smoke.	**Cell 4** A mudslide coats the south side of your house in 1ft, slow flowing mud pushing over anything not fixed down.	**Cell 5** A member of your party has cut themselves severely on some rusty metal and requires attention.	**Cell 6** You find your bagged and boxed supplies of rice, flour, wheat riddled with weevils and mice/rat faeces. Food stored in sealed plastic containers is safe.	**Cell 7** Two police officers knock on your door, after a few minutes of not answering they shout inside telling you there's a mandatory evacuation due to a cat 5 hurricane approaching the area. They push a letter under the door stating this.	**Cell 8** The grid electricity goes down but you have a party member who needs to keep their insulin refrigerated and they will die without it.	**Cell 9** The grid power has been knocked out and a gang of 20 local neighbours are gathering outside looking for anyone with generators or light coming from their house with unsavoury thoughts.	**Cell 10** 3/4 of your ammo store has been soaked in water and is now unusable.	**Cell 11** You realize your biggest tank of stored water has been contaminated by bacteria.
Bug-In Complications Row 4	**Cell 1** The sky is red and fairly thick with smoke as a wildfire approaches your location.	**Cell 2** Prominent points of your house are being shot at from afar on the northern side such as livestock, lights, windows, visible people, pets, solar panels and water/gas tanks. Their primary aim is for entertainment.	**Cell 3** People are walking around your house looking for an easy point to break in thinking it's abandoned like all the others in your street.	**Cell 4** A stray rocket flies into the side of the house where your food stores are kept breaking open half the cans and shattering all the glass jars.	**Cell 5** The power is knocked out to your house and won't be back on again. Stop using all wall powered electronics.	**Cell 6** A camera drone is flying around your house, likely looking for points of entry or weaknesses.	**Cell 7** A party member falls and injures their right leg. 1-2: They break their leg 3-4: Just some bleeding and minor damage. 5-6: Their leg is cut deep from sharp metal.	**Cell 8** A nuclear accident has happened in the nearest plant and has now irradiated your area. Plants grown outside will be toxic and anyone who sets foot outside will succumb to radiation poisoning without medication.	**Cell 9** All external networks are down and you receive no signal on your phone, TV, radio, GPS, etc.	**Cell 10** A fire starts in a room with an electrical heater, candle or a gas lantern/cooker which was left unattended for 5 minutes. Any supplies in that room are destroyed.	**Cell 11** You've been tagged as someone who is prepared for disasters and the government now has 5 armed agents ramming the door to confiscate all your supplies for their own use.
Bug-In Complications Row 5	**Cell 1** Ash is falling onto your roof due to a nearby volcano, it's also raining making the rock extremely heavy, the roof has about 2 hours before it collapses entirely.	**Cell 2** A magnitude 8 earthquake shakes the house knocking 75% of loose objects to the ground breaking them. Breaking glass food jars and denting cans if not secured. Half of your party sustains moderate injuries such as bruises, deep cuts and a broken bone for one member.	**Cell 3** Your house is situated in a warzone as planes shoot each other down above and bombers drop lines of bombs over populated areas. It seems likely that eventually one will hit your house.	**Cell 4** A strong storm and hail shatters 75% of your east-side windows and breaks 50% of your solar panels. 50% of animals outside are killed.	**Cell 5** You hear a window break in a far corner of the house, after a few seconds shots are fired and you lose one of your party instantly.	**Cell 6** It's heavily raining/flooding and the water is starting to flow into the lowest point of your house 5ft (+3ft every hour for 5 hours) and 1/2ft (+1 ft/hr) deep and slowly rising.	**Cell 7** The funnel of a tornado moves over your house destroying the roof in the two south-western most rooms letting rain in.	**Cell 8** A flash grenade is thrown through an open window, soon to be followed by 4 armed assailants.	**Cell 9** A plague of vermin has been into any unsecured food around the house which is now inedible.	**Cell 10** A hurricane is nearby causing a 1ft tidal surge of water equally inside your house rendering all electronics under 1ft unusable.	**Cell 11** One of your party members shows signs of a severe contagious viral infection.
Bug-In Complications Row 6	**Cell 1** You've heard that there's a tsunami heading towards your location which will arrive in 2 hours. It will reach your location for sure but the water level could bet anywhere between 1cm-2m by then.	**Cell 2** It's war and you've been instructed to keep all lights off unless the windows are fully blocked and not to make any noise. If not you will likely be a target for enemy attack or attack from street gangs.	**Cell 3** An armed gang of 8 is roaming the streets, killing people and looting houses, they will be at your house in 20 minutes.	**Cell 4** You find a party member unconscious on the floor in an enclosed room with a running generator.	**Cell 5** Riots are happening in the streets nearby as cars and houses are being set alight. They are slowly working their way down the street to your house.	**Cell 6** You hear the sound of gun fire in the street right outside. It seems two parties have engaged in combat.	**Cell 7** A gang of 30 people have surrounded your location and are attempting to break in as they know you have supplies, they occasionally shoot through windows to scare you. If they can't get in they are likely to just torch the place.	**Cell 8** You hear large aircraft and then a whistling and deafening explosion as a bomb hits the house beside yours destroying half of it and 1/4 of your house on the western side. 1/2 of your party have a variety of different wounds from shattered glass.	**Cell 9** Strong winds from a category 5 hurricane are ripping tiles off your roof and smashing windows. All external rooms have significant damage and no roof.	**Cell 10** A gun misfires into a party members right shoulder during maintenance.	**Cell 11** Thick ash from a nearby eruption is falling on your house. After 5 hours the roof of 2 external rooms will collapse. There's a 33% chance the entire roof will collapse in 7 hours, after which the roof is at capacity and will survive more ash unless it rains. There's no sign of it stopping.

Bug-In Scenarios

These are a variety of scenarios which you can enact to help shore up your household defences and skills. You have to try and work through a scenario from start to finish taking notes on the way about what you can improve.

Scenario 1	Try a home invasion rehearsal with toy guns (nerf, gel or paintball guns) to find the weak spots and possible entry points to your abode both on the offensive and defensive.
Scenario 2	A category 5 hurricane is heading towards your home, rehearse your plan for covering glass and reinforcing one room and bugging in for 3 days.
Scenario 3	A forest fire is burning out of control towards your location, the air is full with smoke and ash. It will be on your location in 2 hours.

Bug-Out Rehearsals

These are the bug-out rehearsal scenarios.

Walking / Hiking

Walking / Hiking	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Bug-Out Hiking Complications Row 1	**Cell 1** A black bear with 2 cubs is 150m (492ft) ahead of you and hasn't seen you yet, it isn't likely to move away even if it sees you.	**Cell 2** The air is thick with ash from a nearby volcano. Protect your lungs.	**Cell 3** A party member finds an engorged tick on themself with a bullseye rash around it. 2/4: They get lyme disease.	**Cell 4** You realize the shelter you packed has a large 20cm rip in it from rubbing against the poles and will need to be patched or you'll get wet if rained on.	**Cell 5** You trip and fall, scraping your knee. There's bits of dirt and tiny rocks in the wound. 5: It gets infected.	**Cell 6** Due to the heat, any type of fires are banned and there's a chance you will start a forest fire if you ignore the warning.	**Cell 7** There's two poisonous snakes on the path ahead of you.	**Cell 8** It's so cold your water begins to freeze and fuel canisters don't work.	**Cell 9** You forgot the toilet paper and toothbrush.	**Cell 10** One member of your party can't walk any more without a break of at least 1h.	**Cell 11** You've sprained your ankle and have to stop or limp slowly for 2 hours.
Bug-Out Hiking Complications Row 2	**Cell 1** There's no longer mobile or internet reception.	**Cell 2** Your backpack becomes wet, soaking through your firelighters and tinder rendering them useless. This affects matches, lighters and piezo ignition.	**Cell 3** You accidentally slice your hand open on a saw or knife. The cut is about 2.5cm (1in) in length and depth.	**Cell 4** All external networks are down and you receive no signal on your phone, radio, GPS, etc.	**Cell 5** It starts pouring with freezing rain for 1 hour, walk 20% slower. Hypothermia will set in without rain protection. **Without Rain Protection** 1-2: A party members gets hypothermia.	**Cell 6** Your feet have been rubbing against your shoe so long that you've got 3 blisters.	**Cell 7** You sustain a tear in your pack and items will fall out if not patched or moved to another compartment.	**Cell 8** You're heading into a slightly irradiated area. Food and water should not be consumed from nature or taps. **Eat or Drink Natural Resources** 1-5: You get minor radiation sickness.	**Cell 9** It's an extremely hot day and you're going to get burnt without protection. You also go through water twice as fast.	**Cell 10** You forgot a can opener and a gas stove. Don't use either if you have them.	**Cell 11** The ground becomes very slick/slippery due to icing over. Roll the dice every 30 minutes, if it's a 1, you fall and sustain an injury.
Bug-Out Hiking Complications Row 3	**Cell 1** It starts hailing on you with ice about 2cm wide. **Without Shelter** 1-2: A party member sustains head injuries.	**Cell 2** A formation of 5 enemy aircraft approaches from the east, likely on a bombing run in the area.	**Cell 3** There is an uncharted cliff in front of you that spans 1km (0.6mi) wide. Find a way around.	**Cell 4** You lose all GPS satellites from now on. Don't use any GPS features.	**Cell 5** You realize a pack of 6 wolves are stalking behind you looking for a moment to strike.	**Cell 6** You brought the wrong map, don't use any paper maps from now.	**Cell 7** You forgot your water filter and purification tablets and have to find other purification methods.	**Cell 8** You begin feeling altitude sickness with nausea, dizziness and dehydration. (Pretend you're at 9,000 ft)	**Cell 9** Your mobile phone somehow corrupts itself and isn't usable.	**Cell 10** You're hiking past a large village for 3km (1.8mi) with potential hostiles living there.	**Cell 11** The area you are heading into is known to have airborne viruses.
Bug-Out Hiking Complications Row 4	**Cell 1** You see a platoon of about 30 enemy soldiers about 3km (1.8mi) away to your heading your direction from the South-East.	**Cell 2** A thick fog covers the landscape reducing visibility to 20m (65ft) ahead.	**Cell 3** Due to a lasting drought all the lakes and rivers in your region have dried up. Find alternative ways to acquire water.	**Cell 4** You realize you don't have a first aid kit in your pack.	**Cell 5** Someone has seen you hiking through their private land from about 300m (984ft) away and they are yelling and running towards you. They appear to be armed.	**Cell 6** Your knee hurts every step you take and must walk slower to avoid extreme pain.	**Cell 7** You forgot to charge your spare batteries and your only remaining torch has 30m of light left.	**Cell 8** The sole of your right shoe breaks off and leaves your feet exposed to the ground.	**Cell 9** You begin throwing up the last meal you had and feel the onset of diarrhoea possibly due to your meal, but it could also have been from unsterilized water.	**Cell 10** You discover a hole in your water bottle/pack and it's all leaked out. You will become dehydrated and can't continue after 1h of hiking.	**Cell 11** A military helicopter with a powerful light is searching the area.
Bug-Out Hiking Complications Row 5	**Cell 1** A rusty nail goes into one of your party members feet, apply medical aid and limp from there. If you roll a 2 or 5 it becomes infected in 3 hours without treatment.	**Cell 2** Your primary methods of fire lighting have failed except flint and BIC lighters.	**Cell 3** There's a gang up ahead, who are likely to shake you down if seen. Stick to the shadows and make as little noise as possible.	**Cell 4** You lose your footing and fall into a lake/river. Guns, lighters, matches, fuel tablets, open food, tinder and un-waterproofed electronics don't work anymore.	**Cell 5** One of your party members accidentally steps on a rattlesnake and it bites them on the leg.	**Cell 6** You forgot to bring any cord. Don't use any cord, rope, paracord or string you have.	**Cell 7** You notice two individuals who have been following you for a long time, and believe they want to harm you.	**Cell 8** A party member is absolutely exhausted from hiking and is about to collapse. You have to set up camp within 300m overnight or rest for 2 hours.	**Cell 9** Strong winds slow your progress and push over a 40m (131ft) tall tree in your path every 2 hours. Walk around it or find another route. Walk 25% slower. 1-2: Walk 25% slower 3-4: A party member is grazed by a falling branch 5: A falling branch falls on a party members shoulder closest to a tree. (Stop using that arm) 6. A falling branch hits a party members head knocking them unconscious.	**Cell 10** You realize your party is being followed by a two individuals. These people will stop at nothing to get your gear.	**Cell 11** Your knife blade breaks clean off from the handle and can't be re-attached.

Bug-Out Hiking Complications Row 6	**Cell 1** Your mobiles stop working due to an emp. All other electronics with transistors also stop working. This includes complex torches with modes and settings other than an on/off switch.	**Cell 2** You hear a flurry of exchanged gunshots somewhere nearby.	**Cell 3** If you have a fire or a gas stove on, a spark leaps to nearby leaves and ignites a forest fire. You will be burnt to death if you don't get out within 10 minutes and at least 3km (1.8mi) away.	**Cell 4** You trip and fall down an embankment and break your leg.	**Cell 5** This location seems unfamiliar to you and you realize your GPS or compass must be faulty. Walk in a random direction for 1km (0.6mi). 1: North 2: South 3: East 4: West 5: NW 6: SE	**Cell 6** You're in a floodplain and you notice the water level rising considerably fast. Get to ground at least 30m (98ft) above where you currently are or be swept away. Wait at least 3 hours until the water subsides.	**Cell 7** An EMP kills all your electronics (excluding cars) except those protected by a faraday cage. Do not use any of it.	**Cell 8** A tree falls and tears a 50cm (1.6ft) slit in your shelter (except canvas).	**Cell 9** You are ambushed on a hike by 3 armed individuals who tell you to give them your food and water.	**Cell 10** You realize you've been walking the wrong way and are now lost. Walk in a random direction for 2km (1.2mi). 1: North 2: South 3: East 4: West 5: NW 6: SE	**Cell 11** Your fire lighting materials catch fire in your backpack and you can only save 7 items of your choice, the rest are burnt. Any items on your person or outside the bag are safe.

Cycling

Cycling	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Bug-Out Cycling Complications Row 1	**Cell 1** A thick fog covers the landscape reducing visibility to 50m (164ft) ahead.	**Cell 2** You hit a nail and your tyre goes flat.	**Cell 3** The receiver of your primary gun breaks. Don't use it anymore.	**Cell 4** Your drinks holder isn't secured properly and falls of your bike.	**Cell 5** The gears on one of your bikes is jammed in its current gear and you're unable to change it for the rest of the trip.	**Cell 6** It begins to snow heavily making progress slower. Move at half the speed you were.	**Cell 7** You forgot your water filter and purification tablets and have to find other purification methods.	**Cell 8** A huge downed tree lies in your path.	**Cell 9** The ground becomes very slick/slippery due to icing over. Roll the dice every 30 minutes for each party member, if it's a 2, they fall and sustain an injury.	**Cell 10** Your chain comes off the back gears.	**Cell 11** It begins raining heavily.
Bug-Out Cycling Complications Row 2	**Cell 1** One of your party members has an infected cut on their leg they failed to show you earlier and are now clammy and cold.	**Cell 2** Compasses can't be trusted due to a pole magnetic shift.	**Cell 3** You approach a flooded section of road and you aren't sure how deep the water is.	**Cell 4** It's raining which makes it harder to see and gives you more risk of slipping. Roll a dice every hour you are riding and if it's a 4, you fall off your bike and sustain an injury.	**Cell 5** As you go over bumpy terrain you don't realize most of the items in your pant pockets has fallen out. Discard all items in your pockets except 2.	**Cell 6** Your back brakes no longer work.	**Cell 7** You forgot the toilet paper and toothbrush.	**Cell 8** You're cycling past a large village for 3km (1.8mi) with potential hostiles living there.	**Cell 9** You hit a rock and fall off your bike causing a gravel rash and some minor cuts to your left leg and both hands.	**Cell 10** Your chain comes off the gears.	**Cell 11** You don't know why but your tyre keeps getting flatter over time.
Bug-Out Cycling Complications Row 3	**Cell 1** You can't seem to change gears on your bike.	**Cell 2** Snow starts to fall and the temperature drops rapidly.	**Cell 3** You hear gunfire about 1km (0.6 mi) in front of the direction you're going.	**Cell 4** A member of your party is extremely fatigued and doesn't want to continue. They need a rest of at least 1 hour.	**Cell 5** Due to a lasting drought all the lakes and rivers in your region have dried up. Find alternative ways to acquire water.	**Cell 6** It's a very hot day and you've been cycling for hours. One of your party members has some symptoms of heat stroke.	**Cell 7** A lightning storm is approaching and will bring heavy rain, hail (1 in) and lightning. It lasts 1 hour. If you seek shelter under trees roll the dice and if it's a 3 it is struck by lightning and you sustain burns over half your body. If you don't seek shelter roll the dice for each person and if it's a 2-4 they sustain hail injuries.	**Cell 8** There's a government blockage ahead only letting people with a photo and address ID through per person.	**Cell 9** Your bike slips and one of your party members falls into a lake/river. Guns, lighters, matches, fuel tablets, open food, tinder and un-waterproofed electronics carried by them don't work anymore.	**Cell 10** Lava is flowing over your route 100m (328 ft) in front of you. It spans 2km (1.2 mi) in the direction of the nearest mountain so you will have to go around.	**Cell 11** Your clothes become soaked from rain and the temperature is 10°C (50°F). (If you don't have rain protection)
Bug-Out Cycling Complications Row 4	**Cell 1** An armed gang of 8 is roaming the region ahead, killing anyone they encounter.	**Cell 2** You begin feeling altitude sickness with nausea, dizziness and dehydration.	**Cell 3** One of your party members is shot off their bike from a nearby enemy concealed in a bush. They sustain fall injuries and the bullet penetrated their lower leg and isn't life threatening.	**Cell 4** Your chain comes off the gears.	**Cell 5** Your mobiles stop working due to an emp. All other electronics with transistors also stop working. This includes complex torches with modes and settings other than an on/off switch.	**Cell 6** There's two highly venomous snakes on the path/road ahead of you and going around will take 20m longer.	**Cell 7** A minor earthquake rocks the area, causing twigs, sticks and branches to litter your route. Roll the dice every 3 hours for each party member and if it's a 5 you slip on a branch and fall off causing bruising and injury to yourself.	**Cell 8** One of your party members runs over some glass and their tyre goes flat.	**Cell 9** A blizzard seems to be approaching and will hit within 1 hour. During the blizzard you can't see more than a few yards in front of you. Seek shelter or die within 3 hours. The blizzard lasts 5 hours.	**Cell 10** There is an uncharted cliff in front of you that spans 1km (0.6mi) wide. Find a way around.	**Cell 11** You lose all GPS satellites from now on. Don't use any GPS features.
Bug-Out Cycling Complications Row 5	**Cell 1** One of your party members chains detaches from the pedal gears.	**Cell 2** You realize you're being tailed by a black SUV. These people will stop at nothing to get your gear.	**Cell 3** You've been riding over very bumpy terrain which has damaged any unprotected fragile items in your BOB. Stop using unprotected glass items including vials, glowsticks and instant ice packs.	**Cell 4** You lose all GPS satellites from now on due to an EMP. Don't use any GPS features.	**Cell 5** The front brakes on your bike stop working.	**Cell 6** You slip in a wet patch and fall off your bike causing a major gravel rash, dislocated finger and scars to your legs and hands.	**Cell 7** You realize your handlebars are loose and are starting to rotate freely.	**Cell 8** 5 random items (or 1/6) fall from one of your party members BOBs, do not use these items from now on. Roll a dice to determine the items.	**Cell 9** Someone has seen you cycling through their private land from about 300m (984ft) away and they are yelling and running towards you. They appear to be armed.	**Cell 10** You brought an empty gas canister. Don't use your biggest canister.	**Cell 11** You see a small tornado funnel forming ahead of you which will meander in a random direction once grounded. Roll the dice to determine its direction. 1 - North 2 - South 3 - East 4 - West 5 - No Movement 6 - Towards You
Bug-Out Cycling Complications Row 6	**Cell 1** Strong winds slow your progress and push over a 40m (131ft) tall tree in your path every 2 hours. Walk around it or find another route. Walk 25% slower. 1-2: Walk 25% slower 3-4: A party member is grazed by a falling branch 5: A falling branch falls on a party members shoulder closest to a tree. (Stop using that arm) 6. A falling branch hits a party members head knocking them unconscious.	**Cell 2** You fall down a drop on your bike and bend the front wheel slightly so that it is dangerous to keep riding like it is.	**Cell 3** A stick falls into the spokes of you back wheel breaking 4 spokes. There's a chance that the wheel will grow weaker and bend over time. While riding, every hour, roll the dice and if it's a 1 the wheel buckles and becomes unusable.	**Cell 4** 3 armed helicopters with a powerful search lights are coming towards you from the nearest major city. You have 2 minutes before they are on top of you. They search the area for 30 minutes before flying off. Ignore Them: If you roll a 4-6 they shoot at you killing one of your party members and injuring another. If you have camouflage they leave the area within 15 minutes instead.	**Cell 5** This area is littered with hostile enemies who will shoot you if they see any light sources (night), or you have very visible colours on you (day). Swap to camo, hide or do nothing and roll - if you roll a 2 you're shot at.	**Cell 6** One of your party members chains snaps.	**Cell 7** A party member accidentally rides over a rattlesnake. 1-2: The snake doesn't manage to bite them 3-4: The snake doesn't bite them but the member falls off their bike and sustains minor injuries. 5: The snake bites and injects venom. 6: The snake bites them but no venom was injected.	**Cell 8** A gun misfires into a party members left leg during maintenance. The bullet exits cleanly.	**Cell 9** A fall from your bike causes you to fly over the handlebars breaking your right arm and causing major cuts to the right side of your body.	**Cell 10** Something in one of your party members bags catches alight and renders all items un-usable.	**Cell 11** A non-family adult party member decides not to continue to this bug-out location and wants to go their own way taking a lot of the supplies with them. (Only if in a group)

Driving

Driving	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Bug-Out Driving Complications Row 1	**Cell 1** There's a huge tree on the road ahead.	**Cell 2** The region you're entering contains airborne viruses which kill anyone over 3 days if not properly protected.	**Cell 3** 5 random items (or 1/6) fall from your bug-out bag, do not use these items from now on. Roll a dice to determine the items.	**Cell 4** It's currently freezing weather and one of your inflatable sleeping pads has a hole in it.	**Cell 5** It starts pouring with rain for 1 hour, drive 20% slower. Hypothermia will set in without rain protection in about 3h.	**Cell 6** A vicious lighting storm will be on you in 30 minutes and will last 2 hours.	**Cell 7** A minor earthquake rocks the area, pushing small trees over your path. Wait 15 minutes while you clear the tree.	**Cell 8** Compasses can't be trusted due to a pole magnetic shift.	**Cell 9** Snow begins to fall and impedes your movement, move at half the speed you were going.	**Cell 10** All cell phone towers are down and you have no communication on grid based networks.	**Cell 11** Fist sized hail begins to fall accompanying rain for 1 hour. Some vehicle windows will be shattered and head injury will occur if no shelter is found.
Bug-Out Driving Complications Row 2	**Cell 1** Your biggest water storage source has leaked and is now empty. Discard all water in the largest source.	**Cell 2** You bump into an old friend on the way and he asks for supplies. If you decline he becomes more hostile and eventually wants to take it by force.	**Cell 3** You realize the shelter you packed has a large 20cm rip in it from rubbing against the poles and will need to be patched or you'll get wet if rained on.	**Cell 4** You realize you brought the wrong ammo for your main weapon. You've only got 1 clip worth of ammo.	**Cell 5** Your paper maps weren't protected from rain and are now unreadable.	**Cell 6** A formation of 5 enemy aircraft approaches from the east, likely on a bombing run in the area.	**Cell 7** You forgot the toilet paper and realize your air mattress has a hole in it.	**Cell 8** The party leader get a severe migraine, compromising their decision making.	**Cell 9** Half your food supply turns out to be mouldy. Discard half the food supply.	**Cell 10** Your young children won't stop screaming and are fearful for their lives after seeing someone die earlier.	**Cell 11** You forgot a can opener and a gas stove. Don't use either if you have them.
Bug-Out Driving Complications Row 3	**Cell 2** You hear a distant helicopter approaching, it will be on you within 1 minute, it's likely if they see you they will try to fly low and shoot your party.	**Cell 2** Ash is falling from the sky and will clog your lungs if not protected against.	**Cell 3** You begin feeling altitude sickness with nausea, dizziness and dehydration.	**Cell 4** A forest fire is rapidly approaching you from behind and will engulf you in 10 minutes.	**Cell 5** One of your party members shows signs of a severe contagious viral infection.	**Cell 6** Your backpack tears around the lowest compartment and all items in there have to be relocated or left behind.	**Cell 7** Your primary knife blade snaps from the handle rendering it useless. Adapt or don't use it anymore.	**Cell 8** There's a gang up ahead, who are likely to shake you down if seen. Stick to the shadows and make as little noise as possible.	**Cell 9** You sustain a minor elbow cut from falling or sliding off the road. If you don't have bandages roll the dice and if it's a 1 or 4 it becomes infected.	**Cell 10** You path is blocked by a gang 500m (0.3 mi) in front who will shoot on sight if you're seen within 200m (656 ft).	**Cell 11** A thick fog covers the landscape reducing visibility to 20m (65ft) ahead.
Bug-Out Driving Complications Row 4	**Cell 1** One of your party members sustains a severe cut from rusty metal, apply first aid.	**Cell 2** Your tyre pops from a rusty nail - deflate your tyre.	**Cell 3** Your mobiles stop working due to an emp. All other electronics with transistors also stop working. This includes complex torches with modes and settings other than an on/off switch.	**Cell 4** Strong winds slow your progress and push over a 40m (131ft) tall tree in your path every 2 hours. Drive around it or find another route.	**Cell 5** A non-family adult party member decides not to continue to this bug-out location and wants to go their own way taking a lot of the supplies with them. (Only if in a group)	**Cell 6** Strong wind and slippery roads slows down your progress. Drive at half the speed you were.	**Cell 7** A wild bear is in your path 100m (30ft) away and won't be scared off.	**Cell 8** You find yourself completely lost. Drive along random roads for 5-10km (3.1-6.2mi) then find your bearings again.	**Cell 9** A military helicopter with a powerful light is searching the area.	**Cell 10** You realize you're being tailed by a black SUV. These people will stop at nothing to get your gear.	**Cell 11** The cooling fan motor on your vehicle burns out and will overheat the engine if overused.
Bug-Out Driving Complications Row 5	**Cell 1** A party member stands on a camouflaged rusty bear trap and sustains a severe right leg injury. There may be more hidden.	**Cell 2** The driver slams on the brakes to avoid hitting a deer and half the party hits their heads, one person now has a concussion.	**Cell 3** Your fuel tank has a hole and is leaking fuel, fix it or stop using the car in 5k's (3.1 mi).	**Cell 4** It starts snowing heavily and within an hour it will be impossible to drive without chains or snow shoes.	**Cell 5** There's a government blockage ahead only letting people with a photo and address ID through per person.	**Cell 6** Your driver/party leader has sustained a fall and breaks their right arm.	**Cell 7** All satellites have been destroyed and you can't use GPS systems.	**Cell 8** The party leader gets a severe migraine, compromising their decision making.	**Cell 9** A fire-fight between two gangs who you didn't see breaks out in front of you and a member of your party sustains a stray bullet injury to the leg. They haven't seen you.	**Cell 10** You forgot to pack paracord and other types of cord.	**Cell 11** Your clothes become soaked from rain and the temperature is 10°C (50°F). (If you don't have rain protection)
Bug-Out Driving Complications Row 6	**Cell 1** A party member has just run out of their personal medication, but there's no sign of needing it just yet. (Insulin, Inhaler, etc.)	**Cell 2** You see a small tornado funnel forming ahead of you which is likely to meander in a random direction once grounded. Roll the dice to determine its direction. 1: North, 2: South 3: East, 4: West 5: None - slow dissipation 6: Towards You	**Cell 3** An EMP kills all your electronics (excluding cars) except those protected by a faraday cage. Do not use any of it.	**Cell 4** There's a radiation fallout zone ahead of you, it's diameter is 20km's (12.4 mi), generally too big to avoid. Take some iodine pills or you will slowly feel the adverse side effects of radiation sickness.	**Cell 5** Your party is ambushed and held at gunpoint as they take all your supplies and bags. But they are rushed and leave a random bag behind. Roll the dice to choose the bag they leave.	**Cell 6** Your transport slips and cracks the passenger side window or bends a pedal slightly if cycling. There are minor injuries to the passenger.	**Cell 7** This area is littered with hostile enemies who will shoot you if they see any light sources (night), or you have very visible colours on you (day). Swap to camo, hide or do nothing and roll - if you roll a 2 you're shot at.	**Cell 9** Something in one of your party members bags catches alight and renders all items un-usable.	**Cell 8** All your rechargeable batteries turn out to be dead and small electronics (including torches, phone and GPS) can't be used without a recharger or power bank.	**Cell 10** You see a few people 100m down the road who have seen you and are waving for you to stop and help them, but it could be an ambush. The road is narrow and you will come within 5m of them if you drive/walk past.	**Cell 11** Your party or convoy is separated due to uncontrollable circumstances by a distance of at least 500m. (Ignore if everyone is in the same vehicle)

Bug-Out Scenarios

These are a variety of scenarios which you can enact to help shore up your bug-out skills. You have to try and work through a scenario from start to finish taking notes on the way about what you can improve.

Scenario 1	Invading foreign forces have taken over multiple cities near you and are heading towards your town. They will be on your position within 12 hours.
Scenario 2	It's been raining for days and flood waters are approaching the level of your house. Flood waters are currently 15m below the elevation of your house (ground floor) but in 24 hours it is forecast to be 5m over the elevation of your house. Act as if the low lying roads before 15m of your house are flooded.
Scenario 3	

Post-Rehearsal

After the simulation is complete, you should take the notes you've written including the thoughts and ideas from other party members and improve your bug in/out plan for next time. If you realize you didn't have an epi-pen for an anaphylactic shock during the simulation then add one to your kit somewhere and ensure it's in date. The goal is to keep improving (even a little) every practise run until there's nothing else you need to add or subtract. Although there will always be new skills you can learn.

Party Questions	These are questions you can ask your party about their thoughts on the simulation to improve it for next time.	• How did you find the simulation overall? • What did you most enjoy about it? • What did you least like about it? • Do you think the simulation was an accurate representation of what could happen? • What could you have done better next time? • Do you like the current disaster plan?

7 Assessing Vulnerabilities

You're bound to have at least one weakness in your preparedness plan or preps. This section will shore up those weaknesses so one small mistake won't leave you stranded. Risk management involves taking into consideration the likelihood of any risks coupled with the damage the risk will deal if it occurs.

Gear Vulnerability

Your gear or types of gear that might have adverse affects.

Consumable Gear	You have a limited supply of consumable gear such as one use glowsticks. You should have calculated how many consumables are required to reach your destination plus 15% as a general rule.
Broken Gear	Gear may break with use or on the way to your destination. Check the state of your BOB gear every month in case an item has accidentally been broken or crushed during storage. You should have a redundancy or partial redundancy for all gear in your bag, so if something breaks on the way there's another item that can take its place even temporarily.
Spoilable Gear	Some gear may be already spoiled by the time you open it such as canned food or freeze dried food. Take into account items that go off and have an extra 30% spare for edibles such as food and water.
Electricity	You can't depend on electricity in a disaster as it would likely to be the first amenity to be taken out. Therefore you shouldn't entirely depend on your electronics such as your mobile, GPS or torch, particularly if you have no way of generating your own electricity. Not to mention that in an extended disaster, rechargeable batteries could reach their end of life before civilization returns to normal and you can't exactly replace the battery in a phone yourself even if you had a spare.
EMPs	Electronics have the potential to be rendered useless by an EMP, therefore you should always have a way to perform the same function which isn't reliant on that device. An example is having physical maps and a compass instead of using a mobile device and if possible - having a way of communicating distances without electricity such as semaphore.

Environmental Vulnerability

Your location could be your biggest vulnerability, such as having an active volcano nearby or you might be living on a tectonic plate.

Location	Living in a precarious location such as on a fault line only increases the likelihood of a disaster. As preppers it's recommended to live in a stable environment where the fewest disasters are likely to happen.
Climate	A harsh climate will make it much more difficult to reach an end destination. However the flip side is that few people will want to actively live in a harsh climate such as the arctic or a desert so you'll have less threat of people.
Creatures	Some locations have a higher than normal percentage of dangerous creatures such as Australia. It may be best to avoid these places as it falls under the same considerations as avoiding potential natural disasters.

Medical Vulnerability

Any known medically related issues that might affect your disaster plans.

Health Conditions	Some people in your party could have a health condition ranging from minor such as hay fever to diabetes which requires constant medication. Your bug out plans should take all conditions into account no matter how minor as even something as hay fever could be dangerous if your route goes past huge fields of flowers.
Accessibility	If one of your party is confined to a wheelchair or temporary crutches you may need special equipment or alternative plans to bug out safely. Be sure to account for any situations that may arise when they happen such as the broken leg of your primary bug out driver.

Team Vulnerability

Any problems that may arise with your family or bug out party.

Age	Very young or old party members won't have as much stamina or flexibility as the others in the party and may need special requirements. You're only as strong as your weakest member so make sure they are able to keep up with everyone else.
Complaints	Any complaints from other people in the party, but particularly children who aren't used to a sudden change in lifestyle. Have a method to deal with restless kids whether it's music, activities or games. Complaints by adults are harder to address as you may have justified reasons why you can't solve it straight away, this causes them to grow more discontent over time which may spread to other party members.
Betrayal	Some members of your party may choose to desert you due to poor leadership or just a change in heart. It's important to keep the loyalty of your party members or a mutiny could happen which may leave you without anything. Be sure to address concerns from party members before they become a big issue. You should know each party member intimately and have a unique relationship with each one. If possible - have an insider mole who you trust completely and will tell you any news that people are gossiping about behind your back.

Unexpected Vulnerabilities

These are vulnerabilities to your party which you cannot realistically foresee or predict. They can range from minor to catastrophic. You may be preparing for an asteroid to hit within 1,000 kms (621 mi) of your area, but you would never expect it to actually hit your house directly. This is an extreme example of the unexpected. Another example would be a 20-something party member with no history of medical problems suddenly have a major heart attack.

Management	You can't risk manage what you don't expect to happen, therefore as preppers it's best to prepare both for bugging in and out for as wide a range of scenarios as possible.

Risk Management

The sections below will help you identify, categorise and mitigate any risks that you may have relating to disasters or bugging in/out.

Managing Risks	The following is a guide on how you can gauge the approximate impact of any risks you may encounter. **1.** Make a list of every risk that you can think of relating to your bug out plan. Use a list instead of a table, but if you want draw up a table to help visualise their severity. **2.** Try to gauge the chance and the impact they will each have on your bug out plan. **3.** Calculate the severity of each risk by adding the probability chance with the impact chance. Probability No. + Impact No. = Severity **4.** Order them by the calculated severity. **5.** Work on a risk mitigation plan (explained further below) which will either reduce the severity or the chance of the risk. Work on the highest severity first.

Risk Impact

The below chart is a risk impact analysis of any risks you deem probable of occurring during a bug in/out.	**Risk Probability** The risk probability is the chance the risk has of occurring.	**Risk Impact** The risk impact is how much damage the risk will inflict if it occurs.

You first assign a probability of occurrence of the risk between 1-10 then determine the impact of the risk between 1-10 then find the risk impact from the chart. When you have the risk impact level you should take the necessary actions to mitigate or reduce the chance that rick occurs. It is not considered a risk if an event has a 0% or 100% chance of occurring. But the number range is there to cover all numbers such as 0.01% and 99.99% chances. If you create a table similar to the one below you can add as many vertical or horizontal cells as you like such as going up in 10%'s instead of 20%'s.

Risk Probability #5 (80-100% Chance)	**(6) Moderate Risk** Example: The chance of an earthquake between magnitude 3.0-4.0 in New Zealand in a week.	**(7) High Risk** Example: Your home is in a floodplain and will flood if there's a significant downpour.	**(8) Very High Risk** Example: An earthquake in the ocean triggered a tsunami, it's very likely to reach you but you don't know how big the wave will be.	**(9) Extreme Risk** Example: Multiple large economic bubbles and extremely low interest rates which could cause a recession or depression.	**(10) Catastrophic Risk** Example: A scientifically calculated high chance of an asteroid hitting earth which could wipe out life on a continent.
Risk Probability #4 (60-80% Chance)	**(5) Fair Risk** Example: Risk of house damage during a hail storm.	**(6) Moderate Risk** Example: The chance of an earthquake between magnitude 4.0-5.0 in New Zealand in a month.	**(7) High Risk** Example: Chance that you won't be able to reach your BOL in your vehicle - such as multiple downed trees.	**(8) Very High Risk** Example: Chance that you slip off the road, crash or have a medical emergency on the way to your BOL during a disaster.	**(9) Extreme Risk** Example: Very high tensions in a region which could lead to a war.
Risk Probability #3 (40-60% Chance)	**(4) Very Low Risk** Example: A storm front or tropical low which could head towards your location.	**(5) Fair Risk** Example: A meandering category 1-2 cyclone which could head towards your location.	**(6) Moderate Risk** Example: The chance of an earthquake between magnitude 5.0-6.0 in New Zealand in a year.	**(7) High Risk** Example: A meandering category 3-4 cyclone which could head towards your location.	**(8) Very High Risk** Example: A meandering category 5+ cyclone which could head towards your location.
Risk Probability #2 (20-40% Chance)	**(3) Tiny Risk** Example: Chance you forgot to pack something in your BOB you'll need later.	**(4) Very Low Risk** Example: Risk of your knife breaking within the first year of bugging out.	**(5) Fair Risk** Example: Not being able to get to your BOB during a disaster.	**(6) Moderate Risk** Example: A fault line under a major city which has a chance of a magnitude 6.0-7.0 earthquake every year.	**(7) High Risk** Example: A home invasion occurring during times of extreme hardship, riots or war.

Risk Probability #1 (0-20% Chance)	(2) Miniscule Risk Example: Your shoelace coming undone and causing you to trip.	(3) Tiny Risk Example: Chance of lightning hitting your house and knocking out your power.	(4) Very Low Risk Example: Having a car accident on the way to your bug-out location.	(5) Fair Risk Example: Chance your bug out location will be in pristine condition when you reach it.	(6) Moderate Risk Example: A fault line under a major city which has a chance of a magnitude 7.0-8.0 earthquake every year.
	Risk Impact #1 Miniscule Impact A low impact level with little damage if it occurs.	**Risk Impact #2** Low Impact Inflicts a small amount of damage if it occurs.	**Risk Impact #3** Moderate Impact A moderate impact risk will cause a fair impact on you if it occurs.	**Risk Impact #4** High Impact Inflicts substantial damage if this risk occurs.	**Risk Impact #5** Catastrophic Impact A catastrophic impact risk will cause utter devastation if it occurs.

Risk Mitigation

Ways to reduce the effects or the chance of the risk occurring. To mitigate risks you can either reduce the probability or impact of the risk or eliminate the risk completely.

Risk Acceptance	Risk acceptance does not reduce any effects however it is still considered a strategy. This strategy is a common option when the cost of other risk management options such as avoidance or limitation may outweigh the cost of the risk itself.
Risk Avoidance	Risk avoidance is the opposite of risk acceptance. It is the action that avoids any exposure to the risk whatsoever. It's important to note that risk avoidance is usually the most expensive of all risk mitigation options.
Risk Limitation	This strategy limits a company's exposure by taking some action. It is a strategy employing a bit of risk acceptance along with a bit of risk avoidance or an average of both.
Risk Transference	Risk transference is the involvement of handing risk off to a willing third party.
Watch/Monitor	Monitor the environment for changes that affect the nature and/or the impact of the risk.
Reduce Probability	Try to reduce the probability of a risk occurring. A simple example is tying your shoelaces if they are loose to help prevent you tripping. Another example is moving away from a fault line if you live near one.
Reduce Impact	Reduce the impact of a risk by taking steps to prepare for more eventualities. For example you can install roller-shutters on every window of your house to help prevent damage from attacks, hurricanes and hail. You may get some dents, but it's better than shattered windows.
Eliminate Risk	If you have the ability to - you should eliminate risks entirely. For example if there's a risk of not being able to reach your bug-out shelter due to flooding, perhaps you should live in your bug-out location permanently. If you're concerned about tsunamis you should move at least 32km (20 mi) inland where it's almost impossible for a regular sized tsunami to reach you.

8 Situation Monitoring

Without monitoring media and news outlets you won't know what's happening in the world. It's vital to keep up to date with the news and be able to separate the facts from fiction.

Internet	Social media can spread the message pretty fast about impending disasters without any bias that the media has today. You can set keywords on news websites to notify you when certain events happen near you or when a global event takes off.
Friends & Family	The more people in your prepping party that are watching for disasters and keeping an eye on the situation can provide multiple failsafe's if one person doesn't check the news for a few hours. Everyone can ring each other and keep them all informed about a worsening situation and keep in close contact when the time to come has to bug in or bug out.
The Media	There is little (if any) unbiased media today, everyone has their own slant on information which is aimed at getting you to feel, react a or spend your money a certain way. Tv has its place, but it's better to research information yourself, from many different sources to be sure you're getting the truth. For more information on media corruption see the MEDIA section.
Government Organizations	You can sometimes opt into getting text updates to natural disasters or other events that happen in cities. These can be very helpful as you get the information straight from the source such as the weather bureau. It's not always best to trust the government whole-heartedly though.
Government Institutes	Governments will attempt to control all sensitive news released with an impact to the public and will threaten heavy fines or jail time for any media outlet that doesn't comply with these demands. Generally their main aim is to avoid a mass panic and exodus of people which will make it nearly impossible for them and other government agencies such as the police to do their jobs. They typically only look at the big picture and take action to avoid the most causalities from an event by downplaying the news even if that means a small group of people dying,

Monitoring Websites

These are useful websites to help you track and monitor the disasters around the world, whether it's volcanoes, the stock market, hurricanes, tsunamis, earthquakes and more. To have the best chance to reach your bug-out destination before the rest of the population finds out you should be constantly monitoring most of these websites. For a list of other preparedness resources, head to the ADDENDUM > Media section.

Global Monitoring & News Sites

Global Monitoring & News Sites

Emergency and Disaster Information Service	A worldwide map displaying notable disasters and emergencies around the world. ***https://rsoe-edis.org/***
AccuWeather Severe Weather	Shows the different types of severe weather such as flooding, avalanches and fires currently occurring around the world. ***https://www.accuweather.com/en/au/severe-weather***
Prepper News	A prepper news website with topics sorted into different categories to make it easier to find what you need. ***https://www.prepperwebsite.com/***
Zero Hedge	An economic news website dedicated to providing uncensored content, with a focus on the economy. ***https://www.zerohedge.com/***
Summit News	A site providing global uncensored news. **https://summit.news/**
McAlvany Intelligence Advisor	*"Our mission is to awaken, equip and mobilize multiple generations with an absolute objective truth-grid in the digital information age and empower you to prosper in ever-changing geopolitical, cultural and financial ecosystems. With over four decades of battle-tested experience, we know the ropes of gathering and delivering timely global intel."* ***https://www.mcalvanyintelligenceadvisor.com/***

Weather

Weather Maps

Windy	An invaluable website which displays: ● Worldwide Weather Radar ● Worldwide Satellite Weather View ● Worldwide Wind ● Worldwide Rain and Thunder ● Worldwide Temperature ● Worldwide Cloud Cover ● Worldwide Waves ● Worldwide Air Quality ***https://www.windy.com/***
Nullschool	A website very similar to windy.com with a few less features. It shows information on wind, water and ocean conditions. ***https://earth.nullschool.net/***

Earthquakes

Earthquake Maps

Earthquake 3D	A 3D live feed of the earthquakes occurring around the planet. You can also buy and download a much higher quality version with more features from their website. ***http://www.earthquake3d.com/***
Earthquakes USGS	A 2D live world map showing the current earthquakes. USA website. ***https://earthquake.usgs.gov/earthquakes/map/***
USGS Significant Earthquakes	A list of the most recent significant earthquakes. ***https://earthquake.usgs.gov/earthquakes/browse/significant.php***
EMSC Latest Earthquakes Worldwide	A list of the latest earthquakes worldwide. ***https://www.emsc-csem.org/Earthquake/world/***
EMSC Significant Earthquakes	A list of the latest significant earthquakes. ***https://www.emsc-csem.org/Earthquake/significant_earthquakes.php***
Earthquakes@GA	A 2D live world map showing the current earthquakes. Australian website. ***https://earthquakes.ga.gov.au/***

Active Volcanos

Current

Volcano Discovery Erupting Volcanoes	Daily updated map of currently erupting and restless volcanoes. ***https://www.volcanodiscovery.com/erupting_volcanoes.html***
Volcano Discovery	Shows the active volcanoes around the world with last eruption dates. ***https://www.volcanodiscovery.com/volcanoes/today.html***

Buoys & Tsunamis

National Data Buoy Centre	Shows the buoys around the oceans on an interactive map. They flash when they go into "Event Mode" when a change in the median wave height is detected. It is useful to track tsunamis, storm surges and other water based events. ***https://www.ndbc.noaa.gov/***

Hurricanes & Cyclones

Hurricane

National Hurricane Centre	Shows any current hurricanes around the United States only. ***https://www.nhc.noaa.gov/***
AccuWeather Hurricanes	Shows any current hurricanes & cyclones around the world. ***https://www.accuweather.com/en/hurricane***

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Health

Healthmap	Real-time surveillance map of emerging public health threats and disease outbreaks. ***https://healthmap.org/en/***
Outbreaks Map	Displays outbreaks, cases and deaths from viral and bacterial diseases which have the potential to indicate biological terrorism. ***http://outbreaks.globalincidentmap.com/***
COVID-19 Hub	This is a COVID-19 hub with a lot of links to various virus tracking websites. ***https://coronavirus-resources.esri.com/***
GIS COVID-19 Tracker	Johns Hopkins University (JHU) COVID-19 live viewer. ***https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6***
Health Impact News	Uncensored news relating to health around the planet. **https://healthimpactnews.com/**

Economy

World Stock Markets	An overview of all the stock markets of the world. ***http://markets.businessinsider.com/indices/world-stock-markets***
Dow Jones Index	The Dow Jones index. ***https://www.marketwatch.com/investing/index/djia***
S&P 500 Index	The S&P 500 index. ***https://www.marketwatch.com/investing/index/spx***
ASX 200	The ASX 200 index. ***https://www.spglobal.com/spdji/en/indices/equity/sp-asx-200/***
NASDAQ Index	The NASDAQ index. ***https://www.marketwatch.com/investing/index/comp***
U.S. Debt Clock	The total U.S. debt. ***https://www.usdebtclock.org/***
M1 Money Stock	M1 consists of (1) currency outside the U.S. Treasury, Federal Reserve Banks, and the vaults of depository institutions; (2) demand deposits at commercial banks, and (3) other checkable deposits (OCDs). ***https://fred.stlouisfed.org/series/M1SL***
Velocity of M1 Money Stock	The velocity of money is the frequency at which one unit of currency is used to purchase domestically- produced goods and services within a given time period. ***https://fred.stlouisfed.org/series/M1V***

Commodities

Gold Price	The gold spot price. ***https://goldprice.org/*** ***https://www.kitco.com/charts/livegold.html*** ***https://www.kitco.com/charts/techcharts_gold.html***
Silver Price	The silver spot price. ***https://silverprice.org/*** ***https://www.kitco.com/charts/livesilver.html*** ***https://www.kitco.com/charts/techcharts_silver.html***
Platinum Price	The platinum spot price. ***https://www.kitco.com/charts/liveplatinum.html*** ***https://www.kitco.com/charts/techcharts_platinum.html***
Palladium Price	The palladium spot price. ***https://www.kitco.com/charts/livepalladium.html*** ***https://www.kitco.com/charts/techcharts_palladium.html***
Oil Price	The Oil (WTI) Price. ***https://markets.businessinsider.com/commodities/oil-price?type=wti***

External Threats

Sunspots / Solar Flares	Tracking of the sun for solar minimums, maximums, coronal holes, coronal mass ejections, sunspots and solar flares. ***https://www.spaceweatherlive.com/en/solar-activity.html***
Earth Impact Monitoring	Tracking of any space objects or debris which could impact earth. ***https://cneos.jpl.nasa.gov/sentry/***
NEO Earth Close Approaches	Tracking of any space objects or debris which could impact earth. ***https://cneos.jpl.nasa.gov/ca/***

UFO Sightings (America)	A map of all UFO sightings in America. ***http://metrocosm.com/ufo-sightings-map.html***
UFO Sighting Map	A map of all UFO sightings over the world. ***https://www.arcgis.com/apps/webappviewer/index.html?id=ddda71d5211f47e782b12f3f8d06246e***

9 Zero Hour

Zero Hour signifies an unknown date and time that a disaster worthy of preparedness action occurs. You could be anywhere when 'zero hour' strikes and your primary objective from then on is to reach your preps and gather your party together and then decide how you should proceed.

An example of zero hour is the second you hear about a nuclear exchange in your country.

Bug In or Out
When an incident occurs weigh the benefits of bugging in and out and whether it will get harder to travel as time progresses or not.

Be Ready
When the situation arises to bug out, you should be ready to grab the bags and go with enough food you will need to survive the disaster.

Be Aware
You want to be one of the first people to realize the gravity of the disaster and leave long before anyone else considers it or the roads will be parking lots.

Contact	When you first hear about a disaster that is or will affect you, the immediate action taken would be to contact your family and others whom you will meet up with. Whoever hears about the disaster first and contacts the others in the party, will give the others more time to prepare to leave work or meet up at the rendezvous point earlier. Confirm the plans you have with everyone on the phone and where they are currently as they may need assistance getting to the rendezvous point. If your family is at home already get them to start packing the car and be ready when the last person shows up. If no communications is available such as during an EMP you should follow through with the plan you set up prior to the event.
Returning Home	If you're away from your preps the first thing you'll want to do is return to a rendezvous point where your companions or family will meet up. You may not have an available mode of transport for returning home therefore you may have to walk home.
Step 1 Communicate	Communicate with your family or bug out partners if possible and tell them what's happening and to set in motion one of the plans based on the scenario. Try to use code such as: Location X or Location Delta as there's always the chance that people are listening in, or some who will ambush you there. Include what to do if communications are down such as returning home and packing the car ready. **Possibilities** ● Communication Works ● Communications Down ● Everyone is Together
Step 2 Rendezvous Point	The location you will meet if a disaster occurs. It should include an estimated timeframe of when you should expect to meet after a disaster occurs if communications are down.
Step 3 Gear Grab	Your gear is basically essential to grab before you bug out. The only reason you wouldn't is if it's already packed, you can't safely reach it or you are more likely to die trying to retrieve it. You should have your gear pre-packed in a secure, easily accessible location so you can grab it as quickly as possible.
Step 4 Depart	Set out on your selected bug-out route with your party members. If you forget anything after you leave you shouldn't return for it unless it's essential to your survival.

Considerations

Bug-In or Bug-Out	When you reach home, deciding to bug out or not can be a critical decision to make, especially in times of hardship. Hopefully at the end of this section you can make a sound decision whether you should or not. The list below are considerations you should take into account before deciding what to do. Generally you want to Bug-In as this is where all your supplies often are.
Disaster Type (Instant/Snowballing)	Whether the disaster is instant with few warning signs like an Earthquake, EMP or a Terrorist Attack, or takes a while to build or arrive such as a Hurricane, Economic Crash or Pandemic.

Instant
If the disaster is instant there would likely be more frantic people around grabbing food off the shelves and buying up critical survival items. The roads are more likely to be clogged by people trying to get out of town. The situation could get out of hand much faster than a snowballing disaster. There's often little to no time at all to bug out, as the damage is already done and you may not reach your destination. Generally it's recommended to bug-in unless you know the roads are clear to your BOL and you know things will get worse.

Snowballing
A snowballing disaster is one that progressively gets worse, just as a snowball rolling down a snowy hill will gain size and momentum. The earlier you bug out in a snowballing event, the better the chances you will reach your destination before everyone realizes and tries to leave. These disasters are harder to predict but generally tend to worsen over time. It's better to have bugged out when you didn't need to then have stayed when you should have left.

Disaster Duration

Below is the estimated durations of different disasters. This is the time until the damaging elements have subsided such as strong winds, falling ash, flames and viruses. Be warned that natural disasters may create new disasters such as riots, looting, etc, which need to be accounted for. The disaster should end when it's safe to return to your house or restart your previous life with minimal threat to your life. It's recommended to bug out in disasters with a short life such as tornadoes and severe thunderstorms as well as extremely long lasting disasters such as pandemics. You should also bug out in moderate lasting disasters such as wars and floods.

	0-2 Hours	2-12 Hours	12-24 Hours	1 Day	2-3 Days	4-7 Days	7-14 Days	14-31 Days	31-91 Days	91-182 Days	182-365 Days+
Avalanches / Landslides	0-2 Hours to 2-3 Days										
Earthquakes	0-2 Hours to 7-14 Days										
Sinkholes	0-2 Hours to 2-3 Days										

Volcanic Eruptions			12-24 Hours to 4-7 Days								
Floods	0-2 Hours to 14-31 Days										
Limnic Eruptions	0-2 Hours to 4-7 Days										
Tsunami	0-2 Hours to 2-3 Days										
Blizzards	0-2 Hours to 7-14 Days										
Cyclonic Storms				1 Day to 14-31 Days							
Droughts									31-91 Days to 182-365+ Days		
Thunderstorms	0-2 Hours to 12-24 Hours										
Hailstorms	0-2 Hours										
Heat Waves						4-7 Days to 182-365 Days+					
Tornadoes	0-2 Hours										
Wildfires	0-2 Hours to 7-14 Days										
Meteor / Airbursts	0-2 Hours to 14-31 Days										
Solar Flares / EMPs	0-2 Hours to 182-365+ Days										
Pandemics									31-91 Days to 91-365+ Days		
Civil Wars							7 Days to 91-365+ Days				
World Wars							7 Days to 182-365+ Days				
Economic Crashes							7 Days to 182-365+ Days				

Disaster Scale

The scale of the disaster is another consideration to take into account. Will the situation be just as bad at your BOL or will it be better? Below are the three categories of scale for disasters and how they affect people.

Local	Local disasters are based within a small area up to a whole state and aren't nearly as threatening as worldwide disasters as you still have the option to get external assistance from other states and countries. Generally after a local disaster occurs things tend to get better slowly. Some local disasters can create national disasters over time such as pandemics which can spread interstate and overseas fairly easily. During a local disaster it's typically best to bug out to get out of the immediate disaster zone.
National	National disasters affect an entire country and cause much more chaos. Disasters such as economic crashes, pandemics, civil war, and some hurricanes can cause them. Although these types of disasters are much larger than local ones, the country can usually still receive aid from external ones. Generally the government will assist the people as best it can however they could also declare martial law and suppress the rights of the people.
Global	If a worldwide disaster occurs, people around the world would be catatonic and there won't be help coming from other nations. It would be best to take your safety into your own hands then leave it in the hands of a government who may or may not show up, as they have bigger priorities - they may even become a preppers enemy and try to take your resources by force. Generally it would take a much longer time for this scale of disaster to equalize, which could turn into years or decades for some disasters.

Disaster Damage

There is typically damage when a disaster occurs from looting to natural disaster damage which should be taken into consideration. It is required to calculate whether you can make it to your destination or there's likely to be blockages. This row is similar to the earthquake and hurricane destruction scales.

Damage Scale 1	No damage. Disasters such as pandemics where barely any physical damage is done in the early days.
Damage Scale 2	Very light damage such as pushed over pots, loose tiles and leaves/twigs on the road.
Damage Scale 3	Light damage, roads may be shut.
Damage Scale 4	Fair damage such as small branches on roads, tipped over bins, minor looting damage.
Damage Scale 5	Moderate damage to buildings, roads and the environment. some trees may be down across roads, power lines down, snow and ice on the road.
Damage Scale 6	Trees down, power poles down, buildings could be looted, inches of snow and cars smashed. Generally this is the highest you would want to go when bugging out with a fair chance of reaching your destination.
Damage Scale 7	Considerable building damage, broken windows, rolled cars, many trees down, thick snow, collapsed walls.
Damage Scale 8	Vast damage, roofs lifted, walls collapsing, shattered glass, flipped cars, electrical poles down, very deep snow.
Damage Scale 9	Extreme damage to houses, roofs fly off, walls collapse, most trees uprooted, trash everywhere.
Damage Scale 10	Unfathomable damage to everything, roads would be blocked, most buildings would be destroyed, trees uprooted and almost nothing would be standing. If you survived and have shelter still bug-in is recommended.

Disaster Proximity

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How close you are to the epicentre if there is one, such as a VEI-8 volcano or a magnitude 8+ earthquake.
Ignore this question if there's no point of origin or you're equally likely to be affected by it wherever you are such as a solar flare.

10,000-20,000km	A large scale disaster has occurred on the other side of the planet. Recommend monitoring the situation.
7,000-10,000km	A large scale disaster has occurred extremely far away. Recommend monitoring the situation.
4,000-7,000km	A large scale disaster has occurred very away. Recommend monitoring the situation.
2,000-4,000km	A large scale disaster has occurred quite far away. Recommend monitoring the situation. Stock up on additional supplies before panic spreads.
1,000-2,000km	A large scale disaster has occurred some distance away. Recommend monitoring the situation. Stock up on additional supplies before panic spreads.
500-1,000km	A large scale disaster has occurred somewhat close to your area. Recommend monitoring the situation and bugging out if it gets worse. Stock up on additional supplies before panic spreads.
250-500km	A large scale disaster has occurred nearby to your area. Recommend monitoring the situation and bugging out if it gets worse and you're more likely to die if you stay where you are. Stock up on additional supplies before panic spreads.
100-250km	A large scale disaster has occurred very close to your area. Recommend bugging out if your life is at risk if you stay.
50-100km	A large scale disaster has occurred extremely close to your area. Recommend bugging out immediately if your life is at risk if you stay.
0-50km	A large scale disaster has occurred to your area. Recommend bugging out immediately if your life is at risk if you stay.

Bug-Out Risks

Ask yourself: Are there any risks with bugging out? Such as virus particles in the air, gangs roaming the streets or strong winds. The percent is the chance you will die on the way to the BOL.

Risk Level 1	**0-10% of Dying** (Almost) No risk, it's a perfectly sunny day and the birds and chirping.
Risk Level 2	**10-20% of Dying** Minor risks to personal safety such as looters, gangs and minor weather anomalies.
Risk Level 3	**20-30% of Dying** Fair risk to personal safety along your route such as marauders, gangs, virulent particles,
Risk Level 4	**30-40% of Dying** Low Moderate risk to personal safety along your route such as flooding, forest fires, insane gangs, looters, power lines and falling trees.
Risk Level 5	**40-50% of Dying** Moderate risk to personal safety along your route such as flooding, forest fires, insane gangs, looters, power lines and falling trees.
Risk Level 6	**50-60% of Dying** Moderate High to personal safety along your route such as looters, gangs and weather anomalies. It's advised to bug out if this level is reached unless the risk of bugging out is higher.
Risk Level 7	**60-70% of Dying** High risk to personal safety along your route such as looters, gangs and weather anomalies.
Risk Level 8	**70-80% of Dying** Very High risk to personal safety along your route such as violent looters and gangs going door to door, huge forest fires, rising floodwaters or a smouldering volcano.
Risk Level 9	**80-90% of Dying** Extreme risks to personal safety along your route such as flooding, radiation, volcanic eruption, street violence, bush fires and nuclear blasts.
Risk Level 10	**90-100% of Dying** Unfathomable risk, if you step outside you will almost surely die from viruses, gangs, strong winds, radiation, being shot etc. Also you are probably very likely to die inside your home as well.

Bug-In Risks

Ask yourself: Are there any risks with bugging in? Such as armed looters roaming the streets who could come door kicking, extreme winds, lava flows, tsunamis. The percent is the chance you will die staying in your house.

Risk Level 1	**0-10% of Dying** (Almost) No risk, it's a perfectly sunny day and the birds are chirping.
Risk Level 2	**10-20% of Dying** Minor risk to personal safety such as looters, gangs and minor weather anomalies.
Risk Level 3	**20-30% of Dying** Fair risk to personal safety such as looters, aftershocks, gangs and minor weather anomalies.
Risk Level 4	**30-40% of Dying** Low Moderate risk to personal safety such as looters, aftershocks, gangs and minor weather anomalies.

Risk Level 5	**40-50% of Dying** Moderate risk to personal safety such as looters, gangs and weather anomalies.
Risk Level 6	**50-60% of Dying** Moderate High risk to personal safety such as looters, gangs and weather anomalies. It's advised to bug out if this level is reached unless the risk of bugging out is higher.
Risk Level 7	**60-70% of Dying** High risk to personal safety such as looters, gangs and weather anomalies.
Risk Level 8	**70-80% of Dying** Very High risk to personal safety such as violent looters and gangs going door to door, huge forest fires, rising floodwaters or a smouldering volcano.
Risk Level 9	**80-90% of Dying** Extreme risks such as flooding, radiation, volcanic eruption, street violence, bush fires and nuclear blasts.
Risk Level 10	**90-100% of Dying** Unfathomable risk, you are almost guaranteed to die if you stay where you are from hurricanes, lava flows, radiation, rising floodwater, etc.

Weather

The weather will play a key role in your decision to bug in our bug out, clear weather provides an optimum environment to leave whereas disastrous weather will prove impossible to travel anywhere fast.

Weather Level 1	Clear weather, not a cloud in the sky. This is generally the optimum weather for bugging out.
Weather Level 2	A from 25% to 75% overcast, but overall it's still a great day.
Weather Level 3	A completely overcast day. This may be the best time to bug out in hot climates.
Weather Level 4	Consistent, Light rain is falling.
Weather Level 5	Consistent, Moderate rain.
Weather Level 6	Consistent, Heavy Rain. It may also be accompanied by a small thunderstorm. If you're after a stealthy bug-out, this is the optimum weather to leave in.
Weather Level 7	A severe thunderstorm coupled with heavy rain. It's highly recommended to bug-in at this point.
Weather Level 8	A category 1 Cyclone/Hurricane is very close to your position. It's recommended to bug-in at this point.
Weather Level 9	A category 3 Cyclone/Hurricane is very close to your position. It's highly recommended to bug-in at this point.
Weather Level 10	A category 5 Cyclone/Hurricane is very close to your position. It's definitely recommended to bug-in at this point.

Exposure Risk

How exposed you are to the elements.

Bunkered	You're safe and sound in a nuclear bunker underground somewhere and wouldn't be able to tell if a bomb went off nearby.
Protected	You're holding up in a reinforced building like a bank or mall which should withstand a cat 5 storm.
Sheltered	You're protected in a typical first-world home or building of similar construction.
Shielded	You're partially shielded by a small or weak building such as a park shelter, bus stop cove or a bridge.
Exposed	You're out in the open with no man-made cover besides what nature can provide.

Panic Level

The panic level is the level is desperation of those caught in a disaster. The higher the panic - the more chaotic the environment and the faster it will spiral out of control. As a prepper you should be keeping an eye out on the current panic level in your local area. If it gets too high (3+), you should act on it. Panic levels can be categorised by a lack of (or a perceived lack of) the essentials needed to live a normal lifestyle.

This is drawn upon on the ratings below. Below is a scale of the panic ratings an ordinary member of the public is likely to experience during hardship. The panic levels below are the average level of panic among local residents. Some may be more panicked and some may be less panicked. The panic level only applies to a mass panic relating to a disaster and doesn't apply to an individual crisis. The deviation is the percentage of how far society has deviated from its 'norms', with 0% being life as normal and 100% being EVERYONE is in survival mode.

Panic Level	Panic Ratings	Examples	Deviation	Resource Lack	Scarcity Signs
0	Business as usual. Nothing is out of the ordinary and the world's problems couldn't be further away. If there is a disaster - they are oblivious to it.	Business as usual	0%	People generally have everything they need to survive comfortably.	• Normal Life
1	An insignificant problem occurring nearby but little thought is given to it. People believe they can cope with this minor event.	A string of robberies in a distant city.	10%	People may be slightly inconvenienced by a lack of high level resources such as internet.	• No Internet • No Communications • Vast Wealth Movements • Minor Media Coverage
2	A few people such as preppers begin to comprehend the disaster and decide what action to take. Other people are in denial that anything could happen to them. People may buy a few items to balance the current situation such as candles.	A breakout of a contagious flu in your local area.	20%	People may be experiencing uncommon, but not an unusual lack of essentials like electricity.	Previous Plus: • No Electricity • Minor Media Coverage

3	This is the extent of the "normal panic" that is experienced by unprepared individuals. They will begin to worry about the disaster but may only take small actions to prepare for it.	A murderer killing weekly in a local town.	30%	People are under threat of losing their home and normality of their current lifestyle. They are under threat of losing some non-critical resources such as electricity, gas and fuel.	Previous Plus: ● Market Correction ● Moderate Media Coverage
4	Unprepared individuals begin stocking up on resources to brace for a disaster. They are fairly sure of the odds of impending doom. Some people are desperate enough to eat and drink they could start fights over resources.	A breakout of a contagious flu in an entire state or country.	40%	People are lacking or are under threat of losing some non-critical resources such as electricity, gas and fuel.	Previous Plus: ● Market Recession ● Job Cuts ● High Media Coverage
5	Everyone is quite panicked about the disaster but they are still living the same lifestyle and going to work.	A worldwide pandemic with cases detected in your local city.	50%	People's current lifestyles are revolving around protecting and stocking up on vital resources while they continue working with the loom of the threat in their mind daily.	Previous Plus: ● Market Recession ● Shops Closed ● Restricted Bank Access ● High Media Coverage
6	At this stage people may not (or can't) go to work, they are trying to prepare and stock up on all the resources they can.	Businesses begin closing, shops start to go bare.	60%	People are lacking or are under threat of losing some important resources for survival such as shelter, food and water.	Previous Plus: ● Fights over food and water in shops ● Job Scarcity ● Market Depression ● Shelter ● Banks Closed ● Excessive Media Coverage
7	Many people have left their jobs and are preparing for the disaster. They may develop plans to escape but by now the roads are completely blocked.	A large hurricane is bearing down on a town.	70%	People are lacking or are under threat of losing many important resources for survival such as shelter, food and water.	Previous Plus: ● Fights over food and water in shops ● Excessive Media Coverage
8	People are almost all exclusively focused on the disaster and most of them have suspended their old lifestyles and jobs to ensure their survival.	A virus is spreading rapidly across the globe with a high kill rate and late onset of symptoms.	80%	People are lacking some critical resources for survival such as shelter, food and water.	Previous Plus: ● Increased attacks, violence and murders ● Fights over food and water in streets ● Excessive Media Coverage
9	People are acting insane and finding food and water is their prime driving force. They would do almost anything to get what they need. Media stations are either ransacked or not watched due to no electricity.	Almost complete breakdown of society with only a very few number of people going about their normal business.	90%	People are lacking many critical resources for survival such as shelter, food and water.	Previous Plus: ● Fights over food and water in homes ● Little/No Media
10	A panic level where people would literally do anything to ensure the continued survival of themselves and their family. This level generally only occurs after a huge nationwide or worldwide disaster.	Complete breakdown of society, nobody working, shops bare or closed down. Stock Market Crash.	100%	People are lacking all critical resources for survival such as shelter, food and water.	Previous Plus: ● Fights over all food and water ● Consistent attacks, violence and murders ● No Media

Bug Out Flowchart

This is the bug out flowchart designed to assist you in making a decision whether to bug in our out in a disaster. When you get to a question, answer truthfully and follow the arrow to the next question or resolution. Blue Cells are questions. Grey cells summarise your last decision. Green cells are recommended actions of your choices. Start at Cell 6:6.

It is assumed that you're a prepper and have a BOB, INCH and GH Bags as well as a stockpile of food and water in your primary residence. The ultimate aim is to keep you and your family alive at all costs irrelevant of money, location or disaster type. You've had experience bugging out and have had trial runs to your destination in all sorts of weather.

Legend	The following cells are a legend to the diagram below. Each colour represents a different type of cell to assist in readability.	Dark blue represents the starting cell. There is only one of these.	**Response** Grey is a response to a question asked by other cells and usually provides more information about it.	**Questions** Light blue cells are questions to refine your situation further.	**Resolution** Green cells are ends to the diagram and will provide you with a recommendation on what you should do in your situation.

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Row 1	**Stay** You should stay inside your house until the disaster has passed, boarding up the windows monitoring the surroundings and news for updates, rationing food and designating a reinforced room as a bunker with mattresses in it.	**Yes** I have the skills to grow, hunt, forage and fish for the food I need which still can be found in the environment. ▶	**Question 6** Do you know any family, friends, or government shelters you can stay at away from the general population who are better off than yourself? ▼▶	**Yes** I have friends or family nearby who are better off and have resources we can use. ▶	**Leave** Bug out and head for their house taking as many resources as you can with you to assist.						
Row 2	**No** I don't have the skills to support my group and live off the land, or the natural wildlife could be dead or hunted out already. ▲	**Question 5** Are there natural resources left around your home and do you possess the skills to live off the land and support your group by doing so? ◀▲	**No** I don't have family accessible nearby who are better off than us. ▼		**No** You should stay inside your house until the disaster has passed, boarding up the windows monitoring the surroundings and news for updates, rationing food and designating a reinforced room as a bunker with mattresses in it.	**Question 5** Is your house in a built-up area? ◀▲	**No** I can't leave the country for the duration of the disaster. ◀	**Question 4** Can you leave the country for the duration of the disaster? ◀▶	**Yes** You should take what you can and leave the country before things get worse, but only if the disaster is confined to your country.		
Row 3		**No** I don't have a Bug Out Location or I can't reach it safely. ▲	**Bug-In Temporarily** You should bug in until it's safe to leave for a destination with ample resources you can survive on. Monitor the situation.					**No** You don't have a BOL. ▲		**Stay** You're more likely to stay alive if you stay indoors away from the threats. Board up the windows and monitor the surroundings and news for updates, rationing food and designating a reinforced room as a bunker	
Row 4	**Yes** You should bug out to your destination shelter which should be in a remote part of the country with food and water access until the threat is well over.	**Question 4** Do you have a BOL far from civilization with ample food water and other supplies stocked inside? ◀▲	**Leave** You are more likely to survive if you left the house. ◀	**Question 3** Are you more likely to survive if you stay in your house or leave for an alternate destination? ◀▼	**Currently Underway** The disaster is well underway and people are panicking and stripping the shelves. You can't leave the country due to panic. ◀	**Question 2** What stage is this disaster in? Is it an imminent threat or is it currently well underway? ◀▶	**Imminent Threat** The disaster is a possible threat, but people generally aren't panicked yet. ▶	**Question 3** Do you have a BOL far from civilization and threats with food, water and other supplies stocked inside? ▲▶	**Yes** You should bug out to your destination shelter which should be in a remote part of the country with food and water access until the threat is well over.	**Question 4** Are you more likely to survive if you stay in your house or leave for an alternate destination? Assuming you aren't trapped inside the house. ▲▶	**Leave** You are more likely to survive if you left the house. ▼
Row 5		**Degrade** The disaster is likely to worsen and cause more damage over time as people become desperate. You should bug out permanently with an INCH bag as you still have time before people get desperate or the roads become impassable.		**Stay** You should stay inside your house until the disaster has passed, boarding up the windows monitoring the surroundings and news for updates, rationing food and designating a reinforced room as a bunker with mattresses in it.		**National Scale** The disaster affects all or most of the country and could last up to 6 months. (Solar Flare, EMP, Flood, Drought / Heat, Meteorite, War, Civil War, Terrorism, Cyclone, Employee Strikes) ▲		**Yes** You should stay inside your house until the disaster has passed, boarding up the windows monitoring the surroundings and news for updates, rationing food and designating a reinforced room as a bunker with mattresses in it.	**Question 3** Do you have enough resources to survive the disaster and aftermath plus have 50% spare in your house? ◀▲	**No** You don't have enough food and water to last the disaster comfortably. ▲	**Question 5** Do you think you have enough resources to survive the disaster and aftermath plus have 50% spare in your house? ▼
Row 6	**Improve** Your best bet is to stay in your house and monitor the news hourly for updates and have your supplies ready for bug out if needed. Stock up on resources if you can now.	**Question 3** Is this disaster likely to improve or degrade over time? ◀▲	**Imminent Threat** The disaster is a possible threat, but people generally aren't panicked yet. ◀	**Question 2** What stage is this disaster in? Is it an imminent threat or is it currently well underway? ◀▼	**Global** The disaster is happening on a global or national scale and is likely to last a few months to a year or more. The threats are almost entirely other people. (Solar Flare, EMP, Peak Oil, Food Shortage, Global War, Pandemic, The Rapture, Economic Collapse, Overpopulation) ◀	**START** **(Follow the Arrows)** **Question 1** What scale of area is the disaster affecting? Local (state), national (country) or global (worldwide) ◀▲▶	**Local Scale** The disaster is local and confined to a state or two and will last a month maximum. (Tornado, Wildfires, Volcano, Avalanche, Landslide, Limnic Eruption, Blizzard, Storms, Earthquake, Tsunami, Crash / Collisions) ▶	**Question 2** Is the disaster currently happening in your area or heading your way? ▼▶	**In Progress** The disaster is currently affecting your area and causing panic and damage. ▲	**Question 3** Do you have enough resources to survive the disaster plus 50% spare at your BOL? ▼▶	**No** I don't have enough resources to last me and my family for the estimated duration of the disaster. It's recommended you still bug out to the destination and ration what you have as the risk of dying if you stay where you are outweighs the risk of leaving.
Row 7		**Secure or No Conflict** Your house is secure and you have necessary stocks ready for the long haul. Stay inside and monitor the surroundings, ration food and water.	**Question 3** Is your current location secure or can it be secured from intruders? Is armed conflict likely in your area? ◀▼	**Currently Underway** The disaster is well underway and people are panicking, stripping the shelves and becoming desperate. ◀		**(Flowchart is Currently Incomplete)**		**Heading This Way** The disaster has a high probability of hitting your home and causing major damage. ▼		**Yes** Bug out to your destination until the disaster has passed, monitoring the news for updates and return when everything has stabilized.	**Question 5** Do you have enough resources to survive the disaster plus 50% spare at your BOL? ◀▲
Row 8			**Insecure or Conflict** The house is inadequate for reinforcements and can be breached easily. Begin fortifications immediately as it's currently your best bet of staying alive. Ration food and resources as a global disaster could last many months.				**No BOL** You don't have a BOL. ▼	**Question 3** Do you have a BOL out of the disaster zone? ◀▶	**Have a BOL** I have a BOL selected with multiple routes to it and it's away from the threat. ▶	**Question 4** Will you be able to reach your destination or are there likely to be road blockages such as trees down, traffic or gangs? ▼▶	**Reachable** There will be minimal blockages on the road and should be easily accessible. ▲
Row 9							**Question 4** Do you know any family, friends, or government shelters you can stay at? ▼▶	**Yes** You have somewhere in mind you could head towards to escape the disaster. Jump to Col:10, Row:8		**Unreachable** There are very likely to be blockages or threats to the safety of the occupants. ▼	
Row 10					**No** The only advice is to get hand-outs where you can and for creating alliances with neighbours, or at the extreme end joining a gang.		**No** There's no locations you know you can stay at. ▼			**Question 5** Are you more likely to survive if you stay in your house or leave? ▼▶	**Leave** You should bug out if staying would mean your death, even if the weather outside is terrible. Take precautions and go slow avoiding main roads.
Row 11				**Yes** You should bug out and take what supplies you can with you and return once the threat is over.	**Question 6** Do you have the skills and ability to survive in the wild, by camping or living out of your vehicle until the disaster is over? ◀▲	**No** You have no money or barter items to use in emergencies. ◀	**Question 5** Do you have a stockpile of cash for emergencies that you have access to? ◀▶	**Yes** Bug out and use the money to rent a hotel in a city outside the disaster zone.		**Stay** Bug in and secure the house, designate a secure room and fortify it until the disaster has passed.	

10 Bugging In

This section begins when you reach home, during the start of a gradually increasing disaster, or after an instant one has struck in your area. It describes what actions to take and how to prepare yourself.

Contact

First the initiator of the Bug-In plan should contact everyone in the party and tell them to enact the plan you desire. An example of this would be citing "Operation El-Dorado - I@H0815RN10004". As discussed in the 'Plan Template' section above, this code would represent:

- I - Bugging In
- @H2500 - Meeting at Home at 8:15am
- RN - Route 'None' - No bug out route since we're bugging in
- 1000 - The time the party is set to leave on this trip, but since we're bugging in it would be the time when everyone should be home.
- 4 - The number of party members participating in this bug-out

The initiator of a plan can usually only be the party leader - A predefined person who leads the party. However you can discuss with the party who is able to initiate a plan, otherwise party members will have to raise their concerns with the party leader and go from there.

This stage ends with everyone knowing that the Bug-In plan has initiated.

Gather

Once you've contacted everyone or have been contacted by the party leader you need to kick it into gear and stop whatever you're doing and prepare. Wherever you are, (such as the workplace) they should grab any supplies or get home bags you have nearby and prepare to meet the rest of the party at the requested time. If the designated rendezvous (meetup) time is a few hours ahead and the trip there will only take 10 minutes, you may want to consider picking up additional supplies on the way and refuel your vehicle.

It's better to bring more gear than you need back home rather than getting there and needing to go back to pick something up. Don't take any unnecessary risks purchasing any other equipment or food you don't need, as it's better you make it to the meeting location safely than narrowly making it back with an angry tailgater, who you snatched the last can of beans from earlier.

This stage ends with every party member at the rendezvous point along with all the gear they need to Bug-In.

Fortify

Once you're at the meeting location you can begin preparing for whatever disaster may be coming. An example would be fortifying your house for the onslaught of a hurricane by covering the windows and removing loose objects from the back yard. Even if you've decided to bug in, it's always a good idea to have the car packed and ready to go in the event that the situation changes and you have to leave immediately.

During this stage you should continually check the news for updates on the situation whether it's improving or deteriorating. If it's improving, don't drop the plot before the threat is gone entirely and if it's deteriorating, try to work faster and focus on the most vulnerable parts of the house first.

For more information on fortifying your house, see the DEFENCE section.

11 Bugging Out

This section begins when you've decided to bug out, before or after a disaster is unfolding in your area. It describes what actions to take and how to prepare yourself.

Contact

First the initiator of the Bug-Out plan should contact everyone in the party and tell them to enact the plan you desire. An example of this would be citing "Operation Jericho - O@H2500RB16004". As discussed in the 'Plan Template' section above, this code would represent:

- O - Bugging Out
- @H2500 - Meeting at Home ASAP (Since 2500 isn't an actual time)
- RB - Route B - The Bulbasaur Route, AKA: Grassland Route
- 1600 - The time the party is set to leave on this trip
- 4 - The number of party members participating in this bug-out

This stage ends with everyone knowing that the Bug-In plan has initiated.

Gather

Once you've contacted everyone or have been contacted by the party leader you need to kick it into gear and stop whatever you're doing and prepare. Wherever you are, (such as the workplace) you should grab any supplies or get home bags you have nearby and prepare to meet the rest of the party at the requested time. If the designated rendezvous time is a few hours ahead and the trip there will only take 10 minutes, you may want to consider picking up additional supplies on the way and refuelling your vehicle.

It's better to bring more gear than you need back to the rendezvous location rather than getting there and needing to go back to pick something up. Don't take any unnecessary risks getting any other equipment or food you don't need, as it's better you make it to the meeting location safely than narrowly making it back with an angry person on your tail who you grabbed the last can of beans from, or you cut off earlier.

This stage ends with every party member at the rendezvous point along with all the gear they need to Bug-In.

Pack

PREPAREDNESS Bug-Out Implementation Pack

Once you're at the meeting location you can begin packing to leave. Don't wait for others to make it back before packing as you may only have a limited amount of time to pull everything together - for example if there's a wildfire coming. If there's no vehicles to pack then make a pile of items to pack right beside where the vehicle will be to save a bit of time.

Bug Out

This is the stage where you leave your home and begin your journey to your Bug Out Location (BOL). Once you've left you shouldn't return for anything unless it's absolutely critical for your survival. During disasters every second counts and don't want to be wasting time if it risks you and your families lives.

Bug Out Routes

Avoid main roads which could be ambush zones for looters. Choose routes with minimal houses and traffic lights and an alternate route without trees and other possible downed obstacles. Store caches of food and other supplies on your route in case you're robbed along the way. You should have recorded the locations of your caches well so you can find them even if it's now overgrown.

Route Decision	Choose your desired route based on the conditions of the disaster and which point of the Bug-Out triangle you want to prioritise whether it's Speed, Supplies or Safety.

12 Real World Tips

These are tips and tricks from people who have lived through a disaster so you can learn from their experience. Even if you rehearse for a disaster you're still missing a critical element of surprise and randomness, plus you have the unknown element of knowing how those around you will react to the disaster.

If you have your own disaster experiences you would like to submit, please email them to myself using the contact info in the first page of this document, or via my website. To make it worthwhile, please have at least 10 dot points in a similar format to those below.

Fluidic Ice - Cyclone Alfred

This section was on my experiences and lessons learnt in a category 1 Cyclone that hit Brisbane in Mar 2025. It wasn't anywhere near severe as some of the other stories below, but having a preparedness oriented mind, I paid attention and took thorough notes throughout it. In the end we only lost power for 3 days; however I was sick with a cold for the duration which made the experience even more miserable.

● A cyclone in Brisbane is a rare occurence which has only happened a few times in recent history, however this one made a sharp right turn towards us and hit directly after a LOT of meandering and loops out in the ocean. There were plenty of memes about it taking its sweet time getting here that people had let their guard down. Some had said they had already gone through their cyclone supplies before it even hit.
● One of my power stations didn't last anywhere near how long I thought it would when powering my fridge. Test your equipment on the appliances you are going to be using them on beforehand and time them.
● We had mobile data during the outage, but I learnt that mobile towers (at least in Australia) have a battery backup that will last between 3 and 12 hours. After that, you may lose comms.
● It's a real pain having to wake up at night to turn the power supply to the fridges and freezers on and off to conserve power. Buy an auto timer.
● As soon as a disaster occurs, get out a notepad and make notes of lessons learnt and what you did throughout. I kept track of when I turned the fridge and freezer on and off and how long they were cooling for.
● I powered the freezer too often as I was concerned about losing the meats and drew the battery down quickly. A FULL freezer can stay unplugged for up to 48 hours and still be turned back on. 24 hours for a HALF-FULL one. However I ran ours every 12 hours to be safe even though it was 3/4 full.
● Fill your vehicles and spare fuel cans at least a week out from the disaster. Fuel becomes scarce very quickly.
● Keep showers very short and use as little hot as possible. We didn't run out of hot water over the 3 days and didn't notice any cooling of it.
● Put a "DO NOT OPEN" sign on the fridge and freezer to remind yourselves to be very efficient when using them. When we needed to open it, we had two people grabbing the items we needed and limited the open time to about 5 seconds.
● Make a list of what you know to be in the fridges and freezers if the power is already out. Better yet, make a quick video of every shelf of your fridge and freezer before the power goes out and update it as you make changes so you know what you need to eat first.
● We had no idea what temperature our fridge and freezers were during the outage. I have since bought wireless temperature sensors.
● I didn't fill our bathtub with water as it was being repaired. A Waterbob would have solved that issue and given us water to use if we needed it.
● At one point the freezer's warning light came on and I had no idea what that meant (besides being temperature related). So I have since downloaded all the manuals for our appliances to be able to look them up on my phone if it happens again.
● I wish I had a faster charger for my power stations. I only had a 15A charger when a 25A would have allowed it to charger much faster if the power temporarily came back on.
● Buy anything even remotely preparedness related AT LEAST a week before it hits. Including food, gas, camp stoves, fuel, power banks, etc.
● Since we are used to washing our hands with the hot water, we put cups over the hot tap to remind ourselves to save the hot water for showers.
● Water, bread, canned meals, milk, noodles and rice disappear from the shelves first. They started to go bare about a week prior to its arrival.
● The neighbours only had a couple of dim and broken torches to use. I offered them a headlamp but they declined. I recommend having a bucket full of different prepper items spares for those who aren't as prepared. Additionally I should have readily gone around to their houses earlier in the disaster to help out where needed and to maintain contact.
● At the start of the power outage we should have done a quick whole house clean to get stuff off the floors which can be tripped on. A couple of times we kicked our toes and stood on things which were laying around while in the dark.
● Sauces can pretty much last indefinitely outside of the fridge. Also don't take items out of the fridge which can help keep it cool - like water bottles. Just drink the tap water (if it's safe to do so).
● I could not recharge my power station with portable solar panels for two reasons. 1. On the power station I built, I forgot to flick the fuse switch to 'on', which I only realized a week after the cyclone. 2. The sky was too cloudy to get much more than a few watts out of the rainy skies.

Donexodus (Reddit) - Hurricane Irma

The following section was posted by Donexodus on Reddit regarding his experiences in Hurricane Irma on the U.S. Virgin Islands. (Posted with Permission)
https://www.reddit.com/r/preppers/comments/cyjo70/how_to_survive_a_cat5_and_the_aftermath_what_irma/

He has also posted a story on his experiences which can be found here:
https://www.reddit.com/r/preppers/comments/7vs7so/being_hit_by_the_eye_of_hurricane_irma_in_the_us/ (Part 1)
https://www.reddit.com/r/preppers/comments/7vzqfe/part_2_being_hit_by_the_eye_of_hurricane_irma_in/ (Part 2)

- Make block ice now. Take Tupperware, fill with water. Freeze it, remove when frozen and repeat. This ice can last for over a week and will turn your fridge and freezer into a cooler so you don't lose a ton of food.
- Cash is king. Withdraw beforehand.
- Chips and salsa are the best food. No refrigeration, won't spoil, and you can nibble on it anytime- even if you don't have an appetite. Out of all the food we had this was always gone immediately.
- Fix a flat! Grab a few cans. Tons of nails and debris afterwards, flat tires are almost a certainty. Even better- tire plugs and a tire inflator.
- Headlamps are infinitely better than flashlights. You can cook / function and have both hands free.
- Aluminium foil, rubbing alcohol (70%), tarps and Home Depot buckets can be used for almost anything. For example, rubbing alcohol can be put on a paper towel and used to wash, can sterilize cuts, clean countertops, start a fire, etc. Home Depot buckets can be used to transport water, store water, collect rainwater, transport things, store things to reduce clutter, and as a place to sit.
- Buy plastic plates, forks, knives, cups, etc. Doing dishes without running water is a pain. Have lots of garbage bags.
- Just because you have a generator doesn't mean it works. Test it now.

- Generators: You have two options- get a big one which will power more stuff, and guzzle gas, or get an inverter generator. The inverters are more expensive per kW capacity, but use almost no gas. I could run a window AC unit and fan on my (LPT wont let me post links- Google Wen 56200i) for a solid 8 hours on 1.2 gallons of gas. You cant do laundry etc, but they're silent, lightweight, and great for electronics. You'll also need a surge protector and long extension cord. NEVER EVER run one indoors- this often kills more people than the storm itself.
- Bug a salt gun. They're on amazon, and shoot salt to kill flies. Flies will be everywhere, and they cost me a lot of sleep. Every morning I'd wake up because flies were landing on me non stop. Kill them.
- A knife, twine, duct tape, gloves and paracord will come in handy literally every day.
- Get pepper spray / tear gas ASAP. A ranged- non-lethal weapon is of absolute importance. If you only have non-ranged, you put yourself at a significant disadvantage.
- Propane camping stoves are cheap and will allow you to easily cook. If not, build a 3 wall stove out of rocks and cook using downed branches and a grill grate. Or dig a hole and start a fire. After a few days though, cold food is what you'll crave.

- Spam is AMAZING! Black pepper spam, thinly sliced and fried. Serve with black beans and rice, OR take a potato, cut into fries. Sprinkle with Parmesan cheese and black pepper. You're welcome. Oh- potato's are cheap, last forever at room temp, and you can do anything with them.
- Fill your prescriptions beforehand. Snag antibiotics if you can, z-packs are great, as is ciprofloxacin. You will get sick.
- Fill your bathtub with water beforehand. Can scoop with home depot bucket to flush toilets, clean, etc. Also, adding bleach to your toilet will keep it somewhat sanitary if you can only flush once a day.
- Take pictures and videos of you're property and possessions the day before. Will help with insurance, FEMA, etc.
- Broom and dustpan- lots of debris but surprisingly good at removing water.
- If water is coming through the walls or windows consider killing the power. Our place caught on fire during Irma due to water in the walls. This happened to a lot of people during Maria as well.
- Keep electronics off the ground. If it floods and your power is on, and you're standing in the water, you'll have bad day.
- If you have an electric stove, make sure you have some sort of grill and that it has fuel. Charcoal is good and you don't necessarily need a grill for it.
- Keep a journal. Years later or for the next storm it will be priceless.

- Consider rigging a simple alarm. Pull string alarms are great. I moved into my cottage 2 months after the storms because my house was uninhabitable. I was alone, and rigging one on my gate helped me sleep a lot better.
- Do laundry and dishes beforehand, clean your house.
- Chainsaws are king! Don't forget replacement blades. Without them, you may be trapped at your house for days.
- Do not isolate yourself. Aside from safety issues, you will desperately need to be around people, whether you realize it or not. Isolation after a traumatic experience will make it significantly worse.
- Your brain won't work for a few days, super brain fog. Everyone will have PTSD, even if you were not frightened at all during the storm itself. Performing the most simple task will overload you. Imagine trying to have a conversation while loud music, a loud TV, a siren, flashing lights are surrounding you- in the middle of an earthquake. With everything around you destroyed, there's simply too much stimuli for you to process anything. Every day I'd be in the middle of a conversation with someone at the bar (meet up spot), and either myself or the person I was talking to would walk away mid sentence without saying anything. This wasn't deliberate, your brain is just full of squirrels.

- Chilli, goulash, lasagne, etc are great to make and freeze for later so you don't have to cook.
- Don't tell people what you have. If you mention having food and power people get resentful.
- Don't let too many people join you, if you do, they won't want to leave and will tell others, it snowballs super fast.
- Be home over an hour before dark.
- Time will stop and no one will know what day it is. It was day 1, day 2, etc for the first 3 weeks.
- You may disagree with this, but having a good weapon can be more important than having bottled water. If s*** really hits the fan, everything else can become a distant second in the blink of an eye. Personally, I'm pro common sense gun control, but I'll never be without a powerful semiautomatic rifle or pistol again.
- The first night you'll be ecstatic you made it through, with random bits of crying. It gets a little harder every day
- Be aware of your surroundings and of people
- Tempers will be high Day 2-6, same with rumours. Fog of war is very real in a close community with no cell service.
- Gas cans- for generator and avoiding long lines. Not sure if Florida runs out of gas or not. 4 5-gallon cans worked well for me.

- Freeze water bottles. They can be cut in half and put in a yeti to keep your drink cold all day. They can also be placed under armpits and on the side of your neck to cool off / help you sleep. You will be craving ANYTHING cold.
- Keeping morale high is the most important thing
- Keep off the road unless you absolutely must. In addition to wasting gas, awful traffic and road hazards, you're preventing emergency vehicles / recovery workers from doing their job.
- NEVER lend out something you cannot replace. I lent out all of my battery powered fans once I got my generator. When the generator went down, I was miserable, and asked several of my co-workers/friends for just one of my fans back. It took a week before ONE of the people forked one of the fans over.
- Board games books etc are great.
- Ice will be worth its weight in gold.
- Bug spray

Commented Tips

● I would suggest having a battery-powered FM radio (and extra batteries if it's battery powered, or get one which charges via USB like the one I linked) to listen to the news and get vital information.

● Also (if not too late), order a sawyer mini (best) or Lifestraw (not as good). If you don't have access to clean water it can help you stay healthy (beware of chemical contamination which cannot be removed by these).

● If you have the money, get a Garmin inReach satellite communicator (requires a (relatively cheap) subscription, down to $15ish a month). You can request SOS (much like 911), and send/receive SMS and e-mails, even without cell coverage. Excellent to keep in touch with relatives and in case of emergency. Can be used year-round when hiking, snow-mobile, skiing, … Don't tell anyone you have this…

● Download the offline map of your area on Google Maps on your phone beforehand. Can be priceless to navigate around and doesn't require internet access. Also get the Maps.Me app and download the map of your area too. Google Maps offline maps will expire and disappear from your phone after 30 days (I believe), Maps.Me maps will not.

● If the cell service in your area is out of order, use your phone in airplane mode so that it doesn't continuously and desperately looks for a cell to connect to, which will drain the battery VERY quickly. Also use it on the lowest practical brightness setting to save battery power.

● If not too late, get big USB power banks (>=10000mAh such as this one) and fully charge them beforehand. It's good as barter items and it can be nice to recharge your things when you have no access to a generator (on the go, or if you don't want to run the generator to avoid attracting attention). You can also get USB lights (this one for instance) and your powerbank doubles as a flashlight with a very long battery life.

● Get a first aid kit, and not just one with bandaids… Get a CAT tourniquet, trauma dressing, Celox (preferred) or QuikClot bandage, triangular bandage, SAM splint, … and know how to use them. Also get the basic medicines (stomach/diarrhoea relief, basic painkillers, anti-allergy, and any prescription medicine if you require any). Remember 911 service may be unavailable for some time and you need to be able to take care of injuries. Tourniquets save lives, everyone should have one readily available.

● I am a radio amateur and in these situations I like to have one or two portable radio for two-way communication but I realize it is not for everybody. Still, a pair of FRS/GMRS radio can be helpful. Please note that GMRS requires a (cheap) license in the USA. I would recommend this model which also allows to be used as a scanner and to program the NOAA weather frequencies (do it beforehand) and some local police/EMS/fire frequencies (if allowed in your jurisdiction).

● Please DO NOT use a radio made for amateur radio use, where you can transmit on any frequency, such as the UV-5R; you may interfere with emergency communications, even if you can't hear them, miles away. Please stick to the FRS/GMRS frequencies. The radio above guarantees safe operation and still allows to be used as a scanner.

● Take pictures of all your important documents (ID, properties, …) and store them in a waterproof plastic bag. Try to keep at least your passport and driver license with you during the storm…

● If you have a sump pump, try to arrange so that it can be battery powered and/or connected to your generator. If using battery power, get a battery charger and/or a generator connection, if the outage lasts and the battery runs down. Sometimes homes are not affected by the main storm but are flooded due to the lack of power around the storm and are still ruined, and that's totally preventable.

● Also, beforehand, depending of the situation you might want to BLOCK your main sewage pipe. This way you might avoid sewage backflow into your home. There are normally valves already installed but in case of serious flooding (high backpressure) they sometimes are not up to the task.

● Download a few offline movies on the Netflix app. I never lived though a hurricane but I assume after a few days/weeks, you might want some entertainment. You can also download e-books. Bonus if it's survival-related e-books."

24 Prepping Mistakes - Hurricane Helene

PinaColada-PorFavor on Reddit summarised this video: https://www.youtube.com/watch?v=hx9z2PivCnY "24 Prepping Mistakes I Made for Hurricane Helene | Lessons Learned in Disaster Preparedness" which was uploaded by Kim to the channel "Single Girls DIY".
Kim also has a longer description on her website "https://singlegirlsdiy.com/prepping-mistakes-hurricane-helene/".

● Have enough cooking redundancies: outdoor grills, electric burners, solar cookers, camping stoves, etc. obviously you'll need to be able to run them so may need propane or generators. Have other redundancies like flashlights, batteries, etc.
● Back up communications: She suggests Starlink
● Enough cookware: She did not have running water or hot water so her pans were dirty and piling up. She suggests having enough disposable cooking pans/baking pans, etc. Someone suggested wiping down with a paper towel after cooking, using a spray bottle with water and dish soap, then wiping again with paper towel, as a good hack.
● Have enough heavy duty rain gear, rain boots are so helpful in flooding situations.
● Be organized: have all your prep stuff in an easy to access location so you aren't searching all over when you need something.
● Take a shower the night before expected disaster so you start fresh/clean.
● Pack the freezer with water bottles/bags to keep stuff cold longer.
● Do laundry before expected disaster so you have plenty of clean clothes.
● Penny on ice tray trick: most know this one. Put a penny on frozen ice in the freezer so if you see the penny has fallen to the bottom, you know the ice melted and maybe the food went bad.
● Have enough insulated water bottles to keep cold liquids cold and hot liquids hot for moral boost.
● Use your stuff before disaster so you know how they actually work and you won't be figuring it out when you absolutely need it.
● Emergency radio - best for most accurate local information happening right now.
● Satellite communication - when all else is out, satellite communications are helpful. She says iPhone 14 and above have a setting for satellite use.
● Facebook - know that there's a lot of misinformation during disasters so stay skeptical and double/triple check with other sources.
● Quick cooking foods - in a disaster it is way easier to have quick cooking foods than to have to make things from scratch.
● Emergency toilets - very helpful when flush isn't working. Build up of excrement will get stinky fast. Look up different camping toilets, etc.
● Take assistance if available. It's a good way to keep in contact with community. Disaster relief places can give out food, water, toiletries, etc.
● Store things in plastic containers/totes. If in cardboard boxes, flooding can ruin things.

● Have plenty of clean towels and blankets.
● Keep windows closed if you can. Something about mold and heat coming in but understandable if you need to air the place out or need ventilation.
● Have moral boosting food on hand, her suggestion was chocolate which is often not a donated disaster food because it melts.
● Check on neighbors. Ask specific questions about what they need because if you just ask "Are you ok?" They will likely just say yes.
● Know that deliveries could take days to weeks to be available.
● Facebook groups can be very helpful to know exactly what is happening and available in your community.

Limp_Assignment_3436 (Reddit) - Texas Freeze

The following section was posted by Limp_Assignment_3436 on Reddit regarding his experiences in the Texas Freeze of February 2021.
https://www.reddit.com/r/preppers/comments/lmj166/lessons_learned_from_cold_dark_texas_apartment/

PREPAREDNESS
Real World Tips

I've been without power and water since late Sunday in an apartment. My prep is pretty solid but some things turned out unexpectedly bad. I want to share this with you so you don't make the mistakes that I did.

● Lesson #1, rice and beans are meh, and cans are useless. Rice and beans blow when you don't have convenient fuel. Chances are, if you're out of power long term, the weather will be so awful it will literally put your fire out. "Junk" food like crackers and jerky are ESSENTIAL for apartment prep. Be careful about cans too, most of my friends apartments dropped below freezing and their cans are ruined!
● Lesson #2, water is heavy!!!! I'm 8 floors up with no water, no power, and no elevators. I only have gas. I've gone up 4 times tonight and I don't think my weak ass legs could do it again. In those 4 trips I got enough water to flush the toilet 3 times and a flashlight. That's it. BTW I got this water by taking a hammer to the frozen swimming pool. It's definitely not drinkable. I had filled the tub but I woke up with it empty. MIND THE SEAL. I have enough to drink but not nearly enough to flush the toilets.

● Lesson #3. You need gas!!! Everything is out here, except gas. Against all advice, I've been heating my apartment with my gas stove. 90% of my area is out of power, and 90% of those people are freezing their asses off because they dont have gas. My friends are sheltering here because my apartment is 60 when theirs are 30 or less. Their food and water is frozen, even cans ruined, preps gone. If you can control one single thing about your next apartment make sure you have gas. There's no other way to have enough energy around for heat.
● Lesson #4 GET A BATTERY BACKED CO AND FLAMMABLE GAS SENSOR. This is the singular reason I feel safe enough to use a gas stove for heat. Battery backed units will burn about one battery every 24 hours. Plan accordingly.
● Lesson #5 charging time. I have a ton of batteries for my phone, laptop, a few general purpose I can hook up to variable boost buck converters (I'm a nerd). I ran into a big problem real fast. Most of my batteries take 4-6 hours to charge. I can't idle my car that long, nearby gas stations are sold out. Once I drained all my batteries over the initial two days I've fallen back to my two USB-C PD batteries that charge within an hour or two. All my batteries that take 3+ hours to charge are useless. Charging time is extremely important if you're relying on your car for charge. Which you are if you're in an apartment....

● Gas service is vital for apartment prep, just to repeat again. I would have used saran wrap to promise a good seal on my bathtub. I would have bought a "power station" I could charge rapidly froman inverter clipped to my car battery. The only fast charge one I know of is ECOFLOW models which charge in less than two hours. All the other big batteries I can find charge in 3+ hours. Not useful when you're burning precious fuel that will be sold out everywhere.
● Another thing, an inverter with direct to battery jumper cable style pickups is as vital as gas. That's why I can post this rant now. I cut my jumper cables to hook up this inverter and still have charged batteries when most people don't even have phones now. They've gone dark.

EDIT: Water is back but low pressure and boil notice. Again gas is saving my ass, boiling water takes ton of energy.
Stay safe y'all and if you're in apartment maybe my experience will be helpful

Gear

Selecting and using essential preparedness equipment

"Nothing makes a journey more difficult than a heavy backpack filled with nice but unnecessary things."
Randy Alcorn

Introduction

In a materialistic world we tend to gravitate towards and become attached to our items and gear. These items either complete a multitude of tasks poorly or one task very well. It's important to have a few primary redundancy items because they will break or wear out eventually. The groups and items below have been tested and tried in many survival situations and have shown they are reliable and useful. This isn't an exhaustive list, so you may want to add your own personal flair or modifications to the items. You should only carry what you are comfortable with and above all - know how to use your gear.

NOTE: There's quite a lot of prepper terms in this section so be sure to know what they all mean prior to reading. You can find definitions in the INTRODUCTION or 'ADDENDUM > Dictionary' sections. "Recommended Brands" or "Top Brands" simply refers to brands which are known to deliver, work well and have a good price to punch ratio. Most recommendations are of my own personal use combined with research.

Purpose	The aim of GEAR is to explain the typical backpacks and bags that preppers have on hand including how to pack and wear them properly. There's also a strong emphasis on keeping packs light and the need to only include the essentials for survival. It also discusses each recommended item in great detail to help you make more informed decisions when purchasing products. The end of this category covers any specialist gear you may need for unique circumstances and other gear which doesn't fit into a backpack.
Lost?	• For a more complete list of medical gear, see the MEDICAL section. • For a list of pandemic gear, see the MAN-MADE DISASTERS > Pandemic section. • For a list of recommended food, see the FOOD section. • For tips on reducing the amount of gear you have, see the HOMESTEADING > Minimalism section. • If you want to find out about other ingenious uses for common items, see the MATERIALS > Alternative Uses section. • For a complete list of portable shelters and shelter types, see the SHELTER section.

Contents

1 Preparedness Kits

This section explains the different types of 'bags' you can use to carry and store your gear. The term bag doesn't fully cover each of the below lists such as the pocket survival kit and the EDC kit, neither of which come in a bag. Generally you want your gear pre-packed and ready for an emergency at all times of the day, month and year, therefore if you borrow an item from your bag, be sure to replace it immediately after you're finished with it. Each bag has a specific purpose and are carried at different times depending on the situation. Items in the bags must be rotated out when they reach their expiry date such as food, water, glowsticks, medication and energy bars so it's recommended to keep a spreadsheet of these dates.

GEAR | Preparedness Kits

Pocket Survival Kit (PSK)

Pocket Survival Kit (PSK)

Pocket Survival Kit	Example Items
Fits into a small metal tin (altoids tin) and covers the basic survival needs excluding shelter. You should last at least five days on its supplies excluding food and water. Because only small items will fit into an altoids tin you must be extremely careful what you pack. You may end up on a tropical island with only this kit and have to survive months. This kit is easily able to be stored in a pocket, workplace, car or the home to be easily grabbed when needed. You may also want to consider having multiple kits with exactly the same items for those situations where you may not be able to grab another one, but if you can grab multiple, then you can give one away or have the redundant one as a backup.	• Thin Mirror • Small Flint Rod • Tritium Light • Small Blade • Medication • Purification Tablets

Size	Weight		
The pocket survival kit should be small enough to fit into a pocket. A recommended size would be the size of an 'Altoids' tin or approximately 2.36" (6cm) x 3.75"(9.5cm) x 0.7" (2cm) High.	Your PSK kit should be extremely lightweight and inconspicuous, typically below 150 grams (0.3 lbs).		

GEAR | Preparedness Kits

Every Day Carry (EDC)

Every Day Carry (EDC)

EDC Gear (Every Day Carry)	Example Items
This gear is carried by you every day and should be able to be presented any time. These items aren't packed into a bag but instead worn on your person such as on a belt, on your wrist or in your pocket. These items should be ones you typically use every day or ones that you won't be able to live without if SHTF that day - such as a way to start fire.	• Pocket Knife • Watch • Mobile Phone • Keys

These items aren't in a bag like the other types of gear, and are either worn on your body or can be shown to anyone 99% of the time.

Size	Weight		
Your EDC kit should all fit inside a moderate sized organising cell approximately 12cm (4.7") x 12cm (4.7") x 4cm (1.5"). But keep in mind that not all of it will be stored in this case, but instead on your body.	Your EDC kit should be very lightweight and inconspicuous, typically below 500 grams (1.1 lbs).		

This pack isn't limited to a bag but also includes clothes, wearables such as watches and a gun. The 5 C's of survival which the EDC kit generally should cover is: Cutting, Cordage, Combustion, Cover and Container.

GEAR | Preparedness Kits

Get Home Bag (GHB)

Get Home Bag (GHB)

Get Home Bag (GHB)

GH Gear (Get Home)	Example Items
These items are only to assist you getting home within 24 hours if a disaster occurs while your away from your BOB. The gear should include everything required for a trip home from work or other place where you're frequently at. The bag could also accommodate one overnight camp (if required) which will generally consist of a mylar bag to keep things minimal and lightweight. This bag would generally stay in your car or your place of work in anticipation of a disaster situation.	• Mylar Bag • Food Rations • Water • Mini Medical Kit

Size	Weight		
A GHB should be the size of a small backpack. This can be between a 10L and 20L backpack. (2.1 - 4.2 gal). Size and fit should be based off the person's size.	The GH bag should be a lightweight pack under 3kgs (6.6 lbs) which doesn't draw attention to yourself.		

The bag is designed to get you home within 24 hours and can only sustain you for this period - including overnight once. It is assumed that you won't have access to any reasonable food or clean water along the way home thus bringing your own is essential.

GEAR | Preparedness Kits

Bug Out Bag (BOB)

Bug Out Bag (BOB)

BOB Gear (Bug Out Bag)
A bag designed to only get you to your BOL (Bug-Out Location) within approximately 3 days or less - where you should have food, water and other supplies stored already. BOB's should be stored in a secure location such as a house until needed. They could also be located at your place of work if you aren't planning on travelling with others.

Size	Weight		
Your Bug Out Bag's size should be between 30L and 80L. (6.5 - 17.5 gal) Size and fit should be based off the person's size.	Your BOB should weigh at most 1/5th of your weight. For ultralight the weight should be below 5kgs (11 lbs) or 1/15th of your weight.		

These bags are typically designed to be carried on foot however - hiking frames, bikes and cars are also useful ways to transport your gear.

GEAR

I'm Never Coming Home Bag (INCH)

CH)

INCH Gear (I'm Never Coming Home)
This bag will help you stay in the wild indefinitely with it's many tools and heavy duty items. INCH bags can be extremely heavy if you're truly planning on never returning home again as they will contain everything needed to set up a shelter and live off the land long term. Despite the term "Never" used in INCH, at some point you will want to return to the suburbs - particularly years down the track when most things have settled down again.

Example Items
- Heavier Tools
- Lots of Paracord
- Redundancy Items

Size
Your INCH bag should be between 50L and 120L. (11 - 26.3 gal) Size and fit should be based off the person's size.

Weight
Your INCH bag should weigh at most 1/4th of your weight, assuming you're carrying it yourself.

Typically INCH bags are accompanied with a transport mode such as a car or a bicycle as they can weigh up to 100kg's. The bag includes more tools then all other bags which are single function to increase their longevity and efficiency. The bag only has 7 days worth of food and water for one person - therefore acquiring an income of food and water is vital early on.

Survival Comfort And Redundancies (SCAR)

SCAR (Survival Comforts And Redundancy)
The Survival Comfort And Redundancy (SCAR) bag is a term I (fluidicice) coined in response to all the spare prepper gear I accumulated that wouldn't make it into any of my other bags. Its primary purpose is to store your spare and redundant supplies to increase your comfort and give you more options when bugging out. It should be grabbed in addition to your other bags if you have the space available in your car.

However if it's not required later on, or you can't carry it any more you can safely ditch it knowing that you already have the basic gear in your BOB/INCH bags. Redundancy is key and if you're permanently bugging out and your primary tools break, what will you use? You won't last much longer without an axe, hatchet or saw to construct a shelter. Typically used when you have a limited time to bug out, these bags will boost your longevity and estimated survival time as well as provide more specialized equipment for certain scenarios, seasons or climates.

Examples
- Blankets
- Extra Clothes
- Stronger Shelter
- Backup Axe
- Backup Knife
- Larger Gas Masks
- Additional Barter Items
- Pandemic Equipment
- Cigars/Alcohol
- Folding Furniture

Size
There's really no size or weight limit to a SCAR bag, and you can have as many SCAR's as you need as long as you can lift them. I recommend either a duffel bag or a plastic tub to easily throw them into the car.

Weight
Weight shouldn't matter in a SCAR bag as it will only be used if you are using vehicle transport and have free space. However an average estimate would be 5-30kgs (11 - 66 lbs).

The bags are not meant to be hiked with and can be dumped if they are slowing you down or you have to set out on foot. Their entire function could be just to take with you regardless and decide what you need from it at your destination if you have to bug out fast. Ensure they will fit in your mode of transport as there's no point having a SCAR bag if it will only reduce visibility or slow you down. Never keep this bag if hiking on foot long distances. If you need to dump a bag on the run, this is the bag you will choose first without hesitation.

There's also no loss because the items would have been looted in your house anyway. Nearly every prepper has additional preps at home which aren't in their BOB, these items are best served in a SCAR bag which you can just grab and go with if you have the space for them. The bag is called "Survival Comforts" because it's generally not up to the standards of regular home comforts you current live in, but still improved over a regular bug out situation.

Shelter SCAR Bag
Providing a bolster to protection, camouflage, weather and comfort. You can't control the elements and nature can be deadly when it wants. Occasionally you need that strong shelter to provide safety, morale and camouflage. The additional shelter should be an add-on to your current shelter. An example being a weatherproof tarp or a top layer of a tent that's packed in this bag as it's too heavy for typical bug-out situations.

Water / Food SCAR Bag
Contains lightweight foods, extra gas, water, water filters and cooking utensils. What if it's tougher to get established at your BOL than you prepared for? What if it's winter when you bug-out and the animals are hibernating and the plants are dead?

Energy SCAR Bag
As many different types of batteries, chargers and cables you can fit inside it - but which you're still likely to use.

Items
- AAA, AA,18650 Batteries
- C, D Batteries
- 9v Batteries
- Solar Panels
- Power Banks
- Charger Cables
- Voltage Adapters

Hygiene SCAR Bag
Because you'll eventually run out of toilet paper, razors and toothpaste. A folding or rigid toilet would be a good foundation to this bag as it might take some people a bit of time to adapt to having to dig a hole and "going" in it.

Items
- Portable Toilet
- Toilet Paper
- Toilet Cleaner
- Soap
- Toothbrush & Paste

Items
- Shampoo & Conditioner
- Trowel
- Razors
- Towel & Facewashers
- Female Urine Device

Weapons SCAR Bag
A bag stuffed full of additional ammo, guns, grenades and knives. Because why not? You may need to shoot yourself out of a situation.

Barter SCAR Bag
This bag is full of tradeable items which you can use to barter for items you require. It's always advised to only trade weapons with people you know to avoid a potential situation where your weapons are used on you. It can contain almost any item but the items people are likely to need are to the right. See the ECONOMY > Bartering section for more information.

Items
- Food
- Water
- Medical Equipment
- Alcohol
- Condoms

- Cigarettes
- Tea & Coffee
- Hygiene Products
- Weapons

This bag could contain things like extra warm clothing and blankets, tool redundancies like hatchets, knives and shovels, extra camping gas, fishing snares and larger traps, long rolls of paracord or advanced medical equipment. Most preppers have spare items that didn't make it into their BOB's so why not have them in a bag themselves to grab if the need arises and you have the space available.

Car Kit

Car Kit A car kit (or Bug-Out Vehicle Kit) is a collection of survival items which you keep in your vehicle for car related emergencies. It's different to a Get-Home Bag (GHB) because it's only for vehicle related personal disasters where you will normally stay with the vehicle until it's repaired or towed. However you should also have your GHB in the vehicle anyway in the event you need to ditch the car. Be sure to keep things like your spare tyre ready to go at all times. Most of these can be packed into a plastic tub (ideally with wheels) so it can be easily moved around.			**Example Items** • Reflective Triangles • Vehicle Tools • First Aid Kit
Safety Gear Gear which will make you visible and help fix any dangerous situations. Put the high-vis vest in the glove box so it can be put on after you break down, but before you even get out of the car to avoid further accidents.		**Items** • High-Vis Vest • Headlamp & Btty's • Reflective Triangles • First Aid Kit • Whistle	• Signal Flares • Face Mask • Fire Extinguisher • Safety Glass Breaker • Seatbelt Cutter
Tools In some circumstances, you might be able to fix the vehicle yourself if you have the right knowledge and tools on you.	**Items** • Screwdrivers • Socket Set • Spare Fuses • Duct Tape • WD-40/Lubricant • Gloves • 12v Air Compressor	• 4 Way Wheel Brace • Cleaning Cloths • Shovel • Air Pump • Jack Stand • Spare Oil • Recovery Tracks • Vehicle Manual	• Spare Coolant • Water for Vehicle • Scissors • Jumper Leads • Ratchet Straps • Tow Rope • Paper & Pens • Road Maps
Preparedness Gear Include gear which will help get you through tough weather if you have to wait with the car for hours, up to days before assistance arrives (and the grid is still up). You are likely to leave most of this gear with the car if you need to "Get Home", so don't pack anything you don't mind leaving.		**Items** • Canned Food • Blankets / Pillow • Torches and Batteries • Tarps & Paracord • Umbrella • Long Life Snacks • Power Bank	• Mini Stove • Hand Warmers • Water for Drinking • Radio • Spare Clothing • Walking Shoes • Toilet Paper • Hat

2 Backpacks

Backpacks are an essential resource in the prepping community, they are designed to carry your gear and take the weight of them off your back. There are multiple types of prepping backpacks each with a unique purpose, and even though you don't need them all, they have their place in your life. Generally they are designed to hike out into the mountains with and be fairly lightweight however every person is different and so should their bag. Having a lightweight pack means you can travel further and faster allowing you to GOOD faster if SHTF. For the recommended contents of this kits, see the GEAR section.

Preparedness Kits

This section explains the different types of 'bags' you can use to carry and store your gear. The term bag doesn't fully cover each of the below lists such as the pocket survival kit and the EDC kit, neither of which come in a bag. Generally you want your gear pre-packed and ready for an emergency at all times of the day, month and year, therefore if you borrow an item from your bag, be sure to replace it immediately after you're finished with it. Each bag has a specific purpose and are carried at different times depending on the situation. Items in the bags must be rotated out when they reach their expiry date such as food, water, glowsticks, medication and energy bars so it's recommended to keep a spreadsheet of these dates.

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Size The pocket survival kit should be small enough to fit into a pocket. A recommended size would be the size of an 'Altoids' tin or approximately 2.36" (6cm) x 3.75"(9.5cm) x 0.7" (2cm) High.	**Weight** Your PSK kit should be extremely lightweight and inconspicuous, typically below 150 grams (0.3 lbs).		

Every Day Carry (EDC)

EDC Gear (Every Day Carry) This gear is carried by you every day and should be able to be presented any time. These items aren't packed into a bag but instead worn on your person such as on a belt, on your wrist or in your pocket. These items should be ones you typically use every day or ones that you won't be able to live without if SHTF that day - such as a way to start fire.	**Example Items** • Pocket Knife • Watch • Mobile Phone • Keys
These items aren't in a bag like the other types of gear, and are either worn on your body or can be shown to anyone 99% of the time.	

Size Your EDC kit should all fit inside a moderate sized organising cell approximately 12cm (4.7") x 12cm (4.7") x 4cm (1.5"). But keep in mind that not all of it will be stored in this case, but instead on your body.	**Weight** Your EDC kit should be very lightweight and inconspicuous, typically below 500 grams (1.1 lbs).		

This pack isn't limited to a bag but also includes clothes, wearables such as watches and a gun. The 5 C's of survival which the EDC kit generally should cover is: Cutting, Cordage, Combustion, Cover and Container.

Get Home Bag (GHB)

GH Gear (Get Home)
These items are only to assist you getting home within 24 hours if a disaster occurs while your away from your BOB. The gear should include everything required for a trip home from work or other place where you're frequently at. The bag could also accommodate one overnight camp (if required) which will generally consist of a mylar bag to keep things minimal and lightweight. This bag would generally stay in your car or your place of work in anticipation of a disaster situation.

Example Items
- Mylar Bag
- Food Rations
- Water
- Mini Medical Kit

Size A GHB should be the size of a small backpack. This can be between a 10L and 20L backpack. (2.1 - 4.2 gal). Size and fit should be based off the person's size.	**Weight** The GH bag should be a lightweight pack under 3kgs (6.6 lbs) which doesn't draw attention to yourself.		

The bag is designed to get you home within 24 hours and can only sustain you for this period - including overnight once. It is assumed that you won't have access to any reasonable food or clean water along the way home thus bringing your own is essential.

Bug Out Bag (BOB)

BOB Gear (Bug Out Bag)
A bag designed to only get you to your BOL within approximately 3 days or less - where you should have food, water and other supplies stored already. BOB's should be stored in a secure location such as a house until needed. They could also be located at your place of work if you aren't planning on travelling with others.

Size Your Bug Out Bag's size should be between 30L and 80L. (6.5 - 17.5 gal) Size and fit should be based off the person's size.	**Weight** Your BOB should weigh at most 1/5th of your weight. For ultralight the weight should be below 5kgs (11 lbs) or 1/15th of your weight.		

These bags are typically designed to be carried on foot however - hiking frames, bikes and cars are also useful ways to transport your gear.

I'm Never Coming Home Bag (INCH)

INCH Gear (I'm Never Coming Home)
This bag will help you stay in the wild indefinitely with it's many tools and heavy duty items. INCH bags can be extremely heavy if you're truly planning on never returning home again as they will contain everything needed to set up a shelter and live off the land long term. Despite the term "Never" used in INCH, at some point you will want to return to the suburbs - particularly years down the track when most things have settled down again.

Example Items
- Heavier Tools
- Lots of Paracord
- Redundancy Items

Size Your INCH bag should be between 50L and 120L. (11 - 26.3 gal) Size and fit should be based off the person's size.	**Weight** Your INCH bag should weigh at most 1/4th of your weight, assuming you're carrying it yourself.		

Typically INCH bags are accompanied with a transport mode such as a car or a bicycle as they can weigh up to 100kg's. The bag includes more tools then all other bags which are single function to increase their longevity and efficiency. The bag only has 7 days worth of food and water for one person - therefore acquiring an income of food and water is vital early on.

Survival Comfort And Redundancies (SCAR)

SCAR (Survival Comforts And Redundancy)
The Survival Comfort And Redundancy (SCAR) bag is a term I coined in response to all the spare prepper gear I accumulated that wouldn't make it into any of my other bags. Its primary purpose is to store your spare and redundant supplies to increase your comfort and give you more redundancies during bugging out. It should be grabbed in addition to your other bags if you have the space available in your car.

However if it's not required later on, or you can't carry it any more you can safely ditch it knowing that you already have the basic gear in your BOB/INCH bags. Redundancy is key and if you're permanently bugging out and your primary tools break, what will you use? You won't last much longer without an axe, hatchet or saw to construct a shelter. Typically used when you have a limited time to bug out, these bags will boost your longevity and estimated survival time as well as provide more specialized equipment for certain scenarios, seasons or climates.

Examples
- Blankets
- Extra Clothes
- Stronger Shelter
- Backup Axe
- Backup Knife
- Larger Gas Masks
- Additional Barter Items
- Pandemic Equipment
- Cigars/Alcohol
- Folding Furniture

Size Your SCAR bag could be between 10L and 150L. (2.1 - 33 gal) Any bigger than 150L (33 gal) then this bag may be a struggle to carry depending on what's inside. This bag doesn't have to be a backpack, but could also be a duffel bag or other type of bag.	**Weight** Weight shouldn't matter in a SCAR bag as it will only be used if you are using vehicle transport and have free space. However an average estimate would be 5-30kgs (11 - 66 lbs).		

The bags are not meant to be hiked with and can be dumped if they are slowing you down or you have to set out on foot. Their entire function could be just to take with you regardless and decide what you need from it at your destination if you have to bug out fast. Ensure they will fit in your mode of transport as there's no point having a SCAR bag if it will only reduce visibility or slow you down. Never keep this bag if hiking on foot long distances. If you need to dump a bag on the run, this is the bag you will choose first without hesitation.

There's also no loss because the items would have been looted in your house anyway. Nearly every prepper has additional preps at home which aren't in their BOB, these items are best served in a SCAR bag which you can just grab and go with if you have the space for them. The bag is called "Survival Comforts" because it's generally not up to the standards of regular home comforts you current live in, but still improved over a regular bug out situation.

Shelter SCAR Bag
Providing a bolster to protection, camouflage, weather and comfort. You can't control the elements and nature can be deadly when it wants. Occasionally you need that strong shelter to provide safety, morale and camouflage. The additional shelter should be an add-on to your current shelter. An example being a weatherproof tarp or a top layer of a tent that's packed in this bag as it's too heavy for typical bug-out situations.

Water / Food SCAR Bag
Contains lightweight foods, extra gas, water, water filters and cooking utensils. What if it's tougher to get established at your BOL than you prepared for? What if it's winter when you bug-out and the animals are hibernating and the plants are dead?

Energy SCAR Bag
As many different types of batteries, chargers and cables you can fit inside it - but which you're still likely to use.

Items
- AAA, AA,18650 Batteries
- C, D Batteries
- 9v Batteries
- Solar Panels
- Power Banks
- Charger Cables
- Voltage Adapters

Hygiene SCAR Bag
Because you'll eventually run out of toilet paper, razors and toothpaste. A folding or rigid toilet would be a good foundation to this bag as it might take some people a bit of time to adapt to having to dig a hole and "going" in it.

Items
- Portable Toilet
- Toilet Paper
- Toilet Cleaner
- Soap
- Toothbrush & Paste

Items
- Shampoo & Conditioner
- Trowel
- Razors
- Towel & Face Washers
- Female Urine Device

Weapons SCAR Bag
A bag stuffed full of additional ammo, guns, grenades and knives. Because why not? You may need to shoot yourself out of a situation.

Barter SCAR Bag
This bag is full of tradeable items which you can use to barter for items you require. It's always advised to only trade weapons with people you know to avoid a potential situation where your weapons are used on you. It can contain almost any item but the items people are likely to need are to the right. See the ECONOMY > Bartering section for more information.

Items
- Food
- Water
- Medical Equipment
- Alcohol
- Condoms

- Cigarettes
- Tea & Coffee
- Hygiene Products
- Weapons

This bag could contain things like extra warm clothing and blankets, tool redundancies like hatchets, knives and shovels, extra camping gas, fishing snares and larger traps, long rolls of paracord or advanced medical equipment. Most preppers have spare items that didn't make it into their BOB's so why not have them in a bag themselves to grab if the need arises and you have the space available.

Kit Bags

Kit bags are the small bags or pouches that hold most of your equipment so it's all not just loose in your bag. They arrange your fire, water, food, medical and misc kits conveniently so all the items are in one place and easily accessible. Try to keep the kit bags as light as possible as they already have the protection of the bag around them. Use a slightly stronger bag if it's going to contain sharp items such as stoves, knives, cutlery, needles etc.

Can Hold
- Fire Lighting Equipment
- Water Equipment
- Food
- Medical Equipment
- Misc Kits
- Clothing

Kitbag Companies
Sea to Summit: Known as 'Packing Cells' by S2S.
Kifaru: They make a range of kit bags for storing your gear.
Tread Lite: An ebayer who sells Cuben Fiber kit bags.
Eagle Creek: Makes ultralight kit bags.

Dry Bags

Flexible bags which keep anything inside them dry, often by folding down the top and clipping them shut. Dry bags are often used in kayaking, canoeing, rafting, canyoning, and other outdoor activities where sensitive items would otherwise get wet. Dry bags aren't as necessary for camping unless you expect a lot of rain, or you're going to have to cross lakes and rivers.

Dry bags are NOT waterproof, they generally try to meet an IPX6 or IP66 rating meaning they are protected from heavy seas and more particularly: 'Water projected at all angles through a 12.5mm nozzle at a flow rate of 100 litres/min at a pressure of 100kN/m2 for 3 minutes from a distance of 3 meters."

Protects
- Electronics
- Clothing
- Consumables
- Water
- Tinder
- Firelighters
- Medical Gear

Packing Tips

Don't Overfill	Pack Snugly	Pull Together	Securing	Snap Shut	
If you overfill the bag it will compromise its waterproofing.	Pack items close together so they don't rattle and you conserve space.	Make sure the stiffened blades are together and that nothing is protruding from the top.	Roll the blades three times for optimum waterproofing.	Once rolled, snap the clips together to secure it and create a handle on top.	

Stuff Sacks

A stuff sack is a type of drawstring bag, usually used for storing camping items. Stuff sacks are commonly used for the storage of sleeping bags, which are otherwise bulky and difficult to manage. Generally they are just stuffed into the sack to the save time it would take to roll it up into a smaller size again.

Compression Sacks

The compression sack is a type of stuff sack designed particularly for the storage of sleeping bags in internal-frame backpacks. It is equipped with a cloth lid that is attached to the opposite (sealed) end of the sack by adjustable straps. When the straps are forcibly shortened, the sack and its non-rigid contents are reduced in size.

Bear Bags

Bags which keep in the scent of food and are thrown over high branches to prevent bears getting into them overnight. There are also bear canisters but these are generally too bulky to be carried in/on a BOB. You can find more information on bear bags in the "Safety & Security > Safety > Bear Bag" section.

Backpack Features

These are backpack features that may be present on most backpacks available today. Some features you will need and others you won't depending on your needs, location and size.

Size	Weekender (1-3 Nights)	Multiday (3-5 Nights)	Extended Trip (5+ Nights)
The size of the backpack is the first item you should look at. It's better to buy the backpack once you have your gear and ensure it all fits first.	30-50 Litres	50-80L	70L+

Adjustability / Fit
An adjustable bag can adapt from almost any body size and can take a lot of the weight off your shoulders. An adjustable bag is vitally important as you can customise it to your changing weight or even the size of someone else if you are no longer able to carry the bag. An ill-fitting backpack will cause pain at the shoulders and sometimes the hips and make your journey very uncomfortable. When fitting a backpack your height matters the most.

Frame	Internal Frame	External Frame	Frameless
A frame is very beneficial to a backpack to support the weight across multiple points on your body and make carrying it easier. Most hiking backpacks have some kind of frame to keep them stable and increase comfort. The best kind have whole bag frames in an "L" shape to distribute the weight more evenly and make carrying easier. The stronger and larger the frame however, the heavier the backpack will be and will slow you down, so be sure to find a lightweight metal.	Body-hugging internal frame packs designed to keep a hiker stable on uneven terrain.	Great if you're carrying a heavy or irregular load. They also offer good ventilation and lots of gear organization options.	For hiking fast and light where the frame is removed for weight savings.

Ventilation
Ventilation allows your body to breathe through the fabric and wick the sweat away from your body. When bugging out on foot you are sure to become very sweaty, especially if you're not physically prepared for that kind of hike. Therefore it's important to have a backpack that allows sweat to evaporate - cooling you down and keeping you drier. This type of backpack uses a suspended mesh back panel to let air escape around the sides known as a tension-mesh suspension.

Pack Access	Concealed Access	Quick Access	Top-Loading Openings	Panel Access
How many access points you have on the backpack and their distribution around the bag. A good pack will have at least 3 points of access, two of which should access the same main compartment, one at the bottom and the other at the top.	Some bags have a concealed compartment where your back goes to prevent the more valuable items being stolen.	Some items such as the medical kit and waterproof clothing will require quick access when the need arises and should be packed on top to facilitate this.	Generally what comes with backpacks today, although it's harder to reach the deeper items without pulling everything else out.	On these backpacks the whole side of the pack unzips revealing the interior making it easy to reach any item you need.

Pockets	Elasticized Side Pockets	Hipbelt Pockets	Shovel Pockets	Front Pockets
How many and what sorts of pockets are present on the bag - if any. A number of pockets on the outside of the backpack will have you store various items in easily recovered positions such as maps and navigation gear which will be used often.	These are used to hold water bottles but take up no additional space when empty.	Holds items in convenient positions so you can grab them quickly.	Flaps stitch on the front of a backpack and generally held with a buckle closure for larger lightweight items.	Often found on shovel pockets these pockets can hold small items.

Comfort / Padding
How long you can carry the bag without your back or shoulders becoming painful and forcing you to take a break. Combines with weight to make carrying less painful. The comfort of the bag is crucial when bugging out on foot, especially if you're trying to put as much distance between you and a disaster as possible. The more uncomfortable the more you'll be stopping to adjust it or take a break. More padding on a bag will often lead to a heavier backpack which controversially leads to less comfort so try to find the thin line between. Padding can be found on the waist to support the hips, on the back to help it fit to your back more comfortably and on the shoulders to pad some of the weight across a larger distance.

Weight
A very important factor when bugging out. A heavier bag will make you slower and burn energy faster. In general for an empty backpack you will want to aim around 1kg total weight to keep things lightweight. The section for total backpack weight including gear can be found in the section below.

Fabric / Materials
The type of fabric found on the backpack can range dramatically and affect the lifespan and durability of the bag as well as providing useful features like being waterproof. Consider which features you need in a backpack and look for the correct type of fabric that supports that such as being waterproof or being lightweight. The higher quality the materials used in the backpack - the more expensive and generally the heavier it becomes unless it's specially designed to be light.

Weatherproofing / Rain Cover
A rain cover encases the backpack to reduce the amount that enters the bag. A backpack cover is very cheap and can save you the heartache of opening it to find ruined food, a soggy notepad and rusted tools. The cover can also be bought in varying colours such as grey to camo to disguise its true purpose to others.

Backpack Lid
A top flap of the bag that folds up or down to shed rain easier and prevent it getting into the bag. Most hiking backpacks today come with a lid, sometimes with a zippered compartment for storing items. The lid flap sometimes attaches with clips on the front section allowing for a large item to go underneath which is usually a sleeping bag or tarp.

Stealth
How covert your backpack looks to others when bugging out. Generally size is the primary factor when looking at stealth as people will notice you a lot more when you're walking around with a camping store on your back. A camo backpack will help you when you're out in the bush but will draw attention when you're in the suburbs on foot making you more liable to being robbed. It gives the impression you're serious about survival and have some good gear. A 50L camo backpack with a grey toned rain cover would be ideal for all situations as you can use the rain cover until you reach the forests to blend in easier. Noise can be a very important factor when trying to stay hidden. You'll draw a lot of attention if you've got metal pots and pans attached to the outside banging loudly every step. Velcro and zips can also give away your position if loud enough.

Durability
How durable and hardy the backpack is against rough use. You definitely want a bag that's not going to fall apart on the first trip, or pieces falling off, so be sure to buy from a reputable brand that has good materials and zips.

Removable Daypack
A secondary bag that attaches to the primary backpack for lightweight hiking during the day. Some backpacks have a section on the front for a smaller removable backpack which lets you travel lighter from the main campsite when scouting.

Sleeping Bag Compartment
A dedicated compartment for a sleeping bag. Not a very useful option but still helpful if you're looking to keep an item separate from the others in an easy to reach location.

Attachment Points
Points all over the bag that allow various other items to attach such as hiking poles, torches and mattresses. Some backpacks have clips all over it for attaching various items you may need when hiking which can come in very handy to grab without stopping, putting the bag down and then searching for what you need. Be sure you don't over clutter the exterior of the bag as this can alter the weight distribution and cause a lot of noise if they are pots and pans. It will also draw a lot of attention to yourself if people can see what you have on you. Some attachment points are found as webbing where you're able to slide gear under the webs to hold them fairly securely. This works better with bulkier items as there's less chance of them falling out.

Hydration Reservoir
A storage location for a hydration bladder including a hole to put the tube through for drinking on the go. It's important to restore any water you lose while hiking and a water bladder section will make drinking on the go very easy. Depending on the size of the bag you should have enough space for between 1L-3L water bladders.

Fitting

After deciding on a backpack or pulling one out of the cupboard you should ensure that it fits you snugly in all the vital areas.

Torso Length Choosing the height of a bag depends on the length of your torso primarily and must be taken into consideration when looking at a backpack.	**Torso Length** Measure your torso length from the C7 vertebrae parallel to your shoulder height down to your hip shelf located at the top of your hip bone.	**Torso Length** **Pack Size / Torso Length** Extra Small - Up to 15"+ Small - 16" - 17"+ Medium - 18" - 19"+ Large - 20"+	**Waist Size** Generally backpacks support a waist size between 20-40 inches. This is a vital area to get right as they are supported 80% by the waist alone.	**Youth-Specific** Due to the size difference of youth there are specific backpacks made to accommodate their size.	**Women-Specific** Due to physiological differences, there are a number of women's backpacks available to purchase which better accommodate the change in body size,

Adjustments These are adjustments that can be made to the bag to better fit your body type and to help prevent back pain after carrying it for long periods.	**Load Lifter Straps** Stitched onto the shoulder straps and connected to the frame, these straps prevent the pack from pulling away from your body which would cause it to sag on your lumbar region.	**Sternum Strap** A horizontal mid chest strap used to connect the shoulder straps together improving stability and preventing the pack from moving abruptly when moving.

Weight

This section discusses the different weights of backpacks people use and the benefits and disadvantages to each of them.

Total Weight

This section discusses the weight of the backpack and how to lighten the load. Consumables such as food and water aren't included in the total weight of the pack. So if you're aiming for ultralight, remove the consumables before weighing. Below is a table detailing pack weights and the weight category they fall into. Remember that every person is different so you should tailor your own BOB's weight to your own size and weight. The pack weights below exclude food, water and fuel from the total weight calculation.

Name	Weight	Description	Advantages	Disadvantages
Super Ultralight	<3kg (<6.6 lbs)	The "I drill holes in my toothbrush to save weight" mentality where every gram counts. They sacrifice lots of comfort for the lightest pack possible, but they can travel rapidly across terrain. Only has the essentials.	● Rapid Movement ● Much less fatigue ● The Most "Grey Man" ● Very Resourceful	● Often Unarmed ● Almost no comfort ● Barely Weather-Proof ● Few Redundancies

Ultralight	3-5kg (6.6-13.2lbs)	A good weight for the Get Home Bag. You've done well if you can get your BOB down to this weight as travelling will be easier and you won't tire as quickly. Useful if you are escaping on foot.	• Quick Movement • Less fatigue	• Weak in combat • Little Comfort • Less Redundancies • Less Weather-Proof
Lightweight	5-10kg (13.2-22lbs)	A lighter pack allowing you to potentially reach your BOL quicker. A good step up from a moderate weight pack if you can manage to cut out some items.	• Faster Movement • Can travel longer	• Less Weather-Proof • Less Comfort
Moderate	10-15kg (22-33lbs)	A good average pack weight for your regular Bug Out Bag.	• Average Movement • Decent comfort • Good Redundancy	• Possible Theft Target
Heavy	15-20kg (33-44lbs)	Most new preppers tend to overfill their BOBs and automatically drop into this category.	• Better in combat • More Weather-Proof	• Slower Movement • Harder to carry • Possible Theft Target
Ultraheavy	20-30kg (44-66.1lbs)	This weight would be a good fit for an INCH Bag. People with bags this heavy often like their sleeping setups and don't want to compromise on a good night's sleep.	• More Redundancies • Very Weather-Proof	• Very Slow Movement • Difficult to carry • Need more breaks • A Theft Target
Super Ultraheavy	>30kg (>66.1lbs	A bag which would be a good fit for an INCH Bag if you're heading to the woods - if you can carry it. This kind of bag would be fine if your main method of transport is a car or bike for most of the journey.	• Often Heavily Armed • Lots of Redundancies • Highly Weather-Proof • Not Very Resourceful	• Glacial Movement • Painful to carry • Need regular breaks • High Theft Target

Ultraheavy'ers
Ultraheavy backpacking is not really style at all but is rather a term for people who aren't planning on carrying their backpack, but rather drive with it in the car. Generally the people with these backpacks aren't capable of carrying them long term and don't plan on even carrying them on their backs. Newbie preppers often over pack their bags until they are unable to carry them and then have to scale back what they packed - often with great difficulty. Knowledge is the best substitute for weight, the more you know the less you have to carry.

Fluid Weight Calculation

Using the fluid points system below, add up the total weight of your BOB essentials (further below). If the result is < 0 you are lighter then average, otherwise you are heavier. Write down the current weight of your items below to measure where you lie and what you should reduce in your backpack first if required. "Moderate" is the typical camper's item weight averaged between many of that class. UL'ers should aim for less than 0.

General Ultralight Ratios	Abbreviations	Fluid Weight Calculation	Example Current Weight
Super Ultraheavy: >200%	Super Ultraheavy: (SUH)	Super Ultraheavy: +3 Points	BOB = -3
Ultraheavy: <200%	Ultraheavy: (UH)	Ultraheavy: +2 Points	(BOB's weight is 20% below average)
Heavy: <150%	Heavy: (H)	Heavy: +1 Point	
Moderate: <100%	Moderate: (M)	Moderate: +0 Points	
Light: <80%	Light: (L)	Light: -1 Point	
Ultralight: <60%	Ultralight: (UL)	Ultralight: -2 Points	
Super Ultralight: <40%	Super Ultralight: (SUL)	Super Ultralight: -3 Points	

Fluid Backpack Essentials Weight

Backpack	Tent/Tarp/Bivy/Swag	Sleeping Bag & Mattress	Stove & Fuel	Cooking / Canteen Set	Survival Knife
Super Ultraheavy: >3kg	Super Ultraheavy: >7kg	Super Ultraheavy: >5kg	Super Ultraheavy: >500g	Super Ultraheavy: >750g	Super Ultraheavy: >1.5kg
Ultraheavy: <3kg	Ultraheavy: <7kg	Ultraheavy: <5kg	Ultraheavy: <300g	Ultraheavy: <750g	Ultraheavy: <1.5kg
Heavy: <2kg	Heavy: <5kg	Heavy: <4kg	Heavy: <200g	Heavy: <500g	Heavy: <1kg
Moderate: <1.5kg	Moderate: <3kg	Moderate: <3kg	Moderate: <100g	Moderate: <300g	Moderate: <800g
Light: <800g	Light: <1kg	Light: <1kg	Light: <85g	Light: <200g	Light: <600g
Ultralight: <500g	Ultralight: <600g	Ultralight: <800g	Ultralight: <60g	Ultralight: <100g	Ultralight: <200g
Super Ultralight: <300g	Super Ultralight: <400g	Super Ultralight: <500g	Super Ultralight: <40g	Super Ultralight: <75g	Super Ultralight: <100g
Water Purification	**Fire Starters**	**Food (1 Day's Worth)**			
Super Ultraheavy: >1kg	Super Ultraheavy: >150g	Super Ultraheavy: >600g			
Ultraheavy: <1kg	Ultraheavy: <150g	Ultraheavy: <600g			
Heavy: <500g	Heavy: <100g	Heavy: <400g			
Moderate: <200g	Moderate: <80g	Moderate: <200g			
Light: <100g	Light: <60g	Light: <150g			
Ultralight: <80g	Ultralight: <40g	Ultralight: <120g			
Super Ultralight: <50g	Super Ultralight: <20g	Super Ultralight: <80g			

The 343 Method

A simple method by 'fjäderlätt' to lighten gear by limiting "The Big Three" to a total of 3kg's.

Numbers can be split between the three and don't have to be 1kg for each item. Such as: 1.4kg + 0.7kg + 0.9kg = 3.0kg. Done correctly, you should still have a modicum of comfort when sleeping and will put you well on the way of becoming an UL'er.

The Big Three
- Shelter (Tent/Tarp)
- Sleeping (Bag/Quilt/Pad)
- Carrying (Backpack)

Weight Reduction

A section for those who wish to reduce the weight of their backpack to make the journey easier on the shoulders and back. As always, only reduce what you can afford to lose and that won't have a huge negative impact on your survival.

Basic Reduction

Reducing the weight of your backpack is often the most difficult part as you don't want to part with gear you're attached to. The following are a few easy ways to lighten the load of your backpack.

Removing Items	Remove any items that aren't a necessity to survival. Go through each item and ask "Do I really NEED this?" and "What will happen if I don't have this?".
Multi-Purpose Items	Have one item that can be used multiple ways such as a titanium pot for boiling, eating from and drinking from.
Lighter Variants	Buy lighter materials for the necessary items such as titanium instead of stainless steel.

Location	Have the right gear for the situation and location. You don't need to bring warm clothes if you're in a warm part of the globe.
Simplicity	Forego luxury items for a simpler form of living, try to reduce the necessary items you need such as coffee or fancy shelters.
No Redundancy	Generally redundancy is key - unless it's a BOB where you're heading to a destination with all the supplies you need.
Knowledge	The more you know - the less you carry. If you can use materials nature provides you don't need to bring it yourself.
Morale	Include a small morale booster in your pack such as a chocolate bar or alcohol to make the transition to a lighter pack easier and so you have something to look forward to.
Safety First	Ensure safety comes first, don't remove items you can't live without, start slowly removing a few items each trip.

Advanced Reduction

The following methods are extreme ways you can lose every milligram from your backpack and should be looked at last if you want the lightest bag possible. There are many ways to shed weight even further - the most common exaggeration being drilling holes in your toothbrush.

Remove Packaging	Remove un-necessary packaging from your items such as excess plastic, tags and stickers.
Drill Holes	Drill holes in malleable plastics/metals which can withstand the loss and won't break.
Trim Excess	Cut the excess material from objects. If you have a tarp that is slightly too big for your needs, trim it a little for a perfect fit.
Replace Items	You can replace small items with lighter weight alternatives that do the same thing such as lighter carabineers on bags.

Packing

Pack the most important items at the top and side pockets for fast access such as medical kit, rain poncho and navigation items. Keep the heaviest items at the base of the pack and as close to your body as possible to keep the weight centred. Below is an ordered list of gear by frequency of use and how it should be stored in the backpack or on your person.

Immediate Access	Items which need to be used swiftly or which affect the health of individuals, such as a medical kit. These items should be accessible within a few seconds from your backpack or kept on you.	• First Aid Kit • Weapons • Rain Poncho • Medication	• Knife • Binoculars • Gas Mask
Frequent Access	Items which will be used at least 5 times a day and don't have an impact on health or safety. They should be stored in outer pockets.	• Compass / GPS • Maps • Phone • Water Bottle • Radio	• Whistle • Torch / Headlamp • Glasses / Sunglasses • Water Purification Tabs
Infrequent Access	Items which are used 1-2 times a day. These should be stored in outer pockets.	• Food • Clothing • Cutlery and Pots • Hygiene Products	• Fire Lighting Tools • Notepad & Pen
Uncommon Access	Items which are used about once a day.	• Fishing Kit • Hunting Kit • Morale Boosters • Cash / Money	• Trowel / TP
Rare Access	Items which may not need to be used at all or items which take up a lot of space such as a tent and sleeping bag.	• Tent / Swag / Bivy • Hatchet / Shovel • Sleeping Bag • Groundsheet	

Redundancy

Redundancy is the art of having more than one way to accomplish a task such as having some matches in your PSK and a lighter in your BOB - both which are used to start a fire. Redundancy helps if one of the items breaks or is worn out you will still have another way to accomplish that task. You could also be robbed of your pack and still have a way to light fire in your PSK which wasn't stolen.

EDC	In an EDC kit item redundancy isn't required. Any redundancy items will only weigh down the user as an EDC is meant to be wearable and light. An example is why have a spare mini torch when you have a phone with a torch built in?	**Redundancy Categories** • None
BOB	A BOB should only have a few redundancies. A BOB's primary use is to get you to your Bug Out Shelter within 3 days. If an item breaks in this time you should be able to do without it for the time being until you restock at your shelter.	**Redundancy Categories** • Fire Lighting • Self Defence
INCH	An INCH bag should have redundancies for most tools. An INCH bag should have redundancies of vital items such as two ways to cut logs, make fire and shelter etc. You aren't intending on reaching a well stocked final location therefore you should have a few backups in all major categories.	**Redundancy Categories** • Food Acquisition • Water Purification • Shelter Building • Fire Lighting • Self Defence
GH	A GH bag shouldn't have more than the most basic redundancies.	**Redundancy Categories** • Fire Lighting
SCAR	SCAR bags are basically redundancy bags so no additional duplicates are needed as these items ARE the redundancies.	

3 Gear Lists

These lists contain the most recommended gear for each preparedness bag. For more detailed information on each item see the Gear Descriptions further below. Some rows aren't applicable to some bags such as the clothing row for the PSK as the kit is too small for clothes. Items will overlap between bags in case you don't have one of the bags. So a knife will be listed in the GH, BOB and INCH bags. PP means Per Person.

Item Rating
The item rating shows the recommendation of how much this item should be in the given survival bag. All possible fields are as follows:

Essential Item	This item should always be in your survival bag as it provides critical functionality without which you could die.	**Ex: Knife / Water Bottle**
Important Item	An item that provides a strong advantage for surviving but you might be able to get by without one or make one yourself in the field.	**Ex: Tent / Paracord**
Useful Item	Items which can be used in survival situations to make life easier but by no means is required to keep you alive.	**Ex: Solar Panel / GPS**
Conditional Item	These items are based heavily on a specific condition such as your location or medical requirements.	**Ex: Thermals / Epi Pen**
Optional Item	Items which you don't need to survive but can provide a morale boost or keep you grounded.	**Ex: Coffee / Bible**

PSK Gear

PSK Gear (Pocket Survival Kit)
Fits into a small metal tin (altoids tin) and covers the very basic survival needs excluding shelter. This tin should be about 10x7x2cm to be able to fit in a pocket. This kit is designed to give you better odds of survival if it's the only thing you have on you. It may be beneficial to store it in a zip lock bag to protect the contents from liquids which also works as an additional water bag you can use later. The basic aim of a PSK is to provide fire, potable water, some medication and medical aid, a cutting utensil and a way to signal for help.

Water

Unlubricated Condom Qty: 1-2 Necessity: Essential Used as a 1L water container and for sex. Can start fires when filled with water in sunlight.	**Water Sterilization Tablets** Qty: 5 Necessity: Essential Purifies 1L of water and can be used in conjunction with the condom.	**Zip Lock Bag** Qty: 1 Necessity: Important Around 500ml (1pt). Used as a water bottle and can be placed in the sun for SODIS.			

Food & Cooking

Tin Qty: 1 Necessity: Essential The tin which holds the survival kit can be used to cook and boil water in.	**Alum Foil** Qty: 1 Necessity: Useful Can be used for signalling, reflecting heat, SODIS and a lid. An A4 piece folded down should suffice	**Snare Wire** Qty: 2 Necessity: Important Used for catching wild animals.			

Clothing

Not applicable for this kit

Shelter

Not applicable for this kit

Hygiene

Tablet Napkin Qty: 1-2 Necessity: Useful Used for cleaning, washing and as toilet paper.					

Medical

Isopropyl Wipes Qty: 5 Necessity: Essential For killing bacteria on wounds and starting fires.	**Analgesic** Qty: 3 Necessity: Essential Relieves pain. Common choices include panadol and nurofen.	**Intestinal Sedative** Qty: 3 Necessity: Essential Treats chronic and acute diarrhoea.	**Antihistamine** Qty: 2 Necessity: Important For allergies, insect bites and stings.	**Anti-Malaria Tablet** Qty: 2 Necessity: Conditional Vital in areas with malaria.	**Potassium Permanganate** Qty: 2 Grams Necessity: Important Water sterilizer and antiseptic.
Band-Aids Qty: 7 Necessity: Essential For covering minor scrapes, cuts and blisters. Waterproof and silver impregnated ones are optimal.	**Butterfly Sutures** Qty: 4 Necessity: Important Holds together the edges of clean wounds.	**IOsat** Qty: 1-2 Necessity: Conditional Helps prevent the absorption of radioactive iodine. Take 1 per day while in radiation.			

Tools

Paracord Qty: 1m Necessity: Important For building shelters, tying items and repairs.	**Duct Tape** Qty: 30cm Necessity: Useful For repairs on anything that needs it.	**Razor Blade** Qty: 2 Necessity: Essential Used as a makeshift knife for cutting, feathering, gutting, shaving and medical requirements	**Tiny Pen & Paper** Qty: 1 Tiny Pen, 1 Sheet Necessity: Useful For writing survival notes. Waterproof pens and books would be ideal.	**Flexible Saw** Qty: 1 Necessity: Important Can cut down trees with a diameter smaller than 2 inches.	

Light & Fire

Flint Rod & Striker Qty: 1 Necessity: Essential Used for starting fires. Ensure it's a thick enough rod to get 1,000 strikes.	**Matches & Striker** Qty: 5 Necessity: Important Regular, waterproof or windproof matches to use when flint fails.	**Mini BIC Lighter** Qty: 1 Necessity: Important Used in emergencies when the other methods fail you.	**Tiny LED Torch** Qty: 1 Necessity: Important A torch for illumination. Includes a fully charged battery. Aim for 90+ Lumens.	**Cotton Ball** Qty: 3 Necessity: Useful Can be used as tinder or swabbing wounds.	**Birthday Candle** Qty: 1 Necessity: Useful A candle to assist in fire lighting and transferring fire.
Tritium Light Qty: 1 Necessity: Useful A light source which softly glows via a radioactive substance tritium. Used as a marker or reading light.	**Fresnel Lens** Qty: 1 Necessity: Essential Used to start fires when the other methods fail.				

Comms & Navigation

Small Mirror Qty: 1 Necessity: Essential A mirror for signalling and medical purposes.	**Tiny Whistle** Qty: 1 Necessity: Useful For signalling others to help them find you or for communication.	**Button Compass** Qty: 1 Necessity: Essential Helps you navigate and find north.			

Self Defence

Not applicable for this kit

Misc

Tiny USB Qty: 1 Necessity: Important • Survival Guides & TPE • Family Pictures • Local Maps • Entertainment & Music • Important Documents	**Cash** Qty: $20-$100 USD Necessity: Useful For buying essentials if you find society again and it's still functioning.	**Tea Bag** Qty: 1 Necessity: Optional Great for morale if you need it, and will give you some energy.	**Needles** Qty: 2 Necessity: Useful For fixing clothing.	**Thread** Qty: 10m Necessity: Useful For fixing clothing.	**Fishing Line** Qty: 20m Necessity: Important For fishing.
Hooks Qty: 2 Necessity: Important For fishing.	**Small Sinker** Qty: 2 Necessity: Important For fishing.				

EDC Gear

EDC Gear (Every Day Carry)
This gear is carried by you every day and should be able to be presented any time. The following are ideas of equipment you can carry and aren't items you should carry. EDC items are included because if you have to leave quickly for a disaster these items should already be on you. Most of these items are optional and are carried based on personal taste.

Water

Not applicable for this kit

Food & Cooking

Not applicable for this kit

Clothing

Current Clothing Qty: 1 Necessity: Essential The clothes you're currently wearing to protest your modesty.	**Paracord Gear** Qty: 1 Necessity: Useful These are survival items made of paracord such as a belt or bracelet. Some have extra items inside.	**Eyewear** Qty: 1 Necessity: Conditional Glasses and sunglasses to retain the ability to see.			

Shelter

Not applicable for this kit

Hygiene

Not applicable for this kit

Medical

Not applicable for this kit

Tools

Watch Qty: 1 Necessity: Useful Used for telling the time, date and some other useful features such as apps, compass and alarm.	**Multitool** Qty: 1 Necessity: Important A very handy tool which performs a variety of tasks.				

Light & Fire

Flint Rod Qty: 1 Necessity: Important Flint can be carried as a necklace or weaved into the shoelace of your boot.	**Keychain Torch** Qty: 1 Necessity: Useful A torch for illumination. Includes a fully charged battery. Aim for 90+ Lumens.				

Comms & Navigation

Mobile Phone Qty: 1 Necessity: Essential Almost essential in todays society with all the functions it can provide.	**Charger Cable** Qty: 1 Necessity: Optional Used to charge your mobile if you're running low on power.				

Self Defence

Gun / Knife Qty: 1 Necessity: Conditional Depending on your country you may need protection or laws may prevent you carrying one.					

Misc

Wallet / Purse Qty: 1 Necessity: Essential For paying your way in todays society.	**Keys** Qty: 1 Necessity: Essential Gains you access to your house and car.	**Necklace** Qty: 1 Necessity: Conditional Some form of necklace. It could be modified to include a few small survival items.	**USB Drive** Qty: 1 Necessity: Important • Survival Guides & TPE • Family Pictures • Local Maps • Entertainment & Music • Important Documents	**1oz Gold/Silver Coin** Qty: 1 Necessity: Optional A valuable coin kept on you to ensure it's safe at all times.	**Cash** Qty: $10-$100 USD Necessity: Useful For buying items in your daily routine.

GH Gear

GH Gear (Get Home)
These items are only to assist you getting home within 24 hours assuming a disaster has occurred - including one overnight camp. This kit is best left in your car and shouldn't contain items that can be destroyed in extreme heat or cold.

Water

1L Water Bottle Qty: 1-2 Necessity: Essential Storage for water and used in conjunction with purification tablets.	**Water Purification Tablets** Qty: 5-10 Necessity: Essential Purifies 1L of water and can be used in conjunction with the condom.				

Food & Cooking

Energy/Hiking Bars Qty: 3-5 Necessity: Essential This should be your only food and nothing should require heating up.					

Clothing

Socks Qty: 2 Pairs Necessity: Essential You are likely to be walking all the way home so fresh socks will be a lifesaver.	**Rain Poncho** Qty: 1 Necessity: Important Helps protects you from rain, dust, ash etc.	**Walking Boots** Qty: 1 Pair Necessity: Essential You are likely to be walking all the way home so be sure to have a comfortable pair of walking boots.	**Lightweight Clothes** Qty: 1 Set Necessity: Important Fresh clothes to change into if a disaster occurs while you're in business attire.	**Eyewear** Qty: 1 Necessity: Conditional Backup glasses and sunglasses to retain the ability to see.	

Shelter

GEAR | Gear Lists | GH Gear

Light Tarp / Hootchie Qty: 1 Necessity: Important If you're too tired to keep walking this will provide some shelter while you sleep.	**Survival Blanket** Qty: 1 Necessity: Important A thermal blanket to keep you warm and protect you from some bugs.				

Hygiene

Toilet Paper Qty: 1 Roll Necessity: Useful For when you need to do number 2's in the bush. Also good for tinder.	**Toothbrush** Qty: 1 Necessity: Useful To brush your teeth with.	**Toothpaste** Qty: 1 Necessity: Useful To brush your teeth with.	**Feminine Products** Qty: A few Necessity: Conditional A lifesaver if you're in need of them.		

Medical

First Aid Kit Qty: 1 Necessity: Essential A pre-packaged kit to take care of your medical needs.	**IOsat** Qty: 3 Necessity: Conditional Helps prevent the absorption of radioactive iodine. Take 1 per day while in radiation.	**Blister Pads** Qty: 7 Necessity: Important Moleskin pads placed above a blister to prevent it rubbing further.			

Tools

Knife Qty: 1 Necessity: Essential A strong knife for a huge array of tasks.	**Paracord** Qty: 10-30m Necessity: Important For building shelters, tying items and repairs.				

Light & Fire

Flint Rod & Striker Qty: 1 Necessity: Essential Used for starting fires. Ensure it's a thick enough rod to get 1,000 strikes.	**Matches & Striker** Qty: 5 Necessity: Important Regular, waterproof or windproof matches to use when flint fails.	**Mini BIC Lighter** Qty: 1 Necessity: Important Used in emergencies when the other methods fail you.	**Headlamp** Qty: 1 Necessity: Essential A hands free torch to assist when walking at night. 1,000+ Lumens.	**Battery** Qty: 1 Necessity: Important For the headlamp if you take multiple nights to get home.	**Torch** Qty: 1 Necessity: Important A backup torch for illumination. Includes a fully charged battery. 300+ Lumens.

Comms & Navigation

Compass Qty: 1 Necessity: Important Helps you find your bearings if you're in an unfamiliar area.	**Local Map** Qty: 2 Necessity: Important Helps you find your location if you're in an unfamiliar area.	**Small Mirror** Qty: 1 Necessity: Useful A mirror for signalling and medical purposes.	**Radio** Qty: 1 Necessity: Useful An emergency radio for listening to NOAA broadcasts. Solar powered is a bonus.	**Power Bank** Qty: 1 Necessity: Useful 10,000mAh+ to charge your devices if they're low.	

Self Defence

A Weapon Qty: 1 Necessity: Conditional A weapon of your selection based on your country. Ex: Bow, Slingshot, Handgun, Rifle.	**Ammo** Qty: 10-25 Rounds Necessity: Conditional Some extra rounds for your chosen weapon.	**Insect Repellent** Qty: 1 Necessity: Useful Keeps away pesky insects and mosquitoes.			

Misc

Cash Qty: $100-$300 USD Necessity: Useful For buying essentials if you find society again and it's still functioning.	**Charger Cable** Qty: 1 Necessity: Useful Used with the power bank to charge your phone.	**N95 Face Mask** Qty: 1 Necessity: Useful Protection from airborne viruses, dust etc.			

BOB Gear

BOB Gear

BOB Gear (Bug Out Bag)
A bag designed to only get you to your BOL within 3 days where you have food and supplies stored already. If you missed it, further up is a section on backpacks including guides to how much they should weigh and how to pack them properly.

Water

1L Water Bottle Qty: 1 Necessity: Essential Storage for water and used in conjunction with purification tablets. Ensure it's full.	**Water Purification Tablets** Qty: 10-30 Necessity: Essential Purifies 1L of water and can be used in conjunction with the condom.	**Unlubricated Condom** Qty: 2-4 Necessity: Essential Used as a 1L water container and for sex. Can start fires when filled with water in sunlight.	**Water Filter** Qty: 1-2 Necessity: Essential Filters pathogens from water to render it drinkable.		

Food & Cooking

Food Qty: 3-6 Meals PP Necessity: Essential Food to survive on until you reach your BOL.	**Energy/Hiking Bars** Qty: 3-5 PP Necessity: Important These will give you energy boosts throughout the day.	**Stove** Qty: 1 Necessity: Important A stove to cook food on.	**Fuel** Qty: 1-3 Necessity: Important For powering your stove. Either fuel tablets, alcohol or gas canisters.	**Cooking Pot** Qty: 1 Necessity: Essential A metal tin, pot or pan to cook your food in and boil water with.	**Cup** Qty: 0-1 Necessity: Optional For boiling water in and having a nice hot beverage.
Utensils Qty: 1 Necessity: Important A knife / fork / spork / chopsticks etc for eating with.	**Scrubber** Qty: 1 Necessity: Important For cleaning your containers with.	**Snare Wire** Qty: 3 Necessity: Important Used for catching wild animals.			

Clothing

Lightweight Clothes Qty: 1 Set Necessity: Important Fresh clothes to change into if a disaster occurs while you're in business attire.	**Warm Clothes** Qty: 1 Set Necessity: Conditional Warm clothes to layer up with if you have to bug out in the middle of winter.	**Rain Poncho** Qty: 1 Necessity: Important Helps protects you from rain, dust, ash etc.	**Walking Boots** Qty: 1 Pair Necessity: Essential You are likely to be walking a lot so be sure to have a comfortable pair of walking boots.	**Underwear** Qty: 2 Pairs Necessity: Essential A fresh change of underwear will keep you hygienic and give you something to change into if you get wet.	**Hat** Qty: 1 Necessity: Important Important to protect yourself from the sun in warmer climates.
Gloves Qty: 1 Necessity: Important Hand protection as you're likely to be touching a lot of	**Shemagh** Qty: 1 Necessity: Important A shemagh can be used for covering the face, filtering debris from water, concealment etc.	**Eyewear** Qty: 1 Necessity: Conditional Glasses and sunglasses to retain the ability to see.	**Socks** Qty: 2 Pairs Necessity: Essential You are likely to be walking all the way home so fresh socks will be a lifesaver.		

Shelter

Shelter Qty: 1 Necessity: Essential Whether it's a tent, swag, bivy or tarp.	**Ground Pad** Qty: 1 Necessity: Essential Any type of mattress to give you some padding and distance from the cold ground.	**Sleeping Bag** Qty: 1 Necessity: Essential Keeps you warm and cosy.	**Groundsheet** Qty: 1 Necessity: Optional Used to protect your tent from punctures and tears.	**Wool Blanket** Qty: 1 Necessity: Optional Keeps you warm in colder climates.	

Hygiene

Hand Sanitizer Qty: 1 Necessity: Useful Kills germs so you don't get sick as easily. The gel or spray types are easiest.	**Pack Towel** Qty: 1 Necessity: Useful For washing yourself or drying off.	**Toilet Paper** Qty: 1 Roll Necessity: Useful For when you need to do number 2's in the bush. Also good for tinder.	**Toothbrush** Qty: 1 Necessity: Useful To brush your teeth with.	**Toothpaste** Qty: 1 Necessity: Useful To brush your teeth with.	**Feminine Products** Qty: A few Necessity: Conditional A lifesaver if you're in need of them.

Medical

First Aid Kit Qty: 1 Necessity: Essential A pre-packaged kit to take care of your medical needs.	**Isopropyl Wipes** Qty: 10 Necessity: Essential For killing bacteria on wounds and starting fires.	**Analgesic** Qty: 10 Necessity: Essential Relieves pain. Common choices include panadol and nurofen.	**Intestinal Sedative** Qty: 8 Necessity: Essential Treats chronic and acute diarrhoea.	**Antihistamine** Qty: 6 Necessity: Important For allergies, insect bites and stings.	**Anti-Malaria Tablet** Qty: 4 Necessity: Conditional Vital in areas with malaria.
Potassium Permanganate Qty: 5 Grams Necessity: Important Water sterilizer and antiseptic.	**Band-Aids** Qty: 14 Necessity: Essential For covering minor scrapes, cuts and blisters. Waterproof and silver impregnated ones are optimal.	**Butterfly Sutures** Qty: 6 Necessity: Important Holds together the edges of clean wounds.	**IOsat** Qty: 6 Necessity: Conditional Helps prevent the absorption of radioactive iodine. Take 1 per day while in radiation.	**Antibiotics** Qty: 1-2 Boxes (30ea) Necessity: Conditional Helps prevent the absorption of radioactive iodine. Take 1 per day while in radiation.	**Wound Dressings** Qty: 10 Necessity: Essential For covering larger injures. Waterproof and silver impregnated ones are optimal.
Surgical Blades Qty: 2-3 Necessity: Important For performing medical operations.					

Tools

Knife Qty: 1 Necessity: Essential A strong knife for a huge array of tasks.	**Multitool** Qty: 1 Necessity: Important A very handy tool which performs a variety of tasks.	**Flexible Saw** Qty: 1 Necessity: Important Can cut down trees with a diameter smaller than 2 inches.	**Pen & Book** Qty: 1 Pen, 1 Book Necessity: Useful For writing survival notes. Waterproof pens and books would be ideal.		

Light & Fire

GEAR | Gear Lists | BOB Gear

Flint Rod & Striker Qty: 1 Necessity: Essential Used for starting fires. Ensure it's a thick enough rod to get 1k strikes.	**Matches & Striker** Qty: 5 Necessity: Important Regular, waterproof or windproof matches to use when flint fails.	**Headlamp** Qty: 1 Necessity: Essential A hands free torch to assist when walking at night. 1,000+ Lumens.	**Battery** Qty: 2-3 Necessity: Important For the headlamp and torch.	**Candle** Qty: 1 Necessity: Useful A 2.5cm (1in) candle to provide light, assist in fire lighting and transferring fire.	**Fresnel Lens** Qty: 1 Necessity: Essential Used to start fires when the other methods fail.
Tritium Light Qty: 1-2 Necessity: Useful A light source which softly glows via a radioactive substance tritium. Used as a marker or reading light.	**Torch** Qty: 1 Necessity: Important A backup torch for illumination. Includes a fully charged battery. 300+ Lumens.	**Glowstick** Qty: 0-3 Necessity: Optional Provides instant light for 8 hours when snapped.			

Comms & Navigation

Mobile Phone Qty: 1 Necessity: Essential Almost essential in todays society with all the functions it can provide.	**Charger Cable** Qty: 1 Necessity: Optional Used to charge your mobile if you're running low on power.	**Compass** Qty: 1 Necessity: Important Helps you find your bearings if you're in an unfamiliar area.	**Local Map** Qty: 1 Necessity: Important Helps you find your location if you're in an unfamiliar area.	**Map Case** Qty: 1 Necessity: Important A transparent and waterproof map case to keep it protected from the elements.	**Signal Flares** Qty: 5 Necessity: Conditional Helps people find you when shot into the air.
Radio Qty: 1 Necessity: Useful An emergency radio for listening to NOAA broadcasts. Solar powered is a bonus.	**Solar Panel** Qty: 1 Necessity: Optional A solar panel to charge your electronics during the day.	**Power Bank** Qty: 1 Necessity: Optional 10,000mAh+ to charge your devices if they're low. Can be recharged via solar panel.	**Whistle** Qty: 1 Necessity: Useful For signalling others to help them find you or for communication.	**Binoculars** Qty: 1 Necessity: Optional Or monocular for scouting out what's ahead. Recommended in dangerous areas.	

Self Defence

A Weapon Qty: 1 Necessity: Conditional A weapon of your selection based on your country. Ex: Bow, Slingshot, Handgun, Rifle.	**Ammo** Qty: 25-50 Rounds PP Necessity: Conditional Some extra rounds for your chosen weapon.	**Insect Repellent** Qty: 1 Necessity: Useful Keeps away pesky insects and mosquitoes.			

Misc

Backpack Qty: 1 Necessity: Essential This is used to carry all the items above.	**Cash** Qty: $300-$500 USD Necessity: Useful For buying essentials if you find society again and it's still functioning.	**Brew Kit** Qty: 1 Necessity: Optional A small kit to restore morale containing tea, coffee and everything required to make them.	**Barterable Coins** Qty: 0-10oz Necessity: Optional Gold and silver coins to be used for bartering for goods if the situation arises.	**Needles** Qty: 3 Necessity: Useful For fixing clothing.	**Thread** Qty: 20m Necessity: Useful For fixing clothing.
Fishing Line Qty: 50m Necessity: Important For fishing.	**Hooks** Qty: 5 Necessity: Important For fishing.	**Small Sinkers** Qty: 5 Necessity: Important For fishing.	**Latex Tubing** Qty: 1m Necessity: Important Used for binding, as a straw, as a slingshot tube etc.	**N95 Face Mask** Qty: 1 Necessity: Useful Protection from airborne viruses, dust etc.	**ID Documents** Qty: Varies Necessity: Essential Carried identification such as your birth cert, passport, drivers licence etc.
Playing Cards Qty: 1 Deck Necessity: Optional Something to keep you entertained if you're bored.	**Morale Boosters** Qty: 1-2 Necessity: Optional Treat yourself to a small item like chocolate, alcohol or a cigar.				

INCH Gear

INCH Gear

INCH Gear (I'm Never Coming Home)
This bag will help you bug out indefinitely with it's many tools and heavy duty items, possibly with a little assistance of stored caches along the way. The INCH bag focuses on obtaining resources from nature and setting up your new life away from home.

Water

1L Water Bottle Qty: 1-3 Necessity: Essential Storage for water and used in conjunction with purification tablets. Ensure it's full.	**Water Purification Tablets** Qty: 25-100 Necessity: Essential Purifies 1L of water and can be used in conjunction with the condom.	**Unlubricated Condom** Qty: 3-5 Necessity: Essential Used as a 1L water container and for sex. Can start fires when filled with water in sunlight.	**Water Filter** Qty: 2 Necessity: Essential Filters pathogens from water to render it drinkable.		

Food & Cooking

Food Qty: 14-21 Meals PP Necessity: Essential Food to survive on until you reach your BOL.	**Energy/Hiking Bars** Qty: 5-10 PP Necessity: Important These will give you energy boosts throughout the day.	**Stove** Qty: 1-2 Necessity: Important A stove to cook food on.	**Fuel** Qty: 3-9 Necessity: Important For powering your stove. Either fuel tablets, alcohol or gas canisters.	**Cooking Pot** Qty: 1-2 Necessity: Essential A metal tin, pot or pan to cook your food in and boil water with.	**Cup** Qty: 0-1 Necessity: Optional For boiling water in and having a nice hot beverage.
Utensils Qty: 1-2 Necessity: Important A knife / fork / spork / chopsticks etc for eating with.	**Scrubber** Qty: 1 Necessity: Important For cleaning your containers with.	**Multivitamins** Qty: 5-50 Necessity: Important Helps keep your healthy as you're likely to lack essential vitamins when SHTF.			

Clothing

Lightweight Clothes Qty: 1 Set Necessity: Important Fresh clothes to change into if a disaster occurs while you're in business attire.	**Warm Clothes** Qty: 1 Set Necessity: Conditional Warm clothes to layer up with if you have to bug out in the middle of winter.	**Rain Poncho** Qty: 1 Necessity: Important Helps protects you from rain, dust, ash etc.	**Walking Boots** Qty: 1 Pair Necessity: Essential You are likely to be walking a lot so be sure to have a comfortable pair of walking boots.	**Underwear** Qty: 3 Pairs Necessity: Essential A fresh change of underwear will keep you hygienic and give you something to change into if you get wet.	**Hat** Qty: 1 Necessity: Important Important to protect yourself from the sun in warmer climates.
Gloves Qty: 1 Necessity: Important Hand protection as you're likely to be touching a lot of	**Shemagh** Qty: 1 Necessity: Important A shemagh can be used for covering the face, filtering debris from water, concealment etc.	**Eyewear** Qty: 1 Necessity: Conditional Glasses and sunglasses to retain the ability to see.	**Socks** Qty: 3 Pairs Necessity: Essential You are likely to be walking all the way home so fresh socks will be a lifesaver.		

Shelter

Shelter Qty: 1 Necessity: Essential Whether it's a tent, swag, bivy or tarp.	**Ground Pad** Qty: 1 Necessity: Essential Any type of mattress to give you some padding and distance from the cold ground.	**Sleeping Bag** Qty: 1 Necessity: Essential Keeps you warm and cosy.	**Groundsheet** Qty: 1 Necessity: Optional Used to protect your tent from punctures and tears.	**Wool Blanket** Qty: 1 Necessity: Optional Keeps you warm in colder climates.	

Hygiene

Hand Sanitizer Qty: 1 Necessity: Useful Kills germs so you don't get sick as easily. The gel or spray types are easiest.	**Pack Towel** Qty: 1 Necessity: Useful For washing yourself or drying off.	**Toilet Paper** Qty: 1 Roll Necessity: Useful For when you need to do number 2's in the bush. Also good for tinder.	**Toothbrush** Qty: 1 Necessity: Useful To brush your teeth with.	**Toothpaste** Qty: 1 Necessity: Useful To brush your teeth with.	**Feminine Products** Qty: A few Necessity: Conditional A lifesaver if you're in need of them.

Medical

First Aid Kit Qty: 1 Necessity: Essential A pre-packaged kit to take care of your medical needs.	**Isopropyl Wipes** Qty: 50 Necessity: Essential For killing bacteria on wounds and starting fires.	**Analgesic** Qty: 50 Necessity: Essential Relieves pain. Common choices include panadol and nurofen.	**Intestinal Sedative** Qty: 32 Necessity: Essential Treats chronic and acute diarrhoea.	**Antihistamine** Qty: 24 Necessity: Important For allergies, insect bites and stings.	**Anti-Malaria Tablet** Qty: 10 Necessity: Conditional Vital in areas with malaria.
Potassium Permanganate Qty: 20 Grams Necessity: Important Water sterilizer and antiseptic.	**Band-Aids** Qty: 100+ Necessity: Essential For covering minor scrapes, cuts and blisters. Waterproof and silver impregnated ones are optimal.	**Butterfly Sutures** Qty: 25 Necessity: Important Holds together the edges of clean wounds.	**IOsat** Qty: 18 Necessity: Conditional Helps prevent the absorption of radioactive iodine. Take 1 per day while in radiation.	**Antibiotics** Qty: 2-4 Boxes (30ea) Necessity: Conditional Helps prevent the absorption of radioactive iodine. Take 1 per day while in radiation.	**Wound Dressings** Qty: 50 Necessity: Essential For covering larger injures. Waterproof and silver impregnated ones are optimal.
Surgical Blades Qty: 3-5 Necessity: Important For performing medical operations.					

Tools

Knife Qty: 2-3 Necessity: Essential A strong knife for a huge array of tasks.	**Multitool** Qty: 1 Necessity: Important A very handy tool which performs a variety of tasks.	**Flexible Saw** Qty: 1 Necessity: Important Can cut down trees with a diameter smaller than 2 inches.	**Folding Saw** Qty: 1 Necessity: Important Can cut down trees with a diameter smaller than 5-7 inches.	**Hatchet/Axe** Qty: 1 Necessity: Important For felling full size trees easier during shelter building.	**Sharpening Stone** Qty: 1 Necessity: Important Keeps your knife, hatchet and other tools sharp.

Folding Shovel Qty: 1 Necessity: Important For digging holes, retrieving caches etc.	**Pen & Book** Qty: 2 Pens, 1 Book Necessity: Useful For writing survival notes. Waterproof pens and books would be ideal.	**Snare Wire** Qty: 15 Necessity: Important Used for catching wild animals.	**Traps** Qty: 15 Necessity: Important Used for catching wild animals. Traps such as lobster pots, bear traps etc.		

Light & Fire

Flint Rod & Striker Qty: 2 Necessity: Essential Used for starting fires. Ensure it's a thick enough rod to get 1k strikes.	**Matches & Striker** Qty: 20-30 Necessity: Important Regular, waterproof or windproof matches to use when flint fails. Split in half to save space.	**Headlamp** Qty: 1 Necessity: Essential A hands free torch to assist when walking at night. 1,000+ Lumens.	**Battery** Qty: 3-10 Necessity: Important For the headlamp and torch. Ensure they are rechargeable and can be used with a solar panel.	**Battery Charger** Qty: 1 Necessity: Optional A charger which can be connected to a solar panel to recharge batteries.	**Candle** Qty: 2 Necessity: Useful A 2.5cm (1in) candle to provide light, assist in fire lighting and transferring fire.
Fresnel Lens Qty: 1 Necessity: Essential Used to start fires when the other methods fail.	**Tritium Light** Qty: 1-2 Necessity: Useful A light source which softly glows via a radioactive substance tritium. Used as a marker or reading light.	**Torch** Qty: 1 Necessity: Important A backup torch for illumination. Includes a fully charged battery. 300+ Lumens.	**Glowstick** Qty: 0-3 Necessity: Optional Provides instant light for 8 hours when snapped.		

Comms & Navigation

Mobile Phone Qty: 1-2 Necessity: Essential Almost essential in todays society with all the functions it can provide.	**Charger Cable** Qty: 1-2 Necessity: Optional Used to charge your mobile if you're running low on power.	**Compass** Qty: 1-2 Necessity: Important Helps you find your bearings if you're in an unfamiliar area.	**Local Map** Qty: 2-3 Necessity: Important Helps you find your location if you're in an unfamiliar area.	**Map Case** Qty: 2-3 Necessity: Important A transparent and waterproof map case to keep it protected from the elements.	**Signal Flares** Qty: 5-10 Necessity: Conditional Helps people find you when shot into the air.
Radio Qty: 1 Necessity: Useful An emergency radio for listening to NOAA broadcasts. Solar powered is a bonus.	**Solar Panel** Qty: 1-2 Necessity: Optional A solar panel to charge your electronics during the day.	**Power Bank** Qty: 1 Necessity: Optional 10,000mAh+ to charge your devices if they're low. Can be recharged via solar panel.	**Whistle** Qty: 1 Necessity: Useful For signalling others to help them find you or for communication.	**Binoculars** Qty: 1 Necessity: Optional Or monocular for scouting out what's ahead. Recommended in dangerous areas.	

Self Defence

A Weapon Qty: 1-2 Necessity: Conditional A weapon of your selection based on your country. Ex: Bow, Slingshot, Handgun, Rifle.	**Ammo** Qty: 100-200 Rounds PP Necessity: Conditional Some extra rounds for your chosen weapon.	**Insect Repellent** Qty: 1-3 Necessity: Useful Keeps away pesky insects and mosquitoes.			

Misc

Backpack Qty: 1 Necessity: Essential This is used to carry all the items above.	**Cash** Qty: $500-$1,000 USD Necessity: Useful For buying essentials if you find society again and it's still functioning.	**Brew Kit** Qty: 1 Necessity: Optional A small kit to restore morale containing tea, coffee and everything required to make them.	**Barterable Coins** Qty: 0-100oz Necessity: Optional Gold and silver coins to be used for bartering for goods if the situation arises.	**Needles** Qty: 3-5 Necessity: Useful For fixing clothing.	**Thread** Qty: 100-200m Necessity: Useful For fixing clothing.
Fishing Line Qty: 100m-1km Necessity: Important For fishing & limited shelter construction.	**Hooks** Qty: 10-20 Necessity: Important For fishing.	**Small Sinkers** Qty: 10-20 Necessity: Important For fishing.	**Fishing Net** Qty: 1-3 Necessity: Important For the unmanned catching of larger fish.	**Yoyo Reel** Qty: 2-5 Necessity: Important For the unmanned catching of fish.	**N95 Face Mask** Qty: 1-2 Necessity: Useful Protection from airborne viruses, dust etc.
Latex Tubing Qty: 1-3m Necessity: Important Used for binding, as a straw, as a slingshot tube etc.	**Seed Bank** Qty: 1 Collection Necessity: Important A collection of heirloom seeds to begin growing food straight away.	**Identification** Qty: Varies Necessity: Essential Carried identification such as your birth cert, passport, drivers licence etc.	**Playing Cards** Qty: 1 Deck Necessity: Optional Something to keep you entertained if you're bored.	**Morale Boosters** Qty: 1-2 Necessity: Optional Treat yourself to a small item like chocolate, alcohol or a cigar.	

4 Gear Descriptions

The following section is a categorization of all the common gear people use in their preparedness bags. Each item described above will be found here in much more detail. A few items from each category will provide you with a solid starting point for any situation you may face. This gear list is only a guide to get you thinking about what you may need, however everyone's situation is different and gear should be built around you. Each item has a usefulness rating which should be used as a guide only as everything is subjective. Safety first and pack the medicine and medication you require.

Subheadings

		1. Survival Rating	**2. Top 10 Items**	**3. Water**	**4. Food**		

		5. Shelter	6. Clothing	7. Fire	8. Medical		
		9. Medication	10. First Aid Kit	11. Trauma Kit	12. Dental Kit		
		13. Hygiene	14. Tools	15. Light & Power	16. Communication		
		17. Weapons	18. Tactical	19. Morale	20. Navigation		
		21. Misc	22. Sewing Kit	23. Fishing Kit			

1 Survival Rating

The survival rating (shown right) is a simple guide in each category to assist in choosing which items are the most important in your pack. The large number is the total score of the item, dictating how useful it is to have in a survival situation based on multiple fields. The acronyms at the bottom signify which preparedness bags this item should be in. These are discussed in more detail below.

Item Name
Item Rating
5/5
EDC, BOB, INCH

Fields

These are the attributes which form the total score of each item. Each one is carefully considered and calculated with different weightings to give a good idea of its usefulness. Some don't apply to each item such as Nutrition and taste.

Size	**How much space the item will consume in your pack.** 5 - Extremely small item 1 - Large and bulky item
Weight	**How much weight the item will add to your pack.** 5 - Virtually no weight 1 - Extremely heavy
Durability / Quality	**How tough the item is and how long it's likely to last.** 5 - Likely lasts forever 1 - Will break quickly
Usefulness	**How much use the item will get.** 5 - Daily Use 1 - Very Rare Use
Rarity	**How hard the item will be to find or reproduce in a SHTF world.** 5 - Impossible to find 1 - Very common item
Shelf Life	**How long the item will last before its expiry. The item may last longer than the written date.** 5 - 30+ Years 4 - 10 to 20 Years 3 - 5 to 10 Years 2 - 1-5 Years 1 - Under 1 Year
Convenience	**How easy the item is to operate or use.** 5 - Super simple 3 - Moderately complex 1 - Very complex
Nutrition	**How many calories and nutritional benefits the food has.** 5 - Nutritionally rich 3 - Not good nor bad 1 - Bad for you
Taste	**How the product tastes.** 5 - Delicious 3 - Meh, Edible 1 - Almost Inedible
Cost	Cost isn't included in the rating total as once the item's purchased it's no longer thought about, especially in a SHTF situation. Cost also varies wildly.

Item Usefulness

These are the different tiers of gear usefulness. Some items are essential in every kit whereas others are conditional items based on other information such as your location or health.

Essential Item	This item should always be in your survival bag as it provides critical functionality without which you could die.	**Ex: Knife / Water Bottle**
Important Item	An item that provides a strong advantage for surviving but you might be able to get by without one or make one yourself in the field.	**Ex: Tent / Paracord**
Useful Item	Items which can be used in survival situations to make life easier but by no means is required to keep you alive.	**Ex: Solar Panel / GPS**
Conditional Item	These items are based heavily on a specific condition such as your location or medical requirements.	**Ex: Thermals / Epi Pen**
Optional Item	Items which you don't need to survive but can provide a morale boost or keep you grounded.	**Ex: Coffee / Bible**

Recommended Bags

The final field shows which bags this item would be beneficial inside as some items are designed for certain bags such as a hatchet in an INCH bag. The following is a complete list of bags the items could be in. SCAR bags are excluded because any item could go into them.

All Bags: This item could go into any bags but may be constrained by size in some.
Person: This item can be worn on your person such as a watch or clothing.
PSK: An item which should go into a tiny 'Pocket Survival Kit' easily about the size of an altoids tin.
EDC: An item which will suit an EDC (Every Day Carry) bag.
GH: An item which will suit a GH (Get Home) bag.
BOB: An item which will suit a BOB (Bug Out Bag).
INCH: An item which will suit an INCH (I'm Never Coming Home) bag.
Ext: This is short for external location, meaning a bug-out location, car or prepper cache.

2 Top 10 Items

The following items are arguably the most important if you're limited to carrying a few.

#1 Knife	Infinite uses such as self defence, carving containers, striking natural flint, gutting animals, cutting cordage, cutting wood, hammering, reflecting light etc. If you can only have one item, a knife is an excellent choice.
#2 Metal Bottle	Used to boil and store water, it's placed before fire because it's possible to produce fire without a ferro rod, however it's much harder to boil water with items found in nature.
#3 Flint Rod	AKA: Ferrocerium Rod. Because fire is too difficult to procure in harsh conditions without one. The knife can be used with it to produce sparks. A shorter term, but easier option to use would be a BIC lighter.
#4 Tarp	Used for erecting a shelter, capturing rain, capturing distilled water, sleeping inside, reflecting heat etc.
#5 Paracord >30m (100ft)	Used for traps, constructing shelters and furniture, suturing, rappelling, tourniquet, fishing net, fishing line, hanging etc.
#6 Medical Kit	For patching yourself up when you're ill or injured. Some injuries and illnesses can knock you down quickly when it's more important than ever to think clearly.
#7 Latex Tube	Used for crafting a bow, crossbow, slingshot, tourniquet, straw, siphoning tube.
#8 Transparent Sheeting	Used to make a shelter, build a solar still, as insulation, as a rain collector, as a ground sheet or a dry bag.
#9 Local Maps	For finding your location and working out the ideal spots to set up camp. You can estimate your position based on the topography and landmarks or build a makeshift compass.
#10 Backpack	Without this you will be trying to haul most of the items around in the tarp with a paracord knot. They can also be used for foraging, a makeshift pillow and keeping dry.

Assumptions
Similar to the style of the "Alone" Tv series where participants had to choose 10 items to take with them, but were given some such as a medical kit. It's assumed that a disaster is occurring and you've bugged out into the wild and don't want to be found. Your aim is to stay in the wild as long as possible to avoid the disaster. Generally items consisting of multiple parts aren't allowed, but that excludes a small medical kit.

Large items which are cumbersome or difficult to carry such as a whole tent or swag aren't allowed. You have typical civilian clothing on you for the time of year and you don't have any EDC gear. You start with no food or water and had to run out of the house with the clothes on your back. Having redundancies are a waste of a slot therefore if there's an overlap it's a happy coincidence.

Exclusions Some items are excluded for various reasons, they are as follows.	**Compass** There are a few ways to find direction without a compass, but without a map you're completely lost.	**Signalling Devices** You probably don't want to be found or they may try to rob or kill you. You can make a fire instead to signal.	**Technology** It's obvious that when they run out of power they will be useless, including torches.	**Guns** Left out because ammo is finite and you can make either a bow or slingshot with the latex tube.

3 Water

This section helps you choose the water related items in your kits.

Water Bottle

Water Bottle Essential Item 5/5 **GH, BOB, INCH**	A water bottle allows the transportation of water whether potable or not, when travelling between water sources and should last until you refill. It's recommended to have at least one metal container or bottle to boil water in and something to store the purified water in once complete, unless you have another purification method such as tablets or a filter. The only reason a bottle isn't needed is if you filter water directly from the source, there's ample water nearby and you aren't planning on travelling.

Bottle Types

Solid Bottle A rigid bottle which is resistant to deformation and breaking. It takes up the most amount of space. Their weight can range between mid-light to heavy in the case of Nalgene.	**Materials** • Plastic • Tritan • Glass • Ceramic	A strong yet heavy bottle which can't be compressed in any way which may be resilient to breaking if it's not made from glass or ceramics. Some materials are better than others such as Tritan which is virtually unbreakable but rather heavy.

Semi-Solid Bottle A semi-solid bottle such as those you can buy in supermarkets which can be depressed when squeezed.	**Materials** ● Plastic ● Silicon	A great medium between a solid and flexible bottle with lightweight properties. Semi solid bottles will shrink if boiling water is poured into them.
Flexible Bottle A flexible bottle is any container that can be deformed and packed down into a smaller size. They are fairly light but aren't as tough as solid bottles and may eventually break over the fold creases.	**Materials** ● Plastic ● Silicon	Flexible bottles are extremely lightweight at the cost of durability. They shouldn't be bent along the crease lines too often as it will weaken them and they will eventually split along it. A flexible bottle should be combined with another more solid bottle such as solid, semi-solid or metal.
Metal Bottle A metal bottle is the strongest type of container at the cost of weight. However you can boil water in it and it can't be broken.	**Materials** ● Aluminium ● Stainless Steel ● Titanium	The best bottle to take into the field which can be used to boil water as well as drinking from. If you can afford it - titanium has the best weight to strength ratio. Aluminium may melt in a fire depending on its thickness.
Insulated Bottle Insulated bottles generally aren't useful in the field as they are bulky, heavy, can't be used to boil water and there's not much need for keeping water hot or cold.	**Materials** ● Plastic ● Metal	Fairly useless to use as the bottle will explode if heated over a fire and will be extra heavy due to being double walled. Beneficial if you wish to heat up water prior to rehydrate a meal or have a hot drink on the move.
Hydration Bladder A hiker's best friend which allows them to drink without using their hands. They are space efficient and often quite light. They can be hard to refill and clean.	**Materials** ● Plastic ● Silicon	A fairly lightweight drinking method best used for hiking and hands free drinking. Bladders can be somewhat prone to tears so keep it on your backpack preferably in its own compartment.

Bottle Sizes

Storage size is the amount of water a bottle can hold. There are a number of reasons why you'd want a specific size bottle which are discussed below.

<= 500ml	Too small for any real BOB or purification options. 1L purification tablets could be cut in half and used if needed.
750ml	A reasonable size for hiking where water is easily accessible. 1L is still recommended however.
1L	The optimum size of a water pack which allows easy treatment of water via tablets coupled with a good amount of storage.
1.5L	1L+ is better than under 1L as you don't need to fill it up completely to use purification tablets and too much water is always better than too little as you can always tip some out. Negatives include a larger bottle to store.
2L	Generally too large for a water bottle but plausible for a hydration bladder where the water can curve to the shape of your body.

Total Storage

Total storage is the total amount of water you're aiming at carrying. Depending on where you live, how fit you are, how far between refill points, how much you sweat etc, depends on how much water you will need to carry. Below is a list of storage factors that should be considered when choosing a bottle. Below are the factors you should consider when deciding how much water you'll need for your EDC, BOB or INCH bags.

Location	In warmer countries you will consume more water than someone in colder locations.
Bodily Needs	Each person is different and you may use up water faster or slower than someone else by means of sweating etc.
Availability	How accessible water is in your region determines how much you need to stockpile before reaching another water source.
Company	Depending on how many people are in your party you may have to carry your children's water for them.

Storage Location
Water can be stored wherever you please, however inside a pack will keep it cleaner and safer. Storing water on the exterior of a pack can increase the noise you make, unbalance you and make you more visible. It will make it easier to drink though. Water will be constantly sourced on your journey so keep it easily accessible at all times so you can stay hydrated easily.

Colour

The colour of a bottle can have a range of effects, so choose carefully. For more gear colour effects see the LIGHT section.

Black	Absorbs heat better when exposed to sunlight and thus can reach higher temperatures to kill bacteria.
White	Reflects light and keeps the bottle cooler than all other colours.
Clear	Lets sunlight and UV rays through the bottle to kill contaminants.
Bright Colours	Draws the eye easily especially in outback areas where there's only greens, blacks and browns. Avoid if you can.

Weight

If weight is important to you, try to choose thinner containers or flexible storage containers. Solid bottles such as Nalgene ones are very heavy duty and even perhaps needlessly heavy over lighter counterparts. A reasonable aim for the weight of each water bottle is between 28-56g (1-2 oz).

Bottle Mouth

There are a huge array of cap designs that prevent spilling liquid to stopping it coming open when bounced around. This section will cover the prominent ones.

Regular Mouth	A small mouth on the bottle to make drinking easier, however cleaning inside becomes harder.

Wide Mouth	Bottles that have a large opening for faster filling, emptying and sometimes allow connection with a purifier. However it may be spilt easily when going over bumps.
Lid Lock	Some bottles have a latch that keeps the lid on tightly so it won't break open.

Fittings

Bottle fittings are extensions that can be bought to alter the features of it.

Sipper Lid	A lid which converts a wide mouth Nalgene bottle into a regular mouth bottle to make drinking easier.
Pillid	Nalgene has third party lid sections that can be screwed onto their bottles to store items such as purification tablets.

Tips

- Transparent plastic bottles can be used for SODIS to purify the water if left in the sun.
- Ensure the type of plastic is suitable for the long term storage of water and won't leak chemicals over time.
- Volume markings make rationing and measuring water much easier which is particularly useful for freeze dried meals.
- You can find combinations of bottles and cups where the cup fits snugly over the end to conserve space.
- Never buy aluminium bottles for putting over a fire as it can melt.
- Go for stainless steel or titanium. See the MATERIALS section for details of metal melting points.
- Metal bottles should NOT have any form of plastic coating on the inside of the bottle.
- Keep in mind the colour of your bottle if you're trying to stay stealthy.
- Bottles that contain a purification system or a filter can eliminate the need for another piece of kit.

Brands

These are some of the most respected and recommended water bottle brands.

Nalgene	Nalgene bottles are wide mouth bottles, made of Tritan which is virtually unbreakable and there are a few "mods" that can be added to bottles for extra features such as a pillid and sipper mouthpiece. These bottles are quite heavy though and cannot boil water.
Camelbak	
Klean Kanteen	Makers of high quality stainless steel bottles, but ensure you pick a non-insulated one.
Keith Titanium	They make titanium cookware, canteens and bottles. They are quite expensive.
Pathfinder	
Stanley	
Unbranded	Generally unbranded bottles will suffice as long as the material is of good quality. Ensure it won't leak or is easily punctured or broken.

Cost

Water bottles come in fairly cheap at $5-20. Hydration bladders are much more expensive costing between $30-$100.

Water Storage

Zip Lock Bag Useful Item 4/5 Tin, EDC, GH, BOB	An ultra compact water storage option which is also effective at SODIS. These bags have multiple uses from storing gear inside to make them waterproof, lighting fires with them, and storing and purifying water.	**Uses** • Waterproofing Gear • Holding Water • Tablet Purification • Solar Purification	**Top Brands** • Pack4Life • Kraft • Generic Ebay Brands
Condom Useful Item 3/5 Tin, EDC, GH, BOB	Used for backup water storage containers and are so compact they can fit into pocket survival kits. Make sure the condom is unlubricated and unpowdered to avoid water contamination. Generally these are one use only and can be tied off to store water for a later date. With use they will stretch slowly until they become unusable or leak. To purify water with a condom, first fill it with about 1L of water and then add a purification tablet then tie it off and leave it for the designated time. You can also use them for their designated purpose - sex if you feel like you won't be needing it as a water container in the future.	**Uses** • Temporary Bucket • Holding Water • Purifying Water • Protecting Limbs • Slingshot Material • Sex	**Cost** Condoms can be picked up for a few dollars for a packet of 20 or so.

Water Filter

Water Filter Essential Item 5/5 EDC, GH, BOB, INCH	Used to filter particulate and organisms from water for immediate use or storage. Useful if you need a quick supply of water if there's no time for boiling or you're on the move bugging out, otherwise boiling is probably better as it's infinitely re-usable and a filter will clog over time. You can back-wash filters but you'll need to use clean water on hand already filtered or boiled and filtered through a piece of smooth to remove particulate. For more information see the WATER section.

Filter Type	**Gravity Filter** A filter which uses gravity as the driving force by hanging two bags or using barrels.	**Pump Filter** Required to be pumped by hand to purify water from the source.	**Bottle Filter** A filter in the cap of a bottle which removes contaminants as you drink. Allows you to scoop up water and keep moving quickly.	**Straw Filter** Powered by sucking through the straw and requires you to be at the source while you drink.	**UV Purifier** Purifies low turbidity water by waving a UV light around to kill the contaminants.	

Filter Life	The filters life is measured in litres (or gallons) pumped and assumes it's regularly maintained during its life. Generally the advertised life of a filter isn't accurate so you should always have a backup in the situation it fails or becomes blocked.
Flow Rate	How fast you can purify water whether by pumping or gravity. A flow rate of 1L/min is average for all types of filters with some reaching up to 2L a minute. The flow rate often slows over time as the filter becomes blocked.
Weight	The weight of the entire setup including bottles, bags and cleaning equipment if included. A weight between 141-283g (5-10oz) is typical for a filter.
Brands	**Top Brands** ● Sawyer ● Platypus ● Lifestraw ● MSR ● Katadyn ● Steripen
Cost	The cost of a filter can vary wildly based on what type of filter you're looking for. The typical range can be from $25 for a decent cheap filter like the sawyer mini to $300 for the MSR Guardian.

Water Purification

Water Purification Tablets Essential Item 5/5 Tin, EDC, GH, BOB, INCH	Tablets or additives that kill bacteria, viruses and protozoa in water. Generally it's 1 tablet to 1 litre of water with a killing time that ranges from 30m for most bacteria and viruses to 4 hours for cryptosporidium. These take up such little space and are so light that it's easy to throw a sheet into a BOB. Just ensure you renew them then they are about to expire. See the WATER section for more information on any of the purification methods below.

Types (Powder / Crystals)

Potassium Permanganate (Condy's Crystals)	It can be used to purify water, treat infections and fungal infections.	**Top Brands** ● Gold Cross	**Shelf Life** Forever if stored properly	
Calcium Hypochlorite (65%+)	Purifies water by creating a bleach solution.	**Top Brands** ● N/A	**Shelf Life** Around 10 years if stored in an airtight container.	Found in some supermarkets in the pool cleaning aisle in white plastic tubs. This is an oxidiser and can therefore be a hazard to your health. Never breathe in the fumes. Store away from heat and light or it could combust. Airtight containers may require "breathing" every so often as it will consume the oxygen in it and cause a vacuum.
Iodine (Tetraglycine Hydroperiodide)	Purifies water when dissolved and left for 30m-4h.	**Top Brands** ● Potable Pure ● Coghlans		

Types (Tablets)

Sodium Dichloroisocyanurate (Chlorine)	Purifies water when dissolved and left for 30m-4h.	**Top Brands** ● Katadyn ● Aquatabs ● Potable Aqua	**Shelf Life** Between 2-4 years depending on storage methods	The most common type of chlorine tablet and often found for cheap in camping stores.
Chlorine Dioxide (Chlorine)	Purifies water when dissolved and left for 30m-4h.	**Top Brands** ● Lifesystems ● CleanOxide	**Shelf Life** About 10 Years if stored properly	A harder to find chlorine tablet which has a longer life than Sodium Dichloroisocyanurate.

Types (Liquids)

Bleach (Unscented)	Purifies water when dissolved and left for 30m-4h.	**Top Brands** ● N/A	**Shelf Life** Approximately 1 year from manufacture or a few weeks after the expiry date on the bottle.	Ensure it's unscented or you could poison yourself when drunk.
Hydrogen Peroxide	Purifies water when dissolved and left for 30m-4h.	**Top Brands** ● Gold Cross ● Sanofi	**Shelf Life** Around 1 year, or a week or two after the expiry date.	
Colloidal Silver	Silver is a known antibacterial therefore colloidal silver will slowly purify water over time.	**Top Brands** ● Fulhealth (or make some yourself)		

Flocculation

Flocculation	Flocculation refers to the process by which fine particulates are caused to clump together into a floc. The floc may then float to the top of the liquid (creaming), settle to the bottom of the liquid (sedimentation).	**Top Brands** ● Chlor-Floc	**Shelf Life** 4 year shelf life	There's commonly 30 packets per a box. See the WATER section for more information.

Emergency Water

Emergency Water Conditional Item 2/5 GH, BOB, Ext	Emergency water is commonly a small foiled packet of potable water which should be used when there are no other options available. They have saved people's lives in the past and are small and light enough to put one or two inside your pack for emergencies. They are only rated 2/5 because they're expensive and aren't as useful as carrying a few purification tablets or a filter. They are more for stockpiling in houses, boats and caches.				**Shelf Life** Water never expires if stored correctly, although some of the chemicals of the bag could leech into the water over time.
Types	Generally all emergency water comes in foil packets but there are some other styles.	**Foil Packet** The foil packets are flexible tri-laminate pouches and are torn in a corner when needed. They are generally 125ml (4.22floz).	**Cans** Your typical 354ml (12floz) soda can but containing water instead. Opened the same way as sodas.		
Brands	Common brands of emergency water are as follows.	**Mayday** Yellow and black hazard style pattern foil containers. 125ml (4.22floz) each, 5 year shelf life.	**S.O.S** 125ml (4.22floz) each, 5 year shelf life.	**Datrex** 125ml (4.22floz) each, white bag with blue writing. 5 year shelf life.	**Blue Can** 354ml (12floz) each can.

4 Food

This section helps you choose the food related items in your kits.

Canned Food

Canned Food Conditional Item 3/5 GH, BOB, INCH, Ext	The most common survival food that comes to mind. Often very heavy due to the water it contains therefore it's not recommended to put into backpacks. Canned food typically lasts forever if kept at a cool temperature, this excludes a few types of ingredients such as tomatoes which can cause the can to bulge over time. Cans often require a can opener or knife to get it open unless it has a ring pull seal. Canned food is self-contained and simply requires heating before eating. The can is reusable when you're done for a multitude of purposes. If water is limited in the environment eating canned food is ideal as it will provide you with some liquids.				**Shelf Life** Never expires if stored correctly and there's no rust on the seams.
Food Types	The following are the types of food that can be found in cans. Buy the foods you like and that you'll eat as well as ones that give you the calories you need.	**Meals** Meals which contain a few different ingredients such as meat, veges and sauce.	**Soup** Various soups such as pea and ham, tomato and potato.	**Fish** Fish and fish products like sardines, salmon and tuna.	**Fruit** Any type of fruits like apples, pears and blueberries.
Food Types	**Veges** Canned vegetables such as peas, carrots and potatoes.	**Sweets** Desserts or sweets such as condensed milk.	**Drinks** You can get some canned drinks such as fruit juice, coffee and tea.		
Can Variations	These are some canned food variations that may affect your purchasing decisions.	**Ring Pull** Some cans have a ring pull mechanism making it easier to open, however if they rust around the indent they are much more likely to spoil.	**Shape** Cans come in all shapes and sizes and cylinders are very inefficient when storing food due to the wasted space.		
Brands	Brands don't generally matter when buying canned food, just buy the ones you like the taste of.				
Weight	The heaviest of all the foods combining a metal can with the weight of watery food. You should try to avoid carrying canned food if you're backpacking due to it simply being a waste of weight. Canned food should be used in circumstances where you need to bug out fast and stay on your feet or you don't have the ability to boil water.				
Waste	The resulting products from eating a can is the can itself and the lid and possibly the label. The can could be reused in multiple other ways but the lid isn't much use. An empty can weighs up to 28g (1oz) and isn't compressed easily which can be annoying when trying to fit it back into your pack. Unless the can is cleaned thoroughly it will attract animals in search for food such as bears.				
Cost	A very cheap source of food coming in at about a dollar or two per can. Ensure any cans you buy are dent and rust free.				

Freeze Dried Food

Freeze Dried Food Conditional Item 4/5 BOB, INCH, Ext	Great tasting, lightweight food which only requires boiling water and about 10 minutes till it's ready. Canned food contains the water it needs inside it therefore it's much heavier then it's freeze dried and MRE counterparts. I would recommend Mountain House as their food has been guaranteed to a 30 year shelf life. Competing brands don't often contain oxygen absorbers which greatly increases shelf life. For more information see the FOOD section.	**Shelf Life** Depends on the brand, but most last 5 years minimum with Mountain House lasing up to 30 years.

Food Types

The following are the types of freeze dried food you can buy. As always you should buy the foods you like and that you'll eat as well as giving you the calories you need.

Meals	Freeze dried meals such as spaghetti bolognese, chilli mac and chicken nachos.
Soup	Powdered soups such as pea and ham, tomato and potato.
Fruit	Freeze dried sliced fruit.
Veges	Freeze dried vegetables like as peas, carrots and potatoes.
Dessert	Packaged desserts like freeze dried ice cream and cheesecake.
Drinks	Powdered and freeze dried drinks like coffee, tea and smoothies.

Heating / Eating

These are a few ways you can cook and eat your freeze dried food (FDF).

Boiling Water	The most common way to heat FDF is to add boiling water to it and letting it sit.
Flameless Heater	To use a flameless heater bag just add the water and put it inside the heater bag. You can also buy foil pouches to retain more heat as it cooks.
Flame Heating	Simply add both the package contents and water to a bowl and heat over a flame.
Eat Cold	You don't even need to heat the food to be able to eat it if you so desire.
Eat Dehydrated	You could eat FDF without adding water in an emergency and don't have time to stop. Only do this if you're on the run and have enough water. You shouldn't eat food when you're low on water.

Brands	**Top Brands** ● Mountain House ● Back Country Cuisine ● Outdoor Gourmet ● Wise ● Campers Pantry ● Outdoor Gourmet				
Weight	The lightest option for camping food if you have water on hand to reconstitute it.				
Waste	When you're done with the food you have the packet left over which might be useful for transporting water with. Unlike the left over can, this package can be compressed down to a small size to transport back home afterwards. Some packs have oxygen absorbers inside the pack to help it last longer, but they generate more waste.				
Cost	The most expensive option for survival foods which can cost between $10-20 a packet.				

MREs

MREs **Conditional Item** 3/5 **GH, BOB, INCH, Ext**	An MRE or "Meal Ready to Eat" is a military ration that contains everything required for a days worth of food in one package. They contain water and are therefore bulkier and heavier than freeze-dried foods. They often contain two meals, a breakfast, jams, jellies, coffee sachet, sugar, energy bars and more.	**Shelf Life** Generally they have a 10 year shelf life which is good but doesn't quite compare with the 30+ years of some freeze dried food.	**Convenience** Most of it is done for you with MRE's, all you need to do is heat it up and eat it. It also comes with a lot of extra packets to make it taste perfect.

Food Types	Generally MRE's have a limited selection of food types which cover the basic food types and food allergies. MRE's often contain plenty of additional snacks to eat throughout the day as well as useful items like matches. Food types generally consist of curry, meatballs and beef stews.									
Brands	**Top Brands** ● Russian MRE's ● US Surplus MREs ● Hungerbuster ● Ameriqual									
Weight	**Weight** Because MRE's contain everything required to eat them, including water they weigh quite a bit.	**Size** MRE's are quite bulky and thick as they contain a lot of different food packets.								
Waste	MRE's generate a huge amount of waste in the form of empty packets and plastic containers. It will be quite annoying to carry these back with you in your pack assuming you follow the Leave No Trace methodology.									
Cost	MRE's are hard to get a hold of, especially ones which have a very distant expiry date. Due to their elusiveness they may cost a fair bit to get a hold of. Cost ranges from $15 to $30.									

Rations

GEAR | Descriptions | Gear | Food | Rations

Rations Conditional Item 3/5 GH, BOB, INCH, Ext	A bar packed with energy and nutrition designed to last up to 10 years for use while bugging out to prevent the need to cook. Not to be confused with energy bars which are designed to only give you a boost of energy before a race, event or run and have a much shorter lifespan. They can come in different sizes typically - 400 calorie, 1200 calorie, 2400 calorie and 3600 calorie. Ensure the package has a vacuum prior to opening or it may be spoiled.								**Shelf Life** Can last between 5-10 years.	
Food Types										
Brands	**Top Brands** ● Mayday ● Datrex ● ER ● Grizzly Gear ● Mainstay ● S.O.S.									
Weight	Rations can be quite heavy as they are packed into a solid 'brick' of nutrition. Generally they are vacuum packed so they save as much space as possible while preventing oxygen and light from spoiling them as quickly. They do however contain small amounts of moisture and therefore aren't as light as if they were freeze-dried, and some are designed to help prevent you from becoming dehydrated.									
Waste	Probably the food type that has the least waste for the calories and the plastic can also be compressed into the smallest size when you're finished eating.									
Cost	Ration bars are generally pretty cheap coming in at $5 - $15 per bar depending on size and calories.									

Energy Bars

Energy Bars Useful Item 2/5 EDC, GH, BOB, INCH	Energy bars will fill your stomach and give you an energy boost when you need it most, but doesn't have much nutritional value.				**Shelf Life** Generally have shelf lives of around 1-2 years depending on the ingredients.

Types

Energy Bar Types	**Organic Bars** These are energy bars that focus largely on providing energy in as natural a method as possible. Organic bars reject artificial sweeteners and inserted protein, preferring to have a compact load of simple ingredients.	**Meal Replacement Bars** These are designed more for dieting and weight loss rather than a quick burst of energy during hiking or backpacking. They are meant to provide the complete nutrition of a lunch or breakfast and to fill you up.	**Protein Bars** Some energy bars, such as protein bars, are designed to help you gain muscle mass. These bars attempt to cram as much protein as possible for recovery from strenuous workouts or backpacking trips with high-mile days.	**Endurance Bars** Endurance bars are primarily designed to be eaten before a long workout. They typically have a higher proportion of carbohydrates to provide complex, non-sugary energy that is digested over a long period of time.	**Activity Bars** Similar to endurance bars, activity bars focus on prolonging energy. However, they tend to focus on all-day outdoor activities that require both energy and some meal-replacement nutritional features. Clif Bar is perhaps the most prevalent bar in this category.
Food Types	Today you can find a wide range of energy bars in supermarkets, so finding one you like the taste of and provides you with a boost of energy will be easy.		**Types** ● Nut Bars ● Power Gels ● Jelly/Lolly Style Bars ● GORP Bars		
Brands	**Top Brands** ● Clif Bars ● Bloks Bars ● Bear Valley Pemmican ● ProBar ● PowerBar Triple Threat ● Larabar ● Hammer Bar				
Weight	These are often fairly light and sometimes come in sections which can be pulled apart to eat it over the day. They usually weigh between 10g-100g.				
Waste	Bars have a fairly small amount of packaging around them but it can add up quickly. Waste should always be taken with you in the wild so consider how you will dispose of it beforehand.				
Cost	Very cheap bars which can be bought in most any shop today for $2-$5.				

Utensils

Utensils Essential Item 5/5 GH, BOB, INCH	An eating utensil is essential in a BOB for keeping your hands clean and allowing easier transferral of food to your mouth. You should only need one spork coupled with your primary knife to complete any basic kitchen tasks required in the campsite.	**Utensils** ● Fork ● Knife ● Spoon ● Spork ● Serrated Knife ● Chopsticks ● Toothpick ● Skewer	

Types

GEAR | Gear | Descriptions | Food | Utensils

Types of eating utensils.

Fork The most common eating utensil today allowing easy pickup of solid foods.	**Serrated Knife** An additional knife shouldn't be necessary to your primary, but a redundancy is always useful.	**Spoon** A spoon for scooping up and eating liquids and liquid-like foods.	**Spork** A spork combines the usefulness of a fork and a spoon at a slight efficiency cost to each utensil.	**Chopsticks** Chopsticks can be used instead of a fork if you're adept at using one. They can also suit many other camping tasks.	**Toothpick** You can pick up small chunks of food with this utensil as well as clean your teeth when done.
Skewer Similar to chopsticks but designed to be pushed through meats and cooked over a fire.					

Materials

Utensils can come in many different materials each with their own benefits.

Plastic Most camping plastics are typically unbreakable and can withstand fairly high temperatures. Not to be used over open flames.	**Stainless Steel** Probably the most trusted type of metal which has been used for decades as the metal of choice. It can be quite heavy though.	**Aluminium** A lightweight metal which has corrosion resistance and is often found in cutlery.	**Titanium** A lightweight and strong metal with great corrosion resistance. However it is often expensive.		

Build

Some utensils have a certain build style which can greatly affect the use of the product.

Folding Cutlery Packs down to a smaller size, however its lock may snap out while in use sending your food flying.	**Locking System** Some sets of cutlery have a locking system so they don't jangle when in your pack.	**Carabineer Holes** Some items may have holes which you can thread your carabineer through to secure it better.	**Long Handle** Very useful in combination with freeze dried foods which have deep bags.	**Double Ended** You may come across a double ended utensil such as a spoon with a fork at the other end.	**Multi-Use** Some products may have a secondary tool built into a primary tool such as a knife section built into the side of a fork.

Weight / Size

Generally the weight of an eating utensil is miniscule coming in at under 28g (1oz). The size however may be a bit too big to fit inside a self contained cooking kit especially chopsticks.

Cost

Often very cheap coming in between $1 for the plastic type and $20 for a titanium cutlery set of 3.

Brands

Keith Titanium A great brand for titanium cookware which is ultralight and well made.	**lightmyfire** A brand which sells a few nifty lightweight plastic cutlery products which they say can't break.	**Sea to Summit** Great quality cutlery with a focus on light weight.	**Jetboil** Slightly bulkier and heavier cutlery but works well.	**Toaks** A good quality camping manufacturer who makes cutlery, pots and pans.	**Ebay** There's plenty of unbranded copies on eBay which are likely to last as long as the branded ones albeit slightly bulkier or heavier.

Can Opener

Can Opener Conditional Item 3/5 BOB, INCH	A quality rustproof can opener is required if you have canned food or are planning to run into canned food on your journey. You should use a manual can opener with as few moving parts as possible to help prevent it breaking. The P-38 is the smallest and lightest can opener available, however it takes some skill to use.	**Types** • Solid Metal • Twist Type • Automatic

Cooking Pot

Cooking Pot Essential Item 5/5 BOB, INCH	A cooking pot, pan or canteen cup is vital to cook food and boil water in. Make sure it's not aluminium and that it will fit everything you want to cook inside. It should hold at least 500ml. Try to combine the pot, canteen, spork, stove, fuel and scrubber together to save space by ensuring they all fit inside the pot. The more pots that fit snugly inside or around your primary pot allows you to have more utensils while only slightly increasing space used.

Metals	**Aluminium** Lightweight but could melt if placed in a fire directly but fine if you will be cooking over a gas stove.	**Stainless Steel** Very strong and won't corrode but fairly heavy.	**Titanium** A lightweight metal just as strong as stainless steel.	**Cast Iron** Extremely heavy but will last a lifetime.	

GEAR	Gear	Food	Cooking Pot					
				Features	**Hanger** Look for pots with a metal hanger so you can hold it above a fire.	**Handles** Use a pot that has handles to protect yourself from burns. Some handles have a sheath to protect your hands more.	**Lid** A lid will assist in cooking food quicker.	**Spout** A spout can prove to be useful when boiling water and makes it easy to pour into bottles.
				Considerations	**Fuel** Matching your pot size to your fuel canister will make the most of the space.	**Cup** Try to find a cup that fits snugly outside your pot. It won't take any extra space and it can be used for drinks.	**Base Size** Make sure your pot is large enough to fit on your stove securely.	**Volume** Ensure the pot is big enough to boil water in for your dehydrated meals and that it will fit the entirety of your canned meal.
				Weight / Size	Generally metal pots are fairly lightweight, especially if they are made of aluminium or titanium. The size of the pot doesn't matter too much as long as you can store items inside it such as the fuel, stove, spork and cleaning items.			
				Cost	Cost can range from a few dollars up to $100 for the well known brands with many features. The lighter the metal, generally the higher the cost.			
				Brands	**Top Brands** • Jetboil • Keith • Triangia • 360 Degrees • MSR			

Scrubber

GEAR	Gear	Food	Scrubber	
				Scrubber **Useful Item** 3/5 **BOB, INCH**	The easiest way to clean a pot in the wilderness. You should cut the handle off as they can usually weight more then the scrubber. Ensure the bristles don't fall out over time with use and that it cleans well. Never use metal bristles as they are prone to falling out and ending up in food. There aren't any *best* brands, as good scrubbers can be found for $1 almost anywhere. Give the bristles a pull and see if they will fall out with some effort. If you don't want the extra weight you can always use a rag or a piece of clothing. Snow and leaves may also work to clean pots and utensils in certain situations.

Stove

GEAR	Descriptions	Food	Stove			
				Stove **Essential Item** 5/5 **BOB, INCH**	A stove for cooking meals and boiling water with. Unless you want to light a fire every time you want to cook or boil I recommend a portable stove. There are a range of choices each with its benefits and shortfalls. For more information on stoves see the COOKING section.	**Top Gas Stove Brands** • MSR • Coleman • Soto • Jetboil • Gasmate • Companion

Stove Types

GEAR	Descriptions	Food	Stove						
				Gas Stoves Gas stoves are the fastest way to boil water but require gas canisters which will eventually expire leaving the stove useless. **Requires: Gas Canisters**	**Alcohol Stove** An alcohol stove requires you to bring alcohol or other burnable material with you but can still be used as a tiny wood stove if you need. **Requires:** Alcohol	**Petroleum Stoves** Use petrol or kerosene under pressure to generate a flame. They require a lot of maintenance and aren't often recommended. **Requires:** Petrol (Gas)	**Chemical Stove** Small folding stoves which use flammable solids such as hexamine as fuel. **Requires:** Solid Fuel	**Wood Stove** A wood stove will allow you to burn any material on the go including hexamine tablets and will last the longest time. **Requires:** Wood	**Candle Stove** Stoves which use candles to heat up food. These are difficult and slow to cook with. **Requires:** Candles
GEAR	Descriptions	Food	Stove	**Solar Stoves** Any stoves which use the power of the sun to heat and cook food. **Requires:** Sunlight	**Flameless Stoves** Flameless heater bags which when exposed to oxygen, heat up immensely and can cook or reheat food. They are one use only. **Requires:** Nothing Extra	**Electric Stoves** Stoves which use electricity to heat coils. **Requires:** Electricity			

Fuel

GEAR	Gear	Food	Fuel			
				Fuel **Conditional Item** 3/5 **BOB, INCH**	If you have any type of stove you'll need some sort of fuel to burn. This can either be solid, liquid or gas. Solid fuel can be found as wood in the environment and thus makes your pack lighter. You can also bring hexamine tablets which efficiently burn with almost no smoke or smell. Liquid fuel can be quite heavy if you pack a lot of it and it may degrade slowly over time. It's possible to distil more at home but otherwise you're out. Gas fuel can be the most efficient and cleanest to burn of the three but can't be made at home. However it's very cheap, doesn't expire and comes in various sized canisters. There are also different mixes of gases used for different environments. For more information see the FUEL section.	**Gas Brands** • MSR • Jetboil • Coleman • Soto • Primus • Gasmate

Solid Fuels

GEAR	Gear	Food	Fuel						
				Size As you use the fuel it will free up more and more space.	**Weight** Fairly light to transport.	**Efficiency** Moderate efficiency as it's difficult to get the heat desired as it burns down.	**Ease of Use** Just light and put it under a pot or pan.	**Portability** Simple to transport but some may need to be vacuum packed.	**Hazards** Little to no hazards.

GEAR Descriptions Food Fuel

Problems Often requires a flame to light it. Hard to extinguish and use elsewhere if you're done cooking.	**Cost** Very cheap to buy.				

Liquid Fuels

Size Unlike solid fuels you won't gain more space as you use the fuel up.	**Weight** Very heavy to transport.	**Efficiency** Hard to tailor the flame to your requirements as it's either lit or unlit.	**Ease of Use** More difficult to use than solid or gas fuels.	**Portability** Difficult to transport and may leak over your equipment.	**Hazards** Could leak in your pack rendering it all flammable.
Problems Spillable unlike the other fuel types.	**Cost** Slightly more costly than gas or solid fuels.				

Gas Fuels

Size You're left with a canister until the gas is all used up and you can discard it.	**Weight** Moderately heavy to transport.	**Efficiency** Very efficient fuel providing a high amount of heat.	**Ease of Use** Just attach a stove and light.	**Portability** Easy to transport by throwing into a pack.	**Hazards** Could explode if heated over 50°C.
Problems Won't work in freezing conditions. Canister must be warmed up first.	**Cost** Moderately priced depending on the type of fuel.				

For more information see the FUEL section.

Multivitamin

Multivitamin Conditional Item 3/5 BOB, INCH	Replenishes vitamin levels if you're unable to get the recommended doses of everything or you're living off pre-processed foods. Ensure you get the highest quality brand and check the expiration dates every 6 months to ensure they still safe to consume. Typically you will only need to take one tablet every 3-5 days to keep your vitamin levels up. They are so small and worth the effort to throw a few into a BOB in case you ever need them. They may also help cure some diseases such as scurvy due to a lack of specific vitamins when SHTF.	**Top Brands** ● Blackmore's ● Cenovis ● Nature's Own ● Berocca

5 Shelter

This section helps you choose the shelter related items in your kits.

Shelters

Tarp Essential Item 5/5 BOB, INCH	A shelter building material, blanket, poncho or weather shield which can be set up into multiple form factors. There are many different types of tarps ranging from poly to canvas which all provide a different level of protection and all weight differently.	**Common Types** ● Poly Tarps ● Canvas Tarps ● Heavy Duty Tarps ● Vinyl Tarps ● Mesh Tarps ● Cuben Fiber ● Tyvek

Tarp Types

Poly Tarp	A lightweight tarp which is moderately heavy and has fair puncture resistance.
Canvas Tarp	A heavy tarp which is extremely puncture resistant.
Heavy Duty Tarp	A heavy tarp which is very puncture resistant.
Vinyl Tarp	Vinyl Tarps offer long-lasting, superior protection against issues such as rips, punctures, abrasion, liquids, mildew, oil, grease, acid, and wind.
Mesh Tarp	A heavy woven tarp with tiny holes which helps keep grass alive underneath.
Cuben Fiber	Light, yet expensive material which is puncture resistant.
Tyvek	Ultralight house wrap material with puncture resistant properties. Great for groundsheets. Crinkly to lie on when new which may give away your position.

Tent / Swag / Bivy Essential Item 4/5 BOB, INCH	The biggest item you will generally have to carry with you, but it will protect you from nearly everything outside its walls. Each form of shelter such as a tent, swag, bivvy and a hammock each has different benefits such as size, strength, durability, versatility and materials. See the SHELTER section for more information on choosing a shelter.

Tent Brands

Top Tent Brands ● MSR ● Snugpak ● Coleman ● Nemo ● Carinthia	**Top Swag Brands** ● Darche ● Oztrail ● Jolly Swagman	**Top Bivy Brands** ● Snugpak ● Outdoor Research ● Tactical Assault Systems ● Woodland Camo			

Sleeping Bag

Sleeping Bag Essential Item 5/5 GH, BOB, INCH	A sleeping bag is essential in cold environments as they will keep you warm via insulation and protected from the environment outside. They often contain either duck down, feathers, cotton, wool or modern synthetic materials to keep you warm. There's a lot of various cold weather ratings they range from so you should pick one depending on the minimum temperature of the environment you're planning on camping / bugging out in.

Types

The shape of the sleeping bag when looked at from above.

Rectangle A typical rectangular shape which allows a lot of room for movement.	**Rounded** A rounded bag is the middle of the lot which cuts down a bit on weight and size while keeping a fair bit of room for movement.	**Mummy** A mummy shaped bag tapers off from the broader top to a thinner base for the feet to save weight and size.			

Weather Rating

Upper Limit The highest air temperature at which an average man can sleep comfortably.	**Comfort** The lowest air temperature at which an average woman can sleep comfortably.	**Lower Limit** The lowest air temperature at which an average man can sleep comfortably.			

Materials

These are the most common materials found in and on sleeping bags.

Down (Filling)	A down sleeping bag will provide the most insulation, especially goose down. It takes up very little room when compressed and fluffs up nicely once unrolled. Good down usually has a fill rating of about 500 to 800 inches per ounce. Down sleeping bags are very soft and have a great warmth-to-weight ratio. Down sleeping bags, however, are not the best for wet or humid environments as down will not insulate when wet.
Synthetic (Filling)	Synthetic-fill sleeping bags were designed to combine the qualities of down with better insulation qualities when the sleeping bag becomes wet. Although synthetic insulations don't compress as well as down insulation, they are machine washable and dryable. For summer camping and hiking, synthetic-fill sleeping bags are ideal.
Nylon / Polyester / Taffeta (Liner)	These soft, smooth fabrics are the most popular sleeping-bag lining fabrics. They are breathable and comfortable, and they don't heat up as much as others when you're lying in the same spot for a while. Less expensive sleeping bags will use nylon or polyester linings, while taffeta is the highest quality of the three fabrics.
Fleece (Liner)	Fleece and other brushed linings help you feel warmer when the temperature starts to dip. They feel very soft on the skin, but because fleece traps heat, they could be uncomfortable when you're sleeping in the same spot for a long period of time. Fleece and brushed linings are generally seen in rectangular sleeping bags where you'll have more room to shift positions.
Silk (Liner)	Silk is soft, supple and breathable, and it won't overheat from trapping body warmth. Silk is often seen in very expensive mummy-style down sleeping bags. It tears more easily than other liners and is hard to repair, which can be a problem in a down sleeping bag.
Flannel / Cotton (Liner)	These fabrics are most often seen in rectangular sleeping bags. They are natural materials that are breathable, durable and lightweight. They are easy to clean and repair. Cotton and flannel both trap moisture and should be reserved for campouts in moderate to dry environments.
Nylon, Polyester, Taffeta (Shell)	These are the most common materials used for mummy sleeping bags. They are the least durable of the synthetic materials and are best for car camping or general walk-in camping. Nylon, polyester and taffeta are low cost and extremely breathable fabrics. Use these for late spring, summer and early fall camping because temperatures will be moderate. The sleeping bags need to be water-proofed for damper conditions.
Ripstop (Shell)	Ripstop is nylon or polyester that has heavier threads woven into the material. The heavier threads reinforce the shell, making it stronger and more resistant to both tears and moisture, while still remaining breathable. Ripstop is great for three-season camping where conditions won't be too damp.
DryClime, Microfiber, Gossamer Micro (Shell)	These are very tightly woven materials that are strong and moisture-resistant. They are softer than Ripstop, though, because they lack the heavier threads sewn into the material. Sleeping bags made of these fabrics are a great choice for three-season camping or even four-season camping, provided you're not camping in snow caves and your winter camping has ideal conditions.
DryLoft (Shell)	This fabric has water-resistant abilities, but it is very breathable, making it very comfortable. It won't trap any moisture inside. You'll stay warm and dry on the inside and leave the wet and dampness on the outside of the sleeping bag. Look for DryLoft if four-season camping, backcountry camping or canoe camping is what you plan to do.

Weight / Size

A sleeping bag is one of the "Big Three" items in your BOB, therefore to keep things lightweight it's recommended to aim for 1kg.

Cost

You can pick up a sleeping bag for $15 all the way up to $500 depending on the material and insulation rating.

GEAR | Descriptions | Gear | Shelter | Sleeping | Mattress

Brands

Top Brands • Sea to Summit • Marmot • Sierra Designs • Coleman • Teton					

Mattress

Mattress Essential Item 5/5 GH, BOB, INCH	Vital in any environment as the cold ground will sap all the warmth from your body to equalize the temperature. Quite a few different designs of mattresses are on the market today with different benefits, sizes and shape. Choosing the right one may be quite a challenge with so many options.	**Types** • Foam Mattress • Air Mattress • Self-Inflating • Closed-Cell Foam	**Best Brands** • Klymit • Therm-a-Rest • Rei • Coleman • Sea to Summit • Exped

Types

Air Mattress A mattress which only uses air for inflation to keep it as light weight and small as possible. You can blow it up with your mouth or a pump.	**Self-Inflating** A self inflating mat starts to expand automatically when spread out due to a compressible piece of foam inside.	**Foam Mattress** A flat foam pad which generally can't be compressed. They may also be known as yoga mats.	**Closed-Cell Foam** Made up of cells that are completely closed. The cells are pressed together, so air and moisture are unable to get inside the foam. Because of this, closed cell foam is much more rigid and stable than open cell foam.		

Overall Shape

The shape of the mattress when looked at from above.

Rectangle A typical rectangular shape which allows a lot of room for movement.	**Rounded** A rounded mattress which cuts down a bit on weight and size while keeping a fair bit of room for movement.	**Rectangle** A typical rectangular shape which allows a lot of room for movement.	**Rounded** A rounded mattress which cuts down a bit on weight and size while keeping a fair bit of room for movement.		

Comfort Shape

The contours and shape of individual cells or the air.

Flat The mattress is the same thickness the whole way across. This generally applies to foam, self-inflating and closed cell mattresses.	**Air Strips** Some air mattresses may have air strips either going horizontally or vertically from one edge to the other.	**"V" Pattern** Air cells in the shape of the letter V over the length of the mattress.	**Checkerboard Pattern** A pattern mimicking a checkerboard with high and low areas of air.		

Materials

Most mattresses use a composite plastic with ripstop capabilities. Modern mattresses are quite highly tear and puncture resistant but pay attention to how thick the outer material is.

Thickness

The thicker the mattress, the more protected you will be from the cold ground which can be a killer in any climate. Mattresses can range from 0.5cm in height all the way to 10cm+ (when inflated) to provide a cushy nights sleep. See the insulation row below for information on the R-Value rating which can help decide in what thickness to buy.

Insulation

R-Value R-Value is a sleeping pad's ability to insulate its user from the ground. This insulation is measured on a scale from 0 to 6. The higher the R-value, the warmer it will be.	Some manufacturers, don't use R-values. They opt instead to simply specify a temperature range their pads are suited for. An important thing to remember is R-Value is not an independently verified value. One brands R-Value 2.5 pad may differ from another manufactures.	**R-Value Range** **°C = °F = R-Value** 16°C = 60°F = 0.5 10°C = 50°F = 1.0 4°C =40°F = 1.5 -1°C = 30°F = 2.0 -7°C = 20°F = 2.5 -12°C = 10°F = 3.0	**R-Value Range** **°C = °F = R-Value** -18°C = 0°F = 3.5 -23°C = -10°F = 4.0 -29°C = -20°F = 4.5 -34°C = -30°F = 5.0 -40°C = -40°F = 5.5 -45°C = -50°F = 6.0

Weight

Weight is an important aspect of bugging out, so naturally you will want to find a mattress that won't hurt your back while carrying it. Air mattresses are the lightest and therefore the best option when backpacking, also their comfort may leave something to be desired especially for side sleepers.

Compressed Size

When backpacking you want the smallest possible form factor so you can save room for other equipment. The following cells detail the size that each types packs down to. Foam and closed-cell mattresses can only be rolled up and very slightly compressed with compression straps if you have them, so they aren't recommended for backpacking. Self-inflating mattresses can be deflated up until a point where the pressure of the sponge trying to re-inflate will be too great to compress it any further. Air mattresses are often chosen because they can be deflated to the size of a 1L water bottle. You can find ones that come even smaller but they sacrifice durability for size.

GEAR | Gear | Shelter | Mattress

Cost

Generally the larger, the more elaborate and lighter the mattress, the higher the price. Prices can range from $50 to over $300 (AUD) so have a budget in mind.

Brands

The market for camping mattresses has expanded greatly lately and so have the manufacturers.	**Top Mattress Brands** ● Therm-a-Rest ● Klymit ● Exped ● Coleman ● Sea to Summit

Blanket

Blanket **Conditional Item** 3/5 **BOB, INCH**	Only really essential in cold environments, but deadly if you forget one and you need it. Try to buy a wool blanket as they provide the most warmth overall but are a little bulkier and heavier than alternatives. There's not really a best brand to buy as long as you're getting nearly 100% pure material.	**Types** ● Down ● Bamboo ● Silk ● Wool ● Synthetic ● Linen ● Cotton

Materials

These are common blanket materials.

Down Blanket (Lightweight)	A down blanket or down throw is thinner and lighter than a down comforter. The spaces between the down clusters in a blanket trap warm air, keeping you warm without added weight.
Synthetic (Lightweight – Midweight)	Synthetic fibres such as polyester, nylon, and acrylic tend to be ultra-soft. Electric blankets are usually made with synthetic materials.
Bamboo (Lightweight)	Luxuriously soft and lightweight, bamboo fabric is similar to modal, with its smooth hand and flowing drape. Called rayon from bamboo, these fabrics are known for their soft, comfortable, and highly absorbent properties.
Linen (Midweight)	Linen is hypoallergenic, moisture-wicking and adjusts to your body temperature to stay cool in the summer and warm in the winter. Linen becomes softer with every wash.
Wool & Cashmere (Midweight – Heavyweight)	Wool blankets tend to be heavier and warmer than other fabrics. Wool fibres come from the fleece of lambs, sheep, goats, camels, llamas, alpacas and vicunas. Wool from sheep is the most common. Softer, more luxurious wool comes from Cashmere goats, Angora goats and Merino sheep. The spaces between the fibres in a fuzzy or napped blanket trap warm air, keeping you warmer.
Cotton (Lightweight – Midweight)	Cotton blankets can vary in weight and texture, making them a year-round bedding staple. Unlike synthetic fibres, cotton fibres breathe naturally and are absorbent. Cotton will wick moisture away from the skin and leave a layer of warm, dry air. If allergies are a concern, cotton is an excellent choice since it can be washed in hot water.
Silk (Midweight)	Known for its strength, softness and warmth, silk blankets offer the ultimate in luxury. Silk also has natural anti-fungal and anti-microbial properties. Silk blankets should be dry cleaned.

Size

Throw	Twin	Full	Queen	King	
127 x 177cm (50" x 70")	183 x 228cm (72" x 90")	203 x 228cm (80" x 90")	228 x 228cm (90" x 90")	274 x 228cm (108" x 90")	

Cost

Generally quite cheap but can range between $5 to $100.

Brands

Brands don't generally matter when buying blankets as so many manufacturers make them and provide almost identical warmth.

Groundsheet

Groundsheet **Important Item** 5/5 **GH, BOB, INCH**	A fairly essential piece of kit to help protect the tent, swag or bivy against punctures. The sheet can be any range of thickness from 0.5mm all the way to 3mm thick. Try to get a piece that will hold your shelter without excess being visible to save weight and space in your pack. The sheet has a variety of other uses such as rainwater collection, reflecting heat and used as a roof over your shelter if required therefore the term "Groundsheet" is a bit restrictive for all the functions it can provide.

Types

Tarpaulin	These are versatile, multi-purpose tarpaulins made from woven polyethylene (often with a laminated coating) that come in various sizes, thicknesses, and colors. They are widely available at hardware and camping stores. **Materials:** Polyethylene (PE). **Purpose:** Can be used as a basic groundsheet under a tent (though you need to ensure it's tucked under the tent edges to prevent water pooling), as a rain fly, sun shade, gear cover, or emergency shelter. **Advantages:** Very affordable, widely available, waterproof, durable for their cost, versatile. **Disadvantages:** Can be bulky and heavy, noisy when crinkled, don't breathe, water can pool on them if not correctly sized or pitched, can get very hot in the sun.

GEAR Descriptions Gear Shelter Groundsheet

Tent Footprints	These are groundsheets specifically designed to match the exact dimensions and shape of a particular tent model. They are typically cut slightly smaller than the tent's floor to prevent water from pooling between the footprint and the tent in rainy conditions. **Materials:** Often made from durable, lightweight coated nylon (e.g., ripstop nylon with a PU or silicone coating), polyester, or sometimes more premium ultralight materials like Dyneema Composite Fabric (DCF). **Purpose:** To add an extra layer of protection to the tent's floor from abrasion, punctures (from rocks, twigs), and moisture, thereby prolonging the life of the tent. They also help keep the bottom of the tent clean. **Advantages:** Perfect fit, lightweight, often comes with attachment points that align with the tent, minimal bulk. **Disadvantages:** Can be more expensive than generic tarps, only usable with the specific tent model it's designed for.
Mesh Groundsheets	These are woven mesh mats that allow dirt, sand, and water to fall through, keeping the top surface cleaner. They are popular for caravanning, under awnings, or in sandy environments. **Materials:** Heavy-duty shade cloth material, PVC-coated mesh, or patented multi-weave fabrics (like C-Gear Multimats). **Purpose:** To provide a clean, breathable, and sand-filtering surface for living areas outside the tent (e.g., under an awning), or as a protective layer under swags or tents in certain conditions. **Advantages:** Easy to clean, sand and dirt fall through, non-absorbent, breathable, won't rot or mold, good for protecting grass underneath in some campsites. **Disadvantages:** Not waterproof, do not provide a barrier against moisture from the ground, can be slippery when wet (especially the multi-weave types), more expensive than basic tarps.
Canvas Groundsheets	Traditional, heavy-duty groundsheets made from woven cotton canvas, often treated for water resistance. They are typically thick and robust. **Materials:** Cotton canvas (sometimes polycotton blends). **Purpose:** Offer excellent protection against rough ground, punctures, and provide insulation. Commonly used under traditional canvas tents, swags, or as heavy-duty covers. **Advantages:** Very durable and long-lasting, breathable, waterproof (when properly treated/weathered), offer good insulation, mildew resistant if cared for. **Disadvantages:** Very heavy and bulky, expensive, can be hard to clean and stain easily, require more maintenance.
Ultralight Groundsheets	These are extremely lightweight and compact materials often used as DIY footprints or purchased as minimalist options. **Materials:** ● Tyvek: A spun-bonded olefin material (like house wrap), known for being lightweight, strong, puncture-resistant, and breathable. It can be a bit crinkly initially but softens with use. ● Polycryo (Polyethylene Film): A very thin, clear plastic film (like window insulation shrink wrap). It is exceptionally lightweight and waterproof. ● Dyneema Composite Fabric (DCF / formerly Cuben Fiber): The lightest and strongest material for its weight, completely waterproof, but also the most expensive. **Purpose:** To provide a minimal protective barrier under ultralight tents or bivvy bags, reducing pack weight. **Advantages:** Extremely lightweight, pack down incredibly small, waterproof (except for Tyvek which is breathable), durable for their weight (especially Tyvek and DCF). **Disadvantages:** Can be less durable than heavier options against sharp objects (especially polycryo), expensive (DCF), Tyvek can be crinkly/noisy, polycryo can be slippery and hard to manage in wind.

Weight / Size					

Cost					

Brands					

Heat Reflector

Heat Reflector **Conditional Item** 3/5 **BOB, INCH**	A pad made of a heat reflective material such as aluminium used to bounce heat back while sleeping or used as a fire reflector. Keeping warm is typically one of the most important survival rules as you can die in 3 hours without shelter in freezing conditions. It can also be used to reflect heat away from yourself in summer if tied to a frame between you and the sun, which should be more effective than an ordinary roof. Pads can range from the cheap medical thermal blankets to a heavy duty one which can sustain more damage and last longer. For more information see the SHELTER section. A groundsheet can be used as a less effective reflector if you don't want to carry one of each.	**Other Uses** ● Heat Reflector ● Heat Retainer ● Solar Cooking ● Signalling Device

Materials					

Weight / Size					

Cost					

Brands					

6 Clothing

Clothing is required to cover any weather, season or time of day that you may need to get home in. Clothing can be used as a makeshift water filter, shoelaces can be used as paracord and it all keeps you warm. Every country is different and it may be very hot or cold wherever you are, therefore pack for your local climate.	**Typical Clothing** ● Shirt ● Shorts ● Underwear ● Socks ● Shoes	**Other Clothing** ● Warm Weather Gear ● Poncho ● Quick Dry Clothes ● Hiking Boots ● Heavy Duty Gloves

GEAR | Descriptions | Gear | Clothing

Beneficial Clothing

These are the types of clothing that would be beneficial in a survival situation.

Moisture Absorbing	Clothing that absorbs and dissipates moisture created from sweat.
Quick Drying	Clothes that dry rapidly when they become wet.
Sun Protection	Clothing that has an SPF rating to reduce sun damage to the skin.
Insect protection	Insect repellent and pesticide clothing that helps prevent you from being bitten.
Protective Clothing	Thick and heavy clothing with defensive properties to protect from various elements.
Tactical Clothing	Black clothing designed to blend into the night.
Camouflage Clothing	Camo clothing to help you blend into the local environment.

Long Sleeve Shirt & Pants

Long Sleeve Shirt & Pants Essential Item 5/5 EDC, GH, BOB, INCH	A long sleeve shirt and full length pants are important in addition to the clothes you were originally wearing to swap out from. They can keep you warm and give you a level of protection from bugs, insects, ticks and leeches. These can take up a decent amount of space and weight in your BOB but if you have to drop one set of clothes, remove the short sleeve.	**Best Brands** • Fjallraven • The North Face • Arc'teryx • Kathmandu

Short Sleeve Shirt & Pants

Short Sleeve Shirt & Pants Conditional Item 3/5 EDC, GH, BOB, INCH	In addition to the long sleeve, a short sleeve can be a life saver in hot conditions and be made of a lighter material. You can easily cut long clothes to become shorter but it's much harder to lengthen short clothes.	**Best Brands** • Fjallraven • The North Face • Arc'teryx • Kathmandu

Underwear

Underwear Essential Item 5/5 EDC, GH, BOB, INCH	Having some spare underwear is vital to be able to wash the other pair and helps establish a basic level of hygiene. It's better to pick a type you're comfortable with rather than the "best" type made of kevlar or something.	**Types** • Briefs • Boxers • Quick Drying

Socks

Socks Essential Item 5/5 EDC, GH, BOB, INCH	Your feet will be hit hard during a bug out situation and the last thing you need is damp or wet feet which can cause disease and bacteria. A second or even third pair or socks will go a long way and keep fungal infections at bay. The relief of changing to a fresh pair of socks after a long day of hiking is such a morale booster as well.	**Types** • Cotton Socks • Wool Socks • Bamboo Socks • Waterproof Socks

Jacket

Jacket Conditional Item 4/5 GH, BOB, INCH	Vital in cold weather situations, look for ones with down filled sections and full body coverage. A waterproof one would be beneficial but only if you don't already have a rain poncho.

Hat

GEAR
Gear
Clothing
Wide Brim Hat

Hat
Important Item
4/5
EDC, GH, BOB, INCH

Used to keep the sun off you and prevent your skin from burning. A hat with a strap will keep it fixed on your head in strong winds or prevent the need to hold it. Hats are vital in warmer climates such as Australia, India, Mexico and all those around the equator.

Gloves

Gloves
Useful Item
4/5
EDC, GH, BOB, INCH

There will likely be a lot of heavy log lifting and splinters will be a real possibility without a good set of gloves. Find a pair that's designed for heavy use which go up past your wrist a little for maximum protection. They're also great for protecting your hands from freezing as well as providing a basic level of sanitary protection. If you want to use your mobile with gloves, be sure to pick a type that has touchscreen capabilities or the fingerless type.

Rain Poncho

Rain Poncho
Important Item
4/5
GH, BOB, INCH

An important piece of clothing to reduce the amount of rain that reaches you. Wet clothes can be horrible especially when times are already tough and it could cause fungal diseases. A full length poncho would be ideal to shed as much rain as possible. Ensure the hood extends a little further to prevent getting rain on your face. A secondary waterproof jacket would be beneficial underneath as there's bound to be stray drops that get through the gaps.

Shemagh

Shemagh
Important Item
4/5
GH, BOB, INCH

Used for camouflage, covering your face from air particles and removing water sediment. Buying a green or camo shemagh will allow you to blend in to a degree if you're wanting to stay hidden. You can use it as a pillow, insulation layer, handkerchief, foraging container, towel, tourniquet, water filter, sling and washcloth.

Eyewear

Glasses
Conditional Item
5/5
EDC, GH, BOB, INCH

If you wear glasses this is an essential item as you don't want to end up being unable to see if you accidentally break your only pair. If the frame breaks you can always use some small pieces of duct tape to repair it, however if the glass breaks you're stuck. Because of this it's a good idea to bring just the glass as a third backup so you can make your own frame with sticks and tape in an emergency.

Sunglasses
Useful Item
4/5
EDC, GH, BOB, INCH

Helps prevent glare, strong sunlight as well as snow blindness. There are a few additional features you can add to sunglasses today including polarising, glare reduction, different tints and various light reduction ranges.

Protective Glasses
Useful Item
3/5
BOB, INCH

Heavy duty glasses made for protection against sandstorms, snowstorms, dust storms, virus protection etc. These are similar to a gas mask but instead of covering your whole face, they just protect your eyes.

Beanie

Beanie
Conditional Item
3/5
BOB, INCH

Keeps your head warm and camouflages your silhouette. A cold head will make nights tougher as you lose a lot of your heat through your head.

Belt

GEAR | Descriptions | Gear | Clothing | Belt

Belt Useful Item 4/5 EDC, GH, BOB, INCH	Keeps your pants up and provides room for molle attachments and other gear. You can also buy some made from paracord which can be utilized in an emergency situation.

Shoes

Shoes Essential Item 5/5 EDC, GH, BOB, INCH	Essential piece of gear preventing foot injury and making it easier to hike across tough terrain. The ideal shoes should be hiking boots with high sides that reach fairly high up your leg to reduce the number of injuries you're likely to get. Steel caps and soles provide a lot of extra protection but will be a huge weight gain and make hiking a lot harder.

Thermals

Thermals Conditional Item 4/5 GH, BOB, INCH	Generally used by sports athletes and swimmers but can come in handy in snowy conditions when the temperature drops near freezing. Can be rather heavy clothing and underutilized in summer but it's worth its weight to keep you alive in the other months.

7 Fire

This section helps you choose the fire related items in your kits.

Fire Starter

Fire Starter Essential Item 5/5 Tin, EDC, GH, BOB, INCH	For igniting tinder to create a fire with. Some may be more difficult to light then others, so use what you're comfortable with. NOTE: Have at least two ways at minimum to start a fire. For more information see the FIRE section.	**Examples** • Matches • Flint & Striker • Magnifying Glass • Lighter	**Fire Uses** • Warmth • Cooking • Boiling • Sterilizing	**Best Brands** • BIC • Zippo • Z-Plus
Lighter	A self-contained lighter mechanism capable of producing a steady flame. Generally the EDC lighter is an easy to use lighter which generates a solid flame.		**Uses** • Fire lighting	**Recommended** • BIC Lighter • Zippo Lighter • Matches

See the FIRE section for more information on fire starters.

Tinder

Tinder Conditional Item 4/5 Tin, EDC, GH, BOB, INCH	Tinder is a combustible material easily burned to help start a fire when the weather isn't on your side. The amount of tinder you need to pack is difficult to determine as your environment affects it heavily. It's generally used if there's none naturally available or the weather is poor. It should be stored in a weatherproof container to prevent it becoming damp. For more information see the FIRE section.		**Recommended Tinders** • Shaved Magnesium • Alcohol • Fat Wood • Char cloth • Lint
A small amount of tinder can be used to ignite a spark and fuel a larger fire. Kindling on the other hand can only be lit from a flame next to it for about 2 seconds and should not be brought in any of your bags.		**Uses** • Fire lighting	**Types** • Shoelace • Fatwood • Magnesium

See the FIRE and FUEL sections for more information on tinders.

Candle

Candle Useful Item 3/5 Tin, EDC, GH, BOB, INCH	A small candle can be used for lighting other parts of a fire, keeping a flame alive for longer or camp lighting. Larger candles are best suited as a lighting source but ensure they aren't likely to fall over and ignite nearby gear. Citronella candles "can" repel bugs and mosquitoes within a small radius which could come in handy over regular candles but from experience there's not too much of a difference between that and regular candles. Candles about 1 inch (2.5cm) are the most optimum for burning as they reduce wasted wax and have the longest burn time. For more information see the FIRE section.

8 Medical

This section helps you choose the medical related items in your kits.

First Aid Kit

First Aid Kit Essential Item 5/5 Tin*, EDC*, GH*, BOB, INCH	An essential item as you will certainly get some form of injury during the disaster from a minor cut to a sting, or a broken bone. Include the typical items in a first aid kit or buy a pre-packaged one from the shops. See the section below for a list of recommended items in this kit. *It's not possible for a whole first aid kit to fit inside a survival tin, EDC bag or Get Home bag, but some components of the kit can, such as Band-Aids and sutures.

Trauma Kit

Trauma Kit Essential Item 5/5 EDC*, GH*, BOB, INCH	Used for major and life threatening injuries which are also bound to occur at some point in the future. See the trauma section below for a list of recommended items in this kit. *It's not possible for a whole trauma kit to fit inside an EDC bag or Get Home bag, but some components of the kit can, such as Band-Aids, sutures and surgical blades.

Dental Kit

Dental Kit Useful Item 3/5 BOB, INCH	Tooth problems can inflict real pain depending on the problem. This kit should relieve some of the pain and provide a solution. See further below for a list of recommended items in this kit.

Insect Repellent

Insect Repellent Important Item 3/5 GH, BOB, INCH	Insects can be a real nuisance when bugging out, not to mention their ability to transmit diseases and this will provide some protection during the worst periods.

Survival Blanket

Survival Blanket Useful Item 4/5 GH, BOB, INCH	Can be used as an emergency shelter to hop into in extreme conditions, under you as a heat reflector while you sleep or it can reflect heat from a fire back towards you. They generally take up an extremely small size but unfortunately can't be re-compressed back down to that size so you either have to make space for it or discard it. They can sound like a bag of chips when you're moving it around, so be warned that it can give away your position.

Masks

Face Mask Useful Item 4/5 BOB, INCH	A mask to cover your face while treating the wounded, or for those who are sick.
Gas Mask Important Item 4/5 BOB, INCH	An important piece of kit in any preppers bag. You don't know what disaster may have happened and a gas mask can reduce dust, volcanic ash and viruses that reach you. Get one that either fits over your whole face or just your nose and make sure the filters fit it and you have a variety for multiple scenarios. Have enough backup filters for about a week in case it takes you longer then you think to reach your destination, or if they become clogged fast. Full face fitting masks are recommended over nose masks but a beard can leave a slight gap in it thus allowing minor amounts of particulate in. Carry a razor to reduce this risk.

Snake/Spider Bite Kit

GEAR | Descriptions | Medical | Snake/Spider

Snake/Spider Bite Kit Conditional Item 3/5 BOB, INCH	A kit that slows the spread of venom around your body long enough to hopefully let your liver process the toxins in smaller quantities. It may include a venom extractor to pull out some of the venom from the wound. Some countries may not have any venomous creatures and so this is a conditional item based on locale. Prevention is always the best method, so if you don't have one of these kits you should be extra careful where you tread and stick your hands.	**Often Includes** ● 2+ Bandages ● 1 Razor ● Alcohol Wipes ● 1 Venom Extractor ● 1 Medical Guide	**Best Brands** ● Sawyer Extractor

Medical | Potassium

Potassium Permanganate

Potassium Permanganate Important Item 4/5 Tin, BOB, INCH	Multiple uses from wound treatment, fungal treatment and water purification. The most versatile medication you will encounter with multiple uses in different fields. Can also be combined with glycerine to produce fire.

GEAR | Gear | Medication

9 Medication

This section helps you choose the medication related items in your kits.

Descriptions | Medication | Medications

Medications

Antibiotics Essential Item 5/5 BOB, INCH	Treats bacterial infections which are life threatening when ignored. Be sure they are kept in a cool, dark environment to extend their life as long as possible. Doctors can prescribe antibiotics if you explain why you want them and your concerns for the situation of the world. Examples: Penicillin, Amoxicillin, Doxycycline, Cephalexin, Ciprofloxacin, Clindamycin, Metronidazole, Azithromycin.
Intestinal Sedative Important Item 4/5 Tin, EDC, GH, BOB, INCH	Settles the stomach and prevents diarrhoea for a few hours. Examples: Loperamide (Imodium), Diphenoxylate (Lomotil), Bismuth, Codeine, Cholestyramine (Questran).
Analgesic Essential Item 5/5 Tin, EDC, GH, BOB, INCH	Reduces the amount of pain felt. Examples: Panadol, Asprin, Nurofen, Codeine, Acetaminophen (Tylenol), Naproxen (Aleve), Diazepam (Valium).
Antihistamines Conditional Item 4/5 Tin, EDC, GH, BOB, INCH	Treats allergy symptoms. This is a conditional item and it's recommended you bring a few if you're prone to allergies. Examples: Polaramine, Benadryl.
Antihelmetics Conditional Item 3/5 BOB, INCH	Anthelmintics or antihelminthics are a group of antiparasitic drugs that expel parasitic worms (helminths) and other internal parasites from the body by either stunning or killing them and without causing significant damage to the host. These are most useful in countries with subpar standards of hygiene but can also be useful to take if you suspect a worm. Examples: Mebendazole, Albendazole, Praziquantel.
Personal Medication Essential Item 5/5 EDC, GH, BOB, INCH	Medication specific to you to keep an affliction at bay. Examples include an inhaler for asthma, an insulin pen for diabetics and an epi-pen if for allergies.
Anti-Malaria Tablets Conditional Item 3/5 Tin, EDC, GH, BOB, INCH	Prevents malaria in regions where it's prevalent.

10 First Aid Kit

This section helps you choose the first aid related items in your kits.

Kit Items

Alcohol Prep Pads Essential Item 5/5 Tin, GH, BOB, INCH, Ext	For cleaning bacteria and debris from wounds, it kills any viruses and bacteria it comes in contact with and it can be used as tinder which will catch any spark. You should have at minimum 5 of these pads in any kit.
Tweezers / Needles Essential Item 4/5 GH, BOB, INCH, Ext	For removing ticks and splinters. These are generally tiny and lightweight and can fit into any kit.
Gauze Bandages Essential Item 5/5 GH, BOB, INCH, Ext	Wraps the wound up to protect it and let it heal.
Band-Aids Essential Item 5/5 Tin, GH, BOB, INCH, Ext	To place over minor wounds and letting them heal.
Moleskin Pads Important Item 4/5 GH, BOB, INCH, Ext	Prevents friction points in shoes and shields blisters.
Eye Wash Useful Item 2/5 BOB, INCH, Ext	Washes foreign objects from the eye or washes out debris from wounds.
Surgical Tape Useful Item 4/5 GH, BOB, INCH, Ext	To wrap around bandages to hold them in place. This is only required if you have non-stick bandages in your kit.
Super Glue Useful Item 3/5 GH, BOB, INCH, Ext	For closing up smaller wounds but may burn the skin. You can purchase tiny 1ml bottles of super glue which are ideal for skin application purposes or repairing small devices with minimum wastage.
Triangle Sling Useful Item 4/5 BOB, INCH, Ext	For binding up a limb to prevent further injury after a break.

11 Trauma Kit

This section helps you choose the trauma related items in your kits.

Trauma Kit Items

Stethoscope Important Item 3/5 BOB, INCH, Ext	For checking the heart rate of a patient. This item should only be included in a dedicated medical kit if you have one.
Blood Pressure Cuff Useful Item 2/5 BOB, INCH, Ext	To check the blood pressure of a patient.
Tourniquet Essential Item 5/5 BOB, INCH, Ext	To temporarily stop the flow of blood.
Splints / Bandages Important Item 3/5 BOB, INCH, Ext	For holding broken bones in place. SAM splits are recommended due to their ability to be rolled up lengthways easily when not in use but once you bend it along the width, it forms a rigid structure allowing it to hold the bone. It can also be cut with scissors into any length, shape or size that is required. You could always save space and use sticks or nearby materials instead of a custom made splint, however it won't be as comfortable.
Israeli Dressing Important Item 4/5 BOB, INCH, Ext	A bandage used on large wounds to absorb blood, hold them tight and provide a non stick bandage. They come in sterile bags which have had the air removed and are straight-forward to open and apply to wounds. There are a variety of sizes they come in so having a few different types on hand is ideal to choose the right one for the type of wound.
Quick Clot Powder Important Item 4/5 BOB, INCH, Ext	To clot wounds quickly if bleeding won't stop. The granules should be tipped into any openly bleeding wound and held until the bleeding slows or stops. These have expiry dates so be sure to refresh them once they are getting to their end of their life.
Nasopharyngeal Airway Useful Item 3/5 BOB, INCH, Ext	A nasopharyngeal airway is used to keep an airway open - generally long enough for other drugs to work.
Suture / Staple Kit Important Item 3/5 BOB, INCH, Ext	For fixing up larger skin breaks. Staples should be used on the head whereas sutures should be used on any malleable skin which is broken.
Gloves / Sanitizer Important Item 4/5 BOB, INCH, Ext	To prevent the spread of bacteria into the patient. Sanitizer could be isopropyl alcohol, alcohol wipes, Dettol etc.
Defibrillator Useful Item 2/5 INCH, Ext	To restart the heart if it's stopped. Make sure you know how to use it if you have one. These are quite bulky and heavy and are therefore only really recommended to have in a car or external location. It will also be a problem to recharge it in a SHTF environment. They are however, extremely valuable if you need to use one to save a life.

Numbing Agents Useful Item 4/5 BOB, INCH, Ext	To reduce localized pain if required. Some numbing agents are just wipes which are used directly on the skin and others which are injected and require refrigeration at certain temperatures.

12 Dental Kit

A dental kit isn't required for the minor bags, but can get pretty important in a long term off grid situation.

Dental Kit Items

Dental Mirrors Important Item 4/5 INCH, Ext	For looking around the teeth.
Tooth Filler Useful Item 4/5 INCH, Ext	Filler material for teeth.
Dental Picks Useful Item 2/5 INCH, Ext	For scraping the teeth.
Forceps Important Item 3/5 INCH, Ext	For grabbing and pulling out teeth.
Tweezers Important Item 4/5 INCH, Ext	For grabbing and pulling out small items. A pair of these should be in your first aid kit anyway.
Cotton Balls Useful Item 3/5 INCH, Ext	For holding the gums away from the teeth. They can also be used as tinder.
Dental Wax Useful Item 2/5 INCH, Ext	Relief from braces and other in-mouth metal devices.
Surgical Gloves Important Item 4/5 INCH, Ext	Keeps the hands clean and free of bacteria. A few pairs of these should also be in the trauma kit.
Toothache Reliever Important Item 3/5 INCH, Ext	Relieves the pain of toothaches. A good choice is 'Oil of Cloves' or 'Clove Oil', which is obtainable from any chemist.

13 Hygiene

Hygiene is an important category to have, since it prevents disease and injury.

Tablet Napkins

Tablet Napkins Useful Item 2/5 GH, BOB	Compact and versatile for cleaning messes or yourself. A more permanent towel and washer is recommended for INCH bags and external locations. They can be used as toilet paper if wet slightly.

Hand Sanitizer

Hand Sanitizer Useful Item 4/5 GH, BOB, INCH	Isopropyl, hand cleaner fluid or wet wipes are ideal. Can also be used for fire lighting.

Soap

Soap Important Item 4/5 GH, BOB, INCH	Either a small bar of soap or wafer-thin one use soap strips.

Small Mirror

Small Mirror Essential Item 5/5 Tin, GH, BOB, INCH	A mirror can be used for self observation for hygiene or medical purposes. It can also be used to bounce light to a target area to signal them. Reflected at aircraft, this mirror can prove life saving to show where you're located. A mirror can reflect light over 10km's (6.2mi) and only requires a single flash for someone to notice. Look for the unbreakable, ultralight compact ones which take up next to no room and weight. It's recommended to buy one with an aiming hole in the middle to make it easier to hit your target, however this makes it annoying when you're using it to look at yourself.

Microfibre Towel

Microfibre Towel Useful Item 4/5 BOB, INCH	Pack a small one to dry off easily after bathing or getting wet. In an emergency it could also be used as toilet paper if you're fine with rinsing it thoroughly and sterilizing it after each use.

Toilet Paper

Toilet Paper Useful Item 2/5 GH, BOB, INCH	The travel kind to save space. It's recommended to have biodegradable toilet paper so you can just bury it once its used.

Toothbrush & Paste

Toothbrush & Paste Useful Item 3/5 BOB, INCH	For cleaning teeth to prevent dental issues.

Personal Necessities

Personal Necessities Conditional Item 5/5 **EDC, GH, BOB, INCH**	These are conditional items such as tampons which make life much easier. Tampons can also be used as tinder and wound care if needed.

14 Tools

This covers the basic tools everyone needs in their kits.

Knife

Knife Essential Item 5/5 **EDC, GH, BOB, INCH**	Arguably the most important item in your BOB. A knife can perform a limitless number of tasks from gutting fish to sparking flint. The most versatile piece of equipment with an infinite number of uses. A few types of knives can be worn around the neck or strapped to the leg and still remain invisible to others, you don't want to be considered a threat. A lollipop could be carried around as a makeshift weapon when held tight in a fist.	**Uses** ● Cutting ● Skinning ● Opening ● Defence ● Shaving ● Whittling ● Reflecting	**Weapons** ● Knife ● Pocket Knife ● Gun ● Lollipop	**Best Brands** ● Smith & Wesson ● Schrade ● Ka-Bar ● Gerber ● CRKT

Types

Fixed Blade A knife with a blade which doesn't move constructed from a solid piece of metal.	**Folding-Assist Open** A knife that folds away and can be opened but must be done manually unlike a switchblade.	**Switchblade** A knife which flicks open at the press of a button.	**Throwing** A small and lightweight knife designed for throwing.		

Tang

Full Tang The steel extends from the tip all the way through the handle to the base.	**Skeletonized Tang** The tang has been cut out to save weight at the cost of strength and durability.	**Partial Tang** A tang which doesn't extend to the end of the handle, but partially through it.	**Narrowing Tang** A tang which slowly tapers down inside the handle.	**Stick Tang** A thin but long tang which runs most of the length of the handle.	

Tang Styles

Scaled The handle has two pieces fastened to each side of the tang with rivets.	**Encapsulated** The handle is moulded around the tang.	**Extended** The tang extends beyond the butt, usually functioning as a hammer surface.	**Stick** The tang is much narrower than the blade to cut weight.	**Hidden** The rivets and edges of the tang are hidden.	**Skeletonized** The tang metal is hollowed out, to cut weight and often to make a storage compartment.
Tapered The tang is tapered from blade to butt to gradually reduce the size, thickness, and weight.	**Push** The tang is inserted (pushed) into the handle and then fastened.				

Blade Styles

Plain Edge A continuous, smooth, sharpened cutting edge without any serrations.	**Serrated** Features a saw-like edge with a series of "teeth" or scallops.	**Combination Edge** The blade is sharpened on both sides, tapering to a central point, allowing it to cut on both the push and pull strokes.	**Double-Edged** A knife with two cutting edges. Do not use for batoning wood.		

Blade Length

2 Inch For intricate detail work and fine tasks.	**3 Inch** Leatherman knife size. Great for everyday carry.	**4 Inch** Versatile for general utility and outdoor tasks.	**5 Inch** The minimum size to baton wood.	**6 Inch** A good medium for a survival knife size.	**7 Inch** Superior reach for combat and heavy cutting.
8 Inch For heavy-duty chopping and large game.	**9 Inch** Great leverage for significant bushcraft tasks.	**10 Inch** Ultimate reach and power for extreme chopping.			

Blade Thickness

<1mm Ideal for skin incisions and medical use.	**1mm** Best used for very fine work such as medical purposes.	**2mm** Still quite a fine blade, best used for medical purposes, cutting rope and whittling.	**3mm** Solid for chopping smaller pieces of wood. The smallest size required for batoning wood.	**4mm (5/32")** Good for chopping all kinds of wood and will last quite a long time.	**5mm** An average thickness survival blade which should last decades with moderate use.

GEAR Gear Tools Knife

6mm Getting on the heavier side with less benefits over the thinner blades. Good for INCH bags.	**7mm** A heavy duty blade which should last decades with heavy use.	**8mm** One of the thickest and heaviest blades you can buy and likely the most durable.			

GEAR Tools Knife

Handle Material

Wood Classic feel, aesthetic warmth, natural grip.	**Plastic** Lightweight, durable, inexpensive, low maintenance.	**Rubberised** Excellent grip, shock absorption, comfortable, non-slip.	**Metal** Extremely durable, strong, hygienic, elegant look.	**Coated Leather** Good grip, comfortable, classic look, durable.	

Edge

Plain / Straight A smooth cutting, which isn't necessarily "straight" as it usually has curves, especially a belly.	**Partially Serrated** A portion of the knife blade near the handle may have serrations or scallops.	**Serrated** Serrations on the knife. Serrations can cut fibrous materials like ropes and straps, which are difficult for a straight edge.			

GEAR Descriptions Tools Knife

Blade Point

Straight-Back The back of the knife is straight.	**Drop-Point** This point features a gradual and convex curve that drops from the spine to the point. It's probably the most common design for survival knives because of its strength and ease of sheathing.	**Clip-Point** The reverse of the drop point, where the curve is concave from the spine to point like metal was 'clipped' out of the blade. This is a common design for survival blades.	**Tanto-Point** Points of this kind have many variations but all feature one or more straight edges to the point. The design is optimized for fighting and tactical uses.	**Spear-Point** Like the name says, designed for spearing, with symmetrical convex curves from spine and belly. Since spearing is just one of dozens survival knife uses, this point is specialized.	**Trailing-Point** A trailing point knife is a knife that has a back edge that curves upward. The "trailing point" is named for the point which trails higher than the generalized axis of the spine of the knife blade.

GEAR Gear Tools Knife

Features

Clip A clip allowing attachment to a belt, backpack or similar.	**Lanyard Hole** A hole allowing it to be tied to something with cord.				

Butt / Pommel

The pommel is the same as the butt of the knife. Most of the time, the butt is the generic name for the end of the handle, while a pommel is a specific piece – either part of the tang or an end cap – that reinforces the butt so it can be used for striking or hammering. In survival knives, a pommel is common, as it adds the 'hammer' functionality, even if it is limited.

GEAR Tools Knife

Sheath Material

Plastic A low quality material which is waterproof but may not last long.	**Nylon** o	**Leather** If the leather is of high quality it will last a lifetime.	**Zytel** o		

GEAR Descriptions Tools Knife

Blade Grinds

Centerline Grind A blade grind resembling that of a double-edged knife in which the top and bottom bevels meet in the center of the blade's width. Only the bottom edge is sharpened and the spine of the knife is left unsharpened to create a swedge.	**False Edge** A sharpened secondary edge on the spine of a blade near the point. If unsharpened, it is called a swedge.	**Flat Saber Grind** A blade ground with flat bevels that extend from the centerline of the blade to the cutting edge. This grind maintains full thickness through a larger portion of the blade for increased strength.	**Full Flat Grind** A blade ground with flat bevels that extend from the spine all the way to the cutting edge. This grind reduces drag during cutting and decreases overall weight.	**Hamaguri (Appleseed)** Japanese for "clam" or "clamshell," it describes a blade ground with convex radiused bevels. Also called an Appleseed or Moran grind, it is often produced by grinding on a slack grinding belt.	**Hollow Grind** A blade with bevels that are ground with a concave radius. The bevels may extend the full width of the blade (full hollow grind) or only a portion of its width.
Single-Bevel Grind Also called a chisel grind, this describes a blade that is beveled on only one side. It may be flat or hollow ground.	**Swedge** An unsharpened bevel on the spine of a blade near the point. If it were sharpened it would be considered a false edge. A swedge reduces blade weight, enhances balance, and improves penetration.	**Zero Grind** A grind similar to a full-flat grind but without the secondary bevel at the cutting edge. The plane of the bevel continues to create the cutting edge.	**Zero Saber Grind** zerosabergrind (Scandinavian or "Scandi" grind) Similar to a flat-ground saber, but without a secondary bevel at the cutting edge. The plane of the bevel continues to create the cutting edge.		

GEAR Gear Tools Knife

GEAR Tools Knife

Properties of Knife Steel

Hardness	Hardness is the ability to resist deforming when subject to stress and applied forces. Hardness in knife steels is directly correlated to strength and is generally measured using the Rockwell C scale (aka "HRC").
Toughness	Toughness is the ability to resist damage like cracks or chips when subject to impact or "sudden loads". Chipping is a knife's worst enemy and never easy to fix. There are a number of different ways to measure toughness (i.e. Charpy, Izod) thus it's less standardized than hardness when it comes to knives. In general, the harder the steel the less tough it's likely to be.

Wear Resistance	Wear resistance is the steel's ability to withstand damage from both abrasive and adhesive wear. Abrasive wear occurs when harder particles pass over a softer surface. Adhesive wear occurs when debris is dislodged from one surface and attaches to the other. Wear resistance generally correlates with the steel's hardness but is also heavily influenced by the specific chemistry of the steel. In steels of equal hardness, the steel with larger carbides (think microscopic, hard, wear resistant particles) will typically resist wear better. However, carbides can become brittle and crack, thus decreasing toughness.
Corrosion Resistance	Corrosion resistance is the ability to resist corrosion such as rust caused by external elements like humidity, moisture and salt. Note that a high resistance to corrosion does involve a sacrifice in the overall edge performance.
Edge Retention	Edge Retention represents how long the blade will retain its sharpness when subject to periods of use. It's what everyone talks about these days but unfortunately the measurement of edge retention lacks any defined set of standards and so much of the data is subjective. Edge retention is a combination of wear resistance and an edge that resists deformation.
Knife Steel Categories	
Carbon	Generally made for rough use where toughness and durability is important. Common in survival knives and machetes. They take a sharp edge and are relatively easy to re-sharpen. The trade-off is being more prone to corrosion given the low chromium content. The most popular carbon knife steel is 1095.
Tool Steel	Primarily hard steel alloys used in cutting tools. Some popular tool steels in this group include D2, O1 and Crucible's CPM series (i.e. CPM 3V) plus more advanced high speed steels like M4.
Stainless Steel	Basically carbon steel with added chromium to resist corrosion and other elements which increase performance levels but usually at the expense of inferior toughness. Easily the most popular category today for EDC knives and includes the 400, 154CM, AUS, VG, CTS, MoV, Sandvik and Crucible SxxV series of steels. Note that to qualify as a true stainless steel there must be at least 13% chromium.
Specific Knife Steels	
1095	This is the most popular 10-series standard carbon steel (about 1% carbon) with low corrosion resistance and average edge retention properties. Why would you want 1095 steel? The appeal here is 1095 is a tough steel that's resistant to chipping, it's easy to sharpen, takes a crazy sharp edge and is inexpensive to produce. This makes it desirable for larger heavy duty fixed blades and survival knives which are going to be subject to more abuse than your typical EDC. Many manufacturers will coat their 1095 knives to delay the onset of any corrosion but a simple oil treatment will do the trick.
CPM S110V	Quite simply the ultimate in wear resistance and edge retention in 'mainstream' knife production. Still relatively rare in the marketplace and arguably indistinguishable from CPM-S90V outside of the laboratory, but the fact remains that nothing holds an edge like Crucible's CPM-S110V. It's costly, a bitch for knifemakers to work with and sharpening can drive you nuts but a CPM-S110V blade will hold up for a ridiculous amount of time.
CPM M4	A high performance tool steel which excels at toughness and arguably holds and edge better than any other carbon steel. Like all CPM steels, CPM M4 is created using Crucible's patented Crucible Particle Metallurgy process, which provides an extremely homogeneous, stable and grindable product compared to the traditional processes. CPM M4 provides superbly balances levels of abrasion resistance and toughness through high doses of molybdenum (hence the "M"), vanadium and tungsten together with reasonably high levels of carbon. It can be hardened to around 62-64 HRC but note M4 is a carbon steel is not considered stainless with relatively low levels of chromium. So, while this is one of the best steels around for cutting, it has to be properly cared for and may develop a patina over time. Some manufacturers have resorted to coatings which do help but note they won't last forever. Easy to sharpen? Ah, no.
440C	Once considered the high-end in US knife steels, 440C is a good all-round steel that has now been overshadowed by many of the newer super-steels on the block. This is a stainless steel commonly used on many mass-manufactured pocket knives and represents a solid affordable all-round choice. It's reasonably tough and wear resistant but it really excels at stain resistance. Holds an edge better than it's 400-series counterpart 420HC but at the expense of some corrosion resistance. The 440C blades can be sharpened relatively easily. It has the highest levels of carbon and chromium in this group.
1084	An excellent balance between hardness and toughness, making them ideal for creating resilient knives with superior edge retention. It will only rust if you leave it wet.
420HC	Generally considered the king of the 420 steels, 420HC is similar to 420 steel but with increased levels of carbon (HC stands for High Carbon) which makes the steel harder. Still considered a lower-mid range steel but the more competent manufacturers (e.g. Buck) can really bring out the best in this affordable steel using quality heat treatments. That results in better edge retention and resistance to corrosion. In fact, this is one of the most corrosion resistant steels out there, despite it's low cost. You'll find it mostly on budget blades (< $50) and multi-tools. Many leatherman knives use this steel.
AUS8	In the world of stainless steel, AUS 8 offers a great compromise between quality and price. It can take an incredibly sharp edge. It won't hold that edge as well as something like 154CM because it's a lot softer, but that also makes it tough enough to be a good working knife, and it will almost always make a knife more affordable than if you used any other decent quality stainless steel. If you're putting an AUS-8 blade under consistently heavy use, you will spend a fair bit of time maintaining the edge, but all that sharpening will be done with a lot less effort than VG-10 or AUS-10, and it usually makes a knife cheap enough that a chipped edge doesn't really feel like a huge loss.
D2	D2 steel is a tool steel often referred to as "semi-stainless" as it falls just short of the required amount of chromium (13%) to qualify as full stainless yet it still provides a good amount of resistance to corrosion. On the flip side D2 steel is much harder than other steels in this category such as 154CM or ATS-34 and as a result holds its edge a little better. That said, it's not as tough as many other steels and exponentially tougher to sharpen. In fact, you really need to be a master-sharpener to get a fine edge on D2.
5160	Alloy Steel 5160, or AISI 5160, is a high carbon and chromium steel. Users benefit from its outstanding toughness, ductility, and fatigue resistance. Although 5160 is a high-quality steel for knives, it isn't commonly used in shorter blades. Instead, you're more likely to see it in survival knives and swords due to its flexible yet durable qualities. With its high carbon and chromium alloy, 5160 is the steel of choice for sword manufacturers due to its high impact resistance. The biggest drawback to 5160 as a popular knife making steel is its lower edge retention, but this very down side is what makes it appropriate for survival knives. If you're out in the bush and don't have access to a regular knife sharpener, you can get decent results using a rock. A 5160 spring steel knife is also great for camping and other outdoor activities because it can handle tasks such as batoning and wood chopping without breaking or chipping.
Weight	

Ranges from 3oz - 16oz. Make sure to buy one you're happy with the weight of, as you may be carrying it on your belt, necklace or backpack. As a knife is one of the most versatile items you'll carry, you should never skimp on it. A hefty knife will provide it's weight in gold even if it's a few extra ounces.

Cost

You can expect to pay from $100-$700 USD for a quality knife which will last as long as you. Stay away from the cheap and nasty ones and do your research before purchasing. With that said, there are some decent quality 'cheap' knives that will suit the purpose of bushcraft for a while.

Multitool

Multitool
Important Item
3/5
EDC, GH, BOB, INCH

Used for fixing gear, making repairs and as a secondary knife. Generally the additional tools only come in handy in suburban areas or if you have a bike or other small machinery.

Best Brands
- Leatherman
- Gerber
- SOG

A handy tool comprised of multiple useful tools which cover a range of common scenarios. Ensure it contains all the tools you're likely to use and excludes the ones you will never need. Buy a lightweight one if you're trying to shed weight. If you're bugging out via bike you might as well get a bike specific multitool with every tool you may need for a breakdown.

Uses
- Knife
- Bottle Opener
- File
- Pliers
- Saw
- Screwdriver
- Carabineer

Tools

Weight

The weight can vary substantially from about 96g to over 300g for one of the highest end multitools so pick one with only what you will use and no more.

Cost

For a Leatherman you can pick the Skeletool up for $80 USD and the highest end one for about $250.

Wire Saw

Wire Saw
Useful Item
2/5
BOB, INCH

A wire saw is best utilized in the smaller kits where a folding saw won't fit. They can generally cut through trees and branches up to 5cm (2 in) thick. Some types have a chainsaw blade instead of a wire which can help cut faster but requires more strength to pull. The wire saw is tiny and extremely light so it could be worth throwing one in your BOB if you'll use it.

Folding Saw

Folding Saw
Essential Item
3/5
BOB, INCH

A folding saw is a typical woodworking saw that folds into the handle to save space and protect the blade. They are much easier to cut wood with than wire saws and can generally be sharpened. They come in a wide range of sizes to fit into different bags - but generally go into INCH bags and not BOBs.

Best Brands
- Silky Bigboy
- Bahco

Hatchet

Hatchet
Important Item
4/5
INCH, Ext

Hatchets can primarily be used to cut trees for shelter building and hammering pegs among some other minor uses. They are much heavier than hatchets and wire saws but can last longer without needing to be sharpened and aren't as likely to break as with the wire and blade of the other two. These should only be carried in INCH bags in general but you decide based on your requirements and Bug Out Route.

Best Brands
- Estwing
- Fiskars
- Husqvarna

Folding Shovel

Folding Shovel
Important Item
3/5
BOB, INCH

For digging holes to dispose waste or to assist in shelter building. A shovel will always come in handy at some point when you're working with the earth. It's basically essential if you're never coming home so you can dig latrines, do gardening, dig for food and even cook on.

Best Brands
- SOG
- IUNIO
- Gerber

GEAR | Descriptions | Light & Power | Gear

15 Light & Power

Any light and power needs you should have.

Headlamp

Headlamp Essential Item 4/5 GH, BOB, INCH	The only option for a hands free light so you can still perform tasks like cooking. The batteries should last the entire 3 day (Bug Out) trip home if used wisely. For INCH bags you will want a couple of spare batteries and a way to recharge them such as solar or a hand crank generator. Light is essential and can deter enemies, provide visibility and signal others. A modest brightness is around 700 lumens which should provide ample visibility when hiking at night, as they get brighter you drain the batteries quicker and sometimes you only need a weak light. Look for a headlamp with a 1 lumen mode to save batteries if you just want to read in your tent.	**Headlamp** • 700+ Lumens • Headband Attachment • Brightness Settings • Different Colours	**Best Brands** • Olight • CREE • LED Lenser

You may want to think about getting a headlamp with multiple colours to use in different situations. An example being that red light can maintain your night vision better than other colours whereas green light is better to use to remain undetected in forest situations.
For more information on torches see the LIGHT section.

Keychain Torch

Keychain Torch Useful Item 3/5 EDC, GH, BOB, INCH	A small backup LED light for finding bag contents and lighting your way if your headlamp dies. Try to find a torch which uses a common battery type such as AAA or AA which are easier to replace if yours die or don't recharge well anymore. Look for something between 80-200 lumens like the i3E EOS from Olight.	**Best Brands** • Olight • Finware • Maglite • Energizer
Torch	Valuable in dark areas and for use at night. For more information on torches see the LIGHT section.	**Uses** • Lighting • Glass Breaking • Deterring Animals • Signalling

Glowstick

Glowstick Useful Item 4/5 GH, BOB, INCH	Temporary instant light if required and better for stealth work than torches. You can buy glowsticks in any colour required including infrared. Glowsticks can be cooled down to extend the duration of the light at the cost of brightness and heat them up to speed up the reaction, making them brighter. Glowsticks are wind and water proof allowing them to be used during rain, storms and underwater and are therefore prized during natural disasters.	**Activation** To use a glowstick, bend the tube until the inner glass vial breaks and then shake a few times to mix the compounds.	**Brightest Colours** 1. Green 2. Yellow 3. Orange 4. Red 5. Blue 6. Pink 7. Purple 8. White

For more information on glowsticks, see the LIGHT section.

Batteries

Batteries Conditional Item 4/5 GH, BOB, INCH	Batteries in one form to power all electronics like GPS and radio. For more information see the ELECTRICITY section.	**Common Batteries** • AAA • AA • C • D • 18650 • 9v	**Best Brands** • Olight • Eneloop • Energizer • Duracell

See the ELECTRICITY section for more information on batteries.

Battery Charger

Battery Charger Conditional Item 3/5 BOB, INCH	A charger for the batteries (above) to convert sunlight into electricity so you can continue to use your electronics.

Power Bank

Power Bank Important Item 4/5 GH, BOB, INCH	A useful device when you need some information from your phone or you have to make a call and your phone is dead. The need to keep updated with what's happening is vital and if the communications grid is still up you can use the internet to find out how the disaster is unfolding - but only if you have power.	**Size** Look for a power bank that's 10,000+ mAh	**Best Brands** • Anker • MI • Jackery

For more information on batteries, see the ELECTRICITY section.

Solar Panel

GEAR | Gear | Light & Power | Solar Panel

Solar Panel Useful Item 3/5 BOB, INCH	To recharge the power bank and phone. May be combined with the power bank. One of the easiest ways to gather electricity, simply put it in direct sunlight and let it charge a battery bank. This item should generally only be in an INCH bag or be located at your final bug-out location. If you will be living off the grid from a backpack it's recommended to have one to help charge your mobile and other electronics.	**Best Brands** • Anker • Rockpals • ACOPOWER • RAVPower

Types	
Regulator	Generally a portable solar panel will contain a regulator, but for those panels which just come with a positive and negative lead, this will be an additional purchase you need to make. You have to choose the regulator carefully to exceed the panel's maximum volt and amperage outputs.
Wattage	A 15W solar panel is the minimum wattage you should have to charge a modern smart phone in full sunlight. However I recommend a 50W minimum to charge a smart phone even in cloudy situations. A 120W panel is recommended as a minimum for a small group of people but won't fit into a backpack.
Maintenance	Solar panels don't require much maintenance. You should wipe it down every week or so to help it gather the maximum light possible. If you want the most efficient panels you can get it's also recommended to aim the panel directly at the sun every 4 hours or so to track it across the sky.
Weight	
Cost	

Crank Charger

Crank Charger Conditional Item 3/5 BOB, INCH	If the sky is cloudy for multiple days in a row, you can use a crank charger to power your electronics. You have to be actively turning the handle to generate electricity which will tire you out quite quickly as opposed to a solar panel where you just need to place it in the sun.	**Best Brands** • HUABAN • Kaito • RunningSnail

16 Communication

This section covers the communication devices you should have in your bag.
For more information on Mobile Phones, Apps and the best prepper mobile devices, see the COMMUNICATION section.

Mobile Phone

Mobile Phone Essential Item 5/5 EDC	A multipurpose device to find location, play games, play music, read information and more. As useful as they might be - they still might give away your location if you're being tracked by the government.	**Best Brands** • Samsung • Apple • Asus • HTC
	Almost everyone has one and uses it daily, great for pictures, information and maps. You may be able to be tracked via your phone even if the grid is down so keep it secure. You can keep some cash inside your phone case for emergencies.	**Uses** • Maps • Entertainment • Communication • Note taking
Accessories	It's wise to have some sort of protective casing around the phone or waterproofing if it isn't already.	**Accessories** • Case / Cover • Waterproof Bag • Charger Cable • Wall Plug • Screen Protector • Earphones
Comms	Communication is vital in this day and age, however this feature will be useless without a working grid. There are some apps that allow text and call communications over a wifi and bluetooth hotspot however you need to be in a relatively close proximity.	
Music	One of the most widespread use of phones is the ability to play any music you want - provided it's on the device in SHTF. Ensure you have a set of earphones and you can listen to whatever you load the device up with.	
Internet Access	Currently you have the world at your fingertips and access to any knowledge on the internet. When this goes down however all this will be lost. Download any information you need and get the books and apps you need before you realize there's no internet.	
Navigation	Phones with a connection to the GPS servers can pinpoint your location and provide you with your location if you have a map app. The app works offline however you will need to download the maps of your region so you can use them when the grid is down.	**Topographic Apps** • Alpine Quest • Backcountry Navigator • AndNav • Maverick • OruxMaps • Osmdroid • TrekBuddy

Apps	Try not to update any apps if they currently work just fine, but if you do ensure you test it thoroughly.	**Useful App Types** ● Informational ● Instructional ● Entertainment
Entertainment	Keeping occupied is vital when bugging out and there's nothing to do, a mobile can solve most of those problems as long as you have the games downloaded beforehand.	**Entertainment Types** ● Music ● Games ● Reading Books

Whistle

Whistle Essential Item 4/5 GH, BOB, INCH	Used signal for help if you are lost or want to attract attention. Whistles can be finger sized all the way up to large spiral shapes to maximize the sound of the whistle. Some whistles have finger holes to allow for more pitches.

Radios

Radio Essential Item 5/5 GH, BOB, INCH	Listen in to emergency broadcast stations and get weather updates. A radio with NOAA weather and shortwave is ideal to get news from a greater distance and even outside your country. Some phones come with a built-in FM radio which can eliminate the need to have a second device. Radios these days can be extremely tiny and fit in the palm of your hand, although you shouldn't expect any more than FM radio from them.	**Best Brands** ● Tecsun ● Panasonic ● Sangean ● Kaito
Scanner Useful Item 2/5 GH, BOB, INCH	A scanner radio which has more functions than a conventional radio. In addition to listening to AM and FM stations they can tune into short wave, aviation, police, ambulance, NOAA etc. This may not be needed unless you're dedicated to getting regular updates to the weather or want to listen to the police or aviation broadcasts. For more information, see the COMMUNICATIONS section.	**Best Brands** ● Baofeng ● Uniden

Transmitting

Two Way Radio Conditional Item 4/5 EDC, GH, BOB, INCH	Lets you chat with your team or other people in close proximity. Extremely useful when the mobile networks and internet are down and you have to separate from the members of your party. For information on using a Two Way Radio, see the COMMUNICATIONS section.	**Best Brands** ● ICOM ● Baofeng ● Uniden ● Midland ● Arcshell

555nm 50mw Laser

555nm 50mw Laser Conditional Item 3/5 EDC, GH, BOB, INCH	A strong laser to produce a bright visible beam for location at night or deterrence of adversaries and animals. 555nm green light is the most visible wavelength. 532nm is the most common green coloured laser. This can be a very small unit if custom built, or easily usable in a laser pen form. 50mw lasers won't harm the eyes unless directly shone into them, so never aim directly at people or planes. When SHTF you will want the laser to be on as little as possible to avoid unwanted attention, therefore only use short bursts. The beam will travel over about 10km's horizontally, but will only be visible a few km's if shone vertically. Don't forget the batteries, and it's recommended that you remove the batteries if it won't be used for long periods.

17 Weapons

The weapons you should have in your kit.

Defensive Weapon

Defensive Spray Conditional Item 4/5 EDC, GH, BOB, INCH	Capsicum or other form of deterrent spray for people and animals.

GEAR | Descriptions | Weapons | Defensive Weapons

Taser Useful Item 2/5 EDC, GH, BOB, INCH	A non lethal weapon if you don't want to kill the individual but instead only make a get-away. Useful in the city or until you get out of the suburbs. May be difficult to recharge.

Primary Weapon

Primary Weapon Essential Item 5/5 BOB, INCH	This is generally a rifle of some sort but it could also be a handgun, bow, crossbow, sword, air rifle etc. See the WEAPONS and OFFENCE sections for more information.
Rifle	For defending yourself from people or animals.
Bow / Crossbow	An almost silent alternative to a gun for hunting or defence.
Sword / Machete	A close range option for defence or hacking through undergrowth.

Secondary Weapon

Handgun Conditional Item 4/5 EDC, GH, BOB, INCH	For hunting animals or people and defending yourself.
Slingshot / Sling Conditional Item 2/5 GH, BOB, INCH	For hunting wild game and defending yourself.
Knife	Refer to the tools section above for the rating of knives.

Ammo

Ammo Conditional Item 5/5 EDC, GH, BOB, INCH	Essential if you have a gun or other primary weapon which requires it, unless you make your own.
Arrows Conditional Item 3/5 GH, BOB, INCH	Required if you have a bow, unless you fletch your own from natural materials.
Bolts Conditional Item 3/5 GH, BOB, INCH	Required if you have a crossbow, unless you fletch your own from natural materials.
Ball Bearings Conditional Item 2/5 GH, BOB, INCH	Some ball bearings for shooting from a slingshot. These could be fishing sinkers instead to provide dual-uses. Generally though, rocks should be used instead of both of these due to their availability in the environment.

18 Tactical

Any tactical gear to keep you stealthy.

GEAR GEAR GEAR GEAR GEAR GEAR GEAR
Descriptions Gear Descriptions Gear
Tactical Monocular /

Monocular / Binoculars

Monocular / Binoculars Optional Item 3/5 GH, BOB, INCH	For observing people, locations and animals from afar. Some situations will call for scouting and you will have a huge advantage if you see threats before they see you. This could also be a scope on a rifle instead of an additional monocular.	**Best Brands** • Bushnell • Nikon • Wingspan • Skygenius

Tactical Face Paint

Face Paint

Face Paint Conditional Item 1/5 GH, BOB, INCH	Camouflages any exposed skin to provide additional stealth. This is a conditional item and may only be needed in certain situations but particularly when you don't want to be observed by other humans or animals. If stealth is of the utmost importance you should also have a camo net to conceal your shelter.

Tactical Camo Net

Camo Net

Camo Net Useful Item 1/5 GH, BOB, INCH	Material used to cover colourful objects and prevent glint. They are perfect for blending your shelter into the surrounds if you don't wish to be seen. Ensure you have the correct coloured net to match your environment and season.

19 Morale

Gear which will keep your morale up.

Morale Family Pictures

Family Pictures

Family Pictures Useful Item 5/5 EDC, GH, BOB	To show people if you've lost a family member or to remind you of the good times.

Morale Alcohol / Cigar

Alcohol / Cigar

Alcohol / Cigar Optional Item 3/5 GH, BOB, INCH	Something to look forward to and will keep you going, however they are not recommended due to the mental impairment they offer once consumed.

Morale Games

Games

Games Useful Item 3/5 GH, BOB, INCH	A pack of cards, music or a mobile game can go a long way to restore morale.

Morale Religion

Religious Items

Religious Items Conditional Item 4/5 EDC, GH, BOB, INCH	If you adhere to a religion take a physical or digital Bible to save weight and stay grounded in your faith.

ptions

GEAR Descriptions

20 Navigation

Equipment which will help you navigate.

Plans

Plans Essential Item 5/5 EDC, GH, BOB, INCH	These are your bug out or bug-in plans either on a mobile device or a printed format so you can easily access them.

Local Maps

Local Maps Essential Item 5/5 GH, BOB, INCH	Maps of the local topography to assist in navigation and bugging out. Ensure you have enough maps to cover the entirety of any bug-out plans including extra terrain around it in case you have to change your plans. You should have both digital maps and physical maps in case something happens to one such as an EMP which kills your mobile devices.

Compass

Compass Essential Item 5/5 GH, BOB, INCH	To guide you in the right direction if your GPS fails. Be sure you know how to use your compass or you could get extremely lost.	**Best Brands** • Silva • Eyeskey • SUUNTO

Handheld GPS

Handheld GPS Useful Item 3/5 GH, BOB, INCH	A primary location device to help navigate if the satellites still work. A mobile phone also works as a GPS device if you have the correct apps and maps downloaded.	**Best Brands** • Garmin

Altimeter

Altimeter Conditional Item 3/5 GH, BOB, INCH	To find your altitude to help boiling water and crossing terrain in high elevation areas. An altimeter can also help in determining altitude sickness. Some phones can provide this functionality via apps to save additional weight.	**Best Brands** • Garmin • Sun Company

21 Misc

All other equipment which isn't covered by another topic is included here.

Cash

Cash Essential Item 5/5 EDC, GH, BOB, INCH	If you require to barter and cash is still valued. The grid may still be up when you return to civilization and you could hire a taxi home and buy a cheeseburger.

Barter Coins

Barter Coins Important Item 3/5 BOB, INCH, Ext	Gold and Silver will work well to trade for things you need. Be sure you know how to verify gold and silver coins from fakes.

Notepad & Pen

Notepad & Pen Important Item 4/5 BOB, INCH	Writing notes like plant locations, things to do or past experiences.	**Best Brands** ● Rite in the Rain
Notebook	Use this for taking notes, numbers and other information you require stored.	**Uses** ● Note taking ● Drawing ● Games ● Origami
Pen	For writing on the notepad or your skin if required.	**Uses** ● Writing ● Stabbing

Snare Wire

Snare Wire Important Item 3/5 INCH	To trap animals without using fishing line which will break. Set and forget. (But not forever)

Paracord / Rope

Paracord / Rope Essential Item 5/5 EDC, GH, BOB, INCH	Vital to keep - from shelter building to rappelling and even fire starting. Have at least 30 metres (100ft) of cordage. If you cut paracord, use a small flame to bind the ends so they don't unravel.

Duct Tape

Duct Tape Important Item 4/5 GH, BOB, INCH	A strong backup to paracord for construction, restraining or repairs.

Garbage Bag

Garbage Bag Essential Item 5/5 GH, BOB, INCH	For water gathering, a solar still, a makeshift shelter and for storage.

Sewing Kit

Sewing Kit Useful Item 3/5 INCH	To repair your tent and clothes. See further below for the recommended contents of the sewing kit.

Fishing Kit

Fishing Kit Useful Item 3/5 INCH	A bit of line, sinkers and hooks, and maybe an automatic fishing reel. See below for the recommended contents of the fishing kit.

Latex Tubing

Latex Tubing Useful Item 4/5 BOB, INCH	To use as a tourniquet, slingshot elastic, bowstring or piping.

Hand Warmer

Hand Warmer Conditional Item 2/5 GH, BOB, INCH	Extremely useful in cold environments when bugging out to warm the body and hands. The adhesive ones can be applied to the chest to prevent your core temperature from dropping too low. They generally last about 4 hours for the majority of the heat release and take 15 minutes to warm up once opened.

Documentation

Documentation Essential Item 5/5 EDC, GH, BOB, INCH	Documents may be vital in SHTF scenarios for crossing borders, proving your identity or at the very worst, corpse identification. Most of the listed documents are one sheet and very light however they are the type of things you don't want to fold to make it more compact. Generally you will want to carry the originals on you as they are useless if left at home where anyone can find and use it.

Prepper Plan	A detailed plan of your actions, bug out route and secret codes if SHTF. Generally you will have other people in your bug out plan and this document will remind them what to do if the worst does happen so they know what they're doing when disaster strikes. There should be a lot of redundancies in the plan for the most plausible scenarios and disasters. For more information see the PREPAREDNESS section.			
Birth Certificate	The second most important documentation piece can prove your existence and birthplace generally recognised worldwide. Take the original one and fold it very neatly so it fits into your pack better.			
Passport	Probably the most vital piece of documentation which should always be carried. This will allow you to cross borders if you need to flee the country and there's still a form of government and border protection. Not as necessary in un-bordered countries such as Australia but still important to carry.			
Marriage Certificate	Proof that you're married to someone. Some countries prohibit intercourse between unmarried individuals which could become a problem without this certificate.			
Immunization Records	To keep track of what diseases you're immunized against. If you're injured you can look back over when you had your last shot to determine your risk of infection and proceed from there. It will help you make better decisions about using your rare antibiotics which will likely be highly sought after when SHTF.			
Drivers Licence	As a form of ID that includes a picture and it's compact size makes it a useful one for identifying yourself.			
Important Numbers	Some additional numbers you should keep on hand in case you require them.	**Other Numbers** • Social Security Number • Tax File Number	**Bank Account Details** • BSB • Account Number • Account Name • Bank phone no.	**Family and Friends Details** • Name • Address • Phone Number

Flash Drive

Flash Drive Essential Item 5/5 EDC, GH, BOB, INCH	With survival guides, books, important documents and entertainment. Used for storage of important documents, maps, prepping tips and music. Takes up no space and is incredibly light. Ensure you have tested that the USB is compatible with your phone or that you have an adapter for it. Test the utilities used to open the PDF's, Maps and Contact List. Once tested on your phone be sure not to update the applications automatically or manually as this could end the compatibility of your USB or Micro SD card. The best storage to size and weight option is the microSD cards where you can now get 400gb in a form factor the size of your thumb, however always store the information in multiple places in case it fails. Digital storage can fail so its recommended that you have an exact copy of the drive on a spare located somewhere else in your BOB as well as on your phone.

GEAR | Gear | Misc | Flash Drive

USB Drive / Micro SD	Recommended Brands • SanDisk • Samsung • Corsair	Recommended Sizes • 32Gb • 64Gb • 128Gb • 256Gb Any larger and the risk of losing the data is too great, unless you have redundancies.	Important Files (Encrypted) • Passport Information • Medical Information • Birth Certificate • Medicare Details • List of Contact No's. • "Return to" Lost Info	Prepper Files • TPE Spreadsheet • Your Bug-Out Plan • BOB/INCH Bag Contents • Local Maps (PNG, JPG) • Local Digital Topo Maps • Survival Books	Entertainment Files • Novels • Movies • Music • Podcasts (eg. TSP) • Pics of Family & Friends	

GEAR | Descriptions | Misc | Credit Card

Credit Card

Credit Card Essential Item 5/5 EDC, GH, BOB, INCH	So you can purchase things since the grid may still be up.

GEAR | Gear | Misc | Backpack

Backpack

Backpack Essential Item 5/5 N/A	A way to hold and organize all your items. Choose one that's inconspicuous and not too large. Camo backpacks will draw too much attention to yourself if you're attempting to bug out.

GEAR | Misc | Metal Straw

Metal Straw

Metal Straw Useful Item 3/5 BOB, INCH	Used to drink from recently boiled water and to blow on fires.

GEAR | Descriptions | Misc | Wallet / Purse

Wallet / Purse

Wallet / Purse Important Item 3/5 EDC, GH, BOB, INCH	Used to carry ID, money, notes etc.	
Wallet	Wallets house your credit and other discount cards, money and sometimes coins.	**Uses** • Daily Transactions • Holding Cards • Holding Coins • Holding Cash • Metal Survival Cards
Purse	The female form of a wallet however it generally contains a lot more space for beauty and hygiene products.	**Uses** • Daily Transactions • Holding Cards • Holding Coins • Holding Cash • Metal Survival Cards • Hygiene Products • Beauty Products

GEAR | Gear | Misc | Keys

Keys

Keys Essential Item 4/5 EDC, GH, BOB, INCH	For unlocking your house, car, safe, shed and anything at your bug out location.

GEAR Descriptions Misc Keys

Keys / Keyring	For unlocking your house and car - typically something everyone has at least one of. Generally people have a few extra items on their keyring from toys to flashlights which can come in useful.	**Uses** ● Unlocking House ● Unlocking Car ● Unlocking Storage ● Other Locks	**Useful Attachments** ● Mini Torch ● Mini Knife ● USB Drive ● Carabineer / Clip ● Bottle Opener ● Pill Bottle ● Mini Lighter

Watch

GEAR Gear Misc Watch

Watch **Important Item** 4/5 **EDC, GH, BOB, INCH**	For telling the time and finding north with. A solar powered watch can recharge itself when it comes into contact with the sun and will often last up to 10 years before the battery fails.	**Best Brands** ● Casio ● Timex

Features

The importance of keeping time is a valuable tool in any society, including SHTF. However these days watches do so much more then tell time.	**Features** ● Luminous Hands/Digits ● Water Resistance ● Alarm ● Solar ● Calendar ● Chronograph	**Features** ● Light ● Compass ● Altimeter ● Barometer ● Thermometer ● Tachymeter	**Features** ● Annual Calendar ● Perpetual Calendar ● Leap Year ● Time Zones ● Moon Phase ● Heart Rate Monitor	**Features** ● Power Reserve Indicator ● Tourbillon ● Foudroyante

Watch Types

Analog Watch
Can use for finding north using the hands and the sun. More sensitive to heat and shocks. Slightly less accurate than digital watches.

Digital Watch
Uses slightly less power than analog watches. A more robust and weather proof watch type. More difficult and less accurate to find north with.

Smart Watch
Smart watches use the most power and a lot of features will be unavailable during SHTF. It's not recommended to have this watch type due to all the negatives in a survival situation. The watch may give away your position when alarms go off or other notifications.

Watch Complication Descriptions

Power Source Battery Solar & Battery Auto Wind Manual Wind	**Luminous Hands/Digits** Use this to reduce the amount of power consumed instead of a button press light.	**Water Resistance** 30M - Splash Resistant 50M - Shower Resistant 100M - Swim Resistant 300M - Dive Resistant **100M+ Recommended**	**Alarm** Excellent for reminding you to do something - although may give away your position in SHTF.	**Solar** Excellent for SHTF when you won't be able to find replacement batteries.	**Calendar** Keeping track of the day and date will be important to remember birthdays and keep morale up.
Chronograph Useful for timing relatively short intervals or the speed of grabbing your BOB.	**Light** May give away your position at night but worthwhile to have in survival situations.	**Compass** A great redundancy to have in case your primary compass breaks or fails.	**Altimeter** Displays the altitude you are at, useful for water boiling and oxygen requirements.	**Barometer** Measures atmospheric pressure and is useful for determining short term weather patterns.	**Thermometer** Useful if you need to know the ambient temperature.
Tachymeter Used for measuring the speed of objects between known distances.	**Annual Calendar** A calendar that only needs updating once a year in February to account for leap years.	**Perpetual Calendar** A calendar that never requires updating and is always accurate.	**Time Zones** Lets you find the time in different parts of the world.	**Moon Phase** Shows you the moon phase if you don't want to look up.	**Heart Rate Monitor** For measuring heart rate during exercise or at rest.
Power Reserve Indicator Displays how much power is left in the watch.	**Tourbillon** Counters the effects of gravity by mounting the escapement and balance wheel in a rotating cage, negating gravity when the timepiece is stuck in a certain position.	**Foudroyante** A sub-dial indicating fractions of a second. This complication is also known as the flying seconds hand.			

Band Type

Jewellery

GEAR Descriptions Misc Jewellery

Jewellery **Optional Item** 1/5 **EDC, GH, BOB, INCH**	Any jewellery on or in your body. A watch is considered jewellery but it's included below due having additional features. Each of these can have a unique use in a survival situation, from being a conductor to bartering. You can buy paracord jewellery such as a wristband, belt or keychain which often has other built in survival items like flint.	**Common Jewellery** ● Necklace ● Rings ● Piercings ● Bangle ● Earrings ● Rings

GEAR
Gear
Descriptions
Sewing Kit

22 Sewing Kit

The items which you should include in your sewing kit.

Scissors

Scissors	
Scissors Useful Item 2/5 BOB, INCH	For cutting cloth, cord, rope and thread. Look for a small pair of folding ones. You can also use a knife to cut thread but it won't be as clean and could be hard to thread through a needle. Some multitools have a pair of scissors on them.

Needles

Needles	
Needles Essential Item 5/5 BOB, INCH	For sewing with. Choose a variety of lengths and thicknesses. Try to keep them in a solid container where they can't be lost or poke through fabric. Needles can also be used for medical purposes when a probe is needed. They could also be turned into a rudimentary compass if you have a magnet.

Pins

Pins	
Pins Important Item 4/5 BOB, INCH	Get the type of pins with a spherical coloured end. Can be used for temporarily holding cloth, clothes or shelters together.

Thread

Thread	
Thread Important Item 4/5 BOB, INCH	To sew with. White, Black, Olive, Green and Brown recommended. To save space, fill bobbins instead of packing the whole roll of thread.

Buttons / Zipper

Buttons / Zipper	
Buttons / Zipper Useful Item 2/5 BOB, INCH	For attaching missing buttons or broken zippers to clothes.

Patches

Patches	
Patches Useful Item 3/5 BOB, INCH	To patch up ripped clothing and tents.

Elastic Strips

GEAR Descriptions Gear Sewing Kit Elastic Strips

Elastic Strips
Useful Item
3/5
BOB, INCH

To re-do the elastic if it breaks.

Safety Pins

Safety Pins
Useful Item
4/5
BOB, INCH

To hold two pieces of fabric together.

Thimble

Thimble
Useful Item
2/5
BOB, INCH

To prevent sewing injuries. Even a pinprick can get infected in a SHTF situation where there's little sanitisation.

Measuring Tape

Measuring Tape
Useful Item
3/5
BOB, INCH

To measure fabric.

Seam Ripper

Seam Ripper
Useful Item
2/5
BOB, INCH

For scavenging other materials to reuse or repairing clothing.

23 Fishing Kit

The items which you should include in your fishing kit. Generally a fishing kit is only needed in an INCH bag.

Strong Fishing Line

Strong Fishing Line
Essential Item
5/5
BOB, INCH

To attach hooks and sinkers to. Can also be used as backup cordage.

Hooks

Hooks
Important Item
4/5
INCH

For catching fish.

Sinkers / Floaters

Sinkers / Floaters Conditional Item 2/5 INCH	Various types to drop the line deep in the ocean or to keep it on the surface. You could use sticks and rocks instead to save a bit of weight if desired.

Yoyo Reel

Yoyo Reel Useful Item 4/5 INCH	Set and forget and hopefully you'll have fish by the end of the day. A highly recommended item which should make acquiring food much easier with almost no effort.

Retractable Fishing Rod

Retractable Fishing Rod Conditional Item 2/5 INCH	For regular fishing. Sticks will also work as a rod but be prepared for them to break.

Lures

Lures Conditional Item 2/5 INCH	For attracting fish, can include mini glowsticks and fish shaped lures.

Fishing Net

Fishing Net Useful Item 4/5 INCH	For pulling in fish and catching them in rivers. Make sure the net is strong and won't break if it gets caught on rocks and sticks.

5 Specialist Gear

This section is gear exclusively for specific climates or locations but is certainly essential in those locations.

Mountain Gear

Specific gear used for mountaineering.

Climbing Ropes Conditional Item 4/5 Specialist Gear	Ropes used for ascending or descending steep drops that mountainous terrain offers. Some ropes may not be retrievable once used and it's recommended you bring more length than you think you need. See the KNOTS section for more on types of ropes.
Hiking Boots Conditional Item 4/5 Specialist Gear	Choose footwear appropriate for the terrain (ankle support for rocky terrain, lighter shoes for well-maintained trails). Ensure they are broken in and ideally waterproof. Don't forget your hiking socks which should be moisture-wicking (wool or synthetic) to prevent blisters. Carry an extra pair as well.

Moisture-Wicking Clothes
Conditional Item
4/5
Specialist Gear

Worn next to the skin, they pull sweat away from your body to keep you dry. Crucial for comfort and preventing hypothermia when you sweat. (Avoid cotton – it absorbs moisture and stays wet). Materials: Merino wool, synthetic blends.

Gaiters
Conditional Item
4/5
Specialist Gear

These are fabric sleeves that go over your boots and lower pants. They keep out debris pebbles, dirt, snow and moisture, and can protect from scratches in overgrown trails.

Sunglasses
Conditional Item
4/5
Specialist Gear

Protects eyes from harsh glare and UV radiation. Essential for eye health and comfort, especially on bright days or with snow cover.

Trekking Poles
Conditional Item
4/5
Specialist Gear

Improve balance, reduce strain on knees (especially downhill), and provide stability on uneven or slippery terrain. Highly recommended for mountain hiking.

Cave Gear

Specific gear used for spelunking.

Powerful Headlamp
Conditional Item
4/5
Specialist Gear

Your BOB is likely going to contain a torch, but a headlamp will allow handsfree light. This should be a decently powerful headlamp to illuminate at least 30m ahead. Choose a model where the batteries can be instantly replaced, and be sure to bring plenty of spares. One with plenty of lighting options (low, medium, bright, strobe, red light, etc) will allow you to adapt to the changing conditions.

Secondary Headlamp
Conditional Item
4/5
Specialist Gear

A second headlamp in case the first fails. This will also allow you to have light while you replace the batteries in the other one.

Caving Helmet
Conditional Item
4/5
Specialist Gear

Hard-shell, durable, designed for caving, with secure clips for headlamps. Head protection from falls, falling rocks, and bumps in confined spaces.

Caving Harness
Conditional Item
4/5
Specialist Gear

Robust, simple, no padding (padding absorbs water and gets heavy), designed for comfort during long hangs. Connects you to ropes for ascending and descending.

Ascenders
Conditional Item
4/5
Specialist Gear

Mechanical devices for gripping a rope and allowing upward movement. Usually a chest ascender (Croll) and a handled ascender (Jumar/Basic). For climbing ropes out of pits.

Descenders
Conditional Item
4/5
Specialist Gear

Friction device for controlled rope descent (e.g., Petzl Stop, Rack). For safely lowering yourself into vertical shafts.

Cowstails
Conditional Item
4/5
Specialist Gear

Dynamic or semi-static rope lanyards, often one long and one short, attached to the harness. For clipping into safety points, passing knots on rope, and maintaining connection to the system.

Carabiners
Conditional Item
4/5
Specialist Gear

Locking carabiners (screw-gate or auto-locking) of various shapes (HMS, D-shape). Minimum 6-8 per person. Essential connectors for all parts of the SRT system.

Foot Loop / Etrier Conditional Item 4/5 Specialist Gear	Webbing loop attached to ascender for foot placement during ascent. Provides leverage for climbing ropes.
Climbing Ropes Conditional Item 4/5 Specialist Gear	Ropes used for ascending or descending steep drops that mountainous terrain offers. Some ropes may not be retrievable once used and it's recommended you bring more length than you think you need. Choose low-stretch static ropes specifically rated for caving/SRT. Lengths determined by cave depth.See the KNOTS section for more on types of ropes.
Drill & Bolt Kit Conditional Item 4/5 Specialist Gear	For installing or replacing anchors in the cave roof/walls.
Rope Protectors Conditional Item 4/5 Specialist Gear	Durable material placed at rope edges. Prevents rope abrasion against sharp rocks.
Undersuit/Thermal Conditional Item 4/5 Specialist Gear	Wicking material (fleece, polypropylene, wool) that retains warmth when wet. Avoid cotton. Caving environments are cold and wet. Keeps you warm and prevents hypothermia.
Caving Overalls/Suit Conditional Item 4/5 Specialist Gear	Durable, abrasion-resistant material (e.g., Cordura, PVC-coated nylon), often padded at knees/elbows. Protects skin and undersuit from abrasion, dirt, and water.
Neoprene Socks Conditional Item 4/5 Specialist Gear	Thick neoprene to provide insulation when wet. Keeps feet warm in cold, wet conditions.
Sturdy Caving Boots Conditional Item 4/5 Specialist Gear	Excellent grip (Vibram soles recommended), good ankle support, durable, drainable. Rubber wellingtons are common for wet caves. Navigating slippery, uneven, and often muddy terrain.
Gloves Conditional Item 4/5 Specialist Gear	Durable, grippy, and abrasion-resistant (e.g., gardening gloves with rubberized palms, specialized caving gloves). Protects hands from rope burn, sharp rocks, and cold.
Trash Bags Conditional Item 4/5 Specialist Gear	To remove waste from the cave.
Oxygen Meter Conditional Item 4/5 Specialist Gear	Deep inside caves there may be lower levels of oxygen, or it could be non-existent which is why an oxygen meter is essential.
Cave Radios Conditional Item 4/5 Specialist Gear	Specialized cave radios (e.g., Heyphone) for surface-to-underground communication.

GEAR Specialist Gear Cave

Spare Lights
Conditional Item
5/5
Specialist Gear

If the cave you will be entering is deep and doesn't have natural holes allowing light in you'll need a consistent way to produce your own light including a ton of spare batteries and various charging mechanisms. This particularly applies if you will be living inside a cave, however if so you might want to consider setting up a solar panel on the outside with cables leading in. If you're deep in a cave you may want to ensure you choose a light that doesn't consume oxygen like a torch or glowstick over a flame.

Snow Gear

Specific gear used for arctic and snowy climates.

Show Shoes
Conditional Item
4/5
Specialist Gear

Show shoes are important if you know you'll be walking on freshly fallen snow.

Show Shovels
Conditional Item
4/5
Specialist Gear

At least one sturdy snow shovel. Consider different types: a regular push shovel for clearing paths and a smaller, more robust shovel for breaking up ice or heavier snow. Ergonomic handles can reduce back strain.

Ice Melt / Rock Salt
Conditional Item
4/5
Specialist Gear

Chemical pellets (sodium chloride, calcium chloride, magnesium chloride) or sand/grit. These prevent ice formation and melts existing ice on walkways, steps, and driveways, preventing slips and falls. Be mindful of pet-safe options.

Ice Scrapers
Conditional Item
4/5
Specialist Gear

Handheld tools with a blade for scraping ice off surfaces. For clearing ice from vehicle windows, steps, and small patches of pavement.

Gumboots
Conditional Item
4/5
Specialist Gear

Helps prevent your feet from getting damp from the snow.

Roof Rake
Conditional Item
4/5
Specialist Gear

A long-handled tool with a wide head for pulling snow off rooftops. Prevents "ice dams" (where melting snow refreezes at the eaves, causing water to back up under shingles and into your home) and reduces heavy snow load on the roof.

Thermal Gear
Conditional Item
5/5
Specialist Gear

Used for very cold climates such as the polar regions or anywhere where the temperature drops extremely low.

Sunglasses
Conditional Item
5/5
Specialist Gear

Used to prevent snow blindness.

Desert Gear

Specific gear used for desert environments.

Multiple Water Bottles
Conditional Item
5/5
Specialist Gear

You're going to need a lot of water in the desert. If you are unable to find another water source by the time you're half out, you will need to go back to refill. So even though it's a burden, you will need as much as you can reliably carry without being overburdened. Include a couple of flexible ones to save on weight and space - but be gentle with them.

Solar Still Materials
Conditional Item
5/5
Specialist Gear

Plastic sheeting, a small container, and tubing. (Knowledge of how to construct and operate is essential, yield is typically low).

Wide Hat Conditional Item 5/5 Specialist Gear	A wide brimmed hat will help keep the sun off you. White is recommended to reflect more of the sun.
Electrolyte Drinks Conditional Item 2/5 Specialist Gear	These drinks can quickly and effectively replace any lost minerals and keep you hydrated for longer.
Face Wrap Conditional Item 4/5 Specialist Gear	A face wrap or shemagh will further protect your body from the sun and any sandstorms that come your way. I recommend one that's white if you're in the desert to help reflect the sun.
Sunglasses Conditional Item 5/5 Specialist Gear	Protects your eyes from the sun. But ones that wrap around your face to help protect your eyes from sand particles the wind kicks up.
Sunscreen Conditional Item 4/5 Specialist Gear	Helps prevent sunburn and resulting skin cancer by protecting your skin. This isn't as necessary if you're covered by loose-fitting white clothes covering most of your visible skin.
Lip Balm Conditional Item 4/5 Specialist Gear	Prevents cracked and sunburnt lips.
Shovel Conditional Item 2/5 Specialist Gear	For digging in sand (to get unstuck, find cooler ground, bury waste, or construct a simple shelter).
Portable Shelter Conditional Item 2/5 Specialist Gear	A portable shelter can be pitched in the sand and used as a reprieve from the sun when needed. It's not essential but you will probably wish you had one at least once. A tarp will also work to give you a reprieve from the sun.
Breathable Footwear Conditional Item 5/5 Specialist Gear	Hiking boots or shoes with good ankle support: Protect from rough terrain, rocks, and potential bites (snakes, scorpions). Good ventilation is key.
Moisture Wicking Socks Conditional Item 5/5 Specialist Gear	Wool or synthetic: Several pairs to prevent blisters and manage sweat.
Warm Clothes Conditional Item 5/5 Specialist Gear	Deserts can drop below freezing at night depending on the country and warm clothes are extremely important to pack. This includes: a down jacket, gloves, a beanie and a warm sleeping bag. You may not want the warm sleeping bag if you're considering only moving at night and sleeping during the day.
Vehicle Recovery Gear Conditional Item 5/5 Specialist Gear	If traveling by vehicle, essential for getting unstuck: sand ladders/traction boards, tow strap, high-lift jack, tire repair kit, air compressor (12V).

Jungle Gear

Specific gear used for jungle survival.

Machete Conditional Item 5/5 Specialist Gear	Perfect for slashing your way through thick undergrowth and vines if required.
Full Length Clothes Conditional Item 5/5 Specialist Gear	These will help protect you from sharp sticks and undergrowth as well as provide a barrier from mosquitos, ticks and leeches.
Dry Bags Conditional Item 5/5 Specialist Gear	Essential for keeping critical items (clothing, sleeping bag, electronics, first aid kit, fire starters) completely dry inside your pack.
Bag Rain Cover Conditional Item 5/5 Specialist Gear	Keeps the rain off your backpack.
Hammock Conditional Item 5/5 Specialist Gear	Elevates you off the wet, bug-infested, and potentially snake-ridden ground. The bug net is also helpful for protection against mosquitoes (malaria, dengue, Zika) and other biting insects.
Bug Spray Conditional Item 5/5 Specialist Gear	Permethrin spray (for clothing/gear) and strong insect repellent (DEET/Picaridin).
Head Net Conditional Item 5/5 Specialist Gear	A small and light item which will prove invaluable in a region where flies and mosquitos are thick in the air.
Mosquito Net Conditional Item 5/5 Specialist Gear	A small and light item which will prove invaluable in a region where flies and mosquitos are thick in the air. It will let you sleep more comfortably without having to keep slapping yourself. It attaches to the top of the tent and covers you while you sleep and acts as a secondaary barrier for flying and biting insects which happen to make it into your tent. In some regions, mosquitoes have diseases which you certainly don't want in a disaster scenario.
Wide Hat Conditional Item 5/5 Specialist Gear	For sun protection, and keeping rain off your face.
Anti-fungal Cream Conditional Item 5/5 Specialist Gear	To prevent the proliferation of fungal infections exacerbated by the damp.
Malaria Tablets Conditional Item 5/5 Specialist Gear	Essential in regions where malaria is prevalent. Some of the most common types are: Chloroquine (Aralen), Doxycycline (Vibramycin, Oracea, Adoxa, Atridox), Quinine (Qualaquin), Mefloquine (Lariam), Atovaquone/proguanil (Malarone), Artemether/lumefantrine (Coartem), and Primaquine phosphate (Primaquine).
Tick Remover Conditional Item 5/5 Specialist Gear	To remove ticks.

Sea Gear

Specific gear used for living on or near the sea.

GEAR | Specialist Gear | Sea Gear

Rash Vest Conditional Item 5/5 Specialist Gear	The primary defense against jellyfish stings (including Irukandji and Box Jellyfish in tropical waters). While not 100% impenetrable, they significantly reduce exposed skin. They also provide excellent sun protection.
Vinegar Conditional Item 5/5 Specialist Gear	Essential in regions where jellyfish are prominent as it inactivates the stinging cells that haven't fired. It is also useful to clean rust off metal due to living so close to the ocean air.
Reef Shoes Conditional Item 5/5 Specialist Gear	Protect feet from sharp objects (broken shells, coral), stonefish, stingrays, and other creatures camouflaged on the seafloor. Essential when wading or swimming in rocky, reefy, or murky areas. Shuffling your feet when walking in sandy shallows can also help scare off stingrays, preventing you from stepping directly on them.
Snorkeling Gear Conditional Item 5/5 Specialist Gear	Allows you to see what's in the water around you, helping you identify potential threats and avoid them.
Insect Repellent Conditional Item 5/5 Specialist Gear	Protects against mosquitoes and sandflies, which can be prevalent near beaches, especially around dawn and dusk, or in vegetated areas. Look for repellents containing DEET, Picaridin, or oil of lemon eucalyptus for effective protection.

Medical Specialist Gear

GEAR | Specialist Gear | Medical Gear

Specialised gear and larger equipment used by medical professionals. These would generally need a dedicated exam room to be used in. All equipment needs to be robust, easily repairable, and have readily available spare parts. Skilled personnel are essential. Many of these items require specialized training to use effectively and safely.

Exam Table Conditional Item 3/5 Specialist Gear	Provides a stable and adjustable surface for examining patients. Look for a sturdy, manually adjustable table (height, backrest).
Procedure Chair Conditional Item 3/5 Specialist Gear	For minor procedures, phlebotomy, or patient positioning.
Operating Room Table Conditional Item 3/5 Specialist Gear	For surgical procedures. A sturdy, adjustable table is essential.
Portable X-Ray Machine Conditional Item 3/5 Specialist Gear	For diagnosing fractures, pneumonia, and other conditions. Some portable X-ray units have battery or hand-crank power options, though image quality may be limited. This is a very complex and specialized piece of equipment.
Ultrasound Machine Conditional Item 3/5 Specialist Gear	For imaging internal organs, assessing pregnancies, and guiding procedures. Portable ultrasound machines with battery power are available, though image quality will be lower than a full-size unit.
Autoclave Conditional Item 3/5 Specialist Gear	For sterilizing surgical instruments. Pressure cookers can be adapted for this purpose, but proper training is crucial.

Microscope Conditional Item 3/5 Specialist Gear	For examining blood smears, urine samples, and other specimens. A basic optical microscope is necessary.
Centrifuge Conditional Item 3/5 Specialist Gear	For separating blood components. A hand-crank centrifuge is a better choice in a grid-down scenario.
Oxygen Concentrator Conditional Item 3/5 Specialist Gear	Provides supplemental oxygen. Some models can run on batteries or solar power.
Nebulizer Conditional Item 3/5 Specialist Gear	For delivering inhaled medications. Some portable nebulizers are battery-powered.
Suction Machine Conditional Item 3/5 Specialist Gear	For clearing airway obstructions. Hand-operated suction devices are available.
Surgical Lights Conditional Item 3/5 Specialist Gear	For illumination during procedures. LED lights are energy-efficient and can run on batteries.
Cautery Unit Conditional Item 3/5 Specialist Gear	For controlling bleeding during surgery. Battery-powered units exist but are less common.
Ambu Bag Conditional Item 3/5 Specialist Gear	For manual ventilation. This is a crucial item, also listed previously.
Spinal Board & Cervical Collars Conditional Item 3/5 Specialist Gear	For immobilizing patients with suspected spinal injuries.
Stretcher Conditional Item 3/5 Specialist Gear	For transporting patients.
Medication Storage Conditional Item 3/5 Specialist Gear	Maintaining the stability of medications (especially temperature-sensitive ones like insulin) is critical.
Basic Laboratory Items Conditional Item 3/5 Specialist Gear	For basic testing. This includes: Microscopes (mentioned above), Test tubes, beakers, and other glassware, Bunsen burner (for heating, if fuel is available), Manual cell counter, Simple scales

Generator Conditional Item 3/5 Specialist Gear	To provide electricity for essential equipment. Requires fuel, which may be scarce.

Pandemic Gear

Gear which should be possessed in a pandemic situation.

Plastic Sheeting Conditional Item 3/5 Specialist Gear	Used to cordon off rooms to isolate potential viruses.
Duct Tape Conditional Item 3/5 Specialist Gear	Used to fix the plastic sheeting to the walls and doors. It can also be used to seal gaps in windows and doors.
Disposable Coveralls Conditional Item 3/5 Specialist Gear	Full-body protective suits designed to protect against splashes, particulates, and some chemical/biological agents. Provides full-body barrier protection for tasks involving higher risk of contamination (e.g., caring for a severely ill person, decontamination). They can be hot, difficult to don/doff without contaminating oneself, and single-use.
Boot Covers Conditional Item 3/5 Specialist Gear	Disposable or reusable shoe covers for entry/exit points, or dedicated "dirty" footwear for specific high-risk areas. Prevents tracking pathogens into clean areas of the home.
Decontamination Sprayers Conditional Item 3/5 Specialist Gear	Battery-operated or manual sprayer for applying disinfectants over larger surfaces or for personal decontamination. Efficiently applies disinfectants for large-scale cleaning of surfaces or for decontaminating PPE.
UV-C Sterilization Lamps Conditional Item 3/5 Specialist Gear	Ultraviolet germicidal irradiation devices. Can be used to disinfect surfaces or potentially decontaminate certain PPE (like N95s) if manufacturer guidelines allow. Dangerous if used improperly (can cause skin burns, eye damage). Requires careful adherence to safety protocols.
Oxygen Concentrator Conditional Item 3/5 Specialist Gear	Generates concentrated oxygen from ambient air, or pre-filled oxygen tanks. For individuals with pre-existing respiratory conditions, or to support someone experiencing severe respiratory distress. Requires a prescription for oxygen tanks and knowledge of flow rates.
Powered Air-Purifying Respirators Conditional Item 3/5 Specialist Gear	PAPRs are a battery-operated unit that filters ambient air and delivers it through a hose to a loose-fitting hood or tight-fitting mask. Filters are typically P100 (99.97% filtration of airborne particles).
Humidifier Conditional Item 3/5 Specialist Gear	Can help keep nasal passages moist, which may aid in filtering out pathogens, and alleviate coughs/sore throats when sick.
Biohazard Bin Conditional Item 3/5 Specialist Gear	For segregating and safely storing potentially infectious waste. Why Advanced: Critical for infection control, especially when caring for sick individuals.

6 Household Gear

GEAR Household Gear

This section contains a list of gear to stockpile if you have a homestead and space isn't an issue for you. It's better to have it and not need it - then need it and not have it. It's sorted by room, but you don't have to store the items for that room IN that room. For those where quantities aren't included, just store as many as is reasonable that you will use. Think of this list as a worst case scenario where everything goes down and there's no manufacturing anymore. I got the idea for this section from SouthernPrepper1 who is essentially stocking up his homestead enough to be considered a small hardware shop where he is able to grab whatever he needs, or barter that which others need.

Kitchen

Items found in the kitchen which you will likely need multiple of during a grid-down situation.

Kitchen

- Trash Bags - Lots of different sizes, and include ones which are biodegradable.
- Sanitiser Sprays & Wipes, Washing Gloves
- Pots & Pans in various sizes and metals.
- Kitchen Cooking Utensils (Forks, Knives, Spoons, Graters, Cutting Boards, Scales, Timers)
- Cooking Gas - If you use a gas stove not reliant on an external gas tank
- Spare Electrical Appliances (Scales, Beaters, Toasters, Air Fryers, Microwaves)
- Spare Water Filters & Filter Replacement Parts
- Lighters & Matches
- Fire Extinguishers & Fire Blankets
- Disposable Plates and Cutlery
- Plastic Containers & Chinese Containers - For storage of pretty much anything you need.
- Canning Equipment (Jars, Lids, Pressure Cookers, etc)

Kitchen

- Cookbooks
- Bottled Water
- Mylar Bags - To store foods in.
- Knives, both kitchen knives and survival knives
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Bedroom

The items which are normally stored in the bedroom which you will need.

Bedroom

- Clothing to last each person 10+ years. Account for aging and a decrease in people's sizes as many will lose weight in a survival situation.
- Blankets, Sleeping Bags, Linen & Sheets
- AM/FM/Shortwave Radios and earphones to use them quietly
- Portable Fans
- Curtains & Curtain Rods
- Device Charger Cables, Spare Phone Batteries
- Battery Chargers
- Batteries - Every type you use, but specifically ones that are for commonly used items in disasters like headlamps.
- Electronic Devices - Phones, Tablets, Speakers and anything else you could barter or use yourself.
- Guns, Lots of Guns, and enough ammunition for a small army.
- USBs & Hard Drive - Fill them with prepper information.
- Glasses Backups - The last thing you need in a disaster is broken glasses and no replacement.

Bathroom & Toilet

Any items you need stored up that are related to the bathroom or toilet.

Bathroom

- Bath & Tile Cleaning Products
- Soap, Handwash, Shampoo
- Toothbrushes & Toothpaste
- Brooms & Mops
- Insecticides & Vermin Control
- Common Medicines (See the Home Clinic section below for more)
- Spare Taps, Tap Washers, Toilet Seals, Flusher Replacement Parts
- Toilet Cleaners, Sprays and Scrubbers
- Toilet Paper, Razors
- Urine Collector - Used to separate the urine from the faeces to make disposal easier
- Medications, Prescriptions & Vitamins
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Nursery

These are the items you will need if you are raising a baby. There are more detailed explanations of some of the items below in the "Baby Gear" section. See the Baby Safety section in DEFENCE for more tips on keeping them safe at home.

Nursery

- A Nappy Bag to contain all the essential items
- Clothes: Onesies, Bodysuits, Footed Pajamas, Pants, Shirts, Singlets, Sleep Suit, Hats, Shoes
- Nappies or Reusable Nappies (See below for a detailed calculation for quantity)
- Lots of scented nappy bags
- Educational Materials & School Books
- Baby Wipes
- Baby-Proofing Equipment (Gates, Corners, Safety Plugs, Drawer Lockers)
- Crib/Cot/Bassinet and Mattress
- Swaddle Cloths
- Towling/Burp Cloths
- Baby Monitor
- Change Mat

- Dummies (Pacifiers)
- Formula & Glass Bottles for feeding. Include extra teat sizes as they grow up.
- Breast Pump, Milk Storage Bottles, Breast Pads
- Bibs
- Rash Cream
- Play Mat (Waterproof is ideal)
- Bathtub, wash clothes, baby soap, towels
- Nail clippers/scissors,
- Nasal Aspirator
- Car Seat
- Plenty of Toys & Children's Books to give them as they develop, including bath toys
- Ensure your medical kit accounts for baby and child specific items. (Infant Paracetamol, small band-aids etc)

- Baby Bouncer
- Stroller/Pram with extra accessories as needed (Rain cover, cup holder, spare parts, etc)
- Portable Cot to use if travelling
- Baby Carrier/Sling
- Doorway Gates/Playpen
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Baby Gear

This section is focused on providing a complete list of items a baby needs growing up. You may be surprised by how many nappies and other items they can go through. Keep in mind that every baby is different and the nappy sizes may shift up or down based on their weight and how fast they grow.

Nappies

How many nappies you're likely going to need to raise a baby from birth until they are completely toilet trained. This only counts disposable nappies, you can work out how many reuseable nappies you will need from the below numbers.

Baby Stage	Baby Weight	Approx Age	Nappy Sizes	Total Nappies Needed	Notes
Preemie	< 3Kg	Before Due Date	P3 size for babies less than 500g. P2 size for babies less than 1,000g. P1 size for babies less than 1,800g. 0	Depends how early they are born. Best to have a box of P1's and 0's if you have the money and the space.	Not applicable to all babies, but it could add up to 10 weeks worth of items onto the list. Additionally, a lot of specialist gear may be required based on how early they arrive.
Newborn	< 5 Kg	0-3 Months	0 or 1	**8-12 Per Day = 720-1,080 Nappies**	
Infant	3-8 Kg	1-6 Months	2	**6-9 Per Day = 540-810 Nappies**	
Crawler	6-11 Kg	4-12 Months	3	**5-7 Per Day = 900-1,260 Nappies**	
Toddler	9-14 Kg	6-24 Months	4	**4-6 Per Day = 1,440-2,160 Nappies**	
Walker	12-18 Kg	1-3 Years	5	**4-5 Per Day = 1,440-1,800 Nappies**	
Junior	16+ Kg	2+ Years	6		
Extra Large	17+ Kg	3+ Years	7	Depends how long they need more nappies	Some kids need more time to toilet train.
			TOTAL DISPOSABLE NAPPIES	**5,000 to 7,000+**	This covers every nappy they will ever need.

Above is a summarised list of the total nappies above to make it easy to see at a glance how many you approximately need.

Formula

Below is a table of how much formula a baby will need if they are entirely fed with it from birth. Formula (or breastmilk) remains the main source of nutrition until at least 12 months of age, even after solids are introduced. Most babies will not exceed 960 mL (32 ounces) of formula in a 24-hour period. Remember that every baby is different. Your baby may eat more or less than these averages. Always feed on demand and watch for your baby's hunger and fullness cues. A 900g tub would then yield approximately 900 g×7 mL/g=6300 mL or 6.3 litres of prepared formula.

To use the table:
1. Find your baby's current weight in the first column.
2. Look across to see the recommended formula intake per kilogram and the estimated total daily amount.
3. Divide the total daily amount by the average number of feeds for your baby's age/weight to get an idea of how much to prepare per bottle.
4. Adjust based on your baby's cues. If they're regularly finishing bottles and still rooting, offer a little more. If they're leaving a lot, offer a little less.

Example
If your baby weighs 5 kg, they likely need around 5 kg×150 mL/kg/day=750 mL of formula per day.
If they feed 7 times a day, each bottle would be about 750 mL/7 feeds≈107 mL. You might prepare 120 mL bottles.

Baby Weight & Stage	Approx Age	Formula Per kg of Body Weight (mL/kg/day)	Est. Total Daily Formula (mL)	Average Feed Size	Est. Daily Formula Powder Needed (g)	Monthly Formula Powder Needed (g)	Monthly Tubs Needed (900g tub ≈ 6.3L)	Cumulative Tubs Needed	Notes
Newborn 0-4 Kg	Birth - 1 Month	100-150	100 - 600 (avg. 350)	8-12 ml	14 - 86 (avg. 50)	1500	1.7	1.7	Starting very small, increasing rapidly
Newborn 4-5 Kg	1-2 Months	150	600 - 750 (avg. 675)	6-10 ml	86 - 107 (avg. 96)	2880	3.2	4.9	

Infant 5-6 Kg	2-3 Months	150	750 - 900 (avg. 825)	6-8 ml	107 - 129 (avg. 118)	3540	3.9	8.8	
Infant 6-7 Kg	3-4 Months	120-150	720 - 900 (avg. 810)	5-7 ml	103 - 129 (avg. 116)	3480	3.9	12.7	
Crawler 8-9 Kg	4-6 Months	120	840 - 960 (avg. 900)	5-7 ml	120 - 137 (avg. 129)	7740 (2 mths)	8.6 (2 mths)	21.3	
Crawler 9-10+ Kg	6-9 Months	90-120	720 - 950 (avg. 835)	4-6 ml	103 - 136 (avg. 119)	10710 (3 mths)	11.9 (3 mths)	33.2	Formula decreasing as solids increase
Toddler 9-10+ Kg	9-12 Months	75-100	700 - 900 (avg. 800)	3-4 ml	100 - 129 (avg. 114)	10260 (3 mths)	11.4 (3 mths)	44.6	Significant solids intake

After 12 months, babies normally transition to cow's milk, but they can stay on formula as well.

Clothing

Below is a list of clothes needed for babies up until they are about 4 years old.

Newborn 0-3 Months	• Bodysuits (short-sleeve): 5-7 (base layer for warmth or standalone in warm weather) • Bodysuits (long-sleeve): 5-7 (for cooler weather or layering) • One-piece Sleepers/Footed Rompers: 7-10 (easy for sleeping and general wear; choose zip-up for convenience) • Footed Pants/Leggings: 3-5 (great for layering over bodysuits) • Hats (soft cotton): 2-3 (for warmth, especially post-bath or in cool temps) • Socks/Booties: 5-7 pairs (keep tiny feet warm) • Light Jackets/Cardigans: 2-3 (for layering in cooler rooms or outdoors) • Swaddles/Sleep Sacks: 3-5 (for safe sleep)
Baby (3-12 Months)	• Bodysuits/T-shirts (short-sleeve): 7-10 • Bodysuits/Long-sleeve Tops: 5-7 • Pants/Leggings/Soft Jeans: 5-7 pairs (durable for crawling) • Shorts/Capris: 3-5 pairs (for warmer weather) • Dresses/Skirts (for girls): 3-5 (often come with matching bloomers) • One-piece Sleepers/Pajamas: 5-7 • Light Sweaters/Hoodies/Cardigans: 2-3 (for layering) • Outerwear (light jacket/coat): 1-2 (depending on climate) • Socks: 7-10 pairs • Hats (sun/warmth): 1-2 each (season-appropriate) • Swimwear (optional): 1-2 sets (if applicable)
Toddler (1-2 Years)	• T-shirts/Tops (short-sleeve): 7-10 • Long-sleeve Tops/Sweaters: 5-7 • Pants/Jeans/Track Pants: 7-10 pairs (easy for movement, potentially toilet training) • Shorts/Capris: 5-7 pairs • Dresses/Skirts: 5-7 • Underwear/Training Pants: 7-10+ (if toilet training; you'll need many extra changes) • Pajamas: 4-5 sets • Mid-weight Jacket/Coat: 1-2 (for warmth) • Rain Jacket/Windbreaker: 1 • Socks: 7-10 pairs • Hats (sun/warmth): 1-2 each • Swimwear: 1-2 sets • Shoes: Sneakers/walking shoes (2 pairs), sandals/water shoes (1 pair), winter boots (if applicable, 1 pair)
Preschooler (2-4 Years)	• T-shirts/Tops (short-sleeve): 7-10 • Long-sleeve Tops/Sweaters: 5-7 • Pants/Jeans/Track Pants: 7-10 pairs (durable for play) • Shorts/Capris: 5-7 pairs • Dresses/Skirts: 5-7 • Underwear: 7-10+ pairs • Pajamas: 4-5 sets • Mid-weight Jacket/Coat: 1-2 • Rain Jacket/Windbreaker: 1 • Socks: 7-10 pairs • Hats (sun/warmth): 1-2 each • Swimwear: 1-2 sets • Shoes: Sneakers (2 pairs), sandals/water shoes (1 pair), dressier shoes (1 pair), winter boots (if applicable, 1 pair)

Total Estimated Garments (Excluding Burp Cloths/Bibs): Approximately 200-280+ items over the 4-year period, representing the flow of clothing in and out of your child's wardrobe due to growth. This doesn't mean you have 200 items in the closet at once, but rather the cumulative number of unique items you would purchase or receive across all the sizes your child will wear in these categories. Remember, this is a substantial investment. Many parents rely on gifts, hand-me-downs, and second-hand stores to manage costs and reduce waste.

School Room

This room is used for younger kids to play in from about 4 to 12 and also covers the items that kids will need over the years, including schooling materials.

Study

This room is used for schooling, study and research and covers the time period of teenagers to adults.

- Pens, Pencils, Permanent Markers.
- Printing Paper, Lined Paper, Grid Paper
- Sticky Tapes, Glue
- Paper Tools (Rulers, Compasses, Protractors, Erasers, Hole Punches, Clipboards)
- Stickers and coloured stickers (Useful for prep identification and documenting gear)
- Whiteboards and Markers
- Books - As many as you can store on as many prepper related topics you can think of.
- Sewing Machine & lots of Thread & Fabrics
- Cash & Precious Metals (In a safe) - Preferably in coins to be able to barter easily.

Laundry

The laundry and everything you should stock in it.

- Washing Powders/Tablets, Laundry Soap, Bleach
- Hot Water System Spare Parts
- Pet Beds, Toys, Kitty Litter
- Dustpan/Brushes & Mops
- Insect Repellant
- Scrubbing Board - For washing clothes manually
- Manual Washing Machine
- 3/4" and 1" Laundry Hose Replacements
- Cleaning Scrubbing Brushes & Plungers

Living Room

The living room, where the family can play together and stay entertained.

- Novels for all ages to keep the family entertained
- Physical DVD's - To keep you entertained in the event the internet goes down.
- Board Games - To keep the family entertained if there's no electricity.
- Candles or LED Lanterns
- Cushions and Blankets
- Bibles

Home Clinic

These are items you would need to run a small doctor's office and pharmacy all in one in your self-sufficient home.

Basic Equipment

- An Extensive Medical Library
- Headlamps & Batteries
- Antibacterial Soap/Hand Sanitizers and Antiseptic/Alcohol Wipes
- Gauze Pads (Plenty of types and sizes)
- Non-Stick Gauze
- Triangular Bandages (A few, as these can be washed)
- Safety Pins (All Sizes)
- Israeli Bandages (Choose a few sizes)
- Band-Aids (Lots of different shapes and sizes)
- Absorbent Pads in multiple sizes
- Medical Tape - To tape down absorbent pads
- Duct Tape (For holding broken limbs)
- Tourniquets
- Moleskin / Skin Blister kit
- Reusable Cold Packs/Heat Packs
- Cotton Eye Pads, Patches
- Cotton Swabs & Cotton Balls
- Disposable Gloves
- Face Masks
- Bandage Scissors
- Tweezers (Various Shapes and Tips)
- Magnifying Glass
- Headlamp or Penlight
- Kelly Clamps

• Sutures & Needle Holder	• 2.5% Lidocaine cream
• Scalpels (Buy a variety of tips)	• Panadol/Ibuprofen/Aspirin
• Hemostatic Agents	• Benadryl / Claritin
• Saline Solution (Wound Wash)	• Imodium
• Survival Sheet/Solar Blanket - To keep the injured warm	• Pepto-Bismol
• Thermometers - Have at least a contactless and an in-ear one	• Essential Oils (Lavender, Peppermint, Eucalyptus, Clove, Oregano, etc)
• Antiseptic Solutions (Dettol, Betadine, Isopropyl Alcohol)	• Oral Rehydration Packs
• Herbal Teas, Tinctures and Salves	• Water Purification Filter or Tablets
• Antibiotic Ointment	• Silvadene Cream
• Sunscreen & Lip Balms	• Oral Antibiotics
• Insect Repellent (Deet is preferred)	•
• 1% Hydrocortisone Cream	•
• Neck Collar	
• Eye cups, eye wash	
• Ammonia inhalants	
• Slings and Splints	
• Irrigation Syringes	
• Emergency Obstetric Kit	
• Cidex Solution	
• Lidocaine	
• Epinephrine (Epi-Pen)	
• Terconazole cream (antifungal)	
• Wart removal cream/ointment/solution	
• Hemorrhoid cream/ointment	

Medications

This is a list of recommended medications for a home clinic set up to serve about 100 people over 3 years.

• Paracetamol (Panadol, Dymadon, Tylenol) - 1,000 units	• Metronidazole (Flagyl, Metronex) - 150 units
• Ibuprofen (Nurofen, Brufen, Advil) - 500 units	• Trimethoprim/Sulfamethoxazole (Bactrim, Septrin) - 100 units
• Acetylsalicylic Acid (Aspirin, Aspro, Disprin) - 200 units	• Doxycycline (Doryx, Vibramycin, Doxy-Caps) - 100 units
• Codeine (Panadeine Forte, Nurofen Plus) - 100 units	• Ceftriaxone (Rocephin) - 50 units
• Morphine Sulfate (MS Contin, Kapanol, Sevredol) - 50 units	• Aciclovir (Zovirax, Lovir) - 50 units
• Naloxone (Narcan) - 10 units	• Fluconazole (Diflucan, Candis) - 20 units
• Lidocaine (Xylocaine, Lignocaine) - 50 units	• Clotrimazole (Topical Cream) (Canesten, Clomazol) - 10 units
• Lidocaine (Topical) (Xylocaine Viscous, LMX 4) - 10 units	• Albendazole/Mebendazole (Zentel, Vermox) - 50 units
• Amoxicillin (Amoxil, Moxacin) - 300 units	• Permethrin (Topical Cream) (Lyclear, Kwellada) - 5 units
• Amoxicillin + Clavulanic Acid (Augmentin, Amox-Clav) - 150 units	• Tetanus Toxoid Vaccine (Adacel, Boostrix) - 50 doses
• Azithromycin (Zithromax, Aziclar) - 100 units	• Tetanus Immunoglobulin (Tetagam P, HyperTET) - 5 doses
• Ciprofloxacin (Cipro, Ciproxin) - 150 units	• Salbutamol (Albuterol) Inhaler (Ventolin, Asmol) - 20 units
• Salbutamol (Nebulizer Solution) (Ventolin Nebules) - 10 units	• Atenolol (Tenormin, Noten) - 50 units
• Prednisolone (Predsone, Panafcort) - 50 units	• Glyceryl Trinitrate (GTN) (Anginine, Nitrolingual) - 50 units
• Dexamethasone (Dexmethsone, Oradexon) - 20 units	• Furosemide (Lasix, Urex) - 50 units
• Oral Rehydration Salts (Hydralyte, Gastrolyte) - 500 sachets	• Aspirin (Low Dose) (Cartia, Astrix) - 100 units
• Loperamide (Imodium, Gastro-Stop) - 50 units	• Insulin (Mixed Types) (Novolin, Humulin, Levemir, Novorapid) - 50 vials
• Bisacodyl (Dulcolax, Lax-Tabs) - 20 units	• Metformin (Diaformin, Glucophage) - 100 units
• Aluminium or Magnexium Hydroxide (Mylanta, Gaviscon) - 20 units	• Glucose (Oral) (Dextrose tabs, Glucogel) - 20 units
• Omeprazole (Losec, Nexium, Somac) - 50 units	• Glucagon (GlucaGen) - 2 units
• Ondansetron (Zofran, Nausetrol) - 20 units	• Levothyroxine (Eutroxsig, Oroxine, Synthroid) - 50 units
• Amlodipine (Norvasc, Amlo) - 100 units	• Hydrocortisone (Oral/Injectable) (Solu-Cortef, Cortef) - 20 units
• Enalapril (Renitec, Vasotec) - 100 units	• Diazepam (Oral) (Valium, Antenex) - 50 units
• Hydrochlorothiazide (Dithiazide, Hydrodiuril) - 50 units	• Diazepam (Rectal Gel/Injectable) (Stesolid, Valium) - 5 units
• Phenobarbitone (Phenobarb) - 20 units	• Chloramphenicol Eye Drops/Ointment (Chlorsig, Chemicetina) - 5 units
• Fluoxetine (Prozac, Lovan, Zactin) - 50 units	• Artificial Tears (Refresh, Systane, Hylo-Forte) - 5 units
• Haloperidol (Serenace, Haldol) - 10 units	• Combined Oral Contraceptives (Levlen, Yaz, Microgynon) - 30 cycles
• Chlorphenamine (Chlorpheniramine) (Piriton, Allerest) - 50 units	• Progestogen-only Pills (Microlut, Noriday, Cerazette) - 10 cycles
• Loratadine/Cetirizine (Claratyne, Zyrtec, Telfast) - 50 units	• Emergency Contraception (Levonorgestrel) (Postinor-1, EllaOne) - 5 units
• Epinephrine (Adrenaline) (Adrenaline Chloride, EpiPen - Note: EpiPen is an auto-injector, this refers to the ampoule) - 20 units	• Oxytocin (Syntocinon) - 5 units
• Povidone-iodine Solution (Betadine, Povidone) - 2 units	• Ferrous Sulphate (Ferro-grad C, Fefol) - 50 units
• Chlorhexidine Solution (Surgi-Prep, Hibiclens) - 2 units	• Folic Acid (Folacin, Megafol) - 20 units
• Hydrocortisone Cream (1%) (Hydrozole, DermAid) - 10 units	• Sodium Chloride 0.9% IV (Normal Saline) (Saline IV) - 100 units
• Mupirocin Ointment (Bactroban) - 5 units	• Glucose 5% IV (Dextrose 5%) (Dextrose IV) - 50 units
• Emollient Cream (e.g., Paraffin-based) (QV Cream, Sorbolene) - 5 units	• Multivitamin supplements (Centrum, Swisse, Blackmores) - 50 units
	• Activated Charcoal (Charcodote, Actidose) - 5 units

Clinic Equipment

• Treatment Table	• Sterile Drapes
• Portable Bed	• Air Splints
• Plaster of Paris Cast Kits	• SAM Splints
• Naso-oropharyngeal Airway Tubes	• Scrub Suits
• Nasal Airways	• IV equipment (Saline, Tubes, Syringes, Needles, Paper Tape, IV Stands)
• Resuscitation Bag	• Folding Stretchers
• Endotracheal Tube/Laryngoscope	• Towels
• Portable Defibrillator	• Bulb Syringes
• Blood Pressure Cuff (Manual and Automatic)	• Moveable Medical Light
• Stethoscopes	• Assorted Clamps
• Otoscope and Ophthalmoscope	• Emergency Obstetric Kit
• Pregnancy Test Kits	• Obstetric Forceps

• Uterine Sound & Uterine Dilators
• Bone saw (for amputations)
• Chest decompression kits and drains
• Penrose Drains
• Foley Catheters
• Urine Bags
• Enema Kit
• Nasogastric Tubes
• Pressure Cooker, Autoclaver or Ultrasonic Cleaner (For Sterilization)
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Dental Equipment

• Cotton Pellets and Rolls
• Dental Mirror, Dental pick, Toothpicks
• Dental Floss
• Clove Bud Oil
• Zinc Oxide
• Commercial Dental Dits
• Needle Holder
• Extraction Equipment
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Basement

The room where you store all of the supplies in these sections as well as other misc items that need to be kept cool.

• As much long life food as possible. (Stored on pallets off the concrete)
• Water Barrels (Immovable) (Stored on pallets off the concrete)
• Water Jugs with Bungs & Taps (Portable ones)
• Water Filters & filtration parts.
• Battery Backups / Power Stations.
• Backup Off-Grid Electrical (Inverters, Cabling, DC Converters, Switches)
• Alcohol for drinking, medical use, tincture-making and barter
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Garage

Any items in the garage that you should have stocked up.

• Fasteners (Screws, Bolts, Nails, Glue, Duct Tape) Store as many types and sizes you can.
• Household Electrical (Light Bulbs, Wires, Circuit Breakers, Outlets, Switches, Power Boards, Extension Leads)
• Hand Tools (Spanners, Socket Sets, Screwdrivers, Pliers, Clamps, Chisels, Saws, Measuring Tools, Hammers, Mallets, Hex Sets, Staple Gun, Glue Gun)
• Power Tools (Drills, Grinders, Blowers, Multitools, Power Saws, Planers, Routers, Sanders)
• Electrical Tools (Multimeter, Crimpers, Cable Cutters, Soldering Iron, Solder)
• Safety Equipment (Ear Muffs, Protective Glasses, Face Masks, Hard Hats, First Aid Kits, Gas Masks, Gloves, Boots, Coveralls, Roof-Climbing Safety)
• Wood Fittings (Cabinet Fittings, Latches, Knobs, Handles)
• Generators (Petrol, Diesel or Battery)
• Vehicle Maintenance Equipment (Jack Stands, Oil Pan, Oil, Car Batteries, Coolant, Cleaning Sprays, Rags)
• Welding Equipment
• Plumbing Spares (Toilet Seals, Tap Washers)
• Masonry, Plastering Tools & Cement

• Tie-Downs, Ropes, Paracord
• Camping Water Heaters
• Mattresses (Inflatable or Regular)
• Tents & Tent Pegs, Shadecloths, Gazebos, Tarps, Umbrellas - To use as shelters or water collection objects.
• BBQ's, Lighters & Outdoor Ovens (Include lots of fuel for these)
• Passive Home Defence (Barb Wire, Locks, Tripwires, Fake Cameras, Lights, Motion Sensors, Dogs?)
• Pre-cut wooden boards to put over the windows in emergencies
• Pre-cut wooden dowel pieces to bar the windows
• Replacement Fly-Screen
• Lots of garage shelving
• TONS of plastic tubs to store all of this gear - Ones where you can access the gear from the side rather than unstacking it each time
• Knives

Shed

Gear stored in the shed which can be used for household repairs and DIY.

- Misc Pieces of Metal - Useful for projects.
- Misc Pieces of Wood - Also useful for projects, but you never know when you need a certain piece of wood for repairs.
- Fuel Cans - For use with your Bug-Out Vehicle (BOV), or generator.
- Outdoor Woodworking Tools - Axes, Hatchets, Saws.
- Mechanic Tools - To repair your cars with.
- Spare BOV Parts - So you can fix it yourself if something breaks. (Don't forget to download the how-to videos)
- Spare components for household electronics for repairs - Computer, Vacuum, Fan, Fridge, Freezer, Generator, etc
- Backup Transport - Bicycles, Scooters, Motorbikes, etc.
- Garden Tools - Rake, Hoe, Shovel, Pruners, Lawn Mower.
- Garden Hoses, attachments and fittings including hoses and fittings for water tanks.
- Gardening - Pots, Soil, Seeds, Fertilizer, Mulch, Potting Mix, Netting.
- External Household Spares (PVC Piping, Gutter Lengths, Bricks)

- Work Benches, Saw Horses, Tool Chests
- Spare Antennas for the TV, HAM and Radio Communication
- Roofing Insulation
- Ladders
- Spare Window Glass & tools to cut it to size
- Fences and Gate sections - Used as replacements
- BBQ's and Outdoor Cooking
- Various Types of Wire
- Coolers & Eskies
- Pool Shock (Calcium Hypochlorite)
- Plasterboard
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Outside

Any items you can store outside which you should have on a homestead.

- Tinder/Twigs/Branches (Anything smaller than firewood to help get it started)
- Firewood (As much wood as you can store if you use it frequently)
- Water Tanks (As many tanks as you can have)
- Backup Solar Panels
- Spare Gas Cylinders (Protected from the sun)
- Spare Land for Waste Disposal
- Spare Land for a Toilet-Pit or Sewage Treatment Plant (If you don't already have a composting toilet and are reliant on the sewage lines)
- Bricks to use for future projects - Such as building an oven, walls, garden beds or even a granny-flat.
- Spare fencing to replace any which becomes damaged.
- Pallets & Spare Wood - Great for various projects and construction.
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7 External Gear

This section is for gear not found in your bags or on your person, but is still required in most preparedness situations such as transportation and larger items. For additional information on vehicle types and what can be found in them, take a look at the TRANSPORT and LOCATIONS categories.

Backpack

The backpack isn't inside the BOB but is still essential to have. See the GEAR > Backpacks section above for more information.

Hiking Frame

A hiking frame is a type of trailer which holds your gear as you hike across tough terrain. It has one wheel which makes contact with the ground and another curved handle which you can either hold manually or attach to a belt clip keeping your hands free. An example of a hiking frame is the monowalker. They are basically essential if you're planning on bugging out on foot but it's also useful to have one in your car to make seamless transitions between the two transport types.

Car / Van / SUV / 4WD

Any type of car is the likeliest method of transport people will use when bugging out, as most people own at least one and have the knowledge to drive it. They all have their advantages and disadvantages such as a car getting great mileage in the suburbs and cities and the 4WD being able to go off-road.

Motorbike

Motorbikes are great bug out vehicles for individuals wanting to go fast and have the ability to avoid most traffic. They have the drawbacks of not being able to carry many supplies and being very loud in most cases which can draw unwanted attention.

Bicycle

GE Bicy

External Gear

A bicycle is another common bug-out transport method suitable for escaping under the radar as they can go off-road and fit through much smaller gaps than a car can. Although most of them come at the cost of requiring the rider to be fit and healthy unless it's an electric model. Another drawback is that they won't fit anywhere near as much gear as a car, but they have the ability to add a small bike trailer on the back and saddle bags to the sides.

Campervan / Tiny House

Campervans and tiny houses are great ways to continue your current lifestyle in any location you choose. The ability to move an entire house on demand takes a powerful engine but gives you all the comforts of home as you bug out, either to an alternative destination or to set up your home in a more secure location.

Bus

GEAR External Gear Bus

A bus can be a great transport method for larger families or combined families if you're all going to the same destination. It would also work well if you have a huge amount of gear to take with you, allowing you to basically take your entire stockpile of food with you. As seen on doomsday preppers you can also use them as a defensive wall if parked correctly or if you have multiple buses at your disposal.

Trailer

Trailer

Trailers can greatly expand your storage space when bugging out in a land vehicle. They can come in a multitude of sizes to suit your needs and allow you to carry more than you normally would. They can also be disconnected in a hurry and abandoned if they're slowing you down or putting you at risk such as on icy slopes. They can also be modified to allow you to sleep inside them if required.

Boat

GEAR External Gear Boat

As the only way to travel across water, boats can be both a blessing and a curse depending on what type of boat it is and how big the body of water is. If you have a boat docked at any point in your bug out plan there's always the chance that it may be damaged, looted or gone when you arrive to sail away. Because of this it's best to tow the boat behind a car to the waters edge so you're certain that you have a mode of transport when you bug out.

Helicopter

Plane

GEAR External Gear Plane

The ultimate way to travel quickly across both land and water. Planes can be expensive to buy, time consuming to learn and sometimes tough to pilot in a disaster, but once those barriers are out of the way they can get you wherever you need to be - fast, as long as there's a landing strip. However they come at the cost of safety, if for some reason your runway of choice has obstacles on it or you become a shooting target to those below.

Survival

How to survive in the wilderness and foreign climates

“The history of the world, my sweet,
is who gets eaten and who gets to eat."
Sweeney Todd

Introduction

Survival skills are techniques that a person may use in order to sustain life in any type of natural environment. These techniques are meant to provide basic necessities for human life which include water, food, and shelter. The skills also support proper knowledge and interactions with animals and plants to promote the sustainability of life over a period of time. Survival skills are often associated with the need to survive in a disaster situation but should be learned prior.

Purpose	The aim of SURVIVAL is to help the reader stay alive in any climate, scenario or location they may find themselves in. Whether it's surviving on a desert island after a plane crash, surviving in a log cabin in the alps or surviving in a major city after the country has torn itself apart.
Lost?	● For identifying, collecting and purifying naturally occurring water, see the WATER section. ● For surviving specific disasters, see the NATURAL DISASTERS section. ● If you want to know how to identify plants and in particular, edible ones, see the PLANTS section. ● For information on catching wild food, see the HUNTING and FISHING sections. ● If you're looking for survival tips after a plane crash, see the PERSONAL DISASTERS section. ● For information on the different climates around the globe, see the GEOGRAPHY section.

Contents

1 Killers

Death is the permanent cessation of all biological functions that sustain a living organism. Phenomena which commonly bring about death include aging, physiological or organ failure, predation, poisoning, malnutrition, disease, suicide, homicide, asphyxia, drowning, severe burns, drug intoxication, starvation, dehydration, electrocution, intense heat or cold, radiation toxicity, warfare attacks such as bombings, as well as explosions and accidents or major trauma resulting in fatal injury. The remains of a living organism begin to decompose shortly after death. It is an inevitable process eventually occurring in all living organisms. This is certainly a morbid start to this section, but an essential one to know if you're trying to survive as long as possible.

As of the early 21st century, over 150,000 humans die each day.

Death, particularly of humans, has commonly been considered a sad or unpleasant occasion, due to the affection for the deceased and the termination of social and familial bonds. Other concerns include fear of death, necrophobia, anxiety, sorrow, grief, emotional pain, depression, sympathy, compassion, solitude, or saudade. Many cultures and religions have the idea of an afterlife, and also hold the idea of judgement and reward for good deeds or punishment for sin.

Common Deaths

The following is a list of the causes of human deaths worldwide for different years arranged by their associated mortality rates. In 2002, there were about 57 million deaths. In 2005 about 58 million people died. In 2010 52.8 million people died. In 2016, the WHO recorded 56.7 million deaths with the leading cause of death as cardiovascular disease causing more than 17 million deaths (about 31% of the total) as shown in the chart to the side.

Below are the most common reasons for death in today's world. Survival includes these just as much as out of the ordinary events such as SHTF. The statistics below are from 2014[n].

Cardiovascular Disease 17,650,000 Deaths/year	**Cancers** 8,930,000 Deaths/year	**Respiratory Disease** 3,540,000 Deaths/year	**Diabetes/Blood & Endocrine Disease** 3,190,000 Deaths/year
Dementia 2,530,000 Deaths/year	**Lower Respiratory Infections** 2,380,000 Deaths/year	**Neonatal Deaths** 1,730,000 Deaths/year	**Diarrheal Diseases** 1,660,000 Deaths/year
Road Incidents 1,340,000 Deaths/year	**Liver Disease** 1,260,000 Deaths/year	**Tuberculosis** 1,210,000 Deaths/year	**Kidney Disease** 1,190,000 Deaths/year
Digestive Disease 1,090,000 Deaths/year	**HIV/AIDS** 1,030,000 Deaths/year	**Suicide** 810,000 Deaths/year	**Malaria** 710,000 Deaths/year
Homicide 390,000 Deaths/year	**Nutritional Deficiencies** 370,000 Deaths/year	**Meningitis** 320,000 Deaths/year	**Protein-energy Malnutrition** 310,000 Deaths/year
Drowning 230,000 Deaths/year	**Maternal Deaths** 210,000 Deaths/year	**Parkinson's Disease** 170,000 Deaths/year	**Alcohol Disorder** 160,000 Deaths/year
Intestinal Infections Diseases 140,000 Deaths/year	**Drug Disorders** 130,000 Deaths/year	**Hepatitis** 130,000 Deaths/year	**Fire** 130,000 Deaths/year
Conflict 120,000 Deaths/year	**Heat-releated Deaths (Hot/Cold)** 50,000 Deaths/year	**Terrorism** 30,000 Deaths/year	**Natural Disasters** 10,000 Deaths/year

Life Expectancy

Life expectancy is a statistical measure of the average time an organism is expected to live, based on the year of its birth, its current age, and other demographic factors including gender. The most commonly used measure is life expectancy at birth (LEB), which can be defined in two ways. Cohort LEB is the mean length of life of an actual birth cohort (all individuals born in a given year) and can be computed only for cohorts born many decades ago so that all their members have died. Period LEB is the mean length of life of a hypothetical cohort assumed to be exposed, from birth through death, to the mortality rates observed at a given year.

The longest verified lifespan for any human is that of Frenchwoman Jeanne Calment, who is claimed to have lived to age 122 years, 164 days, between 21 February 1875 and 4 August 1997, which however is disputed. This is referred to as the "maximum life span," which is the upper boundary of life, the maximum number of years any human is known to have lived.

This is a chart of the average life expectancy in every country of the world, as of 2015.

Unusual Deaths

This is a list of unusual deaths, to entertain, but also to point out the fragility of life.

● A poodle named Cachy, fell from 13 floors and fatally hit 75-year-old Marta Espina, killing both instantly. In the course of the events, 46-year-old Edith Sola, who came to see the incident, was fatally hit by a bus. An unidentified man, who witnessed Edith's death, had a heart attack and also died on his way to the hospital.
● An entire football team of 11 in Eastern Kasai, Democratic Republic of the Congo, were fatally struck by lightning while playing. The other team left unharmed.
● Three people died of carbon dioxide suffocation and drowning when 25 kg of dry ice was thrown into an indoors swimming pool at a sauna party in Moscow to create a layer of thick white fog over water surface, which, inadvertently, displaced oxygen.
● Hoong Leong, 37, was struck in the shoulder by a falling gas cylinder whilst walking home during stormy conditions. Leong survived the initial impact but went into cardiac arrest and died upon arrival at hospital.
● Sergio Millán, 59, was alone in his apartment in Torreforta, Tarragona, Spain when an explosion in a petrochemical plant 3 kilometers away launched a one-ton iron plate into the apartment above him, which caused the ceiling to collapse, killing him.
● Elena "Lena" Struthers-Gardner, 60, was carrying a mason-jar style drinking glass with a screw-top lid in her kitchen when she collapsed. The 10-inch stainless steel straw entered her left eye socket and pierced her brain.

● Salvator Disi, 62, was decapitated while using a power cart to jump start a helicopter in Hernando County, Florida. The unexpected up-and-down motion of the helicopter caused the rotor blades to strike Disi.
● Jennifer Riordan, 43, a passenger aboard Southwest Airlines Flight 1380, died after debris from an engine failure struck and destroyed the window she was sitting next to. She was partially blown out through the window, but was pulled back into the aircraft and was given CPR until an emergency landing was made. She died upon arrival at hospital with her cause of death determined to be blunt trauma to the head, neck and torso.
● 16-year-old high-school student Kyle Plush died after becoming trapped in his Honda Odyssey. Attempting to reach his tennis equipment, Plush leaned over the third row of seats into the trunk. When the row of seats "squashed his chest", Plush became pinned and later died. During the incident, the teen called 9-1-1 twice, by using Apple iPhone's Siri voice-activation. Responding to the 9-1-1 calls, police were not able to find Plush; he was eventually discovered in the vehicle by his father about six hours later.
● Rajesh Maru, 32, died at Nair Hospital in Mumbai after carrying a metal oxygen tank into a room housing an MRI scanner; the machine's magnetic field pulled Maru in, pinning his hand and breaching the tank, releasing liquid oxygen. An autopsy showed that Maru died instantly from pneumothorax brought on by exposure to very high levels of leaked oxygen.

● Elizabeth Isherwood, 60, walked naked into an airing cupboard at the villa she was renting and shut the door. When she tried to leave, part of the door handle broke off in her hand. She dug into the wall in an attempt to escape, but struck and burst a pipe, which sprayed water into the cupboard and caused her eventual death by hypothermia. She was found several days later. Why she had shut herself in the cupboard in the first place remained a mystery.
● Rebecca Burger, 33, died after a pressurized canister of whipped cream exploded and struck her in the chest. The injury caused Burger to go into cardiac arrest.
● Debra Bedard, 58, died after falling from a golf cart onto shards of wine glasses that had broken in her hands.
● Elisa Lam, from Vancouver, British Columbia, was missing for several weeks before being found dead in a large water tank on the roof of the Cecil Hotel in Los Angeles, after guests complained about the taste of the water.
● Peng Fan, a chef in Foshan, China, was bitten by a cobra's severed head, which he had cut off 20 minutes earlier while preparing a soup.
● Robert Dreyer, 89, drowned on his birthday after crashing his car into a fire hydrant. Dreyer successfully stepped out of his car, but was swallowed by a sinkhole likely created as a result of the destruction of the fire hydrant and subsequent water pressure.

● Charlie Holt, 5, was killed at the Sun Dial Restaurant, a rotating restaurant at the top of Westin Peachtree Plaza Hotel in Atlanta, Georgia; his head was caught in a small space between the rotating and non-rotating sections.
● On 21 November 2016, a powerful southerly change in Melbourne, Australia, resulted in the death of 10 asthmatic people who succumbed to respiratory failure. This was due to a stark wind (60 km/hour) that distributed ryegrass pollen into the moist air, rupturing them into very fine specks, particles small enough to enter people's lungs.
● Michael Scaglione died after smashing his golf club against a golf cart. The head broke off and impaled him in the throat, severing his jugular vein.
● Allan Pinkerton, the founder of the Pinkerton Detective Agency, was in Chicago, Illinois when he tripped on the pavement and severely bit on his tongue. His tongue became infected with gangrene, ultimately leading to his death.
● Isadora Duncan, broke her neck when her long scarf caught on the wheel of a car in which she was a passenger.
● Caleb Schwab, 10, was decapitated when he was ejected from his raft on Verrückt, a 168-foot-tall (51 m) water slide.
● Lottie Michelle Belk, 55, was fatally stabbed in the chest by a beach umbrella blown by a strong wind. Wind speeds at the time reached 20–25 miles per hour (32–40 km/h).

● V. Kamaraj, a 40-year-old Indian bus driver, was claimed by local Indian newspapers to have been killed by a meteorite which left a two-foot (61 cm) crater.
● Stephen Whinfrey, 50, became trapped and asphyxiated when rabbiting near Doncaster, England, after his head became stuck down a rabbit hole.
● Ravi Subramanian, an Air India technician, was sucked into an aircraft's jet engines.
● Charmayne Maxwell, died after falling backward while holding a wine glass. During the fall the wine glass shattered on the ground behind Maxwell's head, and the shards pierced her neck, causing profuse bleeding.
● Peter Biaksangzuala, an Indian association football player from Mizoram state, died after sustaining spinal cord injuries while awkwardly landing a somersault celebrating a goal.
● Frank Hayes, a 35-year-old jockey of Elmont, New York won his first and only race when he was dead. Riding a horse, Sweet Kiss, Frank suffered a fatal heart attack mid-race and collapsed on the horse. Sweet Kiss managed to still win with Frank Hayes' body on it, meaning he technically won.
● Garry Hoy, a lawyer in Toronto, fell to his death from the 24th floor of the Toronto-Dominion Centre while demonstrating to a group of visitors that the building's windows were "unbreakable." Hoy threw himself against the window, which did not break but popped out of its frame.

- Christophe de Margerie, an oil executive, was killed when his corporate jet collided with a snowplow reportedly driven by a drunk driver.
- Miguel Martinez, 14, from Lubbock, Texas, was impaled through the chest by the horn of a bull statue while playing hide-and-seek at night.
- Denver Lee St. Clair was asphyxiated by an "atomic wedgie" administered by his stepson during a fight. After St. Clair had been knocked unconscious, the elastic band from his torn underwear was pulled over his head and stretched around his neck, strangling him.
- João Maria de Souza, 45, was crushed in his bed by a cow falling through the roof of his home in Caratinga, Minas Gerais in Southeast Brazil. The cow had climbed on top of the house from a steep hillside behind it. Both the cow and de Souza's wife (who had been in bed next to him) were unharmed.
- An unnamed Belarusian fisherman, 60, bled to death after being bitten by a beaver which he had tried to grab in order to have his picture taken with it.
- A seven-year-old girl died after being struck by a stone thrown by an elephant from its enclosure at the zoo at Rabat, Morocco.
- Roger Mirro was crushed by a trash compactor while looking through a dumpster for his phone.
- 88-year-old Ilda Vitor Maciel died in a Brazilian hospital in Barra Mansa (south of state of Rio de Janeiro), as a result of nursing technicians injecting soup through her IV drip instead of her feeding tube.

- Erica Marshall, a 28-year-old British veterinarian in Ocala, Florida, died when the horse she was treating in a hyperbaric oxygen chamber kicked the wall, released a spark from its horseshoes which triggered an explosion.
- Jimmy Ferrozzo, died while engaging in sexual intercourse with his girlfriend Theresa Hill on a grand piano that was lowered from the ceiling by a hydraulic motor. Ferrozzo accidentally activated the lifting mechanism which pinned him against the ceiling leading to his suffocation. Hill survived the accident.
- Edward Archbold, 32, of West Palm Beach, Florida, choked on "arthropod body parts" during a cockroach-eating contest.
- Mike Edwards, 62, died when a large round bale of hay rolled down a hill and collided with the van he was driving.
- Muraka Jenny Vearncombe, 42, was decapitated by a piece of a metal pipe flung by a tractor-pulled lawnmower as she walked to work in Townsville, Australia.
- A 14-year-old boy from Jiaozhou, Shandong, China was killed when the pneumatic cylinder in his office chair exploded.
- Larry Ely Murillo-Moncada, a 25-year-old supermarket employee from Council Bluffs, Iowa, is believed to have fallen into the 18-inch gap between a cooler and a wall and become trapped. His body was not discovered for almost ten years, when the cooler was finally moved.

- A 43-year-old Irish mother of four died of an allergic reaction after having sex with a German Shepherd dog.
- Humberto Hernandez, a 24-year-old Oakland, California resident, was killed after being struck in the face by an airborne fire hydrant while walking. A passing car had struck the fire hydrant and the water pressure shot the hydrant at Hernandez with enough force to kill him.
- Steve Irwin was a world-renowned Australian wildlife expert died from blood loss after being pierced in the heart by a startled short-tail stingray's barb while filming in shallow water in the Great Barrier Reef during a lull in filming for Ocean's Deadliest.
- Michael Kosanovich, 21, was crushed to death by a 2002 Lexus IS300s automobile after its owner started it by remote control. The car rolled forward, and he was pinned between two vehicles.
- Truls Hellevik, a Norwegian diver, was explosively dismembered in a diving bell accident at the North Sea. Hellevik was exposed to an eight-atmosphere change in air pressure which instantaneously forced his body through a 60-centimetre-diameter (24 in) opening. Three other divers were also killed in the accident.
- Kenneth Pinyan died from injuries caused by anal sex with a stallion.
- Sam Ballard, 29, died from angiostrongyliasis (infection by a roundworm) after eating a garden slug as a dare eight years earlier.

- John Hutcherson drove home drunk with his friend Francis Brohm hanging out the passenger window. Hutcherson ran off the road and sideswiped a telephone-pole support wire, decapitating Brohm. Hutcherson continued the final 12 miles to his Atlanta, GA home, parked in the driveway and then went to bed. A neighbor found the headless body in the truck the next morning.
- Phillip Quinn, 24, from Kent, Washington, was killed when a lava lamp he was heating on a stove exploded and a shard pierced his heart.
- Hitoshi Nikaidoh, a doctor in Houston, Texas, was decapitated after his head was trapped in the doors of an elevator at his workplace.
- Brian Douglas Wells from Erie, Pennsylvania, was killed by an explosive collar around his neck, as part of a bank-robbery scheme.
- Michael Colombini, 6, died during an MRI scan at a New York-area hospital, after an oxygen tank was magnetically pulled into the machine and fractured his skull.
- Bliss Scott, 7, died after touching an African snail, from which she contracted meningo-encephalitis caused by Angiostrongylus cantonensis.
- Jonathan Capewell, 16, died from a heart attack brought on by the buildup of butane and propane in the blood after excessive use of deodorant sprays.
- William Snyder, a 13-year-old, died in San Francisco, California, when a circus clown swung him around by his heels.

- After watching the "Kung Fu Kapers" episode of The Goodies, Alex Mitchell laughed continuously for 25 minutes and then fell dead on his sofa from heart failure.
- Brandon Lee, 28-year-old film actor, martial artist, and son of Bruce Lee, was accidentally shot to death by co-star Michael Massee while filming a scene for The Crow, as the result of an improperly-loaded prop gun.
- Yulia Sharkom, 21, was trying to grab her 2-year-old daughter from her car through the half-open front seat window in Belarus when her neck was jammed by the window after her daughter pressed the automatic switch. She died eight days later, having suffered asphyxia leading to brain damage.
- Henry Taylor, a pall bearer at Kensal Green Cemetery in London, tripped over a stone and stumbled as he was carrying a coffin. The other pall bearers let go of the coffin and it fell on top of Taylor, crushing him to death in front of all the mourners. The widow of the man in the coffin reportedly "nearly went into hysterics".

2 Stressors

These are common stresses which can affect you in a survival situation.

Physiological Stressors

In a survival situation, individuals face a complex interplay of physical and psychological demands that act as significant stressors. These stressors can severely impact decision-making, physical performance, and overall well-being.

Hunger & Thirst

The fundamental lack of food and water creates intense physiological stress. Dehydration can quickly lead to fatigue, dizziness, impaired cognitive function, and eventually organ failure. Starvation causes weakness, metabolic changes, and a severe reduction in energy and mental acuity. Prolonged hunger can lead to "hanger," affecting mood and judgment.

Sleep Deprivation

The inability to get adequate, restorative sleep due to fear, discomfort, or the need for vigilance significantly impairs cognitive abilities, including decision-making, problem-solving, memory, and concentration. It also negatively affects physical coordination, mood regulation, and can lead to hallucinations in extreme cases.

Extreme Temperatures

Exposure to severe cold (hypothermia) or extreme heat (hyperthermia) directly stresses the body, requiring immense energy to maintain core temperature. This can lead to exhaustion, confusion, and loss of consciousness.

Injury and Illness

Physical injuries, no matter how minor, cause pain, limit mobility, and drain energy. Illnesses, often exacerbated by exposure, poor hygiene, and nutritional deficiencies, further weaken the body and distract the mind.

Fatigue and Exhaustion

The cumulative effect of physical exertion, lack of rest, and the physiological demands of survival can lead to profound fatigue, making even simple tasks overwhelming and increasing the risk of accidents.

Psychological Stressors

Fear and Anxiety

The constant threat of danger (animals, harsh environment, unknown future) triggers the "fight, flight, or freeze" response, leading to heightened anxiety, panic attacks, and impaired rational thinking.

Uncertainty and Lack of Control

Not knowing when rescue will come, where the next meal will be, or if help is available creates immense psychological distress and can lead to feelings of helplessness and hopelessness.

Isolation and Loneliness

Being alone for extended periods can lead to profound psychological effects, including depression, hallucinations, and a loss of will to survive. Even with others, a breakdown in group dynamics can add stress.

Decision-Making Pressure

Every choice in a survival situation can have life-or-death consequences. The constant need to make critical decisions under extreme duress, often with incomplete information, is a major source of stress.

Boredom and Monotony

While it might seem counterintuitive, periods of inactivity or repetitive tasks can lead to boredom, which can erode morale, focus, and mental resilience.

Loss of Hope/Despair

When all efforts seem to fail and the situation appears insurmountable, individuals can experience profound despair, leading to a loss of motivation and the will to continue.

Guilt or Responsibility

If others are involved, feelings of guilt over perceived failures or an overwhelming sense of responsibility for their safety can be immense stressors.

3 Resource Priority

This is an ordered list of what your priorities should be when in a survival situation. Each of them is explained in more detail below.

Positive Mental Attitude	As attested by those who have survived wilderness emergencies, a positive mental attitude may be the most essential element in survival.
First Aid	If an injury is life threatening, such as rapid loss of blood, first aid becomes the most important thing to do.
Shelter	Extreme weather conditions such as extreme heat or cold make finding or building a shelter of high importance. At such times even painful but minor injuries must wait until shelter is available. This is even more urgent if night is approaching.
Fire	Often, along with shelter, you will need a fire for warmth and signalling. Fuel should be secured and the fire started before dark.

Signalling	Signalling. When you have taken the first steps in dealing with the emergency, you will need to prepare rescue signals.
Water	Water. Under all circumstances, water is essential. You can live only a few days without it. Finding water is even more urgent when the weather is hot and dry.
Food	A person can live several weeks without food; it does not rate high as a survival priority.
Companionship	Humans are made to have company. Going without another person, or another form of life can literally send someone insane over a long period.

Positive Mental Attitude

Positive Mental Attitude (PMA) is the philosophy that having an optimistic disposition in every situation in one's life attracts positive changes and increases achievement. By keeping optimistic you can combat the 3 Seconds Without Hope rule whereby with no hope you will surely die. Being focused on survival and knowing you can succeed is the biggest advantage you will have over everybody else in a disaster who will see the situation as hopeless. If you aren't in a positive state of mind yet there's no point going any further down the list until you're dedicated to surviving. If you're reading this, you're obviously alive and that's the only prerequisite you need. You're here for a reason and you're survived everything up until now so don't quit!

For more information on your mental state see the POPULATION > Psychology section.

First Aid

Healing your body is the next step required. If you're injured in any way be sure to take care of it immediately as it could get infected.

For more information on first aid and medical related issues, see either the MEDICAL, MEDICATION, ILLNESS, INJURY, EMOTIONAL or NATURAL REMEDIES sections.

Shelter

Start to look for or construct a shelter if one isn't readily available, this should be done as a top priority if there's extreme adverse weather such as a hurricane, blizzard or sandstorm occurring.

For more information on shelters, shelter building and house repairs, see the SHELTER section.

Fire

A fire will restore morale and keep you warm as well as letting you cook food and boil water. Fire is often a prerequisite for water which requires boiling if there's no filters available. Fire is often a prerequisite for signalling for help by using the smoke and flames to catch people's attention.

For more information on fires and signalling see the FIRE and COMMUNICATION sections.

Water

A source of water is next to accomplish. Be sure it's free from pathogens and you have enough to sustain your body's needs with some spare.

For more information on water, see the WATER section.

Signalling

Set up a signal fire nearby and have your campfire on standby to light it if you hear or see a plane or boat.

For more information on signalling see the COMMUNICATION section.

Food

Another requirement is food. Ensure you can forage or hunt for food in your location to sustain your body. You should always have adequate water before thinking about food or eating it as it takes quite a lot of water to process it.

For information on finding food and cooking food, see the FOOD, COOKING, RECIPES, HUNTING, FISHING, PLANTS, and ANIMALS sections.

Companionship

4 Documentation

During any survival situation you should keep a record of all events, particularly discoveries of edible plants and other nearby resources. Keep a track of what day it is for morale and remember small things like birthdays to keep your spirits high. It's also useful to create a map of the local landscape to help you plan for the future and potential future disasters such as flooding.

Documenting can stave away boredom and loneliness and keep your mind occupied. Research the surrounds of your area thoroughly and learn what plants can be used for food, water and medicine. Know what predators are in the area and how to keep them at bay.

Documenting

Here you will find tips on what to document and how to document them properly so you can refer back to your notes and understand any valuable information you have noted during your surviving period.

Pre-Planning for Documentation

Gather Basic Tools:
- Writing Utensils: Waterproof pens, pencils.
- Notebook/Paper: Waterproof paper (Rite in the Rain is excellent), durable notebook, or a logbook.
- Digital Devices: Charged smartphone, camera, voice recorder. Consider spare batteries, power banks, and solar chargers.
- Secure Storage: Waterproof bag/container for documentation tools and collected data.
- Makeshift Book: Rocks, Inner Bark & Leaves can all make useful writing surfaces, with Charcoal, plant juices or soot being ink replacements.

Establish a System:
- Decide on a format (e.g., chronological journal, specific forms).
- Consider establishing codes or abbreviations for common events or observations to save time.

What to Document

Date and Time
- Always begin each entry with the precise date and time. This is fundamental for chronological understanding. If you aren't sure of the date, you could note the date you believe it to be on the first entry and put down "Day 2, 3.. etc" for the remainer.

Location
- Specific Address/GPS Coordinates: As exact as possible.
- Relative Location: If GPS is unavailable, landmarks, distances from known points, terrain features.
- Changes in Location: Note every move, including direction, distance, and reason for movement.

Environmental Conditions
- Weather: Temperature (estimated or actual), precipitation (rain, snow, hail), wind (direction, strength), cloud cover, sunlight conditions.
- Terrain: Condition of ground (wet, dry, muddy), accessibility, hazards (fallen trees, landslides, floods).
- Natural Hazards: Fires, floods, storms, earthquakes, wildlife encounters.

Personal Status
- Physical Health: Injuries (type, severity, treatment), symptoms of illness, fatigue levels, hydration status (water intake), hunger (food intake).
- Mental/Emotional State: Mood, stress levels, clarity of thought, any signs of panic or despair, morale.
- Vitals (if monitored): Heart rate, respiratory rate.
- Clothing/Gear Status: Condition, any damage or loss.

Actions Taken
- Decisions Made: What decisions were made and why (e.g., "Decided to move east due to rising water").
- Tasks Performed: Building shelter, purifying water, foraging, signaling, administering first aid, maintaining equipment, attempting communication.
- Resources Used: What resources were consumed (food, water, fuel, medical supplies).
- Failures/Challenges: What didn't work and why.

Observations
- Sensory Details: Sights, sounds, smells (e.g., "saw smoke to the west," "heard distant sirens," "smelled burning plastic").
- Signs of Life/Activity: Human (footprints, distant lights, aircraft, rescue efforts), animal (wildlife, domestic animals), vegetation changes.
- Damage/Impacts: To infrastructure, natural environment, property.
- Resource Availability: Potential water sources, edible plants, shelter materials.

Communication Attempts
- Method: Radio, phone, satellite phone, signaling (fires, mirrors).
- Time: When attempts were made.
- Outcome: Success/failure, content of communication.
- Contacts: Who was contacted.

Group Dynamics
- Number of People: Initially and any changes.
- Names/Roles: Of individuals.
- Individual Status: Health and morale of others.
- Interactions: Conflicts, cooperation, leadership.

How to Document

Maintain a Chronological Journal/Log
- Regular, timestamped entries are crucial. Even short notes are better than nothing.
- Be consistent, even when tired or stressed.
- Use a simple, clear writing style.
- If using paper, number pages for easy reference.

Photographs and Videos
- Capture Context: Don't just focus on damage; show scale, location, and the general environment.
- Timestamp: Ensure your camera/phone is set to the correct date and time.
- Variety: Take wide shots, close-ups, and sequential photos showing progression.
- Selfies (for personal status): Can be useful for documenting physical changes or injuries.
- Video: Can capture movement, sounds, and a more dynamic sense of the situation. Narrate if possible.

Voice Recordings
- If writing is difficult (e.g., in the dark, cold, or injured), use a voice recorder or smartphone.
- State date, time, and your location at the beginning of each recording.
- Speak clearly and concisely.

Maps and Sketches
- If possible, mark your route, hazards, resource locations, and significant observations on a map.
- Simple sketches can convey information about shelter construction, injuries, or unknown objects more effectively than words alone.

Be Objective and Factual
- Stick to observations and actions. While emotions are valid, try to keep documentation factual for later analysis.
- Avoid assumptions or speculation. Note what you see and do.

Secure and Back Up Data
- Protect physical notes from water, fire, and loss.
- If using digital devices, consider how you will power them and if you can transfer data to a more secure, off-site storage method (e.g., cloud storage, external hard drive) when possible.

Planning

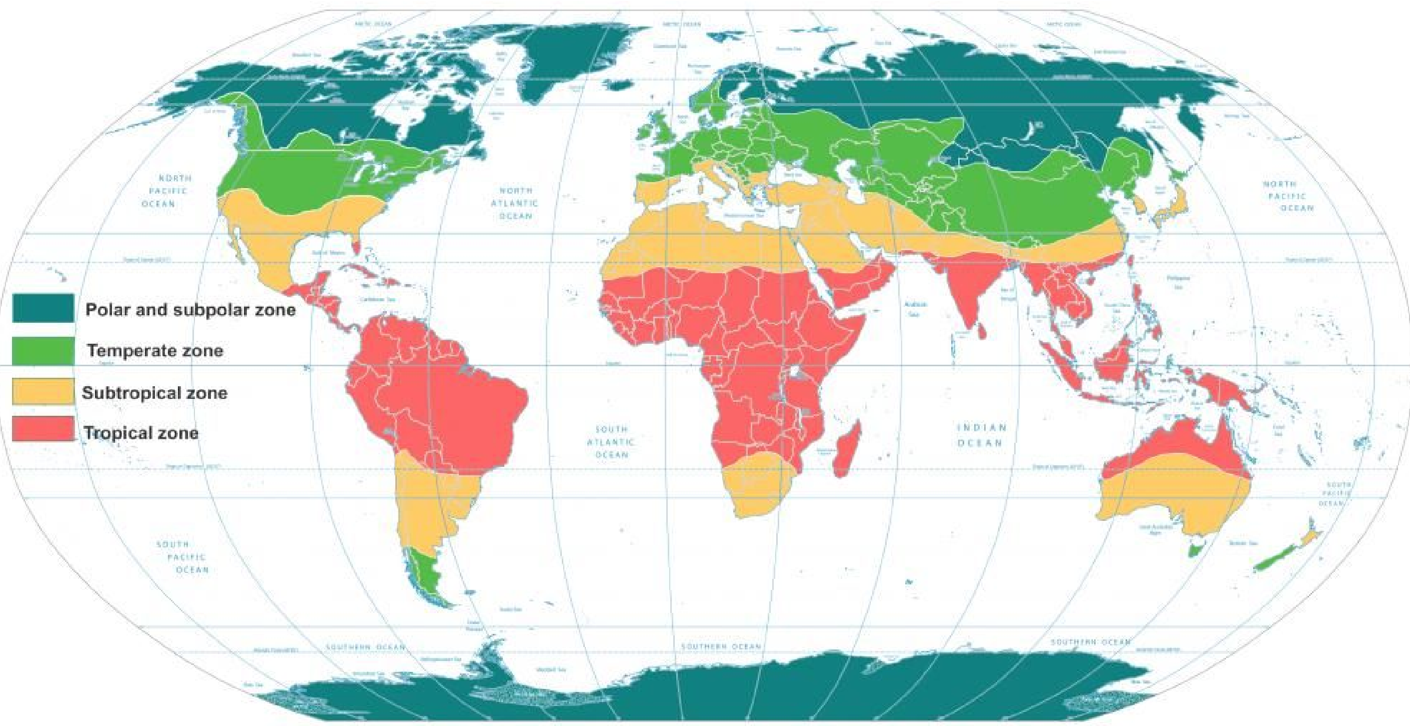
This section details how you can best plan for wilderness survival if you know you'll be in a certain area when disaster strikes.

Entry Phase The entry into the operation field.	**Objectives** The objectives to complete during the mission.	**Recovery** The plan for evacuation and returning home.	**Contingency Plans** Backup plans in case things take a turn or don't work out.		

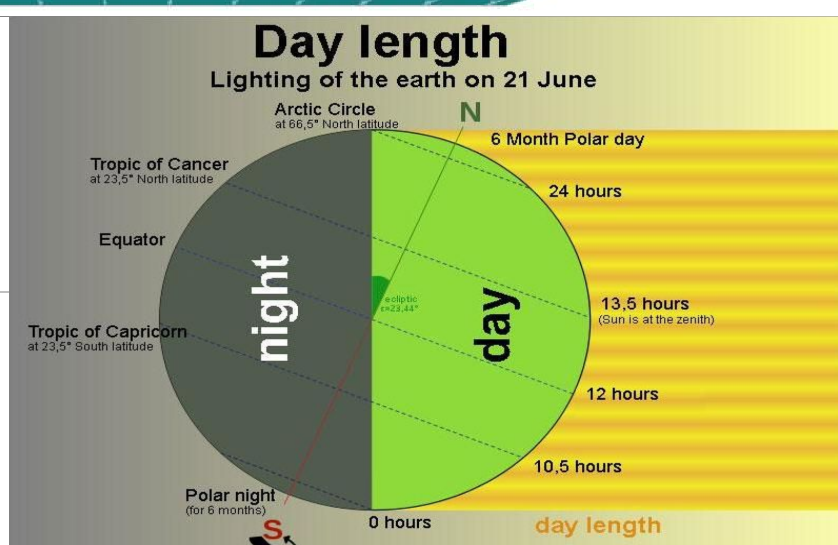
5 Climate

Climate refers to the average weather conditions in a particular region over a long period, typically 30 years or more. It encompasses patterns of temperature, precipitation, humidity, wind, and other atmospheric phenomena. Unlike weather, which describes day-to-day atmospheric conditions, climate represents the expected range and variability of these conditions over an extended timeframe.

Climate Zones



Legend
- **Dark Green**: Polar and Subpolar Zones
- **Green:** Temperate Zones
- **Orange:** Subtropical Zones
- **Red:** Tropical Zones



Tropical Zone

Tropical Zone

Tropical Zone 0°–23.5°	In the regions between the equator and the tropics (equatorial region), the solar radiation reaches the ground nearly vertically at noontime during almost the entire year. Thereby, it is very warm in these regions. Through high temperatures, more water evaporates and the air is often moist. The resulting frequent and dense cloud cover reduces the effect of solar radiation on ground temperature.			
Area Around the equator, from 23.5° further north to 23.5° southern latitude	**Sun Path** Sun at the zenith (90°) at least once per year, never lower than 43°	**Average Temperature** >20 to 30°C (68 to 86°F)	**Minimal Temperature** 0°C (32°F) (no frost) **Maximal Temperature** Up to 40°C (104°F) (seldom more)	**Climate** Humid - warm. Often precipitation (humid), sometimes (short) drought. "Day time" instead of "season climate" (daily changes in temperature are bigger than the annual changes of daily averages).
Day Length 10 to 13.5 hours	**Precipitation** Rain - will be defined by trade winds and its seasonal shift		**Vegetation** Evergreen forests, savannah	**Properties** More than 40% of Earth's population live in the tropics, with an increasing tendency

Subtropical Zone

Subtropical Zone 23.5°–40°	The subtropics receive the highest radiation in summer, since the Sun's angle at noon is almost vertical to the Earth, whilst the cloud cover is relatively thin. These regions receive less moisture (see trade winds), what increases the effect of radiation. Therefore, most of the deserts in the world are situated in this zone. In winter, the radiation in these regions decreases significantly, and it can temporarily be very cool and moist.			
Area Between the tropical zone and the temperate zone (25° to 40° North and South latitude)	**Sun Path** 90 to 27° above the horizon, according to place and season	**Average Temperature** >20 to 35°C (68 to 95°F)	**Minimal Temperature** -5°C (23°F) **Maximal Temperature** +66°C (150.8°F) (Libya, Iran)	**Climate** Tropic summer, non-tropic winter
Day Length 9 to 15 hours	**Precipitation** Dry, winter humidity and always wet areas		**Vegetation** Semi-deciduous or evergreen forests, hardwood forests with winter rain, savannah, pasture land, semi-desert, warm temperate moist forests, nemoral deciduous forests.	**Properties** Extreme heat, strong precipitation and drought in some areas

Temperate Zone

Temperate Zone 40°–60°	In the temperate zone, the solar radiation arrives with a smaller angle, and the average temperatures here are much cooler than in the subtropics. The seasons and day length differ significantly in the course of a year. The climate is characterised by less frequent extremes, a more regular distribution of the precipitation over the year and a longer vegetation period - therefore the name "temperate".			
Area Between the cold zone and the subtropical zone (40° to 60°)	**Sun Path** Maximum 73°, minimum 0° (at Arctic Circle)	**Average Temperature** Between 0 and 20°C (32 to 68°F)	**Minimal Temperature** -40°C (-40°F) **Maximal Temperature** +40°C (104°F)	**Climate** Warm and cold temperate
Day Length 4 to 16 hours 8 to 12 hours at 50°N	**Precipitation** From 300 to 2000 mm, average 800 mm		**Vegetation** Deciduous forests, warm temperate forests, savannah	**Properties** Extreme temperature and precipitation is rare

Cold Zone

Cold Zone 60°–90°	The polar areas between 60° latitude and the poles receive less heat through solar radiation, since the Sun has a very flat angle toward the ground. Because of the changes of the Earth axis angle to the Sun, the day length varies most in this zone. In the summer, polar days occur. Vegetation is only possible during a few months per year and even then is often sparse. The conditions for life in these regions are very hard.			
Area 60° to 90° North and South latitude	**Sun Path** 53° above the horizon (polar day) to under the horizon (polar night)	**Average Temperature** -47 to 0°C (-52.6 to 32°F)	**Minimal Temperature** -89°C (-128.2°F) (Antarctica) **Maximal Temperature** +25°C (77°F) (Tundra)	**Climate** Ice climate (average temperature of the warmest month below 0°C (32°F)), and tundra climate (average temperature of the warmest month between 0 and 10°C (32°F and 50°F)
Day Length 0 to 24 hours (polar night respectively polar day)	**Precipitation** Variable, mostly in the form of snow		**Vegetation** Polar area: scarce Tundra: moss, lichens, grass, boreal forest with conifer wood	**Properties** Hostile to life, polar lights

Earth's Climate

Details on the different climates on planet earth.

Polar Regions

The polar regions are the coldest areas on Earth, located at the planet's northernmost and southernmost extremities. Defined generally by the Arctic and Antarctic Circles (approximately 66.5 degrees North and South latitude), these regions experience extreme variations in daylight, including periods of 24-hour darkness in winter and 24-hour daylight in summer, due to the Earth's axial tilt.

Characterized by incredibly low temperatures, substantial ice and snow cover, and unique ecosystems, the polar regions play a critical role in regulating global climate by reflecting solar radiation back into space.

Ice Sheet

an ice sheet is a massive, continental-scale body of glacial ice that covers a large land area, typically exceeding 50,000 square kilometers (about 19,000 square miles). These vast ice masses are formed by the accumulation and compression of snow over thousands of years.

Polar Desert

A polar desert is a type of cold desert found in the Earth's polar regions, primarily the Arctic and Antarctic. Despite being covered in vast amounts of ice and snow, they are considered deserts due to extremely low precipitation.

Tundra

Tundra is a distinct biome characterized by its treeless landscape, a direct result of extremely cold temperatures, strong winds, and a permanently frozen layer of subsoil known as permafrost. While the surface soil thaws briefly during the short, cool summers, this shallow thaw is insufficient for deep-rooted trees to establish. Instead, the vegetation consists primarily of low-growing plants like mosses, lichens, sedges, and dwarf shrubs, all adapted to the harsh conditions.

Despite often being covered in snow, tundra regions receive very little annual precipitation, sometimes earning them the moniker "cold deserts." These conditions create a unique environment found predominantly in the far Northern Hemisphere as Arctic tundra, encircling the pole, and also at high altitudes on mountains worldwide, known as alpine tundra.

Arctic Tundra

Found in the far Northern Hemisphere, circling the North Pole and extending south to the taiga (boreal forest).

Alpine Tundra

Located on high mountains around the world, above the treeline where temperatures are too low for trees to grow.

Northern Coniferous Forest

The Northern Coniferous Forest, also widely known as the Boreal Forest or Taiga, is the largest terrestrial biome on Earth, forming a vast, circumpolar belt across the high northern latitudes of North America, Europe, and Asia. This biome is characterized by its long, cold, and often snowy winters, coupled with short, cool, and moist summers. The dominant vegetation consists of coniferous evergreen trees like spruce, fir, and pine, which are uniquely adapted to these harsh conditions.

Their needle-like leaves, often coated in wax, help reduce water loss and allow them to photosynthesize even in cooler temperatures, giving them a head start on growth in spring compared to deciduous trees.

Beneath the dense canopy of these conical trees, which allows snow to easily slide off their branches, the forest floor typically has a thin, acidic, and nutrient-poor soil layer. This is due to the slow decomposition of conifer needles in the cold climate and the leaching of nutrients by acidic precipitation. Despite the limited biodiversity compared to warmer biomes, the Northern Coniferous Forest supports a variety of cold-adapted wildlife, including moose, bears, wolves, lynx, and various bird species, many of which migrate or adapt to the long winters through hibernation or specialized diets. This immense forest plays a crucial role in global carbon cycling, storing vast amounts of carbon, particularly in its extensive peatlands and slow-decomposing organic matter.

Taiga

Taiga, also known as boreal forest or snow forest, is a biome characterized by coniferous forests consisting mostly of pines, spruces and larches.

Deciduous Forest

A deciduous forest is a type of biome characterized by trees that seasonally shed all of their leaves, typically in autumn. The word "deciduous" itself comes from Latin, meaning "to fall off." This shedding of leaves is an adaptation to conserve water and energy during colder winter months or dry seasons when photosynthesis is less efficient or impossible.

Before dropping, the leaves of these trees often change color to vibrant reds, oranges, yellows, and browns, creating the spectacular displays associated with autumn in many parts of the world.

These forests are predominantly found in temperate regions across the middle latitudes, including large areas of eastern North America, western Europe, and northeastern Asia. They thrive in climates with four distinct seasons: warm, wet summers ideal for growth, and cold winters during which the trees enter a dormant state. The decomposition of the annually shed leaves enriches the soil with nutrients, making the ground in deciduous forests typically fertile. This nutrient-rich soil, combined with moderate precipitation distributed throughout the year, supports a diverse array of plant and animal life that have adapted to the seasonal changes, with many animals hibernating or migrating during the colder months.

Temperate Broadleaf Forest

Temperate broadleaf and mixed forest is a temperate climate terrestrial biome, with broadleaf tree ecoregions, and with conifer and broadleaf tree mixed coniferous forest ecoregions.

Temperate Grassland

Temperate grasslands are a major terrestrial biome characterized by vast open spaces dominated by grasses, with very few trees or large shrubs. These ecosystems are typically found in mid-latitude regions across continents, far from the moderating influence of oceans.

They experience distinct seasonal changes, with hot summers and cold winters, often with significant temperature fluctuations both seasonally and even within a single day. Rainfall is moderate, generally ranging from 250 to 900 millimeters (10 to 35 inches) annually, which is sufficient to support grasses but not enough for widespread tree growth.

The absence of trees in temperate grasslands is also maintained by factors like seasonal droughts, occasional natural fires (often ignited by lightning), and grazing by large native herbivores. The soil in these regions is typically deep, dark, and exceptionally fertile due to the extensive, densely branched root systems of the grasses. When these roots die and decompose, they contribute a rich layer of organic matter (humus) to the soil, making temperate grasslands some of the most productive agricultural lands in the world. Examples of temperate grasslands include the prairies of North America, the steppes of Eurasia, the pampas of South America, and the veld of South Africa.

Dry Steppe

The Dry Steppe is a particular type of grassland biome that represents a transition zone between the more humid temperate grasslands and true deserts. It's characterized by a semi-arid climate, meaning it's too dry to support forests but not quite dry enough to be a full desert. Key features of a dry steppe include very low annual precipitation, typically less than 250-400 millimeters (10-16 inches), which falls erratically throughout the year. This limited rainfall results in shorter, sparser grasses compared to the taller, denser vegetation found in more humid temperate grasslands like prairies. Trees are generally absent except along watercourses.

Dry steppes experience significant temperature extremes, with hot summers and cold winters, often with large diurnal (daily) temperature swings. The soils are often less fertile than those of the wetter grasslands and are more prone to erosion due to less continuous vegetation cover. Examples include parts of Central Asia (the traditional "steppe" regions), the Patagonian steppe in Argentina, and the fringes of many subtropical deserts.

Temperate Steppe

Temperate Steppe is a type of grassland biome found in the Earth's mid-latitudes, characterized by a semi-arid continental climate. This means it experiences distinct seasons with hot summers and cold winters, often with significant temperature fluctuations throughout the day. While it receives more precipitation than a true desert, it's not enough to support the growth of large forests, leading to a landscape dominated by grasses and scattered shrubs. The amount of rainfall, which typically ranges from 250 to 500 millimeters (10 to 20 inches) annually, determines the density and height of the grass cover.

Compared to other temperate grasslands like the North American prairies, which tend to be more humid and support taller grasses, the temperate steppe generally features shorter, sparser grasses. This is partly due to lower and more erratic rainfall. The soils of temperate steppes, though often rich in organic matter from decaying grass roots, can be less fertile and more prone to erosion than those of wetter grasslands. These vast, treeless plains are found in continental interiors, such as the expansive Eurasian Steppe, parts of the Great Plains in North America, and the Patagonian steppe in South America, supporting a variety of grazing animals and resilient plant life adapted to the dry, windy conditions.

Mediterranean Regions

A Mediterranean Region is defined by a specific type of climate known as a Mediterranean climate, which is characterized by hot, dry summers and mild, wet winters. This distinct seasonal pattern is a key defining feature, as most other regions with warm summers receive their highest precipitation during those hotter months.

These regions are typically found in the mid-latitudes, roughly between 30° and 45° North and South of the equator, and almost exclusively on the western coasts of continents. The name originates from the Mediterranean Basin, where this climate is most widespread, but it also occurs in other scattered locations globally, including parts of California, central Chile, the southwestern tip of South Africa, and parts of southern and southwestern Australia.

The vegetation in these regions is highly adapted to the unique rainfall pattern, often featuring evergreen shrubs and small trees with leathery leaves, deep root systems, and adaptations to frequent wildfires.

Mediterranean Vegetation

Mediterranean vegetation, any scrubby, dense vegetation composed of broad-leaved evergreen shrubs, bushes, and small trees usually less than 2.5 m (about 8 feet) tall and growing in regions lying between 30° and 40° north and south latitudes.

Tropical Forests

Tropical forests are expansive forested regions found in the Earth's tropical zones, primarily located between the Tropic of Cancer and the Tropic of Capricorn, which are roughly 23.5 degrees north and south of the equator. These biomes are characterized by consistently warm temperatures throughout the year, typically ranging between 20°C (68°F) and 29°C (85°F), with very little seasonal variation. They also receive significant amounts of annual rainfall, making them incredibly humid environments.

This combination of consistent warmth and abundant moisture fosters an astonishing level of biodiversity, housing an immense variety of plant and animal species, often accounting for a disproportionately large percentage of the world's total species despite covering a relatively small portion of the Earth's land surface.

While often synonymous with "rainforests," the term "tropical forests" actually encompasses a broader range of forest types based on their specific rainfall patterns. Tropical rainforests are the most well-known, experiencing high rainfall year-round with no distinct dry season. Other types include seasonal tropical forests (also known as tropical moist deciduous forests or monsoon forests), which have a pronounced wet and dry season, with trees shedding their leaves during the drier periods.

There are also tropical dry forests, which experience an even longer and more intense dry season, leading to more drought-adapted vegetation, and specialized types like cloud forests (found at higher altitudes with persistent mist and fog) and mangrove forests (found in coastal, brackish water environments). Despite their incredible ecological importance as carbon sinks and biodiversity hotspots, tropical forests worldwide face significant threats from deforestation, agricultural expansion, and climate change.

Tropical Rainforest

Tropical rainforests are the most biodiverse and lush type of tropical forest, characterized by consistently high temperatures and very abundant rainfall throughout the year, with no distinct dry season. They are primarily located in a band around the Earth's equator, between the Tropic of Cancer and the Tropic of Capricorn. This continuous warmth and moisture create ideal conditions for incredibly dense and tall vegetation, dominated by broad-leaved evergreen trees that form multiple layers, including an emergent layer of towering trees, a dense canopy that blocks much of the sunlight, an understory, and a relatively clear forest floor.

Despite their incredible richness in plant and animal species – housing an estimated 50% or more of the world's total biodiversity – the soils in tropical rainforests are often surprisingly poor in nutrients. This is because the high rainfall rapidly leaches nutrients away, and the incredibly fast decomposition rates mean that nutrients are quickly taken up by the dense plant life rather than being stored in the soil. The rapid cycling of nutrients, coupled with the consistent warm and wet conditions, makes tropical rainforests incredibly productive ecosystems, playing a vital role in global climate regulation and the water cycle.

Subtropical Rainforest

A Subtropical Rainforest is a type of dense, evergreen forest found in regions that transition between tropical and temperate climates. It shares many characteristics with true tropical rainforests, but it's typically located further from the equator, generally between 23.5° and 35° north and south latitude. This geographical position means that while they still experience consistently warm temperatures and high humidity year-round, they may have a slightly cooler average temperature than tropical rainforests, and can sometimes exhibit more seasonal variation, including a less pronounced but still present dry season or occasional cooler periods.

In terms of flora and fauna, subtropical rainforests are incredibly biodiverse, though perhaps slightly less so than their tropical counterparts. They feature a multi-layered canopy of tall, broad-leaved evergreen trees, many of which exhibit buttressing (flared bases for support) similar to tropical species. Large woody vines (lianas) and abundant epiphytes (plants that grow on other plants, like orchids and ferns) are also common. These forests typically thrive on fertile soils, often derived from basalt or alluvium, and require substantial annual rainfall, generally exceeding 1300mm. Significant examples of subtropical rainforests are found in regions like eastern Australia, the southeastern United States, and parts of southern China and Brazil.

Subtropical Dry Forest

A Subtropical Dry Forest is a type of forest biome that occupies a transitional zone between the more humid subtropical rainforests and drier grasslands or deserts. Unlike rainforests that receive consistent rainfall, subtropical dry forests are defined by a distinct seasonality in their precipitation, experiencing hot, rainy summers and long, pronounced dry seasons. While temperatures remain warm to hot year-round, the extended periods of drought are the key environmental factor shaping these ecosystems.

The vegetation in subtropical dry forests is highly adapted to cope with these dry periods. While many species are deciduous, shedding their leaves during the dry season to conserve water (similar to temperate deciduous forests but driven by drought, not cold), some are evergreen, featuring adaptations like thick, leathery leaves or waxy coatings to minimize water loss. The canopy is generally lower and less dense than in rainforests, and the presence of thorny shrubs and succulents can be common. These forests support a diverse range of wildlife that also exhibit adaptations to the dry conditions, such as seasonal migrations or estivation (a state of animal dormancy, similar to hibernation, characterized by inactivity and a lowered metabolic rate, that occurs in response to high temperatures and arid conditions). You can find examples of subtropical dry forests in regions like parts of Queensland and New South Wales in Australia (often referred to as "dry rainforests" or "dry vine thickets"), Mexico, South America, and Africa.

Monsoon Forest

A Monsoon Forest, also known as a tropical deciduous forest or tropical seasonal forest, is a type of forest biome characterized by its distinct wet and dry seasons, a result of the powerful influence of monsoon winds. Unlike tropical rainforests that receive high rainfall year-round, monsoon forests experience a hot, very rainy summer (the monsoon season) followed by a long, pronounced dry season. This dramatic shift in precipitation dictates the life cycle of the vegetation.

During the wet season, the forest is lush and green, with trees in full leaf, often appearing similar to a rainforest. However, as the dry season approaches, most trees adapt by shedding their leaves to conserve precious water, a process that can lead to the forest looking quite barren and open. The trees in these forests are generally not as tall or dense as those in rainforests, and the undergrowth can vary from sparse during the dry season to quite thick during the wet. These forests are found in tropical regions where monsoon circulation is a dominant climatic factor, including parts of South and Southeast Asia, northern Australia, Africa, and Central and South America. They play a vital ecological role, supporting diverse wildlife adapted to the seasonal changes.

Montane Forest

A Montane Forest is a type of forest ecosystem found at higher elevations in mountainous regions around the world. The term "montane" literally means "of or inhabiting mountains." These forests exist in a distinct altitudinal zone, typically above lowland forests and below the treeline (where the forest gives way to alpine tundra or bare rock). The specific elevation range varies greatly depending on latitude and local climate; for instance, montane forests in tropical regions will be found at much higher altitudes than those in temperate or boreal zones.

The climate of a montane forest is generally cooler and often wetter than that of the surrounding lowlands due to increased elevation. This cooler temperature, combined with frequent cloud cover, mist, and higher precipitation (often including snow), creates a unique environment. The vegetation of montane forests is highly diverse, ranging from coniferous trees (like pines, firs, and spruces) in temperate and boreal mountains to broadleaf evergreen species in tropical montane regions. Trees often exhibit adaptations to the cooler temperatures, strong winds, and shallower, rockier soils, sometimes appearing stunted or gnarled at higher elevations. The presence of mosses, lichens, and epiphytes (plants growing on other plants) is often abundant, especially in "cloud forests," which are a specific type of montane forest perpetually shrouded in mist. These forests are vital for biodiversity, watershed protection, and carbon sequestration.

Savannah

A savanna (also spelled savannah) is a type of grassland biome characterized by vast open spaces dominated by grasses, but unlike temperate grasslands, they have scattered trees and shrubs that are widely spaced, preventing a closed canopy from forming. The defining feature of savannas is their distinct seasonal climate, with a hot, rainy summer followed by a long, pronounced dry season. This seasonal rainfall pattern, along with factors like frequent natural fires and the grazing of large herbivores, prevents the widespread growth of dense forests, allowing grasses to thrive.

Savannas are most extensively found in tropical and subtropical regions, particularly across large parts of Africa (famous for its iconic wildlife like lions, elephants, and giraffes), South America, Australia, and parts of Asia.

The specific types of trees and grasses vary by region, but common adaptations include deep root systems to access water during dry periods, thick bark to resist fires, and deciduous habits (shedding leaves) during the dry season. Savannas are crucial ecosystems for global biodiversity and play a significant role in carbon cycling, acting as a transitional zone between lush tropical rainforests and arid deserts.

Grass Savannah

A Grass Savanna is a specific type of savanna biome that is predominantly characterized by its extensive grass cover, with trees and shrubs being either completely absent or extremely sparse and widely scattered. While all savannas feature grasses as a dominant vegetation component, a "grass savanna" emphasizes the minimal presence of woody plants. This open landscape is maintained by a combination of factors, including a distinct wet and dry season (where the dry season often leads to natural fires), low and often erratic rainfall that discourages widespread tree growth, and the intensive grazing pressure from large herbivores.

These environments are typically found in tropical and subtropical regions, acting as a transition zone between true grasslands and areas with more tree cover. The grasses, which are often tall and coarse, are well-adapted to the seasonal changes, growing rapidly during the wet season and often dying back or turning brown during the dry season to conserve water. The deep root systems of these grasses enable them to survive droughts and recover quickly after fires, which are a natural and important part of maintaining the grass-dominated landscape by clearing out woody seedlings.

Tree Savannah

A Tree Savanna is a specific type of savanna biome that features a more prominent presence of trees compared to a pure "grass savanna," though the trees are still widely scattered and do not form a closed canopy like in a forest. This open woodland-grassland structure allows ample sunlight to reach the ground, supporting a continuous layer of grasses and other herbaceous plants. The density of trees in a tree savanna can vary significantly, but generally, their spacing is sufficient to prevent them from completely shading out the understory.

Like all savannas, tree savannas are characterized by a distinct seasonal climate with hot, rainy summers and prolonged dry seasons. The trees present in these ecosystems are highly adapted to these conditions, often exhibiting features like deep taproots to access groundwater during droughts, thick bark to resist frequent fires, and deciduous habits where they shed their leaves during the dry season to conserve moisture. Common tree species vary by region, but examples include acacia and baobab trees in Africa, and various eucalyptus species in Australia. The balance between trees and grasses in a tree savanna is maintained by a complex interplay of factors including rainfall patterns, soil conditions, frequency of fires (which can suppress tree growth), and the grazing activities of large herbivores.

Desert

A desert is an extremely arid land area characterized by very low precipitation, typically receiving less than 250 millimeters (10 inches) of rain per year. This severe lack of available moisture is the defining feature, making water the most limiting factor for life. As a result, deserts support only sparse vegetation, with plants and animals exhibiting specialized adaptations to survive the harsh, dry conditions.

Despite the common image of hot, sandy landscapes, deserts can occur in various forms and temperatures. While many are indeed hot with significant daily temperature swings (very hot days and cold nights), "cold deserts" or "polar deserts" also exist in high latitudes, where precipitation is similarly low but temperatures are consistently freezing.

The lack of dense vegetation in deserts exposes the land surface to significant weathering processes by wind and occasional, intense flash floods, often leading to distinctive landforms such as sand dunes, stony plains, and exposed bedrock.

Arid Desert

An arid desert is essentially a desert that is specifically defined by its extreme dryness. The term "arid" itself means very dry and lacking in rainfall. So, when we talk about an arid desert, we are emphasizing the primary characteristic that makes it a desert: its severe lack of precipitation.

These environments receive less than 250 millimeters (10 inches) of rain annually, and often much less, sometimes experiencing years with virtually no rainfall at all. The high temperatures common in many arid deserts, combined with strong winds, lead to very high evaporation rates, meaning any moisture that does fall quickly evaporates. This combination of minimal rainfall and high evaporation results in landscapes that are often barren or have very sparse vegetation, with plants and animals that possess remarkable adaptations to survive the extremely dry conditions. The arid zone covers a significant portion of the Earth's land area, including many of the world's most famous deserts like the Sahara, the Arabian Desert, and a large portion of Australia's interior.

Semiarid Desert

A Semiarid Desert is a transitional biome that lies on the fringes of true arid deserts. The key distinction is that while still very dry, it receives slightly more precipitation than an arid desert, typically between 250 and 500 millimeters (10 to 20 inches) annually. This increased, though still limited, rainfall allows for a greater density of vegetation compared to arid deserts.

The landscape of a semiarid desert is generally dominated by sparse grasslands, often featuring short, scattered grasses, and a greater presence of drought-resistant shrubs and small, thorny trees. The climate is characterized by hot summers and cool to cold winters, with significant daily temperature swings. While less harsh than an arid desert, water scarcity is still a defining challenge, and the vegetation and animal life are highly adapted to survive prolonged dry periods, sometimes punctuated by unpredictable rainfall. Examples include parts of the Great Basin in North America, the Australian Outback surrounding the central deserts, and the fringes of the Sahara and Arabian deserts.

Xeric Shrubland

A Xeric Shrubland is a type of biome characterized by its dry (xeric comes from the Greek word for "dry") conditions and the dominance of woody-stemmed shrubs and hardy plants. It's often found in areas that are too dry for forests but not quite as extreme as true deserts, serving as a transitional zone. These regions receive very low annual rainfall, typically less than 250 millimeters (10 inches) on average, though it can sometimes reach up to 500 millimeters in marginal areas. What truly defines them is that evaporation usually exceeds the amount of precipitation, leading to a persistent moisture deficit.

The vegetation in xeric shrublands is highly adapted to conserve water and withstand prolonged drought. Plants often have small, leathery, or waxy leaves to reduce water loss, deep root systems to tap into scarce groundwater, or are succulents that store water in their tissues, like cacti. Examples of common plants include creosote bush, sagebrush, and various thorny shrubs.

While many xeric shrublands experience hot days and cold nights due to the lack of insulating humidity, their temperature variability can range from hot year-round to regions that become quite cold in winter (like parts of the Gobi Desert). These biomes are found across various continents, including significant areas of Australia (such as the Carnarvon xeric shrublands in Western Australia and parts of the Central Ranges), North America, Africa, and Asia, and are critical for a diverse array of specially adapted animal life.

Ocean

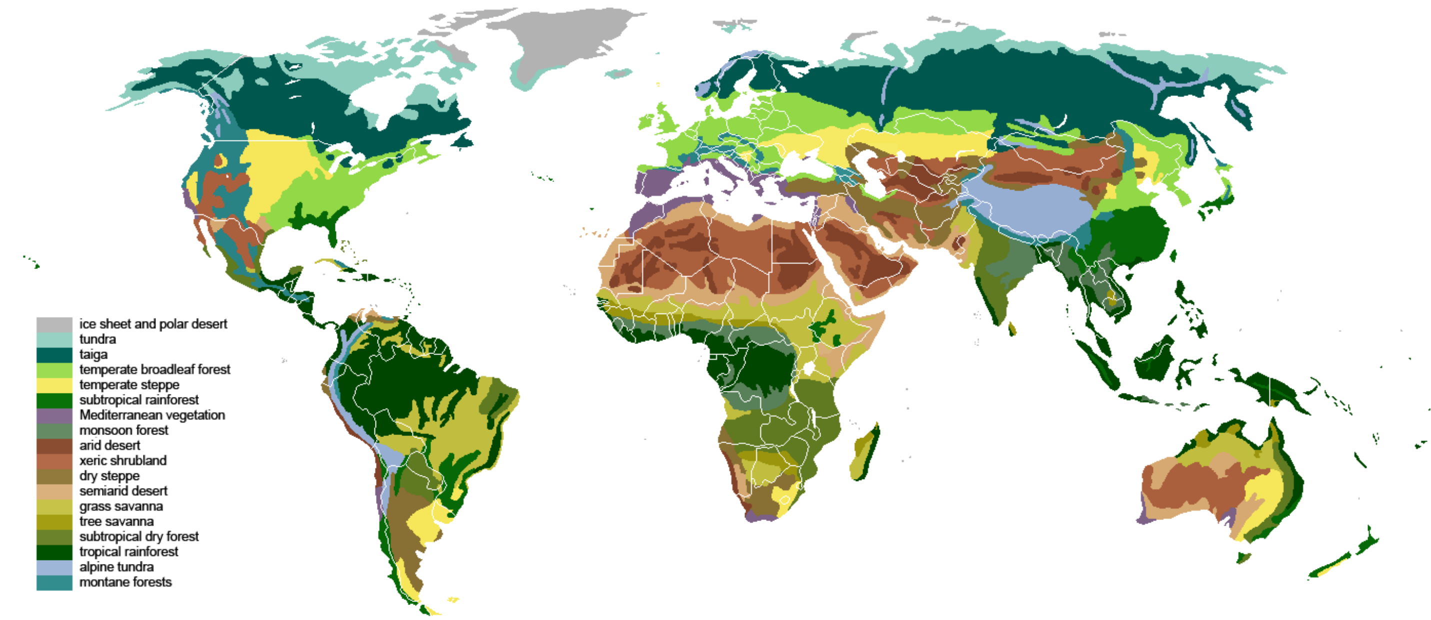
The ocean refers to the vast, continuous body of salt water that covers approximately 71% of Earth's surface. It is the largest reservoir of water on the planet, holding about 97% of all Earth's water. While often divided into five major oceans (Pacific, Atlantic, Indian, Southern/Antarctic, and Arctic) for geographical convenience, these are all interconnected and water flows freely between them, effectively forming one global ocean.

The ocean plays a critical role in regulating Earth's climate and weather patterns due to its immense capacity to absorb, store, and transport heat and carbon dioxide. Its waters are constantly in motion through currents, waves, and tides, influenced by factors like temperature, salinity, winds, and gravitational forces from the Moon and Sun.

The ocean is also an incredibly diverse habitat, supporting the vast majority of Earth's animal and protist life, and is fundamental to the planet's oxygen production through microscopic marine plants called phytoplankton.

Vegetation

Below is a map of the world showing the corresponding vegetation types per region.



6 Landforms

Landforms are the various types of land you will encounter throughout the world. Some are useful for survival purposes such as setting up a tent and others are good for observation points. This can be used as a guide for identifying landforms and helping choose where you should bug out to with examples of advantages, disadvantages and hazards at each location. The survival rating is a score from 1-5 which rates how ideal the landform is as a permanent Bug-Out Location (BOL).

Subheadings

1. Mountainous	2. Continental Plain	3. Fluvial	4. Glacial
5. Oceanic and Coastal	6. Volcanic	7. Aeolian	8. Artificial

1 Mountainous

Table Butte

Table Butte 2/5 A dangerous and hard to reach location with few resources yet fair protection.	A table is a butte, flank of a mountain, or mountain, that has a flat top.	**Advantages** • Line of Sight • Hard to Spot by Ground • Flat Area • Natural Protection • Fair Animal Protection	**Disadvantages** • Easily Spotted by Air • Hard to Reach • Hard to Escape • Little/No Water • Mostly Rock • Little Vegetation

Survival Perspective
A table butte may be a naturally protective location for a campsite but its height means that it's not likely to have any water on it which means climbing up and down the steep faces over and over. It will provide a fantastic lookout point from the top for threats and make it easier to find natural resources while making other tasks difficult. If you select this site for a camp, pitch at least 30m from an edge in case an entire shelf breaks off and falls.

Hazards
• Falling Off
• Eroding Cliffs
• Strong Winds
• Slippery When Wet

Flat

Flat 3/5 Good location for pitching, could flood during rain, few trees make shelter building difficult.	A flat is a relatively level surface of land within a region of greater relief, such as hills or mountains.	**Advantages** • Flat • Plenty of Wildlife • Soft Grasses • Soft Ground • Typically Water Nearby	**Disadvantages** • Easily Spotted • Hard to Escape • Few Trees

Survival Perspective
A flat would be a fairly good location to set up a camp site due to the flat, level ground with a lot of flora and fauna nearby as well as water sources. There may or may not be many trees for cover so choose a spot wisely and ensure that it's not likely to be flooded out.

Hazards
• Possible Flood Plain
• Large Wild Animals

Hill

Hill 4/5 Good location safe from floodwater and has a great line of sight. Ensure there's water nearby.	A hill is a landform that extends above the surrounding terrain. It often has a distinct summit.	**Advantages** • Line of Sight • Flood Resistant	**Disadvantages** • Sloped Ground • Tough Climb

A hill is one of the best choices for setting up a camp, but ensure you're not right at the top or right at the bottom to avoid being detected as easily. Choose an area that's as flat as possible with fewer trees nearby which could fall.

Hazards
- Wild Animals

Mountain

Mountain
4/5
A high location away from other people. Can be very cold and lacks some resources higher up. Avalanche risk.

A mountain is a large landform that stretches above the surrounding land in a limited area, usually in the form of a peak. A mountain is generally steeper than a hill.

Advantages
- Extreme Line of Sight
- Flood Resistant

Disadvantages
- Tough Climb
- Little Fauna
- Little Flora
- Snow Coverage
- Little Water
- Foggy / Cloudy

If you choose to bug out to a mountain, ensure that it has a selection of flora and fauna on it as well as a means to get water easily. Due to the height of the mountain it may be difficult to find a flat piece of ground or find water. You don't want to have to walk up and down a mountain repeatedly to retrieve resources. It may be beneficial to camp above 3.6kms (12,000ft) to prevent a lot of people reaching this area due to altitude sickness. Only young, fit people are likely to encounter you and be able to tolerate the cold.

Hazards
- Avalanches
- Landslides
- Cold
- Slippery
- Altitude Sickness

Mountain Range

Mountain Range
4/5
The best location to conceal yourself from others. Has a lot of resources and pools of water are common.

A mountain range or hill range is a series of mountains or hills ranged in a line and connected by high ground.

Advantages
- Easily Concealed
- Water Pockets
- Flood Resistant

Disadvantages
- Tough Terrain
- Low-ish Line of Sight

A mountain range is a great camping spot away from civilization and tucked away from view. It can have its own rivers and lakes from which to source water. Generally ranges are also home to a variety of flora and fauna which can be hunted. The height means it's cooler near the top which is ideal for hotter environments. Typically there's no settlements or people living on mountain ranges due to the difficulty in putting roads through them and getting resources there. If you head deep into a mountain range you're not likely to meet anyone else if it's far enough away from any major cities.

Hazards
- Avalanches
- Landslides
- Cold
- Slippery
- Altitude Sickness

Plateau

Plateau
1/5
Extremely difficult to reach and very exposed on the top, few resources and often no water.

A plateau is an area of a highland, usually consisting of relatively flat terrain that is raised significantly above the surrounding area, often with one or more sides with steep slopes.

Advantages
- Line of Sight
- Protection from Wildlife
- Protection from Humans

Disadvantages
- Easily Spotted by Air
- Difficult to Climb
- Hard to Escape
- Little/No Water
- Exposed to Wind
- Mostly Rock
- Little Vegetation

Plateau's are a very challenging terrain to reach the top of as they are almost vertical rock surfaces. Camping at the top isn't recommended as there's little resources, no protection from the elements and it's almost entirely rock. However if you do make it to the top and set up camp you will have the ultimate protection from animal predators and humans.

Hazards
- Falling
- Slipping
- Collapsing Pillars
- Rockslide

Ridge

Ridge
3/5
A rocky location with sloped ground which may prove difficult to set up a shelter.

A ridge or mountain ridge are geological features consisting of a chain of mountains or hills that form a continuous elevated crest for some distance. The sides of the ridge slope away from narrow top on either side.

Advantages
- Line of Sight

Disadvantages
- Steep Climb
- Difficult Hike
- Non Flat Ground

Camping on a ridge would be a challenging task but worth it if you can find some flat enough ground. You will have a fantastic line of sight and be well concealed if there's enough vegetation. Water may be difficult to source when you're up high and there's likely to be quite a variety of wildlife nearby.

Hazards
- Slipping
- Falling Rocks
- Landslide
- Avalanches
- Altitude Sickness

Valley

Valley
4/5
A beautiful location hidden from sight with plenty of water and resources.

A valley is a low area between hills or mountains often with a river running through it. In geology, a valley or dale is a depression that is longer than it is wide.

Advantages
- Water
- Flora
- Fauna
- Concealed
- Hunting

Disadvantages
- Low Visibility

Valleys provide shelter from storms, wind and a variety of other natural phenomenon and often have a river flowing through them. If there's no river, water can be obtained by digging at the lowest points until it flows into the hole. Wild animals are likely to be a big risk here, especially those large enough to tear you apart. The ample water will draw them all here.

Hazards
- Floods
- Flash Floods
- Avalanches
- Landslides
- Falling Rocks
- Wild Animals

2 Continental Plain

Ice Sheet

Ice Sheet 1/5 Extremely cold and barren environment with no flora and very little fauna.	An ice sheet is a mass of glacier ice that covers surrounding terrain and is greater than 50,000 km2 (19,000 sq mi).	**Advantages** ● Far From Civilization	**Disadvantages** ● Impossible to Sustain Life ● Little Flora ● Little Fauna ● Lifeless Landscape ● Nothing to Do ● 6 Months Day/Night

Only added to include everything, if you tried living here in a SHTF scenario and are planning to catch your own food you're likely to run out very quickly. This location may work as a hideout if you brought a shipload of food and other resources then stored it away, or just lived off the ship. This method would be particularly useful if the rest of the world was involved in a global war.	**Hazards** ● Freezing ● Avalanches

Plain

Plain 3/5 Open flat plains great for surviving on and great for farming. Watch out for flooding.	A plain is a flat, sweeping landmass that generally does not change much in elevation. Plains occur as lowlands along the bottoms of valleys or on the doorsteps of mountains, as coastal plains, and as plateaus or uplands.	**Advantages** ● Nearby Mountain Lookout ● Line of Sight ● Soft Grass ● Crop Planting	**Disadvantages** ● Easily Visible ● Few Trees

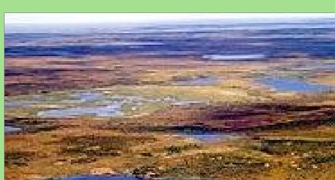
Grasslands would be a fairly good location for a campsite as there's not many risks of disasters provided you're far enough away from mountains. The mountain will provide a great lookout point and can work as an escape point if flooding does occur in the plains. The land would be soft and fertile, perfect for planting large amounts of crops.	**Hazards** ● Flooding ● Avalanche

Steppe

Steppe 2/5 Few trees and shrubs around so you're easily visible. May be difficult to shelter build and have fires without wood.	A steppe is an ecoregion in the montane grasslands and shrublands and temperate grasslands, savannahs and shrublands biomes, characterized by grassland plains without trees apart from those near rivers and lakes.	**Advantages** ● Line of Sight ● Soft Grass ● Crop Planting	**Disadvantages** ● No Trees ● You're Easily Visible ● No Protection

A steppe may provide a suitable camping/BOL but you will be easily visible from quite a distance due to the plain terrain. There might be quite a hike for any form of resources such as wood, food and water. You will also be exposed to any weather even that may arise.	**Hazards** ● Wildlife

Tundra



Tundra 1/5 Extremely cold and barren environment which takes special training to survive in.	Tundra is a type of biome where the tree growth is hindered by low temperatures and short growing seasons.	**Advantages** ● Few People	**Disadvantages** ● Few Animals ● Polar Bears

The tundra environment would be a difficult one to survive in for long periods due to the shortage of resources like flora and fauna. Wood would be hard to obtain to keep warm with and it's tough for anything to grow in this cold environment.	**Hazards** ● Extreme Cold

3 Fluvial

Alluvial Fan

Alluvial Fan 3/5 plenty of rocks which can be used to build a shelter. Never build near the rocks. Fair amount of trees and resources.	An alluvial fan is a fan- or cone-shaped deposit of sediment crossed and built up by streams. If a fan is built up by debris flows it is properly called a debris cone or colluvial fan.	**Advantages** ● Construction Material	**Disadvantages** ● Obvious from Satellite ● Rocky Ground ● Few Trees Under Fan

An alluvial fan is a strange terrain form based on rocks but could be beneficial during construction projects. Don't set up camp on the fan as the sediment is placed there by a strong water flow, but somewhere nearby on higher ground so you can still use the rocks in your house.	**Hazards** ● Flash Flooding

Beach

Beach 4/5 A nice location with lots of resources such as fish and trees. Don't build on the sand. Fairly exposed to bad weather.	A beach is a landform alongside a body of water which consists of loose particles. The particles composing a beach are typically made from rock, such as sand, gravel, beach, pebbles, or cobblestones.	**Advantages** ● Scenic ● Water ● Visible from Air (Rescue)	**Disadvantages** ● Sand Construction ● Very Windy ● Rusts Metal Faster ● Visible from Air (Combat) ● Water Desalination Req.

Possibly everyone's ideal bug out scenario where you sit on the sand drinking coconuts. The sand would make it difficult to build a permanent shelter but heading inland a bit more can provide better protection. A private beach would be best, especially one which is surrounded by steep hills and rocks similar to the picture. If you're near large oceans you need to be mindful that earthquakes can trigger large tsunami's which can wipe out your shelter within hours.

Hazards
- Tsunamis
- High Tide
- Storm Surge
- Cyclones/Hurricanes

Canyon

Canyon
2/5
A barren landscape with nearly sheer drops and few trees. Little water and has a risk of flash floods.

A canyon or gorge is a deep cleft between escarpments or cliffs resulting from weathering and the erosive activity of a river over geologic timescales.

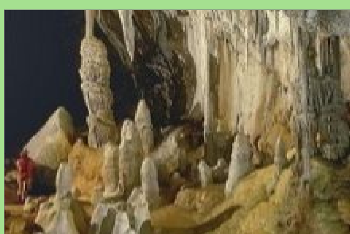
Advantages
- Shelter
- Hideaway
- Hidden from View

Disadvantages
- Difficult Climb
- Rocky Terrain
- Few Trees
- Few Animals
- Few Escape Points
- Possibly Strong Winds

Never camp in the depression of a canyon as they are formed by erosion and rivers but look for higher ground overlooking it. Generally canyons are barren landscapes but occasionally they can be lush and vibrant. You may have a hard time acquiring food and water in this landscape due to being quite barren.

Hazards
- Flash Flooding
- Flooding
- Erosion
- Falling Rocks
- Slipping

Cave



Cave
5/5
Excellent location, choose one deep enough which isn't prone to flooding. Ensure no animal has made their home inside it. May contain water and sheer drops.

A cave is a hollow place in the ground, specifically a natural underground space large enough for a human to enter.

Advantages
- Pre-Made Shelter
- Hidden from Everything
- Keeping Dry

Disadvantages
- Possibly Few Exits
- Fire Smoke Build-up

Caves are probably one of the best landforms to camp in depending on the type of cave. Some can be a few metres deep and others can be huge complexes. Be careful to scout the cave completely before setting up inside one and look out for signs that something already lives inside it. Caves can be extremely deep and can often have vertical cliffs inside them. If they go on endlessly, block off a section and use it as a shelter. Make a map of the internals of a cave so you don't get lost inside and document any important features there are such as running water and other entrances. Be especially sure you check the strength of the cave so it doesn't collapse on top of you while you're inside. You can also reinforce the ceiling by building wooden structures inside. Be especially sure that a cave near sea level won't flood at high tide and that there's always at least one exit at all times - unless you don't mind being cut off for a few hours a day.

Hazards
- Flooding
- Flash Flooding
- Falling Rocks
- Collapsing Walls
- Wild Animals
- Becoming Lost
- Steep Cliffs

Cliff

Cliff
3/5
Cliffs make great lookouts and provide nice protection on one side, but you are fairly exposed.

A cliff is a vertical, or nearly vertical, rock exposure.

Advantages
- Line of Sight
- Flank Protection

Disadvantages
- Windy

Cliffs aren't recommended for camping/survival locations, although they will protect your flank and give you a great view over the edge. Don't camp too close to the edge in case of landslides.

Hazards
- Falling
- Erosion
- Landslides

Floodplain

Floodplain
2/5
You should never camp on a known floodplain as you could get washed away. Even one-nighters are risky if there's rain nearby.

A floodplain is an area of land adjacent to a stream or river which stretches from the banks of its channel to the base of the enclosing valley walls, and which experiences flooding during periods of high discharge.

Advantages
- Easy Water Access
- Lots of Wildlife

Disadvantages
- Mosquitoes/Bugs
- Wild Animals

You should never camp in the lower flat areas beside a river as they could easily flood in times of heavy rain. Instead you should look for an area of higher ground near the river, but even this may not be high enough in times of extreme rainfall.

Hazards
- Flooding
- Flash Flooding
- Crocodiles

Lake

Lake
5/5
A great location with ample resources, food and water.

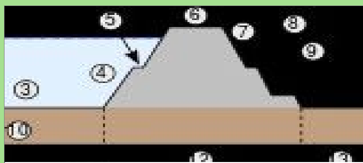
A lake is an area filled with water, localized in a basin, that is surrounded by land, apart from any river or other outlet that serves to feed or drain the lake.

Advantages
- Easy Water Access
- Abundant Wildlife
- Bathing
- Fishing

Disadvantages
- May Freeze in Winter
- Mosquitoes/Bugs

Camping/surviving beside a lake is a commonly chosen location but it's best to be at least 100m (328ft) from the water's edge. Lakes allow unlimited water collection and often sport a bounty of animals, trees and edibles nearby too. They are great for bathing in if the temperature is warm and can be crossed easily by boat.	**Hazards** • Flooding • Crocodiles • Flooding

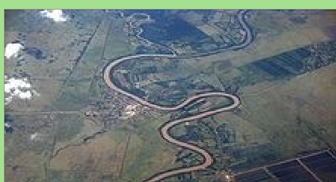
Levee



Levee 3/5 A fairly safe landform to camp on flooding wise and will provide water. You are fairly exposed however.	A levee dike, dyke, embankment, floodbank or stopbank is an elongated naturally occurring ridge or artificially constructed fill or wall, which regulates water levels.	**Advantages** • Ability for Dam • Water Access • Ample Wildlife	**Disadvantages** • May Breakdown

Don't camp on the lower sides of a levee as they could flood in times of great rainfall. The embankment could also break and flood the other low side. Camping at the top of the ridge should protect you from the water but you will be exposed to the elements and a line of sight from others.	**Hazards** • Flooding

Meander



Meander 3/5 Good water source, but be careful from flooding. More difficult to use a boat on.	A meander is one of a series of regular sinuous curves, bends, loops, turns, or windings in the channel of a river, stream, or other watercourse.	**Advantages** • Water Source • Fishing	**Disadvantages** • Longer Sailing Distance

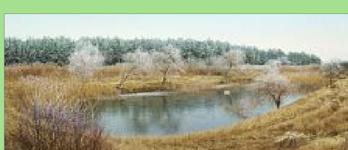
Choosing a BOL along a meander can be a good location if it's sufficiently high to avoid flooding of the river should it occur. However if it does flood you will likely be trapped on your newfound island until the water subsides.	**Hazards** • Flooding • Flash Flooding

Oasis

Oasis 2/5 Attracts a lot of animals but you may run out if the oasis is small. Few resources for building with.	An oasis is an isolated area in a desert, typically surrounding a spring or similar water source, such as a pond or small lake.	**Advantages** • Water • Animals • Aquatic Life	**Disadvantages** • Surrounding Desert • Obvious Hideaway • Very Hot (Day) • Very Cold (Night) • Wild Animals • Few Building Materials

An oasis may sound like a perfect place to bug out to however it's certainly an obvious location if you're running from someone in particular. There's a limited number of trees which will make shelter construction and firewood risky to do, often at the cost of natural shade and sometimes edible fruit trees. There may not be many natural food options fishing and hunting wise but the local animals are sure to gather to this spot for their water requirements. It will be difficult to leave this location due to the surrounding desert and the lack of other water sources.	**Hazards** • Hypothermia • Hyperthermia • Wild Animals

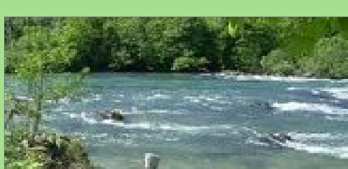
Pond



Pond 4/5 Pond water requires more filtration but also attracts a lot of wild animals.	A pond is a body of standing water, either natural or artificial, that is usually smaller than a lake.	**Advantages** • Water • Aquatic Life • Drinking Hole	**Disadvantages** • Easily Fished Out • Stagnant Water

Camping near a pond will give you sufficient water but if you're fishing from it, you may run out of fish fairly quickly depending on the size of it. Animals should be plenty around this area which will come to drink in the mornings and afternoons.	**Hazards** • Flood Risk • Mosquitoes • Bacteria/Pollution

Rapids



Rapids 4/5 A fast flowing river makes it easy to flee and often sports a variety of fish and healthy trees.	Rapids are sections of a river where the river bed has a relatively steep slope.	**Advantages** • Quick Getaways • Water • Washing	**Disadvantages** • Can't Swim • No Boats • Little Aquatic Life • Harder to Hear

A fast flowing river provides almost identical benefits of a regular river (below) including a water source and food. Rapids can provide the unique tool of a fast escape if you need one and have a boat on standby, but should only be attempted if desperate. Before attempting a getaway you should know what lies ahead in the river, whether it's large rocks, a lake or a waterfall.	**Hazards** • Flood Risk • Being Washed Away

River

River

	**River** 4/5 The most optimum location to camp but ensure it's wide enough so it doesn't dry up in summer. Camp high in case it floods.	A river is a natural flowing watercourse, usually freshwater, flowing towards an ocean, sea, lake or another river.	**Advantages** ● Fresh Flowing Water ● Aquatic Life ● Washing	**Disadvantages** ● Wet Crossing
A river can provide a constant source of clean water to drink from and wash with as well as fish. The water is constantly renewed and refreshed unlike a lake so there's less of a worry of contamination. Ensure you set up camp at least 100m (328ft) from the river and preferably uphill slightly to avoid the threat of flooding.				**Hazards** ● Predators ● Flooding

River Mouth

	**River Mouth** 3/5 A mix of fresh and saltwater making it a requirement to desalinate, upriver is a better option.	A river mouth is the part of a river where the river flows into another river, a lake, a reservoir, a sea, or an ocean.	**Advantages** ● Fresh and Saltwater ● Access to Salt ● Flowing Water	**Disadvantages** ● Contaminated Freshwater
A river mouth is another location similar to a river (above) but with the added benefit of having the ocean or another river nearby as additional water sources. It's best not to choose a location on the corner of the intersection as it's likely to flood in heavy rains but if it's considerably above the ground level then it should be safe.				**Hazards** ● Predators ● Flooding

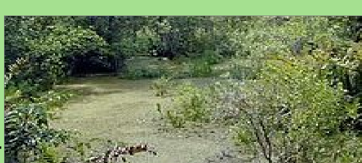
River Valley

	**River Valley** 4/5 Often very rocky and sometimes creates underwater rivers. Camp up higher.	A valley formed by flowing water, called fluvial valley or river valley, is usually V-shaped.	**Advantages** ● Concealed ● Flowing Water ● Rocky Floor ● Fishing	**Disadvantages** ● Low Line of Sight
Again this is similar to a river but pressed further into the landscape and may sometimes flow in and out of small caves and underground. It's recommended not to camp close to the river depression as the water is likely to reach a high level when it rains a lot. Watch out for water marks showing where the water level has previously reached. These marks include grasses on high branches, bent trees and grasses at a high tide level.				**Hazards** ● Flooding ● Flash Floods ● Wildlife

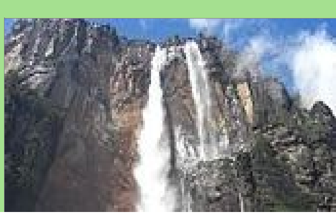
Strait

	**Strait** 3/5 Great for boats and fishing in and often has a variety of resources.	A strait is a naturally formed, narrow, typically navigable waterway that connects two larger bodies of water. Most commonly it is a channel of water that lies between two land masses.	**Advantages** ● Fishing ● Boating	**Disadvantages** ● Hard to Cross ● Easily Spotted
Similar to lakes and beaches where you have access to a lot of water but the difference is to reach the other landmass you will have to cross the water. Great location if you have a ship or a bunch of ships to protect them from incline weather.				**Hazards** ● Threats on the Land ● Dangerous Sea Life

Swamp

	**Swamp** 2/5 A difficult location to survive in, footwear will be constantly wet, lots of bugs.	A swamp is a wetland that is forested. Many swamps occur along large rivers where they are critically dependent upon natural water level fluctuations.	**Advantages** ● Hard to be spotted ● Ample Wood	**Disadvantages** ● Thick Vegetation ● Wet Boots ● Viral/Bacterial Water ● Lack of Land
A swamp will shelter you well from those seeking to find you but you will have a lot of natural threats to deal with such as water being everywhere and having damp and cold feet. Any shelter you construct will likely have to be above ground to avoid the water, either in the trees or between trees such as a hammock. It's only recommended to set up in a swamp if it's your last option, but it can be done successfully, it will just be challenging to survive in.				**Hazards** ● Mosquitoes/Bugs ● Hidden Crocodiles ● Trench foot

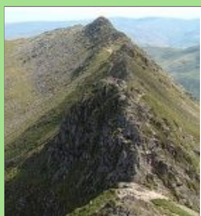
Waterfall

	**Waterfall** 4/5 Waterfalls sport a water source and a free shower however the sound may draw people to it.	A waterfall is a place where water flows over a vertical drop or a series of steep drops in the course of a stream or river.	**Advantages** ● Shower/Bathing ● Camouflages Noise	**Disadvantages** ● Harder to Hear ● May Draw People

You have 3 options of where to camp near a waterfall, the top, the bottom or inside it (if applicable), each has its own benefits and risks involved. Camping at the top keeps one side of your camp safe from people and predators and reduces the noise of the water significantly. Camping at the bottom lets you have waterfall showers to get clean and it masks some of the noise you make. Camping inside the waterfall is probably the best option combining a cave with a waterfall to provide a secure shelter, hidden from sight and a masking noise.	**Hazards** • Slipping • Flooding • Falling Rocks

4 Glacial

Arête



	Arête 3/5 A high location which may have water in the valleys and often has lots of resources. Ground is rocky rarely flat.	An arête is a narrow ridge of rock which separates two valleys.	**Advantages** • Line of Sight • One Sided Wind Shield	**Disadvantages** • Not Flat • Often Rocky • May be in Clouds
An arête could make a fine shelter if you can find some land flat enough and ensuring that the terrain goes high enough above the valleys to avoid floodwaters if they occur. If a flood occurs you might become cut off from the mainland until the water subsides which could take up to a few days depending on how deep the valleys are.				**Hazards** • Falling • Slipping • Rockslide

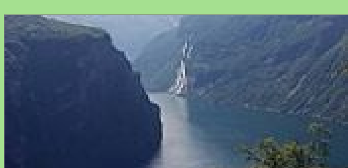
Cirque

	Cirque 3/5 Provides a level of shelter and elemental protection but may flood easily.	A cirque is an amphitheatre-like valley formed by glacial erosion.	**Advantages** • Weather Protection • Hidden • Water Deposit	**Disadvantages** • Rocky • Few Trees
These can provide you with some great elemental protection but are often prone to flooding due to their low set nature. They are very rocky and it may be a challenge to find enough trees to use for firewood or shelter building.				**Hazards** • Flooding

Esker

	Esker 2/5 An often barren landscape with few resources.	An esker or eschar is a long, winding ridge of stratified sand and gravel, examples of which occur in glaciated and formerly glaciated regions of Europe and North America.	**Advantages** • Navigational Mark • Wind Wall	**Disadvantages** • Obvious Location • Easily Spotted • Cold • Barren Landscape
A fairly barren environment caused by glaciers with limited trees and flora nearby. These landforms aren't likely to house many fauna due to the lack of water nearby too.				**Hazards** • Glaciers

Fjord



	Fjord 3/5 A scenic location but tricky to climb repeatedly to retrieve resources. Often rocky.	A fjord or fiord is a long, narrow inlet with steep sides or cliffs, created by a glacier.	**Advantages** • Concealed Entry • Line of Sight	**Disadvantages** • Few Disembark Points • Lots of Climbing
A fjord is certainly a breathtaking landform but not very ideal when you need to fetch water and other resources by going up and down a cliff multiple times a day. If you can find some kind of cave on the side of a fjord that would be a great location to use, and you can then design a pulley system to fetch watch when you need it.				**Hazards** • Falling Rocks • Erosion

Glacier

	Glacier 1/5 Glaciers are constantly moving so your shelter will likely fall apart or slide into an ocean.	A glacier is a persistent body of dense ice that is constantly moving under its own weight; it forms where the accumulation of snow exceeds its ablation (melting and sublimation) over many years, often centuries.	**Advantages** • Changing Landscape • No People	**Disadvantages** • Unsafe for Shelter • Cold
You should never build a shelter on a glacier as the slow moving ice will thwart any attempt to complete an upright structure and because over time it won't be where you built it since glaciers can move on average 30m (98ft) per day.				**Hazards** • Shelter May Move • Destroys Shelter

Tunnel Valley

	Tunnel Valley 3/5 Often very cold but offers some shielding from the weather.	A tunnel valley is a large, long, U-shaped valley originally cut under the glacial ice near the margin of continental ice sheets such as that now covering Antarctica and formerly covering portions of all continents during past glacial ages.	**Advantages** ● Shielded ● Lookout Points	**Disadvantages** ● Very Cold
Glaciers which have filled with vegetation are the ideal choices as there are also tunnel valleys without trees.				**Hazards** ● Glaciers ● Avalanches

5 Oceanic and Coastal

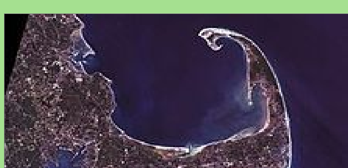
Atoll

	Atoll 3/5 Isolated from others and may be difficult to reach but it could sport a great variety of resources and food. The atoll may be very small sometimes and survival will be hard.	An atoll sometimes called a coral atoll, is a ring-shaped coral reef including a coral rim that encircles a lagoon partially or completely.	**Advantages** ● Fishing ● Swimming ● Secluded	**Disadvantages** ● Little Land ● Hard to Reach ● Rusts Metal Faster ● Water Desalination Req.
An atoll would be quite a unique experience to bug out to but may be difficult getting there and sustaining yourself for long periods. You are very likely to be alone permanently and have a large variety of seafood all to yourself. However there are often poisonous sea creatures. Depending on the thickness of the atoll there may be few trees to use and running out of wood and other resources is something to keep in mind.				**Hazards** ● Sea Predators ● Poisonous Creatures

Bay

	Bay 4/5 A semi protected landform from LOS, tsunamis and strong winds and makes a good location for boating.	A bay is a recessed, coastal body of water that directly connects to a larger main body of water, such as an ocean, a lake, or another bay.	**Advantages** ● Aquatic Life ● Fishing ● Sheltered Water	**Disadvantages** ● Very Windy ● Rusts Metal Faster ● Water Desalination Req.
A bay is similar to a beach for bugging out to but it provides a greater level of protection from large waves from open waters. It may be easier to fish in a bay due to a higher level of underwater sand versus a regular beach.				**Hazards** ● Sea Predators

Cape



	Cape 4/5 Uninhabited capes are a great choice for survival with water on all sides for fishing and often ample resources.	In geography, a cape is a headland or a promontory of large size extending into a body of water, usually the sea.	**Advantages** ● Secluded ● Water ● Fishing	**Disadvantages** ● Long Distance ● Salty Air ● Very Windy ● Rusts Metal Faster ● Water Desalination Req.
Camping at the end of a cape could be a nice secluded area and provide a similar experience to an island - but connected to the mainland. You would have great views of the surrounding ocean and have a lot of opportunity to catch sea life. The risks include high tide which could cut you off from the mainland and tsunami's which are guaranteed to be deadly.				**Hazards** ● Tsunamis ● High Tide ● Storm Surge

Channel

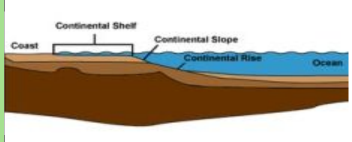
	Channel 3/5 A fairly shallow river great for fishing in, but you risk it flooding in downpours.	A channel is a type of landform consisting of the outline of a path of relatively shallow and narrow body of fluid, most commonly the confine of a river, river delta or strait.	**Advantages** ● Fresh Water ● Aquatic Life ● Walk Across Easily	**Disadvantages** ● Few Large Fish
A channel is great for fishing in but may contain dangerous animals such as crocodiles. There's a risk of flooding due to the shallow nature of the channel.				**Hazards** ● Predators ● Flooding

Coast

	Coast 4/5 The coast is a great place to get both good resources and allow fishing.	A coastline or a seashore is the area where land meets the sea or ocean, or a line that forms the boundary between the land and the ocean or a lake.	**Advantages** ● Fishing ● Salt	**Disadvantages** ● Windy ● Cold ● Rusts Metal Faster ● Water Desalination Req.

A great place to bug out to with a variety of resources and the ability to fish from. It allows fast travel by a boat if desired as well.	**Hazards** • Tsunamis • Tropical Storms

Continental Shelf



Continental Shelf			
Continental Shelf 3/5 A coastal shelf makes fishing easier and allows wading out to nearby islands.	The continental shelf is an underwater landmass which extends from a continent, resulting in an area of relatively shallow water known as a shelf sea.	**Advantages** • Hand Fishing • Degrades Tsunami's	**Disadvantages** • Tidal Change • Windy • Rusts Metal Faster • Water Desalination Req.

A landmass which could be perfect for fishing on due to the fairly shallow shelf. It will also cause any tsunami's to lose their power very fast.	**Hazards** • Flooding • Predators

Coral Reef

Coral Reef			
Coral Reef 2/5 Excellent place for your choice of seafood and it's easy to obtain.	Coral reefs are diverse underwater ecosystems held together by calcium carbonate structures secreted by corals.	**Advantages** • Abundant Food	**Disadvantages** • Underwater • Requires Swimming Skills • Requires Diving Skills

A coral reef can provide you with an abundance of fish if you have the skills to catch them.	**Hazards** • Poisonous Creatures • Sharks

Estuary

Estuary			
Estuary 3/5 Lots of water to choose from but may flood in times of downpour.	An estuary is a partially enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea.	**Advantages** • Hand Fishing	**Disadvantages** • Brackish Water • Water Desalination Req.

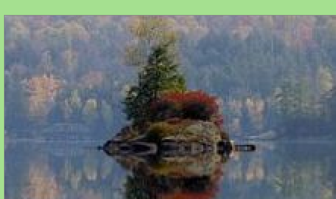
An estuary will trap fish that swim into it during high tide which can be caught easier during low tide.	**Hazards** • Predators

High Island

High Island			
High Island 1/5 Very formidable landmass with little flora or fauna and a chance of eruption.	In geology a high island or volcanic island is an island of volcanic origin.	**Advantages** • Being Alone • Line of Sight • No People	**Disadvantages** • Hard to Reach • Few/No Trees • Few/No Fauna • Very Rocky • Very Windy • Water Desalination Req.

A volcanic island isn't an optimum place to survive on due to the lack of flora and fauna and the need to desalinate all the water you drink.	**Hazards** • Sharp Rocks

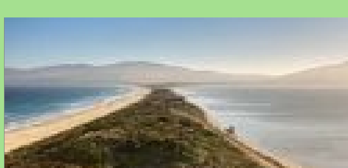
Island



Island			
Island 5/5 Assuming the island is big enough and doesn't have anyone else on it and has the required resources to survive.	An island or isle is any piece of sub-continental land that is surrounded by water.	**Advantages** • No People • Water • Fishing • Line of Sight	**Disadvantages** • Hard to Reach • No/Little Food • Open to the Elements

One of the most ideal locations to bug out to, a private island can provide you with ample resources such as food, water and protection from predators and people.	**Hazards** •

Isthmus



Isthmus			
Isthmus 2/5 You will easily be found by other people moving from one landmass to the other.	An isthmus is a narrow piece of land connecting two larger areas across an expanse of water by which they are otherwise separated.	**Advantages** • Water • Fishing • Line of Sight	**Disadvantages** • Easily Spotted • People Crossing

Not an optimal place for a survival camp due to the fact it's often very thin and people will be driven along it and are very likely to find your camp.	**Hazards** • Tsunami • Floods

Lagoon

Lagoon

Lagoon
4/5
A personal swimming hole with lots of resources nearby and it's easy to catch fish.

A lagoon is a shallow body of water separated from a larger body of water by barrier islands or reefs.

Advantages
- Fishing

Disadvantages
- Tide Variable

A lagoon is similar to an estuary but sealed off from a large body of water which should make fishing much easier as well as the water being shallower.

Hazards
- Predators

Peninsula

Peninsula
4/5
Fairly secure location for survival with the ocean and other resources nearby.

A peninsula is a piece of land surrounded by water on the majority of its border, while being connected to a mainland from which it extends.

Advantages
- Water
- Fishing

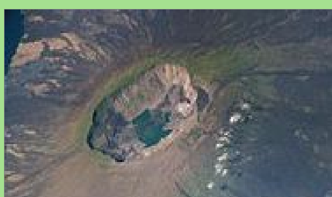
Disadvantages
- One Escape Route

Another fairly good piece of land to survive on, especially if you can seal off the only link to it so you can have the whole place to yourself. Peninsula's can range from very small to huge and often provide a high level of security. There is only one exit however, unless you have a boat.

Hazards
- Tsunami

6 Volcanic

Caldera



Caldera
5/5
Perfect, shielded location with ample water, flora, supplies and often far from people.

A caldera is a large cauldron-like depression that forms following the evacuation of a magma chamber/reservoir.

Advantages
- Environment Protection
- Water
- Few/No People

Disadvantages
- Obvious Position
- High Altitude
- Flooding

This would be an optimum place for a camp but you just have to ensure that it's not going to erupt while you're living in it. You're highly protected from most weather events if you set up camp within the lip of the volcano and have amazing views and line of sight to protect yourself from enemies. Make sure that it's not likely for the entire caldera to fill up with water during heavy rainfall. You can also make an artificial drainage channel to prevent this.

Hazards
- Eruptions
- Flooding
- Rockslides

Crater Lake

Crater Lake
4/5
A nice location with ample resources but at a risk of flooding and other people.

A crater lake is a lake that forms in a volcanic crater or caldera, such as a maar; less commonly and with lower association to the term a lake may form in an impact crater caused by a meteorite, or in the crater left by an artificial explosion caused by humans.

Advantages
- Environment Protection
- Water

Disadvantages
- Obvious Position
- High Altitude

Basically the same as a caldera but usually found at lower altitudes and created by meteors or artificial explosions. You lose a bit of an advantage from a caldera due to the fact a crater lake is often pushed into the ground and not situated on a mountain which makes it more prone to flooding.

Hazards
- Flooding
- Other People

Geyser

Geyser
2/5
May provide warmth and water at a risk of volcanic activity.

A geyser is a spring characterized by intermittent discharge of water ejected turbulently and accompanied by steam.

Advantages
- Warm/Hot Water/Springs
- Hard Water
- Hot Shower

Disadvantages
- May not Shoot

As spectacular geysers are they aren't an ideal location for bugging out to as the geological events occurring below the ground could become unstable very quickly.

Hazards
- Burns
- Eruptions
- Earthquakes

Lava Dome

Lava Dome
1/5
Very few resources and difficult to pitch a shelter on.

In volcanology, a lava dome or volcanic dome is a roughly circular mound-shaped protrusion resulting from the slow extrusion of viscous lava from a volcano.

Advantages
- Line of Sight

Disadvantages
- No Flora
- Rocky Land

Basically a rock with very little resources nearby. It is also difficult to climb and there's nothing of value on this landform.

Hazards
- Eruptions
- Falling Rocks

Lava Field

	**Lava Field** 1/5 Very little resources and difficult to build on and exposure to the elements.	A lava field, also called a lava plain or lava bed, is a large expanse of nearly flat-lying lava flows.	**Advantages** • Line of Sight	**Disadvantages** • Easily Spotted • Rocky Land • Little Water • Little Flora • Little Fauna
A flat, nearly lifeless field with little vegetation and even less animal life.				**Hazards** • Fresh Lava

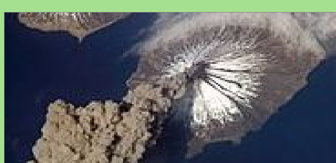
Lava Plateau

	**Lava Plateau** 1/5 Very little resources and difficult to build on and exposure to the elements.	Lava plateaus are formed by highly fluid (runny) basaltic lava during numerous successive eruptions through numerous vents without violent explosions (quiet eruptions).	**Advantages** • Generally Flat • Line of Sight	**Disadvantages** • Little Flora • Little Fauna • Rocky Land • Little Water
A flat, nearly lifeless field with little vegetation and devoid of animal life. The lava may have made strange shapes and could offer a cave to dwell in.				**Hazards** • Eruptions

Volcanic Crater

	**Volcanic Crater** 2/5 Susceptible to flooding and has little flora.	A volcanic crater is a roughly circular depression in the ground caused by volcanic activity.	**Advantages** • Hidden Well • Environment Protection	**Disadvantages** • Little Flora • Rocky Land
Very rocky and has a potential to fill up with water in downpours. There isn't much vegetation nearby and little animal life.				**Hazards** • Eruptions • Flooding

Volcano

	**Volcano** 1/5 Too risky to permanently camp on and few resources nearby.	A volcano is a rupture in the crust of a planetary-mass object, such as Earth, that allows hot lava, volcanic ash, and gases to escape from a magma chamber below the surface.	**Advantages** •	**Disadvantages** • Rocky Land
Danger of eruption and a lifeless terrain consisting of rocks and hardened lava.				**Hazards** • Eruptions

Wall Rock

	**Wall Rock** 2/5 Provides some protection at a risk but few resources nearby overall.	Wall rock is the rock that constitutes the wall of an area undergoing geologic activity.	**Advantages** • Wind Protection	**Disadvantages** • Rain Off-pour • Erosion
The rock wall could provide some degree of protection but rocks could also fall from the top if you camp at the sides of it. Dwelling on top of this structure is dangerous.				**Hazards** • Falling Rocks

7 Aeolian

Desert

	**Desert** 2/5 A difficult landscape to survive in but few people will be around and there's often water if dug for.	A desert is a barren area of landscape where little precipitation occurs and consequently living conditions are hostile for plant and animal life.	**Advantages** • Secluded • Line of Sight	**Disadvantages** • Little Water • Little Flora • Little Fauna • Temperature Extremes
A dry, hot and often flat landscape consisting of rocks, sand or dirt. Water is hard to find but there's often plant life nearby.				**Hazards** • Hyperthermia • Hypothermia

Dry Lake

Dry Lake 2/5 A dry lake which may contain salts and water if dug down, few resources nearby and temperature extremes.	A dry lake is either a basin or depression that formerly contained a standing surface water body, which disappeared when evaporation processes exceeded recharge.	**Advantages** • Line of Sight	**Disadvantages** • Deep Water • Little Flora • Temperature Extremes
A lake which has dried up and is extremely flat and desolate with little flora and fauna.			**Hazards** • Flash Flood

Dune

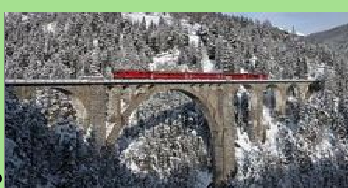
Dune 1/5 Better off surviving at a low point in a desert where water is more likely.	In physical geography, a dune is a hill of loose sand built by aeolian processes (wind) or the flow of water.	**Advantages** • Line of Sight	**Disadvantages** • Windy • Little Ground Strength • Little Water • Little Flora • Little Fauna • Temperature Extremes
It's never a good idea to build a shelter on sand, especially a mountain of sand which changes shape often.			**Hazards** • Sand Avalanche • Sand in the Air

8 Artificial

Artificial Island

Artificial Island 3/5 This island is likely to be heavily populated and you may have to travel to the mainland for resources.	An artificial island or man-made island is an island that has been constructed by people rather than formed by natural means.	**Advantages** • Water Source • Buildings	**Disadvantages** • Population
An artificial island created to house people on. There's likely to be structures on it already but be careful that it doesn't flood.			**Hazards** • Flooding

Bridge



Bridge 2/5 Fairly risky to camp on due to being exposed and make certain there won't be any trains/cars coming across.	A bridge is a structure built to span physical obstacles without closing the way underneath such as a body of water, valley, or road, for the purpose of providing passage over the obstacle.	**Advantages** • Crossing Point • Easy to Defend	**Disadvantages** • 2 Access Points • Easy to Spot • Elemental Exposure
A bridge could be a solid location for a shelter provided it's protected from the elements by a mountain and been well built. Wider bridges are better for shelters and offer more space. There's generally only 2 points of access to bridges making it easier to defend, although resources will need to be hauled up to them.			**Hazards** • Vehicles / Transport • Falling • Bridge Failure • Transport Crossing

Building

Building 5/5 Choose a building far from other people as this is typically the only risk facing this location.	A building, or edifice, is a structure with a roof and walls standing more or less permanently in one place, such as a house or factory.	**Advantages** • Weather Shelter	**Disadvantages** • Built Up Area
A building is the most common dwelling today, choose one that's secluded and has a lot of resources nearby naturally.			**Hazards** • Other People

Canal (Man-Made)

Canal 2/5 Canals are likely to be in larger cities and therefore dangerous to camp near.	Canals, or navigations, are human-made channels, or artificial waterways, for water conveyance, or to service water transport vehicles.	**Advantages** • Ample Water	**Disadvantages** • Often in Cities
Canals which are man made are very likely to be built up and therefore can be dangerous to live near.			**Hazards** • Other People

Dam

Dam

Dam
4/5
May be a hotspot for people to head to, but can provide unlimited water and electricity if maintained.

A dam is a barrier that stops or restricts the flow of water or underground streams.

Advantages
- Ample Water
- Electricity
- Strong Structure

Disadvantages
- Easily Spottable

Dams are a very solid structure which should be easy to defend from their edges although you could be ambushed with no escape point. They are likely to be targeted by enemy planes and ships so only head there once you're sure the war has left your area.

Hazards
- Flooding
- Dam Breaking
- Water Overflow

Ditch

Ditch
2/5
Ample water with the ability to transport it distances but may dry up or flood in heavy rain.

A ditch is a small to moderate depression created to channel water.

Advantages
- Water Transportation
- Water

Disadvantages
- Vehicle Barrier

A ditch is a simple channel which is built to transport water along particularly in farmland and to villages without water. Ditches may overflow if there's sufficient rain so always have that in mind. You could also create your own diversion to a campsite if you require - as blocking it completely might alert someone to your presence.

Hazards
- Flooding

Land Reclamation

Land Reclamation
2/5
Often highly built up and sometimes prone to flooding.

Land reclamation, usually known as reclamation, and also known as land fill (not to be confused with a landfill), is the process of creating new land from ocean, riverbeds, or lake beds.

Advantages
- At Sea Level

Disadvantages
- High Population
- Difficult to Escape

Reclaimed land is often built upon due to needing more land for various reasons.

Hazards
- Flooding
- Tsunami Risk

Polder

Polder
3/5
Would be perfect for farmland and water but prone to flooding.

A polder is a low-lying tract of land enclosed by dikes (levees) that form an artificial hydrological entity, meaning it has no connection with outside water other than through manually operated devices.

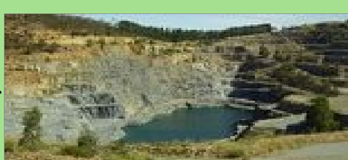
Advantages
- Ample Water
- Water Control
- Farming

Disadvantages
- Damp Ground

This would make a fair shelter location but enemies could destroy the levee and allow water to rush in if it's high enough. You could also generate electricity from the levee if there's somewhere the water can flow on to, or be used as.

Hazards
- Flooding

Quarry



Quarry
2/5
Few resources and may flood but provides some elemental protection.

A quarry is a place from which dimension stone, rock, construction aggregate, riprap, sand, gravel, or slate has been excavated from the ground.

Advantages
- Useful Rocks
- Wind Shelter

Disadvantages
- Low Line of Sight

A fairly barren location with few trees and wildlife. There's often a small lake at the bottom due to rain and water seepage.

Hazards
- Flooding

Reservoir

Reservoir
4/5
Provides ample water and there's often wood nearby, should make a good shelter location.

A large artificial lake used as a source of water supply.

Advantages
- Ample Water
- Good Line of Sight

Disadvantages
-

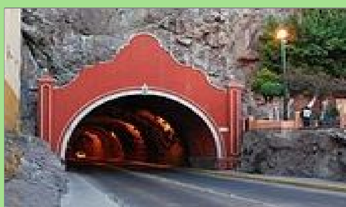
An artificial lake would provide a great source of water and will often have plenty of wildlife and resources such as trees nearby.

Hazards
- Flooding

Road

	**Road** 2/5 Abandoned roads could provide a fair location for a shelter but people may travel along the road and find you. Hard to fix down shelters.	A road is a thoroughfare, route, or way on land between two places that has been paved or otherwise improved to allow travel by foot or some form of conveyance, including a motor vehicle, cart, bicycle, or horse.	**Advantages** ● Easy Movement ● Generally Flat	**Disadvantages** ● High Population Area ● May be Blocked ● Hard to Affix Shelter
Roads are a risky shelter location as people often travel them either on food or in a vehicle. It's very difficult to set up a shelter on concrete, but at least it's flat and free of debris.				**Hazards** ● Traffic

Tunnel

	**Tunnel** 5/5 A tunnel could provide an excellent shelter from all forms of weather and a defence against people if the ends are blocked.	A tunnel is an underground passageway, dug through the surrounding soil/earth/rock and enclosed except for entrance and exit, commonly at each end.	**Advantages** ● Weather Shelter ● Easy Movement ● Bomb Shelter	**Disadvantages** ● Little Line of Sight ● Few Escapes ● Dark ● Possible Blockages ● No Solar Use
If setting up in a tunnel, make sure you know how it's drained and keep those systems operational. Don't use generators or you could be suffocated inside. The perfect tunnel would be one that has one end higher than the other or is an **inverted** "U" shape to allow water and air to flow through. Never choose a tunnel in a "U" shape that goes under the ground level. Tunnels will be very dark even during the day depending on their length so you will need some form of lighting it using lights or mirrors to bounce the light around. The biggest bonus for tunnels is their few entrances and the ability to resist gunfire, missiles and other forms of weapons, so they are the best choice in a war scenario.				**Hazards** ● Flooding ● Carbon Monoxide

7 Water Survival

This section describes how to survive on the ocean and how to properly cross bodies of water while heeding the dangers.

Swimming

Swimming is the self-propulsion of a person through water or other liquid, such as saltwater or freshwater environments, usually for recreation, sport, exercise, or survival. Swimmers achieve locomotion by coordinating limb and body movements to achieve hydrodynamic thrust that results in directional motion. Newborns can instinctively hold their breath underwater and exhibit rudimentary swimming movements as part of a survival reflex. Swimming requires endurance, skill, and efficient techniques to maximize speed and minimize energy consumption.

Treading Water

The swimmer is in the water head up and feet down. Different kicks, such as the whip kick or eggbeater kick, and hand movements (Sculling) are used to stay afloat. This is useful to keep the head out of the water for a better view or to catch an object as for example in water polo. In addition, treading water is used in training by competitive swimmers in order to build up the strength of the kick; butterfly or scissors kick are most common when training vertically.

Non-swimmers often splash and kick in an effort to stay above the surface but their lack of technique along with shortness of breath and the panic factor make for a very ineffective method of treading water. They will usually tire quickly and not be able to stay above the surface very long.

Experienced swimmers use a variety of techniques to stay above the surface. These techniques often involve sculling, flutter kick, and other unofficial techniques of staying above the surface.

Whip Kick / Frog Kick: Consists of two phases: bringing the feet into position for the thrust phase and the insweep phase. From the initial position with the legs stretched out backward, the feet are moved together towards the posterior, while the knees stay together. The knees should not sink too low, as this increases the drag. Then the feet point outward in preparation for the thrust phase. In the thrust phase, the legs are moved elliptically back to the initial position. During this movement, the knees are kept together. The legs move slower while bringing the legs into position for the thrust phase, and move very fast during the thrust phase.

Eggbeater Kick: The swimmer's back must be straight, knees bent so that the thighs are parallel to the surface of the water, and lower legs perpendicular to the surface.

The left foot makes a clockwise motion while the right leg makes a counterclockwise motion towards the axis of the body, in a similar manner to operating the pedals on a bicycle. The legs should never meet as when one foot is on the inside of the motion, the other should be on the outside. The arms are not involved directly in this kick. The most critical aspect to having an effective eggbeater kick is flexibility. A very good hip motion range is needed to achieve a good eggbeater kick.

Sculling: This is a figure 8 movement of the hands for forward motion or upward lift. Used in surf lifesaving, water polo, synchronized swimming and treading water.

Survival Floating / Drownproofing

Drownproofing is a method for surviving in water disaster scenarios without sinking or drowning. Lying on the prone (face down in water) with minimal leg movement, and staying afloat with the natural buoyancy. Lift the head to breathe only then return to floating again. This style is only to stay afloat and to rest. This is also known as dead man float and drownproofing.

In Drownproofing terminology, the great majority of people are "floaters". That is to say that, with the lungs fully inflated (or say at total lung capacity), they have slightly less specific gravity than water and will not start to sink until they exhale. An average floater has 3–4 lb (1.4–1.8 kg) of positive buoyancy in fresh water. "Sinkers" can also benefit from a modified technique, but will find it more difficult to learn and will probably need specialised coaching.

In the Drownproofing survival technique, the subject floats in a relaxed, near-vertical posture, with the top of the head just above the surface. Using the arms or legs to exert a downward pressure, the subject raises himself sufficiently so that the mouth is above the surface and a breath is taken, before dropping back into the relaxed float. This is done several times a minute (typically between 5 and 10), depending upon the needs of the individual. It is important to keep the lungs fully inflated for the maximum possible time and to exhale and inhale rapidly when a breath is taken. The technique is easy to learn and does not require arduous training or a high standard of physical fitness. With practice, it is possible to remain afloat in this way for a long time with minimal effort. Lanoue taught his students to perform the technique with hands and feet tied, thus demonstrating that it is possible to survive even when injured or otherwise disabled.

Back Floating

Similar to the survival floating, except on the back.

Front Crawl

The fastest style for swimming on the surface. Done while face down. The arms alternate while the legs perform a flutter kick.

Flutter Kick: Flutter kicks are a four-count exercise. Starting position is lying flat on the back with the feet and head approximately 6 inches (15 cm) off the ground. Hands are under the buttocks to support the lower back. Count one: raise the left leg to a 45-degree angle, keeping the right leg stationary. Count two: raise the right leg off the ground to a 45-degree angle while, at the same time, moving the left leg to the starting position. Counts three and four are repetitions of the same movements. Legs must be locked, with toes pointing away from the body.

Trudgen

The trudgen is similar to the front crawl, except that it is paired with a scissors kick, similar to that used in the sidestroke.

Scissors Kick: A scissor kick occurs when the legs are asymmetrical and the knees are apart. The legs move simultaneously but in different directions, like the blades of scissors.

Butterfly Stroke

Performed face down in the water. The legs perform a dolphin kick while the arms move symetrically in a forward circle at the same time. The butterfly stroke boasts a higher peak velocity than the front crawl, owing to the synchronous propulsion generated by the simultaneous pull/push of both arms and legs.

Dolphin Kick: The dolphin kick is named for its resemblance to the motions made by a swimming dolphin. It is typically used in competitive swimming immediately after a swimmer enters the water or after turns. The swimmer performs the kick by moving both legs together, vertically, which sends a wave through the swimmer's body, propelling them forward. The shoulders rise with a strong up and medium down kick, then lower with a strong down and up kick. A fluid undulation connects the motion. The feet are pressed together to avoid loss of water pressure. The feet naturally point downwards, give thrust downwards, move up the feet, and press down the head.

Breaststroke

Performed face down in the water without rotating the torso. The arms stay in the water and move synchronously, while the legs perform a whip kick (which is sometimes called a breaststroke kick). It is possible to keep the head elevated out of the water throughout the stroke, although the head usually dips in and out.

Whip Kick / Frog Kick: Consists of two phases: bringing the feet into position for the thrust phase and the insweep phase. From the initial position with the legs stretched out backward, the feet are moved together towards the posterior, while the knees stay together. The knees should not sink too low, as this increases the drag. Then the feet point outward in preparation for the thrust phase. In the thrust phase, the legs are moved elliptically back to the initial position. During this movement, the knees are kept together. The legs move slower while bringing the legs into position for the thrust phase, and move very fast during the thrust phase.

Backstroke

Done while lying on the back. One arm reaches behind the head with a fingertip entry while the other arm is by the side. The legs perform a flutter kick. In backstroke, the arms contribute most of the forward movement. The arm stroke consists of two main parts: the power phase (consisting of three separate parts) and the recovery. The arms alternate so that one arm is always underwater while the other arm is recovering. One complete arm turn is considered one cycle. From the initial position, one arm sinks slightly under water and turns the palm outward to start the catch phase (first part of the power phase). The hand enters downward (pinkie finger first) then pulling out at a 45-degree angle, catching the water.

During the power phase the hand follows a semi-circular path from the catch to the side of the hip. The palm is always facing away from the swimming direction, while remaining straight as an extension of the arm, and the elbow always points downward towards the bottom of the pool. This is done so that both the arms and the elbow can push the maximum amount of water back in order to push the body forward. At the height of the shoulders, the upper and lower arms should have their maximum angle of about 90 degrees. This is called the Mid-Pull of the power phase.

The Mid-Pull phase consists of pushing the palm of the hand as far down as possible with the fingers pointing upward. Again, the goal is to push the body forward against the water. At the very end of the Mid-Pull, the palm flaps down for a last push forward down to a depth of 45 cm, creating the finish of the power phase. Besides pushing the body forward, this also helps with the rolling back to the other side as part of the body movement. During the power phase, the fingers of the hand can be slightly apart, as this will increase the resistance of the hand in the water due to turbulence.

To prepare for the recovery phase, the hand is rotated so that the palms point towards the legs and the thumb side points upwards. At the beginning of the recovery phase of the one arm, the other arm begins its power phase. The recovering arm is moved in a semicircle straight over the shoulders to the front. During this recovery, the palm rotates so that the small finger enters the water first, allowing for the least amount of resistance, and the palms point outward. After a short gliding phase, the cycle repeats with the preparation for the next power phase.

Sidestroke

The sidestroke is a swimming stroke, so named because the swimmer lies on one's side with asymmetric arm and leg motion. It is helpful as a lifesaving technique and is often used for long-distance swimming. The sidestroke allows the swimmer increased endurance because instead of working both arms and legs simultaneously in the same way, the side stroke uses them simultaneously but differently. A swimmer tired of exercising one side can turn over and use the other, the change of action helping the limbs to recover.

On the side, pull the water as if with a rope with arms going out and stopping in the middle while ensuring that the strokes are most hydrodynamic when moving towards the desired location, and pushing the most water when moving away from the location. In addition, the legs are performing a scissors kick, which is like whip kick, but sideways.

Dog Paddle

The dog paddle or doggy paddle is a simple swimming style. It is characterized by the swimmer lying on their chest and moving their hands and legs alternately in a manner reminiscent of how dogs and other quadrupedal mammals swim. It is effectively a "trot" in water, instead of land. It is often the first swimming stroke used by young children when they are learning to swim. The dog paddle has also been taught as a military swimming stroke when a silent stroke is needed - since neither arms or legs break the surface.

Face over water and paddling with alternate hands, often with the nose and mouth above the water. This stroke can be used in reverse to propel the body feet first.

Snorkeling

Snorkeling is the practice of swimming face down on or through a body of water while breathing the ambient air through a shaped tube called a snorkel, usually with swimming goggles or a diving mask, and swimfins. In cooler waters, a wetsuit may also be worn. The snorkel may be an independent item or integrated with the mask. The use of this equipment allows the snorkeler to observe the underwater environment for extended periods with relatively little effort, and to breathe while face-down at the surface.

Snorkel: A snorkel is a device used for breathing air from above the surface when the wearer's head is facing downwards in the water with the mouth and the nose submerged. It may be either separate or integrated into a swimming or diving mask. The integrated version is only suitable for surface snorkeling, while the separate device may also be used for underwater activities such as spearfishing, freediving, finswimming, underwater hockey, underwater rugby and for surface breathing with scuba equipment. A swimmer's snorkel is a tube bent into a shape often resembling the letter "L" or "J", fitted with a mouthpiece at the lower end and constructed of light metal, rubber or plastic.

Diving

Underwater diving, as a human activity, is the practice of descending below the water's surface to interact with the environment. It is also often referred to as diving, an ambiguous term with several possible meanings, depending on context. Immersion in water and exposure to high ambient pressure have physiological effects that limit the depths and duration possible in ambient pressure diving. Humans are not physiologically and anatomically well-adapted to the environmental conditions of diving, and various equipment has been developed to extend the depth and duration of human dives, and allow different types of work to be done.

In ambient pressure diving, the diver is directly exposed to the pressure of the surrounding water. The ambient pressure diver may dive on breath-hold (freediving) or use breathing apparatus for scuba diving or surface-supplied diving, and the saturation diving technique reduces the risk of decompression sickness (DCS) after long-duration deep dives. Atmospheric diving suits (ADS) may be used to isolate the diver from high ambient pressure. Crewed submersibles can extend depth range to full ocean depth, and remotely controlled or robotic machines can reduce risk to humans.

Freediving

Freediving, free-diving, free diving, breath-hold diving, or skin diving, is a mode of underwater diving that relies on breath-holding until resurfacing rather than the use of breathing apparatus such as scuba gear. Besides the limits of breath-hold, immersion in water and exposure to high ambient pressure also have physiological effects that limit the depths and duration possible in freediving.

Scuba Diving

Scuba diving is a mode of underwater diving whereby divers use breathing equipment that is completely independent of a surface breathing gas supply, and therefore has a limited but variable endurance. The word scuba is an acronym for "Self-Contained Underwater Breathing Apparatus" and was coined by Christian J. Lambertsen in a patent submitted in 1952. Scuba divers carry their own source of breathing gas, usually compressed air, affording them greater independence and movement than surface-supplied divers, and more time underwater than freedivers. Although the use of compressed air is common, other gas blends are also used.

Open-circuit scuba systems discharge the breathing gas into the environment as it is exhaled and consist of one or more diving cylinders containing breathing gas at high pressure which is supplied to the diver at ambient pressure through a diving regulator. They may include additional cylinders for range extension, decompression gas or emergency breathing gas.

Closed-circuit or semi-closed circuit rebreather scuba systems allow recycling of exhaled gases. The volume of gas used is reduced compared to that of open-circuit, making longer dives feasible. Rebreathers extend the time spent underwater compared to open-circuit for the same metabolic gas consumption. They produce fewer bubbles and less noise than open-circuit scuba, which makes them attractive to covert military divers to avoid detection, scientific divers to avoid disturbing marine animals, and media divers to avoid bubble interference.

River Crossing

Different ways to cross a body of moving water safely.

Dangers

There are many dangers around crossing rivers, some of which may not be very obvious at first.

Water Speed	The water speed plays a huge factor in the danger of crossing the river, and geneally the one people think of the most. Further down in the River Crossing section, under Raft Crossing is the internationally accepted rating system for rafting on rapids. It will give you a scale of how dangerous a river is to try and cross.
River Width	The wider the river, generally, the more dangerous it will be. However when rivers widen, they often lose some depth.
Water Depth	The water depth, combined with its speed are two of the greatest factors in determining its safety. You want to look for a crossing point where the depth is generally unchanged.
Water Temperature	If the water is colder, it will make it more difficult to cross due to the 'shock' of freezing or cold water on your body.
Water Clarity	The muddier the water, the harder it will be to see threats under its surface.
Noise	Rapids can drown out your voice easily, so if you're with a team, use hand signals you all agree on before you begin.

SURVIVAL | Water Survival | River Crossing | Dangers

Moving Hazards	In deep, rapid flowing water, there may be debris such as logs being carried downstream which will likely knock you off your feet. Some flowing water can carry along boulders along the floor of the river.
Fixed Hazards	There could be fixed hazards under the surface of the water such as a chasm, tree roots, very sharp rocks or even sheared parts of metal man-made structures.
Tree Entrapment	Trees lying across the river surface with their branches hanging down form a natural sieve which can easily entrap a swimmer. If you cannot avoid floating towards a strainer or tree you must change position from the white water float position to a head first position. From this position a front crawl stroke can be used to assist the swimmer to propel themselves up and over the tree. This can be a difficult manoeuvre especially if the tree has a large trunk. As an absolute last resort if the swimmer cannot get up and over the tree, they must plan to dive underneath head first, timing their breathing and attempting to pull themselves through the branches. When participating in any recreational activity on rivers where trees are a factor participants must plan on scouting around corners before entering the water especially after floods.
Foot Entrapment	Foot Entrapment is a very common drowning scenario and is usually caused by swimmers finding themselves in relatively shallow moving water and attempting to stand up. In this situation it is very easy to wedge a foot between two large rocks especially if the swimmer is wearing hiking boots. The force of the current will carry their body forward forcing their head under the water. Once entrapment of this type occurs it is difficult if not virtually impossible for a victim to escape unaided. Rescuers must try and reach the victim without putting themselves at risk. This can be done by either shallow water crossing up fo the victim or as a last resort swimming down. The intention being to reach the victim and keep their head above water until extrication can be achieved.
Wildlife	The most dangerous wildlife you need to watch out for during crossings would be alligators, crocodiles, piranhas, jellyfish, bears, hippos and potentially sharks if you're a little upstream from the ocean. Keep in mind that crocodiles can hold their breath up to 8 hours and typically stay submerged for over 1 hour at a time. Alligators typically need to take a breath every 20 up to 45 minutes but can hold their breath many hours. See the 'Sea Threats' section below for more on wildlife dangers.

Crossing Basics

● Take the time to study the water and alternative routes before crossing.
● Have multiple points of contact at all times.
● Know your entry and exit points to the water.
● Don't fight the current, use it to help you cross by moving diagonally across it.
● Use mutual support if you are part of a team crossing.
● Avoid wearing baggy clothes.
● Swim if you fall in.
● Anticipate what could go wrong in the crossing and have a contingency plan for each event.

Crossing Point

Anticipate what would happen if someone is swept away. Choose a place where the water leads into easier conditions such as a calm pool or shallower water. Ensure you know the layout of the river and down the river a few hundred metres before you attempt to cross. Analyse the threats mentioned above at different point along the river and choose the safest location from them all.

Wading Across

When the current is strong, but still safe enough to cross, face upstream and shuffle across the river sideways. By crossing at a shallow diagonal angle, you can reduce the risk of being pushed backward and slipping on an unseen obstacle. Move one foot at a time. Do not cross your legs. Make small careful steps. Work your way sideways and slightly upstream using the full strength of your legs to keep yourself secure. Keep two points of contact securely pressed into the ground at all times. Make sure that each foot is firmly planted before you make your next move.

Pack Floating
Used where crossing is deep and the river is clear of debris and the current is not a problem. Hold the pack in front with one hand and use your other hand (with the aid of your legs) to propel your pack and yourself towards the bank. The contents of pack should be water-proofed before any pack float. Everyone pack floating should be able to swim.

If You Fall In
Your backpack will quickly become a waterlogged anchor that may rotate on top of you and pin you down. If this happens, save yourself by ditching your pack if you need to. Otherwise lean back on pack and face downstream and push down on pack straps to keep the pack on your back. Keep your feet in a running position and head diagonally towards the bank. Remove the pack only if you lose control of it and/or it pushes you under.

Unbuckle your pack before you start your crossing so that you can quickly jettison it if you're panicked during the crossing. It may be a good idea to keep the most essential items on your belt in case this happens. Only you can determine your essentials, but these are most likely to be a communication device, a knife, a water bottle and a tarp.

If You Are Swept Away without your Backpack
Point your feet downstream and ensure you are on your back. You want to look where you're going and use your feet to protect yourself from impacts. Protect your head and face as you go. Swim quickly to shore and away from hazards.

Pole Crossing

In most situations, you want to use one or two trekking poles or sturdy sticks. Lean into your pole(s) and lean into the current. It's debatable and situation dependent whether you want to use one or two poles. If the current is moving your poles around, you might find that you need both hands to manage a single pole. But if a single pole breaks or moves, you don't have the security of the second pole. It can be a good idea to remove your trekking pole basket to reduce drag.

SURVIVAL Water Survival River Crossing Pole Crossing

- Hold the pole diagonally across the body.
- Have your body parallel to the direction of river flow.
- Pole positioned upstream and moved through the water.
- Pole dimensions approximately 2 metres x 6cm.
- Pack straps loosened and waist band undone.
- Maximum depth of water approximately thigh deep.
- Lean on pole using it as a '3rd' leg as you move your feet forward.
- Move diagonally across and slightly downstream in an 'arc' fashion.
- Used for individual crossings.
- Lacks strength of mutual support methods.
- Suitable for rivers with reasonably smooth bottoms and no hazards down stream.
- Always wear footwear.

Long Pole Crossing (Group)

This is a group crossing technique where every member holds onto a long pole or tree branch and crosses.

- The group should be parallel to direction of the river flow.
- Strongest person on the upstream end, they also control the movement of the group.
- Second strongest person on the downstream end.
- Pack straps loosened. Waist belt undone.
- Upstream arm over and downstream arm under the pole. Everyone's arms should be linked together.
- The maximum water depth should be up to waist height.
- The pole diameter should be around 6-7 cm.
- The group should move diagonally across and slightly downstream.
- Used by groups of 3-6 people where river conditions are too dangerous for individual crossing.
- Very strong and stable method.
- Retreat backwards if conditions are too difficult. Do not turn around.
- Always wear footwear.

Mutual Support Crossing (Group)

A method for groups to use when crossing strong rivers when a long pole isn't available.

- Strongest person on the upstream end.
- Upstream person slightly forward.
- Second strongest person at downstream end.
- Link your arms at the elbow.
- The group should be parallel to the current.
- The maximum river depth approximately should be about thigh deep.
- Pack straps loosened and waist band undone.
- Used by groups of 3-5 people.
- Suitable for rivers with uneven beds.
- Groups move as a single unit.
- Always wear footwear.

Rope Crossing

Disclaimer
Ropes are often poorly used by backpackers crossing creeks. They can pin you down, strangle you and kill you in a multitude of ways. Don't even think about it unless you're a swiftwater expert. Make sure that nobody is ever tied into a rope and that the rope is never tied around the thrower if used to rescue someone in the water. A knife must be carried in an accessible position by the person controlling the rope in order to cut a trapped person free if this becomes necessary.

Carrying floating ropes is a major advantage in any river crossing, provided they are used with care and the group have practised in a safe environment beforehand. A rope throw bag is nylon bag with two ends - one end is a fixed size where the floating rope comes out and the other end has a drawstring to aid in the rope coming out when it's thrown. The small end of the bag has the rope with a loop tied into it so it can't be pulled back into the bag which is also threaded through a closed-cell foam pad to aid in flotation and a washer on either side of the foam. This is the end that the individual in distress grabs. Through the middle of the bag is the rest of the wound rope, with the other end coming out of the bag and is held by the rescuer or tied to a sturdy object.

Crossing with Injured

If there is an injured person in the party, it is best to stay and wait for help to arrive. But if the situation arises where an evacuation is required, the following two methods work well:

Mutual Support Using a Pole

This method is the same as the pole crossing except that the group will form two parallel lines behind the leader. The leader moves into the water, facing upstream with the pole out in front in both hands and the bottom end pushed into the river bed about a metre upstream. The rest of the team lines up in two parallel lines behind the leader. The pair directly behind the leader use their outside arm to pull down (not back) on the leaders shoulders or pack straps if wearing a pack and link their inside arms across each other's shoulders and so forth down the line.

It will depend on how many members in the party as to where the biggest and strongest members will be placed. They can either link inside arms with the patient sitting on their arms or sit the patient on a pole carried between them. The load can also be shared between two pairs in this manner with the pair in front supporting the legs. The patient if conscious can relieve some of the load by wrapping their arms around either shoulder of the main carriers. The load bearers are placed in the middle of the line and the rest of the party closes up to form mutual support.

Carrying a Stretcher

If the patient is seriously injured or too heavy for the above method, a stretcher can be made out of poles or rope. The stretcher is placed down the centre of the two lines and lifted with the inside arms of the rescuers. Each person in the line grasps the outside shoulder of the person directly in front with their outside arm as in the method above. The group closes up to gain mutual support and moves as a team under the instructions of the leader.

Never tie a person into a stretcher when crossing water in case the people carrying slip and fall. The patient if tied in would have no chance of survival unless rescued immediately. Do not place a patient face down in a stretcher or allow their head to go under the water. If the patient is strapped in, remove all ties before reaching the rivers edge and pack them safely away. Re-strap the patient only when the party is safely on the opposite shore. Carrying a patient on a stretcher successfully across a river will take some practice and will generally require a large group.

In all group crossing methods the person at the front of the line calls the commands and in the case of a large group will need to call loudly and clearly.

Swimming Across

When the river is too deep to walk and there is no other option such as walking down to the nearest bridge or waiting for the river to drop, the party may be able to cross by swimming. This does however carry a considerable risk factor especially if some of the party are not strong swimmers. It is the responsibility of the leader to always be aware of the capabilities of all members in the group.

Swimming, Using a Pack as a Float

This method is for strong swimmers only, as each person swims separately and therefore does not have any support from the rest of the party. Most swimmers will need a clear run and if there is any current a long run out so a careful choice of the crossing place is necessary. The swimmer wades out into the river facing upstream with the pack in front floating on the water. As long as it has been well packed, with all items secured inside a water proof bag, the pack will have considerable buoyancy.

As the water becomes deeper, the pack can be used like a kick board either held out in front or by pushing it under the chest area to keep the upper body slighily raised out of the water. The arms and legs are used for propulsion as one would when swimming and an attempt must always be made to stay facing upstream angling towards the far bank.

If the party has a rescue throw bag the strongest swimmer can swim across first and assist the other members by throwing a rope out as soon as they get close. Once the person swimming receives the rope they then roll over onto their backs into the white water float position with the pack downstream. Taking the rope over the opposite shoulder will pendulum them to shore.

Recovery of Swimmers

There is always a possibility that something can go wrong during a crossing, but as long as the crossing place is chosen carefully this need not lead to disaster. The main problem that will occur is people getting swept off their feet. When this happens the pack becomes a lifejacket. The swimmer assumes the white water float position leaning back on the pack, with their head upstream and body turned slightly towards the direction of travel. Kicking with the legs and using the arms in a backstroke motion provides a more than adequate means of propulsion. The swimmer must wait until safely eddied out before any attempt is made to stand up. With the modern camlock waist belts keeping them cinched tight will stop the pack riding up allowing hands to stay free for swimming. Older style packs will generally have to be taken off and used as flotation devices.

Team River Crossing

If you have multiple people crossing a river, you can use these techniques.

Mutual Support Method / Human Chain / Line Abreast

This is one of the most common and effective methods for groups of 3-6 people.

Formation: Group members stand in a line parallel to the river flow, facing slightly upstream.
Positioning: The strongest and tallest person should be positioned at the upstream end, as they break the force of the current for those downstream. The second strongest person is often at the downstream end.
Linking: Individuals link arms, grasp each other's pack straps, or hold onto each other's hip belts. The goal is to create a solid, interlinked unit that moves together.
Movement: The group moves as one unit, taking small, shuffling steps. They move diagonally across the river, slightly downstream with the current, rather than trying to go straight across. This minimizes resistance and uses the current's force to assist the crossing.
Communication: Constant communication within the group is vital to coordinate steps and react to changes in the riverbed or current.

Human Tripod / Triangle Formation

This technique is particularly effective for groups of three.

Formation: Three individuals form a triangle, interlocking arms or holding onto each other's shoulders, with the strongest person at the apex facing slightly upstream into the current.
Movement: The group moves in unison, taking coordinated small steps. The triangular formation provides excellent stability, distributing the force of the water across multiple points of contact.

Advantages: This method offers good all-around stability and allows for a 360-degree awareness of surroundings.

Line Astern / Strongest Person Leading

This method involves people lining up one behind the other, facing upstream into the current.

Formation: Group members stand in a line, one behind the other, each holding onto the pack or waist of the person in front. The strongest person leads from the front, breaking the current.
Movement: The leader coordinates the movement, often a sideways "crab walk," while the rest of the group follows, maintaining the connection.
Advantages: This can be effective in narrower channels or where the current is very strong, as the leader bears the brunt of the force.

Group Rope Technique

This technique is used for larger groups or when conditions are particularly challenging, requiring specialized equipment and skills.

Deployment: A strong swimmer or a pair of strong swimmers (preferably with swift water rescue training) crosses the river first, taking a rope with them.
Anchoring: The rope is securely anchored on both sides of the river (using sturdy trees or rock formations and appropriate knots like a bowline or figure-eight follow-through).
Crossing: The remaining group members then cross one at a time, or sometimes in small groups, using the rope as a handrail and a stabilizing aid. Packs can be attached to the rope with carabiners to be pulled across.
Safety: This method requires careful planning, proper knot-tying, and strong anchoring points. Downstream safety (with a throw bag and rescue personnel) should be considered.

Ocean Crossing

SURVIVAL | Water Survival | Ocean Crossing

How to cross the ocean in a boat or ship. It's assumed that the journey will take quite some time without the ability to stop for additional resources. See the TRANSPORT > Sea > Liveaboard section for more information on living on a boat.

Considerations

Food	
Water	
Waste	
Power	
Medical	
Communication	
Passports	If the grid is still up, or is up in another country, you are going to need a passport to get your into the other country successfully.

Dangers

There are a few dangers and consideration to take into account when crossing the ocean.

Storms	
Animals	

Rafting

Rafting and whitewater rafting are recreational outdoor activities which use an inflatable raft to navigate a river or other body of water. This is often done on whitewater or different degrees of rough water.

Rapids Categorization

Below is the internationally accepted rating system for rafting on rapids. It will give you a scale of how dangerous it is to try and cross.

Class I	Moving water with a few ripples and small waves. Few or no obstructions.
Class II	Rapids with smaller waves, clear channels that are obvious without scouting. Some maneuvering might be required.
Class III	Rapids with high, irregular waves. Narrow passages that often require precise manoeuvring. (This is the one that's a whole lot of fun)
Class IV	Long, difficult rapids with constricted passages that often require complex maneuvering in turbulent water. The course may be hard to determine and scouting is often necessary.
Class V	Extremely difficult, long, and very violent rapids with highly congested routes, which should be scouted from shore. Rescue conditions are difficult, and there is a significant hazard to life in the event of a mishap. Expert paddlers only.
Class VI	The difficulties of Class V carried to the extreme. Nearly impossible and very dangerous. For teams of experts only. Involves risk of life. Class VI rapids are not commercially raftable.

Marine Hazards

These are threats you may come across or have to consider when swimming in water or floating in a boat. Threats range from sharp rocks to deadly sea creatures.

Storms

See the NATURAL DISASTERS section for more on storms.

Waves

Wind waves or wind-generated waves, are water surface waves that occur on the free surface of bodies of water. They result from the wind blowing over an area of fluid surface. Waves in the oceans can travel thousands of miles before reaching land. Wind waves on Earth range in size from small ripples, to waves over 100 ft (30 m) high, being limited by wind speed, duration, affected area and water depth.

When directly generated and affected by local waters, a wind wave system is called a wind sea (or wind waves). Wind waves will travel in a great circle route after being generated - curving slightly left in the southern hemisphere and slightly right in the northern hemisphere. After moving out of the area of fetch, wind waves are called swells and can travel thousands of miles. A noteworthy example of this are waves generated south of Tasmania during heavy winds that will travel to southern California producing desirable surfing conditions. More generally, a swell consists of wind-generated waves that are not significantly affected by the local wind at that time. They have been generated elsewhere or some time ago. Wind waves in the ocean are called ocean surface waves.

Wind waves have a certain amount of randomness: subsequent waves differ in height, duration, and shape with limited predictability. They can be described as a stochastic process, in combination with the physics governing their generation, growth, propagation, and decay—as well as governing the interdependence between flow quantities such as: the water surface movements, flow velocities and water pressure. The key statistics of wind waves (both seas and swells) in evolving sea states can be predicted with wind wave models.

Although waves are usually considered in the water seas of Earth, the hydrocarbon seas of Titan may also have wind-driven waves.

Rogue Wave

Rogue waves (also known as freak waves, monster waves, episodic waves, killer waves, extreme waves, sneaker waves, and abnormal waves) are unusually large, unexpected and suddenly appearing surface waves that can be extremely dangerous, even to large ships such as ocean liners.

Rogue waves present considerable danger for several reasons: they are rare, are unpredictable, may appear suddenly or without warning, and can impact with tremendous force. A 12-metre (39 ft) wave in the usual "linear" wave model would have a breaking pressure of 6 metric tons per square metre (t/m2) (59 kPa; 8.5 psi). Although modern ships are designed to tolerate a breaking wave of 15 t/m2 (150 kPa; 21 psi), a rogue wave can dwarf both of these figures with a breaking pressure of 100 t/m2 (0.98 MPa; 140 psi).

In oceanography, rogue waves are more precisely defined as waves whose height is more than twice the significant wave height (Hs or SWH), which is itself defined as the mean of the largest third of waves in a wave record. Therefore, rogue waves are not necessarily the biggest waves found on the water; they are, rather, unusually large waves for a given sea state. Rogue waves seem not to have a single distinct cause, but occur where physical factors such as high winds and strong currents cause waves to merge to create a single exceptionally large wave.

Rogue waves can occur in media other than water. They appear to be ubiquitous in nature and have also been reported in liquid helium, in nonlinear optics and in microwave cavities. Recent research has focused on optical rogue waves which facilitate the study of the phenomenon in the laboratory. A 2015 paper studied the wave behaviour around a rogue wave, including optical, and the Draupner wave, and concluded that "rogue events do not necessarily appear without a warning, but are often preceded by a short phase of relative order". A 2012 study confirmed the existence of oceanic rogue holes, the inverse of rogue waves, where the depth of the hole can reach more than twice the significant wave height.

Rocks

Rocks can be dangerous to any form of boat or swimmer as they can shred through wood or metals given enough speed. Rocks or other water obstructions should always be watched for.

Icebergs

Very similar to rocks, however these can constantly move and may come towards you if the wind favours them. It may be deceptive but one did sink the supposedly unsinkable titanic.

Sandbank

Sandbanks, especially when they are submerged or partially hidden, can cause boats to ground, leading to damage, delays, and potentially dangerous situations. They are not static and can shift and change shape due to tides, currents, and weather conditions, making navigation challenging and potentially dangerous. When wind and tide combine, shallow sandbanks can create breaking water, which can be dangerous for boats, especially smaller ones, to navigate. Sandbanks can act as obstacles, narrowing channels and forcing boats to take unpredictable routes, increasing the risk of collisions or grounding. If a boat grounds on a sandbank, it can become difficult to maneuver or free, potentially leading to loss of control and further damage.

Creatures

See the ANIMALS section for more dangerous sea creatures and information on how to treat animal attacks.

Jellyfish

Jellyfish stings can cause pain and other health problems, and some species, like the box jellyfish and Irukandji, can be life-threatening, potentially leading to conditions like Irukandji syndrome with symptoms including severe pain, muscle cramps, and heart problems.

Crocodile & Alligator

Crocodiles are potentially dangerous to humans. People should never take unnecessary risks in crocodile habitat. Saltwater crocodiles inhabit both saltwater and freshwater habitats.

Some of the ways to stay safe in areas that may have saltwater crocodiles include:
• Never swim in water where crocodiles may live even if there is no warning sign. Only swim in designated safe swimming areas.
• Follow all crocodile warning signs - they are there for your safety and protection.
• Always keep a watch for crocodiles. They will see you before you see them.
• Never provoke, harass or interfere with crocodiles, even small ones.
• Never feed crocodiles - it is illegal and dangerous.
• Be extra vigilant around water at night and during the breeding season from September to April (Australia).
• Avoid approaching the edge of the water and don't paddle or wade at the edge of the water.
• Stay well back from any crocodile slide marks. Crocodiles may be close by and may approach people and boats.
• The smaller the boat, the greater the risk.
• Always stand a minimum of five metres from the water's edge when fishing.
• Be especially vigilant when launching or retrieving your boat in saltwater crocodile habitat.

• Do not lean over the edge of a boat or stand on logs overhanging water.
• Never dangle your arms or legs over the side of a boat. If you fall out of a boat, get out of the water as quickly as possible.
• Camp at least 2 metres above the high water mark and at least 50 metres from the water's edge. Avoid places where native animals and domestic stock drink.
• Avoid returning regularly to the same spot at the water's edge to fill your bucket.
• Dispose of food scraps, fish offal and other waste properly and away from your campsite.
• Never leave food scraps, fish frames or bait at your campsite. Always check that previous campers have not left these behind.
• Never prepare food, wash dishes or pursue any other activities near the water's edge or adjacent sloping banks. Instead, fill up your bucket and move away from the edge of the water before you start any tasks.

Shark

Piranha

Barracuda

Stingray

Octopus

8 Desert Survival

This section focuses on how to survive in hot climates.

Desert Tips

● Take it slow – The last thing you need to worry about is passing out in the middle of the desert, so take it easy, rest lots, and drink a ton of water. If you need to sit down often, that's fine! Go at your own pace and enjoy the hike.
● Bring a friend – Because the desert is such a hostile environment, it's not a good idea to go alone. Invite a friend, or better yet, a group of people. There's both safety and fun in numbers.
● Don't bring your dog – A ton of hikers love hitting the trails with their four-legged friends, but the desert is not a safe place for your pup. The hot sand can be severely damaging to the pads of their paws, and it just means extra water for you to drag along.
● Bring your phone, but turn it off – Extreme heat causes most phones to malfunction and drain the battery a lot faster than usual. Save your battery just in case you need your phone and keep it off until that happens. If you need your phone on, bring a backup battery.
● Do NOT eat the cacti – This is a huge myth – eating the insides of a cactus will not quench your thirst. It will very likely make you sick to your stomach, which will dehydrate you faster.

● Take advantage of shade when you get it – There's not much shade in the desert, so when you come across it, take a break. This will help conserve energy, water, and keep your health in a good place.
● Have an emergency plan in place – Do not, under any circumstances, hike into the desert without telling anyone of your plan. This is as easy as contacting a friend and telling them where you'll be hiking, when you should be back by, and when to assume you've gone missing. Finding lost hikers in the desert is like finding a needle in a haystack, so make it easy and have a plan.

Water Requirements

All the body's fluids make up one large body fluid pool. Losses of fluid from any one source is reflected in the levels of all the body's other fluids: e.g. profuse sweating will ultimately result in decreased blood volume. If a patient loses enough fluid through any manner-bleeding, sweating, vomiting, or diarrhoea-the end result is the same: dehydration and, potentially, volume shock. Adequate fluid is also critically important in hot environments to help our body thermo regulate. Dehydration is always easier to prevent than it is to treat. So it is important to ensure that all members of your group replace their regular fluid losses by drinking adequate amounts of water.

Your body absorbs fluids best when you drink frequently and in small amounts rather than drinking large amounts at one time. It also helps with fluid absorption if you drink while eating. A pinch of salt and sugar in the water will do if no food is available. Very dilute mixtures of sports drinks like Gatorade (add just enough to taste) work well for this purpose. Don't depend on feeling thirsty to tell you when to drink. Thirst is a late response of the body to fluid depletion. Once you feel thirsty, you are already low on fluids. The best indicator of proper fluid levels is urine output and colour. You, and all the people in your group should strive to be "copious and clear." Ample urine that is light coloured to clear shows that the body has plenty of fluid. Dark urine means that the body is low on water, and is trying to conserve its supply by hoarding fluid which means that urine becomes more concentrated (darker).

Season	Fluids / Day	Explanation
Fall / Spring	1.8-2.8L (0.47-0.73gal)	This is what an average person will need on a daily basis in general temperate conditions.
Hot Weather	2.8-3.7L (0.73-1gal)	In hot and humid weather you are losing additional fluid through sweating which must be replaced.
Winter	2.8-3.7L (0.73-1gal)	In the winter time you are losing moisture through evaporation to the dry air and especially through respiration. Dry air entering the lungs heats up and is exhaled saturated with moisture.
All Seasons	1.8L (0.47gal)	At high altitude the body looses more fluid. Increase your fluid intake if you are travelling at high altitudes (over 8,000 feet/2,438 meters)

Body Regulation

Fluids & Salts
Another factor in overall fluid balance is the replacement of salts lost to sweat. In most cases the salts found in normal food consumption is adequate for salt replacement. In the event of severe dehydration, a solution of ½ teaspoon salt and ½ teaspoon of baking soda per quart/litre of water can be used to replace lost fluid and salt. Use lukewarm fluids. Discontinue the fluids if the person becomes nauseated or vomits. Restart fluids as soon as the person can tolerate it.

Thermoregulation
The body has a number of mechanisms to properly maintain its optimal core temperature of 98.6° F (37° C). Above 105° F (40° C) many body enzymes become denatured and chemical reactions cannot take place leading to death. Below 98.6° F (37° C) chemical reactions slow down with various complications which can lead to death. Understanding thermoregulation is important to understanding Heat Illnesses and Cold Injuries.

Body Core Regulation
- **Vasodilation:** Increases surface blood flow which increases heat loss (when ambient temperature is less that body temperature).
- **Vasoconstriction:** Decreases blood flow to periphery, decreases heat loss.
- **Sweating:** Cools body through evaporative cooling.
- **Shivering:** Generates heat through increase in chemical reactions required for muscle activity. Visible shivering can maximally increase surface heat production by 500%. However, this is limited to a few hours because of depletion of muscle glucose and the onset of fatigue.
- **Activity:** Increasing/Decreasing Activity will cause corresponding increases in heat production and decreases in heat production.
- **Behavioural Responses:** Putting on or taking off layers of clothing will result in thermoregulation.

Heat Challenge

In hot weather, especially with humidity, you can lose a great deal of body fluid through exercise. This can lead to a variety of heat related illnesses including Heat Exhaustion and Heat Stroke. Heat Challenge is a combination of a number of external heat factors. Balanced against this Heat Challenge is your body's methods of Heat Loss (passive and active). When Heat Challenge is greater than Heat Loss, you are at risk for a heat-related injury. In order to reduce the risk you need to either decrease the Heat Challenge or increase your Heat Loss. Fluids are a central part of exercising in a Heat Challenge.

Heat Challenge
(Negative Factors)
- Temperature
- Exercise
- Humidity
- Body Wetness from sweating
- Wind

Passive Heat Loss
(Positive Factors)
- Body Size/shape - your surface to volume ratio effects how quickly you lose heat.
- Insulation - type of clothing layers
- Body Fat - amount of body fat also effects how quickly you lose heat
- Shell/Core Response - allows the body shell to act as a thermal barrier

Active Heat Loss
(Positive Factors)
- Radiant Heat from the body
- Sweating which causes heat loss through evaporation. Amount of sweating is limited by your fluid levels and level of fitness.

Heat Index

This chart provides guidelines for assessing the potential severity of heat stress. Individual reactions to heat will vary. Heat illnesses can occur at lower temperature than indicated on this chart. Exposure to full sunshine can increase values up to 8.3°C (15°F).

Temperature / Humidity	21°C (70°F)	24°C (75°F)	27°C (80°F)	29°C (85°F)	32°C (90°F)	35°C (95°F)	38°C (100°F)	41°C (105°F)	43°C (110°F)	46°C (115°F)	49°C (120°F)
0%	18°C (64°F)	20°C (69°F)	23°C (73°F)	26°C (78°F)	28°C (83°F)	31°C (87°F)	33°C (91°F)	35°C (95°F)	37°C (99°F)	39°C (103°F)	42°C (107°F)
10%	18°C (65°F)	21°C (70°F)	24°C (75°F)	27°C (80°F)	29°C (85°F)	33°C (90°F)	35°C (95°F)	38°C (100°F)	41°C (105°F)	44°C (111°F)	47°C (116°F)
20%	19°C (66°F)	22°C (72°F)	25°C (77°F)	28°C (82°F)	30°C (87°F)	33°C (93°F)	37°C (99°F)	41°C (105°F)	44°C (112°F)	49°C (120°F)	54°C (130°F)
30%	19°C (67°F)	23°C (73°F)	26°C (78°F)	29°C (84°F)	33°C (90°F)	36°C (96°F)	40°C (104°F)	45°C (113°F)	51°C (123°F)	57°C (135°F)	64°C (148°F)
40%	20°C (68°F)	23°C (74°F)	26°C (79°F)	30°C (86°F)	34°C (93°F)	38°C (101°F)	43°C (110°F)	56°C (123°F)	58°C (137°F)	66°C (151°F)	
50%	20°C (69°F)	24°C (75°F)	27°C (81°F)	31°C (88°F)	36°C (96°F)	42°C (107°F)	49°C (120°F)	57°C (135°F)	66°C (150°F)		
60%	21°C (70°F)	24°C (76°F)	28°C (82°F)	33°C (90°F)	38°C (100°F)	46°C (114°F)	56°C (132°F)	65°C (149°F)			
70%	21°C (70°F)	25°C (77°F)	29°C (85°F)	34°C (93°F)	41°C (106°F)	51°C (124°F)	62°C (144°F)				
80%	22°C (71°F)	26°C (78°F)	30°C (86°F)	36°C (97°F)	45°C (113°F)	58°C (136°F)					
90%	22°C (71°F)	26°C (79°F)	31°C (88°F)	39°C (102°F)	50°C (122°F)						
100%	22°C (72°F)	27°C (80°F)	33°C (91°F)	42°C (108°F)							

Apparent Temperature	32-40°C (90-104°F)	31-54°C (105-130°F)	Over 54°C (130°F)
Heat-stress risk with physical activity and/or prolonged exposure.	Heat Cramps / Exhaustion possible.	Heat Cramps / Exhaustion likely. Heat Stroke possible.	Heat Stroke very likely.

Heat Illnesses

Heat Cramps

Heat cramps are a form of muscle cramp brought on by exertion and insufficient salt.

Treatment
Replace salt and fluid and stretch the muscle. Kneading and pounding the muscle is less effective than stretching and probably contributes to residual soreness.

Heat Syncope

Heat Syncope (fainting) is a mild form of heat illness which results from physical exertion in a hot environment. In an effort to increase heat loss, the skin blood vessels dilate to such an extent that blood flow to the brain is reduced, resulting in symptoms of faintness, dizziness, headache, increased pulse rate, restlessness, nausea, vomiting, and possibly even a brief loss of consciousness. Inadequate fluid replacement which leads to dehydration contributes significantly to this problem.

Treatment
Heat Syncope should be treated as fainting. The person should lie or sit down, preferably in the shade or in a cool environment. Elevate the feet and give fluids, particularly those containing salt (commercial "rehydration" mix or ½ teaspoon salt and ½ teaspoon baking soda per quart/0.9 litre). The patient should not engage in vigorous activity for at least the rest of that day. Only after they have completely restored their body fluids and salt and have a normal urinary output should exercise in a hot environment be resumed (and then cautiously).

Heat Exhaustion

This occurs when fluid losses from sweating and respiration are greater than internal fluid reserves (volume depletion). Heat Exhaustion is really a form of volume shock. The lack of fluid causes the body to constrict blood vessels especially in the periphery (arms and legs). To understand Heat Exhaustion think of a car with a radiator leak pulling a trailer up a mountain pass. There is not enough fluid in the system to cool off the engine so the car overheats. Adding fluid solves the problem.

Symptoms of Heat Exhaustion
- Sweating
- Skin - Pale, clammy (from peripheral vasoconstriction)
- Pulse - Increased
- Respirations - Increased
- Temperature - normal or slightly elevated
- Urine Output - Decreased
- Patient feels weak, dizzy, thirsty, "sick," anxious
- Nausea and vomiting (from decreased circulation in the stomach)

Treatment

Victims of Heat Exhaustion must be properly re-hydrated and must be very careful about resuming physical activity (it is best to see a physician before doing so). Treatment is as described above for Heat Syncope, but the person should be more conservative about resuming physical activity to give the body a chance to recover. Have the person rest (lying down) in the shade. Replace fluid with a water/salt solution (commercial "rehydration" mix or ½ teaspoon salt and ½ teaspoon baking soda per quart/0.9 litre). Drink slowly, drinking too much, too fast very often causes nausea and vomiting. Evacuation usually is not necessary, however, Heat Exhaustion can become Heat Stroke if not properly treated. A victim of Heat Exhaustion should have be closely monitored to make sure that their temperature does not go above 39° C (103° F). If it does so, treat the person for Heat Stroke.

Heat Stroke (Hyperthermia)

Heat Stroke is one of the few life threatening medical emergencies. A victim can die within minutes if not properly treated. Heat Stroke is caused by an increase in the body's core temperature. Core temperatures over 105° (41° C) can lead to death. The rate of onset of Heat Stroke depends on the individual's fluid status. To understand Heat Stroke, think of that same car pulling a trailer up a mountain pass on a hot day. This time the radiator has plenty of fluid, but the heat challenge of the engine combined with the external temperature is too much. The engine can't great rid of the heat fast enough and the engine overheats. There are two types of Heat Stroke-fluid depleted (slow onset) and fluid intact (fast onset).

- Fluid depleted - The person has Heat Exhaustion due to fluid loss from sweating and/or inadequate fluid replacement, but continues to function in a heat challenge situation. Ultimately, the lack of fluid has minimized the body's active heat loss capabilities to such an extent that the internal core temperature begins to rise. Example: a runner on a hot day with limited water.
- Fluid intact (fast onset) - The person is under an extreme heat challenge. The heat challenge overwhelms the body's active heat loss mechanisms even though the fluid level is sufficient. Example: a runner pushing hard on a 40° C (104° F) day.

Symptoms

- The key to identifying Heat Stroke is hot skin. Some victims may have hot, dry skin, others may have hot, wet skin because they have just moved from Heat Exhaustion to Heat Stroke.
- Peripheral vasoconstriction (skin gets pale)
- Pulse Rate - increased
- Respiratory Rate - increased
- Urine Output - decreased
- Temperature - increased (over 105°F / 41°C)
- Skin - may be wet or dry, flushed
- AVPU - Severe changes in mental status and motor/sensory changes, then the person may become comatose, possibility of seizures.
- Pupils - may be dilated and unresponsive to light

- Efforts to reduce body temperature must begin immediately. Move the patient to a cooler spot or shade the victim. Remove clothing. Pour water on the extremities and fan the person to increase air circulation and evaporation. Or cover the extremities with cool wet cloths and fan the patient. Immersion in cool (not cold) water is also useful. During cooling the extremities should be massaged vigorously to help propel the cooled blood back into the core.
- After the temperature has been reduced to 39°C (102°F), active cooling should be reduced to avoid hypothermia (shivering produces more heat). The patient must be monitored closely to make sure that temperature does not begin to go up again.
- Volume replacement - the victim will probably need fluid regardless of the type of onset.
- Basic life support, CPR if needed.
- Afterwards there can be serious medical problems. Prepare to evacuate your patient.

For more information on heat related illnesses, see the INJURY > Environmental section.

9 Arctic Survival

This section focuses on how to survive in cold climates.

Cold Water Survival

Cold water is estimated to be around and under the temperature of 21°C (70°F). However, this will vary in each case due to the specific circumstances and physical condition of the person involved. Many of the fatal boating accidents occur in the "out-of-season" months when the water is cold. What happens to the body when suddenly plunged into cold water? The first hazards to contend with are panic and shock. The initial shock can place severe strain on the body, producing instant cardiac arrest, as happened to a 15 year old scout in the month of March in Pennsylvania several years ago. Survivors of cold water accidents have reported the breath driven from them on first impact with the water. Should your face be in the water during that first involuntary gasp for breath, it may well be water rather than air. Total disorientation may occur after cold water immersion.

Persons have reported "thrashing helplessly in the water" for thirty seconds or more until they were able to get their bearings. Immersion in cold water can quickly numb the extremities to the point of uselessness. Cold hands cannot fasten the straps of a lifejacket, grasp a thrown rescue line, or hold onto an over-turned boat. Within minutes, severe pain clouds rational thought. And, finally, hypothermia (exposure) sets in, and without rescue and proper first aid treatment, unconsciousness and death. Normal body temperature of course, is 37°C (98.6°F) Shivering and the sensation of cold can begin when the body temperature lowers to approximately 36°C (96.5°F). Amnesia can begin to set in at approximately 34°C (94°F), unconsciousness at 30°C (86°F) and death at approximately 26°C (79°F).

How to Survive
Cold water robs the body's heat 32 times faster than cold air. If you should fall into the water, all efforts should be given to getting out of the water by the fastest means possible. Persons boating in the cold water months should be thoroughly skilled in rescue and self-rescue techniques. Most accidents involve small boats which with practice, can be righted and re-entered. Most boats, even filled with water, will support the weight of its occupants. If the boat has capsized and cannot be made right, climb on top of it. Physical exercise such as swimming causes the body to lose heat at a much faster rate than remaining still in the water. Blood is pumped to the extremities and quickly cooled. Few people can swim a mile in fifty degree water. Should you find yourself in cold water and are not able to get out, you will be faced with a critical choice - to adopt a defensive posture in the water to conserve heat and wait for rescue, or attempt to swim to safety. Should you find yourself in the water, avoid panic. Air trapped in clothing can provide buoyancy as long as you remain still in the water. Swimming or treading water will greatly increase heat loss and can shorten survival time by more than 50%. The major body heat loss areas are the head, neck, armpits, chest and groin. If you are not alone, huddle together or in a group facing each other to maintain body heat.

Preparation
Proper preparation is essential when boating on cold water. Make sure your boat and equipment are in first class condition. Check the weather forecast before leaving for your event. Always tell someone where you are going and when you expect to return. Dress in several layers of light clothing. Next to a diver's wet suit, wool clothing offers the best protection. Always wear a personal flotation device (PFD) when boating.

Treatment
Treatment for hypothermia depends on the condition of the person. Mild hypothermia victims who show only symptoms of shivering and are capable of rational conversation may only require removal of wet clothes and replacement with dry clothes or blankets. In more severe cases where the victim is semi-conscious, immediate steps must be taken to begin the rewarming process. Get the person out of the water and into a warm environment. Remove the clothing only if it can be done with a minimum of movement of the victim's body. Do not massage the extremities. Lay the semi-conscious person face up, with the head slightly lowered, unless vomiting occurs. The head down position allows more blood to flow to the brain. If advanced rescue equipment is available it can be administered by those trained in its use. Warm humidified oxygen should be administered by face mask. Immediately attempt to rewarm the victims body core. If available, place the person in a bath of hot water at a temperature of 105-110°F. It is important that the victim's arms and legs be kept out of the water to prevent "after-drop". After-drop occurs when the cold blood from the limbs is forced back into the body resulting in further lowering of the core temperature. After-drop can be fatal. If a tub is not available, apply hot, wet towels or blankets to the victim's head, neck, chest, groin, and abdomen. Do not warm the arms or legs. If nothing else is available, a rescuer may use their own body heat to warm a hypothermia victim. Never give alcohol to a hypothermia victim.

Facts

Most persons recovered in cold water "near" drowning cases show the typical symptoms of death:
- Cyanotic (blue) skin coloration
- No detectable breathing
- No apparent pulse or heartbeat
- Pupils fully dilated (opened)

These symptoms, it was discovered, did not always mean the victim was dead. They were, on the other hand, the body's way of increasing its chances of survival through what scientists call the mammalian diving reflex. This reflex is most evident in marine mammals such as whales, seals or porpoises. In the diving reflex, blood is diverted away from the arms and legs to circulate (at the rate of only 6-8 beats per minute, in some cases) between the heart, brain and lungs. Marine mammals have developed this ability to the point where they can remain under water for extended periods of time (over 30 minutes in some species) without brain or body damage. Humans experience the diving reflex, but it is not as pronounced as in other mammals. The factors which enhance the diving reflex in humans are:

- Water temperature - less than 21°C (70°F) or colder, the more profound the response and perhaps the more protective to the brain
- Age - the younger the victim, the more active the reflex
- Facial immersion - the pathways necessary for stimulating this series of responses seem to emanate from facial cold water stimulation.

The diving reflex is a protective mechanism for humans in cold water immersions, but it may confuse the rescuer into thinking the victim is dead. Resuscitative efforts for these victims should be started immediately utilizing CPR in accordance with your training.

Cold Water Survival Time

The following is a table comparing the water temperature to the amount of time symptoms set in and the expected survival time.

Water Temperature	Exhaustion or Unconsciousness in:	Expected Survival Time
21–27°C (70–80°F)	3–12 hours	3 hours – indefinitely
16–21°C (60–70°F)	2–7 hours	2–40 hours
10–16°C (50–60°F)	1–2 hours	1–6 hours
4–10°C (40–50°F)	30–60 minutes	1–3 hours
0–4°C (32.5–40°F)	15–30 minutes	30–90 minutes
<0°C (<32°F)	Under 15 minutes	Under 15–45 minutes

Cold Weather Injuries

Heat Loss

These are the ways in which heat can be lost from your body.

Radiation	Loss of heat to the environment due to the temperature gradient (this occurs only as long as the ambient temperature is below 98.6). Factors important in radiant heat loss are the surface area and the temperature gradient.
Conduction	Through direct contact between objects, molecular transference of heat energy. Water conducts heat away from the body 25 times faster than air because it has a greater density (therefore a greater heat capacity). Stay dry = stay alive! Steel conducts heat away faster than water. Example: Generally conductive heat loss accounts for only about 2% of overall loss. However, with wet clothes the loss is increased five times.
Convection	Is a process of conduction where one of the objects is in motion. Molecules against the surface are heated, move away, and are replaced by new molecules which are also heated. The rate of convective heat loss depends on the density of the moving substance (water convection occurs more quickly than air convection) and the velocity of the moving substance.
Evaporation	Heat loss from converting water from a liquid to a gas. (Perspiration - evaporation of water to remove excess heat)
Perspiration (General)	It is important to recognize the strong connection between fluid levels, fluid loss, and heat loss. As body moisture is lost through the various evaporative processes the overall circulating volume is reduced which can lead to dehydration. This decrease in fluid level makes the body more susceptible to hypothermia and other cold injuries.
Perspiration (Sweating)	Body response to remove excess heat Insensible Perspiration - body sweats to maintain humidity level of 70% next to skin - particularly in a cold, dry environment you can lose a great deal of moisture this way Respiration - air is heated as it enters the lungs and is exhaled with an extremely high moisture content
Wind Chill	Is an example of the effects of air convection, the wind chill table gives a reading of the amount of heat lost to the environment relative to a still air temperature.

Cold Response

Cold Challenge - (negative factors) ● Temperature ● Wet (rain, sweat, water) ● Wind (blowing, moving, e.g. biking) Total = Cold Challenge	**Heat Retention - (positive factors)** ● Size/shape (Eskimo vs. Masai) ● Insulation (layering/type) ● Fat (as insulation) ● Shell/core (shunt blood to core) shell acts as a thermal barrier Total = Heat Retention	**Heat Production - (positive factors)** ● Exercise, shivering Limited by: ○ Fitness ○ Fuel stores (glycogen) ○ Fluid status (efficient exercise) ○ Food intake (kindling, sticks, logs)

Core Temperature
- Heat is both required and produced at the cellular level. The environment acts as either a heating or a cooling force on the body. The body must be able to generate heat, retain heat, and discharge heat depending on the body activity and ambient external temperature.
- Body temperature is a measure of the metabolism - the general level of chemical activity within the body.
- The hypothalamus is the major centre of the brain for regulating body temperature. It is sensitive to blood temperature changes of as little as 0.5°C and also reacts to nerve impulses received from nerve endings in the skin.
- The optimum temperature for chemical reactions to take place in the body is 37°C (98.6°F). Above 105 F many body enzymes become denatured and chemical reactions cannot take place leading to death. Below 98.6°F chemical reactions slow down with various complications which can lead to death.
- Core = the internal body organs, particularly the heart, lungs, and brain.
- Core temperature is the temperature that is essential to the overall metabolic rate of the body. The temperature of the periphery is not critical.

Core Temperature Regulation

How the body regulates core temperature.

1	Vasodilation - increases surface blood flow, increases heat loss (when ambient temperature is less that body temperature). Maximal vasodilation can increase cutaneous blood flow to 3000 ml/minute (average flow is 300-500 ml/minute).
2	Vasoconstriction - decreases blood flow to periphery, decreases heat loss. Maximal vasoconstriction can decrease cutaneous blood flow to 30 ml/minute.
3	Sweating - cools body through evaporative cooling.
4	Shivering - generates heat through increase in chemical reactions required for muscle activity. Visible shivering can maximally increase surface heat production by 500%. However, this is limited to a few hours because of depletion of muscle glucose and the onset of fatigue.
5	Increasing/Decreasing Activity will cause corresponding increases in heat production and decreases in heat production.
6	Behavioural Responses - putting on or taking off layers of clothing will result in heat regulation

Hypothermia

1. Hypothermia - "a decrease in the core body temperature to a level at which normal muscular and cerebral functions are impaired."	**2.** Conditions Leading to Hypothermia ● Cold temperatures ● Improper clothing and equipment ● Wetness ● Fatigue, exhaustion ● Dehydration ● Poor food intake ● No knowledge of hypothermia ● Alcohol intake - causes vasodilation leading to increased heat loss	**3.** What are "hypothermia" temperatures ● Below freezing ● 40° - Ex. Shenandoah's, wind and rain ● 60° - Ex. Rayanna and hurricane ● Any temperature less than 98.6° can be linked to hypothermia

Hypothermia Symptoms

Basic Hypothermia	Watch for the "Umbles" - stumbles, mumbles, fumbles, and grumbles which show changes in motor coordination and levels of consciousness.
Mild Hypothermia	**Core temperature 35.5-37°C (96-98.6°F)** ● Shivering - not under voluntary control ● Can't do complex motor functions (ice climbing or skiing) can still walk & talk ● Vasoconstriction to periphery

Moderate Hypothermia	**Core temperature 33.8-35°C (93-95°F)** ● Dazed consciousness ● Loss of fine motor coordination - particularly in hands - can't zip up parka, due to restricted peripheral blood flow ● Slurred speech ● Violent shivering ● Irrational behaviour - Paradoxical Undressing - person starts to take off clothing, unaware s/he is cold ● "I don't care attitude" - flattened affect
Severe Hypothermia	**Core temperature 30-33.3°C (86-92°F) and below (immediately life threatening)** ● Shivering occurs in waves, violent then pause, pauses get longer until shivering finally ceases - because the heat output from burning glycogen in the muscles is not sufficient to counteract the continually dropping core temperature, the body shuts down on shivering to conserve glucose ● Person falls to the ground, can't walk, curls up into a fetal position to conserve heat ● Muscle rigidity develops - because peripheral blood flow is reduced and due to lactic acid and CO_2 build-up in the muscles ● Skin is pale ● Pupils dilate ● Pulse rate decreases ● At 32°C (90°F) the body tries to move into hibernation, shutting down all peripheral blood flow and reducing breathing rate and heart rate. ● At 30°C (86°F) the body is in a state of "metabolic icebox." The person looks dead but is still alive.
Hypothermia Death	● Breathing becomes erratic and very shallow ● Semi-conscious ● Cardiac arrhythmias develop, any sudden shock may set off Ventricular Fibrillation ● Heart stops, death

Assessment
- If shivering can be stopped voluntarily = mild hypothermia
- Ask the person a question that requires higher reasoning in the brain (count backwards from 100 by 9's). If the person is hypothermic, they won't be able to do it. (Note: there are also other conditions such as altitude sickness that can also cause the same condition)
- If shivering cannot be stopped voluntarily = moderate - severe hypothermia
- If you can't get a radial pulse at the wrist it indicates a core temp below 90-86°F
- The person may be curled up in a fetal position. Try to open their arm up from the fetal position, if it curls back up, the person is alive. Dead muscles won't contract only live muscles.

For more information on cold related illnesses, see the INJURY > Environmental section.

10 Urban Survival

Survival in the suburbs, particularly in times of turmoil is a completely different beast to surviving on say, a desert island where your priorities and threats are completely different. This section aims to get you prepared for any situation which may arise where you are at a high risk of dying in the cities or suburbs.

Urban Survival

When the grid is up, one can survive in major population centres without a lot of issues. The biggest issue will be sheltering from unsavoury weather such as the cold, storms and flooding, parti

Street Smarts

Obtaining Food

Urban Threats

These are the threats you may encounter in an urban environment.

Crime

Competition

Competition of limited resources.

Limited Resources

In cities, food is trucked in from the farms which lay on the outskirts or another part of the country entirely which makes obtaining it difficult when a disaster strikes a city.

Food Removal

Have you noticed that cities and most suburbs almost never have plants which grow food in them?

Homeless Survival

You will generally only find long-term homeless individuals in the cities or suburbs, since out in the more remote places you generally have more liberty to build your own home. Even if you don't have the skills, country folk are often more hospitable and will take in those in need. This section aims to help you survive as a homeless individual if you are in a densely populated area.

11 Search & Rescue

This section will either help you to perform a search and rescue, or help you to avoid being found if that's your goal.

Search and Rescue (SAR) is the search for and provision of lifesaving assistance to people in distress and imminent danger of loss of life. SAR arrangements are intended to complement other emergency services (police, fire, ambulance) in circumstances where those services are unable to operate effectively. Depending upon the extent and complexity of the incident and on the available staff and facilities, SAR may take many forms in response to a distress situation. Unless the action is indivisible from that of safeguarding life, a SAR operation does not, however, include salvage or the saving of property.

Subheadings

1 Rescuer Training

The importance of thorough training for all personnel employed on SAR missions cannot be overemphasised. Failure of a single link in the often complex chain of action required in SAR missions can compromise the success of the operation, resulting in loss of lives of SAR personnel, lives of those that might otherwise have been saved and/or loss of valuable resources. The purpose of training is to meet SAR system objectives by developing SAR specialists. Since considerable experience and judgement are needed to handle SAR situations, necessary skills require significant time to master. Training can be expensive but contributes to operational effectiveness. Quality of performance will match the quality of training. This is the training and skills that rescuers should have before attempting search and rescue:

Land SAR Training	Search and Rescue (SAR) training.
Search and Rescue Crew Training	SAR Authorities should coordinate SAR exercises in conjunction with search and rescue crews to ensure practice is maintained in techniques employed in SAR operations.
Dropmaster and Dispatchers	The dispatch of survival stores and equipment from an aircraft to survivors on land or over water is an exacting task, which, if not performed well, can nullify or seriously delay the rescue effort and may endanger the aircraft and its crew.
Air Observer Training	Major SAR operations require a considerable number of observers who may be drawn from various organisations.
Aviation Search and Rescue Units (SRU)	Accordingly, operators are given training in one or more of the following aspects of SAR operations: ● Visual search procedures/techniques; ● Airborne location of distress beacons using aural homing techniques; ● Airborne location of distress beacons using DF equipment; ● On ground location of localised distress beacons; ● Operation of electronic sensor systems in SAR operations; ● Aerial delivery of supplies/equipment overland and/or over water; and ● Helicopter rescue techniques.
First Aid Training	All personnel involved in SAR need to be trained in basis first aid. JRCC, ADF and State/Territory have first aid training capabilities, via the Ambulance Services. While all personnel should have a basic first aid knowledge, at least one member of each search team should be qualified to a higher level of training, Senior First Aid or First Response First Aid. Regular training needs to be carried out to instill confidence in the delivery of first aid in remote situations.
Map Reading and Navigation	● Training is to be in accordance with the established map/chart reading plans for each State/Territory. The World Geodetic System (WGS) is a standard for use in cartography, geodesy, and navigation worldwide. It is the reference coordinate system used by the Global Positioning System (GPS). WGS standardises the Earth as a spheroid with its accompanying coordinate framework. The Australian Geodetic Datum (AGD), both the 1966 and 1984 versions, has been replaced by Geocentric Datum of Australia (GDA94). ● Training in map/chart usage is to be based on a combination of manual/historical methods and electronic methods to ensure an all-round capability.
Radio Operating Procedures	Training is to be in accordance with established standards within the JRCC, ADF and State/Territory and the Australian Emergency Manual—Communications
Field Craft	Field craft is a broad subject which is difficult to define in its entirety. It is a series of practical skills which can only be taught in the field. The aspects of field craft which are important to the searcher are: ● Searching ground by eye; ● Judging distance; ● Basic tracking; and ● Living in the bush.
Observation Skills	Observation is the skill of looking for clues and may be required to be conducted by day or night. The principles of clue recognition and interpretation are shown as Appendix E-13 to this Manual.

Observation Skills-Day

The ability to 'see' rather than just look, may need to be taught when operating in the unfamiliar bush environment, and observing changes and noting details are skills which must be developed in most people. To understand why things are seen, it must be explained that several factors are involved which aid this process:
- Shape—regular shapes do not occur in nature.
- Shine—rarely do natural things shine.
- Shadow—unusual shadows will often reveal what may appear to be hidden.
- Movement—immediately attracts the eye.
- Colour—differences to the natural background are obvious to the trained eye.
- Spacing—regular spacing does not occur in nature.

Observation Skills-Night

Due to the physical characteristics of the eye, if an observer looks directly at a small or dim object at night, it may not be seen. To optimise night vision objects should be observed 'off centre':
- Off Centre (Averted Vision): To achieve 'off centre' vision, the eye should be 'aimed off' from the object about a fist's width at arm's length. Only by experiment can the searcher find out which direction is most suitable for their aim off i.e. above, below or to one side of the object. It is important that the searcher resist the temptation to look directly at the object.
- Scanning: Scanning is the short, abrupt movement of the eye over or around an area of observation or an object that is being kept in view. It is used in conjunction with off centre vision in order to gain the maximum use of the eyes at night. Therefore, the observer should move their visual axis every 4–10 seconds. Night scanning differs from day-time scanning. Should the daytime technique of looking from left to right in overlapping parallel bands from near to far be used, then nothing would be seen.
- Starring: It is important to realise that when staring at a stationary light or prominent object in an otherwise black scene, the object may start moving. This happens because the eye has no bearing on which to check the exact position. This can be prevented by 'placing' the object against something else such as a finger at arm's length.
- Confidence: In order to gain confidence in the ability to see under low light levels, the correct use must be made of the eyes. Objects seen at night tend to be fuzzy and hazy around their extremities. Through practice, an observer must learn to recognise objects at night and how they differ from their day-time appearance. Once a searcher is familiar with the techniques of seeing at night, the confidence necessary for night operations will quickly follow.

Protection of Night Vision: Any bright light will spoil night vision. It is important that the searcher instinctively closes, or covers one eye when faced with any light at night. In addition they should:
  - Avoid looking at any bright light unnecessarily;
  - Shield the eyes with their hand from flares, spotlights or headlights (by so doing it's possible to see objects moving beyond the lights and it protects night vision);
  - Avoid waving torches about as not everybody will be quick enough to close their eyes in order to avoid being dazzled;
  - Put one hand over the glass when using torches to map read, and use the fingers to limit both the area illuminated and the brightness of the light (keep one eye shut and the time spent on reading the map to a minimum); and
  - Use of coloured filters on torches will assist in maintaining night vision although similar coloured markings on maps cannot be seen.

Team and Individual Skills

Each individual search team member must receive training in:
- Map/chart reading and navigation;
- Radio operating procedures;
- Basic first aid;
- Field craft/seamanship;
- Observation; and
- Search techniques.

Searchers

All persons involved in searches need specific skills, attributes, equipment and both physical and mental capabilities:
- Personal Equipment - Each searcher must be self-sufficient in personal equipment. Such equipment should be capable of being carried on the person, in pockets or on a belt. The carriage of excess equipment should be avoided as searchers must remain highly mobile. Suggested items include:
  - Clothing and footwear appropriate to the weather and the environment;
  - Appropriate headgear;
  - Filled water bottles, snacks and nibbles;
  - Pocket knife, whistle, notebook and pen;
  - Compass and map (if required);
  - Sun cream, insect repellent etc.; and
  - Minor personal first aid items.
- Attitude - Must be psychologically prepared for both the rigours of the search operation and for the possibility of locating a seriously injured or deceased person.
- Readiness—A readiness for the search including:
  - Commitment to the task;
  - Time commitment for the entire search rather than small segments of it;
  - Discipline and teamwork; and
  - Acceptance of hardships.
- Fitness—Searchers must be sufficiently fit to cope with the physical demands for the search activity.

Search Team Leaders/ On-Scene Commanders

Desirable Qualities: Searches involve people, therefore it is essential that the STL/OSC has the knowledge, experience and personality to effectively lead and control the team. They must be an effective manager, must be aware of the capabilities of the team, have an understanding of each member's limitations and have their general well-being in mind. There is a need for adequate rest, food and shelter during operations and the STL/OSC must ensure that this is provided.

The attributes of a STL/OSC include:
- Leadership skills;
- Dedication;
- Knowledge; and
- Flexibility.

The main skills for a STL/OSC are as follows:
- Orders - The ability to give clear, concise and detailed orders;
- Map/chart Reading and Navigation - The ability to read a map/chart and navigate in a variety of environmental conditions;
- Use of Radios - Use a radio, pass messages and use the terrain to best effect;
- Casualty Handling - They must have a sound knowledge of first aid and casualty handling procedures;
- Fieldcraft/seamanship - Must be skilled in living, navigating and operating in the field or at sea as appropriate; and
- Search Techniques - Must be competent in the implementation of all appropriate search techniques.

2 Distress and Emergency Signals

There are many signals that can be used to indicate a distress or other emergency. These emergency signals may be made by radio, satellite, telephone, texting, internet (email, social media, etc.). RADAR (e.g. transponders), flags, pyrotechnics, flashing lights, smoke, sounds, shapes and ground panels.

Emergency Signals

Marine Radio Alarm Signal	With the full implementation of the Global Maritime Distress and Safety System (GMDSS) in February 1999 the automatic alarm devices used on 2182 kHz are no longer required. However, some maritime communication stations may still use the voice alarm signal consisting of two sinusoidal audio frequency tones, one of 2200 Hz and the other of 1300 Hz, producing a distinct warbling sound to draw attention to a distress broadcast. Merchant shipping complying with the SOLAS Convention now guard the Digital Selective Calling (DSC) distress frequencies.
RTF Distress Signal	The distress signal “MAYDAY” is used to indicate that a craft or person is threatened by grave and imminent danger and requires immediate assistance. It has precedence over all other communications. The distress message is preceded by the word MAYDAY spoken three times.
RTF Urgency Signal	The urgency signal “PAN PAN” is used to indicate that the calling station has a very urgent message to transmit covering the safety of a ship, aircraft or person. It has precedence over all other communications, except distress traffic. The urgency message is preceded by the words 'PAN PAN' spoken three times.
RTF Safety Signal	The safety signal “SECURITÉ” indicates that the station is about to transmit a message concerning the safety of navigation or providing an important meteorological warning. The safety message is preceded by the word 'SECURITÉ' spoken three times. All stations hearing a distress, urgency or safety signal shall not make any transmissions that might interfere with those signals and be ready to copy any message that follows.
Radiotelephony Distress/Emergency Frequencies	The following frequencies have been designated as distress or emergency frequencies.

Radio Telephone	**DSC**	**NBDP**			
2182	2187.5	2174.5			
4125	4207.5	4177.5			
6215	6312	6268			
8291	8414.5	8376.5			
12 290*	12 577.0	12 520.0			
16 420*	16 804.5	16 695.0			
VHF: Ch. 16	VHF: Ch. 70	VHF not used			

Note: None of the MF/HF DSC or NBDP frequencies are used when calling. The AMSA HF DSC network monitors DSC in the 4 – 16 MHz bands.

* The frequencies 12 290 kHz and 16 420 kHz be used only for distress, urgency and safety communications, and safety-related calling limited to that, to and from rescue coordination centres.

2182 kHz	The international MF voice distress frequency primarily for ship-to-ship communications, the upper side band 2182 kHz is used for follow-on communications after an initial DSC distress alert on 2187.5 kHz for GMDSS shipping. In Australia, some Limited Coast Radio Stations operated by Volunteer Marine Rescue (VMR) Groups around the coast advertise the monitoring of the 2182 frequency. Contact the local VMR Unit to ascertain its monitoring of 2182. The two-tone alarm may still be used on 2182 kHz to draw attention but auto alarms are no longer a part of the Radio Regulations.
4125, 6215, 8291, 12290 and 16420 kHz	These frequencies have been authorised for common use by ships and coast stations using the HF frequencies for upper sideband radiotelephony on a simplex basis for calling, reply and safety purposes. The frequencies quoted are the carrier frequencies. The State and Territory Coast Radio Stations monitor the distress and safety frequencies in the 4, 6 and 8 kHz bands.
121.5 MHz	The international aeronautical emergency frequency for aircraft and those aeronautical stations primarily concerned with the safety and regularity of flight and having equipment in the 118-136 MHz VHF band. Ships fitted with the capability are authorised to communicate on this frequency with aircraft for safety purposes.
156.8 MHz (Marine VHF Channel 16)	The international distress, safety and calling frequency for radiotelephony stations of the maritime mobile service, when using frequencies in the Marine VHF bands 156 to 174 MHz. State and Territory limited coast radio stations, port authorities, merchant ships, fishing craft and pleasure craft use VHF Ch. 16. Merchant ships maintain a continuous bridge listening watch on VHF channel 16 to the maximum extent practicable when at sea; and is monitored in all active marine rescue bases. 156.3 MHz (Marine VHF Channel 6) is used for coordination at the scene of an incident
243 MHz	243 MHz is the international military aeronautical emergency frequency.
Safety Frequencies	The following table indicates Safety frequencies in use in Australia.

156.375 MHz	VHF FM RTF (Marine channel 67)	Marine safety: Australia only (supplementary to Channel 16 and used to broadcast weather and warnings from State/Territory limited coast stations)
27.88 MHz (Channel 88)	HF (Marine) RTF	27 MHz band, pleasure craft safety frequency (in Australia) 27.88 MHz has been overtaken in popularity by VHF 16 by the general public.
2524 kHz	MF (Marine) RTF	Pleasure boat safety, volunteer SAR organisations (in Australia)

Global Maritime Distress and Safety System (GMDSS)	Ships subject to the Safety of Life at Sea (SOLAS) Convention are obliged to be outfitted with certain communications equipment to participate in the Global Maritime Distress and a Safety System (GMDSS). Fishing vessels and small craft around Australia, if carrying compatible GMDSS equipment can also participate.

Ships operating under GMDSS requirements in the Australian SRR can be expected to carry:
- MF DSC;
- VHF radiotelephone (Channels 6, 13, 16 and 67);
- VHF DSC (Channel 70);
- Inmarsat-C or HF DSC;
- An AIS-SART or RADAR SART; and
- An EPIRB.

Daylight Emergency Signalling Devices

Mirrors	Reflective mirrors (heliographs), used by survivors to reflect the sun's rays towards a SAR unit, are an effective daylight device. Mirrors have been detected as far away as 80 kilometres (45 miles) and from as high as 10,000 feet, although the average distance is about 18 kilometres (10 miles). Fluorescent material (known as retro-reflective tape) that reflects a large percentage of sunlight is usually sewn on one side of lifesaving craft coverings and has been detected as far away as 9 kilometres (5 miles) with an average of 6 kilometres (3.5 miles).

Fluorescent Sea Dye Marker	This stains the water a green or red colour, has been sighted as far away as 18 Kilometres (10 miles), with an average of 5 kilometres (3 miles). However, sea dye is not visible when searching up-sun because of surface glare.
Orange Smoke	Orange smoke generating signals have been sighted as far away as 20 kilometres (12 miles) with an average of 14 kilometres (8 miles). Smoke signals are most effective in calm wind conditions and open terrain. The effectiveness of smoke signals decreases rapidly with an increase of wind speed above 15 knots (25 kph).
Flares	Pyrotechnic flares may be used in daylight; however their detectable range is only about 10 per cent of the night-time range.

Night-time Emergency Signalling Devices

Fires	On land, fires are arguably the most effective night time signal that survivors may use. Fires have been sighted as far as 90 kilometres (50 miles) away, with the average range varying with the size of the fire, the absence of other light sources on the earth's surface, the terrain and Height of Eye of the search asset.
Flashing Strobe Lights	Flashing strobe lights are an effective compact night signalling device available for individual survivors. Strobe lights have been sighted as far as 35 kilometres (20 miles) away with an average of 6 kilometres (3.5 miles).
Incandescent Lights	Incandescent lights that are used on some individual lifejackets have a much smaller detectable range than strobe lights, generally about 1 kilometre (0.5 mile).
Flares, Star shells and Rockets	Flares, star shells and rockets have been detected as far away as 60 kilometres (35 miles), with an average of 45 kilometres (25 miles) from the air.
Night Vision Goggles	With the use of Night Vision Goggles (NVG) objects emitting small amounts of light such as mobile telephone screens are able to be seen from great distances. There is no need for a telephone signal, it is the lit screen that is being detected. Larger light sources such as fires, torches, and strobe lights can be viewed from considerably farther. E-Flares and some LED strobe lights have been identified as being invisible on NVG due to the frequencies used. Searchers must be aware of this.

RADAR/IFF/SSR

The basic equipment consists of an interrogator and a transponder. The interrogator, which is usually incorporated into air search RADAR systems, transmits electronic challenges, and if any replies are received will display them on the Radarscope. The transponder, which is usually installed in aircraft, ships and boats, is triggered into operation by the interrogator's challenge and transmits a series of pulses. The reply is displayed as small bars slightly beyond the RADAR target of the transponderequipped craft. Since interrogators usually use the same antenna as the air search RADAR, replies are only received as the search RADAR beam sweeps across the transponder-equipped craft. In addition, transponder replies will be detected at much greater ranges than the RADAR return from the craft itself.

Secondary Surveillance RADAR (SSR) is the name used to describe similar equipment in use by Airservices Australia and civil aircraft. Military mode 3 is the same as civil mode A and thus the systems are compatible for air traffic control and emergency purposes. Military mode 3, code 7700 and civil mode A, code 7700 transmits an emergency signal and, unless amplified by additional information, will be considered as a distress signal.

Radio and Distress Beacons

In addition to the obvious uses of standard radio for transmitting emergency signals and messages, there are a variety of types of emergency equipment designed for use by survivors or carried in the vessel's wheelhouse. These include:
- Hand held VHF transmitters found in life rafts;
- 406 MHz distress beacons (GMDSS approved); An AIS-SART; and
- 9 GHz SAR Transponders.

Satellites

The COSPAS-SARSAT system uses three search and rescue satellite constellations: LEOSAR, GEOSAR and MEOSAR. Each LEOSAR satellite makes a complete orbit of the earth around the poles in about 100 – 105 minutes. The satellite views a "swath" of the earth of approximately 4000 km wide as it circles the globe, giving an instantaneous "field of view" about the size of a continent. When viewed from the earth, the satellite crosses the sky in about 15 minutes, depending on the maximum elevation angle of the particular pass.

LEOSAR satellites are not equally spaced and hence do not pass over a particular place at regular intervals. In view of this, pass schedules are computed for each LUT every day. On average a satellite will pass over continental Australia every 90 minutes but, because of the irregularity of passes, there could be up to five (5) hours between passes.

The current GEOSAR constellation is composed of satellites provided by the USA, India, Russia and Europe. These satellites provide continuous global coverage for 406 MHz beacons with the exception of the Polar Regions. As the GEOSAR satellites appear stationary from Earth, if the direct line of sight from the beacon to the GEOSAR satellite is blocked (for example, by terrain such as a mountain, called shadowing), the beacon will not be detected by the GEOSAR satellite.

The MEOSAR satellites consist of satellites provided by the United States, the Russian Federation and the European Union. The full MEOSAR constellation will have about 72 satellites. These MEOSAR satellites orbit the Earth at altitudes between 19,000 and 24,000 km, a range considered as a medium-altitude Earth orbit. The footprint of a MEOSAR satellite is between 12000 and 13000 km and the satellites provide continuous global coverage of the Earth. These satellites send the beacon message back to earth where it is detected by a MEOLUT (MEOSAR Local User Terminal).

With sufficient information, the MEOLUT will generate a location for the distress beacon. The beacon activation information is forwarded to a Mission Control Centre (MCC) and then to the relevant Rescue Coordination Centre (RCC) which responds to the beacon activation. The MEOSAR system will detect beacons in almost real-time (i.e. within 5 minutes). If the beacon is detected by three or more MEOSAR satellites, then the location of the beacon will be determined as well. When the full constellation of MEOSAR satellites is in operation, this will mean location will be determined within 10 minutes, 95 percent of the time.

Beacon Detection

A LUT tracking LEOSAR satellites is known as a LEOLUT. A LEOLUT generates the position of a distress beacon using Doppler shift, which is caused by the relative movement between a satellite and a beacon. As a satellite approaches a beacon there is an apparent rise in the beacon frequency and as the satellite moves away the frequency appears to fall. When a satellite is at its closest point to a beacon the received frequency is the same as the transmitted frequency (the point of inflection) and provides the "Time of Closest Approach" (TCA).

This method of calculation produces two possible positions for each beacon (labelled A and B), either side of the satellite's ground track; one is the true position and the other is its mirror image. The ambiguity is due to the equipment only being able to determine the distance between a satellite and a beacon and not the direction. Position ambiguity is subsequently resolved by using other independent location data (for example; an encoded location or data from another LEOSAR satellite pass).

A LUT tracking MEOSAR satellites is known as a MEOLUT. A MEOLUT generates the position of a distress beacon using DOA (Difference of Arrival) processing. Upon receiving a transmission (a beacon burst) from a 406 MHz distress beacon via a MEOSAR satellite, a MEOLUT will generally measure two key values: the Time of Arrival (TOA) and the Frequency of Arrival (FOA). Assuming reception of a beacon transmission through at least three distinct MEOSAR satellites, MEOLUT processing can provide a two-dimensional (longitude and latitude) beacon location using a combination of time difference of arrival (TDOA) and frequency difference of arrival (FDOA) computations. The location computed by a MEOLUT is known as a difference of arrival (DOA) location. Three-dimensional locations (i.e., with the addition of a computed altitude) are possible when the beacon burst is relayed to a MEOLUT via four or more MEOSAR satellites.

Beacons

There are three types of COSPAS-SARSAT distress beacons:
- Emergency Locator Transmitters (ELT) used by aviators (generally larger devices mounted in the tail of an aircraft);
- Emergency Position Indicating Radio Beacons (EPIRB) used by mariners (waterproof and required to float upright); and
- Personal Locator Beacons (PLB) used on land (initially not required to be waterproof or buoyant but new generation ones are becoming so.).

A distress beacon with GNSS (Global Navigation Satellite System, also known as a GPS) capability is able to transmit an encoded location as part of its beacon message. There are two mechanisms used to derive the GNSS location: either the distress beacon has an internal GNSS receiver or the distress beacon receives the GNSS data from an external device that connects to the beacon. Due to the popularity of the GPS system, the encoded location is often known as the GPS location of the beacon. Aviators and mariners often carry PLBs as personal back up devices to ELTs and EPIRBs.

Because 406 MHz beacons transmit an extremely stable frequency, positions calculated by the LUT usually fall within a radius of 5km from the actual beacon position. All 406 MHz beacons sold in the Australian region are required to transmit on a side frequency of 121.5 MHz to facilitate homing.

406 MHz beacons use digital technology that allows an identifier to be sent when the beacon is activated. This identifier correlates to a registration database held at the JRCC and allows additional information to be gained about the target. 406 MHz beacons should be coded with a country code and registered in the country that maintains the database for that country code. It is therefore important that all Australian 406 MHz beacons are registered with JRCC Australia.

Other Distress Alerting Devices

SPOT Personal Satellite Messenger device (SPOT)	The SPOT device and its associated service originate from a USA company called SPOT LLC. SPOT is primarily a tracking device which can also send preformatted messages indicating that a person is safe or that they require non-emergency assistance. In addition the user is able to alert an Alerting Post that they are in distress. SPOT LLC has contracted for the provision of 24-hour emergency monitoring and response to SPOT users through the International Emergency Response Coordination Centre (IERCC), an Alerting Post located in the United States of America. These devices operate on cellular or satellite telephone networks and are therefore vulnerable to coverage limitations. The devices offer a range of functions which may be more attractive to a hiker or bushwalker than a COSPAS-SARSAT approved device but there are limitations to the devices that could hamper a search and rescue effort.
AIS-SART	The AIS-SART derives position and time synchronization from a built in GNSS receiver and transmits its position with an update rate of one (1) minute. Every minute the position is sent as a series of eight (8) equal position reports, this is to maintain a high probability that at least one of the position reports is sent on the highest point of a wave.
Maritime Survivor Locating Systems. VHF DSC Maritime Survivor Locating Devices (MSLD)	The VHF DSC MSLD, such as the Mobilarm Crewsafe series of beacons, transmit a MAYDAY using a synthesised voice on VHF Channel 16 and a distress alert on DSC (VHF Channel 70) immediately a man overboard incident occurs (or when the unit is manually activated), this is repeated once the MSLD obtains a GPS position (within 1 minute) and is updated every 5 minutes for the first 30 minutes, and then every 10 minutes for the life of the battery (24 hrs.). The MSLD includes the MMSI for identification; some MSLD may also transmit on AIS and a 121.5 MHz homing signal.
Thuraya Satellite Devices	The Thuraya Telecommunications Company ("Thuraya") runs and operates the Thuraya Satellite Network to provide telecommunications products and services in the coverage area of the Thuraya Satellite System. Thuraya devices have the capability to a provide distress alerting function to subscribers. The Thuraya subscriber will initiate an emergency call by pressing and holding a "special button" or activating a special function on the Thuraya device. The device will then obtain a GPS fix and send the location and event request via the Thuraya satellite system.

Merchant Shipping and GMDSS

Communications between merchant vessels in distress and SAR organisations are achieved by a satellite and radio watch system known as the Global Maritime Distress and Safety System (GMDSS). The GMDSS enables a distress alert to be transmitted and received automatically over short and long distances. The system allows SAR authorities as well as shipping in the vicinity of the distress to be rapidly alerted so that a coordinated search and rescue operation can be commenced with the minimum of delay.

Additionally the GMDSS provides for urgency and safety communications, and the dissemination of Maritime Safety Information (MSI). Certain fishing vessels and other marine craft may also carry GMDSS equipment. GMDSS equipped vessels perform the following functions wherever they operate:
- Transmit ship-to-shore distress alerts by two independent means;
- Receive shore-to-ship alerts (usually relayed by International RCCs);
- Transmit and receive;
- Ship-to-shore alerts;
- SAR coordinating communications;
- On-scene communications;
- Locating signals;
- Maritime safety information;
- General radio communications to and from shore; and
- Bridge to bridge communications.

Limited Coast Radio Stations (Australia)

In Australia, Limited Coast Radio Stations (LCRS) are located in nine locations: Sydney, Gladstone, Cairns, Darwin, Port Hedland, Fremantle, Adelaide, Melbourne and Hobart and maintain a continuous radio watch by monitoring the following distress frequencies:
- 4125, 6215, and 8291 kHz with 8176 kHz used to broadcast weather and warnings at regular times;
- 156.8 MHz (VHF CH16). Channel 16 is monitored in various other locations in each State/Territory;
- Channel 67 is used to broadcast weather and warnings

Ship Stations

SURVIVAL Search & Rescue Distress and Emergency Signals Ship Stations

There are three distinct categories of vessels to be catered for by the marine SAR system; these are:
- Deep sea vessels (SOLAS);
- Fishing vessels; and
- Pleasure craft.

Most deep-sea vessels will carry communications equipment compatible with the GMDSS. Other vessels, most of which use satellite communications, may extend this coverage. A continuous bridge listening watch is kept on VHF Ch16, as far as is practicable. Vessel Tracking System (VTS) is utilised by most states/territories to monitor the location of SOLAS vessels with the reef systems and other locations posing heavy traffic or environmental concerns.

Fishing Vessels
Some fishing vessels will carry GMDSS equipment; however the majority of fishing vessels carry a variety of radio equipment and do not maintain regular watches. Frequencies allocated to fishing vessels are normally not compatible with large ships. Some fishing vessel operators are members of cooperatives and their normal procedure whilst fishing is to maintain daily radio schedules with the cooperative base station. AFMA and some State Fisheries Authorities use Vessel Monitoring Systems (VMS) utilising Inmarsat-C polling to track fishing vessels in their fisheries for regulatory reasons. These authorities may be able to assist an RCC in contacting or locating fishing vessels.

Pleasure Craft
These craft are under state control and hence the regulations concerning the carriage of radio and other SAR equipment vary from state to state, and within the state, depending upon the type and size of craft and its area of operations. There is a general acceptance by the boating community of the need to carry some type of radio. The 27 MHz marine radio is a popular choice. 27.88 MHz has been designated as the primary distress, safety and calling frequency, with 27.86 MHz as the secondary. These frequencies are often referred to as channels 88 and 86 respectively and care must be taken not to confuse them with the VHF Marine FM frequencies that are always referred to as channels. VHF Marine FM radio is increasingly being used by pleasure craft.

3 Communication

SURVIVAL Search & Rescue Communication

Frequencies
The most common methods of radio communications are listed below:

HF (High Frequency)	HF operates in the band 3 to 30 MHZ. In addition to ground waves, sky wave operation is possible which vastly increases the range. This type of transmission relies on 'bouncing' radio waves from a layer of ionised gases 150 km above the earth's surface and back down to ground. Considerable distances can be achieved using HF. However, the system tends to be noisy and requires large aerial installations and some degree of expertise to operate. It would normally be used only as a rear link back to a search headquarters;
VHF (Very High Frequency)	VHF operates in the band 30–300 MHZ. This type of transmission is commonly used by mobile radio fleets and gives reliable communications over a distance of 20– 30 km. It is primarily 'line of sight' transmissions. This means that hills or major obstacles may impede reliable communications and the base site should always be as high as possible. difficulty may be experienced at times by searchers losing communications. If this happens, operators should be aware that a small change in location or moving to a high point may assist in regaining contact. This applies equally to UHF.
UHF (Ultra High Frequency)	UHF operates in the band 300– 3000 MHZ. This method is strictly 'line of sight' and in flat or open terrain, to increase its range, it requires repeater stations on some high point to relay messages and therefore requires some degree of technical expertise to install.

Radios in General
UHF CB style radios provide the best balance between portability and communications. Not only searchers and headquarter bases should be provided with UHF radios but their carriage and usage by persons travelling in the more remote areas of Australia should be encouraged.
- A vehicle mounted radio attached to an external antenna will provide the best coverage although a hand-held device will also work, albeit with a limited range. Spare batteries should always be carried if the radio is not hard wired.
- UHF Channel 9 or 40 have been identified as "listening channels". Once a call has been established, users can move to a clear channel.
- UFH Channel 5 is a designated emergency channel, while this is Duplex it is also an emergency Simplex channel and there are no duplex repeaters on this channel in the bush.
- UHF Channel 11 is a dedicated Australian calling frequency which after establishing contact users move to another channel.
- While the above channels are dedicated, a search asset with a scanning radio will detect a missing person calling on any channel within range. Modern scanning radios cover all 40-80 channels every 4 seconds, ensuring that not active channel is missed.

Attention must be given to the state of the batteries in portable sets and spare batteries should always be available. Batteries should not be left in sets which will not be used for any length of time. It is recognised that most radio failures are caused by a lack of care and knowledge on the part of operators, rather than deficiencies within the sets themselves.

Loss of communications: During search operations it is likely that situations will arise where radio communications are less than 100% effective. Teams should be briefed as to their actions in case of a loss of communications. These actions may include backtracking to their last point of communication, problem solving, using other forms of communication, relaying through other stations, non-use of Distress Devices – 'no news is good news', or carrying on with an assigned task – 'be at this spot at this time'.

Ground to Air Communications: Aircraft operate on aviation transport group frequencies allocated by Australian Communications Authority and can be contacted through the airport control tower, but radios are available which can contact aircraft on a special frequency. Prior arrangement with the aircraft pilot is necessary to work on this channel as the aircraft normally listens out on tower frequencies. Another alternative is to place on board the aircraft a portable radio on the same frequency as is being used by the search teams.

Procedures and Practices
To achieve efficiency, standard radio procedure should be used. Although two- way conversations will be needed, messages should be written for reference at a future time. It may also be necessary to refer to past actions or decisions and this makes necessary the keeping of a written record. Search Team Leaders should carry a note book to record messages.

Other Methods of Communications
Mobile telephones: The rapid expansion of the mobile telephone network throughout Australia has provided the SAR coordinator with another option for SAR communications, although it must be noted that they do not work in all locations. A number of considerations must be taken into account by the SMC when considering mobile telephones as a communications method:
- The use of a radio net should always be the first option,
- The extent of the networks and coverage at the search location
- The availability and type of mobile telephones at the search location
- The battery life and ability to recharge those mobile telephones available
- The ability to send and receive spoken words, text messages and photographs.
- Mobile telephones may be considered as a secondary communication method, and when direct and private contact is to be made between the SMC and teams.

- The use of text messages may be more successful than verbal communications. Text messages require less signal strength and will be received when a mobile telephone comes within range even if it is some time since it was originally sent.

Other methods of communicating, which can be used but require some degree of prior planning are:
- Control of Contact or Close Search - Whistles, loud hailers, and simple voice orders. (To contact both single and multiple teams).
- Location of Search Teams or Finds - Smoke, light (fire), signalling mirrors.
- Recall signals - Whistles, sirens, gun shots, pyrotechnic rockets.
- The General Public - Commercial radio stations for supplying information and instructions to the public.
- Mobile Communications - For relay points.
- Field Signals - Searchers may be required to use field hand signals or audible sounds to communicate within or between teams. Recognised audible signals are:
  - One short blast at irregular intervals - searchers looking for a missing person and as an acknowledgment of a distress signal;
  - Three short blasts together, regularly spaced—distress signal; and
  - Four short blasts together, regularly spaced—which is recall signal.

4 Information

When the SAR system first becomes aware of an actual or potential emergency, the information collected and the initial action taken are often critical to a successful SAR operation. It must be assumed that in each incident there are survivors who will need assistance and whose chances of survival are reduced by the passage of time. The success of a SAR operation depends on the speed with which the operation is planned and carried out. Information must be gathered and evaluated to determine the nature of the distress, the appropriate emergency phase, and what action should be taken. Prompt receipt of all available information by the RCC is necessary for thorough evaluation, immediate decision on the best course of action and a timely activation of SAR assets to make it possible to achieve the following:
- Locate, support and rescue persons in distress in the shortest possible time.
- Use any contribution survivors may still be able to make towards their own rescue while they are still capable of doing so.

Experience has shown that the chances for survival of injured persons decrease by as much as 80% during the first 24 hours, and those for uninjured persons diminish rapidly after the first three days. Following an accident, even uninjured persons who are apparently able-bodied and capable of rational thought are often unable to accomplish simple tasks and are known to have hindered, delayed or even prevented their own rescue.

Several factors will influence the extent and manner of an initial SAR response. In general these are the:
- Extent and reliability of information about the location of the missing persons
- Availability of aircraft, marine assets and land parties for searching;
- Prior, actual and forecast weather conditions;
- Times of daylight/darkness;
- Nature of terrain/sea conditions;
- Availability of survival supplies and supply dropping teams; and
- Time delay in notification.

Air, Marine or Land Incident Information

The following information, or as much of it as is required to address an emergency situation, should be obtained from the craft or the individual reporting the actual or potential emergency situation or incident. As many of the items should be obtained as circumstances permit.

- Name, address, and telephone number or contact point of person reporting.
- Distressed craft (name/type/callsign/registration) or identification.
- Position of emergency (latitude/longitude or bearing/distance) from a known point or the last reported position and the next reporting position).
- Nature of emergency (fire, collision, person overboard, disabled, overdue, crash or missing hiker etc.).
- Date/time of emergency occurrence and the Date/time of notification.
- For aircraft, altitude, attitude, heading, speed and endurance.
- Craft description (size, type, markings, hull, colour of cabin, deck, rigging, fuselage colour, tail colour, wingtip colour, unusual features).
- Details of persons on board, persons involved (POB) including number of people involved, ages, state of health, injuries, and intentions.
- Date, time and departure point, planned route, speed, ETA and destination.
- Radio frequencies currently in use monitored or scheduled.
- Emergency radio equipment and frequencies, EPIRB, ELT, or flares.
- Actual weather/sea conditions.
- Local action being taken or assistance required.
- Owner/agent of distressed craft and contact method.
- Possible route deviations.
- Navigation capabilities.
- Survival equipment including quantity of food/water and signaling devices.
- Mobile phone numbers of any person.

Missing Person

- Personal details (Name, DOB, address, telephone numbers, employment, social status, married);
- Physical features (Description, fitness, ability, past history);
- State of health (physical and mental);
- Medication (taken, carried or left behind) (what are the effects of this?);
- Psychological issues (Happiness, depression, family trouble, financial trouble, legal trouble)
- Dress (Wearing now and what taken? Is it suitable for the conditions?);
- Food/water (Any? Sufficient? Will last how long?);
- Handedness, (Left or right);
- Any means of transport (Where is it? Public transport?);
- Time last seen (Intentions, intended routes, previous routes?); and
- Any other information considered relevant.

Such information may well dictate the urgency of the search. If, for example, the person has a history of going missing, it may suggest a policy of wait and see.

Objects/Evidence

When conducting a search for an object such as aircraft, vessel, vehicle, or any other article it will be necessary to gain a complete description of the object. This should include:
- Description;
- Make;
- Model;
- Colour;
- Size;
- Weight;
- Registration number;
- Markings; and
- Safety aspects/danger.

Where an object is unlikely to be readily identifiable, the requirement for detail is increased. If possible, a model, photograph, or drawing should be obtained. Particular emphasis should be on safety factors if the object is likely to offer a hazard to the finder. An example would be the hazards associated with modern aircraft.

5 Emergency Phases

Emergency phases are based on the level of concern for the safety of persons, vessels or aircraft. Upon initial notification the notified SAR authority or ATS unit classifies the SAR incident as being in one of the three following emergency phases:
- Uncertainty Phase (INCERFA).
- Alert Phase (ALERFA).
- Distress Phase (DETRESFA).

The emergency phase may be reclassified by the SMC as the situation develops. The current emergency phase should be used in all communications about the SAR incident as a means of informing all interested parties of the current level of concern for the safety of persons or craft which may be in need of assistance.

Maritime search and rescue in Australia is based on the GMDSS and although there are three forms of messages from a ship to the SAR authority, there is no mention of emergency phases in GMDSS documentation or IAMSAR Volume 3, the SAR manual carried by ships. Emergency phases should be used internally among maritime SAR authorities to indicate the level of concern and as criteria for escalating a SAR action. An uncertainty phase relates to a safety broadcast, the alert phase to an urgency broadcast and a distress phase to the distress broadcast.

Uncertainty Phase

The uncertainty phase is assigned any time doubt/uncertainty exists as to the safety of an aircraft, vessel or person because of knowledge of possible difficulties, or because of lack of information concerning progress or position. The keyword is DOUBT. This does not mean that the SMC has doubt that a SAR situation exists, more that there is doubt about the level of safety of those involved.

An Uncertainty Phase is said to exist when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require dispatching of resources. When there is doubt about the safety of persons, vessel or aircraft, the situation should be investigated and information gathered. For aircraft, an INCERFA is declared when:
- No communication has been received from an aircraft within a period of fifteen (15) minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made, whichever is the earlier.
- An aircraft fails to report departure from a Mandatory Broadcast Zone (MBZ) or non-standard Common Traffic Advisory Frequency (CTAF) area after a call notifying readiness to taxi or take-off or after an airborne call from within a MBZ or CTAF area, within five (5) minutes after estimate for the boundary.
- An aircraft fails to arrive within 15 minutes of the last estimated time of arrival last notified to or estimated by ATS units; whichever is the later, except when no doubt exists as to the safety of the aircraft and its occupants

For persons, vessels or aircraft, an Uncertainty Phase is declared where the persons, vessels or aircraft have:
- Been reported overdue at the intended destination;
- Failed to make an expected position safety report; or
- There has been no immediate request for assistance received but the possibility exists that a situation could escalate.

Alert Phase

The alert phase is assigned any time apprehension exists for the safety of persons, vessels or aircraft because of definite information that serious difficulty exists which does not amount to a distress or because of a continued lack of information concerning progress or position. The key word is APPREHENSION.

An Alert Phase exists when persons, vessels or aircraft are having some difficulty and may need assistance, but are not in immediate danger. Apprehension is usually associated with the Alert Phase, but there is no known threat requiring immediate action. SRUs may be dispatched or other SAR assets diverted to provide assistance if it is believed that conditions might worsen or that SAR assets might not be available or able to provide assistance if conditions did worsen at a later time.

For a SAR involving an overdue target, the Alert Phase is declared when apprehension exists as to the safety of an aircraft/vessel or persons. Apprehension exists due to the lack of progress or positions of persons, vehicles or aircraft or inability to confirm safety in a suitable timeframe. At the Alert Phase, coordinators should begin or continue communications searches, land searches and in some cases tasking of vessels/aircraft to high probability locations. Vessels in the area may be asked to maintain a sharp lookout, report all sightings and render assistance if needed.

An Alert Phase is declared when:
- Following the Uncertainty Phase, subsequent attempts to establish communication with persons, vessels or aircraft have failed or inquiries to other relevant sources have failed to reveal any news.
- An aircraft has been cleared to land and fails to land within five (5) minutes of the estimated time of landing and communication has not been re-established with the aircraft.
- Information has been received which indicates that the operating efficiency of the aircraft, ship or other craft has been impaired but not to the extent that a forced landing or distress situation is likely, except when evidence exists that would allay apprehension as to the safety of that craft and its occupants.
- An aircraft is known or believed to be the subject of unlawful interference.

Distress Phase

The distress phase is assigned whenever immediate assistance is required by persons, vessels or aircraft threatened by grave or imminent danger or because of continued lack or information concerning progress or position. The key words are GRAVE or IMMINENT DANGER and IMMEDIATE ASSISTANCE.

The Distress Phase exists when there is reasonable certainty that the targets are in imminent danger and require immediate assistance. For SAR incidents involving an overdue target, a distress exists when communications searches and other forms of investigation have not succeeded in locating the target or revising its ETA so that it is no longer considered overdue. If there is sufficient concern for the safety of a target and the persons aboard to justify search operations, the incident should be classified as being in the Distress Phase. For aircraft, a Distress Phase is declared when:
● Following the Alert Phase, the further unsuccessful attempts to establish communication with the aircraft and more widespread unsuccessful inquiries point to the probability that the aircraft is in distress.
● The fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety.
● Information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely.
● Information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing, except when there is reasonable certainty that the aircraft and its occupants do not require immediate assistance.
● A report is received that a radio distress beacon has been activated or other visual distress signals have been observed.

For ships, other craft or people, a Distress Phase is declared when:
● Positive information is received that a ship or other craft or people are in danger and need immediate assistance; or
● Information is received which indicates that the operating efficiency of the ship or other craft has been impaired to the extent that a distress situation is likely.

6 Uncertainty Phase Procedures

● Verify the information received, considering the need to extend inquiries to:
○ Landing areas including the aerodrome of departure and other locations close to the route where a subject aircraft might have landed
○ Aircraft, including the subject aircraft, known to be on the same route, in the same area or within communication range, by way of ATS units, or radio contacts calling or listening out, including monitoring emergency frequencies.
○ Vessels known to be on the same route, in the same area or within communication range, by way of VMS, VTS, Coastal radio stations or vessel broadcasts.
○ Persons known to be on the same route, in the same area or within communication range, by way of electronic/social media (television, radio, Facebook, mass texting, etc.) and/or speaking to persons located within the search area.
○ Family, friends, operator of the aircraft, marinas, etc.

● When no flight plan has been filed, or in the case of ships or other craft, no information is available on the intentions of the captain, attempt to obtain information from which the route and departure, flight and arrival times of the aircraft, ship or other craft may be determined.
● Establish close liaison with alerting units to ensure that the following occurs:
○ New information, (e.g.: obtained through widespread communication checks, requests to the public, review of weather factors, etc.) will be made immediately available for evaluation, plotting, decision making etc.
● Plot the route of the subject craft, making use of all available intelligence.
● Conduct a communications search. (More information below)

● Determine actual weather conditions along the route and at the destination.
● Record all incoming information and progress reports, details of action as described below, subsequent developments and decisions.

Communication Search

The communication search can be conducted by the following two primary methods:
● Attempting to communicate with the person, vessel or aircraft by all means of electronic communications through various paths.
● Determining the target craft's most probable location by:
○ Making inquiries at aerodromes (including the aerodrome of departure) and other locations where an aircraft might have landed or at locations where a ship or other craft might have stopped or called (including the point or port of departure).
○ Contacting other appropriate sources including persons who may have knowledge of the intentions of the pilot in command or ship's captain.
○ Using electronic methods to track mobile telephones, leave text or voice mail messages or utilise electronic/social media (television for witnesses, radio, Facebook or similar).

When the communications search or other information received indicates that the person, vessel or aircraft is not in distress, the SAR authority will close the incident and immediately inform the operating agency, the reporting source and any alerted authorities, centres, or services. However, if apprehension regarding the safety of the person, vessel or aircraft and its occupants continues, the Uncertainty Phase should progress to the Alert Phase.

7 Distress Phase Procedures

When a distress phase has been declared by a SAR authority or transferred by Airservices, another RCC or SAR authority, the SAR authority should:
● Initiate or continue any appropriate actions normally performed during the Uncertainty and Alert Phases.
● Ensure an SMC has been appointed and that all interested parties have been informed of the incident.
● Examine the detailed plans of operation for the conduct of SAR operations in the area.
● Determine the availability of SAR assets to conduct SAR operations and attempt to obtain more assets if a need for them is anticipated.
● Estimate the position of the target, estimate the degree of uncertainty of this position and determine the extent of the area to be searched and if a significant search effort is anticipated, use search planning techniques to maximise the chances of finding the survivors.
● Develop a search action plan or rescue plan as appropriate for the conduct of the SAR operation and communicate the plan to the appropriate authorities.

● Initiate action, activating SAR assets as appropriate such as:
○ Search assets may be dispatched from their bases in accordance with the search plan.
○ Aircraft and vessels may be diverted in-flight or en-route.
○ Whenever practicable, aircraft dispatched early should carry droppable supplies (suitable for the environment in which the incident is occurring) unless these aircraft are unsuitable for dropping and/or an unacceptable delay would result to their departure on account of loading.
○ In the latter case, droppable supplies should be loaded on a suitable aircraft as soon as possible.
● Amend the plan as the operation develops.
● Notify the State of registry of the target craft, if applicable.
● Notify JRCC Australia, ADF, State or Territory Police, Maritime Authorities, ATSB and/or CASA, Media as appropriate.
● At an early stage, request aircraft, vessels, coastal radio stations and other relevant services to:
○ Maintain a listening watch for transmissions from the target, by voice, survival radio equipment and from an emergency beacon (ELT/EPIRB/PLB);
○ Assist the target as far as practicable if found; and
○ Inform the RCC of any developments.
● Maintain close liaison with the following:
○ Appropriate agencies for onward transmission to the target (if possible) and for traffic coordination.
○ Other RCCs along the planned route of the target as well as those whose SRRs are within the target's maximum radius of action as determined from its last known position (i.e. the possibility area), ensuring that any information they receive regarding the incident is conveyed to the coordinating RCC.
● Inform community groups by way of radio and television broadcasts requesting sighting and hearing reports and any other intelligence regarding the whereabouts of the subject craft using established procedures for contacting designated personnel at broadcasting stations and specifying messages in precise form.

8 Intelligence Gathering and Assessment

Information relating to a missing craft may be gathered from a variety of sources, in particular from the owner or operator, Airservices and general maintenance records and from the public at large. Careful and accurate assessment of intelligence and information is a vital part of search action and may be instrumental in modifying probability areas, reprioritising search activities and adopting revised search strategies.

Type of Information

● Missing target (aircraft, vessel, and person). As much information as possible regarding the target(s) needs to be obtained.
● Objects: When conducting a search for an object such as aircraft, vessel, vehicle, or any other article, it will be necessary to gain a complete description of the object.
● Weather: It is of vital importance to gain knowledge of weather conditions that have or are likely to prevail in the area of search prior to, during and in the immediate future. In extremes, this will indicate the possible time frame for any involved person's survival.

● Area of Search: The success of an operation will depend to a large extent upon accurate prior knowledge of the area/locality to be covered. It will be necessary to have knowledge of:
- ○ General sea conditions and topography;
- ○ Known problem areas;
- ○ Hazards and terrain;
- ○ Sea state/foliage/ground cover; and
- ○ Rendezvous points

Therefore it is desirable that a field reconnaissance be carried out as early as possible.

● Resources. These resources are basically in two groups:
1. Personnel. Information should include:
   - ○ Number available;
   - ○ Experienced/inexperienced;
   - ○ Capability and response considerations
   - ○ Time available; and
   - ○ Special requirements (e.g. mountain rescue).
2. Equipment. This may include:
   - ○ Vehicles;
   - ○ Vessels (Inshore and off shore);
   - ○ Aircraft (Drones)
   - ○ Radios;
   - ○ Electronic aids (Tracking devices, mobile telephone locators, etc.);
   - ○ Maps, charts and plotting equipment; and
   - ○ Special equipment

Availability and access of information

Having detailed the type of information required, there are three factors to consider:
● Where can the information be obtained?
● How may the information be accessed (e.g. medical records)?
● How much is enough?

Sources of Information

● About Missing Persons (whether from vessel, aircraft or missing): Sources of quality information may include:
- ○ Family;
- ○ Friends;
- ○ School;
- ○ Employer;
- ○ Family doctor;
- ○ Last known contact;
- ○ Hospitals/medical centres;
- ○ Public transport companies;
- ○ Social media; and
- ○ Mobile telephone tracking.

● About the Weather: Sources may include:
- ○ Bureau of Meteorology;
- ○ Local knowledge;
- ○ Local records;
- ○ Experience;
- ○ Electronic sources and archives; and
- ○ Reconnaissance teams.

● About the Area: Sources may include:
- ○ Maps (topographic, parish, forestry);
- ○ Charts (RAN, RN, etc.);
- ○ Electronic (Google maps, Google Earth, satellite images);
- ○ Sketches;
- ○ Local knowledge;
- ○ Aerial photographs; and
- ○ Reconnaissance.

● About Resources: Sources may include:
- ○ Police;
- ○ Emergency services;
- ○ Volunteer services (SES, Coast Guard, Volunteer Marine Rescue);
- ○ Bushwalking club;
- ○ Defence services;
- ○ General aviation;
- ○ Community facilities/organisations; and
- ○ Media.

Evaluating Information: The SMC must consider the traits of the missing person, vessel or aircraft, together with the merit of all available information, to predict the person's possible movement, or to reduce the area of probability. Because total required information will not be available prior to commencing a search, information gathering and evaluation will be continuous throughout an operation. On evaluating the information the SMC will need to make some judgment of the urgency or severity of the situation and whether to take any action of not.

Search Information Phases

The phases for gathering search information include the following:

Pre-Search Phase (Collection, collation, evaluation): In the period between raising the alarm and the actual beginning of the search, as much relevant information as possible needs to be acquired and evaluated. The assessment of information is described earlier in this chapter and this may determine that an alarm has been raised prematurely and the search should be delayed or cancelled, or it may reinforce the sense of urgency due to factors such as:

- Missing person's physical or mental condition (experience, capability, preparedness);
- Vessel, vehicle or aircraft mechanical condition
- Weather conditions; or
- Sea conditions or terrain in the area.

Briefing Phase (Dissemination) - The decision to mount a search has been made and search assets are being prepared to commence the operation. Pilots, masters, and team leaders are required to attend a briefing at which orders will be given regarding the conduct of the search. Details that need to be covered are:

- Briefing needs to be in the SMEAC format, standard among SAR assets;
- Information relevant to the missing target;
- The area to be searched;
- The recommended search pattern;
- The command and communications system; and
- Any special instructions

All this information must be clearly and fully understood by the participants. The omission of a single item of information may lead to an unsuccessful search conclusion.

Search Operations Phase - In the conduct of the operation, the search assets must constantly seek and provide further relevant information. This may be provided in the form of:

- Location of physical clues;
- Information from persons in the area;
- Interpretation of topographical factors; and
- General experience.

Debriefing Phase (Collection, collation, evaluation, dissemination)—As search assets return to the RCC, pilots, masters and team leaders need to be debriefed. Care needs to be taken that all relevant information is gathered and then re-evaluated as the situation develops. This information will then be distributed to assets still searching or before new assets are deployed.

Interviewing Witnesses

Care must be taken in the selection of a person to interview witnesses. Consideration should be given to the use of specially trained officers, e.g. a police officer with SAR training.

When interviewing witnesses, the following points should be kept in mind:

- The interview should be conducted as soon as practicable after the event. Many people forget important facts quickly and are influenced by other opinions, press reports.
- The interviewer should know the subject, be aware of the details reported previously, and have questions prepared in advance to clarify points on which further information is required.
- After identifying himself, the interviewer should explain the purpose of the Interview clearly.
- Persons being interviewed should be asked to give a personal account of events without coercion or suggestion. They may then be asked questions designed to solicit other facts.
- When possible, statements should be tested by related occurrences, e.g. the distance of the craft from the observer by weather phenomena such as visibility and cloud base; the time of observation by the extent of daylight, position of the sun or radio program.
- If witnesses are not clear about particular aspects, they may be left to consider the incident further and be given opportunity to contact you should additional information subsequently come to mind.

Urgency of Response

Evaluating incidents to determine the urgency and the extent of required SAR response, or the termination of response is a function requiring information, judgement and experience. In emergency situations requiring immediate assistance, the action taken must be accomplished quickly and positively. Where uncertainty exists, evaluation is usually more difficult and time consuming because of the many factors involved.

Perhaps the most difficult task the SMC undertakes is the evaluation of these factors. They usually become apparent between the time the incident is reported and the execution of the search. This is a time when speed and reliability will be most important, however it is also a time when incident reports may be incomplete or confused. The most serious limitation is time. When persons are injured or are subjected to adverse climatic or water conditions, the chances of survival decrease rapidly.

Time limitation also may be dictated by the number of hours left for a daylight search, although the SMC should not arbitrarily rule out night search, especially in unpopulated areas, over the ocean, and over flat terrain or deserts. The facilities available to conduct a search may be limited by lack of available personnel and search assets. The SMC must be aware of availability of SAR facilities within their region. Terrain, weather and oceanographic conditions can affect all areas in SAR planning and operations.

Search visibility, aircraft limitations, search effectiveness, safety of flight and time available to complete the search are some of the factors that will affect search capability. Whenever practicable, pertinent data should be plotted on a chart to aid in evaluating related factors. Normally the SMC determines the urgency and extent of SAR services required for an incident. A rapid but systematic approach is essential since prompt response to emergency incidents is the essence of the SAR system.

General Time Factors

The probability of finding survivors and their chances of survival diminish with each minute after an incident occurs. Prompt positive action is required so that no life will be lost or jeopardised through wasted or misdirected effort. Individual incidents will vary with local conditions such as terrain, climatic conditions, ability and endurance of survivors, emergency equipment available and SAR units available to the SAR system. In the case of seriously injured survivors or survivors in a hostile environment, the reaction time of the SAR system must be measured in minutes. Critically injured survivors of any accident usually die within the first 24 hours if not given emergency medical care.

For survivors not equipped with any type of detection aids daylight visual search is usually the only search method available to the SMC. If darkness were approaching this would be another limiting factor for the SMC to consider.

If it is known or suspected that the survivors have detection aids such as pyrotechnic flares or other night signalling devices or can display other lights, night searches should always be conducted. Night searches, visual and electronic are particularly effective at sea, over sparsely populated areas, flat terrain and deserts. Night aural and visual search should be considered.

Modern electronic detection methods may be effective in locating targets. The capability of these devices should be discussed with the operators of the equipment. Consideration should be given to the use of Night Vision Googles (NVG) or Forward Looking Infra-Red Radar (FLIR) particularly when searching from the air.

First and Last Search Light

First and last search light describes the optimal times that searching should commence and cease taking into account the angle of the sun and the limiting factors caused by a low sun on searchers. First search light is 45 minutes after sunrise and last search light is 45 minutes before sunset. These times allow for the sun to either rise above the horizon sufficiently for searching towards the east, or to be sufficiently above the horizon for searching towards the west. In mountainous or built up areas these times may vary due to darkness extending for lengthier periods.

Given the urgency and circumstances a SMC may choose to utilise these times to conduct searches. Civil twilight is that period of time when the sun is 6° (24 minutes) below the horizon, either before sunrise or after sunset. This time can be utilised by aircraft to travel to their respective search area, but originally related to when a star sighting could be taken from an aircraft. Nautical twilight is that period when the sun is 12° (48 minutes) below the horizon, either before sunrise or after sunset. This time can be utilised by vessels to travel to their respective search area but originally related to when a star sighting could be taken from a ship.

Weather/Oceanographic Factors

It is of vital importance to gain knowledge of weather conditions that have or are likely to prevail in the area of search prior to, during and in the immediate future. In extremes, this will indicate the possible time frame for the missing person's survival. Adverse weather prevailing in or approaching an area where survivors are located may also limit the time available to conduct a SAR operation. Not only are survivors of an incident more difficult to detect under adverse weather conditions, but also SAR units themselves operate at lower efficiency due to conditions and higher stresses on the search personnel.

Accurate knowledge of weather conditions and the prudent judgment based on it will enhance the likelihood of a successful mission. Knowledge of the prevailing weather conditions will also play an important role in the safety of the search units. If weather will not allow for a search operation to be mounted without endangering additional lives, the search effort should be deferred or suspended. If weather is currently good but forecast to deteriorate in a short time, more rapid action is required and detailed planning may suffer due to the time available. If weather is good and forecast to remain so, more extensive planning may be accomplished.

Wind, visibility and cloud cover influences the search track spacing. Therefore, the better the weather information, the more realistic will be the derived track spacing. Maintaining accurate search patterns is difficult in adverse weather. Aerial units are particularly vulnerable. For this reason the patterns selected should allow for more precise navigational accuracy. Safety may sometimes be prejudiced by actual weather conditions, which must, therefore, be monitored continuously by the SMC.

Low cloud base and restricted visibility are particularly hazardous during searches that cover large areas where many aircraft are employed. Should air search be conducted under adverse weather conditions that deteriorate below the required flight conditions, then air search may have to be suspended. In situations where survivors are adrift in regions of high velocity water current, searches should be mounted without delay. The probability of locating survivors is high during the early stages of survival craft drift as the drift factor allowed for in search calculations will be of reasonable accuracy over a short time period.

When missions involve overdue craft, the weather situation should be evaluated to determine what effect it may have had upon the craft's operating capabilities and/or the actions of the craft's operator prior to SAR system activation. To obtain an overall weather picture an attempt should be made to complete the following questionnaire:

- What was the weather at the departure point, destination and along the planned track at the time the overdue craft should have been in those areas? If no established weather facilities are available, the information should be obtained from local reliable sources in the areas concerned, such as police or marine volunteers, if possible.
- What was the enroute and forecast weather briefing given to the crew of the missing craft, and what was the operator's reaction to the weather briefing?
- What was the weather in the area where the missing craft is presumed to be and if the time of emergency is known, what were the actual weather conditions at the craft's estimated position?
- Were there any marked changes in wind or sea currents that might have resulted in navigation errors?
- Were there any areas of low ceiling, poor visibility, precipitation, thunderstorms, frontal activity, turbulence, icing, that may have caused the craft to attempt circumnavigation, or that could have exceeded either the crafts or operator's capability?
- Were there any areas of marked pressure changes that may have caused aircraft altimeter errors?

Terrain Factors

Terrain may be a major factor in evaluating an incident. Terrain may dictate the type of search pattern required, and may limit the selection of search aircraft that can be used. Aircraft that are highly manoeuvrable and will be effective at moderately high altitudes may be required in rugged mountain areas. High performance or large transport aircraft may be unusable in confined areas and helicopters may not be able to operate in the thin air and turbulence associated with mountains and contour searches. Terrain may also limit the time available for search. For example low-level searches in mountain areas are normally limited to daylight only, often restricted by increased shadows due to deep valleys and high mountains.

The type of survival kit carried by the distressed craft and the equipment, such as the type of hoist device used by available helicopters will also be influencing factors. Dense foliage may hamper both visual and electronic searches and require increased numbers of aircraft and closer search track spacing. Man-made additions to the terrain such as power-lines, towers and bridges must also be considered when planning search areas and the altitudes of search aircraft. The type of rescue team used after the distress site has been located is also dependent upon terrain. When there is doubt about survivors or the area is inaccessible, time is a factor. Should other help not be readily available, airdrops or parachutists may be required. Before deploying parachutists, the ability for them to land, to be resupplied and recovered must be considered.

Survival Equipment Factors

The amount and type of survival and signalling equipment available to the survivor will influence not only the urgency of the SAR system's response, but also the methods and procedures employed in various SAR stages. The SMC may concurrently conduct a high level electronic search and a visual search. The SMC must use their common sense, good judgment and background experience to evaluate the appropriate response for taking advantage of the survivor's capability to signal and survive.

Risks v Gain Factors

SAR assets are responsible for taking whatever action they can to save life at any time and place where their facilities are available and can be effectively used. Nevertheless, there may be a point beyond which SAR services are not expected and cannot be justified. Known and inherent risk must be carefully weighed against the mission's chances for success and the gains to be realised. SAR personnel and equipment shall not be placed at risk, nor the mission attempted, unless lives are known to be at stake and the chances for saving lives are within the capability of the personnel and equipment available. All reasonable action shall be taken to locate distressed personnel, determine their status and bring about their rescue. Prolonged SAR operations after all probability of survival has been exhausted are uneconomical and not warranted. The decision to conduct such operations must be based on probability of detection.

Studies have shown that the period within 12 to 24 hours of a distress incident is the most critical for recovery of survivors. The best chance of successful recovery occurs during this time period. Within 48 hours, chances are still good, but after that time the chance of successful recovery decreases rapidly.

9 Search Planning and Evaluation

The wellbeing of survivors is critically dependent on early location and support. It is vital that as soon as possible after becoming aware of an incident, SAR authorities quickly implement procedures for a rapid search of the most likely area of distress. In general, the initial SAR response requires ready application of simple procedures to quickly cover the most likely area of distress. The search area described will be of rudimentary construction, e.g. a circle, square or rectangle depending on the nature of the target.

The stage 1 search area (equivalent to a Reflex search on land) will be of sufficient proportions to cover all reasonable alternative tracks of the target and will incorporate areas highlighted by intelligence information. This strategy precedes the more complex calculations that will give rise to a more precise area which, failing the success of stage one search will form the basis for a formally planned and executed action at a later time. The stage one search may be undertaken in relatively short time and allow ready allocation and briefing of the few necessary resources.

All of the basic search theory concepts are described in this chapter. Practical examples are provided for each concept, showing how it may be applied to the search-planning problem. These examples require only basic arithmetic skills and an understanding of the basic probability concepts encountered in everyday life. Although search planning may be perceived to be complex, each step is relatively simple.

Aviation and Marine Search Planning Steps

Search planning involves the following steps:

- Evaluating the situation, including the results of any previous searching (This may include incidents that have occurred in that location in the past and search efforts on previous days);
- Estimating the distress incident location and probable error of that location;
- Estimating the survivors' post-distress movements and probable error of that estimate;
- Using these results to estimate the most probable location (datum) of survivors and the uncertainty (probable error of position) about that location;
- Determining the best way to use the available search assets so the chances of finding the survivors are maximised (optimal search effort allocation);
- Defining search sub-areas and search patterns for assignment to specific search assets; and
- Providing a search plan that includes a current description of the situation, search target description(s), specific search responsibilities to search assets, on-scene coordination instructions and search asset reporting requirements.

These steps are repeated until either the survivors are located or evaluation of the situation shows that further searching would be futile. While the JRCC and the ADF generally cease search efforts upon the Time Frame for Survival (TFFS) being reached, police have obligations under jurisdictional Coroner's Acts to continue searching for, and recovering, deceased persons that were previously the subject of a SAR operation.

Estimating the Distress Incident Location

The first step in search planning is to determine the limits of the area containing all possible survivor locations. This is usually done by determining the maximum distance survivors could have travelled (by aircraft, vessel, vehicle or on foot), or survivors in the water might have drifted, between the time of their last known position (LKP) or splash point (SP), and the known or assumed time that search assets can reach the commence search point, by drawing a circle with a radius equal to that distance around the LKP (S/T/D calculation) or SP. Knowing the extreme limits of possible locations allows the search planner to determine where to seek further information related to the missing craft or people and whether any incoming intelligence might apply to the incident.

This initially may result in a very large search area that may be too large to search with the available resources. Therefore, the next step is to develop one or more scenario/s or sets of known facts plus some carefully considered assumptions, describing what may have happened to the survivors since they were last known to be safe. Each scenario must be consistent with the known facts of the case, have a high likelihood of being true and allow the search planner to establish a corresponding geographic reference or datum for the survivors' most probable position (MPP). Three possible situations may exist with respect to the location of a distress incident when it is reported.

Approximate Position Known	The incident may have been witnessed: reported as a navigational fix by another craft or the craft in distress; or computed by the SMC as a dead reckoning position from a previously reported and reliable position of the craft in distress (manually or electronically).
Approximate Track Known	The craft in distress may have filed a trip or voyage plan prior to departure that included the intended track or route but the craft's actual position along the track is unknown. A single line of position, such as a flare sighting or DF, should be treated the same as a track known situation.
Approximate Area Known	When neither the position nor the intended track is known, at least an area that the craft in distress was probably within can usually be determined. The SMC should try to reduce this area to an area of high probability that can be used as the initial search area or, if the area is small enough for adequate searching with available assets, use it.

Search Response Stages

A search typically involves three stages:

- Stage 1 - Immediate response. An initial visual and/or electronic search along the missing target's planned route.
- Stage 2 - Nominated area either side of track. Normally a search conducted in an area 10 nautical miles either side of track but this can be varied depending on circumstances.
- Stage 3 - Mathematically derived area. An expanded search of a probability area calculated using the navigational tolerances of the missing and search craft, allowing for drift if applicable and the application of a safety factor.

Stage 1 and 2 searches can be run concurrently. By way of example, if a distress incident occurs at the end of daylight or during the night, when the first visual search cannot be undertaken until the following day, then it may be appropriate to conduct both stages simultaneously. Note that an essential part of any search stage will be the establishment of a rescue plan, coordination with the Police and consideration of the early dropping of SAR datum buoys. Some emergency situations will suggest a still more spontaneous reaction. Where a target reports encountering a distress situation, the location is reasonably well known and there are other assets of opportunity in the near vicinity, it may be possible to divert an asset to the area or intercept the distressed target's track with instructions to undertake a track crawl search along the known route.

If circumstances allow, the diverted asset may be instructed to proceed parallel to the distressed targets track at an appropriate off-set distance to one side and to return at the same off-set distance on a reciprocal heading on the other side of the targets track. Such a procedure can provide coverage of the distressed target's track and the most likely lateral area either side of it. Whether this is practicable will be dependent on such factors as endurance of the diverted craft, its suitability for the task, weather, daylight and terrain. The pertinent factors should be discussed with the crew of the diverted craft prior to tasking

Factors Affecting the Search Response Plan

There is a wide spectrum of factors that may influence the extent and manner of an initial SAR response. To summarise some of the more important ones:
● Extent and reliability of information about the location of the distressed craft and its occupants;
● Availability of aircraft, marine craft and land parties for searching;
● Actual and forecast weather conditions;
● Times of daylight/darkness;
● Nature of terrain; and
● Availability of survival supplies and rescue assets

Initial Search Procedures

When the distress position is not known with certainty, the procedure most frequently used first is to search along the intended track of the missing target. If not already completed, inspection of possible landing places should continue. It may be necessary to allocate one or more aircraft to the task of examining those possible landing areas that have not been inspected during the landing site and communications checks. The size of the area to be considered for this purpose will be at the discretion of the SMC, however, they should be guided in determining final limits to landing site checks by the size of the probability area, modified by any pertinent intelligence information.

Unless it is positively determined that the missing target does not have an emergency beacon, information should be obtained from the JRCC on the satellite pass schedule and an aircraft should be quickly allocated to an electronic search. It may be possible to arrange for an electronic search to be flown either before or after some other task but it should be noted that it is not practicable for an aircraft to be tasked for a combined electronic and visual search. All aircraft on visual searches however, as on other tasks, should be briefed to keep a listening watch on 121.5 MHz and 406.0 MHz, but the maintenance of a listening watch will be supplementary to the primary task. Likewise, an aircraft assigned to an electronic search should be briefed to keep a general look out for visual signals if possible.

Maximum Search Effort

When a situation of actual distress is either known or strongly suspected to exist, the time available for search will usually be limited. A maximum search effort must be completed within this time. Quite often a large search area is also involved, further compounding the SMC's problems. The following method has proved successful in approaching this situation:
● Determine a search area that gives a high POD of successfully finding the search object;
● Use a track spacing equal to sweep width (C = 1.0, or no lower than 0.5);
● Decide the time by which the search must be completed (available light, first and last search light, electronic searching);
● Select the number of SAR asset hours required to complete one search of the area within the allocated time (refer to the ATNPS formula);
● Dispatch sufficient SAR assets to complete one search of the area within the allocated time; and
● If unsuccessful, expand and/or repeat in accordance with the repeated expansion concept.

Do not re-orientate the search or change SAR unit assignments whilst on task if it can be avoided.

Once a large-scale search is ordered and SAR assets are dispatched, reorientation of the search area for that particular search is both difficult and wasteful. Planning should therefore be thorough and then adhered to. The SMC must also resist the temptation to re-deploy assets whenever new intelligence or doubtful hearing or sighting reports are received.

New intelligence should be evaluated with the possibility that the information needs immediate action. Additional assets should be dispatched to investigate leads that come to light after the assigned assets have commenced searching. This will prevent unsearched areas and maintain the momentum of the search. It is almost impossible to resume a search in an area after that asset has been diverted to another search area. Holes in searches create doubt and reduce the overall POD.

Search Sequence

There is no single sequence of search types, search patterns, etc. which can be suggested as standard procedures. The matrix in the table below shows one search sequence employing various factors and search parameters. Such a sequence could be used where large areas must be searched initially and search assets are limited. Each incident will require its own specific sequence and parameters should be recalculated for each search. Searching both a land and marine environment with aircraft provides the most rapid response and greatest chance of survival.

In instances where aircraft are unavailable or in insufficient numbers then a vessel search will become necessary in a marine incident. A vessel search may be limited initially to a trackline search to provide a maximum POD. Vessel visual, electronic, wreckage and beacon searches are limited by the height of eye (Hoe) of searchers and the sea conditions at the time.

Search No	Type	Period	Target	Speed (Kt)	Track Spacing (NM)	Altitude AGL/ AMSL (FT)
Initial	Track line	Day/Night	Active target	100/200	5	Below 5000
1	Electronic Beacons	Day/ Night	Electronic	150/500	20	High as practicable
2	Visual (aids)	Night	Fires, flares, torch, etc.	100/150	10	1500-3000
3	Visual (aids)	Day	Mirrors, dye, smoke, etc.	100/150	10	1500-2000
4	Visual (rafts)	Day	Life rafts	100/150	1.5	300-1500
5	Visual (wreckage)	Day	Wreckage, survivors	75/130	0.5	200-2000

The most effective search, by far, is an electronic search for a beacon. Electronic searches cover larger areas very rapidly with a high POD. After a beacon search, and given that it is known that the survivors from a maritime incident have distress flares, the next most effective detection aids are luminous types used at night.

The SMC therefore plans to use a search unit on a night track line search during the first darkness period following the ditching. This pattern is also expanded laterally, but at a track spacing of 20 miles. Since the survivors will be in better physical and mental condition during the early stages of their ordeal, the SMC takes advantage of this by deploying a night search at the first opportunity. This minimises the possibility of the detection aids being lost prior to their use, or of the survivors becoming too weak to use them effectively.

The third most effective group of detection aids are the daylight aids such as mirrors, smoke and sea dye marker. The first daylight visual search is therefore based on this group of detection aids. A larger area can be covered initially by using 10-mile track spacing. In addition, the SMC is taking advantage of the probable better physical and mental condition of the survivors, in the same manner as when the early night search for the luminous detection aids was commenced.

If in a maritime incident, the electronic search, the night visual search and the day visual search for detection aids are unsuccessful; the SMC must next plan to search for life rafts. Just as the SMC assumed that the survivors were able to use their beacon, luminous detection aids and daylight detection aids in previous searches, he now assumes that the survivors were able to board their life rafts after ditching or abandoning their vessel. Therefore the SMC uses slower aircraft at close track spacing to search visually for life rafts.

If these raft searches were also unsuccessful, the SMC must then use extremely small track spacing and search for survivors in the water, wreckage and debris. From the second search on, the SMC should have also directed that all SAR assets maintain RADAR search, where RADAR is available, even though the search was planned on the more tangible effective detection aids available to the survivors.

Determination of Search Areas

The possibility area is the area in which a missing craft could be located. Usually the area is too big to be considered the search area but knowledge of its extent and boundaries may be of use when assessing intelligence information, in particular sighting or hearing reports.

The possibility area is displayed as a circle drawn around the last known position (LKP) of the target. The radius of this circle should equal the endurance at the time of the LKP expressed in terms of distance and taking into account wind velocity for aircraft or drift for vessels. It is assumed that the target may have proceeded in any direction until its fuel was exhausted.

The possibility area may be determined by:
● For aircraft, drawing a wind vector downwind from the LKP to a scale representing a distance equal to the wind speed multiplied by the known or estimated remaining fuel endurance time, while for vessels, drawing the drift for the time period since the LKP; then
● Drawing a circle from the end of the wind vector or drift, of a radius (using the same scale) representing a distance equal to the aircraft TAS or vessel speed multiplied by the known or estimated remaining fuel endurance.

Figure 3-1 shows the possibility area for an aircraft with a last known position of A. Position B is the aircraft's datum once the wind vector has been applied. The circle is derived using a radius, centred on B, of the aircrafts remaining endurance, which in this example is 150 NM.

Where: A = LKP, TAS = 100kt, W/V +180/15 (Wind vector is 180°T (Blowing from the south) at 15kts), Endurance remaining at A = 90 minutes. Therefore A-B = 22.5 NM (15kt winds x 90mins endurance (1.5hrs) and radius B-C = 150 NM (100kt speed x 90mins endurance (1.5hrs)).

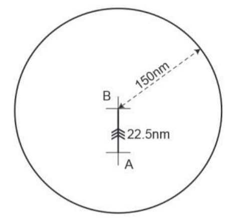


Figure 3-1 Possibility Area

The probability area is the area in which a missing craft and/or survivors are most likely to be found, taking into account possible errors in the navigation of the missing craft and of the search asset, together with an allowance for any water movement (should the incident occur on or over water) and a safety factor. When the position of an incident is reported by a witness, or reported as a navigational fix determined by RADAR or another craft or by the distressed craft itself, or calculated by the RCC in the form of DR position, the probability area is enclosed by a circle of probability centred on that position, taking into account the applicable above mentioned factors.

In the case of a downed aircraft, joining lines 10 NM either side of the aircraft's known, planned or suspected route will normally form the initial probability area for an aircraft search. The 10 NM may be adjusted to allow for the type of flight, e.g. a transiting helicopter may be 5 NM either side of track where as a turbo prop or jet aircraft may be 15 NM or more. This is referred to as a Stage 2 search.

When Stage 1 and Stage 2 search actions fail to locate the target, the probability area should be determined by drawing circles of probability around the last known position, the first missed report position, and any turning points along the planned track.

Tangents to the circles then enclose the intervening area. This is referred to as a Stage 3 search and is shown in Figure 3.3. Planning for the Stage 3 search should commence when it is apparent the target cannot be located by the Stage 2 search.

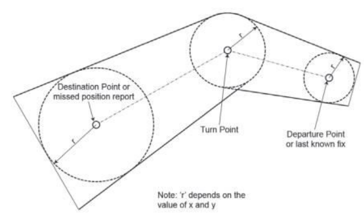


Figure 3-3: Stage 3 Search Area (Mathematically Derived)

Search Radius

This is defined as the radius of a circle, centred at the most probable position of the target at any given time (the Datum), equal in length to the Total Probable Error of Position (E) in nautical miles, increased by a safety factor. For successive searches of the probability area the safety factor is increased progressively. The safety factors applied to the Total Probable Error of Position to obtain a Search Radius (R) are shown in Table 3-2.

Search Effort	Safety Factor						
Initial Probability Area	1.1						
First Expansion	1.6						
Second Expansion	2.0						
Third Expansion	2.3						
Final Expansion	2.5						

Drift Error for Waterborne Targets
Over land, the Datum is the last known position; however when survivors are known or thought to be in or on the water an allowance must be made for movement of the water resulting from the effects of wind and current. The degree of displacement of the Datum from the last known position assumes increasing importance with the passing of time, and MUST be allowed for in search planning. This displacement is a function of:
● The average sea current;
● The average wind current; and
● Leeway

Sea Current
Tidal and local geographic features may affect sea currents near the coast. When areas near the coast are to be searched, the water movement for the area should be discussed more fully with local experts.

Tidal Streams
Tides are caused by the gravitational pull of the moon and sun, modified by the depth and shape of the sea basin along the coastal areas. Currents in coastal waters are usually affected by tides, changing in predictable velocity as the state of the tide changes. In some locations tidal streams are of the reversing type, abruptly changing direction 180 degrees at about the time of high and low water. In other places the direction will change in small increments so as to create a constant rotary movement. Variations of these tidal effects may also be found.

The exact effect of the tide on currents in any specific area may be found by consulting tide tables or local charts. Local knowledge is again of great value in dealing with movements of tidal streams. While the changes in direction of tidal streams have a tendency to nullify the cumulative effect, they must nevertheless be considered in computing drift for the following reasons:
- Often, with reversing streams, the effect in one direction is greater than in the other so that, over a period of time, the resultant effect is more in one direction than in the other; and
- Even over short periods of time the flow of tidal streams will cause significant changes in the probable position of a search object.

River Current
River current will affect SAR incidents that occur in offshore areas near river mouths. Tidal streams affect the river current speeds near the mouths of the rivers. In large rivers this affect may be noticed several kilometres upstream from the mouth. Published current tables often give values which are combinations of tidal and river flow effects. These are among areas where reversing streams will be greater in one direction that the other. On the other hand, river current affects both total current and sea current at its mouth. Some major rivers extend their influence quite significantly off shore. Seasonal variations in water volume and velocity should be considered.

Longshore Current
Longshore currents are caused by incoming swells striking the shore at an angle. Longshore current information must be obtained from direct observation or local knowledge.

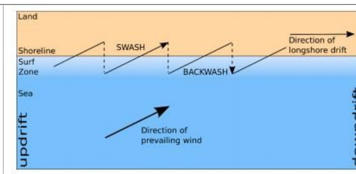


Figure 3-8 Longshore Currents

Swell/Wave Current
In calm conditions, swells and waves may affect rafts and other small marine search targets. The effect is similar to leeway in that the raft is being moved through the water. However swell/wave current speed is so small, under 0.1 knot, that the drift force is usually ignored in determining general search areas. It is useful however for determining probable direction of target movement in some cases.

Surf Current
Surf current is only considered for incidents occurring in coastal surf areas. It is more of a rescue or salvage factor than a search planning factor. Surf currents will move a drifting object after it enters the surf zone. If no longshore current is present, the surf current will move the object towards the shore perpendicular to the line of breakers. If a long shore current is present, the object will be displaced in the direction of the long shore current.

Rip Current
Rip current is a special type of surf current. It is a narrow band of current flowing seaward through the surf line as a result of the long shore current building up a large volume of water along the beach line, and then bursting through the incoming surf on its way back to sea. Rip currents are only a few metres wide through the surf line, but they fan out and slow down when in smoother water. Rip currents occur when longshore currents are present, and in places where some form of bottom trough, bottom rise or shoreline feature assists in deflecting the long shore current build up in a seaward direction.

Local Wind Current
Local wind current is the current generated by wind acting on the surface of the water. The current changes with variations of the wind pattern. Near the coast, wind current can be affected by various factors and consideration should be given to omitting the wind current vector from search areas close to the coast. Offshore, consideration should also be given to omitting the wind current vector, if it is considered to be an area of consistent winds.

The velocity of a wind current is calculated from:
- Wind data for the 48 hours preceding splash time;
- Actual and forecast winds between splash time and Datum time; and
- The application of coefficients taken from tables held in RCCs.

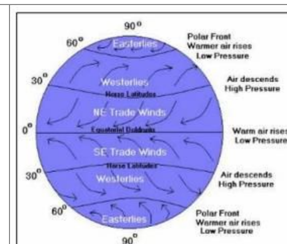


Figure 3-9 Wind Direction and Speed

Wind current is calculated for 6-hour periods, the periods being coincident with the meteorological synoptic periods. The current for any given synoptic period is the cumulative effect of the wind in the area for the 48 hours prior to the end of the synoptic period being considered. The direction and speed coefficients obtained from the tables allow for the effect of Coriolis, and the reversal of wind direction, to express the result as 'SET'.

Leeway
Leeway is the movement of a search object caused by it being pushed through the water by local winds blowing against its exposed surfaces. A boat, raft or any other type of marine craft has a certain proportion of its hull and superstructure exposed above the surface of the water at all times. This exposed area is blown against by local winds, which in turn have the effect of pushing the marine craft through the water.

The more surface area the wind has to blow against, the greater will be the wind's effect on drift. If the silhouette of a boat were projected onto a flat plane, which was perpendicular to the wind direction, the area enclosed by the silhouette would be called the exposed flat-plane area. As the boat's heading changes relative to the wind, its flat-plane area also changes, usually becoming least when the boat is heading directly into the wind or downwind.

The pushing force of the wind is countered by the water drag on the underwater hull. The drag varies with the volume, shape, depth and orientation of the underwater hull. When a marine craft is parallel to the wind direction the least amount of underwater drag will exist since the craft will be pushed through the water in the direction its hull is designed to move.

Almost the same conditions exist when the boat is pointed directly into the wind and is being pushed backwards through the water longitudinally. When the boat's heading is perpendicular to the local wind, however, the greatest amount of underwater drag will exist since the boat must now be pushed sideways through the water. Between these extremes the amount of underwater drag will vary depending on the heading of the boat.

Datum Plot

The bearing and distance of a Datum from its associated Last known position is found by combining four vectors as shown in Figure 3-10:

- The sea current;
- The wind current; and
- Two leeway vectors, one each for left and right divergence.

The value of the vectors may change with time; therefore it is necessary to calculate a mean value for each vector for the period between splash time and datum time. All calculations are related to meteorological synoptic periods, or part thereof.

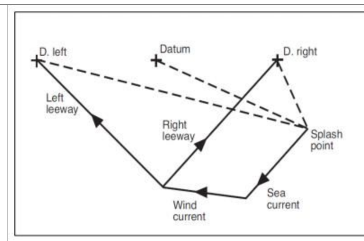


Figure 3-10 Datum Plot

The objective being to calculate the movement attributable to each factor during the period under consideration, with a vector summation for the whole period and then to combine the individual effects to establish a most probable position for the target. When the most probable position has been established, an allowance is made for possible errors, which is then combined with the navigation error allowances in the Total Probable Error (E) of Position formula.

Land Search Planning

Land SAR is the operational coordination and management of a search and rescue response for the following situations:

- A person/vehicle/vessel or aircraft reported missing in a land environment.
- A person/vehicle/vessel or aircraft reported overdue as a result of either scheduled contact time or a planned excursion in a land environment.
- A request from another SAR authority to assist in a land based SAR incident
- Evidentiary and crime searching in a land based environment

It is important for the SMC to make an assessment of the facts of the situation relating to the missing person, as soon as possible after receiving significant information. These assessments may prevent any of the following errors being made:

- A search operation too slowly implemented due to a poor appreciation of the missing person's life and death situation.
- A search operation which is terminated prematurely because it is falsely assumed that the missing person could not have survived.
- A search operation which is conducted in too small or large a search area because of a lack of knowledge related to the missing person's mobility.

Unless each search is considered in detail and likely problems identified, the result could be:

- Loss of life
- An ineffective search
- An aggravation of the situation
- Bad publicity
- A loss of community credibility for the SAR Authority and/or searchers
- A loss of organisation or individual morale
- Any combination of the above

Before any SAR incident can be prosecuted the SMC must have situational awareness in relation to the incident. Without this the SMC is blindfolded and will be making decisions that are not based on the actualities of the incident. If the SMC is in unfamiliar terrain then any time spent gaining situational awareness, either through a drive around, a fly over or at the least, a study of a topographical map, is never wasted.

Definition: The accepted definition of situational awareness is 'The perception of the elements in the environment within a volume of space and time, the comprehension of their meaning and the projection of their status in the near future.'

The first part is recognising all the small components that make up the SAR scenario at that particular time and location. As the scenario develops these small components will change, making them only valid for a short period. These small components may include:

- Weather
- Missing person/vehicle/vessel or aircraft
- Terrain/topography
- Incident location
- Daylight/darkness
- Resources available
- Lead times for resources
- Coordination activities

The second part is understanding what each of these small components means. Examples of this are as follows:

- Weather – What impact will the immediate weather have on the search, the searchers, the missing person/vehicle/vessel or aircraft, visibility, specialised clothing and food requirements?
- Missing person/vehicle/vessel or aircraft – What is the description of the target, changes that may occur as a result of the incident causes (Crash, overturned, fire), difficult of finding the target, location of the target, safety and/or danger features.
- Terrain/topography – how will this impact on the search, searchers, search area determination, person/vehicle/vessel or aircraft, resource requirements, time, funnel points, barriers.
- Incident location – transport to and from scene, travel from FSH to search areas, lead time, specialist transport/search techniques, resource availability.
- Daylight/darkness – search time available, travel time, search visibility

- Resources available – type and number, suitability, availability, lead time, specialist resources.
- Lead times for resources – time to scene, time on scene, resupply
- Coordination activities – availability of trained coordination staff, incident command system, availability of maps, electronic aids, printers, communication systems

Search planning involves the following steps:

- Evaluating the situation, including the results of any previous searching;
- Identifying the Last Known Position (LKP) of the MP and any error associated with that location;
- Estimating the MP's post LKP movements and any associated error of that estimate;
- Using these results to estimate the most probable location or route of the MP and the uncertainty about that location;
- Determining the best way to use the available search assets so the chances of finding the MP are maximized (optimal search effort allocation);
- Defining search sub-areas and search patterns for assignment to specific search assets; and
- Providing a search plan that includes a current description of the situation, search object description(s), specific search responsibilities to search assets, on-scene coordination instructions and search asset reporting requirements.

Scenario-Based Assessment

Scenario-Based Assessment

Scenario-based searching assesses the reasons for the loss of an object or the disappearance of a person and can be used alone or in conjunction with an appreciation. Consideration is given to all factors that may assist or impede the discovery of the missing person or object. A search strategy is developed from this in the eight stage process as described below.

This method presents a better alternative to speculative searching as it is based on a full evaluation of all information available. It also allows for the consideration of multiple scenarios and ensures that the most appropriate assets available are used. If more than one scenario emerges, action must be prioritised according to the relevant merits of each scenario and the resources available.

The eight stage process, SCENARIO, is a mnemonic designed to ensure that all of the objectives are achieved when searching for any type of object.
S - Specify person or item sought
C - Confirm last location
E - Establish circumstances of disappearance
N - Note factors influencing discovery
A - Analyse possible strategies
R - Raise search strategies
I - Identify priority search
O - Ongoing reassessment

Search Urgency Assessment (SUA)

A Search Urgency Form will be completed as soon as possible to establish the seriousness of the incident to determine the appropriate response.

There are eleven categories to be assessed:
● Number of MP's in group;
● Age;
● Medical conditions;
● Intent
● Cognitive capacity
● Experience profile
● Physical condition;

● Clothing;
● Equipment;
● Experience;
● Weather; and
● Terrain and hazards

Each of the eleven categories are individually assessed in line with information received. Each category is then assigned a number depending upon the situation (e.g. Section 1 relates to the number of missing persons. If there is only one then a number 1 is assigned to that section; if there are two MP's then a 2 is assigned etc.)

After the completion of the assessment the assigned numbers are added to determine the overall seriousness of the incident. The appropriate responses are:
● 11-17 Immediate response
● 18-27 Measured response
● 28-42 Conduct further inquiries and re-evaluate the situation
Also, if there is a number 1 assigned to any of the categories then an immediate response is required.

Terrain Factors

Terrain may be a major factor in evaluating an incident. Terrain may dictate the type of search pattern required, and may limit the selection of search assets that can be used. Terrain may also limit the time available for search. For example low-level searches in mountain areas are normally limited to daylight only. Equipment, such as the type of hoist device used by available helicopters will also be influencing factors. Dense foliage may hamper both visual and electronic searches and require increased numbers of aircraft and closer search track spacing.

Man-made additions to the terrain such as power-lines, towers and bridges must also be considered when planning search areas and the altitudes of search aircraft. The type of rescue team used after the distress site has been located is also dependent upon terrain. When there is doubt about survivors or the area is inaccessible, time is a factor. Should other help not be readily available, search teams may need to be winched into the search area. Before deploying assets under these conditions, the ability for them to land, to be re-supplied and recovered must be considered.

Environments

Rainforest

All rainforests have a crown cover of 80 per cent or more and so are classified as closed forests. Rainforests comprise a significant proportion of Australia's closed forest, but only 2.6 per cent of the total area of native forests. Rainforest ground-covers are often sparse due to the low levels of light under the dense canopies. Understoreys are varied depending on the kind of rainforest. Some are characterised by vines or ferns. Mosses and other epiphytes are often a feature of rainforests.

Vine forests are a kind of rainforest characterised by the presence of significant vines growing on the trees. They are largely confined to the tropics and sub-tropics. Rainforest with a significant cover of ferns and mosses are concentrated in the temperate zones and at high altitudes in the tropics. There are many types of rainforest, varying mainly with rainfall and latitude.

Be aware that lost person in rainforest conditions may exhibit any or all of the following:
● Failure to make shelter;
● May be hidden in the buttress roots of many rain forest fig varieties;
● Discard their equipment;
● Disorientated – walking any direction;
● Tend to walk down hill (depending on level of experience – experienced walkers may try to access high areas to resolve their position or to gain telephone service);
● Following a path of least resistance;
● Cold Temperate areas – may exhibit characteristics of Alpine areas.

Rainforest Resources considerations:
● Experienced Search Teams – with local knowledge and the ability to navigate within a featureless environment;
● National Park Rangers – or local rangers;
● Police Mounted Units, Search and Rescue Mounted Units;
● Aviation support – consider limitations;
● Tracker dogs, may be valuable first up but will otherwise be easily distracted by the many rain forest smells;
● Motorcycles/bicycles- search and rescue trained.

Alpine Environment

Alpine areas relate to high mountainous areas which are subject to extreme environment changes involving rain, snow, hail and strong winds. Alpine search teams differ from normal ground search teams mainly due to the different weather, altitude and hazards they must face and the different variety equipment and skills they use to overcome and travel in these hazardous conditions. Due to these hazardous conditions an Alpine searcher should be a trained SAR member skilled in
movement over snow & alpine survival skills able to move efficiently, skillfully and with safety in winter or sub winter conditions through terrain at low or high altitudes.

This member must be of a high fitness level, able to cope with the physical and mental demands required to move efficiently in this changing environment. All alpine SAR members must able to work as a team member and prepared and equipped for overnight survival when necessary. These guidelines are intended to differentiate Alpine searchers from normal searchers to allow for the selection of teams to handle situations that are specific to their expertise and training.

The following considerations should be taken into account:
● Equipment - Alpine equipment is very specialized to deal with extreme temperatures and conditions. All equipment should be suitable for the conditions and be checked by a team leader before entering an alpine environment. Poor equipment can put searchers lives in danger.
● Alpine searchers - Due to extreme conditions and change environment only trained alpine searchers should be used in the field on an alpine search. When entering remote areas a team should be no less than four members who are self-sufficient for overnight.
● Time frame for Survival In Alpine environment it is critical that immediate actions be taken to reduce the likely risk of exposure to hypothermia of the missing person/s.
● Medical training - Due to difficult access and remoteness of an alpine search, Paramedics or equivalent medical expertise in search teams or readily available to render assistance.
● Search techniques and search patterns – A search manager should utilize local knowledge of Alpine SAR members and/or ski patrol to assist in search tactics due to alpine mobility issues of search teams and lost persons.
● Restrictions in mobility of search teams and lost persons. Allow for greater time periods in the travel of distances.
● Makeup, search technique and search patterns used by searchers.
● Avalanche risks - A search manager should use only trained avalanche specialist in declaring search areas safe and when leading search teams in specialized searching using probes and avalanche receivers.

Hypothermia is the lowering of a body's core temperature and is the most common condition missing persons will suffer from in an alpine environment. A search manager and team leaders should be aware that lost person in alpine conditions may exhibit any or all of the following:
● Failure to make shelter
● Discard their equipment
● Disrobing of clothing
● Failure to respond to searchers
● Following a path of least resistance

This should be considered when clothing or equipment is located by search teams. The majority of missing persons in alpine environments wear high visibility clothing and equipment. Due to changing weather conditions they become disorientated, misjudge distances and become benighted.

Alpine Resources considerations:
● Overland snow/all-terrain vehicles
● Ski patrols
● Alpine horse riders and bush walkers from volunteer rescue agencies
● Aviation support
● Thermal imaging / night vision
● Avalanche specialists
● Mountain trained members in mountaineering, steep, snow and ice techniques
● GPS – carried by search teams
● Medical staff on standby.

Arid Environment

Australia is the world's driest inhabited continent. Over 70% of the continent receives between 100mm and 350mm of rainfall per year, classifying it as semi-arid or arid. Desert regions are found mostly in central and Western Australia, which makes up approximately 18% of the mainland. All of Australia's deserts are classed as subtropical deserts, given their location between the latitudes of 20 degrees and 30 degrees south of the Equator.

They are hot deserts, which means they have little rainfall and extreme temperatures, often reaching over 50°C. Humidity averages at between 10 and 20 percent. Searing day time temperatures, cold nights and lack of surface water are just a few of the challenges facing travellers in the desert. Desert surfaces are not always sandy; some consist of stones or 'gibbers' and have no sand at all.

In desert conditions, because of the extremes of temperature, both hyperthermia and hypothermia can affect the missing person. The amount of water carried and the methods which it is used by the missing person can have a critical effect on survival times. During the initial action stage an assessment of the target needs to be made in relation to their possible actions while the search is being conducted.

Persons who are level headed and remain in a sheltered or shady location will survive for much longer periods than a person who is attempting to self-help by walking throughout the day. The general rule is for a target to remain with their vehicle if lost as it is far easier to find a larger object such as a vehicle than a smaller target such as a person.

Historically most targets will spend a small percentage of time with their vehicle and then decide to walk off in search of help. In areas that are familiar to the target this may be a successful strategy, but in most instances it results in death. It is unusual for the SMC to be the first person on the scene of a SAR incident. Vital clues as to the direction, speed and condition of the target can be gathered from observations of their footprints or other markings in the immediate vicinity of a vehicle.

Consideration should be given by the SMC to brief all teams about the possible destruction of clues around vehicles. When the target's vehicle is located one team member should approach it from the hardest surface possible to ascertain if there are persons inside or if notes or other information has been left. The area in the vicinity of the vehicle should then be thoroughly inspected for footprints and other marks and the direction in which they are going. Further planning can then be made on the information obtained. If there are no obvious signs left at the vehicle, then this would be used as a possible LKP with search planning concentrated on that point.

In featureless country it is almost impossible to navigate accurately without extensive equipment. A target will often aim to walk a straight path but in reality will wander. The handedness of the target will provide a clue the direction of the wanderings. Right handed persons will tend to walk in circles veering off to the left, with left handed persons going in right hand circles. Mental condition will also play a significant part in the survival of the target. There are many stories of the explorers surviving tremendously difficult conditions without water for days.

Historically this has been attributed to the harder living conditions and tougher life styles of those explorers. With the increased pampering of people today the physical ability to survive in harsh desert conditions has diminished. The mental state will have a large effect on a target's survival. Those with a 'no give up' attitude may have better odds of survival that a person with no will power.

Be aware that lost persons in arid conditions may exhibit any or all of the following:
● May shelter in or under their vehicle;
● May dig themselves in under the sand, if experienced;
● May discard their equipment;
● May become disorientated – walking any direction;
● May sleep by day and walk by night, if experienced;
● Following a path of least resistance; and
● May seek out river beds and ranges in search for water.

The following resource considerations should be made:
● The use of indigenous trackers or visual trackers;
● Making air search a priority;
● The use of trail bikes and helicopters;
● Use of helicopters for transport of searchers and logistics supplies;
● Hardening experienced Search Teams to the environment; and
● The use of ground teams to recover the missing person once located, unless a helicopter has access.

Mountain Environment

Although Australia is considered the flattest of the world's continents it does contain some significant mountain areas with respect to SAR. Whilst about 10% of the country may be considered mountainous due to the elevation, a much smaller proportion contains areas of high relief that create substantial SAR issues. Due to the fact that many of Australia's mountain areas are National or Wilderness Parks they are often in close proximity too many of Australia's largest population centres.

Access: Many mountain areas are in wilderness or National parks. As such access into these areas is often limited. Resources in terms of searchers often have to trek great distances to reach their allotted search areas. Air support may not be available due to weather conditions, terrain or vegetation. Additional human resources may be needed to move equipment.

Communications: Many of the mountain areas are not serviced by regular communication networks. It is important to liaise with emergency services that may be able to provide additional portable sites to improve forward net coverage. Even with additional radio communications, there will be no guarantee of continuous coverage. It means that briefings and operational instructions to Team leaders must be absolutely and thoroughly conveyed.

Containment: It is almost impossible to contain an area in mountainous terrain to keep the target within it. The importance of continually monitoring trails, significant points, log books or known 'trap points' where persons could move through is essential.

TFFS: In mountainous areas the targets are often adventurous, with activities such as bush walking, canyoning, trekking, rafting, abseiling and climbing. Often the report of a missing person will not be received until the person is well overdue. With many adventurous activities extending over many days, time becomes critical as injury or misadventure may well have occurred earlier in the activity. Therefore the missing person or group may well be approaching their TFFS by the time emergency services are notified. Search strategies that emphasise fast and reconnaissance methods are indicated.

LPB: Persons who venture into mountainous areas are often motivated and aim to achieve a task. Ascertaining as much data as possible regarding the MP will enable the SMC to determine the likely characteristics of the person. Often these persons are trail orientated and will seek water and/or shelter if injured.

Vertical Rescue: Where called to search areas of high relief for missing people it is advisable to ensure that emergency services with skills in Vertical Rescue are placed on Alert or called to be part of the search so as not to delay the arrival of these trained operators should they be subsequently be needed.

Training: High levels of fitness and resourcefulness are needed as Mountain search crews may well be deployed not only in difficult terrain but over protracted days without opportunity of relief in often poor or changeable weather. Excellent navigation and map reading skills are required in any search team. The ability to effectively use GPS technology should also be considered as a skill within each search team.

● Contain any search area as quickly as possible. This can be done by using FAST and reconnaissance strategies in deploying teams to tracks, LKP, intended destination, lookouts, major camp grounds or known 'trap points' where a person or persons must pass through. These would be the initial high probability areas.
● Many mountainous area and lookouts contain logbooks or visitors' books. It is imperative that these are checked as soon as possible in an effort to narrow down the search area.
● Set up a forward net communication as soon as possible.
● Postpone a general search strategy until there is clear evidence or a definite clue to the missing person's whereabouts (e.g. Found backpack, clothing, footprints etc.) Be flexible about search team sizes, e.g. A team of 2 where communications is excellent across most of the area being searched, a team of 3 where communications is intermittent and a team of 4 where communications is poor or marginal.

● A search team of 3 is a very flexible team size as this size can strike a good balance between rapid movement and deployment and team security. A team of 3 can search in a Single File, Track Sweep, Point and Flank and Purposeful Meandering.
● Use the 'call and listen' techniques. Note that in calling from a ridgeline, the sound will not travel down the sides of a ridge or spur, sound will only travel out to the facing slopes. It is important to therefore call out from opposite ridges into a valley.

● Caves and Mines: Enthusiasts are now delving deeper and further underground into increasingly more difficult areas of caves or abandoned mines. Caves and older mines pose many problems to both the caver and potential rescuers, including narrow constrictions, vertical shafts, water at varying levels, risk of collapse and rock falls, bad air and almost complete darkness. Search and rescue in these environments should only be undertaken by trained specialists. There are several spelunking groups in the southern states and most of the underground mines have mine rescue specialists that could be called upon in an emergency.

Urban Searching

Land searches in urban areas are often required for targets such as those intending suicide and those with dementia or similar ailments. The general strategy employed for urban search is similar to that of the rural or 'bush' search, but the problems encountered are different. Urban search problems include:
● Greater number of places of concealment;
● Complicated search areas;
● Greater number of property owners; and
● Distinguishing between the missing person and the local population. It is vital to have a good description and preferably, a current photograph of the missing person or object

Urban Search Strategies: Urban search and rescue should not be confused with USAR which is the locating and rescuing of persons trapped inside fallen buildings such as in an earthquake. This task normally falls to the respective Fire and Rescue Authorities. Urban land searches will usually progress through the stages of:

- Reconnaissance;
- General search; and
- Building/contact search.

Though the stages are similar to that of a rural search, variations to some of the methods and techniques are required.
Urban Search - Major Complex: In the case of a major complex, e.g. a large hospital, each of these stages would be included within the boundaries of the complex. If the lost person is not found, then a new search area surrounding the complex is determined.

Urban Search Area Segmentation: The same segmentation principles apply as for rural search operations. Boundaries will generally be defined by artificial features, such as roads, drainage channels, railway lines and major complexes (industry, commerce, government). Some natural features which may form boundaries include rivers, shorelines and nature strips. Where roads are used as boundaries between search segments, the boundary would normally follow the centre line of the road.

Urban Environment - Reconnaissance Search: The reconnaissance stage requires small search teams to carry out a quick check of specific areas of high probability within the area of possibility. Areas which should be checked during the reconnaissance stage:

- Locations that are familiar to the lost person, e.g. current or previous residence, the home of friends and family, church, hotel, even if assurances are given that these areas have been checked.
- Hazardous areas e.g. construction sites, quarries, rooms/buildings that are rarely used (locked or unlocked).

Urban Environment -General Search: A general search stage is carried out in an area of probability, checking for signs or indications of the missing person. A check of such places as public buildings e.g. public toilets, railway station and other shelters, such as store and plant rooms or a large building, large culverts and beneath bridges, should be carried out. A special check of hazardous areas, including railway tracks, banks of rivers, lakes, swimming pools, drains, dams and construction sites where the missing person could be trapped or injured, should be made.

Urban Environment - Building/Contact Search: Building search as it implies, requires the systematic searching of each and every corridor, room and possible place of concealment within a building. Several buildings may be contained within one property, therefore requiring a systematic search of the property surrounding the buildings. Always gain permission to search property or seek police assistance. Building searches in large complexes, such as a hospital or shopping centre, present a different problem. Divide these buildings into sectors by wings or, in the case of a multi-story building, by floors. Appoint a separate team leader for each of these sectors and, where possible, have a member of the staff who occupy the building (with knowledge of the building) accompany the team leader.

The team leader must progressively report those areas searched and list those areas not searched, ensure that they are searched, later.

Urban Environment, Conclusion: Don't be misled by thoughts or statements such as 'there wouldn't be anyone in there', or information like 'I've already searched that building'. If you have the responsibility to search an area, then you make sure that you or those for whom you are responsible cover the whole area.

Telephone Triangulation

With most people now carrying mobile telephones the potential for telephone triangulation by the various telephone carriers can reduce SAR efforts dramatically. During the information gathering stages it should be canvassed as to whether the MP has a mobile telephone with them. Something as simple as making a telephone call, sending a text message or leaving a voice message may resolve a SAR incident. If these methods do not produce results, contact with the service provided can often produce a location or direction from a mobile telephone tower.

The individual State/Territory methods in contacting service providers will differ, as will any charges that are made by these providers. If the MP is in an urban area and their telephone is on, a triangulation can be reasonably successful within a small space of time. A large number of mobile telephone towers in an area can produce a very defined search area, whereas a small number or only one tower will produce a much larger search area, such as a bearing and distance from a particular tower. MP's lost in rural, mountainous or remote areas may have little mobile reception, with an associated small chance of triangulation. Mobile telephones with dead batteries will not be of much use. A triangulation should be requested as part of the initial intelligence gathering.

Reflex Search

Reflex tasking can be likened to a bicycle wheel with the hub situated on the LKP or IPP. The spokes represent the various routes, tracks, trails or directions that could have been taken by the MP. The tyre represents the limit of the reflex search which is recommended at 300-50m.

The reflectors represent places of high probability within this reflex area. These could include huts, track junctions, hazards, lookouts, cliffs and water courses. A reflex task requires minimal planning and it used as a first response search. The first SRU on scene can be tasked while the SMC is on route.

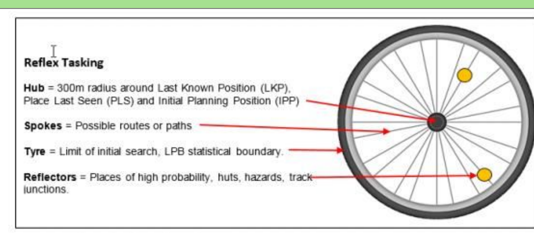


Figure 3 - 31 Bicycle method for Reflex Tasking

Formal Search

There are four strategies in determining the formal search area in a land environment:

- Theoretical (How far could the MP have travelled in the time period)
- Statistical (Using Lost Person Behaviour, what is the statistical distance the MP could be located within)
- Subjective/Decision Points (Using the terrain to determine likely search areas)
- Deductive (Looking closely at the facts, clues and assumptions)

Each of the methods are laid over each other to give a very accurate representation of the situation, and if done correctly will serve to reduce the search area to the highest probable locations.

Theoretical Search Strategy (Naismith's Rule)
The first step in land search planning is to determine the limits of the area containing all possible MP locations. This is usually done by determining the maximum distance the MP's could have travelled between the time of their last known position (LKP) and the known or assumed time the SAR incident occurred. By utilising Naismith's Rule a general indication of the maximum distance that could be travelled by the MP will be obtained. Using this as the radius a circle can then be drawn around the LKP, which will indicate the maximum distance the MP will have walked from the LKP. This method only works when it is known that the MP does not have access to other forms of transport. Knowing the extreme limits of possible locations allows the SMC to determine where to seek further information related to the MP's and whether an incoming report might apply to the incident. However, systematic search of such a large area is normally not practical.

Time missing: This time is calculated from when the MP was last seen (Time last seen TLS), not the time they were reported missing or the time they were due back. If there is no definite time last seen this may have to be estimated, on similar lines to estimating the IPP if a LKP is not viable. Commencing this calculation from TLS is done because an incident may have occurred at any time between when they started their activity and the planned return time.

Naismith's Rule: In gauging the speed of travel, Naismith's Rule describes the distance a person may travel per hour over flat terrain and was devised in 1892.
- 5 km/hour - Easy going over open country.
- 3 km/hour - Easy scrambling over rocky ground.
- 1–1.5 km/hour - Difficult going through thick scrub, heavy sand or snow.

Where a person is missing for extended periods or is likely to traverse hilly country, the possible search radius will need to be reduced due to fatigue and slower travel. For each 500 metres of ascent or 1000 metres of descent over the estimated distance travelled, reduced the possible search radius by the equivalent of one hour travel. For every 5 hours the person is missing, reduce the possible search radius by the equivalent of one hour travel for fatigue. The calculation for the possible distance travelled by the MP is relatively simple to perform. Appendix E-6 and E-7 expands on Naismith's Rule and provides further information.

Example: A 3 year old MP has been missing 13 hours in the Lamington NP. The intended route suggests medium conditions or easy scrambling (3kph) with a 500m ascent and a 500m descent.

13hrs missing -
- 1. Calculate any fatigue by dividing the time missing by 5 and ignore any remainders. (13÷5=2 3/5 = 2hrs) 13hrs – 2hrs = 11hrs
- 2. Calculate any ascent Rule is for every 500m of climbing one hour of travel time is taken off: 500m = 1hr. 11hrs – 1hr = 10hrs
- 3. Calculate any descent Rule is for every 1000m of going downhill one hour of travel time is taken off, therefore 500m would be the equivalent of 0.5hrs being taken off the total: 500m = 0.5hrs. 10hrs - .5hr = 9.5hrs.
- 4. Calculate distance travelled: 9.5hrs x 3kph = 28.5km

It is very unlikely that a 6 year old child will have walked 28.5km however, this is an indication of the maximum distance it could be possible to walk in the time frame. Without using Naismith's Rule, this calculation would have been 13hrs x 3kph = 39km. The area encompassed by a 39km radius circle is vastly larger, almost double, that of a 28.5km circle.

This initial calculation provides the SMC with a possible distance that the MP could have travelled in the time since they were last seen. It does not provide a direction or take into account any other factors, including age or behaviour, at this stage. This area is much too large to search adequately, being approximately 2550km². Being a theoretical distance it is highly probable that this distance would not be walked in a straight line but that the MP would wander somewhat and cover a shorter linear distance from LKP.

Statistical Strategy (Lost Person Behaviour)

Lost Person Behaviour: This method relies on Lost Person Behaviour (LPB) to determine the distance that the MP may have travelled from the LKP. By analysing the behaviour of past lost persons in similar situations, it may be possible to 'predict' what the subject now being sought might do, where he/she might go or where he/she might be. This concept is a search planning tool, dealing with generalities, and not absolutes. Lost person behaviour studies provide the SMC with two important items:
- Behaviour traits of lost persons by category.
- Distances travelled by specific categories of lost person

General Categories of Lost Persons: The following are the commonly used categories of lost persons:
- Children 1 to 3 years
- Children 4 to 6 years
- Children 7 to 12 years
- Adolescent Youth 13 to 15 years
- Mental Development Problems.
- Despondent
- Psychological problems
- Bushwalkers
- Dementia/Alzheimer's
- Climbers
- Hunters
- Prospectors
- Children with ADD, ADHD, Asperger's and Autism

Specific factors of LPB that may affect search planning:
- State of Health: The physical health of the lost person will have a direct impact on their ability to selfhelp and formulate rational decisions. Recent illnesses, poor fitness, disease, lack of adequate nutrition and lack of sleep will restrict a person's ability to cope with situations such as being lost in an unfamiliar environment. Increased physical stress will result in fatigue and exhaustion setting in, reducing the ability to think clearly. Good physical health may be an indication of an ability to withstand the rigors of being lost.
- Past Experiences: Studies have shown that persons who often challenge themselves in new ways or expand their comfort zones will be more adaptable to adverse situations, such as being lost. Gathering evidence of past experiences will provide an insight as to the missing person's ability to cope with challenging or stressful situations. A person who rarely does or tries anything new is more likely to be helpless and a liability when lost.

- Physiological effects of the environment: While it is acknowledged that extremes of heat and cold will have a detrimental effect on a missing person, a combination of normal temperatures with rain and/or wind will quickly have adverse effects on a missing person. Wind and wet chill can quickly lower the core body temperature, and will cause a person to seek shelter which will limit their detectability by searchers. Hypothermia has been identified as a leading cause in death and accidents in the outdoors from a search and rescue perspective. Persons suffering from either hypothermia or hyperthermia become irrational and lose the ability to help themselves. Altitude exacerbates any effects of these debilitating conditions.

Fear Factors
- An aspect that is often overlooked with respect to missing persons is general fear. Fear can be categorised as five basic types; fear of being alone, fear of the dark, fear of animals, fear of suffering and fear of death. A SMC must take these fears into account when planning a SAR mission, not just from a lost person point of view but also from a searcher viewpoint.
- Fear of being alone: In Australia this could also be termed fear of the bush. While some people choose the isolation of the bush the average person finds it haunting. The bush, and this term covers everything from the central deserts, coastal rain forests, snowy alps, eucalypt, brigalow and gidyea forests and northern swamps, is a very harsh and difficult place to survive adequately. Most of the continent has very little surface water and native foods are difficult to safely identify.

- Fear of the dark: Most humans have a primeval fear of the dark. This coupled with the noisy nocturnal activities of most native animals makes the bush darkness a stressful place to be. Compounding this is the general loss of our most important sense, sight. Without being able to see objects in the darkness our imagination can often conjure up images that can cause the strongest to be afraid. This sensation is not confined to lost persons, as it also has an effect on searchers. Those searchers on the extremes of any line search will eventually creep closer to the centre because of this fear of the dark, hence a 100m wide search initially will eventually diminish to cover a much smaller area. It is amazing how a small amount of light, from a torch or fire, can alleviate this fear.
- Fear of animals: Although Australia has no known predatory animals that actively prey on humans there is an irrational fear of being in the bush alone. Most native animals are nocturnal and their nightly activity can unnerve people and preclude a good night sleep.

- Fear of suffering: The spectre of survival can cause an often rational fear of suffering in lost persons. Australia is an extremely harsh continent, not designed to support lost persons. The possibility of dehydration, starvation, hypo- and hyperthermia, illness and injury are all real possibilities, and there are many examples of each throughout our history. The thought of the lingering agony of each situation can create a very real fear among some lost persons.
- Fear of death: The fear of a lingering death can haunt many people, particularly when they consider the many things yet to do; leaving loved ones behind, tying up loose ends and the hereafter. In some instances the fear of death can actually hasten it.

Biological Cycles

- These cycles have been recognised in the medical world for many years and do have some application to search and rescue. Most humans go through a cycle of highs and lows which can vary from periods as short as a day to periods of months.
- Female biological cycles are relatively easy to map and generally fall in line with their menstruation cycle.
- Males have similar but less detectable cycles. Studies have shown that married males will generally mirror their female partner's cycles.
- A person at the high point of a cycle may see being lost as a challenge to be met head on. These
people will attempt to self-help and have a greater chance of survival in adverse conditions. Conversely, a person at a low point of a cycle may have little energy to assist themselves and may succumb to conditions more quickly.

Behaviour while Lost

- The recognition of being lost occurs at different stages for people. It may be the slow awareness that it is taking far longer to reach a destination than was calculated or the instant realisation that what was once familiar territory is now not. A lost person can go one of two ways; sit tight and quietly reflect the situation and work out a solution or to hasten their pace as the destination 'could just be over the next hill'. This second situation can then also go in two directions; the realisation that they are getting further into unknown territory and sit down to reflect the situation or to increase their pace and run to avoid the fear of the bush, which now appears to be closing in around them. In other words they are panicking.
- Those persons who take the time to ponder may identify their location and self-help to safety. If this is not possible they will often form a shelter and wait for rescue.

- Those who are compelled to continue in a blind rush often find themselves injured in locations often far removed from their original intended track and therefore take longer to locate and rescue. It is worth considering that these people may often attempt to travel up hill to either locate a path or orientate themselves to their environment before fatigue, despair and/or depression takes over and they tend downwards on the path of least resistance. These people will often take risks beyond their capability and as a result suffer more injuries than would normally be expected.
- In both the above circumstances shock will be suffered by the lost person. This will manifest itself in many different ways depending on the person's mental strength, from simply forgetting incidents that have occurred to failing to seek shelter from rain or snow.

The trauma of being lost may also have the following effects on a lost person:

- Not seeking shelter. Many persons do not make an adequate shelter nor build a fire for warmth. With hypothermia and hyperthermia being very prevalent, particularly in desert, mountainous and urban areas, this is a vital necessity and will extend a person's chances of survival. Survivor questioning has often elicited the assumption that it is not worth the effort of making a shelter even if it will limit heat loss and provide a measure of mental comfort.
- Discarding equipment: Many persons discard their equipment without thought for using it to survive. While it is true that most lost persons are not prepared for the conditions as they only expected to be out for a few hours, there have been many instances of people being extremely well prepared and failing to use the items that had with them, particularly tents and fire making apparatus. Discarding clothing and backpacks is common and may be contributed to the shock of being lost.

- Discarding clothing: Many persons discard their clothing while wandering in the bush. This may because of overheating in warm areas, but soon becomes regrettable as the sun sets and the temperature cools down. While understandable in hotter areas it also happens during the early stages of hypothermia in colder areas. The net benefit of discarding clothing is that the lost person succumbs sooner.
- Sense of abandonment: Often with the shock of being lost is the sense of abandonment, the feeling that nobody is looking for them. Throughout Australia a search mission will be commenced once the alarm has been raised by a concerned party. If the SMC has an itinerary and LKP then the task of locating the MP is much easier. If there is no itinerary, no LKP and the MP has not been seen for some time then the task is that much harder.

- Clothing: Self-helping and responsiveness is a big factor in determining what type of search to opt for. A MP wearing bright clothing and actively seeking assistance will be easily located when compared to a small child dressed in dark clothing hiding in the undergrowth for shelter. Children are often taught 'stranger danger' and are reluctant to approach a stranger in these circumstances. MP suffering shock or other mental issues may make no attempt to draw attention to themselves even if they see a searcher, motor vehicle or helicopter.
- Navigation aids: Ignoring aids such as tracks, paths and fences is a common problem associated with MP's suffering shock. Common sense dictates that if a MP locates one of the above it will lead to a main road, gate or house where help can be obtained. On many occasions a MP will cross a track, path or fence, often without realising it, only to be further lost in an area outside a high probability search area.

10 Air Search

Once the optimal search area has been determined, a systematic search for the search object should be planned. Before a search operation takes place, the search planner should provide a detailed search action plan to all involved, specifying when, where and how individual search assets are to conduct their search operations. Coordination instructions, communications frequency assignments, reporting requirements, and any other details required for the safe, efficient and effective conduct of the search must also be included in the search action plan.

Many of the general factors involved in aerial and maritime search have similarities in their prosecution and planning and are considered together in this manual. Once the search area has been determined, a systematic search for the target should be planned. Factors such as the weather conditions, time available for search, aircraft and vessel speed, search altitude, sighting range and height of eye, size of target, etc., should be taken into account. These factors are related but some may be more important than others. In planning a search operation, the SMC should endeavour to meet the requirements of the more important factors while satisfying the requirements of the others as far as practicable.

Search Area coverage is the systematic search of selected areas of land, or water, to ensure the optimum probability of detection of the object being sought. The factors affecting detection capability have been reduced to four inter-related expressions. The terms and their symbols are:

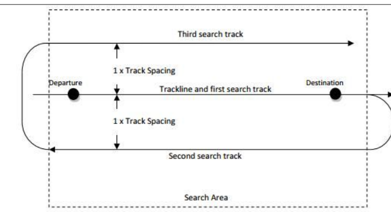
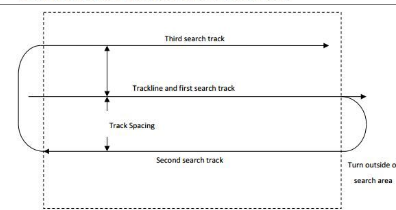
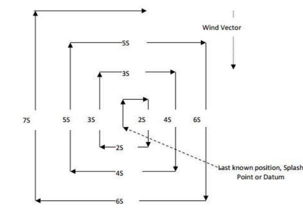
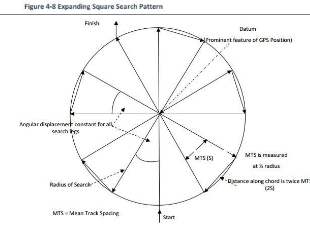
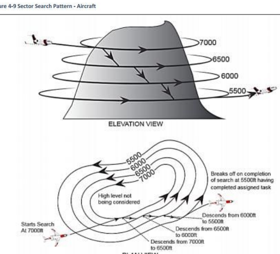
- Sweep Width (W)
- Track spacing (S)
- Coverage Factor (C)
- Probability of Detection (POD)

The type and number of available search assets will be a factor in determining search area coverage. More time will be required to search a large area thoroughly when there are limited numbers of search assets available unless the distance between successive sweeps of the area is increased. This is not desirable since it would reduce the probability of detection of the target. It may, therefore, be necessary to seek additional search assets from other sources. It is usually preferable to cover a search area from the beginning with an adequate number of search assets.

Visual Search Patterns (Marine and Aviation)

There are six main groups of search patterns:

- Track line;
- Parallel track (search legs are aligned with the major axis of an individual search area);
- Creeping line (search legs are aligned parallel with the minor axis of an individual search area);
- Expanding square;
- Sector;
- Contour

Track Line Search	This procedure is normally employed when an aircraft or vessel has disappeared without a trace. It is based on the assumption that the target has crashed, made a forced landing or ditched on or near the intended route and will be easily seen, or that there are survivors capable of signalling their position by a flashing lamp or other means. It consists of a rapid and reasonably thorough search on either side of the intended route of the target, normally at a height of 1000 to 2000 ft. during day or at 2000 to 3000 ft. at night. A track line pattern is often used as an initial reaction to a distress situation, the second, intensive phase being introduced on the failure of the track line search.	 Figure 4-6 Track Line Search where aircraft is returning back along track
Parallel Track Pattern	Parallel track search patterns can be used for searches involving one or a group of search assets and are the simplest patterns available. The pilot/coxswain of a search vessel steers straight courses or search legs, each leg being one track spacing from the other. Parallel track patterns are normally used when: ● The search area is large and the terrain is relatively level, e.g. desert and maritime areas; ● Uniform coverage is required; and ● The location of the target is not known with any precision	 Figure 4-4 Vessel trackline search
Creeping Line Pattern	These are the same type of searches but the legs are parallel to the short side of the search area. These patterns would be used when there is a stronger probability of the craft in distress being closer to one end of the search area. The SMC should be aware of the drift rate to ensure that the target is not drifting through the search area faster than the search assets are capable of searching. The search unit begins the pattern at the end of the search area where the target is most likely to be. These patterns can also be used both in single and multi-unit searches.	
Expanding Square Search	This procedure begins at the reported position or most probable location and expands outwards in concentric squares. It is a very precise pattern and requires accurate navigation. It may be advisable for vessels, especially when searching for a person in the water with either an expanding square search (SS) to use dead reckoning (DR) navigation rather than more accurate navigational methods. DR navigation will minimize pattern distortion relative to the search object since it will automatically account for the currents affecting the search object's drift during the search.	 Figure 4-8 Expanding Square Search Pattern
Sector Search	This pattern may be employed when the position of distress is known within close limits and the area to be searched is not extensive. It is simple to execute, is likely to provide greater navigational accuracy than a square search and, because the track spacing is very small near the centre, it ensures a high probability of detection in the area where the target is most likely to be located.	 Figure 4-9 Sector Search Pattern - Aircraft
Contour Search (Requires Aircraft)	Contour search is used to examine mountain slopes and valleys when sharp changes in elevation make other types of search impractical. The procedure requires that the search aircraft be flown at a selected contour level adjacent to the side of steep terrain, starting at the highest selected level. The search is started above the highest peak with the search aircraft completely circling the mountain at that level. Then the search aircraft descends a planned vertical distance while making an orbit in the direction opposite to the search (forming a figure eight), then it makes another circuit of the mountain, and so on. If the mountain cannot be circled, successive sweeps at the same intervals should be flown along its side.	 Figure 4-11 Contour Search Pattern

Search Considerations

Night Time Multi-Unit Searches
Extreme care should be taken during multi-asset searches to maintain the observers' night vision whilst working in close proximity to search lights. The operators of searchlights should always remain aware of this concern and direct the search light from a bearing right ahead to a bearing of approximately 45° to port or starboard. For small targets such as a person in the water, search asset track spacing must be adjusted so that the beams of the searchlights maintain a good overlap at all times.

Drift Compensation
In maritime areas where there is a high drift rate, care must be taken to ensure the target does not drift out of a SAR asset's area. This problem occurs when the rate of creep of the SAR asset is less than the rate of drift of the target. When this condition exists some methods of resolving the problem are to:
- Align the SAR assets search legs with the drift vector;
- Use shorter legs for the SAR unit to increase the rate of creep; and
- Increase the SAR asset's speed.

Irregularly Shaped Areas
The foregoing method of allocating aircraft assumes a regularly shaped search area. At times it is more practical to define search area boundaries by geographical features. In these situations, it is frequently impossible to set out geometrically aligned, regularly spaced search tracks. Pilots should be briefed to make every effort to conform to the standard patterns but it may be necessary, at times, to leave the execution of the search pattern to the discretion of the pilots

Search by Infrared (IR) Devices

Infrared (IR) devices such as IR TV cameras or Forward Looking Infrared (FLIR) are passive detection systems used to detect thermal radiation. They operate on the principle of detecting temperature differences to produce a video picture. Therefore, IR devices may detect survivors by their body heat. IR devices are normally preferred for night use. Search height should normally be 200 to 500 ft. for small targets such as persons in the water, and up to a maximum of approximately 1,500 ft. for larger targets or those having a larger heat signature. The track spacing can be based on consultation with the operating crew and taking into consideration the effective detection range as provided by the manufacturer.

Night Vision Goggles

Use of night vision goggles (NVGs) can be effective in search carried out by various types of search units.
The following factors may influence the effectiveness of NVGs for searching:
- NVG quality;
- Crew training and experience;
- Environmental conditions, visibility, moonlight, cloud coverage, rain;
- Level and glare effects of ambient light, natural and artificial;
- SAR asset speed;
- Height of the observer above the surface;
- Surface conditions (like snow), and sea state;
- Size, illumination, and reflectivity of the search object. The presence of reflective tape greatly enhances detectability; and
- Types of survival equipment or light sources used by the survivors.

Glare should be minimised as much as possible within the facility where the NVG users are stationed. This may involve opening or removing windows where practicable. Also proper scanning techniques are important for reducing the adverse effects of moonlight or artificial light sources like, lighthouses, offshore rigs, ships, navigation and strobe lights.

Visible moonlight can significantly improve detection of unlighted search objects when using NVGs. Search object light sources, like strobe or similar lights, mobile telephone screens or even cigarettes, can greatly improve detection even in poor visibility conditions. Recent studies have found that certain LED lights, because of the frequencies they emit on, are invisible to NVG. RCC staff should be aware that sweep width needs to be discussed with the crew conducting the mission and modified according to the conditions encountered in the search area.

11 Land Search

Searching for people lost on land.

Search Dog Capabilities

Search dogs can be trained in a range of different ways to respond to different conditions and circumstances. Understanding these differences, including the benefits and limitations, will assist in determining the most effective search dog capability to be utilised. Search dog capabilities are categorised into 6 main groups indicated in the table below:

Type	Description	Uses
Air Scenting Area Search	Work off lead and use airborne scent. They are normally nondiscriminate and will detect any human scent and other relevant scents to home in on their subject.	• Considered to be the most efficient tool for search controllers • Can efficiently search large areas • Can search difficult, steep terrain more easily than humans • Can easily integrate into a search area • Not bounded by time constraints • Can catalogue the smell of team members • Can search buildings that have collapsed or otherwise damaged • Will detect live and deceased people on land and underwater • Best used in less populated areas such as bush land and rural areas • Able to locate people who are actively hiding, deceased bodies, deliberately concealed bodies and submerged bodies • 'Live find' trained
Ground Disturbance Tracking	Working on lead, this category follows a subject's footsteps by utilising ground scent.	• Most effective when a short period of time has passed (preferably 1-2 hours) • Requires the search area to be uncontaminated where there has been no other recent foot traffic • 'Live find' trained
Scent Specific Tracking	By working on a harness and long lead, this category is trained to detect human scent on the ground. After smelling a scent article/source from the missing person they will search around the last known position to determine the path the missing person walked in order to find them.	• Scent discriminating by following the scent trail of a specific individual • Can be used to rapidly establish direction of travel where a scent source or article of the missing person is available • Requires an uncontaminated scent article/source of the subject • Handlers prefer to obtain the scent article themselves • People in the area are not to interfere with a scent specific tracking dog • There is no time constraint. 24 hours on any surface is within their capability and 48 hours or more if the conditions are suitable • 'Live find' trained
Cadaver/Human Remains Detection (HRD)	Work off lead and search for the presence of deceased persons or human remains that may be on the surface, buried, or hanging.	• Used in missing persons response, cold cases, mass graves, disaster responses including fires, floods, earthquakes etc.
Water Search	Predominantly Cadaver/HRD trained dogs that are trained to work along the shoreline or from a boat, to search for the presence of human remains in salt or fresh water.	• Can work in rivers, lakes, dams, or the ocean • Dogs are trained to alert and their handlers who then take a GPS reading to mark location • Important that they work closely with Police dive teams on the scene to pinpoint location for divers • 'Live find' trained
Avalanche	Search avalanche and heavy snow conditions for the presence of persons buried.	• Rapid activation of teams is essential • Pre-developed MOUs and activation protocols should be in place to optimise response • 'Live find' trained
Urban Search and Rescue (USAR)	Search collapsed structures and debris piles from man-made or natural disasters for the presence of live victims.	• Work off lead without a collar • Used to working at distance from their handlers • Particularly valuable in areas that are too difficult or dangerous to send humans • 'Live find' trained

SURVIVAL | Search & | Land Search | Search Dog Capa

Explanatory Terms

● 'Live find' Dogs - The term 'live find' dog is used for dogs that have been trained to find missing people that are still alive. However, most 'live find' dogs will also be able to find deceased people. All search dogs have been trained as 'live find' dogs, with the exception of Cadaver/HRD Dogs which have been trained specifically to focus on deceased persons.

● 'Scent picture' - All matter gives off scent to some degree which enables Search dogs to utilise their superior sense of smell as their primary search tool. They are able to do this by following a 'scent picture' that is made up of a combination of minute particles that tend to fall to the ground at varying distances from the source.

Composite scents consist of natural and artificial scent. The scent picture will vary with each individual, depending on ethnicity, diet and habits. Other contributing scents may include body odour, hair oil, toothpaste, equipment, footwear and those scents released from brushing and breaking of vegetation and the crushing of small insects.

More to come

Water

Methods of finding, purifying and storing water

*"Nothing is softer or more flexible than water,
yet nothing can resist it."*
Lao Tzu

Introduction

Water is essential for almost all forms of life on the planet without which we could not sustain ourselves due to the sheer amount we lose daily without realising. It's something that we all take for granted. We turn on the faucet and there it is, plentiful, clean, drinkable and seemingly endless. Without such a simple way to acquire water many people would panic out of sheer thirst and drink contaminated water from a stream, lake or worse yet - the ocean.

With an atmospheric temperature of 20°C (68°F) the average adult requires 2 to 3 litres (quarts) of water daily. The following section will inform you on multiple ways to acquire water and how to sterilize it to properly kill any viruses or pathogens that may be in it.

Purpose	The aim of WATER is to provide foundational knowledge on finding, harvest and purifying naturally occurring water until it's ready for human consumption. It also outlines how you can protect electronics from water and expounds on how the flow of water around the planet occurs by means of the ocean, rips, tides and waves.
Lost?	● For information on swimming and crossing bodies of water, see the SURVIVAL > Water Survival section. ● For ships, sailing and living on boats, see the TRANSPORT section. ● For tsunamis and flooding, see the NATURAL DISASTERS section. ● For dam failures, see the MAN-MADE DISASTERS section.

Contents

1 Types of Water

Here you can find a description of all the different types of water you may encounter, from distilled to bore water.

The distribution of water on the Earth's surface is extremely uneven. Only 3% of water on the surface is fresh; the remaining 97% resides in the ocean. Of freshwater, 69% resides in glaciers, 30% underground, and less than 1% is located in lakes, rivers, and swamps. Looked at another way, only one percent of the water on the Earth's surface is usable by humans, and 99% of the usable quantity is situated underground.

Water Distribution
- Ocean Water (96.5%)
- Ice and Snow (1.76%)
- Groundwater (1.69%)
- Lakes (0.013%)
- Atmosphere (0.00093%)
- Swamps (0.00083%)
- Rivers (0.00015%)
- Biological Water (0.000081%)

Tap Water	Water from a faucet, may or may not be suitable for drinking depending on country.	**May be Safe to Drink**
Mineral Water	Water that naturally contains minerals and is obtained from underground sources. No further minerals added and cannot be treated before packaging.	**Safe to Drink**
Spring Water	Rainwater leaking from the surface as a spring or puddle. Not passed through a community water system but is suitable for drinking.	**May be Safe to Drink**
Well Water	A well is an excavation or structure created in the ground by digging, driving, or drilling to access liquid resources, usually water. The oldest and most common kind of well is a water well, to access groundwater in underground aquifers.	**Requires Treatment**
Purified Water	Water which has been treated at a water plant removing bacteria, contaminants and dissolved solids.	**Safe to Drink**
Distilled Water	Demineralised water has been treated to remove all the minerals and salt via reverse osmosis. It's not recommended for drinking over long periods of time as it can cause mineral deficiencies.	**Safe to Drink (For a Limited Time)**
Sparkling Water	Water which has undergone carbonation (the addition of carbon dioxide) to make it fizzy. It may be spring water, purified water or spring water.	**Safe to Drink**
Bore Water	Bore water is groundwater that has been accessed by drilling a bore into underground aquifers (water storages) and pumping to the surface. Aquifers may contain chemicals and micro-organisms that are potentially harmful. Some of these chemicals are naturally occurring (such as those present in soils and rocks) while others are a result of contamination.	**Requires Treatment**
Drinking Water (Potable Water)	Drinking water, also known as potable water, is water that is safe to drink or to use for food preparation. The amount of drinking water required to maintain good health varies, and depends on physical activity level, age, health-related issues, and environmental conditions.	**Safe to Drink**

2 Water Loss

This section is about any form of water loss, from natural evaporation to water lost as sweat.

Bodily Water Loss

These are the different methods in which water can be lost from the body.

Exhaling Water Vapour	Water is lost from your body through breathing. Depending on the humidity level of the air, we lose about 300-500ml (0.3-0.5 quarts) of fluid a day through breathing.
Perspiration	You can lose up to 1.9L (2 quarts) of water per hour while exercising. Your body temperature rises about 3°C when engaged in physical activity. Sweating is your body's natural cooling system by releasing H2O in the form of perspiration.
Urine	We lose water through urination. A person typically loses 1.5 litres of water a day through urine. If your water intake is high then your kidneys produce larger amounts of water to help maintain a balance.
Bowels	Water keeps the food you eat moving through your intestines which also need water to help keep stools soft and easy to pass. All faeces contain water, causing water loss during a bowel movement. A person typically loses about 6% of their water through faeces.
Diet	Diets containing heavily processed foods could lead to water loss in your body. Heavily processed foods lack the moisture of fresh foods. Meat proteins pull water from the body to aid in digestion. Less moisture in your foods may be causing your body to pull more water from its water supply.

Water Loss Modifiers

The following list will multiply any water loss you are experiencing, so try to minimise their impact.

Heat Exposure	When an individual is exposed to very high temperatures, water lost in sweat can be increased to as much as 3.5 quarts an hour. Water loss at this increased rate can deplete the body fluids in a short time.
Exercise	Physical activity increases the loss of water by: ● The increased respiration rate causes increased water loss by evaporation through the lungs. ● The increased body heat causes excessive sweating.
Cold Exposure	As the temperature decreases, the amount of water vapour in the air also decreases. Therefore, breathing cold air results in increased water loss by evaporation from the lungs.
High Altitude	At high altitudes, increased water loss by evaporation through the lungs occurs not only as a result of breathing cooler air but also as a result of the increased respiratory efforts required.
Burns	After extensive burns, the outermost layer of skin is destroyed. When this layer is gone, there is no longer a barrier to water loss by diffusion, and the rate of water loss in this manner can increase up to 5 quarts a day.

Illness	Severe vomiting or prolonged diarrhoea can leas to serious water depletion.

Natural Water Loss

This covers any form of natural forms of water loss such as evaporation.

Evaporation	Water naturally evaporates over time but can really add up when you have large quantities of it.
Freezing	When water freezes it becomes ice. Ice is unusable in it's current form but can easily be turned back into water again by applying a low, steady heat.
Steam	Water can be lost in the form of steam. This occurs when the water reaches its boiling point. It's difficult to capture and turn steam back into water so try to keep it below boiling point.

Water Conservation

Some tips on conserving both bodily water and natural water.

Conserving Water
- Avoid exertion, rest
- Keep cool, stay in shade
- Don't lie on heated surfaces
- Don't eat, or eat as little as possible
- Don't drink alcohol which requires fluid to break down
- Don't talk and breathe through the nose, not the mouth
- Drink in small sips, even if you have an ample supply

Conserving Household Water
- Flush the toilet once a day for liquids and solids every use
- Fill a bucket for washing hands and add antibacterial elements
- Wash your clothes manually in a scrubber bag
- Use disposable cutlery and eating utensils to prevent washing up
- Take sponge baths instead of showers and especially baths
- Utilise rain, lakes or rivers for showers

Rationing Water
Try to ration water in any survival situation unless you have large amounts of it readily available. Don't drink more water than is necessary in your current situation if water is limited. Extra water will only come out as urine in a few hours and oversaturation doesn't have many additional benefits. Do not ration a limited amount of water and only take sips if you're very thirsty. It's better used early on to keep your mind and body strong so you can search for more.

3 Water Acquisition

Acquiring water is a vital skill in survival situations and should be one of the top priorities after medical needs. The section below will describe how to find water in different environments.

Minimum Water Intake
You need about 2L (64oz) of water per day to stay alive. This depends heavily on how much you are moving and the environment you're in. Find a suitable source of water that won't dry up over time such as a lake or spring.

Locating Water

The below are some tips on finding bodies of water using nature.

Animals	Animals require water regularly, grazing ones are never far from water as they drink at dawn and dusk.
Birds	Birds are never far from water. When they fly straight and low they are heading for water. They fly from tree to tree when returning from water - resting frequently.
Insects	Bees only fly 6.5km (4mi) from their hives at most. Flies keep within 90m (295ft) of water.
Valleys	Look in valley bottoms where water naturally drains. If none look for patches of green vegetation and dig.
Stream Beds	Dig in gullies and dry stream beds. Go deep enough and you should find water spilling in from the sides.
Mountains	In mountains look for water trapped in crevices.
Coast	On the coast dig above the high water line or look for lush vegetation in cliff faults - there may be a spring.
Warnings	Be wary of pools with no green vegetation around or contains animal bones. Watch out for mineral build-ups around the edges of lakes which indicate alkaline conditions. In the desert lakes with no outlets become very salty - distil to drink.

Polar Water Tips
Ice will yield more water per given volume than snow and requires less heat to do so. If the sun is shining, snow or ice may be placed on a dark surface to melt. If snow must be used for drinking water, use the snow closest to the ground. This snow is packed tighter and will produce more water. To melt snow, add it a little at a time to a pot over a fire preventing burning out the bottom of the container through insulation and airspace. All arctic water should be purified by some means. In the summer surface water may be discoloured but is drinkable when purified. You can use body heat to melt ice and snow using a waterproof container and placed between clothing layers. Do not place it directly next to the skin. Do not ingest unmelted snow or ice as it will lower the body's temperature, inducing dehydration and causing minor cold injury to lips and mouth.

Tundra Water Tips
The tundra is usually a wet place because the low temperatures cause evaporation of water to be slow. Much of the arctic has rain and fog in the summers, and water gathers in bogs and ponds.

Northern Coniferous Forest Water Tips
- Follow animal tracks (they could lead you to a water source).
- Look for lush green plants (a sign that water can be close by).
- Keep moving until you find water.
- Listen for running water.
- Look for low-lying areas or valleys (water always flows downhill).
- Collect rainwater and dew.
- Melt snow or ice. Do not eat frozen snow and ice, which will lower your body temperature and lead to dehydration.

Deciduous Forest Water Tips
Collecting rainwater is the safest way to obtain drinking water. You can use all the containers you have and strategically place them in areas to catch rain water. If you have a tarp you can tie it to trees creating a catch that drains into a container. You can also collect water that plants release through transpiration. You can also collect drinking water from snow and ice.

Temperate Grassland Water Tips
There's little rainfall in the temperate grasslands so your best bet would be to look for valleys or pools of water.

Mediterranean Regions Water Tips
The Mediterranean region is one of the most water-scarce regions in the world, however there are often plenty of rivers flowing into it to be found.

Tropical Forests Water Tips
Water is abundant in tropical forests such as in large vines which can be cut at the bottom and a nick higher up to allow the water to trickle out. You can also head to lower ground to find either a river or puddles of water. There's often a lost of dew on low-lying plants in the morning, so grab some cloth and gently wipe over safe plants and squeeze it into a container before filtering it.

Savanna Water Tips
Dehydration is a serious threat out in the open if you are unexpectedly isolated. High daytime temperatures can cause you to lose body fluids rapidly and become dehydrated. Rain is an infrequent event on the savanna, but if it rains while you are stranded, try to catch as much rainwater as possible with whatever containers you have at your disposal. If there has been recent rain, rocky outcrops are a good place to find fresh water in shallow depressions on the rocks.

A smart strategy to look for water is to find some higher ground to get an elevated view of your surroundings. Scan the landscape for clumps of trees or a line of trees across the plains, which could indicate a watercourse. If there is water in the stream or river, you can use it for drinking, but it would be better to boil it first. Always check for crocodiles and hippos in any body of water. Animals move to and from water sources to drink in the savanna, so following animal trails heading downhill could lead to water.

Standing pools of water are usually unsafe to drink because of bacteria and parasite contamination. Dig in the sand a little way from the water's edge to access water filtered through the sand. This water should be clean enough to drink, but boiling it first would be the best option. In dry river beds, look for the lowest points of the watercourse and dig into the sand in the river bed to find water. A favorable location is the inside of any bends in the watercourse, where the water flows the slowest and has a chance to seep into the sandy river bed. Once you feel the sand in the hole becoming moist, dig a little deeper and wait for the water to filter into the hole.

Plants can be a good source of water if you know where to look and which plants to use. But this option can be unsafe if you use the wrong plants. An accessible plant source of water is the baobab tree, which is distinctive in shape on the African plains. These trees capture rainwater in crevices in the tree's crown and can be a valuable resource if you are desperate for water.

Desert Water Tips
Sufficient water to last until the next water hole is reached should be on hand. Be prepared to backtrack if you cannot find your next source. Look for water before your supply is exhausted. Water canteens should be transported in such as way that they cannot be damaged or the seams split. You can drink 2.1L (2.2 quarts) of water at a time. The body sweats this amount in two hours. To maximise your water intake drink slowly and in sips. Drink as much as you can, rest and slowly drink again. Repeat this a few times until your body is saturated. To conserve water, do not travel in the heat of the day but only in the early morning, late evening or on a moonlit night. Set up a sheltered rest area for the day. The optimum drinking water temperature is between 10° - 15°C (50 - 59°F). To cool water, it can be wrapped in a wet cloth which will cause cooling when the water evaporates. Palm trees will grow where the water table is closest to the surface. Dig for water at the low point between dunes.

Ocean Water Tips
Collect rainwater in any available containers and store for future use. Collect dew on metal surfaces on foggy days. Use a Solar Still to distil the seawater. Use a desalter kit if there are no other options available.

Water Sources

Rain	Collect with a tarp and store for 7 days max without filtering. Can drink immediately.
Snow	Melt snow gradually and keep adding more to the liquid so you don't burn the bottom of the pot. It's 10% water depending on the type and isn't as efficient to collect as rain or hail. If the snow is fresh it doesn't typically require boiling.
Hail	Melt hail gradually and keep adding more to the liquid. Hail is 100% water and contains pathogens so boiling is essential.
Rivers	Filter the pathogens, viruses and particulate out. Always filter no matter how clear it looks.
Ocean	Desalinate - boil the water and recondense in a container. The average salinity of Earth's oceans is about 35 grams of salt per kilogram of sea water (3.5% salt). Most of this salt was released from volcanic activity or extracted from cool igneous rocks.
Lakes	Filter pathogens, viruses and particulate out. Ensure there's no green algae around the edges or carcasses nearby.

Evapotranspiration (Water Transpiration Bag)	Shake leaves to remove bugs. Place transparent bags over some of the fresh leaves on a medium tree or large shrub and tie at ends with a clean rock in the corner and a tube with a tap if available to prevent opening the bag. Do not use for more than three days consistently. Ensure the plant isn't toxic. Provides 3.7L/bag a day. Water may taste bitter.
Plant Condensation	Dig a shallow hole next to a plant with many leaves. Place a plastic bag over the plant and have its side slope to the lowest point which is in the hole. Tie or tighten the opening of the bag around the base of the plant. The plant will collect water with its root system. It should work for a few days as long as the plant isn't too exposed to the sun as it will be killed by overheating.
Vegetation Bag	Cut foliage from trees or herbaceous plants, sealing it in a large clear plastic bag and allow it to heat in the sun to extract the fluids contained within. The bag should be filled with about 1 cubic yard of foliage, sealed and exposed to the sun. The average yield is 320ml/bag in a 5 hour day. The water can be bitter to taste caused by leaf breakdown in the water. Use a taste test prior to consumption to test for toxins.
Dew Collection	Use clothing to mop up morning dew and wring into a cup. Dew and condensation settles on cold surfaces. These surfaces can be pieces of metal, grass, smooth rocks. Dew will evaporate at sunrise.
Fog Harvesting	Mesh netting made of nylon or polyethylene - AKA shade netting. Placed in a location with common fog on a mountain. The altitude should be 2/3rds of the stratocumulus cloud's thickness above the base - around 400-1000m. Mountain fog is denser then coastal fog. Harvests about 50L per day per m.
Atmospheric Water Generator	An atmospheric water generator (AWG) is a device that extracts water from humid ambient air. Water vapour in the air is condensed by cooling the air below its dew point, exposing the air to desiccants, or pressurizing the air. Unlike a dehumidifier, an AWG is designed to render the water potable.
Animals	In an emergency you can filter fresh animal blood for viruses and treat it for bacteria - only if you were the one to kill it. The eyes can be sucked for water as well. Large fish have a drinkable fluid along their spines. Gut the fish and keeping it flat remove the backbone being careful not to spill the liquid. In Aus desert frogs that burrow in the ground can be dug up and squeezed for their water.
Plants	Plants trap water in cavities. Shake old bamboo to find it and cut each notch to retrieve. Vines can store water but ensure sap isn't poisonous. Cut a deep notch high up and then close to the ground letting it drain, then work your way up.
Roots	Water Tree, Desert Oak, Bloodwood have roots near the surface. Pry them up and cut in 30cm lengths. Remove the bark and suck out the moisture or shave to a pulp and squeeze over mouth.
Cacti	Water is stored in the fruit and bodies but some are poisonous. Prickly pears are moisture laden in the fruit and 'ears'.
Vines	Slice the vine high up to prevent water capillary action and slice the bottom off. Water should slowly flow out. Avoid the liquid if it's cloudy, milky or has a bitter or sour taste. Do not touch the vine with your mouth. If the flow stops, cut another nick in the opposite end to drinking.
Green Bamboo	Water may be trapped within sections of bamboo. Shake it to determine if there's water inside by listening for sloshing. Cut two 45° notches on the same side and pry the piece away. Ensure the inside walls are clean and white and the water will be safe. If there are brown or black spots or any discolouration the water should be purified first.
Moss	Moss in tropical forests can be wrung of its water into your mouth.
Soil & Sand	In a muddy or damp area dig a hole one to two feet. Allow water to seep into the hole. Purify this to drink. Wet sand can be put in a piece of cloth which is then pressed or wrung to force the water out. The water will be cloudy for both methods but if left - will settle or can be filtered through a fine cloth.
Coast Water	Along coasts, water may be found by digging beach wells. Locate the wells behind the first or second pressure ridge. Wells can be dug 3-5 feet deep and should be lined with driftwood to prevent stirring up sand when procuring the water. The average well may take as long as 2 hours to produce 4 to 5 gallons of water.
Solar Still	Dig a hole 90cm across and 60cm deep in a moist area and cover with plastic sheet held by rocks then place a container in the centre. Ensure area receives lots of sunlight. Add a tube to drink from.
Sandy Beach & Salty Lakes	Along sandy beaches or salty desert lakes, dig a hole in a sand depression 30m (100ft) from the shore. Filtered water will gradually seep into the hole.
Dry Rivers	Follow a dry river bed and because of the rock structure or composition a stream might emerge. Dig a pit if the soil is moist. Follow the riverbed to the source. There might still be a trickle of water or humid soil. Dry meandering stream beds might have water deposits just below the surface at outside bends. Dig in these bends for water.
Groundwater	Groundwater is part of precipitation that seeps down through the soil until it reaches impervious rock. If the water can not find any area to flow into it saturates the area above the rock with water. It then slowly moves underground, generally at a downward angle and may eventually seep into streams, lakes and oceans. Dig deep into the earth at a low point to reveal. Filtering may be required.
Sinkholes	Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. Sinkholes are dramatic because the land usually stays intact for a while until the underground spaces get too big. If there is not enough support for the land above the spaces then a sudden collapse of the land surface can occur.
Rocky Ground	In rocky ground, look for springs and seepages.
Limestone and Lava	Limestone and lava rocks will have more and larger springs than any other rocks. Most lava rocks contain millions of bubble holes; ground water may seep through them.
Lava Flows	Look for springs along the walls of valleys that cross a lava flow.
Clay	Water moves slowly through clay, but many clays contain strips of sand which may yield springs. Look for a wet place on the surface of clay bluffs and try digging it out.
Granite	Most common rocks, like granite contain water only in irregular cracks. A crack in a rock with a bird dung around the outside may indicate a water source that can be reached by a piece of surgical house used as a straw or siphon.
Tree Spile	Requires: Drill, Bit, Mallet, taps, vinyl tube, bucket, bleach. Number of taps per tree by diameter: 12" - 1 Tap, 18" - 2 taps, 24+ - 3 taps. Drill a 12mm hole up at an angle up into the tree 5cm deep and insert spile tapping it gently. Connect the tube and run it to the bucket. Sap will collect slowly over days. Store in a cool place. Sap most likely Jul-Early Sep.

WATER
Water Acquisition
Water Sources

Cliffs	Find water at the leeward base (the steep side of the dune opposite the direction of the wind) of large dunes or at a very low spot between dunes.
Iceberg Water	Composed of freshwater and can be used as a source of drinking water.
Old Sea Ice	A bluish or blackish ice which shatters easily and generally has rounded corners. It's almost salt free.
New Sea Ice	Is milky or gray coloured with sharp edges and angles. This type of ice will not shatter or break easily. Snow and ice may be saturated with salt from blowing spray; if it tastes salty select a different source.
Urine	Drinking urine straight is not recommended but possible. Consume within 6 hours after urinating. Using a solar still, distillation or reverse osmosis membrane, generates pure drinking water. Boiling, water filters and purifying tablets kill bacteria but leave the waste products, but it's drinkable. Urine is 95% water, 2.5% is urea and 2.5% hormones, enzymes and salts.

Urban

Urban Water Sources

Household Water Sources

WATER
Water Acquisition
Urban Water Sources
Household Water Sources

Tap	As long as there's water pressure you can get water from the tap. However this supply will run out quickly if SHTF. Use the lowest tap in your home to get every drop.
Hot Water System	A limited supply of water which can be utilised. Can give you from 125L-315L.
Fridge & Freezer	Use water melted from the freezer to purify.
Hoses	There could be residual water in outdoor hoses which you can collect and filter if required. Uncoil, lift one end and collect the water coming out.
Toilet Water	You can use the water in the tank (not the bowl) to purify. Drinking from the bowl only if desperate and you have sufficiently strong purification.
Air Conditioners	If you have a water collection tray you can use this water to distil to provide drinking water. Note: The trays are typically home to a host of various bacteria, protozoa and possibly viruses.
Fish Tank Water	If you use a strong filter (0.02 microns or less) you can filter and drink tank water. Freshwater is much easier to purify as saltwater requires distillation or desalination.
Drains	Drains will hold water for a long period of time. However it will require extreme purification methods.
Cars	You can get water from the wiper fluid container on cars which have been abandoned, but filter it prior to use.

Suburban Water Sources

WATER
Water Acquisition
Urban Water Sources
Suburban Water Sources

Park Taps	Using a sillcock key you can turn on these taps and drain them. Some taps may have a typical handle or a lever style tap.
Water Towers	Hold large amounts of water, typically found on hills to increase the water pressure but may be difficult to access due to fences and proprietary water keys.
Fire Hydrants	Fire hydrants are very difficult to open due to having a pentagonal socket. **Signage** ● H = Potable Water ● RH = Recycled Non Potable ● P = Pathway (Location) ● R = Roadway (Location)
Wells	

Retrieving Water

WATER
Water Acquisition
Retrieving Water
Sillcock Keys

Sillcock Keys

The taps - known as "Anti Vandal Taps" are used in parks, water treatment plants and other government run areas to prevent water theft. This water can be accessed by using a special key on the top of the tap to turn it on. The keys are called "Sillcock Keys" in America and "Vandal Proof Keys" generally everywhere else. A special type of key used for recycled water is called an "Anti Vandal Recycled Water Key". There a multitude of key types which should be covered in the next cells but it helps to have the four-way key for opening multiple types of taps.

Key Shape	Used For
Rectangle with convex short ends	Generally on the 4-way keys.
Reverse Cog-shaped teeth with flat sections on upper and lower areas	Generally on the 4-way keys.
Zig-Zagged Teeth	Generally on the 4-way keys. I've seen a few of these in parks, some are marked as recycled water.
Fire Hydrant Wrench Hexagonal	Allows the opening of fire hydrants for use of the water.
Square	These are rarely seen, but it seems harder to get this type of key as they aren't included in the general 4-way keys.
Zig-Zagged Circular Teeth with flat base and pointed teeth	A mid-way key shape between the cog and the zig-zagged shape. Generally on the 4-way keys.

Pumps

Water

Pumps are used for transporting water either horizontally or vertically. They are useful for moving volumes of water over a distance or retrieving it from wells. The two main categories of water pumps are: Centrifugal pumps, and Positive Displacement Pumps.

Positive Displacement Pumps	Positive displacement pumps work by delivering a fixed amount of water through mechanical contraction and expansion of a flexible diaphragm. While such pumps are relatively efficient, there is the drawback that they need a very small clearance between the rotating pump and the unit's outer edge. Hence, rotation might be carried out at a slow speed. In cases when higher speeds are necessary, the liquids might erode and consequently reduce the pump's overall efficiency. **Typical Uses** Positive displacement water pumps are commonly used as they are very efficient. This is mainly because they remove air from the lines and consequently, eliminate the need for bleeding. These pumps are ideal for liquids that have a high viscosity and where sensitive solids might be present.
Rotary Displacement Pumps	Rotary displacement pumps include gear pumps, screw pumps, hollow disk pumps, rotary vane pumps and vibratory pumps. All of these are considerably efficient as they are able to manipulate highly viscous fluids which typically have higher flow rates. **Typical Uses** Such pumps are most commonly used to circulate lubricating oil in mechanical equipment. They are also used to provide pressure for hydraulic operating systems.
Dynamic Pumps	Dynamic, or rotodynamic pumps, are velocity pumps which add kinetic energy to the fluid to raise its flow velocity. As a result, the higher energy is transformed into pressure, until the velocity decreases as it nears the discharge line. **Typical Uses** Dynamic pumps are used for water supply, to pump crude oil as well as in the food industry. They are also commonly used in the chemical industry, and various commercial applications.
Centrifugal Pumps	A centrifugal water pump makes use of a rotating impeller in order to move the water within. Then it pressurises the discharge flow. There are different types of centrifugal water pumps, including standard models and submersible models. At times these kinds of pumps need recirculating liquid in order to prevent overheating problems which can be caused by low flows. It is also important to prime or fill the pump with the pumped fluid in order to help it work properly. **Typical Uses** These pumps work well when thin liquids need to be handled. As a result, practically all kinds of liquids, even those with low viscosity can be pumped with centrifugal pumps. They offer very high flow rates too. Centrifugal pumps are used in various kinds of water system applications, especially for agricultural purposes. Such pumps will typically move water from a dam or bore, direct it to the pipes for storage or to use it for irrigation. These pumps are also used for dewatering and in pumping sewage and construction-related applications. They are commonly used to pump water supplies in buildings, and to pump water from domestic wells. Such pumps are also used to boost the pressure in the water intake lines. Most centrifugal pumps are compatible with pneumatic systems too.
Axial & Radial Centrifugal Pumps	Radial centrifugal pumps pressurise the pumped flow and move it outwards through downstream piping. Axial pumps provide fluid motion by means of a lifting force caused by the impeller vanes. **Typical Uses** Such pumps are typically used in diverse commercial, industrial and domestic settings. These include the provision of water supply in residential areas, sewage disposal, in chemical, food and beverage manufacturing, as well as in oil and gas industrial operations.
Reciprocating Pumps	Reciprocating pumps fall under the positive displacement pumps category. They have an expanding cavity on the suction side, and a decreasing cavity on the discharge side. The water pump will work by filling the cavity and displacing the fluid. This is done alternately and with each cycle a constant volume is carried out. **Typical Uses** Reciprocating pumps are commonly used to pump high viscosity fluids, such as oils, resins and paints. They are ideal in applications where high pressure output is required. Such pumps are generally self-priming and since they have the advantage of not being affected by pressure levels, they are ideal in applications where the supply is irregular.
Submersible Pumps	Submersible pumps, as the name itself implies, will be submerged in the fluid. They operate by using the principle of electric submersible pumping. By lowering the flow pressure, the pressure at the bottom is also decreased. **Typical Uses** Such pumps can be quite expensive since they might require the use of special electricity cables, and the electric usage is generally considerably higher. They are used in deep wells such as oil wells, and in applications where the motor is able to operate under high pressures and temperatures. They are also suited to dealing with groundwater flooding in basements to keep properties dry, using sump pumps that sit inside a pit.
Peristaltic Pumps	A peristaltic pump is sometimes also referred to as a hose pump or a tube pump. This type of pump works by applying positive displacement principles, whereby the fluid is supplied in the tubing by rotating rollers. Then it is squeezed in a soft tube, and as the roller passes through it, it expands and forms a vacuum. This enables the fluid to enter. These rollers rotate either directly or by a motor, and there is no need for valves in such pumps. Such pumps have the advantages of being self-priming and ideal for flow regulation. They are tolerant to contamination with particles. **Typical Uses** These kinds of pumps are ideal in cases where viscous and corrosive fluids are being handled. This is because the only piece of the pump which comes into contact with the liquid is the tubing. These pumps are relatively maintenance free.
Diaphragm Pumps	A diaphragm pump, or membrane pump is another type of positive displacement pump. The diaphragm is either made from rubber, thermoplastic or Teflon. Its reciprocating action combined with the proper valves on the sides will pump the liquid. There are three main types whereby: The diaphragm is sealed with one front in the liquid being pumped, and the other in air, or in hydraulic liquid. This diaphragm is flexible, so the volume of the pump chamber can increase or decrease as required. There is a set of non-return valves which block the reverse flow. Electro-mechanical movement is carried out, and the system flexes the diaphragm, which has one head open for air. One or more unsealed diaphragms are employed to pump on both heads. When the volume of a chamber is increased, the pressure will diminish and as a result the fluid will make its way in the chamber. This will later rise so that the fluid is driven out. The cycle ends when the diaphragm moves up. **Typical Uses** Such pumps are generally used when chemicals such as acids, bleach and caustics are involved. They are also used to move abrasive fluids such as concrete. These pumps are also commonly found in the aircraft and automobile industries.

Wells

Wells are dug to hopefully provide a reliable and ample supply of water.

Dug Wells	Made with a pick and a shovel if the ground is soft and the water table is shallow. They are often lined with stones to prevent them from collapsing. They cannot be dug much deeper than the water table because it keeps filling up with water. During the dry season or a drought the water table will fall and the depth of the well can be increased.
Driven Wells	Built by driving a small diameter pipe into soft earth, such as sand or gravel. A screen is usually attached to the bottom of the pipe to filter out sand and other particles. They can only tap shallow water, and because the source of the water is so close to the surface, contamination from surface pollutants can occur.
Drilled Wells	Most modern wells are drilled. Drill rigs are often mounted on big trucks. Drilled wells can be drilled more than 1,000 feet deep. Often a pump is placed at the bottom to push water up from the surface.

Other Water

Bottled Water
Water stored in a bottle for consumption. Some bottles may leach chemicals into the water when heated. Water jug dispensers can also be found in some households. The jugs are generally 19L (5 gal).

Canned Water
More sustainable than bottled water and won't leach chemicals into the water. Some manufacturers started to use Nitrogen flush to remove air and bacteria from their cans to prolong shelf life to 30 years or longer, making the water suitable for long term storage. May have resealable lids or the common ring pull lid system.

Water Pouches Water Pouches are small flexible pouches of clean drinking water which you cut open to drink from. They generally hold 125ml each and have expiry dates of around 5 years. They aren't practical for anything but consumption and are often fairly expensive. Pouches are considered more durable, freeze resistant, impact resistant and heat resistant then water bottles thus giving them a unique purpose.	**Known Brands** • Datrex • Mainstay • Mayday • SOS Emergency	**Expiry** Chemicals may leak into the water over its lifetime and may be contaminated after it's expired. It's recommended to boil the water when expired. It will generally last 5 years.

4 Water Purification

This sections covers how to turn potentially dangerous water into drinking water.

In general there are 3 stages to producing drinking water from any type of water.

1. Remove Sediment	Filter out unwanted matter in the water such as dirt and sand. This makes it easier to kill pathogens.
2. Kill/Remove Pathogens	Remove the risk of pathogens by either killing them or removing them from the water. The first step can be combined with this step sometimes.
3. Remove Odour/Flavour	Remove/correct any natural bad taste lingering in the water or resulting from additives in the previous step.

Water Purification Overview

This section is a tabular description of each purification method to assist with choosing the best way to purify water. Each of the following purification methods are expanded in more detail in the sections below. Bugout convenience is how easy the purification is to accomplish on the go and how easy it is to store, use and repair. The scores signify the convenience of using this technique in a survival or bug-out situation. For more information on any of the techniques below, head to the section below entitled "Purification".

Note the difference between **Kills** and **Removes** as it could be important. "Improves" and "Reduces" are used for a slightly less effectiveness than "Removes" or "Kills" respectively.

Filter Type	Convenience Score	Effects & Requirements	Treatment Time & Effectivity	Lifespan & Maintenance
Makeshift Water Filter A custom filter built in the field from sand, cloth, rocks and moss.	**Makeshift Water Filter** **3/5** Easy filter to build and use in the field, but won't filter pathogens.	**Effects** • Removes Larger Particulate **Requires** • Plastic Body • Filterable Materials	**Treatment Time (1L)** 2 Minutes **Not Effective On** • Viruses • Chemicals	**Effective Lifespan** Infinite **Maintenance Required** Wash thoroughly prior to first use. May become clogged over time.
Manufactured Filters Any form of manufactured water filter.	**Manufactured Filters** **5/5** Very easy to use and maintain. Slowly blocks with age.	**Effects** • Removes Protozoa • Removes Bacteria • Removes Viruses* **Requires** • A Filter • Clean Water Container	**Treatment Time (1L)** 2 Minutes **Not Effective On** • Viruses* • Chemicals • Salts	**Effective Lifespan** 50L-1,000L Clogs as it ages **Maintenance Required** Occasional back flushing when it becomes clogged. *Only some models remove viruses.
Bank Filtration Water is filtered naturally through a bank to remove contaminants.	**Bank Filtration** **3/5** If you're near the ocean a bank should be common. Be 100% sure the water is consumable.	**Effects** • Lowers Turbidity **Requires** • A suitable bank • Digging Utensil	**Treatment Time (1L)** o **Not Effective On** • Viruses	**Effective Lifespan** o **Maintenance Required** o

Tap Filters Filters that fit over household faucets.	**Tap Filters** **2/5** Can only be used with taps. Large and Bulky.	**Effects** • Removes Protozoa • Removes Bacteria • Removes Chlorine • Removes Lead • Removes Asbestos • Removes Odours **Requires** • Tap Filter • Grid Water • Tap Pressure	**Treatment Time (1L)** 1 Minute **Not Effective On** • Viruses • Chemicals • Salts	**Effective Lifespan** 50L-1,000L Clogs as it ages **Maintenance Required** Occasional back flushing when it becomes clogged.
Carbon Filtering Putting water through carbon removes particulate and bad taste but leaves the bacteria and viruses.	**Carbon Filtering** **3/5** Only removes particulate and bad taste.	**Effects** • Removes Larger Particulate • Removes Bad Taste **Requires** • Carbon	**Treatment Time (1L)** 2 Minutes **Not Effective On** •	**Effective Lifespan** o **Maintenance Required** o
Activated Charcoal Charcoal with a large surface area for holding contaminants.	**Activated Charcoal** **3/5** Only removes particulate and bad taste.	**Effects** • Removes Larger Particulate • Removes Bad Taste **Requires** • Activated Charcoal	**Treatment Time (1L)** 2 Minutes **Not Effective On** •	**Effective Lifespan** o **Maintenance Required** o
Hand Filtering (Straining) Filtering water through a piece of fine clothing folded over at least 8 times.	**Hand Filtering (Straining)** **3/5** Only removes particulate. Very easy to use.	**Effects** • Reduces Protozoa • Reduces Bacteria • Reduces Turbidity **Requires** • Large Cloth or Material	**Treatment Time (1L)** 2 Minutes **Not Effective On** • Viruses • Chemicals • Salts	**Effective Lifespan** o **Maintenance Required** Rinsing out of the straining material.
Slow Sand Filter A filter using sand and a biofilm layer to kill microorganisms.	**Slow Sand Filter** **2/5** Takes a long time to set up but provides ample clean water. Removes most contaminants. Lots of maintenance and space required. Lots of resources required to build.	**Effects** • Removes Protozoa • Removes Bacteria • Removes Viruses • Removes Turbidity • Removes Heavy Metals • Improves Odour, Taste • Reduces Iron • Reduces Manganese • Reduces Arsenic **Requires** • Lots of Space	**Treatment Time (1L)** o **Not Effective On** • Salts • Fluoride • Chemicals	**Effective Lifespan** Infinite **Maintenance Required** Have to maintain the biofilm layer to keep the filter running.
Rapid Sand Filter Rapid sand filtration is a purely physical drinking water purification method. Rapid sand filters (RSF) provide rapid and efficient removal of relatively large suspended particles.	**Rapid Sand Filter** **2/5** Takes a long time to set up but provides ample clean water. Removes most contaminants. Lots of maintenance and space required. Lots of resources required to build.	**Effects** • Removes Turbidity **Requires** • Lots of Space	**Treatment Time (1L)** 4k-12k Litres per Hour **Not Effective On** • Bacteria • Viruses • Fluoride • Arsenic • Salts	**Effective Lifespan** o **Maintenance Required** • Frequent Cleaning • Skilled Supervision • High Energy Input • Backwashing
Biosand Filter Biosand filters remove pathogens and suspended solids from water using biological and physical processes that take place in a sand column covered with a biofilm.	**Biosand Filter** **2/5** Takes a long time to set up but provides ample clean water. Removes most contaminants. Lots of maintenance and space required. Lots of resources required to build.	**Effects** • Removes Protozoa • Removes Bacteria • Removes Turbidity • Removes Colour • Removes Odour • Removes Iron **Requires** •	**Treatment Time (30L)** 1 Hour **Not Effective On** • Dissolved Compounds • Viruses	**Effective Lifespan** Has a Long Life **Maintenance Required** • Requires Constant Use
Sedimentation Sedimentation is the process of settling or being deposited as a sediment.	**Sedimentation** **2/5** Only clumps particulate together for removal.	**Effects** • Reduces Sediment • Reduces Turbidity • Reduces Viruses • Reduces Bacteria • Reduces Protozoa **Requires** • Sediment Chemicals	**Treatment Time (1L)** o **Not Effective On** • Most Things • Chemicals	**Effective Lifespan** One Time Use **Maintenance Required** • Careful PH control
Coagulation Coagulates the sediment so it falls out of suspension for easy removal.	**Coagulation** **2/5** Only clumps particulate together for removal.	**Effects** • Clumps Sediment • Reduces Turbidity • Reduces of Protozoa • Reduces of Bacteria • Reduces of Viruses **Requires** • Coagulants	**Treatment Time (1L)** 5 Minutes **Not Effective On** • Most Things • Chemicals	**Effective Lifespan** o **Maintenance Required** o
Boiling Boil water at high temperatures to kill pathogens.	**Boiling** **5/5** The most convenient way to purify water in the field.	**Effects** • Kills Protozoa • Kills Bacteria • Kills Viruses **Requires** • Fire • Metal Pot	**Treatment Time (1L)** 5 Minutes **Not Effective On** • Turbidity • Chemicals • Taste • Smell • Colour	**Effective Lifespan** Infinite **Maintenance Required** • None

Solar Pasteurisation The heating of water to levels over 65°C (149°F) and under boiling can kill all pathogens over a longer period of time.	**Solar Pasteurisation** **3/5** Similar to SODIS and boiling but uses less energy. Harder to confirm organisms are dead.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Kills Viruses **Requires** ● Heat Source ● Unmeltable Container	**Treatment Time (1L)** 6 Minutes **Not Effective On** ● Turbidity ● Chemicals	**Effective Lifespan** Infinite **Maintenance Required** ● None
Distillation Collection of the steam from boiling water recondensed back into a liquid.	**Distillation** **4/5** Guarantees water purity but takes a long time and special equipment.	**Effects** ● Removes Turbidity ● Removes Protozoa ● Removes Bacteria ● Removes Viruses ● Removes Salts ● Removes Sugars **Requires** ● Fire ● Condensation Tubing ● Funnel Section ● Boiling Container ● Collection Container	**Treatment Time (1L)** 30 Minutes **Not Effective On** ● None?	**Effective Lifespan** Infinite **Maintenance Required** ● None
Chlorination Add chlorine to water and mix to kill pathogens.	**Chlorination** **5/5** Very easy to purify water. Must to wait some time for it to work. Tiny tablets.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Kills Viruses **Requires** ● Chlorine (Such as:) ○ Sodium Hypochlorite ○ Calcium Hypochlorite ○ Electrolytic Purification	**Treatment Time (1L)** 30m for Bacteria / Protozoa or 4h for Cryptosporidium **Not Effective On** ● Turbidity ● Chemicals	**Effective Lifespan** ○ **Maintenance Required** None
Electrolytic Water Purifier Generates chlorine from salty water to kill pathogens. (WATA) (Sodium Hypochlorite)	**Electrolytic Water Purifier** **4/5** Generates chlorine with salt easily and quick to use. Batteries Required.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Reduces Viruses **Requires** ● Salt ● Chlorine Generator	**Treatment Time (1L)** 1 Minute Initial 30m or 4h Chlorination **Not Effective On** ● Cryptosporidium ● Turbidity ● Chemicals ● Taste ● Smell ● Odour	**Effective Lifespan** Infinite **Maintenance Required** Keeping the batteries charged.
UV Light Shining of a light into clear water to kill pathogens.	**UV Light** **3/5** Often requires additional filtration methods. Batteries required.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Kills Viruses **Requires** ● UV Purifier	**Treatment Time (1L)** 2 Minutes **Not Effective On** ● Turbidity ● Chemicals ● Taste ● Odour	**Effective Lifespan** About 5,000 hours until the LED dies. **Maintenance Required** Keeping the batteries charged.
SODIS (Solar Disinfection) The use of the sun's UV rays to kill contaminants in water.	**SODIS** **3/5** Easy to access materials but takes a long time to purify.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Kills Viruses **Requires** ● Full Sunlight for 8h	**Treatment Time (1L)** ● 6 Hours ● 2 Days (If Cloudy) **Not Effective On** ● Chemicals	**Effective Lifespan** Infinite **Maintenance Required** None
Copper / Silver Ionization / Electrolysis Metals with antimicrobial properties that kills pathogens slowly.	**Copper/Silver Ionization / Electrolysis** **2/5** Infinite reusability but slow and hard to tell when the water is drinkable.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Kills Viruses **Requires** ● Specific Metals	**Treatment Time (1L)** 2 Days **Not Effective On** ●	**Effective Lifespan** ○ **Maintenance Required** None
Colloidal Silver An antibacterial solution of silver that kills pathogens.	**Colloidal Silver** **2/5** Hard to obtain colloidal silver and use to treat water effectively.	**Effects** ● Kills Protozoa ● Kills Bacteria ● Kills Viruses **Requires** ● Silver ● Electricity Source ● Colloidal Generator	**Treatment Time (1L)** 4 Hours **Not Effective On** ●	**Effective Lifespan** ○ **Maintenance Required** Generation of colloidal silver solution
Ceramic Candle Filter A vertical gravity fed ceramic filter which purifies water.	**Ceramic Candle Filter** **3/5** Large and bulky but simple to use.	**Effects** ● Removes Protozoa ● Removes Bacteria ● Removes Most Viruses **Requires** ● Filtration Device	**Treatment Time (1L)** 2 Minutes **Not Effective On** ●	**Effective Lifespan** ○ **Maintenance Required** Scrubbing the filter clean
Membrane Filtration A simple membrane which filters out contaminants.	**Membrane Filtration** **4/5** Generally compact, portable and easy to use.	**Effects** ● Removes Protozoa ● Removes Bacteria ● Removes Some Viruses **Requires** ● Membrane Filter	**Treatment Time (1L)** 2 Minutes **Not Effective On** ●	**Effective Lifespan** ○ **Maintenance Required** ○

Reverse Osmosis An extremely fine filter membrane that removes most contaminants.	**Reverse Osmosis** **3/5** Removes virtually every contaminant but requires maintenance and parts are large and hard to get.	**Effects** • Removes Protozoa • Removes Bacteria • Removes Viruses • Removes Salts • Removes Sugars • Removes Chemicals • Removes Pesticides • Removes Synth Dyes • Removes Heavy Metals • Removes Pharma Drugs **Requires** • RO Filter • Water Pressure	**Treatment Time (1L)** 30 Seconds **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** Replacement of the old filters when they wear down.
Hydrogen Peroxide Mix hydrogen peroxide to kill pathogens.	**Hydrogen Peroxide** **2/5** ○	**Effects** • **Requires** • Hydrogen Peroxide • Mixing Container	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Ozonation The use of ozone gas molecules to kill contaminants.	**Ozonation** **2/5** Requires complex resources and electricity to use.	**Effects** • Removes Protozoa • Removes Bacteria • Removes Viruses • Adds Bad Taste • Adds Bad Odour **Requires** • Ozone Generator	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Adsorption over Metal-Organic Frameworks (MOFs) Adsorption processes with porous materials. (e.g. zeolites, activated carbon, silica gel, metal-organic frameworks)	**Adsorption over Metal-Organic Frameworks (MOFs)** **1/5** Extremely difficult to accomplish off-grid due to resources needed.	**Effects** • Removes small neutral contaminants • Removes Boron • Heavy Metals • Removes Salt **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Solar Desalination Solar desalination is a technique to produce water with a low salt concentration from sea-water or brine using solar energy.	**Solar Desalination** **1/5** Extremely difficult to accomplish off-grid due to resources needed.	**Effects** • Removes Salt **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Electrodialysis Desalination Electrodialysis reversal desalination (EDR), is a water desalination process in which electricity is applied to electrodes to pull naturally occurring dissolved salts through an ion exchange membrane to separate the water from the salts.	**Electrodialysis Desalination** **1/5** Extremely difficult to accomplish off-grid due to resources needed.	**Effects** • Removes Salt **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Ion Exchange Ion exchange is a water treatment process commonly used for water softening or demineralization, but it also is used to remove other substances from the water in processes such as dealkalization, deionization, and disinfection.	**Ion Exchange** **1/5** Extremely difficult to accomplish off-grid due to resources needed.	**Effects** • Removes Salt • Removes Nitrate • Removes Fluoride • Removes Sulphate • Removes Arsenic **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Geothermal Desalination Geothermal desalination is a process under development for the production of fresh water using heat energy.	**Geothermal Desalination** **1/5** Not yet a functioning way to purify water.	**Effects** • Removes Salt **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Freezing Desalination Freeze-thaw desalination uses freezing to remove fresh water from salt water.	**Freezing Desalination** **1/5** Extremely difficult to accomplish off-grid due to resources needed.	**Effects** • Removes Salt **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○
Advanced Oxidation Processes Advanced oxidation processes (AOPs), in a broad sense, are a set of chemical treatment procedures designed to remove organic (and sometimes inorganic) materials in water and wastewater by oxidation through reactions with hydroxyl radicals.	**Advanced Oxidation Processes** **1/5** Extremely difficult to accomplish off-grid due to resources needed.	**Effects** • Removes Salt **Requires** •	**Treatment Time (1L)** ○ **Not Effective On** •	**Effective Lifespan** ○ **Maintenance Required** ○

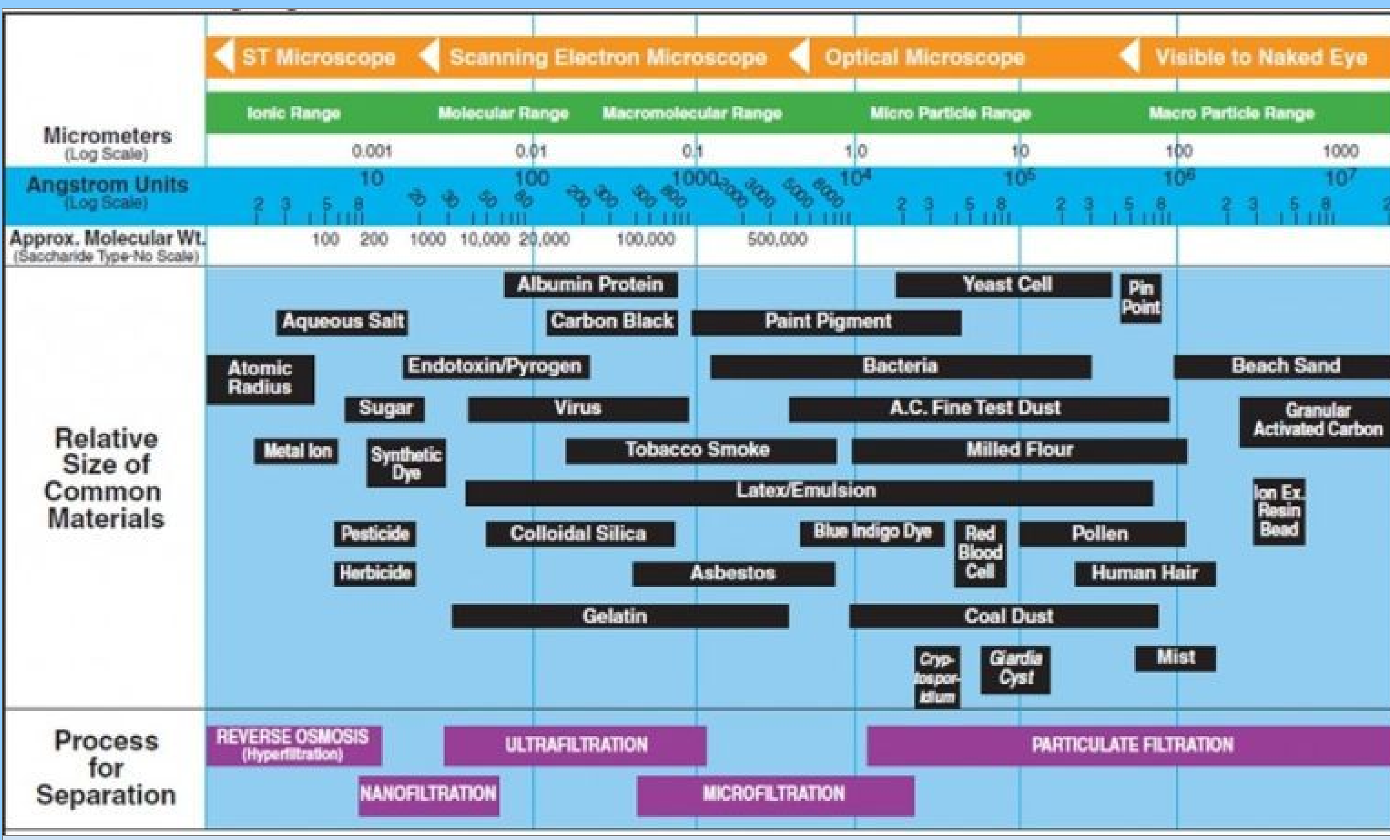
Filter Membrane Size

The table below shows the sizes of various materials that are filtered from water and the type of membane required to filter them out.

Name	Filters	Filtration Material

10,000 Micron Filter (1cm)	Filters anything larger plus: • Leaves • Sticks • Plastics (wrappers, caps etc.)	• Large Insects (Beetles, etc)	• Stones in a handmade filter
1,000 Micron Filter (1mm)	Filters anything larger plus: • Bugs • Insects		• Sand in a handmade filter • Fly Screen
100 Micron Filter (0.1mm)	Filters anything larger plus: • Sand • Dust Mites • Food Scraps		• Loose Clothing (folded over a few times)
10 Micron Filter (0.01mm) (10,000nm)	Filters anything larger plus: • Hair (Thin end first) • Rust • Dust	• Pollen • Fine Sand • Plant Spores • White Blood Cells	• Tightly Knit Clothing (folded over) • Activated Charcoal
1 Micron Filter (1,000nm)	Filters anything larger plus: • Protozoan Cysts • Giardia • Cryptosporidium	• Red Blood Cells • Mould • Coffee • Cement Dust	• All Manufactured Filters (Lifestraw, Katadyn, MSR)
0.1 Micron Filter (100nm)	Filters anything larger plus: • Bacteria • Clay	• Paint Pigment • Asbestos • Radioactive Fallout	• Most Manufactured Filters (Sawyer Mini, Katadyn Pocket)
0.01 Micron Filter (10nm)	Filters anything larger plus: • Atmospheric Dust • Colloidal Silica	• Natural Smoke	• Specific Manufactured Filters (MSR Guardian)
0.001 Micron Filter (1nm)	Filters anything larger plus: • Viruses • Pesticides • Synthetic Dye		• Reverse Osmosis
0.00001 Micron Filter (0.01nm)	Filters anything larger plus • Hydrogen Atoms • Helium Atoms		• None Known

Filter Size Table



Size of Objects in Microns (μm)

Filter Size Table

Anthrax: 1-5	**Clay:** 0.1-50	**Lead Dust:** 0.1-0.7	**Salt:** 0.0003-0.002
Antiperspirant: 6-10	**Coal Dust:** 1-100	**Liquid Droplets:** 0.5-5	**Skin Flakes:** 0.5-10
Asbestos: 0.7-90	**Copier Toner:** 0.5-15	**Mist:** 70-350	**Natural Smoke:** 0.01-0.1
Car Emissions: 1-150	**Corn Starch:** 0.1-0.8	**Mould:** 3-12	**Spider Web:** 2-3
Colloidal Silver: 0.001-0.01	**Dust Mites:** 100-300	**Mould Spores:** 10-30	**Plant Spores:** 3-100
Bacteria: 0.3-60	**Eye of a Needle:** 1,230	**Oxygen:** 0.0005	**Starches:** 3-100
Beach Sand: 100-10,000	**Fertilizer:** 10-1,000	**Paint Pigments:** 0.1-5	**Sugars:** 0.0008-0.005
Water Molecule: 0.000275	**Fibre Insulation:** 1-1,000	**Pesticides:** 0.001	**Textile Fibres:** 10-1,000
Bromine: 0.1-0.7	**Glass Wool:** 1,000	**Pollen:** 10-1,000	**Viruses:** 0.005-0.3
Burning Wood: 0.2-3	**Hair:** 40-300	**Radioactive Fallout:** 0.1-10	**Atmospheric Dust:** 0.001-30
Carbon Dioxide: 0.00065	**Household Dust:** 0.05-100	**Red Blood Cells:** 5-10	**Synthetic Dye:** 0.001-0.005
Cement Dust: 3-100	**Iron Dust:** 4-20	**Sawdust:** 30-600	**Water Molecule:** 0.000275

Filters vs Purifiers

This is the difference between water filters and water purifiers.

Water Filter	A water filter is a porous substance such as activated carbon which removes sediment and unwanted substances such as harmful chemicals and toxins from our water. Although filters are valuable, by themselves they are generally inadequate for turning municipal or well water into healthy drinking water. A filter improves taste and odour and reduces the level of many chemical contaminants in drinking water.
Water Purifier	A water purifier is defined as a system that removes 90-95% of all contaminants in water. There are three recognized purifier technologies known today: reverse-osmosis, deionization, and distillation. Because of their powerful capabilities, purifiers must form the foundation of any drinking water system to have a chance at creating truly pure water.

Membrane Classifications

These are the different classifications of water filter membranes. These are useful when purchasing a filter and you don't understand the terms used.

Microfiltration (MF) **Pore Size: ~0.1µm** **(±0.05-5)**	● High effectiveness in removing protozoa ● Moderate effectiveness in removing bacteria ● Not effective in removing viruses ● Not effective in removing chemicals
Ultrafiltration (UF) **Pore Size: ~0.01µm** **(±0.001-0.05)**	● Very high effectiveness in removing protozoa ● Very high effectiveness in removing bacteria ● Moderate effectiveness in removing viruses ● Low effectiveness in removing chemicals.
Nanofiltration (NF) **Pore Size: ~0.001µm** **(±0.008-0.01)**	● Very high effectiveness in removing protozoa ● Very high effectiveness in removing bacteria ● Very high effectiveness in removing viruses ● Moderate effectiveness in removing chemicals.
Reverse Osmosis (RO) **Pore Size: ~0.0001µm**	● Very high effectiveness in removing protozoa (for example, Cryptosporidium, Giardia); ● Very high effectiveness in removing bacteria. ● Very high effectiveness in removing viruses ● Removes common chemical contaminants (metal ions, aqueous salts), including sodium, chloride, copper, chromium, and lead; may reduce arsenic, fluoride, radium, sulphate, calcium, magnesium, potassium, nitrate, and phosphorous.

Micron Ratings

The micron Absolute, Nominal and Mean Filter ratings can vary significantly in purchased water filters. Knowing which you are buying will give you the best quality.

Absolute Micron Rating (International Rating)	The absolute rating, or cut-off point of a filter refers to the diameter of the largest spherical glass particle normally expressed in micrometres (mm), which will pass through the filter under laboratory conditions. It represents the pore opening size of the filter medium. Theoretically filter media with an exact and consistent pore size or opening has an exact absolute rating.
Nominal Micron Rating (US Rating)	The nominal rating refers to a filter capable of cutting off a nominated minimum percentage by weight of solid particles of a specific contaminant (usually glass beads) greater than a stated micron size normally expressed in micrometres (mm). I.e. 90% of 10 micron.
Mean Filter Rating	The mean filter rating refers to the measurement of the average pore size of a filter element. It establishes the particle size above which the filter starts to be effective. It is determined by the bubble point test and it is more meaningful than a nominal rating and in case of filter elements with varying pore size, more realistic than an absolute rating.

Water Filter Pore Size in Microns

Following is a list of popular water filters and their 'claimed' micron rating. The actual rating may differ due to the testing methods stated above.	**3 Micron Filters** ● Aquamira Frontier **0.2 Micron Filters** ● Lifestraw ● Katadyn Pocket ● Lifestraw Family ● MSR Trailshot ● MSR Miniworks EX ● Katadyn Hiker ● Katadyn Hiker PRO	**0.2 Micron Filters (cont)** ● Katadyn Vario ● Katadyn Expedition ● Katadyn BeFree ● Platypus GravityWorks ● MSR Sweetwater ● Black Berkey ● MSR HyperFlow ● MSR AutoFlow Gravity	**0.1 Micron Filters** ● Sawyer Filter ● Sawyer Squeeze ● MSR Miniworks ● Survival Hax Filter ● First Need XL ● Miniwell Filter ● Berkey Ceramic ● Versa Flow	**0.05 Micron Filters** ● Survivor Filter **0.02 Micron Filters** ● Etekcity Portable ● MSR Guardian **0.01 Micron Filters** ● AquaPura Premium ● Survivor Filter PRO ● Etekcity 1500L	

Water Filter Testing

You can test a water filters provided micron rating without specialist equipment at home using typical household items. Each material will be dissolved in water and will allow a certain filter type to remove it or not. The following are the items and the micron size that filters them out.
(Ordered Smallest to Largest) This was developed by myself (Fluidic Ice) but hasn't been tested yet so use at your own discretion.

Filter Method	Particle Size	Description	Filters

Salt	0.0003-0.002	Mix salt with pure water until fully diluted. Filter the mixture and if you can't taste salt at the end the filter is smaller than 0.0003-0.002 microns.	All Viruses +
Sugar	0.0008-0.005	Mix sugar with pure water until fully diluted. Filter the mixture and if you can't taste sugar at the end the filter is smaller than 0.0008 - 0.005 microns.	All Viruses +
Synthetic Dye	0.001-0.005	Mix a synthetic dye with pure water until fully diluted. Filter the mixture and if it isn't coloured at the end the filter is smaller than 0.001-0.005 microns.	All Viruses +
Colloidal Silver	0.001-0.01	Filter colloidal silver and if you can't taste the mixture at the end the filter is smaller than 0.001-0.01 microns.	Most Viruses +
Corn Starch	0.1-0.8	Mix corn starch with pure water until fully diluted. Filter the mixture and if you can't taste corn starch at the end the filter is smaller than 0.1-0.8 microns.	Most Bacteria +

Purification Methods

A study by Rob Reed using brass jugs showed a major reduction of bacteria with containers made of brass. "In brass vessels, the live E. coli levels fell and after 48 hours they were at undetectable levels." Brass sheds copper particles into the water that kill the bacteria. The levels of the metal in the water is less then the daily recommended dose.

Oligodynamic Effect (Copper)

Oligodynamic Effect
The oligodynamic effect is a biocidal effect of metals, especially heavy metals, that occurs even in low concentrations. Brass doorknobs and silverware both exhibit this effect to an extent. The oligodynamic effect was discovered in 1893 as a toxic effect of metal ions on living cells, algae, moulds, spores, fungi, viruses, prokaryotic, and eukaryotic microorganisms, even in relatively low concentrations. This antimicrobial effect is shown by ions of copper as well as mercury, silver, iron, lead, zinc, bismuth, gold, and aluminium. In 1973, researchers at Battelle Columbus Laboratories conducted a comprehensive literature, technology and patent search that traced the history of understanding the "bacteriostatic and sanitizing properties of copper and copper alloy surfaces", which demonstrated that copper, in very small quantities, has the power to control a wide range of moulds, fungi, algae and harmful microbes.

Copper Inhibits
Actinomucor elegans, Aspergillus niger, Bacterium linens, Bacillus megaterium, Bacillus subtilis, Brevibacterium erythrogenes, Candida utilis, Penicillium chrysogenum, Rhizopus niveus, Saccharomyces mandshuricus, and Saccharomyces cerevisiae in concentrations above 10 g/L. Candida utilis (formerly, Torulopsis utilis) is completely inhibited at 0.04 g/L copper concentrations. Tubercle bacillus is inhibited by copper as simple cations or complex anions in concentrations from 0.02 to 0.2 g/L. Achromobacter fischeri and Photobacterium phosphoreum growth is inhibited by metallic copper. Paramecium caudatum cell division is reduced by copper plates placed on Petri dish covers containing infusoria and nutrient media. Poliovirus is inactivated within 10 minutes of exposure to copper with ascorbic acid. A subsequent paper probed some of copper's antimicrobial mechanisms and cited no fewer than 120 investigations into the efficacy of copper's action on microbes. The authors noted that the antimicrobial mechanisms are very complex and take place in many ways, both inside cells and in the interstitial spaces between cells. The 3-dimensional structure of proteins can be altered by copper, so that the proteins can no longer perform their normal functions. The result is inactivation of bacteria or viruses. Copper may disrupt enzyme structures, and functions by binding to sulphur- or carboxylate-containing groups and amino groups of proteins.

Copper facilitates deleterious activity in superoxide radicals. Repeated redox reactions on site-specific macromolecules generate HO radicals, thereby causing "multiple hit damage" at target sites. Copper can interact with lipids, causing their peroxidation and opening holes in the cell membranes, thereby compromising the integrity of cells. This can cause leakage of essential solutes, which in turn, can have a desiccating effect. Copper damages the respiratory chain in Escherichia coli cells. and is associated with impaired cellular metabolism. Faster corrosion correlates with faster inactivation of microorganisms. This may be due to increased availability of cupric ion, Cu^{2+}, which is believed to be responsible for the antimicrobial action.

In inactivation experiments on the flu strain, H1N1, which is nearly identical to the H5N1 avian strain and the 2009 H1N1 (swine flu) strain, researchers hypothesized that copper's antimicrobial action probably attacks the overall structure of the virus and therefore has a broad-spectrum effect. Microbes require copper-containing enzymes to drive certain vital chemical reactions. Excess copper, however, can affect proteins and enzymes in microbes, thereby inhibiting their activities. Researchers believe that excess copper has the potential to disrupt cell function both inside cells and in the interstitial spaces between cells, probably acting on the cells' outer envelope.

Efficacy on Copper Surfaces
Recent studies have shown that copper alloy surfaces kill E. coli O157:H7. Over 99.9% of E. coli microbes are killed after just 1–2 hours on copper. On stainless steel surfaces, the microbes can survive for weeks. Results of E. coli O157:H7 destruction on an alloy containing 99.9% copper (C11000) demonstrate that this pathogen is rapidly and almost completely killed (over 99.9% kill rate) within ninety minutes at room temperature (20°C, 68°F).

At chill temperatures (4°C, 39.2°F), over 99.9% of E. coli O157:H7 are killed within 270 minutes. E. coli O157:H7 destruction on several copper alloys containing 99%–100% copper (including C10200, C11000, C18080, and C19700) at room temperature begins within minutes.

At chilled temperatures, the inactivation process takes about an hour longer. No significant reduction in the amount of viable E. coli O157:H7 occurs on stainless steel after 270 minutes. Studies have been conducted to examine the E. coli O157:H7 bactericidal efficacies on 25 different copper alloys to identify those alloys that provide the best combination of antimicrobial activity, corrosion/oxidation resistance, and fabrication properties. Copper's antibacterial effect was found to be intrinsic in all of the copper alloys tested.

As in previous studies, no antibacterial properties were observed on stainless steel (UNS S30400). Also, in confirmation with earlier studies the rate of drop-off of E. coli O157:H7 on the copper alloys is faster at room temperature than at chill temperature. For the most part, the bacterial kill rate of copper alloys increased with increasing copper content of the alloy. This is further evidence of copper's intrinsic antibacterial properties.

Oligodynamic Effect (Brass, Bronze, Copper-Nickel Alloys)

Efficacy on Brass, Bronze, Copper-Nickel Alloys
Brasses, which were frequently used for doorknobs and push plates in decades past, also demonstrate bactericidal efficacies, but within a somewhat longer time frame than pure copper. All nine brasses tested were almost completely bactericidal (over 99.9% kill rate) at 20°C (68°F) within 60–270 minutes. Many brasses were almost completely bactericidal at 4°C (39.2°F) within 180–360 minutes. The rate of total microbial death on four bronzes varied from within 50–270 minutes at 20°C (68°F), and from 180 to 270 minutes at 4°C (39.2°F).

The kill rate of E. coli O157 on copper-nickel alloys increased with increasing copper content. Zero bacterial counts at room temperature were achieved after 105–360 minutes for five of the six alloys. Despite not achieving a complete kill, alloy C71500 achieved a 4-log drop within the six-hour test, representing a 99.99% reduction in the number of live organisms.

Oligodynamic Effect (Stainless Steel)

WATER
Water Purification
Purification Methods
Oligodynamic Effect

Efficacy on Stainless Steel
Unlike copper alloys, stainless steel (S30400) does not exhibit any degree of bactericidal properties. This material, which is one of the most common touch surface materials in the healthcare industry, allows toxic E. coli O157:H7 to remain viable for weeks. Near-zero bacterial counts are not observed even after 28 days of investigation. Epifluorescence photographs have demonstrated that E. coli O157:H7 is almost completely killed on copper alloy C10200 after just 90 minutes at 20°C (68°F); whereas a substantial number of pathogens remain on stainless steel S30400. Copper alloys kill more than 99.9% of MRSA within two hours. Subsequent research conducted at the University of Southampton (UK) compared the antimicrobial efficacies of copper and several non-copper proprietary coating products to kill MRSA.

At 20°C (68°F), the drop-off in MRSA organisms on copper alloy C11000 is dramatic and almost complete (over 99.9% kill rate) within 75 minutes. Stainless steel S30400 did not exhibit any antimicrobial efficacy. After incubation for one hour on copper, active influenza A virus particles were reduced by 75%. After six hours, the particles were reduced on copper by 99.999%. Influenza A virus was found to survive in large numbers on stainless steel.

Oligodynamic Effect (Silver)

The metabolism of bacteria is adversely affected by silver ions at concentrations of 0.01–0.1 mg/L. Therefore, even less soluble silver compounds, such as silver chloride, also act as bactericides or germicides, but not the much less soluble silver sulphide. In the presence of atmospheric oxygen, metallic silver also has a bactericidal effect due to the formation of silver oxide, which is soluble enough to cause it. Bactericidal concentrations are reduced rapidly by adding colloidal silver, which has a high surface area. Even objects with a solid silver surface (e.g., table silver, silver coins, or silver foil) have a bactericidal effect.

Silver drinking vessels were carried by military commanders on expeditions for protection against disease. It was once common to place silver foil or even silver coins on wounds for the same reason. Silver sulfadiazine is used as an antiseptic ointment for extensive burns. An equilibrium dispersion of colloidal silver with dissolved silver ions can be used to purify drinking water at sea. Silver is incorporated into medical implants and devices such as catheters.

Surfacine (silver iodide) is a relatively new antimicrobial for application to surfaces. Silver-impregnated wound dressings have proven especially useful against antibiotic-resistant bacteria. Silver nitrate is used as a haemostatic, antiseptic and astringent. At one time, many states required that the eyes of newborns be treated with a few drops of silver nitrate to guard against an infection of the eyes called gonorrhoeal neonatal ophthalmia, which the infants might have contracted as they passed through the birth canal.

Silver ions are increasingly incorporated into many hard surfaces, such as plastics and steel, as a way to control microbial growth on items such as toilet seats, stethoscopes, and even refrigerator doors. Among the newer products being sold are plastic food containers infused with silver nanoparticles, which are intended to keep food fresher, and silver-infused athletic shirts and socks, which claim to minimize odours.

Purification By Effect

This section groups purification methods with the same effect together so you can quickly find which one you need to achieve the desired results such as needing to remove the salt from water or only the viruses from water. Some purification methods are mentioned more than once which fit into multiple categories such as distillation in Kills/Filters Contaminants and desalination.

Filters Particulate Only

These are types of water purification methods which removes the particulate only while leaving the viruses and bacteria.

DIY Water Filter	● Cloth ● Rocks ● Coarse Sand ● Fine Sand ● Charcoal ● Moss ● Sphagnum ● Cheesecloth ● Fine Cloth
Water Filter	All manufactured water filters almost entirely eliminate particulate in water.
Carbon Filtering	Heat dense wood/cloth in a pot without access to oxygen until black and crumbly. Charcoal removes contaminants and impurities using chemical adsorption. Removes chlorine, sediment, volatile organic compounds, taste and odour from water. Not effective at removing minerals, salts, and dissolved inorganic compounds.
Activated Charcoal	Powder charcoal, 25% (weight) solution of Calcium Chloride to water, add charcoal to make paste, spread paste, bake at 107°C (224.6°F) for 30m. 454g of activated charcoal contains a surface area of approximately 404k m2.
Hand Filtering	Pour water into an alternative container through a piece of fine fabric folded over about 8 times to catch particles.
Rapid Sand Filter (RSF)	Filters particulate from water.
Sedimentation	Leave water for 2 hours until particles drop to the bottom of the container. Over 1-2 days of settling will remove larger microbes such as some parasites, and some microbes. Viruses and bacteria will not be removed as they are too small.
Coagulation	Clumps sediment together which then drop out of suspension. Add coagulants to the water to quicken the sedimentation process. Coagulants: Aluminium sulphate, polyaluminium chloride (liquid alum) and ferric sulphate. Natural Coagulants: Prickly Pear Cactus, Moringa seeds, broad beans, fava beans.

Kills/Filters Contaminants

These are types of water purification which kills the viruses and bacteria only while leaving particulate such as dirt in the water.

Boiling	Altitudes under 2km - 1 Minute Rolling Boil. Altitudes over 2km - boil for 3 minutes. Prevent recontamination by ensuring flames engulf the whole bottle and threads before pouring it out.
Distillation	Boil water in a pot with a cold convex lid to collect the moisture into a container below. Has a ratio of 200:1 - 450:1 to create one litre.
Solar Pasteurisation	Heating water to 65°C (149°F) for 6 minutes, or to a higher temperature for a shorter time, will kill all germs, viruses, and parasites. Above 50°C (122°F), time decreases at roughly a factor of 10 for every 10°C (50°F) increase in pasteurisation temperature. Viruses appear the hardest to kill and essentially set the boundary for acceptable time-temperature processes.

Chlorination	Chlorine kills viruses and bacteria in water. 30m for most bacteria, 4 hours for Cryptosporidium. Types: ● Chlorine ● Iodine ● Chlorine Dioxide ● Calcium Hypochlorite (70%) ● Bleach (6%) Some chlorine formulations can be used for cleaning wounds.
UV Light	Ensure water isn't too turbid and use the UV light for 1 minute every litre for 0 NTU. If water is turbid stir the light around.
SODIS	<50% cloud - 6 hours. >50% cloud - 2 days. Temp >50°C (122°F) - 60 min. Temp >60°C (140°F) - 1 min. Use bottles less then 5cm wide. Use reflective surface to maximise light. Requires less then 30 NTU water. Shake a 3/4 bottle to oxygenate it prior to placing then fill the rest and do not touch it again.
Copper / Silver Ionization / Electrolysis	Colloidal Silver and Copper act as antimicrobials and slowly ionize the water and purify it. They destroy biofilms slowly.
Electrolytic Water Purifier	Creates chlorine (Sodium Hypochlorite) from a brine solution. (Salty water) Mix the solution into the water to be purified. Potable Aqua - Pure Use any semi pure non-salty water. Generates from 1-20L. 1L - 20s, 10L - 3m. Reduces all bacteria and viruses by 99.99%. Lasts 60k Litres. 150L per charge. 1h Solar Charge = 2L. 30m mixture time for bacteria and viruses, 4h for crypto. 37g salt storage. 2.22kg's for 60k L. Can use any type of sodium chloride, food grade recommended.

Filters Particulate & Kills/Filters Contaminants

These purification techniques remove both the particulate and the bacteria and viruses from water, leaving potable water.

Reverse Osmosis	Removes most contaminants by filtering through a semi permeable membrane. 0.0001 micron filter size, Does not filter chlorine, radon, pesticides, benzene, toluene and trihalomethanes. Filters out salt. Requires a lot of filter replacement and maintenance.
Water Purification: Adsorption over Metal-Organic Frameworks	Experimental Prototypes Only.
Slow Sand Filter (SSF)	Removes turbidity and pathogenic organisms. High reliability and low lifecycle costs. Biological process vs RSF. Removes sediment and biologically filters via the biofilm. Microbes are sourced from water source and establish within a few days (3 weeks for full community). The predatory bacteria feed on water-borne microbes passing through the filter. Requires Filter Chamber, Reservoir and pipes. Order: Water inlet flows to the top of the SSF leaving 1-1.5m water on top, Schmutzdecke / microbial community, Sand bed - 0.6-1.2m deep, 50cm gravel, drainage layer and pipes last. The total height of the filter is between 2.5-4m. Requires slow filter time at 0.1-0.3 m3/h per 1sq m. Water remains several hours prior to being filtered. Water requires pressure (or weight) to push it through the sand. No bacteria present at the outlet. Turbidity < 1 NTU = 90-99% bacteria and viruses. Highly effective for: Bacteria, Protozoa, Viruses, Turbidity, Heavy Metals (Zn, Cu, Cd, Pb), Somewhat effective for: Odour, Taste, Iron, Manganese, Organic Matter, Arsenic. Not effective for: Salt, Fluoride, Chemicals. Chlorination may be used as a final treatment step to kill remaining bacteria. Flow rate = 0.1-0.3 m/h for microorganism nutrients and oxygen. Organism build up may occur and clog filter - so scrape the top layer off.
Biosand Filter	0.9m tall cylinder and 61cm wide. Filled with: water (10%), washed sand (70%), gravel (20%). Water 5cm deep adjusted from outlet pipe coming from the bottom then U turns at the top allowing the biofilm layer. Diffusion layer avoids disruption of biofilm layer maturing in 20-30 days. Kills pathogens via: Mechanical Trapping (Sieve), Adsorption (Pathogens become attached to each other), Predation (Pathogens absorbed by microorganisms) and Natural Death (Not enough food or oxygen for the pathogens). Removes: Bacteria 87-98%, Viruses 70-90%, Protozoa > 99%, Turbidity 85%, Iron 90-95%.
Ozone Water Filter	Infuses incoming water with highly reactive ozone molecules. Starts with an ozone generator chamber where a high intensity UV light is used to break the bonds of oxygen molecules and create the unstable ozone molecule. The ozone air is forced into through the generator chamber into the recycling tank. Once the ozone enters the water it oxidizes biological components including almost all bacteria and viruses. It also bonds with many dissolved minerals, causing them to precipitate to the bottom of standing water. Ozone has been found to effectively remove 99% of all biological pathogens including Giardia and Cryptosporidium. It also is effective at removing iron and manganese as well as freeing up chlorine to kill even more microbes if used in a multiple step system. The ozone has a half-life of only a few minutes, so after it has purified the water any remaining molecules break down into standard oxygen. This creates an environment that highly oxygenates the water.

Desalination

These purification techniques remove salt in the water and can be used for purifying seawater.

Distillation	Distillation, the process involving the conversion of a liquid into vapor that is subsequently condensed back to liquid form.
Solar Desalination	Solar desalination is a technique that harnesses solar energy to convert saline water into fresh water, making it suitable for human consumption and irrigation.
Reverse Osmosis	Reverse Osmosis uses membranes to remove salt and impurities from seawater. RO is efficient, scalable, and can save energy with the right systems. Cleaning seawater before using RO improves filter performance, and energy-saving measures can reduce power usage by 30-40%, making RO a great choice for obtaining freshwater from the sea.
Electrodialysis Desalination	Electrodialysis is a versatile technology that employs membranes and electricity to remove salt from seawater, but its applications go beyond producing drinking water. It can also be utilized to extract salt, de-salt soy sauce, and recover valuable substances from salt-containing wastewater. In essence, it offers various practical uses beyond just purifying drinking water.
Ion Exchange Desalination	Ion exchange is a water treatment method where one or more undesirable ionic contaminants are removed from water by exchange with another non-objectionable, or less objectionable ionic substance.
Geothermal Desalination	Geothermal desalination refers to the process of using geothermal energy to power the process of converting salt water to fresh water.
Freezing Desalination	Freezing desalination is a water treatment process that uses controlled freezing to remove dissolved salts and impurities from saline water like seawater or brackish groundwater. It works by cooling the feedwater below its freezing point, causing pure water molecules to crystallize into ice crystals while expelling contaminants. These ice crystals then separate from the resulting concentrated brine solution and get washed and melted to produce fresh water.

Removes Bad Taste/Odour

These filtration materials remove bad taste and odours from water.

WATER | Water Purification | Purification Methods | Purification

Charcoal/Carbon	Tap water can contain artificial, organic pollutants such as pharmaceuticals, herbicides, pesticides, lead, uranium, or mercury that can affect your health even in low amounts. Placing a charcoal stick in your water removes these toxins because charcoal filters have large porous surfaces that attract, and hold contaminates to the inside. Carbon filters contain an alkaline effect that helps soften and give your water a pleasant taste.
Activated Charcoal	Activated charcoal is a black powder that's odorless. Chlorinated tap water can taste bitter and unpleasant but activated charcoal works to bond with sodium hypochlorite (a chlorine compound) within its structure, thus improving the quality and taste of water. Activated charcoal is different to regular charcoal by how much material it 'absorbs' due to having more pores to trap materials.

Filtering Info

Bacteria / Virus Sizes Giardia: 8-12 microns Cryptospor: 4-6 microns Bacteria: 0.2-4 microns Viruses: 0.004-0.1 microns	**Filter Sizes** Guardian: 0.02 Microns Sawyer: 0.1 Microns Miniwell: 0.1 Microns RO: 0.0001 Microns	**Water Pollutants** **(Micron Size which stops the Particles)** **10 Micron** - Rust, Pollen, Fine Sand, Plant Spores **1 Micron** - Protozoan Cysts **0.1 Micron** - Bacteria **0.01 Micron** - Asbestos, Colloidal Silica **0.001 Micron** - Viruses, Synthetic Dyes **0.0001 Micron** - Dissolved Solids, Radioactive Substances, Heavy Metals, Pharmaceutical Drugs	**Cloth Filter** Using clothing or a cloth can remove fine particulate from water sources but leaves the smaller bacteria and viruses intact.

Water Additives

These are compounds that can be added to water to help clean, purify or kill pathogens present.

Potassium Permanganate (KMnO4)
Expiry: Never
Mix 3-4 crystals per Litre of water until light pink (background colour) and wait 2 hours before drinking. Store solution and crystals out of sunlight and in a cool place.

AKA: Condy's Crystals

Calcium Hypochlorite
Expiry: 10 Years
Mix 1g (70%+) into a 1L solution with water, then use to treat 100L as a 1:100 ratio, filtering the sediment out. Wait 1 hour before drinking or 2h if below 15°C (59°F) or water is cloudy. A faint chlorine odour should be present. Store chlorine solution in a sealed container out of direct sunlight and discard after 2 weeks. Corrosive at pH (14-16) - Therefore can't be used on wounds. May require sodium bicarbonate to decrease alkalinity.

Water/Wound Disinfection: 1g/L (1000ppm or 0.1%)
General Disinfection:
- Clean - 1g/L - 0.1%
- Med. Clean - 2g/L - 0.2%
- Dirty - 5g/L - 0.5%
- Blood - 10g/L - 1%

Bleach
Expiry: 1.5 Years
Use two drops per litre, only unscented bleach.

Chlorine
Expiry: 5y.
Each 1.67g tablet of NaCC releases 1g chlorine - in 1L (0.1% solution or 1000ppm) pH of 6-7 and therefore can be used for cleaning wounds.

Tablet Formulations
Sodium Dichloroisocyanurate (NaDCC, sodium troclosene)

Water Treatment
1g/200L (Unless pre-packaged)

Troclosene Sodium (Chlorine) Expiry: 2 Years One tablet/L if clear, wait 30m before drinking or 4h for cryptosporidium. Two tablets if high turbidity. AKA: Sodium Dichloroisocyanurate	**Chlorine Disinfection** **Water/Wound Disinfection** 1g/L (1000ppm or 0.1%) **General Disinfection** ● Clean - 1g/L - 0.1% ● Med. Clean - 2g/L - 0.2% ● Dirty - 5g/L - 0.5% ● Blood - 10g/L - 1%	**Sodium Dichloroisocyanurate** **(Troclosene Sodium)** Used in most of the water purification tablets manufactured today. Some may contain silver. **Use:** 1 Tablet in 1L **Expiry:** 10 Years **Storage:** Cool, dark, dry area **Brands:** Aquatabs.
Chlorine Dioxide Expiry: Forever < 24°C (75.2°F) Most effective treatment. One tablet per litre, wait 30m before drinking or 4h for cryptosporidium.	**Chlorine Dioxide** Used in a few brands of water purification tablets. **Use:** 1 Tablet in 1L **Expiry:** Infinite if kept cool **Storage:** Cool, dark, dry area **Brands:** Katadyn Micropur MP1, Lifesystems, Potable Aqua. Created by mixing 28% sodium chlorite solution with an acid such as citrus juice. AKA: MMS	

Iodine
Expiry: 7 Years
Treat water with two drops per litre. Avoid using for extended periods.
AKA: Tetraglycine Hydroperiodide

Iodine can come in liquid, powder or granular forms. Not to be confused with iodide which is used to saturate the thyroid gland during radiation.

Colloidal Silver
Expiry: 10 Years ~ 20-29°C (68°F-84.2°F) in a dark glass jar.
Colloidal Silver is simply silver ions and microscopic silver particles produced by electrolysis and suspended in distilled water. It is a mineral supplement that may provide support for your body's natural immune system. It should not be confused with old style silver medicines that contained chemically or mechanically powdered silver. This modern form of Colloidal silver can be made at home using distilled water that costs just a few dollars for 4 litres.

Using Colloidal Silver
.05 microns to .0008. 1ppm = 1mg Silver.
Combine with Hydrogen Peroxide for more effectiveness. 100 drops a day of 15 ppm CS is safe.
Use 50ml/L to treat water. CS can be used in place of chlorine when storing water to keep it biologically safe.
Treats Irrible Bowel Syndrome (IBS). Colloidal Silver is an Antibacterial, Antifungal and Antiviral.

Hydrogen Peroxide (H_2O_2)
Expiry: 1y Unopened, 1m opened.
1-2ppm (1-2mg/L - 11drops/L) stir and leave for 10m. When injected into water, hydrogen peroxide releases a large amount of dissolved oxygen which has a strong oxidizing effect, destroying odors and oxidizing iron and other contaminants. Hydrogen peroxide does not add chemical by-products into the water, only oxygen and water.

Calcium Hydroxide (Slaked Lime)
Expiry: 10+ Years if stored correctly away from carbon dioxide and moisture.
One significant application of calcium hydroxide is as a flocculant, in water and sewage treatment. It forms a fluffy charged solid that aids in the removal of smaller particles from water, resulting in a clearer product. This application is enabled by the low cost and low toxicity of calcium hydroxide. It is also used in fresh-water treatment for raising the pH of the water so that pipes will not corrode where the base water is acidic, because it is self-regulating and does not raise the pH too much. It's an odorless white powder.

Aluminium Sulphate
Expiry: Legal shelf life is 5 years.
Sedimentation agent for turbid water. Flocculation creates flocs of a higher density by agglomerating fine particles in suspension in the water.

Treatment Plant Set-up

Centralised drinking water treatment plants treat large amounts of water from many households in one single spot and consequently most often require more operation and maintenance and the construction of a water distribution system. Semi-centralised drinking water treatment plants are middle-scaled units e.g. on community level. These systems are most often designed to remove several types of contaminants from anthropogenic or natural origin: suspended and dissolved solids, ions (metals, fluorine, phosphates, nitrates), organic compounds (organic micropollutants, natural organic matter), and microorganisms (bacteria, viruses).

As there is no water treatment method able to remove all these contaminants in one step semi-centralised and centralised treatment often needs multistep plants, which combine several techniques to purify water. Here a general overview of plant set-up for drinking water production is given.

Summary	**Working Principle** Combines several processes (e.g. aeration, coagulation-flocculation, filtration, disinfection) to remove a wide variety of contaminants present in water.	**Capacity/Adequacy** Sophisticated combination of water treatment processes. Skilled labour required to guarantee the performance of each process.	**Performance** Efficient for all kinds of water when treatment plants are adequately designed and set up.	**Costs** Relatively high implementation and operation costs because of high inputs of labour, chemicals and electricity.	**Self-Help Compatibility** The incoming water and treated water quality has to be monitored to optimise each step of the plant.
	O&M Continuous operation and maintenance staff is required.	**Reliability** Highly reliable if the treatment plant is well maintained.	**Main Strength** Very efficient for any kind of water.	**Main Weakness** The whole system has to be controlled on a regular basis to be efficient, hence the system is sophisticated and requires skilled labour, energy, technical equipment and chemicals.	

Advantages	• Very efficient and reliable for purifying water	• Can be adapted to any kind of water	• Relatively low cost for drinking water production	
Disadvantages	• Skilled labour, technical equipment, electricity and chemicals required to design and operate the plant	• Plant has to be continuously controlled and maintained	• High initial investment costs to build infrastructure	

Introduction
Drinking water treatment plants involve several consecutive processes, which remove solids, organic and inorganic pollutants, some metals and pathogenic microorganisms. The treatment plant set-up should be designed to take into account the quality of water being treated. In general, water treatment can be divided into: primary treatment to remove solids; secondary treatment to remove organic compounds as well as nitrogen and phosphorous; and tertiary treatment for disinfection. Different sizes of treatment plants exist like centralised plants for big cities requiring a developed distribution system and semi-centralised plants adapted to provide drinking water to smaller communities at the point of use (POU).

Treatment Plants
There is no precise method for treating surface water because of the various qualities of water that exists. Groundwater typically requires less treatment than water from lakes, rivers and the sea. Nevertheless, a series of conventional processes can be identified; they are presented in the figures below. In general the treatment of fresh water involves the following key steps:

Step 1	**Primary Steps** Aeration: The water is mixed to liberate dissolved gases and to suspend particles in the water column. Sometimes a pre-oxidation step is also performed at this stage. Coagulation-Flocculation: In this step coagulants are added to remove the suspended particles (clay, organic material, metals, microorganisms), which stick to the coagulants forming heavy particles. Sedimentation: The heavy particles (flocs) settle to the bottom leading to clear water.

Step 2	**Secondary Step** Filtration: The water is run through a series of filters, which trap and remove particles still remaining in the water column. Typically, slow or rapid sand filtration and more recently membranes or reverse osmosis are used to accomplish this task. Due to growing concerns regarding micro-pollutants, additional treatments such as advanced oxidation processes, activated carbon adsorption alone or combined with ozonation or H2O2 are sometimes used to remove these trace organic compounds.
Step 3	**Tertiary Step** Disinfection: The water is now largely free of particles, organics and microorganism and is now treated to destroy any remaining disease-causing pathogens. This is commonly done with chlorination, ozonation, hydrogen peroxide, or UV radiation (similar to the point of use UV tubes). The water is then sent to the pumping station for distribution to homes and businesses. Chlorination is the most widely used disinfection method because it permits maintaining residual chlorine at a level efficient enough to guarantee the absence of microorganism until the water has reached its point of use. When drinking water is produced from the sea, the water is desalinated by electrolysis or membranes such as reverse osmosis or by a solar process desalination.

Operation and Maintenance
Drinking water treatment plant operation and maintenance includes the following tasks:

- Operate and adjust equipment controls to purify and clarify water.
- Inspect equipment and monitor operating conditions, meters, and gauges to determine load requirements and detect malfunctions.
- Add chemicals, such as ammonia, chlorine, and lime, to purify and disinfect water and other chemicals, such as ferric chloride, peroxide, and polymers, to enhance water treatment.
- Collect and test water samples, using test equipment.
- Record operational and laboratory data, observations of processes, and meter and gauge readings on specified forms.
- Clean and maintain tanks, basins and filter beds, using hand tools and power tools.
- Maintain, repair, and lubricate equipment, using hand tools and power tools.

Many of these tasks can be automated in modern treatment plants but trained operators and engineers are still required to control and maintain the system. Moreover, operation of the treatments also requires a significant amount of chemicals, which might not be available in little industrialised or remote areas. Required energy input is significant. In Switzerland, required energy input for treatment and distribution of drinking water, including abstraction, is relatively low (around 0.4kWh/m3) due to the excellent quality of groundwater. In case of polluted or seawater treatment in semi-centralised plants, the required input is higher (around 1-2 kWh/m3). Smaller drinking water treatment plants may be installed at semi-centralised level or point of use in order to minimise energy requirements for distribution.

Average Costs
The cost of high quality municipal drinking water including transport is between less than 1 $/m3 in the US and more than 2 $/m3 in Denmark and Germany. The cost of drinking water from semi-centralised treatment plants operating in developing countries depends on water source quality and capacity. In the case of seawater and polluted sources it is typically around 1-2 $/m3. An important initial investment is required to build the treatment plant, which should be designed properly taking into account water composition to minimise the costs.

Applicability
Centralised drinking water treatment plants are useful when water is supplied from a source containing natural or anthropogenic contaminants such as lakes, rivers, seas or groundwater. Many different types of raw water can be purified in treatment plants as processes are designed for each case considering water quality and desired capacity. The treatment plants need to be maintained by skilled labour to regularly control water quality and optimise processes. Smaller drinking water treatment plants may be installed at semi-centralised level or point of use in order to minimise energy requirements for distribution.

5 Purification Methods

This is a more detailed explanation of the purification methods in the section above. Keep in mind that you may have to combine two methods to make water drinkable as some only do half the job.

Subheadings

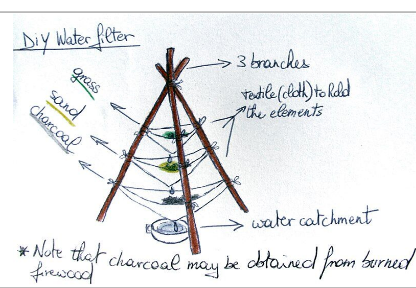
1. Makeshift Filter	2. Manufactured Filters	3. Boiling	4. Tap Filters
5. Carbon Filtering	6. Activated Charcoal	7. Hand Filtering	8. Slow Sand Filter
9. Rapid Sand Filter	10. Biosand Filter	11. Sedimentation	12. Coagulation
13. Bank Filtration	14. Solar Pasteurisation	15. Distillation	16. Chlorination
17. Electrolytic Purification	18. UV Light	19. SODIS	20. Silver Ionization
21. Colloidal Silver	22. Ceramic Candle Filter	23. Membrane Filtration	24. Reverse Osmosis
25. Hydrogen Peroxide	26. Ozonation	26. Solar Desal.	28. Electrodialysis Desalination
29. Ion Exchange	30. Geothermal Desal.	31. Freezing Desal.	32. Advanced Oxidation

1 Makeshift Filter

A crude water filter made from easily obtainable materials such as rocks, sand and cloth. These are your best bet when there is no other way to purify water or you're in a survival situation.

Materials Needed
- Plastic Bottle
- Knife/Scissors
- Tiny Rocks/Gravel
- Coarse Sand
- Fine Sand
- Charcoal Dust
- Fine Cloth/Coffee Filter

Assembly
1. Cut the base off of the container
2. Wrap and tie the fine cloth over the nozzle of the bottle.
3. Fill the bottle in layers of materials, starting with the charcoal, fine sand, then coarse sand and finally the rocks.
4. The bottle should be basically full and split evenly into the different fillings.
5. Add another piece of cloth over the top of the bottle so it's capped at both ends.
6. Filter a few litres through the filter to flush anything remaining out.
7. The filter is ready and should remove most particulate.



The filtered water will still need to be sterilized to kill pathogens. The picture is an example of a similar method of filtration using sticks and cloth.

2 Manufactured Filters

Portable water purification devices are self-contained, easily transported units used to purify water from untreated sources (such as rivers, lakes, and wells) for drinking purposes. Their main function is to eliminate pathogens, and often also of suspended solids and some unpalatable or toxic compounds. These units provide an autonomous supply of drinking water to people without access to clean water supply services, including inhabitants of developing countries and disaster areas, military personnel, campers, hikers, and workers in wilderness, and survivalists. See Filter Membrane Size for more information on filters.

Household Purifiers

These are some common household purification systems.

Big Berkey Water Filter	Filters water through a charcoal medium and drips into the chambers below to generate safe drinking water. Sizes range from 1.5Gal (5.6L) to 6Gal (22.7L) with varying flow rates from 2.75G/h (10L) to 26G/h (98L). Some filters have 1 charcoal filter with up to 8 for the largest. For more information on these types of filters, have a look at #22 below titles "Ceramic Candle Filter".
Non-Electric Distiller	Excellent water purifier that works over a gas stove, campfire or electric hotplate. Produces about 3.2 quarts (3L) of 100% steam distilled water in 1.2 hours using 8900 Btu/hr gas burner or 2600 watt electric burner. Waterwise 1600 distiller model.
Berkefeld Water Filter	Similar to the Big Berkey but uses ceramic filters.
LMS Water Purification	A commercial and large water filter used by governments and emergency agencies during disasters which are usually mounted on the back of a ute or a skid for easy trailer transport. It generates about 4,000L of drinking water per hour.

3 Boiling

Boiling is the rapid vaporization of a liquid, which occurs when a liquid is heated to its boiling point, the temperature at which the vapour pressure of the liquid is equal to the pressure exerted on the liquid by the surrounding atmosphere. There are two main types of boiling: nucleate boiling where small bubbles of vapour form at discrete points, and critical heat flux boiling where the boiling surface is heated above a certain critical temperature and a film of vapour forms on the surface. Transition boiling is an intermediate, unstable form of boiling with elements of both types. The boiling point of water is 100°C (212°F) but is lower with the decreased atmospheric pressure found at higher altitudes. Boiling water is used as a method of making it potable by killing microbes that may be present. The sensitivity of different micro-organisms to heat varies, but if water is held at 70°C (158°F) for ten minutes, many organisms are killed, but some are more resistant to heat and require one minute at the boiling point of water.

Boiling Water

As a method of disinfecting water, bringing it to its boiling point at 100 °C (212 °F), is the oldest and most effective way since it does not affect the taste, it is effective despite contaminants or particles present in it, and is a single step process which eliminates most microbes responsible for causing intestine related diseases. Water's boiling point rests at around 100 °C (212 °F), when at an elevation of 0. In places having a proper water purification system, it is recommended only as an emergency treatment method or for obtaining potable water in the wilderness or in rural areas, as it cannot remove chemical toxins or impurities.

The elimination of micro-organisms by boiling follows first-order kinetics—at high temperatures, it is achieved in less time and at lower temperatures, in more time. The heat sensitivity of micro-organisms varies, at 70 °C (158 °F), Giardia species (causes Giardiasis) can take ten minutes for complete inactivation, most intestine affecting microbes and E. coli (gastroenteritis) take less than a minute; at boiling point, Vibrio cholerae (cholera) takes ten seconds and hepatitis A virus (causes the symptom of jaundice), one minute.

Boiling does not ensure the elimination of all micro-organisms; the bacterial spores Clostridium can survive at 100 °C (212 °F) but are not water-borne or intestine affecting. Thus for human health, complete sterilization of water is not required. The traditional advice of boiling water for ten minutes is mainly for additional safety, since microbes start getting eliminated at temperatures greater than 60 °C (140 °F) and bringing it to its boiling point is also a useful indication that can be seen without the help of a thermometer, and by this time, the water is disinfected. Though the boiling point decreases with increasing altitude, it is not enough to affect the disinfecting process.

Summary

Boiling drinking water with fuel is the oldest and most commonly practiced household water treatment method. The water needs to be heated until the appearance of the first big bubbles to ensure that it is pathogen free. Many organizations recommend boiling both for water treatment in developing countries and to provide safe drinking water in emergency situations throughout the world - though it is quite laborious and uses a lot of energy. Boiling only kills pathogens and does not remove turbidity or chemical pollution (e.g. arsenic) from drinking water. So prior to boiling, water can be purified by settling or filtration method.

Advantages	• Effectively kills most pathogens.	• Easy, simple and widely accepted method of disinfection (particularly in tea-consuming cultures)	• Biogas cooking stoves can be used for the cooking stove (e.g. biogas linked toilet)		
Disadvantages	• Can be costly due to fuel consumptions	• Use of traditional fuel (firewood, kerosene/gas) contributes to deforestation and indoor air pollution	• Potential user taste objections • Time consuming	• Does not remove turbidity, chemicals, taste, smell, colour	• Water needs to cool down before use unless it's used for hot drinks
	• Risk of injuries (especially when children are around)				

Boiling

Boiling is oldest and most effective household drinking water treatment. It is promoted in both developing countries where water is routinely of uncertain microbial quality and in developed countries when conventional water treatment fails or water supplies are interrupted as a result of disasters or other emergencies. 21.2% of the population in South-east Asia report boiling their water before drinking it. The WHO recommends bringing water to a rolling boil as an indication that a disinfection temperature has been achieved. If practised correctly, boiling is one of the most effective water treatment methods to kill or deactivate all classes of waterborne pathogens, including bacterial spores and protozoan cysts that have shown resistance to chemical disinfection and viruses that are too small to be mechanically removed by microfiltration. Heating water to even 55°C (131°F) has been shown to kill or inactivate most pathogenic bacteria, viruses, helminths and protozoa that are commonly water borne. A clean container should be used for the boiling and after boiling, water should be stored in a clean and covered container, and handled carefully (no utensils should be brought in contact with the water, thus water needs to be poured in another clean recipient for consumption) to minimise the recontamination. Despite its effectiveness and simplicity, boiling has the disadvantage to require affordable and sufficient fuel to have properly boiled water for a regular drinking purpose, and is quite labour intensive.

Effectiveness		
If the boiling point is reached, boiling is effective in killing bacteria, viruses, protozoa, helminths and most pathogens from drinking water. Incomplete inactivation of pathogens in boiled water is attributed to users not heating the water to the boiling point and/or recontamination of boiled water in storage. Boiling does not remove turbidity, chemicals (e.g. arsenic), taste, smell or colour from water. Therefore, settling or even filtration (by cloth or slow sand or biosand filter) is often needed prior to boiling.	**Bacteria** Lab: 100% **Viruses** Lab: 100%	**Protozoa** Lab: 100% **Helminths** Lab: 100%

Applicability
Chemical pollution such as arsenic is not removed by boiling. Also water with high amounts iron (with reddish colour), calcium or chlorine is not suitable for boiling. White scales may deposit in container bottom after boiling if calcium is high in waters. In such case, the container should be washed properly after every use. Boiled water tastes flat and people may not like that. Thus, boiled water can be chilled in freezer or cooled down to room temperature to have good taste. Boiling is suitable where enough fuel sources (e.g. wood, kerosene, electricity, gas, charcoal etc.) are locally available all the time in affordable cost. Especially in densely populated areas, boiling with fuel wood is not appropriate to the overexploitation of the wood resources and the subsequent environmental damage such as desertification and soil erosion. Boiled water may cause burn injuries if not handled properly. Long term exposure in fire or stove smoke of the person boiling the water may cause associated respiratory diseases. For this indoor cooking space should be made well ventilated.

4 Tap Filters

Tap filters are filters that can be fitted directly onto a faucet. They are easy to handle and quite effective since they remove pathogens (e.g. Cryptosporidium and Giardia), contaminants (e.g. chlorine, lead, asbestos), sediments and bad odours. The user can turn the filter on and off by switching a small handle. Most often, these filters are based on activated carbon (see also adsorption). The filter medium should be changed frequently (following providers' requirements) to ensure its effectiveness. Costs vary between $20 and $40 USD (depending on country and provider). The filters should not be used without assessing their performance and the water quality to treat.

5 Carbon Filtering

Carbon filtering is a method of filtering that uses a bed of activated carbon to remove contaminants and impurities, using chemical adsorption. Each particle, or granule, of carbon provides a large surface area, or pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media. One gram of activated carbon has a surface area in excess of 3,000 m2 (32,000 sq ft). Activated carbon works via a process called adsorption, whereby pollutant molecules in the fluid to be treated are trapped inside the pore structure of the carbon substrate. Carbon filtering is commonly used for water purification, air filtering and industrial gas processing, for example the removal of siloxanes and hydrogen sulphide from biogas. Active charcoal carbon filters are most effective at removing chlorine, particles such as sediment, volatile organic compounds (VOCs), taste and odour from water. They are not effective at removing minerals, salts, and dissolved inorganic substances. Typical particle sizes that can be removed by carbon filters range from 0.5 to 50 micrometres. The particle size will be used as part of the filter description. The efficacy of a carbon filter is also based upon the flow rate regulation. When the water is allowed to flow through the filter at a slower rate, the contaminants are exposed to the filter media for a longer amount of time.

Activated Carbon Filtering
Activated carbon filters normally have a pre-filter to remove sediments and avoid damage of the carbon unit. They are well suited to sediment and particulate removal as well as the reduction of chlorine, chlorine disinfection bi-products, a wide range of volatile organic compounds, and other contaminants responsible for bad tastes and odours. The filter system WH3, for example, is a good choice for well water, lake water, stream water, and municipal (city) water treatment applications. These filter systems are expensive (up to 200 US$ and more) and require periodic maintenance (change of filter components).

6 Activated Charcoal / Carbon

Activated carbon filtration is a commonly used technology based on the adsorption of contaminants onto the surface of a filter. This method is effective in removing certain organics (such as unwanted taste and odours, micropollutants), chlorine, fluorine or radon from drinking water or wastewater. However, it is not effective for microbial contaminants, metals, nitrates and other inorganic contaminants. The adsorption efficiency depends on the nature of activated carbon used, the water composition, and operating parameters. There are many types of activated carbon filters that can be designed for household, community and industry requirements. Activated carbon filters are relatively easy to install but require energy and skilled labour and can have high costs due to regular replacement of the filter material.

Overview	**Working Principle** The pollutants are removed from water through adsorption on the surface of the activated carbon. Use at the POE or POU (e.g. advanced filters).	**Capacity/Adequacy** Simple technique using abundant raw material (e.g. petroleum coke, bituminous coal, lignite, wood products, coconut shell or peanut shell). Skilled labour required at least occasionally.	**Performance** Efficient for pollutant having high affinity with activated carbon surface (non-polar compounds).	**Costs** Relatively low operation costs.	**Self-Help Compatibility** Initial analysis of water is required to choose proper adsorbent (type of activated carbon).
	O&M Regular replacement or regeneration of carbon cartridge.	**Reliability** Reliable if the water composition is taken into account when choosing the type of activated carbon used as filter material.	**Main Strength** Activated carbon can be produced relatively easily everywhere in the world.	**Main Weakness** Filter has to be replaced on a regular basis.	

Advantages	• Easy to install and maintain	• Can be used at the point-of-entry (semi-centralised drinking water treatment plants, wastewater treatment plants) or at the point-of-use (household / community filters)	• Efficient to remove certain organics, chlorine, radon	• Based on materials available everywhere	
Disadvantages	• Filter has to be replaced regularly	• Skilled labour required, at least occasionally	• Water analysis is required to choose the most adapted type of activated carbon	• Contaminants are separated from water but not destroyed	

Introduction
The use of carbon in the form of charcoal has been used since antiquity for many applications. In Hindu documents dating from 450 BC charcoal filters are mentioned for the treatment of water. Charred wood, bones and coconut charcoals were used during the 18th and 19th century by the sugar industry for decolourising solutions. Activated carbon is a material prepared in such a way that it exhibits a high degree of porosity and an extended surface area. During water filtration through activated carbon, contaminants adhere to the surface of these carbon granules or become trapped in the small pores of the activated carbon. This process is called adsorption. Activated carbon filters are efficient to remove certain organics (such as unwanted taste and odours, micropollutants), chlorine, fluorine or radon, from drinking water or wastewater. However, it is not effective for microbial contaminants, metals, nitrates and other inorganic contaminants. Activated carbon filtration is commonly used in centralised treatment plants and at household level, to produce drinking water and in industries to treat effluents. It is also an upcoming treatment applied for the removal of micropollutants both in drinking water production and for the purification of treated wastewater before disposal.

Treatment Principles
There are two basic types of water filters: particulate filters and adsorptive/reactive filters. Particulate filters exclude particles by size, and adsorptive/reactive filters contain a material (medium) that either adsorbs or reacts with a contaminant in water. The principles of adsorptive activated carbon filtration are the same as those of any other adsorption material. The contaminant is attracted to and held (adsorbed) on the surface of the carbon particles. The characteristics of the carbon material (particle and pore size, surface area, surface chemistry, etc.) influence the efficiency of adsorption. The characteristics of the chemical contaminant are also important. Compounds that are less water-soluble are more likely to be adsorbed to a solid. A second characteristic is the affinity that a given contaminant has with the carbon surface. This affinity depends on the charge and is higher for molecules possessing less charge. If several compounds are present in the water, strong absorbers will attach to the carbon in greater quantity than those with weak adsorbing ability.

Preparation
The medium for an activated carbon filter is typically petroleum coke, bituminous coal, lignite, wood products, coconut shell or peanut shell. The carbon medium is “activated” by subjecting it to stream (a gas like water, argon or nitrogen) and high temperature (800-1000°C) usually without oxygen. In some cases, the carbon may also undergo an acidic wash or be coated with a compound to enhance the removal of specific contaminants. The activation produces carbon with many pores and a high specific surface area. It is then crushed to produce a granular or pulverised carbon product.

Use
Activated carbon units are commonly used to remove organics (odours, micropollutants) from drinking water at centralised and decentralised level. At centralised level, they are generally part of one of the last steps, before the water is fed into the water distribution network. At decentralised level, activated carbon filtration units can either be point-of-use (POU) or point-of-entry (POE) treatment. A POE device is recommended for the treatment of radon and volatile organic compounds because these contaminants can easily vaporise from water in showers or washing machines and expose users to health hazards. POU devices are useful for the removal of lead and chlorine. The structure of POU devices can either be in-line, line-bypass faucet mounted (see also advanced filters) or pour-through (similar to the design of ceramic candles, colloidal silver or biosand filters). Activated carbon filters can also be used as a tertiary treatment in wastewater treatment plants to remove micropollutants from municipal effluents or recalcitrant contaminants from industrial effluents.

Combination
Activated carbon is often used as pre-treatment to protect other water treatment units such as reverse osmosis membranes and ion exchange resins from possible damage due to oxidation or organic fouling. The combination of ozonation with activated carbon is a very efficient technique for eliminating organic matter including micropollutants. Besides, the lifetime of activated carbon filters is extended drastically when used in combination with ozone, deceasing operation costs substantially.

Cost
Installation costs are moderate but additional technical equipment is required. Operating costs are usually limited to filter replacement. Depending on the type and concentration of the contaminant being removed, some carbon filters may require special hazardous waste handling and disposal, which can be costly.

Operation
Carbon filters are relatively easy to install and maintain but skilled labour is required at least occasionally for monitoring the removal performance over time of both POU and POE equipment. Activated carbon filters have a limited lifetime. After long-term use, their surfaces are saturated with adsorbed pollutants and no further purification occurs. The filter material therefore has to be replaced at regular intervals, according to manufacturer's instructions. Replacement intervals should be calculated based on the average daily water use through the filter and the amount of contaminant being removed. Cartridge disposal depends on usage. A carbon cartridge can be backwashed and then reused or discarded if non-toxics have been adsorbed.

Applicability
Activated carbon filters are widely used to produce drinking water at household and community level (to remove certain organics, chlorine or radon from drinking water) and to treat industrial or municipal wastewaters. It is not efficient for disinfection and nitrates removal. Adsorption on activated carbon is a simple technology based on materials such as fossil fuels (petroleum coke, lignite...) and even agricultural waste (e.g. coconut shell, wood, etc.). To choose the most applicable type of activated carbon for a given application it is important to analyse the composition of the influent water previously. The carbon filter has to be replaced or regenerated regularly to remain efficient. Activated carbon can also be used as a pre-treatment to protect other water treatment units.

7 Hand Filtering (Straining)

Straining is a very simple method of filtration. In this process, water is poured through a piece of cloth which has been folded a few times, which removes some of the suspended silt and solids and destroys some pathogens. After straining, water may not be perfectly safe for drinking but it can be a drinking water improvement step for people with no other treatment options. It is very important to use a clean cloth, as a dirty cloth may introduce additional pollutants into the water.

Advantages	• Simple, low cost and easy technique	• Consumes little time	• Reduces turbidity from drinking water	• Known to reduce the risk of cholera if used correctly	• No particular equipment needed
Disadvantages	• Requires extra washing of sari after use	• Not completely effective for removal of bacteria	• Not effective for removal of viruses and chemical		

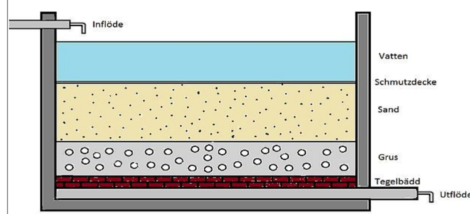
Effectiveness
Straining water through a piece of clean cloth is an extremely simple, low- resource method and widely used for household water treatment. Cloth filters have been used in many cultures for centuries. Typically in South Asia, a sari or saree (a strip of unstitched cloth ranging from four to nine meters in length that is draped over the body of women (it is also a traditional garment) is folded 7 to 8 times and used as a filter. In laboratory experiments using electron microscopy, it was found that an inexpensive sari cloth, folded four to eight times provides a filter of about 20 µm mesh size, was small enough to remove all zooplankton, most phytoplankton, all Vibrio Choleraeattached to the plankton and other particulates larger than 20 µm. The risk of cholera is therefore reduced of about 50%. Water is poured through the folded sari cloth and collected in a pot underneath. The efficiency of straining depends on the weave of the cloth and the number of times it has been folded. Specific monofilament filter cloths are very efficient where guinea worm disease is prevalent. Such cloths remove organisms known as copepods, which act as intermediate hosts for the guinea-worm larvae. Dracunculiasis, more commonly known as guinea worm disease, is caused by drinking water hosting a parasite called Dracunculus medinensis.

Very Effective ● Helminths ● Protozoa	**Fairly Effective** ● Turbidity ● Bacteria ● Taste ● Colour ● Smell	**Not Effective** ● Viruses ● Chemicals	In a laboratory experiments, it was found that an old sari cloth made up of cotton is most effective in removing V. Cholerae. After several launderings, threads of an old sari become soft and loose, reducing the pore size compared to a new sari cloth. Cloth filters do not remove chemical contaminants or dissolved compounds from water. After straining, additional treatment methods can further improve the safety of drinking water.

Applicability
Though the water collected from cloth filter is not perfectly safe, it is a drinking water improvement step for people with limited options. This procedure can be used as the first stage of treatment. Then water can be treated through available methods like sand filtering (see also biosand filter) or treated further with disinfection methods such as SODIS, boiling, chlorination and others. Both cotton and nylon cloths are suitable for filtration. It is very important to use clean and dry cloth, as a dirty cloth may introduce additional pollutants or pathogens into the water.

8 Slow Sand Filter

Slow sand filters are used in water purification for treating raw water to produce a potable product. They are typically 1 to 2 metres deep, can be rectangular or cylindrical in cross section and are used primarily to treat surface water. The length and breadth of the tanks are determined by the flow rate desired by the filters, which typically have a loading rate of 200 to 400 litres per hour per square metre (or 0.2 to 0.4 cubic metres per square metre per hour). Slow sand filters differ from all other filters used to treat drinking water in that they work by using a complex biological film that grows naturally on the surface of the sand. The sand itself does not perform any filtration function but simply acts as a substrate. Although they are often preferred technology in many developing countries because of their low energy requirements and robust performance, they are also used to treat water in some developed countries. Slow sand filters now are also being tested for pathogen control of nutrient solutions in hydroponic systems.



A Slow Sand Filter Example

Method of Operation
Slow sand filters work through the formation of a gelatinous layer (or biofilm) called the hypogeal layer or Schmutzdecke in the top few millimetres of the fine sand layer. The Schmutzdecke is formed in the first 10–20 days of operation and consists of bacteria, fungi, protozoa, rotifera and a range of aquatic insect larvae. As an epigeal biofilm ages, more algae tend to develop and larger aquatic organisms may be present including some bryozoa, snails and Annelid worms.

The surface biofilm is the layer that provides the effective purification in potable water treatment, the underlying sand providing the support medium for this biological treatment layer. As water passes through the hypogeal layer, particles of foreign matter are trapped in the mucilaginous matrix and soluble organic material is adsorbed. The contaminants are metabolised by the bacteria, fungi and protozoa. The water produced from an exemplary slow sand filter is of excellent quality with 90-99% bacterial cell count reduction.

Slow sand filters slowly lose their performance as the biofilm thickens and thereby reduces the rate of flow through the filter. Eventually, it is necessary to refurbish the filter. Two methods are commonly used to do this. In the first, the top few millimetres of fine sand is scraped off to expose a new layer of clean sand. Water is then decanted back into the filter and re-circulated for a few hours to allow a new biofilm to develop. The filter is then filled to full volume and brought back into service.

The second method, sometimes called wet harrowing, involves lowering the water level to just above the hypogeal layer, stirring the sand; thus precipitating any solids held in that layer and allowing the remaining water to wash through the sand. The filter column is then filled to full capacity and brought back into service. Wet harrowing can allow the filter to be brought back into service more quickly.

Features
● Unlike other filtration methods, slow sand filters use biological processes to clean the water, and are non-pressurized systems. Slow sand filters do not require chemicals or electricity to operate.
● Cleaning is traditionally done by use of a mechanical scraper, which is usually driven into the filter bed once the bed has been dried out. However, some slow sand filter operators use a method called "wet harrowing", where the sand is scraped while still under water, and the water used for cleaning is drained to waste.
● For municipal systems there usually is a certain degree of redundancy, since it is desirable for the maximum required throughput of water to be achievable with one or more beds out of service.
● Slow sand filters require relatively low turbidity levels to operate efficiently. In summer conditions with high microbial activity and in conditions when the raw water is turbid, blinding of the filters due to bioclogging occurs more quickly and pre-treatment is recommended.
● Unlike other water filtration technologies that produce water on demand, slow sand filters produce water at a slow, constant flow rate and are usually used in conjunction with a storage tank for peak usage. This slow rate is necessary for healthy development of the biological processes in the filter.

While many municipal water treatment works will have 12 or more beds in use at any one time, smaller communities or households may only have one or two filter beds. In the base of each bed is a series of herringbone drains that are covered with a layer of pebbles which in turn is covered with coarse gravel. Further layers of sand are placed on top followed by a thick layer of fine sand. The whole depth of filter material may be over 1 metre in depth, the majority of which will be fine sand material. On top of the sand bed sits a supernatant layer of unpurified water.

As they require little or no mechanical power, chemicals or replaceable parts, and they require minimal operator training and only periodic maintenance, they are often an appropriate technology for poor and isolated areas. Slow sand filters, due to their simple design, may be created DIY. DIY-slow sand filters have been used in Afghanistan and other countries to aid the poor. Slow sand filters are recognized by the World Health Organization, Oxfam, and the United States Environmental Protection Agency as being superior technology for the treatment of surface water sources.

According to the World Health Organization, "Under suitable circumstances, slow sand filtration may be not only the cheapest and simplest but also the most efficient method of water treatment." Due to the low filtration rate, slow sand filters require extensive land area for a large municipal system. Many municipal systems in the U.S. initially used slow sand filters, but as cities have grown they subsequently installed rapid sand filters, due to increased demand for drinking water.

Summary
Slow sand filtration is a type of centralised or semi-centralised water purification system. A well-designed and properly maintained slow sand filter (SSF) effectively removes turbidity and pathogenic organisms through various biological, physical and chemical processes in a single treatment step. Only under the prevalence of a significantly high degree of turbidity or algae-contamination, pre-treatment measures (e.g. sedimentation) become necessary. Slow sand filtration systems are characterised by a high reliability and rather low lifecycle costs.

Moreover, neither construction nor operation and maintenance require more than basic skills. Hence, slow sand filtration is a promising filtration method for small to medium-sized, rural communities with a fairly good quality of the initial surface water source. As stated by the WHO, slow sand filtration provides a simple but highly effective and considerably cheap tool that can contribute to a sustainable water management system.

Advantages	● Very effective removal of bacteria, viruses, protozoa, turbidity and heavy metals in contaminated fresh water	● Simplicity of design and high self-help compatibility: construction, operation and maintenance only require basic skills and knowledge and minimal effort	● If constructed with gravity flow only, no (electrical) pumps required	● High reliability and ability to withstand fluctuations in water quality	● Easy to install in rural, semi-urban and remote areas, Simplicity of design and operation
	● Local materials can be used for construction	● No necessity for the application of chemicals	● Long lifespan (estimated >10 years)		
Disadvantages	● Minimal quality and constant flow of fresh water required: turbidity (<10-20 NTU) and low algae contamination. Otherwise, pre-treatment may be necessary	● Cold temperatures lower the efficiency of the process due to a decrease in biological activity	● Very regular maintenance essential; some basic equipment or ready-made test kits required to monitor some physical and chemical parameters	● Possible need for changes in attitude (belief that water that flows through a green and slimy filter is safe to drink without the application of chemicals), Chemical compounds (e.g. fluorine) are not removed	● Natural organic matter and other DBPs precursors not removed (may be formed if chlorine is applied for final disinfection)
	● May require electricity	● Loss of productivity during the relatively long filter skimming and ripening periods	● Requirement of a large land area, large quantities of filter media and manual labour for cleaning, Low filtration rate		

Introduction

Slow sand filtration has been an effective water treatment process for preventing the spread of gastrointestinal diseases for over 150 years, having been used first in Great Britain and later in other European countries. SFFs are still used in London and were relatively common in Western Europe until recently and are still common elsewhere in the world.

The move away from slow sand filtration in industrialised countries has largely been a function of rising land prices and labour costs, which increased the cost of SSF produced water. Where this is not the case, SSFs still represent a cost-effective method for water treatment. Since these conditions prevail in many developing countries, it is a very promising technique for water purification and, therefore, the development of a sustainable water system.

Design Principles

The basic principle of the process is very simple. Contaminated freshwater flows through a layer of sand, where it not only gets physically filtered but biologically treated. Hereby, both sediments and pathogens are removed. This process is based on the ability of organisms to remove pathogens. In this context, it is important to distinguish slow and rapid sand filtration.

The difference between the two is not simply a matter of the filtration speed, but of the underlying concept of the treatment process. Slow sand filtration is essentially a biological process whereas rapid sand filtration is a physical treatment process (WHO n.y.). To learn more about rapid sand filtration have a look at the factsheet: rapid sand filtration.

Although the physical removal of sediments is an important part of the purification process, the relevant aspect is the biological filtration. The top layers of the sand become biologically active by the establishment of a microbial community on the top layer of the sand substrate, also referred to as 'schmutzdecke'. These microbes usually come from the source water and establish a community within a matter of a few days. The fine sand and slow filtration rate facilitate the establishment of this microbial community.

The majority of the community are predatory bacteria that feed on water-borne microbes passing through the filter. Hence, the underlying principle of the SSF is equivalent to the bio-sand filtration. While the former is applied to semi-centralised water treatment, the latter mainly serves household purposes.

Structure

As the process itself, the basic structure is very elementary. Essentially, only the filter chamber, a type of reservoir and pipes are required. The filter chamber can either be constructed as an open or as a closed box. Depending on climatic and other factors, the one or the other is more reasonable (e.g. cold climate requires a closed box since low temperatures decrease the performance of the process).

Once a SSF facility is built, only clean sand is required for occasional replacement. The sand layers are put in gradually according to their grain sizes: rather coarse grains at the bottom and fine grains at the top. The sand-bed is usually covered with one meter of supernatant water.

As the process of biological filtration requires a fair amount of time in order to purify the water sufficiently, SSFs usually operate at slow flow rates between 0.1 – 0.3 m3/h per square metre of surface. The water thus remains in the space above the medium for several hours and larger particles are allowed to separate and settle (see also sedimentation).

It then passes through the sand-bed where it goes through a number of purification processes. The water requires some kind of physical pressure in order to pass the drag created by the sand layers. In terms of construction, two different types are feasible. The pressure can be built up either by pumps or gravity. While pump systems need some type of engine and a more elaborate construction, gravity systems work without any highly technological means.

Health Aspects

Slow sand filtration is an extremely efficient method for removing microbial contamination and will usually have no indicator bacteria present at the outlet. SSFs are also effective in removing protozoa and viruses. If the effluent turbidity is below 1.0 nephelometric turbidity units (NTU), a 90 to 99% reduction in bacteria and viruses is achieved. Yet, slow sand filtration is generally not effective for the majority of chemicals.

However, it can be argued that chemical standards for drinking water are of secondary concern in water supply subject to severe bacterial contamination. Although SSFs are very effective for the removal of microbiological pathogens, disinfectants (e.g. chlorination) are often used in treatment facilities as a step subsequent to the SSF unit.

Firstly for the purpose of inactivating any remaining bacteria as the final unit of treatment, and secondly, for the provision of a residual disinfectant that will remove any bacteria introduced during storage and/or distribution. Chlorine is generally added after the filter unit in order to not affect the biological process.

If the water contains high amounts of natural organic matter (NOMs), e.g. surface waters in tropical regions, chlorination should be avoided due to the risk of the formation of disinfection by-products (DBPs). When attacked by chlorine radicals, NOMs form trihalomethane (THM) and other organic DBPs, which are known to be carcinogenic.

Effectiveness	**Highly Effective** ● Bacteria ● Protozoa ● Viruses ● Turbidity ● Heavy Metals	**Fairly Effective** ● Odour ● Taste ● Iron ● Manganese ● Organic Matter ● Arsenic	**Not Effective** ● Salts ● Fluoride ● Trihalomethane Precursors ● Most Chemicals		

Construction
A SSF consists of a box, often made of concrete in which a bed of sand is placed over a layer of gravel and perforated pipes. These pipes collect the treated water. For community use, filter chambers can also be made out of brick or ferro-cement. Recently, also plastic boxes have been used as filter chambers. The simple design of SSFs makes it easy to use local materials and skills in their construction. Due to the simplicity of construction, SSFs can be built by experienced contractors, or by communities with external technical assistance. Basic hydrological equipment like valves and measurement devices become necessary only if the facility is rather large.

Operation / Maintenance
For a SSF to be effective, it must be operated and maintained properly. If topographic circumstances allow the water to flow through gravity during the whole process, no pumps and thus no electricity is required. However, the flow of water must be maintained at a rate between 0.1–0.3 metres per hour. This provides a stable flow of nutrients and oxygen to the microorganisms in the filter and gives them time to treat the water. After several weeks to a few months, the population of microorganisms may get too dense and start to clog the filter.

If flow rates are too low, the filter must be drained and the top layer of the sand scraped off, washed, dried in the sun, and stored. After several scrapings, the cleaned and dried sand is added back to the filter, together with new sand, to make up for losses during washing. Every two months, all the valves must be opened and closed to keep them from becoming stuck, and any leaks in the system must be repaired immediately.

SSFs can be operated and even monitored by communities, provided the caretakers are trained well. It takes a caretaker less than one hour a day to check whether the filter is functioning properly and to adjust flow rates. Several people can clean a filter unit in only one day, but it is important that hygienic measures are observed constantly. If the filter is well-designed and constructed, hardly any repairs of the filter tanks and drainage system will be necessary, although the valves and metal tubing may need occasional attention.

If water test kits are available, water quality can be easily monitored without special training. Nevertheless, a SSF for community use requires considerable organisation for scraping and re-sanding the filter units. A local caretaker will have to be trained. Apart from extra sand, some chlorine and test materials, very few external inputs are needed. With proper external assistance, water organisations can manage their water treatment independently.

Costs
Construction costs strongly depend on local conditions. Since SSFs demand rather large land areas but low input of construction materials, the capital costs primarily consist of wages and costs for land acquisition. The cost of imported materials and equipment may be kept to almost negligible proportions. Therefore, water purification through a SSF is very economical in areas where labour costs are low and land is not a limiting factor. Operational costs are incurred almost solely from the cleaning of the filter beds. No chemicals or other materials are needed for the process. No compressed air, mechanical stirring, or high-pressure water is needed for backwashing. There is thus a saving not only in the provision of plant but also in the cost of fuel or electricity.

9 Rapid Sand Filter

Rapid sand filtration is a purely physical drinking water purification method. Rapid sand filters (RSF) provide rapid and efficient removal of relatively large suspended particles. Two types of RSF are typically used: rapid gravity and rapid pressure sand filters. For the provision of safe drinking water, RSFs require adequate pre-treatment (usually coagulation-flocculation) and post-treatment (usually disinfection with chlorine).

Both construction and operation is cost-intensive. It is a relatively sophisticated process usually requiring power-operated pumps, regular backwashing or cleaning, and flow control of the filter outlet. Rapid sand filtration is common in developed countries for the treatment of large quantities of water where land is a strongly limiting factor, and where material, skilled labour, and continuous energy supply are available.

Overview	**Working Principle** After being pre-treated (coagulation-flocculation), freshwater flows through a sand- and gravel bed. Hereby, particles are removed through a physical filtering process	**Capacity/Adequacy** Large urban areas where land area is limited and chemicals, electricity and skilled labour are easily available	**Self-Help Compatibility** Rather low, highly technical facilities, chemicals and energy required	**Costs** In general, construction, operation and maintenance costs for rapid sand filters are significantly higher than costs for slow sand filters	**Performance** 4'000 – 12'000 litres per hour per square metre of surface; generally only removes solids and suspended particles; requires pre-treatment (coagulation-flocculation) and post-treatment (disinfection)
	O&M Very frequent cleaning (every 24 - 72h) and skilled caretakers required	**Reliability** Highly reliable if properly operated	**Main Strength** Rapid and efficient in removing turbidity	**Main Weakness** Not effective for the removal of bacteria, pre-treatment (e.g. coagulation/flocculation) and final disinfection (e.g. chlorine) are therefore needed	

Advantages	● Highly effective for removal of turbidity (usually < 0.1-1 NTU)	● High filter rate (4'000 – 12'000 litres per hour per square metre of surface), small land requirements	● No limitations regarding initial turbidity levels (if coagulant or flocculant is available and correctly applied)	● Cleaning time (backwashing) only takes several minutes and filters can be put back into operation instantly	
Disadvantages	● Not effective in removing bacteria, viruses, fluoride, arsenic, salts, odour and organic matter (requires pre- and post-treatment)	● High capital, energy input and operational costs	● Frequent cleaning (backwashing) required (every 24-72h)	● Skilled supervision essential (e.g. for flow control and dosage of disinfectant)	● Backwashing water and sludge needs treatment; sewage system or stabilisation ponds required

Introduction
Rapid sand filters evolved at the end of the 19th century in the United States and quickly gained popularity. By the 1920s, they were widely used as a major water purification method, since necessary facilities required less land area compared to slow sand filters. Today, a combination of flocculation and coagulation, sedimentation, filtration and disinfection (e.g. chlorination, ozonation) is the most widely applied water treatment technology for treating large quantities of drinking water in industrialised countries. Rapid sand filtration, in contrast to slow sand filtration, is a purely physical treatment process. As the water flows through several layers of coarse-grained sand and gravel, relatively large particles are held back safely. However, RSFs never provide safe drinking water without adequate pre-treatment and final disinfection. Usually, coagulation and flocculation and chlorination are applied for that purpose.

Treatment Process
The filter chamber is usually made out of reinforced concrete, filled with sand and gravel to the height of 1.5-2 metres. The water is supplied to the top of the sand-bed and filtered as it flows through the layers of graded sand and gravel. A system of perforated pipes on the bottom drains the chamber.

The filter chamber can be constructed as open tanks (rapid gravity filters) or closed tanks (pressure filters). This filtering process is determined by two basic physical principles. First, relatively large suspended particles get stuck between the sand grains as they pass the filter medium (mechanical straining). Second, smaller particles adhere to the surface of the sand grains caused by the effect of the van der Waals forces (physical adsorption).

The major parts of a gravity rapid sand filter
- Chamber: filter tank or filter box
- Filter media (sand)
- Gravel support
- Under drain system
- Wash water troughs

A chemical filter-aid (i.e. coagulant or flocculant) might be added to promote additional adhesion. In the course of these processes, more and more particles accumulate in the filter medium, increasingly causing clogged filters and decreased performance. Initial filtering performance can be re-achieved through a cleaning of the filter bed. This is usually conducted through backwashing: the flow of water is reversed, so that treated water flows backwards through the filter. The sand is re-suspended and the solid matter is separated in the surface water.

Often, air is injected additionally to support the cleaning process (WHO 1996). As soon as most particles are washed out and the backward flowing water is clear, the filter is put back to operation. Clearly, relatively large quantities of sludge are generated through backwashing and require some form of treatment before discharge into the environment.

Health Aspects
Rapid sand filtration is a highly effective method to remove turbidity if it is correctly applied. Equally, solids formed during pre-treatment, i.e. coagulation-flocculation, are filtered. A well-operated RSF reduces turbidity to less than 1 NTN and often less than 0.1 NTU. Regarding the removal of most other contaminants, the RSFs are ineffective. If combined with adequate pre-treatment measures and final disinfection, rapid sand filtration usually produces safe drinking water. Typical treatment performance of rapid sand filters if freshwater has been pre-treated with coagulation-flocculation.

Effectiveness	**Moderately Effective** ● Turbidity ● Iron ● Manganese	**Somewhat Effective** ● Odour ● Taste ● Bacteria ● Organic Matter	**Not Effective** ● Viruses ● Fluoride ● Arsenic ● Salts		

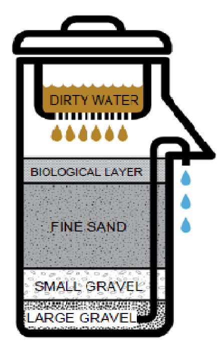
Construction
The construction of a RSF requires the supervision of a competent engineer and highly skilled workers. It involves the construction of reinforced concrete fundaments and walls and many technical installations. Only a very precise realisation guarantees a functioning water treatment. Operation of a rapid sand filter consists of flow control, regular backwashing and cleaning. The period between backwashes depends on the quality of the influent water and normally lies between 24 – 72 hours (UNEP 1998). The cleaning process requires an interruption of the purification process of 5 - 10 minutes per filter bed. Several parallel filter units are required to guarantee constant water supply. The backwash process must be observed carefully; in particular the rate of flow must be controlled to avoid erosion of the filter medium. Periodic repacking of the filter bed may be required at infrequent intervals to ensure efficient operation (UNEP 1998). Operation and maintenance thus requires skilled and highly reliable workers.

Costs
The construction cost of rapid sand filters is determined primarily by the cost of materials such as cement, building sand, gravel, reinforcing steel, filter media, pipes, and valves. However, the cost of land and transport of materials could add substantially to the total cost. The cost of energy required to operate a rapid sand filter and the costs for treatment of generated sludge during backwashing may add significant costs. Although operation is usually conducted automatically, frequent inspection by a well-educated worker is necessary to ensure proper treatment. Maintenance costs will include repairs of the filters and replacement of equipment. In general, construction, operation and maintenance costs for rapid sand filters are significantly higher than costs for slow sand filters.

Applicability
Rapid sand filtration requires very complex technical installations, highly skilled workers for construction and operation as well as large energy inputs. Unless pre-treatment and disinfection is applied, the filtered water is not safe for drinking. Its application is hence reserved for industrialised countries or urban areas where land is a limiting factor. RSF can provide a very efficient method in larger urban water supply systems if preconditions are met. For any other areas, RSFs are usually economically unreasonable.

10 Biosand Filter

A biosand filter (BSF) is a point-of-use water treatment system adapted from traditional slow sand filters. Biosand filters remove pathogens and suspended solids from water using biological and physical processes that take place in a sand column covered with a biofilm. BSFs have been shown to remove heavy metals, turbidity, bacteria, viruses and protozoa.



BSFs also reduce discoloration, odour and unpleasant taste. Studies have shown a correlation between use of BSFs and a decrease in the occurrence of diarrhoea. Because of their effectiveness, ease of use, and lack of recurring costs, biosand filters are often considered appropriate technology in developing countries.

It is estimated that over 200,000 BSFs are in use worldwide. Biosand filters are typically constructed from concrete or plastic. At the top of the filter, a tightly fitted lid prevents contamination and unwanted pests from entering the filter. Below this, the diffuser plate prevents disturbance of the biofilm when water is poured into the filter.

Water then travels through the sand column, which removes pathogens and suspended solids. Below the sand column, a layer of gravel prevents sand from entering the drainage layer and clogging the outlet tube. Below the separating layer is the drainage layer consisting of coarser gravel that prevents clogging near the base of the outlet tube.

Filtration Process
Pathogens and suspended solids are removed by biological and physical processes that take place in the biolayer and the sand layer. These processes include:

Mechanical Trapping	Suspended solids and pathogens are trapped in the spaces between the sand grains.

Predation	Pathogens are consumed by microorganisms in the biolayer.
Adsorption	Pathogens are absorbed into each other and to suspended solids in the water and sand grains.
Natural Death	Pathogens finish their life cycles or die because there is not enough food or oxygen.
Running	The high water level (hydraulic head) in the inlet reservoir zone pushes the water through the diffuser and filter, then decreases as water flows evenly through the sand. The flow rate slows because there is less pressure to force the water through the filter. The inlet water contains dissolved oxygen, nutrients, and contaminants. It provides the oxygen required by the microorganisms in the biofilm. Large suspended particles and pathogens are trapped in the top of the sand and partially plug the pore spaces between the sand grains. This causes the flow rate to decrease. Idle time typically comprises greater than 80% of the daily cycle; during this time, microbial attenuation processes are likely to be significant. Most removal occurs where water is in contact with the biofilm. The processes that occur in the biofilm have not been identified. When the standing water layer reaches the level of the outlet tube, the flow stops. Ideally, this should be high enough to keep the biofilm in the sand layer wet and allow oxygen to diffuse through the standing water to the biolayer. The pause period allows microorganisms in the biolayer to consume the pathogens and nutrients in the water. The rate of flow through the filter is restored as they are consumed. If the pause period is too long, the biolayer will consume all of the pathogens and nutrients and will die, reducing the efficiency of the filter when it is used again. The pause period should be between 1 and 48 hours. Pathogens in the non-biological zone die from a lack of nutrients and oxygen.
Maintenance	Over time, particles accumulate between the filter's sand grains. As more water is poured, a biofilm forms along the top of the diffuser plate. Both of these occurrences cause a decrease in flow rate (clogging and bioclogging). Although slower flow rates generally improve water filtration due to idle time, it may become too slow for the users' convenience. If flow rates fall below 0.1 litres/minute, it is recommended by CAWST to perform maintenance. The "swirl and dump", or wet harrowing cleaning technique, is used to restore flow rate. About 1 US gallon (3.8 L) is poured into the filter before cleaning (assuming the filter is empty). The upper layer of sand is then swirled in a circular motion. Dirty water from the swirling is dumped out and the sand is smoothed out at the top. This process is repeated until flow rate is restored. Cleaning the diffuser plate, outlet tube, lid, and outside surfaces of the filters regularly is also recommended. Long-term sustainability and efficacy of biosand filters depends on education and support from knowledgeable support personnel.

Contaminant Removal

Turbidity	Results for turbidity reductions vary depending on the turbidity of the influent water. Turbid water contains sand, silt and clay. Feed turbidity in one study ranged from 1.86 to 3.9 NTU. In a study water was obtained from sample taps of water treatment plants from three local reservoirs. It poured through a slow sand filter and results showed that turbidity decreased to a mean of 1.45 NTU. In another study using surface water a 93% reduction in turbidity was observed. As the biofilm above the sand ripens, turbidity removal increases. Although biosand filters remove much turbidity, slow sand filters, which have a slower filtration rate, remove more.
Heavy Metals	There is limited research on the removal of heavy metals by biosand filters. In a study conducted in South Africa, the filter removed about 64% of iron and 5% of magnesium.
Bacteria	In laboratory studies, the biosand filter has been found to remove about 98-99% of bacteria. In removal of Escherichia coli it was found that the biosand filter may increase due to biofilm formation over about two months. The removal after this time ranged from 97-99.99% depending on the daily water volume and percent primary effluent added. The addition of primary effluent or waste water facilitates growth of the biofilm which aids bacterial die-off. Research shows that biosand filters in use in the field remove fewer bacteria than ones in a controlled environment. In research conducted in 55 households of Bonao, Dominican Republic, the average E. coli reduction was about 93 percent.
Viruses	Lab tests have shown that while the filters reduce significant quantities of E. coli, they remove significantly fewer viruses because viruses are smaller. In a study using bacteriophages, virus removal ranged between 85% and 95% after 45 days of usage. A recent study has suggested that virus removal increases significantly over time, reaching 99.99% after approximately 150 days.
Protozoa	In one lab test the biosand filter removed more than 99.9% of protozoa. In tests for one type of protozoa, Giardia lamblia, the filter removed 100% over 29 days of use. It removed 99.98% of the oocysts of another protozoa, Cryptosporidium sp., possibly due to their smaller size. This removal was comparable with that of the slow sand filter.

Advantages	• High removal of pathogens	• Removal of turbidity, colour, odour and iron (water tastes and looks good)	• Relatively high flow-rates can be achieved (over 30 L per hour)	• One-time installation with few maintenance requirements and negligible operation costs	• Can be fabricated from locally available materials generating an opportunity for local businesses
	• Long life	• Easy to operate and maintain			
Disadvantages	• Biological layer takes 20 to 30 days to develop to maturity	• Low rate of virus inactivation	• High turbidity (> 50 NTU) will cause filter to clog and requires more maintenance	• Requires that the filter be used on a regular basis	• Cannot remove dissolved compounds
	• Lack of residual protection (risk of re-contamination)	• Can be difficult to move or transport (due to weight)	• Requires that the filter be used on a regular basis		

How it Works
The biosand filter is an innovation on traditional slow sand water filters (which have been used for community water treatment for hundreds of years CAWST 2009), specifically designed for intermittent or household use. The BSFs was developed by Dr. David Manz in the 1990s at University of Calgary, Canada. The filter is simple to use and can be produced locally anywhere in the world because it is built using materials that are readily available. Their capital costs depend on the local material and labour costs. However, they require no consumables and the operating costs are negligible. BSFs consist of a simple container with a lid, enclosing layers of sand and gravel, which traps physically sediments, pathogens and other impurities from the water. A biofilm, which forms as a shallow layer of water, sits atop the sand column and contributes to the elimination of pathogens.

The filter container can be made of concrete, plastic or any other water-proof, rust-proof and non-toxic material. The most widely used version is however the concrete container, approximately 0.9 m tall and with a surface of 0.3 m2 (LANTAGNE et al. 2006). The concrete filter box is cast from a steel mould or made with a pre-fabricated pipe. The container is filled with layers of sieved and washed sand and gravel, also referred to as filter media (CAWST 2009). There is a standing water height of 5 cm above the sand layer, which is maintained by adjusting the height of the outlet pipe. It is this design feature that allows the formation of a biofilm layer and distinguishes the BSF from other slow sand filters, allowing for small-scale construction and intermittent use.

A diffusion layer avoids that water reaches the sand surface too fast, which could disturb the biofilm layer. The filter operation is very simple. Water is poured onto the top of the filter as needed. Then the water will travel slowly through the sand and gravel bed. At the base of the filter the water is collected in a pipe and is drained through plastic piping out of the filter for be collected and stored in a clean water container. Concrete filters have the outlet pipe embedded in the concrete, protecting it against breaks and leaks. The treated water should be collected by the user in a safe storage container placed on a block or stand, so that the container opening is just under the outlet, minimising the risk for recontamination.

Pathogens and suspended solids are removed through a combination of biological and physical processes that take place in the biofilm layer and within the sand layer. These processes include mechanical trapping, predation, adsorption, and natural death.

- Mechanical trapping and sieving: Suspended solids and pathogens are physically trapped in the spaces between the sand grains.
- Adsorption and attachment: Pathogens become attached to each other (and thus more easily sieved), suspended solids in the water, and the sand grains.
- Predation: Pathogens are consumed by other microorganisms in the biological layer. This biological layer matures over one to three weeks, depending on volume of water put through the filter and the amount of nutrients and micro-organisms in the water.
- Natural death: Pathogens finish their life cycle or die because there is not enough food or oxygen for them to survive.

Effectiveness
The biosand Filter is a proven technology, which removes pathogens such as bacteria, protozoa and helminth. BSFs are also somewhat effective for the removal of virus (CAWST 2009). Physical parameters such as turbidity and iron are also eliminated from drinking water.

However, dissolved chemicals (such as organic pesticides or arsenic) are not removed. The treated water generally has an agreeable colour, taste and odour. The table below shows the biosand filter treatment efficiency in removing pathogens, turbidity and iron.

Bacteria
Lab: Up to 96.5%
Field: 87.9 to 98.5%

Viruses
Lab: 70 to >99%
Field: N/A

Protozoa
Lab: >99.9%
Field: N/A

Turbidity
Lab: 95%
Field: 85%

Iron
Lab: N/A
Field: 90-95%

Operation & Maintenance
The flow rate through the filter will slow down over time as the pore openings between the sand grains become clogged. For turbidity levels greater than 50 NTU (Nephelometric Turbidity Units), the water should first be strained through a cloth or sedimented before using the BSF. When the flow rate drops to a level that is inadequate for the household use the filter needs to be cleaned. This is done by a simple 'swirl and dump' procedure performed on the top of the sand, and only takes a few minutes. The swirl and dump process consist in agitating the surface sand, thereby suspending captured material in the standing layer of the water (see cawst.org). The dirty water is than removed and dumped away. The process can be repeated as many times as necessary to regain the desired flow rate. The need for cleaning depends on the amount and quality of water being put through the filter. If the water is relatively clean (turbidity less than 30 NTU), the filter can likely run for several months without this maintenance procedure. When a BSF is used for the first time, there is no biofilm yet. The biological layer typically takes 20 to 30 days to develop to maturity in a new filter depending on inlet water quality and usage (CAWST 2009). Removal efficiency and the subsequent effectiveness of the filter increase throughout this period. After cleaning, a re-establishment of the biological layer takes place, quickly returning removal efficiency to its previous level.

Applicability
BSF are suitable for the treatment of water at household-, school- or community-level. BSF can efficiently and directly treat contaminated surface or ground water since it also removes turbidity and iron. However, it is recommended not to use water with turbidity more than 50 NTU. Further, dissolved chemicals (e.g. organic pesticides or arsenic) are not removed. Chlorinated water should not be poured into this filter as chlorine kills microorganisms presented in biofilm resulting in low pathogen removal performance. Nevertheless, the water can be chlorinated after filtration in order to improve the security for elderly or infant members of the household/community. A BSF should be constructed only by trained technicians. Though the construction and installation look very simple, incorrect filter design and installation can lead to poor filter performance. However, materials are generally locally available and the construction by trained local staff may create opportunities for local business.

11 Sedimentation

Sedimentation is a physical water treatment process using gravity to remove suspended solids from water. Solid particles entrained by the turbulence of moving water may be removed naturally by sedimentation in the still water of lakes and oceans. Settling basins are ponds constructed for the purpose of removing entrained solids by sedimentation. Clarifiers are tanks built with mechanical means for continuous removal of solids being deposited by sedimentation.

Sedimentation is recommended as simple pre-treatment of water prior to application of other purification treatments such as filtration and disinfection methods. It removes undesirable small particulate suspended matters (sand, silt and clay) and some biological contaminants from water under the influence of gravity. The longer the water is sedimented, the more the suspended solids and pathogens will settle to the bottom of the container. Adding special chemicals or some natural coagulants can accelerate sedimentation.

Three common chemicals used are aluminium sulphate, polyaluminium chloride (also known as PAC or liquid alum) and ferric sulphate. 'PUR' is a powder product containing both coagulants and disinfectant. Some native plants like prickly pear cactus, Moringa seeds, broad beans and Fava beans have all been traditionally used as natural coagulant to help sediment water in a number of countries in Africa and Latin America.

Advantages	• Simple and low cost water pre-treatment technology. • Certain contaminants such as lead and barium can be also effectively removed by coagulation	• Coagulants reduce the time required to settle out suspended solids.	• Natural coagulants can sometimes be obtained for free or at a low cost.	• Coagulation can also be effective in removing protozoa, bacteria and viruses, particularly when polyelectrolyte is used. Some bacteria and viruses can attach themselves to the suspended particles in water that cause turbidity. Thus, reducing turbidity levels through coagulation may also improve the quality of water.	
Disadvantages	• If only settling or plain sedimentation is practised, it removes only partially turbidity and some microorganisms	• Maximum effectiveness requires careful control of coagulant dose and pH, and consideration of the quality of the water being treated, as well as mixing	• Costs are variable depending on coagulant; some coagulants like polyelectrolyte are expensive to buy. Effectiveness of coagulants varies from one to another	• Without using coagulants, a long sedimentation time is needed	• Training is required for coagulant dosage, jar testing and frequent monitoring

	● Except with the use of specific coagulants, it is not effective for removing dissolved chemicals from the water	● May be toxic if used improperly	● Natural coagulants are not available in a usable form and need to be prepared		

Sedimentation
The suspended particles in water vary considerably in source, composition, charge, particle size, shape and density. The smaller particles present in water are kept in suspension by the action of physical forces on the particles themselves. One of the forces playing a dominant role in stabilisation results from the surface charge present on the particles. Most solids suspended in water possess a negative charge and since they have the same charge sign, repel each other when they come close together. Therefore they will remain in suspension rather than clump together and settle out of the water. Sedimentation is a simple, low cost pre-treatment technology to reduce settable solids and some microbes from water under the influence of gravity prior to application of other purification methods. It also improves the visual qualities of the water and increases its acceptance by consumers. The longer the water is stored, the more the suspended solids and pathogens will settle to the bottom of the container. Adding chemical or natural coagulants to the water can quicken the sedimentation process. Aluminium sulphate, polyaluminium chloride (also known as PAC or liquid alum) and ferric sulphate are three common types of chemicals used for the coagulation. Some examples of natural coagulants are prickly pear cactus, Moringa seeds, broad beans and Fava beans. Some products like "PUR" contain both coagulants and disinfectant. Coagulants are dosed in solution at a rate determined by raw water quality. After sedimentation, the water should be filtered to further remove suspended materials and pathogens.

Working Mechanism
Much of the suspended material can be removed by simply allowing the water to stand and settle for some time. This retention time (from one hour up to two days, the longer the better) is required to settle particles in the bottom. Storing water for at least one day will also promote the natural die-off of some bacteria. Coagulants enhance sedimentation because they neutralise the surface charge of suspended particles. Particles that cause turbidity (e.g. silt, clay) are generally negatively charged, making it difficult for them to clump together because of electrostatic repulsion.

But chemical coagulant particles are positively charged, and they chemically attracted to negative turbidity particles, neutralising the latter's negative charge and accumulate to form larger particles (flocs), which settle faster. Natural coagulants contain significant quantities of water-soluble proteins, which carry an overall positive charge when in solution. The proteins bind to the predominantly negatively charged particles that cause turbidity and form flocs. The flocs can be settled out or removed by filtration. Bacteria and viruses can attach themselves to the suspended particles in water. Therefore, reducing turbidity levels through coagulation may also improve the microbiological quality of water.

Effectiveness
Plain sedimentation often is effective in reducing water turbidity, but it is not consistently effective in reducing microbial contamination. Storing water for as little as a few hours will sediment the large, dense particles like inorganic sands and silts, large microbes and any other. Overnight or 1-2 days longer settling times will remove larger microbes, including Helminth ova and some parasites, some microbes, such as certain algae, and the larger clay particles. Most viruses and bacteria and fine clay particles are too small to be settled out by simple gravity sedimentation. Sedimentation by using coagulant reduces the time required to settle out suspended solids and is very effective in removing fine particles. Some bacteria and viruses can also attach themselves to suspended particles. Therefore, reducing turbidity level through coagulation may also improve some microbiological quality (bacteria, viruses, protozoa and helminths) of water. The use of Moringa Oleifera seeds for water treatment is efficient in reducing 80% to 99.5% of turbidity accompanied by 90% to 99.99% bacterial reduction.

Bacteria - Lab: >90-99%
Viruses - Lab: >90-99%
Protozoa - Lab: >90-99%
Helminths - Lab: >90-99%
Turbidity - Lab: 80-99.5%

The effectiveness of the coagulants has a complex dependence on the type of coagulant used, the nature of the raw water, being affected by such things as temperature, pH and especially the specific proportions of organic, inorganic and biological particles that constitute the suspended solids as well as mixing. The best approach for determining the treatability of a water source and determining the optimum parameters (most effective coagulant, required dose rates, pH) is by use of a jar tester. Plain sedimentation or settling is not effective for removing dissolved chemicals from the water.

Applicability
Sedimentation is used to remove solids from water. It is suitable for water with high sediment content. It is easy to perform and requires a minimum of materials and skill. It can be done with as little as two or more simple storage vessels such as pots and buckets by manual transfer. Typically, at least two containers are needed to settle water: one to act as the settling vessel and another to be the recipient of the supernatant water after the settling period. Care must be taken to avoid disturbing the sedimented particles when recovering the supernatant water by decanting or other methods. Staffs need to be adequately trained to carry out jar tests to determine coagulant dosage. For better results, the coagulants should be rapidly and thoroughly mixed in water. Coagulants can be expensive to buy (particularly polyelectrolyte) and need accurate dosing equipment to function efficiently. When water is sedimented in vessel, the sediment should be removed and the vessel should be cleaned after each use. More rigorous physical or chemical cleaning is needed to avoid the microbial colonization of the vessel surface. Some communities have opted not to use aluminium based coagulants because of unsubstantiated reports that claim that the aluminium in drinking water poses a risk to public health despite of scientific evidences. Based on the WHO (2008), there is no evidence of health risk. Studies have been carried out to determine the potential risks associated with the use of M. Oleifera seed in water treatment but there is no evidence to suggest any acute or chronic effects on humans, particularly at the low doses required for water treatment.

12 Coagulation (Flocculation)

In water treatment, coagulation flocculation involves the addition of polymers that clump the small, destabilized particles together into larger aggregates so that they can be more easily separated from the water. Coagulation is a chemical process that involves neutralization of charge whereas flocculation is a physical process and does not involve neutralization of charge. The coagulation-flocculation process can be used as a preliminary or intermediary step between other water or wastewater treatment processes like filtration and sedimentation. Iron and aluminium salts are the most widely used coagulants but salts of other metals such as titanium and zirconium have been found to be highly effective as well.

Coagulation is affected by the type of coagulant used, its dose and mass; pH and initial turbidity of the water that is being treated; and properties of the pollutants present. The effectiveness of the coagulation process is also affected by pre-treatments like oxidation. In a colloidal suspension, particles will settle very slowly or not at all because the colloidal particles carry surface electrical charges that mutually repel each other. A coagulant (typically a metallic salt) with the opposite charge is added to the water to overcome the repulsive charge and "destabilize" the suspension. For example, the colloidal particles are negatively charged and alum is added as a coagulant to create positively charged ions. Once the repulsive charges have been neutralized (since opposite charges attract), the van der Waals force will cause the particles to cling together (agglomerate) and form micro floc.

Introduction
Coagulation-flocculation is a chemical water treatment technique typically applied prior to sedimentation and filtration (e.g. rapid sand filtration) to enhance the ability of a treatment process to remove particles. Coagulation is a process used to neutralise charges and form a gelatinous mass to trap (or bridge) particles thus forming a mass large enough to settle or be trapped in the filter. Flocculation is gentle stirring or agitation to encourage the particles thus formed to agglomerate into masses large enough to settle or be filtered from solution.

WATER Purification Methods Coagulation

Overview	Self-Help Compatibility Skilled operators required	Capacity/Adequacy Relatively simple technology	Performance High efficiency in removing charged suspended and dissolved particles	Costs Relatively low cost	Working Principle Suspended particles are destabilised by addition of a clarifying agent leading to the neutralisation of their charges. Particles thus agglomerate (flocs formation) and are able to decant.
	O&M Continuous consumption of chemicals and electricity	Reliability Reliable if operating conditions are optimised taking into account wastewater content	Main Strength Removes solids and improves filtration	Main Weakness Continuous input of chemicals required	

Advantages	• Simplicity and cost-effectiveness	• Separates many kind of particles from water	• Enhances filtration process	• Uses abundant and low cost chemicals	
Disadvantages	• Input of chemicals required	• Qualified personnel required for design (e.g. construction of chambers and dosage of chemicals) and system maintenance	• Transfer of toxic compounds into solid phase and formation of sludge that has to be treated subsequently	• Relatively time consuming process	

Introduction
Dissolved and suspended particles are present in most of natural waters. These suspended materials mostly arise from land erosion, the dissolution of minerals and the decay of vegetation and from several domestic and industrial waste discharges. Such material may include suspended, dissolved organic and/or inorganic matter, as well as several biological organisms, such as bacteria, algae or viruses.

This material has to be removed, as it causes deterioration of water quality by reducing the clarity (e.g. causing turbidity or colour), and eventually carrying pathogenic organisms or toxic compounds, adsorbed on their surfaces. To separate the dissolved and suspended particles from the water coagulation and flocculation processes are used. Coagulation and flocculation is relatively simple and cost-effective, provided that chemicals are available and dosage is adapted to the water composition.

Regardless of the nature of the treated water and the overall applied treatment scheme, coagulation-flocculation is usually included, either as pre-treatment (e.g. before rapid sand filtration) or as post-treatment step after sedimentation (see also centralised water purification plants). Most solids suspended in water possess a negative charge; they consequently repel each other. This repulsion prevents the particles from agglomerating, causing them to remain in suspension.

Coagulation and flocculation occur in successive steps intended to overcome the forces stabilising the suspended particles, allowing particle collision and growth of flocs, which then can be settled and removed (by sedimentation) or filtered out of the water. Coagulation-Flocculation is also a common process to treat industrial and domestic wastewater in order to remove suspended particles from the water.

Coagulation Principles
Coagulation destabilises the particles' charges. Coagulants with charges opposite to those of the suspended solids are added to the water to neutralise the negative charges on dispersed non-settable solids such as clay and organic substances. Once the charge is neutralised, the small-suspended particles are capable of sticking together.

The slightly larger particles formed through this process are called microflocs and are still too small to be visible to the naked eye. A high-energy, rapid-mix to properly disperse the coagulant and promote particle collisions is needed to achieve good coagulation and formation of the microflocs. Over-mixing does not affect coagulation, but insufficient mixing will leave this step incomplete. Proper contact time in the rapid-mix chamber is typically 1 to 3 minutes.

Flocculation
Following coagulation, flocculation, a gentle mixing stage, increases the particle size from submicroscopic microfloc to visible suspended particles. The microflocs are brought into contact with each other through the process of slow mixing. Collisions of the microfloc particles cause them to bond to produce larger, visible flocs. The floc size continues to build through additional collisions and interaction with inorganic polymers formed by the coagulant or with organic polymers added. Macroflocs are formed.

High molecular weight polymers, called coagulant aids, may be added during this step to help bridge, bind, and strengthen the floc, add weight, and increase settling rate. Once the floc has reached its optimum size and strength, the water is ready for the separation process (sedimentation, floatation or filtration). Design contact times for flocculation range from 15 or 20 minutes to an hour or more.

Coagulation Flocculation Separation In water treatment, coagulation and flocculation are practically always applied subsequently before a physical separation. The Coagulation-Flocculation process consists of the following steps:	1. Coagulation-flocculation: The use of chemical reagents to destabilise and increase the size of the particles; mixing; increasing of flog size 2. A physical separation of the solids from the liquid phase. This separation is usually achieved by sedimentation (decantation), flotation or filtration.	The common reagents are: mineral and/or organic coagulants (typically iron and aluminium salt, organic polymers), flocculation additives (activated silica, talcum, activated carbon…), anionic or cationic flocculants and pH control reagents such as acids or bases. Certain heavy metal chelating agents can also be added during the coagulation step.

Jar Test
The jar test is used to identify the most adapted mix of chemical compounds and concentrations for coagulation-flocculation. It is a batch test consisting of using several identical jars containing the same volume and concentration of feed, which are charged simultaneously with six different doses of a potentially effective coagulant. The six jars can be stirred simultaneously at known speeds. The treated feed samples are mixed rapidly and then slowly and then allowed to settle. These three stages are an approximation of the sequences based on the large-scale plants of rapid mix, coagulation flocculation and settling basins. At the end of the settling period, test samples are drawn from the jars and turbidity of supernatant liquid is measured. A plot of turbidity against coagulant dose gives an indication of the optimum dosage (i.e. the minimum amount required to give acceptable clarification).

The criteria thus obtained from a bench jar test are the quality of resultant floc and the clarity of the supernatant liquid after settling. The design of the full-scale plant process is then done based on the bench-scale selection of chemicals and their concentrations. Unfortunately, the jar test suffers from a number of disadvantages, despite its widespread application. It is a batch test, which can be very time-consuming. And the results obtained from a series of jar tests might not correspond to the results obtained on a full-scale plant.

Operation and Maintenance
The operation of coagulators, flocculators and clarifiers requires trained operators. Maintenance work should be undertaken regularly. The key aspects of operation and maintenance of coagulators, flocculators and clarifiers are:
- Chemical stock: There should be a good stock (at least sufficient for one month of operation).
- Plant layout: The flocculator and clarifiers should be located close to one another and water should flow slowly between them so as to not break up the flocs.
- Dosing control: Correct dosing of coagulant chemicals is very important for efficient and effective removal of suspended solids. Samples of raw water should be taken regularly, and tested with a range of coagulant concentrations to determine the optimum dose rate of coagulant. The results should be used to adjust the coagulant dose.
- Flocculation should be achieved by gentle mixing so as to maximise the number of collisions between suspended particles and flocs, without breaking the flocs up through rapid mixing.
- Rapid mixing of the water and coagulant chemicals at the point where the chemicals are added is essential.

During the course of coagulation-flocculation treatment, a substantial amount of sludge coming from the settling process is generated. This sludge can be reused as fertiliser for agriculture when no toxic compounds are present. In the presence of toxic sludge the solid waste has to be treated or disposed of in an environmentally proper manner.

Applicability
Coagulation-flocculation is a conventional pre-treatment method (typically in combination with sedimentation] and rapid sand filtration) used to separate the suspended and dissolved compounds (turbidity) from the water in (semi-)centralised drinking water treatment plants. Many charged species such as suspended mineral, organics, pathogens, and dissolved species such as metal ions, phosphates, fluoride, and radionuclides can be separated by these processes. Chemicals reactants (flocculants and coagulants) concentration must be adjusted properly to the exact composition of the water. The operation of coagulators, flocculators and clarifiers requires trained operators. Maintenance work should be undertaken regularly to guarantee an efficient treatment. Coagulation-flocculation is also often used to remove suspended solids in domestic and industrial wastewater treatment plants.

Determining Coagulant Dose
Jar Test
The dose of the coagulant to be used can be determined via the Jar Test. The jar test involves exposing same volume samples of the water to be treated to different doses of the coagulant and then simultaneously mixing the samples at a constant rapid mixing time. The microfloc formed after coagulation further undergoes flocculation and is allowed to settle. Then the turbidity of the samples is measured and the dose with the lowest turbidity can be said to be optimum.

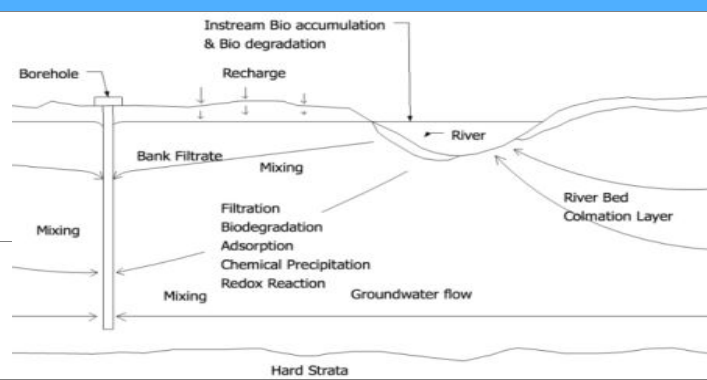
Microscale Dewatering Tests
Despite its widespread use in the performance of so-called "dewatering experiments", the jar test is limited in its usefulness due to several disadvantages. For example, evaluating the performance of prospective coagulants or flocculants requires both significant volumes of water/wastewater samples (litres) and experimental time (hours). This limits the scope of the experiments which can be conducted, including the addition of replicates. Furthermore, the analysis of jar test experiments produces results which are often only semi-quantitative. Coupled with the wide range of chemical coagulants and flocculants that exist, it has been remarked that determining the most appropriate dewatering agent as well as the optimal dose "is widely considered to be more of an 'art' rather than a 'science'". As such, dewatering performance tests such as the jar test lend themselves well to miniaturization.

Limitations
Coagulation itself results in the formation of floc but flocculation is required to help the floc further aggregate and settle. The coagulation-flocculation process itself removes only about 60%-70% of Natural Organic Matter (NOM) and thus, other processes like oxidation, filtration and sedimentation are necessary for complete raw water or wastewater treatment. Coagulant aids (polymers that bridge the colloids together) are also often used to increase the efficiency of the process.

13 Bank Filtration

Bank filtration (BF) is a drinking water pre-treatment step, where river water is induced to percolate in subsurface passage through a river bed and mix with ambient (or natural) groundwater, before being extracted through a pumping well adjacent to the river bed.

It can be applied as first step within a multi-barrier approach in an overall treatment chain where groundwater quantity is insufficient or of poor quality (e.g. geogenic pollution).



Advantages	• Can dampen pollution peaks and buffer extreme climatic conditions (quality and quantity).	• Huge freshwater storage capacity.	• Can reduce costs of supplementary treatment steps.	• Low requirements for skilled labour, chemicals and energy use (depending on purpose of output water).	
Disadvantages	• Prone to clogging/colmation at high levels of suspended solids.	• Permeability can be influenced by high (seasonal) temperature amplitude.	• High organic pollution and high mean temperatures can lead to lowered treatment efficiency.		

Design
During subsurface passage in biologically active soil layers (with aerobic, anaerobic and anoxic milieus), water quality of surface water can be improved before being mixed with groundwater and extracted for use. BF systems involve several physical, chemical and biochemical processes and are particularly known for the efficient reduction/removal (or even elimination) of suspended solids, organic pollutants, microorganisms, heavy metals, nitrogen, toxic algae as well as organic trace compounds (e.g.: pharmaceutical products), salinity or taste- and odour causing compounds. Relying on natural processes, design and treatment capacity (and efficiency) of BF systems strongly depends on local circumstances such as quality and quantity of available river- and ground water, hydraulic residence times of the water in the soil, the porosity of the soil, the hydraulic potential of the aquifer, temperature, pH values and oxygen concentrations as well as underlying redox processes. Depending on the bank filtrate quality, disinfection or even supplementary treatment steps are necessary to achieve drinking water quality. Besides its polishing function, BF also provides huge fresh water storage capacity for buffering extreme climatic conditions and shock loads, but also represents an artificial groundwater recharge technique preventing the overuse of aquifers, saltwater intrusion and land subsidence.

Operation
Basic requirements for the operation of a BF system are the availability of surface water as primary water source and a detailed consideration of the groundwater level in the surroundings of the abstraction well. Water abstraction should not result in adverse effects on the aquifer or the river downstream of the site. Depending on the BF site's characteristics and purpose of the output water, operation of a BF system is easy and only little maintenance is needed. Compared to high-end technologies, requirements for skilled labour and energy & chemical use are very low. However, more requirements may arise in relation to design, operation and maintenance of the water abstraction well. One challenge in relation to well operation is the prevention/handling of colmation of the infiltration path.

Cost
Costs for establishing riverbank filtration systems depend on many factors, including aquifer characteristics, type of well-screen installation, facility design, and distance to the population served. However, costs can be classified as moderate. Using natural treatment processes, BF system can be considered as cost-effective system, which ideally can reduce costs for subsequent treatment steps. Additional costs can arise in dependency of raw-water quality and continuative treatment steps for diverging intended purpose (e.g. drinking water use). Investment costs are costs for the abstraction well (construction, pump, main, control system etc.) as a minimum, as well as costs for groundwater monitoring of BF processes and water quality. Operational costs are primarily costs for pumping electricity for abstraction well operation. For abstraction (and treatment) facilities skilled personal is required.

14 Solar Pasteurisation

Contrary to belief, it is not necessary to boil certain water to make it safe to drink. Heating water to 65°C (149°F) for 6 minutes, or to a higher temperature for a shorter time, will kill all germs, viruses, and parasites. This process is called pasteurisation. Solar pasteurisation has proven to be a very low-cost disinfection method to produce drinking water out of non-turbid fresh water.

However, solar pasteurisation is not that easy to implement and monitor, thus it is not a wide spread method for point-of-use water treatment. Pasteurisation is one of many techniques to disinfect drinking water and is applicable to developing countries. Other techniques such as chlorination, ozonation or operation of wells may be more suitable particularly if a large amount of water is needed.

Conversely, if a relatively small amount of water is needed, pasteurisation systems, like other HWTS methods have the advantage of being able to be scaled down with a corresponding decrease in cost. In other words, if only little money is available, you can use pasteurisation to get a little clean water, perhaps enough for a family, but not a village.

Today, throughout the world, beverages such as milk, fruit juice, beer and wine are disinfected through pasteurisation on an industrial scale. Consumers are familiar with and trust the process of pasteurisation. Apart from water, milk can also be pasteurised at home, a procedure used to make it more durable. In case of milk, pasteurisation is reached when heated above 63°C for 30 minutes.

Solar Pasteurisation
Pasteurisation is the process of disinfecting water by heat or radiation without boiling. Typical water pasteurisation achieves the same effect as boiling, but at a lower temperature (usually 65-75°C/ 149-167°F), over a longer period of time. A simple method of pasteurising water is to put blackened containers with water in a solar cooker. The solar cooker reflects sunlight onto the container, which heats up the content.

The cooker may be an insulated box made of wood, cardboard, plastic, or woven straw, with reflective panels to concentrate sunlight onto the water container. It may also be an arrangement of reflective panels, or a reflective "satellite dish", on which the water pot sits. The box cooker should be frequently repositioned to ensure it is catching all available sunlight (and never in shade). A thermometer or indicator is needed to tell when the required temperature is reached for pasteurisation to monitor the required exposure time of six minutes.

Common devices for monitoring the water temperature use either beeswax, which melts at 62°C (143.6°F), or soybean fat, which melts at 69°C (156.2°F). A simple device known as the Water Pasteurisation Indicator (WAPI) has been developed at the University of California. Water may take one to four hours or more to heat to those temperatures. Heating the water to the pasteurisation temperature rather than the boiling point reduces the energy required by at least 50%.

However, solar pasteurisation is only effective if treated water is protected from post-treatment contamination during storage. The Water Pasteurisation Indicator (WAPI) indicates when water is safe to drink. When the soybean wax inside a small tube melts at about 70°C (158°F), the wax changes from solid (left) to liquid (right) state. An iron ring ensures that the tube is staying in the same position while in the solar cooker.

Advantages	● The system requires no additional inputs (electricity, chemicals or fossil fuels) after installation.	● Simple designs are available at very low cost, and this device may be built with parts available in most countries.	● Anyone can be trained to construct a solar cooker and there are no specific manufacturing hazards.	● Solar pasteurisation boxes can also be used as solar cookers for cooking meals.	● Compared to boiling, the pasteurisation process does not consume wood, charcoal or other biomass as energy supply (environmentally more sustainable) and does not take time and energy for its procurement.
Disadvantages	● Requires sunny weather and does not work during continuous rainfall, on very cloudy days, or under freezing conditions.	● Recontamination is possible after the water has cooled because it contains no residual disinfectant; subsequent safe storage is essential.	● Does not reduce turbidity, odour, taste or colour and does not remove chemical pollutants from water.	● While construction is low-cost, the life-cycle costs (chlorination, sand filters, UV treatment) are relatively high compared to competition.	● Users require a thermometer or pasteurisation indicator device.
	● Users need to keep track of containers to know which ones have been treated and to ensure that they always have treated water (batch process).	● Users may need to wait for water to cool prior to use. Cookers are made from lightweight and easily breakable materials.	● Boiling is sometimes preferred because it provides a visual measure of the water reaching sufficient temperature without requiring a thermometer.		

How it Works
Boiling or heating with fuel is perhaps the oldest means of disinfecting water at the household level and is also one of the most effective. It kills or deactivates all classes of waterborne pathogens, including protozoan cysts that have shown resistance to chemical disinfection and viruses that are too small to be mechanically removed by microfiltration.

As the water heats due to radiation from the sun, the increased temperature will kill or inactivate an important part of commonly waterborne pathogenic bacteria, viruses, helminths, and protozoa at a temperature between 65° and 75°C (149-167°F). But, spores are more resistant to thermal inactivation than vegetative cells; treatment to reduce spores requires a thermal treatment up to boiling point and must ensure sufficient temperature and time.

Furthermore, solar pasteurisation does not improve turbidity, odour, taste, colour or chemical contamination. As temperatures reach 50°C or greater, pathogenic microbes are inactivated. The temperatures which cause approximately a 1-log decrease in viability within 1 min are 55°C for protozoan cysts; 60°C for E. coli, enteric bacteria, and rotavirus; and 65°C for hepatitis A virus (3, 5, 7–9, 16).

When the WAPI wax melts at about 70°C, the cumulative lethal effect is determined by the gradual increase in temperature, often at least 30 min from 50 to 70°C, as well as the gradual cooling once the water is removed. In addition, the water at the bottom of the black jar is often 5 to 10°C cooler than the water at the top of the jar. Microbes in the upper portion will have been inactivated before those in the bottom portion, where the WAPI is located.

Temperature

Pasteurisation time decreases exponentially with increasing temperature. Above 50°C, time decreases at roughly a factor of 10 for every 10°C increase in pasteurisation temperature. Viruses appear the hardest to kill and essentially set the boundary for acceptable time-temperature processes. In rural Kenya, a simple thermo indicator which changes colour at 70°C was applied to show household members when pasteurisation temperature had been reached. This increased the number of households whose drinking water was free of coliforms from 10.7 to 43.1% and significantly reduced the incidence of severe diarrhoea compared to a control group.

Temperature Safety Zone
- 72°C at 6m
- 70°C at 8m
- 68°C at 15m
- 66°C at 25m
- 64°C at 40m

- 100% E.coli killed in 1.5 hours at 60°C
- 100% Viruses killed in 1.5 hours at 70°C
- 100% Protozoa killed in 45 seconds at 70°C

Solar Pasteurisation Devices

Literature distinguishes between batch devices and flow-through solar devices. Batch devices are used to heat water on a home scale with a simple solar cooker. While potentially inexpensive, durability of the solar box needs further investigation. Compared to other energy sources it can save fuel costs, but not labour costs, which are still relatively high. A portable version is the AquaPac, a low cost polyethylene plastic with UV inhibitors added, and air-filled bubble pack sheeting. An example for an enhanced batch device is the solar puddle, which essentially is a puddle in a greenhouse. A combination of (black) plastic sheeting is put in a shallow pit and then filled with water to be pasteurised by the solar heat. On days with good sunshine the required temperature with a water depth of up to 62 mm (2 1/2 inches) can be reached. Another way to pasteurise water is to use flow-through pasteurisation devices. They can be enhanced with a heat exchanger by recycling heat from the outgoing pasteurised water. Flow-through devices have several advantages over the simpler batch processes.

First, potable water becomes available throughout the day as new increments of treated water are added to the clean storage vessel. Second, this type of unit can adapt to variable solar conditions and is an automatic process, also decreasing the likelihood of an accident occurring when transferring water in and out of a batch unit e.g. a solar cooker jar. Flow-through devices can make use of wasted heat like the one generated in traditional clay ovens, so called "chullis". The main drawback of flow-through solar pasteurisation devices is the difficulty of ensuring safe storage, as the water needs to be transferred to a new recipient before consumption. The Solar Pasteuriser with Integral Heat Exchanger (SPIHX) collects and converts solar energy to heat energy to bring water to pasteurisation levels. Once pasteurised, the thermostat valve opens and the water flows through the bottom channel. The middle aluminium sheet facilitates heat exchange between the hot outgoing pasteurised water and cold incoming contaminated water.

Applicability

The solar pasteurisation method is effective to remove bacteria, viruses, protozoa and helminths from raw fresh water. It cannot produce drinking water from raw water with high turbidity and dissolved matter. While the removal capacity has predominantly been proved in laboratory tests, the solar pasteurisation method seems more suitable on household level rather than for producing high quantities of drinking water. Because it relies on solar energy its effectiveness depends on the daily hours of sunshine in the area of application. Solar pasteurisation might be an option on both, the village and household level. But household usage is more competitive because village-scale alternatives have much lower treatment cost. Existing solar devices have water disinfection costs that are an order of magnitude less than boiling. Solar thermal pasteurisation with existing manufactured devices costs more than the remaining alternatives but is highly effective and lowest in maintenance. Quite some solar pasteurisers that have been developed are an educational tool or curiosity rather than practical methods of producing safe water applicable in developing countries on a large scale.

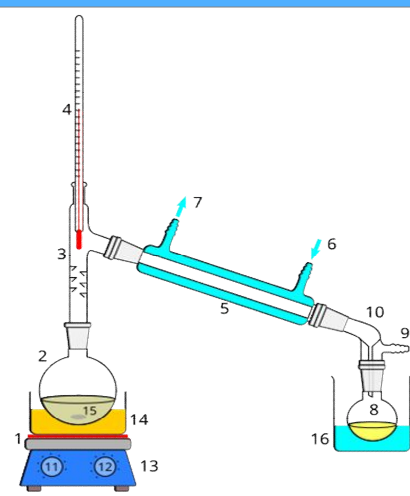
15 Distillation

Distillation is a process that relies on evaporation to purify water. Contaminated water is heated to form steam. Inorganic compounds and large non-volatile organic molecules do not evaporate with the water and are left behind. The steam then cools and condenses to form purified water.

Distillation is most effective in removing inorganic compounds such as metals (iron and lead) and nitrate; hardness (calcium and magnesium); and particulates from a contaminated water supply. The boiling process also kills microorganisms such as bacteria and some viruses.

The effectiveness of distillation in removing organic compounds varies, depending on such chemical characteristics of the organic compound as solubility and boiling point. Organic compounds that boil at temperatures greater than the boiling point of water (some pesticides) can be effectively removed from the water.

Organic compounds that boil at temperatures lower than the boiling point of water (ex., benzene and toluene) will be vaporized along with the water. If these harmful compounds are not removed prior to condensation, they will re-contaminate the purified product.



Laboratory distillation set-up using, without a fractionating column
1: Heat source
2: Still pot
3: Still head
4: Thermometer/Boiling point temperature
5: Condenser
6: Cooling water in
7: Cooling water out
8: Distillate/receiving flask
9: Vacuum/gas inlet
10: Still receiver
11: Heat control
12: Stirrer speed control
13: Stirrer/heat plate
14: Heating (Oil/sand) bath
15: Stirrer bar/anti-bumping granules
16: Cooling bath.

16 Chlorination

Water disinfection by chlorination was massively introduced in the early twentieth century. It set off a technological revolution in water treatment and complemented the known and used process of filtration. In addition to destroying harmful microorganisms, chlorination also reduces the amount of iron, manganese and hydrogen sulphide in water. Chemical disinfection using chlorine has the benefits of being relatively quick, simple, and cheap and allows a residual amount of chlorine to remain in the water to provide some protection against recontamination.

Advantages	• Simple, inexpensive and reliable technique	• Effectively kills bacteria and viruses	• Provides residual chlorine for some protection against re-contamination	• Widely available in different countries	• Easy to use
Disadvantages	• Requires that users purchase chlorine on a continuous basis and may not affordable by very poor people	• Does not deactivate parasites like Giardia, cryptosporidium and worm eggs	• Taste is unacceptable to some users	• Dose is product specific	• Availability may be restricted in rural and remote areas

	• Requires clear water to be most effective	• Chlorination of water with high organic matter leads to the risk of toxic disinfection by-products formation			

Chlorination
The disinfection of drinking water by adding chlorine is called chlorination. Chlorine was used for the first time in 1850 when John Snow used it in London's water distribution system to combat cholera. Similarly, American cities like Chicago and New Jersey started to use chlorination around 1908, a step which brought a significant decrease in the number of deaths caused by cholera, typhoid, diarrhoea and hepatitis A. Today, chlorination is used to treat most of drinking water in the world since it is easy, inexpensive and reliable. Chlorine is widely available in different countries with different brand and names. Chlorination can be achieved by using liquefied chlorine gas, sodium hypochlorite solution or calcium hypochlorite granules and on-site chlorine generators (e.g. WATA). Chlorine is widely applied for the centralised disinfection of drinking water in municipal water supply systems. International agencies have also been promoting chlorination at household level as effective and simple drinking water treatment option in developing countries. Chlorine as a household level point of use treatment is available either a solution which is added at doses of one to several drops per litre of water to treat, or as tablets, which will dissolve in the treated water. Aside from these commercial products, water can also be treated at the community level by mixing chlorine in water tanks, wells and household vessels.

How it Works
When chlorine is added to water, the chemical element dissolves and forms radicals. These kill pathogens such as bacteria and viruses by breaking the chemical bonds in their molecules or by attacking the cells of the microorganisms. The different radicals and ions formed during chlorination destroy many bacteria and viruses, but also oxidise some organic matter, dissolve colours and destroy chloramines, toxic products derived from ammonia. It takes about 30 minutes to make water safe to drink.

Chlorine Use
The correct amount of chlorine solution must be used. If the concentration of chlorine is inadequate the solution may fail to destroy all the harmful micro-organisms and if in excess, health may be adversely affected. Only an appropriate amount of chlorine can destroy most of harmful micro-organisms and provide a safe amount of residual chlorine. Chlorine that does not combine with other components and remains in the water is called "Free Residual Chlorine" (FRC). FRC makes sure that water which has been treated by chlorination will not get recontaminated when being transported or stored. According to WHO guidelines, the FRC concentration in drinking water should be between 0.2 to 0.5 mg/L.

Effectiveness
Chlorine disinfection of drinking water is limited for the protozoan pathogens (in particular cryptosporidium) and some viruses (WHO 1996). Turbidity can protect microorganisms from disinfection. Further, when the natural organic matter (NOM) of the water is high, this can lead to the formation of disinfection by-products (DBPs) such as halogenated organic molecules, mainly trihalomethanes (THM), some of which are potentially hazardous.

However, the risks to health from these by-products are extremely small in comparison with the risks associated with inadequate disinfection, and disinfection should not be compromised in attempting to control DBPs.

In 1991, the International Agency for Research on Cancer evaluated the carcinogenic potential of chlorinated drinking water. IARC concluded, that "there is inadequate evidence for the carcinogenicity of chlorinated drinking-water in humans".

However, for water containing large amounts of organics, the formation of carcinogenic halogenated disinfection products derived from the organic matter attacked by the chlorine is extremely high – it is therefore recommended to use pre-filtration (e.g. slow sand filtration or bio-sand filtration).

Very Effective
• Bacteria

Fairly Effective
• Viruses
• Most Protozoa
• Helminths

Not Effective
• Cryptosporidium
• Turbidity
• Chemicals
• Taste
• Smell
• Colour

Clear Water
1 Tablet

Turbid Water
2 Tablets

Applicability
Chlorination is very suitable for places where people are directly drinking water from bacterial contaminated water sources but where other contamination (e.g. natural organic matter, arsenic) are not of concern. It is socially acceptable by general public for purifying water because of easy handling, cost effectiveness as well as good removal of microbial organism in drinking water. It is most commonly used for water disinfection during emergencies. However, a constant supply of chlorine must be guaranteed.

17 Electrolytic Purification

Chlorination, which means adding active chlorine (Sodium Hypochlorite) to water, is the most common method used for disinfecting of drinking water. Active chlorine destroys or inactivates most pathogenic microorganisms, including parasites, bacteria and viruses with a very high reliability. The WHO estimates that chlorination is the most secure, effective and economic option. Yet, generally speaking, chlorine is not produced in low-income countries, but imported in the form of tablets or bleach, at relatively high cost. WATA is technology and approach developed by Antenna Foundation which integrates health education with the local production of chlorine by electrolysis (through the WATA device) in a sustainable supply chain, making safe water treatment a profitable activity.

Advantages	• Local production (avoids most storage and transportation problems and environment impacts)	• Generation of income for local communities (e.g. water kiosk)	• Especially suitable for humanitarian response or war-thorn areas, where for example chlorine gas is banned.	• Quality control is possible at every stage of production and use	• Disinfectant can be used for a large range of applications (e.g. disinfecting laboratory equipment, wounds, cleaning latrines, disinfecting surfaces etc.)
	• Solar versions available for autonomous use	• Low Cost	• Easy to use		
Disadvantages	• Reaction time of 30 min required before consumption after treatment	• Education and training for operators are essentials, especially when using Maxi-WATA®	• Only clear water can be used to produce WATA® solution and the solution only effective to treat clean water	• Electricity required (but can be run with solar energy)	• Chlorination can cause the generation of a very low concentration of toxic disinfection by-products (DBPs) in the case of disinfecting water with a high organic matter content
	• Dosage might be more difficult than with tablets	• Chlorine taste and smell			

Electrolytic Water Purifier

To prevent waterborne diseases it is fundamental to deliver safe water at the point of use. The 2017 published Joint Monitoring Programme (JMP) report from WHO and UNICEF shows that recontamination occurs very often between the point of collection and the point of use and thus leads to an increase in waterborne diseases. It is thus fundamental to find a solution to enable populations to address their drinking water problem in a self-sufficient and perennial way. To respond to the need of BoP communities to have access to simple and affordable water treatment methods at the household level, Antenna Foundation has developed a range of WATA devices (Mini-WATA, WATA-Standard, WATA-Plus, Midi-WATA and Maxi-WATA), and control reagents (the WataBlue & WataTest). Until today WATA kits have been used in over 100 countries.

WATA Devices The WATA is a handy, robust device designed specifically for the production of active chlorine through the electrolysis of salted water under conditions in developing countries. The resulting solution can be used for drinking water disinfection (1 Litre of chlorine per 4,000 Litres of contaminated water) since the strong oxidising power of the chlorine will destroy most of the pathogenic germs and the water will be drinkable after 30 minutes.	**Mini-WATA** 1 (g/h) active chlorine 0.5L or active chlorine in 3h **WATA-Standard** 4.8 (g/h) active chlorine 1L of active chlorine in 2h 30m	**WATA-Plus** 22.5 (g/h) active chlorine 15L of active chlorine in 4h **Midi-WATA** 45 (g/h) active chlorine in 4h	**Maxi-WATA** 80 (g/h) active chlorine 60L of active chlorine in 4h 30m

		10L	20L	100L				
Indicative dosages for chlorinating drinking water by concentration Active chlorine concentration using the WataTest.	**3 g/L** **4 g/L** **5 g/L** **6 g/L** **7 g/L**	5.0ml 3.8ml 3.0ml 2.5ml 2.1ml	10.0ml 7.5ml 6.0ml 5.0ml 4.3ml	50.0ml 37.5ml 30.0ml 25.0ml 21.4ml	Volume of water to be disinfected in Litres.			

WATA

This sodium hypochlorite solution can also be used as a disinfectant for home use. The WATA® system is extremely adaptable to meeting the disinfectant needs of larger institutions such as health facilities also. Additionally, the sodium hypochlorite solution is similar to Dakin's solution, a neutral disinfectant, and can be used directly for cleaning wounds.

Use of WATA

The device requires only water, salt and electricity to function. It is important to note that clear water is a requirement for both the production process and as an input for the disinfection process. For the production process, highly turbid water will interfere with the electrolysis process and the resulting solution may not be at 6g of active chlorine per litre. If the turbidity (a measure of the suspended solids in the water) of the water to be disinfected exceeds 5 units of turbidity (NTU), it could diminish the treatment's efficiency and not guarantee adequate inactivation of microbes. If highly turbid water is the only source available, the suspended solids need to be removed, for example by (cloth) filtration, sedimentation or flocculation. The WATA is appropriate for urban and rural areas and foster people's autonomy where the technology is implemented. Since the WATA devices need a reliable electricity supply to operate, the Mini-WATA, WATA-Standard and the WATA-Plus are designed to be easily powered with solar energy.

Sodium Hypochlorite Production

The user first prepares salt water at 25g NACl/Litre. The WATA device needs to be immersed in the salt water and connected to a reliable source of electricity. The salt water is converted into sodium hypochlorite solution with a 6 g/L concentration of active chlorine through a process known as electrolysis. Potentially contaminated water can be made potable by adding a small dose of chlorine (5 mL chlorine per 20 L water). Despite the simplicity of operating a WATA device, the production of active chlorine and disinfection of potable water for a community is a responsibility, and thus requires skilled people as operators, specially trained and dedicated for that purpose.

Testing

WataTest and WataBlue reagents are part of the WATA kits and allow the user simple onsite water quality control. WataTest and WataBlue are non-toxic and inexpensive reagents which are used to measure the active chlorine concentration of sodium hypochlorite and free residual chlorine in the water, respectively. Free residual chlorine (FRC) is important because sufficient levels are required to ensure adequate inactivation of microbes and to guarantee the residual effect that chlorine has of preventing the recontamination of water during handling or consumption. Since increasing levels of FRC makes the water taste and smell unappealing, the WHO recommends a level of FRC between 0.2 and 0.5 ppm in order to strike a balance between disinfection and water taste and smell. 0.5 ppm is the level of FRC that the WHO recommends as striking the balance between effective disinfection and acceptability in terms of taste and smell. The WataBlue allows the user to carry out a safe and systematic quality control of the treated drinking water to ensure that this level is reached.

Maintenance

Devices need to be rinsed after each procedure with clean water. If after several uses you notice white marks on the WATA, prepare a solution of 50% white vinegar (or lemon juice) and 50% clean water. For the Mini-WATA and WATA-Standard, leave the device to soak for several hours (overnight for example) and then rinse it with clear water. Never scrub the titanium plates. WATA-Plus, Midi-WATA and Maxi-WATA need to be soaked for at least 24 hours and be completely immersed in the 6 – 10 L solution.

Storage

Properly used, well maintained and carefully stored after each use, WATA devices are designed to operate for 10,000 operating hours, or around 5 years of use. Active chlorine is very sensitive to light. It is therefore very important to store the solution produced with the WATA devices in closed and opaque, non-metallic recipients and label it with the production date. Place the container in a cool place, out of reach of children. Do not expose it to sunlight. The sodium hypochlorite should be used within 24 hours as the concentration of active chlorine will decline if the solution is not stabilized.

Potable Pure Aqua

The Potable Pure Aqua PURE Electrolytic Water Purifier is an example of one of these purifiers which is lightweight, small and can easily be fit into a BOB.

Electrolysis FAQ

- **White Blobs:** Adding too much salt to the brine solution causes white globs to form in the mixture.
- **Colour Change:** If the water is too "hard" it may alter the colour of the water during electrolysis.
- **Electrode Rust:** This is due to not washing the cathode and anode off after use and continual use will add rust to the water.

18 UV Light

The bactericidal effect of concentrated ultraviolet (UV) light is used in many areas and in many set-ups. For drinking water treatment, simple, commercially available UV tubes can be used to kill pathogenic microorganisms in the drinking water. Such UV tube water disinfection devices are an effective, low-cost and simple mean for a very rapid disinfection. They generally consist of a pipe, through which water slowly flows, and in which an UV light bulb is installed, which can be run on electric or solar power. There are many ways to design UV tubes devices and they can be used at household, community or institutional level. Even though very effective, however, chemical or physical pollution (e.g. salinity, heavy metals turbidity) cannot be treated and in opposition to chlorine, there is no residual disinfection effect.

Advantages	• Large quantities of disinfected water can be obtained quickly	• Minimum behaviour change required	• Can be constructed with locally available material	• Highly effective on broad range of pathogens, including E. Coli, Guardia and Cryptosporidium	• No risk for DBP formation (e.g. trihalomethanes)
	• Inactivation independent of pH and temperature	• No transportation, storage or handling of chemicals	• No unpleasant taste or odour (as it can appear for chemical treatments)		
Disadvantages	• Higher cost of equipment when compared with chlorine solution	• Requires regular power source for operation	• Lamp tube needs replacement every 6-12 months	• Some investment for installation is required	• UV lamp needs to be cleaned regularly and handled with care because of their mercury content
	• Only effective for microbial pollution	• No residual disinfection effect and risk of re-growth or recontamination			

UV Light
The bactericidal effect of concentrated ultraviolet (UV) light has been known over many years and is used in many areas and set-ups. The first use of UV light for drinking water disinfection has been reported to be in France in 1910. With the recent development of the UV tube, using locally available components, this technology is now a viable household water treatment method (CAWST 2009).

Facing the challenge that disinfection by-products (DBPs) are formed during chlorination of water containing high organic contents, simple physical instead of chemical disinfection methods, such as UV tubes have gained in interest. A typical UV system provides a flow path surrounding a UV lamp, structured to provide close proximity of the water flow along the length of the UV lamp all by preventing direct contact.

UV Radiation Disinfection Mechanism
The UV tube is basically the same as a commercial fluorescent bulb, except that it lacks the phosphor coating and the glass exterior is replaced by fused quartz. This means the bulb emits mostly UV light. UV light is generally defined to be wavelength of electromagnetic radiation shorter than 400 nm and is further divided into UV-A (315-400nm), UV-B (280-315nm) and UV-C (200-280 nm). UVA and UVB are responsible for sun tanning and sunburning. UVB is partly filtered out by the atmosphere and only a few percent reach the earth surface.

This is good, because UVB light can be directly absorbed by DNA, where it would induce cellular damage. UVC also penetrates cells and damage the DNA, but it is almost entirely filtered out by the ozone layer. The UV tubes used for disinfection do contain the whole spectrum of UV light, including the UVB and UVC. The light, when it reaches microbial cells leads to damage of the genetic material (DNA), rendering them unable to replicate.

The bulbs are suspended inside a larger tube in a covered channel. Water enters at one end and flows through the outlet at the other end. While the water flows through the tube, the UV light emitted from the bulb inactivates the microorganisms. The inactivation is directly related to continuous UV dose and depends on the intensity of the UV light and the duration of UV exposition. The height of the outlet determines the depth of the water in the tube and thus the hydraulic retention time.

In theory, the hydraulic retention time is equal to the exposure time of the microorganisms and should be designed, depending on the bulb intensity, to achieve a sufficiently long contact time for all microorganisms to be inactivated. For the calculations of the HRT, the intensity of the bulb may be adjusted according to the water depth of the farthest point away from the light source as the UV light is attenuated as it penetrates the water.

Effectiveness
UV tubes are effective in inactivating most pathogens, including bacteria, viruses, and cyst forming protozoa such as cryptosporidium (CAWST 2009). Yet, the effectiveness depends strongly on the UV dose. UV tubes are not effective for all pollution other than microbial (chemical and physical pollution) and there is now residual disinfection effect during storage of the treated water. The efficiency of UV light for bacterial inactivation is lowered by the presence of organic matter, iron, sulphites, and nitrites. Turbidity can also interfere with UV radiation, protect microorganisms from inactivation and serve as a food source for re-growth after the disinfection step. Therefore, it is common for UV tubes to incorporate a pre-filtration step, such as a settling unit.

Effective For
• Bacteria
• Viruses
• Protozoa
• Helminth Eggs

Not Effective For
• Turbidity
• Chemicals
• Taste
• Odour
• Colour

Operation
Operation and maintenance of UV tubes is generally low, provided that there is a more or less continuous source of electricity to run the bulb. Once the system is installed, the user needs to make sure that the theoretical flow rate of the water and the corresponding HRT are respected and that the bulb is working correctly. If the bulb becomes dirty, it needs to be taken out and cleaned to maintain the light emission intensity. The systems have generally a long life spam, but bulbs should be replaced at least once every 12 months. During any maintenance activity, however it is important that operators or users protect their skin and eyes from the UV radiation as it is also damaging for human cells.

Applicability
Ultraviolet is being widely used in the water supply systems for disinfection and has a potential to kill most bacteria, viruses, protozoa or helminths. Though, a more or less continuous energy supply is required and the system is not suitable for removing chemical contaminants or turbidity. There is also possibility of re-contamination during distribution or storage of the treated water as there is no residual disinfection effect. However, as it is only a physical treatment, there is low risk for the formation of toxic disinfection by-products (DBP). The UV tubes can be produced with locally available material and be installed at household, community or institutional level, as long as electricity is provided.

19 SODIS (Solar Disinfection)

When microbially polluted water is exposed to solar light in transparent PET bottles, bacteria, virus and some parasites are inactivated by the solar UV-A radiation. 1 to 2 litres of water are filled into clean bottles and exposed to the sun for at least 6 hours if the sky is bright. UV-A radiation is strongly attenuated by clouds; furthermore, turbidity or water depth protects the pathogens from UV-A radiation. Hence the process depends strongly on the local climate, and only low volumes with relatively low turbidity can be treated at a time. SODIS is extremely low-cost and simple and is one of the WHO recommended household level water treatments. However, chemical pollution (e. g. arsenic, fluoride, agricultural residues) cannot be removed by solar disinfection (SODIS).

Advantages	• Improves the microbiological quality of drinking water and therefore health	• Extremely low-cost	• Easy to understand and simple to use	• Relies on locally available resources, plastic bottles and sunlight, a renewable energy source	

Disadvantages	● Does not treat chemical pollution	● Is strongly climate and weather dependent	● Needs large efforts in terms of promotion and information to have an impact	● Requires the availability of PET bottles (or plastic bags)	● Only small volumes can be treated at a time and regardless the simplicity, it is relatively time-consuming to cover the entire water consumption of a household with SODIS

SODIS

Solar Water Disinfection (SODIS) is a simple water treatment technology that can be used at household level. As a point-of-use water purification method, SODIS improves the microbiological quality of drinking water with solar radiation at almost zero investment and maintenance costs. Today, SODIS is one of the recommended household level water treatment technologies by the World Health Organisation (WHO). PET (Polyethylene terephthalat) bottles or plastic bags with a volume of 1 to 2 litres are filled with water of low turbidity and exposed to the sun for a certain time, depending on the local weather conditions. The SODIS reference centre (www.sodis.ch) recommends, that 6 hours are sufficient under bright to 50% cloudy sky, whereas 2 days of exposure are required for 100% cloudy sky. The treatment efficiency can be improved if the plastic bottles are exposed on sunlight-reflecting surfaces such as aluminium- or corrugated iron sheets. During periods of continuous rainfall, SODIS does not perform satisfactorily and rainwater harvesting is recommended during these days.

- Use clean bottles
- Fill bottles
- Close the lid
- Expose to sunlight
- Water can be stored in the bottles

Process

UV-B light (280 to 320 nm) can directly be absorbed by DNA, leading to damage, but only 1% of natural solar light is of this type. Hence, sunlight used during the SODIS process consists mainly of UV-A light (320 to 400 nm), which makes 6% of the total solar light. This light can be absorbed by molecules, which are naturally present in the water. When these molecules (called photosensitizers) have absorbed the energy, they can pass it to the oxygen in the surrounding water, leading to the formation of reactive oxygen species (ROS). ROS include free radicals such as the superoxide anion as well as non-radicals such as hydrogen peroxide. ROS damage the membranes proteins, enhancing the oxidative stress of the cell and accelerating their aging process. But ROS can also lead to some DNA damage, such as single strand breaks and nucleic base modifications, which may be lethal and mutagenic. This type of pathogen inactivation Is called photooxidative stress. Photo- because it is the light which generates ROS, and oxidative stress, because these reactive oxygen species (ROS) lead to stress.

When the water temperature reaches more than 45°C, a synergistic effect of UV-A radiation (optical inactivation) and infrared light (thermal inactivation) is observed. At increased water temperatures, the exposure time needed to disinfect the water is reduced. But during cloudy weather conditions, the solar infrared light is reduced and bottles need to be exposed for 2 days to guarantee that the radiation dose received is sufficient to disinfect the water. In contrast to infrared light (heat), UV-A radiation is only slightly attenuated by clouds. But turbidity in the water reduces the amount of UV radiation that penetrates the water. Therefore, the containers used for SODIS should be relatively flat (i.e. not exceed a depths of 10 cm). Water turbidity can easily be determined: Place the full bottle on a newspaper headline (the letters should have a size of about 1.5 cm) and look through the bottle from top to bottom. Water turbidity is less than 30 NTU if you can read the letters through the water. If not, the water must be filtered first so that SODIS will work.

Suitable Containers

Suitable containers for SODIS are PET or glass bottles. Ordinary window glass is almost opaque to UV light and cannot be used to construct SODIS containers. The use of PVC bottles is not recommended. It is normally marked on the bottle whether it is PET or PVC, however, the labels vary from country to country. PET and PVC bottles are normally marked accordingly. The labels can vary from country to country, though. If the bottles are not marked, you can only tell the difference between the bottles by setting fire to them. PET burns quickly and easily when it is held in a flame. When it is taken out of the flame, the fire goes out slowly, or it may keep burning. The smoke smells sweet. PVC does not burn easily. The material does not burn at all when not in the flame. PVC smoke smells acrid. Heavily scratched or old PET bottle should be replaced regularly as the scratching makes them opaque.

Applicability

SODIS is not a replacement of the access to safe drinking water, as it is required to reach the millennium development goals, but a simple and extremely low cost method to improve the microbial quality of drinking water at household levels. Large volumes cannot be provided with the use of this method. SODIS can be used in both rural areas and urban slums, but PET bottles are generally more available in urban regions. SODIS cannot treat water that is chemically polluted (e.g. arsenic, fluoride or industrial and agricultural organic contaminants). SODIS is very well adapted as a secondary treatment of water coming from an improved source (e.g. well water), which does not meet the microbial quality standards. As SODIS requires a consistently sunny climate and solar irradiation, it is most suited for regions within latitudes of 15°N/ S and 35°N/ S. Turbidity can deteriorate the effect and if the latter is higher than 30 NTU, pre-filtration is required.

As SODIS is extremely low cost, it is adapted for population with little income. However it should not be sold as a method for the poor as this could lower the attractivity of SODIS as people don't like to be labelled as 'poor'. To distribute PET bottles for free will not result in a sustainable application. The integrated promotion together with other household-level drinking water treatments (e.g. chlorination, filtration) to give people the option to make a choice, seems the most promising. It is also recommended to combine SODIS with other interventions to improve the health, sanitation and hygiene situation. This approach allows also working in close collaboration with governmental or other large-scale interventions.

20 Copper/Silver Ionization

Copper-silver ionization is brought about by electrolysis. An electric current is created through copper-silver, causing positively charged copper and silver ions to form. Copper-silver ionization brings us back to basic chemistry: an ion; an electrically charged atom, has a positive charge when it gives up an electron and a negative charge when it takes up an electron. A positively charged ion in called a kation and a negatively charged ion is calles an anion. During ionization, atoms turn into kations or anions. When copper-silver ionization is applied, positively charged copper (Cu^+ and Cu^{2+}) and silver (Ag^+) ions are formed.

The electrodes are placed close together. The water that is disinfected flows past the electrodes. An electric current is created, causing the outer atoms of the electrodes to lose an electron and become positively charged. The larger part of the ions flows away through the water, before reaching the opposite electrode. Generally the amount of silver ions at a copper ion rate of 0.15 to 0.40 ppm lies between 5 and 50 ppb.
The ion concentration is determined by the water flow. The number of ions that is released increases, when electric charges are higher.
When copper ions (Cu^+) dissolve in water, they are oxidized immediately to form Cu^{2+} ions. Copper can be found in the water in free form. It is commonly bond to water particles. Copper (Cu^+) ions are unstable in water, unless a stabilizing ligand is present.

In the United States, several drinking water production companies use copper-silver ionization as an alternative for chlorine disinfection and to prevent the formation of disinfection byproducts. The standard for trihalomethanes was decreased by EPA from 100 to 80 µg/L.
When copper-silver ionization is combined with chlorine disinfection, it is an excellent disinfection mechanism to deactivate viruses and bacteria.

The affectivity of copper-silver disinfection depends on a number of factors:
Firstly, the concentration of copper and silver ions in the water should be sufficient. The required concentration is determined by the water flow, the volume of water in the system, the conductivity of the water and the present concentration of microorganisms.
Secondly, the electrodes should be in good condition. When the water is hard or fouling takes place as a consequence of water hardness and quality, there will be a decrease in electrode release and the additional effect will decrease. By using pure silver and pure copper, the supply of copper and silver ions can be regulated separately. These electrodes suffer from less limestone formation and fouling.
Thirdly, the affectivity of copper-silver ionization depends on the pH value of the water. When pH values are high, copper ions are less effective. When the pH value exceeds 6, insoluble copper complexes will precipitate. When the pH value is 5, copper ions mainly exist as Cu(HCO3)+; when the pH value is 7 as Cu(CO3) and when the pH values is 9 as Cu(CO3)22-.
Fourthly, copper-silver ionization affectivity is determined by the presence of chlorine. Chlorine causes silverchlorine complex formation. When this occurs, silver ions are no longer availbale for disinfection.

Copper-silver ionization can deactivate Legionella bacteria and other microorganisms in slow-running water and still water. Legionella bacteria are very susceptive to copper-silver ionization. Copper-silver ionization also takes care of bio film. Copper remains within the bio film, causing a residual effect. It appears that copper-silver ionization additon causes the number of Legionella bacteria to diminish. After a short period of time, however, the number of Legionella bacteria will rise again because they can also be found in the bio film.

Copper that stays behind in the bio film takes care of these bacteria. When copper and silver ions are added to water constantly, the concentration of Legionella bacteria remains low.
The deactivation rate of copper-silver ionization is lower than that of ozone or UV. A benefit of copper-silver ionization is that ions remain in the water for a long period of time. This causes long-term disinfection and protection from recomtamination. Copper and silver ions remain in the water untill they precipitate or absorb to bacteria or algae, and are removed from water by filtration after that.

Benefits
Copper-silver ionization affectively deactivates Legionella bacteria and bio film and it improves water quality. Copper-silver ionization has a larger residual effect than most other disinfectants. Copper and silver ions remain in the water for a long period of time. Because of its local affectivity, the effect is larger than that of UV. Copper-silver is effective throughout the entire water system, even in dead-end points and parts of the system that contain slow-running water.

Copper-silver use affectivity does not depend on water temperature. When copper-silver is used, less maintenance to the water system is required. Copper-silver is non-corrosive; it causes less strain on the distribution system. Because of a decrease in the use of chemicals, the lids and pumps are not affected. Furthermore, shower heads, tanks and taps are not contaminated. When copper-silver ionization is applied, there are no transport and storage difficulties.

Drawbacks
Copper-silver affectivity depends on the pH value of the water. At a pH value of 9, only one tenth of all Legionella bacteria are removed. When dissolved solid concentrations are high, silver will precipitate. This means silver ions are no longer available for disinfection.
Silver ions easily react with chlorines and nitrates that are present in the water, causing them to no longer be effective.
Some species of microorganisms can become resistant to silver ions. They can remove metal from their systems or convert it to a less toxic product. These microorganisms can become resistant to copper-silver ionization.

Although it is suggested that Legionella bacteria can develop resistance to copper-silver ionization, this disinfectant still appears to be effective for Legionella deactivation. To affectively kill pathogenic microorganisms, copper and silver ions should be present in the entire water system. When the system is used little and the water flow is quite slow, or when there are dead-end points in the system, this can causes problems for disinfection.

21 Colloidal Silver

Colloidal Silver Filters (CSF) are simple household water treatment devices based on a physical treatment, which does not require energy supply. CSFs use a clay candle, pot or disc made of porous ceramic materials similar to traditional ceramic filters. But in CSFs, colloidal silver is used to enhance the inactivation of bacteria and other germs. A filter set consists of two containers: the upper unit holds the ceramic coated with colloidal silver, filtering the water and killing microorganisms, while a lower unit stores the treated water. CSFs remove pathogens and turbidity from drinking water. They can be constructed with locally available material, which can contribute to the development of local commerce.

Advantages	• High removal of bacteria and protozoa; moderate removal of viruses	• Simple to install, operate and maintain	• Local production can create an opportunity small business	• Removes turbidity	• Water tastes and looks good
	• Portable container	• Easy to operate and maintain			
Disadvantages	• Does not removal chemical pollution (e.g. organics, arsenic, fluoride)	• Does not remove all viruses	• Needs to be cleaned regularly especially when using turbid water or water containing iron	• Relatively low flow rate	• Ceramic parts are fragile and are difficult to transport
	• Not applicable for extremely turbid water	• No residual disinfection effect (risk of recontamination)	• Small fissures and cracks may lead to reduced removal of pathogens		

Locally produced ceramics have been used to filter water for hundreds of years. Water is poured into a porous ceramic filter pot or in a pot containing a ceramic candle or disc, filtering the water. The filtered water is collected in another container. The filter removes turbidity and traps and kills pathogens from drinking water (see also ceramic candle filters). To enhance ceramic candle filters, colloidal silver can be added. Colloidal silver helps in pathogen removal and prevents the growth of microorganisms within the filter itself.

These enhanced forms of ceramic filters are called colloidal silver filters (CSF). CSFs were developed at the Central American Industrial Research Institute (ICAITI) in Guatemala in 1981 and are extensively promoted today. Currently, the most widely distributed ceramic filter is the Potters for Peace (PFP) colloidal silver filter, which is shaped like a flowerpot (see also pottersforpeace.org). The filters are designed in particular for simple household use and are a recommended household water treatment and safe storage (HWTS).

They can be produced locally by attending simple technical training. Ceramic filters consist of a set of two containers. The upper unit contains the ceramic unit, which filters the water and the lower unit collects filtered and safe water. A tab device allows the users to withdraw the water for consumption while preventing recontamination by contact with hands or other objects that could bear bacteria. The porous ceramic devices can be either one or two candles, a disc or a pot.

During use, tiny silver particles (colloidal silver) are suspended in the liquid acting as a disinfectant, preventing bacterial growth in the ceramic filter and enhancing inactivation of the bacteria in the filter. The colloidal silver is either added to the clay mixture before firing or impregnated on the fired ceramic pot.

How it Works
Pathogens and suspended material are removed from water through physical processes such as mechanical trapping and adsorption. Colloidal silver breaks down the pathogens' cell walls causing them to die. The filter operation is simple. First, the filter needs to be cleaned with clean water and left aside to dry naturally. Then, the filter units need to be assembled and the upper unit should be filled with water. Then, one has to wait until the water has passed the filter fort he first time. For security, the water filtered for the first time should not be used for consumption. Then, the filter can be refilled and the now filtered water collected in the lower storage unit can is ready to drink. To prevent clogging, water with a high turbidity (levels greater than 50 NTU) should first be strained (through a cloth) or settled before using the filter. The filter pot should be regularly cleaned using a cloth or soft brush to remove any accumulated material. It is recommended that the filter pot, candle or disc be replaced every 1-2 years. Cleaning prevents the formation of a biofilm and protects against fine invisible cracks, which may have developed over time. Any cracks will reduce the effectiveness since water can short-circuit without being filtered through the ceramic pores. However, make sure not to remove all the silver when using a brush for cleaning.

Treatment Efficiency
Candle filters and disc filters normally have a lower contact surface for the water and therefore the filters produce less treated water per day than pot filters. However, the effective treatment rate (or flow rate) depends on the design). A typical pot filter can produce up to 1-3 L/hour while a candle filter produces only 0.1 to 1 L/hour. The effectiveness of ceramic filters at removing bacteria, viruses and protozoa depends on the pore size of the ceramic material and the production quality of the filter unit. Most ceramic filters are effective at removing the majority of the larger protozoan and bacterial organisms and helminths, but not the smaller viral organisms. Laboratory testing has shown that although the majority of the bacteria are removed mechanically through the filter's small pores, colloidal silver is necessary to inactivate almost 100 % of the bacteria. The effectiveness of colloidal silver on viruses is not well known but estimated to be lower due to the smaller size of virus compared or silver particles. Turbidity (solids) is efficiently removed by physical straining (filtration) and also taste, odour and colour of filtered water by CSF is generally improved. Iron is partially removed but other dissolved chemical pollutions are not removed. The effectiveness of CSF colloidal filter has been proven in many studies, where the reduction of diarrhoeal disease incidence among users has been documented. For lack of residual protection, however, it is important for users to be trained on proper operation and maintenance of the ceramic filter and receptacle.

Applicability
CSFs are suitable for households using turbid and contaminated water. However, ceramic filters do not remove arsenic, fluoride, pesticides or other dissolved chemicals. Due to the limited flow rate and storage capacity, CSFs are suitable for households with small families, organisations or school classes. As iron is only partially eliminated, it is recommended to use raw water with little iron only (< 0.3mg/L). Chlorinated water should not be filtered in CSFs. Due to the risk of clogging, water with a turbidity above 50 NTU should be pre-settled or strained to avoid frequent cleaning of the filter.

Creating Colloidal Silver
Distilled water is a fairly good insulator, with a constant voltage connected to silver electrodes in distilled water, the initial current flow is very low because the water has high resistance to electron flow. However, as the silver ions and particles finally do start to accumulate in the water, the resistance in the water drops from the conductive silver building up. The silver comes off the positive electrode as ions (single atoms, missing an electron) carrying a positive electrical charge due to the lack of an electron. As silver particles build up the resistance decreases creating more faster. Silver ions build up and keep gaining size, reflecting yellow light and falling out of suspension. Mechanical stirring solves this problem and uniformity of size is very important. Do not use salt in the reaction. Thicker wire = lower gauge. 14 gauge - 1.63mm, 12 gauge - 2.06mm and 10 gauge - 2.59mm. Thicker gauge silver wires have more surface area and because the size of particles made is directly related to the amount of electrical current per unit area, the thicker gauge wires will make smaller colloidal silver particles for the entire processing run. If you want to skew the range of particle sizes to smaller particles, use 12 and even better, 10 gauge wire, rather than 14 gauge. 1-100nm is a typical size for colloidal silver.

22 Ceramic Candle Filter

Ceramic candle filters (or Berkey Filters) are simple devices made out of clay and used to filter drinking water in order to removes turbidity, suspended materials and pathogens. Removal takes place by physical process such as mechanical trapping and adsorption on the ceramic candles, which have micro-scale pores. Water is poured into the upper of two container and flows through a candle situated in the bottom. Once the water has passed through the candle, it is collected in the lower container. This system both treats the water and provides safe storage until it is used. The filters are easy to assemble and no energy is required. Maintenance includes frequent scrubbing with a brush and proper care during transport and its use. They can be constructed with locally available material, which can contribute to the development of local commerce.

Advantages	• Cheap, simple and easy to use and clean	• Can be constructed with locally available material	• Somewhat effective for the removal of viruses and iron	• Improves taste, smell and colour of water	• Removes pathogens, turbidity and suspended solids
	• Keeps water cold and safe	• Durable, easy to move and transport (except clay pot)			
Disadvantages	• Does not remove all the pathogens	• Does not remove chemical contaminants and colour	• Highly turbid or iron containing water plugs candle pores	• Low flow rate	• Ceramic candle and clay container is not easy to transport due to its fragility and heavy weight
	• Quality control difficult to ensure in local production				

Ceramic Candle Filter
The use of ceramic material for the filtration of drinking water is one of the oldest drinking water treatments. Nowadays, the ceramic candle filters and the colloidal silver filter (see also the colloidal silver filter factsheet) are the most widely used. The devices consist of two compartments, which allow simultaneous treatment and save storage of the drinking water. Candle filters are used in various countries and produced by a range of manufacturers around the globe. Ceramic candle filters basically consist of an upper and a lower container, one or more ceramic candles in between, a tap and a lid. Usually the containers have a diameter of about 30 by 25 cm depth for a treatment capacity of about 8 L and a flow rate of 1-2 L per hour per candle. The ceramic candles are screwed into the base of the upper container. To the lower container is attached a tap that allow to withdraw safe water without risking recontamination. A lid is placed on top of the upper container to prevent contamination. Candles can have very slow flow rates, so it is common to use two or more candles in one filter. The candles are made up of clay and the container can be made from plastic, aluminium, copper, steel or clay material. Though clay containers keep water cold and tasty, due to its fragile nature other materials nowadays replace it.

How It Works
Water is poured into the upper container and flows through the candle and collects in lower container. Turbidity, suspended materials and pathogens are removed from water through mechanical trapping and adsorption in micro-scale pores of ceramic candles. Colloidal silver is sometimes used in candle for more effective pathogen removal.

Operation and Maintenance
Water should be poured slowly into the container, not above the candle as regular water pressure may damage fragile candle. Candle needs to be replaced if any cracks are found: cracks will reduce the effectiveness since water can pass through that crack without being filtered through the ceramic pores. Candle needs regular cleaning, particularly when the flow rate slows down. The candle is cleaned by (slightly) scrubbing the candle surface with a soft scrubber brush or cloth to remove any accumulated dirt. Only clean water (no soap, chlorine or other chemicals!) should be used for cleaning. The candle should not be touched with dirty hands, and not placed on a dirty surface during cleaning. Storage containers, tap and lid should be cleaned on a regular basis using soap and water.

Effectiveness Ceramic candle filters are effective in removing bacteria, protozoa, helminths and turbidity from water. It also removes some viruses and iron and taste, smell and colour of water are improved. The effectiveness of the filter also depends on the production quality, the initial water quality, and the handling practices of users. Highly turbid or iron containing water may plug candle pores easily so that container and candle need to be cleaned more frequently. In this case, the water should be pre-settled before pouring it into filter. It is recommended to use raw water with less iron (<0.3mg/L) and turbidity (<5NTU).	**Bacteria** Lab: >99% Field: >99.95% **Viruses** Lab: >90% Field: N/A **Protozoa** Lab: >100% Field: >100%	**Helminths** Lab: >100% Field: >100% **Turbidity** Lab: 88-97% Field: 97-99%

Production
Candle filters can be manufactured at a local level and contribute to the development of local commerce. Local production process provides financial supports to household and voluntary labours. However, the production of ceramic filters is a lengthy process and a quality control process is required to ensure candle filter's effectiveness. Quality can be affected by variations in clay composition across geographic regions. Variability in weather conditions also makes long-term production planning difficult, and lack of storage can complicate storage of filters. The fragility of ceramic filters can make their transport difficult. A supply chain and market availability for replacement of candles and taps is required. Filters typically come with illustrated instructions in market.

Applicability
Ceramic candle filters are easy to set up and operate, cheap and effective in removing bacteria, protozoa, helminths and turbidity from water. It also removes some viruses and iron and taste, smell and colour of water are improved. But due to the limited flow rate (i.e. 1-2liter/hour) and storage capacity, filters are only suitable for small families, organisations or school classroom. It is suitable where drinking water is little turbid (<5NTU) and contaminated and with little iron (<0.3mg/L). In the case of too high turbidity, water can be presettled. Chlorinated water should not be used in candle filters! Except for clay, filter containers of other materials are easy to transport and handle.

23 Membrane Filtration

Membranes are thin and porous sheets of material able to separate contaminants from water when a driving force is applied. Once considered a viable technology only for desalination, membrane processes are increasingly employed in both drinking water and wastewater treatment for removal of bacteria and other microorganisms, particulate material, micropollutants, and natural organic material, which can impart colour, tastes, and odours to the water and react with disinfectants to form disinfection by-products (DBP). As advancements are made in membrane production and module design, capital and operating costs continue to decline.

Membranes emerged as a viable means of water purification in the 1960s with the development of high performance synthetic membranes. Implementation of membranes for water treatment has progressed using more advanced membranes made from new materials and employed in various configurations. An increasing scarcity in fresh water sources fuelled a push towards alternative resources such as ocean water. Membranes are becoming increasingly popular for production of potable drinking water from ground, surface and seawater sources, as well as for the advanced treatment of wastewater and desalination.

Overview	**Working Principle** Pollutants are separated as water is forced to pass through the membrane.	**Capacity/Adequacy** Simple but high-tech.	**Performance** Excellent separation capacity.	**Costs** Relatively low operation costs.	**Self-Help Compatibility** Process can be automatized but operators required for the control.
	O&M Membranes have to be backwashed on a regular basis to avoid fouling and to increase their lifetime.	**Reliability** Reliable when membranes are maintained properly (backwashing).	**Main Strength** High performance and simple.	**Main Weakness** Membrane fouling, which implies backwashing operation or membrane replacement.	

Advantages	• High performance	• Compact units: less space needed than conventional treatment schemes	• Simple operation	• Membranes available can be used to separate many kinds of contaminants	• Disinfection can be performed without chemicals
Disadvantages	• Membrane fouling	• Production of polluted water (from backwashing)	• Membranes have to be replaced on a regular basis		

Membranes
There are four main types of modules: plate-and-frame, tubular, spiral wound, and hollow fibre. The plate-and-frame module is the simplest configuration, consisting of two end plates, the flat sheet membrane, and spacers. In tubular modules, the membrane is often on the inside of a tube, and the feed solution is pumped through the tube. The most popular module in industry for nanofiltration or reverse osmosis membranes is the spiral wound module. This module has a flat sheet membrane wrapped around a perforated permeate collection tube. The feed flows on one side of the membrane. Permeate is collected on the other side of the membrane and spirals in towards the centre collection tube. Hollow fibre modules used for seawater desalination consist of bundles of hollow fibres in a pressure vessel. They can have a shell-side feed configuration where the feed passes along the outside of the fibres and exits the fibre ends. Hollow fibre modules can also be used in a bore-side feed configuration where the feed is circulated through the fibres. Hollow fibres employed for wastewater treatment and in membrane bioreactors are not always used in pressure vessels. Bundles of fibres can be suspended in the feed solution and the permeate is collected from one end of the fibres.

Water treatment processes employ several types of membranes. They include microfiltration (M-F), ultrafiltration (U-F), reverse osmosis (R-O), and nanofiltration (N-F) membranes. Microfiltration membranes have the largest pore size and typically reject large particles and various microorganisms. Ultrafiltration membranes have smaller pores than microfiltration membranes and therefore, in addition to large particles and microorganisms, they can reject bacteria and soluble macromolecules such as proteins. Reverse osmosis membranes are effectively non-porous and, therefore, exclude particles and even many low molar mass species such as salt ions, organics, etc. Nanofiltration membranes are relatively new and are sometimes called "loose" reverse osmosis membranes. They are porous membranes, but since the pores are on the order of ten angstroms or less, they exhibit performance between that of reverse osmosis and ultrafiltration membranes.

Membrane Materials
Most membranes are synthetic organic polymers (e.g. polysulfone, cellulose acetate). Microfiltration and ultrafiltration membranes are often made from the same materials, but they are prepared under different membrane formation conditions so that different pore sizes are produced. Membranes can also be prepared from inorganic materials such as ceramics or metals. Ceramic membranes are microporous, thermally stable, chemically resistant, and often used for microfiltration. However, disadvantages such as high cost and mechanical fragility have hindered their widespread use. Metallic membranes are often made of stainless steel and can be very finely porous. Their main application is in gas separations, but they can also be used for water filtration at high temperatures or as a membrane support. The current tendency on membrane development is to use nanofunctionalised membranes. Polymer membranes doped with silver nanoparticles to avoid biofouling is an example of such modern membranes.

Membrane Fouling
Membrane fouling is a process where solute or particles deposit onto amembrane surface or into membrane pores in a way that degrades the membrane's performance. It is a major obstacle to the widespread use of this technology. Membrane fouling can cause severe flux decline and affect the quality of the water produced. Severe fouling may require intense chemical cleaning or membrane replacement. This increases the operating costs of a treatment plant. There are various types of pollutants: colloidal (clays, flocs), biological (bacteria, fungi), organic (oils, polyelectrolytes, humics) and scaling (mineral precipitates). Fouling can be divided into reversible and irreversible fouling based on the attachment strength of particles to the membrane surface. Reversible fouling can be removed by a strong shear force of backwashing. Formation of a strong matrix of fouling layer with the solute during a continuous filtration process will result in reversible fouling being transformed into an irreversible fouling layer. Irreversible fouling is the strong attachment of particles, which cannot be removed by physical cleaning.

Operation
Raw water quality must be reviewed frequently and operational parameters of the membrane treatment train should be continually trended and compared to original start up conditions. Pre-treatment efficiencies and post treatment works should also be monitored closely. These tasks can alert operators of pending problems in time for corrective action to occur before production capabilities are impacted. While some changes in the treatment process may not significantly impact plant productivity or finished water quality, they may result in membrane degradation, more frequent cleaning, and generally higher operating costs over time if not properly addressed. When treatment or equipment failures become apparent, it is critical that adequate maintenance resources are made available. As with any industrial facility, routine preventive maintenance activities should be performed prudently as scheduled, while responsiveness to unforeseen repairs also needs to be timely. Unlike other treatment technologies, which produce lower quality product as the raw water quality degrades, membrane systems produce consistent water quality while the systems themselves degrade. Therefore, early detection of raw water changes and making adjustments to the operational parameters to accommodate the changes are the key to successful plant operation. A well-designed plant should include the necessary “tools” and have proper and adequate provisions for conducting routine tests and inspections. Such provisions include a well-equipped laboratory, tools and provisions for testing, and sample points for profiling.

Costs
Membrane filtration systems’ capital costs, on a basis of dollars per volume of installed treatment capacity, do not escalate rapidly as plant size decreases. This factor makes membranes quite attractive for small systems. In addition, for groundwater sources that do not need pre-treatment, membrane technologies are relatively simple to install, and the systems require little more than a feed pump, a cleaning pump, the membrane modules, and some holding tanks.

Applicability
Membrane processes have become more attractive for potable water production and advanced wastewater treatment in recent years due to the increased stringency of regulations, water scarcity, and decreasing costs of membranes. Membrane processes have excellent separation capabilities and show promise for meeting many of the existing and anticipated drinking water standards. Membrane processes are very versatile: for example ultrafiltration and microfiltration are efficient for turbidity suspended particles and microbial removal, nanofiltration and ultrafiltration membranes for organics (e.g. DBP precursors, micropollutants) and viruses separation, and reverse osmosis process for desalination and removal of small size organic contaminants.

24 Reverse Osmosis

Reverse osmosis has become the water purification method of choice for drinking water in many households and bottling plants throughout the world. It is a very efficient method to purify water from even very small molecules. There are many providers of reverse osmosis filter devices but, in general, the treatment stages are the same. It is possible to combine reversed osmosis filters with UV, infrared technology, or ozonation for disinfection (see also UV tubes and ozonation). Most reverse osmosis filters have 4 to 6 filter stages in different combinations.

Stage 1	**5 Micron Sediment Filter:** Removes dirt, rust and sand particles.
Stage 2	**Granular Activated Carbon Filter or Carbon Block Filter:** Takes out 99% of the chlorine and organic chemicals and provides enhanced reduction of taste, odour, and colour.
Stage 3	**1 Micron Sediment Filter:** Provides effective filtration to protect the membrane.
Stage 4	**Reverse Osmosis (RO) Membrane:** A thin film composite (TFC) high quality membrane processes 80 gallons (300 litres) per day. It removes the following hard water contaminants that may be present in the water: lead, cooper, barium, chromium, mercury, sodium, cadmium, fluoride, nitrite, nitrate, and selenium.
Additional Filter Stages	Some systems may use these additional filters below.
Stage 5	**Post Carbon Filter:** Removes objectionable tastes and odours to enhance the quality of drinking water.
Stage 6A	**Deionisation (DI) Filter:** Produces 99.99% pure water by simply attaching this convenient deionisation filter with RO unit. A convenient post RO filtration DI unit (RO/DI unit) provides crucial supplemental filtration to remove most impurities for pure polished product water. Excellent in areas with hard water.
Stage 6B	**Mineral Filter:** This filter improves the qualities of clean water by adding minerals which are necessary for proper human development and health, such as calcium, magnesium, sodium, potassium and others readily found in many natural mineral waters.
Stage 6C	**Ultraviolet Water Steriliser:** Ultraviolet light (UV), a natural part of sunlight is widely accepted as a reliable, efficient & environmentally friendly solution for water disinfection. The UV lamp destroys 99.99% of bacteria and viruses.

Reversed osmosis filter systems might be too expensive for some parts of the world. They also need a power supply (pump) if the water pressure is too low and should not be used for water which is over 45°C (113°F). The filter system should not be frozen and an ideal water pressure should be provided. The three pre-filters should be changed every 6 months depending on water quality.

25 Hydrogen Peroxide

Hydrogen peroxide (H2O2), a colourless water-like liquid, is one of the most versatile, reliable and environmentally friendly oxidising agents. The relative safety and simplicity of its uses has led to the development of a number of applications in water treatment such as odour removal, disinfection or metal removal. Hydrogen peroxide is also used in advanced oxidation processes (AOP) and can be combined with catalysts or other oxidisers to produce reactive oxygen species (ROS) able to attack a wide range of organic compounds and microorganisms. The production of hydrogen peroxide is usually performed at industrial scale but can also be done directly in drinking water (or pre-treated wastewater) by electrolysis.

Overview	**Working Principle** H2O2 s breaks down (spontaneously or with a catalyst) into water producing reactive species that react with microorganisms and pollutants	**Capacity/Adequacy** Relatively high-tech equipment required for "catalysed" H2O2 treatments	**Performance** High efficiency	**Costs** Relatively high operation costs for "catalysed" H2O2 treatments	**Self-Help Compatibility** Engineers are required for the design
	O&M Continuous input of H2O2 required	**Reliability** Reliable if the treatment is designed according to each application	**Main Strength** Very versatile and environmentally compatible oxidising agent	**Main Weakness** Continuous input of H2O2 required	

Advantages	• Destroys toxic organic compounds without pollution transfer to another phase	• Does not produce harmful residues	• Can be combined with catalysts and other oxidisers	• Works for water disinfection (destruction of microorganisms)	• Efficient in treating almost all organic pollutants and in removing some toxic metals
Disadvantages	• Relatively high operation costs due to input of H2O2	• Engineers, additional power and/or chemicals are required for the design of "catalysed" H2O2 treatment systems			

Hydrogen Peroxide
Hydrogen peroxide (H2O2) is a powerful oxidiser that decomposes into an environmental compatible product (water and oxygen). H2O2 is formed under the action of sunlight in natural surface waters due to the presence of natural organic constituents. This mechanism contributes to water purification within the environment. H2O2 is widely used as a bleaching agent for paper and textiles as well as in industrial applications to manufacture or process products. H2O2 can be used for water treatment alone or combined with UV light, a catalyst and/or other oxidants like ozone (see also ozonation). The hydrogen peroxide-based processes are versatile and can treat organics, microbial contamination as well as some inorganic compounds. H2O2-based treatments can be used both for drinking water purification (e.g. to remove bacteria, odour, micropollutants, etc.), and for municipal or industrial wastewater treatment (effluent disinfection, organics degradation, see also advanced oxidation).

Process
The active part of hydrogen peroxide is the peroxide group, which is an oxidant similar to ozone (see ozonation) or chlorine (see chlorination). When dissolved in water, H2O2 spontaneously breaks down into water and oxygen. This decomposition leads to the formation of reactive oxygen species (ROS), which can oxidise certain organics and metal ions and can also kill pathogens. Optimisation of conditions using H2O2 to destroy these pollutants can involve control of pH, temperature and reaction time. No additional additives are required.

"Catalysed" Hydrogen Peroxide
H2O2 can be used in combination with catalysts: UV light and/or other oxidants. The UV light allows the production of an oxidising agent (ROS) called hydroxyl radical (.OH). .OH is one of the strongest oxidants known, much more efficient than hydrogen peroxide alone and is therefore much more efficient in killing microorganisms and degrading organics in water.

H2O2 + UV light --> 2 .OH

Another way of generating hydroxyl radical from H2O2 is the use of a catalyst. The use of iron ions as a catalyst is a common approach and is referred to as Fenton process.

Fe2+ + H2O2 --> Fe3+ + OH- + .OH

This reaction is enhanced by the use of solar light (photo-Fenton).

The addition of both hydrogen peroxide and ozone (peroxone) to wastewater accelerates the decomposition of ozone and enhances the production of hydroxyl radical.

Hydrogen Peroxide Generation
The classical manufacturing process involves the catalytic reaction of Hydrogen (H2) with atmospheric oxygen (O2) to give H2O2. Anthraquinone (Q) is used as a hydrogen carrier. Palladium catalyses the reaction between H2 and Q to create H2Q in solution. Then the solution is oxidised by blowing air producing H2O2 (H2Q + O2 --> H2O2 + Q). Hydrogen peroxide can also be produced directly in wastewater by water electrolysis using electrodes. The required oxygen can be supplied by transfer from the atmosphere.

Cost Considerations
Costs depend on the specifics of the requirement (e.g. H2O2 strength and grade, volume per year, packaging and delivery volumes, and location/proximity to production plant, etc.). For large amounts of technical grade 30% H2O2, the price is roughly a few dollars per kg.

Applicability
The strong oxidising power of H2O2 makes it suitable for the destruction of a variety of pollutants such as bacteria, toxic organic compounds and some metals. The process has many applications in drinking water production: taste and odour control, hydrogen sulphide removal, metal removal, ozone enhancement and disinfection. H2O2has also been used for many years to degrade organics in industrial or municipal wastewater. It can also be used for the disinfection of wastewater treatment plants. When H2O2 is combined with UV light, catalyst or other oxidants, the resulting treatment is more efficient in destroying organics present in high strength wastewaters. When H2O2 is used on its own, the operational costs are limited to input of H2O2. In case of "catalysed" H2O2 treatments, the design is more complex and additional power and/or chemicals input is required.

26 Ozonation

Ozonation (also referred to as ozonisation) is a chemical water treatment technique based on the infusion of ozone into water. Ozone is a gas composed of three oxygen atoms (O3), which is one of the most powerful oxidants. Ozonation is a type of advanced oxidation process, involving the production of very reactive oxygen species able to attack a wide range of organic compounds and all microorganisms. The treatment of water with ozone has a wide range of applications, as it is efficient for disinfection as well as for the degradation of organic and inorganic pollutants. Ozone is produced with the use of energy by subjecting oxygen (O2) to high electric voltage or to UV radiation. The required amounts of ozone can be produced at the point of use but the production requires a lot of energy and is therefore costly. Ozone (O3) has been used in water treatment since the late 19th century. Today it is applied for the disinfection of drinking water, for the removal of effluents from wastewater treatment plants in a process called ozonation (or ozonisation) as well as for the degradation of organic and inorganic pollutants in wastewater (see also advanced oxidation process).

Overview	**Working Principle** Infusion of ozone, a gas produced by subjecting oxygen molecules to high electrical voltage, which reacts with microorganisms and pollutants	**Capacity/Adequacy** High tech equipment required	**Performance** High efficiency	**Costs** Relatively high operation costs	**Self-Help Compatibility** Engineers are required for the design
	O&M Continuous input of electrical power required	**Reliability** Reliable if operating conditions are scaled taking into account wastewater content	**Main Strength** Very efficient and fast method for disinfection and as a AOP	**Main Weakness** Requires complicated equipment as well as large amounts of energy and qualified operators	

Advantages	• Rapidly reacts with bacteria, viruses and protozoa over a wide pH range	• Stronger germicidal properties than chlorination	• No chemicals are added to water	• Also efficient for organics degradation and inorganics removal	• Removes colour, taste and odour
Disadvantages	• Relatively high equipment costs	• Requires large amounts of energy	• Qualified professionals required for design and system maintenance	• Formation of potentially harmful disinfection by-products (DBPs) in the case of brome existence in water	• No residual effect is present in the distribution system
	• Potential fire hazard and toxicity associated with ozone generation				

Disinfection with Ozone
Ozone is an excellent disinfectant and can even be used to inactivate microorganisms such as protozoa, which are very resistant to conventional disinfectants. However, ozone is an unstable gas that transforms to oxygen hence no residual disinfection effect takes place with ozonation.

Degradation of Pollutants
Ozonation is an efficient treatment to reduce the amounts of micropollutants released in the aquatic systems by wastewater treatment plants. Although no residual by-products are generated by ozone itself, some concerns are raised regarding oxidation by-products when water containing both organics and ions, such as bromide, iodide and chlorine ions, are treated with ozonation. A typical ozonation system consists of an ozone generator and a reactor where ozone is bubbled into the water to be treated.

Ozone Effect
The effectiveness of ozone results from its powerful oxidising effect on chemicals and microorganisms caused by the generation of reactive oxygen species during ozone transformation to oxygen. Ozone directly attacks the surface of microorganisms and destroys their cell walls. The cells thus loose their cytoplasm and can no longer reactivate themselves. Ozone can induce an oxidative degradation of many organics and leaves more biodegradable compounds. Besides, ozone can oxidise metallic ions such as Fe(II), Mn(II) or As(III) producing insoluble solid oxides that can be easily separated from water by filtration or sedimentation.

Ozone Production
Because of its relatively short half-life, ozone is generated on-site by an ozone generator. The conventional ways to produce ozone are UV-light and corona-discharge. Ozone generation by corona-discharge is most common nowadays and has many advantages such as longer lifespan of the unit, higher ozone production and higher cost efficiency. Production with UV-light is an option where only small amounts of ozone are required. Other ozone generators that are available involve electrolysis of water and the use of membranes. With this method, the ozone is dissolved in the process water as soon as it is formed resulting in ozonation using minimum equipment.

Technical Aspects
Whilst ozone is the most effective disinfectant overall and is more effective than chlorine in inactivating viral agents, there are significant disadvantages to its use. Ozone does not provide residual protection against recontamination during distribution and as ozone affects biological stability, it may encourage re-growth of bacteria. However, given the concerns about the use of chlorine in many countries because of the formation of toxic disinfection by-products (DBP), the use of ozone is increasingly investigated and the lack of residual may be dealt with by employing regular booster ozonation during distribution.

Cost
The cost of ozone disinfection systems depends on the manufacturer, the site, the capacity of the plant, and the characteristics of the wastewater to be disinfected. Ozonation costs are generally high in comparison to other disinfection techniques. For the removal of micropollutants in wastewater, the additional operation costs for ozonation combined with sand filtration are around 3-4 Swiss cents/m3.

Operation
Ozone generation uses a significant amount of electrical power. Constant attention must thus be given to the system to ensure that power is available. Moreover, ozone should not be released from the system and connections in or surrounding the ozone generator should not be leaking. The operator must monitor the appropriate subunits on a regular basis to ensure that they are not overheated. Therefore, the operator must check for leaks routinely since a very small leak can cause unacceptable ambient ozone concentrations.

Health
There are significant health and safety concerns for operators regarding the production and application of ozone. However, far less is known about ozonation and the effect of ozone on human health. There are also concerns regarding by-product formation during the disinfection of drinking water containing bromide ions.

Applicability
Ozonation has been successfully applied for water disinfection and can kill most bacteria viruses and protozoa. However, there is no residual disinfection effect and ozonation is more expensive than chlorination. Ozonation is a suitable process to degrade organic pollutants (e.g. for micropollutants removal and landfill leachate pre-treatment) and oxidise metallic ions (e.g. iron manganese). Design and construction needs skilled staff and high-tech equipment. Sophisticated generators consuming high-amounts of electricity are required to produce ozone. Although operation and maintenance costs are relatively low, precise monitoring and dosing adjustment of ozone is needed to ensure the efficiency of the treatment.

27 Solar Desalination

Solar desalination is a technique to produce water with a low salt concentration from sea-water or brine using solar energy.

WATER Purification Methods Electrodialysis

28 Electrodialysis Desalination

Electrodialysis is a membrane-based process involving transport of ions through semipermeable membranes using an applied electric field. The applications employing electrodialysis include desalination, table salt production, wine stabilization, whey demineralization, and pickling bath recovery. The process involves an electrodialysis cell in which the feed stream and the permeate stream are separated by polyelectrolyte membranes. Electrodialysis is quite unique among practical desalination processes since it literally desalts the feed source, whereas other processes actually remove pure water. ED is a membrane process utilizing charge-selective membranes and is pressure-based, like RO.

Electrodialysis (ED) was the first commercialized membrane-based desalination technology. It currently serves a relatively small percentage of the drinking water industry having been displaced by the preferential adoption of RO.

29 Ion Exchange

Ion exchange is a water treatment method where one or more undesirable ionic contaminants are removed from water by exchange with another non-objectionable, or less objectionable ionic substance. Both the contaminant and the exchanged substance must be dissolved and have the same type of electrical charge (positive or negative). A typical example of ion exchange is a process called "water softening" aiming to reduce calcium and magnesium content. Nevertheless, ion exchange is also efficient in removing toxic metals from water.

Overview	**Working Principle** Undesirable ionic contaminants are removed from water by exchange with another non-objectionable, or less objectionable ionic substance.	**Capacity/Adequacy** Relatively simple technology.	**Performance** Efficient technology to remove ionic substances from water and to soften water.	**Costs** Relatively low costs.	**Self-Help Compatibility** Monitoring is necessary to manage the regeneration process.
	O&M Ion exchange resin must be regenerated regularly.	**Reliability** Reliable if ion exchange resin regenerated properly.	**Main Strength** Efficient to remove dissolved inorganics.	**Main Weakness** Do not remove particles or bacteria.	

Advantages	• One of the most appropriate technologies to removes dissolved inorganic ions effectively	• Possibility to regenerate resin	• Relatively inexpensive initial capital investment
Disadvantages	• Does not remove effectively bacteria	• High operation costs over long-term	• The process of regenerating the ion exchange beds dumps salt water into the environment (regeneration)

Introduction
In 1850, Thomas and Way performed some of the first scientific research that indicated the existence of an ion exchange process. In their experiment, a solution of ammonium sulphate was passed through soil. The filtrate collected was composed of calcium sulphate instead of ammonium sulphate. The importance of this discovery (in ion exchange terms) was not fully understood until later in that decade, when it was found that this reaction was reversible. Ion exchange was then primary used to soften water. The presence of calcium and/or magnesium in water results in water being considered "hard". Calcium and magnesium ions in water react with heat, metallic plumbing and chemical agents such as detergents to decrease the effectiveness of nearly any cleaning task. Hard water can be softened using an ion exchange softening process. Ion exchange processes can also remove various charged atoms or molecules (ions) such as nitrates, fluoride, sulphates, perchlorate, iron and manganese ions as well as toxic metals (radium, uranium, chromium, etc.) from water. The most typical application of ion exchange is the preparation of high purity water for industrial applications, water softening, recovery or removal of metals in the chemical industry.

Ion Exchange Resins
Synthetic and industrially produced ion exchange resins consist of small, microporous beads that are insoluble in water and organic solvents. The most widely used base-materials are polystyrene and polyacrylate. The diameter of the beads is in the range of 0.3 to 1.3 mm. The beads are composed of around 50% water, which is dispersed in the gel-structured compartments of the material. Since water is dispersed homogenously throughout the bead, water-soluble materials can move freely in and out. To each of the monomer units of the polymer, so called "functional groups" are attached. These functional groups can interact with water-soluble species, especially with ions. Ions are either positively charged (cations) or negatively charged (anions). Since the functional groups are also charged, the interaction between ions and functional groups is exhibited via electrostatic forces. Positively charged functional groups interact with anions and negatively charged functional groups interact with cations. The binding force between the functional group and the attached ion is relatively weak. The exchange can be reversed by another ion passing across the functional group. This process can be repeated continually, with one exchange reaction following another.

Ion Exchange Process
The main component of ion exchange equipment is a microporous exchange resin, which is supersaturated with a loosely held solution. For water softening, this is usually done with sulfonated polystyrene beds that are supersaturated with sodium to cover the bed surface. As water passes through this resin bed, ions attach to the resin beads releasing the loosely held solution into the water. After a time, the beds become saturated and the exchange resin must be regenerated or recharged. To regenerate, the ion exchange resin is flushed with a salt brine solution. The sodium ions in the salt brine solution are exchanged with the ions, which are flushed out with wastewater.

Operation
Maintenance of water softening equipment is somewhat dependent on the type of softener. Some degree of monitoring or managing the regeneration process is generally required. Adequate backwashing of the resin bed is important to ensure the regeneration of the unit. However, regeneration creates wastewater.

Costs
The costs for ion exchange systems are very variable depending on scale and region. Moreover, costs depend on pre-treatment requirements, discharge requirements and utilisation.

Health Aspects
People on restricted sodium diets due to health reasons should account for increased intake through softened water. Drinking and cooking with softened water is often avoided by having a cold water line to the kitchen tap that bypasses the water softener. This provides hard water for drinking cooking and other uses. It is not recommended to repeatedly use softened water for plants, lawns or gardens due to the sodium content.

Applicability
The most common applications of ion exchangers are water softening (remove calcium and magnesium ions), water demineralisation (removal of all ions), and de-alkalisation (removal of bicarbonates). Cation exchange resins can also remove most positively charged ions in water such as iron, lead, radium, barium, aluminium and copper among others. Anionic exchange units can remove nitrate, sulphate, and other negatively charged atoms (called anions). Researchers are developing resins to selectively remove nitrate more efficiently than can currently be done. Ion exchangers are also used to remove or recover metal ions from wastewater in the chemical industry. Some contaminants (such as arsenic, fluoride, lithium ions) are difficult to remove with ion exchange due to a poor selectivity of the resins. Ion exchangers are also used to remove or recover metal ions from wastewater in the chemical industry. Some contaminants (such as arsenic, fluoride, lithium ions) are difficult to remove with ion exchange due to a poor selectivity of the resins.

30 Geothermal Desalination

Geothermal desalination is a process under development for the production of fresh water using heat energy.

31 Freezing Desalination

Freeze-thaw desalination uses freezing to remove fresh water from salt water.

32 Advanced Oxidation Processes

Hazardous organic waste, widely spread in water by industrial, military and domestic sources, is an emerging issue. Advanced Oxidation Processes (AOPs) are efficient methods to remove organic contamination not degradable by means of biological processes. AOPs are a set of processes involving the production of very reactive oxygen species able to destroy a wide range of organic compounds. AOPs are driven by external energy sources such as electric power, ultraviolet radiation (UV) or solar light, so these processes are often more expensive than conventional biological wastewater treatment. Moreover, AOPs can be applied for the disinfection of water, air and for remediation of contaminated soils.

Overview	**Working Principle** Production of reactive oxygen species able to destroy toxic compounds and biologic contamination in water.	**Capacity/Adequacy** High-tech equipment required.	**Performance** High efficiency except for few chemicals	**Costs** High operation costs	**Self-Help Compatibility** Engineers are required for the design
	O&M Generally continuous supply of chemicals (ozone, H2O2…) required	**Reliability** Reliable if operating conditions are scaled taking into account wastewater content	**Main Strength** Destroys almost all organics without pollution transfer to another phase	**Main Weakness** Operation costs	

Advantages	• Destroys toxic organic compounds without pollution transfer to another phase	• Very efficient to treat almost all organic pollutants and remove some toxic metals	• Works also for water disinfection	• Cheap to install	• Adaptable to small scales in developing countries
Disadvantages	• Relatively high operation costs due to chemicals and/or energy input	• Formation of oxidation intermediates potentially toxic	• Engineers are required for the design and often also for operation	• Emerging technologies (still a lot of research is required)	

Introduction
Advanced Oxidation Processes (AOPs) refer to a set of oxidative water treatments that can be used to treat toxic effluents at industrial level, hospitals and wastewater treatment plants. AOPs are successful to transform toxic organic compounds (e.g. drugs, pesticides, endocrine disruptors etc.) into biodegradable substances. AOPs in general are cheap to install but involve high operating costs due to the input of chemicals and energy required. To limit the costs, AOPs are often used as pre-treatment combined with biologic treatment. Advanced oxidation was recently also used as quaternary treatment or a polishing step to remove micro-pollutants from the effluents of municipal wastewater treatment plants and for the disinfection of water. The combination of several AOPs is an efficient way to increase pollutant removal and reduce costs.

Examples of AOPs
Many methods are classified under the broad definition of AOPs. The table shows some of the most studied processes. Advanced oxidation generally uses strong oxidising agents like hydrogen peroxide (H_2O_2) or ozone (O_3), catalysts (iron ions, electrodes, metal oxides) and irradiation (UV light, solar light, ultrasounds) separately or in combination under mild conditions (low temperature and pressure). Among different available AOPs, those driven by light seem to be the most popular technologies for wastewater treatment as shown by the large amount of data available in the literature (STASINAKIS 2008). Solar AOPs are particularly attractive due to the abundance of solar light in regions where water scarcity is high and due to their relatively low costs and high efficiencies.

Dark AOP
- Ozone (O_3)
- Fenton (Fe^{2+} + H_2O_2)
- Electrolysis (electrodes + current)
- Sonolysis (Ultrasounds)

Light Driven AOP
- Photolysis (UV + H_2O_2)
- Photocatalysis (light + catalyst)
- Photo-Fenton (solar light + Fenton)

AOP Mechanism
Advanced oxidation involves several steps schematised in the figure below and explained as follows:

1	Formation of strong oxidants (e.g. hydroxyl radicals).
2	Reaction of these oxidants with organic compounds in the water (KOMMINENI et al. 2008) producing biodegradable intermediates.
3	Reaction of biodegradable intermediates with oxidants referred to as mineralisation (i.e. production of water, carbon dioxide and inorganic salts).

Strategies to Implement AOPs
The costs of AOPs are relatively high and directly related to the efficiency and operational time of the processes. It is therefore worth optimising implementation of AOPs at the right place to limit costs. Several strategies were found to achieve this:
- Simultaneous application of different AOPs promotes the rates of organics oxidation. Typical examples include UV/H_2O_2, UV/H_2O_2/TiO_2, UV/Fenton and Ultrasound/UV/TiO_2, among others. These types of combinations may lead to synergetic effects when treatment efficiencies are greater than the sum of efficiencies that could be achieved by the individual treatments alone.
- Sequential application of various AOPs can treat effluents containing a mixture of organics. This approach is useful when the compounds in the mixture present different levels of reactivity towards different AOPs.
- Application of separation treatment prior to AOP treatment to transfer pollutants to another phase so that they can be treated more easily. Such separation treatment includes stripping, coagulation-flocculation, sedimentation, filtration, adsorption etc.

- AOPs can be applied in pre-treatment stage to enhance biodegradability and to reduce toxicity followed by biological post-treatment. This approach is based on the fact that biological treatment is perhaps less costly and more environmentally friendly than other destructive treatments and that complete mineralisation by AOPs incurs excessive treatment costs.
- AOPs can be installed at different stages of waste (and also drinking) water treatment plants depending on influent composition and desired effluent quality. AOPs can be installed either as tertiary treatment after the biological (secondary) treatment of wastewater, or as pre-treatment stage in order to enhance the biodegradability of trace organic contaminants.

Applicability
AOPs have a wide range of applications such as air (odour elimination, purification), soil (remediation) and water decontamination. In water, these processes have the ability to destroy organic pollutants but they can also be adapted to the removal of inorganic metals. Furthermore AOPs are successful to inactivate bacteria, viruses etc. Different kinds of water are therefore suitable for an AOP treatment: for example industrial wastewater containing toxic compounds can be treated by solar photo-Fenton; surface or ground water can be disinfected by means of improved solar water disinfection by adding H_2O_2 (see also H_2O_2 and SODIS); both bacteria in drinking water plants or micro-pollutants in sewage systems can be degraded using ozonation; Dissolved arsenic can be removed from water by co-precipitation by means of simple methods in presence of iron.

5 Water Storage

Already treated or purified water has to be stored properly to prevent recontamination. Safe storage means keeping your treated water away from sources of contamination, and using a clean and covered container. It also means that drinking from the container should be done in a way that cross-contamination can be avoided. The container should prevent hands, cups and dippers from touching the water, so that the water does not get recontaminated. There are several possibilities to store water. They range from very small covered buckets to large tanks or cisterns. Another possibility is to store water in bottles. Furthermore, the hygienic conditions in a household are crucial. Good hygienic measures include the following.

- Careful storage of household water and regular cleaning of all household water-storage facilities.
- Construction, proper use, and maintenance of latrines.
- Regular hand washing, especially after defecation and before eating, preparing food or handling drinking water.
- Careful storage and preparation of water and food.

Treated water should be stored in plastic, ceramic, or metal containers especially when using treatment options that do not leave residual protection. The following characteristics of containers serve as physical barriers to recontamination.

- A small opening with a lid or cover that discourages users from placing potentially contaminated items such as hands, cups, or ladles into the stored water.
- A spigot or small opening to allow easy and safe access to the water without requiring the insertion of hands or objects into the container.
- A size appropriate for the household water treatment method, with permanently attached instructions for using the treatment method and for cleaning the container.

The following aspects should be considered when planning for safe storage and prevention of recontamination. The water storage container must be covered and only used for treated water.
- Location of storage vessel
- Design of storage vessel
- Removal of water

Containers

Container Types

These are the different plastic types ordered by resin identification code. This code is the number printed onto any plastic items which is surrounded by a recycle icon. They are generally pretty easy to spot and can help identifying what that plastic can be used for.

Plastic Type	Use	Notes & Safety	Water Storage	Food Storage
Plastic #1 - PET Polyethylene Terephthalate (PET)	Water, juice and soft drink bottles	Considered safe but PET can leach metal antimony. The longer it sits on a shelf - the greater the dose present based on factors like sunlight, temperature and pH level.	Shouldn't use for water storage	Safe for food storage
Plastic #2 - HDPE High Density Polyethylene (HDPE)	Milk, water, juice bottles, shampoo containers, cereal liners and grocery bags	Has been found to release estrogenic chemicals which can disrupt hormones and alter cell structure. Can contain the common plastic toxin BPA.	Safe for water storage	Safe for food storage
Plastic #3 - PVC Polyvinyl Chloride (PVC)	Bags for bedding, shrink wrap, deli and meat wrap, plastic toys, plastic flooring, table cloths and medication blister packs	Contains toxins like DEHP which is a plastic softener. Linked to allergies, asthma and autism.	Avoid for water storage	Avoid for food storage
Plastic #4 - LDPE Low Density Polyethylene (LDPE)	Bread bags, newspapers, fresh produce, household garbage, frozen food, paper milk cartons, hot + cold beverage cups	Does not contain BPA but may leach other estrogenic chemicals.	Safe for water storage	Shouldn't use for food storage
Plastic #5 - PP Polypropylene (PP)	Yoghurt containers, plastic ware, deli foods, medications and take-out meals	High heat tolerance making it unlikely to leach chemicals.	Safe for water storage	Safe for food storage
Plastic #6 - PS Polystyrene (PS)	Cups, bowls, take-out containers and meat trays	Known to leach styrene which can damage nervous system and is linked to cancer. Heating PS releases more chemicals faster.	Avoid for water storage	Shouldn't use for food storage

Plastic #7 - Other Other	Sauce bottles, condiment bottles, babies' feeding bottles, infants' drinking cups, reusable water bottles	Usually often contains BPA or BPS which are endocrine disruptors.	Avoid for water storage	Avoid for food storage
Tritan - Nalgene Nalgene Bottles	Water Bottles	Categorized as Plastic #7 Contains no BPS, BPA or estrogen.	Safe for water storage	?

Portable Containers (1-5 Litres)

These are bottles or other containers that are used to transport small quantities of water and can easily fit in a backpack.

Water Bottle	Water bottles can hold any amount of water, but typically from 200ml to 2L. Consider the weight of the bottle when purchasing it as it could add quite a lot of additional weight you don't need. Be sure that the bottle is strong enough to last weeks or months depending on your situation and choose a size based on your location. (Larger for desert areas)
Flexible Water Bottle	Flexible bottles range from 1L to 10L. Flexible water bottles are light bottles that can be folded to a compact size when empty to save pack space.
Water Bladder	Water bladders typically hold between 1-10L of water. Bladders are used in backpacks and often have a sipper function that lets you drink from them while hiking without hands.

Semi-Portable Containers (5-100 Litres)

These containers are larger than bottles and are often bought from camping shops letting you fill them from home. These containers are better for longer trips without access to clean water and can be used for showering as well. Typically they come in either blue or white plastics to make it easier to identify the contents.

Fixed Containers (100+ Litres)

Fixed containers are not easily portable containers (once filled) that contain large amounts of water

Water Tanks	**Rigid Water Container** ○	**PVC Water Holder** ○			

Water Towers

Water towers can be made of concrete or steel and can take various forms. The most suitable form for concrete towers is a cylinder with a curved shaped bottom or with a flat bottom. Steel tanks may have a spherical or dome shaped bottom. The shape chosen is usually a compromise between function, construction and maintenance costs, as well as aesthetics. The lowest water level in the tank is determined according to the pressure requirements in the pipeline. The pressure in the pipelines may vary depending on the type of community and pressure needs of different areas in a city. To keep pumping costs low, water depth in the tank is generally kept small. Due to structural considerations, the depth is kept equal to the diameter.

Storing

Tips on how to store water in containers and how to store the containers.

Water Storage Tips	Containers must not contain BPA and only have been used to store water. Airtight containers prevent bacteria growing. Treat water with chlorine or colloidal silver before storing and again after storage. Check for contamination before drinking stored water. Water becomes flat over time, shake it to reoxygenate it. Ensure a tight seal and that barrels aren't stored on cement which can leak chemicals. Hard containers should resist 5 drop tests full of water from 2m high, flexible containers should resist two drops from 2 metres (6ft) high. Don't use recycled plastics for long term water storage.
Storage Life	

Using Stored Water

These are tips on using water that has been stored for a long time.

- Check the smell of the water. If there's still a slight chlorine smell then it's most likely still good for drinking straight away.
- If there's no smell and it still looks pure, it would be best to put a few purification tablets and stir them in.
- If there is fouling of the water or a bad smell when you open the container, you should re-filter it and add some purification tablets - more than you would in the last step.

In all cases you should shake the water container to 're-oxygenate' it.

6 Water Purity

In many parts of the world, water is not safe enough to drink. There are basic qualitative observations that quickly determine if water is not safe to consume. However, there are also many “invisible” substances that must be tested for professionally to identify the contaminants and to figure out how the specific polluted water can be purified. Testing can be done in the field with portable test kits or mobile laboratories. Water samples can also be collected and sent to a professional laboratory.

Drinking water can come from different sources depending on where we live in the world. Three sources that are used to collect drinking water are: ● Groundwater ● Surface water ● Rainwater	Water is in continuous movement on, above, and below the surface of the earth. As water is recycled through the earth, it picks up many things along its path. Water quality will vary from place to place, with the seasons, and with the various kinds of rock and soil it moves through. For the most part, it is largely natural processes that affect water quality. For instance, water moving through underground rocks and soils may pick up natural contaminants, even with no human activity or pollution in the area. In addition to nature's influence, water is also polluted by human activities, such as open defecation, dumping garbage, poor agricultural practices, and chemical spills at industrial sites. When considering drinking water quality, microbiological contamination is the main concern in most cases since it is responsible for the majority of illnesses and deaths related to drinking unsafe water.

Even though water may be clear, it does not necessarily mean that it is safe for us to drink. It is important for us to judge the safety of water by taking the following three qualities into consideration (see also pathogens and contaminants): **1. Microbiological** – bacteria, viruses, protozoa, and worms **2. Chemical** – minerals, metals and chemicals **3. Physical** – temperature, colour, smell, taste and turbidity	Safe drinking water should have the following microbiological, chemical and physical qualities: ● Free of pathogens ● Low in concentrations of toxic chemicals ● Clear ● Tasteless and colourless (for aesthetic purposes)

Qualitative Observations

The first step to check water quality can be done by very simple observations:

Water Observation	Possible Contaminants
Foamy or Bubbly	Detergents
Black in colour	Manganese, bacterial growth
Brown, yellow or reddish in colour	Iron
Dark brown or yellow in colour	Tannins and pigment from leaves and bark
White deposits or scale	Hardness, dissolved metals
Earthy, fishy, muddy, peaty odour	Organic matter, algae, bacteria
Rotten egg odour	Hydrogen sulphide
Chlorine odour	Chlorine residual from water treatment process
Bitter or metallic taste	pH, zinc, copper

Portable Testing Kits
Analyses for many physical, chemical and microbiological contaminants can be carried out in the field or in a temporary laboratory using specifically designed products that are portable and relatively easy to use. A significant advantage of field analysis is that tests are carried out on fresh samples whose characteristics have not been contaminated or otherwise changed as a result of being stored and transported over long distances. Portable water quality test kits should have the following characteristics:

● Easy to use with simple instructions
● Small and easy to transport
● No restrictions on air transport
● Fast results
● Limited requirement for distilled or deionised water
● Dilution not necessary

● Does not require calibration
● Robust (limited effects from UV light, shock, humidity or temperature)
● Can test several parameters
● Easy to repair or replace
● Limited consumables or consumables are easy to obtain

Inorganic Contaminants

Below is a list of some harmful inorganic contaminants in drinking water and their potential health effects.

Contaminant	MCL (Maximum Contaminant Level)	Potential Health Effects from Long-Term Exposure Above the MCL (Unless specified as short-term)
Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar
Arsenic	0.01	Skin damage or problems with circulatory systems, and may increase the risk of getting cancer
Barium	2	Increase in blood pressure
Beryllium	0.004	Intestinal lesions
Cadmium	0.005	Kidney damage
Chromium (total)	0.1	Allergic dermatitis
Copper	1.3	Short term exposure: gastrointestinal distress
Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems
Fluoride	4	Decreased IQ and cognitive ability; Bone disease (pain and tenderness of the bones); children may get mottled teeth
Lead	0.015	Infants and children: delays in physical or mental development; children could show slight deficits in attention span and learning abilities
Mercury (inorganic)	0.002	Kidney damage
Nitrate (measured as nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome
Nitrite (measured as nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome
Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems
Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems

Water Testing

How to test water for pH, turbidity, chlorine, bacteria, viruses, dissolved compounds etc.

Faecal Coliform Count

Measures the concentration of total coliform bacteria associated with the possible presence of disease causing organisms.

Turbidity Test

Measures the amount of suspended matter in a water supply.

Chlorine and pH Test

Measures the amount of chlorine and pH levels in the water.

Conductivity

By touching the negative and positive leads of a voltmeter that is on in the resistance setting allows you to measure the conductivity of water, a test of its purity. When water conducts electricity, it is made possible by water impurities such as metal and salt.

Materials
- Voltmeter / Multimeter
- Battery
- Wire
- Water Sample

Method
Pour the water into a container. Turn on the voltmeter and connect the battery to the corresponding electrical lead based on which end you've connected. Take note of the voltage. Then place the wire on the positive end of the battery with the voltmeter's negative end on the negative side of the battery. Dip the batteries wire and the positive voltmeter end into the water read the measurement.

Example Measurements
Battery - 1.57v - 100%
Sea Water - 0.6v - 38%
Tap Water - 0.146v - 9.29%
Distilled Water - 0.0059v - 0.37%
Bottled Water - 0.0046v - 0.29% - Very Pure Water

The higher the voltage the less pure the water is. Temperature should also be accounted for in the measurement, as this drastically changes the conductivity.

In standard water (such as tap water) the conductivity result will change by around 2% per °c change. In deionised water the effect of temperature is amplified, and can reach as high as 10% per °c change.

Chemical Tests

Chemical tests such as litmus paper tests which tests the pH of the water.

pH Ranges

Potential Hydrogen
pH or Potential of Hydrogen measures the acidity or basicity of an aqueous solution in moles/L of Hydrogen atoms. Solutions with a pH less then 7 are acidic and solutions with a pH greater then 7 are basic.

Range 0-3
- Battery Acid (-0.2)
- Gastric Fluid (1.2)
- Lemon Juice (2.2)
- Carbonated Drinks (2.5)
- Vinegar (3.0)

Range 3-6
- Orange Juice (3.6)
- Beer (4.3)
- Black Coffee (4.9)
- Pure Rain (5.6)
- Egg Yolk (5.6)

Range 6-9
- Milk (6.6)
- Distilled Water (7)
- Blood (7.4)
- Seawater (8)
- Baking Soda (8.2)

Range 9-12
- Milk of Magnesia (10.6)
- Ammonia (11.4)

Range 12-15
- Bleach (12.7)
- Lye/Caustic Soda (13.6)

Inorganic Materials

A list of the inorganic materials commonly found in water in (MCL/(mg*L-1).

Antimony - 0.0006
Arsenic - 0.01
Barium - 2
Beryllium - 0.004
Cadmium - 0.005

Chromium (total) - 0.1
Copper - 1.3
Cyanide - 0.2
Fluoride - 4
Lead - 0.015

Mercury - 0.002
Nitrate - 10
Nitrile - 10
Selenium - 0.05
Thallium - 0.002

Turbidity

NTU stands for Nephelometric Turbidity Unit. Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.

Fluids can contain suspended solid matter consisting of particles of many different sizes. While some suspended material will be large enough and heavy enough to settle rapidly to the bottom of the container if a liquid sample is left to stand (the settable solids), very small particles will settle only very slowly or not at all if the sample is regularly agitated or the particles are colloidal. These small solid particles cause the liquid to appear turbid.

NTU	Level	Description
0-5	**No identifiable matter in the bottle**	Crystal clear water, recommended turbidity level prior to consumption. The only NTU level safe for UV sterilization.
6-24	**Between 10-20% reduced visibility through a standard Nalgene bottle**	Slight Turbidity, drinkable but filtering below 10 NTU is preferred. Boiling highly recommended.
25-50	**Between 20-50% reduced visibility through a standard Nalgene bottle**	Minor Turbidity, drinkable but filtering is preferred. Boiling essential.
50-100	**Between 50-90% reduced visibility through a standard Nalgene bottle**	Some Turbidity, drinkable but filtering is highly preferred. Distillation Preferred.

100-150	**90-100% Opaque liquid in a standard Nalgene bottle**	Fair Turbidity, not drinkable without filtration. Distillation Essential.
150-300	**100% Opaque liquid in a standard Nalgene bottle**	Moderate Turbidity, filtering through a good filter will correct it easily. Boiling not recommended - find alternative water. Distillation Essential.
300-500	**Fingers disappear if hand put in up to wrist**	Moderate Turbidity, filtering through a shirt will reduce it easily. Distillation Essential.
500-1000	**Fingernail disappear if a whole finger is put in**	High Turbidity, recommended filtering through a high quality filter. Distillation Essential.
1000-2000	**Fingernail disappears if immersed up to the first finger joint**	Extreme Turbidity, recommended filtering through a high quality filter. Distillation Essential.
2000+	**Anything disappears almost instantly**	Insane Turbidity, recommended filtering through a high quality filter. Distillation Essential.

Treating Turbid Water

Flocculation / Coagulation
Use Aluminium Sulphate, Ferric Chloride, Gypsum or Poly-Aluminium Chloride as a coagulation agent to drop suspended particles to the bottom. Coagulation will remove about 95.6% of turbidity from the water based on variables. Filtering through a fine medium such as an item of clothing will reduce the turbidity a little.

7 Water Resistance

Information on water resistance and types of waterproofing.

Water Resistance

Water resistance is an important fact to consider when you're going to be immersed in water or walking in rain. It measures the resilience of gear to liquids and how long they can survive immersion. Generally it applies to mobile phones and watches. Watches are often classified by watch manufacturers by their degree of water resistance which, due to the absence of official classification standards, roughly translates to the following (1 metre ≈ 3.29 feet). These vagueries have since been superseded by ISO 22810:2010, in which "any watch on the market sold as water-resistant must satisfy ISO 22810 – regardless of the brand.

Resistance Types

Depth Rating
Terms such as “water resistant to 50 meters” or “water resistant to 200 meters” indicate that the watch can be worn underwater to various depths but it can be misleading. Generally a watch used for water sports and swimming should have at least 100m (10bar) water resistance.

Bar Rating
The bar is a metric unit of pressure, but is not approved as part of the International System of Units (SI). It is defined as exactly equal to 100,000 Pa, which is slightly less than the current average atmospheric pressure on Earth at sea level.

1 Bar Approximately Equals
- 0.987 ATM
- 14.5038 PSI Absolute
- 29.53 inHg
- 750.06 mmHg
- 750.06 Torr
- 1,019.72 centimetres of water (cmH2O).

Atmospheres (ATM)
The ATM of a watch is short for Atmospheres and is a measure of the level of water pressure a watch is designed to withhold. A higher ATM means that a watch can withhold more water pressure, whilst a lower ATM mean that it was designed to withstand less pressure.

Japanese Industrial Standard (JIS)
The Japan Industrial Standards (JIS) for water resistance uses a "0" to "8" scale to define the level of water ingress protection built into each product.

JIS Grade 0	Non-protected
JIS Grade 1	Vertically dripping water shall have no harmful effect (Drip resistant 1)
JIS Grade 2	Dripping water at an angle up to 15 degrees from vertical shall have no harmful effect (Drip resistant 2)
JIS Grade 3	Falling rain at an angle up to 60 degrees from vertical shall have no harmful effect (Rain resistant)
JIS Grade 4	Splashing water from any direction shall have no harmful effect (Splash resistant) ● Protected against solid foreign objects 1.0 mm diameter and greater.
JIS Grade 5	Direct jetting water from any direction shall have no harmful effect (Jet resistant) ● Dust protected. Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.
JIS Grade 6	Direct jetting water from any direction shall not enter the enclosure (Water tight) ● Dust tight. No ingress of dust.
JIS Grade 7	Water shall not enter the enclosure when it is immersed in water under defined conditions (Immersion resistant)

JIS Grade 8	The equipment is usable for continuous submersion in water under specified pressure (Submersible)

IP Code (Ingress Protection Marking)

Classifies and rates the degree of protection provided against intrusion (body parts such as hands and fingers), dust, accidental contact, and water by mechanical casings and electrical enclosures.

First Digit
Solid particle protection
● The first digit indicates the level of protection that the enclosure provides against access to hazardous parts (e.g., electrical conductors, moving parts) and the ingress of solid foreign objects.

Protects Against
X - No Data
0 - No Protection
1 - Objects >50 mm
2 - Objects >12.5 mm
3 - Objects >2.5 mm
4 - Objects >1 mm
5 - Dust Protected
6 - Dust Tight

Second Digit
Liquid ingress protection
● The second digit indicates the level of protection that the enclosure provides against harmful ingress of water. The ratings for water ingress are not cumulative beyond IPX6. A device which is compliant with IPX7, covering immersion in water, need not be compliant with IPX5 or IPX6, covering exposure to water jets.

Protects Against
X - No Data
0 - No Protection
1 - Dripping water
2 - Dripping water when tilted at 15°
3 - Spraying water
4 - Splashing of water
5 - Water jets
6 - Powerful water jets
6K - Powerful water jets with increased pressure
7 - Immersion, up to 1 m depth
8 - Immersion, 1 m or more depth
9K - Powerful high temperature water jets

Additional Letters
D - Wire
f - Oil resistant
H - High voltage device
M - Device moving during water test
S - Device standing still during water test
W - Weather conditions

North America (NEMA Rating)

In the USA, the National Electrical Manufacturers Association defines NEMA enclosure types in NEMA standard number 250. The following table outlines which IEC 60529 IP code each respective NEMA rating meets. Ratings between the two standards are not directly equivalent: NEMA ratings also require additional product features and tests (such as functionality under icing conditions, enclosures for hazardous areas, knock-outs for cable connections and others) not addressed by IP ratings.

NEMA / IP Code Equivalency
- 1 = IP20
- 2 = IP22
- 3, 3X, 3S, 3SX = IP55
- 3R, 3RX = IP24
- 4, 4X = IP66
- 5 = IP53
- 6 = IP67
- 6P = IP68
- 12, 12K, 13 = IP54

Resistance Equivalency

Water Resistance Rating

Depth Rating	Bar Rating	Atmospheres (ATM)	PSI	Japanese Industrial Standard (JIS)	Suitability	Remarks
Non-Water Resistant	0 Bar	0 Atmospheres	0 PSI	JIS Grade 0	Avoid direct contact with all water.	
Water Resistant (W.R) 10m-30m (32-98ft)	1-3 Bar	~1-3 Atmospheres	14.7-44.1 PSI	JIS Grade 1 JIS Grade 2 JIS Grade 3	Can withstand perspiration, face washing water drops, rain, etc., in daily life, but cannot be used for water-using works, water sports, skin diving, and other types of diving. Do not use it under conditions in which the water pressure changes sharply.	Standing at sea level, your watch is already experiencing 1 atmosphere.
30m (98ft)	3 Bar	~3 Atmospheres	44.1 PSI	JIS Grade 4 JIS Grade 5 JIS Grade 6	Suitable for everyday use. Splash/rain resistant.	Not suitable for showering, bathing, swimming, snorkelling, water related work, fishing, and diving.
50m (164ft)	5 Bar	~5 Atmospheres	73.5 PSI	JIS Grade 7	Suitable for everyday use, showering, bathing, snorkelling, water related work, fishing. Splash/rain resistant.	Not suitable for diving or swimming.
100m (328ft)	10 Bar	~10 Atmospheres	147.0 PSI	JIS Grade 8	Suitable for recreational surfing, snorkelling, sailing and water sports.	Not suitable for diving, it can be taken swimming but it's not recommended.
200m (980ft)	20 Bar	~20 Atmospheres	294 PSI	JIS Grade 8	Suitable for professional marine activity, serious surface water sports and skin diving.	Suitable for skin diving.
300m (984ft)	30 Bar	~30 Atmospheres	441 PSI	JIS Grade 8	Suitable for professional marine activity, serious surface water sports and skin diving.	Suitable for skin diving.
1,000m (3280ft)	100 Bar	~100 Atmospheres	1470 PSI	JIS Grade 8	Suitable for all the above including deep sea diving.	
2,000m (6561ft)	200 Bar	~200 Atmospheres	2940 PSI	JIS Grade 8	Suitable for all the above including deep sea diving.	
Diver's 100 m				JIS Grade 8	Minimum ISO standard (ISO 6425) for scuba diving at depths not suitable for saturation diving.	Diver's 100 m and 150 m watches are generally old(er) watches.
Diver's 200 m or 300 m				JIS Grade 8	Suitable for scuba diving at depths not suitable for saturation diving.	Typical ratings for contemporary diver's watches.
Diver's 300+ m for mixed-gas diving				JIS Grade 8	Suitable for saturation diving (helium enriched environment).	Watches designed for mixed-gas diving will have the DIVER'S WATCH xxx M FOR MIXED-GAS DIVING additional marking to point this out.

ISO 2281

The International Organization for Standardization issued a standard for water-resistant watches which also prohibits the term waterproof to be used with watches, which many countries have adopted. This standard was introduced in 1990 as the ISO 2281:1990 and only designed for watches intended for ordinary daily use and are resistant to water during exercises such as swimming for a short period. They may be used under conditions where water pressure and temperature vary; German Industrial Norm DIN 8310 is an equivalent standard.

However, whether they bear an additional indication of overpressure or not, they are not intended for submarine diving. The ISO 2281 standard specifies a detailed testing procedure for each mark that defines not only pressures but also test duration, water temperature, and other parameters. Besides this ISO 2859-2 Sampling plans indexed by limiting quality (LQ) for isolated lot inspection and ISO 2859-3 Sampling procedures for inspection by attributes – Part 3: Skip-lot sampling procedures concerning procedures regarding lot sampling testing come into play, since not every single watch has to be tested for ISO 2281 approval.

- Resistance when immersed in water at a depth of 10 cm. Immersion of the watch in 10 cm of water for 1 hour.
- Resistance to different temperatures. Immersion of the watch in 10 cm of water at the following temperatures for 5 minutes each, 40 °C, 20 °C and 40 °C again, with the transition between temperatures not to exceed 1 minute. No evidence of water intrusion or condensation is allowed.
- Resistance to water overpressure. Immersion of the watch in a suitable pressure vessel and subjecting it within 1 minute to the rated pressure for 10 minutes, or to 2 bar in case where no additional indication is given. Then the overpressure is reduced to the ambient pressure within 1 minute. No evidence of water intrusion or condensation is allowed.

- Condensation test. The watch shall be placed on a heated plate at a temperature between 40 °C and 45 °C until the watch has reached the temperature of the heated plate (in practice, a heating time of 10 minutes to 20 minutes, depending on the type of watch, will be sufficient). A drop of water, at a temperature between 18 °C and 25 °C shall be placed on the glass of the watch. After about 1 minute, the glass shall be wiped with a dry rag. Any watch which has condensation on the interior surface of the glass shall be eliminated.
- Resistance of operative parts. Immersion of the watch in 10 cm of water with a force of 5 N perpendicular to the crown and pusher buttons (if any) for 10 minutes.
- Resistance to air overpressure. Exposing the watch to an overpressure of 2 bar. The watch shall show no air-flow exceeding 50 µg/min.

- No magnetic or shock resistance properties are required.
- No negative pressure test is required.
- No corrosion test is required.

ISO 6425

The standards and features for diving watches are regulated by the ISO 6425 – Divers' watches international standard. This standard was introduced in 1996. ISO 6425 defines such watches as: A watch designed to withstand diving in water at depths of at least 100 m and possessing a system to control the time. Diving watches are tested in static or still water under 125% of the rated (water) pressure, thus a watch with a 200-metre rating will be water resistant if it is stationary and under 250 metres of static water. ISO 6425 testing of the water resistance or water-tightness and resistance at a water overpressure as it is officially defined is fundamentally different from non-dive watches, because every single watch has to be tested. Testing diving watches for ISO 6425 compliance is voluntary and involves costs, so not every manufacturer present their watches for certification according to this standard.

- Reliability under water. The watches under test shall be immersed in water to a depth of 30±2 cm for 50 hours at 18 to 25 °C and all the mechanisms shall still function correctly. The condensation test shall be carried out before and after this test to ensure that the result is related to the above test.
- Resistance to thermal shock. Immersion of the watch in 30±2 cm of water at the following temperatures for 10 minutes each, 40 °C, 5 °C and 40 °C again. The time of transition from one immersion to the other shall not exceed 1 minute. No evidence of water intrusion or condensation is allowed.
- Water-tightness and resistance at a water overpressure. The watches under test shall be immersed in water contained in a suitable vessel. Then an overpressure of 125% of the rated pressure shall be applied within 1 minute and maintained for 2 hours. Subsequently, the overpressure shall be reduced to 0.3 bar within 1 minute and maintained at this pressure for 1 hour. The watches shall then be removed from the water and dried with a rag. No evidence of water intrusion or condensation is allowed.

- Resistance of crowns and other setting devices to an external force. The watches under test shall be subjected to an overpressure in water of 125% of the rated pressure for 10 minutes and to an external force of 5 N perpendicular to the crown and pusher buttons (if any). The condensation test shall be carried out before and after this test to ensure that the result is related to the above test.
- An optional test originating from the ISO 2281 tests (but not required for obtaining ISO 6425 approval) is exposing the watch to an overpressure of 200 kPa. The watch shall show no air-flow exceeding 50 µg/min.
- Condensation test. The watch shall be placed on a heated plate at a temperature between 40 and 45 °C until the watch has reached the temperature of the heated plate (in practice, a heating time of 10 minutes to 20 minutes, depending on the type of watch, will be sufficient). A drop of water, at a temperature of 18 to 25 °C shall be placed on the glass of the watch. After about 1 minute, the glass shall be wiped with a dry rag. Any watch which has condensation on the interior surface of the glass shall be eliminated.

Diver's Watches

Diving at a great depth and for a long period is done in a diving chamber, with the (saturation) diver spending time alternately in the water and in a pressurized environment, breathing a gas mixture. In this case, the watch is subjected to the pressure of the gas mixture and its functioning can be disturbed. Consequently, it is recommended to subject the watch to a special extra test. ISO 6425 defines a diver's watch for mixed-gas diving as: A watch required to be resistant during diving in water to a depth of at least 100 m and to be unaffected by the overpressure of the mixed gas used for breathing.

- Test of operation at a gas overpressure. The watch is subject to the overpressure of gas which will actually be used, i.e. 125% of the rated pressure, for 15 days. Then a rapid reduction in pressure to the atmospheric pressure shall be carried out in a time not exceeding 3 minutes. After this test, the watch shall function correctly. An electronic watch shall function normally during and after the test. A mechanical watch shall function normally after the test (the power reserve normally being less than 15 days).
- Test by internal pressure (simulation of decompression). Remove the crown together with the winding and/or setting stem. In its place, fit a crown of the same type with a hole. Through this hole, introduce the gas mixture which will actually be used and create an overpressure of the rated pressure/20 bar in the watch for a period of 10 hours. Then carry out the test at the rated water overpressure. In this case, the original crown with the stem shall be refitted beforehand. After this test, the watch shall function correctly.
- Marking. Watches used for mix-gas diving which satisfy the test requirements are marked with the words "DIVER'S WATCH xxx M FOR MIXED-GAS DIVING". The letters xxx are replaced by the diving depth, in metres, guaranteed by the manufacturer. The composition of the gas mixture used for the test shall be given in the operating instructions accompanying the watch.

Waterproofing

Information on how to waterproof anything from electronics to tents.

8 Water Flow

This section details the ways water moves and how it moves, such as in the form of waves, currents, rips and tides.

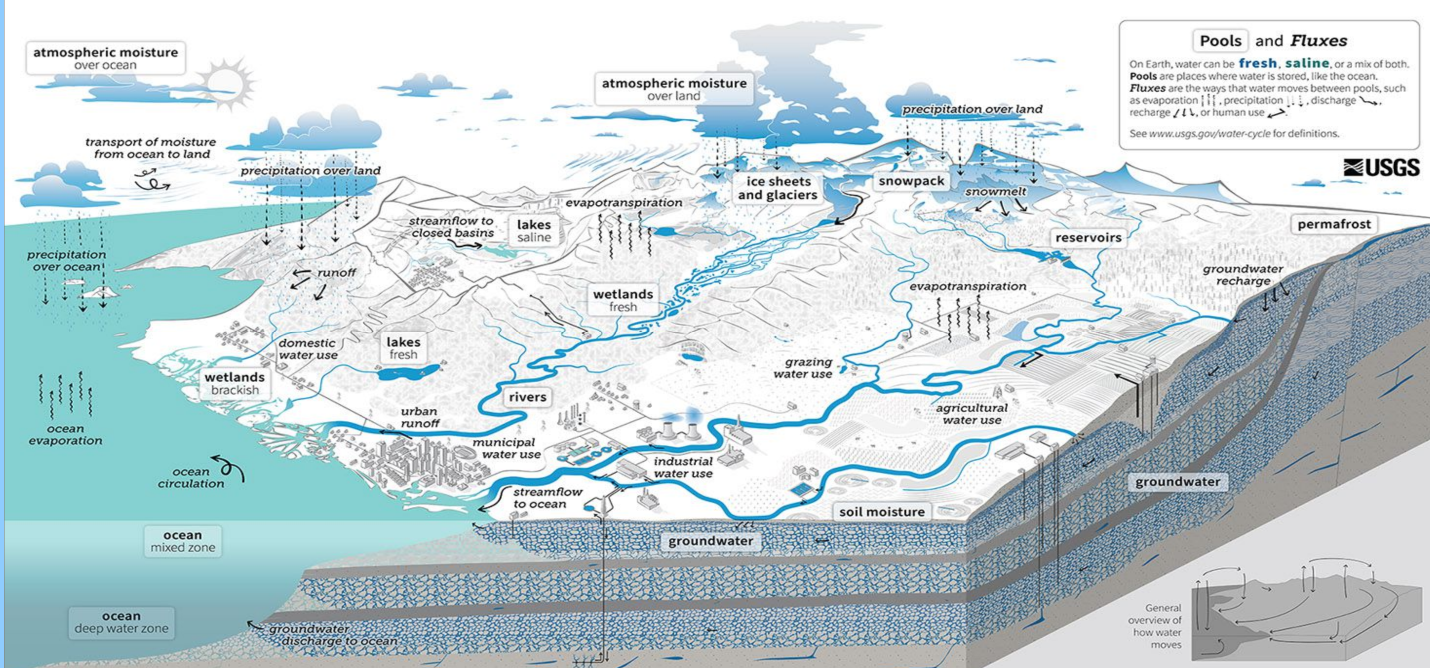
The Water Cycle

The water cycle (or hydrologic cycle or hydrological cycle), is a biogeochemical cycle that involves the continuous movement of water on, above and below the surface of the Earth. The mass of water on Earth remains fairly constant over time. However, the partitioning of the water into the major reservoirs of ice, fresh water, salt water and atmospheric water is variable and depends on climatic variables. The water moves from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere. The processes that drive these movements are evaporation, transpiration, condensation, precipitation, sublimation, infiltration, surface runoff, and subsurface flow. In doing so, the water goes through different forms: liquid, solid (ice) and vapor. The ocean plays a key role in the water cycle as it is the source of 86% of global evaporation.

The water cycle involves the exchange of energy, which leads to temperature changes. When water evaporates, it takes up energy from its surroundings and cools the environment. When it condenses, it releases energy and warms the environment. These heat exchanges influence the climate system.

The evaporative phase of the cycle purifies water because it causes salts and other solids picked up during the cycle to be left behind. The condensation phase in the atmosphere replenishes the land with freshwater. The flow of liquid water and ice transports minerals across the globe. It also reshapes the geological features of the Earth, through processes including erosion and sedimentation. The water cycle is also essential for the maintenance of most life and ecosystems on the planet.

Human actions are greatly affecting the water cycle. Activities such as deforestation, urbanization, and the extraction of groundwater are altering natural landscapes (land use changes) all have an effect on the water cycle. On top of this, climate change is leading to an intensification of the water cycle. Research has shown that global warming is causing shifts in precipitation patterns, increased frequency of extreme weather events, and changes in the timing and intensity of rainfall. These water cycle changes affect ecosystems, water availability, agriculture, and human societies.



A detailed diagram depicting the global water cycle. The direction of movement of water between reservoirs tends towards upwards movement through evapotranspiration and downward movement through gravity. The diagram also shows how human water use impacts where water is stored and how it moves.

Overall process

Further information: Water distribution on Earth

The water cycle is powered from the energy emitted by the sun. This energy heats water in the ocean and seas. Water evaporates as water vapor into the air. Some ice and snow sublimates directly into water vapor. Evapotranspiration is water transpired from plants and evaporated from the soil. The water molecule H_2O has smaller molecular mass than the major components of the atmosphere, nitrogen (N_2) and oxygen (O_2) and hence is less dense. Due to the significant difference in density, buoyancy drives humid air higher. As altitude increases, air pressure decreases and the temperature drops (see Gas laws). The lower temperature causes water vapor to condense into tiny liquid water droplets which are heavier than the air, and which fall unless supported by an updraft. A huge concentration of these droplets over a large area in the atmosphere becomes visible as cloud, while condensation near ground level is referred to as fog.

Atmospheric circulation moves water vapor around the globe; cloud particles collide, grow, and fall out of the upper atmospheric layers as precipitation. Some precipitation falls as snow, hail, or sleet, and can accumulate in ice caps and glaciers, which can store frozen water for thousands of years. Most water falls as rain back into the ocean or onto land, where the water flows over the ground as surface runoff. A portion of this runoff enters rivers, with streamflow moving water towards the oceans. Runoff and water emerging from the ground (groundwater) may be stored as freshwater in lakes. Not all runoff flows into rivers; much of it soaks into the ground as infiltration.

Some water infiltrates deep into the ground and replenishes aquifers, which can store freshwater for long periods of time. Some infiltration stays close to the land surface and can seep back into surface-water bodies (and the ocean) as groundwater discharge or be taken up by plants and transferred back to the atmosphere as water vapor by transpiration. Some groundwater finds openings in the land surface and emerges as freshwater springs. In river valleys and floodplains, there is often continuous water exchange between surface water and ground water in the hyporheic zone. Over time, the water returns to the ocean, to continue the water cycle.

The ocean plays a key role in the water cycle. The ocean holds "97% of the total water on the planet; 78% of global precipitation occurs over the ocean, and it is the source of 86% of global evaporation". Important physical processes within the water cycle include (in alphabetical order):

Advection	The movement of water through the atmosphere. Without advection, water that evaporated over the oceans could not precipitate over land. Atmospheric rivers that move large volumes of water vapor over long distances are an example of advection.
Condensation	The transformation of water vapor to liquid water droplets in the air, creating clouds and fog.
Evaporation	The transformation of water from liquid to gas phases as it moves from the ground or bodies of water into the overlying atmosphere. The source of energy for evaporation is primarily solar radiation. Evaporation often implicitly includes transpiration from plants, though together they are specifically referred to as evapotranspiration. Total annual evapotranspiration amounts to approximately 505,000 km3 (121,000 cu mi) of water, 434,000 km3 (104,000 cu mi) of which evaporates from the oceans. 86% of global evaporation occurs over the ocean.
Infiltration	The flow of water from the ground surface into the ground. Once infiltrated, the water becomes soil moisture or groundwater. A recent global study using water stable isotopes, however, shows that not all soil moisture is equally available for groundwater recharge or for plant transpiration.
Percolation	Water flows vertically through the soil and rocks under the influence of gravity.
Precipitation	Condensed water vapor that falls to the Earth's surface. Most precipitation occurs as rain, but also includes snow, hail, fog drip, graupel, and sleet. Approximately 505,000 km3 (121,000 cu mi) of water falls as precipitation each year, 398,000 km3 (95,000 cu mi) of it over the oceans. The rain on land contains 107,000 km3 (26,000 cu mi) of water per year and a snowing only 1,000 km3 (240 cu mi). 78% of global precipitation occurs over the ocean.
Runoff	The variety of ways by which water moves across the land. This includes both surface runoff and channel runoff. As it flows, the water may seep into the ground, evaporate into the air, become stored in lakes or reservoirs, or be extracted for agricultural or other human uses.
Subsurface Flow	The flow of water underground, in the vadose zone and aquifers. Subsurface water may return to the surface (e.g. as a spring or by being pumped) or eventually seep into the oceans. Water returns to the land surface at lower elevation than where it infiltrated, under the force of gravity or gravity induced pressures. Groundwater tends to move slowly and is replenished slowly, so it can remain in aquifers for thousands of years.
Transpiration	The release of water vapor from plants and soil into the air.

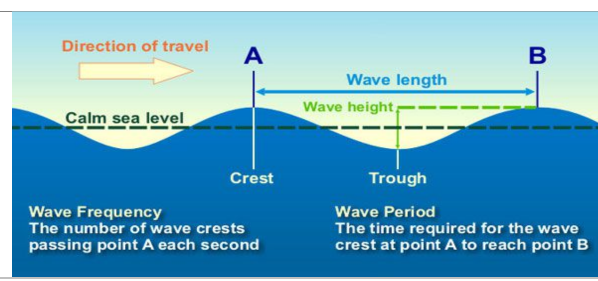
Waves

In fluid dynamics, a wind wave, or wind-generated water wave, is a surface wave that occurs on the free surface of bodies of water as a result of the wind blowing over the water's surface. The contact distance in the direction of the wind is known as the fetch. Waves in the oceans can travel thousands of kilometers before reaching land. Wind waves on Earth range in size from small ripples to waves over 30 m (100 ft) high, being limited by wind speed, duration, fetch, and water depth. When directly generated and affected by local wind, a wind wave system is called a wind sea. Wind waves will travel in a great circle route after being generated – curving slightly left in the southern hemisphere and slightly right in the northern hemisphere. After moving out of the area of fetch and no longer being affected by the local wind, wind waves are called swells and can travel thousands of kilometers. A noteworthy example of this is waves generated south of Tasmania during heavy winds that will travel across the Pacific to southern California, producing desirable surfing conditions. Wind waves in the ocean are also called ocean surface waves and are mainly gravity waves, where gravity is the main equilibrium force.

Wind waves have a certain amount of randomness: subsequent waves differ in height, duration, and shape with limited predictability. They can be described as a stochastic process, in combination with the physics governing their generation, growth, propagation, and decay – as well as governing the interdependence between flow quantities such as the water surface movements, flow velocities, and water pressure. The key statistics of wind waves (both seas and swells) in evolving sea states can be predicted with wind wave models.

Although waves are usually considered in the water seas of Earth, the hydrocarbon seas of Titan may also have wind-driven waves. Waves in bodies of water may also be generated by other causes, both at the surface and underwater (such as watercraft, animals, waterfalls, landslides, earthquakes, bubbles, and impact events).

Formation
The great majority of large breakers seen at a beach result from distant winds. Five factors influence the formation of the flow structures in wind waves:
1. Wind speed or strength relative to wave speed – the wind must be moving faster than the wave crest for energy transfer to the wave.
2. The uninterrupted distance of open water over which the wind blows without significant change in direction (called the fetch)
3. Width of the area affected by fetch (at a right angle to the distance)
4. Wind duration – the time for which the wind has blown over the water.
5. Water depth
All of these factors work together to determine the size of the water waves and the structure of the flow within them.



The main dimensions associated with wave propagation are:
- Wave height (vertical distance from trough to crest)
- Wave length (distance from crest to crest in the direction of propagation)
- Wave period (time interval between arrival of consecutive crests at a stationary point)
- Wave direction or azimuth (predominantly driven by wind direction)

Types
Three different types of wind waves develop over time:

- Capillary waves, or ripples, dominated by surface tension effects.
- Gravity waves, dominated by gravitational and inertial forces.
    - Seas, raised locally by the wind.
- Swells, which have traveled away from where they were raised by the wind, and have to a greater or lesser extent dispersed.

Ripples appear on smooth water when the wind blows, but will die quickly if the wind stops. The restoring force that allows them to propagate is surface tension. Sea waves are larger-scale, often irregular motions that form under sustained winds. These waves tend to last much longer, even after the wind has died, and the restoring force that allows them to propagate is gravity. As waves propagate away from their area of origin, they naturally separate into groups of common direction and wavelength. The sets of waves formed in this manner are known as swells. The Pacific Ocean is 19,800 km from Indonesia to the coast of Colombia and, based on an average wavelength of 76.5m, would have ~258,824 swells over that width. It is sometimes alleged that out of a set of waves, the seventh wave in a set is always the largest; while this isn't the case, the waves in the middle of a given set tend to be larger than those before and after them.

Individual "rogue waves" (also called "freak waves", "monster waves", "killer waves", and "king waves") much higher than the other waves in the sea state can occur. In the case of the Draupner wave, its 25 m (82 ft) height was 2.2 times the significant wave height. Such waves are distinct from tides, caused by the Moon and Sun's gravitational pull, tsunamis that are caused by underwater earthquakes or landslides, and waves generated by underwater explosions or the fall of meteorites—all having far longer wavelengths than wind waves.

The largest ever recorded wind waves are not rogue waves, but standard waves in extreme sea states. For example, 29.1 m (95 ft) high waves were recorded on the RRS Discovery in a sea with 18.5 m (61 ft) significant wave height, so the highest wave was only 1.6 times the significant wave height. The biggest recorded by a buoy (as of 2011) was 32.3 m (106 ft) high during the 2007 typhoon Krosa near Taiwan.

Tides

Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted by the Moon and the Sun, and the rotation of the Earth. Tide tables can be used for any given locale to find the predicted times and amplitude (or "tidal range"). The predictions are influenced by many factors including the alignment of the Sun and Moon, the phase and amplitude of the tide (pattern of tides in the deep ocean), the amphidromic systems of the oceans, and the shape of the coastline and near-shore bathymetry.

They are however only predictions, the actual time and height of the tide is affected by wind and atmospheric pressure. Many shorelines experience semi-diurnal tides – two nearly equal high and low tides each day. Other locations have a diurnal tide – one high and low tide each day. A "mixed tide" – two uneven magnitude tides a day – is a third regular category.

Tides vary on timescales ranging from hours to years due to a number of factors, which determine the lunitidal interval. To make accurate records, tide gauges at fixed stations measure water level over time. Gauges ignore variations caused by waves with periods shorter than minutes. These data are compared to the reference (or datum) level usually called mean sea level.

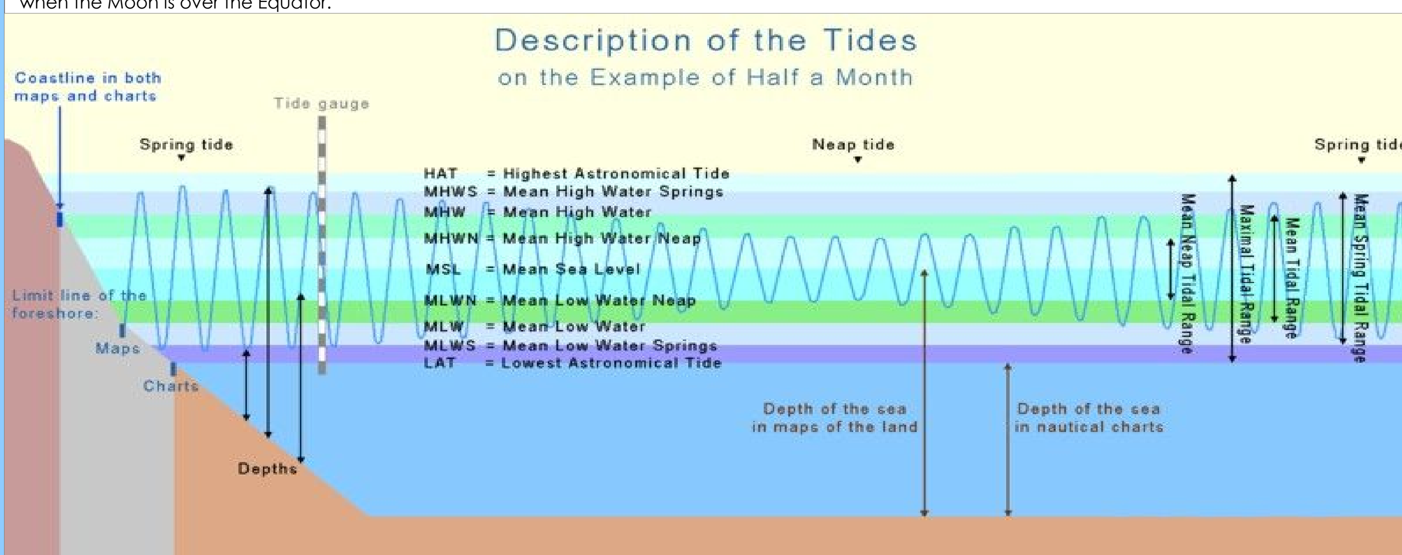
While tides are usually the largest source of short-term sea-level fluctuations, sea levels are also subject to forces such as wind and barometric pressure changes, resulting in storm surges, especially in shallow seas and near coasts. Tidal phenomena are not limited to the oceans, but can occur in other systems whenever a gravitational field that varies in time and space is present. For example, the shape of the solid part of the Earth is affected slightly by Earth tide, though this is not as easily seen as the water tidal movements.

Characteristics

Tide changes proceed via the following stages:
- Sea level rises over several hours, covering the intertidal zone; flood tide.
- The water rises to its highest level, reaching high tide.
- Sea level falls over several hours, revealing the intertidal zone; ebb tide.

The water stops falling, reaching low tide.

Oscillating currents produced by tides are known as tidal streams. The moment that the tidal current ceases is called slack water or slack tide. The tide then reverses direction and is said to be turning. Slack water usually occurs near high water and low water. But there are locations where the moments of slack tide differ significantly from those of high and low water. Tides are commonly semi-diurnal (two high waters and two low waters each day), or diurnal (one tidal cycle per day). The two high waters on a given day are typically not the same height (the daily inequality); these are the higher high water and the lower high water in tide tables. Similarly, the two low waters each day are the higher low water and the lower low water. The daily inequality is not consistent and is generally small when the Moon is over the Equator.



- Highest astronomical tide (HAT) – The highest tide which can be predicted to occur. Note that meteorological conditions may add extra height to the HAT.
- Mean high water springs (MHWS) – The average of the two high tides on the days of spring tides.
- Mean high water neaps (MHWN) – The average of the two high tides on the days of neap tides.
- Mean high water neaps (MHWN) – The average of the two high tides on the days of neap tides.
- Mean sea level (MSL) – This is the average sea level. The MSL is constant for any location over a long period.
- Mean low water neaps (MLWN) – The average of the two low tides on the days of neap tides.
- Mean low water springs (MLWS) – The average of the two low tides on the days of spring tides.
- Lowest astronomical tide (LAT) and Chart Datum (CD) – The lowest tide which can be predicted to occur.

Head of Tide
Head of tide or tidal limit is the farthest point upstream where a river is affected by tidal fluctuations, or where the fluctuations are less than a certain amount. This applies to rivers which flow into tidal bodies such as oceans, bays and deltas. Though this point may vary due to storms, spring tides, and seasonal or annual differences in water flows, there is generally an average point which is accepted as the head of tide. A river's tidal data are recorded at various locations downstream of this point.

A river's head of tide may be considered the upper boundary of its estuary. The head of tide is important in surveying, navigation, and fisheries management, and thus many jurisdictions establish a legal head of tide. As the head of tide is useful for navigation, separate maps can be made of the tidal zones up to the head of tide, such as was done in New Jersey. The head of tide may be many miles upstream from the river's mouth. For example, on the Hudson River, it is located 140 miles (225 km) upstream, near Albany, New York. On the Saint Lawrence River, tides affect shipping upstream past Quebec City, which is located several hundred miles inland from the Gulf of Saint Lawrence and the Atlantic Ocean.

Storm Surge

A storm surge, storm flood, tidal surge or storm tide is a coastal flood or tsunami-like phenomenon of rising water commonly associated with low pressure weather systems (such as tropical cyclones and strong extratropical cyclones), the severity of which is affected by the shallowness and orientation of the water body relative to storm path, as well as the timing of tides. Most casualties during tropical cyclones occur as the result of storm surges. It is a measure of the rise of water beyond what would be expected by the normal movement related to tides. The two main meteorological factors contributing to a storm surge are a long fetch of winds spiralling inward toward the storm, and a low-pressure-induced dome of water drawn up under and trailing the storm's centre.

Mechanics

At least five processes can be involved in altering tide levels during storms:	• The atmospheric pressure effect • The direct wind effect • The rainfall effect. • The effect of the Earth's rotation • The effect of waves near the shore

The pressure effects of a tropical cyclone will cause the water level in the open ocean to rise in regions of low atmospheric pressure and fall in regions of high atmospheric pressure. The rising water level will counteract the low atmospheric pressure such that the total pressure at some plane beneath the water surface remains constant. This effect is estimated at a 10 mm (0.39 in) increase in sea level for every millibar (hPa) drop in atmospheric pressure. Strong surface winds cause surface currents at a 45° angle to the wind direction, by an effect known as the Ekman Spiral.

Wind stresses cause a phenomenon referred to as "wind set-up", which is the tendency for water levels to increase at the downwind shore and to decrease at the upwind shore. Intuitively, this is caused by the storm blowing the water toward one side of the basin in the direction of its winds. Because the Ekman Spiral effects spread vertically through the water, the effect is proportional to depth. The pressure effect and the wind set-up on an open coast will be driven into bays in the same way as the astronomical tide. The Earth's rotation causes the Coriolis effect, which bends currents to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. When this bend brings the currents into more perpendicular contact with the shore, it can amplify the surge, and when it bends the current away from the shore it has the effect of lessening the surge.

The effect of waves, while directly powered by the wind, is distinct from a storm's wind-powered currents. Powerful wind whips up large, strong waves in the direction of its movement. Although these surface waves are responsible for very little water transport in open water, they may be responsible for significant transport near the shore. When waves are breaking on a line more or less parallel to the beach, they carry considerable water shoreward. As they break, the water particles moving toward the shore have considerable momentum and may run up a sloping beach to an elevation above the mean water line, which may exceed twice the wave height before breaking.

The rainfall effect is experienced predominantly in estuaries. Hurricanes may dump as much as 12 in (300 mm) of rainfall in 24 hours over large areas and higher rainfall densities in localized areas. As a result, surface runoff can quickly flood Streams and rivers. This can increase the water level near the head of tidal estuaries as storm-driven waters surging in from the ocean meet rainfall flowing downstream into the estuary.

Extratropical Storms
Similar to tropical cyclones, extratropical cyclones cause an offshore rise of water. However, unlike most tropical cyclone storm surges, extratropical cyclones can cause higher water levels across a large area for longer periods of time, depending on the system. In North America, extratropical storm surges may occur on the Pacific and Alaska coasts, and north of 31°N on the Atlantic Coast. Coasts with sea ice may experience an "ice tsunami" causing significant damage inland. Extratropical storm surges may be possible further south for the Gulf coast mostly during the wintertime, when extratropical cyclones affect the coast, such as in the 1993 Storm of the Century.

Reverse Storm Surge
Water can also be sucked away from shore prior to a storm surge. This was the case on the western Florida coast in 2017, just before Hurricane Irma made landfall, uncovering land usually underwater. This phenomenon is known as a reverse storm surge, or a negative storm surge.

Rips

A rip current, often simply called a rip, or by the misnomer rip tide, is a specific kind of water current which can occur near beaches with breaking waves. A rip is a strong, localized, and narrow current of water which moves directly away from the shore, cutting through the lines of breaking waves like a river running out to sea, and is strongest near the surface of the water. Rip currents can be hazardous to people in the water. Swimmers who are caught in a rip current and who do not understand what is going on, and who may not have the necessary water skills, may panic, or exhaust themselves by trying to swim directly against the flow of water.

Because of these factors, rips are the leading cause of rescues by lifeguards at beaches, and rips are the cause of an average of 46 deaths by drowning per year in the United States. A rip current is not the same thing as undertow, although some people use the term incorrectly when they often mean a rip current. Contrary to popular belief, neither rip nor undertow can pull a person down and hold them under the water. A rip simply carries floating objects, including people, out beyond the zone of the breaking waves.

Cause

A rip current forms because wind and breaking waves push surface water towards the land, and this causes a slight rise in the water level along the shore. This excess water will tend to flow back to the open water via the route of least resistance. When there is a local area which is slightly deeper, or a break in an offshore sand bar or reef, this can allow water to flow offshore more easily, and this will initiate a rip current through that gap.

Water that has been pushed up near the beach flows along the shore towards the outgoing rip as "feeder currents", and then the excess water flows out at a right angle to the beach, in a tight current called the "neck" of the rip. The "neck" is where the flow is most rapid. When the water in the rip current reaches outside of the lines of breaking waves, the flow disperses sideways, loses power, and dissipates in what is known as the "head" of the rip.

Rip currents can often occur on a gradually shelving shore where breaking waves approach the shore parallel to it, or where underwater topography encourages outflow at a specific area. Rip currents can form at the coasts of oceans, seas, and large lakes, whenever there are waves of sufficient energy. The location of rip currents can be difficult to predict; whereas some tend to recur always in the same places, others can appear and disappear suddenly at various locations along the beach.

The appearance and disappearance of rip currents is dependent on the bottom topography and the exact direction that the surf and swells are coming in from. Rip currents can potentially occur wherever there is strong longshore variability in wave breaking. This variability may be caused by such features as sandbars, by piers and jetties, and even by crossing wave trains, and are often located in places such as where there is a gap in a reef or low area on a sandbar. Rip currents may deepen the channel through a sandbar once they have formed.

Rip currents are usually quite narrow, but tend to be more common, wider, and faster, when and where breaking waves are large and powerful. Local underwater topography makes some beaches more likely to have rip currents; a few beaches are notorious in this respect. Although rip tide is a misnomer, in areas of significant tidal range, rip currents may only occur at certain stages of the tide, when the water is shallow enough to cause the waves to break over a sand bar, but deep enough for the broken wave to flow over the bar. (In parts of the world with a big difference between high tide and low tide, and where the shoreline shelves gently, the distance between a bar and the shoreline may vary from a few meters to a kilometre or more, depending whether it is high tide or low tide.)

A fairly common misconception is that rip currents can pull a swimmer down, under the surface of the water. This is not true, and in reality a rip current is strongest close to the surface, as the flow near the bottom is slowed by friction. The surface of a rip current may appear to be a relatively smooth area of water, without any breaking waves, and this deceptive appearance may cause some beach goers to believe it is a suitable place to enter the water.

Visible Signs

Rip currents have a characteristic appearance, and, with some experience, they can be visually identified from the shore before entering the water. This is useful to lifeguards, swimmers, surfers, boaters, divers and other water users, who may need to avoid a rip, or in some cases make use of the current flow. Rip currents often look a bit like a road or a river running straight out to sea, and are easiest to notice and identify when the zone of breaking waves is viewed from a high vantage point. The following are some characteristics that can be used to visually identify a rip:

- A noticeable break in the pattern of the waves — the water often looks flat at the rip, in contrast to the lines of breaking waves on either side of the rip.
- A "river" of foam — the surface of the rip sometimes looks foamy, because the current is carrying foam from the surf out to open water.
- Different colour — the rip may differ in colour from the surrounding water; it is often more opaque, cloudier, or muddier, and so, depending on the angle of the sun, the rip may show as darker or lighter than the surrounding water.
- It is sometimes possible to see that foam or floating debris on the surface of the rip is moving out, away from the shore. In contrast, in the surrounding areas of breaking waves, floating objects are being pushed towards the shore.

These characteristics are helpful in learning to recognize and understand the nature of rip currents so that a person can recognize the presence of rips before entering the water. In the United States, some beaches have signs created by the National Oceanic and Atmospheric Administration (NOAA) and United States Lifesaving Association, explaining what a rip current is and how to escape one. These signs are titled, "Rip Currents; Break the Grip of the Rip". Beachgoers can get information from lifeguards, who are always watching for rip currents, and who will move their safety flags so that swimmers can avoid rips.

Dangers

Rip currents are a potential source of danger for people in shallow water with breaking waves in seas, oceans and lakes. Rip currents are the proximate cause of 80% of rescues carried out by beach lifeguards. Rip currents typically flow at about 0.5 m/s (1.6 ft/s), but they can be as fast as 2.5 m/s (8.2 ft/s), which is faster than any human can swim. However, most rip currents are fairly narrow, and even the widest rip currents are not very wide; usually swimmers can exit the rip easily by swimming at a right angle to the flow, parallel to the beach. Swimmers who are unaware of this fact may exhaust themselves trying unsuccessfully to swim against the flow. The flow of the current also fades out completely at the head of the rip, outside the zone of the breaking waves, so there is a definite limit to how far the swimmer will be taken out to sea by the flow of a rip current.

In a rip current, death by drowning occurs when a person has limited water skills and panics, or when a swimmer persists in trying to swim to shore against a strong rip current, thus eventually becoming exhausted and unable to stay afloat. According to NOAA, over a 10-year average, rip currents cause 46 deaths annually in the United States, and 64 people died in rip currents in 2013. However, the United States Lifesaving Association "estimates that the annual number of deaths due to rip currents on our nation's beaches exceeds 100." A study published in 2013 in Australia revealed that rips killed more people on Australian territory than bushfires, floods, cyclones and shark attacks combined.

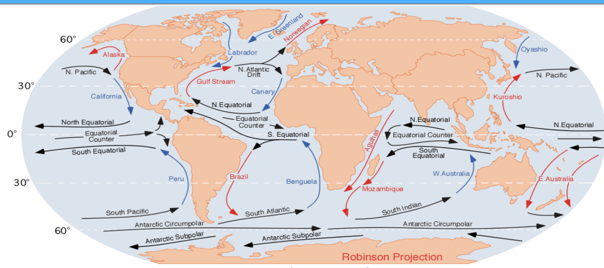
People caught in a rip current may notice that they are moving away from the shore quite rapidly. It is often not possible to swim directly back to shore against a rip current, so this is not recommended. Contrary to popular misunderstanding, a rip does not pull a swimmer under the water, it simply carries the swimmer away from the shore in a narrow band of moving water. The rip is like a moving treadmill, which the swimmer can get out of by swimming across the current, parallel to the shore, in either direction, until out of the rip current, which is usually not very wide. Once out of the rip, swimming back to shore is relatively easy in areas where waves are breaking and where floating objects and swimmers are being pushed towards the shore.

As an alternative, swimmers who are caught in a strong rip can relax and go with the flow (either floating or treading water) until the current dissipates beyond the surf line, and then they can signal for help, or swim back through the surf diagonally away from the rip and towards the shore. It is necessary for coastal swimmers to understand the danger of rip currents, to learn how to recognize them and how to deal with them, and if possible to swim in only those areas where lifeguards are on duty. Experienced and knowledgeable water users, including surfers, body boarders, divers, surf lifesavers and kayakers, will sometimes use rip currents as a rapid and effortless means of transportation when they wish to get out beyond the breaking waves.

Currents

An ocean current is a continuous, directed movement of seawater generated by a number of forces acting upon the water, including wind, the Coriolis effect, breaking waves, cabbeling, and temperature and salinity differences. Depth contours, shoreline configurations, and interactions with other currents influence a current's direction and strength.

Ocean currents move both horizontally, on scales that can span entire oceans, as well as vertically, with vertical currents (upwelling and downwelling) playing an important role in the movement of nutrients and gases, such as carbon dioxide, between the surface and the deep ocean.



Ocean currents flow for great distances and together they create the global conveyor belt, which plays a dominant role in determining the climate of many of Earth's regions. More specifically, ocean currents influence the temperature of the regions through which they travel. For example, warm currents traveling along more temperate coasts increase the temperature of the area by warming the sea breezes that blow over them.

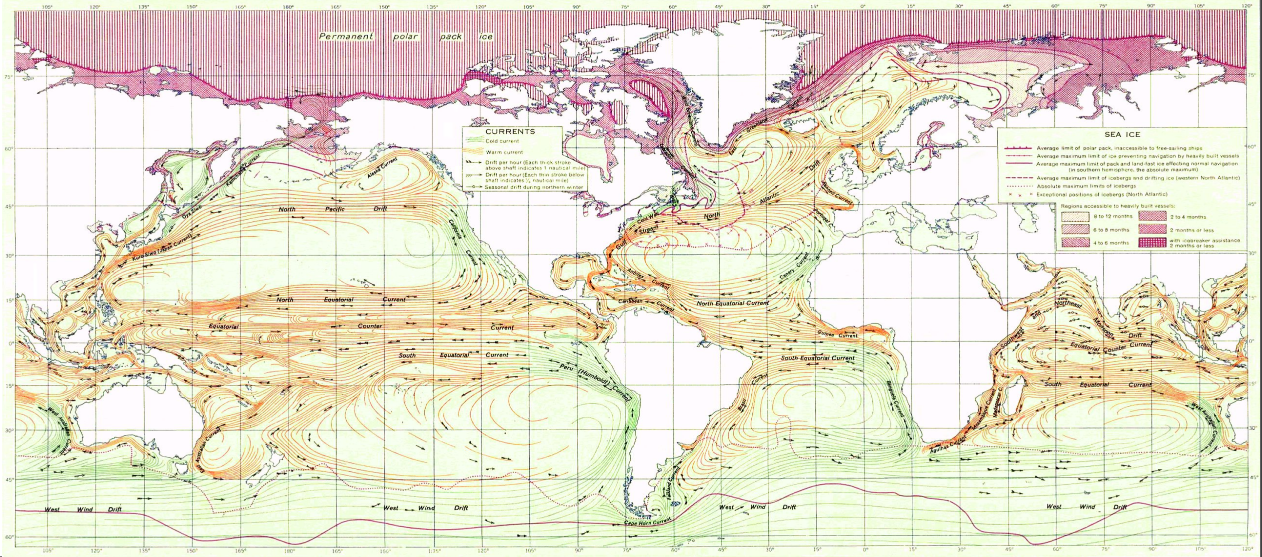
Perhaps the most striking example is the Gulf Stream, which, together with its extension the North Atlantic Drift, makes northwest Europe much more temperate for its high latitude than other areas at the same latitude. Another example is Lima, Peru, whose cooler subtropical climate contrasts with that of its surrounding tropical latitudes because of the Humboldt Current.

Causes

Ocean currents are driven by the wind, by the gravitational pull of the moon in the form of tides, and by the effects of variations in water density. Ocean dynamics define and describe the motion of water within the oceans.

Ocean temperature and motion fields can be separated into three distinct layers: mixed (surface) layer, upper ocean (above the thermocline), and deep ocean. Ocean currents are measured in units of sverdrup (Sv), where 1 Sv is equivalent to a volume flow rate of 1,000,000 m3 (35,000,000 cu ft) per second. There are two main types of currents, surface currents and deep water currents. Generally surface currents are driven by wind systems and deep water currents are driven by differences in water density due to variations in water temperature and salinity.

A 1943 map of the world's ocean currents



Food

Types and the shelf life of foods, and the best foods to stock

"Food is our common ground, a universal experience."
James Beard

Introduction

This category is an overview of foods including the properties of foods, calories, types of foods and shelf life. It should give you an idea of what foods are best to store long term, how to store them and which foods are better for your BOB.

Purpose	The aim of FOOD is to explain the different terms of food, discusses the most common long-life prepper foods, lists the shelf life of a range of different foods and how to prolong the life of food.
Lost?	● If you want a list of recipes, see the RECIPES section. ● For the cooking of food, see the COOKING section. ● If you're looking for food preservation, see the COOKING > Preservation section. ● For growing your own food, see the GARDENING section. ● If you're looking for eating all kinds of wild and foraged foods as well as the wild food edibility test, see the PLANTS section. ● If you're looking for the food groups, see the HEALTH section. ● If you want to know how to properly prepare wild game for consumption, see the FIELD DRESSING section.

Contents

1 Food

Food is any substance consumed to provide nutritional support for an organism. Food is usually of plant or animal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals. The substance is ingested by an organism and assimilated by the organism's cells to provide energy, maintain life, or stimulate growth.

Historically, humans secured food through two methods: hunting and gathering and agriculture, which gave modern humans a mainly omnivorous diet. Worldwide, humanity has created numerous cuisines and culinary arts, including a wide array of ingredients, herbs, spices, techniques, and dishes.

Today, the majority of the food energy required by the ever-increasing population of the world is supplied by the food industry. Food safety and food security are monitored by agencies like the International Association for Food Protection, World Resources Institute, World Food Programme, Food and Agriculture Organization, and International Food Information Council. They address issues such as sustainability, biological diversity, climate change, nutritional economics, population growth, water supply, and access to food.

Food Terms

These are the terms used in food manfacturing which specify the edibility of all food products.

Date of Manufacture	The date the food becomes the product as described.

Date of Packaging	The date the food is placed in the immediate container.
Best Before Date (Date of Minimum Durability)	The date which signifies the end of the period which the product will remain fully marketable and will retain the quality of the contents.
Use-By-Date	Date which signifies the end of the estimated period of storage conditions.
Shelf Life	The length of time that a commodity may be stored without becoming unfit for use, consumption, or sale.
Freshness Date	A freshness date is the date used in the brewing industry to indicate either the date the beer was bottled or the date before which the beer should be consumed.
Shelf-Stable Food (Ambient Food)	Food of a type that can be safely stored at room temperature in a sealed container. This includes foods that would normally be stored refrigerated but which have been processed so that they can be safely stored at room or ambient temperature for a usefully long shelf life.

Lack of Food

This section discusses what you can do when you don't have food.

Limited Pantry Food

If you only have remnants of ingredients left in your pantry you may not be able to make any meals out of them but you can still ration them and eat them slowly to at least give you some sustenance.

Absolutely No Food

If you absolutely don't have ANY food to eat but you have a lot of water to drink, you can gorge yourself on water so you feel full. You can also head outside and look for plants to forage or use the edibility test to see if some berries or leaves are edible.

2 Pantry

These are foods commonly stockpiled or consumed by preppers which are either very nutritious, give a boost of energy or have a long shelf life.

Common Pantry Food

A list of foods generally found in the home and are moderately easy to obtain. These foods should form the basics of a pantry and can create a large variety of dishes.

Almond Extract For adding a little extra flavour to desserts, pie crusts, vegetables and other dishes.	**Apples** For long storage, eating out of hand and making desserts.	**Applesauce** For snacking, cooking, baking and an easy dessert.	**Balsamic Vinegar** For flavouring dishes and making salad dressings.	**Baking soda** For baking and cleaning.	**Baking Powder** For baking.
Barbecue Sauce For cooking and flavouring.	**Bay Leaves** For seasoning soups, stocks, roasts, sauces and poaching liquids.	**Beans (Dried and Canned)** For soups, stews and other dishes.	**Bouillon (Beef, Chicken, and Vegetable)** For soups, seasoning, casseroles and marinades.	**Breadcrumbs** For toppings, stuffing's and other dishes.	**Brown Rice** For casseroles, soups, stuffing's and side dishes.
Brown Sugar For cooking, baking and seasoning.	**Canned Cream Soup** For a quick lunch, or to add to side dishes, soups, casseroles and other dishes.	**Canned Tomatoes** For sauces, salads, soups, stews, casseroles and other dishes.	**Canned Tuna Fish** For quick sandwiches and casseroles.	**Carrots** For long storage, snacking, soups, side dishes, roasting meats, casseroles, stews and more.	**Cocoa Powder** For baking and making hot cocoa.
Cold Cereal For baking, topping casseroles, snacking and breakfast.	**Cooking Sprays** For greasing pans for baking or frying.	**Cornmeal** For cornbread, breading proteins and for baking white bread.	**Cornstarch** For thickening puddings, sauces, stews and gravies.	**Crackers** For snacking, appetizers and topping casseroles.	**Cream of Tartar** For whipping egg whites.
Dried Fruit For desserts, sauces, roasting meat and poultry and snacking.	**Dried Herbs** For seasoning sweet and savoury dishes (good ones to have on hand: basil, oregano, thyme, rosemary, dill, cilantro, tarragon, chives)	**Dried spices** For seasoning sweet and savoury dishes (good ones to have on hand: cinnamon, nutmeg, cumin, paprika, mustard, ginger, allspice, cayenne pepper)	**Garlic** For flavouring or garlic bread.	**Ginger** Fresh for mincing or grating and adding to dishes for a spark.	**Honey** For seasoning, cooking, or eating on biscuits or cereal.
Hot Sauce For adding a touch of spice to dishes.	**Jams or Jellies** For making sandwiches, desserts or sauces.	**Ketchup** For flavouring sandwiches or other dishes.	**Salt** For seasoning	**Lemons and Limes** For squeezing into fresh juice or using the zest in cooking.	**Lentils** For soups, stews and other dishes.

Maple Syrup For breakfasts and baking	**Mayonnaise** For salads, sandwiches, salad dressings and many other dishes; low-fat or fat-free are also good choices.	**Nutmeg** For sweet and savoury dishes and sauces.	**Nuts** A selection of your favourite nuts for breads, muffins, desserts, casseroles and side dishes.	**Oatmeal** For baking, cooking and as a breakfast cereal.	**Olive Oil** For cooking, greasing pans or making salad dressings.
Onions For seasoning meats, soups, stews, casseroles and many other dishes.	**Pasta** For eating plain, with butter, or a sauce; also great for using in soups, stews, casseroles, or as a side dish.	**Peanut Butter** For cooking, baking and snacking.	**Peppercorns** For including whole in soups, stocks, marinades and roasts and for grinding for cooking and table use.	**Powdered Sugar** For making frosting, cooking, baking and decorating.	**Prepared Mustard** For sandwiches, mayonnaise-based salads, salad dressings and marinade.
Potatoes For baking, boiling, roasting and mashing.	**Red Wine Vinegar** For cooking and seasoning.	**Semisweet Chocolate Chips** For desserts and snacking.	**Solid Shortening** For baking and greasing pans.	**Soy Sauce** For flavouring and quick stir-frying.	**Tomato Paste** For making pasta sauces, stews, soups and casseroles.
Unbleached White Flour For cooking, baking, thickening.	**Unsweetened Chocolate** For baking and cooking.	**Vanilla** For flavouring many dishes, especially desserts; only use the real flavouring or vanilla beans.	**Vegetable Oil** For frying, cooking, salad dressings and greasing pans.	**White Sugar** For cooking and seasoning.	**White Wine Vinegar** For salads, flavouring and cleaning coffee pots.
Worcestershire Sauce For seasoning and adding colour.	**Yeast** For baking.				

Energy Food

Any food which gives the consumer a boost of energy to help get through the day.

Bars

Clif Bars	
Chocolate Bars	

Nutritional Foods

Cricket Protein
Besides being far easier to farm and far more ecologically friendly, they are a whole food and highly nutritious. Its easy and light to carry with no liquid and can be added to other foods to boost their nutrition.

- Double the protein of beef
- More calcium than milk
- More Omegas and B12 than wild salmon
- More Iron than Spinach

EnergyBits (Spirulina)
EnergyBits are a nutritionally dense source of mental and physical energy made from the world's purest algae. Spirulina is a cultivated algae that has been consumed for thousands of years by the indigenous peoples in Mexico and Africa. It has the highest concentration of protein on earth - triple that of steak - as well as the second highest concentration of an Essential Fatty Acid called GLA (second only to mother's milk). According to energybits, research done by NASA showed that that 1 kg of spirulina had the nutritional equivalent of 1,000 kg of fruits and vegetables… consider that many International Health Organizations including the United Nations have hailed spirulina as one of the "Greatest Superfoods on Earth.

- Rich vegetable protein (60~ 63 %, 3~4 times higher than fish or beef)
- Multi Vitamins (Vitamin B 12 is 3~4 times higher than animal liver)
- A wide range of minerals (including Iron, Potassium, Magnesium Sodium, Phosphorus, Calcium etc.)
- A high volume of Beta- carotene which protects cells (5 time more than carrots, 40 time more than spinach)
- High volumes of gamma-Linolein acid (which can reduce cholesterol and prevent heart disease).

EnergyBits (Chlorella)
Bits Are A Nutritionally Dense Source Of Mental And Physical Energy Made From The World's Purest Algae. Chlorella algae is harvested in fresh water tanks and has been used for over fifty years in Asia. It has a remarkable ability to help remove toxins and help build the immune system. All naturally. Chlorella contains over 40 nutrients including all the B vitamins, iron, zinc and many minerals. It offers so many benefits we would never have enough room here to list them all. The Japanese were the first to discover the detoxifying properties of Chlorella to remove poisonous substances from the body such as radiation. After atomic weapons were dropped on Hiroshima and Nagasaki, Chlorella was used to remove radiation from the bodies of those who had become contaminated. Chlorella soaks up radiation like a sponge.

Common Prepper Foods

These foods are commonly stored by preppers due to their long life span, their nutrition and their light weight.

- Maize (Corn)
- Pasta
- Rice
- Sorghum
- Wheat
- Beans
- Lentils
- Peas

- Ghee
- Vegetable Oils
- Fish Canned
- Corned Beef
- Chicken Canned
- Pork Canned
- Ready Meal Canned
- Tomato Paste Canned

- Canned Cheese
- Baby Food
- Coffee
- Seasoning Cube
- Iodized Salt
- Sugar
- Black Tea
- Yeast

- Dry Skimmed Milk DSM
- Dry Whole Milk DWM
- Energy Food Bar
- Biscuit
- Multivitamin
- Peanut Butter
- MRE

Food Degredation

Below is a list of processes, reactions and contaminants which causes food to spoil faster.

Oxygen	Oxygen oxidises the food it comes into contact with, reducing its shelf life the more it is exposed.
Pests	Pests, either rodents or microscopic bugs such as botulism or bacteria can get into your food and cause contamination.
Humidity & Moisture	Humidity deteriorates food and causes it to spoil much faster.
Heat	Heat causes food to spoil faster by speeding up the oxidation process.
Light	Exposure to light can degrade food faster than darkness.
Gas Transmission	The transmission of gases through the walls of containers can cause additional degredation.
Mechanical Stress	Bumps, bangs and dents can also reduce the shelf life and quality of food.

Canned Food

Check for dents and rust that may compromise the can. Bulging cans could mean a hydrogen build up in acidic foods such as tomatoes or citrus fruit. It's due to the acids attacking the metal lining of the can with a by-product of hydrogen. Bulging cans could also mean that the food has been spoiled by bacteria which release carbon dioxide gas, this food could kill you if eaten. Throw away any cans with an incorrect/almond smell. Rust: Iron, water and oxygen together causes rust, therefore try to minimize their impact when storing food.

Dented Cans

Dented cans shouldn't be any different to regular cans, however watch out for holes at the crease points in severely dented cans. You may need to take the label off to thoroughly check for pinprick holes before consuming them.

Bulging Cans

Bulging cans could mean that the food has been spoiled by bacteria which release carbon dioxide gas. This food could kill you if eaten and any non acidic bulging food cans should be thrown out. Bulging cans could also mean a hydrogen build up in acidic foods such as tomatoes or citrus fruit. It's due to the acids attacking the metal lining of the can with a by-product of hydrogen. High acidic foods in a bulging can could mean they are safe to eat but have simply reacted with the can. Make certain before you eat any bulging can as it could contain both a high acid food and bacteria. Bulging cans will spray food quite a distance if opened so be sure to open them away from all other food sources just in case they contain bacteria.

High Acid Foods

High acid foods have a pH of less than 4.6. The environment contains concentrated hydrogen ions which prevents the growth of most bacteria, fungi and yeast. Acidity stops germination of clostridium botulinum preventing the release of it's deadly neurotoxin therefore mitigating the need to kill the spores. Combinations of varying pH foods can raise or lower the pH level above the threshold. Tomatoes which are considered high pH could be raised above 4.6pH in a bolognese mix.

High Acid Foods
- Tomatoes
- Fruits
- Juices
- Picked Foods
- Fermented Foods

Low Acid Foods

Low acid foods have a pH of more than 4.6. Botulinum spores are a perfect environment for germination and producing its toxin.

Low Acid Foods
- Meat
- Fish
- Vegetables

Food Rarity

This section will go into what foods will be common and easily found during a disaster, to the ones that will go off quickly and will be impossible to find.

Canned Food	Generally one of the first types of food to disappear from the shelves during any kind of disaster.

3 Consumption

This section details how food can and should be consumed and tips on making food go further in a survival situation.

Consuming Food

Food should never be eaten when you don't have a supply of clean water to drink because it takes quite a lot of water to break down food in your stomach. Doing so will cause you to become dehydrated much quicker and as you may know, you will die in 3 days without water and about 3 weeks without food. You can however eat foods high in liquid content to be able to satisfy both needs at the same time. An example of a food rich in liquid are most fruits and canned soups.

Eating Order

This is the order you should consume food in during a disaster, assuming you have lost power but you can keep the fridge and freezers running a few more days. All food has a shelf life and you could waste a lot of it if you begin eating the canned food before the fresh food. Be sure to check that the food hasn't spoiled before you eat it, as you may only get through half the food in the fridge before it becomes risky to eat.

1	**Refrigerated Foods (Eat within 24H of power loss)** Any foods in the fridge which have a few days shelf life. You may need to eat these before the fresh foods depending on how cold the fridge is. Eat these within a day, or within 2 hours of the temperature becoming 'too high'. Some refrigerated foods will last well at room temperature such as fruits, veges and most sauces. The fridge is your top priority as it consumes the most power and you want to disconnect your power supply from it as soon as possible - assuming it's limited.
2	**Frozen Foods** A full freezer without power will safely keep food edible for 48 hours. A half-full freezer will keep it edible up to 24 hours. In both cases, you can safely re-freeze the food if you can still see ice crystals anywhere on the product. After these timeframes, you should eat the food as soon as you can - as long as it feels as if it's been refrigerated.
3	**Fresh Foods (Eat within a week)** Fruit, vegetables, bread and other unrefrigerated food which will spoil within a week or two. This includes any food you grow.
4	**Pantry Foods** The next food to go should be the pantry foods such as flour, cereal, rice etc. If you need to find a meal, combine some pantry foods with your canned foods.
5	**Snack Foods** Individually packaged mid-life foods such as potato chips, dried fruit, chocolate, lollies, muesli bars etc which often last between 6 months to a year.
6	**Ration Bars** If you have ration bars you should eat these next.
7	**MREs (Eat within a few years)** The next thing to go as these will last 10 years on average, but may already be well into this expiry date.
8	**Freeze Dried Food** Lasts between 10-35 years so this should be eaten close to last.
9	**Canned Food** Most canned foods will last indefinitely if stored correctly so these should be eaten last.

Prolonging Food

Below are a few things you can do before or after you've lost power to prolong the cold air in your fridge and freezer and thus extending the life of the food inside.

- Move the fridge/freezer to the coldest room in the house
- Wrap the fridge/freezer in insulating material such as blankets, sheets and foam, but avoid covering the sides which generate heat.
- Limit the opening of the fridge/freezer. On your first open you should take a picture of the contents inside and use that as a guide to tell you what food is remaining and where it is so you can quickly grab it without losing too much cold air. 1 second of an open door reduces the duration the food will stay cold by 6 minutes.
- A full fridge/freezer keeps colder far longer than an empty one - but only if it's full (and cold) before you lose power.
- When the power goes off, bottles of water in the fridge and freezer act as "cold batteries" which release their stored energy over a long period of time. So you should have a couple pre-frozen just in case. The same works for those cold bricks you can buy.

4 Shelf Life

Various food preservation and packaging techniques are used to extend a food's shelf life. Decreasing the amount of available water in a product, increasing its acidity, or irradiating or otherwise sterilizing the food and then sealing it in an air-tight container are all ways of depriving bacteria of suitable conditions in which to thrive. Commercial Canning involves cooking food and sealing it in sterilized tin cans. Home canning usually involves mason jars and boiling the containers to kill or weaken any remaining bacteria as a form of sterilization. Retort pouches involve heat processing the food in sterilized heat-stable flexible packages. This is used for camping food and military field rations. The first shelf-stable formulation of ranch dressing, created in 1983, had a shelf life of 150 days. Pasteurized milk in aseptically processed cartons (Tetra Brik, etc)) is shelf stable without refrigeration. Fruit juice can be processed with proper pasteurization to allow shelf stable options.

Extending Shelf Life
Elimination of oxygen and preventing oxygen to get in touch with the product. Potentially hazardous foods should be stored below 5°C (41°F) throughout their storage life.

Canned Food
Non acidic canned foods can last hundreds of years if properly stored. Foods which contain acidic content will slowly break down the lining of the can and cause it to bulge. Discard any bulging cans, heavily rusted cans or cans when don't smell right upon opening.

SOME OF THE FOOD LISTED BELOW HAS BEEN REPACKAGED INTO MYLAR BAGS FOR THE BEST SHELF LIFE. READ EACH COMMENT CAREFULLY.

Short Life Foods (1-3 Years)

These foods will last a couple of years. If a disaster looks like it'll last over 3 years it would be best to grow your own fresh foods.

Meat, Dehydrated	**Shelf Life** 2 Years	(Mylar Packaged)
Pet Biscuits, Dry	**Shelf Life** 0.5 Years	(Mylar Packaged)
Rice, Brown	**Shelf Life** 0.5 Years	

Medium Life Foods (3-5 Years)

These foods will last up to half a decade.

Baby Formula	**Shelf Life** 3-5 Years	(Mylar Packaged)
Coffee Beans, Roasted	**Shelf Life** 3-5 Years	(Mylar Packaged)
Crackers/Biscuits	**Shelf Life** 4 Years	(Mylar Packaged)

Dehydrated Fruit Slices	**Shelf Life** 5 Years	
Granola	**Shelf Life** 4-5 Years	(Mylar Packaged)
Lentils / Peas	**Shelf Life** 3-5 Years	(No Packaging)
Pearled Barley	**Shelf Life** 5 Years	(Mylar Packaged)
Popcorn	**Shelf Life** 5 Years	(Mylar Packaged)

Long Life Foods (5-10 Years)

These foods will last between 5 years to a decade.

Almond Meal	**Shelf Life** 5-8 Years	(Mylar Packaged)
Barley Grain	**Shelf Life** 10 Years	(Mylar Packaged)
Buckwheat	**Shelf Life** 10 Years	(Mylar Packaged)
Bullion Stock Powder	**Shelf Life** 5-10 Years	(Mylar Packaged)
Cereals	**Shelf Life** 10 Years	(Mylar Packaged)
Coffee, Grounded	**Shelf Life** 10+ Years	(Mylar Packaged)
Cornflour	**Shelf Life** 5-10 Years	(Mylar Packaged)
Eggs, Powdered	**Shelf Life** 5-10 Years	(Mylar Packaged)
Flax/Linseed	**Shelf Life** 8-12 Years	(Mylar Packaged)
Herbs	**Shelf Life** 5-7 Years	(Mylar Packaged)
Milk, Powdered (Full Fat)	**Shelf Life** 5-7 Years	(Mylar Packaged)
Millet	**Shelf Life** 8-12 Years	(Mylar Packaged)
MREs	**Shelf Life** 5-10 Years	MRE's have a written shelf life of 5 years, but they can often be safely consumed after that time. Use your best judgement whether to eat it or not.
Pepper, Whole	**Shelf Life** 7-10 Years	(Mylar Packaged)
Polenta/Cornmeal	**Shelf Life** 5-8 Years	(Mylar Packaged)
Quinoa	**Shelf Life** 7-9 Years	(Mylar Packaged)
Rye	**Shelf Life** 8+ Years	(Mylar Packaged)
Seeds, Edible	**Shelf Life** 5-10 Years	(Mylar Packaged)
Seeds, Sprouting	**Shelf Life** 4-7 Years	(Mylar Packaged)
Spices	**Shelf Life** 2-10 Years	(Mylar Packaged)

Extra Long Life Foods (10-50 Years)

These staples will last an extremely long time if stored correctly.

Amaranth Grain	**Shelf Life** 10 Years	(Mylar Packaged)
Arrowroot Powder	**Shelf Life** 10+ Years	(Mylar Packaged)
Baking Powder	**Shelf Life** 30+ Years	(Mylar Packaged)
Beans, Dried	**Shelf Life** 20-30 Years	(Mylar Packaged) Most beans will last between 20 and 30 years if packaged correctly.
Butter Powder	**Shelf Life** 15 Years	(Mylar Packaged)
Cheese Powder	**Shelf Life** 10-15 Years	(Mylar Packaged)
Cocoa Powder	**Shelf Life** 15 Years	(Mylar Packaged)
Corn, Dried	**Shelf Life** 10+ Years	(Mylar Packaged)
Corn, Dry (Maize)	**Shelf Life** 10-15 Years	(Mylar Packaged)
Couscous	**Shelf Life** 10+ Years	(Mylar Packaged)
Coffee (Instant)	**Shelf Life** 25+ Years	(Mylar Packaged) Instant coffee is freeze-dried, therefore it will last as long as regular freeze-dried foods.
Coffee Beans, Green	**Shelf Life** 20+ Years	(Mylar Packaged)
Dried/Dehydrated Food	**Shelf Life** 10-20 Years	

FOOD Shelf Life Extra Long Life Foods

Freekeh	**Shelf Life** 10+ Years	(Mylar Packaged)
Freeze Dried Fruit	**Shelf Life** 25+ Years	(Mylar Packaged)
Freeze Dried Veges	**Shelf Life** 25+ Years	(Mylar Packaged)
Lentils	**Shelf Life** 25+ Years	(Mylar Packaged)
Milk, Powdered (Skim)	**Shelf Life** 15-25 Years	(Mylar Packaged) This only applies to powdered skim milk in mylar bags. If it's full fat powdered milk, it will only last around 5 years in mylar bags.
Mountain House Meals	**Shelf Life** 30 Years	Mountain house products have a 30 year guarantee and are likely to taste just as good.
Oats, Hulled	**Shelf Life** 30 Years	(Mylar Packaged)
Oats, Rolled	**Shelf Life** 30 Years	(Mylar Packaged)
Oats, Steel-Cut	**Shelf Life** 15 Years	(Mylar Packaged)
Onion, Dehydrated	**Shelf Life** 10-15 Years	(Mylar Packaged)
Pasta	**Shelf Life** 25-30 Years	(Mylar Packaged)
Peanut Butter Powder	**Shelf Life** 10-15 Years	(Mylar Packaged)
Peas, Black Eyed	**Shelf Life** 15-20 Years	(Mylar Packaged)
Peas, Dehydrated	**Shelf Life** 15 Years	(Mylar Packaged)
Peas, Split	**Shelf Life** 25+ Years	(Mylar Packaged)
Pet Biscuits, Freeze Dried	**Shelf Life** 25+ Years	(Mylar Packaged)
Potatoes	**Shelf Life** 30 Years	(Mylar Packaged)
Potatoes, Instant	**Shelf Life** 15-20 Years	(Mylar Packaged)
Rice, White	**Shelf Life** 20-30 Years	(Mylar Packaged)
Spelt Grain	**Shelf Life** 10-12 Years	(Mylar Packaged)
Sorghum	**Shelf Life** 10+ Years	(Mylar Packaged)
Tea Bags	**Shelf Life** 30+ Years	(Mylar Packaged)

Indefinite Life Foods (50+ Years)

These foods will last around the span of a human life. It's extremely unlikely that any disaster will last more than 50 years. If it does then it would be easier to just grow your own food.

Baking Soda	**Shelf Life** Indefinite	(Mylar Packaged)
Canned Foods	**Shelf Life** Indefinitely	Excluding canned acids such as tomatoes which bulge over time and may leak out. Cans last between 25 years to forever. Heated cans won't affect the food inside but may cause them to rust or go off faster. Every 5.556°C (10°F) rise in temperature, the shelf life generally halves.
Honey	**Shelf Life** Indefinite	Honey may crystallize the older it gets. If this happens, put it in some hot water and give it a stir slowly.
Sugar	**Shelf Life** Indefinite	Sugar may turn into a brick over time. Hit it with something hard in a flexible bag to break it up again.
Salt	**Shelf Life** Indefinite	Salt may turn into a brick over time. Hit it with something hard in a flexible bag to break it up again.

Prolonging Food

Below are a few things you can do before or after you've lost power to prolong the cold air in your fridge and freezer and thus extending the life of the food inside.

- Move the fridge/freezer to the coldest room in the house
- Wrap the fridge/freezer in insulating material such as blankets, sheets and foam
- Limit the opening of the fridge/freezer. On your first open you should take a picture of the contents inside and use that as a guide to tell you what food is remaining and where it is so you can quickly grab it without losing too much cold air.
- A full fridge/freezer keeps colder far longer than an empty one - but only if it's full (and cold) before you lose power.
- When the power goes off, bottles of water in the fridge and freezer act as "cold batteries" which release their stored energy over a long period of time. So you should have a couple pre-frozen just in case. The same works for those cold bricks you can buy.

5 Food Shelf Life

These is the shelf life of most common nuts and grains, both pre-packaged and raw. The Pantry, Refrigerator and Freezer columns show how long the product will last when stored in each of those environments. A blank cell means it shouldn't be stored this way.

Subheadings

1. Nuts & Grains Shelf Life	**2. Vegetables Shelf Life**	**3. Fruits Shelf Life**	**4. Meat Shelf Life**

1 Nuts & Grains Shelf Life

These is the shelf life of most common nuts and grains, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Almonds, Commercially Bagged Or Purchased In Bulk - In The Shell	2-4 Weeks	12 Months	2 Years	How long do almonds last in the shell? The exact answer depends to a large extent on storage conditions -because of their high oil content, almonds must be stored properly to avoid becoming rancid. To maximize the shelf life of unshelled almonds, store in cool, dry area; after opening the package, place the almonds in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. How long do unshelled almonds last at room temperature? Properly stored, unshelled almonds will generally stay at best quality for 2 to 4 weeks at room temperature. To further extend the shelf life of unshelled almonds, the almonds may be stored in the fridge or freezer; place almonds in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. How long do unshelled almonds last in the refrigerator? Properly stored, unshelled almonds will generally stay at best quality for about 12 months in the refrigerator. How long do unshelled almonds last when stored in the freezer? Unshelled almonds will generally stay at best quality for about 2 years in the freezer; the freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Unshelled almonds can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How to tell if unshelled almonds are bad? Rancid almonds will often develop a bitter, unpleasant taste; if almonds develop an off odor or taste, or if mould appears, they should be discarded.
Almonds, Commercially Bagged Or Purchased In Bulk - Out Of The Shell	2-4 Weeks	9 Months	1 Year	The precise answer to the question "How long do shelled almonds last?" depends to a large extent on storage conditions -because of their high oil content, almonds must be stored properly to avoid becoming rancid. To maximize the shelf life of shelled almonds, store in cool, dry area; after opening the package, place the almonds in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of shelled almonds, the almonds may be stored in the fridge or freezer; place almonds in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Almonds can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do almonds last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if almonds are bad? Rancid almonds will often develop a bitter, unpleasant taste; if almonds develops an off odor, flavour or appearance, they should be discarded.
Angel Hair Pasta, Dry, Uncooked, Commercially Packaged, Sold Unrefrigerated—Unopened Or Opened	3 Years			How long does a package of dry angel hair pasta last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of dry angel hair pasta store in a cool, dry area. How long does a package of dry angel hair pasta last once opened? Properly stored, a package of dry angel hair pasta will generally stay at best quality for about 3 years at room temperature. To maximize the shelf life of dry angel hair pasta, keep the package tightly closed at all times. To further maximize the shelf life of dry angel hair pasta once the package is opened, transfer dry angel hair pasta to a covered airtight container or place the dry angel hair pasta package in a resealable plastic freezer bag. Is dry angel hair pasta safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged dry angel hair pasta will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the dry angel hair pasta will remain at peak quality. Storage time shown is for best quality only - after that, the dry angel hair pasta's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if dry angel hair pasta is bad or spoiled? The best way is to smell and look at the dry angel hair pasta: if the dry angel hair pasta develops an off odor, flavour or appearance, or if mould or insects appear, it should be discarded.
Baked Beans, In Sauce, Commercially Canned Or Bottled - Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	1-2 Months	How long does a can of baked beans last once opened? The precise answer depends to a large extent on storage conditions - keep opened baked beans refrigerated and tightly covered. To maximize the shelf life of canned baked beans after opening, refrigerate in covered glass or plastic container. How long do opened canned baked beans last in the refrigerator? Canned baked beans that have been continuously refrigerated will keep for about 3 to 4 days. Are canned baked beans safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned baked beans will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the baked beans will remain at peak quality. To further extend the shelf life of opened canned baked beans, freeze them: to freeze canned baked beans, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned baked beans will be softer after freezing and thawing; the thawed baked beans will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned baked beans last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - baked beans that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned baked beans last after being frozen and thawed? Baked beans that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; baked beans that were thawed in the microwave or in cold water should be used immediately.
Barley, Commercially Bagged Or Purchased In Bulk - Cooked	1 Year (Uncooked)	3-5 Days	1 Month	Refrigerate within two hours of cooking; store in covered container. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Bean Soup, Commercially Canned Or Bottled — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	4-6 Months	How long does bean soup last once opened? The precise answer depends to a large extent on storage conditions - keep opened bean soup refrigerated and tightly covered. To maximize the shelf life of canned or packaged bean soup after opening, refrigerate in covered glass or plastic container. How long does opened bean soup last in the refrigerator? Bean soup that has been continuously refrigerated will keep for about 3 to 4 days. Is bean soup safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged bean soup will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the bean soup will remain at peak quality. To further extend the shelf life of opened bean soup, freeze it: to freeze bean soup, place inside covered airtight containers or heavy-duty freezer bags. How long does bean soup last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - bean soup that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does bean soup last after being frozen and thawed? Bean soup that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; bean soup that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened bean soup is bad or spoiled? The best way is to smell and look at the bean soup: if the bean soup develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Black Beans, Commercially Canned Or Bottled — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	1-2 Months	How long does a can of black beans last once opened? The precise answer depends to a large extent on storage conditions - keep opened black beans refrigerated and tightly covered. To maximize the shelf life of canned black beans after opening, refrigerate in covered glass or plastic container. How long do opened canned black beans last in the refrigerator? Canned black beans that have been continuously refrigerated will keep for about 3 to 4 days. Are canned black beans safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned black beans will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the black beans will remain at peak quality. To further extend the shelf life of opened canned black beans, freeze them: to freeze canned black beans, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned black beans will be softer after freezing and thawing; the thawed black beans will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned black beans last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - black beans that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Discard all black beans from cans or packages that are leaking, rusting, bulging or severely dented. How long do canned black beans last after being frozen and thawed? Black beans that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; black beans that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned black beans are bad or spoiled? The best way is to smell and look at the black beans: if the black beans develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Black-Eyed Peas, Commercially Canned Or Bottled — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	1-2 Months	How long does a can of black-eyed peas last once opened? The precise answer depends to a large extent on storage conditions - keep opened black-eyed peas refrigerated and tightly covered. To maximize the shelf life of canned black-eyed peas after opening, refrigerate in covered glass or plastic container. How long do opened canned black-eyed peas last in the refrigerator? Canned black-eyed peas that have been continuously refrigerated will keep for about 3 to 4 days. Are canned black-eyed peas safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned black-eyed peas will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the black-eyed peas will remain at peak quality. To further extend the shelf life of opened canned black-eyed peas, freeze them: to freeze canned black-eyed peas, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned black-eyed peas will be softer after freezing and thawing; the thawed black-eyed peas will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned black-eyed peas last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - black-eyed peas that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned black-eyed peas last after being frozen and thawed? Black-eyed peas that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; black-eyed peas that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned black-eyed peas are bad or spoiled? The best way is to smell and look at the black-eyed peas: if the black-eyed peas develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all black-eyed peas from cans or packages that are leaking, rusting, bulging or severely dented.
Brazil Nuts, Commercially Bagged Or Purchased In Bulk - In The Shell	2-4 Weeks	12 Months	12-18 Months	The exact answer to the question ? How long do Brazil nuts last in the shell? depends to a large extent on storage conditions -because of their high oil content, Brazil nuts must be stored properly to avoid becoming rancid. To maximize the shelf life of unshelled Brazil nuts, store in cool, dry area; after opening the package, place the Brazil nuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of unshelled Brazil nuts, the Brazil nuts may be stored in the fridge or freezer; place Brazil nuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Unshelled Brazil nuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do unshelled Brazil nuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if unshelled Brazil nuts are bad? Rancid Brazil nuts will often develop a bitter, unpleasant taste; if Brazil nuts develop an off odor or taste, or if mould appears, they should be discarded.
Brazil Nuts, Commercially Bagged Or Purchased In Bulk - Out Of The Shell	2-4 Weeks	9 Months	1 Year	The precise answer to the question ? How long do Brazil nuts last once shelled? depends to a large extent on storage conditions -because of their high oil content, Brazil nuts must be stored properly to avoid becoming rancid. To maximize the shelf life of shelled Brazil nuts, store in cool, dry area; after opening the package, place the Brazil nuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Shelled Brazil nuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do shelled Brazil nuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if shelled Brazil nuts are bad? Rancid Brazil nuts will often develop a bitter, unpleasant taste; if Brazil nuts develop an off odor or taste, or if mould appears, they should be discarded.
Cereal, Ready-To-Eat, Commercially Packaged - Opened	2-3 Months (Best Quality) (Unopened)			How long does an opened package of cereal last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of opened cereal (including corn and bran flakes, toasted oats, rice puffs, corn puffs, granola, wheat squares) store in a cool, dry area. How long does opened cereal last at room temperature? Properly stored, an opened package of cereal will generally stay at best quality for about 2 to 3 months at room temperature. To maximize the shelf life of opened cereal, keep package tightly closed. Is opened cereal safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged cereal will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cereal will remain at peak quality. Storage time shown is for best quality only - after that, the cereal's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if cereal is bad or spoiled? The best way is to smell and look at the cereal: if cereal develops an off odor, flavour or appearance, or if mould appears, it should be discarded.

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Cereal, Ready-To-Eat, Commercially Packaged - Unopened	1 Year (Best Quality)			How long does an unopened package of cereal last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of unopened cereal (including corn and bran flakes, toasted oats, rice puffs, corn puffs, granola, wheat squares) store in a cool, dry area. Properly stored, an unopened package of cereal will generally stay at best quality for about one year. Is unopened cereal safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged cereal will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cereal will remain at peak quality. Storage time shown is for best quality only - after that, the cereal's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if cereal is bad or spoiled? The best way is to smell and look at the cereal: if cereal develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Coconuts, Fresh — In The Shell	1 Week	1 Month		Store in cool, dry area. Refrigerate for longer storage.
Coconuts, Fresh — Milk Or Water Only		2 Days	1-2 Months	Refrigerate in covered airtight container. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Coconuts, Fresh — Shelled		4-5 Days	6 Months	Refrigerate in covered airtight container. To freeze, shred coconut meat and place in airtight plastic container or heavy-duty freezer bag. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cornstarch — Unopened Or Opened Package	Keeps Indefinitely			How long does cornstarch last? The precise answer depends to a large extent on storage conditions — to maximize the shelf life of cornstarch, store in a cool, dark cupboard, away from direct heat or sunlight. To maximize the shelf life of cornstarch, keep the package tightly sealed after opening. Properly stored, cornstarch will stay safe indefinitely without a loss of quality. Is cornstarch safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged cornstarch may carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cornstarch will remain at peak quality. Does cornstarch ever spoil? No, commercially packaged cornstarch does not spoil and will remain safe provided it has been stored properly.
Hazelnuts / Filberts, Commercially Bagged Or Purchased In Bulk - In The Shell	3 Months	9 Months	12 Months	The precise answer to the question? How long do hazelnuts last in the shell? depends to a large extent on storage conditions -because of their high oil content, hazelnuts (filberts) must be stored properly to avoid becoming rancid. To maximize the shelf life of unshelled hazelnuts, store in cool, dry area; after opening the package, place the hazelnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of unshelled hazelnuts, the hazelnuts may be stored in the fridge or freezer; place hazelnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Unshelled hazelnuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do unshelled hazelnuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if unshelled hazelnuts are bad? Rancid hazelnuts will often develop a bitter, unpleasant taste; if hazelnuts develop an off odor or taste, or if mould appears, they should be discarded.
Kidney Beans, Commercially Canned Or Bottled — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	1-2 Months	How long does a can of kidney beans last once opened? The precise answer depends to a large extent on storage conditions - keep opened kidney beans refrigerated and tightly covered. To maximize the shelf life of canned kidney beans after opening, refrigerate in covered glass or plastic container. How long do opened canned kidney beans last in the refrigerator? Canned kidney beans that have been continuously refrigerated will keep for about 3 to 4 days. Are canned kidney beans safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned kidney beans will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the kidney beans will remain at peak quality. To further extend the shelf life of opened canned kidney beans, freeze them: to freeze canned kidney beans, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned kidney beans will be softer after freezing and thawing; the thawed kidney beans will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned kidney beans last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - kidney beans that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned kidney beans last after being frozen and thawed? Kidney beans that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; kidney beans that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned kidney beans are bad or spoiled? The best way is to smell and look at the kidney beans: if the kidney beans develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Lasagne - Purchased Commercially Frozen			18 months (best quality)	How long does frozen lasagne last? The precise answer to that question depends to a large extent on storage conditions - keep lasagne frozen at all times. Properly stored, frozen lasagne will maintain best quality for about 18 months in the freezer, although it will usually remain safe to eat after that. Is frozen lasagne safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen lasagne will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the lasagne will remain at peak quality. How long will frozen lasagne remain safe to eat? Frozen lasagne that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long can you safely leave frozen lasagne at room temperature? Frozen lasagne should be discarded if left for more than 2 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How long does frozen lasagne last in the fridge after being cooked? Frozen lasagne that has been cooked can be kept for 3 to 5 days in the fridge; refrigerate the lasagne in airtight containers or wrap tightly in aluminium foil or plastic wrap. How to tell if frozen lasagne is no longer good? If dry spots or discoloration have developed on the frozen lasagne, freezer burn has begun to set in - this will not make the lasagne unsafe to eat, but it will harm the texture and taste.
Macadamia Nuts, Commercially Bagged Or Purchased In Bulk - Out Of The Shell	2-4 Weeks	6 Months	9-12 Months	The precise answer to the question ? How long do macadamia nuts last once shelled? depends to a large extent on storage conditions -because of their high oil content, macadamia nuts must be stored properly to avoid becoming rancid. To maximize the shelf life of shelled macadamia nuts, store in cool, dry area; after opening the package, place the macadamia nuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of shelled macadamia nuts, the macadamia nuts may be stored in the fridge or freezer; place macadamia nuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Shelled macadamia nuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do shelled macadamia nuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if shelled macadamia nuts are bad? Rancid macadamia nuts will often develop a bitter, unpleasant taste; if macadamia nuts develop an off odor or taste, or if mould appears, they should be discarded.
Mixed Nuts, Commercially Canned Or Bottled - Opened	1 Month	4-6 Months	9-12 Months	Keep container tightly sealed after opening. Refrigerate to extend shelf life. To freeze, place nuts in airtight container or heavy-duty freezer bag. If nuts develop an off odor or taste they should be discarded.
Noodles And Sauce, Dry Mix, Commercially Packaged - Unopened Or Opened	2 Years (Best Quality)			How long does a package of noodles and sauce mix last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of noodles and sauce mix store in a cool, dry area. How long does noodles and sauce mix last at room temperature? Properly stored, a package of noodles and sauce mix will generally stay at best quality for about 2 years at room temperature. To maximize the shelf life of noodles and sauce mix, keep the package tightly closed at all times. Is noodles and sauce mix safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged noodles and sauce mix will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the noodles and sauce mix will remain at peak quality. 'Storage time shown is for best quality only - after that, the noodles and sauce mix's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if noodles and sauce mix is bad or spoiled? The best way is to smell and look at the noodles and sauce mix: if the noodles and sauce mix develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Oatmeal, Cooked		4-6 Days	6 Months	How long does cooked oatmeal last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate oatmeal within two hours of cooking. To maximize the shelf life of cooked oatmeal, refrigerate in covered airtight containers or resealable plastic bags. Properly stored, cooked oatmeal will last for 4 to 6 days in the refrigerator. How long can cooked oatmeal be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); oatmeal should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked oatmeal, freeze it; freeze oatmeal in covered airtight containers or heavy-duty freezer bags. How long does cooked oatmeal last in the freezer? Properly stored, it will maintain best quality for 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked oatmeal that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cooked oatmeal is bad? The best way is to smell and look at the oatmeal; discard any oatmeal with an off smell or appearance, do not taste the cooked oatmeal first.
Oatmeal, Regular Or Instant, Uncooked — Unopened Or Opened Package	18-24 months (best quality)			How long does oatmeal last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of oatmeal store in a cool, dry area. How long does oatmeal last at room temperature? Properly stored, a package of oatmeal will generally stay at best quality for about 18 to 24 months at room temperature. To maximize the shelf life of oatmeal once the package is opened, transfer to a covered airtight container or place original oatmeal package in a resealable plastic freezer bag. Is oatmeal safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged oatmeal will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the oatmeal will remain at peak quality. Storage time shown is for best quality only - after that, the oatmeal's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if oatmeal is bad or spoiled? The best way is to smell and look at the oatmeal: if oatmeal develops an off odor, flavour or appearance, or if insects appear, it should be discarded.
Oats, Commercially Packaged (Including Steel-Cut, Rolled, Instant Types) — Cooked	18-24 months (best quality)	4-6 Days	6 Months (Best Quality)	How long do cooked rolled oats last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate rolled oats within two hours of cooking. To maximize the shelf life of cooked rolled oats, refrigerate in covered airtight containers or resealable plastic bags. Properly stored, cooked rolled oats will last for 4 to 6 days in the refrigerator. How long can cooked rolled oats be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); rolled oats should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked rolled oats, freeze them; freeze cooked rolled oats in covered airtight containers or heavy-duty freezer bags. How long do cooked rolled oats last in the freezer? Properly stored, they will maintain best quality for 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked rolled oats that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cooked rolled oats are bad? The best way is to smell and look at the rolled oats; discard any rolled oats with an off smell or appearance, do not taste the cooked rolled oats first.
Pasta - Cooked Leftovers		3-5 Days	1-2 Months	How long does cooked pasta last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate pasta within two hours of cooking. To maximize the shelf life of cooked pasta for safety and quality, refrigerate the pasta in shallow airtight containers or resealable plastic bags. Properly stored, cooked pasta will last for 3 to 5 days in the refrigerator. How long can cooked pasta be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked pasta should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked pasta, freeze it; freeze in covered airtight containers or heavy-duty freezer bags. Cooked pasta dishes containing sauce freeze best; cooked dry pasta may become overly mushy when thawed. How long does cooked pasta last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked pasta that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked pasta last after being frozen and thawed? Cooked pasta that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; pasta that was thawed in the microwave or in cold water should be eaten immediately. How to tell if cooked pasta is bad? If cooked pasta develops an off odor, flavour or appearance, or if mould appears, it should be discarded; do not taste first.
Peanut Butter, Commercially Manufactured And Processed (Containing Hydrogenated Fat Or Other Stabilizers) - Opened Jar	3 Months	3-4 months after pantry storage		How long does peanut butter last once opened? The precise answer depends to a large extent on storage conditions - keep opened peanut butter tightly covered at all times and store in a cool, dark area. Pantry storage will allow opened peanut butter to spread more easily; about 3 months after opening, refrigeration is recommended to help retain the peanut butter's flavour and prevent oil separation. Storage time shown is for best quality only - after that, the opened peanut butter's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the opened peanut butter will still be safe to consume after that date, as long as it has been stored properly and kept continuously refrigerated after opening. How can you tell if peanut butter has gone bad? If peanut butter develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears, discard the entire product.
Peanut Butter, Commercially Manufactured And Processed (Containing Hydrogenated Fat Or Other Stabilizers) - Unopened Jar	2 Years (Best Quality)			How long does an unopened jar of peanut butter last? The precise answer depends to a large extent on storage conditions - to maximize shelf life, store in a cool, dry area. How long does an unopened jar of peanut butter last at room temperature? Properly stored, an unopened jar of peanut butter will generally stay at best quality for about 2 years. Is unopened peanut butter safe to use after the expiration date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged peanut butter will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the peanut butter will remain at peak quality. Storage time shown is for best quality only - after that, the peanut butter's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if peanut butter is bad or spoiled? The best way is to smell and look at the peanut butter: if the peanut butter develops an off odor, flavour or appearance, or if mould appears, it should be discarded.

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Peanut Butter, Natural (Does Not Contain Hydrogenated Fat Or Other Stabilizers) - Unopened Or Opened Container		6 Months		Refrigerating natural peanut butter in a covered container will slow down the rate at which it becomes rancid. Over time, oil will separate and rise to the top of the container; this is harmless and can be resolved by simply stirring the oil back into the peanut butter.
Peanuts, Commercially Bagged Or Purchased In Bulk - In The Shell	1-2 Months	4-6 Months	9-12 Months	The exact answer to the question ? How long do peanuts last in the shell? depends to a large extent on storage conditions -because of their high oil content, peanuts must be stored properly to avoid becoming rancid. To maximize the shelf life of unshelled peanuts, store in cool, dry area; after opening the package, place the peanuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of unshelled peanuts, the peanuts may be stored in the fridge or freezer; place peanuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Unshelled peanuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do unshelled peanuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if unshelled peanuts are bad? Rancid peanuts will often develop a bitter, unpleasant taste; if peanuts develop an off odor or taste, or if mould appears, they should be discarded.
Peanuts, Commercially Bagged Or Purchased In Bulk - Out Of The Shell	2-4 Weeks	4-6 Months	9-12 Months	The precise answer to the question ? How long do peanuts last once shelled? depends to a large extent on storage conditions -because of their high oil content, peanuts must be stored properly to avoid becoming rancid. To maximize the shelf life of shelled peanuts, store in cool, dry area; after opening the package, place the peanuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of shelled peanuts, the peanuts may be stored in the fridge or freezer; place peanuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Shelled peanuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do shelled peanuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if shelled peanuts are bad? Rancid peanuts will often develop a bitter, unpleasant taste; if peanuts develop an off odor or taste, or if mould appears, they should be discarded.
Pecans, Commercially Bagged Or Purchased In Bulk - In The Shell	2-4 Weeks	12 Months	2 Years	The exact answer to the question ? How long do pecans last in the shell? depends to a large extent on storage conditions -because of their high oil content, pecans must be stored properly to avoid becoming rancid. To maximize the shelf life of unshelled pecans, store in cool, dry area; after opening the package, place the pecans in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of unshelled pecans, the pecans may be stored in the fridge or freezer; place pecans in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Unshelled pecans can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do unshelled pecans last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if unshelled pecans are bad? Rancid pecans will often develop a bitter, unpleasant taste; if pecans develop an off odor or taste, or if mould appears, they should be discarded.
Pecans, Commercially Bagged Or Purchased In Bulk - Out Of The Shell	2-4 Weeks	9 Months	2 Years	The precise answer to the question ? How long do pecans last once shelled? depends to a large extent on storage conditions -because of their high oil content, pecans must be stored properly to avoid becoming rancid. To maximize the shelf life of shelled pecans, store in cool, dry area; after opening the package, place the pecans in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of shelled pecans, the pecans may be stored in the fridge or freezer; place pecans in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Shelled pecans can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do shelled pecans last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if shelled pecans are bad? Rancid pecans will often develop a bitter, unpleasant taste; if pecans develop an off odor or taste, or if mould appears, they should be discarded.
Ravioli In Tomato Sauce, Commercially Canned Or Bottled — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of ravioli last once opened? The precise answer depends to a large extent on storage conditions - keep opened ravioli refrigerated and tightly covered. To maximize the shelf life of canned ravioli after opening, refrigerate in a covered glass or plastic container. How long does opened canned ravioli last in the refrigerator? Ravioli that has been continuously refrigerated will keep for about 5 to 7 days. Is canned ravioli safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged ravioli will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the ravioli will remain at peak quality. To further extend the shelf life of opened canned ravioli, freeze it: to freeze canned ravioli, place inside covered airtight containers or heavy-duty freezer bags. How long does canned ravioli last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned ravioli that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned ravioli last after being frozen and thawed? Canned ravioli that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; ravioli that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned ravioli is bad or spoiled? The best way is to smell and look at the ravioli: if the ravioli develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Refried Beans, Commercially Canned — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	1-2 Months	How long does a can of refried beans last once opened? The precise answer depends to a large extent on storage conditions - keep opened refried beans refrigerated and tightly covered. To maximize the shelf life of canned refried beans after opening, refrigerate in covered glass or plastic container. How long do opened canned refried beans last in the refrigerator? Canned refried beans that have been continuously refrigerated will keep for about 3 to 4 days. Are canned refried beans safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned refried beans will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the refried beans will remain at peak quality. To further extend the shelf life of opened canned refried beans, freeze them: to freeze canned refried beans, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned refried beans will be softer after freezing and thawing; the thawed refried beans will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned refried beans last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - refried beans that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned refried beans last after being frozen and thawed? Refried beans that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; refried beans that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned refried beans are bad or spoiled? The best way is to smell and look at the refried beans: if the refried beans develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Rice, Brown - Cooked		4-6 Days	6 Months	How long does cooked brown rice last? The precise answer to that question depends to a large extent on storage conditions - refrigerate rice within two hours of cooking. To maximize the shelf life of cooked brown rice, refrigerate in covered airtight containers or resealable plastic bags. How long does cooked brown rice last in the refrigerator? Properly stored, cooked brown rice will last for 4 to 6 days in the refrigerator. How long can cooked brown rice be left out at room temperature? Cooked brown rice should be discarded if left out for more than 2 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). To further extend the shelf life of cooked brown rice, freeze it; freeze rice in covered airtight containers or heavy-duty freezer bags. How long does cooked brown rice last in the freezer? Properly stored, it will maintain best quality for 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only – cooked brown rice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cooked brown rice is bad? The best way is to smell and look at the rice; discard any rice with an off smell or appearance, do not taste the cooked rice first.
Rice, Brown - Uncooked, Unopened Or Opened Package	3-6 Months	6-12 Months	12-18 Months	How long does brown rice last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of uncooked brown rice, store in a cool, dry area. How long does brown rice last at room temperature? Properly stored, a package of brown rice will generally stay at best quality for about 3-6 months at room temperature. Due to the high oil content of brown rice, pantry storage will cause it to spoil relatively quickly compared to white rice. To maximize the shelf life of brown rice once the package is opened, transfer brown rice to a covered airtight container or place original brown rice bag in a resealable plastic freezer bag. Can you keep brown rice in the fridge or freezer? Yes, to further extend the shelf life of brown rice, refrigerate or freeze it; place the brown rice inside covered airtight containers or heavy-duty freezer bags. How long does brown rice last in the fridge? Brown rice will maintain best quality for about 6-12 months in the refrigerator. The freezer time shown is for best quality only — brown rice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does brown rice last in the freezer? Properly stored, brown rice will maintain best quality for about 12-18 months in the freezer, but will remain safe beyond that time. Is brown rice safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged brown rice will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the brown rice will remain at peak quality. Storage time shown is for best quality only - after that, the brown rice's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if brown rice is bad or spoiled? The best way is to smell and look at the brown rice: if the brown rice develops an off odor, flavour or appearance, or if insects appear, it should be discarded.
Rice, White - Cooked		4-6 Days	6 Months	How long does cooked white rice last? The precise answer to that question depends to a large extent on storage conditions - refrigerate rice within two hours of cooking. To maximize the shelf life of cooked white rice, refrigerate in covered airtight containers or resealable plastic bags. How long does cooked white rice last in the refrigerator? Properly stored, cooked white rice will last for 4 to 6 days in the refrigerator. How long can cooked white rice be left out at room temperature? Cooked white rice should be discarded if left out for more than 2 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). To further extend the shelf life of cooked white rice, freeze it; freeze rice in covered airtight containers or heavy-duty freezer bags. How long does cooked white rice last in the freezer? Properly stored, it will maintain best quality for 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only – cooked white rice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cooked white rice is bad? The best way is to smell and look at the rice; discard any rice with an off smell or appearance, do not taste the cooked rice first.
Rice, White - Uncooked (Including Regular, Converted, Instant) Unopened Or Opened Package	Keeps indefinitely	Keeps indefinitely	Keeps indefinitely	The precise answer to the question "How long does white rice last?" depends to a large extent on storage conditions - when properly stored and kept free from contaminants, uncooked white rice has an indefinite shelf life. To maximize the shelf life of white rice, store in a cool dry area; after opening the package, place the uncooked white rice in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Can you keep white rice in the fridge or freezer? Yes, for added protection against bugs, dust or other contaminants, uncooked white rice may also be stored in the fridge or freezer - place white rice in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. How long does white rice last once cooked? Cooked white rice will generally stay good for 4-6 days in the refrigerator and 6 months in the freezer. How long does uncooked brown rice last? Thanks to its higher oil content, brown rice will only keep for 3 to 6 months at room temperature. How to tell if white rice is bad? If the white rice develops an off odor, flavour or appearance, or if insects or other contaminants appear, it should be discarded.
Soybeans, Dried, Commercially Bagged Or Purchased In Bulk — Cooked At Home	1 Year (Uncooked)	5-7 Days	6 Months	Refrigerate within two hours of cooking. Refrigerate in covered container. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Spaghetti In Tomato Sauce / Spaghetti And Meatballs, Commercially Canned Or Packaged — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of spaghetti last once opened? The precise answer depends to a large extent on storage conditions - keep opened spaghetti refrigerated and tightly covered. To maximize the shelf life of canned spaghetti after opening, refrigerate in a covered glass or plastic container. How long does opened canned spaghetti last in the refrigerator? Spaghetti that has been continuously refrigerated will keep for about 5 to 7 days. Is canned spaghetti safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged spaghetti will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the spaghetti will remain at peak quality. To further extend the shelf life of opened canned spaghetti, freeze it: to freeze canned spaghetti, place inside covered airtight containers or heavy-duty freezer bags. How long does canned spaghetti last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned spaghetti that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned spaghetti last after being frozen and thawed? Canned spaghetti that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; spaghetti that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned spaghetti is bad or spoiled? The best way is to smell and look at the spaghetti: if the spaghetti develops an off odor, flavour or appearance, or if mould appears, it should be discarded. Discard all spaghetti from cans or packages that are leaking, rusting, bulging or severely dented.
Spaghetti - Cooked, Leftovers		3-5 Days	1-2 Months	How long does cooked spaghetti last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate spaghetti within two hours of cooking. To maximize the shelf life of cooked spaghetti for safety and quality, refrigerate the spaghetti in shallow airtight containers or resealable plastic bags. Properly stored, cooked spaghetti will last for 3 to 5 days in the refrigerator. How long can cooked spaghetti be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked spaghetti should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked spaghetti, freeze it; freeze in covered airtight containers or heavy-duty freezer bags. Cooked spaghetti dishes containing sauce freeze best; cooked dry macaroni noodles by themselves may become overly mushy when thawed. How long does cooked spaghetti last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked spaghetti that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked spaghetti last after being frozen and thawed? Cooked spaghetti that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; spaghetti that was thawed in the microwave or in cold water should be eaten immediately. How to tell if cooked spaghetti is bad? If cooked spaghetti develops an off odor, flavour or appearance, or if mould appears, it should be discarded; do not taste first.

Split Peas, Commercially Canned Or Bottled — Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	How long does a can of split peas last once opened? The precise answer depends to a large extent on storage conditions - keep opened split peas refrigerated and tightly covered. To maximize the shelf life of canned split peas after opening, refrigerate in covered glass or plastic container. How long do opened canned split peas last in the refrigerator? Canned split peas that have been continuously refrigerated will keep for about 3 to 4 days. Are canned split peas safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned split peas will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the split peas will remain at peak quality. To further extend the shelf life of opened canned split peas, freeze them: to freeze canned split peas, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned split peas will be softer after freezing and thawing; the thawed split peas will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned split peas last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - split peas that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned split peas last after being frozen and thawed? split peas that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; split peas that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned split peas are bad or spoiled? The best way is to smell and look at the split peas: if the split peas develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Walnuts, Commercially Bagged Or Purchased In Bulk - In The Shell	2-4 Weeks	9-12 Months	12 Months	How long do walnuts last in the shell? depends to a large extent on storage conditions -because of their high oil content, walnuts must be stored properly to avoid becoming rancid. To maximize the shelf life of unshelled walnuts, store in cool, dry area; after opening the package, place the walnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. To further extend the shelf life of unshelled walnuts, the walnuts may be stored in the fridge or freezer; place walnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. Unshelled walnuts can be thawed and refrozen repeatedly during the freezer time shown without any significant loss of flavour or texture. How long do unshelled walnuts last when stored in the freezer? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if unshelled walnuts are bad? Rancid walnuts will often develop a bitter, unpleasant taste; if walnuts develop an off odor or taste, or if mould appears, they should be discarded.
Walnuts, Commercially Bagged Or Purchased In Bulk - Out Of The Shell	2-4 Weeks	9-12 Months	18-24 Months	How long do shelled walnuts last? The precise answer depends to a large extent on storage conditions - because of their high oil content, walnuts must be stored properly to avoid becoming rancid. To maximize the shelf life of shelled walnuts, store in cool, dry area; after opening the package, place the walnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. How long do shelled walnuts last at room temperature? Properly stored, shelled walnuts will keep well for about 2 to 4 weeks at normal room temperature. To extend the shelf life of shelled walnuts, refrigerate them; place walnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. How long do shelled walnuts last in the refrigerator? Shelled walnuts will keep well for about 1 year in the fridge when properly stored. To further extend the shelf life of shelled walnuts, freeze them: place walnuts in a sealed airtight container or place original package in a resealable heavy-duty freezer bag. How long do shelled walnuts last in the freezer? Properly stored, shelled walnuts will maintain best quality for about 18 to 24 months in the freezer, but will remain safe to consume after that time if they have been continuously frozen. The freezer time shown is for best quality only – shelled walnuts kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

2 Vegetables Shelf Life

These is the shelf life of most vegetables, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Arugula (Rocket) — Fresh, Raw	2-3 Days			Store in tightly sealed plastic bag. Do not wash until ready to eat. Does not freeze well.
Asparagus - Commercially Frozen			10-12 Months	Keep frozen until ready to use. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Once prepared, refrigerate leftovers in a covered container for up to four days.
Asparagus - Fresh, Cooked	3-5 Days		10-12 Months	How long does cooked asparagus last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate asparagus within two hours of cooking. To maximize the shelf life of cooked asparagus for safety and quality, refrigerate the asparagus in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked asparagus will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked asparagus, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked asparagus last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked asparagus that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked asparagus last after being frozen and thawed? Cooked asparagus that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; asparagus that was thawed in the microwave or in cold water should be eaten immediately. How long can cooked asparagus be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked asparagus should be discarded if left out for more than 2 hours at room temperature.
Asparagus - Fresh, Raw	3-4 Days		12-18 Months	How long does raw asparagus last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep asparagus refrigerated at all times. To maximize the shelf life of raw asparagus, wrap bottom of asparagus stalks in damp paper towel, then refrigerate in an unsealed plastic bag. How long does raw asparagus last in the fridge? Properly stored, raw asparagus will usually keep well for about 3 to 4 days in the refrigerator. How long does asparagus last in the fridge once it has been cooked? Cooked asparagus will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze asparagus? Yes, to freeze: (1) Wash thoroughly and trim stalks by removing scales with a sharp knife; (2) Cut asparagus into even-sized pieces; (3) Blanch (plunge into boiling water) for three minutes and chill quickly in ice cold water; (4) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. How long does asparagus last in the freezer? Properly stored, it will maintain best quality for about 12 to 18 months, but will remain safe beyond that time. The freezer time shown is for best quality only - asparagus that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if asparagus is bad or spoiled? Asparagus that is spoiling will typically become soft and discoloured and the tips will start to darken; discard any asparagus that has an off smell or appearance.
Asparagus, Commercially Canned Or Bottled — Opened	3-4 Days		1-2 Months	How long does a can of asparagus last once opened? The precise answer depends to a large extent on storage conditions - keep opened asparagus refrigerated and tightly covered. To maximize the shelf life of canned or packaged asparagus after opening, refrigerate in a covered glass or plastic container. How long does opened canned asparagus last in the refrigerator? Asparagus that has been continuously refrigerated will keep for about 3 to 4 days. Is canned asparagus safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged asparagus will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the asparagus will remain at peak quality. To further extend the shelf life of opened canned asparagus, freeze it: to freeze asparagus, place inside covered airtight containers or heavy-duty freezer bags. How long does canned asparagus last in the freezer? Properly stored, it will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - asparagus that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned asparagus last after being frozen and thawed? Canned asparagus that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; asparagus that was thawed in the microwave or in cold water should be used immediately.
Asparagus, Commercially Canned Or Bottled — Unopened	3-5 Years			How long does unopened canned asparagus last? The precise answer depends to a large extent on storage conditions - to maximize shelf life, store in a cool, dry area. How long does unopened canned asparagus last at room temperature? Properly stored, unopened canned asparagus will generally stay at best quality for about 3 to 5 years, although it will usually remain safe to use after that. Is unopened canned asparagus safe to use after the "expiration" date on the can or package? Yes, provided it is properly stored and the can is undamaged - commercially packaged canned asparagus will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the canned asparagus will remain at peak quality. Storage time shown is for best quality only - after that, the canned asparagus's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the can is undamaged, and there are no signs of spoilage. How can you tell if canned asparagus is bad or spoiled? The best way is to smell and look at the canned asparagus: if the canned asparagus develops an off odor, flavour or appearance, or if mould appears, it should be discarded. Discard all canned asparagus from cans or packages that are leaking, rusting, bulging or severely dented.
Baby Carrots - Fresh, Raw	2-3 Weeks		12-18 Months	How long do baby carrots last? The precise answer to that question depends to a large extent on storage conditions - keep baby carrots refrigerated. To maximize the shelf life of baby carrots, refrigerate in covered container or resealable plastic bag or wrap tightly in aluminium foil or plastic wrap. How long do baby carrots last in the fridge? Properly stored, baby carrots will last for 2 to 3 weeks in the refrigerator. Can you freeze baby carrots? Yes, to freeze: (1) Blanch (plunge into boiling water) baby carrots for two minutes and chill quickly in ice cold water; (2) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Frozen baby carrots will soften when thawed and are best used in cooked dishes. How long do baby carrots last in the freezer? Properly stored, they will maintain best quality for about 12 to 18 months, but will remain safe beyond that time. The freezer time shown is for best quality only - carrots that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if baby carrots are bad or spoiled? The best way is to smell and look at the baby carrots: discard any carrots that have an off smell or appearance; if mould appears, discard the baby carrots.
Beans (All Varieties) - Commercially Frozen			10-12 Months	Keep frozen until ready to use. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Once prepared, refrigerate leftovers in a covered container for up to four days.
Beans, Snap, String Or Wax (Green Or Yellow) - Fresh, Raw		3-5 Days	12-18 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash thoroughly and remove ends; (2) Leave beans whole, or cut into 1 to 1 1/2 inch pieces; (3) Blanch (plunge into boiling water) for three minutes and chill quickly in ice cold water; (4) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Beans, Snap, String Or Wax (Green Or Yellow) - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked green beans last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate green beans within two hours of cooking. To maximize the shelf life of cooked green beans for safety and quality, refrigerate the green beans in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked green beans will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked green beans, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked green beans last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked green beans that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked green beans last after being frozen and thawed? Cooked green beans that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; green beans that were thawed in the microwave or in cold water should be eaten immediately. How long can cooked green beans be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked green beans should be discarded if left out for more than 2 hours at room temperature.
Beans, Snap, String Or Wax (Green Or Yellow), Commercially Canned Or Bottled — Opened		3-4 Days	1-2 Months	How long does a can of green beans last once opened? The precise answer depends to a large extent on storage conditions - keep opened green beans refrigerated and tightly covered. To maximize the shelf life of canned green beans after opening, refrigerate in covered glass or plastic container. How long do opened canned green beans last in the refrigerator? Canned green beans that have been continuously refrigerated will keep for about 3 to 4 days. Are canned green beans safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned green beans will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the green beans will remain at peak quality. To further extend the shelf life of opened canned green beans, freeze them: to freeze canned green beans, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned green beans will be softer after freezing and thawing; the thawed green beans will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned green beans last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. How long do canned green beans last after being frozen and thawed? Green beans that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; green beans that were thawed in the microwave or in cold water should be used immediately.
Beans, Snap, String Or Wax (Green Or Yellow), Commercially Canned Or Bottled — Unopened	3-5 Years (Best Quality)			How long do unopened canned green beans last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of canned green beans, store in a cool, dry area. How long does an unopened can of green beans last at room temperature? Properly stored, an unopened can of green beans will generally stay at best quality for about 3 to 5 years, although it will usually remain safe to use after that. Are unopened canned green beans safe to use after the "expiration" date on the can or package? Yes, provided they are properly stored and the can is undamaged - commercially packaged canned green beans will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the canned green beans will remain at peak quality. Storage time shown is for best quality only - after that, the canned green beans' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the can is undamaged, and there are no signs of spoilage. How can you tell if canned green beans are bad or spoiled? The best way is to smell and look at the canned green beans: if the canned green beans develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all canned green beans from cans or packages that are leaking, rusting, bulging or severely dented.
Beets - Fresh, Raw		2 Weeks	12-18 Months	Store in plastic bag in the refrigerator; do not wash before refrigerating. To freeze: (1) Wash beets and trim tops, leaving 1/2 inch of stem; (2) Cook beets until tender; (3) Cool then peel beets and cut into slices or cubes; (4) Place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

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Beets - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked beets last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate beets within two hours of cooking. To maximize the shelf life of cooked beets for safety and quality, refrigerate the beets in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked beets will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked beets, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked beets last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked beets that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked beets last after being frozen and thawed? Cooked beets that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; beets that were thawed in the microwave or in cold water should be eaten immediately. How long can cooked beets be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked beets should be discarded if left out for more than 2 hours at room temperature.
Beets, Commercially Canned Or Bottled — Opened		3-4 Days	1-2 Months	How long does a can of beets last once opened? The precise answer depends to a large extent on storage conditions - keep opened beets refrigerated and tightly covered. To maximize the shelf life of canned beets after opening, refrigerate in covered glass or plastic container. How long do opened canned beets last in the refrigerator? Canned beets that have been continuously refrigerated will keep for about 3 to 4 days. Are canned beets safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned beets will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the beets will remain at peak quality. To further extend the shelf life of opened canned beets, freeze them: to freeze canned beets, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned beets will be softer after freezing and thawing; the thawed beets will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned beets last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. How long do canned beets last after being frozen and thawed? Beets that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; beets that were thawed in the microwave or in cold water should be used immediately.
Beets, Commercially Canned Or Bottled — Unopened	3-5 Years			How long do unopened canned beets last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of canned beets, store in a cool, dry area. How long does an unopened can of beets last at room temperature? Properly stored, an unopened can of beets will generally stay at best quality for about 3 to 5 years, although it will usually remain safe to use after that. Are unopened canned beets safe to use after the "expiration" date on the can or package? Yes, provided they are properly stored and the can is undamaged - commercially packaged canned beets will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the canned beets will remain at peak quality. Storage time shown is for best quality only - after that, the canned beets' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the can is undamaged, and there are no signs of spoilage. How can you tell if canned beets are bad or spoiled? The best way is to smell and look at the canned beets: if the canned beets develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all canned beets from cans or packages that are leaking, rusting, bulging or severely dented.
Bell Peppers / Sweet Peppers / Capsicum (Including Green, Red, Yellow, Orange) - Fresh, Raw, Whole		1-2 Weeks	10-12 Months	How long do raw bell peppers last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep bell peppers refrigerated at all times. To maximize the shelf life of raw bell peppers, store in a plastic bag in the vegetable crisper of refrigerator. Green bell peppers will usually last longer than orange or red bell peppers. How long do raw bell peppers last in the refrigerator? Properly stored, bell peppers will usually keep well for 1 to 2 weeks in the fridge. Do you need to wash raw bell peppers before eating them? Yes, bell peppers should be thoroughly washed in running water before eating. How long do raw bell peppers last after they have been sliced or chopped? Chopped raw bell peppers will last for about 2 to 3 days in the refrigerator. How long do bell peppers last in the fridge once they have been cooked? Cooked bell peppers will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze bell peppers? Yes, to freeze: (1) Slice or chop bell peppers (2) Spread in a single layer on cookie tray (3) Freeze, then promptly transfer frozen bell peppers from cookie tray to airtight containers or heavy-duty freezer bags and return to freezer.
Bell Peppers / Sweet Peppers / Capsicum (Including Green, Red, Yellow, Orange) - Fresh, Raw, Sliced Or Chopped		2-3 Days	10-12 Months	How long do chopped bell peppers last? The precise answer to that question depends to a large extent on storage conditions - keep chopped peppers refrigerated. To maximize the shelf life of chopped peppers, refrigerate in covered container or resealable plastic bag or wrap tightly in aluminium foil or plastic wrap. How long do chopped bell peppers last in the fridge? Properly stored, chopped peppers will last for 2 to 3 days in the refrigerator. Can you freeze chopped peppers? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags, or wrap tightly in heavy-duty aluminium foil or plastic wrap. How long do chopped bell peppers last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - peppers that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if chopped peppers are bad or spoiled? The best way is to smell and look at the chopped peppers: discard any peppers that have an off smell or appearance; if mould appears, discard the chopped peppers.
Broccoli - Commercially Frozen			10-12 Months	How long does frozen broccoli last? The precise answer to that question depends to a large extent on storage conditions - keep broccoli frozen at all times. Properly stored, frozen broccoli will maintain best quality for about 12 months in the freezer, although it will usually remain safe to eat after that. Is frozen broccoli safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen broccoli will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the frozen broccoli will remain at peak quality. How long will frozen broccoli remain safe to eat? Frozen broccoli that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long can you safely leave frozen broccoli at room temperature? Frozen broccoli should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen broccoli is no longer good? If dry spots or discoloration have developed on the frozen broccoli, freezer burn has begun to set in - this will not make the broccoli unsafe to eat, but it will harm the texture and taste.
Broccoli - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked broccoli last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate broccoli within two hours of cooking. To maximize the shelf life of cooked broccoli for safety and quality, refrigerate the broccoli in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked broccoli will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked broccoli, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked broccoli last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked broccoli that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked broccoli last after being frozen and thawed? Cooked broccoli that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; broccoli that was thawed in the microwave or in cold water should be eaten immediately. How long can cooked broccoli be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked broccoli should be discarded if left out for more than 2 hours at room temperature.
Broccoli - Fresh, Raw		3-5 Days	12-18 Months	How long does raw broccoli last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep broccoli refrigerated at all times. To maximize the shelf life of raw broccoli, refrigerate in a plastic bag; do not wash until ready to use. Properly stored, broccoli will usually keep well for about 3 to 5 days in the refrigerator. Do you need to wash raw broccoli before eating it? Yes, broccoli should be thoroughly washed in running water before eating. How long does raw broccoli last after it's been sliced or chopped? Chopped raw broccoli will last for 1 to 2 days in the refrigerator. How long does broccoli last in the fridge once it has been cooked? Cooked broccoli will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze broccoli? Yes, to freeze: (1) Wash thoroughly, cut off leaves and woody stems; (2) Spit flowerets and stalks into 1 to 1 1/2 inch pieces; (3) Blanch (plunge into boiling water) broccoli for three minutes and chill quickly in ice cold water; (4) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. How long does broccoli last in the freezer? Properly stored, it will maintain best quality for about 12 to 18 months, but will remain safe beyond that time.
Cabbage - Fresh, Raw		1 Week	12-18 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash thoroughly and remove course outer leaves; (2) Cut cabbage into thin wedges or separate into leaves; (3) Blanch (plunge into boiling water) for 2 minutes and chill quickly in ice cold water; (4) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cabbage - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked cabbage last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate cabbage within two hours of cooking. To maximize the shelf life of cooked cabbage for safety and quality, refrigerate the cabbage in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked cabbage will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked cabbage, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked cabbage last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked cabbage that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked cabbage last after being frozen and thawed? Cooked cabbage that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; cabbage that was thawed in the microwave or in cold water should be eaten immediately. How long can cooked cabbage be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked cabbage should be discarded if left out for more than 2 hours at room temperature.
Carrots - Commercially Frozen			10-12 Months	How long do frozen carrots last? The precise answer to that question depends to a large extent on storage conditions - keep carrots frozen at all times. Properly stored, frozen carrots will maintain best quality for about 12 months in the freezer, although they will usually remain safe to eat after that. Are frozen carrots safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially frozen carrots will typically carry a Best By, Best if Used By, Best Before, or Best When Used By date but this is not a safety date, it is the manufacturer's estimate of how long the frozen carrots will remain at peak quality. How long will frozen carrots remain safe to eat? Frozen carrots that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen carrots at room temperature? Frozen carrots should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen carrots are no longer good? If dry spots or discolorations have developed on the frozen carrots, freezer burn has begun to set in - this will not make the frozen carrots unsafe to eat, but it will harm the texture and taste.
Carrots - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked carrots last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate carrots within two hours of cooking. To maximize the shelf life of cooked carrots for safety and quality, refrigerate the carrots in shallow airtight containers or resealable plastic bags. Properly stored, cooked carrots will last for 3 to 5 days in the refrigerator. How long can cooked carrots be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked carrots should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked carrots, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked carrots last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked carrots that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked carrots last after being frozen and thawed? Cooked carrots that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; carrots that were thawed in the microwave or in cold water should be eaten immediately.
Carrots - Fresh, Raw, Chopped, Carrot Sticks		2-3 Weeks	12-18 Months	How long do chopped carrots or carrot sticks last? The precise answer to that question depends to a large extent on storage conditions - keep chopped carrots refrigerated. To maximize the shelf life of chopped carrots, refrigerate in covered container or resealable plastic bag or wrap tightly in aluminium foil or plastic wrap. How long do chopped carrots last in the fridge? Properly stored, chopped carrots will last for 2 to 3 weeks in the refrigerator. Can you freeze chopped carrots? Yes, to freeze: (1) Blanch (plunge into boiling water) chopped carrots for two minutes and chill quickly in ice cold water; (2) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Frozen chopped carrots will soften when thawed and are best used in cooked dishes. How long do chopped carrots last in the freezer? Properly stored, they will maintain best quality for about 12 to 18 months, but will remain safe beyond that time. The freezer time shown is for best quality only - carrots that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if chopped carrots are bad or spoiled? The best way is to smell and look at the chopped carrots: discard any carrots that have an off smell or appearance; if mould appears, discard the chopped carrots.
Carrots - Fresh, Raw, Unpeeled		3-4 Weeks	10-12 Months	How long do raw carrots last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep carrots refrigerated at all times. To maximize the shelf life of raw carrots, refrigerate in a plastic bag. How long do raw carrots last in the refrigerator? Properly stored, carrots will usually keep well for about 3 to 4 weeks in the fridge. Do you need to wash raw carrots before eating them? Yes, carrots should be thoroughly washed in running water before eating. How long do raw carrots last after they have been sliced or chopped? Chopped raw carrots will last for about 2 to 3 weeks in the refrigerator. How long do carrots last in the fridge once they have been cooked? Cooked carrots will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze carrots? Yes, to freeze: (1) Wash, peel and cut into 1/2 inch slices, cubes or strips; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. How long do carrots last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Carrots, Commercially Canned Or Bottled — Opened		3-4 Days	1-2 Months	How long does a can of carrots last once opened? The precise answer depends to a large extent on storage conditions - keep opened carrots refrigerated and tightly covered. To maximize the shelf life of canned carrots after opening, refrigerate in covered glass or plastic container. How long do opened canned carrots last in the refrigerator? Canned carrots that have been continuously refrigerated will keep for about 3 to 4 days. Are canned carrots safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned carrots will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the carrots will remain at peak quality. To further extend the shelf life of opened canned carrots, freeze them: to freeze canned carrots, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned carrots will be softer after freezing and thawing; the thawed carrots will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned carrots last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - carrots that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Carrots, Commercially Canned Or Bottled — Unopened	3-5 Years (Best Quality)			How long do unopened canned carrots last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of canned carrots, store in a cool, dry area. How long does an unopened can of carrots last at room temperature? Properly stored, an unopened can of carrots will generally stay at best quality for about 3 to 5 years, although it will usually remain safe to use after that. Are unopened canned carrots safe to use after the "expiration" date on the can or package? Yes, provided they are properly stored and the can is undamaged - commercially packaged canned carrots will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the canned carrots will remain at peak quality. Storage time shown is for best quality only - after that, the canned carrots' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the can is undamaged, and there are no signs of spoilage. How can you tell if canned carrots are bad or spoiled? The best way is to smell and look at the canned carrots: if the canned carrots develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all canned carrots from cans or packages that are leaking, rusting, bulging or severely dented.
Cauliflower - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked cauliflower last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate cauliflower within two hours of cooking. To maximize the shelf life of cooked cauliflower for safety and quality, refrigerate the cauliflower in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked cauliflower will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked cauliflower, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked cauliflower last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked cauliflower that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked cauliflower last after being frozen and thawed? Cooked cauliflower that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; cauliflower that was thawed in the microwave or in cold water should be eaten immediately. How long can cooked cauliflower be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked cauliflower should be discarded if left out for more than 2 hours at room temperature.
Cauliflower - Commercially Frozen			10-12 Months	How long does frozen cauliflower last? The precise answer to that question depends to a large extent on storage conditions - keep cauliflower frozen at all times. Properly stored, frozen cauliflower will maintain best quality for about 12 months in the freezer, although it will usually remain safe to eat after that. Is frozen cauliflower safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen cauliflower will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the frozen cauliflower will remain at peak quality. How long will frozen cauliflower remain safe to eat? Frozen cauliflower that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long can you safely leave frozen cauliflower at room temperature? Frozen cauliflower should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen cauliflower is no longer good? If dry spots or discoloration have developed on the frozen cauliflower, freezer burn has begun to set in - this will not make the cauliflower unsafe to eat, but it will harm the texture and taste.
Cauliflower - Fresh, Raw		1 Week	12-18 Months	How long does raw cauliflower last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep cauliflower refrigerated at all times. To maximize the shelf life of raw cauliflower, refrigerate in a plastic bag; do not wash until ready to use. Properly stored, cauliflower will usually keep well for about 1 week in the refrigerator. Do you need to wash raw cauliflower before eating it? Yes, cauliflower should be thoroughly washed in running water before eating. How long does cauliflower last in the fridge once it has been cooked? Cooked cauliflower will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze cauliflower? Yes, to freeze: (1) Wash thoroughly, cut off leaves; (2) Split cauliflower into 1 to 1 1/2 inch pieces; (3) Blanch (plunge into boiling water) for three minutes and chill quickly in ice cold water; (4) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. How long does cauliflower last in the freezer? Properly stored, it will maintain best quality for about 12 to 18 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cauliflower that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chopped Onions - Commercially Frozen			10-12 Months	How long do frozen chopped onions last? The precise answer to that question depends to a large extent on storage conditions - keep chopped onions frozen at all times. Properly stored, frozen chopped onions will maintain best quality for about 12 months in the freezer, although they will usually remain safe to eat after that. Are frozen chopped onions safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially frozen chopped onions will typically carry a Best By, Best if Used By, Best Before, or Best When Used By date but this is not a safety date, it is the manufacturer's estimate of how long the frozen chopped onions will remain at peak quality. How long will frozen chopped onions remain safe to eat? Frozen chopped onions that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen chopped onions at room temperature? Frozen chopped onions should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen chopped onions are no longer good? If dry spots or discolorations have developed on the frozen chopped onions, freezer burn has begun to set in - this will not make the frozen chopped onions unsafe to eat, but it will harm the texture and taste.
Corn — Commercially Frozen			10-12 Months	How long does frozen corn last? The precise answer to that question depends to a large extent on storage conditions - keep corn frozen at all times. Properly stored, frozen corn will maintain best quality for about 12 months in the freezer, although it will usually remain safe to eat after that. Is frozen corn safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen corn will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the frozen corn will remain at peak quality. How long will frozen corn remain safe to eat? Frozen corn that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long can you safely leave frozen corn at room temperature? Frozen corn should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen corn is no longer good? If dry spots or discoloration have developed on the frozen corn, freezer burn has begun to set in - this will not make the corn unsafe to eat, but it will harm the texture and taste.
Corn On The Cob - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked corn on the cob last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate corn on the cob within two hours of cooking. To maximize the shelf life of cooked corn on the cob for safety and quality, refrigerate the corn on the cob in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked corn on the cob will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked corn on the cob, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Before freezing, cut kernels off the cobs and place in an airtight plastic container or heavy-duty freezer bag. How long does cooked corn on the cob last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked corn on the cob that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked corn on the cob last after being frozen and thawed? Cooked corn on the cob that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; corn on the cob that was thawed in the microwave or in cold water should be eaten immediately.
Corn On The Cob - Fresh, Raw		1-3 Days	8 Months	How long does raw corn on the cob last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep corn on the cob refrigerated at all times. To maximize the shelf life of raw corn on the cob and to ensure best quality, keep the husks on until ready to use. If the husks have already been removed from the raw corn on the cob, wrap the corn in plastic or foil before refrigerating. Properly stored, raw corn on the cob will usually keep well for about 1 to 3 days in the refrigerator. How long does corn on the cob last in the fridge once it has been cooked? Cooked corn on the cob will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze corn on the cob? Yes, to freeze whole corn on the cob: (1) Husk corn, remove silk and wash; (2) Blanch (plunge into boiling water) corn for 7 minutes (for small ears) to 11 minutes (for large ears) and chill quickly in ice cold water; (3) Drain off excess moisture, and package in airtight containers or freezer bags. To freeze whole kernel corn: (1) Husk corn, remove silk and wash; (2) Blanch (plunge into boiling water) corn for 4 minutes and chill quickly in ice cold water; (3) Drain, cut kernels from the cob and package in airtight containers or freezer bags. How long does corn on the cob last in the freezer? Properly stored, it will maintain best quality for about 8 months, but will remain safe beyond that time.
Corn, Commercially Canned Or Bottled (All Varieties) — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	1-2 Months	How long does a can of corn last once opened? The precise answer depends to a large extent on storage conditions - keep opened corn refrigerated and tightly covered. To maximize the shelf life of canned or packaged corn after opening, refrigerate in a covered glass or plastic container. How long does opened canned corn last in the refrigerator? Corn that has been continuously refrigerated will keep for about 3 to 4 days. Is canned corn safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged corn will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the corn will remain at peak quality. To further extend the shelf life of opened canned corn, freeze it: to freeze corn, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned corm will be softer after freezing and thawing; the thawed canned corn will be best suited to cooked dishes, such as sauces, soups and casseroles. How long does canned corn last in the freezer? Properly stored, it will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - corn that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Commercially Canned Soups — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	4-6 Months	How long does canned soup last once opened? The precise answer depends to a large extent on storage conditions - keep opened cream of asparagus soup refrigerated and tightly covered. To maximize the shelf life of canned soup after opening, refrigerate in covered glass or plastic container. How long does soup last in the refrigerator? Continuously refrigerated, it will keep for about 3 to 4 days. Is soup safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged cream of asparagus soup will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cream of asparagus soup will remain at peak quality. To further extend the shelf life of opened soup, freeze it: to soup, place inside covered airtight containers or heavy-duty freezer bags. How long does soup last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - soup that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does soup last after being frozen and thawed? Soup that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; soup that was thawed in the microwave or in cold water should be used immediately.
Cucumber - Fresh, Raw, Sliced Or Chopped		1-2 Days		Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Cucumber does not freeze well.
Cucumber - Fresh, Raw, Whole		1 Week		How long do cucumbers last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep cucumbers refrigerated at all times. To maximize the shelf life of cucumbers, store in a plastic bag in the vegetable crisper of refrigerator; do not wash until ready to use. Properly stored, cucumbers will usually keep well for 1 week in the fridge. Do you need to wash cucumbers before eating them? Yes, cucumbers should be thoroughly washed in running water before eating. How long do cucumbers last after they have been sliced or chopped? Chopped cucumbers will last for about 1 to 2 days in the refrigerator. Can you freeze cucumbers? Cucumbers do not freeze well and freezing is not recommended: cucumbers are high in moisture, which turns to ice when frozen, causing a mushy, wilted texture when thawed. How to tell if cucumbers are bad or spoiled? Cucumbers that are spoiling will typically become soft and discoloured; discard any cucumbers that have an off smell or appearance.
Dandelion Greens — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Dandelion Greens — Fresh, Raw		1-2 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash greens thoroughly and cut off woody stems; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Dried Vegetables, Commercially Packaged (Including Vegetable Soup Blends) — Unopened Or Opened	1 Year			Store in airtight container.
French Fries (French Fried Potatoes) - Commercially Frozen			10-12 Months	How long do frozen French fries last? The precise answer to that question depends to a large extent on storage conditions - keep French fries frozen at all times. Properly stored, frozen French fries will maintain best quality for about 12 months in the freezer, although they will usually remain safe to eat after that. Are frozen French fries safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially frozen French fries will typically carry a Best By, Best if Used By, Best Before, or Best When Used By date but this is not a safety date, it is the manufacturer's estimate of how long the frozen French fries will remain at peak quality. How long will frozen French fries remain safe to eat? Frozen French fries that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen French fries at room temperature? Frozen French fries should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen French fries are no longer good? If dry spots or discolorations have developed on the frozen French fries, freezer burn has begun to set in - this will not make the frozen French fries unsafe to eat, but it will harm the texture and taste.
Garlic - Fresh, Raw, Chopped		5-7 Days	10-12 Months	Refrigerate in airtight container or wrap tightly in plastic wrap and use as soon as possible. To freeze, wrap chopped garlic tightly in plastic freezer wrap or aluminium foil, or place in airtight container or heavy-duty freezer bag. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Garlic - Fresh, Raw, Whole Bulb / Head	3-5 Months		10-12 Months	How long does garlic last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep fresh whole garlic in a cool, dry, area. How long does fresh garlic last at room temperature? Properly stored, whole raw garlic will last for about 3 to 5 months at normal room temperature. To maximize the shelf life of garlic, store it in a moderately warm 12.7°C-15.5°C (55°-60°F) area; at higher room temperatures, the shelf life of garlic will be shorter. To further maximize the shelf life of garlic, store it a container that allows for air circulation, such as a wire-mesh basket, a paper bag, or a garlic keeper with holes. Should you refrigerate raw garlic? Whole, raw garlic should ideally not be refrigerated; doing so can cause it to sprout quickly. Once the whole garlic bulb is broken, individual cloves will last unpeeled for about 7-10 days at room temperature. How long does raw garlic last after it's been peeled and chopped? Chopped garlic will usually stay good for about 5 to 7 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze raw garlic? Yes, to freeze garlic: (1) Wrap whole, unpeeled bulbs in plastic freezer wrap or aluminium foil, or place in airtight container or freezer bag and remove individual cloves from freezer as needed; or (2) Peel then chop or crush garlic and wrap tightly in plastic freezer wrap or aluminium foil, or place in airtight container or freezer bag.
Garlic, Commercially Bottled And Chopped, Sold Unrefrigerated - Opened	2 Years (Unopened)	2 years or date on package		Refrigerate after opening to maintain quality. After time shown, most commercially bottled products will still be safe to consume, but the quality may suffer - taste, appearance and consistency can change after prolonged storage.
Ginger Root - Fresh, Raw		2-3 Weeks	1 Month	Refrigerate in plastic bag. To freeze, place in covered airtight container or heavy-duty freezer bag. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Green Onions (Scallions) - Fresh, Raw		7-10 Days	10-12 Months	Wrap in plastic and refrigerate in vegetable crisper. To freeze: (1) Wash green onions and dry thoroughly; (2) Chop or leave whole and place in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Kale — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Kale - Commercially Frozen			10-12 Months	How long does frozen kale last? The precise answer to that question depends to a large extent on storage conditions - keep kale frozen at all times. Properly stored, frozen kale will maintain best quality for about 12 months in the freezer, although it will usually remain safe to eat after that. Is frozen kale safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen kale will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the frozen kale will remain at peak quality. How long will frozen kale remain safe to eat? Frozen kale that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long can you safely leave frozen kale at room temperature? Frozen kale should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen kale is no longer good? If dry spots or discoloration have developed on the frozen kale, freezer burn has begun to set in - this will not make the kale unsafe to eat, but it will harm the texture and taste.
Kale - Fresh, Raw, Loose		5-7 Days	10-12 Months	How long does raw kale last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep kale refrigerated at all times. To maximize the shelf life of raw kale, refrigerate in a plastic bag; do not wash until ready to use. Properly stored, raw kale will usually keep well for about 5 to 7 days in the refrigerator. Do you need to wash raw kale before eating it? Yes, kale should be thoroughly washed in running water before eating. How long does kale last in the fridge once it has been cooked? Cooked kale will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze raw kale? Yes, to freeze: (1) Wash kale thoroughly and cut off woody stems; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. How long does kale last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - kale that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Kale, Fresh, Commercially Bagged And Prewashed - Opened Bag		3-5 Days	10-12 Months	How long does an opened bag of prewashed kale last in the fridge? The precise answer to that question depends to a large extent on storage conditions -keep an opened bag of prewashed kale refrigerated at all times. How long can an opened bag of prewashed kale be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); an opened bag of prewashed kale should be discarded if left out for more than 2 hours at room temperature. To maximize the shelf life of an opened bag of prewashed kale, place package upright in the refrigerator and keep closed. How long does an opened bag of prewashed kale last in the refrigerator? Properly stored, an opened bag of prewashed kale will usually keep well for about 3 to 5 days in the fridge. Do you need to wash an opened bag of prewashed kale before eating it? No, it is not necessary to re-wash a prewashed kale; if you choose to re-wash the salad, be sure that it does not come in contact with unclean surfaces or utensils, in order to help to avoid cross contamination. How to tell if an opened bag of prewashed kale is bad or spoiled? An opened bag of prewashed kale that is spoiling will typically become slimy and mushy and its colour will deteriorate; discard an opened bag of prewashed kale if it has an off smell or appearance.
Kale, Fresh, Commercially Bagged And Prewashed - Unopened Bag		7-10 days or date on bag	10-12 Months	How long does an unopened bag of prewashed kale last in the fridge? The precise answer to that question depends to a large extent on storage conditions -keep an unopened bag of prewashed kale refrigerated at all times. How long can an unopened bag of prewashed kale be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); an unopened bag of prewashed kale should be discarded if left out for more than 2 hours at room temperature. To maximize the shelf life of an unopened bag of prewashed kale, place package upright in the refrigerator and keep closed. How long does an unopened bag of prewashed kale last in the refrigerator? Properly stored, an unopened bag of prewashed kale will usually keep well for about 7 to 10 days in the fridge (or the date on the package, if earlier). Do you need to wash an opened bag of prewashed kale before eating it? No, it is not necessary to re-wash a prewashed kale; if you choose to re-wash the salad, be sure that it does not come in contact with unclean surfaces or utensils, in order to help to avoid cross contamination. How to tell if an unopened bag of prewashed kale is bad or spoiled? An unopened bag of prewashed kale that is spoiling will typically become slimy and mushy and its colour will deteriorate; discard an unopened bag of prewashed kale if it has an off smell or appearance.
Leeks — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Leeks — Fresh, Raw		7-14 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash leeks thoroughly and slice; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Lettuce, Bibb, Boston, Butter - Fresh, Raw		3-4 Days		How long does lettuce last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep bibb lettuce refrigerated at all times. How long can lettuce be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); lettuce should be discarded if left out for more than 2 hours at room temperature. To maximize the shelf life of lettuce, refrigerate in a loosely closed plastic bag and do not wash the lettuce until ready to eat. How long does lettuce last in the refrigerator? Properly stored, lettuce will usually keep well for about 3 to 4 days in the fridge. Do you need to wash a head of lettuce before eating it? Yes, lettuce should be thoroughly washed in running water before eating. Can you freeze lettuce? Bibb lettuce does not freeze well and freezing is not recommended: lettuce is high in moisture, which turns to ice when frozen, causing a mushy, wilted texture when thawed. How to tell if lettuce is bad or spoiled? Lettuce that is spoiling will typically become slimy and mushy and its colour will deteriorate; discard bibb lettuce if it has an off smell or appearance.
Lettuce, Iceberg, Romaine Or Cos - Fresh, Raw		7-10 Days		How long does iceberg lettuce last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep iceberg lettuce refrigerated at all times. How long can iceberg lettuce be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); iceberg lettuce should be discarded if left out for more than 2 hours at room temperature. To maximize the shelf life of iceberg lettuce, refrigerate in a loosely closed plastic bag and do not wash the iceberg lettuce until ready to eat. How long does iceberg lettuce last in the refrigerator? Properly stored, iceberg lettuce will usually keep well for about 7-10 days in the fridge. Do you need to wash a head of iceberg lettuce before eating it? Yes, iceberg lettuce should be thoroughly washed in running water before eating. Can you freeze iceberg lettuce? Iceberg lettuce does not freeze well and freezing is not recommended: iceberg lettuce is high in moisture, which turns to ice when frozen, causing a mushy, wilted texture when thawed. How to tell if iceberg lettuce is bad or spoiled? Iceberg lettuce that is spoiling will typically become slimy and mushy and its colour will deteriorate; discard iceberg lettuce if it has an off smell or appearance.
Lettuce, Leaf (Red Or Green) - Fresh, Raw		1 Week		How long does leaf lettuce last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep leaf lettuce refrigerated at all times. How long can leaf lettuce be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); leaf lettuce should be discarded if left out for more than 2 hours at room temperature. To maximize the shelf life of leaf lettuce, refrigerate in a loosely closed plastic bag and do not wash the leaf lettuce until ready to eat. How long does leaf lettuce last in the refrigerator? Properly stored, leaf lettuce will usually keep well for about 1 week in the fridge. Do you need to wash a head of leaf lettuce before eating it? Yes, leaf lettuce should be thoroughly washed in running water before eating. Can you freeze leaf lettuce? Leaf lettuce does not freeze well and freezing is not recommended: leaf lettuce is high in moisture, which turns to ice when frozen, causing a mushy, wilted texture when thawed. How to tell if leaf lettuce is bad or spoiled? Leaf lettuce that is spoiling will typically become slimy and mushy and its colour will deteriorate; discard leaf lettuce if it has an off smell or appearance.
Lettuce, Lollo Rosso - Fresh, Raw		2-3 Days		Store in a loosely closed plastic bag. Do not wash lettuce until ready to eat. Lettuce does not freeze well.
Lima Beans — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mixed Vegetables - Commercially Frozen			10-12 Months	How long do frozen mixed vegetables last? The precise answer to that question depends to a large extent on storage conditions - keep mixed vegetables frozen at all times. Properly stored, frozen mixed vegetables will maintain best quality for about 12 months in the freezer, although they will usually remain safe to eat after that. Are frozen mixed vegetables safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially frozen mixed vegetables will typically carry a Best By, Best if Used By, Best Before, or Best When Used By date but this is not a safety date, it is the manufacturer's estimate of how long the frozen mixed vegetables will remain at peak quality. How long will frozen mixed vegetables remain safe to eat? Frozen mixed vegetables that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen mixed vegetables at room temperature? Frozen mixed vegetables should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen mixed vegetables are no longer good? If dry spots or discolorations have developed on the frozen mixed vegetables, freezer burn has begun to set in - this will not make the frozen mixed vegetables unsafe to eat, but it will harm the texture and taste.
Mixed Vegetables, Commercially Canned Or Bottled — Opened	3-5 Years (Unopened) (Best Quality)	3-4 Days	1-2 Months	How long does a can of mixed vegetables last once opened? The precise answer depends to a large extent on storage conditions - keep opened mixed vegetables refrigerated and tightly covered. To maximize the shelf life of canned mixed vegetables after opening, refrigerate in covered glass or plastic container. How long do opened canned mixed vegetables last in the refrigerator? Canned mixed vegetables that have been continuously refrigerated will keep for about 3 to 4 days. Are canned mixed vegetables safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned mixed vegetables will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the mixed vegetables will remain at peak quality. To further extend the shelf life of opened canned mixed vegetables, freeze them: to freeze canned mixed vegetables, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned mixed vegetables will be softer after freezing and thawing; the thawed mixed vegetables will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned mixed vegetables last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. How long do canned mixed vegetables last after being frozen and thawed? Mixed vegetables that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; mixed vegetables that were thawed in the microwave or in cold water should be used immediately.
Mung Bean Sprouts - Fresh, Raw		3-5 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash sprouts thoroughly; (2) Blanch (plunge into boiling water) for three minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mushrooms (Including White, Button, Portabella, Shiitake, Oyster, Enoki Varieties) - Fresh, Raw, Sliced Or Chopped		1-2 Days	10-12 Months	Refrigerate sliced mushrooms in covered container or wrap in aluminium foil or plastic wrap. To freeze: (1) Steam sliced mushrooms for three minutes or sauté mushrooms in butter or margarine until almost done; (2) Let cool, then package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Mushrooms (Including White, Button, Portabella, Shiitake, Oyster, Enoki Varieties) - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked mushrooms last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate mushrooms within two hours of cooking. To maximize the shelf life of cooked mushrooms for safety and quality, refrigerate the mushrooms in shallow airtight containers or resealable plastic bags. Properly stored, cooked mushrooms will last for 3 to 5 days in the refrigerator. How long can cooked mushrooms be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked mushrooms should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked mushrooms, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked mushrooms last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked mushrooms that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked mushrooms last after being frozen and thawed? Cooked mushrooms that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; mushrooms that were thawed in the microwave or in cold water should be eaten immediately.
Mushrooms (Including White, Button, Portabella, Shiitake, Oyster, Enoki Varieties) - Fresh, Raw, Whole		4-7 Days	10-12 Months	How long do raw mushrooms last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep raw whole mushrooms refrigerated at all times. To maximize the shelf life of raw mushrooms, refrigerate the mushrooms in a paper bag; do not wrap in plastic or store in airtight container, as this will speed spoilage. How long do raw mushrooms last in the refrigerator? Properly stored, raw whole mushrooms will usually keep well for 4 to 7 days in the fridge. Do you need to wash raw mushrooms before eating them? Yes, mushrooms should be thoroughly washed in running water before eating. How long do raw mushrooms last after they have been sliced or chopped? Chopped raw mushrooms will last for about 1 to 2 days in the refrigerator. How long do mushrooms last in the fridge once they have been cooked? Cooked mushrooms will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze mushrooms? Yes, to freeze: (1) Wash mushrooms thoroughly and slice; (2) Steam mushrooms for three minutes or sauté in butter or margarine until almost done; (3) Let cool, then package in airtight containers or freezer bags and freeze immediately. How long do mushrooms last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Mushrooms, Commercially Canned Or Bottled (Including Whole, Pieces And Stems) — Opened	3-5 Years (Unopened) (Best Quality)	3-4 Days	1-2 Months	How long does a can or bottle of mushrooms last once opened? The precise answer depends to a large extent on storage conditions - keep opened mushrooms refrigerated and tightly covered. To maximize the shelf life of canned mushrooms after opening, refrigerate in covered glass or plastic container. How long do opened canned mushrooms last in the refrigerator? Canned mushrooms that have been continuously refrigerated will keep for about 3 to 4 days. Are canned mushrooms safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned mushrooms will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the mushrooms will remain at peak quality. To further extend the shelf life of opened canned mushrooms, freeze them: to freeze canned mushrooms, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned mushrooms will be softer after freezing and thawing; the thawed mushrooms will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned mushrooms last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - mushrooms that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mushrooms, Dried (Including Porcini, Morel) — Opened Or Unopened Package	1 Year			Store in airtight container.
Onions (Including Yellow, White, Red, Spanish, Pearl, Vidalia Varieties) - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked onions last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate onions within two hours of cooking. To maximize the shelf life of cooked onions for safety and quality, refrigerate the onions in shallow airtight containers or resealable plastic bags. Properly stored, cooked onions will last for 3 to 5 days in the refrigerator. How long can cooked onions be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked onions should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked onions, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked onions last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked onions that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked onions last after being frozen and thawed? Cooked onions that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; onions that were thawed in the microwave or in cold water should be eaten immediately.
Onions (Including Yellow, White, Red, Spanish, Pearl, Vidalia Varieties) - Fresh, Raw, Sliced Or Chopped		7-10 Days	6-8 Months	How long do chopped onions last? The precise answer to that question depends to a large extent on storage conditions - keep chopped onions refrigerated. To maximize the shelf life of chopped onions, refrigerate in covered container or resealable plastic bag or wrap tightly in aluminium foil or plastic wrap. How long do chopped onions last in the fridge? Properly stored, chopped onions will last for 7 to 10 days in the refrigerator. Can you freeze chopped onions? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags, or wrap tightly in heavy-duty aluminium foil or plastic wrap. Frozen chopped onions will have a softer texture once thawed and are best used in cooked dishes. How long do chopped onions last in the freezer? Properly stored, they will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. The freezer time shown is for best quality only - onions that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if chopped onions are bad or spoiled? The best way is to smell and look at the chopped onions: discard any onions that have an off smell or appearance; if mould appears, discard the chopped onions.
Onions, All Varieties Except Sweet (Including Yellow, White, Pearl) - Fresh, Raw, Whole	2-3 Months	2-3 Months	6-8 Months	How long do onions last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep whole raw onions in a dry, dark area. Whole raw onions will last for 2 to 3 months in a cool (7.2°C-12.7°C, 45-55°F; warmer than the refrigerator, but colder than normal room temperature) dark area. If a cool, dark area is not available, then onions should be refrigerated to ensure maximum shelf life. Properly stored, whole raw onions will last for 2 to 3 months in the refrigerator. To extend the shelf life of onions, store onions in a loosely covered paper or mesh bag or basket to allow for air circulation; do not store onions in plastic bags, as the lack of air movement will reduce their shelf life. To further extend the shelf life of onions, do not store onions near potatoes, as the chemical reaction will speed the spoilage of both. How long do raw onions last after they've been sliced or chopped? Chopped raw onions will last 7 to 10 days in the refrigerator; store in covered airtight containers. Can you freeze raw onions? Yes, to freeze: (1) Peel, then slice or chop onions; (2) Place in airtight containers or heavy-duty freezer bags, or wrap tightly in heavy-duty aluminium foil or plastic wrap.
Onions, Commercially Canned Or Bottled — Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Texture will be softer after freezing and thawing; the thawed food will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Onions, Sweet (Including Vidalia, Maui Varieties) - Fresh, Raw, Whole	1-2 Months	1-2 Months	10-12 Months	Pantry time shown is for storage in cool 7.2°C-12.7°C (45°-55°F) dry area with good air circulation; if such an area is not available, refrigerate. Do not store onions near potatoes, as the chemical reaction will speed the spoilage of both. To freeze: (1) Peel, then slice or chop onions; (2) Place in airtight containers or heavy-duty freezer bags, or wrap tightly in heavy-duty aluminium foil or plastic wrap. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Parsnips — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Parsnips - Fresh, Raw		3-4 Weeks	10-12 Months	Refrigerate in plastic bag. To freeze: (1) Wash, peel and cut into 1/2-inch cubes; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Peas And Carrots / Onions, Commercially Canned Or Bottled — Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Texture will be softer after freezing and thawing; the thawed food will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Peas, Green — Fresh, Raw, Still In The Pod		3-5 Days	12-18 Months	Refrigerate in plastic bag; do not shell peas until ready to use. To freeze: (1) Shell and wash peas; (2) Blanch (plunge into boiling water) for 1 1/2 minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Peas, Green - Commercially Frozen			10-12 Months	How long do frozen peas last? The precise answer to that question depends to a large extent on storage conditions - keep peas frozen at all times. Properly stored, frozen peas will maintain best quality for about 12 months in the freezer, although they will usually remain safe to eat after that. Are frozen peas safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially frozen peas will typically carry a Best By, Best if Used By, Best Before, or Best When Used By date but this is not a safety date, it is the manufacturer's estimate of how long the frozen peas will remain at peak quality. How long will frozen peas remain safe to eat? Frozen peas that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen peas at room temperature? Frozen peas should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen peas are no longer good? If dry spots or discolorations have developed on the frozen peas, freezer burn has begun to set in - this will not make the frozen peas unsafe to eat, but it will harm the texture and taste.
Peas, Green - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked peas last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate peas within two hours of cooking. To maximize the shelf life of cooked peas for safety and quality, refrigerate the peas in shallow airtight containers or resealable plastic bags. Properly stored, cooked peas will last for 3 to 5 days in the refrigerator. How long can cooked peas be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked peas should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked peas, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked peas last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked peas that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked peas last after being frozen and thawed? Cooked peas that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; peas that were thawed in the microwave or in cold water should be eaten immediately.
Peas, Green, Commercially Canned Or Bottled — Opened	3-5 Years (Unopened) (Best Quality)	3-4 Days	1-2 Months	How long does a can of green peas last once opened? The precise answer depends to a large extent on storage conditions - keep opened green peas refrigerated and tightly covered. To maximize the shelf life of canned green peas after opening, refrigerate in covered glass or plastic container. How long do opened canned green peas last in the refrigerator? Canned green peas that have been continuously refrigerated will keep for about 3 to 4 days. Are canned green peas safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned green peas will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the green peas will remain at peak quality. To further extend the shelf life of opened canned green peas, freeze them: to freeze canned green peas, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned green peas will be softer after freezing and thawing; the thawed green peas will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned green peas last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. How long do canned green peas last after being frozen and thawed? Green peas that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; green peas that were thawed in the microwave or in cold water should be used immediately.
Peas, Sugar Snap — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Peas, Sugar Snap — Fresh, Raw		3-5 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash thoroughly, remove stems and leave peas whole; (2) Blanch (plunge into boiling water) for 1 1/2 minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Peppers, All Varieties (Including Bell Peppers) - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked peppers last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate peppers within two hours of cooking. To maximize the shelf life of cooked peppers for safety and quality, refrigerate the peppers in shallow airtight containers or resealable plastic bags. Properly stored, cooked peppers will last for 3 to 5 days in the refrigerator. How long can cooked peppers be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked peppers should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked peppers, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked peppers last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked peppers that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked peppers last after being frozen and thawed? Cooked peppers that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; peppers that were thawed in the microwave or in cold water should be eaten immediately.

Peppers, Roasted, Commercially Canned Or Bottled - Opened	2-5 Years (Unopened)	1-2 Months	4-6 Months	How long does a can of roasted peppers last once opened? The precise answer depends to a large extent on storage conditions - keep opened roasted peppers refrigerated and tightly covered. To maximize the shelf life of canned roasted peppers after opening, refrigerate in covered glass or plastic container. How long do opened canned roasted peppers last in the refrigerator? Canned roasted peppers that have been continuously refrigerated will keep for about 1 to 2 months. Are canned roasted peppers safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned roasted peppers will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the roasted peppers will remain at peak quality. To further extend the shelf life of opened canned roasted peppers, freeze them: to freeze canned roasted peppers, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned roasted peppers will be softer after freezing and thawing; the thawed roasted peppers will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned roasted peppers last in the freezer? Properly stored, they will maintain best quality for about 6 months, but will remain safe beyond that time.
Pickled Beets, Commercially Jarred Or Canned, Sold Unrefrigerated - Opened	12-18 Months	1-3 Months (Best Quality)		How long do pickled beets last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened pickled beets keep them refrigerated and tightly covered. How long do opened pickled beets last in the refrigerator? Pickled beets that have been continuously refrigerated will generally stay at best quality for about 1 to 3 months. Are opened pickled beets safe to use after the expiration date on the jar or can? Yes, provided they have been stored properly, the jar or can is undamaged, and there are no signs of spoilage - commercially packaged pickled beets will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the pickled beets will remain at peak quality. The storage time shown for opened pickled beets is for best quality only - after that, the pickled beets' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been kept continuously refrigerated, the jar or can is undamaged, and there are no signs of spoilage. How can you tell if opened pickled beets are bad or spoiled? The best way is to smell and look at the pickled beets: if the pickled beets develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all pickled beets from jars or cans that are leaking, rusting, bulging or severely dented.
Pickled Peppers, Commercially Jarred, Sold Unrefrigerated - Opened	2 Years (Unopened) (Best Quality)	1 Year (Best Quality)		How long do pickled peppers last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened pickled peppers keep them refrigerated and tightly covered. How long do opened pickled peppers last in the refrigerator? Pickled peppers that have been continuously refrigerated will generally stay at best quality for about 1 year. Are opened pickled peppers safe to use after the expiration date on the jar? Yes, provided they have been stored properly, the jar is undamaged, and there are no signs of spoilage - commercially packaged pickled peppers will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the pickled peppers will remain at peak quality. The storage time shown for opened pickled peppers is for best quality only - after that, the pickled peppers' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been kept continuously refrigerated, the jar is undamaged, and there are no signs of spoilage. How can you tell if opened pickled peppers are bad or spoiled? The best way is to smell and look at the pickled peppers: if the pickled peppers develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Potatoes (All Varieties Except Sweet Potatoes And Yams) - Fresh, Cooked (Including Baked, Mashed, Scalloped, Roasted)		3-5 Days	10-12 Months	How long do cooked potatoes last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate all cooked potatoes (including baked, scalloped, roasted and mashed potatoes) within two hours of cooking. To maximize the shelf life of cooked potatoes for safety and quality, refrigerate the potatoes in shallow airtight containers or resealable plastic bags. Properly stored, cooked potatoes will last for 3 to 5 days in the refrigerator. How long can cooked potatoes be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked potatoes should be discarded if left out for more than 2 hours at room temperature. Can you freeze whole baked potatoes or boiled potatoes? Whole cooked potatoes will be watery when thawed, and freezing is not recommended. Can you freeze mashed, roasted or scalloped potatoes? Yes, these types of cooked potatoes freeze well; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked potatoes last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked potatoes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Potatoes (All Varieties Except Sweet Potatoes And Yams) - Fresh, Raw	1-2 weeks (at normal room temperature)	3-4 Weeks* *If you must refrigerate raw potatoes (eg, due to a lack of pantry storage space or hot, humid room conditions), the potatoes will last for about 3 to 4 weeks in the fridge, but will likely develop a sweet taste and darken when cooked; this effect can sometimes be offset by storing the potatoes at room temperature for a few days after removing them from the	10-12 Months	How long do potatoes last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep potatoes in a dry, dark area. Properly stored, raw potatoes will last for 1 to 2 weeks at normal room temperature. To maximize the shelf life of potatoes, store in a cool (45-55° F; warmer than the refrigerator, but colder than normal room temperature) dark area; under those storage conditions, potatoes will last about 2 to 3 months. To further extend shelf life of potatoes, do not store potatoes near onions, as the chemical reaction will speed the spoilage of both; store potatoes in a loosely covered bag or basket to allow for air circulation. Should you refrigerate raw potatoes? Whole, raw potatoes should ideally not be refrigerated; doing so can give them a sweet taste and cause them to darken when cooked. How long do raw potatoes last after they've been cut? Cover the cut, raw potatoes completely with cold water and refrigerate; use the cut potatoes within 24 hours. How long do potatoes last in the fridge once they have been cooked? Cooked potatoes will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. To freeze cooked potatoes: (1) Wash, peel and boil potatoes until tender; (2) Mash potatoes and allow to cool; (3) Place in covered airtight containers or heavy-duty freezer bags.
Potatoes, Commercially Canned Or Bottled — Opened	3-5 Years (Unopened) (Best Quality)	3-4 Days	1-2 Months	How long does a can of potatoes last once opened? The precise answer depends to a large extent on storage conditions - keep opened potatoes refrigerated and tightly covered. To maximize the shelf life of canned potatoes after opening, refrigerate in covered glass or plastic container. How long do opened canned potatoes last in the refrigerator? Canned potatoes that have been continuously refrigerated will keep for about 3 to 4 days. Are canned potatoes safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned potatoes will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the potatoes will remain at peak quality. To further extend the shelf life of opened canned potatoes, freeze them: to freeze canned potatoes, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned potatoes will be softer after freezing and thawing; the thawed potatoes will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned potatoes last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. How long do canned potatoes last after being frozen and thawed? Potatoes that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; potatoes that were thawed in the microwave or in cold water should be used immediately.
Pumpkin — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pumpkin — Fresh, Raw, Cut Up		2-4 Days	10-12 Months	Refrigerate in covered container or wrap in aluminium foil or plastic wrap. To freeze: (1) Cut pumpkin into sections and remove seeds; (2) Cook pumpkin until soft; (3) Remove pumpkin pulp from rind and mash; (4) Let cool and then place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pumpkin - Fresh, Raw, Whole	1-2 Months		10-12 Months	Pantry time shown is for storage in a cool (50Â° - 60°F) dry area; if kept at normal room temperature, storage times will be shorter. Refrigeration is not recommended, as it will harm the texture and flavour. To freeze: (1) Cut pumpkin into sections and remove seeds; (2) Cook pumpkin until soft; (3) Remove pumpkin pulp from rind and mash; (4) Let cool and then place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pumpkin, Commercially Canned Or Bottled — Opened	3-5 Years (Unopened) (Best Quality)	5-6 Days	2-3 Months	How long does a can of pumpkin last once opened? The precise answer depends to a large extent on storage conditions - keep opened pumpkin refrigerated and tightly covered. To maximize the shelf life of canned or packaged pumpkin after opening, refrigerate in a covered glass or plastic container. How long does opened canned pumpkin last in the refrigerator? Pumpkin that has been continuously refrigerated will keep for about 5 to 7 days. Is canned pumpkin safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged pumpkin will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the pumpkin will remain at peak quality. To further extend the shelf life of opened canned pumpkin, freeze it: to freeze pumpkin, place inside covered airtight containers or heavy-duty freezer bags. The freezer time shown is for best quality only - pumpkin that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned pumpkin last after being frozen and thawed? Canned pumpkin that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; pumpkin that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned pumpkin is bad or spoiled? The best way is to smell and look at the pumpkin: if the pumpkin develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Shallots — Fresh, Raw, Sliced Or Chopped		2-3 Days	10-12 Months	Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap or plastic wrap. Freeze in covered airtight containers or freezer bags or wrap tightly in heavy-duty aluminium foil. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Shallots - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked shallots last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate shallots within two hours of cooking. To maximize the shelf life of cooked shallots for safety and quality, refrigerate the shallots in shallow airtight containers or resealable plastic bags. Properly stored, cooked shallots will last for 3 to 5 days in the refrigerator. How long can cooked shallots be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked shallots should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked shallots, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked shallots last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked shallots that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked shallots last after being frozen and thawed? Cooked shallots that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; shallots that were thawed in the microwave or in cold water should be eaten immediately.
Shallots - Fresh, Raw, Whole	1 Month	1 Month	10-12 Months	Pantry time shown is for storage in cool (45Â° - 55Â° F) dry area with good air circulation; if such an area is not available, refrigerate. To freeze: Peel and chop first, then place in covered airtight containers or freezer bags, or wrap tightly in heavy-duty aluminium foil or plastic wrap. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Snow Peas — Fresh, Raw		3-4 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash thoroughly, remove stems and leave peas whole; (2) Blanch (plunge into boiling water) for 1 1/2 minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Snow Peas - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked snow peas last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate snow peas within two hours of cooking. To maximize the shelf life of cooked snow peas for safety and quality, refrigerate the snow peas in shallow airtight containers or resealable plastic bags. Properly stored, cooked snow peas will last for 3 to 5 days in the refrigerator. How long can cooked snow peas be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked snow peas should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked snow peas, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked snow peas last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked snow peas that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked snow peas last after being frozen and thawed? Cooked snow peas that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; snow peas that were thawed in the microwave or in cold water should be eaten immediately.
Sorrel — Fresh, Raw		1-2 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash thoroughly and cut off woody stems; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Soybeans — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Soybeans — Fresh, Raw		3-5 Days	8 Months	Refrigerate in plastic bag. To freeze: (1) Wash beans; (2) Blanch (plunge into boiling water) for five minutes and chill quickly in ice cold water; (3) Squeeze soybeans out of pods, drain off excess moisture and package in airtight containers or freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

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Spinach - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked spinach last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate spinach within two hours of cooking. To maximize the shelf life of cooked spinach for safety and quality, refrigerate the spinach in airtight containers or resealable plastic bags. Properly stored, cooked spinach will last for 3 to 5 days in the refrigerator. How long can cooked spinach be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked spinach should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked spinach, freeze it; freeze in covered airtight containers or heavy-duty freezer bags. How long does cooked spinach last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked spinach that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked spinach last after being frozen and thawed? Cooked spinach that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; spinach that was thawed in the microwave or in cold water should be eaten immediately.
Spinach - Fresh, Raw, Loose		5-7 Days	10-12 Months	How long does raw spinach last in the fridge? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep spinach refrigerated at all times. To maximize the shelf life of raw spinach, refrigerate in a plastic bag; do not wash until ready to use. Properly stored, raw spinach will usually keep well for about 5 to 7 days in the refrigerator. Do you need to wash raw spinach before eating it? Yes, spinach should be thoroughly washed in running water before eating. How long does spinach last in the fridge once it has been cooked? Cooked spinach will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. Can you freeze raw spinach? Yes, to freeze: (1) Wash spinach thoroughly and cut off woody stems; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. How long does spinach last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - spinach that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Spinach, Commercially Canned Or Bottled — Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Texture will be softer after freezing and thawing; the thawed food will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squash - Commercially Frozen			10-12 Months	How long does frozen squash last? The precise answer to that question depends to a large extent on storage conditions - keep squash frozen at all times. Properly stored, frozen squash will maintain best quality for about 12 months in the freezer, although it will usually remain safe to eat after that. Is frozen squash safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen squash will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the frozen squash will remain at peak quality. How long will frozen squash remain safe to eat? Frozen squash that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long can you safely leave frozen squash at room temperature? Frozen squash should be discarded if left for more than 6 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen squash is no longer good? If dry spots or discoloration have developed on the frozen squash, freezer burn has begun to set in - this will not make the squash unsafe to eat, but it will harm the texture and taste.
Squash, Summer (Including Zucchini, Crookneck, Scallop, Patty Pan) — Fresh, Raw, Sliced Or Chopped		2-3 Days	10-12 Months	Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. To freeze: (1) Wash and cut into 1/2 inch slices (zucchini may also be grated); (2) Blanch (plunge into boiling water) for three minutes (steam grated zucchini for 2 minutes) and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squash, Summer (Including Zucchini, Crookneck, Scallop, Patty Pan) — Fresh, Raw, Whole		4-5 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to eat. To freeze: (1) Wash and cut into 1/2 inch slices (zucchini may also be grated); (2) Blanch (plunge into boiling water) for three minutes (steam grated zucchini for 2 minutes) and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squash, Summer (Including Zucchini, Crookneck, Scallop, Patty Pan) - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked summer squash last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate summer squash within two hours of cooking. To maximize the shelf life of cooked summer squash for safety and quality, refrigerate the summer squash in airtight containers or resealable plastic bags. Properly stored, cooked summer squash will last for 3 to 5 days in the refrigerator. How long can cooked summer squash be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked summer squash should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked summer squash, freeze it; freeze in covered airtight containers or heavy-duty freezer bags. How long does cooked summer squash last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked summer squash that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked summer squash last after being frozen and thawed? Cooked summer squash that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; summer squash that was thawed in the microwave or in cold water should be eaten immediately.
Squash, Summer, Commercially Canned Or Bottled (Including Zucchini, Crookneck, Scallop, Patty Pan) — Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Texture will be softer after freezing and thawing; the thawed food will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squash, Winter (Including Acorn, Hubbard, Butternut, Spaghetti) — Fresh, Raw, Sliced Or Chopped		2-4 Days	10-12 Months	Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Raw squash does not freeze well; cook before freezing. To freeze: (1) Cook squash until soft; (2) Remove pulp from rind and mash; (3) Let cool and place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squash, Winter (Including Acorn, Hubbard, Butternut, Spaghetti) - Fresh, Raw, Whole	1-2 Months		10-12 Months	Pantry time shown is for storage in a cool (50Â° - 60°F) dry area; if kept at normal room temperature, storage times will be shorter. Refrigeration is not recommended, as it will harm the texture and flavour. Raw squash does not freeze well; cook before freezing. To freeze: (1) Wash squash, then cook until soft; (2) Remove pulp from rind and mash; (3) Let cool and place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squash, Winter (Including Acorn, Hubbard, Butternut, Spaghetti) - Fresh, Cooked		3-5 Days	10-12 Months	How long does cooked winter squash last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate winter squash within two hours of cooking. To maximize the shelf life of cooked winter squash for safety and quality, refrigerate the winter squash in airtight containers or resealable plastic bags. Properly stored, cooked winter squash will last for 3 to 5 days in the refrigerator. How long can cooked winter squash be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked winter squash should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked winter squash, freeze it; freeze in covered airtight containers or heavy-duty freezer bags. How long does cooked winter squash last in the freezer? Properly stored, it will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked winter squash that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked winter squash last after being frozen and thawed? Cooked winter squash that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; winter squash that was thawed in the microwave or in cold water should be eaten immediately.
Sweet Potatoes - Fresh, Cooked (Including Baked, Mashed, Casseroles)		3-5 Days	10-12 Months	How long do cooked sweet potatoes last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate sweet potatoes (including mashed and baked sweet potatoes) within two hours of cooking. To maximize the shelf life of cooked sweet potatoes for safety and quality, refrigerate the sweet potatoes in shallow airtight containers or resealable plastic bags. Properly stored, cooked sweet potatoes will last for 3 to 5 days in the refrigerator. How long can cooked sweet potatoes be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked sweet potatoes should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked sweet potatoes, freeze them. To freeze whole baked sweet potatoes: Wrap potatoes individually in foil and then place together in heavy-duty freezer bags or airtight containers. To freeze boiled and sliced or mashed sweet potatoes: sprinkle first with a small amount of lemon juice to prevent discoloration and then place in covered airtight containers or heavy-duty freezer bags. How long do cooked sweet potatoes last after being frozen and thawed? Cooked sweet potatoes that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; sweet potatoes that were thawed in the microwave or in cold water should be eaten immediately.
Sweet Potatoes - Fresh, Raw	1-2 weeks (at normal room temperature)		10-12 Months	How long do sweet potatoes last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep sweet potatoes in a dry, dark area. Properly stored, raw sweet potatoes will last for 1 to 2 weeks at normal room temperature. To maximize the shelf life of sweet potatoes, store in a cool (45-55Â° F; warmer than the refrigerator, but colder than normal room temperature) dark area; under those storage conditions, sweet potatoes will last about 1 month. To further extend shelf life of sweet potatoes, store in a loosely covered bag or basket to allow for air circulation. Should you refrigerate raw sweet potatoes? Whole, raw sweet potatoes should ideally not be refrigerated; doing so can give them a hard centre and unpleasant taste. How long do raw sweet potatoes last after they've been cut? Cover the cut, raw sweet potatoes completely with cold water and refrigerate; use the cut sweet potatoes within 24 hours. How long do sweet potatoes last in the fridge once they have been cooked? Cooked sweet potatoes will usually stay good for 3 to 5 days in the refrigerator and 10 to 12 months in the freezer. To freeze cooked sweet potatoes (1) Wash, peel and boil sweet potatoes until tender; (2) Slice or mash potatoes and sprinkle with a small amount of lemon juice to prevent discoloration; (3) Let cool and place in covered airtight containers or heavy-duty freezer bags.
Sweet Potatoes, Commercially Canned Or Bottled — Opened	3-5 Years (Unopened) (Best Quality)	3-4 Days	1-2 Months	How long does a can of sweet potatoes last once opened? The precise answer depends to a large extent on storage conditions - keep opened sweet potatoes refrigerated and tightly covered. To maximize the shelf life of canned sweet potatoes after opening, refrigerate in covered glass or plastic container. How long do opened canned sweet potatoes last in the refrigerator? Canned sweet potatoes that have been continuously refrigerated will keep for about 3 to 4 days. Are canned sweet potatoes safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned sweet potatoes will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the sweet potatoes will remain at peak quality. To further extend the shelf life of opened canned sweet potatoes, freeze them: to freeze canned sweet potatoes, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned sweet potatoes will be softer after freezing and thawing; the thawed sweet potatoes will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned sweet potatoes last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. How long do canned sweet potatoes last after being frozen and thawed? Sweet potatoes that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; sweet potatoes that were thawed in the microwave or in cold water should be used immediately.
Tomato Paste, Sold In Tube — Unopened	2-3 Years			Store in cool, dry area. Storage time shown is for best quality only— after that, the product's taste, texture and nutritional value may change, but in most cases, the unopened paste will still be safe to consume if it has been stored properly and the package is not damaged. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the unopened product will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Tomato Paste, Commercially Canned Or Bottled - Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	3-4 Months	Do not store tomato paste in opened metal can - refrigerate in covered glass or plastic container after opening. Freeze tomato paste in airtight plastic containers or heavy-duty freezer bags, or spoon tomato paste into ice cube trays - once paste is frozen, transfer cubes to a heavy-duty freezer bag. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Tomato Sauce, Commercially Canned Or Bottled - Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	2-3 Months	How long does a can of tomato sauce last once opened? The precise answer depends to a large extent on storage conditions - keep opened tomato sauce refrigerated and tightly covered. To maximize the shelf life of canned or packaged tomato sauce after opening, refrigerate in covered glass or plastic container. How long does opened canned tomato sauce last in the refrigerator? Tomato sauce that has been continuously refrigerated will keep for about 5 to 7 days. Is canned tomato sauce safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged tomato sauce will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the tomato sauce will remain at peak quality. To further extend the shelf life of opened canned tomato sauce, freeze it: to freeze tomato sauce, place inside covered airtight containers or heavy-duty freezer bags. How long does canned tomato sauce last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - tomato sauce that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does tomato sauce last after being frozen and thawed? Tomato sauce that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; tomato sauce that was thawed in the microwave or in cold water should be used immediately.
Tomato Soup, Commercially Canned Or Packaged, Sold Unrefrigerated — Opened	18-24 Months (Best Quality) (Unopened)	3-4 Days	4-6 Months	How long does tomato soup last once opened? The precise answer depends to a large extent on storage conditions - keep opened tomato soup refrigerated and tightly covered. To maximize the shelf life of canned or packaged tomato soup after opening, refrigerate in covered glass or plastic container. How long does opened tomato soup last in the refrigerator? Tomato soup that has been continuously refrigerated will keep for about 3 to 4 days. Is tomato soup safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged tomato soup will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the tomato soup will remain at peak quality. To further extend the shelf life of opened tomato soup, freeze it: to freeze tomato soup, place inside covered airtight containers or heavy-duty freezer bags. How long does tomato soup last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - tomato soup that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does tomato soup last after being frozen and thawed? Tomato soup that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; tomato soup that was thawed in the microwave or in cold water should be used immediately.

Tomatoes (Including Red, Yellow, Green, Cherry, Plum, Roma) - Fresh, Cooked		3-5 Days	10-12 Months	How long do cooked tomatoes last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate tomatoes within two hours of cooking. To maximize the shelf life of cooked tomatoes for safety and quality, refrigerate the tomatoes in shallow airtight containers or resealable plastic bags. Properly stored, cooked tomatoes will last for 3 to 5 days in the refrigerator. How long can cooked tomatoes be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked tomatoes should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked tomatoes, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked tomatoes last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked tomatoes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked tomatoes last after being frozen and thawed? Cooked tomatoes that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; tomatoes that were thawed in the microwave or in cold water should be eaten immediately.
Tomatoes (Including Red, Yellow, Green, Cherry, Plum, Roma) - Fresh, Raw, Sliced Or Chopped		3-4 Days	2 Months	How long do chopped fresh tomatoes last? The precise answer to that question depends to a large extent on storage conditions - keep chopped tomatoes refrigerated. To maximize the shelf life of chopped tomatoes, refrigerate in covered container or resealable plastic bag or wrap tightly in aluminium foil or plastic wrap. How long do chopped tomatoes last in the fridge? Properly stored, chopped fresh tomatoes will last for 3 to 4 days in the refrigerator. Can you freeze chopped tomatoes? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags, or wrap tightly in heavy-duty aluminium foil or plastic wrap. Frozen chopped tomatoes will become mushy when thawed and are best used in cooked dishes. How long do chopped tomatoes last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - tomatoes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if chopped tomatoes are bad or spoiled? The best way is to smell and look at the chopped tomatoes: discard any tomatoes that have an off smell or appearance; if mould appears, discard the chopped tomatoes.
Tomatoes (Including Red, Yellow, Green, Cherry, Plum, Roma) - Fresh, Raw, Whole	1-5 days or until ripe	5-7 days once ripe	2-3 Months	How long do tomatoes last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep tomatoes in a dry area. Properly stored, tomatoes will become fully ripe in about 1 to 5 days at normal room temperature. How can you make tomatoes ripen faster? To hasten ripening, put tomatoes in a brown paper bag, close it and leave on the counter. Do not refrigerate tomatoes until they are fully ripe - allowing to ripen at room temperature will result in more flavourful, juicy tomatoes. To extend the shelf life of fully ripe tomatoes, place in a plastic bag and refrigerate; bring the tomatoes back to room temperature before using. How long do tomatoes last in the refrigerator? Fully ripe tomatoes will last for about 5 to 7 days in the fridge. Remove tomatoes from the refrigerator about 30 minutes prior to serving for best flavour. Can you freeze raw tomatoes? Yes: (1) Wash tomatoes and pat dry; (2) Leave skins on, or if desired, peel tomatoes by dipping in boiling water for 30 seconds to loosen skins; (3) Leave tomatoes whole or cut into pieces; (4) Place tomatoes in a single layer on cookie tray in freezer; (5) Once tomatoes are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer.
Tomatoes, Commercially Canned Or Packaged (Including Crushed, Stewed, Whole, Or Diced) - Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	2-3 Months	How long does a can of tomatoes last once opened? The precise answer depends to a large extent on storage conditions - keep opened tomatoes (including crushed, stewed, whole, or diced tomatoes) refrigerated and tightly covered. To maximize the shelf life of canned or packaged tomatoes after opening, refrigerate in covered glass or plastic container. How long do opened canned tomatoes last in the refrigerator? Tomatoes that have been continuously refrigerated will keep for about 5 to 7 days. Are canned tomatoes safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned tomatoes will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the tomatoes will remain at peak quality. To further extend the shelf life of opened canned tomatoes, freeze them: to freeze tomatoes, place inside covered airtight containers or heavy-duty freezer bags. How long do canned tomatoes last in the freezer? Properly stored, they will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - tomatoes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned tomatoes last after being frozen and thawed? Tomatoes that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; tomatoes that were thawed in the microwave or in cold water should be used immediately.
Tomatoes, Sun-Dried, Packed In Oil — Opened	12 Months (Unopened)	6-12 Months		Refrigerate in covered container. Store in cool, dark area.
Turnip Greens — Commercially Frozen			10-12 Months	Keep frozen until ready to use. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Once prepared, refrigerate leftovers in a covered container for up to two days.
Turnip Greens — Fresh, Cooked		3-5 Days	10-12 Months	Refrigerate within two hours of cooking. Refrigerate in covered container or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turnip Greens — Fresh, Raw		1-2 Days	10-12 Months	Refrigerate in plastic bag; do not wash until ready to use. To freeze: (1) Wash greens thoroughly and cut off woody stems; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turnip Greens, Commercially Canned Or Bottled — Opened	2-5 Years (Unopened) (Best Quality)	3-4 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Texture will be softer after freezing and thawing; the thawed food will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turnips - Fresh, Raw		2-3 Weeks	8-10 Months	Refrigerate in plastic bag. To freeze: (1) Wash, peel and cut into 1/2-inch cubes; (2) Blanch (plunge into boiling water) for two minutes and chill quickly in ice cold water; (3) Drain off excess moisture, package in airtight containers or freezer bags and freeze immediately. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turnips - Commercially Frozen			10-12 Months	Keep frozen until ready to use. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Once prepared, refrigerate leftovers in a covered container for up to four days.
Turnips - Fresh, Cooked		3-5 Days	8-10 Months	How long do cooked turnips last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - refrigerate turnips within two hours of cooking. To maximize the shelf life of cooked turnips for safety and quality, refrigerate the turnips in shallow airtight containers or resealable plastic bags. Properly stored, cooked turnips will last for 3 to 5 days in the refrigerator. How long can cooked turnips be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked turnips should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cooked turnips, freeze them; freeze in covered airtight containers or heavy-duty freezer bags. How long do cooked turnips last in the freezer? Properly stored, they will maintain best quality for 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked turnips that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked turnips last after being frozen and thawed? Cooked turnips that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; turnips that were thawed in the microwave or in cold water should be eaten immediately.
Vegetable Broth Or Stock, Commercially Canned Or Packaged, Sold Unrefrigerated - Opened	18-24 Months (Best Quality) (Unopened)	4-5 Days	4-6 Months	How long does a can or package of vegetable broth last once opened? The precise answer depends to a large extent on storage conditions - keep opened vegetable broth refrigerated and tightly covered. To maximize the shelf life of canned or packaged vegetable broth after opening, refrigerate in covered glass or plastic container. How long does opened vegetable broth last in the refrigerator? Vegetable broth that has been continuously refrigerated will keep for about 4 to 5 days. Is vegetable broth safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged vegetable broth will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the vegetable broth will remain at peak quality. To further extend the shelf life of opened vegetable broth, freeze it: to freeze vegetable broth, place inside covered airtight containers or heavy-duty freezer bags. How long does vegetable broth last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - vegetable broth that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does vegetable broth last after being frozen and thawed? Vegetable broth that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; vegetable broth that was thawed in the microwave or in cold water should be used immediately.
Vegetable Soup, Commercially Canned Or Packaged, Sold Unrefrigerated— Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	4-6 Months	How long does vegetable soup last once opened? The precise answer depends to a large extent on storage conditions - keep opened vegetable soup refrigerated and tightly covered. To maximize the shelf life of canned or packaged vegetable soup after opening, refrigerate in covered glass or plastic container. How long does opened vegetable soup last in the refrigerator? Vegetable soup that has been continuously refrigerated will keep for about 3 to 4 days. Is vegetable soup safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged vegetable soup will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the vegetable soup will remain at peak quality. To further extend the shelf life of opened vegetable soup, freeze it: to freeze vegetable soup, place inside covered airtight containers or heavy-duty freezer bags. How long does vegetable soup last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - vegetable soup that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does vegetable soup last after being frozen and thawed? Vegetable soup that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; vegetable soup that was thawed in the microwave or in cold water should be used immediately.

3 Fruits Shelf Life

These is the shelf life of most fruit, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Apples - Commercially Frozen			1 Year	Freeze in original packaging. Freezer time shown is for best quality - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apples - Fresh, Raw, Cut Up		3-4 Days	10-12 Months	How long do cut apples last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up apples refrigerated. Apples discolour quickly when cut - to prevent browning, sprinkle the cut apples with a little lemon juice before refrigerating. To maximize the shelf life of cut apples, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut apples last in the fridge? Properly stored, cut apples will last for 3 to 4 days in the refrigerator. Can you freeze cut apples? Yes, to freeze apples: (1) Wash, peel, core and slice apples; (2) Coat apples with a solution made of 1 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do cut apples last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up apples that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut apples are bad or spoiled? The best way is to smell and look at the cut apples: discard any apples that have an off smell or appearance; if mould appears, discard the cut apples.
Apples - Fresh, Raw, Whole	5-7 Days	1-2 Months	10-12 Months	How long do apples last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep apples in a dry area. How long do apples last at room temperature? Apples will generally keep well at room temperature for about 5 to 7 days; longer storage at room temperature can cause the apples to shrivel and lose flavour and crispness. To extend the shelf life of apples, refrigerate in a plastic bag. How long do apples last in the refrigerator? Properly stored, apples will usually keep well for 1 to 2 months in the fridge. The shelf life of apples can be extended to 6 months or more if the apples are stored in an area where the temperature is between 30°F and 40°F with high humidity (difficult to find in most households). Can you freeze apples? Yes: (1) Wash, peel, core and slice apples; (2) Coat apples with a solution made of 1 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do apples last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - apples that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apples, Commercially Canned Or Bottled - Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can - refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Apples, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apricots — Fresh, Raw, Cut Up		3-4 Days	10-12 Months	Wrap cut fruit tightly with plastic wrap or aluminium foil before refrigerating, or store in airtight container. To freeze apricots: (1) Wash, pit and halve or slice apricots; (2) Coat apricots with a solution made of 1/2 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Mix 1/2 cup sugar into each quart of fruit and stir until sugar is dissolved; (4) Place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apricots - Fresh, Raw, Whole	1-3 days or until ripe	4-5 days once ripe	10-12 Months	Once ripe, refrigerate in plastic bag. To freeze apricots: (1) Wash, pit and halve or slice apricots; (2) Coat apricots with a solution made of 1/2 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Add 1/2 cup sugar to each quart of fruit and stir until sugar is dissolved; (4) Place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apricots, Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apricots, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Avocados - Fresh, Raw, Cut Up		3-4 Days	3-6 Months	How long do cut avocados last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up avocados refrigerated. Avocados discolour quickly when cut - to keep sliced avocado from turning brown, wrap tightly in plastic; sprinkling a small amount of lemon or lime juice onto the exposed avocado flesh will also help prevent discoloration To maximize the shelf life of cut avocados, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut avocados last in the fridge? Properly stored, cut avocados will last for 3 to 4 days in the refrigerator. Can you freeze cut avocados? Yes, to freeze avocados: (1) Peel and puree avocados; (2) Add to the puree 1/2 tablespoon of lemon juice for every avocado used to prevent browning; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do cut avocados last in the freezer? Properly stored, they will maintain best quality for about 3 to 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up avocados that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut avocados are bad or spoiled? The best way is to smell and look at the cut avocados: discard any avocados that have an off smell or appearance; if mould appears, discard the cut avocados.
Avocados - Fresh, Raw, Whole	4-7 days or until ripe	3-5 days once ripe	3-6 Months	How long do avocados last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep avocados in a dry area. Properly stored, avocados will become fully ripe in about 4 to 7 days at normal room temperature. How can you make avocados ripen faster? To hasten ripening, put avocados in a brown paper bag, close it and leave on the counter; to ripen them even faster, add an apple to the bag. Do not refrigerate avocados until they are fully ripe - allowing to ripen at room temperature will result in more flavourful avocados. To extend the shelf life of fully ripe avocados, place in a plastic bag and refrigerate; for best results, bring the avocados back to room temperature before using. How long do avocados last in the refrigerator? Fully ripe avocados will last for about 3 to 5 days in the fridge. Can you freeze avocados? Yes: (1) Peel and puree avocados; (2) Add to the puree 1/2 tablespoon of lemon juice for every avocado used to prevent browning; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do avocados last in the freezer? Properly stored, they will maintain best quality for about 3 to 6 months, but will remain safe beyond that time.
Bananas - Fresh, Raw, Cut Up		3-4 Days	2-3 Months	How long do cut bananas last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up bananas refrigerated. Bananas discolour quickly when cut - to prevent browning, sprinkle the cut bananas with a little lemon juice before refrigerating. To maximize the shelf life of cut bananas, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut bananas last in the fridge? Properly stored, cut bananas will last for 3 to 4 days in the refrigerator. Can you freeze cut bananas? Yes, to freeze bananas: (1) Peel and mash; (2) Add one tablespoon of lemon juice or 1/2 teaspoon ascorbic acid for each cup of mashed banana to prevent browning; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do cut bananas last in the freezer? Properly stored, they will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up bananas that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut bananas are bad or spoiled? The best way is to smell and look at the cut bananas: discard any bananas that have an off smell or appearance; if mould appears, discard the cut bananas.
Bananas - Fresh, Raw, Whole	2-5 days or until ripe	5-7 days once ripe	2-3 Months	How long do bananas last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep bananas in a dry area. Properly stored, bananas will become fully ripe in about 2 to 5 days at normal room temperature. How can you make bananas ripen faster? To hasten ripening, put bananas in a brown paper bag on the counter; to ripen bananas even faster, add an apple to the bag. Should you refrigerate raw bananas? Yes: Store bananas at room temperature until they are fully ripe, then refrigerate to extend shelf life. How long do bananas last in the refrigerator? Fully ripe bananas will last for about 5 to 7 days in the fridge. Refrigeration will turn banana skins black, but will not harm the fruit. Can you freeze raw bananas? Yes- to freeze bananas: (1) Peel and mash; (2) Add one tablespoon of lemon juice or 1/2 teaspoon ascorbic acid for each cup of mashed banana to prevent browning; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do bananas last in the freezer? Properly stored, they will maintain best quality for 2 to 3 months, but will remain safe beyond that time.
Bananas, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Blackberries - Fresh, Raw		2-3 Days	10-12 Months	How long do blackberries last? The precise answer to that question depends to a large extent on storage conditions and how ripe the berries were when purchased or picked - for maximum shelf life, keep blackberries refrigerated at all times. How long do blackberries last at room temperature? Blackberries should only be left out at room temperature if being consumed within the same day, as blackberries are highly perishable and do not ripen after being picked. Refrigerate blackberries in their closed plastic clamshell container (if purchased in one) or place berries loosely in a shallow container and cover with plastic wrap. Discard any bruised or mouldy blackberries before refrigerating. To extend the shelf life of blackberries, do not wash the berries until ready to eat or use. How long do blackberries last in the refrigerator? Properly stored, blackberries will usually keep for about 2 to 3 days in the fridge. Can you freeze whole blackberries? Yes, to freeze: (1) Wash berries carefully in cold water, pat dry and place in a single layer on cookie tray in freezer; (2) Once berries are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. How long do whole blackberries last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Blackberries, Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Blueberries - Fresh, Raw		1-2 Weeks	10-12 Months	How long do blueberries last? The precise answer to that question depends to a large extent on storage conditions and how ripe the berries were when purchased or picked - for maximum shelf life, keep blueberries refrigerated at all times. How long do blueberries last at room temperature? Blueberries should only be left out at room temperature if being consumed within the same day, as blueberries are highly perishable and do not ripen after being picked. Refrigerate blueberries in their closed plastic clamshell container (if purchased in one) or place berries loosely in a shallow container and cover with plastic wrap. Discard any bruised or mouldy blueberries before refrigerating. To extend the shelf life of blueberries, do not wash the berries until ready to eat or use. How long do blueberries last in the refrigerator? Properly stored, blueberries will usually keep for about 1 to 2 weeks in the fridge. Can you freeze whole blueberries? Yes, to freeze:(1) Wash berries carefully in cold water, pat dry and place in a single layer on cookie tray in freezer; (2) Once berries are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. How long do whole blueberries last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Blueberries, Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Blueberries, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cherries - Fresh, Raw		4-10 Days	10-12 Months	How long do cherries last? The precise answer to that question depends to a large extent on storage conditions - for maximum shelf life, keep cherries refrigerated at all times. How long do cherries last at room temperature? Cherries should only be left out at room temperature if being consumed within the same day, as cherries are highly perishable and do not ripen after being picked. Refrigerate cherries in a plastic bag; discard any bruised or mouldy cherries before refrigerating. To extend the shelf life of cherries, do not wash the cherries until ready to eat or use. How long do cherries last in the refrigerator? Properly stored, cherries will usually keep for about 4 to 10 days in the fridge. Can you freeze whole cherries? Yes, to freeze: (1) Wash, stem and pit cherries; (2) Add 3/4 cup sugar to each quart of cherries and stir until sugar is dissolved; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do whole cherries last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cherries that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cherries, Commercially Canned Or Bottled (Except Maraschino) — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of cherries last once opened? The precise answer depends to a large extent on storage conditions - keep opened canned cherries refrigerated and tightly covered. To maximize the shelf life of canned cherries after opening, refrigerate in covered glass or plastic container. How long do opened canned cherries last in the refrigerator? Canned cherries that have been continuously refrigerated will keep for about 5 to 7 days. Are canned cherries safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned cherries will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cherries will remain at peak quality. To further extend the shelf life of opened canned cherries, freeze them: to freeze canned cherries, place inside covered airtight containers or heavy-duty freezer bags. How long do canned cherries last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cherries that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned cherries last after being frozen and thawed? Cherries that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; cherries that were thawed in the microwave or in cold water should be used immediately.
Cherries, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Dates - Opened Or Unopened Package	1-2 Months	1 Year	1-2 Years	Store in tightly sealed container or plastic bag. Freeze in airtight containers or heavy-duty freezer bags. Hard dates will generally keep longer when frozen than softer varieties. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Elderberries — Fresh, Raw		2-3 Days	10-12 Months	Place elderberries loosely in a shallow container, cover with plastic wrap and refrigerate. Do not wash elderberries until ready to eat, as excess moisture during storage will hasten decay. To freeze: (1) Wash berries carefully in cold water, pat dry and place in a single layer on cookie tray in freezer; (2) Once berries are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Feijoa - Fresh, Raw	2-3 days or until ripe	1-2 days once ripe	10-12 Months	Store at room temperature until ripe, then refrigerate. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Figs — Fresh, Raw		1-2 Days	10-12 Months	Refrigerate in plastic bag. To freeze figs: (1) Wash and peel if desired; (2) Coat figs with a solution made of 1 1/2 teaspoons of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Figs — Stewed		2-4 Days		Refrigerate in covered container.

Figs, Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Figs, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Fruit Cocktail /Salad /Mixed Fruit, Commercially Canned Or Bottled — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of fruit cocktail last once opened? The precise answer depends to a large extent on storage conditions - keep opened fruit cocktail refrigerated and tightly covered. To maximize the shelf life of canned or packaged fruit cocktail after opening, refrigerate in covered glass or plastic container. How long does opened canned fruit cocktail last in the refrigerator? Fruit cocktail that has been continuously refrigerated will keep for about 5 to 7 days. Is canned fruit cocktail safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned fruit cocktail will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the fruit cocktail will remain at peak quality. To further extend the shelf life of opened canned fruit cocktail, freeze: to freeze canned fruit cocktail, place inside covered airtight containers or heavy-duty freezer bags. How long does canned fruit cocktail last in the freezer? Properly stored, it will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - fruit cocktail that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned fruit cocktail last after being frozen and thawed? Canned fruit cocktail that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; fruit cocktail that was thawed in the microwave or in cold water should be used immediately.
Fruit Salad - Fresh, Raw		3-5 Days		How long does fresh fruit salad last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate fruit salad within two hours of preparing or purchasing. To maximize the shelf life of fresh fruit salad for safety and quality, refrigerate the fruit salad in airtight containers. Properly stored, fresh fruit salad will last for about 3 to 5 days in the refrigerator. How long can fruit salad be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); fruit salad should be discarded if left out for more than 2 hours at room temperature. How to tell if fruit salad is bad? If fruit salad develops an off odor, flavour or appearance, or if mould appears, it should be discarded; do not taste first.
Grapefruit Sections, Commercially Canned Or Bottled - Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can - refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Grapefruit - Fresh, Raw, Cut Up		3-4 Days	10-12 Months	How long does cut grapefruit last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up grapefruit refrigerated. To maximize the shelf life of cut grapefruit, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long does cut grapefruit last in the fridge? Properly stored, cut grapefruit will last for 3 to 4 days in the refrigerator. Can you freeze cut grapefruit? Yes, to freeze grapefruit: (1) Divide fruit into sections, removing all membranes and seeds; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over grapefruit; (4) Place grapefruit and syrup in covered airtight containers or heavy-duty freezer bags. How long does cut grapefruit last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up grapefruit that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut grapefruit is bad or spoiled? The best way is to smell and look at the cut grapefruit: discard any grapefruit that has an off smell or appearance; if mould appears, discard the cut grapefruit.
Grapefruit - Fresh, Raw, Whole	1 Week	3-4 Weeks	10-12 Months	How long does grapefruit last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep grapefruit in a cool, dry area. How long does grapefruit last at room temperature? Grapefruit will generally keep well at room temperature for about one week; longer storage at room temperature can cause the grapefruit to shrivel and lose flavour. To extend the shelf life of grapefruit, refrigerate in a plastic bag. How long does grapefruit last in the refrigerator? Properly stored, grapefruit will usually keep well for about 3 to 4 weeks in the fridge. Can you freeze grapefruit? Yes: (1) Wash and peel, then divide fruit into sections, removing all membranes and seeds; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over grapefruit; (4) Place grapefruit and syrup in covered airtight containers or heavy-duty freezer bags. How long does grapefruit last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - grapefruit that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if grapefruit is bad or spoiled? The best way is to smell and look at the grapefruit: discard any grapefruit if mould appears or if the grapefruit has an off smell or appearance.
Grapes - Fresh, Raw		7-14 Days	10-12 Months	How long do grapes last? The precise answer to that question depends to a large extent on storage conditions - for maximum shelf life, keep grapes refrigerated at all times. How long do grapes last at room temperature? Grapes should only be left out at room temperature if being consumed within the same day, as grapes are highly perishable and do not ripen after being picked. Refrigerate grapes in perforated plastic bag; discard any bruised or mouldy grapes before refrigerating. To extend the shelf life of grapes, do not wash the grapes until ready to eat or use. How long do grapes last in the refrigerator? Properly stored, grapes will usually keep for about 7 to 14 days in the fridge. Can you freeze whole grapes? Yes, to freeze:(1) Take off the stems, wash grapes carefully in cold water, pat dry and place in a single layer on cookie tray in freezer; (2) Once grapes are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. How long do whole grapes last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - grapes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Grapes, Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Guava — Fresh, Raw, Cut Up		3-4 Days	10-12 Months	Wrap cut fruit tightly with plastic wrap or aluminium foil before refrigerating, or store in airtight container. To freeze guavas: (1) Wash, peel, and cut in half; (2) In a saucepan, combine 1 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over guavas; (4) Place guavas and syrup in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Guava - Fresh, Raw, Whole	2-5 days or until ripe	3-4 days once ripe	10-12 Months	Store at room temperature until ripe, then refrigerate in plastic bag. To freeze guavas: (1) Wash, peel, and cut in half; (2) In a saucepan, combine 1 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over guavas; (4) Place guavas and syrup in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Honeydew Melons - Fresh, Raw, Cut Up		3-5 Days	10-12 Months	How long does cut honeydew melon last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up honeydew melon refrigerated. To maximize the shelf life of cut honeydew melon, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long does cut honeydew melon last in the fridge? Properly stored, cut honeydew melon will last for 3 to 5 days in the refrigerator. Can you freeze cut honeydew melon? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags. How long does cut honeydew melon last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up honeydew melon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut honeydew melon is bad or spoiled? The best way is to smell and look at the cut honeydew melon: discard any honeydew melon that has an off smell or appearance; if mould appears, discard the cut honeydew melon.
Honeydew Melons - Fresh, Raw, Whole	2-4 Days	5-7 Days	10-12 Months	How long does honeydew melon last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep honeydew melon in a cool, dry area. How long does honeydew melon last at room temperature? Honeydew melon will generally keep well at room temperature for about 2 to 4 days. To extend the shelf life of honeydew melon, refrigerate. How long does honeydew melon last in the fridge? Properly stored, honeydew melon will usually keep well for about 5 to 7 days in the refrigerator. Can you freeze honeydew melon? Yes, to freeze: (1) Cut honeydew melon in half and remove seeds and rind; (2) Slice or cube melon, or cut into balls; (3) Place in covered airtight containers or heavy-duty freezer bags. How long does honeydew melon last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - honeydew melon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if honeydew melon is bad or spoiled? The best way is to smell and look at the honeydew melon: if honeydew melon develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard all of the honeydew melon.
Lemons - Fresh, Raw, Cut Up		3-4 Days	3-4 Months	How long do cut lemons last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up lemons refrigerated. To maximize the shelf life of cut lemons, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut lemons last in the fridge? Properly stored, cut lemons will last for 3 to 4 days in the refrigerator. Can you freeze cut lemons? Yes, cut up lemons may be frozen "as is" in plastic bags; they will be mushy when thawed, but can be used for juice. Freeze fresh lemon juice in ice cube trays and then transfer to heavy-duty freezer bags. How long do cut lemons last in the freezer? Properly stored, they will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up lemons that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut lemons are bad or spoiled? The best way is to smell and look at the cut lemons: discard any lemons that have an off smell or appearance; if mould appears, discard the cut lemons.
Lemons - Fresh, Raw, Whole	1 Week	3-4 Weeks	3-4 Months	How long do lemons last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep lemons in a cool, dry area. How long do lemons last at room temperature? Lemons will generally keep well at room temperature for about one week; longer storage at room temperature can cause the lemons to shrivel and lose flavour. To extend the shelf life of lemons, refrigerate in a plastic bag. How long do lemons last in the refrigerator? Properly stored, lemons will usually keep well for about 3 to 4 weeks in the fridge. Can you freeze whole lemons? Yes: Whole lemons may be frozen "as is" in plastic bags; they will be mushy when thawed, but can be used for juice. Defrost frozen lemons in the microwave for a few seconds (or submerge in cold water for about 15 minutes). How long do whole lemons last in the freezer? Properly stored, they will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - lemons that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Limes - Fresh, Raw, Cut Up		3-4 Days	3-4 Months	How long do cut limes last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up limes refrigerated. To maximize the shelf life of cut limes, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut limes last in the fridge? Properly stored, cut limes will last for 3 to 4 days in the refrigerator. Can you freeze cut limes? Yes, cut up limes may be frozen "as is" in plastic bags; they will be mushy when thawed, but can be used for juice. Freeze fresh lemon juice in ice cube trays and then transfer to heavy-duty freezer bags. How long do cut limes last in the freezer? Properly stored, they will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up limes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut limes are bad or spoiled? The best way is to smell and look at the cut limes: discard any limes that have an off smell or appearance; if mould appears, discard the cut limes.
Limes - Fresh, Raw, Whole	1 Week	3-4 Weeks	3-4 Months	How long do limes last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep limes in a cool, dry area. How long do limes last at room temperature? Limes will generally keep well at room temperature for about one week; longer storage at room temperature can cause the limes to shrivel and lose flavour. To extend the shelf life of limes, refrigerate in a plastic bag. How long do limes last in the refrigerator? Properly stored, limes will usually keep well for about 3 to 4 weeks in the fridge. Can you freeze whole limes? Yes: Whole limes may be frozen "as is" in plastic bags; they will be mushy when thawed, but can be used for juice. Defrost frozen limes in the microwave for a few seconds (or submerge in cold water for about 15 minutes). How long do whole limes last in the freezer? Properly stored, they will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - limes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Litchis (Lychees) — Fresh, Raw		5-7 Days	10-12 Months	Store unpeeled in the refrigerator. Freezer time shown is for best quality — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Litchis (Lychees), Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mango, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mangos (Mangoes) — Fresh, Raw, Cut Up		3-4 Days	10-12 Months	Wrap cut fruit tightly with plastic wrap or aluminium foil before refrigerating, or store in airtight container. To freeze: (1) Wash, peel and slice mangoes; (2) Place mango slices in a single layer on cookie tray in freezer; (3) Once slices are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mangos (Mangoes) - Fresh, Raw, Whole	2-5 days or until ripe	5-7 days once ripe	10-12 Months	Store at room temperature until ripe, then refrigerate in plastic bag. To freeze: (1) Wash, peel and slice mangoes; (2) Place mango slices in a single layer on cookie tray in freezer; (3) Once slices are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Maraschino Cherries, Commercially Canned Or Bottled — Opened	1-2 Months	6-12 Months		How long do maraschino cherries last once opened? The precise answer depends to a large extent on storage conditions - keep opened maraschino cherries tightly covered. To maximize the shelf life of maraschino cherries after opening, keep in a cool, dark area. How long do opened maraschino cherries last at room temperature? Maraschino cherries that have stored properly will stay at best quality for about 1 to 2 months at room temperature. How long do opened maraschino cherries last in the refrigerator? Maraschino cherries that have been continuously refrigerated will keep for about 6 to 12 months. Are maraschino cherries safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the package is undamaged, and there are no signs of spoilage - commercially maraschino cherries will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cherries will remain at peak quality. How can you tell if opened maraschino cherries are bad or spoiled? The best way is to smell and look at the cherries: if the cherries develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all cherries from cans or bottles that are leaking, rusting, bulging or severely dented.
Maraschino Cherries, Commercially Canned Or Bottled — Unopened	3 Years (Best Quality)			How long do unopened maraschino cherries last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of maraschino cherries, store in a cool, dry area. How long do unopened maraschino cherries last at room temperature? Properly stored, an unopened bottle of maraschino cherries will generally stay at best quality for about 3 years, although it will usually remain safe to use after that. Are unopened maraschino cherries safe to use after the "expiration" date on the can or package? Yes, provided they are properly stored and the can is undamaged - commercially packaged maraschino cherries will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the maraschino cherries will remain at peak quality. Storage time shown is for best quality only - after that, the maraschino cherries' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the bottle is undamaged, and there are no signs of spoilage. How can you tell if maraschino cherries are bad or spoiled? The best way is to smell and look at the maraschino cherries: if the maraschino cherries develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all maraschino cherries from bottles or cans that are leaking, rusting, bulging or severely dented.
Mixed Berries - Commercially Frozen			1 Year	How long do frozen mixed berries last? The precise answer to that question depends to a large extent on storage conditions - keep mixed berries frozen at all times. Properly stored, frozen mixed berries will maintain best quality for about 12 months in the freezer, although they will usually remain safe to eat after that. Are frozen mixed berries safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially frozen mixed berries will typically carry a Best By, Best if Used By, Best Before, or Best When Used By date but this is not a safety date, it is the manufacturer's estimate of how long the frozen mixed berries will remain at peak quality. How long will frozen mixed berries remain safe to eat? Frozen mixed berries that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How to tell if frozen mixed berries are no longer good? If dry spots or discolorations have developed on the frozen mixed berries, freezer burn has begun to set in - this will not make the frozen mixed berries unsafe to eat, but it will harm the texture and taste.
Mixed Fruit- Fresh, Raw, Cut Up		3-5 Days	10-12 Months	How long does cut mixed fruit last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up mixed fruit refrigerated. To maximize the shelf life of cut mixed fruit, refrigerate in covered container or resealable plastic bag. How long does cut mixed fruit last in the fridge? Properly stored, cut mixed fruit will last for about 3 to 5 days in the refrigerator. Can you freeze cut mixed fruit? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags. How long does cut mixed fruit last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up mixed fruit that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut mixed fruit is bad or spoiled? The best way is to smell and look at the cut mixed fruit: discard any mixed fruit that has an off smell or appearance; if mould appears, discard the cut mixed fruit.
Nectarines — Fresh, Raw, Cut Up		3-4 Days	10-12 Months	Wrap cut fruit tightly with plastic wrap or aluminium foil before refrigerating, or store in airtight container. To freeze nectarines: (1) Wash, pit and halve or slice nectarines; (2) Coat nectarines with a solution made of 1/2 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Add 2/3 cup sugar to each quart of fruit and stir until sugar is dissolved; (4) Place in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Nectarines - Fresh, Raw, Whole	2-3 days or until ripe	3-5 days once ripe	10-12 Months	How long do nectarines last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep nectarines in a dry area. Properly stored, nectarines will become fully ripe in about 2 to 3 days at normal room temperature. How can you make nectarines ripen faster? To hasten ripening, put nectarines in a brown paper bag, close it and leave on the counter. Do not refrigerate nectarines until they are fully ripe - allowing to ripen at room temperature will result in more flavourful, juicy nectarines. To extend the shelf life of fully ripe nectarines, place in a plastic bag and refrigerate; for best results, bring the nectarines back to room temperature before using. How long do nectarines last in the refrigerator? Fully ripe nectarines will last for about 3 to 5 days in the fridge. Can you freeze raw nectarines? Yes: (1) Wash, pit and halve or slice nectarines; (2) Coat nectarines with a solution made of 1/2 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Add 2/3 cup sugar to each quart of fruit and stir until sugar is dissolved; (4) Place in covered airtight containers or heavy-duty freezer bags. How long do nectarines last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Olives, Green Or Black (All Types, Including Pimiento-Stuffed, Kalamata, Pitted, Manzanilla), Commercially Canned Or Bottled - Opened	2-3 Years (Unopened) (Best Quality)	4-6 Months (Best Quality)		How long do olives last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened olives keep them refrigerated and tightly covered. How long do opened olives last in the refrigerator? Olives that have been continuously refrigerated will generally stay at best quality for about 4 to 6 months. Are opened olives safe to use after the "expiration date" on the jar or can? Yes, provided they have been stored properly, the jar or can is undamaged, and there are no signs of spoilage - commercially packaged olives will typically carry a " Best By," "Best if Used By," "Best Before" or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the olives will remain at peak quality. The storage time shown for opened olives is for best quality only - after that, the olives' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been kept continuously refrigerated, the jar or can is undamaged, and there are no signs of spoilage. How can you tell if opened olives are bad or spoiled? The best way is to smell and look at the olives: if the olives develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all olives from cans or bottles that are leaking, rusting, bulging or severely dented.
Olives, Loose, In Oil		1-2 Months (Best Quality)		How long do loose olives (or deli olives) last? The precise answer depends to a large extent on storage conditions - keep olives them refrigerated and tightly covered. To maximize the shelf life of loose olives, refrigerate in covered glass or plastic container and keep olives submerged in liquid when storing. How long do loose olives last in the refrigerator? Loose olives that have been continuously refrigerated will generally stay at best quality for about 1 to 2 months. How can you tell if loose olives are bad or spoiled? The best way is to smell and look at the loose olives: if the olives develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Oranges - Fresh, Raw, Cut Up		3-4 Days	10-12 Months	How long do cut oranges last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up oranges refrigerated. To maximize the shelf life of cut oranges, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut oranges last in the fridge? Properly stored, cut oranges will last for 3 to 4 days in the refrigerator. Can you freeze cut oranges? Yes, to freeze oranges: (1) Wash and peel, then divide fruit into sections, removing all membranes and seeds; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over oranges; (4) Place oranges and syrup in covered airtight containers or heavy-duty freezer bags. How long do cut oranges last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up oranges that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut oranges are bad or spoiled? The best way is to smell and look at the cut oranges: discard any oranges that have an off smell or appearance; if mould appears, discard the cut oranges.
Oranges - Fresh, Raw, Whole	5-7 Days	3-4 Weeks	10-12 Months	How long do oranges last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep oranges in a cool, dry area. How long do oranges last at room temperature? Oranges will generally keep well at room temperature for about one week; longer storage at room temperature can cause the oranges to shrivel and lose flavour. To extend the shelf life of oranges, refrigerate in a plastic bag. How long do oranges last in the refrigerator? Properly stored, oranges will usually keep well for about 3 to 4 weeks in the fridge. Can you freeze oranges? Yes: (1) Wash and peel, then divide fruit into sections, removing all membranes and seeds; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over oranges; (4) Place oranges and syrup in covered airtight containers or heavy-duty freezer bags. How long do oranges last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - oranges that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if oranges are bad or spoiled? The best way is to smell and look at the oranges: discard any oranges if mould appears or if the oranges have an off smell or appearance.
Passion Fruit (Granadilla) - Fresh, Raw	2-5 days or until ripe	5-7 days once ripe	6-8 Months	Leave at room temperature to ripen, then refrigerate. To freeze: (1) Scoop out flesh and place in ice cube trays; (2) Once frozen, transfer cubes to airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Peaches - Fresh, Raw, Cut Up		3-4 Days	10-12 Months	How long do cut peaches last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up peaches refrigerated. Peaches discolour quickly when cut - to prevent browning, sprinkle the cut peaches with a little lemon juice before refrigerating. To maximize the shelf life of cut peaches, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut peaches last in the fridge? Properly stored, cut peaches will last for 3 to 4 days in the refrigerator. Can you freeze cut peaches? Yes, to freeze peaches: (1) Wash, pit and halve or slice peaches; (2) Coat peaches with a solution made of 1/2 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Add 2/3 cup sugar to each quart of fruit and stir until sugar is dissolved; (4) Place in covered airtight containers or heavy-duty freezer bags. How long do cut peaches last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up peaches that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut peaches are bad or spoiled? The best way is to smell and look at the cut peaches: discard any peaches that have an off smell or appearance; if mould appears, discard the cut peaches.
Peaches - Fresh, Raw, Whole	1-3 days or until ripe	3-5 days once ripe	10-12 Months	How long do peaches last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep peaches in a dry area. Properly stored, peaches will become fully ripe in about 1 to 3 days at normal room temperature. How can you make peaches ripen faster? To hasten ripening, put peaches in a brown paper bag, close it and leave on the counter. Do not refrigerate peaches until they are fully ripe - allowing to ripen at room temperature will result in more flavourful, juicy peaches. To extend the shelf life of fully ripe peaches, place in a plastic bag and refrigerate; for best results, bring the peaches back to room temperature before using. How long do peaches last in the refrigerator? Fully ripe peaches will last for about 3 to 5 days in the fridge. Can you freeze raw peaches? Yes: (1) Wash, pit and halve or slice peaches; (2) Coat peaches with a solution made of 1/2 teaspoon of ascorbic acid for each 6 tablespoons of cold water to prevent darkening; (3) Add 2/3 cup sugar to each quart of fruit and stir until sugar is dissolved; (4) Place in covered airtight containers or heavy-duty freezer bags. How long do peaches last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Peaches, Commercially Canned Or Bottled — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of peaches last once opened? The precise answer depends to a large extent on storage conditions - keep opened canned peaches refrigerated and tightly covered. To maximize the shelf life of canned or packaged peaches after opening, refrigerate in covered glass or plastic container. How long do opened canned peaches last in the refrigerator? Peaches that have been continuously refrigerated will keep for about 5 to 7 days. Are canned peaches safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned peaches will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the peaches will remain at peak quality. To further extend the shelf life of opened canned peaches, freeze them: to freeze peaches, place inside covered airtight containers or heavy-duty freezer bags. How long do canned peaches last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - peaches that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned peaches last after being frozen and thawed? Peaches that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; peaches that were thawed in the microwave or in cold water should be used immediately.
Peaches, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pears - Fresh, Raw, Cut Up		3-4 Days	10-12 Months	How long do cut pears last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up pears refrigerated. Pears discolour quickly when cut - to prevent browning, sprinkle the cut pears with a little lemon juice before refrigerating. To maximize the shelf life of cut pears, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long do cut pears last in the fridge? Properly stored, cut pears will last for 3 to 4 days in the refrigerator. Can you freeze cut pears? Yes, to freeze pears: (1) Wash, core and slice pears; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Heat pears in the boiling syrup for 1 to 2 minutes, depending on the size of the slices; (4) Drain and cool; (5) Place pears and syrup in covered airtight containers or heavy-duty freezer bags. How long do cut pears last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up pears that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut pears are bad or spoiled? The best way is to smell and look at the cut pears: discard any pears that have an off smell or appearance; if mould appears, discard the cut pears.
Pears - Fresh, Raw, Whole	1-4 days or until ripe	5-7 days once ripe	10-12 Months	How long do pears last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep pears in a dry area. Properly stored, pears will become fully ripe in about 1 to 4 days at normal room temperature. How can you make pears ripen faster? To hasten ripening, put pears in a brown paper bag, close it and leave on the counter. Do not refrigerate pears until they are fully ripe - allowing to ripen at room temperature will result in more flavourful, juicy pears. To extend the shelf life of fully ripe pears, place in a plastic bag and refrigerate; for best results, bring the pears back to room temperature before using. How long do pears last in the refrigerator? Fully ripe pears will last for about 5 to 7 days in the fridge. Can you freeze raw pears? Yes: (1) Wash, core and slice pears; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Heat pears in the boiling syrup for 1 to 2 minutes, depending on the size of the slices; (4) Drain and cool; (5) Place pears and syrup in covered airtight containers or heavy-duty freezer bags. How long do pears last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.

Pears, Commercially Canned Or Bottled — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of pears last once opened? The precise answer depends to a large extent on storage conditions - keep opened canned pears refrigerated and tightly covered. To maximize the shelf life of canned or packaged pears after opening, refrigerate in covered glass or plastic container. How long do opened canned pears last in the refrigerator? Pears that have been continuously refrigerated will keep for about 5 to 7 days. Are canned pears safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned pears will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the pears will remain at peak quality. To further extend the shelf life of opened canned pears, freeze them: to freeze pears, place inside covered airtight containers or heavy-duty freezer bags. How long do canned pears last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - pears that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned pears last after being frozen and thawed? Pears that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; pears that were thawed in the microwave or in cold water should be used immediately.
Pears, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pineapple (Chunks, Sliced, Crushed, Tidbits), Commercially Canned Or Bottled — Opened	18-24 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of pineapple last once opened? The precise answer depends to a large extent on storage conditions - keep opened pineapple (including chunks, sliced, crushed, tidbits) refrigerated and tightly covered. To maximize the shelf life of canned or packaged pineapple after opening, refrigerate in covered glass or plastic container. How long does opened canned pineapple last in the refrigerator? Pineapple that has been continuously refrigerated will keep for about 5 to 7 days. Is canned pineapple safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned pineapple will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the pineapple will remain at peak quality. To further extend the shelf life of opened canned pineapple, freeze: to freeze canned pineapple, place inside covered airtight containers or heavy-duty freezer bags. How long does canned pineapple last in the freezer? Properly stored, it will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - pineapple that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned pineapple last after being frozen and thawed? Canned pineapple that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; pineapple that was thawed in the microwave or in cold water should be used immediately.
Pineapple - Commercially Frozen			1 Year	How long does frozen pineapple last? The precise answer to that question depends to a large extent on storage conditions - keep pineapple frozen at all times. Properly stored, frozen pineapple will maintain best quality for about 12 months in the freezer, although it will usually remain safe to eat after that. Is frozen pineapple safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen pineapple will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the frozen pineapple will remain at peak quality. How long will frozen pineapple remain safe to eat? Frozen pineapple that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How to tell if frozen pineapple is no longer good? If dry spots or discoloration have developed on the frozen pineapple, freezer burn has begun to set in - this will not make the pineapple unsafe to eat, but it will harm the texture and taste.
Pineapple - Fresh, Raw, Cut Up		3-4 Days	10-12 Months	How long does cut pineapple last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up pineapple refrigerated. To maximize the shelf life of cut pineapple, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long does cut pineapple last in the fridge? Properly stored, cut pineapple will last for 3 to 4 days in the refrigerator. Can you freeze cut pineapple? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags. How long does cut pineapple last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up pineapple that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut pineapple is bad or spoiled? The best way is to smell and look at the cut pineapple: discard any pineapple that has an off smell or appearance; if mould appears, discard the cut pineapple.
Pineapples - Fresh, Raw, Whole	1-2 Days	3-5 Days	10-12 Months	How long do pineapples last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep whole pineapples in a cool, dry area. How long do pineapples last at room temperature? Whole pineapples will generally keep well at room temperature for about 1 to 2 days. To extend the shelf life of fresh pineapples, refrigerate. How long do pineapples last in the fridge? Properly stored, whole pineapples will usually keep well for about 3 to 5 days in the refrigerator. Can you freeze pineapples? Yes, to freeze: (1) Pare pineapples and remove core and eyes; (2) Slice or dice the pineapples, or cut into wedges or sticks; (3) Place in covered airtight containers or heavy-duty freezer bags. How long do pineapples last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - pineapples that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if pineapples are bad or spoiled? The best way is to smell and look at the pineapples: if pineapples develop an off odor, flavour or appearance, they should be discarded; if mould appears, discard all of the pineapple.
Pineapples, Dried - Unopened Or Opened Package	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Plums - Fresh, Raw, Whole	2-3 days or until ripe	3-5 days once ripe	10-12 Months	How long do plums last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, keep plums in a dry area. Properly stored, plums will become fully ripe in about 2 to 3 days at normal room temperature. How can you make plums ripen faster? To hasten ripening, put plums in a brown paper bag, close it and leave on the counter. Do not refrigerate plums until they are fully ripe - allowing to ripen at room temperature will result in more flavourful, juicy plums. To extend the shelf life of fully ripe plums, place in a plastic bag and refrigerate; for best results, bring the plums back to room temperature before using. How long do plums last in the refrigerator? Fully ripe plums will last for about 3 to 5 days in the fridge. Can you freeze raw plums? Yes: (1) Wash and leave whole or cut in halves or quarters and remove pit; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over plums; (4) Place plums and syrup in covered airtight containers or heavy-duty freezer bags. How long do plums last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Plums, Commercially Canned Or Bottled — Opened	12-18 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pomegranates - Fresh, Raw	1-2 Weeks	1-2 Months	10-12 Months	Pomegranates may be stored at room temperature; to extend shelf life, refrigerate. To freeze: (1) Scoop out pomegranate seeds and place in a single layer on cookie tray in freezer; (2) Once seeds are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Prickly Pears — Fresh, Raw, Cut Up		3-4 Days	10-12 Months	Wrap cut fruit tightly with plastic wrap or aluminium foil before refrigerating, or store in airtight container. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Prickly Pears - Fresh, Raw, Whole	2-5 days or until ripe	1-3 days once ripe	10-12 Months	Store at room temperature until ripe, then refrigerate. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Prunes (Dried Plums) - Cooked At Home		2-4 Days	1-2 Months	Refrigerate within two hours of cooking. Store in covered glass or plastic container. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Prunes (Dried Plums) - Unopened Or Opened Bag	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Prunes (Dried Plums), Commercially Canned Or Bottled - Opened	12-18 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can - refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Raisins, Commercially Packaged - Unopened Or Opened	6-12 Months	6-12 Months	12-18 Months	Store in cool, dry area; after opening, place in tightly sealed airtight container or heavy-duty plastic bag. Refrigeration will extend shelf life after opening and is recommended in hot, humid environments. Freeze in airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Raspberries - Fresh, Raw		2-3 Days	10-12 Months	How long do raspberries last? The precise answer to that question depends to a large extent on storage conditions and how ripe the berries were when purchased or picked - for maximum shelf life, keep raspberries refrigerated at all times. How long do raspberries last at room temperature? Raspberries should only be left out at room temperature if being consumed within the same day, as raspberries are highly perishable and do not ripen after being picked. Refrigerate raspberries in their closed plastic clamshell container (if purchased in one) or place berries loosely in a shallow container and cover with plastic wrap. Discard any bruised or mouldy raspberries before refrigerating. To extend the shelf life of raspberries, do not wash the berries until ready to eat or use. How long do raspberries last in the refrigerator? Properly stored, raspberries will usually keep for about 2 to 3 days in the fridge. Can you freeze whole raspberries? Yes, to freeze: (1) Wash berries carefully in cold water, pat dry and place in a single layer on cookie tray in freezer; (2) Once berries are frozen, transfer to airtight containers or heavy-duty freezer bags and return to freezer.
Raspberries, Commercially Canned Or Bottled — Opened	12-18 Months (Unopened)	5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Strawberries - Fresh, Raw		3-7 Days	10-12 Months	How long do strawberries last? The precise answer to that question depends to a large extent on storage conditions and how ripe the berries were when purchased or picked - for maximum shelf life, keep strawberries refrigerated at all times. How long do strawberries last at room temperature? Strawberries should only be left out at room temperature if being consumed within the same day, as strawberries are highly perishable and do not ripen after being picked. Refrigerate strawberries in their closed plastic clamshell container (if purchased in one) or place berries loosely in a shallow container and cover with plastic wrap. Discard any bruised or mouldy strawberries before refrigerating. To extend the shelf life of strawberries, do not wash the berries until ready to eat or use. How long do strawberries last in the refrigerator? Properly stored, strawberries will usually keep for about 3 to 7 days in the fridge. Can you freeze whole strawberries? Yes, to freeze: (1) Rinse berries and blot dry (2) Slice stems off at top of berry (3) Place strawberries, cut side down, on a cookie sheet lined with waxed paper (4) Place uncovered cookie sheet in the freezer for several hours, until frozen (5)Transfer frozen strawberries to covered airtight containers or heavy-duty freezer bags. How long do whole strawberries last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time.
Strawberries, Commercially Canned Or Bottled — Opened		5-7 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Tangerines (Mandarin Oranges) - Fresh, Raw	1 Week	1-2 Weeks	10-12 Months	Tangerines may be stored at room temperature; to extend shelf life, refrigerate. To freeze tangerines: (1) Wash and peel, then divide fruit into sections, removing all membranes and seeds; (2) In a saucepan, combine 2 3/4 cups sugar and 4 cups water, mix until the solution is clear, and bring to a boil; (3) Cool the syrup and pour over tangerines; (4) Place tangerines and syrup in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Tangerines (Mandarin Oranges), Commercially Canned Or Bottled — Opened	12-18 Months (Best Quality) (Unopened)	5-7 Days	1-2 Months	How long does a can of mandarin oranges last once opened? The precise answer depends to a large extent on storage conditions - keep opened canned mandarin oranges refrigerated and tightly covered. To maximize the shelf life of canned or packaged mandarin oranges after opening, refrigerate in covered glass or plastic container. How long do opened canned mandarin oranges last in the refrigerator? Mandarin oranges that have been continuously refrigerated will keep for about 5 to 7 days. Are canned mandarin oranges safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned mandarin oranges will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the mandarin oranges will remain at peak quality. To further extend the shelf life of opened canned mandarin oranges, freeze them: to freeze mandarin oranges, place inside covered airtight containers or heavy-duty freezer bags. How long do canned mandarin oranges last in the freezer? Properly stored, they will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - mandarin oranges that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned mandarin oranges last after being frozen and thawed? Mandarin oranges that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; mandarin oranges that were thawed in the microwave or in cold water should be used immediately.

Watermelon - Fresh, Raw, Cut Up		3-5 Days	10-12 Months	How long does cut watermelon last? The exact answer to that question depends to a large extent on storage conditions - keep cut-up watermelon refrigerated. To maximize the shelf life of cut watermelon, wrap tightly with plastic wrap or aluminium foil, or place in covered container or resealable plastic bag and refrigerate. How long does cut watermelon last in the fridge? Properly stored, cut watermelon will last for 3 to 5 days in the refrigerator. Can you freeze cut watermelon? Yes, to freeze: Place in airtight containers or heavy-duty freezer bags. How long does cut watermelon last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cut-up watermelon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cut watermelon is bad or spoiled? The best way is to smell and look at the cut watermelon: discard any watermelon that has an off smell or appearance; if mould appears, discard the cut watermelon.
Watermelon - Fresh, Raw, Whole	7-10 Days	2 Weeks	10-12 Months	

4 Meat Shelf Life

These is the shelf life of most meat, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Bacon - Cooked, Leftovers		4-5 Days	2-3 Months	How long does cooked bacon last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate bacon within two hours of cooking. To maximize the shelf life of cooked bacon for safety and quality, refrigerate the bacon in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked bacon will last for 4 to 5 days in the refrigerator. To further extend the shelf life of cooked bacon, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked bacon last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked bacon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked bacon last after being frozen and thawed? Cooked bacon that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; bacon that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked bacon last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked bacon should be discarded if left for more than 2 hours at room temperature.
Bacon, Raw, Commercially Vacuum Packaged - Opened Package		7-10 Days	1-2 Months	How long does an opened package of bacon last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep bacon refrigerated at all times. How long does bacon last after the sell-by date? After bacon is opened, it may be refrigerated for about 7 to 10 days - the "sell-by" date on the package may expire during that storage period, but the bacon will remain safe to use after the sell by date if it has been properly stored. Opened bacon may be kept in its original store packaging when refrigerating; to maximize the shelf life of opened bacon, place the opened package inside a resealable plastic bag or wrap tightly with aluminium foil or plastic wrap. How long can bacon be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); bacon should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of bacon, freeze; when freezing, place bacon in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of bacon in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does bacon last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - bacon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Bacon, Raw, Commercially Vacuum Packaged - Unopened Package		1 week after "sell by" date on package	1-2 Months	How long does an unopened package of bacon last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep bacon refrigerated at all times. How long does an unopened packaged of bacon last after the sell-by date? After bacon is purchased, it may be kept refrigerated for about 1 week after the "sell-by" date on the package if it has been properly stored. Unopened bacon may be kept in its original store packaging when refrigerating; to maximize the shelf life of bacon, do not open the package until ready to use. How long can bacon be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); bacon should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of bacon, freeze; when freezing, place bacon in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of bacon in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does an unopened package of bacon last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - bacon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Beef Brisket - Cooked		3-4 Days	2-3 Months	How long does cooked beef brisket last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate beef brisket within two hours of cooking. To maximize the shelf life of cooked beef brisket for safety and quality, refrigerate the beef brisket in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked beef brisket will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked beef brisket, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked beef brisket last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked beef brisket that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked beef brisket last after being frozen and thawed? Cooked beef brisket that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; beef brisket that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked beef brisket last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked beef brisket should be discarded if left for more than 2 hours at room temperature.
Beef Brisket - Fresh, Raw		3-5 Days	6-12 Months	How long does raw beef brisket last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep beef brisket refrigerated at all times. How long does raw beef brisket last after the sell-by date? After beef brisket is purchased, it may be refrigerated for 3 to 5 days - the "sell-by" date on the package may expire during that storage period, but the beef brisket will remain safe to use after the sell by date if it has been properly stored. Unopened beef brisket may be kept in its original store packaging when refrigerating; to maximize the shelf life of beef brisket, do not open the package until ready to use. How long can raw beef brisket be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); beef brisket should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of beef brisket, freeze; when freezing, place beef brisket in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of beef brisket in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw beef brisket last in the freezer? Properly stored, it will maintain best quality for about 6 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - beef that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely How long does raw beef brisket last after being frozen and thawed? Beef brisket that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before cooking; beef brisket that was thawed in the microwave or in cold water should be cooked immediately.
Beef Burgers, Cooked - Purchased Commercially Frozen			6 Months (Best Quality)	How long do frozen cooked beef burgers last? The precise answer to that question depends to a large extent on storage conditions - keep cooked beef burgers frozen at all times. Properly stored, frozen cooked beef burgers will maintain best quality for about 6 months in the freezer, although they will usually remain safe to eat after that. Are frozen cooked beef burgers safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen cooked beef burgers will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cooked beef burgers will remain at peak quality. How long will frozen cooked beef burgers remain safe to eat? Frozen cooked beef burgers that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen cooked beef burgers at room temperature? Frozen cooked beef burgers should be discarded if left for more than 2 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen cooked beef burgers are no longer good? If dry spots or discoloration have developed on the frozen cooked beef burgers, freezer burn has begun to set in - this will not make the cooked beef burgers unsafe to eat, but it will harm the texture and taste.
Beef Burgers, Raw — Purchased Commercially Frozen			6 Months	How long do frozen raw beef burgers last? The precise answer to that question depends to a large extent on storage conditions - keep raw beef burgers frozen at all times. Properly stored, frozen raw beef burgers will maintain best quality for about 6 months in the freezer, although they will usually remain safe to eat after that. Are frozen raw beef burgers safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen raw beef burgers will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the raw beef burgers will remain at peak quality. How long will frozen raw beef burgers remain safe to eat? Frozen raw beef burgers that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen raw beef burgers at room temperature? Frozen raw beef burgers should be discarded if left for more than 2 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen raw beef burgers are no longer good? If dry spots or discoloration have developed on the frozen raw beef burgers, freezer burn has begun to set in - this will not make the beef burgers unsafe to eat, but it will harm the texture and taste.
Beef Entrees / Dinners — Commercially Frozen			3-4 Months	Keep frozen until ready to use. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Beef Jerky — Homemade		1-2 Months		Keep refrigerated and wrapped tightly in plastic wrap or aluminium foil. Does not freeze well.
Beef Jerky, Commercially Vacuum Packaged - Opened	1 Year (Unopened)	2-3 Months		Refrigerate after opening. Does not freeze well.
Beef Ribs, All Cuts (Including Back Ribs, Short Ribs) - Cooked		3-4 Days	2-3 Months	How long do cooked beef ribs last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate beef ribs within two hours of cooking. To maximize the shelf life of cooked beef ribs for safety and quality, refrigerate the beef ribs in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked beef ribs will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked beef ribs, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked beef ribs last in the freezer? Properly stored, they will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked beef ribs that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked beef ribs last after being frozen and thawed? Cooked beef ribs that have been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; beef ribs that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked beef ribs last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked beef ribs should be discarded if left for more than 2 hours at room temperature.
Beef Ribs, All Cuts (Including Back Ribs, Short Ribs) - Fresh, Raw		3-5 Days	6-12 Months	How long do raw beef ribs last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep beef ribs refrigerated at all times. How long do raw beef ribs last after the sell-by date? After beef ribs are purchased, they may be refrigerated for 3 to 5 days - the "sell-by" date on the package may expire during that storage period, but the beef ribs will remain safe to use after the sell by date if they has been properly stored. Unopened raw beef ribs may be kept in its original store packaging when refrigerating; to maximize the shelf life of beef ribs, do not open the package until ready to use. How long can raw beef ribs be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); beef ribs should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw beef ribs, freeze; when freezing, place beef ribs in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of beef ribs in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long do raw beef ribs last in the freezer? Properly stored, they will maintain best quality for about 6 to 12 months, but will remain safe beyond that time. How long do raw beef ribs last after being frozen and thawed? Beef ribs that have been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before cooking; beef ribs that were thawed in the microwave or in cold water should be cooked immediately.
Beef Roast, All Cuts (Including Chuck, Rib, Flank, Tenderloin, Round, Shoulder, Blade) — Purchased Commercially Frozen, Raw			12 Months	Keep frozen until ready to use. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Beef Roast, All Cuts (Including Chuck, Rib, Flank, Tenderloin, Round, Shoulder, Blade) - Fresh, Raw		3-5 Days	6-12 Months	How long does a raw beef roast last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep beef roast refrigerated at all times. How long does a raw beef roast last after the sell-by date? After beef roast is purchased, it may be refrigerated for 3 to 5 days - the "sell-by" date on the package may expire during that storage period, but the beef roast will remain safe to use after the sell by date if it has been properly stored. Unopened beef roast may be kept in its original store packaging when refrigerating; to maximize the shelf life of beef roast, do not open the package until ready to use. How long can a raw beef roast be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); beef roast should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of beef roast, freeze; when freezing, place beef roast in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of beef roast in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does a raw beef roast last in the freezer? Properly stored, it will maintain best quality for about 6 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - beef that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely How long does a raw beef roast last after being frozen and thawed? Beef roast that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before cooking; beef roast that was thawed in the microwave or in cold water should be cooked immediately.
Beef Roast, All Cuts (Including Chuck, Rib, Flank, Tenderloin, Round, Shoulder, Blade) - Cooked		3-4 Days	2-3 Months	How long does cooked beef roast last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate beef roast within two hours of cooking. To maximize the shelf life of cooked beef roast for safety and quality, refrigerate the beef roast in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked beef roast will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked beef roast, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked beef roast last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked beef roast that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked beef roast last after being frozen and thawed? Cooked beef roast that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; beef roast that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked beef roast last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked beef roast should be discarded if left for more than 2 hours at room temperature.
Beef Steak, All Cuts (Including Chuck, Sirloin, Flank, Rib Eye, Strip, Tenderloin, Round, Porterhouse, T-Bone, Filet Mignon) - Fresh, Raw		3-5 Days	6-12 Months	How long does raw steak last in the fridge or freezer? The exact answer depends to a large extent on storage conditions - keep steak refrigerated at all times. How long does raw steak last after the sell-by date? After steak is purchased, it may be refrigerated for 3 to 5 days - the "sell-by" date on the package may expire during that storage period, but the steak will remain safe to use after the sell by date if it has been properly stored. Unopened steak may be kept in its original store packaging when refrigerating; to maximize the shelf life of steak, do not open the package until ready to use. How long can raw steak be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); steak should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of steak, freeze; when freezing, place steak in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of steak in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw steak last in the freezer? Properly stored, it will maintain best quality for about 6 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - steak that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Beef Steak, All Cuts (Including Chuck, Sirloin, Flank, Rib Eye, Strip, Tenderloin, Round, Shoulder, Porterhouse, T-Bone, Filet Mignon) - Cooked		3-4 Days	2-3 Months	How long does cooked steak last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate steak within two hours of cooking. To maximize the shelf life of cooked steak for safety and quality, refrigerate the steak in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked steak will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked steak, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked steak last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked steak that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked steak last after being frozen and thawed? Cooked steak that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; steak that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked steak last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked steak should be discarded if left for more than 2 hours at room temperature.
Beef, Ground (Hamburger) - Cooked		3-4 Days	2-3 Months	How long does cooked ground beef last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate ground beef (including cooked hamburgers) within two hours of cooking. To maximize the shelf life of cooked ground beef for safety and quality, refrigerate the ground beef in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked ground beef will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked ground beef, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. The freezer time shown is for best quality only - cooked ground beef that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked ground beef last after being frozen and thawed? Cooked ground beef that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; ground beef that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked ground beef last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked ground beef should be discarded if left for more than 2 hours at room temperature.
Beef, Ground (Hamburger) - Fresh, Raw		1-2 Days	3-4 Months	How long does raw ground beef last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep ground beef (including raw hamburgers) refrigerated at all times. How long does raw ground beef last after the sell-by date? After ground beef is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the ground beef will remain safe to use after the sell by date if it has been properly stored. Unopened raw ground beef may be kept in its original store packaging when refrigerating; to maximize the shelf life of ground beef, do not open the package until ready to use. How long can raw ground beef be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); ground beef should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw ground beef, freeze; when freezing, place ground beef in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of ground beef in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw ground beef last in the freezer? Properly stored, it will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - ground beef that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does raw ground beef last after being frozen and thawed? Ground beef that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; ground beef that was thawed in the microwave or in cold water should be cooked immediately.
Bologna Deli Meat / Cold Cuts, Commercially Pre-Packaged - Opened Package		5-7 Days	1-2 Months	How long does an opened package of bologna deli meat last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep bologna deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. To maximize the shelf life of bologna deli meat after opening, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. Properly stored, an opened package of bologna deli meat will last for 5 to 7 days in the refrigerator. How long can bologna deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); bologna deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of opened bologna deli meat, freeze it; when freezing, place bologna deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of bologna deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does bologna deli meat last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - bologna deli meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Bologna Deli Meat / Cold Cuts, Commercially Pre-Packaged - Unopened Package		1 week after "use by" date on package	1-2 Months	How long does an unopened package of bologna deli meat last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep packaged bologna deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. How long does an unopened package of bologna deli meat last after the ? sell-by date or ? best before date on the package? After bologna deli meat is purchased, it may be kept refrigerated for about 1 week after the ? sell by or ? best before date on the package if it has been properly stored. Unopened bologna deli meat may be kept in its original store packaging when refrigerating; to maximize the shelf life of bologna deli meat, do not open the package until ready to use. How long can an unopened package of bologna deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); bologna deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of packaged bologna deli meat, freeze; when freezing, place bologna deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of unopened bologna deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does pre-packaged bologna deli meat last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - bologna deli meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Breakfast Sausages - Cooked, Leftovers		3-4 Days	1-2 Months	Refrigerate within two hours of cooking. Refrigerate cooked meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Breakfast Sausages - Fresh, Raw (Not Smoked)		1-2 Days	1-2 Months	Unopened meat may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Breakfast Sausages, Smoked, Links Or Patties — Opened Package		7 Days	1-2 Months	Keep refrigerated and wrapped tightly in plastic wrap or aluminium foil. To freeze, wrap tightly with heavy-duty aluminium foil or freezer wrap or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Breakfast Sausages, Smoked, Links Or Patties — Unopened Package		1 week after "use by" date on package	1-2 Months	Keep refrigerated. Unopened meat may be kept in its original packaging when freezing — if freezing for longer than 2 months, overwrap packaging with airtight heavy-duty aluminium foil or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Canadian Bacon — Purchased As Chunk		1 Week	1-2 Months	Keep refrigerated and wrapped tightly in plastic wrap or aluminium foil. To freeze, wrap tightly with heavy-duty aluminium foil or freezer wrap or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Canadian Bacon — Purchased Sliced		3-4 Days	1-2 Months	Keep refrigerated and wrapped tightly in plastic wrap or aluminium foil. To freeze, wrap tightly with heavy-duty aluminium foil or freezer wrap or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken Pieces, Including Chicken Breasts / Thighs / Wings - Cooked		3-4 Days	4 Months	How long does cooked chicken last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate chicken within two hours of cooking. To maximize the shelf life of cooked chicken for safety and quality, refrigerate the chicken in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked chicken will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked chicken, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked chicken last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked chicken that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked chicken last after being frozen and thawed? Cooked chicken that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; chicken that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked chicken last at room temperature? Bacteria grow rapidly at temperatures between 40°F and 140°F; cooked chicken should be discarded if left for more than 2 hours at room temperature.
Chicken Pieces, Including Chicken Breasts / Thighs / Wings - Fresh, Raw		1-2 Days	9-12 Months	How long does raw chicken last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep chicken refrigerated at all times. How long does raw chicken last after the sell-by date? After chicken is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the chicken will remain safe to use after the sell by date if it has been properly stored. Unopened raw chicken may be kept in its original store packaging when refrigerating; to maximize the shelf life of chicken, do not open the package until ready to use. How long does raw chicken last at room temperature? Bacteria grow rapidly at temperatures between 40° F and 140° F; chicken should be discarded if left for more than 2 hours at room temperature. To further extend the shelf life of raw chicken, freeze; when freezing, place chicken in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of chicken in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn.

Chicken Deli Meat / Cold Cuts, Commercially Pre-Packaged		5-7 Days	1-2 Months	How long does an opened package of chicken deli meat last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep chicken deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. To maximize the shelf life of chicken deli meat after opening, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. Properly stored, an opened package of chicken deli meat will last for 5 to 7 days in the refrigerator. How long can chicken deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); chicken deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of opened chicken deli meat, freeze it; when freezing, place chicken deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of chicken deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does chicken deli meat last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - chicken deli meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken Strips, Commercially Packaged, Fully Cooked And Sold Refrigerated - Opened Package		5 Days	6 Months	Keep refrigerated and tightly sealed. Freeze in heavy-duty freezer bag or airtight container. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken Strips, Commercially Packaged, Fully Cooked And Sold Refrigerated — Unopened Package		Date on Package	6 Months	Keep refrigerated. If freezing, place in freezer before the time shown for refrigerator storage has elapsed. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken Tenderloins, Commercially Packaged, Fully Cooked And Sold Refrigerated - Opened Package		5 Days	6 Months	Keep refrigerated and tightly sealed. Freeze in heavy-duty freezer bag or airtight container. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken Tenderloins, Commercially Packaged, Fully Cooked And Sold Refrigerated — Unopened Package		Date on Package	6 Months	Keep refrigerated. If freezing, place in freezer before the time shown for refrigerator storage has elapsed. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken, Commercially Canned Or In Vacuum Pouch - Opened	3-5 Years (Best Quality)	3-4 Days	1-2 Months	How long does a can of chicken last once opened? The precise answer depends to a large extent on storage conditions - keep opened chicken refrigerated and tightly covered. To maximize the shelf life of canned chicken (or chicken sold in a vacuum-sealed pouch) after opening, refrigerate in a covered glass or plastic container. How long does opened canned chicken last in the refrigerator? Chicken that has been continuously refrigerated will keep for about 3 to 4 days. Is canned chicken safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged chicken will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the chicken will remain at peak quality. To further extend the shelf life of opened canned chicken, freeze it: to freeze canned chicken, place inside covered airtight containers or heavy-duty freezer bags. How long does canned chicken last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned chicken that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned chicken last after being frozen and thawed? Canned chicken that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; chicken that was thawed in the microwave or in cold water should be used immediately.
Chicken, Whole — Purchased Commercially Frozen, Raw			1 Year	Keep frozen until ready to use. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chicken, Whole - Cooked (Including Roasted, Rotisserie, Barbecued)		3-4 Days	4 Months	How long does cooked rotisserie chicken last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate rotisserie chicken within two hours of cooking. To maximize the shelf life of cooked rotisserie chicken for safety and quality, refrigerate the rotisserie chicken in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked rotisserie chicken will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked rotisserie chicken, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked rotisserie chicken last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. How long does rotisserie chicken last after being frozen and thawed? Rotisserie chicken that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; chicken that was thawed in the microwave or in cold water should be eaten immediately.
Chorizo Sausage, Spanish, Dry		2-3 Weeks	1-2 Months	Keep refrigerated and wrapped tightly in plastic wrap or aluminium foil. To freeze, wrap tightly with heavy-duty aluminium foil or freezer wrap or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Corned Beef - Cooked		3-4 Days	2-3 Months	How long does cooked corned beef last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate corned beef within two hours of cooking. To maximize the shelf life of cooked corned beef for safety and quality, refrigerate the corned beef in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked corned beef will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked corned beef, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked corned beef last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked corned beef that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked corned beef last after being frozen and thawed? Cooked corned beef that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; corned beef that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked corned beef last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked corned beef should be discarded if left for more than 2 hours at room temperature.
Corned Beef Hash, Commercially Canned — Opened	3-5 Years (Unopened) (Best Quality)	3-4 Days	2-3 Months	How long does a can of corned beef hash last once opened? The precise answer depends to a large extent on storage conditions - keep opened corned beef hash refrigerated and tightly covered. To maximize the shelf life of canned corned beef hash after opening, refrigerate in a covered glass or plastic container. How long does opened canned corned beef hash last in the refrigerator? Corned beef hash that has been continuously refrigerated will keep for about 3 to 4 days. Is canned corned beef hash safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged corned beef hash will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the corned beef hash will remain at peak quality. To further extend the shelf life of opened canned corned beef hash, freeze it: to freeze canned corned beef hash, place inside covered airtight containers or heavy-duty freezer bags. How long does canned corned beef hash last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned corned beef hash that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned corned beef hash last after being frozen and thawed? Canned corned beef hash that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; corned beef hash that was thawed in the microwave or in cold water should be used immediately.
Country Ham - Cooked At Home, Leftovers		7 Days	1 Month	Refrigerate within two hours of cooking. Refrigerate cooked meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Deer — Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Deer - Fresh, Raw		3-5 Days	6-9 Months	Unopened meat may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Dried Beef / Chipped Beef, Commercially Canned Or Bottled — Opened	2-5 Years (Unopened)	1 Month	1-2 Months	Keep refrigerated in covered container. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Fried Chicken - Homemade Or Takeout		3-4 Days	4 Months	How long does fried chicken last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate chicken within two hours of cooking or purchasing. To maximize the shelf life of fried chicken for safety and quality, refrigerate the chicken in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, fried chicken will last for 3 to 4 days in the refrigerator. To further extend the shelf life of fried chicken, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does fried chicken last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - fried chicken that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does fried chicken last after being frozen and thawed? Fried chicken that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; chicken that was thawed in the microwave or in cold water should be eaten immediately. How long does fried chicken last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); fried chicken should be discarded if left for more than 2 hours at room temperature.
Ham Deli Meat / Cold Cuts - Sliced At Grocery Deli Counter		3-5 Days	1-2 Months	How long does sliced ham deli meat last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep ham deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. To maximize the shelf life of ham deli meat after opening, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. Properly stored, sliced ham deli meat will last for 3 to 5 days in the refrigerator. How long can ham deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); ham deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of ham deli meat, freeze it; when freezing, place ham deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of ham deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does ham deli meat last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. How long does ham deli meat last after being frozen and thawed? Sliced ham deli meat that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; sliced ham deli meat that was thawed in the microwave or in cold water should be used immediately.
Ham Deli Meat / Cold Cuts, Commercially Pre-Packaged - Unopened		1 week after "use by" date on package	1-2 Months	How long does an unopened package of ham deli meat last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep packaged ham deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. How long does an unopened package of ham deli meat last after the ? sell-by date or ? best before date on the package? After ham deli meat is purchased, it may be kept refrigerated for about 1 week after the ? sell by or ? best before date on the package if it has been properly stored. Unopened ham deli meat may be kept in its original store packaging when refrigerating; to maximize the shelf life of ham deli meat, do not open the package until ready to use. How long can an unopened package of ham deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); ham deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of packaged ham deli meat, freeze; when freezing, place ham deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of unopened ham deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does pre-packaged ham deli meat last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - ham deli meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Ham, Commercially Canned, Sold Unrefrigerated — Opened	2 Years (Unopened)	3-4 Days	2-3 Months	How long does a can of shelf-stable ham last once opened? The precise answer depends to a large extent on storage conditions - keep opened ham refrigerated and tightly covered. To maximize the shelf life of canned ham after opening, refrigerate in a covered glass or plastic container. How long does opened canned ham last in the refrigerator? Ham that has been continuously refrigerated will keep for about 3 to 4 days. Is canned ham safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged ham will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the ham will remain at peak quality. To further extend the shelf life of opened canned ham, freeze it: to freeze canned ham, place inside covered airtight containers or heavy-duty freezer bags. How long does canned ham last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned ham that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned ham last after being frozen and thawed? Canned ham that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; ham that was thawed in the microwave or in cold water should be used immediately.

Hot Dogs (Hotdogs) / Frankfurters / Wieners - Cooked, Leftovers		3-4 Days	1-2 Months	How long do cooked hot dogs last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate hot dogs (hotdogs) within two hours of cooking. To maximize the shelf life of cooked hot dogs for safety and quality, refrigerate the hot dogs in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked hot dogs will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked hot dogs, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked hot dogs last in the freezer? Properly stored, they will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked hot dogs that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked hot dogs last after being frozen and thawed? Cooked hot dogs that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; hot dogs that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked hot dogs last at room temperature? Bacteria grow rapidly at temperatures between 40°F and 140°F; cooked hot dogs should be discarded if left for more than 2 hours at room temperature.
Italian Sausages - Cooked, Leftovers		3-4 Days	1-2 Months	How long do cooked Italian sausages last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate Italian sausages within two hours of cooking. To maximize the shelf life of cooked Italian sausages for safety and quality, refrigerate the Italian sausages in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked Italian sausages will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked Italian sausages, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked Italian sausages last in the freezer? Properly stored, they will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked Italian sausages that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked Italian sausages last after being frozen and thawed? Cooked Italian sausages that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; Italian sausages that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked Italian sausages last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked Italian sausages should be discarded if left for more than 2 hours at room temperature.
Italian Sausages - Fresh, Raw		1-2 Days	1-2 Months	How long do raw Italian sausages last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep Italian sausages refrigerated at all times. How long do raw Italian sausages last after the sell-by date? After Italian sausages are purchased, they may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the Italian sausages will remain safe to use after the sell by date if they has been properly stored. Unopened raw Italian sausages may be kept in its original store packaging when refrigerating; to maximize the shelf life of Italian sausages, do not open the package until ready to use. How long can raw Italian sausages be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); Italian sausages should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw Italian sausages, freeze; when freezing, place Italian sausages in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of Italian sausages in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long do raw Italian sausages last in the freezer? Properly stored, they will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - Italian sausages that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Lamb Chops, All Cuts (Including Shoulder, Loin, Rib) - Cooked		3-4 Days	2-3 Months	How long do cooked lamb chops last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate lamb chops within two hours of cooking. To maximize the shelf life of cooked lamb chops for safety and quality, refrigerate the lamb chops in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked lamb chops will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked lamb chops, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked lamb chops last in the freezer? Properly stored, they will maintain best quality for 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked lamb chops that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked lamb chops last after being frozen and thawed? Cooked lamb chops that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; lamb chops that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked lamb chops last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked lamb chops should be discarded if left for more than 2 hours at room temperature.
Lamb Chops, All Cuts (Including Shoulder, Loin, Rib) - Fresh, Raw		3-5 Days	6-9 Months	How long do raw lamb chops last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep lamb chops refrigerated at all times. How long do raw lamb chops last after the sell-by date? After lamb chops are purchased, they may be refrigerated for 3 to 5 days - the "sell-by" date on the package may expire during that storage period, but the lamb chops will remain safe to use after the sell by date if they has been properly stored. Unopened raw lamb chops may be kept in its original store packaging when refrigerating; to maximize the shelf life of lamb chops, do not open the package until ready to use. How long can raw lamb chops be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); lamb chops should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw lamb chops, freeze; when freezing, place lamb chops in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of lamb chops in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long do raw lamb chops last in the freezer? Properly stored, they will maintain best quality for about 6 to 9 months, but will remain safe beyond that time. The freezer time shown is for best quality only - lamb chops that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Luncheon Meat, Commercially Canned — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	2-3 Months	How long does a can of luncheon meat last once opened? The precise answer depends to a large extent on storage conditions - keep opened luncheon meat refrigerated and tightly covered. To maximize the shelf life of canned luncheon meat after opening, refrigerate in a covered glass or plastic container. How long does opened canned luncheon meat last in the refrigerator? Luncheon meat that has been continuously refrigerated will keep for about 3 to 4 days. Is canned luncheon meat safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged luncheon meat will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the luncheon meat will remain at peak quality. To further extend the shelf life of opened canned luncheon meat, freeze it: to freeze canned luncheon meat, place inside covered airtight containers or heavy-duty freezer bags. How long does canned luncheon meat last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned luncheon meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned luncheon meat last after being frozen and thawed? Canned luncheon meat that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; luncheon meat that was thawed in the microwave or in cold water should be used immediately.
Meat Pie, Freshly Baked (Including Steak And Kidney Pie, Tourtiere)		3-5 Days	1-2 Months	How long does meat pie last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked meat pie (including steak and kidney pie, tourtiere) refrigerated. How long can meat pie be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); meat pie should be discarded if left out for more than 2 hours at room temperature. How long does meat pie last in the fridge? Freshly baked meat pie will keep for about 3 to 5 days in the fridge; refrigerate covered with aluminium foil or plastic wrap. Can you freeze meat pie? Yes, to freeze: wrap meat pie tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long does meat pie last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - meat pie that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if meat pie is bad or spoiled? The best way is to smell and look at the meat pie: discard any that has an off smell or appearance; if mould appears, discard the meat pie.
Meatballs, Cooked - Homemade Or Take-Out		3-4 Days	3-4 Months	How long do cooked meatballs last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate meatballs within two hours of cooking. To maximize the shelf life of cooked meatballs for safety and quality, refrigerate the meatballs in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked meatballs will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked meatballs, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked meatballs last in the freezer? Properly stored, they will maintain best quality for 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked meatballs that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked meatballs last after being frozen and thawed? Cooked meatballs that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; meatballs that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked meatballs last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked meatballs should be discarded if left for more than 2 hours at room temperature.
Meatloaf - Homemade, Leftovers		3-4 Days	3-4 Months	How long does cooked meatloaf last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate meatloaf within two hours of cooking. To maximize the shelf life of cooked meatloaf for safety and quality, refrigerate the meatloaf in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked meatloaf will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked meatloaf, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Cooked meatloaf dishes containing sauce freeze best; cooked dry meatloaf may become overly mushy when thawed. How long does cooked meatloaf last in the freezer? Properly stored, it will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked meatloaf that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked meatloaf last after being frozen and thawed? Cooked meatloaf that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; meatloaf that was thawed in the microwave or in cold water should be eaten immediately.
Pepperoni, Dry — Opened Package		2-3 Weeks	1-2 Months	Refrigerate after opening. To freeze, wrap tightly with heavy-duty aluminium foil or freezer wrap or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pepperoni, Dry - Unopened Package	4-6 Weeks	6 Months	2-3 months (after refrigeration)	Refrigerate to extend storage life. If freezing, place in freezer before time shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil or freezer wrap or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pork, All Cuts (Including Loin, Centre-Cut, Rib) - Cooked		3-4 Days	2-3 Months	How long do cooked pork chops last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate pork chops within two hours of cooking. To maximize the shelf life of cooked pork chops for safety and quality, refrigerate the pork chops in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked pork chops will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked pork chops, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked pork chops last in the freezer? Properly stored, they will maintain best quality for 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked pork chops that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked pork chops last after being frozen and thawed? Cooked pork chops that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; pork chops that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked pork chops last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked pork chops should be discarded if left for more than 2 hours at room temperature.
Pork, All Cuts (Including Loin, Centre-Cut, Rib) - Fresh, Raw		3-5 Days	4-6 Months	How long do raw pork chops last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep pork chops refrigerated at all times. How long do raw pork chops last after the sell-by date? After pork chops are purchased, they may be refrigerated for 3 to 5 days - the "sell-by" date on the package may expire during that storage period, but the pork chops will remain safe to use after the sell by date if they has been properly stored. Unopened raw pork chops may be kept in its original store packaging when refrigerating; to maximize the shelf life of pork chops, do not open the package until ready to use. How long can raw pork chops be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); pork chops should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw pork chops, freeze; when freezing, place pork chops in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of pork chops in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long do raw pork chops last in the freezer? Properly stored, they will maintain best quality for about 4 to 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - pork chops that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Prosciutto, Parma Or Serrano Ham (Dry Cured) - Purchased As Chunk		2-3 Months	1-2 months (after refrigeration)	Keep refrigerated and wrapped tightly in plastic wrap or aluminium foil. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Rabbit — Cooked		3-4 Days	4-6 Months	Refrigerate within two hours of cooking. Refrigerate cooked meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Rabbit, Whole - Fresh, Raw		1-2 Days	1 Year	Unopened meat may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Roast Beef Deli Meat / Cold Cuts - Sliced At Grocery Deli Counter		3-5 Days	1-2 Months	How long does sliced roast beef deli meat last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep roast beef deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. To maximize the shelf life of roast beef deli meat after opening, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. Properly stored, sliced roast beef deli meat will last for 3 to 5 days in the refrigerator. How long can roast beef deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); roast beef deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of roast beef deli meat, freeze it; when freezing, place roast beef deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of roast beef deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does roast beef deli meat last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. How long does roast beef deli meat last after being frozen and thawed? Sliced roast beef deli meat that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; sliced roast beef deli meat that was thawed in the microwave or in cold water should be used immediately.
Salami Deli Meat / Cold Cuts - Sliced At Grocery Deli Counter		3-5 Days	1-2 Months	How long does sliced salami deli meat last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep salami deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. To maximize the shelf life of salami deli meat after opening, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. Properly stored, sliced salami deli meat will last for 3 to 5 days in the refrigerator. How long can salami deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); salami deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of salami deli meat, freeze it; when freezing, place salami deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of salami deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does salami deli meat last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. How long does salami deli meat last after being frozen and thawed? Sliced salami deli meat that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; sliced salami deli meat that was thawed in the microwave or in cold water should be used immediately.
Sausage Patties - Purchased Commercially Frozen			6 Months (Best Quality)	How long do frozen sausage patties last? The precise answer to that question depends to a large extent on storage conditions - keep sausage patties frozen at all times. Properly stored, frozen sausage patties will maintain best quality for about 6 months in the freezer, although they will usually remain safe to eat after that. Are frozen sausage patties safe to eat after the expiration date on the package? Yes, if properly stored - commercially frozen sausage patties will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the sausage patties will remain at peak quality. How long will frozen sausage patties remain safe to eat? Frozen sausage patties that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as they have been stored properly and the package is not damaged. How long can you safely leave frozen sausage patties at room temperature? Frozen sausage patties should be discarded if left for more than 2 hours at room temperature, as bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F). How to tell if frozen sausage patties are no longer good? If dry spots or discoloration have developed on the frozen sausage patties, freezer burn has begun to set in - this will not make the sausage patties unsafe to eat, but it will harm the texture and taste.
Sausages - Cooked		3-4 Days	1-2 Months	How long do cooked sausages last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate sausages within two hours of cooking. To maximize the shelf life of cooked sausages for safety and quality, refrigerate the sausages in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked sausages will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked sausages, freeze them; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long do cooked sausages last in the freezer? Properly stored, they will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked sausages that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do cooked sausages last after being frozen and thawed? Cooked sausages that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; sausages that were thawed in the microwave or in cold water should be eaten immediately. How long do cooked sausages last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked sausages should be discarded if left for more than 2 hours at room temperature.
Sausages, Fresh, Raw		1-2 Days	1-2 Months	How long do raw sausages last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep sausages refrigerated at all times. How long do raw sausages last after the sell-by date? After sausages are purchased, they may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the sausages will remain safe to use after the sell by date if they has been properly stored. Unopened raw sausages may be kept in its original store packaging when refrigerating; to maximize the shelf life of sausages, do not open the package until ready to use. How long can raw sausages be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); sausages should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw sausages, freeze; when freezing, place sausages in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of sausages in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. The freezer time shown is for best quality only - sausages that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do raw sausages last after being frozen and thawed? Sausages that have been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; sausages that were thawed in the microwave or in cold water should be cooked immediately.
Shepherd's Pie, Freshly Baked		3-5 Days	4-6 Months	How long does shepherd's pie last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked shepherd's pie refrigerated. How long can shepherd's pie be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); shepherd's pie should be discarded if left out for more than 2 hours at room temperature. How long does shepherd's pie last in the fridge? Freshly baked shepherd's pie will keep for about 3 to 5 days in the fridge; refrigerate covered with aluminium foil or plastic wrap. Can you freeze shepherd's pie? Yes, to freeze: wrap shepherd's pie tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long does shepherd's pie last in the freezer? Properly stored, it will maintain best quality for about 4 to 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - shepherd's pie that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if shepherd's pie is bad or spoiled? The best way is to smell and look at the shepherd's pie: discard any that has an off smell or appearance; if mould appears, discard the shepherd's pie.
Turkey Deli Meat / Cold Cuts - Sliced At Grocery Deli Counter		3-5 Days	1-2 Months	How long does sliced turkey deli meat last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep turkey deli meat (also known as lunch meat, luncheon meat or cold cuts) refrigerated at all times. To maximize the shelf life of turkey deli meat after opening, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. Properly stored, sliced turkey deli meat will last for 3 to 5 days in the refrigerator. How long can turkey deli meat be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); turkey deli meat should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of turkey deli meat, freeze it; when freezing, place turkey deli meat in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of turkey deli meat in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does turkey deli meat last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - turkey deli meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turkey Pieces — Cooked		3-5 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked poultry in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turkey Pieces - Fresh, Raw		1-2 Days	9 Months	Unopened poultry may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turkey, Commercially Canned - Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	Do not store in opened metal can - refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Turkey, Whole - Cooked		3-4 Days	2-3 Months	The precise answer to the question ? How long does cooked turkey last? depends to a large extent on storage conditions - refrigerate within two hours of cooking; if turkey is stuffed, remove stuffing to a separate container before refrigerating or freezing leftovers. To maximize the shelf life of cooked turkey, refrigerate cooked poultry in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To further extend the shelf life of cooked turkey, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked turkey last in the freezer for safety purposes? The freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked turkey last after being frozen and thawed? Cooked turkey that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; turkey that was thawed in the microwave or in cold water should be eaten immediately. How long does Thanksgiving turkey last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); turkey should be discarded if left for more than 2 hours at room temperature. How to tell if cooked turkey is bad? The best way is to smell and look at the turkey: signs of bad turkey are a sour smell and a slimy texture to the cooked turkey; discard any turkey with an off smell or appearance, do not taste the turkey first.
Turkey, Whole - Fresh, Raw		1-2 Days	1 Year	Fresh turkey may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing fresh turkey, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing fresh, uncooked turkey for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown for fresh turkey is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Veal Steak - Fresh, Raw		3-5 Days	6-12 Months	Unopened meat may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Veal Steak — Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Venison — Cooked		3-5 Days	6-9 Months	Refrigerate within two hours of cooking. Refrigerate cooked meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Venison - Fresh, Raw		3-5 Days	6-9 Months	Unopened meat may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Vienna Sausages, Commercially Canned - Opened	2-5 Years (Unopened)	3-4 Days	1-2 Months	Do not store in opened metal can — refrigerate in covered glass or plastic container after opening. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

5 Seafood Shelf Life

These is the shelf life of most seafood, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips

Anchovies, Commercially Canned Or Bottled — Opened	18 Months (Unopened)	1-2 Months	3 Months	Keep refrigerated and tightly covered. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Caviar, Fresh, Commercially Jarred Or Tinned, Sold Refrigerated — Opened		2-3 Days 2-4 Weeks (Unopened)		Keep refrigerated and tightly covered. Caviar does not freeze well.
Clams — Fresh, Cooked		3-4 Days	3 Months	Refrigerate within two hours of cooking. Refrigerate cooked clams in covered airtight containers. To freeze, place clams in airtight plastic containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Clams — Fresh, Raw, Shucked		1-2 Days	3-4 Months	Keep refrigerated in covered container. To freeze, place clams in airtight plastic containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Clams - Fresh, Live		1-2 Days	2-3 Months	How long do raw clams last in the fridge or freezer? The exact answer to that question depends to a large extent on storage conditions - keep clams refrigerated at all times. Store live, raw clams in the refrigerator in an open container and cover with damp cloths or paper towels. How long do raw clams last in the fridge? After clams are purchased, they may be refrigerated for 1 to 2 days. Raw clams must be kept alive before cooking. How long can raw clams be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); clams should be discarded if left out for more than 2 hours at room temperature and always discard if clams are no longer alive. To further extend the shelf life of raw clams, freeze; when freezing, place clams in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of clams in the freezer by placing the clams inside a heavy-duty freezer bag in order to prevent freezer burn. How long do raw clams last in the freezer? Properly stored, they will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - clams that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do raw clams last after being frozen and thawed? Clams that have been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; clams that were thawed in the microwave or in cold water should be cooked immediately. How long do clams last in the fridge once they are cooked? Cooked clams will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer.
Clams, Commercially Canned — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	3 Months	How long does a can of clams last once opened? The precise answer depends to a large extent on storage conditions - keep opened clams refrigerated and tightly covered. To maximize the shelf life of canned clams after opening, refrigerate in covered glass or plastic container. How long do opened canned clams last in the refrigerator? Canned clams that have been continuously refrigerated will keep for about 3 to 4 days. Are canned clams safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned clams will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the clams will remain at peak quality. To further extend the shelf life of opened canned clams, freeze them: to freeze canned clams, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned clams will be softer after freezing and thawing; the thawed clams will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned clams last in the freezer? Properly stored, they will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - clams that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned clams last after being frozen and thawed? Clams that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; clams that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned clams are bad or spoiled? The best way is to smell and look at the clams: if the clams develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all clams from cans or packages that are leaking, rusting, bulging or severely dented.
Cod - Fresh, Cooked		3-4 Days	2-3 Months	How long does cooked cod last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate cod within two hours of cooking. To maximize the shelf life of cooked cod for safety and quality, refrigerate the cod in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked cod will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked cod, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked cod last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked cod that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked cod last after being frozen and thawed? Cooked cod that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; cod that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked cod last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked cod should be discarded if left for more than 2 hours at room temperature. How to tell if cooked cod is bad? The best way is to smell and look at the cod: signs of bad cod are a sour smell and a slimy texture; discard any cod with an off smell or appearance, do not taste first.
Cod - Fresh, Raw		1-2 Days	6-8 Months	How long does raw cod last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep cod refrigerated at all times. How long does raw cod last after the sell-by date? After cod is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the cod will remain safe to use after the sell by date if it has been properly stored. Unopened raw cod may be kept in its original store packaging when refrigerating; to maximize the shelf life of cod, do not open the package until ready to use. How long can raw cod be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cod should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of raw cod, freeze; when freezing, place cod in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of cod in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw cod last in the freezer? Properly stored, it will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cod that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does raw cod last after being frozen and thawed? Cod that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; cod that was thawed in the microwave or in cold water should be cooked immediately. How long does cod last in the fridge once it is cooked? Cooked cod will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer. How to tell if raw cod is bad? The best way is to smell and look at the cod: signs of bad cod are a sour smell, dull colour and slimy texture; discard any cod with an off smell or appearance.
Crab — Fresh, Cooked, Still In The Shell		3-5 Days	3 Months	Refrigerate within two hours of cooking. Refrigerate cooked crab in covered airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To freeze, place whole cooked crabs in heavy-duty freezer bags or place in airtight plastic containers. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Crab - Fresh, Raw, Live		1-2 Days		Store live crabs in the refrigerator in an open container and cover with damp cloths, paper towels or newspaper. Crabs must be kept alive before cooking.
Crab Meat - Fresh, Cooked, Out Of The Shell		3-5 Days	3 Months	How long does cooked crab meat last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate crab meat within two hours of cooking. To maximize the shelf life of cooked crab meat for safety and quality, refrigerate the crab meat in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, cooked crab meat will last for 3 to 5 days in the refrigerator. To further extend the shelf life of cooked crab meat, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked crab meat last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked crab meat that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked crab meat last after being frozen and thawed? Cooked crab meat that has been thawed in the fridge can be kept for an additional 3 to 5 days in the refrigerator before cooking; crab meat that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked crab meat last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked crab meat should be discarded if left for more than 2 hours at room temperature. How to tell if cooked crab meat is bad? The best way is to smell and look at the crab meat: signs of bad crab meat are a sour smell and a slimy texture; discard any crab meat with an off smell or appearance, do not taste first.
Frozen Seafood Dinners/ Entrees — Purchased Commercially Frozen			6-8 Months	Keep frozen until ready to use. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Halibut - Fresh, Cooked		3-4 Days	2-3 Months	How long does cooked halibut last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate halibut within two hours of cooking. To maximize the shelf life of cooked halibut for safety and quality, refrigerate the halibut in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To further extend the shelf life of cooked halibut, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does cooked halibut last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. Properly stored, cooked halibut will last for 3 to 4 days in the refrigerator. The freezer time shown is for best quality only - cooked halibut that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked halibut last after being frozen and thawed? Cooked halibut that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; halibut that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked halibut last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked halibut should be discarded if left for more than 2 hours at room temperature. How to tell if cooked halibut is bad? The best way is to smell and look at the halibut: signs of bad halibut are a sour smell and a slimy texture; discard any halibut with an off smell or appearance, do not taste first.
Halibut - Fresh, Raw		1-2 Days	6-8 Months	How long does raw halibut last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep halibut refrigerated at all times. How long does raw halibut last after the sell-by date? After halibut is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the halibut will remain safe to use after the sell by date if it has been properly stored. How long can raw halibut be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); halibut should be discarded if left out for more than 2 hours at room temperature. Unopened raw halibut may be kept in its original store packaging when refrigerating; to maximize the shelf life of halibut, do not open the package until ready to use. To further extend the shelf life of raw halibut, freeze; when freezing, place halibut in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of halibut in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw halibut last in the freezer? Properly stored, it will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. The freezer time shown is for best quality only - halibut that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does raw halibut last after being frozen and thawed? Halibut that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; halibut that was thawed in the microwave or in cold water should be cooked immediately. How long does halibut last in the fridge once it is cooked? Cooked halibut will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer. How to tell if raw halibut is bad? The best way is to smell and look at the halibut: signs of bad halibut are a sour smell, dull colour and slimy texture; discard any halibut with an off smell or appearance.
Lobster - Fresh, Live		1-2 Days		Store live lobster in the refrigerator in a large bowl or baking tray and cover with damp cloths or newspaper. Lobster must be kept alive before cooking.
Lobster - Fresh, Cooked, Shell Removed		3-4 Days	3 Months	How long does cooked lobster last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate lobster within two hours of cooking. To maximize the shelf life of cooked lobster for safety and quality, refrigerate the lobster in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To further extend the shelf life of cooked lobster, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Properly stored, cooked lobster will last for 3 to 4 days in the refrigerator. How long does cooked lobster last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked lobster that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked lobster last after being frozen and thawed? Cooked lobster that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; lobster that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked lobster last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked lobster should be discarded if left for more than 2 hours at room temperature. How to tell if cooked lobster is bad? The best way is to smell and look at the lobster: signs of bad lobster are a sour smell and a slimy texture; discard any lobster with an off smell or appearance, do not taste first.
Mackerel — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Mackerel - Fresh, Raw		1-2 Days	2-3 Months	How long does raw mackerel last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep mackerel refrigerated at all times. How long does raw mackerel last after the sell-by date? After mackerel is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the mackerel will remain safe to use after the sell by date if it has been properly stored. Unopened raw mackerel may be kept in its original store packaging when refrigerating; to maximize the shelf life of mackerel, do not open the package until ready to use. How long can raw mackerel be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); mackerel should be discarded if left out for more than 2 hours at room temperature. You can maximize the shelf life of mackerel in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. To further extend the shelf life of raw mackerel, freeze; when freezing, place mackerel in the freezer before the number of days shown for refrigerator storage has elapsed. How long does raw mackerel last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. How long does raw mackerel last after being frozen and thawed? Mackerel that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; mackerel that was thawed in the microwave or in cold water should be cooked immediately. The freezer time shown is for best quality only - mackerel that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does mackerel last in the fridge once it is cooked? Cooked mackerel will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer.
Mullet — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mullet - Fresh, Raw		1-2 Days	2-3 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Octopus — Fresh, Cooked		2-3 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Octopus - Fresh, Raw		1-2 Days	2-3 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Oysters — Fresh, Cooked		3-4 Days	3 Months	Refrigerate within two hours of cooking. Refrigerate cooked oysters in covered airtight containers. To freeze, place oysters in airtight plastic containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Oysters - Fresh, Live		1-2 Days	2-3 Months	Store live oysters in the refrigerator in an open container and cover with damp cloths or paper towels. Oysters must be kept alive before cooking. To freeze, place whole oysters in heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Perch — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Perch - Fresh, Raw		1-2 Days	4 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Salmon - Fresh, Cooked		3-4 Days	2-3 Months	How long does cooked salmon last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate salmon within two hours of cooking. To maximize the shelf life of cooked salmon for safety and quality, refrigerate the salmon in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To further extend the shelf life of cooked salmon, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Properly stored, cooked salmon will last for 3 to 4 days in the refrigerator. How long does cooked salmon last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked salmon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked salmon last after being frozen and thawed? Cooked salmon that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; salmon that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked salmon last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked salmon should be discarded if left for more than 2 hours at room temperature. How to tell if cooked salmon is bad? The best way is to smell and look at the salmon: signs of bad salmon are a sour smell and a slimy texture; discard any salmon with an off smell or appearance, do not taste first.
Salmon - Fresh, Raw		1-2 Days	2-3 Months	How long does raw salmon last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep salmon refrigerated at all times. Unopened raw salmon may be kept in its original store packaging when refrigerating; to maximize the shelf life of salmon, do not open the package until ready to use. How long does raw salmon last after the sell-by date? After salmon is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the salmon will remain safe to use after the sell by date if it has been properly stored. How long can raw salmon be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); salmon should be discarded if left out for more than 2 hours at room temperature. You can maximize the shelf life of salmon in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. To further extend the shelf life of raw salmon, freeze; when freezing, place salmon in the freezer before the number of days shown for refrigerator storage has elapsed. How long does raw salmon last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. How long does raw salmon last after being frozen and thawed? Salmon that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; salmon that was thawed in the microwave or in cold water should be cooked immediately. The freezer time shown is for best quality only - salmon that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does salmon last in the fridge once it is cooked? Cooked salmon will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer. How to tell if raw salmon is bad? The best way is to smell and look at the salmon: signs of bad salmon are a sour smell, dull colour and slimy texture; discard any salmon with an off smell or appearance.
Sardines, Commercially Canned In Oil Or Sauce — Opened	3-5 Years (Unopened)	3-4 Days	3 Months	How long does a can of sardines last once opened? The precise answer depends to a large extent on storage conditions - keep opened sardines refrigerated and tightly covered. To maximize the shelf life of canned sardines after opening, refrigerate in covered glass or plastic container. How long do opened canned sardines last in the refrigerator? Canned sardines that have been continuously refrigerated will keep for about 3 to 4 days. Are canned sardines safe to use after the "expiration" date on the package? Yes, provided they have been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned sardines will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the sardines will remain at peak quality. To further extend the shelf life of opened canned sardines, freeze them; to freeze canned sardines, place inside covered airtight containers or heavy-duty freezer bags. The texture of canned sardines will be softer after freezing and thawing; the thawed sardines will be best suited to cooked dishes, such as sauces, soups and casseroles. How long do canned sardines last in the freezer? Properly stored, they will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - sardines that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do canned sardines last after being frozen and thawed? Sardines that have been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; sardines that were thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned sardines are bad or spoiled? The best way is to smell and look at the sardines: if the sardines develop an off odor, flavour or appearance, or if mould appears, they should be discarded. Discard all sardines from cans or packages that are leaking, rusting, bulging or severely dented.
Sea Bass — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Sea Bass - Fresh, Raw		1-2 Days	2-3 Months	How long does raw sea bass last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep sea bass refrigerated at all times. How long does raw sea bass last after the sell-by date? After sea bass is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the sea bass will remain safe to use after the sell by date if it has been properly stored. Unopened raw sea bass may be kept in its original store packaging when refrigerating; to maximize the shelf life of sea bass, do not open the package until ready to use. To further extend the shelf life of raw sea bass, freeze; when freezing, place sea bass in the freezer before the number of days shown for refrigerator storage has elapsed. How long can raw sea bass be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); sea bass should be discarded if left out for more than 2 hours at room temperature. You can maximize the shelf life of sea bass in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw sea bass last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - sea bass that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does raw sea bass last after being frozen and thawed? Sea bass that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; sea bass that was thawed in the microwave or in cold water should be cooked immediately. How long does sea bass last in the fridge once it is cooked? Cooked sea bass will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer. How to tell if raw sea bass is bad? The best way is to smell and look at the sea bass: signs of bad sea bass are a sour smell, dull colour and slimy texture; discard any sea bass with an off smell or appearance.
Sea Trout — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Sea Trout - Fresh, Raw		1-2 Days	4 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Shrimp, Commercially Canned — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	3 Months	How long does a can of shrimp last once opened? The precise answer depends to a large extent on storage conditions - keep opened shrimp refrigerated and tightly covered. To maximize the shelf life of canned shrimp after opening, refrigerate in a covered glass or plastic container. How long does opened canned shrimp last in the refrigerator? Shrimp that has been continuously refrigerated will keep for about 3 to 4 days. Is canned shrimp safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged shrimp will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the shrimp will remain at peak quality. To further extend the shelf life of opened canned shrimp, freeze it; to freeze canned shrimp, place inside covered airtight containers or heavy-duty freezer bags. How long does canned shrimp last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. How long does canned shrimp last after being frozen and thawed? Canned shrimp that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; shrimp that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned shrimp is bad or spoiled? The best way is to smell and look at the shrimp: if the shrimp develops an off odor, flavour or appearance, or if mould appears, it should be discarded. The freezer time shown is for best quality only – canned shrimp that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. Discard all shrimp from cans or packages that are leaking, rusting, bulging or severely dented.
Snapper — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Snapper - Fresh, Raw		1-2 Days	6-8 Months	How long does raw snapper last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep snapper refrigerated at all times. How long does raw snapper last after the sell-by date? After snapper is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the snapper will remain safe to use after the sell by date if it has been properly stored. Unopened raw snapper may be kept in its original store packaging when refrigerating; to maximize the shelf life of snapper, do not open the package until ready to use. How long can raw snapper be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); snapper should be discarded if left out for more than 2 hours at room temperature. You can maximize the shelf life of snapper in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. To further extend the shelf life of raw snapper, freeze; when freezing, place snapper in the freezer before the number of days shown for refrigerator storage has elapsed. How long does raw snapper last in the freezer? Properly stored, it will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. How long does raw snapper last after being frozen and thawed? Snapper that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; snapper that was thawed in the microwave or in cold water should be cooked immediately. The freezer time shown is for best quality only - snapper that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does snapper last in the fridge once it is cooked? Cooked snapper will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer.

Squid / Calamari — Fresh, Cooked		3-4 Days	3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Squid / Calamari - Fresh, Raw		1-2 Days	3-6 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Sushi — Fresh, Raw		1 Day		Keep refrigerated in covered container. Does not freeze well.
Tilapia - Fresh, Cooked		3-4 Days	2-3 Months	How long does cooked tilapia last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate tilapia within two hours of cooking. To maximize the shelf life of cooked tilapia for safety and quality, refrigerate the tilapia in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To further extend the shelf life of cooked tilapia, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Properly stored, cooked tilapia will last for 3 to 4 days in the refrigerator. How long does cooked tilapia last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. How long does cooked tilapia last after being frozen and thawed? Cooked tilapia that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; tilapia that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked tilapia last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked tilapia should be discarded if left for more than 2 hours at room temperature. How to tell if cooked tilapia is bad? The best way is to smell and look at the tilapia: signs of bad tilapia are a sour smell and a slimy texture; discard any tilapia with an off smell or appearance, do not taste first. The freezer time shown is for best quality only - cooked tilapia that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Tilapia - Fresh, Raw		1-2 Days	6-8 Months	How long does raw tilapia last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep tilapia refrigerated at all times. Unopened raw tilapia may be kept in its original store packaging when refrigerating; to maximize the shelf life of tilapia, do not open the package until ready to use. How long does raw tilapia last after the sell-by date? After tilapia is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the tilapia will remain safe to use after the sell by date if it has been properly stored. How long can raw tilapia be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); tilapia should be discarded if left out for more than 2 hours at room temperature. You can maximize the shelf life of tilapia in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw tilapia last in the freezer? Properly stored, it will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. To further extend the shelf life of raw tilapia, freeze; when freezing, place tilapia in the freezer before the number of days shown for refrigerator storage has elapsed. How long does raw tilapia last after being frozen and thawed? Tilapia that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; tilapia that was thawed in the microwave or in cold water should be cooked immediately. The freezer time shown is for best quality only - tilapia that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does tilapia last in the fridge once it is cooked? Cooked tilapia will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer. How to tell if raw tilapia is bad? The best way is to smell and look at the tilapia: signs of bad tilapia are a sour smell, dull colour and slimy texture; discard any tilapia with an off smell or appearance.
Trout, Lake Or Rainbow — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Trout, Lake Or Rainbow - Fresh, Raw		1-2 Days	2-3 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Trout, Smoked — Whole Fish Or Large Pieces		5-8 Days	2 Months	Keep refrigerated and tightly wrapped in plastic or aluminium wrap. To freeze, wrap tightly with heavy-duty aluminium foil or freezer wrap or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Tuna (Including Yellowfin) - Fresh, Cooked		3-4 Days	2-3 Months	How long does cooked tuna last in the fridge? The precise answer to that question depends to a large extent on storage conditions - refrigerate tuna within two hours of cooking. To maximize the shelf life of cooked tuna for safety and quality, refrigerate the tuna in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. To further extend the shelf life of cooked tuna, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Properly stored, cooked tuna will last for 3 to 4 days in the refrigerator. How long does cooked tuna last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. How long does cooked tuna last after being frozen and thawed? Cooked tuna that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; tuna that was thawed in the microwave or in cold water should be eaten immediately. How long does cooked tuna last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked tuna should be discarded if left for more than 2 hours at room temperature. The freezer time shown is for best quality only - cooked tuna that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cooked tuna is bad? The best way is to smell and look at the tuna: signs of bad tuna are a sour smell and a slimy texture; discard any tuna with an off smell or appearance, do not taste first.
Tuna (Including Yellowfin) - Fresh, Raw		1-2 Days	2-3 Months	How long does raw tuna last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - keep tuna refrigerated at all times. How long does raw tuna last after the sell-by date? After tuna is purchased, it may be refrigerated for 1 to 2 days - the "sell-by" date on the package may expire during that storage period, but the tuna will remain safe to use after the sell by date if it has been properly stored. How long can raw tuna be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); tuna should be discarded if left out for more than 2 hours at room temperature. Unopened raw tuna may be kept in its original store packaging when refrigerating; to maximize the shelf life of tuna, do not open the package until ready to use. Unopened raw tuna may be kept in its original store packaging when refrigerating; to maximize the shelf life of tuna, do not open the package until ready to use. To further extend the shelf life of raw tuna, freeze; when freezing, place tuna in the freezer before the number of days shown for refrigerator storage has elapsed. How long does raw tuna last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. You can maximize the shelf life of tuna in the freezer by overwrapping the original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does raw tuna last after being frozen and thawed? Tuna that has been defrosted in the fridge can be kept for an additional 1 to 2 days in the refrigerator before cooking; tuna that was thawed in the microwave or in cold water should be cooked immediately. The freezer time shown is for best quality only - tuna that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does tuna last in the fridge once it is cooked? Cooked tuna will usually stay good for 3 to 4 days in the fridge and 4 months in the freezer.
Tuna, Commercially Canned Or Vacuum-Sealed Pouch (In Oil Or Water) — Opened	3-5 Years (Best Quality) (Unopened)	3-4 Days	3 Months	How long does a can of tuna last once opened? The precise answer depends to a large extent on storage conditions - keep opened tuna refrigerated and tightly covered. To maximize the shelf life of canned tuna (or tuna sold in a vacuum-sealed pouch) after opening, refrigerate in a covered glass or plastic container. How long does opened canned tuna last in the refrigerator? Tuna that has been continuously refrigerated will keep for about 3 to 4 days. Is canned tuna safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged tuna will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the tuna will remain at peak quality. To further extend the shelf life of opened canned tuna, freeze it: to freeze canned tuna, place inside covered airtight containers or heavy-duty freezer bags. How long does canned tuna last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only – canned tuna that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does canned tuna last after being frozen and thawed? Canned tuna that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; tuna that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened canned tuna is bad or spoiled? The best way is to smell and look at the tuna: if the tuna develops an off odor, flavour or appearance, or if mould appears, it should be discarded. Discard all tuna from cans or pouches that are leaking, rusting, bulging or severely dented.
Whitefish — Fresh, Cooked		3-4 Days	2-3 Months	Refrigerate within two hours of cooking. Refrigerate cooked fish in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Whitefish - Fresh, Raw		1-2 Days	2-3 Months	Unopened fish may be kept in its original store packaging when refrigerating - do not open package until ready to use. If freezing, place in freezer before the number of days shown for refrigerator storage has elapsed. If freezing for longer than 2 months, overwrap original store packaging with airtight heavy-duty aluminium foil, plastic wrap, or freezer paper or place the package inside a heavy-duty freezer bag in order to prevent freezer burn. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

6 Dairy Shelf Life

These is the shelf life of most dairy, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
American Cheese, Pasteurized Processed Slices (Individually Wrapped) - Opened Package		1-2 Months	3 Months	Keep refrigerated and tightly covered. If cheese slices develop an off odor, flavour or appearance, they should be discarded for quality purposes. To freeze: wrap cheese slices tightly in heavy-duty aluminium foil or plastic freezer wrap or place in heavy-duty freezer bags. Frozen cheese may become crumbly and lose some of its flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Brick Cheese, Shredded Or Sliced, Commercially Packaged — Unopened Package		1 week after date on package	3 months	Keep refrigerated; do not open package until ready to use. If cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard the entire package. To freeze, place original packaging in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. Frozen cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Brick Cheese, Shredded Or Sliced, Commercially Packaged - Opened Package		5-7 Days	3 months	How long does an opened package of shredded brick cheese last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep shredded brick cheese refrigerated at all times. To maximize the shelf life of shredded brick cheese after opening, tightly seal original packaging or place the cheese in resealable plastic bags or airtight containers. Properly stored, an opened package of shredded brick cheese will last for about 5 to 7 days in the refrigerator. Once the package is opened, consume or freeze the shredded brick cheese within the time shown for refrigeration, even if the "Best By," "Best if Used By," or "Use By" date has not yet been reached. How long can shredded brick cheese be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); shredded brick cheese should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of opened shredded brick cheese, freeze it; when freezing, place shredded brick cheese in the freezer before the number of days shown for refrigerator storage has elapsed. To freeze shredded brick cheese, tightly seal original packaging and place in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. The freezer time shown is for best quality only - shredded brick cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Brick Cheese, Sold In Wrapped Block - Unopened Or Opened		2-3 Weeks	2 Months	How long does a chunk of brick cheese last? The exact answer to that question depends to a large extent on storage conditions - keep the cheese refrigerated at all times. To maximize the shelf life of a chunk of brick cheese after opening, wrap the original packaging tightly in plastic wrap or aluminium foil; for even better results, wrap the cheese first in wax or parchment paper and then cover with plastic wrap before refrigerating. Properly stored, a chunk of brick cheese will last for 2 to 3 weeks in the refrigerator. Is a chunk of brick cheese still safe after the ? sell by date or "best by date" on the package? Yes - assuming it is properly stored, it will typically remain safe to use for 2 to 3 weeks, even if the "sell-by" or "best by date on the package expires. If a chunk or block of brick cheese has mould on it, is it still safe to eat? Yes - cut away at least 1 inch around and below the mouldy area (do not touch mould with the knife) and re-cover the cheese in fresh wrap. Note: if mould appears in a package of shredded, sliced or crumbled brick cheese, the entire package should be discarded. To further extend the shelf life of brick cheese, freeze it; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. To freeze a chunk or block of brick cheese: Cut the cheese into portions no larger than 1/2 pound each, and wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. How long does a chunk of brick cheese last after being frozen and thawed? A chunk of brick cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; a chunk of brick cheese that was thawed in the microwave or in cold water should be used immediately. Frozen cheese may become crumbly and lose some of its flavour; the thawed chunk of brick cheese will be best suited to cooked dishes, such as sauces, soups and casseroles.
Brie Cheese, Sold In Wrapped Wedge - Unopened Or Opened		1-2 Weeks	3 months	How long does a wedge of Brie cheese last? The exact answer to that question depends to a large extent on storage conditions - keep the cheese refrigerated at all times. To maximize the shelf life of a wedge of Brie cheese after opening, wrap the original packaging tightly in plastic wrap or aluminium foil; for even better results, wrap the cheese first in wax or parchment paper and then cover with plastic wrap before refrigerating. Properly stored, a wedge of Brie cheese will last about 1 to 2 weeks in the refrigerator. If a wedge of Brie cheese has mould on it, is it still safe to eat? If mould that was not a normal part of the manufacturing process appears on the Brie cheese, discard it entirely. To further extend the shelf life of Brie cheese, freeze it; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. Frozen cheese may become crumbly and lose some of its flavour; the thawed Brie cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. To freeze a wedge or block of Brie cheese: Cut the cheese into portions no larger than 1/2 pound each, and wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. How long does a wedge of Brie cheese last after being frozen and thawed? A wedge of Brie cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; a wedge of Brie cheese that was thawed in the microwave or in cold water should be used immediately.
Butter - Unopened Or Opened Package		1 month after "sell by" date on package	6-12 Months	How long does butter last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of butter, keep it refrigerated at all times. To maximize the shelf life of butter, keep refrigerated in airtight containers or wrapped tightly in plastic wrap or aluminium foil. To further maximize the shelf of butter, do not store butter in the moulded butter compartment of the refrigerator door, where the temperature is warmer - butter will keep much longer when stored in the main body of the refrigerator. How long does butter last in the refrigerator? Butter will generally last for about one month after the "sell-by" date on the package, assuming it has been continuously refrigerated. How long can butter be left out at room temperature? Butter may be kept at room temperature for 1 to 2 days, but it will begin to spoil rapidly if not refrigerated after that. To further extend the shelf life of butter, freeze it: to freeze butter, wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. How long does butter last in the freezer? Frozen salted butter will generally maintain best quality for about 12 months, while unsalted butter will stay at peak quality for about 6 months; in both cases, the butter will remain safe beyond those times. The freezer time shown is for best quality only - butter that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if butter is bad or spoiled? The best way is to smell and look at the butter: If butter develops an off odor, flavour or appearance, it should be discarded.
Cheddar Cheese, Shredded Or Sliced, Commercially Packaged — Unopened Package		1 week after date on package	3 months	Keep refrigerated; do not open package until ready to use. If cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard the entire package. To freeze, place original packaging in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. Frozen cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cheddar Cheese, Shredded Or Sliced, Commercially Packaged - Opened Package		5-7 Days	3 months	How long does an opened package of shredded cheddar cheese last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep shredded cheddar cheese refrigerated at all times. To maximize the shelf life of shredded cheddar cheese after opening, tightly seal original packaging or place the cheese in resealable plastic bags or airtight containers. Properly stored, an opened package of shredded cheddar cheese will last for about 5 to 7 days in the refrigerator. Once the package is opened, consume or freeze the shredded cheddar cheese within the time shown for refrigeration, even if the "Best By," "Best if Used By," or "Use By" date has not yet been reached. How long can shredded cheddar cheese be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); shredded cheddar cheese should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of opened shredded cheddar cheese, freeze it; when freezing, place shredded cheddar cheese in the freezer before the number of days shown for refrigerator storage has elapsed. Frozen cheddar cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. To freeze shredded cheddar cheese, tightly seal original packaging and place in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn.
Cheddar Cheese, Sold In Wrapped Chunk Or Block - Opened		3-4 Weeks	6 Months	How long does a chunk of cheddar cheese last once opened? The exact answer to that question depends to a large extent on storage conditions - keep the cheese refrigerated at all times. To maximize the shelf life of a chunk of cheddar cheese after opening, wrap the original packaging tightly in plastic wrap or aluminium foil; for even better results, wrap the cheese first in wax or parchment paper and then cover with plastic wrap before refrigerating. Properly stored, an opened chunk of cheddar cheese will last for 3 to 4 weeks in the refrigerator. How long does a chunk of cheddar cheese last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. Is an opened chunk of cheddar cheese still safe after the "sell by" date or "best by date" on the package? Yes - after the cheese is opened, it will typically remain safe to use for 3 to 4 weeks, even if the "sell-by" or "best by" date on the package expires. If a chunk or block of cheddar cheese has mould on it, is it still safe to eat? Yes - cut away at least 1 inch around and below the mouldy area (do not touch mould with the knife) and re-cover the cheese in fresh wrap. Note: if mould appears in a package of shredded, sliced or crumbled cheddar cheese, the entire package should be discarded. To further extend the shelf life of cheddar cheese, freeze it; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. To freeze a chunk or block of cheddar cheese: Cut the cheese into portions no larger than 1/2 pound each, and wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. How long does a chunk of cheddar cheese last after being frozen and thawed? A chunk of cheddar cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; a chunk of cheddar cheese that was thawed in the microwave or in cold water should be used immediately.
Chocolate Milk / Flavoured Milk, Pasteurized (Including Whole, 2% Varieties), Sold Refrigerated - Unopened Or Opened		1 week after "sell by" date on package	3 months	How long does chocolate milk last? The precise answer to that question depends to a large extent on storage conditions - to maximize the shelf life of chocolate milk, keep it refrigerated at all times. How long does chocolate milk last after the sell-by date? Chocolate milk will generally remain drinkable for about one week after the "sell-by" date on the package, assuming it has been continuously refrigerated; be sure to keep the temperature of your refrigerator at or below 40° F at all times. To maximize the shelf of chocolate milk, do not store it on the fridge door, as the temperature is too warm - the chocolate milk will last longer when they stored in the main body of the refrigerator, in its original package. How long can chocolate milk be left at room temperature? If kept at temperatures above 40 °F, chocolate milk will rapidly develop signs of spoilage; chocolate milk should be discarded if left out for more than 4 hours at room temperature. To further extend the shelf life of chocolate milk, freeze it; frozen chocolate milk will often become separated and the texture may become somewhat grainy, but it is usually acceptable for cooking and baking purposes. Freeze chocolate milk in an airtight container and leave at least 1/2 inch headspace at the top, as chocolate milk will expand when frozen; thaw in refrigerator. How long does chocolate milk last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - chocolate milk that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if chocolate milk is bad? The best way is to smell and look at the chocolate milk: signs of bad chocolate milk are a sour smell, off colour and a thick or clumpy texture.
Cream Cheese, Sold In Foil-Wrapped Block - Opened Package		1-2 Weeks	2 Months	How long does cream cheese last once opened? The exact answer to that question depends to a large extent on storage conditions - to maximize the shelf life of cream cheese, keep it refrigerated at all times. How long does cream cheese last after the sell-by date? An opened package of cream cheese will generally last for about one to two weeks after the "sell-by" date on the package, assuming it has been continuously refrigerated. How long can cream cheese be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cream cheese should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of cream cheese, freeze it: to freeze cream cheese, wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. Frozen cream cheese may become crumbly and lose some of its flavour; the thawed cream cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. How long does cream cheese last in the freezer? Properly stored, it will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cream cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cream cheese last after being frozen and thawed? Cream cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; cream cheese that was thawed in the microwave or in cold water should be used immediately.
Cream Cheese, Sold In Foil-Wrapped Block - Unopened Package		1 month after date on package	2 Months	How long does an unopened package of cream cheese last? The exact answer depends to a large extent on storage conditions - to maximize the shelf life of cream cheese, keep it refrigerated at all times. How long does unopened cream cheese last after the "sell by" date or "best before" date? Cream cheese will generally keep for about 1 month after the "sell by" or " best before" date on the package, assuming it has been continuously refrigerated. How long does cream cheese last at room temperature? If kept at temperatures above 40 °F, cream cheese will rapidly develop signs of spoilage; cream cheese should be discarded if left for more than 2 hours at room temperature. To further extend the shelf life of opened cream cheese, freeze it: Unopened cream cheese sold in a foil-wrapped block may be frozen in its original packaging. Frozen cream cheese may become crumbly and lose some of its flavour; the thawed cream cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. How long does cream cheese last in the freezer? Properly stored, it will maintain best quality for about 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cream cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cream cheese last after being frozen and thawed? Cream cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; cream cheese that was thawed in the microwave or in cold water should be used immediately.
Cream, Whipped - Homemade Using Fluid Cream		1 Day	1-2 Months	Keep refrigerated. To freeze, spoon mounds of whipped cream onto cookie sheet and place in freezer; when frozen, transfer to airtight container. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Custard, Made With Milk — Homemade		5-6 Days		Keep refrigerated in covered container. Does not freeze well.
Eggs - Cooked, Hard Boiled		1 Week		How long do hard boiled eggs last in the fridge? The exact answer to that question depends to a large extent on storage conditions - refrigerate hard boiled eggs within two hours of cooking. To maximize the shelf life of hard boiled eggs for safety and quality, refrigerate the hard boiled eggs in shallow airtight containers or resealable plastic bags or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, hard boiled eggs will last one week in the refrigerator. How long can hard boiled eggs be left at room temperature? Bacteria grow rapidly at temperatures between 40°F and 140°F; hard boiled eggs should be discarded if left out for more than 2 hours at room temperature. Can you freeze hard boiled eggs? Whole, hard boiled eggs do not freeze well; the whites will become tough and rubbery. You can freeze the cooked egg yolks of hard boiled eggs successfully as follows: (1) Place cooked yolks in covered airtight container or heavy-duty freezer bag; (2) Freeze yolks up to for 3 months for best quality. How to tell if hard boiled eggs are bad? The best way is to smell and look at the eggs; discard any discoloured eggs or eggs with an off smell or appearance, do not taste the eggs first. The easiest way to peel hard boiled eggs: Buy eggs at least 7 to 10 days before using them and peel eggs right after they've been cooked and cooled.
Eggs - Fresh, Raw, In The Shell		4-5 Weeks	10-12 Months	How long do raw eggs last in the fridge or freezer? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of eggs, keep refrigerated at all times. How long do raw eggs last after the expiration date or sell-by date? After eggs are purchased, they will maintain their best quality for about 3 weeks after the "sell by", "use by", "best by", or "expiration" date on the carton, assuming continuous refrigeration. To maximize the shelf life of eggs, do not store them in the moulded egg rack of the refrigerator door, as the temperature is too warm - the eggs will last much longer when they are stored in the main body of the refrigerator, in their purchased carton. How long can raw eggs be left at room temperature? Bacteria grow rapidly at temperatures between 40°F and 140 °F; raw eggs should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of eggs, freeze them; do not freeze eggs in their shells. To freeze whole eggs: (1) Remove eggs from their shells; (2) Pierce yolks and gently mix in 1/2 teaspoon of salt for every one cup of raw eggs (if using eggs for main dishes) or 1 tablespoon of sugar (if using for baking or desserts); (3) Place in covered airtight containers or heavy-duty freezer bags and freeze. How long do raw eggs last in the freezer? Properly stored, they will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - eggs that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long do eggs last in the fridge if they are hard boiled? Hard boiled eggs will generally stay good for one week in the refrigerator; freezing hard boiled eggs is not recommended. How to tell if eggs are bad? The best way is to crack open the egg and examine it: a fresh egg will have a round, high bright yellow yolk and the white will be thick and cloudy; a bad egg will have a very flat yolk and the white will be runny and watery.
Farmer Cheese — Opened Package		5-7 Days	6 Months	Keep refrigerated and tightly covered. If cheese develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears, discard the entire package. To freeze, tightly seal original package and place inside a heavy-duty freezer bag in order to prevent freezer burn. Frozen farmer cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Farmer Cheese — Unopened Package		1 week after date on container	6 Months	Keep refrigerated and tightly covered. If cheese develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears, discard the entire package. To freeze, tightly seal original package and place in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. Frozen farmer cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Feta Cheese, Packaged In Brine		3 Months	3 Months	Keep refrigerated and covered in brine contained in package. If additional brine is needed, mix one pound of salt (preferably kosher) with one gallon of water — milk may also be used instead of brine. If mould appears on the feta cheese, discard it entirely. To freeze, drain feta and wrap tightly in plastic freezer wrap or place in heavy-duty freezer bag. Frozen feta may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Goat Cheese/ Chevre, Fresh — Unopened Or Opened		2-3 Weeks	3 Months	Keep refrigerated and tightly covered. If cheese develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears on goat cheese, discard the cheese entirely. To freeze, wrap tightly in plastic freezer wrap or place in heavy-duty freezer bag. Frozen goat cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Heavy Cream, Plain Pasteurized - Opened Package		5-7 Days	4 Months	How long does heavy cream last once opened? The precise answer depends to a large extent on storage conditions — keep opened heavy cream refrigerated and tightly closed. To maximize the shelf of opened heavy cream, do not store it on the fridge door, as the temperature is too warm - the opened heavy cream will last longer when stored in the main body of the refrigerator, in its original package. How long does opened heavy cream last in the refrigerator? Heavy cream that has been continuously refrigerated will keep for about 5 to 7 days after opening. To further extend the shelf life of heavy cream, freeze it: frozen heavy cream will not whip well when thawed, will often become separated and the texture may become somewhat grainy, but it is usually acceptable for cooking and baking purposes. Freeze heavy cream in an airtight container and leave at least 1/2 inch headspace at the top, as heavy cream will expand when frozen; thaw in refrigerator. How long does heavy cream last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - heavy cream that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if heavy cream is bad? The best way is to smell and look at the heavy cream: signs of bad heavy cream are an off smell, off colour and a thick or clumpy texture.
Light Cream, Plain Pasteurized - Opened Package		5-7 Days	4 Months	How long does light cream last once opened? The precise answer depends to a large extent on storage conditions — keep opened light cream refrigerated and tightly closed. To maximize the shelf of opened light cream, do not store it on the fridge door, as the temperature is too warm - the opened light cream will last longer when stored in the main body of the refrigerator, in its original package. How long does opened light cream last in the refrigerator? Light cream that has been continuously refrigerated will keep for about 5 to 7 days after opening. To further extend the shelf life of light cream, freeze it: frozen light cream will not whip well when thawed, will often become separated and the texture may become somewhat grainy, but it is usually acceptable for cooking and baking purposes. Freeze light cream in an airtight container and leave at least 1/2 inch headspace at the top, as light cream will expand when frozen; thaw in refrigerator. How long does light cream last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - light cream that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if light cream is bad? The best way is to smell and look at the light cream: signs of bad light cream are an off smell, off colour and a thick or clumpy texture.
Light Cream, Plain Pasteurized - Unopened Package		1-2 weeks after date on package	4 Months	How long does unopened light cream last? The precise answer to that question depends to a large extent on storage conditions - to maximize the shelf life of unopened light cream, keep it refrigerated at all times. How long does unopened light cream last in the fridge? Unopened light cream will generally stay at best quality for about 1 to 2 weeks after the date on the package, assuming it has been continuously refrigerated. To maximize the shelf of unopened light cream, do not store it on the fridge door, as the temperature is too warm - the unopened light cream will last longer when stored in the main body of the refrigerator, in its original package. To further extend the shelf life of light cream, freeze it: frozen light cream will not whip well when thawed, will often become separated and the texture may become somewhat grainy, but it is usually acceptable for cooking and baking purposes. Freeze light cream in an airtight container and leave at least 1/2 inch headspace at the top, as light cream will expand when frozen; thaw in refrigerator. How long does light cream last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - light cream that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if light cream is bad? The best way is to smell and look at the light cream: signs of bad light cream are an off smell, off colour and a thick or clumpy texture.
Milk, Evaporated, Commercially Canned - Opened	18-24 Months (Best Quality) (Unopened)	4-6 Days		How long does a can of evaporated milk last once opened? The precise answer depends to a large extent on storage conditions - keep opened evaporated milk refrigerated and tightly covered. To maximize the shelf life of canned evaporated milk after opening, covered opened can tightly with a plastic wrap or lid, or with aluminium foil. How long does opened canned evaporated milk last in the refrigerator? Evaporated milk that has been continuously refrigerated will keep for about 4 to 6 days. Is canned evaporated milk safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned evaporated milk will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the evaporated milk will remain at peak quality. Can you freeze evaporated milk? Freezing is not recommended, as the evaporated milk will separate and become watery when thawed. How can you tell if canned evaporated milk is bad or spoiled? The best way is to smell and look at the canned evaporated milk: if the canned evaporated milk develops an off odor, flavour or appearance, it should be discarded. Discard all canned evaporated milk from cans that are leaking, rusting, bulging or severely dented.
Milk, Powdered, Dry — Reconstituted Into Liquid Milk		5-7 Days	3 Months	Keep refrigerated. Freeze in airtight container and leave at least 1/2 inch headspace at the top, as milk will expand when frozen; thaw in refrigerator. Freezer time shown is for best quality only— foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Milk, Regular, Pasteurized (Including Whole, Skim, 2%, 1% Varieties), Sold Refrigerated - Unopened Or Opened		5-7 days after "sell by" date on package	3-4 Months	How long does milk last? The precise answer to that question depends to a large extent on storage conditions - to maximize the shelf life of milk, keep it refrigerated at all times. How long does milk last after the sell-by date? Milk will generally remain drinkable for about one week after the "sell-by" date on the package, assuming it has been continuously refrigerated; be sure to keep the temperature of your refrigerator at or below 40° F at all times. To maximize the shelf of milk, do not store it on the fridge door, as the temperature is too warm - the milk will last longer when they stored in the main body of the refrigerator, in its original package. How long can milk be left at room temperature? If kept at temperatures above 40 °F, milk will rapidly develop signs of spoilage; milk should be discarded if left out for more than 4 hours at room temperature. To further extend the shelf life of milk, freeze it; frozen milk will often become separated and the texture may become somewhat grainy, but it is usually acceptable for cooking and baking purposes. Freeze milk in an airtight container and leave at least 1/2 inch headspace at the top, as milk will expand when frozen; thaw in refrigerator. How long does milk last in the freezer? Properly stored, it will maintain best quality for about 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only - milk that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if milk is bad? The best way is to smell and look at the milk: signs of bad milk are a sour smell, an off-white or yellowish tinge to the colour and a thick or clumpy texture.
Milk, Sweetened, Condensed, Commercially Canned - Opened	1 Year (Unopened)	4-6 Days		How long does a can of sweetened condensed milk last once opened? The precise answer depends to a large extent on storage conditions - keep opened sweetened condensed milk refrigerated and tightly covered. To maximize the shelf life of canned sweetened condensed milk after opening, covered opened can tightly with a plastic wrap or lid, or with aluminium foil. How long does opened canned sweetened condensed milk last in the refrigerator? Sweetened condensed milk that has been continuously refrigerated will keep for about 4 to 6 days. Is canned sweetened condensed milk safe to use after the "expiration" date on the package? Yes, provided it has been stored properly, the can or package is undamaged, and there are no signs of spoilage - commercially canned sweetened condensed milk will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the sweetened condensed milk will remain at peak quality. Can you freeze sweetened condensed milk? Freezing is not recommended, as the sweetened condensed milk will separate and become watery when thawed. How can you tell if canned sweetened condensed milk is bad or spoiled? The best way is to smell and look at the canned sweetened condensed milk: if the canned sweetened condensed milk develops an off odor, flavour or appearance, it should be discarded. Discard all canned sweetened condensed milk from cans that are leaking, rusting, bulging or severely dented.
Milk, Ultra-High-Temperature (UHT), Sold Unrefrigerated — Opened	2-4 weeks after date on package (Unopened)	7-10 Days		How long does shelf-stable, ultra-high temperature (UHT) milk last once opened? The precise answer depends to a large extent on storage conditions — keep opened shelf-stable UHT milk (UHT milk that has been sold unrefrigerated) refrigerated and tightly closed. To maximize the shelf of opened shelf-stable UHT milk, do not store it on the fridge door, as the temperature is too warm - the opened shelf-stable UHT milk will last longer when stored in the main body of the refrigerator, in its original package. How long does opened shelf-stable UHT milk last in the refrigerator? Shelf-stable UHT milk that has been continuously refrigerated will keep for about 7 to 10 days after opening. How can you tell if opened shelf-stable UHT milk is bad or spoiled? The best way is to smell and look at the shelf-stable UHT milk: if the shelf-stable UHT milk develops an off odor, flavour or appearance it should be discarded.
Mozzarella Cheese, Fresh, High Moisture (Including Buffalo/Buffalo Varieties) — Unopened Or Opened		1-2 Weeks	3 Months	Keep refrigerated and covered in liquid contained in package. If cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard the cheese entirely. To freeze, drain cheese and wrap tightly in plastic freezer wrap or aluminium foil or place in heavy-duty freezer bag. Frozen cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mozzarella Cheese, Low Moisture Variety - Sliced At Grocery Deli Counter		2-3 Weeks	2 Months	How long does sliced Mozzarella deli cheese last? The exact answer to that question depends to a large extent on storage conditions - after purchasing from the deli, keep sliced Mozzarella deli cheese refrigerated at all times. How long does sliced Mozzarella deli cheese last after the sell-by date? After sliced Mozzarella deli cheese is purchased from the deli, it may be refrigerated for 2 to 3 weeks. Unopened sliced Mozzarella deli cheese may be kept in its original store deli packaging when refrigerating; to maximize the shelf life of the cheese, do not open the package until ready to use. To further extend the shelf life of sliced Mozzarella deli cheese, freeze; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of sliced Mozzarella deli cheese in the freezer by wrapping the sliced cheese tightly in heavy-duty aluminium foil or plastic freezer wrap or place in heavy-duty freezer bags. How long does sliced Mozzarella deli cheese last in the freezer? Properly stored, it will maintain best quality for 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - Mozzarella deli cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does sliced Mozzarella deli cheese last after being frozen and thawed? Sliced Mozzarella deli cheese that has been defrosted can be kept for an additional 3 to 4 days in the refrigerator before using; for best results, thaw cheese in the refrigerator. Frozen cheese may become crumbly and lose some of its flavour; the thawed slice Mozzarella deli cheese will be best suited to cooked dishes, such as sauces, soups and casseroles.
Mozzarella Cheese, Shredded Or Sliced, Commercially Packaged — Unopened Package		1 week after date on package	3 Months	Keep refrigerated; do not open package until ready to use. If cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard the entire package. To freeze, place original packaging in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. Frozen cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mozzarella Cheese, Shredded Or Sliced, Commercially Packaged - Opened Package		5-7 Days	3 Months	How long does an opened package of shredded mozzarella cheese last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep shredded mozzarella cheese refrigerated at all times. To maximize the shelf life of shredded mozzarella cheese after opening, tightly seal original packaging or place the cheese in resealable plastic bags or airtight containers. Properly stored, an opened package of shredded mozzarella cheese will last for about 5 to 7 days in the refrigerator. Once the package is opened, consume or freeze the shredded mozzarella cheese within the time shown for refrigeration, even if the "Best By," "Best if Used By," or "Use By" date has not yet been reached. How long can shredded mozzarella cheese be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); shredded mozzarella cheese should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of opened shredded mozzarella cheese, freeze it; when freezing, place shredded mozzarella cheese in the freezer before the number of days shown for refrigerator storage has elapsed. Frozen mozzarella cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. How long does shredded mozzarella cheese last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. To freeze shredded mozzarella cheese, tightly seal original packaging and place in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. How can you tell if shredded mozzarella cheese is bad or spoiled? The best way is to smell and look at the cheese: if cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard all of the shredded mozzarella cheese.
Parmesan Cheese, Grated, Sold Unrefrigerated, Commercially Packaged - Opened		9-12 Months	9-12 Months	How long does opened grated Parmesan cheese last? The precise answer to that question depends to a large extent on storage conditions - to maximize the shelf life of opened grated Parmesan cheese, keep it tightly covered and store it in a cool, dry area. To further maximize the shelf life of opened grated Parmesan cheese, keep it in the refrigerator. How long does opened grated Parmesan cheese last in the fridge? Opened grated Parmesan cheese will generally stay at best quality for about 9-12 months in the refrigerator. To further extend the shelf life of opened grated Parmesan cheese, freeze it: to freeze, place grated Parmesan cheese in covered airtight containers or heavy-duty freezer bags. Frozen Parmesan cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. How long does grated Parmesan cheese last in the freezer? Properly stored, it will maintain best quality for about 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - grated Parmesan cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if grated Parmesan cheese is bad or spoiled? The best way is to smell and look at the cheese: if cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard all of the grated Parmesan cheese.

Parmesan Cheese, Grated, Sold Unrefrigerated, Commercially Packaged - Unopened	9-12 Months	9-12 Months	9-12 Months	How long does unopened grated Parmesan cheese last? The precise answer to that question depends to a large extent on storage conditions - to maximize the shelf life of unopened grated Parmesan cheese, keep it in a cool, dry area. How long does unopened grated Parmesan cheese last at room temperature? Unopened grated Parmesan cheese that has been sold unrefrigerated will generally stay at best quality for about 9-12 months at room temperature. How long does unopened grated Parmesan cheese last in the fridge? Unopened grated Parmesan cheese will generally stay at best quality for about 9-12 months in the refrigerator. To further extend the shelf life of unopened grated Parmesan cheese, freeze it: to freeze, place grated Parmesan cheese in covered airtight containers or heavy-duty freezer bags. Frozen Parmesan cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. How long does grated Parmesan cheese last in the freezer? Properly stored, it will maintain best quality for about 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - grated Parmesan cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if grated Parmesan cheese is bad or spoiled? The best way is to smell and look at the cheese: if cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard all of the grated Parmesan cheese.
Parmesan Cheese, Sold In Wrapped Chunk Or Block - Unopened Or Opened		1 Year	10-12 Months	How long does a chunk of Parmesan cheese last? The exact answer to that question depends to a large extent on storage conditions - keep the cheese refrigerated at all times. To maximize the shelf life of a chunk of Parmesan cheese after opening, wrap the original packaging tightly in plastic wrap or aluminium foil; for even better results, wrap the cheese first in wax or parchment paper and then cover with plastic wrap before refrigerating. Properly stored, a chunk of Parmesan cheese will last for 1 year in the refrigerator. Is a chunk of Parmesan cheese still safe after the ? sell by date or "best by date" on the package? Yes - provided it is properly stored, it will typically remain safe to use for 1 year, even if the "sell-by" or "best by date on the package expires. Note: if mould appears in a package of shredded, sliced or crumbled Parmesan cheese, the entire package should be discarded. To further extend the shelf life of Parmesan cheese, freeze it; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. To freeze a chunk or block of Parmesan cheese: Cut the cheese into portions no larger than 1/2 pound each, and wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. How long does a chunk of Parmesan cheese last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only - Parmesan cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does a chunk of Parmesan cheese last after being frozen and thawed? A chunk of Parmesan cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; a chunk of Parmesan cheese that was thawed in the microwave or in cold water should be used immediately.
Pasteurized Processed Cheese Spread, Dip, Or Sauce, Commercially Packaged —		3-4 Weeks	3 Months	Keep refrigerated and tightly covered. If processed cheese product develops an off odor, flavour or appearance, it should be discarded for quality purposes. Freeze in airtight containers or place in heavy-duty freezer bags. Frozen cheese product may lose some of its texture and flavour; the thawed cheese product will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pasteurized Processed Cheese Spread, Dip, Or Sauce, Commercially Packaged — Unopened	5-6 months or date on package		3 Months	Store in cool, dry area — if package was sold refrigerated, store in refrigerator for best results. If cheese product develops an off odor, flavour or appearance, it should be discarded for quality purposes. Freeze in airtight containers or place in heavy-duty freezer bags. Frozen cheese product may lose some of its texture and flavour; the thawed cheese product will be best suited to cooked dishes, such as sauces, soups and casseroles. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Powdered Milk, Dry, Nonfat - Opened Package	3 Months		3 Years	How long does a package of opened powdered milk last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened powdered milk store in a cool, dry area and keep tightly closed. How long does opened powdered milk last at room temperature? Properly stored, a package of opened powdered milk will generally stay at best quality for about 3 months at room temperature. Is powdered milk safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged powdered milk will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the powdered milk will remain at peak quality. Can you keep opened powdered milk in the freezer? Yes, to further extend the shelf life of opened powdered milk, freeze it; place the opened powdered milk inside covered airtight containers or heavy-duty freezer bags. How long does opened powdered milk last in the freezer? Properly stored, it will maintain best quality for about 3 years, but will remain safe beyond that time. The freezer time shown is for best quality only — powdered milk that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if powdered milk is bad or spoiled? The best way is to smell and look at the opened powdered milk: if the opened powdered milk develops an off odor, flavour or appearance, or if mould or insects appear, it should be discarded.
Powdered Milk, Dry, Nonfat - Unopened Package	12-18 months (best quality)		3 Years	How long does a package of unopened powdered milk last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of unopened powdered milk store in a cool, dry area. How long does unopened powdered milk last at room temperature? Properly stored, a package of unopened powdered milk will generally stay at best quality for about 12 to 18 months at room temperature. Is unopened powdered milk safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged powdered milk will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the powdered milk will remain at peak quality. Storage time shown is for best quality only - after that, the powdered milk's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. Can you keep powdered milk in the freezer? Yes, to further extend the shelf life of powdered milk, freeze it; place the unopened powdered milk inside heavy-duty freezer bags. How long does powdered milk last in the freezer? Properly stored, it will maintain best quality for about 3 years, but will remain safe beyond that time. The freezer time shown is for best quality only — powdered milk that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if powdered milk is bad or spoiled? The best way is to smell and look at the powdered milk: if the powdered milk develops an off odor, flavour or appearance, or if mould or insects appear, it should be discarded.
Provolone Cheese - Sliced At Grocery Deli Counter		2-3 Weeks	2 Months	How long does sliced Provolone deli cheese last? The exact answer to that question depends to a large extent on storage conditions - after purchasing from the deli, keep sliced Provolone deli cheese refrigerated at all times. How long does sliced Provolone deli cheese last after the sell-by date? After sliced Provolone deli cheese is purchased from the deli, it may be refrigerated for 2 to 3 weeks - the "sell-by" date on the package may expire during that storage period, but the cheese will remain safe to use after the sell by date if it has been properly stored. Unopened sliced Provolone deli cheese may be kept in its original store deli packaging when refrigerating; to maximize the shelf life of the cheese, do not open the package until ready to use. To further extend the shelf life of sliced Provolone deli cheese, freeze; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. You can maximize the shelf life of sliced Provolone deli cheese in the freezer by wrapping the sliced cheese tightly in heavy-duty aluminium foil or plastic freezer wrap or place in heavy-duty freezer bags. How long does sliced Provolone deli cheese last in the freezer? Properly stored, it will maintain best quality for 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - Provolone deli cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does sliced Provolone deli cheese last after being frozen and thawed? Sliced Provolone deli cheese that has been defrosted can be kept for an additional 3 to 4 days in the refrigerator before using; for best results, thaw cheese in the refrigerator. Frozen cheese may become crumbly and lose some of its flavour; the thawed slice Provolone deli cheese will be best suited to cooked dishes, such as sauces, soups and casseroles.
Sour Cream - Opened Package		2 Weeks		How long does sour cream last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened sour cream, keep it refrigerated at all times. To maximize the shelf life of sour cream after opening, keep refrigerated and tightly covered, either in the original packaging or in an airtight container. Properly stored, an opened package of sour cream will generally last for about two weeks after opening, assuming it has been continuously refrigerated. How long can sour cream be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); sour cream should be discarded if left out for more than 2 hours at room temperature. Can you freeze sour cream? Freezing is not recommended, as the texture of sour cream once thawed will be watery and clumpy. How can you tell if sour cream is bad or spoiled? The best way is to smell and look at the sour cream: discard any sour cream with an off smell or appearance or if mould appears; do not taste the sour cream first.
Sour Cream - Unopened Package		10-14 days after date on package		How long does an unopened package of sour cream last? The exact answer depends to a large extent on storage conditions - to maximize the shelf life of sour cream, keep it refrigerated at all times. How long does unopened sour cream last after the sell-by date? Sour cream will generally keep for one to two weeks after the "sell-by" date on the package, assuming it has been continuously refrigerated; be sure that the temperature of your refrigerator remains at or below 40 ? at all times. How long does sour cream last at room temperature? If kept at temperatures above 40 °F, sour cream will rapidly develop signs of spoilage; sour cream should be discarded if left for more than 2 hours at room temperature. Can you freeze sour cream? Freezing is not recommended, as the texture of sour cream once thawed will be watery and clumpy. How long does sour cream last once opened? Sour cream will generally last for about 2 weeks after opening, assuming it has been continuously refrigerated. How can you tell if sour cream is bad or spoiled? The best way is to smell and look at the sour cream: discard any sour cream with an off smell or appearance or if mould appears; do not taste the sour cream first.
Swiss Cheese, Shredded Or Sliced, Commercially Packaged - Opened Package		5-7 Days	3 months	How long does an opened package of shredded Swiss cheese last in the fridge? The exact answer to that question depends to a large extent on storage conditions - keep shredded Swiss cheese refrigerated at all times. To maximize the shelf life of shredded Swiss cheese after opening, tightly seal original packaging or place the cheese in resealable plastic bags or airtight containers. Properly stored, an opened package of shredded Swiss cheese will last for about 5 to 7 days in the refrigerator. Once the package is opened, consume or freeze the shredded Swiss cheese within the time shown for refrigeration, even if the "Best By," "Best if Used By," or "Use By" date has not yet been reached. How long can shredded Swiss cheese be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); shredded Swiss cheese should be discarded if left out for more than 2 hours at room temperature. To further extend the shelf life of opened shredded Swiss cheese, freeze it; when freezing, place shredded Swiss cheese in the freezer before the number of days shown for refrigerator storage has elapsed. Frozen Swiss cheese may lose some of its texture and flavour; the thawed cheese will be best suited to cooked dishes, such as sauces, soups and casseroles. To freeze shredded Swiss cheese, tightly seal original packaging and place in freezer; if freezing for longer than 2 months, place package inside a heavy-duty freezer bag in order to prevent freezer burn. How long does shredded Swiss cheese last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - shredded Swiss cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if shredded Swiss cheese is bad or spoiled? The best way is to smell and look at the cheese: if cheese develops an off odor, flavour or appearance, it should be discarded; if mould appears, discard all of the shredded Swiss cheese.
Swiss Cheese, Sold In Wrapped Block - Unopened		6 Months	6-8 Months	How long does an unopened chunk of Swiss cheese last? The exact answer to that question depends to a large extent on storage conditions - keep the unopened chunk of cheese refrigerated at all times. An unopened chunk of Swiss cheese may be kept in its original packaging when refrigerating; to maximize the shelf life, do not open the package until ready to use. Properly stored, an unopened chunk of Swiss cheese will last for about 6 months in the refrigerator. Is an unopened chunk of Swiss cheese still safe after the ? sell by date or "best by date" on the package? Yes -the unopened Swiss cheese will typically remain safe to use for about 6 months, even if the "sell-by" or "best by date on the package expires. If an unopened chunk or block of Swiss cheese has mould on it, is it still safe to eat? Yes - cut away at least 1 inch around and below the mouldy area (do not touch mould with the knife) and re-cover the cheese in fresh wrap. Note: if mould appears in a package of shredded, sliced or crumbled Swiss cheese, the entire package should be discarded. To further extend the shelf life of Swiss cheese, freeze it; when freezing, place the cheese in the freezer before the number of days shown for refrigerator storage has elapsed. To freeze an unopened chunk or block of Swiss cheese: Cut the cheese into portions no larger than 1/2 pound each, and wrap tightly in heavy-duty aluminium foil or plastic freezer wrap, or place inside a heavy-duty freezer bag. How long does an unopened chunk of Swiss cheese last in the freezer? Properly stored, it will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. The freezer time shown is for best quality only - Swiss cheese that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does an unopened chunk of Swiss cheese last after being frozen and thawed? An unopened chunk of Swiss cheese that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; an unopened chunk of Swiss cheese that was thawed in the microwave or in cold water should be used immediately. Frozen cheese may become crumbly and lose some of its flavour; the thawed chunk of Swiss cheese will be best suited to cooked dishes, such as sauces, soups and casseroles.
Whipped Cream (Real), Sold In Aerosol Can - Unopened Or Opened		3-4 Weeks		Keep refrigerated. Does not freeze well.
Yogurt (Yoghurt), Commercially Frozen — Unopened			2-4 Months	Store in original container and keep frozen at all times. If frozen yogurt thaws completely, discard it— do not refreeze, as harmful bacteria may develop. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Yogurt (Yoghurt), Commercially Frozen - Opened			1-2 Months	Keep frozen at all times. After opening, place plastic wrap over the surface of exposed yogurt before re-closing the package; this will minimize the formation of ice crystals and prevent the loss of texture. If frozen yogurt thaws completely, discard it- do not refreeze, as harmful bacteria may develop. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Yogurt (Yoghurt), Commercially Packaged, Sold Refrigerated - Unopened Or Opened Package		1-2 weeks after "sell by" date on package	1-2 Months	How long does yogurt last in the fridge? The precise answer to that question depends to a large extent on storage conditions - keep yogurt refrigerated and tightly covered at all times. How long does yogurt last after the sell-by date? Yogurt that has been continuously refrigerated will usually keep for at least 1 to 2 weeks after the "sell by" date on the package. How long does yogurt remain at peak quality after opening? Opened yogurt will typically stay at peak quality for 5 to 7 days after opening, but will generally remain safe to consume for at least 1 to 2 weeks after the "sell by" date on the package, provided it has been properly stored- discard entire package if any sign of mould appears. How long can yogurt be left at room temperature? Bacteria grow rapidly at temperatures between 40°F and 140°F; yogurt should be discarded if left out for more than 2 hours at room temperature. Can you freeze yogurt? Yes - to further extend the shelf life of yogurt, freeze it in a covered airtight container or heavy-duty freezer bag. How long does yogurt last in the freezer? Properly stored, it will maintain best quality for 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - yogurt that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does yogurt last after being frozen and thawed? Yogurt that has been defrosted in the fridge can be kept for an additional 3 to 4 days in the refrigerator before using; yogurt that was thawed in the microwave or in cold water should be used immediately. How to tell if yogurt is bad? The best way is to smell and look at the yogurt: signs of spoilage include a highly runny and watery consistency, a clumpy texture and a sour smell; if any sign of mould appears, discard the entire package, do not taste the yogurt first.

7 Snacks Shelf Life

These is the shelf life of most snacks, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Baking Powder - Opened Package	6 Months 18 Months (Unopened)			How long does baking powder last once opened? The precise answer to the question depends to a large extent on storage conditions; store in cool, dry area. To maximize the shelf life of opened baking powder, keep the package tightly sealed after opening. How long does opened baking powder last at room temperature? Properly stored, opened baking powder will generally stay at best quality for about 6 months. Is baking powder safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged baking powder will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the baking powder will remain at peak quality. How can you tell whether opened baking powder is still good to use? To test whether opened baking powder is still potent enough to be effective: add one teaspoon of baking powder to one-third cup of hot water - if mixture bubbles, the baking powder is still potent enough to use.
Baking Soda - Opened Package	6 Months 2 Years (Unopened)			How long does baking soda last once opened? The precise answer to the question depends to a large extent on storage conditions; store in cool, dry area. To maximize the shelf life of opened baking soda, keep the package tightly sealed after opening. How long does opened baking soda last at room temperature? Properly stored, opened baking soda will generally stay at best quality for about 6 months. Is baking soda safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged baking soda will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the baking soda will remain at peak quality. How can you tell whether opened baking soda is still good to use? To test whether opened baking soda is still potent enough to be effective: add one teaspoon of baking soda to 3 tablespoons of vinegar - if mixture bubbles, the baking soda is still potent enough to use.
Biscuits, Freshly Baked - Homemade Or Bakery	1-2 Days	1 Week	2-3 Months	How long do biscuits last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked biscuits in a dry area. To maximize the shelf life of biscuits, cover with foil or plastic wrap or place in plastic bag to prevent drying out. Properly stored, freshly baked biscuits will last for about 1 to 2 days at normal room temperature. How long do biscuits last in the fridge? Freshly baked biscuits will keep well for about 1 week in the fridge when properly stored. Can you freeze biscuits? Yes, to freeze: wrap biscuits tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long do biscuits last in the freezer? Properly stored, they will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - biscuits that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if biscuits are bad or spoiled? The best way is to smell and look at the biscuits: discard any that have an off smell or appearance; if mould appears, discard the biscuits.
Blackberry Jam, Commercially Jarred - Opened	2 years (best quality) (Unopened)	1 year (best quality)		How long does blackberry jam last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened blackberry jam, keep it refrigerated and tightly covered. How long does opened blackberry jam last in the refrigerator? Blackberry jam that has been continuously refrigerated will generally stay at best quality for about 1 year. Is opened blackberry jam safe to use after the expiration date on the jar? Yes, provided it has been stored properly, the jar is undamaged, and there are no signs of spoilage - commercially jarred blackberry jam will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the blackberry jam will remain at peak quality. The storage time shown for opened blackberry jam is for best quality only - after that, the jam's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the jar is undamaged, and there are no signs of spoilage. How can you tell if opened blackberry jam is bad or spoiled? The best way is to smell and look at the blackberry jam: if the jam develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Bread Crumbs, Dried, Commercially Packaged — Unopened Or Opened Package	1 Year		1 Year	Store in cool, dry area; keep tightly covered after opening. Freezing is recommended in hot, humid environments. Storage time shown is for best quality only — after that, the bread crumbs' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly. If bread crumbs develop an off odor, flavour or appearance, they should be discarded for quality purposes; if mould appears, discard entire product. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the unopened bread crumbs will still be safe to consume after that date, as long as they have been stored properly and the package is not damaged. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cheesecake, Freshly Baked - Homemade Or Bakery		1 Week	2-3 Months	How long does cheesecake last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked cheesecake refrigerated. How long can cheesecake be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cheesecake should be discarded if left out for more than 2 hours at room temperature. How long does cheesecake last in the fridge? Freshly baked cheesecake will keep for about 1 week in the fridge; refrigerate covered loosely with aluminium foil or plastic wrap. Can you freeze cheesecake? Yes, to freeze: wrap cheesecake tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long does cheesecake last in the freezer? Properly stored, it will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cheesecake that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cheesecake is bad or spoiled? The best way is to smell and look at the cheesecake: discard any that has an off smell or appearance; if mould appears, discard the cheesecake.
Cherry Pie, Freshly Baked - Homemade Or Bakery	2 Days	4-5 Days	6-8 Months	How long does cherry pie last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked cherry pie in a dry area. To maximize the shelf life of cherry pie, cover loosely with foil or plastic wrap. How long does cherry pie last at room temperature? Properly stored, freshly baked cherry pie will last for about 2 days at normal room temperature. How long does cherry pie last in the fridge? Freshly baked cherry pie will keep well for about 4 to 5 days in the refrigerator; cover loosely with foil or plastic wrap. Can you freeze cherry pie? Yes, to freeze: wrap cherry pie tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long does cherry pie last in the freezer? Properly stored, it will maintain best quality for about 6 to 8 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cherry pie that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if cherry pie is bad or spoiled? The best way is to smell and look at the cherry pie: discard any that has an off smell or appearance; if mould appears, discard the cherry pie.
Chocolate - Milk Chocolate	1 year (best quality)		1 year (best quality)	How long does milk chocolate last? The precise answer depends to a large extent on storage conditions - store milk chocolate in a cool, dry area. To maximize the shelf life of milk chocolate, store at a room temperature between 60°F -75°F and keep milk chocolate tightly wrapped after opening. How long does milk chocolate last at room temperature? Properly stored, milk chocolate will generally stay at best quality for about 1 year at normal room temperature. Is milk chocolate safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged milk chocolate will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the milk chocolate will remain at peak quality. Storage time shown is for best quality only - after that, the milk chocolate's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. If milk chocolate has white spots or white film on the surface, it is still safe to eat? Yes when milk chocolate is exposed to overly warm or humid conditions, whiteness can develop on the surface --this affects appearance only and the milk chocolate will still be safe to eat. Should you refrigerate milk chocolate? Milk chocolate should ideally not be refrigerated, as doing so may cause the milk chocolate to absorb odours from other foods and it may also develop a moist surface when brought back to room temperature. In very hot, humid environments (consistently above 75°F), milk chocolate can be refrigerated; keep the milk chocolate tightly wrapped or place in a covered airtight container or plastic freezer bag. Can you keep milk chocolate in the freezer? Yes, it is fine to store milk chocolate in the freezer, although doing so will not significantly change the shelf life; to freeze, place the milk chocolate inside covered airtight containers or heavy-duty freezer bags.
Chocolate - Dark, Baking, Bittersweet, Semi-Sweet	2 years (best quality)		2 years (best quality)	How long does chocolate last? The precise answer depends to a large extent on storage conditions - store chocolate in a cool, dry area. To maximize the shelf life of chocolate, store at a room temperature between 60°F -75°F and keep chocolate tightly wrapped after opening. How long does chocolate last at room temperature? Properly stored, dark, baking, bittersweet and semi-sweet chocolate will generally stay at best quality for about 2 years at normal room temperature. How long does milk chocolate last? Properly stored, milk chocolate will generally stay at best quality for about 1 year at normal room temperature. Dark chocolate will keep well for about 5 years if it is constantly stored at temperatures ranging between 60°F - 65°F. Is chocolate safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged chocolate will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the chocolate will remain at peak quality. Storage time shown is for best quality only - after that, the chocolate's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. If chocolate has white spots or white film on the surface, it is still safe to eat? Yes when chocolate is exposed to overly warm or humid conditions, whiteness can develop on the surface --this affects appearance only and the chocolate will still be safe to eat. Should you refrigerate chocolate? Chocolate should ideally not be refrigerated, as doing so may cause the chocolate to absorb odours from other foods and it may also develop a moist surface when brought back to room temperature. In very hot, humid environments (consistently above 75°F), chocolate can be refrigerated; keep the chocolate tightly wrapped or place in a covered airtight container or plastic freezer bag. Can you keep chocolate in the freezer? Yes, it is fine to store chocolate in the freezer, although doing so will not significantly change the shelf life; to freeze, place the chocolate inside covered airtight containers or heavy-duty freezer bags.
Chocolates, Boxed, Regular, Assorted Pieces - Unopened Or Opened Package	6-9 months (Best Quality)	9-12 months (Best Quality)	12-18 months (Best Quality)	Store in cool, dry area and keep covered. For pantry storage, room temperature should not exceed 70°F; if this is not possible, refrigeration or freezing is recommended. When exposed to overly warm or humid temperatures, chocolate may develop a white film - this affects appearance only; the chocolate will still be safe to eat. To refrigerate or freeze, place original box or package in heavy-duty freezer bag. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cocoa Powder, Unsweetened, Commercially Packaged — Opened	3 years (Best Quality) Keeps Indefinitely (Unopened)			How long does an opened package of cocoa powder last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of opened unsweetened cocoa powder store in a cool, dry area. How long does opened cocoa powder last at room temperature? Properly stored, an opened package of unsweetened cocoa powder will generally stay at best quality for about 3 years at room temperature. To maximize the shelf life of opened cocoa powder, keep package tightly closed. Is opened cocoa powder safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged unsweetened cocoa powder will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cocoa powder will remain at peak quality. Storage time shown is for best quality only - after that, the unsweetened cocoa powder's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if unsweetened cocoa powder is bad or spoiled? The best way is to smell and look at the unsweetened cocoa powder: if unsweetened cocoa powder develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Crackers, Commercially Packaged (All Types, Including Saltines, Water Crackers) — Opened	1-2 months 6-9 months (Best Quality) (Unopened)			How long does an opened package of crackers last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of crackers (including saltines, water crackers, rice crackers, oyster crackers and animal crackers) store in a cool, dry area. How long do opened crackers last at room temperature? Properly stored, an opened package of crackers will generally stay at best quality for about 1 to 2 months at room temperature. To maximize the shelf life of opened crackers, keep package tightly closed. Are opened crackers safe to use after the "expiration" date on the package? Yes, provided they are properly stored and the package is undamaged - commercially packaged crackers will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the crackers will remain at peak quality. Storage time shown is for best quality only - after that, the crackers' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if crackers are bad or spoiled? The best way is to smell and look at the crackers: if crackers develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Crusty White Bread, Freshly Baked, Homemade Or Bakery	2-3 Days		3 Months	How long does crusty white bread last? The precise answer to that question depends to a large extent on storage conditions - keep crusty white bread in a cool, dry area. To maximize the shelf life of bakery-bought crusty white bread, keep in original packaging and store at room temperature. Properly stored, crusty white bread will last for about 2 to 3 days at normal room temperature. To maximize the shelf life of homemade crusty white bread, cool thoroughly before storing and place in plastic storage bag or breadbox, or wrap in foil and store at room temperature. How long does crusty white bread last in the fridge? crusty white bread should ideally not be refrigerated, as the bread will dry out and become stale faster than at room temperature. If you must refrigerate crusty white bread (eg, due to a lack of pantry storage space or very hot, humid room conditions), the bread will typically last for only about a day before getting stale. Can you freeze crusty white bread? Yes, to freeze: (1) Slice bread or leave loaf whole; (2) Wrap tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag and freeze. How long does a loaf of crusty white bread last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - crusty white bread that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if crusty white bread is bad or spoiled? The best way is to smell and look at the bread: discard any bread that has an off smell or appearance; if mould appears, discard the entire loaf.

Flour, White, All-Purpose - Unopened Or Opened Package	1 Year	2 Years	2 Years	How long does a package of white flour last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of white flour (all-purpose white flour) store in a cool, dry area. How long does white flour last at room temperature? Properly stored, a package of white flour will generally stay at best quality for about 1 year at room temperature. To maximize the shelf life of white flour once the package is opened, transfer flour to a covered airtight container or place original flour bag in a resealable plastic freezer bag. Is white flour safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged white flour will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the white flour will remain at peak quality. Storage time shown is for best quality only - after that, the white flour's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. Can you keep white flour in the fridge or freezer? Yes, to further extend the shelf life of white flour, refrigerate or freeze it; place the white flour inside covered airtight containers or heavy-duty freezer bags. How long does white flour last in the fridge? White flour will maintain best quality for about 2 years in the refrigerator. How long does white flour last in the freezer? Properly stored, it will maintain best quality for about 2 years, but will remain safe beyond that time. The freezer time shown is for best quality only — white flour that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if white flour is bad or spoiled? The best way is to smell and look at the white flour: if the white flour develops an off odor, flavour or appearance, or if insects appear, it should be discarded.
Flour, Whole Wheat - Unopened Or Opened Package	1-3 Months	6-8 Months	1 Year	How long does a package of whole wheat flour last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of whole wheat flour store in a cool, dry area. How long does whole wheat flour last at room temperature? Properly stored, a package of whole wheat flour will generally stay at best quality for about 1 to 3 months at room temperature. To maximize the shelf life of whole wheat flour once the package is opened, transfer flour to a covered airtight container or place original flour bag in a resealable plastic freezer bag. Is whole wheat flour safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged whole wheat flour will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the whole wheat flour will remain at peak quality. Storage time shown is for best quality only - after that, the whole wheat flour's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. Can you keep whole wheat flour in the fridge or freezer? Yes, to further extend the shelf life of whole wheat flour, refrigerate or freeze it; place the whole wheat flour inside covered airtight containers or heavy-duty freezer bags. How long does whole wheat flour last in the fridge? Whole wheat flour will maintain best quality for about 6 to 8 months in the refrigerator. How long does whole wheat flour last in the freezer? Properly stored, it will maintain best quality for about 1 year, but will remain safe beyond that time. The freezer time shown is for best quality only — whole wheat flour that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if whole wheat flour is bad or spoiled? The best way is to smell and look at the whole wheat flour: if the whole wheat flour develops an off odor, flavour or appearance, or if insects appear, it should be discarded.
Graham Crackers, Commercially Packaged — Opened	1-2 Months 6-9 Months (Unopened)			How long does an opened package of graham crackers last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of graham crackers, store in a cool, dry area. How long do opened graham crackers last at room temperature? Properly stored, an opened package of graham crackers will generally stay at best quality for about 1 to 2 months at room temperature. To maximize the shelf life of opened graham crackers, keep package tightly closed. Are opened graham crackers safe to use after the "expiration" date on the package? Yes, provided they are properly stored and the package is undamaged - commercially packaged graham crackers will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the graham crackers will remain at peak quality. Storage time shown is for best quality only - after that, the graham crackers' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if graham crackers are bad or spoiled? The best way is to smell and look at the graham crackers: if graham crackers develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Granola Bars, Commercially Packaged - Unopened Or Opened Package	6-9 Months (Best Quality)			How long does a package of granola bars last? The precise answer depends to a large extent on storage conditions -to maximize the shelf life of granola bars, store in a cool, dry area. Properly stored, a package of granola bars will generally stay at best quality for about 6 to 8 months. Are granola bars safe to use after the "expiration" date on the package? Yes, provided they have been properly stored and the package is undamaged - commercially packaged granola bars will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the granola bars will remain at peak quality. Storage time shown is for best quality only - after that, the granola bars' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if granola bars are bad or spoiled? The best way is to smell and look at the granola bars: if granola bars develop an off odor, flavour or appearance, or if mould appears, the package should be discarded.
Hard Candies, Commercially Packaged Or Purchased In Bulk - Unopened Or Opened Package	1 Year	1 Year	1 Year	Store in cool, dry area. Refrigeration or freezing is recommended in very hot, humid environments (over 80°F). Freeze in covered airtight containers or heavy-duty freezer bags. Storage time shown is for best quality only - after that, the candy's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. If candy develops an off odor, flavour or appearance, it should be discarded for quality purposes. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the candy will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Honey, Pure, Liquid, Commercially Bottled - Unopened Or Opened	Keeps Indefinitely	Keeps Indefinitely	Keeps Indefinitely	How long does honey last? The answer depends to a large extent on storage conditions - store honey in a cool, dry area and keep tightly covered at all times. Properly stored, honey will remain safe to consume indefinitely. Is honey still safe after the "Best Before" or "Best By" date? Yes- honey will remain safe to use indefinitely if it has been stored properly. After prolonged storage, honey may darken in colour and lose some of its flavour, but it will still be safe to consume if it has been stored properly. Over time, the honey may become cloudy and crystallize - this is not harmful; the honey will still be safe to consume if it has been stored properly. If honey crystallizes, place the honey jar in warm water and stir until the crystals dissolve. Should you refrigerate honey? Refrigeration of honey is not recommended, as it accelerates the crystallization process. Should you freeze honey? While not necessary, freezing honey will help prevent crystallization; to freeze honey, store in an airtight container and leave at least 1/2 inch headspace at the top.
Ice Cream, Commercially Frozen (All Flavours) — Opened Package			2-4 Months (Best Quality) 8-12 Months (Unopened) (Best Quality)	How long does opened ice cream last? The precise answer to that question depends to a large extent on storage conditions — keep ice cream frozen at all times. How long does opened ice cream last in the freezer? Opened ice cream that has been kept constantly frozen at 0°F will maintain best quality for about 2 to 4 months in the freezer. To maximize the shelf life of ice cream after opening, place plastic wrap over the surface of the exposed ice cream before re-closing the package; this will minimize the formation of ice crystals and prevent the loss of texture. Is opened ice cream safe to eat after the "expiration" date on the package? Yes, if properly stored - commercially packaged ice cream will typically carry a "Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the ice cream will remain at peak quality. How long will opened ice cream remain safe to eat? Opened ice cream that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely, as long as it has been stored properly and the package is not damaged. How long does opened ice cream last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); opened ice cream should be discarded if left for more than 2 hours at room temperature. Can you re-freeze ice cream that has melted or thawed out? If opened ice cream thaws completely, discard it — do not refreeze, as harmful bacteria may develop. How to tell if ice cream is bad? Ice cream that has been stored too long will typically develop ice crystals on the surface and the ice cream will lose its creamy texture; ice cream that develops an off odor or flavour should be discarded.
Lollipops, Commercially Packaged Or Purchased In Bulk	1 Year	1 Year	1 Year	Store in cool, dry area. Refrigeration or freezing is recommended in very hot, humid environments (over 80°F). Freeze in covered airtight containers or heavy-duty freezer bags. Storage time shown is for best quality only — after that, the candy's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. If candy develops an off odor, flavour or appearance, it should be discarded for quality purposes. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the candy will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Maple Syrup, 100% Pure — Opened Container	1 Year (Unopened)	1 Year	Keeps Indefinitely	Refrigerate after opening - for longer-term storage, freeze. If syrup was purchased in a tin container, transfer the syrup to an airtight plastic or glass jar when refrigerating. To freeze, pour syrup into airtight plastic containers.
Marshmallows, Commercially Packaged Or Purchased In Bulk — Opened Package	2-4 Months (Unopened)	1 Month		Store in cool, dry area and keep tightly covered. Storage time shown is for best quality only — after that, the marshmallows' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly. If marshmallows develop an off odor, flavour or appearance, they should be discarded for quality purposes. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the unopened marshmallows will still be safe to consume after that date, as long as they have been stored properly and the package is not damaged.
Molasses, Commercially Packaged Or Purchased In Bulk — Unopened Or Opened	2 Years			Store in cool, dry area and keep tightly covered. Storage time shown is for best quality only — after that, the molasses' texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. If molasses develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears, discard the entire product. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the molasses will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged. If mould appears, discard the entire product.
Muffins (Including Bran, Blueberry, Banana, Corn, Chocolate Chip) - Freshly Baked	1-2 Days	1 Week	2-3 Months	How long do muffins last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked muffins (including bran, blueberry, banana, corn, chocolate chip) in a dry area. To maximize the shelf life of muffins, cover with foil or plastic wrap or place in plastic bag to prevent drying out. Properly stored, freshly baked muffins will last for about 1 to 2 days at normal room temperature. How long do muffins last in the fridge? Freshly baked muffins will keep well for about 1 week in the fridge when properly stored. Can you freeze muffins? Yes, to freeze: wrap muffins tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long do muffins last in the freezer? Properly stored, they will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - muffins that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if muffins are bad or spoiled? The best way is to smell and look at the muffins: discard any that have an off smell or appearance; if mould appears, discard the muffins.
Multi-Grain Bread, Freshly Baked, Homemade Or Bakery	4-5 Days		3 Months	How long does multi-grain bread last? The precise answer to that question depends to a large extent on storage conditions - keep multi-grain bread in a cool, dry area. To maximize the shelf life of bakery-bought multi-grain bread, keep in original packaging and store at room temperature. To maximize the shelf life of homemade multi-grain bread, cool thoroughly before storing and place in plastic storage bag or breadbox, or wrap in foil and store at room temperature. Properly stored, multi-grain bread will last for about 4 to 5 days at normal room temperature. How long does a loaf of multi-grain bread last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. How long does multi-grain bread last in the fridge? Multi-grain bread should ideally not be refrigerated, as the bread will dry out and become stale faster than at room temperature. If you must refrigerate multi-grain bread (eg, due to a lack of pantry storage space or very hot, humid room conditions), the bread will typically last for only about 2-3 days before getting stale. Can you freeze multi-grain bread? Yes, to freeze: (1) Slice bread or leave loaf whole; (2) Wrap tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag and freeze. The freezer time shown is for best quality only - multi-grain bread that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if multi-grain bread is bad or spoiled? The best way is to smell and look at the bread: discard any bread that has an off smell or appearance; if mould appears, discard the entire loaf.
Pancake / Breakfast Syrup, Commercially Bottled, Artificial Maple Or Butter Flavour — Unopened Or Opened	1 Year			Store in cool, dry area. Storage time shown is for best quality only — after that, the syrup's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. If product develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears, discard the entire product. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the syrup will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Pastries (Including Danish Pastry) — Filled With Cream, Custard Or Cheese		3-4 Days	2-3 Months	Keep refrigerated; cover pastries with foil or plastic wrap or place in plastic bag when refrigerating to prevent drying out. To freeze, wrap pastries tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pizza, Cooked, Leftovers		3-4 Days	1-2 Months	How long does leftover pizza last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate pizza within two hours of cooking or purchasing. To maximize the shelf life of leftover pizza for safety and quality, refrigerate the pizza in shallow airtight containers or wrap tightly with heavy-duty aluminium foil or plastic wrap. Properly stored, leftover pizza will last for 3 to 4 days in the refrigerator. To further extend the shelf life of leftover pizza, freeze it; freeze in covered airtight containers or heavy-duty freezer bags, or wrap tightly with heavy-duty aluminium foil or freezer wrap. How long does leftover pizza last in the freezer? Properly stored, it will maintain best quality for about 1 to 2 months, but will remain safe beyond that time. The freezer time shown is for best quality only - leftover pizza that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does leftover pizza last after being frozen and thawed? Leftover pizza that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; pizza that was thawed in the microwave or in cold water should be eaten immediately. How long does leftover pizza last at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); leftover pizza should be discarded if left for more than 2 hours at room temperature. How to tell if leftover pizza is bad? If leftover pizza develops an off odor, flavour or appearance, or if mould appears, it should be discarded.

Potato Chips, Commercially Packaged - Opened	1-2 Weeks 2-3 months after date on package (best quality)			How long does an opened package of potato chips last? The precise answer depends to a large extent on storage conditions - store in cool, dry area. How long do opened potato chips last at room temperature? Properly stored, an opened package of potato chips will generally stay at best quality for about 1 to 2 weeks at room temperature. To maximize the shelf life of opened potato chips, keep package tightly closed. Are opened potato chips safe to use after the "expiration" date on the package? Yes, provided they are properly stored and the package is undamaged - commercially packaged potato chips will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the potato chips will remain at peak quality. Storage time shown is for best quality only - after that, the potato chips' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if potato chips are bad or spoiled? The best way is to smell and look at the potato chips: if potato chips develop an off odor, flavour or appearance, or if mould appears, they should be discarded.
Protein Bars, Commercially Packaged Or Purchased In Bulk	1 month after date on package			Store in cool, dry area; after opening box, leave individually wrapped bars sealed.
Raspberry Jam, Commercially Jarred - Opened	2 Years (Best Quality) (Unopened)	1 Year (Best Quality)		How long does raspberry jam last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened raspberry jam, keep it refrigerated and tightly covered. How long does opened raspberry jam last in the refrigerator? Raspberry jam that has been continuously refrigerated will generally stay at best quality for about 1 year. Is opened raspberry jam safe to use after the expiration date on the jar? Yes, provided it has been stored properly, the jar is undamaged, and there are no signs of spoilage - commercially jarred raspberry jam will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the raspberry jam will remain at peak quality. The storage time shown for opened raspberry jam is for best quality only - after that, the jam's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the jar is undamaged, and there are no signs of spoilage. How can you tell if opened raspberry jam is bad or spoiled? The best way is to smell and look at the raspberry jam: if the jam develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Raspberry Jelly, Commercially Jarred - Opened	2 Years (Best Quality) (Unopened)	1 Year (Best Quality)		How long does raspberry jelly last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened raspberry jelly, keep it refrigerated and tightly covered. How long does opened raspberry jelly last in the refrigerator? Raspberry jelly that has been continuously refrigerated will generally stay at best quality for about 1 year. Is opened raspberry jelly safe to use after the expiration date on the jar? Yes, provided it has been stored properly, the jar is undamaged, and there are no signs of spoilage - commercially jarred raspberry jelly will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the raspberry jelly will remain at peak quality. The storage time shown for opened raspberry jelly is for best quality only - after that, the jelly's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the jar is undamaged, and there are no signs of spoilage. How can you tell if opened raspberry jelly is bad or spoiled? The best way is to smell and look at the raspberry jelly: if the jelly develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Sandwiches, Homemade Or Store-Prepared		2-3 Days	1 Month	Keep refrigerated; wrap sandwiches tightly with aluminium foil or plastic wrap or place in plastic bag or airtight sandwich container. For best results when freezing, coat bread completely with a layer of butter or margarine before adding filling; this will help prevent soggy bread when thawed. Lettuce and tomatoes do not freeze well and should not be used in sandwiches that will be frozen.
Scones, Freshly Baked - Homemade Or Bakery	1-2 Days	1 Week	2-3 Months	How long do scones last? The precise answer to that question depends to a large extent on storage conditions - keep freshly baked scones in a dry area. To maximize the shelf life of scones, cover with foil or plastic wrap or place in plastic bag to prevent drying out. Properly stored, freshly baked scones will last for about 1 to 2 days at normal room temperature. How long do scones last in the fridge? Freshly baked scones will keep well for about 1 week in the fridge when properly stored. Can you freeze scones? Yes, to freeze: wrap scones tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag. How long do scones last in the freezer? Properly stored, they will maintain best quality for about 2 to 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - scones that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if scones are bad or spoiled? The best way is to smell and look at the scones: discard any that have an off smell or appearance; if mould appears, discard the scones.
Snack Bars, Fruit-Flavoured, Commercially Packaged Or Purchased In Bulk	6-8 Months			Store in cool, dry area; after opening box, leave individually wrapped bars sealed. Storage time shown is for best quality only — after that, the product's texture, colour or flavour may change, but in most cases, the unopened snack bars will still be safe to consume if they have been stored properly and each foil packet is still sealed. If bars develop an off odor, flavour or appearance, they should be discarded for quality purposes. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the unopened snack bars will still be safe to consume after that date, as long as they have been stored properly and the package is not damaged.
Strawberry Jam, Commercially Jarred - Opened	2 Years (Best Quality) (Unopened)	1 Year (Best Quality)		How long does strawberry jam last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened strawberry jam, keep it refrigerated and tightly covered. How long does opened strawberry jam last in the refrigerator? Strawberry jam that has been continuously refrigerated will generally stay at best quality for about 1 year. Is opened strawberry jam safe to use after the "expiration date" on the jar? Yes, provided it has been stored properly, the jar is undamaged, and there are no signs of spoilage - commercially jarred strawberry jam will typically carry a Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the strawberry jam will remain at peak quality. The storage time shown for opened strawberry jam is for best quality only - after that, the jam's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the jar is undamaged, and there are no signs of spoilage. How can you tell if opened strawberry jam is bad or spoiled? The best way is to smell and look at the strawberry jam: if the jam develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Sugar, Brown - Unopened Or Opened Package	Keeps Indefinitely			How long does brown sugar last? The precise answer depends to a large extent on storage conditions - store brown sugar in a cool, dry area. To maximize the shelf life of brown sugar, keep the package tightly sealed after opening. To further extend the shelf life of brown sugar and to prevent it from hardening once opened, place sugar in a covered airtight container or cover original package with a heavy-duty plastic bag and seal. How long does brown sugar last at room temperature? When properly stored and kept free from contaminants, brown sugar has an indefinite shelf life. To moisten brown sugar that has hardened, place a cut piece of apple in the package with the sugar, reseal and leave overnight. If hardened brown sugar is needed immediately, wrap the sugar with foil or plastic wrap and pound with a hammer.
Sugar, Granulated (White) - Unopened Or Opened Package	Keeps Indefinitely			How long does granulated white sugar last? The precise answer depends to a large extent on storage conditions - store granulated sugar in a cool, dry area. To maximize the shelf life of granulated white sugar, keep tightly sealed after opening. How long does granulated white sugar last at room temperature? When properly stored and kept free from contaminants, granulated white sugar has an indefinite shelf life. To further extend the shelf life of granulated white sugar and to prevent it from hardening once opened, place sugar in a covered airtight container or cover original package with a heavy-duty plastic bag and seal.
Taco Shells, Commercially Packaged — Opened	1 Month 1 Year (Unopened)			Store in covered airtight container. Storage time shown is for best quality only — after that, the shells' texture, colour or flavour may change, but in most cases, they will still be safe to consume if they have been stored properly. If shells develop an off odor, flavour or appearance, they should be discarded for quality purposes; if mould appears, discard entire package. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the shells will still be safe to consume after that date, as long as they have been stored properly and the package is not damaged.
Tortillas, Commercially Packaged, Sold Unrefrigerated — Unopened Or Opened Package	2-4 weeks or date on package		3 Months	Keep tortillas tightly closed in original packaging and store at room temperature. To freeze, overwrap original packaging with aluminium foil or place in a heavy-duty freezer bag. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
White Bread, Freshly Baked (Soft-Crusted), Homemade Or Bakery	4-5 Days		3 Months	How long does white bread last? The precise answer to that question depends to a large extent on storage conditions - keep white bread in a cool, dry area. To maximize the shelf life of bakery-bought white bread, keep in original packaging and store at room temperature. To maximize the shelf life of homemade white bread, cool thoroughly before storing and place in plastic storage bag or breadbox, or wrap in foil and store at room temperature. Properly stored, white bread will last for about 4 to 5 days at normal room temperature. How long does white bread last in the fridge? White bread should ideally not be refrigerated, as the bread will dry out and become stale faster than at room temperature. If you must refrigerate white bread (eg, due to a lack of pantry storage space or very hot, humid room conditions), the bread will typically last for only about 2-3 days before getting stale. Can you freeze white bread? Yes, to freeze: (1) Slice bread or leave loaf whole; (2) Wrap tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag and freeze. How long does a loaf of white bread last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. The freezer time shown is for best quality only - white bread that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if white bread is bad or spoiled? The best way is to smell and look at the bread: discard any bread that has an off smell or appearance; if mould appears, discard the entire loaf.
White Rolls Or Buns — Homemade	4-5 Days		3 Months	Cool home-baked rolls thoroughly before storing. Place rolls in plastic storage bag, or wrap in foil and store at room temperature. Refrigerator storage is not recommended, as rolls will quickly dry out and become stale — for longer-term storage, freeze rolls instead. To freeze, wrap tightly with aluminium foil or place in a heavy-duty freezer bag. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Whole Wheat Bread, Freshly Baked, Homemade Or Bakery	4-5 Days		3 Months	How long does whole wheat bread last? The precise answer to that question depends to a large extent on storage conditions - keep whole wheat bread in a cool, dry area. To maximize the shelf life of bakery-bought whole wheat bread, keep in original packaging and store at room temperature. To maximize the shelf life of homemade whole wheat bread, cool thoroughly before storing and place in plastic storage bag or breadbox, or wrap in foil and store at room temperature. Properly stored, whole wheat bread will last for about 4 to 5 days at normal room temperature. How long does a loaf of whole wheat bread last in the freezer? Properly stored, it will maintain best quality for about 3 months, but will remain safe beyond that time. How long does whole wheat bread last in the fridge? Whole wheat bread should ideally not be refrigerated, as the bread will dry out and become stale faster than at room temperature. If you must refrigerate whole wheat bread (eg, due to a lack of pantry storage space or very hot, humid room conditions), the bread will typically last for only about 2-3 days before getting stale. Can you freeze whole wheat bread? Yes, to freeze: (1) Slice bread or leave loaf whole; (2) Wrap tightly with aluminium foil or plastic freezer wrap, or place in heavy-duty freezer bag and freeze. The freezer time shown is for best quality only - whole wheat bread that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if whole wheat bread is bad or spoiled? The best way is to smell and look at the bread: discard any bread that has an off smell or appearance; if mould appears, discard the entire loaf.
Yeast, Dry, Commercially Packaged — Opened	12-18 months or expiration date on package	4-6 Months (Best Quality)	10-12 Months (Best Quality)	How long does an opened package of active dry yeast last? The precise answer depends to a large extent on storage conditions - store opened dry yeast in the refrigerator or freezer. To maximize the shelf life of active dry yeast once the package is opened, transfer yeast to a covered airtight container or place original yeast package in a resealable plastic freezer bag. Is active dry yeast safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged active dry yeast will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the active dry yeast will remain at peak quality. How long does active dry yeast last in the fridge? Active dry yeast will maintain best quality for about 4 to 6 months in the refrigerator. How long does active dry yeast last in the freezer? Properly stored, it will maintain best quality for about 10 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only — active dry yeast that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if active dry yeast is still good to use? To test whether yeast is still potent enough to be effective: Add 1 teaspoon sugar to 1/4 cup warm water and stir in 1 envelope (or 2 1/4 teaspoons) of yeast; let stand 10 minutes — if the yeast foams up to the 1/2 cup mark, it will still be effective.

8 Herbs & Spices Shelf Life

These is the shelf life of most herbs and spics, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Allspice, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.

Basil - Fresh, Raw	7-10 Days		4-6 Months	How long does fresh basil last? The precise answer to that question depends to a large extent on storage conditions - after purchasing, store fresh basil in a dry area and keep loosely covered. Should you refrigerate fresh basil? No, refrigerating fresh basil is not recommended, as it can cause the leaves to turn black. How should fresh basil be stored? To maximize the shelf life of fresh basil: (1)Trim the ends and place basil in a glass containing about one inch of water; (2) Cover with a loose-fitting plastic bag and leave at room temperature; (3) Replace water when it gets cloudy. How long does fresh basil last at room temperature? Properly stored, fresh basil will usually keep well for about 7 to 10 days at room temperature. Can you freeze fresh basil? Yes, to freeze fresh basil: (1) Wash, trim and chop the basil; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. How long does fresh basil last in the freezer? Properly stored, fresh basil will maintain best quality for about 4 to 6 months in the freezer, but will remain safe beyond that time. The freezer time shown is for best quality only - basil that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if basil is bad or spoiled? Basil that is spoiling will typically become soft and discoloured and the leaves will start to darken; discard any basil that has an off smell or appearance.
Basil Leaves, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only — commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it — if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Bay Leaves, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years (Best Quality)			How long do dried bay leaves last? The precise answer depends to a large extent on storage conditions —to maximize the shelf life of dried bay leaves store in a cool, dark cupboard, away from direct heat or sunlight. How long do dried bay leaves last at room temperature? Properly stored, dried bay leaves will generally stay at best quality for about 1 to 3 years. To maximize the shelf life of dried bay leaves purchased in bulk, and to better retain flavour and potency, store in containers with tight-fitting lids. Are dried bay leaves safe to use after the "expiration" date on the package? Yes, provided they are properly stored and the package is undamaged — commercially packaged dried bay leaves will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the dried bay leaves will remain at peak quality. Do dried bay leaves ever spoil? No, commercially packaged dried bay leaves do not spoil, but they will start to lose potency over time and not flavour food as intended - the storage time shown is for best quality only. How can you tell if dried bay leaves are still good? To test whether dried bay leaves are still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell them - if the aroma is weak and the flavour is not obvious, the dried bay leaves should be replaced.
Black Pepper, Cracked, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	3-4 Years (Best Quality)			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only — commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it — if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Black Pepper, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years (Best Quality)			How long does ground black pepper last? The precise answer depends to a large extent on storage conditions —to maximize the shelf life of ground black pepper store in a cool, dark cupboard, away from direct heat or sunlight. How long does ground black pepper last at room temperature? Properly stored, ground black pepper will generally stay at best quality for about 3 to 4 years. To maximize the shelf life of ground black pepper purchased in bulk, and to better retain flavour and potency, store in containers with tight-fitting lids. Is ground black pepper safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged ground black pepper will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the ground black pepper will remain at peak quality. Does ground black pepper ever spoil? No, commercially packaged ground black pepper does not spoil, but it will start to lose potency over time and not flavour food as intended - the storage time shown is for best quality only. How can you tell if ground black pepper is still good? To test whether ground black pepper is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the ground black pepper should be replaced.
Chilli Pepper, Ground, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Chilli Powder, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Chives - Fresh, Raw		10-14 Days	4-6 Months	To store fresh chives: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh chives: (1) Wash, trim and chop the chives; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Chives, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Cilantro (Coriander) - Fresh, Raw		7-10 Days	4-6 Months	To store fresh cilantro: (1) Trim the ends and place in a glass containing about one inch of water; (2) Cover with a loose-fitting plastic bag and refrigerate; (3) Replace water when it gets cloudy. To freeze fresh cilantro: (1) Wash, trim and chop the cilantro; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Cinnamon Sticks, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	4 Years (Best Quality)			How long do cinnamon sticks last? The precise answer depends to a large extent on storage conditions —to maximize the shelf life of cinnamon sticks store in a cool, dark cupboard, away from direct heat or sunlight. How long do cinnamon sticks last at room temperature? Properly stored, cinnamon sticks will generally stay at best quality for about 4 years. To maximize the shelf life of cinnamon sticks purchased in bulk, and to better retain flavour and potency, store in containers with tight-fitting lids. Are cinnamon sticks safe to use after the "expiration" date on the package? Yes, provided they are properly stored and the package is undamaged — commercially packaged cinnamon sticks will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the cinnamon sticks will remain at peak quality. Do cinnamon sticks ever spoil? No, commercially packaged cinnamon sticks do not spoil, but they will start to lose potency over time and not flavour food as intended - the storage time shown is for best quality only. How can you tell if cinnamon sticks are still good? To test whether cinnamon sticks are still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell them - if the aroma is weak and the flavour is not obvious, the cinnamon sticks should be replaced.
Cinnamon, Ground, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Cloves, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Cloves, Whole, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Coriander, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Cumin, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Curry Powder, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Dehydrated Garlic, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	2 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Dill - Fresh, Raw		10-14 Days	4-6 Months	To store fresh dill: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh dill: (1) Wash, trim and chop the dill; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Fennel Seed, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Garlic Powder, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Garlic Salt, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-2 Years			Store in cool, dark cupboard, away from direct heat or sunlight. Time shown is for best quality only — commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it — if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Garlic, Minced, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	2-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Ginger, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Italian Seasoning, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Jalapeno Peppers, Diced, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	2-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Lavender, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Lemon Grass - Fresh, Raw		10-14 Days	4-6 Months	To store fresh lemon grass: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh lemon grass: (1) Wash, trim and chop the lemon grass; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Lemon Grass, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Mint (Including Peppermint, Spearmint) - Fresh, Raw		7-10 Days	4-6 Months	To store fresh mint: (1) Trim the ends and place in a glass containing about one inch of water; (2) Cover with a loose-fitting plastic bag and refrigerate; (3) Replace water when it gets cloudy. To freeze fresh mint: (1) Wash, trim and chop the mint; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Mustard Seed, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Mustard, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Nutmeg, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Nutmeg, Whole, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Oregano - Fresh, Raw		10-14 Days	4-6 Months	To store fresh oregano: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh oregano: (1) Wash, trim and chop the oregano; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Oregano Leaves, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Oregano, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Paprika, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Parsley - Fresh, Raw		10-14 Days	4-6 Months	To store fresh parsley: (1) Trim the ends and place in a glass containing about one inch of water; (2) Cover with a loose-fitting plastic bag and refrigerate; (3) Replace water when it gets cloudy. To freeze fresh parsley: (1) Wash, trim and chop the parsley; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.

Parsley Flakes, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Red Pepper, Crushed, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	2-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Red Pepper, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Rosemary - Fresh, Raw		10-14 Days	4-6 Months	To store fresh rosemary: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh rosemary: (1) Wash, trim and chop the rosemary; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Rosemary Leaves, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Rosemary, Crushed, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Sage - Fresh, Raw		10-14 Days	4-6 Months	To store fresh sage: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh sage: (1) Wash, trim and chop the sage; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags.
Salt - Table	Keeps Indefinitely			The answer to the question "How long does salt last?" is a matter of quality, not safety, assuming proper storage conditions — when properly stored, a package of salt has an indefinite shelf life, even after it has been opened. To maximize the shelf life of salt for quality purposes, store in a cool dry area away from direct heat or sunlight; keep tightly closed when not in use. Is salt safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged salt may carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the salt will remain at peak quality. How to tell if salt has gone bad? The shelf life of salt is indefinite, but if salt develops an off flavour or appearance, it should be discarded for quality purposes.
Sea Salt	Keeps Indefinitely			Store in cool, dry area. Salt has an indefinite shelf life.
Sesame Seed, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Taco Seasoning Mix, Dry - Unopened Or Opened	2-3 Years (Best Quality)			How long does a package of taco seasoning mix last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of taco seasoning mix store in a cool, dry area. How long does taco seasoning mix last at room temperature? Properly stored, a package of taco seasoning mix will generally stay at best quality for about 2-3 years at room temperature. To maximize the shelf life of taco seasoning mix, keep the package tightly closed at all times. Is taco seasoning mix safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged - commercially packaged taco seasoning mix will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the taco seasoning mix will remain at peak quality. Storage time shown is for best quality only - after that, the taco seasoning mix's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly, the package is undamaged, and there are no signs of spoilage. How can you tell if taco seasoning mix is bad or spoiled? The best way is to smell and look at the taco seasoning mix: if the taco seasoning mix develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Thyme - Fresh, Raw		10-14 Days	4-6 Months	To store fresh thyme: Wrap in a damp paper towel and place in a plastic bag in the refrigerator. To freeze fresh thyme: (1) Wash, trim and chop the thyme; (2) Allow to dry thoroughly; (3) Once dry, place in heavy-duty freezer bags or freeze in ice cube trays with a small amount of water, then transfer to freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Thyme Leaves, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	1-3 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Thyme, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Turmeric, Ground, Dried, Commercially Bottled Or Purchased In Bulk - Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Vanilla Beans, Dried, Commercially Bottled Or Purchased In Bulk — Unopened Or Opened	3-4 Years			Store in cool, dark cupboard, away from direct heat or sunlight; keep tightly closed when not in use. Spices and herbs bought in bulk will better retain flavour and potency if stored in containers with tight-fitting lids. Storage time shown is for best quality only - commercially dried spices and herbs do not spoil, but they will lose their potency over time and not flavour food as intended. To test whether a spice or herb is still potent enough to be effective: Rub or crush a small amount in your hand, then taste and smell it - if the aroma is weak and the flavour is not obvious, the herb or spice should be replaced. Best By, Best if Used By, and Use By dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the dried spice or herb will still be safe to consume after that date, although it will lose potency over time. Freezing is not recommended.
Vinegar, Apple Cider, Commercially Bottled - Unopened Or Opened	2 Years (Best Quality) (Safe Indefinitely)			How long does apple cider vinegar last? The precise answer depends to a large extent on storage conditions — to maximize the shelf life of apple cider vinegar, store in a cool, dark cupboard, away from direct heat or sunlight. To maximize the shelf life of apple cider vinegar, keep the bottle tightly sealed after opening. How long does apple cider vinegar last at room temperature? Properly stored, apple cider vinegar will generally stay at best quality for about 2 years, but will stay safe indefinitely. Is apple cider vinegar safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged apple cider vinegar will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the apple cider vinegar will remain at peak quality. Does apple cider vinegar ever spoil? No, commercially packaged apple cider vinegar does not spoil, but the appearance and flavour may start to deteriorate over time — the storage time shown is for best quality only. Is cloudy apple cider vinegar safe to use? Yes: over time, apple cider vinegar may become cloudy - this is not harmful; the vinegar will still be safe to consume if it has been stored properly.
Vinegar, Balsamic, Commercially Bottled - Unopened Or Opened	3 Years (Best Quality) (Safe Indefinitely)			How long does balsamic vinegar last? The precise answer depends to a large extent on storage conditions — to maximize the shelf life of balsamic vinegar, store in a cool, dark cupboard, away from direct heat or sunlight. To maximize the shelf life of balsamic vinegar, keep the bottle tightly sealed after opening. How long does balsamic vinegar last at room temperature? Properly stored, balsamic vinegar will generally stay at best quality for about 3 years, but will stay safe indefinitely. Is balsamic vinegar safe to use after the "expiration" date on the package? Yes, provided it is properly stored and the package is undamaged — commercially packaged balsamic vinegar will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the balsamic vinegar will remain at peak quality. Does balsamic vinegar ever spoil? No, commercially packaged balsamic vinegar does not spoil, but the appearance and flavour may start to deteriorate over time — the storage time shown is for best quality only. Is cloudy balsamic vinegar safe to use? Yes: over time, balsamic vinegar may become cloudy - this is not harmful; the vinegar will still be safe to consume if it has been stored properly.

9 Drinks Shelf Life

These is the shelf life of most drinks, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Almond Milk, Sold Unrefrigerated - Opened	3-4 weeks after date on package (Unopened)	7-10 Days		How long does shelf-stable almond milk last once opened? The precise answer depends to a large extent on storage conditions — keep opened shelf-stable almond milk almond milk that has been sold unrefrigerated) refrigerated and tightly closed. To maximize the shelf of opened shelf-stable almond milk, do not store it on the fridge door, as the temperature is too warm - the opened shelf-stable almond milk will last longer when stored in the main body of the refrigerator, in its original package. How long does opened shelf-stable almond milk last in the refrigerator? Shelf-stable almond milk that has been continuously refrigerated will keep for about 7 to 10 days after opening. How can you tell if opened shelf-stable almond milk is bad or spoiled? The best way is to smell and look at the shelf-stable almond milk: if the shelf-stable almond milk develops an off odor, flavour or appearance it should be discarded.

Apple Juice, Commercially Canned Or Bottled, Sold Unrefrigerated - Opened	18-24 Months (Best Quality) (Unopened)	7-10 Days	8-12 Months	How long does apple juice last once opened? The precise answer depends to a large extent on storage conditions — keep opened apple juice refrigerated and tightly closed. How long does opened apple juice last in the refrigerator? Apple juice that has been continuously refrigerated will keep for about 7 to 10 days after opening. To further extend the shelf life of opened apple juice, freeze it: to freeze apple juice, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. How long does apple juice last in the freezer? Properly stored, it will maintain best quality for about 8 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only — apple juice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does apple juice last after being frozen and thawed? Apple juice that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before using; apple juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if apple juice is bad? If apple juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded. Discard all apple juice from cans or bottles that are leaking, rusting, bulging or severely dented.
Apple Juice, Sold In Refrigerated Container - Unopened		1 week after date on package	8-12 Months	Keep refrigerated at all times. Consume or freeze juice before the number of days shown for refrigerator storage has elapsed. To freeze, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Apple Juice, Sold In Refrigerated Container - Opened		7-10 Days	8-12 Months	Keep refrigerated at all times. Once opened, consume or freeze product within the time shown for refrigeration, even if the date on package has not yet been reached. To freeze, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. Freezer time shown is for best quality - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Champagne - Opened Bottle		3-5 Days		Re-cork the champagne - if a stopper is not available, cover opening with plastic wrap and place a rubber band around the bottle neck to seal plastic tightly. Depending on the champagne variety and method used to re-close the bottle, opened champagne may go flat before the time shown above, but will remain safe to drink; consuming the champagne as soon as possible after opening will result in the best taste and appearance. Keep refrigerated until ready to drink.
Coffee — Freshly Brewed		1 Day	3-4 Months	For best results, store coffee in vacuum storage bottle or thermal carafe. To refrigerate, store coffee in tightly covered container. To freeze, pour into airtight plastic containers or pour coffee into ice cube trays; once cubes are frozen, transfer to a heavy-duty freezer bag.
Coffee, Ground, Commercially Canned Or Bagged, Vacuum-Packed - Opened	1-2 Weeks 1 Year (Unopened)		1 month (best quality)	How long does ground coffee last once opened? The precise answer depends to a large extent on storage conditions - store in cool, dry area and keep package tightly sealed at all times. To maximize the shelf life of ground coffee after opening, transfer the ground coffee to a canister that blocks out light and has an airtight seal. How long does ground coffee last at room temperature? Properly stored, an opened package of ground coffee will generally stay at best quality for about 1 to 2 weeks at room temperature, assuming it has been properly stored. Should ground coffee be stored in the fridge? No, you should not refrigerate ground coffee, as the temperature fluctuations will affect the taste and flavour of the coffee. Should you freeze ground coffee? Frozen ground coffee may lose some of its flavour, so freezing is recommended only for coffee that cannot be used up within two weeks of opening the package. Freeze ground coffee in tightly sealed original package or place inside covered airtight container. How long does ground coffee last in the freezer? Properly stored, it will maintain best quality for about 1 month, but will remain safe beyond that time. The freezer time shown is for best quality only - ground coffee that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How can you tell if ground coffee is bad or spoiled? Ground coffee typically loses flavour over time and develops a stale taste - if coffee develops an off odor, flavour or appearance, it should be discarded for quality purposes; if mould appears, discard the ground coffee.
Diet Soda / Soft Drinks (Including Diet Cola, Ginger Ale, Root Beer), Commercially Canned Or Bottled — Opened	3-6 months after date on package (Unopened)	1-4 Days 3-6 months after date on package (Unopened)		How long do diet soft drinks last once opened? The precise answer depends to a large extent on storage conditions — keep opened diet soft drinks refrigerated and tightly closed. How long do diet soft drinks last in the refrigerator once opened? Diet soft drinks that have been continuously refrigerated will keep at best quality for about 1 to 4 days after opening. Are opened diet soft drinks safe to drink after the "expiration" date on the bottle? Yes, provided they are properly stored and the bottle or can is undamaged - commercially packaged diet soft drinks will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the diet soft drinks will remain at peak quality. How can you tell if opened diet soft drinks are bad or spoiled? After opening, commercially manufactured diet soft drinks will start to become flat and lose flavour; if the diet soft drinks develop an off odor, flavour or appearance they should be discarded. Discard all diet soft drinks from cans or bottles that are leaking, rusting, bulging or severely dented.
Energy Drinks, Commercially Canned Or Bottled, Sold Unrefrigerated - Opened	6-9 months after date on package (Unopened)	2-4 Days		How long do energy drinks last once opened? The precise answer depends to a large extent on storage conditions — keep opened energy drinks refrigerated and tightly closed. How long do energy drinks last in the refrigerator once opened? Energy drinks that have been continuously refrigerated will keep at best quality for about 2 to 4 days after opening. Are opened energy drinks safe to drink after the "expiration" date on the bottle? Yes, provided they are properly stored and the bottle or can is undamaged - commercially packaged energy drinks will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the energy drinks will remain at peak quality. How can you tell if opened energy drinks are bad or spoiled? If energy drinks develop an off odor, flavour or appearance they should be discarded. Discard all energy drinks from cans or bottles that are leaking, rusting, bulging or severely dented.
Iced Tea (Ice Tea), Ready To Drink, Sold Unrefrigerated, Commercially Bottled Or Canned — Unopened	18-24 Months (Best Quality)			How long does unopened iced tea last? The precise answer to the question depends to a large extent on storage conditions - store unopened bottles of iced tea in a cool, dark area. To extend the shelf life of unopened iced tea, keep unopened iced tea away from direct sources of heat or light. How long does unopened iced tea last at room temperature? Properly stored, unopened iced tea will generally stay at best quality for about 18-24 months when stored at room temperature, although it will usually remain safe to drink after that. Is unopened iced tea safe to drink after the "expiration" date on the bottle? Yes, provided it is properly stored and the bottle is undamaged - commercially packaged iced tea will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the unopened iced tea will remain at peak quality. Storage times shown are for best quality only - after that, the unopened iced tea's colour or taste may change, but in most cases, it will still be safe to consume if it has been stored properly and the bottle is not damaged. How to tell if iced tea is bad? If iced tea develops an off odor, flavour or appearance, it should be discarded.
Instant Coffee, Commercially Bottled - Opened	12-18 months (Best Quality) 18-24 months (Best Quality) (Unopened)			How long does a package of opened instant coffee last? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened instant coffee store in a cool, dry area and keep tightly closed. How long does opened instant coffee last at room temperature? Properly stored, an opened package of instant coffee will generally stay at best quality for about 12 to 18 months at room temperature. Storage time shown is for best quality only - after that, the coffee's texture, colour or flavour may change, but in most cases, the opened instant coffee will still be safe to consume if it has been stored properly and shows no signs of spoilage. Is opened instant coffee safe to use after the "expiration" date on the package? Yes, if properly stored - commercially packaged coffee will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the coffee will remain at peak quality. How can you tell if instant coffee is bad or spoiled? Instant coffee typically loses flavour over time and develops a stale taste - if coffee develops an off odor, flavour or appearance or if mould appears, it should be discarded.
Juice Boxes, Drink Boxes, Sold Unrefrigerated — Opened	12-18 Months (Unopened) (Best Quality)	5-7 Days	8-12 Months	How long do juice boxes last once opened? The precise answer depends to a large extent on storage conditions — keep opened juice boxes refrigerated and tightly closed. How long do opened juice boxes last in the refrigerator? Juice boxes that have been continuously refrigerated will keep for about 5 to 7 days after opening. To further extend the shelf life of juice boxes, freeze: pour juice into an airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. How long do juice boxes last in the freezer? Properly stored, the juice will maintain best quality for about 8 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only — juice boxes that have been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does juice last after being frozen and thawed? Juice that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before using; juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if juice boxes are bad or spoiled? The best way is to smell and look at the juice: if the juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded. Discard all juice from juice boxes that are leaking, bulging or severely dented.
Lemon & Lime Juice — Freshly Squeezed		2-3 Days	3-4 Months	How long does freshly squeezed lemon juice last? The precise answer depends to a large extent on storage conditions — keep freshly squeezed lemon juice refrigerated. To maximize the shelf life of freshly squeezed lemon juice, refrigerate in a covered glass or plastic container. How long does freshly squeezed lemon juice last in the refrigerator? Freshly squeezed lemon juice that has been continuously refrigerated will keep for about 2 to 3 days. To further extend the shelf life of freshly squeezed lemon juice, freeze it: to freeze freshly squeezed lemon juice, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. How long does freshly squeezed lemon juice last in the freezer? Properly stored, it will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only — freshly squeezed lemon juice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does freshly squeezed lemon juice last after being frozen and thawed? Freshly squeezed lemon juice that has been defrosted in the fridge can be kept for an additional 2 to 3 days in the refrigerator before using; freshly squeezed lemon juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if freshly squeezed lemon juice is bad or spoiled? The best way is to smell and look at the freshly squeezed lemon juice: if the freshly squeezed lemon juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Liquid Breakfast Drink — Canned, Unopened	6 Months			Store in cool, dry area. Discard all food from cans that are leaking, rusting, bulging or severely dented. Storage time shown is for best quality only — after that, the drink's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. “Best By,” “Best if Used By,” and “Use By” dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the unopened drink will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Orange Juice — Freshly Squeezed		2-3 Days	3-4 Months	How long does freshly squeezed orange juice last? The precise answer depends to a large extent on storage conditions — keep freshly squeezed orange juice refrigerated. To maximize the shelf life of freshly squeezed orange juice, refrigerate in a covered glass or plastic container. How long does freshly squeezed orange juice last in the refrigerator? Freshly squeezed orange juice that has been continuously refrigerated will keep for about 2 to 3 days. To further extend the shelf life of freshly squeezed orange juice, freeze it: to freeze freshly squeezed orange juice, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. How long does freshly squeezed orange juice last in the freezer? Properly stored, it will maintain best quality for about 3 to 4 months, but will remain safe beyond that time. The freezer time shown is for best quality only — freshly squeezed orange juice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does freshly squeezed orange juice last after being frozen and thawed? Freshly squeezed orange juice that has been defrosted in the fridge can be kept for an additional 2 to 3 days in the refrigerator before using; freshly squeezed orange juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if freshly squeezed orange juice is bad or spoiled? The best way is to smell and look at the freshly squeezed orange juice: if the freshly squeezed orange juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Orange Juice, Commercially Canned Or Bottled, Sold Unrefrigerated — Opened	12-18 Months (Unopened)	5-7 Days	8-12 Months	Refrigerate after opening. Once opened, consume or freeze product within the time shown for refrigeration, even if the "Best By," "Best if Used By," or "Use By" date has not yet been reached. Freeze in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. Freezer time shown is for best quality — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Orange Juice, Sold In Refrigerated Carton Or Bottle - Unopened		1 week after date on package	8-12 Months	How long does unopened orange juice last? The precise answer to that question depends to a large extent on storage conditions - to maximize the shelf life of unopened orange juice, keep it refrigerated at all times. How long does unopened orange juice last in the fridge? Unopened orange juice will generally stay at best quality for about 1 week after the date on the package, assuming it has been continuously refrigerated. To further extend the shelf life of orange juice, freeze it: to freeze orange juice, store in airtight container and leave at least 1/2 inch headspace at the top, as orange juice will expand when frozen. How long does orange juice last in the freezer? Properly stored, it will maintain best quality for about 8 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only — orange juice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does orange juice last after being frozen and thawed? Orange juice that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before using; orange juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened orange juice is bad or spoiled? The best way is to smell and look at the orange juice: if the orange juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Orange Juice, Sold In Refrigerated Carton Or Bottle — Opened		7-10 Days	8-12 Months	How long does orange juice last once opened? The precise answer depends to a large extent on storage conditions — keep opened orange juice refrigerated and tightly closed. How long does opened orange juice last in the refrigerator? Orange juice that has been continuously refrigerated will keep for about 7 to 10 days after opening. To further extend the shelf life of opened orange juice, freeze it: to freeze orange juice, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. How long does orange juice last in the freezer? Properly stored, it will maintain best quality for about 8 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only — orange juice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does orange juice last after being frozen and thawed? Orange juice that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before using; orange juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if opened orange juice is bad or spoiled? The best way is to smell and look at the orange juice: if the orange juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Pineapple Juice, Commercially Canned Or Bottled, Sold Unrefrigerated — Opened	12-18 Months (Unopened)	7-10 Days	8-12 Months	How long does pineapple juice last once opened? The precise answer depends to a large extent on storage conditions — keep opened pineapple juice refrigerated and tightly closed. How long does opened pineapple juice last in the refrigerator? Pineapple juice that has been continuously refrigerated will keep for about 7 to 10 days after opening. To further extend the shelf life of opened pineapple juice, freeze it: to freeze pineapple juice, store in airtight container and leave at least 1/2 inch headspace at the top, as juice will expand when frozen. How long does pineapple juice last in the freezer? Properly stored, it will maintain best quality for about 8 to 12 months, but will remain safe beyond that time. The freezer time shown is for best quality only — pineapple juice that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does pineapple juice last after being frozen and thawed? Pineapple juice that has been defrosted in the fridge can be kept for an additional 3 to 5 days in the refrigerator before using; pineapple juice that was thawed in the microwave or in cold water should be used immediately. How can you tell if pineapple juice is bad? If pineapple juice develops an off odor, flavour or appearance, or if mould appears, it should be discarded. Discard all pineapple juice from cans or bottles that are leaking, rusting, bulging or severely dented.

Regular Soda / Soft Drinks (All Flavours, Including Cola, Lemon-Lime, Ginger Ale, Root Beer) Commercially Canned Or Bottled — Opened	6-9 months after date on package (Unopened)	2-4 Days 6-9 months after date on package (Unopened)		How long do soft drinks last once opened? The precise answer depends to a large extent on storage conditions — keep opened soft drinks refrigerated and tightly closed. How long do soft drinks last in the refrigerator once opened? Soft drinks that have been continuously refrigerated will keep at best quality for about 2 to 4 days after opening. Are opened soft drinks safe to drink after the "expiration" date on the bottle? Yes, provided they are properly stored and the bottle or can is undamaged - commercially packaged soft drinks will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the soft drinks will remain at peak quality. How can you tell if opened soft drinks are bad or spoiled? After opening, commercially manufactured soft drinks will start to become flat and lose flavour; if the soft drinks develop an off odor, flavour or appearance they should be discarded. Discard all soft drinks from cans or bottles that are leaking, rusting, bulging or severely dented.
Rum, Commercially Bottled - Unopened Or Opened Bottle	Keeps Indefinitely			The answer to the question How long does rum last? is a matter of quality, not safety, assuming proper storage conditions - when properly stored, a bottle of rum has an indefinite shelf life, even after it has been opened. To maximize the shelf life of rum for quality purposes, store in a cool dry area away from direct heat or sunlight; keep tightly closed when not in use. Once a bottle of rum is opened, the contents may begin to evaporate slowly and some flavour may be lost over time, but the rum will remain safe to consume if it has been stored properly. How to tell if rum has gone bad? The shelf life of rum is indefinite, but if rum develops an off odor, flavour or appearance, it should be discarded for quality purposes.
Sparkling Water, Commercially Bottled — Opened	12-18 months (Best Quality) (Unopened)	2-3 Days		How long does sparkling water last once opened? The precise answer depends to a large extent on storage conditions — keep opened sparkling water refrigerated and tightly closed. How long does sparkling water last in the refrigerator once opened? Sparkling water that has been continuously refrigerated will keep at best quality for about 2 to 3 days after opening. Is opened sparkling water safe to drink after the "expiration" date on the bottle? Yes, provided it is properly stored and the bottle is undamaged - commercially packaged sparkling water will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the sparkling water will remain at peak quality. How can you tell if opened sparkling water is bad or spoiled? After opening, commercially manufactured sparkling water will start to become flat; if the sparkling water develops an off odor, flavour or appearance it should be discarded. Discard all sparkling water from cans or bottles that are leaking, rusting, bulging or severely dented.
Tea Bags, Commercially Packaged — Unopened Or Opened	18-14 months (best quality)			How long do tea bags last? The precise answer depends to a large extent on storage conditions — to maximize the shelf life of tea bags (including black, green, herbal and oolong), store in a cool, dark cupboard, away from direct heat or sunlight. How long do tea bags last at room temperature? Properly stored, tea bags will generally stay at best quality for about 18 to 24 months. To maximize the shelf life of tea bags, and to better retain flavour and potency, store in airtight containers. Are tea bags safe to use after the "expiration" date on the package? Yes, provided they are properly stored and the package is undamaged — commercially packaged tea bags will typically carry a "Best By," "Best if Used By," "Best Before," or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the tea bags will remain at peak quality. Do tea bags ever spoil? No, commercially packaged tea bags do not spoil, but will start to lose potency and flavour over time — the storage time shown is for best quality only. Should you store tea bags in the refrigerator or freezer? Storing tea bags in the fridge or freezer is not recommended, since condensation can result, which will harm the taste and flavour of the tea. How can you tell if tea bags are still good? To test whether tea bags are still good, brew a cup of tea for at least 3 to 5 minutes - if the aroma is weak and the flavour is not obvious, the tea bags should be replaced.
Water, Commercially Bottled — Opened	Keeps Indefinitely (Unopened)	4-6 Days		How long does bottled water last once opened? The precise answer depends to a large extent on storage conditions — keep opened bottled water refrigerated and tightly closed. How long does bottled water last in the refrigerator once opened? Bottled water that has been continuously refrigerated will keep at best quality for about 4 to 6 days after opening. Is opened bottled water safe to drink after the "expiration" date on the bottle? Yes, provided it is properly stored and the bottle is undamaged - commercially packaged bottled water will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the bottled water will remain at peak quality. How can you tell if opened bottled water is bad or spoiled? If the bottled water develops an off odor, flavour or appearance it should be discarded.
Whiskey (Whisky), Commercially Bottled - Unopened Or Opened Bottle	Keeps Indefinitely			The answer to the question ? How long does whiskey last? is a matter of quality, not safety, assuming proper storage conditions - when properly stored, a bottle of whiskey (whisky) has an indefinite shelf life, even after it has been opened. To maximize the shelf life of whiskey for quality purposes, store in a cool dry area away from direct heat or sunlight; keep tightly closed when not in use. Once a bottle of whiskey is opened, the contents may begin to evaporate slowly and some flavour may be lost over time, but the whiskey will remain safe to consume if it has been stored properly. How to tell if whiskey has gone bad? The shelf life of whiskey is indefinite, but if whiskey develops an off odor, flavour or appearance, it should be discarded for quality purposes.
Wine, Red - Opened Bottle	3 years and up, depending on vintage (Unopened)	3-5 Days	4-6 Months	How long does red wine last once opened? The precise answer to that question depends to a large extent on storage conditions - re-cork the wine as soon as finished drinking. Should an opened bottle of red wine be refrigerated? Yes, refrigerating an opened bottle of red wine will help keep it fresher than storing it at normal room temperature; take the red wine out of the fridge about an hour before serving to bring back to room temperature. How long does opened red wine last in the refrigerator? An opened bottle of red wine will usually keep for about 3 to 5 days in the refrigerator (be sure to re-cork it first). If a cork or stopper is not available for the opened bottle of red wine, cover the opening with plastic wrap and place a rubber band around the bottle neck to seal plastic tightly. In general, opened bottles of full-bodied red wines such as cabernet sauvignon, merlot and syrah will maintain their flavour longer than lighter varieties such as pinot noir. Can you freeze red wine? Yes, leftover red wine may be frozen and used later for cooking - freeze the red wine in airtight containers or pour wine into ice cube trays; once the red wine is frozen, transfer cubes to a heavy-duty freezer bag. How long does red wine last in the freezer? Properly stored, red wine will maintain best quality for about 6 months, but will remain safe beyond that time; red wine that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if an opened bottle of red wine is bad? The best way is to smell and look at the red wine: red wine that has gone bad often develops an off smell and a brownish appearance.
Wine, White - Opened Bottle	3 years and up, depending on vintage (Unopened)	3-5 Days	4-6 Months	How long does white wine last once opened? The answer to that question depends to a large extent on storage conditions - re-cork the wine as soon as finished drinking. Keep an opened bottle of white wine refrigerated until ready to drink. If a cork or stopper is not available for the opened bottle of white wine, cover the opening with plastic wrap and place a rubber band around the bottle neck to seal plastic tightly. Leftover white wine may be frozen and used later for cooking - freeze the white wine in airtight containers or pour wine into ice cube trays; once the white wine is frozen, transfer cubes to a heavy-duty freezer bag. How long does white wine last in the freezer for safety purposes? The freezer time shown is for best quality only -foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How to tell if an opened bottle of white wine is bad? The best way is to smell and look at the white wine: white wine that has gone bad often develops an off smell and a yellowish-brown appearance.

10 Condiments Shelf Life

These is the shelf life of most condiments, both pre-packaged and raw.

	Pantry	Refrigerator	Freezer	Food Tips
Barbecue Sauce (Bbq Sauce), Commercially Bottled - Opened	1 Month (Opened) 1 Year (Unopened) (Best Quality)	6-9 months (best quality)		How long does BBQ sauce last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened BBQ sauce, store in a cool, dark place and keep tightly covered at all times. How long does an opened bottle of BBQ sauce last at normal room temperature? Opened BBQ sauce will usually keep well for 1 month when stored in the pantry. To extend the shelf life of opened barbecue sauce, refrigerate it. How long does opened BBQ sauce last in the refrigerator? BBQ sauce that has been continuously refrigerated will generally stay at best quality for about 6 to 9 months. Is opened BBQ sauce safe to use after the "expiration date"? Yes, provided it has been stored properly, the bottle is undamaged, and there are no signs of spoilage - commercially bottled barbecue sauce will typically carry a " Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the BBQ sauce will remain at peak quality. The storage time shown for opened BBQ sauce is for best quality only - after that, the BBQ sauce's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the bottle is undamaged, and there are no signs of spoilage. How can you tell if opened BBQ sauce is bad or spoiled? The best way is to smell and look at the BBQ sauce: if the BBQ sauce develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Ketchup (Tomato Sauce), Commercially Bottled - Opened	1 Month 1 Year (Unopened) (Best Quality)	9-12 months (best quality)		How long does ketchup last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened ketchup, store in a cool, dark place and keep tightly covered at all times. How long does an opened bottle of ketchup last at normal room temperature? Opened ketchup will usually keep well for 1 month when stored in the pantry. To extend the shelf life of opened ketchup, refrigerate it. How long does opened ketchup last in the refrigerator? Ketchup that has been continuously refrigerated will generally stay at best quality for about 9 to 12 months. Is opened ketchup safe to use after the "expiration date"? Yes, provided it has been stored properly, the bottle is undamaged, and there are no signs of spoilage - commercially bottled ketchup will typically carry a "Best By," "Best if Used By," " Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the ketchup will remain at peak quality. The storage time shown for opened ketchup is for best quality only - after that, the ketchup's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the bottle is undamaged, and there are no signs of spoilage. How can you tell if opened ketchup is bad or spoiled? The best way is to smell and look at the ketchup: if the ketchup develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Mayonnaise, Commercially Packaged - Opened	3-4 months after date on package (Unopened)	2-3 months after date on package		How long does mayonnaise last once opened? The precise answer depends to a large extent on storage conditions - keep opened mayonnaise refrigerated and tightly covered at all times. How long does opened mayonnaise last in the refrigerator? Mayonnaise that has been continuously refrigerated will generally stay at best quality for about 2 to 3 months after the "Best By" date on the package. How long can opened mayonnaise be left at room temperature? Bacteria grow rapidly at temperatures between 40°F and 140 °F; opened mayonnaise should be discarded if left out for more than 8 hours at room temperature. Is opened mayonnaise safe to use after the "expiration date" on the package? Yes, provided it has been stored properly, the package is undamaged, and there are no signs of spoilage - commercially packaged mayonnaise will typically carry a " Best By," "Best if Used By," " Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the mayonnaise will remain at peak quality. How can you tell if mayonnaise is bad or spoiled? The best way is to smell and look at the mayonnaise: if mayonnaise develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Mustard, Commercially Bottled, All Types (Including Yellow, Dijon, Whole Grain) - Opened	1-2 Months 2 Years (Unopened) (Best Quality)	12-18 months (best quality)		How long does mustard last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened mustard, store in a cool, dark place and keep tightly covered at all times. How long does an opened bottle of mustard last at normal room temperature? Opened mustard will usually keep well for 1 to 2 months when stored in the pantry. To extend the shelf life of opened mustard, refrigerate it. How long does opened mustard last in the refrigerator? Mustard that has been continuously refrigerated will generally stay at best quality for about 12-18 months. Is opened mustard safe to use after the "expiration date"? Yes, provided it has been stored properly, the bottle is undamaged, and there are no signs of spoilage - commercially bottled mustard will typically carry a "Best By," "Best if Used By," "Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the mustard will remain at peak quality. The storage time shown for opened mustard is for best quality only - after that, the mustard's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the bottle is undamaged, and there are no signs of spoilage. How can you tell if opened mustard is bad or spoiled? The best way is to smell and look at the mustard: if the mustard develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Olive Oil, Commercially Bottled - Opened	18-24 Months 2 Years (Unopened)	18-24 Months 2 Years (Unopened)		How long does olive oil last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened olive oil, store in a cool, dark place and keep tightly covered at all times. How long does an opened bottle of olive oil last at normal room temperature? Opened olive oil will usually keep for 18 to 24 months when stored in the pantry. Should olive oil be refrigerated? An opened bottle of olive oil can be refrigerated to extend its shelf life - refrigeration is recommended in hot, humid environments. Refrigerating an opened bottle of olive oil may cause the oil to become cloudy and solidify, but this will not affect the quality or flavour - once the olive oil is brought back to room temperature, it will return to its normal consistency and colour. Is an opened bottle of olive oil safe after the Use By or Best By date? Yes: "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the opened bottle of olive oil will still be safe to consume after that date, as long as it has been stored properly. How can you tell if an opened bottle of olive oil has gone bad? To determine if oil is still suitable for use, smell and taste it: If the oil has developed an off odor, flavour or appearance, it should be discarded for quality purposes.
Pesto, Sold In Refrigerated Container — Opened		3-4 Days	1-2 Months	Keep refrigerated. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only — foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Pesto, Sold In Refrigerated Container - Unopened		3-4 Weeks or date on carton	1-2 Months	Keep refrigerated. Freeze in covered airtight containers or heavy-duty freezer bags. Freezer time shown is for best quality only - foods kept constantly frozen at -18°C (0°F) will keep safe indefinitely.
Relish, Commercially Jarred, All Types (Including Hotdog, Hamburger, Sweet, India, Pickle, Piccalilli) - Opened	2 Years (Best Quality) (Unopened)	1 Year (best quality)		How long does relish last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened relish (including hotdog, hamburger, sweet, India, pickle, piccalilli), keep it refrigerated and tightly covered. How long does opened relish last in the refrigerator? Relish that has been continuously refrigerated will generally stay at best quality for about 1 year. Is opened relish safe to use after the expiration date on the jar? Yes, provided it has been stored properly, the jar is undamaged, and there are no signs of spoilage - commercially jarred relish will typically carry a Best By," "Best if Used By," Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the relish will remain at peak quality. The storage time shown for opened relish is for best quality only - after that, the relish's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the jar is undamaged, and there are no signs of spoilage. How can you tell if opened relish is bad or spoiled? The best way is to smell and look at the relish: if the relish develops an off odor, flavour or appearance, or if mould appears, it should be discarded.

FOOD

Life

Condiments Shelf Life

FOOD

Shelf

FOOD

Food

Condiments Shelf Life

Soup Mix, Dry, Commercially Packaged (All Types, Including Onion, Vegetable, Chicken Noodle) — Unopened Or Opened	18-24 Months (Best Quality)			
Soy (Soya) Sauce, Commercially Bottled - Opened	3 Years (Best Quality)	2 years (best quality)		How long does soy sauce last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened soy sauce (or soya sauce), refrigerate and keep tightly covered at all times. How long does opened soy sauce last in the refrigerator? Soy sauce that has been continuously refrigerated will generally stay at best quality for about 2 years. Is opened soy sauce safe to use after the "expiration date"? Yes, provided it has been stored properly, the bottle is undamaged, and there are no signs of spoilage - commercially bottled soy sauce will typically carry a "Best By," "Best if Used By," "Best Before, or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the soy sauce will remain at peak quality. The storage time shown for opened soy sauce is for best quality only - after that, the soy sauce's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the bottle is undamaged, and there are no signs of spoilage. How can you tell if opened soy sauce is bad or spoiled? The best way is to smell and look at the soy sauce: if the soy sauce develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Spaghetti Sauce/ Pasta Sauce, Tomato-Based (Including Marinara Sauce), Commercially Canned Or Bottled - Opened	2-5 Years (Unopened)	7-10 Days	4-6 Months	How long does spaghetti sauce last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened spaghetti sauce, keep refrigerated and keep tightly covered at all times. How long does opened spaghetti sauce last in the refrigerator? Spaghetti sauce that has been continuously refrigerated will generally keep for about 7 to 10 days. For best quality, do not store spaghetti sauce in opened metal can - refrigerate in covered glass or plastic container after opening. To further extend the shelf life of opened spaghetti sauce, freeze in covered airtight containers or heavy-duty freezer bags. How long does spaghetti sauce last in the freezer? Properly stored, it will maintain best quality for about 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only — spaghetti sauce that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does spaghetti sauce last at room temperature? If kept at temperatures above 40 °F, spaghetti sauce will rapidly develop signs of spoilage; spaghetti sauce should be discarded if left for more than 4 hours at room temperature. How can you tell if spaghetti sauce has gone bad? If spaghetti sauce develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Spaghetti / Pasta Sauce, Tomato-Based (Including Marinara Sauce) - Homemade		3-4 Days	4-6 Months	How long does cooked, homemade pasta sauce last in the fridge or freezer? The precise answer to that question depends to a large extent on storage conditions - refrigerate pasta sauce within two hours of cooking. To maximize the shelf life of cooked pasta sauce for safety and quality, refrigerate the pasta sauce promptly in covered airtight containers. Properly stored, cooked pasta sauce will last for 3 to 4 days in the refrigerator. To further extend the shelf life of cooked pasta sauce, freeze it; freeze in covered airtight containers or heavy-duty freezer bags. How long does cooked pasta sauce last in the freezer? Properly stored, it will maintain best quality for about 4 to 6 months, but will remain safe beyond that time. The freezer time shown is for best quality only - cooked pasta sauce that has been kept constantly frozen at -18°C (0°F) will keep safe indefinitely. How long does cooked pasta sauce last after being frozen and thawed? Cooked pasta sauce that has been thawed in the fridge can be kept for an additional 3 to 4 days in the refrigerator before cooking; pasta sauce that was thawed in the microwave or in cold water should be eaten immediately. How long can cooked pasta sauce be left at room temperature? Bacteria grow rapidly at temperatures between 4.4°C and 60°C (40°F and 140°F); cooked pasta sauce should be discarded if left for more than 2 hours at room temperature. How to tell if cooked pasta sauce is bad? If cooked pasta sauce develops an off odor, flavour or appearance, or if mould appears, it should be discarded.
Spaghetti Sauce / Pasta Sauce, Tomato-Based (Including Marinara Sauce), Commercially Canned Or Bottled - Unopened	12-18 Months			Store unopened spaghetti sauce in cool, dry area. Storage time shown is for best quality only - after that, the unopened spaghetti sauce's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. If spaghetti sauce develops an off odor, flavour or appearance, it should be discarded for quality purposes. "Best By", "Best if Used By", and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality - in most cases, the unopened spaghetti sauce will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Vegetable Oil Sprays, Commercially Canned — Unopened Or Opened	2 Years			Store in cool, dry area. Storage time shown is for best quality only — after that, the product's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been stored properly. If spray develops an off odor, flavour or appearance, it should be discarded for quality purposes. "Best By," "Best if Used By," and "Use By" dates on commercially packaged foods sold in the United States represent the manufacturer's estimate of how long the product will remain at peak quality — in most cases, the spray will still be safe to consume after that date, as long as it has been stored properly and the package is not damaged.
Worcestershire Sauce, Commercially Bottled - Opened	4-5 Years (Unopened) (Best Quality)	3 Years (Best Quality)		How long does Worcestershire sauce last once opened? The precise answer depends to a large extent on storage conditions - to maximize the shelf life of opened Worcestershire sauce, refrigerate and keep tightly covered at all times. How long does opened Worcestershire sauce last in the refrigerator? Worcestershire sauce that has been continuously refrigerated will generally stay at best quality for about 3 years. Is opened Worcestershire sauce safe to use after the "expiration date"? Yes, provided it has been stored properly, the bottle is undamaged, and there are no signs of spoilage - commercially bottled Worcestershire sauce will typically carry a "Best By," "Best if Used By," "Best Before", or "Best When Used By" date but this is not a safety date, it is the manufacturer's estimate of how long the Worcestershire sauce will remain at peak quality. The storage time shown for opened Worcestershire sauce is for best quality only - after that, the Worcestershire sauce's texture, colour or flavour may change, but in most cases, it will still be safe to consume if it has been kept continuously refrigerated, the bottle is undamaged, and there are no signs of spoilage. How can you tell if opened Worcestershire sauce is bad or spoiled? The best way is to smell and look at the Worcestershire sauce: if the Worcestershire sauce develops an off odor, flavour or appearance, or if mould appears, it should be discarded.

Field Dressing

How to bleed, skin, gut and prepare wild game

"Confucis say: butcher who back into meat grinder get a little behind in his orders."
Unknown

Introduction

This section outlines how to butcher and prepare all types of meats caught in the wild.

Purpose	The aim of FIELD DRESSING is to provide step-by-step instructions on how to bleed, gut and skin animals you've caught in preparation for consumption. It also includes details on what animals and insects you shouldn't eat and what parts of animals to avoid.
Lost?	● For information on killing animals humanely see the HUNTING section. ● If you want a list of recipes, see the RECIPES section. ● For the cooking of food, see the COOKING section. ● If you're looking for eating all kinds of wild and foraged foods as well as the wild food edibility test, see the PLANTS section. ● If you're looking for the food groups, see the HEALTH section. ● If you want to know how to properly prepare wild game for consumption, see the FIELD DRESSING section. ● For a list of recommended foods and food storage, see the FOOD section.

Contents

1 Insects

Subheadings

1 Insects to Avoid

- Don't eat brightly coloured bugs.
- Avoid hairy bugs - they may have stingers.
- Avoid bugs with a potent smell.

2 Beetle

Some species of beetles are edible, although a large portion of them are brightly coloured and are potentially toxic. Even the edible ones have a tendency to be extremely bitter and distasteful.

Preparation
o

3 Stinkbug

Preparation
Rid them of their smell by soaking in warm water for 10 minutes then cook very well in a dry pan. They can live a week after being boiled.

4 Butterfly & Moth

5 Cricket & Grasshopper

Crickets and grasshoppers are a delicacy in many places, especially Mexico where they are often fried with chilli powder, garlic, and lime juice. They're sold as street food in many parts of Mexico and I thoroughly enjoyed them on my many trips there. They also have a high risk of parasites though, so always cook them through.

Preparation
Pull off their heads and the entrails should come with it. Entrails are edible but to reduce parasite transmission always cook before eating.

6 Scorpion

Scorpions can also be eaten so long as you are careful not to get stung. They are usually best deep fried or roasted over a fire.

Preparation
Roast over fire until well browned.

7 Spider

Tarantula's in particular are eaten all over southeast Asia as well as the Amazon basin in south America. Cambodia serves tarantulas that are gathered in rice patties and deep fried in a crunchy sweet batter. The flavour is fairly enjoyable.

Preparation
Remove hair and don't eat the fangs.

8 Worm

Earth worms in particular are very high in protein. The main concern with earthworms is parasites, so be sure to cook them before ingesting them.

Preparation
Can be eaten raw but it's better to cook them. Skewer them and cook over an open flame until crispy.

9 Grub

Grubs are usually the larva of beetles and other winged insects. They can often be found in dead/punky wood. They can be eaten raw or cooked, but are much better cooked. Most grubs have a tendency to be bitter before they're cooked.

10 Mealworm

Mealworms can be easily obtained at pet stores or from farms that sell online. The ease with which they can be obtained combined with their mild nutty flavour makes them the perfect choice for beginning insect eaters. They taste just like a nestle crunch bar when toasted in a pan and dipped in melted chocolate.

11 Caterpillar

	Preparation Cook well. May be toxic, research the type first.

12 Bee & Wasp

Bees and wasps are eaten in many parts of Asia, including China and Japan. They are usually deep fried in a sweet sauce and eaten with rice or noodles.	**Preparation** Cut off the stingers and cook well.

13 Ant

	Preparation Catch and boil for 6 minutes which neutralizes the body acids. If you eat them raw, ensure they are dead first.

14 Termite

Much like ants, termites live in huge social colonies. They may be small, but in a colony, they can provide quite a bit of food. Termites are eaten all through Africa and Australia. I think they taste fairly good and nutty when toasted in a pan.	**Preparation** Roast them in a dry pan.

15 Snail & Slug

Snails and slugs are notorious carriers of pathogens and parasites and require processing to be considered safe for consumption. First gut them, then char them over a fire until they tasted like burnt bacon. The amount of meat you get per slug isn't worth the effort. However, special snails are eaten as escargot. They are usually oven-roasted in garlic butter sauce and can be quite pleasant when done properly. Usually the snails need to be fed lettuce for a few days to make sure they haven't ingested anything harmful to humans.	**Preparation** Remove Shell and cook thoroughly. Likely they have fed on poisonous plants so keep in a container for a day until the toxins diminish.

2 Small Game

Subheadings

1. Fish	**2. Bird**	**3. Rabbits**	**4. Turkey**
5. Duck	**6. Chicken**		

1 Fish

Killing Strike the head with a heavy object separating it. Can also cut the spinal cord and head with a knife. Fish begin multiplying bacteria immediately, keep it cold.	**Gutting & Cleaning** 1. Use a knife to remove scales underwater. 2. Insert knife shallowly at the tailfin and slice to gills. 3. Remove entrails and gills. 4. Gouge out kidneys. 5. Rinse stomach cavity.	**Filleting** 1. Cut down to the backbone just behind the fish's head, then turn the knife and cut down towards the tail, repeat on other side. 2. Remove ribcage. 3. To skin, place it skin-side down, grip the tail firmly and begin cutting at an angle form the tail forward.

2 Bird

Killing o	**Gutting & Cleaning** o	

3 Rabbits

Killing	Gutting & Cleaning	
○	○	

4 Turkey

Killing	Gutting & Cleaning	
○	○	

5 Duck

Killing	Gutting & Cleaning	
○	○	

6 Chicken

Killing	Gutting & Cleaning	
○	○	

3 Large Game

Subheadings

1. Cow	2. Sheep	3. Moose	4. Elk
5. Deer	6. Goat	7. Kangaroo	

1 Cow

Killing	Gutting & Cleaning				
○	○				

2 Sheep

Killing	Gutting & Cleaning				
○	○				

3 Moose

Killing	Gutting & Cleaning				
○	○				

4 Elk

Killing	Gutting & Cleaning				
○	○				

5 Deer

Killing	Gutting & Cleaning				
○	○				

6 Goat

FIELD DRESSING
Large Game

Killing ○	**Gutting & Cleaning** ○				

7 Kangaroo

Killing ○	**Gutting & Cleaning** ○				

Cooking

Cooking all types of food and food preservation methods

"You are what you eat.. That's strange,
I don't think I've eaten any sexy beasts today.."
Unknown

Introduction

A section detailing the preparation of different foods, types of ovens and various cooking styles. Tips on how to preserve spoilable foods such as rice, fruit, cheese and pastas.

Purpose	The aim of COOKING is to provide a comprehensive list of ways to make food safe for consumption through the various forms of cooking techniques available today. It also includes sections on cooking safety and food preservation if you don't wish to eat it straight away.
Lost?	● If you want a list of recipes, see the RECIPES section. ● If you're looking for eating all kinds of wild and foraged foods as well as the wild food edibility test, see the PLANTS section. ● For stove and oven construction, see the CRAFTING > Kitchen Items section. ● If you're looking for the food groups, see the HEALTH section. ● If you want to know how to properly prepare wild game for consumption, see the FIELD DRESSING section. ● For a list of recommended foods and food storage, see the FOOD section.

Contents

1 Food Preparation

How to preparing food for cooking.

2 Cookware

Various materials have different strengths and weaknesses when used for cooking. This section will discuss what the benefits of each is and when to use it.

Cooking Materials

Aluminium	Aluminium is the lightest of the common materials used for backpacking cookware. It is soft, and not nearly as durable as steel or titanium. Over time, it will age, pit and feel nasty. Aluminium conducts heat much better than stainless steel, which conducts heat far better than titanium. Aluminium cookware should be able to utilize more heat generated by a stove for heating its contents than titanium.
Steel	Plain steel is used for making food packing cans. These cans tend to be made of minimal thickness material, which makes them light weight. They are prone to rusting, but can be easily replaced.
Stainless Steel	Stainless steel is a nice material for cooking with. It is durable, easy to find and generally inexpensive. It wears like iron and is a reasonable heat conductor. It also tends to be heavier than titanium and aluminium cookware.
Titanium	Titanium cookware can be very durable while still being lightweight. It tends to be pricey and more difficult to find. Titanium cookware tends to not evenly distribute the heat from your stove and may create hot spots and burn your food. Hot spots are not a real concern if you are just boiling water.
Cast Iron	Cast iron heats up evenly and retains heat. This is good for actually cook many types of foods, but cast iron cooking utensils are generally too heavy for backpacking but may be an option for car camping.
Dual Metal Clad Cookware	These pots are usually made of durable stainless steel on the side contacting your food and made of aluminium or copper on the side that doesn't. The aluminium or copper conducts heat better than steel and will distribute it much better. As these tend to be higher end cookware options, these are made to last and will be much heavier than the basic thin hiking cookware available.

Shape

Wider pots tend to maximize heat from camp stoves compared to narrower pots. Narrower pots may be easier to balance on narrow stoves, such as sideburner alcohol stoves. Short pots may be more stable than tall ones. Tall pots may be able to maximize more of the heat from a stove if a tight windscreen is used. Taller pots are also able to store taller windscreens more easily. Tall narrow pots will benefit from a tight cone shaped windscreen.

Windshield

A wind screen serves two purposes. It acts as a radiation shield, reflecting heat back at your stove and pot, and shields your stove against the wind, which can easily blow out many alcohol and gas stoves. Rocks, trees, snow walls, packs (not too close) and trekkers may be used to block some wind, but a properly designed wind screen works so much better. Commercial and DIY aluminium screens should more than make up for their extra weight in fuel savings and decreased cook times. A tight fitting windscreen around stove mounted over a gas fuel canister or petrol tank can be very dangerous. This can cause overheating and lead to an explosion.

Making a Windshield
Aluminium flashing, a disposable bake pan, heavy duty aluminium foil (folded over on itself 1-4 times for durability or not at all) and sidewalls from beverage cans can work great for a lightweight windscreen. Aluminium foil can be held together temporality with paperclips or permanently with folds. Use a hole punch and punch out holes in bottom row or cut out a square section to face away from the wind to allow air to enter the windscreen. If you want a windscreen that needs to be so close to your stove that it touches the flames, consider using titanium or stainless shim 0.003" or thinner instead of aluminium. You can also make a windscreen that's cone shaped to allow it to have enough space away from your stove at the bottom and then come in around a narrow pot at the top. This creates a skirt which concentrates stove heat around the side and bottom of your pot.

Health Concerns

Aluminium	There are a few concerns that go along with choosing the right cookware. The most popular cookware questions in the backpacking community deals with the safety of aluminium pots. Much of this concern deals with an old and out-dated theory that suggests aluminium from cookware may be the cause of Alzheimer's disease. This is based on findings in the 1970's of high concentrations of aluminium in brain tissues of patient's with Alzheimer's disease. There are also many old urban myths floating around about the hazards of aluminium cookware, most notably Rudolph Valentino's death attributed to eating food prepared in aluminium cookware. The exact role of aluminium in Alzheimer's Disease isn't clear yet, and current research suggests that aluminium cookware doesn't pose a real risk to developing Alzheimer's or dementia. Aluminium cans have a heat cured coating inside and out. There may be some health concern with using this to cook with.
Teflon	There may be a hazard with the coatings often found on them. Teflon has been know to cause Teflon Flu (AKA metal fume fever or polymer fume fever). This happens when you heat up your cookware enough that the Teflon separates from your cookware and is inhaled. There are also concerns about blood levels of Teflon and a possible risk of cancer. If you use Teflon or other coated cookware, avoid overheating it, such as melting snow without first adding some water.
Galvanized Steel	Galvanized steel containers should never be used for cooking, as it may cause heavy metal poisoning.

3 Cooking Techniques

This section contains a list of cooking techniques which covers almost any kind of food you might want to cook.

Grill: Food placed on wire grid above or below heat, cooked by thermal radiation.
Frying: Cooking of food in oil or fat using a pan.
Rotisserie: A slow cooking process where the food is skewered on a spit and rotated slowly to cook evenly.
Earth Oven: An oven pit in the ground used to trap heat and bake, smoke or steam food.
Masonry Oven: An oven consisting of a baking chamber make of brick, concrete, stone or clay. Used for heating, baking, drying or cooking foods.
Dehydrating: Removes the moisture from foods using a fan and low heat to preserve them longer.
Liquid Stove: Prime the stove by preheating the generator prior to use. Consumption is about 0.25L/h for a small family or 0.75L/h for a large family.
Sun Stove: A stove that focuses the heat of the sun in a point which cooks food.
Wood Stove: o

Subheadings

1. Baking	2. Barbecuing	3. Blanching	4. Boiling
5. Frying	6. Grilling	7. Poaching	8. Pressure Cooking

1 Baking

Baking is cooking food in an oven with dry heat applied evenly throughout the oven and is synonymous with roasting. Although it is common in some cultures to use the term baking for the so-called baked-goods, such as breads, cakes and pastries, and 'roasting' for other foods, such as meats and vegetables, the terms can also be used interchangeably. The dry heat of baking causes the outside of the food to brown or char, giving it an attractive appearance and pleasing taste. The browning is caused by caramelization of sugars and is the result of the Maillard reaction. Despite common misconceptions about the browning process, moisture is never entirely sealed into the food.

Over time an item being baked will continue to lose moisture. This can be an advantage, especially in situations where drying is the desired outcome, for example in drying herbs or in roasting certain types of vegetables. Where drying is not desired, a protective layer of butter, oil, or, in the case of breads and pastries, egg wash, can slow the loss of moisture as well as providing flavour and additional browning. Alternatively, some foods are replenished with moisture during baking by placing a small amount of liquid (such as water or broth) in the bottom of the pan and letting it steam up into or around the food.

2 Barbecuing

Barbecuing is cooking food slowly with relatively low heat and hardwood smoke. Spices, marinades or brines, and sauces may all be used in the food preparation process. Grilling as a barbecue method is hotly debated in most of the US. In places like North Carolina and Texas where barbecue is part of their history and heritage, they believe grilling is not a barbecue method. Using different select hardwoods will infuse foods with distinct smoky flavours. Gas and electric smokers allow for more temperature control than smokers using charcoal or wood. In North Carolina, pork is traditionally barbecued while in Texas it is beef. However, for the common American, barbecue means pork.

3 Blanching

Blanching is a cooking technique involving boiling food (usually vegetables and fruits) in water for a very short time. Blanching is often followed by plunging the food into ice water to stop the cooking process. Though the word means to make something white or pale, blanching certain vegetables like broccoli will make their colours more vivid. Blanching is commonly used to remove skins from tomatoes and almonds. Vegetables are often blanched prior to freezing or canning. This helps preserve the food by slowing down or halting enzyme action that causes foods to break down, losing colour, flavour, and nutritional value. Blanching is similar to parboiling, which also involves boiling food briefly in water. Certain vegetables may benefit from being blanched or parboiled before being stir-fried. One quick way to blanch vegetables is to boil fresh vegetables in water, with salt, for about 30 seconds to 1 minute, before immediately draining and freezing them.

4 Boiling

Boiling, as it applies to cooking, means cooking foods in boiling water. In most populated parts of the world, plain water boils at temperatures from about 95°C to 100°C (200°F to 212°F). This varies with the atmospheric pressure, which in turn varies with both altitude and weather. When the water is salted, the boiling temperature is slightly higher than for clean water. When the atmospheric pressure on the surface of the water is lessened, boiling takes place at a lower temperature than that mentioned, and in extremely high altitudes the boiling point is so lowered that to cook certain foods by means of boiling water is difficult. As the water heats in the process of boiling, tiny bubbles appear on the bottom of the vessel in which it is contained and rise to the surface. Then, gradually, the bubbles increase in size until large ones form, rise rapidly, and break, thus producing constant agitation of the water.

Effects
Boiling has various effects on foods. It toughens the albumin in eggs, softens the fibre and dissolves the connective tissues in meat, softens the cellulose in cereals, vegetables, and fruits, and dissolves other substances in many foods. A good point to bear in mind in preparing foods by boiling is that slowly boiling water has the same temperature as rapidly boiling water and is therefore able to do exactly the same work. However, certain recipes may specify rapid boiling or slow boiling due to other conditions (such as not wanting to disintegrate soft food, or wanting to make use of the bubbles that appear in rapid boiling).

Turning the stove on high, keeping the gas burning full heat, or running the fire hard to keep the water boiling rapidly is therefore unnecessary; besides, it wastes fuel without doing the work any faster and sometimes not so well. However, there are several factors that influence the rapidity with which water may be brought to the boiling point; namely, the kind of utensil used, the amount of surface exposed, and the quantity of heat applied.

A cover placed on a saucepan or a kettle in which food is to be boiled retains the heat, and thus causes the temperature to rise more quickly; besides, a cover so used prevents a loss of water by condensing the steam as it rises against the cover. As water boils, some of it constantly passes off in the form of steam, and for this reason syrups or sauces become thicker the longer they are cooked.

The evaporation takes place all over the surface of the water; consequently, the greater the surface exposed, the more quickly is the quantity of water decreased during boiling. Another point to observe in the boiling process is that foods boiled rapidly in water have a tendency to lose their shape and are reduced to small pieces if allowed to boil long enough. Many recipes for pork ribs call for parboiling them before cooking, but this method is not recommended, as water is a solvent and may wash away flavours.

Health Purposes
Besides serving to cook foods, boiling also renders water safe, as it kills off any germs that may be present. Boiled water, as is known, loses its good taste. However, as this change is brought about by the loss of air during boiling, the flavour can be restored and air again introduced if the water is shaken in a partly filled jar or bottle, or beaten vigorously for a short time with an egg beater or whisk.

5 Frying

Cockaigne

This technique is used for cooking chicken using a 'poaching' technique (the chicken isn't suspended from the bottom of the pan), where the chicken is cooked from the outside in over time using medium to low heat. If followed exactly, the chicken will be cooked to the safe temperature of 165°F and ready to use in any recipe.

Deep Fat Frying

Cooking Techniques | Frying

Deep frying involves fully immersing food in hot oil. It is an extremely fast cooking method, and, despite the use of liquid oil, is best classified as a dry cooking method because it does not involve liquid water. With a deep fat fryer, deep frying is reasonably safe, but hot cooking oil is intrinsically dangerous, and one should be very careful so as to avoid fires and/or severe burns.

Sautéing

Sautéing is cooking food in a small quantity of fat or oil. When sautéing, which is a type of frying, a very small amount of oil is placed in a shallow pan, and when it is sufficiently hot, the food is put into it. Foods that are to be sautéed are usually sliced thin or cut into small pieces, and they are sometimes turned frequently during the process of cooking. Sauté is French for "jumping", used to describe the action of the food in the pan. The term pan-frying is sometimes the English equivalent of sautéing (which is a French word) if only a very small amount of oil is used. Some people consider it a different technique, which uses more fat and takes longer. Stir-frying uses higher temperatures and continual stirring. With modern non-stick pans the amount of oil required can be quite small, or even omitted.

Stir-Frying

Stir-frying involves frying food quickly over very high heat in an oiled pan. While stir-frying, you generally stir continually. A special slope-sided pan called a wok is designed for stir-frying. An open flame heat source such as gas works best when using a wok. Different frying oils produce different results. A light oil such as sesame produces a slightly healthier and much more tasty result but can burn if overheated. Olive oil has a low smoking point and may heat too quickly.

Tips
- Make sure all ingredients are prepared before you begin stir-frying.
- Heat the wok on medium-high or high heat at least one minute before adding oil. Do not pre-heat the wok if it has non-stick coating, as the heat can damage the coating.
- Drizzle the oil down the sides of the wok to maximize oil coverage as well as to heat the oil more quickly.
- Cook meat on high heat in order to keep it juicy.
- Remove the meat before stir-frying the vegetables. Add the meat back into the mix once the vegetables are almost cooked.
- If you are cooking over an electric range, replace the wok with an ordinary heavy-bottomed frying pan. You will achieve better results this way since electric ranges will not properly heat the curved sides of a wok.
- If you are using an electric range, you can preheat the pan or wok in an oven set to its highest setting, and only use the electric range to maintain heat during cooking. Be careful, as the pan's handle will be very hot.

Deglazing

Deglazing is a cooking technique for removing and dissolving browned food residue from a pan to make a sauce, known as a pan sauce, that is often made to accompany sautéed meats. The browned residue is due to either the Maillard reaction or caramelization. Generally speaking, a pan sauce is made by sautéing a meat at high temperature in a skillet.

The meat is removed and the majority of the fat is poured off, leaving a small amount with the dried and browned meat juices. The pan is returned to the heat, and a liquid such as vegetable or meat stock, an alcoholic beverage, some wine, or verjuice (a highly acidic juice made by pressing unripe grapes, crab-apples or other sour fruit) is added to act as a solvent.

This allows the cook to scrape the dark spots from the bottom of the pan and dissolve them, incorporating the remaining browned material at the bottom of the pan into a basic sauce. The culinary term fond, French for "base" or "foundation", refers to this sauce, although it is also sometimes used to describe the browned food bits instead (commonly in the United States). The flavour of the pan sauce is determined chiefly by the meat, the liquid used for deglazing, and any flavouring or finishing ingredients added, such as aromatics, herbs, or butter.

This method is the cornerstone of many well known sauces and gravies. The resulting liquid can be seasoned and served on its own (sometimes called a jus), or with the addition of aromatic vegetables, such as onions or shallots, carrots and celery. The sauce can also be thickened by whisking in butter, through the addition of a starch, such as flour, cornstarch, or arrowroot, or simply simmered down with a steady heat to form a rich, concentrated reduction.

6 Grilling

Grilling is a fast, dry method of cookery which uses the intense heat radiated by an: Electrical element, Gas flame, Glowing charcoal or an open wood fire. The heat source can be either above or below the food (or both) and the heat, in the form of infra-red waves, is transferred to the surface of the food. Infra-red waves penetrate only about 1 mm into food (whereas microwave radiation penetrates about 40 mm/l½ in.) Heat is transferred from the surface to the centre of the food by conduction. (If the food comes into contact with hot grill bars, which is almost certain to happen, there is also some conduction at the surface.) It is important that the grill is preheated so that it reaches the high temperatures necessary for efficient infra-red radiation.

Grilling cooks fast because: Very high temperatures are used, the food can be positioned close to the heat source and because the energy passes from the heat source almost instantly, without having to be carried in a liquid or through much air. How much heat the food absorbs depends on the colour of its surface: darker foods tend to absorb the infra-red more easily than light ones (which reflect some of the heat). This is the same effect as a black car getting hotter in the sun than a white car (or why a person in a white shirt stays cooler in the hot sun in the summer than the same person would wearing a black shirt.)

7 Poaching

Poaching is a method of cooking that employs a liquid, usually a small amount, that is hot but not actually bubbling. The French term is frisonne – shivering. The ideal temperature is between 160F and 180F (75-80C). The cooking liquid is often water, but broth, stock, milk or juice can also be used. Delicate foods such as fish, eggs out of the shell, or fruits are commonly cooked by poaching. The cooking method is also used to partially cook certain foods such as sweetbread in order to eliminate undesirable flavours and to firm the product before final cooking. It should be noted that the term is occasionally used to describe foods that have been boiled or simmered.

Tips
- Use a thermometer to gauge the temperature of the cooking liquid or watch for bubbling and adjust the heat as necessary.
- Do not allow the food being cooked to touch the bottom of the pan or it may cook too rapidly or burn.
- When poaching eggs, add a splash of vinegar to the water. This will help quickly firm the egg white so multiple eggs can be cooked at once without all sticking together.

Hole Technique
1. Heat water to just under simmering.
2. With a pushpin, carefully pierce one end of the egg.
3. Place egg on a large spoon, and lower it gently into the water. Keep submerged for 20-30 seconds. Some egg protein may start to come out of the hole in "streamers".
4. Raise spoon, gently crack egg, and drop into water.

Pre-cooking the egg by letting some hot water inside the shell will result in a firmer egg once opened, and it will be less likely to come apart in the water while cooking.

8 Pressure Cooking

Pressure cooking is a method of cooking in which the boiling temperature of water is increased using a special vessel, causing the food to cook faster. Cooking times can be reduced by a factor of three or four. For example, shredded cabbage is cooked in one minute, fresh green beans take about five, small to medium-sized potatoes (up to 200 g) may be ready in five minutes or so and a whole chicken takes no more than twenty-five minutes.

It is often used to simulate the effects of long braising or simmering in shorter periods of time. This is accomplished using a pressure cooker, a sealed vessel that does not permit steam to escape until a preset pressure is achieved. Because water's boiling point increases as the pressure increases, the pressure built up inside the cooker allows the liquid in the pot to rise to a temperature higher than 100 °C (212 °F) before boiling.

A safety valve releases steam when the pressure exceeds the safety limit for the cooker; usually the steam pressure lifts a weighted stopper allowing excess pressure to escape. There is usually a backup pressure release mechanism, in the form of a hole in the lid blocked by a plug of low melting-point alloy, a rubber seal and pin, or a rubber ring seal. If internal temperature (and hence pressure) gets too high, the release mechanism will trigger, resulting in a release of the pressure. However, it is best not to rely on this feature.

A pressure cooker can be used at high altitude to compensate for lower atmospheric pressure. Without it, water boils off before reaching 100 °C, lengthening the cooking time for recipes. In some countries, the microwave has replaced the pressure cooker as a technical fix for faster cooking, but cannot perform the same task that programmable electronic pressure cookers, as delayed cooking and other features.

See the Preservation Section further below for more information.

9 Roasting

Roasting is high-heat baking with very little moisture. Roasted foods get drier and browned on the outside by initially exposing it to a high temperature. This keeps most of the moisture from being cooked out of the food. Temperature is then lowered to cook the meat through. The flavours of both meats and vegetables are retained and enhanced by roasting. A typical roasting temperature is 425-450 °F, with an initial temperature of over 500 °F for a period of 15 to 20 minutes. You can either roast in an oven or over an open fire.

Spit-roasting is a variation where the meat is impaled on a spit and rotated as it roasts. Once meat has been removed from the roasting environment it should be allowed to rest, this ensures that the juice inside the meat returns to the outer edges. The even distribution of juice allows each slice to retain more moisture. Un-rested meat is typically dry around the edge and over saturated in the middle, leading to a loss of moisture.

10 Rotisserie

Rotisserie, also known as spit-roasting, is a style of roasting where meat is skewered on a spit – a long solid rod used to hold food while it is being cooked over a fire in a fireplace or over a campfire, or roasted in an oven. This method is generally used for cooking large joints of meat or entire animals, such as pigs or turkeys. The rotation cooks the meat evenly in its own juices and allows easy access for continuous self-basting.

11 Simmering

Simmering, or stewing, is a modification of boiling. By this method, food is cooked in liquid at a temperature below the boiling point, or anywhere from 185-200°F (85-95°C). Water at the simmering point always moves gently--never rapidly as it does in boiling. Less heat and consequently less fuel are required to cook foods in this way, unless, of course, the time consumed in cooking the food at a low temperature is much greater than that consumed in cooking it more rapidly. Aside from permitting economy in the use of fuel, simmering, or stewing, cooks deliciously certain foods that could not be selected for the more rapid methods.

For example, tough cuts of meat and old fowl can be made tender and tasty by long cooking at a low temperature, for this method tends to soften the fibre and to develop an excellent flavour. Tough vegetables, too, can be cooked tender by the simmering process without using so much fuel as would be used if they were boiled, for whatever method is used they require long cooking. Beets, turnips, and other winter vegetables should be stewed rather than boiled, as it is somewhat difficult to cook them tender, especially in the late winter and early spring. If dry beans and peas are brought to the simmering point and then allowed to cook, they can be prepared for the table in practically the same length of time and without so much fuel as if they boiled continuously.

12 Steaming

Steaming is the cooking of food by the application of steam. In this cooking process, the food is put into a steamer, which is a cooking utensil that consists of a vessel with a perforated bottom placed over one containing water. As the water boils, steam rises and cooks the food in the upper, or perforated, vessel. Steamers are sometimes arranged with a number of perforated vessels, one on top of the other. Such a steamer permits of the cooking of several foods at the same time without the need of additional fuel, because a different food may be placed in each vessel.

Steaming is preferable to boiling in some cases, because there is no loss of mineral salts nor food substances. The flavour is not so likely to be lost as when food is boiled. Some delicate fish is best cooked by steaming as it does not break up as it might in boiling water. Vegetables prepared in this way prove very palatable, and very often variety is added to the diet by steaming bread, cake, and pudding mixtures and then, provided a crisp outside is desired, placing them in a hot oven to dry out the moist surface.

13 Stewing

In culinary terms 'stewing can best be described as slowly cooking food in its own juices with the aid of a minimum amount of moistening agent in the form of stock, wine, beer, sauce, butter etc. During cooking the liquid is flavoured by extracts from the stewed food, the result is a highly flavoured liquor or sauce which forms an integral part of the stew. Throughout this process, which is generally a lengthy one, evaporation is kept to a minimum by covering the stewing vessel with a tight fitting lid and simmering the stew on top of the stove or in the oven.

Condensation, which continually forms on the inside of the lid, acts as a self basting process keeping the food moist. If the rate of evaporation is not kept to a minimum the stew will become dry and could burn. Therefore it may be necessary to add additional liquid as needed throughout the cooking period. Once cooked the liquid and food are usually served together to form the complete dish. Tougher cuts of meat may be made tender and palatable by this method.

Cooking Tec | Stewing

Foods for stewing are cut into small pieces or cuts before cooking and may comprise of meats, fish, vegetables and fruit. The flavour and colour of stock used will be determined on the type of meat to be cooked and the colour required of the finished dish, e.g. brown beef stew using brown beef stock. When a brown colour is required the meat and vegetables are sealed and browned in oil/dripping at a high temperature to ensure correct colour and sealing of the meat. Colour is also achieved by browning the roux and by using a brown stock.

If a white coloured product is required less heat is applied to seal gently and without browning. The most suitable mediums for this process are butter and margarine. Where a roux is required it is cooked to the blond stage before being moistened with stock to effect a white colour. In some instances meats used for white stews are blanched and refreshed as a means of sealing the meat and also extracting the scum, which would otherwise discolour the resultant sauce.

4 Cooking Platforms

These are the different platforms you can cook food on, such as ovens and stoves.

Subheadings

1. Electric Cookers	2. Wild Oven	3. Wood Stove	4. Liquid Stove
5. Gas Stove	6. Candle Stove	7. Solar Stove	8. Flameless Stove
9. Calcium Carbide Stove			

1 Electric Cookers

Electric stoves are any stoves which are powered by electricity to heat an element.

Immersion Coil	These are coils which can either be plugged in or battery operated and submerged to heat water.
Induction Cooktop	Induction cooking is performed using direct induction heating of cooking vessels, rather than relying on indirect radiation, convection, or thermal conduction. Induction cooking allows high power and very rapid increases in temperature to be achieved, and changes in heat settings are instantaneous. In an induction cooktop, a coil of copper wire is placed under the cooking pot and an alternating electric current is passed through it. The resulting oscillating magnetic field induces an electrical current in the pot. For nearly all models of induction cooktops, a cooking vessel must be made of, or contain, a ferrous metal such as cast iron or some stainless steels. The iron in the pot concentrates the current to produce heat in the metal. If the metal is too thin, or does not provide enough resistance to current flow, heating will not be effective. Most induction tops will not heat copper or aluminium vessels because the magnetic field cannot produce a concentrated current; "all metal" induction tops use much higher frequencies to overcome that effect. Any vessel can be used if placed on a suitable metal disk which functions as a conventional hotplate. Induction cooking has good electrical coupling between the pan and the coil and is thus quite efficient, which means it puts less waste heat into the kitchen, can be quickly turned on and off, and has safety advantages compared to gas stoves. Cooktops are also usually easy to clean, because the cooktop itself does not get very hot.
Electric Cooktop	An electric stove or electric range is a stove with an integrated electrical heating device to cook and bake. Electric stoves became popular as replacements for solid-fuel (wood or coal) stoves which required more labour to operate and maintain. Some modern stoves come in a unit with built-in extractor hoods. Electric cooktops may have a glass covering to assist in cleaning up spills.

2 Wild Oven

Earth Oven	
Masonry Oven	
Dutch Oven	

3 Wood Stove

A wood stove is any cooking platform that uses wood as a fuel. For fuels and wood types see the FUEL or CRAFTING categories. For information on wood types and how different woods burn see the MATERIALS section.

Advantages	• Wood is easy to find	• Don't have to carry fuel			
Disadvantages	• May produce a large amount of smoke	• Blackening of pots which may get over your gear	• Variable heat output	• Fires may be banned	• Requires constant attention and feeding
	• May be heavy				

Campfire
A campfire stove is a simple fire with supports able to hold pots and pans.

Rocket Stove
A rocket stove is an efficient and hot burning stove using small-diameter wood fuel. Fuel is burned in a simple combustion chamber containing an insulated vertical chimney, which ensures almost complete combustion prior to the flames reaching the cooking surface. Rocket stove designs are most often used for portable stoves for cooking but the design is also used for large fixed stoves in institutions, and to make rocket mass heaters for heating.

Kelly Kettle
Efficient portable devices for boiling water outdoors using twigs and other small combustible materials; these devices consist of a water jacket surrounding a fire chamber which creates an upward chimney draft ensuring efficient and rapid boiling even in windy or wet weather. AKA: Storm Kettle, Ghillie Kettle, Thermette and Volcano Kettle.

4 Liquid Stove

Cooking Platforms
Liquid Stove
Alcohol

Alcohol Stove

Advantages	• Ultralight	• Fuel Availability	• Customisable	• Easily Built	• Simplicity
	• Reliable	• Quiet	• Odourless	• No Maintenance	• Safety
	• Low Cost				
Disadvantages	• Fixed Heat Output	• Reduced Output	• Invisible Flame	• Cold Sensitive	• Low Durability

Open Flame Alcohol Stove

These are the simplest of all alcohol stove designs. Since enough alcohol vaporizes at room temperature to allow for easy ignition and generally not enough to be explosive under most conditions, you can simply burn alcohol in an open shallow metal tin. Simply open up a can of tuna or cat food, empty the contents, pour in some fuel and light. More refined versions incorporate a wick made of non-flammable fibreglass insulation, perlite (volcanic rock used in insulation and horticulture) or something comparable to help vaporize fuel and prevent spilling. Open flame stoves are popular with thruhikers wanting a failsafe system.

Chimney Alcohol Stove (Updraft Stove)

These stoves incorporate ventilation similar to a Bunsen burner to facilitate mixing of oxygen with fuel as air is "sucked" into the stove by the low pressure field created by an updraft from the burning fuel. This design allows for better air fuel mixing, more controlled burning when vents are sized properly (with or without a simmer accessory) and good heat feedback to the stove (needed to keep it running). Basically, they operate better than just a simple empty can, may be set up with adjustable heat output with the proper hardware and are more dependable than pressurized stoves.

Low Pressure SideBurner Alcohol Stove

Most use a simple updraft concept to preheat the stove and fuel, but they also turn into pressurized sideburners when a pot is placed on top of them. Made with the right number, configuration of and sized holes/ventilation, and you'll have a very light weight and dependable stove that doesn't need a pot stand.

Open Jet Alcohol Stove

These stoves work by vaporizing fuel and shooting them out little jets where the fuel is burned, creating a gas range-like effect. They are beautiful little gems, but may be more difficult to construct and more finicky than other stove types listed here. They are very simple to use, just pour your fuel in the centre and light.

Hybrid SideBurner Jet Alcohol Stove

These are open jet stoves with jets on the side. Like the regular open jet stoves, alcohol is poured in an open centre fuel port and lit. Once the jets ignite, you set your pot on top of the stove and seal off the centre fuel port, creating a pressurized system. The advantage of these systems is that you don't need a separate pot stand to cook with.

Pressurized Jet Alcohol Stove

These stoves also have little jets like the open jet stoves, but lack the open centre fuel port. Instead, the fuel port is generally closed off with a screw or are nonexistent (jets double as fuel ports). This allows for the stove to build up pressure as it heats up, forcing streams of fuel vapour through its jets. These stoves generally must be preheated by burning a small amount of fuel at the base or on top of the stove. These can be very difficult to design and construct, but allow you the potential for very fast and hot cooking and possibly greater fuel efficiency.

Fuels for Alcohol Stoves
See the FUEL section.

White Gas/Petroleum

White Gas/Petroleum Stove

Advantages	• Works well in subfreezing temperatures	• Readily Available Fuel	• Fast Cooking		
Disadvantages	• Very Loud	• Heavy Setup	• Lots of maintenance to keep it operational	• Fuel smell which could leech into your pack	

Gas Stove

5 Gas Stove

There are several commercial alcohol stoves available on the market these days and a great many DIY versions. Each versions has it's own special characteristics, limitations and special little advantages over others, yet most share a few basic common features and can be categorized into six distinct designs:

Types
- Open Flame
- Chimney/Updraft
- Low Pressure SideBurner
- Open Jet
- Hybrid SideBurner Jet
- Pressurized Jet

Advantages	• Easy to Use	• Clean Burn	• Cheap		
Disadvantages	• Fuel may freeze and stop working in cold temperatures				

Open Flame	These are the simplest of all alcohol stove designs. Since enough alcohol vaporizes at room temperature to allow for easy ignition and generally not enough to be explosive under most conditions, you can simply burn alcohol in an open shallow metal tin. Simply open up a can of tuna or cat food, empty the contents, pour in some fuel and light. More refined versions incorporate a wick made of non-flammable fibreglass insulation, perlite (volcanic rock used in insulation and horticulture) or something comparable to help vaporize fuel and prevent spilling. Open flame stoves are popular with thruhikers wanting a failsafe system.
Chimney/Updraft	These stoves incorporate ventilation similar to a Bunsen burner to facilitate mixing of oxygen with fuel as air is "sucked" into the stove by the low pressure field created by an updraft from the burning fuel. This design allows for better air fuel mixing, more controlled burning when vents are sized properly (with or without a simmer accessory) and good heat feedback to the stove (needed to keep it running). Basically, they operate better than just a simple empty can, may be set up with adjustable heat output with the proper hardware and are more dependable than pressurized stoves.
Low Pressure SideBurner	Most use a simple updraft concept to preheat the stove and fuel, but they also turn into pressurized sideburners when a pot is placed on top of them. Made with the right number, configuration of and sized holes/ventilation, and you'll have a very light weight and dependable stove that doesn't need a pot stand.
Open Jet	These stoves work by vaporizing fuel and shooting them out little jets where the fuel is burned, creating a gas range-like effect. They are beautiful little gems, but may be more difficult to construct and more finicky than other stove types listed here. They are very simple to use - pour your fuel in the open centre and light.
Hybrid SideBurner Jet	These are open jet stoves with jets on the side. Like the regular open jet stoves, alcohol is poured in an open centre fuel port and lit. Once the jets ignite, you set your pot on top of the stove and seal off the centre fuel port, creating a pressurized system. The advantage of these systems is that you don't need a separate pot stand to cook with.
Pressurized Jet	These stoves also have little jets like the open jet stoves, but lack the open centre fuel port. Instead, the fuel port is generally closed off with a screw or are nonexistent (jets double as fuel ports). This allows for the stove to build up pressure as it heats up, forcing streams of fuel vapour through its jets. These stoves generally must be preheated by burning a small amount of fuel at the base or on top of the stove. These can be very difficult to design and construct, but allow you the potential for very fast and hot cooking and possibly greater fuel efficiency.

Fuel
This type of stove uses compressed canisters of Butane, Propane or a mixture of them. See the "Fuel" section for more information on fuels.

6 Candle Stove

A stove which uses one or more candles as the source of heat.

Advantages	• Lightweight and portable	• Easily made			
Disadvantages	• Low Heat Output				

Depending on the size of the flame, candle stoves may take a while to heat up food. It likely won't get hot enough to boil water, but only warm it up. The only real advantage of a candle stove is that the candle burns a long time and provides enough light to see by.

7 Solar Stove

A stove which focuses the suns heat to cook food.

Advantages	• Eco Friendly	• Virtually unlimited fuel as long as it's day and clear.			
Disadvantages	• Very slow cooking based on region	• Reduced effectiveness in colder months	• Often bulky and hard to transport		

Depending on what part of the world you're from the solar stove can be extremely effective, such as in an Australian summer to almost useless in an the arctic. Wherever you decide to set it up though it will still take some time to cook the food and is therefore only really useful for cooking lunches or early dinners with the afternoon rays.

8 Flameless Stove

A common name for "cooking" freeze-dried meals while camping using chemicals which produce heat to heat the food. This isn't really considered cooking, but more so reheating the food as freeze-dried meals are safe to eat hot or cold.

Advantages	• Very light and portable	• No Flames / Stealthy	• No harmful by-products so you can use it in your tent	• Great for small meals for 1-2 people	• Simple to use
Disadvantages	• Generates Rubbish	• Single Use Only	• For Reheating Only	• Typically only come in single serve bag sizes	• Not convenient for large groups of people

If you're looking for a quick and easy way to warm up food on a short trip then this is the most compact and lightest method for doing so. The bags are also relatively cheap coming in at about $3-5.

9 Calcium Carbide Stove

A chemical reaction between calcium carbide and water produces acetylene, calcium oxide and heat. The acetylene is then burned for light and/or heat. This very old technology is still a favourite among many cavers and newer head mounted lanterns are still produced today. These setups may not be ideal for backpacking as the hard to find fuel must be kept dry to avoid igniting while in your pack and its by-products include caustic calcium hydroxide ($Ca(OH)2$) and calcium oxide (CaO aka Lime), chemicals you don't want in your pack. This stove type is only mentioned for those seeking superfluous trivia, tinkers looking for a unique project and in the interest of being complete (at the expense of practicality).

Advantages	• Very Unique Stove				

Disadvantages	• Dangerous Chemicals	• Difficult to find chemicals			

5 Preservation

Different ways to preserve a variety of food.

Subheadings

1 Mylar Preservation

This section shows you how to preserve different kinds of food in mylar bags to greatly extend their shelf life.

Mylar Bag Basics

This is some basic information on how the Mylar bagging process works.

Oxygen Absorbers (OA's)	You can use more OA's than necessary. Most OA's will absorb 180% to 300% of their rating for a buffer of safety. OA's take about 2 hours to absorb all the oxygen. Do not use OA's with foods high in fat or which have over 10% moisture to avoid botulism. Dried food has 10-20% moisture and is bendable, whereas dehydrated food only has 2.5-5% moisture so they should snap when bent. Use OA's within 10-15 minutes of opening or reseal them in an airtight container. Mylar Bags come in 1mil-8mil thicknesses. Use 5mil+ for long-term storage. Store Dry (<10% moisture), low fat foods only. Multiple smaller OA's will absorb oxygen faster than a larger OA. Mylar bags are NOT rodent proof, so store them in an impenetrable barrier such as a sealed plastic storage crate or food grade bucket. Do not use OA's with powders or granules like salt and sugar, as they will become rock hard.
Moisture Absorbers (MA's) AKA: Silica Gel / Desiccants	Use Silica Gel in a Mylar bag to absorb trapped moisture vapour. MA's absorbs about 40% humidity of their weight. Silica Gel is most effective below 25°C (77°F) and starts losing its absorption capabilities as the temperature rises. Distributed smaller sachets will reduce moisture levels faster than one larger sachet. Silica Gel can be reused by drying it in an oven at 80-110°C (176-230°F) for 15 minutes to 2 hours depending on absorption levels. MA's absorb about 10% of their capacity per hour but slow down as they fills up.

This is a table showing the cubic centimetres of air which will likely be sealed into the Mylar bag once the food is packaged. You need to select an oxygen absorber that is equal to or more than the CC number listed in the table.

If you have a Medium (quart) bag and are packaging oats, then we need at least a 150cc oxygen absorber or more.

Mylar Bag Size	* 35% Air * Beans, Lentils, Rice, Sugar	* 50% Air * Flour, Mixes, Powders	* 75% Air * Pasta, Flakes, Oats, Wheat
Small (Pint) 16oz – 473ml	OA - 50cc	OA - 50cc	OA - 100cc
Medium (Quart) 32oz – 946ml	OA - 100cc	OA - 100cc	OA - 150cc
Large (2 Quart) 64oz – 1.89L	OA - 150cc	OA - 200cc	OA - 350cc
XLarge (1 Gal) 128oz – 3.78L	OA - 300cc	OA - 400cc	OA - 500cc
XXLarge (5 Gal) 639oz – 18.9L	OA - 1,400cc	OA - 2,000cc	OA - 2,500cc

Sealing Mylar Bags

These are the steps I developed to seal Mylar Bags with pretty much any type of food. This guide refers to Oxygen Absorbers as OA's and Moisture Absorbers (Silica Gel or Desiccants) as MA's.

Step **1**	Choose a day with low humidity (<60%) or package the food in an air-conditioned room. Ensure that any food purchased from air-conditioned shops has reached ambient room temperature before packaging it into Mylar bags, otherwise condensation will form. Try to seal newly purchased foods as much as possible, as this will give the food the longest life possible.
Step **2**	Get the equipment you need: • The Food, • Scissors, • Mylar bags • OA's, • MA's, • Permanent Marker • Heat Sealer or Hair Straightener, • Funnel or Measuring Cup • A Dry Cloth, • A Humidity Gauge (If not packing in air conditioning)
Step **3**	Visually size the food you are sealing to the correct Mylar bag. Have some smaller Mylar bag sizes handy for leftovers.
Step **4**	Write the number of: • OA's and MA's you intend to add based on the tables overleaf before you begin so you aren't working it out on the go. Try to use a whole packet of OA's at once so you do not have to store the leftovers in an airtight container. Then write the • Food Type, • Quantity (grams), • Packaged date (today), • Original expiry date of the food, • New best before date, and any other pertinent information such as the humidity level during packing or storage requirements. These will help you troubleshoot what went wrong in the case the food has spoiled once opened. You may have to measure and write the quantity (in grams/kg) after the bag has been filled if you are not sure how much you fit into the bag, so if you are unsure - leave it blank.
Step **5**	Open the Mylar Bag and extend the gusset (the base) if it has one. It is best to stand them in Tupperware containers to help prevent them falling over during the initial filling. Then Put any Moisture Absorber(s) into the bottom of the package before filling. (Do not use MA's if you are packaging sugar or powdered substances. Check the table overleaf for a complete list)

Step 6	Using a wide funnel (if required), pour the food into the Mylar bag and give it a good shake between fills to ensure the gusset is fully extended and the food has compacted down to reduce the air. Do not overfill the bag since this will cause problems when sealing the bag later, so check that you can still close the bag every so often while filling it if you are unsure. Using a measuring cup or funnel will help prevent powders sticking to the sides, which causes bubbles when sealing the bag, or may even prevent a proper seal forming. Alternatively you can add sticky tape to the sealing edge to keep it clean. Powders such as flour tend to billow up and out the top when you squeeze the air out, so be sure to remove the air and seal the zip-lock before wiping the edge or removing the sticky tape.
Step 7	Once filled and as much air as possible has been removed, seal the zip-lock if it has one and wipe any powder from the inner sealing edge with a dry cloth to ensure a proper heat seal is made, or remove the sticky tape. Then repeat steps 4-7 and fill the remaining bags. If you want, you can also pre-seal most of the bag with your heat sealer while leaving a small gap to insert the OA's later.
Step 8	When you have your Mylar bags full of food and clean sealing edges, they are ready to seal. Partially open the zip-lock on them all then cut open the OA packet and insert the amount written on the bag. From now on you have 15mins max to get them sealed.
Step 9	Again, push any remaining air out of the bags. Be careful when pushing the air out of sharper foods like pasta, since it can penetrate the bag if pushed hard enough. Do this very slowly this time, especially for powdered substances since this could re-coat the sealing surface with powder. Then seal the zip-lock (wipe again if needed) and heat-seal the top. Try to avoid ripples when sealing the bag with a hair straightener (HS). This occurs when pulling the HS across the sealing edge rather than swiping upwards off the bag. To seal properly, put the HS on the edge of the package, close it and move it upwards off the bag.
Step 10	Ensure the bags are fully labelled and haven't been damaged in any way. If you believe one of them is compromised, put it under water in a sink, press down, and check for any streams of air bubbles from the bag.
Step 11	After a few days, check that the bag is still intact and has a slightly vacuum-packed look for any solid ingredients such as rice, grains and pasta. Some ingredients don't have the vacuum packed look once sealed since they are very fine, such as flour.

Mylar Bag Food Shelf Life

This is a list of foods and their new shelf life in years after being bagged in Mylar. (Counting from the manufacture date) Always bag the freshest product you can get for the best shelf life.

A-C		C-M		M-R		R-Z	
Almond Meal°₲	5-8?	Coffee Beans, Roast°₲	3-5				
Amaranth Grain°₲	10+	Coffee, Ground°₲	10+	Meat, Dehydrated*₲	2	Rice, Brown*₲	⊘
Arrowroot Pdr°₲	10+?	Coffee, Instant FD°₲	25+	Milk Powder, Skim[2]₲	15-25	Rice, White°₲	20-30
Ascorbic Acid°₲	10-15	Corn, Dry (Maize)°₲	10-15	Milk Powdr, Full Fat[2]₲	5-7	Rye°	8+
Baby Formula[2]	3-5	Cornflour°₲	5-10	Millet°₲	8-12	Salt*₲	Inf.
Baking Powder*~₲	30+	Couscous°	10+	Nuts*₲	⊘	Spelt Grain°	10-12
Baking Soda*~₲	30+	Crackers/Biscuits°	4	Oats°₲?	8+	Seeds, Edible°	5-10
Barley Grain°	10+	Dehydrated Fruit°₲	10-15	Oats, Hulled°₲?	30	Seeds, Sprouting*~	4-7
Barley, Pearled°	5+	Dehydrated Veges°₲	10-20	Oats, Pearled°₲?	10	Sorghum°₲	10+
Beans (Most)°₲	10-30	Dried Fruit (Soft)*₲	⊘	Oats, Rolled°₲?	30	Spices°₲	2-10
Beans, Kidney°₲	20	Dried Veges (Soft)*₲	⊘	Oats, Steel Cut°₲?	15	Sugar (Brown)[x]₲	Inf.
Beans, Lima°₲	20	Drink Mixes*~	8+	Onions Dehyd°₲	10-15	Sugar (White)*₲	Inf.
Beans, Mung°₲	8-10	Eggs, Powdered[2]₲	5-15	Pasta/Noodles°	25-30	Tea Bags/Loose[2]₲	30+
Beans, Pink°₲	20-30	Freekeh°	10+	Peanut Buttr Powdr°₲	10-15	TVP°₲	15-20
Beans, Pinto°₲	30+	Freeze Dried Fruit°₲	25+	Peas, Black-Eyed°₲	15-20	Vitamins (A,D,C)[2,3]₲	+5-8
Beans, Red°₲	8-10	Freeze Dried Veg°₲	25+	Peas, Dehyd°₲	15	Vitamins (E,K)[2,3]₲	+3-5
Beans, Soy°₲	8-10	Flax/Linseed°₲	8-12	Peas, Split°₲	25+	Vitamins, Multivita~[3]₲	+1-3
Buckwheat°₲	10+	Flour, White°^	10-20	Pepper (Whole)°₲	7-10	Wheat, Cracked°	25
Bullion (Stock)°	5-10	Flour, Whole Whet°^	10	Pet Biscuits (Dry)°	0.5	Wheat, Durum°	10+
Butter Powder[2]₲	15	Flour, Unbleached°^	5	Pet Biscuits (FD)°	25+	Wheat Flakes°	5
Cereals°	10	Gluten°	5	Polenta/Cornmeal°₲	5-8	Wheat, Hard Red°	30+
Chickpeas°₲	25+	Granola*	4-5	Popcorn*~₲	5	Wheat, Hard White°	30
Cheese Powder[2]₲	10-15	Herbs°₲	5-7	Potatoes (Most)°	30	Wheat, Whole Whit°	10+
Cocoa Powder[2]₲	15	Honey[x]₲	⊘ Inf.	Potatoes, Instant[2]	15-20	Whey Powder°₲	15
Coffee Beans, Gren°₲	20+	Lentils°₲	25+	Quinoa°₲	7-9	Yeast*~₲	2-5+

Legend:
* = Don't use OA's ^ = Don't use MA's [x] = Don't use either ~ = Use MA's ° = Use OA's [2] = Use Both
[3] = OA use varies by type + = A plus before a number means to add this time to the expiry date. ₲ = Gluten Free
⊘ = Do not store this in Mylar Bags - it will either go rancid quickly, is a liquid or will be dangerous to eat if bagged.
Package the food as close to the manufacturing date as possible for the best shelf life.
When opening a Mylar bag check its appearance and smell for anything abnormal.

2 Fruit Preserves

Fruit preserves are preparations of fruits, vegetables and sugar, often stored in glass jam jars and Mason jars.

Many varieties of fruit preserves are made globally, including sweet fruit preserves, such as those made from strawberry or apricot, and savory preserves, such as those made from tomatoes or squash. The ingredients used and how they are prepared determine the type of preserves; jams, jellies, and marmalades are all examples of different styles of fruit preserves that vary based upon the fruit used. In English, the word, in plural form, "preserves" is used to describe all types of jams and jellies.

3 Canning

Canning is the process in which foods are placed in jars or cans and heated to a temperature that destroys microorganisms and inactivates enzymes. This heating and later cooling forms a vacuum seal. The vacuum seal prevents other microorganisms from decontaminating the food within the jar or can. Acid foods such as fruits and tomatoes can be processed or "canned" in boiling water (also called the "water bath method"), while low acid vegetables and meats must be processed in a pressure canner at 240°F (10 pounds pressure at sea level). See this page for why you should use a canner and how to choose one. There are a large number of unsafe canning methods that people use, from the no processing at all (just fill the jars and seal, called "open kettle" canning) to oven canning, microwave canning and even using the dishwasher.

Canning Food Equipment	**Water Bath Canner** Cans Acid food - Tomato, Pickles, Jams/Jelly Jar content must have a high acidity level.	**Pressure Canner** Cans Low Acid Food - Meats, Vegetables, Potato Dial Gauge or Pressure Gauge	**Electric Canner** o	**Oven Canning** o	**Tools** ● Canner ● Jars ● Lid Grabber ● Jar Grabber ● Bubble Remover ● Funnels
	Research Acid Foods National Centre for Home Food Preservation http://nchfp.uga.edu/	**Jar Sizes** ● 118.29ml (4oz) ● 490ml (16.56oz) ● 945ml (31.95oz)	● Separate jars from the bottom of the canner or they will crack. ● Sterilize jars prior to use by boiling for 10m. ● All American Pressure Canner is a well tried and tested canner.		

Food pH Levels

The pH and/or acidity of a food is generally used to determine the safe home canning methods and conditions. The term "pH" is a measure of acidity; the lower its value, the more acid the food. The equipment used for determining pH was generally pH meters. Canning methods are described on this page. Some liquids, like lemon juice, lime juice and vinegar, are used as acidifiers, to help lower the pH of foods to increase safety. The approximate ranges of pH values for many common fresh and processed foods are listed below. Keep in mind that considerable variation exists between varieties, condition of growing and processing methods, etc. The data presented is applicable to the edible portion of foods in their normal and natural state, unless otherwise designated. Acid foods are foods that contain enough acid to have a pH of 4.6 or lower. They include fruits, pickles, sauerkraut, jams, jellies, marmalades, and fruit butters. Acidic foods can be processed safely in a boiling water canner, usually without added acid (lemon juice, vinegar or citric acid).

This is necessary to control botulinum bacteria. Acidity may be natural, as in most fruits, or added, as in pickled food. Low-acid canned foods are not acidic enough to prevent the growth of these bacteria. Acid foods contain enough acid to block their growth, or destroy them more rapidly when heated. The acidity level in foods can usually be increased by adding lemon juice, citric acid, or vinegar, although this by itself, does not mean the recipe is safe. Low-acid foods have pH values higher than 4.6 up to 6.9. (non-acidic, or alkaline foods have pH values of 7.0 or greater) .They include red meats, seafood, poultry, milk, and all fresh vegetables except for most tomatoes. Most mixtures of low-acid and acid foods also have pH values above 4.6 unless their recipes include enough lemon juice, citric acid, or vinegar to make them acid foods. In using this table, bear in mind that considerable variation exists between varieties, condition of growing and processing methods, etc. Data is presented for the edible portion of foods in their normal and natural state, unless otherwise designated.

pH Levels Key

Very High Acidity 0-3	**High Acidity** 3-4	**Medium Acidity** 4-5	**Low Acidity** 5-6	**Neutral pH** 6-8	**Low Alkaline** 8-9	**Medium Alkaline** 9-10	**High Alkaline** 10-11	**Very High Alkaline** 11-14			

Food pH

Apple, Baked with Sugar 3.20 - 3.55	**Apple, Eating** 3.30-4.00	**Apple – Delicious** 3.9	**Apple – Golden Delicious** 3.6	**Apple – Jonathan** 3.33	**Apple – McIntosh** 3.34	**Apple Juice** 3.35-4.00	**Apple Sauce** 3.10-3.60	**Apple – Winesap** 3.47	**Apricots** 3.30-4.80	**Apricot Nectar** 3.78	**Apricots, Pureed** 3.42-3.83
Artichokes 5.50-6.00	**Artichokes, Canned, Acidified** 4.30-4.60	**Artichokes, Jerusalem, Cooked** 5.93-6.00	**Asparagus** 6.00-6.70	**Avocados** 6.27-6.58	**Baby Corn** 5.20	**Bamboo Shoots** 5.10-6.20	**Bananas** 4.50-5.20	**Beans** 5.60-6.50	**Beans, Black** 5.78-6.02	**Beans, Kidney** 5.40-6.00	**Beans, Lima** 6.50
Beans, Soy 6.00-6.60	**Beans, String** 5.60	**Beans, Wax** 5.30-5.70	**Beans, Pork & Tomato Sauce** 5.10-5.80	**Beets** 5.30-6.60	**Beets, Canned, Acidified** 4.30-4.60	**Blackberries, Washington** 3.85-4.50	**Blueberries, Maine** 3.12-3.33	**Blueberries, Frozen** 3.11-3.22	**Broccoli** 6.30-6.85	**Brussels Sprout** 6.00-6.30	**Cabbage** 5.20-6.80
Cabbage, Green 5.50-6.75	**Cactus** 4.70	**Cantaloupe** 6.13-6.58	**Carrots** 5.88-6.40	**Cauliflower** 5.6	**Celery** 5.70-6.00	**Cherries, California** 4.01-4.54	**Cherries, Red, Water Pack** 3.25-3.82	**Cherries, Royal Ann** 3.80-3.83	**Corn** 5.90-7.50	**Cucumbers** 5.12-5.78	**Cucumbers, Dill Pickles** 3.20-3.70
Cucumbers, Pickled 4.20-4.60	**Eggplant** 4.5-5.3	**Figs, Calamyrna** 5.05-5.98	**Four Bean Salad** 5.60	**Fruit Cocktail** 3.60-4.00	**Grapes, Concord** 2.80-3.00	**Grapes, Niagara** 2.80-3.27	**Grapes, Seedless** 2.90-3.82	**Grapefruit** 3.00-3.75	**Horseradish, Ground** 5.35	**Jam, Fruit** 3.50-4.50	**Jellies, Fruit** 3.00-3.50
Ketchup 3.89-3.92	**Leeks** 5.50-6.17	**Lemon Juice** 2.00-2.60	**Lime Juice** 2.00-2.35	**Lime** 2.00-2.80	**Loganberries** 2.70-3.50	**Mangoes, Ripe** 5.80-6.00	**Mangoes, Green** 3.40-4.80	**Maple Syrup** 5.15	**Melon, Honey Dew** 6.00-6.67	**Mint Jelly** 3.01	**Mushrooms** 6.00-6.70
Nectarines 3.92-4.18	**Okra, Cooked** 5.50-6.60	**Olives, Black** 6.00-7.00	**Olives, Green Fermented** 3.60-4.60	**Olives, Ripe** 6.00-7.50	**Onions, Pickled** 3.70-4.60	**Onions, Red** 5.30-5.880	**Onions, White** 5.37-5.85	**Onions, Yellow** 5.32-5.60	**Oranges, Florida** 3.69-4.34	**Orange Juice, California** 3.30-4.19	**Orange Juice, Florida** 3.30-4.15
Palm, Heart of 6.70	**Papaya** 5.20-6.00	**Parsnip** 5.30-5.70	**Peaches** 3.30-4.05	**Pears, Bartlett** 3.50-4.60	**Peas, Canned** 5.70-6.00	**Peas, Garbanzo** 6.48-6.80	**Peppers** 4.65-5.45	**Peppers, Green** 5.20-5.93	**Persimmons** 4.42-4.70	**Pickles, Fresh Pack** 5.10-5.40	**Pimiento** 4.40-4.90
Pineapple 3.20-4.00	**Plums, Blue** 2.80-3.40	**Plums, Red** 3.60-4.30	**Pomegranate** 2.93-3.20	**Potatoes** 5.40-5.90	**Prunes** 3.63-3.92	**Pumpkin** 4.990-5.50	**Radishes, Red** 5.85-6.05	**Radishes, White** 5.52-5.69	**Raspberries** 3.22-3.95	**Rhubarb** 3.10-3.40	**Sauerkraut** 3.30-3.60
Spinach 5.50-6.80	**Squash, Acorn, Cooked** 5.18-6.49	**Squash, White, Cooked** 5.52-5.80	**Squash, Yellow, Cooked** 5.79-6.00	**Strawberries** 3.00-3.90	**Sweet Potatoes** 5.30-5.60	**Three-Bean Salad** 5.40	**Tofu (Soybean Curd)** 7.20	**Tomatillo** 3.83	**Tomatoes** 4.30-4.90	**Tomatoes, Juice** 4.10-4.60	**Tomatoes, Paste** 3.50-4.70
Tomatoes, Puree 4.30-4.47	**Tomatoes, Vine Ripened** 4.42-4.65	**Vinegar** 2.40-3.40	**Vinegar, Cider** 3.10	**Watermelon** 5.18-5.60	**Zucchini, Cooked** 5.69-6.10						

Ingredients pH

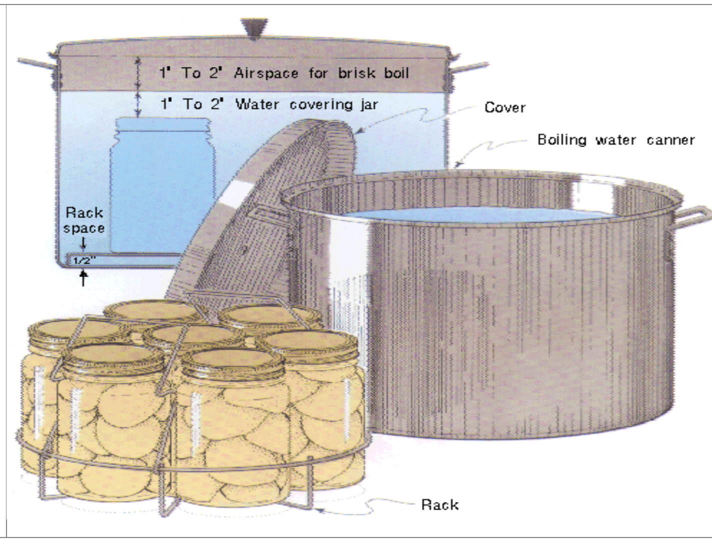
Butter 6.1-6.4	Corn Starch 4.0-7.0	Corn Syrup 5.0	Flour 6.0-6.3	Honey 3.9	Molasses 5.0-5.5	Sugar 5.0-6.0	Vinegar 2.0-3.4				

Water Bath Canning

Water bath canning is the process most people use to can fruits, vegetables, jams, jellies, and pickles at home. Unfortunately, the canners rarely come with directions, and the instructions in many canning books can be complicated and hard to follow. These boiling water bath canning directions below may serve as a guide and a reminder to the basic steps in home pressure canning food whether you have misplaced your canning books, are new to home canning or just need a refresher.

Essentially, a water bath canner is a very, very large pot, with dimensions to hold at least 7 quart jars and allow them to be submerged by 1 to 2 inches of water.   The canners usually include a rack with handles to make it easier (and safer) to put the jars in and take them out of the boiling water. Most boiling water canners are made of aluminum or porcelain-covered steel. Many boiling water canners do not have completely flat bottoms, so if you have a smooth-top stove (such as a ceramic or glass topped stove), see this page for alternatives . Gas stoves are ideal for home canning since either a flat or ridged bottom may be used on a gas burner. To ensure uniform processing of all jars with an electric range, the canner should be no more than 4 inches wider in diameter than the element on which it is heated.

(When centered on the burner or element, the canner should not be more than 2 inches wider on any side) Keep in mind that water bath canners are suitable only for acidic foods (See the pH table above for the pHs of common fruits, vegetables, grains, breads and common food products). Low acid foods must be canned in a pressure canner. You must use the type of canner called for in the recipe. Keep in mind that you can always use a pressure canner as a water bath canner (just don't seal it up, so it doesn't pressurize!) so if you can only afford one canner, get the pressure canner, and you can use it for all types of food. Pressure canners are much more expensive, though, so most people start with a water bath canner, even though it limits what they may can.



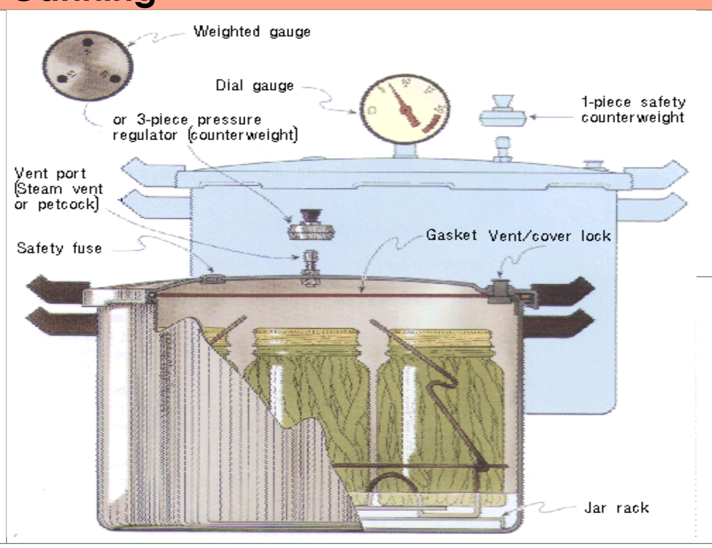
1. Sterilize jars prior to use by boiling for 10m.
2. Fill the jars and leave headspace at the top. This creates a vacuum and stops the food overflowing.
3. Remove any trapped air on the sides of the jar.
4. Using a damp coth, clean around the rim of the jar prior to putting the ring and lids on.
5. Fill up the water bath canner with hot water until it's 3 cm's over the tallest jar.
6. Place the jars in the canner on the rack and turn the heat to high. When it starts boiling the timer starts.
7. After the canning time is complete, raise the canning rack and remove the jars and place onto a towel. Make sure the room isn't cold or the jars could break.
8. Leave out for 24 hours to let the lid seal. The lid is sealed if the indentation is down.
9. Write the date canned on the lid and remove any excess drips of food from the outside of the jars.

Pressure Canning

Pressure cooking is the process of cooking food, using water or other cooking liquid, in a sealed vessel known as a pressure cooker. This simulates the effects of long braising within a shorter time. Almost any food that can be cooked in steam or water-based liquids can be cooked in a pressure cooker.

The cooker works by trapping the steam produced from boiling the cooking liquid inside the vessel. This causes internal pressure and temperature to rise quickly. After use, the steam is slowly released so that the vessel can be opened safely.

Pressure Canning and Botulinum
Unfortunately, Botulinum spores are fairly resistant to heating at boiling water temperatures. In fact, proper processing of low acid foods in a water-bath canner takes so long that doing so will significantly diminish the quality of your final product. Instead, botulism can be prevented by processing low acid food in a pressure canner. This effectively raises the maximum temperature that you can reach during processing. Instead of maxing out at 100°C, a pressure canner can heat food up to 118°C. At this high temperature, Botulinum spores are rapidly killed and the processing time is significantly reduced.



A home canner chooses their method of processing based on the pH of the food they are preserving. It all comes down to safety, and preventing the growth of C. Botulinum. This insistence on safety is what established the pH dividing line of 4.6, and provides a relatively simple way to know how to process your food.

Pressure Canning Steps
1. Sterilize jars prior to use by boiling for 10m.
2. Fill the jars and leave headspace at the top. This creates a vacuum and stops the food overflowing.
3. Remove any trapped air on the sides of the jar.
4. Using a damp coth, clean around the rim of the jar prior to putting the ring and lids on.
5. Fill up the pressure canner - usually 2 inches and then place the jars in. You can separate jar rows with separators. Add oil to the rim to prevent sticking.
6. Put the lid on and line up the arrow and then lock the lid on using the opposite toggles first until finger tight.

COOKING Preservation Canning Pressure Canning

7. Turn the stove on med-high to high and it will come up to pressure in about 30 minutes. Let the vent hiss for 10m before putting the weighted gauge on. Know your elevation to determine how long to cook the food.
8. Wait until the weight jiggles 4 times a minute and watch the pressure gauge until it's around the required PSI. Start the timer when it's up to pressure.
9. Stay nearby and monitor the pressure as it will climb slowly, reduce the pressure if necessary and lower the heat a little. Keep the pressure above the minimum pressure required for cooking.
10. After the food has cooked for the appropriate time (approx 1h 15m) turn off the heat and wait for the pressure to drop to 0. Remove the weighted gauge at 0 PSI and wait 10m before opening the lid.
11. Raise the canning rack and remove the jars and place onto a towel. Make sure the room isn't cold or the jars could break. Leave out for 24 hours to let the lid seal. The lid is sealed if the indentation is down. Write the date canned on the lid and remove any excess drips of food from the outside of the jars.

COOKING Preservation Canning Open Kettle

Open Kettle Canning (Inversion Canning)

The open-kettle method means placing hot food in jars and sealing with no further heat treatment. This is the method that many grandma's used in which granny fills a jar (sanitized or not) with hot fruit, pickles, etc., puts the lid and ring on, then turns it upside down. The jar will cool and seal, BUT it is NOT sterile, as the contents were exposed to the air (and airborne bacteria) just before sealing. From the moment the jars were filled, the contents started cooling, so airborne bacteria contacting the cooling surfaces will still be viable. They were not exposed to a heat high enough, nor long enough to destroy them. Then granny gives the jars away, playing Russian Roulette. Maybe you'll get sick, maybe not. Again, this method is NOT recommended for home canning because the amount of heat applied may not be sufficient to destroy bacteria and the product may spoil quickly or cause illness when consumed.

COOKING Preservation Canning Steam Canning

Steam Canning

The steam canner was designed as a means to process foods using steam without the aid of pressure. The manufacturer claims this process uses less water, saves time and energy, and recommends identical processing times as those required for boiling-water bath treatments.

"Steam canning is not recommended at this time for either acid or low acid foods. Processing times for use with current models have not been adequately researched. Today's steam canner looks like an upside-down boiling water canner. The base is a shallow pan with a rack that is covered with a high dome lid. After the jars of foods are placed on the canner's base, a small amount of water in the base is brought to a boil and the dome fills with steam. The jars and foods in them are heated by the steam surrounding them. However, steam canners do not heat foods in jars exactly the same as boiling water canning does. Low acid foods are potentially deadly because Clostridium botulinum bacteria could survive the steam canning and produce the poison that causes botulism. Acid foods may also be underprocessed and therefore could spoil."
National Home Food Preservation Centre

Study Conclusions
● Atmospheric steam canners result in significantly lower product temperatures at the beginning and end of the scheduled process when compared to water-bath canning.
● Use of steam canners as instructed by the manufacturer would result in under processing and considerable economic spoilage.
● Because steam canners may not heat foods in the same manner as boiling water canners, using boiling-water process times with steam canners may result in spoilage. There is no tested nor approved conversion factor.

COOKING Preservation Canning Oven Canning

Oven Canning

Oven-canning is extremely hazardous. The oven canning method involves placing jars in an oven and heating. In oven canning, product temperatures never exceed the boiling point, and uniform heat penetration cannot be assured. It is, therefore, not considered safe to use for home canning. Because this process fails to destroy the many bacteria, including the spores of Clostridium botulinum, it can cause the food to become toxic during storage. Also, canning jars are not designed for intense dry heat and may explode resulting in serious cuts or burns.

"There is not sufficient, research-based documentation to support that 'canning' any food in a dry oven as described on this web page or any page that proposes oven canning is even sufficient heating to destroy bacteria of concern, let alone enough to produce a proper seal with today's home canning lids."
USDA

COOKING Preservation Canning Other Canning Methods

Other Canning Methods

Solar Canning	The heat generated from captured sunlight is not a reliable method to process acid foods and should never be used to can low-acid foods.
Micro-Dome Food Preserver	Micro-Dome Food Preserver Recalled Washington, DC--The U.S. Consumer Product Safety Commission (CPSC) in cooperation with Micro-Dome of San Ramon, CA, has warned consumers of certain safety hazards associated with the use of the "Micro-Dome Food Preserver" manufactured by Micro-Dome and sold and distributed to consumers after August 1987. The CPSC has also urged consumers to destroy all food that has been preserved using a Micro-Dome Food Preserver.
Microwave Processing	Microwave oven cannot be used for home canning. Microwaved food reaches 100°C (212°F) but heating is not uniform. There is also a danger of explosion of the jars within the microwave oven or as food is being removed from the oven.
Dishwashing Processing	Processing canned foods in a dishwater cycle is dangerous. The temperature of the water during the cleaning and rinsing cycle is far below that required to kill harmful microorganisms. Thus the product will be underprocessed and unsafe to eat. Note that it is fine to use the dishwasher to clean and sanitize the empty jars, especially if your dishwasher has a "sanitize" setting - the empty jars will get hot enough.
Aspirin / Salicylic Acid	So-called canning powders are useless as preservatives and do not replace the need for proper heat processing. You may have heard of someone's grandmother canning corn by boiling the corn, adding aspirin or salicylic acid from the drugstore, then sealing the corn in jars with no further processing. According to the University of Illinois, a recipe circulated several years ago, using aspirin to acidify tomatoes and beans for canning. Aspirin is not recommended for canning. While it contains salicylic acid, it does not sufficiently acidify low acid foods like tomatoes or beans for safe hot water bath canning. Low acid foods (without added acids) should only be processed safely in a pressure canner. Lemon juice or vinegar is recommended to acidify tomato products for safe water bath processing. Salicylic acid, in the ways in which it is used in the preparation of food products, is not only not harmful, but is a preservative to health, inasmuch as the process of decomposition which it prevents would be far more dangerous.

Canning Tips

Canned Jar Storage

- Store the jars between 10°C-21°C (50°-70°F)
- Do not store over 35°c (95°F) at which point the seals could undo themselves.
- Store oldest at the front and the newer at the back.
- Don't store the jars stacked or the pressure could be relieved.
- Store the jars in the box that they came in for a snug fit.

Canning Food Tips

If the jar spurts upon opening it contains Botulism and must discard immediately and anything it came in contact with. The smell should be okay upon opening the jar, if it smells bad, throw it out. Check if the lid is sealed firmly when opening the jars, toss any that aren't sealed. Add a splash of white vinegar if there's a white film on the jars, this is called scaling. Canned food does not need to be cooked after opening the jar.

- Jar canned meat lasts about 2-3 years.
- Pressure can all soup
- Pressure Canning takes about 3 hours per load.

Canning Guidelines

Canning guidelines were revised in 1989 following extensive research. Canning instructions printed before 1989 may be unsafe. Here are some of the newer recommendations you should be using (these are incorporated into all of the recipes on pickyourown.org - we use only the most up-to-date directions and recommendations from the USDA, Ball and major university food science labs:

- Bottled lemon juice should be added to all canned tomatoes.
- Jellies, jams, and preserves should be processed in a boiling water bath.
- Pickles and pickled products should be processed in a boiling water bath.
- The pressure for your pressure canner and the time for processing in a boiling water bath should be adjusted according to your local altitude.

Pressure Canning Bacon

Place about 17 strips of bacon on natural parchment paper and add another strip covering the top half, flip it over and press it down. Roll it up into a cylinder, tucking excess paper under and place it in a wide mouth jar. 10lb pressure for 90m.

Pressure Canning Bread

4 Pickling

Pickling is another form of canning. Pickled products have an increased acidity that makes it difficult for most bacteria to grow. The amount of acid present is very important to the safety of the product. Pickled products are also heated in jars at boiling temperatures to destroy any other microorganisms present and form a vacuum in the jar.

5 Jams & Jellies

Jams and Jellies have a very high sugar content. The sugar binds with the liquid present making it difficult for microorganisms to grow. To prevent surface contamination after the product is made and thus possible yeast or mould growth, these are either canned, frozen, or refrigerated.

See the 'Fruit Preserves' section above for more about preserving fruit as jams.

6 Waxing

Some foods can be waxed to preserve them many years such as cheese and eggs.

Waxing Cheese	Dry cheese for 48 hours in a cool area/fridge (airtight container) at about 15°c and 90% humidity. At least 60% air in the container. Use a damp cloth for humidity. Use a double boiler to melt the wax at about 111°c which kills mould spores. Dip cheese in each half at a time for 3-4 layers holding it in for 5 seconds, letting it dry between waxes, dip cheese < 5 seconds, store it under 12°c to preserve 25 years. Using straight heat will cause thin wax layers - dip more times, ensure cheese is dry before waxing or it will crack and peel off.
Waxing Eggs	Coat eggs with cheese wax to preserve them for 10 years. Paint it on using a brush to prevent them cooking inside.

7 Salting

Salting is the preservation of food with dry edible salt. It is related to pickling in general and more specifically to brining (preparing food with brine, that is, salty water) and is one form of curing. It is one of the oldest methods of preserving food, and two historically significant salt-cured foods are salted fish (usually dried and salted cod or salted herring) and salt-cured meat (such as bacon). Vegetables such as runner beans and cabbage are also often preserved in this manner.

Salting is used because most bacteria, fungi and other potentially pathogenic organisms cannot survive in a highly salty environment, due to the hypertonic nature of salt. Any living cell in such an environment will become dehydrated through osmosis and die or become temporarily inactivated.

It was discovered in the 19th century that salt mixed with nitrates (saltpeter) would color meats red, rather than grey, and consumers at that time then strongly preferred the red-colored meat. The food hence preserved stays healthy and fresh for days avoiding bacterial decay.

8 Smoking

Smoking is the process of flavoring, browning, cooking, or preserving food by exposing it to smoke from burning or smoldering material, most often wood. Meat, fish, and lapsang souchong tea are often smoked. In Europe, alder is the traditional smoking wood, but oak is more often used now, and beech to a lesser extent. In North America, hickory, mesquite, oak, pecan, alder, maple, and fruit-tree woods, such as apple, cherry, and plum, are commonly used for smoking. Other biomass besides wood can also be employed, sometimes with the addition of flavoring ingredients. Chinese tea-smoking uses a mixture of uncooked rice, sugar, and tea, heated at the base of a wok.

Smoking can be done in four ways: cold smoking, warm smoking, hot smoking, and through the employment of "liquid smoke". However, these methods of imparting smoke only affect the food surface, and are unable to preserve food, thus, smoking is paired with other microbial hurdles, such as chilling and packaging, to extend food shelf-life.

9 Drying / Dehydrating

Drying removes most of the moisture from foods. Thus microorganisms cannot grow and enzyme action is slowed down. Dried foods should be stored in airtight containers to prevent moisture from rehydrating the products and allowing microbial growth.

10 Freezing

Freezing reduces the temperature of the food so that microorganisms cannot grow, however many will survive. Enzyme activity is slowed down, but not stopped during freezing.

11 Freeze Drying

Freeze drying, also known as lyophilisation or cryodesiccation, is a low temperature dehydration process that involves freezing the product, lowering pressure, then removing the ice by sublimation. This is in contrast to dehydration by most conventional methods that evaporate water using heat. Freeze drying results in a high quality product because of the low temperature used in processing. The original shape of the product is maintained and quality of the rehydrated product is excellent. Primary applications of freeze drying include biological (e.g., bacteria and yeasts), biomedical (e.g., surgical transplants), food processing (e.g., coffee) and preservation.

Store freeze dried food in a cool, dry place to extend life.

12 Preservation Tips

- Volume - Food Volume = Air Volume
- Air Volume x 0.21 (Air is 21% oxygen) = Oxygen absorber size
- 1g per CC
- Use powdered eggs instead of regular eggs to save space and weight.
- Ensure there's no bugs in the rice by freezing it for a week.
- Freeze grains for 7-10 days to kill weevils and the eggs.
- Store foods with oxygen absorbers equal to the amount of "Cubic Centimetres" of air in the container.
- Use mylar bags for storage of food as they protect from light, moisture and air the best.
- Use 4.5mil mylar bags or more to prevent light entering.
- Oxygen absorbers lose their absorption properties after about 4 hours
- Oxygen absorbers require slight moisture and won't work with desiccants or vacuum packing.

Oxygen Absorbers	Food Storage Variables	Mylar Bag Uses		
100cc - 15x22cm Bag 100cc - 9x13cm Bag 50cc - 6x8cm Bag 200cc - 20x30cm Bag	• Oxygen • Pests • Humidity • Heat • Light	• Oats • Rice • Flour • Beans • Lentils		

6 Cooking Safety

This section shows how to safely prepare food to avoid bacteria, cross-contamination and other contaminants in the food and to help prevent injury to the cooker.

Temperature Safety

- **-23-17°C (-10-0°F):** Best storage temperature for frozen foods.
- **-17-0°C (0-32°F):** Freezing temperatures permit slow growth of some bacteria, yeasts and moulds.
- **0-21°C (32-70°F):** Cold temperatures permit slow growth of some bacteria, yeasts and mould.
- **10-35°C (50-95°F):** Best storage temperatures for canned and dried foods.
- **21-60°C (70-140°F):** Danger Zone, These temperatures allow rapid growth of bacteria, yeast and mould.
- **35-60°C (95-140°F):** Maximum Storage temperatures for canned foods.
- **60-100°C (140-212°F):** Temperature water boils at sea level. Canning temperatures for acid fruits, tomatoes, pickles and jellied products in a boiling-water canner.
- **60-74°C (140-165°F):** Warning temperatures prevent growth but may allow survival of some microorganisms
- **82-100°C (180-212°F):** Canning temperatures are used to destroy most bacteria, yeasts and moulds in acid foods. Time required to kill these decreases as temperature increases.
- **115-121°C (240-250°F):** Canning temperatures for low acid vegetables, meat and poultry in a pressure canner.

Refrigerating Opened Cans
Storing food in an open can is normally safe for a short period, but inadvisable.

1	Cans used to be made of tin, which is toxic. Modern cans are made from either steel or aluminium. If the contents of the can are acidic, cans are lined with a polymer (plastic) inner layer. If that layer is broken -- say, by a major dent in the can or by using a knife to scrape out contents -- then the acid can get to the metal and, over time, corrode it, and some of the now-oxidized metal will dissolve into the food. As far as we know, the oxidized metal is not toxic, but it tastes horrible.
2	Contamination. Any open container of food can become contaminated when an airborne water droplet (tiny -- microns wide) containing a nasty microbe drips or settles into it. The major biological culprit here is Listeria, which can grow in any moist environment, including spaces refrigerated below 40F (5C). Also, if juices from your raw meat drips onto an upper shelf, which later gets wiped inadvertently into your container of ready-to-eat food, you are likely to get Salmonella or E coli. This risk can be mitigated if you keep your raw meats on the lowest shelf, but not eliminated. Also, it is worth noting that contamination through this pathway is a relatively rare event -- but even so, it is not worth the risk.
3	Have you ever put an ice cube in your beverage and notice your beverage tastes strange? The chemical compounds that give food their flavour tend to be volatile (meaning they will readily leave the food into the surrounding air). Also, the mustiness of a refrigerator/freezer is due to volatile compounds produced by mould and mildew. Foods that are wet and/or fatty can be molecular velcro to these compounds.

COOKING Cooking Safety Reheating

Reheating

Food which isn't consumed when cooked need to be stored correctly and then reheated when you wish to eat it. That's where this section comes in.

Simmer Reheating	
Microwave Reheating	
Heating in Cans	Cans could have an epoxy coating on the inside which when heated could melt and make its way into the food. Chromium and nickel can find their way out of steel, but the amounts would be miniscule to none. Aluminium-large amounts of which have been linked to nervous system disorders and other health problems could in theory leach out of cans into their food or drink contents. The insides of most cans on grocery shelves today are coated with food-grade epoxy. But these liners have been shown to contain Bisphenol-A (BPA) and other potentially harmful chemicals. Therefore it's recommended to tip the cans contents into another container before cooking.

Recipes

Step-by-step guides to cooking in the wild or homestead

"A joyful life is an individual creation
that cannot be copied from a recipe."
Mihaly Csikszentmihalyi

Introduction

This section contains tasty recipes divided into complexity based on food availability. For a list of what foods are likely to be common in SHTF, take a look at the "SHTF Food Rarity" section under "FOOD".

Purpose	The aim of RECIPES is to provide you with a range of foods you can cook regardless of your location or supplies. You'll find information on the staples of cooking such as bread, foraging recipes which you should be able to locally acquire from nature, homesteading recipes if you have an established farm and modern recipes which can draw from all of the ingredients available in supermarkets today.
Lost?	● For the cooking of food, see the COOKING section. ● If you're looking for eating all kinds of wild and foraged foods as well as the wild food edibility test, see the PLANTS section. ● If you're looking for the food groups, see the HEALTH section. ● If you want to know how to properly prepare wild game for consumption, see the FIELD DRESSING section. ● For a list of recommended foods and food storage, see the FOOD section.

Contents

1 Staple Recipes

These recipes are for the most basic items you can make such as bread.

Staples

Yeast

Yeasts are chemoorganotrophs, as they use organic compounds as a source of energy and do not require sunlight to grow. Carbon is obtained mostly from hexose sugars, such as glucose and fructose, or disaccharides such as sucrose and maltose. Some species can metabolize pentose sugars such as ribose, alcohols, and organic acids. Yeast species either require oxygen for aerobic cellular respiration (obligate aerobes) or are anaerobic, but also have aerobic methods of energy production (facultative anaerobes). Unlike bacteria, no known yeast species grow only anaerobically (obligate anaerobes). Most yeasts grow best in a neutral or slightly acidic pH environment.

Yeasts vary in regard to the temperature range in which they grow best. For example, Leucosporidium frigidum grows at −2 to 20 °C (28 to 68 °F), Saccharomyces telluris at 5 to 35 °C (41 to 95 °F), and Candida slooffi at 28 to 45 °C (82 to 113 °F). The cells can survive freezing under certain conditions, with viability decreasing over time.

In general, yeasts are grown in the laboratory on solid growth media or in liquid broths. Common media used for the cultivation of yeasts include potato dextrose agar or potato dextrose broth, Wallerstein Laboratories nutrient agar, yeast peptone dextrose agar, and yeast mould agar or broth. Home brewers who cultivate yeast frequently use dried malt extract and agar as a solid growth medium. The fungicide cycloheximide is sometimes added to yeast growth media to inhibit the growth of Saccharomyces yeasts and select for wild/indigenous yeast species. This will change the yeast process.

The appearance of a white, thready yeast, commonly known as kahm yeast, is often a byproduct of the lactofermentation (or pickling) of certain vegetables, usually the result of exposure to air. Although harmless, it can give pickled vegetables a bad flavor and must be removed regularly during fermentation

Ingredients	• Glass Container • Measuring Cup (1 Cup) • 1 Cup Flour • 2 Cups Warm Water
Making Yeast	1. Use a glass container with a covering that allows air in 2. Pour in 1 cup of warm water and add 1 cup of flour. 3. Stir and cover. 4. Wait 24 Hours. 5. Pour half the mixture out and add 1 cup warm water and one cup flour. Re-cover. 6. Repeat daily.
Yeast Outcomes	1. Nothing - Then move container near open window. 2. Mould develops - Smells wrong so throw it out. 3. Yeast grows - Smells good like bread or alcohol.
Proofing Yeast	Proofing ensures the yeast is alive and working. Combine yeast with a little warm water and sprinkle sugar and wait. 5-10 minutes later there should be some froth, if there's none the yeast isn't working.
Tips	• Use stored yeast to kick-start a new culture by putting it into an equal mix of water and flour. • Lactobactillus is the yeast starter for sourdough bread. • Use yeast that occurs in alcohol to leaven bread.

Bread

Ingredients	**Basic Ingredients** • Flour • Water • Yeast • Salt	**White Bread Ingredients** • 2 Tbsp Vegetable Oil • 2 Tsp Salt • 1 Cup Warm Milk • 1 Cup Warm Water • 1 Cup Warm Yeast • 1 Pk dry Yeast • 1/4 Cup Warm Water • 6 Cups White Flour		
Method	1. Proof the Yeast. 2. Combine hot milk and water and wait till cool. 3. Add Yeast. 4. Mix well. 5. Add 3/5 Flour and mix until well blended and not lumpy. 6. Add the rest of the flour until dough forms. 7. Knead Gently for 2 mins, adding remaining flour until no longer sticky. 8. Leave it for 10m under a wet cloth.		9. Knead until smooth and elastic. 10. Place in bowl with damp cloth. 11. Allow to rise, doubling in size. 12. Shape into loaves. 13. Place in loaf pans and cover with damp cloth and let it double again. 14. Bake at 218°C (425°F) for 15m. 15. Continue baking at 190°C (375°F) for 30m.	
Kneading	Folding the dough in half, pushing down and away. Rotate 90° then repeat. When ready the dough should be less sticky and won't cling to the surface.			

2 Foraging Recipes

These are very simple recipes that involve easily foraged ingredients.

Entrée

Buttered Chickweed Salad

	The freshness of chickweed combined with the healthy goodness of onions make this a great side dish to serve.			**Prep Time:** 5 Mins **Cook Time:** 5 Mins **Yields:** 2 Serves
Ingredients	• 2 cups chopped chickweed • 1 finely chopped onion • Butter (If desired) • Salt (If desired) • Pepper (If desired)			**Foraged Food in Recipe** • Chickweed

Method	**Instructions** Wash chickweed thoroughly and place in boiling salted water. Cook only for only two to three minutes, drain well. (Reserve the liquid to make a tea) Melt a small amount of butter in a frying pan. Sauté the onion until translucent then add chickweed. Add salt, pepper or any other spices. Sauté one minute.

Chickweed Salad

	A salad with the fresh, unique flavour of a tasty wild green.			**Prep Time:** 15 Mins **Cook Time:** 0 Mins **Yields:** 4 Serves
Ingredients	• 1 cup chickweed leaves • 1 bunch scallions or 1 small red onion finely sliced • 1 beet • Pinch of sea salt	• 3 tbsp. organic coconut oil • 2 tbsp. wine vinegar • 1/2 tsp. mustard of choice		**Foraged Food in Recipe** • Chickweed
Method	**Instructions** Rinse and drain chickweed. Thinly cut scallions. Grate a raw beet. Place in bowl. Combine the coconut oil, wine vinegar and mustard well then toss through salad. Sprinkle a pinch of salt over salt and enjoy.			

Nutricized Purslane

	A fresh tasting salad that is sure to please everyone.			**Prep Time:** 15 Mins **Cook Time:** 00 Mins **Yields:** 2 Serves
Ingredients	• 3 cups chopped purslane • 1 sliced hard-boiled egg • 1/2 cup pigweed (amaranth) leaves • 1/4 cup mozzarella cheese diced into small pieces	• 1 chopped onion • 1 cup chopped chickweed • 1 ripe avocado (peeled and diced) • 1 tsp garlic salt • Juice of 1/2 lemon	• Chia seeds or sunflowers seeds if desired	**Foraged Food in Recipe** • Purslane
Method	**Instructions** Place into a bowl the purslane, chickweed, pigweed and onion. Add the avocado and the egg. Mix in the cheese. Drizzle the lemon over the salad, add the garlic salt, and mix well. If desired sprinkle with seeds of your choice.			

Plantain Salad

	A refreshing and simple-to-make summertime salad that is sure to please everyone! This low-cost plantain salad packs a nutritional punch that your body will love.			**Prep Time:** 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 cups of plantain leaves finely chopped (Broadleaf or Narrowleaf Plantain) • ½ cup of cabbage finely chopped • 1 large can of chick peas (28 oz), drained	• 1 onion thinly chopped • 1 celery stalk finely chopped • 1 or 2 garlic gloves finely chopped • 1/8 cup olive oil • 1/8 cup wine vinegar • 1 tsp. salt		**Foraged Food in Recipe** • Broadleaf Plantain
Method	**Instructions** Mix all the above ingredients (except the oil and vinegar) in a large bowl and refrigerate. Once chilled, add the oil and vinegar. If you find the salad a bit dry, then increase the quantity of olive oil and wine vinegar equally until you have the desired moistness.			

Sesame and Wilted Green Sauté

	A quick sauté that is a powerhouse of nutrients.			**Prep Time:** 10 Mins **Cook Time:** 5 Mins **Yields:** 2 Serves
Ingredients	• 2 cloves of garlic, peeled and finely chopped • 2tbsp. sesame oil • 2 litres (8 cups) wild greens (possibilities: plantain, dandelion, lamb's quarters, mustard)	• 1 tbsp. tamari or soy sauce • 2 tbsp. orange juice • 2tbsp. toasted almonds • toasted sesame seeds for garnish		**Foraged Food in Recipe** • Broadleaf Plantain • Dandelion • Garlic Mustard • Lamb's Quarters
Method	**Instructions** In a heated skillet, sauté your choice of wild greens for two minutes with sesame oil. Add tamari (or soy sauce), orange juice and toasted almonds. Blend well. Remove from heat. Sprinkle toasted sesame seeds on top as a garnish and serve.			

Summer Salad

	A light salad with a big taste. This is a refreshing salad that has the perfect blend of flavours that's sure to please.			**Prep Time:** 15 Mins **Cook Time:** 0 Mins **Yields:** 2 Serves
Ingredients	• 1 sliced cucumber • 1/8 cup chopped purslane • 5 – 7 radishes (your choice), thinly sliced • 3/4 cup raisons	• 1/2 cup plain yogurt • 2 tsp finely chopped fresh mint • sea salt to taste		**Foraged Food in Recipe** • Purslane
Method	**Instructions** In a salad bowl combine all ingredients. Let sit in fridge 30 minutes before serving.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** ●			**Foraged Food in Recipe** ●
Method	**Instructions** o			

Mains

Baked Dandelion

	Baked dandelion leaves will have you re-thinking eating potato chips. Healthy, tasty, and so easy to make, dandelion chips are a great snack.			**Prep Time:** 5 Mins **Cook Time:** 10 Mins **Yields:** 00 Serves
Ingredients	● Fresh large dandelion leaves (washed and dried) ● 1 cup whole wheat flour ● 1 1/2 cup water ● 1 egg	● 2 tbsp. wheat germ ● 2 tbsp. spiked salt (or a variety of spices of your choosing)		**Foraged Food in Recipe** ● Dandelion
Method	**Instructions** Preheat oven to 204°C (400°F). Combine the flour, water, egg, wheat germ and spices into a bowl and mix well. Dip leaves into the batter and place onto a baking sheet lined with parchment paper. Be sure to not to overlap for best results. Bake 5 -10 minutes if the leaves used are very large. If the dandelion leaves are smaller then start watching them at about the 3-4 minute mark to ensure they do not burn. Serve warm or once cooled!			

Baked Plantain

	These plantain chips are simple to make and home grown! Loaded with nutrients, these chips are a great potato chip alternative.			**Prep Time:** 5 Mins **Cook Time:** 10 Mins **Yields:** 00 Serves
Ingredients	● Fresh large plantain leaves (washed and dried) ● 1 cup whole wheat flour ● 1 1/2 cup water ● 1 egg	● 2 tbsp. wheat germ ● 2 tbsp. spiked salt (or a variety of spices of your choosing)		**Foraged Food in Recipe** ● Broadleaf Plantain
Method	**Instructions** Preheat oven to 204°C (400°F). Combine the flour, water, egg, wheat germ and spices into a bowl and mix well. Dip leaves into the batter and place onto a baking sheet lined with parchment paper. Be sure to not to overlap for best results. Bake 5 -10 minutes if the leaves used are very large. If the plantain leaves are smaller then start watching them at about the 3-4 minute mark to ensure they do not burn. Serve warm or once cooled!			

Buffalo Style Milkweed Pods Recipe

	The vegetarian answer to buffalo style chicken wings.			**Prep Time:** 10 Mins **Cook Time:** 30 Mins **Yields:** 2 Serves
Ingredients	● 1 and 1/2 cup Panko (Japanese bread crumbs) (Or any other bread crumbs) ● 1/4 cup flour ● 1 tbsp. garlic powder ● 1 egg	● 1 tsp. of each: paprika, oregano, cayenne and turmeric ● 1/2 cup almond milk ● 1/2 cup water ● Hot wing sauce of your choice		**Foraged Food in Recipe** ● Milkweed
Method	**Instructions** Preheat oven to 176°C (350°F). Mix dry ingredients together. Mix egg, almond milk and water together then blend in dry ingredients. Mix well. Dip milkweed pods into batter and place on a baking sheet covered with parchment paper. Place in oven and cook for 15-20 minutes. When crisp take out and place in a bowl. Add in your favourite wing sauce (enough to evenly coat) and mix. Place milkweed pods back on the baking sheet and cook for an additional 10 minutes.			

Burdock Brown Rice and Mushroom

				Prep Time: 10 Mins **Cook Time:** 45 Mins **Yields:** 00 Serves
Ingredients	● 4 large mushrooms of your choice ● 1 tbsp. olive oil ● 1 medium burdock root ● Cold, salted water for soaking burdock root	● 2 cups cold water for cooking rice ● 1 cup long-grain brown rice ● 1 grated carrot ● 1/2 tsp. sea salt		**Foraged Food in Recipe** ● Burdock
Method	**Instructions** Preheat oven to 176°C (350°F). Cut mushrooms into small pieces. Scrub burdock and whittle into slivers – then place them into the cold, salted water. Soak for 5 minutes. Drain and place burdock into a pan with 2 cups water, olive oil, rice, mushrooms, carrots and salt. Bring to a boil while stirring occasionally. Remove from stove and place into a lightly greased casserole dish – cover and bake for 45 minutes. Remove from oven, uncover, fluff and let stand 5 minutes before serving.			

Cattail Rice

Cattail Rice				**Prep Time:** 5 Mins **Cook Time:** 5 Mins **Yields:** 00 Serves
Ingredients	● 1 tbsp. olive oil ● 1/2 cup peeled and chopped cattail shoots ● 1 cup chopped shallots ● 2 cloves chopped garlic	● 3 cups cooked brown rice ● 2 tbsp soy sauce ● 1/2 teaspoon cayenne pepper		**Foraged Food in Recipe** ● Cattail
Method	**Instructions** Heat the olive oil in a large skillet. Add the cattails, shallots and garlic and sauté for 5 minutes. Add the remaining ingredients and cook until the rice is hot. Stir frequently to prevent sticking.			

Chicken Weed Wrap

Chicken Weed Wrap	Fast, easy and tasty chicken wraps with fresh greens are sure to be a hit when you're tight on time.			**Prep Time:** 5 Mins **Cook Time:** 0 Mins **Yields:** 00 Serves
Ingredients	● 1 large whole wheat tortilla wrap ● 1 cooked breaded chicken finger (or 2 if they are small) ● 1 cup chopped greens	● Hot sauce and/or any other condiment you prefer ● Optional: grated cheese of your choice.		**Foraged Food in Recipe** ● Broadleaf Plantain ● Dandelion ● Garlic Mustard ● Lamb's Quarters ● Purslane
Method	**Instructions** Place one cup of chopped greens that grow in your garden such as: purslane, dandelion, garlic mustard, lamb's quarters, wild lettuce, red clover leaves, white clover leaves, plantain, etc., on your tortilla. If desired add in some fresh parsley, cilantro or any other herb. Place the cooked chicken strip on top. Add cheese if desired. Top off with your favourite hot sauce, dressing or other condiment. Wrap and enjoy!			

Dandelion Fritters

Dandelion Fritters	Enjoy the health benefits of dandelion flowers in a fritter batter with the spices you and your family love. Edible dandelion flowers are a fabulous way to add a touch of wild to your meal!			**Prep Time:** 10 Mins **Cook Time:** 10 Mins **Yields:** 4 Serves
Ingredients	● 4 cups of fresh picked (washed) dandelion flowers ● 2 cups flour ● 2 eggs ● 2 cups milk			**Foraged Food in Recipe** ● Dandelion
Method	**Instructions** Mix the milk, flour and eggs and beat until blended well. Warm some olive oil in a skillet on the stove (keep at medium heat). Holding the underneath of the flowers, dip into the batter until totally covered in the fritter batter then place into skillet, flower side down. Once they are brown, flip and brown the other side. If need be, continue flipping until the batter coating is light brown. Remove from oil and allow excess oil to soak onto a towel or paper towel. Eat plain or drizzle with maple syrup, honey, or even roll them in icing sugar while they are still warm. Be creative – add your favourite spices or herbs to the fritter batter!			

Dandy Pasta

Dandy Pasta	Pasta never tasted so good and so nutritious as well.			**Prep Time:** 15 Mins **Cook Time:** 15 Mins **Yields:** 2 Serves
Ingredients	● 2 cups of bowtie whole wheat pasta (or pasta of your choice) ● 2-3 cups of freshly picked (washed) dandelions with roots ● 1 large red onion	● 2 large cloves of garlic ● 1/4 cup butter ● 3 tbsp coconut oil ● 2 tbsp spiked salt (or 2 tbsp of spices of your choice - but go very easy on the salt!)		**Foraged Food in Recipe** ● Dandelion
Method	**Instructions** Cut dandelion roots from the leaves right at the top of the root so that the leaves stay intact (if using young shoots). Finely chop the roots. Finely chop the onion and garlic cloves. In a stove top frying pan (or wok) melt butter and coconut oil over low heat. Add spices and blend well. Add dandelion root, garlic and onions and allow to simmer 5-10 minutes. After simmering add drained pasta to the pan and stir well. Simmer 1-2 minutes. Add dandelion leaves and stir. Let simmer 1 minute and serve! (If using larger leaves you may want to increase the spices you use to help offset the bitter taste.)			

Fried / Baked Purslane

Fried / Baked Purslane				**Prep Time:** 5 Mins **Cook Time:** 15 Mins **Yields:** 00 Serves
Ingredients	● 1 cup of purslane ● Ground bread crumbs (fresh or use Panko for best flavour) ● 1/2 cup flour ● 1 egg			**Foraged Food in Recipe** ● Purslane
Method	**Instructions** Mix the purslane in a beaten egg and flour. Then cover the purslane with bread crumbs. Sauté the purslane in butter or coconut oil for about five minutes or until golden brown. Or if you prefer, bake in an oven at about 148°C (300°F) for about 15 minutes.			

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Grape Leaf Burritos

	Bean burritos wrapped in nutrient-dense grape vine leaves makes this meal a very healthy choice.				**Prep Time:** 20 Mins **Cook Time:** 15 Mins **Yields:** 2 Serves
Ingredients	• 10 large grapevine leaves • 1 can refried beans • 1 cup cooked quinoa • 4 onions finely chopped • garlic salt and pepper to taste	• taco seasoning to taste (homemade preferable) • spaghetti sauce • grated mozzarella and cheddar cheese			**Foraged Food in Recipe** • Wild Grape Vine
Method	**Instructions** Preheat oven at 350°F. Sauté three quarters of the chopped onions. In a bowl, mix the can of refried beans, the quinoa, sautéed onions, and taco seasoning. Cover a baking sheet with parchment paper. Place some of the burrito mixture in the centre of a grape leaf, roll and place on baking sheet with the folded side faced down. Repeat with the remaining leaves. Once arranged in two rows, spoon some spaghetti sauce over the folded leaves. Take the remaining onions and place them over the burritos. Sprinkle some grated cheese over the burritos then season with garlic salt and pepper. Bake 15 minutes.				

Lamb's Quarters Gnudi

	Gnudi is a fantastic dish that tastes incredible.				**Prep Time:** 15 Mins **Cook Time:** 35 Mins **Yields:** 4 Serves
Ingredients	• 1 cup chopped lamb's quarters • 1 cup cottage cheese • 1 egg • 1 cup flour • sea salt (to taste)	• 1/2 cup grated parmesan cheese • 4 tablespoons butter • Spice mixture – your choice			**Foraged Food in Recipe** • Lamb's Quarters
Method	**Instructions** Finely chop the lamb's quarters. Combine with the cottage cheese, egg, 3/4 cup of flour, sea salt and 1/4 cup of parmesan cheese. Mix well and form into dough. Knead and add rest of flour until it becomes a workable consistency. Don't overwork. Let sit 30 minutes. Break off small clumps of dough, roll in flour, and form into dumplings (about 2 " long and 1" wide). Boil water in a pot; add some salt and a few drops of oil. Once boiling, place the gnudi into water and let boil for about 7 minutes. Do not crowd the gnudi. Drain. Place in a fry pan with butter and brown. Sprinkle with the remainder of the parmesan cheese and spice mixture.				

Milkweed Rice

	Milkweed rice is a tasty, healthy and uniquely flavoured side dish that goes well with most meals.				**Prep Time:** 10 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 cup basmati rice • 1 cup vegetable stock (or make an herbal tea of your choice and use this) • 1/2 cup milkweed • flower buds (or flowers just as they bloom)	• 1/2 cup white wine • 3 cloves garlic (chopped finely) • 3 tbsp finely chopped yellow onions • 3 tbsp butter • 1 tbsp olive oil	• Grated Parmesan cheese (optional) • Sea salt and/or pepper to taste		**Foraged Food in Recipe** • Milkweed
Method	**Instructions** Place the vegetable (or herbal) stock and wine in a saucepan and add rice. Bring to a boil and reduce heat to simmer. Slightly cover rice and stir occasionally until all moisture is absorbed. Remove from heat, cover and let sit. As the rice is in the simmering stage, in a small skillet melt butter and the olive oil in your pan until melted, then add garlic and onions. Sauté for no more than two minutes, add flower buds (or fresh flowers) and sauté one more minute. Mix the sautéed mixture into the rice and let sit two minutes and serve. If desired add some Parmesan cheese, sea salt, and/or pepper.				

North African Style Purslane

					Prep Time: 10 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 3 cups steamed purslane • 2 chopped garlic cloves • 1/2 cup cilantro • 3/4 cup parsley • 1 tsp paprika	• 1 tsp chilli • 1 tsp cumin • Olives • Lemon juice of one lemon and its pulp • Coconut oil (about 2 tbsp)			**Foraged Food in Recipe** • Purslane
Method	**Instructions** In a frying pan melt the coconut oil. As it melts add in cilantro, parsley, chopped garlic and simmer over low heat for a few minutes stirring often. Add the purslane, paprika, lemon pulp and stir constantly for about 5 minutes. Add cumin and lemon juice. Stir well. Garnish with olives. This can be served warm or cold.				

Roasted Lambs Quarters

	Lamb's quarters stems are just as useful in the kitchen as the leaves and seeds. Roast the stems and enjoy these as a tasty treat.				**Prep Time:** 15 Mins **Cook Time:** 25 Mins **Yields:** 00 Serves
Ingredients	• 2 cups (soft) lamb's quarters stems chopped into pieces (about 6cm long) • 2 tbsp. flax seed oil (or oil of your choice) • Spices (as many as you like)	• garlic powder • black pepper • sea salt			**Foraged Food in Recipe** • Lamb's Quarters

Method	**Instructions** Wash the lamb's quarters stems and place into a bowl. Add the oil and spices and blend well. Place parchment paper on a baking sheet and evenly spread the stems on the sheet. Sprinkle with sea salt. Bake at 350°F until crispy (or to your liking). As some ovens differ in heat distribution, ten minutes may be sufficient depending on thickness of the stems. Check frequently to avoid burning them. I have suggested spices above but this is a recipe to can tailor to your taste preference. When cooked crispy, roasted lamb's quarters can be broken and added to salads for extra flavour!

Roasted Reed Rhizomes

				Prep Time: 10 Mins **Cook Time:** 25 Mins **Yields:** 00 Serves
Ingredients	● 12 phragmites rhizomes (at least 6" long) ● olive oil ● Sea salt and pepper (or other spices) to taste			
Method	**Instructions** After washing the phragmites rhizomes place them on a baking sheet. Or if you choose to, you can coat them with a tiny bit of olive oil and spices then place on a baking sheet. Bake at 350 degree Fahrenheit for 25 minutes.			

Salt and Vinegar Lambs Quarters

	This salt and vinegar recipe is a healthy alternative to regular salads. There is no going wrong when you serve lambs quarters.			**Prep Time:** 10 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	● 5 cups washed chopped lamb's quarter leaves ● 2 tbsp. raw apple cider vinegar ● 2 tbsp. olive oil ● 1/4 tsp. sea salt	● Optional: 2 tbsp. of any finely chopped fresh garden herb of your choice (rosemary, basil, thyme, mint, etc.)		**Foraged Food in Recipe** ● Lamb's Quarters
Method	**Instructions** Wash and chop greens and place into a bowl. Add all other ingredients and mix well. This can be eaten fresh or you can bake this for 20 minutes at 162°C (325°F). (Spread evenly on a baking sheet.)			

Stuffed Milkweed Pods

				Prep Time: 15 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	● 4 oz. cream cheese softened ● 1 tbsp. diced red onion ● 2 slices of cooked bacon ● 1 small jalapeno chopped fine ● Salt and pepper	● 20 milkweed pods, boiled and split ● Bread crumbs		**Foraged Food in Recipe** ● Milkweed
Method	**Instructions** Heat oven to 190°C (375°F). Place the softened cream cheese in a bowl and mix in the diced onion, jalapeno, bacon, salt and pepper. Remove the immature seeds and silk from the boiled milkweed pods, and spoon in about 2 tsp. of cream cheese filling until the pod is full. Roll the exposed seam of cream cheese in bread crumbs and place seam side up on a baking sheet covered with a sheet of parchment paper. Bake the stuffed pods for 15-20 minutes. Serve warm.			

Weed Burger

	Vegetarian burgers never tasted so good. Adding some wild greens into the mix boosts flavour and nutritional levels.			**Prep Time:** 10 Mins **Cook Time:** 10 Mins **Yields:** 8 Burgers
Ingredients	● 2 2/3 cups cooked quinoa ● 4 large eggs, beaten ● 1/2 teaspoon salt ● 3 cloves garlic finely chopped ● 1 onion finely chopped	● 3/4 cup gluten free whole grain breadcrumbs (or regular) ● 1 cup of finely chopped wild edibles of your choice ● 1 tbsp spices of your choosing		
Method	**Instructions** Combine the cooked quinoa, eggs, salt and spices in a large bowl. Stir in the onion and the garlic. Stir in the bread crumbs and wild edibles. Let the mixture sit for a few minutes so the crumbs absorb some of the moisture. Form into thick patties and cook in a frying pan 10 minutes (5 minutes each side) or a couple of extra minutes until slightly crispy on the outside. Use coconut oil (or butter) of your choice when cooking the burgers. Makes about 8 burgers. Serve as a burger or on its own with chickpea gravy.			

Wild Pizza

				Prep Time: 15 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	● Premade pizza shell or pita ● 8 cups of wild greens (packed tightly) ● 2 onions medium sized finely chopped ● 3 tbsp. olive oil or butter ● 1/2 cup sour cream ● 1 egg	● 1/4 teaspoon ground nutmeg ● Pinch ground cloves ● Pinch cayenne ● 1/4 cup grated parmesan cheese ● 2 cups grated mozzarella cheese		**Foraged Food in Recipe** ● Broadleaf Plantain ● Dandelion ● Garlic Mustard ● Lamb's Quarters

Method	**Instructions** (Recommended greens include: plantain, dandelion, wild lettuce, garlic mustard and lamb's quarters.) Preheat oven to 232°C (450°F). Chop greens and place in a small amount of water, boil until tender and wilted. Older greens may be boiled more than once in a change of water to lessen bitterness if desired. Drain well. Once cooled, squeeze out excess liquid. Sauté onions in oil or butter until soft. Add in greens and sauté about 5 minutes. In a bowl beat egg and sour cream. Add cloves, nutmeg, cayenne, parmesan cheese, sautéed onions and greens. Spread evenly on premade pizza shell or pita, leaving a small border around the edge. Sprinkle mozzarella cheese on top. Cook for 15 minutes or when cheese starts to bubble			

Wood Sorrel and Onion Tart

	If you like quiche then you'll love this wood sorrel, onion and wild green tart with feta cheese. This nutrient-dense quiche-like tart will have you going for seconds.			**Prep Time:** 15 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 tbsp. butter • 1/2 large (or one small) onion thinly sliced • 1/8 cup of dry white wine • 1/4 tsp. salt	• 1 tbsp. flour • 3/4 fresh wood sorrel leaves, flowers and pods (avoid tough stems) • 2 eggs • 1 cup heavy cream	• 6 freshly ground black pepper • 3/4 cup grated gruyere cheese • pinch of nutmeg • 1 pre-baked pie shell • pepper	**Foraged Food in Recipe** • Wood Sorrel
Method	**Instructions** Sauté onion in salt and butter slowly on medium-low heat until onions are soft. Raise the heat to medium and add the wine allowing it to evaporate. Add flour and stir well. Add sorrel and stir constantly for one minute. Remove from heat. In a large bowl whisk together the cream, eggs, pepper and nutmeg. Combine the sorrel mixture with the egg mixture and half of the cheese. Place the other half of the cheese evenly			

Yarrow Omelette

	So simple, tasty, and incredibly healthy, this yarrow omelette is easy to make. Within minutes you can be enjoying a very healthy breakfast or lunch.			**Prep Time:** 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 6 eggs • ¼ cup finely chopped yarrow • 1 small onion finely chopped • Salt and pepper to taste			**Foraged Food in Recipe** • Fern Leaf Yarrow
Method	**Instructions** In a mixing bowl beat eggs. Add in finely chopped yarrow and onion and blend well. Cook the omelette your favourite way then enjoy!			

Soups

B17 Soup

				Prep Time: 15 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	• 12 cups water • 2 or 3 cans of chick peas • 2 cups dried red lentils • 1 head of broccoli chopped fine (or more if desired)	• 4 cups chopped spinach • 2 large onions finely chopped • 3 tbsp (heaping) granulated garlic • 2 tbsp (heaping) turmeric • 2 tbsp (heaping) cumin	• (Optional) wildcrafted alfalfa (1/4 to 1/2 cup dried or fresh) • Salt and pepper to taste	**Foraged Food in Recipe** • Alfalfa
Method	**Instructions** Place lentils and water in a pot. Bring to a boil and immediately reduce temperature to medium. Stir often to ensure lentils do not stick to the bottom of the pot. Once the lentils are soft add all other ingredients and stir well. Let simmer 20 minutes. Add salt and pepper if desired.			

Burdock Root Soup

				Prep Time: 10 Mins **Cook Time:** 45 Mins **Yields:** 00 Serves
Ingredients	• Burdock root (8-12"), peeled and cut into 1.5 inch pieces. (Pre-soak in water 15 minutes) • 2 organic carrots, peeled and cut into thin pieces	• 6 honey dates cut up • 1/8 cup goji berries • 6 cups water • Spices of your choice		**Foraged Food in Recipe** • Burdock
Method	**Instructions** Put water and burdock root in a pot and bring to a boil. Let simmer 30 minutes. Add carrots and continue simmering for 45 minutes. Add in the dates and goji berries and simmer another 15 minutes. Season to taste with whatever spices you prefer then enjoy!			

Cattail Soup

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves

Ingredients	● 2 1/2 cups almonds ● 10 cups water ● 2 cups thinly sliced cattail shoots ● 1/4 cup fresh spearmint leaves or other mint leaves, finely chopped ● Juice of half a lemon			**Foraged Food in Recipe** ● Cattail
Method	**Instructions** Cover the almonds with water and soak overnight in the refrigerator. Puree the soaked almonds with about 3 cups of the almond/water mixture at a time in a blender until all the almonds have been pureed. Pour the puree into a colander lined with cheesecloth or thin nylon fabric over a bowl. Twist the top of the cloth and squeeze the remaining water. Discard the pulp and mix the remaining ingredients with the almond milk. Serve chilled.			

Fiddlehead Soup

	Mouth-watering soup that's easy to make and tantalizes the tastebuds.			**Prep Time:** 15 Mins **Cook Time:** 30 Mins **Yields:** 4 Serves
Ingredients	● 5 medium potatoes cubed ● 2 1/2 cups fiddleheads ● 1 cup chopped wild leeks ● 3 stalks of celery chopped ● 2 onions chopped	● 5 cups water ● 2 cups vegetable broth ● 4 cloves of fresh garlic minced ● salt and pepper to taste ● 1 to 2 cups cream (optional)	If wild leeks are not available then substitute them with a medium-large size onion. Make large batches of this and freeze so you can enjoy fiddlehead soup in the winter months!	
Method	**Instructions** Pour the water and vegetable broth into a large pot. Add the cubed potatoes, chopped celery, wild leeks, onions, garlic, salt and pepper. Bring to a boil then turn the stove down to simmer. Add fiddleheads. Simmer until the vegetables are soft. Put the soup mixture in a blender until desired consistency is reached. If you want to make this a creamy soup then return soup to the pot and slowly add cream until it is thickened.			

Lambs Quarters Soup

	A unique soup that is perfect for a warm summer's day.			**Prep Time:** 15 Mins **Cook Time:** 15 Mins **Yields:** 4-6 Serves
Ingredients	● 1 tomato cut in half ● 3 cups of water ● 2-3 cloves of garlic ● 1/2 of a juiced lime ● 1 tbsp. of olive oil	● 1 tsp. of honey or agave syrup ● 1/2 tsp. sea salt ● 2 cups freshly picked lamb's quarters (washed and chopped) ● 1/2 an avocado (chopped)	● 1 thinly sliced sautéed red pepper ● 1 chopped sautéed onion ● 2 celery stalks chopped thin and sautéed	**Foraged Food in Recipe** ● Lamb's Quarters
Method	**Instructions** Blend the first seven ingredients in blender until smooth. Pour in to a pot on the stove. Then add the last five ingredients. Simmer (do not boil) until onions celery are soft. Decorate with marigold or other edible flower petals and serve.			

Leek and Nettle Soup

	This health-nourishing nettle soup goes well with your favourite crackers or all on its own. One bowl is not enough of this easy-to-make, nutrient-rich soup.			**Prep Time:** 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	● 2 large (washed) potatoes cut up small with skin on ● 10 cups water ● 4 cups thinly sliced leeks ● 1/2 cup dried stinging nettle (or equivalent fresh)	● Handful of fresh finely chopped dandelions ● Handful of dried or fresh (washed) red clovers ● 2 tsp. of dried thyme (or equivalent fresh)	● 1 tsp. salt ● 1 tsp. pepper ● 3 tsp. garlic powder ● 3 tsp. dulce flakes (reserve one teaspoon for garnishing)	**Foraged Food in Recipe** ● Dandelion ● Red Clover ● Stinging Nettle
Method	**Instructions** In one pot bring potatoes to a boil. Once par-boiled, drain and rinse. In a large pot, pour in water, add stinging nettle. Bring to a boil. Lower temperature and add all remaining ingredients (including potatoes). Stir well. Simmer 30 minutes. Place soup mixture in a blender and turn on low for 10-20 seconds. Pour into bowls and garnish with dulce flakes. (Garnish with fresh parsley as well if you have it!)			

Stinging Nettle Soup

	A healthy soup that delivers great taste and loads of nutrients.			**Prep Time:** 15 Mins **Cook Time:** 45 Mins **Yields:** 4-6 Serves
Ingredients	● 4 cups young nettle leaves ● 4 cups spinach ● 4 cups chicken or vegetable stock ● 4 cold cooked sausages(vegetarian sausages can also be used)	● 3 tbsp. sour cream ● 3 tbsp. flour ● Salt and pepper to taste ● Cold milk		**Foraged Food in Recipe** ● Stinging Nettle
Method	**Instructions** Wash the nettle leaves after you have carefully taken them off the stems with thick protective gloves. Blanch the leaves and drain. Wash the spinach and add to the nettles in a saucepan. Pour hot stock over the nettles and spinach. Season and simmer for 45 minutes adding more stock if needed. Leave soup to cool and blend in blender. Mix the flour to a smooth paste with some cold milk. Add this to the soup and bring to a boil. Chop the sausages into small rounds and add to the soup. Swirl in the sour cream just before serving.			

Wild Leek and Potato Soup

	An aromatic soup that is simple to make and tastes fabulous.			**Prep Time:** 10 Mins **Cook Time:** 30 Mins **Yields:** 4 Serves

Ingredients	• 12 cups water • 10 cups cut up potatoes • 3 cups wild leeks • 2 tbsp granular garlic (or garlic to taste)	• Salt to taste		
Method	**Instructions** In a large pot cook the potatoes in the water until soft. Let cool. In a blender, purée in batches with the wild leeks. Return to stove and simmer 30 minutes. Add spices to taste.			

Yellow Rocket Soup

	This creamy soup provides a fresh taste to the palate and has a hint of mustard from the yellow rocket greens. A summertime soup that can be enjoyed with your favourite crackers or bread.			**Prep Time:** 10 Mins **Cook Time:** 20 Mins **Yields:** 2 Serves
Ingredients	• 2 cups yellow rocket leaves (chopped) • 3/4 cup chopped green onions • 2 cups vegetable broth • 2 cups milk • 2 tbsp coconut oil	• 2 tbsp flour • spices to taste		**Foraged Food in Recipe** • Yellow Rocket
Method	**Instructions** In a large saucepan sauté onions in coconut oil. Add flour and stir until thick. Add broth and the winter cress then let simmer for 15 minutes. Add milk and spices then simmer another 5 minutes.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Foraged Food in Recipe** •
Method	**Instructions** o			

Dessert & Snacks

Autumn Olive and Poppy Seed Cake

	This delicious autumn olive poppy seed cake with orange icing is moist and simple to make. It boasts a fresh orange flavour, along with the wonderful taste of autumn olive berries.			**Prep Time:** 15 Mins **Cook Time:** 60 Mins **Yields:** 1 Loaf
Ingredients	• 1 1/4 cup all-purpose flour • 1 tsp baking powder • 1/2 tsp salt • 1/2 cup sugar • Zest of 1 orange (save the juice) • 1/2 cup buttermilk	• 1/2 cup unsalted butter, room temperature • 1 tsp vanilla paste or extract • 1/2 teaspoon orange extract • 2 eggs	• 2 tbsp poppy seeds • 1/2 cup autumn olives, washed and separated from stem • 1/2 cup powdered sugar, sifted • 1 tbsp freshly squeezed orange juice	
Method	**Instructions** Heat the oven to 350°F. Grease and flour a 9"x5" loaf pan and set aside. Whisk the flour, baking powder, salt and set aside. Stir the sugar and the orange zest together until well-combined and fragrant. Using a stand mixer with a paddle attachment, cream the butter and sugar/zest mixture together until light. Add the vanilla and orange extracts. Add the eggs one at a time, mixing well until thoroughly incorporated, scraping down the sides of the bowl as needed. Add the flour mixture in two additions, alternating with the buttermilk. Add the poppy seeds. Process the batter until smooth, about 15-20 seconds. Fold in the red currants. To make the orange glaze, whisk the powdered sugar and orange juice until creamy. If needed, add more orange juice, a little at a time, until the correct consistency is achieved (thick, smooth, yet still liquid). Pour the batter into the pan and bake until the cake is firm and a tester inserted into the centre comes out clean, about 50-60 minutes. Cool for an hour and drizzle with orange glaze. Let glaze set before serving.			

Autumn Olive Cookies

	Autumn olive berries explode with flavour when used in cookies.			**Prep Time:** 15 Mins **Cook Time:** 15 Mins **Yields:** 12 Serves
Ingredients	• 1/2 cup butter • 1/4 cup organic cane sugar • 1/3 cup light or dark brown sugar • 1 egg • 1 tsp vanilla extract • 2 tbsp milk	• 1/2 tsp salt • 1/4 tsp baking soda • 1/2 tsp baking powder • 1 1/4 cups unbleached flour • 2 cups autumn olive berries		
Method	**Instructions** Preheat oven to 176°C (350°F). Line a baking sheet with parchment paper. Cream sugars with the butter. Add the egg, vanilla extract and milk then mix well. In a separate bowl combine all dry ingredients. Slowly add the wet mixture into the dry mixture and continue to stir until completely mixed. Once all ingredients are blended fold in the autumn olive berries. Drop by spoonful's onto the baking sheet leaving about 1" between cookies. Bake 12-15 minutes until thoroughly baked (test with a toothpick to ensure the centre is dry).			

Chewy Pine Granola Bars

	No need for supplements with these nutrient-dense granola bars. They are chock full of vitamins and minerals that your body needs.			**Prep Time:** 15 Mins **Cook Time:** 25 Mins **Yields:** 12 Bars
Ingredients	● 2 cups oatmeal ● 1 cup pine nuts (or almonds) crushed into small pieces ● 1 cup shredded coconut (sweetened or unsweetened) ● 3 tbsp + 1 tsp softened butter	● 1/4 cup yellow dock flour (or 1/8 cup dock flour + 1/8 cup pine needle flour) ● 1/4 cup wheat germ ● 1/8 cup hemp seeds ● 1/4 cup wild dried cranberries (or regular dried cranberries)	● 2/3 cup unpasteurized honey ● 1/4 cup brown sugar ● 2 tsp vanilla ● 1/2 cup dates ● 1/2 cup prunes ● 1/4 dried barberries (or raisins)	
Method	**Instructions** Preheat oven to 162°C (325°F). Stir the first three ingredients together then spread them over a parchment paper-lined baking sheet. Toast in the oven 5 minutes, mix around, and then toast another 5 minutes. Reduce oven heat to 300°F. Place in bowl being mindful of the heat. Add the wheat germ, yellow dock flour (and pine flour if using this) and hemp seeds. Mix well. In a small saucepan place the butter, sugar, honey and vanilla. Blend well and bring to a boil. Remove from stove and using a spatula, add to the dry mixture. Mix well. In a processor place the fruit. Process until the fruit is in small pieces. Add to the mixture and if necessary, use your hands to mix thoroughly. Place combined mixture into a parchment paper-lined glass oblong baking dish (9"x13"). Press the mixture into the dish until all corners are filled and the top is flat. Bake 25 minutes. Let cool at least 2 ½ hours until cutting into granola bar shapes. Will store in fridge 5 to 7 days.			

Coconut Pine Cookies

	Boreal forest meets tropical fruit in a shortbread cookie.			**Prep Time:** 10 Mins **Cook Time:** 12 Mins **Yields:** 60 Serves
Ingredients	● 3 cups unbleached flour ● 1 cup organic cane sugar ● 1/4 cup shredded sweetened coconut ● 10 tbsp pine powder ● 1/2 cup melted butter	● 3 eggs ● 1 tsp vanilla		
Method	**Instructions** Place all dry ingredients into a bowl. In another bowl blend together melted butter, eggs, and vanilla. Mix the wet ingredients into the dry ingredients and blend well. Roll cookie dough into balls about 3/4 the size of a golf ball and place on ungreased cookie sheet. Use a fork to flatten the cookies until they are about 1/4" thick. Bake at 176°C (350°F) for about 10-12 minutes. Makes about 5-6 dozen.			

Coltsfoot Sorbet

				Prep Time: 15 Mins **Cook Time:** 22 Mins **Yields:** 00 Serves
Ingredients	● 65 fresh coltsfoot flowers ● 1 cup organic cane sugar ● 3 1/3 cups water ● 1 tsp fresh squeezed lemon juice ● 1 egg white			**Foraged Food in Recipe** ● Coltsfoot
Method	**Instructions** Make sure you have only the yellow petals from 65 coltsfoot flowers. (Remove the petals by rubbing the flowers between your thumb and forefinger. Make sure there are no green sepals in with the petals.) Place the petals, sugar and water into a pan. Bring to a boil and cook for 2 minutes then remove from the heat and let steep for 20 minutes. Filter through a sieve and refrigerate the syrup until chilled. Add the egg white and whisk. Either place in an ice cream maker or in the freezer. As the sorbet churns, the egg white will trap air bubbles and this turns the sorbet white. If you have chosen the freezer method you will need to whisk briskly every five minutes for the first hour, then every fifteen minutes until the sorbet sets.			

Dandelion Banana Bread

				Prep Time: 15 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	● 3 large or 4 medium ripe bananas ● 1/2 cup organic canola oil (or a baking oil of your choice) ● 1 egg ● 1/3 cup organic cane sugar	● 1 cup buckwheat flour ● 1/3 cup fresh picked dandelion flower petals ● 1/4 cup wheat germ ● 1/2 tsp. (aluminium-free) baking soda		**Foraged Food in Recipe** ● Dandelion
Method	**Instructions** Mash the bananas then add the oil, egg and sugar, mix well. Stir in flour, wheat germ, dandelion flowers and the baking soda and mix until everything is perfectly blended. If desired, add in chopped walnuts or chocolate chips. Scoop into greased and floured muffin or loaf (bread) baking tins. Bake at 176°C (350°F) for 15-20 minutes. Check at the 15 minute mark by inserting a toothpick or knife – if it comes out clean then it is done.			

Dandy Muffin Tops

	Light, tasty, and packed with nutrients, these dandelion muffins have earned their name as being Dandy Muffin Tops. Enjoy worry-free snacking when dandelion muffins are in your kitchen.			**Prep Time:** 10 Mins **Cook Time:** 10 Mins **Yields:** 4-6 Serves

Ingredients	• 1.5 cups dandelion flowers (lightly packed) • 1 cup unbleached flour • 1 cup rolled oats • 1 cup apple sauce	• 2 eggs • 1/2 cup organic cane sugar • 1/2 cup melted coconut oil • 1 tsp vanilla extract • 1 tsp baking soda	Notes: • Dandelion flowers – when picking them, snip off the green sepal to ensure you are collecting mostly the yellow petals. Some green sepal matter is ok but keep it to a minimum as this can add a bit of a bitter taste to the muffin tops. • You can use sweetened or unsweetened apple sauce.	**Foraged Food in Recipe** • Dandelion
Method	**Instructions** Preheat oven to 350°F. In one bowl place all wet ingredients and mix with a blender for 20-30 seconds. In another bowl, place all dry ingredients and blend well. Slowly mix the wet ingredients to the dry and stir well until everything has blended thoroughly. Using a large soup spoon, scoop dough onto a parchment paper-covered baking sheet leaving about 1" between dough. Bake about 10 minutes until the middle it properly cooked - allow to cool.			

Elderflower Gelato

	Elderflower gelato is a refreshing treat to enjoy on a warm afternoon.			**Prep Time:** 5 Mins **Cook Time:** 10 Mins **Yields:** 6-8 Serves
Ingredients	• Pinch sea salt • 1/2 cup (144 g) sugar • 2 tbsp (21 g) superfine white rice flour • 2 1/2 cups (540 ml) heavy cream, divided • 1/4 cup (180 ml) elderflower cordial		Note: Regular rice flour is typically made by grinding medium- or long-grain rice into a powder. Superfine rice flour is made by grinding short-grain and/or sticky glutinous rice into a finer powder. This produces flour with higher starch content that will dissolve much easier, making it ideal for thickening liquids.	
Method	**Instructions** Prepare the ice cream machine by freezing the machine's ice cream bowl for 8 hours or overnight. To a medium saucepan, add the salt, sugar and rice flour and whisk to combine. Add 2 tablespoons (30 ml) of the cream and whisk to make an even paste. Over medium-low heat, start whisking in the rest of the cream and cook, stirring, for 3 to 5 minutes, until the mixture bubbles a little and it thickens a bit. Off the heat, whisk the cordial in and combine well. Pour the mixture into a bowl and cover it with plastic wrap so the mixture doesn't form a skin. Let this chill in the refrigerator for 8 hours or up to overnight. Pour the chilled mixture into the frozen ice cream bowl and let the mixture churn for 18 to 20 minutes or according to the manufacturer's instructions. Transfer the gelato to a freezer-proof container and let it chill for at least 4 hours.			

Gingerbread Mushrooms

	Enjoy these festive gingerbread mushrooms anytime of year when you get a hankering for wild mushrooms!			**Prep Time:** 3 Hours **Cook Time:** 36 Mins **Yields:** 16 Serves
Ingredients	• 1 cup shortening • 1 cup sugar (or organic cane sugar) • 1 cup dark molasses • 1/2 cup water • 5 cups unbleached flour	• 1 tsp. baking soda • 2 tsp. ginger • 1 tsp. allspice • 1/2 tsp. cinnamon • 1/2 tsp salt		
Method	**Instructions** Cream shortening and sugar. Blend in molasses and water. In a separate bowl blend all dry ingredients. Slowly mix the dry ingredients into the wet mixture until perfectly mixed. Cover; chill 2 hours. Heat oven to 190°C (375°F). Cut chilled dough into quarters. Roll dough onto pre-cut parchment paper (one quarter at a time – you will have to repeat this three more times) that fits onto a baking sheet. (So no flour is required during rolling, use another sheet of parchment paper and roll dough in between the two pieces.) Roll until about 1/8" thick. (This will not totally fill an average sized baking sheet.) Carefully lift the rolled dough on the parchment paper onto a baking sheet. Bake one baking sheet at a time for 9 or 10 minutes. Cool. Place pattern pieces onto cooled gingerbread and hold in place using thumbtacks. Using a sharp knife, carefully cut your pieces. Use royal icing and food colours and decorate your gingerbread mushrooms!			

Healthy Heart Vegan Hawthorn Cookies

	Enjoy a mouth-watering vegan cookie that contains wild edible hawthorn berries. Very healthy for your heart!			**Prep Time:** 15 Mins **Cook Time:** 10 Mins **Yields:** 12 Serves
Ingredients	• 1 cup gluten-free flour • 1/2 cup fresh hawthorn berries (then mash) • 1/2 cup almond butter • 1/4 cup organic cane sugar	• 3 tbsp almond milk • 1 tsp vanilla extract • 3/4 tsp baking soda • 1/4 tsp salt • Jam or jelly of your choice		**Foraged Food in Recipe** • Common Hawthorn
Method	**Instructions** Preheat the oven to 350°F and line a cookie sheet with parchment paper. In a large bowl, stir together the almond butter, coconut sugar, almond milk, vanilla extract, and optional stevia extract. In a small bowl, whisk together the flour, baking soda, and salt. Place the dry ingredients into the wet ingredients (which includes the hawthorn berry mash) and mix just until thoroughly blended. Create balls that are just slightly bigger than golf balls. Press the balls into patties and place them on a baking sheet. Use a small spoon to indent a thumbprint into the cookies. Reshape any large cracks that form on the edges of the cookie dough. Fill each thumbprint with a jam or jelly of your choice. (Cookies in the image contain autumn olive jam.) Bake for 9-11 minutes - be sure not to over bake. Cool thoroughly before enjoying!			

Honey Cattail Cookies

				Prep Time: 25 Mins **Cook Time:** 60 Mins **Yields:** 00 Serves

Ingredients	• 1 brown cattail • 2 cups coconut flakes (sweetened or unsweetened) • 2 cups oats • 1 tsp vanilla	• 3 tsp cinnamon • 1/2 cup honey • 4 tbsp coconut butter		**Foraged Food in Recipe** • Cattail
Method	**Instructions** Grind the cattail fluff with the oats to make the flour fluffy. Place in a bowl and add in the rest of the ingredients. Knead until thoroughly mixed and shape into cookies. Eat as is (raw) or dry in the oven at 150F for 1-2 hours. Bake about 1 hour at 176°C (350°F) or until a knife inserted in the centre comes out dry. Cool on a rack.			

Japanese Knotweed Bread

	Take a bite out of this invasive plant. This nutrient-dense bread is made with Japanese knotweed and it can be enjoyed as a breakfast bread or an anytime snack.			**Prep Time:** 15 Mins **Cook Time:** 60 Mins **Yields:** 1 Loaf
Ingredients	• 2 cups unbleached flour • 1/2 cup organic cane sugar • 1 1/2 tsp baking powder • 1/2 tsp salt • 1 egg	• 1/8 cup honey • 2 tbsp sunflower or safflower oil • 3/4 cup orange juice • 3/4 cup chopped walnuts • 1 cup puréed Japanese knotweed		
Method	**Instructions** Sift all dry ingredients together into a large bowl. In another bowl, beat the egg, oil, honey and orange juice. Add walnuts and purée to dry ingredients. Then add the moist ingredients. Blend only until all ingredients are moist. Spoon into a greased loaf pan.			

Lemon and Autumn Olive Tart

	An incredibly tasty and healthy lemon meringue-like pie. This is sure to become an autumn favourite.			**Prep Time:** 15 Mins **Cook Time:** 15 Mins **Yields:** 1 Pie
Ingredients	• 1 cup unbleached all purpose flour • 1/2 cup softened butter • 1/4 cup icing sugar • 2 large eggs • 1 cup organic cane sugar	• 1/2 tsp baking powder • 2 tbsp fresh squeezed lemon juice • 1 to 1 1/2 cups of autumn olive berries		
Method	**Instructions** Heat oven to 176°C (350°F). Thoroughly mix the flour, butter and icing sugar. Press in an ungreased pie plate or 8x8x2 baking pan. Build up the edges so that there is a half inch edge. Bake 15 minutes. Beat remaining ingredients except the berries. Be sure to beat minimum 3 minutes or until the mixture is light and fluffy. Fold in the berries. Pour over the cooked hot crust. Bake about 20 minutes or until no imprint remains when lightly touched. Cool thoroughly.			

No Bake Chocolate Seed Balls

	Loaded with Omega-3, fibre, calcium and magnesium, these no bake treats make a healthy anytime snack.			**Prep Time:** 5 Mins **Cook Time:** 0 Mins **Yields:** 4 Serves
Ingredients	• 1 cup pitted dates, finely chopped • 1/8 cup chia seeds • 1 tbsp hemp seed • 1 tbsp yellow dock seed (ground) • 1 tbsp cacao powder	• 2 tsp coconut oil • 2 tsp raw (or unpasteurized) honey • Shredded coconut (sweetened or unsweetened) for rolling.		
Method	**Instructions** Place dates and coconut oil in a food processor; process until you have fine, sticky crumbles. Add the cacao powder, honey and all seeds; pulse until well blended. Create small balls using the palms of your hands. Roll them in the shredded coconut. Store in the refrigerator for a maximum of 10 days.			

Nutty Plantain Snack

				Prep Time: 10 Mins **Cook Time:** 15 Mins **Yields:** 00 Serves
Ingredients	• 1 handful of plantain seed • 3 handfuls of pumpkin seeds • 3 handfuls of sesame seeds • Olive oil (enough to just cover the seeds) • Sea salt to taste			**Foraged Food in Recipe** • Broadleaf Plantain
Method	**Instructions** Place seeds into a bowl, add olive oil and salt. Be sure to coat all seeds. Either roast seeds in oven on a baking sheet at 148°C (300°F) for 10-15 minutes or roast them in a frying pan on the stove.			

Pine Cookies

	Pine needle cookies that taste great. No pine nuts are used in this recipe.			**Prep Time:** 10 Mins **Cook Time:** 12 Mins **Yields:** 60 Serves
Ingredients	• 3 cups unbleached flour • 1 1/2 cups organic cane sugar • 8 tbsp white or red pine powder • 1/2 cup melted butter • 3 eggs • 1 tsp vanilla			

Method	**Instructions** Place all dry ingredients into a bowl. In another bowl blend together melted butter, eggs, and vanilla. Combine the wet ingredients into the dry ingredients and blend well. Roll cookie dough into balls about 3/4 the size of a golf ball and place on ungreased cookie sheet. Use a fork to flatten the cookies until they are about 1/4" thick. Bake at 162°C (325°F) for about 10-12 minutes. Makes about 5-6 dozen. To make pine powder: Collect pine needles (still on the branches) and hang them in your home to dry (choose a dry area of your home). After 2-3 weeks (depending on moisture levels in your home) remove the needles from the branches (it is ok if little bits of branches get into the needles). Place the needles into a good quality coffee grinder or mixer and grind into powder!

Pine Muffins

	Pine trees provide us with great health benefits and when baked into muffins, those pine needles are simply mouth-watering.			**Prep Time:** 15 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	• 1 1/3 cups flour of your choice • 1 cup quick cooking rolled oats • 1/4 cup brown sugar • 1/2 cup raisins • 3 tbsp (heaping) pine powder	• 1 tbsp baking powder • 1 egg • 1 cup milk • 2 tbsp melted butter		
Method	**Instructions** Preheat oven to 375°F. Grease muffin tins. Combine the first 6 ingredients. Add egg, butter and milk then stir until the flour is moistened. Fill muffin cups 3/4 full. Bake 20 minutes or until an inserted knife comes out clean.			

Wild Chocolate Brownies

	Simple to bake, scrumptious gluten-free chocolate brownies you'll want to share. Loaded with wild goodness, you'll feel great knowing that these taste amazing and are healthy for you and your family.			**Prep Time:** 15 Mins **Cook Time:** 30 Mins **Yields:** 4-6 Serves
Ingredients	• 1 cup softened butter • 1 cup organic cane sugar • 1/2 cup gluten-free flour • 1/2 cup curly ground curly dock seed • 3/4 cup cocoa powder	• 4 eggs • 1 tsp. vanilla extract • 1/2 tsp. baking powder • autumn olive jam (or any homemade or store-bought jam if not available)		
Method	**Instructions** Preheat oven to 350°F. Line a baking pan (9x9in) with parchment or grease. Beat softened butter and sugar together until light and fluffy; then add eggs and vanilla. Blend flour, ground dock seed, cocoa and baking powder together. Slowly beat dry ingredients into the wet ingredients until well blended; about one minute. Spread mix in lined (or greased) baking pan (it will be thick). With a spoon, drop jam in various spots, carefully swirl jam with a knife across the surface mixing it just slightly into the brownie batter. Bake 25 to 30 minutes or until centre comes out clean with a knife. Sprinkle with icing sugar if desired. Cut into squares once cooled and enjoy!			

Wild Grape Chiffton

				Prep Time: 15 Mins **Cook Time:** 40 Mins **Yields:** 00 Serves
Ingredients	• 2-1/4 cups flour • 1-1/2 cups organic cane sugar • 1 tbsp baking powder • 1/2 tsp sea salt • 6 eggs, yolks and whites separated • 3/4 cup wild grape juice	• 2 tbsp crushed wild grapes (seeds removed) • 1/2 cup vegetable oil • 2 egg whites • 1/4 tsp cream of tartar		
Method	**Instructions** In large bowl, sift flour, 3/4 cup of the sugar, baking powder and salt. In separate bowl, whisk egg yolks, crushed wild grapes, wild grape juice, and oil; pour over flour mixture and whisk just until smooth. Set aside. In large bowl, beat 8 egg whites until foamy. Add cream of tartar; beat until soft peaks form. Beat in remaining sugar until stiff glossy peaks form; gently stir one-quarter into batter. Fold in remaining egg white mixture; scrape into a rectangular baking (cake) pan. Run spatula through batter to eliminate any large air bubbles; smooth top. Bake at 176°C (350°F) until a knife comes out clean when inserted (about 40 minutes).			

Wild Harvest Pie

	Go wild with a mouth-watering fruit-filled pie that's sure to have everyone asking for seconds. Served warm or cold, these healthy individual-sized fruit pies make a great grab and go snack!			**Prep Time:** 20 Mins **Cook Time:** 35 Mins **Yields:** 2 Pies
Ingredients	• 2 baked pie shells Filling: • 3 cups peeled, finely chopped apples (about 5 large) • 2 cups fresh (or frozen/thawed) finely chopped cranberries	• 2 cups elderberries (or another fruit of choice finely chopped) • 1/2 cup organic cane sugar • 1/4 cup spelt (or unbleached) flour • 2 teaspoons ground cinnamon '• 1/4 teaspoon ground nutmeg	Topping: • 1/4 cup spelt (or unbleached) flour • 1/3 cup packed brown sugar • 2 teaspoons ground cinnamon • 1/4 cup butter • 1/3 cup chopped pecans (optional)	

RECIPES | Foraging Recipies | Dessert & Snacks | Wild Harvest

Method	**Instructions** Heat oven to 190°C (375°F). In a large bowl, mix apples, cranberries and elderberries. In small bowl, mix remaining filling ingredients. Add dry ingredients to fruit and blend well. Spoon into pre-baked pie shells. In small bowl, mix all topping ingredients except butter and pecans. Soften butter then add to the mixture. Once fully blended add pecans. Carefully place the topping onto the fruit mixture. Take pieces of foil wrap and cover the crust edges of the pie so that they do not burn while baking. Bake 35 minutes or until the fruit is tender and the topping is golden brown. If desired, serve warm with whipped cream or ice cream. You can make this recipe using pre-baked tart pie shells. Topping can be optional.			

RECIPES | Foraging Recipies | Dessert & Snacks | Entree

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** ●			**Foraged Food in Recipe** ●
Method	**Instructions** ○			

RECIPES | Foraging Recipies | Dessert & Snacks | Entree

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** ●			**Foraged Food in Recipe** ●
Method	**Instructions** ○			

Beverages

Belgium Wild Beer

RECIPES | Foraging Recipies | Beverages | Belgium Wild Beer

	A wild beer that's sure to please all beer drinkers.			**Prep Time:** 45 Mins **Cook Time:** 10 Days **Yields:** 16 Serves
Ingredients	● 1 gallon water (3.75 L) ● 0.2 ounce (2 g) wormwood ● 0.2 ounce (2 g) common yarrow ● 0.5 ounce (6 g) fresh ground ivy (creeping charlie)	● 0.3 ounces (4 g) chopped dried dandelion roots ● 3-4 crushed stems bitter dock 3 to 4 inches (7.5 to 10 cm) long or 1 to 2 lemons	● 1 1/4 pounds (680 g) brown sugar ● Yeast (wild or commercial)	**Foraged Food in Recipe** ● Bitter Dock ● Common Yarrow ● Creeping Charlie ● Dandelion
Method	**Instructions** Place the sugar, wormwood, yarrow, dandelion roots and bitter dock stems into a large pot with water (cut and squeeze the lemons if you used them). Bring to a light boil for 30 minutes. Add the fresh ground ivy after 15 minutes of boiling. Remove from heat and strain the brew into the fermenter then add the yeast. Position the airlock or cover your fermenter with a paper towel or cheesecloth. Let the beer ferment for 10 days. Start counting when the fermentation is active (may take 2 to 3 days with a wild yeast starter). Siphon into swing-top bottles (16 oz - 500ml) and prime them with ½ teaspoon (2g) brown sugar for carbonation. Close the bottles and store somewhere not too hot. The beer will be ready to drink in around 3 weeks.			

Campfire Coffee

RECIPES | Foraging Recipies | Beverages | Campfire Coffee

	Basic coffee, not much more to say.			**Prep Time:** 5 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	● Coffee ● Water			
Method	**Instructions** Fresh ground coffee Bring water to boil; add fresh ground coffee; immediately remove from fire; pour from top.			

Burdock Tonic Tea

RECIPES | Foraging Recipies | Beverages | Burdock Tonic Tea

	This nourishing brew relaxes and provides you with lots of nutrients.			**Prep Time:** 5 Mins **Cook Time:** 30 Mins **Yields:** 1 Serve
Ingredients	● 1 tsp dried burdock root ● 1 tsp dried dandelion root ● 2 dried red clover flowers ● Dried peppermint leaves to taste			**Foraged Food in Recipe** ● Burdock ● Dandelion ● Red Clover

RECIPES | Foraging Recipies | Beverages

Method	**Instructions** Combine all the above ingredients and place into a large mug. Add boiling water and steep covered for 30 minutes. Strain, and enjoy. This tea helps to stimulate the kidney and liver functions and can possibly help to treat acne and eczema.

Elderflower Cordial

	Elderflower cordial is a classic summer beverage that is easy to make and tastes refreshing. Let your taste buds come alive with this fragrant drink.			**Prep Time:** 48 Hours **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	● 1kg (2 1/4 lbs) sugar ● 1.5 litres (6 cups) boiling water ● 4 lemons ● 30 large elderflower heads ● 55g / 2 oz citric acid			
Method	**Instructions** Place the sugar into a large Pyrex bowl. Pour boiling water over the sugar and stir until all the sugar has dissolved. Allow to cool. Grate the rind of the lemons with a fine grater then add to the sugar water. Slice the lemons and add to the sugar water. Add the citric acid and stir. Add the flower heads to the water and stir again. Cover and let steep for 48 hours. After 48 hours strain through a cheesecloth into a clean bowl. Using a funnel, fill sterilized bottles. Seal and store in a cool, dark place (not the refrigerator) for two to three weeks or freeze in plastic containers.			

Fire Cider

				Prep Time: 8 Weeks **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	● 4 cups organic apple cider vinegar ● 1/2 cup grated horseradish root ● 1/8 cup chopped garlic ● 1/2 cup of chopped onion ● 1/2 cup of grated ginger ● 1 tsp. fresh grated cayenne		Fire Cider Uses: Drink straight or mixed with some water or tomato juice. Drink a shot glass a day to help fight off many ailments. Add some honey to help ease a cough. Breathe in to ease a congested chest. Place some of the mixture on sore	
Method	**Instructions** Place all ingredients in a 4 cup (1 litre) mason jar and cover with apple cider vinegar. Cover tightly. Steep for 8 weeks. Strain into clean jar. Important: do not use a metal lid because the vinegar will corrode it. Use a plastic lid if possible or put a layer of cellophane between the jar and lid, then tighten the lid. Or better still, put a piece of plastic over the mouth of the jar and hold it tight with a rubber band. (If you use unpasteurized vinegar you may get a film that forms at the top of what is called, 'the mother'. Skim it off when you decant.)			

Healthy Heart Tea

	A pleasant tasting, nutritious and healthy tea that your heart will love!			**Prep Time:** 5 Mins **Cook Time:** 20 Mins **Yields:** 00 Serves
Ingredients	● Motherwort (1 teaspoon dried or 4-6 fresh leaves) ● 1/8 cup of hawthorn berries (fresh, crushed berries or a few berries with leaves as well)	● 2 thin slices of fresh ginger root ● 2 pinches of fennel seeds		**Foraged Food in Recipe** ● Motherwort
Method	**Instructions** Add all herbs into five cups of cold water in a saucepan. Bring to a boil over low heat, reduce heat, then simmer for 20 minutes. Let steep until cool enough to drink. Add honey or lemon to taste if desired. Yields just over 4 cups.			

Highbush Cranberry Juice

	Highbush cranberries, orange juice and maple syrup makes for a tasty drink that leaves you wanting more. Gathering berries in the winter months is a great way to enjoy the fruits of winter foraging.			**Prep Time:** 5 Mins **Cook Time:** 30 Mins **Yields:** 1 Serve
Ingredients	● 3 cups water ● 2 cups highbush cranberries (they can remain on the wooden umbels so long as they look healthy)	● 2 cups orange juice ● 1 tsp (pure) maple syrup		
Method	**Instructions** Bring water to boil then turn stove off. Place the berries into the water and slightly mash. Let sit 30 minutes. After 30 minutes, thoroughly strain. Allow this cranberry liquid to thoroughly cool. Once cool, add the orange juice and maple syrup; stir. Store in fridge up to 5 days.			

Milkweed Flower Cordial

	A unique floral taste with light, citrus notes, makes this an enjoyable summertime beverage.			**Prep Time:** 10 Mins **Cook Time:** 4-5 Days **Yields:** 8 Cup Serves
Ingredients	● 8 cups water ● 2 1/2 cups flowers ● 2 cups organic cane sugar (or white sugar)	● 2 sliced lemons ● 2 tbsp. white vinegar ● Mason jars		**Foraged Food in Recipe** ● Milkweed

Method	**Instructions** Pour water and sugar into a large bowl – be sure to dissolve sugar. Add in vinegar. Evenly divide the flowers and sliced lemons into 2 (or more) mason jars. Pour into jar(s) the water mixture. Let sit four days (out of direct sunlight) at room temperature and be sure to keep the lid loose. Stir (or tighten lid to shake) once daily then be sure you loosen the lid after shaking. After four days strain flowers and lemons. Seal jars for one day to build up carbonation. Keep in a bucket with a lid in the event it may explode. Strain to remove yeast. Refrigerate then enjoy! Optional: If you choose to, you can omit the carbonation step and simply strain and refrigerate after 4 days of infusing. It still makes a unique tasting beverage.

Mullein Tea

	Nourishing mullein tea can help quell the onset of a cough and is beneficial in many other ways. It is easy to make and nourishes your body.			**Prep Time:** 20 Mins **Cook Time:** 15 Mins **Yields:** 1 Serve
Ingredients	● 1-2 tsp of dried mullein leaves and/or flowers ● 1 cup boiling water			**Foraged Food in Recipe** ● Mullein
Method	**Instructions** Pour 1 cup of boiling water over the dried mullein flowers and leaves. Steep for 10 - 15 minutes. Pour the liquid through a cheesecloth or a coffee filter to strain out the plant's tiny hairs as they may irritate the throat. Mullein leaf tea has a soothing effect on the urinary tract and facilitates urination. It also eases a nervous, irritable bladder and incontinence. Prepare mullein tea as directed above (minus the mullein flowers) and drink 3 - 4 cups daily. (Be sure to ask your health practitioner first if this is suitable for your condition.)			

Purslane Smoothie and Popsicles

	Purslane smoothies nourish your body and satisfy your craving for something different. On a hot day, purslane smoothies or purslane popsicles will have you wanting more.			**Prep Time:** 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	● 1 1/2 cups pureed purslane with lemon juice ● 1 or 2 bananas ● 1 cup organic applesauce ● 1/4 cup 100% pure maple syrup			**Foraged Food in Recipe** ● Purslane
Method	**Instructions** Blend all ingredients until smooth. Pour any leftover smoothie into popsicle moulds and freeze. If you have hens and chicks (Sempervivum tectorum) these can be used instead of purslane.			

Red Clover Ice Tea

	Harvest and store red clover flowers so that you can enjoy this tasty, healthy ice tea any time of the year.			**Prep Time:** 10 Mins **Cook Time:** 60 Mins **Yields:** 8 Serves
Ingredients	● 12 red clover flowers (with leaves is fine) ● 8 cups water ● 3/4 cup organic can sugar (or sweetener of your choice) ● one half lemon, squeezed			**Foraged Food in Recipe** ● Red Clover
Method	**Instructions** Boil water in a saucepan, then remove from stove and allow to cool 10 minutes. Place red clover flowers in water; let infuse minimum 1/2 hour. (For a stronger flavour and more nutrients allow to sit 1-2 hours.) Strain, add sweetener of your choice and the fresh squeezed lemon juice. (The amount of sweetener can be reduced or increased based on your taste buds.) Place in ridge to chill then enjoy!			

Stinging Nettle Beer

	Stinging nettle beer can be an acquired taste, but knowing how high in nutrients this is makes home brewing well worth the time.			**Prep Time:** 3-5 Days **Cook Time:** 30 Mins **Yields:** 4 Litres
Ingredients	● 5 kg young nettle leaves ● 4 litres of water + 1/2cup boiled water cooled to about 25°C ● Fresh squeezed juice from 2 lemons and 2 oranges	● 1 cup of brown sugar ● 100g cream of tartar ● 1 sachet of wine yeast ● (For a more bitter beer add a large dandelion root)	● (For a more spicy beer add a large ginger root)	**Foraged Food in Recipe** ● Stinging Nettle
Method	**Instructions** Before hops were widely used in the 17th century all sorts of plants were used to make beer including nettles. Not only is nettle beer inexpensive to make, it is believed to help alleviate rheumatic pain, gout and asthma.			
Making Wort	Making the wort: Boil nettle leaves (and dandelion root (or) ginger root) in 4 litres of water for 30 minutes. Strain off the nettles (squeeze excess liquid) and save the liquid. Add lemon and orange juice, brown sugar and cream of tartar to the liquid. Pour mixture into a sterile container (fermenter) with lid. Cool to 20-27°C (68-80°F) overnight. Brewing: Sprinkle yeast into 1/2 cup of boiled water that has cooled down and wait for it to sink. Gently stir yeast and gently pour evenly into fermenter. Place lid on fermentation pail and wait 3-5days, or until foam has collapsed. For proper fermentation keep beer at a constant temperature between 20-27°C (68-80°F).			

Wild Grape Juice

				Prep Time: 2 Hours **Cook Time:** 10 Mins **Yields:** 00 Serves
Ingredients	• 2 cups wild grapes • 8 cups water • organic cane sugar to taste			
Method	**Instructions** Place grapes in a pot with the water. Bring to a boil then turn stove off. Mash the berries and let sit two hours. Strain and pour juice into a juice container. Sweeten to taste and chill.			

Yarrow Tea

	A slightly bitter tea that aids in digestion and helps to fight colds.			**Prep Time:** 5 Mins **Cook Time:** 10 Mins **Yields:** 1 Serve
Ingredients	• 1 tsp. of dried yarrow • 1 cup boiling water • Slice of lemon			**Foraged Food in Recipe** • Fern Leaf Yarrow
Method	**Instructions** Add the dried yarrow in a mug of boiling water and allow to steep minimum 10 minutes. Strain leaves. Add honey to sweeten if desired or a slice of lemon. Alternative method: Add 2 fresh large Yarrow leaves to a cup of boiling water and let steep minimum 10 minutes. Remove leaves then if desired, add honey to sweeten or a slice of lemon.			

Frying Pan Cookies

				Prep Time: 5 Mins **Cook Time:** 10 Mins **Yields:** 36 Serves
Ingredients	• 2 Eggs, unbeaten • 1 c Sugar* • 1 1/2 c Dates, chopped • Salt			
Method	**Instructions** Cook over a low heat for 10 minutes, stirring constantly. Remove from stove and add 2 cups of Rice Krispies. Roll in balls and dip in coconut. *Would recommend from nil to 1/2 c sugar. Dates, coconut and Rice Krispies supply sufficient sweetener.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Foraged Food in Recipe** •
Method	**Instructions** o			

3 Homestead Recipes

These recipes are more complex than the foraging recipes as they require either purchasing the ingredients or having an established homestead to make them yourself.

Entrée

Dutch Oven Bisquits

				Prep Time: 15 Mins **Cook Time:** 10 Mins **Yields:** 00 Serves
Ingredients	• 2 c Flour • 1/2 ts Salt • 3 ts Baking powder • 4 tb Solid shortening • 1 c Milk (diluted canned ok)			**Grown Food in Recipe** •

Method	**Instructions** Blend flour, salt, baking powder and mash in shortening with a fork until crumbly. Add milk and stir until the dough sags down into trough left by spoon as it moves around the bowl. Turn dough out on a floured surface, knead for 30 seconds, pat out gently until it is 1/2 inch thick. Cut with a round cutter or pinch off pieces of dough and form by hand. Put bisquits into a greased Dutch Oven, cover, and bury in bright coals for 5 or 10 minutes or until golden brown.

Egg in a Nest

(Toad in a Hole)				**Prep Time:** 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 Slice of bread • 1 Egg			**Grown Food in Recipe** •
Method	**Instructions** Make a hole in the centre of the slice of bread and place in frying pan and break egg in the centre of the hole and leave to cook.			

Camping Seasoning Mix

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1/3 c Salt • 1 tb Paprika • 1 tb Garlic Powder • 2 ts Onion Powder • 1/2 ts Cayenne or substitute Curry • 1/2 ts Pepper			**Grown Food in Recipe** •
Method	**Instructions** Mix well and store in a double zip-lock bag or a good screw-top container.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Grown Food in Recipe** •
Method	**Instructions** o			

Mains

Nettle Ravioli in Nettle Pasta

	Nettles are a traditional springtime food wherever they grow. There is a reason for this. Despite their ferocious stingers, stinging nettles are incredibly high in vitamins C, D, iron, potassium, manganese, and calcium. Nettles are unusually high in protein for a green plant, and are usually pretty common in cool, wet weather. Many, many cultures turn to nettles to break the nutritional privations of winter, when few green things are available. This is what happened in Italy's alpine regions, among other places. This is a bit of a project. While it doesn't take that long, the process of making the pasta and then the ravioli requires a few hours — too much for a weeknight. But once you make them, you can freeze the ravioli for later in the week. To properly do this, arrange the finished, uncooked ravioli on a baking sheet that has been dusted with semolina or cornmeal. Put the baking sheet into the freezer. When the ravioli have frozen solid, about 2 hours, you can move them to a freezer bag and store that way. They will keep for about 2 months; after that, they get brittle. Serve these ravioli with simple, high-quality butter, fresh ground black pepper and some grated dry cheese. A Tocai Friulano or other big white wine would be an ideal accompaniment.			**Prep Time:** 3 Hours **Cook Time:** 10 Mins **Yields:** 35-40 Ravioli
Ingredients	• 1 batch stinging nettle pasta • 2 cooked Yukon Gold or other waxy potatoes, about 8 ounces • 4 ounces mascarpone	• 4 ounces blanched stinging nettles, about a cup • Salt and pepper		**Grown Food in Recipe** •
Method	You will want to start the process by making the pasta. Instructions for doing so are here. While the pasta dough is resting, make the filling. To make the filling, you will need two or three big tong-fulls of fresh nettles to get your 4 ounces. I say tong-fulls because you do not want to pick up fresh nettles, as they will sting you. Get a large pot of water boiling and add a handful of salt. Grab the nettles with tongs and put them into the boiling water. Stir around and boil for 1-3 minutes, depending on how old the nettles are. Fish them out with a skimmer or the tongs and immediately dump them into a big bowl with ice water in it. Once they are cool, put them in a colander to strain. Get a cloth towel, like a tea towel, and put the nettles in it. Wrap one end of the towel one way, then the other end of the towel the other and squeeze out as much moisture as you can. Chop the nettles finely — don't use a food processor or you will get a mush. In a bowl, mash the potatoes, mascarpone and nettles into a cohesive paste. Again, not a food processor! Do this by hand, as it is important for the texture. Taste it and add salt and pepper to your liking. If you want, a little nutmeg is good, too.			

RECIPES	Homestead Recipies	Mains	Nettle Ravioli in Nettle Pasta		
				Method	Roll out your pasta dough. Cut the dough ball into 4 to 6 equal pieces. Keep each piece covered in plastic or under a tea towel until you need it. Using a pasta maker, roll the dough into long sheets at least 2 inches wide. Roll them very thin: I go to No. 8, which is the second-thinnest on my Atlas. Lay the sheets down on a work surface (I use a large maple board) and place about a heaping teaspoon of filling on each one, at least 2 inches apart. Cover them with another piece of the dough. As you are laying the second piece of dough down, carefully press it to remove any trapped air. Start from one end of the sheet and work toward the other. It takes practice to do this seamlessly, and I don't always get every ravioli right. Cut each ravioli out with a circle cutter or a wineglass. Of course, you can also use a standard ravioli mould or cut them into squares with a ravioli cutter. When each ravioli is finished, lay it out on a well floured board to dry a bit. Repeat this with the rest of the dough.
				Method	You can let the ravioli sit out for a couple hours, but for more than that you should refrigerate them. Don't refrigerate for more than 8 hours, though, or the filling will destroy the ravioli. If you need to store them for any length of time, freeze them according to the instructions above. To cook the ravioli, bring a large pot of water to a boil and salt it well; it should taste of the sea. While the water is heating, melt some butter or olive oil in a large sauté pan set over medium-low heat. Add some minced garlic if you'd like. Don't let the garlic brown, though. Boil the ravioli for 2 to 3 minutes, or about 90 seconds after they start to float to the top. Move them to the sauté pan and toss to coat with the butter. Serve at once with freshly ground black pepper and grated pecorino or parmesan cheese.

Hot Dog Surprise

RECIPES | Homestead Recipies | Mains | Hot Dog Surprise

				Prep Time: 5 Mins **Cook Time:** 45 Mins **Yields:** 00 Serves
Ingredients	● 10 x Hot Dogs ● American cheese (or boutique brand Wisconsin cheddar sliced into hot dog-length fingers ● 10 sl Bacon ● Hot Dog Buns			**Grown Food in Recipe** ●
Method	**Instructions** At home or on the road, cut a deep slit in each wiener, and stuff with fingers of cheese. Then wrap on the diagonal, like an old bias-ply tire, with the bacon. Seal individually in foil. These are great for stuffing into those odd places on the engine where you can't fit a turkey or a suckling pig. Cook about 45 minutes, or until cheese is melted and bacon is somewhat crisp.			

Campers Pizza Pie

RECIPES | Homestead Recipies | Mains | Campers Pizza Pie

				Prep Time: 00 Mins **Cook Time:** 10 Mins **Yields:** 00 Serves
Ingredients	● 1 lb Wheat bread ● 1/4 lb Mozzarella cheese pizza or spaghetti sauce Pepperoni			**Grown Food in Recipe** ●
Method	**Instructions** Using a pie iron, take two slices of bread, put 1 1/2 tablespoons pizza sauce on one slice of bread. Top with Mozzarella cheese and sliced pepperoni. Place other side of bread on top and butter outer sides of bread. Put sandwich into pie iron and place in coals of fire. Cook until bread is toasted.			

Buttermilk Biscuits

RECIPES | Homestead Recipies | Mains | Buttermilk Biscuits

				Prep Time: 15 Mins **Cook Time:** 15 Mins **Yields:** 00 Serves
Ingredients	● 1/4 cup shortening ● 1/4 teaspoon baking soda ● 2 cups self-rising flour ● 3/4 cup buttermilk			**Grown Food in Recipe** ●
Method	**Instructions** Cut shortening into flour. Stir soda in milk and pour into flour and shortening. Stir until well blended. Pour out onto a floured surface and knead 12 to 15 times. Roll out and cut. Place on a baking sheet and bake at 450 degrees F. until brown.			

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RECIPES | Homestead Recipies | Mains | Gorp

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	● 1 c Corn syrup or molasses or Honey ● 3/4 c Milk powder ● 1 c Oatmeal ● 1/2 c Peanut butter ● 1/2 c Chocolate chips	● 1/2 c Wheat Germ ● 1/2 c Crushed peanuts ● 1/2 c Raisins		**Grown Food in Recipe** ●
Method	**Instructions** Mix all the ingredient thoroughly. Roll into balls and each in a small piece of wax paper, twisting ends and chill.			

Sauerkraut

		Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves

RECIPES | Homestead Recipies | Mains | Sauerkraut

Ingredients	• 1 qt Sauerkraut • 1 ea Onion, chopped • 1 t Caraway seeds • 2 T Butter • 1 ea Potato, grated			**Grown Food in Recipe** •
Method	**Instructions** Melt the butter and add the onion and cook until brown. Add the sauerkraut and cook for 8 minutes. Add the caraway seed and potato, cover with boiling water and cook for 30 minutes in an uncovered vessel over a slow fire. Cover the kettle and cook 30 minutes longer. Brown sugar or an apple may be added to give different flavour.			

Corned Beef & Cabbage

RECIPES | Homestead Recipies | Mains | Corned Beef & Cabbage

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 lb Well trimmed corned beef boneless brisket or round • 1 sm Head green cabbage, cut into • 6 Wedges • 6 md Carrots cut into quarters	• 1 sm Onion, quartered • 1 Clove garlic, crushed		**Grown Food in Recipe** •
Method	**Instructions** Pour enough cold water on corned beef in Dutch oven to just cover. Add onion and garlic. Heat to boiling, reduce head. Cover and simmer until beef is tender, about 2 hours. Remove beef to warm platter, keep warm. Skim fat from broth. Add cabbage and carrots, heat to boiling. Reduce heat and simmer uncovered 15 min.			

Roast Corn

RECIPES | Homestead Recipies | Mains | Roast Corn

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 Ears or corn • Salt and pepper • Butter • String			**Grown Food in Recipe** •
Method	**Instructions** Peel ears leaving husks on at bottom and remove corn silk. Replace husks covering ears and tie around top. Dip corn in salt water. Place corn on screen over hot coals and turn often until all side are done. When cooked remove husks and add salt and pepper and margarine.			

Onion Swiss Steak

RECIPES | Homestead Recipies | Mains | Onion Swiss Steak

				Prep Time: 00 Mins **Cook Time:** 120-180 Mins **Yields:** 00 Serves
Ingredients	• 3 lb Round steak, 3/4" thick • 1 1/2 ts Salt • 1/4 ts Pepper • 2 pk Onion soup mix • 2 cn (10 oz) tomatoes			**Grown Food in Recipe** •
Method	**Instructions** Cut steak into serving pieces, season with salt and pepper and place into Dutch oven. Sprinkle onion soup mix over top and pour tomatoes over all. Cover and cook over slow fire for 2 to 3 hours or until meet is done and tender.			

Sticky Bones

RECIPES | Homestead Recipies | Mains | Sticky Bones

				Prep Time: 00 Mins **Cook Time:** 20 Mins **Yields:** 4-5 Serves
Ingredients	• 1 c Vinegar • 1/2 c Honey • 2 T Worcestershire sauce • 1/2 c Ketchup • 1 t EACH salt, dry mustard, paprika	• 1/4 t Black pepper • 1 Clove garlic, minced • 4 lb Beef ribs		**Grown Food in Recipe** •
Method	**Instructions** In saucepan, combine vinegar, honey, Worcestershire, ketch- up, salt, mustard, paprika, pepper, and garlic. Cover, bring to boil, reduce heat and simmer 15 minutes. In baking pan, place ribs. Cover with hot marinade, then bake ribs at 325 degrees for 1 hour, turning and basting often with marinade. Or grill over medium coals, basting and turning often, until browned, about 20 minutes.			

Meat Loaf

RECIPES | Homestead Recipies | Mains | Meat Loaf

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 1/2 lb Ground beef • 3/4 c Quick oats • 1 Eggs • 1/4 ts Dry mustard • 1/4 c Bell pepper	• 1 pk Onion soup mix • 3/4 ts Salt • 1/8 ts Marjoram		**Grown Food in Recipe** •
Method	**Instructions** Mix all ingredients and put in casserole pan. Place in Dutch oven. Bake 1 hour, covered.			

Great Outdoors Potatoes

RECIPES | Homestead Recipies | Mains | Great Outdoors Potatoes

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 6 Potatoes • 1/4 c Olive oil • 2 ts Lemon juice • 1 ts Dijon mustard • 1/2 ts Coriander	• 1/2 ts Fresh ground pepper • 1 ts Minced onion • 1 Pureed garlic clove . • 1 ts Paprika		**Grown Food in Recipe** •
Method	**Instructions** Scrub potatoes and cut into quarters, keeping skins on. Boil until tender, and coat them with the dressing which you can prepare in advance. Wrap the potato quarters in tin foil, and place on coal to brown. Delicious with meat or fish.			

Foiled Burgers

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 lb Ground beef • 4 Squares heavy duty foil (16x16 inches) • 4 Carrots; chopped • 1 cn New potatoes; sliced (16oz)	• 2 sm Green peppers; chopped • Dehydrated onion flakes • Worcestershire sauce • Salt & pepper to taste		**Grown Food in Recipe** •
Method	**Instructions** Separate the meat into 4 portions. Place each portion in the centre of a aluminium foil square. Top with equal portions of chopped carrots, potatoes and bell peppers. Season with dehydrated onion flakes, Worcestershire sauce, salt and/or pepper to suit your taste. Seal the foil, check for leaks. Place on the coals for 10 to 15 minutes per side.			

Flank Steak Teriyaki

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 4 - 6 flank steaks • 1 tb Salad oil • 1/4 c Sugar • 1 ts Ginger • 1/2 ts MSG	• 4 - 6 pineapple slices • 1/2 c Soy sauce • 2 tb Sherry (optional) • 1 Clove garlic, crushed.		**Grown Food in Recipe** •
Method	**Instructions** To form marinade, combine all except steaks and pineapple. Mix well and pour over steaks. Let marinate 1 to 1-1/2 hours. Fry steaks in very hot oven or skillet brushing once with marinade. Add pineapple during last few minutes, brush with marinade and cover. Cook 3-5 min. Serve over rice.			

Venison Goulash

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 tb Oil • 1 1/2 lb Venison, from neck, flank, Shanks, cut into cubes 1 to 1 1/2 inches • 3 md Onions, very thinly sliced • 2 tb Paprika	• 1 ts Salt • 1 md Green Bell pepper, thinly • Sliced, seeds & pith removed • 1/2 c Water		**Grown Food in Recipe** •
Method	**Instructions** In a Dutch Oven, heat oil and brown venison, stirring often. Add the onions, sprinkle with paprika and salt while stirring, sauté over med heat until onions are soft. Put in the green pepper and water, cover the Dutch Oven but do not put coals on top. Cook 1 to 1 1/2 hours, until the venison is fork tender. Traditionally Goulash is served with broad noodles.			

Pork Chops & Garden Vegetables

				Prep Time: 15 Mins **Cook Time:** 45 Mins **Yields:** 00 Serves
Ingredients	• 6 (1" thick) pork chops • 3 Carrots, cut 1/2" slices • 3 sm Potatoes, peeled, 1/2" cubes • 1 ts Basil • 1 1/2 c Fresh green beans, cut	• 6 (1/4 oz) instant onion soup mix 2 c water • 3 tb Butter, melted		**Grown Food in Recipe** •
Method	**Instructions** Brown chops on both sides in butter in bottom of oven, drain. Place vegetables in bottom of oven and replace chops on top. Combine dry soup mix and water, mixing well. Pour over chops and bring to a boil. Cover and reduce heat, simmer 45 min or until chops are tender.			

Campfire Meatloaf

				Prep Time: 10 Mins **Cook Time:** 60 Mins **Yields:** 00 Serves
Ingredients	• 1 1/2 lb Ground beef • 3/4 c Quick oats • 1 Eggs • 1/4 ts Dry mustard • 1/4 c Bell pepper	• 1 pk Onion soup mix • 3/4 ts Salt • 1/8 ts Marjoram		**Grown Food in Recipe** •
Method	**Instructions** Mix all ingredients and put in casserole pan. Place in Dutch oven. Bake 1 hour, covered.			

Grilled Sausage & Sweet Mustard in Tortillas

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 lb Hot or sweet Italian sausage or Spanish choriza* • 1 c Hearty red wine (such as Italian Barolo or Spanish R10ia) • 9 8-inch flour or 6-inch corn tortillas • Honey mustard** or Dijon mustard			**Grown Food in Recipe** •
Method	**Instructions** Place sausage in single layer in 9-inch skillet. Pour wine over sausage. Bring to boil. Reduce heat, cover partially and simmer until sausages are cooked through, turning frequently, about 12 minutes. Remove sausage from pan and cool slightly. Discard liquid. (Can be prepared 1 day ahead. Cover tightly and refrigerate. Bring to room temperature before continuing.) Prepare barbecue (medium-high heat). Cut sausages into 1/2-inch slices. Thread slices on long metal skewers, using 3 to 4 skewers. Cut tortillas into quarters and wrap in foil. Place tortillas on side of grill to heat through. Grill sausage until heated through and charred on all sides, about 5 minutes. Remove sausage from skewers and place in serving bowl. Serve sausage with tortillas and mustard. *A fresh pork link sausage flavoured with garlic and spices, and milder than Mexican chorizo. Spanish chorizo is available at Spanish markets.			

Honey Mustard Grilled Chicken

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 lb Boneless chicken parts (may use bone in parts) • 2 tb Honey • 2 tb Dijon mustard • 2 tb Melted margarine	• 1 ts Basil Leaves • 1/2 ts California Style Blend Garlic Powder		**Grown Food in Recipe** •
Method	**Instructions** Preheat grill for direct-heat cooking. Place chicken on grill rack. Combine remaining ingredients. During last 3-4 minutes per side of grilling time, brush chicken with sauce.			

Pizza Baby

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• Biscuit mix • Part of can of tomato soup • Parmesan cheese • Cold meats • Chopped green pepper	• Oregano • Seasoning		**Grown Food in Recipe** •
Method	**Instructions** Mix pizza dough and shape into a shallow dish about 12 cm across. Spoon soup into dish and top with other ingredients Place in a double wrap of heavy aluminium foil. Cook in hot coals or on rack over hot coals close to the heat.			

Foiled Chicken

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 sm Green pepper; chopped • 1/2 sm Red pepper; chopped • 10 Mushrooms; chopped • 4 lg Chicken breasts • 1 cn Pineapple slices (8oz)	• Non-stick cooking spray *or* 1 tsp butter • Garlic powder, salt and/or pepper to taste . • 4 Squares heavy duty foil (16x16 inches)		**Grown Food in Recipe** •
Method	**Instructions** Divide the bell peppers and mushrooms into 4 equal parts. Coat a small area in the centre of the foil with cooking spray or a small amount of butter. Place a portion of peppers and mushrooms on the greased area of the foil. Top with a chicken breast and a pineapple slice. Season with garlic powder, salt and pepper to your taste. Fold the foil securely and check for leaks. Place on the coals for 10 to 15 minutes per side.			

One Pan Breakfast

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 3 sausage links • 3 eggs • 1/2 spud • 1/4 cup shredded cheese • 3 tablespoons milk			**Grown Food in Recipe** •
Method	**Instructions** Dice sausage links and cook until done, setting aside drippings. Dice the spud into small hash size pieces, cook in drippings until done (not crispy)and drain. Beat eggs and milk and add to spuds. Cook to a soft scramble, add cheese and sausage. Cook until cheese is melted. Serve with cold milk and toast. Serves one.			

20 Minute Hamburger Skillet Stew

RECIPES | Homestead Recipies | Mains | 20 Minute Hamburger St

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1/4 lb Lean ground beef • 1 lg Onion, sliced wafer-thin • 4 Carrots, sliced wafer-thin • 2 Potatoes, halved, sliced wafer-thin • 3 Ribs celery, sliced wafer-thin	• 1 c Boiling water • 2 t Beef extract OR bouillon • 2 Bay leaves • 1/4 t Dried thyme • Salt OR garlic salt	• Pepper 1/4 c Dry red wine OR tomato juice • 2 T All purpose flour	**Grown Food in Recipe** •
Method	**Instructions** Use melon baller and shape meat into tiny meatballs. Brown in skillet. Discard any fat. Stir onion into skillet and cook 1 min. Add boiling water or broth and extract or bouillon. Add remaining veggies, seasonings. Cover, cook over low heat, 15 mins until vegs are tender. Combine wine or water and flour in covered jar. Shake and stir into skillet. Cook and stir until sauce is thick, 4 mins.			

Campfire Pasta

RECIPES | Homestead Recipies | Mains | Campfire Pasta

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 lb Pasta; any kind • 1 pk Spaghetti sauce mix • 1 cn Tomato paste • 1 lb Lean hamburger; ground turkey or italian sausage	• 2 Pots • 2 Stirring spoons • 1 Lid • Potholders or gloves		**Grown Food in Recipe** •
Method	**Instructions** Heat water to a boil in a large pot. In a smaller pot cook the meat and add the sauce mix, water, and tomato paste according to the instructions on the sauce package. Cook the pasta in the water for 8-10 minutes. Place the lid on the pot and with gloves or pot holders drain the water from the pasta through the crack between the lid and the pot. Putting the pot on a stump or log and letting the stump or log hold the weight of the pot helps. Mix the sauce with the drained pasta and serve. Grated cheese may be used with the pasta. Pasta notes: Spaghetti is the traditional pasta, but wheels, or other forms that are more compact and larger will be much easier to drain.			

Easy Stroganoff

RECIPES | Homestead Recipies | Mains | Easy Stroganoff

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 ts Butter or margarine • 1 cn Cream of mushroom soup • 1 lb Round steak cut into thin stripes • 1/4 c Water • 1/2 c Sour cream	• 1/2 c Chopped onion • 1/2 ts Paprika		**Grown Food in Recipe** •
Method	**Instructions** Melt butter or margarine in skillet. Brown strips of round steak in hot fat. Add onion and brown. Stir in soup, water, sour cream and paprika. Cover and cook over low heat about 45 minutes, or until meat is tender. Stir frequently. Serve over hot noodles (wide egg noodles, etc.) or rice.			

Camp Chilli

RECIPES | Homestead Recipies | Mains | Camp Chili

				Prep Time: 00 Mins **Cook Time:** 45 Mins **Yields:** 00 Serves
Ingredients	• 1 c Lentils • 3 tb Tomato soup powder • 2 tb Masa or Corn flour • 1 tb Chilli Powder • 1 tb Onion Flakes	• 1 tb Cumin • 1 ts Oregano • 1 ts Salt • 1 Clove Garlic • 4 c Water		**Grown Food in Recipe** •
Method	**Instructions** Combine all the ingredients and simmer 30 - 45 Min.			

Campers Hobo Pie

RECIPES | Homestead Recipies | Mains | Campers Hobo Pie

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 lb Ground beef • 4 Carrots sliced • 2 Potatoes cubed • 1 md Onion, sliced in 1/4" pieces • Butter			**Grown Food in Recipe** •
Method	**Instructions** Form hamburger patties and put one patty, with individual servings of whole carrots, sliced potatoes and sliced onions, on a sheet of aluminium foil. Brush everything with butter and sprinkle with salt and pepper. Fold foil over food and place on charcoal or open fire Cook for an hour, turning every 15 minutes. Chicken can be substituted for the hamburger meat.			

Campfire Pork And Beans

RECIPES | Recipies | Mains | k And Beans

		Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves

Ingredients	• 8 Bacon slices, cut 1 1/2" • 1/2 c Chopped onion • 1/2 c Chopped green bell pepper • 53 oz Can pork and beans • 1/4 c Molasses • 1/4 ts Tabasco sauce			**Grown Food in Recipe** •
Method	**Instructions** Heat oven to 375 degrees. Fry bacon until crisp; set aside. Reserve 2 tablespoons drippings in pan. Sauté onion and green pepper in drippings until tender. Combine beans, molasses and red pepper sauce in a 2 1/2 quart casserole. Bake 40 to 45 minutes. Top with bacon.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Grown Food in Recipe** •
Method	**Instructions** o			

Soups

Camper's Stew

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 cn Whole new potatoes • 1 cn Green beans • 1 cn Diced carrots • 1 cn Meatballs with gravy • 8 oz Can tomato sauce • 2 tb Dehydrated onion			**Grown Food in Recipe** •
Method	**Instructions** Drain liquid from vegetables, save 1 cup. Combine all ingredients, bring to a boil and serve. Delicious also with "biscuit mix" dumplings. Follow directions on package. Serves 2 to 3. Easily doubled.			

Camp Stew

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 lb Hamburger • 1 Can stewed tomatoes • 1 Can corn • 8 oz Elbow macaroni • 1/2 c Chopped onions	• 1 c Water • 1/4 lb Longhorn cheddar cheese		**Grown Food in Recipe** •
Method	**Instructions** Brown beef in Dutch oven, kettle, or skillet. Drain. Stir in tomatoes, corn, macaroni, and water. Cook until done. Just before serving add cheese.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Grown Food in Recipe** •
Method	**Instructions** o			

Dessert & Snacks

Power Bars

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 c Whole wheat flour • 1/2 c Packed brown sugar • 1/4 c Skim milk powder • 1/4 c Wheat germ • 1 ts Baking powder	• 1 1/2 c Raisins or chopped dried apricots • 1/2 c Unsalted sunflower seeds • 2 Eggs • 1/2 c Vegetable oil	• 1/2 c Molasses • 1/3 c Peanut butter	**Grown Food in Recipe** •

Method	**Instructions** In bowl, combine flour, sugar, skim milk powder, wheat germ and baking powder; stir in raisins and sunflower seeds. Combine eggs, oil, molasses and peanut butter. Add to dry ingredients, blending well. Spread in greased 9 inch square cake pan. Bake in 350F oven for 35 minutes or until browned and firm to the touch. Let cool completely. Cut into 24 bars. Bars can be stored in air tight container for up to 5 days.

S'Mores

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• Marshmallows • Hershey bars • Graham crackers • Green sticks or coat hangers			**Grown Food in Recipe** •
Method	**Instructions** Get prepared by getting 1 large graham cracker and breaking it in half. Cover 1/2 of the graham cracker with Hershey bar. Put a marshmallow (or 2) on the stick and hold it over the fire until roasted. Some people like them lightly golden, others like to catch them on fire and then blow the fire out. If you do that, be careful. You have to put the fire out quickly or your marshmallow will fall on the ground. When the marshmallow's roasted, place on top of the Hershey bar, put the other graham cracker on top.			

Blazing Trail Mix

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 16 Serves
Ingredients	• 2 c Shredded miniature wheat or bran squares • 1 c Unsalted thin pretzel sticks; broken into pieces • 1/2 c Cooked lentils	• 1/2 c Quick-cooking rolled oats • 1/2 c Raisins • 1/2 c Chopped dried apples • 1/4 c Honey • 2 ts Curry powder	• 1/2 ts Ground coriander • 1/4 ts Ground cumin • 1/4 ts Paprika • 1/8 ts Ground red pepper	**Grown Food in Recipe** •
Method	**Instructions** In a 13x9-inch baking pan, combine the wheat or bran squares, pretzels, lentils, oats, raisins, and apples. In a small bowl, stir together the honey, curry powder, coriander, cumin, paprika and pepper. Drizzle the honey mixture over the cereal mixture. Toss until evenly coated. Bake at 350 degrees for 15 to 20 minutes or until crisp, stirring occasionally. Store in an airtight container or self-closing plastic bags.			

Biscuits

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 8 Biscuits
Ingredients	• 1/4 cup commercial biscuit mix • 4 teaspoons milk			**Grown Food in Recipe** •
Method	**Instructions** Combine biscuit mix and milk with a fork. Drop by half-teaspoonful's onto a well greased pan. Bake 10 minutes.			

Cherry Fudge Goodies

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 ea Box fudge brownie mix • 1 1/2 c Shredded Coconut • 1 1/2 c Chopped, Candied cherries • 2 tb Cherry flavouring oil • 1 c Chopped walnuts	• Powdered Sugar • Shortening		**Grown Food in Recipe** •
Method	**Instructions** Follow brownie mix directions/recipe on box. Add coconut, 3/4 C walnuts, flavouring oil and cherries. Blend well. Pour batter into greased Dutch Oven or covered baking pan. Add coals 5 on top 7 under (350) Bake. Its done when a knife comes out clean. Top with remaining walnuts and sprinkle with the powdered sugar. Let cool. Cut into squares.			

Camp Cobbler Delight

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 cn Sliced peaches, large • 1 cn Fruit cocktail, large • 1 cn Crushed pineapple, small • 1/2 c Instant tapioca • 1/4 lb Margarine	• 1 c Brown sugar • 1 pk Cake mix		**Grown Food in Recipe** •
Method	**Instructions** In 12 inch foil lined Dutch Oven, combine fruit and tapioca. Sprinkle cake mix evenly over top of fruit. Sprinkle brown sugar over cake mix. Dab butter all over top of brown sugar. Place lid on oven. Bake 45 minutes to 1 hour. Use 6 to 8 coals on the bottom and 14 to 16 on the top. Cake is done when top is brown and cake has absorbed juices and is no longer dry.			

Campfire Cinnamon Coffeecake

RECIPES | Homestead Recipies | Dessert & Snacks | Campfire Cinnamon Coffeec

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 tb Butter or margarine • 1 c Packaged biscuit mix • 1/3 c Evaporated milk, undiluted • 1 tb Prepared cinnamon-sugar			**Grown Food in Recipe** •
Method	**Instructions** Make Coffeecake: Cut butter into tiny pieces over biscuit mix in medium bowl. Toss lightly with fork until butter is coated. Make a well in centre. Pour in milk and cinnamon-sugar, stirring with fork just until mixture is moistened. Turn dough into a lightly greased and floured 8-inch shiny, heavy skillet. With floured hands, pat down evenly into the skillet. Cook, covered, over very low heat, 12 to 15 minutes, or until a cake tester or wooden pick inserted in centre comes out clean. For Topping: Spread the coffeecake with 2 Ts butter or margarine. Then sprinkle 1 ts prepared cinnamon-sugar over all of it. Cut into quarters, and serve warm.			

Camper's Cookies

RECIPES | Homestead Recipies | Dessert & Snacks | Camper's Cookies

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 c Flour • 1 ts Baking soda • 1/2 ts Salt • 1/2 ts Baking powder • 1 c Margarine	• 1 c White sugar • 1 c Brown sugar • 2 Eggs • 1 ts Vanilla • 2 c Oats	• 6 oz Semi-sweet chocolate chips • 1 c Nuts	**Grown Food in Recipe** •
Method	**Instructions** Sift together the flour, baking soda, salt, and baking powder. Cream the margarine and the sugars together. Add the eggs and beat. Add the flour mixture and mix well. Add the vanilla, oats, chocolate chips, and nuts. Grease a 13x9x2 pan, and press mixture in evenly. Bake in a preheated oven 15 minutes at 350 F.			

Camper's Buckwheat Pancakes

RECIPES | Homestead Recipies | Dessert & Snacks | Camper's Buckwheat

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 3/4 c Buckwheat Flour • 3/4 c Flour, All-Purpose • 1/2 ts Salt • 1/3 c Dried Whole Egg • 1/2 c Non-fat Dry Milk	• 1 1/2 ts Baking Powder • 4 tb Margarine • 1 1/2 c Water		**Grown Food in Recipe** •
Method	**Instructions** Mix all ingredients, except margarine, with water to make a creamy batter. Melt margarine and add gradually to batter while stirring. Makes about 30-40 2-inch pancakes.			

RECIPES | Homestead Recipies | Dessert & Snacks | Entree

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Grown Food in Recipe** •
Method	**Instructions** o			

Beverages

Mexican Coffee

RECIPES | Homestead Recipies | Beverages | Mexican Coffee

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 qt Milk • 1 ts Ground cinnamon • 1 ts Vanilla extract • 2/3 c Instant cocoa mix • 8 c Boiling water	• 1/3 c Instant coffee granules • Whipped cream • Garnish: cinnamon sticks		**Grown Food in Recipe** •
Method	**Instructions** Combine first 3 ingredients in a Dutch oven; cook over medium heat until thoroughly heated. Stir in instant cocoa mix. Combine boiling water and coffee granules; stir into milk mixture. Serve with a dollop of whipped cream and, if desired, garnish with cinnamon stick.			

Hot Cocoa

RECIPES | Homestead Recipies | es

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves

RECIPES | Homestead Recipies | Beverages | Hot Cocoa

Ingredients	• 1/2 c Cocoa Powder • 1 t Corn Starch • 1/3 c Sugar • 1 c Water (Divided) • 1 c Milk			**Grown Food in Recipe** •
Method	**Instructions** Mix Cocoa, corn starch and sugar with 1/2 cup water. Heat on low until ingredients are dissolved. Add remaining 1/2 cup water and milk. Heat over low heat until mixture thickens. Recommended high quality cocoas are Pernigotti and De Zaan. Hershey's cocoa may require reducing corn starch to 1/2 tsp.			

Russian Tea

RECIPES | Homestead Recipies | Beverages | Russian Tea

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 3/4 c Tang (orange drink mix) • 1 pk (1/2 oz) lemonade, unsweetened • 1 c Sugar (optional) • 1 c Instant tea • 1 ts Cinnamon	• 1/2 ts Ground cloves • Dash salt		**Grown Food in Recipe** •
Method	**Instructions** Mix ingredients. Use 2 teaspoons per serving.			

Iced Tea

RECIPES | Homestead Recipies | Beverages | Iced Tea

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1/2 ts Vanilla • 1/2 ts Almond Extract • 1/4 c Lemon Juice • 1/2 c Sugar • 1 qt Tea, freshly brewed			**Grown Food in Recipe** •
Method	**Instructions** Combine all ingredients.			

Cauldron Brew

RECIPES | Homestead Recipies | Beverages | Cauldron Brew

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 qt Apple juice • 1 1/2 Cups Canned, unsweetened pineapple • 2 tb Fresh lemon juice • 3 Cinnamon Sticks			**Grown Food in Recipe** •
Method	**Instructions** Mix all ingredients together in a saucepan. Heat over low heat until ready to serve. Remove cinnamon sticks. Ladle brew into serving cups.			

Tea Punch

RECIPES | Homestead Recipies | Beverages | Tea Punch

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 3 c Tea; strong • 1 c Lemon juice • 4 c Orange juice • 2 c Raspberry syrup; or grenadine • 2 qt Club soda; chilled	• 1 Cup Pineapple, crushed • Sugar; to taste		**Grown Food in Recipe** •
Method	**Instructions** Combine all ingredients except club soda in a punch bowl with a large block of clear ice; allow to chill thoroughly. (If fresh fruit juices are used, they should be strained.) Add club soda just before serving.			

Indian Style Lemonade

RECIPES | Homestead Recipies | Beverages | Indian Style Lemonade

				Prep Time: 5 Mins **Cook Time:** 0 Mins **Yields:** 00 Serves
Ingredients	• 8 Cups Water • 1/2 Cup Fresh lime juice • 2/3 Cup Fresh lemon juice • 1 1/3 Cup Maple syrup • 1/2 tb Freshly grated ginger • 1/8 ts Cayenne, optional			**Grown Food in Recipe** •
Method	**Instructions** Combine all ingredients in a large pitcher or punch bowl. Serve at room temperature or chilled.			

Hot Cider Punch

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 4 c Water • 4 c Apple cider • 2/3 c Orange flavour Tang • 1/4 ts Cinnamon • 1/8 ts Nutmeg • 1/8 ts Ground cloves			**Grown Food in Recipe** •
Method	**Instructions** Combine ingredients in a saucepan; mix well. Heat just to boiling. Serve hot in punch cups or mugs. This makes about 2 quarts.			

Hot Buttered Cow

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 lb Brown sugar • 1/4 lb Soft butter • 1/2 ts Vanilla • 1/2 ts Cinnamon • 1/4 ts Nutmeg	• 1/4 ts Cloves • 1/4 ts Mace • 1/4 ts Allspice • 1 pn Salt		**Grown Food in Recipe** •
Method	**Instructions** Beat sugar and butter together until thoroughly creamed and fluffy. Beat in vanilla and spices. Chill. For each cup to be served, place 1+1/2 teaspoons batter in a preheated mug (Could also include: 1 1/2 ounces dark rum and 1/2 ounce gold or white rum.) Stir well. Fill with hot milk and serve.			

Lemonade Syrup

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 2 c Sugar • 1 pt Water • 6 Lemons • 1 Lemon Rind, grated			**Grown Food in Recipe** •
Method	**Instructions** Cook the sugar and water together without stirring until it is a thick syrup, adding the grated outer rind of one lemon. When this is cool, add the juice of the lemons and bottle. By diluting with ice water, you have lemonade on short notice.			

Root Beer

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1 oz Sassafras • 1 oz Allspice • 1 oz Yellowdock • 1 oz Wintergreen • 1/2 oz Wild cherry bark	• 1/2 oz Coriander seeds • 1 oz Hops • 3 qt Molasses • 1/2 pt Yeast • 4 ga Cold water		**Grown Food in Recipe** •
Method	**Instructions** Mix together the sassafras, allspice, yellow dock, wintergreen, wild cherry bark, coriander seeds, hops and molasses. Cover them with boiling water, allow to stand for 24 hours, then filter, add the yeast and cold water. The beer will be ready in twenty-four hours. Bottle and seal.			

Lemonade Stall

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 8 Lemons • 1 c Sugar • 10 Ice cubes			**Grown Food in Recipe** •
Method	**Instructions** Bring lemons to room temp. Roll; slice in half and squeeze into gallon container. Toss lemon rinds into container. Pour sugar over rinds. Let sit for one half hour. Add ice cubes and enough water to fill container. Stir and serve. Each 12 oz serving has 91 calories and 0 grams fat.			

Ice Tea (Sun Method)

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 4 Tea bags • 1 1/2 qt Cold water			**Grown Food in Recipe** •

Method	**Instructions** In a two quart clear glass container, place tea bags. Add 1 1/2 quarts of cold water. Cover. Let stand in full sun 2 to 3 hours or until desired strength. Remove tea bags, serve over ice. Store this tea in refrigerator. NOTE: You don't need the sun to brew Sun Tea. Simply prepare as directed above, except let stand at room temperature several hours or until desired strength.

Doughboys

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	• 1/2 c Flour • 1 ts Baking powder • 1 ts Shortening • pn Salt • 1/4 c Water • 1 Hot dog			**Grown Food in Recipe** •
Method	**Instructions** You can also use 3/4 cup of biscuit mix. Mix ingredients with shortening and then add water. Put hot dog on green stick and wrap dough around it. Cook holding 6 inches from coals so inside will cook and then brown nearer to the coals. Ensure the dough is not too sticky.			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Grown Food in Recipe** •
Method	**Instructions** o			

4 Modern Recipes

These are the most common recipes today which are based on the current availability of modern foods in stores. These will be very difficult to make during SHTF.

Entrée

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** o			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** o			

Mains

		Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves

Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** ○			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** ○			

Soups

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** ○			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** ○			

Dessert & Snacks

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •
Method	**Instructions** ○			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** •			**Rare Food in Recipe** •

Method	**Instructions** ○

Beverages

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** ●			**Rare Food in Recipe** ●
Method	**Instructions** ○			

				Prep Time: 00 Mins **Cook Time:** 00 Mins **Yields:** 00 Serves
Ingredients	**Ingredients** ●			**Rare Food in Recipe** ●
Method	**Instructions** ○			

Fire

Methods for starting fires, types of tinder and firestarters

"Build a man a fire, and he'll be warm for a day.
Set a man on fire, and he'll be warm for the rest of his life."
Terry Pratchett

Introduction

Fire is an absolutely essential item to have in a survival kit, there are so many reasons to have fire on hand, from cooking to water sterilization to morale. You should be well versed in the ability to make a fire in any conditions, from the rain and snow to the dry outback. Fire is easy to start with modern inventions such as the BIC lighter, ZIPPO or matches, but can also be accomplished with a few other items around the house such as a battery.

Purpose	The aim of FIRE is to educate the reader on the uses of fire, the different types of fires and their individual uses and how to properly light fires using any number of techniques available today. It also includes information on fire resistance, fire safety and how to extinguish fires to help avoid a man-made disaster.
Lost?	• If you're looking for wildfire information, see the NATURAL DISASTERS > Wildfire section. • If you want to build a signal fire to be seen by, head to the COMMUNICATION section. • For a list of fire temperatures, see the CRAFTING > Blacksmithing section. • For cooking on different types of fires, see the COOKING section. • For a list of fire-based weapons, see the OFFENCE section. • If you want to know the best types of woods for a fire, see the FUEL section. • For burns and fire-related injuries, see the INJURY section.

Contents

1 Fire Uses

These are some of the most common uses of fire.

Cooking	The primal use of fire, to make food safe for consumption.
Warmth	A by-product of fire which is lifesaving in cold climates.
Light	Fires give off light which can be utilized to see with.
Water Purification	Purification by boiling water for 3m will kill viruses and pathogens.

Charcoal	The fire's by-product charcoal, which has many uses.
Sterilizing	Put metal objects in a flame to kill bacteria, viruses and protozoa.
Signalling	A pillar of black smoke can be seen for many miles - use young green leaves.
Discouraging Predators	Generally repels and wards off animals and predators.
Wound Disinfection	Use a flame to disinfect wounds when there's no other option, you can also cauterise wounds to stop them bleeding.
Morale	A warm fire after a cold day can make the going much easier.
Sewing	Preventing ends from fraying and unravelling.
Removing Evidence	Fire removes traces of your existence.
Cleaning	Smoke gets bacteria off you?
Crafting	Fires can help create tools and materials such as soap.
Blacksmithing	Smithing tools, armour and weapons.
Landscaping	Burning brush and altering the landscape.
Energy	The energy released from a fire can be harnessed and converted to electricity.
Save Electricity	Instead of using torches and heaters.
Drying Clothes	Leaving clothes near a fire can dry them faster.
Incinerating Rubbish	Burning rubbish is easier than holding onto it to dispose of later.
Smoking Meats	Smoke meats to preserve them for longer.
Flaming Weapons	Flaming arrows, spears etc.
Heat Treatment	Materials become more pliable when heated and can be moulted into other shapes.
Discourage Bugs	Mosquitoes and other bugs don't like staying around smoke.
Heating Stones	Heating stones for use in heating something else such as a bed or water.

2 Fire Starters

This section lists the various ways you can start fires.

Subheadings

1. Natural Occurrence	**2. Friction**	**3. Percussion**	**4. Air Compression**
5. Solar	**6. Electricity**	**7. Chemical**	**8. Spontaneous Comb.**

1 Natural Occurrence

These are the most common naturally occurring ways fire can be created.

Volcanos & Lava	Occurs naturally under the earths crust, however they may sometimes make their way to the surface.
Meteorites	Causes massive friction and force when impacting the earth creating fires in the vicinity.
Lightning Strikes	Can ignite combustible materials on the ground, it usually only lasts if it's not raining.
Spontaneous Combustion	The ignition of tinderous materials via natural heat which occurs when the temperature of an object exceeds it's combustion point.

2 Friction

Hand Drill	This repeated spinning and downward pressure causes black dust to form in the notch of the fireboard, eventually creating a hot, glowing coal.
Bow Drill	Takes a lot of practice, rub hard wood and soft woods together to generate friction and put the ember into a tinder bunch.
Pump Drill	A variant of the bow drill that uses a coiled rope around a cross-section of wooden stake spin the shaft by pumping up and down a cross-member.
Fire Plough	Consists of a stick cut to a dull point, and a long piece of wood with a groove cut down its length. The stake is pressed down hard and rubbed quickly against the groove of the second piece in a "ploughing" motion.
Fire-Saw	A method by which a piece of wood is sawed through a notch in a second piece or pieces to generate friction. The tinder may be placed between two slats of wood with the third piece or "saw" drawn over them above the tinder so as to catch a coal, but there is more than one configuration.

Fire-Thong	Uses a non-melting cord, ratan, or flexible strip of wood to 'saw' the wood creating friction. On the board, opposite side the cord, is a well with a hole through the board to gathered the charred, soon-to-smoke, wood dust.

3 Percussion

Percussion is the striking of two elements together to generate heat or sparks.

Stone & Flint

Commonly used to throw sparks onto tinder. Will work when completely wet. Flint can be found naturally and is quite common. Strike with a 90° edge of steel to throw sparks.

Quartz / Jasper / Agate Stones	Strike with steel to throw sparks onto tinder.
Firesteel (Fire Striker)	Firesteel is a manufactured rod of purified flint which can be struck with a 90° edge of steel to throw sparks.
Blast Matches	An automatic flint striker. When pushed down it throws sparks out the bottom onto tinder. It can be used one-handed as opposed to any other flint striker methods.

Matches

Matches are a modern invention to make fire creation simple. Simply strike the match on the specific strip and it will combust and slowly burn down the stick.

Safety Matches	Strike the match on the specialised box strip to create a flame.
Windproof Matches	Matches that can't go out in the wind or underwater.
Strike Anywhere Matches	Matches you can strike on any object to ignite them.

Lighters

Lighters are the most common way to produce fire in the modern day world. They will work in any conditions, provide a solid flame and are extremely easy to use. Not only this but the gas will last a very long time if used occasionally or forever if it's never used.

BIC Lighter

A disposable lighter consisting of a flint wheel with steel which lights a small jet of butane gas. Unlike Zippo lighters the fuel doesn't have to be refilled once a week as it dried out due to having a sealed fuel compartment. BIC lighters can't be refuelled yourself.

'Fluid' Lighter (Zippo Lighter)

A refillable lighter that uses liquid fuel, also referred to as a Zippo. Zippo lighters use white gas to burn but can run dry if not refuelled often. Zippo lighters aren't recommended due to the fuel drying up quickly and require replacement wicks.

White Gas
White gas is a generic term for camp stove and lantern fuel. It can also be known as Pure Gasoline and Un-dyed gasoline.

Lighter Gases
- Zippo Fluid
- Coleman Gas
- Naptha
- 100% Alcohol
- Paint Thinners

(Best to Worst)

Butane Lighter (Z-Plus)

A refillable lighter which uses butane gas instead of white gas. The most commonly bought brand is Z-Plus! Both inserts come designed to fit in a Zippo lighter case so you can choose how it looks. Or you can forego a case and shed some weight. This is the most recommended style of lighter as the gas doesn't evaporate over time and it's easier to refuel.

Candle Flame
There are two types of butane lighters, the first has a candle style red/orange flame which is lit by flint rod the same as the BIC lighters. The gas stream activates when the lid of the lighter opens.

Jet Flame
The other style has a small cone of blue flame which makes a similar sound to a jet. This lighter uses piezo ignition and is often good for a couple of thousand sparks. The gas stream activates as long as the button is held, and at the bottom of the button is the piezo ignition lever.

Flame Adjustment
Adjust the height of the flame using the lever on the bottom of the lighter.

Refilling Lighters

Butane Purity
Butane is a dirty gas that requires repeated refining to remove particles. Therefore always refill lighters with 3x-9x refined butane to prevent clogging the lighter over multiple refills. You can see the particulate floating in the liquid in non-triple refined gas sources if the bottle/container is transparent.

Refilling
Butane lighters require refilling whenever the gas level becomes low. It's best to refill them only when empty. Refill lighters by turning them upside down and pressing the gas into the hole in the bottom firmly for a few seconds. If the lighter is upright when refilled it will be filled with air instead of gas and give inconsistent ignitions.

If attempted refill exceeded the maximum, the lighter's valve opening may have been "blown" open. To check for this, place another flame to tip of lighter, click switch and check for butane emission. If a large 6 inch flame is present, adjust valve toward the minus. If no flame is present, adjust toward the plus. If attempted refill had butane canister pointed up, it is necessary to "burp" the lighter and release unwanted air. Use a pointed object to push in the lighter's pin valve. Point the bottom of lighter up, push in valve and gas will be ejected. Point away from eyes and any other flame. After burping, refill correctly.

Step 1	Clean the flint wheel and the nozzle by brushing them with a small, specially designed stiff-bristled brush.
Step 2	Push the end of a wooden match against the filler valve on the base of the lighter to purge it. You'll hear a hissing noise as the gas escapes. Repeat until the lighter is empty.
Step 3	Press the plastic nozzle extension tube attached to a can of compressed air against the lighter gas outlet valve. Hold the canister plunger down for one or two seconds. Move the extension tube back an inch or two to blow remaining residue from the lighter recess. Refill the lighter with triple-refined butane gas, and test.
Step 4	Unwind a strand from a piece of fine fishing tracer wire. Poke the end of the fine strand into the lighter nozzle if blasting with compressed air fails. Do not apply sideways pressure or work the hardened steel wire back and forth; this will ream out and deform the nozzle outlet. Apply a second blast from the compressed air canister. Retest.

4 Air Compression

Uses the compression of air to generate enough heat to cause combustion of a flammable piece of cloth.

Fire Piston	Compresses air very rapidly into a smaller space raising the temperate drastically and igniting a piece of char cloth inside.

5 Solar

Solar is any form of firelighting using the sun. These methods may take some time depending on the temperature, cloud cover and the season.

Magnifying Glass	Focuses the rays of sunlight into a single point to generate heat to start a fire.
Fresnel Lens (Overhead Projector Lens)	A fresnel lens is a flat piece of plastic with concentric grooves in the surface to focus the light to a point. Spherical aberration is a loss of definition in an image arising from the surface geometry of a spherical mirror or lens. The grooved side should face the sun if you want the maximum effect. If the flat side is facing the sun then not all the light meets at the focal point and it takes approximately 2.4 times longer to light a fire. A linear fresnel lens focuses the light into a line rather than a point. These lenses are often found in rear projection tvs. A spot fresnel lens focuses the light into a point which has better effectiveness.
Light Bulb	A broken incandescent light bulb around the curved end can focus the light into a point.
Ice Lens	Using very clear ice, you can shape it into a generic lens shape which lets you then focus the light and start a fire. It may need a lot of perfecting to get the curvature correct but it's definitely possible to achieve it. Generally it's a strong curve used to focus the light properly - so start with a sphere and slowly turn it into an oval.
Drinks/Pressurised Can	The bottom of a coke can or any other pressurised canister can be used to start a fire if the bottom is polished so that it becomes reflective. Once it's polished you can find the focal point by using some thin newspaper to focus the spot of light into a pin point.
Binoculars	Using binoculars in reverse can start a fire. Let the light enter the larger end of the binoculars and bring the eye piece end near the tinder to focus it.
Spherical Water Bag	A spherical bag of water can be used as a makeshift lens to focus the light.
Mirror / Reflector	Uses a concave mirror to reflect the suns rays back into a point where a piece of tinder is located. **Flashlight Reflector** Using the reflector from a flashlight could be used to start a fire.

6 Electricity

Electricity can be used to create sparks to light tinder if applied correctly.

Battery Sparks	Created when the terminals from a high voltage and amperage battery touch. Striking the leads of a 12v car battery together towards tinder can ignite it if aimed correctly.
Battery Heated Filament	Using a battery to rapidly heat a thin metal element. An example element would be a thin wire or steel wool, as long as the batteries voltage and amperage is high enough.
Piezo Ignition	Uses piezoelectricity to generate a small spark which jumps between metal contacts. Best used in liquid and gas fuels.
Arc Lighter (Electric Lighter)	Uses high voltage to generate a beam to ignite.

7 Chemical

These are chemical combinations that can start fires.

Calcium Hypochlorite + Automotive Brake Fluid (polyethylene glycol)	After a few seconds the reaction violently erupts into flame. Brake fluid can last indefinitely unopened but about 1 year opened. Calcium Hypochlorite lasts up to 10 years.
Potassium Permanganate + Glycerine + Room Temp above 22°C (70°F)	After a few seconds a flame erupts from the mixture. Requires a pile of about 3x3cm to generate a flame.
Potassium Permanganate + Acetone + Sulfuric Acid	
Potassium Permanganate + Antifreeze	
Sodium Chlorate + Sugar + Sulfuric Acid	
Ammonium Nitrate Powder + Finely Ground Zinc Powder + Hydrochloric Acid	
Sulfuric Acid + Zinc + Platinum	

8 Spontaneous Combustion

Spontaneous combustion or spontaneous ignition is a type of combustion which occurs by self-heating (increase in temperature due to exothermic internal reactions), followed by thermal runaway (self heating which rapidly accelerates to high temperatures) and finally, autoignition.

Cause
1. A substance with a relatively low ignition temperature (hay, straw, peat, etc.) begins to release heat. This may occur in several ways, either by oxidation in the presence of moisture and air, or bacterial fermentation, which generates heat.
2. The heat is unable to escape (hay, straw, peat, etc. are good thermal insulators), and the temperature of the material rises.
3. The temperature of the material rises above its ignition point (even though much of the bacteria are destroyed by ignition temperatures).
4. Combustion begins if sufficient oxidizer, such as oxygen, and fuel are present to maintain the reaction into thermal run-away.

Lighting (Linseed Method)
To utilize spontaneous combustion to start a fire you will need a metal can or container, air for oxidation, lots of cloth and linseed oil. Moisten the cloth with linseed oil so that they are damp but won't drip if held up. Pack them into the can tightly, then just wait.

Affected Materials

- Hay piles and compost piles may self-ignite because of heat produced by bacterial fermentation.
- Linseed oil and Danish oil in a confined space (such as a pile of oil-soaked rags left out in an uncovered container, especially if rags afterward used with anti-moisture solvent to clean up the oil) can oxidize leading to a build-up of heat and thus ignition.
- Coal can ignite spontaneously when exposed to oxygen, which causes it to react and heat up when there is insufficient ventilation for cooling.
- Pyrite oxidation is often the cause of coal spontaneous ignition in old mine tailings.
- Cotton and linen. When these materials come into contact with polyunsaturated vegetable oils (linseed, massage oils), bacteria slowly decompose the materials, producing heat. If these materials are stored in a way so the heat cannot escape, the heat build-up increases the rate of decomposition and thus the rate of heat build-up increases. Once ignition temperature is reached, combustion occurs with oxidizers present (oxygen).
- Large manure piles can spontaneously combust during conditions of extreme heat.
- Pistachio nuts are highly flammable when stored in large quantities, and are prone to self-heating and spontaneous combustion.
- Nitrate film, when improperly stored, can deteriorate into an extremely flammable condition and combust.

Hay

Hay is one of the more studied materials in spontaneous combustion. As hay varies by the type of grass and location grown utilized in its preparation, it is very hard to establish a unified theory of what occurs in hay self-heating. It is anticipated that dangerous heating will occur in hay that contains more than 25% moisture. The largest number of fires occurs within 2 to 6 weeks of storage, with the majority occurring at 4 to 5 weeks. The process may begin with microbiological activity (bacteria or mould), but at some point, the process has to become chemical. Microbiological activity will also limit the amount of oxygen available in the hay. Moisture appears to be quite important, no matter what process. At 100 °C, wet hay absorbed twice the amount of oxygen of dry hay. There has been conjecture that the complex carbohydrates present in hay break down to simpler sugars, which are more readily oxidized.

Charcoal

Charcoal, when freshly prepared, can self-heat and catch fire. This is separate from hot spots which may have developed from the preparation of charcoal. Charcoal that has been exposed to air for a period of eight days is not considered to be hazardous. There are many factors involved, two being the type of wood and the temperature at which the charcoal was prepared.

Coal

Self-heating in coal has been extensively studied. The tendency to self-heat decreases with increasing rank of the coal. Lignite coals are more active than bituminous coals, which are more active than anthracite coals. Freshly mined coal consumes oxygen more rapidly than weathered coal, and freshly mined coal self-heats to a greater extent than weathered coal. The presence of water vapour may also be important, as the rate of heat generation accompanying the absorption of water in dry coal from saturated air can be an order of magnitude or more than the same amount of dry air.

Oil Seeds and Oil-Seed Products

Oil seeds and residue from oil extraction will self-heat if too moist. Typically, storage at 9–14% moisture is satisfactory, but limits are established for each individual variety of oil seed. In the presence of excess moisture just under levels required for germinating seed, the activity of mould fungi to generate heat is a likely candidate. This has been established for flax and sunflower seeds, as well as soy beans. Many of the oil seeds generate oils that are self-heating. Palm kernels, rapeseed, and cotton seed have also been studied. Rags soaked in linseed oil can spontaneously ignite if improperly stored or discarded.

3 Tinder

Tinder is easily combustible material used to start a fire. Tinder is a finely divided, open material which will begin to glow under a shower of sparks. Air is gently wafted over the glowing tinder until it bursts into flame. The flaming tinder is used to ignite kindling, which in turn is used to ignite the bulk material, to produce a fire. Tinder can be made of any flammable substance, as long as it is finely divided and has an open structure.

Common Tinder

These are some great materials for tinder which can be found around most houses.

Cotton	Fine fibres that should ignite easily from a spark.
Cardboard	Lights well from a flame, difficult to light from a spark.
Paper	Scrunched up or shredded - paper provides a moderately easy way to start a fire from a spark, instant from a flame.
Dryer Lint	Lights from a spark easily.
Paracord	After pulling the cord out and dividing the fibres this can be lit moderately easily by a spark.
Toilet Paper	Scrunch up or shred to provide an easy way to start a fire from a spark.
Charcloth	Heat dense wood/cloth in a pot without access to oxygen until black and crumbly. Lights easily from a spark.
Create Char Cloth	Cut an 8x8cm 100% cotton piece of cloth and cook it in a metal container with a hole in the lid until smoke stops.

Manufactured Tinder

FIRE | Tinder | Manufactured Tinder

These are some manufactured tinders which often light easier and are more efficient burners than the common tinders above.

Petroleum Jelly	When mixed with other fibrous tinder it provides an easy way to light fire from sparks.
Wetfire	Extremely easy to light and remains lit in adverse conditions.
Magnesium Powder	Burns extremely hot and is fairly easy to light with a spark.
Steel Wool	Ideally lit by a 12v battery.
Mayan Dust	
Hexamine	
Trioxane	

Liquid Tinder

These are easily combustible liquid tinders which you are likely to find around your house or garage.

Isopropyl Alcohol	Easily ignited from a flame or spark.
Alcohol	Very easy to light with flint or a spark.
Nail Polish Remover	
Turpentine	
Gasoline	
Paint Thinner	
Lighter Fluid	
Aerosol Cans	
Linseed Oil	
WD-40	

Plant Tinders

Cattail

Cattails are wetland plants with a different flowering spike and flat, blade-like leaves that reach heights from 3 to 10 feet. The highly flammable cotton-like seeds are hidden within their thin brown outer shell, located at the very top of the plant. Be careful in trying to extract the seeds because they are under high pressure and will burst out and catch the wind when released. The easiest way to retrieve them with minimal loss is to merely place the brown tip in a plastic bag and tear the outer skin. Make sure you have a sufficient amount because they burn out very quickly.

Eucalyptus Leaves

The oil will take a spark and burst into flame. These are readily found in Australia.

Red Cedar Bark

This tree is unique with its shaggy red bark which is highly flammable. Take your knife or any sharp objects you can find and scrape off only the thin layer of reddish bark fibres. After you've collected a couple of handful of fibres, make a small bundle. Leave a small gap in the middle for your Ferrocerium Rod and shower them with sparks.

Birch Bark

The Birch tree is noticeable with its white bark and dark horizontal fissures. This tree is highly flammable and water resistant, which makes this tree bark useful even in wet weather conditions. Start by gliding your knife down the tree trunk and peel off sheets of barks. Do this on fallen trees as it's much easier to tear. Tear the bark into thin strips and wrap it around your finger for a few moments to make it curly making it easier to catch a spark. Create some sparks with your fire rod and it should only take a moment for the oils in the bark to catch on fire. You can also turn the birch bark into a fine flammable powder. Take one of your pieces of bark and lightly scrape the inside, creating dust. When you have about a tablespoon full of this birch bark powder, light it on fire.

Pine Cones

Pine Cones are very flammable. You can quickly locate them just below pine trees. Pine cones contain the same flammable oils and resins as the interior of pine trees. First, you need to break down the pine cones by crushing them in your hand. Remove the large chunks, so you're only left with a small, fine fire starter. Now take your fire rod and immerse the little pieces of pine cones with a flood of sparks. Be patient as this will take a bit of time to catch on fire. Another notable mention is pine resin. Pine Resin is not considered tinder, so it's not a very good fire starter but it is great as a fuel to an already existing fire. You can find pine resin secreting from trees, it's gold in colour and very sticky, but it burns very well when thrown in a small fire.

Tinder Fungus

Tinder Fungus is a familiar name that was given to a wide variety of fungal species. You can find this fungus growing on the surface of dead or alive Birch trees and on the bottom of oak trees, to name a few. They vary in colour, but one thing they all have in common is their darker spongy core. Most of these cores are rust in colour. Cut a big chunk of fungus from the tree and look on the inside. The darker coloured part is what to use as your igniter fuel. To check if you indeed have it right, cut a piece of the darker interior region and feel it; If its spongy, yet firm, you've got fuel. Now take your Ferrocerium Rod and let the sparks fall. It shouldn't be long until a bright ember forms. These embers will stay active for a significant amount of time, so it's great to carry with you to your next location, be careful not to burn yourself or your belongings. If you immediately need a fire, gently blow on the ember and place it in a pile of dry kindle and dead grass. It shouldn't take long until you have an intense fire going.

Fire Weed

If you find yourself out in the forest and in a large clearing, then you might see some fireweed. You can't miss this plant since it can grow upwards of eight feet tall. The purple flowers growing on them is also eye-catching. In both late summer and early fall, this plant will generate a cotton-like seed that you can use as combustible tinder. What is unique about this plant is that in the winter, when resources are scarce, you can still find this cotton like substance on the inside of the fireweeds. Just rub them in your hands to reveal it's flammable seeds. Bring that back to your fire pit and throw a few sparks with your Ferrocerium Rod and watch it instantly burst into flames. Another significant advantage to fireweed is that it will burn for a considerable amount of time. The denser you pack it, the longer your fire will last.

Thistle Seed

You can find unopened Thistle Seeds as early as late spring. They can easily be opened, exposing their flammable seeds. You can also find them in the summer after they have fully bloomed, completely exposing its fluffy white cotton seeds. As with fireweed, this natural tinder should be gathered in a big enough bundle. Using your Ferrocerium Rod, let the sparks fall onto them until they catch on fire. It won't take long as this is highly combustible. After its sufficiently burning, it should then be placed at the bottom of your fire pit to let the slow-burning substance create a more significant fire. Way too easy!

Punk Wood

Punk wood is commonly referred to as trees that are in the process of rotting to the point where they no longer contain any structural integrity. You can find punk wood reasonably easy on the forest floor around half standing dead trees. You'll know if you've discovered punk wood as this fallen tree will be very brittle and quickly fall apart in your hands. Due to the fact that it is such a fragile dust, it will be very susceptible to a flutter of sparks raining down upon it. As you turn your newly found punk wood into a beautiful bright ember, place it into a pile of dead grass and voila, fire!

Fat Wood

Fat Wood comes from the wood of old pine stumps left for waste after logging, it is made from splitting the stumps of pine trees that contain a high concentration of natural resin. As the stump wood hardens over time, the resin or sap concentrates to create an all-natural, chemical-free fire starter. Fat Wood can also be found on the part of branches that is the closest to the stump. The resin that was within the branch has seeped down and settled at the bottom.

Wood Shavings

Wood shavings are often the driest tinder around in perpetually wet areas. The inside portion of standing dead wood is usually dry under the bark and below the surface of the wood. Scrape fine wood shavings from dead, dry hard and soft woods with steel knives or stone scrapers. The wood needs to be dead and dry in order for the tinder to scrape and burn properly. Place something under the branch or log to catch the shavings, and always scrape away from yourself to prevent injury The shavings can be held in a bundle of coarser tinder, or packed tightly for an all-wood-shaving tinder bundle. A bird nest shape is good, unless the shavings are too small to hold together. If the shavings won't hold together, use them in some other tinder as a core, or mixed throughout the outer bundle.

Dried Grasses

Most dead grasses make excellent tinder. Use leaf blades and seed tops primarily, and stems and stalks secondarily.
Usually grass doesn't require much processing to become tinder, as long as it is dry and broken off above ground. If the grass is pulled up out of the ground, the damp roots and lower stalks should be cut or broken off. If there are seed heads, the seeds should be shaken out if possible, as seeds are not flammable. The grass must be dry and it needs to have died on its own. Live grass that is cut and then dried (like hay) retains a lot of nitrogen and moisture, both of which are flame retardants. Grass can be coiled around to form a bird nest-shaped tinder bundle, which is easily done by hand with most grasses. The finer materials should be placed in the centre to provide the best fuel for coal and spark ignition.

Leaves

Most dead leaves from trees and plants can be used as good tinder. Leaves tolerate dampness differently, but in general leaves are a much better tinder than grass. Some dead leaves remain on their trees (i.e. oak and beech) making them a great resource when the ground is damp. If the leaves are damp, place them in the sun to dry. Wind can help in the drying process as long as the humidity is low. To make dry dead leaves into useable tinder, you should crumble them. Leaves work best with open flame ignition. They often perform poorly with spark rods, as the sparks just bounce off the flat leaf surfaces.

Pine Needles

The dead needles from most pines can be used as tinder. Pine needles handle dampness very well, perhaps better than any other tinder. Because of the small amount of flammable pitch in the needles, they should burn well unless they are soaking wet or rotten. Pine needles usually need no processing other than drying, although some pounding will split and shred the needles, increasing the surface area of the longer needled species of pine. Pine needles can be collected under the protection of their trees or from sunny spots where they collect from blowing in the wind.

Inner Bark

The dry inner bark from countless dead trees and plants can be stripped and processed into excellent tinder material. Look for the dead inner bark from trunks and branches of tulip poplar, cedar, juniper, mulberry, and some oaks. Plants that are used for cordage material, such as milkweed, dogbane, stinging nettle, and fireweed, can also provide inner bark tinder.

Inner bark can be processed by pounding, tearing, twisting, scraping, or buffing. Pounding is usually the best way to fluff up barks. When processing in any of the ways listed above, catch the fine fibres in some container and use them as the core of the finished bundle. These fine fibres and dust will make the best fuel. The finer materials should be placed in the centre to provide the best fuel for coals, though that shouldn't be necessary for spark rods or open flames. The inner bark of trees are among the longest and steadiest burning tinder's.

Outer Bark

Some outer bark, such as that from cedar, juniper, and birch can also be used like inner bark. Outer bark that is fibrous can be processed in the same ways as inner bark. Birch bark should be shredded as finely as possible. Cedar and juniper tend to smoulder, without flaming up too much. This can be frustrating if you're trying to build a friction fire, but it's a great quality if you're trying to build a long match. The papery outer bark of most birch species makes a great tinder for open-flame fire starting, though it isn't very easy to light with spark rods. The best feature of birch bark is its high oil content. This acts like a waterproofing, allowing the bark to burn even when soaked with water.

Weed Tops and Seed Down

The dead tops from many plants can be used as tinder. Some tops, such as goldenrod, have several grades of tinder in their top. Seed down can also be used as tinder. When used with friction fire coals, it usually doesn't produce flame on its own, and instead just smoulders. But apply a spark rod or open flame to the seed down, and it is explosive. Collect this downy fluff from thistle, cattail, milkweed, and even certain trees, like cottonwood.

Weed tops usually need no processing. Seed down may need to be removed from pods, fluffed, and shaken to remove the seeds, which, as stated, are not flammable. It's neighbourly of you to drop or plant these seeds to renew the resource you are using. Weed tops can be mixed together into bird nest bundles, with the finer material in the centre. There may need to be some outer layer to hold loose materials together. Any dry leaves or fibrous tinder should make a fine outer layer. Seed down can mixed throughout any tinder bundle for a quarter or a third of its volume. It can also be used as an inner core for friction fire tinder bundles.

Tropical Tinder

In southern coastal areas, there are all kinds of tinder that work well for fire building. The fabric-like bark of certain palm trees can be excellent tinder when ripped apart or folded into a wad. Some coconut shells have fibre in their husk, which makes a good tinder, and the dried husks can even be used as "firewood" where fuel is scarce. Certain mosses, such as dead and dry Spanish moss, can be used as tinder when mixed with other tinder. The gumbo limbo tree has a papery bark that readily peels off the tree and resembles a red-coloured birch bark. This papery bark can be shredded and used as great tinder in tropical areas.

Dangerous Tinder

All smoke is carcinogenic, so be careful not to breathe much of it when handling and blowing on any form of tinder. However, some good looking tinder should not be used at all because of its toxicity. The inner bark of the black locust is toxic and can cause a headache if smoke from it is inhaled. Large, old poison ivy vines are covered with a fuzzy, brown fibre that appears to be a great tinder source, but even handling the fuzz will cause those who are allergic to it to break out in a rash. Burning any part of poison ivy, poison sumac, or poison oak can even more dangerous. The smoke can carry the toxic oils into the lungs, and cover exposed skin and clothing.

Good Tinders

- Cliffrose (Cowania)- Outer bark from trunk and larger limbs.
- Cottonwood (Populus)- Inner cambium layer on old dead trees.
- Sagebrush (Artemisia tridentata)- Outer bark from trunk of larger plants.
- Juniper (Juniperus)- Outer bark from trunk of mature trees.
- Yucca (Yucca)- Fibres from pounded dead leaves or ready-made at the base of dead plants.
- Nettle (Urtica)- Fibres from pounded dead stalks.
- Milkweed (Asclepias)- Fibres from pounded dead stalks; also silk from pods.
- Dogbane (Apocynum)- Fibres from pounded dead stalks.
- Thistle (Cirsium)- Down from tops.
- Cattail (Typha)- Down from seed heads.
- Various grasses: Dead leaf blades, partially decomposed, lying at base of plants.

Collecting & Processing Tinder

Bark	Dry bark can be pried from dead trees to use as tinder if fluffed up.
Sticks	Never use green or living sticks on the fire as they won't easily catch fire. If the ground is wet from rain or snow, look for twigs that aren't resting on the ground but instead still on dead branches or leaning up against things. Sticks can be feathered by using a knife or axe in downward strokes to make it easier for a spark to catch it.
Logs	Larger logs should be split prior to use on the fire unless the fire is already large. Ideally logs should be left to dry for a year in a warm, dry location after being freshly cut.
Wet Logs	Wet or damp logs should be placed near a fire to help them dry out faster. If logs are green and wet/damp you should seek alternative wood sources.

4 Types of Fires

The following lists various types of fires and how they can be made or avoided if they are wildfires.

Controlled Fires

Teepee Fire

The Teepee fire is an efficient fire. It lights easily, burns well, and is fairly easy to start and maintain. The Teepee fire gives off a great amount of heat even if it is relatively small in size. Select an area for your fire. Depending on the conditions, choose the best site for your situation.

Construction
1. Gather your tinder, kindling and wood you will use to fuel the fire. How much of all will depend on the size of the fire you are building.
2. Clear a circle for your fire, making sure the area is free of anything that could catch fire, above you as well as around you.
3. Place your tinder in the centre of the circle.
4. Use your kindling to build the frame of the Teepee fire. Lay the small diameter twigs and sticks against one another and over the tinder bundle to form a teepee shape. Leave a small opening in the frame on the upwind side. You will use this opening to light the fire.
5. Gradually start adding larger, thicker twigs as you build outwards, leaving plenty of air space between the sticks. Be careful to maintain the shape of the teepee at all times.
6. Light the fire through the small opening you left in the frame. After the small twigs begin to burn, continue to add more and more larger pieces remembering not to suffocate the fire. You want to make sure that plenty of air gets into the heart of the fire.

Criss-Cross Fire

A crisscross fire, or council fire, is one of the best fire lays for cooking. This fire produces a large, deep bed of coals and is easy to maintain for long periods. It is built with layers of fuel crisscrossed at right angles to each other. To make a crisscross fire, place two logs on the ground parallel to each other. Place you tinder in between the two logs. Lay the logs on the fire in layers, one layer crossing the other. Leave a little space between each log for air to circulate. Finish with a few small logs on top, and simply add more logs as needed.

Fire Ring

Creating a fire ring will help contain your fire. Choose an area in a clearing so that you can keep sparks away from trees or brush. Clear a spot for The circle of rocks. Remove sticks and branches or anything that may catch fire from stray sparks. Collect large, dry rocks to encircle your fire. Avoid using rocks that may be saturated with water (like those found under or near a water source).

When these rocks are heated, steam pressure will build up and the rocks can explode. Dig a circle in the centre of your clearing. If you dig about five or six inches deep this will help protect you fire from the wind. Place the large rocks firmly into the dirt around the edge of the hole all the way around. Fit the rocks tightly together to make a solid wall around the hole. Inside your fire circle you can build a number of types of fire. From a Teepee fire to an A-frame, just choose the type that will best suite your fire ring, situation and available resources.

Keyhole Firepit

A keyhole fire is made in a keyhole-shaped fire ring, and is used for cooking. The large round area is used to build a fire in order to create coals. As coals develop, they are scraped into the long thin end of the ring to cook.

Long Fire

A long fire is typically as long as your body and is perfect for ease of maintaining and keeping your whole body warm at night. The long fire is a versatile, multi-purpose fire lay. The long fire begins as a trench, the length of which is laid to take advantage of existing wind. The long fire can also be built above ground using two parallel green logs to hold the coals together. These logs should be at least six inches in diameter and situated so you can lay things like cooking pots and such upon the logs. Two, one inch thick sticks can be placed under both logs, one at each end of the long fire. This is done to allow the coals to receive more air.

V Fire

This V fire lay is a modified version of the long fire. The way the V fire is arranged allows you to either block strong winds, or take advantage of light breezes. During high wind conditions, the part of the lay where the two logs come together is placed in the direction from which the winds are coming. This will shelter the tinder (kindling) for ignition. Reversing the lay will funnel light breezes into the tinder (kindling) making it easy to ignite.

Swedish Torch

A Swedish torch (also Swedish candle, Finn candle, Swedish fire, Siberian tree torch or Russian tree torch) is a source of heat and light from a vertically set tree trunk, incised and burning in the middle. Due to its flat surface and good embers, it can also be used for cooking. Compared to a campfire, it is more compact, and therefore several small heat sources can be distributed over an area.

Trench Fire

A Trench fire is simply a fire built in the bottom of a trench. In situations where you are forced to use poor quality wood and when cooking is made more difficult because of windy weather conditions, building a trench fire is best. Start by digging or scraping a rectangular trench that's length runs in the same direction that the wind is blowing. This will help assure a proper draft. The trench should be about a foot deep, two or three feet long, and anywhere from 6 inches to a foot wide. Make the windward end deeper sloping upward to a shallow end where the wood can be fed into the fire. Line the bottom of the trench with a layer of rocks.

This will protect the fire from damp ground and radiate heat. You make your fire on this layer of rocks. You can also use rocks to bank both sides of the length of your trench leaving the ends open to take advantage of the draft. These rocks will create a support should the ground become loose and the sides fall into the hole. If the trench is wider than your cooking gear, you may have to use green sticks to create a base to cook on. Rest the (pot, pan, etc.) on the deepest end of the trench.

Parallel Fire

Sometimes a fire is build between two long logs. If the logs are the same size, the tops of the log can be used to place pots for cooking. It has the added advantage of prolonging the fire since the insides of the log are burning too, and its easy to direct the fire up or down the length of the side log, literally until the entire log eventually consumed. A similar fire is the trench fire, used almost exclusively for cooking. These work by either blocking the wind or in funnelling the wind into the fire for a more concentrated and hotter "burn". Several pots can be placed over the trench and the fire can be maintained at different levels for a variety of cooking options.

Star Fire (Indian Fire)

This is not known as one of the popular types of camp fires, but it's an interesting one if you'd like to try it. You need five thick logs to make the five points of the star. Simply arrange them so they look like the rays of the sun, with a small empty area in the epicentre. Then light the end of each log that is closest to the centre. As the fire burns up the logs, push them further into the centre.

Pyramid/Platform Fire

This fire consists of a foundation framework of large logs laid side by side to form a solid base. A slightly shorter log is laid perpendicular and on top of this first layer. Each subsequent layer is slightly shorter as the platform or pyramid rises. This solid mass of right angle firewood takes a little effort to light but it's well worth it for the huge amount of coals it produces, especially when the fire is lit on the top most layer and burns down through the layers. A lighter version of the Pyramid fire is the platform. It's similar in shape to the pyramid fire except the logs are layered only along the outside edge (like walls on a log cabin) with each level of logs slightly shorter than the ones beneath. This creates a hollow wood platform into which smaller kindling can be placed and ignited. It can provide quick warmth and be the start of any number of larger blazes.

Stump Fire

A stump makes a great fire site, especially for cooking. Since they're underground, there's no source of oxygen to sustain the flame so the part of the stump under the surface won't burn.

Construction
Carve out the centre of the stump into the rough shape of a bowl, including a channel cut on one side that allows good air access as well as a good spot to light your fire. Once You have the rough bowl shape, put in a layer of dry tinder (ground leaves, cattail, tinder bundle, etc.) Light the tinder in the stump and slowly feed the fire with twigs and such until it's burning good. Add a few larger pieces and let it burn down into the bowl making a nice bed of coals. The edges of the stump are still good and solid, this makes a great cooking platform.

Tree Torch

As an alternative to the traditional signal fire, you can create what the US Army calls a "tree torch". If you can locate a tree in a clearing which has green leaves and is a considerable distance away from other trees (thus less likely to spark a forest fire), you can use it to make a giant torch. Load all easily reachable branches with dry tinder that will light easily. When lit, the tinder will burn while the living tree creates a massive smoke plume which will be visible for miles.

Signal Fire

Choose a good strong visual point to be seen from. Any fire you build, must be in a clear location to ensure passing crafts stand the best chance of spotting you. In a clearing or on a hilltop, make three signal fires, place them in a triangular pattern (a known signal for help). Space them about 50ft. apart so that the pattern can be distinguished from overhead. You want the smoke from your signal fire to show up against your background area. In snowy conditions for example you will want dark smoke (black). You can make dark smoke by burning the tires on your car, your vehicles oil, even plastics may work. In a forest you would want white smoke. You can get this by burning dry leaves and or green boughs. For ample smoke, use green and wet wood on top of your burning fire.

Wildfires

Crown Fires

A forest fire that spreads from treetop to treetop. This type of fire generally spreads to the ground if it hasn't already as flaming debris falls. Crown fires burn trees up their entire length to the top. These are the most intense and dangerous wild fires.

Surface Fires

Surface fires burn only surface litter and duff. These are the easiest fires to put out and cause the least damage to the forest.

Ground Fires

Ground fires (sometimes called underground or subsurface fires) occur in deep accumulations of humus, peat and similar dead vegetation that become dry enough to burn. These fires move very slowly, but can become difficult to fully put out, or suppress. Occasionally, especially during prolonged drought, such fires can smoulder all winter underground and then emerge at the surface again in spring.

For more information on Wildfires, see the 'NATURAL DISASTERS > Wildfire' section.

5 Fire Lighting

This section will teach you the theory on fire lighting and how to light one quickly and effectively.

Fire Theory

Starting a Fire

Fire Triangle Require all three sides of the fire triangle to light any fire. • **Air (Oxygen)** • **Heat** • **Fuel**	Start with the finest materials in a bundle such as cotton, alcohol or wood shavings. When smouldering, wrap it in a nest of fine, dry and fibrous material such as grass. One burning better place it under a pile of twigs to start it burning. There should be a teepee of larger sticks above the twigs and large logs on the outside ready to put on.

Stick Pyramid
- **Layer 1:** If lighting with flint, have a very fine, easily combustible tinder to start with such as magnesium, lint or cotton.
- **Layer 2:** The next layer should consist of a double fist sized bundle of dried grass or other burnable material or larger. This is typically put in the shape of a birds nest with the smaller tinder in the middle.
- **Layer 3:** The third layer should be a combination of small twigs and a few more dried materials such as leaves to assist the flames in taking hold.
- **Layer 4:** Once the twigs are alight you can now move on to larger sticks and thicker branches up to a diameter of 2-3cms (1 inch).
- **Layer 5:** Large branches can then be added with sizes from 3cm to 10cm diameter.
- **Layer 6:** You can then add the large trunks with diameters anything from 10cm to 30 cm (12 inch). Once lit, these will burn for most of the night and don't require much attention.

Flame Types

With hydrocarbon flames, such as gas, the amount of oxygen supplied with the gas determines the rate of combustion, flame colour and temperature. In all but exceptional cases, like decorative gas fireplace flames, you always want a blue flame from a gas appliance burner.

Blue Flame	A blue gas stove flame indicates complete combustion, meaning you aren't wasting gas and money.
Red / Yellow Flame	Red or yellow gas flames may be the sign of incomplete combustion, wasted gas and a serious safety hazard.

Flame Temperatures

A flame colour temperature guide for fires excluding gas.

Just Visible 525°C (977°F)	**Dull** 700°C (1,292°F)	**Dull Cherry Red** 800°C (1,472°F)	**Full Cherry Red** 900°C (1,652°F)	**Clear Red** 1,000°C (1,832°F)	**Deep Orange** 1,100°C (2,012°F)
Clear Orange 1,200°C (2,192°F)	**Whiteish** 1,300°C (2,372°F)	**Bright White** 1,400°C (2,552°F)	**Dazzling White** 1,500°C (2,732°F)		

Welding Flame Types

There are three basic flame types: neutral (balanced), excess acetylene (carburizing), and excess oxygen (oxidizing).

Carburizing Flame	A carburizing flame will produce iron carbide, causing a chemical change in steel and iron. For this reason a carburizing flame is not used on metals that absorb carbon.
Neutral Flame	A neutral flame is named neutral since in most cases will have no chemical effect on the metal being welded.
Oxidizing Flame	An oxidizing flame is hotter than a neutral flame and is often used on copper and zinc.

Autoignition Temperatures

Fires start from increasing the tinder's temperature until it combusts. Tinder is a material that combusts first (as an ember or flame) and in doing so heats other material (heavier tinder, twigs, kindling, etc.) until it burns (as a flame). Fine tinder is characterized by its ability to combust from a spark, friction, or other action from the below methods. Many forms of tinder are available - charcloth is preferred by many; tinder fungus and related fungus grows in most northern areas; most friction methods using wood generate their own fine tinder; today a pile of magnesium or ferrocerium shavings is common; and a moisture-resistant DIY tinder are cotton balls impregnated with petroleum jelly. Below are the minimum temperatures required to ignite a gas or vapour in air without a spark or flame being present.

Woods Wood - 300°C (572°F) Dry Oak Wood - 482°C (900°F) Pine Wood - 427°C (800°F)	**Solids** Charcoal - 349°C (660°F) Coal - 454°C (850°F) Peat - 227°C (441°F) Cotton Fibres - 455°C (851°F) Paper - 230°C (446°F) Leather - 206°C (446°F) Carbon - 700°C (1,292°F) Phosphorus - 34°C (93°F)	**Gases** Butane - 405°C (761°F) C. Monoxide - 609°C (1,128°F) Hydrogen - 500°C (932°F) Isobutane - 462°C (864°F) Methane - 580°C (1,076°F) Propane - 455°C (851°F) Ethane - 515°C (959°F)	**Liquids** Ethanol - 365°C (689°F) Petrol - 246-280°C (475-536°F) Petroleum - 400°C (752°F) Diesel - 210°C (410°F) Glycerol - 370°C (698°F) Kerosene - 295°C (563°F) Isopropyl Alcohol - 399°C (750°F)
Metals Tin - 940°C (1,720°F) Iron - 1,315°C (2,399°F) Lead - 850°C (1,560°F) Magnesium - 473°C (883°F) Molybdenum - 780°C (1,440°F)			

Lighting Methods

These are the different methods for lighting fires.

Using a Hand Drill

Uses the hands to rapidly rotate a spindle to create embers in a fireboard.	**Components** • Fireboard with drilled holes and notches • Drill Shaft (Spindle) • Hand Piece	See the bow drill section below for setting up the Hand Drill excluding the bow.

Using a Bow Drill

FIRE | Fire Lighting | Lighting Methods | Using a Bow Drill

A version of the hand drill using a bow to spin the stick faster instead of your hands.	**Components** ● Fireboard with drilled holes and notches ● Drill Shaft (Spindle) ● Hand Piece ● Bow	The fireboard should have holes and notches in it which to put the drill shaft into and where the embers fall down into. The wood should be of medium hardness like cottonwood, willow, aspen, tamarack, cedar, sassafras, sycamore, and poplar. Preferably, for the fireboard, you should use a wood of medium-hardness, like cottonwood, willow, aspen, tamarack, cedar, sassafras, sycamore, and poplar, which are the very best. For the spindle, you should use either the same wood or harder wood. I find that an aspen fireboard and a yucca spindle work well. Remember, use a dead, very dry branch for the spindle and fireboard. Green wood is too wet and won't start well.

For the handhold, use a piece of hardwood or a rock with an indent in one side that fits in your palm comfortably. The bow should be a flexible, slightly curved piece of wood about as long as your arm. Tie a piece of paracord on the bottom with a fairly permanent knot, then tie it loosely (not too much slack, but some) to the top with an easily adjustable knot. The spindle will be the spinning piece of wood. It is about 3/4 of an inch in diameter, 8-12 inches long, and round. It should be made out of a piece of wood about the same hardness or harder as the fireboard.

On one end, the top end, it should taper down to a point, then the point ground off slightly to dull it. On the other end, the bottom, it should be pointed also, but not tapered down, more rounded. Also ground this point off. The fireboard will be medium-hard wood about 1/2 to 3/4 of an inch thick, at least twice as wide as your spindle, and as long as you want. This should be dead wood and extremely dry. On one end, make an indentation by putting the tip of your knife on the board (about one spindle away from the edge) and twisting to make a shallow hole. This is a piece of hardwood that can fit comfortably in your left hand (lefties reverse from now on).

Carve a hole in one end like in the fireboard. You can also use a stone with a depression in it. Just make sure it's big enough to keep your fingers from going under-it gets hot down there! The bow should be a stick about as long as your arm and as thick as your thumb at the base. It should be flexible and slightly curved. Tie a strong string at the bottom using a permanent knot of your choice. Now bend the bow and tie the string at the top in an easily adjustable knot, since you will be adjusting it very often. Make sure the string is slack enough for your spindle to be twisted in it, but tight enough for it not to slip around it.

In this step, you will drill the holes in the handhold and the fireboard so that the spindle won't slip out. Begin by putting your left foot to the left of the notch you carved out in your fireboard. Put your right knee down a comfortable distance behind your left foot. Now twist the spindle in this way: hold the bow under your right arm, pinned against your side, so that both hands are free. The thick end should be the one pinned under your arm, and the string should be on top, over the bow.

Put the spindle in so that the bottom end, the one that is more rounded and will be in the fireboard, is on the right. Make sure that the string is resting on the middle of the spindle. Now reverse your hands so that you're grabbing the left of the spindle with your right hand and the right with your left. Twist the spindle clockwise, pulling it up slightly, so that the string twists with it. You can release the bow with your arm, as long as the spindle stays in place.

So, to check: The spindle is twisted in the bowstring, on the outside. It should be up and down in the notch of the fireboard, and the wood part of the bow is on the right of the spindle. Put the handhold on the top of the spindle, the notch on the tip, and hold it with your left hand. Make sure to steady your wrist on your left shin. Hold the end of the bow with your right hand, and start drilling slowly, moving the bow toward you and then away from you. Don't worry about speed right now, just work on getting the motion down.

Push down with your left hand, not too hard, but just hard enough so that the spindle doesn't pop out. If it does, carve the notches deeper in the fireboard and the handhold. Now start to drill faster, and push down harder, remembering to use the entire bowstring and to keep your bowing arm straight. Keep going, until you see smoke, and even then keep going until you can't.

When it's all drilled in, take the spindle out and let it untwist. Wait for it to cool down, and then rub the tip of the top, the one that was and will be in the handhold, in some grease or oil or soap to minimize friction in the socket. If you're in the wilderness and without grease, rub it in your hair and on the sides of your nose. Just remember not to get them mixed up from now on, or else the socket in the fireboard will get grease in it, and that will get rid of valuable friction. Now, carve a triangular notch in the socket in the fireboard. This is where the coal will form. It should go almost to the middle, but not quite, and should be a little less than 1/8 of a pie. Just experiment, because if it's too small, the coal won't have enough oxygen, but if it's to big, the spindle will fly out, and believe me, it hurts.

Carve it out a little on the bottom, just for a little extra oxygen. Put bark or a thin piece of wood underneath it to catch the coal. When you find the right tinder you should put it near your body in between the first two layers of your clothes, so that it can dry out and therefore catch easier. You should fluff it out by rubbing it in between your hands so that it stays together in a clump. You should then collect the ultra fine material that then falls out and put it in the hole you make with your thumb to put the coal in.

Creating Fire
Drill it exactly like you did in step 5, only now it has a notch, so put a piece of bark or a thin piece of wood underneath to catch the coal. Proper form is imperative. Keep a straight back and bowing arm, and keep the bow flat and level. Again, start slowly, and remember that the important thing is not speed, but using the whole bowstring. Apply more and more weight on the handhold, increasing weight in relation to speed.

Keep going until your arm aches and feels like it will fall off, and then do 10 more strokes. It is better to take the spindle off itself then to let it launch out, but what happens, happens. Look at the black dust in the notch that has formed while you were bowing. If it continues to smoke, that means that you may have a coal. Poke it out with your knife tip or a toothpick sized twig.

Fan it with your hand. If it holds together in a clump and continues to smoke, keep fanning it. If it is a true coal, it will eventually start glowing red. Remove the fireboard from the bark and sprinkle extra powder, which will have built up around the notch, on the coal to keep it going. Now put your tinder bundle on the coal, and in a quick motion turn it over to get the coal in it.

Softly bunch the bundle around the coal, hold it above your head and blow it, softly at first, into flame. Remember, long, sustained breaths are better than short ones. When it bursts into flame, don't be afraid of burning your fingers. Put it in your fire lay (teepee, lean-to, etc.) and let it catch on the kindling.

Using a Pump Drill

A variation of the hand drill which uses a pumping motion on a horizontal board instead of a spinning motion.	**Components** ● Fireboard with drilled holes and notches ● Drill Shaft (Spindle) ● Crossbeam with Rope ● Counterweight	A pump drill works by pumping a cross-piece of wood up and down. This is tied to the drill in such a way that the pumping action causes the drill to rotate first one way and then the other quickly, similar to the drill in the bowdrill. A counterweight (at the bottom of the drill) is necessary to provide momentum to the drill. Without it, the drill would lose its momentum instantly because of the friction with the fireboard. It's recommended to have some components of the pump drill pre-made and located in your BOB such as the counterweight, rope and cross-piece to ease the task of building it in the wild.

Using a Fire Plough

A fireplough is operated by quickly rubbing some wood back and forth along a "V" groove in a fireboard. This builds up a pile of hot coals at the end of the groove.	**Components** ● Fireboard with a "V" groove ● Plough stick shaped to a dull point	Find a piece of soft wood. You might get it off a piece of furniture or from an abandoned building. As long as you can make a mark on it with your fingernail, it is soft enough. Make sure it's no more than two feet long, no more than six inches wide, and no more than an inch thick. Find a very hard stick, about a foot long and a half an inch thick. With this one you shouldn't be able to leave a mark on it with your fingernail, otherwise it is too soft. Kneel down over the soft wood. Rest one end of the hard stick on your thigh and the other end on the wood. It should slant either right or left (depending on whether you are right or left-handed) at about a 45-degree angle.

Get a good grip on the stick and start rubbing it up and down the soft wood, making sure the keep the path straight as it forms a groove. The "ploughing" should be hard and fast. This is where your stamina comes into play.

Ignore your burning muscles and keep at it! Soon a pile of wood shavings will form at the end of the wood. Eventually the wood will be hot enough to ignite the wood shavings into embers. Immediately place your kindling on the embers and gently blow on it until the kindling ignites.

Using a Fire-Saw

One piece of bamboo is sliced in half lengthwise then rubbed quickly back and forth in a slot cut across another similar piece of bamboo. Underneath the slot is a tinder bundle. The hot dust from the sawing action falls into the tinder and is blown into flame.	**Components** ● Fireboard with a "V" groove ● Plough stick shaped to a dull point	Start by splitting a piece of bamboo. It should be long enough to wedge between your stomach and the ground while kneeling. You'll need to pad the stomach end, unless you leave that end blunt by cutting it at a node. There should be a long, straight, sharp edge facing away from your body. This piece needs to be fairly beefy since you'll be leaning into it. For the moving piece you need another short section of split bamboo. You grip this with two hands and saw up and down, with the curved side of the hand piece against the sharp edge of the belly piece. Once you've worn a good groove in the hand piece you need to prepare the tinder. Scrapings from the inside of the bamboo work great for this.

You put the tinder inside the hand piece, then put a little bamboo shim over the tinder. To use, grab the hand piece with both hands, while lightly holding the shim with both thumbs. A coal will (hopefully) form in the tinder after you burn a hole through the hand piece. To get the sharpest edge on bamboo, don't cut it - peel little splits off the edge. Peel from the outside of the bamboo toward the centre so that the hard outer layer forms the edge.

"Fire Hole" variation:
This is another variation called the "fire hole" technique - basically a non-bamboo version of the above. Make the stomach piece out of any bowdrill wood, making sure to create a sharp knife-like edge. The hand piece is a partially split branch, held open about 1/4" with a small wood/stone wedge. Fill the split with tinder, then poke a thimble sized hole in it where the hot dust will build up.

Using a Fire-Thong

The fire thong is a fire-by-friction technique requiring a split branch for the heath board and a piece of split rattan. The rattan thong was sawed back and forth against the underside of the heath board.	**Components** ● Log cut in half with two conical holes cut out of one end ● Rope with a toggle at each end	The heath board can be prepared three different ways for a fire thong. For each method, the heath board has an overall general configuration. Imagine a piece of branch split in half. The top side is flat from the split and the other side is rounded due to the curve of the branch.

1	For one method of preparing the heath board, a V-shaped trough is carved in the centre of the top, flat side of the heath board. A punctured hole is drilled to the base of the trough on the middle of the curved side. The hole is less than 1/8 inch (.3175 cm) in diameter. A shallow slot is cut over the tiny hole to guide the split rattan.
2	For the second method of preparing the heath board, the heath board is bound about 6 to 7 inches down the end of the wood. The end is split crosswise and a wooden wedge is placed to hold the split open. The binding keeps the wood from splitting further. The thong is positioned underneath the narrow gap.
3	For the third method of preparing the heath board, a conical shaped hole is bored on the flat side of the heath board. On the middle of the curved side, a very small hole punctures the bottom of the conical crater. The pierced hole is less that 1/8 inch (.3175 cm) in diameter. A slight groove is whittled alongside the hole to hold the split rattan.

The grips for the end of the split rattan were either coiled rattan, wooden toggles or the cut ends of the rattan. When rattan was prepared and carried, it was stored in a tightly coiled configuration. When needed, the fire maker unravelled one end to the desired length and wound the rest of the end for a hand hold. The other coiled end became the other hand grip. When toggles were utilized, the rattan was cut to the required length and the ends were thinned to tie an overhand knot to secure the short wooden stick. The last method for gripping the rattan was to cut the split rattan to a suitable length and just grab the cut ends of the rattan as the hand hold.

Using a Ferrocerium Rod (Flint and Steel)

Flint and steel is the age old way of creating fire. It can spark in the rain and pretty much any other condition you will be in. A single rod will give you thousands of lights and is the most recommended way of carrying fire on you.	**Components** ● Flint Bar ● Steel Striker	Strike the flint and steel into a tinder source until it takes hold, ensure the black coating is removed from the rod before attempting to light.

Using a Fire Piston

One of the harder methods to make a fire with as you require an easily burnable tinder such as char-cloth and lubricant for the rod. Ensure the rubber gasket is fresh and doesn't have any cracks in it and that it fits into the rod snugly. Lubricate the rubber so it slides easily on the outside. Make sure there's a good amount of resistance when pressing it down. Put the fresh tinder into the end of the piston and put the rod onto the very top and place it on a hard surface. Push down the piston very quickly and pull it out from the base. This will compress the air inside to a high level and should ignite the material. Pull it out quickly, the tinder should be smouldering. If you don't pull it out fast enough the lack of oxygen will extinguish it. Quickly put the coal into a bundle of tinder and blow gently until it catches.

Using a Magnifying Glass

FIRE / Fire Lighting / Lighting Methods

The larger the magnifying glass, the easier it will be to light a fire. The ease of lighting this type of fire comes from the position of the sun and the season. Midday in summer would be the easiest. Dawn/Dusk in summer would be a challenge. Midday in winter would be a challenge and Dawn/Dusk in winter would be near impossible. Simply put your tinder on the ground and focus the light into a single point and hold it there until a flame appears. You should use sunglasses when lighting a fire with this method as the spot is incredibly bright. Reading glasses can be used instead to light the fire if they are for close-up work or reading. Long distance glasses spread out the light instead of focusing it.

Using Water and a Bag

Using the same principle as a magnifying glass by refracting light into a single point. Fill the bag with <=5 NTU water. The larger the sphere the more effective the method. Ensure there's no crinkles in the sides of the bag and that the bag is as transparent as possible. Focus it into a point until a fire starts and blow on it gently then put it into a tinder bundle.

Using a Lighter

The easiest modern method for making fire. Commonly used for lighting cigarettes, candles and gas stoves. Press down the flint cylinder swiftly with your thumb and resting it on the gas trigger button. If done correctly a spark lights the stream of gas that emits when the lever is pressed. Release the lever to extinguish the flame. Some lighters are child proof and have a metal loop around the flint to stop it being triggered easily.

Using a Concave Mirror

A concave mirror is similar to the magnifying glass however it will focus the light at a point in front of itself, therefore you will need a small stand to place the burnable material. Add the tinder to the mirrors stand, or hold a few pieces of grass in front of it until it begins to smoulder. You may need an object to hold the grass as the process could take some time to light it depending on the amount of sunlight. When alight, quickly add more flammable materials to it and place it under your twigs and logs.

Using Battery Sparks

Battery sparks from powerful batteries, when aimed at tinder can ignite readily allowing the combustion of the materials. This method can be dangerous as the sparks could fly in any direction and the contacting metal can get extremely hot if left in position. Keep one end of the metal fixed to one end of the battery and put the other end very close to the tinder and repeatedly touch the remaining ends together.

Using a Battery and Steel Wool

This combination uses the travelling electrons through the steel wool to rapidly heat it up igniting it in the process. Simply touch the battery to the steel wool and it will heat up quickly and burst into flames. The finer the wool the faster it will burn up.

Using a Coil Lighter

A plasma arc generated by electricity can be used to ignite tinder easily. Simply open the lighter end and press the button to generate the arc then place a burnable material between the contacts. The lighter will emit a high frequency tone while in use.

Using Chemicals

Chemical fires typically have volatile reaction due to the oxidation of one of the chemicals. Give them plenty of space. Large amounts of chemicals in a reaction could also explode sending burning fragments in all directions. Put the solid chemical in a small tinder bundle of grass or easily burnable material and then add the catalyst and stand back. If done correctly the burnable materials should each take light in the correct order and start a larger fire. After the chemical reaction subsides it's typically safe to walk up to the fire and nurture it.

Fire Spread

Fire Catching Difficulty (Hardest to Easiest)
The below is a table of how easily an ignition method can light various materials. It starts out with piezo ignition which can basically only ignite gasses. Sparks such as from a ferrocerium rod, can ignite everything above on the table such as butane gas and includes a few extras such as magnesium shavings. Lower down a lighter flame can begin to light more commonly found materials such as leaves and paper, but again, can also be used to light easier substances such as dryer lint or alcohol.

Ignition	Description	Can Light
Piezo Ignition	A short current of electricity jumps between two contacts. Requires material to be between contacts. An extremely difficult way to light any materials besides gas.	• Butane • Propane • LPG • Petrol • Alcohol Soaked Cloth
Ember / Light Refraction	A tiny red hot ember typically from a fire piston or bow drill. Put the ember on the material and blow. A very difficult way to light.	(Previous Plus) • Charcloth • Dried Grass • Cotton • Dryer Lint • Shredded Paper • Alcohol • Toilet Paper
Spark	A very hot spark from a ferrocerium rod. A difficult way to light larger materials.	(Previous Plus) • Magnesium Shavings • Fatwood • Paracord
Lighter Flame (2cm) (0.7in)	A small flame from a lighter about 2cm high (0.7in).	(Previous Plus) • Paper • Cardboard • Candles • Dried Leaves • Steel Wool • Matches

Small Flame (5cm) (1.9in)	A steady flame of about 5cm (1.9in).	(Previous Plus) • Twigs • Sticks • Bark
Flame (10cm) (4in)	A steady flame of about 10cm (4in). Smaller flames may be able to light branches eventually, but a 10cm flame is optimal.	(Previous Plus) • Branches
Large Flame (30cm) (1ft)	A steady flame of about 30cm (1ft).	(Previous Plus) • Planks • Dry Thick Logs
Campfire (1m) (3.2ft)	A steady flame of about 1m (3.2ft).	(Previous Plus) • Damp Branches • Green Foliage
Inferno (5m+) (16.4ft+)	A raging flame of 5m+ (16.4ft+). Generally your fires shouldn't get over 1m high unless you're using as a signal fire.	(Previous Plus) • Damp Logs

6 Extinguishing Fire

If you're planning on starting fires you should have some means of putting them out in case they accidentally spread. The below discusses methods of putting out different types of fires safely.

Fire Types

General

To extinguish fires in general you need to remove one or multiple sides of the fire triangle. By removing either the heat, fuel or oxygen the fire will go out.

Campfires

Separate the unburned wood from the burning wood and remove any burnable material from nearby. Douse the fire with water, dirt or sand, beware of water as it could spit back at you. Keep adding water until everything is damp or wet or the fire is mixed thoroughly with your physical medium. Do not just bury the fire with sand or dirt as it will retain heat even longer and keep burning underneath but instead mix them together. Ensure the ground/embers are cool to the touch.

Electrical Fires

Switch off the appliance and pull out plug if possible. Smother fire with blanket or Type C extinguisher. Never try to extinguish with water as water conducts electricity and can give you an electric shock.

Cooking Fires

Shut off stove or oven, smother pan with lid, baking soda or Type B extinguisher. Smother fire in oven by keeping door closed and/or throwing baking soda on food. Never move the Pan. It will fan the fire or splatter grease. Never turn on the exhaust fan or use water. The fan will draw the flames into a concealed space. Let fat cool in oven or else contact with air may make fire flare up again. Hot grease can spatter and ignite any paper, cloth, or wood materials nearby. Cooking oil auto-ignites at around 400-435°C (752-815°F).

Gas Fires

Shut off gas supply. Smother with rug, blanket or Type B extinguisher or cool with water. Ventilate the area to let out the gases. Call the Fire Department to have the area pipes checked for further hazards. Then call the gas company. If there is a gas fire, it may be better to let the gas burn rather than extinguish the fire, which would let the gas fill the room or house creating the potential for an explosion. Therefore, the primary key is to shut off the gas supply and call the fire department. Never enter an area with a lighted match or cigarette if you smell gas from a pipe, heater or stove. Do not turn light switches on or off.

Extinguisher Types

Choosing the correct type of fire extinguisher for the fire is critical to extinguish it as fast as possible.

Class	Description	Symbol
Class A	For ordinary combustible materials such as paper, wood, cardboard, and most plastics. The numerical rating on these types of extinguishers indicates the amount of water it holds and the amount of fire it can extinguish.	Geometric symbol (green triangle)
Class B	Involve flammable or combustible liquids such as gasoline, kerosene, grease and oil. The numerical rating for class B extinguishers indicates the approximate number of square feet of fire it can extinguish.	Geometric symbol (red square)
Class C	Involve electrical equipment, such as appliances, wiring, circuit breakers and outlets. Never use water to extinguish class C fires - the risk of electrical shock is far too great! Class C extinguishers do not have a numerical rating. The C classification means the extinguishing agent is non-conductive.	Geometric symbol (blue circle)
Class D	Commonly found in a chemical laboratory. They are for fires that involve combustible metals, such as magnesium, titanium, potassium and sodium. These types of extinguishers also have no numerical rating, nor are they given a multi-purpose rating - they are designed for class D fires only.	Geometric symbol (Yellow Decagon)
Class E	Electrical equipment: once the electrical item is removed, the fire changes class.	
Class F	For fires that involve cooking oils, trans-fats, or fats in cooking appliances and are typically found in restaurant and cafeteria kitchens.	Geometric symbol (black hexagon)

Extinguisher Chemicals

It is vital to know what type of extinguisher you are using. Using the wrong type of extinguisher for the wrong type of fire can be life-threatening.

Chemical	Description	Effectiveness	
Water **Label: Bright Red**	Water extinguishers are the most common fire extinguisher type for class A fire risk. Most premises will require either water or foam extinguishers.	**Water Uses** • Combustible Materials	**Do Not Use On** • Electrical Fires • Kitchen Fires • Flammable Gas
Foam **Label: Cream**	Foam extinguishers are most common type of fire extinguisher for Class B fires, but also work on Class A fires as they are water-based.	**Foam Uses** • Combustible Materials • Flammable Liquids	**Do Not Use On** • Electrical Fires • Kitchen Fires • Flammable Metals
Dry Powder **Label: Blue**	Standard dry powder extinguishers are also called 'ABC' extinguishers because they tackle class A, B and C fires, however they are not recommended for use in enclosed spaces. This is because the powder can be easily inhaled, and also the residue is very difficult to clean up after. ABC powder extinguishers can also be used on some electrical fires. Specialist dry powder extinguishers are used for flammable metals.	**Dry Powder Uses** • Combustible Materials • Flammable Liquids • Flammable Gases • Flammable Metals • Electrical Equipment	**Do Not Use On** • Oil Fires • Electrical Fires > 1000v
Carbon Dioxide **Label: Black**	CO2 extinguishers are predominantly used for electrical fire risks and are usually the main fire extinguisher type provided in computer server rooms. They also put out Class B fires (flammable liquids, such as paint and petroleum).	**Carbon Dioxide Uses** • Flammable Liquids • Electrical Equipment	**Do Not Use On** • Kitchen Fires • Combustible Materials • Flammable Metals
Wet Chemical **Label: Yellow**	Wet chemical extinguishers are designed for use on Class F fires, involving cooking oils and fats. They can also be used on Class A fires although it is more usual to have a foam or water extinguisher for this type of fire risk.	**Wet Chemical Uses** • Combustible Materials • Deep Fat Fryers	**Do Not Use On** • Flammable Liquids • Flammable Gas • Electrical Fires • Flammable Metals

7 Fire Resistance

Various items and whether or not they are destroyed, partially destroyed or can survive a fire.

Jewellery	Although they may endure superficial damage when they're engulfed by flames, most items of jewellery maintain their compositions amid high heat. Diamonds, which are formed below earth's surface under intense heat and pressure, melt at about 3,315°C (6,000°F). Gold melts at a much cooler temperature - about 1,093°C (2,000°F) - but that's enough to survive most house fires. Platinum jewellery is the priciest, so it's a good thing that the metal's melting point is just higher than 1,760°C (3,200°F). Sapphire and Ruby also possess extremely high melting points.	
Precious Metals	Precious metals can survive all but the most extreme fires fairly well. See the MATERIALS section for a complete listing of the melting points of metal. See Fire Safety below for a list of the temperatures of various fires.	**Metal Melting Points** Copper: 1,083°C (1,981°F) Gold (24k): 1,063°C (1,946°F) Palladium: 1,555°C (2,831°F) Platinum: 1,770°C (3,220°F) Silver (Pure): 961°C (1,762°F) Silver (Sterling): 893°C (1,640°F)
Filing Cabinets	Steel filing cabinets are built to last so that businesses won't have to deal with the loss of important files after building fires. Many people keep personal documents in filing cabinets, which are often kept in home offices. Their steel composition and usual placement within a home – often away from the kitchen or fireplace – give them a high survival rate.	
Tools	Do-it-yourselfers might not have to repurchase the tools they'll need to rebuild their homes after a fire. Steel tools are extremely durable – the melting point of carbon steel is between 1,426-1,537°C (2,600-2,800°F) and the melting point of stainless steel is roughly 1,482°C (2,700°F).	
Cookware	Cookware is built to endure extremely high temperatures. Most pots and pans are made of steel and iron; the latter of which melts at just below 1,537°C(2,800°F). Like silverware, their placement within confined spaces helps them survive the not-so-severe fires.	
Firesafe	The steel composition of a firesafe allows it endure 926°C (1,700°F) infernos.	

8 Fire Safety

This section is for any fire safety tips.

Fire Heat

This section discusses the temperatures different types of fires can reach.

Wood Fire Wood - 1,027°C (1,880°F) Campfire - 593°C (1,099°F) Bonfire - 1,100°C (2,012°F) Housefire - 585°C (1,100°F)	**Butane Gas** 1,970°C (3,578°F)	**Propane Gas** 1,970°C (3,578°F) **Propane Blowtorch** 1,200-1,700°C (2,192-3,092°F)	**Candle** 829°C (1,524°F)	**Incinerator** 870-980°C (1,598-1,796°F)
Charcoal Fire 750-1,200°C (1,382-2,192°F)	**Methane** 900-1,500°C (1,652-2,732°F)	**Bunsen Burner Flame** 900-1,600°C (1652-2912°F)	**Candle Flame** ≈1,100°C (≈2,012°F)	**Magnesium** 1,900-2,300°C (3,452-4,172°F)
Acetylene Blowtorch Up to ≈2,300°C (≈4,172°F)	**Oxyacetylene** Up to 3,300°C (5,972°F)	**Methanol** 1,200°C (2,192°F)	**Dicyanoacetylene** 4,990°C (9,010°F)	**The Sun** **Exterior:** 2,000,000°C (1,111,093°F) **Interior:** 15,000,000°C (8,333,315°F)

Shelter

Types of shelters, building survival shelters and shelter strengths

"A house is more than just a shelter;
that it is a way of improving your way of life."
William Krisel

Introduction

In harsh conditions such as adverse weather or snow you will only last about 3 hours therefore a form of shelter is essential to survival. This shelter encompasses all forms of shelter you can find and how to create some of your own.

Purpose	The aim of SHELTER is to provide detailed information on all kinds of shelters, from natural shelters like boulders and caves, to survival shelters like log cabins and even man-made structures such as houses and military bunkers.
Lost?	• For tips on establishing a home, see the HOMESTEADING section. • For tips on remaining undetected while in a shelter and stealth camping, see the SECURITY section. • For a list of commonly carried portable shelters, see the GEAR section. • For knots related to shelter building, see the KNOTS section. • For a list of the strengths and weaknesses of existing and man-man shelters, see the LOCATIONS section. • For tips on defending yourself while in a shelter, see the DEFENCE > Shelter Defence section. • For tips on wood shelter building, or furniture building see the CRAFTING > Woodworking section. • For a list of the best materials to build shelters from, see the MATERIALS section.

Contents

1 Shelter Types

The shelters in this section are divided into categories to give an idea of what they will fare against in adverse weather. Category 1 shelters should be able to withstand moderate winds and short strong gusts. Category 3 shelters should be able to withstand violent storms. Category 5 should be able to withstand explosions and fare well against nuclear explosions.

	Category 1 A shelter in this category should survive moderate winds and gusts.	**Category 2** This type of shelter should survive a storm with moderate winds, rain, light snow and small hail.	**Category 3** This type of shelter should survive an intense storm with winds, rain, moderate snow and large hail.	**Category 4** A shelter in this category should survive category 1-3 hurricane winds, heavy snow and falling branches.	**Category 5** This type of shelter should survive category 4-5 hurricane winds, bombs and nuclear blasts.

Shelters

Natural Shelters	Natural formed caves can make excellent shelters in bad weather.	**Category 4** Caves should hold up against most winds but becomes dangerous in flooding conditions.	Caves would be the most ideal shelters as long as they are structurally sound and there's no animals living inside.
Survival Shelters	Shelters you build yourself out of natural materials such as sticks, rocks and leaves.	**Category 1-2** Depending on how they are built they can survive stronger weather.	Generally these are made for staying in for a few days as they won't survive strong winds. They use leaves on the top to shed rain and are primarily used for one night stays while moving through a location. They can be easily and quickly demolished leaving no trace that you were there.
Advanced Survival Shelters	Shelters built from stacked logs and rocks to be more stable which are in the shape of modern houses but which still have gaps and no insulation.	**Category 3-4** Custom built log cabins should be able to survive harsh storms if built and grounded correctly.	They take a while to construct but can survive much stronger winds. Not easily disassembled and it would take time to make it look like it's part of the environment again.
Portable Shelters	Any form of lightweight modern shelter that can be pitched and moved with ease such as a tent, and can withstand moderate weather events.	**Category 2** Tents, bivys and hammocks can't survive for long in heavy hail	Canvas swags are made with heavy duty materials which can resist large hail and falling branches therefore they may be able to survive longer than polyester tents.
Public Shelters	Any form of man-made object that isn't designed as a permanent shelter such as a bridge, park shelter, bus shelter etc.	**Category 2** Shelters which will stand up to strong winds but not protect against rain or hail much.	These types of shelters aren't often thought of but will provide a level of protection if required and they can often be built up.
Transport Shelters	Any form of erect modern shelter that can be transported by a vehicle such as a caravan, trailer etc.	**Category 3** Transportable shelters become very dangerous in hurricane strength winds and shouldn't be used.	
Buildings	Any building with four walls and a roof which is made for habitation and is generally waterproof, windproof and inspect proof.	**Category 4** Modern houses (in first world countries) can generally take category 1-3 hurricane force winds well with minimal damage.	
Reinforced Buildings	Buildings with a primary use of concrete such as banks, casinos, vaults etc.	**Category 4** Reinforced buildings can take category 1-3 hurricane force winds well with little to no damage.	
Missile Silos	An extremely heavy duty military grade shelter built underground and designed to shield from nuclear bombs.	**Category 5** Designed to take fire from missiles and explosives and will stand up easily in adverse weather.	
Bunkers	An extremely heavy duty military grade shelter built underground and designed to shield from nuclear bombs.	**Category 5** Will fare extremely well in all types of weather and nuclear wars.	Bunkers are the ultimate prepper's fortress which can help you survive any disaster.

2 Natural Shelters

These are naturally occurring shelters such as caves, valleys and large boulders.

Subheadings

1. Caves	**2. Valleys**	**3. Ledges & Cliffs**	**4. Boulders & Rocks**
5. Standing Trees	**6. Fallen Trees**	**7. Thick Forest**	

1 Caves

Caves are a common choice for sheltering against the elements and for turning into established shelters. For their advantages of an extremely sturdy natural shelter, there's certainly a lot of dangers that come with them, so be sure the one you pick is safe.

Advantages	• All-Weather Protection • Cyclone/Hurricane Resistant
Disadvantages	• Little to no light the deeper you go
Hazards	• Animals Living in the Cave System (Bears, Bats, Weasels, Salamander, Owl) • Poisonous Insects and Creatures (Spiders, Snakes, Scorpions, Remipedes) • Cave-ins • Cave Floor Collapsing • Flooding • Lack of Oxygen • Getting Lost • Cave Flooding at High Tide

2 Valleys

Valleys can reduce the wind factor by quite a degree depending on how steep the valley is. They will unfortunately gather water in downpours which can be life-threatening in certain situations.

Advantages	• Some wind protection
Disadvantages	• May increase the wind in certain circumstances
Hazards	• Flooding

3 Ledges & Cliffs

These can provide a single wall of protection from the elements such as wind and rain, however they may not be so useful if weather is coming from the other direction.

Advantages	• Provides a single wall of protection from the elements
Disadvantages	• May be quite muddy in the rainy season if the cliffs aren't covered by plants
Hazards	• Falling Off • Falling Rocks

4 Boulders & Rocks

Rocks and boulders are useful for shielding you from the elements, however they may be difficult to attach a tarp to since you won't be able to hammer pegs into them.

Advantages	• Resistant to all forms of weather and threats • Won't attract lightning like a tree would
Disadvantages	• Their round shape may be difficult to utilize effectively
Hazards	• Be careful of boulders and rocks which may be close to falling over as they will easily be able to crush you.

5 Standing Trees

Trees make a decent shelter if they provide enough leaf coverage and are rooted deeply enough. Never camp under Eucalyptus trees or any trees with questionable limbs as they can drop whole branches onto you.

Advantages	• Still growing and getting stronger • Provides shelter from rain and hail
Disadvantages	• May not have leaves in Autumn/Fall • May shed its leaves all over your shelter
Hazards	• Potential target for lightning • May drop branches

6 Fallen Trees

A large fallen tree can be a useful shelter if it's tall enough. It will protect you from the wind and provides a solid backing which you can connect a tarp to.

Advantages	• Protection from falling trees if you sleep as close as you can to it • You can use the fallen branches to make a lean-to shelter without having to look for wood
Disadvantages	• Slowly decomposing, weakening the tree • May have lots of branches you have to clear out of the way
Hazards	• Concealed Animal Hazards (Snakes) • Insect Hazards (Ants, Termites, Spiders, Scorpions) • The chance of it rolling over and crushing you

7 Thick Forest

SHELTER | Natural Shelters | Thick Forest

A forest full of trees can be a useful shelter from the elements if you're deep enough inside. You'll have plenty of trees to hang your hammock from and generally a bare forest floor since most of the sunlight will be blocked from any small shrubs.

Advantages	• Reduces the speed of the wind • Keeps you dry fairly easily
Disadvantages	• Chance of getting lost • Little Sunlight
Hazards	• Falling Branches • Falling Trees

3 Survival Shelters

These are shelters you build yourself out of natural materials such as sticks, logs, rocks and leaves. It's assumed you will have a few materials to assist in the construction of the shelter such as a tarp, ground sheet and some form of rope or fishing line. These forms of shelters will rarely stand up to any strong wind.

Materials
- **Natural Elements:** It's ideal to start the shelter using a natural feature of the land such as a (stable) fallen log or large boulder.
- **Logs & Sticks:** For the framework of the structure.
- **Leaves:** Used for the roofing and shedding water.
- **Rocks:** Rocks could be used to secure the frame to or to hold down the sides.
- **Healthy Trees:** These can be used as a strong tie off point for your shelter, or you could build the shelter around it.

Ground Shelters

These are shelters that are built on the ground.

Round Lodge

The round lodge is a hybrid from many cultures. Part tipi, part wicki-up, and influenced by many architectural styles, a round lodge can block wind, rain, cold, and sun. It is structured like a tipi, with the addition of a solid doorway. These typically have a smoke hole through the roof, and can accommodate a tiny fire for heat and light.

This shelter can be thatched with grass or mats; or it can be buried with a thick coat of leaf litter. Lodge styles like this abounded in the historic and prehistoric American west. This architecture worked equally well in wetter climates, and was used in pre-Roman Britain.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials	**Construction**	**Warnings / Hazards**
• Sticks • Logs • Rope	o	o

Debris Shelter

Debris survival shelters come in a variety of structural designs, but the most common is an A-frame. Natural debris, such as tree foliage and dead leaves, can be utilized to insulate your shelter and protect you from the elements.

Keep in mind that your debris won't hold your shelter together nor withhold its strength against strong wind. Incorporate mud (or clay if available) into your structure to make it sturdier. When you're in the forest, look for materials that require little to no alterations (especially when you don't have tools) to build your structures.

Category 1
The leaves will blow away with a moderate wind reducing the waterproofing of the shelter.

Materials	**Construction**	**Warnings / Hazards**
• Sticks • Logs • Rope • Leaves	o	o

Ramada

A ramada is a type of outdoor shelter characterized by a solid roof supported by posts, but typically lacking full walls or being only partially enclosed. Ramadas can be temporary structures made from natural materials for survival or quick shade, but are more commonly permanent, robust constructions made from wood, concrete, or steel.

They are designed primarily to provide shade from the sun and offer protection from other elements like light rain or wind, while still allowing for air circulation. They are often used as extensions of outdoor living spaces, such as covers for patios, decks, outdoor kitchens, or poolside areas, and can be free-standing or attached to an existing building.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Ramada	**Materials** ● Tarp ● Logs ● Rope	**Construction** Ensure the chosen area is clear of debris and as level as possible. Precisely mark the exact spots for your support posts, ensuring they form a true square or rectangle. Dig holes for your posts to the required depth (often below the frost line in cooler climates). Pour Concrete (Optional: Place concrete footings in the holes. Set your main support posts (e.g., 4x4 or 6x6 timber) into the wet concrete, using a level to ensure they are perfectly vertical (plumb) and bracing them until the concrete cures. Alternatively, use post anchors bolted to cured concrete. Measure and cut your horizontal beams (larger timber, e.g., 2x8 or 2x10) to span between the tops of your posts. Lift and attach the beams to the tops of the posts. This can be done by notching the posts, using metal connectors, or through-bolting. Ensure they are level. Use appropriate fasteners (e.g., lag screws, carriage bolts) for strong connections. Measure and cut the roof joists (smaller timber, e.g., 2x6) to span across the beams. For a flat roof, they will be uniform. For a pitched roof, they will be cut at an angle to meet at a ridge. Lay out the joists evenly across the beams according to your design. Secure them to the beams using joist hangers, nails, or screws.	**Warnings / Hazards** ○

Quinzhee

Quinzhee		a quinzhee is an effective emergency shelter built from a large, consolidated pile of loose snow. Unlike an igloo, which uses cut blocks of hard snow, a quinzhee relies on the "sintering" process, where disturbed snow crystals bond together and harden after being piled and left to settle for a few hours. Once the mound is firm, an entrance tunnel is excavated, leading into a larger, dome-shaped inner chamber. A critical step involves creating an elevated sleeping platform within the cave to separate occupants from the coldest air, which naturally sinks. Finally, a small ventilation hole is poked through the roof to ensure air circulation and prevent carbon dioxide buildup, vital for safety in a confined snow shelter.	**Category 2-3** It can survive moderate winds but likely won't survive a storm well.
Quinzhee	**Materials** ● Snow ● Sticks	**Construction** Start by piling up some moveable gear under a tarp. Backpacks are commonly used for this. Then pile snow over the tarp and gear. Pack the snow down, estimating when it is two feet thick all the way around. Next, insert 12 inch long sticks around the dome. Use 3 or 4 dozen of these guide sticks. Burrow into the side of the quinzhee, and retrieve the tarp and gear. Excavate snow inside the mound until you reach the base of every stick. This will ensure uniform thickness of the dome. Make a fist sized ventilation hole in the roof of the quinzhee.	**Warnings / Hazards** All snow shelters eventually collapse or melt.

Quinzhee

Warnings / Hazards Continued
Quinzhees can collapse from poor snow conditions, warm weather, blowing rain, construction problems (hitting a supporting wall), failure to let the snow sinter long enough, or from people climbing on them. Collapse poses a danger of suffocation for occupants. Quinzhees should not be used when temperatures are warmer than −4 °C (25 °F) due to risk of collapse. The greatest risk of collapse occurs during the excavation process. Longer sintering time generally reduces risk of excavation collapse. To reduce undue loading on the roof of the quinzhee, the interior ceiling should be excavated first, then the interior walls and floor. One person should be outside the quinzhee while another is digging inside. Place a shovel, branch, hiking pole, or such near the head of a sleeping person for roof support, to break a falling roof to create an air gap, and/or as a tool to dig out. One shovel should be left outside to mark the door and aid rescuers in digging occupants out. Some users prefer a marker to be left outside the quinzhee nearest the heads of sleeping occupants to indicate where rescuers should start digging.

Quinzhee are typically built on a flat area where snow is in abundance, on a day colder than −4 °C (25 °F). Builders break up layers of naturally fallen snow into powder and thoroughly mix bottom and top layers of snow to increase sintering, thus strengthening the eventual structure. Snow is typically piled 1.5 to 2 meters (6 to 10 feet) high in a dome 3 to 4 meters (10 to 12 feet) in diameter. It is then left for at least 2 hours to sinter, allowing both temperature and moisture in the snow to homogenize and the snow crystals to bond with each other. Packing can speed the bonding process and strengthen the structure. Small sticks, approximately 30 to 35 cm (12–14 inches) are pushed into the structure to act as thickness guides when the interior is hollowed out. According to Halfpenny and Ozane, the wall at the base should be at least 30 cm (12 inches) wide and at the top about 20 cm (8 inches) thick, though wall-base thicknesses of >60 cm (2 ft) are possible.

Excavation may be accomplished more quickly if large blocks of interior snow are carved and slid out through a large, temporary "excavation door". Strength increases when all interior wall and ceiling surfaces follow an arched curve, with no flat sections. Once excavation is complete the excavation door can be permanently blocked using previously excavated blocks, and a smaller permanent door can be cut in the most desirable spot. Time and effort are required to hollow out the centre of a Quinzhee, though these can be reduced by piling snow around a hollow structure, such as a pile of packs or a makeshift tent or dome.

Allowing the interior temperature to rise above freezing point risks weakening the shelter significantly, especially if the outside air temperature is near freezing. A small hole for air circulation should be poked through the ceiling. To avoid dripping melt-water, irregular or bumpy surfaces are often smoothed to direct the flow of water down the walls to gather around the edges. A non-airtight fabric door cover will minimize the amount of cold air coming into the quinzhee. An empty, well built snow structure, 16 or more hours old, in weather below −12 °C (10 °F) may be strong enough to support a group of adults standing on top of it.

Snow Cave

Snow Cave		A snow cave is an emergency shelter constructed by digging into a deep, stable snowdrift. Its primary purpose is to provide immediate protection from extreme cold, wind, and precipitation. The thick snow walls act as excellent insulation, trapping body heat and maintaining an interior temperature significantly warmer than the outside air, often around freezing even when external temperatures are well below zero. A snow cave's design typically includes an entrance tunnel that slopes upwards into the main chamber, effectively creating a "cold sink" where the densest, coldest air settles, leaving warmer air for the occupants on an elevated sleeping platform. A small ventilation hole poked through the roof is vital for safety, ensuring adequate airflow and preventing the dangerous buildup of carbon dioxide or carbon monoxide from any heat sources.	**Category 1-2** This won't survive long in very strong winds before being torn apart.

SHELTER | Survival Shelters | Ground Shelters | Snow Cave

Materials	Construction	Warnings / Hazards
Materials ● Snow ● Shovel (Helps)	**Construction** First, locate a deep, stable snowdrift, ideally on a gentle slope or the leeward side of a hill. Begin by digging a small entrance tunnel, ideally sloping slightly upwards into the snow bank. This upward slope helps trap warmer air inside the cave. Continue to hollow out the interior, expanding it into a dome or igloo-like shape. The curved ceiling is crucial for structural integrity and to prevent drips from melting snow. Aim for walls and a ceiling at least 12-18 inches thick for insulation and stability. Once the main chamber is excavated, create an elevated sleeping platform inside, higher than the entrance, to keep you above the coldest air. Smooth the interior walls and ceiling to minimize dripping. Finally, poke a small ventilation hole (about 2 inches in diameter) through the roof, preferably at the highest point, using a ski pole or stick to ensure constant airflow and prevent carbon dioxide buildup. The entrance can be blocked with a snow block or backpack for added warmth, but always ensure the ventilation hole remains clear.	**Warnings / Hazards** o

Wedge Tarp

SHELTER | Survival Shelters | Ground Shelters | Wedge Tarp

A wedge tarp shelter is a simple yet effective emergency shelter created using a single tarp. It provides protection from wind, rain, and snow. The basic setup involves securing one long edge or corner of the tarp low to the ground, often by pegging it directly into the earth or weighing it down with logs or rocks. The opposite edge or corner is then elevated, typically by tying it to a tree or using a trekking pole or sturdy stick as a prop, creating a sloped, wedge-like shape. This design funnels precipitation away and offers a degree of windbreak, with the low side facing into the prevailing wind for maximum protection. The open side allows for ventilation and can accommodate a small fire if safe to do so.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials	Construction	Warnings / Hazards
Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Arrowhead Tarp Shelter

SHELTER | Survival Shelters | Ground Shelters | Arrowhead Tarp Shelter

An arrowhead tarp shelter is a highly versatile and protective configuration that maximizes a tarp's coverage to create a relatively enclosed space. It's often favored for its ability to offer significant protection from wind and rain, and can even provide some insulation in colder conditions. This setup typically involves using a ridgeline (rope) strung between two anchor points, like trees. The tarp is then draped over this ridgeline, with a portion of it extended to the ground to form a floor and one or more walls, while the remaining sections are pulled taut and staked out to create a triangular, tent-like structure with a pointed arrowhead shape at one end. This design allows for a relatively compact and wind-resistant shelter, often with a single opening that can be partially or fully closed, making it efficient for retaining heat from body warmth or a small, carefully managed internal fire.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials	Construction	Warnings / Hazards
Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Basic Fly Shelter

SHELTER | Survival Shelters | Ground Shelters | Basic Fly Shelter

A simple, often quickly erected tarp configuration primarily designed for overhead protection from rain or sun. It typically involves suspending a tarp horizontally or with a slight pitch over a ridgeline, which is a rope strung between two trees or elevated points. The corners of the tarp are then pulled out and secured to the ground using stakes or weighted objects, creating a minimalist roof. While offering essential protection from precipitation and direct sun, a basic fly provides limited defense against wind, cold, or insects, making it most suitable for milder conditions or as a quick temporary cover. Its simplicity and speed of deployment are its key advantages when immediate overhead shelter is needed.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials	Construction	Warnings / Hazards
Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Body Bag

SHELTER | Survival Shelters | Ground Shelters | Body Bag

A specific and highly protective tarp configuration designed to provide maximum enclosure and weather resistance, often in colder or more exposed conditions. It's named for its ability to envelop the user much like a sleeping bag or a bodybag, offering significant protection from wind, rain, and even some insulation from cold. This setup typically involves creating a completely enclosed or nearly enclosed space by carefully folding and staking a tarp. It often utilizes a ridgeline for overhead support, with the tarp's edges brought down to the ground and overlapping to form a fully sealed, tube-like, or wedge-shaped shelter. This maximizes trapped air for warmth and minimizes exposure to the elements, making it an excellent choice when prioritizing thermal retention and full-body protection from severe weather.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Envelope

This is a specific tarp configuration designed to maximize ground protection and offer a degree of enclosure, making it particularly useful in damp or windy conditions. It's constructed by utilizing a portion of the tarp as a ground sheet, which then folds upwards to form a low wall or the base of one side of the shelter. The remaining part of the tarp is then extended over a ridgeline or supported by poles, creating a sloped roof. This "envelope" effectively separates the user from the cold or wet ground, a critical factor in preventing heat loss through conduction, while the low profile and enclosed design provide a good windbreak and shed precipitation effectively. It prioritizes a dry sleeping area and modest overhead protection over expansive internal space.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Forest Tent

A robust and relatively enclosed tarp configuration that leverages natural features, primarily trees, to create a secure and protective space, often resembling a small tent. This setup usually involves a ridgeline strung between two trees, over which the tarp is draped. The key characteristic is that the sides of the tarp are then pulled down and secured to the ground, often forming walls that meet the ground or even extend slightly inward to create a small "bathtub" floor. This design maximizes protection from wind, rain, and snow, as it significantly reduces exposure to the elements compared to more open tarp setups. It's an excellent choice for extended stays or harsh conditions, as it provides a more enclosed and thermally efficient environment, allowing for better heat retention from body warmth or a carefully managed internal fire.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Rain Fly

A tarp setup specifically focused on providing maximum protection from precipitation. While any tarp can be used as a rain fly, this configuration emphasizes creating a waterproof overhead barrier for a primary shelter, whether it's a sleeping bag, a bivy sack, or even another, less waterproof structure like a mesh tent. The tarp is typically pitched with a good slope to effectively shed water, often in an A-frame, diamond, or lean-to style, and is secured tautly to prevent water from pooling or wind from flapping it excessively. The main goal is to keep the occupant and their gear completely dry, which is critical for preventing hypothermia and maintaining morale in wet, cold conditions, especially in regions prone to sudden downpours.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Square Arch

A tarp configuration designed for quick setup and moderate protection, particularly useful when overhead clearance is desired. It's characterized by its nearly square or rectangular footprint and an arching roofline. Typically, this is achieved by running two parallel ridgelines or poles at a similar height, over which the tarp is draped. The long ends of the tarp are then pulled outwards and staked down, creating a central, relatively open space with a rounded or arched roof, and potentially low walls on two sides. This design offers good head height, sheds rain effectively, and provides a decent windbreak from two directions, making it a good balance between openness and protection for a variety of conditions where direct overhead cover and some interior space are priorities.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

SHELTER | Survival Shelters | Ground Shelters

Trekking Pole

Trekking Pole		
	A "trekking pole shelter" leverages a backpacker's existing equipment to create a lightweight and adaptable emergency shelter. This type of shelter uses one or two trekking poles as the primary vertical supports for a tarp, eliminating the need for finding suitable trees or carrying dedicated tent poles. Common configurations include an A-frame, where the tarp is draped over a ridgeline supported by two trekking poles at either end, or a lean-to, where one side of the tarp is elevated by a pole while the other is staked to the ground. The versatility of trekking poles allows for pitching the tarp in various shapes to best combat wind, rain, or sun, making it a highly efficient and weight-saving option for minimalist survival or unexpected overnight stays where speed and portability are crucial.	**Category 1-2** This won't survive long in very strong winds before being torn apart.
Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Windshed Wedge

Windshed Wedge		
	A tarp configuration specifically designed to offer superior protection from strong winds and driving rain or snow, making it ideal for exposed environments. It's characterized by its low-profile, wedge-like shape, with one long edge of the tarp secured very close to the ground, facing directly into the prevailing wind. The opposite side is then elevated to create the roof, which slopes sharply down towards the windward side. This steep angle and minimal exposed surface area act to "cut" through the wind rather than catching it like a sail, significantly reducing flapping and structural stress. While it offers limited interior space and may require crawling to enter, its primary strength lies in its ability to withstand severe weather, providing a crucial refuge where other tarp setups might fail.	**Category 1-2** This won't survive long in very strong winds before being torn apart.
Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Tarp Wing

Tarp Wing		
	A tarp wing shelter is a simple and quick-to-deploy tarp configuration designed primarily to offer overhead protection from rain or sun, often sacrificing significant wind protection for ease of setup and ventilation. It's typically created by elevating two opposite corners of the tarp relatively high (e.g., tied to trees or supported by poles), while the other two opposite corners are anchored low to the ground. This creates a large, open "wing" or diamond shape that effectively sheds precipitation and provides shade over a wider area. While it's excellent for keeping a campsite or fire dry in wet, mild conditions, its open nature makes it less suitable for strong winds, extreme cold, or situations requiring full enclosure against the elements.	**Category 1-2** This won't survive long in very strong winds before being torn apart.
Materials ● Tarp ● Rope ● Tent Pegs or Rocks	**Construction** o	**Warnings / Hazards** o

Tarp Burrito

Tarp Burrito		
	A highly effective, minimalist configuration focused on maximizing insulation and protection against cold, wind, and wet conditions, particularly when external temperatures are low. As the name suggests, it involves wrapping oneself tightly within the tarp, much like a burrito. This is often achieved by laying the tarp flat, placing an insulating layer (like leaves, pine needles, or a sleeping pad) on one half, lying down, and then folding the remaining half of the tarp over the body. The ends are then secured or tucked to minimize drafts, creating a fully or nearly fully enclosed personal cocoon. While it offers very little headroom or space for movement, its strength lies in creating a highly efficient micro-climate that traps body heat, making it an excellent choice for an emergency bivy or when lightweight, immediate thermal protection is the priority.	**Category 1-2** This won't survive long in very strong winds before being torn apart.
Materials ● Tarp	**Construction** o	**Warnings / Hazards** Be careful not to suffocate yourself during the night due to lack of oxygen.

Tarp Tipi

A robust and highly protective tarp configuration that mimics the conical shape of a traditional Native American tipi, offering excellent wind resistance and heat retention. It's typically built around a central pole (a sturdy branch or trekking pole) or by stringing a ridgeline between trees to create the peak. The tarp is then wrapped around this central support and staked out in a circular or hexagonal pattern at the base, creating enclosed walls that shed rain and block wind from all directions. This design maximizes interior volume and allows for an efficient centralized heat source (like a small, contained fire or hot rocks, with proper ventilation), making it a superior choice for colder, windier, or more prolonged survival situations where a more substantial and insulated shelter is required.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Tarp
- Logs

Construction
o

Warnings / Hazards
o

A-Frame Tarp Shelter

The A-frame is a tarp design that gives great coverage against rain and wind, when built close to the ground. When suspended higher, it still provides coverage from rain, but it allows more airflow underneath. A-frames go up fast. Once you pick your shelter site, you should have your tarp hung up in 10 minutes or less, leaving plenty of time in the day to accomplish other survival tasks. To get started, suspend a line of cordage between two trees or similar supports. Lay your tarp over the line and tie down all four corners of your tarp. This shelter is a great addition to a tarp hammock or strung up over a springy bough bed. You can even use a poncho as an A-frame tarp shelter.

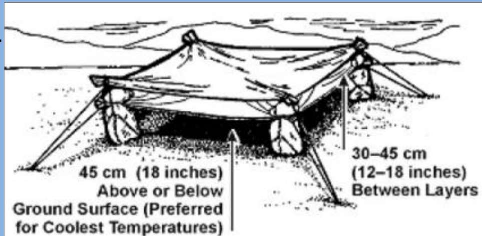
Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Tarp
- Rope
- Tent Pegs or Rocks

Construction
o

Warnings / Hazards
o

Desert Tarp



If you have material such as a poncho, canvas, or a tarp, use it along with terrain features like rock outcroppings, mounds of sand, or depressions between dunes or rocks to make your shelter. The objective is to create a covering while keeping all sides open to air current and circulation.

Category 1-2
This won't survive long in very strong winds before being torn apart.

In all methods below, if you have enough tarp material, fold it in half and form a 30- to 45-centimeter (12- to 18-inch) airspace between the two halves. This airspace will provide insulation and reduce the temperature under the shelter by as much as 25 degrees. This double-roofed shelter dates back centuries and is used in many desert survival scenarios. In addition, digging a depression in the ground can reduce the midday heat as much as 15-25 degrees. However, digging may expend too much energy to be practical. If possible, dig before or after the hottest part of the day (you may build the shelter coverage first, then dig a depression later).

Materials
- Tarp
- Rope
- Rocks

Construction (Rocky Outcrops)
1. Anchor one end of your poncho (canvas, tarp, or other material) on the edge of the outcrop using rocks or other weights.
2. Extend and anchor the other end of the poncho so it provides the best possible shade.

Construction (Sandy Area)
1. Build a mound of sand or use the side of a sand dune for one side of the shelter.
2. Anchor one end of the material on top of the mound using sand or other weights.
3. Extend and anchor the other end of the material so it provides the best possible shade.

Warnings / Hazards
o

Construction (Poles & Sticks Available for Use)
1. Dig a low spot on the ground.
2. Lay the tarp over the low spot and drive the stakes through the corners of the tarp.
3. Tie the tarp to the stake.
4. Drive the stakes into the ground leaving enough space between the ground and the tarp to provide adequate coverage.
5. If possible, drive additional anchors into the ground about 1-2 feet from each stake. Tie from the top of the stake to the anchor to provide additional support.

Tarp Hammock

Tarp Hammock

A tarp hammock combines the benefits of a suspended sleeping system with overhead protection from the elements. This setup involves hanging a hammock between two sturdy anchor points, typically trees, to get the user off the cold, wet, or uneven ground – a crucial advantage in preventing heat loss through conduction and avoiding ground-dwelling insects or creatures. Crucially, a separate tarp is then suspended above the hammock, pitched in a rain-shedding configuration (like an A-frame or diamond fly) to provide a waterproof roof. This dual-component system offers superior comfort, ventilation, and protection from rain, wind, and sun compared to purely ground-based shelters, making it ideal for forested environments or any situation where suitable hanging points are available.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Tarp
- Climbing Rope

Construction
o

Warnings / Hazards
Ensure you use quality climbing rope or it may snap dropping you onto potentially sharp objects.

Bough Bed

A bough bed is a form of improvised insulation and comfort, built directly on the ground to separate a person from the cold, damp earth. Constructed from a thick layer of evergreen boughs (branches with needles, such as pine, fir, or spruce), it works by creating an insulating air pocket between the ground and the user, significantly reducing heat loss through conduction. The boughs are typically laid in an overlapping, shingle-like pattern with the cut ends facing the feet, forming a resilient, springy mattress that can be several inches to over a foot thick. This simple yet effective bed is vital for maintaining core body temperature, preventing hypothermia, and ensuring restorative rest in wilderness survival scenarios.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Logs
- Springy Green Leaves

Construction
o

Warnings / Hazards
o

Wickiup

a wickiup is a traditional, dome-shaped or conical shelter, historically used by various Indigenous peoples, particularly in the southwestern and western United States. It's built by creating a framework of flexible poles (often saplings) bent and tied together to form a sturdy, somewhat open structure. This frame is then covered with available natural materials like brush, bark, reeds, grass, or even animal hides, creating an insulated and weatherproof shell. Wickiups are valued in survival scenarios for their ability to be constructed relatively quickly using readily available forest materials, offering excellent protection from wind, rain, and snow. They often incorporate a central fire pit for warmth, with a smoke hole at the top for ventilation, making them efficient at retaining heat in cold environments.

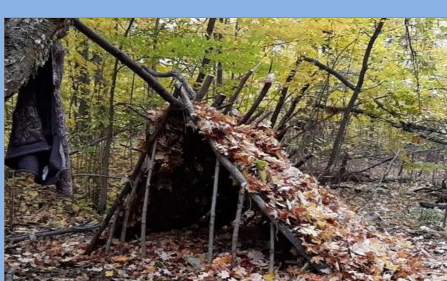
Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Logs
- Brush
- Vegetation

Construction
1. Cut about 30 pine tree saplings -- nice long slender ones. They have to be green and flexible. Preferably 8-10 feet tall.
2. Trim all the little branches off of them and sort the little branches from the trunks. Put the little branches aside for later.
3. Mark a circle and also mark where you want 14 pine poles to go.
4. Dig holes where you marked the pine poles to go. You may have to wet the ground to soften it.
5. Put the poles into the holes and pack the dirt around the poles to keep them sturdy.
6. Bend all the poles over two at a time and tie the ends up at the top.
7. Wrap 3 poles around at different levels and fasten them with rope.
8. Tie the boughs onto the frame, covering it except for a doorway. You will need at least more than one.

Warnings / Hazards
o

Leaf Hut



A leaf hut is a simple, highly insulated shelter constructed primarily from natural, readily available materials, designed to offer superior protection against cold. It is essentially a small, dome-shaped or conical framework of branches, often resembling a small lean-to or A-frame, which is then covered with an extremely thick layer of dry, loose organic matter, predominantly leaves, but also grass, pine needles, or moss. The effectiveness of a leaf hut lies in the significant insulating properties of the packed organic material, which traps air and prevents heat loss from the occupant's body through convection and conduction. The thicker the layer of leaves (ideally several feet), the better the insulation, making it an excellent choice for a survival scenario in a cold environment where maintaining core body temperature is paramount.

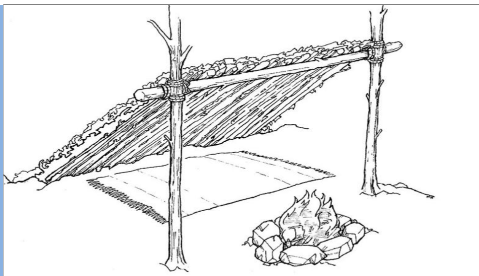
Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Logs
- Sticks
- Leaves

Construction
o

Warnings / Hazards
The leaves may blow off easily leaving you vulnerable to rain.

Lean-To



A lean-to is one of the most fundamental and quickly constructed shelters, designed for immediate protection primarily from precipitation and wind coming from one direction. It consists of a simple framework, typically a horizontal support pole or branch lashed between two trees or propped up by vertical stakes, with other branches or a tarp leaned against it at an angle. The sloped side, facing the prevailing wind and rain, is then covered with available materials like evergreen boughs, bark, large leaves, or a tarp to create a roof that sheds water. While easy to build and offering decent overhead cover, a lean-to is open on one or more sides, providing limited insulation and less protection from cold or insects, making it best suited for milder conditions or as a temporary emergency solution.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Logs
- Sticks
- Leaves
- Rope

Construction
o

Warnings / Hazards
o

Igloo

An igloo, also known as a snow house or snow hut, is a type of shelter built of snow, typically built when the snow is easy to compact. Snow is used because the air pockets trapped in it make it an insulator. On the outside, temperatures may be as low as −45°C (−49°F), but on the inside the temperature may range from −7 to 16°C (19 to 61°F) when warmed by body heat alone.

Category 1-2
This won't survive long in very strong winds before being torn apart.

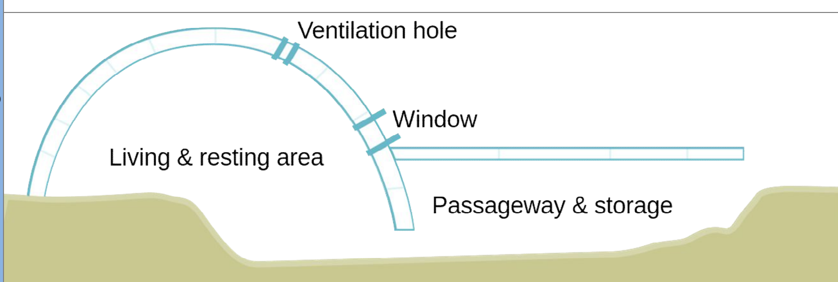
There are three traditional types of igloos, all of different sizes and used for different purposes.
- The smallest were constructed as temporary shelters, usually only used for one or two nights so they were easier to build. These were built and used during hunting trips, often on open sea ice.
- Intermediate-sized igloos were for semi-permanent, family dwelling. This was usually a single room dwelling that housed one or two families. Often there were several of these in a small area, which formed an Inuit village.
- The largest igloos were normally built in groups of two. One of the buildings was a temporary structure built for special occasions, the other built nearby for living. These might have had up to five rooms and housed up to 20 people. A large igloo might have been constructed from several smaller igloos attached by their tunnels, giving common access to the outside. These were used to hold community feasts and traditional dances.

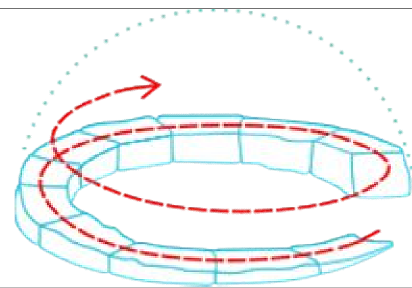
Materials
- Snow
- Sticks
- Shovel (Helps)

Construction
Snow igloos are not spherical, but are built in a catenary curve, a shape more closely resembling a paraboloid. Using this shape, the stresses of snow as it ages and compresses are less likely to cause it to buckle because in an inverted paraboloid or catenoid the pressures are nearer to being exclusively compressive. Since stress is a force per unit area, if the walls are of uniform thickness the compressive stress is independent of wall thickness; thicker walls provide better insulation but do not strengthen the structure because of added weight. The individual snow bricks start out 4-sided and being cut out of the ground with saws and machete-like blades, but are then often cut into 5 or 6-sided shapes to increase structural interlocking, similar to the stones used in the Inca Empire. Igloos gradually become shorter with time due to the compressive creep of the snow.

Warnings / Hazards
Be careful you don't pile too much snow on top or it may collapse on top of you.

The snow used to build an igloo must have enough structural strength to be cut and stacked appropriately. The best snow to use for this purpose is snow which has been blown by wind, which can serve to compact and interlock the ice crystals. The hole left in the snow where the blocks are cut is usually used as the lower half of the shelter. Sometimes, a short tunnel is constructed at the entrance to reduce wind and heat loss when the door is opened. Snow's effective insulating properties enable the inside of the igloo to remain relatively warm. In some cases, a single block of clear ice is inserted to allow light into the igloo. Animal skins were used as door flaps to keep warm air in. Igloos used as winter shelters had beds made of ice and caribou furs. These 'ice beds' are unique to the region and Inuit culture.





Architecturally, the igloo is unique in that it is a dome that can be raised out of independent blocks leaning on each other and polished to fit without an additional supporting structure during construction. An igloo that is built correctly will support the weight of a person standing on the roof. In the traditional Inuit igloo, the heat from the kudlik (qulliq, stone lamp) causes the interior to melt slightly. This melting and refreezing builds up a layer of ice that contributes to the strength of the igloo. The sleeping platform is a raised area. Because warmer air rises and cooler air settles, the entrance area acts as a cold trap whereas the sleeping area will hold whatever heat is generated by a stove, lamp, body heat, or other device. The Central Inuit, especially those around the Davis Strait, lined the living area with skin, which could increase the temperature within from around 2 °C (36 °F) to 10–20 °C (50–68 °F).

Air Shelters

Treehouse

A treehouse, in a survival context, is an elevated shelter built within the branches or trunk of a large, sturdy tree, designed primarily to escape ground-level threats. Its key advantage is providing protection from predators, flash floods, or other ground-based dangers common in certain environments. While more complex and time-consuming to construct than ground shelters, a well-built treehouse can offer a secure, dry, and observation-friendly refuge. It typically involves creating a stable platform within the tree and then building a rudimentary enclosed structure, often from salvaged materials or natural branches and leaves. Access usually requires climbing or a makeshift ladder, adding to its defensive capabilities, though its complexity limits its practicality to scenarios where an extended stay or persistent ground threat justifies the effort.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Logs
- Rope

Construction
o

Warnings / Hazards
If it breaks you have quite a way to fall.

Log Suspended Shelter

Unlike the image, this type of shelter is made of a hatched square or triangle log base with strong ropes connected to a strong tree or very thick branch above. This shelter keeps you off the ground and away from the potentially dangerous cold and predators, while letting you swing gently in the breeze. You could suspend this shelter to one, two, or multiple different points to distribute the weight between multiple trees. The more points you're attached to, the less it will swing in the breeze and the more secure it will be.

Category 2
This won't survive long in very strong winds before becoming dangerous.

Materials
- Logs
- Climbing Rope

Construction
o

Warnings / Hazards
Do not use this in a storm due to the chance of lightning striking the tree.

Water Shelters

Wooden Raft

A custom made wooden raft for sheltering on. This can be used when the land is too dangerous to sleep on such as there being predators at night. There are quite a lot of risks involved in this but it would be fun to try.

Category 1-2
This won't survive long in very strong winds before being torn apart.

Materials
- Wooden Logs
- Rope

Construction
o

Warnings / Hazards
You would have to do excessive testing prior to actually sleeping on a raft and ensure there's no threats such as crocodiles.

4 Advanced Survival Shelters

Shelters built from logs and rocks to be more stable which are in the shape of modern houses but which still have gaps and limited insulation.

Log Shelter

A log shelter is a more substantial and long-term shelter built using fallen trees or logs as the primary structural material. Unlike temporary tarp or debris shelters, a log shelter offers significant protection from extreme weather elements like severe cold, heavy snow, and strong winds, due to the mass and insulating properties of the timber. Construction typically involves stacking logs horizontally, often with interlocking notches at the corners, to form solid walls. A roof, often made from smaller logs, branches, and a thick layer of natural insulation like leaves or sod, is then added. While requiring considerable effort, time, and potentially tools like an axe, a well-built log shelter provides a highly durable and thermally efficient refuge for prolonged stays in the wilderness, offering a greater sense of security and a more comfortable interior than most other improvised shelters.

Category ?

Rock Shelter

	A shelter made primarily from rocks is a more robust and permanent structure than simply using a natural rock overhang. This type of shelter is constructed by intentionally stacking rocks to form walls, or by utilizing existing large boulders as anchors and building up from there. The main advantage is the creation of a strong, durable barrier against severe wind and, if properly roofed, precipitation. The thermal mass of the rocks can also help to absorb and radiate heat, moderating internal temperatures. While labor-intensive and requiring careful selection of stable rocks to prevent collapse, a purpose-built rock shelter offers superior long-term protection in exposed, rocky environments where other building materials like timber are scarce, providing a secure and resilient refuge.	**Category ?**

Log Wall

	How to create a log wall to create a perimeter around a house.	**Category N/A** Not used as a shelter

5 Portable Shelters

Any form of lightweight modern shelter that can be pitched and moved with ease such as a tent. An easier description would be any complete shelter that you can purchase.

Tent

A tent is a shelter consisting of sheets of fabric or other material draped over, attached to a frame of poles or attached to a supporting rope. While smaller tents may be free-standing or attached to the ground, large tents are usually anchored using guy ropes tied to stakes or tent pegs. First used as portable homes by nomads, tents are now more often used for recreational camping and as temporary shelters.

Tent Types

These are the different variants of tents you can purchase today. These days you can get tents that are suspended above the ground, tents that pop out from a vehicle and tents that even float, so this is your first decision when looking at one.

Suspended Tent	A tent that is suspended in the air by 3 or more points.
Hanging Tents	A tent that hangs from a tree by a single point instead of two like a hammock.
Floating Tent	A floating tent is about the size of a large canoe which also doubles as a canoe. Ensure there's no risk to popping it from sticks, creatures or keys.
Floating Tent Raft	A floating tent raft is a larger version of a floating tent in a squarer form factor rather than a pod shape. Ensure there's no risk to popping it from sticks, creatures or keys.
Car Roof Tent	A shelter that is designed to be set up on a cars roof racks. A tent that is supported by your vehicle's roof racks. Every car tent may have a unique way to set it up so it's best to consult the information manual.
Floating Tent Raft	A floating tent raft is a larger version of a floating tent in a squarer form factor rather than a pod shape. Ensure there's no risk to popping it from sticks, creatures or keys.
Extendable Car Shelter	A tent which uses the car as a fixation point to pitch it from, giving easy access.
Pickup Truck / Ute Tent	These fit into the back of a ute and is pitched from there.
Trailer Tent	A tent that's based on a flat trailer towed by a car.

Tent Shapes

This is a list of the different types of shapes that tents can come in.

Ridge Tent	They had a pole at each end and sometimes a cross pole called a ridge holding up a tent-shaped roof: Hence the name 'ridge tent'. Ridge tents are remarkably stable and range from tiny one-person tents right up to large marquees. They are easy to pitch and still make excellent shelters today.
Dome Tent	Dome tents are the most common design today and are shaped like a dome. They have two poles that cross each other in the centre and bend down to reach the corners of the tent. A rainfly rests on top of the poles for added protection from the elements. This style of tent is easy to set up and a has a relatively high centre point giving you a decent amount of room and headspace. The rounded edges allow the tent to shed water and rain, preventing build up on the top. Some dome tents have a vestibule in front of the door that acts as a makeshift mudroom to keep dirt and muddy gear dry and out.
Geodesic Tent	A geodesic tent was created from the geodesic dome structure. For a tent, it is when we add crisscrossing poles which creates either triangles, pentagons, or hexagons. Since these shapes are known to have a higher capacity for strength, this design was made. The geodesic tent is able to withstand heavy winds, snow, and even bad rain storms.

Teepee Tent	These are cone shaped tents with a central support, material draped around the centre, and guy lines for support. The teepee tents of today are similar in design, however, they are made of modern materials. With a central pole acting as the main support, guy lines and stakes play a critical role in giving this structure its form. The taller they are the less stable they become.
Instant Tent (Pop-Up Tents)	Pop up tents are relatively new to the tent game and have grown in popularity in recent years. These tents are designed with spring loaded poles that "pop" into shape in just a few seconds. They are made to be lightweight, super convenient, and quick to set up. Pop up tents are super convenient and great to use in a pinch or on a whim, however, for more serious camping a dome or geodesic tent are more practical options.
Inflatable Tent	Inflatable tents are another newcomer to the camping game and the inflatable poles are a radical design shift from standard tent poles. Rather than having aluminium or plastic tent poles that hold the tent up, they have air beams that you inflate to support the tent structure. They require an air pump or someone with an insane lung capacity to inflate. They are still in the relatively early stages of product design and depending on the manufacturer their durability and ability to handle extreme weather varies greatly.
Tunnel Tent	Tunnel tents are similar in style to a dome tent, however, they are extended in the middle section and end up resembling a tunnel. They are held up with a series of poles that wrap from one side of the tent to the other giving them a rounded shape. Their stability comes from the tent stakes, guy lines, and pole structure. These tents are almost never freestanding and rely on a large number of attachment points, mainly because of their large size. They have high ceilings and more room than a standard tent, making them a great fit for larger groups of people.
POD Tent	Modular camping system that allows tents to be connected together using a tunnel to create interconnected tents. The perfect social camping tent for large groups or families.
A-Frame Tent	An A-Frame tent is the classic, triangular tent that looks like an 'A' with a rectangular floor, hence the 'A-Frame'. Frame tents that you buy in stores are usually double-skin tents. There is one skin that goes over the frame and protects the tent from the elements.

Tent Materials

This is a list of the materials tents are commonly made out of. Each material has its advantages and disadvantages so choose carefully when you buy one.

Cotton	Cotton tents are highly breathable, which significantly reduces condensation inside and helps regulate temperature, keeping the tent cooler in warm weather and warmer in cool weather. They are also durable, naturally insulating, quieter in wind, and offer a more traditional aesthetic. However, they are heavy, bulky, slower to dry, and require "weathering" (pre-wetting to swell fibers) to become fully waterproof. They can also be prone to mold and mildew if packed away wet.
PVC Coated	PVC (Polyvinyl Chloride) coated fabrics are excellent for waterproofness and durability. The coating creates a strong barrier against water, making tents inherently waterproof without needing a weathering process. They are very resistant to abrasion, chemicals, and UV degradation, leading to a long lifespan. PVC-coated fabrics are often used in larger, heavy-duty tents and offer a smooth finish, but can be less breathable, potentially leading to more condensation.
Polycotton Canvas	Polycotton is a blend of polyester and cotton, aiming to combine the best attributes of both. It offers good breathability (reducing condensation) and temperature regulation from the cotton, with enhanced durability, UV resistance, and faster drying times from the polyester. Polycotton tents are generally quieter in wind than pure synthetics and more robust than lightweight polyester, making them ideal for longer trips or varied climates. However, they are heavier and bulkier than pure synthetics and may still require some initial weathering.
Polyester	Polyester is a popular synthetic fabric for tents due to its affordability, lightweight nature, and good water resistance (often with a polyurethane coating). It dries quickly, resists mold and mildew, and has good UV resistance compared to nylon. Polyester tents are generally durable against abrasion and tears, and they pack down relatively small, making them a common choice for backpacking and general camping. However, they can be less breathable than cotton blends, leading to condensation, and can be noisy in strong winds.
Nylon	Nylon is known for its excellent strength-to-weight ratio, making it a top choice for ultralight tents and backpacking. It's highly durable, particularly ripstop nylon which resists tears, and is often treated with silicone or PU coatings for water resistance. Nylon tents are very lightweight and compact, allowing for quick setup and easy portability. A potential downside is that nylon can stretch and sag when wet, requiring re-tensioning, and it is more susceptible to UV degradation over long-term exposure than polyester.
Tarpaulin	A general term for a heavy-duty, waterproof sheet, in the context of tents, it often refers to materials like reinforced polyethylene (PE) or heavy-duty PVC-coated fabrics. Tarpaulins are primarily valued for their exceptional waterproofness, durability, and resistance to wear and tear. They are highly versatile for creating temporary shelters, groundsheets, or protective covers, and are generally very cost-effective. However, they are typically less breathable and can be very bulky and heavy depending on the material and thickness.
Gore-Tex	Gore-Tex is a highly advanced, patented membrane primarily known for its exceptional waterproofness, windproofness, and breathability. Its unique microporous structure allows water vapor (perspiration) to escape while preventing liquid water (rain) from entering, keeping the user dry and comfortable. While not commonly used for the entire main body of large tents due to cost, it's often found in high-performance bivy sacks, specialized expedition tents, or as a component in waterproof/breathable sleeping bags.

Tent Pegs

Tent pegs are often needed to secure a tent when you aren't inside it. This section will assist in providing information on choosing some pegs for your tent which best fit your scenario. In some situations tent pegs won't even be necessary such as in ultralight tents when you only set them up when you're going to sleep.

Types

There are a lot of different styles of tent pegs which are designed for a specific soils and situations.

Hard Ground Pegs	These are designed for tough ground and ground with small rocks.
Sand Pegs	Pegs that are designed to hold well in sand and usually have spirals or a large surface area.
Rock Peg	Pegs which are designed to penetrate well in rocky ground provided there's enough force. These usually require a mallet or hammer.

Materials

Tent pegs are made from various materials which can affect their life span and bendability.

Steel	The strongest metal but very heavy and can rust over time.

SHELTER | Portable Shelters | Tent | Tent Pegs

Stainless Steel	Similar to above but a different alloy to prevent rusting when exposed to the weather.
Galvanised Steel	Steel with a coating of zinc to prevent it from rusting.
Plastic	Not terribly strong and not designed for driving into hard soil. Preferably used for sand.
Aluminium	A lightweight metal which works well as a tent peg.
Titanium	Another lightweight metal which is commonly used for pegs although at a higher cost.
Biodegradable	A tent peg made of potato starch that degrades naturally in the earth if you've left it behind.

Sizes

The size of tent pegs varies quite dramatically and it can have a big effect on holding power and weight.

15cm	Tiny tent pegs which can secure something minimally.
20cm	A good medium size for a tent peg to save on weight and to secure a tent well.
25cm	An average size for fixing a tent securely to the ground.
30cm	A long tent peg for additional fixing power.
35cm	This length will provide a lot of staying power in windy conditions.
40cm	A very long tent peg to secure the tent from the most insane winds.

Shapes

Tent pegs come in a lot of various shapes and sizes to achieve various outcomes. The following should assist you choosing the correct tent peg for the situation.

Roundwire Peg	Supplied with most tents the round wire peg comes in a variety of lengths and is good for medium firm ground such as grass but easily bent on buried stones.
Skewer Peg	Similar to the wire peg, the skewer peg also comes in different lengths and the twisted design gives extra grip on the ground.
Ripple Peg	Great for guy lines on sand and gravel surfaces, ripple pegs provide a greater surface area and more drag resistance than a standard wire peg.
Ground Anchor	Widely regarded as the greatest innovation to hit the peg bag for many years, many campers now swear by the Delta Peg as the saviour of many a tent in extreme conditions. Designed to bury deeper into the ground when under strain.
Groundsheet Peg	A lightweight, small peg designed to hold your footprint groundsheet in the ground without a raised profile on the peg. The groundsheet peg is low strength peg good for its intended purpose.
Halfround U Peg	A high strength steel peg designed to give maximum resistance and be used in a wide variety of ground conditions.
Screw Type Rock Peg	These are a variation of the rock peg with an added screw thread on the peg for increased stability and grip. Designed to turn if they hit a stone, the Screw Type Rock Peg can sometimes be inserted with a cordless drill depending if they come with a compatible head.
Screw Peg	For the lazy camper, screw pegs simply screw into the ground with a cordless drill adaptor or hand wheel attachment. Available in various sizes, screw pegs offer exceptional hold in firm to soft ground, although they cannot be used in concrete, tarmac or rock ground as they will break.
Tent Stake	A variety of degradable pegs are now available which degrade naturally over time if accidentally left in the ground. Great for festival camping, the process takes quite a while so there is no loss to your security whilst camping.
Harpoon Peg	A new design, the harpoon peg gives excellent grip on both medium and soft ground, giving a large surface area to prevent drag and extra grip at the base for a tenacity not round on standard wire pegs. Great for sand, gravel and grass.

Thickness

The thickness of the metal of a tent peg determines how well it can be driven into solid ground. It applies to all different shapes of pegs.

1-2mm	Very thin and light pegs which may be easily bent on insertion.
3mm	A good moderation between lightweight and strength but still may be bent easily.
4mm	Another good size to look for when buying tent pegs, but may be starting to get on the heavy side.
5mm	A very strong tent peg which should make easy work of anything you are putting it in.
6mm+	Generally the thickest pegs you can find which can be driven into almost anything with enough force.

Number of Pegs

The number of tent pegs you need is determined on your tent, for a single person tent it's typically 6-8 but can be more or less depending on the size.

0 Pegs	You don't need any tent pegs if you are only sleeping inside it and there's no wind around, this works best for tiny tents and small bivvies.
3 Pegs	Probably the minimum you should carry on you if you are using tent pegs, two in the corners where the wind is coming from and the other on the opposite side.
4 Pegs	A good stable amount for securing a tent from all sides.
6 Pegs	The optimal amount of pegs to secure the corners of a tent and the middle at two points.
8 Pegs	8 pegs is used for securing the tent well while using 2 or so on the ropes to hold flaps up.

SHELTER | Portable Shelters | Tent | Tent Pegs

10 Pegs	The absolute most you should carry for any tent if you're concerned about weight. 10 pegs works best when they are all under 3 grams as it's better to have more light pegs then fewer heavier.

Weight

Weight is a vital factor when bugging out so choosing a lightweight peg is essential.

1-5g	Ultralight tent pegs which are perfect for backpacking or bugging out weight wise but are generally poor for holding a tent and are bent easily. ● Gram Counter Titanium Pin Pegs - 2g
5-10g	Very light pegs which provide a fair amount of holding power. ● MSR Carbon Core Tent Stakes - 6g
10-15g	An average weight for tent pegs today with a good compromise between strength and weight. ● MSR Groundhog - 11g
15-20g	Still a fairly average weight for tent pegs but getting on the heavier side but they have greater holding power. ● Gram-Counter Gear Titanium Nail Pegs - 15g
20-25g	Quite heavy tent pegs but they rarely bend and generally hold tents very well. ● Heavy Duty Tent Pegs
25-30g	Heavy tent pegs used for securing a tent in strong winds. ● Steel Tent Pegs
30-50g	Very heavy tent pegs which are generally made of thick steel and can be driven into rocky soil easily. ● MSR Blizzard Sand Stake Tent Peg - 33g
50g+	Ultra heavy tent pegs for only the windiest scenarios or the rockiest areas. ● Steel Tent Pegs

Other Factors

Peg Tip Shape	The tip of a peg can be flat, cone shaped, or twisted and many other variants so choose carefully.
Hollow Peg	Some tent pegs are hollow on the inside to reduce weight, these are typically easier to bend then regular pegs.
Colour	Most tent pegs come in a multitude of colours but if you're trying to be stealthy go for one which is brown or green and non reflective.
Plastic Tops	Some pegs have plastic tops to hold the ropes. This style may break easier than full metal pegs when hammered hard.
Mallet	Generally you need a mallet when hammering tent pegs unless you can "stomp" them in or use a rock. This could add a lot of wasted weight if you need to carry one.

Retrieval

Pulling out tent pegs can be a nightmare sometimes but this row will discuss factors to consider.

Puller Tool	Some pegs are difficult to retrieve and may require a pulling tool or another tent peg to get them out.
Camouflage	If your pegs are driven in too far or are painted in camo colours (and the guy lines have detached), they may be difficult to find.
Speed	Sometimes you may have to pack up camp fast and flee, so take note of how fast you can pull out the pegs.

Weather Rating

2 Season	A 2 season tent will likely only be designed for camping in relatively good weather in the sunnier parts of the year. It'll cope with mild rain and wind, but anything really heavy could push it beyond its design. It may have permanent ventilation flaps you can't close to keep you cool that will let wind through but stop mild rain.
3 Season	A 3 season tent will be able to stand up to heavier rain and winds, and hence while it'll often have ventilation flaps you'll often be able to close them on a 3 season tent to stop heavier rain and winds driving though. It'll also probably have more / stronger guy ropes, and the material may be stronger too.
4 Season	A 4 season tent will be designed for use in winter / snowy climates so it will be able to survive snow being driven at the tent, heavy constant winds, etc. Ventilation flaps probably won't be a feature - otherwise even when closed, fine snow could blow into the tent. This will often be replaced with a panel at the top of the inside tent that can be opened to provide some ventilation in warmer climates. But the main purpose of the tent is to protect against harsh elements rather than provide features for warmer climates.

Tent Assembly

Assembling a tent can at times be a tough chore, it may be raining, snowing or there may be no logical way to set it up. This section is aimed at providing tips on setting them up if you aren't sure what order to do it in or

Setting Up There are many ways to set up the multitude of tents out today, but the following should provide an outline on what to do.	1. Lay out the structure ensuring the door is the correct way you want it to face. 2. Put the flexible beams through the loops and into the eyelets on the base so the frame stands up by itself. 3. When the tent is standing up hammer in the tent pegs where necessary. 4. If the tent has guy lines (ropes) stretch them out, ensuring they have a bit of slack and hammer them into the ground. Finish by pulling them taught. 5. Secure tarps with a quick release knot such as a bowknot to allow the shelter to be dropped quickly in the event of any contact, so that its detection does not betray the position.

Tent Repairs

There's endless ways your tent could become damaged, so here's a table detailing each one and how to rectify it.

Damage

These are any forms of damage that can befall your tent.

	Description	Affected Components	Cause	Damage Resistance	Results (of occurrence)	Fix	Notes
Break (Solid Materials)	A component breaks in half such as a fibreglass beam.	● Fibreglass Beams ● Tent Poles ● Hiking Pole	● Over-bending the fibreglass ● Heavy Falling Weight ● Old Age	● Use stronger poles (at the expense of added weight) ● Try not to over-bend	● Lack of tent support	Replacement fibreglass rods would be very difficult to find in SHTF. Use a repair sleeve or something else rigid to repair the pole.	Duct tape the new component to the tent to keep it in position, but this may use a lot of tape over time.
Snap (Rope and Elastic)	The snapping of a cord or rope.	● Fibreglass Stretch Cord ● Outriggers	● Overstretching ● Old Age	● Try not to pull ropes and elastics too tight	● Less Stability ● Stretching	Use paracord instead of rope. Broken elastic can be worked around but it just takes a little longer to set up the tent.	Snaps are probably the easiest to fix due to being non critical components. They can easily be replaced using paracord.
Bend	The bending of a component out of its original shape.	● Tent Pegs ● Tent Poles	● Hammering Incorrectly ● Heavy Weight on Top	● Hammer tent pegs correctly and with proper hammering utensils	● Less Effective ● Harder to Use ● May Break ● Becomes Useless	Hammering tent pegs back into their correct shape can make them useful again.	Try to find alternate tent poles if they broke, such as a stick.
Puncture	A small hole caused by a sharp object in any surface of your tent.	● Tent Walls ● Tent Floor	● Sharp Object Contact ● Some Insects	● Look for a canvas tent or one made from thicker materials	● Rain Leakage ● Groundwater Leakage	Use a patch to cover the puncture to prevent it spreading and seal it with super glue.	A puncture can spread if not dealt with swiftly and can cause the entire tent to come apart over time.
Tear	A surface of the tent is torn by force or sliced open by a sharp object.	● Tent Walls ● Tent Floor	● Slicing motion of sharp object ● Stretching of a puncture	● Look for a canvas tent or one made from thicker materials	● Rain Leakage ● Groundwater Leakage	Sew the tear back together and apply water sealant to the hole, or sew and superglue it back together.	Tears can spread if not dealt with swiftly and can cause the entire tent to come apart over time.
Unstitching	A stitched part of the tent is unfastening slowly with use.	● Any Sewn Edges	● Overstretching ● Old Age ● Bad Construction	● Use a heavy duty fabric and look for special stitching to prevent unravelling	● Sides can't be fixed down as well ● Slow tear progression	Manually restitching where it's coming apart.	Unstitching usually occurs at points where the poles come in contact with the base of the tent due to bad stitching.
Stuck Zip	A zip that won't move along it's path or becomes stuck on parts of the tent.	● Zips	● Untrimmed threads ● Overlapping tent sections	● Tents with larger higher quality zips don't get stuck as often. ● Trim away any loose material from around zips	● Unable to seal the tent ● Unable to enter or exit the tent (possibly)	Wiggle the zip until it's unstuck and then trim the loose material or lubricate it.	You may have to try and trim the material from the tent before attempting to move the zip.
Broken Zip	A zip which has come off the tent entirely and is unable to be re-attached.	● Zips	● Excessive Force ● A stuck zip which broke ● Cheaply Made Zip	● Being careful using the zips ● Purchasing quality tents	● Unable to seal the tent ● Entry by bugs, and inquisitive mammals	Lots of safety pins around the fabric to seal up what you can or use a tarp as an entry flap.	This is a difficult one to fix due to needing to seal it at multiple points while trying to keep out the tiniest insects.
Water Leakage (Non Polymer Tents)	Water leaks into the tent through fabric pores which grow in size over time.	● Canvas Tents	● Lack of Initial Waterproofing ● Old Age	● Waterproofing the tent prior to use by dousing it 3 times after it dries	● Damp Roof ● Wet Clothes ● Dripping Roof	Adding an extra flysheet above the tent or replacing the tent.	This typically can't be fixed and only happens when the tent is exceptionally old and has had lots of use.
Grommet Tear	A grommet which has either been torn off or has torn the material extensively.	● All Tents	● Excessive Pull ● Poor Material Quality	● Stronger Material ● Reinforced Grommets ● Reinforced Corners	● Can't tie down the tent / tarp as well	Sew a reinforcing patch over the top to hold it or create a new hole in the material and secure it from there.	You could always just secure it less if that will suffice for your purposes.

Repair Kit

If possible you should take a small tent repair kit with you. Try to keep a repairs kit as light as possible because you may never need to use it.

Kit Items
- 8cm (3" inch) wall fabric squares
- 8cm (3" inch) floor fabric squares
- Spare Elastic
- Spare Cord
- Pole Repair Sleeve
- Super Glue

Other Kit Items
(You should already have)
- Scissors or Knife
- Needle and Thread

Swag

A smaller and often heavier shelter than a tent, generally being made of canvas and commonly uses hoops as supports. They typically have a top section that opens the full length or half the length of a body which is used to step into the swag. The canvas offers superior protection against animals, falling sticks etc and will probably be the most durable portable shelter for longer term bugging out.

Weathering (Seasoning)	New swags need to be weathered prior to use to bind the fibres closer together and prepare it for rain. To weather a swag firstly set it up then either wait for heavy rain or use a garden nozzle on the shower mode to completely soak every side of it. Let it dry completely after the first soaking and then repeat the soaking and drying loop two more times. After wetting for the final time, inspect the inside of the canvas to see if it's watertight. If there is still water coming through, you may need to apply a seam sealing product. Note: Never pack the swag away when wet or it can develop mould.
Setting Up	Easier to set up than a tent as it only uses between 1 and 3 poles. Tent pegs are recommended but not necessary in calm conditions. Roll out the swag and put in any hoops that are included then add the mattress if you have one. Finally peg out the corners of it followed by any guy lines.

Bivy

A small sleeping bag style shelter used for protection against the elements and insects overnight. They generally don't have hoops or poles to keep the bag from touching your face. The best option for stealth camping and they can be commonly found in camo colours. Bivys are the fastest to set up and dismantle as they only require unrolling and rolling back up again. Some come with additional features such as a fly net and pockets to store valuables but generally they are simple bags.

Setting Up	Bivys don't require any more setup than laying it on the ground and possibly adding pegs if windy weather is expected. Generally you will only set it up when you're ready to go to sleep and the weight of your body will keep it to the ground.

Hammock

A form of shelter hung between trees to suspend you off the ground. Very useful in areas where there's a chance of ground water and wild animals on the ground at night. They can come with tree straps to prevent damage to the tree.

Setting Up	Look for sturdy trees 3.6-4.6m apart. Attach webbing straps around trees at 1.8m and attach to hammock at about a 30 degree angle to the start of the hammock. Keep the hammock 30-46cm above the ground. Sleep in a hammock at a slight angle to stay mostly flat. Hang the hammock evenly between trees and at the same height on slopes.
Trailer Pop-Up Shelter	

6 Public Shelters

Any form of man-made object that isn't designed as a permanent shelter such as a bridge, park shelter, bus shelter etc.

Possible Public Shelters	● Street ● Abandoned Building ● Bus Shelters ● Under Bridges ● On Bridges	● Park Benches ● Park Shelters ● Tunnels ● Train Stations ● Stadium / Arena	● Parking Garage		
Trailer Pop-Up Shelter					

Street

How you can shelter from a disaster when you're in a street with no accessible buildings nearby.

● Hard-Topped, Fully Enclosed Vehicles: If a building isn't immediately accessible, a hard-topped, fully enclosed vehicle (like a car or truck, not a convertible or motorcycle) can offer some protection, especially from lightning. The metal frame of the vehicle acts as a Faraday cage, diverting the lightning around the occupants. Pull over safely away from trees, power lines, and low-lying areas prone to flooding, turn off the engine, close windows and vents, and stay inside until the storm passes.

● Underground or Below-Ground Areas (Last Resort for Tornadoes/Extreme Wind): In the event of a tornado or extremely severe winds, if no other options are available, a ditch, culvert, or the lowest possible depression in the ground can offer minimal protection from flying debris. Lie flat on the ground and cover your head with your arms or a backpack. This is a very last resort and still carries significant risk. Never shelter under a bridge or overpass during a tornado, as they can create a wind tunnel effect and offer no real protection from debris.

Avoid
● Trees and Utility Poles: These are lightning magnets and can fall.
● Lightweight or Flammable Structures: Sheds, carports, and flimsy kiosks offer no real protection.
● Large, Unreinforced Metal Buildings: These can be very vulnerable to collapse in strong winds.
● Underpasses/Overpasses: As mentioned, these are extremely dangerous during tornadoes.
● Water: Stay away from flooded streets, creeks, and low-lying areas.

Abandoned Building

Sheltering in an abandoned building carries significant risks, and it should generally be a last resort. However, if circumstances necessitate it, these are some crucial precautions to take.

Prioritize Safety & Assess Risks
● Structural Integrity: This is the paramount concern. Avoid any building showing obvious signs of collapse, such as severe cracks in walls, sagging roofs, leaning structures, or shifted foundations. Even if it looks intact, years of neglect, weather exposure, fire damage, or vandalism can severely compromise its stability, making it prone to collapse during strong winds or heavy rain.
● Falling Debris: Be acutely aware of loose roof tiles, crumbling masonry, broken glass, or unstable chimneys that could fall during the storm. Stay away from windows and exterior walls.
● Entry and Egress: Ensure there are clear and safe ways to enter and, more importantly, exit the building. Blocked or unstable doorways, stairs, or collapsed floors can trap you inside.

Hazard Awareness
● Hazardous Materials: Assume the presence of hazardous materials like asbestos, lead paint, mold (black mold can be very dangerous, triggering respiratory issues), and potentially discarded chemicals or drug paraphernalia. Avoid disturbing any suspicious materials and consider wearing a respirator or mask if available.
● Electrical Hazards: Live wires, outdated wiring, or overloaded circuits are common in abandoned buildings and can become extremely dangerous, especially when wet from a storm. Avoid touching any exposed wires, metal components, or anything that could be electrically charged.
● Pest Infestations: Abandoned buildings are often home to rodents (rats, mice), insects (cockroaches, bed bugs), bats, and other animals. These can carry diseases, bite, or cause contamination. Be alert for their presence and avoid disturbing them.
● Human Threats: Be aware of the potential for squatters, criminals, or other individuals who may view your presence as an intrusion. If you encounter anyone, prioritize de-escalation and your safety.

During the Storm
● Seek Interior Space: Once inside, move to an interior room away from windows and exterior walls. Smaller rooms, especially those with no or few windows, generally offer more structural integrity.
● Elevate Yourself: If there's any risk of flooding, try to move to a higher level within the building, assuming the upper floors are structurally sound.
● Listen & Monitor: Pay attention to the sounds of the storm and the building. Any creaking, groaning, or shifting noises should prompt immediate re-evaluation of your location.
● Prepare for Collapse: As a last resort, if the building begins to break up, shelter under a sturdy table, bench, or even a mattress in the strongest part of the structure (e.g., a small interior room, hallway, or cellar if accessible and safe).

General Survival Principles
● Don't Go Alone: If possible, do not enter an abandoned building alone.
● Communicate: Let someone know where you are going and when you expect to return. Mobile signal may be unreliable during a storm.
● Be Prepared: Carry a flashlight (with extra batteries), a first-aid kit, water, and any necessary personal protective equipment (e.g., N95 mask, gloves).
● Have an Exit Strategy: Always be aware of your escape routes.

Bus Shelter

Sheltering in a bus shelter during a storm, particularly a severe one, offers minimal protection and should generally be considered a last resort. They are designed for passive weather protection (sun, light rain), not for severe weather events like thunderstorms with lightning, strong winds, or hail.

SHELTER Public Shelters Bus Shelter

Assess the Storm's Severity
If it's a light rain shower, a bus shelter is fine. If it involves lightning, strong winds, or hail, seek a more substantial shelter immediately (a large building, or a hard-topped, enclosed vehicle). Bus shelters offer no protection from lightning and can be dangerous due to flying debris in high winds.

Position Yourself Safely
● Stay in the most enclosed part: If the shelter has any solid walls, position yourself against the most protected side, ideally with your back to the wind and rain.
● Avoid glass panels: If the shelter has glass or thin plastic panels, stay as far away from them as possible. They can shatter and create dangerous projectiles in strong winds or hail.
● Stay away from the edges: Don't stand directly at the opening.
● Elevate if possible: If there's a bench, sit on it to get slightly off the ground, especially if there's any risk of puddling or minor flooding.

Minimize Exposure
● Crouch low: In severe wind, crouching can reduce your profile and make you less susceptible to being hit by debris.
● Cover your head: Use your arms, a backpack, or any available item to protect your head and neck from falling or flying debris.
● Stay dry: While limited, try to stay as dry as possible under the roof. Wet clothing increases the risk of hypothermia in cold conditions.

Be Aware of Surroundings
● Watch for falling objects: Keep an eye out for falling branches, power lines, or other street furniture that could be dislodged by wind or lightning.
● Monitor flooding: Be alert for rising water levels on the street or around the shelter. If water starts to accumulate rapidly, abandon the shelter for higher ground if it's safe to do so.
● Look for a better option: Continuously assess if the storm's intensity decreases or if a safer, more substantial shelter (like an open business or large building) becomes accessible nearby.

Bridges

Shelting in and under bridges.

On Bridges

Prioritize Evacuation from the Bridge
The first and most critical step is to leave the bridge entirely if humanly possible. Bridges are extremely dangerous during storms due to:
● Extreme Wind Exposure: They are often much higher and more exposed than surrounding terrain, acting as wind tunnels. This drastically increases the risk of the bus shelter being destroyed, and of you being struck by large, fast-moving debris.
● Lightning Risk: Metal components in bridges make them highly susceptible to lightning strikes, and the open nature of bus shelters offers no protection.
● Structural Integrity: While modern bridges are robust, extreme weather can still stress them, and the shelter itself could detach.
● Flash Flooding (underneath): If the bridge spans a waterway, there's a risk of rapid water rise or debris flow underneath.
● Slippery Surfaces: The bridge deck can become extremely slippery, making it hard to move safely.

If Trapped on the Bridge
● Crouch as low as possible: Reduce your profile to minimize exposure to wind and flying debris.
● Get away from glass: If the shelter has glass or thin plastic panels, position yourself away from them, ideally against any solid back wall. These panels can shatter violently.
● Protect your head and neck: Use your arms, a backpack, or anything available to shield yourself from impacts.
● Face away from the strongest wind: Position yourself with your back to the direction of the strongest wind and driving rain/hail.
● Be aware of water accumulation: Even on a bridge, water can pool. Stay as dry as possible to prevent hypothermia.
● Continuously seek better options: Constantly scan for any opportunity to move off the bridge to a substantial, enclosed building or a hard-topped, enclosed vehicle as soon as conditions allow.

Under Bridges

Sheltering in a bus shelter under a bridge during a storm is an extremely dangerous proposition and should be avoided at all costs. While the bridge might offer some overhead cover, it introduces severe hazards that far outweigh any perceived benefit.

Why it's Dangerous
● Wind Tunnel Effect: Bridges, especially underpasses, act as natural wind tunnels during storms. This accelerates wind speeds significantly, turning even small debris into dangerous projectiles. A bus shelter's flimsy construction will be no match for these intensified winds, and you'll be at extreme risk of being hit by flying glass, metal, or other large debris.
● Flash Flooding: Areas under bridges are often low-lying and prone to rapid and deep flash flooding. You can be quickly trapped or swept away by rising water.
● Lightning Risk (Still Present): While the bridge might offer some shielding from direct strikes, lightning can still strike the bridge structure itself and conduct through metal components. You're still not safe from indirect strikes or ground currents.
● Structural Integrity of the Shelter: The bus shelter itself might not be anchored to withstand the forces under a bridge in a storm.
● Visibility and Emergency Access: Being under a bridge can make you less visible to emergency services and hinder their ability to reach you.

Alternatives
● Your absolute safest bet is a sturdy, fully enclosed building. Get out from under the bridge immediately and seek refuge in a substantial structure like a shop, public building, or even a solid house.
● If a building is not an option, a hard-topped, fully enclosed vehicle (like a car or truck) is far safer than a bus shelter under a bridge, especially for lightning. Pull over safely away from the bridge and other hazards, stay in the vehicle, and crouch below window level.
● As a true last resort in a tornado or extreme wind event, if no other option exists, get as low as possible in a ditch or depression away from the bridge, lying flat and covering your head. This is still highly risky but generally preferable to being under an overpass.

Park Bench

Park Shelter

Sheltering in a park shelter during a storm, while offering some overhead cover, provides limited protection and should be considered a temporary or last-resort option, especially during severe weather. These shelters are typically open-sided structures like gazebos, picnic shelters, or open pavilions, offering minimal defense against strong winds, driving rain/hail, or lightning.

Assess the Storm's Severity
● Light Rain/Sun: A park shelter is generally adequate for mild conditions, providing a dry spot and shade.
● Thunderstorms (Lightning, High Winds, Hail): If lightning is present (you can hear thunder, see flashes), do not use a park shelter. These open structures, especially those with metal roofs or poles, offer no protection from lightning and can attract strikes or conduct electricity. Similarly, their open design makes them highly vulnerable to being damaged or having debris blow through in strong winds. Seek a sturdy, fully enclosed building (like a visitor center, public restroom, or a nearby business) or a hard-topped, fully enclosed vehicle immediately.

If a Park Shelter is Your Only Option (Last Resort for Severe Weather)
● Position Yourself Safely: Move to the most protected side of the shelter, ideally the side facing away from the wind and driving rain/hail. Get as far into the interior as possible.
● Avoid Exposed Areas: Stay away from the open edges of the shelter.
● Crouch Low: In high winds, crouching down can reduce your profile and make you less susceptible to being hit by flying debris.
● Protect Your Head and Neck: Use your arms, a backpack, or any available item to shield your head and neck from falling branches or flying debris.
● Stay Dry: Do your best to remain dry under the shelter's roof. Wet clothing increases the risk of hypothermia.
● Watch for Falling Debris: Be acutely aware of any trees, branches, or other park furniture that could be dislodged by strong winds and fall onto or near the shelter.
● Monitor for Flooding: If the park shelter is in a low-lying area, be aware of rapidly rising water levels.

Tunnel

Sheltering in a tunnel during a storm can be extremely risky and should be carefully considered, as tunnels pose unique and severe hazards. While they offer overhead cover, the dangers can often outweigh the benefits, especially if you're unfamiliar with the specific tunnel.

● Prioritize Flash Flood Risk: This is the most significant danger in a tunnel during a storm. Tunnels, by design, often collect water, and in a heavy downpour, they can flash flood extremely rapidly and deeply, turning into dangerous waterways. Water can rise to life-threatening levels within minutes, sweeping you away or drowning you. Never enter a tunnel if there's any risk of flash flooding or if water is already accumulating. If you see water beginning to rise, exit immediately to higher ground, even if it means exposing yourself to the storm above.

Assess Tunnel Type and Stability
● Pedestrian/Utility Tunnels: Some tunnels are for pedestrians or utilities, while others are for vehicles. A tunnel not designed for human traffic might have poor lighting, ventilation, and unpredictable hazards.
● Structural Integrity: Similar to abandoned buildings, tunnels can suffer from structural weaknesses due to age, earthquakes, or poor maintenance. ● Listen for creaking, cracking, or dripping sounds that might indicate instability.

● Lightning Risk (Still Present): While a deep tunnel offers some protection from a direct lightning strike, lightning can still strike the ground near the tunnel entrance or even the tunnel structure itself, with currents potentially traveling through the ground or metal components. Deeper, fully enclosed tunnels offer more protection, but open-ended or short tunnels are still vulnerable.

● Vehicle Tunnels: If it's a vehicle tunnel, especially without active ventilation, exhaust fumes can build up rapidly, posing a serious health risk. Avoid these unless absolutely necessary and for a very short duration.
General Ventilation: Even non-vehicle tunnels might have limited airflow, leading to stagnant air or the accumulation of other gasses.

Traffic and Other Hazards
● Active Tunnels: If it's an active road or rail tunnel, the danger from vehicles or trains is immense. Never enter an active traffic tunnel for shelter.
● Debris: Storms can cause landslides, rockfalls, or send debris into tunnel entrances.
● Visibility: Tunnels can be very dark. A reliable light source (flashlight, headlamp) is essential.

If a Tunnel is Your Absolute Last Resort and Appears Dry and Stable
● Enter Carefully: Be extremely cautious of your footing, as surfaces can be slippery.
● Stay near an entrance (but not too close): Position yourself just inside an entrance, allowing for a quick exit if flooding or other hazards emerge. Don't go deep into an unknown tunnel.
● Stay Elevated: If there's any slight elevation, use it.
● Monitor Conditions: Continuously observe for any signs of water inflow, unusual noises, or changes in air quality.
● Have an Exit Strategy: Be prepared to abandon the tunnel at the first sign of danger.

Train Station

Stadium / Arena

Parking Garage

7 Transport Shelters

Any form of modern shelter that can be transported by a vehicle such as a caravan, trailer etc. They may be completely set up already or partially set up such as a top that requires popping up.

Trailer Pop-Up Shelter	A low pop up shelter that's generally only used for sleeping in and contains a few storage areas.
Trailer Fixed Shelter	A full height shelter that's generally only used for sleeping in and contains a few storage areas.
Towed Caravan	A towed caravan separate from the vehicle which can be lived in.

Campervan	A compact home within the back of a vehicle with the engine on the same section.
Motor Home	A larger form of a campervan to house more people.
Tiny House	A complete house including furnishings that can be towed. Generally they are 5m+ in length and a maximum of 2.4m wide.

8 Buildings

Any building with four walls and a roof which is designed for habitation and is generally waterproof, windproof and inspect proof.

Modern House	
Military Urban Shelter	Select the site carefully as many buildings may have suffered structural damage. Falling masonry, exposed reinforcing rods or other jagged surfaces and exposed electrical wiring are clear hazards. Keep out of occupied buildings. Sleep or rest towards the centre of the building. Always maintain security, as buildings offer multi-level, three dimensional considerations and many areas for infiltration and ambush from concealed locations.

Reinforced Buildings

Any building which has extra strong walls, floors and roof to protect it against bullets, bombs or nukes.

Banks	Many banks have extra thick walls to help prevent thieves. The vaults can typically withstand a bomb blast or even a nuclear blast.
Bunker	An extremely heavy duty military grade shelter designed to shield from nuclear bombs.
Missile Silo	
Mountain Base	

9 Shelter Components

These are the components that make up each part of a shelter such as the tarpaulin to the groundsheet and the sleeping bag.

Shelter Components
- **Tarp / Sheeting:** For creating the general structure of the shelter to keep you dry.
- **Rigid Materials:** For creating the frame of the shelter if there's no objects around.
- **Rope/Cord:** For fixing the sheeting to an object.
- **Ground Pad:** To keep you warm and dry by lifting you off the ground while you sleep.
- **Padding:** Used below the bed to soften the ground and acting like insulation.

Subheadings

1. Tarpaulin	**2. Groundsheet**	**3. Sleeping Pad**	**4. Sleeping Bag**
5. Pillow	**6. Blanket**	**7. Temperature Regulation**	

1 Tarpaulin

A tarpaulin, often simply called a tarp, is a versatile sheet of strong, flexible, waterproof, or water-resistant material, typically made from plastics like polyethylene (PE) or canvas coated with PVC. Its primary function is to provide protection from the elements, whether it's rain, sun, wind, or dust. Tarpaulins come in various sizes, colors, and thicknesses, often featuring reinforced grommets (eyelets) along the edges to allow for tying, staking, or securing the sheet over objects or to form temporary structures. Due to their durability and protective qualities, tarpaulins are widely used in construction, agriculture, camping, and disaster relief, serving as groundsheets, temporary roofs, equipment covers, or components in improvised shelters like those discussed in a survival context.

Tarpaulin Types

These are the different types of tarpaulins available today. Some make great shelter building materials where others fail miserably.

Poly Tarps	Poly tarps are a plastic based material. Poly is short for polyethylene (pòllee éth? leen). Polyethylene is a synthetic polymer: a plastic polymer of ethylene. Most poly material is used for manufacture of containers, packaging, and electrical insulation or in this case poly tarps. Polyethylene tarps a.k.a. Poly tarps are made with polyethylene, nylon tarp threading inside the material with a rope reinforcement around the perimeter of the poly tarp material. Polyethylene (PE) resins are milky white, translucent substances derived from ethylene (CH29CH2).
Canvas Tarps	Canvas tarps have been a wide use item for many years. Canvas, closely woven, plain weave fabric made of natural or synthetic fibres. The firm cloth is used in making awnings, soft luggage and tarpaulins. In this case canvas tarpaulin a.k.a. canvas tarps. Although canvas is also known as sailcloth, modern sails are constructed of fabric, made to select specifications, which may bear little resemblance to fabrics generally marketed as sailcloth or canvas.
Heavy Duty Tarps	The heavy duty tarps are highly recommended for agricultural, industrial and commercial sectors. These tarps are manufactured with strength and resistance to demanding work and severe weather conditions. So for jobs that need tougher tarps, choose from our line of heavy-duty tarps.
Fire Retardant Tarps	Fire or flame retardant tarps are canvas materials that are used for protecting people and properties from exposure or damage caused by fire. When exposed to fire they will not easily burn or fuel any combustion.
Vinyl Tarps	Compared to the other kind of tarps, Vinyl tarps are thicker and have a higher abrasion resistance. This means they can resist acid, oil, mildew and grease. Their tough nature allows them to be used for heavy-duty purposes.

SHELTER Shelter Components Tarpaulin Tarpaulin Types

Mesh Tarps	Mesh tarps are built with a nylon tarp threading that weaves a material that is screen like. Nylon mesh tarps are used for purposes for water or wind to go through. A mesh tarp is a great way to prevent hard winds on the applied area. When building a shade screen tent, mesh tarp covers and sides weaken winds that hit the canopy tent. Hard winds enter one side of the mesh tarp and blows through slowly on the other side so the wind gets defused by the mesh material. This is a great way to secure a tent or canopy.
Truck Tarps	Truck tarpaulins are made with a super strong heavy duty poly coating. Truck Tarps are heavy duty tarp covers made for secure fitting coverage over trucks that need to travel long distances. Truck covers can be comprised of rubberized tarps and heavy duty polyethylene material. The truck tarp has double reinforced fabric around the hems. Truck Tarps hems are reinforced with 1/4" triple braided roping, double stitched in hems, corners and reinforced seams. All Truck Tarps have heat sealed interior seams. Truck tarps are equipped with D Rings - One stainless steel plated on nylon webbing every 2 feet, triangular reinforced fabric at each D Ring. This assures a secure fit around the perimeter of the truck tarp cover. Solid brass grommets surround the perimeter and in each corner for additional secure fitting.
Hay Tarps	These tarps offer good protection while minimising field transportation. These UV treated hay tarps will help prevent the formation of rot and moisture and are designed for long-term coverage. With resistance to ultraviolet rays, the tarp can prevent the heat from decreasing the nutrients of hay. Since it is also resistant to acid, all the damaging agents of the rain cannot damage this tarp. This tarp also has arctic flexibility, which means the tarp will not stiffen in freezing temperatures.
Boat Tarps	The poly boat tarps provide protection from sun and rain. They can also be used during the winter season.

2 Groundsheet

SHELTER Shelter Components Groundsheet

A groundsheet is important for keeping your ground based shelter hole free and to extend its life. It's placed under the tent in the position you will most likely find yourself sleeping to prevent sharp objects such as sticks, rocks and glass puncturing your shelter. Try to match your groundsheet up with your tent to save on space - unless you want a bigger size to use as a door mat. Tarps have multiple purposes and one of these is as a groundsheet. In a pinch you can convert a tarp to a tent and back as required. Unfortunately they are very heavy, particularly the more durable ones such as canvas.

Materials
- Tarp (Heavy)
- Cuben Fibre (Light)
- Tyvek (Light)

3 Sleeping Pad

SHELTER Shelter Components Sleeping Pad

A sleeping pad shields you from the ground and is below the sleeping bag and above the ground protector. Essential for cold environments as the ground will sap all your warmth overnight.

Types

- **Air Pad:** Air pads are inflated with your breath and offer a fair amount of comfort.
- **Self Inflating:** Pads that have foam inside which adds additional spring and lets it inflate itself.
- **Closed Cell / Foam:** Typically made to fold and comprises of dense foam filled with tiny closed air cells.

Types

Air Pad	Don't blow up a sleeping pad in freezing conditions as the condensation from your breath will freeze in the night.
Self Inflating	These pads generally come in at a slightly larger size due to the foam core which helps it expand by itself. If you're determined to get the smallest and lightest pad possible, don't buy a self inflating pad.
Closed Cell / Foam	Pads that come primarily made out of foam and can't be inflated with air. These can provide the comfiest sleep if there's a mix of more solid foam on the bottom and soft foam on the top. They can be bought in an 'egg shell' style of foam which helps to equally distribute your weight all over the mattress.

Weight

Depending on what you're doing, whether car camping, or backpacking you will want to look at weight more closely. For the absolute lightest pad, the Therm-a-Rest NeoAir UberLite comes in at 170g (6 oz). The weight can range all the way up to many kilograms for the very thick non-air mattresses.

Length

There's quite a range of lengths you can purchase today, from pads made for children to pads made for the tall people - up to 2m (79 in).

Width

The width of pads can range from about 50cm to 90cm. You should choose one based on who will be using it, basing it off the width of their shoulders.

R Value

The R-value of a mattress indicates its level of thermal resistance. In short, the higher the R-value the better the product will be for use in cold temperatures.

Rails

Some pads have larger side baffles, often called "rails," to cradle you and help keep you from rolling off as you turn during sleep. Keep in mind that, on average, women and children tend to sleep colder than men, but also that everyone is unique.

4 Sleeping Bag

SHELTER Shelter Components Sleeping Bag

A sleeping bag is an insulated covering for a person, essentially a lightweight quilt that can be closed with a zipper or similar means to form a tube, which functions as lightweight, portable bedding in situations where a person is sleeping outdoors (e.g. when camping, hiking, hill walking or climbing). Its primary purpose is to provide warmth and thermal insulation through its synthetic or down insulation. It also typically has a water-resistant or water-repellent cover that protects, to some extent, against wind chill and light precipitation, but a tent is usually used in addition to a sleeping bag, as it performs those functions better. The bottom surface also provides some cushioning, but a sleeping pad or camp cot is usually used in addition for that purpose. The bottom surface of a sleeping bag may be moderately water repellent, but a plastic tarp or groundsheet is often used to protect against moist ground.

Shape

Rectangular	Offers maximum room to stretch out and move around, providing a comfortable, bed-like feel ideal for warmer weather and car camping.

Semi-Rectangular	Balances warmth and roominess, providing more wiggle room than a mummy bag while still offering good thermal efficiency, suitable for cooler weather and side sleepers.
Mummy	Designed for maximum thermal efficiency by minimizing internal air space, making it the warmest, lightest, and most packable option for cold weather and backpacking.
Double Wide	Provides ample space for two people to share body heat, offering enhanced comfort and warmth for couples or families while camping.

Material

Synthetic Insulation	● Insulates when Wet: This is its primary and most significant advantage. Unlike down, synthetic fibers retain most of their insulating properties even when damp or wet, which is crucial for safety in humid, rainy, or snowy conditions where down would lose its loft and warmth. ● Faster Drying: Synthetic insulation dries much more quickly than down, making it more practical for trips where exposure to moisture is likely. ● Less Expensive: Generally, synthetic sleeping bags are more affordable than comparable down bags, offering a good value for the performance. ● Hypoallergenic: For individuals with allergies to down feathers, synthetic insulation is an excellent, non-irritating alternative. ● Easier Care: Synthetic bags are typically easier to clean and maintain than down bags.
Goose-Down Insulation	● Superior Warmth-to-Weight Ratio: Ounce for ounce, goose down provides more warmth than synthetic insulation, making down bags incredibly lightweight for their temperature rating. This is a huge benefit for backpacking and mountaineering where every gram counts. ● Excellent Compressibility: Down compresses into a very small packed size, taking up minimal space in a backpack. This is also highly valued by ultralight enthusiasts. ● Exceptional Durability and Longevity: With proper care, a high-quality down sleeping bag can last for decades, maintaining its loft and insulating power over many years of use. ● Breathability: Down is naturally breathable, which helps to manage moisture and reduce condensation inside the bag. ● Softness and Comfort: Down offers a plush, soft feel that many find exceptionally comfortable.
Water-Resistant Down Insulation	● Improved Wet-Weather Performance: This type of down is treated with a durable water-repellent (DWR) polymer that coats individual down plumes. This significantly reduces down's tendency to absorb moisture, allowing it to retain more loft and insulate better in damp or humid conditions compared to untreated down. ● Faster Drying When Wet: While still not as fast as synthetic, water-resistant down dries considerably faster than untreated down if it does get wet. ● Enhanced Durability: The treatment can also improve the integrity and longevity of the down clusters. ● Combines Benefits: It aims to bridge the gap between traditional down and synthetic, offering much of down's superior warmth-to-weight and compressibility while mitigating its main weakness against moisture, making it a versatile choice for varied conditions.

Weather Rating

Comfort Rating (T-Comfort)	This is the lowest temperature at which an "average woman" (defined by standard parameters) is expected to sleep comfortably in a relaxed position. If you tend to sleep cold, this is the most important rating to consider for a good night's rest.
Limit Rating (T-Limit or Lower Limit)	This is the lowest temperature at which an "average man" (defined by standard parameters) can sleep without feeling uncomfortably cold. They might need to curl up to stay warm, but should not be shivering significantly or at risk of hypothermia. If you tend to sleep warm, this rating might be more relevant for you.
Extreme Rating (T-Extreme)	This is a survival rating only. It represents the minimum temperature at which the bag is expected to prevent a "standard woman" from dying of hypothermia for about six hours. You will be very cold, uncomfortable, and likely won't sleep. This rating is not for comfortable camping and should only be considered for absolute emergency situations where survival is the sole goal.

Other Features

These are any sleeping bag accessories that may be of use.

Sleeping Bag Hood	You'll lose a lot of heat through your head. Consider a semi-rectangular bag with a built-in hood. When cinched with a drawcord, the hood prevents heat from radiating away.
Stash Pocket	This keeps small items, such as an MP3 player, watch or glasses, close at hand.
Sleeping Pad Sleeve	On some bags, the underside insulation has been replaced with a sleeve to fit a sleeping pad. The result: no more rolling off the sleep pad in the middle of the night!
Pillow Pocket	Allows you to stuff your clothes inside to create a pillow.
Stuff Sack	Many bags come with a stuff sack to easily transport your bag.
Storage Sack	You can prolong the life of any sleeping bag by hanging it in your garage or storing it loosely in a cotton storage sack—and not rolled up tight in a stuff sack. This long-term storage prevents the insulation from getting permanently compressed, which reduces its insulating properties.
Sleeping Bag Liner	Slip a soft sleeping bag liner inside your bag to minimize wear and keep the bag clean.

5 Pillow

A pillow is a support of the body at rest for comfort, therapy, or decoration. Below are the different type of pillows.

Typical Pillow	A pillow stuffed with soft materials such as down or cotton to provide the softest pillow possible.
Inflatable Pillow	A pillow which can be inflated with air. These aren't as comfortable as a regular pillow.
Self-Inflating Pillow	A pillow that inflates itself if left outside its compression bag. Usually these have breath toggles to allow a bit more air inside.

6 Blanket

These will keep you warm during the cold months. Each material has different properties as shown below.

Down (Lightweight)	A down blanket or down throw is thinner and lighter than a down comforter. The spaces between the down clusters in a blanket trap warm air, keeping you warm without added weight.

Bamboo (Lightweight)	Luxuriously soft and lightweight, bamboo fabric is similar to modal, with its smooth hand and flowing drape. Called rayon from bamboo, these fabrics are known for their soft, comfortable, and highly absorbent properties.
Silk (Midweight)	Known for its strength, softness and warmth, silk blankets offer the ultimate in luxury. Silk also has natural anti-fungal and anti-microbial properties. Silk blankets should be dry cleaned.
Wool / Cashmere (Midweight - Heavyweight)	Wool blankets tend to be heavier and warmer than other fabrics. Wool fibres come from the fleece of lambs, sheep, goats, camels, llamas, alpacas and vicunas. Wool from sheep is the most common. Softer, more luxurious wool comes from Cashmere goats, Angora goats and Merino sheep. The spaces between the fibres in a fuzzy or napped blanket trap warm air, keeping you warmer.
Synthetic (Lightweight - Midweight)	Synthetic fibres such as polyester, nylon, and acrylic tend to be ultra-soft. Electric blankets are usually made with synthetic materials.
Linen (Midweight)	Linen is hypoallergenic, moisture-wicking and adjusts to your body temperature to stay cool in the summer and warm in the winter. Linen becomes softer with every wash.
Cotton (Lightweight - Midweight)	Cotton blankets can vary in weight and texture, making them a year-round bedding staple. Unlike synthetic fibres, cotton fibres breathe naturally and are absorbent. Cotton will wick moisture away from the skin and leave a layer of warm, dry air. If allergies are a concern, cotton is an excellent choice since it can be washed in hot water.

7 Temperature Regulation

Keeping Warm	● Light a fire and use the warmth. ● Layer up clothes and go for thicker layers. ● Use thermal blankets to retain your body heat. ● Stuff newspapers and clothing between layers to insulate. ● Move around and keep active to generate more body heat and refuel by eating lots of fats.	**Gain Heat** ● Thermogenesis / Food ● External Heat ● Shivering ● Exercise
Keeping Cool	● Stay in the shade, the darker the shade the better. ● Don't expend energy which heats up the body, rest during the hottest part of the day. ● Find a breeze if possible and remain in it, or use a fan. ● Wrap a wet shemagh around your neck or head to cool it down. ● If avoiding the sunlight isn't possible, wear white clothes to reflect the rays and heat. ● Wear loose-fitting moisture wicking clothes made of cotton. ● Hydrate often to replace the water you lose sweating. ● Find the lowest point in the terrain near water and dig down for a temporary shelter.	**Thermogenesis** ● Radiation ● Conduction ● Convection ● Evaporation

10 Shelter Location

Choosing the correct location to set up your portable shelter is one of the most important factors to consider. A good choice can keep you dry, safe and secure and a bad choice could leave you dead.

Location Tips

Positioning	● **Water Positioning:** Make sure you're at least 100m (328ft) from any water source. ● **Food Positioning:** You should be at least 60m (196ft) from your kitchen/bear bag/food processing location. ● **Bathroom Positioning:** You should also be at least 100m (328ft) from your bathroom and human waste location. ● **Position Triangulation:** Overall the previous three locations should be at least 100m (328ft) from any other one of them. ● **Avoid Trails:** Camp at least 50m (164ft) from any walking trail or game trail.
Tree Integrity	● **Healthy Trees:** Ensure all surrounding trees are healthy with strong roots. ● **Avoid Weak Trees:** Make sure there's no trees that are prone to falling in wind such as Gum Trees like Eucalyptus. ● **Fallen Branches:** A bad sign for trees is seeing a lot of fallen branches nearby. ● **Dead Branches:** Check for dead trees and branches lodged in trees which have been caught by other trees. ● **Snowed Trees:** Don't camp under trees in heavy snow as the weight can snap the branches. ● **Tree Diseases:** Check for tree diseases and leaking sap. If anything looks wrong, find another spot. ● **Avoid All Trees:** Try not to camp directly under tall trees if it can be helped.
Water	● **Elevated Position:** Place your shelter on a slight elevation in relatively flat ground to keep the bottom from getting soaked. ● **Avoid Ditches:** Avoid all small ditches where water can pool under you. ● **Avoid Floodplains:** Be sure you aren't in a floodplain or low valley which can collect water. ● **Water Diversion:** If you're at the base of a mountain redirect water by piling up mud into a "V" shape further up the slope.
Ground	● **Ground Clearing:** Clear the ground of leaves, snow, rocks, sticks and other items that may puncture the shelter. ● **Flat Ground:** Try to find the flattest ground possible when setting up. ● **Insects:** Check for in-ground insect nests, holes and other spots creatures could hide.
Natural Disasters	● **Minimise Wind:** Reduce the effect of strong winds by choosing a location with a natural wind break like boulders or fallen logs. ● **Avoid Cyclones:** Avoid Cyclone and Hurricane winds entirely by leaving the area prior to arrival, or seek a very sturdy shelter. ● **Flash Flood Signs:** Check for any signs of flash floods like consistent debris around rivers.
Insect / Animal Threats	● **Insects:** Check for in-ground insect nests, holes and other spots creatures could hide. ● **Trails:** Avoid game trails whenever you see them as they may be regularly used by fauna. ● **Other Insects:** Make sure there's no other nests nearby such as wasps, spider webs etc. ● **Avoid Faeces:** If you see any animal faeces avoid that area. ● **Nesting Birds:** Stay away from nesting birds, particularly those that swoop.
Stealth Shelters	For tips on stealth camping, see the SECURITY section.

11 Construction

Information on building or repairing a modern house.

Standards

Building Classes

These are the different classes of buildings.

Class 1 (A-B)	A - A single dwelling being a detached house, or one or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit. B - A boarding house, guest house, hostel or the like with a total area of all floors not exceeding 300m2, and where not more than 12 reside, and is not located above or below another dwelling or another Class of building other than a private garage.
Class 2	A building containing 2 or more sole-occupancy units each being a separate dwelling.
Class 3	A residential building, other than a Class 1 or 2 building, which is a common place of long term or transient living for a number of unrelated persons. Example: boarding-house, hostel, backpackers accommodation or residential part of a hotel, motel, school or detention centre.
Class 4	A dwelling in a building that is Class 5, 6, 7, 8 or 9 if it is the only dwelling in the building.
Class 5	An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9.
Class 6	A shop or other building for the sale of goods by retail or the supply of services direct to the public. Example: café, restaurant, kiosk, hairdressers, showroom or service station.
Class 7 (A-B)	A - A building which is a car park. B - A building which is for storage or display of goods or produce for sale by wholesale.
Class 8	A laboratory, or a building in which a handicraft or process for the production, assembling, altering, repairing, packing, finishing or cleaning of goods or produce is carried on for trade, sale or gain.
Class 9 (A-C)	A building of a public nature A - A health care building, including those parts of the building set aside as a laboratory. B - An assembly building, including a trade workshop, laboratory or the like, in a primary or secondary school, but excluding any other parts of the building that are of another class. C - An aged care building.
Class 10 (A-C)	A non-habitable building or structure. A - A private garage, carport, shed or the like. B - A structure being a fence, mast, antenna, retaining or free standing wall, swimming pool or the like. C - A private bushfire shelter.

Staircase Construction

Staircases (For Building Class 1-10)
General Requirements – Staircase used in habitable rooms or used externally must comply with the Building Code of Australia Part 3.9.1. All areas not specified in Building Code of Australia should be referenced in the Australian Standard AS1657 Section 4.

Staircases to storage areas or un-habitable rooms such as attics can be constructed outside the Building Code of Australia though must comply to the Australian Standards AS 1657. Your staircase must have no less than 2 risers or have no more than 18 risers without a 750mm2 landing or rest area.
Each tread and riser must be of the same measurement within a single flight. The riser opening if your staircase is of Open Rise Construction must not allow a 125mm sphere to pass through. All treads and top nosing must have a slip-resistant finish or a non-slip strip system near the edge of each tread nosing.

A flight must not have more than 3 winders in a quarter landing section or 6 winders in a half landing section.
If a door in your home opens onto a staircase a landing is required unless the floor to floor dimension is less than 570mm. If the floor to floor is less than 570mm all that is required is a zero tread.

Width and Angle	Stairways shall be not less than 600 mm wide measured between the inside edges of the handrails. The angle of pitch of a staircase shall be not less than 26.5 degrees and not greater than 45 degrees.
Straight Flights	Your staircase must have no more than 18 risers without a 750mm2 landing or rest area. The staircase should have no more than 36 rises without a change of direction.
Minimum Vertical Clearance	Unless otherwise approved by the regulatory authority, the head clearance shall be not less than 2000 mm measured vertically from the nosing line.
Riser and Going Dimensions	Riser Max: 190 Riser Min: 115 Going Max: 355 Going Min: 240 Slope Relationship Max: 700 Slope Relationship Min: 550 125mm sphere must not pass between treads.
Balustrades	A continuous handrail must be provided along the side of any stairway or ramp. A balustrade is required to any staircase A balustrade is required to any staircase, balcony, ramp, hallway, veranda, mezzanine or bridge were the potential to fall from the above mentioned area is 1000mm or greater to the surface below. The height of the balustrade on the pitch of the staircase must be not less than 865mm form the nosing line. This dimension is taken plump from the nosing line with the rail or balustrade running parallel up the pitch of the staircase. The height of the balustrade on a finished floor, balcony, landing or path must me above 1000mm. Openings in the balustrades must be constructed so that any opening does not permit a 125mm sphere to pass through it. This space is tested above the nosing line only. With floors or balconies were potential to fall more than 4000mm to the surface below, all horizontal elements between 150mm and 760mm above the floor or balcony must not facilitate climbing.

Staircases to Un-Habitable rooms	Any staircase or balustrade to a storage area or un-habitable rooms must comply to all other regulations above apart from NCC Part 3.9.1.2. The Staircase rise and goings for an un-habitable room must be constructed in accordance with AS 1657 – 4.2.1. Each rise shall be >= 130 mm and <= 225 mm. Each going shall be >= 215 mm and <= 335 mm. The product of the going, measured in millimetres, and the rise, measured in millimetres, shall be >= 45,000 and <= 48,000. The tread width shall be not less than the going and there shall be a minimum overlap of 10 mm.

House Construction

The Frame

The overall frame is composed from a number of individual wall panels, which when fixed to the base and fastened together form a rigid box like structure.

Structural Loads	The frame carries several main structural loads: It takes the load of the roof, and any upper floors, down to the foundation. It resists the wind trying to push the building over. Provides lateral support for the brick walls. Holds the windows in place. It gives a secure fixing point for the internal wall and ceiling lining boards. In the case of weatherboard or lightweight render construction it supports the outer skin of the building.
Additional Functions	Provides a route and fixing points for cables and pipes. Retains insulation. Supports cupboards and shelves. Fixing of building wrap.

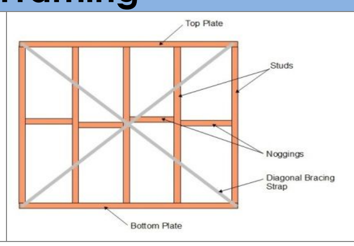
Framing Materials

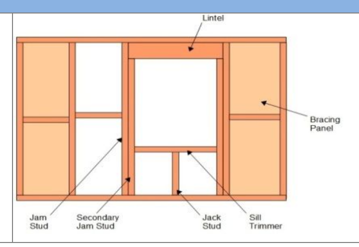
These are the different materials you can use for framing.

Wood	- Termites a Possibility - Natural Weaknesses + Cheap
Brick	+ Termite Proof + Cooler - Heavy - Takes More Space
Metal	+ Termite Proof - Thermal Expansion Noise - Heat Conductive

Timber Framing

These are the definitions of the timber framing components of a wall segment.





Components	● Top Plate ● Studs ● Noggings ● Bottom Plate ● Diagonal Bracing Strap
Minimum Timber Size	95x35mm Additional Insulation = depth of 125mm. More strength = 45mm thick instead of 35mm.
Studs	Main structural component supporting the main vertical load of the roof. Normal spacing is 450mm for external walls and 600mm for internal walls.
Top Plate	Fixes the stud in position and acts as a mounting point. Can not support major loads such as roof trusses and upper beams. Can add a second beam for strength.
Bottom Plate	The bottom plate holds the frame to the base and fixes the bottom of the studs in position. Needs to be firmly fixed to the base.
Noggings	Individual short pieces of timer between studs. They prevent studs bowing under load. They must fit perfectly. Max spacing is 135cm. One or more nogging per 2.74m required.
Diagonal Bracing Strap	The straps are galvanised steel nailed to each strut. The bracing resists any sideways deformation such as wind loading. Vital to overall strength.

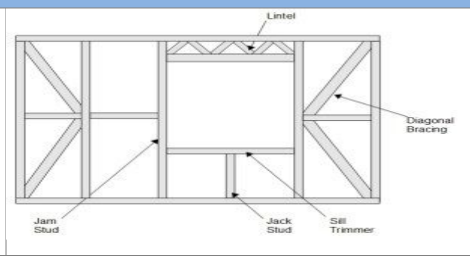
Timber Framing Openings

Components	● Bracing Panels ● Lintel ● Jam Stud ● Secondary Jam Stud ● Sill Trimmer ● Jack Stud

Bracing Panels	The bracing panels replace the bracing straps to keep the frame square and ensure the panel resists sideways forces. They are a sheet material that is nailed to the studs top plate, bottom plate, and noggins. Usually the panels are ply although I have seen other materials such as particle board.
Lintel	The lintel carries loads from above to the studs either side of the opening. The size of the lintel will depend on the width of the opening.
Jam Stud	The jam stud in normally the last full height stud before the opening.
Secondary Jam Stud	As well as assisting the jam stud to carry the lintel load the Secondary Jam Stud also provides extra stiffness to counteract the fact that there is only one noggin.
Sill Trimmer	This forms a fixing point for a window frame, and also the top fixing point for any Jack Studs. For a small window a Head Trimmer may be used between the lintel and the top of the opening.
Jack Stud	The jack stud is a short vertical stud. It can be between: ● The Bottom Plate and the Sill Trimmer. ● The Lintel and a Head Trimmer.

Steel Framing

Steel framing is relatively thin and doesn't require heavy duty cutting tools.



Components	● Diagonal Brace ● Lintel
Diagonal Brace	The diagonal braces are used instead of a panel of sheet material in the timber frame to resist sideways forces on the frame.
Steel Lintel	Rather than a solid beam, a truss structure is formed to carry loads over the opening.
Masonry Veneer	Requires a solid frame to be completed consisting of either wood or steel. The frame is usually wrapped prior to bricks being added. Appears solid however it only supports itself and relies on ties to the frame to keep it stable. It provides a weatherproof skin to the building. Easy to insulate.
Joists	
Sheathing	Sheathing is a process whereby we apply sheets of structural timber such as plywood to the outside of the timber wall and roof framing to add an additional layer of strength and bracing and also to create an additional air and water barrier for increased insulation.
Bracing	Bracing is where use galvanised steel strapping that we tension to create extra structural support.
Plasterboard	**Types** Reduced Noise Transmittance Improved Noise Absorption Increased Impact Resistance Better Water Resistance Higher Fire Resistance Flexible Boards
Windows	Building code requires at least 10% of the floor area as windows. Windows that go to the floor restrict where you can put furniture. 20-25% Glazing in South facing rooms and 40% in North facing rooms. Single Glaze or Double Glaze

Roofing

Metal Roofing	- Noisier in Rain + Fairly Light + Resistance to wind & hail - Possible dent with hail + Less likely to leak + Can lay at lower pitch + Minimal Rusting + Reflects Sunlight & Heat + More Expensive + Fitting Solar is Cheaper
Tiled Roofing	- Can be expensive + Better Insulation - Heavier - Brittle + Very Strong - Screwed down in high wind + Wide Colour Range + Looks Better
Solar Roof Direction	East-West

SHELTER Construction

Roof Slope	10°

Utilities

SHELTER Construction Utilities

Electrical	**Wiring:** Switch Wiring
Plumbing	**Valves:** Check Valve
Gas	

House Features

SHELTER Construction House Features

Doors
Sort the doors out prior to designing the electrical plan for placement of the switches.

Swing Direction	The direction the door swings, either into the next room or away from it.
Hinge Side	Typically hinged on the side nearest to a wall.

Buffer Zones
Buffer Zones are enclosed rooms which can be sealed off from others. These zones assist in heating and cooling spaces with maximum efficiency to avoid altering un-used areas. Buffer zones can come at the expense of impeding natural airflow throughout the house.

Electricity

Power generation, schematics and battery types

"With great power comes an even greater electricity bill."
Unknown

Introduction

A category for all things electronic such as batteries, renewable energy, schematics and generators. It includes sections on repairing electronics, componentry and schematics for electronics.

Purpose	The aim of ELECTRICITY is to educate the reader on all forms of preparedness related electricity usage and electrical devices. There are sections devoted to the basics of electronics, electricity generation, electrical storage, schematics and repairing electronics.
Lost?	● For information on using electricity to start a fire, see the FIRE section. ● For information on lightning, see the METEOROLOGY section. ● For using electricity to generate light, see the LIGHT section. ● For a list of recommended electrically based gear such as solar panels, see the GEAR section. ● For electronic games, see the ENTERTAINMENT section.

Contents

1 Electricity Introduction

Electricity Basics

Nucleus is made up of protons and neutrons, and the number of protons and neutrons are balanced. Neutrons have no electric charge, protons have positive charges (+) and electrons have negative charges (-). A positive charge of proton equals a negative charge of electron. Electrons are bound in their orbit by attraction of protons, but electrons in the outer band can become free of their orbit by some external forces. These are referred to as free electrons, which move from one atom to the next, electron flows are produced. These are the basis of electricity. Materials that allow many electrons to move freely are called conductors and materials that allow few free electrons to move are called insulators.

All matters are made up of atoms that have electric charges. Therefore, they have electric charges. For the matter that has a balanced the number of protons and electrons, positive charge force and negative charge force are balanced. It is called neutral state of an atom. (The number of protons and electrons remains equal) Static electricity represents a situation that all things are made up of electric charges. For example, the rubbing of material against another can cause the static electricity. Free electrons of one material move forcefully till they are freed of their orbits around nucleus and move to another. Electrons of one material decrease, it presents positive charges. At the same time, electrons of another increase, it has negative charges.

Current	An electrical phenomenon is caused by flow of free electrons from one atom to another. The characteristics of current electricity are opposite to those of static electricity. Wires are made up of conductors such as copper or aluminium. Atoms of metal are made up of free electrons, which freely move from one atom to the next. If an electron is added in wire, a free electron is attracted to a proton to be neutral. Forcing electrons out of their orbits can cause a lack of electrons. Electrons, which continuously move in wire, are called Electric Current. For solid conductors, electric current refers to directional negative-to-positive electrons from one atom to the next. Liquid conductors and gas conductors, electric current refers to electrons and protons flow in the opposite direction. Current is flow of electrons, but current and electron flow in the opposite direction. Current flows from positive to negative and electron flows from negative to positive. Current is determined by the number of electrons passing through a cross-section of a conductor in one second. Current is measured in amperes, which is abbreviated "amps". The symbol for amps is a letter "A". A current of one amp means that current pass through a cross-section of two conductors, which are placed in parallel 1 meter apart with 2x10-7 Newton per meter force occur in each conductor. It can also mean charges of one coulomb (or 6.24x1018 electrons) passing through a cross-section of a conductor in one second.
Voltage	Electric current is flow of electrons in a conductor. The force required to make current flow through a conductor is called voltage and potential is the other term of voltage. For example, the first element has more positive charges, so it has higher potential. On the other hand, the second element has charges that are more negative so it has lower potential. The difference between two points is called potential difference. Electromotive force means the force which makes current continuously flows through a conductor. This force can be generated from power generator, battery, flashlight battery and fuel cell, etc. Volt, abbreviated "V", is the unit of measurement used interchangeably for voltage, potential, and electromotive force. One volt means a force which makes current of one amp move through a resistance of one ohm.
Resistance	Electrons move through a conductor when electric current flows. All materials impede flow of electric current to some extent. This characteristic is called resistance. Resistance increases with an increase of length or decrease of cross-section of a material. The unit of measurement for resistance is ohms and its symbol is the Greek letter omega (Ω). The resistance of one ohm means a conductor allows a current of one amp to flow with a voltage of one volt. All materials are difference in allowing electrons flow. Materials that allow many electrons to flow freely are called conductors such as copper, silver, aluminium, hydrochloric solution, sulphuric acid and saltwater. In contrast, materials which allow few electrons to flow are called insulators such as plastic, rubber, glass and dry paper. Another type of materials, semiconductors have characteristics of both conductors and insulators. They allow electrons to move while being able to control flow of electrons and examples are carbon, silicon and germanium, etc. The resistance of conductor depends on two main factors as the followings: 1. Types of material 2. Temperature of material

Electrical Functions

Electric current is the ability to do work. Electric current can be converted to heat, power and magnetism, to name a few.	**Electrical Functions** 1. Heat and power 2. Electrochemistry 3. Magnetism

Heat and Power	• For example, current-carrying nichrome wire that nichrome wire has a high resistance and creates heat. This is applied to be component of electric ovens, toasters, electric irons and light bulbs, etc.
Electrochemistry	• For example, when current is passed through sodium chloride (NaCl) solution, a chemical reaction called electrolysis occurs. This is applied to produce electrolysis, galvanizing and battery, etc.
Magnetism	• The example of this electric work is a current-carrying wire, magnetic lines of flux occur. This is applied to produce electric motors, electric transformers and tape recorders, etc.

Electrical Measurement

Measuring Current	The instrument used to measure current is called ampere meter or ammeter. • Connect a small light bulb to a dry cell. Measure current that passes through light bulb by connecting positive terminal (+) of ammeter to negative terminal (-) of a dry cell.
Measuring Voltage	The instrument used to measure voltage, difference potential or electromotive force is called voltmeter. • Connect a small light bulb to a dry cell. A voltmeter is wired in parallel with the light bulb to measure voltage across the light bulb. Connect positive terminal (+) of voltmeter to positive terminal (+) of a dry cell and connect negative terminal (-) of voltmeter to negative terminal (-) of a dry cell.
Measuring Resistance	The instrument used to measure resistance is called test meter or multimeter. • The multimeter or test meter is used to make various electrical measurements such as current, voltage and resistance. It combines the functions of ammeter, voltmeter and ohmmeter. Turn the face dial to a position for required measuring, resistance, then touch both of terminals of multimeter and adjust the meter range to 0 Ω. Touch both of terminals of meter to a resistance and take the reading.

2 Power Usage

Provides information on the power draw of appliances and how to conserve power.

Power Consumption Percentages

This are the general details about how we use power in our everyday lives. For other alternatives to common household items see the 'HOMESTEADING > Alternatives' section.

Usage Percentages An ordered list of the most electrically consuming household categories.	**Space Cooling:** 17.5% **Water Heating:** 9.6% **Lighting:** 9.1% **Refrigeration:** 7.3%	**Space Heating:** 6.9% **Entertainment:** 5.8% **Computer:** 5% **Clothes Drying:** 4.4%	**Small Electronics:** 3% **Cooking:** 2.3% **Dishwashers:** 1.9% **Clothes Washing:** 0.6%

Space Cooling	• Air Conditioner • Peltier Cooler • Evaporative Cooler • Fan • Mister	**Alternatives** • Live somewhere cold • Airflow • Water Evaporation
Water Heating	• Sink Water • Shower Water • Kettle	**Alternatives** • Solar Heating • Gas Heating
Lighting	• Lights • Spotlights • Floodlights	**Alternatives** • Sunlight • Torch / Headlamp • Fairy Lights • Candles • Fireplace
Refrigeration	• Fridge • Freezer	**Alternatives** • Snow/Ice • Dehydrated / Freeze Dried Food
Space Heating	• Heater	**Alternatives** • Gas Heater (CO2)
Entertainment	• Tv • Speakers • Console	**Alternatives** • None • Board Games
Computer	• Computer • Monitors • Speakers	**Alternatives** • Mobile Phone • Laptop
Clothes Drying	• Dryer	**Alternatives** • Air Drying
Small Electronics	• Laptop • Mobile Phone • Battery Charger • Vacuum Cleaner • Iron	**Alternatives** • None
Cooking	• Oven • Grill • Microwave • Stove	**Alternatives** • Gas Stove • Sun Cooker
Dishwashers	• Dishwasher	**Alternatives** • Hand Washing • Disposable Plates
Clothes Washing	• Washing Machine	**Alternatives** • Hand Washing

Appliance Power Consumption

These are the average power consumptions of household devices, sorted by AC and DC appliances.

AC Appliances

Appliance	Minimum	Maximum	Standby	Appliance	Minimum	Maximum	Standby
100W light bulb (Incandescent)	100W	100W	0W	**Hand Wash Oversink Water Heater**	3000W	3000W	N/A
22 Inch LED TV	17W	17W	0.5W	**Heated Bathroom Mirror**	50W	100W	N/A
25" Colour TV	150W	150W	N/A	**Heated Hair Rollers**	400W	400W	N/A
3" belt sander	1000W	1000W	N/A	**Home Air Conditioner**	1000W	4000W	N/A
32 Inch LED TV	20W	60W	1W	**Home Internet Router**	5W	15W	N/A
42 Inch LED TV	58W	60W	0.3W	**Home Phone**	3W	5W	2W
46 Inch LED TV	60W	70W	1W	**Home Sound System**	95W	95W	1W
49 Inch LED TV	85W	85W	1W	**Hot Water Dispenser**	1200W	1300W	N/A
60W light bulb (Incandescent)	60W	60W	0W	**Hot Water Immersion Heater**	3000W	3000W	N/A
65 Inch LED TV	120W	130W	1W	**Humidifier**	35W	40W	N/A
82 Inch LED TV	228W	295W	0.5W	**iMac**	60W	240W	1W
9" disc sander	1200W	1200W	N/A	**Induction Hob (per hob)**	1400W	1800W	N/A
Air Cooler	65W	80W	N/A	**Inkjet Printer**	20W	30W	N/A
Air Fryer	1500W	1500W	N/A	**Inverter Air conditioner**	1300W	1800W	N/A
Air Purifier	25W	30W	N/A	**Iron**	1000W	1000W	N/A
Amazon Echo	3W	3W	2W	**Kitchen Extractor Fan**	200W	200W	N/A
American-style Fridge Freezer	40W	80W	N/A	**Laptop Computer**	50W	100W	N/A
Apple TV	3W	6W	0.3W	**Laser Printer**	600W	800W	N/A
Aquarium Pump	20W	50W	N/A	**Lawnmower**	1000W	1400W	N/A
AV Receiver	450W	450W	N/A	**LED Christmas Lights**	5W	5W	N/A

Bathroom Towel Heater	60W	150W	N/A	**LED Light Bulb**	7W	10W	0W
Ceiling Fan	60W	70W	0W	**Mi Box**	5W	7W	3W
Chromebook	45W	45W	N/A	**Microwave**	600W	1700W	3W
Chromecast	2W	2W	N/A	**Night Light**	1W	1W	0W
Clock radio	1W	2W	N/A	**Nintendo Switch AC Adapter**	7W	40W	N/A
Clothes Dryer	1000W	4000W	N/A	**Outdoor Hot Tub**	60W	500W	N/A
Coffee Maker	800W	1400W	N/A	**Oven**	2150W	2150W	N/A
Computer Monitor	25W	30W	N/A	**Paper Shredder**	200W	220W	N/A
Cooker Hood	20W	30W	0W	**Pedestal Fan**	50W	60W	N/A
Corded Drill	600W	850W	N/A	**Percolator**	800W	1100W	N/A
Corded Handheld Leaf Blower	2500W	2500W	N/A	**Philips Hue Smart Bulb**	8W	9W	0.4W
Cordless Drill Charger	70W	150W	N/A	**Phone Charger**	4W	7W	N/A
Curling Iron	25W	35W	0W	**Playstation 4**	85W	90W	N/A
DAB Mains Radio	5W	9W	N/A	**Power Shower**	7500W	10500W	0W
Deep Freezer	19W	19W	N/A	**Pressure Cooker**	700W	700W	N/A
Dehumidifier	240W	240W	N/A	**Projector**	220W	270W	1W
Desktop Computer	100W	450W	N/A	**Refrigerator**	100W	200W	N/A
Dishwasher	1200W	1500W	N/A	**Rice Cooker**	200W	800W	N/A
Domestic Water Pump	200W	300W	0W	**Sandwich Maker**	700W	1000W	N/A
DVD Player	26W	60W	N/A	**Scanner**	10W	18W	N/A
Electric Blanket	200W	200W	N/A	**Set Top Box**	27W	30W	N/A
Electric Boiler	4000W	14000W	N/A	**Sewing Machine**	70W	80W	N/A
Electric Doorbell Transformer	2W	2W	N/A	**Singer Sewing Machine**	100W	100W	N/A
Electric Heater Fan	2000W	3000W	N/A	**Sky Q 2TB Box**	40W	40W	N/A
Electric Kettle	1200W	3000W	0W	**Slow Cooker**	160W	180W	N/A
Electric Mower	1500W	1500W	N/A	**Space Heater**	2000W	5000W	N/A
Electric Pressure Cooker	1000W	1000W	N/A	**Steam Iron**	2200W	2500W	N/A
Electric Shaver	15W	20W	N/A	**Steriliser**	650W	650W	N/A
Electric stove	2000W	2000W	N/A	**Straightening Iron**	75W	300W	N/A
Electric Tankless Water Heater	6600W	8800W	N/A	**Strimmer**	300W	500W	N/A
Electric Thermal Radiator	500W	500W	N/A	**Submersible Water Pump**	200W	400W	N/A
Espresso Coffee Machine	1300W	1500W	N/A	**Table Fan**	10W	25W	N/A
EV Car Charger	2000W	7000W	N/A	**Tablet Charger**	10W	15W	N/A
EV Home Charger	1600W	3400W	N/A	**Tablet Computer**	5W	10W	N/A
Evaporative Air Conditioner	2600W	2600W	N/A	**Toaster**	800W	1800W	0W
Extractor Fan	12W	12W	N/A	**Tower Fan**	60W	60W	N/A
Fluorescent Lamp	28W	45W	N/A	**Treadmill**	280W	900W	N/A
Food Blender	300W	400W	N/A	**Tube Light (1500mm)**	22W	22W	N/A
Food Dehydrator	800W	800W	N/A	**TV (19" colour)**	40W	100W	1W
Freezer	30W	50W	N/A	**Vacuum Cleaner**	450W	900W	0W
Fridge	100W	220W	N/A	**Wall Fan**	45W	60W	0W
Fridge / Freezer	150W	400W	N/A	**Washing Machine**	500W	500W	1W
Fryer	1000W	1000W	N/A	**Water Dispenser**	100W	100W	N/A
Game Console	120W	200W	N/A	**Water Feature**	35W	35W	N/A
Gaming PC	300W	700W	1W	**Water Filter and Cooler**	70W	100W	N/A
Garage Door Opener	300W	400W	N/A	**WiFi Booster**	1W	2W	N/A
Google Home Mini	15W	15W	2W	**WiFi Router**	4W	10W	4W
Guitar Amplifier	20W	30W	N/A	**Wine cooler (18 bottles)**	83W	83W	0W
Hair Blow Dryer	1800W	2500W	N/A	**Xbox One**	50W	110W	14W

DC Appliances

These are the draw rates for 12v DC appliances. To convert KWH to Ah, Multiply by 1000 then divide by the voltage. (E.g. 0.15 @ 12v)(0.15x1000=150, 150/12 = 12.5Ah) For alternatives to power drawing devices see the 'HOMESTEADING > Minimalism' section.

Appliance	Minimum	Maximum	Standby	Appliance	Minimum	Maximum	Standby
15L Fridge - 24h Run Time - 12.5Ah				12v Pc Fan - 7h - 3.5Ah			
35L Fridge - 24h Run Time - 20.4Ah				12v Tv - 4h - 12Ah			
47L Fridge - 24h Run Time - 20.9Ah				12v LED Light - 4h - 2Ah			
60L Fridge - 24h Run Time - 21.4Ah				12v Kettle -			
78L Fridge - 24h Run Time - 25.7Ah				12v Air Pump -			
12v Floodlight - 5h - 8.35Ah				12v Grill -			
12v 8" Fan - 6.5h - 4Ah				12v Hot Water -			

Conserving Power

Tips on conserving power around the house.

Heating and Cooling

- Install a programmable thermostat
- Use window blinds effectively
- Have your HVAC system checked yearly
- Find and seal air leaks
- Install storm windows or plastic sheeting
- Insulate the room

Water Heating	● Turn down your water heater thermostat ● Insulate your water heater ● Wash clothes with cold water ● Take shorter showers
Cooking	● Use the appropriate pot size for cooking ● Use lids on pots ● Use a toaster oven when possible
Lighting	● Replace older incandescent light bulbs ● Turn lights of when not needed
Miscellaneous	● Choose Energy Star rated appliances ● Upgrade old refrigerators ● Use power strips to reduce phantom loads ● Minimize clothes dryer use
Mobile Phone	● Disable "High Performance Mode" if your phone has that option ● Enable power saving mode or extreme power saving mode and select all the lowest options. ● Lower the brightness to the minimum setting ● Lower the screen resolution ● Limit CPU power ● Disable the always on display ● Turn off sound and vibrate ● Close all unnecessary apps ● Try not to use your phone unless absolutely necessary, which includes using it to see the time ● Turn off: WiFi, Bluetooth, Mobile Data, GPS, NFC

Conservation
- Keep electricity use to a minimum and only when necessary or electricity is ample
- LED Bulbs use much less power and give off more light then regular bulbs
- Use natural alternatives where possible such as sunlight instead of bulbs and drying clothes outside
- Insulate the house to make heating and cooling easier
- Unplug devices when not in use as they continue to use electricity in standby mode

Power Tips

Air Conditioner	**Air Conditioner Power** 100-150sqft = 5K BTU = 1.5 KWh 150-200sqft = 6K BTU = 1.75 KWh 250-300sqft = 7K BTU = 2 KWh 300-350sqft = 8K BTU = 2.3 KWh
	Adjustments to Power ● Room heavily shaded - 10% ● Room Very Sunny + 10% ● Add 600 BTU pp over 2 ● Add 4K BTU if in Kitchen
Fridge/Freezer	● A freezer will stay cold for 2 days after a power cut, extend this time with blankets on the top. ● Keep the freezer full of food/water to keep everything colder longer if the power is lost.

3 Breakers & Fuses

House Breaker & Fuses

Service Panel
A service panel is a steel box with a hinged door or lift-up panel on the front. With the door open, you can access all the circuit breakers in the panel. Typically, one panel feeds the entire house, but there can also be another, smaller panel, called a subpanel, which may be used to serve a specific area, such as an addition, a large kitchen, or a detached garage. A subpanel works just like a main service panel but is supplied by the home's main panel rather than by the utility lines. Each circuit breaker is controlled with a lever that can be set manually to an ON or OFF position. If a circuit breaker trips, usually due to an overload or other problem with the circuit, the lever will automatically move to a third position between ON and OFF. Breakers should be labelled to identify the main area or appliance served by the breaker's circuit. Labels may be stickers or hand-written words next to breakers or on a sheet adhered to the inside of the panel door. Note: Older homes that have not had their electrical services upgraded may have service panels with fuses rather than circuit breakers, which have been standard since the 1960s.

Inside
When you open it, the panel door gives you access to the circuit breaker switches, but that's all. And that's as far as most homeowners need to go. However, to get inside the panel to install or replace a circuit breaker, you have to remove the protective cover around the breaker switches, known as the dead front cover. The dead front cover is typically held in place with a screw in each corner. Removing the cover provides access to all components of the panel. Some panels have a separate door and cover; others have a door and cover as parts of the same unit. Warning: Always shut off the main circuit breaker (see next slide) before removing the dead front cover. This shuts off the power to all of the circuit breakers and household circuits but does not shut off the power from the utility. The utility service lines and the terminals they connect to inside the panel remain live (carrying deadly electrical current) unless the utility company shuts off the service to the home.

Main Circuit Breaker
The main circuit breaker is a large breaker usually located at the top of the panel but sometimes near the bottom or along one side. It controls all the power of the branch circuit breakers (the breakers controlling individual circuits) in the panel. Power comes from the utility service lines, flows through the electrical meter on the outside of your house, and continues into the service panel. The main circuit breaker is often called a double-pole service disconnect and is what controls the live power energizing the circuits in the electrical panel. It's easily recognizable by the two thick black wires feeding it from the electrical meter and consists of two circuit breaker handles joined together. The main is used to turn power to all the branch circuits ON or OFF at the same time. The main circuit breaker also identifies the total amperage capacity of the service panel and will have a number on it identifying its amp capacity, such as 100, 150, or 200. The standard for new panels today is 200 amps, but panels can have higher capacity. Warning: The main circuit breaker shuts off the power to all of the branch circuits but does not shut off the power from the utility. The utility service lines and the terminals they connect to inside the panel remain live (carrying deadly electrical current) unless the utility company shuts off the service to the home.

Hot Bus Bars
The two thick, black service wires feeding the main circuit breaker each carry 120 volts from the electric meter and feed the two "hot" bus bars in the panel. Circuit breakers snap into place onto one or both of the bus bars to provide power to the circuits. Single-pole circuit breakers provide 120 volts and connect to just one hot bus bar. Double-pole circuit breakers provide 240 volts to a circuit and snap into both hot bus bars. The electrical current leaves the service panel through the hot wires that are connected to the circuit breakers. Single-pole breakers have one hot wire (usually black), while double-pole breakers have two hot wires, which may be black, red, white, or another colour.

Circuit Breakers
The circuit breaker is the weak link in each electrical circuit. But that's a good thing, as it's designed to fail safely. When a circuit draws more current than it is designed to handle, the wiring gets hot and becomes a fire hazard. Excessive current in a circuit is prevented by the use of over current safety devices, such as circuit breakers (or, in older system, fuses). Circuit breakers connect to the hot bus bars and come in a variety of types and capacities:
● Single-pole breakers provide 120 volts and typically come with ratings of 15 amps or 20 amps. These breakers make up most of the breakers in your home.
● Double-pole breakers provide 240 volts and come in ratings from 15 amps to 50 amps. These breakers usually serve dedicated circuits for large appliances, such as electric dryers, stoves, and air conditioners.
● Ground-fault circuit-interrupter (GFCI) breakers protect an entire circuit from ground faults.
● Arc-fault circuit-interrupter (AFCI) breakers protect an entire circuit from arc faults. Some dual-function breakers may provide both GFCI and AFCI protection simultaneously.

Neutral Bus Bar
Once the power leaves the electrical service panel through the hot wire(s) of a circuit and does its work through the electrical devices (light bulbs, outlets, etc.), the electrical current returns back to the service panel through the neutral (usually white) circuit wire, which is connected to the neutral bus bar. The bar connects to the main service neutral and returns the current back to the electric utility grid. In many service panels, the neutral bus bar also serves as the grounding bus bar and is where the individual bare copper circuit ground wires are terminated. In this case, it is often referred to as a neutral/ground bus bar.

Blown Fuse
The most common sign of a blown fuse is a power outage in one or more areas of your home. Fuses, unlike breakers, do not have on-off switches. Instead, most fuses have a small glass window that allows you to examine the fuse itself. Look for the blown fuse and unscrew the unit. Be sure to replace your fuse with the correct size. Most fuse boxes don't have a safeguard against installing the wrong fuse. Installing an under-powered fuse will result in constant overloading. Likewise, an overpowered fuse will allow too much current to flow through a particular circuit. In extreme cases, this can damage your wiring and even cause fires.

Fuse Types

These are the common types of household fuses. The size of the fuse is determined by its voltage or amperage. Be sure you know which size works for your fuse box before installing a new fuse.

Edison Base (Type-T) Fuses	Type-T fuses are designed to handle no more than 125 volts and have an ampere rating of no more than 30 amps. Edison Base fuses are only suitable for installations in which there is no sign of tampering or over fusing. Over fusing means installing a fuse that accepts a higher amount of electricity than the circuit can handle.
Type-S Fuses	Type-S fuses consist of two components: an adapter and the fuse itself. Each level of amperage has a matching socket adapter with a different threading to prevent mismatching fuses.
Main Fuses	Many fuse boxes have a main fuse. These are usually located above the individual fuses and housed in plastic casings. Pulling this fuse will interrupt power to your entire house. Main fuses are self-contained and hold two canister-style fuses.

Replacing a Fuse

Swapping out a blown fuse isn't as easy as flipping a breaker, but it's still a simple fix.

Step 1	Turn off your power. Pull the main fuse in your fuse box to cut power to the box. Some fuse boxes have two main fuses: Pull all the main fuses if you have more than one.
Step 2	Locate the blown fuse. Older homes weren't designed to handle modern electrical loads, so most fuse boxes house several fuses. All fuses have a glass top that allows you to see the fuse itself. Use a flashlight to locate the blown fuse. Similar to a light bulb, a blown fuse will have a broken and charred filament or circuit.
Step 3	Remove the fuse. Unscrew the blown fuse and install the replacement.
Step 4	Turn on the power. Replace the main fuses to restore power to your home.

Car Fuse Box

Fuse Location
Check your owner's manual for the location of your fuse box. It's often under the hood. Vehicles today have 40 or more auto fuses grouped in two or more places. Usually located in or around the instrument panel near the dash, fuses can also be found under the hood and even under the rear seat. Next time your radio, lights or other device stops working, chances are a blown fuse is the culprit. Look under "Fuses" in your owner's manual for help finding your fuse panels. Most manuals have a diagram showing you where each fuse box is. Each fuse panel cover should have a diagram listing each device and the corresponding fuse. Never replace a blown fuse with a higher-amp fuse. Always replace the fuse with one with the specified amp rating. You may install the next-smaller-rated fuse to get you by in a pinch until you can purchase a replacement.

Fuse Check
Clamp the grounding lead of your test light to a metal component. Turn the ignition key to the "run" position. Then probe both of the tiny test ports in the face of each fuse. The light should illuminate at each port. If it doesn't, the fuse is blown. Turn the key to the "run" position and press the tester prongs into the test ports. The LED will light up if the fuse is good. There are at least seven different styles, so you'll need the blown fuse to match it up with the right replacement. Here are the three most common sizes of car fuses.

Replacing the Fuse
Remove the fuse that's labelled for the device that's not working, for example, the fan, radio, lighter or marker lights. Use a needle-nose pliers or a fuse puller (available at auto parts stores). Hold the fuse up to the light to see if it's burned out. You'll see a fine wire connecting the two sides if the fuse is good. If a section of that wire has burned away, the fuse is bad. The picture on the left shows what a blown fuse looks like. In a good fuse, the wire between the two sides is still whole. Most fuses used in vehicles today are one of three types: mini, standard or maxi. The mini and standard are fast-acting fuses that protect the majority of your vehicle's circuits, including those for lights and radios. The maxi car fuses are slow-acting fuses that protect circuits with a large current draw such as those for anti-lock brakes, rear window defogger and traction control. Car fuses are colour coded by amp rating. For example, a standard blue fuse has a 15-amp rating, yellow is 20 amps and green is 30. Before you buy car fuses, keep in mind that the fuse panel cover often contains spare fuses and even a fuse puller. Just be sure to replace the spares so they'll be there the next time you need them. You can buy them at any auto parts store and at well-stocked service stations. Note: If your new fuse blows soon after installing it, you could have problems in that circuit. Schedule an appointment with your service station or dealer for an expert diagnosis to repair the problem.

In-Line Fuses
Some accessories that aren't factory installed may have a remote in-line fuse. These fuses can be located under the dash, under the hood or even in the trunk depending on the circuit they protect. They most likely protect an aftermarket accessory like fog lights or a CD changer. The best way to find an in-line fuse is to trace the wire from the accessory to the fuse panel. Along the way, you'll notice a fuse container that looks like one of these shown. Open the housing to pull out the fuse and examine it. Replace it with one of the same size and amperage and snap the housing back together.

4 Power Types

Renewable Power

A list of renewable power forms you could utilize.

Solar Photovoltaic	Converts the sun's rays into electricity. Works: 8/24 hrs Pros: Doesn't need much maintenance. Cons: Only works during daylight hours.
Hydroelectric	Converts water movement into electricity as long as there's a flow. Works: 24/24 Hours Pros: Constant electricity generation, lots produced. Cons: Requires waterfall or dam, long cables to house.
Dynamo	Converts human work into electricity. Works: When wound. Pros: Doubles as exercise. Cons: Takes a lot of effort.
Thermoelectric	Uses a temperature difference to generate electricity. Works: When there's a temperature difference. Pros: Synergises with Steam Energy. Cons: Little electricity production.
Wind	Uses the wind to spin a turbine. Works: When windy. Pros: No maintenance. Cons: Little electricity production.

Non-Renewable Power

A list of non-renewable power forms you could utilize.

Steam Pressure	Uses pressure to spin a turbine. Works: When burning things. Pros: Can be used to heat the home. Cons: Requires lots of wood stockpiled and constant attention.
Fuel Generator	Spins an alternator by burning fuel. Works: When fuel is available.
Chemical Energy	Combines chemicals to generate electricity. Works: Until reaction is complete. Pros: Simple to use and ready to go. Cons: Often one-time use.
The Grid	"Magic" power. Works: As long as society is functioning. Pros: AC Power, no need to worry about source. Cons: Controlled externally, may fail anytime.
Wood Gasifier	Converts wood into Gas

5 Renewable

Forms of renewable energy you can use around your homestead.

Solar

How to generate electricity from the sun.

- 80w Panels = 4-5a a day
- 120w Panels = 6-7.5a a day

Solar/Wind/Hydro MPPT

Amp Requirements
- Solar Array Wattage
- Battery Bank Voltage
- Watts / Volts = Amps

Solar Tips

Various tips on using solar panels.

- Sunlight is most useful between 10am and 4pm. (6h)
- Solar panels only put out about 70% of stated wattage.
- 1m2 of solar panels returns about 100-150w of power in direct sunlight based on 15-20% efficiency.
- Require 3x the electrical capacity of batteries to avoid a short battery life.
- Add a fuse between the panels and the regulator rated at the maximum amperage of the regulator.
- Choose an amp rating higher then the solar panels combined.
- Slight loss of performance above 25°C (77°F) of -0.3% per °C.
- Pulse Width Modulation (PWM) (70% Efficiency) vs Maximum Power Point Tracking (MPPT) (96% Efficiency)

Water

If you have a running water source with constant flow there's the possibility of performing some civil engineering work to create a miniature dam on your land or BOL. Power outputs typically range from 500W to 60kW depending on the size and number of generators.

Wind

The environment must have significant duration of wind speed at more then 4m/s for wind to be a viable generation option. The maximum wind speed during a climatic event - such as a cyclone or hurricane needs to be lower then 43m/s (150km/h) otherwise you will need to shut down the generator. The set-up site shouldn't be close to houses as it could produce quite a lot of noise and vibrations. You need to ensure you have voltage protection if high winds occasionally blow.

Gravity

Gravity can be used to generate power via a dynamo. A setup with a bucket of rocks attached to the dynamo can be designed so that light is generated as the rocks are pulled down. When the rocks reach the ground, simply reset the device and lift the rocks back into the bucket.

Dynamo

Dynamo power is the generation of electricity from a rotating turbine. The electricity can then either be stored or used straight away.

These are the different types of dynamo electricity generation.

Winding, Pedal or Pull Cord	Wind a crank or pedal a bike to generate power.
Squeeze	Squeeze a lever to generate power.
Shake	Shake a magnet through a coil to generate power.

6 Non-Renewable

Coal

Coal is a fossil fuel which is burnt to produce electricity. There's only a limited amount available and will eventually run out.

Oil

Oils are refined to produce fuels for transportation but it's non renewable.

Natural Gas

Nuclear Power

A dangerous form of power and highly unlikely you will be using this on your property, but it's included anyway.

7 Batteries

Batteries are the primary source of power in electronics today and we rely on them heavily.

General Information

This section covers the general information about batteries such as types, storage and safety.

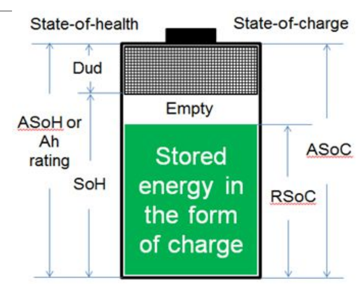
Battery Types

NiMH	Nickel Metal Hydride. Nickel-metal-hydride batteries are closely connected to Nickel Cadmium batteries, with the hydrogen being used as the active element rather than cadmium. Unlike the NiCd, this battery does NOT contain toxic metals, and is usually used in mobile phones and laptops. This type of battery are now a common consumer and industrial type battery. It has practically taken over the NiCd battery in applications. The cell voltage for these types of batteries is 1.2 volts, with the electrolyte being alkaline potassium hydroxide. The energy density of NiMH batteries is around double that of lead acid batteries, and around 40% higher than NiCd batteries. Unlike the NiCd battery, the NiMH battery is not susceptible to the “memory effect”. This type of battery is not suitable when the battery is not being used frequently (within around 30 days) or for devices which are low energy drawing, such as clocks, TV remotes and smoke alarms. NiMH batteries are around half the cost of Lithium ion batteries and are becoming more in line price-wise with NiCd batteries.
NiCd (Nickel Cadmium)	This type of battery is used when price, a high discharge rate and battery life are important. This type of battery has quite a low energy density and uses nickel oxide hydroxide and metallic cadmium as electrodes. NiCd batteries are also susceptible to a “memory effect.” The NiCd (chemicals symbols of nickel and cadmium) battery has a terminal voltage of around 1.2 volts during discharge. They are made in various sizes and capacities and have a distinct advantage over other rechargeable batteries in their ability to deliver at high discharge rates. Nickel Cadmium batteries use an alkaline chemistry and have an energy density approximately twice that of lead acid batteries. Although once the preferred battery choice for applications regarding low power portable products, they have since been overtaken by the newer Nickel-Metal Hydride (NiMH) and Lithium batteries.
Li-Ion (Lithium Ion)	The Lithium Ion battery is used where light weight and high energy density are important factors. Lithium Ions move from the negative to the positive electrode during discharge and back when charging. The electrodes in these type of batteries are made up of lightweight lithium and carbon. These batteries require a protection circuit due to the fragile technology used. The Li-ion battery loses charge very slowly when not in use. Lithium Ion batteries are safe as long as particular precautions are taken when charging and discharging. They are slightly lower in energy density than Lithium Metal batteries and around double that of Nickel Cadmium. The Lithium Ion is a low maintenance battery, which is an added advantage. They have no memory and do not require scheduling to prolong battery life. The self-discharge of Lithium Ion batteries is less than half that of Nickel Cadmium. As well as its fragile nature, another disadvantage of the Lithium Ion battery is ageing. This may also be an issue whether the battery is in use or not, and these types of battery can be known to fail after only two or three years. Nickel-Metal Hydride batteries can also have ageing as a concern if exposed to high ambient temperatures. However, Lithium Ion is progressively being improved with new, enhanced chemical combinations being introduced on a regular basis, which may improve the ageing issue. Storing in a cool place also improves the ageing process of Lithium Ion.
Lithium Ion Polymer (Li-ion Polymer)	The Lithium Ion Polymer battery offers similar elements to the Li-ion battery in an ultra-slim and simplified packaging form. It is of lithium-ion technology in a pouch format. This makes them lighter, but less rigid. The Li-polymer is different from other batteries in the type of electrolyte used, a dry solid polymer electrolyte. Rather than conducting electricity, this electrolyte allows an exchange of ions (electrically charged atoms or groups of atoms). The Lithium Polymer has an advantage over the Lithium Ion battery in regard to cost, durability and flexibility. They can be shaped to fit various devices and in virtually any way manufacturers please. They offer a slightly higher specific energy to the Lithium Ion battery, can be made thinner and in various shapes and sizes, but generally have a high manufacturing cost by around 10% to 30%. The technology used in both Lithium Ion Polymer and Lithium Ion batteries vary quite significantly to that used in NiCd and NiMH batteries. Another advantage of lithium polymer cells over NiCd and NiMH is their much lower rate of self-discharge. Lithium cells have the highest energy density as well as qualities which require particular safety considerations. Because there is no liquid or gelled electrolyte used, there is no danger of flammability. The main reason to switch to the Lithium Polymer from the Lithium Ion is form factor, they can be formed to almost any shape and size. As with Lithium Ion batteries, Lithium Polymer have a nominal voltage of 3.6 volts.
Lead Acid / SLA (Sealed Lead Acid)	Sealed Lead Acid Battery. The lead acid battery is the oldest type of rechargeable battery, invented in 1859. These type of batteries have changed little since this time and are still widely used today. The lead acid battery is an economical option for larger power applications, and where weight is of little or no importance. They are robust, tried and tested. Lead acid batteries comprise of flat lead plates immersed in electrolyte, and most types of lead acid batteries require regular water addition. Lead acid batteries are toxic due to heavy metal elements of lead-dioxide cathode, a sulphuric acid solution electrolyte, and a sponge metallic lead anode. Lead acid batteries are able to supply high surge currents, despite having low energy to weight and energy to volume ratios. Therefore, the cells have quite a large power to weight ratio, which, combined with their low cost, makes them popular for use in motor vehicles. The correct voltage must be observed when charging lead acid batteries, and although simple to charge, they are slow charging. These types of batteries are not “memory affected”. Lead acid batteries work well in cold temperatures and are better performers than Lithium-Ion batteries in subzero conditions.
Saltwater Battery (No Longer Made)	A salt water battery employs a concentrated saline solution as its electrolyte. They are non-flammable and more easily recycled than batteries that employ toxic or flammable materials. They’re inherently safe due to their chemistry, and they boast a 100% depth-of-discharge capability, with a life cycle of around 3,000 cycles. Aquion’s S30 batteries were optimized for long-duration daily cycling, which means 4 to 20+ hour charge and discharge cycles, which is ideal for solar. They were supposedly abuse tolerant and did not degrade from partial state of charge cycling, which is typical of solar applications. The main drawbacks were the slightly lower life cycle compared to lithium-ion and a 5-year warranty (as opposed to Tesla’s 10-year warranty for the Powerwall). They also have a low power output per stack – about 0.68kW of steady power – which means that you need to buy at least 5 stacks (0.68kW x 5 = 3.4 kW steady power) to get enough power output to power an average home.

Battery Terms

Batteries are specified by three main characteristics: chemistry, voltage and specific energy (capacity). A starter battery also provides cold cranking amps (CCA), which relates to the ability to provide high current at cold temperatures.

Primary Batteries	Primary batteries are non-rechargeable batteries. Primaries play an important role, especially when charging is impractical or impossible, such as in military combat, rescue missions and forest-fire services. High specific energy, long storage times and instant readiness give primary batteries a unique advantage over other power sources. They can be carried to remote locations and used instantly, even after long storage. The most popular primary battery is alkaline. It has a high specific energy and is cost effective, environmentally friendly and leak-proof even when fully discharged. Alkaline can be stored for up to 10 years, has a good safety record and can be carried on an aircraft without being subject to UN Transport and other regulations. The negative is low load currents, limiting its use to light loads such as remote controls, flashlights and portable entertainment devices.
Rechargeable Batteries	A rechargeable battery, storage battery, or secondary cell is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reaction. Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electrode materials and electrolytes are used, including lead–acid, nickel–cadmium (NiCd), nickel–metal hydride (NiMH), lithium-ion (Li-ion), and lithium-ion polymer (Li-ion polymer).
Chemistry	The most common battery chemistries are lead, nickel and lithium, and each system needs a designated charger. Charging a battery on a charger designed for a different chemistry may appear to work at first but might fail to terminate the charge correctly. Observe the chemistry when shipping and disposing of batteries as each chemistry has a different regulatory requirement.
Voltage	Batteries are marked with nominal voltage; however, the open circuit voltage (OCV) on a fully charged battery is 5–7 percent higher. Chemistry and the number of cells connected in series provide the OCV. The closed circuit voltage (CCV) is the operating voltage. Always check for the correct nominal voltage before connecting a battery.
Capacity	Capacity represents specific energy in ampere-hours (Ah). Ah is the discharge current a battery can deliver over time. You can install a battery with a higher Ah than specified and get a longer runtime; you can also use a slightly smaller pack and expect a shorter runtime. Chargers have some tolerance as to Ah rating (with same voltage and chemistry); a larger battery will simply take longer to charge than a smaller pack, but the Ah discrepancy should not exceed 25 percent. European starter batteries are marked in Ah; North America uses Reserve Capacity (RC). RC reflects the discharge time in minutes at a 25A discharge.
Cold Cranking Amps (CCA)	Starter batteries, also known as SLI (starter light ignition) are marked with CCA. The number indicates the current in ampere that the battery can deliver at –18°C (0°F).
Specific Energy, Energy Density	Specific energy, or gravimetric energy density, defines battery capacity in weight (Wh/kg); energy density, or volumetric energy density, reflects volume in litres (Wh/l). Products requiring long runtimes at moderate load are optimized for high specific energy; the ability to deliver high current loads can be ignored.
Specific Power	Specific power, or gravimetric power density, indicates loading capability. Batteries for power tools are made for high specific power and come with reduced specific energy (capacity).
C-Rates	The C-rate specifies the speed a battery is charged or discharged. At 1C, the battery charges and discharges at a current that is on par with the marked Ah rating. At 0.5C, the current is half and the time is doubled, and at 0.1C the current is one-tenth and the time is 10-fold.
Load	A load defines the current that is drawn from the battery. Internal battery resistance and depleting state-of-charge (SoC) cause the voltage to drop under load, triggering end of discharge. Power relates to current delivery measured in watts (W); energy is the physical work over time measured in watt-hours (Wh).
State-of-Health (SoH)	The three main state-of-health indicators of a battery are: ● Capacity, the ability to store energy ● Internal resistance, the capability to deliver current, and ● Self-discharge, reflecting mechanical integrity and stress-related conditions Li-ion reveals SoH in capacity. Internals resistance and self-discharge stay low under normal circumstances. SoH is commonly hidden form the user in consumer products; only state-of-charge (SoC) is provided.
State-of-Charge (SoC)	SoC reflects the battery charge level; a reading battery user is most familiar with. The SoC fuel gauge can create a false sense of security as a good and faded battery show 100 percent when fully charged. SoC is sometimes divided into: ● Absolute state-of-charge (ASoC), the ability to take the specified charge when the battery is new ● Relative state-of-health (RSoC), available charge level taking capacity fade into account.
State-of-Function (SoF)	SoF reflects battery readiness in terms of usable energy by observing state-of-charge in relation to the available capacity. This can be shown with the tri-state fuel gauge in which the usable capacity is reflected as stored energy in the form of charge (RSoH); the part that can be filled as empty and the unusable part that cannot be restored as dud. SoF can also be presented with the fishbowl icon for a battery evaluation at a glance. Tri-state fuel gauges are seldom used in fear of elevated warranty claims.



● ASoH Absolute state-of-health of a new battery.
● **SoH** State-of-health. Generic term for battery health. Capacity is leading health indicator.
● **RSoC** Relative state-of-charge; charge level with capacity fade.
● **ASoC** Absolute state-of-charge of a new battery
● **RSoH** Relative state-of-health relating to available capacity
● **SoC** State-of-charge. Generic term for charge level

Priming Batteries

Not all rechargeable batteries deliver the rated capacity when new, and they require formatting. While this applies to most battery systems, manufacturers of lithium-ion batteries disagree. They say that Li-ion is ready at birth and does not need priming. Although this may be true, users have reported some capacity gains by cycling after a long storage.

Formatting vs Priming
Both address capacities that are not optimized and can be improved with cycling. Formatting completes the fabrication process that occurs naturally during use when the battery is being cycled. A typical example is lead- and nickel-based batteries that improve with usage until fully formatted. Priming, on the other hand, is a conditioning cycle that is applied as a service to improve battery performance during usage or after prolonged storage. Priming relates mainly to nickel-based batteries.

Lead Acid	Formatting a lead acid battery occurs by applying a charge, followed by a discharge and recharge. This is done at the factory and is completed in the field as part of regular use. Experts advise not to strain a new battery by giving it heavy duty discharges at first but gradually working it in with moderate discharges, like an athlete trains for weight lifting or long-distance running. This, however, may not be possible with a starter battery in a vehicle and other uses. Lead acid typically reaches the full capacity potential after 50 to 100 cycles. Deep-cycle batteries are at about 85 percent when new and will increase to 100 percent, or close to full capacity, when fully formatted. There are some outliers that are as low as 65 percent when tested with a battery analyser. The question is asked, "Will these low-performers recover and stand up to their stronger brothers when formatted?" A seasoned battery expert said that "these batteries will improve somewhat but they are the first to fail." The function of a starter battery lies in delivering high load currents to crank the engine, and this attribute is present from the beginning without the need to format and prime. To the surprise of many motorists, the capacity of a starter battery can fade to 30 percent and still crank the engine; however, a further drop may get the driver stranded one morning.
Nickel-Based	Manufacturers advise to trickle charge a nickel-based battery for 16–24 hours when new and after a long storage. This allows the cells to adjust to each other and to bring them to an equal charge level. A slow charge also helps to redistribute the electrolyte to eliminate dry spots on the separator that might have developed by gravitation. Nickel-based batteries are not always fully formatted when leaving the factory. Applying several charge/discharge cycles through normal use or with a battery analyser completes the formatting process. The number of cycles required to attain full capacity differs between cell manufacturers. Quality cells perform to specification after 5–7 cycles, while lower-cost alternatives may need 50 or more cycles to reach acceptable capacity levels. Cycling also restores lost capacity when a nickel-based battery has been stored for a few months. Storage time, state-of-charge and temperature under which the battery is stored govern the ease of recovery. The longer the storage and the warmer the temperature, the more cycles will be required to regain full capacity. Battery analysers help in the priming functions and assure that the desired capacity has been achieved.
Lithium-ion	Some battery users insist that a passivation layer develops on the cathode of a lithium-ion cell after storage. Also known as interfacial protective film (IPF), this layer is said to restrict ion flow, cause an increase in internal resistance and in the worst case, lead to lithium plating. Charging, and more effectively cycling, is known to dissolve the layer and some battery users claim to have gained extra runtime after the second or third cycle on a smartphone, albeit by a small amount. Whatever the outcome on the passivation of Li-ion may be, there is no parallel to the "memory" effect with NiCd batteries that require periodic cycling to prevent capacity loss. The symptoms may appear similar but the mechanics are different. Nor can the effect be compared to sulfation of lead acid batteries. Lithium-ion is a very clean system that does not need additional priming once it leaves the factory, nor does it require the level of maintenance that nickel-based batteries do. Additional formatting makes little difference because the maximum capacity is available right from the beginning, (the exception may be a small capacity gain after a long storage). A full discharge does not improve the capacity once the battery has faded — a low capacity signals the end of life. A discharge/charge may calibrate a "smart" battery but this does little to improve the chemical battery. Instructions recommending charging a new Li-ion for 8 hours are written off as "old school," a left-over from the old nickel battery days.
Non-Rechargeable Lithium	Primary lithium batteries, such as lithium-thionyl chloride (LTC), benefit from passivation in storage. Passivation is a thin layer that forms as part of a reaction between the electrolyte, the lithium anode and the carbon-based cathode. (Note that the anode of a primary lithium battery is lithium and the cathode is graphite, the reverse of Li-ion.) Without this layer, most lithium batteries could not function because the lithium would cause a rapid self-discharge and degrade the battery quickly. Battery scientists even say that the battery would explode without the formation of lithium chloride layers and that the passivation layer is responsible for the battery's existence and the ability to store for 10 years. Temperature and state-of-charge promote the build-up of the passivation layer. A fully charged LTC is harder to depassivate after long storage than one that was kept at a low charge. While LTC should be stored at cool temperatures, depassivation works better when warm as the increased thermal conductivity and mobility of the ions helps in the process.

Storing Batteries

How to store batteries properly to extend their life. The recommended storage temperature for most batteries is 15°C (59°F); the extreme allowable temperature is –40°C to 50°C (–40°C to 122°F) for most chemistries. If you're storing batters for an extended time, say 2 months or more, it's recommended you take the battery out in case it leaks and corrodes the device internals.

Lead Acid	You can store a sealed lead acid battery for up to 2 years. Since all batteries gradually self-discharge over time, it is important to check the voltage and/or specific gravity, and then apply a charge when the battery falls to 70 percent state-of-charge, which reflects 2.07V/cell open circuit or 12.42V for a 12V pack. (The specific gravity at 70 percent charge is roughly 1.218.) Lead acid batteries may have different readings, and it is best to check the manufacturer's instruction manual. Some battery manufacturer may further let a lead acid to drop to 60 percent before recharge. Low charge induces sulfation, an oxidation layer on the negative plate that inhibits current flow. Topping charge and/or cycling may restore some of the capacity losses in the early stages of sulfation. Sulfation may prevent charging small sealed lead acid cells after prolonged storage. These batteries can often be reactivated by applying an elevated voltage. At first, the cell voltage under charge may go up to 5V and draw very little current. Within 2 hours or so, the charging current converts the large sulphate crystals into active material, the cell resistance drops and the charge voltage gradually normalizes. At between 2.10V and 2.40V the cell is able to accept a normal charge. To prevent damage, set the current limit to a very low level. Do not attempt to perform this service if the power supply does not have current limiting.
Nickel-Based	Recommended storage is around 40 percent state-of-charge (SoC). This minimizes age-related capacity loss while keeping the battery operational and allowing for some self-discharge. Nickel-based batteries can be stored in a fully discharged state with no apparent side effect. Measuring SoC by voltage is difficult on nickel-based batteries. A flat discharge curve, agitation after charge and discharge and temperature affects the voltage. The good news is that the charge level for storage is not critical for this chemistry, so simply apply some charge if the battery is empty and store it in a cool and dry place. With some charge, priming should be quicker than if stored in a totally discharged state. Nickel-metal-hydride can be stored for 3–5 years. The capacity drop that occurs during storage is partially reversible with priming. Nickel-cadmium stores well. The US Air Force was able to deploy NiCd batteries that had been in storage for 5 years with good recovered capacities after priming. It is believed that priming becomes necessary if the voltage drops below 1V/cell. Primary alkaline and lithium batteries can be stored for up to 10 years with only moderate capacity loss.
Lithium-Based	There is virtually no self-discharge below about 4.0V at 20°C (68°F); storing at 3.7V yields amazing longevity for most Li-ion systems. Finding the exact 40–50 percent SoC level to store Li-ion is not that important. At 40 percent charge, most Li-ion has an OCV of 3.82V/cell at room temperature. To get the correct reading after a charge or discharge, rest the battery for 90 minutes before taking the reading. If this is not practical, overshoot the discharge voltage by 50mV or go 50mV higher on charge. This means discharging to 3.77V/cell or charging to 3.87V/cell at a C-rate of 1C or less. The rubber band effect will settle the voltage at roughly 3.82V. Figure 1 shows the typical discharge voltage of a Li-ion battery.

Alkaline	Alkaline and other primary batteries are easy to store. For best results, keep the cells at cool room temperature and at a relative humidity of about 50 percent. Do not freeze alkaline cells, or any battery, as this may change the molecular structure. Some lithium-based primary batteries need special care.

Capacity Loss During Storage

Storage induces two forms of losses: Self-discharge that can be refilled with charging before use, and non-recoverable losses that permanently lower the capacity. The table below illustrates the remaining capacities of lithium- and nickel-based batteries after one year of storage at various temperatures. Li-ion has higher losses if stored fully charged rather than at a SoC of 40 percent.

Temperature	**Lead Acid** (at full charge) (After 6 Months)	**Nickel-Based** (at any charge)	**Lithium-Ion (Li-Cobalt)** (40% Charge)	**Lithium-Ion (Li-Cobalt)** (100% Charge) (After 3 Months)	
0°C	97%	99%	98%	94%	
25°C	90%	97%	96%	80%	
40°C	62%	95%	85%	65%	
60°C	38%	70%	75%	60%	

Batteries are often exposed to unfavourable temperatures, and leaving a mobile phone or camera on the dashboard of a car or in the hot sun are such examples. Laptops get warm when in use and this increases the battery temperature. Sitting at full charge while plugged into the mains shortens battery life. Elevated temperature also stresses lead- and nickel-based batteries.

Nickel-metal-hydride can be stored for 3–5 years. The capacity drop that occurs during storage is partially reversible with priming. Nickel-cadmium stores well. The US Air Force was able to deploy NiCd batteries that had been in storage for 5 years with good recovered capacities after priming. It is believed that priming becomes necessary if the voltage drops below 1V/cell. Primary alkaline and lithium batteries can be stored for up to 10 years with only moderate capacity loss.

You can store a sealed lead acid battery for up to 2 years. Since all batteries gradually self-discharge over time, it is important to check the voltage and/or specific gravity, and then apply a charge when the battery falls to 70 percent state-of-charge, which reflects 2.07V/cell open circuit or 12.42V for a 12V pack. (The specific gravity at 70 percent charge is roughly 1.218.) Lead acid batteries may have different readings, and it is best to check the manufacturer's instruction manual. Some battery manufacturer may further let a lead acid to drop to 60 percent before recharge. Low charge induces sulfation, an oxidation layer on the negative plate that inhibits current flow. Topping charge and/or cycling may restore some of the capacity losses in the early stages of sulfation.

Sulfation may prevent charging small sealed lead acid cells, such as the Cyclone by Hawker, after prolonged storage. These batteries can often be reactivated by applying an elevated voltage. At first, the cell voltage under charge may go up to 5V and draw very little current. Within 2 hours or so, the charging current converts the large sulphate crystals into active material, the cell resistance drops and the charge voltage gradually normalizes. At between 2.10V and 2.40V the cell is able to accept a normal charge. To prevent damage, set the current limit to a very low level. Do not attempt to perform this service if the power supply does not have current limiting.

Alkaline batteries are easy to store. For best results, keep the cells at cool room temperature and at a relative humidity of about 50 percent. Do not freeze alkaline cells, or any battery, as this may change the molecular structure.

- Primary batteries store well. Alkaline and primary lithium batteries can be stored for 10 years with moderate loss capacity.
- When storing, remove the battery from the equipment and place in a dry and cool place.
- Avoid freezing. Batteries freeze more easily if kept in discharged state.
- Charge lead acid before storing and monitor the voltage or specific gravity frequently; apply a charge if below 2.07V/cell or if SG is below 1.225 (most starter batteries).
- Nickel-based batteries can be stored for 3–5years, even at zero voltage; prime before use.
- Lithium-ion must be stored in a charged state, ideally at 40 percent. This prevents the battery from dropping below 2.50V/cell, triggering sleep mode.
- Discard Li-ion if kept below 2.00/V/cell for more than a week. Also discard if the voltage does not recover normally after storage.

Self Discharge

Self-discharge is a phenomenon in batteries in which internal chemical reactions reduce the stored charge of the battery without any connection between the electrodes or any external circuit. Self-discharge decreases the shelf life of batteries and causes them to initially have less than a full charge when actually put to use. How fast self-discharge in a battery occurs is dependent on the type of battery, state of charge, charging current, ambient temperature and other factors. Primary batteries aren't designed for recharging between manufacturing and use, thus have battery chemistry that has to have a much lower self-discharge rate than older types of Secondary cells, but they have lost that advantage with the development of rechargeable Secondary Cells with very low self discharge rates like Low Self Discharge NiMH cells.

Self-discharge is a chemical reaction, just as closed-circuit discharge is, and tends to occur more quickly at higher temperatures. Storing batteries at lower temperatures thus reduces the rate of self-discharge and preserves the initial energy stored in the battery. Self-discharge increases with age, cycling and elevated temperature. Discard a battery if the self-discharge reaches 30 percent in 24 hours.

Battery Chemistry	Rechargeable	Typical Self-Discharge or Shelf Life
Lithium Metal	No	10 years shelf life (10% reduction in 5 years)
Alkaline	No	5 years shelf life (2-3% per year reduction)
Zinc–Carbon	No	2–3 years shelf life
Lithium-Ion	Yes	5% in 24h, 1–3% per month; (plus 3% for safety circuit) (ca. 4% p.m.)
Lithium-Polymer	Yes	~5% per month
Low Self-Discharge NiMH	Yes	As low as 0.25% per month
Lead–Acid	Yes	4–6% per month
Nickel–Cadmium	Yes	10–15% in 24h, then 15–20% per month
Nickel–Metal Hydride (NiMH)	Yes	30% per month

Specific Energy

This is the specific energy comparison of secondary and primary batteries showing that non-rechargeable batteries can store much more charge than their rechargeable counterparts.

Specific energy only indicates the capacity a battery can hold and does not include power

Battery Type	Rechargeable?	Wh/Kg	Self-Discharge Rate/mth
Lead Acid	Yes	30-40	3-20%
NiCd	Yes	30	10%
NiMH	Yes	100	30%
Li-Cobalt	Yes	195	~4.5%
Li-Phosphate	Yes	90-160	4.5%
Li-Manganese	Yes	150	~4.5%

delivery, a weakness with most primary batteries.

Alkaline	No	85–190	0.17%
Lithium Primary	No	150–330	1%

Depending on the load of your electronic device and how long it needs to run you may want to specifically choose whether you want a primary or rechargeable battery. The higher the Wh/Kg the longer your battery is likely to last depending on the current. Most torches are a low draw device and if it's in a BOB you won't need to recharge it before reaching your destination within 3 days if you choose a primary battery. You aren't likely to have a solar panel in your BOB anyway, they should be in an INCH bag.

Charge Cycles

A charge cycle is the process of charging a rechargeable battery and discharging it as required into a load. The term is typically used to specify a battery's expected life, as the number of charge cycles affects life more than the mere passage of time. Discharging the battery fully before recharging may be called "deep discharge"; partially discharging then recharging may be called "shallow discharge". In general, number of cycles for a rechargeable battery indicates how many times it can undergo the process of complete charging and discharging until failure or it starting to lose capacity.

Apple Inc. clarifies that a charge cycle means using all the battery's capacity, but not necessarily by discharging it from 100% to 0%: "You complete one charge cycle when you've used (discharged) an amount that equals 100% of your battery's capacity — but not necessarily all from one charge. For instance, you might use 75% of your battery's capacity one day, then recharge it fully overnight. If you use 25% the next day, you will have discharged a total of 100%, and the two days will add up to one charge cycle."

Different types and makes of batteries have different levels of charge cycles based on what they're made for. For example an Eneloop Pro is designed for high-drain devices such as camera flashes and would be inefficient if used in a clock, it also has much fewer charge cycles than other Eneloop lines. An Eneloop Lite battery is optimised for light use and would optimally be used in a clock or radio as you will be able to recharge it many more times even though the mAh is significantly less than the Eneloop Pro batteries.

Battery Type	Bty Colour	AAA Cycles	AAA mAh	AA Cycles	AA mAh	C Cycles	C mAh	D Cycles	D mAh
Eneloop Lite (2nd Gen)	Light Blue	3,000 min	550	3,000 min	950	N/A	N/A	N/A	N/A
Eneloop White (4th Gen)	White	2,100 min	750	2,100 min	1,900	1,000 min	3,000	1,000 min	5,700
Eneloop Pro (5th Gen)	Black	500 min	930	500 min	2,500	N/A	N/A	N/A	N/A

As per the table above I recommend choosing the Eneloop White batteries in your INCH bag for a good average between milliamp-hours and charge cycles, but only if you plan on recharging them. For a BOB I recommend **not** choosing rechargeable batteries as 'primary' batteries can hold a much higher charge and you'll only really be needing them for 3 days until you reach your bug out location - bring 'primary' spares just in case it takes longer than you thought to reach your destination.

Secondary Battery Comparison

This table compares the characteristics of the four commonly used rechargeable battery systems, showing average performance ratings at time of publication. Li-ion is divided into different types, named by their active materials, which are cobalt, manganese, phosphate and titanate.

Characteristic	Lead Acid	NiCd	NiMH	Li-ion Cobalt	Li-ion Manganese	Li-ion Phosphate
Specific Energy	30-50	45-80	60-120	150-250	100-150	90-120
Internal Resistance	Very Low	Very Low	Low	Moderate	Low	Very Low
Cycle Life (80% DoD)	200-300	1,000	300-500	500-1,000	500-1,000	1,000-2,000
Overcharge Tolerance	High	Moderate	Low	Low	Low	Low
Self-Discharge / Month (Room Temp)	5%	20%	30%	<5%	<5%	<5%
Cell Voltage	2V	1.2V	1.2V	3.6V	3.7V	3.2-3.3V
Charge Voltage Cut-off	2.4	Full Charge Detection		4.2	4.2	3.6
Discharge Cut-off Voltage	1.75V	1.00V	1.00V	2.5-3V	2.5-3V	2.5V
Peak Load Current - Best Result	5C 0.2	20C 1C	5C 0.5C	2C <1C	>30C <10C	>30C <10C
Charge Temperature	-20 to 50°C -4 to 122°F	0 to 45°C 32 to 113°F	0 to 45°C 32 to 113°F	0 to 45°C 32 to 113°F	0 to 45°C 32 to 113°F	0 to 45°C 32 to 113°F
Discharge Temperature	-20 to 50°C -4 to 122°F	-20 to 65°C -4 to 149°F	-20 to 65°C -4 to 149°F	-20 to 60°C -4 to 140°F	-20 to 60°C -4 to 140°F	-20 to 60°C -4 to 140°F
Maintenance	3-6 Months toping chg.	Full discharge every 90 days when in full use		Maintenance-free		
Safety Requirements	Thermally Stable	Thermally stable, fuse protection		Protection circuit mandatory		
Toxicity	Very High	Very High	Low	Low	Low	Low
Cost	Low	Moderate		High	High	High

Dangers

Lead	Lead is a toxic metal that can enter the body by inhalation of lead dust or ingestion when touching the mouth with lead-contaminated hands. If leaked onto the ground, acid and lead particles contaminate the soil and become airborne when dry. Children and fetuses of pregnant women are most vulnerable to lead exposure because their bodies are developing. Excessive levels of lead can affect a child's growth, cause brain damage, harm kidneys, impair hearing and induce behavioural problems. In adults, lead can cause memory loss and lower the ability to concentrate, as well as harm the reproductive system. Lead is also known to cause high blood pressure, nerve disorders, and muscle and joint pain. Researchers speculate that Ludwig van Beethoven became ill and died because of lead poisoning. Lead occurs naturally in soil at 15–40mg/kg level. This level can increase multi-fold near lead battery manufacturing and recycling plants. Soil levels in developing countries, including on the continent of Africa, recorded lead contamination levels of 40–140,000mg/kg.
Sulfuric Acid	The sulphuric acid in a lead acid battery is highly corrosive and is more harmful than acids used in most other battery systems. Contact with eye can cause permanent blindness; swallowing damages internal organs that can lead to death. First aid treatment calls for flushing the skin for 10–15 minutes with large amounts of water to cool the affected tissue and to prevent secondary damage. Immediately remove contaminated clothing and thoroughly wash the underlying skin. Always wear protective equipment when handling sulphuric acid.

Cadmium	Cadmium used in nickel-cadmium batteries is considered more harmful than lead if ingested. Workers at NiCd manufacturing plants in Japan have been experiencing health problems from prolonged exposure to the metal, and governments have banned disposal of nickel-cadmium batteries in landfills. The soft, whitish metal that occurs naturally in the soil can damage kidneys. Cadmium can be absorbed through the skin by touching a spilled battery. Since most NiCd batteries are sealed, there are no health risks in handling intact cells; caution is required when working with an open battery. Nickel-metal-hydride is considered non-toxic and the only concern is the electrolyte. Although toxic to plants, nickel is not harmful to humans. Lithium-ion is also benign — the battery contains little toxic material. Nevertheless, caution is required when working with a damaged battery. When handling a spilled battery, do not touch your mouth, nose or eyes. Wash your hands thoroughly.
Ventilation	Charging batteries in living quarters should be safe, and this also applies to lead acid. Ventilate the area regularly as you would a kitchen when cooking. Lead acid produces some hydrogen gas but the amount is minimal when charged correctly. Hydrogen gas becomes explosive at a concentration of 4 percent. This would only be achieved if large lead acid batteries were charged in a sealed room. Over-charging a lead acid battery can produce hydrogen sulphide. The gas is colourless, very poisonous, flammable and has the odour of rotten eggs. Hydrogen sulphide also occurs naturally during the breakdown of organic matter in swamps and sewers; it is present in volcanic gases, natural gas and some well waters. Being heavier than air, the gas accumulates at the bottom of poorly ventilated spaces. Although noticeable at first, the sense of smell deadens the sensation with time and potential victims may be unaware of its presence. As a simple guideline, hydrogen sulphide becomes harmful to human life if the odour is noticeable. Turn off the charger, vent the facility and stay outside until the odour disappears. Other gases that can develop during charging and the operations of lead acid batteries are arsine (arsenic hydride, AsH_3) and (antimony hydride, SbH_3). Although the levels of these metal hydrides stay well below the occupational exposure limits, they are a reminder to provide adequate ventilation.
Protection Circuits	Batteries can release high energies and the safety requirements for nickel- and lithium-based batteries and cells for portable applications are harmonized under IEC 62133. The standard came into effect in 2012 to reduce the global risk in transporting, storing and operating batteries. The most basic safety device in a battery is a fuse that opens on high current. Some fuses open permanently and render the battery useless; others are more forgiving and reset. The resistance of the positive thermal coefficient (PTC) (blue) is low during normal operation and increases when the temperature rises above a critical level to reduce current flow. The PTC is reversible and returns to high conductivity when the temperature normalizes. The current interrupt device (CID) is a fuse-type device that cuts off the electrical circuit permanently when triggered by excessive cell pressure, high temperature, or high voltage, depending on design. The last safety device is the vent that releases gas during an anomaly and can be resealed. However, the pressure of a disintegrating cell can be so large that the gases are unable to escape in an orderly way and venting with flame occurs. In some cases the top of the cell escapes like a bullet from a shotgun. Similar to a nuclear meltdown that cannot be stopped once in progress; a Li-ion battery once in disintegration should be allowed to burn out in a safe place with ventilation.
Children	Keep small batteries out of children's reach. Children younger than four are the most likely to swallow batteries, and the most common types that are ingested are button cells. Each year in the United States alone, more than 2,800 children are treated in emergency rooms for swallowing button batteries. According to a 2015 report, serious injuries and deaths from swallowing batteries have increased nine-fold in the last decade. The battery often gets stuck in the oesophagus (the tube that passes food). Water or saliva creates an electrical current that can trigger a chemical reaction producing hydroxide, a caustic ion that causes serious burns to the surrounding tissue. Doctors often misdiagnose the symptoms, which can reveal themselves as fever, vomiting, poor appetite and weariness. Batteries that make it through the oesophagus often move through the digestive tract with little or no lasting damage. The advice to a parent is to choose safe toys and to keep small batteries away from young children.
Recycling	Spent batteries should be removed from the household. Old primary cells are known to leak and cause damage to the surrounding area. Do not store old lead acid batteries where children play. Simply touching the lead poles can be harmful. Each battery chemistry has its own recycling procedure and the process begins by sorting the batteries into the correct categories. When NiCd batteries are disposed of carelessly, the metallic cell cylinder eventually corrode in the landfill. Cadmium dissolves and seeps into the water supply. Once contamination begins, authorities are helpless to stop the carnage. Nickel and the electrolyte in NiMH are semi-toxic. If no disposal service is available in an area, individual NiMH batteries can be discarded with other household waste in small quantities; however, with 10 or more batteries, the user should consider disposal them in a secure waste landfill. These batteries contain metallic lithium that reacts violently when in contact with moisture and must be disposed of appropriately. If thrown in a landfill in a charged state, heavy equipment operating on top could crush the cases and the exposed lithium could ignite a fire. Landfill fires are difficult to extinguish and can burn for years underground. Before recycling, apply a full discharge to consume the lithium content. Li-ion is reasonably harmless but spent packs should be disposed of properly. Li-ion contains harmful elements that are at the toxicity level of electronic devices.

Battery Voltage Chart

This is a battery voltage chart I created to determine how full a battery is based on its voltage. It also contains many other useful fields discussed above. Table by Fluidic Ice.

Battery Voltage to Percentage 2024-10-03

Type	Primary Batteries (Non-Rechargeable)											
Common Name	Carbon Zinc (Zinc-Carbon) (LeClanche)		Zinc-Chloride	Alkaline (Zinc-Manganese Dioxide)			Lithium (Lithium-Iron Disulfide)	Lithium (Lithium Metal) (Lithium-Manganese Dioxide)			Silver Oxide (Button Battery) (Silver-Zinc)	
Scientific	Zn/C		Zn/Cl_2	Zn/MnO_2			$LiFeS_2$	Li/MnO_2			Zn/Ag_2O	
Example	Cheap Toys		Cheap Toys	Varta			Energiser	Default Lithium			Watch Battery	
$	$		$	$$			$$$	$$$			$$$$	
Nom. Volt	1.5v	6.0v	1.5v	1.5v	6.0v	9.0v	1.5v	1.5v	3.0v	9.0v	1.5v	3v
Energy	0.13		0.27	0.40 - 0.59			1.20	0.83 - 1.01			0.47	
Self Discharge	3.84% PY 0.32% PM		3.84% PY 0.32% PM	2-3% PY 0.16-0.25% PM			2% PY 0.16% PM	2% PY 0.16% PM			2-10% PY 0.16-0.83% PM	
Shelf Life	3-5 Years		2-3 Years	10 Years			15+ Years	10-20 Years			2-5 Years	
Cycles	N/A		N/A	N/A			N/A	N/A			N/A	N/A
100%□	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100%	1.65	6.60	1.65	1.59	7.75	9.54	1.82	1.70	3.40	9.70	1.60	3.20
90%	1.46	5.84	1.46	1.44	7.02	8.64	1.70	1.53	3.06	8.50	1.57	3.14
80%	1.41	5.64	1.41	1.38	6.73	8.28	1.70	1.52	3.04	8.50	1.55	3.10
70%	1.38	5.52	1.38	1.34	6.53	8.04	1.70	1.51	3.02	8.50	1.55	3.10
60%	1.32	5.28	1.32	1.32	6.44	7.92	1.70	1.50	3.00	8.50	1.55	3.10
50%	1.30	5.20	1.30	1.30	6.34	7.80	1.69	1.49	2.98	8.50	1.55	3.10
40%	1.28	5.12	1.28	1.28	6.24	7.68	1.68	1.47	2.94	8.40	1.55	3.10
30%	1.22	4.88	1.22	1.26	6.14	7.56	1.58	1.45	2.90	8.25	1.55	3.10
20%	1.20	4.80	1.20	1.23	6.00	7.38	1.55	1.40	2.80	7.90	1.55	3.10
10%	1.10	4.40	1.10	1.20	5.85	7.20	1.50	1.38	2.76	7.50	1.49	2.98
0%	0.80	3.20	0.80	1.00	5.36	6.60	1.40	1.20	2.40	6.00	0.90	1.80
Cell	1.5v	6v	1.5v	1.5v	6v	9v	1.5v	1.5v	3v	9v	1.5v	3v

	Rechargeable Batteries																Type
Name	Lead Acid				NiCd (Nickel Cadmium)	NiMH (Nickel Metal Hydride)		NiMH LSD (Nickel Metal Hydride Low Self Discharge)	Lithium-ion (Lithium Polymer)		Lithium Iron Phosphate (LFP)				Lithium Manganese Oxide	Lithium Titanate (LTO)	Common Name
Chemis	AGM/GEL/SLA				Ni-Cd	Ni-MH		Ni-MH LSD	Li-ion		$LiFePO_4$				Li/Mn_2O_4	Li_2TiO_3	Scientific
E.g.	Car Battery							Eneloops	Olight/Icom Bty		Solar / House Battery						Example
$	$$				$	$		$	$$$$		$$$				$$$	$$$	$
N.Volt	2.2v	6.0v	12v	24v	1.2v	1.2v	8.4v	1.2v	3.6v	7.2v	3.2v	12v	24v	48v	3.8v	2.4v	Nom. Volt
MJ/kg	>0.14				>0.14	>0.36		>0.36	0.36-0.95		>0.32				>0.36	>0.23	Energy
@24°C	40% PY 10-15% in 24H, 3% PM				180% PY 15% PM	360% PY 30% PM		3% PY 0.25% PM	30-40% PY 5% in 24H		36-60% PY 3-5% PM				1-2% PY 0.08-0.16%	2-10% PY 0.16%-	Self Discharge
@24°C	3-5 Years				1-3 Years	5 Years		5 Years	2-3 Years		5 Years				10-20 Years	25+	Shelf Life
Cycles	100-300				1,000	300-500		500-3,000	400-1,000		3,000 (100%)-10,000 (40%)				300-700	3,000-7,000	Cycles
□	1.287	6.89	13.78	27.56	1.400	1.500	11.25	1.590	4.37	8.74	3.65	14.6	29.2	58.4	4.40	2.60	100%□
100%	1.277	6.37	12.75	25.46	1.340	1.480	10.36	1.480	4.37	8.74	3.40	13.6	27.2	54.4	4.40	2.60	100%
90%	1.258	6.31	12.62	25.24	1.270	1.350	9.45	1.350	3.85	7.70	3.35	13.4	26.8	53.6	4.15	2.25	90%
80%	1.238	6.25	12.50	25.00	1.220	1.300	9.10	1.300	3.75	7.50	3.32	13.3	26.6	53.1	4.12	2.20	80%
70%	1.217	6.19	12.37	24.74	1.210	1.285	9.00	1.285	3.74	7.48	3.30	13.2	26.4	52.8	4.11	2.15	70%
60%	1.195	6.12	12.24	24.48	1.190	1.281	8.97	1.281	3.70	7.40	3.27	13.1	26.1	52.3	4.07	2.10	60%
50%	1.172	6.05	12.10	24.20	1.180	1.280	8.96	1.280	3.70	7.40	3.26	13.0	26.1	52.2	4.01	2.05	50%
40%	1.148	5.98	11.96	23.92	1.175	1.275	8.93	1.275	3.70	7.40	3.25	13.0	26.0	52.0	3.99	2.00	40%
30%	1.124	5.91	11.81	23.62	1.160	1.260	8.82	1.260	3.68	7.36	3.22	12.9	25.8	51.5	3.95	1.97	30%
20%	1.098	5.83	11.66	23.32	1.130	1.240	8.68	1.240	3.60	7.20	3.20	12.8	25.6	51.2	3.93	1.87	20%
10%	1.073	5.75	11.51	23.02	1.080	1.200	8.40	1.200	3.50	7.00	3.00	12.0	24.0	48.0	3.85	1.80	10%
0%	0.986	5.25	10.50	21.00	0.900	0.800	5.60	0.800	2.10	4.20	2.50	10.0	20.0	40.0	3.70	1.60	0%
Cell	2.2v	6v	12v	24v	1.5v	1.5v	9v	1.5v	3.6v	7.2v	3.2v	12v	24v	48v	3.8v	2.4v	Cell

Legend:	Ideal	Ideal Long Term Storage Level	Good	Ideal Usage Range	Avoid	Avoid for Storage	Caution	Possible Damage	Warning	Minor Damage	Danger	Heavy Damage

Small Batteries (<=12v)

Small batteries are those such as AAA, AA, C, D, 9v. Keep the battery at a cool temperature and out of direct sunlight. Check them occasionally if they are still charged before you require them in emergencies.

Battery Sizes

Type	Capacity	Size	Weight	Use
AAA	Alkaline: 1,200 mAh	D: 10.5mmØ L: 44.5mm	Alkaline: 11.5g (0.41 oz) Lithium: 7.6 g (0.27 oz)	
AA	Alkaline: 2,700 mAh Zinc-Carbon: 400-900 mAh	D: 14.5mmØ L: 50.5mm	Alkaline: 23g (0.81 oz) Lithium: 15 g (0.53 oz) NiMH: 31 g (1.1 oz)	
C	Alkaline: 8,000 mAh NiMH: 6,000 mAh Zinc-Carbon: 3,800 mAh	D: 26.2mmØ L: 50mm	Alkaline: 65g NiCad: 72g NiMH: 80g	
D	Alkaline: 12,000 mAh	D: 34.2mmØ L: 61.5mm	Alkaline: 135g NiCad: 105-145 NiMH: 105-160g	
9v	Alkaline: 565 mAh	L: 26.5mm W:17.5mm H: 48.5mm	Alkaline: 45g	
6v Lantern (Rectangular)	Alkaline: 26,000 mAh Carbon-Zinc: 10,500 mAh	W: 68.2mm L: 68.2mm H: 115mm		
18650	2,600-3,600 mAh	D: 18mmØ L: 68mm Protected L: 65mm Unprotected		
12 Sealed Solar	Varies	Varies	0.31kg/Ah Average	Lead Acid for radio and solar setups.
12 Sealed Car	Varies	Varies	0.31kg/Ah Average	High Instant-Discharge for 30s to start engine.

Small Battery Information
- Do not store batteries in the freezer, it does not extend the life but instead diminishes it.
- It's recommended to have D Cell Alkaline batteries for torches as they have 4x the life of AA's.
- If stored at room temperature 22°C (72°F) the battery will have 82-84% of original energy at the date.
- For greater life for consumer electronics use x D cells in series and connect to the appliance via wires.

Power Banks

Power banks can be highly useful items in a SHTF scenario due to their portability and rechargeability. Their best feature is the ability to be charged from solar panels during the day so you can use its power at night. Power banks most commonly contain the 18650 batteries and a small protection circuit against overloads. They typically have a minimum power draw of about 50mA otherwise they will sense that they aren't being used and turn off. This can be a problem when directly powering radios and LEDs.

Recharge Capacity	**Recharge Formula** (Bank Capacity x 3.7 / Output Voltage) x 0.85 / Device Capacity = Recharges	**Example (iPhone 8)** Bank Capacity - 16,000 Output Volts - 5v iPhone8 Bty - 1,821mAh (16,000 x 3.7 / 5) x 0.85 / 1821 = 5.5 Charges	**Example (Samsung S8)** Bank Capacity - 16,000 Output Volts - 5v SamsungS8 Bty - 3,000mAh (16,000 x 3.7 / 5) x 0.85 / 3000 = 3.3 Charges

Size / Storage

Educated guesses on how long each sized power bank will power a mobile for, without being recharged.

5,000mAh	A fairly small power bank. This size should be fine for charging during the day and charging at night.
10,000mAh	An average sized power bank which would provide enough power to charge mobiles multiples times over a few days.
15,000mAh	A high amount of power which should last almost a week of charges for a mobile phone.
25,000mAh	A very large power bank which will keep most mobiles constantly charged for over a week. Anything larger encroaches on the 'Power Station' terrain.

Amperage Output

5v @ 1A = 5 Watts	Will charge a device slowly
5v @ 2.4A = 12 Watts	Will charge a device faster
9-12v @ 2.4A = 21.6-28.8 Watts	A modern 'fast charger' where the voltage can vary between 9v and 12v.

LED Charge Lights

A lot of power banks come with the same type of charge indicator lights which are explained below.

Battery Level	4 LEDs	Red/Green LED
Dead	No Lights	No Lights
~0% Battery	No Lights	Solid Red LED
0-25% Battery	First light is flashing	Flashing Red LED
25-50% Battery	Second light is flashing	Flashing Red LED
50-75% Battery	Third light is flashing	Flashing Red LED
75-100% Battery	Fourth light is flashing	Flashing Red LED
100% Battery	All four lights are solid	Solid Green LED

Protection

Over Current Protection	OCP prevents too much power going into the battery pack and the power going out to the connected equipment, protecting the delicate circuitry of both devices.
Over Voltage Protection	Like OCP, OVP protects both the battery pack and the connected device by keeping the voltage within recommended safety parameters to avoid damage.
Over Discharge/Charge Protection	High-performing batteries should not be overcharged or fully discharged to prolong their life expectancy. Some battery packs consistently monitor charge states to prevent this from happening.
Extreme Temperatures	While using batteries in extreme temperatures isn't advised anywhere, it can be a good indicator of weaknesses in design and construction. Batteries which pass such stringent testing will be more durable and offer improved assurances of overall safety and performance.

Large Batteries (12v+)

Large batteries are those which generally have capacities over 1Ah and power larger electronics such as cars or golf buggies. They are also used for off-grid home power sources which generally consist of an array of batteries connected in series and parallel.

Tables and important information relevant to 12v batteries.	**12v Charge Voltage** 100%: 12.7v 80%: 12.4v 60%: 12.2v 40%: 11.9v 20%: 11.5v 0%: 10.5v	**Battery Weight (0.31kg/Ah Average)** 20Ah: ~6.2kg 50Ah: ~16kg 100Ah: ~31kg 150Ah: ~42kg 200Ah: ~62kg 250Ah: ~72kg	**Depth of Discharge** 100% DOD: 250 Discharges 50% DOD: 625 Discharges 30% DOD: 1600 Discharges This shows the number of discharges before the battery dies - based on how deeply the battery is discharged.

Large Battery Storage
Deep cycle batteries can tolerate deep discharges and car batteries are supposed to be constantly topped up. Batteries will always eventually fail in SHTF, it just may take some time. The Nickel Iron/Edison Battery lasts the longest.

Connections

Series Connection	Connecting the opposite polarities together increases the voltage but not the capacity.
Parallel Connection	Connecting the same polarities together increases the capacity but not the voltage.
Series/Parallel Connection	Connect first the series and then parallel batteries to increase both capacities.

Tips

- Keep the battery at a cool temperature and out of direct sunlight.
- 1 Ah = 1 amp per hour at the designated voltage.
- Choose a deep cycle battery for camping as they won't leak, have thick walls and can be greatly discharged without much capability loss.
- Don't discharge more then 50-70% as they will last longer and provide backup power in case it can't be charged. Ideal = 30% used.
- Discharging below 20% will have a devastating effect on the battery.
- Wire in parallel by connecting same polarities together = 12v, Doubles the duration
- Wire in series by connecting the opposite polarities together = 24v, Halves the duration.
- Car batteries give large current for a short time. Deep cycle batteries give a steady current for a long time.

Integrated Batteries

Integrated batteries are any batteries that are used in a modern device that are rarely replaced. Below is a list of common mobile phones and the size of the batteries so you can calculate the number of recharges from power banks. Some phone batteries such as in the Galaxy S5 can be swapped out easily but are still considered integrated as they generally aren't.

Phones

Apple

iPhone SE 1,960 mAh	**iPhone 6s** 1,715 mAh	**iPhone 6s Plus** 2,750 mAh	**iPhone 7** 1,960 mAh	**iPhone 7 Plus** 2,900 mAh	**iPhone 8** 1,821 mAh	**iPhone 8 Plus** 2,675 mAh	**iPhone X** 2,716 mAh				

Samsung

Galaxy A3 1,900 mAh	**Galaxy A5** 2,300 mAh	**Galaxy S5 Neo** 2,800 mAh	**Galaxy S6 Edge** 2,550 mAh	**Galaxy S7** 3,600 mAh	**Galaxy S7 Edge** 3,600 mAh	**Galaxy S8** 3,000 mAh	**Galaxy S8+** 3,500 mAh	**Galaxy S9** 3,000 mAh	**Galaxy S10** 5,000 mAh	**Galaxy S10+** 5,000 mAh	**Galaxy S20** 4,000 mAh
Galaxy S20 Plus 4,500 mAh	**Galaxy S20 Ultra** 5,000 mAh										

Galaxy Note

Samsung Note 5 3,000 mAh	**Samsung Note 6** 3,050 mAh	**Samsung Note 8** 3,300 mAh									

Google

Pixel 2 2,700 mAh	**Pixel 2 XL** 3,520 mAh	**Pixel 3** 2,915 mAh	**Pixel 3 XL** 3,430 mAh								

Other

OnePlus 3 3,000 mAh	**Motorola Moto X Force** 3,760 mAh	**Huawei Y7 Pro** 4,000 mAh	**Nokia 8.1 (X7)** 3,500	**Sony Xperia XZ3** 3,300 mAh	**LG Q9** 3,000 mAh	**HTC Desire 12** 3,075 mAh	**Asus Zenfone Max Pro** 5,000 mAh	**Asus Zenfone Max (M2)** 4,000 mAh	**Asus Zenfone 5** 3,300 mAh		

Tablets

Apple	**Apple iPad 2** 6,930 mAh	**Apple iPad 3** 11,560 mAh.	**Apple iPad 4** 11,560 mAh	**Apple iPad Air** 8,827 mAh	**Apple iPad Mini 3** 6,471 mAh	**Apple iPad Mini 4** 5,124 mAh	**Apple iPad Pro** 10,307 mAh	**iPad Pro 9.7** 8,827 mAh	**iPad Pro 10.5** 8,134 mAh	**iPad Pro 11** 7,812 mAh	

Samsung	Tab S5e 7,040 mAh	Tab S6 7,040mAh	Tab S7 8,000mAh								
Other											

Power Stations

Power stations are essentially heavy duty power banks, often having large batteries that can can power 240/120v devices. The advantages over generators is that they are silent and can be recharged by solar power. The disadvantages include having to wait for them to recharge unlike simply refilling the fuel tank. Their ideal use is for taking on camping trips and campervans to power fridges, coffee makers and to recharge your mobile devices.

They generally have at least one AC wall-plug, a 12v DC Car Port, a few USB ports, a digital display and an input port for charging it via solar and/or AC. These kinds of power banks are often very heavy ranging from 3kg up to 20kg due to the battery they contain.

Below is an estimated guide to appliance run-time. X's indicate that this size power station can't run this appliance due to not meeting the minimum energy draw.

Appliance Running Time Guide (in hours)

Appliance	200W Station	300W Station	500W Station	1000W Station	1500W Station
Laptop	3.5	5.4	10.75	21.5	29.7
Tablet	35.6	54	107.5	215	297
Fridge (Medium)	1.7	2.7	5.4	10.8	14.9
Freezer	5.9	9	17.9	35.8	49.5
Washing Machine (1200W Min)	X	X	X	2.2	3
Vacuum Cleaner	X	X	1.2	2.4	3.3
Water Filter and Cooler	2.5	3.9	7.7	15.4	21.2
Radio	35.6	54	107.5	215	297
Home Phone	59.4	90	179	358	495
Electric Kettle	X	X	X	X	1.2
LED Light Bulb	25.4	38.6	76.8	153.6	212.1
Phone Charger	17.8	27	53.75	107.5	148.5
65" LED TV	1.5	2.3	4.5	9	12.4

Battery Arrays

Battery arrays are a set of non-portable batteries used for powering caravans or homesteads. They generally consist of deep cycle marine batteries in a series of 2-48 batteries, however they can be in any configuration you wish.

8 Componentry

An electronic component is any basic discrete device or physical entity in an electronic system used to affect electrons or their associated fields. Electronic components have a number of electrical terminals or leads. These leads connect to create an electronic circuit with a particular function (for example an amplifier, radio receiver, or oscillator). This sections aims to give you the ability to recognise components and repair essential electronics if they break down during a disaster or even create your own using the schematics below.

These are the different classifications of components in electronics.

Wire	The basic source of electrical transmission, wires come in a huge range of types, sizes and styles.
Active Components	Rely on a source of energy (usually from the DC circuit) and usually can inject power into a circuit, though this is not part of the definition.
Passive Components	Can't introduce net energy into the circuit or rely on a source of power, except for what is available from the (AC) circuit they are connected to. As a consequence they can't amplify (increase the power of a signal), although they may increase a voltage or current (such as is done by a transformer or resonant circuit). Passive components include two-terminal components such as resistors, capacitors, inductors, and transformers.
Electromechanical Components	Carries out electrical operations by using moving parts or by using electrical connections

Wire

Everything wire related is in this section.

Wiring Selector Chart

This is a chart I created to determine what type of cable is needed for an electrical project.

Electrical Cable Specifications & Conversions

Cable Gauge B&S (AWG)	Cable Area Rounded (mm²)	Cable Area Metric UL486 (mm²)	Circular Mils (CM)	Circular Mils (MCM)	Power Transmission Continual Current 60°C 140°F (Amps)	Power Transmission Continual Current 75°C 167°F (Amps)	Chassis Wiring Continual Current (Amps)	Max Surge Current ~10s (Amps)	Max Surge Current ~1s (Amps)	Maximum Continual Wattage (75°C / 167°F) 12v (Watts)	24v (Watts)	48v (Watts)	240v (Watts)	Gauge	Cable Diameter mm Ø	Cable Diameter in Ø	Heat Shrink Size Min/Max (mm Ø)	Wire Diameter mm Ø	Wire Diameter in Ø	Resistance (20°C / 68°F) Ω/Km	Resistance Ω/1K ft	Cable Weight g/m	Bootlace Ferrules French (Fre)	Bootlace Ferrules DIN 46228 (DIN)	Bootlace Ferrules Weidmüller (Wei)	Cable Area mm²	Gauge AWG
0000	120 mm²	107.2²	211,600	212	195 A	230 A	380 A	3,200 A	33,000 A	2,760 W	5,520 W	11,040 W	55,200 W	4/	16.3	0.64	20-21	11.68	0.460	0.18	0.0490	954				120²	4/0
000	95 mm²	85.0²	167,810	168	165 A	200 A	328 A	2,700 A	26,000 A	2,400 W	4,800 W	9,600 W	48,000 W	3/	14.8	0.58	18-20	10.41	0.410	0.23	0.0618	756				95²	3/0
00	70 mm²	67.4²	133,080	133	145 A	175 A	283 A	2,300 A	21,000 A	2,100 W	4,200 W	8,400 W	42,000 W	2/	13.5	0.53	16-18	9.27	0.365	0.29	0.0780	600				70²	2/0
0	55 mm²	53.5²	105,530	106	125 A	150 A	245 A	1,900 A	16,000 A	1,800 W	3,600 W	7,200 W	36,000 W	0	12.3	0.48	15-16	8.25	0.325	0.37	0.0983	475				55²	1/0
1	50 mm²	42.4²	83,694	84	110 A	130 A	211 A	1,600 A	13,000 A	1,560 W	3,120 W	6,240 W	31,200 W	1	11.3	0.44	13-15	7.35	0.289	0.47	0.1240	377	B	B	Oli	50²	1
2	35 mm²	33.6²	66,373	66	95 A	115 A	181 A	1,300 A	10,200 A	1,380 W	2,760 W	5,520 W	27,600 W	2	9.8	0.38	12-13	6.54	0.258	0.57	0.1563	299	R	R	Bei	35²	2
3		26.7²	52,634	53	85 A	100 A	158 A	1,100 A	8,100 A	1,200 W	2,400 W	4,800 W	24,000 W	3	8.9	0.35		5.83	0.229	0.71	0.1970	237					3
4	25 mm²	21.2²	41,742	42	70 A	85 A	135 A	946 A	6,400 A	1,020 W	2,040 W	4,080 W	20,400 W	4	8.2	0.32	10-12	5.19	0.204	0.91	0.2485	188	Bl	Y	Br	25²	4
5		16.8²	33,102	33	63 A	75 A	118 A	795 A	5,100 A	900 W	1,800 W	3,600 W	18,000 W	5				4.62	0.182	1.12	0.3133	149					5
6	16 mm²	13.3²	26,250	26	55 A	65 A	101 A	668 A	4,000 A	780 W	1,560 W	3,120 W	15,600 W	6	6.5	0.25	8-10	4.12	0.162	1.44	0.3951	118	Ivo	B	G	16²	6
7		10.5²	20,816	21	48 A	58 A	89 A	561 A	3,200 A	690 W	1,380 W	2,760 W	13,800 W	7				3.67	0.144	1.78	0.4982	93.8					7
8	10 mm²	8.37²	16,509	17	40 A	50 A	73 A	472 A	2,500 A	600 W	1,200 W	2,400 W	12,000 W	8	5.5	0.21	7-8	3.26	0.129	2.36	0.6282	74.4	Br	R	Ivo	10²	8
9		6.63²	13,094	13	35 A	43 A	64 A	396 A	2,000 A	510 W	1,020 W	2,040 W	10,200 W	9				2.91	0.114	2.77	0.7921	58.9					9
10	6 mm²	5.26²	10,381	10	30 A	35 A	55 A	333 A	1,600 A	420 W	840 W	1,680 W	8,400 W	10	4.2	0.16	5-6	2.59	0.102	3.64	0.9989	46.7	G	Y	Bl	6²	10
11		4.17²	8,234	8.2	25 A	30 A	47 A	280 A	1,300 A	360 W	720 W	1,440 W	7,200 W	11				2.31	0.091	4.44	1.260	37.1					11
12	4 mm²	3.31²	6,529	6.5	20 A	25 A	41 A	235 A	1,000 A	300 W	600 W	1,200 W	6,000 W	12	3.3	0.13	4-5	2.05	0.081	5.41	1.588	29.5	Or	Gr	Gr	4²	12
13		2.62²	5,178	5.1	17 A	23 A	35 A	198 A	798 A	270 W	540 W	1,080 W	5,400 W	13				1.83	0.072	7.02	2.003	23.4					13
14	2.5 mm²	2.08²	4,106	4.1	15 A	20 A	32 A	166 A	633 A	240 W	480 W	960 W	4,800 W	14	2.8	0.11	3-4	1.63	0.064	8.79	2.525	18.5	Gr	B	B	2.5²	14
15		1.65²	3,256	3.2	13 A	18 A	28 A	140 A	502 A	180 W	360 W	720 W	3,600 W	15				1.45	0.057	11.2	3.184	14.7					15
16	1.5 mm²	1.31²	2,582	2.5	12 A	17 A	22 A	117 A	398 A	120 W	240 W	480 W	2,400 W	16	2.4	0.094	3-3.5	1.29	0.059	14.7	4.016	11.6	Bl	Bl	R	1.5²	16
17	1.0 mm²	1.04²	2,048	2.0			19 A	99 A	316 A	102 W	204 W	408 W	2,040 W	17				1.15	0.045	17.8	5.064	9.23	R	R	Y	1.0²	17
18	0.75 mm²	0.823²	1,624	1.6	10 A	14 A	16 A	83 A	250 A	84 W	168 W	336 W	1,680 W	18	2.1	0.082		1.02	0.040	23.0	6.385	7.32	Lt B	Gr	W	0.75²	18
19		0.653²	1,288	1.2			14 A	70 A	198 A	72 W	144 W	288 W	1,440 W	19				0.91	0.036	28.3	8.051	5.80					19
20	0.50 mm²	0.518²	1,021	1.0	5 A	11 A	11 A	58 A	158 A	60 W	120 W	240 W	1,200 W	20	1.8	0.071	2-2.5	0.81	0.032	34.5	10.15	4.60	W	W	Or	0.50²	20
21		0.410²	810	0.81			9 A	49 A	125 A	48 W	96 W	192 W	960 W	21				0.72	0.029	44.0	12.80	3.65					21
22	0.34 mm²	0.326²	642	0.64	3 A	7 A	7 A	41 A	99 A	36 W	72 W	144 W	720 W	22	1.6	0.063		0.64	0.025	54.8	16.14	2.89	Pin	Tur	Tur	0.34²	22
23		0.258²	509	0.50			4.7 A	35 A	79 A	30 W	60 W	120 W	600 W	23				0.57	0.023	70.1	20.36	2.29					23
24	0.25 mm²	0.205²	404	0.40	2.1 A	3.5 A	3.5 A	29 A	62 A	24 W	48 W	96 W	480 W	24	1.4	0.055		0.51	0.020	89.2	25.67	1.82	Vio	Y	Lt B	0.25²	24
25		0.162²	320	0.32			2.7 A	24 A	49 A	18 W	36 W	72 W	360 W	25				0.46	0.018	111	32.37	1.44					25
26	0.14 mm²	0.129²	254	0.25	1.3 A	2.2 A	2.2 A	20 A	39 A	12 W	24 W	48 W	240 W	26	1.3	0.051	1.5-2	0.41	0.016	146	40.81	1.14	Br	Gr	Gr	0.14²	26
27		0.102²	201	0.20			1.7 A	17 A	31 A	10 W	20 W	40 W	200 W	27				0.36	0.014	176	51.47	0.91					27
28	0.08 mm²	0.081²	160	0.16	0.83 A	1.4 A	1.4 A	14 A	24 A	8.4 W	17 W	34 W	170 W	28	1.2	0.047		0.32	0.013	232	64.90	0.72				0.08²	28
29		0.064²	127	0.12			1.2 A	12 A	20 A	7.2 W	14 W	28 W	140 W	29				0.29	0.011	282	81.83	0.57					29
30	0.05 mm²	0.051²	100	0.10	0.52 A	0.86 A	0.86 A	10 A	15 A	6.0 W	12 W	24 W	120 W	30	1.1	0.043		0.26	0.010	350	103.2	0.45				0.05²	30
AWG	mm²		CM	MCM	Amps		Amps	Amps		Watts					mm Ø	in Ø	mm Ø	mm Ø	in Ø	Ω/Km	Ω/1K ft	g/m	Fre	DIN	Wei	mm²	AWG
Cable Gauge	Cable Area (Rounded / Metric UL486 / Circular Mils / MCM)				Continual Current (Bundled Cables)		Continual Current (Single Cable)	~10s Surge	~1s Surge	12v	24v	48v	240v	Gauge	Cable Diameter		Heat Shrink Size	Wire Diameter		Resistance		Cable Weight	Bootlace Ferrules			Cable Area	Gauge

Wire Stripping (Method): Stanley Knife / Score with Wire Cutters; Swivel Wire Stripper; Automatic Wire Stripper; Manual Wire Stripper; Lighter / Fingernails

Crimping (Method): Electric Hydraulic Crimper; Hydraulic Crimper; Hammer Crimper; Hexagonal Crimper; Ratcheting Hand Crimper; Manual Crimper; Yellow Crimper; Blue Crimper; Red Crimper; Standard Bootlace Female Crimper

Chart created by Fluidic Ice, version 2023-08-04.

Active Components

Semiconductors

Diode	A diode is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other. A diode vacuum tube or thermionic diode is a vacuum tube with two electrodes, a heated cathode and a plate, in which electrons can flow in only one direction, from cathode to plate. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals.
Rectifier	A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification, since it "straightens" the direction of current. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches.
Bridge Rectifier	A diode bridge is an arrangement of four (or more) diodes in a bridge circuit configuration that provides the same polarity of output for either polarity of input. When used in its most common application, for conversion of an alternating-current (AC) input into a direct-current (DC) output, it is known as a bridge rectifier. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared to a rectifier with a 3-wire input from a transformer with a centre-tapped secondary winding.
Light-Emitting Diode	A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern. Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

Photodiode

A photodiode is a semiconductor device that converts light into an electrical current. The current is generated when photons are absorbed in the photodiode. Photodiodes may contain optical filters, built-in lenses, and may have large or small surface areas. Photodiodes usually have a slower response time as their surface area increases. The common, traditional solar cell used to generate electric solar power is a large area photodiode. Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fibre connection to allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiode use a PIN junction rather than a p–n junction, to increase the speed of response. A photodiode is designed to operate in reverse bias.

Avalanche Photodiode	An avalanche photodiode (APD) is a highly sensitive semiconductor electronic device that exploits the photoelectric effect to convert light to electricity. APDs can be thought of as photodetectors that provide a built-in first stage of gain through avalanche multiplication. From a functional standpoint, they can be regarded as the semiconductor analog photomultipliers. By applying a high reverse bias voltage (typically 100–200 V in silicon), APDs show an internal current gain effect (around 100) due to impact ionization (avalanche effect). However, some silicon APDs employ alternative doping and beveling techniques compared to traditional APDs that allow greater voltage to be applied (> 1500 V) before breakdown is reached and hence a greater operating gain (> 1000). In general, the higher the reverse voltage, the higher the gain. Among the various expressions for the APD multiplication factor (M), an instructive expression is given by the formula.

Solar Cell, Photovoltaic Cell, PV array	A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Individual solar cell devices can be combined to form modules, otherwise known as solar panels. In basic terms a single junction silicon solar cell can produce a maximum open-circuit voltage of approximately 0.5 to 0.6 volts. Solar cells are described as being photovoltaic, irrespective of whether the source is sunlight or an artificial light. They are used as a photodetector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity. In contrast, a solar thermal collector supplies heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation from heat. A "photoelectrolytic cell" (photoelectrochemical cell), on the other hand, refers either to a type of photovoltaic cell, or to a device that splits water directly into hydrogen and oxygen using only solar illumination.
Constant-Current Diode	Constant-current diode is an electronic device that limits current to a maximal specified value for the device. It is known as current-limiting diode (CLD), current-regulating diode (CRD). These diodes consist of an n-channel JFET with the gate shorted to the source, which functions like a two-terminal current limiter or current source (analogous to a voltage-limiting Zener diode). They allow a current through them to rise to a certain value, and then level off at a specific value. Unlike Zener diodes, these diodes keep the current constant instead of the voltage constant. These devices keep the current flowing through them unchanged when the voltage changes.
Peltier Cooler	Thermoelectric cooling uses the Peltier effect to create a heat flux between the junction of two different types of materials. A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC). It can be used either for heating or for cooling, although in practice the main application is cooling. It can also be used as a temperature controller that either heats or cools. This technology is far less commonly applied to refrigeration than vapour-compression refrigeration is. The primary advantages of a Peltier cooler compared to a vapour-compression refrigerator are its lack of moving parts or circulating liquid, very long life, invulnerability to leaks, small size, and flexible shape. Its main disadvantages are high cost and poor power efficiency. Many researchers and companies are trying to develop Peltier coolers that are cheap and efficient. A Peltier cooler can also be used as a thermoelectric generator. When operated as a cooler, a voltage is applied across the device, and as a result, a difference in temperature will build up between the two sides. When operated as a generator, one side of the device is heated to a temperature greater than the other side, and as a result, a difference in voltage will build up between the two sides (the Seebeck effect).

Transistors

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal.

Bipolar Junction Transistor	A bipolar junction transistor (bipolar transistor or BJT) is a type of transistor that uses both electron and hole charge carriers. In contrast, unipolar transistors, such as field-effect transistors, only use one kind of charge carrier. The basic function of a BJT is to amplify current. This allows BJTs to be used as amplifiers or switches, giving them wide applicability in electronic equipment, including computers, televisions, mobile phones, audio amplifiers, industrial control, and radio transmitters.
Photo Transistor	A photodiode is a semiconductor device that converts light into an electrical current. The current is generated when photons are absorbed in the photodiode. Photodiodes may contain optical filters, built-in lenses, and may have large or small surface areas. Photodiodes usually have a slower response time as their surface area increases. The common, traditional solar cell used to generate electric solar power is a large area photodiode. Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fibre connection to allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiode use a PIN junction rather than a p–n junction, to increase the speed of response. A photodiode is designed to operate in reverse bias.

Field-Effect Transistor

The field-effect transistor (FET) is a transistor that uses an electric field to control the electrical behaviour of the device. FETs are also known as unipolar transistors since they involve single-carrier-type operation. Many different implementations of field effect transistors exist. Field effect transistors generally display very high input impedance at low frequencies. The conductivity between the drain and source terminals is controlled by an electric field in the device, which is generated by the voltage difference between the source and the gate of the device.

JFET	The junction gate field-effect transistor (JFET or JUGFET) is one of the simple type of field-effect transistor. JFETs are three-terminal semiconductor devices that can be used as electronically-controlled switches, amplifiers, or voltage-controlled resistors. A JFET is usually ON when there is no potential difference between its gate and source terminals.
MOSFET	The metal-oxide-semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET) is a type of field-effect transistor (FET), most commonly fabricated by the controlled oxidation of silicon. It has an insulated gate, whose voltage determines the conductivity of the device. This ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronic signals. The MOSFET is by far the most common transistor in digital circuits, as billions may be included in a memory chip or microprocessor.

Thyristors

A thyristor is a solid-state semiconductor device with four layers of alternating P- and N-type materials. It acts exclusively as a bistable switch, conducting when the gate receives a current trigger, and continuing to conduct until the voltage across the device is reversed biased, or until the voltage is removed (by some other means). A three-lead thyristor is designed to control the larger current of the Anode to Cathode path by controlling that current with the smaller current of its other lead, known as its Gate. In contrast, a two-lead thyristor is designed to switch on if the potential difference between its leads is sufficiently large (breakdown voltage). Thyristors may be used in power-switching circuits, relay-replacement circuits, inverter circuits, oscillator circuits, level-detector circuits, chopper circuits, light-dimming circuits, low-cost timer circuits, logic circuits, speed-control circuits, phase-control circuits, etc.

Integrated Circuits

Digital Electronics	Digital electronics or digital (electronic) circuits are electronics that operate on digital signals. In contrast, analog circuits manipulate analog signals whose performance is more subject to manufacturing tolerance, signal attenuation and noise. Digital techniques are helpful because it is a lot easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values. Digital electronic circuits are usually made from large assemblies of logic gates (often printed on integrated circuits), simple electronic representations of Boolean logic functions.

Analog	Analogue electronics (American English: analog electronics) are electronic systems with a continuously variable signal, in contrast to digital electronics where signals usually take only two levels. The term "analogue" describes the proportional relationship between a signal and a voltage or current that represents the signal. The word analogue is derived from the Greek word ανάλογος (analogous) meaning "proportional". An analogue signal uses some attribute of the medium to convey the signal's information. For example, an aneroid barometer uses the angular position of a needle as the signal to convey the information of changes in atmospheric pressure. Electrical signals may represent information by changing their voltage, current, frequency, or total charge. Information is converted from some other physical form (such as sound, light, temperature, pressure, position) to an electrical signal by a transducer which converts one type of energy into another (e.g. a microphone).

Current Sensor	A current sensor is a device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control. The sensed current and the output signal can be:	**Alternating Current Input** • Analog output, which duplicates the wave shape of the sensed current. • Bipolar output, which duplicates the wave shape of the sensed current. • Unipolar output, which is proportional to the average or RMS value of the sensed current.	**Direct Current Input** • Unipolar, with a unipolar output, which duplicates the wave shape of the sensed current • Digital output, which switches when the sensed current exceeds a certain threshold

Optoelectronic Devices

Optoelectronics is the study and application of electronic devices and systems that source, detect and control light, usually considered a sub-field of photonics. In this context, light often includes invisible forms of radiation such as gamma rays, X-rays, ultraviolet and infrared, in addition to visible light. Optoelectronic devices are electrical-to-optical or optical-to-electrical transducers, or instruments that use such devices in their operation. Electro-optics is often erroneously used as a synonym, but is a wider branch of physics that concerns all interactions between light and electric fields, whether or not they form part of an electronic device. Optoelectronics is based on the quantum mechanical effects of light on electronic materials, especially semiconductors, sometimes in the presence of electric fields.	**Photoelectric or Photovoltaic Effect Uses** • Photodiodes (including solar cells) • Phototransistors • photomultipliers • Optoisolators • Integrated optical circuit (IOC) elements	**Photoconductivity Uses** • Photoresistors • Photoconductive camera tubes • Charge-coupled imaging devices

LED Display	An LED display is a flat panel display, which uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors where they are visible in the sun for store signs and billboards, and in recent years they have also become commonly used in destination signs on public transport vehicles, as well as variable-message signs on highways. LED displays are capable of providing general illumination in addition to visual display, as when used for stage lighting or other decorative (as opposed to informational) purposes.

Display Technologies

Filament Lamp	An incandescent light bulb, incandescent lamp or incandescent light globe is an electric light with a wire filament heated to such a high temperature that it glows with visible light (incandescence). The filament is protected from oxidation with a glass or fused quartz bulb that is filled with inert gas or a vacuum. In a halogen lamp, filament evaporation is slowed by a chemical process that redeposits metal vapour onto the filament, thereby extending its life. The light bulb is supplied with electric current by feed-through terminals or wires embedded in the glass. Most bulbs are used in a socket which provides mechanical support and electrical connections. They require no external regulating equipment, have low manufacturing costs, and work equally well on either alternating current or direct current. As a result, the incandescent bulb is widely used in household and commercial lighting, for portable lighting such as table lamps, car headlamps, and flashlights, and for decorative and advertising lighting. Incandescent bulbs are much less efficient than other types of electric lighting; incandescent bulbs convert less than 5% of the energy they use into visible light, with standard light bulbs averaging about 2.2%. The remaining energy is converted into heat. Incandescent bulbs typically have short lifetimes compared with other types of lighting; around 1,000 hours for home light bulbs versus typically 10,000 hours for compact fluorescents and 30,000 hours for lighting LEDs.
Vacuum Fluorescent Display	A vacuum fluorescent display (VFD) is a display device used commonly on consumer electronics equipment such as video cassette recorders, car radios, and microwave ovens. A VFD operates on the principle of cathodoluminescence, roughly similar to a cathode ray tube, but operating at much lower voltages. Each tube in a VFD has a phosphor coated anode that is bombarded by electrons emitted from the cathode filament. Standard illumination figures for VFDs are around 640 cd/m2 with high-brightness VFDs operating at 4,000 cd/m2, and experimental units as high as 35,000 cd/m2 depending on the drive voltage and its timing. The choice of colour (which determines the nature of the phosphor) and display brightness significantly affect the lifetime of the tubes, which can range from as low as 1,500 hours for a vivid red VFD to 30,000 hours for the more common green ones. VFDs can display seven-segment numerals, multi-segment alpha-numeric characters or can be made in a dot-matrix to display different alphanumeric characters and symbols.
Cathode Ray Tube	The cathode ray tube (CRT) is a vacuum tube that contains one or more electron guns and a phosphorescent screen, and is used to display images. It modulates, accelerates, and deflects electron beam(s) onto the screen to create the images. The images may represent electrical waveforms (oscilloscope), pictures (television, computer monitor), radar targets, or other phenomena. CRTs have also been used as memory devices, in which case the visible light emitted from the fluorescent material (if any) is not intended to have significant meaning to a visual observer (though the visible pattern on the tube face may cryptically represent the stored data). In television sets and computer monitors, the entire front area of the tube is scanned repetitively and systematically in a fixed pattern called a raster. An image is produced by controlling the intensity of each of the three electron beams, one for each additive primary colour (red, green, and blue) with a video signal as a reference. In all modern CRT monitors and televisions, the beams are bent by magnetic deflection, a varying magnetic field generated by coils and driven by electronic circuits around the neck of the tube.
LCD	A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. Since LCD screens do not use phosphors, they rarely suffer image burn-in when a static image is displayed on a screen for a long time, e.g., the table frame for an airline flight schedule on an indoor sign. LCDs are, however, susceptible to image persistence. The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than CRTs can be.

Neon	Neon lighting consists of brightly glowing, electrified glass tubes or bulbs that contain rarefied neon or other gases. Neon lights are a type of cold cathode gas-discharge light. A neon tube is a sealed glass tube with a metal electrode at each end, filled with one of a number of gases at low pressure. A high potential of several thousand volts applied to the electrodes ionizes the gas in the tube, causing it to emit colored light. The color of the light depends on the gas in the tube. Neon lights were named for neon, a noble gas which gives off a popular orange light, but other gases and chemicals are used to produce other colors, such as hydrogen (red), helium (yellow), carbon dioxide (white), and mercury (blue). Neon tubes can be fabricated in curving artistic shapes, to form letters or pictures. They are mainly used to make dramatic, multicolored glowing signage for advertising, called neon signs, which were popular from the 1920s to the 1950s.
LED	A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern. Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.
Plasma Display	A plasma display panel (PDP) is a type of flat panel display common to large TV displays 30 inches (76 cm) or larger. They are called "plasma" displays because they use small cells containing electrically charged ionized gases, which are plasmas. Plasma displays have lost nearly all market share, mostly due to competition from low-cost LCD and more expensive but high-contrast OLED flat-panel displays. Plasma displays are bright (1,000 lux or higher for the module), have a wide colour gamut, and can be produced in fairly large sizes—up to 3.8 metres (150 in) diagonally. They had a very low-luminance "dark-room" black level compared with the lighter grey of the unilluminated parts of an LCD screen (as plasma panels are locally lit and do not require a backlight, blacks are blacker on plasmas and greyer on LCDs).

Optical Detectors & Emitters

Photodetectors, also called photosensors, are sensors of light or other electromagnetic radiation. A photo detector has a p–n junction that converts light photons into current. The absorbed photons make electron–hole pairs in the depletion region. Photodiodes and photo transistors are a few examples of photo detectors. Solar cells convert some of the light energy absorbed into electrical energy.

Phototube or Photodiode	A phototube or photoelectric cell is a type of gas-filled or vacuum tube that is sensitive to light. Such a tube is more correctly called a 'photoemissive cell' to distinguish it from photovoltaic or photoconductive cells. Phototubes were previously more widely used but are now replaced in many applications by solid state photodetectors. The photomultiplier tube is one of the most sensitive light detectors, and is still widely used in physics research. Phototubes operate according to the photoelectric effect: Incoming photons strike a photocathode, knocking electrons out of its surface, which are attracted to an anode. Thus current is dependent on the frequency and intensity of incoming photons. Unlike photomultiplier tubes, no amplification takes place, so the current through the device is typically of the order of a few microamperes. The light wavelength range over which the device is sensitive depends on the material used for the photoemissive cathode. A caesium-antimony cathode gives a device that is very sensitive in the violet to ultra-violet region with sensitivity falling off to blindness to red light. Caesium on oxidised silver gives a cathode that is most sensitive to infra-red to red light, falling off towards blue, where the sensitivity is low but not zero.

Power Sources

Battery	An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell. Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current.
Fuel Cell	A fuel cell is an electrochemical cell that converts the chemical energy from a fuel into electricity through an electrochemical reaction of hydrogen fuel with oxygen or another oxidizing agent. Fuel cells are different from batteries in requiring a continuous source of fuel and oxygen (usually from air) to sustain the chemical reaction, whereas in a battery the chemical energy comes from chemicals already present in the battery. Fuel cells can produce electricity continuously for as long as fuel and oxygen are supplied. The first fuel cells were invented in 1838. The first commercial use of fuel cells came more than a century later in NASA space programs to generate power for satellites and space capsules. Since then, fuel cells have been used in many other applications. Fuel cells are used for primary and backup power for commercial, industrial and residential buildings and in remote or inaccessible areas. They are also used to power fuel cell vehicles, including forklifts, automobiles, buses, boats, motorcycles and submarines. In addition to electricity, fuel cells produce water, heat and, depending on the fuel source, very small amounts of nitrogen dioxide and other emissions. The energy efficiency of a fuel cell is generally between 40–60%; however, if waste heat is captured in a cogeneration scheme, efficiencies up to 85% can be obtained.
Power Supply	A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power.

All power supplies have a power input connection, which receives energy in the form of electric current from a source, and one or more power output connections that deliver current to the load. The source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells, generators or alternators, solar power converters, or another power supply.

The input and output are usually hardwired circuit connections, though some power supplies employ wireless energy transfer to power their loads without wired connections. Some power supplies have other types of inputs and outputs as well, for functions such as external monitoring and control.

Photo Voltaic Device (Solar)	A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Individual solar cell devices can be combined to form modules, otherwise known as solar panels. In basic terms a single junction silicon solar cell can produce a maximum open-circuit voltage of approximately 0.5 to 0.6 volts. Solar cells are described as being photovoltaic, irrespective of whether the source is sunlight or an artificial light.	**The operation of a photovoltaic (PV) cell requires three basic attributes:** • The absorption of light, generating either electron-hole pairs or excitons. • The separation of charge carriers of opposite types. • The separate extraction of those carriers to an external circuit.

They are used as a photodetector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity. In contrast, a solar thermal collector supplies heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation from heat.

A "photoelectrolytic cell" (photoelectrochemical cell), on the other hand, refers either to a type of photovoltaic cell (like that developed by Edmond Becquerel and modern dye-sensitized solar cells), or to a device that splits water directly into hydrogen and oxygen using only solar illumination.

Thermo Electric Generator	A thermoelectric generator (TEG), also called a Seebeck generator, is a solid state device that converts heat flux (temperature differences) directly into electrical energy through a phenomenon called the Seebeck effect (a form of thermoelectric effect). Thermoelectric generators function like heat engines, but are less bulky and have no moving parts. However, TEGs are typically more expensive and less efficient. Thermoelectric generators could be used in power plants in order to convert waste heat into additional electrical power and in automobiles as automotive thermoelectric generators (ATGs) to increase fuel efficiency. Another application is radioisotope thermoelectric generators which are used in space probes, which has the same mechanism but use radioisotopes to generate the required heat difference.
Electrical Generator	In electricity generation, a generator is a device that converts motive power (mechanical energy) into electrical power for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and even hand cranks. Generators provide nearly all of the power for electric power grids. The reverse conversion of electrical energy into mechanical energy is done by an electric motor, and motors and generators have many similarities. Many motors can be mechanically driven to generate electricity and frequently make acceptable manual generators.
Piezoelectric Generator	Direct piezoelectricity of some substances, like quartz, can generate potential differences of thousands of volts. The best-known application is the electric cigarette lighter: pressing the button causes a spring-loaded hammer to hit a piezoelectric crystal, producing a sufficiently high-voltage electric current that flows across a small spark gap, thus heating and igniting the gas. The portable sparkers used to ignite gas stoves work the same way, and many types of gas burners now have built-in piezo-based ignition systems. A similar idea is being researched by DARPA in the United States in a project called Energy Harvesting, which includes an attempt to power battlefield equipment by piezoelectric generators embedded in soldiers' boots. However, these energy harvesting sources by association affect the body. DARPA's effort to harness 1–2 watts from continuous shoe impact while walking were abandoned due to the impracticality and the discomfort from the additional energy expended by a person wearing the shoes. Other energy harvesting ideas include harvesting the energy from human movements in train stations or other public places and converting a dance floor to generate electricity. Vibrations from industrial machinery can also be harvested by piezoelectric materials to charge batteries for backup supplies or to power low-power microprocessors and wireless radios.

Passive Components

Resistors

Power Resistor	Power resistors are designed to withstand and dissipate large amounts of power. In general they have a power rating of at least 5 Watt. They are made from materials with a high thermal conductivity, allowing efficient cooling. They are often designed to be coupled with heat sinks to be able to dissipate the high amount of power. Some might even need forced air or liquid cooling while under maximum load. Some are wire wound, some are made from wire grids for ease of cooling, but the common thing for all power resistors is that they are built to dissipate the most power while keeping their size as small as possible. An example use for power resistors are load banks used to dissipate power generated during engine braking in vehicles using electrical motors, such as locomotives or trams.
Wirewound Resistors	Wire wound resistors are made by winding a metal wire around a solid form, often made of ceramic, fibreglass or plastic. Metal caps are attached to the end of the winding and metallic leads are attached to the ends. The end product is often coated with a non-conductive paint or enamel to offer some protection from the environment. Wire wound resistors can be built to withstand high temperatures, sometimes up to 450 °C. These resistors are often built to tight tolerances thanks to the material used, an alloy of nickel and chrome called Nichrome. The body of the device is then coated with a non-conductive paint, enamel or plastic.
Chip/SMD Resistors	Chip resistors are resistors which look like integrated circuit chips. Surface mount power resistors are made from many different materials, such as pressed carbon, ceramics and metal (cermet resistors) or metal foil. Wire wound chip resistors are also available. SMD resistors are actually smaller form, surface mounted chip resistors. The resistor itself consists of a metal oxide film deposited onto a ceramic substrate. The thickness and length of film determines the resistance. They have power dissipation ratings much lower than those of grid resistors or water resistors and can usually dissipate no more than a few watts, provided they have appropriate cooling.

Variable Resistors

Potentiometer	A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.
Thermistor	A thermistor is a type of resistor whose resistance is dependent on temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors (negative temperature coefficient or NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements (positive temperature coefficient or PTC type typically). Thermistors are of two opposite fundamental types: With NTC thermistors, resistance decreases as temperature rises. An NTC is commonly used as a temperature sensor, or in series with a circuit as an inrush current limiter. With PTC thermistors, resistance increases as temperature rises. PTC thermistors are commonly installed in series with a circuit, and used to protect against overcurrent conditions, as resettable fuses. Thermistors differ from resistance temperature detectors (RTDs) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The thermistors are in the form of beads, rods and discs but RTDs are in different shapes and sizes. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a greater precision within a limited temperature range, typically −90 °C to 130 °C.

Humistor	A humistor is a type of variable resistor whose resistance varies based on humidity. A capacitive humidity sensor detects humidity based on a change of capacitance between two detection electrodes provided on a semiconductor substrate. The capacitance type humidity sensor detects humidity by measuring the change in the electrostatic capacity of an element corresponding to the ambient humidity. A resistive humidity sensor detects relative humidity by measuring the change in the resistance of an element corresponding to the ambient humidity. Most of the resistance type humidity sensors include an electrolytic, polymeric, or metallic oxide sensor element. An impedance humidity sensor changes its electrical impedance as the humidity of the surrounding environment changes, and the measured impedance is converted into humidity readings.
Photoresistor	A photoresistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits. A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as several megohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices.

Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands. A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, for example, silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap.

Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.

Memristor	A memristor is a hypothetical non-linear passive two-terminal electrical component relating electric charge and magnetic flux linkage. According to the characterizing mathematical relations, the memristor would hypothetically operate in the following way: the memristor's electrical resistance is not constant but depends on the history of current that had previously flowed through the device, i.e., its present resistance depends on how much electric charge has flowed in what direction through it in the past; the device remembers its history — the so-called non-volatility property. When the electric power supply is turned off, the memristor remembers its most recent resistance until it is turned on again. In 2008, a team at HP Labs claimed to have found Chua's missing memristor based on an analysis of a thin film of titanium dioxide thus connecting the operation of ReRAM devices to the memristor concept. There are, however, some serious doubts as to whether a genuine memristor can actually exist in physical reality. Additionally, some experimental evidence contradicts Chua's generalization since a non-passive nanobattery effect is observable in resistance switching memory. A simple test has been proposed by Pershin and Di Ventra to analyse whether such an ideal or generic memristor does actually exist or is a purely mathematical concept. Up to now, there seems to be no experimental resistance switching device (ReRAM) which can pass the test.
Heater	Heaters are appliances whose purpose is to generate heat (i.e. warmth) for the building. This can be done via central heating. Such a system contains a boiler, furnace, or heat pump to heat water, steam, or air in a central location such as a furnace room in a home, or a mechanical room in a large building. The heat can be transferred by convection, conduction, or radiation. Heaters exist for various types of fuel, including solid fuels, liquids, and gases. Another type of heat source is electricity, normally heating ribbons composed of high resistance wire (see Nichrome). This principle is also used for baseboard heaters and portable heaters. Electrical heaters are often used as backup or supplemental heat for heat pump systems.

Capacitors

Fixed Capacitors

Ceramic Capacitor	A ceramic capacitor is a fixed-value capacitor in which ceramic material acts as the dielectric. It is constructed of two or more alternating layers of ceramic and a metal layer acting as the electrodes. The composition of the ceramic material defines the electrical behaviour and therefore applications. Ceramic capacitors are divided into two application classes: ● Class 1 ceramic capacitors offer high stability and low losses for resonant circuit applications. ● Class 2 ceramic capacitors offer high volumetric efficiency for buffer, by-pass, and coupling applications. Ceramic capacitors, especially multilayer ceramic capacitors (MLCCs), are the most produced and used capacitors in electronic equipment that incorporate approximately one trillion (1012) pieces per year. Ceramic capacitors of special shapes and styles are used as capacitors for RFI/EMI suppression, as feed-through capacitors and in larger dimensions as power capacitors for transmitters.
Electrolytic Capacitor	An electrolytic capacitor (e-cap) is a polarized capacitor whose anode or positive plate is made of a metal that forms an insulating oxide layer through anodization. This oxide layer acts as the dielectric of the capacitor. A solid, liquid, or gel electrolyte covers the surface of this oxide layer, serving as the (cathode) or negative plate of the capacitor. Due to their very thin dielectric oxide layer and enlarged anode surface, electrolytic capacitors have a much higher capacitance-voltage (CV) product per unit volume compared to ceramic capacitors or film capacitors, and so can have large capacitance values. There are three families of electrolytic capacitor: aluminium electrolytic capacitors, tantalum electrolytic capacitors, and niobium electrolytic capacitors. The large capacitance of electrolytic capacitors makes them particularly suitable for passing or bypassing low-frequency signals, and for storing large amounts of energy.

They are widely used for decoupling or noise filtering in power supplies and DC link circuits for variable-frequency drives, for coupling signals between amplifier stages, and storing energy as in a flashlamp. Electrolytic capacitors are polarized components due to their asymmetrical construction, and must be operated with a higher voltage (ie, more positive) on the anode than on the cathode at all times. For this reason the anode terminal is marked with a plus sign and the cathode with a minus sign.

Applying a reverse polarity voltage, or a voltage exceeding the maximum rated working voltage of as little as 1 or 1.5 volts, can destroy the dielectric and thus the capacitor. The failure of electrolytic capacitors can be hazardous, resulting in an explosion or fire. Bipolar electrolytic capacitors which may be operated with either polarity are also made, using special constructions with two anodes connected in series.

Aluminium Electrolytic Capacitor	Aluminium electrolytic capacitors are polarized electrolytic capacitors whose anode electrode (+) is made of a pure aluminium foil with an etched surface. The aluminium forms a very thin insulating layer of aluminium oxide by anodization that acts as the dielectric of the capacitor. A non-solid electrolyte covers the rough surface of the oxide layer, serving in principle as the second electrode (cathode) (-) of the capacitor. A second aluminium foil called "cathode foil" contacts the electrolyte and serves as the electrical connection to the negative terminal of the capacitor. Aluminium electrolytic capacitors are divided into three subfamilies by the type of electrolyte: ● Non-solid (liquid, wet) aluminium electrolytic capacitors, ● Solid manganese dioxide aluminium electrolytic capacitors, and ● Solid polymer aluminium electrolytic capacitors.

Aluminium electrolytic capacitors with non-solid electrolyte are the most inexpensive type and also those with widest range of sizes, capacitance and voltage values. They are made with capacitance values from 0.1 µF up to 2,700,000 µF (2.7 F), and rated voltages values from 4 V up to 630 V. The liquid electrolyte provides oxygen for re-forming or self-healing of the dielectric oxide layer.

However, it can evaporate through a temperature-dependent drying-out process, which causes electrical parameters to drift, limiting the service life time of the capacitors. Due to their relatively high capacitance values aluminium electrolytic capacitors have low impedance values even at lower frequencies like mains frequency.

They are typically used in power supplies, switched-mode power supplies and DC-DC converters for smoothing and buffering rectified DC voltages in many electronic devices as well as in industrial power supplies and frequency converters as DC link capacitors for drives, inverters for photovoltaic, and converters in wind power plants. Special types are used for energy storage, for example in photoflash or strobe applications or for frequency coupling in audio applications. Aluminium electrolytic capacitors are polarized capacitors because of their anodization principle. They can only be operated with DC voltage applied with the correct polarity. Operating the capacitor with wrong polarity or with AC voltage leads to a short circuit and can destroy the component.

Lithium-Ion Capacitor	A lithium-ion capacitor (LIC) is a hybrid type of capacitor classified as a type of supercapacitor. Activated carbon is typically used as the cathode. The anode of the LIC consists of carbon material which is pre-doped with lithium ions. This pre-doping process lowers the potential of the anode and allows a relatively high output voltage compared with other supercapacitors.	**Typical Properties** ● High capacitance compared to a capacitor, because of the large anode, though low capacity compared to a Li-ion cell ● High energy density compared to a capacitor(14 Wh/kg reported), though low energy density compared to a Li-ion cell ● High power density ● High reliability ● Operating temperatures ranging from −20 °C to 70 °C ● Low self-discharge (<5% voltage drop at 25 °C over three months)

Variable Capacitor

Tuning Capacitor	A tuning capacitor is a variable capacitor used in an electronic circuit of a radio. It usually connects in parallel to a loop antenna. There are many uses and applications for a variable capacitor; the most typical use is in an AM Radio Circuit. If you were building a crystal radio, then you will most definitely need this component. A typical capacitor will look like this. It will often have six pins at the back, and sometimes an additional pin at the front-side, which connects to the shaft. It is normally used in a radio capable of receiving AM and FM bands. They typically consist of four individually ganged variable capacitors inside. There are two gangs of equal capacitance for the AM side, and two gangs of equal capacitance for the FM side. The first priority is to figure which is the top side and the lower side. There is normally some writing at the back to provide a clue to the orientation of the component. The three pins on the lower side are for the FM Radio. If you are building an AM Crystal Radio, then you ignore those pins. The three pins on the top side are for the AM radio. For a crystal radio, you need to connect the centre pin to the earthy side of your coil, and only one of the side pins to the antenna side of your coil.
Trimmer Capacitor	The Trimmer capacitor is the parts that its capacitance can be changed freely. The Trimmer capacitor is used in some applications that generally have no need to adjust again after the initial adjustment. The trimmer capacitor has an adjustable structure adding to general ceramic capacitor to adjust capacitance. There are basically three different principles shown in below that can be adjust capacitance. Generally most of the commercial products are using the first principle. ● Principle 1: change the overlap electrode area between parallel facing electrodes. ● Principle 2: change the distance between parallel facing electrodes. ● Principle 3: change the dieelectric constant of ceramics. The actual trimmer capacitor product has a dielectric ceramic between two parallel facing electrodes. One side of electrode is movable (can be rotated) so that a capacitance can be changed by adjusting the overlap electrode area between the movable and the fixed electrode. According to this process, a capacitance value can be changed linearly depending on the rotation angle of a movable electrode. Murata trimmer capacitor is also using above the Principle 1 and has more than 50% market share in the world.

Capacitors for Special Applications

Power Capacitor	Power capacitors are passive electronic components that provide a static source of reactive power in electrical distribution systems. They consist of two conducting plates separated by an insulating material called the dielectric. Multilayer dielectrics provide excellent temperature stability and frequency characteristics. Single layer dielectrics are also available. Capacitance, a measure of energy storage ability, is typically expressed as C = K A/D, where A is the area of the electrodes, D is their separation, and K is a function of the dielectric between the electrodes. Power capacitors are used in: ● The aerospace and automotive industries ● Power factor correction and lighting circuits ● Power supplies ● Motor starters. Some devices can handle one-phase voltages while others are designed for three-phase voltages.
Light-Emitting Capacitor	Light emitting capacitor (LEC) is an electroluminescent device in which the active layer is an electroluminescent polymer - a polymer which emits photons when an electrical current is passed through it. The polymers used are conjugated polymers, meaning the chemical and electronic structure of the material allow it to act as an ionic conductor, giving it the electronic and optical properties of a semiconductors. LECs provide multiple advantages - they are compatible with inexpensive manufacturing processes, eliminate the need for a transparent anode, and are independent of the difference in the work function of the electrodes. This article will elaborate on the working, construction and applications of LECs. The active polymer layer consists of electronic and ionic conductors. This layer is in between the two electrodes. When an electric charge is applied on the electrodes, electrons and holes are released and they accumulate around the polymer layer. The recombination of the electron hole pairs causes the polymer layer to emit light.

Motor Capacitor	A motor capacitor, such as a start capacitor or run capacitor (including a dual run capacitor) is an electrical capacitor that alters the current to one or more windings of a single phase AC induction motor to create a rotating magnetic field. There are two common types of motor capacitors, run capacitors and start capacitors. The units of capacitance are labelled in microfarads (μF). Older capacitors may be labelled with the obsolete terms "mfd" or "MFD" which can be ambiguous but are, especially in this context, used for microfarad as well (a millifarad is 1000 microfarad and not usually seen on motors). Motor capacitors are used with air conditioners, hot tub/Jacuzzi spa pumps, powered gates, large fans or forced-air heat furnaces for example. A "dual run capacitor" is used in some air conditioner compressor units, to boost both the fan and compressor motors. Start capacitors briefly increase motor starting torque and allow a motor to be cycled on and off rapidly. A start capacitor stays in the circuit long enough to rapidly bring the motor up to a predetermined speed, which is usually about 75% of the full speed, and is then taken out of the circuit, often by a centrifugal switch that releases at that speed. Afterward the motor works more efficiently with a run capacitor. Start capacitors have ratings above 70 μF, with four major voltage classifications: 125 V, 165 V, 250 V, and 330 V.
	Examples of motor capacitors are: a 35 μF, at 370 V, run capacitor, or an 88–108 μF at 250 V start capacitor. Start capacitors above 20 μF are always non-polarized aluminium electrolytic capacitors with non solid electrolyte and therefore they are only applicable for the short motor starting time. The motor will not work properly if the centrifugal switch is broken. If the switch is always "open", the start capacitor is not part of the circuit thus preventing startup of the motor. If the switch is always "closed", the start capacitor is always enabled, thus likely destroying the capacitor. If a motor does not start, the capacitor is far more likely the problem than the switch. Some single-phase AC electric motors require a "run capacitor" to energize the second-phase winding (auxiliary coil) to create a rotating magnetic field while the motor is running. Run capacitors are designed for continuous duty while the motor is powered, which is why electrolytic capacitors are avoided, and low-loss polymer capacitors are used. Run capacitors are mostly polypropylene film capacitors (historically: metallised paper capacitors) and are energized the entire time the motor is running. Run capacitors are rated in a range of 1.5 to 100 μF, with voltage classifications of 370 V or 440 V. If a wrong capacitance value is installed, it will cause an uneven magnetic field around the rotor. This causes the rotor to hesitate at the uneven spots, resulting in irregular rotation, especially under load. This hesitation can cause the motor to become noisy, increase energy consumption, cause performance to drop and the motor to overheat.
Photoflash Capacitor	A photoflash capacitor is an electrolytic capacitor used in flash cameras, professional flashes, and also in solid-state laser power supplies. Their usual purpose is to briefly power a high-voltage flash tube, used to illuminate a photographic subject or optically pump a laser rod. As flash tubes require very high current for a very short time to operate, photoflash capacitors are designed to supply high discharge current pulses without excessive internal heating. The light energy emitted by a flash is supplied by the capacitor, and is proportional to the product of the capacitance and the voltage squared; photoflash capacitors have capacitance in the range 80-160 microfarads (μF) and voltages from 180–330 volts for flash units built into small disposable and compact cameras, increasing for units delivering higher light energy. A typical manufacturer's range includes capacitors operating at 330–380V, with capacitance from 80 to 1,500 μF.

Magnetic (Inductive) Devices

Inductor, Coil, Choke, Variable Inductor	An inductor, also called a coil, choke, or reactor, is a passive two-terminal electrical component that stores energy in a magnetic field when electric current flows through it. An inductor typically consists of an insulated wire wound into a coil around a core. When the current flowing through an inductor changes, the time-varying magnetic field induces an electromotive force (e.m.f.) (voltage) in the conductor, described by Faraday's law of induction. According to Lenz's law, the induced voltage has a polarity (direction) which opposes the change in current that created it. As a result, inductors oppose any changes in current through them. An inductor is characterized by its inductance, which is the ratio of the voltage to the rate of change of current. Inductors have values that typically range from 1 μH (10−6 H) to 20 H. Many inductors have a magnetic core made of iron or ferrite inside the coil, which serves to increase the magnetic field and thus the inductance. Along with capacitors and resistors, inductors are one of the three passive linear circuit elements that make up electronic circuits. Inductors are widely used in alternating current (AC) electronic equipment, particularly in radio equipment. They are used to block AC while allowing DC to pass; inductors designed for this purpose are called chokes. They are also used in electronic filters to separate signals of different frequencies, and in combination with capacitors to make tuned circuits, used to tune radio and TV receivers.
Transformer	A transformer is a static electrical device that transfers electrical energy between two or more circuits. A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a varying electromotive force (emf) or "voltage" across a second coil. Electric power can be transferred between the two coils, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described the effect of induced voltage across the secondary coil. Transformers are used to increase or decrease the alternating voltages in electric power applications. Since the invention of the first constant-potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electrical energy. A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range in size from RF transformers less than a cubic centimetre in volume to units interconnecting the power grid weighing hundreds of tons.
Magnetic Amplifier (Toroid)	The magnetic amplifier (colloquially known as a "mag amp") is an electromagnetic device for amplifying electrical signals. The magnetic amplifier was invented early in the 20th century, and was used as an alternative to vacuum tube amplifiers where robustness and high current capacity were required. The magnetic amplifier has now been largely superseded by the transistor-based amplifier, except in a few safety critical, high-reliability or extremely demanding applications.
Ferrite Impedances, Beads	A ferrite bead or ferrite choke is a passive electric component that suppresses high frequency noise in electronic circuits. It is a specific type of electronic choke. Ferrite beads employ high frequency current dissipation in a ferrite ceramic to build high frequency noise suppression devices. Ferrite beads may also be called blocks, cores, rings, EMI filters, or chokes. Ferrite beads prevent electromagnetic interference(EMI) in two directions: from a device or to a device. A conductive cable acts as an antenna – if the device produces radio frequency energy, this can be transmitted through the cable, which acts as an unintentional radiator. In this case the bead is required for regulatory compliance, to reduce EMI. Conversely, if there are other sources of EMI, such as household appliances, the bead prevents the cable from acting as an antenna and receiving interference from these other devices. This is particularly common on data cables and on medical equipment. Large ferrite beads are commonly seen on external cabling. Various smaller ferrite beads are used internally in circuits—on conductors or around the pins of small circuit-board components, such as transistors, connectors and integrated circuits. Ferrite beads are used as a passive low-pass filter, by converting RF energy to heat, by design. The energy is either reflected back up the cable, or dissipated as low level heat. Only in extreme cases is the heat noticeable.
Motor	An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates in the reverse direction, accepting mechanical energy (such as from flowing water) and converting this mechanical energy into electrical energy. Electric motors may be classified by considerations such as power source type, internal construction, application and type of motion output. In addition to AC versus DC types, motors may be brushed or brushless, may be of various phase (see single-phase, two-phase, or three-phase), and may be either air-cooled or liquid-cooled.

General-purpose motors with standard dimensions and characteristics provide convenient mechanical power for industrial use. The largest electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts. Electric motors are found in industrial fans, blowers and pumps, machine tools, household appliances, power tools and disk drives.

Small motors may be found in electric watches. In certain applications, such as in regenerative braking with traction motors, electric motors can be used in reverse as generators to recover energy that might otherwise be lost as heat and friction. Electric motors produce linear or rotary force (torque) and can be distinguished from devices such as magnetic solenoids and loudspeakers that convert electricity into motion but do not generate usable mechanical force, which are respectively referred to as actuators and transducers.

Generator	In electricity generation, a generator is a device that converts motive power (mechanical energy) into electrical power for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and even hand cranks. The first electromagnetic generator, the Faraday disk, was invented in 1831 by British scientist Michael Faraday. Generators provide nearly all of the power for electric power grids. The reverse conversion of electrical energy into mechanical energy is done by an electric motor, and motors and generators have many similarities. Many motors can be mechanically driven to generate electricity and frequently make acceptable manual generators.
Solenoid	A solenoid and eidos is a coil wound into a tightly packed helix. The term was invented by French physicist André-Marie Ampère to designate a helical coil. In physics, the term refers to a coil whose length is substantially greater than its diameter, often wrapped around a metallic core, which produces a uniform magnetic field in a volume of space (where some experiment might be carried out) when an electric current is passed through it. A solenoid is a type of electromagnet whose purpose is to generate a controlled magnetic field. If the purpose of the solenoid is instead to impede changes in the electric current, a solenoid can be more specifically classified as an inductor rather than an electromagnet. Not all electromagnets and inductors are solenoids; for example, the first electromagnet, invented in 1824, had a horseshoe rather than a cylindrical solenoid shape. In engineering, the term may also refer to a variety of transducer devices that convert energy into linear motion. The term is also often used to refer to a solenoid valve, which is an integrated device containing an electromechanical solenoid which actuates either a pneumatic or hydraulic valve, or a solenoid switch, which is a specific type of relay that internally uses an electromechanical solenoid to operate an electrical switch; for example, an automobile starter solenoid, or a linear solenoid, which is an electromechanical solenoid. Solenoid bolts, a type of electronic-mechanical locking mechanism, also exist.
Loudspeaker (Speaker)	A loudspeaker is an electroacoustic transducer; which converts an electrical audio signal into a corresponding sound. The most widely used type of speaker in the 2010s is the dynamic speaker. The dynamic speaker operates on the same basic principle as a dynamic microphone, but in reverse, to produce sound from an electrical signal. When an alternating current electrical audio signal is applied to its voice coil, a coil of wire suspended in a circular gap between the poles of a permanent magnet, the coil is forced to move rapidly back and forth due to Faraday's law of induction, which causes a diaphragm (usually conically shaped) attached to the coil to move back and forth, pushing on the air to create sound waves. Besides this most common method, there are several alternative technologies that can be used to convert an electrical signal into sound.

The sound source must be amplified or strengthened with an audio power amplifier before the signal is sent to the speaker. Speakers are typically housed in a speaker enclosure or speaker cabinet which is often a rectangular or square box made of wood or sometimes plastic. The enclosure's materials and design play an important role in the quality of the sound.

Where high fidelity reproduction of sound is required, multiple loudspeaker transducers are often mounted in the same enclosure, each reproducing a part of the audible frequency range. In this case the individual speakers are referred to as "drivers" and the entire unit is called a loudspeaker. Drivers made for reproducing high audio frequencies are called tweeters, those for middle frequencies are called mid-range drivers, and those for low frequencies are called woofers.

Microphone	A microphone, colloquially nicknamed mic or mike is a transducer that converts sound into an electrical signal. Microphones are used in many applications such as telephones, hearing aids, public address systems for concert halls, motion picture production, sound recording, two-way radios, megaphones, radio broadcasting, and in computers for recording voice and for non-acoustic purposes such as ultrasonic sensors or knock sensors. Several different types of microphone are in use, which employ different methods to convert the air pressure variations of a sound wave to an electrical signal. The most common are the dynamic microphone, which uses a coil of wire suspended in a magnetic field; the condenser microphone, which uses the vibrating diaphragm as a capacitor plate, and the piezoelectric microphone, which uses a crystal of piezoelectric material. Microphones typically need to be connected to a preamplifier before the signal can be recorded or reproduced.

Transducers, Sensors, Detectors

Buzzer	A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. The electric buzzer was invented in 1831 by Joseph Henry. They were mainly used in early doorbells until they were phased out in the early 1930s in favour of musical chimes, which had a softer tone. Piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufacturers and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of cooperative efforts by Japanese manufacturing companies. In 1951, they established the Barium Titanate Application Research Committee, which allowed the companies to be "competitively cooperative" and bring about several piezoelectric innovations and inventions.	**Types** ● Electromechanical ● Mechanical ● Piezoelectric
Inclinometer	An inclinometer or clinometer is an instrument used for measuring angles of slope (or tilt), elevation, or depression of an object with respect to gravity's direction. It is also known as a tilt indicator, tilt sensor, tilt meter, slope alert, slope gauge, gradient meter, gradiometer, level gauge, level meter, declinometer, and pitch & roll indicator. Clinometers measure both inclines (positive slopes, as seen by an observer looking upwards) and declines (negative slopes, as seen by an observer looking downward) using three different units of measure: degrees, percent, and topo. A tilt sensor can measure the tilting in often two axes of a reference plane in two axes. In contrast, a full motion would use at least three axes and often additional sensors. One way to measure tilt angle with reference to the earth's ground plane, is to use an accelerometer.	
Motion Sensor	A motion detector is a device that detects moving objects, particularly people. Such a device is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area. They form a vital component of security, automated lighting control, home control, energy efficiency and other useful systems. An electronic motion detector contains an optical, microwave, or acoustic sensor, and in many cases a transmitter for illumination. However, a passive sensor senses a signature only from the moving object via emission or reflection, i.e., it can be emitted by the object, or by some ambient emitter such as the sun or a radio station of sufficient strength. Changes in the optical, microwave, or acoustic field in the device's proximity are interpreted by the electronics based on one of the technologies listed below. Most low-cost motion detectors can detect up to distances of at least 15 feet (4.6 m).	

Tomographic motion detection systems can cover much larger areas because the radio waves are at frequencies which penetrate most walls and obstructions, and are detected in multiple locations, not only at the location of the transmitter. Motion detectors have found wide use in domestic and commercial applications. One common application is activating automatic door openers in businesses and public buildings. Motion sensors are also widely used in lieu of a true occupancy sensor in activating street lights or indoor lights in walkways, such as lobbies and staircases.

In such smart lighting systems, energy is conserved by only powering the lights for the duration of a timer, after which the person has presumably left the area. A motion detector may be among the sensors of a burglar alarm that is used to alert the home owner or security service when it detects the motion of a possible intruder. Such a detector may also trigger a security camera to record the possible intrusion.

Sensor Technology Passive Infrared (PIR)	Passive infrared (PIR) sensors are sensitive to a person's skin temperature through emitted black body radiation at mid-infrared wavelengths, in contrast to background objects at room temperature. No energy is emitted from the sensor, thus the name passive infrared.
Sensor Technology Microwave	These detect motion through the principle of Doppler radar, and are similar to a radar speed gun. A continuous wave of microwave radiation is emitted, and phase shifts in the reflected microwaves due to motion of an object toward (or away from) the receiver result in a heterodyne signal at a low audio frequency.
Sensor Technology Ultrasonic	An ultrasonic transducer emits an ultrasonic wave (sound at a frequency higher than a human ear can hear) and receivers reflections from nearby objects. Exactly as in Doppler radar, heterodyne detection of the received field indicates motion. The detected doppler shift is also at low audio frequencies (for walking speeds) since the ultrasonic wavelength of around a centimetre is similar to the wavelengths used in microwave motion detectors.
Sensor Technology Tomographic Motion Detector	These systems sense disturbances to radio waves as they pass from node to node of a mesh network. They have the ability to detect over large areas completely because they can sense through walls and other obstructions.
Flow Meter	Flow measurement is the quantification of bulk fluid movement. Flow can be measured in a variety of ways. Positive-displacement flow meters accumulate a fixed volume of fluid and then count the number of times the volume is filled to measure flow. Other flow measurement methods rely on forces produced by the flowing stream as it overcomes a known constriction, to indirectly calculate flow. Flow may be measured by measuring the velocity of fluid over a known area. For very large flows, tracer methods may be used to deduce the flow rate from the change in concentration of a dye or radioisotope.
Accelerometer	An accelerometer is a device that measures proper acceleration. Proper acceleration, being the acceleration (or rate of change of velocity) of a body in its own instantaneous rest frame, is not the same as coordinate acceleration, being the acceleration in a fixed coordinate system. For example, an accelerometer at rest on the surface of the Earth will measure an acceleration due to Earth's gravity, straight upwards (by definition) of g ≈ 9.81 m/s2. By contrast, accelerometers in free fall (falling toward the centre of the Earth at a rate of about 9.81 m/s2) will measure zero. Accelerometers have multiple applications in industry and science. Highly sensitive accelerometers are components of inertial navigation systems for aircraft and missiles. Accelerometers are used to detect and monitor vibration in rotating machinery. Accelerometers are used in tablet computers and digital cameras so that images on screens are always displayed upright.

Accelerometers are used in drones for flight stabilisation. Coordinated accelerometers can be used to measure differences in proper acceleration, particularly gravity, over their separation in space; i.e., gradient of the gravitational field. This gravity gradiometry is useful because absolute gravity is a weak effect and depends on local density of the Earth which is quite variable.

Single- and multi-axis models of accelerometer are available to detect magnitude and direction of the proper acceleration, as a vector quantity, and can be used to sense orientation (because direction of weight changes), coordinate acceleration, vibration, shock, and falling in a resistive medium (a case where the proper acceleration changes, since it starts at zero, then increases). Micromachined microelectromechanical systems (MEMS) accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.

Thermistor	A thermistor is a type of resistor whose resistance is dependent on temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors (negative temperature coefficient or NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements (positive temperature coefficient or PTC type typically). Thermistors are of two opposite fundamental types: With NTC thermistors, resistance decreases as temperature rises. An NTC is commonly used as a temperature sensor, or in series with a circuit as an inrush current limiter. With PTC thermistors, resistance increases as temperature rises. PTC thermistors are commonly installed in series with a circuit, and used to protect against overcurrent conditions, as resettable fuses. Thermistors differ from resistance temperature detectors (RTDs) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The thermistors are in the form of beads, rods and discs but RTDs are in different shapes and sizes. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a greater precision within a limited temperature range, typically −90 °C to 130 °C.
Resistance Temperature Detector (RTD)	Resistance thermometers, also called resistance temperature detectors (RTDs), are sensors used to measure temperature. Many RTD elements consist of a length of fine wire wrapped around a ceramic or glass core but other constructions are also used. The RTD wire is a pure material, typically platinum, nickel, or copper. The material has an accurate resistance/temperature relationship which is used to provide an indication of temperature. As RTD elements are fragile, they are often housed in protective probes. RTDs, which have higher accuracy and repeatability, are slowly replacing thermocouples in industrial applications below 600 °C.
Magnetometer	A magnetometer or magnetic sensor is an instrument that measures magnetism—either the magnetization of a magnetic material like a ferromagnet, or the direction, strength, or relative change of a magnetic field at a particular location. A compass is a simple type of magnetometer, one that measures the direction of an ambient magnetic field. The first magnetometer capable of measuring the absolute magnetic intensity was invented by Carl Friedrich Gauss in 1833 and notable developments in the 19th century included the Hall effect, which is still widely used. Magnetometers are widely used for measuring the Earth's magnetic field and in geophysical surveys to detect magnetic anomalies of various types. They are also used in the military to detect submarines. Consequently, some countries, such as the United States, Canada and Australia, classify the more sensitive magnetometers as military technology, and control their distribution. Magnetometers can be used as metal detectors: they can detect only magnetic (ferrous) metals, but can detect such metals at a much larger depth than conventional metal detectors; they are capable of detecting large objects, such as cars, at tens of metres, while a metal detector's range is rarely more than 2 metres. In recent years, magnetometers have been miniaturized to the extent that they can be incorporated in integrated circuits at very low cost and are finding increasing use as miniaturized compasses (MEMS magnetic field sensor).

Hygrometer	A hygrometer is an instrument used for measuring the amount of humidity and water vapour in the atmosphere, in soil, or in confined spaces. Humidity measurement instruments usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed. By calibration and calculation, these measured quantities can lead to a measurement of humidity. Modern electronic devices use temperature of condensation (the dew point), or changes in electrical capacitance or resistance to measure humidity differences. The first crude hygrometer was invented by the Italian Renaissance polymath Leonardo da Vinci in 1480 and a more modern version was created by Swiss polymath Johann Heinrich Lambert in 1755. The maximum amount of water vapour that can be held in a given volume of air (saturation) varies greatly by temperature; cold air can hold less mass of water per unit volume than hot air. Most instruments respond to (or are calibrated to read) relative humidity (RH), which is the amount of water relative to the maximum at a particular temperature expressed as per cent.
Photo Resistor	A photoresistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits. A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as several megohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, for example, silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.

Antennas

Elemental Dipole	In radio and telecommunications a dipole antenna or doublet is the simplest and most widely used class of antenna. The dipole is any one of a class of antennas producing a radiation pattern approximating that of an elementary electric dipole with a radiating structure supporting a line current so energized that the current has only one node at each end. A dipole antenna commonly consists of two identical conductive elements such as metal wires or rods. The driving current from the transmitter is applied, or for receiving antennas the output signal to the receiver is taken, between the two halves of the antenna. A common example of a dipole is the "rabbit ears" television antenna found on broadcast television sets. The dipole is the simplest type of antenna from a theoretical point of view. Most commonly it consists of two conductors of equal length oriented end-to-end with the feedline connected between them.
Yagi	A Yagi–Uda antenna, commonly known as a Yagi antenna, is a directional antenna consisting of multiple parallel elements in a line, usually half-wave dipoles made of metal rods. Yagi–Uda antennas consist of a single driven element connected to the transmitter or receiver with a transmission line, and additional "parasitic elements" which are not connected to the transmitter or receiver: a so-called reflector and one or more directors. The reflector element is slightly longer than the driven dipole, whereas the directors are a little shorter. The parasitic elements absorb and reradiate the radio waves from the driven element with a different phase, modifying the dipole's radiation pattern. The waves from the multiple elements superpose and interfere to enhance radiation in a single direction, achieving a very substantial increase in the antenna's gain compared to a simple dipole.

Also called a "beam antenna", or "parasitic array", the Yagi is very widely used as a high-gain antenna on the HF, VHF and UHF bands. It has moderate to high gain which depends on the number of elements used, typically limited to about 20 dBi, linear polarization, unidirectional (end-fire) beam pattern with high front-to-back ratio of up to 20 db. and is lightweight, inexpensive and simple to construct.

The bandwidth of a Yagi antenna, the frequency range over which it has high gain, is narrow, a few percent of the centre frequency, and decreases with increasing gain, so it is often used in fixed-frequency applications. The largest and best-known use is as rooftop terrestrial television antennas, but it is also used for point-to-point fixed communication links, in radar antennas, and for long distance shortwave communication by shortwave broadcasting stations and radio amateurs.

Phased Array	In antenna theory, a phased array usually means an electronically scanned array, a computer-controlled array of antennas which creates a beam of radio waves that can be electronically steered to point in different directions without moving the antennas. In an array antenna, the radio frequency current from the transmitter is fed to the individual antennas with the correct phase relationship so that the radio waves from the separate antennas add together to increase the radiation in a desired direction, while cancelling to suppress radiation in undesired directions. In a phased array, the power from the transmitter is fed to the antennas through devices called phase shifters, controlled by a computer system, which can alter the phase electronically, thus steering the beam of radio waves to a different direction.

Since the array must consist of many small antennas (sometimes thousands) to achieve high gain, phased arrays are mainly practical at the high frequency end of the radio spectrum, in the UHF and microwave bands, in which the antenna elements are conveniently small. Phased arrays were invented for use in military radar systems, to scan the radar beam quickly across the sky to detect planes and missiles. These phased array radar systems are now widely used, and phased arrays are spreading to civilian applications.

The phased array principle is also used in acoustics, and phased arrays of acoustic transducers are used in medical ultrasound imaging scanners (phased array ultrasonics), oil and gas prospecting (reflection seismology), and military sonar systems. The term is also used to a lesser extent for unsteered array antennas in which the phase of the feed power and thus the radiation pattern of the antenna is fixed. For example, AM broadcast radio antennas consisting of multiple mast radiators fed so as to create a specific radiation pattern are also called "phased arrays".

Loop Antenna	A loop antenna is a radio antenna consisting of a loop or coil of wire, tubing, or other electrical conductor usually fed by a balanced source or feeding a balanced load. Within this physical description there are two distinct antenna types. The large self-resonant loop antenna has a circumference close to one wavelength of the operating frequency and so is resonant at that frequency. This category also includes smaller loops 5% to 30% of a wavelength in circumference, which use a capacitor to make them resonant. These antennas are used for both transmission and reception. In contrast, small loop antennas less than 1% of a wavelength in size are very inefficient radiators, and so are only used for reception. An example is the ferrite (loopstick) antenna used in most AM broadcast radios. Loop antennas have a dipole radiation pattern; they are most sensitive to radio waves in two broad lobes in opposite directions, 180° apart. Due to this directional pattern they are used for radio direction finding (RDF), to locate the position of a transmitter.

Parabolic Dish	A parabolic (or paraboloid or paraboloidal) reflector (or dish or mirror) is a reflective surface used to collect or project energy such as light, sound, or radio waves. Its shape is part of a circular paraboloid, that is, the surface generated by a parabola revolving around its axis. The parabolic reflector transforms an incoming plane wave travelling along the axis into a spherical wave converging toward the focus. Conversely, a spherical wave generated by a point source placed in the focus is reflected into a plane wave propagating as a collimated beam along the axis. Parabolic reflectors are used to collect energy from a distant source (for example sound waves or incoming star light). Since the principles of reflection are reversible, parabolic reflectors can also be used to focus radiation from an isotropic source into a narrow beam. In optics, parabolic mirrors are used to gather light in reflecting telescopes and solar furnaces, and project a beam of light in flashlights, searchlights, stage spotlights, and car headlights. In radio parabolic antennas are used to radiate a narrow beam of radio waves for point-to-point communications in satellite dishes and microwave relay stations, and to locate aircraft, ships, and vehicles in radar sets. In acoustics, parabolic microphones are used to record faraway sounds such as bird calls, in sports reporting, and to eavesdrop on private conversations in espionage and law enforcement.
Log-Periodic Dipole Array	A log-periodic antenna (LP), also known as a log-periodic array or log-periodic aerial, is a multi-element, directional antenna designed to operate over a wide band of frequencies. The most common form of log-periodic antenna is the log-periodic dipole array or LPDA, The LPDA consists of a number of half-wave dipole driven elements of gradually increasing length, each consisting of a pair of metal rods. The dipoles are mounted close together in a line, connected in parallel to the feedline with alternating phase. Electrically, it simulates a series of two or three-element Yagi antennas connected together, each set tuned to a different frequency. LPDA antennas look somewhat similar to Yagi antennas, in that they both consist of dipole rod elements mounted in a line along a support boom, but they work in very different ways. Adding elements to a Yagi increases its directionality, or gain, while adding elements to a LPDA increases its frequency response, or bandwidth. One large application for LPDAs is in rooftop terrestrial television antennas, since they must have large bandwidth to cover the wide television bands of roughly 54–88 and 174–216 MHz in the VHF and 470–890 MHz in the UHF while also having high gain for adequate fringe reception. One widely used design for television reception combined a Yagi for UHF reception in front of a larger LPDA for VHF.
Biconical	In radio systems, a biconical antenna is a broad-bandwidth antenna made of two roughly conical conductive objects, nearly touching at their points. Biconical antennas are broadband dipole antennas, typically exhibiting a bandwidth of three octaves or more. A common subtype is the bowtie antenna, essentially a two-dimensional version of the biconial design which is often used for short-range UHF television reception. These are also sometimes referred to as butterfly antennas. The biconical antenna has a broad bandwidth because it is an example of a travelling wave structure; the analysis for a theoretical infinite antenna resembles that of a transmission line. For an infinite antenna, the characteristic impedance at the point of connection is a function of the cone angle only and is independent of the frequency. Practical antennas have finite length and a definite resonant frequency. A simple conical monopole antenna is a wire approximation of the solid biconical antenna and has increased bandwidth (over a simple monopole). Biconical (or "bicon") antennas are often used in electromagnetic interference (EMI) testing either for immunity testing, or emissions testing.
Feedhorn	In parabolic antennas such as satellite dishes, a feed horn (or feedhorn) is a small horn antenna used to convey radio waves between the transmitter and/or receiver and the parabolic reflector. In transmitting antennas, it is connected to the transmitter and converts the radio frequency alternating current from the transmitter to radio waves and feeds them to the rest of the antenna, which focuses them into a beam. In receiving antennas, incoming radio waves are gathered and focused by the antenna's reflector on the feed horn, which converts them to a tiny radio frequency voltage which is amplified by the receiver. Feed horns are used mainly at microwave (SHF) and higher frequencies. The feedhorn also selects the polarization of the waves to be received, which helps to attenuate unwanted signals from adjacent channels and transponders, and from other communications satellites at nearby orbital positions.

This can be either horizontal or vertical if the polarization is linear, or clockwise or counter clockwise (also called left- and right-handed) if it is circular. Certain devices can also allow a feedhorn to accept both linear and circular, though these cause a slight insertion loss to all incoming signals. When used with a parabolic reflector or lens antenna, the phase centre of the horn is usually placed at the focal point of the reflector, with the 3 dB points of the horn's radiation pattern set to be at the edge of the reflector.

On a satellite dish, the feedhorn is what is mounted at the end of a mast from the centre of the dish, or on tripod legs mounted to the edge of the dish. In satellite dishes, part of the receiver electronics, the RF front end, is usually mounted in a box just behind the feed horn. This converts the high satellite microwave downlink frequencies to a lower frequency so it can be more easily sent through the coaxial cable feedline to the receiver inside the building.

Assemblies, Modules

Oscillator	An electronic oscillator is an electronic circuit that produces a periodic, oscillating electronic signal, often a sine wave or a square wave. Oscillators convert direct current (DC) from a power supply to an alternating current (AC) signal. They are widely used in many electronic devices. Common examples of signals generated by oscillators include signals broadcast by radio and television transmitters, clock signals that regulate computers and quartz clocks, and the sounds produced by electronic beepers and video games. Oscillators are often characterized by the frequency of their output signal. A low-frequency oscillator (LFO) is an electronic oscillator that generates a frequency below approximately 20 Hz. An audio oscillator produces frequencies in the audio range, about 16 Hz to 20 kHz. An RF oscillator produces signals in the radio frequency (RF) range of about 100 kHz to 100 GHz. Oscillators designed to produce a high-power AC output from a DC supply are usually called inverters.	
Digital Voltmeters	A digital voltmeter (DVM) measures an unknown input voltage by converting the voltage to a digital value and then displays the voltage in numeric form. DVMs are usually designed around a special type of analog-to-digital converter called an integrating converter. DVM measurement accuracy is affected by many factors, including temperature, input impedance, and DVM power supply voltage variations. Less expensive DVMs often have input resistance on the order of 10 MΩ. Precision DVMs can have input resistances of 1 GΩ or higher for the lower voltage ranges (e.g. less than 20 V). To ensure that a DVM's accuracy is within the manufacturer's specified tolerances, it must be periodically calibrated against a voltage standard such as the Weston cell.	
Filter	Electronic filters are circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones, or both. The most common types of electronic filters are linear filters, regardless of other aspects of their design. See the article on linear filters for details on their design and analysis.	**Filters Can Be** ● Passive or Active ● Analog or Digital ● High-pass, low-pass, band-pass, band-stop (band-rejection; notch), or all-pass. ● Discrete-time (sampled) or continuous-time ● Linear or non-linear ● Infinite impulse response (IIR type) or finite impulse response (FIR type)

Prototyping Aids

Wire-Wrap	Wire wrap was invented to wire telephone crossbar switches, and later adapted to construct electronic circuit boards. Electronic components mounted on an insulating board are interconnected by lengths of insulated wire run between their terminals, with the connections made by wrapping several turns of uninsulated sections of the wire around a component lead or a socket pin. Wires can be wrapped by hand or by machine, and can be hand-modified afterwards. Wire wrap construction can produce assemblies which are more reliable than printed circuits: connections are less prone to fail due to vibration or physical stresses on the base board, and the lack of solder precludes soldering faults such as corrosion, cold joints and dry joints.
Breadboard	A breadboard is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

Electromechanical

Piezoelectric Devices, Crystals, Resonators

Crystal	A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency. This frequency is often used to keep track of time, as in quartz wristwatches, to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.	
Ceramic Resonator	A ceramic resonator is an electronic component consisting of a piece of a piezoelectric ceramic material with two or more metal electrodes attached. When connected in an electronic oscillator circuit, resonant mechanical vibrations in the device generate an oscillating signal of a specific frequency. Like the similar quartz crystal, they are used in oscillators for purposes such as generating the clock signal used to control timing in computers and other digital logic devices. The thickness of the ceramic substrate determines the resonant frequency of the device. A typical ceramic resonator package has either two or three connections. They come in both surface-mount and through-hole varieties with a number of different footprints. The oscillation takes place across two of the pins (connections). The third pin (if present; typically the centre pin) is connected to ground. Ceramic resonators can be used as the source of the clock signal for digital circuits such as microprocessors where the frequency accuracy is not critical. Quartz has a 0.001% frequency tolerance, while PZT has a 0.5% tolerance. They are used in timing circuitry for a wide array of applications such as TVs, VCRs, automotive electronic devices, telephones, cameras, communication equipment, remote controls and toys. A ceramic resonator is often used in place of quartz crystals as a reference clock or signal generator in electronic circuitry due to its low cost and smaller size.	
Surface Acoustic Qave (SAW) Filters	Electronic filters are circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones, or both. The most common types of electronic filters are linear filters, regardless of other aspects of their design. See the article on linear filters for details on their design and analysis.	**Electronic Filters** ● Passive or Active ● Analog or Digital ● High-pass, low-pass, band-pass, band-stop (band-rejection; notch), or all-pass. discrete-time (sampled) or continuous-time ● Linear or Non-Linear
Ultrasonic Motor	An ultrasonic motor is a type of electric motor powered by the ultrasonic vibration of a component, the stator, placed against another component, the rotor or slider depending on the scheme of operation (rotation or linear translation). Ultrasonic motors differ from piezoelectric actuators in several ways, though both typically use some form of piezoelectric material, most often lead zirconate titanate and occasionally lithium niobate or other single-crystal materials.	

Terminals / Connectors

Terminal	A terminal is the point at which a conductor from an electrical component, device or network comes to an end and provides a point of connection to external circuits. A terminal may simply be the end of a wire or it may be fitted with a connector or fastener. In network analysis, terminal means a point at which connections can be made to a network in theory and does not necessarily refer to any real physical object. In this context, especially in older documents, it is sometimes called a pole. The connection may be temporary, as seen in portable equipment, may require a tool for assembly and removal, or may be a permanent electrical joint between two wires or devices. All electric cells have two terminals. The first is the positive terminal and the second is the negative terminal. The positive terminal looks like a metal cap and the negative terminal looks like a metal disc. The current flows from the positive terminal, and out through the negative terminal, replicative of current flow (positive (+) to negative (-) flow).	**Terminal Types** ● Splices ● Cups ● Hooks ● Solder Lugs ● Tongue Crimp terminals (ring terminals) ● Turrets ● Test probes (pogo terminals) ● Clips ● Screw terminals
Connector	An electrical connector, is an electro-mechanical device used to join electrical terminations and create an electrical circuit. Electrical connectors consist of plugs (male-ended) and jacks (female-ended). The connection may be temporary, as for portable equipment, require a tool for assembly and removal, or serve as a permanent electrical joint between two wires or devices. An adapter can be used to effectively bring together dissimilar connectors. Hundreds of types of electrical connectors are manufactured for power, signal and control applications. Connectors may join two lengths of flexible copper wire or cable, or connect a wire or cable to an electrical terminal. In computing, an electrical connector can also be known as a physical interface (compare physical layer in OSI model of networking). Cable glands, known as cable connectors in the US, connect wires to devices mechanically rather than electrically and are distinct from quick-disconnects performing the latter.	
Socket	Plug and socket connectors are usually made up of a male plug (typically pin contacts) and a female receptacle (typically socket contacts) Jack commonly refers to a connector often with the female electrical contact or socket, and is the "more fixed" connector of a connector pair. Plug commonly refers to a movable connector, often (but not always) with the male electrical contact or pin, and is the movable (less fixed) connector of a connector pair. Some connector styles may contain both pin and socket connection types. Plugs generally have one or more pins or prongs that are inserted into openings in the mating socket. The connection between the mating metal parts must be sufficiently tight to make a good electrical connection and complete the circuit. When working with multi-pin connectors, it is helpful to have a pinout diagram to identify the wire or circuit node connected to each pin.	

ELECTRICITY	Componentry	Electromechanical Components	Terminals / Connectors	**Screw Terminal, Terminal Blocks**	A screw terminal is a type of electrical connector where a wire is held by the tightening of a screw. The wire may be wrapped directly under the head of a screw, may be held by a metal plate forced against the wire by a screw, or may be held by what is, in effect, a set screw in the side of a metal tube. The wire may be directly stripped of insulation and inserted under the head of a screw or into the terminal. Otherwise, it may be either inserted first into a ferrule, which is then inserted into the terminal, or else attached to a connecting lug. which is then fixed under the screw head. Screw terminals are used extensively in building wiring for the distribution of electricity - connecting electrical outlets, luminaires and switches to the mains, and for directly connecting major appliances such as clothes dryers and ovens drawing in excess of 15 amperes.
				Pin Header	A pin header (often abbreviated as PH, or simply header) is a form of electrical connector. It consists of one or more rows of male pins typically spaced 2.54 millimetres (0.1 in) apart. The distance between pins is commonly referred as pitch in the electronic community. Pin headers are often associated with ribbon cable connectors, pin headers often also function as recipients for jumpers. The most common jumper spacing is 2.54 millimetres (0.1 in), though 2.0 millimetres (0.079 in) is sometimes used in smaller products.
ELECTRICITY	Componentry		Cable	**Cable Assemblies**	
ELECTRICITY	Componentry	Electromechanical Components	Cable Assemblies	**Power Cord**	A power cord, line cord, or mains cable is an electrical cable that temporarily connects an appliance to the mains electricity supply via a wall socket or extension cord. The terms are generally used for cables using a power plug to connect to a single-phase alternating current power source at the local line voltage—(generally 100 to 240 volts, depending on the location). The terms power cable, mains lead, flex or kettle lead are also used.
				Patch Cord	A patch cable, patch cord or patch lead is an electrical or optical cable used to connect ("patch in") one electronic or optical device to another for signal routing. Devices of different types (e.g., a switch connected to a computer, or a switch to a router) are connected with patch cords. Patch cords are usually produced in many different colours so as to be easily distinguishable, and are relatively short, perhaps no longer than two metres. Types of patch cords include microphone cables, headphone extension cables, XLR connector, Tiny Telephone (TT) connector, RCA connector and ¼" TRS phone connector cables (as well as modular Ethernet cables), and thicker, hose-like cords (snake cable) used to carry video or amplified signals. A patch cord cable differs from a standard structured cabling in that a patch cable is stranded for flexibility, whereas a standard cable is solid copper. As length increases, the cables are usually thicker and/or made with more shielding, to prevent signal loss (attenuation) and the introduction of unwanted radio frequencies and hum (electromagnetic interference). Patch cords are often made of coaxial cables, with the signal carried through a shielded core, and the electrical ground or earthed return connection carried through a wire mesh surrounding the core. Each end of the cable is attached to a connector so that the cord may be plugged in.
				Test Lead	A test probe is a physical device used to connect electronic test equipment to a device under test (DUT). Test probes range from very simple, robust devices to complex probes that are sophisticated, expensive, and fragile. Specific types include test prods, oscilloscope probes and current probes. A test probe is often supplied as a test lead, which includes the probe, cable and terminating connector.
				Switches	
ELECTRICITY	Componentry	Electromechanical Components	Switches	**Switch**	In electrical engineering, a switch is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch removes or restores the conducting path in a circuit when it is operated. It may be operated manually, for example, a light switch or a keyboard button, may be operated by a moving object such as a door, or may be operated by some sensing element for pressure, temperature or flow. A switch will have one or more sets of contacts, which may operate simultaneously, sequentially, or alternately. Switches in high-powered circuits must operate rapidly to prevent destructive arcing, and may include special features to assist in rapidly interrupting a heavy current. Multiple forms of actuators are used for operation by hand or to sense position, level, temperature or flow. Special types are used, for example, for control of machinery, to reverse electric motors, or to sense liquid level. Many specialized forms exist. A common use is control of lighting, where multiple switches may be wired into one circuit to allow convenient control of light fixtures.
			Switches	**Keypad**	A keypad is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters. Pads mostly containing numbers are called a numeric keypad. Numeric keypads are found on alphanumeric keyboards and on other devices which require mainly numeric input such as calculators, push-button telephones, vending machines, ATMs, Point of Sale devices, combination locks, and digital door locks. Many devices follow the E.161 standard for their arrangement.
ELECTRICITY	Componentry	Electromechanical Components	Switches	**DIP Switch**	A DIP switch is a manual electric switch that is packaged with others in a group in a standard dual in-line package (DIP). The term may refer to each individual switch, or to the unit as a whole. This type of switch is designed to be used on a printed circuit board along with other electronic components and is commonly used to customize the behaviour of an electronic device for specific situations. DIP switches are an alternative to jumper blocks. Their main advantages are that they are quicker to change and there are no parts to lose. There are many different kinds of DIP switches. Some of the most common are the slide, rocker, piano (side), and rotary types. Rotary DIP switches contain multiple electrical contacts, one of which is selected by rotating the switch to align it with a number printed on the package. These may be large like thumbwheels, or so small that a screwdriver must be used to change them (although there are also small potentiometers of this type). The slide and rocker types, which are very common, are arrays of simple single pole, single throw (SPST) contacts, which can be either on or off.
ELECTRICITY	Componentry	Electromechanical Components	Switches	**Relay**	A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

Thermostat	A thermostat is a component which senses the temperature of a physical system and performs actions so that the system's temperature is maintained near a desired setpoint. Thermostats are used in any device or system that heats or cools to a setpoint temperature, examples include building heating, central heating, air conditioners, HVAC systems, water heaters, as well as kitchen equipment including ovens and refrigerators and medical and scientific incubators. In scientific literature, these devices are often broadly classified as thermostatically controlled loads (TCLs). Thermostatically controlled loads comprise roughly 50% of the overall electricity demand in the United States. A thermostat operates as a "closed loop" control device, as it seeks to reduce the error between the desired and measured temperatures. Sometimes a thermostat combines both the sensing and control action elements of a controlled system, such as in an automotive thermostat.
Humidistat	A humidistat is an electronic device analogous to a thermostat but which responds to relative humidity, not temperature. Humidistats are used in a number of devices including dehumidifiers, humidifiers, and microwave ovens. In humidifiers and dehumidifiers the humidistat is used where constant relative humidity conditions need to be maintained such as a refrigerator, greenhouse, or climate-controlled warehouse. When adjusting the controls in these applications the humidistat would be what is being set. In microwaves they are used in conjunction with "smart cooking" one-button features such as those for microwave popcorn. Humidistats employ hygrometers but are not the same. A humidistat has the functionality of a switch and is not just a measuring instrument like a hygrometer is. For heating, ventilation, and air conditioning (HVAC) of buildings, humidistats or humidity sensors are used to sense the air relative humidity in the controlled space and turn on and off the HVAC equipment.

Protection Devices

Fuse	In electronics and electrical engineering, a fuse is an electrical safety device that operates to provide overcurrent protection of an electrical circuit. Its essential component is a metal wire or strip that melts when too much current flows through it, thereby interrupting the current. It is a sacrificial device; once a fuse has operated it is an open circuit, and it must be replaced or rewired, depending on type. Fuses have been used as essential safety devices from the early days of electrical engineering. Today there are thousands of different fuse designs which have specific current and voltage ratings, breaking capacity and response times, depending on the application. The time and current operating characteristics of fuses are chosen to provide adequate protection without needless interruption. Wiring regulations usually define a maximum fuse current rating for particular circuits. Short circuits, overloading, mismatched loads, or device failure are the prime reasons for fuse operation. A fuse is an automatic means of removing power from a faulty system; often abbreviated to ADS (Automatic Disconnection of Supply). Circuit breakers can be used as an alternative to fuses, but have significantly different characteristics.
Circuit Breaker	A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. Circuit breakers are made in varying sizes, from small devices that protect low-current circuits or individual household appliance, up to large switchgear designed to protect high voltage circuits feeding an entire city. The generic function of a circuit breaker, RCD or a fuse, as an automatic means of removing power from a faulty system is often abbreviated as OCPD (Over Current Protection Device).
Resettable Fuse	A resettable fuse is a polymeric positive temperature coefficient (PPTC) device that is a passive electronic component used to protect against overcurrent faults in electronic circuits. The device is also known as a multifuse or polyfuse or polyswitch. They are similar in function to PTC thermistors in certain situations but operate on mechanical changes instead of charge carrier effects in semiconductors.
Ground-Fault Protection / Residual-Current Device	A residual-current device (RCD), or residual-current circuit breaker (RCCB), is a device that instantly breaks an electric circuit to prevent serious harm from an ongoing electric shock. Injury may still occur in some cases, for example if a human falls after receiving a shock. These electrical wiring devices are designed to quickly and automatically disconnect a circuit when it detects that the electric current is not balanced between the supply and return conductors of a circuit. Any difference between the currents in these conductors indicates leakage current, which presents a shock hazard. Current of around 30 mA (0.030 amperes) through the human body is potentially sufficient to cause cardiac arrest or serious harm if it persists for more than a small fraction of a second. RCDs are designed to disconnect the conducting wires ("trip") quickly enough to prevent serious injury. An RCD does not provide protection against overcurrent (overload) or short circuit in the circuit, and so cannot replace a fuse. RCDs are often integrated with some kind of circuit breaker, such as a fuse or miniature circuit breaker (MCB), which protects against excess current in the circuit. RCDs also cannot detect a human accidentally touching both conductors at the same time. RCDs are testable and resettable devices.
Inrush Current Limiter	An inrush current limiter is a component used to limit inrush current to avoid gradual damage to components and avoid blowing fuses or tripping circuit breakers. Negative temperature coefficient (NTC) thermistors and fixed resistors are often used to limit inrush current. NTC thermistors can be used as inrush-current limiting devices in power supply circuits when added in series with the circuit being protected. They present a higher resistance initially, which prevents large currents from flowing at turn-on. As current continues to flow, NTC thermistors heat up, allowing higher current flow during normal operation. NTC thermistors are usually much larger than measurement type thermistors, and are purposely designed for power applications.
Lightning Arrester	A lightning arrester (alternative spelling lightning arrestor) (also called lightning diverter) is a device used on electric power systems and telecommunication systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a high-voltage terminal and a ground terminal. When a lightning surge (or switching surge, which is very similar) travels along the power line to the arrester, the current from the surge is diverted through the arrester, in most cases to earth. In telegraphy and telephony, a lightning arrester is placed where wires enter a structure, preventing damage to electronic instruments within and ensuring the safety of individuals near them. Smaller versions of lightning arresters, also called surge protectors, are devices that are connected between each electrical conductor in power and communications systems and the Earth.

These prevent the flow of the normal power or signal currents to ground, but provide a path over which high-voltage lightning current flows, bypassing the connected equipment. Their purpose is to limit the rise in voltage when a communications or power line is struck by lightning or is near to a lightning strike. If protection fails or is absent, lightning that strikes the electrical system introduces thousands of kilovolts that may damage the transmission lines, and can also cause severe damage to transformers and other electrical or electronic devices.

Lightning-produced extreme voltage spikes in incoming power lines can damage electrical home appliances. Lightning arresters are used to protect electric fences. They consist of a spark gap and sometimes a series inductor. Lightning arresters can form part of large electrical transformers and can fragment during transformer ruptures.

Other

Printed Circuit Boards	A printed circuit board (PCB) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it. Printed circuit boards are used in all but the simplest electronic products. PCBs require additional design effort to lay out the circuit, but manufacturing and assembly can be automated. Mass-producing circuits with PCBs is cheaper and faster than with other wiring methods, as components are mounted and wired in one operation. Large numbers of PCBs can be fabricated at the same time, and the layout only has to be done once.

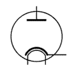
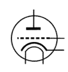
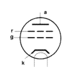
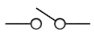
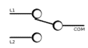
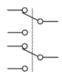
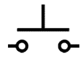
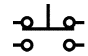
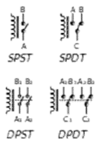
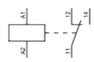
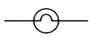
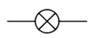
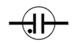
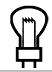
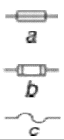
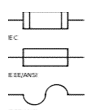
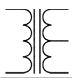
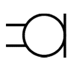
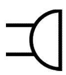
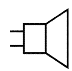
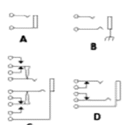
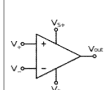
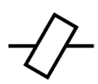
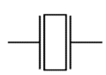
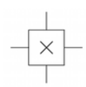
PCBs can also be made manually in small quantities, with reduced benefits. PCBs can be single-sided (one copper layer), double-sided (two copper layers on both sides of one substrate layer), or multi-layer (outer and inner layers of copper, alternating with layers of substrate). Multi-layer PCBs allow for much higher component density, because circuit traces on the inner layers would otherwise take up surface space between components.

The rise in popularity of multilayer PCBs with more than two, and especially with more than four, copper planes was concurrent with the adoption of surface mount technology. However, multilayer PCBs make repair, analysis, and field modification of circuits much more difficult and usually impractical.

Lamp	An electric light is a device that produces visible light from electric current. It is the most common form of artificial lighting and is essential to modern society, providing interior lighting for buildings and exterior light for evening and night time activities. In technical usage, a replaceable component that produces light from electricity is called a lamp. Lamps are commonly called light bulbs; for example, the incandescent light bulb. Lamps usually have a base made of ceramic, metal, glass or plastic, which secures the lamp in the socket of a light fixture. The electrical connection to the socket may be made with a screw-thread base, two metal pins, two metal caps or a bayonet cap. The three main categories of electric lights are incandescent lamps, which produce light by a filament heated white-hot by electric current, gas-discharge lamps, which produce light by means of an electric arc through a gas, and LED lamps, which produce light by a flow of electrons across a band gap in a semiconductor.

Component Symbols

Traces	IEC-Style Trace Junction	Trace Crossing								
Circuit Return	IEC-Style Ground (GND) Symbol	Signal/Low Noise Ground (GND) Symbol	IEC-Style Chassis-Ground Symbol							
Sources	Single Cell, Multi-Cell Battery	Battery, Multi-Cell	Voltage Source	Controlled Voltage Source	Current Source	Controlled Current Source	AC Voltage Source			
Resistors	a b c		(a) Resistor (b) Rheostat (Variable Resistor) (c) potentiometer (All of them are American style symbols)		a b c		(a) Resistor (b) Rheostat (Variable Resistor) (c) potentiometer (All of them are IEC style symbols)		Thermistor	
Capacitors	IEC-Style Capacitor, General Symbol	Capacitor, Polarized (American)	Capacitor, Variable	IEC-Style Ganged (Co-Moving) Variable Capacitors	Trimmer Capacitor					
Inductors	IEC-Style Air-Cored Inductor	Inductor with Magnetic Core (IEEE Std 315)	IEC-Style Tapped Inductor							
Transistors (Unipolar)	N-Channel Junction Gate Field-Effect Transistor (JFET) G D S	P-Channel Junction Gate Field-Effect Transistor (JFET) G D S	Metal-Oxide-Semiconductor Field-Effect Transistor	Enhancement Mode, N-Channel MOSFET	Enhancement Mode, P-Channel MOSFET					
Transistors (Bipolar)	NPN Bipolar Junction Transistor (BJT) B C E	PNP Bipolar Junction Transistor (BJT) B E C	NPN Darlington	PNP Darlington						
Diodes	Diode	Zener Diode	Tunnel Diode	Schottky Diode	Light Emitting Diode (LED)	Photodiode	Varicap	Shockley Diode Anode Cathode	Silicon-Controlled Rectifier (SCR)	Constant-Current Diode
Antennas	IEC-Style Antenna	IEC-Style Dipole Antenna	IEC-Style Loop Antenna	Loop Antenna						

Vacuum Tubes	Vacuum Tube Diode 	Vacuum Tube Triode 	Vacuum Tube Tetrode 	Vacuum Tube Pentode 		
Switches	Switch, Single Pole/Single Throw (SPST) 	Switch, Single Pole/Double Throw (SPDT) 	Switch, Double Pole/Double Throw (DPDT) 	Pushbutton, Momentary or Spring-Return, make 	Pushbutton, Momentary or Spring-Return, break 	Pushbutton, Momentary or Spring-Return, two circuit 
Relays	American-Style Relays 	IEC Relay Symbol, SPDT 				
Lamps	Indicating Lamp 	Incandescent Lamp 	Incandescent Light Bulb (as an indicator) 	Neon Lamp 	Light Bulb 	
Current Limiters	IEC Fuse 	Moulded Case Circuit Breaker (MCCB) 	Fuse: IEC (top) and American (lower two) 			
Transformers	Transformer with Centre Tap 	Transformer with Two Secondary Windings 	Current Transformer 	Zero-Sequence Current Transformer (ZSCT) 	Bushing-Type Current Transformer 	Voltage Transformer 
Electro-Acoustic Devices	IEC-Style Microphone 	Microphone 	Buzzer 	Loudspeaker 		
Miscellaneous Devices	Phone Jacks 		Operational Amplifier 	Ferrite Bead Ring (IEEE Std 315) 	Crystal Oscillator 	Hall Effect Sensor 

9 Repairs

These are the most common problems with electronic devices and ways you can fix them. Devices are sorted alphabetically.

Air Conditioner Repairs

Failed Capacitor

Problem Motors not running or compressor fails to start.	**Symptoms** Air con labours to start the compressor or tries but can't start it. The longer it takes to start up the more degraded the capacitor is.	**Cause** Most common cause of failure is the fan or compressor capacitor.	**Solution** Replacement capacitors may be difficult to salvage in SHTF due to needing to replace with an exact or very similar capacitor. Salvaging a similar one off another broken air conditioner should suffice. The failed air conditioner capacitor can either be a start motor or running motor one. Instead of replacing a start capacitor you can give the fan a push and see if it takes off.

Low Gas Levels

Problem There isn't enough gas in the system to cool the air.	**Symptoms** Air isn't very cold or there's no temperature change.	**Cause** The gas levels may drop over time and require re-gassing at this point.	**Solution** o

Inverter

Problem o	**Symptoms** o	**Cause** o	**Solution** o

Radio

How to fix bad reception or static from a radio.

Repositioning	The antenna may be in the wrong spot to receive a strong signal. Try moving it around or head to the top of a hill.
Longer Antenna	Lengthen the antenna by attaching another antenna or soldering a long wire to it.
Interference	Interference can be caused by anything with an electrical or magnetic current. Changing weather patterns can also cause problems with radio reception.
Distance	You may be too far from the transmitter and so the signal will be weak.

10 Schematics

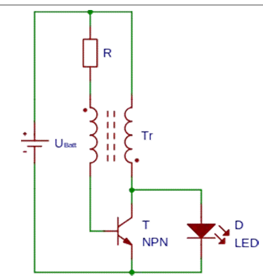
These are schematics which can be built to assist in your survival. Each schematic serves a different purpose and require varying degrees of components to build, some which may be difficult to find.

Joule Thief

Used for creating electricity from 'apparently dead' batteries by flashing the LED multiple times every second. This uses up any residual power which higher draw electronics are unable to use.

Materials
- LED
- 2N440 Transistor
- 1K Ohm Resistor (500-2Kohm)
- Insulated Wiring
- Dead Battery
- Toroidal Inductor

Method
1. Strip Toroidal Core of wires.
2. Pass both wires through the core with a little space leaving 3cm wire each end. Leave 1cm of core unwired.
3. Solder two strands from opposite sides together.
4. Solder the middle lead of the transistor to the resistor.
5. Solder the other resistor end to a wire from the core.
6. Separate transistor legs and solder LED to one leg.
7. Connect remaining core wire to positive LED leg.
8. Connect negative LED leg to battery.
9. Connect core wire to positive battery side.



If you don't know what a toroidal inductor is, it's those circular rings with wire wrapped around them multiple times which are commonly found on modern electronics.

Chlorine Producing Unit

Purifies water by generating chlorine using salt and electrolysis.

Materials
- 12v Battery
- Titanium Mesh Cathode
- Iridium/Ruthenium Metal Anode

Method
o

Using the Device
1. Mix salt & water solution (approx. ¼ cup salt to 16 oz water)
2. Connect wires to 12 volt source
3. Pour the saltwater solution through the CPU into another bottle (observe the bubbling process)
4. Carefully repeat the pour-through process 5 times. This is different from a chlorate cell as that the water free flows through the unit which does not allow chlorates or perchlorates to form. This process operates at a different voltage and a much lower temperature.
5. Unhook the battery wires.
6. Rinse the CPU by pouring clean water through it.
7. Add 10 drops of the solution for each gallon of drinking water.
8. Wait one hour before drinking.

One of the major obstacles has been finding appropriate electrodes to do the splitting, particularly the anode. Efficient electrodes exist, but they involve oxides of platinum group metals such as iridium or ruthenium to act as catalysts. Iridium costs more than half as much as gold, and even ruthenium is far too expensive for large-scale use. The anodes and cathodes can often be found in pool purification and chlorine systems as metal plates through which the water passes.

Colloidal Silver Generator

Generates a silver colloid (silver suspended in a liquid) from a piece of pure silver.

EMP Generator

EMP Generator (By Christopher Voute)
In this series, I'll be exploring electromagnetic weapons, how to build them, their function and application to the future, and the amazing possibilities electromagnetism has to offer. First, the electromagnetic pulse generator, or EMP. You've probably heard of these before, and their devastating effects on electronics. A simple EMP consists of a capacitor, transformer, trigger, and coil of copper wire. This, when triggered, would produce an intense magnetic field for a brief period, similar to a coil gun (see this article for more info). On a small scale, this would be enough to reset a calculator or electronic clock, but not enough to be of any use. However, it is quite easy to make a more effective one (at close range), with a few more components, and time. I'll be going over capacitors and transformers in this article, and discussing which are most applicable to an EMP.

Capacitors
There are many kinds of capacitors, but I'll categorize them in "electrolyte" and "non-electrolyte". In a way, capacitors are quite similar to batteries. They both store electrical energy; however, there is a major difference. That is, capacitors only STORE electrons, never produce them. In a battery, a chemical reaction between two terminals and an acidic solution PRODUCES electrons. Inside the capacitor, the terminals connect to two metal plates separated by a non-conducting substance, or dielectric. Its quite easy to make a capacitor from two pieces of aluminium foil and a piece of paper or plastic, like a leyden jar. Depending on the voltage rating and capacitance rating, capacitors can be a small as a grain of rice, or as large as a garbage can and bigger. For a practical DIY EMP, a simple 5000uf 400V capacitor (or capacitor bank) would be legitimate. There are two ways to create a capacitor bank; series or parallel. This article explains the differences in series and parallel quite well. A capacitor bank for an EMP should have capacitors linked together in parallel. This increases the capacitance and reduces electrolyte damage. For example, if you had six capacitors at 650uf 400V each in parallel, your final capacitance and voltage would be 3900uf 400V. The voltage does not change, but the capacitance increases. The image below is a circuit diagram representation of capacitors in parallel. Your capacitor bank should be similar (if not exact) in design. Also, keep in mind electrolyte capacitors have a positive and a negative (polarity). The white line on an electrolyte capacitor represents negative, ensure your capacitor bank has an orderly, constant polarity.

Transformers
Now you have the storage availability, what about filling it? For that, you'll need a transformer. A transformer takes electricity and basically shifts around the voltage: current ratio. In a transformer, there is generally a primary winding/coil, and a secondary winding/coil. They rarely are made up of exact gauge/number of windings, and usually contain a core made out of ferrite or metal. A transformer turns electricity into a magnetic field with a coil of copper, then back into electricity again using another coil. You'll need a fairly powerful high voltage transformer to fill your capacitor bank quickly, a MOT (microwave transformer) or ZVS flyback transformer would work nicely, if properly used (these are VERY DANGEROUS and can KILL YOU INSTANTLY). Of course, you'll need a DC voltage source to charge your capacitor bank, so ensure you have a diode (or similar rectification device). The two outside "humps" or coils represent inductors, and the centre portion represents a core. Most (all) flyback transformers have a ferrite core, and most MOTs have a steel or similar metal core. In this article, I'll be covering Triggers and Coils, part two of the series (see part one here). Generally, a simple EMP generator consists of four components; a capacitor, a transformer, a trigger and a coil of copper wire. The transformer component can be varied, but the coil is very important, and must be precisely tuned.

Triggers
Simply said, a trigger is basically a way of closing the circuit and allowing the energy stored in the capacitor(s) to flow through the coil and create the magnetic field. However, the trigger (or switch) must be capable of handling large loads of current. For example, imagine trying to cross a river by bridging it with a thin, weak stick vs a large tree. The bridge represents the switch, and you the load (current). Pretty simple, eh? Just bridging a circuit gap. In an EMP generator, the size and operation of the switch is proportional to the amount of current (basically how big your capacitor bank is) you are switching. If you followed my earlier article on capacitors and transformers, then your looking at a fairly big switch. Depending on the dimensions of your finished product (whether its a "gun shape" or simply a bench top experiment), you'll either want to use a relay and trigger switch, or just a relay. The relay should consist of a solenoid and two thick metal contacts that, when triggered, are "smashed" together by the solenoid, completing the circuit. As seen above, there are two very large conductive terminals encased in an acrylic case (spark/molten metal shield). When triggered, the linear actuator (most likely a solenoid) will smash these terminals together very quickly, completing the circuit and triggering the EMP generator.

Coils
Now here's the difficult part, the coil. Depending on your voltage, current, and size of your EMP generator, the coil could either be very big and effective, or very small and ineffective unless used at close range to target. A typical EMP generator doesn't require hundreds of windings, quite the opposite. Thick copper tubing works very effectively. In this case, a capacitor bank at 400v 4000uf would need a coil of medium sized copper tubing and probably 8 to 12 turns (or windings). I've experimented with different coil formations, and the "inclined plain wrapped helically around an axis" works best, in other words, the picture above. However, feel free to experiment with different coil formations and an (old) calculator. Set a constant (distance from calculator) and voltage, then change the coil layout until the calculator stops working.

Warnings
- The electricity discussed in this article is more than enough to literally fry you to a crisp. Be extremely careful! I cannot stress this enough.
- When testing an EMP generator, be sure to keep all valuable electronics away! It could potentially (more than likely) destroy them.
- I am not responsible for any damage you cause!
- DO NOT use this as a weapon and/or to destroy electronics you do not own!

11 Generators

Petrol Generator

Small and very quiet generator, easily portable. Can usually power up to 550W of equipment. Can last up to 1000 hours if well maintained.

Diesel Generator

Diesel Generator 6-15kVA
Perfect if you make your own Biodiesel at home and require power. Standard generator for when mains isn't accessible or reliable. Requires minor maintenance with air filters, fuel filters and oil filters.

Noise reduction highly recommended.
Industrial: 78db @ 7m
Residential L1: 63db @ 7m
Residential L2: 58db @ 7m

Diesel Generator 20-300kVA
For use at 150m ASL and 30°C (86°F) ambient.

Gas Generator

Current Modification

Any way that an electrical current can be modified and therefore change its uses.

DC > AC (Inverter)	Inverter, Lets you power 240v equipment from 12v source. Not recommended to have 240v appliances off-grid as they will sap energy. Use the inverter occasionally when needed for high-power devices for short periods. Connected leads between the battery and inverter should be as short as possible to minimise loss and voltage reduction. Inverter efficiency should be > 90%.
AC > DC (Rectifier)	Rectifier, Lets you power 12v equipment from a 240v source.
Voltage Stabiliser	Placed in front of a UPS to stabilise fluctuating AC current for sensitive equipment.
UPS	Uninterrupted Power Supply, To back up the power supply of 240v equipment with an independent power source.

12 Power Transmission

Transmission lines carry electric energy from one point to another in an electric power system. They can carry alternating current or direct current or a system can be a combination of both. Also, electric current can be carried by either overhead or underground lines. The main characteristics that distinguish transmission lines from distribution lines are that they are operated at relatively high voltages, they transmit large quantities of power and they transmit the power over large distances.

Overhead Power Lines

Low Voltage (LV) Distribution Lines	Less than 1,000 volts, used for connection between a residential or small commercial customer and the utility.
Medium Voltage (MV) Subtransmission / Distribution Lines	Between 1,000 volts (1 kV) and 69 kV, used for distribution in urban and rural areas.
High Voltage (HV) Subtransmission Lines	Subtransmission or transmission at voltages such as 115 kV and 138 kV), used for sub-transmission and transmission of bulk quantities of electric power and connection to very large consumers.
Extra High Voltage (EHV)	From 345 kV, up to about 800 kV, used for long distance, very high power transmission.
Ultra High Voltage (UHV)	800 kV+.

Line Conductors

Power Line Materials
- Copper
- Aluminium
- Steel

Solid Conductor	A single conductor of solid circular section
Stranded Conductor	A group of wires made into a single conductor

Other Lines

Overhead AC Lines	These share one characteristic; they carry 3-phase current. The voltages vary according to the particular grid system they belong to. Transmission voltages vary from 69 Tv up to 765 Tv. The following are examples of different overhead transmission line structures in use today. The DC voltage transmission tower has lines in pairs rather than in threes (for 3-phase current) as in AC voltage lines. One line is the positive current line and the other is the negative current line.
Subtransmission Lines (Distribution Lines)	Carry voltages reduced from the major transmission line system. Typically, 34.5 Tv to 69 Tv, this power is sent to regional distribution substations. Sometimes the subtransmission voltage is tapped along the way for use in industrial or large commercial operations. Some utilities categorize these as transmission lines.
Underground Transmission Lines	Are more common in populated areas. They may be buried with no protection, or placed in conduit, trenches, or tunnels.

Line Components

Towers	Towers for support of the lines are made of wood either grown or laminated, steel or aluminum (either lattice structures or tubular poles), concrete, and occasionally reinforced plastics. The bare wire conductors on the line are generally made of aluminum (either plain or reinforced with steel or composite materials such as carbon and glass fiber), though some copper wires are used in medium-voltage distribution and low-voltage connections to customer premises. A major goal of overhead power line design is to maintain adequate clearance between energized conductors and the ground so as to prevent dangerous contact with the line, and to provide reliable support for the conductors, resilience to storms, ice loads, earthquakes and other potential damage causes. Today overhead lines are routinely operated at voltages exceeding 765,000 volts between conductors.
Structures	
Pole in Ground	Often has cross-arm beams to support conductors. Found in suburbs.

Lattice Structure	Large structures used for high voltage transmission over longer distances.
Circuits	
Single Line	A single-circuit transmission line carries conductors for only one circuit. For a three-phase system, this implies that each tower supports three conductors.
Double Line	A double-circuit transmission line has two circuits. For three-phase systems, each tower supports and insulates six conductors. Single phase AC-power lines as used for traction current have four conductors for two circuits. Usually both circuits operate at the same voltage.
Insulators	Insulators must support the conductors and withstand both the normal operating voltage and surges due to switching and lightning. Insulators are broadly classified as either pin-type, which support the conductor above the structure, or suspension type, where the conductor hangs below the structure.
Conductors	The most common conductor in use for transmission today is aluminium conductor steel reinforced (ACSR). Also seeing much use is all-aluminium-alloy conductor (AAAC). Aluminium is used because it has about half the weight of a comparable resistance copper cable (though larger diameter due to lower specific conductivity), as well as being cheaper. Typical 4cm wide ASCR conductors have 6 layers of 4mm circular wires with slight air gaps between the circles. Modern carbon core conductors eliminate the space between layers by using trapezoidal shape strands.
Bundle Conductors	For transmission of power across long distances, high voltage transmission is employed. Transmission higher than 132 kV poses the problem of corona discharge, which causes significant power loss and interference with communication circuits. To reduce this corona effect, it is preferable to use more than one conductor per phase, or bundled conductors. Bundle conductors consist of several parallel cables connected at intervals by spacers, often in a cylindrical configuration. The optimum number of conductors depends on the current rating, but typically higher-voltage lines also have higher current.
Ground Wires	Overhead power lines are often equipped with a ground conductor (shield wire, static wire, or overhead earth wire). The ground conductor is usually grounded (earthed) at the top of the supporting structure, to minimize the likelihood of direct lightning strikes to the phase conductors. In circuits with earthed neutral, it also serves as a parallel path with the earth for fault currents. Very high-voltage transmission lines may have two ground conductors. These are either at the outermost ends of the highest cross beam, at two V-shaped mast points, or at a separate cross arm. Older lines may use surge arresters every few spans in place of a shield wire; this configuration is typically found in the more rural areas of the United States. By protecting the line from lightning, the design of apparatus in substations is simplified due to lower stress on insulation.
Insulated Conductors	Overhead insulated cables are rarely used, usually for short distances (less than a kilometre). Insulated cables can be directly fastened to structures without insulating supports. An overhead line with bare conductors insulated by air is typically less costly than a cable with insulated conductors. A more common approach is "covered" line wire. It is treated as bare cable, but often is safer for wildlife, as the insulation on the cables increases the likelihood of a large-wing-span raptor to survive a brush with the lines, and reduces the overall danger of the lines slightly. These types of lines are often seen in the eastern United States and in heavily wooded areas, where tree-line contact is likely. The only pitfall is cost, as insulated wire is often costlier than its bare counterpart. Many utility companies implement covered line wire as jumper material where the wires are often closer to each other on the pole, such as an underground riser/pothead, and on reclosers, cutouts and the like.
Train Power	Overhead lines or overhead wires are used to transmit electrical energy to trams, trolleybuses or trains. Overhead line is designed on the principle of one or more overhead wires situated over rail tracks. Feeder stations at regular intervals along the overhead line supply power from the high-voltage grid. For some cases low-frequency AC is used, and distributed by a special traction current network.

Electricity Distribution

A text flowchart of the process and modifications to electricity during distribution.

Generating Station	Generates power via any number of means at about 13,000 volts.
Transmission Substation (Step Up)	Increases the voltage to 345,000 volts for efficient long distance delivery.
Transmission	Multiple high power transmission lines. Industrial customer with unique electrical requirements may have a private substation and lines going to the factory.
Transmission Substation (Step Down)	Drops the voltage down to around 69,000 volts.
Subtransmission Substation	Transmits 69,000 volts over a distance.
Distribution Substation (Step Down)	A second voltage reduction drops the voltage down to around 13,800 volts.
Commercial Customer	Customers with high power requirements use this higher voltage.
Distribution Transformer	Lowers the voltage to 120/240 volts for household use.
Residential Customer	Home power use.

Power Line Safety

13 Modern Electronics

Modern electronics which can be of benefit in a SHTF scenario and require little maintenance and knowledge.

World Possible Store **(Rachel Corrections 3.0)** **(Rachel-Plus 3.0)** **(Rachel-Pi)**	A portable wifi router which hosts web pages found on the internal SD card which have been previously downloaded. Just power up the server and users can easily connect over wifi or Ethernet to access an enormous collection of top quality materials including Wikipedia, Khan Academy (KA Lite), and much more. The latest version of the RACHEL-Pi comes complete and ready-to-use for serving RACHEL content for approximately 10 computers or tablets simultaneously, depending on usage. Requires wall socket power but they can be run from power banks or batteries if adapted.	**Included Content** ● KA Lite Essentials ● Wikipedia for Schools ● Interactive World Map ● GCF LearnFree.org ● Wikivoyage ● Wiktionary ● CK-12 Textbooks	**Included Content** ● Great Books of the World ● African Storybook Proj. ● Infonet-Biovision ● Practical Action ● MedlinePlus Medical ● Hesperian Health ● Music Theory

Computers

Any form of modern computers and anything related to them.

Hardware Repairs

Hardware Repairs	This is a list of pc components and connections between them which could be causing errors.	**Pc Hardware (Essential)** ● Case ● Motherboard (MB) ● PSU (Power Supply) ● CPU (Processor) ● CPU Fan / Heatsink ● RAM / Memory ● Hard Drive / SSD ● GPU (Graphics) ● Monitor ● Keyboard ● Mouse	**Pc Hardware (Extras)** ● Keyboard ● Mouse ● Router
Cabling	A list of all the essential cables in a computer and where they should be plugged into. It is often good to unplug them and replug them to fix connection issues.	**Power Pc Cables** ● Wall > PSU ● Wall > Monitor ● PSU > MB (24 Pin) ● PSU > MB (4 Pin) ● PSU > HDD ● PSU > GPU ● GPU or MB > Monitor	**Motherboard Pc Cables** ● MB > HDD / SSD ● MB > Case Buttons ● MB > USB Header ● MB > 3 Pin Fans ● Mouse > MB ● Keyboard > MB
Common Solutions	**Dusting:** Dust is a computers enemy so ensure it is kept dust free and clean it out from time to time. Ensure the heat sinks, fans and air filters are cleaned when they become dusty. **RAM Reseating:** RAM is a common cause of problems so take it out and reseat it or take one out and see if the remaining one works or not. **Replug Cables:** Sometimes the cables are the cause of the problems so unplug them and replug them in again.		

Internet Repairs

You may have an internet connection nearby which isn't working, but don't have the internet to troublesheet the problem, that's where this section comes in handy.

Type of Problem	**Narrow Down:** Try to narrow down the problem to either hardware or software. Then try to eliminate working hardware devices down to one.
Hardware Checks	**Check Cables:** Check and re-plug all the cables between the router, switch, wall and pc. **Wireless to Wired:** If you are using the wireless and the device has an ethernet port, try plugging in a cable and seeing if it works. **Restart Devices:** Restart all the devices that the signal travels through.
Software Checks	**Connectivity:** Check that the router has internet connectivity and you have entered the passwords correctly.

Fuel

All types of fuels from solid to liquid to gas and its effectiveness

"You are a wicked motorcar, and I shall not give you any more petrol until you go."
Bertrand Russell

Introduction

Information on all types of fuel from butane, hexamine, and petrol to wood.

Purpose	The aim of FUEL is provide a detailed description of the common types of fuels, whether that's solid fuel, liquid fuel or gas fuels. It also goes into how you can create your own fuels at home.
Lost?	● For a list of the stoves and equipment that can be used with these fuels, see the GEAR section. ● For a list of the different types of woods and their recommended uses, see the MATERIALS section. ● To learn more about the fire burning the fuel, see the FIRE section. ● For information on cooking on stoves, see the COOKING section.

Contents

1 Solid Fuels

Solid fuel refers to various forms of solid material that can be burnt to release energy, providing heat and light through the process of combustion. Solid fuels can be contrasted with liquid fuels and gaseous fuels. Common examples of solid fuels include wood, charcoal, peat, coal, Hexamine fuel tablets, wood pellets, corn, wheat, rye, and other grains. Solid fuels are extensively used in rocketry as solid propellants. Solid fuels have been used throughout human history to create fire and solid fuel is still in widespread use throughout the world in the present day.

Wood

Wood is a cheap and abundant fuel source which is readily available in most countries around the world.

Wood Power

These are all the different ways wood can be used as energy.

Direct Combustion (Heat Energy)

This is the most straightforward method, where the heat from burning wood is used directly or to create steam.

Fireplaces and Wood Stoves	The most common domestic application, providing warmth and a cozy ambiance.
Cookstoves/Rocket Stoves	Efficient designs for cooking food, especially in off-grid or developing regions.
Outdoor Ovens/BBQs	Wood-fired pizza ovens, smokers, and traditional barbecues.

Water Heaters	Boilers that heat water for domestic use.
Industrial Kilns & Furnaces	Historically used for firing pottery, bricks, glass, and for smelting in early metallurgy.
Bread Ovens	Traditional bakeries often use wood-fired ovens.
Steam Locomotives (Trains)	Many early, and some historical, steam trains were entirely wood-fired, particularly in regions with abundant timber.
Traction Engines	Large, self-propelled steam engines used for agricultural work (ploughing, threshing) and hauling heavy loads. They were common in the late 19th and early 20th centuries and were often wood-fired.
Steamships and Steamboats	Early steam-powered vessels used wood to fire their boilers.
Sawmills	Steam engines powered by wood (often sawdust and waste wood from the mill itself) were common in sawmills for cutting timber.
Factories and Mills	The steam engine, a cornerstone of the Industrial Revolution, was frequently powered by wood (and later coal) to drive machinery via belts and shafts (e.g., textile mills, mining operations, general manufacturing).
Stationary Steam Engines	Used to power pumps, generators, and other industrial equipment.
Steam Rollers	Used for road construction.
Steam Turbines	Modern biomass power plants burn wood (chips, pellets, waste wood) to heat water, produce high-pressure steam, which then drives a turbine connected to a generator to produce electricity. This is a significant source of renewable energy today.
Combined Heat and Power (CHP) Systems	These systems generate both electricity and useful heat from wood combustion, improving overall efficiency.

Gasification (Producing Wood Gas)

This process involves heating wood in a low-oxygen environment to produce "wood gas" (also known as producer gas or syngas), which is a combustible mixture primarily of carbon monoxide, hydrogen, and methane. This gas can then be used to power internal combustion engines.

Vehicles (during fuel shortages)	Famously used during World War II and other periods of petroleum scarcity, cars, trucks, buses, tractors, and even some military vehicles were converted to run on wood gas generators mounted to them or on trailers. This technology is still used in some remote or developing regions today.
Internal Combustion Engines	Any engine designed to run on gasoline or natural gas can potentially be modified to run on wood gas, though with lower power output and requiring extensive gas cleaning. This includes: ● Generators: To produce electricity in off-grid or emergency situations. ● Pumps: For irrigation or water supply. ● Small Industrial Equipment: Where an engine is needed to drive machinery.
Heating Systems	Wood gas can be burned directly in boilers or furnaces for space heating or water heating.

Pyrolysis (Producing Bio-Oil or Biochar)

Heating wood in the complete absence of oxygen produces bio-oil (a liquid fuel) and biochar (a charcoal-like solid).

Engines/Turbines (with bio-oil)	Bio-oil can be used as a substitute for fuel oil or diesel in some engines or turbines, though often requiring significant processing.
Cooking and Heating (with biochar/charcoal)	Biochar, or charcoal, is a much cleaner-burning solid fuel than raw wood, producing less smoke and burning hotter. It's used in grills, traditional stoves, and can even be powdered for fuel briquettes.

Wood Stoves

Homemade wood stoves can be as simple as setting up a windscreen and burning the wood inside it (pot set on stakes or rocks). More complex versions are elevated off the ground to protect your fire and ground, incorporate integrated pot stands and sometimes even have electric fans.

Advantages
● Don't have to carry fuel
● Able to melt enormous amounts of snow without carrying huge amounts of fuel
● Cheap to make, free fuel
● Potential for unlimited hot water and even water purification
● Smoke may decrease the amount of bugs in your campsite
● Use as a heater to warm you up
● Produces less overall pollution than other fuels (no drilling, refining, transporting, etc)
● Renewable energy source

Disadvantages
● Weight, bulk
● Blackening of pots and everything your pot and stove touches
● Everything you hike with will smell like smoke
● Need to hunt for fuel at the end of the day or during your trek
● Dependence on availability of dry burnable wood
● Slow cook time
● Need to fiddle with the fire
● Knowledge of fire building required
● Potential to start forest fire in dry windy areas
● May be banned in your hike area

Toxic Solid Fuels

These are woods and other things you should avoid burning.

"Poisonous" Plants

These are at the top of the list for good reason. They contain irritating oils (like urushiol in poison ivy) that become airborne in smoke and can cause severe reactions.
● Poison Ivy
● Poison Oak
● Poison Sumac
● Brazilian Peppertree (also known as Mexican Pepper)
● Poisonwood

Highly Toxic Trees/Shrubs

These plants contain various toxic compounds that can be released when burned, affecting respiratory systems, skin, or causing systemic poisoning.
● Oleander: Every part of this plant is highly toxic. Burning it can release dangerous fumes. Never use its branches for roasting food.
● Yew (Taxus baccata and Japanese Yew): All parts of the tree (except the fleshy red aril of the berry) contain highly toxic alkaloids called taxines.
● Manchineel Tree: Found in tropical regions, this is considered one of the most dangerous trees in the world. Its sap causes extreme blistering, and even standing near its smoke can cause severe respiratory issues and temporary blindness.
● Laburnum: Poisonous wood.

Treated or Manufactured Wood Products

These are perhaps the most dangerous to burn due to the chemicals they contain.
● Pressure-Treated Wood: Often green or greenish, this wood is treated with chemicals like copper, chromium, and arsenic (CCA, common before the early 2000s) to prevent rot and insects. Burning it releases highly toxic fumes, including arsenic compounds, which are extremely dangerous and carcinogenic.
● Painted, Stained, Varnished, or Sealed Wood: The finishes contain various chemicals, pigments, and heavy metals (like lead in old paint) that release toxic fumes when burned.
● Plywood, Particle Board, MDF (Medium-Density Fiberboard), Chipboard: These are made with glues, resins, and formaldehyde, which release toxic fumes when burned.
● Laminated Flooring/Wood: Contains adhesives and plastics that are toxic when burned.
● Wood Pallets (unless certified as heat-treated - HT): Many pallets are chemically treated (e.g., with methyl bromide, indicated by "MB") to prevent pest infestations. Only burn pallets marked "HT" (Heat Treated) and ensure they are clean and free of spills or contaminants.

Driftwood

While it might seem appealing, driftwood soaked in saltwater can release chlorine and other metal salts when burned, leading to the formation of dioxins. Dioxins are highly toxic and carcinogenic.

Green or Wet Wood

While not "toxic" in the same way as treated wood, burning green (freshly cut) or wet wood is extremely inefficient and harmful:
● Excessive Smoke: High moisture content creates a lot of smoke, which is irritating to the eyes and lungs.
● Creosote Buildup: The incomplete combustion of wet wood leads to a significant buildup of creosote in your chimney or flue. Creosote is highly flammable and is a leading cause of chimney fires.
● Low Heat Output: Much of the energy goes into boiling off the water rather than producing heat, making it inefficient.

Moldy or Rotten Wood

Burning moldy wood can release mold spores and toxins into the air, which can be particularly problematic for individuals with allergies, asthma, or compromised immune systems. Rotten wood also burns poorly and produces more smoke.

Some Softwoods

While not strictly toxic like the above, some softwoods like pine, spruce, and fir contain high levels of sap and resin. When burned, these resins can contribute significantly to creosote buildup in chimneys, increasing the risk of chimney fires. If you must burn them, ensure they are extremely well-seasoned and that your chimney is regularly cleaned.

Contaminated Wood

Any wood that has been in contact with chemicals, oil, grease, or other hazardous substances (e.g., old railway sleepers, some construction site offcuts) should not be burned.

Seasoning

Seasoning wood for a fireplace is crucial for efficient, clean, and safe burning. "Green" or unseasoned wood contains a high moisture content, making it difficult to light, producing excessive smoke, and leading to dangerous creosote buildup in your chimney. Seasoned wood, on the other hand, has had most of its moisture evaporated, resulting in a hotter, cleaner burn.

Timing is Key (Plan Ahead!):

When to Cut/Buy: The best time to cut or buy green wood for seasoning is in late winter or early spring (around February-April in the Northern Hemisphere, or August-October in the Southern Hemisphere like Queensland). This allows the wood to dry throughout the hottest and driest months.
Seasoning Duration:
● Softwoods (pine, spruce, fir): Typically need at least 6 months to a year.
● Hardwoods (oak, maple, ironbark, redgum, spotted gum - common in Australia): Can take 1 to 2 years, sometimes even longer for very dense wood.
Aim for Moisture Content: Properly seasoned wood should have a moisture content of below 20%, ideally closer to 10-15%. You can test this with a moisture meter (available at hardware stores).

Preparation (Cut and Split):

Cut to Size: Cut logs into manageable lengths that fit your fireplace or wood heater (typically around 35-40 cm or 14-16 inches).
Split the Wood: This is one of the most critical steps!
● Why split? Splitting exposes more surface area to the air and sun, significantly speeding up the drying process. Unsplt rounds will take much, much longer to dry and are prone to rot.
● Size: Aim for pieces that are 10-15 cm (4-6 inches) in diameter. Smaller pieces dry faster.
● Bark: While not essential to remove, some people split barkless or peel bark where possible, as bark can trap moisture.

Storage Location (The "Holy Trinity" of Air, Sun, and Protection):

Outdoors is Best: Wood seasons most effectively outdoors where it's exposed to wind and sun. Avoid storing large quantities indoors due to fire risk and potential pest issues.
Sunny Spot: Choose a location that receives as much direct sunlight as possible.
Good Airflow: This is paramount. The wind helps to wick moisture away.
- Avoid Stacking Against Walls: Leave space (at least a few inches) between the wood stack and any walls to allow air circulation on all sides.
- Don't Stack Too Tightly: Leave small gaps between individual logs within the stack.

Off the Ground: Elevate your stack to prevent moisture absorption from the ground and deter pests. Use pallets, concrete blocks, old tires, or dedicated firewood racks. Aim for at least 15 cm (6 inches) off the ground.

Protected from Rain: While sunlight and wind are good, rain is the enemy.
- Cover the Top Only: Use a waterproof cover (tarp, sheet of corrugated iron, custom firewood cover) over the top of the stack.
- Allow Ends to Be Open: Crucially, do not cover the sides or ends of the stack down to the ground. This traps moisture and inhibits airflow, leading to mold and slow drying. The ends of the logs are where most of the moisture escapes.
- Open-Sided Shed/Woodshed: An ideal solution is a dedicated woodshed or structure with a roof but open sides, providing excellent protection from rain while allowing maximum airflow.

Stacking Techniques

Single Rows: Stacking wood in single rows (or no more than two rows deep) maximizes exposure to wind and sun for each piece.
Criss-Cross or "Log Cabin" Style: This method (stacking alternate layers perpendicularly) creates excellent airflow pockets within the stack. While it takes up more space, it significantly speeds up drying.
Bark Up: When stacking, try to place logs with the bark side facing upwards. This helps shed rainwater away from the wood.
Orientation: If possible, orient your stacks perpendicular to the prevailing wind direction to maximize airflow through the pile.

Monitoring and Maintenance

Moisture Meter: Invest in an inexpensive moisture meter. This is the most reliable way to know when your wood is truly seasoned. Insert the probes into a freshly split face of a log for an accurate reading.
Visual/Auditory Cues (Less Precise but Helpful):
- Color: Seasoned wood will fade in color and look duller or grayer.
- Weight: It will feel significantly lighter than green wood.
- Sound: When you hit two seasoned pieces together, they'll make a hollow, ringing sound, as opposed to a dull thud from wet wood.
- End Cracks: Seasoned wood will often have visible cracks (checking) at the ends of the logs.
- Bark: Bark may be loose or peeling on seasoned wood.

Rotate (FIFO): If you have multiple stacks, use a "First In, First Out" system to ensure you're always burning the driest, oldest wood.
Keep it Clean: Remove any debris, leaves, or growth around your wood stacks that could impede airflow or harbor pests.

Hardwood Properties

	Heat	Weight (Pound/Cord - Seasoned)	Splitting Ease	Starting Ease	Coal Qualities	Sparks	Fragrance		
Alder	Medium-Low	2,506	Easy	Moderate	Good	Moderate	Slight		
Apple	High-Medium	4,132	Difficult	Difficult	Excellent	Few	Excellent		
Ash, Black	Medium	4,132	Easy-Moderate	Fair-Difficult	Good-Excellent	Few	Slight		
Ash, Green	High	3,590	Easy-Moderate	Fair-Difficult	Good-Excellent	Few	Slight		
Ash, White	High	3,689	Easy-Moderate	Fair-Difficult	Good-Excellent	Few	Slight		
Aspen, Bigtooth	Low	2,439	Easy	Easy	Good	Few	Slight		
Aspen, Quaking	Low	2,373	Easy	Easy	Good	Few	Slight		
Basswood	Low	2,174	Easy	Easy	Poor	Few	Good		
Beech	High	3,757	Difficult	Difficult	Excellent	Few	Good		
Beech, American	High	3,793	Difficult	Difficult	Excellent	Few	Good		
Beech, Blue	High	3,890	Difficult	Difficult	Excellent	Few	Good		
Birch, White	Medium	3,179	Easy	Easy	Good	Moderate	Slight		
Birch, Sweet	Medium	4,065	Easy	Easy	Good	Moderate	Slight		
Birch, Gray	Medium	3,179	Easy	Easy	Good	Moderate	Slight		
Birch, Paper	Medium	3,260	Easy	Easy	Good	Moderate	Slight		
Birch, Yellow	High-Medium	3,723	Moderate	Easy	Good	Moderate	Slight		
Birch, Black	High-Medium	3,890	Moderate	Easy	Good	Moderate	Slight		
Buckeye, Horsechestnut	Low	2,235	Moderate		Poor	Few	Slight		
Boxelder	Low	2,797	Easy		Poor	Many	Slight		
Butternut (White Walnut)	Low	2,440	Easy						
Catalpa	Low	2,360	Difficult		Good	Few	Fair		
Cherry, Black	Medium	2,880	Easy	Difficult	Excellent	Few	Excellent		
Cherry	Medium	3,184	Easy	Difficult	Excellent	Few	Excellent		
Chestnut	Low	2,708	Easy			Many	Good		
Coffeetree, Kentucky	High	3,112	Moderate		Good	Few	Good		
Cottonwood	Low	2,102	Easy	Easy	Good	Moderate	Slight		
Dogwood	High	4,331	Difficult	Easy	Fair	Few			
Elm, American	Medium	3,116	Very Difficult	Moderate	Good	Very Few	Fair		
Elm, Rock	Medium	3,860	Very Difficult	Moderate	Good	Very Few	Fair		
Elm, Siberian	Medium	3,020	Very Difficult	Moderate	Good	Very Few	Fair		
Elm, Slippery	Medium	3,251	Very Difficult	Moderate	Good	Very Few	Fair		
Eucalyptus	Very High	4,560	Difficult						
Eucalyptus - Swamp Yate			Difficult	Difficult	Excellent	Few	Good		
Eucalyptus - Sugar Gum			Difficult	Difficult	Excellent	Few	Good		
Eucalyptus - Tasmanian Blue Gum			Moderate	Moderate	Good	Few	Good		
Eucalyptus - River Red Gum			Difficult	Difficult	Excellent	Moderate	Good		
Eucalyptus - SA Blue Gum			Difficult	Difficult	Excellent	Few	Good		

Hackberry	High	3,319	Easy		Good	Few	Slight
Hazel	High		Moderate	Moderate			
Hawthorn	High		Moderate	Moderate			
Hickory, True	Very High	4,327	Moderate	Fair-Difficult	Excellent	Moderate	Excellent
Hickory, Mockernut	Very High	4,332	Moderate	Fair-Difficult	Excellent	Moderate	Excellent
Hickory, Pignut	Very High	4,332	Moderate	Fair-Difficult	Excellent	Moderate	Excellent
Hickory, Shagbark	Very High	4,333	Moderate	Fair-Difficult	Excellent	Moderate	Excellent
Hickory, Shellbark	Very High	4,195	Moderate	Fair-Difficult	Excellent	Moderate	Excellent
Holly, American		3,387	Difficult				
Honeylocust	High	3,832	Easy		Excellent	Few	Slight
Hophornbeam, Eastern		4,266					
Ironwood (Hornbeam)	Very High	4,267	Very Difficult	Very Difficult	Excellent	Few	
Laurel, California		3,456					
Locust, Black	Very High	4,470	Very Difficult	Difficult	Excellent	Very Few	Slight
Madrone	High	3,925	Difficult	Difficult	Excellent	Very Few	Slight
Maple, Bigleaf	High-Medium	2,980	Moderate	Fair-Difficult	Excellent	Few	Excellent
Maple, Silver	High-Medium	2,981	Moderate	Fair-Difficult	Excellent	Few	Fair
Maple, Black	High-Medium	3,523	Moderate	Fair-Difficult	Excellent	Few	Excellent
Maple, Soft	High-Medium	2,924	Moderate	Fair-Difficult	Excellent	Few	Excellent
Maple, Red	High-Medium	3,318	Moderate	Fair-Difficult	Excellent	Few	Excellent
Maple, Sugar	High	3,793	Moderate	Difficult	Excellent	Few	Excellent
Mesquite	Very High		Very Difficult	Very Difficult	Excellent	Few	
Mulberry	Medium	3,712	Easy		Excellent		Good
Oak, Bur	High	3,928	Easy	Difficult	Excellent	Few	Fair
Oak, Red	High	3,680	Moderate	Difficult	Excellent	Few	Fair
Oak, White	Very High	4,200	Moderate	Difficult	Excellent	Few	Excellent
Osage Orange	High	4,728	Moderate		Excellent	Many	Excellent
Pecan	High		Moderate		Good	Few	Good
Persimmon		4,332	Moderate				
Pine, Lodgepole	Low	2,610	Easy	Easy	Fair	Moderate	Good
Poplar, Yellow (Tuliptree)	Low	2,708	Easy	Easy	Fair	Moderate	Bitter
Sweet Gum	Medium	3,115	Difficult	Moderate	Fair	Few	
Sycamore	Medium	3,115	Difficult	Very Difficult	Good	Few	Good
Walnut	High-Medium	3,454	Moderate	Moderate	Good	Few	Fair
Willow	Low	2,438	Easy	Moderate	Poor	Moderate	Slight

Softwood Properties

	Heat	Weight (Pound/Cord - Seasoned)	Splitting Ease	Starting Ease	Coal Qualities	Sparks	Fragrance
Cedar, White	Medium-Low	2,100	Easy	Easy	Poor	Moderate	Excellent
Cedar, Eastern	Medium-Low	2,981	Easy	Easy	Poor	Many	Excellent
Cedar, W. Red	Medium-Low	2,100	Easy	Easy	Poor	Many	Excellent
Cypress	Medium	2,844	Easy	Moderate		Few	
Fir, Douglas	Medium	3,049	Easy	Easy	Fair	Moderate	Slight
Fir, Balsam	Low	2,236	Easy	Easy	Fair	Moderate	Slight
Fir, Grand	Low	2,371	Easy	Easy	Fair	Moderate	Slight
Fir, White	Low	2,104	Easy	Easy	Fair	Moderate	Slight
Hemlock, Eastern	Medium-Low	2,573	Easy	Easy	Poor	Many	Good
Hemlock, Western	Medium-Low	2,847	Easy	Easy	Poor	Many	Good
Juniper	Medium	3,150	Moderate		Poor	Many	Excellent
Larch, Western (Tamarack)	High-Medium	3,318	Easy-Moderate	Easy-Fair	Fair	Many	Slight
Pine, Lodgepole	Low	2,576	Easy	Easy	Fair	Moderate	Good
Pine, Ponderosa	Medium-Low	2,573	Easy	Easy	Fair	Moderate	Good
Pine, E&W White	Medium-Low	2,303	Easy	Easy	Fair	Moderate	Good
Pine, Sugar	Low	2,302	Easy	Easy	Fair	Moderate	Good
Pine, Yellow	High-Medium	2,610	Easy	Easy	Fair	Moderate	Good
Pinon	High	3,000	Easy			Many	
Redwood, Old Growth	Medium	2,573	Easy	Easy-Fair	Poor	Many	Slight
Redwood, Second Growth	Medium	2,302	Easy	Easy-Fair	Poor	Many	Slight
Spruce, Black	Low	2,575	Easy	Easy	Poor	Few	Slight
Spruce, Engeiman	Low	2,234	Easy	Easy	Poor	Few	Slight
Spruce, Norway	Low	2,240	Moderate	Easy	Poor	Many	Slight
Spruce, Sitka	Low	2,506	Easy		Poor		Slight
Yew	High		Difficult	Difficult			Good

Wood Gas

TODO: Wood gasifier.

Wood Storage

For storage of wood see the HOMESTEADING section.

Hexamine

Hexamine (also known as hexamethylenetetramine or methenamine) is a heterocyclic organic compound with the chemical formula $(CH_2)_6N_4$. It's formed by the reaction of formaldehyde and ammonia.

The tablets burn smokelessly, have a high energy density, do not liquefy while burning and leave no ashes. They burn for 5-7 minutes and can boil about 240ml of water. Fire starter tablets aren't as hot as hexamine and produce a black soot on pans. Can boil about 240ml with a tablet. Probably the third best choice for stealth cooking behind alcohol and gas cooking. Esbit tablets are about 14g and the 45x45mm tablets are 26g.

Hexamine tablets often come with a sheet metal stove to burn them on. The stove folds up to contain the tablets and unfolds to burn them. Hexamine can emit a variety of harmful gases, including formaldehyde, hydrogen cyanide, ammonia and oxides of nitrogen on combustion, and repeated or prolonged contact can cause skin sensitization. Half a hexamine tablet can boil about two cups of water.

Form: It's a white, crystalline solid, typically compressed into small, lightweight tablets.
Combustion: Hexamine tablets burn with a smokeless flame and produce a high energy density. They are known for being easy to ignite with a match or lighter.
Residue: A notable characteristic is that they do not liquify while burning and leave very little ash (though they can leave a sticky, dark residue on the bottom of pots).
Shelf Life: Hexamine has an almost unlimited shelf life if stored properly in a sealed, dry container.

Common Applications
● Camping and Backpacking: Extremely popular for lightweight cooking and heating in outdoor settings, often used with small, foldable stoves.
● Military Field Rations: Historically and currently used by various militaries for heating combat rations.
● Emergency Kits: Due to its stability and ease of use, it's a common component in emergency preparedness kits.
● Model Engines: Used to power small steam engines in models.
● Fire Starters: Can be used to help ignite larger fires.

Safety Considerations of Hexamine

● Combustion Byproducts: While smokeless, hexamine combustion can produce noxious fumes, including formaldehyde, ammonia, carbon oxides, nitrogen oxides, and potentially hydrogen cyanide (HCN), especially in poorly ventilated areas. This is why it's critical to use it outdoors or in very well-ventilated spaces.
● Respiratory Irritation: Inhaling these fumes can cause respiratory irritation.
● Ingestion: Harmful if ingested, potentially causing nausea, vomiting, gastrointestinal disturbances, and kidney damage.
● Precursor for Explosives: It's important to note that hexamine is a precursor chemical for the synthesis of certain high explosives, such as RDX. For this reason, its possession and sale can be regulated in some regions (e.g., the UK).
● Sticky Residue: Can leave a difficult-to-clean residue on cookware.
Sensitivity to Wind/Dampness: While effective, its efficiency can be reduced by strong wind or damp conditions, requiring wind shelters or additional tablets.

Hexamine vs Trioxane
● For maximum heat output and long burn time per gram, Hexamine (Esbit) is often cited as having a slightly higher energy output.
● For stealth (low luminosity flame), Trioxane has an advantage, which is why it's favoured by some military forces.
● For general safety, particularly regarding accidental ingestion by children/pets, Trioxane is generally considered less acutely dangerous than the neurotoxin metaldehyde, and arguably slightly safer in that specific regard than hexamine (though both are still very toxic if ingested).
● For general outdoor use, both require excellent ventilation due to the harmful byproducts (formaldehyde, CO, etc.).

Trioxane

AKA - triox, GI fuel tabs, metaformaldehyde, trioxane,1,3,5-trioxacyclohexane, 1,3,5-trioxane, aldeform, formagene. The US military uses trioxane fuel bars which are cheap (you can buy cases of 750 from many surplus dealers) and are said to have "an almost infinite shelf life." Because of this, they are great for survivalists who want to store large amounts of supplies that are easily procurable and economical (GI surplus is a also a plus with many of these folks). Trioxane has about half the potential heat value per ounce than hexamine but burns a light blue which is more tactically sound than the bright yellow of hexamine.

Warning
These fuel tabs contain metaformaldehyde which is toxic and releases formaldehyde gas (also toxic) when it decomposes. This fuel is toxic despite the many websites that claim theirs are "nontoxic".

Note
The Trioxane used in antimalarial agents is 1,2,4-Trioxane and is structurally different than Trioxane Fuel tabs.

Form: Like metaldehyde, trioxane is typically a white, crystalline solid at room temperature and is compacted into tablets or pellets for use as a fuel.
Flame Characteristics: It burns with a smokeless, low-luminosity flame. This low luminosity is particularly advantageous for military applications where maintaining a low visual signature is important, such as heating field rations without revealing a position at night.
Ease of Ignition: Trioxane is known for its easy ignition.

Applications
● Military Field Rations: Widely used by armed forces (e.g., US military) for heating MREs (Meals, Ready-to-Eat) and other field cooking needs.
● Camping and Outdoor Cooking: Its compact size and ease of use make it suitable for lightweight backpacking and emergency kits.
● Fire Starting: Can be used as a fire starter to ignite larger fuels.

Safety Considerations
While often presented as a safer alternative to some other solid fuels, trioxane still has safety considerations that are important to understand:

Flammable Solid: It is classified as a flammable solid and requires careful handling and storage away from heat, sparks, and open flames.
Decomposition to Formaldehyde: When heated, trioxane can decompose and release formaldehyde vapor. Formaldehyde is a known irritant to the respiratory system, eyes, and skin. Prolonged or high-level exposure can be harmful and it is classified as a human carcinogen. Therefore, it's crucial to use trioxane in well-ventilated areas.

May Cause Respiratory Irritation: Inhalation of the fumes, particularly if ventilation is poor, can cause respiratory irritation.
Suspected of Damaging Fertility or Unborn Child: Some safety data sheets (SDS) indicate it is suspected of having reproductive toxicity.
Toxicity (if ingested): While generally considered less acutely toxic than metaldehyde, it is still not for ingestion and can cause harm if swallowed.
No Obvious Odor: Unlike some fuels, its burning may not produce a strong warning odor, which can be a concern if used in poorly ventilated areas.

Comparison with Metaldehyde

The key difference and reason for trioxane's more widespread use as a field fuel compared to metaldehyde is its lower acute toxicity when ingested. While neither should ever be eaten, metaldehyde is an extremely potent neurotoxin with a high risk of fatality even in small amounts, making it a serious hazard, especially around children and pets. Trioxane's primary concern revolves around the release of formaldehyde during combustion and its flammability, rather than acute systemic poisoning from accidental ingestion in the same way as metaldehyde.

Metaldehyde

Metaldehyde (met-AL-duh-hyde) is a chemical compound with the formula $(C_2H_4O)_x$, where 'x' represents a variable number, typically a tetramer (meaning four acetaldehyde units). It's primarily known as a molluscicide, used in slug and snail baits. However, it was originally developed and is still used as a solid fuel.

Key Characteristics and Uses

Form: It's typically sold in tablet form for use as a solid fuel. These tablets are often white, crystalline, and can have a mild, menthol-like odor.
Flammability: Metaldehyde is highly flammable and burns with a relatively smokeless flame. This makes it appealing for portable heating and cooking applications where smoke might be undesirable.
Applications:

- Camping Fuel: A common use is in small, portable camping stoves for heating water or cooking light meals.
- Military Purposes: Due to its solid form and efficiency, it has been used in military field rations for heating.
- Preheating Stoves: It can be used for preheating certain types of liquid-fuel stoves (like Primus stoves).
- Lamps: Sometimes used as a solid fuel in small lamps.
- Novelty Products: In some cases, it's used in products designed to produce colored flames.

Despite its utility as a fuel, metaldehyde has significant drawbacks due to its toxicity.

- Poisonous if Ingested: This is the most critical hazard. Metaldehyde is a potent neurotoxin. Ingesting even small amounts can cause severe poisoning in humans and animals, leading to symptoms like muscle tremors, seizures, hyperthermia (high body temperature), respiratory failure, and can be fatal. This is why it's so effective as a snail bait, but also why it poses a major risk to pets and young children who might mistake the pellets or tablets for food.
- Irritant: It can be irritating to the skin and eyes.

Fumes: While it burns smokelessly, it can release irritating and/or toxic gases, including oxides of carbon, if combustion is incomplete or in confined spaces. Inhalation of these fumes can cause central nervous system depression, dizziness, nausea, and even coma, especially in poorly ventilated areas.

- Decomposition: Upon heating (above 80°C), metaldehyde can depolymerize back into acetaldehyde, which is also a toxic chemical.

Contrast with other fuels

Unlike alcohol-based gels or gas canisters, metaldehyde provides a solid, compact fuel source. However, its significant toxicity means it must be handled with extreme care and stored well away from anything that could be accidentally ingested. Its widespread use as a molluscicide also adds to the risk, as people might not realize that the "snail bait" and the "camping fuel" can be the same dangerous substance.

Wax

	Advantages	Disadvantages
Wax has a great deal of heat potential per ounce but can be difficult to harness enough to make it worthwhile as much of the heat is used to heat up and melt the wax and some of the fuel will go unburnt and blacken your pot. Stoves fuelled by paraffin wax (not to be confused with kerosene - often referred to as paraffin) generally incorporate a wick and are basically wide candles with enough wick(s) to cook. These stoves have their own advantages and drawbacks compared to other stove types.	• Light Source • Heat Source • Can Waterproof Matches	• Lots of Soot • Easily Blown Out • Only Warms Food • Can't Boil Water

Wax Gasifier Stove	The G-Micro PSL wax gasifying stove will melt, gasify and burn solid wax and is purpose made for solo and duo outdoors use. It will also burn alcohol and a few other liquid fuels which makes it a truly multi-fuel stove. This makes for a very useful travel stove which runs on economical, waterproof fuel (wax) which will never spill in your pack. The G-Micro PSL with wax fuel can even be checked at an international airport which can make adventure travelling that much less complicated since you don't need to spend time looking for fuel at your destination as it's already packed. If you run out of fuel, you can use alcohol or wax from cut up candles, which are generally available world wide. It will also burn kerosene in a pinch, but will leave your pot quite sooty. There are certainly downsides to using this and other wax powered stoves, but there are certain applications where this one will shine.
Paraffin Candle Stoves	Nuwick paraffin candle stoves strive to be so environmentally friendly that they use soy wax in their stoves. You might be able to bring water to a boil with these and they work best indoors and protected from drafts. The LIFE LITE line is one of the few commercial beeswax survival candle options on the market. Beeswax is a renewable fuel and is thought to burn cleaner and longer than paraffin.
Tealight Candles	Tealights are widely used to cook with and to heat up tea and other items.
Candle Lanterns	Candle Lanterns are built with a transparent windscreen/chimney so that you can use the candle as a light without it blowing out. Some are even built with a stove top to allow you to melt, warm and/or boil. These tend to be made with glass and are on the heavy side. Smaller commercial tea candle lanterns may be lighter than their pound-plus brothers but are still on the hefty side for an ultralight hiker. A lightweight homemade lantern can be as simple as using a cut down plastic bottle for a wind screen or a bit fancier and constructed to be mobile, hangable and/or useable as a stove. The one above is lightweight and functions as both a candle lantern and as a stove. This sootless system works great for slowly heating up and keeping tea hot or for melting snow while providing a nice night light. If you want to use an aluminium can as a teapot, you might want to make your lantern out of a Guinness beer can which will support just about any size can (including a 24oz Heineken can). Note - various sized lantern chimney/globes can be purchased or made in stainless mesh or glass for those wanting something more heat resistant than a PET plastic. A plastic chimney will work if you are careful loading lit candles into your lantern and don't build them too narrow or tall for your flame. The Chinese have been making lanterns made from paper and bamboo since 250 BC. Paper lanterns don't seem weather resistant or durable enough for most hikers' use.

Buddy Burners	Homemade candle stoves have also been around for centuries. It doesn't take much imagination to envision one of Merlin's alchemists in a darkened room boiling up a small tonic with the heat from a smoky tallow candle. Commonly referred to as Tuna Can Stoves or Buddy Burners, a simple and more modern candle stove can be easily made by pouring melted wax in a metal can (tuna or 7oz cat food is fine) filled with rolled up corrugated cardboard (centre wick is optional). If you over fill the wax so that it covers your wick, use a knife to scrape it off before trying to light it. These candle stoves have several good qualities. They are completely waterproof, don't spill when stored, are easy and economical to make, are not an explosion hazard, don't decompose like other solid fuels, don't require any environmental constraints for storage and are ready to use as is without any special stove or equipment. Their indefinite storage life and easy of construction/use makes them ideal for stockpiling for an emergency. This makes them also popular with survivalists and the Zombie Apocalypse crowd. People who use this type of stove to cook report that using a cardboard to section off the wax as shown above allows for better air flow to the gasified wax. This allows more efficient burning of wax with less waste.
Liquid Candles	Liquid candles are just like solid candles in that they require a wick to vaporize fuel for burning but also need some sort of holder. Ready made liquid candles can be purchased in either refillable or disposable plastic containers such as the one above (also available in tealight 1oz size), all of which can be refilled (use a needle and syringe for or squeeze fill the non-refillable types) with various flammable fuels and oils. Vegetable oils, candle fuel, lamp fuel and other liquid oils can be burned with a wick but can be quite sooty, depending on your lamp, wick (type and length) and fuel. Remember that some oils will solidify or gel at low temperatures encountered on winter treks.
Plant/Vegetable Oil Stoves (Pflanzenölkocher)	A simple, yet adequate, stove can be made from an aluminium can, aluminium foil and tissue paper. Fuel such as plant or vegetable oil will allow you to cook with this stove system. Soy bean oil is classed as a drying oil and will leave a residue on metal parts and wick and should not be used, Corn oil leaves a crusty residue on wicks and should not be used. But blends of various oils including these are possible, and can be explored. There is a good amount of effort going into creating better vegetable oil burning stoves. Vegetable oil is readily available globally and is very renewable. These stove also offer many in the developing world a cook system with reduced emissions compared to biomass and kerosene fuelled stoves.
Oil Lamps	These can be a simple film canister or aluminium can with a tissue wick or as ornate as the carved wood version shown above. Ideally you will either want a good resealable lamp/stove so that you don't end up with leaks in your pack, or to carefully add just enough fuel (with syringe, straw or very careful pouring) to your lamp/stove as you would with a simple alcohol stove. If you plan to use plastic containers for lamps, you may need to distance the flame from your plastic parts to prevent melting. You can use a glass tube (wick holder), metal cylinder, or rolled up aluminium to distance the flame. If you want to use a resealable plastic bottle (e.g. pill bottle) with a narrow opening, you may need to build it so that the wick holder can be pulled up high enough to prevent damage to the container while being able to be pushed back in for storage. Gaskets can be made from bicycle inner tubes or do it yourself gasket sheets found at auto parts stores. Another option for a narrow topped bottle lamp is modifying the lid so that the wick holder and wick will fit within the top itself. This can be done by drilling a hole in the original lid and epoxying on a second lid (show above). If you would like to get fancy with a beverage can lamp, you can use a Monster Energy Drink can with a resealable lid to make a lamp/stove you can seal when you are done. You can also use a plastic or glass bottle/jar to make a resealable lamp with a built in globe to protect the flame from wind.
Qulliq (Blubber Lamp)	Stone qulliqs (blubber lamps, aka Kudlik) have been used for centuries in Alaska and Siberia. If you are in an area where seal blubber is the only fuel available, a stove can be made from a carved out stone or a an empty tin can. Take a handful of seal fat and mash it down with a kautaq (caribou antler hammer) inside a kaugarvik (stone bowl) and put it in your qulliq. Then set several wicks made with arctic cotton (kanugujak) or moss around one side of the stove and light.

Wax Types

Paraffin Wax	The most common and cheapest wax used in candles today. It is made from petroleum waste and produces smoke and soot. There is big talk these days about cancer caused by inhalation of paraffin candle smoke. Candles made form this wax are ideal for those who shop at the dollar store (or pound store) and don't worry themselves about cancer reports.
Beeswax	Made by bees, this is considered by many to be the cleanest burning wax around. This may stem from times of old when beeswax was reserved for the church as it is long burning, clean, flagrantly and didn't not stain the precious walls and windows of the church like tallow candles. It also burns much longer and produces more heat per gram than paraffin wax. And because of the lack of smoke and soot, these waxes are considered safe by many. This fuel is also more expensive than paraffin per gram but their longer burn times may offset the price difference. Some hunters use honey burners or beeswax candles to attract hungry bears, which could be a plus if you are hunting but not such a desirable feature after a long day of hiking. This is probably the best choice of wax for hikers unless the chance of attracting bears and other critters is undesirable.
Stearin	Stearin candles are made up of stearic acid that is often mixed with palmaitic acid. This wax is produced by the saponification (mixing with a strong alkali) of vegetable and/or animal fats. Stearic acid is also used to add firmness to paraffin wax and increases candle burn time.
Gel Wax	This wax is made of white mineral oil, gelliants, and butylated hydroxy toluene. Because of their softness, these waxes must be used in containers with ridged wicks. Ideal for those who like colours, smells and don't have allergies.
Soywax (Vegetable Wax)	Soywax is made from hydrogenated soybean oil. Not the best candle material around as it may only melt the core of the candle and can be brittle. It does burn cleaner than paraffin (but produces more soot than beeswax), is considered safe to use and doesn't shrink when it cools.
Carnuba Wax (Vegetable Wax)	A wax exuded by the leaves of the Brazilian Carnauba Palm nuts.
Ceresine (Vegetable Wax)	This is made from palm oil and coconut wastes modified with other vegetable waxes. It is a higher quality wax than paraffin.
Bayberry (Vegetable Wax)	Made from bayberries. A sweet-smelling wax that burns clean.
Tallow	Tallow is made from suet. Very smoky, sooty and produces an acrid odour when burned. Some of these candles can be made to be edible.
Stearic Acid	This is produced by the saponification (mixing with a strong alkali) of vegetable or animal fats (also found in chocolate) and is used to add firmness to paraffin wax and increases their burn time.
Spermacetiti	Made form the crystallizing oil found in the heads of sperm whales. A one pound candle made form this wax is the standard source of light for one "candle power." Spermaceti wax doesn't produce an acrid odour when burned, is harder than tallow or beeswax, doesn't soften or bend in the summer heat, and produces a pure bright light.
Seal Oil	Oil from blubber can be used with a wick and has been used for centuries in Alaska and Siberia.
Lamp and Candle Fuel	Many brands are straight kerosene, while others are refined into heavier and cleaner hydrocarbons in liquid form (at room temperature).

Vegetable Oils	Oils such as olive oil can be used for lamps, but tend to burn very sooty.

Wicks

A wick can really change and even improve the functionality of an alcohol stove.

1. Wicks fuel into a flame - important for ignitions of certain fuel depending on temperature.
2. Soaks up liquid fuel like a sponge to reduce spill hazard.
3. Works as a platform for fuel, such as when used as a priming bracelet around a stove.
4. Mobilizes fuel from one area to another.
5. Heat resistant structure for supporting pot, stove parts or as a protective handle for either.
6. Heat resistant insulation.

Wick Types

Flame Wick	For Candles and low volatility fuels, such as lamp fuel and various oils, the wick mobilizes fuel into a flame. This increases the surface area with oxygen and more importantly exposes the fuel to the hot part of a flame. After ignition, the wick continues to mobilize liquid fuel into the flame. This can be a simple and small as a candle wick in a tealight or as large as a "mop head" wick for a large kerosene heater.
Spill Protection Wick	Many stovers use wicks to hold fuel in their stoves. This makes it less likely that fuel will spill and spread flames everywhere if the stove is bumped or even knocked over. This can make a stove much safer to operate. In some cases, it even makes the stove easier to fill.
Wick Fuel Mobilizer	Wick have been used in conjunction with and without tubes to move liquid fuel from one area into another. Examples include wicking fuel from a fuel tank into tubes for the stove jet or even onto anther wick.
Wick Support	Wick material can be used to support a pot over a stove or hold stove parts together. Wicking fabric can be epoxied to surfaces, sewn together with heat resistant thread or even tied together to itself or other items. You can wrap a wick around your pot, and use this ridge to support your pot on a tight windscreen or potstand.
Wick Insulation	Since many wick materials used by stovers are also heat resistant, they can make excellent flame-proof/resistant insulation. You can use this to cover pots to create grab areas, make pot cozies, make stove sleeves to insulate stoves from the cold and many other high heat uses.
Non-Cored Wicks	
Cored Wicks	Usually cotton braided around a zinc, tin, lead, cotton or paper core. The core adds rigidity to the wick which is needed for candles that easily melt. In 1974 the US National Candle Association agreed to discontinue using lead-cored wicks and in 2003, the US Consumer Product Safety Commission banned lead-cored wicks because of health concern. But even with these bans in place, you can still find lead in candle wicks in the US and in other countries. There are also new concerns about the burning of zinc. If you are concerned about lead in your wick, you can rub a white piece of paper over an un-burnt wick and look for a lead streak. If it has a lead streak, look for a different candle or wick.

Wick Materials

Material	Melting Point °C	Melting Point °F	Notes
Graphite Felt	2000°C	4500°F	
Zoltek Pyron	1371°C	2500°F	Flame Protector
Silica Seals	1260°C	2300°F	Seals for ovens
Carbon Felt	1200°C	2192°F	
Asbestos	1200+°C	2192+°F	Cancer
Fibreglass	1200°C	2192°F	Softens and degrades
Wool	600°C	1112°F	Ignition temp
Kevlar	500°C	932°F	Doesn't melt - Degrades
Technora	500°C	932°F	Fancy Kevlar/Tech Cord
Vectran	330°C	626°F	
Baking Silicone Mat	316°C	600°F	
JB Weld Epoxy	316°C	600°F	10 minute exposure limits
Polyester	250-300°C	480-580°F	
Nylon	190-350°C	374-663°F	
Cotton	150°C	300°F	Decomposes; Easily burns at 255˚C
Sisal	150°C	300°F	
Manila	150°C	300°F	
Spectra	147°C	297°F	
Super Glue	82°C	180°F	Slightly better for Hi temp super glue

Makeshift Wicks

Fibreglass Insulation	Sections can be scavenged from the walls or attics of your house or from scraps at a construction site. A more user friendly size comes in 1/2 inch thick pipe insulation and can be trimmed and stacked or rolled up. Note: When burned, fibreglass produces a good deal of polycyclic aromatic hydrocarbon and Volatile organic compound (VOC i.e. benzene, toluene, ethyl benzene and styrene). Fibreglass can also cause local irritation and an inhalational hazard.
Fibreglass Wicks	Made for lanterns or for fire shows (often Kevlar blend), these can be wrapped around stoves as an alternative to using a primer pan. fibreglass comes in cord (with various weaves) and tape of all sizes.
Fibreglass Stove Gasket	You can find various braided wicks sold as stove gaskets. These can be rather large. You may have these at your local hardware centre or local stove shop.
Fibreglass Exhaust Wrap	Looks great when you first wrap it around your exhaust. It wears poorly on an off-road vehicle and leave dust on trailer queens. You should be able to find this in the better autoparts shops.
Fibreglass Medical Gauze	This has resin built in and begins to harden as soon as the package is opened. Water allows you to mould it and speed up setting. It's used to make casts and splints at the doctor's office. This material may be better suited as a structural part than a wick.

Fibreglass Cloth	Fibreglass cloth comes in various configurations for use as auto body and marine body repair. You should be able to find this in most autopart and marine shops.
Fibreglass Drywall Tape	Self-adhesive fibreglass gauze. It's like using duct tape, but you will need too technique in rolling your edges, else you'll have fuzzy edges.
Kevlar Cord/Rope	Used by fire jugglers and for other high temp applications which need a durable cord. Kevlar also comes in various sized tape, cloth and webbing for high strength, high temperature applications.
Kevlar Speargun Line	Kevlar cord is also used for spear guns.
Kevlar Thread	Kevlar thread has good thermal stability and retains a high percentage of room temperature properties even up to 300°C after one to two hours exposure in air. It does not melt, or support combustion, but will oxidize at 400-430°C. However, at temperatures as low as 196°C Kevlar shows no loss of strength. This makes it ideal for high temperature applications. It is good for up to 320°F continuous.
Alumina Thread	This is the highest temperature rated thread available. It's good for up to 2200°F continuous.
Carbon Felt	An asbestos replacement. Used for very high temp applications, such as for insulation or back drop for soldering/welding. Carbon felt will begin to slowly oxidize at approximately 300°F and can ignite in air above these temperatures. Carbon felt is heat resistant to 1200°C+.
Graphite Carbon Felt	Even a higher temperature rating than carbon felt. Graphite felt will begin to slowly oxidize above 500 degrees F and can ignite in air above these temperatures. Graphite carbon felt is heat resistant to 2000°C+.
Zoltek Pyron Fibre Sheet	This oxidized PAN fibre felt is found in the soldering and welding department of hardware stores. Good up to 2500°F.
Perlite	This is found in the gardening section of hardware stores and is made up of tiny volcanic rocks. This option can be very messy when used and requires metal mesh or something else to hold it in place. It may be best to use the larger pieces depending on your application and throw out the dust and small pieces. Expect to get a little (or a lot) of dust spillage. Expanded perlite has been used at service temperatures as high as 2,000°F (1,100°C) and is used in high temperature applications in the steel and foundry industries.
Cotton Wicks	This is popular for candle, lantern and stove use. Cotton begins to decompose at a relatively low temperature compared to other options, but will work fine for certain applications. You should be able to find these in most candle shops and many hobby shops or bigger stores with a crafts section. And just about anything cotton can be turned into a wick.
Natural Fibres	Anything from dried moss to twisted up wood fibres can be used as a wick. This will allow you to burn just about any flammable liquid or wax you can find in the woods.
Steel Wool	Many stovers have used steel wool in various ways as a "wick". The results are mixed as the mass and presence of the steel can alter the performance of your stove, sometime increasing your own performance goals due to thermal feedback or slowing warm up - depending on how you use it. I don't see it working as a "wick" in the sense that it moves fuel into it, but maybe I've missed something interesting here. If so, please let me know. Steel wool will also readily rust once it becomes wet, unless you are using stainless steel.

Wax Hazards

When solid, wax is pretty inert. It doesn't react with water or air, and can even be chewed and swallowed in most cases without much ill consequence, except for the potential of blocking up your intestines. But like with kerosene stoves, there are many who are concerned about exposure to the hydrocarbon by-products of burning candles. Many feel that synthetic paraffin creates more soot and cancer causing by-products when burned compared to beeswax or soy wax. It appears that Philip Fine (1999) found that beeswax does produce a different emissions signature than paraffin wax when burned. Beeswax did produce less sooting but had higher emission rates per mass of wax burned than the paraffin candle due to lower burn rates and longer smouldering times. Emissions from this smouldering would be limited by cutting off the tip of the wick, which avoids the creation of an ember at the end of the wick.

Some studies suggest that paraffin waxes are as safe as other waxes used to make candles. However their reports lack consideration of key hazards found in burning fumes which may make paraffin as well as other waxes potentially hazardous. It is also equally important to note that a good amount of the claims that beeswax is safer than paraffin waxes likewise comes from those selling beeswax. Soy wax claims are similar.

Soot

The thermal structure of combustion is quire complex for waxes. As it burns, it can produce various flame colours. The blue colour is due to chemiluminescence, while the visible yellow colour is due to radiative emission from hot soot particles. The soot is formed through a series of complex chemical reactions, leading from the fuel molecule through molecular growth, until multi-carbon ring compounds are formed. The majority of emissions include organic compounds such as alkanes, alkenes, alkanoic acids, wax esters, cyclohexylalkanes, and alkanals. Soot inhalation has known health hazards. Proper wick trimming and configuration will substantially reduce soot emissions from most candles but will not eliminate them. The amount of particulate matter found from burning incense and candles is thought to increases your risk of cancer more than burning tobacco.

Hot Wax

Wax gets really hot and because of the large size of its molecules, it stores a good deal of energy. So when hot liquid wax hits your skin, it sticks and keeps burning. Once burned, you are more likely to drop or throw your candle and ignite items nearby.

Fires

Fires started by candles are far more common than it should be worldwide. People aren't so concerned about leaving a burning candle in a room or tent unattended.

Lead

Lead core wicks were common prior to the 1970's where lead was used to stiffen wicks to hold them erect. The US candle manufacturing industry voluntarily agreed to cease production of lead-containing candles in 1974. In the developed world, metals other than lead are favoured in wicks, yet wicks in the developed world still can contain large amounts of lead in them. In less regulated parts of the world, you can expect lead to be more common in candles. Lead is a known health and developmental hazard and is still the dominating hazard from burning candles. Burning of lead core wick has be shown to produce hazardous levels of lead in the air.

Trace Metals

Metals such including Cd, Cr, Co, Mn, Ni, and Zn are found in addition to lead in candle smoke. These metals cause everything from minor irritation to chronic lung disease to cancer.

Carbon Monoxide

This is the odourless part of the smoke and fumes emitted by any wax powered stove or lantern. If you see a yellow flame, you can expect a fair amount of carbon monoxide. If you see a flame, you can expect some amount of carbon monoxide. See the Carbon Monoxide page for more information on this hazard.

Aroma Additives

These are all really bad for you. Avoid any waxes with scent additives - even if they claim to ward off mosquitoes or wolves.

Incense

There area several studies that show exposure to incense smoke is related to many illnesses, including cancer, leukaemia in children, childhood brain tumours, asthma, and contact dermatitis.

Bears

One common way hunters attract bears is by heating up honey or burning beeswax candles. Bears love honey and if you are in bear country, bears will take notice when you fire up a beeswax candle or stove. They may even be interested in your solid beeswax candle you have packed away in your pack.

Solid Alcohol

AKA - Dry Spirit, Waxed Solid Fuel, Pastilles Carburant Solide, Flaming Solid Alcohol, stearyl alcohol, octadecanol. Solid alcohol fuel is generally considered safer to use than liquid alcohol as it has much less of a spill hazard potential. These fuels range from pure solid alcohol to solid compounds to waxy semisolid forms to gel structures. And depending on makeup, they may be free standing, wrapped in shrink wrap with or without foil, sealed in thin plastic containers or stored in metal tins.

American Gelled Alcohol	Gelled alcohol is the most commonly used form of "solid alcohol." It generally an alcohol of blend of alcohols trapped in a chemical matrix - forming a gel. It must be stored in an airtight container (generally metal). More information on this may be found on the Gelled Alcohol Stoves page.
Chinese Solid Alcohol	"Flaming" solid alcohol is a solid alcohol made from carbinol, ethanol and "condensate." It is widely used in Asia as a safe alternative to liquid alcohol fuel (which causes a high number of burns each year). Since it is more of a solid than gelled alcohol and sublimes rather than melts, it does not require a metal container to contain it.
Japanese Waxed Methanol	Another popular cooking fuel in Asia is shrink-wrapped solid alcohol with foil wrapped around the bottom. The plastic not only protects the fuel for drying up, but is also flammable to help the fuel ignite. These are packed 10 per airtight bag. These are very common to see these in use in restaurants and hotels in Japan. For our Japanese speakers, here is a copy of the paper that came with the package. Although this fuel works rather nicely and is easy to find in Japan, it tends to dry out rather rapidly over time and is not a good choice if you don't plan on using it within a month time.
Stearyl Alcohol	Stearyl Alcohol and other large chained alcohols are often solid at room temperature and is quite flammable. META by LONZA Ltd had an alcohol fuel in a tube made from ethylene added to alcohol which had a calorific value of about 6,000kcal/kg.
Dry Spirit	One fuel includes waxed solid fuel tablets or "Dry Spirit." These are often used by miniature steam engines and are more common in Europe and Asia than in the USA. It can be difficult to determine what a fuel is made of as the term "Dry Spirit" is often used to describe hexamine fuels such as Esbit. It is not clear if the above fuel is a solid alcohol or hexamine. Another method of solidifying alcohol involves mixing it with stearin and sodium hydroxide. This has been used in the days of old in Europe and can be made at home pretty easily if you don't mind working with sodium hydroxide (lye) in your kitchen.

Homemade Solid Alcohol

Caution
The following recipes involve use of sodium hydroxide, which is a very caustic material and is very dangerous to work with. Please read up on this chemical prior to conducting any experiments and take precautions to protect exposed skin and eyes. This recipe is rather dangerous and can cause an explosion - showering the cook with very dangerous chemicals. Do so at your own risk.

Precautions
- Read up on soap and candle making prior to working with lye.
- Always wear gloves and goggles when working with lye
- Never pour water into lye (Caustic Soda).
- If you use water with lye - Never use warm or hot water with lye. Ideally use 50% ice with water.
- Never use tin, zinc or aluminium with lye.
- Have vinegar available to douse skin if lye comes in contact with it.
- Prevent overheating of fuels - as this can cause a fire and/or explosion.

Homemade Solid Alcohol Method 1	US Patent 4436525 describes a solid alcohol fuel that leaves only 6% residue.	**Ingredients (all ingredients are anhydrous)** • 67.7 parts Methanol • 26 parts Isopropanol • 5.5 parts Stearic Acid • 0.8 parts Sodium Hydroxide (aka - NaOH, lye or caustic soda)	**Directions** • Make a 10% NaOH/methanol solution - 10 gms of NaOH are dissolved in 90 gms of methanol • Warm solution to 100°F	**Directions** • Stearic acid is added to isopropanol and remaining methanol and heated to 140°F (stearic acid should melt) • Add NaOH/methanol mixture to stearic acid/alcohol mixture and mix • Pour in moulds

Homemade Solid Alcohol Method 2	**Ingredients** • 100 units of alcohol • 10 units of stearin (glyceryl ester of stearic acid) powder or finely chopped flakes (sold as candle/soap making material or can be made from edible 100% stearin candles) • 3 units of Sodium Hydroxide. Lye may also be homemade with certain wood ashes and distilled water.	**Directions** • Create a water bath to heat your ingredients without overheating them (which could cause an unexpected fire or explosion). This is done by placing a smaller pot (should not be aluminium) within a larger pan or pot filled with water. The larger pan/pot is heated which in turn heats the smaller pot floating in the heated water. • Add your sodium hydroxide and stir. • Add your alcohol to the smaller pot and slowly add stearin to allow it to melt. • Pour your solution into a non aluminium container and allow it to cool down and harden.
Fuel Paste	AKA - Fire Paste, Fire Starting Ribbon, etc. Often used for starting fires or preheating liquid stoves. These pastes can and have been made from many different ingredients.	

FUEL
Liquid Fuel

Liquid fuels are combustible or energy-generating molecules that can be harnessed to create mechanical energy, usually producing kinetic energy; they also must take the shape of their container. It is the fumes of liquid fuels that are flammable instead of the fluid. Most liquid fuels in widespread use are derived from fossil fuels; however, there are several types, such as hydrogen fuel (for automotive uses), ethanol, and biodiesel, which are also categorized as a liquid fuel. Many liquid fuels play a primary role in transportation and the economy.

Examples	**Alcohol** ● Denatured ● Grain ● Methyl ● Isopropyl ● Gelled ● Diethylene	**Petroleum's** ● Petrol ● Diesel ● Kerosene	**Kerosene** Can be used for lamps, wick burners, pressure burners and anti-freeze.	

Alcohol

Various types of alcohol fuels that are used by the camping & backpacking community.

Denatured Alcohol

Uses ● Alcohol Stoves ● Window Cleaning ● Removal of Ink Stains ● Paint Removal	(ethanol with methanol (added as a denaturing agent), methyl ethyl ketone, acetone, water, and possibly other chemicals - aka methylated spirits, metho, shellac thinner, marine stove fuel, liquid fondue fuel, chafing dish fuel)

Methylated spirits isn't light, control over the stove is poor by modern standards, it takes twice as long to boil some water and it uses twice the weight of fuel to do so. The efficiency of metho as a fuel is very poor. Fuel availability in some countries is also poor. Found in marine shops and in the paint department of most hardware stores. Many brands of this solvent are specifically marketed for use as marine stove fuel and/or chafing fuel. This form of fuel has anywhere from 1% to 80% methanol and other poisonous chemicals in it. Because of the great variability of contents in denatured alcohol, some brands burn better than others. One trick to test the suitability of a particular brand of denatured is to burn a small amount in a dish and reject it if there is any residue left after it has burned. Lab grade ethanol may have benzene or other chemicals mixed in with it.

Grain Alcohol

Uses ● Alcohol Stoves ● Fire Starters ● Disinfectant ● Cleaner	(aka pure ethanol, pure grain alcohol, PGA, grain neutral spirits, GNS, rectified spirit, rectified alcohol, medical grade ethanol, ethyl anhydrous, moonshine)

Everclear Grain Alcohol and Golden Grain alcohol from the David Sherman Corporation come in 95% (190 proof) bottles. This fuel works well but is an expensive option and may be illegal or difficult to purchase in many places. It is also non-toxic and can double for medicinal uses. Grain alcohol can also be made at home in large quantities, though perhaps not legally in your area without special permits or permission. Pure ethanol (aka absolute alcohol or dehydrated alcohol) can also be purchased from chemical supply distributors and as medical grade ethyl alcohol for a very high price. Since production of alcohol greater than 95.4% requires a special dehydration process that includes benzene or glycerine, these fuels can be very toxic.

Methyl Alcohol

Uses ● Alcohol Stoves ● Antifreeze ● Producing Biodiesel ● Denaturant Additive	(aka methanol, wood alcohol, methyl hydrate, liquid fondue fuel, camp stove fuel, gas line antifreeze)

Found in some hardware store paint departments as paint thinner or at gas stations and general stores as gas-line antifreeze such as HEET brand (Yellow is Methanol, Red is Isopropyl). Hikers can stock up on HEET at Wal-Mart at the end of winter when surplus antifreeze goes on sale. You may also be able to purchase this for around US$3 per gallon at race shops that sell it as race fuel. The vaporization pressures of methanol are much higher than ethanol throughout the applicable temperature ranges and the jets in your stove might light up faster when using this fuel. This is also a very poisonous fuel and you should consider the health concerns of this fuel if you decide to use it long term (thru-hikers beware and others may want to avoid storing contaminated stoves in their cook pots or bowls). Air Brake Antifreeze is also mainly methanol with other additives. It can be purchased by the gallon, half gallon and quart at big truck parts shops.

Isopropyl Alcohol

Uses ● Alcohol Stoves ● Cleaning ● Disinfectant ● Removing Ink and Marker Stains	(Isopropanol, 2-Propanol, rubbing alcohol) Not recommended

Found in drug, food and general stores (HEET in red container). Rubbing alcohol is generally only 70% alcohol and won't work in many stoves. Alcohol with 91% or greater alcohol content will work, but will leave a sooty residue on your pot and brown water in your stove. The heat potential for this fuel is high, but it doesn't generally burn completely (yellow flame and unburned soot) and is generally mixed with water that isn't burned and hinders fuel efficiency. If you want to use rubbing alcohol (cheapest easily available fuel on this list) for fuel, you may want to use an open flame stove instead of a jetted stove. If you decided to use a jetted stove, you may need to use larger jets in your stove (#57 drill, pushpin size, ~1.4mm or larger) and try to empty as much left over liquid from your stove as you can after each use (as this will further hinder future fire ups) for it to operate.

Gelled Alcohol

Uses ● Alcohol Stoves ● Buffet Heating ● Heat Source	(Sterno, Canned Heat, jelled alcohol)

This is either methanol or ethanol trapped in a network of solid calcium acetate forming a gel. This gel is a little safer to use than liquid alcohol since there is less of a spill hazard. Unfortunately, most gelled alcohol stoves have small top openings and often don't get food hot enough to cook or bring water to a boil. This fuel usually comes in a resealable can and may be the best choice for young and clumsy campers, since kicking it over is less likely to cause a significant fire hazard as would other liquid and gas stoves. Due to costs and limitations, it is not highly recommended for most long distance backpackers.

Diethylene Glycol

Uses ● Alcohol Stoves ● Solvent for Resins, Dyes and Oils ● A component in brake fluid, lubricants, artificial fog and more	(DEG, 3-oxa-1,5-pentanediol, diglycol, ethylene diglycol, or dihydroxy diethyl ether) Not recommended

Diethylene glycol is used in many brands of chafing fuels and must use a wick to burn. It is considered non-flammable by the US Department of Transportation, can be air transported and is therefore much more economical to transport and store. These transportation and storage classifications make it ideal for the retail market and it's safe to assume that any chafing fuel can with a wick uses diethylene glycol until proven otherwise. This fuel is difficult to light and is extremely poisonous. It is in fact the deadly chemical implicated in the 1937 Elixir Sulfanilamide Incident that killed 107 and was the main motivation for hastening of the enactment of the 1938 Federal Food, Drug, and Cosmetic Act. This fuel can be used but is not recommended for backpacking stove use due to its toxicity and non-flammable nature.

Petroleums

Petrol

Petrol can keep six months at 20°C (68°F) or three months at 30°C (86°F). Fuel stabilizer can preserve fuel for up to a year. Should be protected from the sun, well ventilated and free of flammable materials. Keep a fire extinguisher and sand on hand. Never use genuine petrol in a stove. The refinery adds a number of quite nasty things to it to make cars run better which aren't good for your health such as lead (brain damage), benzene (serious carcinogen) and other more esoteric things.

Petrol Stove Lighting
In general you do not need to prime a petrol stove. There are enough volatiles in petrol that it should light quite easily under most conditions. However, in the snow you may need to help it a long a bit as the 'volatiles' may no longer be evaporating. In warm weather most jets will spray the fuel out in a manner fit for a flame-thrower. In fact, the greatest hazard is fumbling the action of lighting the stove, such that liquid petrol spills everywhere. This is extremely dangerous: do it well outside your tent. If cooking in a hut, consider lighting the stove outside, or at least in the stone fireplace.

Petrol Hazards
'Whoomp' is all very well, but sometimes petrol goes slightly more than whoomp. The following is true by the way: the information was obtained directly from the people concerned. A canoe party was travelling in outback Canada and they were cooking a meal for the whole party over two petrol stoves of a very well-known brand. Unfortunately, either through too much familiarity with the stoves, or perhaps not quite enough knowledge of the hazards, they made several mistakes.

- They put the two stoves very close together.
- They were using very large diameter cooking pots which nearly overhung the petrol tanks.
- They did not have someone sitting there looking after the stoves all the time.

The result was that radiation, and possibly hot exhaust air too, from under the pots hit the tanks and heated them up. One tank in particular got far too hot. Yes, they did notice that the stoves were sounding rather noisy after a while, but did not realise the hazard until too late. Then as a member of the party went to check the stoves, the over-heated petrol tank exploded. Yes, one of those pumped aluminium fuel tanks we all know so well: it split opened up. Instant petrol vapour fireball. The adjacent tent flashed of course, but you can always buy another tent. Far worse was the damage done to a couple in the party who were near the stoves. The man had his face burnt a bit and one hand severely damaged. His wife got fuel up one arm and lost the skin there. The pictures show the damage, I believe some time later, after extensive treatment.

Kerosene

This is really just a less volatile part of the refinery output, and kero stoves are very similar to petrol ones. The fuel is not souped up with extra additives like with petrol, which is optimised for a car engine. In fact, kero is at least partly designed for lighting and for stoves. Anyhow, kero is not as volatile as Shellite, and it does not go whoomp if you throw a lighted match onto a pool of it. You have to heat it up to get it to vaporise before you can get a flame. Technically, it has larger or longer molecules than petrol, going up to very roughly around C14. That is, petrol consists largely of hydrocarbons with small numbers of carbon atoms per molecule, while the hydrocarbon molecules in kero are bigger.

There is no real concrete borderline. The vaporising of the fuel is done by running the liquid kero through a preheat or generator tube which goes over the top of the burner, through the flame. Many petrol stoves have one of these as well to make them work well in cold conditions. Brands of stoves are generally the same as for petrol. Some can burn both petrol and kero, although you're meant to change both the generator tube and the jet when swapping fuels.

Several manufacturers recommend doing this changeover. The larger kero molecules require more heating to vaporise them and a smaller jet. Anyhow, kero has several definite advantages over 'petrol': it does not go whoomp and it does not have all sorts of toxic nasties in it. As a result it is a preferred choice for many people in the mountains. Also it is readily available everywhere around the world, including places like Nepal, where kero stoves and kero lamps are the order of the day. If you are going to use kero there are few other tricks of the trade to watch. Sure, it isn't as volatile as 'petrol', but you still have to seal the container tightly. Kero can creep out of bottles under strange circumstances, and can contaminate anything surrounding it (especially food). The red nylon ""Nalgene"" fuel bottles sold in bushwalking shops can hold kero, but the caps will not seal well in practice.

Kero is not a lubricant, and the surface of the nylon seems to go ""rough"" and the cap will not do up properly. Putting a fat neoprene O-ring into the sealing groove will solve this if you can find suitable O-rings. (Try the yellow pages: O-rings are readily available.) Luminium bottles (Sigg, Laken) can also be used provided you make sure the O-ring seal is in good condition. But make sure you know which bottles contain fuel and which contain water! For that matter, the author has successfully cached kero in the Australian Alps for some time in sheltered spots in 1.25L soft drink PET bottles. They have a fair seal under the cap too.

Failure to seal a kero container can have worse consequences than a bad taste in your food. There are a couple of stories about Antarctic explorers having trouble with unsealed kero containers. One was leaving kero in cans in his caches on the outward trip, but found on the return trip that the kero had crept out of the cans despite the lids being ""tight"". The lack of fuel had unfortunate results for the party.

Another party with this problem was Treseder and Jarvis in October 1999, who had to abort a trip after losing seven litres of fuel and the food which absorbed it. Keep your kero (and petrol) separate from your food! For historical interest, the first 'wickless kerosene pressure stoves' were made by Primus. It was believed for a while that a Swede by the name of F.W. Lindqvist was responsible for this invention, but it now seems that the real inventor was a Dane - Frederik Ferdinand Tretow-Loof. Or so an article on the Classic Camp Stove web site says. Just thought you might be interested.

Lighting Kerosene

Lighting a kero stove takes more skill than lighting a petrol stove, but it isn't that difficult if you know how. There usually is a bit of a kerosene smell when starting, which can pong out a tent or hut. Prime the stove and preheat the generator tube. You can do this with kero, but that is unreliable and smoky, and good at blocking the jet too. A little metho works very well and is much cleaner. A good way of handling this is with a small dropper bottle: you can get some suitable Nalgene ones in good bushwalking shops, or you may find some miniature shampoo bottles in hotels. A quite small squish of metho is usually enough, although using too little can make it difficult to repeat the exercise without cooling the stove down first.

Now for the magic (and essential) bit: before you light the metho make sure the generator tube is full of kero! Otherwise, when you open the valve the cold kero coming in will chill the generator tube back down so the kero doesn't vaporise and the stove won't light. Just as the metho flame runs out, gently open the kero valve and the stove should spring into life. Once you have done this a few times (practice at home!) it gets to be fairly easy. A side benefit of having the generator tube quite full before you start is that some kero leaks out when it gets warm, adding a little extra burn time to the priming process.

Shellite	It is a volatile mix of hydrocarbons from the petroleum refineries.
Coleman Fuel	
White Gas	
Diesel	
Vodka	These fuels have very long carbon-chain molecules and generate a fair bit of tar in the generator tube and block the jets.
Straight Vegetable Oil	

3 Gas Fuel

Gas fuel refers to any type of fuel that is in a gaseous state under normal conditions. These fuels are typically composed of hydrocarbons like methane or propane, but can also include hydrogen or carbon monoxide, or mixtures thereof. They are highly efficient energy sources that can be readily transported and distributed through pipelines or in pressurized containers, making them versatile for applications ranging from heating and cooking to power generation and vehicle propulsion.

Gas Types
- Butane
- Propane
- Isobutane
- LPG
- Biogas
- Natural Gas (NG)

Gas Uses
- Stoves (Cooking)
- Lanterns (Light)
- Heaters (Heat)
- Torch (Welding)
- Sterilizing (Medical)
- Attacking (Defence)

Butane Gas

Butane is a flammable hydrocarbon gas with the chemical formula C_4H_{10}. It is a member of the alkane family, characterized by its single carbon-carbon bonds. This gas exists in two isomeric forms, n-butane and isobutane, which share the same chemical formula but have slightly different arrangements of their atoms, leading to subtle variations in their physical properties, such as boiling point.

Under normal room temperature and pressure, butane is a gas, but it can be readily liquefied under moderate pressure or by cooling it slightly. This property is fundamental to its widespread use, as it allows for efficient storage and transport in cylinders. The boiling point of butane is around -0.5°C to 1°C, a crucial detail because its performance as a fuel is significantly impacted by ambient temperature. If the temperature drops below this range, the liquid butane within a container may not vaporize effectively, leading to poor or no operation of appliances.

Butane Gas Stove Use
Keep the notch on butane bottle upright when in use or it will shoot liquid into the stove and flare up and could possibly explode.

In its pure state, butane is colorless and odorless. For safety, a strong-smelling chemical, typically a mercaptan, is intentionally added to commercial butane products. This additive provides the distinctive "rotten egg" smell that allows for easy detection of leaks, which is vital given butane's high flammability. Butane vapor is also heavier than air, meaning that in the event of a leak, it will sink and accumulate in low-lying areas. This characteristic presents a significant fire and explosion risk if an ignition source is present in such an accumulated gas pocket.

Butane's versatility and high energy content make it suitable for numerous applications. It is a primary component of Liquefied Petroleum Gas (LPG). However, smaller, disposable gas canisters for camping stoves often contain pure butane or a butane/propane mix. Butane is also the fuel used in many cigarette lighters and is employed as a propellant in various aerosol products, such as deodorants and hairsprays. Furthermore, forms of butane, particularly isobutane (R600a), are utilized as environmentally friendlier refrigerants in modern cooling systems. In the petrochemical industry, butane serves as a chemical feedstock for producing other valuable compounds.

Given its flammable nature, safety is paramount when handling butane. It must be used in well-ventilated areas to prevent the accumulation of gas and to ensure adequate oxygen. Direct contact with liquid butane can cause severe cold burns or frostbite due to its rapid vaporization. Tragically, butane is also a substance sometimes abused through inhalation, which carries severe health risks, including fatal cardiac arrhythmias.

Propane Gas

Propane is a hydrocarbon and an alkane with the chemical formula C_3H_8. It is a three-carbon chain molecule, entirely composed of carbon and hydrogen atoms linked by single bonds. At standard room temperature and pressure, propane exists as a gas, but it is easily liquefied under relatively low pressure or by cooling, a characteristic that makes it highly efficient for storage and transport in cylinders.

The boiling point of propane is notably low, approximately -42°C. This low boiling point is a significant advantage as it allows propane to readily vaporize and turn back into a gas even in very cold ambient temperatures. This property makes it a reliable fuel source for outdoor storage and use in a wide range of climates.

In its natural state, pure propane is colorless and odorless. For safety purposes, a pungent odorant, typically ethyl mercaptan, is always added to commercial propane. This additive provides the distinctive "rotten egg" smell, enabling prompt detection of leaks, which is crucial due to propane's high flammability. Propane vapor is heavier than air, meaning that if a leak occurs, the gas will sink and accumulate in low-lying areas such as basements, pits, or depressions. Such accumulations pose a severe fire and explosion hazard if an ignition source is present.

The versatility and high energy content of propane lead to its widespread use across numerous applications. It is a major component of Liquefied Petroleum Gas (LPG) and is commonly used for residential heating, water heating, and cooking, both indoors and for outdoor activities like grilling. Propane also serves as a fuel for various industrial processes, agricultural equipment, and is used to power some vehicles, referred to as autogas. Furthermore, it acts as a propellant in certain aerosol products and finds use as a refrigerant in some systems.

Despite its utility, strict safety precautions are essential when handling propane. Its extreme flammability means that any leak in an enclosed space, without proper ventilation, can lead to a dangerous fire or explosion. Due to its nature as a heavier-than-air gas, areas where it is stored or used must be well-ventilated to prevent hazardous accumulations. In high concentrations, propane can also act as an asphyxiant by displacing oxygen in the air. Direct skin contact with liquid propane can cause severe cold burns or frostbite.

Isobutane Gas

Isobutane, also known as 2-methylpropane, is a hydrocarbon that shares the same chemical formula as n-butane (C_4H_{10}), making it an isomer of butane. While they have the same number and type of atoms, their molecular structures are different: n-butane has a straight chain of four carbon atoms, whereas isobutane has a branched structure with a central carbon atom bonded to three other carbon atoms (a methyl group attached to propane).

This difference in structure gives isobutane distinct physical properties compared to n-butane. Notably, isobutane has a lower boiling point of approximately -11.7°C (10.9°F), which is significantly lower than n-butane's boiling point of around -0.5°C. This characteristic makes isobutane more suitable for use in colder conditions, as it will vaporize more readily at lower temperatures, leading to better stove performance.

Like n-butane, isobutane is a colorless, highly flammable gas at room temperature and pressure. It is typically shipped as a liquefied gas under pressure. While naturally odorless, an odorant is added to commercial isobutane for safety, allowing leaks to be detected. Its vapors are heavier than air and will accumulate in low-lying areas if there is a leak, posing a fire and explosion hazard.

Common uses for isobutane include:

- Refrigerant: Isobutane (often designated as R600a) is widely used as an environmentally friendly refrigerant in household refrigerators, freezers, and air conditioning systems, as it has a very low global warming potential and no ozone depletion potential.
- Fuel: It is frequently blended with propane and n-butane in camping gas canisters, particularly in "four-season" or "winter blend" mixes, to improve performance in colder weather due to its lower boiling point.
- Aerosol Propellant: It serves as a propellant in various aerosol products, including cosmetics and spray paints.
- Chemical Feedstock: Isobutane is an important precursor molecule in the petrochemical industry, used in processes like alkylation to produce high-octane gasoline components and other chemicals.

Safety considerations for isobutane are similar to those for other highly flammable liquefied petroleum gases. It is extremely flammable, and any leak, especially in an enclosed or poorly ventilated space, can lead to a fire or explosion. Inhalation of high concentrations can act as an asphyxiant by displacing oxygen, and direct contact with liquid isobutane can cause severe cold burns or frostbite.

LPG Gas

LPG, or Liquefied Petroleum Gas, is a highly versatile and flammable fuel composed primarily of a mixture of hydrocarbon gases, specifically propane and butane. It is derived from the processing of natural gas and the refining of crude oil. What makes LPG so useful is its ability to be easily liquefied under relatively low pressure. This transformation from a gas to a liquid significantly reduces its volume, allowing large quantities to be stored and transported efficiently in cylinders or tanks. When the pressure is released, such as by opening a valve on a gas bottle, the liquid rapidly converts back into a usable gas.

The specific composition of LPG can vary, with the proportion of propane to butane being influenced by factors like climate and intended use. Propane has a very low boiling point (around -42°C), meaning it vaporizes readily even in very cold conditions. This characteristic makes propane-heavy LPG blends ideal for outdoor storage and use in colder climates.

Butane, on the other hand, has a higher boiling point (around -0.5°C) and performs less effectively in freezing temperatures, making it more suited for warmer environments or specific indoor applications. Regardless of the blend, a strong-smelling odorant is always added to LPG, as it is naturally odorless, providing a crucial safety feature for detecting leaks.

LPG is utilized in a vast array of applications globally. In residential settings, it powers cooktops, ovens, water heaters, and heating systems, especially in areas without access to natural gas pipelines. Its portability makes it an indispensable fuel for outdoor cooking with barbecues and for heating in caravans, RVs, and boats. Beyond domestic use, LPG is a significant fuel for commercial kitchens, industrial processes, agriculture, and as a motor fuel (autogas) for vehicles. Its clean-burning properties, high energy density, and ease of transport contribute to its widespread adoption as an efficient and convenient energy source.

Odorant: A strong-smelling chemical like ethyl mercaptan (ethanethiol) is always added to LPG. In its pure form, LPG is odorless, so the odorant provides the distinctive "rotten egg" smell that allows people to detect leaks for safety reasons.

Biogas

Biogas is a renewable energy source produced from the breakdown of organic matter in the absence of oxygen, a process known as anaerobic digestion. This natural biological process is carried out by microorganisms, primarily bacteria, that feed on and decompose various types of organic waste materials. These feedstocks can include animal manure, food scraps, agricultural residues (like crop waste), municipal solid waste, and sewage sludge. The controlled environment for this decomposition is typically a sealed container called an anaerobic digester or biodigester.

The gas produced from this digestion process is a mixture, primarily consisting of methane (CH_4), which is the combustible component, and carbon dioxide (CO_2). Methane typically makes up 50-75% of biogas, while carbon dioxide accounts for 25-50%. Biogas can also contain trace amounts of other gases such as hydrogen sulfide (H_2S), nitrogen (N_2), hydrogen (H_2), and water vapor. The exact composition varies depending on the type of organic waste used as feedstock and the operating conditions of the digester.

Biogas is a valuable energy source with a range of applications. It can be burned directly for heating and cooking, which is common in rural areas or developing countries. It can also be used to generate electricity and heat in combined heat and power (CHP) plants. Furthermore, if biogas is cleaned and purified to remove carbon dioxide, hydrogen sulfide, and other impurities, it becomes what is known as biomethane (or renewable natural gas, RNG). Biomethane is essentially pure methane and is chemically identical to fossil natural gas, meaning it can be injected into existing natural gas pipelines or used as a vehicle fuel. This makes biogas a key component in sustainable waste management and the transition to a low-carbon energy economy, as it captures methane that would otherwise be released into the atmosphere from decomposing organic waste, a potent greenhouse gas.

Natural Gas

Natural gas, as a gas fuel, is a naturally occurring fossil fuel primarily composed of methane (CH_4). While methane constitutes the bulk of natural gas, typically ranging from 70% to over 90%, it often includes smaller amounts of other light hydrocarbons like ethane, propane, and butane, as well as non-combustible gases such as nitrogen and carbon dioxide, and sometimes impurities like hydrogen sulfide.

A key characteristic of natural gas is that it is lighter than air. This means that in the event of a leak, it tends to rise and disperse into the atmosphere, which can be a safety advantage compared to heavier-than-air gases like propane or butane that can accumulate in low-lying areas. In its pure form, natural gas is odorless, colorless, and tasteless. For safety reasons, a strong-smelling odorant, such as mercaptan, is deliberately added to give it a distinctive "rotten egg" smell, allowing leaks to be readily detected by humans.

Natural gas is a highly valued fuel due to its clean-burning properties, producing fewer greenhouse gas emissions and air pollutants compared to other fossil fuels like coal or oil when combusted. It is delivered to consumers directly through extensive underground pipeline networks, providing a continuous and on-demand supply. This makes it an incredibly convenient and often cost-effective energy source for a wide range of applications globally, including electricity generation in power plants, heating homes and water, cooking, and various industrial processes. It can also be converted into liquefied natural gas (LNG) for transport over long distances by ship.

Gas Canister Tips

Canister Circumferences
- Butane 220g: 6.7cm
- Jetboil 100g: 8.75cm
- Jetboil 230g: 10.66cm
- Jetboil 450g: 10.66cm

Canister Durations
- Butane 220g: Boils ~15L
- Jetboil 100g: Boils ~10L
- Jetboil 230g: Boils ~23L
- Jetboil 450g: Boils ~45L

Canister Weights Full
- Butane 220g Full: 322g
- Isobutane 100g Full: 200g
- Isobutane 230g Full: 380g
- Isobutane 450g Full: 670g

Gas Canisters will pop their convex base out when about to explode. Don't use Propane gas on a Butane stove. You can pre-heat gas canisters with a candle if it's very cold and the gas won't work.

Boiling Points:
- Butane: -0.4°C (31.2°F)
- Isobutane: -11.75°C (10.8°F)
- Propane: -42°C (-43.6°F)

Canister Weights Empty
- Butane 220g Empty: 102g
- Isobutane 100g Empty: 94g
- Isobutane 230g Empty: 126g
- Isobutane 450g Empty: 195g

Canister Prices (2018[n])
($ per 100g)
- Butane 220g: $1.25 ($0.56)
- Jetboil 100g: $12.00 ($12)
- Jetboil 230g: $8 ($3.47)
- Jetboil 450g: $12 ($2.66)

Refilling Gas Canisters

Refilling gas canisters is the transfer of some or all the gas from one canister to another less-full one. Refilling gas canisters can lower the cost, fill only what you will use for a trip to reduce weight and topping off cans.

Warning
- Only refill each canister between 12-15 times. If the threads look old, toss the canister.
- Never fill backpacking canisters with 100% propane, it may not have the strength.
- Only refill each canister between 12-15 times. If the threads look old, toss the canister.
- Never fill backpacking canisters with 100% propane, the canister may not have the strength.

Weigh the canisters when they are full and empty so you know the weight of the liquid inside and how full it is. Weigh the refiller component and write it down. Mark the canisters' full and empty weights and how many times it's been refilled.

Dangers
- Overfilling
- Gas Leaks
- Damage to Threads
- Too Much Pressure
- Water in threads
- Overheating

Adapter Weights
G-Works R1 - 36g?
G-Works Plus - ?
Butane Adapter - ?

Setup
Place the donor canister into a pot of warm water keeping the threads dry. Prepare an ice bath for the receiving canister, also keeping the threads dry.

Connecting Canisters
Dry the donating canister. Make sure the latch is closed. Hook up the receiving canister then the donor canister to the adapter then open the latch. Every few minutes check the weight of the receiving canister and re-warm the top canister until the receiving canister is full. If using butane, there is a vapour feed tube in the canister in an L bend pointing down toward the notch. For maximum transfer tilt the canister with the notch pointing down. Transfers are very slow and could take a couple of hours. The receiving canister may need to be chilled and the donating canister warmed. Can hear a bubbling in the donating canister if it's transferring and you press your ear up to it. Refill canisters outside as vapours can escape and explode if lighting sources are nearby. No two canisters have the same strength, propane has more pressure then butane.

4 Creating Fuel

This section explains how to create different types of fuel for yourself.

Wood Gasifier

A wood gasifier is a device that converts solid biomass, typically wood or other carbon-containing materials like charcoal or agricultural waste, into a combustible gas known as wood gas (also called producer gas or syngas). This process is called gasification, and it's fundamentally different from simple burning or combustion.

Instead of burning the wood completely with ample oxygen, a gasifier operates in an oxygen-limited environment and at high temperatures. Within the gasifier, the wood undergoes several stages:

Drying	Any moisture in the wood is evaporated.
Pyrolysis (Devolatilization)	As the wood heats up without much oxygen, it decomposes, releasing volatile gases (which include methane, hydrogen, carbon monoxide, and also tars and other complex organic compounds) and leaving behind a solid residue called char (or charcoal).
Combustion/Oxidation	A small, controlled amount of oxygen (usually air) is introduced, causing some of the char and volatile gases to partially burn. This partial combustion generates the high temperatures needed to drive the subsequent reactions.
Reduction	The hot gases produced (like carbon dioxide and water vapor) then pass through a bed of incandescent char. Here, they react with the hot carbon in a reduction process, converting them into more desirable combustible gases like carbon monoxide (CO) and hydrogen (H_2). This is where the majority of the usable "wood gas" is formed.

The resulting wood gas is a mixture primarily of carbon monoxide, hydrogen, and some methane, along with non-combustible gases like nitrogen (from the air introduced) and carbon dioxide, and potentially impurities like tar and particulates (soot). This raw wood gas needs to be cooled and filtered to remove tars and particulates, especially if it's going to be used in an internal combustion engine, as these contaminants can cause significant damage.

Once cleaned, the wood gas can be used as a versatile fuel. Historically, wood gasifiers were notably used during fuel shortages, such as World War II, to power vehicles like cars, trucks, and buses. Today, they are still used, particularly in rural or off-grid areas, to generate electricity using internal combustion engines, provide heat, or even for direct cooking and heating applications. Wood gasification is considered a renewable energy technology because it utilizes biomass, which can be regrown, and it offers a cleaner burning alternative to direct wood combustion.

Building a Wood Gasifier

Building a wood gasifier is a complex project that requires significant technical understanding, metalworking skills, and a strong commitment to safety. It is absolutely not a beginner's project and should only be undertaken by individuals with experience in welding, fabrication, and a solid grasp of thermodynamics and gas chemistry. Improperly built or operated gasifiers can be extremely dangerous, posing risks of explosions, carbon monoxide poisoning, and serious burns.

Since it's impractical to include a complete set of instructions with pictures on this document, I have given an outline as to to how to proceed if you want to build one. I recommend purchasing my 'Prep Drive' if you want a collection of information such as this all on a USB drive.

Phase 1: Design and Planning

1. Research Thoroughly:
This is paramount. Do not proceed without deeply understanding the principles of gasification, different gasifier designs (e.g., downdraft, updraft, stratified), and the specific implications of each. Look for established plans (like the FEMA gasifier plans from WWII or modern open-source designs) and adapt them only with caution and understanding.

2. Determine Your Needs:
Fuel Type: While "wood" gasifier, the specific type and size of wood fuel (chips, chunks, pellets) will influence design.
Output (Gas Quality/Quantity): What do you want to power? A small engine for a generator? A cookstove? This dictates the size and complexity of the gasifier and the necessary gas cleaning.
Materials: Identify available materials. Steel drums, propane tanks (empty and properly purged!), exhaust pipes, and various fittings are common. Never use galvanized steel for hot components, as welding it produces toxic fumes.

3. Component Sizing: The size of key components like the fire tube (reactor/reduction zone) and nozzles is critical and depends on the desired engine horsepower or heat output. Consult established charts and formulas for this.

4. Safety First: Integrate safety features into your design from the outset. This includes robust construction, pressure relief mechanisms, flashback arrestors, and well-designed seals. Plan for proper ventilation during operation.

5. Tools & Skills Assessment: Be honest about your capabilities. You will likely need:
- Welder (arc, MIG, or TIG) and welding safety gear.
- Angle grinder, drill press, cutting tools.
- Metal fabrication experience.
- Understanding of airtight sealing.

Phase 2: Gathering Materials and Fabrication

1. Main Body/Reactor:
Outer Shell: Often constructed from large steel drums (e.g., 200-liter oil drums) or repurposed propane tanks (expertly emptied and purged first!). This forms the outer casing and often part of the gas collection chamber.
Inner Reactor/Fire Tube: A smaller diameter steel pipe or drum is used for the core reaction zone. This needs to be very robust and heat-resistant.

2. Fuel Hopper:
This sits above the reactor and feeds fuel into it. It needs to be airtight to prevent air ingress.
Often a larger steel drum or cone-shaped section.

3. Grate System:
A robust, heat-resistant grate (e.g., made from thick steel plate, rebar, or cast iron) is needed at the bottom of the reaction zone to support the fuel bed and allow ash and char to fall through. Many designs incorporate a "shaker grate" mechanism to clear ash and maintain gas flow.

4. Air Inlets (Nozzles/Tuyeres):
Pipes or tubes that introduce a controlled amount of air into the combustion/oxidation zone. Their size, number, and placement are critical for efficient gasification and tar cracking. They are often made of durable materials like stainless steel.

5. Ash Clean-out:
An airtight access port at the bottom of the gasifier to remove accumulated ash and char. This typically involves a removable plate with a gasket and bolts.

6. Gas Outlet:
A pipe that draws the raw wood gas out of the gasifier. This should be positioned to collect the gas efficiently.

Phase 3: Gas Cleaning System

This is often as complex as the gasifier itself and critical for reliable operation and engine longevity.

1. Cyclone Filter: The first stage, using centrifugal force to remove larger particulate matter (soot, char dust) from the hot gas.
2. Condenser/Cooler: A heat exchanger that cools the gas, causing water vapor and heavier tars to condense out. This can be a tube-in-shell design or simply long runs of pipe.
3. Media Filter (Dry Filter): A secondary filter using materials like wood chips, sawdust, steel wool, or even specialized filter media to trap smaller particulates and remaining tar aerosols. This needs to be easily cleanable or replaceable.
4. Fine Filter (Optional but Recommended): For very sensitive engines, a final, even finer filter might be used.

Phase 4: Ancillary Components and Controls

1. Draft System
- Vacuum Source: For downdraft gasifiers, a vacuum source (e.g., a fan, a dedicated blower, or the engine's manifold vacuum once running) is needed to pull air through the gasifier and draw out the gas.
- Flare Stack: A simple pipe where the raw gas can be ignited and burned off initially to confirm gas quality before feeding it to an engine.

2. Ignition Port: An access point to ignite the wood fuel inside the gasifier.

3. Instrumentation:
- Temperature gauges in various zones.
- Pressure gauges (manometers) to monitor pressure drop across the system and filters.
- Carbon monoxide detectors (absolutely essential for safety).

4. Seals and Gaskets: All connections, access ports, and joints must be absolutely airtight to prevent air leaks into the gasifier (which can lead to uncontrolled combustion or explosions) and gas leaks out (posing CO poisoning risks). High-temperature gaskets and sealants are required.

Phase 5: Testing and Operation

1. Leak Testing: Before any fuel is introduced, thoroughly leak-test the entire system.
2. Initial Startup: This is a delicate process involving careful ignition and managing air supply to establish the correct reaction zone.
3. Gas Quality Testing: Observe the flare flame (should be clear and blue, not smoky or yellow) to assess gas quality.
4. Engine Integration: If powering an engine, careful tuning and carburetor adjustments will be required to run on wood gas, which has a lower energy density than gasoline or natural gas.
5. Ongoing Maintenance: Regular cleaning of ash, char, and especially the gas cleaning system is vital.

Phase 6: Improvements

Once you have a working gasifier you are likely to have picked up some tips that you could have done better next time. You may even come up with some better ideas on how to redesign the components for better efficiency. As with all things, safety first.

Biodiesel

Biodiesel is made from vegetable and animal oils and fats or triglycerides. It can't be made from engine oil. Triglycerides consist of three long-chain fatty acid molecules joined by a glycerine molecule. Lye acts as a catalyst breaking off the glycerine molecule and combining each of the three fatty acids chains with a molecule of methanol creating mono-alkyl esters. The glycerine sinks to the bottom and is removed. The process is called transesterification. It can be used straight in any diesel tank without modifications.

Processor Materials
- 3L HDPE Container with 2 lids
- Electric Hotplate w/Temp
- Pasta Cooker/Square
- Colander
- Electric Drill
- Stirrer
- 2 x 1/2L PET Bottles
- Thermometer
- 1/2L 50% Translucent HDPE Container with screw on cap and spare cap
- Scrap 3cm angle iron for drill stand.

Chemicals Required
- Alcohol - Either Methanol or Ethanol (Harder with Ethanol but it's also renewable)
- 1L Vegetable Oil
200ml Methanol 99%+
- Lye Catalyst - 97%+ 3.5g of Sodium Hydroxide or Potassium Hydroxide (99% - 4.9g, 92% - 5.3g, 90% - 5.5g, 85% - 5.8g)
- Mini-Processor and Attachments (Left)
- Scales accurate to 0.01g
- Measuring Beakers for meth and oil
- Duct Tape
- Thermometer

Finding Methanol
Methanol can be called methyl alcohol, wood alcohol, wood naphtha, wood spirits, methyl hydrate, carbinol, colonial spirits, columbian spirits, Manhattan spirits, methylol, methyl hydroxide, hydroxymethane, monohydroxymethane, pyroxylic spirit or MeOH. The methanol must be 99%+ pure. Also used as a paint solvent.

Finding Lye/ Caustic Soda
Can be potassium hydroxide (KOH) or sodium hydroxide (caustic soda, NaOH) Lye is hygroscopic - they rapidly absorb moisture from the atmosphere which makes them less effective. Keep containers sealed and airtight.

NaOH is cheaper but KOH is a better catalyst. The process is the same for both but KOH requires 1.4025x more and comes in various qualities. NaOH is a drain cleaner and found in hardware stores.

Dangers
Lye is extremely caustic, keep it off your skin and out of your eyes and don't breathe in the fumes and keep the process away from food. Lye reacts with aluminium, tin and zinc. Use HDPE (High-Density Polyethylene), glass, enamel or stainless steel containers for methoxide.

Best Oil
Beginners should use new, unused oil.

Use: Rapeseed oil, canola oil, corn oil, soy oil and sunflower oil.
Avoid: Peanut oil, palm oil, coconut oil, tallow, lard and olive oil.

Procedure Overview
1. Pre-heat the oil to 55°C (131°F) and pour into blender.
2. Pour in the methoxide from the HDPE container and secure lid tightly.
3. Mix for 20-30 minutes or longer on a low speed.
4. Pour it into the 2L PET bottle for settling and screw the lid on tightly, let air in if it contracts.
5. Let it settle for 12-24+ hours. The darker glycerine will collect at the bottom with the biodiesel above.
6. Separate the biodiesel from the glycerine and store in a PET bottle being careful not to mix any glycerine in.
7. Use the wash-test and the methanol test to check the quality of the biodiesel.
8. If the biodiesel passed the tests, wash the rest of it.

Procedure

This is the procedure on creating biodiesel.

1	**Building the Mini-Processor** Create a drill stand above the 3L container's lid so it can attach and keep churning the oil handsfree. The stirrer is a length of 6mm steel rod with a churning end which fits through the lid of the 3L container. Add a lid strengthening piece of wood/metal to the lid with a 6mm hole in it to keep the drill bit straight and lubricate it. The container should be mostly airtight and a close a fit as possible. Secure with epoxy.
2	**Warming Up** Heat up the oil in a saucepan and pour it into the mini-processor. Slide the stirrer inside and put the lid on firmly. Fill the other 1/2L bottles with water at or above the processing temperature. Put the Processor in the colander and wedge in position with a PET bottle on either side. Add hot water to the cooker just below the level of the oil or before it floats. Adjust the heat to the processing temperature then turn off the heat. Attach the drill to the stand, tighten and start stirring.
3	**Methoxide Bottle** Using the transparent bottle drill two holes in the lid and fit two short sections of plastic or 4mm copper piping, fix on both sides with strong epoxy. To one on the inside fix a length of rigid 6mm plastic tubing that almost touches the bottom. To the other on the outside add a length of flexible 6mm tubing. Fit a third section of copper piping to the small lid of the processor.

4	**Creating Methoxide** Measure 200ml methanol into 1/2L container via the funnel quickly as it absorbs water in the air. Add Lye to the container via the second funnel and replace the bung and screw on tightly. Swirl the container around to mix them together for a minute over a period of time the lye will dissolve forming sodium methoxide/potassium methoxide which will also heat up. When the mixture is clear with no undissolved particles it's ready.
5	**Methoxide Mixing** Add methoxide by removing the lid and bung from the bottle of pre-mixed (cool) methoxide and screw on the transfer lid tightly. Fit the other end of flexible tubing to the inlet pipe of the processor. Carefully lift the methoxide bottle above the processor and turn it upside-down. Air goes into the open pipe through the processor lid into the oil to be mixed. When empty righten the bottle and put it down beside the processor. Any stray methanol fumes that don't condense inside the processor vent into the methoxide bottle and condense there.
6	**Mixing and Draining** Mix the compound with the drill? monitoring the temperature, heating when necessary which should only be twice an hour at room temp. When the process is complete disconnect the drill, remove the container and stand on it's side to settle with the small lid down to drain it later. Once settled loosen the small lid and let the orange glycerine liquid drain out.
7	**Wash-Test** Put 150ml of settled unwashed biodiesel in a 1/2L glass jar or PET bottle. Add 150ml (room temp) water, screw the lid on tight and shake it violently for 10s and let it settle. The biodiesel should separate from the water in half an hour or less with amber biodiesel on the top and milky water below with nothing more then a paper thin line between them. Go to the washing stage. If it looks like mayonnaise or won't separate or separates slowly with a thick white dividing line in the middle, the process needs improving.
8	**Methanol Test** Take 25ml biodiesel and dissolve it in 225ml methanol in a measuring glass. The biodiesel should be fully soluble in it forming a clear bright phase. If not there is pollution in the biodiesel. Each ml of undissolved material corresponds to 4% by volume and it shows the reaction is not complete. The biodiesel will dissolve readily while the oils and fats won't, remaining on the bottom. To fix, alter the processing method and mixing time and check chemical quantities.
9	**Test Tips** It may take several attempts to pass the tests based on different blenders and processors. Ensure the chemicals are the correct measurements and top quality. **Wash Failure:** Either there's too much catalyst which made excess soap. Or there's an incomplete reaction with poor conversion that has left fuel contaminants that also act as emulsifiers. Emulsifiers are used to make stable mixtures of oil and water.
10	**Washing** If the biodiesel passed the tests, wash the rest of it by using 2 2L PET bottles in succession with 1/2L tap water added for each of the 3-4 washes required. Pierce a small 2mm hole in the bottom corner of each of the two bottles and cover the hole securely with duct tape. Pour the biodiesel into one of the wash bottles. Add the 1/2L of fresh water.
11	**Stir-Washing** Using a paint stirrer and a variable drill, mix until the liquids appear homogenous. Settle 3h+ then drain off the water from the bottom of the bottle by removing the duct tape from the hole and block it when it reaches biodiesel. Transfer the biodiesel to the second wash bottle, add fresh water and wash again. Clean the first bottle and replace the duct tape and repeat until finished.
12	**Drying** When it's clear/translucent it's dry and ready to use. It might clear quickly or it might take a few days. To speed it up - gently heat it to 48°C (118.4°F) and allow to cool. This evaporates the remaining water, so let it ventilate.

Alcohol Distillation

Zeolite 3A for getting alcohol above 95% so it can be mixed with Gasoline. It is reusable.	**Materials** ● Bucket ● Fermentation Lock ● Pure Raw Sugar ● 16L Water ● Yeast	**Materials** ● Distiller ● Electric Timer ● Hygrometer ● 3A Zeolite Beads ● Large Steel Mixing Pot ● Thermometer

Method - Fermentation
Pour 4.5kg's (9.9 lbs) sugar into 19L (5 gal) bucket. Add 16L (4.2 gal) water. Mix. Add Yeast and mix. Seal the lid on. Add fermentation lock, take the cover off and add water. Let it sit in a warm place 27-30°C (80.6-86°F) for 7-10 days.

Method
Distill #1: Solution should look thicker and white. Fill the distiller with the wash. Add the lid and plug into the wall with a timer inline set for 2h 25m which results in about 50% alc. Alc level slowly drops over distilling time. Stop process when it's about 50%. Wait 30m until distiller cools before removing lid.
Distill #2: Distil the 50% solution which will then go above 80% alc. Stop when it reaches about 80%. Pour any left over alc after distilling back into the bucket.
Distill #3: Start third distillation of the 80% alc which should return 89-90% alc at about 1.9L.
Distill #4: = 93%+ alc.

Covert 93.5% to 95% Alc **Method 1** 1.9L 90% Ethanol 1.9L E85 3.8L Gasoline **Method 2** 3 Angstrom Molecular Sieve for water Adsorption. Pour both into a pot and stir, heat will be released and leave 95%-99.8% Alc.	**Mixing Alc + Gas** Car should be newer then 1982. Mix 50% Gasoline with 50% Alcohol. Must be 95% or higher Alc or it won't all mix together.	

Purity of Alcohol (Ethanol) Per Distillation Cycle

FUEL | Creating Fuel | Alcohol Distillation | Purity of Alcohol (Ethanol) Per Distillation Cycle

When making alcohol (specifically ethanol) through distillation, achieving high purity is a stepwise process. The fundamental principle is that ethanol has a lower boiling point (78.4°C) than water (100°C), so it vaporizes more readily. However, a significant limitation arises due to the formation of an azeotrope with water.

An azeotrope is a mixture of two or more liquids that boils at a constant temperature and has the same composition in the vapor phase as in the liquid phase. For ethanol and water, this occurs at approximately 95.6% ethanol by weight (or ~96% by volume). Once this concentration is reached, further simple distillation will not increase the purity, as the vapor produced will have the same 95.6% ethanol / 4.4% water ratio as the liquid.

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To achieve purities above this azeotropic point (i.e., "absolute" or "anhydrous" alcohol, approaching 100%), more advanced and specialized techniques are required. These methods typically involve breaking the azeotrope. Common industrial methods include:

- Azeotropic Distillation: Adding a third component (an "entrainer" like benzene, cyclohexane, or toluene) that forms a new, lower-boiling azeotrope with the water, effectively removing the water. This method often leaves trace impurities of the entrainer, making the alcohol unsuitable for consumption.
- Molecular Sieves: Using a desiccant material (like synthetic zeolites) that selectively absorbs water molecules from the 95.6% ethanol.
- Pressure Swing Distillation: Distilling at different pressures to shift the azeotropic point.
- Extractive Distillation: Adding a solvent to alter the relative volatilities of ethanol and water.

Given these limitations, here is a generalized table showing how alcohol purity might increase with successive distillation cycles using standard fractional distillation, and then acknowledging the methods required to go beyond the azeotrope:

This table assumes an initial fermented wash of 10-15% alcohol, and efficient fractional distillation setups. Actual results can vary based on still design (pot still vs. reflux still, number of theoretical plates), operating conditions, and starting concentration.

Distillation Cycle	Ethanol Purity	Notes
Initial Wash	5% - 20%	This is the starting fermented liquid (e.g., beer, wine, sugar wash). Purity is limited by yeast tolerance to alcohol.
Distillation #1	40% - 80%	A single pass in a pot still or initial run in a reflux still. Often referred to as "stripping run" or "low wines." Significant increase in alcohol concentration.
Distillation #2	80% - 92%	Re-distilling the product from the first cycle. Purity increases further, and heads (volatile impurities like acetone, methanol) and tails (fusel oils, higher alcohols) are typically separated in this stage for quality.
Distillation #3	92% - 95%	Continued fractional distillation. Gains in purity become smaller with each subsequent run as you approach the azeotrope.
Distillation #4	~95.6% (Azeotrope)	This is the practical maximum purity achievable through conventional fractional distillation of an ethanol-water mixture. At this point, the vapor and liquid compositions are the same, preventing further separation by distillation alone. This is often called "rectified spirit."
Beyond Azeotrope (Requires Specialized Methods)		
Azeotropic Distillation / Molecular Sieves / etc.	96% - 99.5%	To break the azeotrope, techniques like adding an entrainer (e.g., benzene, cyclohexane) or using molecular sieves are employed. This process removes the remaining water. The resulting alcohol is often referred to as "absolute" or "anhydrous" ethanol.
Further Purification (Advanced Labs/Industrial)	99.5% - 99.999%	Achieving extremely high purities (e.g., for analytical grade or specific industrial applications) requires further rigorous drying methods, specialized chromatography, or very precise vacuum distillation techniques in highly controlled laboratory or industrial settings, often with continuous monitoring and strict contamination control.

Light

Generating light and understanding lighting

"It is during our darkest moments that we must focus to see the light."
Aristotle

Introduction

This section will cover all types of lights, lighting and benefits of different lights. Lighting can be a valuable asset as much as a detriment to your vision in a night scenario. It's important to get your choice of lighting right for the type of expedition you're going on. The speed of light in vacuum, commonly denoted c, is a universal physical constant important in many areas of physics. Its exact value is 299,792,458 metres per second (approximately 300,000 km/s (186,000 mi/s)).

Purpose	The aim of LIGHT is to inform you about the different types and uses of lights and to demonstrate the effects of lighting with respect to the colour, the range and the different power levels. It also includes how to ignite and use the various forms of light you may encounter, such as butane lanterns and kerosene lanterns. The category concludes with information on using light as a becon to signal to others, and information on darkness and light concealment if you wish to remain hidden from sight.
Lost?	• If you're looking for light based equipment, see the GEAR section. • For more information on the power sources of light, see the ELECTRICITY section. • If you're looking for information on power-outages, see the MAN-MADE DISASTERS section. • For using fire as light, see the FIRE section. • If you're looking for the light-weight definition of light, see the GEAR > Backpacks section. • For light-based deterrence mechanisms, see the DEFENCE section. • For offensive light-based weapons such as lasers, see the OFFENCE section. • For information on lightning, see the METEOROLOGY section.

Contents

1 Light

Without light and the ability to see, it becomes much more difficult and slower to accomplish even simple tasks. You will almost always need a couple of light sources in a SHTF situation. A couple of ways it can be used follows in the next cell.

Light Uses
• Reading Maps
• Lighting Paths
• Signalling

Advantages	● Eliminates Darkness ● Bright lights lets you see more detail ● Expels fear when you can see ● Can be used as a form of communication.
Disadvantages	● Light can give away your position ● Lights generally take batteries or a decaying source of power to run ● Lights can get very hot when running ● Some lights are single use only ● Light can make it hard to sleep
Speed	The speed of light in vacuum, commonly denoted c, is a universal physical constant important in many areas of physics. Its exact value is 299,792,458 metres per second (approximately 300,000 km/s (186,000 mi/s)). It is exact because by international agreement a metre is defined to be the length of the path travelled by light in vacuum during a time interval of 1/299792458 second.

Wavelengths

Name	Wavelength	Frequency (Hz)	Photon energy (eV)		
Gamma ray	less than 0.01 nm	more than 30 EHz	more than 124 keV		
X-ray	0.01 nm – 10 nm	30 EHz – 30 PHz	124 keV – 124 eV		
Ultraviolet	10 nm – 400 nm	30 PHz – 790 THz	124 eV – 3.3 eV		
Visible	400 nm–700 nm	790 THz – 430 THz	3.3 eV – 1.7 eV		
Infrared	700 nm – 1 mm	430 THz – 300 GHz	1.7 eV – 1.24 meV		
Microwave	1 mm – 1 meter	300 GHz – 300 MHz	1.24 meV – 1.24 µeV		
Radio	1 meter – 100,000 km	300 MHz –3 Hz	1.24 µeV – 12.4 feV		

Measurement

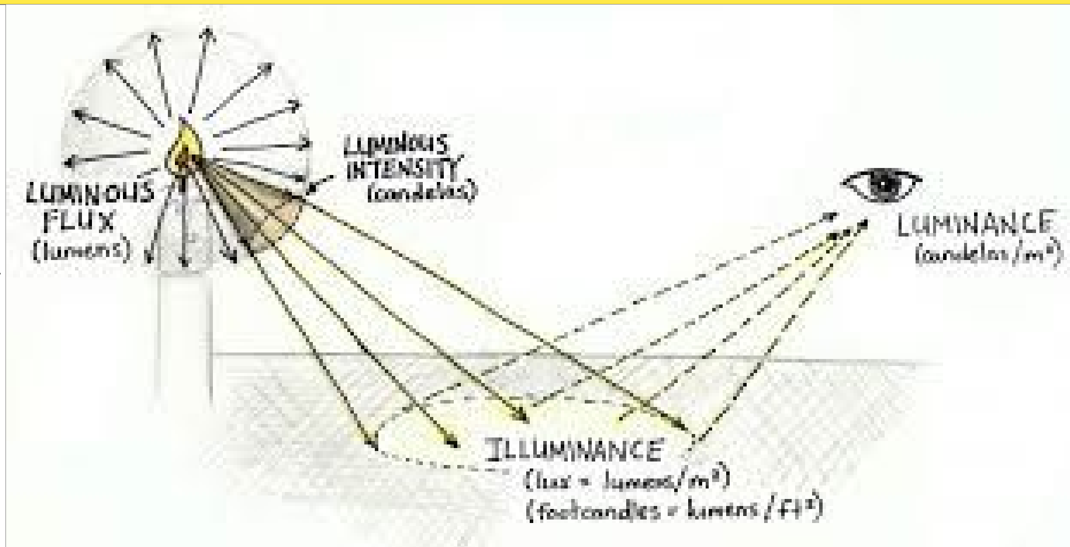
Lumen (lm)
Unit of light flow or luminous flux measuring the total perceived power of light.

Candela (cd)
Unit of luminous intensity, measuring the amount of light travelling in a certain direction from the source.

Luminance
The amount of light reaching your eye.

Illumination (Lux)
Full Daylight - 10,752
Overcast Day - 1,075
Room Lighting - 500
Twilight - 10.8
Full Moon - 0.108
Starlight - 0.0011

Foot-candle (fc/ftc/ftcd)
British standard of Illuminance (Lux). Measured in lumens/ft².



Lux (lx)
Illuminance, The amount of light falling on a surface. Measured in lumens/m².
1 lux = 1 lumen/m².

2 Colour

Coloured light can assist you in various circumstances depending on the colour of the light. The section below will discuss the different colours of lights you can use and the benefits and drawbacks of each.

Light Type
The type of light can vastly affect the colour of the light, particularly between LED and incandescent bulbs. Most lights colour can't be changed once it's made, however some lights chance colour over their life due to ageing. RGB LED's colour can be changed only because they contain multiple diodes to create each visible colour. Incandescent bulbs with coloured filters and even white LED's with filters aren't as effective as an LED made to output a single colour.

Colour Rendering Index

A colour rendering index (CRI) is a quantitative measure of the ability of a light source to reveal the colours of various objects faithfully in comparison with an ideal or natural light source. Light sources with a high CRI are desirable in colour-critical applications such as neonatal care and art restoration. It is defined by the International Commission on Illumination (CIE) as follows: Colour rendering: Effect of an illuminate on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminate. The CRI of a light source does not indicate the apparent colour of the light source; that information is given by the correlated colour temperature (CCT). The CRI is determined by the light source's spectrum. An incandescent lamp has a continuous spectrum, a fluorescent lamp has a discrete line spectrum; the incandescent lamp has the higher CRI. Numerically, the highest possible CIE Ra value is 100 and would only be given to a source identical to standardized daylight or a black body (incandescent lamps are effectively black bodies), dropping to negative values for some light sources. Low-pressure sodium lighting has negative CRI; fluorescent lights range from about 50 for the basic types, up to about 98 for the best multi-phosphor type. Typical LEDs have about 80+ CRI, while some manufacturers claim that their LEDs have achieved up to 98 CRI.

Light Colours

There are various effects light colour can have on the situation which are mentioned in the following cells.

Blue Light	● Third brightest light ● Resembles moon colour ● Best for avoiding detection ● Ruins night-vision ● May miss rivers or lakes on maps ● May prevent seeing veins
Green Light	● Second brightest light ● Second best for avoiding detection, especially in forests ● May not see forests or fields on a map
Red Light	● Fourth Brightest Light ● Easy to detect ● Retains night vision ● May not see highways on a map
Amber Light	● Attracts Fewer Bugs
Neutral White (5,500K)	● Brightest Light ● Easy to detect ● No negatives viewing maps
Cool White	● Brightest Light ● Easy to detect ● No negatives viewing maps
Warm White	● Brightest Light ● Easy to detect ● No negatives viewing maps
Infrared	● Invisible
Ultraviolet (UV-A) (Blacklight)	● Invisible ● Causes fluorescent colours to glow ● UV-B light can kill bacteria ● Lights up scorpions

Colour & Heat Retention

The colour of an object can dramatically affect how hot it gets in direct sunlight. Most of us know that white reflects the most light while black absorbs the more light, but what about all the colours between? This can be used to help choose your gear colour based on requirements, such as choosing a darker coloured bottle which will be used to boil water. The following table shows the temperature of different coloured plastic squares which have been exposed to the same amount of sunlight for the same amount of time.

Colour	°C	°F	Description
White	36.7	98.06	Use white if you want to keep items cool.
Grass	41.3	106.34	Used as a 'control' item to see the temperature difference verses grass.
Pink	44.8	112.64	
Yellow	51.5	124.7	
Red	55.7	132.26	
Green	57.7	135.86	
Brown	60.8	141.44	
Blue	61.3	142.34	
	71.5	160.7	Choose black if you want items to be warmer than usual.

As you can see, black retains almost twice the amount of heat as white.

Gear Colours

These are examples of different colours you can buy gear in and their features.

White	Reflects sunlight and keeps the item cooler than if it was another colour. Use it to prevent items in the sun getting as hot. Light colours don't attract mosquitoes as much.
Black	Black absorbs light and heat more than any other colour. Useful to keep things hot.
Transparent	Allows light through the material and provides disinfection if placed in the sun.
Camo	The best colour scheme to conceal items in the environment.
Bright Colours	Bright Lime, Orange, Red, Blue etc, attract the eye, especially if in the wild. It also attracts various types of bugs over duller colours.

Kelvin Colours

These are the different colours of the Kelvin scale with an example of that coloured light.

1,000 Kelvin	
2,000 Kelvin	**Match Flame** - 1,700-1,800K **Candle** - 1,850-1,930K **Sunrise** - 2,000-3,000K **Street Lights** - 2,200K
3,000 Kelvin	**Warm White Halogen Lamp** - 2,700-3,000K **Tungsten Lamp** - 3,000K
4,000 Kelvin	**Natural White Metal Halide** - 4,000-4,500K **Fluorescent** - 2,700-6,500K **White LED** - 3,000-5,600K
5,000 Kelvin	**Direct Sunlight** - 4,800K **Daylight** - 5,000-6,000K
5,500 Kelvin	**Pure White**
6,000 Kelvin	**Hydrargyrum Medium-Arc Iodine (HDI)** - 5,600K **Sunlight and Sky** - 6,500K
7,000 Kelvin	**Cool White** - 7,000-7,500K
8,000 Kelvin	**Summer Shade** - 8,000K
9,000 Kelvin	
10,000 Kelvin	**Blue Sky** - 10,000K

Colour Wavelengths

This shows the colour wavelengths of the various colours of light.

Colour Wavelength Frequency	**Far Ultraviolet**	**Near Ultraviolet**	**Violet**	**Blue**	**Cyan**	**Green**	**Yellow**	**Orange**	**Red**	**Infrared**
Wavelength	<200–250	250–380 nm	380–450 nm	450–485 nm	485–500 nm	500–565 nm	565–590 nm	590–625 nm	625–740 nm	740–1000+
Frequency	>1500 THz	1000 THz	680–790 THz	620–680 THz	600–620 THz	530–600 THz	510–530 THz	480–510 THz	405–480 THz	<300 THz

3 Light Sources

These are the different sources of light which you can utilize.

Natural

The Sun **Lux:** 10,752 **Duration:** 12h/day **Source:** Sun **Notes:** Sunlight hours may differ based on region **Warning:** Never look directly at the sun	**LED Torch** **Lumens:** 1-10,000 **Duration:** 10h **Source:** Electricity **Notes:** None **Warning:** None	**Butane Lantern** **Lumens:** 500 **Duration:** 10h **Source:** Butane Gas **Notes:** None **Warning:** Replaces Oxygen with Carbon Monoxide - Use in open spaces	**Kerosene Lantern** **Lumens:** 37 **Duration:** 10h **Source:** Kerosene **Notes:** Kerosene lasts about 75h per 1L **Warning:** Consumes oxygen, so ensure ventilation	**Candle** **Lumens:** 15 **Duration:** 10h **Source:** Wick **Notes:** None **Warning:** Consumes oxygen, so ensure ventilation	
Campfire **Lumens:** 1,000-5,000 **Duration:** 10h **Source:** Wood **Notes:** None **Warning:** Consumes oxygen, so ensure ventilation	**UV Paqlite** **Lumens:** 1-100 **Duration:** 10h **Source:** Light **Notes:** Requires light from another source to glow up to 10h **Warning:** None				

Artificial

L.E.D **Life:** 50k-100k/h Efficiency:	**Incandescent** **Life:** 2-20k/h Efficiency:	**Halogen Lamp** **Life:** 3k-6k/h Efficiency:	**Fluorescent Lamp** **Life:** 8k-20k/h Efficiency: **Lighting Parent:** Gas-Discharge Lamp	**Metal Halide Lamp** **Life:** 6k-20k/h Efficiency:	
Sulphur Lamp **Life:** 15k-20k/h Efficiency:	**High Pressure Sodium** **Life:** 10k-40k/h Efficiency:	**Electrodeless Lamp** **Life:** 80k-100k/h Efficiency:	**Xenon Arc Lamps** Life: Efficiency:		

4 Natural Light

Natural light is any source of light which comes from external sources not made by man.

Natural Sources (Space)
- Sun
- Moon
- Stars
- Airglow
- Meteor

Natural Sources (Land)
- Fire
- Lightning
- Aurora
- Lava
- Earthquake

Subheadings

1. Sun	2. Moon	3. Stars	4. Airglow
5. Meteor	6. Fire	7. Lightning	8. Aurora
9. Lava	10. Earthquake		

1 Sun

Sunlight is a portion of the electromagnetic radiation given off by the Sun, in particular infrared, visible, and ultraviolet light. On Earth, sunlight is filtered through Earth's atmosphere, and is obvious as daylight when the Sun is above the horizon. When the direct solar radiation is not blocked by clouds, it is experienced as sunshine, a combination of bright light and radiant heat. When it is blocked by clouds or reflects off other objects, it is experienced as diffused light.

The World Meteorological Organization uses the term "sunshine duration" to mean the cumulative time during which an area receives direct irradiance from the Sun of at least 120 watts per square meter. Other sources indicate an "Average over the entire earth" of "164 Watts per square meter over a 24 hour day". The ultraviolet radiation in sunlight has both positive and negative health effects, as it is both a requisite for vitamin D3 synthesis and a mutagen. Sunlight takes about 8.3 minutes to reach Earth from the surface of the Sun.

A photon starting at the centre of the Sun and changing direction every time it encounters a charged particle would take between 10,000 and 170,000 years to get to the surface. Sunlight is a key factor in photosynthesis, the process used by plants and other autotrophic organisms to convert light energy, normally from the Sun, into chemical energy that can be used to synthesize carbohydrates and to fuel the organisms' activities.

Sunlight at the top of Earth's atmosphere is composed (by total energy) of about 50% infrared light, 40% visible light, and 10% ultraviolet light. The atmosphere in particular filters out over 70% of solar ultraviolet, especially at the shorter wavelengths. Solar ultraviolet radiation ionizes Earth's dayside upper atmosphere, creating the electrically conducting ionosphere.

Measurement
Researchers can measure the intensity of sunlight using a sunshine recorder, pyranometer, or pyrheliometer. To calculate the amount of sunlight reaching the ground, both the eccentricity of Earth's elliptic orbit and the attenuation by Earth's atmosphere have to be taken into account. The total amount of energy received at ground level from the Sun at the zenith depends on the distance to the Sun and thus on the time of year. It is about 3.3% higher than average in January and 3.3% lower in July.

If the extra-terrestrial solar radiation is 1367 watts per square meter (the value when the Earth–Sun distance is 1 astronomical unit), then the direct sunlight at Earth's surface when the Sun is at the zenith is about 1050 W/m2, but the total amount (direct and indirect from the atmosphere) hitting the ground is around 1120 W/m2. In terms of energy, sunlight at Earth's surface is around 52 to 55 percent infrared (above 700 nm), 42 to 43 percent visible (400 to 700 nm), and 3 to 5 percent ultraviolet (below 400 nm).
At the top of the atmosphere, sunlight is about 30% more intense, having about 8% ultraviolet (UV), with most of the extra UV consisting of biologically damaging short-wave ultraviolet. Direct sunlight has a luminous efficacy of about 93 lumens per watt of radiant flux. This is higher than the efficacy (of source) of most artificial lighting (including fluorescent), which means using sunlight for illumination heats up a room less than using most forms of artificial lighting. Multiplying the figure of 1050 watts per square metre by 93 lumens per watt indicates that bright sunlight provides an illuminance of approximately 98 000 lux (lumens per square meter) on a perpendicular surface at sea level.

The illumination of a horizontal surface will be considerably less than this if the Sun is not very high in the sky. Averaged over a day, the highest amount of sunlight on a horizontal surface occurs in January at the South Pole. Dividing the irradiance of 1050 W/m2 by the size of the sun's disk in steradians gives an average radiance of 15.4 MW per square metre per steradian.

Composition

The spectrum of the Sun's solar radiation is close to that of a black body with a temperature of about 5,800 K. The Sun emits EM radiation across most of the electromagnetic spectrum. Although the Sun produces gamma rays as a result of the nuclear-fusion process, internal absorption and thermalization convert these super-high-energy photons to lower-energy photons before they reach the Sun's surface and are emitted out into space. As a result, the Sun does not emit gamma rays from this process, but it does emit gamma rays from solar flares. The Sun also emits X-rays, ultraviolet, visible light, infrared, and even radio waves; the only direct signature of the nuclear process is the emission of neutrinos. Although the solar corona is a source of extreme ultraviolet and X-ray radiation, these rays make up only a very small amount of the power output of the Sun (see spectrum at right). The spectrum of nearly all solar electromagnetic radiation striking the Earth's atmosphere spans a range of 100 nm to about 1 mm (1,000,000 nm). This band of significant radiation power can be divided into five regions in increasing order of wavelengths:

Ultraviolet C (UVC)	Which spans a range of 100 to 280 nm. The term ultraviolet refers to the fact that the radiation is at higher frequency than violet light. Due to absorption by the atmosphere very little reaches Earth's surface. This spectrum of radiation has germicidal properties, as used in germicidal lamps.
Ultraviolet B (UVB)	Spans 280 to 315 nm. It is also greatly absorbed by the Earth's atmosphere, and along with UVC causes the photochemical reaction leading to the production of the ozone layer. It directly damages DNA and causes sunburn, but is also required for vitamin D synthesis in the skin and fur of mammals.
Ultraviolet A (UVA)	Spans 315 to 400 nm. This band is used in cosmetic artificial sun tanning (tanning booths and tanning beds). However, UVA is now known to cause significant damage to DNA via indirect routes (formation of free radicals and reactive oxygen species), and can cause cancer.
Visible Range	Light spans 380 to 780 nm. As the name suggests, this range is visible to the naked eye. It is also the strongest output range of the Sun's total irradiance spectrum.
Infrared Range	Spans 700 nm to 1,000,000 nm (1 mm). It comprises an important part of the electromagnetic radiation that reaches Earth. Scientists divide the infrared range into three types on the basis of wavelength: ● Infrared-A: 700 nm to 1,400 nm ● Infrared-B: 1,400 nm to 3,000 nm ● Infrared-C: 3,000 nm to 1 mm.

Brightness

The perceived brightness varies based on the time of day. The following shows the average levels of brightness during a day.	12am-6am 0 Lux	6am-7am 30>45 Lux	7-9am 45>60 Lux	9-11am 60>95 Lux	11-1pm 95>100>95 Lux	1-3pm 95>60 Lux	3-5pm 60>45 Lux	5-6pm 45>30 Lux	6-12am 0 Lux

Sun Power

Brightest Sunlight 120,000 lux	**Bright Sunlight** 111,000 lux	**Global Solar Sunlight** 109,870 lux	**Shade Illuminated by Clear Blue Sky** 20,000 lux	**Overcast Day** 1,000 - 2,000 lux	
Thickest Clouds <200 lux	**Sunrise/set Ambience** 400 lux	**Fully Overcast Sunrise/set** 40 lux	**Thickest Clouds Sunrise/set** <1 lux		

Twilight

Twilight on Earth is the illumination of the lower atmosphere when the Sun itself is not directly visible because it is below the horizon. Twilight is produced by sunlight scattering in the upper atmosphere, illuminating the lower atmosphere so that Earth's surface is neither completely lit nor completely dark. The word twilight is also used to denote the periods of time when this illumination occurs. The farther the Sun is below the horizon, the dimmer the twilight (other things such as atmospheric conditions being equal). When the Sun reaches 18° below the horizon, the twilight's brightness is nearly zero, and evening twilight becomes night-time. When the Sun again reaches 18° below the horizon, night-time becomes morning twilight.

Owing to its distinctive quality, primarily the absence of shadows and the appearance of objects silhouetted against the lit sky, twilight has long been popular with photographers, who sometimes refer to it as "sweet light", and painters, who often refer to it as the blue hour, after the French expression l'heure bleue. Twilight should not be confused with auroras, which can have a similar appearance in the night sky at high latitudes. By analogy with evening twilight, the word twilight is also sometimes used metaphorically, to imply that something is losing strength and approaching its end.

Three subcategories of twilight are established and widely accepted: civil twilight (brightest), nautical twilight, and astronomical twilight (darkest).	**Civil Twilight** The typical colour of the sky when civil twilight is occurring. Occurs between 0°-6°. The sun takes 24 minutes to move 6°.	**Nautical Twilight** The typical colour of the sky when nautical twilight is occurring. Occurs between 6°-12°. The sun takes 24 minutes to move 6°.	**Astronomical Twilight** The typical colour of the sky when astronomical twilight is occurring. Occurs between 12°-18°. The sun takes 24 minutes to move 6°.

Civil Twilight

Morning civil twilight begins when the geometric centre of the sun is 6° below the horizon and ends at sunrise. Evening civil twilight begins at sunset and ends when the geometric centre of the sun reaches 6° below the horizon. In the United States' military, the initialisms BMCT (begin morning civil twilight, i.e. civil dawn) and EECT (end evening civil twilight, i.e. civil dusk) are used to refer to the start of morning civil twilight and the end of evening civil twilight, respectively. Civil dawn is preceded by morning nautical twilight and civil dusk is followed by evening nautical twilight. Under clear weather conditions, civil twilight approximates the limit at which solar illumination suffices for the human eye to clearly distinguish terrestrial objects. Enough illumination renders artificial sources unnecessary for most outdoor activities. At civil dawn and at civil dusk sunlight clearly defines the horizon while the brightest stars and planets can appear.

As observed from the Earth, sky-gazers know Venus, the brightest planet, as the "morning star" or "evening star" because they can see it during civil twilight. Lawmakers have enshrined the concept of civil twilight. Such statutes typically use a fixed period after sunset or before sunrise (most commonly 20–30 minutes), rather than how many degrees the sun is below the horizon. Examples include the following periods: when drivers of automobiles must turn on their headlights (called lighting-up time in the UK); when hunting is restricted; when the crime of burglary is to be treated as night-time burglary, which carries stiffer penalties in some jurisdictions. The period may affect when extra equipments, such as anti-collision lights, are required for aircraft to operate. In the US, civil twilight for aviation is defined in Part 1.1 of the Federal Aviation Regulations (FARs) as the time listed in the American Air Almanac.

Nautical Twilight

Morning nautical twilight begins (nautical dawn) when the geometric centre of the sun is 12° below the horizon in the morning and ends when the geometric centre of the sun is 6° below the horizon in the morning. Evening nautical twilight begins when the geometric centre of the sun is 6° below the horizon in the evening and ends (nautical dusk) when the geometric centre of the sun is 12° below the horizon in the evening. Nautical dawn is the moment when the geometric centre of the Sun is 12° below the horizon in the morning. It is preceded by morning astronomical twilight and followed by morning nautical twilight. Nautical dusk is the moment when the geometric centre of the Sun is 12° below the horizon in the evening. It marks the beginning of evening astronomical twilight and the end of evening nautical twilight. Before nautical dawn and after nautical dusk, sailors cannot navigate via the horizon at sea as they cannot clearly see the horizon.

At nautical dawn and nautical dusk, the human eye finds it difficult, if not impossible, to discern traces of illumination near the sunset or sunrise point of the horizon ("first light" after nautical dawn but before civil dawn and "nightfall" after civil dusk but before nautical dusk). Under good atmospheric conditions with the absence of other illumination, during nautical twilight, the human eye may distinguish general outlines of ground objects but cannot participate in detailed outdoor operations. Nautical twilight has military considerations as well. The initialisms BMNT (begin morning nautical twilight, i.e. nautical dawn) and EENT (end evening nautical twilight, i.e. nautical dusk) are used and considered when planning military operations. A military unit may treat BMNT and EENT with heightened security, e.g. by "standing to", in which everyone assumes a defensive position. This is partially due to tactics dating back to the French and Indian War, when combatants on both sides would launch attacks at nautical dawn or dusk.

Astronomical Twilight

Astronomical dawn is the moment when the geometric centre of the Sun is 18° below the horizon in the morning. Astronomical dusk is the moment when the geometric centre of the Sun is 18 degrees below the horizon in the evening. After astronomical dusk and before astronomical dawn, the sky is not illuminated by the sun. Morning astronomical twilight begins (astronomical dawn) when the geometric centre of the sun is 18° below the horizon in the morning and ends when the geometric centre of the sun is 12° below the horizon in the morning. Evening astronomical twilight begins when the geometric centre of the sun is 12° below the horizon in the evening and ends (astronomical dusk) when the geometric centre of the sun is 18° below the horizon in the evening. In some places (away from urban light pollution, moonlight, auroras, and other sources of light), where the sky is dark enough for nearly all astronomical observations, astronomers can easily make observations of point sources such as stars both during and after astronomical twilight in the evening and both before and during astronomical twilight in the morning.

However, some critical observations, such as of faint diffuse items such as nebulae and galaxies, may require observation beyond the limit of astronomical twilight. Theoretically, the faintest stars detectable by the naked eye (those of approximately the sixth magnitude) will become visible in the evening at astronomical dusk, and become invisible at astronomical dawn. However, in other places, especially those with skyglow, astronomical twilight may be almost indistinguishable from night. In the evening, even when astronomical twilight has yet to end and in the morning when astronomical twilight has already begun, most casual observers would consider the entire sky fully dark. Because of light pollution, observers in some localities, generally in large cities, may never have the opportunity to view even fourth-magnitude stars, irrespective of the presence of any twilight at all, and to experience truly dark skies.

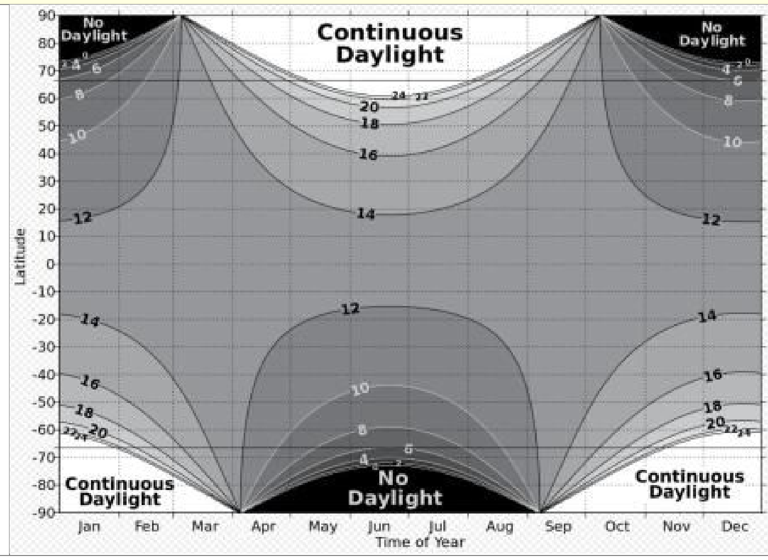
Observers within 48.5 degrees of the Equator can view twilight twice each day on every date of the year between astronomical dawn, nautical dawn, or civil dawn, and sunrise as well as between sunset and civil dusk, nautical dusk, or astronomical dusk. This also occurs for most observers at higher latitudes on many dates throughout the year, except those around the summer solstice. However, at latitudes closer than 9 degrees to either Pole, the Sun cannot rise above the horizon nor sink more than 18 degrees below it on the same day on any date, this example of twilight cannot occur because the angular difference between solar noon and solar midnight elevates less than 18 degrees. At latitudes greater than about 48.5 degrees North or South, on dates near the summer solstice, twilight can last from sunset to sunrise, since the Sun does not go more than 18 degrees below the horizon, so complete darkness does not occur even at solar midnight. These latitudes include many densely populated regions of the Earth, including the entire United Kingdom and other countries in northern Europe.

In Arctic and Antarctic latitudes in wintertime, the polar night only rarely produces complete darkness for 24 hours each day. This can occur only at locations within 5.5 degrees of latitude of the Pole, and there only on dates close to the winter solstice. At all other latitudes and dates, the polar night includes a daily period of twilight, when the Sun is not far below the horizon. Around winter solstice, when the solar declination changes slowly, complete darkness lasts several weeks at the Pole itself, e.g., from May 11 to July 31 at Amundsen–Scott South Pole Station. North Pole has the experience of this from November 12 to January 30. At latitudes within 9 degrees of either Pole, as the sun's angular elevation difference is less than 18 degrees, twilight can last for the entire 24 hours. This occurs for one day at latitudes near 9 degrees from the Pole and extends up to several weeks the further towards the Pole one goes. The only permanent settlement to experience this condition is Alert, Nunavut, Canada, where it occurs for a week in late February, and again in late October.

Duration

The number of daylight hours depends on the latitude and time of year. Each pole has continuous daylight near its summer solstice. The apparent travel of the sun occurs at the rate of 15° per hour (360° per day), but sunrise and sunset happen typically at oblique angles to the horizon and the actual duration of any twilight period will be a function of that angle, being longer for more oblique angles. This angle of the sun's motion with respect to the horizon changes with latitude as well as the time of year (affecting the angle of the Earth's axis with respect to the sun).

At Greenwich, England (51.5°N), the duration of civil twilight will vary from 33 minutes to 48 minutes, depending on the time of year. At the equator, conditions can go from day to night in as little as 20–25 minutes. This is true because at low latitudes the sun's apparent movement is perpendicular to the observer's horizon. But at the poles, civil twilight can be as long as 2–3 weeks. In the Arctic and Antarctic regions, twilight (if there is any) can last for several hours. There is no astronomical twilight at the poles near the winter solstice (for about 74 days at the North Pole and about 80 days at the South Pole).



As one gets closer to the Arctic and Antarctic circles, the sun's disk moves toward the observer's horizon at a lower angle. The observer's earthly location will pass through the various twilight zones less directly, taking more time. Within the polar circles, twenty-four-hour daylight is encountered in summer, and in regions very close to the poles, twilight can last for weeks on the winter side of the equinoxes. Outside the polar circles, where the angular distance from the polar circle is less than the angle which defines twilight (see above), twilight can continue through local midnight near the summer solstice. The precise position of the polar circles, and the regions where twilight can continue through local midnight, varies slightly from year to year with Earth's axial tilt. The lowest latitudes at which the various twilights can continue through local midnight are approximately 60.561° (60°33′43″) for civil twilight, 54.561° (54°33′43″) for nautical twilight and 48.561° (48°33′43″) for astronomical twilight.

These are the largest cities of their respective countries where the various twilights can continue through local solar midnight:	**Civil twilight from sunset to sunrise:** Tampere, Umeå, Trondheim, Tórshavn, Reykjavík, Nuuk, Whitehorse, Anchorage, Fairbanks, Ålesund, Nome, and Baltasound.	**Nautical twilight from civil dusk to civil dawn:** Moscow, Vitebsk, Vilnius, Riga, Tallinn, Wejherowo, Flensburg, Helsinki, Stockholm, Copenhagen, Oslo, Newcastle upon Tyne, Glasgow, Belfast, Letterkenny, Petropavl, Grande Prairie, Juneau, Ushuaia, and Puerto Williams.	**Astronomical twilight from nautical dusk to nautical dawn:** Hulun Buir, Erdenet, Astana, Samara, Kiev, Minsk, Warsaw, Košice, Paris, Dublin, Zwettl, Prague, Stanley (Falkland Islands), Berlin, Luxembourg City, Brussels, Amsterdam, London, Cardiff, Calgary, Unalaska, Bellingham (largest in the continental USA), Rio Gallegos, and Punta Arenas.

Major cities that near astronomical twilight from nautical dusk to nautical dawn: Saguenay (48°25′0″N), Brest (48°23′26″N), Thunder Bay (48°22′56″N), Vienna (48°12′30″N), Bratislava (48°8′38″N), Munich (48°8′0″N)

Although Helsinki, Oslo, Stockholm, Tallinn, and Saint Petersburg also enter into nautical twilight after sunset, they do have noticeably lighter skies at night during the summer solstice than other locations mentioned in their category above, because they do not go far into nautical twilight. A white night is a night with only civil twilight which lasts from sunset to sunrise.

At the winter solstice within the polar circle, twilight can extend through solar noon at latitudes below 72.561° (72°33′43″) for civil twilight, 78.561° (78°33′43″) for nautical twilight, and 84.561° (84°33′43″) for astronomical twilight.

Twilight on Mars is longer than on Earth, lasting for up to two hours before sunrise or after sunset. Dust high in the atmosphere scatters light to the night side of the planet. Similar twilights are seen on Earth following major volcanic eruptions.

2 Moon

Moonlight consists of mostly sunlight (with little earthlight) reflected from the parts of the Moon's surface where the Sun's light strikes. The intensity of moonlight varies greatly depending on its phase, but even the full Moon typically provides only about 0.05–0.1 lux illumination. When the full Moon is at perigee and viewed around upper culmination from the tropics, the illuminance can reach up to 0.32 lux. From Earth, the apparent magnitude of the full Moon is only about 1⁄380,000 that of the Sun. The colour of moonlight, particularly around full Moon, appears bluish to the human eye compared to most artificial light sources due to the Purkinje effect. Moonlight is not actually tinted blue, and although moonlight is often referred to as "silvery", it has no inherent silvery quality. The Moon's albedo is 0.136, meaning only 13.6% of incident sunlight is reflected from the lunar surface. Moonlight generally hampers astronomical viewing, so astronomers usually avoid observing sessions around full Moon. It takes approximately 1.26 seconds for moonlight to reach Earth's surface.

Moon Power	**Moonlight Clear Night** <1 lux	**Full Moon Clear Night** 0.25 lux	**Quarter Moon Clear Night** 0.01 lux								

3 Stars

Starlight is the light emitted by stars. It typically refers to visible electromagnetic radiation from stars other than the Sun observable from Earth during the night time although a component of starlight is observable from the Earth during the daytime. Sunlight is the term used for the Sun's starlight observed during daytime. During night-time, albedo describes solar reflections from other Solar System objects including moonlight.

Starlight Power	Starlight, Moonless Night w/airglow	Starlight Moonless Night wo/airglow	Venus at Brightest	Starlight Overcast Moonless Night							
	0.002 lux	0.0002 lux	0.00014 lux	0.0001 lux							

4 Airglow

Airglow (also called nightglow) is a faint emission of light by a planetary atmosphere. In the case of Earth's atmosphere, this optical phenomenon causes the night sky to never be completely dark, even after the effects of starlight and diffused sunlight from the far side are removed. Airglow is caused by various processes in the upper atmosphere of Earth, such as the recombination of atoms which were photoionized by the Sun during the day, luminescence caused by cosmic rays striking the upper atmosphere, and chemiluminescence caused mainly by oxygen and nitrogen reacting with hydroxyl free radicals at heights of a few hundred kilometres. It is not noticeable during the daytime due to the glare and scattering of sunlight. Even at the best ground-based observatories, airglow limits the photosensitivity of optical telescopes. Partly for this reason, space telescopes like Hubble can observe much fainter objects than current ground-based telescopes at visible wavelengths. Airglow at night may be bright enough for a ground observer to notice and appears generally bluish.

Although airglow emission is fairly uniform across the atmosphere, it appears brightest at about 10° above the observer's horizon, since the lower one looks, the greater the depth of atmosphere one is looking through. Very low down, however, atmospheric extinction reduces the apparent brightness of the airglow. One airglow mechanism is when an atom of nitrogen combines with an atom of oxygen to form a molecule of nitric oxide (NO). In the process, a photon is emitted. This photon may have any of several different wavelengths characteristic of nitric oxide molecules. The free atoms are available for this process, because molecules of nitrogen (N2) and oxygen (O2) are dissociated by solar energy in the upper reaches of the atmosphere and may encounter each other to form NO. Other species that can create air glow in the atmosphere are hydroxyl (OH), atomic oxygen (O), sodium (Na), and lithium (Li). The sky brightness is typically measured in units of apparent magnitude per square arcsecond of sky.

5 Meteor

When a meteoroid, comet, or asteroid enters Earth's atmosphere at a speed typically in excess of 20 km/s (72,000 km/h; 45,000 mph), aerodynamic heating of that object produces a streak of light, both from the glowing object and the trail of glowing particles that it leaves in its wake. This phenomenon is called a meteor or "shooting star". A series of many meteors appearing seconds or minutes apart and appearing to originate from the same fixed point in the sky is called a meteor shower.

6 Fire

A flame is a mixture of reacting gases and solids emitting visible, infrared, and sometimes ultraviolet light, the frequency spectrum of which depends on the chemical composition of the burning material and intermediate reaction products. In many cases, such as the burning of organic matter, for example wood, or the incomplete combustion of gas, incandescent solid particles called soot produce the familiar red-orange glow of "fire". This light has a continuous spectrum. Complete combustion of gas has a dim blue colour due to the emission of single-wavelength radiation from various electron transitions in the excited molecules formed in the flame. Usually oxygen is involved, but hydrogen burning in chlorine also produces a flame, producing hydrogen chloride (HCl). Other possible combinations producing flames, amongst many, are fluorine and hydrogen, and hydrazine and nitrogen tetroxide. Hydrogen and hydrazine/UDMH flames are similarly pale blue, while burning boron and its compounds, evaluated in mid-20th century as a high energy fuel for jet and rocket engines, emits intense green flame, leading to its informal nickname of "Green Dragon".

The glow of a flame is complex. Black-body radiation is emitted from soot, gas, and fuel particles, though the soot particles are too small to behave like perfect blackbodies. There is also photon emission by de-excited atoms and molecules in the gases. Much of the radiation is emitted in the visible and infrared bands. The colour depends on temperature for the black-body radiation, and on chemical makeup for the emission spectra. The dominant colour in a flame changes with temperature. The photo of the forest fire in Canada is an excellent example of this variation. Near the ground, where most burning is occurring, the fire is white, the hottest colour possible for organic material in general, or yellow. Above the yellow region, the colour changes to orange, which is cooler, then red, which is cooler still. Above the red region, combustion no longer occurs, and the uncombusted carbon particles are visible as black smoke.

7 Lightning

The charged regions in the atmosphere temporarily equalize themselves through this discharge referred to as a flash. A lightning flash can also be a strike if it involves an object on the ground. Lightning creates light in the form of black body radiation from the very hot plasma created by the electron flow, and sound in the form of thunder. Lightning may be seen and not heard when it occurs at a distance too great for the sound to carry as far as the light from the strike or flash.

8 Aurora

An aurora sometimes referred to as polar lights, northern lights (aurora borealis) or southern lights (aurora australis), is a natural light display in the Earth's sky, predominantly seen in the high-latitude regions (around the Arctic and Antarctic). Auroras are produced when the magnetosphere is sufficiently disturbed by the solar wind that the trajectories of charged particles in both solar wind and magnetospheric plasma, mainly in the form of electrons and protons, precipitate them into the upper atmosphere (thermosphere/exosphere) due to Earth's magnetic field, where their energy is lost. The resulting ionization and excitation of atmospheric constituents emits light of varying colour and complexity. The form of the aurora, occurring within bands around both polar regions, is also dependent on the amount of acceleration imparted to the precipitating particles. Precipitating protons generally produce optical emissions as incident hydrogen atoms after gaining electrons from the atmosphere. Proton auroras are usually observed at lower latitudes. Most auroras occur in a band known as the "auroral zone", which is typically 3° to 6° wide in latitude and between 10° and 20° from the geomagnetic poles at all local times (or longitudes), most clearly seen at night against a dark sky.

A region that currently displays an aurora is called the "auroral oval", a band displaced towards the night side of the Earth. Early evidence for a geomagnetic connection comes from the statistics of auroral observations. In northern latitudes, the effect is known as the aurora borealis or the northern lights. The former term was coined by Galileo in 1619, from the Roman goddess of the dawn and the Greek name for the north wind. The southern counterpart, the aurora australis or the southern lights, has features almost identical to the aurora borealis and changes simultaneously with changes in the northern auroral zone. The Aurora Australis is visible from high southern latitudes in Antarctica, Chile, Argentina, New Zealand, and Australia. A geomagnetic storm causes the auroral ovals (north and south) to expand, and bring the aurora to lower latitudes. The instantaneous distribution of auroras ("auroral oval") is slightly different, being centred about 3–5° nightward of the magnetic pole, so that auroral arcs reach furthest toward the equator when the magnetic pole in question is in between the observer and the Sun. The aurora can be seen best at this time, which is called magnetic midnight. See METEOROLOGY for more information on auroras.

Colour

Red
At the highest altitudes, excited atomic oxygen emits at 630 nm (red); low concentration of atoms and lower sensitivity of eyes at this wavelength make this colour visible only under more intense solar activity. The low number of oxygen atoms and their gradually diminishing concentration is responsible for the faint appearance of the top parts of the "curtains". Scarlet, crimson, and carmine are the most often-seen hues of red for the auroras.

Green
At lower altitudes, the more frequent collisions suppress the 630-nm (red) mode: rather the 557.7 nm emission (green) dominates. Fairly high concentration of atomic oxygen and higher eye sensitivity in green make green auroras the most common. The excited molecular nitrogen (atomic nitrogen being rare due to high stability of the N2 molecule) plays a role here, as it can transfer energy by collision to an oxygen atom, which then radiates it away at the green wavelength. The rapid decrease of concentration of atomic oxygen below about 100 km is responsible for the abrupt-looking end of the lower edges of the curtains.

Blue
At yet lower altitudes, atomic oxygen is uncommon, and molecular nitrogen and ionized molecular nitrogen take over in producing visible light emission, radiating at a large number of wavelengths in both red and blue parts of the spectrum, with 428 nm (blue) being dominant. Blue and purple emissions, typically at the lower edges of the "curtains", show up at the highest levels of solar activity. The molecular nitrogen transitions are much faster than the atomic oxygen ones.

Ultraviolet
Ultraviolet radiation from auroras (within the optical window but not visible to virtually all humans) has been observed with the requisite equipment. Ultraviolet auroras have also been seen on Mars, Jupiter and Saturn.

Infrared
Infrared radiation, in wavelengths that are within the optical window, is also part of many auroras.

Yellow & Pink
A mix of red and green or blue. Other shades of red, as well as orange, may be seen on rare occasions; yellow-green is moderately common. As red, green, and blue are the primary colours of additive synthesis of colours, in theory, practically any colour might be possible, but the ones mentioned in this article comprise a virtually exhaustive list.

9 Lava

10 Earthquake

An earthquake light (EQL) is a luminous aerial phenomenon that reportedly appears in the sky at or near areas of tectonic stress, seismic activity, or volcanic eruptions. Sceptics point out that the phenomenon is poorly understood and many of the reported sightings can be accounted for by mundane explanations. One of the first records of earthquake lights is during 869 Sanriku earthquake, described as "strange lights in the sky" in Nihon Sandai Jitsuroku.

The lights are reported to appear while an earthquake is occurring, although there are reports of lights before or after earthquakes, such as reports concerning the 1975 Kalapana earthquake. They are reported to have shapes similar to those of the auroras, with a white to bluish hue, but occasionally they have been reported having a wider colour spectrum. The luminosity is reported to be visible for several seconds, but has also been reported to last for tens of minutes. Accounts of viewable distance from the epicentre varies: in the 1930 Idu earthquake, lights were reported up to 70 miles (110 km) from the epicentre.

Earthquake lights were reportedly spotted in Tianshui, Gansu, approximately 400 kilometres (250 mi) north-northeast of the 2008 Sichuan earthquake's epicentre. During the 2003 Colima earthquake in Mexico, colourful lights were seen in the skies for the duration of the earthquake. During the 2007 Peru earthquake lights were seen in the skies above the sea and filmed by many people. The phenomenon was also observed and caught on film during the 2009 L'Aquila and the 2010 Chile earthquakes.

Video footage has also recorded this happening during the 9 April 2011 eruption of Sakurajima Volcano, Japan. The phenomenon was also reported around the Amuri Earthquake in New Zealand, that occurred 1 September 1888. The lights were visible in the morning of 1 September in Reefton, and again on 8 September.

More recent appearances of the phenomenon, along with video footage of the incidents, happened in Sonoma County of California on August 24, 2014, and in Wellington New Zealand on November 14, 2016 where blue flashes like lightning were seen in the night sky, and recorded on several videos. In September 8, 2017, many people reported such sightings in Mexico City after a 8.2 magnitude earthquake with epicentre 460 miles (740 km) away, near Pijijiapan in the state of Chiapas. Appearances of the earthquake light seem to occur when the quakes have a high magnitude, generally 5 or higher on the Richter scale. There have also been incidents of yellow, ball-shaped lights appearing before earthquakes.

Earthquake lights may be classified into two different groups based on their time of appearance: (1) preseismic EQL, which generally occur a few seconds to up to a few weeks prior to an earthquake, and are generally observed closer to the epicentre and (2) coseismic EQL, which can occur either near the epicentre ("earthquake-induced stress"), or at significant distances away from the epicentre during the passage of the seismic wavetrain, in particular during the passage of S waves ("wave-induced stress"). EQL during the lower magnitude aftershock series seem to be rare.

5 Artificial Light

Operation

This sections details the types of common lights used in survival situations and how to operate them.

Fire

Fire has been the primal source of light for most of the history of the world.

Fire	
Match	
Candle	
Fire Torch	
Campfire	
Bonfire	
Signal Fire	

For more on fire, see the FIRE section.

Glowstick

A glow stick is a self-contained, short-term light-source. It consists of a translucent plastic tube containing isolated substances that, when combined, make light through chemiluminescence, so it does not require an external energy source. The light cannot be turned off and can only be used once. Glow sticks are often used for recreation, but may also be relied upon for light during military, police, fire, or EMS operations. They are also used by military and police to mark 'clear' areas. Glow sticks emit light when two chemicals are mixed. The reaction between the two chemicals is catalysed by a base, usually sodium salicylate. The sticks consist of a tiny, brittle container within a flexible outer container. Each container holds a different solution. When the outer container is flexed, the inner container breaks, allowing the solutions to combine, causing the necessary chemical reaction. After breaking, the tube is shaken to thoroughly mix the components. The glow stick contains two chemicals, a base catalyst, and a suitable dye (sensitizer, or fluorophor). This creates an exothermic reaction. The chemicals inside the plastic tube are a mixture of the dye, the base catalyst, and diphenyl oxalate. The chemical in the glass vial is hydrogen peroxide. By mixing the peroxide with the phenyl oxalate ester, a chemical reaction takes place, yielding two moles of phenol and one mole of peroxyacid ester (1,2-dioxetanedione). The peroxyacid decomposes spontaneously to carbon dioxide, releasing energy that excites the dye, which then relaxes by releasing a photon.

The wavelength of the photon—the colour of the emitted light—depends on the structure of the dye. The reaction releases energy mostly as light, with very little heat. By adjusting the concentrations of the two chemicals and the base, manufacturers can produce glow sticks that either glow brightly for a short amount of time or more dimly for an extended length of time. This also allows design of glow sticks that perform satisfactorily in hot or cold climates, by compensating for the temperature dependence of reaction. At maximum concentration (typically only found in laboratory settings), mixing the chemicals results in a furious reaction, producing large amounts of light for only a few seconds. The same effect can be achieved by adding copious amounts of sodium salicyate or other bases. Heating a glow stick also causes the reaction to proceed faster and the glow stick to glow more brightly for a brief period. Cooling a glow stick slows the reaction a small amount and causes it to last longer, but the light is dimmer. This can be demonstrated by refrigerating or freezing an active glow stick; when it warms up again, it will resume glowing. The dyes used in glow sticks usually exhibit fluorescence when exposed to ultraviolet radiation—even a spent glow stick may therefore shine under a black light.

Chemicals

Blue Light 9,10-Diphenylanthracene (DPA).	**Blue-Green Light** 1-chloro-9,10-diphenylanthracene (1-chloro(DPA)) and 2-chloro-9,10-diphenylanthracene (2-chloro(DPA)) emit blue-green light more efficiently than nonsubstituted DPA	**Green Light** 9,10-Bis(phenylethynyl)anthracene (BPEA) emits green light with maximum at 486 nm.	**Yellow-Green Light** 1-Chloro-9,10-bis(phenylethynyl)anthracene emits yellow-green light, used in 30-minute high-intensity Cyalume sticks.	**Green Light** 2-Chloro-9,10-bis(phenylethynyl)anthracene emits green light, used in 12-hour low-intensity Cyalume sticks.	**Yellow Light** 1,8-dichloro-9,10-bis(phenylethynyl)anthracene emits yellow light, used in Cyalume sticks.
Orange-Yellow Light Rubrene emits orange-yellow at 550 nm.	**Orange Light** 5,12-Bis(phenylethynyl)naphthacene emits orange light	**Orange Light** Violanthrone emits orange light at 630 nm.	**Infrared Light** 1-N,N-dibutylaminoanthracene emits infrared & 6-methylacridinium iodide emits infrared & 16,17-butyloxyviolanthrone.	**Infrared at 725nnm** 16,17-dihexyloxyviolanthrone.	**Deep Red Light** 2,4-di-tert-butylphenyl 1,4,5,8-tetracarboxynaphthalene diamide emits deep red light, together with DPA is used to produce white or hot-pink light, depending on their ratio.
Red Light N,N'-bis(2,5,-di-tert-butylphenyl)-3,4,9,10-perylenedicarboximide emits red.	**Red Light at 680nm** 16,17-(1,2-ethylenedioxy)violanthrone.				

Operation	**Step 1** Hold the glow stick with both hands and bend it until the glass vial breaks and you see some light.	**Turning Off** Glowsticks can't be turned off once activated so just hide it under something if you don't need the light.	You can speed up the mixing by breaking the vial in multiple places and then shaking the glow stick.	**Increase Brightness** Heating the glowstick will cause the reaction to progress faster thus producing more light in a shorter amount of time.	**Reduce Brightness** To dim the glowstick slow down the reaction by cooling or freezing the chemicals.

Beta Light

Tritium radioluminescence is the use of gaseous tritium, a radioactive isotope of hydrogen, to create visible light. Tritium emits electrons through beta decay and, when they interact with a phosphor material, light is emitted through the process of phosphorescence. The overall process of using a radioactive material to excite a phosphor and ultimately generate light is called radioluminescence.

As tritium illumination requires no electrical energy, it has found wide use in applications such as emergency exit signs, illumination of wristwatches, and portable yet very reliable sources of low intensity light which won't degrade human night vision. Gun sights for night use and small lights (which need to be more reliable than battery powered lights yet not interfere with night vision or be bright enough to easily give away one's location) used mostly by military personnel fall under the latter application.

Tritium lighting is made using glass tubes with a phosphor layer in them and tritium gas inside the tube. Such a tube is known as a "gaseous tritium light source" (GTLS), or beta light (since the tritium undergoes beta decay). The tritium in a gaseous tritium light source undergoes beta decay, releasing electrons that cause the phosphor layer to phosphoresce. During manufacture, a length of borosilicate glass tube that has had the inside surface coated with a phosphor-containing material is filled with radioactive tritium.

The tube is then sealed at the desired length using a carbon dioxide laser. Borosilicate is preferred for its strength and resistance to breakage. In the tube, the tritium gives off a steady stream of electrons due to beta decay. These particles excite the phosphor, causing it to emit a low, steady glow. Tritium is not the only material that can be used for self-powered lighting.

Promethium briefly replaced radium as a radiation source. Tritium is the only radiation source used in radioluminescent light sources today. Various preparations of the phosphor compound can be used to produce different colours of light. Some of the colours that have been manufactured in addition to the common phosphors are green, red, blue, yellow, purple, orange, and white. The GTLSs used in watches give off a small amount of light: not enough to be seen in daylight, but enough to be visible in the dark from a distance of several meters.

The average such GTLS has a useful life of 10–20 years. As the tritium component of the lighting is often more expensive than the rest of the watch itself, manufacturers try to use as little as possible. Being an unstable isotope with a half-life of 12.32 years, the rate of beta emissions decreases by half in that period. Additionally, phosphor degradation will cause the brightness of a tritium tube to drop by more than half in that period.

The more tritium that is initially placed in the tube, the brighter it is to begin with, and the longer its useful life. Tritium exit signs usually come in three brightness levels guaranteed for 10-, 15-, or 20-year useful life expectancies. The difference between the signs is how much tritium the manufacturer installs. The light produced by GTLSs varies in colour and size. Green is usually the brightest colour and white the least bright. Sizes range from tiny tubes small enough to fit on the hand of a watch to ones the size of a pencil. Large tubes (5mm diameter and up to 100mm long) are usually only found in green, and can surprisingly be not as bright as the standard 22.5mm x 3mm sized tritium; this smaller size is usually the brightest and is used mainly in keychains available commercially.

Operation	**Step 1** These lights are permanently activated from manufacture and have a glow life of about 10 years.	**Turning Off** Beta lights can't be turned off so just hide it under something if you don't need the light.	Beta lights give a fairly weak light, enough to read a few words at a time but best suited as a marker.		

LED Lights

Generally have a button to activate an deactivate the light, although modern torches have many settings. The settings on the light vary between devices but a few tips can be found in the "Modes" section below.

Operation	**Step 1** Press the On/Off switch until the torch activates.	**Turning Off** Press or hold the On/Off switch until the torch deactivates.	There may be other buttons or modes with additional features so see the user guide.		

Gas Lamp

Modern gas lamps can be purchased to fit onto canisters of gas to provide light. These gas lamps utilize propane, butane, LPG or a mixture of these fuels. Gas lamps are safer to use than kerosene or other petroleum based lamps due to being a gas already.

Operation	**Step 1** Ensure the lamp has a mantle attached or attach one if it doesn't.	**Step 2** Attach the lantern to the gas bottle ensuring it's on tight and upright.	**Step 3** Rotate the lever on the lamp until you hear a hissing sound of gas.	**Step 4** Ignite the gas using any open flame or piezo button. The mantle should slowly get brighter as it heats up.	**Turning Off** Rotate the lever in the opposite direction you turned it on until you can't turn it anymore and it stops emitting light.

Kerosene Lantern (Flat-Wick)

These lanterns have a wick dipped into kerosene which allows long burn times and light output similar to a candle. Flat-wick lamps have the lowest light output, centre-draft round-wick lamps have 3–4 times the output of flat-wick lamps, and pressurized lamps have higher output yet; the range is from 8 to 100 lumens. A kerosene lamp producing 37 lumens for 4 hours per day consumes about 3 litres of kerosene per month.

AKA
- Storm Lantern
- Paraffin Lamp

Requirements
- Lantern
- Kerosene
- Wicks
- Lighter / Matches

Output (12.57 Lumens = 1 CP)	Flat-Wick Width	0.95cm (3/8")	1.27cm (1/2")	1.58cm (5/8")	1.9cm (3/4")	2.2-2.5cm (7/8"–1")	3.81cm (1-1/2)"	2× 2.5cm (1") 2.69cm (1-1/16") 2.85cm (1-1/8")	2× 3.81cm (1-1/2")	3.17cm (1-1/4") Round "Dressel"	3.81cm (1-1/2") Round "Rayo"
	Candle Power	4 CP	7 CP	9 CP	10 CP	12 CP	20 CP	30 CP	50 CP	67 CP	80 CP
	Lumens	50 Lumen	88 Lumen	113 Lumen	125 Lumen	151 Lumen	251 Lumen	377 Lumen	628.5 Lumen	842 Lumen	1000 Lumen
	Watts	3.3w	5.9w	7.5w	8.3w	10.1w	16.7w	25w	42w	56w	66.6w

Operation	**Step 1** Fill the lantern with kerosene via the inlet.	**Step 2** Ensure the wick is long enough to touch the kerosene.	**Step 3** Light the wick.	**Step 4** Rotate the knob to adjust the wick height and thus the amount of light.	**Turning Off** o
Fuel	Flat-wick kerosene lamps should only be operated with kerosene or lamp oil, but alternative fuels can be used in an emergency. Such fuels may produce additional smoke and odour and may not be usable indoors. Tractor vaporizing oil is made from kerosene with some additive to make a motor fuel for tractors. No. 1 diesel fuel (also called winter diesel) is about the same as kerosene but with the additives to make it a motor fuel. Jet A jet-engine fuel is essentially kerosene with a few additives. RP-1 (Rocket Propellant-1) is a highly refined form of kerosene outwardly similar to jet fuel, used as rocket fuel.				

Kerosene Lantern (Pressure)

A kerosene lantern that converts kerosene to a gas via pressure and allows this gas to be lit thus lighting the mantle. These lanterns are very complicated to use and must be cleaned occasionally. They give off much more light than unpressurised lanterns due to the mantle. Flat-wick lamps have the lowest light output, centre-draft round-wick lamps have 3–4 times the output of flat-wick lamps, and pressurized lamps have higher output yet; the range is from 8 to 100 lumens. A kerosene lamp producing 37 lumens for 4 hours per day consumes about 3 litres of kerosene per month.

AKA
- Storm Lantern
- Paraffin Lamp
- Petromax
- Coleman Lamp

Requirements
- Lantern
- Kerosene
- Mantle
- Alcohol
- Lighter / Matches

Mantle Priming / Replacement If you have a new mantle on the lantern it needs to be primed prior to use.	**Step 1** Remove the old mantle if necessary by pulling it off or cutting the string.	**Step 2** Attach the mantle to the lantern, tying it off or removing the metal prongs depending on the type.	**Step 3** With a lighter or match burn the mantle until it's black. Once complete the mantle is very fragile.	

Operation
Step 1: Ensure the lantern is clean, there's no blockages, you have kerosene and alcohol and there's a mantle attached.
Step 2: Fill the lantern with kerosene via the inlet.
Step 3: Close the fuel valve.
Step 4: Add pressure to the tank by pumping the valve.
Step 5: If the lantern has a cleaning lever, make sure it's in the correct position. (Usually down)
Step 6: Take the top and glass off the lantern and fill the preheater cup with alcohol and light until it's almost all burnt off.
Step 7: Before the flames go out open the fuel valve slightly until the burning alcohol lights the mantle.
Step 8: Ensure the mantle is lit and the flames turn into light. The alcohol should burn itself out.

Turning Off
To stop the lantern turn the fuel valve in the opposite direction until you can't anymore and the light should soon go out.

Care Instructions
The mantle is extremely fragile and will break if it's bumped too much or touched by anything. If it breaks it generally needs replacing. If the glass becomes sooty rub it with a coarse cloth in water. Know how to take apart and clean the lantern, everything from the handle to the generator. If the lantern is subjected to bumps and shock, the mantle could tear. Always have a few backup just in case but in general mantles can last forever if taken care of. Mantles aren't fragile prior to being burnt so they can be placed or shoved into any pockets in your BOB.

If the lantern bursts into flames it could mean:
- The lantern wasn't primed
- There's incomplete conversion to a gas
- The pressure is too high
- The fuel valve is open too much

Fuel
Generic lamp oil is available clear or in a choice of several colours and in scented and unscented forms. Although more expensive, lamp oil is highly refined and burns more cleanly and with less odour than kerosene. "Lamp oil" must not be liquid paraffin. "Water-clear" K-1 kerosene is the next grade of preferred fuel for kerosene wick lamps. In some locations "red kerosene" is sold, which is dyed red and is slightly less expensive than K-1 kerosene, as no motor-fuel taxes are collected on it.

Red kerosene is not recommended because the dye will gradually clog the lantern wick, causing odour and reduced performance. Citronella-scented lamp oil containing lemongrass oil is sold for its insect repellent properties. Citronella fuels should only be used outdoors. Liquid paraffin-based "lamp oil" should only be used in round-wick lamps with a wick diameter of less than 5⁄8 inch (16 mm). Used in larger wicks, this fuel causes the wicks to clog.

Note: Contamination of lamp fuel with even a small amount of gasoline results in a lower flash point and higher vapour pressure for the fuel, with potentially dangerous consequences. Vapours from spilled fuel may ignite; vapour trapped above liquid fuel may lead to excess pressure and fires. Kerosene lamps are still extensively used in areas without electrical lighting; the cost and dangers of combustion lighting are a continuing concern in many countries.

Direction

The direction of light is important in understanding how it travels and how far it's visible for.

Angle

Lights can have various beam widths and angles each with unique properties.
0° Spread: A beam of light with no (or virtually no) spread such as a laser which travels extreme distances.
10° Spread: A very narrow light typically used for scouting very long distances.
30° Spread: A narrow beam for fair distances.
45° Spread: A spread that is good for mid-distance observing.
60° Spread: An average spread of light in torches to provide a nice amount of coverage.
90° Spread: Another common spread of light used for medium range.
120° Spread: The angle of typical SMD lights to light building interiors.
150° Spread: Very wide angled light which would be beneficial as a short throw torch.
180° Spread: This type of light (if it exists) would light up almost an entire side from the torch.
360° Spread: A light such as a glowstick which emits light in every direction.

Power

Lights have different levels of power, these different outputs are discussed here. Lumen levels between 0-10 can be seen as stealth levels, especially if you use your natural night vision to see as well. Lumen levels over 5,000 are optimal for strategic use such as signalling, blinding enemies and searching.

0-1 Lumens	Generally called "moonlight" mode which can give you enough light to see basic objects and find items in a backpack. It can include phosphorous charged lights and beta (tritium) lights.
1-5 Lumens	These light up the surrounds a bit more than the 1 lumen allowing easier detection of local objects.
5-10 Lumens	Lights that are usable for reading and close range tasks. String lights and Christmas lights are about 5 lumens.
10-25 Lumens	Covers the range of basic torches and mini torches. These can be used to light a room dimly and are the lowest recommended lumens for reading.
25-50 Lumens	Slightly brighter torches, these can be used to light a room fairly well.
50-100 Lumens	A torch which can light a room well where it's aimed. A good medium between light and power consumption.
100-500 Lumens	A well rounded lumen level for short distance night viewing.
500-1,000 Lumens	A common range for tactical lights while keeping them small which light up a small area very well. This is the minimum light level for intensive staring work.
1,000-5,000 Lumens	Powerful lights used for extensively lighting an area, these torches may get quite hot with heavy use.

5,000-10,000 Lumens	Very powerful lights used for extensively lighting an area, these torches may get very hot with use.
10,000+ Lumens	Ridiculously powerful lights which require lots of cooling. These are used by search parties and scouting locations. These torches are generally wide beamed due to the extreme amount of light.

Modes

Some lights come pre-programmed with different modes. This section will discuss the most common ones. The values for lumen outputs are subjective and based on the torch you have.

Moonlight Mode	**0.5 - 1 Lumens**	This mode is useful for finding items in your bag and for stealthy operations. This mode will have the longest battery life of all the modes and often lasts a few weeks.
Low	**5 - 50 Lumens**	A good level for general use such as cooking food.
Medium	**50 - 300 Lumens**	Better viewing distance for setting up tents and other activities that require looking for things around camp.
High	**300 - 1,000 Lumens**	A level which would be best used for hiking and observing the path ahead for trip hazards.
Ultra/Turbo Mode	**1,000 - 30,000+ Lumens**	This mode can't be used for long so it's use is limited to scouting a specific area or looking for the source of a sound. A mode which pushes the capability of the torch higher for a limited period of time. Generally with this mode the torch increases the lumen output for up to 2-5 minutes before swapping down a level to cool down. Torches often get very hot in this mode and the duration of the brightness is based on the battery percentage and the heat.
Strobe Mode	The strobe mode is a quick succession of flashes which easily draw the eye. It is best used if you are lost and are wanting the attention of someone else. Strobe mode can also be used defensively when shone in the eyes of an attacker. The bucha effect is an effect of bright strobing lights which disorients the subject. It has become quite popular with police as an aid in subduing belligerent suspects.	
SOS Mode	The SOS mode is a timed succession of flashes in the common international distress signal format. The SOS mode makes it easier to distinguish people with torches from people who need saving. See the COMMUNICATION section for more information on SOS.	**SOS** • • • — — — • • •

Common Lumens

Minimum Room Lumens	**Reading** - 98 **Closet** - 381 **Dressing** - 1,680	**Dining Table** - 315 **Kitchen Counters** - 360 **Range** - 450	**Sink** - 450 **Toilet** - 45 **Vanity** - 1,680	**Outdoor Entrance** - 996 **Paths** - 297 **Stairs/Hallway** - 1,200	**Adequate Room Lumens** **Kitchens:** 5,000-10,000 Lumens **Bathroom:** 4,000-8,000 Lumens **Bedrooms:** 2,000-4,000 Lumens **Living Rooms:** 1,500-3,000 **Dining Rooms:** 3,000-6,000 Lumens **Study:** 3,000-6,000 Lumens

6 Luminescence

Luminence is the emission of light by a substance that has not been heated, as in fluorescence and phosphorescence.

Luminence	Description	Example
Chemoluminescence	This process creates light through a chemical reaction.	• Glow Sticks
Crystalloluminescence	Light is made during crystallization and it is theorized that the light comes from small fractures in the crystal.	• Crushing Sugar or Salt
Electroluminescence	This occurs when an electromagnetic field is applied to solid or gaseous material. This excites the molecules and the substance glows. Requires AC current.	• Watch Backlight
Fluorescence	Fluorescent materials absorb light and then they glow for a certain time. A cheaper form of Phosphorescence and glows less.	• Glowing Stickers
Phosphorescence	Phosphorescent materials also glow in the dark; but, their glow lasts longer than fluorescence, making them good for glow in the dark applications.	• UvPaqlite • Watch Dials
Photoluminescence	This is a process where a substance absorbs photons and then re-emits them. The electromagnetic energy is absorbed at a certain wavelength and is emitted at a different wavelength which is most commonly longer.	
Radioluminescence	Light from this process is made from using radiation or high energy particles to bombard a substance. This is used in medical physics and radar screens.	• Beta-Light • Tritium Light
Sonoluminescence	This produces light from bubbles that are hitting one another when sound waves passed through the liquid. The sound waves cause bubbles which emit light when popped.	• Popping Bubbles by Sound
Thermoluminescence	Light comes from using heat to release of electrons that were trapped in a substance. This process is used in archaeological dating.	• Irradiated Crystals
Triboluminescence	In this process, the light coming from the substance is made by friction, like rubbing, crushing, or scratching. The friction pulls apart chemical bonds, thus causing electrical charges.	• Tearing Duct Tape

Fluorescence / Phosphorescence
Reusable, rechargeable glowing camp lights which can stay glowing for most of the night after exposure of a few minutes to strong light. Useful for saving battery power if you only need a small amount of light to read, or navigate by. Doesn't draw much attention to yourself during the night if you wish to stay concealed. Requires a strong light (1000+ Lumens) to charge it well for up to a minute which could give your position away unless covered. UvPaqlite is an example company which makes quality phosphorescence lights.

7 Types

Different types of lights.

Light Types

	Torch Handheld torch for illumination.	**Automatic Light** Turns on when power is cut.	**Solar Light** Turn on when it gets dark and recharges during the day.	**Flood Light** o	

Light Positioning

Positioning	**Hand** A light held in the hand.	**Head** A headlamp is a handsfree light.	**Gun** Lights are often mounted on guns to allow more control of the gun.	**Hanging** A light which hangs from another object.	

Interior

Lighting Types	**Ambient Lighting** Provides an even, overall light to a room. Also known as general lighting, it radiates a comfortable level of brightness without glare and allows you to see and walk about safely. In some spaces such as laundry rooms, the ambient lighting also serves as the primary source of task lighting. **Task Lighting** Helps you perform specific tasks, such as reading, grooming, preparing and cooking food and studying. It can be provided by recessed and track lighting, pendant lighting and under cabinet lighting, as well as by portable floor and desk lamps. **Accent Lighting** Used to create different focal points. As part of an interior design scheme, it is used to draw the eye to houseplants, paintings, sculptures and other prized possessions. It can also be used to highlight the texture of a brick or stone wall, window treatments or outdoor landscaping.

Lighting Fixtures	**Architectural Cove** Cove lighting is located in a ledge, shelf or recess high up on a wall, and the light is bounced toward the ceiling or upper wall.	**Architectural Soffit** Soffit lighting is located in a soffit or cornice near the ceiling, and the light radiates downward, washing the wall with light.	**Architectural Valance** Valance lighting is located in a wood, metal or glass valance (horizontal shield) mounted above a window or high on the wall, and the light bounces both upward and downward.	**Track** Mounted or suspended from the ceiling, track lighting consists of a linear housing containing several heads that can be positioned anywhere along a track; the direction of the heads is adjustable also. Track lighting is often used for task or accent lighting.	**Recessed** Installed above the ceiling, this type of lighting has an opening that is flush with the ceiling. A recessed light requires at least 6 inches of clearance above the ceiling, and insulation is essential to ensure that condensation does not drip into the fixture. Recessed lighting sends a relatively narrow band of light in one direction; it can be used to provide ambient, task or accent lighting.
Lighting Fixtures	**Under Cabinet** Mounted under kitchen cabinets, this type of lighting can be linear or a single puck-shaped fixture. Under cabinet lighting is extremely popular as task lighting in a kitchen.	**Pendants** Suspended from the ceiling, a pendant light directs its light down, typically over a table or kitchen island. A pendant can enhance the decorative style of a room. Pendants can provide ambient or task lighting.			

8 Beacon

You may use light as a beacon to be seen easier or to assist in being rescued. This section will go into detail in using light to be found in various ways.

Reflection	The reflection of light, particularly sunlight is the simplest way to get someone's attention without having to generate any light yourself. A small mirror with a hole in the middle can be effectively used to bounce light towards a potential rescuer. The light can grab attention from many kilometres away due to the flash that is observed.
Torch	Torches and other light sources can be effective at signalling for attention if done correctly. If you know where the potential rescuers are you can use reflective material to act as a cone around the lights emitter to focus it more precisely at the target. Movement and flashes also works well for attracting attention so move it as much as possible in their general direction. You can flash the torch in the SOS pattern to signal for help if there are people nearby who aren't rescuers to let them know you need assistance.

Laser	A laser is an effective signalling tool over long distances, particularly ones that have a strong visible beam. Starting at 50mw, a lasers beam can begin to be seen in the dark as a line. Although the colour of the laser greatly affects how much it can be seen. The further the lasers colour is from green the dimmer it is perceived to be, so for maximum impact you should use a 555nm laser.
Communication	A beacon of light directed at another individual can be used as a means of communication if both people know the light code. Morse code is one type of these codes which can be used to transmit a message to a distant party. See the COMMUNICATION section for more information.

9 Darkness

Darkness, the polar opposite of brightness, is understood as a lack of illumination or an absence of visible light. Human vision is unable to distinguish colour in conditions of either high brightness or high darkness. In conditions with insufficient light levels, colour perception ranges from achromatic to ultimately black. Darkness is generally synonymous with night which begins when the sun drops lower than 18° below the horizon. Before this point it is considered twilight and the sky isn't completely dark yet.

Advantages
- Greatly increased stealth
- Aids stealth and concealment
- Easier to sleep
- Enables astronomical observation
- Visibility of light sources
- Energy conservation
- Circadian rhythm regulation
- Deep space photography
- Sensory enhancement (other senses)
- Reduced human disturbance (for wildlife)
- Increased quietude
- Reduced insect attraction (to lights)

Disadvantages
- Increased accident risk
- Reduced visibility
- Only lit objects are visible
- Can't perform fine work
- Vulnerability
- Lower productivity
- Hindered emergency response
- Crime facilitation
- Reduced plant photosynthesis
- Compromised security (if no lighting)
- Impacts on mental alertness
- Limited outdoor activities
- Negative mood effects
- Increased/Fear Anxiety
- Becoming Lost
- Unseen Hazards
- Typically requires a light source
- Reduced perception of depth
- Challenges for vulnerable individuals
- Increased need for safety equipment
- Nightvision required for operations

Natural Nightvision

These are some tricks to improving your natural nightvision.

Wear Red-tinted Glasses	This is a common trick that aviators use when they don't have time to sit in perfect darkness and adjust before night flying. Wearing red-tinted glasses before you go out into low light will help train your eye to focus better. If you are looking at a map with a flashlight, cover the flashlight with a red glazed paper. The red light will make the map appear sharper. And if you're buying a new car, look for a dashboard with red illuminated buttons, rather than blue, green, or white.
Use Your Peripheral Vision	Your eyes have natural blind spots and navigating your way through an area in darkness can cause problems if you try to center your gaze. Try to focus your gaze on the side of any object you think is there, or just off-center of the direction you are going as you move forward through a dark area. This allows your peripheral vision to help detect movement and object shape much better than trying to look at something directly. Using your peripheral vision engages more rod cells, which are key in navigating your way through a dark area, identifying shapes, and detecting movement.
Utilise Your Rod Cells	Your rod cells take about 30 to 45 minutes to adapt to a change of light around you. Rod cells can only see black and white and have poor resolution but are very sensitive in night vision circumstances. Photopigments are chemicals contained in both rod and cone cells that are light-sensitive and convert what you see into a language that your brain can understand. Rhodopsin is a photopigment found in rod cells that is critical to night vision. Your ability to adapt to darkness depends on some things that may be out of your control, such as your age, previous eye injury or damage, and any existing eye conditions. In order to see in the darkness, you need to understand what it takes to improve your utilisation of the rod cells and manipulate your eyes to more quickly adapt to a sudden change in light. If you are trying to look at a dim light, don't look directly at it. By doing this, you are utilising your rod cells instead of your cone cells which would happen if you look directly at the dim light. This trick is often used by astronomers.
Avoid Looking at Light Sources	When you look directly at a light source, your pupils are forced to contract. This increases the amount of time it takes for your vision to acclimatize to the low light. If you can't avoid looking at a light source, cover or close one eye until it passes. Looking directly at light sources is a common concern while driving at night. If you are faced with oncoming high-beams, protecting one eye will prevent you from getting flash blindness in both eyes (like a deer in headlights). Another trick while driving at night is to take your eyes off the oncoming high beams and look at the white line on your side of the road to maintain a safe course.
Let your Eyes Adjust to the Dark Naturally	The best way to see in the dark is to let your eyes slowly acclimatize to low light. You can do this by sitting in darkness 20 to 30 minutes before going out into the night. Or you can wear a sleep mask or just cover your eyes. This simple trick helps your eyes easily adjust to the night. Special Forces use the technique of squeezing their eyes shut tightly for 10 seconds once they are in the dark.
Keep your Eyes Moving	Try not to stare at one object as it will cause your eyes to adapt to whatever light source that is available at the point of your focus. Dance your eyes around, scan the area, and you would be able to see better in dark. Keep blinking, too, to avoid your rods (cells in your eyes responsible for night vision) from desensitizing.

LIGHT Darkness Natural Nightvision

Consume More Vitamin A	One of the first signs of vitamin A deficiency is night blindness. In Ancient Egypt, it was discovered that night blindness could be cured by eating liver, which was later found to be a rich source of vitamin A. Low vitamin A levels can also cause the cornea to become very dry, leading to the clouding of the front of the eye, corneal ulcers and vision loss, as well as retina damage and problems with the conjunctiva. Carrots, broccoli, squash, cantaloupe, fish, liver, fortified cereals, dairy products, kale, blueberries, and apricots are all excellent sources of vitamin A. While increasing your consumption of foods that are rich in vitamin A may be helpful, research done in this area has revealed that, in the case of vitamin A, taking supplements provided higher levels than increasing the dietary sources. Plus, excessive consumption doesn't strengthen your eyes. Vitamin A supplements are available in oral doses, like tablets or capsules, and are marketed in either mcg strengths or units. The average recommended adult dose of vitamin A in mcgs is between 800 to 1000 mcg each day. In units, the dose range is between 2600 and 3300 units consumed daily. The protein rhodopsin found in the eye breaks down into retinal and opsin when exposed to light and reforms when back in the dark. A severe lack of vitamin A in the diet may result in night blindness, but extra vitamin A will not help one see better than normal.
Gently Massage Your Eyes	Just close your eyes tightly and apply slight pressure on both your eyes with your palms (use the fleshy part of your palm below your thumb) After about five or 10 seconds, instead of seeing black, your vision will turn white momentarily. When the white goes away and the black comes back, open your eyes, and your vision will be significantly better in the dark. While the above tricks can help improve night vision, they will work even better if you supplement your diet with vision-boosting nutrients.
Stop Smoking	There are studies that shown that smokers are 2 times more prone to night accidents than non-smokers. Nicotine and the hypoxic effect from carbon monoxide reduces your night vision. Just by avoiding both first and second hand smoking can help improve night vision.
Stay Well Hydrated	The surface of the eye is 98% water. Dry eyes will struggle to see at night and are linked to overall dehydration. Drinking plenty of water is essential to overall good health; however the direct link to fluid intake and improving vision is controversial. Some eye experts argue that certain circumstances that negatively impact your level of hydration cause a decrease in the quality of your vision and the overall health of your eyes. For example, being exposed to high temperatures, low humidity climates, or intense sunlight can cause the basal tear layer to dehydrate, resulting in a negative impact on your vision. Follow recommended dietary guidelines for water intake, aiming for about 64 ounces (1.9 liters) each day depending on your work situation and environmental factors, to maintain your eye health.

Bortle Scale

The Bortle scale is a nine-level numeric scale that measures the night sky's brightness of a particular location. NELM stands for Naked-Eye Limiting Magnitude. In astronomy, limiting magnitude is the faintest apparent magnitude of a celestial body that is detectable or detected by a given instrument. The limiting magnitude for naked eye visibility refers to the faintest stars that can be seen with the unaided eye near the zenith on clear moonless nights. The quantity is most often used as an overall indicator of sky brightness, in that light polluted and humid areas generally have brighter limiting magnitudes than remote desert or high altitude areas. The limiting magnitude will depend on the observer, and will increase with the eye's dark adaptation. On a relatively clear sky, the limiting visibility will be about 6th magnitude.

Bortle Class	Title	NELM	Description
Class 1	Excellent Dark-Sky Site	7.6–8.0	• The zodiacal light is visible and colourful • The gegenschein is visible • the zodiacal band is visible • Airglow is readily visible • The Scorpius and Sagittarius regions of the Milky Way cast obvious shadows • Many constellations, particularly fainter ones, are barely recognizable due to the large number of stars • Many Messier and globular clusters are naked-eye objects • M33 is a direct vision naked-eye object • limiting magnitude with 12.5 in (32 cm) reflector is 17.5 (with effort) • Venus and Jupiter affect dark adaptation
Class 2	Typical Truly Dark Site	7.1–7.5	• The zodiacal light is distinctly yellowish and bright enough to cast shadows at dusk and dawn • Airglow may be weakly visible near horizon • Clouds are only visible as dark holes against the sky • Surroundings are barely visible silhouetted against the sky • The summer Milky Way is highly structured • Many Messier objects and globular clusters are naked-eye objects • M33 is easily seen with naked eye • Limiting magnitude with 12.5" reflector is 16.5
Class 3	Rural Sky	6.6–7.0	• The zodiacal light is striking in spring and autumn, and colour is still visible • Some light pollution evident at the horizon • Clouds are illuminated near the horizon, dark overhead • Nearer surroundings are vaguely visible • The summer Milky Way still appears complex • M15, M4, M5, and M22 are naked-eye objects • M33 is easily visible with averted vision • Limiting magnitude with 12.5" reflector is 16
Class 4	Rural/Suburban Transition	6.1–6.5	• The zodiacal light is still visible, but does not extend halfway to the zenith at dusk or dawn • Light pollution domes visible in several directions • Clouds are illuminated in the directions of the light sources, dark overhead • Surroundings are clearly visible, even at a distance • The Milky Way well above the horizon is still impressive, but lacks detail • M33 is a difficult averted vision object, only visible when high in the sky • Limiting magnitude with 12.5" reflector is 15.5
Class 5	Suburban Sky	5.6–6.0	• Only hints of zodiacal light are seen on the best nights in autumn and spring • Light pollution is visible in most, if not all, directions • Clouds are noticeably brighter than the sky • The Milky Way is very weak or invisible near the horizon, and looks washed out overhead • When it is half moon (first/last quarter) in a dark location the sky appears like this, but with the difference that the sky appears dark blue • Limiting magnitude with 12.5" reflector is 15

Class 6	Bright Suburban Sky	5.1–5.5	● The zodiacal light is invisible ● Light pollution makes the sky within 35° of the horizon glow grayish white ● Clouds anywhere in the sky appear fairly bright ● Even high clouds (cirrus) appear brighter than the sky background ● Surroundings are easily visible ● The Milky Way is only visible near the zenith ● M33 is not visible, M31 is modestly apparent ● Limiting magnitude with 12.5" reflector is 14.5
Class 7	Suburban/Urban Transition	4.6–5.0	● Light pollution makes the entire sky light gray ● Strong light sources are evident in all directions ● Clouds are brightly lit ● The Milky Way is nearly or totally invisible ● M31 and M44 may be glimpsed, but with no detail ● Through a telescope, the brightest Messier objects are pale ghosts of their true selves ● When it is full moon in a dark location the sky appears like this, but with the difference that the sky appears blue ● Limiting magnitude with 12.5" reflector is 14
Class 8	City Sky	4.1–4.5	● The sky is light gray or orange – one can easily read ● Stars forming familiar constellation patterns may be weak or invisible ● M31 and M44 are barely glimpsed by an experienced observer on good nights ● Even with a telescope, only bright Messier objects can be detected ● Limiting magnitude with 12.5" reflector is 13
Class 9	Inner-City Sky	4	● The sky is brilliantly lit ● Many stars forming constellations are invisible and many fainter constellations are invisible ● Aside from the Pleiades, no Messier object is visible to the naked eye ● The only objects to observe are the Moon, the planets, and a few of the brightest star clusters

Concealment

In London during the blitz, the citizens had to block out all their windows to prevent light escaping so the Nazi bombers couldn't target them as accurately. In this day and age with GPS technology doing so would be useless, however there are many circumstances that you won't want to let light escape. This section contains ways you can reduce your light footprint and eliminate stray rays to prevent you being located as easily.

Reduce Use	Firstly you can reduce the use of light where possible, so try to complete activities in darkness if the situation allows. If light is required you could try to cut down the time spent with the light on and complete the task faster.
Reduce Lumens	Lowering the output of the light can greatly reduce the distance it's seen from. If you only require a small amount of light to only see where you're going you could make do with a 1 lumen light combined with your natural night vision, instead of a 180 lumen.
Light Colour	Changing the colour of the light based on the environment can reduce the visibility of the light. An example is using a green light in a forest instead of a white light. More about light colours and their purposes can be found the sections above.
Sealed Area	If none of the above options are viable for you and a bright light is required you should attempt to use it in a sealed room or other location. Rooms without windows or canvas swags are ideal for this purpose as they are much easier to seal up than a regular room. If light must be used you should always use it in the designated light room and ensure that the entry is sealed.
Blocking Out Windows	If bright light is required and you're indoors you can try to prevent its escape by sealing any cracks of crevices where it may leak. Keep in mind that light bounces quite a lot and can make its way out of even complex buildings with multiple turns. To block windows find a thick piece of light proof fabric or other dark material and cover the windows, using duct tape making sure to tape every crack. **Usable Materials** ● Curtains ● Blockout Material ● Garbage Bags ● Cardboard
Testing	Turn on the light and step outside, then wait for your natural night vision to work and look for any leaks and seal them while you're out there.

Health

How to keep fit, clean and healthy

"Exercise in the morning, before your brain figures out what you're doing."
Dr Josh Axe

Introduction

Nutrition is the science that interprets the nutrients and other substances in food in relation to maintenance, growth, reproduction, health and disease of an organism. It includes food intake, absorption, assimilation, biosynthesis, catabolism and excretion.

The diet of an organism is what it eats, which is largely determined by the availability and palatability of foods. For humans, a healthy diet includes preparation of food and storage methods that preserve nutrients from oxidation, heat or leaching, and that reduces risk of foodborne illnesses. The seven major classes of human nutrients are carbohydrates, fats, fiber, minerals, proteins, vitamins, and water. Nutrients can be grouped as either macronutrients or micronutrients (needed in small quantities).

In humans, an unhealthy diet can cause deficiency-related diseases such as blindness, anemia, scurvy, preterm birth, stillbirth and cretinism, or nutrient excess health-threatening conditions such as obesity and metabolic syndrome; and such common chronic systemic diseases as cardiovascular disease, diabetes, and osteoporosis. Undernutrition can lead to wasting in acute cases, and the stunting of marasmus in chronic cases of malnutrition.

Purpose	The aim of HEALTH is to provide you with a foundational knowledge for healthy eating, fitness and hygiene to help the human body function optimally.
Lost?	● For the illnesses that can occur from not eating right, see the ILLNESS section. ● For some healthy recipes, see the RECIPES section. ● For information on keeping your mind healthy, see the EMOTIONAL section. ● For growing your own nutritional food, see the GARDENING section. ● For self-defence related fitness activities, see the DEFENCE section. ● To make sure you can physically carry your BOB, see the GEAR > Backpacks section. ● For information on keeping your mind healthy, see the EMOTIONAL section. ● For outdoor activities to help keep you fit, see the ENTERTAINMENT section. ● For the terms and definitions of health and nutrition, see the ADDENDUM > Dictionary section.

Contents

1 Food Groups

These are the different food groups.

Grains	One quarter of your plate should be grains. Half of your grain servings should come from whole grains, meaning that the grain contains all three parts of the kernel – bran, germ and endosperm.	**Nutrition** Whole grains are a source of magnesium, B vitamins and fibre that work collectively to reduce the risk of heart disease and diabetes, while supporting a healthy metabolism.	**Food Types** • Wheat • Rice • Corn • Oats • Barley
Vegetables	Vegetables are loaded with good nutrition and are naturally low fat and cholesterol-free. The MyPlate guide recommends that one half of your plate contain vegetables, as well as fruit.	**Nutrition** Vegetables provide a variety of nutrients including potassium, fibre, folic acid, vitamin A and vitamin C. A diet rich in vegetables reduces the risk of many diseases, including heart disease, stroke, type-2 diabetes and certain types of cancer.	**Food Types** • Carrot • Potato • Broccoli • Tomato • Onion
Fruits	Fruits, as well as vegetables, are nutritional powerhouses that should make up one half of your plate at mealtime, in conjunction with vegetables. Fruits are good sources of potassium, vitamin C, folic acid and fibre.	**Nutrition** Fruits, like vegetables, contain antioxidants that protect cells against damaging free radicals. Many fruits are also naturally low in calories and can contribute to a healthy weight when eaten, instead of high-calorie foods.	**Food Types** • Apple • Banana • Orange • Grapes • Strawberry
Protein	One quarter of your plate should be protein foods, including meat, eggs, fish, shellfish, nuts and seeds. Protein supports muscles and is an important component of body tissues, blood and hormones.	**Nutrition** Fish and shellfish contain heart-healthy omega-3 fatty acids that help prevent heart disease.	**Food Types** • Chicken breast • Beef steak • Eggs • Lentils • Tofu
Dairy	Dairy foods have all the essential nutrients for bone health, including potassium, calcium and vitamin D. Research indicates that incorporating milk and milk products into the diet can help promote bone health and is associated with a lower risk of heart disease.	**Nutrition** The potassium in dairy products also helps reduce blood pressure.	**Food Types** • Milk • Cheese • Yogurt • Butter • Cream
Oils	Oils are often used in cooking and added to other foods in the form of salad dressings or sauces.	**Nutrition** Oils contribute essential fatty acids and the antioxidant vitamin E and are part of a healthful diet.	**Food Types** • Olive oil • Canola oil • Sunflower oil • Coconut oil

2 Nutrients

Human nutrition deals with the provision of essential nutrients in food that are necessary to support human life and health. Poor nutrition is a chronic problem often linked to poverty, food security or a poor understanding of nutrition and dietary practices. Malnutrition and its consequences are large contributors to deaths and disabilities worldwide.

Good nutrition is necessary for children to grow physically, and for normal human biological development. The human body contains chemical compounds such as water, carbohydrates, amino acids (found in proteins), fatty acids (found in lipids), and nucleic acids (DNA and RNA). These compounds are composed of elements such as carbon, hydrogen, oxygen, nitrogen, phosphorus.

Any study done to determine nutritional status must take into account the state of the body before and after experiments, as well as the chemical composition of the whole diet and of all the materials excreted and eliminated from the body (including urine and faeces). Comparing food to waste material can help determine the specific compounds and elements absorbed and metabolized by the body.

The effects of nutrients may only be discernible over an extended period of time, during which all food and waste must be analysed. The number of variables involved in such experiments is high, making nutritional studies time-consuming and expensive, which explains why the science of human nutrition is still slowly evolving.

These nutrient classes are categorized as either macronutrients or micronutrients (needed in small quantities). The macronutrients are carbohydrates, fats, fibre, proteins, and water. The micronutrients are minerals and vitamins. The macronutrients (excluding fibre and water) provide structural material (amino acids from which proteins are built, and lipids from which cell membranes and some signalling molecules are built), and energy. Some of the structural material can also be used to generate energy internally, and in either case it is measured in Joules or kilocalories (often called "Calories" and written with a capital 'C' to distinguish them from little 'c' calories). Carbohydrates and proteins provide 17 kJ approximately (4 kcal) of energy per gram, while fats provide 37 kJ (9 kcal) per gram, though the net energy from either depends on such factors as absorption and digestive effort, which vary substantially from instance to instance.

Nutrient Classes
- Carbohydrates
- Fats
- Fibre
- Minerals
- Proteins
- Vitamins
- Water

Subheadings

1. Carbohydrates	**2. Fat**	**3. Fibre**	**4. Protein**
5. Minerals	**6. Vitamins**	**7. Malnutrition**	**8. Eating Disorders**
9. Obesity	**10. Starvation**	**11. Nutrition Challenges**	**12. Food Insecurity**
13. Nutrition Policy	**14. Macronutrients**	**15. Micronutrients**	

1 Carbohydrates

Carbohydrates may be classified as monosaccharides, disaccharides or polysaccharides depending on the number of monomer (sugar) units they contain. They are a diverse group of substances, with a range of chemical, physical and physiological properties. They make up a large part of foods such as rice, noodles, bread, and other grain-based products, but they are not an essential nutrient, meaning a human does not need to eat carbohydrates.

The brain is the largest consumer of sugars in the human body, and uses particularly large amounts of glucose, accounting for 20% of total body glucose consumption. The brain uses mostly glucose for energy unless it is insufficient, in which case it switches to using fats. Monosaccharides contain one sugar unit, disaccharides two, and polysaccharides three or more. Monosaccharides include glucose, fructose and galactose.

HEALTH Nutrients Carbohydr

Disaccharides include sucrose, lactose, and maltose; purified sucrose, for instance, is used as table sugar. Polysaccharides, which include starch and glycogen, are often referred to as 'complex' carbohydrates because they are typically long multiple-branched chains of sugar units. Simple carbohydrates are absorbed quickly, and therefore raise blood-sugar levels more rapidly than other nutrients. However, the most important plant carbohydrate nutrient, starch, varies in its absorption.

Gelatinized starch (starch heated for a few minutes in the presence of water) is far more digestible than plain starch, and starch which has been divided into fine particles is also more absorbable during digestion. The increased effort and decreased availability reduces the available energy from starchy foods substantially and can be seen experimentally in rats and anecdotally in humans. Additionally, up to a third of dietary starch may be unavailable due to mechanical or chemical difficulty.

2 Fat

HEALTH Nutrients Fat

A molecule of dietary fat typically consists of several fatty acids (containing long chains of carbon and hydrogen atoms), bonded to a glycerol. They are typically found as triglycerides (three fatty acids attached to one glycerol backbone). Fats may be classified as saturated or unsaturated depending on the chemical structure of the fatty acids involved.

3 Fibre

HEALTH Nutrients Fibre

Dietary fibre is a carbohydrate, specifically a polysaccharide, which is incompletely absorbed in humans and in some animals. Like all carbohydrates, when it is metabolized, it can produce four Calories (kilocalories) of energy per gram, but in most circumstances, it accounts for less than that because of its limited absorption and digestibility. The two subcategories are insoluble and soluble fibre. Insoluble dietary fibre consists mainly of cellulose, a large carbohydrate polymer that is indigestible by humans, because humans do not have the required enzymes to break it down, and the human digestive system does not harbour enough of the types of microbes that can do so.

Soluble dietary fibre comprises a variety of oligosaccharides, waxes, esters, resistant starches, and other carbohydrates that dissolve or gelatinize in water. Many of these soluble fibres can be fermented or partially fermented by microbes in the human digestive system to produce short-chain fatty acids which are absorbed and therefore introduce some caloric content.

Whole grains, beans and other legumes, fruits (especially plums, prunes, and figs), and vegetables are good sources of dietary fibre. Fibre is important to digestive health and is thought to reduce the risk of colon cancer. For mechanical reasons, fibre can help in alleviating both constipation and diarrhoea.

Fibre provides bulk to the intestinal contents, and insoluble fibre especially stimulates peristalsis – the rhythmic muscular contractions of the intestines which move digesta along the digestive tract. Some soluble fibres produce a solution of high viscosity; this is essentially a gel, which slows the movement of food through the intestines. Additionally, fibre, perhaps especially that from whole grains, may help lessen insulin spikes and reduce the risk of type 2 diabetes.

4 Protein

HEALTH Nutrients Protein

Proteins are the basis of many animal body structures (e.g. muscles, skin, and hair) and form the enzymes which catalyse chemical reactions throughout the body. Each protein molecule is composed of amino acids which contain nitrogen and sometimes sulphur (these components are responsible for the distinctive smell of burning protein, such as the keratin in hair).

The body requires amino acids to produce new proteins (protein retention) and to replace damaged proteins (maintenance). Amino acids are soluble in the digestive juices within the small intestine, where they are absorbed into the blood. Once absorbed, they cannot be stored in the body, so they are either metabolized as required or excreted in the urine.

Proteins consist of amino acids in different proportions. The most important aspect and defining characteristic of protein from a nutritional standpoint is its amino acid composition. Amino acids which an animal cannot synthesize on its own from smaller molecules are deemed essential. The synthesis of some amino acids can be limited under special pathophysiological conditions, such as prematurity in the infant or individuals in severe catabolic distress, and those are called conditionally essential.

5 Minerals

HEALTH Nutrients Minerals

Dietary minerals are the chemical elements required by living organisms, other than the four elements carbon, hydrogen, nitrogen, and oxygen that are present in nearly all organic molecules. The term "mineral" is archaic, since the intent is to describe simply the less common elements in the diet. Some are heavier than the four just mentioned – including several metals, which often occur as ions in the body.

Some dietitians recommend that these be supplied from foods in which they occur naturally, or at least as complex compounds, or sometimes even from natural inorganic sources (such as calcium carbonate from ground oyster shells). Some are absorbed much more readily in the ionic forms found in such sources. On the other hand, minerals are often artificially added to the diet as supplements; the most well-known is likely iodine in iodized salt which prevents goiter.

6 Vitamins

HEALTH Nutrients Vitamins

As with the minerals discussed above, some vitamins are recognized as essential nutrients, necessary in the diet for good health. (Vitamin D is the exception: it can alternatively be synthesized in the skin, in the presence of UVB radiation). Certain vitamin-like compounds that are recommended in the diet, such as carnitine, are thought useful for survival and health, but these are not "essential" dietary nutrients because the human body has some capacity to produce them from other compounds.

Moreover, thousands of different phytochemicals have recently been discovered in food (particularly in fresh vegetables), which may have desirable properties including antioxidant activity; experimental demonstration has been suggestive but inconclusive.

Other essential nutrients not classed as vitamins include essential amino acids, essential fatty acids, and the minerals discussed in the preceding section. Vitamin deficiencies may result in disease conditions: goiter, scurvy, osteoporosis, impaired immune system, disorders of cell metabolism, certain forms of cancer, symptoms of premature aging, and poor psychological health (including eating disorders), among many others.

7 Malnutrition

HEALTH Nutrients Malnutrition

Malnutrition refers to insufficient, excessive, or imbalanced consumption of nutrients. In developed countries, the diseases of malnutrition are most often associated with nutritional imbalances or excessive consumption. Although there are more people in the world who are malnourished due to excessive consumption, according to the United Nations World Health Organization, the greatest challenge in developing nations today is not starvation, but insufficient nutrition – the lack of nutrients necessary for the growth and maintenance of vital functions. The causes of malnutrition are directly linked to inadequate macronutrient consumption and disease, and are indirectly linked to factors like "household food security, maternal and child care, health services, and the environment."

Illnesses

Nutrient	Deficiency	Excess
Food Energy	Lower Physical and Mental Abilities; Starvation, Marasmus	Obesity, Diabetes Mellitus, Cardiovascular Disease
Simple Carbohydrates	None	Diabetes Mellitus, Obesity
Complex Carbohydrates	None	Obesity
Saturated Fat	Low Sex Hormone Levels	Cardiovascular Disease
Trans Fat	None	Cardiovascular Disease
Unsaturated Fat	None	Obesity
Fat	During Development: Stunted Brain Development and Reduced Brain Weight; Neurodegenerative Diseases; Malabsorption of Fat-Soluble Vitamins, Rabbit Starvation (If protein intake is high),	Cardiovascular Disease
Omega-3 fats	Cardiovascular Disease	Bleeding, Haemorrhages
Omega-6 fats	None	Cardiovascular Disease, Cancer
Cholesterol	During Development: Deficiencies in Myelinization of the Brain; Demyelination of the Brain and Neurodegenerative Diseases (Multiple Sclerosis, Alzheimer)	Cardiovascular Disease
Protein	Kwashiorkor	
Sodium	Hyponatremia	Hypernatremia, Hypertension
Iron	Anaemia	Cirrhosis, Cardiovascular Disease
Iodine	Goiter, Hypothyroidism	Iodine Toxicity (Goiter, Hypothyroidism)
Vitamin A	Xerophthalmia and Night Blindness, Low Testosterone Levels	Hypervitaminosis A (Cirrhosis, Hair Loss)
Vitamin B1	Beriberi	
Vitamin B2	Cracking of skin and Corneal Unclearation	
Niacin	Pellagra	Dyspepsia, Cardiac Arrhythmias, Birth Defects
Vitamin B12	Pernicious Anaemia	
Vitamin C	Scurvy	Diarrhoea Causing Dehydration
Vitamin D	Rickets, Osteoporosis, Balance, Immune System, Inflammation	Hypervitaminosis D (Dehydration, Vomiting, Constipation)
Vitamin E	Nervous Disorders	Hypervitaminosis E (Anticoagulant: Excessive Bleeding)
Vitamin K	Haemorrhage	
Calcium	Osteoporosis, Tetany, Carpopedal Spasm, Laryngospasm, Cardiac Arrhythmias	Fatigue, Depression, Confusion, Anorexia, Nausea, Vomiting, Constipation, Pancreatitis, Increased Urination
Magnesium	Hypertension	Weakness, Nausea, Vomiting, Impaired Breathing, and Hypotension
Potassium	Hypokalemia, Cardiac Arrhythmias	Hyperkalemia, Palpitations
Nutrient	**Deficiency**	**Excess**

Disorders

Mental Agility
Research indicates that improving the awareness of nutritious meal choices and establishing long-term habits of healthy eating has a positive effect on a cognitive and spatial memory capacity, potentially increasing a student's potential to process and retain academic information. Some organisations have begun working with teachers, policymakers, and managed food service contractors to mandate improved nutritional content and increased nutritional resources in school cafeterias from primary to university level institutions. Health and nutrition have been proven to have close links with overall educational success.

Currently less than 10% of American college students report that they eat the recommended five servings of fruit and vegetables daily. Better nutrition has been shown to affect both cognitive and spatial memory performance; a study showed those with higher blood sugar levels performed better on certain memory tests. In another study, those who consumed yogurt performed better on thinking tasks when compared to those who consumed caffeine free diet soda or confections. Nutritional deficiencies have been shown to have a negative effect on learning behaviour in mice as far back as 1951. "Better learning performance is associated with diet induced effects on learning and memory ability".

Mental Disorders

Nutritional supplement treatment may be appropriate for major depression, bipolar disorder, schizophrenia, and obsessive compulsive disorder, the four most common mental disorders in developed countries. Lakhan and Vieira mentioned that the supplements possess amino acids that may change into neurotransmitters and improve mental disorders. Supplements that have been studied most for mood elevation and stabilization include eicosapentaenoic acid and docosahexaenoic acid (each of which are an omega-3 fatty acid contained in fish oil, but not in flaxseed oil), vitamin B12, folic acid, and inositol.

Cancer

Cancer has become common in developing countries. According to a study by the International Agency for Research on Cancer, "In the developing world, cancers of the liver, stomach and oesophagus were more common, often linked to consumption of carcinogenic preserved foods, such as smoked or salted food, and parasitic infections that attack organs." Lung cancer rates are rising rapidly in poorer nations because of increased use of tobacco. Developed countries "tended to have cancers linked to affluence or a 'Western lifestyle' – cancers of the colon, rectum, breast and prostate – that can be caused by obesity, lack of exercise, diet and age."

A comprehensive worldwide report, "Food, Nutrition, Physical Activity and the Prevention of Cancer: a Global Perspective", compiled by the World Cancer Research Fund and the American Institute for Cancer Research, states that there is a significant relation between lifestyle (including food consumption) and cancer prevention. The same report recommends eating mostly foods of plant origin and aiming to meet nutritional needs through diet alone, while limiting consumption of energy-dense foods, red meat, alcoholic drinks and salt and avoiding sugary drinks, processed meat and mouldy cereals (grains) or pulses (legumes). Protein consumption leads to an increase in IGF-1, which plays a role in cancer development.

Metabolic Syndrome and Obesity

Several lines of evidence indicate lifestyle-induced hyperinsulinemia and reduced insulin function (i.e. insulin resistance) as decisive factors in many disease states. For example, hyperinsulinemia and insulin resistance are strongly linked to chronic inflammation, which in turn is strongly linked to a variety of adverse developments such as arterial microinjuries and clot formation (i.e. heart disease) and exaggerated cell division (i.e. cancer). Hyperinsulinemia and insulin resistance (the so-called metabolic syndrome) are characterized by a combination of abdominal obesity, elevated blood sugar, elevated blood pressure, elevated blood triglycerides, and reduced HDL cholesterol.

Obesity can unfavourably alter hormonal and metabolic status via resistance to the hormone leptin, and a vicious cycle may occur in which insulin/leptin resistance and obesity aggravate one another. The vicious cycle is putatively fuelled by continuously high insulin/leptin stimulation and fat storage, as a result of high intake of strongly insulin/leptin stimulating foods and energy.

Both insulin and leptin normally function as satiety signals to the hypothalamus in the brain; however, insulin/leptin resistance may reduce this signal and therefore allow continued overfeeding despite large body fat stores. There is a debate about how and to what extent different dietary factors – such as intake of processed carbohydrates, total protein, fat, and carbohydrate intake, intake of saturated and trans fatty acids, and low intake of vitamins/minerals – contribute to the development of insulin and leptin resistance.

Evidence indicates that diets possibly protective against metabolic syndrome include low saturated and trans fat intake and foods rich in dietary fibre, such as high consumption of fruits and vegetables and moderate intake of low-fat dairy products.

8 Eating Disorders

An eating disorder is a mental disorder defined by abnormal eating habits that negatively affect a person's physical or mental health. They include binge eating disorder, where people eat a large amount in a short period of time; anorexia nervosa, where people eat very little and thus have a low body weight; bulimia nervosa, where people eat a lot and then try to rid themselves of the food; pica, where people eat non-food items; rumination disorder, where people regurgitate food; avoidant/restrictive food intake disorder, where people have a lack of interest in food; and a group of other specified feeding or eating disorders.

Anxiety disorders, depression, and substance abuse are common among people with eating disorders. These disorders do not include obesity. The causes of eating disorders are not clear. Both biological and environmental factors appear to play a role. Cultural idealization of thinness is believed to contribute. Eating disorders affect about 12 percent of dancers. Individuals who have experienced sexual abuse are also more likely to develop eating disorders. Some disorders such as pica and rumination disorder occur more often in people with intellectual disabilities.

Only one eating disorder can be diagnosed at a given time. Treatment can be effective for many eating disorders. Typically, this involves counselling, a proper diet, a normal amount of exercise, and the reduction of efforts to eliminate food. Hospitalization may be needed in more serious cases. Medications may be used to help with some of the associated symptoms. About 70% of people with anorexia and 50% of people with bulimia recover within five years. Recovery from binge eating disorder is less clear and estimated at 20% to 60%. Both anorexia and bulimia increase the risk of death. In the developed world, binge eating disorder affects about 1.6% of women and 0.8% of men in a given year.

Anorexia affects about 0.4% and bulimia affects about 1.3% of young women in a given year. Up to 4% of women have anorexia, 2% have bulimia, and 2% have binge eating disorder at some point in time. Anorexia and bulimia occur nearly ten times more often in females than males. Typically, they begin in late childhood or early adulthood. Rates of other eating disorders are not clear. Rates of eating disorders appear to be lower in less developed countries.

Classification

Bulimia nervosa is a disorder characterized by binge eating and purging, as well as excessive evaluation of one's self-worth in terms of body weight or shape. Purging can include self-induced vomiting, over-exercising, and the use of diuretics, enemas, and laxatives. Anorexia nervosa is characterized by extreme food restriction and excessive weight loss, accompanied by the fear of being fat.

The extreme weight loss often causes women and girls who have begun menstruating to stop having menstrual periods, a condition known as amenorrhea. Although amenorrhea was once a required criterion for the disorder, it is no longer required to meet criteria for anorexia nervosa due to its exclusive nature for sufferers who are male, post-menopause, or who do not menstruate for other reasons.

The DSM-5 specifies two subtypes of anorexia nervosa—the restricting type and the binge/purge type. Those who suffer from the restricting type of anorexia nervosa restrict food intake and do not engage in binge eating, whereas those suffering from the binge/purge type lose control over their eating at least occasionally and may compensate for these binge episodes.

The most notable difference between anorexia nervosa binge/purge type and bulimia nervosa is the body weight of the person. Those diagnosed with anorexia nervosa binge/purge type are underweight, while those with bulimia nervosa may have a body weight that falls within the range from normal to obese.

ICD and DSM

These eating disorders are specified as mental disorders in standard medical manuals, such as in the ICD-10, the DSM-5, or both.

- Bulimia nervosa (BN), characterized by recurrent binge eating followed by compensatory behaviours such as purging (self-induced vomiting, eating to the point of vomiting, excessive use of laxatives/diuretics, or excessive exercise). Fasting and over-exercising may also be used as a method of purging following a binge.

- Muscle dysmorphia is characterized by appearance preoccupation that one's own body is too small, too skinny, insufficiently muscular, or insufficiently lean. Muscle dysmorphia affects mostly males.

HEALTH Nutrients Eating Disorders ICD and DSM

- Binge Eating Disorder (BED), characterized by recurring binge eating at least once a week for over a period of 3 months while experiencing lack of control and guilt after overeating. The disorder can develop within individuals of a wide range of ages and socioeconomic classes.
- Other Specified Feeding or Eating Disorder (OSFED) is an eating or feeding disorder that does not meet full DSM-5 criteria for AN, BN, or BED. Examples of otherwise-specified eating disorders include individuals with atypical anorexia nervosa, who meet all criteria for AN except being underweight, despite substantial weight loss; atypical bulimia nervosa, who meet all criteria for BN except that bulimic behaviours are less frequent or have not been ongoing for long enough; purging disorder; and night eating syndrome.
- Anorexia nervosa (AN), characterized by lack of maintenance of a healthy body weight, an obsessive fear of gaining weight or refusal to do so, and an unrealistic perception, or non-recognition of the seriousness, of current low body weight. Anorexia can cause menstruation to stop, and often leads to bone loss, loss of skin integrity, etc. It greatly stresses the heart, increasing the risk of heart attacks and related heart problems. The risk of death is greatly increased in individuals with this disease. The most underlining factor researchers are starting to take notice of is that it may not just be a vanity, social, or media issue, but it could also be related to biological and or genetic components.

Other

- Compulsive overeating (COE), in which individuals habitually graze on large quantities of food rather than binging, as would be typical of binge eating disorder.
- Prader-Willi syndrome
- Diabulimia, characterized by the deliberate manipulation of insulin levels by diabetics in an effort to control their weight.
- Food maintenance, characterized by a set of aberrant eating behaviours of children in foster care.
- Orthorexia nervosa, a term used by Steven Bratman to characterize an obsession with a "pure" diet, in which people develop an obsession with avoiding unhealthy foods to the point where it interferes with a person's life.
- Avoidant/restrictive food intake disorder (ARFID), previously known as selective eating disorder is where the certain foods are limited based on appearance, smell, taste, texture, brand, presentation, or a past negative experience with the food.
- Drunkorexia, commonly characterized by purposely restricting food intake in order to reserve food calories for alcoholic calories, exercising excessively in order to burn calories from drinking, and over-drinking alcohol in order to purge previously consumed food.
- Pregorexia, characterized by extreme dieting and over-exercising in order to control pregnancy weight gain. Undernutrition during pregnancy is associated with low birth weight, coronary heart disease, type 2 diabetes, stroke, hypertension, cardiovascular disease risk, and depression.
- Gourmand syndrome, a rare condition occurring after damage to the frontal lobe, resulting in an obsessive focus on fine foods.

Signs and Symptoms

Symptoms and complications vary according to the nature and severity of the eating disorder:	• Acne • Constipation • Telogen Effluvium • Osteoporosis • Pellagra	• Xerosis • Diarrhoea • Cardiac Arrest • Electrolyte Imbalance • Scurvy	• Amenorrhoea • Water Retention and/or Edema • Hypokalemia • Hyponatremia • Kidney Failure	• Tooth Loss, Cavities • Lanugo • Death • Brain atrophy • Suicide

Some physical symptoms of eating disorders are weakness, fatigue, sensitivity to cold, reduced beard growth in men, reduction in waking erections, reduced libido, weight loss and failure of growth. Unexplained hoarseness may be a symptom of an underlying eating disorder, as the result of acid reflux, or entry of acidic gastric material into the laryngoesophageal tract. Patients who induce vomiting, such as those with anorexia nervosa, binge eating-purging type or those with purging-type bulimia nervosa are at risk for acid reflux.

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder to affect women. Though often associated with obesity it can occur in normal weight individuals. PCOS has been associated with binge eating and bulimic behaviour. Other possible manifestations are dry lips, burning tongue, parotid gland swelling, and temporomandibular disorders.

Causes

The causes of eating disorders are not clear. Many people with eating disorders also have body dysmorphic disorder, altering the way a person sees themself. Studies have found that a high proportion of individuals diagnosed with body dysmorphic disorder also had some type of eating disorder, with 15% of individuals having either anorexia nervosa or bulimia nervosa.

This link between body dysmorphic disorder and anorexia stems from the fact that both BDD and anorexia nervosa are characterized by a preoccupation with physical appearance and a distortion of body image. There are also many other possibilities such as environmental, social and interpersonal issues that could promote and sustain these illnesses.

Also, the media are oftentimes blamed for the rise in the incidence of eating disorders due to the fact that media images of idealized slim physical shape of people such as models and celebrities motivate or even force people to attempt to achieve slimness themselves. The media are accused of distorting reality, in the sense that people portrayed in the media are either naturally thin and thus unrepresentative of normality or unnaturally thin by forcing their bodies to look like the ideal image by putting excessive pressure on themselves to look a certain way.

While past findings have described eating disorders as primarily psychological, environmental, and sociocultural, further studies have uncovered evidence that there is a genetic component.

Genetics

Numerous studies show a genetic predisposition toward eating disorders. Twin studies have found a slight instances of genetic variance when considering the different criterion of both anorexia nervosa and bulimia nervosa as endophenotypes contributing to the disorders as a whole. A genetic link has been found on chromosome 1 in multiple family members of an individual with anorexia nervosa.

An individual who is a first degree relative of someone who has had or currently has an eating disorder is seven to twelve times more likely to have an eating disorder themselves. Twin studies also show that at least a portion of the vulnerability to develop eating disorders can be inherited, and there is evidence to show that there is a genetic locus that shows susceptibility for developing anorexia nervosa.

About 50% of eating disorder cases are attributable to genetics. Other cases are due to external reasons or developmental problems. There are also other neurobiological factors at play tied to emotional reactivity and impulsivity that could lead to binging and purging behaviours. Epigenetics mechanisms are means by which environmental effects alter gene expression via methods such as DNA methylation; these are independent of and do not alter the underlying DNA sequence.

They are heritable, but also may occur throughout the lifespan, and are potentially reversible. Dysregulation of dopaminergic neurotransmission due to epigenetic mechanisms has been implicated in various eating disorders. Other candidate genes for epigenetic studies in eating disorders include leptin, pro-opiomelanocortin (POMC) and brain-derived neurotrophic factor (BDNF).

Psychological

Eating disorders are classified as Axis I disorders in the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-IV) published by the American Psychiatric Association. There are various other psychological issues that may factor into eating disorders, some fulfil the criteria for a separate Axis I diagnosis or a personality disorder which is coded Axis II and thus are considered comorbid to the diagnosed eating disorder. Axis II disorders are subtyped into 3 "clusters": A, B and C.

The causality between personality disorders and eating disorders has yet to be fully established. Some people have a previous disorder which may increase their vulnerability to developing an eating disorder. Some develop them afterwards. The severity and type of eating disorder symptoms have been shown to affect comorbidity. The DSM-IV should not be used by laypersons to diagnose themselves even when used by professionals there has been considerable controversy over the diagnostic criteria used for various diagnoses, including eating disorders. There has been controversy over various editions of the DSM including the latest edition, DSM-V, due in May 2013.

Cognitive Attentional Bias Issues Attentional bias may have an effect on eating disorders. Many studies have been performed to test this theory.	**Comorbid Disorders** **Axis I** ● Depression ● Substance Abuse, Alcoholism ● Anxiety Disorders ● Obsessive Compulsive Disorder ● Attention-Deficit Hyperactivity Disorder	**Comorbid Disorders** **Axis II** ● Obsessive Compulsive Personality Disorder ● Borderline Personality Disorder ● Narcissistic Personality Disorder ● Histrionic Personality Disorder ● Avoidant Personality Disorder

Personality Traits

There are various childhood personality traits associated with the development of eating disorders. During adolescence these traits may become intensified due to a variety of physiological and cultural influences such as the hormonal changes associated with puberty, stress related to the approaching demands of maturity and socio-cultural influences and perceived expectations, especially in areas that concern body image.

Eating disorders have been associated with a fragile sense of self and with disordered mentalization. Many personality traits have a genetic component and are highly heritable.

Maladaptive levels of certain traits may be acquired as a result of anoxic or traumatic brain injury, neurodegenerative diseases such as Parkinson's disease, neurotoxicity such as lead exposure, bacterial infection such as Lyme disease or parasitic infection such as Toxoplasma gondii as well as hormonal influences.

While studies are still continuing via the use of various imaging techniques such as fMRI; these traits have been shown to originate in various regions of the brain such as the amygdala and the prefrontal cortex. Disorders in the prefrontal cortex and the executive functioning system have been shown to affect eating behaviour.

Celiac Disease

People with gastrointestinal disorders may be more risk of developing disordered eating practices than the general population, principally restrictive eating disturbances. An association of anorexia nervosa with celiac disease has been found. The role that gastrointestinal symptoms play in the development of eating disorders seems rather complex. Some authors report that unresolved symptoms prior to gastrointestinal disease diagnosis may create a food aversion in these persons, causing alterations to their eating patterns.

Other authors report that greater symptoms throughout their diagnosis led to greater risk. It has been documented that some people with celiac disease, irritable bowel syndrome or inflammatory bowel disease who are not conscious about the importance of strictly following their diet, choose to consume their trigger foods to promote weight loss.

On the other hand, individuals with good dietary management may develop anxiety, food aversion and eating disorders because of concerns around cross contamination of their foods. Some authors suggest that medical professionals should evaluate the presence of an unrecognized celiac disease in all people with eating disorder, especially if they present any gastrointestinal symptom (such as decreased appetite, abdominal pain, bloating, distension, vomiting, diarrhoea or constipation), weight loss, or growth failure; and also routinely ask celiac patients about weight or body shape concerns, dieting or vomiting for weight control, to evaluate the possible presence of eating disorders, specially in women.

Environmental Influences (Child Maltreatment)

Child abuse which encompasses physical, psychological and sexual abuse, as well as neglect has been shown to approximately triple the risk of an eating disorder. Sexual abuse appears to about double the risk of bulimia; however, the association is less clear for anorexia.

Environmental Influences (Social Isolation)

Social isolation has been shown to have a deleterious effect on an individual's physical and emotional well-being. Those that are socially isolated have a higher mortality rate in general as compared to individuals that have established social relationships. This effect on mortality is markedly increased in those with pre-existing medical or psychiatric conditions, and has been especially noted in cases of coronary heart disease.

"The magnitude of risk associated with social isolation is comparable with that of cigarette smoking and other major biomedical and psychosocial risk factors." Social isolation can be inherently stressful, depressing and anxiety-provoking.

In an attempt to ameliorate these distressful feelings an individual may engage in emotional eating in which food serves as a source of comfort. The loneliness of social isolation and the inherent stressors thus associated have been implicated as triggering factors in binge eating as well.

Waller, Kennerley and Ohanian (2007) argued that both bingeing–vomiting and restriction are emotion suppression strategies, but they are just utilized at different times. For example, restriction is used to pre-empt any emotion activation, while bingeing–vomiting is used after an emotion has been activated.

Environmental Influences (Parental Influence)

Parental influence has been shown to be an intrinsic component in the development of eating behaviours of children. This influence is manifested and shaped by a variety of diverse factors such as familial genetic predisposition, dietary choices as dictated by cultural or ethnic preferences, the parents' own body shape and eating patterns, the degree of involvement and expectations of their children's eating behaviour as well as the interpersonal relationship of parent and child.

This is in addition to the general psychosocial climate of the home and the presence or absence of a nurturing stable environment. It has been shown that maladaptive parental behaviour has an important role in the development of eating disorders. As to the more subtle aspects of parental influence, it has been shown that eating patterns are established in early childhood and that children should be allowed to decide when their appetite is satisfied as early as the age of two. A direct link has been shown between obesity and parental pressure to eat more. Coercive tactics in regard to diet have not been proven to be efficacious in controlling a child's eating behaviour.

Affection and attention have been shown to affect the degree of a child's finickiness and their acceptance of a more varied diet. Adams and Crane (1980), have shown that parents are influenced by stereotypes that influence their perception of their child's body. The conveyance of these negative stereotypes also affects the child's own body image and satisfaction. Hilde Bruch, a pioneer in the field of studying eating disorders, asserts that anorexia nervosa often occurs in girls who are high achievers, obedient, and always trying to please their parents.

Their parents have a tendency to be over-controlling and fail to encourage the expression of emotions, inhibiting daughters from accepting their own feelings and desires. Adolescent females in these overbearing families lack the ability to be independent from their families, yet realize the need to, often resulting in rebellion. Controlling their food intake may make them feel better, as it provides them with a sense of control.

Environmental Influences (Peer Pressure)

In various studies such as one conducted by The McKnight Investigators, peer pressure was shown to be a significant contributor to body image concerns and attitudes toward eating among subjects in their teens and early twenties. Eleanor Mackey and co-author, Annette M. La Greca of the University of Miami, studied 236 teen girls from public high schools in southeast Florida. "Teen girls' concerns about their own weight, about how they appear to others and their perceptions that their peers want them to be thin are significantly related to weight-control behaviour", says psychologist Eleanor Mackey of the Children's National Medical Centre in Washington and lead author of the study. "Those are really important."

According to one study, 40% of 9- and 10-year-old girls are already trying to lose weight. Such dieting is reported to be influenced by peer behaviour, with many of those individuals on a diet reporting that their friends also were dieting. The number of friends dieting and the number of friends who pressured them to diet also played a significant role in their own choices. Elite athletes have a significantly higher rate in eating disorders. Female athletes in sports such as gymnastics, ballet, diving, etc. are found to be at the highest risk among all athletes. Women are more likely than men to acquire an eating disorder between the ages of 13–30. 0–15% of those with bulimia and anorexia are men.

Environmental Influences (Cultural Pressure)

There is a cultural emphasis on thinness which is especially pervasive in western society. A child's perception of external pressure to achieve the ideal body that is represented by the media predicts the child's body image dissatisfaction, body dysmorphic disorder and an eating disorder. "The cultural pressure on men and women to be 'perfect' is an important predisposing factor for the development of eating disorders". Further, when women of all races base their evaluation of their self upon what is considered the culturally ideal body, the incidence of eating disorders increases.

Eating disorders are becoming more prevalent in non-Western countries where thinness is not seen as the ideal, showing that social and cultural pressures are not the only causes of eating disorders. For example, observations of anorexia in all of the non-Western regions of the world point to the disorder not being "culture-bound" as once thought. However, studies on rates of bulimia suggest that it might be culturally bound. In non-Western countries, bulimia is less prevalent than anorexia, but these non-Western countries where it is observed can be said to have probably or definitely been influenced or exposed to Western culture and ideology.
Socioeconomic status (SES) has been viewed as a risk factor for eating disorders, presuming that possessing more resources allows for an individual to actively choose to diet and reduce body weight. Some studies have also shown a relationship between increasing body dissatisfaction with increasing SES. However, once high socioeconomic status has been achieved, this relationship weakens and, in some cases, no longer exists. The media plays a major role in the way in which people view themselves.

Countless magazine ads and commercials depict thin celebrities like Lindsay Lohan, Nicole Richie, Victoria Beckham and Mary Kate Olsen, who appear to gain nothing but attention from their looks. Society has taught people that being accepted by others is necessary at all costs. Unfortunately this has led to the belief that in order to fit in one must look a certain way. Televised beauty competitions such as the Miss America Competition contribute to the idea of what it means to be beautiful because competitors are evaluated on the basis of their opinion.

Sports

In addition to socioeconomic status being considered a cultural risk factor so is the world of sports. Athletes and eating disorders tend to go hand in hand, especially the sports where weight is a competitive factor. Gymnastics, horse back riding, wrestling, body building, and dancing are just a few that fall into this category of weight dependent sports. Eating disorders among individuals that participate in competitive activities, especially women, often lead to having physical and biological changes related to their weight that often mimic prepubescent stages.

Oftentimes as women's bodies change they lose their competitive edge which leads them to taking extreme measures to maintain their younger body shape. Men often struggle with binge eating followed by excessive exercise while focusing on building muscle rather than losing fat, but this goal of gaining muscle is just as much an eating disorder as obsessing over thinness. The following statistics taken from Susan Nolen-Hoeksema's book, (ab)normal psychology, show the estimated percentage of athletes that struggle with eating disorders based on the category of sport.

- Aesthetic sports (dance, figure skating, gymnastics) – 35%
- Weight dependent sports (judo, wrestling) – 29%
- Endurance sports (cycling, swimming, running) – 20%
- Technical sports (golf, high jumping) – 14%
- Ball game sports (volleyball, soccer) – 12%

Although most of these athletes develop eating disorders to keep their competitive edge, others use exercise as a way to maintain their weight and figure. This is just as serious as regulating food intake for competition. Even though there is mixed evidence showing at what point athletes are challenged with eating disorders, studies show that regardless of competition level all athletes are at higher risk for developing eating disorders that non-athletes, especially those that participate in sports where thinness is a factor.

Media Exposure

While there are many influences to how an individual processes their body image, the media does play a major role. Along with the media, parental influence, peer influence, and self-efficacy beliefs also play a large role in an individual's view of themselves. The way the media presents images can have a lasting effect on an individual's perception of their body image. Eating disorders are a worldwide issue and while women are more likely to be affected by an eating disorder it still affects both genders (Schwitzer 2012). The media influences eating disorders whether shown in a positive or negative light, it then has a responsibility to use caution when promoting images that projects an ideal that many turn to eating disorders to attain.

To try to address unhealthy body image in the fashion world, in 2015, France passed a law requiring models to be declared healthy by a doctor to participate in fashion shows. It also requires re-touched images to be marked as such in magazines. There is a relationship between “thin ideal” social media content and body dissatisfaction and eating disorders among young adult women, especially in the Western hemisphere. New research points to an “internalization” of distorted images online, as well as negative comparisons among young adult women. Most studies have been based in the U.S, the U.K, and Australia, these are places where the thin ideal is strong among women, as well as the strive for the “perfect” body.

In addition to mere media exposure, there is an online "pro-eating disorder" community. Through personal blogs and Twitter, this community promotes eating disorders as a "lifestyle", and continuously posts pictures of emaciated bodies, and tips on how to stay thin. The hashtag "#proana" (pro-anorexia), is a product of this community, as well as images promoting weight loss, tagged with the term "thinspiration". According to social comparison theory, young women have a tendency to compare their appearance to others, which can result in a negative view of their own bodies and altering of eating behaviours, that in turn can develop disordered eating behaviours.

When body parts are isolated and displayed in the media as objects to be looked at, it is called objectification, and women are affected most by this phenomenon. Objectification increases self-objectification, where women judge their own body parts as a mean of praise and pleasure for others. There is a significant link between self-objectification, body dissatisfaction, and disordered eating, as the beauty ideal is altered through social media.

Mechanisms

- Biochemical: Eating behaviour is a complex process controlled by the neuroendocrine system, of which the Hypothalamus-pituitary-adrenal-axis (HPA axis) is a major component. Dysregulation of the HPA axis has been associated with eating disorders, such as irregularities in the manufacture, amount or transmission of certain neurotransmitters, hormones or neuropeptides and amino acids such as homocysteine, elevated levels of which are found in AN and BN as well as depression.

- Serotonin: a neurotransmitter involved in depression also has an inhibitory effect on eating behaviour.

- Norepinephrine is both a neurotransmitter and a hormone; abnormalities in either capacity may affect eating behaviour.

- Dopamine: which in addition to being a precursor of norepinephrine and epinephrine is also a neurotransmitter which regulates the rewarding property of food.

- Neuropeptide Y also known as NPY is a hormone that encourages eating and decreases metabolic rate. Blood levels of NPY are elevated in patients with anorexia nervosa, and studies have shown that injection of this hormone into the brain of rats with restricted food intake increases their time spent running on a wheel. Normally the hormone stimulates eating in healthy patients, but under conditions of starvation it increases their activity rate, probably to increase the chance of finding food. The increased levels of NPY in the blood of patients with eating disorders can in some ways explain the instances of extreme over-exercising found in most anorexia nervosa patients.

- Leptin and ghrelin: leptin is a hormone produced primarily by the fat cells in the body; it has an inhibitory effect on appetite by inducing a feeling of satiety. Ghrelin is an appetite inducing hormone produced in the stomach and the upper portion of the small intestine. Circulating levels of both hormones are an important factor in weight control. While often associated with obesity, both hormones and their respective effects have been implicated in the pathophysiology of anorexia nervosa and bulimia nervosa. Leptin can also be used to distinguish between constitutional thinness found in a healthy person with a low BMI and an individual with anorexia nervosa.

- Gut bacteria and immune system: studies have shown that a majority of patients with anorexia and bulimia nervosa have elevated levels of autoantibodies that affect hormones and neuropeptides that regulate appetite control and the stress response. There may be a direct correlation between autoantibody levels and associated psychological traits. Later study revealed that autoantibodies reactive with alpha-MSH are, in fact, generated against ClpB, a protein produced by certain gut bacteria e.g. Escherichia coli. ClpB protein was identified as a conformational antigen-mimetic of alpha-MSH. In patients with eating disorders plasma levels of anti-ClpB IgG and IgM correalated with patients' psychological traits.

- Infection: PANDAS, is an abbreviation for Paediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococcal Infections. Children with PANDAS "have obsessive-compulsive disorder (OCD) and/or tic disorders such as Tourette syndrome, and in whom symptoms worsen following infections such as "strep throat" and scarlet fever". (NIMH) There is a possibility that PANDAS may be a precipitating factor in the development of anorexia nervosa in some cases, (PANDAS AN).

- Lesions: studies have shown that lesions to the right frontal lobe or temporal lobe can cause the pathological symptoms of an eating disorder.

- Tumours: tumours in various regions of the brain have been implicated in the development of abnormal eating patterns.

- Brain Calcification: a study highlights a case in which prior calcification of the right thalumus may have contributed to development of anorexia nervosa.

- Somatosensory Homunculus: is the representation of the body located in the somatosensory cortex, first described by renowned neurosurgeon Wilder Penfield. The illustration was originally termed "Penfield's Homunculus", homunculus meaning little man. "In normal development this representation should adapt as the body goes through its pubertal growth spurt. However, in AN it is hypothesized that there is a lack of plasticity in this area, which may result in impairments of sensory processing and distortion of body image". (Bryan Lask, also proposed by VS Ramachandran)

- Obstetric complications: There have been studies done which show maternal smoking, obstetric and perinatal complications such as maternal anaemia, very pre-term birth (less than 32 weeks), being born small for gestational age, neonatal cardiac problems, preeclampsia, placental infarction and sustaining a cephalhematoma at birth increase the risk factor for developing either anorexia nervosa or bulimia nervosa.

- Symptom of Starvation: Evidence suggests that the symptoms of eating disorders are actually symptoms of the starvation itself, not of a mental disorder. In a study involving thirty-six healthy young men that were subjected to semi-starvation, the men soon began displaying symptoms commonly found in patients with eating disorders. In this study, the healthy men ate approximately half of what they had become accustomed to eating and soon began developing symptoms and thought patterns (preoccupation with food and eating, ritualistic eating, impaired cognitive ability, other physiological changes such as decreased body temperature) that are characteristic symptoms of anorexia nervosa...

The men used in the study also developed hoarding and obsessive collecting behaviours, even though they had no use for the items, which revealed a possible connection between eating disorders and obsessive compulsive disorder.

Diagnosis

The initial diagnosis should be made by a competent medical professional. "The medical history is the most powerful tool for diagnosing eating disorders"(American Family Physician). There are many medical disorders that mimic eating disorders and comorbid psychiatric disorders. All organic causes should be ruled out prior to a diagnosis of an eating disorder or any other psychiatric disorder. In the past 30 years eating disorders have become increasingly conspicuous and it is uncertain whether the changes in presentation reflect a true increase. Anorexia nervosa and bulimia nervosa are the most clearly defined subgroups of a wider range of eating disorders. Many patients present with subthreshold expressions of the two main diagnoses: others with different patterns and symptoms.

Psychological

After ruling out organic causes and the initial diagnosis of an eating disorder being made by a medical professional, a trained mental health professional aids in the assessment and treatment of the underlying psychological components of the eating disorder and any comorbid psychological conditions. The clinician conducts a clinical interview and may employ various psychometric tests. Some are general in nature while others were devised specifically for use in the assessment of eating disorders. Some of the general tests that may be used are the Hamilton Depression Rating Scale and the Beck Depression Inventory. Longitudinal research showed that there is an increase in chance that a young adult female would develop bulimia due to their current psychological pressure and as the person ages and matures, their emotional problems change or are resolved and then the symptoms decline.

Eating Disorder Specific Psychometric Tests
- Eating Attitudes Test
- Body Attitudes Test
- Eating Disorder Inventory
- SCOFF questionnaire
- Body Attitudes Questionnaire
- Eating Disorder Examination Interview

Differential Diagnoses

- Lyme disease which is known as the "great imitator", as it may present as a variety of psychiatric or neurological disorders including anorexia nervosa.

● Gastrointestinal diseases, such as celiac disease, Crohn's disease, peptic ulcer, eosinophilic esophagitis or non-celiac gluten sensitivity, among others. Celiac disease is also known as the "great imitator", because it may involve several organs and cause an extensive variety of non-gastrointestinal symptoms, such as psychiatric and neurological disorders, including anorexia nervosa.

● Addison's disease is a disorder of the adrenal cortex which results in decreased hormonal production. Addison's disease, even in subclinical form may mimic many of the symptoms of anorexia nervosa.

● Gastric adenocarcinoma is one of the most common forms of cancer in the world. Complications due to this condition have been misdiagnosed as an eating disorder.

● Hypothyroidism, hyperthyroidism, hypoparathyroidism and hyperparathyroidism may mimic some of the symptoms of, can occur concurrently with, be masked by or exacerbate an eating disorder.

● Toxoplasma seropositivity: even in the absence of symptomatic toxoplasmosis, toxoplasma gondii exposure has been linked to changes in human behaviour and psychiatric disorders including those comorbid with eating disorders such as depression. In reported case studies the response to antidepressant treatment improved only after adequate treatment for toxoplasma.

● Neurosyphilis: It is estimated that there may be up to one million cases of untreated syphilis in the US alone. "The disease can present with psychiatric symptoms alone, psychiatric symptoms that can mimic any other psychiatric illness". Many of the manifestations may appear atypical. Up to 1.3% of short term psychiatric admissions may be attributable to neurosyphilis, with a much higher rate in the general psychiatric population. (Ritchie, M Perdigao J,)

● Dysautonomia: a wide variety of autonomic nervous system (ANS) disorders may cause a wide variety of psychiatric symptoms including anxiety, panic attacks and depression. Dysautonomia usually involves failure of sympathetic or parasympathetic components of the ANS system but may also include excessive ANS activity. Dysautonomia can occur in conditions such as diabetes and alcoholism.

Differential Diagnoses (Psychological Disorders)

Psychological disorders which may be confused with an eating disorder, or be co-morbid with one:

● Emetophobia is an anxiety disorder characterized by an intense fear of vomiting. A person so afflicted may develop rigorous standards of food hygiene, such as not touching food with their hands. They may become socially withdrawn to avoid situations which in their perception may make them vomit. Many who suffer from emetophobia are diagnosed with anorexia or self-starvation. In severe cases of emetophobia they may drastically reduce their food intake.

● Phagophobia is an anxiety disorder characterized by a fear of eating, it is usually initiated by an adverse experience while eating such as choking or vomiting. Persons with this disorder may present with complaints of pain while swallowing.

● Body dysmorphic disorder (BDD) is listed as a somatoform disorder that affects up to 2% of the population. BDD is characterized by excessive rumination over an actual or perceived physical flaw. BDD has been diagnosed equally among men and women. While BDD has been misdiagnosed as anorexia nervosa, it also occurs comorbidly in 39% of eating disorder cases. BDD is a chronic and debilitating condition which may lead to social isolation, major depression and suicidal ideation and attempts. Neuroimaging studies to measure response to facial recognition have shown activity predominately in the left hemisphere in the left lateral prefrontal cortex, lateral temporal lobe and left parietal lobe showing hemispheric imbalance in information processing.

Prevention

Prevention aims to promote a healthy development before the occurrence of eating disorders. It also intends early identification of an eating disorder before it is too late to treat. Children as young as ages 5–7 are aware of the cultural messages regarding body image and dieting. Prevention comes in bringing these issues to the light. The following topics can be discussed with young children (as well as teens and young adults). Internet and modern technologies provide new opportunities for prevention. On-line programs have the potential to increase the use of prevention programs. The development and practice of prevention programs via on-line sources make it possible to reach a wide range of people at minimal cost. Such an approach can also make prevention programs to be sustainable.

● Emotional Bites: a simple way to discuss emotional eating is to ask children about why they might eat besides being hungry. Talk about more effective ways to cope with emotions, emphasizing the value of sharing feelings with a trusted adult.

● Say No to Teasing: another concept is to emphasize that it is wrong to say hurtful things about other people's body sizes.

● Body Talk: emphasize the importance of listening to one's body. That is, eating when you are hungry (not starving) and stopping when you are satisfied (not stuffed). Children intuitively grasp these concepts.

● Fitness Comes in All Sizes: educate children about the genetics of body size and the normal changes occurring in the body. Discuss their fears and hopes about growing bigger. Focus on fitness and a balanced diet.

Treatment

Treatment varies according to type and severity of eating disorder, and usually more than one treatment option is utilized. Family doctors play an important role in early treatment of people with eating disorders by encouraging those who are also reluctant to see a psychiatrist. Treatment can take place in a variety of different settings such as community programs, hospitals, day programs, and groups. The American Psychiatric Association (APA) recommends a team approach to treatment of eating disorders. The members of the team are usually a psychiatrist, therapist, and registered dietitian, but other clinicians may be included. That said, some treatment methods are:

● Cognitive behavioural therapy (CBT), which postulates that an individual's feelings and behaviours are caused by their own thoughts instead of external stimuli such as other people, situations or events; the idea is to change how a person thinks and reacts to a situation even if the situation itself does not change. See Cognitive behavioural treatment of eating disorders.

● Acceptance and commitment therapy: a type of CBT

● Cognitive Remediation Therapy (CRT), a set of cognitive drills or compensatory interventions designed to enhance cognitive functioning.

● Dialectical Behaviour Therapy

● Family Therapy including "conjoint family therapy" (CFT), "separated family therapy" (SFT) and Maudsley Family Therapy.

● Behavioural Therapy: focuses on gaining control and changing unwanted behaviours.

● Interpersonal psychotherapy (IPT)

There are few studies on the cost-effectiveness of the various treatments. Treatment can be expensive; due to limitations in health care coverage, people hospitalized with anorexia nervosa may be discharged while still underweight, resulting in relapse and rehospitalisation. For children with anorexia, the only well-established treatment is the family treatment-behaviour. For other eating disorders in children, however, there is no well-established treatments, though family treatment-behaviour has been used in treating bulimia.

- Cognitive Emotional Behaviour Therapy (CEBT)
- Music Therapy
- Recreation Therapy
- Art Therapy
- Nutrition counselling and Medical nutrition therapy
- Medication: Orlistat is used in obesity treatment. Olanzapine seems to promote weight gain as well as the ability to ameliorate obsessional behaviours concerning weight gain. zinc supplements have been shown to be helpful, and cortisol is also being investigated.
- Self-help and guided self-help have been shown to be helpful in AN, BN and BED; this includes support groups and self-help groups such as Eating Disorders Anonymous and Overeaters Anonymous.
- Psychoanalysis
- Inpatient Care

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Outcomes

Outcome estimates are complicated by non-uniform criteria used by various studies, but for anorexia nervosa, bulimia nervosa, and binge eating disorder, there seems to be general agreement that full recovery rates are in the 50% to 85% range, with larger proportions of people experiencing at least partial remission. The outcomes of eating disorders (ED) vary among the cases. For many, it can be a lifelong struggle or it can be overcome within months. In the United States, twenty million women and ten million men have an eating disorder at least once in their lifetime.

The mortality rate for those with anorexia nervosa is 5.4 per 1000 individuals per year. Roughly 1.3 deaths were due to suicide. A person who is or had been in an inpatient setting had a rate of 4.6 deaths per 1000. Of individuals with bulimia nervosa about 2 persons per 1000 persons die per year and among those with EDNOS about 3.3 per 1000 people die per year.

- Miscarriages: Pregnant women with a Binge Eating Disorder have shown to have a greater chance of having a miscarriage compared to pregnant women with any other eating disorders. According to a study done, out of a group of pregnant women being evaluated, 46.7% of the pregnancies ended with a miscarriage in women that were diagnosed with BED, with 23.0% in the control. In the same study, 21.4% of women diagnosed with Bulimia Nervosa had their pregnancies end with miscarriages and only 17.7% of the controls.
- Relapse: An individual who is in remission from BN and EDNOS (Eating Disorder Not Otherwise Specified) is at a high risk of falling back into the habit of self-harm. Factors such as high stress regarding their job, pressures from society, as well as other occurrences that inflict stress on a person, can push a person back to what they feel will ease the pain. A study tracked a group of selected people that were either diagnosed with BN or EDNOS for 60 months. After the 60 months were complete, the researchers recorded whether or not the patients were suffering from a relapse. The results found that the probability of a person previously diagnosed with EDNOS had a 41% chance of relapsing; a person with BN had a 47% chance.
- Attachment insecurity: People who are showing signs of attachment anxiety will most likely have trouble communicating their emotional status as well as having trouble seeking effective social support. Signs that a person has adopted this symptom include not showing recognition to their caregiver or when he/she is feeling pain. In a clinical sample, it is clear that at the pre-treatment step of a patient's recovery, more severe eating disorder symptoms directly corresponds to higher attachment anxiety. The more this symptom increases, the more difficult it is to achieve eating disorder reduction prior to treatment.

Anorexia Nervosa symptoms include the increasing chance of getting osteoporosis. This disease causes the bones of an individual to become brittle, weak, and low in density. Thinning of the hair as well as dry hair and skin are also very common. The muscles of the heart will also start to change if no treatment is inflicted on the patient. This causes the heart to have an abnormally slow heart rate along with low blood pressure. Heart failure becomes a major consideration when this begins to occur. Muscles throughout the body begin to lose their strength. This will cause the individual to begin feeling faint, drowsy, and weak. Along with these symptoms, the body will begin to grow a layer of hair called lanugo. The human body does this in response to the lack of heat and insulation due to the low percentage of body fat.

Bulimia nervosa symptoms include heart problems like an irregular heartbeat that can lead to heart failure and death may occur. This occurs because of the electrolyte imbalance that is a result of the constant binge and purge process. The probability of a gastric rupture increases. A gastric rupture is when there is a sudden rupture of the stomach lining that can be fatal. The acids that are contained in the vomit can cause a rupture in the oesophagus as well as tooth decay. As a result, to laxative abuse, irregular bowel movements may occur along with constipation. Sores along the lining of the stomach called peptic ulcers begin to appear and the chance of developing pancreatitis increases.

Binge eating symptoms include high blood pressure, which can cause heart disease if it is not treated. Many patients recognize an increase in the levels of cholesterol. The chance of being diagnosed with gallbladder disease increases, which affects an individual's digestive tract.

Epidemiology

Eating disorders result in about 7,000 deaths a year as of 2010, making them the mental illnesses with the highest mortality rate. One study in the United States found a higher rate in college students who are transgender.

- Total costs in USA for hospital stays involving eating disorders rose from $165 million in 1999–2000 to $277 million in 2008–2009; this was a 68% increase. The mean cost per discharge of a person with an eating disorder rose by 29% over the decade, from $7,300 to $9,400.
- Over the decade, hospitalizations involving eating disorders increased among all age groups. The greatest increases occurred among those 45 to 65 years of age (an 88% increase), followed by hospitalizations among people younger than 12 years of age (a 72% increase).
- The majority of eating disorder inpatients were female. During 2008–2009, 88% of cases involved females, and 12% were males. The report also showed a 53% increase in hospitalizations for males with a principal diagnosis of an eating disorder, from 10% to 12% over the decade.

9 Obesity

Obesity is a medical condition in which excess body fat has accumulated to an extent that it may have a negative effect on health. People are generally considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight by the square of the person's height, is over 30 kg/m2; the range 25–30 kg/m2 is defined as overweight. Some East Asian countries use lower values. Obesity increases the likelihood of various diseases and conditions, particularly cardiovascular diseases, type 2 diabetes, obstructive sleep apnea, certain types of cancer, osteoarthritis, and depression. Obesity is most commonly caused by a combination of excessive food intake, lack of physical activity, and genetic susceptibility.

A few cases are caused primarily by genes, endocrine disorders, medications, or mental disorder. The view that obese people eat little yet gain weight due to a slow metabolism is not medically supported. On average, obese people have a greater energy expenditure than their normal counterparts due to the energy required to maintain an increased body mass. Obesity is mostly preventable through a combination of social changes and personal choices.

Changes to diet and exercising are the main treatments. Diet quality can be improved by reducing the consumption of energy-dense foods, such as those high in fat or sugars, and by increasing the intake of dietary fibre. Medications can be used, along with a suitable diet, to reduce appetite or decrease fat absorption. If diet, exercise, and medication are not effective, a gastric balloon or surgery may be performed to reduce stomach volume or length of the intestines, leading to feeling full earlier or a reduced ability to absorb nutrients from food. Obesity is a leading preventable cause of death worldwide, with increasing rates in adults and children.

In 2015, 600 million adults (12%) and 100 million children were obese in 195 countries. Obesity is more common in women than men. Authorities view it as one of the most serious public health problems of the 21st century. Obesity is stigmatized in much of the modern world (particularly in the Western world), though it was seen as a symbol of wealth and fertility at other times in history and still is in some parts of the world. In 2013, the American Medical Association classified obesity as a disease.

Classification

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health. It is defined by body mass index (BMI) and further evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors. BMI is closely related to both percentage body fat and total body fat. In children, a healthy weight varies with age and sex. Obesity in children and adolescents is defined not as an absolute number but in relation to a historical normal group, such that obesity is a BMI greater than the 95th percentile. The reference data on which these percentiles were based date from 1963 to 1994, and thus have not been affected by the recent increases in weight. BMI is defined as the subject's weight divided by the square of their height and is calculated as follows.

BMI = m / h²

m = Weight
h = Height

BMI is usually expressed in kilograms of weight per metre squared of height. To convert from pounds per inch squared multiply by 703 (kg/m2)/(lb/sq in). The most commonly used definitions, established by the World Health Organization (WHO) in 1997 and published in 2000, provide the values listed in the table. Some modifications to the WHO definitions have been made by particular organizations. The surgical literature breaks down class II and III obesity into further categories whose exact values are still disputed.

BMI Classification
<18.5 - Underweight
18.5-25 - Normal Weight
25-30 - Overweight
30-35 - Class I Obesity
35-40 - Class II Obesity
>40 - Class III Obesity

- Any BMI ≥ 35 or 40 kg/m2 is severe obesity.
- A BMI of ≥ 35 kg/m2 and experiencing obesity-related health conditions or ≥40–44.9 kg/m2 is morbid obesity.
- A BMI of ≥ 45 or 50 kg/m2 is super obesity.

As Asian populations develop negative health consequences at a lower BMI than Caucasians, some nations have redefined obesity; Japan has defined obesity as any BMI greater than 25 kg/m2 while China uses a BMI of greater than 28 kg/m2.

Effects on Health

Excessive body weight is associated with various diseases and conditions, particularly cardiovascular diseases, diabetes mellitus type 2, obstructive sleep apnea, certain types of cancer, osteoarthritis, and asthma. As a result, obesity has been found to reduce life expectancy.

Mortality
Obesity is one of the leading preventable causes of death worldwide. A number of reviews have found that mortality risk is lowest at a BMI of 20–25 kg/m2 in non-smokers and at 24–27 kg/m2 in current smokers, with risk increasing along with changes in either direction. This appears to apply in at least four continents. In contrast, a 2013 review found that grade 1 obesity (BMI 30–35) was not associated with higher mortality than normal weight, and that overweight (BMI 25–30) was associated with "lower" mortality than was normal weight (BMI 18.5–25). Other evidence suggests that the association of BMI and waist circumference with mortality is U- or J-shaped, while the association between waist-to-hip ratio and waist-to-height ratio with mortality is more positive. In Asians the risk of negative health effects begins to increase between 22–25 kg/m2. A BMI above 32 kg/m2 has been associated with a doubled mortality rate among women over a 16-year period. In the United States, obesity is estimated to cause 111,909 to 365,000 deaths per year, while 1 million (7.7%) of deaths in Europe are attributed to excess weight. On average, obesity reduces life expectancy by six to seven years, a BMI of 30–35 kg/m2 reduces life expectancy by two to four years, while severe obesity (BMI > 40 kg/m2) reduces life expectancy by ten years.

Morbidity
Obesity increases the risk of many physical and mental conditions. These comorbidities are most commonly shown in metabolic syndrome, a combination of medical disorders which includes: diabetes mellitus type 2, high blood pressure, high blood cholesterol, and high triglyceride levels. Complications are either directly caused by obesity or indirectly related through mechanisms sharing a common cause such as a poor diet or a sedentary lifestyle. The strength of the link between obesity and specific conditions varies. One of the strongest is the link with type 2 diabetes. Excess body fat underlies 64% of cases of diabetes in men and 77% of cases in women. Health consequences fall into two broad categories: those attributable to the effects of increased fat mass (such as osteoarthritis, obstructive sleep apnea, social stigmatization) and those due to the increased number of fat cells (diabetes, cancer, cardiovascular disease, non-alcoholic fatty liver disease). Increases in body fat alter the body's response to insulin, potentially leading to insulin resistance. Increased fat also creates a proinflammatory state, and a prothrombotic state.

Medical Field	Condition
Cardiology	• Coronary heart disease: angina and myocardial infarction • Congestive heart failure • High blood pressure • Abnormal cholesterol levels • Deep vein thrombosis and pulmonary embolism
Dermatology	• Stretch marks • Acanthosis nigricans lymphedema • Cellulitis • Hirsutism • Intertrigo
Endocrinology and Reproductive medicine	• Diabetes mellitus • Polycystic ovarian syndrome • Menstrual disorders infertility • Complications during pregnancy • Birth defects • Intrauterine fetal death

Gastroenterology	• Gastroesophageal reflux disease • Fatty liver disease • Cholelithiasis (gallstones)
Neurology	• Stroke • Meralgia paresthetica • Migraines • Carpal tunnel syndrome • Dementia • Idiopathic intracranial hypertension • Multiple sclerosis
Oncology	• Oesophageal • Colorectal • Pancreatic • Gallbladder • Endometrial • Kidney • Leukaemia • Hepatocellular carcinoma • Malignant melanoma
Psychiatry	• Depression in women • Social Stigmatization
Respirology	• Obstructive sleep apnea • Obesity hypoventilation syndrome • Asthma • Increased complications during general anaesthesia
Rheumatology and Orthopedics	• Gout • Poor mobility • Osteoarthritis • Low back pain
Urology and Nephrology	• Erectile dysfunction • Urinary incontinence • Chronic renal failure • Hypogonadism • Buried Penis

Causes

At an individual level, a combination of excessive food energy intake and a lack of physical activity is thought to explain most cases of obesity. A limited number of cases are due primarily to genetics, medical reasons, or psychiatric illness. In contrast, increasing rates of obesity at a societal level are felt to be due to an easily accessible and palatable diet, increased reliance on cars, and mechanized manufacturing. A 2006 review identified ten other possible contributors to the recent increase of obesity:

1. Insufficient sleep
2. Endocrine disruptors (environmental pollutants that interfere with lipid metabolism)
3. Decreased variability in ambient temperature
4. Decreased rates of smoking, because smoking suppresses appetite,
5. Increased use of medications that can cause weight gain (e.g., atypical antipsychotics)
6. Proportional increases in ethnic and age groups that tend to be heavier,
7. Pregnancy at a later age (which may cause susceptibility to obesity in children)
8. Epigenetic risk factors passed on generationally,
9. Natural selection for higher BMI
10. Assortative mating leading to increased concentration of obesity risk factors (this would increase the number of obese people by increasing population variance in weight).

While there is evidence supporting the influence of these mechanisms on the increased prevalence of obesity, the evidence is still inconclusive, and the authors state that these are probably less influential than the ones discussed in the previous paragraph.

Diet

A 2016 review supported excess food as the primary factor. Dietary energy supply per capita varies markedly between different regions and countries. It has also changed significantly over time. From the early 1970s to the late 1990s the average food energy available per person per day (the amount of food bought) increased in all parts of the world except Eastern Europe. The United States had the highest availability with 3,654 calories (15,290 kJ) per person in 1996. This increased further in 2003 to 3,754 calories (15,710 kJ). During the late 1990s Europeans had 3,394 calories (14,200 kJ) per person, in the developing areas of Asia there were 2,648 calories (11,080 kJ) per person, and in sub-Saharan Africa people had 2,176 calories (9,100 kJ) per person. Total food energy consumption has been found to be related to obesity. The widespread availability of nutritional guidelines has done little to address the problems of overeating and poor dietary choice. From 1971 to 2000, obesity rates in the United States increased from 14.5% to 30.9%. During the same period, an increase occurred in the average amount of food energy consumed. For women, the average increase was 335 calories (1,400 kJ) per day (1,542 calories (6,450 kJ) in 1971 and 1,877 calories (7,850 kJ) in 2004), while for men the average increase was 168 calories (700 kJ) per day (2,450 calories (10,300 kJ) in 1971 and 2,618 calories (10,950 kJ) in 2004). Most of this extra food energy came from an increase in carbohydrate consumption rather than fat consumption. The primary sources of these extra carbohydrates are sweetened beverages, which now account for almost 25 percent of daily food energy in young adults in America, and potato chips.

Consumption of sweetened drinks such as soft drinks, fruit drinks, iced tea, and energy and vitamin water drinks is believed to be contributing to the rising rates of obesity and to an increased risk of metabolic syndrome and type 2 diabetes. Vitamin D deficiency is related to diseases associated with obesity. As societies become increasingly reliant on energy-dense, big-portions, and fast-food meals, the association between fast-food consumption and obesity becomes more concerning. In the United States consumption of fast-food meals tripled and food energy intake from these meals quadrupled between 1977 and 1995. Agricultural policy and techniques in the United States and Europe have led to lower food prices. In the United States, subsidization of corn, soy, wheat, and rice through the U.S. farm bill has made the main sources of processed food cheap compared to fruits and vegetables. Calorie count laws and nutrition facts labels attempt to steer people toward making healthier food choices, including awareness of how much food energy is being consumed. Obese people consistently under-report their food consumption as compared to people of normal weight. This is supported both by tests of people carried out in a calorimeter room and by direct observation.

Sedentary Lifestyle

A sedentary lifestyle plays a significant role in obesity. Worldwide there has been a large shift towards less physically demanding work, and currently at least 30% of the world's population gets insufficient exercise. This is primarily due to increasing use of mechanized transportation and a greater prevalence of labour-saving technology in the home. In children, there appear to be declines in levels of physical activity due to less walking and physical education. World trends in active leisure time physical activity are less clear. The World Health Organization indicates people worldwide are taking up less active recreational pursuits, while a study from Finland found an increase and a study from the United States found leisure-time physical activity has not changed significantly. A 2011 review of physical activity in children found that it may not be a significant contributor. In both children and adults, there is an association between television viewing time and the risk of obesity. A review found 63 of 73 studies (86%) showed an increased rate of childhood obesity with increased media exposure, with rates increasing proportionally to time spent watching television.

Genetics

Like many other medical conditions, obesity is the result of an interplay between genetic and environmental factors. Polymorphisms in various genes controlling appetite and metabolism predispose to obesity when sufficient food energy is present. As of 2006, more than 41 of these sites on the human genome have been linked to the development of obesity when a favourable environment is present. People with two copies of the FTO gene (fat mass and obesity associated gene) have been found on average to weigh 3–4 kg more and have a 1.67-fold greater risk of obesity compared with those without the risk allele.

The differences in BMI between people that are due to genetics varies depending on the population examined from 6% to 85%. Obesity is a major feature in several syndromes, such as Prader–Willi syndrome, Bardet–Biedl syndrome, Cohen syndrome, and MOMO syndrome. (The term "non-syndromic obesity" is sometimes used to exclude these conditions.) In people with early-onset severe obesity (defined by an onset before 10 years of age and body mass index over three standard deviations above normal), 7% harbour a single point DNA mutation.

Studies that have focused on inheritance patterns rather than on specific genes have found that 80% of the offspring of two obese parents were also obese, in contrast to less than 10% of the offspring of two parents who were of normal weight. Different people exposed to the same environment have different risks of obesity due to their underlying genetics. The thrifty gene hypothesis postulates that, due to dietary scarcity during human evolution, people are prone to obesity.

Their ability to take advantage of rare periods of abundance by storing energy as fat would be advantageous during times of varying food availability, and individuals with greater adipose reserves would be more likely to survive famine. This tendency to store fat, however, would be maladaptive in societies with stable food supplies. This theory has received various criticisms, and other evolutionarily-based theories such as the drifty gene hypothesis and the thrifty phenotype hypothesis have also been proposed.

Other Illnesses

Certain physical and mental illnesses and the pharmaceutical substances used to treat them can increase risk of obesity. Medical illnesses that increase obesity risk include several rare genetic syndromes (listed above) as well as some congenital or acquired conditions: hypothyroidism, Cushing's syndrome, growth hormone deficiency, and some eating disorders such as binge eating disorder and night eating syndrome. However, obesity is not regarded as a psychiatric disorder, and therefore is not listed in the DSM-IVR as a psychiatric illness.

The risk of overweight and obesity is higher in patients with psychiatric disorders than in persons without psychiatric disorders. Certain medications may cause weight gain or changes in body composition; these include insulin, sulfonylureas, thiazolidinediones, atypical antipsychotics, antidepressants, steroids, certain anticonvulsants (phenytoin and valproate), pizotifen, and some forms of hormonal contraception.

Social Determinants

While genetic influences are important to understanding obesity, they cannot explain the current dramatic increase seen within specific countries or globally. Though it is accepted that energy consumption in excess of energy expenditure leads to obesity on an individual basis, the cause of the shifts in these two factors on the societal scale is much debated. There are a number of theories as to the cause but most believe it is a combination of various factors. The correlation between social class and BMI varies globally. A review in 1989 found that in developed countries women of a high social class were less likely to be obese. No significant differences were seen among men of different social classes.

In the developing world, women, men, and children from high social classes had greater rates of obesity. An update of this review carried out in 2007 found the same relationships, but they were weaker. The decrease in strength of correlation was felt to be due to the effects of globalization. Among developed countries, levels of adult obesity, and percentage of teenage children who are overweight, are correlated with income inequality. A similar relationship is seen among US states: more adults, even in higher social classes, are obese in more unequal states.

Many explanations have been put forth for associations between BMI and social class. It is thought that in developed countries, the wealthy are able to afford more nutritious food, they are under greater social pressure to remain slim, and have more opportunities along with greater expectations for physical fitness. In undeveloped countries the ability to afford food, high energy expenditure with physical labour, and cultural values favouring a larger body size are believed to contribute to the observed patterns. Attitudes toward body weight held by people in one's life may also play a role in obesity. A correlation in BMI changes over time has been found among friends, siblings, and spouses. Stress and perceived low social status appear to increase risk of obesity. Smoking has a significant effect on an individual's weight. Those who quit smoking gain an average of 4.4 kilograms (9.7 lb) for men and 5.0 kilograms (11.0 lb) for women over ten years. However, changing rates of smoking have had little effect on the overall rates of obesity.

In the United States the number of children a person has is related to their risk of obesity. A woman's risk increases by 7% per child, while a man's risk increases by 4% per child. This could be partly explained by the fact that having dependent children decreases physical activity in Western parents. In the developing world urbanization is playing a role in increasing rate of obesity. In China overall rates of obesity are below 5%; however, in some cities rates of obesity are greater than 20%. Malnutrition in early life is believed to play a role in the rising rates of obesity in the developing world. Endocrine changes that occur during periods of malnutrition may promote the storage of fat once more food energy becomes available. Consistent with cognitive epidemiological data, numerous studies confirm that obesity is associated with cognitive deficits. Whether obesity causes cognitive deficits, or vice versa is unclear at present.

Other Factors

A number of reviews have found an association between short duration of sleep and obesity. Whether one causes the other is unclear. Even if shorts sleep does increase weight gain it is unclear if this is to a meaningful degree or increasing sleep would be of benefit. Certain aspects of personality are associated with being obese. Neuroticism, impulsivity, and sensitivity to reward are more common in people who are obese while conscientiousness and self-control are less common in people who are obese.

Management

The main treatment for obesity consists of dieting and physical exercise. Diet programs may produce weight loss over the short term, but maintaining this weight loss is frequently difficult and often requires making exercise and a lower food energy diet a permanent part of a person's lifestyle. Intensive behavioural interventions are recommended by the United States Preventive Services Task Force. In the short-term low carbohydrate diets appear better than low fat diets for weight loss. In the long term; however, all types of low-carbohydrate and low-fat diets appear equally beneficial. A 2014 review found that the heart disease and diabetes risks associated with different diets appear to be similar.

Promotion of the Mediterranean diets among the obese may lower the risk of heart disease. Decreased intake of sweet drinks is also related to weight-loss. Success rates of long-term weight loss maintenance with lifestyle changes are low, ranging from 2–20%. Dietary and lifestyle changes are effective in limiting excessive weight gain in pregnancy and improve outcomes for both the mother and the child.

Intensive behavioural counselling is recommended in those who are both obese and have other risk factors for heart disease. Five medications have evidence for long-term use orlistat, lorcaserin, liraglutide, phentermine–topiramate, and naltrexone–bupropion. They result in weight loss after one year ranged from 3.0 to 6.7 kg (6.6-14.8 lbs) over placebo. Orlistat, liraglutide, and naltrexone–bupropion are available in both the United States and Europe, whereas lorcaserin and phentermine–topiramate are available only in the United States.

European regulatory authorities rejected the latter two drugs in part because of associations of heart valve problems with lorcaserin and more general heart and blood vessel problems with phentermine–topiramate. Orlistat use is associated with high rates of gastrointestinal side effects and concerns have been raised about negative effects on the kidneys. There is no information on how these drugs affect longer-term complications of obesity such as cardiovascular disease or death.

Epidemiology

In earlier historical periods obesity was rare, and achievable only by a small elite, although already recognised as a problem for health. But as prosperity increased in the Early Modern period, it affected increasingly larger groups of the population. In 1997 the WHO formally recognized obesity as a global epidemic. As of 2008 the WHO estimates that at least 500 million adults (greater than 10%) are obese, with higher rates among women than men. The percentage of adults affected in the United States as of 2015–2016 is about 39.6% overall (37.9% of males and 41.1% of females).

The rate of obesity also increases with age at least up to 50 or 60 years old and severe obesity in the United States, Australia, and Canada is increasing faster than the overall rate of obesity. The OECD has projected an increase in obesity rates until at least 2030, especially in the United States, Mexico and England with rates reaching 47%, 39% and 35% respectively. Once considered a problem only of high-income countries, obesity rates are rising worldwide and affecting both the developed and developing world. These increases have been felt most dramatically in urban settings. The only remaining region of the world where obesity is not common is sub-Saharan Africa.

10 Starvation

Starvation is a severe deficiency in caloric energy intake, below the level needed to maintain an organism's life. It is the most extreme form of malnutrition. In humans, prolonged starvation can cause permanent organ damage and eventually, death. The term inanition refers to the symptoms and effects of starvation. Starvation may also be used as a means of torture or execution. According to the World Health Organization, hunger is the single gravest threat to the world's public health. The WHO also states that malnutrition is by far the biggest contributor to child mortality, present in half of all cases. Undernutrition is a contributory factor in the death of 3.1 million children under five every year.

Figures on actual starvation are difficult to come by, but according to the Food and Agriculture Organization, the less severe condition of undernourishment currently affects about 842 million people, or about one in eight (12.5%) people in the world population. The bloated stomach represents a form of malnutrition called kwashiorkor. The exact pathogenesis of kwashiorkor is not clear, as initially it was thought to relate to diets high in carbohydrates (e.g. maize) but low in protein. While many patients have low albumin, this is thought to be a consequence of the condition. Possible causes such as alfatoxin poisoning, oxidative stress, immune dysregulation and altered gut microbiota have been suggested. Treatment can help mitigate symptoms such as the pictured weight loss and muscle wasting, however prevention is of utmost importance.

Signs and Symptoms

Early symptoms include impulsivity, irritability, and hyperactivity. Atrophy (wasting away) of the stomach weakens the perception of hunger, since the perception is controlled by the volume of the stomach that is empty. Individuals experiencing starvation lose substantial fat (adipose tissue) and muscle mass as the body breaks down these tissues for energy.

Catabolysis is the process of a body breaking down its own muscles and other tissues in order to keep vital systems such as the nervous system and heart muscle (myocardium) functioning. The energy deficiency inherent in starvation causes fatigue and renders the victim more apathetic over time. As the starving person becomes too weak to move or even eat, their interaction with the surrounding world diminishes. In females, menstruation ceases when the body fat percentage is too low to support a fetus.

Victims of starvation are often too weak to sense thirst, and therefore become dehydrated. All movements become painful due to muscle atrophy and dry, cracked skin that is caused by severe dehydration. With a weakened body, diseases are commonplace. Fungi, for example, often grow under the oesophagus, making swallowing painful. Vitamin deficiency is also a common result of starvation, often leading to anaemia, beriberi, pellagra, and scurvy. These diseases collectively can also cause diarrhoea, skin rashes, edema, and heart failure.

Individuals are often irritable and lethargic as a result. There is insufficient scientific data on exactly how long people can live without food. Although the length of time varies with an individual's percentage of body fat and general health, one medical study estimates that in adults complete starvation leads to death within 8 to 12 weeks. Starvation begins when an individual has lost about 30%, or about a third, of their normal body weight. Once the loss reaches 40% death is almost inevitable.

Causes

Starvation is an imbalance between energy intake and energy expenditure. The body expends more energy than it takes in. This imbalance can arise from one or more medical conditions or circumstantial situations, which can include:

Medical Reasons
- Anorexia nervosa
- Bulimia nervosa
- Eating disorder, not otherwise specified
- Celiac disease
- Coma
- Major depressive disorder
- Diabetes mellitus
- Digestive disease
- Constant vomiting

Circumstantial Causes
- Child, elder or dependent abuse
- Famine – for any reason, such as political strife and war
- Hunger striking
- Excessive fasting
- Poverty

Biochemistry

With a typical high-carbohydrate diet, the human body relies on free blood glucose as its primary energy source. The level of blood sugar is tightly regulated; as blood glucose is consumed, the pancreas releases glucagon, a hormone that stimulates the liver to convert stored glycogen into glucose. The glycogen stores are ordinarily replenished after every meal, but if the store is depleted before it can be replenished, the body enters hypoglycemia, and begins the starvation response.

After the exhaustion of the glycogen reserve, and for the next 2–3 days, fatty acids become the principal metabolic fuel. At first, the brain continues to use glucose. If a non-brain tissue is using fatty acids as its metabolic fuel, the use of glucose in the same tissue is switched off. Thus, when fatty acids are being broken down for energy, all of the remaining glucose is made available for use by the brain.

After 2 or 3 days of fasting, the liver begins to synthesize ketone bodies from precursors obtained from fatty acid breakdown. The brain uses these ketone bodies as fuel, thus cutting its requirement for glucose. After fasting for 3 days, the brain gets 30% of its energy from ketone bodies. After 4 days, this may go upwards to 70% or more. Thus, the production of ketone bodies cuts the brain's glucose requirement from 80 g per day to 30 g per day, about 35% of normal, with 65% derived from ketone bodies.

But of the brain's remaining 30 g requirement, 20 g per day can be produced by the liver from glycerol (itself a product of fat breakdown). But this still leaves a deficit of about 10 g of glucose per day that must be supplied from some other source. This other source will be the body's own proteins.

After exhaustion of fat stores, the cells in the body begin to break down protein. This releases alanine and lactate produced from pyruvate into the bloodstream, which can be converted into glucose by the liver. Since much of human muscle mass is protein, this phenomenon is responsible for the wasting away of muscle mass seen in starvation. However, the body is able to selectively decide which cells will break down protein and which will not. About 2–3 g of protein has to be broken down to synthesize 1 g of glucose; about 20–30 g of protein is broken down each day to make 10 g of glucose to keep the brain alive. However, this number may decrease the longer the fasting period is continued in order to conserve protein.

Starvation ensues when the fat reserves are completely exhausted and protein is the only fuel source available to the body. Thus, after periods of starvation, the loss of body protein affects the function of important organs, and death results, even if there are still fat reserves left unused. In a leaner person, the fat reserves are depleted faster, the protein depletion occurs sooner, and therefore death occurs sooner. The ultimate cause of death is, in general, cardiac arrhythmia or cardiac arrest brought on by tissue degradation and electrolyte imbalances. Alternatively, things like metabolic acidosis may also cause death in starving people.

Prevention

Starvation can be caused by factors, other than illness, outside of the control of the individual. The Rome Declaration on World Food Security outlines several policies aimed at increasing food security and, consequently, preventing starvation. These include:	• Poverty reduction • Prevention of wars and political instability • Food aid • Agricultural sustainability • Reduction of economic inequality	Supporting farmers in areas of food insecurity through such measures as free or subsidized fertilizers and seeds increases food harvest and reduces food prices.

Treatment

Starving patients can be treated, but this must be done cautiously to avoid refeeding syndrome. Rest and warmth must be provided and maintained. Small sips of water mixed with glucose should be given in regular intervals. Fruit juices can also be given. Later, food can be given gradually in small quantities. The quantity of food can be increased over time. Proteins may be administered intravenously to raise the level of serum proteins.

11 Global Nutrition Challenges

The challenges facing global nutrition are disease, child malnutrition, obesity, and vitamin deficiency.

Disease
The most common non-infectious diseases worldwide, that contribute most to the global mortality rate, are cardiovascular diseases, various cancers, diabetes, and chronic respiratory problems, all of which are linked to poor nutrition. Nutrition and diet are closely associated with the leading causes of death, including cardiovascular disease and cancer. Obesity and high sodium intake can contribute to ischemic heart disease, while consumption of fruits and vegetables can decrease the risk of developing cancer. Food-borne and infectious diseases can result in malnutrition, and malnutrition exacerbates infectious disease. Poor nutrition leaves children and adults more susceptible to contracting life-threatening diseases such as diarrheal infections and respiratory infections. According to the WHO, in 2011, 6.9 million children died of infectious diseases like pneumonia, diarrhoea, malaria, and neonatal conditions, of which at least one third were associated with undernutrition.

Child Malnutrition
According to UNICEF, in 2011, 101 million children across the globe were underweight and one in four children, 165 million, were stunted in growth. Simultaneously, there are 43 million children under five who are overweight or obese. Nearly 20 million children under 5 suffer from severe acute malnutrition, a life-threatening condition requiring urgent treatment. According to estimations at UNICEF, hunger will be responsible for 5.6 million deaths of children under the age of five this year. These all represent significant public health emergencies. This is because proper maternal and child nutrition has immense consequences for survival, acute and chronic disease incidence, normal growth, and economic productivity of individuals. Childhood malnutrition is common and contributes to the global burden of disease. Childhood is a particularly important time to achieve good nutrition status, because poor nutrition has the capability to lock a child in a vicious cycle of disease susceptibility and recurring sickness, which threatens cognitive and social development. Undernutrition and bias in access to food and health services leaves children less likely to attend or perform well in school.

Undernutrition
UNICEF defines undernutrition “as the outcome of insufficient food intake (hunger) and repeated infectious diseases. Under nutrition includes being underweight for one’s age, too short for one’s age (stunted), dangerously thin (wasted), and deficient in vitamins and minerals (micronutrient malnutrient). Under nutrition causes 53% of deaths of children under five across the world. It has been estimated that undernutrition is the underlying cause for 35% of child deaths.

The Maternal and Child Nutrition Study Group estimate that under nutrition, “including fetal growth restriction, stunting, wasting, deficiencies of vitamin A and zinc along with suboptimum breastfeeding- is a cause of 3.1 million child deaths and infant mortality, or 45% of all child deaths in 2011”. When humans are undernourished, they no longer maintain normal bodily functions, such as growth, resistance to infection, or have satisfactory performance in school or work.

Major causes of under nutrition in young children include lack of proper breast feeding for infants and illnesses such as diarrhoea, pneumonia, malaria, and HIV/AIDS. According to UNICEF 146 million children across the globe, that one out of four under the age of five, are underweight. The amount of underweight children has decreased since 1990, from 33 percent to 28 percent between 1990 and 2004.

Underweight and stunted children are more susceptible to infection, more likely to fall behind in school, more likely to become overweight and develop non-infectious diseases, and ultimately earn less than their non-stunted co-workers. Therefore, undernutrition can accumulate deficiencies in health which results in less productive individuals and societies.

Many children are born with the inherent disadvantage of low birth weight, often caused by intrauterine growth restriction and poor maternal nutrition, which results in worse growth, development, and health throughout the course of their lifetime. Children born at low birthweight (less than 5.5 pounds or 2.5 kg), are less likely to be healthy and are more susceptible to disease and early death. Those born at low birthweight also are likely to have a depressed immune system, which can increase their chances of heart disease and diabetes later on in life.

Because 96% of low birthweight occurs in the developing world, low birthweight is associated with being born to a mother in poverty with poor nutritional status that has had to perform demanding labour. Stunting and other forms of undernutrition reduces a child’s chance of survival and hinders their optimal growth and health.

Stunting has demonstrated association with poor brain development, which reduces cognitive ability, academic performance, and eventually earning potential. Important determinants of stunting include the quality and frequency of infant and child feeding, infectious disease susceptibility, and the mother’s nutrition and health status.

Undernourished mothers are more likely to birth stunted children, perpetuating a cycle of undernutrition and poverty. Stunted children are more likely to develop obesity and chronic diseases upon reaching adulthood. Therefore, malnutrition resulting in stunting can further worsen the obesity epidemic, especially in low and middle income countries. This creates even new economic and social challenges for vulnerable impoverished groups.

Data on global and regional food supply shows that consumption rose from 2011-2012 in all regions. Diets became more diverse, with a decrease in consumption of cereals and roots and an increase in fruits, vegetables, and meat products. However, this increase masks the discrepancies between nations, where Africa, in particular, saw a decrease in food consumption over the same years. This information is derived from food balance sheets that reflect national food supplies, however, this does not necessarily reflect the distribution of micro and macronutrients. Often inequality in food access leaves distribution which uneven, resulting in undernourishment for some and obesity for others.

According to FAO, 868 million people (12% of the global population) were undernourished in 2012. This has decreased across the world since 1990, in all regions except for Africa, where undernourishment has steadily increased. The global financial, economic, and food price crisis in 2008 drove many people to hunger, especially women and children. The spike in food prices prevented many people from escaping poverty, because the poor spend a larger proportion of their income on food and farmers are net consumers of food. High food prices cause consumers to have less purchasing power and to substitute more-nutritious foods with low-cost alternatives.

Adult Overweight and Obesity

Malnutrition in industrialized nations is primarily due to excess calories and non-nutritious carbohydrates, which has contributed to the obesity epidemic affecting both developed and some developing nations. In 2008, 35% of adults above the age of 20 years were overweight (BMI 25 kg/m2), a prevalence that has doubled worldwide between 1980 and 2008. Also 10% of men and 14% of women were obese, with a BMI greater than 30. Rates of overweight and obesity vary across the globe, with the highest prevalence in the Americas, followed by European nations, where over 50% of the population is overweight or obese.

Obesity is more prevalent amongst high income and higher middle income groups than lower divisions of income. Women are more likely than men to be obese, where the rate of obesity in women doubled from 8% to 14% between 1980 and 2008. Being overweight as a child has become an increasingly important indicator for later development of obesity and non-infectious diseases such as heart disease. In several western European nations, the prevalence of overweight and obese children rose by 10% from 1980 to 1990, a rate that has begun to accelerate recently.

Vitamin and Mineral Malnutrition

Vitamins and minerals are essential to the proper functioning and maintenance of the human body. Globally, particularly in developing nations, deficiencies in iodine, iron, and zinc among others are said to impair human health when these minerals are not ingested in an adequate quantity. There are 20 trace elements and minerals that are essential in small quantities to body function and overall human health. Iron deficiency is the most common inadequate nutrient worldwide, affecting approximately 2 billion people.

Globally, anaemia affects 1.6 billion people, and represents a public health emergency in mothers and children under five. The World Health Organization estimates that there exists 469 million women of reproductive age and approximately 600 million preschool and school-age children worldwide who are anemic. Anaemia, especially iron-deficient anaemia, is a critical problem for cognitive developments in children, and its presence leads to maternal deaths and poor brain and motor development in children.

The development of anaemia affects mothers and children more because infants and children have higher iron requirements for growth. Health consequences for iron deficiency in young children include increased perinatal mortality, delayed mental and physical development, negative behavioural consequences, reduced auditory and visual function, and impaired physical performance. The harm caused by iron deficiency during child development cannot be reversed and result in reduced academic performance, poor physical work capacity, and decreased productivity in adulthood.

Mothers are also very susceptible to iron-deficient anaemia because women lose iron during menstruation, and rarely supplement it in their diet. Maternal iron deficiency anaemia increases the chances of maternal mortality, contributing to at least 18% of maternal deaths in low and middle income countries.

Vitamin A plays an essential role in developing the immune system in children, therefore, it is considered an essential micronutrient that can greatly affect health. However, because of the expense of testing for deficiencies, many developing nations have not been able to fully detect and address vitamin A deficiency, leaving vitamin A deficiency considered a silent hunger. According to estimates, subclinical vitamin A deficiency, characterized by low retinol levels, affects 190 million pre-school children and 19 million mothers worldwide.

The WHO estimates that 5.2 million of these children under 5 are affected by night blindness, which is considered clinical vitamin A deficiency. Severe vitamin A deficiency (VAD) for developing children can result in visual impairments, anaemia and weakened immunity, and increase their risk of morbidity and mortality from infectious disease.

This also presents a problem for women, with WHO estimating that 9.8 million women are affected by night blindness. Clinical vitamin A deficiency is particularly common among pregnant women, with prevalence rates as high as 9.8% in South-East Asia. Estimates say that 28.5% of the global population is iodine deficient, representing 1.88 billion individuals. Although salt iodization programs have reduced the prevalence of iodine deficiency, this is still a public health concern in 32 nations.

Moderate deficiencies are common in Europe and Africa, and over consumption is common in the Americas. Iodine-deficient diets can interfere with adequate thyroid hormone production, which is responsible for normal growth in the brain and nervous system. This ultimately leads to poor school performance and impaired intellectual capabilities.

Infant and Young Child Feeding

Improvement of breast feeding practices, like early initiation and exclusive breast feeding for the first two years of life, could save the lives of 1.5 million children annually. Nutrition interventions targeted at infants aged 0–5 months first encourages early initiation of breastfeeding. Though the relationship between early initiation of breast feeding and improved health outcomes has not been formally established, a recent study in Ghana suggests a causal relationship between early initiation and reduced infection-caused neo-natal deaths.

Also, experts promote exclusive breastfeeding, rather than using formula, which has shown to promote optimal growth, development, and health of infants. Exclusive breastfeeding often indicates nutritional status because infants that consume breast milk are more likely to receive all adequate nourishment and nutrients that will aid their developing body and immune system. This leaves children less likely to contract diarrheal diseases and respiratory infections.

Besides the quality and frequency of breastfeeding, the nutritional status of mothers affects infant health. When mothers do not receive proper nutrition, it threatens the wellness and potential of their children. Well-nourished women are less likely to experience risks of birth and are more likely to deliver children who will develop well physically and mentally.

Maternal undernutrition increases the chances of low-birth weight, which can increase the risk of infections and asphyxia in fetuses, increasing the probability of neonatal deaths. Growth failure during intrauterine conditions, associated with improper mother nutrition, can contribute to lifelong health complications. Approximately 13 million children are born with intrauterine growth restriction annually.

12 Int. Food Insecurity and Malnutrition

According to UNICEF, South Asia has the highest levels of underweight children under five, followed by sub-Saharan Africans nations, with Industrialized countries and Latin nations having the lowest rates.

United States
In the United States, 2% of children are underweight, with under 1% stunted and 6% are wasting. In the US, dietitians are registered (RD) or licensed (LD) with the Commission for Dietetic Registration and the American Dietetic Association, and are only able to use the title "dietitian," as described by the business and professions codes of each respective state, when they have met specific educational and experiential prerequisites and passed a national registration or licensure examination, respectively.

Anyone may call themselves a nutritionist, including unqualified dietitians, as this term is unregulated. Some states, such as the State of Florida, have begun to include the title "nutritionist" in state licensure requirements. Most governments provide guidance on nutrition, and some also impose mandatory disclosure/labelling requirements for processed food manufacturers and restaurants to assist consumers in complying with such guidance.

In the US, nutritional standards and recommendations are established jointly by the US Department of Agriculture and US Department of Health and Human Services. Dietary and physical activity guidelines from the USDA are presented in the concept of a plate of food which in 2011 superseded the MyPyramid food pyramid that had replaced the Four Food Groups.

The Senate committee currently responsible for oversight of the USDA is the Agriculture, Nutrition and Forestry Committee. Committee hearings are often televised on C-SPAN. The U.S. Department of Health and Human Services provides a sample week-long menu which fulfils the nutritional recommendations of the government. Canada's Food Guide is another governmental recommendation.

Industrialized Countries
According to UNICEF, the Commonwealth of Independent States has the lowest rates of stunting and wasting, at 14 percent and 3 percent. The nations of Estonia, Finland, Iceland, Lithuania and Sweden have the lowest prevalence of low birthweight children in the world- at 4%. Proper prenatal nutrition is responsible for this small prevalence of low birthweight infants. However, low birthweight rates are increasing, due to the use of fertility drugs, resulting in multiple births, women bearing children at an older age, and the advancement of technology allowing more pre-term infants to survive. Industrialized nations more often face malnutrition in the form of over-nutrition from excess calories and non-nutritious carbohydrates, which has contributed greatly to the public health epidemic of obesity. Disparities, according to gender, geographic location and socio-economic position, both within and between countries, represent the biggest threat to child nutrition in industrialized countries. These disparities are a direct product of social inequalities and social inequalities are rising throughout the industrialized world, particularly in Europe.

South Asia
South Asia has the highest percentage and number of underweight children under five in the world, at approximately 78 million children. Patterns of stunting and wasting are similar, where 44% have not reached optimal height and 15% are wasted, rates much higher than any other regions. This region of the world has extremely high rates of underweight children. According to a 2006 Unicef study, 46% of its child population under five is underweight. The same study indicates India, Bangladesh, and Pakistan combined account for half the globe's underweight child population.

South Asian nations have made progress towards the MDGs, considering the rate has decreased from 53% since 1990, however, a 1.7% decrease of underweight prevalence per year will not be sufficient to meet the 2015 goal. Some nations, such as Afghanistan, Bangladesh, and Sri Lanka, on the other hand, have made significant improvements, all decreasing their prevalence by half in ten years.

While India and Pakistan have made modest improvements, Nepal has made no significant improvement in underweight child prevalence. Other forms of undernutrition have continued to persist with high resistance to improvement, such as the prevalence of stunting and wasting, which has not changed significantly in the past 10 years. Causes of this poor nutrition include energy-insufficient diets, poor sanitation conditions, and the gender disparities in educational and social status.

Girls and women face discrimination especially in nutrition status, where South Asia is the only region in the world where girls are more likely to be underweight than boys. In South Asia, 60% of children in the lowest quintile are underweight, compared to only 26% in the highest quintile, and the rate of reduction of underweight is slower amongst the poorest.

Eastern/South Africa
The Eastern and Southern African nations have shown no improvement since 1990 in the rate of underweight children under five. They have also made no progress in halving hunger by 2015, the most prevalent Millennium Development Goal. This is due primarily to the prevalence of famine, declined agricultural productivity, food emergencies, drought, conflict, and increased poverty. This, along with HIV/AIDS, has inhibited the nutrition development of nations such as Lesotho, Malawi, Mozambique, Swaziland, Zambia and Zimbabwe. Botswana has made remarkable achievements in reducing underweight prevalence, dropping 4% in 4 years, despite its place as the second leader in HIV prevalence amongst adults in the globe. South Africa, the wealthiest nation in this region, has the second lowest proportion of underweight children at 12%, but has been steadily increasing in underweight prevalence since 1995. Almost half of Ethiopian children are underweight, and along with Nigeria, they account for almost one-third of the underweight under five in all of Sub-Saharan Africa.

West/Central Africa
West/Central Africa has the highest rate of children under five underweight in the world. Of the countries in this region, the Congo has the lowest rate at 14%, while the nations of Democratic Republic of the Congo, Ghana, Guinea, Mali, Nigeria, Senegal and Togo are improving slowly. In Gambia, rates decreased from 26% to 17% in four years, and their coverage of vitamin A supplementation reaches 91% of vulnerable populations. This region has the next highest proportion of wasted children, with 10% of the population under five not at optimal weight. Little improvement has been made between the years of 1990 and 2004 in reducing the rates of underweight children under five, whose rate stayed approximately the same. Sierra Leone has the highest child under five mortality rate in the world, due predominantly to its extreme infant mortality rate, at 238 deaths per 1000 live births. Other contributing factors include the high rate of low birthweight children (23%) and low levels of exclusive breast feeding (4%). Anaemia is prevalent in these nations, with unacceptable rates of iron deficient anaemia. The nutritional status of children is further indicated by its high rate of child wasting - 10%. Wasting is a significant problem in Sahelian countries – Burkina Faso, Chad, Mali, Mauritania and Niger – where rates fall between 11% and 19% of under fives, affecting more than 1 million children.

Middle East/North Africa
Six countries in the Middle East and North Africa region are on target to meet goals for reducing underweight children by 2015, and 12 countries have prevalence rates below 10%. However, the nutrition of children in the region as a whole has degraded for the past ten years due to the increasing portion of underweight children in three populous nations – Iraq, Sudan, and Yemen. Forty six percent of all children in Yemen are underweight, a percentage that has worsened by 4% since 1990. In Yemen, 53% of children under five are stunted and 32% are born at low birth weight. Sudan has an underweight prevalence of 41%, and the highest proportion of wasted children in the region at 16%. One percent of households in Sudan consume iodized salt. Iraq has also seen an increase in child underweight since 1990. Djibouti, Jordan, the Occupied Palestinian Territory (OPT), Oman, the Syrian Arab Republic and Tunisia are all projected to meet minimum nutrition goals, with OPT, Syrian AR, and Tunisia the fastest improving regions. This region demonstrates that undernutrition does not always improve with economic prosperity, where the United Arab Emirates, for example, despite being a wealthy nation, has similar child death rates due to malnutrition to those seen in Yemen.

East Asia/Pacific
The East Asia/Pacific region has reached its goals on nutrition, in part due to the improvements contributed by China, the region's most populous country. China has reduced its underweight prevalence from 19 percent to 8 percent between 1990 and 2002. China played the largest role in the world in decreasing the rate of children under five underweight between 1990 and 2004, halving the prevalence. This reduction of underweight prevalence has aided in the lowering of the under 5 mortality rate from 49 to 31 of 1000. They also have a low birthweight rate at 4%, a rate comparable to industrialized countries, and over 90% of households receive adequate iodized salts. However, large disparities exist between children in rural and urban areas, where 5 provinces in China leave 1.5 million children iodine deficient and susceptible to diseases. Singapore, Vietnam, Malaysia, and Indonesia are all projected to reach nutrition MDGs. Singapore has the lowest under five mortality rate of any nation, besides Iceland, in the world, at 3%. Cambodia has the highest rate of child mortality in the region (141 per 1,000 live births), while still its proportion of underweight children increased by 5 percent to 45% in 2000. Further nutrient indicators show that only 12 per cent of Cambodian babies are exclusively breastfed and only 14 per cent of households consume iodized salt.

Latin America/Caribbean
This region has undergone the fastest progress in decreasing poor nutrition status of children in the world. The Latin American region has reduced underweight children prevalence by 3.8% every year between 1990 and 2004, with a current rate of 7% underweight. They also have the lowest rate of child mortality in the developing world, with only 31 per 1000 deaths, and the highest iodine consumption. Cuba has seen improvement from 9 to 4 percent underweight under 5 between 1996 and 2004. The prevalence has also decreased in the Dominican Republic, Jamaica, Peru, and Chile. Chile has a rate of underweight under 5, at merely 1%. The most populous nations, Brazil and Mexico, mostly have relatively low rates of underweight under 5, with only 6% and 8%. Guatemala has the highest percentage of underweight and stunted children in the region, with rates above 45%. There are disparities amongst different populations in this region. For example, children in rural areas have twice the prevalence of underweight at 13%, compared to urban areas at 5%.

13 Nutrition Policy

Nutrition Interventions
Nutrition directly influences progress towards meeting the Millennium Goals of eradicating hunger and poverty through health and education. Therefore, nutrition interventions take a multi-faceted approach to improve the nutrition status of various populations. Policy and programming must target both individual behavioural changes and policy approaches to public health.

While most nutrition interventions focus on delivery through the health-sector, non-health sector interventions targeting agriculture, water and sanitation, and education are important as well. Global nutrition micro-nutrient deficiencies often receive large-scale solution approaches by deploying large governmental and non-governmental organizations. For example, in 1990, iodine deficiency was particularly prevalent, with one in five households, or 1.7 billion people, not consuming adequate iodine, leaving them at risk to develop associated diseases.

Therefore, a global campaign to iodize salt to eliminate iodine deficiency successfully boosted the rate to 69% of households in the world consuming adequate amounts of iodine. Emergencies and crises often exacerbate undernutrition, due to the aftermath of crises that include food insecurity, poor health resources, unhealthy environments, and poor healthcare practices. Therefore, the repercussions of natural disasters and other emergencies can exponentially increase the rates of macro and micronutrient deficiencies in populations. Disaster relief interventions often take a multi-faceted public health approach.

UNICEF's programming targeting nutrition services amongst disaster settings include nutrition assessments, measles immunization, vitamin A supplementation, provision of fortified foods and micronutrient supplements, support for breastfeeding and complementary feeding for infants and young children, and therapeutic and supplementary feeding. For example, during Nigeria's food crisis of 2005, 300,000 children received therapeutic nutrition feeding programs through the collaboration of UNICEF, the Niger government, the World Food Programme, and 24 NGOs utilizing community and facility based feeding schemes. Interventions aimed at pregnant women, infants, and children take a behavioural and program-based approach.

Behavioural intervention objectives include promoting proper breast-feeding, the immediate initiation of breastfeeding, and its continuation through 2 years and beyond. UNICEF recognizes that to promote these behaviours, healthful environments must be established conducive to promoting these behaviours, like healthy hospital environments, skilled health workers, support in the public and workplace, and removing negative influences. Finally, other interventions include provisions of adequate micro and macro nutrients such as iron, anaemia, and vitamin A supplements and vitamin-fortified foods and ready-to-use products.

Programs addressing micro-nutrient deficiencies, such as those aimed at anaemia, have attempted to provide iron supplementation to pregnant and lactating women. However, because supplementation often occurs too late, these programs have had little effect. Interventions such as women's nutrition, early and exclusive breastfeeding, appropriate complementary food and micronutrient supplementation have proven to reduce stunting and other manifestations of undernutrition. A Cochrane review of community-based maternal health packages showed that this community-based approach improved the initiation of breastfeeding within one hour of birth. Some programs have had adverse effects. One example is the "Formula for Oil" relief program in Iraq, which resulted in the replacement of breastfeeding for formula, which has negatively affected infant nutrition.

14 Macronutrients

Macronutrients	Deficiency	Toxicity	Sources	RDI
Energy			All Foods.	8700 kj
Total Fat (Sat. / Monosat. / Polysat.)	Dry skin, deficiencies for vitamin A, D, E, K, night blindness, infection susceptibility.	Cardiovascular disease.	Meats, nuts, oil, sweets, dairy products.	78 g
Saturated Fat			Dairy products, meats, sweets, nuts oils.	20 g
Cholesterol			Meat, poultry, full-fat dairy products.	300 mg
Carbohydrates				275 g
Sugars				50 g
Dietary Fibre				28 g
Protein				50 g

15 Micronutrients

Micronutrients are essential nutrients that the human body needs in very small amounts to function properly, maintain overall health, and prevent disease. Unlike macronutrients (carbohydrates, proteins, and fats), which provide energy and building blocks for the body in large quantities, micronutrients do not provide calories.

Vitamins: These are organic compounds that the body generally cannot synthesize on its own (with the exception of Vitamin D, which can be produced in the skin through sunlight exposure) and must be obtained through diet. Vitamins play a crucial role in various metabolic processes, including energy production, immune function, blood clotting, and maintaining healthy tissues. They are further classified as:

Fat-soluble vitamins: Vitamins A, D, E, and K. These dissolve in fat and can be stored in the body's fatty tissues and liver for longer periods.

Water-soluble vitamins: B vitamins (B1, B2, B3, B5, B6, B7, B9/folate, B12) and Vitamin C. These dissolve in water and are not stored in the body for long, meaning they need to be consumed more regularly.

Minerals: These are inorganic elements that the body needs for various functions, including bone health, fluid balance, nerve function, and enzyme activity. Minerals are obtained from the soil and water, which are then absorbed by plants or animals that we consume. Minerals are typically divided into:

Macrominerals: Needed in larger quantities (e.g., calcium, phosphorus, magnesium, sodium, potassium, chloride).
Trace minerals (or microminerals): Needed in smaller quantities (e.g., iron, zinc, iodine, selenium, copper, manganese, fluoride).

Despite being required in small amounts, micronutrients are critical for a vast array of bodily functions. Deficiencies in certain micronutrients can lead to severe health problems, impacting growth, development, immune response, cognitive function, and overall well-being. For example, iron deficiency can cause anemia, vitamin A deficiency can lead to blindness, and iodine deficiency can impair cognitive development. A diverse and balanced diet rich in fruits, vegetables, whole grains, and lean proteins is essential to ensure adequate intake of these vital micronutrients.

3 Vitamins

A vitamin is an organic molecule (or related set of molecules) that is an essential micronutrient that an organism needs in small quantities for the proper functioning of its metabolism. Essential nutrients cannot be synthesized in the organism, either at all or not in sufficient quantities, and therefore must be obtained through the diet. Vitamin C can be synthesized by some species but not by others; it is not a vitamin in the first instance but is in the second.

The term vitamin does not include the three other groups of essential nutrients: minerals, essential fatty acids, and essential amino acids. Most vitamins are not single molecules, but groups of related molecules called vitamers. For example, vitamin E consists of four tocopherols and four tocotrienols.

The thirteen vitamins required by human metabolism are: vitamin A (as all-trans-retinol, all-trans-retinyl-esters, as well as all-trans-beta-carotene and other provitamin A carotenoids), vitamin B1 (thiamine), vitamin B2 (riboflavin), vitamin B3 (niacin), vitamin B5 (pantothenic acid), vitamin B6 (pyridoxine), vitamin B7 (biotin), vitamin B9 (folic acid or folate), vitamin B12 (cobalamins), vitamin C (ascorbic acid), vitamin D (calciferols), vitamin E (tocopherols and tocotrienols), and vitamin K (quinones).

Vitamins have diverse biochemical functions. Vitamin A acts as a regulator of cell and tissue growth and differentiation. Vitamin D provides a hormone-like function, regulating mineral metabolism for bones and other organs. The B complex vitamins function as enzyme cofactors (coenzymes) or the precursors for them. Vitamins C and E function as antioxidants. Both deficient and excess intake of a vitamin can potentially cause clinically significant illness, although excess intake of water-soluble vitamins is less likely to do so.

Water Soluble Vitamins

Water Soluble Vitamins	Deficiency	Toxicity	Sources	RDI
Vitamin B1 (Thiamine)	Burning feet, weak extremities, rapid heart rate, swelling, anorexia, nausea, fatigue, gastrointestinal problems.	None.	Sunflower seeds, asparagus, lettuce, mushrooms, black beans, navy beans, lentils, spinach, peas, eggplant, tomato, tuna, whole wheat, soybeans.	1.2 mg
Vitamin B2 (Riboflavin)	Cracks and sores at corner of mouth and lips, dermatitis, conjunctivitis, photophobia, glossitis of tongue, anxiety, loss of appetite, fatigue.	Harmless intensification of urine colour.	Almonds, soybeans, mushrooms, spinach, whole wheat, yoghurt, mackerel, eggs, liver.	1.3 mg
Vitamin B3 (Niacin)	Dermatitis, diarrhoea, dementia, stomatitis.	No adverse affects known. May cause liver damage in amounts over 750mg over 3 months.	Mushrooms, asparagus, peanuts, brown rice, corn, leafy green veges, potato, lentil, barley, carrots, almonds, celery, turnips, peaches, chicken, tuna, salmon.	16 mg
Vitamin B4 (Choline)	Fatigue, memory loss, cognitive decline, learning disabilities, muscle aches, nerve damage, mood changes.	Vomiting, salivation, sweating, fishy body odour, dizziness, light-headedness.	Eggs, liver, peanuts, meat, poultry, dairy foods, pasta, rice, spinach, wheat, beets.	550 mg
Vitamin B5 (Pantothenic Acid)	Very unlikely.	Nausea, heartburn, diarrhoea.	Broccoli, lentils, split peas, avocado, whole wheat, mushrooms, sweet potato, sunflower seeds, cauliflower, leafy green veges, eggs, strawberries, liver.	5 mg
Vitamin B6 (Pyridoxine)	Chelosis, glossitis, stomatitis, dermatitis, sleeplessness, confusion, nervousness, depression, irritability, anaemia.	Painful neurological symptoms.	Whole wheat, brown rice, leafy green veges, potato, beans, banana, trout, spinach, tomato, avocado, walnuts, peanut butter, tuna, salmon, chicken.	1.7 mg
Vitamin B9 (Folate)	Anaemia, sprue, leukopenia, thrombocytopenia, weakness, weight loss, cracking and red tongue and mouth, diarrhoea.	None from food.	Leafy green veges, asparagus, broccoli, brussels sprouts, citrus fruits, spinach, whole grains, baked beans, green peas, avocado, peanuts, lettuce, tomato juice, banana.	400 µg
Vitamin B12 (Cobalamin)	Pernicious anaemia, neurological problems, sprue.	None.	Fortified cereals, liver, trout, salmon, tuna, haddock, egg.	2.4 µg
Vitamin B17 (Amygdalin)	Cancer.	None Known.	Apple, apricot, peach, pear, prune and plum stones, wheat sprouts, sprouted lentils, apple seeds, common beans, grains, lentil sprout, lima beans, almonds, mulberries, sesame seeds, linseeds, flax seeds, oats, barley.	?
Vitamin H (Biotin)	Very rare.	None.	Leafy green veges, most nuts, whole grain breads, avocado, raspberries, cauliflower, carrots, papaya, banana, salmon, eggs.	30 µg

Vitamin C (Ascorbic Acid)	Bruising, gum infections, lethargy, dental cavities, tissue swelling, dry hair + eyes + skin, bleeding gums, hair loss, joint pain, pitting edema, anaemia, slow healing wounds, bone fragility, scurvy.	Possible kidney stones, excess iron absorption, vitamin B12 deficiency, erosion of dental enamel.	Guava, bell pepper, kiwi, orange, grapefruit, strawberry, brussels sprouts, papaya, broccoli, sweet potato, pineapple, cauliflower, lemon juice, parsley.	90 mg

Fat Soluble Vitamins

Fat Soluble Vitamins	Deficiency	Toxicity	Sources	RDI
Vitamin A	Blindness, risk of infections, night blindness, dry eyes + skin, spots in eyeball.	Blurry vision, bone swelling, bone pain, poor appetite, dizziness, nausea, vomiting, sunlight sensitivity, dry skin.	Liver and fish oils, milk, eggs, leafy green veges, orange, yellow vegetables, tomato, fruits.	900 µg
Vitamin D (Cholecalciferol)	Often no symptoms, difficulty thinking clearly, bone pain, muscle weakness, soft bones, fatigue.	Calcium build-up in blood causing poor appetite, nausea, vomiting, weakness, frequent urination, kidney problems.	Sunlight on skin (Ultraviolet B rays), mushrooms, tuna, trout, sardines, mackerel, salmon, beef liver, cheese, egg yolk.	20 µg
Vitamin E (Tocopherol)	Anaemia, neurological deficits, reproduction and infertility disorders, age spots, cataracts, neurological damage, muscle + liver + brain function abnormalities.	Rarely has adverse effects, possible bleeding, fatigue, muscle weakness, nausea, diarrhoea.	Almonds, spinach, sweet potato, avocado, wheat germ, sunflower seeds, palm oil, trout, olive oil.	15 mg
Vitamin K	Easy bruising, excessive bleeding from wounds, gastrointestinal tract bleeding, blood in urine or stool.	None - Has a limited storage space for the vitamin.	Bacteria in intestinal tract, green leafy veges, brussels sprouts, broccoli, cauliflower, cabbage, fish, liver, meat, eggs.	120 µg

Anti-Vitamins

Anti-vitamins are chemical compounds that inhibit the absorption or actions of vitamins. For example, avidin is a protein in raw egg whites that inhibits the absorption of biotin; it is deactivated by cooking. Pyrithiamine, a synthetic compound, has a molecular structure similar to thiamine, vitamin B1, and inhibits the enzymes that use thiamine.

Examples:
Anti-Vitamin K:

Warfarin (and other coumarins like dicumarol): This is a well-known example used therapeutically as an anticoagulant (blood thinner). Warfarin works by inhibiting vitamin K epoxide reductase, an enzyme crucial for reactivating vitamin K. By blocking this enzyme, it prevents vitamin K from participating in the synthesis of essential blood clotting factors.

Sweet Clover Poisoning: Livestock consuming spoiled sweet clover containing dicumarol can suffer from severe bleeding due to its anti-vitamin K activity.

Anti-Vitamin B1 (Thiamine):

Thiaminases: These are enzymes that specifically break down thiamine, rendering it inactive. They are found in certain raw foods, particularly raw fish (like carp, clams, or some freshwater fish) and some ferns. Cooking usually inactivates thiaminases.
Pyrithiamine and Oxythiamine: These are synthetic compounds that structurally resemble thiamine and act as antagonists, competitively inhibiting enzymes that use thiamine. They are primarily used in research to induce thiamine deficiency.
2'-methoxy-thiamine (MTh): A naturally occurring antivitamin produced by some bacteria to kill competing bacteria by interfering with their B1 function.

Anti-Vitamin B2 (Riboflavin):

Roseoflavin (RoF): A naturally occurring antivitamin of riboflavin, produced by certain microorganisms.

Anti-Vitamin B6 (Pyridoxine):

Ginkgotoxin (GT): A naturally occurring antivitamin of pyridoxine, found in ginkgo seeds.
Desoxypyridoxine: A synthetic antagonist used in research.
Isoniazid: An antitubercular drug that can interfere with vitamin B6 metabolism, sometimes leading to B6 deficiency symptoms.

Anti-Vitamin B9 (Folate/Folic Acid):

Methotrexate: This is a potent antifolate drug widely used in chemotherapy to treat certain cancers and autoimmune diseases. It inhibits dihydrofolate reductase, an enzyme critical for converting folate into its active form, thereby blocking DNA synthesis and cell division in rapidly growing cells (like cancer cells).

Sulfonamides: These are a class of antibiotics that act as antifolates in bacteria. They interfere with the bacterial synthesis of folic acid, which is essential for bacterial growth.

Anti-Vitamin B12 (Cobalamin):

There are various synthetic analogues of Vitamin B12 that are designed to interfere with its metabolic functions, primarily used in research to study B12 deficiency.

Intake

Sources
For the most part, vitamins are obtained from the diet, but some are acquired by other means: for example, microorganisms in the gut flora produce vitamin K and biotin; and one form of vitamin D is synthesized in skin cells when they are exposed to a certain wavelength of ultraviolet light present in sunlight. Humans can produce some vitamins from precursors they consume: for example, vitamin A is synthesized from beta carotene; and niacin is synthesized from the amino acid tryptophan. The Food Fortification Initiative lists countries which have mandatory fortification programs for vitamins folic acid, niacin, vitamin A and vitamins B1, B2 and B12.

Deficient Intake
The body's stores for different vitamins vary widely; vitamins A, D, and B12 are stored in significant amounts, mainly in the liver, and an adult's diet may be deficient in vitamins A and D for many months and B12 in some cases for years, before developing a deficiency condition. However, vitamin B3 (niacin and niacinamide) is not stored in significant amounts, so stores may last only a couple of weeks. For vitamin C, the first symptoms of scurvy in experimental studies of complete vitamin C deprivation in humans have varied widely, from a month to more than six months, depending on previous dietary history that determined body stores.

Deficiencies of vitamins are classified as either primary or secondary. A primary deficiency occurs when an organism does not get enough of the vitamin in its food. A secondary deficiency may be due to an underlying disorder that prevents or limits the absorption or use of the vitamin, due to a "lifestyle factor", such as smoking, excessive alcohol consumption, or the use of medications that interfere with the absorption or use of the vitamin.

People who eat a varied diet are unlikely to develop a severe primary vitamin deficiency, but may be consuming less than the recommended amounts; a national food and supplement survey conducted in the US over 2003-2006 reported that over 90% of individuals who did not consume vitamin supplements were found to have inadequate levels of some of the essential vitamins, notably vitamins D and E.

Well-researched human vitamin deficiencies involve thiamine (beriberi), niacin (pellagra), vitamin C (scurvy), folate (neural tube defects) and vitamin D (rickets). In much of the developed world these deficiencies are rare; this is due to A) an adequate supply of food and B) the addition of vitamins to common foods (fortification). In addition to these classical vitamin deficiency diseases, some evidence has also suggested links between vitamin deficiency and a number of different disorders.

Excess Intake
Some vitamins have documented acute or chronic toxicity at larger intakes, which is referred to as hypertoxicity. The European Union and the governments of several countries have established Tolerable upper intake levels (ULs) for those vitamins which have documented toxicity (see table). The likelihood of consuming too much of any vitamin from food is remote, but excessive intake (vitamin poisoning) from dietary supplements does occur. In 2016, overdose exposure to all formulations of vitamins and multi-vitamin/mineral formulations was reported by 63,931 individuals to the American Association of Poison Control Centres with 72% of these exposures in children under the age of five. In the US, analysis of a national diet and supplement survey reported that about 7% of adult supplement users exceeded the UL for folate and 5% of those older than age 50 years exceeded the UL for vitamin A.

Effects of Cooking
The USDA has conducted extensive studies on the percentage losses of various nutrients from different food types and cooking methods. Some vitamins may become more "bio-available" – that is, usable by the body – when foods are cooked. The table below shows whether various vitamins are susceptible to loss from heat—such as heat from boiling, steaming, frying, etc. The effect of cutting vegetables can be seen from exposure to air and light. Water-soluble vitamins such as B and C dissolve into the water when a vegetable is boiled, and are then lost when the water is discarded.

Vitamin	Soluble in Water	Stable to Air Exposure	Stable to Light Exposure	Stable to Heat Exposure
Vitamin A	No	Partially	Partially	Relatively Stable
Vitamin C	Very Unstable	Yes	No	No
Vitamin D	No	No	No	No
Vitamin E	No	Yes	Yes	No
Vitamin K	No	No	Yes	No
Thiamine (B1)	Highly	No	?	> 100°C
Riboflavin (B2)	Slightly	No	In Solution	No
Niacin (B3)	Yes	No	No	No
Pantothenic Acid (B5)	Quite Stable	No	No	Yes
Vitamin (B6)	Yes	?	Yes	?
Biotin (B7)	Somewhat	?	?	No
Folic Acid (B9)	Yes	?	When Dry	At High Temp
Cobalamin (B12)	Yes	?	Yes	No

Multivitamins

In those who are otherwise healthy, there is little evidence that supplements have any benefits with respect to cancer or heart disease. Vitamin A and E supplements not only provide no health benefits for generally healthy individuals, but they may increase mortality, though the two large studies that support this conclusion included smokers for whom it was already known that beta-carotene supplements can be harmful.

A 2018 meta-analysis found no evidence that intake of vitamin D or calcium for community-dwelling elderly people reduced bone fractures. In Europe are regulations that define limits of vitamin (and mineral) dosages for their safe use as dietary supplements. Most vitamins that are sold as dietary supplements are not supposed to exceed a maximum daily dosage referred to as the tolerable upper intake level (UL).

Vitamin products above these regulatory limits are not considered supplements and should be registered as prescription or non-prescription (over-the-counter drugs) due to their potential side effects. The European Union, United States, Japan establish recommended upper intake levels. Dietary supplements often contain vitamins, but may also include other ingredients, such as minerals, herbs, and botanicals. Scientific evidence supports the benefits of dietary supplements for persons with certain health conditions.

In some cases, vitamin supplements may have unwanted effects, especially if taken before surgery, with other dietary supplements or medicines, or if the person taking them has certain health conditions. They may also contain levels of vitamins many times higher, and in different forms, than one may ingest through food.

This is the typical contents of a multivitamin:	• Vitamin A - 1250 IU • Vitamin B1 - 10 mg • Vitamin B2 - 10 mg • Vitamin B3 - 25 mg • Vitamin B6 - 2 mg • Vitamin B12 - 2 mcg • Vitamin C - 75 mg • Vitamin D3 - 400IU • Vitamin E - 10 IU • Calcium - 10 mg	• Phosphorous - 7.7 mg • Vitamin B5 - 8 mg • Copper - 1 mg • Iron - 5 mg • Magnesium - 36 mg • Manganese - 1 mg • Iodine - 145 mcg • Potassium - 5 mg • Zinc - 1.5 mg			

Multivitamin Tips
- Take 1 multivitamin every week in a survival condition to keep healthy.
- Wrap bottles of vitamins in duct tape to prevent light entering and destroying the nutrients and store in a cool, dry place.

4 Minerals

In the context of nutrition, a mineral is a chemical element required as an essential nutrient by organisms to perform functions necessary for life. However, the four major structural elements in the human body by weight (oxygen, hydrogen, carbon, and nitrogen), are usually not included in lists of major nutrient minerals (nitrogen is considered a "mineral" for plants, as it often is included in fertilizers). These four elements compose about 96% of the weight of the human body, and major minerals (macrominerals) and minor minerals (also called trace elements) compose the remainder.

Minerals, being elements, cannot be synthesized biochemically by living organisms Plants get minerals from soil Most of the minerals in a human diet come from eating plants and animals or from drinking water. As a group, minerals are one of the four groups of essential nutrients, the others of which are vitamins, essential fatty acids, and essential amino acids The five major minerals in the human body are calcium, phosphorus, potassium, sodium, and magnesium All of the remaining elements in a human body are called "trace elements". The trace elements that have a specific biochemical function in the human body are sulphur, iron, chlorine, cobalt, copper, zinc, manganese, molybdenum, iodine and selenium.

Most chemical elements that are ingested by organisms are in the form of simple compounds. Plants absorb dissolved elements in soils, which are subsequently ingested by the herbivores and omnivores that eat them, and the elements move up the food chain. Larger organisms may also consume soil (geophagia) or use mineral resources, such as salt licks, to obtain limited minerals unavailable through other dietary sources.

Bacteria and fungi play an essential role in the weathering of primary elements that results in the release of nutrients for their own nutrition and for the nutrition of other species in the ecological food chain. One element, cobalt, is available for use by animals only after having been processed into complex molecules (e.g., vitamin B12) by bacteria. Minerals are used by animals and microorganisms for the process of mineralizing structures, called "biomineralization", used to construct bones, seashells, eggshells, exoskeletons and mollusc shells.

Roles in Biological Processes

Dietary Element	RDA (US) (mg)	UL (US and EU) (mg)	Category	High Nutrient Density Dietary Sources	Term for Deficiency	Term for Excess
Potassium	4700	Not Established	A systemic electrolyte and is essential in coregulating ATP with sodium	Sweet potato, tomato, potato, beans, lentils, dairy products, seafood, banana, prune, carrot, orange	Hypokalemia	Hyperkalemia
Chlorine	2300	3600	Needed for production of hydrochloric acid in the stomach and in cellular pump functions	Table salt (sodium chloride) is the main dietary source.	Hypochloremia	Hyperchloremia
Sodium	1500	2300	A systemic electrolyte and is essential in coregulating ATP with potassium	Table salt (sodium chloride, the main source), sea vegetables, milk, and spinach.	Hyponatremia	Hypernatremia
Calcium	1200	2500; 2500	Needed for muscle, heart and digestive system health, builds bone, supports synthesis and function of blood cells	Dairy products, eggs, canned fish with bones (salmon, sardines), green leafy vegetables, nuts, seeds, tofu, thyme, oregano, dill, cinnamon.	Hypocalcaemia	Hypercalcaemia
Phosphorus	700	4000; 4000	A component of bones, cells, in energy processing, in DNA and ATP (as phosphate) and many other functions	Red meat, dairy foods, fish, poultry, bread, rice, oats. In biological contexts, usually seen as phosphate	Hypophosphatemia	Hyperphosphatemia
Magnesium	420	350; 250	Required for processing ATP and for bones	Spinach, legumes, nuts, seeds, whole grains, peanut butter, avocado	Hypomagnesemia, Magnesium Deficiency	Hypermagnesemia
Iron	18	45	Required for many proteins and enzymes, notably hemoglobin to prevent anaemia	Meat, seafood, nuts, beans, dark chocolate	Iron Deficiency	Iron Overload Disorder
Zinc	11	40; 25	Pervasive and required for several enzymes such as carboxypeptidase, liver alcohol dehydrogenase, and carbonic anhydrase.	Oysters*, red meat, poultry, nuts, whole grains, dairy products	Zinc Deficiency	Zinc Toxicity
Manganese	2.3	11	A cofactor in enzymefunctions	Grains, legumes, seeds, nuts, leafy vegetables, tea, coffee	Manganese Deficiency	Manganism
Iodine	0.15	1.1; 0.6	Required for synthesis of thyroid hormones, thyroxine andtriiodothyronine and to prevent goiter	Seaweed (kelp or kombu)*, grains, eggs, iodized salt	Iodine Deficiency	IodismHyperthyroidism
Chromium	0.035	Not Established	Involved in glucose and lipid metabolism, although its mechanisms of action in the body and the amounts needed for optimal health are not well-defined	Broccoli, grape juice (especially red), meat, whole grain products	Chromium Deficiency	Chromium Toxicity

HEALTH Minerals Roles in Biologi

Molybdenum	0.045	2; 0.6	The oxidases xanthine oxidase, aldehyde oxidase, and sulphite oxidase	Legumes, whole grains, nuts	Molybdenum Deficiency	Molybdenum Toxicity
Selenium	0.055	0.4; 0.3	Essential to activity ofantioxidant enzymes likeglutathione peroxidase	Brazil nuts, seafoods, organ meats, meats, grains, dairy products, eggs	Selenium Deficiency	Selenosis
RDA = Recommended Dietary Allowance			UL = Tolerable upper intake level; Figures shown are for adults age 31-50, male or female neither pregnant nor lactating		* One serving of seaweed exceeds the US UL of 1100 µg but not the 3000 µg UL set by Japan.	

Possibly Essential

Many ultratrace elements have been suggested as essential, but such claims have usually not been confirmed. Definitive evidence for efficacy comes from the characterization of a biomolecule containing the element with an identifiable and testable function. One problem with identifying efficacy is that some elements are innocuous at low concentrations and are pervasive (examples: silicon and nickel in solid and dust), so proof of efficacy is lacking because deficiencies are difficult to reproduce. Ultratrace elements of some minerals such as silicon and boron are known to have a role but the exact biochemical nature is unknown, and others such as arsenic are suspected to have a role in health, but with weaker evidence.

Element	Description	Excess
Bromine	Possibly important to basement membrane architecture and tissue development, as a needed catalyst to make collagen IV.	Bromism
Arsenic	Essential in rat, hamster, goat and chicken models, but no biochemical mechanism known in humans.	Arsenic Poisoning
Nickel	Nickel is an essential component of several enzymes, including urease and hydrogenase. Although not required by humans, some are thought to be required by gut bacteria, such as urease required by some varieties of Bifidobacterium. In humans, nickel may be a cofactor or structural component of certain metalloenzymes involved inhydrolysis, redox rections, and gene expression. Nickel deficiency depressed growth in goats, pigs, and sheep, and diminished circulating thyroid hormone concentration in rats.	Nickel Toxicity
Fluorine	Fluorine (as fluoride) is not considered an essential element because humans do not require it for growth or to sustain life. Research indicates that the primary dental benefit from fluoride occurs at the surface from topical exposure. Of the minerals in this table, fluoride is the only one for which the U.S. Institute of Medicine has established an adequate Intake.	Fluoride Poisoning
Boron	Boron is an essential plant nutrient, required primarily for maintaining the integrity of cell walls. Boron has been shown to be essential to complete the life cycle in representatives of all phylogenetic kingdoms, including the model species Danio rerio (zebrafish) and Xenopus laevis (African clawed frog). In animals, supplemental boron has been shown to reduce calcium excretion and activate vitamin D.	Nontoxic
Lithium	It is not known whether lithium has a physiological role in any species, but nutritional studies in mammals have indicated its importance to health, leading to a suggestion that it be classed as an essential trace element.	Lithium toxicity
Strontium	Strontium has been found to be involved in the utilization of calcium in the body. It has promoting action on calcium uptake into bone at moderate dietary strontium levels, but a rachitogenic (rickets-producing) action at higher dietary levels.	Rachitogenic (Causing Rickets)
Other	Silicon and vanadium have established, albeit specialized, biochemical roles as structural or functional cofactors in other organisms, and are possibly, even probably, used by mammals (including humans). By contrast, tungsten, the early lanthanides, and cadmium have specialized biochemical uses in certain lower organisms, but these elements appear not to be utilized by humans. Other elements considered to be possibly essential include aluminium, germanium, lead, rubidium, and tin.	Multiple

Macro-Minerals

Macro-Minerals	Deficiency	Toxicity	Sources	RDI
Calcium	Low bone mineral density, rickets, osteomalacia, osteoporosis.	Nausea, vomiting, constipation, dry mouth, thirst, increased urination, kidney stones.	Leafy green veges, legumes, molasses, sardines, trout, rhubarb, sesame seeds.	1.3 g
Phosphorus	Very rare.	Very Rare, soft tissue calcification.	Legumes, nuts, seeds, whole grains, eggs, fish, seafood, corn, wild rice.	1.25 g
Potassium	Not a result of insufficient dietary intake.	Occurs when kidneys can't deal with it, >18g, tingling of extremities, muscle weakness, nausea, vomiting, diarrhoea.	Sweet potato, tomato, leafy green veges, carrots, prunes, beans, molasses, fish, bananas, peaches, apricots, melon, potato, dates, raisins, mushrooms.	4.7 g
Magnesium	Very Rare.	None, supplements result in diarrhoea, low blood pressure, muscle weakness, cardiac arrest.	Legumes, nuts, seeds, whole grains, fruits, avocado.	420 mg
Salt (Sodium Chloride)	Increased fluid retention, nausea, vomiting, headache, cramps, fatigue, disorientation.	Increased fluid volume, nausea, vomiting, diarrhoea, abdominal cramps.	Any processed foods, whole grains, legumes, nuts, seeds, vegetables.	2.3 g

Micro-Minerals

Micro-Mineral	Deficiency	Toxicity	Sources	RDI
Iron	Anaemia	Poisoning in children, increased chronic disease risk, cardiovascular disease, cancer, neurodegenerative diseases.	Almonds, apricot, baked beans, dates, raisins, brown rice, leafy green veges, broccoli, pumpkin seeds, tuna, flounder, chicken, pork.	18 mg

Zinc	Decreased immunity, susceptible to infection, reduced incidents of infection.	Abdominal pain, diarrhoea, nausea, vomiting.	Mushrooms, spinach, sesame seeds, pumpkin seeds, peas, baked beans, cashews, whole grains, flounder, oats, chicken.	11 mg
Copper	Uncommon.	Rare, abdominal pain, nausea, vomiting, diarrhoea.	Mushrooms, leafy green veges, barley, sunflower seeds, navy beans, cashews, molasses, liver.	900 µg
Chromium	Impaired glucose tolerance and elevated circulating insulin.	DNA damage, possible kidney failure.	Lettuce, onion, tomato, whole grains, potatoes, mushrooms, oats, prunes, nuts.	35 µg
Fluoride	Increased dental caries.	Nausea, Abdominal pain, vomiting.	Water, tea, fish.	10 mg
Iodine	Impairs growth, decreased production of thyroid hormones.	Rare, burning mouth, throat and stomach, fever, diarrhoea.	Sea vegetables, iodized salt, eggs, strawberries, asparagus, leafy green veges.	150 µg
Selenium	Juvenile cardiomyopathy and chondrodystrophy.	Dermatologic lesions, brittle hair and nails, gastrointestinal disturbances, skin rash, fatigue.	Brazil Nuts, mushrooms, barley, salmon, whole grains, walnuts, eggs.	55 µg
Manganese	Rarely Observed.	From industrial exposure.	Leafy green veges, berries, lettuce, oats, brown rice.	2.3 mg
Molybdenum	Never Observed.	Very Rare.	Legumes, whole grains.	45 µg

5 Fitness

Fitness helps you to determine your current level of fitness with regards to your age, gender and culture and to help you maintain a proper level of fitness with regards to muscular strength, muscular endurance, cardiovascular endurance and flexibility. It also covers to a lesser extent your mental fitness, emotional fitness and spiritual fitness. Being fit and healthy is vital to maintaining your strength and vigour in stressful situations. This section details fitness levels, workout routines, muscle groups and endurance.

Subheadings

1. Fitness Level	**2. Muscular Strength**	**3. Muscular Endurance**	**4. Endurance**
5. Flexibility	**6. Exercises**	**7. Mental Fitness**	**8. Emotional Fitness**
9. Spiritual Fitness			

1 Fitness Level

Physical fitness is a state of health and well-being and, more specifically, the ability to perform aspects of sports, occupations and daily activities. Physical fitness is generally achieved through proper nutrition, moderate-vigorous physical exercise, and sufficient rest.

Before the industrial revolution, fitness was defined as the capacity to carry out the day's activities without undue fatigue. However, with automation and changes in lifestyles physical fitness is now considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations.

	Ideal BMI Height (m²) / Weight (kg) (1.88 x 1.88) / 73 = 20.65 BMI Underweight: < 18.5 Ideal: 18.5 to 24.9 Overweight: 25-29.9 Obese: 30+	**Aerobic Fitness** Heart rate at rest. A healthy heart rate is 60-100 bpm. Target Heart Rate Zone during intense workouts is - 50-75% more. **Target Heart Rates** 25yo - 98-146 bpm 35yo - 93-138 bpm 45yo - 88-131 bpm 55yo - 83-123 bpm 65yo - 78-116 bpm		

Body fat composition refers to the amount of fat on your body. A 45kg (100 pound) person with a 25% body fat composition will have a lean body mass of 34kg (75 pounds).

Fit	Men must have a body fat composition lower than 17 percent. Women must have a body fat composition lower than 24 percent. The average man tends to have about 18 to 24 percent body fat, while the average woman has 25 to 31 percent body fat.
Workout Routine	

2 Muscular Strength

This is the "power" that helps you to lift and carry heavy objects. Without muscular strength, your body would be weak and unable to keep up with the demands placed upon it.

Muscle Groups	

HEALTH | Fitness | Muscular

3 Muscular Endurance

Endurance is the ability of your muscles to perform contractions for extended periods of time. Rather than just lifting or carrying something for a few seconds, the muscles are used for minutes.

Travel Fitness	Practice carrying the BOB to get used to the weight, lighten the load if you can't travel very far at a time.

4 Cardiovascular Endurance

Cardiovascular endurance is your body's ability to keep up with exercise like running, jogging, swimming, cycling, and anything that forces your cardiovascular system (lungs, heart, blood vessels) to work for extended periods of time. Together, the heart and lungs fuel your body with the oxygen needed by your muscles, ensuring that they have the oxygen needed for the work they are doing.

5 Flexibility

Flexibility is one of the most important, yet often overlooked, components of physical fitness. Without flexibility, the muscles and joints would grow stiff and movement would be limited. Flexibility training ensures that your body can move through its entire range of motion without pain or stiffness.

6 Exercises

7 Mental Fitness

8 Emotional Fitness

9 Spiritual Fitness

6 Hygiene

Keeping clean will not only ward away illnesses but help you to feel refreshed and fairly normal in your day to day routine. Good hygiene will also discourage vermin and other parasites that feast on faeces and food.

Hygiene Items

This is a list of common hygiene items you should have handy.

Soap

Fatty acid content should be > 70%. Moisture content should be < 20%.

Toilet Paper

Imperative to stock unless you use a rag and water. The average person uses 8 sheets of toilet paper per trip or about 22 rolls per year.

Towel

For drying off when you become wet to prevent hypothermia.

HEALTH Hygiene Hygiene Items

Toothbrush

For cleaning your teeth to prevent dental conditions which can be some of the most painful.

Toothpaste

Toothpaste is a paste or gel used with a toothbrush to clean teeth, remove dental plaque, and improve oral hygiene.

Razor / Trimmer

For trimming body hair, trimming hair around wounds and cutting facial hair to help masks fit better.

Shampoo

Shampoo is used for cleaning hair and scalp.

Facewasher

A facewasher is used for washing the face and gentle skin cleansing.

Tampons

Tampons are used for absorbing menstrual flow internally during menstruation.

Quick Lime

Quick Line in a composting toilet covers excrement to avoid smells and scavengers. Spread at regular intervals over waste where covering with earth or ash isn't possible. Dangerous for eyes and respiratory tract, also reacts with water generating high temperatures and may explode.

Sawdust

Sawdust, in a composting toilet, is used to cover waste, absorb moisture, and facilitate the composting process.

House Hygiene

Hygiene methods that should be undertaken in a house during a disaster.

Dish Washing

Vacuuming

Clean Floors

Having clean floors can be the difference between survival and dying without access to medicine. You may have to get out of the house fast which is difficult when there's gear all over the floors, not to mention you could trip and fall on it. Clean floors will deter hiding places for pests and make it easier to stay healthy.

House Waste Discipline

Camp Hygiene

Hygiene methods that should be undertaken when bugging out or when outside.

Clothing Hygiene

Change clothes every few days and underwear everyday. Put clothes near the fire if they develop mould.

Food Hygiene

Tie food up away from the ground if keeping it another day. Never leave scraps near the campsite which could attract vermin. Gut and clean meat at least 100m from camp. Always wash hands before cooking and handling food.

Washing Dishes	
Toilet Hygiene	

Camp Waste Discipline

Waste Discipline	Waste discipline and sanitation are complementary actions that aid in preventative health and hygiene. Waste materials include grey water (sullage water, such as greasy and soapy water from kitchens and ablutions), human waste (faeces, urine), organic waste (kitchen food waste) and hazardous materials (lithium batteries, lead-acid vehicle batteries and POL). All human activity produces waste and if these are not disposed of correctly, the incidence of disease will increase and adversely affect efficiency.
Waste Disposal	Bury waste at least 20cm (8 in) deep and 100 metres (328ft) from water and camp. All categories of waste should be disposed of in a manner which avoids pollution of water supplies, prevents breeding of flies and rodents, and keep odours to an absolute minimum. Careful planning of camp sites and the types and duration of deployments provide a guide to waste disposal measures. There must be careful sitting of latrines and the deep burial of human waste to avoid the breeding of flies. Kitchen washing-up facilities, ablutions, showers, and facilities to dry clothing and aids to kitchen hygiene must all be kept clean and free of residues that can collect bacteria or create pollution.

Body Care

This section details how to keep various parts of your body clean in a disaster situation.

Washing	Wash regularly and keep clothes clean to keep diseases at bay. Removes the sweat worked up over the duration of the day. Check body during washing for ticks, parasites and bites. In snowy environments where water bathing isn't possible, build a sweat lodge to get clean.
Hair Maintenance	Hair can become a real knotty mess if long enough and not maintained properly. Poor hair hygiene can cause dandruff from the build-up of oil and can lead to skin infections such as Tinea Capitis.
Face Cleaning	After sleeping we often have a build up of Rheum around the eyes which should be removed.
Nose Cleaning	
Ear Cleaning	
Teeth Cleaning	Rinse mouth after every meal to remove some food debris. Brush teeth with a fluoride paste if possible, if no paste is available brush them simple to remove any food particles.
Armpit Cleaning	
Hand Hygiene	Wash your hands constantly when preparing food and after every toilet visit.
Fingernail Hygiene	Germs can hide under your nails so be sure to clean them thoroughly particularly when working with food.
Genital Cleaning	
Female Hygiene	
Bottom Cleaning	
Foot Care	
Toenail Hygiene	Toenails as with fingernails can trap dirt between them and the skin and being on the foot it's prone to more dirt than usual.

Blood & Bone Hygiene

Blood & Bone

Blood Cleaning	
Bone Removal	

Corpse Removal

Collect
Collect bodies and move them to the body holding area for storage ensuring mapping and records of the burial as well as the grave's contents. Separate body parts should be treated as individual bodies.

HEALTH | Hygiene | Blood & Bone Hygiene | Corpse Removal

Protect
Bodies should be stored individually in body bags. Where unavailable use plastic sheets or bed sheets to protect the dignity of the remains. Refrigerated storage is best. Personal documents shouldn't be separated from the remains.

Record
Keep a detailed record of every body.
- Unique Body Number
- Brought/Recorded by (name)
- From (exact location)
- Date
- Place the body is stored or buried
- Situation, taking pictures is recommended for identification

Track
Track each body/body bag and any related evidence. The burial site should be tagged and marked indelibly with the assigned body number. Ensure the number is visible to allow tracking of the remains. Ensure chain of custody is recorded about all movements.

Medical

General medical routines, tips and advice

"Whatever you do, always give 100%. Unless you're donating blood."
Bill Murray

Introduction

This category is for any generic medical knowledge such as blood groups, triage and medical equipment. The medical category is split up into 5 different sections as it would have been too big if it was left as one. The categories are: MEDICAL (This Category), MEDICATION, ILLNESS, INJURY and EMOTIONAL.

Purpose	The aim of MEDICAL is to provide a quick triage point for those who are sick or injured to be able to find the correct section quickly. It also goes into details about the human body and bodily systems to provide an overview of how it works. There is a section for the recommended medical items to have stored away for a disaster before finishing the section with information on quitting addictions and preparing to die.
Lost?	***** **QUICK TRIAGE (If you're injured or sick and looking for the correct section)** ***** ● **Sections under ILLNESS:** Radiation Sickness, Parasitic Infections, Bacterial Infections, Viral Infections, Fungal Infections, Altitude Sickness, Poisoning, Chemical Agents, Biological Agents. ● **Sections under INJURY:** Surface Wound & Bruises, Internal Injuries (Back Pain, Cerebral Hemorrhage, Bone Fractures, Dislocation, Concussion) Open Wounds, Avulsion, Burns, Environmental (Anaphylaxis, Heat Stroke, Hypothermia, Hyperthermia, Motion Sickness, Aero-otitis Media), Atmosphere (Asphyxiation, Drowning, Choking, Hypoxia, Carbon Monoxide Poisoning), Animal & Plant (Bites and Stings), Childbirth, Toothaches. ● **Sections under EMOTIONAL:** Depression, Anxiety, Stress, Confidence, Relaxation, Memory & Dementia, Grief & Loss, Postnatal Depression, New Parents, Body Image, Family & Friends and Healthy Living.

● For medications and recommended doses, see the MEDICATION section.
● For curing ailments naturally and herbal remedies, see the NATURAL REMEDIES section.
● For eating disorders, see the HEALTH > Nutrients section.
● See the GEAR > Household Gear > Home Clinic section for another list of medical supplies.

Contents

1 Medical Basics

This is basic medical advice and facts such as blood groups and triage.

Red Blood Cell Compatibility

Blood Type Rarities (Below)		O- Donor (Universal Donor)	O+ Donor	A- Donor	A+ Donor	B- Donor	B+ Donor	AB- Donor	AB+ Donor
6.6% Can receive blood from 6.6% of donors	O- Recipient	Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible
(Most Common Type) 37.4% Can receive blood from 44% of donors	O+ Recipient	Compatible	Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible
6.3% Can receive blood from 12.9% of donors	A- Recipient	Compatible	Not Compatible	Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible
35.7% Can receive blood from 86% of donors	A+ Recipient	Compatible	Compatible	Compatible	Compatible	Not Compatible	Not Compatible	Not Compatible	Not Compatible
1.5% Can receive blood from 8.1% of donors	B- Recipient	Compatible	Not Compatible	Not Compatible	Not Compatible	Compatible	Not Compatible	Not Compatible	Not Compatible
8.5% Can receive blood from 54% of donors	B+ Recipient	Compatible	Compatible	Not Compatible	Not Compatible	Compatible	Compatible	Not Compatible	Not Compatible
(Rarest Blood Type) 0.6% Can receive blood from 30% of donors	AB- Recipient	Compatible	Not Compatible	Compatible	Not Compatible	Compatible	Not Compatible	Compatible	Not Compatible
3.4% Can receive blood from 100% of donors	AB+ Recipient (Universal Recipient)	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible

Triage

Triage is the process of determining the priority of patients' treatments based on the severity of their condition. This rations patient treatment efficiently when resources are insufficient for all to be treated immediately.

- Those who are likely to live, regardless of what care they receive;
- Those who are unlikely to live, regardless of what care they receive;
- Those for whom immediate care might make a positive difference in outcome.

Black / Expectant	They are so severely injured that they will die of their injuries, possibly in hours or days (large-area burns, severe trauma, lethal radiation dose), or in life-threatening medical crisis that they are unlikely to survive given the care available (cardiac arrest, septic shock, severe head or chest wounds); their treatment is usually palliative, such as being given painkillers, to reduce suffering.
Red / Immediate	They require immediate surgery or other life-saving intervention, and have first priority for surgical teams or transport to advanced facilities; they "cannot wait" but are likely to survive with immediate treatment.
Yellow / Observation	Their condition is stable for the moment but requires watching by trained persons and frequent re-triage, will need hospital care (and would receive immediate priority care under "normal" circumstances). Their condition is stable for the moment but requires watching by trained persons and frequent re-triage, will need hospital care (and would receive immediate priority care under "normal" circumstances).
Green / Wait (Walking Wounded)	They will require a doctor's care in several hours or days but not immediately, may wait for a number of hours or be told to go home and come back the next day (broken bones without compound fractures, many soft tissue injuries).
White / Dismiss (Walking Wounded)	They have minor injuries; first aid and home care are sufficient, a doctor's care is not required. Injuries are along the lines of cuts and scrapes, or minor burns.

Tool Sterilization

Sterilization of equipment is vital prior to performing any medical operations - even minor ones. Equipment should be cleaned after every use to remove organic and inorganic matter from the surfaces.

Clean Yourself	Ensure you are clean before attempting to sterilize any equipment or it will be in vain. Use gloves where possible.
Oven Sterilization	Put equipment into sterile sealable bags. Heat in the oven at 300°F for 150 minutes+ or 340°F for an hour+.
Microwave Sterilization	The non-ionizing radiation destroys the microorganisms on the surface of the tools. The microwave stream process is performed on the tools and the heat is used to kill the organisms. It can be used quickly and reliably.
Hydrogen Peroxide	Sterilizing tools with hydrogen peroxide typically involves a specialized low-temperature process called Vaporized Hydrogen Peroxide (VHP) or gas plasma sterilization. Tools are first meticulously cleaned and dried. Then, they are placed in a sealed chamber where a hydrogen peroxide solution is vaporized and introduced under vacuum. This hydrogen peroxide vapor permeates the instruments, chemically oxidizing and destroying microorganisms. Finally, the vapor is vented and broken down into harmless water and oxygen, leaving no toxic residue on the now-sterile tools. This method is used for heat-sensitive instruments and cannot be replicated by simply soaking tools in household hydrogen peroxide.
Ozone Gas Sterilization	Ozone gas sterilization, used for heat-sensitive medical tools, begins with thoroughly cleaning and drying the instruments. They are then placed inside a sealed chamber where an ozone generator produces ozone (O3) gas from medical-grade oxygen or ambient air. This ozone gas fills the chamber, acting as a powerful oxidizing agent that penetrates and destroys microorganisms on the tool surfaces. After a specific exposure time, the ozone is safely converted back into oxygen, leaving no toxic residues and making the instruments ready for use.
Chemical Sterilization	• Peracetic Acid • Formaldehyde • Gluaraldehyde

Boiling Water	Gently boil the instruments for 30 minutes. May not kill all spores however and could rust instruments.
Bleach Soak	Make a 0.1% bleach solution using Bleach or Calcium Hypochlorite and let it sit for 15-30 minutes. Keep to the time or rusting will occur.
Isopropyl Alcohol	Soak in 70-100% isopropyl alcohol for 30 minutes. You an also ignite the solution. The flame and alcohol will sterilize the instruments but eventually causes damage to them.
Pressure Cooker	Clean equipment in a pressure cooker for a canning cycle length to kill all germs and bacteria. It's recommended to have a specific cooker set aside for this purpose.

Death Diagnosis

This section assists in identifying if someone is still alive or has passed away.

The three main signs of death or strong indications that a warm-blooded animal is no longer alive is:
- Respiratory arrest (no breathing)
- Cardiac arrest (no pulse)
- Brain death (no neuronal activity)

The stages that follow after death are:
- Pallor mortis, paleness which happens in the 15–120 minutes after death
- Algor mortis, the reduction in body temperature following death. This is generally a steady decline until matching the ambient temperature
- Rigor mortis, the limbs of the corpse become stiff (Latin rigor) and difficult to move or manipulate
- Livor mortis, a settling of the blood in the lower (dependent) portion of the body
- Putrefaction, the beginning signs of decomposition
- Decomposition, the reduction into simpler forms of matter, accompanied by a strong, unpleasant odor.
- Skeletonization, the end of decomposition, where all soft tissues have decomposed, leaving only the skeleton.
- Fossilization, the natural preservation of the skeletal remains formed over a very long period

The concept of death is a key to human understanding of the phenomenon. There are many scientific approaches and various interpretations of the concept. Additionally, the advent of life-sustaining therapy and the numerous criteria for defining death from both a medical and legal standpoint, have made it difficult to create a single unifying definition.

One of the challenges in defining death is in distinguishing it from life. As a point in time, death would seem to refer to the moment at which life ends. Determining when death has occurred is difficult, as cessation of life functions is often not simultaneous across organ systems. Such determination therefore requires drawing precise conceptual boundaries between life and death. This is difficult, due to there being little consensus on how to define life.

Today, where a definition of the moment of death is required, doctors and coroners usually turn to "brain death" or "biological death" to define a person as being dead; people are considered dead when the electrical activity in their brain ceases. It is presumed that an end of electrical activity indicates the end of consciousness. Suspension of consciousness must be permanent, and not transient, as occurs during certain sleep stages, and especially a coma. In the case of sleep, EEGs can easily tell the difference.

2 Supplies

A list of ideal recommended medical supplies covering medical, trauma and dental supplies.

Medical Supplies

A list of recommended medical supplies for a long-haul disaster.

First Aid Manual	Provides instructions and guidance for responding to medical emergencies and injuries.
Oral antibiotics	Medications taken by mouth to treat bacterial infections throughout the body.
Antibiotic Ointment and/or Antibacterial Herbal Salves	Topical preparations applied to skin wounds to prevent or treat bacterial infections.
Ace Bandages	Elastic wraps used to provide compression and support for sprains, strains, or to secure dressings. Have multiple sizes.
Kerlix or Rolled Gauze	Absorbent cotton rolls used for wound dressing, padding, or securing splints.
Steri Strips, Bandaids and Butterfly Bandages	Adhesive strips used to close small wounds, protect minor cuts, and approximate skin edges respectively. You should have hundreds of them in all different shapes and sizes.
Gauze/Dressings	Sterile or clean pads used to cover wounds, absorb exudate, and protect injuries. Heaps of sterile and non-sterile 4x4s. Include lots of non-adherent “telfa” pads so healing wounds won’t stick to the dressing
ABD pads	Large, thick, absorbent dressings used for heavy bleeding wounds or to cushion injuries.
Tapes	Adhesive strips used to secure dressings, bandages, or splints to the skin. Include duct tape and paper tape.
Quality Bandage Scissor/Trauma Shears	Specialized scissors designed to safely cut through clothing or bandages in emergency situations.
Pliable Splinting Material (“Sam” Splints)	Flexible, moldable splints used to immobilize injured limbs or suspected fractures. You should have everything from finger splints to 36 inch rolls that you can cut to size.
Moleskin with Padding	Adhesive material used to protect skin from friction, prevent blisters, or cushion painful areas.
Scalpels	Extremely sharp surgical blades used for precise cutting of skin or tissue in medical procedures. Blades #10, #11, #15 are the most popular

CPR Masks	Barrier devices used to safely deliver rescue breaths during cardiopulmonary resuscitation (CPR).
Paracord	Strong cordage that can be repurposed in medical emergencies for splinting, securing dressings, or creating slings.
Nitrile Gloves	Disposable, latex-free gloves worn as a barrier to protect both the caregiver and patient from contamination. Buy hypoallergenic to help prevent reactions.
Antibacterial Soap	Soap containing antibacterial agents used to cleanse skin and reduce bacterial load, especially before or after wound care.
Syringes	For wound irrigation, cleaning and precise measurement of liquids.
Antiseptics	Chemical agents applied to living tissue (skin) to reduce the possibility of infection. Hibiclens is excellent.
Universal Cervical Collar	A rigid device used to immobilize the neck and stabilize the cervical spine following suspected neck injuries.
OPAs (Oral Airways)	Devices inserted into the mouth to maintain an open airway by preventing the tongue from obstructing the throat. It prevents occlusion of an airway due to an allergic reaction while waiting for the epi-pen or Benadryl to kick in.
Alcohol Pads	Small pads saturated with alcohol used to disinfect skin prior to injections or to clean small wounds. It also makes a great firestarter.
N-95s Masks	Respirator masks designed to filter out airborne particles, including infectious agents, protecting the wearer's respiratory system.
Dermabond (Rx) / Super Glue	Medical-grade tissue adhesive (Dermabond) or household super glue (in emergency situations) used to close small, clean skin wounds.
Sutures	Threads used to surgically close wounds or to ligate blood vessels. 2-0 nylon (don't bother with 3-0 or smaller unless working with delicate skin on the face, eyelids, etc.)
Skin Stapler/Remover and 2 Adson Forceps	Tools used to quickly close skin wounds with surgical staples and to remove them, with forceps assisting in tissue manipulation.
Curved and Straight Kelly Clamps	Surgical instruments used to clamp blood vessels or grasp tissue, particularly for hemostasis. Also used to remove foreign objects from wounds.
Safety Pins	Simple pins used to secure bandages, slings, or clothing.
Magnifying Glass	Used to closely examine small wounds, splinters, or skin conditions. Can also be used to start fires.
Light Source	Provides illumination for examining injuries, performing procedures, or navigating in low-light conditions. Get a pen light, head lamp, glow stick and flashlight.
Fire Starter	Used to create fire, which can provide warmth, purify water, or sterilize small metal instruments. Include a container for boiling water in your supplies.
Mylar Blankets	Lightweight, reflective blankets used to retain body heat and prevent hypothermia in emergency situations.
Wool Blankets	Provide warmth and insulation to prevent or treat hypothermia, especially in cold environments.
Thermometer	Device used to measure body temperature to assess for fever or hypothermia.
Ammonia Inhalants	Small crushable ampules that release ammonia fumes, used to revive someone who has fainted or is lightheaded.
Cotton Sheets	Clean fabric used for covering patients, creating temporary bandages, or for general hygiene.
Clotting Powders	Topical agents applied to wounds to help stop bleeding by promoting blood coagulation. Quikclot, Celox – (cayenne pepper powder may help minor bleeding)
Tourniquet	A device used to compress a limb to stop severe arterial or venous bleeding, typically as a last resort. An example is the CAT Tourniquet, only use in severe bleeding that will not stop with direct pressure or clotting agents.
Snake Bite Kit	Contains items (like compression bandages or an extractor device) to administer first aid for snakebites, although modern protocols emphasize pressure immobilization over extraction. It must use within 30 seconds of the bite or it is useless.
Tweezers	Small forceps used for removing splinters, ticks, or foreign objects from wounds.
Re-useable GEL packs	Flexible packs that can be heated or cooled to apply thermotherapy for pain, swelling, or muscle aches.
Instant Ice Packs	Break the interior bag and shake to have instant cold.
Hand Warmers	Chemical packs that provide localized heat to warm hands and prevent frostbite in cold conditions. Expose the iron filings to oxygen to begin the reaction. They typically reach 55°c at their hottest.
Flashlight	Provides essential illumination for examining injuries, performing procedures such as gauging alertness, or moving safely in low light.
Pocket Defibrillator	A portable automated external defibrillator (AED) used to deliver an electric shock to restore normal heart rhythm in sudden cardiac arrest.
Aquatabs	Tablets containing a disinfectant (like sodium dichloroisocyanurate) used to purify drinking water in emergency situations.
Athlete's Foot Powder	Antifungal powder used to treat and prevent fungal infections on the feet. The powder lasts longer than creams.
Monistat Cream (or equivalent)	Antifungal cream used to treat yeast infections, commonly vaginal yeast infections in women.
Salt	Can be used medically as an antiseptic rinse for wounds, a gargle for sore throats, or for rehydration solutions.

Prescription Medications	Drugs prescribed by a medical professional to treat specific conditions, ranging from pain relief to chronic disease management.

Dental Care

Medical items to assist with dental care and toothaches.

Dental Mirror	Allows you to see around the mouth much easier.
Dental Extractors/Elevator	Used to loosen and remove teeth from their sockets.
Dental Filling Material	Substances like amalgam or composite resin used to restore the structure and function of teeth damaged by decay or trauma. You can buy commercial or mix your own from zinc oxide powder and 2 drops clove oil.
Baking soda, Hydrogen Peroxide and 2 drops of Peppermint Oil	A homemade mixture sometimes used as a mouth rinse for general gum hygiene or temporary relief of minor mouth irritation.
Hydrogen Peroxide	Makes a great oral mouthwash/gargle for gum swelling and irritations. Do not use on open skin wounds after the initial wound cleaning! Hydrogen peroxide may damage healing cells inside an open skin wound.
Extra Essential Clove Bud Oil	A natural analgesic and antiseptic used topically to temporarily relieve toothache pain due to its eugenol content. Apply to the offending gum directly.
Toothbrush and Toothpaste	To keep the teeth clean and prevent future problems.
Dental Floss	A thin thread used to remove plaque and food particles from between teeth and under the gumline where a toothbrush cannot reach.

Misc Items

Any other medical items which may be of use.

Eye Cup	A small, cup-shaped device used to rinse or apply medication to the eye.
Eye Wash	A sterile solution used to rinse irritants, foreign bodies, or chemicals from the eyes.
Eye Pads / Eye Patch	Helps to prevent further infection of the eye and allows an infected eye to heal.
Claritin (Non-Drowsy Antihistamine)	An oral medication used to relieve allergy symptoms like sneezing, runny nose, and itching without causing drowsiness.
Benadryl (Drowsy Antihistamine)	An oral medication primarily used to relieve allergy symptoms, stings, reduce itching, or as a sleep aid, with a common side effect of drowsiness.
Epi-pen (Rx)	A pre-filled auto-injector of epinephrine used to treat severe allergic reactions (anaphylaxis) as an emergency measure.
Aspirin, Tylenol, and Ibuprofen	Common over-the-counter medications used to reduce pain, fever, and inflammation (Aspirin and Ibuprofen also have anti-inflammatory properties).
Imodium	An oral medication used to treat diarrhea by slowing down bowel movements.
Hydro-Cortisone Cream	A topical corticosteroid cream used to reduce skin inflammation, itching, and irritation from conditions like rashes, insect bites, or eczema.
Vaseline/Petroleum Jelly	A topical ointment used to protect and moisturize skin, aid in wound healing, and prevent friction. Great to make non-stick dressings.
Aloe Vera	A gel derived from the aloe plant used topically to soothe minor burns, skin irritations, and promote healing.
Gatorade or Rehydration Tablets/Powders	Oral solutions or mixes used to replenish electrolytes and fluids lost due to dehydration from vomiting, diarrhea, or intense physical activity.
Multi-vitamins / Vitamin C	Dietary supplements used to ensure adequate intake of essential vitamins for overall health or to boost the immune system. Include zinc, and other supplements to strengthen the immune system

3 First Aid

First aid is the first and immediate assistance given to any person suffering from either a minor or serious illness or injury, with care provided to preserve life, prevent the condition from worsening, or to promote recovery. It includes initial intervention in a serious condition prior to professional medical help being available, such as performing cardiopulmonary resuscitation (CPR) while waiting for an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. First aid is generally performed by someone with basic medical training.

ABC

ABC and its variations (DRSABCD) are initialism mnemonics for essential steps used by both medical professionals and lay persons (such as first aiders) when dealing with a patient. In its original form it stands for Airway, Breathing, and Circulation. The protocol was originally developed as a memory aid for rescuers performing cardiopulmonary resuscitation, and the most widely known use of the initialism is in the care of the unconscious or unresponsive patient, although it is also used as a reminder of the priorities for assessment and treatment of patients in many acute medical and trauma situations, from first-aid to hospital medical treatment. Airway, breathing, and circulation are all vital for life, and each is required, in that order, for the next to be effective.

A Airway	**Airway** Open their mouth - if foreign material is present Place them in the recovery position. Clear their airway with your fingers
B Breathing	**Breathing** Check for breathing - look, listen and feel. **Normal Breathing:** Place in the recovery position. **Not Normal Breathing:** If they aren't breathing normally, check the circulation (medical experts) or begin CPR (below).
C Circulation	**Circulation (In trained medical personnel, otherwise it can stand for CPR for the lay-person)** Once oxygen can be delivered to the lungs by a clear airway and efficient breathing, there needs to be a circulation to deliver it to the rest of the body.

DRSABCD

DRSABCD incorporates the additional S for "shout" (in the UK) or "send for help" (in Australia), and D for "defibrillation".

D Danger	**Danger** Ensure the area is safe for yourself, others and the patient.
R Response	**Response** Check for a response - ask their name - squeeze their shoulders. **Response** - Make them comfortable and monitor their response. **No Response** - Continue below
S Send for Help	**Send for Help** Call '911' (America) or '000' (Australia) for an ambulance or ask another person the make the call. Request them to find you an AED if available. Remember the relevant number for your country.
A Airway	**Airway** Open their mouth - if foreign material is present Place them in the recovery position. Clear their airway with your fingers

- Airway management takes precedence over any other injury including spinal.
- Ideally leave the victim in the position they are found unless they are demonstrating signs of an obstructed airway – gentle handling at all times if they must be moved.
- To clear the airway – open mouth and turn head to allow drainage
- If airway becomes compromised in resuscitation roll onto side to allow clearance and then reassess for responsiveness.
- Remember your airway opening manoeuvres – head tilt chin lift in adults, neutral position in infants.

B Breathing	**Breathing** Check for breathing - look, listen and feel. **Normal Breathing:** Place in the recovery position. **Not Normal Breathing:** If they aren't breathing normally, start CPR (below).

Causes of ineffective breathing include – central causes (e.g. opiates, brainstem injury)/ acute upper airway obstruction / chest wall paralysis or diaphragmatic paralysis / intrapulmonary cause / drowning / suffocation.
Principles in BLS – Look, listen and feel for effective breathing for 10 seconds – if absent declare cardiac arrest. Caution with agonal breaths or see saw breathing where there is a partial obstruction.

Rescue breath technique:
- Open the airway using head tilt chin lift manoeuvre or jaw thrust
- Place mouth over open mouth with nostrils pinched (with care not to lose tilt).
- Give one breath of 1 second duration to give adequate volume to give chest rise
- Causes of failure – obstruction, insufficient air or poor seal
- Alternative methods include: mouth to nose (operator choice, infants, trismus), mouth to mask, mouth to neck stoma.

C CPR	**CPR** Start CPR - 30 chest compressions : 2 breaths Continue CPR until help arrives or the patient recovers.

- Compressions should be started in BLS protocol if victim is unresponsive and has abnormal breathing including agonal respirations. Pulse check is no longer required though it can be done if trained and comfortable to do so.
- Bystander CPR is actively encouraged and should be coached
- Recommended ration remains 30:2 – ARC recommends for all ages though other resources suggest 15:2 in paediatrics. This is a BLS recommendation for simplification. If an expert is present do a ratio of 15:2 in children.
- Compression only CPR is also an option – see links below demonstrating
- All rescuers should perform compressions and if trained and willing, they should be encouraged to provide rescue breaths.
- Paediatric arrests are often hypoxic therefore if there are two people 15:2 should be encouraged and rescue breaths should in particular be encouraged. Consider further rescue breaths prior to going for help
- Location: lower half of the sternum – consensus for simplicity (lower ineffective with risk of visceral injury, higher will be ineffective)
- Rate: 100-120 BPM "Staying alive"

MEDICAL First Aid DRSABCD

- Depth: Adult: 5cm (2inches) to max of 6cm. Paediatric: 1/3rd of depth or 4cm infants, 5cm children
- Allow for chest recoil and avoid leaning on the chest
- Minimise interruptions
- Multiple rescuers – rotate roles – evidence would suggest fatigue of compressor at around 1 minute though only realised by compressor at 5 minutes. Guidelines suggest rotation every 2 minutes. Ensure early help and early access to AED as priority.
- Early defibrillation remains a priority: Defibrillation within 3-5 minutes can produce survival rates as high as 50-70%.
- Continue compressions post defibrillation – the AED will generally prompt you.
- Pulse checks in BLS are not recommended. Rescuers can look for signs of life every 2 minutes / rhythm check if AED prompts you (AED generally has a 2 minute timer between rhythm checks)

D **Defibrillator**	**Defibrillator** Apply defibrilator if available and follow the voice prompts.

AED training is generally required. The machine verbally talks the rescuer through the process of its use when the power button is activated. Pads placement is demonstrated in pictures on the back of them. The end cable from the pads is inserted into the AED. The AED will announce that it is analysing the rhythm and will request hands off the patient i.e. to cease compressions and to stand clear. It will advise if a shock is required or not.

Should a shock be required the AED will charge and deliver this shock. The rescuer's priority is to maintain scene safety and to ensure all other parties stand clear of the activated shocking defibrillator. Chest compressions must be resumed after a shock is delivered or if no shock is advised.

Continue until the patient responds OR you are unable to continue OR a health care professional arrives and takes over care or directs cessation

Risks

- Is there a risk to the victim if they are not in cardiac arrest and they receive chest compressions? The consensus guideline was based on low quality evidence but a high level recommendation. ILCOR argue on a risk benefit basis that the risk of omitting CPR to those in cardiac arrest is greater than causing injury to the non-arrested patient. Observational studies on those who received CPR in the absence of cardiac arrest report a low degree of complications.
- Is there a risk to the rescuer? There is a documented low-risk of disease transmission based on a systematic review done in training and clinical scenarios. However there is some suggestion that using barriers such as face mask reduce bacterial transmission to the rescuer therefore if available this is recommended.

CPR

The basic application of the ABC principle is in first aid, and is used in cases of unconscious patients to start treatment and assess the need for, and then potentially deliver, cardiopulmonary resuscitation.

In this simple usage, the rescuer is required to open the airway (using a technique such as "head tilt - chin lift"), then check for normal breathing. These two steps should provide the initial assessment of whether the patient will require CPR or not.

In the event that the patient is not breathing normally, the current international guidelines (set by the International Liaison Committee on Resuscitation or ILCOR) indicate that chest compressions should be started.

Previously, the guidelines indicated that a pulse check should be performed after the breathing was assessed, and this made up the 'circulation' part of the initialism, but this pulse check is no longer recommended for lay rescuers. Some trainers continue to use circulation as the label for the third step in the process, since performing chest compressions is effectively artificial circulation, and when assessing patients who are breathing, assessing 'circulation' is still important. However, some trainers now use the C to mean Compressions in their basic first aid training.

Mouth-to-Mouth Resuscitation

Mouth-to-mouth resuscitation, a form of artificial ventilation, is the act of assisting or stimulating respiration in which a rescuer presses their mouth against that of the victim and blows air into the person's lungs. Artificial respiration takes many forms, but generally entails providing air for a person who is not breathing or is not making sufficient respiratory effort on their own. It is used on a patient with a beating heart or as part of cardiopulmonary resuscitation (CPR) to achieve the internal respiration.

Pulmonary ventilation (and hence external respiration) is achieved through manual insufflation of the lungs either by the rescuer blowing into the patient's lungs, or by using a mechanical device to do so. This method of insufflation has been proved more effective than methods which involve mechanical manipulation of the patient's chest or arms, such as the Silvester method. It is also known as expired air resuscitation (EAR), expired air ventilation (EAV), rescue breathing, or colloquially the kiss of life. It was introduced as a life saving measure in 1950.

Insufflation, also known as 'rescue breaths' or 'ventilations', is the act of mechanically forcing air into a patient's respiratory system. This can be achieved via a number of methods, which will depend on the situation and equipment available. All methods require good airway management to perform, which ensures that the method is effective. These methods include:

- Mouth-to-mouth - This involves the rescuer making a seal between his or her mouth and the patient's mouth and 'blowing', to pass air into the patient's body
- Mouth-to-nose - In some instances, the rescuer may need or wish to form a seal with the patient's nose. Typical reasons for this include maxillofacial injuries, performing the procedure in water or the remains of vomit in the mouth
- Mouth-to-mouth and nose - Used on infants (usually up to around 1 year old), as this forms the most effective seal
- Mouth-to-mask – Most organisations recommend the use of some sort of barrier between rescuer and patient to reduce cross infection risk. One popular type is the 'pocket mask'. This may be able to provide higher tidal volumes than a Bag Valve Mask.

Most training organisations recommend that in any of the methods involving mouth-to-patient, that a protective barrier is used, to minimise the possibility of cross infection (in either direction). Barriers available include pocket masks and keyring-sized face shields. These barriers are an example of Personal Protective Equipment to guard the face against splashing, spraying or splattering of blood or other potentially infectious materials.

Mouth-to-Mouth on Children Under 8

Mouth-to-Mouth-and-Nose Resuscitation on a Child Under Age 8 or on an Infant

1	Place the child on a hard, flat surface.
2	Look into the mouth and throat to ensure that the airway is clear. If an object is present, try to sweep it out with your fingers. If unsuccessful and the object is blocking the airway, apply the Heimlich maneuver. If vomiting occurs, turn the child onto his or her side and sweep out the mouth with two fingers.
3	Tilt the head back slightly to open the airway.
4	Place your mouth tightly over the nose and mouth. Blow two quick, shallow breaths (smaller breaths than you would give to an adult). Watch for the chest to rise.
5	Remove your mouth. Look for the chest to fall as the child exhales.

6	Listen for the sounds of breathing. Feel for the child's breath on your cheek. If breathing does not start on its own, repeat the procedure.

Mouth-to-Mouth on Adults and Children 8+

Mouth-to-Mouth Resuscitation on a Child Age 8 or Older or on an Adult

1	Make sure the person is lying on a hard, flat surface. Look into the mouth and throat to ensure that the airway is clear. If an object is present, try to sweep it out with your fingers (wear disposable surgical gloves if they are available). Apply the Heimlich maneuver if unsuccessful and the object is blocking the airway. If vomiting occurs, turn the person on his or her side and sweep out the mouth with two fingers. Do not place your finger in the mouth if the person is rigid or is having a seizure.
2	Tilt the head back slightly to open the airway. Put upward pressure on the jaw to pull it forward.
3	Pinch the nostrils closed with thumb and index finger. Place your mouth tightly over the person's mouth. Use a mouthpiece if one is available. Blow two quick breaths and watch for the person's chest to rise.
4	Release the nostrils. Look for the person's chest to fall as he or she exhales. Listen for the sounds of breathing. Feel for the person's breath on your cheek. If the person does not start breathing on his or her own, repeat the procedure.

AED

An AED, or Automated External Defibrillator, is used to help those experiencing sudden cardiac arrest. It's a sophisticated, yet easy-to-use, medical device that can analyze the heart's rhythm and, if necessary, deliver an electrical shock, or defibrillation, to help the heart re-establish an effective rhythm.

Sudden cardiac arrest is among the leading causes of death in the United States. More than 350,000 people will suffer a cardiac arrest this year. Currently, the only way to restore a regular heart rhythm during cardiac arrest is to use an AED. Of course, you can – and should – request the assistance of trained medical professionals. However, because the average response time for first responders once 911 / 000 is called is 8-12 minutes, and for each minute defibrillation is delayed, the odds of survival are reduced by approximately 10%, having access to and AED and knowing how to use one, is critical.

Using an AED

1	Complete the CHECK and CALL steps.
2	As soon as an AED is available, turn it on and follow the voice prompts.
3	Remove clothing and attach pads correctly ● Remove all clothing covering the chest. If necessary, wipe the chest dry ● Place one pad on the upper right side of the chest ● Place the other pad on the lower left side of the chest, a few inches below the left armpit Note: If the pads may touch, place one pad in the middle of the chest and the other pad on the back, between the shoulder blades
4	Plug the pad connector cable into the AED, if necessary
5	Prepare to let the AED analyze the heart's rhythm ● Make sure no one is touching the person ● Say, "CLEAR!" in a loud, commanding voice
6	Deliver a shock, if the AED determines one is needed ● Make sure no one is touching the person ● Say, "CLEAR!" in a loud, commanding voice ● Push the "shock" button to deliver the shock
7	After the AED delivers the shock, or if no shock is advised, immediately start CPR, beginning with compressions.

4 Body Systems

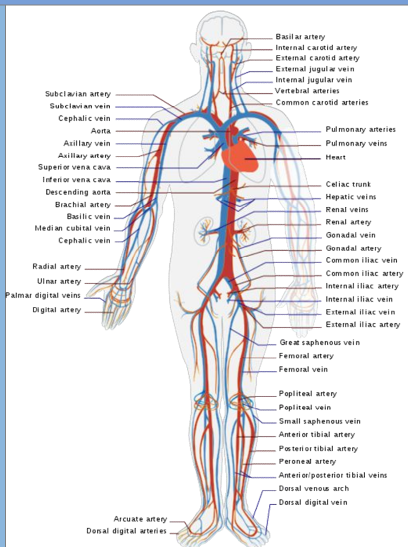
Details of the main systems of the human body. Each system is covered in greater detail below.

Circulatory System	Circulates blood around the body via the heart, arteries and veins, delivering oxygen and nutrients to organs and cells and carrying their waste products away.
Digestive System	System to absorb nutrients and remove waste via the gastrointestinal tract, including the mouth, oesophagus, stomach and intestines.
Excretory System	Eliminates waste from the body.
Endocrine System	Influences the function of the body using hormones.
Integumentary System	Skin, hair, nails, sweat and other exocrine glands.
Exocrine System	Skin, hair, nails, sweat and other exocrine glands.
Immune System	Defends the body against pathogens that may endanger the body.
Lymphatic System	The system comprising a network of lymphatic vessels that carry a clear fluid called lymph.
Muscular System	Enables the body to move using muscles.
Nervous System	Collects and processes information from the senses via nerves and the brain and tells the muscles to contract to cause physical actions.
Urinary System	The system where the kidneys filter blood to produce urine.
Reproductive System	The sex organs required for the production of offspring.
Respiratory System	Brings air into and out of the lungs to absorb oxygen and remove carbon dioxide.

Skeletal System	Bones maintain the structure of the body and its organs.
Hematopoietic System	Creates the cells that travel in blood.

Subheadings

1 Circulatory System



The circulatory system, also called the cardiovascular system or the vascular system, is an organ system that permits blood to circulate and transport nutrients (such as amino acids and electrolytes), oxygen, carbon dioxide, hormones, and blood cells to and from the cells in the body to provide nourishment and help in fighting diseases, stabilize temperature and pH, and maintain homeostasis.

The circulatory system includes the lymphatic system, which circulates lymph. The passage of lymph takes much longer than that of blood. Blood is a fluid consisting of plasma, red blood cells, white blood cells, and platelets that is circulated by the heart through the vertebrate vascular system, carrying oxygen and nutrients to and waste materials away from all body tissues.

Lymph is essentially recycled excess blood plasma after it has been filtered from the interstitial fluid (between cells) and returned to the lymphatic system. The cardiovascular (from Latin words meaning "heart" and "vessel") system comprises the blood, heart, and blood vessels. The lymph, lymph nodes, and lymph vessels form the lymphatic system, which returns filtered blood plasma from the interstitial fluid (between cells) as lymph.

The circulatory system of the blood is seen as having two components, a systemic circulation and a pulmonary circulation. While humans, as well as other vertebrates, have a closed cardiovascular system (meaning that the blood never leaves the network of arteries, veins and capillaries), some invertebrate groups have an open cardiovascular system.

The lymphatic system, on the other hand, is an open system providing an accessory route for excess interstitial fluid to be returned to the blood. The more primitive, diploblastic animal phyla lack circulatory systems. Many diseases affect the circulatory system. This includes cardiovascular disease, affecting the cardiovascular system, and lymphatic disease affecting the lymphatic system. Cardiologists are medical professionals which specialise in the heart, and cardiothoracic surgeons specialise in operating on the heart and its surrounding areas. Vascular surgeons focus on other parts of the circulatory system.

Cardiovascular System

The essential components of the human cardiovascular system are the heart, blood and blood vessels. It includes the pulmonary circulation, a "loop" through the lungs where blood is oxygenated; and the systemic circulation, a "loop" through the rest of the body to provide oxygenated blood. The systemic circulation can also be seen to function in two parts – a macrocirculation and a microcirculation. An average adult contains five to six quarts (roughly 4.7 to 5.7 litres) of blood, accounting for approximately 7% of their total body weight. Blood consists of plasma, red blood cells, white blood cells, and platelets. Also, the digestive system works with the circulatory system to provide the nutrients the system needs to keep the heart pumping. The cardiovascular systems of humans are closed, meaning that the blood never leaves the network of blood vessels. In contrast, oxygen and nutrients diffuse across the blood vessel layers and enter interstitial fluid, which carries oxygen and nutrients to the target cells, and carbon dioxide and wastes in the opposite direction. The other component of the circulatory system, the lymphatic system, is open.

Arteries
Oxygenated blood enters the systemic circulation when leaving the left ventricle, through the aortic semilunar valve. The first part of the systemic circulation is the aorta, a massive and thick-walled artery. The aorta arches and gives branches supplying the upper part of the body after passing through the aortic opening of the diaphragm at the level of thoracic ten vertebra, it enters the abdomen. Later it descends down and supplies branches to abdomen, pelvis, perineum and the lower limbs. The walls of aorta are elastic. This elasticity helps to maintain the blood pressure throughout the body. When the aorta receives almost five litres of blood from the heart, it recoils and is responsible for pulsating blood pressure. Moreover, as aorta branches into smaller arteries, their elasticity goes on decreasing and their compliance goes on increasing.

Capillaries
Arteries branch into small passages called arterioles and then into the capillaries. The capillaries merge to bring blood into the venous system.

Veins
Capillaries merge into venules, which merge into veins. The venous system feeds into the two major veins: the superior vena cava – which mainly drains tissues above the heart – and the inferior vena cava – which mainly drains tissues below the heart. These two large veins empty into the right atrium of the heart.

Portal Veins
The general rule is that arteries from the heart branch out into capillaries, which collect into veins leading back to the heart. Portal veins are a slight exception to this. In humans the only significant example is the hepatic portal vein which combines from capillaries around the gastrointestinal tract where the blood absorbs the various products of digestion; rather than leading directly back to the heart, the hepatic portal vein branches into a second capillary system in the liver.

Heart
The heart pumps oxygenated blood to the body and deoxygenated blood to the lungs. In the human heart there is one atrium and one ventricle for each circulation, and with both a systemic and a pulmonary circulation there are four chambers in total: left atrium, left ventricle, right atrium and right ventricle. The right atrium is the upper chamber of the right side of the heart. The blood that is returned to the right atrium is deoxygenated (poor in oxygen) and passed into the right ventricle to be pumped through the pulmonary artery to the lungs for re-oxygenation and removal of carbon dioxide. The left atrium receives newly oxygenated blood from the lungs as well as the pulmonary vein which is passed into the strong left ventricle to be pumped through the aorta to the different organs of the body.

Coronary Vessels
The heart itself is supplied with oxygen and nutrients through a small "loop" of the systemic circulation and derives very little from the blood contained within the four chambers. The coronary circulation system provides a blood supply to the heart muscle itself. The coronary circulation begins near the origin of the aorta by two coronary arteries: the right coronary artery and the left coronary artery. After nourishing the heart muscle, blood returns through the coronary veins into the coronary sinus and from this one into the right atrium. Back flow of blood through its opening during atrial systole is prevented by the Thebesian valve. The smallest cardiac veins drain directly into the heart chambers.

Lungs
The circulatory system of the lungs is the portion of the cardiovascular system in which oxygen-depleted blood is pumped away from the heart, via the pulmonary artery, to the lungs and returned, oxygenated, to the heart via the pulmonary vein. Oxygen deprived blood from the superior and inferior vena cava enters the right atrium of the heart and flows through the tricuspid valve (right atrioventricular valve) into the right ventricle, from which it is then pumped through the pulmonary semilunar valve into the pulmonary artery to the lungs. Gas exchange occurs in the lungs, whereby CO_2 is released from the blood, and oxygen is absorbed. The pulmonary vein returns the now oxygen-rich blood to the left atrium. A separate system known as the bronchial circulation supplies blood to the tissue of the larger airways of the lung.

Systemic Circulation
Systemic circulation is the portion of the cardiovascular system which transports oxygenated blood away from the heart through the aorta from the left ventricle where the blood has been previously deposited from pulmonary circulation, to the rest of the body, and returns oxygen-depleted blood back to the heart.

Brain
The brain has a dual blood supply that comes from arteries at its front and back. These are called the "anterior" and "posterior" circulation respectively. The anterior circulation arises from the internal carotid arteries and supplies the front of the brain. The posterior circulation arises from the vertebral arteries, and supplies the back of the brain and brainstem. The circulation from the front and the back join together (anastomise) at the Circle of Willis.

Kidneys
The renal circulation receives around 20% of the cardiac output. It branches from the abdominal aorta and returns blood to the ascending vena cava. It is the blood supply to the kidneys, and contains many specialized blood vessels.

Lymphatic System
The lymphatic system is part of the circulatory system. It is a network of lymphatic vessels and lymph capillaries, lymph nodes and organs, and lymphatic tissues and circulating lymph. One of its major functions is to carry the lymph, draining and returning interstitial fluid back towards the heart for return to the cardiovascular system, by emptying into the lymphatic ducts. Its other main function is in the adaptive immune system.

Function

About 98.5% of the oxygen in a sample of arterial blood in a healthy human, breathing air at sea-level pressure, is chemically combined with hemoglobin molecules. About 1.5% is physically dissolved in the other blood liquids and not connected to hemoglobin. The hemoglobin molecule is the primary transporter of oxygen in mammals and many other species.

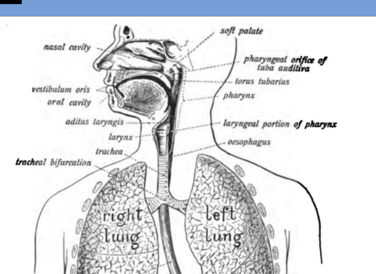
Clinical Significance

Many diseases affect the circulatory system. These include a number of cardiovascular diseases, affecting the cardiovascular system, and lymphatic diseases affecting the lymphatic system. Cardiologists are medical professionals which specialise in the heart, and cardiothoracic surgeons specialise in operating on the heart and its surrounding areas. Vascular surgeons focus on other parts of the circulatory system.

Cardiovascular Disease
Diseases affecting the cardiovascular system are called cardiovascular disease. Many of these diseases are called "lifestyle diseases" because they develop over time and are related to a person's exercise habits, diet, whether they smoke, and other lifestyle choices a person makes. Atherosclerosis is the precursor to many of these diseases. It is where small atheromatous plaques build up in the walls of medium and large arteries. This may eventually grow or rupture to occlude the arteries. It is also a risk factor for acute coronary syndromes, which are diseases which are characterised by a sudden deficit of oxygenated blood to the heart tissue. Atherosclerosis is also associated with problems such as aneurysm formation or splitting ("dissection") of arteries. Another major cardiovascular disease involves the creation of a clot, called a "thrombus". These can originate in veins or arteries. Deep venous thrombosis, which mostly occurs in the legs, is one cause of clots in the veins of the legs, particularly when a person has been stationary for a long time. These clots may embolise, meaning travel to another location in the body. The results of this may include pulmonary embolus, transient ischaemic attacks, or stroke. Cardiovascular diseases may also be congenital in nature, such as heart defects or persistent fetal circulation, where the circulatory changes that are supposed to happen after birth do not. Not all congenital changes to the circulatory system are associated with diseases, a large number are anatomical variations.

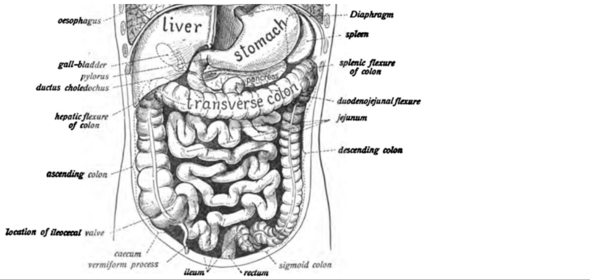
Investigations
The function and health of the circulatory system and its parts are measured in a variety of manual and automated ways. These include simple methods such as those that are part of the cardiovascular examination, including the taking of a person's pulse as an indicator of a person's heart rate, the taking of blood pressure through a sphygmomanometer or the use of a stethoscope to listen to the heart for murmurs which may indicate problems with the heart's valves. An electrocardiogram can also be used to evaluate the way in which electricity is conducted through the heart. Other more invasive means can also be used. A cannula or catheter inserted into an artery may be used to measure pulse pressure or pulmonary wedge pressures. Angiography, which involves injecting a dye into an artery to visualise an arterial tree, can be used in the heart (coronary angiography) or brain. At the same time as the arteries are visualised, blockages or narrowings may be fixed through the insertion of stents, and active bleeds may be managed by the insertion of coils. An MRI may be used to image arteries, called an MRI angiogram. For evaluation of the blood supply to the lungs a CT pulmonary angiogram may be used.

2 Digestive System



The human digestive system consists of the gastrointestinal tract plus the accessory organs of digestion (the tongue, salivary glands, pancreas, liver, and gallbladder). Digestion involves the breakdown of food into smaller and smaller components, until they can be absorbed and assimilated into the body.

The process of digestion has three stages. The first stage is the cephalic phase of digestion which begins with gastric secretions in response to the sight and smell of food. This stage includes the mechanical breakdown of food by chewing, and the chemical breakdown by digestive enzymes, that takes place in the mouth. 'Saliva contains digestive enzymes called amylase, and lingual lipase, secreted by the salivary glands and serous glands on the tongue.



The enzymes start to break down the food in the mouth. Chewing, in which the food is mixed with saliva, begins the mechanical process of digestion. This produces a bolus which can be swallowed down the oesophagus to enter the stomach. In the stomach the gastric phase of digestion takes place.

The food is further broken down by mixing with gastric acid until it passes into the duodenum, in the third intestinal phase of digestion, where it is mixed with a number of enzymes produced by the pancreas. Digestion is helped by the chewing of food carried out by the muscles of mastication, the tongue, and the teeth, and also by the contractions of peristalsis, and segmentation. Gastric acid, and the production of mucus in the stomach, are essential for the continuation of digestion.

Peristalsis is the rhythmic contraction of muscles that begins in the oesophagus and continues along the wall of the stomach and the rest of the gastrointestinal tract. This initially results in the production of chyme which when fully broken down in the small intestine is absorbed as chyle into the lymphatic system. Most of the digestion of food takes place in the small intestine. Water and some minerals are reabsorbed back into the blood in the colon of the large intestine. The waste products of digestion (faeces) are defecated from the anus via the rectum.

Components

There are several organs and other components involved in the digestion of food. The organs known as the accessory digestive organs are the liver, gall bladder and pancreas. Other components include the mouth, salivary glands, tongue, teeth and epiglottis. The largest structure of the digestive system is the gastrointestinal tract (GI tract). This starts at the mouth and ends at the anus, covering a distance of about nine (9) metres. The largest part of the GI tract is the colon or large intestine. Water is absorbed here and the remaining waste matter is stored prior to defecation. Most of the digestion of food takes place in the small intestine which is the longest part of the GI tract.

A major digestive organ is the stomach. Within its mucosa are millions of embedded gastric glands. Their secretions are vital to the functioning of the organ. There are many specialised cells of the GI tract. These include the various cells of the gastric glands, taste cells, pancreatic duct cells, enterocytes and microfold cells. Some parts of the digestive system are also part of the excretory system, including the large intestine.

Mouth

The mouth is the first part of the upper gastrointestinal tract and is equipped with several structures that begin the first processes of digestion. These include salivary glands, teeth and the tongue. The mouth consists of two regions; the vestibule and the oral cavity proper. The vestibule is the area between the teeth, lips and cheeks, and the rest is the oral cavity proper. Most of the oral cavity is lined with oral mucosa, a mucous membrane that produces a lubricating mucus, of which only a small amount is needed. Mucous membranes vary in structure in the different regions of the body but they all produce a lubricating mucus, which is either secreted by surface cells or more usually by underlying glands. The mucous membrane in the mouth continues as the thin mucosa which lines the bases of the teeth. The main component of mucus is a glycoprotein called mucin and the type secreted varies according to the region involved. Mucin is viscous, clear, and clinging. Underlying the mucous membrane in the mouth is a thin layer of smooth muscle tissue and the loose connection to the membrane gives it its great elasticity.

It covers the cheeks, inner surfaces of the lips, and floor of the mouth, and the mucin produced is highly protective against tooth decay. The roof of the mouth is termed the palate and it separates the oral cavity from the nasal cavity. The palate is hard at the front of the mouth since the overlying mucosa is covering a plate of bone; it is softer and more pliable at the back being made of muscle and connective tissue, and it can move to swallow food and liquids. The soft palate ends at the uvula. The surface of the hard palate allows for the pressure needed in eating food, to leave the nasal passage clear. The opening between the lips is termed the oral fissure, and the opening into the throat is called the fauces. At either side of the soft palate are the palatoglossus muscles which also reach into regions of the tongue. These muscles raise the back of the tongue and also close both sides of the fauces to enable food to be swallowed. Mucus helps in the mastication of food in its ability to soften and collect the food in the formation of the bolus.

Mouth - Salivary Glands

There are three pairs of main salivary glands and between 800 and 1,000 minor salivary glands, all of which mainly serve the digestive process, and also play an important role in the maintenance of dental health and general mouth lubrication, without which speech would be impossible. The main glands are all exocrine glands, secreting via ducts. All of these glands terminate in the mouth. The largest of these are the parotid glands—their secretion is mainly serous. The next pair are underneath the jaw, the submandibular glands, these produce both serous fluid and mucus.

The serous fluid is produced by serous glands in these salivary glands which also produce lingual lipase. They produce about 70% of the oral cavity saliva. The third pair are the sublingual glands located underneath the tongue and their secretion is mainly mucous with a small percentage of saliva. Within the oral mucosa, and also on the tongue, palates, and floor of the mouth, are the minor salivary glands; their secretions are mainly mucous and they are innervated by the facial nerve (CN7).

The glands also secrete amylase a first stage in the breakdown of food acting on the carbohydrate in the food to transform the starch content into maltose. There are other serous glands on the surface of the tongue that encircle taste buds on the back part of the tongue and these also produce lingual lipase. Lipase is a digestive enzyme that catalyses the hydrolysis of lipids (fats).

These glands are termed Von Ebner's glands which have also been shown to have another function in the secretion of histatins which offer an early defence (outside of the immune system) against microbes in food, when it makes contact with these glands on the tongue tissue. Sensory information can stimulate the secretion of saliva providing the necessary fluid for the tongue to work with and also to ease swallowing of the food.

Mouth - Saliva

Saliva moistens and softens food, and along with the chewing action of the teeth, transforms the food into a smooth bolus. The bolus is further helped by the lubrication provided by the saliva in its passage from the mouth into the oesophagus. Also of importance is the presence in saliva of the digestive enzymes amylase and lipase. Amylase starts to work on the starch in carbohydrates, breaking it down into the simple sugars of maltose and dextrose that can be further broken down in the small intestine. Saliva in the mouth can account for 30% of this initial starch digestion. Lipase starts to work on breaking down fats. Lipase is further produced in the pancreas where it is released to continue this digestion of fats. The presence of salivary lipase is of prime importance in young babies whose pancreatic lipase has yet to be developed. As well as its role in supplying digestive enzymes, saliva has a cleansing action for the teeth and mouth. It also has an immunological role in supplying antibodies to the system, such as immunoglobulin A. This is seen to be key in preventing infections of the salivary glands, importantly that of parotitis. Saliva also contains a glycoprotein called haptocorrin which is a binding protein to vitamin B12. It binds with the vitamin in order to carry it safely through the acidic content of the stomach. When it reaches the duodenum, pancreatic enzymes break down the glycoprotein and free the vitamin which then binds with intrinsic factor.

Mouth - Tongue

Food enters the mouth where the first stage in the digestive process takes place, with the action of the tongue and the secretion of saliva. The tongue is a fleshy and muscular sensory organ, and the very first sensory information is received via the taste buds in the papillae on its surface. If the taste is agreeable, the tongue will go into action, manipulating the food in the mouth which stimulates the secretion of saliva from the salivary glands. The liquid quality of the saliva will help in the softening of the food and its enzyme content will start to break down the food whilst it is still in the mouth. The first part of the food to be broken down is the starch of carbohydrates (by the enzyme amylase in the saliva). The tongue is attached to the floor of the mouth by a ligamentous band called the frenum and this gives it great mobility for the manipulation of food (and speech); the range of manipulation is optimally controlled by the action of several muscles and limited in its external range by the stretch of the frenum. The tongue's two sets of muscles, are four intrinsic muscles that originate in the tongue and are involved with its shaping, and four extrinsic muscles originating in bone that are involved with its movement.

Mouth - Taste
Taste is a form of chemoreception that takes place in the specialised taste receptors, contained in structures called taste buds in the mouth. Taste buds are mainly on the upper surface (dorsum) of the tongue. The function of taste perception is vital to help prevent harmful or rotten foods from being consumed. There are also taste buds on the epiglottis and upper part of the oesophagus. The taste buds are innervated by a branch of the facial nerve the chorda tympani, and the glossopharyngeal nerve. Taste messages are sent via these cranial nerves to the brain. The brain can distinguish between the chemical qualities of the food. The five basic tastes are referred to as those of saltiness, sourness, bitterness, sweetness, and umami. The detection of saltiness and sourness enables the control of salt and acid balance. The detection of bitterness warns of poisons—many of a plant's defences are of poisonous compounds that are bitter. Sweetness guides to those foods that will supply energy; the initial breakdown of the energy-giving carbohydrates by salivary amylase creates the taste of sweetness since simple sugars are the first result. The taste of umami is thought to signal protein-rich food. Sour tastes are acidic which is often found in bad food. The brain has to decide very quickly whether the food should be eaten or not. It was the findings in 1991, describing the first olfactory receptors that helped to prompt the research into taste. The olfactory receptors are located on cell surfaces in the nose which bind to chemicals enabling the detection of smells. It is assumed that signals from taste receptors work together with those from the nose, to form an idea of complex food flavours.

Mouth - Teeth
Teeth are complex structures made of materials specific to them. They are made of a bone-like material called dentin, which is covered by the hardest tissue in the body—enamel. Teeth have different shapes to deal with different aspects of mastication employed in tearing and chewing pieces of food into smaller and smaller pieces. This results in a much larger surface area for the action of digestive enzymes. The teeth are named after their particular roles in the process of mastication—incisors are used for cutting or biting off pieces of food; canines, are used for tearing, premolars and molars are used for chewing and grinding. Mastication of the food with the help of saliva and mucus results in the formation of a soft bolus which can then be swallowed to make its way down the upper gastrointestinal tract to the stomach. The digestive enzymes in saliva also help in keeping the teeth clean by breaking down any lodged food particles.

Mouth - Epiglottis
The epiglottis is a flap of elastic cartilage attached to the entrance of the larynx. It is covered with a mucous membrane and there are taste buds on its lingual surface which faces into the mouth. Its laryngeal surface faces into the larynx. The epiglottis functions to guard the entrance of the glottis, the opening between the vocal folds. It is normally pointed upward during breathing with its underside functioning as part of the pharynx, but during swallowing, the epiglottis folds down to a more horizontal position, with its upper side functioning as part of the pharynx. In this manner it prevents food from going into the trachea and instead directs it to the oesophagus, which is behind. During swallowing, the backward motion of the tongue forces the epiglottis over the glottis' opening to prevent any food that is being swallowed from entering the larynx which leads to the lungs; the larynx is also pulled upwards to assist this process. Stimulation of the larynx by ingested matter produces a strong cough reflex in order to protect the lungs.

Pharynx
The pharynx is a part of the conducting zone of the respiratory system and also a part of the digestive system. It is the part of the throat immediately behind the nasal cavity at the back of the mouth and above the oesophagus and larynx. The pharynx is made up of three parts. The lower two parts—the oropharynx and the laryngopharynx are involved in the digestive system. The laryngopharynx connects to the oesophagus and it serves as a passageway for both air and food. Air enters the larynx anteriorly but anything swallowed has priority and the passage of air is temporarily blocked. The pharynx is innervated by the pharyngeal plexus of the vagus nerve. Muscles in the pharynx push the food into the oesophagus. The pharynx joins the oesophagus at the oesophageal inlet which is located behind the cricoid cartilage.

Oesophagus
The oesophagus, commonly known as the foodpipe or gullet, consists of a muscular tube through which food passes from the pharynx to the stomach. The oesophagus is continuous with the laryngopharynx. It passes through the posterior mediastinum in the thorax and enters the stomach through a hole in the thoracic diaphragm—the oesophageal hiatus, at the level of the tenth thoracic vertebra (T10). Its length averages 25 cm, varying with an individual's height. It is divided into cervical, thoracic and abdominal parts.

The pharynx joins the oesophagus at the oesophageal inlet which is behind the cricoid cartilage. At rest the oesophagus is closed at both ends, by the upper and lower oesophageal sphincters. The opening of the upper sphincter is triggered by the swallowing reflex so that food is allowed through. The sphincter also serves to prevent back flow from the oesophagus into the pharynx.

The oesophagus has a mucous membrane and the epithelium which has a protective function is continuously replaced due to the volume of food that passes inside the oesophagus. During swallowing, food passes from the mouth through the pharynx into the oesophagus. The epiglottis folds down to a more horizontal position to direct the food into the oesophagus, and away from the trachea. Once in the oesophagus, the bolus travels down to the stomach via rhythmic contraction and relaxation of muscles known as peristalsis.

The lower oesophageal sphincter is a muscular sphincter surrounding the lower part of the oesophagus. The gastroesophageal junction between the oesophagus and the stomach is controlled by the lower oesophageal sphincter, which remains constricted at all times other than during swallowing and vomiting to prevent the contents of the stomach from entering the oesophagus. As the oesophagus does not have the same protection from acid as the stomach, any failure of this sphincter can lead to heartburn.

Diaphragm
The diaphragm is an important part of the body's digestive system. The muscular diaphragm separates the thoracic cavity from the abdominal cavity where most of the digestive organs are located. The suspensory muscle attaches the ascending duodenum to the diaphragm. This muscle is thought to be of help in the digestive system in that its attachment offers a wider angle to the duodenojejunal flexure for the easier passage of digesting material. The diaphragm also attaches to, and anchors the liver at its bare area. The oesophagus enters the abdomen through a hole in the diaphragm at the level of T10.

Stomach
The stomach is a major organ of the gastrointestinal tract and digestive system. It is a consistently J-shaped organ joined to the oesophagus at its upper end and to the duodenum at its lower end. Gastric acid (informally gastric juice), produced in the stomach plays a vital role in the digestive process, and mainly contains hydrochloric acid and sodium chloride. A peptide hormone, gastrin, produced by G cells in the gastric glands, stimulates the production of gastric juice which activates the digestive enzymes. Pepsinogen is a precursor enzyme (zymogen) produced by the gastric chief cells, and gastric acid activates this to the enzyme pepsin which begins the digestion of proteins. As these two chemicals would damage the stomach wall, mucus is secreted by innumerable gastric glands in the stomach, to provide a slimy protective layer against the damaging effects of the chemicals on the inner layers of the stomach. At the same time that protein is being digested, mechanical churning occurs through the action of peristalsis, waves of muscular contractions that move along the stomach wall. This allows the mass of food to further mix with the digestive enzymes. Gastric lipase secreted by the chief cells in the fundic glands in the gastric mucosa of the stomach, is an acidic lipase, in contrast with the alkaline pancreatic lipase. This breaks down fats to some degree though is not as efficient as the pancreatic lipase. The pylorus, the lowest section of the stomach which attaches to the duodenum via the pyloric canal, contains countless glands which secrete digestive enzymes including gastrin. After an hour or two, a thick semi-liquid called chyme is produced.
When the pyloric sphincter, or valve opens, chyme enters the duodenum where it mixes further with digestive enzymes from the pancreas, and then passes through the small intestine, where digestion continues. When the chyme is fully digested, it is absorbed into the blood. 95% of absorption of nutrients occurs in the small intestine. Water and minerals are reabsorbed back into the blood in the colon of the large intestine, where the environment is slightly acidic. Some vitamins, such as biotin and vitamin K produced by bacteria in the gut flora of the colon are also absorbed. The parietal cells in the fundus of the stomach, produce a glycoprotein called intrinsic factor which is essential for the absorption of vitamin B12. Vitamin B12 (cobalamin), is carried to, and through the stomach, bound to a glycoprotein secreted by the salivary glands - transcobalamin I also called haptocorrin, which protects the acid-sensitive vitamin from the acidic stomach contents. Once in the more neutral duodenum, pancreatic enzymes break down the protective glycoprotein. The freed vitamin B12 then binds to intrinsic factor which is then absorbed by the enterocytes in the ileum. The stomach is a distensible organ and can normally expand to hold about one litre of food. This expansion is enabled by a series of gastric folds in the inner walls of the stomach. The stomach of a newborn baby will only be able to expand to retain about 30 ml.

Spleen
The spleen is the largest lymphoid organ in the body but has other functions. It breaks down both red and white blood cells that are spent. This is why it is sometimes known as the 'graveyard of red blood cells'. A product of this digestion is the pigment bilirubin, which is sent to the liver and secreted in the bile. Another product is iron, which is used in the formation of new blood cells in the bone marrow. Medicine treats the spleen solely as belonging to the lymphatic system, though it is acknowledged that the full range of its important functions is not yet understood.

Liver
The liver is the second largest organ (after the skin) and is an accessory digestive gland which plays a role in the body's metabolism. The liver has many functions some of which are important to digestion. The liver can detoxify various metabolites; synthesise proteins and produce biochemicals needed for digestion. It regulates the storage of glycogen which it can form from glucose (glycogenesis). The liver can also synthesise glucose from certain amino acids. Its digestive functions are largely involved with the breaking down of carbohydrates. It also maintains protein metabolism in its synthesis and degradation. In lipid metabolism it synthesises cholesterol. Fats are also produced in the process of lipogenesis. The liver synthesises the bulk of lipoproteins. The liver is located in the upper right quadrant of the abdomen and below the diaphragm to which it is attached at one part, the bare area of the liver. This is to the right of the stomach and it overlies the gall bladder. The liver synthesises bile acids and lecithin to promote the digestion of fat.

Liver - Bile
Bile produced by the liver is made up of water (97%), bile salts, mucus and pigments, 1% fats and inorganic salts. Bilirubin is its major pigment. Bile acts partly as a surfactant which lowers the surface tension between either two liquids or a solid and a liquid and helps to emulsify the fats in the chyme. Food fat is dispersed by the action of bile into smaller units called micelles. The breaking down into micelles creates a much larger surface area for the pancreatic enzyme, lipase to work on. Lipase digests the triglycerides which are broken down into two fatty acids and a monoglyceride. These are then absorbed by villi on the intestinal wall. If fats are not absorbed in this way in the small intestine problems can arise later in the large intestine which is not equipped to absorb fats. Bile also helps in the absorption of vitamin K from the diet. Bile is collected and delivered through the common hepatic duct. This duct joins with the cystic duct to connect in a common bile duct with the gallbladder. Bile is stored in the gallbladder for release when food is discharged into the duodenum and also after a few hours.

Liver - Gallbladder
The gallbladder is a hollow part of the biliary tract that sits just beneath the liver, with the gallbladder body resting in a small depression. It is a small organ where the bile produced by the liver is stored, before being released into the small intestine. Bile flows from the liver through the bile ducts and into the gall bladder for storage. The bile is released in response to cholecystokinin (CCK) a peptide hormone released from the duodenum. The production of CCK (by endocrine cells of the duodenum) is stimulated by the presence of fat in the duodenum.

It is divided into three sections, a fundus, body and neck. The neck tapers and connects to the biliary tract via the cystic duct, which then joins the common hepatic duct to form the common bile duct. At this junction is a mucosal fold called Hartmann's pouch, where gallstones commonly get stuck. The muscular layer of the body is of smooth muscle tissue that helps the gallbladder contract, so that it can discharge its bile into the bile duct.

The gallbladder needs to store bile in a natural, semi-liquid form at all times. Hydrogen ions secreted from the inner lining of the gallbladder keep the bile acidic enough to prevent hardening. To dilute the bile, water and electrolytes from the digestion system are added. Also, salts attach themselves to cholesterol molecules in the bile to keep them from crystallising. If there is too much cholesterol or bilirubin in the bile, or if the gallbladder doesn't empty properly the systems can fail.

This is how gallstones form when a small piece of calcium gets coated with either cholesterol or bilirubin and the bile crystallises and forms a gallstone. The main purpose of the gallbladder is to store and release bile, or gall. Bile is released into the small intestine in order to help in the digestion of fats by breaking down larger molecules into smaller ones. After the fat is absorbed, the bile is also absorbed and transported back to the liver for reuse.

Pancreas
The pancreas is a major organ functioning as an accessory digestive gland in the digestive system. It is both an endocrine gland and an exocrine gland. The endocrine part secretes insulin when the blood sugar becomes high; insulin moves glucose from the blood into the muscles and other tissues for use as energy. The endocrine part releases glucagon when the blood sugar is low; glucagon allows stored sugar to be broken down into glucose by the liver in order to re-balance the sugar levels. The pancreas produces and releases important digestive enzymes in the pancreatic juice that it delivers to the duodenum. The pancreas lies below and at the back of the stomach. It connects to the duodenum via the pancreatic duct which it joins near to the bile duct's connection where both the bile and pancreatic juice can act on the chyme that is released from the stomach into the duodenum. Aqueous pancreatic secretions from pancreatic duct cells contain bicarbonate ions which are alkaline and help with the bile to neutralise the acidic chyme that is churned out by the stomach.

The pancreas is also the main source of enzymes for the digestion of fats and proteins. Some of these are released in response to the production of CKK in the duodenum. (The enzymes that digest polysaccharides, by contrast, are primarily produced by the walls of the intestines.) The cells are filled with secretory granules containing the precursor digestive enzymes. The major proteases, the pancreatic enzymes which work on proteins, are trypsinogen and chymotrypsinogen. Elastase is also produced. Smaller amounts of lipase and amylase are secreted. The pancreas also secretes phospholipase A2, lysophospholipase, and cholesterol esterase. The precursor zymogens, are inactive variants of the enzymes; which avoids the onset of pancreatitis caused by autodegradation. Once released in the intestine, the enzyme enteropeptidase present in the intestinal mucosa activates trypsinogen by cleaving it to form trypsin; further cleavage results in chymotripsin.

Lower Gastrointestinal Tract
The lower gastrointestinal tract (GI), includes the small intestine and all of the large intestine. The intestine is also called the bowel or the gut. The lower GI starts at the pyloric sphincter of the stomach and finishes at the anus. The small intestine is subdivided into the duodenum, the jejunum and the ileum. The cecum marks the division between the small and large intestine. The large intestine includes the rectum and anal canal.

Lower GT - Small Intestine
Partially digested food starts to arrive in the small intestine as semi-liquid chyme, one hour after it is eaten. After two hours the stomach has emptied. In the small intestine, the pH becomes crucial; it needs to be finely balanced in order to activate digestive enzymes. The chyme is very acidic, with a low pH, having been released from the stomach and needs to be made much more alkaline. This is achieved in the duodenum by the addition of bile from the gall bladder combined with the bicarbonate secretions from the pancreatic duct and also from secretions of bicarbonate-rich mucus from duodenal glands known as Brunner's glands. The chyme arrives in the intestines having been released from the stomach through the opening of the pyloric sphincter. The resulting alkaline fluid mix neutralises the gastric acid which would damage the lining of the intestine. The mucus component lubricates the walls of the intestine. When the digested food particles are reduced enough in size and composition, they can be absorbed by the intestinal wall and carried to the bloodstream.

The first receptacle for this chyme is the duodenal bulb. From here it passes into the first of the three sections of the small intestine, the duodenum. (The next section is the jejunum and the third is the ileum). The duodenum is the first and shortest section of the small intestine. It is a hollow, jointed C-shaped tube connecting the stomach to the jejunum. It starts at the duodenal bulb and ends at the suspensory muscle of duodenum. The attachment of the suspensory muscle to the diaphragm is thought to help the passage of food by making a wider angle at its attachment. Most food digestion takes place in the small intestine. Segmentation contractions act to mix and move the chyme more slowly in the small intestine allowing more time for absorption (and these continue in the large intestine). In the duodenum, pancreatic lipase is secreted together with a co-enzyme, colipase to further digest the fat content of the chyme. From this breakdown, smaller particles of emulsified fats called chylomicrons are produced.

There are also digestive cells called enterocytes lining the intestines (the majority being in the small intestine). They are unusual cells in that they have villi on their surface which in turn have innumerable microvilli on their surface. All these villi make for a greater surface area, not only for the absorption of chyme but also for its further digestion by large numbers of digestive enzymes present on the microvilli. The chylomicrons are small enough to pass through the enterocyte villi and into their lymph capillaries called lacteals.

A milky fluid called chyle, consisting mainly of the emulsified fats of the chylomicrons, results from the absorbed mix with the lymph in the lacteals. Chyle is then transported through the lymphatic system to the rest of the body. The suspensory muscle marks the end of the duodenum and the division between the upper gastrointestinal tract and the lower GI tract. The digestive tract continues as the jejunum which continues as the ileum.

The jejunum, the midsection of the small intestine contains circular folds, flaps of doubled mucosal membrane which partially encircle and sometimes completely encircle the lumen of the intestine. These folds together with villi serve to increase the surface area of the jejunum enabling an increased absorption of digested sugars, amino acids and fatty acids into the bloodstream. The circular folds also slow the passage of food giving more time for nutrients to be absorbed. The last part of the small intestine is the ileum.

This also contains villi and vitamin B12; bile acids and any residue nutrients are absorbed here. When the chyme is exhausted of its nutrients the remaining waste material changes into the semi-solids called faeces, which pass to the large intestine, where bacteria in the gut flora further break down residual proteins and starches.

Lower GT - Cecum
The cecum is a pouch marking the division between the small intestine and the large intestine. It lies below the ileocecal valve in the lower right quadrant of the abdomen. The cecum receives chyme from the last part of the small intestine, the ileum, and connects to the ascending colon of the large intestine. At this junction there is a sphincter or valve, the ileocecal valve which slows the passage of chyme from the ileum, allowing further digestion. It is also the site of the appendix attachment.

Lower GT - Large Intestine
In the large intestine, the passage of the digesting food in the colon is a lot slower, taking from 12 to 50 hours until it is removed by defecation. The colon mainly serves as a site for the fermentation of digestible matter by the gut flora. The time taken varies considerably between individuals. The remaining semi-solid waste is termed feces and is removed by the coordinated contractions of the intestinal walls, termed peristalsis, which propels the excreta forward to reach the rectum and exit via defecation from the anus. The wall has an outer layer of longitudinal muscles, the taeniae coli, and an inner layer of circular muscles. The circular muscle keeps the material moving forward and also prevents any back flow of waste. Also of help in the action of peristalsis is the basal electrical rhythm that determines the frequency of contractions. The taeniae coli can be seen and are responsible for the bulges (haustra) present in the colon. Most parts of the GI tract are covered with serous membranes and have a mesentery. Other more muscular parts are lined with adventitia.

Blood Supply
The digestive system is supplied by the celiac artery. The celiac artery is the first major branch from the abdominal aorta, and is the only major artery that nourishes the digestive organs. There are three main divisions – the left gastric artery, the common hepatic artery and the splenic artery. The celiac artery supplies the liver, stomach, spleen and the upper 1/3 of the duodenum (to the sphincter of Oddi) and the pancreas with oxygenated blood. Most of the blood is returned to the liver via the portal venous system for further processing and detoxification before returning to the systemic circulation via the hepatic veins. The next branch from the abdominal aorta is the superior mesenteric artery, which supplies the regions of the digestive tract derived from the midgut, which includes the distal 2/3 of the duodenum, jejunum, ileum, cecum, appendix, ascending colon, and the proximal 2/3 of the transverse colon. The final branch which is important for the digestive system is the inferior mesenteric artery, which supplies the regions of the digestive tract derived from the hindgut, which includes the distal 1/3 of the transverse colon, descending colon, sigmoid colon, rectum, and the anus above the pectinate line.

Nerve Supply
The enteric nervous system consists of some one hundred million neurons that are embedded in the peritoneum, the lining of the gastrointestinal tract extending from the esophagus to the anus. These neurons are collected into two plexuses - the myenteric (or Auerbach's) plexus that lies between the longitudinal and the smooth muscle layers, and the submucosal (or Meissner's) plexus that lies between the circular smooth muscle layer and the mucosa. Parasympathetic innervation to the ascending colon is supplied by the vagus nerve. Sympathetic innervation is supplied by the splanchnic nerves that join the celiac ganglia. Most of the digestive tract is innervated by the two large celiac ganglia, with the upper part of each ganglion joined by the greater splanchnic nerve and the lower parts joined by the lesser splanchnic nerve. It is from these ganglia that many of the gastric plexuses arise.

Clinical Significance
Each part of the digestive system is subject to a wide range of disorders many of which can be congenital. Mouth diseases can also be caused by pathogenic bacteria, viruses, fungi and as a side effect of some medications. Mouth diseases include tongue diseases and salivary gland diseases. A common gum disease in the mouth is gingivitis which is caused by bacteria in plaque.

The most common viral infection of the mouth is gingivostomatitis caused by herpes simplex. A common fungal infection is candidiasis commonly known as thrush which affects the mucous membranes of the mouth. There are a number of esophageal diseases such as the development of Schatzki rings that can restrict the passageway, causing difficulties in swallowing. They can also completely block the esophagus.

Stomach diseases are often chronic conditions and include gastroparesis, gastritis, and peptic ulcers. A number of problems including malnutrition and anemia can arise from malabsorption, the abnormal absorption of nutrients in the GI tract. Malabsorption can have many causes ranging from infection, to enzyme deficiencies such as exocrine pancreatic insufficiency.

It can also arise as a result of other gastrointestinal diseases such as coeliac disease. Coeliac disease is an autoimmune disorder of the small intestine. This can cause vitamin deficiencies due to the improper absorption of nutrients in the small intestine. The small intestine can also be obstructed by a volvulus, a loop of intestine that becomes twisted enclosing its attached mesentery. This can cause mesenteric ischemia if severe enough.

A common disorder of the bowel is diverticulitis. Diverticula are small pouches that can form inside the bowel wall, which can become inflamed to give diverticulitis. This disease can have complications if an inflamed diverticulum bursts and infection sets in. Any infection can spread further to the lining of the abdomen (peritoneum) and cause potentially fatal peritonitis.

Crohn's disease is a common chronic inflammatory bowel disease (IBD), which can affect any part of the GI tract, but it mostly starts in the terminal ileum. Ulcerative colitis an ulcerative form of colitis, is the other major inflammatory bowel disease which is restricted to the colon and rectum. Both of these IBDs can give an increased risk of the development of colorectal cancer. Ulcerative colitis is the most common of the IBDs. Irritable bowel syndrome (IBS) is the most common of the functional gastrointestinal disorders.

These are idiopathic disorders that the Rome process has helped to define. Giardiasis is a disease of the small intestine caused by a protist parasite Giardia lamblia. This does not spread but remains confined to the lumen of the small intestine. It can often be asymptomatic, but as often can be indicated by a variety of symptoms. Giardiasis is the most common pathogenic parasitic infection in humans. There are diagnostic tools mostly involving the ingestion of barium sulphate to investigate disorders of the GI tract. These are known as upper gastrointestinal series that enable imaging of the pharynx, larynx, oesophagous, stomach and small intestine and lower gastrointestinal series for imaging of the colon.

3 Excretory System

The excretory system is a passive biological system that removes excess, unnecessary materials from the body fluids of an organism, so as to help maintain internal chemical homeostasis and prevent damage to the body. The dual function of excretory systems is the elimination of the waste products of metabolism and to drain the body of used up and broken down components in a liquid and gaseous state. In humans and other amniotes (mammals, birds and reptiles) most of these substances leave the body as urine and to some degree exhalation, mammals also expel them through sweating. Only the organs specifically used for the excretion are considered a part of the excretory system.

In the narrow sense, the term refer to the urinary system. However, as excretion involves several functions that are only superficially related, it is not usually used in more formal classifications of anatomy or function. As most healthy functioning organs produce metabolic and other wastes, the entire organism depends on the function of the system. Breaking down of one of more of the systems is a serious health condition, for example renal failure.

Urinary System

The kidneys are bean-shaped organs which are present on each side of the vertebral column in the abdominal cavity. Humans have two kidneys and each kidney is supplied with blood from the renal artery. The kidneys remove from the blood the nitrogenous wastes such as urea, as well as salts and excess water, and excrete them in the form of urine. This is done with the help of millions of nephrons present in the kidney. The filtrated blood is carried away from the kidneys by the renal vein (or kidney vein). The urine from the kidney is collected by the ureter (or excretory tubes), one from each kidney, and is passed to the urinary bladder. The urinary bladder collects and stores the urine until urination. The urine collected in the bladder is passed into the external environment from the body through an opening called the urethra.

Kidneys
The kidney's primary function is the elimination of waste from the bloodstream by production of urine. They perform several homeostatic functions such as:
1. Maintain volume of extracellular fluid
2. Maintain ionic balance in extracellular fluid
3. Maintain pH and osmotic concentration of the extracellular fluid.
4. Excrete toxic metabolic by-products such as urea, ammonia, and uric acid.

The way the kidneys do this is with nephrons. There are over 1 million nephrons in each kidney; these nephrons act as filters inside the kidneys. The kidneys filter needed materials and waste, the needed materials go back into the bloodstream, and unneeded materials becomes urine and is gotten rid of. In some cases, excess wastes crystallize as kidney stones. They grow and can become painful irritants that may require surgery or ultrasound treatments. Some stones are small enough to be forced into the urethra.

Ureter
The ureters are muscular ducts that propel urine from the kidneys to the urinary bladder. In the human adult, the ureters are usually 25–30 cm (10–12 in) long. In humans, the ureters arise from the renal pelvis on the medial aspect of each kidney before descending towards the bladder on the front of the psoas major muscle. The ureters cross the pelvic brim near the bifurcation of the iliac arteries (which they run over). This "pelviureteric junction" is a common site for the impaction of kidney stones (the other being the uteterovesical valve). The ureters run posteriorly on the lateral walls of the pelvis. They then curve anteriormedially to enter the bladder through the back, at the vesicoureteric junction, running within the wall of the bladder for a few centimeters. The backflow of urine is prevented by valves known as ureterovesical valves. In the female, the ureters pass through the mesometrium on the way to the bladder.

Urinary Bladder
The urinary bladder is the organ that collects waste excreted by the kidneys prior to disposal by urination. It is a hollow muscular, and distensible (or elastic) organ, and sits on the pelvic floor. Urine enters the bladder via the ureters and exits via the urethra. Embryologically, the bladder is derived from the urogenital sinus, and it is initially continuous with the allantois. In human males, the base of the bladder lies between the rectum and the pubic symphysis. It is superior to the prostate, and separated from the rectum by the rectovesical excavation. In females, the bladder sits inferior to the uterus and anterior to the vagina. It is separated from the uterus by the vesicouterine excavation. In infants and young children, the urinary bladder is in the abdomen even when empty.

Urethra
In anatomy, the (from Greek – ourethra) is a tube which connects the urinary bladder to the outside of the body. In humans, the urethra has an excretory function in both genders to pass.

Gastrointestinal Tract
The large intestine's main function is to transport food particles through the body and expel the indigestible parts at the other end, but it also collects waste from throughout the body. The typical brown colour of mammal waste is due to bilirubin, a breakdown product of normal heme catabolism. The lower part of the large intestine also extracts any remaining usable water and then removes solid waste. At about 10 feet long in humans, it transports the wastes through the tubes to be excreted.

Biliary System
The liver detoxifies and breaks down chemicals, poisons and other toxins that enter the body. For example, the liver transforms ammonia (which is poisonous) into urea in fish, amphibians and mammals, and into uric acid in birds and reptiles. Urea is filtered by the kidney into urine or through the gills in fish and tadpoles. Uric acid is paste-like and expelled as a semi-solid waste (the "white" in bird excrements). The liver also produces bile, and the body uses bile to break down fats into usable fats and unusable waste. Invertebrates lack a liver, but most terrestrial groups, like insects, possesses a number of blind guts that serve the similar functions. Marine invertebrates do not need the ammonia conversion of the liver, as they can usually expel ammonia directly by diffusion through the skin.

Integumentary System

Skin
Sweat glands in the skin secrete a fluid waste called sweat or perspiration; however, its primary functions are temperature control and pheromone release. Therefore, its role as a part of the excretory system is minimal. Sweating also maintains the level of salt in the body. In mammals, the skin excretes sweat through sweat glands throughout the body. The sweat, helped by salt, evaporates and helps to keep the body cool when it is warm. In amphibians, the lungs are very simple, and they lack the necessary means to the exhale like other tetrapods can. The moist, scale-less skin is therefore essential in helping to rid the blood of carbon dioxide, and also allows for urea to be expelled through diffusion when submerged. In small-bodied marine invertebrates, the skin is the most important excretory organ. That is particularly true for acoelomate groups like cnidarians, flatworms and nemerteans, who have no body cavities and hence no body fluid that can be drained or purified by nephrons, which is the reason acoelomate animals are thread-like (nemertans), flat (flatworms) or only consist of a thin layer of cells around a gelatinous non-cellular interior (cnidarians).

Eccrine
Like sweat glands, eccrine glands allow excess water to leave the body. The majority of eccrine glands are located mainly on the forehead, the bottoms of the feet, and the palms, although the glands are everywhere throughout the body. They help the body to maintain temperature control. Eccrine glands in the skin are unique to mammals. Secretions of sweat from the eccrine glands play a large role in controlling the body temperature of humans. Regulation of body temperature, also known as thermoregulation, is very important when it comes to instances that bring the body's temperature outside of the homeostatic temperature such as with a fever or even exercise. Together these glands make up the size of about one kidney and in one day a human can perspire amounts as much as 10 liters. The two functions consist of secretion of a filtrate in response to acetylcholine and reabsorption of sodium near the duct when there is water in excess so that a sweat can be surfacing the skin. There are three parts to the eccrine sweat gland and these are the pore, the duct, and the gland. The pore is the portion that goes through the outermost layer of the skin and is typically 5-10 microns in diameter. The duct is the part of the sweat gland that connects dermis cells to the epidermis. It is composed by two layers of cells and is between 10 and 20 microns in diameter. The gland does the actual secretion and it lies deep within the dermis. The cells that make up the gland are larger in size than the duct cells and its lumen is around 20 microns in diameter.

Substances

Bile
After bile is produced in the liver, it is stored in the gall bladder. It is then secreted within the small intestine where it helps to emulsify fats in the same manner as a soap. Bile also contains bilirubin, which is a waste product. Bile salts can be considered waste that is useful for the body given that they have a role in fat absorption from the stomach. They are excreted from the liver and along with blood flow they help to form the shape of the liver where they are excreted. For instance, if biliary drainage is impaired than that part of the liver will end up wasting away. Biliary obstruction is typically due to masses blocking the ducts of the system such as tumors. The consequences of this depend on the site of blockage and how long it goes on for. There is inflammation of the ducts due to the irritation from the bile acids and this can cause infections. If rupture of the duct takes place it is very traumatic and even fatal.

Urine
Within the kidney, blood first passes through the afferent artery to the capillary formation called a glomerulus and is collected in the Bowman's capsule, which filters the blood from its contents—primarily food and wastes. After the filtration process, the blood then returns to collect the food nutrients it needs, while the wastes pass into the collecting duct, to the renal pelvis, and to the ureter, and are then secreted out of the body via the urinary bladder.

Faeces
Feces (or faeces) are the solid or semisolid remains of food that could not be digested in the small intestine. Bacteria in the large intestine further break down the material. Feces contain a relatively small amount of metabolic waste products such as bacterially altered bilirubin, and the dead epithelial cells from the lining of the gut. Feces are discharged through the anus or cloaca during defecation. Feces can be used as fertilizer or soil conditioner in agriculture. It can also be burned as fuel or dried and used for construction. Some medicinal uses have been found. In the case of human feces, fecal transplants or fecal bacteriotherapy are in use. Urine and feces together are called excreta. Feces are discharged through the anus or cloaca during defecation. This process requires pressures that may reach 100 mm Hg in humans and 450 mm Hg in penguins. The forces required to expel the feces are generated through muscular contractions and a build-up of gases inside the gut, prompting the sphincter to relieve the pressure and to release the feces. The distinctive odor of feces is due to bacterial action. Gut flora produces compounds such as indole, skatole, and thiols (sulfur-containing compounds), as well as the inorganic gas hydrogen sulfide. These are the same compounds responsible for the odor of flatulence. Consumption of spicy foods may result in the spices being undigested and adding to the odor. The perceived bad odor of feces has been hypothesized to be a deterrent for humans, as consuming or touching it may result in sickness or infection. Human perception of the odor may be contrasted by a non-human animal's perception of it; for example, an animal who eats feces may be attracted to its odor.

Sweat
Perspiration, also known as sweating, is the production of fluids secreted by the sweat glands in the skin of mammals. Two types of sweat glands can be found in humans: eccrine glands and apocrine glands. The eccrine sweat glands are distributed over much of the body. In humans, sweating is primarily a means of thermoregulation, which is achieved by the water-rich secretion of the eccrine glands. Maximum sweat rates of an adult can be up to 2–4 liters per hour or 10–14 liters per day (10–15 g/min·m2), but is less in children prior to puberty. Evaporation of sweat from the skin surface has a cooling effect due to evaporative cooling. Hence, in hot weather, or when the individual's muscles heat up due to exertion, more sweat is produced. Animals with few sweat glands, such as dogs, accomplish similar temperature regulation results by panting, which evaporates water from the moist lining of the oral cavity and pharynx. Although sweating is found in a wide variety of mammals, relatively few (exceptions include humans and horses) produce large amounts of sweat in order to cool down. Sweat contributes to body odor when it is metabolized by bacteria on the skin. Medications that are used for other treatments and diet also affect odor. Some medical conditions, such as kidney failure and diabetic ketoacidosis, can also affect sweat odor. Areas that produce excessive sweat usually appear pink or white, but, in severe cases, may appear cracked, scaly, and soft.

Breath
Breathing (or ventilation) is the process of moving air into and out of the lungs to facilitate gas exchange with the internal environment, mostly by bringing in oxygen and flushing out carbon dioxide. All aerobic creatures need oxygen for cellular respiration, which uses the oxygen to break down foods for energy and produces carbon dioxide as a waste product. Breathing, or "external respiration", brings air into the lungs where gas exchange takes place in the alveoli through diffusion. The body's circulatory system transports these gases to and from the cells, where "cellular respiration" takes place.

The breathing of all vertebrates with lungs consists of repetitive cycles of inhalation and exhalation through a highly branched system of tubes or airways which lead from the nose to the alveoli. The number of respiratory cycles per minute is the breathing or respiratory rate, and is one of the four primary vital signs of life. Under normal conditions the breathing depth and rate is automatically, and unconsciously, controlled by several homeostatic mechanisms which keep the partial pressures of carbon dioxide and oxygen in the arterial blood constant.

Keeping the partial pressure of carbon dioxide in the arterial blood unchanged under a wide variety of physiological circumstances, contributes significantly to tight control of the pH of the extracellular fluids (ECF). Over-breathing (hyperventilation) and under-breathing (hypoventilation), which decrease and increase the arterial partial pressure of carbon dioxide respectively, cause a rise in the pH of ECF in the first case, and a lowering of the pH in the second. Both cause distressing symptoms.

Breathing has other important functions. It provides a mechanism for speech, laughter and similar expressions of the emotions. It is also used for reflexes such as yawning, coughing and sneezing. Animals that cannot thermoregulate by perspiration, because they lack sufficient sweat glands, may lose heat by evaporation through panting.

Clinical Signifiance

Kidney Stones
Scientifically, masses referred to as a renal calculus or nephrolith, or more commonly, "kidney stones," are solid masses of crystals that may be a variety of shapes, sizes, and textures, that can reside within one or both of the kidneys. Kidney stones form when the balance is off between the concentration of substances that pass through urine, and the substances that are supposed to dissolve them. When substances are not properly dissolved, they have the ability to build up, and form these kidney stones. These stones are most commonly made up of substances such as calcium, cystine, oxalate, and uric acid, as these are the substances that normally would dissolve within the urine. When they do not dissolve correctly and further build up, they will commonly lodge themselves in the urinary tract and in this case, are usually small enough to pass through urine. In extreme situations, however, these stones may lodge themselves within the tube that connects the kidney and the bladder, called the ureter. In this case, they become very large in size and will most likely cause great pain, bleeding, and possibly even block the flow of urine. These can occur in both men and women, and studies show that around 12% of men, and 8% of women in America will develop kidney stones within their lifetime.

In those extreme situations, in which kidney stones are too large to pass on their own, patients may seek removal. Most of these treatments involving kidney stone removal are done by a urologist; a physician who specializes in the organs of the Urinary system. A common way of removal is shock wave lithotripsy, in which the urologist will shock the kidney stone into smaller pieces via laser, allowing these pieces to further pass through the urine on their own, as a normal case of kidney stones. Larger, more serious cases may demand Cystoscopy, Ureteroscopy, or Percutaneous Nephrolithotomy, in which the doctor will use a viewing tool or camera to locate the stone, and based on the size or situation, may either chose to continue with surgical removal, or use the shock wave lithotripsy treatment. Once the kidney stone(s) are successfully eliminated, the urologist will commonly suggest medication to prevent future recurrences.

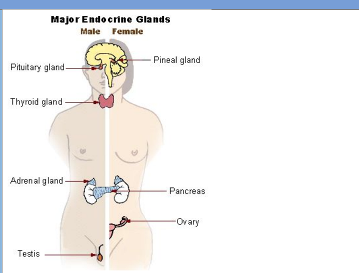
Pyelonephritis
Pyelonephritis is a type of urinary tract infection that occurs when bacteria enters the body through the urinary tract. It causes an inflammation of the renal parenchyma, calyces, and pelvis. There are three main classifications of pyelonephritis: acute, chronic and xanthogranulomatous.

Acute Pyelonephritis	In acute pyelonephritis, the patient experiences high fever, abdominal pain and pain while passing urine. Treatment for acute pyelonephritis is provided via antibiotics and an extensive urological investigation is conducted to find any abnormalities and prevent recurrence.
Chronic Pyelonephritis	In chronic pyelonephritis, patients experience persistent abdominal and flank pain, high fever, decreased appetite, weight loss, urinary tract symptoms and blood in the urine. Chronic pyelonephritis can also lead to scarring of the renal parenchyma caused by recurrent kidney infections.
Xanthogranulomatous Pyelonephritis	Xanthogranulomatous pyelonephritis is an unusual form of chronic pyelonephritis. It results in severe destruction of the kidney and causes granulomatous abscess formation. Patients infected with Xanthogranulomatous pyelonephritis experience recurrent fevers, anemia, kidney stones and loss of function in the affected kidney.

Treatment
A urine culture and antibiotics sensitivity test is issued for patients who are believed to have pyelonephritis. Since most cases of pyelonephritis are caused from bacterial infections, antibiotics are a common treatment option. Depending on the species of the infecting organism and the antibiotics sensitivity profile of the organism, treatments may include fluoroquinolones, cephalosporins, aminoglycosides, or trimethoprim individually or in combination. For patients with xanthogranulomatous pyelonephritis, treatment might include antibiotics as well as surgery. Nephrectomy is the most common surgical treatment for a majority of cases involving xanthogranulomatous pyelonephritis.

Epidemiology
In men, roughly 2-3 cases per 10,000 are treated as outpatients and 1 in 10,000 cases require admission to the hospital. In women, approximately 12-13 in 10,000 cases are treated as outpatients and 3-4 cases are admitted to a hospital. The most common age group affected by Xanthogranulomatous pyelonephritis is middle-aged women. Infants and elderly are also at an increased risk because of hormonal and anatomical changes.

4 Endocrine System



The endocrine system is a chemical messenger system comprising feedback loops of hormones released by internal glands of an organism directly into the circulatory system, regulating distant target organs. In humans, the major endocrine glands are the thyroid gland and the adrenal glands. In vertebrates, the hypothalamus is the neural control center for all endocrine systems. The study of the endocrine system and its disorders is known as endocrinology. Endocrinology is a branch of internal medicine. A number of glands that signal each other in sequence are usually referred to as an axis, for example, the hypothalamic-pituitary-adrenal axis.

In addition to the specialized endocrine organs mentioned above, many other organs that are part of other body systems, including bone, kidney, liver, heart and gonads, have secondary endocrine functions. For example, the kidney secretes endocrine hormones such as erythropoietin and renin. Hormones can consist of either amino acid complexes, steroids, eicosanoids, leukotrienes, or prostaglandins. The endocrine system can be contrasted to both exocrine glands, which secrete hormones to the outside of the body using ducts and paracrine signalling between cells over a relatively short distance.

Structure

Major Endocrine Systems
The human endocrine system consists of several systems that operate via feedback loops. Several important feedback systems are mediated via the hypothalamus and pituitary.

- TRH – TSH – T3/T4
- GnRH – LH/FSH – sex hormones
- CRH – ACTH – cortisol
- Renin – angiotensin – aldosterone
- Leptin vs. Insulin

Glands
Endocrine glands are glands of the endocrine system that secrete their products, hormones, directly into interstitial spaces and then absorbed into blood rather than through a duct. The major glands of the endocrine system include the pineal gland, pituitary gland, pancreas, ovaries, testes, thyroid gland, parathyroid gland, hypothalamus and adrenal glands. The hypothalamus and pituitary gland are neuroendocrine organs.

Cells
There are many types of cells that comprise the endocrine system and these cells typically make up larger tissues and organs that function within and outside of the endocrine system.

- Hypothalamus
- Anterior pituitary gland
- Pineal gland
- Posterior pituitary gland
- Thyroid gland
- Parathyroid gland
- Adrenal glands
  - Adrenal cortex
  - Adrenal medulla
- Pancreas
  - Alpha cells
  - Beta cells
  - Delta cells
  - F Cells
- Ovaries
  - Granulosa cells
- Testis
  - Leydig cells

Function

Hormones
A hormone is any of a class of signaling molecules produced by glands in multicellular organisms that are transported by the circulatory system to target distant organs to regulate physiology and behaviour. Hormones have diverse chemical structures, mainly of 3 classes: eicosanoids, steroids, and amino acid/protein derivatives (amines, peptides, and proteins). The glands that secrete hormones comprise the endocrine system. The term hormone is sometimes extended to include chemicals produced by cells that affect the same cell (autocrine or intracrine signalling) or nearby cells (paracrine signalling). Hormones are used to communicate between organs and tissues for physiological regulation and behavioral activities, such as digestion, metabolism, respiration, tissue function, sensory perception, sleep, excretion, lactation, stress, growth and development, movement, reproduction, and mood. Hormones affect distant cells by binding to specific receptor proteins in the target cell resulting in a change in cell function. This may lead to cell type-specific responses that include rapid changes to the activity of existing proteins, or slower changes in the expression of target genes. Amino acid–based hormones (amines and peptide or protein hormones) are water-soluble and act on the surface of target cells via signal transduction pathways; steroid hormones, being lipid-soluble, move through the plasma membranes of target cells to act within their nuclei.

Cell Signalling
The typical mode of cell signalling in the endocrine system is endocrine signaling, that is, using the circulatory system to reach distant target organs. However, there are also other modes, i.e., paracrine, autocrine, and neuroendocrine signaling. Purely neurocrine signaling between neurons, on the other hand, belongs completely to the nervous system.

Autocrine	Autocrine signaling is a form of signaling in which a cell secretes a hormone or chemical messenger (called the autocrine agent) that binds to autocrine receptors on the same cell, leading to changes in the cells.
Paracrine	Some endocrinologists and clinicians include the paracrine system as part of the endocrine system, but there is not consensus. Paracrines are slower acting, targeting cells in the same tissue or organ. An example of this is somatostatin which is released by some pancreatic cells and targets other pancreatic cells.

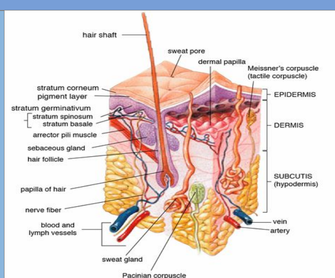
Juxtacrine	Juxtacrine signaling is a type of intercellular communication that is transmitted via oligosaccharide, lipid, or protein components of a cell membrane, and may affect either the emitting cell or the immediately adjacent cells. It occurs between adjacent cells that possess broad patches of closely opposed plasma membrane linked by transmembrane channels known as connexons. The gap between the cells can usually be between only 2 and 4 nm.

Disease

Diseases of the endocrine system are common, including conditions such as diabetes mellitus, thyroid disease, and obesity. Endocrine disease is characterized by misregulated hormone release (a productive pituitary adenoma), inappropriate response to signaling (hypothyroidism), lack of a gland (diabetes mellitus type 1, diminished erythropoiesis in chronic renal failure), or structural enlargement in a critical site such as the thyroid (toxic multinodular goitre). Hypofunction of endocrine glands can occur as a result of loss of reserve, hyposecretion, agenesis, atrophy, or active destruction. Hyperfunction can occur as a result of hypersecretion, loss of suppression, hyperplastic or neoplastic change, or hyperstimulation. Endocrinopathies are classified as primary, secondary, or tertiary. Primary endocrine disease inhibits the action of downstream glands. Secondary endocrine disease is indicative of a problem with the pituitary gland. Tertiary endocrine disease is associated with dysfunction of the hypothalamus and its releasing hormones. As the thyroid, and hormones have been implicated in signaling distant tissues to proliferate, for example, the estrogen receptor has been shown to be involved in certain breast cancers. Endocrine, paracrine, and autocrine signaling have all been implicated in proliferation, one of the required steps of oncogenesis.

Other common diseases that result from endocrine dysfunction include Addison's disease, Cushing's disease and Graves' disease. Cushing's disease and Addison's disease are pathologies involving the dysfunction of the adrenal gland. Dysfunction in the adrenal gland could be due to primary or secondary factors and can result in hypercortisolism or hypocortisolism. Cushing's disease is characterized by the hypersecretion of the adrenocorticotropic hormone (ACTH) due to a pituitary adenoma that ultimately causes endogenous hypercortisolism by stimulating the adrenal glands. Some clinical signs of Cushing's disease include obesity, moon face, and hirsutism. Addison's disease is an endocrine disease that results from hypocortisolism caused by adrenal gland insufficiency. Adrenal insufficiency is significant because it is correlated with decreased ability to maintain blood pressure and blood sugar, a defect that can prove to be fatal. Graves' disease involves the hyperactivity of the thyroid gland which produces the T3 and T4 hormones. Graves' disease effects range from excess sweating, fatigue, heat intolerance and high blood pressure to swelling of the eyes that causes redness, puffiness and in rare cases reduced or double vision.

5 Integumentary System



The integumentary system comprises the skin and its appendages acting to protect the body from various kinds of damage, such as loss of water or damages from outside. The integumentary system includes hair, scales, feathers, hooves, and nails. It has a variety of additional functions; it may serve to waterproof, and protect the deeper tissues, excrete wastes, and regulate body temperature, and is the attachment site for sensory receptors to detect pain, sensation, pressure, and temperature. In most land vertebrates with significant exposure to sunlight, the integumentary system also provides for vitamin D synthesis.

Skin

The skin is the largest organ of the body. In humans, it accounts for about 12 to 15 percent of total body weight and covers 1.5-2m2 of surface area. The human skin (integument) is composed of at least two major layers of tissue: the epidermis and dermis. (The hypodermis or subcutaneous layer is not part of the skin.) The epidermis is the outermost layer, providing the initial barrier to the external environment.It is separated from the dermis by the basement membrane. The epidermis contains melanocytes and gives color to the skin. The deepest layer of epidermis also contains nerve endings. Beneath this, the dermis comprises two sections, the papillary and reticular layers, and contains connective tissues, vessels, glands, follicles, hair roots, sensory nerve endings, and muscular tissue. The deepest layer, the hypodermis, is primarily made up of adipose tissue. Substantial collagen bundles anchor the dermis to the hypodermis in a way that permits most areas of the skin to move freely over the deeper tissue layers.

Epidermis
The epidermis is the top layer of skin made up of epithelial cells. It does not contain blood vessels. Its main functions are protection, absorption of nutrients, and homeostasis. In structure, it consists of a keratinized stratified squamous epithelium; four types of cells: keratinocytes, melanocytes, Merkel cells, and Langerhans cells. The major cell of the epidermis is the keratinocyte, which produces keratin, a fibrous protein that aids in skin protection. An overwhelming amount of keratin can cause disease by giving rise to eruptions from the skin that will protrude outwards and lead to infection. Keratin is also a waterproofing protein. Millions of dead keratinocytes rub off daily. The majority of the skin on the body is keratinized. The only skin on the body that is non-keratinized is the lining of mucous membranes, such as the inside of the mouth. Non-keratinized cells allow water to "stay" atop the structure. The protein keratin stiffens epidermal tissue to form fingernails. Nails grow from a thin area called the nail matrix at an average of 1 mm per week. The lunula is the crescent-shape area at the base of the nail, lighter in color as it mixes with the matrix cells. Also, the stratum corneum is the top part of the epidermis.

Dermis
The dermis is the middle layer of skin, composed of dense irregular connective tissue and areolar connective tissue such as a collagen with elastin arranged in a diffusely bundled and woven pattern. The dermis has two layers. One is the papillary layer which is the superficial layer and consists of the areolar connective tissue. The other is the reticular layer which is the deep layer of the dermis and consists of the dense irregular connective tissue. These layers serve to give elasticity to the integument, allowing stretching and conferring flexibility, while also resisting distortions, wrinkling, and sagging. The dermal layer provides a site for the endings of blood vessels and nerves. Many chromatophores are also stored in this layer, as are the bases of integumental structures such as hair, feathers, and glands.

Hypodermis
The hypodermis, otherwise known as the subcutaneous layer, is a layer beneath the skin. It invaginates into the dermis and is attached to the latter, immediately above it, by collagen and elastin fibers. It is essentially composed of a type of cell known as adipocytes specialized in accumulating and storing fats. These cells are grouped together in lobules separated by connective tissue. The hypodermis acts as an energy reserve. The fats contained in the adipocytes can be put back into circulation, via the venous route, during intense effort or when there is a lack of energy-providing substances, and are then transformed into energy. The hypodermis participates, passively at least, in thermoregulation since fat is a heat insulator.

Functions

The integumentary system has multiple roles in homeostasis. All body systems work in an interconnected manner to maintain the internal conditions essential to the function of the body. The skin has an important job of protecting the body and acts as the body's first line of defense against infection, temperature change, and other challenges to homeostasis. Functions include:

Functions

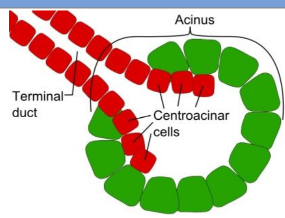
● Protect the body's internal living tissues and organs ● Protect against invasion by infectious organisms ● Protect the body from dehydration ● Protect the body against abrupt changes in temperature, maintain homeostasis ● Help excrete waste materials through perspiration ● Act as a receptor for touch, pressure, pain, heat, and cold (see Somatosensory system)	● Protect the body against sunburns by secreting melanin ● Generate vitamin D through exposure to ultraviolet light ● Store water, fat, glucose, vitamin D ● Maintenance of the body form ● Formation of new cells from stratum germanium to repair minor injuries ● Protect from UV rays. ● Regulates body temperature

It distinguishes, separates, and protects the organism from its surroundings. Small-bodied invertebrates of aquatic or continually moist habitats respire using the outer layer (integument). This gas exchange system, where gases simply diffuse into and out of the interstitial fluid, is called integumentary exchange.

Diseases / Injuries

Possible diseases and injuries to the human integumentary system include:	● Rash ● Yeast ● Athlete's Foot ● Infection ● Sunburn ● Skin Cancer	● Albinism ● Acne ● Herpes ● Herpes labialis, commonly called cold sores ● Impetigo ● Rubella	● Cancer ● Psoriasis ● Rabies ● Rosacea ● Atopic Dermatitis ● Eczema

6 Exocrine System



Exocrine glands are glands that produce and secrete substances onto an epithelial surface by way of a duct. Examples of exocrine glands include sweat, salivary, mammary, ceruminous, lacrimal, sebaceous, and mucous. Exocrine glands are one of two types of glands in the human body, the other being endocrine glands, which secrete their products directly into the bloodstream.

The liver and pancreas are both exocrine and endocrine glands; they are exocrine glands because they secrete products—bile and pancreatic juice—into the gastrointestinal tract through a series of ducts, and endocrine because they secrete other substances directly into the bloodstream.

Structure Exocrine glands contain a glandular portion and a duct portion, the structures of which can be used to classify the gland.	● The duct portion may be branched (called compound) or unbranched (called simple). ● The glandular portion may be tubular or acinar, or may be a mix of the two (called tubuloacinar). If the glandular portion branches, then the gland is called a branched gland.
Method of Secretion Exocrine glands are named apocrine glands, holocrine glands, or merocrine glands based on how their products are secreted.	● Merocrine secretion – cells excrete their substances by exocytosis; for example, pancreatic acinar cells. ● Apocrine secretion – a portion of the cell membrane that contains the excretion buds off. ● Holocrine secretion – the entire cell disintegrates to excrete its substance; for example, sebaceous glands of the skin and nose.

Product Secreted
● Serous cells secrete proteins, often enzymes. Examples include gastric chief cells and Paneth cells
● Mucous cells secrete mucus. Examples include Brunner's glands, esophageal glands, and pyloric glands
● Mixed glands secrete both protein and mucus. Examples include the salivary glands: although the parotid gland 20%is predominantly serous, the sublingual gland 5% mainly mucous gland, and the submandibular gland 70%is a mixed, mainly serous gland.
● Sebaceous glands secrete Sebum, a lipid product. These glands are also known as oil glands, e.g. Fordyce spots and Meibomian glands.

7 Immune System

The immune system is a host defense system comprising many biological structures and processes within an organism that protects against disease. To function properly, an immune system must detect a wide variety of agents, known as pathogens, from viruses to parasitic worms, and distinguish them from the organism's own healthy tissue. In many species, there are two major subsystems of the immune system: the innate immune system and the adaptive immune system. Both subsystems use humoral immunity and cell-mediated immunity to perform their functions. In humans, the blood–brain barrier, blood–cerebrospinal fluid barrier, and similar fluid–brain barriers separate the peripheral immune system from the neuroimmune system, which protects the brain.

Pathogens can rapidly evolve and adapt, and thereby avoid detection and neutralization by the immune system; however, multiple defense mechanisms have also evolved to recognize and neutralize pathogens. Even simple unicellular organisms such as bacteria possess a rudimentary immune system in the form of enzymes that protect against bacteriophage infections. Other basic immune mechanisms evolved in ancient eukaryotes and remain in their modern descendants, such as plants and invertebrates. These mechanisms include phagocytosis, antimicrobial peptides called defensins, and the complement system.

Jawed vertebrates, including humans, have even more sophisticated defense mechanisms, including the ability to adapt over time to recognize specific pathogens more efficiently. Adaptive (or acquired) immunity creates immunological memory after an initial response to a specific pathogen, leading to an enhanced response to subsequent encounters with that same pathogen. This process of acquired immunity is the basis of vaccination. Disorders of the immune system can result in autoimmune diseases, inflammatory diseases and cancer. Immunodeficiency occurs when the immune system is less active than normal, resulting in recurring and life-threatening infections.

In humans, immunodeficiency can either be the result of a genetic disease such as severe combined immunodeficiency, acquired conditions such as HIV/AIDS, or the use of immunosuppressive medication. In contrast, autoimmunity results from a hyperactive immune system attacking normal tissues as if they were foreign organisms. Common autoimmune diseases include Hashimoto's thyroiditis, rheumatoid arthritis, diabetes mellitus type 1, and systemic lupus erythematosus. Immunology covers the study of all aspects of the immune system.

Layered Defence

The immune system protects organisms from infection with layered defenses of increasing specificity. In simple terms, physical barriers prevent pathogens such as bacteria and viruses from entering the organism. If a pathogen breaches these barriers, the innate immune system provides an immediate, but non-specific response. Innate immune systems are found in all plants and animals. If pathogens successfully evade the innate response, vertebrates possess a second layer of protection, the adaptive immune system, which is activated by the innate response. Here, the immune system adapts its response during an infection to improve its recognition of the pathogen. This improved response is then retained after the pathogen has been eliminated, in the form of an immunological memory, and allows the adaptive immune system to mount faster and stronger attacks each time this pathogen is encountered.

Components of the immune system
Innate immune system
- Response is non-specific
- Exposure leads to immediate maximal response
- Cell-mediated and humoral components
- No immunological memory
- Found in nearly all forms of life

Components of the immune system
Adaptive immune system
- Pathogen and antigen specific response
- Lag time between exposure and maximal response
- Cell-mediated and humoral components
- Exposure leads to immunological memory
- Found only in jawed vertebrates

Both innate and adaptive immunity depend on the ability of the immune system to distinguish between self and non-self molecules. In immunology, self molecules are those components of an organism's body that can be distinguished from foreign substances by the immune system. Conversely, non-self molecules are those recognized as foreign molecules. One class of non-self molecules are called antigens (short for antibody generators) and are defined as substances that bind to specific immune receptors and elicit an immune response. Newborn infants have no prior exposure to microbes and are particularly vulnerable to infection. Several layers of passive protection are provided by the mother.

During pregnancy, a particular type of antibody, called IgG, is transported from mother to baby directly through the placenta, so human babies have high levels of antibodies even at birth, with the same range of antigen specificities as their mother. Breast milk or colostrum also contains antibodies that are transferred to the gut of the infant and protect against bacterial infections until the newborn can synthesize its own antibodies. This is passive immunity because the fetus does not actually make any memory cells or antibodies—it only borrows them. This passive immunity is usually short-term, lasting from a few days up to several months. In medicine, protective passive immunity can also be transferred artificially from one individual to another via antibody-rich serum.

Innate Immune System

Microorganisms or toxins that successfully enter an organism encounter the cells and mechanisms of the innate immune system. The innate response is usually triggered when microbes are identified by pattern recognition receptors, which recognize components that are conserved among broad groups of microorganisms, or when damaged, injured or stressed cells send out alarm signals, many of which (but not all) are recognized by the same receptors as those that recognize pathogens. Innate immune defenses are non-specific, meaning these systems respond to pathogens in a generic way. This system does not confer long-lasting immunity against a pathogen. The innate immune system is the dominant system of host defense in most organisms.

Pattern Recognition by Cells
Cells in the innate immune system use pattern recognition receptors (PRRs) to recognize molecular structures that are produced by microbial pathogens. PRRs are germline-encoded host sensors, which detect molecules typical for the pathogens. They are proteins expressed, mainly, by cells of the innate immune system, such as dendritic cells, macrophages, monocytes, neutrophils and epithelial cells, to identify two classes of molecules: pathogen-associated molecular patterns (PAMPs), which are associated with microbial pathogens, and damage-associated molecular patterns (DAMPs), which are associated with components of host's cells that are released during cell damage or death.

Toll-like Receptors
Recognition of extracellular or endosomal pathogen-associated molecular patterns is mediated by transmembrane proteins known as toll-like receptors (TLRs). TLRs share a typical structural motif, the Leucine rich repeats (LRR), which give them their specific appearance and are also responsible for TLR functionality. Toll-like receptors were first discovered in Drosophila and trigger the synthesis and secretion of cytokines and activation of other host defense programs that are necessary for both innate or adaptive immune responses. To date, ten functional members of the TLR family have been described in humans.

Cytosolic Receptors
Cells in the innate immune system have pattern recognition receptors that detect infection or cell damage in the cytosol. Three major classes of these cytosolic receptors are NOD–like receptors, RIG (retinoic acid-inducible gene)-like receptors, and cytosolic DNA sensors.

Inflammasomes
Inflammasomes are multiprotein complexes (consist of an NLR, the adaptor protein ASC, and the effector molecule pro-caspase-1) that form in response to cytosolic PAMPs and DAMPs, whose function is to generate active forms of the inflammatory cytokines IL-1β and IL-18.

Surface Barriers
Several barriers protect organisms from infection, including mechanical, chemical, and biological barriers. The waxy cuticle of most leaves, the exoskeleton of insects, the shells and membranes of externally deposited eggs, and skin are examples of mechanical barriers that are the first line of defense against infection. However, as organisms cannot be completely sealed from their environments, other systems act to protect body openings such as the lungs, intestines, and the genitourinary tract. In the lungs, coughing and sneezing mechanically eject pathogens and other irritants from the respiratory tract. The flushing action of tears and urine also mechanically expels pathogens, while mucus secreted by the respiratory and gastrointestinal tract serves to trap and entangle microorganisms. Chemical barriers also protect against infection. The skin and respiratory tract secrete antimicrobial peptides such as the β-defensins. Enzymes such as lysozyme and phospholipase A2 in saliva, tears, and breast milk are also antibacterials. Vaginal secretions serve as a chemical barrier following menarche, when they become slightly acidic, while semen contains defensins and zinc to kill pathogens. In the stomach, gastric acid serves as a powerful chemical defense against ingested pathogens.

Within the genitourinary and gastrointestinal tracts, commensal flora serve as biological barriers by competing with pathogenic bacteria for food and space and, in some cases, by changing the conditions in their environment, such as pH or available iron. As a result of the symbiotic relationship between commensals and the immune system, the probability that pathogens will reach sufficient numbers to cause illness is reduced. However, since most antibiotics non-specifically target bacteria and do not affect fungi, oral antibiotics can lead to an "overgrowth" of fungi and cause conditions such as a vaginal candidiasis (a yeast infection). There is good evidence that re-introduction of probiotic flora, such as pure cultures of the lactobacilli normally found in unpasteurized yogurt, helps restore a healthy balance of microbial populations in intestinal infections in children and encouraging preliminary data in studies on bacterial gastroenteritis, inflammatory bowel diseases, urinary tract infection and post-surgical infections.

Cellular Components
Leukocytes (white blood cells) act like independent, single-celled organisms and are the second arm of the innate immune system. The innate leukocytes include the phagocytes (macrophages, neutrophils, and dendritic cells), innate lymphoid cells, mast cells, eosinophils, basophils, and natural killer cells. These cells identify and eliminate pathogens, either by attacking larger pathogens through contact or by engulfing and then killing microorganisms. Innate cells are also important mediators in lymphoid organ development and the activation of the adaptive immune system. Phagocytosis is an important feature of cellular innate immunity performed by cells called phagocytes that engulf, or eat, pathogens or particles. Phagocytes generally patrol the body searching for pathogens, but can be called to specific locations by cytokines. Once a pathogen has been engulfed by a phagocyte, it becomes trapped in an intracellular vesicle called a phagosome, which subsequently fuses with another vesicle called a lysosome to form a phagolysosome. The pathogen is killed by the activity of digestive enzymes or following a respiratory burst that releases free radicals into the phagolysosome. Phagocytosis evolved as a means of acquiring nutrients, but this role was extended in phagocytes to include engulfment of pathogens as a defense mechanism. Phagocytosis probably represents the oldest form of host defense, as phagocytes have been identified in both vertebrate and invertebrate animals.

Inflammation
Inflammation is one of the first responses of the immune system to infection. The symptoms of inflammation are redness, swelling, heat, and pain, which are caused by increased blood flow into tissue. Inflammation is produced by eicosanoids and cytokines, which are released by injured or infected cells. Eicosanoids include prostaglandins that produce fever and the dilation of blood vessels associated with inflammation, and leukotrienes that attract certain white blood cells (leukocytes). Common cytokines include interleukins that are responsible for communication between white blood cells; chemokines that promote chemotaxis; and interferons that have anti-viral effects, such as shutting down protein synthesis in the host cell. Growth factors and cytotoxic factors may also be released. These cytokines and other chemicals recruit immune cells to the site of infection and promote healing of any damaged tissue following the removal of pathogens.

MEDICAL Body Systems Immune System

Complement System
The complement system is a biochemical cascade that attacks the surfaces of foreign cells. It contains over 20 different proteins and is named for its ability to "complement" the killing of pathogens by antibodies. Complement is the major humoral component of the innate immune response. Many species have complement systems, including non-mammals like plants, fish, and some invertebrates. In humans, this response is activated by complement binding to antibodies that have attached to these microbes or the binding of complement proteins to carbohydrates on the surfaces of microbes. This recognition signal triggers a rapid killing response. The speed of the response is a result of signal amplification that occurs after sequential proteolytic activation of complement molecules, which are also proteases. After complement proteins initially bind to the microbe, they activate their protease activity, which in turn activates other complement proteases, and so on. This produces a catalytic cascade that amplifies the initial signal by controlled positive feedback. The cascade results in the production of peptides that attract immune cells, increase vascular permeability, and opsonize (coat) the surface of a pathogen, marking it for destruction. This deposition of complement can also kill cells directly by disrupting their plasma membrane.

Physiological Regulation

The immune system is involved in many aspects of physiological regulation in the body. The immune system interacts intimately with other systems, such as the endocrine and the nervous systems. The immune system also plays a crucial role in embryogenesis (development of the embryo), as well as in tissue repair and regeneration.

Hormones
Hormones can act as immunomodulators, altering the sensitivity of the immune system. For example, female sex hormones are known immunostimulators of both adaptive and innate immune responses. Some autoimmune diseases such as lupus erythematosus strike women preferentially, and their onset often coincides with puberty. By contrast, male sex hormones such as testosterone seem to be immunosuppressive. Other hormones appear to regulate the immune system as well, most notably prolactin, growth hormone and vitamin D.

Vitamin D
When a T-cell encounters a foreign pathogen, it extends a vitamin D receptor. This is essentially a signaling device that allows the T-cell to bind to the active form of vitamin D, the steroid hormone calcitriol. T-cells have a symbiotic relationship with vitamin D. Not only does the T-cell extend a vitamin D receptor, in essence asking to bind to the steroid hormone version of vitamin D, calcitriol, but the T-cell expresses the gene CYP27B1, which is the gene responsible for converting the pre-hormone version of vitamin D, calcidiol into the steroid hormone version, calcitriol. Only after binding to calcitriol can T-cells perform their intended function. Other immune system cells that are known to express CYP27B1 and thus activate vitamin D calcidiol, are dendritic cells, keratinocytes and macrophages. It is conjectured that a progressive decline in hormone levels with age is partially responsible for weakened immune responses in aging individuals. Conversely, some hormones are regulated by the immune system, notably thyroid hormone activity. The age-related decline in immune function is also related to decreasing vitamin D levels in the elderly. As people age, two things happen that negatively affect their vitamin D levels. First, they stay indoors more due to decreased activity levels. This means that they get less sun and therefore produce less cholecalciferol via UVB radiation. Second, as a person ages the skin becomes less adept at producing vitamin D.

Sleep and Rest
The immune system is affected by sleep and rest, and sleep deprivation is detrimental to immune function. Complex feedback loops involving cytokines, such as interleukin-1 and tumor necrosis factor-a produced in response to infection, appear to also play a role in the regulation of non-rapid eye movement (REM) sleep Thus the immune response to infection may result in changes to the sleep cycle, including an increase in slow-wave sleep relative to REM sleep. When suffering from sleep deprivation, active immunizations may have a diminished effect and may result in lower antibody production, and a lower immune response, than would be noted in a well-rested individual. Additionally, proteins such as NFIL3, which have been shown to be closely intertwined with both T-cell differentiation and our circadian rhythms, can be affected through the disturbance of natural light and dark cycles through instances of sleep deprivation, shift work, etc. As a result, these disruptions can lead to an increase in chronic conditions such as heart disease, chronic pain, and asthma.

In addition to the negative consequences of sleep deprivation, sleep and the intertwined circadian system have been shown to have strong regulatory effects on immunological functions affecting both the innate and the adaptive immunity. First, during the early slow-wave-sleep stage, a sudden drop in blood levels of cortisol, epinephrine, and norepinephrine induce increased blood levels of the hormones leptin, pituitary growth hormone, and prolactin. These signals induce a pro-inflammatory state through the production of the pro-inflammatory cytokines interleukin-1, interleukin-12, TNF-alpha and IFN-gamma.

These cytokines then stimulate immune functions such as immune cells activation, proliferation, and differentiation. It is during this time that undifferentiated, or less differentiated, like naïve and central memory T cells, peak (i.e. during a time of a slowly evolving adaptive immune response). In addition to these effects, the milieu of hormones produced at this time (leptin, pituitary growth hormone, and prolactin) support the interactions between APCs and T-cells, a shift of the Th1/Th2 cytokine balance towards one that supports Th1, an increase in overall Th cell proliferation, and naïve T cell migration to lymph nodes.

This milieu is also thought to support the formation of long-lasting immune memory through the initiation of Th1 immune responses. In contrast, during wake periods differentiated effector cells, such as cytotoxic natural killer cells and CTLs (cytotoxic T lymphocytes), peak in order to elicit an effective response against any intruding pathogens. As well during awake active times, anti-inflammatory molecules, such as cortisol and catecholamines, peak. There are two theories as to why the pro-inflammatory state is reserved for sleep time.

First, inflammation would cause serious cognitive and physical impairments if it were to occur during wake times. Second, inflammation may occur during sleep times due to the presence of melatonin. Inflammation causes a great deal of oxidative stress and the presence of melatonin during sleep times could actively counteract free radical production during this time.

Nutrition and Diet
Overnutrition is associated with diseases such as diabetes and obesity, which are known to affect immune function. More moderate malnutrition, as well as certain specific trace mineral and nutrient deficiencies, can also compromise the immune response. Foods rich in certain fatty acids may foster a healthy immune system. Likewise, fetal undernourishment can cause a lifelong impairment of the immune system.

Repair and Regeneration
The immune system, particularly the innate component, plays a decisive role in tissue repair after an insult. Key actors include macrophages and neutrophils, but other cellular actors, including γδ T cells, innate lymphoid cells (ILCs), and regulatory T cells (Tregs), are also important. The plasticity of immune cells and the balance between pro-inflammatory and anti-inflammatory signals are crucial aspects of efficient tissue repair. Immune components and pathways are involved in regeneration as well, for example in amphibians. According to one hypothesis, organisms that can regenerate could be less immunocompetent than organisms that cannot regenerate.

Disorders

The immune system is a remarkably effective structure that incorporates specificity, inducibility and adaptation. Failures of host defense do occur, however, and fall into three broad categories: immunodeficiencies, autoimmunity, and hypersensitivities.

Immunodeficiencies

Immunodeficiencies occur when one or more of the components of the immune system are inactive. The ability of the immune system to respond to pathogens is diminished in both the young and the elderly, with immune responses beginning to decline at around 50 years of age due to immunosenescence. In developed countries, obesity, alcoholism, and drug use are common causes of poor immune function. However, malnutrition is the most common cause of immunodeficiency in developing countries. Diets lacking sufficient protein are associated with impaired cell-mediated immunity, complement activity, phagocyte function, IgA antibody concentrations, and cytokine production. Additionally, the loss of the thymus at an early age through genetic mutation or surgical removal results in severe immunodeficiency and a high susceptibility to infection. Immunodeficiencies can also be inherited or 'acquired'. Chronic granulomatous disease, where phagocytes have a reduced ability to destroy pathogens, is an example of an inherited, or congenital, immunodeficiency. AIDS and some types of cancer cause acquired immunodeficiency.

Autoimmunity

Overactive immune responses comprise the other end of immune dysfunction, particularly the autoimmune disorders. Here, the immune system fails to properly distinguish between self and non-self, and attacks part of the body. Under normal circumstances, many T cells and antibodies react with "self" peptides. One of the functions of specialized cells (located in the thymus and bone marrow) is to present young lymphocytes with self antigens produced throughout the body and to eliminate those cells that recognize self-antigens, preventing autoimmunity.

Hypersensitivity

Hypersensitivity is an immune response that damages the body's own tissues. They are divided into four classes (Type I – IV) based on the mechanisms involved and the time course of the hypersensitive reaction. Type I hypersensitivity is an immediate or anaphylactic reaction, often associated with allergy. Symptoms can range from mild discomfort to death. Type I hypersensitivity is mediated by IgE, which triggers degranulation of mast cells and basophils when cross-linked by antigen. Type II hypersensitivity occurs when antibodies bind to antigens on the patient's own cells, marking them for destruction. This is also called antibody-dependent (or cytotoxic) hypersensitivity, and is mediated by IgG and IgM antibodies. Immune complexes (aggregations of antigens, complement proteins, and IgG and IgM antibodies) deposited in various tissues trigger Type III hypersensitivity reactions. Type IV hypersensitivity (also known as cell-mediated or delayed type hypersensitivity) usually takes between two and three days to develop. Type IV reactions are involved in many autoimmune and infectious diseases, but may also involve contact dermatitis (poison ivy). These reactions are mediated by T cells, monocytes, and macrophages.

Idiopathic Inflammation

Inflammation is one of the first responses of the immune system to infection, but it can appear without known cause. Inflammation is produced by eicosanoids and cytokines, which are released by injured or infected cells. Eicosanoids include prostaglandins that produce fever and the dilation of blood vessels associated with inflammation, and leukotrienes that attract certain white blood cells (leukocytes). Common cytokines include interleukins that are responsible for communication between white blood cells; chemokines that promote chemotaxis; and interferons that have anti-viral effects, such as shutting down protein synthesis in the host cell. Growth factors and cytotoxic factors may also be released. These cytokines and other chemicals recruit immune cells to the site of infection and promote healing of any damaged tissue following the removal of pathogens.

Manipulation in Medicine

The immune response can be manipulated to suppress unwanted responses resulting from autoimmunity, allergy, and transplant rejection, and to stimulate protective responses against pathogens that largely elude the immune system (see immunization) or cancer.

Immunosuppression

Immunosuppressive drugs are used to control autoimmune disorders or inflammation when excessive tissue damage occurs, and to prevent transplant rejection after an organ transplant. Anti-inflammatory drugs are often used to control the effects of inflammation. Glucocorticoids are the most powerful of these drugs; however, these drugs can have many undesirable side effects, such as central obesity, hyperglycemia, osteoporosis, and their use must be tightly controlled. Lower doses of anti-inflammatory drugs are often used in conjunction with cytotoxic or immunosuppressive drugs such as methotrexate or azathioprine. Cytotoxic drugs inhibit the immune response by killing dividing cells such as activated T cells. However, the killing is indiscriminate and other constantly dividing cells and their organs are affected, which causes toxic side effects. Immunosuppressive drugs such as cyclosporin prevent T cells from responding to signals correctly by inhibiting signal transduction pathways. Cancer immunotherapy covers the medical ways to stimulate the immune system to attack cancer tumours.

Vaccination

Long-term active memory is acquired following infection by activation of B and T cells. Active immunity can also be generated artificially, through vaccination. The principle behind vaccination (also called immunization) is to introduce an antigen from a pathogen in order to stimulate the immune system and develop specific immunity against that particular pathogen without causing disease associated with that organism. This deliberate induction of an immune response is successful because it exploits the natural specificity of the immune system, as well as its inducibility. With infectious disease remaining one of the leading causes of death in the human population, vaccination represents the most effective manipulation of the immune system mankind has developed. Most viral vaccines are based on live attenuated viruses, while many bacterial vaccines are based on acellular components of micro-organisms, including harmless toxin components. Since many antigens derived from acellular vaccines do not strongly induce the adaptive response, most bacterial vaccines are provided with additional adjuvants that activate the antigen-presenting cells of the innate immune system and maximize immunogenicity.

Tumor Immunology

Another important role of the immune system is to identify and eliminate tumors. This is called immune surveillance. The transformed cells of tumors express antigens that are not found on normal cells. To the immune system, these antigens appear foreign, and their presence causes immune cells to attack the transformed tumor cells. The antigens expressed by tumors have several sources; some are derived from oncogenic viruses like human papillomavirus, which causes cervical cancer, while others are the organism's own proteins that occur at low levels in normal cells but reach high levels in tumor cells.

One example is an enzyme called tyrosinase that, when expressed at high levels, transforms certain skin cells (e.g. melanocytes) into tumors called melanomas. A third possible source of tumor antigens are proteins normally important for regulating cell growth and survival, that commonly mutate into cancer inducing molecules called oncogenes. The main response of the immune system to tumors is to destroy the abnormal cells using killer T cells, sometimes with the assistance of helper T cells.

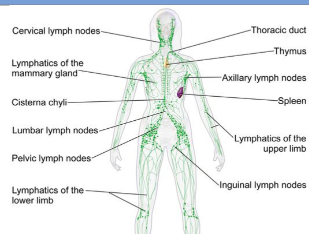
Tumor antigens are presented on MHC class I molecules in a similar way to viral antigens. This allows killer T cells to recognize the tumor cell as abnormal. NK cells also kill tumorous cells in a similar way, especially if the tumor cells have fewer MHC class I molecules on their surface than normal; this is a common phenomenon with tumors. Sometimes antibodies are generated against tumor cells allowing for their destruction by the complement system. This allows killer T cells to recognize the tumor cell as abnormal.

NK cells also kill tumorous cells in a similar way, especially if the tumor cells have fewer MHC class I molecules on their surface than normal; this is a common phenomenon with tumors. Sometimes antibodies are generated against tumor cells allowing for their destruction by the complement system. Clearly, some tumors evade the immune system and go on to become cancers. Tumor cells often have a reduced number of MHC class I molecules on their surface, thus avoiding detection by killer T cells.

Some tumor cells also release products that inhibit the immune response; for example by secreting the cytokine TGF-β, which suppresses the activity of macrophages and lymphocytes. In addition, immunological tolerance may develop against tumor antigens, so the immune system no longer attacks the tumor cells.

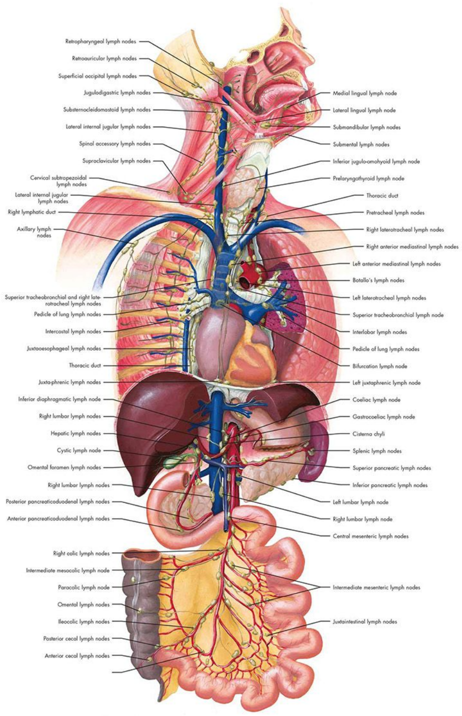
Paradoxically, macrophages can promote tumor growth when tumor cells send out cytokines that attract macrophages, which then generate cytokines and growth factors such as tumor-necrosis factor alpha that nurture tumor development or promote stem-cell-like plasticity. In addition, a combination of hypoxia in the tumor and a cytokine produced by macrophages induces tumor cells to decrease production of a protein that blocks metastasis and thereby assists spread of cancer cells.

8 Lymphatic System

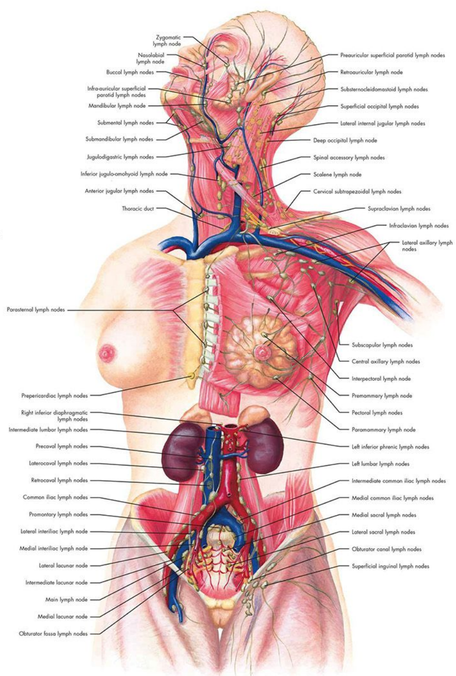


The lymphatic system is part of the vascular system and an important part of the immune system, comprising a large network of lymphatic vessels that carry a clear fluid called lymph directionally towards the heart. Unlike the circulatory system, the lymphatic system is not a closed system. The human circulatory system processes an average of 20 litres of blood per day through capillary filtration, which removes plasma while leaving the blood cells. Roughly 17 litres of the filtered plasma is reabsorbed directly into the blood vessels, while the remaining three litres remain in the interstitial fluid.

One of the main functions of the lymph system is to provide an accessory return route to the blood for the surplus three litres. The other main function is that of defense in the immune system. Lymph is very similar to blood plasma: it contains lymphocytes. It also contains waste products and cellular debris together with bacteria and proteins. Associated organs composed of lymphoid tissue are the sites of lymphocyte production.



Regional lymph nodes of head and neck (deep layer), thoracic organs, upper and lower abdominal organs



Regional lymph nodes of head and neck (superficial layer) and mammary gland. Lymph nodes of axillae, abdominal cavity, pelvis and groin

Lymphocytes are concentrated in the lymph nodes. The spleen and the thymus are also lymphoid organs of the immune system. The tonsils are lymphoid organs that are also associated with the digestive system. Lymphoid tissues contain lymphocytes, and also contain other types of cells for support. The system also includes all the structures dedicated to the circulation and production of lymphocytes (the primary cellular component of lymph), which also includes the bone marrow, and the lymphoid tissue associated with the digestive system.

The blood does not come into direct contact with the parenchymal cells and tissues in the body (except in case of an injury causing rupture of one or more blood vessels), but constituents of the blood first exit the microvascular exchange blood vessels to become interstitial fluid, which comes into contact with the parenchymal cells of the body.

Lymph is the fluid that is formed when interstitial fluid enters the initial lymphatic vessels of the lymphatic system. The lymph is then moved along the lymphatic vessel network by either intrinsic contractions of the lymphatic passages or by extrinsic compression of the lymphatic vessels via external tissue forces (e.g., the contractions of skeletal muscles), or by lymph hearts in some animals. The organization of lymph nodes and drainage follows the organization of the body into external and internal regions; therefore, the lymphatic drainage of the head, limbs, and body cavity walls follows an external route, and the lymphatic drainage of the thorax, abdomen, and pelvic cavities follows an internal route. Eventually, the lymph vessels empty into the lymphatic ducts, which drain into one of the two subclavian veins, near their junction with the internal jugular veins.

Structure

The lymphatic system consists of lymphatic organs, a conducting network of lymphatic vessels, and the circulating lymph. The primary or central lymphoid organs generate lymphocytes from immature progenitor cells. The thymus and the bone marrow constitute the primary lymphoid organs involved in the production and early clonal selection of lymphocyte tissues. Bone marrow is responsible for both the creation of T cells and the production and maturation of B cells. From the bone marrow, B cells immediately join the circulatory system and travel to secondary lymphoid organs in search of pathogens. T cells, on the other hand, travel from the bone marrow to the thymus, where they develop further. Mature T cells join B cells in search of pathogens. The other 95% of T cells begin a process of apoptosis, a form of programmed cell death. Secondary or peripheral lymphoid organs, which include lymph nodes and the spleen, maintain mature naive lymphocytes and initiate an adaptive immune response. The peripheral lymphoid organs are the sites of lymphocyte activation by antigens. Activation leads to clonal expansion and affinity maturation. Mature lymphocytes recirculate between the blood and the peripheral lymphoid organs until they encounter their specific antigen.

Secondary lymphoid tissue provides the environment for the foreign or altered native molecules (antigens) to interact with the lymphocytes. It is exemplified by the lymph nodes, and the lymphoid follicles in tonsils, Peyer's patches, spleen, adenoids, skin, etc. that are associated with the mucosa-associated lymphoid tissue (MALT). In the gastrointestinal wall the appendix has mucosa resembling that of the colon, but here it is heavily infiltrated with lymphocytes. Tertiary lymphoid organs (TLO) are abnormal lymph node–like structures that form in peripheral tissues at sites of chronic inflammation, such as chronic infection, transplanted organs undergoing graft rejection, some cancers, and autoimmune and autoimmune-related diseases. TLOs are regulated differently from the normal process whereby lymphoid tissues are formed during ontogeny, being dependent on cytokines and hematopoietic cells, but still drain interstitial fluid and transport lymphocytes in response to the same chemical messengers and gradients. TLOs typically contains far fewer lymphocytes, and assumes an immune role only when challenged with antigens that result in inflammation. It achieves this by importing the lymphocytes from blood and lymph.

Thymus

The thymus is a primary lymphoid organ and the site of maturation for T cells, the lymphocytes of the adaptive immune system. The thymus increases in size from birth in response to postnatal antigen stimulation, then to puberty and regresses thereafter. The loss or lack of the thymus results in severe immunodeficiency and subsequent high susceptibility to infection. In most species, the thymus consists of lobules divided by septa which are made up of epithelium and is therefore an epithelial organ. T cells mature from thymocytes, proliferate and undergo selection process in the thymic cortex before entering the medulla to interact with epithelial cells. The thymus provides an inductive environment for development of T cells from hematopoietic progenitor cells. In addition, thymic stromal cells allow for the selection of a functional and self-tolerant T cell repertoire. Therefore, one of the most important roles of the thymus is the induction of central tolerance. The thymus is largest and most active during the neonatal and pre-adolescent periods. By the early teens, the thymus begins to atrophy and thymic stroma is mostly replaced by adipose tissue. Nevertheless, residual T lymphopoiesis continues throughout adult life.

Spleen
The main functions of the spleen are:
● to produce immune cells to fight antigens
● to remove particulate matter and aged blood cells, mainly red blood cells.
● to produce blood cells during fetal life

The spleen synthesizes antibodies in its white pulp and removes antibody-coated bacteria and antibody-coated blood cells by way of blood and lymph node circulation. A study published in 2009 using mice found that the spleen contains, in its reserve, half of the body's monocytes within the red pulp. These monocytes, upon moving to injured tissue (such as the heart), turn into dendritic cells and macrophages while promoting tissue healing. The spleen is a center of activity of the mononuclear phagocyte system and can be considered analogous to a large lymph node, as its absence causes a predisposition to certain infections. Like the thymus, the spleen has only efferent lymphatic vessels. Both the short gastric arteries and the splenic artery supply it with blood. The germinal centers are supplied by arterioles called penicilliary radicles. Up to the fifth month of prenatal development the spleen creates red blood cells. After birth the bone marrow is solely responsible for hematopoiesis. As a major lymphoid organ and a central player in the reticuloendothelial system, the spleen retains the ability to produce lymphocytes. The spleen stores red blood cells and lymphocytes. It can store enough blood cells to help in an emergency. Up to 25% of lymphocytes can be stored at any one time.

Lymphoid Tissue (Lymph Nodes)
A lymph node is an organized collection of lymphoid tissue, through which the lymph passes on its way back to the blood. Lymph nodes are located at intervals along the lymphatic system. Several afferent lymph vessels bring in lymph, which percolates through the substance of the lymph node, and is then drained out by an efferent lymph vessel. There are between five and six hundred lymph nodes in the human body, many of which are grouped in clusters in different regions as in the underarm and abdominal areas.

Lymph node clusters are commonly found at the base of limbs (groin, armpits) and in the neck, where lymph is collected from regions of the body likely to sustain pathogen contamination from injuries. The substance of a lymph node consists of lymphoid follicles in an outer portion called the cortex. The inner portion of the node is called the medulla, which is surrounded by the cortex on all sides except for a portion known as the hilum.

The hilum presents as a depression on the surface of the lymph node, causing the otherwise spherical lymph node to be bean-shaped or ovoid. The efferent lymph vessel directly emerges from the lymph node at the hilum. The arteries and veins supplying the lymph node with blood enter and exit through the hilum. The region of the lymph node called the paracortex immediately surrounds the medulla. Unlike the cortex, which has mostly immature T cells, or thymocytes, the paracortex has a mixture of immature and mature T cells. Lymphocytes enter the lymph nodes through specialised high endothelial venules found in the paracortex.

A lymph follicle is a dense collection of lymphocytes, the number, size and configuration of which change in accordance with the functional state of the lymph node. For example, the follicles expand significantly when encountering a foreign antigen. The selection of B cells, or B lymphocytes, occurs in the germinal centre of the lymph nodes. Lymph nodes are particularly numerous in the mediastinum in the chest, neck, pelvis, axilla, inguinal region, and in association with the blood vessels of the intestines.

Other Lymphoid Tissue
Lymphoid tissue associated with the lymphatic system is concerned with immune functions in defending the body against infections and the spread of tumours. It consists of connective tissue formed of reticular fibers, with various types of leukocytes, (white blood cells), mostly lymphocytes enmeshed in it, through which the lymph passes. Regions of the lymphoid tissue that are densely packed with lymphocytes are known as lymphoid follicles. Lymphoid tissue can either be structurally well organized as lymph nodes or may consist of loosely organized lymphoid follicles known as the mucosa-associated lymphoid tissue. The central nervous system also has lymphatic vessels, as discovered by the University of Virginia Researchers. The search for T-cell gateways into and out of the meninges uncovered functional meningeal lymphatic vessels lining the dural sinuses, anatomically integrated into the membrane surrounding the brain.

Lymphatic Vessels
The lymphatic vessels, also called lymph vessels, conduct lymph between different parts of the body. They include the tubular vessels of the lymph capillaries, and the larger collecting vessels–the right lymphatic duct and the thoracic duct (the left lymphatic duct). The lymph capillaries are mainly responsible for the absorption of interstitial fluid from the tissues, while lymph vessels propel the absorbed fluid forward into the larger collecting ducts, where it ultimately returns to the bloodstream via one of the subclavian veins. These vessels are also called the lymphatic channels or simply lymphatics. The lymphatics are responsible for maintaining the balance of the body fluids. Its network of capillaries and collecting lymphatic vessels work to efficiently drain and transport extravasated fluid, along with proteins and antigens, back to the circulatory system. Numerous intraluminal valves in the vessels ensure a unidirectional flow of lymph without reflux. Two valve systems are used to achieve this one directional flow—a primary and a secondary valve system. The capillaries are blind-ended, and the valves at the ends of capillaries use specialised junctions together with anchoring filaments to allow a unidirectional flow to the primary vessels. The collecting lymphatics, however, act to propel the lymph by the combined actions of the intraluminal valves and lymphatic muscle cells.

Development
Lymphatic tissues begin to develop by the end of the fifth week of embryonic development. Lymphatic vessels develop from lymph sacs that arise from developing veins, which are derived from mesoderm. The first lymph sacs to appear are the paired jugular lymph sacs at the junction of the internal jugular and subclavian veins. From the jugular lymph sacs, lymphatic capillary plexuses spread to the thorax, upper limbs, neck and head. Some of the plexuses enlarge and form lymphatic vessels in their respective regions.

Each jugular lymph sac retains at least one connection with its jugular vein, the left one developing into the superior portion of the thoracic duct. The next lymph sac to appear is the unpaired retroperitoneal lymph sac at the root of the mesentery of the intestine. It develops from the primitive vena cava and mesonephric veins. Capillary plexuses and lymphatic vessels spread from the retroperitoneal lymph sac to the abdominal viscera and diaphragm.

The sac establishes connections with the cisterna chyli but loses its connections with neighbouring veins. The last of the lymph sacs, the paired posterior lymph sacs, develop from the iliac veins. The posterior lymph sacs produce capillary plexuses and lymphatic vessels of the abdominal wall, pelvic region, and lower limbs. The posterior lymph sacs join the cisterna chyli and lose their connections with adjacent veins.

With the exception of the anterior part of the sac from which the cisterna chyli develops, all lymph sacs become invaded by mesenchymal cells and are converted into groups of lymph nodes. The spleen develops from mesenchymal cells between layers of the dorsal mesentery of the stomach. The thymus arises as an outgrowth of the third pharyngeal pouch.

Function

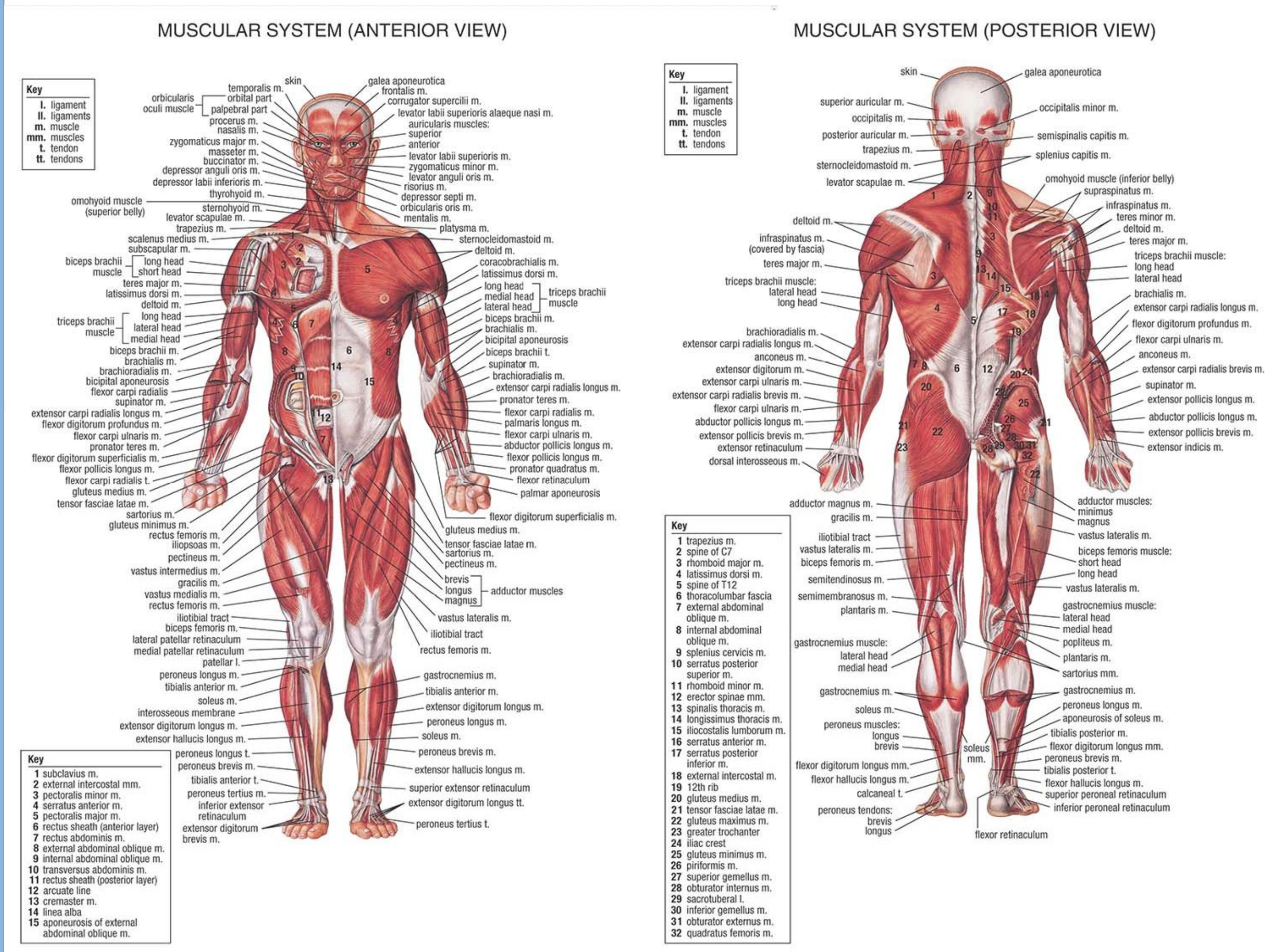
The lymphatic system has multiple interrelated functions:
● It is responsible for the removal of interstitial fluid from tissues
● It absorbs and transports fatty acids and fats as chyle from the digestive system
● It transports white blood cells to and from the lymph nodes into the bones
● The lymph transports antigen-presenting cells, such as dendritic cells, to the lymph nodes where an immune response is stimulated.

Fat Absorption
Lymph vessels called lacteals are at the beginning of the gastrointestinal tract, predominantly in the small intestine. While most other nutrients absorbed by the small intestine are passed on to the portal venous system to drain via the portal vein into the liver for processing, fats (lipids) are passed on to the lymphatic system to be transported to the blood circulation via the thoracic duct. (There are exceptions, for example medium-chain triglycerides are fatty acid esters of glycerol that passively diffuse from the GI tract to the portal system.) The enriched lymph originating in the lymphatics of the small intestine is called chyle. The nutrients that are released into the circulatory system are processed by the liver, having passed through the systemic circulation.

Immune Function
The lymphatic system plays a major role in the body's immune system, as the primary site for cells relating to adaptive immune system including T-cells and B-cells. Cells in the lymphatic system react to antigens presented or found by the cells directly or by other dendritic cells. When an antigen is recognized, an immunological cascade begins involving the activation and recruitment of more and more cells, the production of antibodies and cytokines and the recruitment of other immunological cells such as macrophages.

9 Muscular System

The muscular system is an organ system consisting of skeletal, smooth and cardiac muscles. It permits movement of the body, maintains posture and circulates blood throughout the body. The muscular systems in vertebrates are controlled through the nervous system although some muscles (such as the cardiac muscle) can be completely autonomous. Together with the skeletal system, it forms the musculoskeletal system, which is responsible for movement of the human body.



Muscular System

There are three distinct types of muscles: skeletal muscles, cardiac or heart muscles, and smooth (non-striated) muscles. Muscles provide strength, balance, posture, movement and heat for the body to keep warm.

Skeletal Muscle
Skeletal muscles, like other striated muscles, are composed of myocytes, or muscle fibers, which are in turn composed of myofibrils, which are composed of sarcomeres, the basic building block of striated muscle tissue. Upon stimulation by an action potential, skeletal muscles perform a coordinated contraction by shortening each sarcomere. The best proposed model for understanding contraction is the sliding filament model of muscle contraction. Within the sarcomere, actin and myosin fibers overlap in a contractile motion towards each other. Myosin filaments have club-shaped heads that project toward the actin filaments. Larger structures along the myosin filament called myosin heads are used to provide attachment points on binding sites for the actin filaments. The myosin heads move in a coordinated style; they swivel toward the center of the sarcomere, detach and then reattach to the nearest active site of the actin filament. This is called a ratchet type drive system. This process consumes large amounts of adenosine triphosphate (ATP), the energy source of the cell. ATP binds to the cross bridges between myosin heads and actin filaments. The release of energy powers the swiveling of the myosin head.

When ATP is used, it becomes adenosine diphosphate (ADP), and since muscles store little ATP, they must continuously replace the discharged ADP with ATP. Muscle tissue also contains a stored supply of a fast acting recharge chemical, creatine phosphate, which when necessary can assist with the rapid regeneration of ADP into ATP. Calcium ions are required for each cycle of the sarcomere. Calcium is released from the sarcoplasmic reticulum into the sarcomere when a muscle is stimulated to contract. This calcium uncovers the actin binding sites. When the muscle no longer needs to contract, the calcium ions are pumped from the sarcomere and back into storage in the sarcoplasmic reticulum. There are approximately 639 skeletal muscles in the human body.

Cardiac Muscle
Heart muscles are distinct from skeletal muscles because the muscle fibers are laterally connected to each other. Furthermore, just as with smooth muscles, their movement is involuntary. Heart muscles are controlled by the sinus node influenced by the autonomic nervous system.

Smooth Muscle
Smooth muscles are controlled directly by the autonomic nervous system and are involuntary, meaning that they are incapable of being moved by conscious thought. Functions such as heartbeat and lungs (which are capable of being willingly controlled, be it to a limited extent) are involuntary muscles but are not smooth muscles.

Physiology

Contraction
Neuromuscular junctions are the focal point where a motor neuron attaches to a muscle. Acetylcholine, (a neurotransmitter used in skeletal muscle contraction) is released from the axon terminal of the nerve cell when an action potential reaches the microscopic junction called a synapse. A group of chemical messengers cross the synapse and stimulate the formation of electrical changes, which are produced in the muscle cell when the acetylcholine binds to receptors on its surface. Calcium is released from its storage area in the cell's sarcoplasmic reticulum. An impulse from a nerve cell causes calcium release and brings about a single, short muscle contraction called a muscle twitch. If there is a problem at the neuromuscular junction, a very prolonged contraction may occur, such as the muscle contractions that result from tetanus. Also, a loss of function at the junction can produce paralysis. Skeletal muscles are organized into hundreds of motor units, each of which involves a motor neuron, attached by a series of thin finger-like structures called axon terminals. These attach to and control discrete bundles of muscle fibers. A coordinated and fine tuned response to a specific circumstance will involve controlling the precise number of motor units used. While individual muscle units contract as a unit, the entire muscle can contract on a predetermined basis due to the structure of the motor unit. Motor unit coordination, balance, and control frequently come under the direction of the cerebellum of the brain. This allows for complex muscular coordination with little conscious effort, such as when one drives a car without thinking about the process.

Aerobic and Anaerobic Muscle Activity
At rest, the body produces the majority of its ATP aerobically in the mitochondria without producing lactic acid or other fatiguing byproducts. During exercise, the method of ATP production varies depending on the fitness of the individual as well as the duration and intensity of exercise. At lower activity levels, when exercise continues for a long duration (several minutes or longer), energy is produced aerobically by combining oxygen with carbohydrates and fats stored in the body. During activity that is higher in intensity, with possible duration decreasing as intensity increases, ATP production can switch to anaerobic pathways, such as the use of the creatine phosphate and the phosphagen system or anaerobic glycolysis. Aerobic ATP production is biochemically much slower and can only be used for long-duration, low-intensity exercise, but produces no fatiguing waste products that can not be removed immediately from the sarcomere and the body, and it results in a much greater number of ATP molecules per fat or carbohydrate molecule. Aerobic training allows the oxygen delivery system to be more efficient, allowing aerobic metabolism to begin quicker. Anaerobic ATP production produces ATP much faster and allows near-maximal intensity exercise, but also produces significant amounts of lactic acid which renders high-intensity exercise unsustainable for more than several minutes. The phosphagen system is also anaerobic. It allows for the highest levels of exercise intensity, but intramuscular stores of phosphocreatine are very limited and can only provide energy for exercises lasting up to ten seconds. Recovery is very quick, with full creatine stores regenerated within five minutes.

Disease

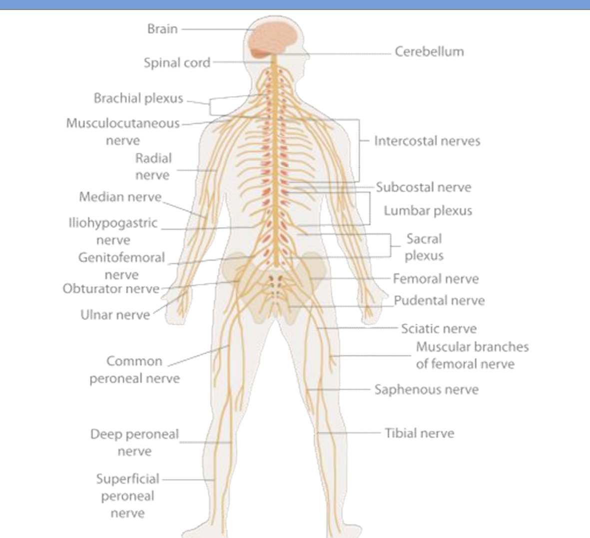
Myopathy
Myopathy is a disease of the muscle in which the muscle fibers do not function properly. This results in muscular weakness. Myopathy means muscle disease. This meaning implies that the primary defect is within the muscle, as opposed to the nerves ("neuropathies" or "neurogenic" disorders) or elsewhere (e.g., the brain). Muscle cramps, stiffness, and spasm can also be associated with myopathy. Muscular disease can be classified as neuromuscular or musculoskeletal in nature. Some conditions, such as myositis, can be considered both neuromuscular and musculoskeletal.

Signs and Symptoms
Common symptoms include muscle weakness, cramps, stiffness, and tetany.

Systemic Diseases
Myopathies in systemic disease results from several different disease processes including endocrine, inflammatory, paraneoplastic, infectious, drug- and toxin-induced, critical illness myopathy, metabolic, collagen related, and myopathies with other systemic disorders. Patients with systemic myopathies often present acutely or sub acutely. On the other hand, familial myopathies or dystrophies generally present in a chronic fashion with exceptions of metabolic myopathies where symptoms on occasion can be precipitated acutely. Most of the inflammatory myopathies can have a chance association with malignant lesion; the incidence appears to be specifically increased only in patients with dermatomyositis.

Treatments
Because different types of myopathies are caused by many different pathways, there is no single treatment for myopathy. Treatments range from treatment of the symptoms to very specific cause-targeting treatments. Drug therapy, physical therapy, bracing for support, surgery, and massage are all current treatments for a variety of myopathies.

10 Nervous System



The nervous system is a highly complex part of an animal that coordinates its actions and sensory information by transmitting signals to and from different parts of its body. The nervous system detects environmental changes that impact the body, then works in tandem with the endocrine system to respond to such events. In vertebrates it consists of two main parts, the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS consists of the brain and spinal cord.

The PNS consists mainly of nerves, which are enclosed bundles of the long fibers or axons, that connect the CNS to every other part of the body. Nerves that transmit signals from the brain are called motor or efferent nerves, while those nerves that transmit information from the body to the CNS are called sensory or afferent.

Spinal nerves serve both functions and are called mixed nerves. The PNS is divided into three separate subsystems, the somatic, autonomic, and enteric nervous systems. Somatic nerves mediate voluntary movement. The autonomic nervous system is further subdivided into the sympathetic and the parasympathetic nervous systems.

The sympathetic nervous system is activated in cases of emergencies to mobilize energy, while the parasympathetic nervous system is activated when organisms are in a relaxed state. The enteric nervous system functions to control the gastrointestinal system. Both autonomic and enteric nervous systems function involuntarily. Nerves that exit from the cranium are called cranial nerves while those exiting from the spinal cord are called spinal nerves.

At the cellular level, the nervous system is defined by the presence of a special type of cell, called the neuron, also known as a "nerve cell". Neurons have special structures that allow them to send signals rapidly and precisely to other cells. They send these signals in the form of electrochemical waves traveling along thin fibers called axons, which cause chemicals called neurotransmitters to be released at junctions called synapses. A cell that receives a synaptic signal from a neuron may be excited, inhibited, or otherwise modulated. The connections between neurons can form neural pathways, neural circuits, and larger networks that generate an organism's perception of the world and determine its behavior.

Along with neurons, the nervous system contains other specialized cells called glial cells (or simply glia), which provide structural and metabolic support. Nervous systems are found in most multicellular animals, but vary greatly in complexity. The only multicellular animals that have no nervous system at all are sponges, placozoans, and mesozoans, which have very simple body plans.

The nervous systems of the radially symmetric organisms ctenophores (comb jellies) and cnidarians (which include anemones, hydras, corals and jellyfish) consist of a diffuse nerve net. All other animal species, with the exception of a few types of worm, have a nervous system containing a brain, a central cord (or two cords running in parallel), and nerves radiating from the brain and central cord. The size of the nervous system ranges from a few hundred cells in the simplest worms, to around 300 billion cells in African elephants. The central nervous system functions to send signals from one cell to others, or from one part of the body to others and to receive feedback.

Malfunction of the nervous system can occur as a result of genetic defects, physical damage due to trauma or toxicity, infection or simply of ageing. The medical specialty of neurology studies disorders of the nervous system and looks for interventions that can prevent or treat them. In the peripheral nervous system, the most common problem is the failure of nerve conduction, which can be due to different causes including diabetic neuropathy and demyelinating disorders such as multiple sclerosis and amyotrophic lateral sclerosis. Neuroscience is the field of science that focuses on the study of the nervous system.

Structure

The nervous system derives its name from nerves, which are cylindrical bundles of fibers (the axons of neurons), that emanate from the brain and spinal cord, and branch repeatedly to innervate every part of the body. Nerves are large enough to have been recognized by the ancient Egyptians, Greeks, and Romans, but their internal structure was not understood until it became possible to examine them using a microscope. A microscopic examination shows that nerves consist primarily of axons, along with different membranes that wrap around them and segregate them into fascicles. The neurons that give rise to nerves do not lie entirely within the nerves themselves—their cell bodies reside within the brain, spinal cord, or peripheral ganglia.

All animals more advanced than sponges have nervous systems. However, even sponges, unicellular animals, and non-animals such as slime molds have cell-to-cell signalling mechanisms that are precursors to those of neurons. In radially symmetric animals such as the jellyfish and hydra, the nervous system consists of a nerve net, a diffuse network of isolated cells. In bilaterian animals, which make up the great majority of existing species, the nervous system has a common structure that originated early in the Ediacaran period, over 550 million years ago.

Cells
The nervous system contains two main categories or types of cells: neurons and glial cells.

Neurons	The nervous system is defined by the presence of a special type of cell—the neuron (sometimes called "neurone" or "nerve cell"). Neurons can be distinguished from other cells in a number of ways, but their most fundamental property is that they communicate with other cells via synapses, which are membrane-to-membrane junctions containing molecular machinery that allows rapid transmission of signals, either electrical or chemical. Many types of neuron possess an axon, a protoplasmic protrusion that can extend to distant parts of the body and make thousands of synaptic contacts; axons typically extend throughout the body in bundles called nerves. Even in the nervous system of a single species such as humans, hundreds of different types of neurons exist, with a wide variety of morphologies and functions. These include sensory neurons that transmute physical stimuli such as light and sound into neural signals, and motor neurons that transmute neural signals into activation of muscles or glands; however in many species the great majority of neurons participate in the formation of centralized structures (the brain and ganglia) and they receive all of their input from other neurons and send their output to other neurons.
Glial Cells	Glial cells (named from the Greek for "glue") are non-neuronal cells that provide support and nutrition, maintain homeostasis, form myelin, and participate in signal transmission in the nervous system. In the human brain, it is estimated that the total number of glia roughly equals the number of neurons, although the proportions vary in different brain areas. Among the most important functions of glial cells are to support neurons and hold them in place; to supply nutrients to neurons; to insulate neurons electrically; to destroy pathogens and remove dead neurons; and to provide guidance cues directing the axons of neurons to their targets. A very important type of glial cell (oligodendrocytes in the central nervous system, and Schwann cells in the peripheral nervous system) generates layers of a fatty substance called myelin that wraps around axons and provides electrical insulation which allows them to transmit action potentials much more rapidly and efficiently. Recent findings indicate that glial cells, such as microglia and astrocytes, serve as important resident immune cells within the central nervous system.

Function
At the most basic level, the function of the nervous system is to send signals from one cell to others, or from one part of the body to others. There are multiple ways that a cell can send signals to other cells. One is by releasing chemicals called hormones into the internal circulation, so that they can diffuse to distant sites. In contrast to this "broadcast" mode of signaling, the nervous system provides "point-to-point" signals—neurons project their axons to specific target areas and make synaptic connections with specific target cells. Thus, neural signaling is capable of a much higher level of specificity than hormonal signaling. It is also much faster: the fastest nerve signals travel at speeds that exceed 100 meters per second. At a more integrative level, the primary function of the nervous system is to control the body. It does this by extracting information from the environment using sensory receptors, sending signals that encode this information into the central nervous system, processing the information to determine an appropriate response, and sending output signals to muscles or glands to activate the response. The evolution of a complex nervous system has made it possible for various animal species to have advanced perception abilities such as vision, complex social interactions, rapid coordination of organ systems, and integrated processing of concurrent signals. In humans, the sophistication of the nervous system makes it possible to have language, abstract representation of concepts, transmission of culture, and many other features of human society that would not exist without the human brain.

Neurons and Synapses
Most neurons send signals via their axons, although some types are capable of dendrite-to-dendrite communication. (In fact, the types of neurons called amacrine cells have no axons, and communicate only via their dendrites.) Neural signals propagate along an axon in the form of electrochemical waves called action potentials, which produce cell-to-cell signals at points where axon terminals make synaptic contact with other cells. Synapses may be electrical or chemical. Electrical synapses make direct electrical connections between neurons, but chemical synapses are much more common, and much more diverse in function. At a chemical synapse, the cell that sends signals is called presynaptic, and the cell that receives signals is called postsynaptic. Both the presynaptic and postsynaptic areas are full of molecular machinery that carries out the signalling process. The presynaptic area contains large numbers of tiny spherical vessels called synaptic vesicles, packed with neurotransmitter chemicals. When the presynaptic terminal is electrically stimulated, an array of molecules embedded in the membrane are activated, and cause the contents of the vesicles to be released into the narrow space between the presynaptic and postsynaptic membranes, called the synaptic cleft.

The neurotransmitter then binds to receptors embedded in the postsynaptic membrane, causing them to enter an activated state. Depending on the type of receptor, the resulting effect on the postsynaptic cell may be excitatory, inhibitory, or modulatory in more complex ways. For example, release of the neurotransmitter acetylcholine at a synaptic contact between a motor neuron and a muscle cell induces rapid contraction of the muscle cell. The entire synaptic transmission process takes only a fraction of a millisecond, although the effects on the postsynaptic cell may last much longer (even indefinitely, in cases where the synaptic signal leads to the formation of a memory trace). There are literally hundreds of different types of synapses. In fact, there are over a hundred known neurotransmitters, and many of them have multiple types of receptors. Many synapses use more than one neurotransmitter—a common arrangement is for a synapse to use one fast-acting small-molecule neurotransmitter such as glutamate or GABA, along with one or more peptide neurotransmitters that play slower-acting modulatory roles. Molecular neuroscientists generally divide receptors into two broad groups: chemically gated ion channels and second messenger systems. When a chemically gated ion channel is activated, it forms a passage that allows specific types of ions to flow across the membrane. Depending on the type of ion, the effect on the target cell may be excitatory or inhibitory.

When a second messenger system is activated, it starts a cascade of molecular interactions inside the target cell, which may ultimately produce a wide variety of complex effects, such as increasing or decreasing the sensitivity of the cell to stimuli, or even altering gene transcription. According to a rule called Dale's principle, which has only a few known exceptions, a neuron releases the same neurotransmitters at all of its synapses. This does not mean, though, that a neuron exerts the same effect on all of its targets, because the effect of a synapse depends not on the neurotransmitter, but on the receptors that it activates. Because different targets can (and frequently do) use different types of receptors, it is possible for a neuron to have excitatory effects on one set of target cells, inhibitory effects on others, and complex modulatory effects on others still. Nevertheless, it happens that the two most widely used neurotransmitters, glutamate and GABA, each have largely consistent effects. Glutamate has several widely occurring types of receptors, but all of them are excitatory or modulatory. Similarly, GABA has several widely occurring receptor types, but all of them are inhibitory. Because of this consistency, glutamatergic cells are frequently referred to as "excitatory neurons", and GABAergic cells as "inhibitory neurons".

Mirror Neurons

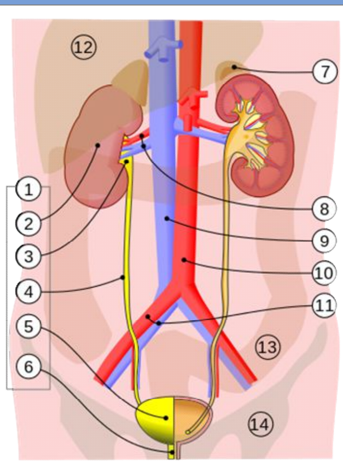
A mirror neuron is a neuron that fires both when an animal acts and when the animal observes the same action performed by another. Thus, the neuron "mirrors" the behavior of the other, as though the observer were itself acting. Such neurons have been directly observed in primate species. Birds have been shown to have imitative resonance behaviors and neurological evidence suggests the presence of some form of mirroring system. In humans, brain activity consistent with that of mirror neurons has been found in the premotor cortex, the supplementary motor area, the primary somatosensory cortex and the inferior parietal cortex. The function of the mirror system is a subject of much speculation. Many researchers in cognitive neuroscience and cognitive psychology consider that this system provides the physiological mechanism for the perception/action coupling (see the common coding theory). They argue that mirror neurons may be important for understanding the actions of other people, and for learning new skills by imitation. Some researchers also speculate that mirror systems may simulate observed actions, and thus contribute to theory of mind skills, while others relate mirror neurons to language abilities. However, to date, no widely accepted neural or computational models have been put forward to describe how mirror neuron activity supports cognitive functions such as imitation. There are neuroscientists who caution that the claims being made for the role of mirror neurons are not supported by adequate research.

Pathology

The central nervous system is protected by major physical and chemical barriers. Physically, the brain and spinal cord are surrounded by tough meningeal membranes, and enclosed in the bones of the skull and vertebral column, which combine to form a strong physical shield. Chemically, the brain and spinal cord are isolated by the blood–brain barrier, which prevents most types of chemicals from moving from the bloodstream into the interior of the CNS. These protections make the CNS less susceptible in many ways than the PNS; the flip side, however, is that damage to the CNS tends to have more serious consequences. Although nerves tend to lie deep under the skin except in a few places such as the ulnar nerve near the elbow joint, they are still relatively exposed to physical damage, which can cause pain, loss of sensation, or loss of muscle control. Damage to nerves can also be caused by swelling or bruises at places where a nerve passes through a tight bony channel, as happens in carpal tunnel syndrome. If a nerve is completely transected, it will often regenerate, but for long nerves this process may take months to complete.

In addition to physical damage, peripheral neuropathy may be caused by many other medical problems, including genetic conditions, metabolic conditions such as diabetes, inflammatory conditions such as Guillain–Barré syndrome, vitamin deficiency, infectious diseases such as leprosy or shingles, or poisoning by toxins such as heavy metals. Many cases have no cause that can be identified, and are referred to as idiopathic. It is also possible for nerves to lose function temporarily, resulting in numbness as stiffness—common causes include mechanical pressure, a drop in temperature, or chemical interactions with local anesthetic drugs such as lidocaine. Physical damage to the spinal cord may result in loss of sensation or movement. If an injury to the spine produces nothing worse than swelling, the symptoms may be transient, but if nerve fibers in the spine are actually destroyed, the loss of function is usually permanent. Experimental studies have shown that spinal nerve fibers attempt to regrow in the same way as nerve fibers, but in the spinal cord, tissue destruction usually produces scar tissue that cannot be penetrated by the regrowing nerves.

11 Urinary System (Renal System)



1. Urinary system
2. Kidney
3. Renal pelvis
4. Ureter
5. Urinary bladder
6. Urethra (Left side with frontal section)
7. Adrenal gland
8. Renal artery and vein
9. Inferior vena cava
10. Abdominal aorta
11. Common iliac artery and vein
12. Liver
13. Large intestine
14. Pelvis

The urinary system, also known as the renal system or urinary tract, consists of the kidneys, ureters, bladder, and the urethra. The purpose of the urinary system is to eliminate waste from the body, regulate blood volume and blood pressure, control levels of electrolytes and metabolites, and regulate blood pH. The urinary tract is the body's drainage system for the eventual removal of urine.

The kidneys have an extensive blood supply via the renal arteries which leave the kidneys via the renal vein. Each kidney consists of functional units called nephrons. Following filtration of blood and further processing, wastes (in the form of urine) exit the kidney via the ureters, tubes made of smooth muscle fibres that propel urine towards the urinary bladder, where it is stored and subsequently expelled from the body by urination (voiding).

The female and male urinary system are very similar, differing only in the length of the urethra. Urine is formed in the kidneys through a filtration of blood. The urine is then passed through the ureters to the bladder, where it is stored. During urination, the urine is passed from the bladder through the urethra to the outside of the body.
800–2,000 milliliters (mL) of urine are normally produced every day in a healthy human. This amount varies according to fluid intake and kidney function.

Structure

The urinary system refers to the structures that produce and transport urine to the point of excretion. In the human urinary system there are two kidneys that are located between the dorsal body wall and parietal peritoneum on both the left and right sides. The formation of urine begins within the functional unit of the kidney, the nephrons. Urine then flows through the nephrons, through a system of converging tubules called collecting ducts. These collecting ducts then join together to form the minor calyces, followed by the major calyces that ultimately join the renal pelvis. From here, urine continues its flow from the renal pelvis into the ureter, transporting urine into the urinary bladder. The anatomy of the human urinary system differs between males and females at the level of the urinary bladder. In males, the urethra begins at the internal urethral orifice in the trigone of the bladder, continues through the external urethral orifice, and then becomes the prostatic, membranous, bulbar, and penile urethra. Urine exits through the external urethral meatus. The female urethra is much shorter, beginning at the bladder neck and terminating in the vaginal vestibule. Under microscopy, the urinary system is covered in a unique lining called urothelium, a type of transitional epithelium. Unlike the epithelial lining of most organs, transitional epithelium can flatten and distend. Urothelium covers most of the urinary system, including the renal pelvis, ureters, and bladder.

Function

The main functions of the urinary system and its components are to:
- Regulate blood volume and composition (e.g. sodium, potassium and calcium)
- Regulate blood pressure.
- Regulate pH homeostasis of the blood.
- Contributes to the production of red blood cells by the kidney.
- Helps synthesize calcitrol the (active form of Vitamin D).
- Stores waste product (mainly urea and uric acid) before it and other products are removed from the body.

Urine Formation
Average urine production in adult humans is about 1–2 litres (L) per day, depending on state of hydration, activity level, environmental factors, weight, and the individual's health. Producing too much or too little urine requires medical attention. Polyuria is a condition of excessive urine production (> 2.5 L/day). Oliguria when < 400 mL (millilitres) are produced, and anuria one of < 100 mL per day. The first step in urine formation is the filtration of blood in the kidneys. In a healthy human the kidney receives between 12 and 30% of cardiac output, but it averages about 20% or about 1.25 L/min.

The basic structural and functional unit of the kidney is the nephron. Its chief function is to regulate the concentration of water and soluble substances like sodium by filtering the blood, reabsorbing what is needed and excreting the rest as urine. In the first part of the nephron, Bowman's capsule filters blood from the circulatory system into the tubules. Hydrostatic and osmotic pressure gradients facilitate filtration across a semipermeable membrane. The filtrate includes water, small molecules, and ions that easily pass through the filtration membrane.

Regulation of Concentration and Volume
The urinary system is under influence of the circulatory system, nervous system, and endocrine system.

However larger molecules such as proteins and blood cells are prevented from passing through the filtration membrane. The amount of filtrate produced every minute is called the glomerular filtration rate or GFR and amounts to 180 litres per day. About 99% of this filtrate is reabsorbed as it passes through the nephron and the remaining 1% becomes urine. The urinary system is regulated by the endocrine system by hormones such as antidiuretic hormone, aldosterone, and parathyroid hormone. Aldosterone plays a central role in regulating blood pressure through its effects on the kidney. It acts on the distal tubules and collecting ducts of the nephron and increases reabsorption of sodium from the glomerular filtrate.

Reabsorption of sodium results in retention of water, which increases blood pressure and blood volume. Antidiuretic hormone (ADH), is a neurohypophysial hormone found in most mammals. Its two primary functions are to retain water in the body and vasoconstriction. Vasopressin regulates the body's retention of water by increasing water reabsorption in the collecting ducts of the kidney nephron. Vasopressin increases water permeability of the kidney's collecting duct and distal convoluted tubule by inducing translocation of aquaporin-CD water channels in the kidney nephron collecting duct plasma membrane.

Urination
Urination is the ejection of urine from the urinary bladder through the urethra to the outside of the body. In healthy humans (and many other animals), the process of urination is under voluntary control. In infants, some elderly individuals, and those with neurological injury, urination may occur as an involuntary reflex. Physiologically, micturition involves coordination between the central, autonomic, and somatic nervous systems. Brain centers that regulate urination include the pontine micturition center, periaqueductal gray, and the cerebral cortex. In placental mammals the male ejects urine through the penis, and the female through the vulva.

Clinical Significance

Urologic disease can involve congenital or acquired dysfunction of the urinary system. As an example, urinary tract obstruction is a urologic disease that can cause urinary retention. Diseases of the kidney tissue are normally treated by nephrologists, while diseases of the urinary tract are treated by urologists. Gynecologists may also treat female urinary incontinence. Diseases of other bodily systems also have a direct effect on urogenital function. For instance, it has been shown that protein released by the kidneys in diabetes mellitus sensitizes the kidney to the damaging effects of hypertension. Diabetes also can have a direct effect in urination due to peripheral neuropathies, which occur in some individuals with poorly controlled blood sugar levels. Urinary incontinence can result from a weakening of the pelvic floor muscles caused by factors such as pregnancy, childbirth, aging, and being overweight. Pelvic floor exercises known as Kegel exercises can help in this condition by strengthening the pelvic floor. There can also be underlying medical reasons for urinary incontinence which are often treatable. In children, the condition is called enuresis. Some cancers also target the urinary system, including bladder cancer, kidney cancer, ureteral cancer, and urethral cancer. Due to the role and location of these organs, treatment is often complicated.

12 Reproductive System

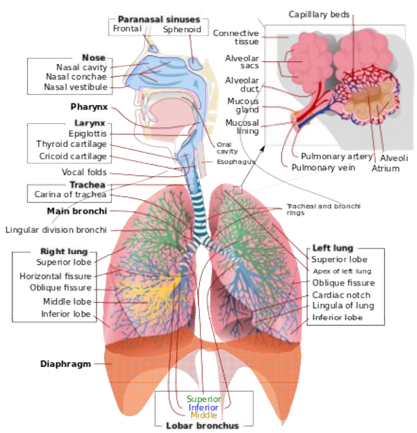
The reproductive system or genital system is a system of sex organs within an organism which work together for the purpose of sexual reproduction. Many non-living substances such as fluids, hormones, and pheromones are also important accessories to the reproductive system. Unlike most organ systems, the sexes of differentiated species often have significant differences. These differences allow for a combination of genetic material between two individuals, which allows for the possibility of greater genetic fitness of the offspring.

Human Reproduction
The human reproductive system usually involves internal fertilization by sexual intercourse. During this process, the male inserts his erect penis into the female's vagina and ejaculates semen, which contains sperm. The sperm then travels through the vagina and cervix into the uterus or fallopian tubes for fertilization of the ovum. Upon successful fertilization and implantation, gestation of the fetus then occurs within the female's uterus for approximately nine months, this process is known as pregnancy in humans. Gestation ends with birth, the process of birth is known as labor. Labor consists of the muscles of the uterus contracting, the cervix dilating, and the baby passing out the vagina (the female genital organ). Human's babies and children are nearly helpless and require high levels of parental care for many years. One important type of parental care is the use of the mammary glands in the female breasts to nurse the baby. The female reproductive system has two functions: The first is to produce egg cells, and the second is to protect and nourish the offspring until birth. The male reproductive system has one function, and it is to produce and deposit sperm. Humans have a high level of sexual differentiation. In addition to differences in nearly every reproductive organ, numerous differences typically occur in secondary sexual characteristics.

Male
The male reproductive system is a series of organs located outside of the body and around the pelvic region of a male that contribute towards the reproduction process. The primary direct function of the male reproductive system is to provide the male sperm for fertilization of the ovum. The major reproductive organs of the male can be grouped into three categories. The first category is sperm production and storage. Production takes place in the testes which are housed in the temperature regulating scrotum, immature sperm then travel to the epididymis for development and storage. The second category are the ejaculatory fluid producing glands which include the seminal vesicles, prostate, and the vas deferens. The final category are those used for copulation, and deposition of the spermatozoa (sperm) within the male, these include the penis, urethra, vas deferens, and Cowper's gland. Major secondary sexual characteristics includes: larger, more muscular stature, deepened voice, facial and body hair, broad shoulders, and development of an adam's apple. An important sexual hormone of males is androgen, and particularly testosterone. The testes release a hormone that controls the development of sperm. This hormone is also responsible for the development of physical characteristics in men such as facial hair and a deep voice.

Female
The human female reproductive system is a series of organs primarily located inside of the body and around the pelvic region of a female that contribute towards the reproductive process. The human female reproductive system contains three main parts: the vulva, which leads to the vagina, the vaginal opening, to the uterus; the uterus, which holds the developing fetus; and the ovaries, which produce the female's ova. The breasts are involved during the parenting stage of reproduction, but in most classifications they are not considered to be part of the female reproductive system. The vagina meets the outside at the vulva, which also includes the labia, clitoris and urethra; during intercourse this area is lubricated by mucus secreted by the Bartholin's glands. The vagina is attached to the uterus through the cervix, while the uterus is attached to the ovaries via the fallopian tubes. Each ovary contains hundreds of egg cells or ova (singular ovum). Approximately every 28 days, the pituitary gland releases a hormone that stimulates some of the ova to develop and grow. One ovum is released and it passes through the fallopian tube into the uterus. Hormones produced by the ovaries prepare the uterus to receive the ovum. It sita her and awaits the sperm for fertilization to occur. When this does not occur i.e. no sperm for fertilization, the lining of the uterus, called the endometrium, and unfertilized ova are shed each cycle through the process of menstruation. If the ovum is fertilized by sperm, it attaches to the endometrium and the fetus develops.

13 Respiratory System



The respiratory system (also respiratory apparatus, ventilatory system) is a biological system consisting of specific organs and structures used for gas exchange in animals and plants. The anatomy and physiology that make this happen varies greatly, depending on the size of the organism, the environment in which it lives and its evolutionary history. In land animals the respiratory surface is internalized as linings of the lungs.

Gas exchange in the lungs occurs in millions of small air sacs called alveoli in mammals and reptiles, but atria in birds. These microscopic air sacs have a very rich blood supply, thus bringing the air into close contact with the blood. These air sacs communicate with the external environment via a system of airways, or hollow tubes, of which the largest is the trachea, which branches in the middle of the chest into the two main bronchi.

These enter the lungs where they branch into progressively narrower secondary and tertiary bronchi that branch into numerous smaller tubes, the bronchioles. In birds the bronchioles are termed parabronchi. It is the bronchioles, or parabronchi that generally open into the microscopic alveoli in mammals and atria in birds. Air has to be pumped from the environment into the alveoli or atria by the process of breathing which involves the muscles of respiration.

In most fish, and a number of other aquatic animals (both vertebrates and invertebrates) the respiratory system consists of gills, which are either partially or completely external organs, bathed in the watery environment. This water flows over the gills by a variety of active or passive means. Gas exchange takes place in the gills which consist of thin or very flat filaments and lammelae which expose a very large surface area of highly vascularized tissue to the water. Other animals, such as insects, have respiratory systems with very simple anatomical features, and in amphibians even the skin plays a vital role in gas exchange. Plants also have respiratory systems but the directionality of gas exchange can be opposite to that in animals. The respiratory system in plants includes anatomical features such as stomata, that are found in various parts of the plant.

Anatomy

In humans and other mammals, the anatomy of a typical respiratory system is the respiratory tract. The tract is divided into an upper and a lower respiratory tract. The upper tract includes the nose, nasal cavities, sinuses, pharynx and the part of the larynx above the vocal folds. The lower tract includes the lower part of the larynx, the trachea, bronchi, bronchioles and the alveoli. The branching airways of the lower tract are often described as the respiratory tree or tracheobronchial tree. The intervals between successive branch points along the various branches of "tree" are often referred to as branching "generations", of which there are, in the adult human about 23. The earlier generations (approximately generations 0–16), consisting of the trachea and the bronchi, as well as the larger bronchioles which simply act as air conduits, bringing air to the respiratory bronchioles, alveolar ducts and alveoli (approximately generations 17–23), where gas exchange takes place. Bronchioles are defined as the small airways lacking any cartilagenous support. The first bronchi to branch from the trachea are the right and left main bronchi. Second only in diameter to the trachea (1.8 cm), these bronchi (1 -1.4 cm in diameter) enter the lungs at each hilum, where they branch into narrower secondary bronchi known as lobar bronchi, and these branch into narrower tertiary bronchi known as segmental bronchi.

Further divisions of the segmental bronchi (1 to 6 mm in diameter) are known as 4th order, 5th order, and 6th order segmental bronchi, or grouped together as subsegmental bronchi. Compared to the, on average, 23 number of branchings of the respiratory tree in the adult human, the mouse has only about 13 such branchings. The alveoli are the dead end terminals of the "tree", meaning that any air that enters them has to exit via the same route. A system such as this creates dead space, a volume of air (about 150 ml in the adult human) that fills the airways after exhalation and is breathed back into the alveoli before environmental air reaches them. At the end of inhalation the airways are filled with environmental air, which is exhaled without coming in contact with the gas exchanger.

Ventilatory Volumes
The lungs expand and contract during the breathing cycle, drawing air in and out of the lungs. The volume of air moved in or out of the lungs under normal resting circumstances (the resting tidal volume of about 500 ml), and volumes moved during maximally forced inhalation and maximally forced exhalation are measured in humans by spirometry. A typical adult human spirogram with the names given to the various excursions in volume the lungs can undergo is illustrated below. Not all the air in the lungs can be expelled during maximally forced exhalation. This is the residual volume of about 1.0-1.5 liters which cannot be measured by spirometry. Volumes that include the residual volume (i.e. functional residual capacity of about 2.5-3.0 liters, and total lung capacity of about 6 liters) can therefore also not be measured by spirometry. Their measurement requires special techniques. The rates at which air is breathed in or out, either through the mouth or nose, or into or out of the alveoli are tabulated below, together with how they are calculated. The number of breath cycles per minute is known as the respiratory rate.

Measurement Minute ventilation **Equation** tidal volume * respiratory rate **Description** The total volume of air entering, or leaving, the nose or mouth per minute.	**Measurement** Alveolar ventilation **Equation** (tidal volume – dead space) * respiratory rate **Description** The volume of air entering or leaving the alveoli per minute.	**Measurement** Dead space ventilation **Equation** dead space * respiratory rate **Description** The volume of air that does not reach the alveoli during inhalation, but instead remains in the airways, per minute.

Breathing Mechanics

In mammals, inhalation at rest is primarily due to the contraction of the diaphragm. This is an upwardly domed sheet of muscle that separates the thoracic cavity from the abdominal cavity. When it contracts the sheet flattens, increasing the volume of the thoracic cavity. The contracting diaphragm pushes the abdominal organs downwards. But because the pelvic floor prevents the lowermost abdominal organs moving in that direction, the pliable abdominal contents cause the belly to bulge outwards to the front and sides, because the relaxed abdominal muscles do not resist this movement. This entirely passive bulging (and shrinking during exhalation) of the abdomen during normal breathing is sometimes referred to as "abdominal breathing", although it is, in fact, "diaphragmatic breathing", which is not visible on the outside of the body. Mammals only use their abdominal muscles only during forceful exhalation (see Fig. 8, and discussion below). Never during any form of inhalation. As the diaphragm contracts, the rib cage is simultaneously enlarged by the ribs being pulled upwards by the intercostal muscles as shown in Fig. 4. All the ribs slant downwards from the rear to the front; but the lowermost ribs also slant downwards from the midline outwards. Thus the rib cage's transverse diameter can be increased in the same way as the antero-posterior diameter is increase by the so-called pump handle movement.

The enlargement of the thoracic cavity's vertical dimension by the contraction of the diaphragm, and its two horizontal dimensions by the lifting of the front and sides of the ribs, causes the intrathoracic pressure to fall. The lungs' interiors are open to the outside air, and being elastic, therefore expand to fill the increased space. The inflow of air into the lungs occurs via the respiratory airways. In health these airways (starting at the nose or mouth, and ending in the microscopic dead-end sacs called alveoli) are always open, though the diameters of the various sections can be changed by the sympathetic and parasympathetic nervous systems. The alveolar air pressure is therefore always close to atmospheric air pressure (about 100 kPa at sea level) at rest, with the pressure gradients that cause air to move in and out of the lungs during breathing rarely exceeding 2–3 kPa. During exhalation the diaphragm and intercostal muscles relax. This returns the chest and abdomen to a position determined by their anatomical elasticity. This is the "resting mid-position" of the thorax and abdomen when the lungs contain their functional residual capacity of air, which in the adult human has a volume of about 2.5–3.0 liters. Resting exhalation lasts about twice as long as inhalation because the diaphragm relaxes passively more gently than it contracts actively during inhalation.

The volume of air that moves in or out (at the nose or mouth) during a single breathing cycle is called the tidal volume. In a resting adult human it is about 500 ml per breath. At the end of exhalation the airways contain about 150 ml of alveolar air which is the first air that is breathed back into the alveoli during inhalation. This volume air that is breathed out of the alveoli and back in again is known as dead space ventilation, which has the consequence that of the 500 ml breathed into the alveoli with each breath only 350 ml (500 ml - 150 ml = 350 ml) is fresh warm and moistened air. Since this 350 ml of fresh air is thoroughly mixed and diluted by the air that remains in the alveoli after normal exhalation (i.e. the functional residual capacity of about 2.5–3.0 liters), it is clear that the composition of the alveolar air changes very little during the breathing cycle. The oxygen tension (or partial pressure) remains close to 13-14 kPa (about 100 mm Hg), and that of carbon dioxide very close to 5.3 kPa (or 40 mm Hg). This contrasts with composition of the dry outside air at sea level, where the partial pressure of oxygen is 21 kPa (or 160 mm Hg) and that of carbon dioxide 0.04 kPa (or 0.3 mmHg). The volume of air that moves in or out (at the nose or mouth) during a single breathing cycle is called the tidal volume. In a resting adult human it is about 500 ml per breath. At the end of exhalation the airways contain about 150 ml of alveolar air which is the first air that is breathed back into the alveoli during inhalation. This volume air that is breathed out of the alveoli and back in again is known as dead space ventilation, which has the consequence that of the 500 ml breathed into the alveoli with each breath only 350 ml (500 ml - 150 ml = 350 ml) is fresh warm and moistened air.

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During heavy breathing, exhalation is caused by relaxation of all the muscles of inhalation. But now, the abdominal muscles, instead of remaining relaxed (as they do at rest), contract forcibly pulling the lower edges of the rib cage downwards (front and sides). This not only drastically decreases the size of the rib cage, but also pushes the abdominal organs upwards against the diaphragm which consequently bulges deeply into the thorax. The end-exhalatory lung volume is now well below the resting mid-position and contains far less air than the resting "functional residual capacity". However, in a normal mammal, the lungs cannot be emptied completely. In an adult human there is always still at least 1 liter of residual air left in the lungs after maximum exhalation. The automatic rhythmical breathing in and out, can be interrupted by coughing, sneezing (forms of very forceful exhalation), by the expression of a wide range of emotions (laughing, sighing, crying out in pain, exasperated intakes of breath) and by such voluntary acts as speech, singing, whistling and the playing of wind instruments. All of these actions rely on the muscles described above, and their effects on the movement of air in and out of the lungs. Although not a form of breathing, the Valsalva maneuver involves the respiratory muscles. It is, in fact, a very forceful exhalatory effort against a tightly closed glottis, so that no air can escape from the lungs. Instead abdominal contents are evacuated in the opposite direction, through orifices in the pelvic floor. The abdominal muscles contract very powerfully, causing the pressure inside the abdomen and thorax to rise to extremely high levels. The Valsalva maneuver can be carried out voluntarily, but is more generally a reflex elicited when attempting to empty the abdomen during, for instance, difficult defecation, or during childbirth. Breathing ceases during this maneuver.

Gas Exchange

The primary purpose of the respiratory system is the equilibration of the partial pressures of the respiratory gases in the alveolar air with those in the pulmonary capillary blood. This process occurs by simple diffusion, across a very thin membrane (known as the blood–air barrier), which forms the walls of the pulmonary alveoli. It consisting of the alveolar epithelial cells, their basement membranes and the endothelial cells of the alveolar capillaries (Fig. 10). This blood gas barrier is extremely thin (in humans, on average, 2.2 μm thick). It is folded into about 300 million small air sacs called alveoli (each between 75 and 300 μm in diameter) branching off from the respiratory bronchioles in the lungs, thus providing an extremely large surface area (approximately 145 m2) for gas exchange to occur. The air contained within the alveoli has a semi-permanent volume of about 2.5-3.0 liters which completely surrounds the alveolar capillary blood. This ensures that equilibration of the partial pressures of the gases in the two compartments is very efficient and occurs very quickly. The blood leaving the alveolar capillaries and is eventually distributed throughout the body therefore has a partial pressure of oxygen of 13-14 kPa (100 mmHg), and a partial pressure of carbon dioxide of 5.3 kPa (40 mmHg) (i.e. the same as the oxygen and carbon dioxide gas tensions as in the alveoli). As mentioned in the section above, the corresponding partial pressures of oxygen and carbon dioxide in the ambient (dry) air at sea level are 21 kPa (160 mmHg) and 0.04 kPa (0.3 mmHg) respectively.

This marked difference between the composition of the alveolar air and that of the ambient air can be maintained because the functional residual capacity is contained in dead-end sacs connected to the outside air by fairly narrow and relatively long tubes (the airways: nose, pharynx, larynx, trachea, bronchi and their branches down to the bronchioles), through which the air has to be breathed both in and out (i.e. there is no unidirectional through-flow as there is in the bird lung). This typical mammalian anatomy combined with the fact that the lungs are not emptied and re-inflated with each breath (leaving a substantial volume of air, of about 2.5-3.0 liters, in the alveoli after exhalation), ensures that the composition of the alveolar air is only minimally disturbed when the 350 ml of fresh air is mixed into it with each inhalation. Thus the animal is provided with a very special "portable atmosphere", whose composition differs significantly from the present-day ambient air. It is this portable atmosphere (the functional residual capacity) to which the blood and therefore the body tissues are exposed – not to the outside air. The resulting arterial partial pressures of oxygen and carbon dioxide are homeostatically controlled. A rise in the arterial partial pressure of CO2 and, to a lesser extent, a fall in the arterial partial pressure of O2, will reflexly cause deeper and faster breathing till the blood gas tensions in the lungs, and therefore the arterial blood, return to normal. The converse happens when the carbon dioxide tension falls, or, again to a lesser extent, the oxygen tension rises: the rate and depth of breathing are reduced till blood gas normality is restored.

Since the blood arriving in the alveolar capillaries has a partial pressure of O2 of, on average, 6 kPa (45 mmHg), while the pressure in the alveolar air is 13-14 kPa (100 mmHg), there will be a net diffusion of oxygen into the capillary blood, changing the composition of the 3 liters of alveolar air slightly. Similarly, since the blood arriving in the alveolar capillaries has a partial pressure of CO2 of also about 6 kPa (45 mmHg), whereas that of the alveolar air is 5.3 kPa (40 mmHg), there is a net movement of carbon dioxide out of the capillaries into the alveoli. The changes brought about by these net flows of individual gases into and out of the alveolar air necessitate the replacement of about 15% of the alveolar air with ambient air every 5 seconds or so. This is very tightly controlled by the monitoring of the arterial blood gases (which accurately reflect composition of the alveolar air) by the aortic and carotid bodies, as well as by the blood gas and pH sensor on the anterior surface of the medulla oblongata in the brain. There are also oxygen and carbon dioxide sensors in the lungs, but they primarily determine the diameters of the bronchioles and pulmonary capillaries, and are therefore responsible for directing the flow of air and blood to different parts of the lungs.

It is only as a result of accurately maintaining the composition of the 3 liters of alveolar air that with each breath some carbon dioxide is discharged into the atmosphere and some oxygen is taken up from the outside air. If more carbon dioxide than usual has been lost by a short period of hyperventilation, respiration will be slowed down or halted until the alveolar partial pressure of carbon dioxide has returned to 5.3 kPa (40 mmHg). It is therefore strictly speaking untrue that the primary function of the respiratory system is to rid the body of carbon dioxide “waste”. The carbon dioxide that is breathed out with each breath could probably be more correctly be seen as a byproduct of the body’s extracellular fluid carbon dioxide and pH homeostats. If these homeostats are compromised, then a respiratory acidosis, or a respiratory alkalosis will occur. In the long run these can be compensated by renal adjustments to the H+ and HCO3− concentrations in the plasma; but since this takes time, the hyperventilation syndrome can, for instance, occur when agitation or anxiety cause a person to breathe fast and deeply thus causing a distressing respiratory alkalosis through the blowing off of too much CO2 from the blood into the outside air.

Oxygen has a very low solubility in water, and is therefore carried in the blood loosely combined with hemoglobin. The oxygen is held on the hemoglobin by four ferrous iron-containing heme groups per hemoglobin molecule. When all the heme groups carry one O2 molecule each the blood is said to be “saturated” with oxygen, and no further increase in the partial pressure of oxygen will meaningfully increase the oxygen concentration of the blood. Most of the carbon dioxide in the blood is carried as bicarbonate ions (HCO3−) in the plasma. However the conversion of dissolved CO2 into HCO3− (through the addition of water) is too slow for the rate at which the blood circulates through the tissues on the one hand, and through alveolar capillaries on the other. The reaction is therefore catalyzed by carbonic anhydrase, an enzyme inside the red blood cells. The reaction can go in both directions depending on the prevailing partial pressure of CO2. A small amount of carbon dioxide is carried on the protein portion of the hemoglobin molecules as carbamino groups. The total concentration of carbon dioxide (in the form of bicarbonate ions, dissolved CO2, and carbamino groups) in arterial blood (i.e. after it has equilibrated with the alveolar air) is about 26 mM (or 58 ml/100 ml), compared to the concentration of oxygen in saturated arterial blood of about 9 mM (or 20 ml/100 ml blood).

Control of Ventilation

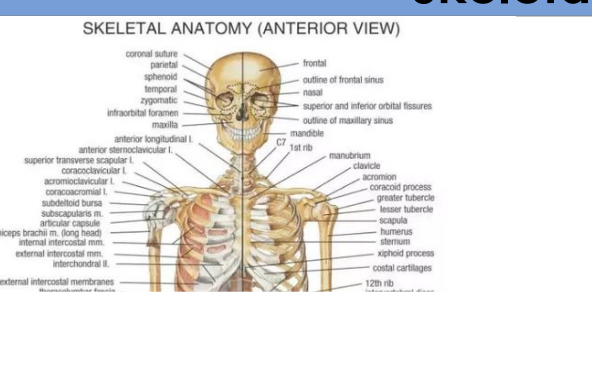
Ventilation of the lungs in mammals occurs via the respiratory centers in the medulla oblongata and the pons of the brainstem. These areas form a series of neural pathways which receive information about the partial pressures of oxygen and carbon dioxide in the arterial blood. This information determines the average rate of ventilation of the alveoli of the lungs, to keep these pressures constant. The respiratory center does so via motor nerves which activate the diaphragm and other muscles of respiration. The breathing rate increases when the partial pressure of carbon dioxide in the blood increases. This is detected by central blood gas chemoreceptors on the anterior surface of the medulla oblongata. The aortic and carotid bodies, are the peripheral blood gas chemoreceptors which are particularly sensitive to the arterial partial pressure of O2 though they also respond, but less strongly, to the partial pressure of CO2. At sea level, under normal circumstances, the breathing rate and depth, is determined primarily by the arterial partial pressure of carbon dioxide rather than by the arterial partial pressure of oxygen, which is allowed to vary within a fairly wide range before the respiratory centers in the medulla oblongata and pons respond to it to change the rate and depth of breathing. Exercise increases the breathing rate due to the extra carbon dioxide produced by the enhanced metabolism of the exercising muscles. In addition passive movements of the limbs also reflexively produce an increase in the breathing rate. Information received from stretch receptors in the lungs limits tidal volume (the depth of inhalation and exhalation).

Disorders

Disorders of the respiratory system can be classified into several general groups:
- Airway obstructive conditions (e.g., emphysema, bronchitis, asthma)
- Pulmonary restrictive conditions (e.g., fibrosis, sarcoidosis, alveolar damage, pleural effusion)
- Vascular diseases (e.g., pulmonary edema, pulmonary embolism, pulmonary hypertension)
- Infectious, environmental and other "diseases" (e.g., pneumonia, tuberculosis, asbestosis, particulate pollutants)
- Primary cancers (e.g. bronchial carcinoma, mesothelioma)
- Secondary cancers (e.g. cancers that originated elsewhere in the body, but have seeded themselves in the lungs)
- Insufficient surfactant (e.g. respiratory distress syndrome in pre-term babies)

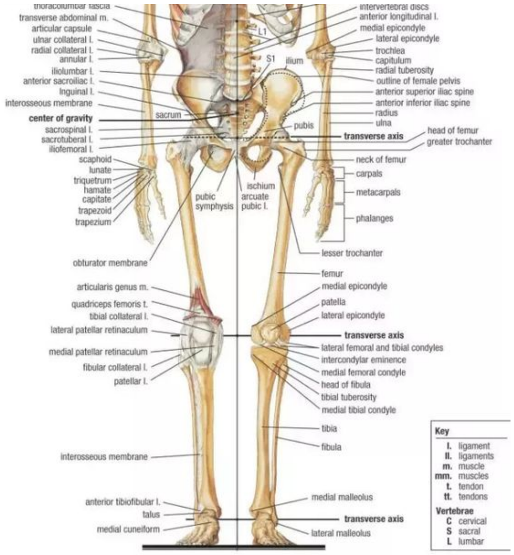
Disorders of the respiratory system are usually treated by a pulmonologist and respiratory therapist. Where there is an inability to breathe or an insufficiency in breathing a medical ventilator may be used.

14 Skeletal System



The skeleton is the body part that forms the supporting structure of an organism. It can also be seen as the bony frame work of the body which provides support, shape and protection to the soft tissues and delicate organs in animals.

There are several different skeletal types: the exoskeleton, which is the stable outer shell of an organism, the endoskeleton, which forms the support structure inside the body, the hydroskeleton, a flexible skeleton supported by fluid pressure, and the cytoskeleton present in the cytoplasm of all cells, including bacteria, and archaea.



Skeleton Types

There are two major types of skeletons: solid and fluid. Solid skeletons can be internal, called an endoskeleton, or external, called an exoskeleton, and may be further classified as pliant (elastic/movable) or rigid (hard/non-movable). Fluid skeletons are always internal.

Exoskeleton	Exoskeletons are external, and are found in many invertebrates; they enclose and protect the soft tissues and organs of the body. Some kinds of exoskeletons undergo periodic moulting or edolysis as the animal grows, as is the case in many arthropods including insects and crustaceans. The exoskeleton of insects is not only a form of protection, but also serves as a surface for muscle attachment, as a watertight protection against drying, and as a sense organ to interact with the environment. The shell of mollusks also performs all of the same functions, except that in most cases it does not contain sense organs. An external skeleton can be quite heavy in relation to the overall mass of an animal, so on land, organisms that have an exoskeleton are mostly relatively small. Somewhat larger aquatic animals can support an exoskeleton because weight is less of a consideration underwater. The southern giant clam, a species of extremely large saltwater clam in the Pacific Ocean, has a shell that is massive in both size and weight. Syrinx aruanus is a species of sea snail with a very large shell.
Endoskeleton	The endoskeleton is the internal support structure of an animal, composed of mineralized tissue and is typical of vertebrates. Endoskeletons vary in complexity from functioning purely for support (as in the case of sponges), to serving as an attachment site for muscles and a mechanism for transmitting muscular forces. A true endoskeleton is derived from mesodermal tissue. Such a skeleton is present in echinoderms and chordates.
Pliant Skeletons	Pliant skeletons are capable of movement; thus, when stress is applied to the skeletal structure, it deforms and then reverts to its original shape. This skeletal structure is used in some invertebrates, for instance in the hinge of bivalve shells or the mesoglea of cnidarians such as jellyfish. Pliant skeletons are beneficial because only muscle contractions are needed to bend the skeleton; upon muscle relaxation, the skeleton will return to its original shape. Cartilage is one material that a pliant skeleton may be composed of, but most pliant skeletons are formed from a mixture of proteins, polysaccharides, and water. For additional structure or protection, pliant skeletons may be supported by rigid skeletons. Organisms that have pliant skeletons typically live in water, which supports body structure in the absence of a rigid skeleton.
Rigid Skeletons	Rigid skeletons are not capable of movement when stressed, creating a strong support system most common in terrestrial animals. Such a skeleton type used by animals that live in water are more for protection (such as barnacle and snail shells) or for fast-moving animals that require additional support of musculature needed for swimming through water. Rigid skeletons are formed from materials including chitin (in arthropods), calcium compounds such as calcium carbonate (in stony corals and mollusks) and silicate (for diatoms and radiolarians).
Cytoskeleton	The cytoskeleton (gr. kytos = cell) is used to stabilize and preserve the form of the cells. It is a dynamic structure that maintains cell shape, protects the cell, enables cellular motion (using structures such as flagella, cilia and lamellipodia), and plays important roles in both intracellular transport (the movement of vesicles and organelles, for example) and cellular division.
Fluid Skeletons	**Hydrostatic Skeleton (Hydroskeleton)** A hydrostatic skeleton is a semi-rigid, soft tissue structure filled with liquid under pressure, surrounded by muscles. Longitudinal and circular muscles around their body sectors allow movement by alternate lengthening and contractions along their lengths. A common example of this is the earthworm.

Human Skeleton

The human skeleton consists of both fused and individual bones supported and supplemented by ligaments, tendons, muscles and cartilage. It serves as a scaffold which supports organs, anchors muscles, and protects organs such as the brain, lungs, heart and spinal cord. Although the teeth do not consist of tissue commonly found in bones, the teeth are usually considered as members of the skeletal system. The biggest bone in the body is the femur in the upper leg, and the smallest is the stapes bone in the middle ear. In an adult, the skeleton comprises around 14% of the total body weight, and half of this weight is water. Fused bones include those of the pelvis and the cranium. Not all bones are interconnected directly: There are three bones in each middle ear called the ossicles that articulate only with each other. The hyoid bone, which is located in the neck and serves as the point of attachment for the tongue, does not articulate with any other bones in the body, being supported by muscles and ligaments. There are 206 bones in the adult human skeleton, although this number depends on whether the pelvic bones (the hip bones on each side) are counted as one or three bones on each side (ilium, ischium, and pubis), whether the coccyx or tail bone is counted as one or four separate bones, and does not count the variable wormian bones between skull sutures. Similarly, the sacrum is usually counted as a single bone, rather than five fused vertebrae. There is also a variable number of small sesamoid bones, commonly found in tendons. The patella or kneecap on each side is an example of a larger sesamoid bone. The patellae are counted in the total, as they are constant.

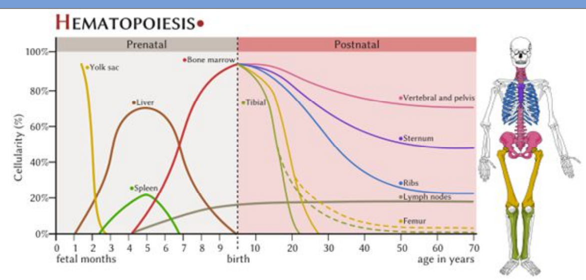
The number of bones varies between individuals and with age – newborn babies have over 270 bones some of which fuse together. These bones are organized into a longitudinal axis, the axial skeleton, to which the appendicular skeleton is attached. The human skeleton takes 20 years before it is fully developed. In many animals, the skeleton bones contain marrow, which produces blood cells. There exist several general differences between the male and female skeletons. The male skeleton, for example, is generally larger and heavier than the female skeleton. In the female skeleton, the bones of the skull are generally less angular. The female skeleton also has wider and shorter breastbone and slimmer wrists. There exist significant differences between the male and female pelvis which are related to the female's pregnancy and childbirth capabilities. The female pelvis is wider and shallower than the male pelvis. Female pelvises also have an enlarged pelvic outlet and a wider and more circular pelvic inlet. The angle between the pubic bones is known to be sharper in males, which results in a more circular, narrower, and near heart-shaped pelvis.

Bones and Cartilage

Bone
Bones are rigid organs that form part of the endoskeleton of vertebrates. They function to move, support, and protect the various organs of the body, produce red and white blood cells and store minerals. Bone tissue is a type of dense connective tissue. Bones have a variety of shapes with a complex internal and external structure they are also lightweight, yet strong and hard. One of the types of tissue that makes up bone tissue is mineralized tissue and this gives it rigidity and a honeycomb-like three-dimensional internal structure. Other types of tissue found in bones include marrow, endosteum and periosteum, nerves, blood vessels and cartilage. There are 206 bones in the adult human body and 270 in an infant.

Cartilage
During embryogenesis the precursor to bone development is cartilage. Much of this substance is then replaced by bone during the second and third trimester, after the flesh such as muscle has formed around it; forming the skeleton. Cartilage is a stiff and inflexible connective tissue found in many areas in the bodies of humans and other animals, including the joints between bones, the rib cage, the ear, the nose, the elbow, the knee, the ankle, the bronchial tubes and the intervertebral discs. It is not as hard and rigid as bone but is stiffer and less flexible than muscle. Cartilage is composed of specialized cells called chondrocytes that produce a large amount of extracellular matrix composed of Type II collagen (except Fibrocartilage which also contains type I collagen) fibers, abundant ground substance rich in proteoglycan, and elastin fibers. Cartilage is classified in three types, elastic cartilage, hyaline cartilage and fibrocartilage, which differ in the relative amounts of these three main components. Unlike other connective tissues, cartilage does not contain blood vessels. The chondrocytes are supplied by diffusion, helped by the pumping action generated by compression of the articular cartilage or flexion of the elastic cartilage. Thus, compared to other connective tissues, cartilage grows and repairs more slowly.

15 Hematopoietic System



The haematopoetic system is the system in the body involved in the creation of the cells of blood.

Structure

The haematopoetic system is the system in the body involved in the creation of the cells of blood. Haematopoietic stem cells (HSCs) reside in the medulla of the bone (bone marrow) and have the unique ability to give rise to all of the different mature blood cell types and tissues. HSCs are self-renewing cells: when they differentiate, at least some of their daughter cells remain as HSCs, so the pool of stem cells is not depleted. This phenomenon is called asymmetric division. The other daughters of HSCs (myeloid and lymphoid progenitor cells) can follow any of the other differentiation pathways that lead to the production of one or more specific types of blood cell, but cannot renew themselves. The pool of progenitors is heterogeneous and can be divided into two groups; long-term self-renewing HSC and only transiently self-renewing HSC, also called short-terms. This is one of the main vital processes in the body.

Function

Haematopoiesis is the formation of blood cellular components. All cellular blood components are derived from haematopoietic stem cells. In a healthy adult person, approximately 10^11–10^12 new blood cells are produced daily in order to maintain steady state levels in the peripheral circulation. All blood cells are divided into three lineages.
● Red blood cells, also called erythrocytes, are the oxygen-carrying cells. Erythrocytes are functional and are released into the blood. The number of reticulocytes, immature red blood cells, gives an estimate of the rate of erythropoiesis.
● Lymphocytes are the cornerstone of the adaptive immune system. They are derived from common lymphoid progenitors. The lymphoid lineage is composed of T-cells, B-cells and natural killer cells. This is lymphopoiesis.
● Cells of the myeloid lineage, which include granulocytes, megakaryocytes and macrophages, are derived from common myeloid progenitors, and are involved in such diverse roles as innate immunity and blood clotting. This is myelopoiesis.

5 Quitting Addictions

This section is about how you can quit unhealthy addictions. Not only to improve your health, but because those items may become scarce in a disaster.

Quitting Smoking

If a disaster happens you may not have the ability to buy cigarettes as readily so this guide will help you stop smoking so you don't have to suddenly deal with running out and stopping cold turkey. When you decide to quit smoking, it can help to find out what to expect as you work through the process. Some people have only a few mild symptoms when they quit but others find it harder. While withdrawal can be challenging, it can help if you look at the symptoms as signs that your body is recovering from the damage smoking has caused. Many people find withdrawal symptoms disappear completely after two to four weeks, although for some people they may last longer. Symptoms tend to come and go over that time. Remember, it will pass, and you will feel better if you hang on and quit for good. Nicotine is highly addictive. While various products can help smokers quit, there is no easy fix.

Reasons to Quit
Twelve hours after stopping, almost all nicotine is out of your system with most by-products gone within five days. After 24 hours, the level of carbon monoxide in your blood has dropped dramatically, meaning your body can take and use oxygen more efficiently. After two days, your senses of taste and smell start to return. After two months, blood flow to your hands and feet improves. After one year, your risk of heart disease rapidly drops. After 10 years, your risk of lung cancer is halved. If you smoke a pack of 20 cigarettes a day at $27, you will save around $10,000 a year. Thinking about what else you would like to do with that money can be a great motivator to stick to your quit plan. Your children will be less at risk from bronchitis, pneumonia, asthma, meningitis and ear infections.

Excuses

These are common excuses why you can't stop smoking.

Excuse 1: The damage is done	You might feel that because you smoke, you've already increased your chance of getting cancer or another smoking-related disease, so quitting now won't make any difference. In fact, as soon as you quit, your body starts to repair itself. You'll notice improvements in your breathing and sense of taste and smell just a few days after stopping. You'll also improve the health of your family and friends by not exposing them to passive smoking.

Excuse 2: I'll gain weight	Medical evidence shows that nicotine doesn't stop you getting hungry. Nicotine makes you burn calories faster, but as long as you remember that you need less food energy, quitting won't actually make you gain weight. Try eating low calorie options and take up an activity instead of replacing cigarettes with food.
Excuse 3: I'll get stressed	Despite what you may think, nicotine doesn't calm you down. Nicotine cravings between cigarettes make you feel stressed and anxious, so when you smoke the cigarette you feel calmer. But you'll feel less stressed once you quit and don't have cravings any more. If you want a cigarette, wait for 10 minutes and the craving will usually pass. Take some deep breaths or go for a walk to relieve the stress and distract you from those cravings.
Excuse 4: It's not the right time to quit smoking	Although it's true that you shouldn't try to quit during particularly stressful times, don't use this as an excuse to never try quitting. Pick a particular date, such as the beginning of a holiday or the beginning of a working week. Work out what makes you want a cigarette, such as having a cup of tea or going to the pub, and pick a day when you can avoid these triggers. Telling lots of people that you're giving up will make you more likely to quit. You won't want to let them down, and you can ask smokers not to offer you cigarettes.
Excuse 5: Quitting will ruin my social life	For many smokers, cigarettes are an important part of their social life. You may class yourself as a social smoker, who only has a cigarette when you're with friends who smoke or during nights out. You may also have bonded with colleagues during cigarette breaks. Although social smoking may seem better than smoking 40 a day, any cigarette smoking damages your health.
Excuse 6: Smoking looks good	For some people, holding a stick of tobacco wrapped in paper seems attractive and fashionable. Teenagers may think it makes them look older or cooler. But many people find the sight of a smoker unattractive. Yellow fingernails, blackened fingers and a stained tongue are not a pretty sight. Smoking also makes your complexion dull and prematurely ages your skin. If you don't want to look old before your time, it's a good idea to quit. There's also the smell — cigarette smoke sticks to your hair and clothes long after you've had your last cigarette of the day. Some people think kissing a smoker is like 'kissing an ashtray'. If you'd prefer to smell fresher, now's the time to quit.
Excuse 7: I can't quit because I'm addicted	There is some truth in this. Smoking is an addiction that's undeniably tough to quit. But it's not impossible. With a lot of determination, you can do it. To quit successfully, you need to deal with your chemical addiction to nicotine and the fact that smoking has become part of your daily routine. The chemical addiction causes physical symptoms when you quit, such as tiredness, irritability and poor concentration. Your doctor can prescribe medication to replace the nicotine. There are counselling and support groups that can give you extra motivation to help you ignore your cravings. Change your routine so that you replace smoking a cigarette with an alternative, such as a drink of water or another activity.

Ways to Quit

The different ways you can quit smoking.

Cold Turkey	For many people the most successful way to quit is going ?cold turkey?. This means stopping completely without cutting down.
Nicotine Replacement Therapy	Using nicotine gum, patches, lozenges, tablets or inhalers may be useful for heavy smokers, though most smokers quit by themselves. Your doctor or pharmacist will explain how to use these products.
Prescription Drugs to Help	Prescription medications can help to reduce withdrawal symptoms when you quit, such as cravings, irritability, and anxiety. But it may not stop them completely.
Alternative Therapies	Some people try herbal remedies, spiritual healing or other alternative therapies, but there is insufficient evidence these methods help you quit.

Symptoms

The symptoms after you quit.

Cravings	These may be strong at first, but they usually only last a few minutes. If you resist each one they will get less powerful in time
Restlessness and trouble concentrating or sleeping	These will pass as your body gets used to not smoking. Relaxation and deep breathing can help. It's also a good idea to reduce your caffeine intake because when you quit smoking your body absorbs almost twice as much caffeine as usual, which can leave you feeling anxious, irritable and restless
Irritability, anger, anxiety, depressed mood	This is all normal: don't panic. Just accept that you will be emotional for a while and that it will pass
Increase in Appetite and Weight Gain	This may last several weeks. Planning ahead can help. Better Health Channel has tips on managing weight gain when you quit.
Less Common Symptoms	● Cold symptoms such as coughing, sore throat and sneezing ● Constipation ● Dizziness or light-headedness ● Mouth ulcers.

As time passes, you will find these symptoms grow weaker, and you will think about smoking less. If you have severe or long-lasting symptoms, it might help to discuss them with a health professional or a quitline.

Coping with Cravings

- Delay acting on the urge to smoke. After five minutes, the urge to smoke weakens. Deep breathe in and out slowly and deeply, and repeat three times.
- Deep breathe in and out slowly and deeply, and repeat three times.
- Drink water, sipping slowly, holding it in the mouth a little longer to savour the taste.
- Do something else. Listen to music, exercise or talk to a friend. After quitting smoking, being more active is the best thing you can do for your general health and wellbeing.
- Remember, each time you resist that urge and do something else instead it's a victory in your quest to quit: you're helping your brain break that link between the activity and the cigarette.
- Many people find withdrawal symptoms disappear completely after two to four weeks.
- Changing your routine can help avoid those triggers that tell your brain it's time for a smoke.

Feeling Emotional
- Within six hours your heart rate will slow and your blood pressure will become more stable.
- Within one day your bloodstream will be almost nicotine free, the level of carbon monoxide in your blood will have dropped, and oxygen will be reaching your heart and muscles more easily.
- Within one week your sense of taste and smell may have improved.
- Within three months you will be coughing and wheezing less, your immune function and circulation to your hands and feet will be improving, and your lungs will be getting better at removing mucus, tar and dust.
- Within six months your stress levels are likely to have dropped, and you are less likely to be coughing up phlegm.
- After one year your lungs will be healthier and breathing will be easier than if you'd kept smoking.
- Within two to five years your risk of heart disease will have dropped significantly (and will continue to do so over time).

- Within five years, a woman's risk of cervical cancer will be the same as if she had never smoked.
- After 10 years your risk of lung cancer will be lower than if you had kept smoking.
- After 15 years your risk of heart attack and stroke will be similar to that of someone who has never smoked.

Quitting Drinking

Quitting isn't even the hardest part. It isn't even what happens to you when you quit. The hardest part of the journey to sobriety is attempting sobriety in the first place. Still, people can and do recover from alcoholism, perhaps more often than you may think. OK so you need to quit, you know it's going to be tough, but you know it's possible. Professional treatment is strongly recommended. What follows is a list of reasons and ways to stay on the path to recovery. There is no particular order of any kind. We have simply combined our knowledge of alcohol treatment to give you a guide on how to stay sober.

Admit the Problem
With drinking, we tend to think in black and white terms: are you an alcoholic or a normal drinker? Meanwhile, the large gray area in between is full of problematic drinkers who either are alcoholics, or are well on their way. If you have a drinking problem, chances are you are aware of it. As the old saying goes, the first step is admitting you have a problem. If you find yourself caught in a thought cycle – comparing your drinking to that of others, taking online assessments, or just asking yourself if you have a problem – give these three things a try:

- Ask the right question. Stop asking yourself whether or not you're an alcoholic. If you're asking yourself this, you probably are one. Sorry to be so harsh. Instead, ask yourself if drinking is preventing you from having the life you want. If yes, step one is over. You've admitted the problem.
- Stop the comparisons. They do you no good. That's not your life. You are an individual with a complicated, unique life. So what if you drink less than Billy down the street… If you have a problem, you have a problem. Comparing your drinking to that of others will only lead to self-justification.
- Think of your future self. Picture yourself five years from now with the same drinking habits. Are you okay with what you see? If not, you likely have a problem with alcohol. Now admit it, so you can begin treating it.

Quitting Reasons
Long-term benefits are rarely enough to motivate people to quit. We often prefer instant gratification. Quitting drinking is no exception. Quitting alcohol (as a drinker) is the healthiest decision you can make. Weight loss, improved liver function, lower cholesterol, stronger immune system, a clearer mind, better emotional balance, and more efficient brain activity are among the ocean of long-term benefits. The long-term benefits are only about saving your health and well-being anyway, so here are 4 short-term benefits we all can relate to:

- Reclaim lost time. Jill is a moderate drinker. She drinks three times a week, 2-3 drinks per occasion. Each time, she 'loses' about 3 hours of productive time being buzzed. Every year, Jill loses a month and a half. That's a lot of lost time that could have been spent sober and productively. Don't forget about any time Jill (or you) may spend hungover.
- Have more meaningful talks. Conversation builds character and makes us grow. Those benefits disappear when you're drunk. Alcohol prevents any meaningful change from talking. It might seem terrifying to meet new people without drinking, but the damage alcohol causes is scarier.
- Get rich quickly. It's easy to spend $150 or more per week as a drinker, especially if you go out. of drinking. After 6 months, quitting could allow you to afford backpacking around the world. Are you willing to pay $600 a month for health problems?
- Sleep better. Alcohol is a depressant, which means it will make you tired. Alcohol also disrupts sleep patterns, throwing off your body's balance.

Set Rules
Giving up alcohol must be made priority number one in your life. A partial commitment is a commitment to failure. Establish rules and do not break them. Say no to bar night, say no to the sale on six-packs, and say no to the devil on your shoulder telling you it's only one drink. Put sobriety on a pedestal and don't remove it until you know your problem is cured. Whether alcohol is a major part of your social life, or it's just something you and the gang do once in a while, it's going to be hard if and when your friends/family drink around you. Step one is telling them all you simply cannot be around drinking for a while. Step two is cutting off anyone with whom all you did was drink. Besides, if the only thing you have in common with someone is knocking them down, you might want to consider unfriending them. I've let go of people in my social circle before and I know it's not easy—but that doesn't make it unnecessary. This might be the hardest thing you do in choosing a life without alcohol. The key is to remember that true friends are an abundant resource. Having a strong social circle is purely a function of the effort you invest into it. That includes choosing to associate with people who are aligned with your purpose, avoiding the energy vampires. Tell people what you're doing. Not only does this add accountability to your goal, it also drops the hint that if your friends are planning on going out and getting wasted, you're probably not interested. Plus, if someone offers you a drink and you look at them and say, "I can't. I'm a full blown alcoholic," they probably won't ask you again.

Quitting Risks
The first 72 hours are the most painful part of recovery. As your body rids itself of alcohol, you'll experience acute withdrawal – unpleasant. Alcoholics can experience especially difficult recoveries, and professional help is recommended for them. Regardless, the benefits of quitting drinking will soon make themselves known. Even though it may not feel like it, the acute withdrawal stage of the recovery timeline is the beginning of something great. Withdrawal symptoms are evidence your body is healing. The onset of withdrawal symptoms can begin as soon as six hours after your last drink. You may experience:

- Elevated temperature
- Increased blood pressure, breathing rate, and pulse
- Excessive sweating
- Tremors
- Insomnia
- In extreme cases, one may experience seizures, sometimes life-threatening.

The body is working overtime to cleanse itself. When done correctly, detox is the most important step in the recovery process. At the same time, many recovering addicts relapse when they use drink as self-medication for the withdrawal symptoms. Ironic, but true. This is why it's crucial to seek professional treatment when necessary.

Attitude Change
Even after you admit that you have a problem, you need to change your attitude regarding your situation. Don't get mad at people when they try to help. Don't put yourself down because you have gone through a rough patch. Instead, get in the right frame of mind by realizing that you are taking the right steps on the road to recovery. Is it easy to have a good attitude when you are dealing with such a difficult situation? Of course not. That being said, when you approach the situation the right way you are going to ease the stress on yourself and make it much easier to reach your goals.

2 Weeks Later
Full detoxification from alcohol can take up to two weeks. As your body is getting rid of its last remnants, some negative symptoms may pop up, but the benefits will already be clear. As expected, recovery comes with emotional highs and lows. The negative effects may include:

- Anxiety & depression
- Decreased energy & metabolism
- Feelings of aggression or hostility
- Declined sexual interest or function
- Sleep disruption & nightmares

Don't let this deter you. The positive effects will be abundant, too many to list.

The worst part of all may be cravings for alcohol, which may last a lifetime. Even after removing all traces of alcohol from your system, the brain will still want it to help return to the balance of chemicals it has gotten used to — but knowing the source of these symptoms is key to dealing with cravings appropriately. Develop and enforce new hobbies and habits that don't include the bottle. In a treatment program, you can attend therapy, perform group work, and receive one-on-one attention from medical and clinical professionals. Building effective coping skills and getting to the root of your addiction is key to alcohol abuse recovery. Seek out a therapist. Attend some type of group meeting, such as AA or NA. It's always helpful to have a support system of counselors and people who understand what you're going through. Utilize your friends and family as well. Go to WAR with your addiction. Recovery is a lifelong process, and post-treatment maintenance is just as important as the initial treatment process.

Quitting Drugs

Developing a drug addiction isn't a character flaw or a sign of weakness, and it takes more than willpower to overcome the problem. Abusing illegal or certain prescription drugs can create changes in the brain, causing powerful cravings and a compulsion to use that makes sobriety seem like an impossible goal. But recovery is never out of reach, no matter how hopeless your situation seems. With the right treatment and support, change is possible. Don't give up—even if you've tried and failed before. The road to recovery often involves bumps, pitfalls, and setbacks.

But by examining the problem and thinking about change, you're already well on your way. For many people struggling with addiction, the toughest step toward recovery is the very first one: recognizing that you have a problem and deciding to make a change. It's normal to feel uncertain about whether you're ready to make a change, or if you have what it takes to quit. If you're addicted to a prescription drug, you may be concerned about how you're going to find an alternate way to treat a medical condition. It's okay to feel torn.

Committing to sobriety involves changing many things, including:
● The way you deal with stress
● Who you allow in your life
● What you do in your free time
● How you think about yourself
● The prescription and over-the-counter medications you take

It's also normal to feel conflicted about giving up your drug of choice, even when you know it's causing problems in your life. Recovery requires time, motivation, and support, but by making a commitment to change, you can overcome your addiction and regain control of your life.

Think About Change
● Keep track of your drug use, including when and how much you use. This will give you a better sense of the role the addiction is playing in your life
● List the pros and cons of quitting, as well as the costs and benefits of continuing your drug use
● Consider the things that are important to you, such as your partner, your kids, your pets, your career, or your health. How does your drug use affect those things?
● Ask someone you trust about their feelings on your drug use
● Ask yourself if there's anything preventing you from changing. What could help you make the change?

Preparation for Change
Remind yourself of the reasons you want to change. Think about your past attempts at recovery, if any. What worked? What didn't? Set specific, measurable goals, such as a start date or limits on your drug use. Remove reminders of your addiction from your home, workplace, and other places you frequent. Tell friends and family that you're committing to recovery, and ask for their support.

Treatment Options
Once you've committed to recovery, it's time to explore your treatment choices. While addiction treatment can vary according to the specific drug, a successful program often includes different elements, such as:
● Detoxification. Usually the first step is to purge your body of drugs and manage withdrawal symptoms.
● Behavioral counseling. Individual, group, and/or family therapy can help you identify the root causes of your drug use, repair your relationships, and learn healthier coping skills.
● Medication may be used to manage withdrawal symptoms, prevent relapse, or treat any co-occurring mental health condition such as depression or anxiety.
● Long-term follow-up can help to prevent relapse and maintain sobriety. This may include attending regular in-person support groups or online meetings to help keep your recovery on track.

Best Treatment
No treatment works for everyone. Everyone's needs are different. Whether you have a problem with illegal or prescription drugs, addiction treatment should be customized to your unique situation. It's important that you find a program that feels right. Treatment should address more than just your drug abuse. Addiction affects your whole life, including your relationships, career, health, and psychological well-being. Treatment success depends on developing a new way of living and addressing the reasons why you turned to drugs in the first place. For example, your drug dependency may have developed from a desire to manage pain or to cope with stress, in which case you'll need to find a healthier way to relieve pain or to handle stressful situations. Commitment and follow-through are key. Drug addiction treatment is not a quick and easy process. In general, the longer and more intense the drug use, the longer and more intense the treatment you'll need. And in all cases, long-term follow-up care is crucial to recovery. There are many places to turn for help. Not everybody requires medically supervised detox or an extended stint in rehab. The care you need depends on a variety of factors, including your age, drug-use history, medical or psychiatric conditions. In addition to doctors and psychologists, many clergy members, social workers, and counselors offer addiction treatment services. Substance abuse and mental health. As you seek help for drug addiction, it's also important to get treatment for any other medical or psychological issues you're experiencing. Your best chance of recovery is by getting combined mental health and addiction treatment from the same treatment provider or team.

Addiction Recovery
Don't try to go it alone—reach out for support. Whatever treatment approach you choose, having positive influences and a solid support system is essential. The more people you can turn to for encouragement, guidance, and a listening ear, the better your chances for recovery. Lean on close friends and family. Having the support of friends and family members is an invaluable asset in recovery. If you're reluctant to turn to your loved ones because you've let them down before, consider going to relationship counseling or family therapy. Build a sober social network. If your previous social life revolved around drugs, you may need to make some new connections. It's important to have sober friends who will support your recovery. Try taking a class, joining a church or a civic group, volunteering, or attending events in your community. Consider moving into a sober living home. Sober living homes provide a safe, supportive place to live while you're recovering from drug addiction. They are a good option if you don't have a stable home or a drug-free living environment. Make meetings a priority. Join a recovery support group such as a 12-step program and attend meetings regularly. Spending time with people who understand exactly what you're going through can be very healing. You can also benefit from the shared experiences of the group members and learn what others have done to stay sober.

Coping with Stress
After addressing your immediate problems with addiction and starting treatment, you'll still have to face the problems that led to your drug abuse. Did you start using to numb painful emotions, calm yourself after an argument, unwind after a bad day, or forget about your problems? Once you're sober, the negative feelings that you dampened with drugs will resurface. For treatment to be successful, you'll first need to resolve your underlying issues. Once you have resolved your underlying issues, you will, at times, continue to experience stress, loneliness, frustration, anger, shame, anxiety, and hopelessness. These emotions are all a normal part of life. Finding ways to address these feelings as they arise is an essential component to your treatment and recovery. There are healthier ways to keep your stress level in check. You can learn to manage your problems without falling back on your addiction. When you're confident in your ability to quickly de-stress, facing strong feelings isn't as intimidating or overwhelming. Different quick stress relief strategies work better for some people than others. The key is to find the one that works best for you.

● Movement. A brisk walk around the block can be enough to relieve stress. Yoga and meditation are also excellent ways to bust stress and find balance.
● Step outside and savor the warm sun and fresh air. Enjoy a beautiful view or landscape.
● Play with your dog or cat. Enjoy the relaxing touch of your pet's fur.
● Experiment with your sense of smell. Breathe in the scent of fresh flowers or coffee beans, or savor a scent that reminds you of a favorite vacation, such as sunscreen or a seashell.
● Close your eyes and picture a peaceful place. Think of a sandy beach, or a fond memory, such as your child's first steps or time spent with friends.
● Pamper yourself. Make yourself a steaming cup of tea, give yourself a neck or shoulder massage. Soak in a hot bath or shower.

Drug Triggers
Your recovery doesn't end at getting sober. Your brain still needs time to recover and rebuild connections that changed while you were addicted. During this rebuild, drug cravings can be intense. You can support your continued recovery by avoiding people, places, and situations that trigger your urge to use:

● Step away from your friends who use. Don't hang out with friends who are still doing drugs. Surround yourself with people who support your sobriety, not those who tempt you to slip back into old, destructive habits.
● Avoid bars and clubs. Even if you don't have a problem with alcohol, drinking lowers inhibitions and impairs judgment, which can easily lead to a relapse. Drugs are often readily available and the temptation to use can be overpowering. Also avoid any other environments and situations that you associate with drug use.
● Be upfront about your history of drug use when seeking medical treatment. If you need a medical or dental procedure done, be upfront and find a provider who will work with you in either prescribing alternatives or the absolute minimum medication necessary. You should never feel ashamed or humiliated about previous drug use or be denied medication for pain; if that happens, find another provider.
● Use caution with prescription drugs. If you were addicted to a prescription drug, such as an opioid painkiller, find alternate ways to manage the pain. It's important to stay away from prescription drugs with the potential for abuse. Drugs with a high abuse potential include painkillers, sleeping pills, and anti-anxiety medication.

Drug Cravings
Sometimes craving cannot be avoided, and it is necessary to find a way to cope:

● Get involved in a distracting activity. Read, see friends, go to a movie, immerse yourself in a hobby, hike, or exercise. Once you're interested in something else, you'll find the urges go away.
● Talk it through. Talk to friends or family members about craving when it occurs. Talking can be very helpful in pinpointing the source of the craving. Also, talking about craving often helps to discharge and relieve the feeling and will help restore honesty in your relationship. Craving is nothing to feel bad about.
● Challenge and change your thoughts. When experiencing a craving, many people have a tendency to remember only the positive effects of the drug and forget the negative consequences. Therefore, you may find it helpful to remind yourself that you really won't feel better if you use and that you stand to lose a lot. Sometimes it is helpful to have these consequences listed on a small card that you keep with you.
● Urge surf. Many people try to cope with their urges by toughing it out. But some cravings are too strong to ignore. When this happens, it can be useful to stay with the urge until it passes. This technique is called urge surfing. Imagine yourself as a surfer who will ride the wave of your drug craving, staying on top of it until it crests, breaks, and turns into less powerful, foamy surf.

Urge Surfing
1. Take an inventory of how you experience the craving. Do this by sitting in a comfortable chair with your feet flat on the floor and your hands in a comfortable position. Take a few deep breaths and focus your attention inward. Allow your attention to wander through your body. Notice where in your body you experience the craving and what the sensations are like. Notice each area where you experience the urge, and tell yourself what you are experiencing. For example, "My craving is in my mouth and nose and in my stomach."
2. Focus on one area where you are experiencing the urge. Notice the exact sensations in that area. For example, do you feel hot, cold, tingly, or numb? Are your muscles tense or relaxed? How large an area is involved? Notice the sensations and describe them to yourself. Notice the changes that occur in the sensation. "My mouth feels dry and parched. There is tension in my lips and tongue. I keep swallowing. As I exhale, I can imagine the tingle of using."
3. Repeat the focusing with each part of your body that experiences the craving. Describe to yourself the changes that occur in the sensations. Notice how the urge comes and goes. Many people, when they urge surf, notice that after a few minutes the craving has vanished. The purpose of this exercise, however, is not to make the craving go away but to experience the craving in a new way. If you practice urge surfing, you will become familiar with your cravings and learn how to ride them out until they go away naturally.

Drug Free Life
You can support your drug treatment and protect yourself from relapse by having activities and interests that provide meaning to your life. It's important to be involved in things that you enjoy, that make you feel needed, and add meaning to your life. When your life is filled with rewarding activities and a sense of purpose, your addiction will lose its appeal.

● Pick up an old hobby or try a new one. Do things that challenge your creativity and spark your imagination—something you've always wanted to try. Learn a musical instrument, a foreign language, or try a new sport.
● Adopt a pet. Yes, pets are a responsibility, but caring for an animal makes you feel loved and needed. Pets can also get you out of the house for exercise.
● Spend time in nature. Take a scenic hike, go fishing or camping, or enjoy regular walks in a park.
● Enjoy the arts. Visit a museum, go to a concert or a play, take an art class or write a memoir.
● Get involved in your community. Replace your addiction with drug-free groups and activities. Volunteer, become active in your church or faith community, or join a local club or neighborhood group.
● Set meaningful goals. Having goals to work toward and something to look forward to can be powerful antidotes to drug addiction. It doesn't matter what the goals are, just that they are important to you.
● Look after your health. Regular exercise, adequate sleep, and healthy eating habits help you keep your energy levels up and your stress levels down. The more you can stay healthy and feel good, the easier it will be to stay sober.

Relapse

Relapse is a common part of the recovery process from drug addiction. While relapse is frustrating and discouraging, it can be an opportunity to learn from your mistakes, identify additional triggers, and correct your treatment course. Various "triggers" can put people at risk of relapsing into old patterns of substance use. Causes of relapse can differ for each person. Some common ones include:

● Negative emotional states (such as anger, sadness, trauma or stress)
● Physical discomfort (such as withdrawal symptoms or physical pain)
● Positive emotional states (wanting to feel even better)
● Testing personal control ("I can have just one pill")
● Strong temptations or urges (cravings to use)
● Conflict with others (such as an argument with a spouse or partner)
● Social pressures to use (situations where it seems as though everyone else is using drugs)
● Good times with others (such as having fun with friends or family)

The important thing to remember is that relapse doesn't mean drug treatment failure. Don't give up. Call your sponsor, talk to your therapist, go to a meeting, or schedule an appointment with your doctor. When you're sober again and out of danger, look at what triggered the relapse, what went wrong, and what you could have done differently. You can choose to get back on the path to recovery and use the experience to strengthen your commitment.

Quitting Caffeine

The positive effects of caffeine are real and valuable, but in this case, more is not better. The mental benefits of caffeine are, for the most part, fully realized at very low doses. Consuming as little as 40 mg of caffeine can improve attention, alertness, vigilance, and reaction time. Higher doses of caffeine can actually be counterproductive from the standpoint of productivity or mental performance: after a certain point, more caffeine will cause anxiety, jitters, and brain fog, and the increase in energy level it produces can make it hard to stay still. To give you some context, here's the amount of caffeine in some common beverages, as reported by the Center for Science in the Public Interest:

- One tall (12 oz.) Starbucks coffee, Pike Place Roast: 235 mg
- One cup of Folgers ground coffee, House blend, made with 2 tablespoons of coffee: 60–80 mg
- One 8 oz. cup of brewed green tea: 29 mg
- One 20 oz. Diet Coke: 76 mg
- One 8 oz. Red Bull: 80 mg
- One 2 oz. 5-Hour Energy (or one caplet of Vivarin or NoDoze): 200 mg

Improvements in physical performance require higher doses of caffeine. Improvements in endurance start happening at dosages of 3 mg per kilogram of body weight, and sometimes even more is needed. Since most people weigh between 40 and 100 kg (1 kg = 2.2 lbs), a minimum of 120 to 300 mg of caffeine is needed to aid with distance running. Improvements in strength and power require even higher dosages, and many studies find that caffeine leads to no improvement at all.

One research review found that 11 of 17 studies found a relationship between caffeine and improvements in power, and 6 of 11 studies found that caffeine was associated with improvements in strength. Of the studies that did show a benefit of caffeine usage before resistance training (weightlifting), the minimum dosage required was always at least 3 mg per kilogram of body weight, and sometimes as high as 6 mg/kg. What most people don't realize is that the physical effects of caffeine are largely due to the placebo effect.

So strong is this effect that it actually gets stronger the more caffeine subjects believe they're consuming. In fact, there's not even a plausible physical mechanism whereby caffeine could improve strength and power—it actually works primarily by boosting your motivation so that you push yourself harder, which you could potentially train yourself to do without caffeine.

Studies also consistently find a greater benefit to caffeine usage early in the morning, when it works in part by banishing any remaining sleepiness from the night before. As you'll see in a minute, it only takes 100 mg or so per day to start getting addicted to caffeine. With that in mind, usage is best limited to very low dosages, taken early in the morning and with an eye toward mental rather than physical benefits.

Caffeine Addiction

This is really two questions: How easily can you get addicted to caffeine? and How much can excessive caffeine consumption hurt you? I'll tackle the "How addictive is it?" question first. Consuming as little as 1.5 mg per kilogram of body weight per day is enough to start building up a tolerance for caffeine. That means tolerance will start to build at a daily intake of somewhere between 70 and 150 mg per day. This amounts to roughly one cup of coffee a day or maybe two cups of relatively weak coffee or tea if you're especially big. Once you build up a tolerance, you become dependent on caffeine just to function normally. Effectively, your baseline level of physical and mental performance goes down, and your usual caffeine dose is only enough to get you up to normal. So if you normally consume 100 mg per day, for instance, after a few weeks you'll be subnormal without caffeine; 100 mg will get you functioning normally, but it will take an even higher dose to truly reap its benefits. Once your consumption rises to around 750 mg a day—the equivalent of 5 to 8 cups of coffee or 15 to 20 cups of tea—your tolerance will be complete. You'll cease to get any benefit from caffeine, even at higher intakes. And, of course, the withdrawal will be … not fun. Withdrawal can begin to occur when you're habitually consuming around 100 mg per day. On the plus side, while caffeine withdrawal is painful, it's not dangerous. Also, some of caffeine's withdrawal symptoms, just like some of its positive effects, are purely subjective—caffeine withdrawal does not significantly reduce cognitive ability, even though it almost always feels like it does.

Everyone knows that caffeine can disrupt your sleep, but most people vastly underestimate just how easily it can do so. The standard advice to stop consuming caffeine in the afternoon actually doesn't go nearly far enough, because even a single moderate dose of caffeine consumed first thing in the morning—such as a double espresso or two cups of coffee—can measurably reduce the amount of time spent in deep sleep later that night. This reduction occurs despite the fact that by nighttime, the caffeine is almost entirely gone from your bloodstream; that is, its effects seem to last beyond the active life of caffeine itself. Note that a much smaller dose of caffeine consumed in the afternoon, like a can of soda, will also have been metabolized by this time and thus could be expected to have the same effect. Caffeine also causes anxiety—in fact, this is likely a secondary mechanism behind its sleep-inhibiting effects. Even 150 mg of caffeine, usually considered a moderate dose, will significantly increase anxiety levels in most people.

Daily consumption of even lower doses of caffeine can have even worse long-term effects. If you regularly consume more than 100 mg a day, you'll experience increased anxiety and have chronically elevated cortisol levels. Cortisol, of course, is known as the body's main "stress hormone." And while it's not as bad of a hormone as it's often made out to be—you want it to be high first thing in the morning, for instance—chronically elevated cortisol levels are one of the most reliable biomarkers of poor overall health. When your cortisol levels are consistently high, you're likely to die sooner. As if that wasn't bad enough, higher cortisol levels can also cut your ability to recover from exercise in half—meaning you'll make half as much progress as you would with low cortisol and only be able to exercise half as much before experiencing symptoms of overtraining. With all that said, there is good news here. You don't need to quit caffeine forever, but habitual users should go on a one- to two-week caffeine detox every so often. Thankfully, there's a way to kick a caffeine addiction in one week with very little pain.

Withdrawl Symptoms

Typical caffeine withdrawal symptoms include the following:

- Lethargy
- Increased heart rate
- Decreased motor activity (you don't feel like moving much)
- Shakes or hand tremors
- Increased need to urinate (i.e., a diuretic effect)
- Skin flushing
- Flu-like symptoms

In addition, the following symptoms can occur, but usually only after a person has been habituated to higher dosages (several hundred milligrams per day):

- Muscle aches and stiffness
- Constipation
- Joint pain
- Abdominal pain
- Nausea and/or vomiting

Withdrawal symptoms usually set in about 12 to 24 hours after cessation of caffeine intake. Fortunately, it only takes about nine days to get over a caffeine addiction and reset your tolerance, and the worst of the withdrawal symptoms will usually be behind you after two to three days. Those first few days can be quite unpleasant, however. The good news is that there are a couple of things you can do to make the process—and particularly the first two days—easier, and in fact nearly painless. Surprisingly, a simple amino acid supplement can block the worst effects of caffeine withdrawal. Here's how that works: While caffeine's primary mechanism of action is inhibition of the depressant neurotransmitter adenosine, the most painful symptoms of caffeine withdrawal aren't linked to this process. Among other things, caffeine causes the brain to overproduce three stimulant hormones and neurotransmitters: dopamine, epinephrine (adrenaline), and norepinephrine. All three of these chemicals are synthesized by the body from the amino acid tyrosine, which in turn is synthesized from the amino acid phenylalanine. The biosynthesis pathway looks like this: Phenylalanine → tyrosine → L-Dopa → dopamine, epinephrine (adrenaline), norepinephrine

Chronic caffeine usage can therefore deplete the brain's stores of tyrosine and phenylalanine, two amino acids that act as building blocks for dopamine and adrenaline. This depletion is partly responsible for caffeine tolerance, as well as some of the more painful side effects of caffeine withdrawal - which is why research shows that phenylalanine and tyrosine depletion reduces the effectiveness of stimulants. As such, it is unsurprising that anecdotally, many people find that supplementing either tyrosine or phenylalanine can make recovery from caffeine addiction (and probably addiction to other dopamine-producing drugs) faster and easier. You might also recognize phenylalanine as an ingredient in diet sodas: a 12 oz. can of Diet Coke, for example, contains 104 mg of phenylalanine, one of the components of aspartame. Of the two recommended supplements—tyrosine and phenylalanine—I recommend phenylalanine, in the form of DL-phenylalanine (abbreviated DLPA), over tyrosine. Since each step in the synthesis pathway described above is irreversible, taking phenylalanine will restore your tyrosine levels as well, whereas taking tyrosine won't directly restore your phenylalanine levels.

DL-phenylalanine is a mixture of the left and right isomers of phenylalanine, and because your brain uses both, it's best to supplement with a mix of the two. The other thing you can do to make the withdrawal process easier is replace your caffeine habit with another habit. According to The Power of Habit, the seminal book on habit change, it's almost impossible to simply get rid of a habit without replacing it with something else. It is far more effective to replace that habit with something else that you can do at the same time and under the same circumstances as your old habit. What this means for caffeine is that you should replace your usual caffeine source with a decaffeinated version of the same thing. This decaffeinated substitute should also be available from the same sources from which you're used to getting your caffeine. So if you normally have coffee at home, instead have decaf at home. If you normally get Diet Coke from 7–11, instead get caffeine-free Diet Coke if your store has it; otherwise, go for diet root beer, which is the closest thing to decaffeinated diet cola.

Addiction Solution

Putting all this information together, here's the exact schedule you should follow to kick your addiction in one week. Before starting: Figure out what your substitute habit is going to be—decaf coffee, herbal tea, root beer, etc. If you normally make or consume your caffeine at home or the office, acquire a supply of your substitute that will last you more than a week. Also get a bottle of DL-phenylalanine capsules. The last day you consume caffeine: Throw out all your caffeine. Coffee, soda, caffeine pills - get rid of them all. You may also take 500 mg of DLPA either in the morning or around noon as desired. Be aware that taking it with or shortly before caffeine will potentiate the effects of the caffeine.

Day 1	Consume 1,000 mg of DL-phenylalanine first thing in the morning and another 1,000 mg around noon. Start consuming your substitute beverage in place of your usual caffeinated beverage at the same time and place you would normally be consuming caffeine.
Day 2	Take 1,000 mg of DLPA in the morning and 1,000 mg at noon. The morning of Day 2 is the hardest for most people—once you go without caffeine that morning, it only gets easier from there.
Day 3	Take 1,000 mg of DLPA in the morning and 500 mg at noon. By the afternoon of Day 3, if not sooner, your caffeine cravings should be all but gone.
Day 4	Take 1,000 mg of DLPA first thing in the morning and 500 mg at noon. Things will be noticeably easier by this day at the latest: withdrawal symptoms should no longer be noticeable, although you're still a few days away from completely resetting your tolerance.
Day 5-6	Take 500 mg of DLPA in the morning and 500 mg at noon.
Day 7-10	Take 500 mg of DLPA in the morning, but not at noon. By Day 7, your tolerance will probably have been completely reset and your addiction will be over, but you should keep going for 10 days just to be absolutely certain.
Day 11+	After 10 days, you can resume having one caffeinated beverage a day, in the morning, if you so choose, as long as it has less than 100 mg of caffeine. Check this list to find the caffeine content of a beverage.

Reset Your Caffeine Tolerance
This system is simple and has been proven effective time and time again. Even for an ardent tea drinker like me, it's well worth taking a week or two off from caffeine in order to once again enjoy the full benefits of the world's favorite drug. Caffeine withdrawal can be tough, but if you follow this system, you'll only experience mild discomfort for the first two days. By Day 3, you'll barely even miss caffeine. After a week or so, your tolerance will have been completely reset—it will be as if you had never had caffeine before. The even better news is that you don't have to quit caffeine forever, and your effort will not have been "wasted" if you start drinking coffee again. In fact, a one-week caffeine washout will allow you to once more experience the full benefits of caffeine from a nice, low dose while still functioning at 100 percent the rest of the time and sleeping soundly at night.

Quitting Sugar

Sugar addiction is such an integral part of our society that we don't even have a word (like "alcoholic", "chocaholic" or "workaholic") to describe people addicted to sugar. "Eaters" are addicted to sugar, but you can eat without sugar. So I'm inventing a new word for sugar addicts: "sugarholics". Sugarholics today are in the same position that smokers were in the 1950s. You used to be able to smoke any time at work. You didn't have to stop work and stand alone in the middle of a field. You weren't vilified for lighting up a cigarette in a restaurant. Quite the opposite; if you didn't smoke, you were the weirdo. Today, sugarholics rule the roost. Everybody is addicted from birth. Not eating the birthday cake in the tea room marks you out as the weirdo. Make no mistake: the task you are about to undertake will not be easy, but it is not an exercise in willpower. Despite what everybody tells you, if you are a sugarholic, you do not have a personality defect. You are not a glutton. You are not weak-willed. You are chemically addicted to a substance in the food supply called fructose. And until you treat that addiction as the powerful biochemical force that it is, you will never loosen its grip. There are five steps to breaking your addiction.

Names for Sugar

Sugar is a master of disguise: just because you don't see "sugar" on the ingredient list when scanning a nutrition label does not guarantee the item is sugar or sweetener-free. Sugar goes by a slew of different names, making it easy for manufacturers to hide how much sugar is truly in a given product.

Basic Simple Sugars • Dextrose • Fructose • Galactose • Glucose • Lactose • Maltose • Sucrose			
Solid / Granulated Sugars • Beet sugar • Brown sugar • Cane juice crystals • Cane sugar • Castor sugar • Coconut sugar • Confectioner's sugar	• Corn syrup solids • Crystalline fructose • Date sugar • Demerara sugar • Dextrin • Diastatic malt • Ethyl maltolFlorida crystals • Golden sugar	• Glucose syrup solids • Grape sugar • Icing sugar • Maltodextrin • Muscovado sugar • Panela sugar • Raw sugar	• Sugar (granulated or table) • Sucanat • Turbinado sugar • Yellow sugar
Liquid or Syrup Sugars • Agave Nectar/Syrup • Barley malt • Blackstrap molasses • Brown rice syrup • Buttered sugar/buttercream • Caramel • Carob syrup	• Corn syrup • Evaporated cane juice • Fruit juice • Fruit juice concentrate • Golden syrup • High-Fructose Corn Syrup (HFCS) • Honey	• Invert sugar • Malt syrup • Maple syrup • Molasses • Rice syrup • Refiner's syrup • Sorghum syrup • Treacle	

Sugar Elimination

Attitude
There are lots of downsides to sugar addiction and the only upside is that you feel normal when you have a hit. Do you really have cause to feel deprived? No, but willpower diets demand that you feel deprived. They ask you to "go without" and to "give up" a treat. Feeling deprived will simply drive you back into the arms of addiction. If you want to succeed, you mustn't feel you are being deprived of anything. You need to take pity on the poor hopeless addicts who are all around you ingesting poison. You need to view any off ering of sugar not as a temptation to be overcome, but as an attempt to poison you (perhaps a little extreme, but you get the idea). So, don't feel deprived. You are not giving up anything. You are simply stopping a dangerous and harmful addiction. It really is that simple to break an addiction. If you have the right attitude, staying sugar-free becomes a lot easier than you could possibly imagine.

Habits
A critical step in breaking your sugar addiction is identifying the habits associated with the addiction. For me, watching TV was a means of relaxation, and it still is. But my sugar addiction had infiltrated that pleasurable experience and made it its own. Sugar had become an integral part of the relaxation process. The pleasure I gained from watching TV was directly associated, in my mind, with the dopamine hit I got from the sugar. It's possible to disassociate the two activities, but you won't do it by abstaining from both using willpower. The trouble with addictions is that they frequently attach themselves to otherwise-pleasurable experiences and it becomes impossible to distinguish the two. Those habits will really test your resolve because of the strong association, and in some cases the strong peer group pressure (such as at birthday parties, Easter and Christmas) to conform. In many instances, the only rational way to deal with the problem is to avoid the habitual events associated with consuming sugar until you break the addiction. So, if you are in the habit of relaxing in front of the TV with a chocolate at the end of the day, stop watching TV and find some other way to relax in the evening for the next month. Or you could continue your TV habit but replace the chocolate with nuts, for example.

Elimination
This step is all about giving you the shopping strategies you need to prevent too much fructose from contaminating your food supply. You are going to need some shelf space for all your fructose-free food, so the first thing you need to do is throw out all the food in your pantry and fridge that is too high in fructose. Chocolate of any description must be sent to a happier hunting ground. The same goes for anything you picked up in the confectionery aisle at the supermarket. Sweet biscuits are slightly less bad than confectionery. To make your cupboards truly fructose-free, all the sweet biscuits should go in the bin. The only drinks you should have in your cupboard or fridge are unflavoured water and unflavoured milk. If you prefer your water with bubbles, then by all means have unflavoured mineral water or soda water. Alcoholic drinks are okay for the recovering sugarholic as long as they don't taste sweet and they are not mixed with other drinks that contain sugar. You can keep the dry wines, beers and spirits, but you need to toss out the dessert wines, ports, sweet sherries, liqueurs and mixers (unless they are diet mixers). If you see honey or sultanas in the name of a cereal, it's usually a good idea to check the sugar content carefully. Don't be fooled by the branding of new ranges of flavoured oat cereals, either. Unlike their unflavoured cousins, they are usually extremely high in sugar.

Withdraw
Walt Disney once said, "The way to get started is to quit talking and begin doing." And that is the point at which we have arrived on our mission to break your sugar addiction. There's nothing fun about the withdrawal period, but it does end. And once it does, you'll be completely free from the desire to eat sugar ever again. A plate of bikkies will hold all the attraction of a plate of raw broccoli. If you are going cold turkey, have one last supper of your favourite sugary treat. Get that Mars Bar or that can of Coke. Sit down and consciously enjoy the very last time in your life that you will eat (or drink) sugar. If you can just get past the next few weeks of danger, you will enjoy the health that sugar has sucked from your life to date. Then, all of a sudden, your desire for sugar will vanish. I know it sounds strange, but it just plain goes. Bang! And you will never want the stuff again.

Restock

Once you start the withdrawal, you'll need to re-stock your now-bare cupboard.

Fruit	Whole fruits do contain fructose (the addictive and harmful half of sugar) - in some cases, very large amounts. But they also contain a fairly large amount of fibre and water.
Vegetables	There is no such thing as a bad vegetable. All vegetables contain some level of fructose, but it is an insignificant amount and is vastly overwhelmed by the fibre content.
Nuts	Like vegetables, there's no such thing as a bad nut. Some have more fructose than others, but even the worst of them, from a fructose perspective, have huge amounts of fibre.
Meat	Meat does not contain any sugar, so knock yourself out. The only possible word of caution is around some of the fancy marinated meats. The marinade is usually very high in sugar and this type of product should generally be avoided.
Eggs, Yoghurt, Milk and Cream	Only choose the tartest of European and natural yoghurts and avoid flavoured milk or whipped cream that you buy in a can.
Cheese	Cheese will have sugar on the ingredients list, but it is all lactose, so there's no need for concern.
Bread	All breads contain some sugar. All of the standard unflavoured white breads lie somewhere between 0.5 and four per cent sugar (two per cent fructose). Multigrain and brown (wholemeal and rye) breads are low-sugar and have approximately twice as much fibre.

Quitting Gambling

Quitting gambling, especially for someone struggling with a gambling addiction, is a significant challenge that often requires professional help and a multi-faceted approach. It's a behavioral addiction, and recovery is a process that involves addressing underlying issues, changing habits, and building a strong support system.

1. Acknowledge and Talk About the Problem
The first crucial step is to admit there's a problem. Gambling addiction often thrives in secrecy. Talking openly and honestly about your gambling with a trusted friend, family member, or professional counsellor can ease the burden, reduce shame, and be the catalyst for seeking help.

2. Seek Professional Help
- Counselling and Therapy: This is often the most effective treatment.
  - Cognitive Behavioural Therapy (CBT): Helps individuals identify and challenge unhealthy thoughts and beliefs related to gambling and develop coping mechanisms.
  - Motivational Interviewing: Helps to build and strengthen motivation for change.
  - Group Therapy: Provides a supportive environment where individuals can share experiences and strategies with peers facing similar challenges.
  - Family Therapy: Addresses the impact of gambling on family relationships and helps create a more supportive home environment.
- Medication: While there are no FDA-approved medications specifically for gambling disorder, some medications (like antidepressants or mood stabilizers) may be prescribed to treat co-occurring conditions such as depression, anxiety, or bipolar disorder, which can often fuel gambling behavior.

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3. Implement Financial Safeguards
● Block Gambling Transactions: Contact your bank to see if they offer features to block gambling payments or transactions to gambling sites/venues.
● Give Control of Finances: Have a trusted person (e.g., family member) manage your money, pay bills, and control access to funds. This can include giving them control of credit cards and bank accounts.
● Self-Exclusion: Legally ban yourself from gambling venues (casinos, clubs, pubs, TABs) or online gambling websites. Australian gambling providers are legally required to offer this option.
● Carry Limited Cash: Avoid carrying large amounts of money that could be used for gambling.
● Seek Financial Counselling: Address any debt or financial difficulties caused by gambling.

4. Identify Triggers and Avoid High-Risk Situations
● Journaling: Keep a journal to track when, where, and why you feel the urge to gamble. Note your thoughts, feelings, and the situations that precede gambling sessions.
● Avoid Venues/People: Steer clear of places (casinos, clubs, betting shops) and people associated with your gambling. If a certain route takes you past a gambling venue, find an alternative.
● Manage Emotions: Recognize if stress, anxiety, boredom, loneliness, or depression trigger your gambling. Develop healthy coping mechanisms for these emotions (e.g., exercise, mindfulness, hobbies, talking to someone).

5. Find Healthy Alternatives and New Hobbies
● Fill the Void: Gambling often fills a significant portion of a person's time and provides a certain "rush." Find new, healthy activities, hobbies, or social engagements to replace gambling. This could include sports, arts, volunteering, learning a new skill, or spending time with loved ones.
● Set Goals: Set short-term and long-term personal goals that are unrelated to gambling to maintain focus and motivation.

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6. Build a Strong Support Network
● Support Groups: Join peer support groups like Gamblers Anonymous (GA), which follows a 12-step program similar to Alcoholics Anonymous. SMART Recovery meetings are another option. These groups provide a sense of community and accountability.
● Lean on Trusted Individuals: Continue to communicate openly with your trusted friends and family members. Their support is vital for recovery.

7. Prepare for Lapses (Relapses)
● Understand Relapse is Part of Recovery: A lapse (or relapse) is when you gamble again after deciding to stop. It doesn't mean you've failed completely, but rather that you need to re-evaluate your strategies.
● Learn from Lapses: Use any lapse as an opportunity to understand what triggered it and what strategies worked or didn't work. Reach out to your support person or counsellor immediately.
● Don't Give Up: Recovery is a marathon, not a sprint. Be fair to yourself and persist with your efforts.

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6 Preparing to Die

MEDICAL Preparing to Die

One day you will die, that's obvious enough but for some people this may occur before you expect it. If you know you're going to die or there's a very high chance of it happening soon then consider yourself lucky that you know the approximate time and can prepare for it. The section below will discuss what you should get in order before your passing, your wishes for the future and who will inherit your possessions. This section assumes that SHTF is in progress so a lot of the law and will sections have been excluded.

Questions

Questions

● Think about where/how you would like to die; in what surroundings; with what things (music? videos?); with which people present?
● Is my will up to date?
● Have I discussed my condition with my family/friends in complete honesty?
● Who will make medical decisions when you can no longer make them?
● What are my beliefs about death?
● Do I need to make peace with myself or a Higher Power?
● Do I need psychological, emotional, spiritual care, counselling or support?
● Have I left a legacy? Identify life lessons, advice, hopes and dreams that you would like to pass on to family and friends. Write or record these. Identify a person who can pass these along to the people to those whom you wish to
receive your legacy.
● Have I written my personal history? You can write it down, or record on audio or video tape, etc. Who is to get my personal history?
● Do I have anything amiss with my family/friends to fix? Can I fix them now?

MEDICAL Preparing to Die Questions

● Do I have letters to write? Calls to make? Make a list of all old grudges, enemies, etc., and attempt to settle those affairs. You may use the "6 things" as a guide.
● Have I created my "bucket list"? What am I able to accomplish with the time I have left? Use this list to help create your "goals of medical care. "
● Do I want to be buried, embalmed, cremated or something else?
● Do you have a plan for someone to take over your position, such as an apprentice?
● Who do I give my personal belongings to? If you are married, most likely all of your belongings will transfer to your spouse or family. If you are single, then you must specify what you want done with these items.
● Who gets my special items, such as photos, mementos, etc.?
● If I am single and have kids, have I set up a guardian for my children for the immediate time after my death? Short-term money for them?
● What should I sell before my death? House? Car? Furniture? Land?
● Have I made arrangements for the care of my pets?
● What unfinished projects around the house, at work, or in the community would I like to complete?

MEDICAL Preparing to Die Questions

● If I have young children, have I left letters or videos to them?
● Are all my digital photos/videos in one place?
● Who do I want notified of my death?
● Do I want to write my own obituary?
● Do I have burial plot? If cremated, where should my ashes be scattered or interned?
● Do I want/need a headstone/grave marker? Have I written out what I want inscribed on it? Design?
● Do I want a Funeral service? Program?
● Do I have special needs for my ceremony? Military? Religious?
● Who will deliver the eulogy? Ask him or her in advance.
● Do I want a wake or memorial party instead of a funeral?

Thoughts

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Discussing / Thoughts	Do you need to discuss with someone about the uncertainty of death? Tell family, friends and enemies anything you have kept secret up until this point. Tell someone or write down all your online passwords to make disabling accounts easier. Have a look at the different religions in the "Religion" section and try praying if you've never done it before.	**Things to Say** "I'm sorry." "I forgive you." "Thank you." "I love you." "Goodbye."

Master File	• Will • Letter of Instruction • Birth Certificates • Marriage Certificates • Citizenship Papers • Financial Assets	• Medicare Numbers • Adoption Papers • Passports • Driver Licences • Military Records • Real Estate	• Other Assets • Liabilities • Trust Documents • Buried/Hidden Assets • Income Sources • Divorce/Separation Papers	• Social worker or caseworker names/info • Passwords, websites and other digital information	• Names/phone numbers of healthcare professionals • Healthcare proxies/living wills • Medications (dosages, name of prescribing doctors, pharmacy) • Address and phone numbers of hospitals of choice

Bucket List

A bucket list is a list of things you want to do, see or experience before you die. The list below has been specially chosen to be able to be completed in a SHTF scenario. As always don't do one if it makes you uncomfortable or it risks your life. Every activity is outdoors based and can be done for free in the right circumstances.

Questions to ask yourself to gauge what sorts of activities you can do. Honestly estimate how long you may have to live. Many years, a few months, weeks? How strong are you? How good is your health? What are your financial resources?

• Make a Personalised Bucket List • Explore a Cave • Dog Sled • Go Bamboo Rafting • Go Skinny Dipping	• Walk a Suspension Bridge • Climb to the top of a Tree • Herd Cattle • Hold a Monkey • Milk a Cow
• Climb a Volcano • Rappel Down a Waterfall • Sail a Boat • Whale Watching • Snowboard	• Walk on Hot Coals • Stand Under a Waterfall • Make a Snowman • Swim in the Ocean • Ride in a Horse & Carriage
• Read the Bible • Roll in a Huge Pile of Leaves • Watch the Sunrise & Sunset in One Day • Kiss in the Rain • Relax in a Natural Hot Spring	• Sleep in a Yurt • Hug a Tree • Horseback Ride on the Beach • Make a Candle • Create a Piece of Art & Sell it
• Find the Meaning of Your Name • Write a Love Letter • Learn Another Language • Start Fire Without Lighters or Matches • Learn to Play a Song on an Instrument	• Go Ice Fishing • Do 24-Hours of Silence • Learn to Juggle • Share Your Most Embarrassing Moment • Go Kayaking
• Drink only Water for a Week • Plant a Tree • Be Grateful for 10 Things Today • Climb a Rock Wall • Shuck Oysters	• Rescue an Animal • Learn the Heimlich Manoeuvre • Feed a Homeless Person • Teach a Class • Spend the Entire Day By Myself
• Have a White Christmas • Go Canoeing • Send a Message in a Bottle • Toss Pizza Dough in the Air • Eat Cactus	• New Years Eve Kiss • Clean Up Litter • Write a Poem • Find a Pearl in an Oyster • Hit the Archery Bulls-Eye
• Sleep in a Treehouse • Throw a Dart at a Map and Just Go • Watch a Meteor Shower • Learn How to Shoot a Gun • Camp in a Storm	• Break a Bad Habit • Give a Stranger a Meal • Dance in the Rain • Sing a Campfire Song • Survive a Campout in Heavy Snow
• Learn Archery • Tell Stories by the Fire • Spear a Fish • Craft a Piece of Furniture • Navigate Using a Map and Compass	• Stealth Camp Overnight • Put a Flag at the Top of a Mountain • Sleep in a Hammock • Build your own Stick Shelter and Sleep in it • Complete a Thru-Hike
• Extract Honey from a Bee Hive • Sleep under the Stars • Play in Mud • Have a Meaningful Conversation With a Stranger • Act in a Play	• Surprise Someone • Rappel into a Cave • Witness a Solar Eclipse • Sleep in an Igloo • Make a Handmade Gift
• Cook Christmas Dinner • Make a Handmade Greeting Card • Create your Own Recipe • Make an Origami Animal • Make Paper	• Sew Something you can Wear • Be a Street Performer • Take a Mud Bath • Pray to God • Bake a Cake for Someone Special
• Make Soap • Watch a Caterpillar Turn into a Butterfly • Jump Into Water Fully Clothed • Explore a Rainforest • Eat Crickets	• Achieve your Ideal Weight • Trap and Eat an Animal • Swim in a Crystal Clear Lake/Ocean • Eat an Insect • Create an Ice Sculpture

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				● Sleep in a Teepee (while reading TPE) ● Bake a Loaf of Bread ● Hunt for Wild Mushrooms ● Ride a Camel ● Go Fly-fishing	● Catch, Cook & Eat a Fish ● Eat Breakfast in Bed ● Watch an Entire Storm ● Learn to Use Chopsticks ● Make Cheese

Medication

Medications and the dosage required for treating illnesses

"We might die from medication but we sure killed all the pain."
Conor Oberst

Introduction

Modern cupboards are often packed full of medication in today's world, especially the sick and elderly. During scavenging you are likely to find a fair amount of it which may be of use to you down the track if only you knew what it was and how to use it. This section contains a description of the medication, it's use, shelf life, dosages and warnings. This section has been reduced in scope and entirely rewitten in version 11 due to the sheer size of the incompleted previous version.

Purpose	The aim of MEDICATION is to provide accurate, up-to-date information of the most common drugs and medications used today. It includes dosage recommendations based on illness type and also includes information on how the medication is supplied, the warnings involved with overdosing and how it affects the body.
Lost?	***** **QUICK TRIAGE (If you're injured or sick and looking for the correct section)** ***** ● **Sections under ILLNESS:** Radiation Sickness, Parasitic Infections, Bacterial Infections, Viral Infections, Fungal Infections, Altitude Sickness, Poisoning, Chemical Agents, Biological Agents. ● **Sections under INJURY:** Surface Wound & Bruises, Internal Injuries (Back Pain, Cerebral Hemorrhage, Bone Fractures, Dislocation, Concussion) Open Wounds, Avulsion, Burns, Environmental (Anaphylaxis, Heat Stroke, Hypothermia, Hyperthermia, Motion Sickness, Aero-otitis Media), Atmosphere (Asphyxiation, Drowning, Choking, Hypoxia, Carbon Monoxide Poisoning), Animal & Plant (Bites and Stings), Childbirth, Toothaches. ● **Sections under EMOTIONAL:** Depression, Anxiety, Stress, Confidence, Relaxation, Memory & Dementia, Grief & Loss, Postnatal Depression, New Parents, Body Image, Family & Friends and Healthy Living.

● For medications and recommended doses, see the MEDICATION section.
● For curing ailments naturally and herbal remedies, see the NATURAL REMEDIES section.
● For eating disorders, see the HEALTH > Nutrients section.
● For medication lists for your BOB, see the GEAR > Gear Descriptions > Medication section.
● For recommended medications for a home clinic over the long term, see the GEAR > Household Gear > Home Clinic > Medications section.

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MEDICATION Introduction Contents

1 Medication Info

This section describes how to properly store medications.

Antibiotics

An antibiotic is a type of antimicrobial substance active against bacteria and is the most important type of antibacterial agent for fighting bacterial infections. Antibiotic medications are widely used in the treatment and prevention of such infections. They may either kill or inhibit the growth of bacteria. A limited number of antibiotics also possess antiprotozoal activity. Antibiotics are not effective against viruses such as the common cold or influenza; drugs which inhibit viruses are termed antiviral drugs or antivirals rather than antibiotics.

Antibiotic Classes

These are the different types of antibiotic classes and what they typically treat.

Name	Treats	Types	Side Effects
Penicillins Inhibits formation of bacterial cell wall	Skin infections, dental infections, ear infections, respiratory tract infections, urinary tract infections and gonorrhoea.	Natural Penicillin, Penicillinase-resistant (methicillin, oxacillin), Aminopenicillins (ampicillin, amoxicillin), Extended-spectrum (mezlocillin, piperacillin, ticarcillin)	Very safe with minimum toxicity, common side effects: Diarrhea, Nausea, vomiting, upset stomach. Rare cases: skin rashes, fever, angioedema, anaphylactic shock.
Cephalosporins Inhibits formation of bacterial cell wall	Pneumonia, strep throat, staph infections, tonsillitis, bronchitis, otitis media, various skin infections, gonorrhea, urinary tract, Cephalexin - bone infections.	**Four Generations:** **1st** - cephalothin, cefazolin, cephapirin, cephradine, cephalexin, cefadroxil. **2nd** - cefaclor, cefamandole, cefonicid, cefuroxime. **3rd** - cefditoren, cefixime, cefodizime, cefoperazone, cefotaxime, cefpodoxime, ceftibuten, ceftriaxone. **4th** - cefclidine, cefepime, cefpirome.	Very safe, causes few side effects. Diarrhoea, nausea, stomach cramps. Shouldn't be used in people with an allergic reaction to penicillins or cephalasporins.
Fluoroquinolones Synthetic and not derived from bacteria. Older - quinolones, newer - fluoroquinolones. Older gen isn't well absorbed and treat urinary tract. Newer generations are broad spectrum and have excellent oral absorption.	Urinary tract, skin infections, respiratory infections (sinusitis, pneumonia, bronchitis), pulmonary infections in cystic fibrosis.	Clinafloxacin, ciprofloxacin, gatifloxacin, levofloxacin, lomefloxacin, ofloxacin, sparfloxacin, trovafloxacin.	Well tolerated and accectable safety level. **Common Side Effects:** Nausea, vomiting, diarrhea, abdominal pain. **Less Common:** Central Nervous System disruptions (headache, confusion, dizziness, tremor), phototoxicity, tendinopathy, tendon rupture, convulsions.
Tetracyclines Bacteriostatic. Effective against microorganisms including spirochetes, atypical bacteria, rickettsia, amebic parasites.	Respiratory tract, cholera, rocky mountain spotted fever, lyme, typhus, prophylaxis of traveler's diarrhea, malaria prophylaxis. Most commonly: acne vulgaris, rosacea.	Doxycycline, minocycline, oxytetracycline, tetracycline.	Stomach cramps, diarrhea, nausea, vomiting, esophageal ulceration, sore mouth or tongue. Can cause increased sunburn risk. Rarely: Severe headaches, vision problems, both signs of secondary intercranial hypertension. Should not be used in children under 8 and may cause yellow teeth.
Macrolides Targets bacterial ribosomes and prevent protein production. Mainly bacteriostatic.	Erythromycin has a similar use to penicillin, azithromycin and clarithyromycin are useful for their excellent lung penetration. Macrolides are used to treat respiratory tract infections (pharyngitis, sinusitis, bronchitis), genital, gastrointestinal tract, skin infections.	Azithromycin, clarithromycin, dirithromycin, erythromycin, roxithromycin, troleandomycin.	Tolerated well, Commonly: nausea, vomiting, abdominal discomfort, diarrhea. Rarely: reversible deafness and allergic reactions (angioedema, anaphylaxis, dermatologic reactions) Used with caution with liver dysfunction.
Aminoglycosides Stops the bacteria making proteins.	Treats gram-negative bacteria. May be used in combination with penicillins or cephalosporins to ensure better coverage. Work well but bacteria can become resistant to them. Can only be injected.	Amikacin, gentamicin, kanamycin, neomycin, streptomycin, tobramycin.	Side Effects: Toxicity causes irreversible damage to the ear and hearing. aminoglycoside may damage kidney.

Shelf Life

The shelf life of medication is a critical aspect of pharmaceutical quality control and patient safety. It refers to the period during which a drug product is expected to remain within its approved specifications of strength, quality, and purity when stored under specified conditions.

Shelf Life
This is the length of time a drug product can be stored, under defined conditions, before its quality attributes (like potency, purity, physical appearance, and dissolution) fall outside the established acceptance criteria. It's determined through rigorous scientific testing.

Expiration Date (EXP Date)
This is the final day that the manufacturer guarantees the full potency and safety of a medication. It's the date beyond which the product should not be used, as its stability is no longer guaranteed by the manufacturer. For most over-the-counter (OTC) and prescription drugs in Australia, the expiration date is a legal requirement. If only a month and year are given (e.g., June 2025), it means the end of that given month.

Shelf Life Factors
- Temperature: Higher temperatures generally increase the rate of chemical reactions, leading to faster degradation. Freezing can also damage some liquid formulations.
- Moisture/Humidity: Water can cause hydrolysis, physical changes (softening, caking), and promote microbial growth.
- Light: UV and visible light can cause photodegradation, leading to loss of potency or formation of toxic byproducts.
- Oxygen: Exposure to oxygen in the air can lead to oxidation, degrading the active ingredients.
- pH: For liquid formulations, changes in pH can significantly affect stability.
- Dosage Form: **Solid forms (tablets, capsules):** Generally more stable due to lower moisture content and less chemical reactivity. **Liquid forms (solutions, suspensions, injections):** More prone to degradation due to the presence of water, which can facilitate hydrolysis and microbial growth. **Creams, ointments, gels:** Can be sensitive to oxidation, microbial growth, and physical separation.
- Container and Closure System: The material and integrity of the packaging play a crucial role in protecting the drug from environmental factors.
- Active Pharmaceutical Ingredient (API) Properties: The inherent chemical stability of the drug molecule itself is a primary determinant.
- Excipients and Interactions: Inactive ingredients can sometimes interact with the API or contribute to instability.

Shelf Life Extension Program (SLEP)

The Shelf Life Extension Program (SLEP) is a joint initiative primarily between the U.S. Department of Defense (DoD) and the U.S. Food and Drug Administration (FDA), established in 1986. Its main purpose is to determine if the actual shelf life of certain federally stockpiled medications and medical supplies extends beyond their manufacturer-assigned expiration dates, thereby deferring replacement costs and ensuring readiness for emergencies.

Here are the key findings and implications of SLEP:

Vast Majority of Drugs Retain Potency Beyond Expiration
One of the most significant findings is that a substantial percentage of tested drugs remain potent and safe for years, and sometimes decades, beyond their labeled expiration dates, provided they are stored under optimal conditions (controlled temperature, humidity, and light).
Studies have shown that approximately 88% of tested drug lots were extended at least one year beyond their original expiration date, with an average extension of about 66 months (5.5 years). Some specific medications have shown demonstrable stability for 4-5 years, or even up to 15 years, after their original expiry.
A notable study from 2012 even found that 86% of 14 tested drugs (multiple batches) that were 28-40 years past expiration still retained at least 90% of their labeled potency, which is generally considered within the FDA's acceptable range.

Significant Cost Savings
The program has resulted in substantial cost savings for the DoD and other participating federal agencies by reducing the need to frequently replace expensive stockpiled medications. In 2023, the DoD reported saving $1.3 billion.

Lot-to-Lot Variability
While many drugs can be extended, the actual stability beyond expiration can show considerable lot-to-lot variability. This means that periodic testing and systematic evaluation of each specific lot are required to guarantee the adequacy of the medications. A blanket extension for a drug product is generally not issued; rather, extensions are granted on a lot-by-lot basis after rigorous testing.

Optimal Storage Conditions are Crucial
The success of shelf life extension is heavily dependent on the medications being stored under controlled and optimal environmental conditions (e.g., proper temperature, protection from light and moisture). This is why SLEP is primarily applied to stockpiles housed in environmentally controlled facilities.

Not Applicable to All Drugs (or Home Use)
- Certain types of medications are generally less stable and may not be good candidates for shelf life extension. These often include:
- Liquid formulations (solutions, suspensions)
- Certain biological products (e.g., some vaccines, insulins)
- Nitroglycerin (a highly unstable medication)
- Some antibiotics (especially once reconstituted)
- Crucially, SLEP data is generally not applicable to medications stored in homes or by the general public. This is because home storage conditions are highly variable and often not controlled, meaning there's no guarantee that the drug has maintained its stability or potency.

Impact on Expiration Dating Philosophy
SLEP findings have fueled a broader discussion about how expiration dates are determined by pharmaceutical manufacturers. The program strongly suggests that for many drugs, the manufacturer's initial expiration date (typically 2-5 years) is often conservative, based on limited initial stability data, and primarily serves commercial interests and liability concerns rather than the drug's true chemical degradation point.

In essence, SLEP has provided invaluable, real-world data demonstrating that many medications, when stored properly, remain safe and effective for significantly longer than their labeled expiration dates. It highlights the often-conservative nature of drug expiration dates and has enabled the DoD to maintain critical medical stockpiles more efficiently and cost-effectively. However, it also underscores the importance of proper storage and the need for rigorous, lot-specific testing for any actual shelf life extension.

Dangerous Meds Post-Expiry

This is a list of medications which are toxic to ingest soon after expiry, or those which lose their potency quickly.

Loss of Potency Risk

Insulin
Used to control blood sugar in diabetes. Expired or improperly stored insulin can rapidly lose potency, leading to uncontrolled high blood sugar (hyperglycemia) and potentially serious complications like diabetic ketoacidosis.

Epinephrine Auto-injectors (e.g., EpiPen, Anapen)
Used for severe allergic reactions (anaphylaxis). Epinephrine degrades relatively quickly. Using an expired auto-injector may mean receiving an insufficient dose of a life-saving drug during an emergency, which could be fatal. While some potency may remain, replacement is strongly advised.

Nitroglycerin (GTN) for Angina/Chest Pain
This medication is very unstable and prone to degradation, especially once the bottle is opened and exposed to air and moisture. Expired GTN may not effectively alleviate chest pain during a heart attack, leading to critical delays in care.

Anticoagulants and Antiplatelets (Blood Thinners)
These drugs (e.g., warfarin, dabigatran, clopidogrel) require precise dosing to prevent blood clots without causing excessive bleeding. Diminished potency could lead to serious events like strokes or deep vein thromboses.

Seizure Medications (Anticonvulsants)
Consistent and adequate dosing is vital to prevent seizures. Reduced potency from expired medication could lead to breakthrough seizures.

Thyroid Medications (e.g., Levothyroxine)
Used to treat hypothyroidism. Precise dosing is crucial for maintaining proper thyroid hormone levels. Sub-potent medication can lead to under-treatment.

Certain Heart Medications (e.g., Antiarrhythmics, some Blood Pressure Meds)
For conditions where precise control is essential, using an expired drug could lead to a worsening of the underlying condition or dangerous cardiac events.

Toxicity Risk

Tetracycline Antibiotics
The older formulation of tetracycline (the parent drug) that was famously associated with Fanconi syndrome (a type of kidney damage) when degraded. While doxycycline is a tetracycline, the specific breakdown products linked to Fanconi syndrome are more associated with tetracycline itself, not generally doxycycline. The risk of toxicity from degraded tetracyclines is rare with modern formulations and storage, but it was a historical concern that contributed to the general caution around expired medications. The primary risk with expired antibiotics, including doxycycline, is often loss of potency, which can lead to:
● Ineffective treatment: The infection isn't fully cleared, allowing it to persist or worsen.
● Antibiotic Resistance: Sub-therapeutic doses can select for resistant bacteria, making future infections harder to treat.

Liquid Medications (especially once opened or reconstituted)
● Oral Liquid Antibiotics (e.g., Amoxicillin suspensions): Once reconstituted with water, these are highly susceptible to bacterial growth, even with preservatives. Their shelf life after mixing is typically very short (e.g., 7-14 days, usually refrigerated). Using them beyond this period risks ingesting contaminated medication.
● Eye Drops, Ear Drops, Nasal Sprays: These are often formulated to be sterile or contain preservatives to prevent microbial growth. Once opened, or if expired, the preservatives can degrade, making the solution vulnerable to bacterial or fungal contamination. Using contaminated drops in sensitive areas like the eyes or ears can lead to serious infections.
● Injectable Medications: Similar to oral liquids, injectables (especially multi-dose vials) can become contaminated or degrade if not used within their "beyond-use date" once punctured.

Other Considerations
● Compounded Medications: Medicines custom-prepared by a pharmacist often have much shorter expiry dates (sometimes just days or weeks) because they don't have the extensive stability testing of mass-produced drugs and may lack robust preservative systems.
● Biologics and Vaccines: These are often sensitive to temperature and time and can lose effectiveness quickly if their cold chain is broken or if they are used past expiry.

Storage

How your medications should be stored.

Temperature

Proper medication storage regarding temperature is crucial for maintaining the drug's effectiveness, stability, and safety. Exposure to temperatures outside the recommended range can degrade the active ingredients, alter the drug's chemical composition, or even make it toxic.

Controlled Room Temperature (CRT) or "Room Temperature"
Range: Generally, 15°C to 25°C (59°F to 77°F). Some manufacturers may specify slightly different ranges, sometimes allowing excursions up to 30°C (86°F) for short periods.
Examples: Many common medications, both prescription and over-the-counter, including most tablets, capsules, and some inhalers (e.g., Albuterol, Amoxicillin capsules, EpiPens).

Cool Temperature
Range: Generally, 8°C to 15°C (46°F to 59°F).
Examples: Some specific medications that need to be kept cooler than room temperature but not necessarily refrigerated. Always check the label.
Key Points: This range bridges the gap between refrigerated and controlled room temperature. Medications requiring "cool" storage are less common than those needing refrigeration or room temperature, but it's crucial to identify them to ensure proper storage.

Refrigerated Medications
Range: 2°C to 8°C (36°F to 46°F). This is often referred to as "cold chain" storage.
Examples: Many vaccines (e.g., influenza, MMR), insulins (before opening), certain antibiotics (especially suspensions after reconstitution), biological products (like monoclonal antibodies), and some eye or ear drops.

Frozen Medications
Range: Typically -20°C (-4°F) or colder.
Examples: Some vaccines (e.g., Varicella, Zoster), certain specialized biological samples, and RNA/DNA samples.
Key Points: These are less common for general home storage but are critical in healthcare settings and laboratories.

Moisture/Humidity

Beyond temperature, moisture (humidity) is a significant factor in medication storage that can drastically affect a drug's stability, potency, and safety. Many medications are sensitive to moisture and can degrade or become less effective when exposed to high humidity.

Why Moisture is a Problem for Medications
Hydrolysis: This is a chemical reaction where water molecules break down the active ingredients in a drug. Many common medications, especially those in solid forms like tablets and capsules, are susceptible to hydrolysis. Once degraded, the drug may lose its potency or even form harmful byproducts.

Physical Changes
● Softening or Sticking: Tablets and capsules can absorb moisture from the air, causing them to soften, swell, or stick together.
● Disintegration: Some medications, particularly effervescent or dispersible tablets, are designed to dissolve in water. Exposure to ambient moisture can cause them to start breaking down prematurely.
● Crystal Formation: In some liquid formulations, moisture can lead to unwanted crystal formation.
● Reduced Effectiveness: Degraded medications may not deliver the intended therapeutic effect, leading to ineffective treatment.
● Potential Toxicity: In rare cases, the breakdown products formed due to moisture exposure can be toxic. For example, aspirin exposed to moisture can break down into salicylic acid and acetic acid (vinegar), which can irritate the stomach.
● Compromised Test Strips: Items like blood glucose test strips are highly sensitive to moisture. Exposure to humidity can lead to inaccurate readings, which can have serious implications for managing conditions like diabetes.

Oxygen

Oxygen is a significant environmental factor that can lead to the degradation of many pharmaceutical products. This process is known as oxidation, and it can compromise a drug's efficacy, safety, and shelf life.

Why Oxygen is a Concern for Medications
● Oxidation Reactions: Oxygen (specifically molecular oxygen, O2, from the air) can react directly with the active pharmaceutical ingredient (API) or excipients (inactive ingredients) in a medication. This is a chemical process involving the loss of electrons from a molecule, which can lead to:
● Loss of Potency: The chemical structure of the API can be altered, rendering it less effective or completely ineffective.
● Formation of Toxic Byproducts: In some cases, the oxidation process can create new compounds that are harmful or toxic to the patient.
● Changes in Physical Appearance: Oxidation can cause discoloration, changes in odor, taste, or texture of the medication (e.g., a pill turning brown, a liquid becoming cloudy).
● Chain Reactions (Autoxidation): Oxidation can sometimes be a self-propagating chain reaction, meaning that once it starts, it can continue to degrade more of the drug even with limited oxygen exposure. This is why preventing initial exposure is crucial.
● Sensitivity Varies: Not all medications are equally susceptible to oxidation. Some classes of drugs, like certain vitamins (e.g., Vitamin C, Vitamin A), some antibiotics, biological products (like insulin or monoclonal antibodies), and drugs with specific chemical functional groups (e.g., phenols, aldehydes, unsaturated fats/oils), are highly prone to oxidation.

Pests

While temperature, moisture, and oxygen are crucial for the chemical stability of medications, pests are a major concern for the physical integrity, contamination, and overall safety of stored pharmaceutical products. This applies across the supply chain, from manufacturing and warehouses to pharmacies and even the home medicine cabinet.

Why Pests are a Problem for Medications
● Physical Damage to Packaging: Rodents (mice, rats), insects (like "drugstore beetles," "biscuit beetles," cockroaches, silverfish, ants), and even birds can chew through or damage medication packaging (boxes, bottles, blister packs, even some soft plastics or foils). This compromises the product's sterility, exposes it to light, moisture, and oxygen, and can lead to contamination.
● Contamination: Pests carry bacteria, viruses, fungi, and other pathogens on their bodies, in their droppings, or in their urine. If they come into contact with medications or their packaging, they can introduce these contaminants, making the medication unsafe for consumption.
● Direct Consumption/Spoilage: While less common for the drug itself, some pests, especially beetles, mites, and rodents, are known to feed on dried goods, including components in medications or even the medication itself if it's palatable.
● Nesting and Breeding: Storage areas can become nesting sites for pests, leading to rapid proliferation and a larger infestation problem.
● Reputation and Economic Loss: For pharmaceutical companies, pharmacies, and even individuals, a pest infestation can lead to significant financial losses due due to spoiled product, require costly remediation, and damage reputation.
● Public Health Risk: Contaminated medications pose a health risk to patients, potentially causing illness or reducing the effectiveness of treatment.

Light

Light, particularly ultraviolet (UV) and certain visible light wavelengths, can significantly degrade many medications through a process called photodegradation (or photolysis). This can lead to a loss of drug potency, altered efficacy, and even the formation of harmful byproducts.

Why Light is a Problem for Medications
● Photochemical Reactions: Light carries energy, and when absorbed by drug molecules, this energy can initiate chemical reactions.
● Oxidation: Light can catalyze oxidation reactions (as discussed previously), accelerating the breakdown of sensitive compounds.
● Isomerization: Light can cause molecules to change their spatial arrangement, potentially rendering them inactive or less effective.
● Polymerization: Light can cause drug molecules to link together, forming larger, often inactive or insoluble, complexes.
● Loss of Potency: The most common consequence of photodegradation is a reduction in the amount of active ingredient in the medication, leading to a diminished or complete loss of its therapeutic effect.
● Formation of Toxic Byproducts: In some cases, the degraded products formed due to light exposure can be toxic or cause adverse reactions.
● Changes in Physical Appearance: Visible signs of photodegradation can include:
● Discoloration: Pills or liquids changing color (e.g., turning yellow, brown, or pink).
● Cloudiness or Precipitation: Liquids becoming cloudy or forming visible particles.
● Changes in Consistency: Gels or creams becoming watery or separating.
● Catalysis: Light can act as a catalyst, speeding up other degradation processes that might occur more slowly in the dark.
● Wavelength Sensitivity: Different drugs are sensitive to different wavelengths of light. UV light (both UVA and UVB) is particularly damaging, but even visible light (especially blue light) can affect some medications.

Medication Suffixes

In pharmacology, medication suffixes are incredibly useful as they often indicate the drug class, its mechanism of action, or its therapeutic use. This helps healthcare professionals and even patients understand what a drug is likely for, even if they don't recognize the full name.

-afil	Phosphodiesterase-5 (PDE5) inhibitors. Used for erectile dysfunction and pulmonary hypertension. Examples: Sildenafil, Tadalafil, Vardenafil
-alol	Alpha and beta-blockers. Used for hypertension. Examples: Labetalol, Carvedilol
-ane	Inhaled anesthetics. Used to induce and maintain general anesthesia. Examples: Halothane, Isoflurane, Sevoflurane
-arin	Anticoagulants (blood thinners). Prevent blood clots. Examples: Heparin, Warfarin, Enoxaparin
-ase	Thrombolytics (clot busters). Break down existing blood clots. Examples: Alteplase, Streptokinase

-asone / -sone / -olone	Corticosteroids. Anti-inflammatory and immunosuppressive agents. Examples: Dexamethasone, Prednisone, Betamethasone, Prednisolone
-azepam / -zolam	Benzodiazepines. Used for anxiety, insomnia, seizures, and muscle spasms. Examples: Diazepam, Lorazepam, Alprazolam, Midazolam
-azosin	Alpha-1 blockers. Used for hypertension and benign prostatic hyperplasia (BPH). Examples: Terazosin, Doxazosin, Prazosin
-barbital	Barbiturates. Sedative-hypnotics, sometimes used for epilepsy. Examples: Phenobarbital, Secobarbital
-bicin	Antineoplastic (cytotoxic) agents / Chemotherapy. Used in cancer treatment. Examples: Doxorubicin, Idarubicin
-caine	Local anesthetics. Block nerve impulses to numb an area. Examples: Lidocaine, Bupivacaine, Procaine
-cillin	Penicillin antibiotics. Treat bacterial infections. Examples: Amoxicillin, Ampicillin, Penicillin
-coxib	COX-2 inhibitors (a type of NSAID). Anti-inflammatory drugs with fewer gastrointestinal side effects than traditional NSAIDs. Examples: Celecoxib
-cycline	Tetracycline antibiotics. Broad-spectrum antibiotics. Examples: Doxycycline, Tetracycline, Minocycline
-dipine	Dihydropyridine Calcium Channel Blockers. Used for hypertension and angina. Examples: Amlodipine, Nifedipine, Felodipine
-dronate	Bisphosphonates. Inhibit bone resorption, used for osteoporosis. Examples: Alendronate, Risedronate, Ibandronate
-fenac / -profen	NSAIDs (Nonsteroidal Anti-inflammatory Drugs). Reduce pain, inflammation, and fever. Examples: Diclofenac, Ibuprofen, Ketoprofen
-floxacin	Fluoroquinolone antibiotics. Broad-spectrum antibiotics. Examples: Ciprofloxacin, Levofloxacin, Moxifloxacin
-fungin	Echinocandin antifungals. Treat fungal infections. Examples: Caspofungin, Micafungin
-gliptin	DPP-4 inhibitors. Used to treat Type 2 diabetes. Examples: Sitagliptin, Saxagliptin
-glitazone	Thiazolidinediones. Used to treat Type 2 diabetes. Examples: Pioglitazone, Rosiglitazone
-ide	This suffix has multiple meanings depending on the class: * Loop Diuretics: Furosemide, Torsemide * Sulfonylureas (for diabetes): Glipizide, Glyburide
-ipramine / -triptyline	Tricyclic Antidepressants (TCAs). Examples: Imipramine, Amitriptyline, Nortriptyline
-mab	Monoclonal Antibodies. Biologic drugs targeting specific cellular components, used in various conditions (cancer, autoimmune diseases). Examples: Trastuzumab, Adalimumab, Rituximab
-lukast	Leukotriene Receptor Antagonists. Used for asthma and allergies. Examples: Montelukast, Zafirlukast
-mycin / -micin	Aminoglycoside antibiotics or Macrolide antibiotics. Aminoglycosides: Gentamicin, Tobramycin Macrolides: Azithromycin, Erythromycin, Clarithromycin
-navir	Protease Inhibitors. Antiviral drugs, primarily used for HIV. Examples: Ritonavir, Lopinavir, Atazanavir
-olol	Beta-blockers. Used for hypertension, angina, arrhythmias, and heart failure. Examples: Metoprolol, Atenolol, Propranolol
-oprazole	Proton Pump Inhibitors (PPIs). Reduce stomach acid, used for GERD, ulcers. Examples: Omeprazole, Lansoprazole, Pantoprazole
-parin	Anticoagulants (specifically low molecular weight heparins or heparinoids). Examples: Dalteparin, Enoxaparin
-phylline	Xanthine Derivatives. Bronchodilators for asthma and COPD. Examples: Theophylline, Aminophylline
-pram / -oxetine / -tine	SSRIs (Selective Serotonin Reuptake Inhibitors). Antidepressants. Examples: Escitalopram, Fluoxetine, Sertraline, Paroxetine
-prazin	Antipsychotics (Phenothiazines). Examples: Chlorpromazine, Fluphenazine
-pril	ACE Inhibitors (Angiotensin-Converting Enzyme Inhibitors). Used for hypertension, heart failure, and kidney protection. Examples: Lisinopril, Enalapril, Ramipril
-ridone / -apine	Atypical Antipsychotics. Treat schizophrenia and bipolar disorder. Examples: Risperidone, Olanzapine, Quetiapine
-sartan	ARBs (Angiotensin II Receptor Blockers). Used for hypertension and heart failure, alternative to ACE inhibitors. Examples: Losartan, Valsartan, Irbesartan
-statin	HMG-CoA Reductase Inhibitors (Statins). Lower cholesterol. Examples: Atorvastatin, Simvastatin, Rosuvastatin
-terol	Beta-agonists (Bronchodilators). Relax airways, used for asthma and COPD. Examples: Albuterol, Salmeterol, Formoterol
-thiazide	Thiazide Diuretics. Remove excess fluid, used for hypertension and edema. Examples: Hydrochlorothiazide, Chlorothiazide
-tidine	H2 Receptor Antagonists (H2 Blockers). Reduce stomach acid. Examples: Cimetidine, Famotidine, Ranitidine
-tinib	Tyrosine Kinase Inhibitors. Targeted cancer therapies. Examples: Imatinib, Erlotinib
-triptan	Serotonin Receptor Agonists (Triptans). Treat migraines. Examples: Sumatriptan, Zolmitriptan, Rizatriptan
-vir	Antiviral Drugs. Treat viral infections (e.g., HIV, herpes, influenza). Examples: Acyclovir, Ritonavir, Oseltamivir
-zodone	Antidepressants (specifically serotonin reuptake inhibitors/antagonists). Examples: Trazodone, Vilazodone

2 Common Drugs

A list of the most common drugs (both over the counter and prescription) and what they do. For a more comprehensive list, see the 'Medication List' section in this category.

Actiq	Actiq is the brand name for fentanyl citrate, which is a narcotic used for the treatment of pain. This particular narcotic is used primarily for cancer patients who experience pain that is not relieved by other types of medications.
Adderall	Adderall is a medication that is given to treat symptoms of attention deficit hyperactivity disorder. Adderall can be habit-forming and is usually given in conjunction with therapy or other treatment. It comes in tablet form and is taken by mouth.
Alcohol	Alcohol is an intoxicating substance made from the fermentation of sugar, starch, and yeast. Consumption of it depresses the central nervous system. Alcohol is quickly absorbed and affects the body's neurotransmitters, resulting in enhanced or depressed sensations and moods.
Alprazolam	Alprazolam is a medication used to treat anxiety and panic disorders. It can also be used to treat depression or pre-menstrual syndrome and may be habit-forming. This medication decreases levels of abnormal excitement in the brain.
Ambien	Ambien is a brand name of the drug zolpidem. It is commonly used as a short-term treatment for insomnia, and it can also be used to treat certain brain disorders. Ambien effectively initiates sleep, but does not effectively maintain sleep.
Amobarbital	Amobarbital is a barbiturate-derived medication used as an injection before anaesthesia prior to surgery, as short-term treatment for insomnia or anxiety relief. It has sedative and analgesic effects and if taken for extended periods of time, dependence can occur.
Amphetamine	Amphetamines are psychoactive drugs that stimulate the central nervous system. They increase the release of dopamine and norepinephrine in the brain while inhibiting reuptake. Amphetamines are prescribed for several conditions, but they are also abused illegally.
Amytal	Amytal is a strong sedative used to treat sleeping disorders like insomnia. It affects the nervous system by inducing drowsiness, eventually allowing the user to sleep. Because of its strength, it is prescribed only for short periods of time.
Anexsia	Anexsia is a brand name used for the combination of acetaminophen and hydrocodone. This narcotic drug is used for the relief of moderate to severe pain. Acetaminophen is used to increase the effectiveness of the hydrocodone.
Antabuse	Antabuse is a brand name of the drug disulfiram, which prevents the breakdown of dopamine. It is used to treat chronic alcoholism by causing sensitivity to alcohol. Antabuse is a possible treatment for cocaine dependence.
Ativan	Ativan is a brand name for lorazepam, which is a benzodiazepine used in the treatment of anxiety, epilepsy, IBS, and several other conditions. Low doses have sedative effects, whereas high doses can be hypnotic. It decreases activity in the brain for relaxation.
Avinza	Avinza is a morphine sulfate extended-release capsule administered once a day. It is used to relieve moderate to severe chronic, long-term, noncancerous pain in adults requiring around-the-clock pain relief. Avinza is used to treat osteoarthritis and lower-back pain.
Biocodone	Biocodone is a brand name medication that contains the narcotic opioid drug hydrocodone. It is most commonly prescribed to treat patients with moderate to severe pain. Side effects can include itching, nausea, drowsiness, and vomiting.
Buprenorphine	Buprenorphine is a drug that causes effects similar to methadone and heroin. When given at low doses, it can help individuals addicted to opioids avoid withdrawal symptoms. The drug is available as a tablet to be placed under the tongue.
Butalbital	Butalbital is a barbiturate, which reduces anxiety and promotes relation. It is combined with acetaminophen and sometimes caffeine, and it is prescribed to treat tension headaches or other serious headaches. Butalbital is not available by itself. It may cause dependency.
Butorphanol	Butorphanol is a drug most commonly used to manage pain. It is a common treatment for sufferers of migraine headaches. Studies have shown that women typically feel more pain relief from this drug than men.
Campral	Campral is a brand name for acamprosate, a medicine given to people who have formerly consumed alcohol to help them avoid drinking again. While it does not prevent withdrawal symptoms, it does help the brain function normally again.
Carisoprodol	Carisoprodol is a muscle relaxant commonly prescribed for muscle injuries such as strains or sprains. Taken as a pill by mouth, the main side effect may be an upset stomach and should be taken with food or milk.
Chlordiazepoxide	Chlordiazepoxide is used to treat the effects of alcohol withdrawal as well as the symptoms of irritable bowel syndrome. To be effective it must be taken regularly; however, it can be habit-forming. Chloridiazepoxide should not be taken for more than four months.
Clonazepam	Clonazepam is a medication used to help control seizures. It also can be prescribed to alleviate panic attacks. This drug works by decreasing electrical activity in the brain. It may take several weeks to see improvement of symptoms.
Clonidine	Clonidine is an antihypertensive used in the treatment of high blood pressure, ADHD, and dysmenorrhea, among other conditions. It relaxes blood vessels and decreases a person's heart rate. Clonidine is taken orally in tablet form and is often combined with other medications.
Cocaine	Cocaine is a stimulant drug and is very addictive. The three routes of administration for cocaine are snorting, injecting, and smoking. It stimulates the brain by releasing dopamine, which causes the user to feel pleasure.
Codeine	Codeine is a prescription pain reliever that is classified as an antitussive and opiate analgesic. This narcotic suppresses coughing, and it alters the body's perception of pain by mimicking natural endorphins. It is taken in pill or liquid form.
Concerta	Concerta is a branded version of methylphenidate. This medication is used to treat the symptoms of ADHD. It is sometimes used to treat narcolepsy. It is part of the central nervous stimulant drug family. It's available in chewable, pill, and liquid form.
Crack Cocaine	Crack cocaine is freebase cocaine. It produces an immediate high and is considered a highly addictive stimulant. Crack cocaine's effects include psychological effects like intense feelings of euphoria, increased energy, insomnia, paranoia, and more.
Crystal Meth	Crystal Meth is one of the street names for methamphetamine. It is a powerful stimulant that speeds up the central nervous system and the effects can last from 6-12 hours depending on the method of use.
Damason-P	Damason-P is a prescription pain reliever that contains a combination of aspirin and hydrocodone. The aspirin reduces fevers and inflammation while the hydrocodone alters the nervous system's response to pain. This drug is classified as a narcotic and can be habit-forming.
Darvocet	Darvocet is a combination of acetaminophen and propoxyphene. It is used to treat pain and to reduce fevers. In large doses it can be harmful or fatal. This drug was removed from the United States market in November 2010 by FDA request.

MEDICATION / Common Drugs	**Darvon**	Darvon is a pharmaceutical-grade pain reliever that contains propoxyphene, caffeine, and aspirin. The FDA withdrew approval of this opioid in 2010 due to the dangers of propoxyphene, as it can have negative effects on the heart.
	Demerol	Demerol is a brand name for meperidine, which is a pain reliever in the narcotics category. This medication is used for pain that is moderate to severe. It is similar to morphine, which can be extremely habit-forming.
	Depade	Depade is used as an addiction-recovery medication to help patients avoid taking drugs or drinking alcohol. This drug is an opiate antagonist, which means it works in the brain to prevent opiate effects and reduce the desire to take opiates.
	Desoxyn	Desoxyn is a brand name for methamphetamine hydrochloride. It is a stimulant drug that causes appetite suppression and is sometimes used to treat obesity in patients who have had unsuccessful outcomes with other treatments. Desoxyn is also used to treat ADHD.
	Dexedrine	Dexedrine is a brand name of the drug dextroamphetamine, which produces feelings of wakefulness, focus, decreased fatigue, and decreased appetite. It is commonly used to treat ADHD and narcolepsy, and it may be used to treat obesity and certain types of depression.
	Dextroamphetamine	Dextroamphetamine is used to increase alertness and focus, as well as to reduce appetite and fatigue. This drug makes up approximately 75 percent of the ADHD treatment Adderall. It also treats narcolepsy, treatment-resistant depression, and exogenous obesity.
Common Drugs	**Dextromethorphan (DXM)**	Dextromethorphan (DXM) is widely used in over-the-counter cough syrups. It works by affecting the part of the brain that controls coughing. DXM is part of the antitussive family of drugs. It can cause dizziness and stomach discomfort.
	Dextropropoxyphene	Dextropropoxyphene is a type of medication that is used to treat mild pain. This analgesic is in the opioid drug category, and is also used for its local anaesthetic and anti-tussive effects. It can be found under the brands Darvon and Darvocet.
	Dextrostat	Dextrostat is a brand name for dextroamphetamine, which is a stimulant used in the treatment of ADHD. It can increase blood pressure and depress the respiratory system while altering the brain's natural chemicals. This amphetamine has high potential for dependence and abuse.
	Di-Gesic	Di-Gesic is the trade name for the analgesic dextropropoxyphene. It is an opioid used to treat mild pain. The medication is no longer used in Europe and the United States because it was linked to arrhythmias and fatal overdoses.
MEDICATION / Common Drugs	**Diazepam**	Diazepam is used to treat muscle spasms, anxiety disorder, and seizures. It also prescribed to control agitation caused by the withdrawal of alcohol. Diazepam is taken by mouth in tablet, extended-release capsule or liquid concentrate form.
	Dicodid	Dicodid is a trade name for hydrocodone, an opioid that acts as both a narcotic analgesic and an antitussive. In addition to managing and relieving moderate to severe pain, Dicodid may also be used as a cough suppressant.
	Dilaudid	Dilaudid is a brand name for the narcotic pain reliever hydromorphone. It works in the brain by increasing tolerance to moderate or severe pain, so it is often used after surgery. Dilaudid is available in liquid or tablet form.
	Disulfiram	Disulfiram is a medication used to treat chronic alcoholism. It works by causing unpleasant side effects when alcohol is consumed, such as headache, vomiting, chest pain and anxiety. It comes in tablet form and is taken by mouth.
	Duodin	Duodin is also known as hydrocodone, which is a semi-synthetic opioid derived from codeine and thebaine. It is used to relieve pain and suppress coughs. It is administered orally in tablet, capsule or syrup form.
Common Drugs	**Duragesic**	Duragesic is an opiate analgesic applied as a skin patch. It is a brand of fentanyl patches, which are used to treat chronic and severe pain that does not lessen considerably with other narcotics. The medication can be habit forming.
	Duramorph	Duramorph is an injected form of morphine. It is a narcotic pain reliever typically given in a clinic or hospital to relieve severe pain. Some patients may be able to give themselves injections at home.
	Ecstasy and MDMA	Ecstasy is the street name for the drug MDMA. MDMA is a synthetic psychoactive drug that induces feelings of euphoria, increased energy, and emotional warmth in the user. It is taken orally as a capsule or tablet.
	Fentanyl	Fentanyl is a potent narcotic analgesic that is used to treat severe or breakthrough pain. It is approximately 50 times more potent than heroin. It is often used in operating rooms, in intensive care units, and for treatment of cancer pain.
	Fioricet	Fioricet is a combination of three active ingredients: caffeine, acetaminophen, and butalbital. This medication is taken orally and can be habit forming. It is usually used to treat migraine headaches. It can cause an upset stomach and should be taken with food.
MEDICATION / Common Drugs	**Fiorinal**	Fiorinal is a medication that contains aspirin, caffeine, and butalbital. Butalbital is a barbiturate. Fiorinal is most commonly used to treat tension headaches and is sometimes used to treat migraines. Butalbital is habit-forming and can lead to dependency.
	Flunitrazepam (Rohypnol)	Flunitrazepam is a potent hypnotic and sedative drug most commonly known as Rohypnol. It is used medically to treat severe insomnia on a short-term basis. Non-medically, it is commonly known as a date rape drug.
	GHB	GHB, which is short for gamma hydroxybutyrate, is a pharmacological substance that was approved to treat narcolepsy. The odourless powder or liquid is often used illegally for intoxication, as it affects the brain's GABA receptors and depresses the central nervous system.
	Halcion	Halcion is a brand name for triazolam, which is a benzodiazepine. This medication is generally used as a short-term treatment for insomnia. It acts as a sedative and hypnotic, and it has a calming effect on the mind and body.
	Hash	Hashish, often referred to as hash, is a product of the cannabis plant. Prepared from marijuana buds, hash is commonly burned and inhaled. The effects are often many times more potent than those of unprocessed marijuana buds.
	Heroin	Heroin is an addictive recreational drug known to induce feelings of intense relaxation and euphoria. It is an opioid derived from morphine, which is derived from the opium poppy. Heroin can be injected, smoked, snorted, or taken orally.
Common Drugs	**Hycodan**	Hycodan is a brand name version of hydrocodone bibartate that is mixed with homatropine methylbromide. This drug is an antitussive and analgesic that reduces coughing. Too much hycodan can cause breathing difficulties. This drug can be physically and mentally addictive.
	Hydrococet	Hydrococet is the brand name for the generic drug hydrocodone. Hydrococet is a narcotic pain reliever that is approximately two-thirds as powerful as oxycodone. Hydrococet is an addictive drug and is among one of the most abused drugs.
	Hydrocodone	Hydrocodone is only available as a component in other medications. It is an opiate analgesic that can control pain as well as minimize coughing. It is taken orally and is available in many forms, including as a tablet and syrup.

Hydromorphone	Hydromorphone is an opioid narcotic drug that is a derivative of morphine. It is medically used as an alternative to morphine to relieve chronic or severe pain. It is also commonly known as Palladone and Dilaudid.
Inhalant	An inhalant is a chemical vapour that is inhaled through the mouth or nose. It can be classified as volatile solvents, gases, aerosol sprays, and nitrites. The effects of inhalants range from an alcohol-like intoxication and intense euphoria to vivid hallucinations.
Kadian	Kadian is a brand name for the generic drug morphine sulfate. It is used to relieve moderate to severe pain. Kadian is classified as a narcotic pain reliever and an opioid. Kadian can be habit-forming.
Kapanol	Kapanol is made of morphine sulfate and is used to treat acute and chronic pain. It is a member of the opioid analgesic drug group. It is available in capsule form. Kapanol can cause drowsiness.
Ketamine	Originally developed as a general anaesthetic, Ketamine is a form of PCP. Ketamine causes its user to have a dissociative experience from his surroundings and himself. In controlled mediums, the drug is also used as an anaesthetic for humans and animals.
Klonopin	Klonopin, the brand name for clonazepam, is used to control certain types of seizures caused by epilepsy. It decreases abnormal electrical activity in the brain. Klonopin is also prescribed to treat panic attacks by relieving anxiety.
LSD	LSD is the abbreviation for lysergic acid diethylamide. LSD, or acid as it is usually called, is a drug that causes several psychological effects including hallucinations. It isn't addictive and is commonly taken orally, via things like sugar cubes or blotter paper.
Laudanum	Laudanum is an alcoholic narcotic mixture that generally contains 10 percent opium, or the equivalent of 1 percent morphine. Commonly available without a prescription until the early 20th century, its use is limited now to severe cases of pain and other conditions.
Levacetylmethadol (LAAM)	Levacetylmethadol (LAAM) is an opioid analgesic and used in the treatment of opioid addiction. It is administered in conjunction with counselling and other rehabilitative measures. Only treatment programs have approval to administer Levacetylmethadol in the U.S.
Librium	Librium is a brand name for chlordiazepoxide, which is used to treat the symptoms of alcohol withdrawal and IBS. It reduces anxiety and agitation by depressing the central nervous system. Librium is classified as a benzodiazepine and can be habit forming.
Lorazepam	Lorazepam is an antianxiety medication that works by slowing brain activity. Often marketed under the names Ativan and Temesta, lorazepam is also helpful in treating insomnia, epilepsy, and nausea caused by cancer treatments. This drug can be habit-forming.
Lorcet	Lorcet is a narcotic analgesic that is combined with acetaminophen, a non-narcotic pain reliever. Patients should avoid grapefruit or grapefruit juice while taking this medication as it can increase the amount of drug in the bloodstream.
Lortab	Lortab is a brand name of a pill that combines the drugs hydrocodone and acetaminophen. It is commonly given to patients to relieve moderate to severe pain. Common side effects include an upset stomach, nausea, and dizziness.
Luminal	Luminal is a brand name of the drug phenobarbital. This drug has sedative and hypnotic effects, but it is most commonly used as an anticonvulsant to treat patients who suffer from any type of seizures.
MS Contin	MS Contin is a version of morphine for oral use. It is available in liquid and tablet forms. This drug is used to control moderate to severe pain. It can be habit-forming. MS Contin should be taken with plenty of liquid.
MSIR	MSIR is the brand name for morphine sulfate immediate release. It is an opiate narcotic analgesic known as morphine. MSIR is a pain reliever often used by cancer patients to relieve long-term moderate to severe pain.
Marijuana	Marijuana, also called cannabis, is a psychoactive drug that is most often smoked. The chemical compound tetrahydrocannabinol, commonly referred to as THC, is the major psychoactive element of cannabis. Marijuana is controversially used to treat some common medical conditions.
Meperidine	Meperidine is a habit-forming narcotic pain reliever that is often compared to morphine. This medication is used to treat pain that is considered moderate to severe. It can also be found under the brand name, Demerol.
Mescaline	Mescaline is a naturally occurring psychedelic drug found in the peyote cactus. Mescaline visually distorts the user's vision. It does not cause hallucinations, and tolerance is built with continued use. Mescaline is illegal in the United States.
Methadone	Methadone is a narcotic analgesic that is prescribed to help patients with withdrawal symptoms from illegal drug use or to deal with severe pain. This medication can be habit-forming and may be prescribed in decreasing amounts to alleviate additional withdrawal.
Methadrine	Methadrine is another name for methamphetamine, an addictive stimulant. It causes brief increases in energy and feelings of euphoria, but it also leads to cognitive impairment and confusion. It has a high potential for abuse and addiction.
Methamphetamine	Methamphetamine is a stimulant that is highly addictive and has a high potential for widespread abuse. This drug affects the central nervous system and is also referred to as speed, ice, crank, meth and crystal.
Methaqualone	Methaqualone is the generic term for Quaaludes. It was initially marketed as a non-habit-forming substitute for barbiturates, but it has slightly different properties and ultimately had a high rate of abuse. This sedative-hypnotic drug can cause euphoric feelings and sleepiness.
Methylphenidate	Methylphenidate, also known under the brand name Ritalin, is a medication used to help control the symptoms of attention deficit hyperactivity disorder. It can be habit-forming and is often used in conjunction with therapy and counselling to obtain the best results.
Morphine	Morphine is an opiate analgesic classified as a narcotic. The drug is derived from opium and used to relieve severe pain. It impairs mental and physical functions, which can result in a euphoric feeling and decreased hunger, among other effects.
Mushrooms	Mushrooms, often called Magic Mushrooms, are a specific strain of fungi that contain the hallucinogens psilocybin. It causes a distortion of the senses, which can be pleasurable or terrifying, when the mushroom is consumed whole or brewed into tea.
Naltrexone	Naltrexone is an opioid receptor antagonist used in medication-assisted treatment of alcohol or drug dependency. Naltrexone is available in tablet form or in an extended-release injection format and acts by blocking the effects of opioids.
Nembutal	Nembutal is a brand name for pentobarbital sodium, which is a part of the group of barbiturate drugs. This medication is primarily used for the purpose of insomnia treatment for short-term relief. It can also be used as a sedative before surgery.

Norco	Norco is a pharmaceutical-grade pain reliever that contains hydrocodone and acetaminophen. This medication is classified as a narcotic and is used to treat moderate to severe pain. The acetaminophen boosts the effects of the hydrocodone, which is an opioid analgesic.
Opium	Opium is a street drug that is eaten, injected, or smoked. It is highly addictive and tolerance is quickly developed in the user. It has analgesic effects and severe withdrawal symptoms including nausea and chills.
Oramorph	Oramorph, most commonly known as morphine, is an opioid drug used to treat chronic or severe pain. Oramorph has the potential to be highly addictive and can cause physiological and physical dependence that can result in difficult withdrawal.
Orlaam	Orlaam is a narcotic analgesic that is prescribed as part of a treatment plan for recovery from illegal narcotic drugs. It helps prevent withdrawal symptoms. It is usually given in gradually decreasing doses until the patient is drug-free.
OxyContin	OxyContin, generically known as oxycodone, is a narcotic used for pain relief. It can be habit-forming. Side effects include fatigue, dizziness, and fainting. It is available as a liquid, tablet, extended-release tablet, and capsule. It can be taken with or without food.
Oxycodone	Oxycodone is a medication prescribed to reduce and control pain. It is a narcotic that can be addictive. An overdose of oxycodone can be fatal. Oxycodone is a class B drug, meaning that it may be safe for use during pregnancy.
PCP	PCP is the abbreviation for phencyclidine, an addictive drug with anaesthetic, sedative, and hallucinogenic effects. It is a white powder that can be dissolved in water or alcohol. PCP can be smoked, snorted, injected, or taken orally.
Palladone	Palladone, also called hydromorphone, is normally prescribed for pain relief and cough control. It is available in liquid, tablet, and suppository form. Palladone can be habit-forming. It can also cause an upset stomach; it should be taken with food.
Panacet	Panacet is a drug used as a pain medication and fever reducer. It contains hydrocodone, which is a narcotic pain reliever, and acetaminophen, which is a non-narcotic pain reliever and fever reducer. Panacet is most commonly swallowed in pill form.
Pentobarbital	Pentobarbital is a type of barbiturate that works by slowing the brain and nervous system activity. It is used to treat insomnia for short-term relief, and has been used for sedation before surgery and as a treatment for seizures in an emergency.
Percocet	Percocet is an analgesic that contains a combination of acetaminophen and oxycodon, used in the management and relief of moderate to severe pain. Percocet is typically used to deal with non-chronic pain. The drug is usually not used for breakthrough pain.
Percodan	Percodan is a mixture of aspirin and oxycodone. The aspirin reduces inflammation while the oxycodone serves as an opiate analgesic. This drug is used to relieve moderate to severe pain, and it can be habit forming.
Peyote	Peyote is a drug found in a small spineless cactus. After eating peyote, the user experiences dream-like hallucinations. The active ingredient in peyote is mescaline, and the effect varies from person to person. Indigenous Americans often used peyote for rituals.
Phenobarbital	Phenobarbital, also known as Luminal, is a barbiturate. It is commonly used as an anticonvulsant to treat patients with seizures. It can also be used to treat those experiencing acute withdrawal from benzodiazepines, which can cause tremors and seizures.
Quaalude	Quaalude is a sedative drug that was once prescribed for insomnia and as a muscle relaxant. It gained popularity in the 1960s and 1970s as a recreational drug and is currently a drug that cannot be prescribed by physicians.
ReVia	ReVia is classified as an opiate antagonist. Also known as naltrexone, this drug is used to help people avoid drinking and using drugs once they have stopped. It is available in tablet form and used in conjunction with counselling.
Ritalin	Ritalin is one of the trade names for the stimulant methylphenidate. It is commonly used for the treatment of attention deficit hyperactivity disorder and the sleep disorder narcolepsy. Ritalin is available in tablet, capsule, and liquid form.
Rohypnol	Rohypnol is used to treat patients in a pre-surgery situation and to treat insomnia. It can be used to reduce muscle tension, to induce sedation, to reduce anxiety, and to prevent convulsions. Rohyphnol causes partial amnesia.
Roxanol	Roxanol, also known as rectal morphine, is an opiate analgesic that is used to relieve moderate to severe pain. This medication comes in suppository form that must be inserted into the rectum. This drug can be habit-forming.
Roxicodone	Roxicodone is an opium-derived drug commonly used to treat patients that suffer from moderate to severe pain. This drug is commonly used in formulations with other drugs, such as acetaminophen or ibuprofen, to create brand name pharmaceuticals.
Ryzolt	Ryzolt is a brand name for tramadol, which is a prescription pain reliever. It is classified as an opiate agonist. Ryzolt is taken as a pill and mimics the effects of natural endorphins to change the body's perception of pain.
Secobarbital	Secobarbital is a barbiturate that slows the activity of your nervous system and your brain. Its main uses are as a pre-surgery sedative and as a short-term insomnia treatment to help you fall asleep and stay asleep.
Seconal	Seconal is a brand name for secobarbital, which is a prescription barbituate. It decreases activity in the brain and is used to control seizures, insomnia, and severe anxiety. This medication is taken orally as a pill.
Soma	Soma is the brand name for the drug carisoprodol, which is a muscle relaxant. It is used as treatment for acute back pain. Dependency and side effects of this drug are controversial and have caused concern in some countries.
Speed	Speed is a slang term for methamphetamine made from chemicals and over-the-counter ingredients. This synthetic drug stimulates the central nervous system, resulting in a short-lived euphoric feeling and an increased heart rate and breathing rate, among other effects.
Steroids	Steroids are a class of drugs used to stimulate certain functions in the body. Medicinally, steroids are prescribed to stimulate cell production or a patient's appetite. When combined with hormones, steroids can be used as a contraceptive.
Stilnox	Stilnox is a brand name for zolpidem, which is a drug that is used to treat insomnia for short-term relief. Additionally, it can also be used for the treatment of some brain disorders. This drug is an anticonvulsant and muscle relaxant.
Sublimaze	Sublimaze is a potent narcotic analgesic that comes in injection form. It is commonly used in or after an operative setting, such as during anaesthesia or in the recovery room. It should only be given by those trained specifically in its use.

Suboxone	Suboxone is an FDA-approved drug used to supplement additional detox treatments for pain killer addictions. It contains buprenorphine and naloxone. When used under the supervision of a physician, this medicine can help an individual overcome an opioid dependence.
Subutex	Subutex is a brand name version of buprenorphine that is used to treat an addiction to narcotics. This is an opioid and is considered addictive. It must be taken as directed to avoid the risk of serious injury or death. The effects of Subutex abuse are serious, so getting help for Subutex addiction is vital.
Symtan	Symtan is a combination medication used to treat symptoms of coughing associated with influenza or during a cold. It contains a decongestant and a narcotic cough suppressant. This medication is not recommended for patients under 6 years of age.
Temesta	Temesta is a brand name for lorazepam, which is a type of medication that is used to treat anxiety, acute seizures and insomnia. This benzodiazepine drug is a muscle relaxant, antiemetic, anticonvulsant, sedative, amnesic and anxiolytic.
Tramadol	Tramadol is a member of the opiate agonists drug family. Its primary use is pain relief, and it is administered in tablet form. Tramadol can be habit-forming. Tramadol dosage should be gradually decreased; abruptly stopping tramadol therapy can have unpleasant side effects.
Tramal	Tramal is a centrally acting analgesic. Tramal is typically used in the management of moderate to severe pain and is effective on pain of all types. The drug has a low risk of dependency and tends to provide relief quickly.
Triazolam	Triazolam is a drug that treats insomnia, so you are better able to fall asleep and stay asleep. It is a part of the benzodiazepines group, and works by affecting the unbalanced brain chemicals that cause the sleeping problems.
Tussionex	Tussionex is a prescription medication that contains a combination of hydrocodone and chlorpheniramine. The hydrocodone suppresses coughing while the other active ingredient serves as an antihistamine. It is used to relieve symptoms of colds and the flu.
Tylox	Tylox is a combination of acetaminophen and oxycodone. It is a narcotic that can become addictive. This drug is contraindicated for patients who are heavy drinkers or who suffer from liver disease. Tylox can cause drowsiness and dizziness.
Ultram	Ultram, also known as tramadol, is used as a pain reliever similar to narcotics. It can help ease moderate to severe pain and is often used to treat chronic pain. Ultram is available in tablet form.
Valium	Valium is in a class of drugs called benzodiazepines. It is used to treat anxiety, seizures and muscle spasms. It can be habit forming, so it should not be taken for an extended period of time.
Vicodin	Vicodin is a mixture of acetaminophen and hydrocodone. This pharmaceutical pain reliever is classified as a narcotic, as hydrocodone is an opioid analgesic. Vicodin depresses the central nervous system and impairs mental and physical functions.
Vicoprofen	Vicoprofen is the brand name of the combination drug that contains hydrocodone and ibuprofen. This narcotic and nonsteroidal anti-inflammatory drug combination is used for the treatment of severe pain as a short-term option for relief.
Vivitrol	Vivitrol is another name for a naltrexone injection. It is prescribed in conjunction with psychological counselling for patients recovering from drug or alcohol addiction. It reduces the urge to drink or use drugs. It cannot be taken together with drugs or alcohol.
Xanax	Xanax is the name brand of the generic drug alprazolam, which is a benzodiazepine. It is primarily used to prevent anxiety and panic attacks, as well as anxiety caused by depression in some patients, by altering the chemicals in the brain.
Xodol	Xodol is a combination of two pain relievers known as hydrocodone and acetaminophen. The presence of acetaminophen increases the effects of hydrocodone, which is classified as a narcotic pain reliever. Xodol is used to relieve moderate to severe pain.
Zolpidem	Zolpidem is a sedative-hypnotic medication used in the treatment of insomnia. It depresses the central nervous system and decreases activity in the brain to cause drowsiness. The drug is taken orally as a pill or spray.
Zydone	Zydone is an opiate that contains a mixture of Hydrocodone Bitartrate and acetaminophen. Zydone is commonly used in the management of pain ranging from moderate to moderately severe. The substance should always be used under the direction of a physician.

3 Making Drugs

This section is for making different types of drugs at home.

Making Penicillin

After SHTF, we may find ourselves in a similar situation that people faced before 1928 when penicillin wasn't freely available. It's important to note that making your own penicillin is possible but not easy. It's not something you should undertake unless you or a loved one is in a truly life-threatening survival situation and there are no other options. While it's true that growing penicillin requires basic items like bread and citrus fruit, you'll also need some equipment and chemicals that you wouldn't expect to find in your typical bug out bag or survival kit.

Warnings

- Contamination: You cannot guarantee that the mold you grow is Penicillium chrysogenum (the species that produces penicillin) and not a harmful mold. Even if it is, contamination with other bacteria or fungi is almost inevitable in a non-sterile home environment.
- Purity: Extracting and purifying penicillin from a mold culture is a complex biochemical process requiring specialized equipment, chemicals, and expertise. Homemade versions would be highly impure, potentially containing toxins from other molds, fermentation byproducts, or residual solvents.
- Potency/Dosage: You would have no way to measure the concentration or potency of the penicillin you produced. Administering an unknown and inconsistent dose is incredibly dangerous – too little could lead to antibiotic resistance and ineffective treatment, while too much could cause severe side effects or toxicity.
- Sterility: Injectable or even oral medications need to be sterile. Achieving and maintaining sterility at home is impossible, leading to a high risk of life-threatening infections if consumed.
- Allergic Reactions: Penicillin can cause severe allergic reactions (anaphylaxis) in some individuals. Without proper medical supervision and emergency care, this could be fatal.

Equipment Needed
- 1 x Citrus fruit or cantaloupe rind
- 2 x Pieces of whole wheat bread
- 1 x Gram scale
- 1 x 1 Liter glass container
- 1 x Separator funnel
- 1 x 750ml Erlenmeyer flask plus non-absorbent plug
- 1 x pH testing kit

Equipment Needed
The following chemicals (dissolved in water):
- Manganese Sulfate (0.044 gm)
- Lactose Monohydrate (44 gm)
- Corn Starch (25 gm)
- Magnesium Sulfate (0.25 gm)
- Sodium Nitrate (3 gm)
- Potassium Monophosphate (0.50 gm)
- Glucose Monohydrate (2.75 gm)
- Zinc Sulfate (0.044 gm)

On top of all that, you'll need to make sure that your culture is grown in a completely sterile environment. If the environment isn't sterile, you risk contamination which could cause bigger problems.

Procedure
1. First, set out the fruit or rind and let it mold naturally for a few days until it turns a bright bluish-green color.
2. Put the flask in an oven for an hour at 315 degrees F to sterilize it.
3. Cut the bread into small, ½-inch pieces and put them in the flask.
4. Scrape off the mold from step one and place it in with the bread.
5. Incubate the flask in a dark area for 5 days. The environment for the flask should be kept at around 70 degrees.
6. Now sterilize the 1-liter container and dissolve all the chemical ingredients in 500 ml of cold water. Once this is done, fill up the rest of the container with cold water.
7. Test the pH of the solution and use hydrochloric acid to get the pH level to 5.0.
8. Sterilize the entire solution similar to the flask in step 2.
9. Let the solution cool, then add in the mold from step 5. Allow this new solution to incubate for another 7 days.
10. Filter the mixture then adjust the pH of the solution to 2.2 with the hydrochloric acid.
11. Mix the solution with ethyl acetate and shake vigorously.
12. Let a beaker chill in an ice bath then drain the ethyl acetate into it. Combine with 1% potassium acetate and shake again.
13. Give the beaker air and let the ethyl acetate evaporate off.
14. If all the steps have been followed correctly, you'll have penicillin.

4 Drug Alternatives

These are alternative drugs that have a similar effect to the original but aren't prescription or restricted to purchase in most countries.

Animal Antibiotics

Animal Medication Equivalents
You might be able to use animal antibiotics for human consumption in an emergency depending on what type you need to cure the infection. The following is the animal equivalent antibiotic. Only use these as a last resort, and ensure you verify that it is the same product as the human version as much as possible.

Fish Antibiotics
- **Fish Cillin** - Ampicillin
- **Fish Zole** - Metronidazole
- **Fish Pen** - Penicillin
- **Fish Mox** - Amoxicillin
- **Fish Flox** - Ciprofloxacin
- **Fish Sulfa** - Sulfamethoxazole

Fish Antibiotics
- **Fish Flex** - Cephalexin
- **Fish Doxy** - Doxycycline
- **Fish Cin** - Clindamycin
- **Fish Fungus** - Ketoconazole
- **Fish Tapes** - Praziquantel
- **Fish Min** - Minocycline Hydrochloride

Bird Antibiotics
- **Bird Biotic** - Doxycycline
- **Bird Sulfa** - Sulfamethoxazole / Trimethoprim

Fish Antibiotics Labelling
This is the visual appearance and labeling of fish antibiotics so you can be sure what you're using is the correct drug.

- Fish Mox: 250mg - Labelled with 'WC 731'
- Fish Mox: 500mg - Green & White
- Fish Flox: 250mg - Labelled with 'CTI 222'
- Fish Flox: 500mg - Labelled with 'CR 500'

Natural Drug Alternatives

Head to the NATURAL MEDICATIONS section for a list of natural drug alternatives.

THE SECTIONS 5-17 BELOW CONTAIN LISTS OF MEDICATIONS BY THERAPEUTIC USE, CATEGORISED BY BODY SYSTEM. THESE SECTIONS ARE TO BE USED TO LOOK UP WHAT MEDICATIONS WORK FOR COMMON ILLNESSES.

5 Cardiovascular Meds

Cardiovascular system medications are a broad category of drugs specifically designed to treat conditions affecting the heart and blood vessels. These conditions can range from common issues like high blood pressure and high cholesterol to more severe problems such as heart failure, irregular heartbeats (arrhythmias), and the formation of dangerous blood clots.

The medications work through various mechanisms to achieve their therapeutic goals, such as relaxing blood vessels to lower blood pressure (e.g., ACE inhibitors, ARBs, calcium channel blockers), reducing the heart's workload (e.g., beta-blockers), preventing or dissolving blood clots (e.g., anticoagulants, antiplatelets, thrombolytics), or managing fluid retention (e.g., diuretics). Ultimately, these medications aim to improve the heart's pumping efficiency, ensure adequate blood flow throughout the body, reduce the risk of serious cardiovascular events like heart attacks and strokes, and alleviate symptoms to improve a patient's quality of life.

Subheadings

1 Antihypertensives

To lower high blood pressure (e.g., ACE inhibitors, ARBs, beta-blockers, calcium channel blockers, diuretics).

Lisinopril (Prinivil, Zestril)	This pharmaceutical medication blocks the enzyme that produces angiotensin II, leading to relaxation of blood vessels and reduced blood volume. It is one of the most commonly prescribed drugs for high blood pressure.
Amlodipine (Norvasc)	This pharmaceutical medication relaxes and widens blood vessels by preventing calcium from entering the muscle cells of arteries. This leads to lower blood pressure and is widely used for various types of hypertension.
Hydrochlorothiazide (HCTZ) (Microzide, Esidrix)	This pharmaceutical "water pill" helps the body eliminate excess sodium and water, reducing blood volume and thereby lowering blood pressure. It is often a first-line treatment for uncomplicated hypertension and frequently found in combination pills.
Valsartan (Diovan)	This pharmaceutical medication blocks the action of angiotensin II, a hormone that narrows blood vessels, thereby relaxing blood vessels and lowering blood pressure. It is a very commonly prescribed drug, especially when ACE inhibitors are not tolerated.
Metoprolol (Lopressor, Toprol XL)	This pharmaceutical medication blocks the effects of adrenaline, slowing the heart rate and relaxing blood vessels. It is widely used to lower blood pressure and also for conditions like angina and heart failure.
Losartan (Cozaar)	This pharmaceutical medication is an angiotensin receptor blocker that works by preventing angiotensin II from narrowing blood vessels. This results in relaxed blood vessels and a decrease in blood pressure.
Ramipril (Altace)	This pharmaceutical medication is an ACE inhibitor that helps relax blood vessels and reduce blood volume by blocking the production of a powerful vasoconstrictor called angiotensin II. It is commonly prescribed for high blood pressure and to protect the heart.
Telmisartan (Micardis)	This pharmaceutical medication is an angiotensin receptor blocker that prevents angiotensin II from constricting blood vessels. It leads to vasodilation and lower blood pressure, often used for long-term management of hypertension.
Enalapril (Vasotec)	This pharmaceutical medication is an ACE inhibitor that helps to relax blood vessels by blocking the formation of a substance that tightens them. It is widely used for hypertension and to improve outcomes in heart failure.
Perindopril (Coversyl)	This pharmaceutical ACE inhibitor helps relax blood vessels and reduce blood pressure by inhibiting the production of angiotensin II. It is commonly prescribed for hypertension and also for heart failure and coronary artery disease.
Benazepril (Lotensin)	This pharmaceutical ACE inhibitor works by blocking the formation of angiotensin II, leading to the relaxation of blood vessels and a reduction in blood pressure. It is used to treat hypertension and can also be prescribed for kidney protection in certain conditions.
Nifedipine (Procardia, Adalat)	This pharmaceutical calcium channel blocker primarily relaxes and widens blood vessels throughout the body, reducing peripheral resistance and lowering blood pressure. It is commonly used for both hypertension and angina.
Diltiazem (Cardizem, Tiazac)	This pharmaceutical calcium channel blocker works by relaxing blood vessels and slowing the heart rate, thereby lowering blood pressure. It is also used to control heart rate in certain arrhythmias.
Verapamil (Calan, Isoptin)	This pharmaceutical calcium channel blocker relaxes blood vessels and slows the heart rate, making the heart pump more easily and lowering blood pressure. It is also extensively used for managing certain heart rhythm disorders and angina.
Labetalol (Trandate, Normodyne)	This pharmaceutical medication is a unique beta-blocker that also has alpha-blocking properties, leading to both heart rate reduction and blood vessel dilation. It is often used for hypertensive emergencies and for managing high blood pressure during pregnancy.
Dietary Approaches to Stop Hypertension (DASH) Diet	This natural dietary pattern emphasizes fruits, vegetables, whole grains, and low-fat dairy, while limiting saturated fat, cholesterol, and sodium. It is a highly recommended and evidence-based non-pharmacological approach to lowering blood pressure.
Potassium-Rich Foods (Bananas, Spinach, Avocados)	Consuming foods naturally rich in potassium helps to counteract the effects of sodium in the body and relax blood vessel walls. This natural dietary adjustment is a fundamental recommendation for managing blood pressure.
Exercise (Regular Physical Activity)	Regular aerobic exercise helps strengthen the heart, making it more efficient at pumping blood, which reduces the force on arteries and lowers blood pressure. It is a cornerstone natural approach to both preventing and managing hypertension.
Hibiscus Tea	This natural herbal tea contains compounds that act as natural ACE inhibitors and diuretics, helping to relax blood vessels and increase fluid excretion. It is a popular traditional remedy and has some scientific backing for its blood pressure-lowering effects.
Garlic (Aged Garlic Extract) (Kyolic)	This natural supplement, particularly aged garlic extract, is believed to lower blood pressure by promoting nitric oxide production, which helps relax blood vessels, and by reducing arterial stiffness. It is a widely used natural remedy for cardiovascular health.
Coenzyme Q10 (CoQ10) (Qunol, Nature Made CoQ10)	This natural antioxidant and essential compound for cellular energy production may help lower blood pressure by improving blood vessel function and reducing oxidative stress. It's often used as a supplement for cardiovascular support.

2 Antiarrhythmics

To regulate irregular heart rhythms (arrhythmias).

Metoprolol (Lopressor, Toprol XL)	This pharmaceutical beta-blocker slows the heart rate and reduces the force of heart muscle contraction by blocking adrenaline's effects. It is widely used to control ventricular rate in atrial fibrillation, reduce symptoms in supraventricular tachycardias, and manage other rhythm disturbances.
Diltiazem (Cardizem, Tiazac)	This pharmaceutical calcium channel blocker slows conduction through the AV node, which helps to control the heart rate in conditions like atrial fibrillation and flutter. It also relaxes blood vessels, impacting blood pressure.
Amiodarone (Cordarone, Pacerone)	This pharmaceutical antiarrhythmic works by blocking potassium, sodium, and calcium channels, as well as alpha and beta receptors, thereby prolonging the cardiac action potential and refractory period. It is a highly effective, broad-spectrum agent used for a wide range of supraventricular and ventricular arrhythmias.
Digoxin (Lanoxin)	This pharmaceutical cardiac glycoside increases the force of heart muscle contraction and slows conduction through the AV node. It is used primarily to control ventricular rate in chronic atrial fibrillation and for heart failure.
Flecainide (Tambocor)	This pharmaceutical sodium channel blocker slows the electrical conduction in the heart, helping to restore normal rhythm and prevent episodes of atrial fibrillation, flutter, and certain ventricular tachycardias. It is often used for "pill-in-the-pocket" strategies.
Sotalol (Betapace)	This pharmaceutical beta-blocker also possesses potassium channel blocking properties, which prolongs the heart's action potential and refractory period. It is used to treat and prevent both atrial and ventricular arrhythmias.

MEDICATION 5. Cardiovascular Meds Antiarrhythmics

Propafenone (Rythmol)	This pharmaceutical sodium channel blocker slows electrical impulses in the heart, helping to maintain normal heart rhythm. It is used to treat and prevent certain supraventricular arrhythmias, including atrial fibrillation.
Verapamil (Calan, Isoptin)	This pharmaceutical calcium channel blocker slows conduction through the AV node, similar to diltiazem, to control heart rate in atrial fibrillation and supraventricular tachycardias. It also has a significant effect on blood pressure.
Adenosine (Adenocard)	This pharmaceutical medication transiently blocks conduction through the AV node, effectively interrupting re-entry pathways responsible for most supraventricular tachycardias (SVTs). It has a very rapid onset and short duration of action, making it ideal for acute SVT termination.
Magnesium (Magnesium Oxide, Magnesium Citrate)	This natural mineral plays a critical role in cardiac electrical stability and muscle function. It is often supplemented, particularly in cases of hypomagnesemia, to help stabilize heart rhythms, especially certain types of ventricular arrhythmias.
Potassium (Potassium Chloride)	This natural electrolyte is crucial for maintaining normal cardiac electrical activity and membrane potential. Supplementation is often necessary to correct hypokalemia, which can trigger or worsen various arrhythmias.
Coenzyme Q10 (CoQ10) (Qunol)	This natural antioxidant and essential compound for cellular energy production may help improve cardiac cell function and energy efficiency. It is sometimes used as a complementary therapy to support heart health, though its direct antiarrhythmic effect is not fully established.

3 Antianginal Agents

MEDICATION 5. Cardiovascular Meds Antianginal Agents

To relieve or prevent chest pain (angina) (e.g., nitrates, some beta-blockers, calcium channel blockers).

Metoprolol	This beta-blocker reduces the heart's workload by slowing the heart rate and decreasing the force of heart muscle contraction. By doing so, it reduces the heart's demand for oxygen, thereby preventing angina.
Amlodipine	This calcium channel blocker primarily works by relaxing and widening blood vessels, including those supplying the heart. This increases blood flow and oxygen supply to the heart muscle, while also reducing the heart's workload.
Nitroglycerin	This medication works by relaxing smooth muscle in blood vessels, leading to widespread vasodilation. This helps to acutely relieve angina by increasing blood flow to the heart and reducing the heart's overall workload.
Diltiazem	This calcium channel blocker not only relaxes blood vessels but also slows the heart rate and reduces the force of heart muscle contraction. These actions decrease myocardial oxygen demand and improve blood flow to the heart.
Ranolazine	This medication helps to improve the heart's efficiency by altering the flow of sodium and calcium into heart cells, which reduces the heart's oxygen demand. It is often used for chronic stable angina, particularly when other treatments are not fully effective or tolerated.
Ivabradine	This drug works by selectively slowing the heart rate without affecting blood pressure or heart muscle contraction. By reducing heart rate, it lowers the heart's oxygen demand and increases the time the heart has to fill with blood, improving oxygen supply.

4 Anticoagulants

5. Cardiovascular Meds Anticoagulants

To prevent blood clot formation (blood thinners) (e.g., warfarin, direct oral anticoagulants).

Warfarin	This oral medication works by inhibiting vitamin K epoxide reductase, an enzyme necessary for the production of several clotting factors in the liver. This reduces the blood's ability to form clots, but requires regular monitoring with INR (International Normalized Ratio) tests.
Rivaroxaban	As a direct oral anticoagulant (DOAC), rivaroxaban directly inhibits Factor Xa, a crucial enzyme in the coagulation cascade. By blocking Factor Xa, it prevents the formation of thrombin, thereby reducing blood clot formation.
Apixaban	Another direct oral anticoagulant (DOAC), apixaban also directly inhibits Factor Xa, similar to rivaroxaban. This targeted action prevents the generation of thrombin, effectively reducing the risk of blood clots.
Enoxaparin (Low Molecular Weight Heparin - LMWH)	This injectable anticoagulant works by enhancing the activity of antithrombin, which then inactivates Factor Xa and, to a lesser extent, thrombin. It is often used for preventing and treating blood clots, particularly in hospital settings or for bridge therapy.
Dabigatran	This direct oral anticoagulant (DOAC) specifically inhibits thrombin (Factor IIa), which is a key enzyme in the final steps of clot formation. By blocking thrombin, dabigatran prevents the conversion of fibrinogen to fibrin and inhibits platelet activation.
Heparin (Unfractionated Heparin - UFH)	Administered intravenously or subcutaneously, heparin works by binding to antithrombin, significantly increasing its ability to inactivate thrombin and Factor Xa. It's primarily used in acute care settings for rapid anticoagulation.

5 Antiplatelet Agents

MEDICATION 5. Cardiovascular Meds Antiplatelet Agents

To prevent platelets from sticking together and forming clots (e.g., aspirin, clopidogrel).

Aspirin	This medication works by irreversibly inhibiting an enzyme called cyclooxygenase (COX-1) in platelets, which prevents the formation of thromboxane A2, a powerful promoter of platelet aggregation. This ultimately reduces the ability of platelets to stick together and form clots.
Clopidogrel	This is a prodrug that, once metabolized, irreversibly blocks the P2Y12 receptor on platelets. By doing so, it prevents adenosine diphosphate (ADP) from binding to this receptor, which is crucial for platelet activation and aggregation.
Ticagrelor	Unlike clopidogrel, ticagrelor is a direct-acting P2Y12 receptor antagonist that reversibly binds to the receptor. This action prevents ADP-mediated platelet activation and aggregation, with a faster onset and more consistent platelet inhibition compared to clopidogrel.
Prasugrel	Similar to clopidogrel, prasugrel is a prodrug that, upon metabolism, irreversibly blocks the P2Y12 receptor on platelets. It offers more potent and consistent platelet inhibition than clopidogrel, but carries a higher risk of bleeding.
Dipyridamole	This agent works by increasing levels of cyclic AMP (cAMP) in platelets through various mechanisms, including inhibiting phosphodiesterase and blocking adenosine reuptake. Higher cAMP levels inhibit platelet aggregation and promote vasodilation.

6 Thrombolytics (Fibrinolytics)

MEDICATION | 5. Cardiovascular Meds | Thrombolytics (Fibrinolytics)

Thrombolytics, often called "clot busters," are powerful medications used in emergency situations to dissolve existing blood clots that are blocking blood flow. Their primary use is in acute, life-threatening conditions where rapid restoration of blood flow is critical.

It's important to note that the use of thrombolytics is confined to specific, acute medical emergencies and is almost exclusively administered in a hospital setting due to their potency and significant risk of bleeding. Therefore, their "common prescription" refers to their frequent use in these critical scenarios rather than outpatient prescriptions. The landscape has also shifted, with newer, more fibrin-specific agents often preferred over older ones in many developed countries.

Alteplase	This medication is a recombinant tissue plasminogen activator (tPA) that directly converts plasminogen into plasmin, an enzyme that breaks down fibrin clots. It is a highly effective clot-busting drug often used for acute ischemic stroke, pulmonary embolism, and certain types of heart attack.
Tenecteplase	This is a modified recombinant tPA that has a longer half-life and higher fibrin specificity than alteplase, allowing for a single bolus administration. It works by converting plasminogen to plasmin, thereby dissolving blood clots, and is commonly used for acute myocardial infarction and increasingly for acute ischemic stroke.
Streptokinase	This older thrombolytic is a bacterial protein that forms a complex with plasminogen, which then activates other plasminogen molecules into plasmin to break down fibrin. While effective and often more affordable, its use has decreased in some regions due to concerns about antigenicity and a higher risk of allergic reactions or re-administration issues.
Reteplase	This is another recombinant plasminogen activator that directly converts plasminogen to plasmin, similar to alteplase but with a slightly different pharmacokinetic profile. It is often administered as a double bolus and is used for acute myocardial infarction.
Urokinase	This thrombolytic directly cleaves plasminogen into plasmin, leading to clot dissolution. It is naturally produced by human kidneys and is often used for dissolving clots in catheters or for peripheral vascular thrombus.

7 Antihyperlipidemics (Lipid-lowering agents)

MEDICATION | 5. Cardiovascular Meds | Antihyperlipidemics (Lipid-lowering agents)

Antihyperlipidemics (also known as lipid-lowering agents) are a class of medications used to reduce elevated levels of lipids (fats) such as cholesterol and triglycerides in the blood. High levels of these lipids, particularly LDL ("bad") cholesterol, are major risk factors for atherosclerosis, heart attacks, and strokes.

Atorvastatin (Lipitor)	This pharmaceutical statin works by blocking an enzyme in the liver responsible for cholesterol production, thereby significantly lowering LDL ("bad") cholesterol and triglycerides, and moderately increasing HDL ("good") cholesterol. It is the most prescribed cholesterol-lowering medication globally.
Rosuvastatin (Crestor)	This pharmaceutical statin is a potent inhibitor of cholesterol synthesis in the liver, leading to substantial reductions in LDL cholesterol and triglycerides, and an increase in HDL cholesterol. It is another very commonly prescribed statin.
Simvastatin (Zocor)	This pharmaceutical statin reduces cholesterol production in the liver by inhibiting a key enzyme, resulting in lower LDL and total cholesterol levels. It is a widely used and effective medication for managing high cholesterol.
Ezetimibe (Zetia)	This pharmaceutical medication works by selectively inhibiting the absorption of cholesterol from the small intestine, leading to a reduction in the amount of cholesterol delivered to the liver and subsequently lower LDL cholesterol. It is often used in combination with statins.
Omega-3 Fatty Acids (Fish Oil/Algae Oil)	These natural/dietary supplements, rich in EPA and DHA, significantly reduce triglyceride levels by decreasing their production in the liver. They are widely consumed for cardiovascular health, with prescription-strength versions available for very high triglycerides.
Pravastatin (Pravachol)	This pharmaceutical statin lowers cholesterol by inhibiting a key enzyme in its production pathway in the liver, leading to reduced LDL and total cholesterol. It is a commonly used statin.
Fenofibrate (TriCor, Lipofen)	This pharmaceutical fibrate primarily lowers high triglyceride levels and can also increase HDL cholesterol, by activating specific receptors that regulate lipid metabolism. It is often prescribed for severe hypertriglyceridemia.
Niacin (Nicotinic Acid) (Niaspan, Niacor)	This pharmaceutical B vitamin lowers LDL cholesterol and triglycerides while increasing HDL cholesterol by reducing the liver's production of very-low-density lipoproteins (VLDL). It can also cause flushing side effects.
Plant Sterols/Stanols (CholestOff, Benecol)	These natural compounds, structurally similar to cholesterol, reduce the absorption of dietary cholesterol in the intestine. They are often found in fortified foods like margarines and yogurts, as well as supplements.
Red Yeast Rice	This natural supplement contains compounds called monacolins, including monacolin K, which is chemically identical to the statin drug lovastatin. It works by inhibiting cholesterol production in the liver, similar to statins.
Alirocumab (Praluent)	This pharmaceutical PCSK9 inhibitor is an injectable medication that blocks a protein called PCSK9, which allows the liver to remove more LDL cholesterol from the blood. It is used for patients with very high cholesterol who need additional lowering, often after maximally tolerated statins.
Evolocumab (Repatha)	This pharmaceutical PCSK9 inhibitor is an injectable medication that works by blocking the PCSK9 protein, leading to increased clearance of LDL cholesterol from the bloodstream by the liver. It is prescribed for severe hypercholesterolemia and cardiovascular risk reduction.
Colesevelam (Welchol)	This pharmaceutical bile acid sequestrant works in the intestine by binding to bile acids, preventing their reabsorption and increasing their excretion. This prompts the liver to use more cholesterol to make new bile acids, thereby lowering LDL cholesterol.
Gemfibrozil (Lopid)	This pharmaceutical fibrate reduces high triglyceride levels and can increase HDL cholesterol by enhancing the breakdown and clearance of triglyceride-rich particles from the blood. It is used to treat severe hypertriglyceridemia.
Cholestyramine (Prevalite, Questran)	This pharmaceutical bile acid sequestrant binds to bile acids in the intestine, preventing their reabsorption. This leads to increased excretion of bile acids, prompting the liver to convert more cholesterol into bile acids, thus lowering LDL cholesterol levels.

8 Diuretics

MEDICATION | 5. Cardiovascular Meds | Diuretics

Diuretics, often called "water pills," are medications that help the body get rid of excess water and salt (sodium) through increased urination. They are commonly used to treat conditions characterized by fluid retention (edema) and high blood pressure, thereby reducing the workload on the heart and improving fluid balance.

Hydrochlorothiazide (Microzide, Esidrix)	This pharmaceutical thiazide diuretic helps the body eliminate excess sodium and water, reducing blood volume and thereby lowering blood pressure and reducing fluid retention (edema). It is one of the most widely prescribed diuretics, often used alone or in combination with other blood pressure medications.
Furosemide (Lasix)	This pharmaceutical loop diuretic is very potent, working in the loop of Henle in the kidneys to remove large amounts of salt and water from the body. It is frequently used for significant fluid retention associated with heart failure, liver disease, or kidney disease, and also for hypertension.
Chlorthalidone (Thalitone, Hygroton)	This pharmaceutical thiazide-like diuretic helps the kidneys remove more fluid and salt from the blood, similar to hydrochlorothiazide. It is widely used for treating high blood pressure and edema, and some studies suggest it may offer superior cardiovascular benefits in certain populations.
Spironolactone (Aldactone)	This pharmaceutical potassium-sparing diuretic and aldosterone antagonist helps the body excrete sodium and water while retaining potassium. It is commonly used for fluid retention in heart failure, liver cirrhosis, and for resistant hypertension.
Torsemide (Demadex)	This pharmaceutical loop diuretic, similar to furosemide, increases urine output by acting on the kidneys to enhance the excretion of salt and water. It is used to treat fluid retention and swelling associated with heart failure, kidney disease, and liver disease.

Indapamide (Natrilix, Indipam)	This pharmaceutical thiazide-like diuretic works by inhibiting sodium reabsorption in the kidneys, leading to increased excretion of water and salt. It is used for the treatment of high blood pressure and edema, and may offer additional benefits in terms of vascular protection.
Bumetanide (Bumex)	This pharmaceutical loop diuretic is very potent, working in the kidneys to remove excess salt and water from the body. It is primarily used to treat fluid retention (edema) associated with heart failure, liver disease, or kidney disease.
Triamterene (Dyrenium)	This pharmaceutical potassium-sparing diuretic works by directly blocking sodium channels in the kidneys, which leads to increased sodium and water excretion while conserving potassium. It is often used in combination with other diuretics to prevent potassium loss.
Dandelion	This natural herb has traditionally been used for its diuretic properties, helping to increase urine production and promote the excretion of salts and water from the kidneys. It is sometimes consumed as a tea.
Green Tea	This natural beverage contains caffeine, which acts as a mild diuretic, promoting increased urine output. It is widely consumed globally and can contribute to fluid elimination.
Parsley	This natural herb has been traditionally used as a diuretic in folk medicine, believed to stimulate the kidneys to excrete more sodium and water. It can be added to food or brewed as a tea.
Hibiscus Tea	This natural herbal tea contains compounds that may act as mild diuretics, helping to increase fluid excretion and reduce water retention. It is also known for potential blood pressure-lowering effects.
Mannitol (Osmitrol)	This pharmaceutical osmotic diuretic is administered intravenously and works by drawing water out of tissues into the bloodstream, increasing urine output. It is primarily used in acute settings to reduce intracranial pressure (brain swelling) or intraocular pressure (eye pressure).

9 Inotropic Agents

Inotropic agents are medications that alter the force or energy of muscular contractions, particularly those of the heart. Positive inotropes strengthen the heart's contractions, increasing cardiac output, and are used to support cardiac function in conditions like acute heart failure, cardiogenic shock, and severe low cardiac output states. Negative inotropes weaken contractions and are used to decrease cardiac workload, for example, in angina or hypertrophic cardiomyopathy (though these are typically classified as beta-blockers or calcium channel blockers and not generally considered "inotropic agents" in the context of increasing contractility).

This list focuses on positive inotropic agents commonly used to enhance cardiac contractility in critical care or chronic heart conditions. Their "common prescription" refers to their frequent use in specific hospital-based situations or for long-term management of heart failure.

Digoxin (Lanoxin)	This pharmaceutical cardiac glycoside increases the force of heart muscle contractions and slows the heart rate. It is widely used orally to manage symptoms of chronic heart failure and to control the heart rate in atrial fibrillation.
Dobutamine (Dobutrex)	This pharmaceutical synthetic catecholamine stimulates beta-1 adrenergic receptors in the heart, increasing the force of heart muscle contraction and cardiac output. It is primarily administered intravenously in acute heart failure or cardiogenic shock to improve heart function.
Milrinone (Primacor)	This pharmaceutical phosphodiesterase-3 inhibitor increases the force of heart muscle contraction and causes vasodilation (widening of blood vessels). It is administered intravenously in acute heart failure to improve cardiac output and reduce systemic vascular resistance.
Dopamine (Intropin)	This pharmaceutical catecholamine acts on dopamine, beta-1, and alpha-1 adrenergic receptors depending on the dose, increasing heart rate, contractility, and blood pressure. It is used intravenously to treat various forms of shock, including cardiogenic and septic shock.
Coenzyme Q10 (CoQ10) (Qunol)	This natural antioxidant and essential compound for cellular energy production plays a vital role in the heart's energy metabolism and function. It is widely used as a dietary supplement to support cardiovascular health, though its direct inotropic effect is not as immediate or potent as pharmaceuticals.
Hawthorn	This natural herb contains flavonoids and proanthocyanidins that are believed to improve cardiac contractility, dilate blood vessels, and have antioxidant effects. It is traditionally used to support heart function, particularly in mild heart failure.
L-Carnitine	This natural amino acid is crucial for transporting fatty acids into mitochondria, where they are converted into energy, thereby supporting the heart muscle's energy production. It is used as a dietary supplement for various cardiovascular conditions.

10 Vasodilators

Vasodilators are a diverse group of medications that work by widening (dilating) blood vessels. This action improves blood flow, reduces the heart's workload, and lowers blood pressure. They are used to treat various conditions, including hypertension, heart failure, angina, and certain peripheral vascular diseases.

It's important to note that many common antihypertensives (like ACE inhibitors, ARBs, and calcium channel blockers) also function as vasodilators as a primary component of their action. This list will include some of the most prominent drugs known for their vasodilatory effects across different classes.

Amlodipine (Norvasc)	This pharmaceutical calcium channel blocker relaxes and widens blood vessels by preventing calcium from entering the muscle cells of arteries. This leads to lower blood pressure and is a cornerstone in the treatment of hypertension.
Lisinopril (Prinivil, Zestril)	This pharmaceutical ACE inhibitor blocks the enzyme that produces angiotensin II, a powerful vasoconstrictor, leading to relaxation of blood vessels and reduced blood pressure. It is one of the most widely prescribed vasodilators for hypertension and heart failure.
Valsartan (Diovan)	This pharmaceutical angiotensin receptor blocker (ARB) directly blocks the action of angiotensin II, a hormone that narrows blood vessels, thereby relaxing blood vessels and lowering blood pressure. It is a very commonly prescribed vasodilator.
Nitroglycerin (Nitrostat, Nitrolingual)	This pharmaceutical nitrate directly relaxes smooth muscle in blood vessel walls, particularly veins, leading to widespread vasodilation that reduces the heart's workload and improves blood flow to the heart muscle. It is a rapid-acting treatment for angina (chest pain).
Hydralazine (Apresoline)	This pharmaceutical direct vasodilator primarily relaxes arterial smooth muscle, leading to a decrease in peripheral vascular resistance and blood pressure. It is used to treat severe hypertension, often in combination with other medications.
Sildenafil (Viagra, Revatio)	This pharmaceutical phosphodiesterase-5 (PDE5) inhibitor increases nitric oxide activity, leading to relaxation of smooth muscle in blood vessels and increased blood flow. While famously known for erectile dysfunction, it is also used for pulmonary hypertension (Revatio).
Telmisartan (Micardis)	This pharmaceutical angiotensin receptor blocker prevents angiotensin II from constricting blood vessels, leading to vasodilation and lower blood pressure. It is a common choice for long-term management of hypertension.
Isosorbide Dinitrate (Isordil, Dilatrate-SR)	This pharmaceutical nitrate is metabolized to nitric oxide, which relaxes vascular smooth muscle, causing vasodilation in both arteries and veins. It is used to prevent and treat angina (chest pain) and manage heart failure.
Minoxidil (Loniten)	This pharmaceutical direct vasodilator works by opening potassium channels in vascular smooth muscle cells, causing profound vasodilation and a significant reduction in blood pressure. Its oral form is used for severe hypertension, while its topical form (Rogaine) stimulates hair growth.
Prazosin (Minipress)	This pharmaceutical alpha-1 adrenergic blocker relaxes both arterial and venous smooth muscle, leading to vasodilation and a reduction in blood pressure. It is used to treat hypertension and also for symptoms of benign prostatic hyperplasia (BPH) and PTSD-related nightmares.
Garlic (Aged Garlic Extract)	This natural supplement is believed to promote nitric oxide production and inhibit ACE activity, leading to relaxation of blood vessels and a modest reduction in blood pressure. It is widely used for cardiovascular health.

MEDICATION

5. Cardiovasc Vasodilators

Hibiscus Tea	This natural herbal tea contains compounds that may act as natural ACE inhibitors and have diuretic properties, helping to relax blood vessels and increase fluid excretion, contributing to blood pressure reduction.
L-Arginine	This natural amino acid is a precursor to nitric oxide, a powerful vasodilator that helps relax and widen blood vessels, improving blood flow. It is often taken as a supplement for cardiovascular health.
Coenzyme Q10 (CoQ10) (Qunol)	This natural antioxidant and essential compound for cellular energy production may help improve blood vessel function and reduce oxidative stress, which can contribute to vasodilation. It is a popular supplement for heart health.
Cayenne Pepper (Capsaicin)	This natural spice contains capsaicin, which can stimulate transient receptor potential (TRP) channels, leading to the release of vasodilating substances like nitric oxide. It is sometimes used in traditional medicine to support circulation.

6 Central Nervous System Meds

Central Nervous System (CNS) medications are a diverse group of drugs that exert their effects directly on the brain and spinal cord, which together constitute the CNS. These medications are used to treat a wide array of neurological and psychiatric conditions by influencing neurotransmitters, receptors, and neural pathways. They can broadly be categorized by their primary action as depressants (slowing down brain activity, like sedatives, hypnotics, and antianxiety agents), stimulants (increasing brain activity, like those for ADHD or narcolepsy), or those that modulate specific neurological functions (such as anticonvulsants for seizures, antipsychotics for psychosis, antidepressants for mood disorders, or pain relievers like opioids). Due to their direct impact on brain function, CNS medications often carry significant side effects and potential for dependence, requiring careful prescription and monitoring regardless of the patient's geographic location.

Subheadings

1. Analgesics (Non-op)	**2. Analgesics (Opioid)**	**3. Antipyretics**	**4. Anesthetics**
5. Anticonvulsants	**6. Antidepressants**	**7. Anxiolytics**	**8. Hypnotics/Sedatives**
9. Antipsychotics	**10. Antiparkinsonian**	**11. CNS Stimulants**	**12. Muscle Relaxants**
13. Antimigraine	**14. Antidementia**		

1 Analgesics (Non-opioid)

Non-opioid analgesics are the cornerstone of pain management for mild to moderate pain, and are often used in combination with opioids for more severe pain (multimodal analgesia). They primarily include acetaminophen (paracetamol) and nonsteroidal anti-inflammatory drugs (NSAIDs).

Paracetamol (Acetaminophen)	This widely available over-the-counter medication is highly effective for relieving mild to moderate pain and reducing fever. It works primarily in the central nervous system, though its exact mechanism is still not fully understood.
Ibuprofen (Advil, Motrin IB)	As a nonsteroidal anti-inflammatory drug (NSAID), ibuprofen reduces pain, inflammation, and fever by inhibiting the production of prostaglandins, which are substances that cause pain and inflammation in the body. It is commonly used for musculoskeletal pain, headaches, and menstrual pain.
Naproxen (Aleve, Naprosyn)	Another NSAID, naproxen works by reducing inflammation and pain through the inhibition of prostaglandin synthesis. It is known for its longer duration of action compared to ibuprofen, making it suitable for conditions requiring less frequent dosing, such as arthritis pain.
Aspirin (Acetylsalicylic Acid) (Bayer Aspirin)	While best known for its antiplatelet properties at low doses, at higher doses, this pharmaceutical NSAID functions as an anti-inflammatory and analgesic by irreversibly inhibiting cyclooxygenase enzymes. It's used for various pain and inflammatory conditions.
Diclofenac (Voltaren, Cataflam)	This NSAID effectively reduces pain and inflammation by inhibiting cyclooxygenase (COX) enzymes, thereby decreasing prostaglandin production. It is available in various forms, including oral tablets, gels, and patches, for conditions like arthritis and acute pain.
Celecoxib (Celebrex)	This is a selective COX-2 inhibitor, a type of NSAID that targets only the COX-2 enzyme, which is primarily involved in inflammation and pain. This selectivity aims to reduce gastrointestinal side effects compared to non-selective NSAIDs, making it useful for chronic inflammatory conditions.
Curcumin (from Turmeric)	This natural compound found in turmeric is well-researched for its potent anti-inflammatory and antioxidant properties, acting on multiple molecular targets to reduce inflammation pathways in the body. It is often used as a supplement for conditions like arthritis and general pain.
Ginger (Fresh Ginger, Ginger Root)	A natural remedy, ginger contains bioactive compounds like gingerols and shogaols that possess anti-inflammatory and analgesic effects by inhibiting prostaglandin and leukotriene synthesis. It is commonly used to alleviate muscle pain, menstrual pain, and reduce inflammation.
Capsaicin (Topical)	This natural compound, derived from chili peppers, works by depleting Substance P, a neurotransmitter involved in sending pain signals to the brain. It is used topically to relieve neuropathic pain, arthritis pain, and muscle soreness.
Gabapentin (Neurontin)	Although primarily an anti-epileptic, gabapentin is widely prescribed for neuropathic pain, such as nerve pain from shingles or diabetes. It is thought to work by affecting calcium channels in nerve cells, which reduces the release of pain-signaling neurotransmitters.
Pregabalin (Lyrica)	Similar to gabapentin, pregabalin also works by modulating calcium channels in nerve endings, thereby reducing the release of excitatory neurotransmitters that contribute to pain. It is used for neuropathic pain, fibromyalgia, and generalized anxiety disorder.
White Willow Bark	This natural botanical contains salicin, a compound similar to the active ingredient in aspirin, which is converted in the body to salicylic acid. It is traditionally used to reduce pain and inflammation, particularly for back pain and osteoarthritis.
Magnesium	This natural mineral plays a crucial role in muscle relaxation and nerve function. It is often supplemented to alleviate muscle cramps, headaches, and neuropathic pain, particularly when a deficiency is present.

2 Analgesics (Opioid)

Opioid analgesics are a class of powerful medications that relieve moderate to severe pain. They work by binding to opioid receptors (primarily mu, kappa, and delta) in the brain, spinal cord, and other areas of the body, which then block pain signals and produce feelings of euphoria or relaxation. Due to their potential for dependence, addiction, and serious side effects (especially respiratory depression), their prescription is carefully controlled.

Hydrocodone (Vicodin, Norco, Lortab)	Often prescribed in combination with acetaminophen, hydrocodone acts on opioid receptors in the brain and spinal cord to relieve moderate to severe pain. It is one of the most commonly dispensed opioids for pain management.
Oxycodone (OxyContin, Percocet, Roxicodone)	This potent opioid analgesic works by binding to opioid receptors in the central nervous system, effectively changing how the body perceives and responds to pain. It is used for moderate to severe acute and chronic pain.

MEDICATION | 6. Central Nervous System Meds | Analgesics (Opioid)

Tramadol (Ultram, Conzip)	This centrally acting analgesic has a dual mechanism, involving both weak opioid receptor binding and inhibition of norepinephrine and serotonin reuptake in the brain. It is used to treat moderate to moderately severe pain.
Codeine (Tylenol with Codeine, Panadeine Forte, Nurofen Plus)	Often found in combination with non-opioid analgesics, codeine is a prodrug that is metabolized into morphine, acting on opioid receptors to provide relief for mild to moderate pain. It also has cough suppressant properties.
Morphine (MS Contin, Kadian, Roxanol)	As a strong opioid, morphine acts directly on opioid receptors in the brain and spinal cord to provide powerful relief for severe pain. It is a fundamental medication for acute severe pain and chronic pain, including in palliative care.
Fentanyl (Duragesic, Actiq, Sublimaze)	This highly potent synthetic opioid acts on opioid receptors, providing rapid and strong pain relief, often used for severe chronic pain (e.g., in transdermal patches) or acute procedural pain (e.g., intravenous forms). It is significantly more potent than morphine.
Hydromorphone (Dilaudid)	This pharmaceutical semi-synthetic opioid is more potent than morphine, binding to opioid receptors to provide potent pain relief for moderate to severe pain. It is often used for acute pain management in hospital settings.
Opium (Various preparations, often historical or illicit)	This natural substance derived from the opium poppy contains a mixture of alkaloids, including morphine and codeine, which bind to opioid receptors to produce pain relief, euphoria, and sedation. Historically, it was a primary source of pain relief.
Heroin (Illicit, derived from morphine)	This semi-synthetic opioid is derived from morphine and is rapidly converted to morphine in the body after administration. It is a highly potent opioid that acts on opioid receptors, producing intense euphoria and pain relief, though its use is primarily illicit due to its high addiction potential.

MEDICATION | 6. Central Nervous System Meds | Antipyretics

3 Antipyretics

To reduce fever.

Paracetamol (Acetaminophen) (Tylenol)	This widely available medication works primarily in the central nervous system, though its exact mechanism is not fully understood, to reduce fever and mild to moderate pain. It is a cornerstone for fever management in both adults and children.
Ibuprofen (Advil)	As a nonsteroidal anti-inflammatory drug (NSAID), ibuprofen reduces fever by inhibiting the production of prostaglandins, which are key mediators of fever and inflammation in the body. It also provides pain relief and anti-inflammatory effects.
Naproxen (Aleve)	Similar to ibuprofen, naproxen is an NSAID that reduces fever by blocking the synthesis of prostaglandins. Its longer duration of action makes it suitable for sustained fever reduction.
Aspirin (Bayer Aspirin)	This older NSAID reduces fever by inhibiting cyclooxygenase enzymes, which are involved in prostaglandin synthesis in the hypothalamus, the brain's temperature-regulating center. However, its use as an antipyretic in children is generally avoided due to the risk of Reye's syndrome.
Diclofenac (Voltaren, Cataflam)	This pharmaceutical NSAID provides significant antipyretic effects by potently inhibiting prostaglandin synthesis. It is used for fever associated with inflammatory conditions, available in various formulations including oral and topical.
Metamizole (Dipyrone) (Novamin, Analgin)	This pharmaceutical pyrazolone derivative reduces fever by acting centrally on the brain's temperature-regulating centers and has anti-inflammatory properties. It is widely used for fever reduction in many parts of the world, though its use is restricted in some countries due to rare blood disorders.
Ginger (Fresh Ginger, Ginger Root)	A natural remedy, ginger contains bioactive compounds that possess anti-inflammatory properties, which may indirectly help reduce fever by addressing the underlying inflammation. It is often consumed as a tea for cold and flu symptoms.
Elderberry (Sambucol)	This natural botanical extract is believed to have antiviral and anti-inflammatory properties, which may help to reduce the severity and duration of fever associated with viral infections like colds and flu. It is commonly taken as a syrup or supplement.
Willow Bark	This natural botanical contains salicin, which is chemically similar to aspirin and is converted into salicylic acid in the body. It has traditional use for reducing fever and pain.
Peppermint	This natural herb has cooling properties due to menthol, and consumption of peppermint tea can help promote sweating, which is a natural mechanism for cooling the body and reducing fever.

MEDICATION | 6. Central Nervous System Meds | Anesthetics

4 Anesthetics

To cause loss of sensation (local) or consciousness (general) during medical procedures.

Propofol (Diprivan)	This pharmaceutical intravenous anesthetic produces rapid onset of unconsciousness with a short duration of action, making it ideal for induction and maintenance of general anesthesia, as well as sedation in critical care. It works by enhancing the activity of GABA, an inhibitory neurotransmitter in the brain.
Lidocaine (Xylocaine, Lignocaine)	This pharmaceutical local anesthetic blocks nerve signals by inhibiting sodium channels in nerve membranes, preventing pain sensation in a specific area of the body. It is widely used for local anesthesia during minor procedures, as a nerve block, and topically for pain relief.
Sevoflurane (Ultane, Sevorane)	This pharmaceutical volatile inhaled anesthetic induces and maintains general anesthesia by depressing central nervous system activity, allowing for rapid onset and recovery. It is a very commonly used inhalation agent, particularly for pediatric anesthesia due to its non-pungent odor.
Desflurane (Suprane)	This pharmaceutical volatile inhaled anesthetic provides rapid induction and emergence from general anesthesia due to its low blood solubility, allowing for precise control of anesthetic depth. It is frequently used for surgical procedures where quick recovery is desired.
Midazolam (Versed)	This pharmaceutical benzodiazepine works by enhancing the effects of GABA in the brain, leading to sedation, anxiety reduction, and amnesia. It is commonly used for conscious sedation during medical procedures and as a pre-anesthetic medication.
Fentanyl (Sublimaze, Duragesic)	This pharmaceutical synthetic opioid, when used as an anesthetic adjunct, provides strong analgesia and sedation by binding to opioid receptors in the brain and spinal cord. It is frequently used in general anesthesia to manage pain and blunt surgical responses.
Isoflurane (Forane)	This pharmaceutical volatile inhaled anesthetic induces and maintains general anesthesia by depressing central nervous system function. It is a commonly used and cost-effective inhalation agent globally.
Ketamine (Ketalar)	This pharmaceutical dissociative anesthetic produces a "dissociative state" where the patient appears awake but is unresponsive to pain and unaware of their surroundings. It is used for anesthesia, sedation, and increasingly for its rapid antidepressant effects.
Bupivacaine (Marcaine, Sensorcaine)	This pharmaceutical long-acting local anesthetic blocks nerve impulse transmission by inhibiting sodium channels. It is commonly used for regional anesthesia, such as epidurals for labor pain, nerve blocks, and for prolonged local pain relief.
Nitrous Oxide (Laughing Gas, Entonox)	This pharmaceutical inhaled anesthetic gas produces analgesia and mild sedation by acting on various neurotransmitter systems in the brain. It is commonly used for dental procedures, minor surgeries, and to provide pain relief during labor due to its rapid onset and offset.
Clove Oil	This natural essential oil contains eugenol, which has local anesthetic and antiseptic properties, numbing the area it's applied to. It is traditionally used as a natural remedy for toothache relief.
Ice/Cold Application	This natural physical method works by constricting blood vessels and slowing nerve conduction, which reduces pain sensation and inflammation in the affected area. It is a very common first-aid measure for minor injuries and localized pain.
Cannabinoids (e.g., THC, CBD)	These natural compounds, derived from the cannabis plant, interact with the body's endocannabinoid system, which plays a role in pain perception. They can provide analgesic and sedative effects, though their use as anesthetics is complementary and largely experimental.

5 Anticonvulsants (Antiepileptics)

Anticonvulsants, also known as antiepileptic drugs (AEDs) or anti-seizure medications, are a diverse group of drugs primarily used to prevent or reduce the frequency and severity of epileptic seizures. Many also have broader uses, such as treating neuropathic pain, bipolar disorder, and migraine prevention.

Valproic Acid (Depakote, Depakene)	This pharmaceutical medication works by making it harder for brain cells to "fire" too quickly, thus preventing seizures. It is effective against many types of epilepsy and is one of the most widely prescribed AEDs globally.
Lamotrigine (Lamictal)	This pharmaceutical medication slows down the abnormal electrical signals in the brain that cause seizures. It is widely used for both focal onset and generalized seizures.
Levetiracetam (Keppra, Spritam)	This pharmaceutical medication helps to lower excessive electrical signals in the brain, though its exact mechanism is not fully understood. It is a very commonly used antiepileptic drug for both focal onset and generalized seizures.
Topiramate (Topamax)	This pharmaceutical medication slows down how fast brain cells work, which helps to stop seizures from developing. It is mainly used to treat generalized epilepsy, including Lennox-Gastaut syndrome.
Gabapentin (Neurontin)	This pharmaceutical medication is thought to work similarly to GABA, a brain chemical that helps calm nerves, thereby decreasing abnormal excitement in the brain to control seizures. It is FDA approved for focal onset seizures.
Carbamazepine (Tegretol, Curatil)	This pharmaceutical sodium channel blocker works by stabilizing the electrical activity in the brain, slowing down how quickly signals are sent. It has been a long-standing treatment primarily for focal seizures.
Phenytoin (Dilantin)	This pharmaceutical medication reduces abnormal brain signals by blocking sodium ion channels in the brain, thereby stopping high-frequency electrical firing. It has been used for a long time to treat various types of seizures.
Oxcarbazepine (Trileptal, Oxtellar XR)	This pharmaceutical medication is similar to carbamazepine and works by decreasing abnormal electrical activity in the brain. It is used to control certain types of seizures, either alone or in combination with other medications.
Pregabalin (Lyrica)	This pharmaceutical medication reduces abnormal electrical activity in the brain to stop seizures, though it is also widely used for nerve pain and anxiety. It is primarily used as an add-on therapy for focal onset seizures.
Clobazam (Onfi, Sympazan)	This pharmaceutical benzodiazepine works in the brain to prevent seizures by enhancing the activity of GABA, an inhibitory neurotransmitter. It is primarily used to help control seizures associated with Lennox-Gastaut syndrome.
Cannabidiol (CBD) (Epidiolex	This natural compound derived from the cannabis plant interacts with the body's endocannabinoid system, showing promise in reducing seizure frequency and severity, particularly in certain severe forms of epilepsy like Dravet syndrome and Lennox-Gastaut syndrome. Epidiolex is the pharmaceutical-grade formulation.
Valerian Root	This natural herb is often used for its sedative and anxiolytic properties, and some traditional uses suggest it may help calm nervous system overactivity, which could potentially contribute to seizure control, though scientific evidence is limited.
Magnesium	This natural mineral is a potential modulator of seizure activity due to its ability to antagonize excitation at certain brain receptors and its role in nerve function. It is sometimes supplemented, particularly in cases of magnesium deficiency, which can lower seizure threshold.
Ketogenic Diet	This natural dietary therapy involves a very high-fat, very low-carbohydrate, and adequate-protein regimen that forces the body to burn fat for fuel, producing ketones. This metabolic state has been shown to reduce seizure frequency in some individuals, particularly children with drug-resistant epilepsy.

6 Antidepressants

Antidepressants are a class of medications used to treat major depressive disorder and other conditions such as anxiety disorders, obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), chronic pain, and sometimes certain eating disorders. They work by affecting the balance of neurotransmitters (chemical messengers) in the brain, primarily serotonin, norepinephrine,

Sertraline (Zoloft)	This pharmaceutical Selective Serotonin Reuptake Inhibitor (SSRI) works by increasing the levels of serotonin in the brain, a neurotransmitter associated with mood regulation. It is one of the most widely prescribed antidepressants for major depressive disorder, anxiety, and obsessive-compulsive disorder.
Escitalopram (Lexapro, Cipralex)	This pharmaceutical SSRI specifically targets serotonin reuptake in the brain, leading to increased serotonin levels and improved mood. It is a very commonly used antidepressant for major depressive disorder and generalized anxiety disorder.
Fluoxetine (Prozac)	This pharmaceutical SSRI increases serotonin levels in the brain by blocking its reabsorption into neurons. It was one of the first SSRIs developed and remains widely used for depression, obsessive-compulsive disorder, and bulimia nervosa.
Venlafaxine (Effexor XR)	This pharmaceutical Serotonin-Norepinephrine Reuptake Inhibitor (SNRI) increases the levels of both serotonin and norepinephrine in the brain. It is used to treat major depressive disorder, generalized anxiety disorder, and panic disorder.
Duloxetine (Cymbalta)	This pharmaceutical SNRI increases the levels of serotonin and norepinephrine in the brain, helping to improve mood and reduce pain. It is prescribed for major depressive disorder, generalized anxiety disorder, and chronic pain conditions like fibromyalgia and neuropathic pain.
Bupropion (Wellbutrin, Zyban)	This pharmaceutical atypical antidepressant works primarily by increasing the levels of norepinephrine and dopamine in the brain. It is used for major depressive disorder, seasonal affective disorder, and as an aid to stop smoking.
Citalopram (Celexa)	This pharmaceutical SSRI selectively blocks the reuptake of serotonin, leading to higher concentrations of serotonin in the brain. It is a commonly prescribed medication for major depressive disorder.
Mirtazapine (Remeron)	This pharmaceutical atypical antidepressant works by blocking certain serotonin and histamine receptors, which leads to increased levels of norepinephrine and serotonin. It is often chosen for its sedative properties and potential to improve sleep and appetite alongside antidepressant effects.
Trazodone (Desyrel)	This pharmaceutical serotonin antagonist and reuptake inhibitor (SARI) primarily works by blocking certain serotonin receptors and weakly inhibiting serotonin reuptake. While also an antidepressant, it is very commonly prescribed off-label for insomnia due to its strong sedative effects.
St. John's Wort	This natural herbal supplement is believed to work by inhibiting the reuptake of several neurotransmitters, including serotonin, norepinephrine, and dopamine, similar to some pharmaceutical antidepressants. It is widely used for mild to moderate depression.
Omega-3 Fatty Acids (Fish Oil, Krill Oil)	These natural essential fatty acids, particularly EPA (eicosapentaenoic acid), are thought to influence brain function by modulating neuroinflammation, neurotransmitter pathways, and cell membrane fluidity. They are often used as a complementary supplement for mood disorders.
S-Adenosylmethionine (SAM-e)	This natural compound, which occurs naturally in the body, is involved in several biochemical processes, including the synthesis of neurotransmitters like serotonin, dopamine, and norepinephrine. It is taken as a dietary supplement for mood support.
5-Hydroxytryptophan (5-HTP)	This natural amino acid is a precursor to serotonin, meaning the body converts it into serotonin. It is used as a dietary supplement with the aim of increasing brain serotonin levels to improve mood.

7 Anxiolytics (Antianxiety Agents)

MEDICATION

6. Central Nervous System Meds

Anxiolytics (Antianxiety Agents)

Anxiolytics are medications primarily used to treat anxiety disorders and related conditions. They work by influencing neurotransmitter activity in the brain to reduce symptoms such as worry, fear, and physical tension. It's important to note that while some medications are specifically called "anxiolytics" (like benzodiazepines and buspirone), many commonly prescribed drugs for anxiety are actually antidepressants or other classes of medication used off-label.

Sertraline (Zoloft)	This pharmaceutical Selective Serotonin Reuptake Inhibitor (SSRI) increases serotonin levels in the brain, helping to regulate mood and reduce anxiety over time. It is a very commonly prescribed antidepressant that is also highly effective for various anxiety disorders.
Escitalopram (Lexapro, Cipralex)	This pharmaceutical SSRI specifically enhances serotonin activity in the brain, which helps to alleviate symptoms of generalized anxiety disorder, panic disorder, and social anxiety disorder. It is widely used for long-term anxiety management.
Alprazolam (Xanax)	This pharmaceutical benzodiazepine enhances the effect of GABA, an inhibitory neurotransmitter in the brain, producing rapid calming and sedative effects. It is widely prescribed for acute anxiety and panic attacks due to its fast action, but typically for short-term use due to addiction potential.
Lorazepam (Ativan)	This pharmaceutical benzodiazepine increases the activity of GABA in the brain, leading to a reduction in anxiety, muscle relaxation, and sedation. It is commonly used for acute anxiety, panic attacks, and preoperative sedation.
Clonazepam (Klonopin)	This pharmaceutical benzodiazepine works by increasing the activity of GABA in the brain, which helps to calm nerve activity and reduce anxiety. It has a longer duration of action compared to some other benzodiazepines, making it suitable for chronic anxiety and panic disorder.
Diazepam (Valium)	This pharmaceutical benzodiazepine enhances the effect of GABA, leading to sedative, anxiolytic, muscle relaxant, and anticonvulsant effects. It is a long-acting benzodiazepine used for anxiety disorders, alcohol withdrawal, and muscle spasms.
Buspirone (BuSpar)	This pharmaceutical non-benzodiazepine anxiolytic works by affecting serotonin and dopamine receptors in the brain, helping to reduce anxiety without causing sedation or dependence commonly associated with benzodiazepines. It is typically used for generalized anxiety disorder and takes longer to show effects.
Hydroxyzine (Vistaril, Atarax)	This pharmaceutical antihistamine has sedative properties that can reduce anxiety by blocking histamine receptors in the brain. It is used for short-term relief of anxiety, often in situations where a non-addictive option is preferred.
Pregabalin (Lyrica)	This pharmaceutical medication reduces abnormal electrical activity in the brain and modulates calcium channels, which contributes to its anxiolytic effects. It is approved for generalized anxiety disorder in some regions and also used for neuropathic pain.
Propranolol (Inderal)	This pharmaceutical beta-blocker primarily blocks the physical symptoms of anxiety, such as a racing heart, sweating, and trembling, by blocking the effects of adrenaline. It is often used for performance anxiety or situational anxiety.
Ashwagandha (Sensoril, KSM-66)	This natural adaptogenic herb is believed to help the body adapt to stress by modulating the stress response system, including cortisol levels. It is widely used as a supplement to reduce anxiety and promote calm.
Valerian Root	This natural herb contains compounds that are thought to increase GABA levels in the brain, promoting relaxation and reducing anxiety. It is commonly used as a natural sleep aid but also for general anxiety.
Chamomile	This natural herb contains apigenin, a flavonoid that binds to benzodiazepine receptors in the brain, leading to mild sedative and anxiolytic effects. Chamomile tea is a widely consumed natural remedy for calming nerves and promoting relaxation.
L-Theanine (Suntheanine)	This natural amino acid, found primarily in green tea, promotes relaxation without drowsiness by increasing alpha brain waves and affecting neurotransmitters like GABA. It is used as a supplement to reduce stress and anxiety.
Kava	This natural root extract from the South Pacific contains kavalactones, which are believed to act on GABA receptors in the brain to produce anxiolytic and sedative effects. Its use is subject to caution due to potential liver toxicity concerns.

8 Hypnotics/Sedatives

Hypnotics and sedatives are medications used to induce sleep (hypnotics) or promote calmness and reduce anxiety (sedatives). Many drugs have both sedative and hypnotic effects, depending on the dosage. Their prescription is carefully managed due to potential for dependence, tolerance, and side effects.

Zolpidem (Ambien)	This pharmaceutical non-benzodiazepine ("Z-drug") acts rapidly on specific GABA receptors in the brain to induce sleep, primarily used for short-term treatment of insomnia. It is one of the most prescribed sleep medications globally.
Temazepam (Restoril)	This pharmaceutical benzodiazepine enhances the effect of GABA, an inhibitory neurotransmitter, leading to sedative and hypnotic effects. It is commonly prescribed for short-term treatment of insomnia, particularly for difficulty staying asleep.
Alprazolam (Xanax)	While primarily an anxiolytic, this pharmaceutical benzodiazepine's strong sedative properties lead to its frequent use for acute insomnia, especially when anxiety is an underlying cause. It quickly enhances GABA's inhibitory effects in the brain.
Lorazepam (Ativan)	This pharmaceutical benzodiazepine enhances GABA activity in the brain, producing sedative effects that aid in sleep induction and maintenance. It is often used in hospital settings for acute insomnia, anxiety, and procedural sedation.
Eszopiclone (Lunesta)	This pharmaceutical non-benzodiazepine ("Z-drug") works by selectively binding to GABA receptors in the brain to promote sleep. It is approved for both short-term and long-term treatment of insomnia.
Clonazepam (Klonopin)	While mainly an anticonvulsant and anxiolytic, this pharmaceutical benzodiazepine's long half-life and sedative effects mean it is often used for chronic insomnia, particularly when associated with anxiety or restless leg syndrome.
Zaleplon (Sonata)	This pharmaceutical non-benzodiazepine ("Z-drug") has a very rapid onset and short duration of action, making it suitable for individuals who have difficulty falling asleep or who wake up in the middle of the night and need to return to sleep quickly. It also works on GABA receptors.
Melatonin (Circadin)	This natural hormone, produced by the pineal gland, regulates the body's sleep-wake cycle (circadian rhythm). It is widely used as a natural or over-the-counter supplement to help with sleep onset, jet lag, and shift work sleep disorder.
Trazodone (Desyrel)	While an antidepressant, this pharmaceutical serotonin antagonist and reuptake inhibitor (SARI) is very commonly prescribed off-label at lower doses for its strong sedative effects to help with insomnia. It primarily works by blocking certain serotonin and histamine receptors.
Diazepam (Valium)	This pharmaceutical long-acting benzodiazepine enhances GABA's inhibitory effects in the brain, providing sustained sedative, anxiolytic, and muscle relaxant properties. It is used for anxiety, alcohol withdrawal, and can aid sleep, especially in cases of agitated insomnia.
Doxepin (low dose) (Silenor)	This pharmaceutical tricyclic antidepressant (TCA) is used at very low doses specifically for insomnia, primarily by blocking histamine H1 receptors, which promotes sleep maintenance.
Valerian Root	This natural herb contains compounds that are believed to increase GABA levels in the brain, promoting relaxation and aiding in sleep. It is one of the most popular herbal remedies for insomnia.
Suvorexant (Belsomra)	This pharmaceutical orexin receptor antagonist works by blocking the wake-promoting signals of orexin neurotransmitters in the brain. It is a newer class of hypnotic specifically designed to help people fall asleep and stay asleep.
Ramelteon (Rozerem)	This pharmaceutical melatonin receptor agonist acts similarly to natural melatonin, targeting specific melatonin receptors in the brain to regulate the sleep-wake cycle. It helps with sleep onset but does not have the risk of dependence associated with benzodiazepines.
Lemborexant (Dayvigo)	This pharmaceutical orexin receptor antagonist also blocks the activity of orexin, a chemical that promotes wakefulness, thereby facilitating sleep onset and maintenance. It is a newer option for insomnia.
Chamomile	This natural herb contains apigenin, a flavonoid that binds to benzodiazepine receptors in the brain, leading to mild sedative effects and promoting relaxation and sleep. Chamomile tea is a widely consumed natural sleep aid.
Lavender	This natural plant is known for its calming aroma, and its essential oil or oral supplements containing silexan are believed to have anxiolytic and mild sedative effects that can promote relaxation and improve sleep quality.
Ashwagandha (Sensoril, KSM-66)	This natural adaptogenic herb is used to help the body manage stress and anxiety, which can often interfere with sleep. While not a direct hypnotic, by reducing stress, it can indirectly improve sleep quality and promote relaxation.

9 Antipsychotics

Antipsychotics are a class of medications primarily used to treat psychotic disorders such as schizophrenia, schizoaffective disorder, and bipolar disorder (especially manic and mixed episodes), as well as certain other conditions like severe agitation and sometimes treatment-resistant depression. They work by affecting neurotransmitters in the brain, primarily dopamine and serotonin.

Quetiapine (Seroquel)	This pharmaceutical atypical antipsychotic balances levels of dopamine and serotonin in the brain, helping to regulate mood, thoughts, and behaviors. It is widely used for schizophrenia, bipolar disorder, and as an add-on for major depressive disorder.
Aripiprazole (Abilify)	This pharmaceutical atypical antipsychotic acts as a partial agonist at dopamine D2 and serotonin 5-HT1A receptors, meaning it can both block and stimulate these receptors depending on the brain's activity. It is used for schizophrenia, bipolar disorder, and as an adjunctive treatment for depression.
Olanzapine (Zyprexa)	This pharmaceutical atypical antipsychotic works by balancing dopamine and serotonin levels in the brain to help manage mood, behaviors, and thoughts. It is commonly prescribed for schizophrenia and bipolar disorder.
Risperidone (Risperdal)	This pharmaceutical atypical antipsychotic blocks receptors for both serotonin and dopamine in the brain, helping to reduce psychotic symptoms. It is widely used for schizophrenia, bipolar disorder, and irritability associated with autism.
Lurasidone (Latuda)	This pharmaceutical atypical antipsychotic affects dopamine and serotonin receptors in the brain to improve mood and reduce psychotic symptoms. It is used for schizophrenia and bipolar depression.
Paliperidone (Invega)	This pharmaceutical atypical antipsychotic is the active metabolite of risperidone and primarily acts as an antagonist at dopamine D2 and serotonin 5-HT2A receptors. It is available in oral and long-acting injectable forms for schizophrenia and schizoaffective disorder.
Haloperidol (Haldol)	This pharmaceutical typical (first-generation) antipsychotic primarily works by blocking dopamine D2 receptors in the brain, effectively reducing positive symptoms of psychosis like hallucinations and delusions. It is a potent and widely used antipsychotic, especially in acute settings.
Ziprasidone (Geodon)	This pharmaceutical atypical antipsychotic blocks dopamine and serotonin receptors and also has some reuptake inhibition effects on serotonin and norepinephrine. It is used for schizophrenia and bipolar disorder, notable for a lower risk of weight gain.
Clozapine (Clozaril)	This pharmaceutical atypical antipsychotic has a complex mechanism, affecting multiple dopamine and serotonin receptors, and is considered highly effective for treatment-resistant schizophrenia. Due to potential serious side effects, its use requires strict monitoring.
Chlorpromazine (Largactil, Thorazine)	This pharmaceutical typical (first-generation) antipsychotic primarily blocks dopamine receptors, helping to control psychotic symptoms. It was one of the first antipsychotics developed and is still used, particularly for its sedative effects.
Lithium (Lithobid, Eskalith)	While primarily known as a mood stabilizer for bipolar disorder, lithium's ability to modulate various neurotransmitter systems can indirectly contribute to stabilizing thought processes and mood swings that may involve psychotic features in bipolar disorder.
Omega-3 Fatty Acids	These natural essential fatty acids, particularly EPA and DHA, are thought to play a role in brain cell membrane function and neurotransmitter modulation. Research suggests they may have a supportive role in reducing the risk or severity of psychotic symptoms, especially in early stages.
Ashwagandha (Sensoril, KSM-66)	This natural adaptogenic herb is believed to modulate stress pathways and neurotransmitter systems, which may indirectly support mental well-being and potentially reduce stress-induced psychotic symptoms, though its direct antipsychotic effect is not established.
Curcumin (from Turmeric)	This natural compound is recognized for its anti-inflammatory and antioxidant properties, which may address some of the inflammatory processes hypothesized in certain psychiatric disorders. Early research suggests it could be an add-on for improving negative and cognitive symptoms in schizophrenia.

10 Antiparkinsonian Agents

Antiparkinsonian agents are medications used to manage the symptoms of Parkinson's disease (PD), a progressive neurodegenerative disorder characterized by a deficit of dopamine in the brain. The goal of treatment is to improve motor symptoms (tremor, rigidity, bradykinesia, postural instability) and non-motor symptoms. These drugs work by increasing dopamine levels, mimicking dopamine's effects, or by affecting other neurotransmitter systems.

Carbidopa/Levodopa (Sinemet, Duopa)	Levodopa is a precursor to dopamine that is converted into dopamine in the brain to replace what is lost in Parkinson's disease, directly addressing motor symptoms. Carbidopa prevents the breakdown of levodopa before it reaches the brain, reducing side effects and increasing effectiveness. This combination is the most effective and widely used treatment for motor symptoms in Parkinson's disease.
Pramipexole (Mirapex)	This pharmaceutical dopamine agonist directly stimulates dopamine receptors in the brain, mimicking the effects of dopamine to improve motor symptoms. It is often used as a first-line treatment or as an add-on therapy, helping with shaking, stiffness, and slow movements.
Ropinirole (Requip)	This pharmaceutical dopamine agonist also directly stimulates dopamine receptors in the brain, helping to reduce the motor symptoms of Parkinson's disease like tremors, rigidity, and slowness of movement. It can be used alone or with levodopa.
Rasagiline (Azilect)	This pharmaceutical MAO-B inhibitor blocks the breakdown of dopamine in the brain, allowing more dopamine to be available to act on receptors. It is used to improve motor symptoms and can be taken as monotherapy in early Parkinson's or as an adjunct to levodopa.
Entacapone (Comtan)	This pharmaceutical COMT inhibitor helps levodopa last longer in the body by preventing its breakdown by the COMT enzyme, allowing more levodopa to reach the brain. It is used as an add-on therapy for patients experiencing "wearing-off" periods with levodopa.
Mucuna Pruriens (Velvet Bean)	This natural plant extract contains naturally occurring levodopa, which acts as a precursor to dopamine in the brain. It has been used traditionally and studied as a natural source of L-dopa to help alleviate Parkinson's symptoms.
Coenzyme Q10 (CoQ10) (Qunol)	This natural antioxidant and essential compound for cellular energy production is believed to support mitochondrial function, which is often impaired in Parkinson's disease. While early studies were mixed, it is widely used as a supplement for overall brain and heart health.
Creatine	This natural compound, involved in cellular energy metabolism, is thought to help improve mitochondrial function and protect neurons. It has been investigated for its potential neuroprotective effects in Parkinson's disease, though clinical trial results have not consistently shown significant symptomatic benefits.

11 CNS Stimulants

Central Nervous System (CNS) stimulants are a class of medications that enhance brain activity, leading to increased alertness, attention, energy, and sometimes elevated mood. They are primarily used to treat Attention-Deficit/Hyperactivity Disorder (ADHD) and narcolepsy, but some are also used for weight management. These medications are carefully controlled due to their potential for abuse and dependence.

Methylphenidate (Ritalin, Concerta)	This pharmaceutical stimulant works by increasing the levels of dopamine and norepinephrine in the brain, improving focus and impulse control. It is one of the most widely prescribed medications for ADHD and narcolepsy.

Amphetamine/Dextroamphetamine Salts (Adderall, Vyvanse)	These pharmaceutical stimulants increase the release of dopamine and norepinephrine in the brain, leading to increased alertness, attention, and energy. They are commonly prescribed for ADHD and narcolepsy.
Caffeine (NoDoz, Vivarin)	This natural stimulant works by blocking adenosine receptors in the brain, reducing feelings of fatigue and increasing alertness. It is the most widely consumed psychoactive substance globally.
Lisdexamfetamine (Vyvanse, Elvanse)	This pharmaceutical prodrug is converted into dextroamphetamine in the body, which then increases dopamine and norepinephrine levels in the brain. It provides a smooth, long-lasting stimulant effect and is widely used for ADHD and binge-eating disorder.
Modafinil (Provigil)	This pharmaceutical wakefulness-promoting agent is thought to affect dopamine, norepinephrine, and histamine systems in the brain to promote alertness and reduce excessive daytime sleepiness. It is used for narcolepsy, sleep apnea, and shift work sleep disorder.
Nicotine (Nicorette, NicoDerm CQ)	This natural alkaloid, primarily consumed through tobacco products or nicotine replacement therapies, acts on nicotinic acetylcholine receptors in the brain, producing stimulating and mood-modulating effects. It is highly addictive.
Armodafinil (Nuvigil)	This pharmaceutical wakefulness-promoting agent is the R-enantiomer of modafinil, having a longer half-life and similar effects in promoting alertness. It is used to treat excessive daytime sleepiness associated with narcolepsy, obstructive sleep apnea, and shift work disorder.
Dextroamphetamine (Dexedrine, Zenzedi)	This pharmaceutical stimulant increases the release of dopamine and norepinephrine in the brain, resulting in increased alertness, improved attention, and reduced impulsivity. It is used for ADHD and narcolepsy.
Coca Leaves	This natural plant, particularly when chewed or brewed as a tea, contains naturally occurring cocaine alkaloids that act as mild stimulants. It is traditionally used in certain cultures to reduce fatigue, hunger, and improve endurance.
Guarana	This natural plant extract contains a high concentration of caffeine, along with other compounds like theobromine and theophylline, providing a sustained stimulating effect. It is a popular ingredient in energy drinks and supplements.
Ephedrine (Bronkaid, Primatene Mist - OTC; Akovaz)	This pharmaceutical sympathomimetic amine stimulates alpha and beta-adrenergic receptors, leading to bronchodilation, vasoconstriction, and CNS stimulation. It is used as a decongestant, for asthma (historically), and occasionally for hypotension.

12 Muscle Relaxants

Muscle relaxants are a class of medications used to treat muscle spasms and muscle spasticity. While both conditions involve muscle stiffness and involuntary contractions, muscle spasms are typically acute and painful (e.g., from injury), while spasticity is a chronic neurological condition (e.g., from multiple sclerosis, cerebral palsy, spinal cord injury).

Cyclobenzaprine (Flexeril)	This centrally acting muscle relaxant works in the brainstem to reduce muscle spasms associated with acute, painful musculoskeletal conditions. It is believed to reduce tonic somatic motor activity, affecting both gamma and alpha motor systems.
Tizanidine (Zanaflex)	This centrally acting alpha-2 adrenergic agonist reduces muscle spasticity by inhibiting the release of excitatory amino acids in the spinal cord. It is effective for spasticity caused by conditions like multiple sclerosis or spinal cord injury.
Carisoprodol (Soma)	This medication is a central nervous system depressant that interrupts neuronal communication within the reticular formation and spinal cord, leading to sedation and alteration in pain perception, thereby providing muscle relaxation. Its primary metabolite, meprobamate, also contributes to its effects.
Methocarbamol (Robaxin)	The exact mechanism of methocarbamol is not fully understood, but it is believed to work by calming overactive nerves in the brain and spinal cord, which helps to relax muscles and alleviate pain and stiffness associated with muscle spasms.
Baclofen (Lioresal)	This medication is a gamma-aminobutyric acid (GABA)-B receptor agonist that works at the spinal cord level to reduce spasticity. It is thought to decrease the release of excitatory neurotransmitters and stimulate inhibitory signals, effectively relaxing muscles.
Diazepam (Valium)	This benzodiazepine enhances the effects of gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter, in the brain and spinal cord. By increasing GABA activity, it helps to calm the central nervous system, leading to muscle relaxation and reduced spasms.

13 Antimigraine Agents

Antimigraine agents are broadly categorized into two main groups: acute (abortive) treatments taken to stop a migraine attack once it starts, and preventive (prophylactic) treatments taken regularly to reduce the frequency, severity, and duration of migraine attacks. Many commonly prescribed medications for migraine fall into established drug classes, but there are also newer, highly targeted therapies.

Sumatriptan (Imitrex, Onzetra, Tosymra)	This pharmaceutical triptan works by stimulating serotonin receptors in the brain, causing constricted blood vessels and blocking pain pathways, which helps to stop a migraine attack. It is the most prescribed triptan for acute migraine relief.
Ibuprofen (Advil, Motrin IB, Nurofen)	This pharmaceutical Non-steroidal Anti-inflammatory Drug (NSAID) reduces the inflammation and pain associated with migraines by inhibiting prostaglandin production. It is a common over-the-counter option for mild to moderate migraine attacks.
Rizatriptan (Maxalt)	This pharmaceutical triptan selectively activates serotonin receptors, leading to constriction of cranial blood vessels and inhibition of pain-signaling pathways. It is used for the acute treatment of migraine headaches with or without aura.
Zolmitriptan (Zomig)	This pharmaceutical triptan works by stimulating serotonin receptors, which constricts blood vessels around the brain and blocks pain signals. It is used for the acute treatment of migraine headaches and is available in oral and nasal spray forms.
Eletriptan (Relpax)	This pharmaceutical triptan activates serotonin receptors to constrict dilated blood vessels in the brain and block pain transmission. It is used for the acute treatment of migraine headaches with or without aura.
Naproxen (Aleve, Naprosyn)	This pharmaceutical NSAID reduces pain and inflammation by inhibiting prostaglandin synthesis, making it effective for mild to moderate migraine attacks or as an adjunct to other migraine treatments.
Topiramate (Topamax)	This pharmaceutical anticonvulsant, while initially developed for epilepsy, works to prevent migraines by stabilizing nerve activity in the brain. It is widely used as a daily preventive medication for chronic and episodic migraines.
Propranolol (Inderal)	This pharmaceutical beta-blocker is primarily used for migraine prevention by blocking the effects of adrenaline, which can help stabilize blood vessels and reduce the frequency of attacks.
Amitriptyline (Elavil, Endep)	This pharmaceutical tricyclic antidepressant is used at low doses to prevent migraines by modulating neurotransmitters like serotonin and norepinephrine in the brain, helping to reduce pain signals and improve sleep.
Aspirin (Acetylsalicylic Acid) (Bayer Aspirin)	This pharmaceutical NSAID, at appropriate doses, can alleviate mild to moderate migraine pain by reducing inflammation and blocking pain pathways. It is often combined with caffeine and acetaminophen for enhanced relief.
Magnesium	This natural mineral is thought to play a role in migraine prevention by stabilizing blood vessels, regulating neurotransmitters, and reducing cortical spreading depression. It is a commonly recommended supplement for migraine prophylaxis.
Caffeine (NoDoz, Vivarin)	This natural stimulant, when used judiciously, can help with acute migraine pain by constricting dilated blood vessels in the brain. It is often combined with other analgesics in over-the-counter migraine remedies.
Coenzyme Q10 (CoQ10)	This natural antioxidant and essential compound for cellular energy production is believed to improve mitochondrial function and reduce oxidative stress, which may contribute to migraine prevention. It is used as a supplement for prophylaxis.
Botulinum Toxin Type A (Botox)	This pharmaceutical neurotoxin works by blocking the release of pain-related neurotransmitters at nerve endings, thereby preventing chronic migraine headaches. It is administered via injections around the head and neck, specifically for chronic migraine (15 or more headache days per month).

MEDICATION
6. Central Nervous System Meds
Antimigraine Agents

Erenumab (Aimovig)	This pharmaceutical Calcitonin Gene-Related Peptide (CGRP) receptor antagonist is a monoclonal antibody that specifically blocks the CGRP receptor, preventing the activation of a key pathway involved in migraine attacks. It is an injectable preventive treatment.
Fremanezumab (Ajovy)	This pharmaceutical CGRP ligand antibody binds to the CGRP molecule itself, preventing it from attaching to its receptor and initiating a migraine attack. It is an injectable preventive treatment for episodic and chronic migraine.
Galcanezumab (Emgality)	This pharmaceutical CGRP ligand antibody also binds to CGRP, preventing it from binding to its receptor and thereby reducing migraine frequency. It is an injectable preventive treatment for migraine and episodic cluster headache.
Ginger (Fresh Ginger, Ginger Root)	This natural root has anti-inflammatory and analgesic properties that can help alleviate migraine pain and associated symptoms like nausea. It is often consumed as a tea or supplement.
Riboflavin (Vitamin B2)	This natural vitamin is involved in cellular energy production, and high doses are sometimes recommended to improve mitochondrial function and potentially reduce migraine frequency.
Rimegepant (Nurtec ODT)	This pharmaceutical calcitonin gene-related peptide (CGRP) receptor antagonist can be used for both acute treatment and preventive treatment of migraine. It works by blocking the CGRP receptor, preventing the pain signals associated with migraine.
Feverfew	This natural herb contains compounds called parthenolides, which are believed to have anti-inflammatory and vasoconstrictive properties that may help prevent migraines or reduce their severity.
Ubrogepant (Ubrelvy)	This pharmaceutical CGRP receptor antagonist is used for the acute treatment of migraine attacks. It blocks the CGRP receptor to alleviate migraine pain and associated symptoms without constricting blood vessels.
Butterbur	This natural herb contains compounds called petasins, which have anti-inflammatory and antispasmodic properties that may help reduce the frequency and severity of migraines.

14 Antidementia Agents

Antidementia Agents

Antidementia agents are medications primarily used to manage the cognitive and sometimes behavioral symptoms of dementia, most commonly Alzheimer's disease. These medications do not cure dementia or stop its progression, but they can temporarily slow the worsening of symptoms or improve quality of life for a period.

Donepezil (Aricept)	This pharmaceutical cholinesterase inhibitor increases levels of acetylcholine, a neurotransmitter important for memory and thinking, by preventing its breakdown in the brain. It is the most commonly prescribed medication for mild to moderate Alzheimer's disease.
Memantine (Namenda, Ebixa)	This pharmaceutical NMDA receptor antagonist works by blocking the activity of glutamate, a neurotransmitter that can be overactive and damage brain cells in Alzheimer's disease. It is used for moderate to severe Alzheimer's disease, often in combination with cholinesterase inhibitors.
Rivastigmine (Exelon)	This pharmaceutical cholinesterase inhibitor boosts acetylcholine levels in the brain by preventing its breakdown, helping to improve memory, thinking, and daily functioning. It is used for mild to moderate Alzheimer's disease and Parkinson's disease dementia, available in oral and transdermal patch forms.
Galantamine (Razadyne, Reminyl)	This pharmaceutical cholinesterase inhibitor increases acetylcholine in the brain and also modulates nicotinic acetylcholine receptors, enhancing nerve communication. It is prescribed for mild to moderate Alzheimer's disease.
Ginkgo Biloba	This natural herb is believed to improve blood flow to the brain and possess antioxidant properties, which may support cognitive function and memory. It is widely used as a dietary supplement for age-related cognitive decline.
Bacopa Monnieri	This natural herb, often called Brahmi, is traditionally used in Ayurvedic medicine as a nootropic, believed to enhance memory, learning, and cognitive processing. It contains compounds called bacosides that have antioxidant and neuroprotective effects.
Lion's Mane Mushroom	This natural mushroom is gaining popularity for its potential neuroprotective properties, believed to stimulate the production of nerve growth factor (NGF), which supports the health and regeneration of neurons. It is used as a supplement to support cognitive function.
Phosphatidylserine (PS)	This natural phospholipid is a crucial component of brain cell membranes and is believed to support neurotransmitter function, cell-to-cell communication, and overall cognitive health. It is used as a supplement to support memory and cognitive function, particularly with age.
Vitamin E	This natural antioxidant may help protect brain cells from damage caused by free radicals, which are implicated in neurodegenerative processes. It is sometimes used as a complementary therapy in dementia, although definitive evidence of its efficacy is still under investigation.
Huperzine A	This natural compound, derived from Chinese club moss, acts as an acetylcholinesterase inhibitor, similar to some pharmaceutical drugs, to increase acetylcholine levels in the brain. It is used as a supplement to support memory and cognitive function.

7 Respiratory Meds

MEDICATION
7. Respiratory Meds

Respiratory system medications are a class of drugs primarily used to manage conditions affecting the lungs and airways, facilitating easier breathing and reducing symptoms like shortness of breath, coughing, and wheezing. This category includes bronchodilators, which work by relaxing the muscles around the airways to open them up (e.g., short-acting and long-acting beta-agonists and anticholinergics), and anti-inflammatory agents like inhaled corticosteroids, which reduce swelling and inflammation in the airways to prevent symptom flare-ups. Additionally, other types of respiratory medications include mucolytics to thin mucus, expectorants to help expel it, decongestants for nasal congestion, and antihistamines for allergic respiratory symptoms.

For infections like bronchitis or pneumonia, antibiotics may also be prescribed. These medications are crucial for managing chronic conditions such as asthma and Chronic Obstructive Pulmonary Disease (COPD), as well as acute respiratory illnesses, often delivered directly to the lungs via inhalers or nebulizers to maximize local effect and minimize systemic side effects.

Subheadings

1. Bronchodilators	**2. Anti-inflammatory**	**3. Antihistamines**	**4. Decongestants**
5. Antitussives	**6. Expectorants**		

1 Bronchodilators

Bronchodilators are medications that relax the muscles around the airways, causing the airways to widen and making it easier to breathe. They are crucial for managing conditions like asthma and chronic obstructive pulmonary disease (COPD). They come in various forms, most commonly inhaled, and can be short-acting (for quick relief) or long-acting (for daily maintenance).

Salbutamol (Albuterol) (Ventolin HFA, ProAir HFA)	This pharmaceutical short-acting beta-2 agonist rapidly relaxes the smooth muscles around the airways, providing quick relief from sudden breathlessness, wheezing, and coughing during an asthma attack or COPD flare-up. It is a widely used "rescue inhaler."

Tiotropium (Spiriva)	This pharmaceutical long-acting anticholinergic bronchodilator blocks the action of acetylcholine, a chemical that can cause airways to constrict, leading to sustained widening of the airways. It is primarily used daily to prevent symptoms in COPD and sometimes asthma.
Formoterol (Foradil, Perforomist)	This pharmaceutical long-acting beta-2 agonist provides prolonged relaxation of airway muscles, helping to keep airways open for an extended period. It is used daily for maintenance treatment in asthma and COPD.
Ipratropium (Atrovent)	This pharmaceutical short-acting anticholinergic bronchodilator blocks acetylcholine in the airways, causing them to relax and widen. It provides quick relief from bronchospasm, particularly in COPD.
Caffeine (NoDoz, Vivarin)	This natural stimulant, a methylxanthine, can cause mild bronchodilation by inhibiting the enzyme phosphodiesterase, which leads to increased levels of cyclic AMP in airway smooth muscle cells. It is widely consumed and has a minor bronchodilatory effect.
Theophylline (Theo-Dur, Theo-24)	This pharmaceutical xanthine derivative relaxes the smooth muscles of the bronchi and also has anti-inflammatory properties, helping to improve airflow. While effective, its narrow therapeutic window and potential for side effects mean it is less commonly used than inhaled bronchodilators.
Epinephrine (Adrenaline) (EpiPen)	This pharmaceutical sympathomimetic agent is a powerful bronchodilator that rapidly relaxes airway smooth muscles by stimulating beta-2 adrenergic receptors. It is primarily used as an emergency treatment for severe allergic reactions (anaphylaxis) due to its quick and strong bronchodilatory and vasoconstrictive effects.
Ginger (Fresh Ginger, Ginger Root)	This natural root contains compounds that may have bronchodilatory and anti-inflammatory effects by modulating intracellular calcium in airway smooth muscle cells. It is often used traditionally to alleviate respiratory symptoms.
Eucalyptus Oil (often in rubs or steam inhalants)	This natural essential oil contains cineole, which has mucolytic and bronchodilatory properties, helping to clear mucus and relax airways. It is commonly used as a decongestant and to ease breathing.
Magnesium	This natural mineral can act as a bronchodilator by blocking calcium channels in airway smooth muscles, leading to relaxation. Intravenous magnesium sulfate is sometimes used in severe acute asthma exacerbations.
Licorice Root	This natural herb has traditionally been used for respiratory conditions, possessing anti-inflammatory and demulcent properties that may help soothe airways and reduce irritation, indirectly supporting bronchodilation.

2 Anti-inflammatory (Respiratory)

Bronchodilators address the airway narrowing, but for chronic respiratory conditions like asthma and COPD, inflammation is a key underlying problem. Respiratory anti-inflammatories are crucial for controlling this inflammation, preventing exacerbations, and improving long-term lung function.

Fluticasone (Flovent, Arnuity Ellipta)	This pharmaceutical inhaled corticosteroid directly reduces inflammation in the airways, making them less swollen and less sensitive to triggers. It is one of the most widely used inhaled corticosteroids for the long-term control of asthma and COPD.
Budesonide (Pulmicort, Rhinocort)	This pharmaceutical inhaled corticosteroid works by reducing inflammation and mucus production in the airways, helping to prevent asthma attacks and improve breathing in COPD. It is a very common daily maintenance treatment.
Montelukast (Singulair)	This pharmaceutical leukotriene receptor antagonist blocks the action of leukotrienes, chemicals that cause inflammation and narrowing of the airways. It is widely used to prevent asthma symptoms, exercise-induced bronchoconstriction, and to relieve symptoms of allergic rhinitis.
Mometasone (Asmanex, Nasonex	This pharmaceutical inhaled corticosteroid reduces inflammation in the airways, making them less reactive and preventing symptoms. It is used for the maintenance treatment of asthma and for nasal allergy symptoms.
Prednisone (Deltasone)	This pharmaceutical oral corticosteroid is a powerful anti-inflammatory that suppresses the immune system's inflammatory response throughout the body. It is used for short bursts to treat severe asthma exacerbations or COPD flare-ups.
Ciclesonide (Alvesco)	This pharmaceutical inhaled corticosteroid reduces inflammation in the lungs by its anti-inflammatory actions. It is used as a maintenance treatment for asthma.
Omalizumab (Xolair)	This pharmaceutical monoclonal antibody targets and blocks immunoglobulin E (IgE), a key component of the allergic inflammatory response. It is an injectable biologic used for severe allergic asthma and chronic hives that are not well controlled by other medications.
Dupilumab (Dupixent)	This pharmaceutical monoclonal antibody blocks the signaling of IL-4 and IL-13, two key cytokines involved in type 2 inflammation. It is an injectable biologic used for severe eosinophilic asthma, atopic dermatitis, and chronic rhinosinusitis with nasal polyps.
Curcumin (from Turmeric)	This natural compound is known for its potent anti-inflammatory and antioxidant properties, acting on multiple molecular targets to suppress inflammatory pathways. It is used as a supplement to support overall inflammatory balance, including respiratory health.
Ginger (Fresh Ginger, Ginger Root)	This natural root contains bioactive compounds like gingerols that possess anti-inflammatory properties, which can help reduce inflammation in the airways. It is often consumed as a traditional remedy for respiratory discomfort.
Quercetin	This natural flavonoid, found in many fruits and vegetables, has strong antioxidant and anti-inflammatory properties. It is believed to stabilize mast cells and inhibit inflammatory pathways, potentially benefiting respiratory conditions.
Vitamin D	This natural vitamin plays a crucial role in immune system modulation and has anti-inflammatory properties by affecting various immune cells and their signaling pathways. Adequate levels are associated with better respiratory health and reduced risk of exacerbations in asthma.
Omega-3 Fatty Acids (Fish Oil/Algae Oil)	These natural essential fatty acids, particularly EPA and DHA, have potent anti-inflammatory effects by modulating the production of inflammatory mediators and resolving inflammation. They are used as supplements to reduce systemic and potentially respiratory inflammation.

3 Antihistamines

Antihistamines are a class of medications that block the action of histamine, a chemical released by the immune system in response to allergens, injuries, or other triggers. Histamine plays a key role in allergic reactions, causing symptoms like itching, sneezing, watery eyes, and runny nose. Antihistamines are primarily used for allergies, but some also have properties that make them useful for insomnia, nausea, and motion sickness.

Antihistamines are generally divided into two main generations:
First-Generation Antihistamines: These are older, often sedating, and have a broader range of effects due to crossing the blood-brain barrier and affecting other receptors (e.g., anticholinergic).
Second-Generation Antihistamines: These are newer, generally less sedating, and more selective for peripheral H1 receptors, leading to fewer central nervous system side effects.
Third-Generation Antihistamines: A non-sedating antihistamine that is derived from second-generation antihistamines, designed to maintain potent antihistaminic effects while further minimizing central nervous system side effects like drowsiness.

Loratadine (Claritin)	This second-generation antihistamine works by selectively blocking histamine H1 receptors, which helps to alleviate common allergy symptoms like sneezing, runny nose, and itchy eyes without causing significant drowsiness. It is widely available over-the-counter.
Cetirizine (Zyrtec)	Another second-generation antihistamine, cetirizine effectively blocks histamine H1 receptors to relieve allergy symptoms such as itching, sneezing, and watery eyes. While generally considered non-drowsy, some individuals may experience mild sedation.
Hydroxyzine (Atarax, Vistaril)	This pharmaceutical first-generation antihistamine is a potent H1 receptor antagonist that produces significant sedative effects in addition to its antihistamine properties. It is commonly prescribed for itchiness, anxiety, and as a short-term sleep aid.
Fexofenadine (Allegra)	This third-generation antihistamine acts by blocking histamine H1 receptors, providing relief from hay fever and hives with a low incidence of drowsiness. It is known for its rapid onset of action and good tolerability profile.

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Loratadine (Claritin, Alavert)	This pharmaceutical second-generation antihistamine blocks histamine H1 receptors to alleviate allergy symptoms such as sneezing, watery eyes, and runny nose, with minimal drowsiness. It is a popular over-the-counter choice for allergy relief.
Diphenhydramine (Benadryl)	A first-generation antihistamine, diphenhydramine blocks histamine H1 receptors in the brain and body, effectively reducing allergy symptoms like itching and sneezing. It is well-known for causing significant drowsiness, which is also why it's used as a sleep aid.
Levocetirizine (Xyzal)	This is the active isomer of cetirizine, also a third-generation antihistamine that selectively blocks histamine H1 receptors. It provides potent relief from allergy symptoms and hives, often with less drowsiness than its parent compound.
Desloratadine (Clarinex)	As the active metabolite of loratadine, desloratadine also works by blocking peripheral histamine H1 receptors. It offers effective and long-lasting relief from allergic rhinitis and chronic idiopathic urticaria with minimal sedative effects.
Chlorpheniramine (Chlor-Trimeton, ChlorTabs)	This pharmaceutical first-generation antihistamine blocks histamine H1 receptors to reduce allergy symptoms, but it can cause drowsiness and other anticholinergic side effects. It is a common ingredient in many over-the-counter cold and allergy formulations.
Quercetin	This natural flavonoid, found in many fruits and vegetables, has antioxidant and anti-inflammatory properties and is believed to act as a natural antihistamine by inhibiting the release of histamine from mast cells. It is used as a supplement to help with allergy symptoms.
Stinging Nettle	This natural herb is traditionally used to alleviate allergy symptoms, with some research suggesting it may inhibit the production and release of histamine and other inflammatory chemicals. It is commonly consumed as a tea or supplement for hay fever.
Butterbur	This natural herb contains compounds called petasins, which are thought to have anti-inflammatory and antispasmodic effects and may also inhibit histamine release. It has been studied for its effectiveness in treating allergic rhinitis and migraines.
Bromelain	This natural enzyme mixture derived from pineapple has anti-inflammatory properties and may help reduce swelling and mucus associated with allergic reactions by breaking down inflammatory proteins. It is often used as a complementary supplement for sinus congestion and allergies.
Vitamin C	This natural antioxidant vitamin is believed to have antihistamine properties by helping to reduce histamine levels and stabilizing mast cells. It is widely supplemented for immune support and may indirectly help with allergy symptoms.

4 Decongestants

MEDICATION | 7. Respiratory Meds | Decongestants

Decongestants are a class of medications used to relieve nasal congestion (stuffiness) caused by colds, allergies, hay fever, or sinus infections. They work by narrowing the swollen blood vessels in the nasal passages, which reduces swelling and allows for easier breathing. They are available in oral and topical (nasal spray/drops) forms.

Pseudoephedrine (Sudafed)	This oral decongestant works by constricting blood vessels in the nasal passages and sinuses, which reduces swelling and allows for easier breathing. It is a sympathomimetic amine that acts on adrenergic receptors.
Oxymetazoline (Afrin)	This nasal spray is a topical decongestant that directly stimulates alpha-adrenergic receptors in the nasal lining, causing blood vessels to constrict and rapidly reducing swelling and congestion. It provides quick and long-lasting relief but should not be used for more than a few days to avoid rebound congestion.
Phenylephrine (Neo-Synephrine, Sudafed PE)	This pharmaceutical systemic decongestant works by constricting blood vessels in the nasal passages, helping to reduce swelling and congestion. Its oral effectiveness as a decongestant has been questioned in some studies, but it is widely available over-the-counter.
Fluticasone (Nasal) (Flonase, Avamys)	This pharmaceutical nasal corticosteroid reduces inflammation in the nasal passages, which in turn alleviates swelling and congestion, particularly effective for allergic rhinitis. While primarily an anti-inflammatory, its congestion-relieving effect is significant and makes it widely used.
Xylometazoline (Otrivine)	Similar to oxymetazoline, this nasal spray is a topical alpha-adrenergic agonist that causes vasoconstriction in the nasal passages. It quickly reduces swelling and congestion, offering effective relief, but also carries the risk of rebound congestion with prolonged use.
Budesonide (Nasal) (Rhinocort)	This pharmaceutical nasal corticosteroid works by reducing inflammation in the nasal lining, which helps to relieve nasal congestion, runny nose, and sneezing caused by allergies. It is used for daily management of allergic rhinitis.
Saline Nasal Spray/Rinse	These natural saline solutions help to moisturize nasal passages, thin mucus, and wash away irritants and allergens, providing gentle and safe relief from congestion. They are widely used and can be used frequently without side effects.
Steam Inhalation (Vicks VapoSteam)	This natural method involves inhaling warm, moist air, which helps to loosen and thin mucus in the nasal passages and airways, making it easier to clear congestion. It is a popular home remedy for colds and sinus issues.
Eucalyptus Oil	This natural essential oil contains cineole, which has mucolytic properties that help to thin and break up mucus, and can also act on receptors in the nasal lining to reduce the sensation of stuffiness. It is often used in rubs or for steam inhalation.
Menthol (from Peppermint Oil) (Vicks VapoRub)	This natural compound, found in peppermint oil, creates a cooling sensation that can make breathing feel easier by stimulating cold receptors in the nasal passages. It is commonly found in chest rubs and inhalers.
Capsaicin (from Chili Peppers)	This natural compound can irritate mucous membranes, leading to increased mucus flow and a temporary clearing of nasal passages. Consuming spicy foods or using capsaicin-containing nasal sprays can provide a decongestant effect.
Naphazoline	While often associated with eye redness relief, naphazoline is also used as a topical nasal decongestant. It works by causing vasoconstriction in the small blood vessels of the nasal mucosa, reducing swelling and congestion.
Ephedrine (Vicks VapoInhaler)	Though less common as a standalone oral decongestant today due to side effects, ephedrine directly and indirectly stimulates adrenergic receptors, causing vasoconstriction and bronchodilation. It's still found in some combination products and inhalers for temporary nasal congestion relief.
Propylhexedrine (Benzedrex)	This decongestant is used in nasal inhalers and works by constricting blood vessels in the nasal passages, similar to other sympathomimetics. It provides temporary relief from nasal stuffiness due to colds or allergies.
Levmetamfetamine (Vicks VapoInhaler)	This decongestant, found in some inhalers, acts as a sympathomimetic to constrict nasal blood vessels, reducing swelling and congestion. It provides temporary relief from nasal stuffiness.

5 Antitussives

MEDICATION | 7. Respiratory Meds | Antitussives

Antitussives are medications used to suppress or relieve coughs. They are generally used for dry, irritating, non-productive coughs that don't involve mucus, as suppressing a productive cough can hinder the body's natural clearing mechanism. Antitussives work by affecting the cough reflex, either centrally (in the brain) or peripherally (in the airways).

Dextromethorphan (Robitussin, Delsym)	This non-opioid cough suppressant works by acting on the cough center in the brain, thereby elevating the cough threshold and reducing the urge to cough. It is one of the most common active ingredients in over-the-counter cough medicines.
Honey (Manuka Honey)	A natural remedy, honey coats the throat, soothing irritation and reducing cough frequency, particularly in children. It's believed to have a demulcent effect that calms the cough reflex.
Codeine (Tylenol with Codeine)	This opioid analgesic acts on opioid receptors in the brain to suppress the cough reflex. While effective, its use has become more restricted due to concerns about addiction and respiratory depression.
Guaifenesin (Mucinex)	While primarily an expectorant that thins mucus, guaifenesin is often combined with antitussives in cough and cold formulations, sometimes making it seem like a direct cough suppressant. It helps to make coughs more productive by loosening phlegm, indirectly easing irritation.
Benzonatate (Tessalon Perles)	This pharmaceutical non-narcotic cough suppressant works by numbing the stretch receptors in the lungs and airways, reducing the cough reflex. It is a prescription-only medication for cough relief.

Hydrocodone (often with other agents) (Tussicaps, Hycodan)	This pharmaceutical opioid cough suppressant binds to opioid receptors in the brain, raising the cough threshold to provide relief from severe coughing. It is a potent prescription cough medicine.
Menthol (Vicks VapoRub, Halls cough drops)	This natural compound, often derived from peppermint oil, creates a cooling sensation in the throat and nasal passages, which can soothe irritation and temporarily relieve cough. It is commonly found in lozenges, rubs, and inhalants.
Levodropropizine (Levopront, Levotuss)	This non-opioid antitussive works by blocking certain nerve fibers (C-fibers) in the airways that transmit cough signals to the brain. It is used to suppress non-productive (dry) coughs.
Licorice Root	This natural herb has demulcent properties, meaning it can soothe irritated mucous membranes, and may also have mild anti-inflammatory effects that help to calm a cough. It is traditionally used for sore throats and coughs.
Slippery Elm	This natural herb forms a soothing gel when mixed with water, which can coat the throat and digestive tract to relieve irritation and inflammation, thereby helping to suppress a cough. It is used in lozenges and teas.
Marshmallow Root	This natural herb contains mucilage, which forms a protective, soothing layer over irritated mucous membranes in the throat, reducing the urge to cough. It is commonly used in cough syrups and teas.

6 Expectorants/Mucolytics

Expectorants and mucolytics are types of mucoactive agents that help clear mucus from the airways. Expectorants work by increasing the volume or hydration of respiratory secretions, making mucus thinner and easier to cough up. Mucolytics work by breaking down the chemical bonds within mucus, reducing its viscosity (thickness) and making it less sticky. These medications are primarily used for conditions that involve excessive or thick mucus production, such as colds, bronchitis, COPD, cystic fibrosis, and bronchiectasis.

Guaifenesin (Mucinex, Robitussin Chest Congestion)	This pharmaceutical expectorant works by thinning and loosening mucus in the airways, making coughs more productive and helping to clear phlegm from the lungs. It is the most common active ingredient in over-the-counter cough and chest congestion medicines.
Acetylcysteine (NAC) (Mucomyst, Fluimucil)	This pharmaceutical mucolytic breaks down the disulfide bonds in mucus proteins, making mucus thinner and less viscous, thereby easier to clear from the airways. It is used for various respiratory conditions with thick mucus, and also as an antidote for acetaminophen overdose.
Ambroxol (Mucosolvan, Ambrox)	This pharmaceutical mucolytic and expectorant works by thinning and loosening mucus, and also has anti-inflammatory and antioxidant properties that support respiratory health. It is widely used in many parts of the world for acute and chronic respiratory diseases.
Carbocysteine (Mucodyne, Rhinathiol)	This pharmaceutical mucolytic works by breaking down the chemical bonds within mucus, reducing its viscosity and making it easier to cough up. It is commonly used for respiratory conditions involving excessive or thick mucus.
Dornase Alfa (Pulmozyme)	This pharmaceutical mucolytic is a recombinant human deoxyribonuclease I (DNase I) enzyme that breaks down DNA in the thick, purulent secretions found in the lungs of cystic fibrosis patients, significantly reducing mucus viscosity. It is a highly specialized, prescription-only medication for cystic fibrosis.
Hypertonic Saline (Inhaled)	This pharmaceutical/natural solution, when inhaled as a nebulized mist, draws water into the airways through osmosis, thinning mucus and making it easier to clear through coughing. It is commonly used in cystic fibrosis and for bronchiolitis.
Steam Inhalation (Vicks VapoSteam)	This natural method involves inhaling warm, moist air, which helps to hydrate and loosen mucus in the respiratory tract, making it easier to cough up and clear. It is a common and accessible home remedy.
Eucalyptus Oil (often in rubs or steam inhalants)	This natural essential oil contains cineole, which has mucolytic properties that help to thin and break up mucus in the airways, making it easier to expectorate. It is often used for chest rubs or in diffusers.
Licorice Root (often as tea or lozenges)	This natural herb has demulcent properties, meaning it can soothe irritated mucous membranes, and may also have mild expectorant effects by stimulating mucus production. It is traditionally used to alleviate cough and respiratory discomfort.
N-Acetyl L-Cysteine (NAC)	This natural supplement is the precursor to glutathione, a powerful antioxidant, and also has mucolytic properties, helping to break down mucus. It is used to support respiratory health and reduce mucus viscosity.
Bromelain	This natural enzyme mixture derived from pineapple has mucolytic properties, helping to break down mucus and reduce its thickness. It is often used as a dietary supplement for respiratory congestion.

8 Gastrointestinal Meds

Gastrointestinal (GI) system medications are a diverse class of drugs specifically formulated to treat a wide range of conditions affecting the digestive tract, from the esophagus down to the anus, including associated organs like the liver and pancreas. These medications address common complaints such as heartburn, indigestion, nausea, vomiting, constipation, and diarrhea, as well as more complex diseases like ulcers, inflammatory bowel disease (IBD), and irritable bowel syndrome (IBS).

Their mechanisms of action vary widely, encompassing agents that neutralize stomach acid (antacids), reduce acid production (proton pump inhibitors, H2-receptor antagonists), promote or slow bowel movements (laxatives, antidiarrheals), prevent vomiting (antiemetics), reduce spasms (antispasmodics), or even target specific infections like Helicobacter pylori or inflammatory pathways in IBD. By alleviating symptoms, restoring normal digestive function, and treating underlying pathologies, GI medications significantly improve the quality of life for countless individuals worldwide.

Example Ailments

Heartburn	Irritable Bowel Syndrome	Diarrhea	Constipation	Indigestion	Digestive Cramping

Example Medications

Zofran	Imodium	Mylanta	Senna	Tums	

Subheadings

1. Antacids	2. Anti-ulcer Agents	3. Antiemetics	4. Antidiarrheals
5. Laxatives	6. Antispasmodics (GI)	7. Digestive Enzymes	

1 Antacids

Antacids are a class of medications that neutralize stomach acid to provide quick relief from heartburn, indigestion, and upset stomach. They are often available over-the-counter (OTC) and are frequently the first line of defense for occasional symptoms. While some antacids are single-ingredient, many are combination products.

Calcium Carbonate (Tums)	This antacid works by directly neutralizing stomach acid upon contact, converting it into water and carbon dioxide. It provides rapid relief for heartburn and indigestion.

MEDICATION — 8. Gastrointestinal Meds — Antacids

Magnesium Hydroxide (Milk of Magnesia)	This antacid neutralizes stomach acid and also acts as a laxative in higher doses. It is often combined with aluminum hydroxide to balance its potential to cause diarrhea.
Baking Soda	When dissolved in water, this natural substance, chemically sodium bicarbonate, quickly neutralizes excess stomach acid. It offers a readily available home remedy for occasional heartburn.
Aluminum Hydroxide	This antacid neutralizes stomach acid and can also help with diarrhea. It is often combined with magnesium hydroxide to counteract the constipating effect that aluminum can have.
Gaviscon	This antacid contains alginic acid, which forms a foam layer on top of stomach contents, creating a physical barrier to reflux. It also typically contains calcium carbonate or other acid-neutralizing salts.
Ginger (Fresh Root)	This natural root is believed to help with acid reflux by reducing irritation of the digestive tract and potentially reducing inflammation. It can be consumed as tea or added to meals.
Honey	A natural remedy, honey is believed to soothe the irritated esophageal lining due to its viscous consistency and potential anti-inflammatory properties. It can provide a coating effect that helps with heartburn symptoms.
Aloe Vera	This natural plant extract has calming and anti-inflammatory properties that may help soothe irritated tissues in the esophagus and stomach, potentially reducing heartburn symptoms. It is consumed as a juice or syrup.
Chamomile Tea	This natural herbal tea contains compounds with anti-inflammatory properties that may help calm digestive symptoms like upset stomach and heartburn. It is often consumed to reduce stress, which can be a trigger for acid reflux.
Licorice (Deglycyrrhizinated Licorice - DGL)	This natural herb, particularly the DGL form which avoids blood pressure side effects, is believed to help soothe the stomach lining and esophagus by promoting the production of protective mucus. It is used as a supplement for heartburn and indigestion.
Slippery Elm	This natural herb forms a gel-like substance when mixed with water, which can coat and soothe the lining of the esophagus and stomach, providing relief from irritation and heartburn. It is often taken as a powder or lozenge.
Apple Cider Vinegar	While acidic, some people use this natural remedy counterintuitively, believing it can help balance stomach acid levels and aid digestion, thereby reducing heartburn symptoms in some individuals.

2 Anti-ulcer Agents

MEDICATION — 8. Gastrointestinal Meds — Anti-ulcer Agents

Anti-ulcer agents are medications used to treat and prevent peptic ulcers, which are sores that develop on the lining of the stomach, lower esophagus, or small intestine (duodenum). The most common causes are infection with Helicobacter pylori (H. pylori) bacteria and long-term use of nonsteroidal anti-inflammatory drugs (NSAIDs). Treatment strategies focus on reducing stomach acid, protecting the mucosal lining, and eradicating H. pylori if present.

Omeprazole (Prilosec, Losec)	This pharmaceutical Proton Pump Inhibitor (PPI) potently reduces stomach acid production by irreversibly blocking the proton pump in stomach cells. It is one of the most widely prescribed drugs globally for healing and preventing ulcers, and treating GERD.
Pantoprazole (Protonix)	This pharmaceutical PPI also effectively reduces stomach acid secretion by inhibiting the proton pump. It is extensively used for treating and preventing ulcers, as well as managing conditions caused by excessive stomach acid.
Esomeprazole (Nexium)	This pharmaceutical PPI is the S-enantiomer of omeprazole and works by profoundly reducing stomach acid production. It is widely used for healing erosive esophagitis and treating peptic ulcers.
Lansoprazole (Prevacid)	This pharmaceutical PPI inhibits the proton pump in the stomach lining, significantly decreasing acid secretion. It is commonly prescribed for the treatment and maintenance of peptic ulcers and GERD.
Famotidine (Pepcid, Zantac 360)	This pharmaceutical H2-receptor antagonist reduces stomach acid production by blocking histamine receptors on stomach cells. It is a popular over-the-counter and prescription medication for heartburn, indigestion, and for treating ulcers.
Ranitidine (Zantac)	This pharmaceutical H2-receptor antagonist reduces stomach acid by blocking histamine receptors in the stomach. While historically one of the most used, it has been largely withdrawn from the market in many regions due to contamination concerns.
Bismuth Subsalicylate (Pepto-Bismol, Kaopectate)	This pharmaceutical and over-the-counter agent has both antacid properties and antimicrobial effects, helping to protect the ulcer lining and eradicate H. pylori. It also helps with diarrhea and upset stomach.
Sucralfate (Carafate)	This pharmaceutical medication works by forming a protective barrier over ulcer sites in the stomach and duodenum, shielding them from acid, pepsin, and bile, allowing them to heal. It does not reduce stomach acid itself.
Clarithromycin (Biaxin)	This pharmaceutical antibiotic is a key component of eradication regimens for Helicobacter pylori, the primary bacterial cause of peptic ulcers. It works by inhibiting bacterial protein synthesis.
Amoxicillin (Amoxil)	This pharmaceutical penicillin-class antibiotic is another crucial component in multi-drug regimens to eradicate Helicobacter pylori from the stomach. It works by inhibiting bacterial cell wall synthesis.
Metronidazole (Flagyl)	This pharmaceutical antibiotic and antiprotozoal agent is often included in combination therapies to eradicate Helicobacter pylori, especially in cases of clarithromycin resistance. It disrupts bacterial DNA synthesis.
Misoprostol (Cytotec)	This pharmaceutical synthetic prostaglandin E1 analogue helps prevent ulcers, particularly in patients taking NSAIDs, by reducing stomach acid secretion and increasing protective mucus and bicarbonate production. It is also used to induce labor or abortion.
Deglycyrrhizinated Licorice (DGL)	This natural form of licorice is processed to remove glycyrrhizin, which can cause side effects like high blood pressure, and is believed to promote the healing of ulcers by increasing protective mucus production in the stomach and intestine.
Mastic Gum	This natural resin from the mastic tree is thought to have antibacterial properties against Helicobacter pylori and may also protect the stomach lining, contributing to ulcer healing. It is used as a dietary supplement.
Aloe Vera	This natural plant extract has soothing, anti-inflammatory, and healing properties that may help to calm irritation and support the healing of the stomach lining. It is consumed as a juice or gel.
Curcumin (from Turmeric)	This natural compound is known for its strong anti-inflammatory and antioxidant properties, and some research suggests it may help protect the stomach lining and aid in ulcer healing, potentially also having anti-H. pylori effects.
Ginger (Fresh Ginger, Ginger Root)	This natural root is believed to have anti-inflammatory and anti-ulcer properties, potentially by protecting the stomach lining and inhibiting H. pylori growth. It is often consumed as a tea or added to food.

3 Antiemetics

MEDICATION — 8. Gastrointestinal Meds — Antiemetics

Antiemetics are a diverse group of medications used to prevent or treat nausea and vomiting. They work by targeting various neurotransmitter pathways in the brain (like dopamine, serotonin, histamine, acetylcholine, substance P) or in the gut that are involved in the sensation of nausea and the act of vomiting.

Ondansetron (Zofran)	This pharmaceutical serotonin 5-HT3 receptor antagonist blocks serotonin's action in the brain and gut, effectively preventing and treating severe nausea and vomiting, especially from chemotherapy, radiation, or surgery. It is a cornerstone antiemetic in clinical settings.
Metoclopramide (Reglan, Gimoti)	This pharmaceutical dopamine receptor antagonist and prokinetic agent blocks dopamine receptors in the brain, reducing nausea, and also speeds up stomach emptying. It is used for chemotherapy-induced nausea, diabetic gastroparesis, and post-surgical nausea.
Promethazine (Phenergan)	This pharmaceutical first-generation antihistamine has strong antiemetic, sedative, and anticholinergic properties, blocking histamine and dopamine receptors in the brain. It is used to prevent and treat various forms of nausea and vomiting, including motion sickness.

Dimenhydrinate (Dramamine)	This pharmaceutical first-generation antihistamine primarily works by blocking histamine H1 receptors in the brain, particularly those in the vomiting center, making it effective for preventing and treating motion sickness. It also causes drowsiness.
Ginger (Fresh ginger root)	This natural root contains compounds that have anti-inflammatory and anti-spasmodic effects on the gastrointestinal tract, helping to calm stomach upset and reduce nausea. It is widely used for morning sickness, motion sickness, and post-surgical nausea.
Meclizine (Antivert, Bonine, Dramamine Less Drowsy)	This pharmaceutical first-generation antihistamine blocks histamine H1 receptors, particularly in the inner ear and brain, to prevent and treat dizziness, vertigo, and nausea associated with motion sickness. It is less sedating than some other first-generation antihistamines.
Dexamethasone (Decadron)	This pharmaceutical corticosteroid is used as an antiemetic, particularly in chemotherapy-induced nausea and vomiting (CINV) and postoperative nausea and vomiting (PONV), though its exact mechanism for this effect is not fully understood. It is believed to have anti-inflammatory effects and may influence neurotransmitters involved in emesis.
Prochlorperazine (Compazine, Compro)	This pharmaceutical phenothiazine antipsychotic primarily blocks dopamine receptors in the brain's chemoreceptor trigger zone, making it effective for severe nausea and vomiting. It can also be used for certain psychiatric conditions.
Peppermint Tea	This natural herb has a calming effect on the stomach muscles and may reduce nausea through its aromatic compounds. Peppermint aromatherapy or tea can be used for various forms of nausea.
Lemon/Lemon Essential Oil	The aroma of lemon, particularly through essential oil inhalation, is believed to help alleviate nausea, especially in pregnant women, possibly due to its fresh and uplifting scent.

4 Antidiarrheals

Antidiarrheals are medications that help to stop or reduce the frequency and severity of loose, watery stools. They work through various mechanisms, such as slowing down intestinal movement, absorbing excess water, or targeting the underlying cause of the diarrhea (like a bacterial infection).

Loperamide (Imodium)	This synthetic opioid derivative works by slowing down the movement of the intestines, allowing more water to be absorbed from the stool and making it firmer. It acts on opioid receptors in the gut, reducing the frequency and urgency of bowel movements.
Bismuth Subsalicylate (Pepto-Bismol)	This medication has anti-inflammatory, antibacterial, and antacid properties. It works by protecting the stomach and intestinal lining, absorbing toxins, and reducing inflammation to help resolve diarrhea and upset stomach symptoms.
Oral Rehydration Solutions (ORS) (Gastrolyte, Hydralyte)	These pharmaceutical/natural electrolyte and glucose solutions help to replace fluids and salts lost due to diarrhea, preventing dehydration. They are crucial for managing diarrhea, especially in children, and are widely used globally.
Psyllium Husk (Metamucil, Fybogel)	This natural soluble fiber absorbs water in the gut, forming a bulky gel that can help solidify loose stools, making it effective for both diarrhea and constipation. It is a widely used dietary supplement.
Diphenoxylate/Atropine (Lomotil)	This combination medication works by slowing down intestinal motility through the opioid action of diphenoxylate, while a small amount of atropine is added to discourage abuse by causing unpleasant side effects if taken in high doses. It's used for acute and chronic diarrhea.
Kaopectate (Kaolin and Pectin)	This older pharmaceutical/natural combination of adsorbent agents works by absorbing toxins and excess water in the gut, helping to solidify stools. While the formulation has changed, the concept of adsorbent products remains in use.
Honey (Various brands, e.g., Manuka Honey)	A natural remedy, honey is believed to have antibacterial properties and can help soothe the digestive tract, potentially reducing inflammation and severity of diarrhea. Its demulcent effect can also help reduce irritation.
Probiotics (Culturelle, Align, Florastor)	These are beneficial live microorganisms (good bacteria or yeasts) that can help restore a healthy balance of gut flora, which can be disrupted by diarrhea. They may shorten the duration of diarrhea, especially after antibiotic use.
Zinc Supplements (Zinc Sulfate, Zinc Gluconate)	Zinc is an essential micronutrient that plays a crucial role in immune function and gut health. Zinc supplementation has been shown to reduce the duration and severity of diarrhea, particularly in children in developing countries.
Racecadotril (Hidrasec)	This medication reduces the secretion of water and electrolytes into the intestine without affecting intestinal motility. It works by inhibiting enkephalinase, an enzyme that breaks down natural opioids in the gut, thereby reducing excessive fluid loss in diarrhea.
Diosmectite (Smecta)	This natural clay acts as an intestinal adsorbent, meaning it binds to toxins, bacteria, and viruses in the gut, and helps to strengthen the intestinal mucus barrier. It helps reduce fluid loss and improve stool consistency.
Berberine	This natural compound found in several plants is believed to have antimicrobial properties against various gut pathogens and can help reduce intestinal fluid secretion, making it useful for certain types of diarrhea.
Ginger (Fresh Ginger, Ginger Root)	This natural root is traditionally used to calm the digestive system and may help reduce symptoms of diarrhea due to its anti-inflammatory and antispasmodic properties. It can be consumed as tea or in food.
Charcoal (Activated) (CharcoCaps)	This natural adsorbent works by binding to toxins and chemicals in the digestive tract, preventing their absorption and helping to solidify stools. It is used for acute poisoning and sometimes for diarrhea and gas.

5 Laxatives

Laxatives are a diverse group of medications used to treat constipation, a common condition characterized by infrequent bowel movements or difficulty passing stools. They work through various mechanisms to facilitate bowel movements.

Polyethylene Glycol (PEG) (MiraLAX, Movicol)	This osmotic laxative works by drawing water into the intestines, which softens the stool and increases its bulk, making it easier to pass. It is highly effective and generally well-tolerated for chronic constipation.
Senna (Senokot, Ex-Lax)	This natural stimulant laxative contains compounds called sennosides that irritate the bowel lining, causing the intestinal muscles to contract and push stool through. It's often used for short-term relief of constipation.
Bisacodyl (Dulcolax)	This stimulant laxative directly stimulates the nerves in the intestinal wall, increasing muscle contractions that help move stool through the colon. It is available in oral and suppository forms for various constipation needs.
Psyllium Husk (Metamucil)	This natural bulk-forming laxative is a soluble fiber that absorbs water in the gut, forming a gel-like substance that adds bulk to the stool. This makes the stool softer and easier to pass, promoting regular bowel movements.
Bisacodyl (Dulcolax, Correctol)	This pharmaceutical stimulant laxative directly irritates the lining of the intestines, causing the muscles to contract and push stool through the bowel. It is a popular over-the-counter choice for quick relief of occasional constipation.
Docusate Sodium (Colace)	This stool softener works by allowing water and fats to penetrate the stool, making it softer and easier to pass without stimulating bowel movements. It is often used to prevent straining, especially after surgery or childbirth.
Magnesium Hydroxide (Milk of Magnesia)	This osmotic laxative draws water into the intestines, softening the stool and promoting bowel movements. It also acts as an antacid in lower doses and provides relatively quick relief for occasional constipation.
Lactulose (Enulose, Kristalose)	This synthetic sugar is an osmotic laxative that is not absorbed by the body. Instead, it is broken down by bacteria in the colon, drawing water into the intestines to soften stools and stimulate bowel movements.
Sorbitol	This natural sugar alcohol acts as an osmotic laxative, drawing water into the colon to soften stool and promote bowel movements. It is often found in some foods, sugar-free candies, and as a pharmaceutical preparation.
Glycerin Suppositories	This pharmaceutical/natural emollient laxative draws water into the rectum to stimulate a bowel movement. It works by irritating the rectal lining and providing lubrication, leading to rapid evacuation of stool.
Castor Oil	This natural stimulant laxative works by breaking down in the small intestine to release ricinoleic acid, which stimulates intestinal contractions. It is a potent laxative typically used for bowel preparation or severe constipation due to its strong effects.

Linaclotide (Linzess, Constella)	This pharmaceutical guanylate cyclase-C agonist increases intestinal fluid secretion and accelerates transit, primarily used for chronic idiopathic constipation (CIC) and irritable bowel syndrome with constipation (IBS-C). It is a prescription medication.
Mineral Oil	This natural lubricant laxative coats the stool and the intestinal lining, making stools softer and easier to pass. It is typically used for short-term relief of constipation due to potential absorption issues with long-term use.
Prunes (Dried Plums)	A popular natural remedy, prunes contain both fiber and sorbitol, a sugar alcohol that has a mild laxative effect by drawing water into the bowel. They are effective for promoting regularity.

6 Antispasmodics (GI)

Gastrointestinal (GI) antispasmodics are medications specifically designed to relieve muscle spasms and cramping in the digestive tract. These spasms can cause significant pain and discomfort, often associated with conditions like Irritable Bowel Syndrome (IBS), functional dyspepsia, or other abdominal discomforts.

Dicyclomine (Bentyl)	This pharmaceutical anticholinergic medication relaxes the smooth muscles in the stomach and intestines by blocking acetylcholine receptors, reducing painful spasms and cramps. It is a widely prescribed medication for symptoms of Irritable Bowel Syndrome.
Hyoscyamine (Levsin)	This pharmaceutical anticholinergic agent works by blocking the action of acetylcholine, leading to relaxation of the smooth muscles in the gastrointestinal tract and reducing spasms, pain, and cramping. It is commonly used for various functional bowel disorders.
Hyoscine Butylbromide (Buscopan)	This pharmaceutical anticholinergic medication directly relaxes the smooth muscles of the digestive and urinary tracts, providing relief from stomach cramps, bowel cramps, and discomfort. It is widely available over-the-counter or by prescription in many countries for acute GI spasms.
Mebeverine (Colofac)	This pharmaceutical direct smooth muscle relaxant acts on the muscles of the gut to relieve spasms without affecting normal gut motility. It is widely used in many regions, particularly Europe, for the symptomatic treatment of Irritable Bowel Syndrome.
Peppermint Oil (Colpermin, IBgard)	This natural essential oil directly relaxes the smooth muscles of the gastrointestinal tract, which helps to alleviate abdominal pain, bloating, and gas associated with Irritable Bowel Syndrome. It is a well-established natural remedy, often taken in enteric-coated capsules.
Drotaverine (No-Spa)	This pharmaceutical selective phosphodiesterase-4 inhibitor directly relaxes the smooth muscles in the gastrointestinal, urinary, and biliary tracts. It is a very common antispasmodic in Eastern Europe and parts of Asia for various types of visceral spasms.
Alverine Citrate (Spasmonal)	This pharmaceutical smooth muscle relaxant directly acts on the muscles of the bowel to relieve painful spasms and bloating. It is used for the symptomatic treatment of Irritable Bowel Syndrome and diverticular disease in some regions.
Ginger (Fresh ginger root)	This natural root possesses antispasmodic and anti-inflammatory properties that can help to relax the muscles of the digestive tract and calm stomach upset. It is a popular natural remedy for general GI discomfort.
Chamomile (Often as tea)	This natural herb contains compounds that have mild antispasmodic and anti-inflammatory effects, helping to relax the smooth muscles of the digestive system and reduce cramping. It is often consumed as a calming tea for digestive upset.
Fennel (Often as seeds or tea)	This natural plant and its seeds contain compounds that can help relax the smooth muscles of the digestive tract, alleviating gas, bloating, and mild spasms. It is a common traditional remedy for digestive discomfort.

7 Digestive Enzymes

Digestive enzymes are proteins that help break down large food molecules into smaller ones that the body can absorb. They are naturally produced in the salivary glands, stomach, pancreas, and small intestine. When the body doesn't produce enough of these enzymes, it can lead to maldigestion and malabsorption, resulting in symptoms like bloating, gas, abdominal pain, and nutrient deficiencies.

Pancrelipase (Creon)	This pharmaceutical combination of lipase, amylase, and protease replaces the digestive enzymes normally produced by the pancreas. It is highly prescribed for individuals with exocrine pancreatic insufficiency, a condition where the pancreas does not produce enough enzymes to digest food.
Lactase (Lactaid)	This pharmaceutical/natural enzyme breaks down lactose, the sugar found in milk and dairy products, into simpler sugars that can be absorbed. It is widely used over-the-counter by individuals with lactose intolerance to prevent digestive discomfort.
Alpha-galactosidase (Beano)	This natural enzyme breaks down complex carbohydrates found in beans, vegetables, and grains into simpler sugars before they can cause gas and bloating. It is a popular over-the-counter supplement used to prevent digestive discomfort from certain foods.
Bromelain (Derived from pineapple)	This natural enzyme complex helps digest proteins and also possesses anti-inflammatory properties. It is commonly used as a dietary supplement to aid digestion and reduce inflammation.
Papain (Derived from papaya)	This natural enzyme effectively breaks down proteins into smaller peptides and amino acids. It is often included in digestive enzyme blends and is traditionally used to aid digestion.
Amylase (from fungal/plant sources)	This natural enzyme helps to break down carbohydrates and starches into simpler sugars for easier digestion. It is a common component in broad-spectrum digestive enzyme supplements.
Lipase (from fungal/plant sources)	This natural enzyme helps break down fats into fatty acids and glycerol, facilitating their absorption. It is frequently included in comprehensive digestive enzyme supplements to support fat digestion.
Protease (from fungal/plant sources)	This natural enzyme aids in breaking down proteins into amino acids, which are then absorbed by the body. It is a key component of many natural digestive enzyme blends.

9 Endocrine & Metabolic Meds

Endocrine and Metabolic medications are a vital class of drugs that target disorders of the endocrine system, a network of glands that produce and secrete hormones, and disruptions in the body's metabolic processes, which involve converting food into energy and managing waste. These medications are used to correct imbalances where glands produce too much or too little of a specific hormone, or when the body struggles to properly utilize nutrients.

Common examples include antidiabetics like insulin and metformin to manage blood sugar levels, thyroid hormones for an underactive thyroid, antithyroid agents for an overactive thyroid, corticosteroids to address adrenal gland imbalances or suppress inflammation, and bone resorption inhibitors for conditions like osteoporosis. By either replacing deficient hormones, blocking excessive hormone action, or directly influencing metabolic pathways, these medications help to restore homeostasis and ensure the proper functioning of crucial bodily systems, significantly impacting conditions ranging from diabetes and thyroid disorders to growth abnormalities and bone health.

Subheadings

1. Antidiabetics	**2. Thyroid Hormones**	**3. Antithyroid Agents**	**4. Corticosteroids**
5. Hormone Replacements	**6. Bone Resorption**	**7. Growth Hormones**	

1 Antidiabetics

Antidiabetic agents are medications used to manage diabetes mellitus, a chronic condition characterized by high blood glucose (sugar) levels. These drugs work through various mechanisms to lower blood glucose, increase insulin sensitivity, stimulate insulin production, or reduce glucose absorption. The choice of medication depends on the type of diabetes (Type 1 or Type 2), individual patient factors, and treatment goals.

Metformin (Glucophage)	This pharmaceutical medication reduces glucose production by the liver and improves the body's sensitivity to insulin, helping to lower blood sugar levels. It is typically the first-line and most widely prescribed oral medication for type 2 diabetes.
Insulin Glargine (Lantus)	This pharmaceutical long-acting insulin analog provides a steady, peakless insulin level over 24 hours, mimicking the body's basal insulin secretion. It is widely used to control blood sugar levels, especially overnight and between meals, for both type 1 and type 2 diabetes.
Semaglutide (Ozempic, Rybelsus, Wegovy)	This pharmaceutical GLP-1 receptor agonist enhances insulin release, decreases glucagon secretion, and slows gastric emptying, leading to improved blood sugar control and often significant weight loss. Its injectable form (Ozempic/Wegovy) and oral form (Rybelsus) have seen skyrocketing use in recent years.
Empagliflozin (Jardiance)	This pharmaceutical SGLT2 inhibitor works by blocking the reabsorption of glucose in the kidneys, causing more glucose to be excreted in the urine. It also provides significant cardiovascular and renal benefits, making it a highly used drug.
Dulaglutide (Trulicity)	This pharmaceutical GLP-1 receptor agonist is administered once weekly and helps to improve blood sugar control by increasing insulin release, reducing glucagon, and slowing gastric emptying. It is also approved for cardiovascular risk reduction in type 2 diabetes.
Sitagliptin (Januvia)	This pharmaceutical DPP-4 inhibitor increases the levels of incretin hormones, which stimulate the pancreas to produce more insulin when blood sugar is high and reduce the amount of glucose produced by the liver. It is a common oral medication for type 2 diabetes.
Dapagliflozin (Farxiga)	This pharmaceutical SGLT2 inhibitor works similarly to empagliflozin by increasing glucose excretion through the kidneys, leading to lower blood sugar levels. It also offers significant benefits for heart failure and kidney disease, broadening its use.
Liraglutide (Victoza, Saxenda)	This pharmaceutical GLP-1 receptor agonist mimics natural hormones that help regulate blood sugar, increase insulin release, and reduce appetite. It is an injectable medication used for type 2 diabetes and also approved for weight management.
Insulin Aspart (NovoRapid, Fiasp)	This pharmaceutical rapid-acting insulin analog starts working quickly after injection, helping to control blood sugar spikes that occur after meals. It is a common choice for mealtime insulin for both type 1 and type 2 diabetes.
Glimepiride (Amaryl)	This pharmaceutical sulfonylurea stimulates the pancreas to release more insulin, thereby lowering blood sugar levels. It is an older but still commonly used oral medication, particularly in combination therapies.
Pioglitazone (Actos)	This pharmaceutical thiazolidinedione improves insulin sensitivity in muscle and fat tissues, helping the body use insulin more effectively to lower blood glucose. It is used to treat type 2 diabetes, often in patients with insulin resistance.
Canagliflozin (Invokana)	This pharmaceutical SGLT2 inhibitor reduces blood sugar by causing the kidneys to remove more glucose from the body through urine. It also has demonstrated benefits for cardiovascular and kidney health in type 2 diabetes patients.
Gliclazide (Diamicron)	This pharmaceutical sulfonylurea stimulates the pancreas to produce more insulin, helping to lower blood sugar levels. It is a commonly prescribed oral antidiabetic, particularly outside of North America.
Berberine	This natural compound found in several plants is thought to help lower blood sugar by activating an enzyme called AMPK, similar to how metformin works, and by improving insulin sensitivity. It is a popular natural supplement for metabolic health.
Cinnamon	This natural spice is believed by some to improve insulin sensitivity and reduce blood sugar levels, although scientific evidence is mixed and more research is needed. It is often consumed as a dietary supplement.
Bitter Melon	This natural fruit is traditionally used for its purported blood sugar-lowering effects, possibly by acting like insulin or inhibiting enzymes that convert carbohydrates into glucose. It is consumed as food or a supplement in many cultures.

2 Thyroid Hormones

Thyroid hormones are essential for regulating metabolism, growth, and development in nearly every cell of the body. When the thyroid gland doesn't produce enough of these hormones (a condition called hypothyroidism), replacement therapy is necessary. The primary goal of treatment is to restore normal thyroid hormone levels, thereby alleviating symptoms of hypothyroidism.

Levothyroxine (Synthroid)	This pharmaceutical synthetic form of thyroxine (T4) is the most widely prescribed thyroid hormone, acting as a direct replacement for the naturally produced hormone to restore normal thyroid levels. The body converts T4 into the active T3 hormone as needed.
Liothyronine (Cytomel)	This pharmaceutical synthetic form of triiodothyronine (T3) is the active thyroid hormone, directly affecting metabolism and cellular function. It acts more quickly but has a shorter half-life than levothyroxine, and is often used in specific cases or in combination with levothyroxine.
Desiccated Thyroid Extract (DTE) (Armour Thyroid)	This natural thyroid hormone preparation derived from the dried thyroid glands of pigs contains both T4 and T3, as well as other thyroid hormones (T1, T2) and calcitonin, in a natural ratio. It is used as a replacement therapy for hypothyroidism, offering a combination of hormones.
Liotrix (Thyrolar)	This pharmaceutical combination of synthetic levothyroxine (T4) and liothyronine (T3) provides both thyroid hormones in a fixed ratio, typically 4:1 T4 to T3. It is used to replace missing thyroid hormones, aiming to mimic the body's natural production.

3 Antithyroid Agents

Antithyroid agents are medications used to treat hyperthyroidism, a condition where the thyroid gland produces too much thyroid hormone. The goal of these treatments is to reduce the production or effects of thyroid hormones to bring thyroid function back to a normal range.

Methimazole (Tapazole)	This pharmaceutical thionamide drug prevents the thyroid gland from producing excessive thyroid hormones by blocking the incorporation of iodine into thyroid hormone precursors. It is the most commonly used antithyroid drug globally for treating hyperthyroidism.
Propylthiouracil (PTU)	This pharmaceutical thionamide drug inhibits the production of thyroid hormones by blocking the iodination of tyrosine and the coupling of iodotyrosines. It also uniquely inhibits the peripheral conversion of T4 to the more active T3, and is often preferred in specific situations like thyroid storm or early pregnancy.
Radioactive Iodine (I-131) (Iodotope)	This pharmaceutical treatment involves administering a dose of radioactive iodine, which is selectively absorbed by the overactive thyroid cells, leading to their gradual destruction and reduction in hormone production. It is a common and effective definitive treatment for hyperthyroidism
Potassium Iodide (SSKI, Lugol's Solution) (ThyroSafe, Iosat)	This pharmaceutical/natural iodine compound temporarily inhibits the release of thyroid hormones from the gland and blocks the uptake of iodine by the thyroid. It is typically used for short periods, such as before thyroid surgery or in thyroid storm, due to its rapid but transient effect.
Propranolol (Inderal)	This pharmaceutical beta-blocker primarily helps manage the symptoms of hyperthyroidism, such as rapid heart rate, tremors, and anxiety, by blocking the effects of excess thyroid hormones on the body's cardiovascular system. It can also mildly inhibit the conversion of T4 to T3.
Bugleweed	This natural herb is believed to reduce thyroid hormone levels and is traditionally used to alleviate symptoms of hyperthyroidism, such as rapid heartbeat and anxiety. It may influence thyroid hormone synthesis or release.

Lemon Balm	This natural herb is thought to inhibit the binding of thyroid-stimulating hormone (TSH) to its receptors on the thyroid gland and may also reduce the peripheral conversion of T4 to T3. It is used as a traditional remedy to help manage symptoms of an overactive thyroid.
Lithium (Lithobid)	This pharmaceutical medication, primarily used for bipolar disorder, can inhibit the synthesis and release of thyroid hormones from the thyroid gland. It is occasionally used as an antithyroid agent in patients who cannot tolerate conventional thionamides.
Potassium Perchlorate (Rarely used in clinical practice)	This pharmaceutical agent inhibits the uptake of iodide by the thyroid gland, thus preventing the production of thyroid hormones. Its use is rare due to concerns about side effects, particularly aplastic anemia.

4 Corticosteroids (Systemic)

Systemic corticosteroids are powerful anti-inflammatory and immunosuppressive medications that mimic the effects of hormones produced by the adrenal glands (glucocorticoids). They are used to treat a wide range of conditions due to their potent effects on the immune system and inflammation.

Prednisone (Deltasone, Rayos)	This pharmaceutical synthetic corticosteroid is converted to prednisolone in the liver and is a highly effective anti-inflammatory and immunosuppressant, widely used for short-term and long-term treatment of various inflammatory and autoimmune conditions.
Prednisolone (Orapred, Prelone, Pediapred)	This pharmaceutical synthetic corticosteroid directly reduces inflammation and suppresses the immune system throughout the body. It is frequently prescribed for conditions like asthma, allergies, arthritis, and autoimmune diseases.
Methylprednisolone (Medrol, Solu-Medrol)	This pharmaceutical synthetic corticosteroid offers potent anti-inflammatory and immunosuppressive effects with less mineralocorticoid (salt-retaining) activity than some other corticosteroids. It is commonly used for severe allergic reactions, asthma exacerbations, and inflammatory conditions.
Dexamethasone (Decadron, DexPak)	This pharmaceutical synthetic corticosteroid is one of the most potent and long-acting corticosteroids, providing strong anti-inflammatory and immunosuppressive effects. It is used in a wide array of conditions, including severe allergies, certain cancers, and cerebral edema.
Hydrocortisone (Cortef, Solu-Cortef)	This pharmaceutical synthetic corticosteroid is chemically identical to the natural hormone cortisol and is used for hormone replacement therapy in adrenal insufficiency, as well as for its anti-inflammatory and immunosuppressive effects in various conditions.
Cortisol (natural hormone)	This natural glucocorticoid hormone is produced by the adrenal glands in response to stress and regulates numerous bodily processes, including metabolism, immune response, and inflammation. While not a "medication" in itself, synthetic hydrocortisone mimics its action.
Betamethasone (Celestone)	This pharmaceutical synthetic corticosteroid has strong anti-inflammatory and immunosuppressive properties. It is used for various conditions requiring systemic steroid therapy, including severe allergic disorders, skin conditions, and respiratory diseases.

5 Hormone Replacements

Hormone replacement therapies (HRT) are medications used to supplement or replace natural hormones that are deficient in the body. These deficiencies can arise due to various reasons, including natural aging processes (like menopause or andropause) or medical conditions (like hypothyroidism, hypogonadism, or surgical procedures. The method of action involves providing exogenous hormones that bind to specific receptors in target cells, mimicking the effects of the naturally produced hormones.

Levothyroxine (Synthroid)	This pharmaceutical synthetic form of thyroxine (T4) is the most widely prescribed hormone replacement globally, used daily to treat hypothyroidism by replacing the thyroid hormone that the body is not producing sufficiently.
Estradiol (Estrace, Vivelle-Dot)	This pharmaceutical synthetic or bioidentical form of estrogen is commonly used in hormone replacement therapy (HRT) for menopausal symptoms like hot flashes and vaginal dryness, and to prevent bone loss. It is available in various forms including oral tablets, patches, gels, and vaginal preparations.
Conjugated Estrogens (Premarin)	This pharmaceutical blend of estrogens, primarily estrone, is derived from natural sources (pregnant mare urine) and is widely used in HRT to manage menopausal symptoms and prevent osteoporosis. It was historically one of the most prescribed estrogens.
Progesterone (Micronized) (Prometrium)	This pharmaceutical bioidentical form of progesterone is often prescribed alongside estrogen in HRT for women with an intact uterus to protect against endometrial cancer. It is also used to treat irregular menstrual cycles.
Testosterone (AndroGel, Testim, Depo-Testosterone)	This pharmaceutical synthetic or bioidentical androgen is used as replacement therapy for men with low testosterone (hypogonadism) to improve symptoms such as low libido, fatigue, and muscle loss. It is available in gels, injections, and patches.
Desiccated Thyroid Extract (DTE) (Armour Thyroid, NP Thyroid)	This natural thyroid hormone preparation, derived from the dried thyroid glands of pigs, contains both T4 and T3 (and other thyroid compounds) in a natural ratio. It is used by some individuals as an alternative replacement therapy for hypothyroidism.
Somatropin (Growth Hormone) (Genotropin, Humatrope, Norditropin)	This pharmaceutical recombinant human growth hormone is used to treat growth hormone deficiency in children and adults, promoting growth and metabolism. It is administered via injection.
Black Cohosh (Remifemin)	This natural herb is a popular non-hormonal supplement used by women to alleviate menopausal symptoms, particularly hot flashes and night sweats, though its exact mechanism is not fully understood.
Soy Isoflavones	These natural plant compounds, found in soy products, are phytoestrogens that can mimic weak estrogen effects in the body, and are sometimes used to help manage menopausal symptoms like hot flashes.
DHEA (Dehydroepiandrosterone)	This natural steroid hormone, produced by the adrenal glands, is a precursor to other hormones like testosterone and estrogen. It is available as a supplement and is sometimes used for age-related decline or to improve well-being, though its efficacy as a general hormone replacement is debated.

6 Bone Resorption Inhibitors

Bone resorption inhibitors are a class of medications used to prevent bone loss and treat conditions like osteoporosis, Paget's disease of bone, and hypercalcemia of malignancy. They work by slowing down the activity of osteoclasts, the cells responsible for breaking down bone tissue.

Alendronate (Fosamax)	This pharmaceutical bisphosphonate is the most widely prescribed oral medication for osteoporosis, working by slowing down the bone-resorbing activity of osteoclasts, thereby preserving bone mass and reducing fracture risk. It is typically taken once a week.
Risedronate (Actonel)	This pharmaceutical bisphosphonate inhibits osteoclast activity, reducing bone turnover and increasing bone mineral density. It is commonly used for the treatment and prevention of osteoporosis and Paget's disease of bone, often taken weekly or monthly.
Zoledronic Acid (Reclast, Zometa)	This pharmaceutical bisphosphonate is a highly potent inhibitor of bone resorption, effectively suppressing osteoclast activity. It is administered as an annual intravenous infusion for osteoporosis treatment and also used in cancer to manage bone complications.

Denosumab (Prolia)	This pharmaceutical monoclonal antibody inhibits bone resorption by binding to RANKL, a protein essential for the formation, function, and survival of osteoclasts. It is administered as a subcutaneous injection every six months for osteoporosis.
Raloxifene (Evista)	This pharmaceutical Selective Estrogen Receptor Modulator (SERM) mimics estrogen's beneficial effects on bone density, reducing bone resorption and increasing bone mineral density, without stimulating breast or uterine tissue. It is used for the prevention and treatment of osteoporosis in postmenopausal women.
Calcium (Caltrate, Os-Cal)	This natural mineral is the primary building block of bones, and adequate intake is essential to prevent bone breakdown and support bone health. While not a direct inhibitor of bone resorption, sufficient calcium reduces the body's need to resorb bone to maintain blood calcium levels.
Vitamin D	This natural vitamin is crucial for the absorption of calcium from the gut and plays a key role in bone mineralization. Adequate Vitamin D levels are essential for effective bone resorption inhibition and overall bone health.
Calcitonin (Miacalcin)	This pharmaceutical hormone naturally produced by the thyroid gland directly inhibits osteoclast activity, thereby reducing bone resorption and decreasing blood calcium levels. It is used to treat postmenopausal osteoporosis, Paget's disease, and hypercalcemia.
Vitamin K2	This natural vitamin is important for activating osteocalcin, a protein that helps incorporate calcium into bone matrix, thus supporting bone mineralization and potentially reducing bone loss. It is found in certain fermented foods and supplements.
Strontium Ranelate (Protelos)	This pharmaceutical agent has a dual mechanism, both inhibiting bone resorption and promoting bone formation. It is used for severe osteoporosis, particularly in Europe, but its use is restricted due to cardiovascular concerns.

7 Growth Hormones

Growth hormones are peptide hormones that stimulate growth, cell reproduction, and cell regeneration in humans. The primary growth hormone used therapeutically is synthetic human growth hormone (HGH), known generically as somatropin. It is prescribed for various conditions where there is a deficiency of natural growth hormone or other conditions causing growth failure.

Somatropin (Norditropin, Genotropin, Humatrope)	This pharmaceutical recombinant human growth hormone is a synthetic form of the body's natural growth hormone (HGH). It is the most commonly prescribed growth hormone to treat growth hormone deficiency in children and adults, as well as certain other growth-related disorders.
Growth Hormone-Releasing Peptides/Amino Acids	These natural supplements aim to stimulate the body's own production and release of growth hormone. While individual results vary and efficacy is often debated, certain amino acids and blends are widely marketed to support natural HGH levels.
Melatonin	This natural hormone, primarily known for regulating sleep-wake cycles, can indirectly support growth hormone secretion, as much of the body's natural HGH is released during deep sleep. It is a very common sleep aid supplement.
Somatrogon (Ngenla)	This pharmaceutical long-acting recombinant human growth hormone is a newer option designed for once-weekly administration. It works similarly to somatropin to replace deficient growth hormone, offering convenience for patients.
Somapacitan-beco (Sogroya)	This pharmaceutical long-acting human growth hormone analog is another once-weekly injectable option. It aims to reduce injection frequency while effectively treating growth hormone deficiency in both adults and children.
Tesamorelin (Egrifta)	This pharmaceutical synthetic peptide is a growth hormone-releasing hormone (GHRH) analog that stimulates the pituitary gland to produce and release its own growth hormone. It is specifically approved to reduce excess abdominal fat in HIV patients with lipodystrophy.

10 Anti-Infective Agent Meds

Anti-infective agents are a critical class of medications designed to combat a wide range of harmful microorganisms that invade the human body and cause disease. This broad category encompasses several distinct types, each targeting specific classes of pathogens: antibiotics (or antibacterials) are used to kill or inhibit the growth of bacteria; antivirals specifically combat viral infections; antifungals treat fungal infections; and antiparasitics target parasitic infestations, including protozoa and worms. These drugs work through diverse mechanisms, such as disrupting microbial cell walls, inhibiting protein synthesis, interfering with DNA or RNA replication, or damaging cell membranes, all with the goal of eliminating the pathogen while minimizing harm to the host.

The development and effective use of anti-infective agents have revolutionized healthcare by allowing for the treatment and prevention of countless infectious diseases, though the growing challenge of antimicrobial resistance continues to drive the need for new discoveries and responsible prescribing practices globally.

Subheadings

1. Antibiotics	**2. Antivirals**	**3. Antifungals**	**4. Antiparasitics**
5. Antituberculosis			

1 Antibiotics/Antibacterials

Antibiotics, also known as antibacterials, are medications used to treat bacterial infections. They work by killing bacteria or inhibiting their growth, thereby allowing the body's immune system to clear the infection. Different classes of antibiotics target different essential bacterial processes. It's crucial to use antibiotics appropriately to prevent the development of antibiotic resistance.

Amoxicillin (Amoxil, Trimox)	This penicillin-class antibiotic works by inhibiting the synthesis of bacterial cell walls, leading to the destruction of the bacteria. It's very commonly prescribed for a wide range of bacterial infections, including ear infections, strep throat, and some respiratory tract infections.
Amoxicillin/Clavulanate Potassium (Augmentin)	This combination medication pairs amoxicillin with clavulanate potassium, which is a beta-lactamase inhibitor. Clavulanate protects amoxicillin from degradation by certain bacterial enzymes, extending the antibiotic's effectiveness against resistant strains.
Azithromycin (Zithromax, Z-Pak)	Belonging to the macrolide class, azithromycin works by inhibiting bacterial protein synthesis, thereby stopping bacterial growth. It's often used for respiratory tract infections, skin infections, and certain sexually transmitted infections, and is known for its convenient dosing schedule.
Cephalexin (Keflex)	This first-generation cephalosporin antibiotic works by interfering with the formation of bacterial cell walls, causing the bacteria to rupture and die. It's effective against a broad range of bacteria, particularly gram-positive strains, and commonly used for skin, bone, and urinary tract infections.
Doxycycline (Vibramycin, Doryx)	This tetracycline antibiotic inhibits bacterial protein synthesis, preventing bacteria from growing and multiplying. It's used for a wide variety of bacterial infections, including respiratory, urinary tract, skin infections, and even some sexually transmitted infections, as well as for malaria prevention.
Sulfamethoxazole/Trimethoprim (Bactrim, Septra)	This combination antibiotic works synergistically by interfering with bacterial folic acid synthesis, which is essential for bacterial DNA and protein production. It's effective against a broad spectrum of bacteria and commonly used for urinary tract infections, respiratory tract infections, and certain skin infections.

MEDICATION

10. Anti-Infective Agent Meds

Antibiotics/Antibacterials

Ciprofloxacin (Cipro)	This fluoroquinolone antibiotic works by inhibiting bacterial DNA gyrase and topoisomerase IV, enzymes crucial for bacterial DNA replication and repair. It is a broad-spectrum antibiotic used for various infections, including urinary tract infections, respiratory infections, and some severe hospital-acquired infections.
Metronidazole (Flagyl)	This antibiotic and antiprotozoal medication works by disrupting the DNA of bacteria and parasites, leading to their death. It is highly effective against anaerobic bacterial infections and certain parasitic infections, such as those causing giardiasis or trichomoniasis.
Garlic	A natural agent, garlic contains compounds like allicin which have demonstrated antibacterial properties, potentially disrupting bacterial cell membranes and inhibiting bacterial growth. It has been traditionally used for its medicinal benefits.
Honey	This natural substance possesses antibacterial properties due to its high sugar content, low pH, and the production of hydrogen peroxide. It can help inhibit bacterial growth and soothe infected areas, especially in wound care.
Clindamycin (Cleocin)	This lincosamide antibiotic inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit. It is primarily used for anaerobic infections and certain serious gram-positive bacterial infections, particularly in penicillin-allergic patients.
Ceftriaxone (Rocephin)	This third-generation cephalosporin antibiotic works by interfering with bacterial cell wall synthesis. It is a broad-spectrum injectable antibiotic often used for serious infections, including meningitis, sepsis, and complicated respiratory or urinary tract infections, due to its potent activity and long half-life.
Vancomycin (Vancocin)	This glycopeptide antibiotic inhibits bacterial cell wall synthesis by blocking peptidoglycan polymerization. It is a crucial antibiotic, primarily used to treat severe infections caused by Gram-positive bacteria, especially methicillin-resistant Staphylococcus aureus (MRSA), usually administered intravenously.
Ginger (Fresh Ginger, Ginger Root)	A natural remedy, ginger contains compounds like gingerols and shogaols that exhibit antimicrobial properties. It has been traditionally used to help fight various bacterial and viral infections and soothe digestive issues.

2 Antivirals

Antivirals

Antivirals are medications specifically designed to treat viral infections by interfering with different stages of the viral life cycle. Unlike antibiotics, which target bacteria, antivirals are virus-specific or target common viral processes. The development of antivirals is challenging because viruses replicate inside host cells, making it difficult to target the virus without harming the host cell.

Oseltamivir (Tamiflu)	This pharmaceutical antiviral works by inhibiting the neuraminidase enzyme on the surface of influenza viruses, preventing them from replicating and spreading in the body. It is widely used for the treatment and prevention of influenza (flu) A and B.
Acyclovir (Zovirax)	This pharmaceutical antiviral is a nucleoside analogue that mimics guanosine and works by interfering with viral DNA replication, effectively stopping the spread of herpesviruses. It is commonly used for infections caused by herpes simplex virus (HSV), varicella-zoster virus (VZV, causing chickenpox and shingles), and Epstein-Barr virus.
Valacyclovir (Valtrex)	A prodrug of acyclovir, valacyclovir is converted to acyclovir in the body and works by the same mechanism to inhibit viral DNA replication. It offers improved bioavailability and less frequent dosing compared to acyclovir, making it a popular choice for herpesvirus infections, including genital herpes and shingles.
Nirmatrelvir/Ritonavir (Paxlovid)	This pharmaceutical combination antiviral is used to treat mild to moderate COVID-19 in high-risk patients. Nirmatrelvir inhibits a key SARS-CoV-2 enzyme required for viral replication, while ritonavir "boosts" nirmatrelvir's levels by inhibiting its breakdown in the body.
Sofosbuvir/Ledipasvir (Harvoni)	This pharmaceutical combination is used to treat chronic hepatitis C virus (HCV) infection. Sofosbuvir inhibits the viral RNA polymerase, while ledipasvir inhibits the NS5A protein, both crucial for HCV replication.
Ginger (Fresh Ginger, Ginger Root)	A natural remedy, ginger contains compounds like gingerols and shogaols that exhibit antiviral and anti-inflammatory properties. It is often used to help alleviate symptoms associated with viral infections, such as colds and flu.
Elderberry (Sambucol)	This natural botanical extract is believed to have antiviral properties, particularly against influenza viruses, by preventing viral entry into cells and inhibiting viral replication. It is commonly used to reduce the duration and severity of cold and flu symptoms.
Garlic (Fresh Garlic, Garlic Supplements)	A natural agent, garlic contains compounds like allicin which have demonstrated antiviral properties by potentially interfering with viral replication and boosting immune responses. It has been traditionally used to help fight various infections.
Baloxavir Marboxil (Xofluza)	This pharmaceutical antiviral works by inhibiting the cap-dependent endonuclease activity of the influenza virus, an enzyme essential for viral gene transcription. It offers a single-dose treatment option for influenza.
Favipiravir (Avigan)	This pharmaceutical antiviral is a prodrug that, once metabolized, inhibits RNA-dependent RNA polymerase (RdRp), an enzyme vital for the replication of many RNA viruses, including influenza and some emerging viral infections. It has been used for influenza and investigated for COVID-19.
Ribavirin (Virazole)	This pharmaceutical antiviral is a nucleoside analog that interferes with viral RNA synthesis and replication. It is used in combination with other antivirals for chronic hepatitis C and for severe respiratory syncytial virus (RSV) infections.

3 Antifungals

Antifungals

Antifungal medications are used to treat fungal infections, which can range from superficial skin conditions (like athlete's foot) to serious systemic infections affecting internal organs. They work by targeting specific components or processes unique to fungal cells, such as their cell wall or cell membrane, thereby minimizing harm to human cells.

Fluconazole (Diflucan)	Fluconazole (Diflucan): This pharmaceutical antifungal works by inhibiting an enzyme crucial for fungal cell membrane synthesis, thereby disrupting the fungal cell and stopping its growth. It is widely used to treat various yeast and fungal infections, including vaginal yeast infections, oral thrush, and some systemic fungal infections.
Clotrimazole (Lotrimin, Canesten)	Clotrimazole (Lotrimin, Canesten): This pharmaceutical antifungal works by damaging the fungal cell membrane, leading to leakage of cellular contents and ultimately the death of the fungus. It is a very common topical treatment for skin infections like athlete's foot, jock itch, ringworm, and vaginal yeast infections.
Terbinafine (Lamisil)	This pharmaceutical antifungal interferes with an early step in fungal cell membrane synthesis, leading to the accumulation of toxic substances within the fungal cell and its death. It is highly effective for fungal nail infections (onychomycosis) and various skin fungal infections.
Miconazole (Monistat, Micatin)	This pharmaceutical antifungal works by altering the permeability of the fungal cell membrane, causing essential cellular components to leak out and the fungus to die. It is a common topical agent for skin and vaginal yeast infections.
Nystatin (Mycostatin, Nystop)	This pharmaceutical antifungal binds to sterols in the fungal cell membrane, creating holes that cause the cell to leak and die. It is primarily used to treat Candida (yeast) infections of the skin, mouth (thrush), and intestinal tract.
Tea Tree Oil	This natural essential oil contains compounds that have demonstrated antifungal properties, possibly by altering the permeability of fungal cell membranes. It is commonly used topically for minor fungal skin infections like athlete's foot.
Apple Cider Vinegar (Bragg's)	This natural remedy is believed to have antifungal properties due to its acetic acid content, which can create an acidic environment unfavorable for fungal growth. It is often used diluted for topical application on fungal skin infections.
Garlic	A natural agent, garlic contains allicin and other compounds that exhibit broad-spectrum antimicrobial activity, including antifungal effects, by potentially disrupting fungal cell processes. It is used both internally and topically.

4 Antiparasitics

Antiparasitic medications are a diverse group of drugs used to treat infections caused by parasites. These parasites include protozoa (single-celled organisms like those causing malaria or giardiasis), helminths (worms like tapeworms, roundworms, and flukes), and ectoparasites (external parasites like lice and scabies). The mechanisms of action vary widely depending on the type of parasite and the drug.

Metronidazole (Flagyl)	While also an antibiotic, metronidazole is a very widely used pharmaceutical antiparasitic that disrupts the DNA of certain protozoan parasites (like Giardia, Trichomonas, and Entamoeba histolytica), leading to their death. It's frequently prescribed for intestinal and other parasitic infections.
Ivermectin (Stromectol)	This pharmaceutical antiparasitic paralyzes and kills parasites by binding to chloride ion channels in nerve and muscle cells of the parasite. It is widely used to treat internal parasitic infections like strongyloidiasis and onchocerciasis, as well as external parasites like scabies and lice.
Albendazole (Albenza)	This pharmaceutical broad-spectrum anthelmintic works by inhibiting microtubule formation in intestinal worms, disrupting their glucose uptake and ultimately leading to their death. It is a key medication for treating various soil-transmitted helminth infections (roundworms, hookworms, whipworms) and some tapeworm infections.
Mebendazole (Vermox, Emverm)	Similar to albendazole, mebendazole is a pharmaceutical anthelmintic that selectively inhibits microtubule synthesis in intestinal worms, impairing their glucose absorption. It is very commonly used for pinworm, roundworm, whipworm, and hookworm infections.
Praziquantel (Biltricide)	This pharmaceutical anthelmintic works by increasing the permeability of the parasite's cell membrane to calcium ions, causing severe muscle contractions, paralysis, and detachment of the parasite from the host. It is the drug of choice for treating tapeworm and fluke infections.
Pyrantel Pamoate (Reese's Pinworm Medicine, Pin-X)	This pharmaceutical anthelmintic acts as a neuromuscular blocking agent, paralyzing intestinal worms so they lose their grip on the intestinal wall and are expelled from the body. It is primarily used for pinworm and roundworm infections.
Nitazoxanide (Alinia)	This pharmaceutical antiparasitic is believed to interfere with the energy metabolism of various protozoa and helminths, leading to their demise. It is effective against Giardia lamblia and Cryptosporidium parvum.
Artemisinin	Derived from the sweet wormwood plant, artemisinin and its derivatives are potent natural antimalarial agents. They work by generating free radicals that damage and kill the malaria parasite within red blood cells.
Berberine	This natural alkaloid, found in plants like goldenseal and barberry, exhibits broad-spectrum antimicrobial activity, including antiparasitic effects. It is thought to interfere with parasitic metabolism and attachment.
Wormwood (Artemisia absinthium)	This natural herb has traditionally been used for its anthelmintic properties, containing compounds that may paralyze or kill intestinal worms. It's often used in herbal formulations for parasitic cleanses.
Oil of Oregano	This natural essential oil contains carvacrol and thymol, compounds with potent antimicrobial properties, including activity against certain parasites. It is used in some natural health circles for parasitic infections.
Quinine	This pharmaceutical antimalarial works by interfering with the malaria parasite's ability to detoxify heme, leading to its accumulation and the parasite's death. It is often used for severe or resistant malaria, particularly where other drugs are not effective.
Praziquantel (Biltricide)	This pharmaceutical anthelmintic works by increasing the permeability of the parasite's cell membrane to calcium ions, causing severe muscle contractions, paralysis, and detachment of the parasite from the host. It is the drug of choice for treating tapeworm and fluke infections.
Chloroquine (Aralen)	This pharmaceutical antimalarial works by concentrating in the parasite's food vacuole and inhibiting the polymerization of heme, which is toxic to the parasite. While once a primary treatment, its use is now limited due to widespread drug resistance in many Plasmodium falciparum strains, but it remains effective for certain types of malaria and non-malarial conditions.
Permethrin (Elimite, Nix)	This antiparasitic is a synthetic pyrethroid that acts as a neurotoxin, disrupting the nervous system of parasites like mites (scabies) and lice, leading to their paralysis and death. It is a very common topical treatment.

5 Antituberculosis Agents

Antituberculosis (anti-TB) agents are specific antibiotics used to treat infections caused by Mycobacterium tuberculosis, the bacterium responsible for tuberculosis (TB). TB treatment typically involves a multi-drug regimen for an extended period (months to years) to effectively kill the slow-growing bacteria and prevent the development of drug resistance. Drugs are categorized as first-line (most effective and commonly used) and second-line (used for drug-resistant TB or when first-line drugs cannot be used).

Isoniazid (INH, Laniazid)	This pharmaceutical bactericidal drug is a cornerstone of TB treatment, working by inhibiting the synthesis of mycolic acids, which are essential components of the mycobacterial cell wall. It is used in combination therapy for active TB and as a standalone for latent TB infection.
Rifampicin (Rifampin) (Rifadin)	This pharmaceutical bactericidal antibiotic inhibits bacterial DNA-dependent RNA polymerase, preventing the bacteria from producing proteins essential for survival. It is a vital part of multi-drug regimens for active TB due to its strong sterilizing activity.
Pyrazinamide (Zinamide)	This pharmaceutical drug is bactericidal against Mycobacterium tuberculosis, particularly effective in the acidic environment within macrophages where the bacteria often reside. It is used in the intensive phase of TB treatment to shorten the overall duration of therapy.
Ethambutol (Myambutol)	This pharmaceutical bacteriostatic drug inhibits cell wall synthesis in Mycobacterium tuberculosis, helping to prevent the development of resistance to other antituberculosis drugs and acting as a critical component in multi-drug regimens.
Streptomycin (Generic)	This pharmaceutical aminoglycoside antibiotic inhibits bacterial protein synthesis, leading to cell death. While an older drug, it is still used as a second-line injectable agent for susceptible mycobacterial infections, particularly in drug-resistant TB.
Bedaquiline (Sirturo)	This pharmaceutical diarylquinoline inhibits mycobacterial ATP synthase, an enzyme essential for the bacteria's energy production. It is a newer drug primarily used in combination with other medicines for multi-drug resistant (MDR) and extensively drug-resistant (XDR) tuberculosis.
Garlic	This natural herb contains compounds like allicin which have demonstrated antibacterial properties against Mycobacterium tuberculosis in various studies. It is often considered a traditional remedy and a dietary supplement to support immune health.
Moxifloxacin (Avelox)	This pharmaceutical fluoroquinolone antibiotic inhibits bacterial DNA gyrase and topoisomerase IV, essential enzymes for DNA replication. It is a potent second-line drug used in regimens for drug-resistant tuberculosis.
Delamanid (Deltyba)	This pharmaceutical nitro-dihydro-imidazooxazole derivative inhibits mycolic acid synthesis, thereby preventing the growth of Mycobacterium tuberculosis. It is a newer medication specifically used for active multidrug-resistant tuberculosis.
Pretomanid (Dovprela)	This pharmaceutical nitroimidazole derivative inhibits cell wall synthesis in Mycobacterium tuberculosis through multiple mechanisms. It is typically used as part of a short, all-oral combination regimen with bedaquiline and linezolid for highly drug-resistant TB.
Turmeric (Curcumin)	This natural spice contains curcumin, which has antibacterial, anti-inflammatory, and antioxidant properties. Research suggests it may have the ability to combat Mycobacterium tuberculosis and support the immune system.
Green Tea	This natural beverage contains epigallocatechin gallate (EGCG), a potent catechin with strong antioxidant and antibacterial qualities, including demonstrated activity against Mycobacterium tuberculosis. Regular consumption may inversely correlate with developing active TB.

11 Immune System & Oncology

MEDICATION

11. Immune System & Oncology

Immune System and Oncology medications represent a rapidly evolving and complex class of drugs that uniquely interact with the body's own defense mechanisms, either to suppress an overactive immune response or to harness it to fight cancer. Immune system medications, such as immunosuppressants, are primarily used to dampen the immune system's activity, which is crucial in treating autoimmune diseases (where the body mistakenly attacks its own tissues, like rheumatoid arthritis or lupus) and preventing the rejection of transplanted organs. Conversely, oncology medications, particularly in the realm of immunotherapy, leverage or boost the immune system's ability to recognize and destroy cancer cells, often by removing "brakes" that cancer uses to hide from the immune system or by genetically engineering immune cells to target tumors more effectively.

Beyond immunotherapy, other oncology medications like chemotherapy directly kill rapidly dividing cells, targeted therapies block specific molecular pathways crucial for cancer growth, and hormone therapies interfere with hormone-dependent cancers. This dual focus on modulating immune responses for therapeutic benefit, whether by suppression or activation, underscores the sophisticated strategies employed to treat debilitating autoimmune conditions and a wide spectrum of cancers globally.

Subheadings

		1. Immunosuppressants	2. Immunostimulants	3. Chemo Agents	4. Biologics/Biotechnology		
		5. Vaccines					

1 Immunosuppressants

Immunosuppressants

Immunosuppressants are a class of drugs that suppress or reduce the strength of the body's immune system. They are crucial in two main scenarios: preventing organ rejection after transplantation and treating autoimmune diseases where the immune system mistakenly attacks the body's own tissues. The mechanisms of action vary widely, targeting different components or pathways of the immune response.

Prednisone (Deltasone)	This pharmaceutical oral corticosteroid is a powerful anti-inflammatory and immunosuppressant, widely used for a broad range of conditions from autoimmune diseases and severe allergies to organ transplant prevention of rejection due to its broad-acting immune suppression.
Methotrexate (Trexall, Otrexup)	This pharmaceutical antimetabolite drug inhibits cell proliferation and has significant anti-inflammatory and immunosuppressive effects. It is a cornerstone treatment for various autoimmune conditions like rheumatoid arthritis, psoriasis, and Crohn's disease, and also used in some cancers.
Cyclosporine (Neoral, Gengraf, Sandimmune)	This pharmaceutical calcineurin inhibitor specifically targets T-cells, crucial immune cells, to prevent organ rejection after transplantation by inhibiting their activation. It is also used in severe autoimmune conditions like psoriasis and rheumatoid arthritis.
Tacrolimus (Prograf, Envarsus XR)	This pharmaceutical calcineurin inhibitor is another potent immunosuppressant that works by inhibiting T-lymphocyte activation. It is widely used to prevent organ rejection in transplant recipients and for severe inflammatory skin conditions.
Mycophenolate Mofetil (CellCept)	This pharmaceutical antiproliferative agent inhibits the proliferation of T and B lymphocytes, thus suppressing the immune system. It is commonly used to prevent organ rejection after transplantation and in some autoimmune diseases like lupus.
Azathioprine (Imuran)	This pharmaceutical antimetabolite drug interferes with DNA synthesis, inhibiting the proliferation of rapidly dividing immune cells. It is used in organ transplantation and for a variety of autoimmune diseases such as rheumatoid arthritis, inflammatory bowel disease, and lupus.
Humira (Adalimumab)	This pharmaceutical TNF inhibitor is a biologic medication that targets and blocks Tumor Necrosis Factor-alpha (TNF-a), a protein that plays a key role in inflammatory processes. It is widely used to treat inflammatory conditions such as rheumatoid arthritis, Crohn's disease, and psoriasis.
Turmeric (Curcumin)	This natural spice contains curcumin, which exhibits potent anti-inflammatory and immunomodulatory properties by influencing various signaling pathways and suppressing pro-inflammatory cytokines. It is widely used as a supplement to help manage inflammatory conditions.
Ginger	This natural root contains bioactive compounds like gingerols that possess anti-inflammatory and immunomodulatory effects, helping to reduce inflammation and modulate immune responses. It is consumed as a food, tea, or supplement for various health benefits.
Reishi Mushroom	This natural fungus is known in traditional medicine for its immunomodulatory properties, containing compounds that can influence immune cell activity. While sometimes described as an immune booster, it can also have balancing effects that may be considered immunosuppressive in certain contexts, particularly by moderating immune responses.
Ashwagandha	This natural herb, commonly used in Ayurvedic medicine, is an adaptogen that can modulate the immune system, often balancing immune responses and reducing inflammation, which can be seen as an immunosuppressive effect in hyperactive immune states.
Sirolimus (Rapamune)	This pharmaceutical mTOR inhibitor prevents the proliferation of T-cells and smooth muscle cells, helping to prevent organ rejection after transplantation and used in some rare conditions like Lymphangioleiomyomatosis (LAM).
Everolimus (Zortress, Afinitor)	This pharmaceutical mTOR inhibitor also suppresses the immune system by inhibiting T-cell activation and proliferation, primarily used to prevent organ rejection and for certain types of cancer and non-cancerous tumors.
Anti-thymocyte Globulin (ATG) (Thymoglobulin, Atgam)	This pharmaceutical antibody preparation derived from horses or rabbits targets and depletes T-lymphocytes, leading to profound immunosuppression. It is primarily used for induction therapy in organ transplantation and to treat severe aplastic anemia.

2 Immunostimulants

Immunostimulants

Immunostimulants are substances that stimulate the immune system, either specifically (e.g., vaccines targeting a particular pathogen) or non-specifically (e.g., enhancing the activity of immune cells). They are used in various contexts, including treating immunodeficiencies, certain cancers, and chronic infections, and as adjuvants in vaccines.

Vaccines (Fluarix, Gardasil)	These pharmaceutical preparations contain weakened or inactivated pathogens, or parts of them, that stimulate the immune system to produce antibodies and memory cells without causing disease. They are the most widespread and effective specific immunostimulants for preventing infectious diseases.
Echinacea	This natural herb is a very popular supplement believed to stimulate the immune system, particularly by enhancing the activity of immune cells like macrophages and natural killer cells. It is commonly used to prevent or reduce the severity of common colds and flu.
Colony-Stimulating Factors (CSFs) (Neupogen, Neulasta)	These pharmaceutical glycoproteins stimulate the production and maturation of specific white blood cells (like neutrophils and macrophages) in the bone marrow. They are widely used to boost white blood cell counts in cancer patients undergoing chemotherapy or after bone marrow transplantation.
Interferons (Avonex, Rebif, Pegasys)	These pharmaceutical proteins, naturally produced by immune cells, have antiviral and immunomodulatory effects, activating immune responses against viral infections and certain cancers. They are used to treat conditions like multiple sclerosis, hepatitis C, and some leukemias.
Vitamin C	This natural vitamin is a powerful antioxidant that plays a crucial role in various immune functions, supporting the activity of immune cells and protecting them from damage. It is a widely used dietary supplement for general immune support.
Vitamin D	This natural vitamin is essential for immune system regulation, influencing the function of various immune cells. Adequate levels are linked to a healthier immune response and reduced susceptibility to infections.
Zinc	This natural mineral is vital for immune cell development and function, playing a role in immune signaling and antioxidant defense. It is commonly taken as a supplement to support immune health and may reduce the duration of common colds.

Beta-Glucans (From mushrooms like Reishi, Shiitake, or Oats)	These natural polysaccharides are potent immunomodulators that activate various immune cells, including macrophages and natural killer cells, enhancing the body's defense mechanisms. They are popular in immune support supplements.
Astragalus	This natural herb is traditionally used in Chinese medicine to enhance immune function by potentially increasing white blood cell production and activity. It is often used as an adaptogen and for general immune system support.
Imiquimod (Aldara)	This pharmaceutical topical immune response modifier activates immune cells through Toll-like Receptor 7 (TLR7), leading to the production of interferons and other cytokines. It is used to treat certain skin conditions, including external genital and perianal warts, and some superficial skin cancers.
Sipuleucel-T (Provenge)	This pharmaceutical autologous cellular immunotherapy is a type of cancer vaccine where a patient's own immune cells are collected, activated with a specific prostate cancer antigen, and then reinfused. It stimulates the patient's immune system to target and attack prostate cancer cells.

3 Antineoplastics (Chemotherapy Agents)

Antineoplastics are medications used to treat cancer. They work by targeting and disrupting the growth and division of cancer cells, often by interfering with DNA, RNA, or protein synthesis, or by directly inducing cell death. While highly effective, they often affect healthy rapidly dividing cells, leading to various side effects.

Keytruda (Pembrolizumab)	This pharmaceutical monoclonal antibody is an immune checkpoint inhibitor that blocks the PD-1 protein on immune cells, unleashing the immune system to recognize and attack cancer cells. It is a leading blockbuster drug approved for a wide range of cancers.
Revlimid (Lenalidomide)	This pharmaceutical immunomodulatory drug affects tumor cell proliferation, angiogenesis (new blood vessel formation), and the immune system. It is a top-selling drug primarily used for multiple myeloma, myelodysplastic syndromes, and mantle cell lymphoma.
Opdivo (Nivolumab)	This pharmaceutical monoclonal antibody is an immune checkpoint inhibitor that also targets the PD-1 protein, helping the body's immune system fight various types of cancer. It has transformed treatment for melanoma, lung cancer, and other advanced malignancies.
Imbruvica (Ibrutinib)	This pharmaceutical Bruton's tyrosine kinase (BTK) inhibitor blocks a protein essential for the survival and proliferation of certain cancer cells, particularly in blood cancers. It is a first-line treatment for chronic lymphocytic leukemia (CLL) and other lymphomas.
Darzalex (Daratumumab)	This pharmaceutical monoclonal antibody targets CD38, a protein found on the surface of multiple myeloma cells, leading to their destruction through various immune mechanisms. It is a highly effective treatment for multiple myeloma.
Ibrance (Palbociclib)	This pharmaceutical cyclin-dependent kinase (CDK) 4/6 inhibitor blocks enzymes that promote cancer cell division and growth. It is primarily used in combination with hormone therapy for hormone receptor-positive, HER2-negative breast cancer.
Taxanes (Paclitaxel - Taxol; Docetaxel - Taxotere)	These pharmaceutical chemotherapy agents work by interfering with the microtubule structures essential for cell division, causing cancer cells to stop dividing and eventually die. They are widely used in breast, ovarian, lung, and other cancers.
Platinum-based drugs (Cisplatin - Platinol; Carboplatin - Paraplatin)	These pharmaceutical chemotherapy agents create cross-links in cancer cell DNA, damaging it and preventing the cells from replicating, leading to their death. They are used in a broad spectrum of cancers, including testicular, ovarian, lung, and colorectal cancer.
Antimetabolites (Fluorouracil - 5-FU, Adrucil)	These pharmaceutical chemotherapy agents mimic essential building blocks of DNA and RNA, tricking cancer cells into incorporating them and disrupting their ability to divide and grow. They are used in various cancers, including colorectal, breast, and leukemia.
Vinca Alkaloids (Vincristine - Oncovin; Vinblastine - Velban)	These pharmaceutical chemotherapy agents interfere with microtubule formation, which is crucial for cell division, thereby preventing cancer cells from dividing and causing them to die. They are used in leukemias, lymphomas, and certain solid tumors.
Curcumin (from Turmeric)	This natural compound found in turmeric has demonstrated anti-inflammatory, antioxidant, and potential anticancer properties by modulating various cellular pathways involved in cancer growth, proliferation, and metastasis. It is widely researched as a complementary agent.
Green Tea Extract (EGCG)	This natural extract contains epigallocatechin-3-gallate (EGCG), a catechin with antioxidant and potential anti-tumor effects, influencing various cellular processes relevant to cancer development. It is widely consumed and supplemented for its health benefits.
Resveratrol	This natural compound found in grapes, red wine, and berries, is an antioxidant with anti-inflammatory properties and has shown preclinical evidence of inhibiting cancer cell growth and inducing apoptosis (programmed cell death). It is available as a dietary supplement.
Artemisinin	This natural compound derived from the sweet wormwood plant has shown promise in preclinical studies for its selective toxicity towards cancer cells, particularly when combined with iron, leading to oxidative stress and cell death. Research is ongoing for its potential in cancer treatment.

4 Biologics/Biotechnology Products

Biologics are a class of medications derived from living organisms or their components, such as proteins, sugars, nucleic acids, cells, or tissues. Unlike traditional "small molecule" drugs that are chemically synthesized, biologics are often much larger and more complex molecules. They typically target specific molecular pathways or immune cells, leading to highly targeted therapeutic effects. This specificity often results in fewer widespread side effects compared to traditional broad-acting drugs.

Humira (Adalimumab)	This pharmaceutical monoclonal antibody targets and blocks Tumor Necrosis Factor-alpha (TNF-a), a key inflammatory protein. It is the world's best-selling biologic, widely used for a broad spectrum of autoimmune diseases including rheumatoid arthritis, Crohn's disease, ulcerative colitis, and psoriasis.
Keytruda (Pembrolizumab)	This pharmaceutical monoclonal antibody is an immune checkpoint inhibitor that blocks the PD-1 protein on immune cells, unleashing the immune system to recognize and attack cancer cells. It has become a leading cancer therapy for numerous types of malignancies.
Enbrel (Etanercept)	This pharmaceutical fusion protein acts as a TNF-a inhibitor, binding to TNF-a to reduce inflammation. It is widely prescribed for autoimmune conditions such as rheumatoid arthritis, psoriatic arthritis, and ankylosing spondylitis.
Stelara (Ustekinumab)	This pharmaceutical monoclonal antibody targets interleukin-12 (IL-12) and interleukin-23 (IL-23), two cytokines involved in inflammatory and immune responses. It is used to treat plaque psoriasis, psoriatic arthritis, Crohn's disease, and ulcerative colitis.
Remicade (Infliximab)	This pharmaceutical chimeric monoclonal antibody also targets TNF-a, neutralizing its inflammatory effects. It is administered intravenously for conditions like Crohn's disease, ulcerative colitis, rheumatoid arthritis, and ankylosing spondylitis.
Dupixent (Dupilumab)	This pharmaceutical monoclonal antibody blocks the signaling of IL-4 and IL-13, two key cytokines involved in type 2 inflammation. It is used to treat atopic dermatitis (eczema), asthma, and chronic rhinosinusitis with nasal polyps.
Insulin (various brands, e.g., Lantus, Humalog, Novolog)	This pharmaceutical/natural protein hormone, produced naturally by the pancreas, regulates blood glucose levels. Pharmaceutical insulin, often produced via biotechnology, is essential for treating diabetes mellitus by allowing cells to absorb glucose for energy.
Rituxan (Rituximab)	This pharmaceutical monoclonal antibody targets the CD20 protein on the surface of B-cells, leading to their destruction. It is used in the treatment of certain lymphomas, leukemias, and autoimmune diseases like rheumatoid arthritis and granulomatosis with polyangiitis.

Curcumin (from Turmeric)	This natural compound is a polyphenol with potent anti-inflammatory and immunomodulatory properties, affecting various cellular signaling pathways. It is widely researched and used as a supplement to influence biological processes related to inflammation and immunity.
Reishi Mushroom (Ganoderma lucidum)	This natural fungus is known in traditional medicine for its immunomodulatory effects, containing bioactive compounds like polysaccharides and triterpenes that can influence various immune cell activities. It is consumed as a supplement for immune support.

5 Vaccines

Vaccines are biological preparations that provide active acquired immunity to a particular infectious disease. They work by introducing a weakened, inactivated, or partial form of a pathogen (or its genetic material) to the immune system. This allows the body to recognize the pathogen's antigens (substances that trigger an immune response) and develop antibodies and memory cells without causing the full-blown illness. If the vaccinated individual is later exposed to the actual pathogen, their immune system can quickly recognize and neutralize it, preventing or mitigating the disease.

Tuberculosis Vaccine (BCG)	This vaccine contains a live, weakened strain of Mycobacterium bovis and is primarily used to prevent severe forms of tuberculosis, especially in infants and young children in high-burden countries. It helps the immune system recognize and fight the bacterium.
Diphtheria, Tetanus, and Pertussis (DTaP/Tdap) Vaccine	This combination vaccine protects against three serious bacterial diseases. The diphtheria and tetanus components are toxoids (inactivated toxins) that train the immune system to neutralize the toxins, while the pertussis component (whooping cough) contains inactivated bacterial parts to prevent infection. It is a cornerstone of childhood immunization and adult boosters.
Polio Vaccine (IPV/OPV)	The inactivated polio vaccine (IPV) contains killed poliovirus to trigger an immune response without causing disease. The oral polio vaccine (OPV) uses weakened live poliovirus to induce immunity in the gut and is crucial for eradicating polio. Both protect against poliomyelitis, a debilitating and potentially fatal disease.
Hepatitis B (HepB) Vaccine	This vaccine contains a purified protein from the surface of the Hepatitis B virus, stimulating the immune system to produce antibodies that protect against infection. It is routinely given to infants to prevent chronic hepatitis B, which can lead to liver cancer and cirrhosis.
Measles, Mumps, and Rubella (MMR) Vaccine	This live-attenuated combination vaccine contains weakened forms of the measles, mumps, and rubella viruses. It stimulates a strong immune response, providing long-lasting protection against these highly contagious viral diseases.
Haemophilus influenzae type b (Hib) Vaccine	This conjugate vaccine contains a purified polysaccharide from the outer capsule of the Hib bacterium linked to a carrier protein. It helps the immune system of infants and young children recognize and fight off Hib, which can cause severe infections like meningitis and pneumonia.
Pneumococcal Conjugate Vaccine (PCV)	This vaccine contains polysaccharides from the outer capsules of several common Streptococcus pneumoniae strains, conjugated to a protein to enhance the immune response. It protects against various pneumococcal diseases, including pneumonia, meningitis, and ear infections, especially in children and older adults.
Rotavirus Vaccine (Rotarix, RotaTeq)	This live-attenuated oral vaccine contains weakened rotavirus strains that replicate in the gut, stimulating an immune response to protect against severe diarrhea and dehydration caused by rotavirus infection in infants.
Influenza (Flu) Vaccine (Fluzone, Afluria, Fluarix)	This vaccine is updated annually and typically contains inactivated or recombinant components of circulating influenza virus strains. It helps the immune system recognize and fight off the flu virus, reducing the risk of severe illness, hospitalization, and death.
Elderberry (Sambucol)	This natural botanical extract is believed to possess antiviral properties that may help to reduce the duration and severity of cold and flu symptoms. It is thought to support immune function.
Vitamin C	While not a vaccine, Vitamin C is a powerful antioxidant that plays a crucial role in immune system function, supporting various cellular functions of both the innate and adaptive immune system. It is commonly taken to boost overall immunity.
Zinc	This essential mineral is vital for immune cell development and function. Adequate zinc levels are important for maintaining a healthy immune response and may help reduce the duration of common colds.

Vaccination Schedules

These are a typical vaccine schedule for a first-world country.

Vaccination Schedule for Persons Birth to 15 Months

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos
Hepatitis B1 (HepB)	1st dose	2nd dose			3rd dose			
Rotavirus2 (RV) RV1 (2-dose series); RV5 (3-dose series)			1st dose	2nd dose	3rd dose			
Diphtheria, tetanus, & acellular pertussis3 (DTaP: <7 yrs)			1st dose	2nd dose	3rd dose			4th dose
Haemophilus influenzae type b4 (Hib)			1st dose	2nd dose	3rd dose		3rd or 4th dose	
Pneumococcal conjugate5 (PCV13)			1st dose	2nd dose	3rd dose		4th dose	
Inactivated poliovirus6 (IPV:<18 yrs)			1st dose	2nd dose	3rd dose			
Influenza7 (IIV)					Annual vaccination (IIV) 1 or 2 doses			
Measles, mumps, rubella8 (MMR)							1st dose	
Varicella9 (VAR)							1st dose	
Hepatitis A10 (HepA)							2 dose series	
Meningococcal11 MenACWY-D ≥9 mos; MenACWY-CRM ≥2 mos)								
Tetanus, diphtheria, & acellular pertussis13 (Tdap: ≥7 yrs)								
Human papillomavirus14 (HPV)								
Meningococcal B12								
Pneumococcal polysaccharide5 (PPSV23)								

Legend				
Meaning	Range of recommended ages for all children	Range of recommended ages for catch-up immunization	Range of recommended ages for certain high-risk groups	No Recommendation

Vaccination Schedule for Persons 18 Months to 18 Years

Vaccine	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Hepatitis B1 (HepB)	3rd dose								
Rotavirus2 (RV) RV1 (2-dose series); RV5 (3-dose series)									
Diphtheria, tetanus, & acellular pertussis3 (DTaP: <7 yrs)									
Haemophilus influenzae type b4 (Hib)									
Pneumococcal conjugate5 (PCV13)									
Inactivated poliovirus6 (IPV:<18 yrs)	3rd dose			4th dose					
Influenza7 (IIV)	Annual vaccination (IIV) 1 or 2 doses				Annual vaccination (IIV) 1 dose only				
Measles, mumps, rubella8 (MMR)				2nd dose					

Vaccine									
Varicella9 (VAR)				2nd dose					
Hepatitis A10 (HepA)	2 dose series								
Hepatitis A10 (HepA)									
Meningococcal11 MenACWY-D ≥9 mos; MenACWY-CRM ≥2 mos)						1st dose		2nd dose	
Tetanus, diphtheria, & acellular pertussis13						Tdap			
Human papillomavirus14 (HPV)									
Meningococcal B12									
Pneumococcal polysaccharide5 (PPSV23)									

Legend				
Meaning	Range of recommended ages for all children	Range of recommended ages for catch-up immunization	Range of recommended ages for certain high-risk groups	No Recommendation

Vaccination Schedule for Adults

Vaccine	19-21 years	22-26 years	27-49 years	50-64 years	≥65 years
Influenza	1 dose annually				
Tdap or Td	1 dose Tdap, then Td booster every 10 yrs				
MMR	1 or 2 doses depending on indication (if born in 1957 or later)				
VAR	2 doses				
RZV (preferred)				2 doses RZV (preferred)	
or ZVL					or 1 dose ZVL
HPV-Female	2 or 3 doses depending on age at series initiation				
HPV-Male	2 or 3 doses depending on age at series initiation				
PCV13	1 dose (includes yellow section)				
PPSV23	1 or 2 doses depending on indication				1 dose
HepA	2 or 3 doses depending on vaccine				
HepB	3 doses				
MenACWY	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains				
MenB	2 or 3 doses depending on vaccine				
Hib	1 or 3 doses depending on indication				

Legend			
Meaning	Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection	Recommended for adults with other indications	No recommendation

12 Musculoskeletal Meds

Musculoskeletal system medications are a diverse group of drugs primarily focused on treating conditions that affect the bones, muscles, joints, ligaments, and tendons, which collectively enable movement and support the body. These medications aim to alleviate symptoms like pain, inflammation, stiffness, and to manage underlying pathologies that can lead to impaired mobility and reduced quality of life.

Common examples include non-steroidal anti-inflammatory drugs (NSAIDs) for pain and inflammation in conditions like arthritis, muscle relaxants for spasms, disease-modifying antirheumatic drugs (DMARDs) and biologics to slow the progression of autoimmune joint diseases such as rheumatoid arthritis, and agents like bisphosphonates to strengthen bones and prevent fractures in osteoporosis. Some medications may also include topical pain relievers, corticosteroid injections directly into joints, or specific treatments for conditions like gout or fibromyalgia, all contributing to improving function and reducing discomfort for individuals worldwide.

Subheadings

1. Anti-inflammatory Drugs	2. Disease-Modifying Antirheumatic Drugs	3. Anti-gout Agents	4. Skeletal Muscle Relaxants

1 Anti-inflammatory Drugs (Non-steroidal)

To reduce inflammation (NSAIDs).

Ibuprofen (Advil, Motrin IB)	This pharmaceutical NSAID is widely used to reduce pain, inflammation, and fever in musculoskeletal conditions by inhibiting prostaglandin production. It is a common first-line treatment for muscle aches, sprains, strains, and various forms of arthritis.
Diclofenac (Voltaren, Cataflam)	This pharmaceutical NSAID is a potent anti-inflammatory that works by inhibiting prostaglandin synthesis, effectively reducing pain and swelling in joints and muscles. It's available in oral, topical (gel, patch), and injectable forms, making it highly versatile for musculoskeletal pain.
Naproxen (Aleve, Naprosyn)	This pharmaceutical NSAID reduces pain and inflammation in musculoskeletal conditions by inhibiting prostaglandin production. Its longer duration of action makes it a preferred choice for chronic conditions like osteoarthritis and back pain, allowing for less frequent dosing.
Celecoxib (Celebrex)	This pharmaceutical NSAID is a selective COX-2 inhibitor, specifically targeting the enzyme involved in inflammation and pain, while aiming to reduce gastrointestinal side effects. It's often prescribed for long-term management of chronic musculoskeletal conditions like osteoarthritis and rheumatoid arthritis.
Meloxicam (Mobic)	This pharmaceutical NSAID preferentially inhibits COX-2, leading to effective anti-inflammatory and pain-relieving effects with a potentially better gastrointestinal safety profile than non-selective NSAIDs. Its once-daily dosing makes it convenient for managing chronic musculoskeletal pain, such as from arthritis.
Curcumin (from Turmeric)	This natural compound found in turmeric possesses strong anti-inflammatory properties by modulating various inflammatory pathways. It is widely used as a supplement to help reduce pain and inflammation associated with joint and muscle conditions like arthritis.

MEDICATION | 12. Musculoskeletal Meds | Anti-inflammatory

Topical Ibuprofen (Nurofen Gel, Advil Gel)	This pharmaceutical NSAID applied directly to the skin provides localized pain and inflammation relief for musculoskeletal injuries like sprains, strains, and localized arthritis. It works by inhibiting prostaglandins at the site of application with potentially fewer systemic side effects than oral NSAIDs.
Ginger	A natural remedy, ginger contains bioactive compounds that exhibit anti-inflammatory effects by inhibiting prostaglandin and leukotriene synthesis. It is commonly used to alleviate musculoskeletal pain and reduce inflammation, particularly in conditions like osteoarthritis and muscle soreness.
Topical Ketoprofen (Ketopron, Fastum Gel)	This pharmaceutical NSAID, applied topically, reduces local pain and inflammation by inhibiting prostaglandin synthesis directly at the affected muscle or joint. It is often used for sprains, strains, and tendonitis.
White Willow Bark	This natural botanical contains salicin, which is converted in the body to salicylic acid, acting as a natural anti-inflammatory and analgesic. It has been traditionally used for musculoskeletal pain, particularly back pain and joint discomfort.

2 Disease-Modifying Antirheumatic Drugs

MEDICATION | 12. Musculoskeletal Meds | Disease-Modifying Antirheumatic Drugs (DMARDs)

Disease-Modifying Antirheumatic Drugs (DMARDs) are a class of medications that slow down the progression of rheumatic diseases, such as rheumatoid arthritis, by targeting specific immune pathways rather than just treating symptoms. They help to prevent joint damage and preserve function.

Methotrexate (Trexall)	This pharmaceutical conventional synthetic DMARD is the most commonly prescribed and often considered the first-line treatment for rheumatoid arthritis and psoriatic arthritis. It works by suppressing parts of the immune system and reducing inflammation.
Adalimumab (Humira)	This pharmaceutical biologic DMARD is a monoclonal antibody that blocks Tumor Necrosis Factor-alpha (TNF-a), a key inflammatory protein. It is widely used for rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis, and other autoimmune conditions.
Hydroxychloroquine (Plaquenil)	This pharmaceutical conventional synthetic DMARD is an antimalarial drug that also has immunomodulatory and anti-inflammatory effects. It is commonly used for milder rheumatoid arthritis and systemic lupus erythematosus.
Etanercept (Enbrel)	This pharmaceutical biologic DMARD is a fusion protein that also acts as a TNF-a inhibitor, reducing inflammation and preventing joint damage. It is widely prescribed for rheumatoid arthritis, psoriatic arthritis, and ankylosing spondylitis.
Infliximab (Remicade)	This pharmaceutical chimeric monoclonal antibody targets TNF-a, neutralizing its inflammatory effects. It is administered intravenously for conditions like rheumatoid arthritis, psoriatic arthritis, and ankylosing spondylitis, as well as inflammatory bowel diseases.
Sulfasalazine (Azulfidine)	This pharmaceutical conventional synthetic DMARD is an anti-inflammatory and immunomodulatory drug. It is used to treat rheumatoid arthritis, psoriatic arthritis, and inflammatory bowel diseases.
Leflunomide (Arava)	This pharmaceutical conventional synthetic DMARD works by inhibiting the development of certain immune cells, thereby suppressing the immune system and reducing inflammation. It is used to treat moderate to severe rheumatoid arthritis.
Rituximab (Rituxan)	This pharmaceutical biologic DMARD is a monoclonal antibody that targets the CD20 protein on the surface of B-cells, leading to their depletion. It is used for rheumatoid arthritis, especially when other DMARDs have been ineffective, and in certain lymphomas.
Tocilizumab (Actemra)	This pharmaceutical biologic DMARD is a monoclonal antibody that blocks the interleukin-6 (IL-6) receptor, reducing inflammation. It is used for rheumatoid arthritis, systemic juvenile idiopathic arthritis, and giant cell arteritis.
Abatacept (Orencia)	This pharmaceutical biologic DMARD works by selectively modulating a co-stimulatory signal required for T-cell activation, thereby dampening the immune response. It is used for rheumatoid arthritis and psoriatic arthritis.
Tofacitinib (Xeljanz)	This pharmaceutical targeted synthetic DMARD is a Janus kinase (JAK) inhibitor that blocks specific enzymes involved in immune signaling. It is an oral medication used for rheumatoid arthritis, psoriatic arthritis, and ulcerative colitis.
Baricitinib (Olumiant)	This pharmaceutical targeted synthetic DMARD is another JAK inhibitor that blocks immune signaling pathways, reducing inflammation. It is used for moderate to severe rheumatoid arthritis and severe atopic dermatitis.
Upadacitinib (Rinvoq)	This pharmaceutical targeted synthetic DMARD is also a JAK inhibitor, highly selective for JAK1, and is used for rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis, and atopic dermatitis.
Curcumin (from Turmeric)	This natural compound is known for its potent anti-inflammatory and immunomodulatory properties by influencing various cellular pathways involved in inflammation. It is widely used as a supplement to help manage arthritis symptoms.
Boswellia Serrata	This natural herb, also known as Indian frankincense, contains boswellic acids that have anti-inflammatory effects by inhibiting enzymes involved in inflammation. It is used as a natural supplement for arthritis and inflammatory conditions.
Ginger (Fresh ginger root)	This natural root contains compounds with anti-inflammatory properties that can help reduce pain and inflammation associated with various forms of arthritis. It is consumed as a food, tea, or supplement.

3 Anti-gout Agents

MEDICATION | 12. Musculoskeletal Meds | Anti-gout Agents

Anti-gout agents are medications and natural substances that target the mechanisms behind gout, a painful form of arthritis caused by the accumulation of uric acid crystals in the joints. They either reduce uric acid levels in the body or manage the inflammation during acute gout attacks.

Allopurinol (Zyloprim)	This pharmaceutical xanthine oxidase inhibitor reduces the production of uric acid in the body, which is crucial for preventing recurrent gout attacks and managing chronic gout. It is the most commonly prescribed long-term medication for gout.
Colchicine (Colcrys)	This pharmaceutical anti-inflammatory agent works by disrupting microtubule formation, which prevents the activation, degranulation, and migration of neutrophils, thereby reducing the inflammatory response to uric acid crystals during an acute gout attack. It is also used at lower doses for gout flare prophylaxis.
Nonsteroidal Anti-inflammatory Drugs (NSAIDs) (Ibuprofen;	These pharmaceutical medications reduce pain and inflammation by inhibiting enzymes involved in the production of inflammatory prostaglandins. They are frequently used to rapidly relieve pain and swelling during acute gout attacks.
Febuxostat (Uloric)	This pharmaceutical non-purine selective xanthine oxidase inhibitor also reduces uric acid production in the body, serving as an alternative to allopurinol for chronic gout management, particularly when allopurinol is not tolerated or effective.
Corticosteroids (Prednisone - Deltasone)	These pharmaceutical powerful anti-inflammatory and immunosuppressive agents quickly reduce the intense pain and inflammation of acute gout attacks. They can be taken orally or injected directly into the affected joint.
Tart Cherry Juice/Cherries	This natural fruit and its juice are rich in anthocyanins and other antioxidants, which are believed to lower serum urate levels and reduce inflammation, thereby potentially reducing the frequency and severity of gout attacks. It is a widely used traditional remedy.
Probenecid (Probalan)	This pharmaceutical uricosuric agent helps the kidneys remove more uric acid from the body by inhibiting its reabsorption in the renal tubules, leading to lower blood uric acid levels. It is used in patients who underexcrete uric acid.
Celery Seed	This natural supplement contains compounds like luteolin and 3-n-butylphthalide, which are believed to have anti-inflammatory and uric acid-lowering properties by inhibiting xanthine oxidase and reducing oxidative stress. It is a traditional remedy for gout.
Ginger (Fresh ginger root)	This natural root possesses anti-inflammatory properties that may help reduce the pain and swelling associated with gout flares. It is also thought to potentially inhibit xanthine oxidase and lower uric acid levels.
Curcumin (from Turmeric)	This natural compound is known for its potent anti-inflammatory and antioxidant effects. Research suggests it may help in gout by inhibiting xanthine oxidase, reducing uric acid production, and alleviating inflammation.
Lesinurad (Zurampic)	This pharmaceutical uricosuric agent selectively inhibits URAT1, a transporter responsible for reabsorbing uric acid in the kidneys, thus increasing its excretion. It was typically used in combination with a xanthine oxidase inhibitor for uncontrolled gout.

Pegloticase (Krystexxa)	This pharmaceutical recombinant uricase enzyme converts uric acid into allantoin, a more soluble and easily excreted substance, rapidly lowering uric acid levels. It is an intravenous medication reserved for severe, chronic refractory gout where other treatments have failed.

4 Skeletal Muscle Relaxants

To alleviate muscle pain and stiffness.

Cyclobenzaprine (Flexeril)	This pharmaceutical centrally acting muscle relaxant works primarily in the brainstem to reduce muscle spasms associated with acute, painful musculoskeletal conditions. It is one of the most commonly prescribed muscle relaxants for short-term use.
Tizanidine (Zanaflex)	This pharmaceutical centrally acting alpha-2 adrenergic agonist reduces muscle spasticity by inhibiting the release of excitatory amino acids in the spinal cord. It is effective for spasticity caused by neurological conditions like multiple sclerosis or spinal cord injury, as well as for acute muscle spasms.
Methocarbamol (Robaxin)	The exact mechanism of this pharmaceutical muscle relaxant is not fully understood, but it is believed to work by calming overactive nerves in the brain and spinal cord, which helps to relax muscles and alleviate pain and stiffness associated with muscle spasms. It's considered to have a relatively mild sedative effect.
Carisoprodol (Soma)	This pharmaceutical central nervous system depressant works by interrupting neuronal communication within the reticular formation and spinal cord, leading to sedation and alteration in pain perception, thereby providing muscle relaxation. Due to its potential for abuse and dependence, its use is more restricted in some regions.
Baclofen (Lioresal)	This pharmaceutical medication is a gamma-aminobutyric acid (GABA)-B receptor agonist that works at the spinal cord level to reduce severe muscle spasticity. It is thought to decrease the release of excitatory neurotransmitters and stimulate inhibitory signals, effectively relaxing muscles in conditions like multiple sclerosis and spinal cord injury.
Diazepam (Valium)	This pharmaceutical benzodiazepine enhances the effects of gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter, in the brain and spinal cord. By increasing GABA activity, it helps to calm the central nervous system, leading to muscle relaxation and reduced spasms, though it also has significant sedative effects.
Magnesium	This natural mineral plays a crucial role in muscle contraction and relaxation by influencing calcium levels and nerve impulse transmission. Magnesium deficiency can contribute to muscle cramps and spasms, and supplementation is commonly used to support muscle function.
Valerian Root	This natural herb contains compounds that are believed to enhance GABA activity in the brain, similar to benzodiazepines, leading to calming and muscle-relaxing effects. It is traditionally used to relieve anxiety, promote sleep, and reduce muscle tension.
Chamomile	This natural herb contains flavonoids and other compounds that have mild sedative and muscle-relaxing properties. It is often consumed as a tea to help calm the nervous system and ease muscle tension and spasms.

13 Urogenital Meds

Urogenital system medications are a specialized category of drugs used to treat a range of conditions affecting both the urinary tract (kidneys, bladder, ureters, urethra) and the reproductive organs. Given the anatomical proximity and shared pathways, especially in males, issues in one system can often impact the other. These medications address diverse problems such as urinary tract infections (UTIs) with antibiotics, overactive bladder and incontinence with anticholinergics or beta-3 agonists that relax bladder muscles, and benign prostatic hyperplasia (BPH) with alpha-blockers or 5-alpha-reductase inhibitors to improve urinary flow.

Additionally, this category includes medications for erectile dysfunction, hormonal therapies related to reproductive health (like contraception or fertility treatments), and agents to manage specific urological pains or kidney stone formation. By targeting various physiological processes in these intertwined systems, urogenital medications aim to restore normal function, alleviate discomfort, and improve the overall quality of life for individuals experiencing these specific health challenges.

Subheadings

1. Urinary Antispasmodics	**2. Prostatic Hyperplasia**	**3. Erectile Dysfunction**	**4. Contraceptives**
5. Urinary Tract Anti-infectives			

1 Urinary Antispasmodics

Urinary antispasmodics are medications and substances used to alleviate spasms of the bladder muscles, which can cause symptoms like urinary urgency, frequency, and incontinence associated with an overactive bladder (OAB) or other bladder irritations. They work by relaxing the bladder muscle, allowing it to hold more urine and reducing the sudden urge to urinate.

Oxybutynin (Ditropan, Ditropan XL)	This pharmaceutical anticholinergic medication works by blocking muscarinic receptors in the bladder muscle, leading to its relaxation and a decrease in bladder spasms, urgency, and frequency. It is one of the oldest and most widely prescribed medications for overactive bladder.
Solifenacin (VESIcare)	This pharmaceutical anticholinergic medication specifically targets muscarinic receptors in the bladder, relaxing the detrusor muscle and increasing bladder capacity to reduce symptoms of overactive bladder. It is a commonly prescribed option for OAB.
Tolterodine (Detrol, Detrol LA)	This pharmaceutical anticholinergic medication also works by blocking muscarinic receptors in the bladder, which helps to relax the bladder muscle and reduce symptoms like urinary urgency, frequency, and urge incontinence. It is widely used for overactive bladder.
Mirabegron (Myrbetriq)	This pharmaceutical beta-3 adrenergic agonist works by activating beta-3 receptors in the bladder, causing the bladder muscle to relax during the filling phase. This increases the bladder's capacity and reduces symptoms of overactive bladder, without the typical anticholinergic side effects.
Trospium (Sanctura, Sanctura XR)	This pharmaceutical anticholinergic medication reduces bladder muscle spasms by blocking muscarinic receptors. Its charged molecular structure means it has less central nervous system penetration, potentially leading to fewer cognitive side effects.
Flavoxate (Urispas)	This pharmaceutical antispasmodic directly acts on the smooth muscles of the urinary tract, helping to relieve spasms, pain, and discomfort associated with bladder irritation or inflammation. It is used for symptomatic relief of bladder conditions.
Pumpkin Seed Extract	This natural extract contains compounds that are believed to strengthen bladder muscles and pelvic floor function, helping to improve bladder control and reduce urinary frequency. It is a popular natural supplement for bladder health.
Gosha-jinki-gan (GJG)	This natural traditional Japanese herbal formula comprises a blend of ten herbs. It is used to improve bladder function and reduce symptoms of overactive bladder and frequent urination, particularly nocturia, through its various active compounds.
Corn Silk (Herbal Terra Corn Silk)	This natural part of the corn plant has traditional uses as a diuretic and anti-inflammatory agent. It is believed to help soothe the urinary tract and may reduce bladder irritation and spasms.

Duloxetine (Cymbalta, Yentreve)	While primarily an antidepressant, this pharmaceutical serotonin-norepinephrine reuptake inhibitor (SNRI) increases the activity of the external urethral sphincter, thereby improving continence. It is specifically approved for the treatment of moderate to severe stress urinary incontinence in some regions.

2 Drugs for Benign Prostatic Hyperplasia (BPH)

Drugs for Benign Prostatic Hyperplasia (BPH) aim to alleviate urinary symptoms caused by an enlarged prostate, such as frequent urination, weak stream, and incomplete bladder emptying. They work by relaxing prostate muscles, shrinking the prostate, or improving overall urinary flow.

Tamsulosin (Flomax)	This pharmaceutical alpha-blocker relaxes the smooth muscles in the prostate and bladder neck, which reduces the obstruction of urine flow and improves urinary symptoms. It is the most commonly prescribed alpha-blocker for BPH.
Finasteride (Proscar)	This pharmaceutical 5-alpha reductase inhibitor blocks the conversion of testosterone to dihydrotestosterone (DHT), a hormone responsible for prostate growth. This leads to a reduction in prostate size over time and can prevent disease progression.
Dutasteride (Avodart)	This pharmaceutical 5-alpha reductase inhibitor is similar to finasteride but blocks both types of the 5-alpha reductase enzyme, leading to a more complete reduction in DHT and a greater potential to shrink the prostate. It is often used for larger prostates or in combination with alpha-blockers.
Tadalafil (Cialis)	This pharmaceutical phosphodiesterase-5 (PDE5) inhibitor, primarily known for erectile dysfunction, also relaxes smooth muscles in the bladder and prostate, helping to improve lower urinary tract symptoms associated with BPH. It is approved for daily use in men with BPH, with or without erectile dysfunction.
Alfuzosin (Uroxatral)	This pharmaceutical alpha-blocker relaxes the muscles in the prostate and bladder neck, making it easier for urine to flow. It is another commonly used alpha-blocker for BPH symptoms, often taken once daily with food.
Silodosin (Rapaflo)	This pharmaceutical alpha-blocker specifically targets the alpha1A-adrenoreceptors in the prostate, bladder, and urethra, relaxing these muscles to improve urine flow and reduce BPH symptoms. It is known for its high selectivity but can cause a reduction in semen volume.
Saw Palmetto (Prostate SR)	This natural extract from the berries of the saw palmetto tree is one of the most common herbal supplements used for BPH. It is believed to work by inhibiting DHT and reducing inflammation, though scientific evidence on its efficacy has been mixed.
Beta-Sitosterol	This natural plant sterol, found in various plants, is thought to improve urinary flow and reduce residual urine volume in men with BPH. It is commonly included in prostate health supplements and is believed to reduce inflammation.
Pygeum Africanum	This natural extract from the bark of the African plum tree has been traditionally used to treat BPH symptoms. It is believed to have anti-inflammatory properties and to affect bladder contractility, helping to relieve urinary issues.
Rye Pollen Extract (Cernilton)	This natural extract from rye grass pollen contains various substances that are believed to help relax the muscles of the urethra and improve bladder emptying. It is used to alleviate symptoms like urinary frequency and urgency.

3 Erectile Dysfunction Agents

Erectile dysfunction (ED) is the inability to achieve or maintain an erection firm enough for satisfactory sexual intercourse. Drugs for ED primarily work by increasing blood flow to the penis, facilitating an erection when sexually stimulated.

Sildenafil (Viagra, Revatio)	This pharmaceutical phosphodiesterase type 5 (PDE5) inhibitor increases blood flow to the penis by relaxing smooth muscles and allowing blood vessels to widen during sexual stimulation. It is the original and most widely recognized oral medication for ED.
Tadalafil (Cialis)	This pharmaceutical PDE5 inhibitor also increases blood flow to the penis but has a longer duration of action, lasting up to 36 hours, earning it the nickname "the weekend pill." It can be taken as needed or in a low daily dose.
Vardenafil (Levitra, Staxyn)	This pharmaceutical PDE5 inhibitor works similarly to sildenafil and tadalafil by increasing blood flow to the penis during sexual arousal. It has a quicker onset of action than sildenafil for some individuals.
L-Arginine	This natural amino acid is a precursor to nitric oxide, a molecule that helps relax blood vessels and increase blood flow to the penis, which is essential for an erection. It is commonly taken as a dietary supplement.
Panax Ginseng (Often as Korean Red Ginseng)	This natural herb is believed to enhance nitric oxide synthesis and may affect central nervous system activity, potentially improving erectile function and libido. It is a widely used traditional remedy.
Avanafil (Stendra)	This pharmaceutical newer PDE5 inhibitor works by selectively blocking PDE5 to increase blood flow to the penis. It is known for its rapid onset of action and potentially fewer side effects compared to older PDE5 inhibitors.
Yohimbe (Derived from bark)	This natural supplement acts as an alpha-2 adrenergic receptor antagonist, which may increase norepinephrine release and blood flow to the penis. However, its use is associated with potential side effects and safety concerns.
Horny Goat Weed	This natural herb contains icariin, which is thought to inhibit PDE5, similar to pharmaceutical ED drugs, thereby increasing blood flow to the penis. While popular, human studies on its efficacy are limited.

4 Contraceptives

Contraceptives are methods used to prevent pregnancy, working through various mechanisms such as blocking sperm from reaching an egg, preventing ovulation, or altering the uterine environment. They can be hormonal, non-hormonal, or behavioral.

Male Condom (Durex, Trojan)	This natural barrier method is a thin sheath worn over the penis that physically prevents sperm from entering the vagina. It is widely accessible, inexpensive, and also provides protection against sexually transmitted infections (STIs).
Combined Oral Contraceptive Pill (Yasmin, Levlen)	This pharmaceutical hormonal method contains both estrogen and progestin, working primarily by preventing ovulation, thickening cervical mucus to block sperm, and thinning the uterine lining. It is one of the most popular and effective forms of reversible birth control.
Progestin-Only Pill (Microlut, Noriday)	This pharmaceutical hormonal method contains only progestin, primarily working by thickening cervical mucus to block sperm and sometimes by suppressing ovulation. It is an option for women who cannot use estrogen, such as those breastfeeding.
Intrauterine Device (IUD) - Hormonal (Mirena, Kyleena)	This pharmaceutical long-acting reversible contraceptive (LARC) is a small, T-shaped device inserted into the uterus that releases progestin, which thickens cervical mucus, thins the uterine lining, and may suppress ovulation. It can provide contraception for several years.
Intrauterine Device (IUD) - Copper (Paragard, Copper T)	This natural/non-hormonal LARC is a small, T-shaped device inserted into the uterus that releases copper ions, which create an inflammatory reaction toxic to sperm and eggs, preventing fertilization. It does not contain hormones and can be effective for up to 10 years or more.
Contraceptive Implant (Nexplanon, Implanon)	This pharmaceutical LARC is a small, flexible rod inserted under the skin of the upper arm that continuously releases progestin, primarily preventing ovulation and thickening cervical mucus. It can provide highly effective contraception for 3 to 5 years.
Contraceptive Injection (Depo-Provera)	This pharmaceutical hormonal method involves an injection of progestin every 3 months, which primarily prevents ovulation and thickens cervical mucus. It offers highly effective, convenient, and reversible contraception.
Natural Family Planning	Various methods like Calendar, Basal Body Temperature, Cervical Mucus. These natural methods involve tracking a woman's menstrual cycle and physiological signs to identify fertile and infertile periods, avoiding unprotected intercourse during fertile times. Their effectiveness relies heavily on consistent and accurate tracking.

Withdrawal Method (Coitus Interruptus)	This natural method involves the male partner withdrawing the penis from the vagina before ejaculation to prevent sperm from entering the female reproductive tract. While widely practiced, its effectiveness is lower due to pre-ejaculate and imperfect timing.
Vaginal Ring (NuvaRing, EluRyng)	This pharmaceutical flexible ring is inserted into the vagina and releases both estrogen and progestin, working similarly to the combined oral contraceptive pill to prevent ovulation. It is typically left in for three weeks, followed by a ring-free week.
Contraceptive Patch (Xulane, Evra)	This pharmaceutical hormonal patch is applied to the skin and releases estrogen and progestin, which are absorbed through the skin to prevent ovulation. A new patch is applied weekly for three weeks, followed by a patch-free week.
Female Condom (FC2, Protectiv)	This natural barrier method is a pouch inserted into the vagina before intercourse, lining the vaginal walls and physically preventing sperm from reaching the cervix. It offers protection against STIs and pregnancy.
Lactational Amenorrhea Method (LAM)	This natural method relies on exclusive or near-exclusive breastfeeding to suppress ovulation. It can be a highly effective temporary contraceptive method for up to 6 months postpartum if specific criteria (amenorrhea, full breastfeeding, infant under 6 months) are met.
Diaphragm/Cervical Cap with Spermicide	These natural barrier methods are domes or cups placed over the cervix before intercourse, blocking sperm. They are used in conjunction with spermicide, which inactivates or kills sperm. They are often used with spermicide.
Spermicide (Contraceptrol, Gynol II)	This chemical agent is inserted into the vagina before intercourse to inactivate or kill sperm, acting as a barrier. It is typically used in combination with other barrier methods like diaphragms or condoms to increase their effectiveness.

5 Urinary Tract Anti-infectives

Urinary Tract Anti-infectives are substances used to treat or prevent infections in the urinary tract, most commonly caused by bacteria. They work by killing or inhibiting the growth of these microbes, often by targeting bacterial processes or by creating an unfavorable environment for them in the urinary system.

Nitrofurantoin (Macrobid, Macrodantin)	This pharmaceutical antibiotic works by interfering with various bacterial enzyme systems, particularly in the urinary tract, which prevents bacterial growth and kills common UTI-causing bacteria. It is a first-line treatment for uncomplicated urinary tract infections.
Sulfamethoxazole/Trimethoprim (Bactrim, Septra)	This pharmaceutical combination antibiotic works synergistically by blocking two sequential steps in bacterial folic acid synthesis, which is vital for bacterial DNA and protein production. It is a very common and effective treatment for urinary tract infections.
Cranberry (extract/juice)	This natural remedy contains proanthocyanidins (PACs) that prevent certain bacteria, particularly E. coli, from adhering to the lining of the urinary tract walls. It is widely used for the prevention of recurrent UTIs.
Cephalexin (Keflex)	This pharmaceutical first-generation cephalosporin antibiotic works by inhibiting the synthesis of bacterial cell walls, leading to bacterial death. It is often used for urinary tract infections, especially in situations where other antibiotics might be less suitable.
Fosfomycin (Monurol)	This pharmaceutical antibiotic inhibits an enzyme crucial for bacterial cell wall synthesis, leading to the destruction of the bacteria. It is known for its single-dose treatment regimen for uncomplicated urinary tract infections.
Ciprofloxacin (Cipro)	This pharmaceutical fluoroquinolone antibiotic works by inhibiting bacterial DNA gyrase, an enzyme essential for bacterial DNA replication and repair. While effective for UTIs, its use for uncomplicated cases is now often reserved due to concerns about resistance and potential side effects.
D-Mannose (AZO D-Mannose)	This natural sugar is thought to work by binding to E. coli bacteria in the urinary tract, preventing them from adhering to the bladder walls and allowing them to be flushed out with urine. It is commonly used as a supplement for UTI prevention.
Amoxicillin/Clavulanate Potassium (Augmentin)	This pharmaceutical combination antibiotic includes amoxicillin, which inhibits bacterial cell wall synthesis, and clavulanate, which protects amoxicillin from bacterial enzymes. It's used for UTIs when other first-line agents are not appropriate.
Uva Ursi (Bearberry Leaf)	This natural herb contains arbutin, which is metabolized into hydroquinone, a compound with antiseptic properties in the urinary tract. It is traditionally used for mild urinary tract infections.

14 Dermatological Meds

Dermatological condition medications encompass a broad range of drugs specifically designed to treat ailments affecting the skin, hair, and nails. These conditions can vary widely, from common issues like acne, eczema, and psoriasis to infections (bacterial, fungal, viral, parasitic) and more complex autoimmune or inflammatory skin disorders. Medications in this field are often applied topically as creams, ointments, lotions, or gels to target the affected area directly, minimizing systemic side effects.

However, for more severe, widespread, or resistant conditions, systemic medications taken orally or by injection are prescribed, including powerful anti-inflammatory agents like corticosteroids, immune-modulating drugs (e.g., biologics), and various anti-infectives. The goal of these treatments is to alleviate symptoms such as itching, redness, inflammation, and pain, as well as to control disease progression, clear infections, promote healing, and ultimately improve the appearance and overall health of the integumentary system.

Subheadings

1 Topical Anti-infectives

Topical anti-infectives are substances applied to the skin, wounds, or mucous membranes to kill or inhibit the growth of microorganisms (bacteria, fungi, viruses) and prevent or treat local infections. They are commonly used for cuts, scrapes, burns, skin infections, and acne.

Povidone-iodine (Betadine)	This pharmaceutical antiseptic releases iodine, which rapidly kills a broad spectrum of bacteria, viruses, fungi, and spores by oxidizing cellular components. It is extensively used for skin disinfection before surgery, wound care, and as a general antiseptic.
Mupirocin (Bactroban)	This pharmaceutical antibiotic ointment works by inhibiting bacterial protein synthesis, effectively stopping the growth of certain bacteria, especially Staphylococcus aureus (including MRSA) and Streptococcus pyogenes. It is commonly prescribed for impetigo and to eliminate nasal MRSA colonization.
Triple Antibiotic Ointment (Neosporin) (Bacitracin/Neomycin)	This pharmaceutical combination ointment contains three different antibiotics that work together to prevent and treat minor skin infections. Bacitracin primarily targets Gram-positive bacteria, while neomycin and polymyxin B cover a range of Gram-negative bacteria.
Clotrimazole (Lotrimin, Canesten)	This pharmaceutical antifungal cream works by damaging the fungal cell membrane, leading to leakage of cellular contents and ultimately the death of the fungus. It is a very common topical treatment for skin fungal infections like athlete's foot, jock itch, and ringworm.

Chlorhexidine (Hibiclens, Savlon)	This pharmaceutical antiseptic is a broad-spectrum antimicrobial that binds to the skin and disrupts bacterial cell membranes, leading to their inactivation. It is widely used for surgical hand scrubs, skin preparation before procedures, and as an oral rinse for gum disease.
Hydrogen Peroxide (Rexall, Peroxide)	This pharmaceutical antiseptic works by releasing oxygen bubbles that help to clean wounds and kill certain bacteria by oxidizing their cellular components. It's a common household antiseptic for minor cuts and scrapes.
Silver Sulfadiazine (Silvadene)	This pharmaceutical topical antimicrobial combines silver ions with sulfadiazine, a sulfonamide antibiotic. The silver ions have broad-spectrum antimicrobial activity, making it highly effective in preventing and treating wound infections, particularly in burn patients.
Tea Tree Oil	This natural essential oil contains compounds like terpinen-4-ol that exhibit broad-spectrum antimicrobial properties, including antibacterial and antifungal effects, by damaging microbial cell membranes. It is frequently used topically for minor skin infections, acne, and fungal conditions.
Honey (Manuka Honey)	This natural substance possesses antibacterial properties due to its high sugar content, low pH, and the production of hydrogen peroxide and other compounds. It has been traditionally used and is increasingly recognized for its efficacy in wound healing and preventing infection.
Acyclovir (Zovirax topical)	This pharmaceutical antiviral cream or ointment works by interfering with viral DNA replication, thereby stopping the spread of herpes simplex virus infections. It is used topically to treat cold sores and genital herpes lesions, helping them heal faster.
Aloe Vera	While known for its soothing properties, the gel from the aloe vera plant also contains compounds with mild antibacterial and antifungal properties. It is often used to soothe and potentially help heal minor skin irritations and infections.

MEDICATION — 14. Dermatological Meds — Topical Anti-infectives

2 Topical Corticosteroids

Topical corticosteroids are anti-inflammatory medications applied to the skin to reduce redness, swelling, itching, and irritation caused by various dermatological conditions like eczema, psoriasis, and dermatitis. They work by mimicking the effects of natural cortisol, a hormone produced by the body, to suppress immune responses and inflammation in the skin.

Hydrocortisone (Cortizone-10, Cortaid, Dermacort)	This pharmaceutical mild-potency corticosteroid works by reducing inflammation, itching, and redness in a wide range of skin conditions like eczema, dermatitis, and insect bites. It's widely available over-the-counter and in prescription strengths.
Triamcinolone Acetonide (Kenalog, Aristocort)	This pharmaceutical moderate-potency corticosteroid effectively reduces inflammation, itching, and redness by suppressing the immune response in the skin. It is commonly prescribed for various skin conditions, including eczema, psoriasis, and allergic reactions.
Mometasone Furoate (Elocon, Nasonex - nasal spray)	This pharmaceutical potent corticosteroid reduces inflammation, itching, and redness by acting on inflammatory pathways in skin cells. It's frequently prescribed for more severe skin conditions such as moderate to severe eczema and psoriasis.
Betamethasone Valerate (Betnovate, Valisone)	This pharmaceutical potent corticosteroid works by decreasing inflammation, swelling, and itching in the skin. It is used to treat a variety of inflammatory skin conditions, including eczema, psoriasis, and dermatitis.
Clobetasol Propionate (Clobex, Temovate)	This pharmaceutical super-potent corticosteroid is one of the strongest topical steroids available, working rapidly to suppress inflammation and itching. It is typically prescribed for very severe inflammatory skin conditions like severe psoriasis and resistant eczema for short periods.
Curcumin (from Turmeric)	This natural compound found in turmeric possesses potent anti-inflammatory properties by modulating various cellular pathways involved in inflammation. It is often used topically in formulations to help reduce redness and swelling in skin conditions.
Aloe Vera	The gel from the aloe vera plant contains compounds with anti-inflammatory, soothing, and healing properties. It is widely used to calm irritated skin, reduce redness, and promote healing in conditions like sunburns and minor skin inflammations.
Witch Hazel	This natural astringent and anti-inflammatory extract from the witch hazel plant contains tannins that can reduce swelling, itching, and redness. It is commonly used topically for minor skin irritations, insect bites, and hemorrhoids due to its soothing and vasoconstrictive effects.
Apple Cider Vinegar (Bragg's, Heinz)	When diluted, this natural substance is believed to have mild anti-inflammatory and antimicrobial properties due to its acetic acid content. It is sometimes used topically for skin conditions like acne or mild rashes, though its direct anti-inflammatory action is less potent than corticosteroids.

MEDICATION — 14. Dermatological Meds — Topical Corticosteroids

3 Antipsoriatics

Antipsoriatics are a class of treatments used to manage psoriasis, a chronic autoimmune skin condition characterized by red, itchy, scaly patches. These agents work by slowing down the rapid growth of skin cells, reducing inflammation, and modulating the immune system.

Topical Corticosteroids (Hydrocortisone, Triamcinolone)	These pharmaceutical medications reduce inflammation, itching, and redness by suppressing the immune response in the skin. They are a first-line and most frequently used treatment for mild to moderate psoriasis.
Calcipotriene (Dovonex, Sorilux)	This pharmaceutical synthetic vitamin D analog works by slowing down the rapid growth and proliferation of skin cells, helping to normalize skin cell turnover in psoriasis. It is a very common topical treatment for plaque psoriasis.
Combination Calcipotriene/Betamethasone (Taclonex)	This pharmaceutical combination product pairs a vitamin D analog with a potent corticosteroid, providing both cell growth regulation and strong anti-inflammatory effects. It is highly effective for plaque psoriasis due to its dual action.
Salicylic Acid (Dermarest Psoriasis)	This pharmaceutical keratolytic agent helps to soften, lift, and remove scales from psoriasis plaques. By descaling the skin, it can also improve the penetration and effectiveness of other topical treatments.
Coal Tar (Fototar, Psoriasin)	This pharmaceutical topical treatment has anti-inflammatory, antipruritic (anti-itch), and antiproliferative (slows cell growth) effects. It is an older, but still used, treatment for various forms of psoriasis, particularly on the scalp.
Tazarotene (Tazorac)	This pharmaceutical topical retinoid is a vitamin A derivative that helps to normalize skin cell growth and reduce inflammation in psoriatic plaques. It is used to treat mild to moderate plaque psoriasis.
Methotrexate (Trexall, Otrexup)	This pharmaceutical systemic medication is an immunosuppressant that works by inhibiting cell growth and inflammation. It is a widely used oral systemic therapy for moderate to severe psoriasis that has not responded to topical treatments.
Adalimumab (Humira)	This pharmaceutical biologic is a TNF-alpha inhibitor that blocks a specific protein (TNF-alpha) involved in the inflammatory process of psoriasis. It is a highly effective injectable treatment for moderate to severe plaque psoriasis and psoriatic arthritis.
Ustekinumab (Stelara)	This pharmaceutical biologic targets specific interleukins (IL-12 and IL-23), key proteins involved in the inflammatory pathway of psoriasis. It is an injectable medication used for moderate to severe plaque psoriasis and psoriatic arthritis.
Etanercept (Enbrel)	This pharmaceutical biologic is a TNF-alpha blocker that acts as a "decoy receptor" for TNF-alpha, preventing it from activating inflammatory responses. It is an injectable treatment used for moderate to severe plaque psoriasis and psoriatic arthritis.
Secukinumab (Cosentyx)	This pharmaceutical biologic specifically targets and neutralizes interleukin-17A (IL-17A), a cytokine that plays a central role in the inflammatory process of psoriasis. It is an injectable treatment for moderate to severe plaque psoriasis, psoriatic arthritis, and ankylosing spondylitis.
Acitretin (Soriatane)	This pharmaceutical oral retinoid (vitamin A derivative) works by slowing down the excessive growth of skin cells. It is used for severe forms of psoriasis, particularly erythrodermic and pustular psoriasis.
Curcumin (from Turmeric)	This natural compound found in turmeric has potent anti-inflammatory and antioxidant properties, which may help to reduce the inflammation and scaling associated with psoriasis. It is often used as a dietary supplement.

MEDICATION — 14. Dermatological Meds — Antipsoriatics

Aloe Vera	The gel from the aloe vera plant has soothing, moisturizing, and anti-inflammatory properties that can help reduce redness and scaling in mild psoriasis. It is used topically to calm irritated skin.
Oatmeal (Colloidal Oatmeal) (Aveeno)	Used in baths or topical products, colloidal oatmeal is a natural emollient that can soothe irritated, itchy, and dry skin characteristic of psoriasis. It forms a protective barrier and reduces inflammation.

4 Emollients/Moisturizers

Emollients, often synonymous with moisturizers, are essential for skin health, especially for dry, irritated, or compromised skin conditions. They work by creating a protective barrier on the skin's surface, trapping moisture, and filling in gaps between skin cells, leading to smoother, softer, and more hydrated skin.

Petroleum Jelly (Vaseline)	This pharmaceutical/natural occlusive agent creates a highly effective protective barrier on the skin, preventing water loss and promoting healing. It is incredibly versatile and widely used for dry skin, cracked lips, minor cuts, and as a barrier for various skin irritations.
Glycerin	This pharmaceutical/natural humectant attracts and binds water from the air and deeper layers of the skin, drawing it to the skin's surface to enhance hydration. It is a common ingredient in many moisturizers and lotions due to its excellent hydrating properties.
Mineral Oil (Baby Oil)	This pharmaceutical/natural occlusive agent forms a thin, protective layer on the skin to prevent moisture loss. It is a highly refined petroleum product, commonly used in baby oils and lotions for its emollient properties and low allergenic potential.
Ceramides	These pharmaceutical/natural lipids are naturally occurring in the skin and are crucial components of the skin barrier, helping to retain moisture and protect against irritants. Many pharmaceutical moisturizers incorporate synthetic ceramides to restore and strengthen the skin's natural barrier.
Lanolin (Lansinoh, Lano)	This natural waxy substance derived from sheep's wool is a powerful occlusive and emollient, forming a protective barrier on the skin to prevent moisture loss and soften rough areas. It is commonly used for dry, chapped skin, and cracked nipples in breastfeeding mothers.
Urea (Eucerin UreaRepair, Urelia)	This pharmaceutical humectant and keratolytic agent helps the skin retain moisture at lower concentrations, and at higher concentrations, it can break down rough, scaly skin. It is frequently used for very dry, rough, scaly conditions like eczema, psoriasis, and keratosis pilaris.
Shea Butter	This natural fat extracted from the shea tree nut is a rich emollient and moisturizer, providing deep hydration and anti-inflammatory benefits due to its fatty acid and vitamin content. It is widely used in creams, lotions, and balms.
Hyaluronic Acid	This pharmaceutical/natural powerful humectant can hold up to 1,000 times its weight in water, drawing moisture into the skin to plump it and reduce the appearance of fine lines. It is a popular ingredient in serums and moisturizers for intense hydration.
Cocoa Butter	This natural fat derived from cocoa beans is a rich emollient that deeply moisturizes and helps to improve skin elasticity, often used to prevent stretch marks and nourish dry skin.
Jojoba Oil	This natural liquid wax, structurally similar to the skin's natural sebum, is a lightweight emollient that provides hydration without clogging pores. It is suitable for all skin types and is often found in moisturizers and cleansers.
Colloidal Oatmeal (Gold Bond)	This natural finely ground oat flour forms a protective, soothing barrier on the skin, reducing itching and inflammation. It is widely used for sensitive, dry, and eczema-prone skin due to its anti-inflammatory properties.
Coconut Oil	This natural edible oil is a rich emollient that provides intense moisturization and has some antimicrobial properties due to its fatty acid content. It is often used for body moisturization and as a natural remedy for dry skin.

5 Acne Treatments

Acne treatments aim to reduce blemishes, inflammation, and scarring by addressing factors like excess oil production, clogged pores, bacteria, and inflammation. They work through various mechanisms, including regulating skin cell turnover, killing bacteria, or reducing hormonal influences.

Benzoyl Peroxide (Proactiv, PanOxyl)	This pharmaceutical topical agent is highly effective due to its antibacterial action against Cutibacterium acnes (formerly Propionibacterium acnes) and its ability to gently exfoliate skin cells, preventing clogged pores. It is widely available over-the-counter and often combined with other treatments.
Topical Retinoids (Adapalene, Tretinoin)	These pharmaceutical vitamin A derivatives work by normalizing skin cell turnover, preventing pores from becoming clogged, and reducing inflammation. Adapalene 0.1% is available over-the-counter, while other retinoids require a prescription.
Salicylic Acid (Clearasil)	This pharmaceutical beta-hydroxy acid (BHA) is a chemical exfoliant that penetrates oil to unclog pores and reduce inflammation. It is commonly found in over-the-counter cleansers, toners, and spot treatments.
Topical Antibiotics (Clindamycin, Erythromycin)	These pharmaceutical medications work by reducing the amount of acne-causing bacteria on the skin and in follicles, as well as providing anti-inflammatory effects. They are typically used in combination with benzoyl peroxide to prevent antibiotic resistance.
Oral Antibiotics (Doxycycline, Minocycline)	These pharmaceutical systemic medications reduce bacterial colonization and inflammation throughout the body, including in the skin's affected follicles. They are prescribed for moderate to severe acne, often for limited durations due to concerns about antibiotic resistance.
Tea Tree Oil	This natural essential oil possesses antibacterial, anti-inflammatory, and antioxidant properties, which help to kill acne-causing bacteria and reduce redness and swelling of pimples. It is a popular natural remedy for mild to moderate acne.
Azelaic Acid (Finacea, Azelex)	This pharmaceutical topical dicarboxylic acid has antibacterial, anti-inflammatory, and mild exfoliating properties, helping to unclog pores and reduce redness. It is effective for both inflammatory acne and the post-inflammatory hyperpigmentation (dark spots) left by acne.
Isotretinoin (Accutane, Roaccutane)	This pharmaceutical powerful oral retinoid dramatically reduces sebum production, normalizes skin cell shedding, and has anti-inflammatory effects, leading to long-term remission for severe, recalcitrant acne. It requires strict medical supervision due to potential side effects.
Witch Hazel	This natural astringent and anti-inflammatory extract from the witch hazel plant can help reduce excess oil, tighten pores, and calm inflamed skin. It is commonly used in toners for oily and acne-prone skin.
Aloe Vera	This natural plant gel has soothing, anti-inflammatory, and antibacterial properties that can help calm irritated skin and reduce the appearance of acne. It is often used as a spot treatment or general skin soother.
Sulfur	This pharmaceutical/natural topical agent has mild antibacterial and keratolytic (exfoliating) properties, helping to dry out blemishes and reduce excess oil. It is often found in spot treatments and masks.

15 Ophthalmic & Otic Meds

MEDICATION 15. Ophthalmic & Otic Meds

Ophthalmic and Otic Condition Medications are distinct but often grouped categories of drugs specifically formulated to treat ailments of the eyes and ears, respectively. Ophthalmic medications are designed for topical application to the eye, typically as drops, gels, or ointments, and are used to address a wide range of conditions such as infections (bacterial, viral, fungal), inflammation (e.g., conjunctivitis, iritis), glaucoma (by reducing intraocular pressure), dry eye syndrome, and allergies. They must be sterile and precisely formulated to avoid irritation and damage to the delicate eye tissues.

Otic medications, conversely, are prepared for application into the ear canal, usually as ear drops. These are primarily used to treat ear infections (e.g., otitis externa or media), reduce inflammation and pain, or aid in earwax removal. Both ophthalmic and otic preparations require careful administration to ensure effectiveness and prevent contamination, and they play a crucial role in maintaining sensory health and comfort.

Subheadings

1 Ophthalmic Agents

Ophthalmic agents are medications and substances used to treat conditions affecting the eyes, such as dryness, infections, glaucoma, and inflammation. They work through various mechanisms to alleviate symptoms, protect eye structures, or improve visual function.

Artificial Tears / Lubricating Eye Drops (Refresh, Systane, TheraTears)	These pharmaceutical drops mimic natural tears to lubricate the surface of the eye, reduce dryness, irritation, and discomfort. They are the most widely used ophthalmic agents for dry eye syndrome, which is a very common condition.
Latanoprost (Xalatan)	This pharmaceutical prostaglandin analog eye drop works by increasing the outflow of fluid from the eye, thereby lowering intraocular pressure. It is a highly effective and very commonly prescribed medication for treating open-angle glaucoma and ocular hypertension.
Timolol (Timoptic)	This pharmaceutical beta-blocker eye drop reduces the production of fluid inside the eye, thereby lowering intraocular pressure. It is a widely used and effective treatment for open-angle glaucoma and ocular hypertension.
Olopatadine (Patanol, Pataday)	This pharmaceutical antihistamine and mast cell stabilizer eye drop blocks histamine receptors and prevents the release of inflammatory substances from mast cells, effectively relieving itchy, red, and watery eyes caused by allergic conjunctivitis. It is a very common over-the-counter and prescription allergy eye drop.
Moxifloxacin (Vigamox, Moxeza)	This pharmaceutical fluoroquinolone antibiotic eye drop works by inhibiting bacterial DNA replication, effectively killing a broad range of bacteria that cause eye infections. It is a commonly prescribed antibiotic for bacterial conjunctivitis and other ocular infections.
Prednisolone Acetate (Pred Forte, Omnipred)	This pharmaceutical corticosteroid eye drop reduces inflammation, swelling, and redness in the eye by suppressing the immune response. It is commonly used for various inflammatory eye conditions, including post-surgical inflammation and severe allergic conjunctivitis.
Cyclosporine Ophthalmic (Restasis, Cequa)	This pharmaceutical immunomodulator eye drop works by decreasing inflammation on the surface of the eye, which can increase the eye's natural tear production. It is used to treat chronic dry eye disease caused by inflammation.
Brimonidine (Alphagan P, Lumify	This pharmaceutical alpha-adrenergic agonist eye drop primarily reduces fluid production in the eye and also increases outflow, thereby lowering intraocular pressure. It is used for open-angle glaucoma and ocular hypertension, and lower concentrations are used for redness relief.
Dorzolamide (Trusopt)	This pharmaceutical carbonic anhydrase inhibitor eye drop works by reducing the production of fluid inside the eye, thereby lowering intraocular pressure. It is often used alone or in combination with other medications for glaucoma.
Hot/Warm Compresses	A natural method, applying a warm compress helps to soothe irritated eyes, promote blood flow, and can help to loosen blockages in oil glands, often used for dry eyes, styes, or blepharitis.
Cold Compresses	A natural method, applying a cold compress helps to constrict blood vessels, reducing swelling, redness, and itching in the eyes. It's often used for allergic reactions, puffy eyes, or minor eye injuries.
Rose Water	This natural floral water has soothing and mild anti-inflammatory properties, often used to calm irritated or tired eyes. It can be applied as a gentle eyewash or compress.
Chamomile Tea Bags (cooled)	This natural herbal remedy, when cooled and placed over the eyes, can provide soothing and mild anti-inflammatory effects due to compounds like flavonoids. It is often used to reduce puffiness and calm irritated eyes.

2 Otic Agents

Otic agents are medications and substances used to treat conditions affecting the ear, such as infections, inflammation, and earwax buildup. They are typically applied topically as ear drops to alleviate pain, reduce microbial growth, or aid in cerumen removal.

Ciprofloxacin/Dexamethasone (Ciprodex)	This pharmaceutical combination ear drop contains an antibiotic (ciprofloxacin) to kill bacteria and a corticosteroid (dexamethasone) to reduce inflammation and swelling. It is very commonly prescribed for middle ear infections (otitis media) with tubes and outer ear infections (otitis externa or "swimmer's ear").
Ofloxacin (Floxin Otic)	This pharmaceutical fluoroquinolone antibiotic ear drop works by inhibiting bacterial DNA replication, effectively killing a broad range of bacteria. It is widely used to treat various ear infections, including otitis externa and chronic suppurative otitis media.
Hydrocortisone/Neomycin/Polymyxin B (Cortisporin Otic)	This pharmaceutical combination ear drop contains a corticosteroid for inflammation and three antibiotics to target a wide spectrum of bacteria. It is a common treatment for otitis externa, especially when inflammation is significant.
Acetic Acid (Vosol, Domeboro Otic)	This pharmaceutical and naturally occurring substance creates an acidic environment in the ear canal, which inhibits the growth of bacteria and fungi responsible for ear infections. It is often used for mild cases of swimmer's ear and to prevent recurrence.
Docusate Sodium (Earwax Removal) (Debrox, Cerumenex)	While not an anti-infective, this pharmaceutical ear drop is a very common over-the-counter agent that softens and loosens earwax. It works by reducing the surface tension of the earwax, making it easier to wash out.
Olive Oil	A natural emollient, warmed olive oil is commonly used to soften earwax, making it easier for the body to expel or for professional removal. It is a gentle home remedy for earwax blockage.
Hydrogen Peroxide (Earwax Removal)	This pharmaceutical and naturally occurring substance works by releasing oxygen bubbles that help to break down and loosen earwax. It is a common over-the-counter option for earwax removal.
Ciprofloxacin (Cipro ear drops)	Similar to its use in combination, ciprofloxacin alone as an ear drop is a pharmaceutical antibiotic that kills bacteria causing ear infections by inhibiting DNA replication. It is used for various bacterial ear infections.
Garlic Oil	This natural remedy contains allicin, a compound with antibacterial and antifungal properties. It is traditionally used by some for ear infections, often by infusing garlic in oil and applying a few drops.
Rubbing Alcohol	This common household item, sometimes used diluted with white vinegar, acts as a drying agent in the ear canal. It helps to evaporate water, which can prevent the growth of bacteria and fungi in cases of swimmer's ear.

MEDICATION

16. Hematological Meds

16 Hematological Meds

Hematological system medications are a specialized category of drugs that specifically target disorders of the blood and blood-forming organs, such as the bone marrow, spleen, and lymph nodes. This vital group of medications addresses a wide range of conditions, including various forms of anemia (by stimulating red blood cell production or supplementing essential nutrients like iron and vitamins), bleeding disorders (by promoting clotting with factors or antifibrinolytics), and clotting disorders (by preventing or dissolving harmful blood clots with anticoagulants, antiplatelet agents, and thrombolytics).

Additionally, some hematological medications are used in the context of blood cancers (leukemias, lymphomas, myelomas), often in conjunction with broader oncology treatments, and may include agents to stimulate white blood cell or platelet production, or targeted therapies for specific blood cell abnormalities. By directly influencing blood cell production, function, and the complex coagulation cascade, these medications are crucial for maintaining blood health, preventing life-threatening complications, and managing chronic hematological diseases worldwide.

Subheadings

1. Hematopoietic Agents	2. Hemostatics

1 Hematopoietic Agents

Hematopoietic agents are substances that stimulate the production, maturation, and differentiation of blood cells, including red blood cells, white blood cells, and platelets. They are crucial for treating various conditions such as anemia, neutropenia (low white blood cell count), and thrombocytopenia (low platelet count), often caused by chronic diseases, chemotherapy, or bone marrow disorders.

Epoetin Alfa (Epogen, Procrit)	This pharmaceutical erythropoiesis-stimulating agent (ESA) is a recombinant form of human erythropoietin, a hormone that stimulates the bone marrow to produce red blood cells. It is widely used to treat anemia associated with chronic kidney disease, chemotherapy, and certain HIV treatments.
Filgrastim (Neupogen, Zarxio)	A recombinant form of human granulocyte colony-stimulating factor (G-CSF). It stimulates the bone marrow to produce neutrophils, a type of white blood cell, to reduce the risk of infection in patients undergoing chemotherapy.
Pegfilgrastim (Neulasta)	A pegylated form of filgrastim, providing a longer-acting effect. It stimulates the bone marrow to produce neutrophils, reducing the frequency of injections needed to prevent febrile neutropenia in chemotherapy patients.
Ferrous sulfate (Feosol, Slow FE)	A common iron supplement. It provides elemental iron necessary for the body to produce healthy red blood cells, treating and preventing iron deficiency anemia.
Eltrombopag (Promacta, Revolade)	A thrombopoietin receptor agonist. It stimulates the bone marrow to produce more platelets, used to increase platelet counts in conditions like chronic immune thrombocytopenia (ITP) and aplastic anemia.
Romiplostim (Nplate)	A thrombopoietin (TPO) mimetic. It binds to and activates the TPO receptor, stimulating platelet production in patients with chronic immune thrombocytopenia (ITP).
Folic Acid	A B vitamin. It is essential for the production of red blood cells and for cell division and growth, used to treat or prevent folate deficiency anemia and to prevent neural tube defects during pregnancy.
Cyanocobalamin (Nascobal)	A manufactured version of vitamin B12. It is vital for red blood cell formation and nervous system function, used to treat and prevent vitamin B12 deficiency anemia.

2 Hemostatics

Hemostatics are substances that promote hemostasis, the process of stopping bleeding. They achieve this by enhancing blood coagulation or by forming a physical barrier to restrict blood flow.

Tranexamic acid (Cyklokapron, Lysteda)	An antifibrinolytic agent that prevents the breakdown of blood clots. It is commonly used to reduce blood loss in various surgical procedures, heavy menstrual bleeding, and other bleeding disorders.
Aminocaproic acid (Amicar)	Another antifibrinolytic agent that inhibits the dissolution of blood clots. It is primarily used to control bleeding in conditions like hemophilia or to prevent excessive bleeding after surgery.
Desmopressin (DDAVP, Stimate)	A synthetic analog of vasopressin that promotes the release of von Willebrand factor and factor VIII from endothelial cells. It is used to improve hemostasis in patients with mild hemophilia A and von Willebrand disease.
Oxidized cellulose (Surgicel)	A topical hemostatic agent that works by providing a physical matrix for clot formation and initiating the coagulation cascade. It is widely used in surgery to control capillary, venous, and small arterial hemorrhages.
Thrombin, topical (Recothrom, Thrombin-JMI)	An enzyme that converts fibrinogen to fibrin, leading to the formation of a stable blood clot. It is applied directly to bleeding surfaces during surgery to achieve local hemostasis.
Fibrin sealant (Tisseel, Evicel)	A biological adhesive composed of human fibrinogen and thrombin. When mixed, they mimic the final stages of the coagulation cascade, forming a fibrin clot that seals tissues and stops bleeding.
Recombinant Factor VIIa (NovoSeven RT)	A recombinant form of human coagulation Factor VIIa. It bypasses deficiencies in the intrinsic coagulation pathway to promote clot formation, primarily used to treat bleeding in hemophilia A or B patients with inhibitors.
Platelet-Rich Plasma (PRP)	A concentration of platelets derived from the patient's own blood. While not a "drug" in the traditional sense, it's a natural biological product used topically in some surgical fields to enhance clotting and promote tissue healing due to its high concentration of growth factors and clotting proteins.

17. Miscellaneous Meds

17 Miscellaneous Meds

These are medications which don't come under one of the categories above, such as antidotes, supplements and diagnostic agents.

Subheadings

1. Antidotes	2. Supplements	3. Diagnostic Agents	4. Smoking Cessation
5. Weight Management			

1 Antidotes

To counteract the effects of poisons or drug overdoses.

N-Acetylcysteine (NAC) (Acetadote, Mucomyst)	This pharmaceutical antidote is the specific treatment for acetaminophen (paracetamol) overdose. It works by replenishing glutathione stores in the liver, which are essential for detoxifying the toxic metabolite of acetaminophen, thereby preventing severe liver damage.
Naloxone (Narcan)	This pharmaceutical opioid receptor antagonist rapidly reverses the effects of opioid overdose by blocking opioid receptors in the brain, restoring breathing and consciousness. It is widely used in emergency situations involving opioid toxicity.
Activated Charcoal (Actidose-Aqua, SuperChar)	This pharmaceutical non-specific adsorbent binds to many drugs and toxins in the gastrointestinal tract, preventing their absorption into the bloodstream. It is often one of the first interventions in many acute poisonings, administered orally or via nasogastric tube.
Activated Charcoal (Natural Source)	While widely used in a pharmaceutical context, activated charcoal is derived from natural sources (e.g., wood, coconut shells) and its mechanism is physical adsorption. It acts as an emergency adsorbent for ingested poisons.
Atropine	This pharmaceutical anticholinergic agent blocks the effects of acetylcholine at muscarinic receptors. It is a primary antidote for organophosphate and carbamate pesticide poisoning, which cause an excess of acetylcholine, by counteracting symptoms like bradycardia and bronchorrhea.
Flumazenil (Romazicon)	This pharmaceutical benzodiazepine receptor antagonist rapidly reverses the sedative and respiratory depressant effects of benzodiazepine overdose. It works by competitively binding to the benzodiazepine site on the GABA-A receptor.
Phytonadione (Vitamin K) (Mephyton)	This pharmaceutical vitamin is essential for the synthesis of several blood clotting factors. It is the specific antidote for warfarin overdose or toxicity, reversing its anticoagulant effects by promoting the production of active clotting factors.
Protamine Sulfate	This pharmaceutical antagonist rapidly reverses the anticoagulant effects of heparin by forming a stable ion pair with heparin, thereby neutralizing its activity. It is used in cases of heparin overdose or bleeding.
Calcium Salts (e.g., Calcium Gluconate, Calcium Chloride)	These pharmaceutical agents are used as antidotes for hydrofluoric acid burns (to neutralize fluoride ions) and for overdose of calcium channel blockers (to restore calcium influx and cardiac function). They help counteract cardiotoxic effects.
Fomepizole (Antizol)	This pharmaceutical alcohol dehydrogenase inhibitor prevents the metabolism of methanol and ethylene glycol into their toxic metabolites. It is the preferred antidote for poisoning with these toxic alcohols.
Antivenoms / Antitoxins (CroFab - for snakebites, Botulism Antitoxin)	These pharmaceutical (and often naturally sourced, e.g., from animal plasma) preparations contain antibodies that specifically neutralize venoms from snakebites, spider bites, or toxins from bacterial infections like botulism or tetanus. They bind to and inactivate the specific toxins.
Pyridoxine (Vitamin B6)	This pharmaceutical vitamin is the specific antidote for isoniazid overdose or poisoning, as isoniazid interferes with pyridoxine's role in GABA synthesis. It helps prevent and treat seizures caused by isoniazid toxicity.
Glucagon (Glucagen)	This pharmaceutical hormone is used as an antidote for beta-blocker overdose, especially when unresponsive to atropine. It works by increasing intracellular cAMP, bypassing the blocked beta-receptors to improve heart rate and contractility.
Milk Thistle (Silymarin)	This natural herb is often used as supportive therapy for liver protection, particularly in cases of mushroom poisoning (e.g., Amanita phalloides). Silymarin is thought to protect liver cells and aid in regeneration.
Strong Tea (Tannins)	In some traditional or very initial poisoning scenarios, strong tea (rich in tannins) might be suggested as a natural agent to help precipitate or bind certain heavy metals or alkaloids, potentially reducing their absorption, though pharmaceutical interventions are always preferred.

2 Nutritional Supplements

These are nutritional supplements that are commonly used.

Multivitamins	These pharmaceutical/dietary supplements contain a combination of various vitamins and minerals designed to fill potential nutritional gaps in the diet. They are the most consumed type of supplement globally, aiming to support overall health and well-being.
Vitamin D	This pharmaceutical/dietary supplement is crucial for bone health, calcium absorption, immune function, and mood regulation. Many people globally have insufficient levels due to limited sun exposure, making it one of the most frequently recommended and consumed supplements.
Omega-3 Fatty Acids (Fish Oil/Algae Oil)	These natural/dietary supplements, rich in EPA and DHA, are known for their anti-inflammatory properties and benefits for heart health, brain function, and eye health. They are widely consumed due to perceived cardiovascular and cognitive advantages.
Vitamin C	This pharmaceutical/dietary supplement is a powerful antioxidant essential for immune function, collagen production, and skin health. It is frequently taken, especially during cold and flu season, for its immune-boosting properties.
Magnesium	This pharmaceutical/dietary mineral is involved in over 300 biochemical reactions in the body, supporting muscle and nerve function, blood sugar control, blood pressure regulation, and bone health. It's commonly supplemented for muscle cramps, sleep, and overall well-being.
Calcium (Caltrate, Ostelin Calcium & D3)	This pharmaceutical/dietary mineral is vital for strong bones and teeth, muscle function, and nerve transmission. It's particularly recommended for women, older adults, and those with dietary restrictions to prevent osteoporosis.
Probiotics (Culturelle, Inner Health)	These natural/dietary supplements contain live beneficial bacteria that help maintain a healthy balance of gut flora. They are widely used to support digestive health, improve gut motility, and boost the immune system.
Vitamin B Complex (including B12, Folate)	These pharmaceutical/dietary supplements contain a range of B vitamins that are essential for energy metabolism, nerve function, and red blood cell formation. B12 and folate are particularly noted for their importance in certain diets (e.g., vegan) or for specific health needs (e.g., pregnancy).
Iron	This pharmaceutical/dietary mineral is crucial for oxygen transport in the blood and preventing anemia. It is often supplemented, particularly in individuals with iron deficiency anemia, pregnant women, and vegetarians/vegans.
Protein Powders (e.g., Whey, Casein, Plant-based)	These natural/dietary supplements provide concentrated protein, essential for muscle repair, growth, and overall satiety. They are highly popular among athletes, fitness enthusiasts, and those looking to increase protein intake.
Turmeric/Curcumin	This natural supplement, derived from the turmeric plant, contains curcuminoids which are known for their potent anti-inflammatory and antioxidant properties. It's widely used for joint health, digestive support, and overall wellness.
Creatine	This natural compound, found in muscle cells, helps muscles produce energy during heavy lifting or high-intensity exercise. It's a very popular dietary supplement among athletes for improving strength, power, and muscle mass.
Ashwagandha	This natural adaptogenic herb is used to help the body adapt to stress, reduce anxiety, and improve sleep and cognitive function. It has gained significant popularity for its stress-modulating properties.
Glucosamine/Chondroitin	These natural compounds are components of cartilage and are used as dietary supplements to support joint health, reduce joint pain, and potentially slow the progression of osteoarthritis.
Zinc	This pharmaceutical/dietary mineral is essential for immune function, wound healing, and cell growth. It's commonly supplemented, especially during cold and flu season, for its immune-modulating effects.

See the NATURAL REMEDIES section for more information on these.

3 Diagnostic Agents

Used to aid in medical diagnosis (e.g., contrast media).

MEDICATION | 17. Miscellaneous Meds | Diagnostic Agents

Iodinated Contrast Media (Omnipaque, Isovue)	These pharmaceutical agents contain iodine which absorbs X-rays, making blood vessels, organs, and other tissues more visible during CT scans, X-rays, and angiography. They are extremely common for enhancing imaging in radiology departments worldwide.
Gadolinium-based Contrast Agents (Dotarem, Gadavist)	These pharmaceutical agents alter the magnetic properties of water molecules, enhancing the visibility of tissues and lesions in MRI scans. They are widely used for detailed imaging of various body parts, including the brain, spine, and joints.
Technetium-99m (Tc-99m) (Sestamibi for Myoview)	This pharmaceutical radioisotope is the most widely used in nuclear medicine. It is tagged to various molecules to target specific organs or tissues, emitting gamma rays that are detected by a gamma camera to create images that assess organ function or detect disease (e.g., bone scans, cardiac stress tests, thyroid scans).
Fluorescein Sodium (Fluorescein)	This pharmaceutical dye is used in ophthalmology to visualize corneal abrasions, foreign bodies, and blood flow in the retina during angiography. It fluoresces under blue light, highlighting areas of damage or vascular leakage in the eye.
Barium Sulfate (Readi-Cat, E-Z-Paque)	This pharmaceutical contrast agent is a dense, insoluble substance that coats the lining of the gastrointestinal tract, making it visible on X-ray images. It is commonly used for upper GI series and barium enemas to diagnose conditions of the esophagus, stomach, and intestines.
Fludeoxyglucose F 18 (FDG-PET)	This pharmaceutical radioactive glucose analog is absorbed by metabolically active cells, particularly cancer cells, which consume more glucose than normal cells. It is a key diagnostic agent in PET scans for detecting and monitoring various cancers, as well as for assessing brain and heart activity.
Indocyanine Green (ICG) (ICG-Pulsion, Cardio-Green)	This pharmaceutical dye binds to plasma proteins and is used for various diagnostic purposes, including assessing liver function, cardiac output, and visualizing blood flow during angiography (e.g., ophthalmic and surgical applications).
Diagnostic Dyes for Endoscopy/Surgery (Methylene Blue, Indigotindisulfonic acid)	These pharmaceutical dyes are used to stain or mark specific tissues during endoscopic procedures or surgery. They help visualize abnormal cells, delineate tissue planes, or confirm anatomical structures.
Urine Dipsticks / Reagent Strips (for urinalysis) (Chemstrip, Multistix)	While technically a device with impregnated chemical agents, these pharmaceutical diagnostic tools contain various reagents that change color in the presence of specific substances (e.g., glucose, protein, blood, nitrites) in urine. They are very commonly used for rapid screening of kidney function, urinary tract infections, and diabetes.
Litmus Paper	This simple natural indicator paper changes color to indicate the acidity or alkalinity (pH) of a substance. While basic, it's a fundamental "diagnostic" tool in many settings, including for assessing bodily fluids in some contexts.
Breath Tests (Pylori-Check, Helikit)	These pharmaceutical tests involve ingesting a substance (e.g., urea labeled with a carbon isotope) which, if broken down by bacteria like H. pylori, releases labeled carbon dioxide detected in the breath. This non-invasive method diagnoses bacterial infections in the stomach.

MEDICATION | 17. Miscellaneous Meds | Smoking Cessation Aids

4 Smoking Cessation Aids

To help people quit smoking.

Nicotine Patches (Nicoderm CQ, Nicorette Patch)	These pharmaceutical patches deliver a steady, controlled dose of nicotine through the skin, reducing withdrawal symptoms and cravings over a 24-hour period. They are a common and convenient form of nicotine replacement therapy (NRT).
Nicotine Gum (Nicotinell Gum)	This pharmaceutical gum releases nicotine when chewed, providing quick relief from cravings and withdrawal symptoms by allowing the user to control their nicotine intake as needed. It's a popular over-the-counter NRT.
Varenicline (Chantix, Champix)	This pharmaceutical prescription medication is a partial agonist at nicotine receptors in the brain, meaning it reduces the pleasure from smoking while also alleviating withdrawal symptoms. It is considered one of the most effective prescription medications for smoking cessation.
Nicotine Lozenges (Nicorette Lozenge, Nicotinell Lozenge)	These pharmaceutical lozenges dissolve in the mouth, releasing nicotine that is absorbed through the oral lining, providing a discreet and convenient way to manage cravings. They offer a quick onset of action for sudden urges.
Bupropion (Zyban, Wellbutrin SR)	This pharmaceutical prescription antidepressant works by affecting neurotransmitters in the brain, reducing nicotine cravings and withdrawal symptoms. It can also help to alleviate depressive symptoms that might arise during quitting.
Nicotine Inhalers (Nicotrol Inhaler, Nicorette Inhalator)	These pharmaceutical devices deliver nicotine vapor into the mouth and throat, mimicking the hand-to-mouth action of smoking while providing nicotine relief. They can help address both the physical and behavioral aspects of addiction.
Nicotine Nasal Sprays (Nicotrol NS)	This pharmaceutical spray delivers a rapid dose of nicotine through the nasal passages, providing fast relief from strong cravings. It offers the quickest nicotine delivery among NRTs, closely mimicking the speed of nicotine from a cigarette.
Cytisine (Tabex, Desmoxan)	This pharmaceutical plant-derived alkaloid acts similarly to varenicline as a partial agonist at nicotine receptors, reducing cravings and withdrawal symptoms. It is a widely used and effective smoking cessation aid, particularly in Eastern Europe.
Black Pepper Essential Oil	Inhaling the vapor from black pepper essential oil is a natural aromatherapy approach that some studies suggest can help reduce the severity and frequency of cigarette cravings. It is thought to provide a sensation similar to smoking.

MEDICATION | 17. Miscellaneous Meds | Weight Management

5 Weight Management

To assist in weight loss.

Semaglutide (Wegovy)	This is a glucagon-like peptide-1 (GLP-1) receptor agonist that helps regulate appetite by signaling to the brain, slowing gastric emptying, and increasing feelings of fullness. It is administered as a weekly injection to promote significant weight loss.
Liraglutide (Saxenda)	Another GLP-1 receptor agonist, this daily injectable medication works by affecting gut hormones that signal to the brain, reducing hunger and increasing satiety. It helps patients feel full more quickly and decrease overall food intake.
Phentermine (Adipex-P)	A stimulant that acts as an appetite suppressant, it helps reduce hunger and can provide an initial boost to weight loss. It is often prescribed for short-term use due to its stimulant properties.
Phentermine/Topiramate (Qsymia)	This combination medication pairs phentermine with topiramate, an anticonvulsant that can decrease appetite and cravings. It offers enhanced efficacy for weight loss by acting on multiple pathways.
Naltrexone/Bupropion (Contrave)	This combination drug works on areas of the brain involved in the pleasure-reward system, helping to reduce cravings and appetite. It combines an opioid antagonist with an antidepressant to aid in weight management.
Orlistat (Xenical, Alli)	This medication works by blocking the absorption of dietary fat in the intestines. It inhibits the enzyme lipase, preventing the breakdown and subsequent absorption of about one-third of the fat consumed.
Green Tea Extract	A natural supplement containing caffeine and catechins, which are believed to boost metabolism and promote fat burning. While widely used, its direct impact on significant weight loss is often modest.
Garcinia Cambogia	Derived from a tropical fruit, this supplement contains hydroxycitric acid (HCA), which is thought to inhibit an enzyme involved in fat production and increase serotonin levels to suppress appetite. Scientific evidence for substantial weight loss is mixed.
Glucomannan	A type of dietary fiber derived from the konjac plant. It absorbs water and expands in the stomach, promoting feelings of fullness and potentially reducing overall food intake.

Dietary Modifications	This broad category encompasses changes to eating habits, such as calorie restriction, portion control, increasing fruit and vegetable intake, reducing processed foods, or adopting specific eating patterns like low-carb or Mediterranean diets. The goal is to create a sustainable calorie deficit while ensuring adequate nutrition.
Exercise	Physical activity in many forms, such as walking, running, strength training, or cycling, burns calories and builds muscle mass, both of which are crucial for creating a calorie deficit and improving metabolism. It also contributes to overall health and well-being.

18 Medication List

This is the list of medications referred to above. They are sorted by medication name (not the brand name) in alphabetical order into evenly split groupings to make finding the one you're after easier. If you're looking for Pandadol/Paracetamol, you would look for Paracetamol below.

If you're looking for a list of which medications you should stockpile, head to the below sections:
- GEAR > Gear Descriptions > Medication
- GEAR > Household Gear > Home Clinic > Medications

BLACK BOX WARNING: For some of the medications below, under the Warnings & Precautions section, you may see a 'BLACK BOX WARNING'. A Black Box Warning, officially known as a Boxed Warning, is the strongest warning that some governments require for prescription drugs and medical devices. Its purpose is to prominently alert healthcare professionals and patients to serious or even life-threatening risks associated with the medication.

As mentioned at the start of this document, none of this information is meant as medical advice. Talk to your own trusted doctor to determine the best course of action for your health.

A - C

Any medications starting with A through to C.

Activated Charcoal

Purpose/Indication	Activated charcoal is primarily used in emergency situations to treat certain types of poisoning or drug overdose. It helps prevent or reduce the systemic absorption of toxins from the gastrointestinal tract. It can also be used for alleviating gas and bloating, though this is a less critical application in a survival scenario.
Method of Action	Activated charcoal works by a process called adsorption. Its highly porous surface binds to ingested toxins and chemicals within the gastrointestinal tract, preventing them from being absorbed into the bloodstream. It's most effective when administered quickly after ingestion of the toxic substance.
Medication Name & Brand Names	♦ Medication Name: Activated Charcoal ♦ Brand Names: Actidose-Aqua, CharcoalAid, Insta-Char, Liqui-Char, Superchar
Pharmaceutical Forms & Appearance	Activated charcoal typically comes as a fine black powder or granules, often suspended in water as a liquid, or available in capsules or tablets. The liquid suspensions are usually thick and black.
Dosage & Administration	For poisoning or overdose, doses are generally high, often 50g for adults and 1g/kg (up to 50g) for children, mixed with water. It should be administered as soon as possible after ingestion of the toxin (ideally within one hour). For gas/bloating, smaller doses (e.g., 250mg tablets) are used, often a few times a day. It is taken orally.
Supplied As	Activated charcoal is supplied as oral capsules, oral tablets, oral granules for reconstitution, and oral suspensions.
Contraindications	Activated charcoal is contraindicated in individuals with unprotected airways (if not intubated or unable to protect their airway), decreased levels of consciousness, or uncontrolled vomiting due to aspiration risk. It should not be used after ingestion of caustic substances (acids/alkalis), hydrocarbons (e.g., gasoline, kerosene), metals (e.g., iron, lithium, lead), or alcohols (e.g., ethanol, methanol). Also contraindicated in intestinal obstruction or recent GI surgery.
Storage & Expiry	Activated charcoal should be stored in a cool, dry place, sealed in its original container, to prevent it from adsorbing moisture or other substances from the air, which would reduce its effectiveness. While specific expiry dates vary by product, its adsorptive capacity can diminish over time, especially if exposed to air.
Side Effects	♦ Common side effects include black stools and constipation. ♦ Less common but more serious side effects can include intestinal blockage (with prolonged or repeated use), vomiting, and aspiration (if inhaled into the lungs, leading to chemical pneumonitis).
Warnings & Precautions	♦ Always consult a medical professional or poison control center before administering activated charcoal for poisoning. ♦ Do not administer to unconscious or seizing individuals unless their airway is protected (e.g., via intubation). ♦ It can bind to and reduce the absorption of other medications, vitamins, and minerals. ♦ The benefits must outweigh the risks, especially the risk of aspiration.
Missed Dose Instructions	For poisoning/overdose, activated charcoal is typically a single or short-course emergency treatment, not a regularly scheduled medication. If a dose is vomited, consult a medical professional immediately. For non-emergency use (e.g., gas), if a dose is missed, take it as soon as remembered unless it's almost time for the next dose; do not double the dose.
Overdose Instructions	If an overdose of activated charcoal itself occurs, it is generally not life-threatening but can worsen side effects like constipation or lead to intestinal blockage. Seek medical advice. In cases of accidental poisoning by other substances where activated charcoal was given, if the patient's condition worsens, immediately seek emergency medical help.
Medicine Interactions	Activated charcoal can significantly reduce the absorption and effectiveness of many orally administered medications, including but not limited to: ♦ Oral contraceptives ♦ Antidepressants ♦ Painkillers (e.g., acetaminophen, ibuprofen) ♦ Heart medications (e.g., propranolol, digoxin) ♦ Antibiotics (e.g., moxifloxacin, sulfamethoxazole/trimethoprim) ♦ Vitamins and minerals ♦ Laxatives (e.g., those containing sorbitol, as sorbitol reduces charcoal's binding capacity). It is generally recommended to separate the administration of activated charcoal from other oral medications by at least 2 hours.

Acyclovir (Zovirax)

Purpose/Indication	Acyclovir is an antiviral medication used to treat infections caused by herpes viruses, including cold sores (herpes labialis), genital herpes, chickenpox, and shingles (herpes zoster). It can help relieve pain, discomfort, and promote the healing of sores. It is not a cure for herpes and does not prevent transmission.

Method of Action	Acyclovir works by selectively inhibiting viral DNA synthesis. When a herpes virus infects a cell, its enzyme, thymidine kinase, converts acyclovir into a monophosphate form. Cellular enzymes then further convert it to a triphosphate, which competes with natural nucleotides and becomes incorporated into the viral DNA, ultimately stopping viral DNA replication and preventing the virus from multiplying.
Medication Name & Brand Names	The generic name is Acyclovir (or Aciclovir in some regions). Common brand names include Zovirax and Sitavig.
Pharmaceutical Forms & Appearance	Acyclovir is available in several forms: oral tablets and capsules, oral suspension (liquid), topical cream or ointment, and intravenous (IV) injection. Oral tablets and capsules are typically white or off-white. The oral suspension is often a white or off-white liquid. Topical creams are white, and ointments are translucent.
Dosage & Administration	Dosage and administration vary significantly based on the specific viral infection, its severity, and the patient's age and kidney function. Oral forms are typically taken multiple times a day, often for 5 to 10 days, but can be used for longer in suppressive therapy. Topical forms are applied directly to affected areas several times daily. IV administration is reserved for severe infections. It's crucial to start treatment as early as possible after symptom onset.
Supplied As	Acyclovir is supplied as oral tablets (various strengths), capsules, oral suspension, topical cream or ointment, and as a sterile powder for intravenous infusion.
Contraindications	Acyclovir is contraindicated in individuals with known hypersensitivity to acyclovir or valacyclovir. Caution is advised in patients with kidney problems, dehydration, or neurological conditions, as dose adjustments or close monitoring may be necessary.
Storage & Expiry	Oral tablets and capsules should be stored at room temperature, protected from moisture and light, and remain stable until their expiry date (usually two years). Acyclovir oral suspension should typically be stored refrigerated, and any unused portion discarded after a specific period (e.g., 28 days after reconstitution). Topical forms are stored at room temperature. Always check the specific product packaging for precise storage and expiry information.
Side Effects	Common side effects include headache, nausea, vomiting, diarrhea, and dizziness. Topical application may cause mild burning or stinging. More serious, but less common, side effects include kidney problems (especially with high doses or in dehydrated patients), confusion, hallucinations, seizures, and severe allergic reactions (e.g., rash, hives, swelling, difficulty breathing).
Warnings & Precautions	Patients with kidney impairment, the elderly, and those receiving high doses should ensure adequate hydration to prevent kidney problems. Acyclovir can cause neurological side effects; caution is advised when driving or operating machinery until effects are known. This medication only treats herpes viruses; it does not prevent the spread of genital herpes, and safe sex practices are still necessary. Resistance to acyclovir can develop, particularly in immunocompromised patients, if treatment is not effective.
Missed Dose Instructions	If an oral dose of Acyclovir is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose to make up for a missed one. For topical applications, apply when remembered and continue the regular frequency.
Overdose Instructions	In case of an Acyclovir overdose, contact a healthcare professional, emergency services, or a poison control center immediately. While typically not life-threatening, an overdose can cause severe gastrointestinal symptoms, headaches, confusion, and in rare cases, kidney dysfunction. Supportive care and hydration are usually recommended.
Medicine Interactions	Acyclovir can interact with other medications, potentially increasing their levels or increasing the risk of kidney toxicity. Notable interactions include with probenecid and cimetidine, which can increase acyclovir levels. Concurrent use with other nephrotoxic drugs (e.g., aminoglycosides, cyclosporine, tacrolimus) may increase the risk of kidney injury. It's important to inform your doctor about all medications, supplements, and herbal products you are taking.

Adalimumab (Humira)

Purpose/Indication	Adalimumab is a biologic medication used to treat various chronic inflammatory and autoimmune conditions. These include rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis, Crohn's disease, ulcerative colitis, plaque psoriasis, hidradenitis suppurativa, and certain types of uveitis. It works by reducing inflammation in the body.
Method of Action	Adalimumab is a monoclonal antibody that specifically binds to and neutralizes tumor necrosis factor-alpha (TNF-a), a protein that plays a key role in inflammatory and immune responses. By blocking TNF-a, adalimumab reduces the inflammation and tissue damage associated with various autoimmune diseases.
Medication Name & Brand Names	The generic name is Adalimumab. The original brand name is Humira. There are also several biosimilar versions available globally, such as Amgevita, Hyrimoz, Idacio, Imraldi, and Yuflyma.
Pharmaceutical Forms & Appearance	Adalimumab is supplied as a clear to slightly opalescent, colorless to pale yellow solution. It is available in prefilled syringes or autoinjector pens for subcutaneous (SC) injection. Some formulations may also be available in single-dose vials.
Dosage & Administration	Adalimumab is administered by subcutaneous injection. The dosage and frequency vary significantly depending on the condition being treated, as well as the patient's age and weight. For many conditions, it is given as an initial loading dose followed by maintenance doses every other week. Patients or caregivers are often trained to self-administer the injections at home.
Supplied As	Adalimumab is typically supplied in single-use prefilled syringes or autoinjector pens. These devices contain the ready-to-use solution for subcutaneous injection. Some original formulations may also be available in single-dose vials.
Contraindications	Adalimumab is contraindicated in patients with a history of hypersensitivity to adalimumab or any of its components. It should not be initiated in patients with active, serious infections, including active tuberculosis. Caution is advised in patients with chronic or recurrent infections, moderate to severe heart failure, or certain demyelinating neurological disorders.
Storage & Expiry	Adalimumab should be stored refrigerated at 2°C to 8°C (36°F to 46°F) in its original carton to protect from light. It must not be frozen. If removed from refrigeration, it can typically be stored at room temperature (up to 25°C or 77°F) for a limited period, usually up to 14 days, but must be discarded if not used within that timeframe. Always refer to the specific product packaging for exact storage conditions and expiration dates.
Side Effects	Common side effects include injection site reactions (redness, pain, swelling), headaches, and upper respiratory tract infections. More serious but less common side effects can include serious infections (e.g., tuberculosis, fungal infections, bacterial sepsis), reactivation of hepatitis B virus, new or worsening heart failure, certain cancers (e.g., lymphoma), and rare neurological reactions. Patients should be monitored for signs of infection.

Warnings & Precautions	Patients must be screened for latent tuberculosis and hepatitis B infection before starting treatment. Live vaccines should not be administered during adalimumab therapy or shortly after discontinuation. Patients should be closely monitored for signs of infection throughout treatment, and any serious infections require discontinuation. Use with caution in patients with a history of malignancy, heart failure, or demyelinating disorders. Hypersensitivity reactions can occur, and patients should be advised on symptoms requiring immediate medical attention.
Missed Dose Instructions	If a dose of Adalimumab is missed, it should be injected as soon as remembered. Subsequent doses should then be administered according to the newly established schedule, maintaining the recommended interval. Do not take a double dose to make up for a missed one. Patients should contact their healthcare provider for specific guidance if a dose is missed.
Overdose Instructions	There is limited clinical experience with adalimumab overdose. In cases of overdose, patients should be monitored for any signs or symptoms of adverse reactions and provided with appropriate symptomatic treatment. Contact a healthcare professional or poison control center immediately for advice.
Medicine Interactions	Concurrent use of Adalimumab with other TNF blockers (e.g., etanercept, infliximab) or other biologic DMARDs (e.g., abatacept, anakinra) is not recommended due to an increased risk of serious infections. Live vaccines should be avoided. While often used with methotrexate, it can increase adalimumab levels. Caution is advised when used with other immunosuppressants. Patients should inform their healthcare provider of all concomitant medications, including over-the-counter drugs and supplements.

Albendazole (Zentel)

Purpose/Indication	Albendazole is an anti-parasitic medication used to treat various worm infections in humans. Its primary uses include treating neurocysticercosis (caused by pork tapeworms), cystic hydatid disease (caused by dog tapeworms), and a range of intestinal worm infections like roundworm, hookworm, whipworm, pinworm, and strongyloidiasis.
Method of Action	Albendazole works by interfering with the worm's metabolism. Specifically, it inhibits tubulin polymerization, which leads to the loss of cytoplasmic microtubules in the parasitic worms. This disruption prevents the worms from absorbing glucose, depleting their energy stores, and ultimately leading to their death.
Medication Name & Brand Names	♦ Medication Name: Albendazole ♦ Brand Name: Albenza (US), Zentel (International)
Pharmaceutical Forms & Appearance	Albendazole is typically available as oral tablets, which may be chewable. The tablets are usually white or off-white.
Dosage & Administration	Dosage varies widely depending on the type of worm infection. For many intestinal infections, a single dose of 400 mg is common. For systemic infections like neurocysticercosis or hydatid disease, higher doses (e.g., 400 mg twice daily) are given for longer durations (days to months), often in cycles with breaks. It should generally be taken with food, especially a fatty meal, to enhance absorption.
Supplied As	Albendazole is supplied as oral tablets, commonly 200 mg or 400 mg strengths.
Contraindications	Albendazole is generally contraindicated in individuals with known hypersensitivity to albendazole or similar drugs (e.g., mebendazole). It is usually avoided during pregnancy, especially in the first trimester, due to potential risk to the fetus. Caution is advised in patients with liver disease or pre-existing bone marrow suppression.
Storage & Expiry	Albendazole tablets should be stored at room temperature (typically below 30°C or 86°F), protected from moisture. Keep them in their original packaging, out of direct light. Always check the specific expiry date printed on the packaging.
Side Effects	Common side effects include headache, nausea, vomiting, abdominal pain, and dizziness. For longer courses of treatment, more serious side effects can occur, such as elevated liver enzymes, temporary hair loss, and suppression of bone marrow (leading to low white blood cell or platelet counts).
Warnings & Precautions	♦ For prolonged treatment, liver function tests and blood counts (e.g., complete blood count) should be monitored. ♦ In neurocysticercosis, treatment can cause increased intracranial pressure or seizures due to the inflammatory response to dying parasites, requiring co-administration of corticosteroids and anticonvulsants. ♦ Women of childbearing age should use effective contraception during and for a period after treatment. ♦ Patients should be advised about potential dizziness affecting the ability to drive or operate machinery.
Missed Dose Instructions	If a dose is missed, take it as soon as remembered with food. However, if it is almost time for the next dose, skip the missed dose and continue the regular dosing schedule. Do not double the dose to catch up. For multi-day or cyclical treatments, adherence is important for efficacy.
Overdose Instructions	In case of an overdose, immediately seek medical attention or contact a poison control center. Symptoms of overdose are generally an exaggeration of known side effects. Supportive care and monitoring for adverse reactions would be the primary approach.
Medicine Interactions	Albendazole's levels can be increased by drugs like dexamethasone and praziquantel, or by grapefruit. Its levels can be decreased by phenytoin and fosphenytoin. Concomitant use with myelosuppressive agents may lead to additive bone marrow suppression. Always inform healthcare providers about all other medications being taken.

Alendronate (Fosamax)

Purpose/Indication	Alendronate is a bisphosphonate medication primarily used to prevent and treat osteoporosis, a condition characterized by weak, brittle bones that are prone to fractures. It is effective in postmenopausal women, men, and individuals with glucocorticoid-induced osteoporosis. It is also used to treat Paget's disease of bone.
Method of Action	Alendronate works by inhibiting osteoclast activity, which are the cells responsible for breaking down bone tissue. By slowing down bone resorption, alendronate allows the bone-forming cells (osteoblasts) to build new bone more effectively, leading to increased bone density and reduced risk of fractures.
Medication Name & Brand Names	♦ Medication Name: Alendronate ♦ Brand Names: Fosamax, Binosto, Fosavance
Pharmaceutical Forms & Appearance	Alendronate is typically available as oral tablets (various strengths), effervescent tablets that dissolve in water, and oral solution (liquid). Tablets are usually white or off-white. The effervescent tablets will fizz when dissolved.

Dosage & Administration	Alendronate is usually taken once daily or once weekly, depending on the indication and specific product. It must be taken first thing in the morning with a full glass of plain water (not mineral water or other beverages), at least 30 minutes before any food, drink, or other medications. Patients must remain upright (sitting or standing) for at least 30 minutes after taking the dose and until after their first food of the day to prevent esophageal irritation.
Supplied As	Alendronate is supplied as oral tablets (e.g., 5 mg, 10 mg, 35 mg, 40 mg, 70 mg), effervescent tablets (70 mg), and oral solution (70 mg/75 mL).
Contraindications	Alendronate is contraindicated in patients with known hypersensitivity to any component, abnormalities of the esophagus that delay esophageal emptying (e.g., stricture, achalasia), inability to stand or sit upright for at least 30 minutes, or hypocalcemia (low blood calcium). It is not recommended for patients with severe renal impairment (creatinine clearance less than 35 mL/min).
Storage & Expiry	Alendronate tablets and solutions should be stored at room temperature, typically between 15°C to 30°C (59°F to 86°F), protected from moisture. Keep in the original container. Effervescent tablets should be protected from moisture. Always check the specific expiry date on the packaging and do not use if expired.
Side Effects	Common side effects include abdominal pain, dyspepsia (indigestion), nausea, constipation, diarrhea, flatulence, and musculoskeletal pain (bone, joint, and/or muscle). Serious but less common side effects include esophageal irritation/ulcers, osteonecrosis of the jaw (ONJ), atypical femur fractures, and severe bone, joint, or muscle pain.
Warnings & Precautions	♦ Ensure adequate calcium and vitamin D intake. Correct hypocalcemia before starting treatment. ♦ Patients must strictly follow administration instructions to minimize esophageal irritation. ♦ Rare cases of osteonecrosis of the jaw (ONJ) have been reported, often associated with dental procedures or poor oral hygiene; dental evaluation is recommended before starting. ♦ Atypical femur fractures have been reported; patients with new or worsening thigh or groin pain should be evaluated. ♦ Discontinue if severe musculoskeletal pain develops. ♦ Use with caution in patients with active upper GI problems or kidney impairment.
Missed Dose Instructions	If a daily dose is missed, skip it and take the next dose as scheduled the following morning; do not take two doses on the same day. If a weekly dose is missed, take it on the morning after remembered; then return to the usual weekly schedule. Do not take two doses on the same day.
Overdose Instructions	Symptoms of overdose may include hypocalcemia, hypophosphatemia, and upper gastrointestinal adverse reactions like upset stomach, heartburn, esophagitis, gastritis, or ulcer. In case of overdose, milk or antacids should be given orally to bind alendronate and minimize absorption. Vomiting should not be induced due to the risk of esophageal irritation. The patient should remain fully upright. Seek immediate medical attention.
Medicine Interactions	♦ Food, beverages (other than plain water), calcium supplements, antacids, iron supplements, and multivitamins with minerals significantly reduce the absorption of alendronate. These should be taken at least 30 minutes, and ideally 2 hours, after alendronate. ♦ NSAIDs (e.g., aspirin, ibuprofen) may increase the risk of upper gastrointestinal side effects when taken with alendronate. ♦ Some specific drugs like ranitidine or certain polyvalent cations can affect absorption.

Amlodipine (Norvasc)

Purpose/Indication	Amlodipine is a calcium channel blocker primarily used to treat high blood pressure (hypertension) and certain types of chest pain (angina pectoris), including chronic stable angina and vasospastic (Prinzmetal's) angina. It helps relax blood vessels, allowing blood to flow more easily and reducing the workload on the heart.
Method of Action	Amlodipine works by blocking the influx of calcium ions into vascular smooth muscle and myocardial (heart muscle) cells. This action causes relaxation of vascular smooth muscle, leading to vasodilation (widening of blood vessels), which lowers blood pressure and increases blood flow to the heart muscle, relieving angina.
Medication Name & Brand Names	♦ Medication Name: Amlodipine ♦ Brand Name: Norvasc
Pharmaceutical Forms & Appearance	Amlodipine is typically available as oral tablets in various strengths (e.g., 2.5 mg, 5 mg, 10 mg). The tablets are usually white and may be scored or debossed with the strength or manufacturer's code.
Dosage & Administration	Amlodipine is usually taken once daily, with or without food. The starting dose for hypertension is often 2.5 mg or 5 mg, which can be titrated up to a maximum of 10 mg daily depending on the patient's response and tolerability. It's important to take it consistently at about the same time each day.
Supplied As	Amlodipine is supplied as oral tablets in various strengths.
Contraindications	Amlodipine is contraindicated in individuals with known hypersensitivity to amlodipine or other dihydropyridine calcium channel blockers. It should be used with caution, or doses may need adjustment, in patients with severe aortic stenosis, obstructive coronary artery disease, or liver impairment.
Storage & Expiry	Amlodipine tablets should be stored at room temperature (typically 15°C to 30°C or 59°F to 86°F), protected from light and moisture. Keep them in their original container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include peripheral edema (swelling, especially in ankles and feet), headache, fatigue, nausea, abdominal pain, and flushing. Less common but more serious side effects can include dizziness, palpitations, excessive lowering of blood pressure (hypotension), and rarely, worsening of angina or myocardial infarction (heart attack) upon initiation or dose increase.
Warnings & Precautions	♦ Caution should be exercised in patients with severe heart failure, as it may worsen their condition in some cases. ♦ Patients with liver impairment may require lower doses and careful monitoring. ♦ Excessive lowering of blood pressure can occur, especially during initial therapy or dose titration. ♦ Peripheral edema is a common side effect and should be monitored, but it is often dose-dependent.
Missed Dose Instructions	If a dose of Amlodipine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose (e.g., within 10-12 hours of the next dose), skip the missed dose and continue with the regular dosing schedule. Do not take a double dose to make up for a missed one.
Overdose Instructions	Overdose can lead to excessive peripheral vasodilation with marked and prolonged systemic hypotension (very low blood pressure) and possibly reflex tachycardia (rapid heart rate). Severe, prolonged hypotension may result in shock and death. Treatment involves supportive cardiovascular care, including monitoring of cardiac and respiratory function, elevation of extremities, and management of fluid volume and blood pressure with vasopressors if necessary. Calcium gluconate may also be administered intravenously. Seek immediate medical attention.

Medicine Interactions	♦ Concurrent use with strong CYP3A4 inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, ritonavir) can significantly increase amlodipine exposure, potentially leading to increased side effects. ♦ Strong CYP3A4 inducers (e.g., rifampicin, St. John's Wort) may reduce amlodipine's effectiveness. ♦ Amlodipine may increase blood levels of simvastatin and tacrolimus. ♦ Grapefruit juice should be consumed in moderation as it may increase amlodipine levels.

Amoxicillin (Amoxil)

Purpose/Indication	Amoxicillin is a common antibiotic prescribed to treat a variety of bacterial infections, including those affecting the ears, nose, throat, lungs, skin, and urinary tract. It is also used in combination with other medications to treat H. pylori infections and associated stomach ulcers. This medication is not effective against viral infections like the common cold or flu.
Method of Action	Amoxicillin acts by inhibiting the synthesis of bacterial cell walls, which is essential for the bacteria's survival and structural integrity. This leads to the weakening and eventual death of the bacterial cells. It is a penicillin-class antibiotic, but its effectiveness can be reduced by certain bacterial enzymes known as beta-lactamases.
Medication Name & Brand Names	The generic name is Amoxicillin. It is widely available under various brand names, including Amoxil, Trimox, Sumox, and Moxatag (an extended-release form).
Pharmaceutical Forms & Appearance	Amoxicillin is available in several oral forms: capsules, tablets (which may be scored or chewable), and as a powder for oral suspension that is reconstituted with water to form a liquid, often pink and flavored, commonly used for children. Dispersible tablets are also an option. In healthcare settings, it may be provided as a powder for injection.
Dosage & Administration	The dosage and duration of Amoxicillin therapy depend on the specific infection, its severity, and patient factors like age, weight, and kidney function. It is typically taken two or three times a day and can be administered with or without food. Completing the full course of treatment, even if symptoms improve, is crucial to effectively eradicate the infection and prevent antibiotic resistance.
Supplied As	Amoxicillin is commonly supplied as capsules, tablets (including chewable and extended-release), and as a dry powder that is reconstituted to form an oral suspension. It can also be found as a powder for injection in medical environments.
Contraindications	Amoxicillin is contraindicated in individuals with a history of severe allergic reactions (e.g., anaphylaxis or severe skin reactions) to amoxicillin or other beta-lactam antibiotics (penicillins or cephalosporins). It should generally be avoided in patients with infectious mononucleosis due to an increased risk of a generalized skin rash.
Storage & Expiry	Capsules and tablets typically have a shelf life of around two years when stored at room temperature in their original, moisture-protected packaging. Once the powder for oral suspension is mixed with water, it usually must be refrigerated and used within 7 to 14 days, after which any remaining portion should be discarded. Always check the specific packaging for storage instructions and expiry dates.
Side Effects	Common side effects include mild gastrointestinal disturbances such as diarrhea, nausea, and vomiting. A skin rash may also occur, which could indicate an allergic reaction, especially if severe. More serious but less frequent side effects can include severe allergic reactions (e.g., hives, swelling, breathing difficulties, requiring immediate medical attention), severe skin conditions, or Clostridioides difficile-associated diarrhea. Rarely, liver issues or drug-induced enterocolitis syndrome can occur.
Warnings & Precautions	Patients should inform their healthcare provider of any allergy history, particularly to penicillins or cephalosporins, as severe allergic reactions can be life-threatening. Amoxicillin should only be used for bacterial infections to prevent antibiotic resistance, and the full course of treatment is vital. Persistent or severe diarrhea should be reported due to the risk of Clostridioides difficile-associated diarrhea. Caution is advised for patients with kidney impairment, potentially requiring dosage adjustments. Amoxicillin can interfere with some urine glucose tests, leading to false-positive results. Use during breastfeeding should be discussed with a healthcare professional, as it can pass into breast milk. Older adults may also require dosage adjustments due to reduced kidney function.
Missed Dose Instructions	If a dose of Amoxicillin is missed, it should be taken as soon as remembered. However, if it is almost time for the next scheduled dose, the missed dose should be skipped, and the regular dosing schedule resumed. Double doses should not be taken to compensate for a missed one, as this can increase the risk of side effects. If multiple doses are missed, consult a healthcare professional for guidance.
Overdose Instructions	In the event of an Amoxicillin overdose, immediate contact with a healthcare professional, emergency services, or a poison control center is recommended. While an overdose is rarely life-threatening, it can lead to significant gastrointestinal symptoms like severe stomach upset and diarrhea, and in rare instances, kidney problems. Increased fluid intake may be advised to help with symptoms.
Medicine Interactions	Amoxicillin can interact with several other medications. It may enhance the effects of blood thinners like warfarin, increasing bleeding risk. Concurrent use with allopurinol can raise the risk of skin rash. Probenecid can increase amoxicillin levels in the body, potentially increasing side effects. Amoxicillin may reduce the effectiveness of some oral contraceptives, necessitating alternative birth control methods. It can also increase levels of methotrexate and may reduce the efficacy of certain live bacterial vaccines. Always inform your healthcare professional about all medications, supplements, and herbal products being taken to prevent potential interactions.

Amoxicillin/Clavulanate (Augmentin)

Purpose/Indication	Amoxicillin/Clavulanate is a combination antibiotic used to treat a wide range of bacterial infections. It's effective against infections of the ear (otitis media), sinus (sinusitis), respiratory tract (pneumonia, bronchitis), skin and soft tissue, and urinary tract, particularly those caused by bacteria that produce beta-lactamase enzymes.
Method of Action	This medication combines amoxicillin, a penicillin-class antibiotic, with clavulanate (clavulanic acid), a beta-lactamase inhibitor. Amoxicillin works by inhibiting bacterial cell wall synthesis, leading to bacterial death. Clavulanate protects amoxicillin from degradation by beta-lactamase enzymes produced by some bacteria, thus extending amoxicillin's spectrum of activity against resistant strains.
Medication Name & Brand Names	♦ Medication Name: Amoxicillin/Clavulanate ♦ Brand Name: Augmentin (most common globally), Co-amoxiclav, Clavamox, Curam, Amoxiclav
Pharmaceutical Forms & Appearance	It is commonly available as oral tablets (various strengths), chewable tablets, and a powder for oral suspension (liquid that needs to be reconstituted with water). Tablets are typically white or off-white, and the reconstituted suspension is usually an off-white to yellowish liquid, often with a fruit flavor.
Dosage & Administration	Dosage varies based on the infection's severity, patient's age/weight, and renal function. It's typically taken two or three times a day, usually at the start of a meal or with a snack to minimize gastrointestinal upset and optimize absorption. The full prescribed course should be completed, even if symptoms improve.

Supplied As	Amoxicillin/Clavulanate is supplied as oral tablets (e.g., 250mg/125mg, 500mg/125mg, 875mg/125mg, 1000mg/62.5mg extended-release) and as a powder for oral suspension (various concentrations, e.g., 200mg/28.5mg/5mL, 400mg/57mg/5mL, 600mg/42.9mg/5mL).
Contraindications	It is contraindicated in patients with a history of severe hypersensitivity (e.g., anaphylaxis, severe skin reactions) to amoxicillin, clavulanate, or other penicillin antibiotics. It should also not be used in individuals with a history of cholestatic jaundice or liver dysfunction associated with previous amoxicillin/clavulanate therapy.
Storage & Expiry	Tablets should be stored at room temperature, protected from moisture. The reconstituted oral suspension must be stored in a refrigerator (2°C to 8°C or 36°F to 46°F) and typically remains stable for 7 to 10 days; discard any unused portion after this time. Check the specific product label for exact storage and expiry information. Do not freeze the suspension.
Side Effects	Common side effects include diarrhea, nausea, vomiting, abdominal pain, and skin rash. More serious, but less common, side effects can include severe allergic reactions (anaphylaxis), liver dysfunction (jaundice), Clostridioides difficile-associated diarrhea (CDAD), and skin reactions (e.g., Stevens-Johnson syndrome).
Warnings & Precautions	♦ Prior to initiation, inquire about previous hypersensitivity reactions to penicillins or cephalosporins. ♦ Monitor liver function tests, especially during prolonged therapy, and discontinue if liver dysfunction occurs. ♦ Clostridioides difficile-associated diarrhea (CDAD) has been reported and can occur even months after therapy; evaluate patients presenting with diarrhea. ♦ A high percentage of patients with mononucleosis treated with amoxicillin/clavulanate develop a rash. ♦ Not effective against viral infections.
Missed Dose Instructions	If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose to make up for a missed one. It's crucial to complete the entire course of antibiotics.
Overdose Instructions	Overdose is generally not life-threatening but can lead to gastrointestinal symptoms such as nausea, vomiting, abdominal pain, and diarrhea. In rare cases, neurological symptoms like seizures may occur, especially in patients with impaired renal function. Treatment is supportive, focusing on managing symptoms and maintaining hydration. Hemodialysis can remove both amoxicillin and clavulanate from the circulation. Seek medical attention for significant overdose.
Medicine Interactions	♦ Probenecid increases amoxicillin levels. ♦ Allopurinol may increase the incidence of skin rash. ♦ Warfarin and other anticoagulants: May increase the risk of bleeding; increased monitoring of INR/prothrombin time may be required. ♦ Oral contraceptives: May reduce the effectiveness of oral contraceptives; advise patients to use an alternative or additional method of contraception. ♦ Methotrexate: May increase methotrexate toxicity by reducing its renal excretion.

Ampicillin (Principen)

Purpose/Indication	Ampicillin is an aminopenicillin antibiotic used to treat a variety of bacterial infections. It is effective against susceptible Gram-positive bacteria (e.g., certain Streptococcus species, Listeria monocytogenes) and some Gram-negative bacteria (e.g., Haemophilus influenzae, Escherichia coli, Salmonella species, Shigella species). Indications include respiratory tract infections, urinary tract infections, gastrointestinal infections, meningitis, and specific infections like listeriosis.
Method of Action	Ampicillin is a beta-lactam antibiotic that acts by inhibiting bacterial cell wall synthesis. It binds to penicillin-binding proteins (PBPs) located on the inner surface of the bacterial cell membrane, which are essential for the cross-linking of peptidoglycan strands, a crucial step in the formation of the bacterial cell wall. By inhibiting this process, ampicillin weakens the cell wall, leading to osmotic lysis and ultimately bacterial cell death (bactericidal action).
Medication Name & Brand Names	♦ Medication Name: Ampicillin (often as Ampicillin Trihydrate or Ampicillin Sodium) ♦ Brand Names: Principen (oral capsules - regional), Omnipen (oral/injection - regional), Amcill (regional), Ampicillin (generic) ♦ Combination Products: Unasyn (ampicillin/sulbactam)
Pharmaceutical Forms & Appearance	Ampicillin is available as oral capsules, oral suspensions (for reconstitution), and powder for injection (for intravenous or intramuscular administration). Oral capsules are typically opaque, with various colors and imprints. Oral suspensions are granular powders that become opaque white or off-white when reconstituted. The powder for injection is white or off-white.
Dosage & Administration	Dosage varies widely depending on the type and severity of infection, patient age, weight, and renal function. For oral infections, typical adult doses are 250 mg to 500 mg every 6 hours. For intravenous/intramuscular severe infections, typical adult doses range from 1 gram to 2 grams every 4-6 hours. It is best taken on an empty stomach (at least 30 minutes before or 2 hours after meals) to optimize absorption. Dose adjustments are necessary for patients with renal impairment.
Supplied As	Ampicillin is supplied as: oral capsules (e.g., 250 mg, 500 mg), powder for oral suspension (e.g., 125 mg/5 mL, 250 mg/5 mL after reconstitution), and powder for injection (e.g., 250 mg, 500 mg, 1 gram, 2 grams per vial).
Contraindications	Ampicillin is strictly contraindicated in patients with known severe hypersensitivity (e.g., anaphylaxis, Stevens-Johnson syndrome) to ampicillin, any penicillin, or any other beta-lactam antibiotic (due to potential cross-reactivity). It is also contraindicated in patients with infectious mononucleosis, as a characteristic non-allergic rash can develop.
Storage & Expiry	Ampicillin oral capsules and powder for injection should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F). The powder for oral suspension should be stored dry, and once reconstituted, the suspension typically requires refrigeration (2°C to 8°C or 36°F to 46°F) and has a limited shelf life (e.g., 14 days). Reconstituted IV solutions also have limited stability and should be used promptly. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances (diarrhea, nausea, vomiting), rash (maculopapular, non-allergic, particularly in mononucleosis), and candidiasis (oral or vaginal thrush). More serious but less common side effects include hypersensitivity reactions (e.g., anaphylaxis, angioedema, urticaria), Clostridioides difficile-associated diarrhea (CDAD), severe skin reactions (e.g., Stevens-Johnson Syndrome), hematologic abnormalities (e.g., anemia, leukopenia, thrombocytopenia), and liver enzyme elevations.
Warnings & Precautions	♦ Hypersensitivity Reactions: Serious and occasionally fatal hypersensitivity (anaphylactic) reactions have been reported, especially in individuals with a history of penicillin or multiple allergen sensitivities. Careful inquiry about previous allergic reactions is essential before starting therapy. Discontinue immediately if an allergic reaction occurs. ♦ Infectious Mononucleosis: Patients with infectious mononucleosis who receive ampicillin often develop a non-allergic, erythematous maculopapular rash. Avoid use in this condition. ♦ Clostridioides difficile-associated Diarrhea (CDAD): Can occur with nearly all antibacterial agents, including ampicillin, ranging from mild diarrhea to fatal colitis. Evaluate patients who present with diarrhea after antibiotic use. ♦ Renal Impairment: Dose adjustments are necessary for patients with impaired renal function due to potential accumulation of ampicillin and increased risk of toxicity. ♦ Hepatic Impairment: Use with caution in patients with hepatic dysfunction. ♦ Superinfection: Prolonged use can lead to overgrowth of non-susceptible organisms, including fungi and other bacteria. ♦ Seizures: High doses, especially in patients with renal impairment, can lead to CNS toxicity and seizures. ♦ Electrolyte Imbalance: High IV doses can lead to sodium overload. ♦ Drug Resistance: Use responsibly to prevent the development of antibiotic resistance.

Missed Dose Instructions	If a dose of Ampicillin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course of antibiotics is crucial for effective bacterial eradication and preventing the development of drug resistance and relapse of infection.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset (nausea, vomiting, diarrhea), and potential for severe allergic reactions or neurological toxicity (e.g., seizures), especially with high doses or in patients with renal impairment. There is no specific antidote for ampicillin. Treatment is supportive and and symptomatic. Hemodialysis can remove ampicillin from the blood and may be beneficial in severe overdose or acute renal failure. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Oral Contraceptives: May reduce the effectiveness of oral contraceptives, increasing the risk of unintended pregnancy. Advise alternative birth control methods during therapy. ♦ Allopurinol: Concomitant use with ampicillin significantly increases the incidence of skin rash, particularly in hyperuricemic patients. ♦ Probenecid: Decreases the renal tubular secretion of ampicillin, leading to increased and prolonged blood levels of ampicillin. This interaction is sometimes used therapeutically to enhance ampicillin's effect. ♦ Tetracyclines: Bacteriostatic antibiotics like tetracyclines may antagonize the bactericidal effect of penicillin-type antibiotics like ampicillin. Avoid concomitant use when the bactericidal effect of ampicillin is crucial. ♦ Aminoglycosides (e.g., gentamicin, amikacin): Can inactivate aminoglycosides in vitro when mixed together, especially in high concentrations or in patients with severe renal impairment. Administer separately. ♦ Warfarin: May potentiate the anticoagulant effect, increasing bleeding risk by altering gut flora. Monitor INR closely. ♦ Methotrexate: Ampicillin may reduce methotrexate clearance, potentially increasing its toxicity. Monitor methotrexate levels.

Apixaban (Eliquis)

Purpose/Indication	Apixaban is an oral anticoagulant used to prevent and treat blood clots. It is primarily indicated to reduce the risk of stroke and systemic embolism in patients with nonvalvular atrial fibrillation. It also treats deep vein thrombosis (DVT) and pulmonary embolism (PE), and prevents recurrent DVT and PE after initial therapy, as well as preventing DVT/PE in patients undergoing hip or knee replacement surgery.
Method of Action	Apixaban is a highly selective, direct Factor Xa (FXa) inhibitor. Factor Xa is a key component in the coagulation cascade, responsible for converting prothrombin to thrombin, which then leads to fibrin formation and clot development. By inhibiting both free and clot-bound FXa, apixaban prevents thrombin generation and thus inhibits blood clot formation.
Medication Name & Brand Names	♦ Medication Name: Apixaban ♦ Brand Name: Eliquis
Pharmaceutical Forms & Appearance	Apixaban is available as oral tablets in various strengths (e.5 mg and 2.5 mg are common). The tablets are typically round, biconvex, and film-coated, with different colors and debossed markings depending on the strength (e.g., 2.5 mg may be yellow, 5 mg may be pink).
Dosage & Administration	Apixaban is usually taken twice daily, with or without food. The dosage varies depending on the indication (e.g., 5 mg twice daily for most atrial fibrillation patients, 2.5 mg twice daily for prophylaxis post-surgery, or initial higher doses for DVT/PE treatment). Consistency in timing is important. Tablets can be crushed and mixed with water, apple juice, or applesauce for those who cannot swallow them whole.
Supplied As	Apixaban is supplied as oral tablets in blister packs, in various strengths (e.g., 2.5 mg, 5 mg).
Contraindications	Apixaban is contraindicated in patients with active pathological bleeding (e.g., active ulcer disease, intracranial hemorrhage) and in those with a history of severe hypersensitivity reaction to apixaban. It should be used with extreme caution or avoided in patients with hepatic disease associated with coagulopathy and clinically relevant bleeding risk, or severe renal impairment.
Storage & Expiry	Apixaban tablets should be stored at room temperature (typically below 30°C or 86°F), protected from moisture and light, in their original packaging. Always check the specific expiry date printed on the packaging and do not use if expired.
Side Effects	The most significant side effect is bleeding, which can range from minor (e.g., bruising, nosebleeds, gum bleeding) to serious or even fatal (e.g., gastrointestinal bleeding, intracranial hemorrhage). Other common side effects include nausea. Allergic reactions, though rare, can also occur.
Warnings & Precautions	♦ Increased Risk of Thrombotic Events after Premature Discontinuation: Premature discontinuation significantly increases the risk of stroke or blood clots. Do not stop taking without consulting a doctor. ♦ Bleeding Risk: Apixaban increases the risk of bleeding. Patients should be advised of signs of bleeding and to report them immediately. Concomitant use with other drugs affecting hemostasis (e.g., NSAIDs, antiplatelet agents, other anticoagulants) further increases this risk. ♦ Spinal/Epidural Hematoma: Risk of severe, potentially permanent paralysis if used with spinal anesthesia or spinal puncture. ♦ Not recommended for patients with prosthetic heart valves. ♦ Caution with liver or kidney disease.
Missed Dose Instructions	If a dose of Apixaban is missed, it should be taken as soon as remembered. However, if it is almost time for the next scheduled dose (e.g., less than 6 hours until the next dose for twice-daily dosing), the missed dose should be skipped, and the regular dosing schedule resumed. Do not take a double dose to make up for a missed one. Consistent adherence is crucial for efficacy.
Overdose Instructions	Overdose with apixaban significantly increases the risk of bleeding. Symptoms are primarily exaggerated bleeding events. There is a specific reversal agent (andexanet alfa) available in some regions for life-threatening or uncontrolled bleeding. Activated charcoal may be considered if ingested within a few hours of a significant overdose to reduce absorption. Hemodialysis does not substantially remove apixaban. Immediate medical attention is crucial for suspected overdose.
Medicine Interactions	♦ Increased Bleeding Risk: Concomitant use with other anticoagulants (e.g., warfarin, heparin), antiplatelet agents (e.g., aspirin, clopidogrel), NSAIDs (e.g., ibuprofen, naproxen), SSRIs/SNRIs, and thrombolytic agents significantly increases the risk of bleeding. Avoid concurrent use where possible, or use with extreme caution. ♦ CYP3A4 and P-gp Inhibitors/Inducers: Strong dual inhibitors of CYP3A4 and P-glycoprotein (e.g., ketoconazole, itraconazole, ritonavir, clarithromycin) can increase apixaban levels and bleeding risk. Strong dual inducers (e.g., rifampicin, carbamazepine, phenytoin, St. John's Wort) can decrease apixaban levels, reducing effectiveness. Dose adjustments or avoidance may be necessary. ♦ Grapefruit juice may increase apixaban levels.

Aspirin (Bayer Aspirin)

Purpose/Indication	Aspirin is a non-steroidal anti-inflammatory drug (NSAID) with multiple uses. It is primarily used to relieve mild to moderate pain (e.g., headache, muscle aches, toothache), reduce fever, and alleviate inflammation (e.g., in arthritis). In low doses, it's widely used to prevent blood clots, thereby reducing the risk of heart attacks and strokes in individuals at high risk.

Method of Action	Aspirin's analgesic, anti-inflammatory, and antipyretic (fever-reducing) effects stem from its irreversible inhibition of cyclooxygenase (COX-1 and COX-2) enzymes. This prevents the synthesis of prostaglandins, which are mediators of pain, inflammation, and fever. Its antiplatelet effect, crucial for cardiovascular prevention, comes from its irreversible inhibition of COX-1 in platelets, which reduces thromboxane A2 production, thereby preventing platelet aggregation and clot formation.
Medication Name & Brand Names	♦ Medication Name: Aspirin (Acetylsalicylic Acid - ASA) ♦ Brand Names: Bayer, Disprin, Ecotrin, Bufferin, Anacin, Excedrin, Empirin (often combined with other drugs)
Pharmaceutical Forms & Appearance	Aspirin is available in various oral forms: regular tablets, chewable tablets, enteric-coated tablets (to reduce stomach irritation), extended-release tablets, and effervescent tablets (dissolve in water). It can also be found in suppository form. Tablets are typically white.
Dosage & Administration	Dosage varies greatly depending on the indication. For pain and fever, doses typically range from 325 mg to 650 mg every 4-6 hours. For cardiovascular prevention, low doses (e.g., 75 mg to 325 mg daily) are commonly used. Enteric-coated tablets should be swallowed whole. It's generally recommended to take aspirin with food or milk to minimize gastrointestinal upset.
Supplied As	Aspirin is supplied as oral tablets (various strengths: e.g., 81 mg, 325 mg, 500 mg), chewable tablets, enteric-coated tablets, extended-release tablets, and effervescent tablets.
Contraindications	Aspirin is contraindicated in individuals with known hypersensitivity (allergy) to aspirin or other NSAIDs, or a history of asthma, urticaria, or other allergic-type reactions after taking NSAIDs. It should not be used in children and teenagers for viral infections (e.g., flu, chickenpox) due to the risk of Reye's syndrome. It is also contraindicated in patients with active peptic ulcer disease, bleeding disorders, or severe liver or kidney impairment.
Storage & Expiry	Aspirin tablets should be stored at room temperature (typically 15°C to 30°C or 59°F to 86°F), protected from moisture. Do not use if the tablets smell strongly of vinegar, as this indicates degradation. Keep in the original container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., heartburn, nausea, stomach pain), and increased risk of bleeding (e.g., bruising, nosebleeds). More serious but less common side effects include gastrointestinal ulcers or bleeding, allergic reactions (rash, difficulty breathing), tinnitus (ringing in ears) at high doses, and kidney dysfunction.
Warnings & Precautions	♦ Bleeding Risk: Aspirin can increase the risk of serious bleeding, including gastrointestinal bleeding and hemorrhagic stroke. Use with caution in patients with bleeding disorders, a history of ulcers, or those undergoing surgery. ♦ Reye's Syndrome: Do not give to children or teenagers with viral illnesses due to the rare but serious risk of Reye's syndrome, which can cause severe liver and brain swelling. ♦ Kidney/Liver Impairment: Use with caution in patients with pre-existing kidney or liver disease. ♦ Asthma: Can exacerbate asthma in some susceptible individuals (aspirin-exacerbated respiratory disease). ♦ Discontinue several days prior to surgery to minimize bleeding risk.
Missed Dose Instructions	For pain/fever relief (as-needed dosing), take a dose when pain/fever is present. For regular low-dose cardiovascular prevention, if a daily dose is missed, take it as soon as remembered unless it's almost time for the next dose; in that case, skip the missed dose. Do not take a double dose. Consistency is important for antiplatelet effect, but missing one dose is usually not critical.
Overdose Instructions	Aspirin overdose (salicylate toxicity) can be very serious and requires immediate medical attention. Symptoms can include tinnitus, dizziness, nausea, vomiting, confusion, rapid breathing, fever, sweating, and in severe cases, seizures, coma, and metabolic acidosis. Treatment involves supportive care, gastric decontamination (e.g., activated charcoal if early), urinary alkalinization to promote excretion, and possibly hemodialysis for severe cases.
Medicine Interactions	♦ Anticoagulants/Antiplatelets: Increased risk of bleeding when taken with warfarin, heparin, clopidogrel, or other NSAIDs. ♦ Corticosteroids: Increased risk of gastrointestinal ulcers and bleeding. ♦ Methotrexate: Aspirin can increase methotrexate levels, leading to increased toxicity. ♦ Diuretics and ACE Inhibitors: Aspirin can reduce the effectiveness of these blood pressure medications. ♦ Alcohol: Increased risk of gastrointestinal bleeding. ♦ Other NSAIDs: Avoid concurrent use with other NSAIDs (e.g., ibuprofen, naproxen) as it can increase side effects without significant additional benefit.

Atazanavir (Reyataz)

Purpose/Indication	Atazanavir is an antiretroviral medication used to treat human immunodeficiency virus (HIV-1) infection in adults and pediatric patients. It belongs to the class of drugs known as protease inhibitors. It is always used in combination with other antiretroviral agents to manage HIV infection, helping to reduce the viral load and increase CD4 cell counts.
Method of Action	Atazanavir works by selectively inhibiting HIV-1 protease, an enzyme essential for the proteolytic cleavage of viral Gag and Gag-Pol polyproteins into mature functional proteins. This inhibition prevents the assembly of new, infectious HIV particles, thereby reducing viral replication and progression of the disease.
Medication Name & Brand Names	♦ Medication Name: Atazanavir ♦ Brand Name: Reyataz
Pharmaceutical Forms & Appearance	Atazanavir is available as oral capsules and as an oral powder (for pediatric use). Capsules are typically opaque, hard gelatin capsules of various colors (e.g., blue and white) with specific imprints indicating the dosage strength. The oral powder is typically a granular powder.
Dosage & Administration	Atazanavir is typically taken once daily, with food, to enhance absorption. The dosage varies based on whether it is boosted with ritonavir or cobicistat, and patient factors like renal or hepatic impairment. It is crucial to take it consistently with a meal to ensure adequate absorption and efficacy.
Supplied As	Atazanavir is supplied as oral capsules (e.g., 150 mg, 200 mg, 300 mg) and as an oral powder (e.g., 50 mg packets) for reconstitution.
Contraindications	Atazanavir is contraindicated in patients with a known hypersensitivity to atazanavir or any of its components. It is also contraindicated in patients with severe hepatic impairment, and in combination with certain medications due to significant drug-drug interactions that can lead to serious and/or life-threatening adverse events (e.g., strong CYP3A4 inducers, specific direct-acting antivirals, certain acid-reducing agents).
Storage & Expiry	Atazanavir capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), in a tightly closed container, protected from moisture and light. The oral powder should also be stored at room temperature. Always check the specific expiry date on the packaging and do not use if expired.

Side Effects	Common side effects include nausea, vomiting, diarrhea, headache, abdominal pain, and rash. A notable side effect is hyperbilirubinemia (increased bilirubin levels), which can cause jaundice (yellowing of skin/eyes), usually benign but can be cosmetically undesirable. Other serious side effects can include kidney stones, PR interval prolongation (heart rhythm issue), and severe skin reactions.
Warnings & Precautions	♦ Cardiac Conduction Abnormalities: Use with caution in patients with pre-existing conduction system disease or those taking drugs that prolong the PR interval. ♦ Hyperbilirubinemia: Patients commonly experience reversible increases in indirect bilirubin, which may cause jaundice or scleral icterus (yellowing of eyes). ♦ Nephrolithiasis/Cholelithiasis: Kidney stones and gallstones have been reported. ♦ Hepatotoxicity: Liver problems, including severe hepatic dysfunction, have occurred. ♦ Diabetes Mellitus/Hyperglycemia: New onset or worsening of diabetes has been reported in patients taking protease inhibitors. ♦ Fat Redistribution: Redistribution/accumulation of body fat can occur. ♦ Immune Reconstitution Inflammatory Syndrome (IRIS): Can occur in HIV-infected patients starting antiretroviral therapy.
Missed Dose Instructions	If a dose of atazanavir is missed and it is within 12 hours of the regularly scheduled time, take it with food as soon as remembered. If it is more than 12 hours past the usual time, skip the missed dose and resume the normal dosing schedule the next day. Do not take a double dose to make up for a missed one. Adherence to the dosing schedule is critical for effective HIV management.
Overdose Instructions	There is limited experience with atazanavir overdose. Symptoms would likely be an exaggeration of known side effects, particularly gastrointestinal issues and potential worsening of hyperbilirubinemia. Treatment should be supportive, involving general supportive measures, monitoring of vital signs, and observation for any adverse reactions. Hemodialysis is unlikely to be effective in removing atazanavir. Contact a healthcare professional or poison control center immediately.
Medicine Interactions	♦ Acid-Reducing Agents: Antacids, H2-receptor antagonists (e.g., famotidine), and proton pump inhibitors (e.g., omeprazole) significantly reduce atazanavir absorption; co-administration is generally not recommended or requires specific timing/dosing adjustments. ♦ CYP3A4 Substrates/Inhibitors/Inducers: Atazanavir is metabolized by and is an inhibitor of CYP3A4. Co-administration with drugs highly dependent on CYP3A4 for clearance can lead to increased levels of those drugs (e.g., statins, sildenafil, certain calcium channel blockers). Strong CYP3A4 inducers (e.g., rifampin, St. John's Wort, carbamazepine, phenytoin) can significantly decrease atazanavir levels, leading to loss of virologic response and resistance; co-administration is generally contraindicated. ♦ Ritonavir/Cobicistat: Atazanavir is typically boosted with low-dose ritonavir or cobicistat to improve its pharmacokinetic profile. ♦ Oral Contraceptives: Atazanavir may alter hormone levels; alternative contraception may be needed.

Atenolol (Tenormin)

Purpose/Indication	Atenolol is a beta-blocker medication used to treat high blood pressure (hypertension), angina pectoris (chest pain), and to manage certain cardiac arrhythmias (irregular heartbeats). It also helps to prevent future heart attacks in patients who have already had one. By slowing the heart rate and relaxing blood vessels, it reduces the heart's workload.
Method of Action	Atenolol selectively blocks beta-1 adrenergic receptors, primarily located in the heart. This blockade leads to a decrease in heart rate, force of myocardial contraction, and cardiac output. It also reduces the release of renin from the kidneys, contributing to its blood pressure-lowering effects. Its selective action means it has less impact on beta-2 receptors in the lungs, making it generally safer for patients with respiratory conditions compared to non-selective beta-blockers.
Medication Name & Brand Names	♦ Medication Name: Atenolol ♦ Brand Name: Tenormin
Pharmaceutical Forms & Appearance	Atenolol is most commonly available as oral tablets in various strengths (e.g., 25 mg, 50 mg, 100 mg). The tablets are typically white, round, or oval, and may be scored or debossed with the strength or manufacturer's identifying marks.
Dosage & Administration	Atenolol is usually taken once daily, with or without food. The starting dose for hypertension is often 25 mg or 50 mg, which can be adjusted based on the patient's response and tolerability, up to a maximum of 100 mg daily. It's important to take it consistently at about the same time each day. It should not be stopped abruptly.
Supplied As	Atenolol is supplied as oral tablets in various strengths (e.g., 25 mg, 50 mg, 100 mg).
Contraindications	Atenolol is contraindicated in patients with severe bradycardia (very slow heart rate), second- or third-degree atrioventricular (AV) block, cardiogenic shock, overt cardiac failure, or sick sinus syndrome (unless a pacemaker is in place). It is also contraindicated in individuals with known hypersensitivity to atenolol or any component of the formulation.
Storage & Expiry	Atenolol tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep them in their original container. Always check the specific expiry date on the packaging and do not use if expired.
Side Effects	Common side effects include bradycardia (slow heart rate), cold extremities, fatigue, dizziness, lightheadedness, nausea, and depression. Less common but more serious side effects can include worsening of heart failure, bronchospasm (in susceptible individuals), hypotension, and very rarely, skin reactions or hallucinations.
Warnings & Precautions	♦ Abrupt Cessation: Do not discontinue atenolol abruptly, especially in patients with coronary artery disease, as it can worsen angina or precipitate a myocardial infarction. Doses should be gradually tapered over 1-2 weeks. ♦ Heart Failure: Use with caution in patients with heart failure, as it can worsen symptoms in some cases. ♦ Bronchospastic Disease: While beta-1 selective, it should be used with caution in patients with asthma or COPD; higher doses or non-selectivity can worsen respiratory issues. ♦ Diabetes: May mask symptoms of hypoglycemia (e.g., rapid heart rate). ♦ Thyrotoxicosis: May mask clinical signs of hyperthyroidism. ♦ Renal Impairment: Dose adjustment is necessary in patients with kidney dysfunction.
Missed Dose Instructions	If a dose of Atenolol is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Consistency in daily dosing is important for maintaining stable blood pressure and heart rate control.
Overdose Instructions	Overdose can lead to severe bradycardia, hypotension, acute cardiac failure, and bronchospasm. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if ingestion was recent. Atropine can be used for bradycardia, glucagon for myocardial depression, and vasopressors for hypotension. Pacemaker insertion may be required for refractory bradycardia. Seek immediate medical attention.
Medicine Interactions	♦ Calcium Channel Blockers (non-dihydropyridine): Concurrent use with verapamil or diltiazem can cause additive effects leading to severe bradycardia, AV block, and heart failure; generally avoided. ♦ Antihypertensive Agents: May have an additive hypotensive effect with other blood pressure-lowering drugs. ♦ Digoxin: Can increase digoxin levels and cause additive bradycardia. ♦ NSAIDs: May blunt the antihypertensive effect of beta-blockers. ♦ Insulin/Oral Hypoglycemics: May mask symptoms of hypoglycemia. ♦ Clonidine: If discontinuing clonidine and a beta-blocker concurrently, taper the beta-blocker first to avoid rebound hypertension.

Atorvastatin (Lipitor)

Purpose/Indication	Atorvastatin is a statin medication used to lower high cholesterol levels and reduce the risk of cardiovascular events such as heart attacks and strokes. It is indicated for treating primary hypercholesterolemia, mixed dyslipidemia, homozygous familial hypercholesterolemia, and for primary prevention of cardiovascular disease in patients with multiple risk factors.
Method of Action	Atorvastatin works by competitively inhibiting HMG-CoA reductase, an enzyme essential for cholesterol synthesis in the liver. By blocking this enzyme, it reduces the production of cholesterol. This leads to a decrease in low-density lipoprotein cholesterol (LDL-C, "bad" cholesterol) and triglycerides, while increasing high-density lipoprotein cholesterol (HDL-C, "good" cholesterol) in the blood.
Medication Name & Brand Names	♦ Medication Name: Atorvastatin ♦ Brand Name: Lipitor
Pharmaceutical Forms & Appearance	Atorvastatin is available as oral tablets in various strengths (e.g., 10 mg, 20 mg, 40 mg, 80 mg). The tablets are typically white to off-white, oval-shaped, and may be debossed with the strength or manufacturer's identifying marks.
Dosage & Administration	Atorvastatin is usually taken once daily, with or without food, at any time of day. However, consistency in timing is often recommended to establish a routine. The starting dose is typically 10 mg or 20 mg daily, which can be adjusted based on the patient's cholesterol levels and treatment goals, up to a maximum of 80 mg daily.
Supplied As	Atorvastatin is supplied as oral tablets in various strengths (e.g., 10 mg, 20 mg, 40 mg, 80 mg).
Contraindications	Atorvastatin is contraindicated in individuals with active liver disease or unexplained persistent elevations of serum transaminases (liver enzymes). It is also contraindicated during pregnancy and breastfeeding, and in patients with known hypersensitivity to atorvastatin or any component of the formulation.
Storage & Expiry	Atorvastatin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light, in their original container. Always check the specific expiry date on the packaging and do not use if expired.
Side Effects	Common side effects include nasopharyngitis, arthralgia (joint pain), diarrhea, pain in extremity, and urinary tract infection. More serious but less common side effects can include myopathy (muscle pain or weakness) and rhabdomyolysis (severe muscle breakdown), liver dysfunction, and elevated blood glucose levels.
Warnings & Precautions	♦ Muscle Effects: Patients should be advised to report any unexplained muscle pain, tenderness, or weakness, especially if accompanied by fever or malaise. Creatine kinase (CK) levels should be checked if muscle symptoms occur. The risk of myopathy/rhabdomyolysis is increased with higher doses and concurrent use of certain interacting drugs. ♦ Liver Dysfunction: Liver function tests should be performed before initiation and periodically during treatment. If persistent elevations in liver enzymes occur, the drug should be discontinued. ♦ Diabetes Risk: Statins may increase HbA1c and fasting serum glucose levels. ♦ Pregnancy/Lactation: Contraindicated due to potential fetal harm.
Missed Dose Instructions	If a dose of Atorvastatin is missed, take it as soon as remembered if it is still within the same day. If a full day has passed or it's almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule the next day. Do not take a double dose to make up for a missed one.
Overdose Instructions	There is no specific treatment for atorvastatin overdose. In the event of an overdose, treatment should be symptomatic and supportive, focusing on managing any adverse effects that arise. Liver function tests and CK levels should be monitored. Because atorvastatin is highly protein-bound, hemodialysis is unlikely to significantly enhance its clearance. Seek immediate medical attention.
Medicine Interactions	♦ Strong CYP3A4 Inhibitors: Co-administration with strong CYP3A4 inhibitors (e.g., cyclosporine, telithromycin, clarithromycin, itraconazole, ritonavir-boosted HIV protease inhibitors) can significantly increase atorvastatin levels, increasing the risk of myopathy/rhabdomyolysis. Avoid or use lower atorvastatin doses. ♦ Gemfibrozil/Fibrates: Increased risk of muscle problems when used with fibrates like gemfibrozil. ♦ Niacin: High doses of niacin (≥1 g/day) can increase the risk of muscle problems. ♦ Colchicine: Increased risk of myopathy. ♦ Grapefruit Juice: Consumption of large quantities of grapefruit juice (e.g., >1.2 liters/day) can significantly increase atorvastatin levels.

Atovaquone/Proguanil (Malarone)

Purpose/Indication	Atovaquone/Proguanil is a combination antimalarial medication used for both the prevention and treatment of malaria, especially against Plasmodium falciparum, including chloroquine-resistant strains. For prevention (prophylaxis), it's typically taken before, during, and after travel to malaria-endemic areas. For treatment, it's used for acute, uncomplicated malaria.
Method of Action	This combination works synergistically by targeting two different pathways in the malaria parasite. Atovaquone inhibits the parasite's mitochondrial electron transport, disrupting pyrimidine biosynthesis. Proguanil, through its active metabolite cycloguanil, inhibits dihydrofolate reductase, thereby disrupting deoxythymidylate synthesis. These combined actions interfere with nucleic acid replication, leading to the death of the malaria parasite.
Medication Name & Brand Names	♦ Medication Name: Atovaquone/Proguanil ♦ Brand Name: Malarone (most common globally)
Pharmaceutical Forms & Appearance	Atovaquone/Proguanil is available as oral tablets, in adult and pediatric strengths. The tablets are typically pink, film-coated, and round or biconvex, with specific engravings.
Dosage & Administration	Dosage depends on whether it's for prophylaxis or treatment, and for treatment, it also depends on the patient's weight. For prophylaxis, adults usually take one adult tablet daily, starting 1-2 days before entering a malaria-risk area, continuing daily throughout the stay, and for 7 days after leaving. For treatment, a higher dose is given daily for 3 consecutive days. It must always be taken with food or a milky drink to ensure proper absorption. If vomiting occurs within 1 hour of dosing, a repeat dose should be taken.
Supplied As	Atovaquone/Proguanil is supplied as oral tablets: adult strength (250 mg atovaquone/100 mg proguanil HCl) and pediatric strength (62.5 mg atovaquone/25 mg proguanil HCl).
Contraindications	Atovaquone/Proguanil is contraindicated in individuals with known hypersensitivity to atovaquone, proguanil hydrochloride, or any component of the formulation. It is also contraindicated for malaria prophylaxis in patients with severe renal impairment (creatinine clearance less than 30 mL/min) due to accumulation of proguanil.
Storage & Expiry	Tablets should be stored at room temperature (typically below 30°C or 86°F), protected from moisture and light, in their original packaging. Always check the specific expiry date printed on the pack.

MEDICATION | Medication | A - C | Atovaquone/Proguanil (Malarone)

Side Effects	Common side effects include abdominal pain, nausea, vomiting, diarrhea, headache, and dizziness. These are often mitigated by taking the medication with food. Less common but more serious side effects can include severe allergic reactions, liver problems (hepatitis, jaundice), and blood disorders like anemia.
Warnings & Precautions	♦ Vomiting/Diarrhea: If patients vomit or have severe diarrhea, absorption of atovaquone may be reduced, potentially leading to treatment failure. Monitor closely and consider antiemetics. ♦ Renal Impairment: Not recommended for prophylaxis in severe renal impairment; use with caution for treatment. ♦ Relapse: This medication does not provide radical cure for all Plasmodium species (e.g., P. vivax, P. ovale), so a relapse may occur. ♦ It does not guarantee complete protection from malaria; mosquito bite prevention measures remain essential.
Missed Dose Instructions	If a dose of Atovaquone/Proguanil is missed, take it as soon as remembered with food. However, if it's almost time for the next dose, skip the missed dose and continue with the regular schedule. Do not take two doses to make up for a missed one. Completing the full course as prescribed is critical for effectiveness.
Overdose Instructions	There is limited information on specific overdose symptoms for atovaquone/proguanil. Overdose would likely lead to an exaggeration of common side effects, primarily gastrointestinal upset. In cases of significant overdose, general supportive care and monitoring for adverse reactions are recommended. Activated charcoal may be considered if ingestion was recent. Hemodialysis is not effective for atovaquone. Seek immediate medical attention.
Medicine Interactions	♦ Rifampin/Rifabutin: Concurrent use significantly decreases atovaquone levels, leading to reduced efficacy. Co-administration is generally contraindicated. ♦ Metoclopramide: May decrease atovaquone levels. ♦ Tetracycline: Concurrent use may decrease atovaquone levels. ♦ Warfarin and other anticoagulants: May enhance the anticoagulant effect of warfarin, increasing bleeding risk; INR monitoring is recommended. ♦ Efavirenz/Indinavir: May reduce atovaquone levels. ♦ Food/Fat: Taking with food, especially fatty meals, enhances atovaquone absorption; taking it without food significantly reduces its effectiveness.

Azathioprine (Imuran)

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Purpose/Indication	Azathioprine is an immunosuppressant medication used to prevent organ rejection after transplantation and to treat severe autoimmune diseases. It is indicated for conditions such as rheumatoid arthritis, Crohn's disease, ulcerative colitis, systemic lupus erythematosus, and certain types of vasculitis, where other treatments have failed or are not tolerated.
Method of Action	Azathioprine is a prodrug that is converted in the body to 6-mercaptopurine (6-MP), and then further metabolized to active thiopurine nucleotides. These metabolites interfere with purine synthesis, which is essential for DNA and RNA production. This inhibits the proliferation of rapidly dividing cells, particularly T and B lymphocytes, thereby suppressing the immune system's activity and reducing inflammation.
Medication Name & Brand Names	♦ Medication Name: Azathioprine ♦ Brand Names: Imuran, Azasan
Pharmaceutical Forms & Appearance	Azathioprine is typically available as oral tablets in various strengths (e.g., 25 mg, 50 mg, 75 mg, 100 mg). The tablets are usually yellow, round, and scored or debossed with identifying marks. It can also be available as a powder for injection for intravenous administration, but oral forms are more common for chronic use.
Dosage & Administration	Dosage varies widely based on the patient's condition, weight, and response, and is often individualized. It is typically taken once daily, with or after food, to minimize gastrointestinal upset. Regular blood tests are required to monitor blood counts and liver function to ensure safe and effective dosing. It is crucial to take this medication exactly as prescribed and not to stop it abruptly without medical guidance.
Supplied As	Azathioprine is supplied as oral tablets (e.g., 25 mg, 50 mg, 75 mg, 100 mg).
Contraindications	Azathioprine is contraindicated in patients with known hypersensitivity to azathioprine or any of its components. It is also contraindicated in patients with severe infections, severe bone marrow suppression, or a history of pancreatitis directly related to prior azathioprine therapy. Pregnancy and breastfeeding are generally considered contraindications due to potential harm to the fetus/infant.
Storage & Expiry	Azathioprine tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture, in a tightly closed container. Always check the specific expiry date on the packaging. Keep out of reach of children.
Side Effects	Common side effects include nausea, vomiting, abdominal pain, diarrhea, and loss of appetite. More serious but less common side effects include bone marrow suppression (leading to low white blood cell count, anemia, or thrombocytopenia), increased risk of infections, liver dysfunction, pancreatitis, and an increased risk of certain cancers (especially lymphoma and skin cancer with long-term use).
Warnings & Precautions	♦ Bone Marrow Suppression: Azathioprine can cause severe and dose-related bone marrow suppression. Regular complete blood counts (CBC) are essential for monitoring. The risk is significantly increased in patients with low or absent thiopurine methyltransferase (TPMT) enzyme activity, which should be tested before or early in treatment. ♦ Increased Risk of Infection: Immunosuppression increases susceptibility to bacterial, viral, fungal, and opportunistic infections. ♦ Hepatotoxicity: Liver function should be monitored regularly. ♦ Malignancy Risk: Long-term use is associated with an increased risk of certain lymphomas, skin cancers, and other malignancies. ♦ Pancreatitis: Can cause pancreatitis. ♦ Avoid live vaccines.
Missed Dose Instructions	If a dose of Azathioprine is missed, take it as soon as remembered if it is on the same day. If a full day has passed or it's almost time for the next scheduled dose, skip the missed dose and take the next dose as scheduled. Do not take a double dose to make up for a missed one. Consistent daily dosing is important for maintaining stable immunosuppression. Contact a healthcare provider for specific guidance, especially for transplant patients.
Overdose Instructions	Symptoms of overdose are primarily an exaggeration of known side effects, particularly severe bone marrow suppression (leading to severe leukopenia, thrombocytopenia, anemia), infection, liver dysfunction, and nausea/vomiting. There is no specific antidote. Treatment is supportive, focusing on managing hematologic toxicities (e.g., blood transfusions, granulocyte colony-stimulating factors) and preventing/treating infections. Liver function should be monitored. Seek immediate medical attention.
Medicine Interactions	♦ Allopurinol/Febuxostat: These drugs (used for gout) significantly inhibit the metabolism of azathioprine, leading to dangerously high levels and severe bone marrow suppression. The dose of azathioprine must be drastically reduced (typically by 75%) if co-administered; co-administration is generally discouraged unless strictly necessary with very careful monitoring. ♦ Warfarin: Azathioprine may reduce the anticoagulant effect of warfarin. INR monitoring is recommended. ♦ Aminosalicylates (e.g., mesalamine, olsalazine, sulfasalazine): Can inhibit TPMT, increasing the risk of bone marrow suppression; requires careful monitoring. ♦ Live Vaccines: Avoid concurrent use due to compromised immune response. ♦ Other Myelosuppressive Agents: Increased risk of bone marrow suppression when used with other drugs that suppress bone marrow.

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Azithromycin (Zithromax)

Purpose/Indication	Azithromycin is a macrolide antibiotic used to treat various bacterial infections. It's commonly prescribed for respiratory tract infections (e.g., bronchitis, pneumonia, sinusitis), ear infections (otitis media), skin and soft tissue infections, and certain sexually transmitted infections (e.g., chlamydia). Its long half-life allows for shorter treatment courses.
Method of Action	Azithromycin works by inhibiting bacterial protein synthesis. It binds to the 50S ribosomal subunit of susceptible bacteria, thereby interfering with the translocation of peptides and inhibiting the assembly of new proteins. This bacteriostatic action ultimately prevents the growth and reproduction of bacteria.
Medication Name & Brand Names	♦ Medication Name: Azithromycin ♦ Brand Names: Zithromax, Zmax
Pharmaceutical Forms & Appearance	Azithromycin is available as oral tablets, oral capsules, extended-release oral suspension, and powder for oral suspension (liquid that needs to be reconstituted). Tablets are typically white or off-white, often oval-shaped. The reconstituted liquid is usually a white to off-white suspension.
Dosage & Administration	Dosage and duration vary depending on the infection. For many infections, a single daily dose for 3-5 days is common (e.g., 500 mg on day 1, then 250 mg on days 2-5). For certain STIs, a single 1 gram dose is often prescribed. It can be taken with or without food, but taking it with food may help reduce gastrointestinal upset. Always complete the full course.
Supplied As	Azithromycin is supplied as oral tablets (e.g., 250 mg, 500 mg, 600 mg), oral capsules (250 mg), powder for oral suspension (various concentrations), and extended-release oral suspension (2 g).
Contraindications	Azithromycin is contraindicated in patients with a history of allergic reactions to azithromycin, erythromycin, any macrolide or ketolide antibiotic. It is also contraindicated in patients with a history of cholestatic jaundice or hepatic dysfunction associated with prior azithromycin use.
Storage & Expiry	Tablets and capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The reconstituted oral suspension must be stored at or below 30°C (86°F) and typically remains stable for 10 days; discard any unused portion after this time. Always check the specific product label for exact storage and expiry information.
Side Effects	Common side effects include diarrhea, nausea, vomiting, abdominal pain, and headache. Less common but more serious side effects can include severe allergic reactions (e.g., Stevens-Johnson syndrome, anaphylaxis), liver problems, QT prolongation (a heart rhythm abnormality that can lead to serious arrhythmias), and Clostridioides difficile-associated diarrhea (CDAD).
Warnings & Precautions	♦ Hypersensitivity Reactions: Serious allergic reactions, including angioedema and anaphylaxis, have been reported. ♦ QT Prolongation: Can prolong the QT interval on an electrocardiogram, increasing the risk of potentially fatal arrhythmias, especially in patients with pre-existing heart conditions, electrolyte disturbances, or those taking other QT-prolonging drugs. ♦ Liver Dysfunction: Use with caution in patients with impaired liver function; severe liver problems have been reported. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): Can occur during or after antibiotic therapy. ♦ Myasthenia Gravis: May exacerbate symptoms of myasthenia gravis. ♦ Not effective against viral infections.
Missed Dose Instructions	If a dose of Azithromycin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose to make up for a missed one. It is crucial to complete the entire course of antibiotics to prevent the development of antibiotic resistance.
Overdose Instructions	Symptoms of overdose are generally an exaggeration of known side effects, primarily severe gastrointestinal symptoms such as nausea, vomiting, diarrhea, and abdominal discomfort. Reversible hearing loss has also been reported with very high doses. Treatment is supportive and symptomatic; activated charcoal may be considered if ingestion was recent. Seek immediate medical attention.
Medicine Interactions	♦ Antacids containing aluminum or magnesium: Can significantly reduce azithromycin absorption; administer azithromycin at least 2 hours before or after these antacids. ♦ Warfarin: May enhance the anticoagulant effect of warfarin, increasing bleeding risk; INR monitoring is recommended. ♦ Digoxin: May increase digoxin levels. ♦ Ergot derivatives (e.g., ergotamine): Concurrent use may lead to acute ergot toxicity (vasospasm with ischemia). ♦ QT-prolonging drugs: Use with caution with other medications that prolong the QT interval (e.g., antiarrhythmics, antipsychotics, certain antidepressants) due to increased risk of arrhythmias. ♦ Cyclosporine: May increase cyclosporine levels; monitoring is recommended.

Azithromycin (Zithromax)

Baloxavir Marboxil (Xofluza)

Purpose/Indication	Baloxavir marboxil is an antiviral medication used to treat acute, uncomplicated influenza (flu) caused by influenza A or B viruses. It is indicated for individuals 12 years of age and older who have been symptomatic for no more than 48 hours. It can also be used for post-exposure prophylaxis of influenza in people aged 12 years and older.
Method of Action	Baloxavir marboxil is a prodrug that is converted to its active form, baloxavir acid. Baloxavir acid acts as a selective inhibitor of influenza cap-dependent endonuclease, an enzyme that is part of the viral polymerase complex. By inhibiting this enzyme, baloxavir interferes with the initiation of messenger RNA (mRNA) synthesis, thereby preventing the replication of the influenza virus.
Medication Name & Brand Names	♦ Medication Name: Baloxavir Marboxil ♦ Brand Name: Xofluza
Pharmaceutical Forms & Appearance	Baloxavir marboxil is available as oral tablets in various strengths (e.g., 20 mg, 40 mg). The tablets are typically light yellow to yellow, oval-shaped, and film-coated, with specific imprints indicating the dosage strength.
Dosage & Administration	Baloxavir marboxil is a single-dose oral treatment. For treatment, the dose is based on the patient's body weight (e.g., 40 mg for 40 kg to <80 kg, 80 mg for ≥80 kg). For post-exposure prophylaxis, the same weight-based single dose applies. It can be taken with or without food, but should be avoided with dairy products, calcium-fortified beverages, or polyvalent cation-containing laxatives, antacids, or oral supplements.
Supplied As	Baloxavir marboxil is supplied as oral film-coated tablets in blister packs (e.g., 20 mg, 40 mg).
Contraindications	Baloxavir marboxil is contraindicated in individuals with known hypersensitivity to baloxavir marboxil or any component of the formulation. It is generally not recommended for use in severe influenza complications requiring hospitalization, or in immunocompromised patients, as its efficacy in these populations has not been established.
Storage & Expiry	Baloxavir marboxil tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light, in their original packaging. Always check the specific expiry date printed on the packaging.

Baloxavir Marboxil (Xofluza)

MEDICATION

Medication

Side Effects	Common side effects include diarrhea, bronchitis, nausea, headache, and nasopharyngitis. Less common but serious side effects can include hypersensitivity reactions (e.g., anaphylaxis, urticaria), although these are rare. Postmarketing reports have included allergic reactions and serious skin reactions.
Warnings & Precautions	♦ Bacterial Co-infections: Baloxavir marboxil is not effective against bacterial infections. Patients should be monitored for bacterial co-infections and treated appropriately if suspected. ♦ Efficacy in Specific Populations: Efficacy has not been established in patients with complicated or severe influenza, or in hospitalized patients, or in immunocompromised patients. ♦ Antiviral Resistance: Resistance to baloxavir can emerge, especially in certain patient populations (e.g., children). ♦ Drug Interactions: Avoid co-administration with polyvalent cation-containing products (see interactions).
Missed Dose Instructions	Baloxavir marboxil is a single-dose treatment. Therefore, there are no "missed dose" instructions in the traditional sense. It should be taken as soon as possible after symptom onset (within 48 hours for treatment) or after exposure for prophylaxis. If the dose is vomited within 30 minutes, a repeat dose may be considered.
Overdose Instructions	There is limited experience with overdose of baloxavir marboxil. In case of overdose, general supportive care and monitoring for any adverse reactions would be recommended. Hemodialysis is unlikely to remove baloxavir acid effectively due to its high protein binding. Contact a healthcare professional or poison control center immediately.
Medicine Interactions	♦ Polyvalent Cation-Containing Products: Co-administration with dairy products, calcium-fortified beverages, or polyvalent cation-containing laxatives, antacids, or oral supplements (e.g., containing iron, zinc, selenium, calcium, magnesium) significantly reduces the plasma concentration of baloxavir, leading to reduced efficacy. These should be avoided for 2 hours before and 6 hours after taking baloxavir marboxil. ♦ No clinically significant interactions with other commonly used medications have been identified.

Bedaquiline (Sirturo)

Purpose/Indication	Bedaquiline is an antitubercular medication specifically used as part of combination therapy to treat pulmonary tuberculosis (TB) caused by Mycobacterium tuberculosis that is resistant to other medicines, particularly multi-drug-resistant TB (MDR-TB). It is crucial that it is used in conjunction with at least three other anti-TB drugs to which the patient's isolate is likely susceptible.
Method of Action	Bedaquiline works by inhibiting mycobacterial ATP synthase, an enzyme essential for the replication of Mycobacterium tuberculosis. By blocking this enzyme, it disrupts the energy generation process of the bacteria, leading to their death and inhibiting their growth. This novel mechanism of action makes it effective against strains resistant to conventional anti-TB drugs.
Medication Name & Brand Names	♦ Medication Name: Bedaquiline ♦ Brand Name: Sirturo
Pharmaceutical Forms & Appearance	Bedaquiline is available as oral tablets, typically in strengths of 20 mg and 100 mg. The tablets are usually white and may be functionally scored (20 mg tablets).
Dosage & Administration	Bedaquiline is administered orally with food. The treatment duration is typically 24 weeks. For the first 2 weeks, it is taken daily (e.g., 400 mg once daily for adults). From Week 3 to Week 24, it is taken three times per week (e.g., 200 mg three times per week for adults), with at least 48 hours between doses. Pediatric dosing is weight-based.
Supplied As	Bedaquiline is supplied as oral tablets, commonly in 20 mg and 100 mg strengths.
Contraindications	Bedaquiline is contraindicated in patients with known hypersensitivity to bedaquiline or any of its components. It is also contraindicated in patients with severe hepatic impairment, a QTc interval of greater than 500 ms (confirmed by repeat ECG), or clinically significant ventricular arrhythmia.
Storage & Expiry	Bedaquiline tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep them in their original container. Always check the specific expiry date printed on the packaging.
Side Effects	Common side effects include nausea, headache, arthralgia (joint pain), and elevated liver enzymes. Serious and important side effects include QT prolongation (a heart rhythm abnormality), hepatotoxicity (liver injury), and a higher rate of mortality compared to placebo in clinical trials (though causes were varied and not directly linked to bedaquiline in all cases).
Warnings & Precautions	♦ QT Prolongation: Bedaquiline can prolong the QT interval; ECGs and electrolyte levels (potassium, magnesium, calcium) must be monitored at baseline and regularly during treatment. Discontinue if significant QT prolongation or ventricular arrhythmia occurs. ♦ Hepatotoxicity: Liver function tests should be monitored monthly. Discontinue if significant liver enzyme elevations occur. ♦ Increased Mortality: An imbalance in deaths was observed in clinical trials; the cause is not fully understood. ♦ Administer as part of combination therapy for MDR-TB only. ♦ Avoid in patients with severe renal impairment.
Missed Dose Instructions	If a dose is missed during the first 2 weeks of daily dosing, do not make up the missed dose; continue with the next scheduled daily dose. From Week 3 onwards (three times a week dosing), if a dose is missed, take it as soon as possible and then resume the three times a week schedule. Ensure at least 24 hours between taking the missed dose and the next scheduled dose, and do not exceed the recommended weekly dose.
Overdose Instructions	Limited information is available on specific overdose symptoms. Overdose would likely lead to an exaggeration of known side effects, particularly QT prolongation and hepatotoxicity. Treatment should be supportive, involving immediate medical attention, monitoring of vital signs, ECG, and liver function. Activated charcoal may be considered if ingestion was recent. Hemodialysis is not effective for removal.
Medicine Interactions	♦ Strong CYP3A4 Inducers: Co-administration with strong CYP3A4 inducers (e.g., rifampicin, phenytoin, carbamazepine, St. John's Wort) significantly reduces bedaquiline exposure, potentially leading to treatment failure. Co-administration is generally contraindicated. ♦ Strong CYP3A4 Inhibitors: Concurrent use with strong CYP3A4 inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, ritonavir-boosted HIV protease inhibitors) can increase bedaquiline exposure, increasing the risk of adverse effects including QT prolongation. Co-administration should be done with caution and increased ECG monitoring. ♦ QT-Prolonging Drugs: Avoid or use with extreme caution with other drugs that prolong the QT interval (e.g., fluoroquinolones, macrolides, clofazimine), as this can lead to additive QT prolongation and increased risk of arrhythmias.

Benzyl Benzoate (Benylate)

Purpose/Indication	Benzyl benzoate is an antiparasitic agent used topically to treat scabies and pediculosis (lice infestations). It works by acting as a miticide (kills mites) and pediculicide (kills lice), effectively eliminating the parasites that cause these highly contagious skin conditions.
Method of Action	The exact mechanism of action of benzyl benzoate is not fully understood, but it is believed to act as a neurotoxin to the parasites. It likely exerts a toxic effect on the nervous system of the mites and lice, causing paralysis and death. It also acts as a solvent for the cement substance that attaches the nits (lice eggs) to hair shafts, aiding in their removal.

Medication Name & Brand Names	♦ Medication Name: Benzyl Benzoate ♦ Brand Names: Scabanca, Ascabiol (historical/regional), Benzemul (historical/regional)
Pharmaceutical Forms & Appearance	Benzyl benzoate is primarily available as a topical lotion or emulsion, typically containing 25% w/v benzyl benzoate. It appears as a white or off-white, slightly viscous liquid with a characteristic aromatic odor.
Dosage & Administration	For scabies, it's typically applied as a 25% emulsion. Adults usually apply it over the entire body (from the neck down) after a warm bath, left on for 24 hours, and then washed off. A second application after 2-3 days may be necessary. For children, it may be diluted. For lice, it's applied to affected hair and scalp. Always follow specific product instructions.
Supplied As	Benzyl benzoate is supplied as a topical emulsion or lotion, commonly in 25% strength, in bottles.
Contraindications	Benzyl benzoate is contraindicated in individuals with known hypersensitivity to benzyl benzoate or any component of the formulation. It should not be applied to inflamed, broken, or weeping skin, or to large areas of the body, especially in very young children, due to potential for systemic absorption and irritation.
Storage & Expiry	Benzyl benzoate emulsion/lotion should be stored at room temperature (typically below 30°C or 86°F), protected from light. Keep the container tightly closed. Always check the specific expiry date on the packaging. Do not use if expired.
Side Effects	Common side effects are usually localized and include skin irritation, itching (which may persist for a few weeks after treatment, even if parasites are gone), burning sensation, redness, or dryness. More serious but less common side effects can include severe skin reactions, neurological symptoms (e.g., tremors, convulsions) if absorbed systemically, especially in children or after extensive application.
Warnings & Precautions	♦ External Use Only: For topical use on skin only. Avoid contact with eyes, mouth, nose, and other mucous membranes. If contact occurs, rinse thoroughly with water. ♦ Skin Irritation: May cause skin irritation. Avoid application to broken or severely inflamed skin. ♦ Children: Use with extreme caution and consider dilution in infants and young children due to increased risk of systemic absorption and neurotoxicity. Always consult a healthcare professional for pediatric use. ♦ Resistance: Excessive or improper use may contribute to resistance in parasites.
Missed Dose Instructions	For scabies, benzyl benzoate is typically a single or two-application treatment. If an application is missed or not performed correctly, consult a healthcare professional for guidance on re-application to ensure effective eradication of the infestation. It is not a daily, ongoing medication.
Overdose Instructions	Overdose from topical application is rare but can occur with excessive use, particularly in children or on compromised skin. Symptoms of systemic absorption may include CNS excitation (e.g., restlessness, tremors, convulsions), especially in young children. Treatment is symptomatic and supportive. Gastric lavage may be considered if accidental oral ingestion occurs, but vomiting should not be induced due to aspiration risk. Seek immediate medical attention.
Medicine Interactions	No significant systemic drug interactions are commonly reported with topical application of benzyl benzoate due to limited systemic absorption. However, avoid co-application with other topical preparations that may increase skin irritation or alter skin permeability.

Bismuth Subsalicylate (Pepto-Bismol)

Purpose/Indication	Bismuth subsalicylate is an antidiarrheal and anti-inflammatory medication commonly used to treat temporary discomforts of the stomach and gastrointestinal tract. Its main indications include diarrhea (including traveler's diarrhea), upset stomach, indigestion, nausea, and heartburn. It can also be used as part of combination therapy to eradicate Helicobacter pylori in peptic ulcer disease.
Method of Action	Bismuth subsalicylate has multiple mechanisms of action. The salicylate component provides anti-inflammatory effects and may inhibit prostaglandin synthesis, contributing to its antidiarrheal action. The bismuth component has direct antimicrobial activity against common gastrointestinal pathogens (e.g., E. coli, H. pylori) and forms a protective coating over irritated stomach and intestinal lining, adsorbing toxins and providing a soothing effect.
Medication Name & Brand Names	♦ Medication Name: Bismuth Subsalicylate ♦ Brand Names: Pepto-Bismol, Kaopectate (some formulations), Diotame
Pharmaceutical Forms & Appearance	Bismuth subsalicylate is widely available as oral liquid suspensions (syrup) and chewable tablets. The liquid suspension is distinctively pink, opaque, and relatively viscous. Tablets are typically pink or white and chewable.
Dosage & Administration	Dosage varies by product and indication, but for adults, it's typically taken every 30 minutes to 1 hour as needed, with a maximum number of doses per 24 hours. The liquid should be shaken well before use. Chewable tablets should be chewed thoroughly before swallowing. It can be taken with or without food.
Supplied As	Bismuth subsalicylate is supplied as oral liquid suspensions (e.g., 262 mg/15 mL, 525 mg/15 mL) and chewable tablets (e.g., 262 mg).
Contraindications	Bismuth subsalicylate is contraindicated in individuals with known hypersensitivity to salicylates (including aspirin) or any component of the formulation. It should not be used in children and teenagers recovering from chickenpox or flu-like symptoms due to the risk of Reye's syndrome. It is also contraindicated in patients with active stomach ulcers, bleeding problems, or black/bloody stools.
Storage & Expiry	Bismuth subsalicylate liquid and tablets should be stored at room temperature (typically between 20°C to 25°C or 68°F to 77°F), protected from light and freezing. Keep bottles tightly closed. Always check the specific expiry date on the packaging and do not use if expired.
Side Effects	Common side effects include darkening of the tongue and black stools (due to reaction of bismuth with sulfur in the mouth/intestine), which are harmless and temporary. Less common but more serious side effects can occur with high doses or prolonged use, especially due to the salicylate component, and include tinnitus (ringing in ears), hearing loss, and rarely, salicylate toxicity.
Warnings & Precautions	♦ Reye's Syndrome: Avoid in children and teenagers with viral infections (e.g., flu, chickenpox) due to the risk of Reye's syndrome, a rare but serious condition affecting the brain and liver. ♦ Salicylate Toxicity: Symptoms like ringing in the ears or hearing loss indicate potential salicylate toxicity; discontinue use and seek medical advice. ♦ Bleeding Risk: Use with caution in patients taking anticoagulants or with bleeding disorders, as the salicylate component can have antiplatelet effects. ♦ Constipation: May cause or worsen constipation. ♦ Gout: Use with caution in patients with gout, as salicylates can interfere with uric acid excretion.

Missed Dose Instructions	Bismuth subsalicylate is typically taken on an as-needed basis for symptom relief. If a dose is missed, take it when symptoms return, adhering to the recommended dosage intervals and maximum daily dose. It is not a regularly scheduled medication where missed doses have cumulative effects.
Overdose Instructions	Overdose is typically due to the salicylate component, leading to salicylate toxicity. Symptoms can include tinnitus, hearing loss, dizziness, confusion, nausea, vomiting, rapid breathing, and in severe cases, metabolic acidosis. Treatment involves supportive care, gastric decontamination (e.g., activated charcoal if early), urinary alkalinization to promote excretion, and possibly hemodialysis for severe cases. Seek immediate medical attention.
Medicine Interactions	♦ Anticoagulants: May increase the risk of bleeding when taken with warfarin or other anticoagulants. ♦ Oral Hypoglycemics: May enhance the effects of certain oral diabetes medications. ♦ Tetracycline Antibiotics: Bismuth can interfere with the absorption of tetracycline antibiotics; administer these medications at least 2 hours apart. ♦ Probenecid and Sulfinpyrazone: Salicylates can reduce the uricosuric (uric acid lowering) effect of these gout medications. ♦ Other Salicylates/NSAIDs: Avoid concurrent use with other salicylate-containing products or NSAIDs (e.g., aspirin, ibuprofen) to prevent additive side effects and increased risk of salicylate toxicity.

Budesonide (Pulmicort)

Purpose/Indication	Budesonide is a corticosteroid medication used to treat various inflammatory conditions. Depending on its formulation, it is indicated for the maintenance treatment of asthma (inhaled), chronic obstructive pulmonary disease (COPD) (inhaled), Crohn's disease and ulcerative colitis (oral and rectal), allergic rhinitis (nasal spray), and eosinophilic esophagitis (oral suspension). It works by reducing inflammation.
Method of Action	Budesonide is a potent glucocorticoid with strong anti-inflammatory activity. It works by binding to intracellular glucocorticoid receptors, which then modulate gene expression to decrease the synthesis and release of inflammatory mediators (e.g., prostaglandins, leukotrienes) and cytokines. It also reduces the activity of immune cells involved in inflammation, thereby suppressing the inflammatory response. The specific formulation determines its targeted action (e.g., topical in the airways, locally in the gut).
Medication Name & Brand Names	♦ Medication Name: Budesonide ♦ Brand Names: Pulmicort (inhaled), Entocort EC (oral for GI), Uceris/Cortiment (oral for UC), Rhinocort (nasal), Jorveza (oral for EoE)
Pharmaceutical Forms & Appearance	Budesonide comes in various forms: metered-dose inhalers (MDIs), dry powder inhalers (DPIs), nebulizer suspensions (for inhalation), oral capsules/tablets (often extended-release or targeted release), rectal foam/enema, and nasal sprays. The appearance varies by form (e.g., white powder for inhalers, capsules/tablets).
Dosage & Administration	Dosage and administration methods are highly specific to the form and condition being treated. Inhaled forms are typically used once or twice daily for asthma/COPD. Oral capsules for Crohn's are taken once daily in the morning. Rectal forms are used for ulcerative colitis. Nasal spray is usually once daily per nostril. It is critical to use the correct formulation for the intended purpose and follow specific instructions.
Supplied As	Budesonide is supplied in various forms, including: inhalers (e.g., Pulmicort Flexhaler, Pulmicort Respules for nebulization), oral capsules (e.g., Entocort EC 3 mg, Uceris 9 mg), rectal foam/enema, and nasal sprays (e.g., Rhinocort Aqua).
Contraindications	Budesonide is generally contraindicated in individuals with known hypersensitivity to budesonide or any component of the formulation. Inhaled forms are contraindicated for the rapid relief of acute bronchospasm. Oral forms for Crohn's/UC are contraindicated in patients with intestinal obstruction. Systemic fungal infections are also a general contraindication for steroid use.
Storage & Expiry	Storage conditions vary by formulation. Inhalers and nebulizer suspensions should typically be stored at room temperature (15°C to 30°C or 59°F to 86°F), protected from light and moisture, and not frozen. Oral capsules should also be stored at room temperature. Always refer to the specific product packaging for precise storage instructions and expiry dates.
Side Effects	Common side effects depend on the route of administration. Inhaled: oral candidiasis (thrush), dysphonia (hoarseness), cough. Oral: dyspepsia, nausea, headache, dizziness, abdominal pain. As a corticosteroid, systemic side effects can occur with higher doses or prolonged use, including adrenal suppression, increased risk of infection, bone density loss, and psychiatric effects.
Warnings & Precautions	♦ Adrenal Suppression: Prolonged use, especially at high doses or switching from systemic corticosteroids, can lead to adrenal insufficiency. Patients may need supplemental systemic corticosteroids during periods of stress. ♦ Infections: May mask signs of infection and increase susceptibility to new infections. Monitor for fungal infections (thrush) with inhaled forms. ♦ Osteoporosis: Long-term use can affect bone mineral density. ♦ Ocular Effects: May cause cataracts or glaucoma; regular eye exams are recommended for long-term users. ♦ Growth Suppression: Can cause growth suppression in children. ♦ Liver Impairment: Use with caution in patients with liver disease as systemic exposure may increase.
Missed Dose Instructions	If a dose of Budesonide (for maintenance therapy) is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Regular, consistent use is important for disease control.
Overdose Instructions	Acute overdose with budesonide is unlikely to cause serious problems due to its low systemic bioavailability and short half-life, especially with inhaled forms. However, chronic overuse, particularly with systemic absorption, can lead to signs and symptoms of hypercorticism (e.g., Cushingoid features, adrenal suppression). Treatment is symptomatic and supportive. Gradual withdrawal may be necessary after chronic excessive use. Seek medical advice if symptoms of overdose occur.
Medicine Interactions	♦ Strong CYP3A4 Inhibitors: Concomitant use with strong CYP3A4 inhibitors (e.g., ketoconazole, itraconazole, ritonavir, cobicistat, clarithromycin, grapefruit juice) can significantly increase systemic exposure to budesonide, potentially leading to increased systemic corticosteroid side effects. Co-administration should be avoided or used with caution and close monitoring. ♦ CYP3A4 Inducers: Strong inducers (e.g., rifampin, carbamazepine, phenytoin) may decrease budesonide levels. ♦ No specific interactions are typically associated with topical or locally acting formulations unless significant systemic absorption occurs.

Calcitonin Salmon (Miacalcic)

Purpose/Indication	Calcitonin salmon is a synthetic hormone preparation used primarily to treat postmenopausal osteoporosis, especially in women who cannot take other osteoporosis medications. It is also indicated for the treatment of Paget's disease of bone, and for the emergency treatment of hypercalcemia (high blood calcium levels). It works by regulating calcium and bone metabolism.

Method of Action	Calcitonin salmon is a polypeptide hormone that directly inhibits bone resorption by binding to receptors on osteoclasts, the cells responsible for breaking down bone tissue. This action reduces the release of calcium and phosphate from bone, thereby decreasing bone turnover. In hypercalcemia, it also increases renal excretion of calcium and phosphate. It also has an analgesic effect, possibly due to a direct effect on the central nervous system.
Medication Name & Brand Names	♦ Medication Name: Calcitonin Salmon ♦ Brand Names: Miacalcin (nasal spray, injection), Fortical (nasal spray)
Pharmaceutical Forms & Appearance	Calcitonin salmon is available as a nasal spray and as an injectable solution (for subcutaneous or intramuscular use). The nasal spray solution is typically clear and colorless. The injectable solution is also clear and colorless.
Dosage & Administration	Dosage and administration vary significantly by indication and form. For osteoporosis, the nasal spray is commonly used (e.g., 200 international units (IU) daily, alternating nostrils). For Paget's disease, injections are typically given subcutaneously or intramuscularly (e.g., 100 IU daily or every other day). For hypercalcemia, higher doses are used via injection.
Supplied As	Calcitonin salmon is supplied as: nasal spray (e.g., a bottle delivering 200 IU per actuation), and injectable solution in multi-dose vials (e.g., 200 IU/mL).
Contraindications	Calcitonin salmon is contraindicated in individuals with known hypersensitivity to calcitonin salmon or any component of the formulation. Products containing fish protein should be avoided in patients with known allergies to salmon.
Storage & Expiry	Nasal spray formulations should be stored refrigerated (2°C to 8°C or 36°F to 46°F) prior to opening. Once opened, they can usually be stored at room temperature (below 25°C or 77°F) for a limited period (e.g., 30 days) and then discarded. Injectable vials should also be refrigerated. Do not freeze. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nasal irritation (with nasal spray), rhinitis, epistaxis (nosebleed), flushing of the face and hands, nausea, and vomiting. Less common but more serious side effects can include hypersensitivity reactions (including anaphylaxis), and a very small potential increased risk of malignancy with long-term use (though data is conflicting and minimal).
Warnings & Precautions	♦ Hypersensitivity Reactions: Serious allergic reactions, including anaphylaxis, can occur. Patients should be warned of potential reactions, especially those with a history of fish allergy. ♦ Malignancy Risk: Long-term use of calcitonin salmon has been associated with a small, increased risk of cancer in some studies; the clinical significance of this is under evaluation. ♦ Hypocalcemia: Although rare, temporary hypocalcemia can occur, especially with high doses; monitor serum calcium. ♦ Nasal Irritation: Nasal spray can cause local irritation; inspect nasal passages regularly. ♦ Renal Impairment: Use with caution in patients with severe renal impairment.
Missed Dose Instructions	For regular maintenance therapy (e.g., osteoporosis nasal spray), if a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For hypercalcemia, it's typically administered in a hospital setting under close medical supervision.
Overdose Instructions	Overdose with calcitonin salmon can lead to symptoms of hypocalcemia (e.g., paresthesia, muscle spasms, tetany, seizures) and exaggerated typical side effects like nausea and vomiting. Treatment involves immediate discontinuation of the drug and supportive measures. Calcium supplementation may be required to correct hypocalcemia. Seek immediate medical attention.
Medicine Interactions	♦ Lithium: Concurrent use may lead to a decrease in plasma lithium concentrations, requiring monitoring and possible dose adjustment of lithium. ♦ No other significant drug interactions are widely reported, as calcitonin salmon is a peptide and is metabolized differently than most small molecule drugs. However, always inform healthcare providers of all medications being taken.

Candesartan (Atacand)

Purpose/Indication	Candesartan is an angiotensin II receptor blocker (ARB) primarily used to treat high blood pressure (hypertension) and heart failure. It helps to relax blood vessels, allowing blood to flow more easily and reducing the workload on the heart. It is also used to reduce the risk of cardiovascular morbidity and mortality in patients with left ventricular systolic dysfunction or heart failure.
Method of Action	Candesartan works by selectively blocking the binding of angiotensin II to the AT1 receptor, which is found in many tissues, including vascular smooth muscle and the adrenal glands. Angiotensin II is a powerful vasoconstrictor and a stimulator of aldosterone secretion. By blocking its effects, candesartan causes vasodilation, reduces sodium and water retention, and ultimately lowers blood pressure.
Medication Name & Brand Names	♦ Medication Name: Candesartan Cilexetil ♦ Brand Name: Atacand
Pharmaceutical Forms & Appearance	Candesartan is available as oral tablets in various strengths (e.g., 4 mg, 8 mg, 16 mg, 32 mg). The tablets are typically white, round, or biconvex, and may be scored or debossed with the strength or manufacturer's identifying marks.
Dosage & Administration	Candesartan is usually taken once daily, with or without food. The typical starting dose for hypertension is 8 mg or 16 mg once daily, which can be adjusted based on response. For heart failure, dosing is typically initiated at a lower dose and gradually titrated up. It's important to take it consistently at about the same time each day.
Supplied As	Candesartan is supplied as oral tablets in various strengths (e.g., 4 mg, 8 mg, 16 mg, 32 mg).
Contraindications	Candesartan is contraindicated in patients with known hypersensitivity to candesartan or any component of the formulation. It is contraindicated in pregnancy due to the risk of fetal harm. It should not be co-administered with aliskiren in patients with diabetes or renal impairment (GFR <60 mL/min/1.73m²) due to increased risk of hypotension, hyperkalemia, and renal failure.
Storage & Expiry	Candesartan tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light, in a tightly closed container. Always check the specific expiry date on the packaging and do not use if expired.
Side Effects	Common side effects include headache, dizziness, upper respiratory tract infection, pharyngitis, and back pain. Less common but more serious side effects can include hypotension (low blood pressure), hyperkalemia (high potassium levels), renal impairment (kidney problems), and angioedema (swelling of face, lips, tongue, throat).

Warnings & Precautions	♦ Fetal Toxicity: Can cause injury or death to the developing fetus; discontinue as soon as pregnancy is detected. ♦ Hypotension: May cause symptomatic hypotension, especially in volume-depleted patients; correct volume depletion before starting. ♦ Renal Impairment: May cause or worsen renal impairment; monitor renal function, especially in patients with pre-existing kidney disease or severe heart failure. ♦ Hyperkalemia: Can cause hyperkalemia; monitor potassium levels, especially in patients with renal impairment, diabetes, or those taking potassium-sparing diuretics or potassium supplements. ♦ Angioedema: Rare but serious swelling of the face, lips, or throat can occur; seek immediate medical attention if symptoms develop.
Missed Dose Instructions	If a dose of Candesartan is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose to make up for a missed one. Regular, consistent use is important for blood pressure and heart failure control.
Overdose Instructions	Overdose is most likely to result in hypotension (low blood pressure) and possibly tachycardia (rapid heart rate) or bradycardia (slow heart rate). Treatment is supportive. If ingestion was recent, gastric lavage and/or administration of activated charcoal may be considered. Intravenous fluids and vasopressors may be needed to manage hypotension. Hemodialysis is not effective for removing candesartan. Seek immediate medical attention.
Medicine Interactions	♦ Potassium-Sparing Diuretics/Potassium Supplements: Increased risk of hyperkalemia. ♦ NSAIDs (Non-Steroidal Anti-Inflammatory Drugs): May blunt the antihypertensive effect and increase the risk of renal impairment, especially in elderly or volume-depleted patients. ♦ Lithium: May increase serum lithium concentrations and lithium toxicity; monitor lithium levels. ♦ Dual Blockade of RAAS: Co-administration with ACE inhibitors or aliskiren increases the risk of hypotension, hyperkalemia, and renal impairment and is generally not recommended, especially with aliskiren in diabetic or renally impaired patients.

Capreomycin (Capastat)

Purpose/Indication	Capreomycin is an injectable polypeptide antibiotic used as a second-line agent for the treatment of active tuberculosis (TB), particularly multi-drug-resistant TB (MDR-TB), caused by susceptible strains of Mycobacterium tuberculosis. It is always used in combination with other effective anti-tuberculosis agents to prevent the development of resistance.
Method of Action	Capreomycin inhibits bacterial protein synthesis by binding to the 70S ribosome, specifically interacting with both the 30S and 50S ribosomal subunits. This binding disrupts the normal function of the ribosome, preventing it from effectively synthesizing proteins. It interferes with the elongation phase of protein synthesis, causing misreading of the mRNA template and obstructing the translocation of tRNA and mRNA.
Medication Name & Brand Names	♦ Medication Name: Capreomycin Sulfate ♦ Brand Name: Capastat Sulfate (less commonly marketed now, often referred to generically)
Pharmaceutical Forms & Appearance	Capreomycin is available as a sterile powder for injection, typically reconstituted with sterile water for injection or 0.9% sodium chloride for intramuscular (IM) or intravenous (IV) administration. The reconstituted solution is almost colorless to pale straw-colored.
Dosage & Administration	Capreomycin is administered by deep intramuscular injection or intravenous infusion. The usual adult dose is 1 gram daily for 60 to 120 days, followed by 1 gram two to three times per week. Dosage adjustments are often necessary for patients with renal impairment. It is crucial to monitor renal function and auditory/vestibular function throughout treatment.
Supplied As	Capreomycin is supplied as a powder for injection in vials (e.g., 1 gram equivalent of capreomycin activity per vial).
Contraindications	Capreomycin is contraindicated in patients with known hypersensitivity to capreomycin. It should be used with extreme caution or contraindicated in patients with pre-existing auditory impairment, severe renal insufficiency, or neuromuscular disorders (e.g., myasthenia gravis, Parkinson's disease) due to the risk of exacerbating these conditions.
Storage & Expiry	Unopened vials of capreomycin powder for injection should be stored at controlled room temperature (typically 15°C to 30°C or 59°F to 86°F), protected from moisture. Once reconstituted, the solution should be refrigerated (2°C to 8°C or 36°F to 46°F) and typically used within 24 hours. Always check the specific product label for precise storage and expiry.
Side Effects	Common side effects include nephrotoxicity (kidney damage), ototoxicity (hearing loss and vestibular dysfunction like dizziness or vertigo), pain and sterile abscesses at the injection site, and abnormalities in electrolyte levels (e.g., hypokalemia, hypomagnesemia). Other side effects can include rash, fever, and eosinophilia.
Warnings & Precautions	♦ Ototoxicity and Nephrotoxicity: These are major concerns. Audiometric and vestibular function tests and renal function (creatinine, BUN, urine output) should be monitored at baseline and regularly during therapy. The risk is increased in elderly patients, those with pre-existing kidney or hearing impairment, or when co-administered with other ototoxic or nephrotoxic drugs. ♦ Neuromuscular Blockade: Can cause partial neuromuscular blockade and respiratory paralysis, especially with rapid IV infusion or in patients with neuromuscular disease. ♦ Electrolyte Abnormalities: Monitor serum potassium, magnesium, and calcium regularly. ♦ Pregnancy: Potential for fetal harm; typically avoided during pregnancy unless benefits outweigh risks.
Missed Dose Instructions	Since Capreomycin is typically administered in a clinical setting by a healthcare professional, missed doses are generally rare. If a dose is missed, the healthcare provider managing the patient's TB treatment should be contacted immediately for instructions. Consistency in dosing is crucial for effective TB therapy and preventing resistance.
Overdose Instructions	Overdose is typically an exaggeration of known side effects, primarily severe nephrotoxicity (kidney failure, oliguria) and ototoxicity (profound hearing loss, severe vertigo). Neuromuscular blockade leading to respiratory depression may also occur. Treatment is supportive and symptomatic. Gastric decontamination is not relevant for injectable forms. Hemodialysis is not effective for removal. Close monitoring of renal function, electrolytes, hearing, and respiratory status is essential. Seek immediate medical attention.
Medicine Interactions	♦ Nephrotoxic/Ototoxic Drugs: Co-administration with other drugs known to cause kidney damage or hearing damage (e.g., aminoglycosides like amikacin, gentamicin, tobramycin; polymyxins; colistin; loop diuretics like furosemide; amphotericin B) significantly increases the risk of these toxicities and should generally be avoided or used with extreme caution and close monitoring. ♦ Neuromuscular Blockers: May enhance the effects of neuromuscular blocking agents (e.g., succinylcholine, rocuronium), leading to prolonged muscle paralysis and respiratory depression. ♦ Live Bacterial Vaccines: May reduce the effectiveness of live bacterial vaccines (e.g., typhoid vaccine).

Carbamazepine (Tegretol)

Purpose/Indication	Carbamazepine is an anticonvulsant medication used to treat various types of seizures (e.g., partial seizures, generalized tonic-clonic seizures), but it is not effective for absence seizures. It is also indicated for the pain associated with trigeminal neuralgia (a severe facial nerve pain), and as a mood stabilizer in bipolar disorder.
Method of Action	Carbamazepine works primarily by stabilizing hyperexcited nerve membranes and inhibiting repetitive neuronal firing. It achieves this by prolonging the inactive state of voltage-gated sodium channels, thereby reducing the spread of abnormal electrical activity in the brain that causes seizures. For trigeminal neuralgia, it reduces synaptic transmission in the trigeminal nucleus. Its mechanism in bipolar disorder is less clear but involves effects on various neurotransmitter systems.
Medication Name & Brand Names	♦ Medication Name: Carbamazepine ♦ Brand Names: Tegretol, Carbatrol, Equetro
Pharmaceutical Forms & Appearance	Carbamazepine is available as immediate-release tablets, chewable tablets, extended-release tablets/capsules, and an oral suspension. Immediate-release tablets are usually white or off-white and may be scored. Extended-release forms are designed for once or twice daily dosing. The suspension is typically an off-white to yellowish liquid.
Dosage & Administration	Dosage varies significantly based on the indication, patient response, and tolerability. It is typically started at a low dose and gradually increased to achieve therapeutic effects while minimizing side effects. Dosing frequency depends on the formulation (e.g., 2-4 times daily for immediate-release, 1-2 times daily for extended-release). It is generally taken with food to reduce GI upset and improve absorption. Blood levels are often monitored.
Supplied As	Carbamazepine is supplied as oral tablets (e.g., 100 mg, 200 mg), chewable tablets, extended-release tablets (e.g., 100 mg, 200 mg, 300 mg, 400 mg) and capsules, and oral suspension (e.g., 100 mg/5 mL).
Contraindications	Carbamazepine is contraindicated in patients with a history of bone marrow depression or known hypersensitivity to carbamazepine or any tricyclic antidepressant. It should not be used in patients with severe cardiac disease, or within 14 days of taking a monoamine oxidase inhibitor (MAOI). Concomitant use with nefazodone is also contraindicated.
Storage & Expiry	Carbamazepine tablets and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in a tightly closed container. Always check the specific expiry date on the packaging. Shake oral suspension well before each use.
Side Effects	Common side effects often experienced initially include dizziness, drowsiness, ataxia (impaired coordination), nausea, vomiting, and blurred vision. More serious but less common side effects include serious dermatologic reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis, especially in individuals with HLA-B*1502 allele), aplastic anemia, agranulocytosis (severe reduction in white blood cells), liver dysfunction, hyponatremia (low sodium), and cardiac conduction abnormalities.
Warnings & Precautions	♦ Serious Dermatologic Reactions: Patients, especially of Asian ancestry (screening for HLA-B*1502 allele is recommended before initiation), are at higher risk. Discontinue at the first sign of rash unless clearly not drug-related. ♦ Aplastic Anemia/Agranulocytosis: Can cause life-threatening blood dyscrasias. Complete blood counts (CBC) should be performed at baseline and regularly during treatment. ♦ Hyponatremia: Can cause clinically significant low sodium levels, especially in elderly patients. ♦ Liver Dysfunction: Monitor liver function tests. ♦ Suicidal Ideation: Antiepileptic drugs carry an increased risk of suicidal thoughts or behavior; monitor patients for changes in mood or behavior. ♦ Cardiac Effects: Use with caution in patients with cardiac conduction disturbances. ♦ Drug Interactions: Numerous significant drug interactions (see below).
Missed Dose Instructions	If a dose of Carbamazepine is missed, take it as soon as remembered unless it's almost time for the next scheduled dose. In that case, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Consistent dosing is important for seizure control and preventing breakthrough seizures. For extended-release forms, if a dose is missed, take it as soon as remembered and then resume the next dose at the regularly scheduled time (do not take more than one dose every 12 hours for twice-daily dosing).
Overdose Instructions	Overdose can cause severe central nervous system depression (drowsiness, coma), respiratory depression, seizures, cardiovascular effects (tachycardia, hypotension, cardiac arrest), and hyponatremia. Treatment involves immediate medical attention, gastric lavage, administration of activated charcoal (repeated doses may be needed), and supportive care. Hemodialysis is generally not effective. Monitor vital signs, ECG, and blood drug levels.
Medicine Interactions	♦ Strong CYP3A4 Inhibitors: Increase carbamazepine levels, leading to toxicity (e.g., macrolide antibiotics like erythromycin/clarithromycin, azoles like ketoconazole/itraconazole, ritonavir, diltiazem, verapamil, grapefruit juice). ♦ CYP3A4 Inducers: Carbamazepine is a strong inducer of many liver enzymes (including CYP3A4, CYP2C9, CYP2C19, UGT), significantly reducing levels of many other drugs, such as: oral contraceptives (leading to contraceptive failure), warfarin, many other antiepileptics (e.g., phenytoin, valproate, lamotrigine), some antidepressants, antipsychotics, corticosteroids, and others. ♦ Lithium: Concurrent use may increase neurotoxicity. ♦ MAOIs: Concomitant use is contraindicated. ♦ Nefazodone: Concomitant use is contraindicated due to increased carbamazepine levels and potential for serious adverse events.

Carvedilol (Coreg)

Purpose/Indication	Carvedilol is a beta-blocker with alpha-blocking activity primarily used to treat heart failure (to improve survival and reduce hospitalizations), high blood pressure (hypertension), and left ventricular dysfunction following a heart attack. It helps to relax blood vessels and slow the heart rate, reducing the heart's workload and improving its pumping efficiency.
Method of Action	Carvedilol acts as a non-selective beta-adrenergic blocker (blocking beta-1 and beta-2 receptors) and a selective alpha-1 adrenergic blocker. Beta-blockade reduces heart rate, myocardial contractility, and oxygen demand. Alpha-1 blockade causes vasodilation, leading to a decrease in peripheral vascular resistance. The combined effect results in a reduction in blood pressure and improved cardiac function in heart failure. It also has antioxidant properties.
Medication Name & Brand Names	♦ Medication Name: Carvedilol ♦ Brand Name: Coreg (immediate-release), Coreg CR (extended-release)
Pharmaceutical Forms & Appearance	Carvedilol is available as immediate-release oral tablets and extended-release capsules. Immediate-release tablets are typically white, oval, and scored, with various strengths (e.g., 3.125 mg, 6.25 mg, 12.5 mg, 25 mg). Extended-release capsules contain beads and are designed for once-daily dosing.
Dosage & Administration	Dosage varies significantly by indication and formulation. For heart failure, it's initiated at a very low dose (e.g., 3.125 mg twice daily for immediate-release) and slowly titrated up over weeks to months. For hypertension, it's typically started at 6.25 mg twice daily. Immediate-release tablets should be taken with food to slow absorption and reduce orthostatic hypotension. Extended-release capsules should be taken once daily with food. Do not stop abruptly.
Supplied As	Carvedilol is supplied as immediate-release oral tablets (e.g., 3.125 mg, 6.25 mg, 12.5 mg, 25 mg) and extended-release oral capsules (e.g., 10 mg, 20 mg, 40 mg, 80 mg).

Contraindications	Carvedilol is contraindicated in patients with decompensated heart failure requiring intravenous inotropic therapy, bronchial asthma or related bronchospastic conditions (including COPD, if severe), second- or third-degree AV block (unless a permanent pacemaker is in place), sick sinus syndrome (unless a permanent pacemaker is in place), cardiogenic shock, severe bradycardia, and severe hepatic impairment.
Storage & Expiry	Carvedilol tablets and capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light, in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, fatigue, hypotension (low blood pressure), bradycardia (slow heart rate), and worsening of heart failure symptoms (especially at initiation or dose increase). Less common but serious side effects include exacerbation of bronchospasm, severe allergic reactions, liver dysfunction, and masking of hypoglycemia symptoms.
Warnings & Precautions	♦ Abrupt Cessation: Do not discontinue carvedilol abruptly, especially in patients with coronary artery disease, as it can worsen angina or precipitate a myocardial infarction. Doses should be gradually tapered over 1-2 weeks. ♦ Heart Failure: Worsening of heart failure or fluid retention can occur during initial titration; diuretics may need adjustment. ♦ Bronchospastic Disease: Use with caution in patients with mild-to-moderate bronchospastic disease; generally contraindicated in severe cases. ♦ Diabetes: May mask symptoms of hypoglycemia and potentially worsen glycemic control. ♦ Peripheral Vascular Disease: May precipitate or aggravate symptoms of arterial insufficiency. ♦ Liver Impairment: Use with caution and lower doses in patients with liver dysfunction.
Missed Dose Instructions	If a dose of Carvedilol is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Consistent daily dosing is important for heart failure management and blood pressure control.
Overdose Instructions	Overdose can lead to severe hypotension (very low blood pressure), bradycardia (slow heart rate), cardiac insufficiency, cardiogenic shock, and bronchospasm. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if ingestion was recent. Atropine can be used for bradycardia, glucagon for myocardial depression, and vasopressors for hypotension. Bronchodilators for bronchospasm. Seek immediate medical attention.
Medicine Interactions	♦ CYP2D6 and CYP2C9 Inhibitors/Inducers: Carvedilol is metabolized by these enzymes. Potent inhibitors (e.g., quinidine, fluoxetine, paroxetine, propafenone, cimetidine) can increase carvedilol levels. Inducers (e.g., rifampicin) can decrease levels. ♦ Rifampin: Significantly decreases carvedilol levels. ♦ Insulin/Oral Hypoglycemics: May enhance the blood-glucose-lowering effect and mask symptoms of hypoglycemia. ♦ Clonidine: If discontinuing clonidine and carvedilol concurrently, taper the beta-blocker first to avoid rebound hypertension. ♦ Digitalis Glycosides: Both can slow AV conduction; additive bradycardia may occur. ♦ Calcium Channel Blockers (non-dihydropyridine): Concurrent use with verapamil or diltiazem can cause additive effects leading to severe bradycardia, AV block, and heart failure; close monitoring is required.

Cefdinir (Omnicef)

Purpose/Indication	Cefdinir is a third-generation cephalosporin antibiotic used to treat a variety of bacterial infections. It is commonly prescribed for respiratory tract infections (e.g., bronchitis, pneumonia, sinusitis, tonsillitis/pharyngitis), acute otitis media (ear infection), and uncomplicated skin and skin structure infections. It is effective against a broad spectrum of gram-positive and gram-negative bacteria.
Method of Action	Cefdinir is a bactericidal antibiotic that works by inhibiting bacterial cell wall synthesis. It binds to penicillin-binding proteins (PBPs) located inside the bacterial cell wall, which are essential for the final stages of cell wall synthesis. This interference weakens the cell wall, leading to bacterial lysis and death.
Medication Name & Brand Names	♦ Medication Name: Cefdinir ♦ Brand Name: Omnicef
Pharmaceutical Forms & Appearance	Cefdinir is available as oral capsules and as a powder for oral suspension (liquid that needs to be reconstituted with water). Capsules are typically opaque, hard gelatin capsules with various colors (e.g., light orange to pink) and imprints indicating the dosage strength. The reconstituted suspension is usually an off-white to yellowish liquid, often with a strawberry flavor.
Dosage & Administration	Dosage varies based on the infection, patient's age (adults vs. children), and renal function. For adults, it is typically taken 300 mg every 12 hours or 600 mg once daily for 5-10 days. For children, it is weight-based. It can be taken with or without food. The full prescribed course should be completed, even if symptoms improve, to prevent resistance.
Supplied As	Cefdinir is supplied as oral capsules (e.g., 300 mg) and as a powder for oral suspension (e.g., 125 mg/5 mL, 250 mg/5 mL).
Contraindications	Cefdinir is contraindicated in patients with known hypersensitivity (severe allergic reaction) to cefdinir, other cephalosporin antibiotics, or any component of the formulation. Caution is advised in patients with a history of penicillin allergy due to the potential for cross-reactivity.
Storage & Expiry	Cefdinir capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The reconstituted oral suspension must be stored at controlled room temperature (20°C to 25°C or 68°F to 77°F) or refrigerated (2°C to 8°C or 36°F to 46°F) and typically remains stable for 10 days; discard any unused portion after this time. Check the specific product label for exact storage and expiry information.
Side Effects	Common side effects include diarrhea, nausea, vomiting, abdominal pain, and rash. Less common but more serious side effects can include severe allergic reactions (e.g., anaphylaxis, Stevens-Johnson syndrome), Clostridioides difficile-associated diarrhea (CDAD), kidney dysfunction, and transient elevations in liver enzymes.
Warnings & Precautions	♦ Hypersensitivity Reactions: Serious and sometimes fatal hypersensitivity reactions have been reported; inquire about prior allergies to cephalosporins or penicillins. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): Can occur during or after antibiotic therapy; evaluate patients presenting with diarrhea. ♦ Renal Impairment: Dose adjustment is necessary in patients with significant kidney impairment. ♦ Fecal Discoloration: Can cause red-orange discoloration of stool in infants due to non-absorbed drug complexing with iron in formulas/foods. ♦ Not effective against viral infections.
Missed Dose Instructions	If a dose of Cefdinir is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose to make up for a missed one. It's crucial to complete the entire course of antibiotics to prevent the development of antibiotic resistance and ensure complete eradication of the infection.
Overdose Instructions	Overdose is generally not life-threatening but can lead to symptoms such as nausea, vomiting, epigastric distress, diarrhea, and possibly convulsions (especially in patients with renal impairment). Treatment is supportive and symptomatic. Hemodialysis is effective in removing cefdinir from the body. Seek medical attention for significant overdose.

Medicine Interactions	♦ Antacids containing aluminum or magnesium: Can reduce the absorption of cefdinir; administer cefdinir at least 2 hours before or after these antacids. ♦ Iron Supplements (including fortified foods/infant formula): Can significantly reduce cefdinir absorption and may cause reddish-brown discoloration of stools. Administer cefdinir at least 2 hours before or after iron supplements. ♦ Probenecid: Decreases the renal excretion of cefdinir, resulting in increased and prolonged plasma levels of cefdinir.

Celecoxib (Celebrex)

Purpose/Indication	Celecoxib is a non-steroidal anti-inflammatory drug (NSAID) primarily used to relieve pain and inflammation. It is indicated for conditions such as osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, acute pain, and primary dysmenorrhea (menstrual pain). As a COX-2 selective inhibitor, it aims to reduce gastrointestinal side effects compared to non-selective NSAIDs.
Method of Action	Celecoxib works by selectively inhibiting cyclooxygenase-2 (COX-2) enzyme. COX-2 is primarily responsible for producing prostaglandins, which are mediators of pain and inflammation, especially at sites of injury or inflammation. By selectively blocking COX-2, celecoxib reduces pain, inflammation, and fever, while theoretically having less impact on COX-1, which is involved in protecting the stomach lining and platelet function.
Medication Name & Brand Names	♦ Medication Name: Celecoxib ♦ Brand Name: Celebrex
Pharmaceutical Forms & Appearance	Celecoxib is available as oral capsules in various strengths (e.g., 50 mg, 100 mg, 200 mg, 400 mg). The capsules are typically opaque, hard gelatin capsules with distinct colors and imprints for different strengths.
Dosage & Administration	Dosage varies by indication and patient response. For osteoarthritis, a common dose is 200 mg once daily or 100 mg twice daily. For rheumatoid arthritis, it's often 100 mg or 200 mg twice daily. It can be taken with or without food, but taking it with food may help reduce gastrointestinal upset.
Supplied As	Celecoxib is supplied as oral capsules in various strengths (e.g., 50 mg, 100 mg, 200 mg, 400 mg).
Contraindications	Celecoxib is contraindicated in patients with a known hypersensitivity (e.g., allergic reactions, asthma, urticaria) to celecoxib, sulfonamides, or aspirin and other NSAIDs. It is also contraindicated in patients with a history of asthma, urticaria, or allergic-type reactions after taking NSAIDs. It should not be used for pain after coronary artery bypass graft (CABG) surgery.
Storage & Expiry	Celecoxib capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include abdominal pain, diarrhea, dyspepsia (indigestion), flatulence, peripheral edema (swelling), and headache. More serious but less common side effects can include cardiovascular thrombotic events (e.g., heart attack, stroke), gastrointestinal bleeding or ulceration, kidney problems, serious skin reactions, and elevated liver enzymes.
Warnings & Precautions	♦ Cardiovascular Risk: NSAIDs, including celecoxib, can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. Contraindicated for pain after CABG surgery. ♦ Gastrointestinal Risk: Can cause serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. Risk is higher in elderly patients or those with a history of GI bleeding. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, especially in dehydrated patients or those with pre-existing kidney disease or heart failure. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Skin Reactions: Serious skin reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis) can occur. Discontinue at first appearance of rash. ♦ Sulfonamide Allergy: Contraindicated in patients with known sulfonamide allergy.
Missed Dose Instructions	If a dose of Celecoxib is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Consistent dosing helps manage pain and inflammation effectively.
Overdose Instructions	Symptoms of acute celecoxib overdose are generally limited to lethargy, drowsiness, nausea, vomiting, and epigastric pain, which are usually reversible with supportive care. Gastrointestinal bleeding, hypertension, acute renal failure, respiratory depression, and coma may occur with more severe overdose. Treatment is symptomatic and supportive. Gastric decontamination with activated charcoal may be considered if ingestion was recent. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate medical attention for significant overdose.
Medicine Interactions	♦ Warfarin and other anticoagulants: Increased risk of bleeding; monitor INR closely. ♦ ACE Inhibitors/ARBs/Diuretics: NSAIDs can reduce the antihypertensive effect and increase the risk of renal impairment. ♦ Lithium: May increase lithium plasma concentrations and toxicity; monitor lithium levels. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Fluconazole: Increases celecoxib plasma concentrations due to CYP2C9 inhibition; reduce celecoxib dose when co-administered. ♦ Dextromethorphan: Celecoxib can increase dextromethorphan levels. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity.

Cephalexin (Keflex)

Purpose/Indication	Cephalexin is a first-generation cephalosporin antibiotic used to treat a wide range of bacterial infections. It is commonly prescribed for infections of the respiratory tract, ear (otitis media), skin and soft tissue, bones and joints, and urinary tract. It is particularly effective against gram-positive bacteria like Staphylococcus aureus and Streptococcus pyogenes.
Method of Action	Cephalexin is a bactericidal antibiotic that works by inhibiting bacterial cell wall synthesis. It binds to penicillin-binding proteins (PBPs), which are enzymes located in the bacterial cell membrane that are crucial for the cross-linking of peptidoglycan, a major component of the bacterial cell wall. This inhibition leads to a defective cell wall, increased osmotic pressure, and ultimately, lysis and death of the bacterial cell.
Medication Name & Brand Names	♦ Medication Name: Cephalexin ♦ Brand Names: Keflex, Zartan (regional), Ceporex (regional)
Pharmaceutical Forms & Appearance	Cephalexin is available as oral capsules, oral tablets, and as a powder for oral suspension (liquid that needs to be reconstituted with water). Capsules are typically opaque with various colors (e.g., green and white, or pink) and imprints indicating the dosage strength. Tablets are usually white and may be scored. The reconstituted suspension is often a pink or off-white liquid, usually with a fruit flavor.
Dosage & Administration	Dosage varies based on the infection's severity, patient's age (adults vs. children), and renal function. For adults, typical doses range from 250 mg to 500 mg every 6 hours or 500 mg every 12 hours. For children, it is weight-based. It can be taken with or without food. The full prescribed course should always be completed, even if symptoms improve, to prevent the development of antibiotic resistance and ensure complete eradication of the infection.

Supplied As	Cephalexin is supplied as oral capsules (e.g., 250 mg, 500 mg), oral tablets (e.g., 250 mg, 500 mg), and powder for oral suspension (e.g., 125 mg/5 mL, 250 mg/5 mL).
Contraindications	Cephalexin is contraindicated in patients with known hypersensitivity (severe allergic reaction) to cephalexin, other cephalosporin antibiotics, or any component of the formulation. Caution is advised in patients with a history of penicillin allergy due to the potential for cross-reactivity.
Storage & Expiry	Cephalexin capsules and tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The reconstituted oral suspension must be stored in a refrigerator (2°C to 8°C or 36°F to 46°F) and typically remains stable for 14 days; discard any unused portion after this time. Check the specific product label for exact storage and expiry information.
Side Effects	Common side effects include diarrhea, nausea, vomiting, abdominal pain, dyspepsia, and rash. Less common but more serious side effects can include severe allergic reactions (e.g., anaphylaxis, Stevens-Johnson syndrome), Clostridioides difficile-associated diarrhea (CDAD), and kidney problems.
Warnings & Precautions	♦ Hypersensitivity Reactions: Serious and sometimes fatal hypersensitivity reactions have been reported; inquire about prior allergies to cephalosporins or penicillins before initiation. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): Can occur during or after antibiotic therapy; evaluate patients presenting with severe diarrhea. ♦ Renal Impairment: Dose adjustment is necessary in patients with significant kidney impairment. ♦ Positive Coombs' Test: Can result in a positive direct Coombs' test, which may interfere with blood typing procedures. ♦ Not effective against viral infections.
Missed Dose Instructions	If a dose of Cephalexin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose to make up for a missed one. It's crucial to complete the entire course of antibiotics to prevent the development of antibiotic resistance and ensure complete eradication of the infection.
Overdose Instructions	Overdose is generally not life-threatening but can lead to symptoms such as nausea, vomiting, epigastric distress, diarrhea, and possibly hematuria (blood in urine) or convulsions (especially in patients with renal impairment). Treatment is supportive and symptomatic. Hemodialysis may be useful in removing cephalexin from the body. Seek medical attention for significant overdose.
Medicine Interactions	♦ Metformin: Cephalexin may increase the plasma concentration of metformin; monitor for metformin-related adverse effects. ♦ Probenecid: Decreases the renal excretion of cephalexin, resulting in increased and prolonged plasma levels of cephalexin. ♦ Oral Contraceptives: While less common than with penicillins, some antibiotics can theoretically reduce the effectiveness of oral contraceptives; advise patients to use an alternative or additional method of contraception if concerned. ♦ Cholestyramine: May reduce the absorption of cephalexin; separate administration by at least 2 hours.

Cetirizine (Zyrtec)

Purpose/Indication	Cetirizine is a second-generation antihistamine used to relieve symptoms of seasonal and perennial allergic rhinitis (hay fever) such as sneezing, runny nose, itchy or watery eyes, and itchy throat. It is also effective in treating chronic idiopathic urticaria (hives) to reduce itching and the number and size of hives.
Method of Action	Cetirizine works by selectively blocking histamine H1 receptors. Histamine is a natural substance released by the body during an allergic reaction, causing symptoms like itching, sneezing, and watery eyes. By blocking these receptors, cetirizine prevents histamine from binding and exerting its effects, thereby alleviating allergic symptoms. As a second-generation antihistamine, it generally causes less drowsiness than older antihistamines because it penetrates the blood-brain barrier poorly.
Medication Name & Brand Names	♦ Medication Name: Cetirizine Hydrochloride ♦ Brand Names: Zyrtec, Reactine (Canada), Cetrine (UK), Allergex (South Africa)
Pharmaceutical Forms & Appearance	Cetirizine is widely available as oral tablets, chewable tablets, oral syrup/solution, and oral dissolving tablets. Tablets are typically white and small, often scored. The syrup is usually clear or slightly yellowish.
Dosage & Administration	For adults and children 6 years and older, the typical dose is 5 mg or 10 mg once daily, with or without food. For children 2-5 years, a lower dose is used. Dosing may be adjusted for patients with kidney or liver impairment. It is often recommended to take it in the evening if drowsiness is a concern, though it is generally non-drowsy.
Supplied As	Cetirizine is supplied as oral tablets (e.g., 5 mg, 10 mg), chewable tablets, oral syrup/solution (e.g., 1 mg/mL, 5 mg/5 mL), and oral dissolving tablets.
Contraindications	Cetirizine is contraindicated in individuals with known hypersensitivity to cetirizine, hydroxyzine, or any piperazine derivatives. It should not be used in patients with severe kidney disease (creatinine clearance less than 10 mL/min).
Storage & Expiry	Cetirizine tablets, chewable tablets, and oral solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include drowsiness (though less than first-generation antihistamines), fatigue, dry mouth, and headache. Less common side effects can include dizziness, nausea, and pharyngitis. In some individuals, paradoxical excitation or agitation may occur, particularly in children.
Warnings & Precautions	♦ Drowsiness/Sedation: While generally considered non-drowsy, some individuals may experience drowsiness, especially at higher doses or when combined with alcohol or other sedatives. Caution should be exercised when driving or operating machinery. ♦ Renal/Hepatic Impairment: Dose adjustment is necessary in patients with kidney or liver dysfunction. ♦ Elderly: Elderly patients may be more susceptible to side effects, particularly drowsiness. ♦ Urinary Retention: Use with caution in patients with conditions that predispose to urinary retention (e.g., prostatic hypertrophy, spinal cord lesion).
Missed Dose Instructions	If a dose of Cetirizine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular daily schedule. Do not take a double dose.
Overdose Instructions	Overdose symptoms can include drowsiness, sedation, tachycardia (rapid heart rate), urinary retention, and rarely, tremors. In children, agitation or restlessness may be prominent. Treatment is symptomatic and supportive. There is no specific antidote. Gastric lavage and activated charcoal may be considered if ingestion was recent. Hemodialysis is not effective. Seek medical attention for significant overdose.

MEDICATION

Medication

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Medicine Interactions	♦ Central Nervous System (CNS) Depressants: Concurrent use with alcohol, sedatives, hypnotics, tranquilizers, or other CNS depressants can enhance CNS depressant effects (e.g., increased drowsiness, impaired alertness). ♦ Theophylline: Concomitant administration of theophylline (at 400 mg daily) resulted in a small decrease in cetirizine clearance, but the clinical significance is minimal. ♦ No other significant drug interactions are commonly reported with cetirizine due to its minimal metabolism by CYP enzymes.

Chloroquine (Aralen)

Purpose/Indication	Chloroquine is an antimalarial and amebicide medication primarily used for the prophylaxis and treatment of malaria, especially in areas where Plasmodium falciparum is still sensitive to it. It is also indicated for the treatment of extraintestinal amebiasis and has been used in some autoimmune conditions like rheumatoid arthritis and systemic lupus erythematosus due to its immunomodulatory effects, though hydroxychloroquine is more commonly used for these.
Method of Action	In malaria, chloroquine accumulates in the parasite's food vacuole and inhibits the detoxification of heme, a toxic byproduct of hemoglobin digestion, into hemozoin. This leads to the accumulation of toxic heme within the parasite, causing oxidative damage and parasitic death. It also has anti-inflammatory and immunomodulatory properties, though its exact mechanism in autoimmune diseases is not fully understood.
Medication Name & Brand Names	♦ Medication Name: Chloroquine Phosphate ♦ Brand Names: Aralen (historical, now often generic), Resochin (regional)
Pharmaceutical Forms & Appearance	Chloroquine is primarily available as oral tablets, usually in strengths of 250 mg or 500 mg (referring to the phosphate salt). Tablets are typically white or yellow, often scored. It can also be available as an injectable solution for severe cases of malaria, though less common.
Dosage & Administration	Dosage varies significantly based on indication (prophylaxis vs. treatment), patient weight, and local resistance patterns. For malaria prophylaxis, it's typically taken once weekly, starting 1-2 weeks before travel and continuing for 4 weeks after leaving. For treatment, a higher initial loading dose is followed by smaller daily doses. It can be taken with food to reduce gastrointestinal upset.
Supplied As	Chloroquine is supplied as oral tablets (e.g., 250 mg, 500 mg chloroquine phosphate, equivalent to different amounts of chloroquine base).
Contraindications	Chloroquine is contraindicated in patients with known hypersensitivity to chloroquine or 4-aminoquinoline compounds. It is also contraindicated in individuals with pre-existing retinal or visual field changes, or long-term use in patients with psoriasis, as it may exacerbate symptoms. Severe liver or kidney impairment may also be a contraindication.
Storage & Expiry	Chloroquine tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in a tightly closed container and out of reach of children. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, abdominal cramps, headache, dizziness, and blurring of vision. More serious side effects, especially with long-term use or high doses, can include retinopathy (irreversible eye damage leading to visual loss), ototoxicity (hearing impairment), cardiomyopathy (heart muscle disease), seizures, and blood disorders.
Warnings & Precautions	♦ Retinopathy: Irreversible retinal damage can occur, especially with high cumulative doses. Regular ophthalmologic examinations, including visual field testing and fundoscopy, are essential for long-term therapy. Discontinue if any visual disturbance occurs. ♦ Cardiac Effects: Can cause QT prolongation and arrhythmias; use with caution in patients with heart disease or those taking other QT-prolonging drugs. ♦ Neurological Effects: May cause seizures, particularly in patients with epilepsy. ♦ Hematologic Effects: Rare cases of bone marrow depression have been reported. ♦ Psoriasis: May exacerbate psoriasis. ♦ Children: Children are particularly sensitive to chloroquine overdose; keep out of reach. ♦ Liver/Kidney Impairment: Use with caution and adjust dose in patients with hepatic or renal dysfunction.
Missed Dose Instructions	For malaria prophylaxis, if a weekly dose of Chloroquine is missed, take it as soon as remembered if it's within a few days. If it's almost time for the next dose, take the missed dose and the next dose as scheduled (for a brief overlap). However, if significant time has passed, consult a healthcare professional for guidance. For treatment, strict adherence to the dosing schedule is crucial, and missed doses should be taken as soon as possible.
Overdose Instructions	Chloroquine overdose is extremely dangerous and can be rapidly fatal, especially in children. Symptoms include headache, drowsiness, visual disturbances, cardiovascular collapse, seizures, severe hypokalemia, and cardiac arrest. Treatment requires immediate and aggressive medical intervention, including respiratory and cardiac support, gastric lavage, activated charcoal (multiple doses), and treatment for arrhythmias and hypokalemia. Diazepam may be used for seizures and to help with cardiac stability. Seek immediate emergency medical attention.
Medicine Interactions	♦ Antacids/Kaolin: May reduce the absorption of chloroquine; separate administration by at least 4 hours. ♦ Mefloquine: Concurrent use may increase the risk of seizures and abnormal heart rhythms. ♦ Amiodarone/Other QT-prolonging drugs: Increased risk of serious ventricular arrhythmias. ♦ Cyclosporine: May increase cyclosporine levels. ♦ Praziquantel: May decrease praziquantel levels. ♦ Vaccines: May reduce the antibody response to rabies vaccine. ♦ Oral Contraceptives: Potential for reduced effectiveness, though clinical significance is debated.

Ciclopirox (Loprox)

Purpose/Indication	Ciclopirox is a broad-spectrum antifungal agent used topically to treat various fungal and yeast infections of the skin, nails, and scalp. It is indicated for conditions such as tinea pedis (athlete's foot), tinea cruris (jock itch), tinea corporis (ringworm), cutaneous candidiasis, and tinea versicolor. It is also available as a lacquer for onychomycosis (fungal nail infections) and as a shampoo for seborrheic dermatitis of the scalp.
Method of Action	Ciclopirox exerts its fungicidal activity by interfering with the synthesis of fungal cell membrane and inhibiting key metabolic processes within the fungal cell. It chelates polyvalent metal ions, such as ferric iron, which are essential cofactors for various enzymes involved in fungal metabolism. This leads to the disruption of fungal cell integrity and metabolic pathways, ultimately resulting in the death of the fungal organism.
Medication Name & Brand Names	♦ Medication Name: Ciclopirox Olamine (topical cream, gel, solution, powder) or Ciclopirox (nail lacquer, shampoo) ♦ Brand Names: Loprox (cream, gel, suspension), Penlac (nail lacquer), Ciclodan (nail lacquer), Stieprox (shampoo)
Pharmaceutical Forms & Appearance	Ciclopirox is available in various topical forms: creams, gels, solutions, powders, nail lacquers, and shampoos. Creams are typically white and opaque. Solutions and gels are often clear to translucent. Nail lacquers are clear, varnish-like solutions. Shampoos are clear or pearlescent liquids.

Dosage & Administration	Dosage and administration vary significantly by form and indication. For skin infections, creams, gels, or solutions are typically applied twice daily to the affected area and surrounding skin for 2-4 weeks. Nail lacquers are applied daily to affected nails. Shampoos are used 2-3 times per week. Always follow the specific product instructions and complete the full course of treatment, even if symptoms improve.
Supplied As	Ciclopirox is supplied as: creams (e.g., 0.77%), gels (e.g., 0.77%), solutions (e.g., 0.77%), topical powders (1%), nail lacquers (e.g., 8%), and shampoos (e.g., 1%).
Contraindications	Ciclopirox is contraindicated in individuals with known hypersensitivity (allergy) to ciclopirox or any component of the formulation. It is for external use only and should not be applied to the eyes or orally.
Storage & Expiry	Ciclopirox topical formulations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and freezing. Nail lacquers should be kept tightly capped to prevent evaporation. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally localized and include mild skin irritation, itching, redness, burning, or stinging at the application site. For nail lacquer, periungual erythema and irritation are possible. Systemic side effects are rare due to minimal absorption.
Warnings & Precautions	♦ External Use Only: For topical application only. Avoid contact with eyes and mucous membranes. ♦ Irritation/Sensitization: If irritation or sensitization develops, discontinue use and institute appropriate therapy. ♦ Not for Ophthalmic, Oral, or Intravaginal Use: Not intended for internal use or use in the eyes. ♦ Nail Lacquer Specific: For onychomycosis, treatment often requires several months to a year, and regular debridement of the nail may be necessary. Not all fungal nail infections respond. ♦ Flammability: Nail lacquer is flammable; avoid use near heat or open flame.
Missed Dose Instructions	If a dose of topical Ciclopirox is missed, apply it as soon as remembered. However, if it is almost time for the next scheduled application, skip the missed dose and continue with the regular schedule. Do not apply a double amount. Consistency is important for effective treatment of fungal infections.
Overdose Instructions	Overdose with topical ciclopirox is highly unlikely to cause systemic toxicity due to minimal absorption through the skin. Accidental oral ingestion may cause gastrointestinal upset (nausea, vomiting), but serious systemic effects are not anticipated. Treatment for accidental ingestion is supportive. Seek medical advice if a large amount is ingested or if severe irritation occurs.
Medicine Interactions	No significant systemic drug interactions are commonly reported with topical application of ciclopirox due to its negligible systemic absorption. However, avoid co-application with other topical preparations on the same area unless directed by a healthcare professional, as this could alter absorption or cause irritation.

Ciprofloxacin (Cipro)

Purpose/Indication	Ciprofloxacin is a fluoroquinolone antibiotic used to treat a broad range of bacterial infections. It is commonly prescribed for urinary tract infections (UTIs), respiratory tract infections (e.g., pneumonia, bronchitis), skin and soft tissue infections, bone and joint infections, infectious diarrhea, and certain sexually transmitted infections. It is also used to treat or prevent anthrax and plague.
Method of Action	Ciprofloxacin is a bactericidal antibiotic that inhibits bacterial DNA gyrase and topoisomerase IV, enzymes essential for bacterial DNA replication, transcription, repair, and recombination. By interfering with these vital processes, ciprofloxacin prevents the bacteria from multiplying and ultimately leads to their death.
Medication Name & Brand Names	♦ Medication Name: Ciprofloxacin Hydrochloride ♦ Brand Names: Cipro, Cipro XR (extended-release), Ciloxan (ophthalmic), Cipro HC (otic)
Pharmaceutical Forms & Appearance	Ciprofloxacin is available as oral tablets (immediate and extended-release), oral suspension, and solutions for intravenous (IV) injection. Ophthalmic solutions/ointments and otic solutions are also available for eye and ear infections, respectively. Oral tablets are typically white to yellowish-white, often oval, and may be scored. The oral suspension is usually a micro-pellet formulation that is white to slightly yellow.
Dosage & Administration	Dosage and duration vary widely based on the infection, its severity, and patient factors (e.g., renal function). Oral doses typically range from 250 mg to 750 mg once or twice daily. Extended-release forms are once daily. IV doses are also common. It can be taken with or without food, but avoid taking it with dairy products, calcium-fortified juices, or antacids, as these can interfere with absorption. Always complete the full course.
Supplied As	Ciprofloxacin is supplied as: oral tablets (e.g., 250 mg, 500 mg, 750 mg), extended-release tablets (e.g., 500 mg, 1000 mg), powder for oral suspension (e.g., 250 mg/5 mL, 500 mg/5 mL), intravenous solution (e.g., 200 mg, 400 mg vials), ophthalmic solution/ointment, and otic solution.
Contraindications	Ciprofloxacin is contraindicated in patients with known hypersensitivity to ciprofloxacin, other fluoroquinolones, or any component of the formulation. Concurrent administration with tizanidine is contraindicated. It is generally not recommended for use in children under 18 years for most indications due to risk of musculoskeletal adverse events, except when benefits outweigh risks (e.g., anthrax, complicated UTIs).
Storage & Expiry	Ciprofloxacin tablets and IV solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. The reconstituted oral suspension should be stored at room temperature or refrigerated and typically used within 14 days; discard any unused portion. Always check the specific product label for precise storage and expiry information.
Side Effects	Common side effects include nausea, diarrhea, abdominal pain, vomiting, and headache. More serious and important side effects (especially from oral/IV forms) include tendonitis and tendon rupture, peripheral neuropathy, central nervous system effects (e.g., dizziness, confusion, seizures), QT prolongation (heart rhythm abnormality), and Clostridioides difficile-associated diarrhea (CDAD).
Warnings & Precautions	♦ Serious Adverse Reactions: Can cause disabling and potentially irreversible serious adverse reactions that may occur together, including tendinitis and tendon rupture, peripheral neuropathy, and central nervous system effects. Discontinue immediately if these occur. ♦ QT Prolongation: Can prolong the QT interval, increasing the risk of potentially fatal arrhythmias. Use with caution in patients with pre-existing heart conditions, electrolyte disturbances, or those taking other QT-prolonging drugs. ♦ Hypersensitivity Reactions: Serious and sometimes fatal hypersensitivity reactions, including anaphylaxis, can occur. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): Can occur during or after antibiotic therapy. ♦ Photosensitivity: Can cause moderate to severe photosensitivity reactions. ♦ Glucose Dysregulation: Can cause hypo- or hyperglycemia. ♦ Aortic Aneurysm/Dissection: Increased risk in elderly patients or those with risk factors. ♦ Resistance: Risk of bacterial resistance development; use only for proven or strongly suspected bacterial infections.

Missed Dose Instructions	If a dose of Ciprofloxacin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. It's crucial to complete the entire course of antibiotics to ensure eradication of the infection and prevent resistance.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including acute renal failure. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if ingestion was recent. Hemodialysis and peritoneal dialysis are generally not effective in removing significant amounts of ciprofloxacin. Maintain adequate hydration. Seek immediate medical attention.
Medicine Interactions	♦ Multivalent Cation-Containing Products: Antacids (aluminum, magnesium, calcium), iron/zinc/calcium supplements, dairy products, and calcium-fortified juices can significantly reduce ciprofloxacin absorption. Administer ciprofloxacin at least 2 hours before or 6 hours after these products. ♦ Tizanidine: Co-administration is contraindicated due to increased tizanidine levels, leading to severe hypotension and somnolence. ♦ Theophylline: Ciprofloxacin can increase theophylline levels, leading to toxicity; monitor theophylline levels. ♦ Warfarin: May enhance the anticoagulant effect of warfarin, increasing bleeding risk; monitor INR. ♦ Cyclosporine: May increase cyclosporine levels, leading to nephrotoxicity. ♦ Methotrexate: May increase methotrexate levels, increasing toxicity. ♦ NSAIDs: Concomitant use may increase the risk of CNS stimulation and convulsions. ♦ QT-prolonging drugs: Increased risk of QT prolongation and arrhythmias.

Clarithromycin (Biaxin)

Purpose/Indication	Clarithromycin is a macrolide antibiotic used to treat various bacterial infections. It is commonly prescribed for respiratory tract infections (e.g., bronchitis, pneumonia, sinusitis, pharyngitis/tonsillitis), skin and soft tissue infections, and disseminated mycobacterial infections (e.g., MAC). It is also a key component of combination therapies for eradicating Helicobacter pylori in peptic ulcer disease.
Method of Action	Clarithromycin works by inhibiting bacterial protein synthesis. It binds to the 50S ribosomal subunit of susceptible bacteria, thereby interfering with the translocation of peptides and inhibiting the assembly of new proteins. This bacteriostatic action prevents the growth and multiplication of bacteria.
Medication Name & Brand Names	♦ Medication Name: Clarithromycin ♦ Brand Names: Biaxin, Klaricid (regional)
Pharmaceutical Forms & Appearance	Clarithromycin is available as immediate-release oral tablets, extended-release oral tablets, and as a powder for oral suspension (liquid that needs to be reconstituted). Immediate-release tablets are typically yellow, film-coated, and oval-shaped. Extended-release tablets are generally larger and also often yellow. The reconstituted suspension is usually a white to off-white liquid.
Dosage & Administration	Dosage and duration vary depending on the infection. For adults, immediate-release tablets are typically 250 mg or 500 mg twice daily. Extended-release tablets are usually 500 mg or 1000 mg once daily with food. For children, it is weight-based and typically given as a suspension. Always complete the full prescribed course, even if symptoms improve, to prevent resistance.
Supplied As	Clarithromycin is supplied as: immediate-release oral tablets (e.g., 250 mg, 500 mg), extended-release oral tablets (e.g., 500 mg, 1000 mg), and powder for oral suspension (e.g., 125 mg/5 mL, 250 mg/5 mL).
Contraindications	Clarithromycin is contraindicated in patients with a history of allergic reactions to clarithromycin, erythromycin, any macrolide or ketolide antibiotic. It is also contraindicated in patients with a history of cholestatic jaundice or hepatic dysfunction associated with prior clarithromycin use. Concurrent use with certain medications (e.g., cisapride, pimozide, ergotamine, colchicine in patients with renal/hepatic impairment, and some statins) is contraindicated due to risk of serious interactions.
Storage & Expiry	Clarithromycin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The reconstituted oral suspension should be stored at room temperature (15°C to 30°C or 59°F to 86°F) and typically remains stable for 14 days; do not refrigerate as it may thicken. Always check the specific product label for precise storage and expiry information.
Side Effects	Common side effects include nausea, vomiting, diarrhea, abdominal pain, altered taste (dysgeusia), and headache. More serious but less common side effects can include severe allergic reactions, liver problems (including cholestatic hepatitis), QT prolongation (a heart rhythm abnormality), and Clostridioides difficile-associated diarrhea (CDAD).
Warnings & Precautions	♦ QT Prolongation: Can prolong the QT interval, increasing the risk of potentially fatal arrhythmias (Torsades de Pointes). Use with caution in patients with pre-existing heart conditions, electrolyte disturbances, or those taking other QT-prolonging drugs. ♦ Hepatotoxicity: Liver dysfunction, ranging from mild elevations in liver enzymes to severe hepatic failure, has been reported. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): Can occur during or after antibiotic therapy. ♦ Renal Impairment: Dose adjustment is necessary in patients with severe kidney impairment. ♦ Myasthenia Gravis: May exacerbate symptoms of myasthenia gravis. ♦ Not effective against viral infections. ♦ Drug Interactions: Numerous significant drug interactions due to strong CYP3A4 inhibition (see interactions).
Missed Dose Instructions	If a dose of Clarithromycin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. It's crucial to complete the entire course of antibiotics to ensure eradication of the infection and prevent resistance.
Overdose Instructions	Symptoms of overdose are generally an exaggeration of known side effects, primarily severe gastrointestinal symptoms such as nausea, vomiting, diarrhea, and abdominal discomfort. Allergic reactions and QT prolongation are also possible. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if ingestion was recent. Hemodialysis and peritoneal dialysis are not effective in removing significant amounts of clarithromycin. Seek immediate medical attention.
Medicine Interactions	♦ Strong CYP3A4 Substrates: Clarithromycin is a strong CYP3A4 inhibitor and can significantly increase levels of drugs metabolized by this enzyme, leading to increased toxicity. Examples include: statins (simvastatin, lovastatin - contraindicated due to rhabdomyolysis risk), colchicine (contraindicated in renal/hepatic impairment), warfarin, oral midazolam, sildenafil, cyclosporine, tacrolimus, carbamazepine, cisapride, pimozide (both contraindicated due to QT prolongation). ♦ QT-prolonging drugs: Increased risk of QT prolongation and arrhythmias with other QT-prolonging agents (e.g., antiarrhythmics, antipsychotics). ♦ Oral Contraceptives: May reduce effectiveness, requiring alternative contraception. ♦ Digoxin: May increase digoxin levels. ♦ Rifampin/Phenytoin/Carbamazepine/St. John's Wort: These strong inducers can decrease clarithromycin levels, potentially leading to treatment failure.

Clindamycin (Cleocin)

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Purpose/Indication	Clindamycin is a lincosamide antibiotic used to treat serious bacterial infections, particularly those caused by anaerobic bacteria (e.g., intra-abdominal infections, pelvic infections) and certain susceptible aerobic gram-positive bacteria (e.g., strep and staph infections). It is often used for skin and soft tissue infections, osteomyelitis, septicemia, and in some cases, for acne (topical) or bacterial vaginosis (topical/oral).
Method of Action	Clindamycin inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit of susceptible bacteria. This binding prevents the elongation of peptide chains by interfering with the peptidyl transferase reaction. This action is primarily bacteriostatic (inhibits growth) but can be bactericidal against highly susceptible organisms or at high concentrations.
Medication Name & Brand Names	♦ Medication Name: Clindamycin Hydrochloride (oral), Clindamycin Phosphate (topical, injectable), Clindamycin Palmitate HCl (oral solution) ♦ Brand Names: Cleocin (oral, injectable, topical), Clinda-Derm (topical), Dalacin C (regional)
Pharmaceutical Forms & Appearance	Clindamycin is available in various forms: oral capsules, oral solution, topical solution/gel/foam/lotion, vaginal cream/suppositories, and injectable solutions. Oral capsules are typically opaque, hard gelatin capsules with various colors and imprints. The oral solution is a clear or slightly viscous liquid. Topical preparations vary in appearance depending on the base. Injectable solutions are clear, colorless to slightly yellow.
Dosage & Administration	Dosage and route of administration vary significantly based on the infection, its severity, and patient factors. Oral doses typically range from 150 mg to 450 mg every 6-8 hours. Injectable doses are higher. Topical preparations are applied once or twice daily. Oral forms can be taken with or without food. Complete the full prescribed course.
Supplied As	Clindamycin is supplied as: oral capsules (e.g., 75 mg, 150 mg, 300 mg), granules for oral solution (e.g., 75 mg/5 mL), injectable solution (e.g., 150 mg/mL), topical solution/gel/foam/lotion (e.g., 1%), and vaginal cream/suppositories.
Contraindications	Clindamycin is contraindicated in patients with a history of hypersensitivity to clindamycin or lincomycin. It is also contraindicated in patients with a history of pseudomembranous colitis associated with antibiotic use.
Storage & Expiry	Clindamycin capsules and topical preparations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The reconstituted oral solution should be stored at room temperature and used within a specific period (check product label, typically 2 weeks). Injectable solutions are stored at room temperature. Always check the specific expiry date on the packaging.
Side Effects	The most significant and common side effect is Clostridioides difficile-associated diarrhea (CDAD), which can range from mild diarrhea to severe, life-threatening pseudomembranous colitis. Other common side effects include nausea, vomiting, abdominal pain, and rash. Topical forms may cause local irritation, dryness, or peeling.
Warnings & Precautions	♦ Clostridioides difficile-Associated Diarrhea (CDAD): This is the most serious and frequent adverse effect. It can occur during or even several weeks after discontinuation of clindamycin. Patients presenting with diarrhea should be evaluated for CDAD. ♦ Severe Allergic Reactions: Anaphylaxis and severe skin reactions (e.g., Stevens-Johnson syndrome, DRESS syndrome) have been reported. ♦ Gastrointestinal Effects: Use with caution in patients with a history of gastrointestinal disease, especially colitis. ♦ Liver/Kidney Impairment: Use with caution in patients with severe hepatic or renal impairment; dose adjustment may be necessary. ♦ Not indicated for the treatment of meningitis due to poor penetration into the CSF.
Missed Dose Instructions	If a dose of Clindamycin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full course of antibiotics is essential for effective treatment and to prevent the development of resistance.
Overdose Instructions	Overdose with clindamycin is rare and typically results in an exaggeration of known side effects, mainly gastrointestinal disturbances (nausea, vomiting, diarrhea, abdominal pain). Severe cases may present with signs of pseudomembranous colitis. Treatment is symptomatic and supportive. Gastric decontamination (e.g., activated charcoal) may be considered if a significant oral overdose was recent. Hemodialysis and peritoneal dialysis are not effective. Seek medical attention if severe symptoms occur.
Medicine Interactions	♦ Neuromuscular Blocking Agents: Clindamycin has neuromuscular blocking properties and can enhance the action of other neuromuscular blocking agents (e.g., succinylcholine, rocuronium), leading to prolonged muscle paralysis and respiratory depression. Use with caution. ♦ Erythromycin: In vitro studies suggest antagonism between clindamycin and erythromycin (another macrolide); co-administration is generally not recommended. ♦ Kaolin-pectin antidiarrheals: May delay or decrease the absorption of oral clindamycin; separate administration by at least 2 hours. ♦ Oral Typhoid Vaccine: Clindamycin can inhibit the growth of the live bacteria in the typhoid vaccine; avoid concomitant use.

Clopidogrel (Plavix)

Purpose/Indication	Clopidogrel is an antiplatelet medication used to prevent serious cardiovascular events such as heart attacks and strokes in patients at high risk. It is indicated for individuals with a recent myocardial infarction (heart attack), recent stroke, established peripheral arterial disease, or those with acute coronary syndrome (ACS), often in combination with aspirin. It works by reducing the formation of blood clots.
Method of Action	Clopidogrel is a prodrug that is metabolized by the liver (primarily by CYP2C19) into an active thiol metabolite. This active metabolite irreversibly blocks the P2Y12 adenosine diphosphate (ADP) receptor on the surface of platelets. By blocking this receptor, it prevents ADP from binding and activating platelets, thereby inhibiting platelet aggregation and the formation of blood clots. Because the binding is irreversible, the antiplatelet effect lasts for the lifetime of the platelet (7-10 days).
Medication Name & Brand Names	♦ Medication Name: Clopidogrel Bisulfate ♦ Brand Names: Plavix, Apo-Clopidogrel (Canada), GenRx Clopidogrel (Australia)
Pharmaceutical Forms & Appearance	Clopidogrel is available as oral tablets, typically in strengths of 75 mg and 300 mg. Tablets are usually pink, round, biconvex, and film-coated, often with specific imprints indicating the dosage strength.
Dosage & Administration	Dosage varies by indication. For acute coronary syndrome, a loading dose of 300 mg or 600 mg is often given, followed by a maintenance dose of 75 mg once daily. For other indications (e.g., recent MI/stroke/PAD), the usual dose is 75 mg once daily. It can be taken with or without food. Consistent daily administration is important.
Supplied As	Clopidogrel is supplied as oral film-coated tablets (e.g., 75 mg, 300 mg).
Contraindications	Clopidogrel is contraindicated in patients with active pathological bleeding (e.g., peptic ulcer, intracranial hemorrhage) and in individuals with known hypersensitivity to clopidogrel or any component of the formulation.
Storage & Expiry	Clopidogrel tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in their original container. Always check the specific expiry date on the packaging.

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Side Effects	The most significant and common side effect is bleeding, which can range from minor (e.g., bruising, nosebleeds) to major (e.g., gastrointestinal bleeding, intracranial hemorrhage). Other common side effects include dyspepsia, abdominal pain, diarrhea, and rash. Less common but serious side effects include thrombotic thrombocytopenic purpura (TTP), severe allergic reactions, and liver dysfunction.
Warnings & Precautions	♦ Bleeding Risk: Clopidogrel increases the risk of bleeding. Use with caution in patients at increased risk of bleeding (e.g., recent surgery, trauma, active ulcers, concomitant use of other anticoagulants/antiplatelets). Discontinue 5-7 days prior to elective surgery if antiplatelet effect is not desired. ♦ Genetic Polymorphism (CYP2C19): Patients who are "poor metabolizers" of CYP2C19 may have diminished antiplatelet response and an increased risk of cardiovascular events. Genetic testing may be considered. ♦ Thrombotic Thrombocytopenic Purpura (TTP): Rare but potentially fatal TTP has been reported, sometimes after short-term use. Prompt treatment is required. ♦ Hypersensitivity: Angioedema or other allergic reactions may occur. ♦ Cross-reactivity: Patients with a history of hypersensitivity to another thienopyridine (e.g., prasugrel, ticlopidine) may be at increased risk of reaction to clopidogrel.
Missed Dose Instructions	If a dose of Clopidogrel is missed and it's less than 12 hours since the usual time, take it as soon as remembered, then continue with the next dose at the regularly scheduled time. If it's more than 12 hours, skip the missed dose and simply take the next dose at the regularly scheduled time. Do not take a double dose. Consistent daily dosing is essential for maintaining antiplatelet protection.
Overdose Instructions	Overdose can lead to prolonged bleeding time and subsequent bleeding complications. Symptoms may include gastrointestinal bleeding, nosebleeds, bruising, or more severe hemorrhages. There is no specific antidote to reverse the antiplatelet effects of clopidogrel immediately. Platelet transfusions may be considered in cases of severe bleeding requiring rapid reversal. Treatment is supportive and symptomatic. Seek immediate medical attention.
Medicine Interactions	♦ CYP2C19 Inhibitors: Strong and moderate inhibitors of CYP2C19 (e.g., omeprazole, esomeprazole, fluoxetine, fluvoxamine, ticlopidine, voriconazole) can reduce the active metabolite formation of clopidogrel, potentially decreasing its antiplatelet effect. Avoid concurrent use, particularly with PPIs like omeprazole/esomeprazole. ♦ Other Antiplatelet Agents/Anticoagulants/NSAIDs: Concurrent use with aspirin, other NSAIDs, warfarin, heparin, or other anticoagulants significantly increases the risk of bleeding. Use with caution and monitor closely. ♦ Opioids: Reduced absorption of clopidogrel has been observed with opioid co-administration, potentially decreasing its antiplatelet effect. ♦ Repaglinide: Clopidogrel can increase repaglinide levels, increasing the risk of hypoglycemia.

Clopidogrel (Plavix)

Clotrimazole (Canesten)

Purpose/Indication	Clotrimazole is an antifungal medication used to treat various fungal and yeast infections of the skin, mouth, and vagina. It is commonly indicated for conditions such as athlete's foot (tinea pedis), jock itch (tinea cruris), ringworm (tinea corporis), oral thrush (oropharyngeal candidiasis), and vaginal yeast infections (vulvovaginal candidiasis).
Method of Action	Clotrimazole is an azole antifungal that works by inhibiting the biosynthesis of ergosterol, a vital component of the fungal cell membrane. By disrupting ergosterol synthesis, it compromises the integrity and permeability of the fungal cell membrane, leading to leakage of essential intracellular components and ultimately, the death of the fungal organism.
Medication Name & Brand Names	♦ Medication Name: Clotrimazole ♦ Brand Names: Lotrimin AF, Canesten, Mycelex, Desenex (some formulations), Gyne-Lotrimin (vaginal)
Pharmaceutical Forms & Appearance	Clotrimazole is available in various topical forms: creams, lotions, solutions, powders, sprays, vaginal tablets, and vaginal creams. For oral use, it's available as lozenges (troches). Creams, lotions, and vaginal creams are typically white and smooth. Vaginal tablets are usually white. Lozenges are white.
Dosage & Administration	Dosage and administration vary significantly by form and indication. For skin infections, creams/lotions are typically applied twice daily to the affected area for 2-4 weeks. Vaginal tablets/creams are inserted once daily at bedtime for 1-7 days depending on strength. Oral lozenges are usually dissolved slowly in the mouth 5 times daily. Always follow specific product instructions and complete the full course.
Supplied As	Clotrimazole is supplied as: topical creams, lotions, solutions, powders, and sprays (e.g., 1%); vaginal creams (e.g., 1%, 2%); vaginal tablets (e.g., 100 mg, 200 mg, 500 mg); and oral lozenges (e.g., 10 mg).
Contraindications	Clotrimazole is contraindicated in individuals with known hypersensitivity (allergy) to clotrimazole or any component of the formulation. Topical forms are for external use only and should not be used in the eyes. Oral lozenges are contraindicated in patients with severe liver impairment.
Storage & Expiry	Clotrimazole topical and vaginal formulations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from heat and moisture. Oral lozenges should also be stored at room temperature. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally localized to the application site and include mild skin irritation, itching, redness, burning, or stinging. Vaginal forms can cause burning, itching, or irritation. Oral lozenges may cause nausea, vomiting, or abnormal liver function tests (rarely). Systemic side effects are rare due to minimal absorption.
Warnings & Precautions	♦ External Use Only: For topical application on skin, in the mouth, or vaginally. Avoid contact with eyes. ♦ Irritation/Sensitization: If irritation or sensitization develops (e.g., worsening redness, swelling, burning), discontinue use and consult a healthcare professional. ♦ Vaginal Use: If symptoms do not improve within a few days or worsen, or if recurrence is frequent, consult a healthcare professional as other conditions may be present. Avoid sexual intercourse during treatment of vaginal infections. ♦ Oral Use: Prolonged use of oral lozenges may lead to liver enzyme elevations; monitor liver function in such cases.
Missed Dose Instructions	If a dose of topical or oral Clotrimazole (for an ongoing course) is missed, apply/take it as soon as remembered. However, if it is almost time for the next scheduled application/dose, skip the missed dose and continue with the regular schedule. Do not apply/take a double amount. Consistency is important for effective treatment of fungal infections.
Overdose Instructions	Overdose with topical or vaginal clotrimazole is highly unlikely to cause systemic toxicity due to negligible absorption. Accidental oral ingestion of topical forms may cause gastrointestinal upset (nausea, vomiting, abdominal pain). Overdose with oral lozenges is also rare but could potentially lead to increased liver enzyme levels. Treatment is symptomatic and supportive. Seek medical advice if a large amount is ingested or if severe irritation occurs.
Medicine Interactions	♦ Topical/Vaginal Forms: No significant systemic drug interactions are commonly reported due to minimal systemic absorption. However, vaginal creams may weaken latex condoms or diaphragms. ♦ Oral Lozenges: Although systemic absorption is low, some potential for interaction with drugs metabolized by CYP450 enzymes (e.g., tacrolimus, cyclosporine) exists, similar to other azole antifungals, but is generally not clinically significant with this formulation. However, always inform healthcare providers of all medications being used.

Clotrimazole (Canesten)

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Cycloserine (Seromycin)

Purpose/Indication	Cycloserine is an antibiotic primarily used as a second-line agent for the treatment of active tuberculosis (TB), especially in cases of multi-drug-resistant TB (MDR-TB) or extensively drug-resistant TB (XDR-TB) caused by susceptible strains of Mycobacterium tuberculosis. It is always used in combination with other anti-tuberculosis drugs to prevent resistance and enhance efficacy. It also has a limited role in treating certain urinary tract infections caused by susceptible organisms when first-line agents are ineffective.
Method of Action	Cycloserine acts as an antimetabolite, interfering with bacterial cell wall synthesis. It is a structural analogue of D-alanine, an essential component of peptidoglycan synthesis in the bacterial cell wall. Cycloserine competitively inhibits two key enzymes: D-alanine racemase (which converts L-alanine to D-alanine) and D-alanine:D-alanine ligase (which joins two D-alanine molecules). This disruption prevents the formation of a stable bacterial cell wall, leading to bacterial lysis and death.
Medication Name & Brand Names	♦ Medication Name: Cycloserine ♦ Brand Name: Seromycin (often referred to generically now)
Pharmaceutical Forms & Appearance	Cycloserine is available as oral capsules, typically in a strength of 250 mg. The capsules are usually hard gelatin capsules, often with a white or off-white body and cap, and may have imprints.
Dosage & Administration	Dosage is individualized based on patient factors, including renal function and plasma cycloserine concentrations, which should be monitored to minimize toxicity. For adults, the typical initial dose for TB is 250 mg twice daily, increasing to 250-500 mg every 12 hours, with a maximum daily dose of 1 gram. It is usually taken by mouth, with or without food.
Supplied As	Cycloserine is supplied as oral capsules (e.g., 250 mg).
Contraindications	Cycloserine is contraindicated in patients with known hypersensitivity to cycloserine. It is also contraindicated in individuals with epilepsy or a history of convulsions, active depression, severe anxiety, or psychosis, as the drug can exacerbate these neurological and psychiatric conditions. Severe renal insufficiency and alcohol abuse are also contraindications.
Storage & Expiry	Cycloserine capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	The most common and significant side effects of cycloserine are neurological and psychiatric, including headache, dizziness, drowsiness, confusion, irritability, anxiety, depression, tremors, psychosis, and seizures. Other side effects can include peripheral neuropathy and, rarely, liver dysfunction.
Warnings & Precautions	♦ Neuropsychiatric Effects: Can cause severe central nervous system toxicity, including psychosis, depression, and seizures. Close monitoring for changes in mental status is essential, especially in patients with pre-existing psychiatric conditions. Pyridoxine (Vitamin B6) should be co-administered to reduce the risk of neurological toxicity, especially peripheral neuropathy. ♦ Renal Impairment: Dose adjustment is necessary in patients with kidney impairment to prevent drug accumulation and toxicity; careful monitoring of serum levels is crucial. ♦ Alcohol: Alcohol consumption should be avoided as it increases the risk of convulsions and CNS toxicity. ♦ Liver Dysfunction: Monitor liver function, although hepatotoxicity is rare. ♦ Drug Monitoring: Therapeutic drug monitoring (plasma cycloserine levels) is highly recommended to guide dosing and minimize toxicity.
Missed Dose Instructions	Given the critical nature of TB treatment and the potential for resistance, if a dose of Cycloserine is missed, the healthcare provider managing the patient's TB therapy should be contacted immediately for specific instructions. Do not take a double dose. Adherence to the prescribed regimen is paramount.
Overdose Instructions	Overdose is most likely to lead to severe neuropsychiatric toxicity, including profound drowsiness, dizziness, confusion, severe psychosis, tremors, and seizures. Coma and respiratory depression can occur in severe cases. There is no specific antidote. Treatment is supportive. Gastric lavage and repeated doses of activated charcoal may be considered if oral ingestion was recent. Hemodialysis can effectively remove cycloserine from the body. Pyridoxine administration is crucial. Seek immediate medical attention.
Medicine Interactions	♦ Alcohol: Concurrent alcohol consumption significantly increases the risk of seizures and CNS toxicity. ♦ Isoniazid (INH): Co-administration with isoniazid can increase the risk of CNS side effects (dizziness, drowsiness), especially if isoniazid dosage is too high or if cycloserine levels are elevated. Pyridoxine is particularly important in this combination. ♦ Ethionamide: Concurrent use may increase the risk of CNS adverse effects. ♦ No other significant drug interactions are commonly reported, but given its CNS effects, caution is advised with other CNS depressants or drugs affecting neurological function.

Cyclosporine (Sandimmune)

Purpose/Indication	Cyclosporine is a potent immunosuppressant medication primarily used to prevent organ rejection after transplantation (kidney, liver, heart, lung, etc.) by suppressing the body's immune response to the transplanted organ. It is also indicated for certain severe autoimmune diseases, such as severe active rheumatoid arthritis, severe psoriasis, and nephrotic syndrome, when other treatments are ineffective or not tolerated.
Method of Action	Cyclosporine works by selectively inhibiting T-lymphocyte activation. It forms a complex with cyclophilin, an intracellular protein, which then inhibits the calcium-dependent phosphatase calcineurin. Calcineurin is crucial for the dephosphorylation of the nuclear factor of activated T-cells (NFAT), preventing its translocation into the nucleus. This ultimately blocks the transcription of early T-cell activation genes, particularly those encoding interleukin-2 (IL-2), a cytokine essential for T-cell proliferation and differentiation, thereby suppressing the immune response.
Medication Name & Brand Names	♦ Medication Name: Cyclosporine (modified or non-modified) ♦ Brand Names: Sandimmune (non-modified), Neoral (modified), Gengraf (modified), Restasis (ophthalmic)
Pharmaceutical Forms & Appearance	Cyclosporine is available as oral capsules (soft gelatin), oral solution, and solution for intravenous (IV) injection. Oral capsules are typically soft gelatin capsules, with various colors and sizes depending on the strength and formulation (modified vs. non-modified). The oral solution is usually an oily, clear liquid. The injectable solution is a clear, yellowish liquid.
Dosage & Administration	Dosage is highly individualized based on the patient's weight, the type of transplant or autoimmune condition, and most importantly, therapeutic drug monitoring of blood levels. It is typically taken twice daily, exactly 12 hours apart, and consistently with or without food. Different formulations (modified vs. non-modified) are not bioequivalent and should not be interchanged without careful dose adjustment and monitoring by a healthcare professional.

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Supplied As	Cyclosporine is supplied as: oral soft gelatin capsules (e.g., 25 mg, 50 mg, 100 mg - both modified and non-modified), oral solution (e.g., 100 mg/mL), and concentrated solution for intravenous infusion (e.g., 50 mg/mL).
Contraindications	Cyclosporine is contraindicated in patients with known hypersensitivity to cyclosporine or any component of the formulation. For non-transplant indications, it is also contraindicated in patients with uncontrolled hypertension, uncontrolled infections, or malignancy. Concomitant use with specific drugs like bosentan (for pulmonary hypertension) or pitavastatin/lovastatin (for cholesterol) is also contraindicated.
Storage & Expiry	Cyclosporine capsules and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. The oral solution should not be refrigerated as it may gel. Keep in its original packaging. Always check the specific expiry date. The IV concentrate must be stored properly and protected from light.
Side Effects	Common side effects include nephrotoxicity (kidney damage), hypertension (high blood pressure), hirsutism (excessive hair growth), gingival hyperplasia (gum overgrowth), tremor, headache, and gastrointestinal upset. More serious side effects can include increased risk of infections (bacterial, viral, fungal, opportunistic), malignancy (especially lymphoma, skin cancer), neurotoxicity (seizures, encephalopathy), hyperkalemia (high potassium), and hyperlipidemia (high cholesterol).
Warnings & Precautions	♦ Nephrotoxicity: Dose-dependent and can be acute or chronic. Renal function (creatinine, BUN) must be monitored closely. ♦ Hypertension: Common and often requires antihypertensive therapy. ♦ Increased Risk of Infection & Malignancy: Immunosuppression significantly increases the risk of opportunistic infections and various cancers, particularly skin cancers and lymphomas. ♦ Neurotoxicity: Tremor, headache, paresthesia are common; seizures and encephalopathy can occur. ♦ Drug Monitoring: Therapeutic drug monitoring (blood cyclosporine levels) is essential to ensure optimal immunosuppression and minimize toxicity. ♦ Bioequivalence: Non-modified and modified formulations are NOT interchangeable without careful supervision due to different bioavailability. ♦ Hyperkalemia/Hyperlipidemia: Monitor potassium and lipid levels. ♦ Hepatotoxicity: Liver function should be monitored.
Missed Dose Instructions	If a dose of Cyclosporine is missed, take it as soon as remembered if it is still within a few hours of the scheduled time. If it is almost time for the next scheduled dose (e.g., more than 6 hours after the usual time), skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Missing doses can increase the risk of organ rejection or worsening of autoimmune disease. Contact your transplant team or healthcare provider for specific advice.
Overdose Instructions	Overdose can lead to an exaggeration of known dose-dependent side effects, primarily severe nephrotoxicity, hypertension, tremor, and neurotoxicity. There is no specific antidote. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if oral ingestion was recent and substantial. Hemodialysis is not effective for removing cyclosporine due to its high protein binding and large volume of distribution. Monitor blood cyclosporine levels, renal function, blood pressure, and neurological status closely. Seek immediate medical attention.
Medicine Interactions	Cyclosporine is a substrate, inhibitor, and inducer of CYP3A4 and a substrate and inhibitor of P-glycoprotein, leading to numerous significant interactions: ♦ CYP3A4 Inhibitors (e.g., azole antifungals like ketoconazole/itraconazole, macrolide antibiotics like erythromycin/clarithromycin, diltiazem, verapamil, amiodarone, grapefruit juice): Significantly increase cyclosporine levels, increasing toxicity risk. Dose reduction of cyclosporine is often required. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, phenobarbital, St. John's Wort): Significantly decrease cyclosporine levels, increasing rejection risk. Avoid co-administration or increase cyclosporine dose with close monitoring. ♦ Nephrotoxic Agents (e.g., aminoglycosides, NSAIDs, amphotericin B, trimethoprim/sulfamethoxazole): Increased risk of nephrotoxicity. Avoid or use with extreme caution and close monitoring. ♦ Potassium-Sparing Diuretics/Potassium Supplements/ACE Inhibitors/ARBs: Increased risk of hyperkalemia. ♦ Statins (lovastatin, simvastatin, pitavastatin): Increased risk of myopathy/rhabdomyolysis; pitavastatin/lovastatin contraindicated with cyclosporine. ♦ Digoxin/Colchicine: Increased levels of these drugs.

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Daptomycin (Cubicin)

MEDICATION | D - G | Daptomycin (Cubicin)

Purpose/Indication	Daptomycin is a lipopeptide antibiotic used to treat serious infections caused by susceptible Gram-positive bacteria. It is indicated for complicated skin and skin structure infections (cSSSI), Staphylococcus aureus bloodstream infections (bacteremia), including those associated with right-sided infective endocarditis. It is active against methicillin-resistant S. aureus (MRSA) and vancomycin-resistant enterococci (VRE).
Method of Action	Daptomycin works by a unique calcium-dependent mechanism. It inserts into the bacterial cell membrane, leading to rapid depolarization of the membrane potential. This disruption inhibits essential bacterial processes such as protein, DNA, and RNA synthesis, ultimately resulting in rapid, concentration-dependent bacterial cell death. Unlike some other antibiotics, it does not penetrate the outer membrane of Gram-negative bacteria.
Medication Name & Brand Names	♦ Medication Name: Daptomycin ♦ Brand Name: Cubicin, Cubicin RF (for rapid reconstitution)
Pharmaceutical Forms & Appearance	Daptomycin is available as a sterile lyophilized powder for intravenous (IV) infusion. The powder is typically white to pale yellow. When reconstituted with sterile water for injection or saline, it forms a clear to pale yellow solution.
Dosage & Administration	Dosage and duration depend on the infection type and severity. For cSSSI, it is typically 4 mg/kg once every 24 hours. For S. aureus bacteremia and endocarditis, a higher dose of 6 mg/kg once every 24 hours is used. It is administered as an intravenous infusion over 30 minutes. Dose adjustment is required for patients with significant renal impairment.
Supplied As	Daptomycin is supplied as a sterile lyophilized powder for intravenous infusion in single-dose vials (e.g., 250 mg, 500 mg).
Contraindications	Daptomycin is contraindicated in patients with known hypersensitivity to daptomycin or any component of the formulation. It is generally not indicated for the treatment of pneumonia, as it is inactivated by pulmonary surfactant.
Storage & Expiry	Unopened vials of daptomycin powder should be stored under refrigeration (2°C to 8°C or 36°F to 46°F). Once reconstituted, the solution should be used promptly. If not used immediately, the reconstituted solution and diluted infusion solution can be stored for a limited time (e.g., up to 12 hours at room temperature or 48 hours refrigerated, depending on the diluent), as specified by the manufacturer. Always check the specific product label for precise storage and expiry information.

Side Effects	Common side effects include headache, nausea, constipation, diarrhea, rash, and injection site reactions. More serious but less common side effects can include muscle pain or weakness (myopathy), often associated with elevated creatine phosphokinase (CPK) levels, eosinophilic pneumonia (a rare lung condition), peripheral neuropathy, and severe allergic reactions.
Warnings & Precautions	♦ Myopathy/CPK Elevation: Can cause muscle pain and weakness, often associated with elevated CPK levels. CPK levels should be monitored at baseline and regularly (e.g., weekly) during treatment. Discontinue if significant CPK elevation or muscle symptoms occur. ♦ Eosinophilic Pneumonia: A rare but potentially serious lung adverse event. Monitor for new or worsening fever, cough, or dyspnea. ♦ Peripheral Neuropathy: Monitor for symptoms of neuropathy. ♦ Hypersensitivity Reactions: Serious and sometimes fatal hypersensitivity reactions, including anaphylaxis and DRESS syndrome, have been reported. ♦ Renal Impairment: Dose adjustment is required in patients with creatinine clearance <30 mL/min, and monitoring for CPK elevation should be more frequent. ♦ Not for Pneumonia: Not effective for the treatment of pneumonia as pulmonary surfactant inhibits its activity. ♦ Monitoring: Regular monitoring of CPK, renal function, and signs of muscle toxicity is essential.
Missed Dose Instructions	Daptomycin is an IV antibiotic administered by a healthcare professional, typically daily. If a scheduled dose is missed in a clinical setting, the healthcare team will be responsible for ensuring it is administered as soon as feasible to maintain consistent drug levels and effective treatment.
Overdose Instructions	Limited information is available on daptomycin overdose. Symptoms would likely be an exaggeration of known side effects, particularly myopathy with elevated CPK and potential for renal toxicity. Treatment is supportive and symptomatic. Daptomycin is slowly cleared by hemodialysis and peritoneal dialysis. Close monitoring of CPK, renal function, and signs of muscle toxicity is essential. Seek immediate medical attention.
Medicine Interactions	♦ Statins (HMG-CoA Reductase Inhibitors): Concomitant use with statins can increase the risk of myopathy and CPK elevations. Consider temporarily suspending statin therapy during daptomycin treatment, or monitor CPK levels more frequently if co-administration is necessary. ♦ Other Myopathy-Associated Drugs: Use with caution with other medications associated with myopathy (e.g., fibrates). ♦ Warfarin: No clinically significant interaction with warfarin requiring dose adjustment; however, monitor for bleeding if used concurrently with other anticoagulants.

Dexamethasone (Decadron)

Purpose/Indication	Dexamethasone is a potent synthetic corticosteroid used for its strong anti-inflammatory and immunosuppressive effects. It is indicated for a wide range of conditions, including allergic disorders, dermatologic diseases, endocrine disorders, gastrointestinal diseases, hematologic disorders, neoplastic diseases (as part of chemotherapy regimens), nervous system conditions (e.g., cerebral edema), ophthalmic diseases, renal diseases, and respiratory diseases. It is also used in the diagnosis of Cushing's syndrome.
Method of Action	Dexamethasone acts by binding to intracellular glucocorticoid receptors, forming a complex that translocates to the nucleus and modulates gene expression. This leads to the inhibition of pro-inflammatory mediators (e.g., prostaglandins, leukotrienes, cytokines) and suppression of various immune cell functions. It also has catabolic and antianabolic effects, influences fat and carbohydrate metabolism, and can stabilize lysosomal membranes.
Medication Name & Brand Names	♦ Medication Name: Dexamethasone ♦ Brand Names: Decadron (historical, now often generic), Dexamethasone Intensol (oral solution), Ozurdex (ophthalmic implant), Dexycu (ophthalmic solution)
Pharmaceutical Forms & Appearance	Dexamethasone is available in numerous forms: oral tablets, oral solution, intravenous (IV) injection, intramuscular (IM) injection, ophthalmic solution/ointment, otic solution, and even ophthalmic implants. Oral tablets are typically white, small, and may be scored. The oral solution is a clear liquid. Injectable solutions are clear and colorless.
Dosage & Administration	Dosage is highly variable and individualized based on the specific condition being treated, severity, and patient response. It can be given once daily or in divided doses. Oral forms can be taken with food or milk to reduce gastrointestinal upset. IV administration is used for rapid effect or severe conditions. Long-term therapy requires careful titration and often a gradual taper to avoid withdrawal symptoms.
Supplied As	Dexamethasone is supplied as: oral tablets (e.g., 0.5 mg, 0.75 mg, 1 mg, 1.5 mg, 2 mg, 4 mg, 6 mg), oral solution (e.g., 0.5 mg/5 mL, 1 mg/mL concentrate), injectable solution (e.g., 4 mg/mL, 10 mg/mL, 20 mg/mL), ophthalmic solutions/ointments, otic solutions, and ophthalmic implants.
Contraindications	Dexamethasone is contraindicated in patients with systemic fungal infections and in individuals with known hypersensitivity to dexamethasone or any component of the formulation. Live or live attenuated vaccines are generally contraindicated during treatment with immunosuppressive doses of corticosteroids.
Storage & Expiry	Dexamethasone tablets and solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging. Some injectable forms may require protection from freezing.
Side Effects	Common side effects with short-term use include increased appetite, weight gain, fluid retention, mood changes (e.g., irritability, insomnia), and indigestion. Long-term or high-dose use can lead to more serious effects such as adrenal suppression, osteoporosis, increased risk of infections, hyperglycemia/diabetes, hypertension, cataracts, glaucoma, Cushingoid features (e.g., moon face, buffalo hump), muscle weakness, and impaired wound healing.
Warnings & Precautions	♦ Adrenal Suppression: Prolonged use suppresses the hypothalamic-pituitary-adrenal (HPA) axis. Abrupt withdrawal can lead to life-threatening adrenal insufficiency. Doses should be tapered gradually. ♦ Increased Susceptibility to Infection: Immunosuppression increases the risk of new infections and exacerbation of latent infections (e.g., tuberculosis, herpes, fungal infections). Masking of infection symptoms is possible. ♦ Ocular Effects: Can cause cataracts and glaucoma; regular eye exams are recommended for long-term users. ♦ Metabolic Effects: Can cause hyperglycemia (and diabetes), hypertension, and dyslipidemia. ♦ Bone Effects: Long-term use can lead to osteoporosis and fractures. ♦ Psychiatric Disturbances: Mood swings, depression, euphoria, or psychotic manifestations can occur. ♦ Peptic Ulcer/GI Bleeding: Increased risk, especially with concomitant NSAIDs. ♦ Growth Suppression: Can cause growth retardation in children.
Missed Dose Instructions	For a short course of Dexamethasone or when used for an acute condition, take the missed dose as soon as remembered. However, if it is almost time for the next dose, skip the missed dose and continue with the regular schedule. Do not double dose. For long-term, chronic conditions, consistent dosing is important, and consultation with a healthcare professional regarding missed doses is advised due to the risk of HPA axis suppression.
Overdose Instructions	Acute overdose with corticosteroids is generally not life-threatening. Chronic overdose, however, leads to signs and symptoms of hypercorticism, resembling Cushing's syndrome (e.g., weight gain, fluid retention, hypertension, hyperglycemia, muscle weakness). Treatment is symptomatic and supportive. Gradual tapering of the drug, rather than abrupt cessation, is typically recommended after chronic overdose to avoid adrenal crisis. Seek medical attention for significant or chronic overdose.

Medicine Interactions	♦ CYP3A4 Inducers: Drugs that induce CYP3A4 (e.g., phenobarbital, phenytoin, rifampin, carbamazepine, ephedrine) can increase dexamethasone metabolism, leading to decreased corticosteroid effect. ♦ CYP3A4 Inhibitors: Drugs that inhibit CYP3A4 (e.g., ketoconazole, macrolide antibiotics, ritonavir) may increase dexamethasone levels. ♦ NSAIDs: Concomitant use increases the risk of gastrointestinal ulceration and bleeding. ♦ Anticoagulants: May alter the effects of oral anticoagulants; monitor INR. ♦ Diabetes Medications: Dexamethasone can increase blood glucose, requiring adjustment of antidiabetic therapy. ♦ Diuretics (potassium-depleting): Increased risk of hypokalemia. ♦ Live Vaccines: Contraindicated during immunosuppressive doses of corticosteroids due to risk of severe infection.

Dextromethorphan (Robitussin DM)

Purpose/Indication	Dextromethorphan (DXM) is a cough suppressant (antitussive) indicated for the temporary relief of cough caused by minor throat and bronchial irritation, such as that occurring with the common cold or inhaled irritants. It is a common ingredient in many over-the-counter (OTC) cough and cold preparations and is generally used to reduce the frequency and intensity of coughing.
Method of Action	Dextromethorphan acts centrally on the cough center in the medulla oblongata of the brain, elevating the cough threshold. While its exact mechanism is not fully understood, it is believed to act as a non-competitive antagonist of N-methyl-D-aspartate (NMDA) receptors, similar to dissociative anesthetics, and also as a sigma-1 receptor agonist. It also weakly inhibits serotonin and norepinephrine reuptake. These actions suppress the urge to cough without causing significant respiratory depression at therapeutic doses.
Medication Name & Brand Names	♦ Medication Name: Dextromethorphan Hydrobromide ♦ Brand Names: Robitussin DM (combination), Delsym (extended-release), Mucinex DM (combination), DayQuil/NyQuil (combination), Vicks NyQuil/DayQuil (combination), Dimetapp Cold & Cough (combination), DXM (generic)
Pharmaceutical Forms & Appearance	Dextromethorphan is widely available in various oral forms, including syrups, lozenges, chewable tablets, capsules, and extended-release suspensions or capsules. Syrups are typically clear or colored liquids, lozenges are solid and flavored, and tablets/capsules vary in color and shape depending on the brand and combination.
Dosage & Administration	Dosage varies by formulation and patient age, typically for short-term use. For adults and children 12 years and older, common doses are 10-30 mg every 4-8 hours as needed, with a maximum daily dose often around 120 mg. Extended-release formulations (e.g., 60 mg) are taken every 12 hours. Doses for children under 12 should follow product labeling or pediatrician's advice. It can be taken with or without food. Do not exceed recommended doses.
Supplied As	Dextromethorphan is supplied in various strengths and forms, often as part of multi-symptom cold medications: oral syrup/solution (e.g., 5 mg/5 mL, 10 mg/5 mL, 15 mg/5 mL, 30 mg/10 mL), extended-release oral suspension (e.g., 30 mg/5 mL), lozenges, capsules, and chewable tablets.
Contraindications	Dextromethorphan is strictly contraindicated in patients taking monoamine oxidase inhibitors (MAOIs) or within 14 days of stopping an MAOI, due to the significant risk of serotonin syndrome. It is also contraindicated in patients with known hypersensitivity to dextromethorphan or any component of the formulation. Its use for chronic productive cough (e.g., associated with asthma, emphysema) is generally not recommended as suppressing these coughs can be harmful.
Storage & Expiry	Dextromethorphan preparations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and excessive moisture. Keep tightly closed and out of reach of children. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include dizziness, drowsiness, nausea, vomiting, and stomach discomfort. Less common but more serious side effects, especially with high doses or drug interactions, include serotonin syndrome (agitation, confusion, rapid heart rate, fever), hallucinations, excitement, and respiratory depression.
Warnings & Precautions	♦ MAOI Interaction: STRICTLY CONTRAINDICATED with MAOIs (or within 14 days of stopping/starting an MAOI) due to the risk of serotonin syndrome. ♦ Serotonin Syndrome: Potentially life-threatening condition that can occur with concomitant use of other serotonergic drugs (e.g., SSRIs, SNRIs, TCAs, triptans, tramadol, linezolid, methylene blue). Symptoms include mental status changes, autonomic instability, neuromuscular aberrations, and GI symptoms. Seek immediate medical attention if suspected. ♦ Abuse Potential: While not an opioid, DXM can cause dissociative effects at supra-therapeutic doses, leading to a potential for abuse (often referred to as "robo-tripping"). Monitor for signs of abuse, especially in adolescents. ♦ Respiratory Depression: While generally safe at recommended doses, high doses or co-administration with other CNS depressants (e.g., alcohol, benzodiazepines) can lead to respiratory depression. ♦ Persistent/Chronic Cough: Do not use for cough that is persistent or chronic (e.g., occurs with smoking, asthma, emphysema) or accompanied by excessive phlegm, unless directed by a doctor. ♦ Hepatic Impairment: Metabolized by CYP2D6; use with caution in patients with hepatic impairment. ♦ Driving/Operating Machinery: May cause drowsiness or dizziness; advise caution when performing tasks requiring mental alertness. ♦ Underlying Conditions: Consult a doctor if cough lasts more than 7 days, recurs, or is accompanied by fever, rash, or persistent headache.
Missed Dose Instructions	Dextromethorphan is an as-needed medication. If a dose is missed, take it when you remember if you still need cough relief, ensuring you do not exceed the maximum daily dose and adhere to the recommended dosing interval (e.g., 4-8 hours). Do not take a double dose to make up for a missed one.
Overdose Instructions	Overdose symptoms are typically related to excessive CNS depression and serotonergic effects. They can include severe dizziness, drowsiness, nausea, vomiting, hallucinations, agitation, confusion, ataxia, nystagmus (involuntary eye movements), serotonin syndrome (e.g., hyperthermia, tachycardia, muscle rigidity), respiratory depression, and rarely, seizures or coma. There is no specific antidote. Treatment is supportive and symptomatic, focusing on maintaining an open airway, ventilation, and cardiovascular support. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Seek immediate emergency medical help.
Medicine Interactions	♦ MAOIs (Monoamine Oxidase Inhibitors, e.g., phenelzine, tranylcypromine, selegiline, linezolid, methylene blue): STRICTLY CONTRAINDICATED. Concomitant use can lead to severe, potentially fatal serotonin syndrome. ♦ Other Serotonergic Drugs (e.g., SSRIs - fluoxetine, paroxetine, sertraline; SNRIs - venlafaxine, duloxetine; TCAs; triptans; tramadol; St. John's Wort; buspirone): Increased risk of serotonin syndrome. Use with caution; monitor for symptoms. ♦ CYP2D6 Inhibitors (e.g., quinidine, fluoxetine, paroxetine, amiodarone, cimetidine, bupropion): Can significantly inhibit the metabolism of dextromethorphan, leading to increased and prolonged plasma levels and an increased risk of adverse effects, including serotonin syndrome and dissociative effects. Avoid or use with extreme caution and reduced dextromethorphan dose. ♦ CNS Depressants (e.g., alcohol, benzodiazepines, opioids, sedatives, hypnotics): Additive CNS depressant effects, increasing drowsiness, dizziness, and respiratory depression. Avoid concomitant use or use with extreme caution. ♦ Grapefruit Juice: May inhibit CYP3A4 and potentially CYP2D6, increasing dextromethorphan levels. Advise caution.

Diazepam (Valium)

Purpose/Indication	Diazepam is a benzodiazepine medication with anxiolytic (anti-anxiety), sedative, hypnotic, anticonvulsant, and muscle relaxant properties. It is indicated for the management of anxiety disorders, short-term relief of anxiety symptoms, acute alcohol withdrawal syndrome (to alleviate symptoms like agitation, tremor, and delirium tremens), as an adjunct in convulsive disorders, and for the relief of skeletal muscle spasm. It can also be used as premedication for medical procedures.

Method of Action	Diazepam enhances the effect of gamma-aminobutyric acid (GABA), the main inhibitory neurotransmitter in the central nervous system (CNS). It binds to specific benzodiazepine receptors on the GABA-A receptor complex, leading to an increased frequency of chloride channel opening. This influx of chloride ions hyperpolarizes the neuron, making it less excitable and resulting in the observed CNS depressant effects, including reduced anxiety, sedation, and anticonvulsant action.
Medication Name & Brand Names	♦ Medication Name: Diazepam ♦ Brand Names: Valium, Diazepam Intensol (oral solution), Diastat (rectal gel), Dizac (injectable)
Pharmaceutical Forms & Appearance	Diazepam is available as oral tablets, oral solution, rectal gel, and solutions for intravenous (IV) or intramuscular (IM) injection. Oral tablets are typically small, scored, and may be colored (e.g., yellow, blue, white) with various strengths. The oral solution is usually clear. Rectal gel is a clear or translucent gel. Injectable solutions are clear and colorless to slightly yellow.
Dosage & Administration	Dosage varies widely depending on the indication, patient's age, and response. For anxiety, it typically ranges from 2 mg to 10 mg, 2-4 times daily. For acute alcohol withdrawal, higher initial doses are used. For status epilepticus, IV administration is common. Rectal gel is used for acute repetitive seizures. Doses should be individualized and initiated at the lowest effective dose. Duration of treatment for anxiety should be short-term due to dependence risk.
Supplied As	Diazepam is supplied as: oral tablets (e.g., 2 mg, 5 mg, 10 mg), oral solution (e.g., 1 mg/mL, 5 mg/5 mL), rectal gel (e.g., 2.5 mg, 5 mg, 10 mg, 15 mg, 20 mg syringes), and injectable solution (e.g., 5 mg/mL).
Contraindications	Diazepam is contraindicated in patients with known hypersensitivity to diazepam or any component of the formulation, acute narrow-angle glaucoma, severe respiratory insufficiency, severe hepatic insufficiency, sleep apnea syndrome, and myasthenia gravis (due to muscle relaxant properties). It should not be used in children younger than 6 months.
Storage & Expiry	Diazepam oral tablets, solution, and rectal gel should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Injectable solutions should also be protected from light. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include drowsiness, fatigue, muscle weakness, and ataxia (impaired coordination). More serious side effects can include respiratory depression, paradoxical reactions (e.g., excitement, agitation, hallucinations), dependence and withdrawal symptoms (upon abrupt cessation), and anterograde amnesia.
Warnings & Precautions	♦ CNS Depression: Can cause significant CNS depression, including drowsiness, sedation, and impaired mental/physical abilities. Caution patients against driving or operating machinery. ♦ Respiratory Depression: Use with extreme caution in patients with respiratory insufficiency (e.g., COPD, sleep apnea) due to risk of respiratory depression. ♦ Dependence and Withdrawal: Prolonged use can lead to physical and psychological dependence. Abrupt discontinuation can precipitate severe withdrawal symptoms (e.g., seizures, delirium, psychosis). Taper doses gradually. ♦ Abuse Potential: Has abuse potential; use with caution in patients with a history of substance abuse. ♦ Paradoxical Reactions: Excitement, agitation, hallucinations, and rage can occur, especially in children, elderly, or psychiatric patients. ♦ Renal/Hepatic Impairment: Use with caution and adjust dose in patients with liver or kidney dysfunction. ♦ Elderly: More sensitive to CNS depressant effects; use lower doses.
Missed Dose Instructions	For chronic conditions, if a dose of Diazepam is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For acute, as-needed use, this instruction may not apply. Do not stop taking the medication abruptly, especially after prolonged use, due to withdrawal risks.
Overdose Instructions	Overdose can cause severe CNS depression ranging from drowsiness to coma, confusion, impaired coordination, slurred speech, and hypotension. In severe cases, respiratory depression, apnea, and cardiac arrest can occur. Treatment is supportive. Maintain a patent airway and provide respiratory support. Flumazenil, a benzodiazepine receptor antagonist, can reverse the sedative effects but may precipitate withdrawal seizures in dependent patients and should be used with extreme caution. Seek immediate medical attention.
Medicine Interactions	♦ CNS Depressants: Increased risk of CNS depression, sedation, and respiratory depression when co-administered with alcohol, opioids, other benzodiazepines, barbiturates, antihistamines, antidepressants, or antipsychotics. Avoid concomitant use of opioids and benzodiazepines unless absolutely necessary, and if so, use the lowest effective doses for the shortest duration. ♦ CYP3A4/CYP2C19 Inhibitors: Drugs that inhibit these enzymes (e.g., cimetidine, fluvoxamine, fluoxetine, omeprazole, ketoconazole, protease inhibitors) can increase diazepam levels, leading to increased sedation and adverse effects. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, St. John's Wort): May decrease diazepam levels. ♦ Digoxin: Diazepam may increase steady-state plasma digoxin concentrations. ♦ Levodopa: May antagonize the therapeutic effects of levodopa.

Diclofenac (Voltaren)

Purpose/Indication	Diclofenac is a non-steroidal anti-inflammatory drug (NSAID) used to relieve pain, inflammation, and stiffness. It is indicated for a wide range of conditions, including osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, acute pain, menstrual pain (dysmenorrhea), and migraine headaches. Various formulations target specific conditions, such as topical for localized pain or ophthalmic for ocular inflammation.
Method of Action	Diclofenac works by inhibiting cyclooxygenase (COX) enzymes, specifically both COX-1 and COX-2. These enzymes are responsible for the synthesis of prostaglandins, which are key mediators of pain, inflammation, and fever. By reducing prostaglandin production, diclofenac effectively reduces pain, swelling, and redness.
Medication Name & Brand Names	♦ Medication Name: Diclofenac Sodium / Diclofenac Potassium ♦ Brand Names: Voltaren (many formulations), Cataflam, Zipsor, Cambia (oral solution), Solaraze (topical gel), Flector (topical patch), Pennsaid (topical solution), Voltaren Emulgel (topical gel)
Pharmaceutical Forms & Appearance	Diclofenac is available in numerous forms: oral tablets (immediate, delayed, and extended-release), oral capsules, oral powder for solution, topical gels, solutions, patches, ophthalmic solutions, and injectable solutions. Oral tablets vary in color, shape, and imprints. Topical gels are typically translucent.
Dosage & Administration	Dosage varies considerably by indication, formulation, and patient response. Oral doses generally range from 50 mg to 75 mg, 2-3 times daily for immediate-release, or once daily for extended-release. Topical formulations are applied to the affected area, typically 2-4 times daily. It is generally recommended to take oral forms with food or milk to minimize gastrointestinal upset. Use the lowest effective dose for the shortest duration.
Supplied As	Diclofenac is supplied as: oral tablets (e.g., 25 mg, 50 mg, 75 mg, 100 mg), oral capsules, oral powder for solution, topical gels (e.g., 1%, 3%, 10%), topical solutions, transdermal patches, ophthalmic solutions, and injectable solutions.

Contraindications	Diclofenac is contraindicated in patients with a known hypersensitivity (e.g., allergic reactions, asthma, urticaria) to diclofenac, aspirin, or other NSAIDs. It is also contraindicated in the setting of coronary artery bypass graft (CABG) surgery and in patients with active gastrointestinal bleeding or peptic ulcer disease. Severe heart failure is also a contraindication.
Storage & Expiry	Diclofenac oral forms and topical preparations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., abdominal pain, nausea, indigestion, diarrhea), headache, and dizziness. More serious and potentially life-threatening side effects can include cardiovascular thrombotic events (e.g., heart attack, stroke), gastrointestinal bleeding, ulceration, or perforation, kidney dysfunction, liver injury, and serious skin reactions (e.g., Stevens-Johnson syndrome).
Warnings & Precautions	♦ Cardiovascular Risk: NSAIDs, including diclofenac, can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. Contraindicated for pain after CABG surgery. ♦ Gastrointestinal Risk: Can cause serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. Risk is higher in elderly patients, those with a history of GI bleeding, or concomitant use of other agents. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, especially in dehydrated patients or those with pre-existing kidney disease or heart failure. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function tests regularly. ♦ Skin Reactions: Serious skin reactions can occur. Discontinue at first appearance of rash. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension.
Missed Dose Instructions	If a dose of Diclofenac is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. For consistent pain and inflammation control, regular dosing is usually preferred.
Overdose Instructions	Symptoms of acute overdose typically include lethargy, drowsiness, nausea, vomiting, epigastric pain, and gastrointestinal bleeding. In severe cases, hypotension, acute renal failure, respiratory depression, and coma may occur. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate medical attention.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin): Increased risk of bleeding; monitor INR closely. ♦ Antiplatelet agents (e.g., aspirin, clopidogrel): Increased risk of bleeding. ♦ Other NSAIDs/Corticosteroids: Increased risk of GI adverse events. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and increase the risk of renal impairment. ♦ Lithium: May increase serum lithium concentrations and toxicity; monitor lithium levels. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ CYP2C9 Inhibitors/Inducers: Diclofenac is metabolized by CYP2C9; inhibitors (e.g., fluconazole, amiodarone) can increase diclofenac levels, while inducers (e.g., rifampin) can decrease them.

Diethylcarbamazine (Banocide)

Purpose/Indication	Diethylcarbamazine (DEC) is an anthelmintic medication primarily used to treat certain parasitic worm infections, particularly filariasis. This includes lymphatic filariasis (caused by Wuchereria bancrofti, Brugia malayi, or Brugia timori), loiasis (African eye worm), and tropical pulmonary eosinophilia. It works by killing the larval forms (microfilariae) of the worms, thereby breaking the cycle of infection.
Method of Action	The exact mechanism of action of diethylcarbamazine is not fully understood, but it is believed to act on the microfilariae in multiple ways. It appears to alter their surface membranes, making them more susceptible to the host's immune system (e.g., phagocytosis by white blood cells). It may also interfere with the parasites' arachidonic acid metabolism and directly affect their muscular function, leading to paralysis and easier elimination by the host's immune response.
Medication Name & Brand Names	♦ Medication Name: Diethylcarbamazine Citrate ♦ Brand Names: Hetrazan, Eofil, Banocide Forte (regional)
Pharmaceutical Forms & Appearance	Diethylcarbamazine is primarily available as oral tablets, usually in strengths of 50 mg, 100 mg, or 150 mg. Tablets are typically white or off-white and may be scored.
Dosage & Administration	Dosage is highly individualized based on the specific type of filarial infection, patient weight, and local guidelines. Treatment often starts with a lower dose to mitigate adverse reactions, gradually increasing over several days. It is typically taken orally, usually three times a day, often after meals to reduce gastrointestinal upset. Complete the full prescribed course.
Supplied As	Diethylcarbamazine is supplied as oral tablets (e.g., 50 mg, 100 mg, 150 mg).
Contraindications	Diethylcarbamazine is contraindicated in patients with known hypersensitivity to diethylcarbamazine or its components. Due to the potential for severe inflammatory reactions (Mazzotti reaction), it should be used with extreme caution or contraindicated in patients with high microfilarial loads, particularly in Loa loa infections (risk of encephalopathy) and Onchocerca volvulus (river blindness) due to severe ocular reactions. It is generally contraindicated in pregnancy (treatment deferred until after delivery), in infants, and in patients with severe cardiac or renal disease.
Storage & Expiry	Diethylcarbamazine tablets should be stored at room temperature (typically below 30°C or 86°F), protected from light and moisture. Keep in a tightly closed container and out of reach of children. Always check the specific expiry date on the packaging.
Side Effects	Side effects are common and often result from the immune response to dying parasites, known as the Mazzotti reaction. These include fever, headache, dizziness, nausea, vomiting, joint pain, rash, itching, lymph node swelling, and facial edema. More serious reactions, particularly in heavy infections, can involve eye damage (onchocerciasis) or neurological effects like encephalitis (loiasis).
Warnings & Precautions	♦ Mazzotti Reaction: Patients with high microfilarial loads can experience a severe inflammatory response to dying parasites, which can be life-threatening. Management often involves starting with low doses and may require corticosteroids to mitigate severe reactions. ♦ Ocular Effects: In onchocerciasis, rapid killing of microfilariae can lead to severe and potentially irreversible eye damage. ♦ Encephalopathy: In loiasis, high microfilarial loads can lead to encephalopathy, which can be fatal. Careful monitoring is crucial. ♦ Renal Impairment: Dose reduction is necessary in patients with renal impairment to avoid drug accumulation and increased toxicity. ♦ Cardiac Disease: Use with caution in patients with underlying cardiac conditions. ♦ Concomitant Corticosteroids: Corticosteroids may be co-administered, especially in severe cases, to reduce inflammatory reactions.

Missed Dose Instructions	If a dose of Diethylcarbamazine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Adherence to the prescribed regimen is important for effective treatment of parasitic infections.
Overdose Instructions	Overdose symptoms are generally an exaggeration of common side effects, including nausea, vomiting, headache, dizziness, and drowsiness. In severe cases, more pronounced allergic or inflammatory reactions could occur. There is no specific antidote. Treatment is supportive and symptomatic. Gastric decontamination may be considered if a significant oral overdose was recent. Seek immediate medical attention.
Medicine Interactions	♦ Corticosteroids: Concurrent use of corticosteroids may be necessary to manage Mazzotti reactions, but they may theoretically reduce the anti-filarial activity of DEC by suppressing the immune response that aids in parasite clearance. ♦ Urinary Alkalinizers: Drugs that make the urine more alkaline may reduce the urinary elimination of diethylcarbamazine, potentially increasing its levels and side effects. ♦ Urinary Acidifiers: Drugs that make the urine more acidic may increase the elimination of diethylcarbamazine. ♦ Cholinergic Medications, Potassium Channel Blockers, Tricyclic Antidepressants, Beta-blockers: Some sources suggest potential interactions that may alter safety or effectiveness, but comprehensive data is limited. Always inform your doctor of all concomitant medications.

Digoxin (Lanoxin)

Purpose/Indication	Digoxin is a cardiac glycoside used to improve the pumping ability of the heart in patients with chronic heart failure (especially with reduced ejection fraction and symptoms) and to control the ventricular rate in patients with chronic atrial fibrillation or flutter. It helps the heart beat more strongly and efficiently, and in atrial fibrillation, it slows the rapid and irregular heart rhythm.
Method of Action	Digoxin exerts its primary therapeutic effect by inhibiting the sodium-potassium adenosine triphosphatase (Na+/K+-ATPase) pump in cardiac muscle cells. This inhibition leads to an increase in intracellular sodium, which in turn reduces the activity of the sodium-calcium exchanger, resulting in increased intracellular calcium. The elevated intracellular calcium enhances the contractility of the heart muscle (positive inotropic effect). Additionally, digoxin enhances vagal tone, which slows conduction through the atrioventricular (AV) node, thereby decreasing the ventricular rate in atrial fibrillation.
Medication Name & Brand Names	♦ Medication Name: Digoxin ♦ Brand Names: Lanoxin, Lanoxicaps (liquid-filled capsules, less common now), Digitek (US, discontinued)
Pharmaceutical Forms & Appearance	Digoxin is available as oral tablets, oral solution/elixir, and solution for intravenous (IV) injection. Oral tablets are typically small, white, and often scored. The oral solution/elixir is a clear liquid. The injectable solution is clear and colorless.
Dosage & Administration	Dosage is highly individualized and determined by the patient's age, renal function, body weight, and response, often guided by therapeutic drug monitoring (serum digoxin levels). For heart failure, a typical maintenance dose is 0.125 mg once daily, but lower doses may be used. For rate control in atrial fibrillation, a loading dose followed by maintenance dosing may be used. It can be taken with or without food. Avoid abrupt discontinuation.
Supplied As	Digoxin is supplied as: oral tablets (e.g., 62.5 mcg, 125 mcg, 250 mcg), oral solution/elixir (e.g., 50 mcg/mL), and injectable solution (e.g., 0.25 mg/mL, 0.1 mg/mL for pediatric use).
Contraindications	Digoxin is contraindicated in patients with known hypersensitivity to digoxin or any component of the formulation, ventricular fibrillation, ventricular tachycardia, Wolff-Parkinson-White syndrome with atrial fibrillation (unless accessory pathway ablation has occurred), and obstructive cardiomyopathy (HCM) unless used to control atrial fibrillation. It is also contraindicated in patients with digoxin toxicity.
Storage & Expiry	Digoxin tablets and solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Digoxin has a narrow therapeutic index, meaning the difference between an effective dose and a toxic dose is small. Side effects are often signs of toxicity. Common side effects include nausea, vomiting, diarrhea, anorexia, fatigue, headache, and visual disturbances (e.g., blurred vision, yellow/green halos). More serious side effects, indicative of toxicity, include various arrhythmias (e.g., bradycardia, AV block, ventricular arrhythmias), severe nausea/vomiting, confusion, and disorientation.
Warnings & Precautions	♦ Narrow Therapeutic Index: Requires careful dosing and monitoring. Toxicity can be life-threatening. ♦ Digoxin Toxicity: Symptoms include GI upset, vision changes, and most critically, cardiac arrhythmias. Risk factors include hypokalemia, hypomagnesemia, hypercalcemia, renal impairment, hypothyroidism, and drug interactions. Monitor serum digoxin levels, electrolytes, and renal function regularly. ♦ Cardiac Arrhythmias: Can cause new or worsen existing arrhythmias. ♦ Renal Impairment: Digoxin is primarily eliminated by the kidneys; dose adjustment is crucial in kidney disease to prevent accumulation and toxicity. ♦ Elderly: More susceptible to toxicity due to reduced renal function and polypharmacy. ♦ Hypokalemia: Increases the risk of digoxin toxicity. Correct potassium deficits. ♦ Thyroid Dysfunction: Both hypothyroidism and hyperthyroidism can affect digoxin levels and sensitivity.
Missed Dose Instructions	If a dose of Digoxin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose (e.g., within 6 hours of the next dose), skip the missed dose and continue with the regular schedule. Do not take a double dose. If more than one dose is missed, or if you are unsure, contact your healthcare provider. Consistent daily dosing is crucial for maintaining therapeutic levels and preventing toxicity.
Overdose Instructions	Digoxin overdose is life-threatening. Symptoms include severe nausea, vomiting, profound bradycardia, various potentially fatal arrhythmias (e.g., severe AV block, ventricular tachycardia/fibrillation), hyperkalemia (in acute massive overdose), and neurological symptoms. Treatment requires immediate emergency medical attention. Digoxin Immune Fab (DigiFab) is a specific antidote that binds to digoxin, neutralizing its effects. Supportive care, including correction of electrolyte abnormalities (especially hyperkalemia with insulin/glucose), and temporary pacing for bradycardia, are also vital.
Medicine Interactions	Digoxin has numerous significant drug interactions. Many drugs can: ♦ Increase Digoxin Levels (leading to toxicity): Amiodarone, verapamil, diltiazem, quinidine, clarithromycin, erythromycin, cyclosporine, propafenone, spironolactone, some proton pump inhibitors. These require careful monitoring and often a reduction in digoxin dose. ♦ Decrease Digoxin Levels: Antacids, cholestyramine, activated charcoal, rifampin, St. John's Wort. ♦ Increase Risk of Arrhythmias/Toxicity: Diuretics (especially loop or thiazide diuretics causing hypokalemia/hypomagnesemia), calcium (IV calcium can cause arrhythmias), beta-blockers, calcium channel blockers (can cause additive bradycardia/AV block). ♦ Angiotensin-Converting Enzyme (ACE) Inhibitors/Angiotensin Receptor Blockers (ARBs): May decrease potassium levels, increasing digoxin toxicity risk.

Diltiazem (Cardizem)

Purpose/Indication	Diltiazem is a non-dihydropyridine calcium channel blocker used primarily to treat hypertension (high blood pressure), angina pectoris (chest pain), and to control ventricular rate in certain supraventricular tachyarrhythmias like atrial fibrillation and atrial flutter. It works by relaxing blood vessels and slowing the heart rate, which reduces the heart's workload and improves blood flow.

Method of Action	Diltiazem inhibits the influx of extracellular calcium ions across the membranes of cardiac and vascular smooth muscle cells. In the heart, this leads to reduced myocardial contractility, decreased heart rate, and slowed conduction through the SA and AV nodes, which is beneficial for controlling arrhythmias. In vascular smooth muscle, it causes vasodilation of both coronary and peripheral arteries, resulting in decreased peripheral vascular resistance and improved blood flow to the heart, thereby lowering blood pressure and reducing angina.
Medication Name & Brand Names	♦ Medication Name: Diltiazem Hydrochloride ♦ Brand Names: Cardizem (CD, LA, SR), Dilacor XR, Tiazac, Cartia XT, Dilt-XR
Pharmaceutical Forms & Appearance	Diltiazem is available as immediate-release tablets, extended-release capsules or tablets (with various release mechanisms like CD, LA, SR, XT, XR), and solutions for intravenous (IV) injection. Immediate-release tablets are typically white, round, and often scored. Extended-release capsules contain beads and come in various colors and sizes. The injectable solution is clear and colorless.
Dosage & Administration	Dosage varies significantly by indication and formulation. For hypertension, extended-release forms are typically taken once daily, with doses ranging from 120 mg to 360 mg. For angina, immediate-release forms may be taken multiple times a day (e.g., 30-120 mg three or four times daily). IV administration is used for rapid rate control in arrhythmias. Extended-release forms should generally be swallowed whole and not chewed or crushed. It can be taken with or without food.
Supplied As	Diltiazem is supplied as: immediate-release oral tablets (e.g., 30 mg, 60 mg, 90 mg, 120 mg), extended-release oral capsules/tablets (e.g., 60 mg to 420 mg), and injectable solution (e.g., 5 mg/mL).
Contraindications	Diltiazem is contraindicated in patients with known hypersensitivity to diltiazem or any component of the formulation. It is also contraindicated in patients with sick sinus syndrome (unless a functional ventricular pacemaker is in place), second- or third-degree AV block (unless a functional ventricular pacemaker is in place), hypotension (systolic BP <90 mmHg), acute myocardial infarction with pulmonary congestion, and severe bradycardia. Intravenous diltiazem is contraindicated in patients with atrial fibrillation/flutter and an accessory bypass tract (e.g., Wolff-Parkinson-White syndrome).
Storage & Expiry	Diltiazem tablets and capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, dizziness, bradycardia (slow heart rate), edema (swelling of ankles/feet), fatigue, flushing, and nausea. More serious but less common side effects can include severe hypotension, severe bradycardia, AV block, worsening of heart failure, and liver injury.
Warnings & Precautions	♦ Cardiac Conduction Abnormalities: Can cause or worsen bradycardia, AV block, and asystole. Use with extreme caution in patients with pre-existing conduction disturbances. ♦ Hypotension: Can cause symptomatic hypotension. ♦ Heart Failure: Use with caution in patients with impaired ventricular function as it can worsen heart failure due to its negative inotropic effect. ♦ Hepatic/Renal Impairment: Use with caution and consider dose reduction in patients with liver or kidney dysfunction. ♦ Abrupt Withdrawal: Avoid abrupt discontinuation, especially in patients with angina, as it may exacerbate symptoms. ♦ Drug Interactions: Numerous significant drug interactions (see interactions).
Missed Dose Instructions	If a dose of Diltiazem is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Consistent daily dosing is important for effective control of blood pressure, angina, or heart rate.
Overdose Instructions	Overdose can lead to severe hypotension, profound bradycardia, various degrees of AV block, asystole, and cardiogenic shock. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if oral ingestion was recent. IV fluids, vasopressors (e.g., dopamine, norepinephrine), atropine for bradycardia, and calcium gluconate/chloride (to reverse calcium channel blockade) are often used. Glucagon may also be beneficial. Temporary cardiac pacing may be necessary. Seek immediate medical attention.
Medicine Interactions	♦ Beta-Blockers (e.g., carvedilol, metoprolol): Additive negative effects on heart rate, AV conduction, and myocardial contractility; increased risk of severe bradycardia, AV block, and heart failure. Close monitoring is essential. ♦ Digoxin: Can increase digoxin plasma concentrations, leading to digoxin toxicity; monitor digoxin levels. ♦ CYP3A4 Substrates: Diltiazem is a moderate CYP3A4 inhibitor and can increase plasma concentrations of many drugs metabolized by this enzyme, including: statins (e.g., simvastatin, lovastatin – increased risk of myopathy/rhabdomyolysis), cyclosporine, tacrolimus, carbamazepine, oral midazolam, sildenafil, quinidine, amiodarone. Dose adjustments or alternative agents may be needed. ♦ Amiodarone: Increased risk of bradycardia, AV block, and sinus arrest. ♦ Grapefruit Juice: Can increase diltiazem levels. ♦ Rifampin: Can significantly decrease diltiazem levels.

Diphenhydramine (Benadryl)

Purpose/Indication	Diphenhydramine is a first-generation antihistamine with sedative, anticholinergic, and antiemetic properties. It is widely used to relieve symptoms of seasonal and perennial allergies (e.g., sneezing, runny nose, itchy/watery eyes, itchy throat), to treat insomnia (as a temporary sleep aid), to prevent and treat motion sickness, to manage symptoms of Parkinsonism (due to anticholinergic effects), and to treat or prevent allergic reactions to blood or plasma. It can also be used topically for itching due to insect bites or minor skin irritation.
Method of Action	Diphenhydramine acts as a competitive antagonist of histamine H1 receptors in the peripheral and central nervous system. By blocking these receptors, it prevents histamine from binding and exerting its effects, thereby reducing allergic symptoms. Its sedative properties are due to its ability to readily cross the blood-brain barrier and block central H1 receptors. Its anticholinergic effects contribute to its use in motion sickness and Parkinsonism, while its antiemetic effects are also centrally mediated.
Medication Name & Brand Names	♦ Medication Name: Diphenhydramine Hydrochloride ♦ Brand Names: Benadryl (various formulations), ZzzQuil, Sominex, Dramamine (some formulations), Nytol, Unisom SleepGels
Pharmaceutical Forms & Appearance	Diphenhydramine is available in numerous forms: oral tablets, capsules, liquid-filled capsules, oral solution/syrup, chewable tablets, topical creams/gels/sprays, and solutions for intravenous (IV) or intramuscular (IM) injection. Oral forms vary widely in color and appearance. Liquids are usually clear. Topical creams are white.
Dosage & Administration	Dosage varies by indication and patient age. For adults, typical oral doses are 25 mg to 50 mg every 4-6 hours for allergy symptoms or 50 mg at bedtime for insomnia. For children, it is weight-based. Topical forms are applied as needed. It can be taken with or without food. Use the lowest effective dose.
Supplied As	Diphenhydramine is supplied as: oral tablets (e.g., 25 mg, 50 mg), capsules (e.g., 25 mg, 50 mg), liquid-filled capsules, oral solution/syrup (e.g., 12.5 mg/5 mL), chewable tablets, topical creams/gels/sprays (e.g., 1%, 2%), and injectable solutions (e.g., 50 mg/mL).

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Contraindications	Diphenhydramine is contraindicated in neonates and premature infants. It is also contraindicated in patients with known hypersensitivity to diphenhydramine or other antihistamines with similar chemical structures. Use with caution or avoid in patients with lower respiratory tract symptoms, including asthma, due to its drying effects.
Storage & Expiry	Diphenhydramine oral forms and topical preparations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include significant drowsiness, dizziness, dry mouth, blurred vision, urinary retention, and constipation (due to anticholinergic effects). In some individuals, particularly children and elderly, paradoxical excitation, restlessness, or irritability may occur.
Warnings & Precautions	♦ CNS Depression/Sedation: Can cause significant drowsiness and impaired alertness. Caution patients against driving or operating machinery. Avoid concurrent use with alcohol or other CNS depressants. ♦ Anticholinergic Effects: Use with caution in patients with conditions exacerbated by anticholinergic activity, such as narrow-angle glaucoma, prostatic hypertrophy, urinary retention, or gastric outlet obstruction. ♦ Elderly: More susceptible to sedative and anticholinergic side effects (e.g., confusion, falls, urinary retention). Use with caution and lower doses. ♦ Respiratory Conditions: Use with caution in patients with asthma, emphysema, or chronic bronchitis as its drying effects may thicken bronchial secretions and impair expectoration. ♦ Photosensitivity: Can cause increased sensitivity to sunlight; advise patients to use sunscreen. ♦ Topical Use: Avoid applying to large areas of skin, to broken or blistered skin, or for prolonged periods due to risk of systemic absorption and side effects.
Missed Dose Instructions	As Diphenhydramine is often used on an as-needed basis for acute symptoms (allergies, insomnia, motion sickness), missed dose instructions are generally not critical. If a dose is missed, take it when remembered, but do not take a double dose. For regular use (e.g., for Parkinsonism), take the missed dose as soon as remembered, but if it's almost time for the next dose, skip the missed one.
Overdose Instructions	Overdose can lead to severe CNS depression (somnolence, coma), respiratory depression, severe anticholinergic effects (e.g., dry mouth, dilated pupils, flushed skin, urinary retention, intestinal immobility), cardiac arrhythmias, seizures, and hallucinations. In children, excitation and convulsions may be more prominent. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if oral ingestion was recent. Physostigmine may be used to reverse severe anticholinergic symptoms, but it has risks. Avoid CNS stimulants. Seek immediate medical attention.
Medicine Interactions	♦ CNS Depressants: Enhanced sedative and CNS depressant effects when co-administered with alcohol, opioids, benzodiazepines, barbiturates, other antihistamines, hypnotics, tranquilizers, or antidepressants. Avoid concomitant use. ♦ Anticholinergic Drugs: Increased anticholinergic side effects (e.g., dry mouth, constipation, urinary retention, blurred vision) when co-administered with other anticholinergic agents (e.g., tricyclic antidepressants, antipsychotics, atropine). ♦ Monoamine Oxidase Inhibitors (MAOIs): Can prolong and intensify the anticholinergic and CNS depressant effects of antihistamines; avoid concomitant use.

Dolutegravir (Tivicay)

Purpose/Indication	Dolutegravir is an antiretroviral medication primarily used to treat human immunodeficiency virus type 1 (HIV-1) infection in adults and children. It is indicated as part of a combination regimen with other antiretroviral agents for both treatment-naive and treatment-experienced patients, including those with integrase strand transfer inhibitor (INSTI) resistance (with specific dosing adjustments). It helps to reduce the amount of HIV in the body and improve the immune system.
Method of Action	Dolutegravir is an integrase strand transfer inhibitor (INSTI). It works by selectively blocking the activity of HIV integrase, an enzyme that is essential for HIV replication. Integrase is responsible for integrating viral DNA into the host cell's DNA. By inhibiting this crucial step, dolutegravir prevents the HIV virus from replicating and infecting new cells, thereby reducing the viral load and helping the immune system recover.
Medication Name & Brand Names	♦ Medication Name: Dolutegravir Sodium ♦ Brand Names: Tivicay (single agent), Triumeq (fixed-dose combination with abacavir and lamivudine), Dovato (fixed-dose combination with lamivudine)
Pharmaceutical Forms & Appearance	Dolutegravir is available as oral film-coated tablets. Tivicay tablets are typically yellow, round, and biconvex, with specific imprints indicating the strength (e.g., 50 mg). Fixed-dose combination tablets (Triumeq, Dovato) have their own distinct appearances.
Dosage & Administration	Dosage varies depending on patient characteristics, prior treatment history, and presence of INSTI resistance. For most treatment-naive adults and adolescents, the dose is 50 mg once daily. In patients with INSTI resistance or taking certain interacting medications, the dose may be increased to 50 mg twice daily. It can be taken with or without food. Adherence to the prescribed regimen is critical for treatment success and preventing resistance.
Supplied As	Dolutegravir is supplied as oral film-coated tablets (e.g., 10 mg, 25 mg, 50 mg). It is also available in fixed-dose combination tablets with other antiretrovirals.
Contraindications	Dolutegravir is contraindicated in patients with known hypersensitivity to dolutegravir or any component of the formulation. Co-administration with dofetilide (antiarrhythmic) is contraindicated due to increased dofetilide plasma concentrations and potential for serious or life-threatening adverse reactions.
Storage & Expiry	Dolutegravir tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include insomnia, headache, nausea, diarrhea, and fatigue. More serious but less common side effects can include hypersensitivity reactions (including rash, fever, and organ dysfunction), liver toxicity, and worsening of depression or suicidal ideation (rare). Weight gain has also been observed in some patients on INSTI-based regimens.
Warnings & Precautions	♦ Hypersensitivity Reactions: Severe hypersensitivity reactions (including rash, fever, malaise, myalgia, arthralgia, vesicles, oral lesions, conjunctivitis, facial edema, eosinophilia, hepatitis) have been reported. Discontinue immediately if severe reaction occurs and monitor clinical status. ♦ Hepatotoxicity: Liver toxicity, including cases requiring liver transplant, has been reported. Monitor liver function tests. ♦ Worsening of Depression/Suicidal Ideation: Rare reports, especially in patients with pre-existing psychiatric conditions. ♦ Neural Tube Defects: A potential risk of neural tube defects has been observed when dolutegravir is taken at the time of conception, though subsequent data have shown the risk to be very low and similar to other antiretrovirals. Discuss with women of childbearing potential. ♦ Drug Interactions: Multiple significant drug interactions due to metabolism and drug transporter inhibition (see interactions). ♦ Resistance: Adherence is key to preventing resistance development.
Missed Dose Instructions	If a dose of Dolutegravir is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose (e.g., within 4 hours of the next dose for once-daily dosing), skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is essential for maintaining viral suppression and preventing resistance.

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Overdose Instructions	Limited information is available on dolutegravir overdose. Symptoms would likely be an exaggeration of known side effects. Treatment is supportive and symptomatic. There is no specific antidote. Hemodialysis is unlikely to be effective due to high protein binding. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Dofetilide: Co-administration is contraindicated due to significantly increased dofetilide levels and risk of serious cardiac arrhythmias. ♦ Polyvalent Cations: Antacids (aluminum, magnesium), iron supplements, calcium supplements, sucralfate, and buffered medications can significantly reduce dolutegravir absorption. Administer dolutegravir at least 2 hours before or 6 hours after these agents. ♦ Metformin: Dolutegravir can increase metformin levels; dose adjustment of metformin may be necessary, and caution is advised in patients with renal impairment. ♦ Rifampicin: Co-administration significantly decreases dolutegravir levels, often requiring a dose increase of dolutegravir to 50 mg twice daily. ♦ Tipranavir/Ritonavir, Efavirenz, Fosamprenavir/Ritonavir: May require dolutegravir dose adjustment due to decreased dolutegravir levels. ♦ St. John's Wort: May decrease dolutegravir levels; avoid concomitant use.

Donepezil (Aricept)

Purpose/Indication	Donepezil is a cholinesterase inhibitor used to treat mild, moderate, and severe Alzheimer's disease. It helps to improve cognitive function, including memory, thinking, awareness, and the ability to perform daily activities, by increasing the availability of a natural substance in the brain. It does not cure Alzheimer's but can help manage its symptoms.
Method of Action	Donepezil works by reversibly inhibiting the enzyme acetylcholinesterase (AChE) in the brain. AChE is responsible for breaking down acetylcholine, a neurotransmitter crucial for memory, learning, and other cognitive processes. By inhibiting AChE, donepezil increases the concentration of acetylcholine in the synaptic clefts, thereby enhancing cholinergic transmission and improving cognitive function in patients with Alzheimer's disease.
Medication Name & Brand Names	♦ Medication Name: Donepezil Hydrochloride ♦ Brand Names: Aricept, Aricept ODT (oral disintegrating tablet), Donepezil-ODT, Donepezil-XR
Pharmaceutical Forms & Appearance	Donepezil is available as oral tablets, oral disintegrating tablets (ODT), and oral solution. Oral tablets are typically small, white or yellow, round, and often film-coated, with varying imprints. Oral disintegrating tablets dissolve rapidly on the tongue. The oral solution is usually clear.
Dosage & Administration	Dosage is initiated at a low dose (e.g., 5 mg once daily) and gradually increased over several weeks to months to a usual maintenance dose of 10 mg once daily, to minimize side effects. For severe Alzheimer's, a 23 mg once daily dose is available after a period on 10 mg. It is typically taken once daily in the evening, just before bedtime, to mitigate potential sleep disturbances. It can be taken with or without food.
Supplied As	Donepezil is supplied as: oral tablets (e.g., 5 mg, 10 mg, 23 mg), oral disintegrating tablets (e.g., 5 mg, 10 mg), and oral solution (e.g., 1 mg/mL).
Contraindications	Donepezil is contraindicated in patients with known hypersensitivity to donepezil, piperidine derivatives, or any component of the formulation.
Storage & Expiry	Donepezil tablets, ODTs, and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, diarrhea, insomnia, muscle cramps, fatigue, and anorexia. More serious but less common side effects can include bradycardia (slow heart rate), syncope (fainting), heart block, seizures, gastrointestinal bleeding, and exacerbation of asthma or COPD.
Warnings & Precautions	♦ Cardiovascular Effects: Can cause bradycardia and heart block, leading to syncope, especially in patients with pre-existing cardiac conduction abnormalities. Use with caution in patients with sick sinus syndrome or other supraventricular conduction conditions. ♦ Gastrointestinal Effects: Can increase gastric acid secretion, potentially leading to ulceration or bleeding. Use with caution in patients with a history of ulcers or those taking NSAIDs. Nausea, vomiting, and diarrhea are common, especially at higher doses. ♦ Cholinergic Effects: Exacerbates conditions that are sensitive to cholinergic activation, such as asthma, COPD, and obstructive pulmonary disease, by increasing bronchial secretions and bronchoconstriction. ♦ Urinary Outflow Obstruction: Use with caution in patients with bladder outflow obstruction. ♦ Seizures: May lower the seizure threshold; use with caution in patients with a history of seizures. ♦ Drug Interactions: Numerous significant drug interactions (see interactions).
Missed Dose Instructions	If a dose of Donepezil is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. If multiple doses are missed, consult a healthcare professional before resuming, as a re-titration from a lower dose may be necessary.
Overdose Instructions	Overdose can lead to a "cholinergic crisis," characterized by severe nausea, vomiting, salivation, sweating, bradycardia, hypotension, collapse, convulsions, muscle weakness (potentially involving respiratory muscles), and increased secretions leading to respiratory distress. Treatment is supportive. Atropine is the antidote for cholinergic crisis. Gastric lavage and activated charcoal may be considered if oral ingestion was recent. Seek immediate medical attention.
Medicine Interactions	♦ Cholinesterase Inhibitors (other): Avoid concomitant use with other cholinesterase inhibitors as it can lead to additive cholinergic effects and increased side effects. ♦ Anticholinergic Drugs: Donepezil may antagonize the effects of anticholinergic medications (e.g., atropine, scopolamine, some antihistamines, tricyclic antidepressants), reducing their effectiveness. ♦ Beta-Blockers/Calcium Channel Blockers: Increased risk of bradycardia and AV block when used concurrently with drugs that slow heart rate. ♦ CYP2D6 & CYP3A4 Inducers: Drugs that induce these enzymes (e.g., rifampin, phenytoin, carbamazepine, phenobarbital, St. John's Wort) can increase donepezil metabolism, leading to decreased donepezil levels and reduced efficacy. ♦ CYP2D6 & CYP3A4 Inhibitors: Drugs that inhibit these enzymes (e.g., quinidine, fluoxetine, paroxetine, ketoconazole, erythromycin) can increase donepezil levels, potentially increasing side effects. ♦ NSAIDs: Increased risk of gastrointestinal bleeding/ulceration.

Doxycycline (Vibramycin)

Purpose/Indication	Doxycycline is a tetracycline antibiotic with a broad spectrum of activity against many bacteria and some parasites. It is used to treat a wide range of infections, including respiratory tract infections, urinary tract infections, skin infections, sexually transmitted infections (e.g., chlamydia, gonorrhea), Lyme disease, malaria prophylaxis, anthrax, and severe acne. It also has anti-inflammatory properties at lower doses.

Method of Action	Doxycycline works by inhibiting bacterial protein synthesis. It reversibly binds to the 30S ribosomal subunit of susceptible bacteria, preventing the attachment of aminoacyl tRNA to the mRNA-ribosome complex. This interference halts the elongation of the peptide chain, thereby inhibiting bacterial growth and replication. It is primarily bacteriostatic.
Medication Name & Brand Names	♦ Medication Name: Doxycycline Hyclate / Doxycycline Monohydrate ♦ Brand Names: Vibramycin, Doryx, Monodox, Oracea (for rosacea), Acticlate, Periostat (for periodontitis)
Pharmaceutical Forms & Appearance	Doxycycline is available as oral capsules (hard or liquid-filled), oral tablets (immediate and delayed-release), and powder for oral suspension. Capsules and tablets vary in color and size. The oral suspension is typically a yellow liquid. It can also be available as an injectable solution for severe cases, though less common.
Dosage & Administration	Dosage varies widely depending on the indication. For most infections, typical adult doses are 100 mg once or twice daily. For malaria prophylaxis, it's 100 mg daily. For acne, lower anti-inflammatory doses (e.g., 20 mg twice daily or 40 mg once daily for Oracea) are used. It should be taken with a full glass of water to reduce the risk of esophageal irritation and generally at least 1 hour before or 2 hours after meals. Avoid taking with dairy products or antacids.
Supplied As	Doxycycline is supplied as: oral capsules (e.g., 50 mg, 100 mg), oral tablets (e.g., 20 mg, 50 mg, 100 mg, 150 mg), delayed-release tablets/capsules, and powder for oral suspension (e.g., 25 mg/5 mL).
Contraindications	Doxycycline is contraindicated in patients with known hypersensitivity to doxycycline or any other tetracycline. It is generally contraindicated in children under 8 years of age due to the risk of permanent tooth discoloration (yellow-grey-brown) and inhibition of bone growth. It is also contraindicated in pregnancy and breastfeeding due to these same effects on the fetus/infant.
Storage & Expiry	Doxycycline capsules, tablets, and oral powder should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging. Once reconstituted, the oral suspension should be used promptly.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, vomiting, diarrhea), esophageal irritation/ulceration (especially if taken without enough water or before lying down), photosensitivity (increased sensitivity to sunlight resulting in severe sunburn), and vaginal candidiasis (yeast infection). More serious but less common side effects include increased intracranial pressure (pseudotumor cerebri), tooth discoloration (in children), and liver dysfunction.
Warnings & Precautions	♦ Tooth Discoloration/Bone Growth: Can cause permanent tooth discoloration (yellow-grey-brown) and temporary inhibition of bone growth in children under 8 years of age, and in the second/third trimesters of pregnancy. Avoid use in these populations unless the benefits outweigh the risks in severe or life-threatening conditions. ♦ Photosensitivity: Can cause severe sunburn; advise patients to use sunscreen and protective clothing and avoid prolonged sun exposure. ♦ Esophageal Irritation/Ulceration: Take with a full glass of water and remain upright for at least 30 minutes (or preferably 1 hour) after taking, especially at bedtime. ♦ Increased Intracranial Pressure (Pseudotumor Cerebri): Can cause symptoms like headache, blurred vision, dizziness; discontinue if suspected. ♦ Superinfections: Can lead to overgrowth of non-susceptible organisms, including Clostridioides difficile (causing CDAD) and candidiasis. ♦ Renal Impairment: Unlike some other tetracyclines, doxycycline is primarily excreted non-renally, making it safer for use in patients with renal impairment, but caution is still advised. ♦ Fixed Drug Eruption: Can cause specific skin reactions.
Missed Dose Instructions	If a dose of Doxycycline is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. Complete the full prescribed course of treatment even if symptoms improve.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset (nausea, vomiting, diarrhea) and photosensitivity. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if oral ingestion was recent and substantial. Dialysis is not effective in removing doxycycline from the blood. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Antacids/Dairy Products/Iron/Calcium/Magnesium/Zinc Supplements: These polyvalent cations can significantly chelate doxycycline and reduce its absorption. Administer doxycycline at least 2-3 hours before or after these products. ♦ Oral Contraceptives: While less definitive than with some other antibiotics, some sources suggest tetracyclines may reduce the effectiveness of oral contraceptives; advise patients to consider backup birth control. ♦ Warfarin: May enhance the anticoagulant effect of warfarin; monitor INR closely. ♦ Barbiturates/Carbamazepine/Phenytoin: These anticonvulsants/enzyme inducers can decrease the half-life of doxycycline, potentially reducing its efficacy. Increased doxycycline dosage may be needed. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Penicillins: Tetracyclines are bacteriostatic and can interfere with the bactericidal action of penicillins; avoid concomitant use.

Econazole (Pevaryl)

Purpose/Indication	Econazole is a broad-spectrum imidazole antifungal agent used topically to treat various fungal and yeast infections of the skin. It is indicated for conditions such as tinea pedis (athlete's foot), tinea cruris (jock itch), tinea corporis (ringworm), cutaneous candidiasis, and tinea versicolor. It helps to relieve associated symptoms like itching, redness, and scaling by targeting the fungi directly.
Method of Action	Econazole works by inhibiting the biosynthesis of ergosterol, a crucial component of the fungal cell membrane. It primarily affects the fungal cytochrome P450-dependent enzyme lanosterol 14α-demethylase, which is essential for ergosterol synthesis. By disrupting ergosterol production, it compromises the integrity and permeability of the fungal cell membrane, leading to leakage of essential intracellular components and ultimately, the death of the fungal organism.
Medication Name & Brand Names	♦ Medication Name: Econazole Nitrate ♦ Brand Names: Spectazole, Ecoza (foam), Pevaryl (regional), Ecostatin (regional)
Pharmaceutical Forms & Appearance	Econazole is primarily available in various topical forms: creams, lotions, solutions, and foams. Creams are typically white and opaque. Lotions and solutions are usually white to off-white, and may be slightly viscous. Foams are white, quick-drying formulations.
Dosage & Administration	Dosage and administration vary by specific formulation and infection. For most skin infections, creams, lotions, or solutions are typically applied once daily to the affected area and surrounding skin. For tinea versicolor, application may be twice daily for a shorter duration. Treatment duration usually ranges from 2 to 4 weeks. Always apply a thin layer and gently rub it in, and continue the full course of treatment even if symptoms improve.
Supplied As	Econazole is supplied as: topical creams (e.g., 1%), topical lotions (e.g., 1%), topical solutions (e.g., 1%), and topical foams (e.g., 1%).

Contraindications	Econazole is contraindicated in individuals with known hypersensitivity (allergy) to econazole or any component of the formulation. It is for external use only and should not be applied to the eyes, orally, or intravaginally unless specifically formulated for vaginal use.
Storage & Expiry	Econazole topical formulations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and freezing. Keep in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally localized to the application site and include mild skin irritation, itching, redness, burning, or stinging. Other localized reactions like blistering, scaling, or peeling of the skin may occur. Systemic side effects are rare due to minimal absorption.
Warnings & Precautions	♦ External Use Only: For topical application only. Avoid contact with eyes and mucous membranes. ♦ Irritation/Sensitization: If irritation, sensitization, or worsening of the condition occurs, discontinue use and consult a healthcare professional. ♦ Not for Ophthalmic, Oral, or Intravaginal Use: Not intended for internal use or use in the eyes. If formulated for vaginal use, it will be clearly specified. ♦ Flammability (Foam): The foam formulation may be flammable; avoid use near heat or open flame. ♦ Complete Course: Advise patients to use for the full prescribed treatment period even if symptoms improve, to prevent recurrence.
Missed Dose Instructions	If a dose of topical Econazole is missed, apply it as soon as remembered. However, if it is almost time for the next scheduled application, skip the missed dose and continue with the regular schedule. Do not apply a double amount. Consistency is important for effective treatment of fungal infections.
Overdose Instructions	Overdose with topical econazole is highly unlikely to cause systemic toxicity due to negligible systemic absorption. Accidental oral ingestion may cause mild gastrointestinal upset (nausea, vomiting), but serious systemic effects are not anticipated. Treatment for accidental ingestion is supportive. Seek medical advice if a large amount is ingested or if severe irritation occurs.
Medicine Interactions	No significant systemic drug interactions are commonly reported with topical application of econazole due to its negligible systemic absorption. However, avoid co-application with other topical preparations on the same area unless directed by a healthcare professional, as this could alter absorption or cause irritation.

Enalapril (Vasotec)

Purpose/Indication	Enalapril is an angiotensin-converting enzyme (ACE) inhibitor used to treat hypertension (high blood pressure) and symptomatic heart failure. It is also indicated for the prevention of symptomatic heart failure in asymptomatic left ventricular dysfunction and for the prevention of coronary ischemic events in patients with left ventricular dysfunction. By lowering blood pressure and reducing the heart's workload, it improves cardiovascular outcomes.
Method of Action	Enalapril is a prodrug that is converted in the liver to its active metabolite, enalaprilat. Enalaprilat inhibits the angiotensin-converting enzyme (ACE), which is responsible for converting angiotensin I to angiotensin II. Angiotensin II is a potent vasoconstrictor and stimulates aldosterone secretion, both of which raise blood pressure. By inhibiting ACE, enalaprilat leads to decreased angiotensin II levels, resulting in vasodilation, reduced aldosterone secretion (leading to sodium and water excretion), and consequently, lower blood pressure and reduced cardiac preload and afterload, benefiting heart failure. It also inhibits the breakdown of bradykinin, a vasodilator.
Medication Name & Brand Names	♦ Medication Name: Enalapril Maleate ♦ Brand Names: Vasotec, Epaned (oral solution), Renitec (regional)
Pharmaceutical Forms & Appearance	Enalapril is available as oral tablets and as a powder for oral solution (which needs to be reconstituted). Oral tablets are typically small, white, round or oval, and may be scored, with various imprints indicating strength. The oral solution is a clear liquid after reconstitution. It can also be administered as an intravenous (IV) injection (enalaprilat) for acute settings.
Dosage & Administration	Dosage is individualized based on the patient's condition, renal function, and response. For hypertension, initial doses are typically 2.5 mg to 5 mg once daily, increasing to 10 mg to 40 mg daily in single or divided doses. For heart failure, lower initial doses are used with gradual titration. It can be taken with or without food.
Supplied As	Enalapril is supplied as: oral tablets (e.g., 2.5 mg, 5 mg, 10 mg, 20 mg), and powder for oral solution. Enalaprilat (active form) is supplied as an injectable solution (e.g., 1.25 mg/mL).
Contraindications	Enalapril is contraindicated in patients with known hypersensitivity to enalapril or any other ACE inhibitor. It is also contraindicated in patients with a history of angioedema related to previous ACE inhibitor treatment, hereditary or idiopathic angioedema. Concurrent use with aliskiren in patients with diabetes or renal impairment is contraindicated. It is contraindicated in pregnancy (especially second and third trimesters) due to risk of fetal harm.
Storage & Expiry	Enalapril tablets and oral solution (before reconstitution) should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. The reconstituted oral solution is typically stable for a limited time (e.g., 60 days) when refrigerated. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include cough (dry, persistent), dizziness (especially with the first dose or dose increases due to hypotension), fatigue, and headache. More serious side effects include angioedema (swelling of face, lips, tongue, throat, potentially life-threatening), hypotension, hyperkalemia (high potassium), renal impairment (especially in patients with renal artery stenosis), and liver dysfunction.
Warnings & Precautions	♦ Angioedema: Can cause potentially life-threatening angioedema involving the face, extremities, lips, tongue, glottis, and larynx. Discontinue immediately if symptoms occur. Higher risk in Black patients. ♦ Hypotension: May cause symptomatic hypotension, especially with the first dose, in volume-depleted patients, or those on diuretics. Initial doses should be low, and patients monitored. ♦ Hyperkalemia: Can cause hyperkalemia, especially in patients with renal impairment, diabetes, or those taking potassium-sparing diuretics or potassium supplements. Monitor potassium levels. ♦ Renal Impairment: Can cause acute renal failure, particularly in patients with severe congestive heart failure, renal artery stenosis, or volume depletion. Monitor renal function. ♦ Cough: A persistent dry cough is a common side effect and typically resolves upon discontinuation. ♦ Pregnancy: Use during the second and third trimesters of pregnancy can cause injury and death to the developing fetus; contraindicated. ♦ Neutropenia/Agranulocytosis: Rare but serious hematologic effects.
Missed Dose Instructions	If a dose of Enalapril is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily administration is important for blood pressure and heart failure management.

Overdose Instructions	Overdose symptoms are primarily severe hypotension, often with bradycardia, and potentially acute renal failure. Treatment is supportive. Administer intravenous fluids to support blood pressure. If ingestion was recent, gastric lavage and activated charcoal may be considered. Enalaprilat (the active metabolite) can be removed by hemodialysis. Seek immediate medical attention.
Medicine Interactions	♦ Potassium-Sparing Diuretics/Potassium Supplements/Salt Substitutes: Increased risk of hyperkalemia. Avoid or use with extreme caution and close monitoring of potassium. ♦ NSAIDs: Can reduce the antihypertensive effect of enalapril and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Lithium: May increase serum lithium concentrations and toxicity; monitor lithium levels. ♦ Diuretics: Additive hypotensive effects, particularly with the first dose; consider discontinuing diuretic or reducing initial enalapril dose. ♦ Aliskiren: Contraindicated in patients with diabetes or renal impairment due to increased risk of hyperkalemia, hypotension, and renal impairment. ♦ mTOR Inhibitors (e.g., sirolimus, everolimus): Increased risk of angioedema. ♦ Racecadotril: Increased risk of angioedema.

Epinephrine (EpiPen)

Purpose/Indication	Epinephrine, also known as adrenaline, is a potent sympathomimetic agent used in life-threatening emergencies due to its rapid and widespread effects. Its primary indications include the emergency treatment of severe allergic reactions (anaphylaxis), cardiac arrest, and severe asthma attacks. It is also used in conjunction with local anesthetics to prolong their action and reduce systemic absorption, and for the symptomatic relief of acute bronchospasm.
Method of Action	Epinephrine acts directly on both alpha (α) and beta (β) adrenergic receptors throughout the body. Its alpha_1 receptor activation causes vasoconstriction, which increases blood pressure, reduces swelling, and shunts blood to vital organs during anaphylaxis. Its beta_1 receptor activation increases heart rate and contractility, useful in cardiac arrest. Its beta_2 receptor activation causes bronchodilation, relieving airway constriction in asthma and anaphylaxis. This combination of effects rapidly counteracts the life-threatening symptoms of severe allergic reactions and helps restore circulation.
Medication Name & Brand Names	♦ Medication Name: Epinephrine (Adrenaline) ♦ Brand Names: EpiPen, EpiPen Jr, Auvi-Q, Adrenaclick (auto-injectors), Adrenalin (injectable solution), Primatene Mist (OTC inhaler, historical/some regional)
Pharmaceutical Forms & Appearance	Epinephrine is available as sterile solutions for injection (IM, SC, IV), and as auto-injectors containing a pre-measured dose. Solutions are typically clear and colorless. Auto-injectors are designed for easy, rapid self-administration. It can also be available as an inhaled solution for nebulization.
Dosage & Administration	Dosage varies significantly by indication and route. For anaphylaxis, auto-injectors deliver a fixed dose (e.g., 0.3 mg for adults, 0.15 mg for children) intramuscularly into the thigh. For cardiac arrest, it is typically given intravenously (IV) or intraosseously (IO) at 1 mg every 3-5 minutes. For severe asthma, it can be given subcutaneously. Doses are determined by weight for children. Repeat doses may be necessary.
Supplied As	Epinephrine is supplied as: auto-injectors (e.g., 0.3 mg/0.3 mL, 0.15 mg/0.3 mL), injectable solution vials/ampules (e.g., 1 mg/mL for IM/SC, 0.1 mg/mL for IV use, often diluted), and prefilled syringes.
Contraindications	Epinephrine is generally contraindicated in patients with known hypersensitivity to epinephrine or any component of the formulation, except in life-threatening situations where the benefits outweigh the risks (e.g., anaphylaxis, cardiac arrest). Relative contraindications for non-life-threatening uses include narrow-angle glaucoma, shock (other than anaphylactic shock), organic brain damage, and certain cardiac conditions like significant coronary artery disease, arrhythmias, or hypertension, due to its cardiac stimulant effects.
Storage & Expiry	Epinephrine solutions and auto-injectors should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and extreme heat or cold. Do not refrigerate or freeze. Check the solution periodically for discoloration or particulate matter (should be clear and colorless); if discolored or cloudy, discard. Always check the specific expiry date and replace expired auto-injectors immediately.
Side Effects	Common side effects are generally transient and include anxiety, restlessness, tremor, headache, dizziness, palpitations, rapid heart rate, and pallor. More serious side effects can include ventricular arrhythmias, angina (chest pain), hypertension, cerebral hemorrhage (rare), and pulmonary edema. Injection site reactions may occur.
Warnings & Precautions	♦ Cardiac Effects: Can cause severe cardiac effects including angina, myocardial infarction, ventricular arrhythmias, and hypertension. Use with extreme caution in patients with heart disease, hypertension, or hyperthyroidism. ♦ Use in Anaphylaxis: The benefits of epinephrine in anaphylaxis generally outweigh the risks; it should not be withheld due to concerns about side effects. Seek immediate medical attention after administration. ♦ Injection Site: Intramuscular injection into the anterolateral aspect of the thigh is preferred for auto-injectors; avoid injection into buttocks, hands, or feet due to risk of tissue necrosis. ♦ Diabetes: Can increase blood glucose levels. ♦ Drug Interactions: Numerous significant drug interactions (see interactions). ♦ Proper Administration: Patients/caregivers should be trained on proper auto-injector use.
Missed Dose Instructions	Epinephrine is typically used in acute, emergency situations, often as a single dose or repeated as necessary under medical supervision. Therefore, "missed dose" instructions in the traditional sense do not apply. Its administration is guided by the immediate clinical need.
Overdose Instructions	Overdose can lead to a severe hypertensive crisis, cerebrovascular hemorrhage, pulmonary edema, renal failure, and potentially fatal cardiac arrhythmias (e.g., ventricular fibrillation). Treatment is symptomatic and supportive, usually requiring rapid medical intervention in an emergency setting. Alpha-adrenergic blocking agents (e.g., phentolamine) may be used to counteract severe hypertension, and beta-blockers may be used for tachyarrhythmias (with caution). Vasodilators can help manage hypertension. Seek immediate medical attention.
Medicine Interactions	♦ Beta-Blockers (non-selective, e.g., propranolol): Can block the bronchodilator and vasodilator effects of epinephrine, leading to unopposed alpha-adrenergic effects resulting in severe hypertension and bradycardia (reflex). Use with extreme caution. ♦ Tricyclic Antidepressants (TCAs), MAO Inhibitors (MAOIs), Catechol-O-methyltransferase (COMT) Inhibitors (e.g., entacapone): Can potentiate the pressor and cardiac effects of epinephrine, leading to increased risk of arrhythmias and hypertensive crisis. Use with extreme caution or avoid. ♦ Digoxin/Other Cardiac Glycosides: Increased risk of arrhythmias. ♦ Diuretics: May reduce the pressor response to epinephrine. ♦ Local Anesthetics: Epinephrine is often combined with local anesthetics to prolong their action and reduce systemic absorption, but high doses of epinephrine can increase systemic effects. ♦ Alpha-Adrenergic Blockers: May antagonize the vasoconstrictor and hypertensive effects of epinephrine.

Erythromycin (Ery-Tab)

Purpose/Indication	Erythromycin is a macrolide antibiotic used to treat a wide range of bacterial infections, particularly in patients allergic to penicillin. It is commonly indicated for respiratory tract infections (e.g., pneumonia, bronchitis, Legionnaires' disease), skin and soft tissue infections, pertussis (whooping cough), diphtheria, chlamydial infections, and some sexually transmitted infections. It also has prokinetic properties, occasionally used to promote gastric emptying.

Method of Action	Erythromycin works by inhibiting bacterial protein synthesis. It reversibly binds to the 50S ribosomal subunit of susceptible bacteria, specifically at the P site, thereby blocking the translocation of peptides and inhibiting the assembly of new proteins. This bacteriostatic action prevents the growth and multiplication of bacteria. At higher concentrations or against highly susceptible organisms, it can be bactericidal.
Medication Name & Brand Names	♦ Medication Name: Erythromycin (various salts: base, ethylsuccinate, stearate, lactobionate, gluceptate) ♦ Brand Names: E-Mycin, Ery-Tab, EryPed, Erygel (topical), Akne-mycin (topical), Ilotycin (ophthalmic), Erythrocin (injectable)
Pharmaceutical Forms & Appearance	Erythromycin is available in numerous forms: oral tablets (film-coated, enteric-coated), oral capsules, oral suspensions, topical solutions/gels/ointments, ophthalmic ointments, and solutions for intravenous (IV) injection. Oral tablets vary in color, shape, and imprints. Oral suspensions are typically granular powders that are reconstituted to a liquid. Topical and ophthalmic forms vary in consistency.
Dosage & Administration	Dosage and duration vary significantly by formulation, infection type, severity, and patient factors. Oral doses typically range from 250 mg to 500 mg, 2-4 times daily. It is often recommended to take oral forms on an empty stomach for better absorption, but some formulations are designed to be taken with food to reduce gastrointestinal upset. IV administration is used for severe infections. Complete the full course of treatment.
Supplied As	Erythromycin is supplied as: oral tablets (e.g., 250 mg, 333 mg, 500 mg), oral capsules, granules for oral suspension (e.g., 200 mg/5 mL, 400 mg/5 mL), topical solution/gel/ointment (e.g., 2%), ophthalmic ointment, and powder for intravenous solution.
Contraindications	Erythromycin is contraindicated in patients with known hypersensitivity to erythromycin or any other macrolide or ketolide antibiotic. It is also contraindicated in patients with a history of cholestatic jaundice or hepatic dysfunction associated with prior erythromycin use. Concurrent administration with certain medications, such as cisapride, pimozide, ergotamine, dihydroergotamine, and some statins (e.g., lovastatin, simvastatin), is contraindicated due to risk of serious interactions (e.g., cardiac arrhythmias, rhabdomyolysis).
Storage & Expiry	Erythromycin tablets and powder for suspension (unreconstituted) should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Reconstituted oral suspensions typically require refrigeration (2°C to 8°C or 36°F to 46°F) and are stable for a limited period (e.g., 10-14 days). Topical and ophthalmic preparations are stored at room temperature. Always check the specific product label for precise storage and expiry information.
Side Effects	Common side effects include gastrointestinal upset (e.g., abdominal cramps, nausea, vomiting, diarrhea), which can be dose-related and severe due to its prokinetic activity. Other side effects include headache and rash. More serious but less common side effects can include QT prolongation (a heart rhythm abnormality leading to potential arrhythmias), liver toxicity (cholestatic hepatitis), hearing loss (reversible, dose-related), and Clostridioides difficile-associated diarrhea (CDAD).
Warnings & Precautions	♦ QT Prolongation: Can prolong the QT interval, increasing the risk of potentially fatal arrhythmias (Torsades de Pointes). Use with caution in patients with pre-existing heart conditions, electrolyte disturbances (hypokalemia, hypomagnesemia), or those taking other QT-prolonging drugs. ♦ Hepatotoxicity: Liver dysfunction, including cholestatic hepatitis, has been reported. Monitor liver function tests, especially with prolonged use. ♦ Gastrointestinal Effects: Common and can be severe, leading to non-adherence. Taking with food or using certain formulations may help. ♦ Hearing Loss: Reversible hearing loss has been reported, particularly at high doses or in patients with renal/hepatic impairment. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): Can occur during or after antibiotic therapy. ♦ Infantile Hypertrophic Pyloric Stenosis (IHPS): Associated with risk in infants receiving erythromycin, especially during the first few weeks of life. ♦ Drug Interactions: Numerous significant drug interactions due to strong CYP3A4 inhibition (see interactions).
Missed Dose Instructions	If a dose of Erythromycin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. It's crucial to complete the entire course of antibiotics to ensure eradication of the infection and prevent resistance.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily severe gastrointestinal symptoms (nausea, vomiting, diarrhea, abdominal pain), and potentially hearing loss, QT prolongation, and liver toxicity. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if oral ingestion was recent. Hemodialysis and peritoneal dialysis are generally not effective. Seek immediate medical attention.
Medicine Interactions	♦ Strong CYP3A4 Substrates: Erythromycin is a potent CYP3A4 inhibitor and can significantly increase levels of drugs metabolized by this enzyme, leading to increased toxicity. Examples include: statins (lovastatin, simvastatin - contraindicated due to rhabdomyolysis risk), carbamazepine, ciclosporin, tacrolimus, sildenafil, theophylline, warfarin, oral midazolam, quinidine, disopyramide, ergot alkaloids (ergotamine, dihydroergotamine - contraindicated due to acute ergotism). ♦ Cisapride/Pimozide: Co-administration is contraindicated due to increased risk of QT prolongation and life-threatening arrhythmias (Torsades de Pointes). ♦ Colchicine: Increased risk of colchicine toxicity, especially in patients with renal or hepatic impairment. ♦ Oral Contraceptives: While less definitive than with some other antibiotics, some sources suggest macrolides may reduce the effectiveness of oral contraceptives; advise patients to consider backup birth control. ♦ Antacids: Some antacids can reduce the absorption of certain erythromycin formulations. ♦ Digoxin: May increase digoxin levels.

Escitalopram (Lexapro)

Purpose/Indication	Escitalopram is a selective serotonin reuptake inhibitor (SSRI) antidepressant used to treat major depressive disorder (MDD) and generalized anxiety disorder (GAD) in adults. It is also sometimes used off-label for other anxiety disorders like panic disorder, social anxiety disorder, and obsessive-compulsive disorder (OCD). It works by helping to restore the balance of a natural substance (serotonin) in the brain.
Method of Action	Escitalopram selectively inhibits the reuptake of serotonin (5-HT) by the presynaptic neuron in the central nervous system. By blocking the serotonin transporter (SERT), it increases the concentration of serotonin in the synaptic cleft, leading to enhanced serotonergic neurotransmission. This increase in serotonin availability is believed to contribute to its antidepressant and anxiolytic effects. Escitalopram is the S-enantiomer of citalopram, and is more potent and selective.
Medication Name & Brand Names	♦ Medication Name: Escitalopram Oxalate ♦ Brand Names: Lexapro, Cipralex (regional)
Pharmaceutical Forms & Appearance	Escitalopram is available as oral tablets and oral solution. Oral tablets are typically white, oval, film-coated, and often scored, with various imprints indicating the strength. The oral solution is a clear, colorless liquid.
Dosage & Administration	Dosage is individualized, typically starting at a low dose (e.g., 10 mg once daily) and gradually increasing based on response and tolerability, up to a maximum of 20 mg once daily. For elderly patients or those with hepatic impairment, a lower maximum dose may be recommended. It can be taken with or without food. Therapeutic effects may take several weeks to become apparent.

Supplied As	Escitalopram is supplied as: oral film-coated tablets (e.g., 5 mg, 10 mg, 20 mg) and oral solution (e.g., 5 mg/5 mL, 1 mg/mL).
Contraindications	Escitalopram is contraindicated in patients with known hypersensitivity to escitalopram, citalopram, or any component of the formulation. It is contraindicated in patients taking monoamine oxidase inhibitors (MAOIs) or within 14 days of discontinuing an MAOI, due to the risk of serotonin syndrome. Co-administration with pimozide (due to QT prolongation) is also contraindicated.
Storage & Expiry	Escitalopram tablets and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, insomnia, diarrhea, constipation, sweating, dizziness, dry mouth, fatigue, and sexual dysfunction (e.g., decreased libido, delayed ejaculation). More serious but less common side effects include serotonin syndrome, QT prolongation, seizures, increased bleeding risk, hyponatremia (low sodium), and suicidal ideation.
Warnings & Precautions	♦ Suicidality Risk: Antidepressants increase the risk of suicidal thoughts and behaviors in children, adolescents, and young adults (up to age 24) with MDD and other psychiatric disorders. Monitor patients closely for clinical worsening, suicidality, or unusual changes in behavior. ♦ Serotonin Syndrome: Potentially life-threatening condition when co-administered with other serotonergic agents (e.g., MAOIs, triptans, fentanyl, lithium, tramadol, St. John's Wort). Symptoms include mental status changes, autonomic instability, neuromuscular abnormalities, and/or GI symptoms. ♦ QT Prolongation: Can cause dose-dependent QT interval prolongation, increasing the risk of Torsades de Pointes. Avoid in patients with congenital long QT syndrome or taking other QT-prolonging drugs. ♦ Seizures: Use with caution in patients with a history of seizures. ♦ Hyponatremia: Can cause clinically significant hyponatremia, particularly in elderly patients or those on diuretics. ♦ Abnormal Bleeding: May increase the risk of bleeding events, especially with concurrent use of NSAIDs, aspirin, or anticoagulants. ♦ Activation of Mania/Hypomania: Use with caution in patients with bipolar disorder. ♦ Discontinuation Syndrome: Abrupt discontinuation can lead to symptoms like dizziness, sensory disturbances, insomnia, agitation; taper dose gradually.
Missed Dose Instructions	If a dose of Escitalopram is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining therapeutic levels and managing symptoms effectively. Do not stop taking the medication abruptly without consulting a doctor due to withdrawal risks.
Overdose Instructions	Overdose symptoms are typically mild to moderate and may include dizziness, tremor, nausea, vomiting, somnolence, tachycardia, and seizures. More severe overdose can lead to serotonin syndrome, QT prolongation, arrhythmias, and coma. Treatment is supportive. Maintain an airway and monitor cardiac and vital signs. Activated charcoal may be considered if ingestion was recent and substantial. There is no specific antidote. Seek immediate medical attention.
Medicine Interactions	♦ Monoamine Oxidase Inhibitors (MAOIs): Concurrent use is contraindicated due to severe, potentially fatal serotonin syndrome. Allow at least 14 days between discontinuing an MAOI and starting escitalopram, and vice versa. ♦ Other Serotonergic Drugs: Increased risk of serotonin syndrome with triptans, tricyclic antidepressants, fentanyl, lithium, tramadol, buspirone, tryptophan, and St. John's Wort. Use with caution. ♦ Pimozide: Co-administration is contraindicated due to increased pimozide levels and potential for QT prolongation and ventricular arrhythmias. ♦ NSAIDs, Aspirin, Warfarin: Increased risk of bleeding. Monitor for signs of bleeding. ♦ Metoprolol: Escitalopram can increase plasma concentrations of metoprolol; monitor metoprolol levels. ♦ Cimetidine/Omeprazole/Esomeprazole: Can increase escitalopram levels. ♦ Alcohol: Avoid alcohol due to additive CNS depressant effects.

Esomeprazole (Nexium)

Purpose/Indication	Esomeprazole is a proton pump inhibitor (PPI) used to reduce the amount of acid produced in the stomach. It is indicated for the treatment of gastroesophageal reflux disease (GERD) including erosive esophagitis, Zollinger-Ellison syndrome, and to reduce the risk of gastric ulcers associated with NSAID use. It is also used in combination with antibiotics to eradicate Helicobacter pylori infection.
Method of Action	Esomeprazole is a proton pump inhibitor, and the S-isomer of omeprazole. It irreversibly binds to and inactivates the H+/K+-ATPase enzyme (the "proton pump") on the secretory surface of parietal cells in the stomach. This enzyme is responsible for the final step in gastric acid production. By blocking the proton pump, esomeprazole significantly reduces gastric acid secretion, regardless of the stimulus, leading to prolonged acid suppression.
Medication Name & Brand Names	♦ Medication Name: Esomeprazole Magnesium / Esomeprazole Strontium ♦ Brand Names: Nexium, Nexium 24HR (OTC), Esomeprazole (generic)
Pharmaceutical Forms & Appearance	Esomeprazole is available as delayed-release capsules, delayed-release tablets, granules for oral suspension, and powder for intravenous (IV) injection. Oral capsules and tablets are often colored (e.g., light purple/pink) and may contain enteric-coated pellets. The oral suspension prepared from granules is typically opaque. The injectable solution is clear.
Dosage & Administration	Dosage varies depending on the condition being treated. For most GERD indications, typical adult doses range from 20 mg to 40 mg once daily. It is usually taken at least 30 to 60 minutes before a meal (preferably breakfast) to maximize its effectiveness, as the proton pumps are activated by food intake. For IV use, it is given once daily. Duration of treatment varies from weeks to months, depending on the condition.
Supplied As	Esomeprazole is supplied as: delayed-release oral capsules (e.g., 20 mg, 40 mg), delayed-release oral tablets (e.g., 20 mg, 40 mg), packets of granules for oral suspension (e.g., 2.5 mg, 5 mg, 10 mg, 20 mg, 40 mg), and powder for intravenous solution (e.g., 20 mg, 40 mg).
Contraindications	Esomeprazole is contraindicated in patients with known hypersensitivity to esomeprazole, substituted benzimidazoles (e.g., omeprazole, lansoprazole), or any component of the formulation. Concurrent use with rilpivirine-containing products is contraindicated due to potential for reduced rilpivirine exposure and loss of virologic response.
Storage & Expiry	Esomeprazole delayed-release capsules/tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. The reconstituted oral suspension should be used promptly. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, nausea, diarrhea, abdominal pain, constipation, and flatulence. Less common but more serious long-term side effects can include increased risk of Clostridioides difficile-associated diarrhea (CDAD), bone fractures (with long-term high dose use), hypomagnesemia (low magnesium), and vitamin B12 deficiency (with prolonged use).

Warnings & Precautions	♦ Serious Gastric Conditions: Symptomatic response to esomeprazole does not preclude the presence of gastric malignancy. ♦ Clostridioides difficile-Associated Diarrhea (CDAD): PPI use may increase the risk of CDAD. Consider diagnosis in patients presenting with diarrhea that does not improve. ♦ Bone Fracture Risk: Long-term and high-dose PPI therapy may increase the risk of hip, wrist, or spine fractures, particularly in the elderly. Use the lowest effective dose for the shortest duration. ♦ Hypomagnesemia: Can occur with prolonged use (usually >3 months). Monitor magnesium levels. ♦ Vitamin B12 Deficiency: Prolonged daily use may lead to vitamin B12 malabsorption. ♦ Kidney Disease: Rarely, acute interstitial nephritis has been observed. ♦ Drug Interactions: Multiple significant drug interactions (see interactions), particularly due to CYP2C19 inhibition. ♦ Rebound Acid Hypersecretion: May occur upon discontinuation.
Missed Dose Instructions	If a dose of Esomeprazole is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing, usually before the first meal, is important for optimal acid control.
Overdose Instructions	Overdose symptoms are generally mild and may include drowsiness, confusion, blurred vision, tachycardia, nausea, sweating, and headache. In rare cases, more severe effects have been reported. There is no specific antidote. Treatment is symptomatic and supportive. Since esomeprazole is highly protein-bound, dialysis is unlikely to be effective. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Rilpivirine-containing products: Co-administration is contraindicated due to potential for reduced rilpivirine exposure and loss of virologic response. ♦ Clopidogrel: Esomeprazole (and omeprazole) can reduce the antiplatelet effect of clopidogrel by inhibiting CYP2C19, which is crucial for clopidogrel activation. Concomitant use is generally discouraged. ♦ Warfarin: May increase INR and risk of bleeding; monitor INR closely. ♦ Digoxin: Increased digoxin absorption, leading to increased digoxin levels and potential toxicity. ♦ Methotrexate: May increase and prolong serum levels of methotrexate and/or its metabolite, potentially leading to toxicity. ♦ Tacrolimus: May increase tacrolimus levels. ♦ Diazepam, Phenytoin, Cilostazol: Esomeprazole is a moderate CYP2C19 inhibitor and can increase levels of drugs metabolized by this enzyme. ♦ Drugs requiring acidic gastric pH for absorption (e.g., iron salts, certain antifungals like ketoconazole, itraconazole, erlotinib): Reduced absorption due to increased gastric pH. ♦ St. John's Wort/Rifampin: May decrease esomeprazole levels.

Ethambutol (Myambutol)

Purpose/Indication	Ethambutol is an antitubercular medication used as a first-line agent in the treatment of active tuberculosis (TB) caused by susceptible strains of Mycobacterium tuberculosis. It is always used in combination with other anti-tuberculosis drugs to prevent the development of resistance and enhance therapeutic efficacy. It helps to stop the growth of the bacteria that cause TB.
Method of Action	Ethambutol works by inhibiting the synthesis of the mycobacterial cell wall. Specifically, it interferes with the enzyme arabinosyl transferase, which is involved in the polymerization of arabinogalactan, an essential component of the mycobacterial cell wall. This disruption leads to impaired cell wall integrity, increased permeability, and ultimately, the inhibition of bacterial growth (bacteriostatic action).
Medication Name & Brand Names	♦ Medication Name: Ethambutol Hydrochloride ♦ Brand Names: Myambutol
Pharmaceutical Forms & Appearance	Ethambutol is available as oral tablets, typically in strengths of 100 mg and 400 mg. Tablets are usually white or off-white, round or oval, and may be scored.
Dosage & Administration	Dosage is typically based on body weight and depends on whether it's daily or intermittent therapy. For adults, a common daily dose is 15 mg/kg orally once daily, often with a maximum of 1000 mg/day. It is always used as part of a multi-drug regimen. It can be taken with or without food. Compliance with the full course of therapy is crucial to prevent drug resistance and treatment failure.
Supplied As	Ethambutol is supplied as oral tablets (e.g., 100 mg, 400 mg).
Contraindications	Ethambutol is contraindicated in patients with known hypersensitivity to ethambutol or any component of the formulation. It is also contraindicated in patients with known optic neuritis due to the risk of exacerbating visual impairment. Additionally, it should not be used in children who are too young to reliably report visual symptoms (e.g., typically under 6 years of age).
Storage & Expiry	Ethambutol tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	The most significant side effect of ethambutol is ocular toxicity, specifically optic neuritis, which can lead to blurred vision, red-green color blindness, and even irreversible vision loss. Other common side effects include headache, dizziness, nausea, vomiting, abdominal pain, and arthralgia (joint pain).
Warnings & Precautions	♦ Ocular Toxicity (Optic Neuritis): This is the most serious side effect. It is dose-dependent and can lead to irreversible blindness. Baseline and regular (e.g., monthly) ophthalmologic examinations, including visual acuity and red-green color discrimination tests, are mandatory during therapy. Patients should be instructed to report any visual changes immediately. ♦ Renal Impairment: Ethambutol is primarily eliminated by the kidneys. Dose adjustment is required in patients with renal impairment to avoid accumulation and increased risk of toxicity, especially ocular toxicity. ♦ Gout: Can increase serum uric acid levels, potentially exacerbating or precipitating gout attacks. ♦ Liver Dysfunction: Monitor liver function, although hepatotoxicity is less common than with other TB drugs. ♦ Children: Not recommended for children under 6 years of age because they cannot reliably report visual symptoms.
Missed Dose Instructions	Given the critical nature of TB treatment and the importance of adherence to prevent resistance, if a dose of Ethambutol is missed, the healthcare provider managing the patient's TB therapy should be contacted immediately for specific instructions. Do not take a double dose. Consistent daily dosing, as part of the overall regimen, is crucial.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset and, most importantly, severe ocular toxicity (optic neuritis) including vision loss. There is no specific antidote. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if oral ingestion was recent and substantial. Hemodialysis may remove some ethambutol from the blood. Seek immediate medical attention.
Medicine Interactions	♦ Aluminum Salts: Aluminum-containing antacids can significantly reduce the absorption of ethambutol. Administer ethambutol at least 4 hours before or after aluminum-containing antacids. ♦ Other Hepatotoxic Drugs: Concurrent use with other drugs known to cause liver injury (e.g., isoniazid, rifampicin) requires careful monitoring of liver function, though ethambutol itself is less hepatotoxic. ♦ Didanosine: May increase the risk of peripheral neuropathy when co-administered. ♦ No other significant drug interactions are commonly reported, but given its specific toxicities, careful consideration of concurrent medications is always warranted.

Etodolac (Lodine)

Purpose/Indication	Etodolac is a non-steroidal anti-inflammatory drug (NSAID) used to relieve pain, inflammation, and stiffness. It is indicated for the acute and long-term management of osteoarthritis and rheumatoid arthritis, and for the management of acute pain. Its anti-inflammatory and analgesic properties help improve patient comfort and mobility in these conditions.
Method of Action	Etodolac works by reversibly inhibiting cyclooxygenase (COX) enzymes, particularly COX-2, which are primarily responsible for the synthesis of prostaglandins involved in inflammation, pain, and fever. While it has some activity against COX-1, its relatively greater selectivity for COX-2 is thought to contribute to a potentially lower incidence of gastrointestinal side effects compared to non-selective NSAIDs. By reducing prostaglandin production, it reduces pain, swelling, and redness.
Medication Name & Brand Names	♦ Medication Name: Etodolac ♦ Brand Names: Lodine (immediate-release), Lodine XL (extended-release)
Pharmaceutical Forms & Appearance	Etodolac is available as oral capsules and oral tablets (immediate-release and extended-release). Oral capsules and tablets vary in color, shape, and imprints. Immediate-release tablets are typically white or off-white. Extended-release tablets are often film-coated.
Dosage & Administration	Dosage varies depending on the indication. For osteoarthritis and rheumatoid arthritis, the immediate-release form is typically 300 mg to 500 mg two to three times daily, or the extended-release form is 400 mg to 1000 mg once daily. For acute pain, a single dose of 200 mg to 400 mg may be used every 6-8 hours as needed. It can be taken with or without food, but taking it with food or milk may help reduce gastrointestinal upset. Use the lowest effective dose for the shortest duration.
Supplied As	Etodolac is supplied as: oral capsules (e.g., 200 mg, 300 mg), oral tablets (e.g., 400 mg, 500 mg), and extended-release tablets (e.g., 400 mg, 500 mg, 600 mg).
Contraindications	Etodolac is contraindicated in patients with a known hypersensitivity (e.g., allergic reactions, asthma, urticaria) to etodolac, aspirin, or other NSAIDs. It is also contraindicated in the setting of coronary artery bypass graft (CABG) surgery and in patients with active gastrointestinal bleeding or peptic ulcer disease. Severe heart failure is also a contraindication.
Storage & Expiry	Etodolac oral forms should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, abdominal pain, indigestion, diarrhea, heartburn), dizziness, and headache. More serious and potentially life-threatening side effects can include cardiovascular thrombotic events (e.g., heart attack, stroke), gastrointestinal bleeding, ulceration, or perforation, kidney dysfunction, liver injury, and serious skin reactions (e.g., Stevens-Johnson syndrome).
Warnings & Precautions	♦ Cardiovascular Risk: NSAIDs, including etodolac, can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. Contraindicated for pain after CABG surgery. ♦ Gastrointestinal Risk: Can cause serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. Risk is higher in elderly patients, those with a history of GI bleeding, or concomitant use of other agents. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, especially in dehydrated patients or those with pre-existing kidney disease or heart failure. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function tests. ♦ Skin Reactions: Serious skin reactions can occur. Discontinue at first appearance of rash. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension.
Missed Dose Instructions	If a dose of Etodolac is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. For consistent pain and inflammation control in chronic conditions, regular dosing is usually preferred.
Overdose Instructions	Symptoms of acute overdose typically include lethargy, drowsiness, nausea, vomiting, epigastric pain, and gastrointestinal bleeding. In severe cases, hypotension, acute renal failure, respiratory depression, and coma may occur. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate medical attention.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin): Increased risk of bleeding; monitor INR closely. ♦ Antiplatelet agents (e.g., aspirin, clopidogrel): Increased risk of bleeding. ♦ Other NSAIDs/Corticosteroids: Increased risk of GI adverse events. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and increase the risk of renal impairment. ♦ Lithium: May increase serum lithium concentrations and toxicity; monitor lithium levels. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ Furosemide/Thiazide Diuretics: May reduce diuretic efficacy.

Famciclovir (Famvir)

Purpose/Indication	Famciclovir is an antiviral medication used to treat infections caused by herpes viruses. Its primary indications include the treatment of acute herpes zoster (shingles), treatment of recurrent genital herpes, and suppression of recurrent genital herpes. It works by interfering with viral replication, helping to reduce the severity and duration of outbreaks.
Method of Action	Famciclovir is a prodrug of penciclovir. After oral administration, it is rapidly absorbed and extensively converted in the body to penciclovir, which is then phosphorylated by viral thymidine kinase in infected cells to penciclovir triphosphate. Penciclovir triphosphate then competitively inhibits viral DNA polymerase, thereby blocking viral DNA synthesis and inhibiting the replication of herpes simplex virus types 1 and 2 (HSV-1, HSV-2) and varicella-zoster virus (VZV).
Medication Name & Brand Names	♦ Medication Name: Famciclovir ♦ Brand Names: Famvir
Pharmaceutical Forms & Appearance	Famciclovir is available as oral film-coated tablets. Tablets are typically white, round or oval, and may be engraved with the strength.
Dosage & Administration	Dosage varies significantly based on the specific infection, its severity, and patient's renal function. For acute herpes zoster, a common adult dose is 500 mg every 8 hours for 7 days. For recurrent genital herpes, a single dose of 1500 mg or 1000 mg twice daily for 1 day might be used. For suppression, doses are typically 250 mg twice daily. Doses must be adjusted in patients with renal impairment. It can be taken with or without food.
Supplied As	Famciclovir is supplied as oral film-coated tablets (e.g., 125 mg, 250 mg, 500 mg).
Contraindications	Famciclovir is contraindicated in patients with known hypersensitivity to famciclovir, penciclovir, or any component of the formulation.

Storage & Expiry	Famciclovir tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, nausea, diarrhea, and fatigue. More serious but less common side effects can include confusion (especially in elderly patients or those with renal impairment), hallucinations, rash, and, rarely, severe cutaneous reactions or angioedema.
Warnings & Precautions	♦ Renal Impairment: Dose adjustment is crucial in patients with impaired renal function to avoid drug accumulation and increased risk of side effects, particularly central nervous system (CNS) effects like confusion. ♦ CNS Effects: Can cause dizziness, headache, and confusion, particularly in the elderly or renally impaired. Advise caution with activities requiring mental alertness. ♦ Immunocompromised Patients: Effectiveness in immunocompromised patients for certain indications may differ, and longer treatment durations or higher doses might be considered based on clinical judgment. ♦ Transmission: Famciclovir is not a cure for herpes and does not prevent the transmission of herpes to others. Advise patients on safe sex practices.
Missed Dose Instructions	For optimal effectiveness in treating viral infections, it is important to take Famciclovir doses regularly. If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Complete the full prescribed course of treatment.
Overdose Instructions	Limited information is available on famciclovir overdose. Symptoms would likely be an exaggeration of known side effects, particularly gastrointestinal upset and CNS effects (e.g., confusion, dizziness). Treatment is supportive and symptomatic. Hemodialysis has been shown to enhance the elimination of penciclovir (the active metabolite) and may be useful in managing overdose, especially in patients with impaired renal function. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Probenecid: Co-administration with probenecid can significantly reduce the renal clearance of penciclovir (active metabolite), leading to increased penciclovir plasma concentrations. Dose adjustment of famciclovir may be necessary, especially in renally impaired patients. ♦ Digoxin: Famciclovir may increase plasma levels of digoxin. ♦ Renally Eliminated Drugs: Use with caution when co-administering with other drugs that are primarily eliminated via active renal tubular secretion, as competition for excretion may occur. No other significant drug interactions are commonly reported, but always consult with a healthcare professional regarding all concomitant medications.

Famotidine (Pepcid)

Purpose/Indication	Famotidine is a histamine-2 (H2) receptor antagonist used to reduce the amount of acid produced in the stomach. It is indicated for the treatment and prevention of various acid-related conditions, including peptic ulcers (gastric and duodenal), gastroesophageal reflux disease (GERD), erosive esophagitis, and Zollinger-Ellison syndrome. It is also commonly used to relieve heartburn and indigestion.
Method of Action	Famotidine competitively inhibits the binding of histamine to the H2 receptors on the gastric parietal cells. Histamine normally stimulates these receptors, leading to the activation of the proton pump and subsequent acid secretion. By blocking the H2 receptors, famotidine effectively reduces both basal and stimulated gastric acid output, as well as pepsin secretion, thereby promoting healing of ulcers and relieving symptoms of acid reflux.
Medication Name & Brand Names	♦ Medication Name: Famotidine ♦ Brand Names: Pepcid, Pepcid AC (OTC), Famotidine (generic)
Pharmaceutical Forms & Appearance	Famotidine is available as oral tablets, chewable tablets, oral suspension, and solution for intravenous (IV) injection. Oral tablets are typically small, white or off-white, and may be film-coated or scored, with various imprints. Chewable tablets may be flavored. The oral suspension is an opaque liquid. The injectable solution is clear and colorless.
Dosage & Administration	Dosage varies depending on the indication, severity, and patient's renal function. For most ulcer conditions, typical adult doses range from 20 mg to 40 mg once daily at bedtime, or twice daily. For heartburn relief, lower doses (e.g., 10 mg) may be taken as needed. It can be taken with or without food. Duration of treatment varies from weeks for acute conditions to long-term for maintenance or chronic conditions.
Supplied As	Famotidine is supplied as: oral tablets (e.g., 10 mg, 20 mg, 40 mg), chewable tablets (e.g., 10 mg, 20 mg), powder for oral suspension (e.g., 40 mg/5 mL after reconstitution), and solution for intravenous injection (e.g., 10 mg/mL, 20 mg/2 mL vials).
Contraindications	Famotidine is contraindicated in patients with known hypersensitivity to famotidine or any component of the formulation. Cross-sensitivity among H2 receptor antagonists (e.g., cimetidine, ranitidine) may occur.
Storage & Expiry	Famotidine tablets and powder for oral suspension (unreconstituted) should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The reconstituted oral suspension typically requires refrigeration and is stable for a limited period (e.g., 30 days). Always check the specific product label for precise storage and expiry information.
Side Effects	Common side effects are generally mild and include headache, dizziness, constipation, and diarrhea. Less common but more serious side effects include allergic reactions (rash, hives), liver enzyme elevations, and, rarely, blood dyscrasias. Long-term use generally has a good safety profile, but very rarely can be associated with confusion in elderly or renally impaired patients.
Warnings & Precautions	♦ Serious Gastric Conditions: Symptomatic response to famotidine does not preclude the presence of gastric malignancy. Further evaluation may be needed. ♦ Renal Impairment: Dose adjustment is necessary in patients with moderate to severe renal impairment (creatinine clearance <50 mL/min) to prevent drug accumulation and increased risk of side effects. ♦ Elderly: More susceptible to central nervous system side effects (e.g., confusion) due to decreased renal clearance. ♦ Liver Dysfunction: Use with caution in patients with liver impairment. ♦ Cardiac Arrhythmias: Rare reports of QT prolongation and ventricular arrhythmias, particularly with IV administration in patients with renal impairment or rapid infusion.
Missed Dose Instructions	If a dose of Famotidine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For chronic conditions, consistent daily dosing is important for maintaining acid suppression.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset and, in severe cases, central nervous system effects (e.g., restlessness, confusion, seizures) and cardiac abnormalities (e.g., QT prolongation, bradycardia). Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if oral ingestion was recent and substantial. Hemodialysis is minimally effective in removing famotidine. Seek medical attention if a large amount is ingested or severe symptoms occur.

Medicine Interactions	♦ Drugs requiring acidic gastric pH for absorption (e.g., certain antifungals like ketoconazole, itraconazole; atazanavir, some iron salts): Famotidine significantly increases gastric pH, which can reduce the absorption and effectiveness of these medications. Administer these drugs at least 2 hours before or after famotidine. ♦ Tizanidine: Famotidine can increase the plasma concentration of tizanidine (a muscle relaxant), potentially leading to increased adverse effects. ♦ Probenecid: May reduce the renal clearance of famotidine, leading to increased famotidine levels. ♦ Antacids: While generally not a significant interaction for systemic absorption of famotidine, antacids can sometimes be taken with famotidine for immediate symptom relief. However, avoid taking them simultaneously with oral suspension to ensure proper dosing.

Fenoprofen (Nalfon)

Purpose/Indication	Fenoprofen is a non-steroidal anti-inflammatory drug (NSAID) used to relieve pain, inflammation, and stiffness. It is indicated for the acute and long-term management of rheumatoid arthritis and osteoarthritis. It also provides relief for mild to moderate pain, including conditions like dysmenorrhea (menstrual pain).
Method of Action	Fenoprofen works by reversibly inhibiting cyclooxygenase (COX) enzymes, both COX-1 and COX-2. These enzymes are crucial for the synthesis of prostaglandins, which are lipid compounds that play a central role in mediating pain, inflammation, and fever. By reducing prostaglandin production, fenoprofen effectively decreases pain, swelling, and redness associated with inflammatory conditions.
Medication Name & Brand Names	♦ Medication Name: Fenoprofen Calcium ♦ Brand Names: Nalfon (historical, now largely generic)
Pharmaceutical Forms & Appearance	Fenoprofen is primarily available as oral capsules and oral tablets. Capsules are typically white, and tablets are often white or off-white, and may be scored.
Dosage & Administration	Dosage varies depending on the indication and patient response. For rheumatoid arthritis and osteoarthritis, typical adult doses range from 300 mg to 600 mg three to four times daily, with a maximum daily dose often around 3200 mg. For mild to moderate pain, 200 mg every 4-6 hours as needed. It should be taken with food or milk to minimize gastrointestinal upset. Use the lowest effective dose for the shortest duration.
Supplied As	Fenoprofen is supplied as: oral capsules (e.g., 200 mg, 300 mg) and oral tablets (e.g., 600 mg).
Contraindications	Fenoprofen is contraindicated in patients with a known hypersensitivity (e.g., allergic reactions, asthma, urticaria) to fenoprofen, aspirin, or other NSAIDs. It is also contraindicated in the setting of coronary artery bypass graft (CABG) surgery and in patients with active gastrointestinal bleeding or peptic ulcer disease. Severe heart failure is also a contraindication.
Storage & Expiry	Fenoprofen oral forms should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, dyspepsia, abdominal pain, constipation), headache, and dizziness. More serious and potentially life-threatening side effects can include cardiovascular thrombotic events (e.g., heart attack, stroke), gastrointestinal bleeding, ulceration, or perforation, kidney dysfunction, liver injury, and serious skin reactions (e.g., Stevens-Johnson syndrome).
Warnings & Precautions	♦ Cardiovascular Risk: NSAIDs, including fenoprofen, can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. Contraindicated for pain after CABG surgery. ♦ Gastrointestinal Risk: Can cause serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. Risk is higher in elderly patients, those with a history of GI bleeding, or concomitant use of other agents. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, especially in dehydrated patients or those with pre-existing kidney disease or heart failure. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function tests. ♦ Skin Reactions: Serious skin reactions can occur. Discontinue at first appearance of rash. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Pregnancy: Avoid use in late pregnancy due to risk of premature closure of the fetal ductus arteriosus.
Missed Dose Instructions	If a dose of Fenoprofen is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. For consistent pain and inflammation control in chronic conditions, regular dosing is usually preferred.
Overdose Instructions	Symptoms of acute overdose typically include lethargy, drowsiness, nausea, vomiting, epigastric pain, and gastrointestinal bleeding. In severe cases, hypotension, acute renal failure, respiratory depression, and coma may occur. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate medical attention.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin): Increased risk of bleeding; monitor INR closely. ♦ Antiplatelet agents (e.g., aspirin, clopidogrel): Increased risk of bleeding. ♦ Other NSAIDs/Corticosteroids: Increased risk of GI adverse events. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and increase the risk of renal impairment. ♦ Lithium: May increase serum lithium concentrations and toxicity; monitor lithium levels. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ Hydantoins (e.g., phenytoin): May increase plasma levels of hydantoins. ♦ Sulfonylureas: May enhance the hypoglycemic effect.

Fexofenadine (Telfast)

Purpose/Indication	Fexofenadine is a second-generation (non-sedating) antihistamine used to relieve symptoms of seasonal allergic rhinitis (hay fever) and chronic idiopathic urticaria (hives). It effectively reduces symptoms like sneezing, runny nose, itchy or watery eyes, itchy throat, and skin itching and hives, without causing significant drowsiness.
Method of Action	Fexofenadine is a selective peripheral H1-receptor antagonist. It works by blocking the action of histamine at H1 receptors, which are responsible for the symptoms of allergic reactions. Unlike first-generation antihistamines, fexofenadine has poor penetration into the central nervous system, which accounts for its non-sedating profile. It also does not bind significantly to cholinergic or alpha-1 adrenergic receptors, contributing to its favorable side effect profile.
Medication Name & Brand Names	♦ Medication Name: Fexofenadine Hydrochloride ♦ Brand Names: Allegra, Telfast, Fexofenadine (generic)

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Pharmaceutical Forms & Appearance	Fexofenadine is available as oral tablets, orally disintegrating tablets (ODT), and oral suspension. Oral tablets are typically peach-colored, oval, and film-coated, often with specific imprints indicating strength. ODTs dissolve rapidly on the tongue. The oral suspension is a white to off-white opaque liquid.
Dosage & Administration	Dosage varies by age and indication. For seasonal allergic rhinitis in adults and children 12 years and older, common doses are 60 mg twice daily or 180 mg once daily. For chronic idiopathic urticaria, 180 mg once daily is typical for adults. For children, a lower dose oral suspension or tablet may be used. It is generally recommended to take fexofenadine with water and to avoid taking it with fruit juices.
Supplied As	Fexofenadine is supplied as: oral tablets (e.g., 30 mg, 60 mg, 120 mg, 180 mg), orally disintegrating tablets (e.g., 30 mg), and oral suspension (e.g., 30 mg/5 mL).
Contraindications	Fexofenadine is contraindicated in patients with known hypersensitivity to fexofenadine or any component of the formulation.
Storage & Expiry	Fexofenadine tablets, ODTs, and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging. The oral suspension should not be frozen.
Side Effects	Common side effects are generally mild and include headache, dizziness, drowsiness (less common than with first-generation antihistamines), and nausea. More serious side effects are rare due to its selective action and minimal CNS penetration.
Warnings & Precautions	♦ Fruit Juice Interaction: Avoid taking fexofenadine with fruit juices (e.g., grapefruit, orange, apple) as they can significantly reduce its absorption and effectiveness. Take with water. ♦ Renal Impairment: Use with caution and consider a reduced dose in patients with impaired renal function, as fexofenadine is primarily eliminated renally. ♦ Elderly: While generally well-tolerated, use with caution in elderly patients due to potentially decreased renal function. ♦ Allergic Reactions: Discontinue use if an allergic reaction occurs.
Missed Dose Instructions	If a dose of Fexofenadine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Regular dosing is important for consistent symptom control in chronic allergic conditions.
Overdose Instructions	Overdose symptoms are generally mild and may include dizziness, drowsiness, and dry mouth. Significant cardiotoxicity (e.g., QT prolongation, arrhythmias) is rare with fexofenadine overdose due to its highly selective peripheral H1 antagonism and lack of cardiac ion channel effects. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if oral ingestion was recent and substantial. Hemodialysis is not effective. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Antacids (containing aluminum or magnesium): Can significantly reduce the absorption of fexofenadine. Administer fexofenadine at least 2 hours before or after antacids. ♦ Fruit Juices: As mentioned, grapefruit, orange, and apple juices can reduce fexofenadine bioavailability. Avoid taking fexofenadine with these juices. ♦ Erythromycin/Ketoconazole: While these drugs were shown to increase fexofenadine levels in early studies, these increases were generally not associated with increased QTc prolongation or increased adverse events. However, caution is still advised. ♦ P-glycoprotein inhibitors/inducers: As fexofenadine is a substrate of P-glycoprotein, drugs that affect this transporter could theoretically alter its levels, but clinically significant interactions are rare.

Fidaxomicin (Dificid)

Purpose/Indication	Fidaxomicin is a macrolide antibacterial medication specifically indicated for the treatment of Clostridioides difficile-associated diarrhea (CDAD) in adults and pediatric patients aged 6 months and older. It is highly effective in targeting C. difficile bacteria in the gut, helping to resolve diarrhea and reduce the risk of recurrence.
Method of Action	Fidaxomicin is a narrow-spectrum, macrocyclic antibiotic that acts locally in the gastrointestinal tract with minimal systemic absorption. It works by inhibiting bacterial RNA polymerase, thereby disrupting bacterial RNA synthesis and protein synthesis, leading to bacterial death. Its specific targeting of C. difficile results in potent bactericidal activity against the pathogen while largely preserving the normal gut microbiota.
Medication Name & Brand Names	♦ Medication Name: Fidaxomicin ♦ Brand Names: Dificid
Pharmaceutical Forms & Appearance	Fidaxomicin is available as oral film-coated tablets and as granules for oral suspension. Tablets are typically pale yellow to white, oval, and film-coated. The granules for oral suspension, when reconstituted, form a uniform white to off-white suspension.
Dosage & Administration	For adults, the typical dose is 200 mg orally twice daily for 10 days. For pediatric patients, dosing is based on weight. It can be taken with or without food. It is crucial to complete the entire 10-day course of fidaxomicin to ensure eradication of the C. difficile infection and minimize the risk of recurrence.
Supplied As	Fidaxomicin is supplied as: oral film-coated tablets (e.g., 200 mg) and granules for oral suspension (e.g., 40 mg/mL after reconstitution, 50 mg/mL after reconstitution for younger children).
Contraindications	Fidaxomicin is contraindicated in patients with known hypersensitivity to fidaxomicin or any component of the formulation.
Storage & Expiry	Fidaxomicin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. The granules for oral suspension should be stored in the refrigerator (2°C to 8°C or 36°F to 46°F) after reconstitution and are typically stable for a limited period (e.g., 14 days). Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, abdominal pain, and gastrointestinal hemorrhage (often mild). Less common but serious side effects can include hypersensitivity reactions, angioedema, and, very rarely, neutropenia or anemia.
Warnings & Precautions	♦ Hypersensitivity Reactions: Serious hypersensitivity reactions, including angioedema and dyspnea, have been reported. Discontinue immediately if symptoms of a severe reaction occur. ♦ Lack of Systemic Activity: Fidaxomicin has minimal systemic absorption, so it is not effective for systemic infections outside of the gut. It is specifically for C. difficile infection. ♦ Duration of Treatment: The full 10-day course is essential to prevent recurrence, even if symptoms improve earlier. ♦ Pseudomembranous Colitis: If severe, persistent diarrhea develops during or after treatment, evaluate for pseudomembranous colitis and C. difficile (if not already the diagnosis).

Missed Dose Instructions	If a dose of Fidaxomicin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the entire course of therapy is critical for effectively treating C. difficile infection and preventing recurrence.
Overdose Instructions	Due to fidaxomicin's minimal systemic absorption, overdose is unlikely to result in systemic toxicity. Symptoms would likely be an exaggeration of gastrointestinal side effects. There is no specific antidote. Treatment is supportive and symptomatic. Hemodialysis is not expected to be effective in removing fidaxomicin. Seek medical advice if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ P-glycoprotein (P-gp) Inhibitors (e.g., cyclosporine, ketoconazole, verapamil, amiodarone, quinidine): Co-administration with P-gp inhibitors can significantly increase systemic exposure to fidaxomicin (though systemic absorption is still minimal). While the clinical significance of this increase is generally considered low given fidaxomicin's local action, caution may be advised in certain situations, especially in patients with severe underlying conditions. ♦ No other significant drug interactions are commonly reported due to its limited systemic absorption.

Fluconazole (Diflucan)

Purpose/Indication	Fluconazole is an antifungal medication belonging to the triazole class, used to treat a variety of fungal and yeast infections. It is commonly indicated for vaginal candidiasis (yeast infections), oropharyngeal and esophageal candidiasis, cryptococcal meningitis, and systemic candidiasis. It can also be used for the prophylaxis of fungal infections in immunocompromised patients.
Method of Action	Fluconazole works by inhibiting the fungal cytochrome P450 enzyme 14-a demethylase. This enzyme is essential for the demethylation of lanosterol to ergosterol, a crucial component of the fungal cell membrane. By disrupting ergosterol synthesis, fluconazole compromises the integrity and permeability of the fungal cell membrane, leading to leakage of essential cellular components and ultimately, the inhibition of fungal growth (fungistatic effect).
Medication Name & Brand Names	♦ Medication Name: Fluconazole ♦ Brand Names: Diflucan, Fluconazole (generic)
Pharmaceutical Forms & Appearance	Fluconazole is available as oral tablets, oral suspension, and solution for intravenous (IV) injection. Oral tablets are typically white, round or oval, and may be scored, with various imprints indicating strength. The oral suspension is usually a white to off-white powder that is reconstituted to a liquid. The injectable solution is clear and colorless.
Dosage & Administration	Dosage varies widely depending on the type and severity of the fungal infection, patient's renal function, and immune status. For vaginal candidiasis, a single oral dose of 150 mg is common. For other infections, daily doses can range from 50 mg to 400 mg or more, often with a loading dose. It can be taken with or without food. Complete the full prescribed course of treatment.
Supplied As	Fluconazole is supplied as: oral tablets (e.g., 50 mg, 100 mg, 150 mg, 200 mg), powder for oral suspension (e.g., 10 mg/mL, 40 mg/mL after reconstitution), and solution for intravenous injection (e.g., 2 mg/mL).
Contraindications	Fluconazole is contraindicated in patients with known hypersensitivity to fluconazole, other azole antifungals, or any component of the formulation. Co-administration with terfenadine (in multiple-dose fluconazole regimens) or cisapride is contraindicated due to increased risk of serious cardiac arrhythmias.
Storage & Expiry	Fluconazole tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. The powder for oral suspension should be stored dry, and the reconstituted suspension is typically stable for a limited time (e.g., 14 days) at room temperature or refrigerated (check specific label). Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, nausea, abdominal pain, diarrhea, and rash. More serious but less common side effects can include elevated liver enzymes, hepatotoxicity (liver injury), QT prolongation, Torsades de Pointes (a type of cardiac arrhythmia), and severe skin reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis).
Warnings & Precautions	♦ Hepatotoxicity: Can cause severe, and rarely fatal, liver injury. Monitor liver function tests during prolonged therapy. Discontinue if signs/symptoms of liver disease develop. ♦ QT Prolongation/Arrhythmias: Can prolong the QT interval, increasing the risk of serious cardiac arrhythmias (Torsades de Pointes). Use with caution in patients with pre-existing heart conditions, electrolyte imbalances (hypokalemia, hypomagnesemia), or those taking other QT-prolonging drugs. ♦ Renal Impairment: Dose adjustment is required in patients with renal impairment to prevent drug accumulation. ♦ Exfoliative Skin Disorders: Rare but serious skin reactions have been reported; discontinue at first sign of rash. ♦ Adrenal Insufficiency: Rare reports of adrenal insufficiency with azole antifungals. ♦ Pregnancy: Avoid use in pregnancy, particularly high doses or prolonged use, due to potential for birth defects (specifically, a pattern of congenital anomalies similar to Antley-Bixler syndrome has been reported with long-term, high-dose use for coccidioidomycosis).
Missed Dose Instructions	If a dose of Fluconazole is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For effective treatment of fungal infections, consistent dosing and completion of the full course are important.
Overdose Instructions	Overdose symptoms may include hallucinations and paranoid behavior, in addition to exaggerated common side effects like nausea and diarrhea. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if oral ingestion was recent and substantial. Fluconazole is largely excreted unchanged in urine, and a 3-hour hemodialysis session decreases plasma levels by approximately 50%. Seek immediate medical attention.
Medicine Interactions	♦ Terfenadine/Cisapride: Co-administration is contraindicated due to increased risk of QT prolongation and life-threatening arrhythmias. ♦ CYP2C9/2C19/3A4 Substrates: Fluconazole is a potent inhibitor of CYP2C9 and a moderate inhibitor of CYP2C19 and CYP3A4. It can significantly increase plasma concentrations of many drugs metabolized by these enzymes, leading to increased risk of toxicity. Examples include: warfarin (increased bleeding risk), phenytoin, sulfonylureas (increased hypoglycemia), cyclosporine, tacrolimus, short-acting benzodiazepines (midazolam, triazolam), some statins (e.g., atorvastatin, simvastatin), rifabutin, theophylline. ♦ Hydrochlorothiazide: Can increase fluconazole levels. ♦ Rifampin: Can decrease fluconazole levels. ♦ Oral Contraceptives: May alter the metabolism of oral contraceptives, but the clinical significance is generally considered low.

Fluoxetine (Prozac)

Purpose/Indication	Fluoxetine is a selective serotonin reuptake inhibitor (SSRI) antidepressant used to treat a range of mental health conditions. Its primary indications include major depressive disorder (MDD), obsessive-compulsive disorder (OCD), bulimia nervosa, panic disorder, and premenstrual dysphoric disorder (PMDD). It helps to improve mood, reduce anxiety, and regulate behavior by affecting certain chemical messengers in the brain.
Method of Action	Fluoxetine works by selectively inhibiting the reuptake of serotonin (5-HT) by the presynaptic neuron in the central nervous system. By blocking the serotonin transporter (SERT), it increases the concentration of serotonin in the synaptic cleft, leading to enhanced serotonergic neurotransmission. This increase in serotonin availability is believed to be responsible for its antidepressant, anxiolytic, and anti-obsessive effects. Fluoxetine also has a long half-life due to its active metabolite, norfluoxetine.
Medication Name & Brand Names	♦ Medication Name: Fluoxetine Hydrochloride ♦ Brand Names: Prozac, Sarafem (for PMDD), Prozac Weekly (delayed-release capsule), Fluoxetine (generic)
Pharmaceutical Forms & Appearance	Fluoxetine is available as oral capsules (hard and delayed-release), oral tablets, oral solution, and orally disintegrating tablets (ODT). Capsules vary in color and size. Tablets are typically white or off-white and may be scored. The oral solution is usually a clear liquid.
Dosage & Administration	Dosage is individualized and varies by indication. For MDD, initial doses are typically 10 mg to 20 mg once daily, gradually increasing up to a maximum of 60 mg to 80 mg daily. For bulimia nervosa, 60 mg once daily is common. It can be taken with or without food. Therapeutic effects may take several weeks (4-6 weeks or more) to become fully apparent.
Supplied As	Fluoxetine is supplied as: oral capsules (e.g., 10 mg, 20 mg, 40 mg), delayed-release capsules (e.g., 90 mg for once-weekly dosing), oral tablets (e.g., 10 mg, 20 mg, 60 mg), and oral solution (e.g., 20 mg/5 mL).
Contraindications	Fluoxetine is contraindicated in patients with known hypersensitivity to fluoxetine or any component of the formulation. It is contraindicated in patients taking monoamine oxidase inhibitors (MAOIs) or within 14 days of discontinuing an MAOI, due to the risk of serotonin syndrome. Co-administration with thioridazine (due to QT prolongation and serious arrhythmias) and pimozide (due to QT prolongation) is also contraindicated.
Storage & Expiry	Fluoxetine capsules, tablets, and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include insomnia, headache, nausea, diarrhea, nervousness, anxiety, sexual dysfunction (e.g., decreased libido, delayed ejaculation), and tremor. More serious but less common side effects include serotonin syndrome, suicidal ideation, seizures, increased bleeding risk, hyponatremia (low sodium), and activation of mania/hypomania.
Warnings & Precautions	♦ Suicidality Risk: Antidepressants increase the risk of suicidal thoughts and behaviors in children, adolescents, and young adults (up to age 24) with MDD and other psychiatric disorders. Monitor patients closely for clinical worsening, suicidality, or unusual changes in behavior. ♦ Serotonin Syndrome: Potentially life-threatening condition when co-administered with other serotonergic agents (e.g., MAOIs, triptans, fentanyl, lithium, tramadol, St. John's Wort). Symptoms include mental status changes, autonomic instability, neuromuscular abnormalities, and/or GI symptoms. ♦ QT Prolongation: Can cause QT interval prolongation, and co-administration with thioridazine or pimozide is contraindicated. ♦ Seizures: Use with caution in patients with a history of seizures. ♦ Hyponatremia: Can cause clinically significant hyponatremia, particularly in elderly patients or those on diuretics. ♦ Abnormal Bleeding: May increase the risk of bleeding events, especially with concurrent use of NSAIDs, aspirin, or anticoagulants. ♦ Activation of Mania/Hypomania: Use with caution in patients with bipolar disorder. ♦ Discontinuation Syndrome: Abrupt discontinuation, particularly after long-term use, can lead to symptoms like dizziness, sensory disturbances, insomnia, agitation; taper dose gradually, though fluoxetine's long half-life may make this less severe than with other SSRIs. ♦ Weight Changes: Can cause weight loss, especially initially.
Missed Dose Instructions	If a dose of Fluoxetine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining therapeutic levels and managing symptoms effectively. Do not stop taking the medication abruptly without consulting a doctor due to withdrawal risks.
Overdose Instructions	Overdose symptoms are typically mild to moderate and may include nausea, vomiting, seizures, sinus tachycardia, somnolence, and rarely, QT prolongation or coma. Fatalities are rare when fluoxetine is taken alone. Treatment is supportive. Maintain an airway and monitor cardiac and vital signs. Activated charcoal may be considered if ingestion was recent and substantial. Due to its large volume of distribution and high protein binding, forced diuresis, dialysis, hemoperfusion, and exchange transfusion are unlikely to be beneficial. Seek immediate medical attention.
Medicine Interactions	♦ Monoamine Oxidase Inhibitors (MAOIs): Concurrent use is contraindicated due to severe, potentially fatal serotonin syndrome. Allow at least 14 days between discontinuing an MAOI and starting fluoxetine, and at least 5 weeks (due to fluoxetine's long half-life) between discontinuing fluoxetine and starting an MAOI. ♦ Other Serotonergic Drugs: Increased risk of serotonin syndrome with triptans, tricyclic antidepressants, fentanyl, lithium, tramadol, buspirone, tryptophan, St. John's Wort. Use with caution. ♦ Thioridazine/Pimozide: Co-administration is contraindicated due to increased levels and risk of QT prolongation and serious arrhythmias. ♦ Drugs Metabolized by CYP2D6: Fluoxetine is a potent CYP2D6 inhibitor and can significantly increase plasma concentrations of drugs metabolized by this enzyme (e.g., tricyclic antidepressants, risperidone, atomoxetine, dextromethorphan, metoprolol, tamoxifen). Dose adjustments may be needed. ♦ NSAIDs, Aspirin, Warfarin: Increased risk of bleeding. Monitor for signs of bleeding. ♦ Alcohol: Avoid alcohol due to additive CNS depressant effects. ♦ Phenytoin: May increase phenytoin levels.

Fluticasone (Flonase)

Purpose/Indication	Fluticasone is a synthetic corticosteroid primarily used for its potent anti-inflammatory and immunosuppressive effects. It is widely indicated for the treatment of asthma (inhaled), allergic and non-allergic rhinitis (nasal spray), and various inflammatory skin conditions such as eczema and psoriasis (topical creams/ointments). It helps to reduce swelling, itching, and allergic reactions in the airways, nasal passages, or on the skin.
Method of Action	Fluticasone works by binding to glucocorticoid receptors in the cytoplasm of target cells. This complex then translocates to the nucleus, where it modulates gene expression. This leads to the upregulation of anti-inflammatory proteins (e.g., lipocortin) and the downregulation of pro-inflammatory mediators (e.g., cytokines, chemokines, adhesion molecules). In the airways, this reduces inflammation, edema, and mucus production. In the nose, it reduces histamine release and inflammatory cell activity. On the skin, it suppresses the immune response and reduces inflammation and pruritus.
Medication Name & Brand Names	♦ Medication Name: Fluticasone Propionate, Fluticasone Furoate ♦ Brand Names: Flovent (HFA, Diskus - inhaled for asthma), Flonase (nasal spray), Veramyst (nasal spray), Cutivate (topical), Flonase Sensimist (nasal spray), Arnuity Ellipta (inhaled for asthma)
Pharmaceutical Forms & Appearance	Fluticasone is available in various forms: metered-dose inhalers (MDIs), dry powder inhalers (DPIs) for oral inhalation; nasal sprays (aqueous suspensions); and topical creams, ointments, and lotions. Inhalers are typically plastic devices containing a canister. Nasal sprays are bottles with an applicator. Topical preparations are white or off-white creams/ointments.

Dosage & Administration	Dosage varies significantly by formulation, indication, and patient age. For asthma, inhaled doses are typically 100 mcg to 1000 mcg daily in divided doses, depending on severity. Nasal sprays are commonly 1-2 sprays per nostril once or twice daily. Topical preparations are applied thinly to the affected skin area once or twice daily. Always follow specific product instructions. For inhaled forms, rinsing the mouth after use is important to prevent oral thrush.
Supplied As	Fluticasone is supplied as: metered-dose inhalers (e.g., 44 mcg, 110 mcg, 220 mcg/puff), dry powder inhalers (e.g., 50 mcg, 100 mcg, 250 mcg/blister), nasal sprays (e.g., 50 mcg/spray, 27.5 mcg/spray), and topical creams/ointments (e.g., 0.05%, 0.005%).
Contraindications	Fluticasone is contraindicated in patients with known hypersensitivity to fluticasone or any component of the formulation. Inhaled fluticasone is contraindicated for the primary treatment of status asthmaticus or other acute episodes of asthma or COPD where intensive measures are required. Topical fluticasone is contraindicated in patients with rosacea, perioral dermatitis, or untreated bacterial, fungal, or viral infections of the skin.
Storage & Expiry	Fluticasone products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from direct sunlight, extreme heat, and freezing. Inhalers should be stored with the mouthpiece down or upright as directed. Always check the specific expiry date on the packaging.
Side Effects	Common side effects for inhaled/nasal forms include headache, throat irritation, hoarseness, cough, and candidiasis (thrush) in the mouth/throat. For topical forms, localized skin reactions like burning, itching, or dryness may occur. Systemic side effects are generally rare with recommended doses but can include adrenal suppression (with high doses or prolonged use), growth retardation in children, and increased risk of cataracts/glaucoma with long-term use.
Warnings & Precautions	♦ Oral Candidiasis (Thrush): Inhaled fluticasone can cause oral candidiasis. Advise patients to rinse mouth with water and spit after each inhaled dose. ♦ Adrenal Suppression: Prolonged use of high doses can lead to systemic corticosteroid effects, including adrenal suppression. Taper doses gradually if discontinuing after prolonged use. ♦ Growth Retardation: Long-term use in children can potentially affect growth; monitor growth. ♦ Immunosuppression: Can increase susceptibility to infections. Avoid exposure to chickenpox or measles if not immune. ♦ Ocular Effects: Long-term use can increase the risk of glaucoma and cataracts. Regular eye exams may be needed. ♦ Bone Mineral Density: Potential for reduced bone mineral density with prolonged use, especially at high doses. ♦ Paradoxical Bronchospasm (Inhaled): Rare but can occur immediately after inhalation; use a short-acting bronchodilator for relief. ♦ Nasal Septal Perforation (Nasal): Rare, but can occur with improper nasal spray use.
Missed Dose Instructions	If a dose of Fluticasone (inhaled, nasal, or topical) is missed, take/apply it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take/apply a double dose. Regular, consistent use is crucial for optimal control of chronic conditions like asthma or allergies.
Overdose Instructions	Acute overdose with fluticasone is generally rare and unlikely to cause life-threatening symptoms due to its low systemic bioavailability and short half-life. Chronic overdose, especially with high doses over prolonged periods, can lead to signs and symptoms of Cushing's syndrome, adrenal suppression, hyperglycemia, and other systemic corticosteroid effects. Treatment is symptomatic and supportive; gradual reduction of the steroid dose under medical supervision is usually indicated. Seek medical advice if an overdose is suspected or severe symptoms occur.
Medicine Interactions	♦ CYP3A4 Inhibitors: Strong CYP3A4 inhibitors (e.g., ritonavir, cobicistat, ketoconazole, itraconazole) can significantly increase systemic exposure to fluticasone, leading to increased risk of systemic corticosteroid side effects (e.g., adrenal suppression, Cushing's syndrome). Co-administration is generally not recommended unless the benefits outweigh the risks, and careful monitoring is required. ♦ No other significant drug interactions are commonly reported due to fluticasone's low systemic absorption from inhaled, nasal, and topical routes at recommended doses.

Fluticasone/Salmeterol (Advair)

Purpose/Indication	Fluticasone/Salmeterol is a combination inhaled medication used for the long-term maintenance treatment of asthma in patients aged 4 years and older, and for the maintenance treatment of airflow obstruction and reduction of exacerbations in patients with chronic obstructive pulmonary disease (COPD). It is not for the relief of acute bronchospasm. This combination helps to control symptoms and improve lung function over time.
Method of Action	This medication combines two active ingredients: Fluticasone, an inhaled corticosteroid (ICS), and Salmeterol, a long-acting beta2-adrenergic agonist (LABA). Fluticasone works locally in the airways as an anti-inflammatory, reducing swelling and mucus production. Salmeterol acts by stimulating beta2-adrenergic receptors in the bronchial smooth muscle, leading to long-lasting bronchodilation and relaxation of the airways. Together, they provide both anti-inflammatory effects and sustained bronchodilation to improve breathing.
Medication Name & Brand Names	♦ Medication Name: Fluticasone Propionate/Salmeterol Xinafoate ♦ Brand Names: Advair Diskus, Advair HFA, AirDuo RespiClick, Wixela Inhub
Pharmaceutical Forms & Appearance	Fluticasone/Salmeterol is available as dry powder inhalers (DPIs) and metered-dose inhalers (MDIs). The DPIs (e.g., Diskus) are typically disc-shaped devices containing blister strips. The MDIs (e.g., HFA) are canisters in plastic actuators. The powder or aerosol contents are white.
Dosage & Administration	Dosage varies by strength and device, and by indication (asthma vs. COPD). It is typically administered as one inhalation twice daily, approximately 12 hours apart. For asthma, different strengths are available, and the dose is individualized. For COPD, a specific strength (e.g., 250/50 mcg) is generally used. It should be used consistently every day, even when feeling well. It is not for acute symptom relief.
Supplied As	Fluticasone/Salmeterol is supplied as: dry powder inhalers (e.g., Advair Diskus: 100/50 mcg, 250/50 mcg, 500/50 mcg per actuation; AirDuo RespiClick: 55/14 mcg, 113/14 mcg, 232/14 mcg per actuation) and metered-dose inhalers (e.g., Advair HFA: 45/21 mcg, 115/21 mcg, 230/21 mcg per actuation).
Contraindications	Fluticasone/Salmeterol is contraindicated in patients with known hypersensitivity to fluticasone, salmeterol, or any component of the formulation. It is also contraindicated as primary treatment of status asthmaticus or other acute episodes of asthma or COPD requiring intensive measures. LABA monotherapy (without an ICS) is contraindicated in asthma.
Storage & Expiry	Fluticasone/Salmeterol inhalers should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from direct sunlight, extreme heat, and freezing. Store dry powder inhalers in a dry place. MDIs should be kept with the mouthpiece down or upright as directed. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include upper respiratory tract infection, pharyngitis, oral candidiasis (thrush), headache, voice changes/hoarseness, and muscle pain. More serious but less common side effects associated with LABAs include increased risk of asthma-related death (with LABA monotherapy), cardiovascular effects (tachycardia, palpitations), and paradoxical bronchospasm. ICS-related systemic effects (e.g., adrenal suppression, bone mineral density loss) are rare with usual doses.

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Warnings & Precautions	♦ LABA Black Box Warning (Asthma): LABA-containing products (like Advair) increase the risk of asthma-related death. This risk is greater in patients not also using an inhaled corticosteroid. Therefore, it should not be used as monotherapy for asthma and only for patients whose asthma is not adequately controlled on an ICS alone or who require both an ICS and a LABA. ♦ Acute Bronchospasm: Not for acute relief of bronchospasm. A short-acting beta-agonist (SABA) should be prescribed for rescue. ♦ Oral Candidiasis: Risk of thrush; advise patients to rinse mouth with water and spit after each dose. ♦ Adrenal Suppression: Can cause systemic corticosteroid effects; monitor for adrenal suppression with high doses or prolonged use. ♦ Immunosuppression: Increased susceptibility to infections. ♦ Cardiovascular Effects: Use with caution in patients with cardiovascular disorders, hypertension, or arrhythmias. ♦ Paradoxical Bronchospasm: Immediately discontinue if bronchospasm worsens. ♦ Ocular Effects: Increased risk of glaucoma and cataracts with long-term use. ♦ Hypokalemia/Hyperglycemia: Can occur rarely.
Missed Dose Instructions	If a dose of Fluticasone/Salmeterol is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose (e.g., within 6 hours of the next 12-hour dose), skip the missed dose and continue with the regular schedule. Do not take a double dose. Regular, consistent use is critical for effective long-term control of asthma and COPD.
Overdose Instructions	Overdose symptoms are primarily related to salmeterol overstimulation of beta-adrenergic receptors, including tachycardia, arrhythmias (e.g., ventricular), tremors, headache, palpitations, and hypertension. Fluticasone overdose effects are generally related to chronic use leading to Cushingoid features or adrenal suppression. Treatment is supportive and symptomatic. Cardio-selective beta-blockers (with extreme caution in asthma/COPD due to bronchospasm risk) may be considered for cardiovascular effects. Seek immediate medical attention.
Medicine Interactions	♦ Strong CYP3A4 Inhibitors (e.g., ritonavir, ketoconazole, itraconazole, clarithromycin, cobicistat): Can significantly increase systemic exposure to both fluticasone and salmeterol, leading to increased risk of systemic corticosteroid side effects (e.g., adrenal suppression, Cushing's syndrome) and cardiovascular effects (e.g., QT prolongation, tremors) from salmeterol. Co-administration is generally not recommended unless benefits outweigh risks and careful monitoring is required. ♦ Beta-Blockers (non-selective, e.g., propranolol): Can block the bronchodilator effect of salmeterol and may cause severe bronchospasm in asthma patients. Avoid concomitant use. Cardioselective beta-blockers should be used with caution. ♦ Diuretics (non-potassium-sparing): The ECG changes and/or hypokalemia that may result from beta-agonists can be acutely worsened by non-potassium-sparing diuretics (e.g., loop or thiazide diuretics), especially with high doses. ♦ Other Sympathomimetics: Additive effects, increased risk of cardiovascular adverse events. ♦ Tricyclic Antidepressants/MAO Inhibitors: Can potentiate the cardiovascular effects of salmeterol. Use with extreme caution.

Fluticasone/Salmeterol (Advair)

Furosemide (Lasix)

Purpose/Indication	Furosemide is a potent loop diuretic used to treat edema (fluid retention) associated with congestive heart failure, liver cirrhosis, and kidney disease. It is also indicated for the management of hypertension (high blood pressure), especially in patients with renal impairment, and for the treatment of acute pulmonary edema. It works by increasing the excretion of excess fluid and salts from the body.
Method of Action	Furosemide primarily acts on the ascending limb of the loop of Henle in the kidney, where it inhibits the sodium-potassium-chloride ($Na+/K+/2Cl-$) co-transporter. By blocking this transporter, it prevents the reabsorption of these ions, leading to a significant increase in their excretion, along with water. This results in potent diuresis (increased urine output), rapid onset of action, and removal of excess fluid from the body. It also has a mild venodilating effect.
Medication Name & Brand Names	♦ Medication Name: Furosemide ♦ Brand Names: Lasix, Salix (historical/regional), Furosemide (generic)
Pharmaceutical Forms & Appearance	Furosemide is available as oral tablets, oral solution, and solution for intravenous (IV) or intramuscular (IM) injection. Oral tablets are typically white, round, and scored, with various imprints indicating strength. The oral solution is usually clear and colorless or light yellow. The injectable solution is clear and colorless.
Dosage & Administration	Dosage varies widely depending on the indication, severity of edema, and patient's renal function. For edema, initial adult oral doses are typically 20 mg to 80 mg once or twice daily, titrating up to a maximum of 600 mg daily. For hypertension, lower doses (e.g., 20 mg to 40 mg twice daily) may be used. IV administration is used for rapid diuresis or in acute settings. It can be taken with or without food, but consistency is recommended.
Supplied As	Furosemide is supplied as: oral tablets (e.g., 20 mg, 40 mg, 80 mg), oral solution (e.g., 10 mg/mL, 40 mg/5 mL), and solution for intravenous/intramuscular injection (e.g., 10 mg/mL).
Contraindications	Furosemide is contraindicated in patients with known hypersensitivity to furosemide or sulfonamides (though cross-reactivity is rare), in patients with anuria (absence of urine production), and in patients with hepatic coma or severe electrolyte depletion until the condition is improved.
Storage & Expiry	Furosemide tablets and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The injectable solution should be protected from light. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include electrolyte imbalances (e.g., hypokalemia, hyponatremia, hypochloremia, hypomagnesemia, hypocalcemia), dehydration, hypotension (dizziness, lightheadedness), and increased urination. More serious side effects can include ototoxicity (hearing impairment, tinnitus, particularly with rapid IV infusion or high doses), allergic reactions, pancreatitis, and gout.
Warnings & Precautions	♦ Fluid and Electrolyte Imbalances: Can cause significant fluid and electrolyte depletion (especially hypokalemia, hyponatremia, hypomagnesemia). Monitor electrolytes regularly. Advise patients on diet or supplements if needed. ♦ Hypotension: Risk of symptomatic hypotension, especially with initial doses, rapid diuresis, or in dehydrated patients. ♦ Ototoxicity: Can cause transient or permanent hearing impairment/tinnitus, especially with high doses, rapid IV infusion, or in patients with renal impairment or concurrent use of other ototoxic drugs. ♦ Sulfonamide Allergy: While cross-reactivity is rare, use with caution in patients with a history of sulfonamide allergy. ♦ Renal Impairment: Use with caution and monitor renal function. Can worsen pre-existing renal dysfunction or lead to acute renal failure, especially in volume-depleted states. ♦ Gout: Can increase serum uric acid levels and precipitate gout attacks. ♦ Diabetes: May increase blood glucose levels; monitor diabetics closely.
Missed Dose Instructions	If a dose of Furosemide is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For once-daily dosing, avoid taking a missed dose too late in the day to prevent nocturia (nighttime urination).

Furosemide (Lasix)

Overdose Instructions	Overdose symptoms are primarily related to severe dehydration and electrolyte imbalances, including profound diuresis leading to hypovolemia, hypotension, electrolyte depletion (especially hypokalemia, hypochloremia), and associated symptoms like dizziness, weakness, muscle cramps, and cardiac arrhythmias. Treatment is supportive and symptomatic. Focus on fluid and electrolyte replacement. Hemodialysis is generally not effective in removing furosemide. Seek immediate medical attention.
Medicine Interactions	♦ Aminoglycoside Antibiotics (e.g., gentamicin): Increased risk of ototoxicity and nephrotoxicity. Avoid concomitant use or monitor closely. ♦ Other Ototoxic Drugs (e.g., cisplatin): Additive ototoxicity risk. ♦ Digoxin: Increased risk of digoxin toxicity due to hypokalemia caused by furosemide. Monitor potassium and digoxin levels. ♦ Lithium: Furosemide can reduce renal clearance of lithium, leading to increased lithium levels and toxicity. Monitor lithium levels closely. ♦ NSAIDs: Can reduce the diuretic and antihypertensive effects of furosemide and increase the risk of renal impairment. ♦ ACE Inhibitors/ARBs: Increased risk of severe hypotension with initial doses, especially in patients already on diuretics. ♦ Corticosteroids: Increased risk of hypokalemia. ♦ Antihypertensive Agents: Additive hypotensive effects. ♦ Sucralfate: Can reduce the absorption of furosemide; separate administration by at least 2 hours. ♦ Phenytoin: May reduce the diuretic effect of furosemide.

Gabapentin (Neurontin)

Purpose/Indication	Gabapentin is an anticonvulsant and neuropathic pain agent used to treat various neurological conditions. Its primary indications include the management of postherpetic neuralgia (nerve pain after shingles) in adults, and as an adjunct therapy for partial onset seizures with or without secondary generalization in adults and children 3 years and older. It is also commonly used off-label for other neuropathic pain conditions, restless legs syndrome, and anxiety disorders.
Method of Action	The precise mechanism of action of gabapentin is not fully understood, but it is believed to involve binding to the α2−δ (alpha-2-delta) subunit of voltage-dependent calcium channels in the central nervous system. This binding modulates the release of several neurotransmitters, including glutamate, norepinephrine, and substance P. This effect is thought to contribute to its anticonvulsant and analgesic properties by reducing neuronal excitability and pain signaling. It does not bind to GABA receptors directly.
Medication Name & Brand Names	♦ Medication Name: Gabapentin ♦ Brand Names: Neurontin, Gralise (extended-release for postherpetic neuralgia), Horizant (extended-release for restless legs syndrome and postherpetic neuralgia)
Pharmaceutical Forms & Appearance	Gabapentin is available as oral capsules, oral tablets (immediate and extended-release), and oral solution. Capsules vary in color and size. Tablets vary in shape and color, often white or off-white, and may be scored. The oral solution is a clear, colorless liquid.
Dosage & Administration	Dosage is highly individualized, starting at a low dose and gradually titrated upwards to achieve therapeutic effect while minimizing side effects. For neuropathic pain, initial doses are typically 300 mg once daily at bedtime, increasing to 300 mg three times daily, with a maximum often around 1800-3600 mg daily in divided doses. For seizures, doses can be higher. Dosing frequency is often three times daily due to its short half-life, but extended-release forms allow once-daily dosing. It can be taken with or without food.
Supplied As	Gabapentin is supplied as: oral capsules (e.g., 100 mg, 300 mg, 400 mg), oral tablets (e.g., 300 mg, 600 mg, 800 mg), extended-release tablets (e.g., Gralise 300 mg, 600 mg; Horizant 300 mg, 600 mg), and oral solution (e.g., 250 mg/5 mL).
Contraindications	Gabapentin is contraindicated in patients with known hypersensitivity to gabapentin or any component of the formulation.
Storage & Expiry	Gabapentin capsules, tablets, and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, somnolence (drowsiness), fatigue, ataxia (impaired coordination), peripheral edema (swelling of extremities), and blurred vision. More serious but less common side effects include suicidal thoughts/behavior, hypersensitivity reactions (e.g., DRESS syndrome), respiratory depression (especially with opioids or in patients with respiratory risk factors), and behavioral changes in children.
Warnings & Precautions	♦ Suicidality Risk: Antiepileptic drugs (AEDs), including gabapentin, increase the risk of suicidal thoughts or behavior. Monitor patients for new or worsening depression, suicidal thoughts, or unusual changes in mood or behavior. ♦ Dizziness/Somnolence/Ataxia: Can cause significant central nervous system (CNS) depression. Advise caution with activities requiring mental alertness (e.g., driving, operating machinery), especially during initial titration. ♦ Respiratory Depression: Serious, life-threatening respiratory depression can occur, particularly when co-administered with opioids or other CNS depressants, or in patients with underlying respiratory compromise. Use with extreme caution. ♦ Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS) / Hypersensitivity: Potentially fatal, multi-organ hypersensitivity reactions can occur. Discontinue immediately if symptoms (e.g., rash, fever, lymphadenopathy, organ involvement) are suspected. ♦ Renal Impairment: Dose adjustment is required in patients with renal impairment to prevent drug accumulation and toxicity. ♦ Withdrawal Seizures: Do not discontinue gabapentin abruptly in patients receiving it for seizures due to the risk of increased seizure frequency. Taper gradually over at least 1 week. ♦ Abuse Potential: Gabapentin can be abused or misused, especially by individuals with a history of substance abuse. Monitor patients for signs of misuse.
Missed Dose Instructions	If a dose of Gabapentin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For chronic conditions, consistent dosing is important for maintaining therapeutic effect and preventing breakthrough symptoms. Do not stop abruptly.
Overdose Instructions	Overdose symptoms are typically lethargy, somnolence, ataxia, slurred speech, ptosis, diarrhea, and double vision. Respiratory depression may occur, especially with co-ingestion of other CNS depressants. Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if oral ingestion was recent and substantial. Hemodialysis can remove gabapentin from the plasma and may be useful in patients with severe renal impairment or life-threatening overdose. Seek immediate medical attention.
Medicine Interactions	♦ Opioids/Other CNS Depressants (e.g., benzodiazepines, alcohol): Increased risk of respiratory depression, profound sedation, hypotension, and coma. Concomitant use should be avoided or used with extreme caution, with reduced doses and close monitoring. ♦ Antacids (containing aluminum or magnesium): Can reduce the absorption of gabapentin. Administer gabapentin at least 2 hours after antacids. ♦ Hydrocodone/Morphine: Gabapentin may increase the plasma concentrations of hydrocodone and morphine. ♦ Naproxen: Can increase the plasma concentration of gabapentin. ♦ No significant interactions with common antiepileptic drugs (e.g., phenytoin, carbamazepine, valproate, phenobarbital) or oral contraceptives.

Glipizide (Glucotrol)

Purpose/Indication	Glipizide is an oral sulfonylurea antidiabetic medication used to manage blood glucose levels in adults with type 2 diabetes mellitus. It is typically used when diet and exercise alone are insufficient to achieve adequate glycemic control. It helps the body produce and use its own insulin more effectively, thereby lowering blood sugar.
Method of Action	Glipizide works primarily by stimulating insulin release from the beta cells of the pancreatic islets. It binds to a specific receptor on the pancreatic beta-cell membrane (the sulfonylurea receptor SUR1, which is part of the ATP-sensitive potassium channel), leading to the closure of potassium channels. This depolarization of the beta cell opens voltage-dependent calcium channels, resulting in an influx of calcium that triggers the secretion of insulin. It also may increase insulin sensitivity in peripheral tissues and reduce hepatic glucose production.
Medication Name & Brand Names	♦ Medication Name: Glipizide ♦ Brand Names: Glucotrol (immediate-release), Glucotrol XL (extended-release), Glipizide (generic)
Pharmaceutical Forms & Appearance	Glipizide is available as immediate-release oral tablets and extended-release oral tablets. Immediate-release tablets are typically white, round or oval, and may be scored. Extended-release tablets are often film-coated and may maintain their shape during transit through the GI tract.
Dosage & Administration	Dosage is individualized, typically starting at a low dose (e.g., 5 mg once daily for immediate-release, 5 mg to 10 mg once daily for extended-release) and gradually titrated upwards based on blood glucose response, usually up to a maximum of 20 mg to 40 mg daily. Immediate-release glipizide should be taken approximately 30 minutes before a meal to maximize insulin release in response to food. Extended-release glipizide should be taken with breakfast.
Supplied As	Glipizide is supplied as: immediate-release oral tablets (e.g., 5 mg, 10 mg) and extended-release oral tablets (e.g., 2.5 mg, 5 mg, 10 mg).
Contraindications	Glipizide is contraindicated in patients with known hypersensitivity to glipizide or other sulfonylureas. It is also contraindicated in patients with type 1 diabetes mellitus or diabetic ketoacidosis, as it requires functioning pancreatic beta cells. It is generally not recommended during pregnancy or breastfeeding.
Storage & Expiry	Glipizide tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	The most common and significant side effect is hypoglycemia (low blood sugar), which can be severe. Other common side effects include nausea, diarrhea, abdominal pain, headache, and dizziness. Less common side effects can include allergic skin reactions, cholestatic jaundice, and, rarely, blood dyscrasias.
Warnings & Precautions	♦ Hypoglycemia: The primary risk is hypoglycemia, which can be severe and prolonged. Patients must be educated on symptoms, management, and prevention of hypoglycemia. Risk is increased with skipped meals, alcohol intake, strenuous exercise, or renal/hepatic impairment. ♦ Cardiovascular Mortality: Some older sulfonylureas were associated with increased cardiovascular mortality; while not definitively established for glipizide, caution is advised. ♦ Renal/Hepatic Impairment: Use with caution and consider dose reduction in patients with impaired renal or hepatic function, as accumulation can increase the risk of hypoglycemia. ♦ G6PD Deficiency: Patients with G6PD deficiency are at increased risk of hemolytic anemia with sulfonylurea treatment. ♦ Loss of Glycemic Control: Over time, the effectiveness of glipizide may decrease due to progression of the underlying diabetes. ♦ Fixed Drug Eruption: Can cause specific skin reactions.
Missed Dose Instructions	If a dose of Glipizide (immediate-release) is missed, take it as soon as remembered if it is still well before your next meal. However, if it is almost time for your next scheduled dose or meal, skip the missed dose and continue with the regular schedule. Do not take a double dose. For extended-release, if a dose is missed, take it with the next meal. Consistent timing with meals is important to reduce hypoglycemia risk.
Overdose Instructions	Overdose primarily leads to severe and prolonged hypoglycemia. Symptoms can range from mild (tremor, sweating, hunger, nervousness, confusion) to severe (seizures, coma, brain damage, death). Treatment involves immediate administration of glucose (oral glucose for conscious patients, IV dextrose for unconscious patients). Hospitalization and prolonged monitoring are necessary due to the potential for recurrence of hypoglycemia. Glucagon may be administered. Seek immediate medical attention.
Medicine Interactions	♦ Drugs that Enhance Hypoglycemic Effect (Increased Hypoglycemia Risk): Beta-blockers (can mask hypoglycemia symptoms), alcohol, NSAIDs, salicylates, sulfonamides, chloramphenicol, probenecid, coumarins, monoamine oxidase inhibitors (MAOIs), quinolones, fibrates, fluconazole, azole antifungals (e.g., miconazole), certain antidepressants (SSRIs). ♦ Drugs that Reduce Hypoglycemic Effect (Increased Hyperglycemia Risk): Thiazide diuretics, corticosteroids, phenothiazines, thyroid hormones, estrogens, oral contraceptives, phenytoin, nicotinic acid, sympathomimetics, calcium channel blockers. ♦ Colesevelam: Can reduce the absorption of glipizide. Administer glipizide at least 4 hours before colesevelam. ♦ Beta-Blockers: Can mask the symptoms of hypoglycemia (e.g., tremor, tachycardia), making it harder for patients to recognize low blood sugar.

Glyburide (Diabeta)

Purpose/Indication	Glyburide is an oral sulfonylurea antidiabetic medication used to manage blood glucose levels in adults with type 2 diabetes mellitus. It is typically prescribed when diet and exercise alone are insufficient to achieve adequate glycemic control. It helps the body produce and release more insulin, thereby lowering blood sugar.
Method of Action	Glyburide works primarily by stimulating insulin release from the beta cells of the pancreatic islets. It binds to a specific receptor on the pancreatic beta-cell membrane (the sulfonylurea receptor SUR1), leading to the closure of ATP-sensitive potassium channels. This closure depolarizes the cell membrane, which opens voltage-dependent calcium channels, resulting in a rapid influx of calcium ions that triggers the secretion of insulin. It may also enhance peripheral glucose utilization and reduce hepatic glucose production.
Medication Name & Brand Names	♦ Medication Name: Glyburide (also known as Glibenclamide in many regions), Glyburide Micronized ♦ Brand Names: Diabeta, Glynase PresTab (micronized), Euglucon (regional), Glyburide (generic)
Pharmaceutical Forms & Appearance	Glyburide is available as oral tablets, including both non-micronized and micronized formulations. Tablets are typically white or off-white, round or oval, and may be scored, with various imprints indicating strength. Micronized tablets are generally smaller.
Dosage & Administration	Dosage is individualized, typically starting at a low dose (e.g., 2.5 mg to 5 mg once daily for non-micronized, 1.25 mg to 2.5 mg once daily for micronized) and gradually titrated upwards based on blood glucose response, usually up to a maximum of 20 mg daily (non-micronized) or 12 mg daily (micronized). It should be taken with breakfast or the first main meal of the day to maximize insulin release in response to food and reduce the risk of hypoglycemia.
Supplied As	Glyburide is supplied as: non-micronized oral tablets (e.g., 1.25 mg, 2.5 mg, 5 mg) and micronized oral tablets (e.g., 1.5 mg, 3 mg, 6 mg).

Contraindications	Glyburide is contraindicated in patients with known hypersensitivity to glyburide, other sulfonylureas, or sulfonamide derivatives. It is also contraindicated in patients with type 1 diabetes mellitus or diabetic ketoacidosis, as it requires functioning pancreatic beta cells. It is generally not recommended during pregnancy or breastfeeding. Concurrent use with bosentan is contraindicated.
Storage & Expiry	Glyburide tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	The most common and significant side effect is hypoglycemia (low blood sugar), which can be severe and prolonged. Other common side effects include nausea, heartburn, abdominal pain, headache, and dizziness. Less common side effects can include allergic skin reactions, cholestatic jaundice, and, rarely, blood dyscrasias or hyponatremia.
Warnings & Precautions	♦ Hypoglycemia: The primary risk is hypoglycemia, which can be severe, prolonged, and life-threatening. Patients must be educated on symptoms, management, and prevention of hypoglycemia. Risk is increased with skipped meals, alcohol intake, strenuous exercise, or renal/hepatic impairment. ♦ Cardiovascular Mortality: Some older sulfonylureas were associated with increased cardiovascular mortality. While not definitively established for glyburide, caution is advised. ♦ Renal/Hepatic Impairment: Use with caution and consider dose reduction in patients with impaired renal or hepatic function, as accumulation can significantly increase the risk of severe hypoglycemia. Glyburide is generally not recommended as a first-line agent in elderly patients or those with moderate to severe renal impairment. ♦ G6PD Deficiency: Patients with G6PD deficiency are at increased risk of hemolytic anemia with sulfonylurea treatment. ♦ Loss of Glycemic Control: Over time, the effectiveness of glyburide may decrease due to progression of the underlying diabetes. ♦ Hypersensitivity: Rare, but serious allergic reactions can occur.
Missed Dose Instructions	If a dose of Glyburide is missed, take it as soon as remembered if it is still with or just before your next meal. However, if it is almost time for your next scheduled meal or dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent timing with meals is important to reduce the risk of hypoglycemia.
Overdose Instructions	Overdose primarily leads to severe and prolonged hypoglycemia. Symptoms can range from mild (tremor, sweating, hunger, nervousness, confusion) to severe (seizures, coma, brain damage, death). Treatment involves immediate administration of glucose (oral glucose for conscious patients, IV dextrose for unconscious patients). Hospitalization and prolonged monitoring (e.g., 24-72 hours) are necessary due to the potential for recurrence of hypoglycemia. Glucagon may be administered. Seek immediate medical attention.
Medicine Interactions	♦ Bosentan: Concurrent use is contraindicated due to increased risk of liver enzyme elevations and potential for reduced efficacy of both agents. ♦ Drugs that Enhance Hypoglycemic Effect (Increased Hypoglycemia Risk): Beta-blockers (can mask hypoglycemia symptoms), alcohol, NSAIDs, salicylates, sulfonamides, chloramphenicol, probenecid, coumarins (warfarin), monoamine oxidase inhibitors (MAOIs), quinolones, fibrates, fluconazole, azole antifungals (e.g., miconazole), certain antidepressants (SSRIs). ♦ Drugs that Reduce Hypoglycemic Effect (Increased Hyperglycemia Risk): Thiazide diuretics, corticosteroids, phenothiazines, thyroid hormones, estrogens, oral contraceptives, phenytoin, nicotinic acid, sympathomimetics, calcium channel blockers. ♦ Colesevelam: Can reduce the absorption of glyburide. Administer glyburide at least 4 hours before colesevelam. ♦ Beta-Blockers: Can mask the symptoms of hypoglycemia (e.g., tremor, tachycardia), making it harder for patients to recognize low blood sugar.

Griseofulvin (Gris-Peg)

Purpose/Indication	Griseofulvin is an oral antifungal medication specifically used to treat dermatophyte fungal infections of the skin, hair, and nails. It is effective against tinea infections (ringworm) such as tinea corporis, tinea capitis, tinea pedis (athlete's foot), tinea cruris (jock itch), tinea unguium (onychomycosis), and tinea barbae. It is used when topical antifungal agents are ineffective or inappropriate, particularly for widespread or difficult-to-treat infections.
Method of Action	Griseofulvin works by interfering with fungal cell division. It deposits in keratin precursor cells and binds to keratin, making newly formed keratin resistant to fungal invasion. Within the fungal cell, it binds to microtubules, disrupting mitotic spindle formation and inhibiting cell division (fungistatic action). It also impairs nucleic acid synthesis. This action allows healthy, uninfected cells to grow, pushing out the infected cells.
Medication Name & Brand Names	♦ Medication Name: Griseofulvin (microsize and ultramicrosize) ♦ Brand Names: Grifulvin V (microsize), Gris-PEG (ultramicrosize), Fulvicin P/G (ultramicrosize), Griseofulvin (generic)
Pharmaceutical Forms & Appearance	Griseofulvin is available as oral tablets and oral suspension. Tablets are typically white or off-white, and may be scored. The oral suspension is usually a white to off-white liquid. Ultramicrosize formulations are generally available in lower strengths but offer better absorption than microsize.
Dosage & Administration	Dosage and duration of treatment vary significantly depending on the infection type, location, and patient's age and weight. Treatment courses are often prolonged, ranging from 2-4 weeks for skin infections, 4-8 weeks for hair and nail infections, and up to several months (e.g., 6-12 months for toenails). It is usually taken once or twice daily. For best absorption, especially of the microsize form, it should be taken with a fatty meal.
Supplied As	Griseofulvin is supplied as: oral tablets (e.g., microsize 250 mg, 500 mg; ultramicrosize 125 mg, 165 mg, 250 mg, 330 mg), and oral suspension (e.g., 125 mg/5 mL).
Contraindications	Griseofulvin is contraindicated in patients with known hypersensitivity to griseofulvin or any component of the formulation. It is also contraindicated in patients with porphyria, severe liver disease, or hepatocellular failure. It is contraindicated in pregnancy and should not be used in men planning paternity within 6 months of treatment, due to potential for teratogenicity.
Storage & Expiry	Griseofulvin tablets and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache (especially early in treatment), gastrointestinal upset (e.g., nausea, vomiting, diarrhea), rash, and photosensitivity. More serious but less common side effects include hepatotoxicity (liver injury), allergic reactions (including severe skin reactions), leucopenia (low white blood cell count), and peripheral neuritis.
Warnings & Precautions	♦ Hepatotoxicity: Can cause liver dysfunction, including severe cases. Monitor liver function tests periodically, especially with prolonged use. ♦ Photosensitivity: Can cause increased sensitivity to sunlight. Advise patients to use sun protection (sunscreen, protective clothing). ♦ Pregnancy/Reproductive Risk: Contraindicated in pregnancy due to teratogenic effects. Men should avoid paternity during and for at least 6 months after treatment due to potential effects on spermatogenesis. Advise effective contraception for women of childbearing potential during and for one month after treatment. ♦ Cross-Reactivity: Possible cross-sensitivity with penicillin due to fungal origin. ♦ Blood Dyscrasias: Rare reports of leukopenia; monitor blood counts periodically. ♦ Renal Impairment: Use with caution in patients with renal impairment. ♦ Alcohol Interaction: May enhance the effects of alcohol, causing flushing, tachycardia, and impaired coordination. Avoid alcohol during treatment.

Missed Dose Instructions	If a dose of Griseofulvin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing and completing the entire, often prolonged, course of treatment are crucial for successful fungal eradication and preventing recurrence.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset, headache, rash, and potential for more severe hepatotoxicity or central nervous system effects (e.g., confusion). Treatment is supportive and symptomatic. Gastric decontamination with activated charcoal may be considered if oral ingestion was recent and substantial. Griseofulvin is largely metabolized in the liver, and dialysis is not expected to be effective in removing it. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Oral Contraceptives: Griseofulvin can decrease the effectiveness of oral contraceptives, potentially leading to breakthrough bleeding or unintended pregnancy. Advise alternative or additional non-hormonal contraception during and for one month after treatment. ♦ Warfarin: Griseofulvin can decrease the anticoagulant effect of warfarin. Monitor INR closely and adjust warfarin dose as needed. ♦ Barbiturates: Phenobarbital and other barbiturates can decrease the absorption of griseofulvin, leading to reduced effectiveness. ♦ Alcohol: May cause a disulfiram-like reaction (flushing, nausea, vomiting, tachycardia) and enhance the effects of alcohol. Avoid alcohol during treatment. ♦ Salicylates: May decrease absorption of griseofulvin.

Guaifenesin (Mucinex)

Purpose/Indication	Guaifenesin is an expectorant used to relieve chest congestion and coughs caused by the common cold, bronchitis, and other upper respiratory tract infections. It helps to thin and loosen mucus in the airways, making it easier to cough up and clear from the lungs. It is often found in combination cold and cough preparations.
Method of Action	Guaifenesin is believed to work by increasing the volume and decreasing the viscosity of secretions in the respiratory tract. While the exact mechanism is not fully understood, it is thought to stimulate goblet cells and serous glands in the bronchial mucosa, leading to increased production of thinner, less tenacious mucus. This action makes coughs more productive and aids in the clearance of phlegm.
Medication Name & Brand Names	♦ Medication Name: Guaifenesin ♦ Brand Names: Mucinex (often extended-release), Robitussin Chest Congestion, Cheratussin, Humibid (historical), Guaifenesin (generic)
Pharmaceutical Forms & Appearance	Guaifenesin is available as oral tablets (immediate and extended-release), oral capsules, oral solution, and oral syrup. Tablets vary in shape and color, often white or off-white. Syrups and solutions are typically clear or colored liquids. It is very frequently found in combination products with other cough/cold medications.
Dosage & Administration	Dosage varies by age and formulation (immediate-release vs. extended-release). For adults and children 12 years and older, immediate-release doses are typically 200 mg to 400 mg every 4 hours as needed, with a maximum daily dose of 2400 mg. Extended-release forms (e.g., Mucinex) are typically 600 mg to 1200 mg every 12 hours. It can be taken with or without food. Adequate hydration is important to help thin mucus.
Supplied As	Guaifenesin is supplied as: immediate-release oral tablets (e.g., 200 mg, 400 mg), extended-release oral tablets (e.g., 600 mg, 1200 mg), oral capsules (e.g., 200 mg, 300 mg), oral solution/syrup (e.g., 100 mg/5 mL, 200 mg/5 mL).
Contraindications	Guaifenesin is contraindicated in patients with known hypersensitivity to guaifenesin or any component of the formulation.
Storage & Expiry	Guaifenesin tablets, capsules, and oral solutions/syrups should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include nausea, vomiting, stomach upset, dizziness, and headache. These are often transient and can be minimized by taking the medication with food. Serious side effects are rare with guaifenesin used alone.
Warnings & Precautions	♦ Persistent Cough: Do not use for chronic persistent cough associated with smoking, asthma, emphysema, or chronic bronchitis unless directed by a doctor. Consult a healthcare professional if cough persists for more than 7 days, recurs, or is accompanied by fever, rash, or persistent headache. ♦ Children: Always follow age-appropriate dosing guidelines. For children under 4 years of age, consult a doctor before use. ♦ Hydration: Encourage adequate fluid intake to help thin mucus. ♦ Masking Symptoms: Be aware that guaifenesin primarily provides symptomatic relief and does not treat the underlying cause of the cough or congestion.
Missed Dose Instructions	As Guaifenesin is often used for symptomatic relief as needed, strict "missed dose" instructions are less critical. If a dose is missed, take it when remembered if symptoms warrant. However, if it's almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose.
Overdose Instructions	Overdose with guaifenesin alone is generally associated with gastrointestinal discomfort (nausea, vomiting), but serious toxicity is rare. Ingesting very large amounts may cause kidney stones (rarely), especially with chronic high-dose abuse. Treatment is supportive and symptomatic. Gastric decontamination may be considered if a very large overdose was recent. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ No significant drug interactions are commonly reported with guaifenesin when used alone at recommended doses. ♦ However, it is frequently found in combination products. When using combination products, check for interactions related to other ingredients (e.g., decongestants, cough suppressants, antihistamines).

H - M

Any medications starting with H through to M.

Hydrochlorothiazide (Microzide)

Purpose/Indication	Hydrochlorothiazide (HCTZ) is a thiazide diuretic commonly used to treat hypertension (high blood pressure) and edema (fluid retention) associated with conditions like congestive heart failure, liver cirrhosis, and kidney disease. It helps the body eliminate excess fluid and salt, which in turn reduces blood pressure and swelling. It is frequently used alone or in combination with other antihypertensive agents.

MEDICATION

Medication

H - M - H

Hydrochlorothiazide (Microzide)

Method of Action	Hydrochlorothiazide works primarily by inhibiting the reabsorption of sodium and chloride ions in the distal convoluted tubule of the kidney. By blocking the Na+/Cl− co-transporter, it increases the excretion of sodium, chloride, and water, leading to increased urine output (diuresis). It also causes a small increase in potassium and magnesium excretion, and a decrease in calcium excretion. Its antihypertensive effect is thought to involve reduced plasma volume and a direct vasodilator effect.
Medication Name & Brand Names	♦ Medication Name: Hydrochlorothiazide (HCTZ) ♦ Brand Names: Microzide, Esidrix (historical), Hydrochlorothiazide (generic) (Often found in combination products like HCTZ/Lisinopril, HCTZ/Valsartan)
Pharmaceutical Forms & Appearance	Hydrochlorothiazide is primarily available as oral tablets and oral capsules. Tablets are typically small, white, and often scored, with various imprints indicating strength. Capsules are usually clear or colored, containing white powder.
Dosage & Administration	Dosage varies depending on the indication. For hypertension, typical adult doses range from 12.5 mg to 50 mg once daily. For edema, initial doses may be 25 mg to 100 mg once or twice daily. It can be taken with or without food, but taking it with food may help reduce stomach upset. It is generally recommended to take it in the morning to avoid nighttime urination.
Supplied As	Hydrochlorothiazide is supplied as: oral tablets (e.g., 12.5 mg, 25 mg, 50 mg) and oral capsules (e.g., 12.5 mg). It is also widely available in fixed-dose combination tablets with other antihypertensive agents.
Contraindications	Hydrochlorothiazide is contraindicated in patients with known hypersensitivity to hydrochlorothiazide, other sulfonamide-derived drugs, or any component of the formulation. It is also contraindicated in patients with anuria (absence of urine production).
Storage & Expiry	Hydrochlorothiazide tablets and capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include electrolyte imbalances (e.g., hypokalemia, hyponatremia, hypomagnesemia, hypercalcemia), dizziness, lightheadedness (due to orthostatic hypotension), headache, and increased urination. Less common but more serious side effects can include allergic reactions (rash, photosensitivity), pancreatitis, blood dyscrasias, and, rarely, acute myopia and secondary angle-closure glaucoma.
Warnings & Precautions	♦ Fluid and Electrolyte Imbalances: Can cause significant fluid and electrolyte depletion, particularly hypokalemia (low potassium). Monitor electrolytes regularly. Advise patients on diet or supplements if needed. ♦ Hypotension: Risk of symptomatic hypotension, especially with initial doses or in volume-depleted patients. ♦ Renal Impairment: Use with caution in patients with severe renal impairment as thiazides may be less effective and can precipitate azotemia. Not effective if creatinine clearance is very low. ♦ Hepatic Impairment: Use with caution in patients with impaired hepatic function or progressive liver disease, as minor fluid and electrolyte alterations can precipitate hepatic coma. ♦ Sulfonamide Allergy: Patients with a history of sulfonamide allergy may have cross-reactivity, though rare. ♦ Photosensitivity: Can cause increased sensitivity to sunlight. Advise patients to use sun protection. ♦ Gout: Can increase serum uric acid levels and precipitate gout attacks. ♦ Diabetes: May increase blood glucose levels and worsen glycemic control; monitor diabetics closely. ♦ Acute Myopia and Secondary Angle-Closure Glaucoma: Rare idiosyncratic reactions that can lead to permanent vision loss; discontinue immediately if symptoms occur. ♦ Skin Cancer Risk: Recent studies suggest a potential increased risk of non-melanoma skin cancer (basal cell carcinoma, squamous cell carcinoma) with increasing cumulative doses of HCTZ. Advise patients to limit sun exposure and perform regular skin examinations.
Missed Dose Instructions	If a dose of Hydrochlorothiazide is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. To avoid nighttime urination, it's best to take the medication in the morning.
Overdose Instructions	Overdose symptoms are primarily related to severe dehydration and electrolyte imbalances, including profound diuresis leading to hypovolemia, hypotension, electrolyte depletion (especially hypokalemia, hyponatremia), and associated symptoms like dizziness, weakness, muscle cramps, and cardiac arrhythmias. Treatment is supportive and symptomatic. Focus on fluid and electrolyte replacement. Hemodialysis is not effective in removing hydrochlorothiazide. Seek immediate medical attention.
Medicine Interactions	♦ Lithium: HCTZ can reduce the renal clearance of lithium, leading to increased lithium levels and toxicity. Monitor lithium levels closely. ♦ NSAIDs: Can reduce the diuretic and antihypertensive effects of HCTZ and increase the risk of renal impairment. ♦ Corticosteroids: Increased risk of hypokalemia. ♦ Digoxin: Increased risk of digoxin toxicity due to hypokalemia. Monitor potassium and digoxin levels. ♦ Antidiabetic agents (e.g., insulin, oral hypoglycemics): HCTZ can increase blood glucose levels, potentially requiring adjustment of antidiabetic medication. ♦ Cholestyramine/Colestipol: Can reduce the absorption of HCTZ; administer HCTZ at least 1 hour before or 4 hours after these bile acid sequestrants. ♦ Other Antihypertensive Agents: Additive hypotensive effects. ♦ Alcohol/Barbiturates/Narcotics: Increased risk of orthostatic hypotension. ♦ Non-depolarizing Skeletal Muscle Relaxants: May prolong their effects.

Hydrocodone/Acetaminophen (Vicodin)

Purpose/Indication	Hydrocodone/Acetaminophen is a combination analgesic used to relieve moderate to severe pain. Hydrocodone is an opioid pain reliever that works on the central nervous system, and acetaminophen (paracetamol) is a non-opioid pain reliever and fever reducer that enhances the analgesic effects of the opioid. This combination provides comprehensive pain relief for acute or chronic conditions where non-opioid options are insufficient.
Method of Action	Hydrocodone, an opioid agonist, binds to mu-opioid receptors in the central nervous system, mimicking the effects of endogenous opioids. This binding inhibits pain signaling pathways, alters pain perception, and produces analgesia, sedation, and euphoria. Acetaminophen's exact mechanism of action is not fully understood, but it is believed to involve inhibition of prostaglandin synthesis in the central nervous system and possibly activation of descending serotonergic pathways, contributing to its analgesic and antipyretic effects without significant anti-inflammatory action.
Medication Name & Brand Names	♦ Medication Name: Hydrocodone Bitartrate/Acetaminophen ♦ Brand Names: Vicodin, Norco, Lortab, Xodol, Zohydro ER (hydrocodone only), Tylenol with Codeine (different opioid), Hydrocodone/APAP (generic)
Pharmaceutical Forms & Appearance	Hydrocodone/Acetaminophen is primarily available as oral tablets and oral solutions/syrups. Tablets vary in shape, color, and imprints depending on the strength and manufacturer (e.g., white, yellow, or orange, often oval or capsule-shaped). The oral solution/syrup is typically a clear or colored liquid.
Dosage & Administration	Dosage is individualized based on pain severity, patient response, and tolerance, using the lowest effective dose for the shortest duration. Typical adult doses range from 2.5 mg to 10 mg of hydrocodone combined with 300 mg to 325 mg of acetaminophen, taken every 4-6 hours as needed for pain. The maximum daily dose of acetaminophen should not exceed 4000 mg (or 3000 mg in some guidelines/preparations) to avoid liver toxicity. Take with food or milk if stomach upset occurs.

Supplied As	Hydrocodone/Acetaminophen is supplied as: oral tablets (various strengths, e.g., 5 mg/325 mg, 7.5 mg/325 mg, 10 mg/325 mg of hydrocodone/acetaminophen) and oral solution/syrup (e.g., 7.5 mg/325 mg per 15 mL).
Contraindications	Hydrocodone/Acetaminophen is contraindicated in patients with known hypersensitivity to hydrocodone, acetaminophen, or any component of the formulation. It is also contraindicated in patients with significant respiratory depression, acute or severe bronchial asthma in an unmonitored setting or in the absence of resuscitative equipment, and known or suspected paralytic ileus. Use in children under 12 years (and under 18 for tonsillectomy/adenoidectomy) is generally contraindicated.
Storage & Expiry	Hydrocodone/Acetaminophen tablets and solutions/syrups should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed, child-resistant containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, drowsiness, lightheadedness, nausea, vomiting, constipation, and headache. More serious side effects can include respiratory depression, liver damage (due to acetaminophen), addiction, dependence, withdrawal symptoms, severe allergic reactions (including skin reactions like SJS), and adrenal insufficiency.
Warnings & Precautions	♦ Addiction, Abuse, Misuse: Opioids carry a significant risk of addiction, abuse, and misuse, which can lead to overdose and death. Assess patient risk factors and monitor for signs of abuse. ♦ Respiratory Depression: Serious, life-threatening, or fatal respiratory depression can occur, especially with initiation or re-initiation of therapy. Monitor patients closely, especially those with respiratory compromise. ♦ Accidental Ingestion: Accidental ingestion by children can be fatal. Keep out of reach of children. ♦ Neonatal Opioid Withdrawal Syndrome: Prolonged use during pregnancy can result in NAS in the newborn. ♦ Hepatotoxicity (Acetaminophen): Acetaminophen can cause severe, potentially fatal liver injury, especially at doses exceeding the maximum recommended daily dose. Avoid other acetaminophen-containing products. ♦ CNS Depression: Causes significant CNS depression. Advise caution with driving or operating machinery. Avoid concurrent use of alcohol or other CNS depressants. ♦ Adrenal Insufficiency: Chronic opioid use can cause adrenal insufficiency. ♦ Serotonin Syndrome: Rare but serious risk when co-administered with other serotonergic drugs (e.g., SSRIs, SNRIs). ♦ GI Effects: Risk of severe constipation and paralytic ileus. ♦ Hypotension: Can cause severe hypotension. ♦ Drug-Drug Interactions: Many significant interactions due to both components. ♦ Withdrawal: Do not discontinue abruptly after prolonged use.
Missed Dose Instructions	Hydrocodone/Acetaminophen is typically taken as needed for pain. If a scheduled dose is missed, take it as soon as remembered if pain warrants. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Adhere to the prescribed dosing interval to avoid excessive acetaminophen intake.
Overdose Instructions	Overdose is a medical emergency. Symptoms of hydrocodone overdose include severe respiratory depression, pinpoint pupils, extreme drowsiness progressing to stupor or coma, limp muscles, cold/clammy skin, and potentially circulatory collapse. Acetaminophen overdose can cause severe liver damage, initially presenting with nausea, vomiting, sweating, and malaise, progressing to jaundice, confusion, and liver failure. Naloxone is the antidote for opioid overdose; N-acetylcysteine (NAC) is the antidote for acetaminophen overdose. Seek immediate emergency medical help.
Medicine Interactions	♦ Other CNS Depressants (e.g., alcohol, benzodiazepines, other opioids, sedatives, hypnotics, tranquilizers): Increased risk of respiratory depression, profound sedation, coma, and death. Avoid concomitant use or use with extreme caution, with reduced doses of one or both agents. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, clarithromycin, ritonavir): Can increase hydrocodone plasma levels, leading to increased opioid effects and respiratory depression. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin): Can decrease hydrocodone plasma levels, leading to reduced efficacy. ♦ Serotonergic Drugs (e.g., SSRIs, SNRIs, triptans, TCAs, tramadol, MAOIs): Increased risk of serotonin syndrome. ♦ Anticholinergic Drugs: Increased risk of urinary retention and severe constipation/paralytic ileus. ♦ Diuretics: Opioids can reduce the diuretic effect of diuretics. ♦ Drugs affecting gastric emptying: May alter absorption. ♦ Naloxone: Precipitates withdrawal in opioid-dependent patients. ♦ Acetaminophen Interactions: Warfarin (increased bleeding risk with chronic high acetaminophen doses), other hepatotoxic drugs.

Hydrocortisone (oral) (Cortef)

Purpose/Indication	Oral hydrocortisone is a corticosteroid medication used to treat a wide range of inflammatory, allergic, and autoimmune conditions. Its primary indications include replacement therapy for adrenal insufficiency (e.g., Addison's disease, congenital adrenal hyperplasia), treatment of severe allergic reactions, various rheumatologic disorders, dermatologic conditions, respiratory diseases (e.g., severe asthma), and certain hematologic and neoplastic disorders. It works by reducing inflammation and suppressing the immune system.
Method of Action	Hydrocortisone is a glucocorticoid that works by binding to intracellular glucocorticoid receptors. This complex then translocates to the nucleus, where it modulates gene expression by either upregulating the production of anti-inflammatory proteins or downregulating the synthesis of pro-inflammatory mediators (e.g., prostaglandins, leukotrienes, cytokines). This leads to widespread anti-inflammatory, immunosuppressive, and anti-allergic effects, as well as influencing metabolism and fluid balance.
Medication Name & Brand Names	♦ Medication Name: Hydrocortisone (oral) ♦ Brand Names: Cortef, Hydrocortone (historical/regional), Hydrocortisone (generic)
Pharmaceutical Forms & Appearance	Oral hydrocortisone is available as tablets. Tablets are typically white, round, and may be scored, with various imprints indicating strength.
Dosage & Administration	Dosage is highly individualized, depending on the condition being treated, its severity, and patient response. For adrenal insufficiency, typical adult replacement doses range from 10 mg to 30 mg daily, often divided into two or three doses, with higher doses during stress. For inflammatory conditions, doses can range from 20 mg to 240 mg daily, or even higher, and are often tapered over time. It can be taken with food or milk to reduce stomach upset.
Supplied As	Oral hydrocortisone is supplied as: oral tablets (e.g., 5 mg, 10 mg, 20 mg).
Contraindications	Oral hydrocortisone is generally contraindicated in patients with systemic fungal infections, except when used as replacement therapy for adrenal insufficiency. It is also contraindicated in patients with known hypersensitivity to hydrocortisone or any component of the formulation. Live or live-attenuated vaccines are generally contraindicated during immunosuppressive doses of corticosteroids.
Storage & Expiry	Hydrocortisone tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects with short-term use include increased appetite, weight gain, fluid retention, insomnia, and mood changes (e.g., irritability, euphoria). Long-term or high-dose use can lead to more serious effects such as Cushing's syndrome, adrenal suppression, osteoporosis, hyperglycemia/diabetes, increased susceptibility to infection, hypertension, peptic ulcers, thin skin, muscle weakness, and cataracts/glaucoma.

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Warnings & Precautions	♦ Adrenal Suppression: Prolonged use can suppress the body's natural cortisol production, leading to adrenal insufficiency upon abrupt discontinuation. Doses should be tapered gradually. During stress (surgery, illness), increased doses may be needed. ♦ Immunosuppression: Increases susceptibility to and masks symptoms of infection. Avoid exposure to chickenpox or measles if not immune. Live vaccines are contraindicated during immunosuppressive doses. ♦ Cushing's Syndrome: Chronic high-dose use can lead to iatrogenic Cushing's syndrome. ♦ Osteoporosis: Increased risk of bone mineral density loss and fractures with long-term use. ♦ Hyperglycemia/Diabetes: Can elevate blood glucose levels; monitor diabetics closely. ♦ Gastrointestinal Effects: Increased risk of peptic ulcer, bleeding, and perforation, especially with concurrent NSAID use. ♦ Cardiovascular Effects: Can cause fluid retention, hypertension, and worsen heart failure. ♦ Psychiatric Disturbances: Can cause mood swings, insomnia, anxiety, depression, or psychosis. ♦ Ocular Effects: Increased risk of cataracts and glaucoma with long-term use. ♦ Growth Retardation: Can inhibit growth in children; monitor growth. ♦ Hypokalemia: Can cause potassium depletion. ♦ Thyroid Function: Corticosteroid metabolism may be altered in hypo- or hyperthyroid states.
Missed Dose Instructions	For chronic replacement therapy (e.g., Addison's disease), if a dose of oral Hydrocortisone is missed, take it as soon as remembered. If it's close to the next dose, take the missed dose and spread the next dose out a bit or take a slightly reduced next dose. Never double a dose. For inflammatory conditions with a tapered dose, follow the doctor's specific instructions. Patients on chronic therapy should carry medical identification indicating their steroid dependence.
Overdose Instructions	Acute overdose with oral hydrocortisone is rarely life-threatening but can exacerbate known side effects, particularly gastrointestinal upset, fluid retention, and electrolyte imbalances. Chronic overdose leads to signs and symptoms of Cushing's syndrome and adrenal suppression. Treatment is supportive and symptomatic. Gradual reduction of the steroid dose under medical supervision is indicated for chronic overdose. Seek medical advice if an overdose is suspected or severe symptoms occur.
Medicine Interactions	♦ CYP3A4 Inducers (e.g., rifampin, phenytoin, barbiturates, carbamazepine): Can increase the metabolism of hydrocortisone, reducing its effectiveness. Increased hydrocortisone dose may be needed. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, ritonavir, cobicistat): Can decrease the metabolism of hydrocortisone, increasing its plasma levels and risk of systemic side effects. Reduced hydrocortisone dose may be needed. ♦ NSAIDs: Increased risk of gastrointestinal ulceration and bleeding. Avoid concurrent use or use with extreme caution. ♦ Diuretics (potassium-depleting, e.g., thiazides, loop diuretics): Increased risk of severe hypokalemia. Monitor potassium levels. ♦ Warfarin: Effects on warfarin can be variable; monitor INR closely. ♦ Antidiabetic Agents (e.g., insulin, oral hypoglycemics): Corticosteroids can increase blood glucose levels, requiring adjustment of antidiabetic medication. ♦ Live Vaccines: Contraindicated during immunosuppressive doses of corticosteroids. ♦ Immunosuppressants (e.g., cyclosporine): Enhanced immunosuppression; cyclosporine levels may be increased. ♦ Cholestyramine/Colestipol: May reduce absorption of oral hydrocortisone.

Hydrocortisone (topical) (Cortaid)

Purpose/Indication	Topical hydrocortisone is a low-potency corticosteroid used to reduce inflammation, itching, and redness associated with various skin conditions. It is commonly indicated for mild to moderate eczema (atopic dermatitis), contact dermatitis, insect bites, rashes, and other inflammatory dermatoses. It provides symptomatic relief by calming the immune response in the skin.
Method of Action	Topical hydrocortisone works by diffusing across cell membranes and binding to intracellular glucocorticoid receptors in the skin cells. This binding initiates a cascade of events that modulates gene expression, leading to the synthesis of anti-inflammatory proteins (e.g., lipocortins) and the inhibition of pro-inflammatory mediators (e.g., prostaglandins, leukotrienes, cytokines). This results in vasoconstriction, decreased capillary permeability, and reduced migration of immune cells to the affected area, thereby suppressing inflammation, itching, and redness.
Medication Name & Brand Names	♦ Medication Name: Hydrocortisone (topical) ♦ Brand Names: Cortaid, Cortizone-10, Dermacort, Hydrocortisone (generic)
Pharmaceutical Forms & Appearance	Topical hydrocortisone is widely available in various forms, including creams, ointments, lotions, solutions, gels, and sprays. Creams are typically white and semi-solid, ointments are greasy and translucent, and lotions/solutions are more fluid. The appearance can vary slightly depending on the base and concentration.
Dosage & Administration	Dosage and frequency of application vary based on the specific formulation, concentration, and severity of the condition. Generally, a thin layer is applied to the affected skin area one to four times daily, or as directed by a healthcare professional. It should be gently rubbed into the skin until absorbed. Avoid covering the treated area with occlusive dressings unless specifically advised, as this can increase systemic absorption. Wash hands before and after application.
Supplied As	Topical hydrocortisone is supplied in tubes, jars, or bottles of various sizes, in concentrations ranging from 0.5% (OTC) to 2.5% (prescription strength). Examples include: creams (0.5%, 1%, 2.5%), ointments (0.5%, 1%, 2.5%), lotions (1%, 2.5%), and solutions.
Contraindications	Topical hydrocortisone is generally contraindicated in patients with known hypersensitivity to hydrocortisone or any component of the formulation. It should not be used on skin areas affected by untreated bacterial, fungal, or viral infections (e.g., herpes simplex, varicella), rosacea, or perioral dermatitis, as corticosteroids can worsen these conditions.
Storage & Expiry	Topical hydrocortisone products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from excessive heat or freezing. Keep containers tightly closed. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are usually localized and include burning, itching, irritation, dryness, and folliculitis at the application site. With prolonged or excessive use, especially on thin skin or with occlusion, more serious local side effects can occur, such as skin thinning (atrophy), striae (stretch marks), telangiectasias (spider veins), acneiform eruptions, and hypopigmentation. Systemic side effects (e.g., adrenal suppression) are rare with low-potency hydrocortisone but can occur with extensive, long-term use on large surface areas, with occlusion, or in children.
Warnings & Precautions	♦ Systemic Absorption: Although minimal, systemic absorption can occur, leading to reversible hypothalamic-pituitary-adrenal (HPA) axis suppression, especially with prolonged use, high doses, occlusion, or in children. ♦ Skin Infections: Can mask or worsen existing skin infections. If infection is present, appropriate anti-infective therapy should be used concurrently. ♦ Pediatric Use: Children may absorb proportionally larger amounts due to a higher skin surface area to body weight ratio, increasing the risk of systemic side effects. Use the least amount for the shortest duration. ♦ Ocular Use: Avoid contact with eyes due to potential for cataracts and glaucoma, though very rare with topical use. ♦ Not for Certain Conditions: Avoid use on rosacea, perioral dermatitis, or acne due to potential worsening. ♦ Duration of Use: Use for the shortest duration necessary to control symptoms. Long-term continuous use, even of low potency, can lead to skin atrophy.
Missed Dose Instructions	If a dose of topical Hydrocortisone is missed, apply it as soon as remembered. However, if it is almost time for the next scheduled application, skip the missed dose and continue with the regular schedule. Do not apply a double dose. Consistent application as prescribed is important for managing chronic inflammatory skin conditions.

Overdose Instructions	Acute overdose with topical hydrocortisone is highly unlikely to cause immediate severe systemic toxicity due to very limited systemic absorption. Chronic excessive use, especially of high doses, on large body surface areas, or under occlusion, can lead to signs of hypercorticism (e.g., Cushing's syndrome features) and reversible HPA axis suppression. Treatment involves gradual withdrawal of the steroid under medical supervision. Seek medical advice if chronic overuse symptoms appear or if accidental ingestion occurs.
Medicine Interactions	♦ No significant drug interactions are commonly reported with topical hydrocortisone due to its minimal systemic absorption. ♦ However, if systemic absorption were to become significant (e.g., with very high doses, extensive application to damaged skin, or prolonged use under occlusion), theoretical interactions similar to oral corticosteroids with strong CYP3A4 inhibitors (e.g., ritonavir, ketoconazole) could occur, leading to increased systemic effects of hydrocortisone. This is exceptionally rare with typical topical use.

Hydroxychloroquine (Plaquenil)

Purpose/Indication	Hydroxychloroquine is an antimalarial and immunomodulatory medication used to treat and prevent malaria, and to manage autoimmune diseases such as systemic lupus erythematosus (SLE) and rheumatoid arthritis (RA). In autoimmune conditions, it helps to reduce inflammation, pain, and stiffness, and can help prevent disease flares and organ damage.
Method of Action	The exact mechanism of action in autoimmune diseases is not fully understood but is thought to involve several pathways. Hydroxychloroquine concentrates in acidic intracellular organelles, such as lysosomes, increasing their pH and inhibiting the activity of various enzymes and protein processing. This can interfere with antigen presentation, cytokine production (e.g., IL-1, IL-6, TNF-a), and T-cell activation. It also inhibits Toll-like receptor (TLR) signaling, particularly TLR7 and TLR9, reducing the inflammatory response. In malaria, it interferes with the parasite's ability to metabolize heme.
Medication Name & Brand Names	♦ Medication Name: Hydroxychloroquine Sulfate ♦ Brand Names: Plaquenil, Hydroxychloroquine (generic)
Pharmaceutical Forms & Appearance	Hydroxychloroquine is available as oral film-coated tablets. Tablets are typically white or off-white, round, and may be engraved with the strength.
Dosage & Administration	Dosage varies by indication and patient response. For autoimmune diseases, common adult doses are 200 mg to 400 mg daily, often taken once daily or divided into two doses. Dosing for malaria prevention or treatment is different. It can be taken with food or milk to minimize gastrointestinal upset. Consistent daily use is important for therapeutic effects in autoimmune conditions, which may take several weeks or months to become apparent.
Supplied As	Hydroxychloroquine is supplied as: oral film-coated tablets (e.g., 200 mg).
Contraindications	Hydroxychloroquine is contraindicated in patients with known hypersensitivity to 4-aminoquinoline compounds (e.g., chloroquine) or any component of the formulation. It is also contraindicated in patients with pre-existing maculopathy of the eye or with a history of retinopathy associated with 4-aminoquinoline treatment. Porphyria is also a contraindication.
Storage & Expiry	Hydroxychloroquine tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, abdominal cramps, diarrhea), headache, dizziness, and rash. The most serious and significant side effect is ocular toxicity, specifically retinopathy (damage to the retina), which can lead to irreversible vision loss. Other serious but less common side effects include cardiomyopathy (heart muscle damage), hypoglycemia, psychiatric effects, and blood disorders.
Warnings & Precautions	♦ Ocular Toxicity (Retinopathy): The most critical warning. Can cause irreversible retinal damage, visual field defects, and color vision changes. Risk is increased with higher daily doses, longer duration of therapy, pre-existing retinal disease, and renal/hepatic impairment. Baseline and regular (e.g., annual after 5 years or for high-risk patients) comprehensive ophthalmologic examinations, including visual field testing and optical coherence tomography (OCT), are crucial. Patients must be educated on visual symptoms and to report them immediately. ♦ Cardiovascular Effects: Rare reports of cardiomyopathy and QT prolongation, especially with concomitant QT-prolonging drugs. Use with caution in patients with heart disease or taking other QT-prolonging agents. ♦ Hypoglycemia: Can cause severe hypoglycemia, including loss of consciousness. Monitor blood glucose, especially in diabetic patients. ♦ Neuropsychiatric Effects: Can cause nervousness, irritability, psychosis, and suicidal thoughts. ♦ Hematologic Effects: Rare reports of bone marrow suppression (anemia, leukopenia, thrombocytopenia). Monitor blood counts periodically. ♦ Myopathy/Neuropathy: Can cause skeletal muscle weakness or peripheral neuropathy. ♦ Psoriasis/Porphyria: Can exacerbate these conditions. ♦ Children: Children are particularly sensitive to the toxic effects; use with extreme caution.
Missed Dose Instructions	For chronic autoimmune conditions, if a dose of Hydroxychloroquine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining therapeutic effects.
Overdose Instructions	Overdose is highly dangerous and can be rapidly fatal, particularly in children. Symptoms include headache, dizziness, drowsiness, visual disturbances, cardiovascular collapse, cardiac arrhythmias (especially QT prolongation, ventricular fibrillation), and seizures. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) should be initiated immediately if recent. Correct electrolyte abnormalities. Antidysrhythmics (e.g., diazepam for seizures) and vasopressors may be needed. Continuous cardiac monitoring is essential. Seek immediate emergency medical help.
Medicine Interactions	♦ Digoxin: Hydroxychloroquine can increase plasma digoxin levels. Monitor digoxin levels. ♦ Insulin/Oral Hypoglycemic Agents: Can potentiate the hypoglycemic effect of these drugs, increasing the risk of hypoglycemia. Monitor blood glucose. ♦ Drugs Known to Prolong QT Interval (e.g., amiodarone, tricyclic antidepressants, certain antipsychotics): Increased risk of ventricular arrhythmias. Use with caution. ♦ Methotrexate: Increased risk of hepatotoxicity. ♦ Cyclosporine: May increase cyclosporine levels. ♦ Antacids (containing aluminum or magnesium): Can reduce the absorption of hydroxychloroquine. Administer hydroxychloroquine at least 4 hours before or after antacids. ♦ Mefloquine: Increased risk of seizures. ♦ Amiodarone: Increased risk of cardiac arrhythmias. ♦ Vaccines: Can reduce the antibody response to some vaccines.

Ibandronate (Boniva)

Purpose/Indication	Ibandronate is a bisphosphonate medication used to prevent and treat osteoporosis in postmenopausal women. It helps to increase bone mineral density and reduce the risk of vertebral (spine) fractures. It is also used to treat hypercalcemia of malignancy (high blood calcium due to cancer) and bone metastases in certain cancers, which helps to reduce skeletal-related events.
Method of Action	Ibandronate works by selectively binding to bone mineral, particularly at sites of active bone remodeling. It is then internalized by osteoclasts (cells responsible for bone resorption). Once inside, it inhibits the activity of farnesyl pyrophosphate synthase, an enzyme critical for osteoclast function and survival. This leads to a decrease in osteoclast activity, thereby inhibiting bone resorption and promoting a net increase in bone mass.

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Medication Name & Brand Names	♦ Medication Name: Ibandronate Sodium ♦ Brand Names: Boniva (oral and IV), Ibandronate (generic)
Pharmaceutical Forms & Appearance	Ibandronate is available as oral tablets and solution for intravenous (IV) injection. Oral tablets are typically white, oval-shaped, and film-coated. The IV solution is clear and colorless.
Dosage & Administration	For osteoporosis, the usual oral dose is 150 mg once a month, taken on the same day each month, or 2.5 mg once daily. For IV administration for osteoporosis, it's 3 mg every 3 months. For oncology indications, IV dosing varies. Oral tablets must be taken with a full glass of plain water (not mineral water or other beverages) at least 60 minutes before the first food, drink, or other medication of the day. Patients must remain upright for at least 60 minutes after taking the oral dose to minimize esophageal irritation.
Supplied As	Ibandronate is supplied as: oral film-coated tablets (e.g., 2.5 mg, 150 mg) and pre-filled syringes for intravenous injection (e.g., 3 mg/3 mL).
Contraindications	Ibandronate is contraindicated in patients with known hypersensitivity to ibandronate or any component of the formulation. Oral forms are contraindicated in patients with uncorrected hypocalcemia, abnormalities of the esophagus that delay esophageal emptying (e.g., stricture, achalasia), and inability to stand or sit upright for at least 60 minutes.
Storage & Expiry	Ibandronate tablets and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., dyspepsia, esophagitis, abdominal pain, diarrhea), musculoskeletal pain, and headache. More serious but less common side effects include esophageal reactions (ulcers, erosions), osteonecrosis of the jaw (ONJ), atypical femoral fractures, severe bone/joint/muscle pain, and ocular inflammation.
Warnings & Precautions	♦ Esophageal Reactions (Oral Forms): Can cause esophageal irritation, ulceration, or erosion, rarely leading to bleeding or stricture. Follow administration instructions precisely (full glass of water, upright for 60 mins, nothing else by mouth). Discontinue if esophageal symptoms worsen. ♦ Osteonecrosis of the Jaw (ONJ): Rare but serious risk, particularly with IV bisphosphonates, higher doses, cancer, dental procedures, or poor oral hygiene. Dental examination before starting therapy is recommended. Avoid invasive dental procedures during treatment if possible. ♦ Atypical Femur Fractures: Rare but serious risk of unusual fractures in the femur with long-term bisphosphonate use. Evaluate new thigh/groin pain. ♦ Musculoskeletal Pain: Severe and occasionally incapacitating bone, joint, and/or muscle pain has been reported. Discontinue if symptoms occur. ♦ Hypocalcemia: Must correct pre-existing hypocalcemia and other mineral and bone metabolism disturbances before initiating therapy. Ensure adequate intake of calcium and Vitamin D. ♦ Renal Impairment: Not recommended for patients with severe renal impairment (creatinine clearance < 30 mL/min). ♦ Asthma Exacerbation: May exacerbate asthma in aspirin-sensitive patients.
Missed Dose Instructions	♦ Monthly Oral Dose: If the monthly dose is missed and the next scheduled dose is more than 7 days away, take one 150 mg tablet the morning after it is remembered. Then return to the original monthly schedule. If the next scheduled dose is within 7 days, skip the missed dose and wait until the next regularly scheduled dose. Do not take two 150 mg tablets in the same week. ♦ Daily Oral Dose: If a daily dose is missed, skip it and resume the usual schedule the next morning. Do not take a double dose.
Overdose Instructions	Oral overdose can result in hypocalcemia, hypophosphatemia, and upper gastrointestinal adverse events such as upset stomach, dyspepsia, esophagitis, gastritis, or ulcer. Milk or antacids may be given to bind ibandronate. Emesis should not be induced, and the patient should remain fully upright. IV overdose may lead to hypocalcemia and hypophosphatemia. Treatment is supportive. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Calcium-Containing Products, Antacids, Iron, Magnesium, Other Oral Medications: Significantly interfere with the absorption of oral ibandronate. Do not take any other oral medications, including vitamins, calcium, or antacids, for at least 60 minutes after taking ibandronate. ♦ Aspirin/NSAIDs: Increased risk of upper gastrointestinal adverse events with concurrent use, especially with oral bisphosphonates. ♦ Proton Pump Inhibitors (PPIs) / H2-Blockers: Chronic use may potentially contribute to ONJ or reduce the efficacy of bisphosphonates, although specific interactions with ibandronate are not well-established. ♦ Thalidomide: May increase risk of ONJ in multiple myeloma patients when combined with bisphosphonates.

Ibandronate (Boniva)

Ibuprofen (Advil)

Purpose/Indication	Ibuprofen is a non-steroidal anti-inflammatory drug (NSAID) widely used to relieve mild to moderate pain, reduce fever, and alleviate inflammation. It is indicated for conditions such as headache, dental pain, menstrual pain (dysmenorrhea), muscle aches, arthritis (rheumatoid arthritis, osteoarthritis), and to reduce fever associated with common colds or flu.
Method of Action	Ibuprofen works by reversibly inhibiting cyclooxygenase (COX) enzymes, specifically both COX-1 and COX-2. These enzymes are responsible for the synthesis of prostaglandins, which are lipid compounds that play a crucial role in mediating pain, inflammation, and fever. By blocking prostaglandin production, ibuprofen reduces inflammatory responses, thereby decreasing pain, swelling, and redness, and lowering body temperature.
Medication Name & Brand Names	♦ Medication Name: Ibuprofen ♦ Brand Names: Advil, Motrin, Nurofen, Brufen, Ibuprofen (generic)
Pharmaceutical Forms & Appearance	Ibuprofen is available in various oral forms (tablets, capsules, chewable tablets, oral suspension, oral drops) and topical forms (creams, gels). Oral tablets/capsules vary in color, shape, and size, often with specific imprints. Oral liquids are typically flavored suspensions or syrups. Topical preparations are usually clear or white.
Dosage & Administration	Dosage varies by age, indication, and formulation. For adults and children 12 years and older, common oral doses for pain/fever are 200 mg to 400 mg every 4-6 hours as needed, with a maximum daily dose typically 1200 mg (OTC) to 3200 mg (prescription). For children, dosing is based on weight. It should be taken with food, milk, or a full glass of water to minimize gastrointestinal upset. Use the lowest effective dose for the shortest duration.
Supplied As	Ibuprofen is supplied as: oral tablets (e.g., 200 mg, 400 mg, 600 mg, 800 mg), oral capsules/softgels (e.g., 200 mg), chewable tablets (e.g., 100 mg), oral suspension/syrup (e.g., 100 mg/5 mL), oral drops (e.g., 50 mg/1.25 mL), and topical creams/gels (e.g., 5%, 10%).
Contraindications	Ibuprofen is contraindicated in patients with a known hypersensitivity (e.g., allergic reactions, asthma, urticaria, rhinitis) to ibuprofen, aspirin, or other NSAIDs. It is also contraindicated in the setting of coronary artery bypass graft (CABG) surgery, and in patients with active gastrointestinal bleeding or peptic ulcer disease. Severe heart failure and severe renal/hepatic impairment are also contraindications.

Storage & Expiry	Ibuprofen products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Oral suspensions should be shaken well before use. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, dyspepsia, abdominal pain, diarrhea, heartburn), headache, and dizziness. More serious and potentially life-threatening side effects can include cardiovascular thrombotic events (e.g., heart attack, stroke), gastrointestinal bleeding, ulceration, or perforation, kidney dysfunction, liver injury, and serious skin reactions (e.g., Stevens-Johnson syndrome).
Warnings & Precautions	♦ Cardiovascular Risk: NSAIDs, including ibuprofen, can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. Contraindicated for pain after CABG surgery. ♦ Gastrointestinal Risk: Can cause serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. Risk is higher in elderly patients, those with a history of GI bleeding, or concomitant use of other agents. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, especially in dehydrated patients, those with pre-existing kidney disease, heart failure, or concurrent use of diuretics/ACE inhibitors. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function tests. ♦ Skin Reactions: Serious skin reactions can occur. Discontinue at first appearance of rash. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Pregnancy: Avoid use in late pregnancy (third trimester) due to risk of premature closure of the fetal ductus arteriosus and kidney dysfunction. ♦ Bleeding Risk: May inhibit platelet aggregation; use with caution in bleeding disorders or with anticoagulants.
Missed Dose Instructions	Ibuprofen is often taken as needed for pain or fever. If a dose is missed, take it when remembered if symptoms warrant, adhering to the recommended dosing interval (e.g., not sooner than 4-6 hours from the last dose). However, if it's almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose.
Overdose Instructions	Overdose symptoms vary but can include nausea, vomiting, epigastric pain, lethargy, drowsiness, dizziness, tinnitus, headache, nystagmus, and gastrointestinal bleeding. In severe cases, acute renal failure, hypotension, respiratory depression, metabolic acidosis, and coma may occur. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate medical attention.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin): Increased risk of bleeding; monitor INR closely. ♦ Antiplatelet agents (e.g., aspirin, clopidogrel): Increased risk of bleeding, especially GI bleeding. Avoid concomitant regular aspirin use for anti-inflammatory effects. ♦ Other NSAIDs/Corticosteroids: Increased risk of GI adverse events. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and increase the risk of renal impairment, especially in elderly or dehydrated patients. ♦ Lithium: May increase serum lithium concentrations and toxicity; monitor lithium levels. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ SSRIs: Increased risk of GI bleeding. ♦ Alcohol: Increased risk of GI bleeding and liver damage.

Imiquimod (Aldara)

Purpose/Indication	Imiquimod is a topical immune response modifier used to treat various dermatological conditions. It is indicated for the treatment of external genital and perianal warts (condyloma acuminata), actinic keratosis (AK) on the face and scalp, and superficial basal cell carcinoma (sBCC) in adults. It works by stimulating the body's immune system to clear the abnormal cells or viral infections.
Method of Action	Imiquimod acts as a toll-like receptor 7 (TLR7) agonist. When applied topically, it stimulates immune cells (such as macrophages, dendritic cells, and monocytes) to release various cytokines, including interferon-alpha (IFN-a), tumor necrosis factor-a (TNF-a), and interleukins (e.g., IL-1, IL-6, IL-8, IL-12). These cytokines enhance the local cellular immune response, leading to the destruction of virally infected cells (warts) or cancerous cells (AK, sBCC).
Medication Name & Brand Names	♦ Medication Name: Imiquimod ♦ Brand Names: Aldara, Zyclara, Imiquimod (generic)
Pharmaceutical Forms & Appearance	Imiquimod is available as a topical cream. It is typically a white to slightly yellow cream. It is supplied in single-use sachets (small packets) to ensure hygienic application and proper dosing.
Dosage & Administration	Dosage and application frequency vary significantly by indication. For external genital/perianal warts, it's typically applied 3 times per week at bedtime and left on for 6-10 hours, then washed off. For actinic keratosis, it's usually applied 2 times per week for 16 weeks. For superficial basal cell carcinoma, it's applied 5 times per week for 6 weeks. Always apply a thin layer to the affected area only, avoiding healthy skin. Wash hands before and after application.
Supplied As	Imiquimod is supplied as: 5% cream in single-use packets (e.g., Aldara) and 3.75% cream in a pump dispenser (e.g., Zyclara).
Contraindications	Imiquimod is contraindicated in patients with known hypersensitivity to imiquimod or any component of the formulation. It is not for ophthalmic, oral, or intravaginal use.
Storage & Expiry	Imiquimod cream should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Do not freeze. Store in tightly closed containers or the original sachets. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are local skin reactions at the application site, including erythema (redness), erosion, flaking, scabbing, swelling, itching, and burning. These reactions are expected as part of the immune response. Systemic side effects are less common but can include headache, fatigue, flu-like symptoms (e.g., fever, body aches), and nausea.
Warnings & Precautions	♦ Local Skin Reactions: Severe local skin reactions (e.g., intense redness, erosions, ulcerations, weeping) are common and expected, but can be severe. Temporary discontinuation may be necessary. Inform patients about these expected reactions. ♦ Systemic Reactions: Flu-like symptoms (fever, fatigue, body aches) can occur, especially with extensive application or during the first few weeks of treatment. ♦ Immunosuppression: Use with caution in immunocompromised patients due to limited data. ♦ Sun Exposure: Advise patients to avoid or minimize sun exposure, as imiquimod may increase sensitivity to sunburn. ♦ Avoid Mucous Membranes/Open Wounds: Not for internal use. Avoid contact with eyes, mouth, or other mucous membranes. Do not apply to broken or open skin until healed. ♦ Sexual Activity: Not a cure for warts and does not prevent transmission. Avoid sexual contact while the cream is on the skin. ♦ Children: Safety and effectiveness not established for all indications in pediatric populations; use with caution.
Missed Dose Instructions	If a dose of Imiquimod is missed, apply it as soon as remembered. However, do not apply a double dose to make up for the missed one. Continue with the regular application schedule. Consistent application as prescribed is important for achieving optimal results.

Overdose Instructions	Topical overdose is unlikely to cause serious systemic effects due to minimal percutaneous absorption. However, application of excessive amounts or application over large areas could potentially lead to increased local skin reactions and/or systemic effects like fever, fatigue, or flu-like symptoms. Treatment is symptomatic and supportive. Discontinue use. Accidental oral ingestion of a sachet or two is unlikely to be harmful but may cause nausea or vomiting; larger ingestions should be reported to a poison control center. Seek medical advice if an overdose is suspected or severe symptoms occur.
Medicine Interactions	♦ No significant drug interactions are commonly reported with topical imiquimod due to its minimal systemic absorption. ♦ Theoretically, its immune-stimulating effects could interact with systemic immunosuppressants, but this is not well-established clinically with topical use.

Indomethacin (Indocin)

Purpose/Indication	Indomethacin is a potent non-steroidal anti-inflammatory drug (NSAID) used to relieve moderate to severe pain, inflammation, and stiffness. It is primarily indicated for conditions such as rheumatoid arthritis, osteoarthritis, ankylosing spondylitis, acute painful shoulder (bursitis/tendinitis), and acute gouty arthritis. It is also used to close a patent ductus arteriosus (PDA) in premature infants.
Method of Action	Indomethacin works by potently inhibiting cyclooxygenase (COX) enzymes, both COX-1 and COX-2. By blocking these enzymes, it prevents the synthesis of prostaglandins, which are key mediators of pain, inflammation, and fever. Its strong anti-inflammatory properties contribute to its effectiveness in various inflammatory and pain conditions.
Medication Name & Brand Names	♦ Medication Name: Indomethacin ♦ Brand Names: Indocin (capsules, suspension, suppository), Tivorbex (capsules), Indomethacin (generic)
Pharmaceutical Forms & Appearance	Indomethacin is available as oral capsules (immediate and extended-release), oral suspension, rectal suppositories, and solution for intravenous (IV) injection. Oral capsules are typically blue and white, or clear and white, varying in size. The oral suspension is usually a clear to light yellow liquid. Rectal suppositories are whitish, torpedo-shaped. The IV solution is clear and colorless.
Dosage & Administration	Dosage varies by indication, severity of condition, and patient response. For inflammatory arthritis, typical oral doses range from 25 mg to 50 mg two to three times daily, with a maximum generally 200 mg per day. For acute gout, higher initial doses may be used. It should be taken immediately after meals or with food, or with antacids, to minimize gastrointestinal upset. Rectal suppositories can be used when oral administration is not feasible.
Supplied As	Indomethacin is supplied as: oral capsules (e.g., 25 mg, 50 mg), extended-release oral capsules (e.g., 75 mg), oral suspension (e.g., 25 mg/5 mL), rectal suppositories (e.g., 50 mg), and powder for solution for intravenous injection (e.g., 1 mg vial).
Contraindications	Indomethacin is contraindicated in patients with a known hypersensitivity (e.g., allergic reactions, asthma, urticaria) to indomethacin, aspirin, or other NSAIDs. It is also contraindicated in the setting of coronary artery bypass graft (CABG) surgery, in patients with active gastrointestinal bleeding or peptic ulcer disease, severe renal impairment, or severe heart failure. Rectal suppositories are contraindicated in patients with active proctitis or recent rectal bleeding.
Storage & Expiry	Indomethacin oral forms and suppositories should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The oral suspension should be shaken well before use. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, dyspepsia, abdominal pain, diarrhea), headache, dizziness, and somnolence. More serious and potentially life-threatening side effects can include severe gastrointestinal bleeding, ulceration, or perforation, cardiovascular thrombotic events (e.g., heart attack, stroke), kidney dysfunction, liver injury, severe skin reactions, and central nervous system effects (e.g., confusion, psychosis, seizures).
Warnings & Precautions	♦ Cardiovascular Risk: NSAIDs, including indomethacin, can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. ♦ Gastrointestinal Risk: Can cause serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. Risk is higher in elderly patients, those with a history of GI bleeding, or concomitant use of other agents. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, especially in dehydrated patients, those with pre-existing kidney disease, heart failure, or concurrent use of diuretics/ACE inhibitors. ♦ CNS Effects: Can cause significant CNS side effects such as headache, dizziness, vertigo, and confusion. Use with caution in patients with psychiatric history, epilepsy, or Parkinson's disease. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function tests. ♦ Skin Reactions: Serious skin reactions can occur. Discontinue at first appearance of rash. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Pregnancy: Avoid use in late pregnancy (third trimester) due to risk of premature closure of the fetal ductus arteriosus and kidney dysfunction. ♦ Bleeding Risk: May inhibit platelet aggregation; use with caution in bleeding disorders or with anticoagulants. ♦ Hyperkalemia: Can cause hyperkalemia, especially in patients with diabetes or renal insufficiency
Missed Dose Instructions	If a dose of Indomethacin is missed, take it as soon as remembered if symptoms warrant, adhering to the recommended dosing interval (e.g., not too close to the next scheduled dose). However, if it's almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent dosing is important for chronic conditions like arthritis.
Overdose Instructions	Overdose symptoms can include nausea, vomiting, epigastric pain, lethargy, drowsiness, dizziness, tinnitus, headache, nystagmus, and gastrointestinal bleeding. In severe cases, acute renal failure, hypotension, respiratory depression, metabolic acidosis, and coma may occur. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate medical attention.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin): Increased risk of bleeding; monitor INR closely. ♦ Antiplatelet agents (e.g., aspirin, clopidogrel): Increased risk of bleeding, especially GI bleeding. Avoid concomitant regular aspirin use for anti-inflammatory effects. ♦ Other NSAIDs/Corticosteroids: Increased risk of GI adverse events. ♦ ACE Inhibitors/ARBs/Diuretics (especially furosemide, thiazides): May reduce the antihypertensive and diuretic effects, and significantly increase the risk of renal impairment, especially in elderly or dehydrated patients. ♦ Lithium: Potent inhibition of lithium excretion, leading to significantly increased serum lithium concentrations and toxicity. Monitor lithium levels extremely closely. ♦ Methotrexate: May increase methotrexate toxicity. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ Beta-Blockers: May reduce the antihypertensive effect of beta-blockers. ♦ Potassium-Sparing Diuretics: Increased risk of hyperkalemia. ♦ SSRIs: Increased risk of GI bleeding. ♦ Alcohol: Increased risk of GI bleeding and CNS effects.

Insulin Glargine (Lantus)

Purpose/Indication	Insulin glargine is a long-acting recombinant human insulin analog used to improve glycemic control in adults and children with type 1 diabetes mellitus and adults with type 2 diabetes mellitus. It provides a constant, peakless basal insulin level over 24 hours, helping to maintain blood glucose levels between meals and overnight. It is typically used once daily in conjunction with rapid-acting insulin at meal times (for type 1) or other oral antidiabetic agents (for type 2).

Method of Action	Insulin glargine is designed for prolonged action and a smooth concentration/time profile without a pronounced peak. After subcutaneous injection, its low solubility at physiological pH (compared to regular insulin) causes it to precipitate, forming micro-precipitates in the subcutaneous tissue. From these micro-precipitates, small amounts of insulin glargine are slowly and continuously released into the bloodstream over approximately 24 hours, providing a consistent basal insulin supply to regulate glucose metabolism.
Medication Name & Brand Names	♦ Medication Name: Insulin Glargine ♦ Brand Names: Lantus, Toujeo, Basaglar, Semglee
Pharmaceutical Forms & Appearance	Insulin glargine is a sterile, clear, colorless solution for subcutaneous injection. It is supplied in vials, cartridges (for reusable pens), and pre-filled pens.
Dosage & Administration	Dosage is highly individualized and determined by a healthcare professional based on the patient's blood glucose levels, lifestyle, and other medications. It is typically administered once daily at the same time each day (e.g., bedtime or morning). It is given by subcutaneous injection into the abdominal wall, thigh, or deltoid. Injection sites should be rotated within the same region. It must never be mixed with other insulins or solutions, and should not be administered intravenously or intramuscularly.
Supplied As	Insulin glargine is supplied as: 100 units/mL (U-100) in 10 mL vials, 3 mL cartridges (for reusable pens), and 3 mL pre-filled pens (e.g., SoloStar, KwikPen). A more concentrated form, 300 units/mL (U-300), is also available (e.g., Toujeo).
Contraindications	Insulin glargine is contraindicated during episodes of hypoglycemia. It is also contraindicated in patients with known hypersensitivity to insulin glargine or any component of the formulation.
Storage & Expiry	Unopened insulin glargine vials, cartridges, and pens should be stored in a refrigerator (2°C to 8°C or 36°F to 46°F), protected from light and direct heat. Do not freeze. Once opened or in-use, it can be stored at room temperature (below 30°C or 86°F) for a specific duration (e.g., 28-56 days, check specific product leaflet), protected from direct heat and light. Always check the specific expiry date on the packaging.
Side Effects	The most common and significant side effect is hypoglycemia (low blood sugar). Other common side effects include injection site reactions (e.g., pain, redness, itching, swelling), lipodystrophy (fat accumulation or atrophy at injection site with improper rotation), weight gain, and peripheral edema. Serious but rare side effects include severe allergic reactions and hypokalemia.
Warnings & Precautions	♦ Hypoglycemia: The most common and serious adverse effect. Patients must be educated on symptoms, management, and prevention of hypoglycemia. Risk is increased with too much insulin, missed meals, increased exercise, or concurrent use of certain medications. ♦ Hypersensitivity Reactions: Severe, life-threatening, generalized allergy, including anaphylaxis, can occur. ♦ Injection Site Reactions/Lipodystrophy: Proper rotation of injection sites is crucial to prevent and manage lipodystrophy. ♦ Never Share Pens: Insulin pens are for single-patient use only. Sharing pens can lead to transmission of blood-borne pathogens. ♦ Medication Errors: Check insulin label carefully before administration to avoid mix-ups with other insulins. Do not dilute or mix with other insulins. ♦ Fluid Retention/Heart Failure: Thiazolidinediones (TZDs) in combination with insulin may cause dose-related fluid retention, potentially exacerbating or leading to heart failure. ♦ Hypokalemia: Insulin can cause a shift of potassium into cells, potentially leading to hypokalemia. Monitor potassium in at-risk patients. ♦ Renal/Hepatic Impairment: Insulin requirements may be altered in patients with renal or hepatic impairment.
Missed Dose Instructions	If a dose of Insulin Glargine is missed, it should be taken as soon as remembered. However, if it's close to the time for the next scheduled dose, patients should consult their healthcare provider for guidance. Do not take a double dose to compensate for a missed one, as this increases the risk of hypoglycemia. Consistent daily administration at the same time is key for maintaining steady basal insulin levels.
Overdose Instructions	Overdose primarily leads to severe and prolonged hypoglycemia. Symptoms can range from mild (tremor, sweating, hunger, nervousness, confusion) to severe (seizures, coma, brain damage, death). Treatment involves immediate administration of glucose (oral glucose for conscious patients, IV dextrose for unconscious patients). Hospitalization and prolonged monitoring are necessary due to the long duration of action of insulin glargine. Glucagon may be administered. Seek immediate emergency medical help.
Medicine Interactions	♦ Drugs that May Increase Hypoglycemic Effect (Increased Hypoglycemia Risk): Oral antidiabetic agents, ACE inhibitors, angiotensin receptor blockers (ARBs), disopyramide, fibrates, fluoxetine, MAO inhibitors, pentoxifylline, pramlintide, propoxyphene, salicylates, somatostatin analogs (e.g., octreotide), sulfonamide antibiotics. ♦ Drugs that May Decrease Hypoglycemic Effect (Increased Hyperglycemia Risk): Corticosteroids, niacin, diuretics (especially thiazides, loop diuretics), sympathomimetics (e.g., albuterol, epinephrine, terbutaline), thyroid hormones, atypical antipsychotics (e.g., olanzapine, clozapine), protease inhibitors. ♦ Beta-Blockers (non-selective): Can mask symptoms of hypoglycemia (e.g., tremor, tachycardia) and delay recovery from hypoglycemia. ♦ Alcohol: Can potentiate the hypoglycemic effect of insulin. ♦ Pioglitazone/Rosiglitazone (TZDs): Increased risk of fluid retention and heart failure when combined with insulin.

Insulin (Lispro, Regular) (Humalog)

Purpose/Indication	Insulin Lispro is a rapid-acting human insulin analog used to improve glycemic control in adults and children with type 1 and type 2 diabetes mellitus. It is primarily taken immediately before or after a meal to control the post-meal rise in blood glucose and can also be used for correction of high blood sugar between meals. Its quick onset and short duration of action make it suitable for a flexible dosing regimen.
Method of Action	Insulin Lispro is a genetically engineered form of human insulin where two amino acids (proline and lysine) have been inverted, preventing its aggregation into hexamers upon injection. This structural change allows it to be rapidly absorbed from the subcutaneous injection site into the bloodstream. Once in circulation, it binds to insulin receptors on cells, facilitating glucose uptake into tissues (muscle, adipose), suppressing hepatic glucose production, and promoting the conversion of glucose to glycogen, thereby lowering blood glucose levels. Its action typically begins within 15-30 minutes, peaks in 30-90 minutes, and lasts 3-5 hours.
Medication Name & Brand Names	♦ Medication Name: Insulin Lispro ♦ Brand Names: Humalog, Admelog, Lyumjev (ultra rapid-acting)
Pharmaceutical Forms & Appearance	Insulin Lispro is a clear, colorless solution for subcutaneous injection. It is supplied in vials, cartridges (for reusable pens), and pre-filled pens. Lyumjev, an ultra rapid-acting formulation, is also a clear, colorless solution.
Dosage & Administration	Dosage is highly individualized and determined by a healthcare professional based on blood glucose levels, carbohydrate intake, and activity. It is typically administered by subcutaneous injection within 15 minutes before a meal or immediately after a meal. For Lyumjev, it can be taken at the start of a meal or up to 20 minutes after starting a meal. Injection sites should be rotated within the same region (abdomen, thigh, deltoid, or buttock). It can be used in insulin pumps.
Supplied As	Insulin Lispro is supplied as: 100 units/mL (U-100) in 10 mL vials, 3 mL cartridges (e.g., KwikPens, Junior KwikPens for reusable pens), and 3 mL pre-filled pens. Lyumjev is available as 100 units/mL and 200 units/mL.

MEDICATION

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Insulin (Lispro, Regular) (Humalog)

Contraindications	Insulin Lispro is contraindicated during episodes of hypoglycemia. It is also contraindicated in patients with known hypersensitivity to insulin lispro or any component of the formulation.
Storage & Expiry	Unopened insulin lispro vials, cartridges, and pens should be stored in a refrigerator (2°C to 8°C or 36°F to 46°F), protected from light and direct heat. Do not freeze. Once opened or in-use, it can be stored at room temperature (below 30°C or 86°F) for a specific duration (e.g., 28 days for Humalog, check specific product leaflet). Always check the specific expiry date on the packaging.
Side Effects	The most common and significant side effect is hypoglycemia (low blood sugar). Other common side effects include injection site reactions (e.g., pain, redness, itching, swelling), lipodystrophy (fat accumulation or atrophy at injection site with improper rotation), weight gain, and peripheral edema. Serious but rare side effects include severe allergic reactions and hypokalemia.
Warnings & Precautions	♦ Hypoglycemia: The most common and serious adverse effect. Patients must be educated on symptoms, management, and prevention of hypoglycemia. Risk is increased with too much insulin, delayed/missed meals after injection, increased exercise, or concurrent use of certain medications. ♦ Hypersensitivity Reactions: Severe, life-threatening, generalized allergy, including anaphylaxis, can occur. ♦ Injection Site Reactions/Lipodystrophy: Proper rotation of injection sites is crucial to prevent and manage lipodystrophy. ♦ Never Share Pens: Insulin pens are for single-patient use only. Sharing pens can lead to transmission of blood-borne pathogens. ♦ Medication Errors: Check insulin label carefully before administration to avoid mix-ups with other insulins. Do not dilute or mix with other insulins in pump reservoirs. ♦ Fluid Retention/Heart Failure: Thiazolidinediones (TZDs) in combination with insulin may cause dose-related fluid retention, potentially exacerbating or leading to heart failure. ♦ Hypokalemia: Insulin can cause a shift of potassium into cells, potentially leading to hypokalemia. Monitor potassium in at-risk patients.
Missed Dose Instructions	Since Insulin Lispro is typically dosed around meals, if a pre-meal dose is missed or a patient forgets to eat after taking it, they should monitor their blood sugar and consider taking the dose immediately after eating, or correct hyperglycemia later, under guidance from their healthcare provider. Due to its rapid action, delayed administration significantly reduces its meal-time effect. Do not double a dose.
Overdose Instructions	Overdose primarily leads to severe and prolonged hypoglycemia. Symptoms can range from mild (tremor, sweating, hunger, nervousness, confusion) to severe (seizures, coma, brain damage, death). Treatment involves immediate administration of glucose (oral glucose for conscious patients, IV dextrose for unconscious patients). Glucagon may be administered. Hospitalization and monitoring may be necessary depending on the severity. Seek immediate emergency medical help.
Medicine Interactions	♦ Drugs that May Increase Hypoglycemic Effect (Increased Hypoglycemia Risk): Oral antidiabetic agents, ACE inhibitors, angiotensin receptor blockers (ARBs), disopyramide, fibrates, fluoxetine, MAO inhibitors, pentoxifylline, pramlintide, propoxyphene, salicylates, somatostatin analogs (e.g., octreotide), sulfonamide antibiotics. ♦ Drugs that May Decrease Hypoglycemic Effect (Increased Hyperglycemia Risk): Corticosteroids, niacin, diuretics (especially thiazides, loop diuretics), sympathomimetics (e.g., albuterol, epinephrine, terbutaline), thyroid hormones, atypical antipsychotics (e.g., olanzapine, clozapine), protease inhibitors. ♦ Beta-Blockers (non-selective): Can mask symptoms of hypoglycemia (e.g., tremor, tachycardia) and delay recovery from hypoglycemia. ♦ Alcohol: Can potentiate the hypoglycemic effect of insulin. ♦ Pioglitazone/Rosiglitazone (TZDs): Increased risk of fluid retention and heart failure when combined with insulin.

Irbesartan (Avapro)

Purpose/Indication	Irbesartan is an angiotensin II receptor blocker (ARB) used to treat hypertension (high blood pressure) and to protect the kidneys in patients with type 2 diabetes and nephropathy (kidney disease) who also have hypertension. By effectively lowering blood pressure, it reduces the risk of cardiovascular events like stroke and heart attack. In diabetic nephropathy, it helps slow the progression of kidney disease.
Method of Action	Irbesartan selectively blocks the binding of angiotensin II to the AT1 (angiotensin II type 1) receptors found in various tissues, including vascular smooth muscle and the adrenal glands. Angiotensin II is a potent vasoconstrictor and a key component of the renin-angiotensin-aldosterone system (RAAS), which plays a central role in blood pressure regulation and fluid balance. By blocking AT1 receptors, irbesartan inhibits the vasoconstrictive and aldosterone-secreting effects of angiotensin II, leading to vasodilation, reduced systemic vascular resistance, and decreased sodium and water retention, all of which contribute to lowering blood pressure.
Medication Name & Brand Names	♦ Medication Name: Irbesartan ♦ Brand Names: Avapro, Aprovel (regional), Irbesartan (generic) (Often found in combination with hydrochlorothiazide: Avalide, Co-Aprovel)
Pharmaceutical Forms & Appearance	Irbesartan is available as oral tablets. Tablets are typically white or off-white, often oval-shaped, and may be scored, with various imprints indicating strength.
Dosage & Administration	Dosage is individualized based on blood pressure response. For hypertension, the usual adult starting dose is 150 mg once daily, which can be increased to 300 mg once daily if needed. For diabetic nephropathy, the target maintenance dose is generally 300 mg once daily. It can be taken with or without food. Consistent daily administration is important for optimal blood pressure control.
Supplied As	Irbesartan is supplied as: oral tablets (e.g., 75 mg, 150 mg, 300 mg). It is also commonly available in fixed-dose combination tablets with hydrochlorothiazide.
Contraindications	Irbesartan is contraindicated in patients with known hypersensitivity to irbesartan or any component of the formulation. It is also contraindicated in combination with aliskiren in patients with diabetes or moderate to severe renal impairment (GFR < 60 mL/min/1.73 m2). Use during pregnancy (especially second and third trimesters) is contraindicated due to risk of fetal injury or death.
Storage & Expiry	Irbesartan tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, lightheadedness (due to hypotension), headache, and fatigue. Less common but more serious side effects can include hyperkalemia (high potassium levels), kidney dysfunction or failure, angioedema (swelling of face, lips, throat), and rhabdomyolysis (rarely).

Warnings & Precautions	♦ Fetal Toxicity: Can cause fetal harm or death when administered to pregnant women, particularly in the second and third trimesters. Discontinue as soon as pregnancy is detected. ♦ Hypotension: Can cause symptomatic hypotension, especially in volume-depleted patients (e.g., those on high-dose diuretics). Correct volume depletion before initiating therapy. ♦ Renal Impairment/Deterioration: Can cause changes in renal function, including acute renal failure, particularly in patients with severe congestive heart failure, pre-existing renal disease, or renal artery stenosis. Monitor renal function periodically. ♦ Hyperkalemia: Risk of hyperkalemia, especially in patients with renal impairment, diabetes, or those concurrently taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium levels. ♦ Angioedema: Rare but potentially life-threatening swelling of the face, lips, tongue, and throat. Discontinue immediately if symptoms occur. ♦ Dual RAAS Blockade: Concomitant use of ARBs, ACE inhibitors, or aliskiren (especially in diabetes or renal impairment) increases the risk of hypotension, hyperkalemia, and renal dysfunction; generally avoid.
Missed Dose Instructions	If a dose of Irbesartan is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining optimal blood pressure control.
Overdose Instructions	Overdose symptoms are primarily related to exaggerated hypotensive effects (dizziness, lightheadedness, syncope) and possibly tachycardia or bradycardia. Treatment is supportive and symptomatic. If ingestion was recent, gastric decontamination (e.g., activated charcoal) may be considered. Intravenous fluids may be administered to correct hypotension. Irbesartan is not removed by hemodialysis. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Potassium-Sparing Diuretics (e.g., spironolactone, triamterene, amiloride), Potassium Supplements, Salt Substitutes (containing potassium): Increased risk of hyperkalemia. Monitor potassium levels closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): Can reduce the antihypertensive effect of irbesartan and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Monitor renal function. ♦ Lithium: Irbesartan can increase serum lithium concentrations and toxicity. Monitor lithium levels. ♦ Aliskiren: Concomitant use is contraindicated in patients with diabetes or moderate to severe renal impairment due to increased risk of hyperkalemia, hypotension, and renal impairment. ♦ Dual RAAS Blockade (e.g., with ACE inhibitors): Generally not recommended due to increased risk of adverse events without clear additional benefit.

Isoniazid (Nydrazid)

Purpose/Indication	Isoniazid (INH) is an antibiotic primarily used for the treatment and prevention of tuberculosis (TB). It is a first-line drug for active tuberculosis, typically used in combination with other anti-tuberculosis medications, and is also effective as monotherapy for latent tuberculosis infection (LTBI) to prevent progression to active disease. Its purpose is to kill or inhibit the growth of Mycobacterium tuberculosis.
Method of Action	Isoniazid is a prodrug that is activated by the catalase-peroxidase enzyme (KatG) of Mycobacterium tuberculosis. Once activated, it interferes with mycobacterial cell wall synthesis by inhibiting the synthesis of mycolic acids, which are essential components of the mycobacterial cell wall. This leads to the disruption of the cell wall and eventually cell death, making it bactericidal against rapidly dividing M. tuberculosis and bacteriostatic against slowly growing bacilli.
Medication Name & Brand Names	♦ Medication Name: Isoniazid (INH) ♦ Brand Names: Nydrazid (historical/regional), Isoniazid (generic)
Pharmaceutical Forms & Appearance	Isoniazid is available as oral tablets and oral syrup, and historically as a solution for injection (though parenteral forms are less common now). Tablets are typically white, round, and often scored. The syrup is usually a clear, colorless to light yellow liquid.
Dosage & Administration	Dosage varies for active TB treatment versus LTBI prevention, and by patient age and weight. For active TB, it's typically 5 mg/kg daily (maximum 300 mg) or 15 mg/kg (maximum 900 mg) two to three times weekly, always in combination with other drugs. For LTBI, it's typically 300 mg daily for 6-9 months, or 900 mg once weekly with rifapentine for 12 weeks. It can be taken with or without food, but taking it with food may reduce gastrointestinal upset. Pyridoxine (Vitamin B6) supplementation is often co-administered to prevent peripheral neuropathy.
Supplied As	Isoniazid is supplied as: oral tablets (e.g., 100 mg, 300 mg) and oral syrup (e.g., 50 mg/5 mL).
Contraindications	Isoniazid is contraindicated in patients with known hypersensitivity to isoniazid or any component of the formulation. It is also contraindicated in patients with a history of previous isoniazid-associated liver injury or severe adverse reactions to isoniazid (e.g., drug-induced fever, chills, arthritis).
Storage & Expiry	Isoniazid tablets and syrup should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include elevated liver enzymes (asymptomatic), peripheral neuropathy (tingling, numbness, pain in hands/feet), and gastrointestinal upset (e.g., nausea, vomiting). More serious but less common side effects include severe hepatotoxicity (drug-induced hepatitis, which can be fatal), severe hypersensitivity reactions (e.g., rash, fever), optic neuritis, and blood dyscrasias.
Warnings & Precautions	♦ Hepatotoxicity: The most significant and potentially fatal adverse effect. Risk is increased with age (especially > 35 years), daily alcohol consumption, pre-existing liver disease, and concurrent use of other hepatotoxic drugs. Monitor liver function tests (ALT, AST) periodically, especially in high-risk patients. Patients should be educated on symptoms of liver injury (e.g., fatigue, weakness, loss of appetite, nausea, vomiting, dark urine, jaundice, pale stools) and advised to seek immediate medical attention if they occur. ♦ Peripheral Neuropathy: Common side effect due to interference with pyridoxine metabolism. Risk is higher in malnourished patients, alcoholics, diabetics, HIV-infected individuals, pregnant women, and patients with renal failure. Pyridoxine (Vitamin B6) supplementation is strongly recommended for all patients on isoniazid, especially those at high risk. ♦ CNS Effects: Can cause seizures, optic neuritis, dizziness, and psychosis. ♦ Hypersensitivity Reactions: Discontinue immediately if severe allergic reactions or drug-induced fever, chills, or rash occur. ♦ Alcohol: Concurrent use of alcohol increases the risk of hepatotoxicity. Advise patients to limit or avoid alcohol. ♦ Renal Impairment: Dose adjustment may be needed in severe renal impairment. ♦ Drug Resistance: Adherence to the full course of therapy and combination regimens is critical to prevent the development of drug-resistant M. tuberculosis.
Missed Dose Instructions	Adherence is crucial for the effectiveness of tuberculosis treatment and prevention. If a dose of Isoniazid is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. If multiple doses are missed, inform the healthcare provider, as this may require a re-evaluation of the treatment regimen.
Overdose Instructions	Isoniazid overdose is a medical emergency and can be life-threatening. Symptoms typically appear within 30 minutes to 3 hours and can include nausea, vomiting, dizziness, slurred speech, hyperreflexia, visual hallucinations, and, characteristically, repetitive generalized seizures (often refractory to conventional anticonvulsants) and severe metabolic acidosis. Treatment involves supportive care, gastric decontamination (if recent), and crucially, administration of large doses of pyridoxine (Vitamin B6) intravenously to counteract the neurotoxic effects. Hemodialysis may be used to remove isoniazid and correct acidosis. Seek immediate emergency medical help.

Medicine Interactions	♦ Carbamazepine, Phenytoin, Valproic Acid, Diazepam: Isoniazid can inhibit the metabolism of these drugs, leading to increased plasma concentrations and potential toxicity (e.g., increased CNS side effects, sedation, hepatotoxicity). Monitor drug levels and adjust doses as needed. ♦ Antacids (containing aluminum): Can reduce the absorption of isoniazid. Administer isoniazid at least 1 hour before antacids. ♦ Alcohol: Increased risk of isoniazid-induced hepatotoxicity. ♦ Disulfiram: Concurrent use can lead to central nervous system effects (e.g., ataxia, psychosis). Avoid concomitant use. ♦ Ketoconazole: Concurrent use can decrease ketoconazole concentrations. ♦ Cycloserine: Increased risk of CNS side effects (e.g., dizziness, drowsiness). ♦ Acetaminophen: Increased risk of hepatotoxicity with chronic high acetaminophen doses. ♦ Oral Contraceptives: May decrease efficacy of oral contraceptives (rarely).

Itraconazole (Sporanox)

Purpose/Indication	Itraconazole is an antifungal medication used to treat various systemic and superficial fungal infections. It is indicated for blastomycosis, histoplasmosis, aspergillosis (invasive and non-invasive), and onychomycosis (fungal nail infections) unresponsive to topical agents. It is also used for candidiasis (oral, esophageal, vulvovaginal), tinea infections, and other serious fungal infections where other antifungals are not appropriate.
Method of Action	Itraconazole is a triazole antifungal that works by inhibiting the fungal cytochrome P450-dependent enzyme 14-a-demethylase. This enzyme is crucial for the synthesis of ergosterol, an essential component of the fungal cell membrane. By blocking ergosterol synthesis, itraconazole disrupts the integrity and permeability of the fungal cell membrane, leading to inhibition of fungal growth (fungistatic effect) and eventual cell death.
Medication Name & Brand Names	♦ Medication Name: Itraconazole ♦ Brand Names: Sporanox (capsules, oral solution), Onmel (capsules for onychomycosis), Tolsura (capsules), Itraconazole (generic)
Pharmaceutical Forms & Appearance	Itraconazole is available as oral capsules and oral solution. Capsules are typically blue and white, with various imprints. The oral solution is a clear, yellowish liquid. Different formulations (capsules vs. solution) have different absorption characteristics and should not be interchanged on a milligram-for-milligram basis.
Dosage & Administration	Dosage and duration vary significantly by indication and severity of infection. For systemic infections, typical adult doses range from 100 mg to 400 mg daily. For onychomycosis, pulse dosing (e.g., 200 mg twice daily for one week, then three weeks off, repeated for several cycles) is common. Capsules should be taken immediately after a full meal to maximize absorption. The oral solution should be taken without food, as absorption is enhanced in the fasted state.
Supplied As	Itraconazole is supplied as: oral capsules (e.g., 100 mg), oral solution (e.g., 10 mg/mL).
Contraindications	Itraconazole is contraindicated in patients with known hypersensitivity to itraconazole or any component of the formulation. It is also strictly contraindicated in patients with congestive heart failure (CHF) or a history of CHF, unless the benefits clearly outweigh the risks due to its potential to worsen heart failure. Concurrent use with numerous drugs that are potent CYP3A4 substrates and/or prolong the QT interval is also contraindicated due to serious and potentially fatal interactions (e.g., certain statins, oral midazolam, cisapride, dofetilide, quinidine).
Storage & Expiry	Itraconazole capsules and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The oral solution should not be frozen. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, vomiting, abdominal pain, diarrhea), headache, dizziness, and rash. More serious side effects include hepatotoxicity (liver damage, including fatal cases), congestive heart failure, peripheral neuropathy, severe allergic reactions (e.g., Stevens-Johnson syndrome), hypokalemia, and visual disturbances.
Warnings & Precautions	♦ Congestive Heart Failure (CHF): Can cause or exacerbate CHF. Contraindicated in patients with CHF or a history of CHF unless the benefit clearly outweighs the risk. Discontinue if signs/symptoms of CHF develop. ♦ Hepatotoxicity: Can cause severe and potentially fatal liver injury. Monitor liver function tests (ALT, AST) periodically, especially with prolonged use or in patients with pre-existing liver disease. Discontinue if signs of liver disease develop. ♦ Drug Interactions: Extensive metabolism via CYP3A4 makes it prone to numerous significant drug interactions. Many are contraindicated due to risk of serious adverse events (e.g., QT prolongation, rhabdomyolysis). Thoroughly review concomitant medications. ♦ Peripheral Neuropathy: Can cause or worsen peripheral neuropathy. Discontinue if symptoms of neuropathy develop. ♦ Hearing Loss: Transient or permanent hearing loss has been reported. ♦ Hypokalemia: Can cause hypokalemia. ♦ Visual Disturbances: Blurred vision, diplopia, and photophobia may occur. ♦ Absorption Differences: Capsules and oral solution are not bioequivalent; do not interchange without dose adjustment. Capsules require gastric acidity for absorption; oral solution is better absorbed in a fasted state. ♦ Renal/Hepatic Impairment: Use with caution and consider dose adjustment in patients with renal or hepatic impairment.
Missed Dose Instructions	If a dose of Itraconazole is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining effective drug levels, especially for serious fungal infections.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset and potentially signs of more severe hepatotoxicity or cardiac effects. Treatment is supportive and symptomatic. There is no specific antidote. Itraconazole is not removed by hemodialysis. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Many Contraindicated Interactions (Strong CYP3A4 Inhibitor): Due to potent CYP3A4 inhibition, co-administration with many drugs is contraindicated due to risk of significantly increased plasma levels and toxicity of the co-administered drug. Examples include: certain statins (lovastatin, simvastatin), oral midazolam, triazolam, cisapride, dofetilide, quinidine, pimozide, ergot alkaloids (e.g., ergotamine, dihydroergotamine), ranolazine, ticagrelor, ivabradine, felodipine. ♦ Gastric Acid Reducers (e.g., antacids, H2-blockers, PPIs): Significantly reduce the absorption of itraconazole capsules. Administer antacids at least 1 hour before or 2 hours after itraconazole capsules. Avoid H2-blockers/PPIs if possible, or take capsules with an acidic beverage (e.g., cola). Note: Oral solution absorption is not affected by gastric pH. ♦ CYP3A4 Inducers (e.g., rifampin, phenytoin, phenobarbital, carbamazepine): Can significantly reduce itraconazole plasma levels, leading to reduced efficacy. Avoid concomitant use. ♦ Digoxin: Increased digoxin levels; monitor digoxin levels. ♦ Calcium Channel Blockers (e.g., dihydropyridines, verapamil): Increased levels of CCBs, increased risk of edema and CHF. ♦ Oral Hypoglycemic Agents: Enhanced hypoglycemic effect. ♦ Warfarin: Increased anticoagulant effect; monitor INR. ♦ Immunosuppressants (e.g., cyclosporine, tacrolimus, sirolimus): Increased levels of immunosuppressants; monitor drug levels. ♦ Colchicine: Increased colchicine toxicity.

Ivermectin (Stromectol)

Purpose/Indication	Ivermectin is an antiparasitic medication used to treat various parasitic infections in humans. Its primary indications include strongyloidiasis (threadworm infection) of the intestinal tract and onchocerciasis (river blindness). It is also used off-label or for scabies and lice infestations, particularly in cases resistant to conventional topical treatments.

Method of Action	Ivermectin acts by binding with high affinity to glutamate-gated chloride channels, which are present in invertebrate nerve and muscle cells of parasites. This binding leads to an increase in the permeability of the cell membrane to chloride ions, resulting in hyperpolarization of the cell and subsequent paralysis and death of the parasite. Ivermectin does not readily cross the mammalian blood-brain barrier, which contributes to its relative safety in humans.
Medication Name & Brand Names	♦ Medication Name: Ivermectin ♦ Brand Names: Stromectol (oral), Soolantra (topical for rosacea), Sklice (topical for lice), Ivermectin (generic)
Pharmaceutical Forms & Appearance	Ivermectin is available as oral tablets and various topical formulations (cream for rosacea, lotion for head lice). Oral tablets are typically white, round, and may be scored, with specific imprints. Topical creams and lotions are typically white to off-white.
Dosage & Administration	Dosage is dependent on the indication and the patient's weight, generally administered as a single oral dose for parasitic infections. For strongyloidiasis, it's typically 200 μg/kg as a single dose. For onchocerciasis, it's 150 μg/kg as a single dose, repeated every 3, 6, or 12 months. It should be taken with a full glass of water on an empty stomach (at least 1 hour before or 2 hours after a meal) for better absorption. For topical forms, follow product-specific instructions.
Supplied As	Ivermectin is supplied as: oral tablets (e.g., 3 mg), topical cream (1%), and topical lotion (0.5%).
Contraindications	Ivermectin is contraindicated in patients with known hypersensitivity to ivermectin or any component of the formulation. It is generally not recommended for use in pregnant or breastfeeding women unless absolutely necessary and the potential benefits outweigh the risks.
Storage & Expiry	Ivermectin tablets and topical formulations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and temporary, and often related to the dying parasites, including dizziness, nausea, diarrhea, pruritus (itching), rash, and asthenia (weakness). For onchocerciasis, Mazzotti reaction (fever, headache, myalgia, arthralgia, skin rash, pruritus, edema) can occur due to the death of microfilariae. More serious but less common side effects include orthostatic hypotension, seizures (rare), and liver function abnormalities (rare).
Warnings & Precautions	♦ Neurological Effects: Can cause dizziness and somnolence. Use with caution in patients with conditions affecting the blood-brain barrier (e.g., meningitis, trypanosomiasis). ♦ Mazzotti Reaction: For onchocerciasis, expect transient, mild to moderate reactions (fever, rash, headache, joint/muscle pain, lymphadenopathy) due to microfilarial destruction. These are usually self-limiting but can be severe. ♦ Pregnancy/Lactation: Generally avoid unless the need is clear. Small amounts are excreted in breast milk. ♦ Children: Safety and efficacy in children weighing less than 15 kg have not been established. ♦ Concurrent Medical Conditions: Use with caution in patients with hepatic impairment. ♦ Not for Viral Infections.
Missed Dose Instructions	Ivermectin is often given as a single dose for parasitic infections. If a single dose is missed, take it as soon as remembered. For regimens involving multiple doses over time (e.g., for onchocerciasis), follow the specific dosing schedule. Consistent adherence is important for parasitic eradication.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including rash, edema, headache, dizziness, asthenia, nausea, vomiting, diarrhea, and abdominal pain. More severe symptoms could include convulsions, ataxia, dyspnea, and paralytic effects. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ CNS Depressants (e.g., benzodiazepines, barbiturates, alcohol): Potential for increased CNS depression due to additive effects, though less common than with other antiparasitics. ♦ Warfarin: Isolated reports suggest possible enhancement of anticoagulant effect; monitor INR closely if co-administered, though data is limited. ♦ No other significant or commonly reported drug interactions are well-established for ivermectin. The primary concern for interactions is with other agents that affect the CNS or blood-brain barrier.

Kanamycin (Kantrex)

Purpose/Indication	Kanamycin is an aminoglycoside antibiotic primarily used to treat serious bacterial infections caused by susceptible Gram-negative bacteria. Its use is limited due to potential toxicity and the availability of newer agents. It is typically reserved for severe infections such as complicated urinary tract infections, bacteremia, septicemia, and some respiratory and skin infections, often when other less toxic antibiotics are ineffective or contraindicated. In some regions, it might be used in multi-drug resistant tuberculosis (MDR-TB) regimens.
Method of Action	Kanamycin exerts its bactericidal effect by irreversibly binding to the 30S ribosomal subunit of susceptible bacteria. This binding interferes with the initiation complex for protein synthesis, causes misreading of the mRNA template, and promotes premature termination of polypeptide chains. The resulting production of abnormal or non-functional proteins disrupts essential bacterial functions, leading to bacterial cell death.
Medication Name & Brand Names	♦ Medication Name: Kanamycin Sulfate ♦ Brand Names: Kantrex (historical, largely discontinued in many regions), Kanamycin (generic)
Pharmaceutical Forms & Appearance	Kanamycin is primarily available as a sterile powder for reconstitution into a solution for intravenous (IV) or intramuscular (IM) injection. It may also be found in some topical or ophthalmic preparations, but systemic use is the main consideration. The powder is typically white or off-white. The reconstituted solution is clear and colorless to pale yellow.
Dosage & Administration	Dosage is highly individualized and based on patient weight, renal function, and the severity and type of infection. It is usually administered by slow intravenous infusion or intramuscular injection. Typical adult doses for systemic infections are 15 mg/kg/day, divided into 2-3 doses. Dosing must be adjusted carefully in patients with impaired renal function, and therapeutic drug monitoring (measuring peak and trough levels) is often employed to optimize efficacy and minimize toxicity. The duration of therapy depends on the infection.
Supplied As	Kanamycin is supplied as: sterile powder for solution for injection (e.g., 500 mg, 1 g, 75 mg/2 mL vial for pediatric use).
Contraindications	Kanamycin is contraindicated in patients with known hypersensitivity to kanamycin or any other aminoglycoside antibiotic. It is also contraindicated in patients with pre-existing hearing loss or vestibular dysfunction, or severe renal impairment, unless the benefits clearly outweigh the very high risks and close monitoring is possible.
Storage & Expiry	Kanamycin powder for injection should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Once reconstituted, the solution should be used promptly or stored according to manufacturer guidelines (e.g., refrigerated for up to 24-48 hours depending on diluent). Always check the specific expiry date on the packaging.

Side Effects	Common side effects include injection site pain. However, kanamycin is well-known for serious and often irreversible toxicities. The most significant side effects are ototoxicity (damage to the inner ear, leading to hearing loss or vestibular dysfunction, often irreversible) and nephrotoxicity (kidney damage, ranging from mild dysfunction to acute renal failure). Other side effects include neuromuscular blockade (leading to respiratory depression or paralysis), hypersensitivity reactions, and gastrointestinal disturbances.
Warnings & Precautions	♦ Ototoxicity: Can cause irreversible bilateral or unilateral hearing loss (cochlear damage) and vestibular dysfunction. Risk is increased with higher doses, prolonged therapy, pre-existing renal impairment, advanced age, dehydration, and concomitant ototoxic drugs. Audiometric monitoring and vestibular function tests are essential before and during therapy. ♦ Nephrotoxicity: Can cause acute tubular necrosis, leading to acute kidney injury. Risk factors are similar to ototoxicity. Monitor renal function (serum creatinine, BUN, urine output) closely throughout treatment. Dosage adjustments are crucial. ♦ Neuromuscular Blockade: Can cause severe and prolonged respiratory depression or paralysis, especially in patients with neuromuscular disorders (e.g., myasthenia gravis) or those receiving neuromuscular blocking agents. ♦ Pregnancy: Aminoglycosides can cause fetal ototoxicity; generally avoided unless essential. ♦ Hydration: Maintain good hydration to prevent nephrotoxicity. ♦ Therapeutic Drug Monitoring (TDM): Monitoring peak and trough serum concentrations is strongly recommended to ensure therapeutic levels while minimizing toxicity. ♦ Concurrent Use with other toxic drugs: Avoid or use with extreme caution with other ototoxic, nephrotoxic, or neuromuscular blocking agents.
Missed Dose Instructions	Given the critical nature of serious infections and the need for precise dosing with aminoglycosides, missed doses should be reported to the healthcare provider immediately. Dosing regimens are usually timed to achieve specific peak and trough levels; missing a dose can impact efficacy and/or alter the drug's accumulation. Do not double a dose.
Overdose Instructions	Overdose with kanamycin typically manifests as severe ototoxicity, nephrotoxicity, and/or neuromuscular blockade (respiratory paralysis). Treatment is supportive and symptomatic. Hemodialysis or peritoneal dialysis can help remove kanamycin from the blood, especially in cases of severe renal impairment or life-threatening toxicity. Calcium salts may reverse neuromuscular blockade. Mechanical ventilation may be required for respiratory depression. Seek immediate emergency medical help.
Medicine Interactions	♦ Nephrotoxic Drugs (e.g., ciclosporin, amphotericin B, platinum-based chemotherapy like cisplatin, NSAIDs, vancomycin, loop diuretics): Significantly increased risk of nephrotoxicity. Avoid concurrent use or monitor renal function extremely closely. ♦ Ototoxic Drugs (e.g., loop diuretics like furosemide, ethacrynic acid; cisplatin, vancomycin): Significantly increased risk of ototoxicity. Avoid concurrent use or monitor hearing closely. ♦ Neuromuscular Blocking Agents (e.g., succinylcholine, rocuronium): Increased and prolonged neuromuscular blockade, leading to increased risk of respiratory depression or paralysis. Monitor closely. ♦ Other Aminoglycosides: Do not administer concurrently due to additive toxicity. ♦ Cephalosporins (especially cephalothin): Increased risk of nephrotoxicity with concomitant use. ♦ Potent Diuretics (e.g., furosemide): Can increase aminoglycoside levels and enhance ototoxicity.

Ketoconazole (Nizoral)

Purpose/Indication	Ketoconazole is an antifungal medication available in both topical and oral forms, though oral use is highly restricted due to significant safety concerns. Topically, it's widely used to treat superficial fungal infections of the skin like tinea corporis, tinea cruris, tinea pedis, and tinea versicolor, as well as seborrheic dermatitis. Oral ketoconazole is reserved for serious systemic fungal infections when alternative therapies are not available or tolerated, and for certain endocrine conditions like Cushing's syndrome off-label due to its ability to inhibit steroid synthesis.
Method of Action	Ketoconazole is an azole antifungal that inhibits the fungal cytochrome P450-dependent enzyme 14-a-demethylase. This enzyme is crucial for the biosynthesis of ergosterol, a primary component of the fungal cell membrane. By blocking ergosterol synthesis, ketoconazole disrupts the structure and function of the fungal cell membrane, leading to increased permeability, leakage of cellular contents, and inhibition of fungal growth (fungistatic) or cell death (fungicidal at higher concentrations).
Medication Name & Brand Names	♦ Medication Name: Ketoconazole ♦ Brand Names: Nizoral (oral, shampoo, cream), Extina (foam), Ketoconazole (generic)
Pharmaceutical Forms & Appearance	Ketoconazole is available as oral tablets, topical creams, topical gels, topical foams, and shampoos. Oral tablets are typically white, round, and may be scored. Topical creams are white and semi-solid, gels are clear, foams are white, and shampoos are typically orange-red.
Dosage & Administration	♦ Topical: Applied once or twice daily to the affected skin area for varying durations, depending on the infection. Shampoos are typically used 2-3 times per week for seborrheic dermatitis or tinea versicolor, then tapered. ♦ Oral: Due to significant risks, oral ketoconazole use is highly restricted. For severe systemic fungal infections, typical adult doses are 200 mg once daily, which may be increased to 400 mg daily if needed. Oral tablets require gastric acidity for absorption; take with food or an acidic beverage. Always adhere strictly to a healthcare professional's prescription for oral use.
Supplied As	Ketoconazole is supplied as: oral tablets (e.g., 200 mg), topical cream (2%), topical gel (2%), topical foam (2%), and shampoo (1%, 2%).
Contraindications	♦ Oral: Contraindicated in patients with acute or chronic liver disease, and concomitant use with numerous drugs that are potent CYP3A4 substrates and/or prolong the QT interval due to serious and potentially fatal interactions (e.g., certain statins, oral midazolam, cisapride, dofetilide, quinidine). Not for use in non-life-threatening fungal infections where safer alternatives exist. ♦ Topical: Contraindicated in patients with known hypersensitivity to ketoconazole or any component of the formulation.
Storage & Expiry	Ketoconazole products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	♦ Oral: The most significant side effects are severe hepatotoxicity (liver damage, including fatal cases) and adrenal insufficiency. Other common side effects include nausea, vomiting, abdominal pain, diarrhea, headache, and dizziness. Less common but serious effects include QT prolongation and severe allergic reactions. ♦ Topical: Local skin reactions like burning, itching, irritation, dry skin, and erythema are common but generally mild. Systemic side effects are rare with topical use.
Warnings & Precautions	♦ Oral: BLACK BOX WARNINGS: Severe hepatotoxicity (including fatal cases) has occurred. Not for use in fungal meningitis or for non-life-threatening infections. Use only when alternative antifungal therapies are not available or tolerated. Concomitant use with specific drugs that can cause QT prolongation and/or significant CYP3A4 inhibition is strictly contraindicated. Risk of adrenal insufficiency. Monitor liver function tests and adrenal function carefully. ♦ Topical: For external use only. Avoid contact with eyes. Discontinue if irritation develops. Minimal systemic absorption but caution with large surface areas or broken skin.

Missed Dose Instructions	♦ Oral: Adherence is critical for systemic fungal infections. If an oral dose is missed, take it as soon as remembered. However, if it's almost time for the next dose, skip the missed dose and continue the regular schedule. Do not double doses. Consult healthcare provider if multiple doses are missed. ♦ Topical: If a topical application is missed, apply it as soon as remembered. Then continue with the regular schedule. Do not apply a double amount.
Overdose Instructions	♦ Oral: Overdose can lead to exacerbation of side effects, particularly severe gastrointestinal upset, hepatotoxicity, and potentially adrenal insufficiency. Treatment is supportive and symptomatic. Gastric decontamination may be considered if recent. Ketoconazole is not removed by hemodialysis. Seek immediate medical attention. ♦ Topical: Acute topical overdose is highly unlikely to cause systemic toxicity due to minimal absorption. Excessive local application might increase skin irritation. Treatment is symptomatic.
Medicine Interactions	♦ Oral: Numerous Contraindicated Interactions (Potent CYP3A4 Inhibitor): Due to potent CYP3A4 inhibition, co-administration with many drugs is strictly contraindicated due to risk of significantly increased plasma levels and toxicity. Examples include: certain statins (lovastatin, simvastatin, atorvastatin), oral midazolam, triazolam, cisapride, dofetilide, quinidine, pimozide, ergot alkaloids, ranolazine, ticagrelor, ivabradine, felodipine. Refer to comprehensive drug interaction checker. ♦ Gastric Acid Reducers (e.g., antacids, H2-blockers, PPIs): Significantly reduce the absorption of oral ketoconazole. Administer antacids at least 1 hour before or 2 hours after ketoconazole. Avoid H2-blockers/PPIs if possible, or take with an acidic beverage (e.g., cola). ♦ CYP3A4 Inducers (e.g., rifampin, phenytoin, phenobarbital, carbamazepine): Can significantly reduce ketoconazole plasma levels, leading to reduced efficacy. Avoid concomitant use. ♦ Warfarin: Increased anticoagulant effect; monitor INR. ♦ Immunosuppressants (e.g., cyclosporine, tacrolimus, sirolimus): Increased levels of immunosuppressants; monitor drug levels. ♦ Digoxin, sulfonylureas, corticosteroids, calcium channel blockers, HIV protease inhibitors, certain oncology drugs: Levels may be increased; monitor and adjust doses. ♦ Topical: Systemic drug interactions are extremely rare and generally not clinically significant with topical formulations due to minimal absorption.

Ketorolac (Toradol)

Purpose/Indication	Ketorolac is a potent non-steroidal anti-inflammatory drug (NSAID) primarily used for the short-term (typically up to 5 days) management of moderately severe acute pain that requires analgesia at the opioid level. It is often used post-operatively or for acute musculoskeletal injuries when a non-opioid alternative is desired. It is available in oral, injectable (IM/IV), nasal, and ophthalmic forms, but systemic use for pain is generally restricted to short durations due to risk of serious side effects.
Method of Action	Ketorolac works by inhibiting cyclooxygenase (COX) enzymes, both COX-1 and COX-2, thereby preventing the synthesis of prostaglandins. Prostaglandins are lipid compounds that play a central role in mediating pain, inflammation, and fever. By reducing prostaglandin production, ketorolac effectively decreases inflammation, pain sensation, and swelling, providing potent analgesic effects.
Medication Name & Brand Names	♦ Medication Name: Ketorolac Tromethamine ♦ Brand Names: Toradol (injectable, oral, nasal), Acular (ophthalmic), Sprix (nasal), Ketorolac (generic)
Pharmaceutical Forms & Appearance	Ketorolac is available as oral tablets, solution for intramuscular (IM) and intravenous (IV) injection, nasal spray, and ophthalmic solution. Oral tablets are typically small, white or off-white, and often round or oval. The injectable solution is clear and colorless to pale yellow. The nasal spray is a clear solution. Ophthalmic solution is clear.
Dosage & Administration	Dosage and route of administration depend on the severity of pain and patient characteristics, with a maximum duration of 5 days for systemic use. For adults, typical IM/IV doses are 30 mg or 60 mg as a single dose, or 15-30 mg every 6 hours, not exceeding 120 mg/day for IM/IV and 40 mg/day for oral/nasal. Oral therapy usually follows injectable therapy. Take oral doses with food or milk to minimize GI upset. It is crucial to always use the lowest effective dose for the shortest possible duration.
Supplied As	Ketorolac is supplied as: oral tablets (e.g., 10 mg), solution for IM/IV injection (e.g., 15 mg/mL, 30 mg/mL, 60 mg/2mL), nasal spray (e.g., 15.75 mg/spray), and ophthalmic solution (e.g., 0.5%).
Contraindications	Ketorolac is strictly contraindicated for chronic use, in patients with a history of serious gastrointestinal bleeding or peptic ulcer disease, advanced renal impairment, cerebrovascular bleeding, or bleeding diatheses. It is also contraindicated in the setting of coronary artery bypass graft (CABG) surgery, before major surgery (due to bleeding risk), in women in labor and delivery, and in patients with known hypersensitivity to ketorolac, aspirin, or other NSAIDs. Concomitant use with other NSAIDs, aspirin, or probenecid is also contraindicated.
Storage & Expiry	Ketorolac products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Keep in tightly closed containers. Ophthalmic and nasal solutions should be protected from freezing. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, dyspepsia, abdominal pain, diarrhea), headache, dizziness, and injection site pain. More serious and potentially life-threatening side effects (which are emphasized due to its potent nature) include severe gastrointestinal bleeding, ulceration, or perforation, acute kidney injury, cardiovascular thrombotic events (e.g., heart attack, stroke), severe allergic reactions (including anaphylaxis, serious skin reactions), and liver injury.
Warnings & Precautions	♦ BLACK BOX WARNINGS: ♦ GI Risk: Increased risk of serious GI adverse events including bleeding, ulceration, and perforation of stomach or intestines, which can be fatal. Risk increases with duration. ♦ Cardiovascular Risk: Increased risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration. Contraindicated for pain after CABG surgery. ♦ Renal Risk: Can cause new onset or worsening of renal impairment, including acute renal failure. Contraindicated in advanced renal disease. ♦ Bleeding Risk: Can cause increased bleeding risk due to antiplatelet effects. Contraindicated before major surgery and in patients with bleeding disorders. ♦ Duration of Use: Limited to 5 days for combined (oral, IM, IV) duration in adults due to increased risk of serious adverse events with prolonged use. ♦ Children: Not recommended for children under 16 years. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Pregnancy: Avoid use in late pregnancy (third trimester).
Missed Dose Instructions	Ketorolac is typically used for short-term, acute pain. If a scheduled dose is missed, take it when remembered if pain warrants, adhering to the recommended dosing interval. Do not exceed the maximum daily dose or the 5-day treatment limit. Do not double a dose.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including severe gastrointestinal upset, metabolic acidosis, renal dysfunction, lethargy, drowsiness, nausea, vomiting, epigastric pain, and potentially more severe GI bleeding, acute renal failure, and respiratory depression. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate emergency medical help.

Medicine Interactions	♦ Anticoagulants (e.g., warfarin) & Antiplatelet agents (e.g., aspirin, clopidogrel): Significantly increased risk of bleeding. Concurrent use is generally contraindicated. ♦ Other NSAIDs: Concomitant use is contraindicated due to additive GI and renal toxicity, and no additional benefit. ♦ Probenecid: Significantly increases ketorolac plasma levels and half-life; concomitant use is contraindicated. ♦ Lithium: Increases serum lithium concentrations and toxicity; monitor lithium levels closely. ♦ Methotrexate: Increases methotrexate toxicity. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and significantly increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Corticosteroids: Increased risk of GI ulceration and bleeding. ♦ SSRIs: Increased risk of GI bleeding. ♦ Pentoxifylline: Increased risk of bleeding. ♦ Alcohol: Increased risk of GI bleeding and liver damage.

Labetalol (Normodyne)

Purpose/Indication	Labetalol is a combined alpha (α1) and beta (β1, β2) adrenergic blocker used to treat hypertension (high blood pressure). It is particularly useful for managing severe hypertension, hypertensive emergencies, and hypertension in pregnancy (including pre-eclampsia), as it rapidly lowers blood pressure without significantly affecting heart rate or cardiac output. It is also used in the long-term management of chronic hypertension.
Method of Action	Labetalol acts as a non-selective beta-adrenergic blocker (blocking β1 and β2 receptors) and a selective alpha-1 adrenergic blocker. By blocking β1 receptors in the heart, it reduces heart rate and myocardial contractility, decreasing cardiac output. Blockade of β2 receptors causes some bronchoconstriction. Crucially, its α1 blockade leads to vasodilation of peripheral blood vessels, reducing total peripheral resistance. The combination of these actions results in a reduction in blood pressure with less reflex tachycardia compared to pure vasodilators, and without the profound bradycardia seen with pure beta-blockers.
Medication Name & Brand Names	♦ Medication Name: Labetalol Hydrochloride ♦ Brand Names: Normodyne (historical), Trandate (historical), Labetalol (generic)
Pharmaceutical Forms & Appearance	Labetalol is available as oral tablets and solution for intravenous (IV) injection. Oral tablets are typically white, round, or capsule-shaped, and may be scored, with various imprints. The IV solution is clear and colorless.
Dosage & Administration	Dosage varies significantly by route and indication. For oral hypertension, initial adult doses are typically 100 mg twice daily, increasing gradually to a usual maintenance range of 200 mg to 400 mg twice daily, with a maximum of 1200 mg to 2400 mg per day. For hypertensive emergencies, IV bolus doses (e.g., 20 mg initially, then 40-80 mg every 10-20 minutes) or continuous IV infusion are used. Oral doses can be taken with or without food, but food may enhance bioavailability.
Supplied As	Labetalol is supplied as: oral tablets (e.g., 100 mg, 200 mg, 300 mg) and solution for intravenous injection (e.g., 5 mg/mL in 20 mL vials, 20 mg/4 mL pre-filled syringes).
Contraindications	Labetalol is contraindicated in patients with known hypersensitivity to labetalol or any component of the formulation. It is also contraindicated in patients with bronchial asthma, overt cardiac failure, greater than first-degree heart block (unless a pacemaker is in place), cardiogenic shock, and severe bradycardia.
Storage & Expiry	Labetalol tablets and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Do not freeze IV solution. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, fatigue, nausea, headache, and orthostatic hypotension (dizziness upon standing). Due to its alpha-blocking effects, transient scalp tingling may occur with initial doses. More serious side effects include symptomatic bradycardia, heart block, worsening heart failure, bronchospasm, and liver injury.
Warnings & Precautions	♦ Hypotension/Orthostatic Hypotension: Can cause symptomatic postural hypotension, especially with initial doses or IV administration. Patients should be advised to rise slowly. ♦ Bradycardia/Heart Block/Heart Failure: Can exacerbate bradycardia, heart block, or precipitate/worsen heart failure. Use with caution in patients with cardiac disease. Discontinue if signs of cardiac failure appear. ♦ Bronchospasm: As a non-selective beta-blocker, it can cause bronchospasm, particularly in patients with asthma or COPD. Avoid in patients with bronchial asthma. ♦ Hepatic Injury: Rare but serious liver injury, including fatal cases, has been reported. Monitor liver function periodically. ♦ Perioperative Risk: Risk of exaggerated hypotensive response with certain anesthetics. Inform anesthetist of labetalol use. ♦ Diabetes: Can mask symptoms of hypoglycemia (e.g., tachycardia) and prolong recovery from hypoglycemia. Use with caution in diabetic patients. ♦ Thyrotoxicosis: Can mask symptoms of hyperthyroidism. Abrupt withdrawal can precipitate thyroid storm. ♦ Pheochromocytoma: Use with caution as it has both alpha and beta blocking activity. An alpha-blocker should be initiated prior to any beta-blocker. ♦ Abrupt Withdrawal: Do not abruptly discontinue therapy in patients with coronary artery disease, as it can exacerbate angina or precipitate myocardial infarction. Taper dose gradually over 1-2 weeks.
Missed Dose Instructions	For chronic hypertension, if a dose of Labetalol (oral) is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining blood pressure control.
Overdose Instructions	Overdose symptoms are primarily related to exaggerated pharmacological effects, including severe hypotension, profound bradycardia, heart block, cardiac failure, bronchospasm, and possibly seizures. Treatment is supportive and symptomatic. For severe bradycardia or heart block, atropine, glucagon, or a pacemaker may be needed. For hypotension, IV fluids and vasopressors are indicated. Bronchospasm may require beta-agonists. Labetalol is not effectively removed by hemodialysis. Seek immediate emergency medical help.
Medicine Interactions	♦ Other Antihypertensives: Additive hypotensive effects. Dose adjustment may be needed. ♦ Calcium Channel Blockers (e.g., verapamil, diltiazem): Increased risk of bradycardia, heart block, and hypotension. Use with caution. ♦ Digoxin: Can increase digoxin levels; monitor digoxin levels. ♦ Beta-Agonists (e.g., albuterol, epinephrine): Labetalol can blunt the bronchodilator effects of beta-agonists. ♦ NSAIDs: May reduce the antihypertensive effect of labetalol. ♦ Cimetidine: May increase labetalol bioavailability. ♦ Tricyclic Antidepressants (TCAs): Increased risk of tremor. ♦ Anesthetics (general): May potentiate the hypotensive effect of labetalol. Inform anesthetist of labetalol use. ♦ MAO Inhibitors: Concurrent use generally not recommended due to possible severe hypertension or hypotension.

Laxatives (Bisacodyl) (Dulcolax)

Purpose/Indication	Bisacodyl is a stimulant laxative used for the short-term relief of occasional constipation and for bowel preparation before medical procedures (e.g., colonoscopy, surgery). It promotes bowel movements by directly stimulating the muscles in the intestines, helping to produce a bowel movement usually within 6-12 hours for oral forms, and 15-60 minutes for rectal forms.

Method of Action	Bisacodyl acts primarily by directly stimulating the nerve endings in the colonic mucosa. This stimulation increases peristalsis (muscle contractions) of the colon, accelerating the movement of stool through the intestines. It also increases the accumulation of water and electrolytes in the colonic lumen, which helps to soften the stool and facilitate its passage, making it easier to evacuate.
Medication Name & Brand Names	♦ Medication Name: Bisacodyl ♦ Brand Names: Dulcolax, Correctol, Feen-a-Mint, Bisacodyl (generic)
Pharmaceutical Forms & Appearance	Bisacodyl is available as oral tablets (enteric-coated) and rectal suppositories. Oral tablets are typically small, yellow or pink, and sugar-coated or enteric-coated to prevent dissolution in the stomach. Rectal suppositories are whitish, torpedo-shaped.
Dosage & Administration	For occasional constipation, the usual adult oral dose is 5-15 mg once daily, preferably at bedtime. For rectal suppositories, the usual adult dose is 10 mg once daily. For bowel preparation, higher doses may be used as directed by a healthcare professional. Oral tablets should be swallowed whole and not chewed or crushed. Do not take within 1 hour of antacids, milk, or dairy products, as this can cause the enteric coating to dissolve prematurely, leading to stomach irritation.
Supplied As	Bisacodyl is supplied as: enteric-coated oral tablets (e.g., 5 mg), and rectal suppositories (e.g., 10 mg).
Contraindications	Bisacodyl is contraindicated in patients with known hypersensitivity to bisacodyl or any component of the formulation. It is also contraindicated in patients with acute abdominal pain, appendicitis, intestinal obstruction, undiagnosed rectal bleeding, severe dehydration, or inflammatory bowel disease (e.g., Crohn's disease, ulcerative colitis).
Storage & Expiry	Bisacodyl tablets and suppositories should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Suppositories should be kept cool, but generally do not require refrigeration. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include abdominal discomfort, cramping, nausea, diarrhea, and rectal irritation (with suppositories). Prolonged or excessive use can lead to electrolyte imbalances (e.g., hypokalemia), fluid loss, dehydration, and laxative dependence or "lazy bowel" syndrome, where the bowel becomes reliant on laxatives for function.
Warnings & Precautions	♦ Short-term Use Only: Intended for short-term relief of occasional constipation. Prolonged daily use can lead to dependence, electrolyte imbalance, and loss of normal bowel function. ♦ Fluid and Electrolyte Imbalance: Excessive use can lead to significant fluid and electrolyte disturbances, particularly hypokalemia and dehydration. ♦ Abdominal Pain: Do not use if severe abdominal pain, nausea, or vomiting is present, as these may indicate a serious condition. ♦ Rectal Bleeding: Discontinue use and consult a doctor if rectal bleeding occurs or if a bowel movement does not occur after use. ♦ Children: Use in children should only be under medical supervision. ♦ Swallow Tablets Whole: Do not chew, crush, or break enteric-coated tablets to avoid stomach irritation. ♦ Avoid Milk/Antacids: Do not take within one hour of milk, dairy products, or antacids due to premature dissolution of the enteric coating.
Missed Dose Instructions	Bisacodyl is typically used as needed for constipation. If a dose is missed, take it when remembered if constipation persists and it is within the recommended dosing interval. However, do not double a dose. For bowel preparation, adhere strictly to the prescribed regimen.
Overdose Instructions	Overdose symptoms are primarily severe abdominal cramping, pain, and profuse watery diarrhea, leading to significant fluid and electrolyte losses (especially hypokalemia). Chronic overdose can result in steatorrhea, kidney stones, and bone damage. Treatment is supportive and symptomatic, focusing on fluid and electrolyte replacement. In severe cases, intravenous fluids may be needed. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Antacids, Milk, Dairy Products: Can cause the enteric coating of oral bisacodyl tablets to dissolve prematurely, leading to gastric or duodenal irritation, cramping, and vomiting. Do not administer within 1 hour of taking bisacodyl. ♦ Diuretics (especially loop or thiazide diuretics) and Corticosteroids: Increased risk of electrolyte imbalance (particularly hypokalemia) when combined with long-term or excessive use of bisacodyl due to enhanced potassium loss. ♦ Cardiac Glycosides (e.g., digoxin): Hypokalemia induced by laxative abuse can potentiate the effects of cardiac glycosides, increasing the risk of toxicity. ♦ Other Laxatives: Concomitant use with other laxatives can increase the risk of adverse effects, including severe dehydration and electrolyte imbalance.

Levetiracetam (Keppra)

Purpose/Indication	Levetiracetam is an antiepileptic drug (AED) used to treat various types of seizures in adults and children. It is indicated for the adjunctive treatment of partial-onset seizures, myoclonic seizures in patients with juvenile myoclonic epilepsy, and primary generalized tonic-clonic seizures. It can also be used as monotherapy for partial-onset seizures in certain cases.
Method of Action	The precise mechanism of action of levetiracetam is not fully understood, but it differs from that of other antiepileptic drugs. It is believed to exert its anticonvulsant effects by modulating synaptic vesicle glycoprotein 2A (SV2A), a protein found on presynaptic vesicles. This interaction is thought to reduce neurotransmitter release, thereby stabilizing neuronal activity and preventing excessive neuronal firing without directly affecting traditional ion channels or neurotransmitter receptors.
Medication Name & Brand Names	♦ Medication Name: Levetiracetam ♦ Brand Names: Keppra (immediate-release and extended-release), Elepsia XR, Roweepra, Levetiracetam (generic)
Pharmaceutical Forms & Appearance	Levetiracetam is available as oral tablets (immediate and extended-release), oral solution, and solution for intravenous (IV) injection. Oral tablets vary in color and shape (e.g., blue, yellow, white, oval), often with specific imprints. The oral solution is a clear, colorless to yellowish liquid. The IV solution is clear and colorless.
Dosage & Administration	Dosage is individualized based on seizure type, patient age, renal function, and response, typically starting low and titrating upwards. For adults, common starting doses for immediate-release tablets are 500 mg twice daily, increasing to usual maintenance doses of 1000 mg to 3000 mg twice daily. Extended-release tablets are given once daily. The oral solution is used for patients who cannot swallow tablets. IV administration is an alternative for patients temporarily unable to take oral medication.
Supplied As	Levetiracetam is supplied as: oral immediate-release tablets (e.g., 250 mg, 500 mg, 750 mg, 1000 mg), oral extended-release tablets (e.g., 500 mg, 750 mg), oral solution (e.g., 100 mg/mL), and solution for intravenous injection (e.g., 500 mg/5 mL vial, 1500 mg/15 mL vial).
Contraindications	Levetiracetam is contraindicated in patients with known hypersensitivity to levetiracetam or any component of the formulation.
Storage & Expiry	Levetiracetam tablets, oral solution, and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.

Side Effects	Common side effects include somnolence (drowsiness), asthenia (weakness), dizziness, behavioral abnormalities (e.g., irritability, aggression, mood swings, anxiety, depression), and nasopharyngitis. More serious but less common side effects include psychiatric and behavioral changes (including psychotic symptoms, suicidal ideation), hematologic abnormalities (e.g., neutropenia, leukopenia), coordination difficulties, and Stevens-Johnson syndrome (rare).
Warnings & Precautions	♦ Neuropsychiatric Adverse Reactions: Can cause behavioral abnormalities (e.g., agitation, hostility, anxiety, apathy, mood swings, depression, psychosis), and suicidal ideation/behavior. Monitor patients for these changes. Advise patients and caregivers to report new or worsening psychiatric symptoms. ♦ Somnolence and Ataxia: Can cause dose-related drowsiness and coordination difficulties. Advise caution with driving or operating machinery, especially during initiation or dose escalation. ♦ Withdrawal Seizures: Antiepileptic drugs should generally not be discontinued abruptly, as this can increase seizure frequency. Taper dose gradually. ♦ Renal Impairment: Requires dose adjustment in patients with impaired renal function due to renal elimination. Monitor renal function. ♦ Hematologic Abnormalities: Rare reports of decreased red blood cell count, white blood cell count, and platelet count. Monitor complete blood counts periodically. ♦ Stevens-Johnson Syndrome (SJS)/Toxic Epidermal Necrolysis (TEN): Rare but serious and potentially fatal skin reactions have been reported. Discontinue at first sign of rash unless clearly not drug-related. ♦ Pregnancy: Data suggests risk of major congenital malformations and adverse pregnancy outcomes; use only if benefits outweigh risks.
Missed Dose Instructions	For chronic seizure management, if a dose of Levetiracetam is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is very important for maintaining seizure control.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including somnolence, agitation, aggression, decreased level of consciousness, respiratory depression, and coma. Treatment is supportive and symptomatic. There is no specific antidote. Hemodialysis can remove approximately 50% of levetiracetam from the body. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ No significant or widely reported drug-drug interactions with levetiracetam, unlike many other AEDs. Levetiracetam is minimally metabolized by the CYP450 system and does not significantly induce or inhibit these enzymes. ♦ Methotrexate: Decreased clearance of methotrexate has been reported with concomitant levetiracetam, leading to increased methotrexate concentrations. Monitor methotrexate levels. ♦ Oral Contraceptives: Levetiracetam does not appear to affect the efficacy of oral contraceptives. ♦ Other Antiepileptic Drugs: No significant pharmacokinetic interactions with commonly used AEDs. However, additive CNS depressant effects (e.g., somnolence, dizziness) can occur if taken with other CNS depressants or alcohol.

Levofloxacin (Levaquin)

Purpose/Indication	Levofloxacin is a fluoroquinolone antibiotic used to treat a wide range of bacterial infections. It is indicated for infections such as community-acquired pneumonia, acute bacterial exacerbation of chronic bronchitis, acute bacterial sinusitis, urinary tract infections (complicated and uncomplicated), pyelonephritis, chronic bacterial prostatitis, complicated skin and skin structure infections, and inhalational anthrax (post-exposure). Its broad spectrum makes it effective against various Gram-positive and Gram-negative bacteria.
Method of Action	Levofloxacin works by inhibiting bacterial DNA gyrase (topoisomerase II) and topoisomerase IV, enzymes essential for bacterial DNA replication, transcription, repair, and recombination. By blocking these enzymes, levofloxacin causes breaks in bacterial DNA, leading to cell death (bactericidal action). This mechanism distinguishes it from other antibiotic classes and contributes to its broad spectrum of activity.
Medication Name & Brand Names	♦ Medication Name: Levofloxacin ♦ Brand Names: Levaquin (USA - brand discontinued but widely known), Tavanic (regional), Levofloxacin (generic)
Pharmaceutical Forms & Appearance	Levofloxacin is available as oral tablets, an oral solution, and a solution for intravenous (IV) infusion. Oral tablets are typically film-coated, oblong, and may vary in color (e.g., yellowish-white) and imprint depending on strength. The oral solution is clear and colorless to yellowish. The IV solution is clear and pale yellow.
Dosage & Administration	Dosage varies significantly by indication, patient's renal function, and type of infection, typically ranging from 250 mg to 750 mg once daily. For uncomplicated UTIs, 250 mg once daily for 3 days is common. For community-acquired pneumonia, 500 mg or 750 mg once daily for 5-14 days. For skin infections, 500 mg once daily for 7-14 days. IV and oral dosages are typically interchangeable. Oral tablets can be taken with or without food. Avoid taking with antacids, iron supplements, or dairy products due to absorption interference. Complete the full prescribed course.
Supplied As	Levofloxacin is supplied as: oral tablets (e.g., 250 mg, 500 mg, 750 mg), oral solution (e.g., 25 mg/mL), and solution for intravenous infusion (e.g., 250 mg/50 mL, 500 mg/100 mL, 750 mg/150 mL in flexible containers).
Contraindications	Levofloxacin is strictly contraindicated in patients with known hypersensitivity to levofloxacin, other fluoroquinolones, or any component of the formulation. It is also contraindicated in patients with a history of tendinitis or tendon rupture associated with fluoroquinolone use.
Storage & Expiry	Levofloxacin oral tablets, oral solution, and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Oral solution should not be refrigerated. IV solutions should be protected from excessive heat and freezing. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, diarrhea, headache, insomnia, and dizziness. More serious and often emphasized side effects (due to black box warnings) include tendinitis and tendon rupture, peripheral neuropathy, and central nervous system effects. Other serious but less common side effects include QT prolongation, Clostridioides difficile-associated diarrhea (CDAD), hypoglycemia/hyperglycemia, and severe hypersensitivity reactions (e.g., anaphylaxis, Stevens-Johnson Syndrome).
Warnings & Precautions	♦ BLACK BOX WARNING: Tendinitis and Tendon Rupture: Fluoroquinolones, including levofloxacin, are associated with an increased risk of tendinitis and tendon rupture in all ages. This risk is higher in older patients, those on corticosteroids, and those with kidney, heart, or lung transplants. Discontinue at the first sign of tendon pain or inflammation. ♦ BLACK BOX WARNING: Peripheral Neuropathy: Fluoroquinolones can cause peripheral neuropathy, a potentially permanent nerve damage, which can occur rapidly. Discontinue if symptoms of neuropathy (pain, burning, tingling, numbness, weakness) develop. ♦ BLACK BOX WARNING: Central Nervous System Effects: Fluoroquinolones are associated with an increased risk of psychiatric adverse reactions (e.g., hallucinations, anxiety, depression, suicidal thoughts) and seizures. Use with caution in patients with CNS disorders. ♦ BLACK BOX WARNING: Exacerbation of Myasthenia Gravis: Fluoroquinolones may exacerbate muscle weakness in patients with myasthenia gravis. Avoid in patients with a known history of myasthenia gravis. ♦ Aortic Aneurysm and Dissection: Increased risk reported, especially in elderly patients. Use with caution in patients with a history of aortic aneurysm. ♦ QT Prolongation: Can prolong the QT interval on ECG, increasing the risk of potentially fatal arrhythmias (torsades de pointes). Avoid in patients with known QT prolongation, uncorrected hypokalemia/hypomagnesemia, or concomitant Class IA/III antiarrhythmics. ♦ Hypoglycemia/Hyperglycemia: Can cause severe blood sugar disturbances, especially in diabetic patients. Monitor blood glucose. ♦ Photosensitivity: Can cause moderate to severe photosensitivity reactions. Advise patients to avoid excessive sun exposure and use sunscreen. ♦ Clostridioides difficile-associated Diarrhea (CDAD): Can occur. ♦ Renal Impairment: Dose adjustment is necessary. ♦ Drug Resistance: Use responsibly and reserve for appropriate indications.

Missed Dose Instructions	If a dose of Levofloxacin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course of antibiotics is crucial for effective bacterial eradication and preventing the development of drug resistance and relapse of infection.
Overdose Instructions	Overdose symptoms are typically exaggerated side effects, including CNS effects (confusion, dizziness, seizures), prolonged QT interval, and gastrointestinal upset (nausea, vomiting). There is no specific antidote for levofloxacin. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Maintain adequate hydration. ECG monitoring is important. Levofloxacin is not effectively removed by hemodialysis or peritoneal dialysis. Seek immediate emergency medical help.
Medicine Interactions	♦ Antacids (containing magnesium, aluminum), Sucralfate, Didanosine (chewable/buffered tablets), Iron Supplements, Zinc Supplements: Form insoluble chelates with levofloxacin, significantly reducing its absorption. Administer levofloxacin at least 2 hours before or 2 hours after these agents. ♦ Dairy Products: Can reduce oral absorption due to calcium content. Take levofloxacin at least 2 hours before or after consuming dairy products. ♦ Warfarin: May enhance the anticoagulant effect of warfarin, increasing the risk of bleeding. Monitor INR closely. ♦ Antiarrhythmics (Class IA e.g., quinidine, procainamide; Class III e.g., amiodarone, sotalol), Tricyclic Antidepressants, Macrolides, Antipsychotics: Increased risk of QT prolongation and torsades de pointes. Avoid concomitant use. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): May increase the risk of CNS stimulation and convulsive seizures when used concurrently with fluoroquinolones. ♦ Corticosteroids: Concomitant use significantly increases the risk of tendinitis and tendon rupture. ♦ Cyclosporine: May increase cyclosporine levels. ♦ Oral Hypoglycemics (e.g., sulfonylureas, insulin): Can cause dysglycemia (hypoglycemia or hyperglycemia), sometimes severe. Monitor blood glucose closely. ♦ Cimetidine/Probenecid: Can reduce renal clearance of levofloxacin, potentially increasing its levels and adverse effects. ♦ Theophylline: May increase theophylline levels.

Levothyroxine (Synthroid)

Purpose/Indication	Levothyroxine is a synthetic thyroid hormone (T4) used primarily for thyroid hormone replacement therapy. It is indicated for the treatment of hypothyroidism (underactive thyroid gland) of any etiology, including primary (thyroidal), secondary (pituitary), and tertiary (hypothalamic) hypothyroidism, and subclinical hypothyroidism. It is also used as an adjunct to surgery and radioiodine therapy in the management of thyroid-stimulating hormone (TSH)-dependent well-differentiated thyroid cancer (to suppress TSH production) and for diffuse goiter.
Method of Action	Levothyroxine sodium is a synthetic form of L-thyroxine (T4), which is identical to the naturally occurring hormone produced by the thyroid gland. Once administered, it is deiodinated in peripheral tissues to form L-triiodothyronine (T3), the active form of thyroid hormone. T3 then enters the cell nucleus and binds to thyroid hormone receptors, which then bind to DNA and activate gene transcription. This process regulates various cellular metabolic processes, including metabolism, growth, and development, thereby restoring normal thyroid function.
Medication Name & Brand Names	♦ Medication Name: Levothyroxine Sodium ♦ Brand Names: Synthroid, Levoxyl, Euthyrox, Unithroid, Tirosint, Levothyroxine (generic)
Pharmaceutical Forms & Appearance	Levothyroxine is available as oral tablets, oral capsules (gelatin-based), and oral solution. Tablets vary widely in color, shape, and imprint depending on the manufacturer and strength, often with different colors for different strengths. Capsules are typically softgels. The oral solution is clear and colorless.
Dosage & Administration	Dosage is highly individualized and determined by the patient's age, weight, cardiovascular status, concomitant medications, and especially TSH levels. It is typically administered once daily in the morning, preferably 30-60 minutes before breakfast, on an empty stomach, and at least 4 hours apart from calcium, iron, antacids, or other medications that can interfere with absorption. Adherence to a consistent administration time and method is crucial for stable hormone levels.
Supplied As	Levothyroxine is supplied as: oral tablets (numerous strengths, e.g., 25 mcg to 300 mcg), oral capsules (e.g., 13 mcg to 150 mcg), and oral solution (e.g., 20 mcg/mL, 100 mcg/mL). (mcg & µg = micrograms)
Contraindications	Levothyroxine is contraindicated in patients with known hypersensitivity to levothyroxine or any component of the formulation. It is also contraindicated in patients with uncorrected adrenal insufficiency (unless adequately treated), untreated thyrotoxicosis, or acute myocardial infarction.
Storage & Expiry	Levothyroxine tablets, capsules, and solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging. Due to sensitivity to light, moisture, and temperature, improper storage can reduce potency.
Side Effects	Side effects are generally related to excessive dosage and symptoms of hyperthyroidism (overactive thyroid). Common side effects include palpitations, tachycardia, arrhythmias, tremors, nervousness, insomnia, weight loss, heat intolerance, excessive sweating, and diarrhea. Serious but less common side effects can include angina, myocardial infarction, heart failure, seizures, and osteoporosis (with long-term overtreatment).
Warnings & Precautions	♦ Cardiac Toxicity: Use with extreme caution in patients with cardiovascular disease (e.g., angina, arrhythmias, coronary artery disease, hypertension, elderly patients), as thyroid hormone replacement can exacerbate or precipitate cardiac symptoms. Start with low doses and titrate slowly. ♦ Adrenal Insufficiency: Must be corrected before initiating levothyroxine therapy, as thyroid hormone replacement can precipitate an acute adrenal crisis. ♦ Thyrotoxicosis: Avoid overtreatment, as it can lead to symptoms of hyperthyroidism, reduce bone mineral density (leading to osteoporosis), and increase cardiovascular risk. Regular monitoring of TSH and free T4 levels is crucial. ♦ Diabetes Mellitus: Thyroid hormone replacement may increase blood glucose levels and insulin requirements. Monitor diabetic patients closely. ♦ Myxedema Coma: IV levothyroxine is preferred for this life-threatening hypothyroid state. ♦ Other Conditions: Use with caution in patients with pituitary insufficiency, malabsorption syndromes, or those undergoing surgery. ♦ Infertility: Untreated hypothyroidism can cause infertility. ♦ Brand Consistency: Patients should generally stick to the same brand and formulation of levothyroxine due to potential differences in bioavailability, which could affect TSH levels. Any change should be monitored with TSH testing.
Missed Dose Instructions	If a dose of Levothyroxine is missed, take it as soon as remembered. However, if it's close to the time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Taking two doses in one day may temporarily elevate thyroid hormone levels. Consistent daily administration is critical for maintaining stable thyroid hormone levels.
Overdose Instructions	Acute or chronic overdose symptoms are indicative of hyperthyroidism, including palpitations, tachycardia, arrhythmias, tremors, nervousness, insomnia, excessive sweating, heat intolerance, weight loss, and diarrhea. In severe cases, cardiovascular complications (angina, myocardial infarction, heart failure), seizures, or even death can occur. Treatment is supportive and symptomatic. Beta-blockers may be used to control cardiovascular symptoms. Antithyroid drugs (e.g., propylthiouracil) may be considered in severe cases, but their benefit is limited due to the slow onset of action. Gastric decontamination (e.g., activated charcoal) may be considered if recent. Seek immediate emergency medical help.

Medicine Interactions	♦ Calcium Carbonate, Iron Supplements, Antacids (aluminum- or magnesium-containing), Sucralfate, Bile Acid Sequestrants (e.g., cholestyramine, colestipol), Proton Pump Inhibitors (PPIs), Soy Products: These can significantly decrease the absorption of levothyroxine from the GI tract. Administer levothyroxine at least 4 hours apart from these agents (and often longer for some, like bile acid sequestrants). ♦ Thyroid Hormone Binding Proteins (e.g., estrogens, oral contraceptives, selective estrogen receptor modulators): Can increase serum thyroid binding globulin (TBG) levels, requiring an increase in levothyroxine dose. ♦ CYP450 Inducers (e.g., rifampin, phenytoin, carbamazepine, phenobarbital): Can increase the metabolism of levothyroxine, potentially requiring a higher dose. ♦ Anticoagulants (e.g., warfarin): Thyroid hormones can enhance the anticoagulant effect of warfarin, increasing bleeding risk. Monitor INR closely and adjust warfarin dose. ♦ Beta-Blockers: May reduce the effect of beta-blockers, particularly those that inhibit T4 to T3 conversion (e.g., propranolol). ♦ Antidiabetic Agents (e.g., insulin, oral hypoglycemics): Levothyroxine can increase blood glucose levels, potentially requiring an increase in antidiabetic medication dosage. ♦ Amiodarone: Can cause both hypothyroidism and hyperthyroidism, and can affect thyroid hormone metabolism. ♦ Sertraline, Chloral Hydrate, Furosemide (high dose): May displace thyroid hormones from binding proteins.

Linezolid (Zyvox)

Purpose/Indication	Linezolid is an oxazolidinone antibiotic used to treat serious infections caused by susceptible Gram-positive bacteria, particularly those resistant to other antibiotics. It is indicated for nosocomial pneumonia, community-acquired pneumonia, complicated skin and skin structure infections, and vancomycin-resistant Enterococcus faecium (VRE) infections. It is a crucial agent against methicillin-resistant Staphylococcus aureus (MRSA) and VRE.
Method of Action	Linezolid acts by inhibiting bacterial protein synthesis through a unique mechanism. It binds to the 23S ribosomal RNA of the 50S ribosomal subunit, preventing the formation of the 70S initiation complex, which is essential for bacterial translation. This action leads to a bacteriostatic effect against many Gram-positive organisms (e.g., enterococci, staphylococci) and a bactericidal effect against some (e.g., streptococci), preventing bacterial growth and replication.
Medication Name & Brand Names	♦ Medication Name: Linezolid ♦ Brand Names: Zyvox, Linezolid (generic)
Pharmaceutical Forms & Appearance	Linezolid is available as oral tablets, oral suspension, and solution for intravenous (IV) infusion. Oral tablets are typically white to off-white, film-coated, and oval-shaped, with various imprints. The oral suspension is an orange-flavored, white to off-white opaque liquid. The IV solution is clear and colorless to pale yellow.
Dosage & Administration	Dosage is typically 600 mg every 12 hours for adults, regardless of the route of administration (oral or IV). It can be given with or without food. Duration of therapy varies by infection type and severity, usually ranging from 10 to 28 days. No dosage adjustment is required for mild to moderate renal or hepatic impairment, but caution and close monitoring are advised in severe cases.
Supplied As	Linezolid is supplied as: oral film-coated tablets (e.g., 600 mg), oral suspension (e.g., 100 mg/5 mL powder for reconstitution), and solution for intravenous infusion (e.g., 2 mg/mL in 300 mL flexible bags).
Contraindications	Linezolid is contraindicated in patients with known hypersensitivity to linezolid or any component of the formulation. It is also contraindicated in patients currently taking or who have taken monoamine oxidase inhibitors (MAOIs) within two weeks, due to the risk of serotonin syndrome.
Storage & Expiry	Linezolid tablets and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Oral suspension powder should be stored at room temperature, and once reconstituted, the suspension is stable for a specific period (e.g., 21 days) when stored at room temperature. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include diarrhea, headache, nausea, vomiting, constipation, and taste alteration. More serious but less common side effects include myelosuppression (e.g., thrombocytopenia, anemia, leukopenia), peripheral and optic neuropathy (especially with prolonged use), serotonin syndrome, lactic acidosis, and C. difficile-associated diarrhea.
Warnings & Precautions	♦ Myelosuppression: Can cause reversible myelosuppression (thrombocytopenia, anemia, leukopenia, pancytopenia), particularly with prolonged use (more than 2 weeks). Complete blood counts should be monitored weekly, especially in patients at increased risk. ♦ Peripheral and Optic Neuropathy: Reported with prolonged linezolid use (usually > 28 days). Patients should be advised to report changes in vision or sensation (e.g., numbness, tingling). Monitor visual function if signs occur. ♦ Serotonin Syndrome: Linezolid is a reversible, non-selective MAOI. Concurrent use with serotonergic agents (e.g., SSRIs, SNRIs, TCAs, triptans, tramadol, meperidine) can lead to serotonin syndrome. Avoid co-administration; if unavoidable, monitor closely. ♦ Lactic Acidosis: Cases of lactic acidosis have been reported. Monitor for symptoms (e.g., nausea, vomiting, abdominal pain, hyperventilation). ♦ Hypoglycemia: Can cause hypoglycemia in diabetic patients taking insulin or oral hypoglycemic agents. ♦ Clostridioides difficile-associated diarrhea (CDAD): Can occur with nearly all antibacterial agents, including linezolid. ♦ Hypertension: May cause a reversible increase in blood pressure due to its MAOI activity; caution with pressor agents. ♦ Children: Safety and efficacy in pediatric patients are similar to adults, but careful monitoring is warranted.
Missed Dose Instructions	For chronic infections requiring regular dosing, if a dose of Linezolid is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent dosing is crucial for effective antibiotic therapy.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including increased gastrointestinal upset, headache, and potential for more severe myelosuppression, neuropathy, or serotonin syndrome. Treatment is supportive and symptomatic. There is no specific antidote. Hemodialysis may remove some linezolid, but it is not highly effective. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Monoamine Oxidase Inhibitors (MAOIs) and Serotonergic Agents (e.g., SSRIs, SNRIs, TCAs, triptans, tramadol, meperidine, dextromethorphan): Concomitant use is contraindicated or requires extreme caution due to the risk of serotonin syndrome (fever, rigidity, myoclonus, autonomic instability, mental status changes). Allow a 2-week washout period before starting linezolid after an MAOI. ♦ Vasopressors (e.g., dopamine, epinephrine, norepinephrine): Linezolid may potentiate the pressor effects of these agents due to its MAOI activity, potentially leading to increased blood pressure. Dose reduction of vasopressors may be needed. ♦ Tyramine-containing Foods/Beverages: Advise patients to avoid large quantities of tyramine-rich foods (e.g., aged cheese, fermented meats, tap beers, red wine) due to potential for hypertensive crisis, though the risk is lower than with irreversible MAOIs. ♦ Pseudoephedrine/Phenylpropanolamine: Increased risk of hypertension. ♦ Rifampin: Can decrease linezolid concentrations, potentially reducing efficacy. Consider alternative antibiotics if possible.

Lisinopril (Zestril)

Purpose/Indication	Lisinopril is an angiotensin-converting enzyme (ACE) inhibitor used primarily to treat hypertension (high blood pressure) and heart failure. It is also indicated to improve survival following a heart attack (acute myocardial infarction) and to slow the progression of kidney disease in patients with diabetes and hypertension who have early signs of kidney damage (microalbuminuria).

Method of Action	Lisinopril inhibits the angiotensin-converting enzyme (ACE), which is responsible for converting angiotensin I to angiotensin II. Angiotensin II is a powerful vasoconstrictor and stimulates aldosterone secretion. By blocking ACE, lisinopril reduces the production of angiotensin II, leading to vasodilation, decreased peripheral vascular resistance, and reduced sodium and water retention. It also decreases the breakdown of bradykinin, a vasodilator, further contributing to its blood pressure-lowering effects.
Medication Name & Brand Names	♦ Medication Name: Lisinopril ♦ Brand Names: Prinivil, Zestril, Lisinopril (generic) (Often found in combination with hydrochlorothiazide: Zestoretic, Prinzide)
Pharmaceutical Forms & Appearance	Lisinopril is available as oral tablets. Tablets vary in color, shape, and imprint depending on the manufacturer and strength (e.g., pink, white, yellow, round, oval), and are often scored.
Dosage & Administration	Dosage is individualized based on the patient's condition, blood pressure response, and renal function. For hypertension, the usual adult starting dose is 10 mg once daily, with a maintenance range typically 20 mg to 40 mg once daily. For heart failure, lower initial doses are used (e.g., 2.5 mg to 5 mg daily). It can be taken with or without food. Consistent daily administration is important for optimal blood pressure control.
Supplied As	Lisinopril is supplied as: oral tablets (e.g., 2.5 mg, 5 mg, 10 mg, 20 mg, 30 mg, 40 mg). It is also commonly available in fixed-dose combination tablets with hydrochlorothiazide.
Contraindications	Lisinopril is contraindicated in patients with known hypersensitivity to lisinopril, any other ACE inhibitor, or any component of the formulation. It is also contraindicated in patients with a history of angioedema related to previous ACE inhibitor treatment, hereditary or idiopathic angioedema, and concomitant use with aliskiren in patients with diabetes or moderate to severe renal impairment (GFR < 60 mL/min/1.73 m2). Use during pregnancy (especially second and third trimesters) is contraindicated due to risk of fetal injury or death.
Storage & Expiry	Lisinopril tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include persistent dry cough, dizziness, headache, and fatigue. More serious but less common side effects can include angioedema (swelling of face, lips, tongue, throat), hyperkalemia (high potassium levels), kidney dysfunction or failure, and severe hypotension.
Warnings & Precautions	♦ Fetal Toxicity: Can cause fetal harm or death when administered to pregnant women, particularly in the second and third trimesters. Discontinue as soon as pregnancy is detected. ♦ Angioedema: Can cause potentially life-threatening angioedema of the face, extremities, lips, tongue, glottis, and/or larynx. If angioedema involving the tongue, glottis, or larynx occurs, it can be fatal. Discontinue immediately and provide appropriate treatment. Higher risk in Black patients. ♦ Hypotension: Can cause symptomatic hypotension, especially with the first dose in volume-depleted patients (e.g., those on high-dose diuretics) or those with severe heart failure. Correct volume depletion before initiating therapy. ♦ Renal Impairment/Deterioration: Can cause changes in renal function, including acute renal failure, particularly in patients with severe congestive heart failure, pre-existing renal disease, or bilateral renal artery stenosis. Monitor renal function periodically. ♦ Hyperkalemia: Risk of hyperkalemia, especially in patients with renal impairment, diabetes, or those concurrently taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium levels. ♦ Cough: A persistent, non-productive, dry cough is a common side effect, which resolves upon discontinuation. ♦ Hepatic Failure: Rare cases of cholestatic jaundice progressing to fulminant hepatic necrosis, sometimes fatal, have been reported. Discontinue if jaundice or marked elevations of liver enzymes develop. ♦ Neutropenia/Agranulocytosis: Rare, but can occur, especially in patients with renal impairment or collagen vascular disease. Monitor blood counts. ♦ Dual RAAS Blockade: Concomitant use of ACE inhibitors, ARBs, or aliskiren (especially in diabetes or renal impairment) increases the risk of hypotension, hyperkalemia, and renal dysfunction; generally avoid.
Missed Dose Instructions	If a dose of Lisinopril is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining optimal blood pressure control.
Overdose Instructions	Overdose symptoms are primarily related to exaggerated hypotensive effects (severe dizziness, lightheadedness, syncope) and possibly electrolyte disturbances (hyperkalemia) or renal failure. Treatment is supportive and symptomatic. If ingestion was recent, gastric decontamination (e.g., activated charcoal) may be considered. Intravenous fluids and vasopressors may be administered to correct hypotension. Lisinopril can be removed by hemodialysis. Seek immediate emergency medical help.
Medicine Interactions	♦ Potassium-Sparing Diuretics (e.g., spironolactone, triamterene, amiloride), Potassium Supplements, Salt Substitutes (containing potassium): Significantly increased risk of severe hyperkalemia. Avoid concurrent use or monitor potassium levels extremely closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): Can reduce the antihypertensive effect of lisinopril and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Monitor renal function. ♦ Lithium: ACE inhibitors can increase serum lithium concentrations and toxicity. Monitor lithium levels. ♦ Diuretics: Can cause excessive blood pressure drop (hypotension), especially with the first dose of lisinopril. Diuretics may need to be stopped or reduced before starting lisinopril. ♦ Aliskiren: Concomitant use is contraindicated in patients with diabetes or moderate to severe renal impairment due to increased risk of hyperkalemia, hypotension, and renal impairment. ♦ Dual RAAS Blockade (e.g., with ARBs): Generally not recommended due to increased risk of adverse events without clear additional benefit. ♦ Gold (parenteral): Nitritoid reactions (facial flushing, nausea, vomiting, hypotension) have been reported rarely in patients receiving injectable gold and concomitant ACE inhibitors. ♦ mTOR Inhibitors (e.g., everolimus, sirolimus, temsirolimus): Increased risk of angioedema with concomitant use. ♦ Racecadotril: Increased risk of angioedema with concomitant use. ♦ Insulin/Oral Hypoglycemics: Increased risk of hypoglycemia, especially at initiation of lisinopril. Monitor blood glucose.

Loperamide (Imodium)

Purpose/Indication	Loperamide is an opioid-receptor agonist used to control and relieve the symptoms of acute non-specific diarrhea, including traveler's diarrhea. It is also used to reduce the volume of discharge from ileostomies and in the symptomatic management of chronic diarrhea associated with inflammatory bowel disease, often as an adjunct to specific therapy.
Method of Action	Loperamide acts directly on the opioid receptors in the intestinal wall, primarily the mu (μ) opioid receptors. By binding to these receptors, it decreases the activity of the myenteric plexus, leading to a reduction in intestinal motility and propulsive peristalsis. This allows more time for water and electrolytes to be absorbed from the gut, reducing the frequency and fluidity of bowel movements. It also increases the tone of the anal sphincter, helping to reduce incontinence.
Medication Name & Brand Names	♦ Medication Name: Loperamide Hydrochloride ♦ Brand Names: Imodium, Imodium A-D, Diamode, Anti-Diarrheal, Loperamide (generic)
Pharmaceutical Forms & Appearance	Loperamide is available as oral tablets, capsules, chewable tablets, and oral solution/liquid. Tablets and capsules vary in color and shape (e.g., white, green, round, oval), often with specific imprints. Oral solutions are typically clear or flavored liquids.

Dosage & Administration	For acute diarrhea in adults and children 12 years and older, the initial dose is typically 4 mg (two 2 mg capsules/tablets) orally, followed by 2 mg after each loose stool, not exceeding 8 mg to 16 mg in 24 hours (depending on specific product and region). For children under 12, dosing is based on weight or age and should be done under medical supervision. Loperamide is intended for short-term use; do not use for more than 2 days for acute diarrhea without consulting a doctor.
Supplied As	Loperamide is supplied as: oral capsules (e.g., 2 mg), oral tablets (e.g., 2 mg), chewable tablets (e.g., 2 mg), and oral solution/liquid (e.g., 1 mg/5 mL).
Contraindications	Loperamide is contraindicated in patients with known hypersensitivity to loperamide or any component of the formulation. It is also contraindicated in conditions where inhibition of peristalsis should be avoided, such as suspected or confirmed bacterial enterocolitis (e.g., Clostridioides difficile infection), acute dysentery (characterized by fever and blood in stool), acute ulcerative colitis, or bacterial infections of the bowel where inhibition of peristalsis could lead to toxic megacolon or worsen the underlying condition.
Storage & Expiry	Loperamide tablets, capsules, and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include constipation, dizziness, nausea, and abdominal cramps. More serious but less common side effects can include severe constipation, paralytic ileus (bowel obstruction), toxic megacolon (especially in severe colitis), and rarely, serious cardiac events (QT prolongation, Torsades de Pointes) with high doses.
Warnings & Precautions	♦ Cardiac Events (High Doses): Serious cardiac adverse reactions (QT prolongation, Torsades de Pointes, other ventricular arrhythmias) have been reported with abuse, misuse, or high doses of loperamide, sometimes leading to death. Do not exceed the recommended dose. ♦ Diarrhea with Fever/Blood in Stool: Do not use if you have a fever or blood/mucus in your stool, as this may indicate a serious bacterial infection or other condition where delaying stool passage could be harmful. ♦ Acute Dysentery/Bacterial Enterocolitis/C. difficile: Contraindicated in these conditions as it can worsen the underlying infection or lead to toxic megacolon. ♦ Hepatic Impairment: Use with caution in patients with hepatic impairment, as it may lead to relative overdose and CNS toxicity due to reduced metabolism. ♦ Dehydration: Diarrhea itself can cause dehydration and electrolyte depletion; adequate fluid and electrolyte replacement are important. ♦ Children: Not recommended for children under 6 years due to risk of ileus and CNS depression. Use with caution in older children and only as directed. ♦ Abuse Potential: While generally having low CNS penetration at therapeutic doses, very high doses can produce opioid-like effects, leading to abuse and dependence, and dangerous cardiac risks.
Missed Dose Instructions	Loperamide is typically taken as needed for diarrhea symptoms. If a dose is missed, take it when the next loose stool occurs, adhering to the maximum daily dose and the recommended dosing interval (e.g., not exceeding the maximum daily dose or using for more than 2 days without medical advice).
Overdose Instructions	Overdose symptoms are similar to opioid overdose, including constipation, CNS depression (drowsiness, stupor, coma), miosis (pinpoint pupils), respiratory depression, and severe cardiac abnormalities (QT prolongation, Torsades de Pointes, cardiac arrest). Children are particularly sensitive to CNS and respiratory depression. Treatment is supportive. Naloxone can reverse opioid effects but may require repeated doses due to loperamide's long duration of action. Gastric lavage and activated charcoal may be considered. Continuous ECG monitoring is essential for potential cardiac arrhythmias. Seek immediate emergency medical help.
Medicine Interactions	♦ CYP3A4/CYP2C8 Inhibitors (e.g., quinidine, ritonavir, ketoconazole, itraconazole, gemfibrozil): Can increase plasma concentrations of loperamide, potentially increasing CNS effects or cardiac risks. Use with caution. ♦ Other CNS Depressants (e.g., opioids, sedatives, tranquilizers, alcohol): Additive CNS depressant effects; increased drowsiness or dizziness. ♦ P-glycoprotein Inhibitors (e.g., quinidine, ritonavir): Can increase loperamide absorption and distribution to the CNS, increasing the risk of CNS depression. ♦ Cholestyramine: May reduce loperamide absorption; administer at different times. ♦ Saquinavir: Loperamide may reduce saquinavir absorption.

Loratadine (Claritin)

Purpose/Indication	Loratadine is a second-generation (non-sedating) antihistamine used to relieve symptoms associated with seasonal allergic rhinitis (hay fever), such as sneezing, runny nose, itchy or watery eyes, and itchy throat or nose. It is also indicated for the symptomatic relief of chronic idiopathic urticaria (hives), reducing itching and the size and number of hives. It provides 24-hour relief with once-daily dosing.
Method of Action	Loratadine is a selective peripheral histamine H1-receptor antagonist. It works by blocking the action of histamine, a substance released by the body during an allergic reaction. By preventing histamine from binding to H1-receptors in peripheral tissues, loratadine alleviates allergic symptoms such as itching, sneezing, rhinorrhea (runny nose), and watery eyes, without causing significant drowsiness due to its poor penetration of the blood-brain barrier.
Medication Name & Brand Names	♦ Medication Name: Loratadine ♦ Brand Names: Claritin, Alavert, Claratyne (regional), Loratadine (generic)
Pharmaceutical Forms & Appearance	Loratadine is available as oral tablets, orally disintegrating tablets (ODT), chewable tablets, and oral syrup. Tablets are typically white, round, or oval, with specific imprints. ODTs are white and dissolve rapidly on the tongue. Chewable tablets may be colored and flavored. The oral syrup is a clear, colorless to yellowish liquid.
Dosage & Administration	For adults and children 6 years and older, the usual dose is 10 mg once daily. For children aged 2-5 years, a lower dose (e.g., 5 mg daily) is typically used. It can be taken with or without food. Consistent daily administration is important for continuous symptom control. Do not exceed the recommended dose.
Supplied As	Loratadine is supplied as: oral tablets (e.g., 10 mg), orally disintegrating tablets (e.g., 10 mg), chewable tablets (e.g., 5 mg), and oral syrup (e.g., 1 mg/mL).
Contraindications	Loratadine is contraindicated in patients with known hypersensitivity to loratadine, desloratadine (its active metabolite), or any component of the formulation.
Storage & Expiry	Loratadine products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from excessive moisture and heat. Keep in tightly closed containers. Oral syrup should be protected from freezing. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include headache, somnolence (drowsiness, though less than first-generation antihistamines), fatigue, dry mouth, and nausea. Serious side effects are rare but can include severe hypersensitivity reactions (e.g., anaphylaxis, angioedema), and very rarely, liver dysfunction or cardiovascular effects (e.g., tachycardia, palpitations, though not typically QT prolongation at therapeutic doses).

Warnings & Precautions	♦ Hepatic/Renal Impairment: Use with caution and consider dose adjustment in patients with severe hepatic impairment or severe renal impairment (creatinine clearance < 30 mL/min), as drug clearance may be reduced, increasing exposure. ♦ Phenylketonuria (PKU): Orally disintegrating tablets and chewable tablets may contain phenylalanine (aspartame), which is a concern for patients with PKU. ♦ Drug Interactions: While generally having fewer significant interactions than first-generation antihistamines, caution should be exercised with concurrent use of medications that inhibit CYP3A4 or CYP2D6, as this can increase loratadine levels. ♦ Elderly: While generally well-tolerated, use with caution in elderly patients who may be more susceptible to adverse effects. ♦ Driving/Operating Machinery: Although less sedating than first-generation antihistamines, individuals should assess their response before engaging in activities requiring mental alertness.
Missed Dose Instructions	Loratadine is typically taken once daily. If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing helps maintain continuous symptom control.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including somnolence, tachycardia, and headache. In children, extrapyramidal symptoms and palpitations have been reported. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if recent. Loratadine is not significantly removed by hemodialysis. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ CYP3A4 and CYP2D6 Inhibitors (e.g., ketoconazole, itraconazole, erythromycin, cimetidine, fluvoxamine): Concomitant use with these inhibitors can increase plasma concentrations of loratadine and its active metabolite (desloratadine). While typically not clinically significant at recommended doses, this could potentially increase the risk of adverse effects. ♦ Alcohol and other CNS Depressants: Although loratadine is generally non-sedating, additive sedative effects could theoretically occur, but are less likely than with first-generation antihistamines. Caution is still advised. ♦ Grapefruit Juice: May inhibit CYP3A4, potentially increasing loratadine levels.

Lorazepam (Ativan)

Purpose/Indication	Lorazepam is a benzodiazepine used primarily for the short-term management of anxiety disorders, anxiety associated with depressive symptoms, and insomnia due to anxiety. It is also a first-line treatment for status epilepticus (a medical emergency involving continuous seizures), and is used for pre-anesthetic medication to induce sedation, reduce anxiety, and produce anterograde amnesia.
Method of Action	Lorazepam enhances the effect of gamma-aminobutyric acid (GABA), the primary inhibitory neurotransmitter in the brain. It binds to specific benzodiazepine receptors on the GABA-A receptor complex, increasing the frequency of chloride channel opening. This allows more chloride ions to enter the neuron, leading to hyperpolarization and reduced neuronal excitability, thereby producing anxiolytic (anti-anxiety), sedative, hypnotic, anticonvulsant, and muscle relaxant effects.
Medication Name & Brand Names	♦ Medication Name: Lorazepam ♦ Brand Names: Ativan, Lorazepam (generic)
Pharmaceutical Forms & Appearance	Lorazepam is available as oral tablets, oral solution, and solution for intravenous (IV) or intramuscular (IM) injection. Oral tablets are typically white, round, or oblong, and may be scored, with various imprints. The oral solution is a clear, colorless liquid. The injectable solution is clear and colorless.
Dosage & Administration	Dosage is highly individualized and varies by indication, patient age, and response. For anxiety, typical oral doses range from 1 mg to 4 mg daily in divided doses. For insomnia, 2-4 mg at bedtime. For status epilepticus, IV doses of 2 mg to 4 mg are given, repeated as needed. For pre-anesthesia, IM or IV doses are used. Oral doses can be taken with or without food. Avoid abrupt discontinuation due to withdrawal risk.
Supplied As	Lorazepam is supplied as: oral tablets (e.g., 0.5 mg, 1 mg, 2 mg), oral solution (e.g., 2 mg/mL), and solution for intravenous or intramuscular injection (e.g., 2 mg/mL, 4 mg/mL in vials or pre-filled syringes).
Contraindications	Lorazepam is contraindicated in patients with known hypersensitivity to lorazepam or any benzodiazepine, or any component of the formulation. It is also contraindicated in patients with acute narrow-angle glaucoma or severe respiratory insufficiency (except when managing acute seizures under close monitoring). Concomitant use with opioids may lead to profound sedation, respiratory depression, coma, and death.
Storage & Expiry	Lorazepam tablets, oral solution, and injectable solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The injectable solution should be protected from freezing. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include sedation, drowsiness, dizziness, weakness, unsteadiness, and ataxia (impaired coordination). More serious side effects include respiratory depression (especially with IV use or high doses), paradoxical reactions (e.g., excitement, aggression), dependence and withdrawal symptoms (especially with prolonged use), and anterograde amnesia.
Warnings & Precautions	♦ CNS Depression/Sedation: Can cause significant CNS depression, including drowsiness, reduced alertness, and impaired coordination. Advise caution with driving or operating machinery. ♦ Respiratory Depression: Can cause respiratory depression, especially with IV use, high doses, or concomitant use of other CNS depressants (e.g., opioids, alcohol). Use with extreme caution in patients with respiratory compromise (e.g., COPD, sleep apnea). ♦ Concomitant Opioid Use: BLACK BOX WARNING: Concomitant use with opioids significantly increases the risk of profound sedation, respiratory depression, coma, and death. Reserve for use when alternative treatment options are inadequate. Monitor for signs of respiratory depression and sedation. ♦ Dependence and Withdrawal: Prolonged use can lead to physical and psychological dependence. Abrupt discontinuation can precipitate severe withdrawal symptoms (e.g., seizures, hallucinations, tremor, anxiety, insomnia, psychosis), especially with high doses or long-term use. Taper dose gradually. ♦ Paradoxical Reactions: Excitement, agitation, hostility, and hallucinations can rarely occur, especially in children and the elderly. ♦ Elderly Patients: More susceptible to CNS depressant effects (drowsiness, ataxia) and paradoxical reactions. Use lowest effective dose. ♦ Hepatic/Renal Impairment: Use with caution and consider dose adjustment in patients with severe hepatic or renal impairment. ♦ Abuse Potential: Has abuse potential; use with caution in patients with a history of substance abuse. ♦ Depression/Suicidal Ideation: Use with caution in patients with depression; may exacerbate symptoms.
Missed Dose Instructions	For chronic anxiety or insomnia, if a dose of Lorazepam is missed, take it as soon as remembered if symptoms warrant. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Missing doses regularly, especially with long-term use, can contribute to withdrawal symptoms.
Overdose Instructions	Overdose symptoms are typically an exaggeration of the pharmacological effects, including somnolence, confusion, diminished reflexes, slurred speech, ataxia, hypotension, and profound CNS and respiratory depression, which can progress to coma and death. Treatment is supportive and symptomatic. Flumazenil, a benzodiazepine receptor antagonist, can reverse the effects but should be used with extreme caution, especially in patients on chronic benzodiazepine therapy or with co-ingestions of other proconvulsant drugs, as it can precipitate acute withdrawal or seizures. Gastric decontamination may be considered if recent. Seek immediate emergency medical help.

Medicine Interactions	♦ Opioids: BLACK BOX WARNING: Profound sedation, respiratory depression, coma, and death. Avoid concomitant use unless absolutely necessary; if so, use lowest effective doses and monitor closely. ♦ Other CNS Depressants (e.g., alcohol, barbiturates, antidepressants, antipsychotics, antihistamines, muscle relaxants, anesthetics): Additive CNS depressant effects; increased sedation and respiratory depression. Avoid or use with extreme caution. ♦ Valproic Acid, Probenecid: Can inhibit the metabolism of lorazepam, leading to increased plasma concentrations and enhanced CNS effects. Reduce lorazepam dose. ♦ Theophylline, Aminophylline: Can reduce the sedative effects of benzodiazepines. ♦ Clozapine: Can cause profound sedation, hypotension, and respiratory depression. Use with extreme caution. ♦ Digoxin: May increase digoxin levels. ♦ Disulfiram: May inhibit lorazepam metabolism.

Losartan (Cozaar)

Purpose/Indication	Losartan is an angiotensin II receptor blocker (ARB) primarily used to treat hypertension (high blood pressure) to reduce the risk of stroke, heart attack, and death from cardiovascular causes. It is also indicated for the treatment of diabetic nephropathy (kidney disease) in patients with type 2 diabetes and a history of hypertension, aiming to slow the progression of kidney disease. It is often used as an alternative for patients who develop a cough with ACE inhibitors.
Method of Action	Losartan works by selectively blocking the binding of angiotensin II to the AT1 (angiotensin II type 1) receptors found in various tissues, including vascular smooth muscle, adrenal glands, and kidneys. Angiotensin II is a potent vasoconstrictor and a key hormone in the renin-angiotensin-aldosterone system (RAAS) responsible for regulating blood pressure and fluid balance. By blocking AT1 receptors, losartan prevents angiotensin II from causing vasoconstriction, aldosterone release, and sodium/water retention, leading to vasodilation, reduced systemic vascular resistance, and decreased blood pressure. It is also metabolized to an active metabolite, E-
Medication Name & Brand Names	♦ Medication Name: Losartan Potassium ♦ Brand Names: Cozaar, Losartan (generic) (Often found in combination with hydrochlorothiazide: Hyzaar, Cozaar Comp.)
Pharmaceutical Forms & Appearance	Losartan is available as oral tablets. Tablets are typically white or off-white, often oval or round, and may be scored, with various imprints indicating strength.
Dosage & Administration	Dosage is individualized based on blood pressure response and patient tolerability. For hypertension, the usual adult starting dose is 50 mg once daily, which can be increased to 100 mg once daily if needed. For diabetic nephropathy, the starting dose is 50 mg once daily, with a target maintenance dose of 100 mg once daily. It can be taken with or without food. Consistent daily administration is important for optimal blood pressure control.
Supplied As	Losartan is supplied as: oral tablets (e.g., 25 mg, 50 mg, 100 mg). It is also commonly available in fixed-dose combination tablets with hydrochlorothiazide.
Contraindications	Losartan is contraindicated in patients with known hypersensitivity to losartan or any component of the formulation. It is also contraindicated in combination with aliskiren in patients with diabetes or moderate to severe renal impairment (GFR < 60 mL/min/1.73 m2). Use during pregnancy (especially second and third trimesters) is strictly contraindicated due to risk of fetal injury or death.
Storage & Expiry	Losartan tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, lightheadedness (due to hypotension), upper respiratory tract infection, and fatigue. Less common but more serious side effects can include hyperkalemia (high potassium levels), kidney dysfunction or failure, angioedema (swelling of face, lips, throat), and rhabdomyolysis (rarely). Unlike ACE inhibitors, a persistent dry cough is much less common.
Warnings & Precautions	♦ Fetal Toxicity: Can cause fetal harm or death when administered to pregnant women, particularly in the second and third trimesters. Discontinue as soon as pregnancy is detected. ♦ Hypotension: Can cause symptomatic hypotension, especially in volume-depleted patients (e.g., those on high-dose diuretics) or those with severe heart failure. Correct volume depletion before initiating therapy. ♦ Renal Impairment/Deterioration: Can cause changes in renal function, including acute renal failure, particularly in patients with severe congestive heart failure, pre-existing renal disease, or renal artery stenosis. Monitor renal function periodically. ♦ Hyperkalemia: Risk of hyperkalemia, especially in patients with renal impairment, diabetes, or those concurrently taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium levels. ♦ Angioedema: Rare but potentially life-threatening swelling of the face, lips, tongue, and throat. Discontinue immediately if symptoms occur. While less common than with ACE inhibitors, it can still occur. ♦ Dual RAAS Blockade: Concomitant use of ARBs, ACE inhibitors, or aliskiren (especially in diabetes or renal impairment) increases the risk of hypotension, hyperkalemia, and renal dysfunction; generally avoid. ♦ Hepatic Impairment: Use with caution in patients with hepatic impairment, as plasma concentrations of losartan may be increased.
Missed Dose Instructions	If a dose of Losartan is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining optimal blood pressure control.
Overdose Instructions	Overdose symptoms are primarily related to exaggerated hypotensive effects (severe dizziness, lightheadedness, syncope) and possibly tachycardia or bradycardia. Treatment is supportive and symptomatic. If ingestion was recent, gastric decontamination (e.g., activated charcoal) may be considered. Intravenous fluids and vasopressors may be administered to correct hypotension. Losartan and its active metabolite are not removed by hemodialysis. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Potassium-Sparing Diuretics (e.g., spironolactone, triamterene, amiloride), Potassium Supplements, Salt Substitutes (containing potassium): Significantly increased risk of hyperkalemia. Avoid concurrent use or monitor potassium levels extremely closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): Can reduce the antihypertensive effect of losartan and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Monitor renal function. ♦ Lithium: Losartan can increase serum lithium concentrations and toxicity. Monitor lithium levels. ♦ Aliskiren: Concomitant use is contraindicated in patients with diabetes or moderate to severe renal impairment due to increased risk of hyperkalemia, hypotension, and renal impairment. ♦ Dual RAAS Blockade (e.g., with ACE inhibitors): Generally not recommended due to increased risk of adverse events without clear additional benefit. ♦ Rifampin, Fluconazole: May affect levels of losartan and its active metabolite. Rifampin may decrease levels, while fluconazole may increase levels.

Malathion (Ovide)

Purpose/Indication	Malathion is an organophosphate insecticide used topically to treat head lice (Pediculus humanus capitis) and their nits (eggs) in patients 6 years of age and older. It is typically reserved for cases where other less toxic treatments (like permethrin) have failed or are not appropriate, due to its classification as a potent anticholinesterase.

Method of Action	Malathion is an organophosphate that acts as a cholinesterase inhibitor. Once absorbed by the lice and their eggs, malathion is metabolized into malaoxon, its active metabolite. Malaoxon irreversibly binds to and inactivates acetylcholinesterase, an enzyme essential for breaking down acetylcholine in the nervous system of insects. This leads to an accumulation of acetylcholine, causing continuous stimulation of nerve and muscle cells, resulting in paralysis and death of the lice.
Medication Name & Brand Names	♦ Medication Name: Malathion Lotion ♦ Brand Names: Ovide (most common), Malathion (generic)
Pharmaceutical Forms & Appearance	Malathion is primarily available as a topical lotion for external use. It is typically a clear, colorless to yellowish, alcoholic solution.
Dosage & Administration	For head lice, apply enough lotion to cover dry hair and scalp thoroughly, ensuring all hair and scalp are saturated. Allow the hair to air dry naturally (do not use a hairdryer, as the product is flammable). Leave on hair for 8 to 12 hours, then wash hair and scalp thoroughly with a non-medicated shampoo. Remove dead lice and nits with a fine-toothed comb. A second application may be needed if live lice are still present after 7-9 days.
Supplied As	Malathion is supplied as: topical lotion (e.g., 0.5% or 0.9% malathion in an alcoholic vehicle) in bottles (e.g., 59 mL or 60 mL).
Contraindications	Malathion is contraindicated in patients with known hypersensitivity to malathion or any component of the formulation. It is also contraindicated in children younger than 6 years due to increased risk of absorption and systemic toxicity. Avoid use on irritated, broken, or inflamed skin.
Storage & Expiry	Malathion lotion should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from heat and open flame, as it is flammable. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and localized, including scalp irritation (e.g., burning, stinging, itching), dry skin, and mild eye irritation if contact occurs. More serious side effects, though rare with proper topical use, can include systemic toxicity symptoms characteristic of organophosphate poisoning (e.g., increased sweating, lacrimation, salivation, miosis, nausea, vomiting, abdominal cramps, diarrhea, muscle tremors, respiratory distress, seizures), especially with excessive application or accidental ingestion.
Warnings & Precautions	♦ Flammability: Malathion lotion is flammable due to its alcohol content. Do not use or dry hair with heat sources (e.g., hair dryers, curling irons, open flames, cigarettes) during application or while hair is wet with the lotion. Apply in a well-ventilated area. ♦ Systemic Absorption/Toxicity: Although topical absorption is generally low, systemic toxicity (cholinesterase inhibition symptoms) can occur, especially with excessive application, prolonged contact, broken skin, or in young children. Symptoms include headache, dizziness, nausea, abdominal cramps, and blurred vision. Discontinue if symptoms of systemic toxicity occur. ♦ Eye Contact: Avoid contact with eyes. If contact occurs, flush immediately with water. ♦ Oral Ingestion: Harmful if swallowed. Keep out of reach of children and pets. ♦ Irritated Skin: Do not apply to open wounds, cuts, or severely irritated skin to prevent increased systemic absorption. ♦ Cholinesterase Monitoring: In rare cases of suspected systemic toxicity or prolonged exposure, plasma cholinesterase levels may be monitored. ♦ Resistance: Improper or overuse can contribute to the development of lice resistance.
Missed Dose Instructions	Malathion for head lice is typically a single application, potentially with a second application 7-9 days later if live lice remain. If the first application was not performed correctly or effectively, repeat as directed. For the second application, if missed, apply as soon as remembered if live lice are still present, maintaining the 7-9 day interval from the initial application if possible, or consult a healthcare professional.
Overdose Instructions	Overdose from topical malathion is rare but can result in systemic organophosphate poisoning symptoms due to significant absorption. Symptoms include increased sweating, lacrimation, salivation, miosis (pinpoint pupils), nausea, vomiting, diarrhea, abdominal cramps, muscle weakness, tremors, respiratory distress, bradycardia, and potentially seizures or coma. Treatment involves immediate medical attention. Atropine is the primary antidote for cholinergic symptoms, and pralidoxime chloride (2-PAM) may also be used to reactivate cholinesterase. Supportive care, including respiratory support, may be necessary. Contaminated skin should be thoroughly washed. Seek immediate emergency medical help.
Medicine Interactions	♦ Other Cholinesterase Inhibitors: Concomitant use with other cholinesterase inhibitors (e.g., certain medications for Alzheimer's disease like donepezil, rivastigmine, galantamine) or neuromuscular blocking agents (e.g., succinylcholine) could theoretically increase the risk of systemic cholinergic toxicity. However, given the topical route and limited systemic absorption, this interaction is generally considered low risk for typical use. ♦ No other significant or commonly reported systemic drug interactions are well-established for topical malathion.

Mebendazole (Vermox)

Purpose/Indication	Mebendazole is an anthelmintic (anti-worm) medication used to treat a variety of parasitic worm infections in the gastrointestinal tract. It is highly effective against common infections such as pinworm (enterobiasis), roundworm (ascariasis), hookworm (ancylostomiasis, necatoriasis), and whipworm (trichuriasis). Its purpose is to eradicate the worms from the digestive system.
Method of Action	Mebendazole works by selectively and irreversibly inhibiting the formation of microtubules in the intestinal cells of the parasites. Microtubules are crucial for glucose uptake and other vital cellular processes in the worms. By disrupting microtubule formation, mebendazole impairs the worm's ability to absorb glucose, leading to depletion of its glycogen stores, reduction in ATP synthesis, and ultimately, starvation and death of the parasite. It has a relatively low systemic absorption in humans.
Medication Name & Brand Names	♦ Medication Name: Mebendazole ♦ Brand Names: Vermox, Emverm, Mebendazole (generic)
Pharmaceutical Forms & Appearance	Mebendazole is available as oral tablets (chewable or regular) and oral suspension. Tablets are typically white or off-white, often round, and may be chewable. The oral suspension is a white to off-white liquid.
Dosage & Administration	Dosage varies depending on the type of worm infection. For pinworms, a single dose of 100 mg orally is typical, which may be repeated in 2-3 weeks to prevent re-infection. For roundworm, hookworm, and whipworm, the usual dose is 100 mg twice daily for 3 days, or 500 mg as a single dose for heavy infestations. It can be taken with or without food, but taking it with a fatty meal may slightly increase absorption.
Supplied As	Mebendazole is supplied as: oral chewable tablets (e.g., 100 mg, 500 mg) and oral suspension (e.g., 100 mg/5 mL).
Contraindications	Mebendazole is contraindicated in patients with known hypersensitivity to mebendazole or any component of the formulation. It is also generally contraindicated in children under 2 years of age due to reports of convulsions in this age group.

Storage & Expiry	Mebendazole tablets and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Oral suspension should not be frozen. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include abdominal pain, diarrhea, and flatulence, especially with heavy worm infestations. More serious but rare side effects can include transient neutropenia (decreased white blood cells), agranulocytosis (severe reduction in white blood cells), hepatitis, and hypersensitivity reactions (e.g., rash, Stevens-Johnson syndrome).
Warnings & Precautions	♦ Children Under 2 Years: Not recommended for children younger than 2 years due to reports of convulsions. Use in this age group only if the potential benefit justifies the potential risk. ♦ Myelosuppression: Rare cases of neutropenia and agranulocytosis have been reported, particularly with higher doses and prolonged treatment duration. Monitor blood counts in such cases. ♦ Hepatotoxicity: Very rare cases of hepatitis and abnormal liver function tests have been reported. Monitor liver function if prolonged use or high doses are necessary. ♦ Absorption: Absorption is variable. Taking with a fatty meal can increase absorption. ♦ Pregnancy/Breastfeeding: Use in pregnancy only if clearly needed. Minimal excretion into breast milk, but caution is advised. ♦ Hygiene Measures: Advise patients on proper hygiene to prevent re-infection, especially for pinworm (e.g., handwashing, cleaning bedding).
Missed Dose Instructions	For single-dose treatments (e.g., pinworm), if the dose is missed, take it as soon as remembered. For multi-dose regimens (e.g., for hookworm, roundworm, whipworm), if a dose is missed, take it as soon as remembered. If it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not double a dose. Completing the full course of treatment is important for effective eradication.
Overdose Instructions	In cases of accidental or intentional overdose, symptoms can include abdominal cramps, nausea, vomiting, and diarrhea. With very high doses or prolonged use, more serious effects like myelosuppression, alopecia, and hepatitis have been reported. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered if ingestion was recent. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Cimetidine: May inhibit the metabolism of mebendazole, leading to increased plasma concentrations. This is generally not clinically significant with typical short-term use, but could be relevant for prolonged or high-dose regimens. ♦ Phenytoin, Carbamazepine: These enzyme inducers may decrease mebendazole plasma concentrations, potentially reducing its efficacy. Concurrent use should be avoided or monitored closely, and an alternative anthelmintic considered. ♦ Metronidazole: Concurrent use of mebendazole and metronidazole has been associated with an increased risk of Stevens-Johnson syndrome/toxic epidermal necrolysis; concomitant use should be avoided if possible. ♦ No other significant or commonly reported drug interactions are well-established for mebendazole with typical short-term use.

Mefenamic Acid (Ponstel)

Purpose/Indication	Mefenamic acid is a non-steroidal anti-inflammatory drug (NSAID) primarily used for the short-term (typically up to 7 days) relief of mild to moderate pain, including muscular pain, traumatic pain, dental pain, and post-operative pain. It is particularly effective and frequently indicated for the treatment of primary dysmenorrhea (menstrual pain) due to its specific action on prostaglandin synthesis, often starting at the onset of menstrual flow.
Method of Action	Mefenamic acid exerts its analgesic, anti-inflammatory, and antipyretic effects by inhibiting the cyclooxygenase (COX) enzymes, both COX-1 and COX-2. This inhibition leads to a reduction in the synthesis of prostaglandins, which are key mediators of pain, inflammation, and fever. In the context of dysmenorrhea, it inhibits prostaglandin synthesis in the uterus, reducing uterine contractions and associated pain.
Medication Name & Brand Names	♦ Medication Name: Mefenamic Acid ♦ Brand Names: Ponstel (historical, largely discontinued in some regions), Ponstan (common in many regions), Mefenamic Acid (generic)
Pharmaceutical Forms & Appearance	Mefenamic acid is primarily available as oral capsules or tablets. Capsules are typically blue and white, sometimes with specific imprints. Tablets may vary in color and shape.
Dosage & Administration	For adults and adolescents 14 years and older, the typical initial dose is 500 mg orally, followed by 250 mg every 6 hours as needed. The maximum recommended duration of treatment is generally 7 days, particularly for acute pain, and 2-3 days for dysmenorrhea, starting at the onset of menstrual flow. It should be taken with food, milk, or antacids to minimize gastrointestinal upset.
Supplied As	Mefenamic acid is supplied as: oral capsules (e.g., 250 mg) and oral tablets (e.g., 500 mg).
Contraindications	Mefenamic acid is contraindicated in patients with known hypersensitivity to mefenamic acid, aspirin, or other NSAIDs. It is also contraindicated in patients with a history of bronchospasm, asthma, rhinitis, or urticaria precipitated by aspirin or other NSAIDs, active gastrointestinal bleeding or peptic ulcer disease, severe renal impairment, or severe hepatic impairment. Concomitant use in the setting of coronary artery bypass graft (CABG) surgery is also contraindicated.
Storage & Expiry	Mefenamic acid capsules/tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, vomiting, abdominal pain, dyspepsia, diarrhea – which can be prominent), headache, and dizziness. More serious side effects, though less common with short-term use, include severe gastrointestinal bleeding, ulceration, or perforation, acute kidney injury, cardiovascular thrombotic events (e.g., heart attack, stroke), liver injury, and severe allergic reactions (including anaphylaxis, serious skin reactions).
Warnings & Precautions	♦ GI Risk: Like other NSAIDs, it carries a risk of serious gastrointestinal adverse events including bleeding, ulceration, and perforation, which can be fatal. This risk increases with duration of use, higher doses, and in certain patient populations (elderly, history of GI disease). ♦ Cardiovascular Risk: Can increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration. Contraindicated for pain after CABG surgery. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, including acute renal failure. Use with caution in patients with pre-existing renal disease, heart failure, or dehydration. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function in prolonged use. ♦ Hematologic Effects: Can cause anemia and other blood dyscrasias. ♦ Hypersensitivity Reactions: Can cause severe allergic reactions, including anaphylaxis and serious skin reactions (e.g., Stevens-Johnson syndrome). Discontinue at first sign of rash or allergic reaction. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Pregnancy: Avoid use in late pregnancy (third trimester) due to risk of premature closure of fetal ductus arteriosus. ♦ Duration of Use: Recommended for short-term use only (maximum 7 days) to minimize risk of serious side effects.
Missed Dose Instructions	Mefenamic acid is typically used as needed for pain. If a dose is missed, take it when remembered if pain warrants, adhering to the recommended dosing interval (e.g., every 6 hours) and the maximum daily dose. Do not exceed the maximum daily dose or the recommended treatment duration (e.g., 7 days). Do not double a dose.

Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily severe gastrointestinal upset (nausea, vomiting, abdominal pain, diarrhea), drowsiness, and potentially more severe GI bleeding, acute renal failure, or even seizures. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate emergency medical help.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin) & Antiplatelet agents (e.g., aspirin, clopidogrel): Significantly increased risk of bleeding. Concurrent use should be approached with extreme caution, and close monitoring of coagulation parameters (e.g., INR) is essential. ♦ Other NSAIDs: Concomitant use is generally not recommended due to additive GI and renal toxicity, and no additional therapeutic benefit. ♦ Lithium: Increases serum lithium concentrations and toxicity; monitor lithium levels closely. ♦ Methotrexate: Increases methotrexate toxicity. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and significantly increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Corticosteroids: Increased risk of GI ulceration and bleeding. ♦ SSRIs: Increased risk of GI bleeding. ♦ Oral Hypoglycemics: Can potentiate the effects of sulfonylurea oral hypoglycemic agents, increasing the risk of hypoglycemia. Monitor blood glucose. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity.

Meloxicam (Mobic)

Purpose/Indication	Meloxicam is a non-steroidal anti-inflammatory drug (NSAID) primarily used for the symptomatic treatment of osteoarthritis, rheumatoid arthritis, and juvenile rheumatoid arthritis (in older children). It helps relieve pain, stiffness, and swelling associated with these chronic inflammatory conditions. Its purpose is to provide long-term management of inflammatory pain.
Method of Action	Meloxicam acts by inhibiting the synthesis of prostaglandins, which are key mediators of pain, inflammation, and fever. It does this by primarily inhibiting the cyclooxygenase-2 (COX-2) enzyme more selectively than COX-1, especially at lower doses. While it has some COX-1 inhibitory activity, its relative COX-2 selectivity is thought to provide anti-inflammatory effects with a potentially lower risk of gastrointestinal side effects compared to non-selective NSAIDs.
Medication Name & Brand Names	♦ Medication Name: Meloxicam ♦ Brand Names: Mobic, Mobicox (regional), Vivlodex, Anjeso (injectable), Meloxicam (generic)
Pharmaceutical Forms & Appearance	Meloxicam is available as oral tablets, orally disintegrating tablets (ODT), oral suspension, and solution for intravenous (IV) injection. Oral tablets are typically light yellow, round, or oblong, and often scored, with various imprints. The oral suspension is a pale yellow liquid. The IV solution is clear and colorless to pale yellow.
Dosage & Administration	Dosage varies by indication and patient response. For osteoarthritis, the usual adult oral dose is 7.5 mg once daily, which may be increased to a maximum of 15 mg once daily. For rheumatoid arthritis, the dose is generally 15 mg once daily. For IV use, the dose is typically 30 mg once daily. It can be taken with or without food, but taking it with food or milk may help reduce gastrointestinal upset. Use the lowest effective dose for the shortest duration consistent with treatment goals.
Supplied As	Meloxicam is supplied as: oral tablets (e.g., 7.5 mg, 15 mg), orally disintegrating tablets (e.g., 7.5 mg, 15 mg), oral suspension (e.g., 7.5 mg/5 mL), and solution for intravenous injection (e.g., 30 mg/mL).
Contraindications	Meloxicam is contraindicated in patients with known hypersensitivity to meloxicam, aspirin, or other NSAIDs. It is also contraindicated in patients with a history of asthma, urticaria, or allergic-type reactions after taking aspirin or other NSAIDs, active gastrointestinal bleeding or peptic ulcer disease, severe renal impairment (unless on dialysis), severe hepatic impairment, or in the setting of coronary artery bypass graft (CABG) surgery.
Storage & Expiry	Meloxicam tablets, oral suspension, and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., dyspepsia, nausea, abdominal pain, diarrhea), headache, dizziness, and edema. More serious side effects, though less common with short-term use or lower doses, include gastrointestinal bleeding, ulceration, or perforation, acute kidney injury, cardiovascular thrombotic events (e.g., heart attack, stroke), liver injury, severe allergic reactions (e.g., anaphylaxis, serious skin reactions), and hypertension.
Warnings & Precautions	♦ BLACK BOX WARNINGS: ♦ Cardiovascular Thrombotic Events: NSAIDs, including meloxicam, increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may occur early in treatment and may increase with duration of use. Contraindicated for pain after CABG surgery. ♦ Gastrointestinal Risk: NSAIDs, including meloxicam, increase the risk of serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. These events can occur at any time during use and without warning symptoms. Elderly patients and those with a history of peptic ulcer disease or GI bleeding are at greater risk. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, including acute renal failure. Use with caution in patients with pre-existing renal disease, heart failure, liver dysfunction, or dehydration. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. Monitor blood pressure closely. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function in prolonged use. ♦ Anaphylactoid Reactions: Can occur in patients without known prior exposure. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Pregnancy: Avoid use in late pregnancy (third trimester) due to risk of premature closure of fetal ductus arteriosus. ♦ Elderly: Increased risk of serious adverse effects, especially GI bleeding and renal dysfunction. Use lowest effective dose.
Missed Dose Instructions	For chronic conditions like arthritis, if a dose of Meloxicam is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing helps manage symptoms.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily severe gastrointestinal upset (nausea, vomiting, abdominal pain), drowsiness, and potentially more severe GI bleeding, acute renal failure, and seizures. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate emergency medical help.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin) & Antiplatelet agents (e.g., aspirin, clopidogrel): Significantly increased risk of bleeding. Concurrent use should be approached with extreme caution, and close monitoring of coagulation parameters (e.g., INR) is essential. ♦ Other NSAIDs: Concomitant use is generally not recommended due to additive GI and renal toxicity, and no additional therapeutic benefit. ♦ Lithium: Increases serum lithium concentrations and toxicity; monitor lithium levels closely. ♦ Methotrexate: Increases methotrexate toxicity. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and significantly increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Corticosteroids: Increased risk of GI ulceration and bleeding. ♦ SSRIs: Increased risk of GI bleeding. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Colestyramine: May increase meloxicam clearance. ♦ Furosemide/Thiazide Diuretics: May reduce diuretic and antihypertensive effects.

Metformin (Glucophage)

MEDICATION

List

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Metformin (Glucophage)

Purpose/Indication	Metformin is an oral antidiabetic medication primarily used to manage type 2 diabetes mellitus, often as a first-line therapy, especially in overweight or obese individuals. It helps to lower elevated blood glucose levels by improving insulin sensitivity and reducing glucose production. It can also be used off-label for polycystic ovary syndrome (PCOS) to manage insulin resistance and related symptoms.
Method of Action	Metformin's primary mechanism of action is to decrease hepatic glucose production (gluconeogenesis and glycogenolysis) by inhibiting the mitochondrial respiratory chain in liver cells, which activates AMP-activated protein kinase (AMPK). It also improves insulin sensitivity by increasing glucose uptake and utilization in peripheral tissues (muscle and fat), and to a lesser extent, reduces intestinal absorption of glucose. Unlike sulfonylureas, it does not stimulate insulin secretion from pancreatic beta cells, thus rarely causing hypoglycemia as monotherapy.
Medication Name & Brand Names	♦ Medication Name: Metformin Hydrochloride ♦ Brand Names: Glucophage (immediate-release), Glucophage XR (extended-release), Fortamet (extended-release), Glumetza (extended-release), Riomet (oral solution), Metformin (generic)
Pharmaceutical Forms & Appearance	Metformin is available as oral tablets (immediate-release and extended-release) and oral solution. Immediate-release tablets are typically white, round or oval, and may be scored, with various imprints. Extended-release tablets vary in color and shape (often oblong) and may have a ghost tablet in the stool due to the non-absorbable matrix. The oral solution is a clear, colorless to pale yellow liquid.
Dosage & Administration	Dosage is individualized, starting low and titrating up to minimize gastrointestinal side effects. For immediate-release, typical adult starting doses are 500 mg once or twice daily, taken with meals, increasing to a maximum of 2000-2550 mg daily in divided doses. Extended-release forms are typically taken once daily with the evening meal. Take with food to reduce GI upset. Regular monitoring of glycemic control (HbA1c) and renal function is essential.
Supplied As	Metformin is supplied as: oral immediate-release tablets (e.g., 500 mg, 850 mg, 1000 mg), oral extended-release tablets (e.g., 500 mg, 750 mg, 1000 mg), and oral solution (e.g., 500 mg/5 mL).
Contraindications	Metformin is strictly contraindicated in patients with severe renal impairment (e.g., eGFR < 30 mL/min/1.73 m2), metabolic acidosis (including diabetic ketoacidosis), and acute or chronic metabolic acidosis with or without hypoxemia. It is also contraindicated in patients with hypersensitivity to metformin and during acute conditions with potential for renal dysfunction, such as dehydration, shock, acute myocardial infarction, or severe infection.
Storage & Expiry	Metformin tablets and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances like nausea, vomiting, diarrhea, abdominal pain, and flatulence, especially during initiation or dose escalation. A metallic taste is also common. More serious but rare side effects include lactic acidosis (a life-threatening metabolic complication), and vitamin B12 deficiency (with long-term use).
Warnings & Precautions	♦ BLACK BOX WARNING: Lactic Acidosis: A rare, but serious and potentially fatal metabolic complication due to metformin accumulation. Risk factors include renal impairment, concomitant use of certain drugs (e.g., topiramate, zonisamide), acute congestive heart failure, severe infection, dehydration, liver impairment, excessive alcohol intake, and acute myocardial infarction. Discontinue metformin if lactic acidosis is suspected. ♦ Renal Function: Renal function (eGFR) should be assessed before initiating metformin and at least annually thereafter. Discontinue if eGFR falls below 30 mL/min/1.73 m2. Dose adjustment is required for eGFR 30-45 mL/min/1.73 m2. ♦ Hypoglycemia: While rare as monotherapy, risk increases when combined with other antidiabetic agents (e.g., sulfonylureas, insulin). ♦ Vitamin B12 Deficiency: Long-term use of metformin is associated with a decrease in vitamin B12 levels, which can lead to peripheral neuropathy or megaloblastic anemia. Monitor B12 levels periodically, especially in patients with pre-existing risk factors. ♦ Iodinated Contrast Media: Temporarily discontinue metformin at the time of or prior to iodinated contrast imaging procedures in patients with an eGFR between 30 and 60 mL/min/1.73 m2, or with a history of liver disease, alcoholism, or heart failure, or who will be administered intra-arterial iodinated contrast. Re-evaluate eGFR 48 hours after the procedure and restart metformin only if renal function is stable. ♦ Alcohol Intake: Avoid excessive alcohol intake, as it can potentiate the effects of metformin on lactate metabolism. ♦ Surgical Procedures: Metformin should be temporarily discontinued for any surgical procedure that requires restriction of food and fluid intake. ♦ Cardiac Function: Use with caution in patients with unstable or acute congestive heart failure.
Missed Dose Instructions	If a dose of Metformin (immediate-release) is missed, take it as soon as remembered with food. If it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For extended-release, take the missed dose with the next meal. Consistent daily administration with meals is important for optimal glucose control and to minimize GI side effects.
Overdose Instructions	Overdose of metformin can lead to severe lactic acidosis, which is a medical emergency. Symptoms include malaise, myalgia, respiratory distress, somnolence, and abdominal distress (e.g., severe nausea, vomiting, diarrhea). Hypothermia, hypotension, and resistant bradyarrhythmias may occur. Treatment is urgent, supportive, and involves correcting acidosis. Hemodialysis is the most effective method for removing lactate and metformin from the blood. Seek immediate emergency medical help.
Medicine Interactions	♦ Alcohol: Potentiates the effect of metformin on lactate metabolism, increasing the risk of lactic acidosis. Avoid excessive alcohol intake. ♦ Iodinated Contrast Media: Increased risk of lactic acidosis. Temporarily discontinue metformin as per guidelines. ♦ Carbonic Anhydrase Inhibitors (e.g., topiramate, zonisamide, acetazolamide, dichlorphenamide): Can increase the risk of lactic acidosis. Monitor patients closely if co-administered. ♦ Cationic Drugs (e.g., amiloride, cimetidine, digoxin, procainamide, quinidine, trimethoprim, ranitidine, vancomycin): These drugs are eliminated by renal tubular secretion and may compete with metformin for renal tubular transport, potentially increasing metformin plasma concentrations. Monitor glycemic control and adverse effects. ♦ Drugs Affecting Renal Function (e.g., NSAIDs, ACE inhibitors, ARBs, diuretics): Can impair renal function, potentially increasing the risk of lactic acidosis. Monitor renal function closely. ♦ Drugs Affecting Glycemic Control (e.g., corticosteroids, diuretics, thyroid hormones, oral contraceptives, phenothiazines, sympathetic mimetics): May decrease blood glucose control, requiring adjustment of metformin dose. ♦ Nifedipine: May increase metformin absorption. ♦ Glyburide: Metformin may decrease glyburide AUC, but interaction is not considered clinically significant.

MEDICATION

Medication

M -

Metoprolol (Lopressor)

Purpose/Indication	Metoprolol is a beta-blocker primarily used to treat hypertension (high blood pressure), angina pectoris (chest pain), and to improve survival after a heart attack (myocardial infarction). It is also indicated for the management of heart failure (specifically the extended-release form, metoprolol succinate) and for the prophylaxis of migraine headaches. It works by reducing the heart's workload and oxygen demand.
Method of Action	Metoprolol is a cardioselective beta-1 (β1)-adrenergic receptor blocker. It primarily antagonizes β1 receptors in the heart, leading to decreased heart rate, reduced myocardial contractility, and decreased cardiac output, thereby lowering blood pressure. It also reduces renin release from the kidneys. At higher doses, its β1 selectivity may diminish, and it can affect β2 receptors in the bronchi and peripheral blood vessels.

Medication Name & Brand Names	♦ Medication Name: Metoprolol Tartrate (immediate-release), Metoprolol Succinate (extended-release) ♦ Brand Names: Lopressor (tartrate), Toprol-XL (succinate), Betaloc (regional), Metoprolol (generic)
Pharmaceutical Forms & Appearance	Metoprolol is available as oral tablets (immediate-release and extended-release) and solution for intravenous (IV) injection. Immediate-release tablets (tartrate) are typically white, round, and may be scored. Extended-release tablets (succinate) are often white, oval, and may be scored. The IV solution is clear and colorless.
Dosage & Administration	Dosage varies significantly by formulation, indication, and patient response. For hypertension, immediate-release doses typically start at 50-100 mg daily in divided doses, while extended-release starts at 25-50 mg once daily. For angina, similar daily doses are used. For heart failure, metoprolol succinate is initiated at very low doses (e.g., 12.5-25 mg daily) and titrated slowly over weeks. Take with or immediately after meals for consistent absorption. Do not crush or chew extended-release tablets.
Supplied As	Metoprolol is supplied as: oral immediate-release tablets (e.g., 25 mg, 50 mg, 100 mg), oral extended-release tablets (e.g., 25 mg, 50 mg, 100 mg, 200 mg), and solution for intravenous injection (e.g., 1 mg/mL in 5 mL vials).
Contraindications	Metoprolol is contraindicated in patients with known hypersensitivity to metoprolol or other beta-blockers, or any component of the formulation. It is also contraindicated in severe bradycardia, greater than first-degree heart block (unless a pacemaker is in place), cardiogenic shock, decompensated heart failure requiring intravenous inotropes, and sick sinus syndrome (unless a pacemaker is in place).
Storage & Expiry	Metoprolol tablets and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include fatigue, dizziness, bradycardia (slow heart rate), lightheadedness, nausea, and dry mouth. More serious side effects can include profound bradycardia, heart block, worsening heart failure, bronchospasm (especially at higher doses or in susceptible individuals), and mask symptoms of hypoglycemia.
Warnings & Precautions	♦ Abrupt Withdrawal: Do not abruptly discontinue therapy, especially in patients with coronary artery disease (CAD), as it can exacerbate angina, precipitate myocardial infarction, or lead to ventricular arrhythmias. Taper dose gradually over 1-2 weeks. ♦ Heart Failure: Beta-blockers can worsen heart failure in some patients. Initiate therapy cautiously and monitor closely. Contraindicated in decompensated heart failure. ♦ Bronchospastic Disease: While cardioselective, high doses or individual sensitivity can cause bronchospasm. Use with caution and lowest effective dose in patients with asthma or COPD; generally avoid in severe cases. ♦ Diabetes: Can mask symptoms of hypoglycemia (e.g., tachycardia, palpitations) and may prolong hypoglycemic episodes. Use with caution in diabetic patients. ♦ Pheochromocytoma: Beta-blockers should not be used alone in pheochromocytoma; an alpha-blocker should be initiated prior to beta-blockade to prevent paradoxical hypertension. ♦ Thyrotoxicosis: Can mask symptoms of hyperthyroidism. Abrupt withdrawal can precipitate thyroid storm. ♦ Peripheral Vascular Disease: May precipitate or aggravate symptoms of arterial insufficiency. ♦ Surgery: Inform anesthetist of beta-blocker use due to potential for exaggerated hypotension. ♦ Renal/Hepatic Impairment: Use with caution; dose adjustments may be needed for severe hepatic impairment.
Missed Dose Instructions	If a dose of Metoprolol is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining stable control of blood pressure or heart rate.
Overdose Instructions	Overdose symptoms are primarily related to exaggerated pharmacological effects, including severe bradycardia, hypotension, heart block, cardiac failure, bronchospasm, and possibly seizures. Treatment is supportive and symptomatic. Atropine for bradycardia, glucagon for refractory bradycardia/hypotension, IV fluids for hypotension, and vasopressors if needed. Bronchospasm may require beta-agonists. Metoprolol is not significantly removed by hemodialysis. Seek immediate emergency medical help.
Medicine Interactions	♦ Other Antihypertensives/Diuretics: Additive hypotensive effects. Monitor blood pressure closely. ♦ Calcium Channel Blockers (e.g., verapamil, diltiazem): Increased risk of bradycardia, heart block, and hypotension. Use with caution. ♦ Digoxin: Increased risk of bradycardia and AV block. Monitor heart rate and ECG. ♦ MAO Inhibitors: Concurrent use generally not recommended due to possible severe hypertension or hypotension. ♦ Clonidine: If discontinuing clonidine, beta-blocker should be tapered first to avoid rebound hypertension. ♦ Reserpine/Other Catecholamine-Depleting Drugs: May cause additive hypotensive and bradycardic effects. ♦ NSAIDs: May reduce the antihypertensive effect of metoprolol. ♦ CYP2D6 Inhibitors (e.g., fluoxetine, paroxetine, quinidine, propafenone, bupropion, amiodarone): Can increase metoprolol plasma levels and enhance its effects. Monitor for increased beta-blockade. ♦ Insulin/Oral Hypoglycemics: Can mask signs of hypoglycemia. ♦ General Anesthetics: May cause additive myocardial depression and hypotension.

Metronidazole (Flagyl)

Purpose/Indication	Metronidazole is an antibiotic and antiprotozoal medication used to treat a wide range of infections caused by anaerobic bacteria and certain parasites. It is commonly indicated for bacterial vaginosis, trichomoniasis, giardiasis, amebiasis, Clostridioides difficile-associated diarrhea (CDAD), and serious anaerobic infections (e.g., intra-abdominal infections, skin and soft tissue infections, bone and joint infections). It can also be used topically for rosacea.
Method of Action	Metronidazole is a nitroimidazole derivative. It enters the bacterial or protozoal cell, where its nitro group is reduced by microbial enzymes, creating highly reactive cytotoxic free radicals and reduced nitro compounds. These reactive intermediates damage the organism's DNA, inhibiting nucleic acid synthesis and leading to microbial cell death. This selective reduction in anaerobic conditions makes it effective against anaerobes and certain parasites, as aerobic cells lack the necessary enzymes for this reduction.
Medication Name & Brand Names	♦ Medication Name: Metronidazole ♦ Brand Names: Flagyl (oral, IV), Flagyl ER (extended-release), MetroGel (topical), Noritate (topical), Metrogel-Vaginal (vaginal gel), Metronidazole (generic)
Pharmaceutical Forms & Appearance	Metronidazole is available as oral tablets (immediate and extended-release), oral suspension, solution for intravenous (IV) infusion, topical cream/gel/lotion, and vaginal gel. Oral tablets are typically white or off-white, often round or oblong, and may be scored. The oral suspension is a flavored, white to off-white liquid. The IV solution is clear and colorless to pale yellow. Topical and vaginal gels are translucent to opaque.
Dosage & Administration	Dosage varies widely depending on the infection type, severity, and formulation. For common infections, oral doses range from 250 mg to 750 mg, administered two or three times daily, or a single high dose (e.g., 2 grams for trichomoniasis). IV administration is used for severe infections. Topical and vaginal forms are applied directly to the affected area, typically once or twice daily. Oral doses can be taken with food to reduce gastrointestinal upset.
Supplied As	Metronidazole is supplied as: oral immediate-release tablets (e.g., 250 mg, 500 mg), oral extended-release tablets (e.g., 750 mg), oral suspension (e.g., 200 mg/5 mL), solution for intravenous infusion (e.g., 500 mg/100 mL bags), topical cream/gel/lotion (e.g., 0.75%, 1%), and vaginal gel (e.g., 0.75%).

Contraindications	Metronidazole is contraindicated in patients with known hypersensitivity to metronidazole, other nitroimidazole derivatives, or any component of the formulation. Oral and IV forms are contraindicated during the first trimester of pregnancy for trichomoniasis. Concomitant use of disulfiram within the past 2 weeks is a contraindication due to risk of psychotic reactions. Concomitant use of alcohol or propylene glycol during and for at least 3 days after metronidazole therapy is contraindicated due to a disulfiram-like reaction.
Storage & Expiry	Metronidazole tablets, oral suspension, IV solution, topical, and vaginal products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light (especially IV bags) and moisture. Keep in tightly closed containers. Oral suspension should not be frozen. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, diarrhea, abdominal pain, metallic taste, headache, and dizziness. More serious side effects, though less common, include peripheral neuropathy (especially with prolonged or high-dose use), seizures, encephalopathy (rarely), aseptic meningitis (rarely), neutropenia, pancreatitis, and severe allergic reactions (e.g., rash, Stevens-Johnson syndrome). A disulfiram-like reaction (flushing, nausea, vomiting, tachycardia) can occur with alcohol.
Warnings & Precautions	♦ Alcohol Interaction: BLACK BOX WARNING: Disulfiram-like reaction with alcohol. Advise patients to avoid alcohol or products containing alcohol/propylene glycol during therapy and for at least 3 days after discontinuation. ♦ Neurological Effects: Seizures and peripheral neuropathy (e.g., numbness, tingling, pain in extremities) have been reported, especially with prolonged or high-dose therapy. Discontinue if symptoms occur. Cases of aseptic meningitis and encephalopathy (including cerebellar symptoms) have also been reported. ♦ Disulfiram Interaction: Psychotic reactions can occur with concurrent use. Avoid co-administration. ♦ Hepatic Impairment: Use with caution and consider dose reduction in patients with severe hepatic impairment, as drug clearance may be reduced. ♦ Blood Dyscrasias: Cases of neutropenia and leukopenia have been reported. Monitor blood counts, especially with prolonged therapy. ♦ Candida Superinfection: May cause candidal overgrowth. ♦ Pregnancy: While generally considered safe in the second and third trimesters, avoid use in the first trimester for trichomoniasis. Consider risks vs. benefits for other infections. ♦ Renal Impairment: While not renally cleared, metabolites can accumulate; use with caution.
Missed Dose Instructions	If a dose of Metronidazole (oral) is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full course of therapy is crucial for effective infection eradication and to prevent resistance.
Overdose Instructions	Overdose symptoms are typically an exaggeration of known side effects, including severe gastrointestinal upset, ataxia, nausea, vomiting, and disorientation. With very high doses or prolonged use, more serious neurological effects like peripheral neuropathy, seizures, and encephalopathy can occur. Treatment is supportive and symptomatic. There is no specific antidote. Hemodialysis can remove some metronidazole. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Alcohol/Propylene Glycol: Contraindicated: Disulfiram-like reaction (flushing, nausea, vomiting, abdominal cramps, headache, palpitations, tachycardia). Avoid during and for at least 3 days after therapy. ♦ Disulfiram: Contraindicated: Psychotic reactions. Avoid concomitant use within 2 weeks of disulfiram. ♦ Warfarin and other Oral Anticoagulants: Potentiates the anticoagulant effect, increasing bleeding risk. Monitor INR frequently and adjust anticoagulant dose. ♦ Lithium: Can increase serum lithium concentrations and lead to toxicity. Monitor lithium levels. ♦ Cimetidine: May prolong the half-life and decrease the clearance of metronidazole, increasing plasma concentrations. ♦ Phenobarbital, Phenytoin: May decrease metronidazole plasma concentrations (due to enzyme induction) and increase phenytoin levels. ♦ Busulfan: May increase busulfan plasma concentrations, increasing risk of toxicity. ♦ Fluorouracil: May increase fluorouracil systemic exposure. ♦ Tacrolimus: Increased tacrolimus levels reported with concurrent use. ♦ Mebendazole: Concurrent use has been associated with increased risk of Stevens-Johnson syndrome/toxic epidermal necrolysis (rare). Avoid if possible.

Miconazole (Monistat)

Purpose/Indication	Miconazole is an antifungal medication used to treat various fungal and yeast infections of the skin (e.g., athlete's foot, jock itch, ringworm), nails, and mucous membranes (e.g., vaginal yeast infections, oral thrush). It is effective against dermatophytes (tinea infections) and yeasts, particularly Candida species.
Method of Action	Miconazole is an imidazole antifungal agent. It primarily works by inhibiting the biosynthesis of ergosterol, a vital component of fungal cell membranes. By interfering with ergosterol synthesis, miconazole disrupts the integrity and permeability of the fungal cell membrane, leading to leakage of essential intracellular components and ultimately fungal cell death. It also inhibits certain fungal enzymes and can increase oxidative stress within the fungal cell.
Medication Name & Brand Names	♦ Medication Name: Miconazole Nitrate ♦ Brand Names: Monistat (vaginal cream/suppository), Daktarin (topical cream, oral gel, powder - regional), Micatin (topical cream), Desenex (topical powder/spray - regional), Miconazole (generic)
Pharmaceutical Forms & Appearance	Miconazole is available in various topical forms, including creams, powders, sprays, solutions, and vaginal suppositories/creams. Oral gels are also available for oral thrush. Topical creams are typically white, smooth, and opaque. Vaginal suppositories are usually white or off-white. Oral gels are translucent and flavored.
Dosage & Administration	Dosage and administration vary significantly by the affected area and formulation. For skin infections, apply a thin layer of cream/lotion/powder to the affected area and surrounding skin, typically once or twice daily for 2-4 weeks. For vaginal yeast infections, vaginal cream or suppositories are inserted once daily at bedtime for 1-7 days, depending on strength. For oral thrush, the oral gel is applied to the affected areas in the mouth, usually after meals. Always wash hands before and after application.
Supplied As	Miconazole is supplied as: topical creams (e.g., 2%), topical powders/sprays (e.g., 2%), vaginal creams (e.g., 2%), vaginal suppositories (e.g., 100 mg, 200 mg, 1200 mg), and oral gels (e.g., 2%).
Contraindications	Miconazole is contraindicated in patients with known hypersensitivity to miconazole, other imidazole antifungals, or any component of the formulation.
Storage & Expiry	Miconazole products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and excessive heat. Keep in tightly closed containers. Oral gels should not be frozen. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and localized, including skin irritation, itching, burning, redness, or dryness at the application site. For vaginal forms, mild vaginal burning, itching, or irritation may occur. For oral gel, nausea, vomiting, and taste alteration can occur. Systemic side effects are rare due to minimal absorption.

Warnings & Precautions	♦ For External/Local Use Only: Topical and vaginal preparations are for external/local use only. Do not ingest. ♦ Avoid Eye Contact: Avoid contact with eyes. If contact occurs, flush thoroughly with water. ♦ Irritated/Broken Skin: Use with caution on severely irritated or broken skin, as it may increase local irritation. ♦ Allergic Reactions: Discontinue use if irritation or sensitization occurs. Rarely, severe allergic reactions (e.g., rash, swelling) can occur. ♦ Pregnancy/Breastfeeding: Generally considered safe for topical/vaginal use during pregnancy and breastfeeding, but consult a healthcare professional. Oral gel has higher systemic absorption; discuss with doctor. ♦ Complete Full Course: Patients should complete the full prescribed course of treatment, even if symptoms improve, to prevent recurrence. ♦ Oral Anticoagulants (for Oral Gel): Miconazole oral gel has significant systemic absorption and can potentiate the effects of oral anticoagulants. Monitor INR and adjust warfarin dose.
Missed Dose Instructions	For topical or vaginal miconazole, if a dose is missed, apply it as soon as remembered. If it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not double a dose. Consistency is important for effective treatment. For oral gel, if a dose is missed, apply it as soon as remembered.
Overdose Instructions	Overdose from topical or vaginal miconazole is unlikely due to minimal systemic absorption. In case of accidental oral ingestion of a large amount, symptoms are generally gastrointestinal upset (nausea, vomiting, diarrhea). Treatment is supportive and symptomatic. Gastric decontamination may be considered if a significant amount was ingested recently. For oral gel, higher systemic absorption could lead to more pronounced effects, especially with interacting medications. Seek medical advice if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Oral Anticoagulants (e.g., warfarin): IMPORTANT for Oral Gel: Miconazole oral gel, due to its systemic absorption, can significantly potentiate the effect of oral anticoagulants, increasing the risk of bleeding. Monitor INR (International Normalized Ratio) closely and adjust warfarin dose as necessary. This interaction is less significant with topical or vaginal miconazole forms due to minimal systemic absorption, but caution is still advised. ♦ Phenytoin/Fosphenytoin: Miconazole, particularly the oral gel, may increase plasma concentrations of phenytoin. Monitor phenytoin levels. ♦ Sulfonylureas (e.g., glipizide, glyburide): Miconazole may enhance the hypoglycemic effect of sulfonylureas. Monitor blood glucose. ♦ Cyclosporine, Tacrolimus, Sirolimus: Miconazole can increase the plasma concentrations of these immunosuppressants. Monitor levels closely. ♦ Statins (e.g., simvastatin, lovastatin): Miconazole (oral gel) can increase statin levels, potentially increasing risk of myopathy/rhabdomyolysis. Avoid co-administration of oral gel with simvastatin/lovastatin.

Morphine (MS Contin)

Purpose/Indication	Morphine is a potent opioid analgesic used for the management of moderate to severe acute and chronic pain, especially when other analgesics are insufficient. It is also used in palliative care for pain relief, for relief of dyspnea (shortness of breath) in acute left ventricular failure and pulmonary edema, and as a pre-operative medication to provide sedation and anxiety relief.
Method of Action	Morphine is a pure opioid agonist that primarily acts on mu (μ) opioid receptors in the central nervous system (CNS). By binding to these receptors, it mimics the effects of endogenous opioids (endorphins), leading to inhibition of pain signal transmission, altered perception of pain, and activation of descending inhibitory pain pathways. This action results in potent analgesia, sedation, euphoria, and respiratory depression, as well as effects on the gastrointestinal tract (constipation) and cough reflex.
Medication Name & Brand Names	♦ Medication Name: Morphine Sulfate ♦ Brand Names: MS Contin (sustained-release tablets), Kadian (extended-release capsules), Roxanol (oral solution), Astramorph (injectable), Duramorph (injectable), Oramorph (oral solution - regional), Morphine (generic)
Pharmaceutical Forms & Appearance	Morphine is available in numerous forms: oral tablets (immediate-release, controlled-release, extended-release), oral solutions/syrups, rectal suppositories, and solutions for injection (intravenous, intramuscular, subcutaneous, epidural, intrathecal). Oral tablets vary widely in color, shape, and imprint depending on strength and formulation. Injectable solutions are typically clear and colorless.
Dosage & Administration	Dosage is highly individualized and depends on the route, patient's pain severity, opioid tolerance, and renal/hepatic function. For acute pain, immediate-release oral doses typically start at 10-30 mg every 4 hours, or IV doses of 2-10 mg every 2-4 hours. Controlled-release forms are given less frequently (e.g., every 8-24 hours). Administer oral forms with food to reduce nausea. Long-term use requires careful titration and monitoring due to tolerance and dependence.
Supplied As	Morphine is supplied as: oral immediate-release tablets (e.g., 15 mg, 30 mg), oral controlled/extended-release tablets/capsules (e.g., 15 mg to 200 mg), oral solutions (e.g., 10 mg/5 mL, 20 mg/mL), rectal suppositories (e.g., 5 mg, 10 mg, 20 mg, 30 mg), and solutions for injection (e.g., 1 mg/mL, 2 mg/mL, 4 mg/mL, 10 mg/mL, 15 mg/mL in vials, ampules, or pre-filled syringes).
Contraindications	Morphine is contraindicated in patients with known hypersensitivity to morphine or other opioids. It is also contraindicated in patients with significant respiratory depression, acute or severe bronchial asthma (in an unmonitored setting or in the absence of resuscitative equipment), paralytic ileus (bowel obstruction), severe CNS depression, and acute alcohol intoxication. Use is also contraindicated in patients with suspected or known gastrointestinal obstruction, including paralytic ileus.
Storage & Expiry	Morphine products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed, child-resistant containers. Injectable solutions should be protected from freezing. Due to its status as a controlled substance, specific storage and handling regulations apply. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, constipation, drowsiness, dizziness, sedation, itching, and urinary retention. More serious side effects include respiratory depression (potentially fatal), severe hypotension, bradycardia, CNS depression, addiction, dependence, and withdrawal symptoms upon abrupt discontinuation. Serotonin syndrome can occur with concomitant use of serotonergic drugs.

Warnings & Precautions	♦ BLACK BOX WARNINGS: Addiction, Abuse, Misuse: Morphine exposes patients and other users to the risks of opioid addiction, abuse, and misuse, which can lead to overdose and death. Assess risk before prescribing and monitor for signs of abuse and addiction. ♦ Respiratory Depression: BLACK BOX WARNING: Serious, life-threatening, or fatal respiratory depression may occur. Monitor closely, especially during initiation and dose escalation. Risk increased with concurrent CNS depressants. ♦ Concomitant Opioid Use with Benzodiazepines/Other CNS Depressants: BLACK BOX WARNING: Concomitant use with benzodiazepines or other CNS depressants (including alcohol) may result in profound sedation, respiratory depression, coma, and death. Reserve for use when alternative treatment options are inadequate. ♦ Neonatal Opioid Withdrawal Syndrome (NOWS): BLACK BOX WARNING (for prolonged use during pregnancy): Prolonged use during pregnancy can result in NOWS, which may be life-threatening if not recognized and treated. ♦ Cytochrome P450 3A4 Interaction: BLACK BOX WARNING (for oral forms): Concomitant use with CYP3A4 inhibitors (or discontinuation of CYP3A4 inducers) can result in increased morphine plasma concentrations and potentially fatal respiratory depression. ♦ Adrenal Insufficiency: Can cause adrenal insufficiency. ♦ Severe Hypotension: Can cause severe hypotension, especially in patients whose ability to maintain blood pressure is compromised. ♦ GI Effects: Risk of severe constipation, paralytic ileus. Use with caution in patients with pre-existing GI conditions. ♦ Head Injury/Increased Intracranial Pressure: Can obscure the clinical course and elevate cerebrospinal fluid pressure. ♦ Drug Dependence: Physical dependence can develop with prolonged use. Abrupt discontinuation will lead to withdrawal symptoms. Taper gradually. ♦ Renal/Hepatic Impairment: Metabolites can accumulate, increasing effects and risk of toxicity. Use with caution and lower doses. ♦ Elderly/Debilitated Patients: More susceptible to respiratory depression and other adverse effects. Use lowest effective dose. ♦ Serotonin Syndrome: Potentially life-threatening, with concomitant use of serotonergic drugs.
Missed Dose Instructions	For scheduled pain management (e.g., controlled-release morphine), if a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For immediate-release or as-needed dosing, take when pain recurs, but adhere to prescribed frequency limits. Consistent dosing is crucial for pain control and minimizing withdrawal symptoms.
Overdose Instructions	Overdose symptoms are characterized by respiratory depression (decreased respiratory rate and depth, Cheyne-Stokes respiration), extreme somnolence progressing to stupor or coma, constricted pupils (miosis), cold and clammy skin, skeletal muscle flaccidity, and sometimes bradycardia, hypotension, and pulmonary edema. Severe overdose can lead to circulatory collapse, cardiac arrest, and death. Treatment involves immediate medical attention, with primary focus on restoring respiration. Naloxone, an opioid antagonist, is the antidote and should be administered immediately. Repeated doses may be required due to morphine's longer duration of action. Supportive measures, including oxygen, IV fluids, and vasopressors, are essential. Seek immediate emergency medical help.
Medicine Interactions	♦ CNS Depressants (e.g., benzodiazepines, other opioids, alcohol, sedatives, hypnotics, general anesthetics, tricyclic antidepressants, phenothiazines): BLACK BOX WARNING: Potentiation of respiratory depression, profound sedation, coma, and death. Avoid concomitant use; if necessary, use lowest effective doses and shortest duration, monitoring closely. ♦ MAO Inhibitors: Can cause severe, unpredictable reactions (e.g., excitation, depression, rigidity, hyperpyrexia, convulsions). Avoid concomitant use and for 14 days after MAOI discontinuation. ♦ Serotonergic Drugs (e.g., SSRIs, SNRIs, TCAs, triptans, tramadol, linezolid): Increased risk of serotonin syndrome. Monitor for symptoms. ♦ Muscle Relaxants: Enhanced neuromuscular blocking action; increased risk of respiratory depression. ♦ Diuretics: May reduce the diuretic effect. ♦ Anticholinergics: Increased risk of urinary retention and severe constipation/paralytic ileus. ♦ Mixed Agonist/Antagonist Opioid Analgesics (e.g., pentazocine, nalbuphine, butorphanol): Can precipitate withdrawal symptoms in opioid-dependent patients or reduce analgesic effect. ♦ Cimetidine: May enhance respiratory depression. ♦ Ritonavir: Can increase plasma morphine concentrations.

Moxifloxacin (Avelox)

Purpose/Indication	Moxifloxacin is a fluoroquinolone antibiotic used to treat various bacterial infections, including acute bacterial sinusitis, acute bacterial exacerbation of chronic bronchitis, community-acquired pneumonia, complicated and uncomplicated skin and skin structure infections, and complicated intra-abdominal infections. It is also used for plague. Due to significant safety concerns, it is generally reserved for situations where other safer antibiotics are ineffective or contraindicated.
Method of Action	Moxifloxacin exerts its bactericidal effect by inhibiting bacterial topoisomerase II (DNA gyrase) and topoisomerase IV, essential enzymes for DNA replication, transcription, repair, and recombination in bacteria. By interfering with these enzymes, moxifloxacin prevents bacterial DNA unwinding and separation, leading to DNA strand breakage and ultimately bacterial cell death. It has a broad spectrum of activity against both Gram-positive and Gram-negative bacteria, as well as atypical organisms.
Medication Name & Brand Names	♦ Medication Name: Moxifloxacin Hydrochloride ♦ Brand Names: Avelox (oral, IV), Vigamox (ophthalmic solution), Moxifloxacin (generic)
Pharmaceutical Forms & Appearance	Moxifloxacin is available as oral tablets, solution for intravenous (IV) infusion, and ophthalmic solution. Oral tablets are typically pale yellow to pinkish-yellow, film-coated, and oblong, with specific imprints. The IV solution is clear and yellowish. The ophthalmic solution is clear and colorless to pale yellow.
Dosage & Administration	Dosage is typically 400 mg once daily for most infections, regardless of oral or IV route. Duration of therapy varies by infection type and severity, usually ranging from 5 to 21 days. It can be taken with or without food. The ophthalmic solution is administered as drops into the affected eye. No dosage adjustment is usually needed for renal impairment, but caution is advised in severe hepatic impairment.
Supplied As	Moxifloxacin is supplied as: oral film-coated tablets (e.g., 400 mg), solution for intravenous infusion (e.g., 400 mg/250 mL flexible bags), and ophthalmic solution (e.g., 0.5% in 3 mL droptainers).
Contraindications	Moxifloxacin is contraindicated in patients with known hypersensitivity to moxifloxacin, other quinolones, or any component of the formulation. It is also contraindicated in patients with a history of tendon disorders related to quinolone use, or in patients with known QT prolongation or a history of Torsades de Pointes.
Storage & Expiry	Moxifloxacin tablets, IV solution, and ophthalmic solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light (especially IV bags) and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, diarrhea, abdominal pain, dizziness, headache, and insomnia. More serious side effects include tendonitis and tendon rupture (including Achilles tendon), peripheral neuropathy (nerve damage), central nervous system effects (e.g., seizures, psychosis), QT prolongation and Torsades de Pointes, liver injury, and Clostridioides difficile-associated diarrhea (CDAD).

Warnings & Precautions	♦ BLACK BOX WARNINGS: Tendinitis, Tendon Rupture, Peripheral Neuropathy, CNS Effects, Exacerbation of Myasthenia Gravis: ♦ Tendinitis and Tendon Rupture: Increased risk of tendinitis and tendon rupture, occurring at any age, but higher risk in elderly, concomitant corticosteroid use, and organ transplant recipients. Discontinue at first sign of pain, inflammation, or rupture. ♦ Peripheral Neuropathy: Can cause peripheral neuropathy, potentially irreversible, manifesting as pain, burning, tingling, numbness, or weakness. Discontinue if symptoms occur. ♦ Central Nervous System Effects: Can cause CNS adverse reactions including seizures, increased intracranial pressure, psychosis, anxiety, depression, confusion, and hallucinations. Use with caution in patients with CNS disorders. ♦ Exacerbation of Myasthenia Gravis: Can exacerbate muscle weakness in patients with myasthenia gravis. Avoid use. ♦ QT Prolongation: Can prolong the QT interval, potentially leading to Torsades de Pointes. Avoid in patients with known QT prolongation, hypokalemia, or concomitant use of other QT-prolonging drugs. ♦ Hypoglycemia/Hyperglycemia: Can cause severe alterations in blood glucose, including hypoglycemia and hyperglycemia, especially in diabetic patients taking insulin or oral hypoglycemics. Monitor blood glucose. ♦ Aortic Aneurysm and Dissection: Increased risk reported, especially in elderly. Use with caution in patients with known aneurysmal disease. ♦ Hepatotoxicity: Cases of severe hepatotoxicity, including fatal cases, have been reported. ♦ Photosensitivity: Can cause moderate to severe photosensitivity reactions. Advise patients to avoid excessive sun exposure. ♦ Clostridioides difficile-associated diarrhea (CDAD): Can occur. ♦ Resistance: Use should be reserved for specific indications due to increasing fluoroquinolone resistance and serious adverse effects.
Missed Dose Instructions	If a dose of Moxifloxacin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full course of therapy is crucial for effective infection eradication and to prevent resistance.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including severe GI upset, CNS effects (dizziness, confusion, tremor, seizures), and QT prolongation. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if recent. Monitor ECG for QT prolongation. Hemodialysis is not effective in removing moxifloxacin. Seek immediate emergency medical help.
Medicine Interactions	♦ QT-Prolonging Drugs (e.g., Class IA and III antiarrhythmics, tricyclic antidepressants, macrolides, antipsychotics): Concomitant use significantly increases the risk of QT prolongation and Torsades de Pointes. Avoid co-administration. ♦ Antacids (aluminum-, magnesium-containing), Sucralfate, Didanosine, Iron Supplements, Zinc Supplements, Multivitamins (containing divalent or trivalent cations): These agents can chelate moxifloxacin and significantly reduce its oral absorption. Administer moxifloxacin at least 4 hours before or 8 hours after these products. ♦ Corticosteroids: Concomitant use increases the risk of tendinitis and tendon rupture. ♦ Warfarin: May enhance the anticoagulant effect of warfarin, increasing bleeding risk. Monitor INR closely. ♦ Antidiabetic Agents (e.g., insulin, sulfonylureas): Increased risk of blood glucose disturbances (hypoglycemia or hyperglycemia). Monitor blood glucose levels. ♦ Theophylline: While generally not a significant interaction with moxifloxacin, other fluoroquinolones have interacted with theophylline. Monitor. ♦ NSAIDs: Concomitant use may increase the risk of CNS stimulation and convulsive seizures. ♦ Drugs affecting renal function: Indirectly increase risk of adverse events if they impair moxifloxacin elimination.

N - Q

Any medications starting with N through to Q.

Nabumetone (Relafen)

Purpose/Indication	Nabumetone is a non-steroidal anti-inflammatory drug (NSAID) used for the long-term management of signs and symptoms of osteoarthritis and rheumatoid arthritis. It helps to reduce inflammation, swelling, stiffness, and pain associated with these chronic joint conditions.
Method of Action	Nabumetone is a prodrug that is converted in the liver to its active metabolite, 6-methoxy-2-naphthylacetic acid (6-MNA). This active metabolite, like other NSAIDs, works by inhibiting cyclooxygenase (COX-1 and COX-2) enzymes. This inhibition reduces the synthesis of prostaglandins, which are key mediators of pain and inflammation. Its prodrug nature and relatively long half-life allow for once-daily dosing.
Medication Name & Brand Names	♦ Medication Name: Nabumetone ♦ Brand Names: Relafen (historical, may not be widely available), Relafen DS (historical, may not be widely available), Nabumetone (generic)
Pharmaceutical Forms & Appearance	Nabumetone is available as oral tablets. Tablets are typically white to off-white, often coated, and may be in various shapes (e.g., modified capsule-shaped), with specific imprints indicating strength (e.g., 500 mg, 750 mg).
Dosage & Administration	For adults, the usual initial dose for osteoarthritis and rheumatoid arthritis is 1000 mg orally once a day, typically at bedtime. The dose can be adjusted as needed, with a usual maximum of 2000 mg per day, given as a single dose or in two divided doses. It can be taken with or without food, but taking it with food or milk may help reduce gastrointestinal upset. Use the lowest effective dose for the shortest duration possible.
Supplied As	Nabumetone is supplied as: oral tablets (e.g., 500 mg, 750 mg, 1000 mg).
Contraindications	Nabumetone is contraindicated in patients with known hypersensitivity to nabumetone, aspirin, or other NSAIDs. It is also contraindicated in patients with a history of asthma, urticaria, or other allergic-type reactions precipitated by aspirin or other NSAIDs, active gastrointestinal bleeding or peptic ulcer disease, severe renal impairment, or in the setting of coronary artery bypass graft (CABG) surgery.
Storage & Expiry	Nabumetone tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed, light-resistant containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., abdominal pain, nausea, dyspepsia, diarrhea, constipation, flatulence), headache, dizziness, and skin rash/itching. More serious side effects include severe gastrointestinal bleeding, ulceration, or perforation, acute kidney injury, cardiovascular thrombotic events (e.g., heart attack, stroke), liver injury, and severe allergic reactions (including anaphylaxis, serious skin reactions).

Warnings & Precautions	♦ BLACK BOX WARNINGS: Cardiovascular Thrombotic Events & Gastrointestinal Risk: Nabumetone, like other NSAIDs, carries an increased risk of serious cardiovascular thrombotic events (e.g., heart attack, stroke) and serious gastrointestinal adverse events (e.g., bleeding, ulceration, perforation), which can be fatal. This risk may increase with duration of use. Avoid use in the setting of CABG surgery. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, including acute renal failure. Use with caution in patients with pre-existing renal disease, heart failure, liver dysfunction, or dehydration. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. Monitor blood pressure closely. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function in prolonged use. ♦ Anaphylactoid Reactions: Can occur in patients without known prior exposure. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Pregnancy: Avoid use in late pregnancy (after 20 weeks gestation), particularly in the third trimester, due to risk of premature closure of fetal ductus arteriosus and potential fetal renal dysfunction. ♦ Elderly: Increased risk of serious adverse effects, especially GI bleeding and renal dysfunction. Use lowest effective dose. ♦ Photosensitivity: May cause more reactions to sun exposure than expected.
Missed Dose Instructions	If a dose of Nabumetone is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for chronic conditions like arthritis.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily severe gastrointestinal upset (nausea, vomiting, abdominal pain), drowsiness, and potentially more severe GI bleeding, acute renal failure, or even seizures. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be useful due to high protein binding. Seek immediate emergency medical help.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin) & Antiplatelet agents (e.g., aspirin, clopidogrel): Significantly increased risk of bleeding. Concurrent use should be approached with extreme caution, and close monitoring of coagulation parameters (e.g., INR) is essential. ♦ Other NSAIDs: Concomitant use is generally not recommended due to additive GI and renal toxicity, and no additional therapeutic benefit. ♦ Lithium: Increases serum lithium concentrations and toxicity; monitor lithium levels closely. ♦ Methotrexate: Increases methotrexate toxicity. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and significantly increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Corticosteroids: Increased risk of GI ulceration and bleeding. ♦ SSRIs: Increased risk of GI bleeding. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ Phenytoin: May increase phenytoin levels.

Naloxone (Narcan)

Purpose/Indication	Naloxone is an opioid antagonist used to rapidly reverse opioid overdose. Its primary indications include the complete or partial reversal of opioid depression, including respiratory depression, caused by natural, synthetic, or semi-synthetic opioids. It is a life-saving medication used in emergency situations to restore normal breathing in individuals experiencing an opioid overdose.
Method of Action	Naloxone works by competitively binding to opioid receptors (mu, kappa, and delta, with highest affinity for mu receptors) in the central nervous system, thereby displacing opioids from these receptors. This action reverses the effects of opioids, including respiratory depression, sedation, and analgesia. Because it has a higher affinity for opioid receptors than most opioids, it can rapidly reverse even severe overdose symptoms.
Medication Name & Brand Names	♦ Medication Name: Naloxone Hydrochloride ♦ Brand Names: Narcan (nasal spray, injectable), Evzio (auto-injector - phased out in some regions), Naloxone (generic)
Pharmaceutical Forms & Appearance	Naloxone is available as an injectable solution (for intravenous, intramuscular, or subcutaneous administration) and as a nasal spray. The injectable solution is typically clear and colorless. The nasal spray is a device that delivers a single dose of clear solution into one nostril.
Dosage & Administration	Dosage varies based on the route of administration, severity of overdose, and patient response. For opioid overdose reversal in an emergency setting, typical adult doses are 0.4 mg to 2 mg administered IV, IM, or SC, which may be repeated every 2-3 minutes as needed until respiratory function improves. The nasal spray usually comes as a single-use device delivering 4 mg (or 2 mg in some formulations) into one nostril. Due to its short half-life, repeat doses may be required, especially with long-acting opioids.
Supplied As	Naloxone is supplied as: solution for injection (e.g., 0.4 mg/mL, 1 mg/mL, 2 mg/mL in ampules, vials, or prefilled syringes), and nasal spray (e.g., 2 mg/spray, 4 mg/spray).
Contraindications	Naloxone is contraindicated in patients with known hypersensitivity to naloxone or any component of the formulation. There are no other absolute contraindications in an emergency opioid overdose situation, as the potential benefit of reversing life-threatening respiratory depression generally outweighs any theoretical risks.
Storage & Expiry	Naloxone injection and nasal spray should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Do not freeze. Keep in the original packaging. Always check the specific expiry date on the packaging. Some products may tolerate brief excursions outside recommended temperatures, but prolonged exposure should be avoided.
Side Effects	Side effects are often related to the rapid reversal of opioid effects and can include opioid withdrawal symptoms (nausea, vomiting, diarrhea, sweating, shivering, body aches, restlessness, irritability, anxiety, piloerection), hypertension, tachycardia, and pulmonary edema (rare). In some cases, severe agitation and aggression may occur.
Warnings & Precautions	♦ Rapid Opioid Withdrawal: Rapid reversal of opioid effects can precipitate an acute opioid withdrawal syndrome, characterized by severe body aches, diarrhea, abdominal cramps, piloerection ("goosebumps"), nausea, vomiting, nervousness, restlessness, irritability, shivering or trembling, muscle spasms, weakness, tachycardia, and increased blood pressure. This can be very distressing for the patient and may be dangerous in patients with cardiovascular disease. ♦ Short Duration of Action: Naloxone has a shorter half-life than many opioids. Therefore, repeated doses may be necessary, and continuous monitoring for recurrent respiratory depression is essential for several hours after initial reversal, especially with long-acting opioids. ♦ Cardiovascular Effects: Rapid reversal can lead to sudden increases in blood pressure, heart rate, and pulmonary edema. Use with caution in patients with pre-existing cardiovascular disease. ♦ Non-Opioid Overdose: Naloxone is ineffective in reversing respiratory depression caused by non-opioid drugs. ♦ Dependence: Naloxone does not produce opioid dependence or cause tolerance. ♦ In Emergency Situations: Administration by laypersons (e.g., family members, first responders) is often crucial and encouraged in opioid overdose emergencies. Training on proper use is vital.
Missed Dose Instructions	Naloxone is an acute, emergency medication. A "missed dose" is not applicable in the typical sense. It is administered when opioid overdose symptoms are present. If a dose is administered and symptoms of opioid overdose reappear, or do not fully resolve, repeat doses should be given as per guidelines (e.g., every 2-3 minutes) until emergency medical services arrive or breathing normalizes.

Naloxone (Narcan)	
Overdose Instructions	Overdose with naloxone is extremely rare and typically results from inadvertent administration of excessively high doses. Symptoms of naloxone overdose are generally not well-defined, as it does not produce opioid-like effects. However, extremely high doses could theoretically exacerbate withdrawal symptoms or cardiovascular side effects. There is no specific antidote for naloxone overdose. Treatment would be supportive and symptomatic. Given its primary use in reversing life-threatening opioid overdose, the risks associated with naloxone overdose are generally minimal compared to the benefits.
Medicine Interactions	♦ Opioids (e.g., morphine, fentanyl, oxycodone, heroin): Naloxone's primary interaction is to antagonize the effects of opioids, leading to their reversal. The degree of reversal depends on the dose of naloxone, the opioid involved, and the degree of opioid dependence. ♦ Buprenorphine: Reversal of buprenorphine-induced respiratory depression may require higher or repeated doses of naloxone due to buprenorphine's high receptor affinity and long duration of action. ♦ No significant direct drug-drug interactions beyond its opioid antagonism are generally reported, as it does not undergo significant metabolism by common cytochrome P450 enzymes. Its rapid action and elimination also limit complex interactions.

Naproxen (Aleve)

Purpose/Indication	Naproxen is a non-steroidal anti-inflammatory drug (NSAID) used to relieve mild to moderate pain, inflammation, and fever. It is widely indicated for conditions such as arthritis (rheumatoid arthritis, osteoarthritis, ankylosing spondylitis), juvenile arthritis, tendinitis, bursitis, acute gout, and primary dysmenorrhea (menstrual pain). It also provides temporary relief of aches and pains associated with the common cold, headache, toothache, and minor injuries.
Method of Action	Naproxen exerts its therapeutic effects by reversibly inhibiting the cyclooxygenase (COX) enzymes, both COX-1 and COX-2. This inhibition leads to a significant reduction in the synthesis of prostaglandins, which are lipid compounds that play a crucial role as mediators of pain, inflammation, and fever. By reducing prostaglandin production, naproxen effectively alleviates pain, reduces swelling, and lowers elevated body temperature.
Medication Name & Brand Names	♦ Medication Name: Naproxen (non-prescription), Naproxen Sodium (non-prescription & prescription), Naproxen (prescription) ♦ Brand Names: Aleve (OTC), Naprosyn (prescription), Anaprox (prescription), Naproxen (generic)
Pharmaceutical Forms & Appearance	Naproxen is available as oral tablets (immediate-release and extended-release), delayed-release tablets, oral suspension, and rectal suppositories. Tablets vary in color, shape, and imprint depending on the manufacturer and strength (e.g., blue, white, round, oval), often scored. The oral suspension is a clear to slightly cloudy liquid.
Dosage & Administration	Dosage varies by indication, patient age, and form (immediate vs. extended release). For adults, typical doses range from 250 mg to 500 mg orally twice daily (for prescription forms) or 220 mg (naproxen sodium) every 8 to 12 hours as needed (for OTC forms). Extended-release forms are usually once daily. For dysmenorrhea, an initial dose of 500 mg followed by 250 mg every 6-8 hours as needed. It should be taken with food, milk, or antacids to minimize gastrointestinal upset. Use the lowest effective dose for the shortest duration.
Supplied As	Naproxen is supplied as: oral tablets (e.g., 220 mg, 250 mg, 375 mg, 500 mg, 550 mg), delayed-release tablets (e.g., 375 mg, 500 mg), extended-release tablets (e.g., 375 mg, 500 mg, 750 mg), oral suspension (e.g., 125 mg/5 mL), and rectal suppositories (e.g., 500 mg).
Contraindications	Naproxen is contraindicated in patients with known hypersensitivity to naproxen, aspirin, or other NSAIDs. It is also contraindicated in patients with a history of bronchospasm, asthma, rhinitis, or urticaria precipitated by aspirin or other NSAIDs, active gastrointestinal bleeding or peptic ulcer disease, severe renal impairment, or in the setting of coronary artery bypass graft (CABG) surgery.
Storage & Expiry	Naproxen tablets, suspension, and suppositories should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (e.g., nausea, vomiting, abdominal pain, dyspepsia, heartburn, constipation), headache, dizziness, and mild swelling (edema). More serious side effects, though less common with short-term use, include severe gastrointestinal bleeding, ulceration, or perforation, acute kidney injury, cardiovascular thrombotic events (e.g., heart attack, stroke), liver injury, and severe allergic reactions (e.g., anaphylaxis, serious skin reactions).
Warnings & Precautions	♦ BLACK BOX WARNINGS: Cardiovascular Thrombotic Events & Gastrointestinal Risk: Naproxen, like other NSAIDs, carries an increased risk of serious cardiovascular thrombotic events (e.g., heart attack, stroke) and serious gastrointestinal adverse events (e.g., bleeding, ulceration, perforation), which can be fatal. This risk may increase with duration of use. Avoid use in the setting of CABG surgery. ♦ Renal Effects: Can cause new onset or worsening of renal impairment, including acute renal failure. Use with caution in patients with pre-existing renal disease, heart failure, liver dysfunction, or dehydration. ♦ Hypertension: Can cause new onset hypertension or worsen pre-existing hypertension. Monitor blood pressure closely. ♦ Fluid Retention/Edema: Use with caution in patients with heart failure or hypertension. ♦ Hepatic Effects: Liver injury, including severe and fatal cases, can occur. Monitor liver function in prolonged use. ♦ Anaphylactoid Reactions: Can occur in patients without known prior exposure. ♦ Asthma Exacerbation: Use with caution in patients with asthma, especially aspirin-sensitive asthma. ♦ Pregnancy: Avoid use in late pregnancy (after 20 weeks gestation), particularly in the third trimester, due to risk of premature closure of fetal ductus arteriosus and potential fetal renal dysfunction. ♦ Elderly: Increased risk of serious adverse effects, especially GI bleeding and renal dysfunction. Use lowest effective dose. ♦ Skin Reactions: Can cause serious skin adverse reactions (e.g., exfoliative dermatitis, Stevens-Johnson Syndrome, toxic epidermal necrolysis). Discontinue at first appearance of rash.
Missed Dose Instructions	For scheduled conditions (e.g., arthritis), if a dose of Naproxen is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For as-needed use, take when pain recurs, adhering to dosage limits.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily severe gastrointestinal upset (nausea, vomiting, abdominal pain), drowsiness, and potentially more severe GI bleeding, acute renal failure, or even seizures. Treatment is supportive and symptomatic. Gastric decontamination (e.g., activated charcoal) may be considered if oral ingestion was recent and substantial. Hemodialysis is unlikely to be effective due to high protein binding. Seek immediate emergency medical help.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin) & Antiplatelet agents (e.g., aspirin, clopidogrel): Significantly increased risk of bleeding. Concurrent use should be approached with extreme caution, and close monitoring of coagulation parameters (e.g., INR) is essential. ♦ Other NSAIDs: Concomitant use is generally not recommended due to additive GI and renal toxicity, and no additional therapeutic benefit. ♦ Lithium: Increases serum lithium concentrations and toxicity; monitor lithium levels closely. ♦ Methotrexate: Increases methotrexate toxicity. ♦ ACE Inhibitors/ARBs/Diuretics: May reduce the antihypertensive and diuretic effects, and significantly increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Corticosteroids: Increased risk of GI ulceration and bleeding. ♦ SSRIs: Increased risk of GI bleeding. ♦ Cyclosporine/Tacrolimus: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ Phenytoin: May increase phenytoin levels. ♦ Beta-blockers: May reduce the antihypertensive effect.

Nifepidine (Procardia)

MEDICATION | Medication List | N - Q | Nifepidine (Procardia)

Purpose/Indication	Nifedipine is a dihydropyridine calcium channel blocker primarily used for the management of hypertension (high blood pressure) and chronic stable angina pectoris (chest pain). Extended-release formulations are preferred for these long-term conditions. It is also used to treat Prinzmetal's (variant) angina and, in some cases, Raynaud's phenomenon. Its purpose is to relax blood vessels, thereby lowering blood pressure and increasing blood flow to the heart.
Method of Action	Nifedipine works by inhibiting the influx of extracellular calcium ions across the cell membranes of vascular smooth muscle and, to a lesser extent, cardiac muscle. This selective inhibition primarily affects the L-type voltage-gated calcium channels in arterial smooth muscle, leading to potent peripheral and coronary vasodilation. This vasodilation reduces systemic vascular resistance, thereby lowering blood pressure, and improves myocardial oxygen supply by dilating coronary arteries, relieving angina. Unlike non-dihydropyridines, it has minimal direct effect on cardiac conduction or contractility at therapeutic doses.
Medication Name & Brand Names	♦ Medication Name: Nifedipine ♦ Brand Names: Procardia (immediate-release - regional), Adalat (immediate-release/extended-release), Procardia XL (extended-release - regional), Adalat CC (extended-release), Nifedical XL (extended-release), Nifedipine (generic)
Pharmaceutical Forms & Appearance	Nifedipine is available as oral immediate-release capsules, and oral extended-release tablets. Immediate-release capsules typically contain a clear, yellowish liquid. Extended-release tablets are generally film-coated, often oblong, and may be yellow, orange, or reddish-brown, with specific imprints indicating strength or being part of an osmotic pump system (e.g., ghost tablet may be expelled in stool).
Dosage & Administration	Dosage varies by formulation and indication. For hypertension and chronic stable angina, extended-release formulations are generally preferred, with typical adult doses ranging from 30 mg to 90 mg once daily, adjusted based on patient response. Immediate-release capsules are rarely used for chronic conditions due to fluctuating blood pressure and increased side effects; they are sometimes used for acute hypertensive urgency but are not recommended for routine use. Extended-release tablets should be swallowed whole; do not chew, crush, or divide. It can be taken with or without food.
Supplied As	Nifedipine is supplied as: oral immediate-release capsules (e.g., 5 mg, 10 mg, 20 mg) and oral extended-release tablets (e.g., 30 mg, 60 mg, 90 mg).
Contraindications	Nifedipine is strictly contraindicated in patients with known hypersensitivity to nifedipine or any component of the formulation. It is also contraindicated in patients with cardiogenic shock, aortic stenosis (severe), unstable angina, and within the first few weeks after a myocardial infarction. Immediate-release nifedipine is particularly contraindicated for acute blood pressure reduction due to the risk of precipitous drops and reflex tachycardia, which can cause ischemic events. Concomitant use with rifampicin is contraindicated.
Storage & Expiry	Nifedipine capsules and tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Immediate-release capsules often come in light-protective containers. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are related to vasodilation and include peripheral edema (swelling of ankles/feet), headache, dizziness, flushing, and reflex tachycardia (increased heart rate, especially with immediate-release forms). Other common effects include nausea, fatigue, and gingival hyperplasia (gum overgrowth with long-term use). More serious but less common effects include symptomatic hypotension and, rarely, myocardial infarction or angina exacerbation (especially with immediate-release forms).
Warnings & Precautions	♦ Hypotension: Can cause symptomatic hypotension, especially at initiation or with dose increases. Use with caution in patients with low blood pressure or those susceptible to significant drops. ♦ Reflex Tachycardia: Immediate-release formulations, due to rapid and profound vasodilation, can cause reflex tachycardia, which may exacerbate angina or lead to myocardial infarction, especially in patients with existing CAD. Avoid immediate-release for acute hypertension or chronic management. ♦ Heart Failure: Use with caution in patients with heart failure or reduced left ventricular function as it can worsen cardiac output, although generally less problematic than non-dihydropyridines. ♦ Angina Exacerbation: Rarely, initiation or dose increase may lead to an increase in frequency, duration, or severity of angina, particularly in patients with severe obstructive CAD. ♦ Gastrointestinal Effects (Extended-Release): Extended-release tablets use a non-deformable osmotic pump system that may appear as a "ghost" tablet in the stool. This is normal. Caution in patients with severe GI narrowing. ♦ Hepatic Impairment: Nifedipine is extensively metabolized in the liver. Use with caution and consider dose reduction in patients with hepatic impairment. ♦ Concomitant Beta-Blockers: While often used together, careful monitoring is needed, as combined effects on blood pressure can be additive, though nifedipine has less direct cardiac depression than verapamil/diltiazem. ♦ Peripheral Edema: Common and dose-related. It is often due to arterial vasodilation rather than fluid overload and may not respond well to diuretics. ♦ Gingival Hyperplasia: Can occur with long-term use; good oral hygiene is essential. ♦ Diabetes Mellitus: Use with caution as it may occasionally affect glucose tolerance.
Missed Dose Instructions	For Nifedipine extended-release (ER) tablets: If a dose is missed, take it as soon as remembered on the same day. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For immediate-release (IR) capsules: If a dose is missed, take it as soon as remembered. If it is close to the next dose, skip the missed dose. Do not take a double dose. Consistency is important for blood pressure and angina control.
Overdose Instructions	Overdose symptoms are primarily severe hypotension, bradycardia (if cardiac depression is significant), reflex tachycardia, and potentially profound peripheral vasodilation with flushing. Other effects might include impaired consciousness, metabolic acidosis, and hyperglycemia. There is no specific antidote for nifedipine. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Maintain an open airway, ventilation, and cardiovascular support. Intravenous fluids and vasopressors (e.g., norepinephrine) may be needed for hypotension. Intravenous calcium gluconate or calcium chloride can help reverse some calcium channel blocker effects. Hemodialysis is not effective due to high protein binding. Seek immediate emergency medical help.
Medicine Interactions	♦ Strong CYP3A4 Inducers (e.g., rifampicin, phenytoin, carbamazepine, phenobarbital, St. John's Wort): Rifampicin is CONTRAINDICATED due to profound reduction in nifedipine levels, leading to loss of therapeutic effect. Other inducers may also significantly decrease nifedipine levels. ♦ Strong CYP3A4 Inhibitors (e.g., azole antifungals like ketoconazole, itraconazole; macrolide antibiotics like erythromycin, clarithromycin; protease inhibitors like ritonavir; fluoxetine; nefazodone; diltiazem; verapamil; grapefruit juice): Can significantly increase nifedipine levels, leading to enhanced effects (e.g., severe hypotension, edema). Dose adjustment or avoidance may be necessary. ♦ Beta-Blockers (e.g., metoprolol, propranolol): Can have additive hypotensive effects. While often co-administered, careful monitoring is needed to avoid excessive bradycardia (less common with nifedipine than verapamil/diltiazem) and hypotension. ♦ Magnesium Sulfate: Concurrent use with IV magnesium sulfate (e.g., in preeclampsia) can cause profound hypotension and neuromuscular blockade. ♦ Digoxin: May increase serum digoxin levels. Monitor digoxin levels. ♦ Theophylline: May increase theophylline levels. ♦ Warfarin: No significant interaction. ♦ Quinidine: Nifedipine may decrease quinidine levels. ♦ Cimetidine: May increase nifedipine levels. ♦ Cisapride: May increase nifedipine levels.

Nitazoxanide (Alinia)

Purpose/Indication	Nitazoxanide is an antiprotozoal medication primarily used to treat diarrhea caused by the protozoa Cryptosporidium parvum and Giardia lamblia in adults and children 1 year of age and older. It is particularly useful when protozoal infection is suspected, especially if diarrhea has lasted for more than 7 days.
Method of Action	Nitazoxanide's mechanism of action involves inhibiting the pyruvate:ferredoxin oxidoreductase (PFOR) enzyme-dependent electron transfer reactions within the anaerobic energy metabolism of certain protozoa and anaerobic bacteria. By disrupting this essential energy pathway, nitazoxanide effectively stops the growth and replication of the parasites, leading to their eradication.
Medication Name & Brand Names	♦ Medication Name: Nitazoxanide ♦ Brand Names: Alinia, Annita (regional), Daxon (regional), Nitamax (regional), Nitazoxanide (generic)
Pharmaceutical Forms & Appearance	Nitazoxanide is available as oral tablets and oral suspension. Tablets are typically yellow, film-coated, round, and may be debossed with specific markings. The oral suspension is a strawberry-flavored liquid, which needs to be shaken well before use.
Dosage & Administration	Dosage varies by age. For adults and children 12 years and older, the typical dose is 500 mg orally every 12 hours with food for 3 days. For children 4 to under 12 years, it's 200 mg every 12 hours with food for 3 days. For children 1 to under 4 years, it's 100 mg every 12 hours with food for 3 days. Always take with food to enhance absorption and minimize gastrointestinal upset.
Supplied As	Nitazoxanide is supplied as: oral tablets (e.g., 500 mg) and oral suspension (e.g., 100 mg/5 mL).
Contraindications	Nitazoxanide is contraindicated in patients with known hypersensitivity to nitazoxanide or any component of the formulation. Caution is advised in patients with hepatic or renal impairment, diabetes, HIV infection, or other immunodeficiencies, as it has not been extensively studied in these populations for its indicated uses.
Storage & Expiry	Nitazoxanide tablets and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The oral suspension, once reconstituted by the pharmacist, typically needs to be used within 7 days and should not be frozen. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances such as abdominal pain, nausea, diarrhea, and vomiting. Other commonly reported side effects are headache and chromaturia (discolored urine, often yellow or greenish). Most side effects are mild and transient.
Warnings & Precautions	♦ Renal/Hepatic Impairment: Has not been studied in patients with significant renal or hepatic impairment; use with caution. ♦ Diabetes: The oral suspension contains sucrose; this should be considered for diabetic patients. ♦ Immunocompromised Patients: Effectiveness for C. parvum in HIV-infected or immunodeficient patients has not been established. ♦ Completing Course: It is important to complete the full prescribed course of treatment to ensure complete eradication of the infection and prevent recurrence. ♦ Hygiene: Advise patients on proper hygiene to prevent re-infection.
Missed Dose Instructions	If a dose of Nitazoxanide is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose to make up for a missed one. It is important to complete the full 3-day course of treatment.
Overdose Instructions	There is limited information on human overdose with nitazoxanide. Symptoms of overdose are likely to be an exaggeration of the known side effects, such as severe gastrointestinal distress (abdominal pain, nausea, vomiting, diarrhea) and headache. Treatment is supportive and symptomatic. Gastric lavage may be considered soon after acute overdose. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Warfarin: Nitazoxanide is highly bound to plasma proteins. Therefore, it may compete for binding sites with other highly plasma protein-bound drugs with narrow therapeutic indices, such as warfarin, potentially increasing the anticoagulant effect. Monitor INR closely if co-administered. ♦ Other highly protein-bound drugs: Theoretical potential for interaction with other highly protein-bound medications (e.g., phenytoin, lorazepam, valproic acid); monitor for altered effects of either drug. ♦ Food: Food enhances the absorption of nitazoxanide, and it should always be taken with food to ensure optimal absorption and minimize gastrointestinal upset.

Nitrofurantoin (Macrobid)

Purpose/Indication	Nitrofurantoin is an antibiotic specifically used for the treatment and prophylaxis of uncomplicated lower urinary tract infections (UTIs) caused by susceptible bacteria. It is effective against common uropathogens like E. coli and Enterococcus. It concentrates in the urine, making it highly effective for bladder infections without significant systemic antibacterial effects.
Method of Action	Nitrofurantoin is a nitrofuran antimicrobial. It works by being reduced by bacterial flavoproteins to highly reactive intermediates within the bacterial cell. These reactive intermediates then damage multiple bacterial macromolecules, including DNA, RNA, ribosomes, and other metabolic enzymes. This broad-spectrum damage inhibits bacterial growth and ultimately leads to bacterial cell death, primarily within the urinary tract. Its mechanism of action is unique, reducing the likelihood of cross-resistance with other antibiotics.
Medication Name & Brand Names	♦ Medication Name: Nitrofurantoin (macrocrystals), Nitrofurantoin monohydrate/macrocrystals ♦ Brand Names: Macrobid (macrocrystals/monohydrate - BID dosing), Macrodantin (macrocrystals - QID dosing), Furadantin (oral suspension - regional), Nitrofurantoin (generic)
Pharmaceutical Forms & Appearance	Nitrofurantoin is available as oral capsules and oral suspension. Macrocrystal capsules (Macrodantin) are typically yellow and white, or entirely yellow. Monohydrate/macrocrystal capsules (Macrobid) are typically yellow and white with specific imprints. The oral suspension is a yellow to orange, opaque liquid.
Dosage & Administration	Dosage varies by formulation and indication. For acute uncomplicated UTIs, Macrobid (monohydrate/macrocrystals) is typically 100 mg orally every 12 hours for 5 to 7 days. Macrodantin (macrocrystals) is typically 50-100 mg orally four times a day for 7 days. For prophylaxis, lower daily doses may be used. It should be taken with food to enhance absorption and minimize gastrointestinal upset.
Supplied As	Nitrofurantoin is supplied as: oral macrocrystal capsules (e.g., 25 mg, 50 mg, 100 mg), oral monohydrate/macrocrystal capsules (e.g., 100 mg), and oral suspension (e.g., 25 mg/5 mL).
Contraindications	Nitrofurantoin is contraindicated in patients with known hypersensitivity to nitrofurantoin or any component of the formulation. It is also contraindicated in patients with anuria, oliguria, or significant renal impairment (e.g., creatinine clearance < 60 mL/min or eGFR < 30-60 mL/min, depending on product and region) due to increased risk of toxicity and lack of efficacy. It is contraindicated in pregnant women at term (38-42 weeks gestation), during labor and delivery, or when the onset of labor is imminent due to the possibility of hemolytic anemia in the neonate. Also contraindicated in infants less than 1 month of age for the same reason.

Storage & Expiry	Nitrofurantoin capsules and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances (e.g., nausea, vomiting, abdominal pain, diarrhea), headache, and dizziness. The urine may turn a harmless brown or rust color. More serious but less common side effects include pulmonary reactions (acute, subacute, or chronic pneumonitis), peripheral neuropathy (potentially irreversible), hepatotoxicity (liver damage), hemolytic anemia (especially in G6PD deficiency), and Clostridioides difficile-associated diarrhea (CDAD).
Warnings & Precautions	♦ Pulmonary Reactions: Can cause acute, subacute, or chronic pulmonary reactions, ranging from mild reversible pneumonitis to severe, irreversible pulmonary fibrosis. Discontinue at first sign of lung injury. Risk increases with long-term use. ♦ Peripheral Neuropathy: Can cause severe and potentially irreversible peripheral neuropathy, particularly in patients with renal impairment, anemia, diabetes mellitus, electrolyte imbalance, or vitamin B deficiency. Discontinue if symptoms occur. ♦ Hepatotoxicity: Rare cases of hepatitis, cholestatic jaundice, and chronic active hepatitis have been reported. Monitor liver function in long-term therapy. ♦ Hemolytic Anemia: Can occur, particularly in patients with G6PD (glucose-6-phosphate dehydrogenase) deficiency. Avoid use in G6PD deficient patients. ♦ Renal Impairment: Use is contraindicated in patients with significant renal impairment due to accumulation and increased risk of toxicity, and lack of efficacy. ♦ Clostridioides difficile-associated diarrhea (CDAD): Can occur with nearly all antibacterial agents, including nitrofurantoin. ♦ Pregnancy (Term)/Infants: Contraindicated in pregnant women at term and in infants < 1 month of age due to risk of hemolytic anemia in the neonate. ♦ Urine Discoloration: May cause urine to turn a harmless brown or rust color. ♦ Hypersensitivity Reactions: Allergic reactions, including skin rashes and anaphylaxis, can occur.
Missed Dose Instructions	If a dose of Nitrofurantoin is missed, take it as soon as remembered with food. If it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. It is crucial to complete the full course of therapy to effectively treat the infection and prevent recurrence or development of resistance.
Overdose Instructions	Overdose of nitrofurantoin is rare. Symptoms are likely to be an exaggeration of the known side effects, particularly severe gastrointestinal disturbances (nausea, vomiting), and potentially more pronounced neurotoxic or pulmonary effects. Treatment is supportive and symptomatic. Increased fluid intake may promote urinary excretion. Hemodialysis is of limited value. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Antacids (magnesium trisilicate-containing): Can decrease the absorption of nitrofurantoin. Avoid co-administration or separate by several hours. ♦ Probenecid/Sulfinpyrazone: Can inhibit renal tubular secretion of nitrofurantoin, leading to increased plasma concentrations and reduced urinary concentrations. This decreases efficacy for UTIs and increases risk of toxicity. Avoid concurrent use. ♦ Quinolones: May reduce the antibacterial effect of quinolones in vitro (clinical significance uncertain). ♦ Live Bacterial Vaccines (e.g., typhoid vaccine): Antibiotics may reduce the therapeutic effect of live bacterial vaccines. Administer vaccine before starting nitrofurantoin, or defer antibiotic if possible. ♦ Food: Taking with food enhances absorption and improves tolerability, particularly for the macrocrystalline form.

Nystatin (Mycostatin)

Purpose/Indication	Nystatin is an antifungal medication primarily used to treat infections caused by Candida species (yeast), particularly candidiasis of the skin, mucous membranes (e.g., oral thrush, vaginal yeast infections), and the gastrointestinal tract. It is not absorbed systemically from these sites, making it effective for localized fungal infections.
Method of Action	Nystatin is a polyene antifungal. It works by binding to ergosterol, a vital sterol component of the fungal cell membrane. This binding creates pores or channels in the fungal cell membrane, leading to increased permeability, leakage of essential intracellular components (such as potassium and other cellular constituents), and ultimately, fungal cell death. Its mechanism is specific to fungi and does not significantly affect human cells, which contain cholesterol instead of ergosterol.
Medication Name & Brand Names	♦ Medication Name: Nystatin ♦ Brand Names: Mycostatin (oral suspension, tablets, topical, vaginal), Nystop (topical powder), Bio-Statin (oral tablets), Nystatin (generic)
Pharmaceutical Forms & Appearance	Nystatin is available in various topical, oral (non-systemic), and vaginal forms: oral suspension (for thrush), oral tablets/lozenges (for GI candidiasis), topical creams, ointments, and powders, and vaginal tablets/suppositories. Oral suspension is typically a yellow, viscous liquid. Oral tablets are usually yellow or brown. Topical creams/ointments are white to yellowish. Vaginal tablets are typically yellow.
Dosage & Administration	Dosage and administration vary significantly by the site of infection and formulation. For oral thrush, the oral suspension is typically 4-6 mL (400,000-600,000 units) swished in the mouth and swallowed, or held in the mouth and then spit out, 4 times daily. For topical infections, apply a thin layer to the affected area 2-3 times daily. For vaginal infections, one vaginal tablet or applicator-full of cream is typically inserted daily for 14 days or as directed. Administer oral suspension after meals for oral thrush.
Supplied As	Nystatin is supplied as: oral suspension (e.g., 100,000 units/mL), oral tablets (e.g., 500,000 units), oral lozenges (e.g., 200,000 units), topical cream (e.g., 100,000 units/g), topical ointment (e.g., 100,000 units/g), topical powder (e.g., 100,000 units/g), and vaginal tablets/suppositories (e.g., 100,000 units).
Contraindications	Nystatin is contraindicated in patients with known hypersensitivity to nystatin or any component of the formulation. It is intended for fungal infections sensitive to nystatin and should not be used for systemic fungal infections due to its negligible absorption from the GI tract and skin.
Storage & Expiry	Nystatin products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and excessive heat. Oral suspension should be kept tightly closed and shaken well before use. Do not freeze any formulations. Always check the specific expiry date on the packaging.
Side Effects	Side effects are generally mild and infrequent, given its poor systemic absorption. Common side effects include gastrointestinal upset (e.g., nausea, vomiting, diarrhea, abdominal pain) with oral forms, and local irritation, itching, or redness at the application site for topical or vaginal forms. Allergic reactions (e.g., rash, urticaria) are rare.
Warnings & Precautions	♦ Not for Systemic Infections: Nystatin is poorly absorbed from the gastrointestinal tract and skin; therefore, it is not effective for systemic fungal infections. ♦ Diagnosis: A definitive diagnosis of candidiasis should be made by appropriate laboratory methods (e.g., potassium hydroxide smears, cultures) before initiating treatment. ♦ Complete Full Course: Patients should complete the full prescribed course of treatment, even if symptoms improve, to ensure complete eradication of the infection and prevent recurrence. ♦ Oral Suspension Administration: For oral thrush, instruct patients to swish the suspension in the mouth for as long as possible before swallowing or spitting out, to maximize contact with the affected areas. ♦ Infants: For infants, apply to affected areas using a clean cloth or swab. ♦ Vaginal Use: Advise patients using vaginal preparations on proper hygiene and to continue use even during menstruation.
Missed Dose Instructions	If a dose of Nystatin is missed, take/apply it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not double a dose. Consistency is important for effective treatment of fungal infections.

Overdose Instructions	Overdose of nystatin is highly unlikely to cause systemic toxicity due to its minimal absorption from the gastrointestinal tract and skin. Symptoms of overdose are generally mild and limited to gastrointestinal upset (e.g., nausea, vomiting, diarrhea) if a large amount is ingested orally. Treatment is supportive and symptomatic. There is no specific antidote. Seek medical advice if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ No significant drug-drug interactions are commonly reported for nystatin due to its negligible systemic absorption. ♦ It does not typically interact with other medications, as it acts locally at the site of infection. However, local interactions with other topically applied medications are theoretically possible, although rare and not well-documented.

Olanzapine (Zyprexa)

Purpose/Indication	Olanzapine is an atypical antipsychotic medication used to treat schizophrenia and bipolar I disorder (manic or mixed episodes, and maintenance treatment). It is also used in combination with fluoxetine for treatment-resistant depression and depressive episodes associated with bipolar I disorder. Its purpose is to manage symptoms like hallucinations, delusions, mania, and severe mood disturbances.
Method of Action	Olanzapine is a thienobenzodiazepine atypical antipsychotic that acts on multiple neurotransmitter receptors in the brain. Its primary actions include antagonism of dopamine D2 and serotonin 5−HT2A receptors. It also has antagonistic effects on adrenergic (α1), histamine (H1), and muscarinic (M1,M2,M3,M4,M5) receptors. This multimodal receptor binding profile contributes to its antipsychotic, mood-stabilizing, and sedative effects, while minimizing the risk of extrapyramidal side effects compared to typical antipsychotics.
Medication Name & Brand Names	♦ Medication Name: Olanzapine ♦ Brand Names: Zyprexa (oral tablets, Zydis ODT, intramuscular injection), Zyprexa Relprevv (long-acting injection - historical, largely discontinued due to post-injection delirium/sedation syndrome risk), Olanzapine (generic)
Pharmaceutical Forms & Appearance	Olanzapine is available as oral tablets, orally disintegrating tablets (ODT), and powder for intramuscular (IM) injection (short-acting and long-acting forms). Oral tablets are typically white, round, or oblong, and may be scored, with various imprints. ODTs are white and dissolve rapidly on the tongue. The injectable powder is white to yellowish, reconstituted before use.
Dosage & Administration	Dosage is highly individualized. For schizophrenia, typical initial oral doses are 5-10 mg once daily, titrating to 10-15 mg/day. For bipolar disorder, initial oral doses are often 10-15 mg once daily. IM injection is used for acute agitation. Oral forms can be taken with or without food. Long-acting injectable forms are administered by healthcare professionals at specific intervals. Do not crush or chew ODTs; allow them to dissolve.
Supplied As	Olanzapine is supplied as: oral tablets (e.g., 2.5 mg, 5 mg, 7.5 mg, 10 mg, 15 mg, 20 mg), orally disintegrating tablets (e.g., 5 mg, 10 mg, 15 mg, 20 mg), and powder for injection for reconstitution (e.g., 10 mg/vial for acute IM, and long-acting forms in various strengths).
Contraindications	Olanzapine is contraindicated in patients with known hypersensitivity to olanzapine or any component of the formulation. It is also contraindicated in patients with narrow-angle glaucoma. The long-acting injectable form (Relprevv, if still available regionally) has additional contraindications due to the risk of post-injection delirium/sedation syndrome (PDSS).
Storage & Expiry	Olanzapine tablets and ODTs should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Injectable forms (powder) should be stored protected from light and reconstituted immediately before use. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include drowsiness, weight gain, increased appetite, dizziness, dry mouth, constipation, and orthostatic hypotension. More serious side effects include metabolic changes (e.g., hyperglycemia, diabetes mellitus, dyslipidemia, weight gain), extrapyramidal symptoms (though less than typical antipsychotics), tardive dyskinesia, neuroleptic malignant syndrome (NMS), seizures, and increased mortality in elderly patients with dementia-related psychosis.
Warnings & Precautions	♦ BLACK BOX WARNINGS: Elderly Patients with Dementia-Related Psychosis: Increased risk of death compared to placebo, particularly due to cardiovascular (e.g., heart failure, sudden cardiac death) or infectious (e.g., pneumonia) causes. Not approved for this indication. ♦ Post-injection Delirium/Sedation Syndrome (PDSS): For long-acting injectable olanzapine (e.g., Zyprexa Relprevv), there is a risk of PDSS, a serious condition involving sedation, confusion, and delirium. Requires post-injection observation. (Note: This specific product has been largely discontinued in many regions due to this risk). ♦ Metabolic Changes: Significant risk of hyperglycemia and diabetes mellitus, dyslipidemia (high cholesterol/triglycerides), and substantial weight gain. Monitor blood glucose, lipids, and weight regularly. ♦ Neuroleptic Malignant Syndrome (NMS): A rare but potentially fatal syndrome characterized by fever, muscle rigidity, altered mental status, and autonomic instability. Discontinue immediately if NMS is suspected. ♦ Tardive Dyskinesia: A syndrome of potentially irreversible, involuntary dyskinetic movements. Risk increases with duration and total cumulative dose. Discontinue if symptoms occur. ♦ Orthostatic Hypotension/Syncope: Can cause dizziness and falls, especially during initial dose titration. Use with caution in patients with cardiovascular disease. ♦ Seizures: Use with caution in patients with a history of seizures or conditions that lower the seizure threshold. ♦ Dysphagia: Esophageal dysmotility and aspiration can occur. ♦ Leukopenia/Neutropenia/Agranulocytosis: Monitor complete blood counts during therapy. ♦ Body Temperature Regulation: May disrupt the body's ability to reduce core body temperature. ♦ Alcohol/Other CNS Depressants: Potentiation of sedation. ♦ Hepatic Impairment: Use with caution; dose adjustments may be needed.
Missed Dose Instructions	If a dose of Olanzapine (oral tablet or ODT) is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For long-acting injectable forms, follow the specific instructions from the healthcare provider for missed injections.
Overdose Instructions	Overdose symptoms are primarily related to CNS depression (drowsiness, slurred speech, coma), tachycardia, hypertension, miosis, and respiratory depression. Aspiration pneumonia and severe extrapyramidal symptoms can also occur. Treatment is supportive and symptomatic. There is no specific antidote. Maintain an open airway, ensure adequate oxygenation and ventilation. Monitor cardiovascular function. Activated charcoal may be considered if recent oral ingestion. Seek immediate emergency medical help.
Medicine Interactions	♦ CNS Depressants (e.g., alcohol, benzodiazepines, opioids, sedatives, hypnotics): Additive CNS depressant effects; increased sedation and respiratory depression. Avoid or use with extreme caution. ♦ Antihypertensives: Additive hypotensive effects. ♦ Drugs that Prolong QT Interval (e.g., certain antiarrhythmics, antipsychotics): Increased risk of QT prolongation and Torsades de Pointes. Use with caution. ♦ CYP1A2 Inducers (e.g., carbamazepine, omeprazole, rifampin, charcoal, smoking): Can significantly increase olanzapine clearance, reducing plasma concentrations and potentially efficacy. Increased doses of olanzapine may be needed. ♦ CYP1A2 Inhibitors (e.g., fluvoxamine, ciprofloxacin): Can significantly decrease olanzapine clearance, increasing plasma concentrations and potential for adverse effects. Reduced doses of olanzapine may be needed. ♦ Levodopa/Dopamine Agonists: Olanzapine may antagonize their effects. ♦ Anticholinergic Drugs (e.g., benztropine, oxybutynin): Additive anticholinergic effects (dry mouth, constipation, urinary retention). ♦ Metabolic Monitoring: Ensure regular monitoring for metabolic side effects, especially when co-prescribing drugs that might also affect glucose or lipid metabolism.

Omeprazole (Prilosec)

Purpose/Indication	Omeprazole is a proton pump inhibitor (PPI) primarily used to reduce stomach acid production. It is indicated for the treatment of gastroesophageal reflux disease (GERD), erosive esophagitis, duodenal and gastric ulcers, and Zollinger-Ellison syndrome. It is also used in combination with antibiotics to eradicate Helicobacter pylori infection, and for the prophylaxis of NSAID-associated ulcers.
Method of Action	Omeprazole is a prodrug that, after absorption, is converted to its active form in the acidic secretory canaliculi of the gastric parietal cells. The active form then irreversibly binds to and inhibits the H+/K+-ATPase enzyme system (the proton pump) on the secretory surface of the parietal cells. This action blocks the final step of acid secretion, significantly reducing both basal and stimulated gastric acid output, leading to potent and prolonged acid suppression.
Medication Name & Brand Names	♦ Medication Name: Omeprazole ♦ Brand Names: Prilosec (prescription), Prilosec OTC (over-the-counter), Zegerid (omeprazole/sodium bicarbonate - prescription & OTC), Omeprazole (generic)
Pharmaceutical Forms & Appearance	Omeprazole is available as delayed-release capsules, delayed-release tablets, and powder for oral suspension. Delayed-release capsules typically contain enteric-coated granules or pellets, often in a clear or colored capsule shell. Delayed-release tablets are film-coated and may vary in color. The powder for oral suspension is a white to off-white granular powder that is mixed with water before administration.
Dosage & Administration	Dosage varies widely depending on the indication. For GERD, common adult doses are 20 mg once daily for 4-8 weeks. For duodenal ulcers, 20 mg once daily for 4 weeks. For H. pylori eradication, it is usually 20 mg twice daily in combination with antibiotics for 7-14 days. Take capsules/tablets before a meal (preferably in the morning). Do not crush or chew delayed-release forms. Oral suspension should be mixed and administered immediately.
Supplied As	Omeprazole is supplied as: oral delayed-release capsules (e.g., 10 mg, 20 mg, 40 mg), oral delayed-release tablets (e.g., 20 mg), and powder for oral suspension (e.g., 2.5 mg/packet, 10 mg/packet, 20 mg/packet).
Contraindications	Omeprazole is contraindicated in patients with known hypersensitivity to omeprazole, substituted benzimidazoles (e.g., lansoprazole, pantoprazole), or any component of the formulation. It is also contraindicated for concomitant use with rilpivirine-containing products.
Storage & Expiry	Omeprazole capsules, tablets, and powder for suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The reconstituted oral suspension should be used within a specific timeframe (e.g., 30 minutes). Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, abdominal pain, nausea, diarrhea, vomiting, and flatulence. More serious side effects, though less common, include Clostridioides difficile-associated diarrhea (CDAD), bone fractures (with long-term use), kidney problems (e.g., acute interstitial nephritis), magnesium deficiency (hypomagnesemia), vitamin B12 deficiency (with long-term use), and very rarely, severe skin reactions or systemic lupus erythematosus.
Warnings & Precautions	♦ CDAD: PPI therapy may increase the risk of Clostridioides difficile-associated diarrhea (CDAD). Use the lowest dose and shortest duration appropriate for the condition. ♦ Bone Fracture: Long-term and multiple daily dose PPI therapy may increase the risk for osteoporosis-related fractures of the hip, wrist, or spine. Use the lowest dose and shortest duration. ♦ Hypomagnesemia: Can occur with long-term therapy (at least 3 months, but usually a year or more). Consider monitoring magnesium levels in patients expected to be on prolonged treatment. ♦ Vitamin B12 Deficiency: Long-term daily treatment (e.g., >2-3 years) can lead to malabsorption of vitamin B12 due to acid suppression. ♦ Acute Interstitial Nephritis: Has been observed in patients taking PPIs, including omeprazole, and can occur at any point during therapy. ♦ Gastric Malignancy: Symptomatic response to therapy does not preclude the presence of gastric malignancy. ♦ Drug Interactions: Careful consideration of drug interactions, especially with clopidogrel (see Interactions). ♦ Atrophic Gastritis/Fundic Gland Polyps: Long-term PPI therapy may lead to atrophic gastritis or fundic gland polyps, especially with prolonged use. ♦ Pregnancy/Lactation: Use only if clearly needed. Minimal excretion into breast milk.
Missed Dose Instructions	If a dose of Omeprazole is missed, take it as soon as remembered before a meal. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for optimal acid suppression.
Overdose Instructions	Overdose symptoms are generally mild and self-limiting, including drowsiness, tachycardia, nausea, vomiting, abdominal pain, and headache. No specific antidote is known. Treatment is supportive and symptomatic. Hemodialysis is not effective for removing omeprazole. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Clopidogrel: Omeprazole reduces the antiplatelet effect of clopidogrel by inhibiting CYP2C19, an enzyme essential for clopidogrel activation. Concomitant use should generally be avoided, or an alternative antiplatelet or PPI with less CYP2C19 inhibition should be considered. ♦ Rilpivirine-containing products: Concomitant use is contraindicated as PPIs significantly reduce rilpivirine absorption. ♦ Warfarin: Increased INR and bleeding risk. Monitor INR closely. ♦ Digoxin: Increased digoxin absorption, leading to increased digoxin levels. Monitor digoxin levels. ♦ Methotrexate: May increase and prolong methotrexate serum levels and/or its active metabolite, potentially leading to toxicity. Consider temporary PPI withdrawal or lower doses of methotrexate. ♦ Tacrolimus: May increase tacrolimus levels. Monitor tacrolimus levels. ♦ Diazepam, Phenytoin, Cilostazol, Citalopram: Omeprazole can inhibit the metabolism of these drugs (CYP2C19/CYP3A4 substrates), increasing their concentrations. Dose adjustments may be needed. ♦ Erlotinib, Dasatinib, Nilotinib, Mycophenolate Mofetil: PPIs can significantly reduce the absorption of these drugs, reducing their efficacy. Avoid concurrent use where possible. ♦ St. John's Wort, Rifampin (CYP2C19/3A4 inducers): May decrease omeprazole plasma levels. ♦ Iron salts: PPIs can reduce the absorption of oral iron supplements.

Ondansetron (Zofran)

Purpose/Indication	Ondansetron is an antiemetic medication primarily used to prevent and treat nausea and vomiting, particularly those associated with chemotherapy, radiation therapy, and surgery (postoperative nausea and vomiting, PONV). It is also sometimes used off-label for severe nausea and vomiting in other conditions, such as hyperemesis gravidarum.
Method of Action	Ondansetron is a selective serotonin 5−HT3 receptor antagonist. It works by blocking serotonin's actions at the 5−HT3 receptors located in the chemoreceptor trigger zone (CTZ) in the brain and on vagal nerve terminals in the gastrointestinal tract. By blocking these receptors, ondansetron prevents the initiation of the vomiting reflex, which is often triggered by the release of serotonin from enterochromaffin cells in the gut in response to emetogenic stimuli (e.g., chemotherapy, radiation).
Medication Name & Brand Names	♦ Medication Name: Ondansetron Hydrochloride ♦ Brand Names: Zofran (oral tablets, ODT, oral solution, injection), Zofran ODT (orally disintegrating tablets), Ondansetron (generic)
Pharmaceutical Forms & Appearance	Ondansetron is available as oral tablets, orally disintegrating tablets (ODT), oral solution, and solution for intravenous (IV) or intramuscular (IM) injection. Oral tablets are typically white to yellow, round or oval, and may be scored, with various imprints. ODTs are white and dissolve rapidly on the tongue. The oral solution is a clear, colorless to pale yellow liquid. The injectable solution is clear and colorless.

Dosage & Administration	Dosage varies significantly by indication and route. For chemotherapy-induced nausea and vomiting (CINV), doses range from 8 mg to 24 mg orally or IV, often given 30 minutes prior to chemotherapy and then every 8-12 hours. For PONV, typical doses are 4 mg IV or orally, given before or after surgery. Oral forms can be taken with or without food. ODTs should be placed on the tongue to dissolve. IV administration should be given slowly (e.g., over 2-5 minutes).
Supplied As	Ondansetron is supplied as: oral tablets (e.g., 4 mg, 8 mg, 16 mg, 24 mg), orally disintegrating tablets (e.g., 4 mg, 8 mg), oral solution (e.g., 4 mg/5 mL), and solution for intravenous/intramuscular injection (e.g., 2 mg/mL in vials or pre-filled syringes).
Contraindications	Ondansetron is contraindicated in patients with known hypersensitivity to ondansetron or other 5−HT3 receptor antagonists (e.g., granisetron, palonosetron), or any component of the formulation. Concomitant use with apomorphine is strictly contraindicated due to reports of profound hypotension and loss of consciousness.
Storage & Expiry	Ondansetron tablets, ODTs, oral solution, and injectable solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Do not freeze the oral solution. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, constipation, diarrhea, fatigue, and dizziness. More serious side effects, though less common, include QT prolongation and Torsades de Pointes (especially with high doses or in susceptible individuals), serotonin syndrome (with concomitant use of serotonergic drugs), and hypersensitivity reactions.
Warnings & Precautions	♦ QT Prolongation and Torsades de Pointes: Can cause dose-dependent QT interval prolongation, which may lead to Torsades de Pointes, a life-threatening arrhythmia. Avoid in patients with congenital long QT syndrome. Use with caution in patients with electrolyte abnormalities (e.g., hypokalemia, hypomagnesemia), congestive heart failure, bradyarrhythmias, or those taking other QT-prolonging drugs. Avoid single IV doses exceeding 16 mg. ♦ Serotonin Syndrome: Potentially life-threatening, can occur with concomitant use of other serotonergic drugs (e.g., SSRIs, SNRIs, MAOIs, tricyclic antidepressants, mirtazapine, fentanyl, tramadol). Symptoms include mental status changes, autonomic instability, neuromuscular abnormalities, and GI symptoms. ♦ Hypersensitivity Reactions: Anaphylaxis and bronchospasm have been reported. ♦ Masking Progressive Ileus: Ondansetron can mask a progressive ileus or gastric distension. Monitor patients with abdominal surgery or chemotherapy-induced nausea for decreased bowel motility. ♦ Hepatic Impairment: Dosage adjustment is recommended for severe hepatic impairment due to reduced clearance. ♦ Phenylketonuria: Orally disintegrating tablets may contain phenylalanine.
Missed Dose Instructions	Ondansetron is typically taken on an as-needed basis for nausea and vomiting, or on a specific schedule around chemotherapy/radiation. If a scheduled dose is missed, take it as soon as remembered if symptoms of nausea/vomiting are present or anticipated. If it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including visual disturbances, severe constipation, hypotension, and potential for fatal arrhythmias (e.g., Torsades de Pointes, especially with massive overdose). Treatment is supportive and symptomatic. Monitor ECG for QT prolongation. There is no specific antidote. Seek immediate emergency medical help.
Medicine Interactions	♦ Apomorphine: Contraindicated: Concomitant use with apomorphine can cause profound hypotension and loss of consciousness. ♦ QT-Prolonging Drugs (e.g., Class IA and III antiarrhythmics, some antipsychotics, macrolides): Increased risk of QT prolongation and Torsades de Pointes. Avoid concurrent use where possible, or monitor ECG closely. ♦ Serotonergic Drugs (e.g., SSRIs, SNRIs, MAOIs, tricyclic antidepressants, lithium, tramadol, fentanyl): Increased risk of serotonin syndrome. Monitor patients for symptoms. ♦ Tramadol: May reduce the analgesic effect of tramadol. ♦ Carbamazepine, Phenytoin, Rifampin: These enzyme inducers can decrease ondansetron plasma concentrations, potentially reducing its efficacy. Increased ondansetron doses may be needed. ♦ Tamoxifen: Concurrent use may result in decreased tamoxifen levels due to CYP2D6 inhibition, potentially reducing its efficacy.

Oral Antacids (Calcium Carbonate) (Tums)

Purpose/Indication	Oral antacids containing calcium carbonate are used for the rapid, temporary relief of heartburn, indigestion, acid reflux, sour stomach, and upset stomach associated with excess stomach acid. They can also be used as a calcium supplement to prevent or treat calcium deficiency (e.g., in osteoporosis), although their primary role as an antacid is for acid neutralization.
Method of Action	Calcium carbonate acts as a direct-acting antacid by neutralizing gastric acid in the stomach. When ingested, it reacts with hydrochloric acid (HCl) in the stomach to form calcium chloride ($CaCl_2$), water (H_2O), and carbon dioxide (CO_2). This neutralization reaction directly raises the pH of the stomach contents, reducing acidity and providing quick relief from acid-related symptoms. The calcium is then partially absorbed.
Medication Name & Brand Names	♦ Medication Name: Calcium Carbonate (as an antacid) ♦ Brand Names: Tums, Rennie (regional), Titralac, Viactiv (as supplement with antacid properties), Caltrate (as supplement with antacid properties), Calcium Carbonate (generic)
Pharmaceutical Forms & Appearance	Oral antacids containing calcium carbonate are commonly available as chewable tablets, chewable gummies, and less commonly as oral suspensions or powders. Chewable tablets come in various flavors (e.g., fruit, mint) and colors, often chalky in texture. Gummies are softer and come in various fruit flavors.
Dosage & Administration	Dosage varies by product and individual need. For acid relief, chew 2-4 tablets as symptoms occur, not exceeding a maximum daily dose (e.g., 7500 mg calcium carbonate in 24 hours, or as per product label). Do not swallow whole. Administer after meals and at bedtime for sustained effect. For calcium supplementation, doses vary; often 500-600 mg elemental calcium per dose, taken with food.
Supplied As	Oral antacids (Calcium Carbonate) are supplied as: chewable tablets (e.g., 200 mg, 500 mg, 750 mg, 1000 mg elemental calcium per tablet), chewable gummies, oral suspensions, and powders.
Contraindications	Calcium carbonate antacids are contraindicated in patients with known hypersensitivity to calcium carbonate or any component of the formulation. They are also contraindicated in patients with hypercalcemia (high blood calcium levels), severe renal impairment (due to risk of hypercalcemia and metabolic alkalosis), and hypophosphatemia.
Storage & Expiry	Calcium carbonate antacid products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include constipation, belching (due to CO_2 production), and flatulence. With excessive or prolonged use, more serious side effects can include hypercalcemia (e.g., nausea, vomiting, constipation, thirst, polyuria, muscle weakness), milk-alkali syndrome (hypercalcemia, metabolic alkalosis, renal impairment), and rebound acid secretion.

Warnings & Precautions	♦ Hypercalcemia: Excessive or prolonged use can lead to hypercalcemia, especially in patients with impaired renal function, or those taking high doses of vitamin D. Symptoms include nausea, vomiting, muscle weakness, and confusion. ♦ Renal Impairment: Use with caution in patients with mild to moderate renal impairment due to increased risk of hypercalcemia and metabolic alkalosis. Contraindicated in severe renal impairment. ♦ Milk-Alkali Syndrome: Rare but serious condition caused by excessive intake of calcium and absorbable alkali (like calcium carbonate), leading to hypercalcemia, metabolic alkalosis, and renal impairment. ♦ Constipation: Can cause or worsen constipation. ♦ Acid Rebound: Chronic high-dose use can sometimes lead to rebound acid secretion upon discontinuation. ♦ Other Medications: Can interact with numerous medications by altering gastric pH or binding to drugs (see Interactions). Separate administration times. ♦ Undiagnosed Symptoms: Not for prolonged use without medical advice, as chronic heartburn could indicate a more serious underlying condition. ♦ Cardiac Patients: Use with caution in patients with cardiac conditions, as high calcium levels can affect heart rhythm.
Missed Dose Instructions	Calcium carbonate antacids are typically used on an as-needed basis for symptom relief. If a dose is missed, it's not applicable in the same way as scheduled medications. Simply take the next dose when symptoms recur, adhering to the maximum daily dose and frequency limits stated on the product label.
Overdose Instructions	Overdose of calcium carbonate is usually due to excessive or chronic intake, leading to hypercalcemia and potentially milk-alkali syndrome. Symptoms of hypercalcemia include nausea, vomiting, constipation, polyuria, polydipsia, muscle weakness, confusion, and lethargy. Severe cases can lead to cardiac arrhythmias, renal failure, and coma. Treatment involves discontinuation of calcium carbonate and any other calcium/vitamin D supplements. Management includes hydration with IV fluids and, in severe cases, loop diuretics or calcitonin. Seek immediate medical attention for significant overdose or severe symptoms.
Medicine Interactions	♦ Tetracyclines & Quinolone Antibiotics (e.g., doxycycline, ciprofloxacin, levofloxacin): Calcium forms insoluble chelates with these antibiotics, significantly reducing their absorption. Separate administration by at least 2-6 hours. ♦ Bisphosphonates (e.g., alendronate): Reduced absorption of bisphosphonates. Separate administration by at least 30 minutes to 2 hours. ♦ Thyroid Hormones (e.g., levothyroxine): Reduced absorption of thyroid hormones. Separate administration by at least 4 hours. ♦ Iron Supplements: Reduced iron absorption. Separate administration by at least 2-4 hours. ♦ Digoxin: Hypercalcemia can predispose to digoxin toxicity. Monitor digoxin levels and calcium. ♦ Thiazide Diuretics: Can increase calcium reabsorption in the kidneys, increasing the risk of hypercalcemia. Monitor calcium levels. ♦ Phosphate Binders: Concomitant use can lead to higher calcium levels. ♦ Vitamin D: High doses of vitamin D increase calcium absorption, increasing risk of hypercalcemia. ♦ Other Antacids: Avoid concurrent use of multiple antacids unless advised by a healthcare professional.

Oral Rehydration Salts (ORS) (Pedialyte)

Purpose/Indication	Oral Rehydration Salts (ORS) are used for the prevention and treatment of dehydration, especially that caused by acute diarrhea (e.g., from cholera or rotavirus), vomiting, or other conditions leading to significant fluid and electrolyte loss. Their purpose is to restore lost fluids and essential electrolytes (sodium, potassium, chloride, bicarbonate/citrate) and provide some glucose for energy, thereby preventing or reversing dehydration and its complications.
Method of Action	ORS works based on the principle of co-transport of glucose and sodium in the small intestine. The glucose facilitates the absorption of sodium, and water passively follows the absorbed sodium, even in the presence of diarrhea. This mechanism allows for effective rehydration despite ongoing fluid losses. The other electrolytes (potassium, chloride, and bicarbonate/citrate) are included to replace losses from diarrhea and correct acid-base imbalances.
Medication Name & Brand Names	♦ Medication Name: Oral Rehydration Salts (ORS) ♦ Brand Names: ORS, Oralyte, Rehydralyte, Hydralyte (regional), Gastrolyte (regional), Pedialyte (regional), WHO ORS (World Health Organization ORS)
Pharmaceutical Forms & Appearance	ORS are typically supplied as a powder or granules that are dissolved in a specific volume of clean drinking water before administration. The powder is usually white and crystalline, and the resulting solution is clear and colorless, though some commercial preparations may have a slight color or flavor.
Dosage & Administration	Dosage depends on the age and severity of dehydration. For mild to moderate dehydration, adults and children should drink small, frequent sips of the prepared ORS solution. After each loose stool, infants under 2 years should be given 50-100 mL, children 2-10 years 100-200 mL, and older children/adults as much as they can drink comfortably. Continue administration until dehydration is corrected and diarrhea stops. Always use clean, safe water for preparation.
Supplied As	Oral Rehydration Salts are supplied as: powder sachets or packets (e.g., pre-measured for 1 liter of water), or as ready-to-use oral solutions (though less common for traditional ORS).
Contraindications	ORS are generally safe, but are contraindicated in conditions where oral fluid administration is not possible or safe, such as paralytic ileus, intestinal obstruction, severe persistent vomiting preventing oral intake, or unconsciousness (unless administered via nasogastric tube under medical supervision). They are also contraindicated in severe dehydration with shock, which requires intravenous fluids.
Storage & Expiry	Unprepared ORS powder sachets should be stored in a cool, dry place (typically room temperature) away from direct sunlight and moisture. Once prepared, the ORS solution should be used within 24 hours (if stored in a refrigerator) or within a shorter period (e.g., 12 hours) at room temperature, as per manufacturer guidelines, to prevent bacterial growth. Always check the specific expiry date on the packaging for the powder.
Side Effects	Side effects are rare when ORS are prepared and administered correctly. Occasionally, nausea or vomiting may occur if the solution is drunk too quickly or in large gulps. Over-hydration or electrolyte imbalances (e.g., hypernatremia) are very rare but possible if prepared incorrectly (too concentrated) or given in excessive amounts in specific situations.
Warnings & Precautions	♦ Proper Preparation: Crucial for efficacy and safety. Use the exact amount of clean drinking water specified on the packet; using too little water can lead to hypernatremia (excess sodium), and too much water can lead to insufficient electrolyte replacement. ♦ Severe Dehydration: ORS are for mild to moderate dehydration. Severe dehydration with shock or altered consciousness requires immediate intravenous fluid therapy. ♦ Persistent Vomiting: While ORS can often be given successfully even with vomiting (small, frequent sips), persistent severe vomiting that prevents adequate intake necessitates medical review and potentially IV fluids. ♦ Renal Impairment: Use with caution in patients with renal impairment, as electrolyte imbalances could worsen. ♦ Diabetic Patients: While ORS contain glucose, the amount is balanced with electrolytes; it generally does not significantly affect blood glucose in diabetics, but monitoring is advised. ♦ Do not add other substances: Do not add sugar, fruit juice, or other drinks to the prepared ORS solution, as this can alter the electrolyte balance and reduce effectiveness or worsen symptoms.
Missed Dose Instructions	ORS are given as needed to replace fluid and electrolyte losses. There isn't a "missed dose" in the traditional sense for scheduled medication. Continue to administer the solution in small, frequent amounts as long as fluid losses from diarrhea or vomiting persist, or until rehydration is achieved.

Overdose Instructions	Overdose of ORS is rare if prepared and administered correctly. If an overly concentrated solution is given or excessive amounts are consumed, it could potentially lead to hypernatremia (high sodium levels) and hypervolemia (fluid overload), especially in infants or those with compromised renal function. Symptoms might include lethargy, irritability, thirst, fever, or edema. Treatment involves discontinuing ORS and seeking immediate medical attention. Management includes careful monitoring of electrolytes and fluid status, and correction of imbalances.
Medicine Interactions	♦ Generally no significant drug-drug interactions with ORS. ♦ However, the effectiveness of ORS relies on its specific electrolyte and glucose balance. Therefore, it is important not to mix ORS with other beverages like fruit juice, soft drinks, or broth, as these can alter the electrolyte concentration and impair the solution's effectiveness or worsen dehydration. ♦ Certain medications that affect electrolyte balance or fluid status (e.g., diuretics) might require closer monitoring of fluid and electrolytes if ORS is being used, but this is usually managed clinically rather than being a direct interaction with ORS.

Oseltamivir (Tamiflu)

Purpose/Indication	Oseltamivir is an antiviral medication used for the treatment of acute, uncomplicated influenza (flu) in patients 2 weeks of age and older who have been symptomatic for no more than 48 hours. It is also used for the prophylaxis (prevention) of influenza in patients 1 year of age and older, either after exposure to an infected individual or during a community outbreak. It is effective against both influenza A and B viruses.
Method of Action	Oseltamivir is a prodrug that is rapidly converted in the body to its active metabolite, oseltamivir carboxylate. This active metabolite acts as a selective inhibitor of influenza virus neuraminidase, an enzyme found on the surface of the virus. Neuraminidase is crucial for the budding of new virions from infected host cells and for the release of virus particles from aggregated virions. By inhibiting neuraminidase, oseltamivir prevents the release of new viral particles, thereby limiting the spread of the virus within the respiratory tract.
Medication Name & Brand Names	♦ Medication Name: Oseltamivir Phosphate ♦ Brand Names: Tamiflu, Oseltamivir (generic)
Pharmaceutical Forms & Appearance	Oseltamivir is available as oral capsules and as a powder for oral suspension. The capsules are typically hard gelatin capsules with various colors (e.g., yellow and grey, yellow and blue) and imprints indicating strength. The powder for oral suspension is a white to off-white granular powder that is reconstituted with water before administration to form a white to off-white suspension with a fruity flavor.
Dosage & Administration	Dosage varies by age, weight, and whether it's for treatment or prophylaxis. For adults with influenza treatment, the typical dose is 75 mg orally twice daily for 5 days. For prophylaxis, it's 75 mg orally once daily for 10 days (after exposure) or up to 6 weeks (during outbreaks). Doses for children are weight-based. It can be taken with or without food, but taking it with food may improve tolerability and reduce gastrointestinal side effects. Begin treatment within 48 hours of symptom onset.
Supplied As	Oseltamivir is supplied as: oral capsules (e.g., 30 mg, 45 mg, 75 mg) and powder for oral suspension (e.g., 6 mg/mL, 12 mg/mL, 15 mg/mL after reconstitution).
Contraindications	Oseltamivir is contraindicated in patients with known hypersensitivity to oseltamivir phosphate or any component of the formulation.
Storage & Expiry	Oseltamivir capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. The powder for oral suspension should be stored dry at room temperature. Once reconstituted, the oral suspension must be stored in a refrigerator (2°C to 8°C or 36°F to 46°F) and typically used within 17 days. Do not freeze the suspension. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, abdominal pain, diarrhea, and headache. In children, vomiting is frequently reported. More serious but rare side effects include severe skin reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis), neuropsychiatric events (e.g., delirium, hallucinations, self-injury) particularly in pediatric patients, and allergic reactions.
Warnings & Precautions	♦ Neuropsychiatric Events: Rare reports of delirium and abnormal behavior leading to self-injury or fatal outcomes, primarily in pediatric patients with influenza who were taking oseltamivir. Monitor patients for signs of unusual behavior. These events have also been reported in patients with influenza not taking oseltamivir. ♦ Serious Skin Reactions: Cases of severe skin reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis, erythema multiforme) have been reported. Discontinue if a severe allergic or skin reaction occurs. ♦ Bacterial Infections: Oseltamivir is only effective against influenza viruses. It does not treat bacterial infections; rule out bacterial infection as a cause of symptoms or treat concomitantly if present. ♦ Not a Substitute for Vaccination: Oseltamivir does not replace influenza vaccination. The use of oseltamivir should not affect the decision to be vaccinated annually. ♦ Renal Impairment: Dose adjustments are necessary for patients with moderate to severe renal impairment. ♦ Cardiac/Respiratory Disease: Efficacy has not been established in patients with chronic cardiac disease or respiratory disease. ♦ Severe Influenza: Not for severe influenza, which may require hospitalization.
Missed Dose Instructions	If a dose of Oseltamivir is missed, take it as soon as remembered. However, if it is within 2 hours of the next scheduled dose (for twice-daily dosing) or within 6 hours (for once-daily dosing), skip the missed dose and continue with the regular schedule. Do not take a double dose. It is crucial to complete the full prescribed course of therapy for effective treatment or prophylaxis.
Overdose Instructions	There are limited reports of overdose. Symptoms are generally consistent with known side effects, including nausea, vomiting, and dizziness. In some cases, accidental overdose in children has resulted in more severe gastrointestinal adverse events. Treatment is supportive and symptomatic. Hemodialysis is not effective for removing oseltamivir carboxylate. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Live Attenuated Influenza Vaccine (LAIV): Concomitant use with LAIV (nasal flu vaccine) is not recommended. Oseltamivir can inhibit the replication of the vaccine virus, reducing the vaccine's effectiveness. Avoid oseltamivir for 2 days before and 2 weeks after LAIV administration. ♦ Probenecid: Probenecid can increase the exposure to oseltamivir carboxylate by reducing its renal tubular secretion. This may require a dose adjustment of oseltamivir in patients with renal impairment or if high doses of probenecid are used. ♦ Other Antiviral Agents: No significant interactions are generally reported with other commonly used medications. However, caution is advised with other drugs primarily eliminated via renal tubular secretion.

Oxaprozin (Daypro)

Purpose/Indication	Oxaprozin is a nonsteroidal anti-inflammatory drug (NSAID) used for the symptomatic relief of pain and inflammation associated with osteoarthritis and rheumatoid arthritis. It is indicated to reduce joint pain, swelling, and stiffness, thereby improving physical function. Its long half-life allows for once-daily dosing.

Method of Action	Oxaprozin, like other NSAIDs, exerts its therapeutic effects primarily by inhibiting the enzyme cyclooxygenase (COX), specifically both COX-1 and COX-2. COX enzymes are responsible for the synthesis of prostaglandins, thromboxanes, and prostacyclins, which are potent mediators of pain, inflammation, and fever. By reducing prostaglandin synthesis, oxaprozin decreases inflammation, pain, and fever.
Medication Name & Brand Names	♦ Medication Name: Oxaprozin ♦ Brand Names: Daypro, Oxaprozin (generic)
Pharmaceutical Forms & Appearance	Oxaprozin is typically available as oral caplets or tablets. Caplets are generally white to off-white, oblong, and often scored, with specific imprints indicating strength or manufacturer.
Dosage & Administration	Dosage is individualized based on the patient's condition and response, with the lowest effective dose for the shortest duration. For osteoarthritis and rheumatoid arthritis, the typical adult oral dose is 1200 mg once daily. Some patients may start with 600 mg once daily. The maximum daily dose is generally 1800 mg or 26 mg/kg (whichever is less) for limited periods. It can be taken with food or milk to minimize gastrointestinal upset.
Supplied As	Oxaprozin is supplied as: oral caplets/tablets (e.g., 600 mg).
Contraindications	Oxaprozin is strictly contraindicated in patients with known hypersensitivity to oxaprozin, aspirin, or any other NSAID, due to the risk of allergic reactions (e.g., asthma, urticaria, rash). It is contraindicated in the setting of coronary artery bypass graft (CABG) surgery, due to increased risk of cardiovascular events. It is also contraindicated in severe uncontrolled heart failure, active gastrointestinal bleeding, or severe renal/hepatic impairment.
Storage & Expiry	Oxaprozin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances (nausea, dyspepsia, abdominal pain, diarrhea, constipation), headache, dizziness, and rash. More serious side effects include gastrointestinal bleeding, ulceration, and perforation, cardiovascular thrombotic events (e.g., heart attack, stroke), renal impairment, liver injury, and hypersensitivity reactions.
Warnings & Precautions	♦ BLACK BOX WARNING: Cardiovascular Thrombotic Events: NSAIDs, including oxaprozin, increase the risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may occur early in treatment and may increase with duration of use. Contraindicated for the treatment of peri-operative pain in the setting of CABG surgery. ♦ BLACK BOX WARNING: Gastrointestinal Risk: NSAIDs, including oxaprozin, cause an increased risk of serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. These events can occur at any time during use and without warning symptoms. Elderly patients and those with a history of peptic ulcer disease and/or GI bleeding are at greater risk. ♦ Renal Effects: Can cause dose-dependent renal toxicity (e.g., acute renal failure, interstitial nephritis) by inhibiting prostaglandin synthesis in the kidneys. Use with caution in patients with pre-existing renal impairment, heart failure, liver dysfunction, or those on diuretics/ACE inhibitors. Monitor renal function. ♦ Hepatic Effects: Can cause elevations in liver enzymes and, rarely, severe hepatic reactions (e.g., fulminant hepatitis). Monitor liver function tests. ♦ Hypertension: Can cause new-onset hypertension or worsen pre-existing hypertension. Monitor blood pressure closely. ♦ Heart Failure: Use with caution in patients with fluid retention or heart failure as it can cause edema. ♦ Anaphylactoid Reactions: Can occur in patients with no known prior exposure to NSAIDs. Seek emergency medical attention. ♦ Hematologic Effects: Can cause anemia and inhibit platelet aggregation. Monitor CBC and coagulation. ♦ Fluid Retention and Edema: Can cause fluid retention; use with caution in patients with cardiac decompensation or conditions predisposing to fluid retention. ♦ Photosensitivity: Rarely reported. ♦ Aseptic Meningitis: Rarely reported, especially in patients with systemic lupus erythematosus (SLE) or mixed connective tissue disease.
Missed Dose Instructions	If a dose of Oxaprozin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing helps maintain therapeutic levels for pain and inflammation control.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal irritation (nausea, vomiting, abdominal pain), drowsiness, and lethargy. More severe symptoms in massive overdose can include acute renal failure, hepatic dysfunction, hypotension, respiratory depression, and coma. There is no specific antidote for oxaprozin. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Maintain an open airway, ventilation, and cardiovascular support. Monitor renal and hepatic function. Dialysis is generally not effective due to high protein binding. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Other NSAIDs, Aspirin, Corticosteroids: Increased risk of gastrointestinal bleeding and ulceration. Avoid concomitant use of multiple NSAIDs. ♦ Anticoagulants (e.g., warfarin), Antiplatelet Agents (e.g., clopidogrel, aspirin), SSRIs/SNRIs: Increased risk of bleeding. Monitor for signs of bleeding and INR for warfarin. ♦ Diuretics (e.g., furosemide, hydrochlorothiazide): May reduce the natriuretic and antihypertensive effects of diuretics. Increased risk of renal impairment. ♦ ACE Inhibitors/ARBs (e.g., enalapril, valsartan): May diminish the antihypertensive effect and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. ♦ Lithium: May increase serum lithium concentrations and toxicity by reducing renal clearance. Monitor lithium levels closely. ♦ Methotrexate: May increase methotrexate levels and toxicity. Avoid or use with extreme caution. ♦ Cyclosporine: Increased risk of nephrotoxicity. ♦ Digoxin: May increase digoxin levels. ♦ Pemetrexed: Avoid concomitant use with high-dose pemetrexed. ♦ CYP2C9 Inhibitors (e.g., fluconazole, amiodarone): May increase oxaprozin levels. ♦ CYP2C9 Inducers (e.g., rifampin, carbamazepine): May decrease oxaprozin levels.

Oxycodone (OxyContin)

Purpose/Indication	Oxycodone is a potent opioid analgesic used for the management of moderate to severe acute and chronic pain. It is often prescribed when other analgesics are insufficient or contraindicated. Extended-release formulations are specifically indicated for continuous, around-the-clock management of moderate to severe pain requiring a continuous, long-term opioid analgesic.
Method of Action	Oxycodone is a pure opioid agonist that primarily acts on mu (μ) opioid receptors in the central nervous system (CNS) and to a lesser extent on kappa (κ) and delta (δ) opioid receptors. By binding to these receptors, it mimics the effects of endogenous opioids (endorphins), leading to inhibition of pain signal transmission, altered perception of pain, and activation of descending inhibitory pain pathways. This action results in potent analgesia, sedation, euphoria, and respiratory depression, as well as effects on the gastrointestinal tract (constipation) and cough reflex.
Medication Name & Brand Names	♦ Medication Name: Oxycodone Hydrochloride ♦ Brand Names: OxyContin (controlled-release tablets), Roxicodone (immediate-release tablets, oral solution), Percocet (oxycodone/acetaminophen combination), Endocet (oxycodone/acetaminophen combination), OxyNorm (immediate-release capsules, oral solution - regional), Targin (oxycodone/naloxone combination - regional), Oxycodone (generic)

Oxycodone (OxyContin)	
Pharmaceutical Forms & Appearance	Oxycodone is available in various oral forms: immediate-release tablets, extended-release tablets, capsules, and oral solutions/concentrates. It is also available as solutions for injection (intravenous, intramuscular, subcutaneous) and occasionally as rectal suppositories. Tablets and capsules come in various colors, shapes, and imprints depending on strength and formulation. Injectable solutions are typically clear and colorless.
Dosage & Administration	Dosage is highly individualized and depends on the route, patient's pain severity, opioid tolerance, and renal/hepatic function. For acute pain, immediate-release oral doses typically range from 5-15 mg every 4-6 hours. Extended-release forms are usually given every 12 hours. Administer oral forms with food to reduce nausea. Long-term use requires careful titration and monitoring due to tolerance and dependence. Extended-release tablets must be swallowed whole and not crushed, chewed, or dissolved.
Supplied As	Oxycodone is supplied as: oral immediate-release tablets (e.g., 5 mg, 10 mg, 15 mg, 20 mg, 30 mg), oral extended-release tablets (e.g., 10 mg to 80 mg, some up to 160 mg), oral capsules (e.g., 5 mg, 10 mg, 20 mg), oral solutions/concentrates (e.g., 5 mg/5 mL, 100 mg/5 mL), and solutions for injection (e.g., 1 mg/mL, 10 mg/mL).
Contraindications	Oxycodone is contraindicated in patients with known hypersensitivity to oxycodone or other opioids. It is also contraindicated in patients with significant respiratory depression, acute or severe bronchial asthma (in an unmonitored setting or in the absence of resuscitative equipment), paralytic ileus (bowel obstruction), severe CNS depression, and acute alcohol intoxication. Use is also contraindicated in patients with suspected or known gastrointestinal obstruction, including paralytic ileus.
Storage & Expiry	Oxycodone products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed, child-resistant containers. Injectable solutions should be protected from freezing. Due to its status as a controlled substance, specific storage and handling regulations apply. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, vomiting, constipation, drowsiness, dizziness, sedation, itching, and dry mouth. More serious side effects include respiratory depression (potentially fatal), severe hypotension, bradycardia, CNS depression, addiction, dependence, and withdrawal symptoms upon abrupt discontinuation. Serotonin syndrome can occur with concomitant use of serotonergic drugs.
Warnings & Precautions	♦ BLACK BOX WARNINGS: Addiction, Abuse, Misuse: Oxycodone exposes patients and other users to the risks of opioid addiction, abuse, and misuse, which can lead to overdose and death. Assess risk before prescribing and monitor for signs of abuse and addiction. ♦ Respiratory Depression: BLACK BOX WARNING: Serious, life-threatening, or fatal respiratory depression may occur. Monitor closely, especially during initiation and dose escalation. Risk increased with concurrent CNS depressants. ♦ Concomitant Opioid Use with Benzodiazepines/Other CNS Depressants: BLACK BOX WARNING: Concomitant use with benzodiazepines or other CNS depressants (including alcohol) may result in profound sedation, respiratory depression, coma, and death. Reserve for use when alternative treatment options are inadequate. ♦ Neonatal Opioid Withdrawal Syndrome (NOWS): BLACK BOX WARNING (for prolonged use during pregnancy): Prolonged use during pregnancy can result in NOWS, which may be life-threatening if not recognized and treated. ♦ Cytochrome P450 3A4 and 2D6 Interaction: BLACK BOX WARNING (for oral forms): Concomitant use with CYP3A4 inhibitors (or discontinuation of CYP3A4 inducers) or CYP2D6 inhibitors (or discontinuation of CYP2D6 inducers) can result in increased or decreased oxycodone plasma concentrations and potentially fatal respiratory depression or reduced efficacy. ♦ Accidental Ingestion: Accidental ingestion of even one dose, especially by a child, can result in a fatal overdose. Keep out of reach of children. ♦ Adrenal Insufficiency: Can cause adrenal insufficiency. ♦ Severe Hypotension: Can cause severe hypotension, especially in patients whose ability to maintain blood pressure is compromised. ♦ GI Effects: Risk of severe constipation, paralytic ileus. Use with caution in patients with pre-existing GI conditions. ♦ Head Injury/Increased Intracranial Pressure: Can obscure the clinical course and elevate cerebrospinal fluid pressure. ♦ Drug Dependence: Physical dependence can develop with prolonged use. Abrupt discontinuation will lead to withdrawal symptoms. Taper gradually. ♦ Renal/Hepatic Impairment: Clearance is reduced. Use with caution and lower initial doses. ♦ Elderly/Debilitated Patients: More susceptible to respiratory depression and other adverse effects. Use lowest effective dose. ♦ Serotonin Syndrome: Potentially life-threatening, with concomitant use of serotonergic drugs.
Missed Dose Instructions	For scheduled pain management (e.g., extended-release oxycodone), if a dose is missed, take it as soon as remembered if it's not too close to the next scheduled dose (e.g., within 4-6 hours for a 12-hour regimen). Otherwise, skip the missed dose and continue with the regular schedule. Do not take a double dose. For immediate-release or as-needed dosing, take when pain recurs, but adhere to prescribed frequency limits. Consistent dosing is crucial for pain control and minimizing withdrawal symptoms.
Overdose Instructions	Overdose symptoms are characterized by respiratory depression (decreased respiratory rate and depth, Cheyne-Stokes respiration), extreme somnolence progressing to stupor or coma, constricted pupils (miosis), cold and clammy skin, skeletal muscle flaccidity, and sometimes bradycardia, hypotension, and pulmonary edema. Severe overdose can lead to circulatory collapse, cardiac arrest, and death. Treatment involves immediate medical attention, with primary focus on restoring respiration. Naloxone, an opioid antagonist, is the antidote and should be administered immediately. Repeated doses may be required due to oxycodone's longer duration of action. Supportive measures, including oxygen, IV fluids, and vasopressors, are essential. Seek immediate emergency medical help.
Medicine Interactions	♦ CNS Depressants (e.g., benzodiazepines, other opioids, alcohol, sedatives, hypnotics, general anesthetics, tricyclic antidepressants, phenothiazines): BLACK BOX WARNING: Potentiation of respiratory depression, profound sedation, coma, and death. Avoid concomitant use; if necessary, use lowest effective doses and shortest duration, monitoring closely. ♦ MAO Inhibitors: Can cause severe, unpredictable reactions (e.g., excitation, depression, rigidity, hyperpyrexia, convulsions). Avoid concomitant use and for 14 days after MAOI discontinuation. ♦ CYP3A4 Inhibitors (e.g., clarithromycin, ketoconazole, ritonavir, grapefruit juice): Can increase oxycodone plasma concentrations, leading to increased and prolonged opioid effects and potentially fatal respiratory depression. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, St. John's Wort): Can decrease oxycodone plasma concentrations, potentially leading to reduced efficacy and withdrawal symptoms. ♦ CYP2D6 Inhibitors (e.g., quinidine, fluoxetine, paroxetine, bupropion): Can reduce the conversion of oxycodone to its active metabolite oxymorphone, potentially altering the analgesic effect. ♦ Serotonergic Drugs (e.g., SSRIs, SNRIs, TCAs, triptans, tramadol, linezolid): Increased risk of serotonin syndrome. Monitor for symptoms. ♦ Muscle Relaxants: Enhanced neuromuscular blocking action; increased risk of respiratory depression. ♦ Anticholinergic Drugs (e.g., benztropine, oxybutynin): Additive anticholinergic effects (dry mouth, constipation, urinary retention), increasing risk of paralytic ileus. ♦ Mixed Agonist/Antagonist Opioid Analgesics (e.g., pentazocine, nalbuphine, butorphanol): Can precipitate withdrawal symptoms in

Pantoprazole (Protonix)

Pantoprazole (Protonix)	
Purpose/Indication	Pantoprazole is a proton pump inhibitor (PPI) used to decrease the amount of acid produced in the stomach. It is indicated for the treatment of gastroesophageal reflux disease (GERD), erosive esophagitis (including maintenance of healing), Zollinger-Ellison syndrome, and other hypersecretory conditions. It is also used in combination with antibiotics to eradicate Helicobacter pylori infection and for the prevention of rebleeding in patients with peptic ulcers following endoscopic therapy.
Method of Action	Pantoprazole is a prodrug that, after absorption, is converted to its active form in the acidic secretory canaliculi of the gastric parietal cells. The active form then irreversibly binds to and inhibits the H+/K+-ATPase enzyme system (the proton pump) on the secretory surface of the parietal cells. This action blocks the final step of acid secretion, significantly reducing both basal and stimulated gastric acid output, leading to potent and prolonged acid suppression.
Medication Name & Brand Names	♦ Medication Name: Pantoprazole Sodium ♦ Brand Names: Protonix (oral tablets, IV), Pantoloc (regional), Pantoprazole (generic)

Pharmaceutical Forms & Appearance	Pantoprazole is available as delayed-release tablets, delayed-release granules for oral suspension, and powder for intravenous (IV) injection. Delayed-release tablets are typically yellow, oval, and film-coated, with specific imprints. The delayed-release granules are for mixing with apple juice or applesauce. The IV powder is a white to off-white lyophilized powder for reconstitution.
Dosage & Administration	Dosage varies depending on the indication. For GERD/erosive esophagitis, the typical adult oral dose is 40 mg once daily for up to 8 weeks. For Zollinger-Ellison syndrome, doses can be much higher and individualized. For H. pylori eradication, it is typically 40 mg once or twice daily in combination with antibiotics for 7-14 days. Oral forms should be taken before a meal (preferably in the morning). Do not crush, chew, or split delayed-release tablets. IV administration is typically given over a short period (e.g., 2 minutes).
Supplied As	Pantoprazole is supplied as: oral delayed-release tablets (e.g., 20 mg, 40 mg), oral delayed-release granules for suspension (e.g., 10 mg, 20 mg, 40 mg packets), and powder for intravenous injection (e.g., 40 mg/vial).
Contraindications	Pantoprazole is contraindicated in patients with known hypersensitivity to pantoprazole, substituted benzimidazoles (e.g., omeprazole, lansoprazole), or any component of the formulation. Concomitant use with rilpivirine-containing products is also contraindicated.
Storage & Expiry	Pantoprazole tablets and granules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. The powder for IV injection should be stored protected from light and reconstituted immediately before use. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, abdominal pain, diarrhea, nausea, flatulence, and dizziness. More serious side effects, though less common, include Clostridioides difficile-associated diarrhea (CDAD), bone fractures (with long-term use), kidney problems (e.g., acute interstitial nephritis), magnesium deficiency (hypomagnesemia), vitamin B12 deficiency (with long-term use), and very rarely, severe skin reactions or systemic lupus erythematosus.
Warnings & Precautions	♦ CDAD: PPI therapy may increase the risk of Clostridioides difficile-associated diarrhea (CDAD). Use the lowest dose and shortest duration appropriate for the condition. ♦ Bone Fracture: Long-term and multiple daily dose PPI therapy may increase the risk for osteoporosis-related fractures of the hip, wrist, or spine. Use the lowest dose and shortest duration. ♦ Hypomagnesemia: Can occur with long-term therapy (at least 3 months, but usually a year or more). Consider monitoring magnesium levels in patients expected to be on prolonged treatment. ♦ Vitamin B12 Deficiency: Long-term daily treatment (e.g., >2-3 years) can lead to malabsorption of vitamin B12 due to acid suppression. ♦ Acute Interstitial Nephritis: Has been observed in patients taking PPIs, including pantoprazole, and can occur at any point during therapy. ♦ Gastric Malignancy: Symptomatic response to therapy does not preclude the presence of gastric malignancy. ♦ Drug Interactions: Pantoprazole has relatively fewer significant drug interactions compared to some other PPIs (e.g., omeprazole) due to less extensive inhibition of certain CYP enzymes. ♦ Atrophic Gastritis/Fundic Gland Polyps: Long-term PPI therapy may lead to atrophic gastritis or fundic gland polyps. ♦ Pregnancy/Lactation: Use only if clearly needed. Minimal excretion into breast milk.
Missed Dose Instructions	If a dose of Pantoprazole is missed, take it as soon as remembered before a meal. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for optimal acid suppression.
Overdose Instructions	Overdose symptoms are generally mild and self-limiting, consistent with known side effects like drowsiness, tachycardia, nausea, vomiting, and abdominal pain. No specific antidote is known. Treatment is supportive and symptomatic. Hemodialysis is not effective for removing pantoprazole. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Rilpivirine-containing products: Concomitant use is contraindicated as PPIs significantly reduce rilpivirine absorption. ♦ Methotrexate: May increase and prolong methotrexate serum levels and/or its active metabolite, potentially leading to toxicity, especially with high-dose methotrexate. Consider temporary PPI withdrawal or lower doses of methotrexate. ♦ Drugs whose absorption is pH-dependent (e.g., ketoconazole, itraconazole, atazanavir, nelfinavir, erlotinib): Pantoprazole significantly reduces gastric acidity, which can impair the absorption and bioavailability of these drugs. Avoid concurrent use where possible, or use with caution and monitor. ♦ Warfarin: Isolated reports of increased INR and prothrombin time. Monitor INR closely, especially when initiating or discontinuing pantoprazole. ♦ Digoxin: May increase digoxin absorption, leading to increased digoxin levels, especially in elderly. Monitor digoxin levels. ♦ Tacrolimus: May increase tacrolimus levels. Monitor tacrolimus levels. ♦ Iron salts: PPIs can reduce the absorption of oral iron supplements.

Paracetamol (Tylenol)

Purpose/Indication	Paracetamol is a widely used analgesic and antipyretic, primarily indicated for the relief of mild to moderate pain (e.g., headache, muscle aches, backache, toothache, menstrual pain, pain from colds/flu, minor arthritis pain) and for the reduction of fever. It is often recommended as a first-line agent for pain and fever, especially when NSAIDs are contraindicated or not tolerated.
Method of Action	The exact mechanism of action of paracetamol is not fully understood, but it is believed to primarily act centrally within the brain and spinal cord, rather than peripherally. It selectively inhibits cyclooxygenase (COX) enzymes, particularly COX-2, in the central nervous system, which leads to a reduction in prostaglandin synthesis in these areas. Prostaglandins are key mediators of pain and fever. Unlike NSAIDs, it has weak anti-inflammatory effects and minimal peripheral COX inhibition.
Medication Name & Brand Names	♦ Medication Name: Paracetamol, Acetaminophen ♦ Brand Names: Panadol, Tylenol, Calpol (regional), Efferalgan (regional), Paracetamol (generic)
Pharmaceutical Forms & Appearance	Paracetamol is available in a wide range of oral forms: tablets (regular, caplets, extended-release, effervescent), chewable tablets, orally disintegrating tablets, oral suspensions/syrups, and granules. It is also available as rectal suppositories and solution for intravenous (IV) infusion. Tablets are typically white, round or oval, and may be scored. Suspensions are clear or slightly cloudy, often flavored.
Dosage & Administration	Dosage varies by age, weight, and formulation. For adults, typical oral doses are 500 mg to 1000 mg every 4-6 hours as needed, not exceeding 4000 mg (4g) in 24 hours. For children, doses are weight-based (e.g., 10-15 mg/kg per dose) every 4-6 hours, not exceeding 4-5 doses in 24 hours. Follow package instructions carefully. Oral forms can be taken with or without food. IV infusion is administered by healthcare professionals.
Supplied As	Paracetamol is supplied as: oral tablets/caplets (e.g., 325 mg, 500 mg, 650 mg), extended-release tablets (e.g., 650 mg), chewable tablets (e.g., 80 mg, 160 mg), oral suspensions/syrups (e.g., 160 mg/5 mL, 250 mg/5 mL), rectal suppositories (e.g., 120 mg, 325 mg, 650 mg), and solution for intravenous infusion (e.g., 10 mg/mL).
Contraindications	Paracetamol is contraindicated in patients with known hypersensitivity to paracetamol or any component of the formulation. It should be used with extreme caution or avoided in patients with severe active liver disease or severe hepatic impairment, due to the risk of hepatotoxicity.

Paracetamol (Tylenol)

Storage & Expiry	Paracetamol products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and excessive heat. Keep in tightly closed containers. Oral suspensions should be shaken well before use. Always check the specific expiry date on the packaging.
Side Effects	Side effects are generally rare and mild when used at recommended doses. The most significant concern is hepatotoxicity (liver damage), which can occur with overdose or excessive cumulative doses, especially in individuals with liver impairment or those who consume alcohol. Other rare side effects include severe skin reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis), and allergic reactions.
Warnings & Precautions	♦ Hepatotoxicity: BLACK BOX WARNING (in some regions/products): The greatest risk of severe liver damage occurs with overdose. Advise patients not to exceed the maximum recommended daily dose and to avoid taking other products containing paracetamol. Risk is increased in chronic alcohol users, patients with liver disease, or those who are malnourished. ♦ Allergic Reactions/Serious Skin Reactions: Rare but potentially fatal skin reactions (e.g., Stevens-Johnson Syndrome, Toxic Epidermal Necrolysis, Acute Generalized Exanthematous Pustulosis) and anaphylaxis have been reported. Discontinue immediately at the first sign of rash or allergic reaction. ♦ Alcohol Use: Advise patients who consume 3 or more alcoholic drinks per day to consult a doctor before using paracetamol due to increased risk of liver damage. ♦ Undiagnosed Symptoms: For self-medication, advise patients not to use for prolonged periods for pain (>10 days for adults, >5 days for children) or fever (>3 days) without consulting a doctor, as symptoms may indicate a serious underlying condition. ♦ Children's Dosing: Emphasize the importance of accurate dosing for children, using appropriate measuring devices for liquid forms.
Missed Dose Instructions	Paracetamol is typically taken on an as-needed basis for pain or fever. If a scheduled dose is missed, take it as soon as remembered if still needed. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Adhere to the recommended dosing interval and maximum daily dose.
Overdose Instructions	Paracetamol overdose is a medical emergency and can cause severe, potentially fatal liver damage. Symptoms may not appear for 24-48 hours and can include nausea, vomiting, abdominal pain, loss of appetite, and general malaise. Later symptoms involve signs of liver failure (jaundice, confusion, bleeding). If an overdose is suspected, seek immediate emergency medical attention, even if there are no symptoms. N-acetylcysteine (NAC) is the antidote and is most effective when administered within 8 hours of ingestion.
Medicine Interactions	♦ Alcohol: Concomitant chronic alcohol use significantly increases the risk of paracetamol-induced hepatotoxicity, even at therapeutic doses. ♦ Warfarin: Regular daily use of paracetamol at higher doses may potentiate the anticoagulant effect of warfarin, increasing the risk of bleeding. Monitor INR more frequently. Intermittent use at lower doses is generally considered safe. ♦ Other Paracetamol-containing products: The most critical interaction is unintentional overdose due to taking multiple products that contain paracetamol (e.g., cold and flu remedies). Advise patients to check all labels. ♦ Carbamazepine, Phenytoin, Rifampin, Phenobarbital (Enzyme Inducers): May increase the metabolism of paracetamol to hepatotoxic metabolites, increasing the risk of liver injury, especially in overdose. ♦ Cholestyramine: May reduce the absorption of paracetamol. Administer paracetamol at least 1 hour before or 4 hours after cholestyramine.

Penicillin V (Veetids)

Purpose/Indication	Penicillin V (also known as phenoxymethylpenicillin) is a narrow-spectrum penicillin antibiotic primarily used to treat mild to moderate bacterial infections susceptible to penicillin. It is commonly indicated for respiratory tract infections (e.g., strep throat, otitis media), skin and soft tissue infections (e.g., erysipelas, cellulitis), and to prevent rheumatic fever recurrence. It is effective against many Gram-positive bacteria, especially Streptococcus pyogenes.
Method of Action	Penicillin V is a beta-lactam antibiotic that exerts its bactericidal effect by inhibiting bacterial cell wall synthesis. It binds to penicillin-binding proteins (PBPs), which are enzymes located in the bacterial cell membrane that are crucial for the cross-linking of peptidoglycan chains, a major component of the bacterial cell wall. By inhibiting PBPs, penicillin V prevents the formation of a rigid, stable cell wall, leading to weakened bacterial cell walls, increased osmotic pressure, and ultimately, bacterial cell lysis and death.
Medication Name & Brand Names	♦ Medication Name: Penicillin V Potassium, Phenoxymethylpenicillin ♦ Brand Names: Pen-Vee K, V-Cillin K (historical), Veetids (historical), Penicillin VK, Penicillin V (generic)
Pharmaceutical Forms & Appearance	Penicillin V is available as oral tablets and as a powder for oral solution or suspension. Oral tablets are typically white, round or oval, and may be scored. The powder for oral solution/suspension is white to off-white and, when reconstituted, forms a solution that is usually clear to slightly hazy, often with a fruit flavor for pediatric use.
Dosage & Administration	Dosage varies by age, weight, and infection severity. For adults, common doses range from 250 mg to 500 mg orally every 6 to 8 hours for 7 to 10 days. For children, doses are typically weight-based (e.g., 25-50 mg/kg/day in divided doses). It can be taken with or without food; however, absorption may be slightly better on an empty stomach. If stomach upset occurs, take with food. Complete the full prescribed course of treatment.
Supplied As	Penicillin V is supplied as: oral tablets (e.g., 250 mg, 500 mg), and powder for oral solution/suspension (e.g., 125 mg/5 mL, 250 mg/5 mL after reconstitution).
Contraindications	Penicillin V is strictly contraindicated in patients with a history of severe hypersensitivity reaction (e.g., anaphylaxis, Stevens-Johnson syndrome) to any penicillin or other beta-lactam antibiotics (e.g., cephalosporins) due to the risk of cross-reactivity.
Storage & Expiry	Unreconstituted penicillin V powder should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Oral tablets should be stored in a tightly closed container. Once reconstituted, the oral solution/suspension must be stored in a refrigerator (2°C to 8°C or 36°F to 46°F) and typically used within 14 days; discard any unused portion after this time. Do not freeze. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances (e.g., nausea, vomiting, diarrhea, abdominal pain), skin rash, and black hairy tongue. More serious but less common side effects include allergic reactions (ranging from mild rash to severe anaphylaxis), Clostridioides difficile-associated diarrhea (CDAD), and hemolytic anemia.
Warnings & Precautions	♦ Hypersensitivity Reactions: Crucial Warning: Serious and occasionally fatal hypersensitivity (anaphylactic) reactions have been reported, particularly with parenteral penicillin. Ask patients about any history of penicillin or other allergen sensitivities. If an allergic reaction occurs, discontinue immediately and initiate appropriate therapy. ♦ Cross-reactivity: Patients with a history of severe reactions to cephalosporins or other beta-lactams may be at higher risk for penicillin allergy. ♦ Clostridioides difficile-associated diarrhea (CDAD): Can occur with nearly all antibacterial agents, including penicillin V, and can range from mild diarrhea to fatal colitis. Consider in patients presenting with diarrhea after antibiotic use. ♦ Renal Impairment: Use with caution in patients with significant renal impairment, as accumulation may occur; dose adjustments may be necessary. ♦ Not for Severe Infections: Penicillin V is an oral antibiotic and is not suitable for severe infections requiring higher tissue concentrations or parenteral administration. ♦ Oral Contraceptives: May reduce the effectiveness of oral contraceptives (though evidence is weak). Advise patients to use alternative contraception.

Missed Dose Instructions	If a dose of Penicillin V is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular dosing schedule. Do not take a double dose. It is crucial to complete the full prescribed course of therapy, even if symptoms improve, to ensure eradication of the infection and prevent antibiotic resistance and recurrence.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset (nausea, vomiting, diarrhea). High doses can also lead to neuromuscular excitability or seizures, particularly in patients with renal impairment. Treatment is supportive and symptomatic. Hemodialysis may be useful in removing penicillin V from the circulation, especially in severe renal impairment. Seek medical attention if a large amount is ingested or severe symptoms occur.
Medicine Interactions	♦ Oral Contraceptives: May reduce the effectiveness of oral contraceptives, potentially leading to breakthrough bleeding or unintended pregnancy. Advise alternative contraception. ♦ Tetracyclines: May antagonize the bactericidal effect of penicillin V; avoid concomitant use. ♦ Probenecid: Probenecid decreases the renal tubular secretion of penicillin V, leading to increased and prolonged blood levels of penicillin V. This interaction is sometimes used therapeutically to enhance penicillin's effect, but also increases the risk of toxicity. ♦ Methotrexate: Penicillins can reduce the renal clearance of methotrexate, potentially increasing methotrexate toxicity. Monitor for methotrexate toxicity. ♦ Live Bacterial Vaccines (e.g., typhoid vaccine): Antibiotics may reduce the therapeutic effect of live bacterial vaccines. Administer vaccine before starting antibiotic, or defer antibiotic if possible.

Perindopril (Aceon)

Purpose/Indication	Perindopril is an angiotensin-converting enzyme (ACE) inhibitor primarily used to treat essential hypertension (high blood pressure) and stable coronary artery disease. It is also indicated for the treatment of symptomatic heart failure and to reduce the risk of cardiovascular events (such as heart attack or stroke) in patients with stable coronary artery disease or other high-risk vascular conditions.
Method of Action	Perindopril is a prodrug that is converted in the liver to its active metabolite, perindoprilat. Perindoprilat works by inhibiting the angiotensin-converting enzyme (ACE), which is responsible for converting angiotensin I to angiotensin II. Angiotensin II is a powerful vasoconstrictor and also stimulates aldosterone secretion. By blocking its formation, perindoprilat causes vasodilation (widening of blood vessels), reduces aldosterone-mediated sodium and water retention, and decreases systemic vascular resistance, leading to lower blood pressure and reduced cardiac workload.
Medication Name & Brand Names	♦ Medication Name: Perindopril Arginine, Perindopril Erbumine ♦ Brand Names: Coversyl (perindopril arginine - regional), Aceon (perindopril erbumine), Perindopril (generic)
Pharmaceutical Forms & Appearance	Perindopril is available as oral tablets. Tablets are typically white, round or oval, and may be scored, with specific imprints indicating strength (e.g., 2 mg, 4 mg, 5 mg, 8 mg, 10 mg).
Dosage & Administration	Dosage is highly individualized based on the patient's condition, response, and renal function. For hypertension, typical initial doses are 4 mg or 5 mg orally once daily, adjusted based on blood pressure response, up to a maximum of 8 mg or 10 mg once daily. For heart failure, lower initial doses (e.g., 2 mg or 2.5 mg) are often used, titrating upwards. Take tablets before a meal (preferably in the morning) for better absorption.
Supplied As	Perindopril is supplied as: oral tablets (e.g., 2 mg, 4 mg, 5 mg, 8 mg, 10 mg).
Contraindications	Perindopril is contraindicated in patients with known hypersensitivity to perindopril or any other ACE inhibitor. It is also contraindicated in patients with a history of angioedema (swelling of the face, lips, tongue, throat) related to previous ACE inhibitor treatment, hereditary or idiopathic angioedema, or concomitant use with sacubitril/valsartan. Concomitant use with aliskiren is contraindicated in patients with diabetes mellitus or renal impairment.
Storage & Expiry	Perindopril tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dry cough (persistent, non-productive), dizziness, headache, fatigue, and nausea. More serious but less common side effects include angioedema (swelling of the face, lips, tongue, throat, potentially life-threatening), hypotension (low blood pressure), hyperkalemia (high potassium levels), renal impairment, and hepatic dysfunction.
Warnings & Precautions	♦ BLACK BOX WARNING (in some regions/products): Fetal Toxicity: Use of ACE inhibitors during the second and third trimesters of pregnancy can cause injury and death to the developing fetus. Discontinue as soon as pregnancy is detected. ♦ Angioedema: Can cause angioedema, which may occur at any time during treatment, particularly early on. If laryngeal stridor or angioedema of the face, extremities, lips, tongue, glottis, or larynx occurs, discontinue perindopril immediately and provide appropriate medical therapy. Higher risk in Black patients. ♦ Hypotension: May cause symptomatic hypotension, especially in volume-depleted patients (e.g., those on diuretics, dialysis) or severe heart failure. Initiate with low doses and monitor. ♦ Hyperkalemia: Can cause hyperkalemia, especially in patients with renal impairment, diabetes, or those taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium. ♦ Renal Impairment: Can cause acute renal failure, particularly in patients with pre-existing renal insufficiency, severe congestive heart failure, or bilateral renal artery stenosis. Monitor renal function regularly. ♦ Dual Blockade of RAAS: Dual blockade of the renin-angiotensin-aldosterone system (RAAS) with ACE inhibitors, ARBs, or aliskiren is associated with increased risks of hypotension, hyperkalemia, and renal function changes; generally avoid. ♦ Cough: Persistent, non-productive cough is common and resolves upon discontinuation. ♦ Hepatic Failure: Rarely associated with a syndrome of cholestatic jaundice progressing to fulminant hepatic necrosis, sometimes fatal. Discontinue if jaundice or marked elevations of hepatic enzymes occur. ♦ Surgery/Anesthesia: May cause hypotension during major surgery or anesthesia due to enhanced effects of hypotensive agents. ♦ Neutropenia/Agranulocytosis: Rare, but monitor white blood cell counts in high-risk patients.
Missed Dose Instructions	If a dose of Perindopril is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for blood pressure control and cardiovascular protection.
Overdose Instructions	Overdose symptoms are primarily severe hypotension, shock, bradycardia, electrolyte disturbances (hyperkalemia), and renal failure. Treatment is supportive and symptomatic. Maintain fluid and electrolyte balance. Lay the patient supine with legs elevated. IV fluid infusion and vasopressors may be needed for hypotension. Hemodialysis is effective in removing perindoprilat. Seek immediate emergency medical help.

Medicine Interactions	♦ Potassium-Sparing Diuretics (e.g., spironolactone, amiloride, triamterene) & Potassium Supplements: Significant risk of severe hyperkalemia. Avoid concomitant use or monitor potassium levels very closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs, including selective COX-2 inhibitors): May reduce the antihypertensive effect of ACE inhibitors and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Use with caution. ♦ Lithium: ACE inhibitors can reduce the renal clearance of lithium, leading to increased serum lithium levels and toxicity. Monitor lithium levels closely. ♦ Diuretics: Enhanced hypotensive effect, especially with the first dose. Consider withholding diuretics prior to initiating perindopril. ♦ Aliskiren: Contraindicated in patients with diabetes or renal impairment due to increased risk of hypotension, hyperkalemia, and renal impairment. ♦ Sacubitril/Valsartan (Neprilysin Inhibitor): Concomitant use is contraindicated due to increased risk of angioedema. A washout period (e.g., 36 hours) is required between stopping an ACE inhibitor and starting sacubitril/valsartan. ♦ mTOR Inhibitors (e.g., sirolimus, everolimus, temsirolimus) and Vildagliptin: Increased risk of angioedema. Use with caution. ♦ Racecadotril: Increased risk of angioedema. ♦ Gold (parenteral): Nitritoid reactions (facial flushing, nausea, vomiting, hypotension) have been reported rarely in patients on concurrent gold therapy and ACE inhibitors. ♦ Insulin/Oral Hypoglycemics: Increased risk of hypoglycemia, particularly at the initiation of ACE inhibitor therapy. Monitor blood glucose.

Permethrin (Nix)

Purpose/Indication	Permethrin is a topical antiparasitic agent used to treat infestations of scabies (caused by the mite Sarcoptes scabiei) and head lice (Pediculus humanus capitis). It is considered a first-line treatment due to its high efficacy and low toxicity when used as directed. Its purpose is to kill the mites, lice, and their eggs (nits).
Method of Action	Permethrin is a synthetic pyrethroid that acts as a neurotoxin to parasites. It works by disrupting the normal function of the neuron membrane in insects and mites. Specifically, it causes a prolonged state of depolarization of the neuronal membrane, leading to sustained hyperexcitation, paralysis, and ultimately death of the parasite. This effect is highly selective for invertebrates, which is why it has low toxicity to mammals.
Medication Name & Brand Names	♦ Medication Name: Permethrin ♦ Brand Names: Elimite (cream for scabies), Nix (cream rinse for lice), Acticin (cream for scabies), Permethrin (generic)
Pharmaceutical Forms & Appearance	Permethrin is primarily available as topical creams (typically 5% for scabies) and topical cream rinses or lotions (typically 1% for head lice). These are usually white to off-white, opaque, and creamy in texture.
Dosage & Administration	Dosage and administration vary significantly by indication. For scabies (5% cream): Apply a thin layer to all skin from the neck down to the soles of the feet, including between fingers and toes, under fingernails, wrists, armpits, and groin. Leave on for 8-14 hours, then wash off thoroughly. One application is usually sufficient, but a second application 7-14 days later may be needed. For head lice (1% cream rinse/lotion): Wash hair with a non-conditioning shampoo, rinse, and towel dry. Apply enough permethrin to saturate the hair and scalp. Leave on for 10 minutes, then rinse thoroughly. Remove nits with a fine-toothed comb. A second application after 7-10 days is often recommended to kill newly hatched lice.
Supplied As	Permethrin is supplied as: topical cream (e.g., 5% in tubes) and topical cream rinse/lotion (e.g., 1% in bottles).
Contraindications	Permethrin is contraindicated in patients with known hypersensitivity to permethrin, any synthetic pyrethroid, pyrethrin, or any component of the formulation (e.g., chrysanthemums for those with severe ragweed allergies).
Storage & Expiry	Permethrin topical cream and cream rinse/lotion should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from excessive heat and freezing. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and local, including transient itching, burning, stinging, redness, or tingling at the application site. These are often distinguishable from the persistent itching of the infestation. Persistent or worsening skin irritation may occur.
Warnings & Precautions	♦ External Use Only: Permethrin is for topical use only. Do not ingest. Avoid contact with eyes; if contact occurs, flush immediately with water. ♦ Skin Irritation: May cause mild skin irritation, especially in sensitive individuals or on broken skin. ♦ Allergic Reactions: Rare but serious allergic reactions are possible. Discontinue if signs of hypersensitivity occur. ♦ Pregnancy/Lactation: Generally considered safe for use in pregnancy and lactation under medical supervision, but use only if clearly needed. ♦ Infants: For infants, special instructions for application (e.g., entire body for scabies, not just neck down) may apply; consult product information or healthcare provider. ♦ Resistance: Though rare, resistance to permethrin has been reported in some areas, particularly for head lice. If treatment fails, re-evaluate diagnosis or consider alternative treatments. ♦ Residual Itching: Scabies itching may persist for up to 2-4 weeks after successful treatment due to residual dead mites or inflammatory reactions; this does not indicate treatment failure or re-infestation.
Missed Dose Instructions	Permethrin is typically a single-application treatment for scabies, or a two-application treatment for lice (7-10 days apart). If a scheduled second application for lice is missed, apply it as soon as remembered. If an initial application for scabies was somehow incomplete or washed off too soon, reapplication may be needed. Always follow the specific instructions on the product label or from a healthcare professional, as proper application is crucial for efficacy.
Overdose Instructions	Topical overdose of permethrin is unlikely to cause systemic toxicity due to minimal dermal absorption. Excessive application may lead to increased local skin irritation. If accidental oral ingestion occurs, symptoms would likely be mild gastrointestinal upset (e.g., nausea, vomiting). In rare cases of massive ingestion, systemic effects such as neurological symptoms (tremor, seizures) might occur, but this is highly uncommon. Treatment for accidental ingestion is supportive and symptomatic; gastric lavage may be considered if large quantities were recently swallowed. Seek medical attention if ingestion occurs or severe symptoms develop.
Medicine Interactions	♦ No significant drug-drug interactions are commonly reported for topical permethrin due to its minimal systemic absorption. ♦ There are no known specific drug interactions that would impact the efficacy or safety of systemically administered medications. ♦ However, avoid applying other creams, lotions, or moisturizers immediately before applying permethrin for scabies, as they might dilute or interfere with its absorption into the skin. Apply permethrin to clean, dry skin.

Piroxicam (Feldene)

Purpose/Indication	Piroxicam is a nonsteroidal anti-inflammatory drug (NSAID) used to relieve the signs and symptoms of osteoarthritis and rheumatoid arthritis. It helps to reduce pain, inflammation, swelling, and stiffness associated with these conditions, but it does not cure the underlying disease. Due to its long half-life and potential for serious gastrointestinal and cardiovascular side effects, it is often reserved for patients who have not responded adequately to other NSAIDs.
Method of Action	Piroxicam, like other NSAIDs, exerts its anti-inflammatory, analgesic, and antipyretic effects primarily by inhibiting the cyclooxygenase (COX) enzymes, specifically both COX-1 and COX-2. This inhibition leads to a decrease in the synthesis of prostaglandins, which are lipid compounds involved in mediating pain, inflammation, and fever. Piroxicam also inhibits the migration of leukocytes into inflammatory sites and prevents thromboxane A2 formation, further contributing to its anti-inflammatory actions.

MEDICATION | Medication List | N - Q | Piroxicam (Feldene)

Medication Name & Brand Names	♦ Medication Name: Piroxicam ♦ Brand Names: Feldene, Therafeldamine (regional), Piroxicam (generic)
Pharmaceutical Forms & Appearance	Piroxicam is available as oral capsules. Capsules are typically hard gelatin capsules, often with distinct colors (e.g., dark green and olive, or dark green) and imprints indicating strength (e.g., 10 mg or 20 mg). The powder inside is usually off-white to light tan or light yellow.
Dosage & Administration	The typical adult oral dosage for osteoarthritis and rheumatoid arthritis is 20 mg once daily, or 10 mg twice daily. Due to its long half-life, steady-state blood levels are not reached for 7 to 12 days, and the full therapeutic effect may take several weeks to become evident. It can be taken with or without food, but taking it with food, milk, or an antacid may help reduce stomach irritation. Do not chew, crush, or open the capsules.
Supplied As	Piroxicam is supplied as: oral capsules (e.g., 10 mg, 20 mg).
Contraindications	Piroxicam is contraindicated in patients with known hypersensitivity to piroxicam, aspirin, or other NSAIDs (e.g., those who have experienced asthma, urticaria, or allergic-type reactions). It is also contraindicated for the treatment of peri-operative pain in the setting of coronary artery bypass graft (CABG) surgery. Use is also contraindicated in patients with a history of recurrent gastrointestinal ulceration or bleeding, or severe heart failure.
Storage & Expiry	Piroxicam capsules should be stored at room temperature (typically 15°C to 30°C or 59°F to 86°F), protected from light and moisture. Keep in a tightly closed container. Always check the specific expiry date on the packaging and dispose of any unused or expired medication safely.
Side Effects	Common side effects include gastrointestinal issues such as stomach upset, nausea, vomiting, abdominal pain, diarrhea, or constipation. Other common effects include headache, dizziness, and tinnitus (ringing in the ears). More serious side effects can include gastrointestinal bleeding, ulceration, or perforation (potentially fatal), cardiovascular thrombotic events (heart attack, stroke), kidney problems, liver problems, and serious skin reactions.
Warnings & Precautions	♦ BLACK BOX WARNINGS: Cardiovascular Thrombotic Events: NSAIDs, including piroxicam, cause an increased risk of serious cardiovascular thrombotic events, including myocardial infarction and stroke, which can be fatal. This risk may occur early in treatment and may increase with duration of use. Piroxicam is contraindicated for peri-operative pain in CABG surgery. ♦ BLACK BOX WARNINGS: Gastrointestinal Bleeding, Ulceration, and Perforation: NSAIDs cause an increased risk of serious GI adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. These events can occur at any time without warning symptoms, especially in older adults. ♦ Hypertension: Can lead to new onset or worsening of pre-existing hypertension. Monitor blood pressure closely. ♦ Heart Failure & Edema: Fluid retention and edema have been observed; use with caution in patients with fluid retention, hypertension, or heart failure. Avoid in severe heart failure. ♦ Renal Toxicity: Long-term administration can result in renal papillary necrosis and other renal injury, especially in patients with impaired renal function, heart failure, or dehydration. Monitor renal function. ♦ Hepatotoxicity: Can cause liver injury; monitor liver function tests. ♦ Serious Skin Reactions: Rare but potentially fatal skin reactions (e.g., Stevens-Johnson syndrome, Toxic Epidermal Necrolysis) have been reported. Discontinue at first sign of rash. ♦ Fetal Toxicity: Use during the last trimester of pregnancy can cause premature closure of the fetal ductus arteriosus and fetal renal dysfunction. Avoid from 20 weeks gestation onwards. ♦ Masking of Inflammation and Fever: Can mask signs of infection.
Missed Dose Instructions	If a dose of Piroxicam is missed, take it as soon as you remember. However, if it is almost time for your next scheduled dose (e.g., if you take it once daily and it's close to the next day's dose), skip the missed dose and continue with your regular schedule. Do not take a double dose to make up for a missed one. Adhering to the prescribed dosing schedule is important for effective pain and inflammation management.
Overdose Instructions	Overdose symptoms are generally an exaggeration of common side effects, including severe stomach pain, nausea, vomiting, drowsiness, and headache. More severe signs of overdose can include gastrointestinal bleeding (black/tarry stools, coffee-ground vomit), kidney failure, hypertension, confusion, coma, and rarely, convulsions or respiratory depression. Treatment is supportive and symptomatic. There is no specific antidote. Gastric decontamination (e.g., activated charcoal) may be considered if recent ingestion. Seek immediate emergency medical attention for any suspected overdose.
Medicine Interactions	♦ Anticoagulants (e.g., warfarin, dabigatran) & Antiplatelet Agents (e.g., aspirin, clopidogrel) & SSRIs/SNRIs: Significantly increased risk of serious gastrointestinal bleeding. Avoid concomitant use or monitor closely with extreme caution. ♦ Other NSAIDs: Concomitant use with other NSAIDs (including low-dose aspirin for antiplatelet effect) increases the risk of GI adverse events; generally avoid. ♦ Diuretics (e.g., furosemide, hydrochlorothiazide): May reduce the natriuretic and antihypertensive effects of diuretics and increase the risk of renal dysfunction. ♦ ACE Inhibitors & Angiotensin Receptor Blockers (ARBs): May reduce the antihypertensive effect and increase the risk of renal impairment (including acute renal failure) and hyperkalemia, especially in elderly or volume-depleted patients. ♦ Lithium: May increase serum lithium levels and the risk of lithium toxicity by reducing its renal clearance. Monitor lithium levels. ♦ Methotrexate: May increase methotrexate levels and toxicity. ♦ Cyclosporine & Tacrolimus: Increased risk of nephrotoxicity. ♦ Corticosteroids: Increased risk of GI ulceration or bleeding. ♦ Alcohol: Increases the risk of GI irritation and bleeding. ♦ CYP2C9 Inhibitors/Inducers: Piroxicam is metabolized by CYP2C9; inhibitors (e.g., fluconazole) may increase piroxicam levels, and inducers (e.g., rifampin) may decrease levels. Monitor for altered effects.

Polyethylene Glycol (Miralax)

Purpose/Indication	Polyethylene Glycol (PEG), often referred to as macrogol, is an osmotic laxative used to treat occasional constipation and for bowel preparation before colonoscopies or other intestinal procedures. For constipation, it helps to soften stools and increase bowel movement frequency. For bowel prep, high-dose formulations are used to induce rapid and thorough bowel emptying.
Method of Action	Polyethylene Glycol is an inert, non-absorbable, and osmotically active polymer. When ingested, it passes through the gastrointestinal tract largely unabsorbed and retains water in the bowel lumen through osmotic action. This increases the water content of the stool, making it softer and increasing stool bulk. The increased bulk distends the colon, stimulating peristalsis and facilitating easier passage of stool. For bowel preparation, very large volumes of PEG solution are used to flush out the bowel.
Medication Name & Brand Names	♦ Medication Name: Polyethylene Glycol (PEG), Macrogol ♦ Brand Names: Miralax, GlycoLax, Movicol (regional, often with electrolytes), Osmolax (regional), PegLyte (for bowel prep, with electrolytes), GoLYTELY (for bowel prep, with electrolytes), PEG (generic)
Pharmaceutical Forms & Appearance	PEG is typically supplied as a white, free-flowing powder that is dissolved in water or other suitable liquids (e.g., juice) before ingestion. For bowel preparation, it often comes as a large container of powder along with electrolyte packets to be mixed into several liters of water. The resulting solution is usually clear and colorless.

Dosage & Administration	Dosage varies significantly between chronic constipation treatment and bowel preparation. For constipation, the typical adult dose is 17 grams (one level cap or scoop) of powder dissolved in 120-240 mL (4-8 ounces) of water or beverage once daily. It may take 1-3 days to produce a bowel movement. For bowel preparation, specific regimens are followed, involving large volumes (e.g., 2-4 liters) of solution consumed over several hours, usually the day before a procedure. Always follow product-specific instructions or healthcare provider's directions.
Supplied As	Polyethylene Glycol is supplied as: powder for oral solution (e.g., 17 g single dose packets, or larger containers with measuring caps/scoops), and as powder for oral solution with electrolytes (for bowel preparation, often in large jars or multiple sachets to be mixed into several liters of water).
Contraindications	Polyethylene Glycol is contraindicated in patients with known hypersensitivity to PEG. It should not be used in patients with known or suspected intestinal obstruction (e.g., paralytic ileus, bowel perforation, toxic megacolon) or acute abdominal conditions requiring surgery. Use with caution in patients with inflammatory bowel disease or impaired gag reflex.
Storage & Expiry	PEG powder should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep containers tightly closed. Once reconstituted, the solution for bowel preparation must be used within a specific timeframe (e.g., 24-48 hours when refrigerated), and usually discarded thereafter. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include bloating, abdominal cramping, flatulence, and nausea. With bowel preparation doses, these symptoms are more pronounced and often include significant abdominal discomfort and diarrhea. Dehydration and electrolyte imbalances are rare with standard constipation doses but can occur with improper use or high doses, especially if not consumed with sufficient fluids or in patients with renal impairment.
Warnings & Precautions	♦ Electrolyte Imbalance: While PEG alone (without added electrolytes) causes minimal electrolyte shifts, high-dose bowel preparations (which usually contain electrolytes) and misuse of PEG can lead to significant fluid and electrolyte imbalances (e.g., hypokalemia, hyponatremia), especially in vulnerable patients (elderly, renal impairment, heart failure). Monitor electrolytes in high-risk patients. ♦ Renal Impairment: Use with caution in patients with renal impairment, particularly with large volumes. ♦ Cardiac/Renal Disease: Use with caution and monitor fluid/electrolytes in patients with heart failure or renal dysfunction due to the potential for fluid shifts. ♦ Aspiration Risk: Use with caution in patients with impaired gag reflex or at risk for aspiration, especially with large volumes of solution. ♦ Inflammatory Bowel Disease (IBD): Use with caution in patients with active IBD, as large volumes may exacerbate symptoms. ♦ Duration of Use: For chronic constipation, prolonged use is generally considered safe, but review chronic use with a healthcare provider. ♦ Not for Immediate Relief: PEG does not produce immediate bowel movements; it typically works within 1-3 days for constipation.
Missed Dose Instructions	For chronic constipation, if a daily dose of PEG is missed, take it as soon as remembered. However, if it's close to the time for the next day's dose, skip the missed dose and resume your regular schedule. Do not take a double dose. For bowel preparation, it's critical to follow the specific instructions and timing given by the healthcare provider; any missed or incomplete doses could compromise the procedure's success.
Overdose Instructions	Overdose of PEG alone is generally well-tolerated due to its low systemic absorption. Symptoms of an overdose might include severe diarrhea, abdominal distention, nausea, and vomiting. With very large amounts or in susceptible individuals (e.g., those with renal issues), electrolyte imbalances (especially hypernatremia or hypokalemia) could theoretically occur if not balanced by fluid intake. Treatment is supportive and symptomatic, focusing on maintaining fluid and electrolyte balance. Seek medical advice if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ No significant direct drug-drug interactions are commonly reported with PEG due to its inert and non-absorbed nature. ♦ However, PEG can decrease the absorption of other orally administered medications if taken concurrently, by rapidly moving them through the GI tract. Therefore, for bowel preparation uses, advise patients to avoid taking any other oral medications within 1 hour before, during, or 1 hour after taking the PEG solution. ♦ For constipation treatment, it's generally prudent to separate PEG administration from other medications by at least 1-2 hours to ensure optimal absorption of other drugs.

Polymyxin B / Colistin (Coly-Mycin S)

Purpose/Indication	Polymyxin B is an antibiotic primarily used to treat infections caused by susceptible Gram-negative bacteria, especially Pseudomonas aeruginosa, E. coli, Klebsiella pneumoniae, and Enterobacter aerogenes. Due to its potential for serious side effects (nephrotoxicity and neurotoxicity), its systemic use (intravenous, intramuscular, intrathecal) is typically reserved for severe, multi-drug resistant infections where less toxic agents are ineffective or contraindicated. It is more commonly found in topical preparations for localized infections of the eye, ear, and skin, often in combination with other antibiotics.
Method of Action	Polymyxin B is a cationic polypeptide antibiotic that acts as a detergent-like agent, disrupting the integrity of the bacterial cell membrane. It binds to the negatively charged lipopolysaccharide (LPS) components of the outer membrane of Gram-negative bacteria. This binding leads to increased permeability of the cell membrane, causing leakage of intracellular components and ultimately leading to bacterial cell lysis and death. It also binds to and neutralizes bacterial endotoxins.
Medication Name & Brand Names	♦ Medication Name: Polymyxin B Sulfate ♦ Brand Names: Polymyxin B (generic, injectable), often found in combination products like Polytrim (Polymyxin B/Trimethoprim ophthalmic), Neosporin (Neomycin/Polymyxin B/Bacitracin topical), Cortisporin (Neomycin/Polymyxin B/Hydrocortisone otic/ophthalmic), Polysporin (Polymyxin B/Bacitracin topical).
Pharmaceutical Forms & Appearance	Polymyxin B is available as a sterile powder for injection (for reconstitution for intravenous, intramuscular, or intrathecal use), and as various topical solutions, suspensions, and ointments, often in combination with other antibiotics or corticosteroids, for ophthalmic (eye), otic (ear), and dermatologic (skin) use. The powder for injection is typically white or off-white. Topical forms vary in appearance (e.g., clear solutions, white creams/ointments).
Dosage & Administration	Dosage and administration vary greatly by route and indication. For systemic infections, it is often given intravenously (e.g., 15,000 to 25,000 units/kg/day in divided doses) or intrathecally (e.g., 50,000 units daily or every other day for meningitis). Topical forms are applied directly to the affected area (e.g., eye drops: 1-2 drops every 3-4 hours; ear drops: 3-4 drops 3-4 times daily; skin ointment: 1-3 times daily). Careful dosing and monitoring are essential for systemic use due to toxicity.
Supplied As	Polymyxin B is supplied as: powder for injection (e.g., 500,000 units per vial), ophthalmic solutions/ointments (often in combination, e.g., Polymyxin B/Trimethoprim eye drops, Neomycin/Polymyxin B/Bacitracin ophthalmic ointment), otic solutions/suspensions (often in combination, e.g., Neomycin/Polymyxin B/Hydrocortisone ear drops), and topical ointments/creams (often in combination, e.g., Neomycin/Polymyxin B/Bacitracin ointment).
Contraindications	Polymyxin B is contraindicated in patients with known hypersensitivity to polymyxin B or any component of the formulation. Systemic use should be avoided in patients with severe renal impairment unless absolutely necessary, and close monitoring is required. For otic use, it is contraindicated if there is a perforated eardrum due to the risk of ototoxicity (hearing damage).

Storage & Expiry	Unreconstituted polymyxin B powder for injection should be stored at room temperature, protected from light. Reconstituted solutions should be used promptly or stored refrigerated for a limited time (e.g., 72 hours). Topical preparations should be stored at room temperature, protected from light and excessive heat, and kept in tightly closed containers. Always check specific product labeling for precise storage conditions and expiry dates.
Side Effects	Systemic (IV/IM/Intrathecal) use: Significant side effects include nephrotoxicity (kidney damage, e.g., albuminuria, azotemia, acute tubular necrosis) and neurotoxicity (e.g., paresthesia, dizziness, vertigo, blurred vision, ataxia, slurred speech, neuromuscular blockade leading to respiratory paralysis). Topical use: Generally well-tolerated with mild local irritation (e.g., transient stinging, burning, redness, itching). Rare systemic absorption with topical use can lead to systemic side effects. Allergic reactions (rash, hives) can occur with any form.
Warnings & Precautions	♦ Systemic Use is Restricted: Due to high risk of nephrotoxicity and neurotoxicity, systemic polymyxin B should only be used in hospitalized patients under constant supervision, for severe, multi-drug resistant Gram-negative infections. ♦ Renal Impairment: Careful monitoring of renal function (urine output, creatinine, BUN) is essential, especially with systemic use. Dose adjustments are required in renal impairment. ♦ Neurotoxicity: Monitor for signs of neurotoxicity, including paresthesias, dizziness, or respiratory depression, particularly when given systemically or concomitantly with neuromuscular blocking agents. ♦ Neuromuscular Blockade: Can cause neuromuscular blockade, leading to respiratory arrest, especially in patients with impaired renal function or concurrent use of muscle relaxants. ♦ Ototoxicity: (Rare but serious) risk of hearing loss or vestibular damage, particularly with ear formulations if eardrum is perforated, or with systemic use. ♦ Superinfection: Prolonged use of any antibiotic can lead to overgrowth of non-susceptible organisms, including fungi. ♦ Hypersensitivity: Monitor for allergic reactions. ♦ Not for Viral/Fungal Infections: Antibiotics only treat bacterial infections.
Missed Dose Instructions	For systemic (injectable) polymyxin B, doses are typically administered by a healthcare professional in a hospital setting, minimizing the chance of a missed dose. If a dose is missed, the healthcare team will adjust the schedule. For topical (eye/ear drops, ointments), if a dose is missed, apply it as soon as remembered. If it's almost time for the next dose, skip the missed one and continue the regular schedule. Do not double the dose. Completing the full course of therapy is important for infection eradication.
Overdose Instructions	Systemic (injectable) overdose can lead to severe nephrotoxicity (acute renal failure), neurotoxicity (e.g., ataxia, dizziness, paresthesia, respiratory paralysis due to neuromuscular blockade), and irreversible ototoxicity. Treatment is supportive and symptomatic; maintain respiration (may require mechanical ventilation), manage fluid and electrolyte balance, and provide renal support. Hemodialysis may remove some polymyxin B. Topical overdose is generally not associated with significant systemic toxicity due to poor absorption, but may cause increased local irritation. Accidental oral ingestion of topical forms would likely cause only gastrointestinal upset. Seek immediate medical attention for any suspected systemic overdose.
Medicine Interactions	♦ Nephrotoxic and Neurotoxic Drugs (e.g., aminoglycosides like gentamicin, amikacin; amphotericin B; cephalosporins; cisplatins; colistin; neuromuscular blocking agents; muscle relaxants): Concomitant use with systemic polymyxin B significantly increases the risk of nephrotoxicity and neurotoxicity. Avoid if possible, or monitor closely and adjust doses. ♦ Non-depolarizing Muscle Relaxants (e.g., atracurium, vecuronium, pancuronium): Polymyxin B can potentiate the neuromuscular blockade, leading to prolonged or enhanced muscle relaxation and respiratory depression. Use with extreme caution. ♦ Other Ototoxic Drugs: Increased risk of ototoxicity if used with other ototoxic medications. ♦ Other Topical Preparations: For topical forms, avoid applying other products simultaneously to prevent dilution or interference with absorption/action.

Prednisone (Deltasone)

Purpose/Indication	Prednisone is a synthetic corticosteroid widely used for its potent anti-inflammatory and immunosuppressive effects. It is indicated for a vast array of conditions, including allergic reactions (e.g., severe asthma, allergic rhinitis), inflammatory conditions (e.g., rheumatoid arthritis, lupus, inflammatory bowel disease, dermatological conditions like severe psoriasis), certain cancers (e.g., lymphomas, leukemias), organ transplant rejection prevention, and respiratory conditions (e.g., COPD exacerbations).
Method of Action	Prednisone is a prodrug that is converted by the liver to its active metabolite, prednisolone. Prednisolone acts by binding to intracellular glucocorticoid receptors, forming a complex that then translocates to the cell nucleus. This complex modulates gene expression, leading to a wide range of effects: it inhibits the synthesis of inflammatory mediators (prostaglandins, leukotrienes), suppresses immune cell function (e.g., lymphocytes, macrophages), stabilizes lysosomal membranes, and reduces capillary permeability. These actions result in profound anti-inflammatory, immunosuppressive, and antiallergic effects.
Medication Name & Brand Names	♦ Medication Name: Prednisone ♦ Brand Names: Deltasone, Prednisone Intensol (concentrated oral solution), Rayos (delayed-release tablets), Prednisone (generic)
Pharmaceutical Forms & Appearance	Prednisone is available as oral tablets, orally disintegrating tablets, and oral solutions/syrups. Oral tablets are typically white, round or oval, and may be scored, with various imprints indicating strength (e.g., 1 mg, 2.5 mg, 5 mg, 10 mg, 20 mg, 50 mg). Oral solutions are clear or slightly viscous liquids, often flavored.
Dosage & Administration	Dosage is highly variable and individualized depending on the specific condition, severity, and patient response. Doses can range from low physiological replacement doses (e.g., 2.5-5 mg daily) to very high immunosuppressive doses (e.g., 60 mg or more daily). It is generally taken orally, usually once daily in the morning or as divided doses. For short-term use, it may be taken with food to reduce stomach upset. Long-term therapy requires gradual tapering to avoid adrenal insufficiency.
Supplied As	Prednisone is supplied as: oral tablets (e.g., 1 mg, 2.5 mg, 5 mg, 10 mg, 20 mg, 50 mg), orally disintegrating tablets (e.g., 10 mg, 15 mg, 30 mg), and oral solution/syrup (e.g., 5 mg/5 mL, 15 mg/5 mL).
Contraindications	Prednisone is contraindicated in patients with known hypersensitivity to prednisone or any component of the formulation. It is generally contraindicated in patients with systemic fungal infections unless specific antifungal therapy is being administered. Live or live-attenuated vaccines should not be given to patients receiving immunosuppressive doses of corticosteroids.
Storage & Expiry	Prednisone tablets and oral solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and light. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Side effects are numerous and dose/duration-dependent. Common short-term effects include increased appetite, weight gain, fluid retention, insomnia, mood changes (e.g., irritability, euphoria, anxiety), increased blood pressure, and hyperglycemia. Long-term effects include osteoporosis, muscle weakness, skin thinning/bruising, increased risk of infection, cataracts, glaucoma, Cushing's syndrome features, adrenal insufficiency (upon withdrawal), and impaired wound healing.

Warnings & Precautions	♦ Adrenal Suppression: Prolonged high-dose therapy can lead to adrenal cortical atrophy and suppression of the hypothalamic-pituitary-adrenal (HPA) axis. Abrupt discontinuation can cause life-threatening adrenal insufficiency (e.g., fatigue, weakness, nausea, vomiting, hypotension). Taper dose gradually. ♦ Increased Risk of Infection: Corticosteroids suppress the immune system, increasing susceptibility to, and masking symptoms of, infection (bacterial, viral, fungal, parasitic). Avoid exposure to chickenpox or measles if not immune. Avoid live vaccines. ♦ Cushing's Syndrome: Chronic use can lead to iatrogenic Cushing's syndrome with characteristic physical changes. ♦ Metabolic Effects: Can cause hyperglycemia, new-onset diabetes, worsening of pre-existing diabetes, dyslipidemia, and weight gain. Monitor blood glucose. ♦ Osteoporosis: Long-term use increases the risk of osteoporosis and fractures. Consider calcium and vitamin D supplementation. ♦ Ophthalmic Effects: Can cause cataracts (posterior subcapsular) and glaucoma (increased intraocular pressure). Regular eye exams are recommended for long-term users. ♦ Cardiovascular Effects: Can cause fluid retention, hypertension, and exacerbate heart failure. Use with caution in cardiovascular disease. ♦ GI Effects: Increased risk of peptic ulcers and GI bleeding/perforation, especially with concurrent NSAID use. ♦ Neuropsychiatric Disturbances: Wide range of effects including mood swings, insomnia, psychosis, depression, and euphoria. ♦ Growth Retardation: In children, chronic use can inhibit growth. ♦ Hypokalemia: Can cause potassium loss. ♦ Immunization: Patients on immunosuppressive doses should not receive live or live-attenuated vaccines. Killed vaccines may have a diminished response. ♦ Pregnancy/Lactation: Use only if potential benefit justifies risk. Excreted in breast milk; potential for adverse effects on infant.
Missed Dose Instructions	For once-daily dosing, if a dose of Prednisone is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For alternate-day or tapered dosing regimens, follow specific instructions provided by the healthcare professional, as consistency is critical. Never abruptly stop prednisone if you've been on it for more than a few days, due to the risk of adrenal insufficiency.
Overdose Instructions	Acute overdose of prednisone is generally not life-threatening. Symptoms are usually an exaggeration of typical side effects, including increased appetite, weight gain, fluid retention, high blood pressure, and agitation. However, chronic overdose can lead to more severe long-term complications such as Cushing's syndrome, severe metabolic disturbances, and immunosuppression. Treatment is supportive and symptomatic. There is no specific antidote. Gradual dose reduction is generally recommended for chronic overdose. Seek medical advice for significant acute overdose or if chronic overdose is suspected.
Medicine Interactions	♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): Increased risk of gastrointestinal ulceration and bleeding. Use with caution. ♦ Diuretics (Potassium-depleting, e.g., thiazides, loop diuretics): Increased risk of hypokalemia. Monitor potassium levels. ♦ Anticoagulants (e.g., warfarin): Corticosteroids can either enhance or diminish the effect of anticoagulants; monitor INR closely. ♦ Insulin/Oral Hypoglycemics: Prednisone can increase blood glucose levels, requiring dose adjustments of antidiabetic medications. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, phenobarbital): Can increase the metabolism of prednisone, reducing its plasma levels and efficacy. Increased prednisone dose may be needed. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, clarithromycin, ritonavir, grapefruit juice): Can decrease the metabolism of prednisone, increasing its plasma levels and risk of side effects. Reduced prednisone dose may be needed. ♦ Live Vaccines: Contraindicated for patients on immunosuppressive doses of corticosteroids. ♦ Immunosuppressants (e.g., cyclosporine, methotrexate): Increased risk of infection and adverse effects. ♦ Cholestyramine, Antacids: May decrease the absorption of prednisone; administer at separate times. ♦ Digitalis Glycosides: Hypokalemia induced by prednisone can increase the risk of digitalis toxicity.

Pregabalin (Lyrica)

Purpose/Indication	Pregabalin is an anticonvulsant and neuropathic pain agent used to treat various conditions. Its primary indications include neuropathic pain associated with diabetic peripheral neuropathy, postherpetic neuralgia (shingles pain), and spinal cord injury. It is also approved for the treatment of fibromyalgia and as adjunctive therapy for partial-onset seizures in adults.
Method of Action	Pregabalin's exact mechanism of action is not fully understood, but it is believed to exert its effects by binding with high affinity to the alpha2-delta (α2−δ) subunit of voltage-gated calcium channels in the central nervous system. This binding modulates the release of several neurotransmitters, including glutamate, norepinephrine, and substance P. By reducing the release of these excitatory neurotransmitters, pregabalin reduces neuronal excitability, thereby decreasing pain signals and stabilizing overactive nerve cells.
Medication Name & Brand Names	♦ Medication Name: Pregabalin ♦ Brand Names: Lyrica, Pregabalin (generic)
Pharmaceutical Forms & Appearance	Pregabalin is available as oral capsules, oral solution, and extended-release tablets. Capsules are typically hard gelatin capsules, varying in color and size depending on the strength, with specific imprints. The oral solution is a clear, colorless liquid. Extended-release tablets are generally white or off-white.
Dosage & Administration	Dosage is highly individualized and depends on the indication, patient's response, and renal function. For most indications, initial doses are typically 50 mg or 75 mg orally two or three times daily, gradually titrated upwards over a week to the effective dose (e.g., 150-300 mg/day or up to 600 mg/day). Extended-release tablets are taken once daily. Take with or without food. Avoid abrupt discontinuation to prevent withdrawal symptoms.
Supplied As	Pregabalin is supplied as: oral capsules (e.g., 25 mg, 50 mg, 75 mg, 100 mg, 150 mg, 200 mg, 225 mg, 300 mg), oral solution (e.g., 20 mg/mL), and extended-release tablets (e.g., 82.5 mg, 165 mg, 330 mg).
Contraindications	Pregabalin is contraindicated in patients with known hypersensitivity to pregabalin or any component of the formulation.
Storage & Expiry	Pregabalin capsules, oral solution, and extended-release tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, somnolence (drowsiness), dry mouth, edema (swelling), blurred vision, weight gain, constipation, and difficulty concentrating. More serious side effects, though less common, include angioedema (swelling of face, lips, tongue), hypersensitivity reactions, suicidal thoughts or behavior, respiratory depression (especially with opioids or in patients with respiratory risk factors), and physical dependence leading to withdrawal symptoms upon abrupt discontinuation.

Warnings & Precautions	♦ Angioedema: Cases of angioedema (swelling of the face, limbs, lips, tongue, glottis, and larynx) have been reported, which may be life-threatening. Discontinue immediately if symptoms occur. ♦ Hypersensitivity Reactions: Discontinue at the first sign of hypersensitivity (e.g., rash, hives). ♦ Suicidal Thoughts and Behavior: Antiepileptic drugs, including pregabalin, may increase the risk of suicidal thoughts or behavior. Monitor patients for new or worsening depression, suicidal thoughts or behavior, or unusual changes in mood or behavior. ♦ Respiratory Depression: Serious, life-threatening, or fatal respiratory depression may occur, particularly in patients with pre-existing respiratory impairment, concomitant use of CNS depressants (e.g., opioids, benzodiazepines), or in the elderly. Use with caution and monitor. ♦ Peripheral Edema: May cause peripheral edema. Use with caution in patients with cardiovascular disease. ♦ Dizziness and Somnolence: Can impair physical and mental abilities. Advise patients not to drive or operate machinery until effects are known. ♦ Withdrawal Symptoms: Do not discontinue abruptly. Gradually taper the dose over at least 1 week to avoid withdrawal symptoms (e.g., insomnia, nausea, headache, anxiety, diarrhea, flu-like symptoms, seizures). ♦ Weight Gain: Common side effect. ♦ Creatine Kinase Elevation: Rare cases of elevated creatine kinase. ♦ Renal Impairment: Dose adjustments are necessary for patients with impaired renal function due to renal excretion. ♦ Drug Abuse and Dependence: Pregabalin has a potential for abuse and dependence, particularly in individuals with a history of substance abuse. It is a controlled substance in many regions.
Missed Dose Instructions	If a dose of Pregabalin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. It is important to avoid missing doses to maintain consistent blood levels and therapeutic effect, and to avoid potential withdrawal symptoms if you've been on it for a long time.
Overdose Instructions	Overdose symptoms are typically exaggerated side effects, including somnolence, confusion, agitation, and restlessness. Less common but more serious effects can include coma and seizures. There is no specific antidote for pregabalin overdose. Treatment is supportive and symptomatic. Maintain airway, breathing, and circulation. Hemodialysis can effectively remove pregabalin from the plasma. Seek immediate emergency medical help.
Medicine Interactions	♦ CNS Depressants (e.g., opioids, benzodiazepines, alcohol, sedatives, hypnotics): Additive CNS depressant effects leading to increased sedation, drowsiness, and potentially respiratory depression. Use with caution, and consider lower doses of one or both agents. ♦ Tramadol: May increase the risk of CNS depression and seizures. ♦ Antidiabetic Agents (e.g., thiazolidinediones like rosiglitazone, pioglitazone): Concomitant use with pregabalin may increase the risk of weight gain and peripheral edema. Monitor for fluid retention. ♦ No significant pharmacokinetic interactions with other commonly used drugs: Pregabalin is primarily excreted renally unchanged and is not significantly metabolized by the cytochrome P450 system, leading to a low potential for metabolic drug interactions.

Propranolol (Inderal)

Purpose/Indication	Propranolol is a non-selective beta-adrenergic receptor blocker used to treat a wide range of cardiovascular and other conditions. Its primary indications include hypertension (high blood pressure), angina pectoris (chest pain), cardiac arrhythmias, and hypertrophic subaortic stenosis. It is also used for the prophylaxis of migraine headaches, essential tremor, and to manage symptoms of anxiety (e.g., performance anxiety) and hyperthyroidism.
Method of Action	Propranolol is a non-selective beta-blocker, meaning it blocks both beta-1 (β1) and beta-2 (β2) adrenergic receptors. By blocking β1 receptors primarily in the heart, it reduces heart rate, myocardial contractility, and cardiac output, leading to decreased blood pressure and reduced oxygen demand. By blocking β2 receptors in the bronchial tree and peripheral blood vessels, it can cause bronchoconstriction and vasoconstriction. It also reduces renin release from the kidneys and has effects on the central nervous system, contributing to its diverse therapeutic actions.
Medication Name & Brand Names	♦ Medication Name: Propranolol Hydrochloride ♦ Brand Names: Inderal (immediate-release tablets, extended-release capsules, solution), Hemangeol (oral solution for infantile hemangioma), Propranolol (generic)
Pharmaceutical Forms & Appearance	Propranolol is available as oral tablets (immediate-release), oral extended-release capsules, oral solution, and solution for intravenous (IV) injection. Immediate-release tablets are typically white to off-white, round or heart-shaped, with various imprints and sometimes scored. Extended-release capsules contain beads and vary in color. The oral solution is a clear liquid.
Dosage & Administration	Dosage is highly individualized and depends on the indication, patient's response, and renal/hepatic function. For hypertension, typical initial adult oral doses are 40 mg twice daily (immediate-release) or 80 mg once daily (extended-release), titrated upwards. For migraine prophylaxis, doses are usually 80-240 mg daily in divided doses or once daily with extended-release. Take with or without food, but consistency is recommended. Do not crush or chew extended-release capsules. Abrupt discontinuation should be avoided.
Supplied As	Propranolol is supplied as: oral immediate-release tablets (e.g., 10 mg, 20 mg, 40 mg, 60 mg, 80 mg), oral extended-release capsules (e.g., 60 mg, 80 mg, 120 mg, 160 mg), oral solution (e.g., 4 mg/mL, 8 mg/mL, 20 mg/5 mL), and solution for intravenous injection (e.g., 1 mg/mL).
Contraindications	Propranolol is contraindicated in patients with known hypersensitivity to propranolol or any component of the formulation. It is strictly contraindicated in patients with bronchial asthma, acute severe exacerbation of COPD, cardiogenic shock, sinus bradycardia, second- or third-degree atrioventricular (AV) block (without a pacemaker), and overt cardiac failure.
Storage & Expiry	Propranolol tablets, capsules, and oral solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. The oral solution for infantile hemangioma (Hemangeol) requires specific refrigeration after opening. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include bradycardia (slow heart rate), fatigue, dizziness, nausea, vomiting, diarrhea, constipation, and cold extremities. More serious side effects include bronchospasm (especially in patients with asthma/COPD), severe bradycardia, hypotension, heart failure exacerbation, masked hypoglycemia symptoms (in diabetics), and depression. Sexual dysfunction can also occur.
Warnings & Precautions	♦ Abrupt Cessation: BLACK BOX WARNING (in some regions/products): Abrupt discontinuation of beta-blockers, especially in patients with ischemic heart disease, can exacerbate angina, lead to myocardial infarction, or ventricular arrhythmias. When discontinuing, gradually taper the dose over 1-2 weeks. ♦ Bronchospastic Disease: Contraindicated in patients with asthma. Use with extreme caution, if at all, in patients with COPD or other bronchospastic diseases, as non-selective beta-blockade can worsen bronchoconstriction. ♦ Cardiac Failure: May depress myocardial contractility and precipitate or worsen cardiac failure. Use with caution in compensated heart failure, and avoid in overt cardiac failure. ♦ Bradycardia/Heart Block: Can cause severe bradycardia or heart block. Use with caution in patients with first-degree AV block or sick sinus syndrome. ♦ Diabetes Mellitus: Can mask symptoms of hypoglycemia (e.g., tremor, tachycardia) and prolong hypoglycemic episodes. Use with caution in diabetic patients, especially those on insulin or oral hypoglycemics. ♦ Thyrotoxicosis: Can mask clinical signs of hyperthyroidism (e.g., tachycardia). Abrupt withdrawal in patients with thyrotoxicosis may precipitate a thyroid storm. ♦ Peripheral Vascular Disease: May precipitate or aggravate symptoms of arterial insufficiency. ♦ Pheochromocytoma: If used in pheochromocytoma, always administer an alpha-blocker first to prevent unopposed alpha-adrenergic stimulation, which can lead to severe hypertension. ♦ Anaphylaxis: Patients taking beta-blockers may be less responsive to epinephrine for the treatment of severe allergic reactions. ♦ Hepatic/Renal Impairment: Metabolized in the liver and partially excreted by kidneys. Use with caution and consider dose adjustment in patients with significant hepatic or renal impairment.
Missed Dose Instructions	If a dose of Propranolol is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose (e.g., a few hours before the next immediate-release dose, or half-way through the interval for extended-release), skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining stable blood pressure and heart rate, and to prevent rebound effects from missed doses.

Overdose Instructions	Overdose symptoms are primarily severe bradycardia, severe hypotension, bronchospasm, acute cardiac failure, and hypoglycemia. Other symptoms may include convulsions, respiratory depression, and coma. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. For bradycardia, atropine or isoproterenol may be used. Glucagon may be effective for severe beta-blocker toxicity. Vasopressors may be needed for hypotension. Pacing may be required for severe bradycardia/heart block. Seek immediate emergency medical help.
Medicine Interactions	♦ Calcium Channel Blockers (e.g., verapamil, diltiazem): Concomitant use can cause severe bradycardia, AV block, and hypotension. Use with extreme caution; monitor ECG and blood pressure. ♦ Other Antihypertensives: Additive hypotensive effects. ♦ Alpha-blockers (e.g., prazosin): Can cause significant first-dose orthostatic hypotension. ♦ Clonidine: Concomitant use can cause rebound hypertension upon withdrawal of clonidine. If discontinuing both, taper propranolol first, then clonidine. ♦ Digoxin: Increased risk of bradycardia and AV block. ♦ Insulin & Oral Hypoglycemics: Can mask symptoms of hypoglycemia (tachycardia, tremor) and prolong hypoglycemic episodes. Monitor blood glucose closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): May reduce the antihypertensive effect of beta-blockers. ♦ CYP2D6 Inhibitors (e.g., fluoxetine, paroxetine, quinidine): Can increase propranolol plasma levels due to inhibition of metabolism, potentially leading to increased beta-blockade and adverse effects. ♦ CYP1A2/CYP2C19/CYP3A4 Inhibitors/Inducers: Propranolol is metabolized by multiple CYP enzymes; concomitant use with inhibitors or inducers of these enzymes can alter propranolol levels. ♦ Theophylline: Beta-blockers can antagonize the bronchodilatory effects of theophylline. ♦ Ergot Alkaloids: Increased risk of peripheral vasoconstriction. ♦ Epinephrine: Beta-blockers can cause an exaggerated hypertensive and bradycardic response to epinephrine due to unopposed alpha-adrenergic stimulation.

Pseudoephedrine (Sudafed)

Purpose/Indication	Pseudoephedrine is a sympathomimetic amine used as a nasal decongestant. It is primarily indicated for the temporary relief of nasal congestion and sinus pressure caused by the common cold, hay fever, other upper respiratory allergies, or sinusitis. It works by shrinking swollen nasal passages, allowing for easier breathing.
Method of Action	Pseudoephedrine acts as a direct and indirect sympathomimetic, primarily by stimulating alpha-adrenergic receptors in the smooth muscle of nasal blood vessels and to a lesser extent, beta-adrenergic receptors. It causes vasoconstriction (narrowing) of the arterioles in the nasal mucosa, reducing blood flow to the area. This leads to a decrease in swelling and mucus formation, thereby opening up nasal passages and relieving congestion. It also causes indirect release of norepinephrine from adrenergic nerve endings.
Medication Name & Brand Names	♦ Medication Name: Pseudoephedrine Hydrochloride, Pseudoephedrine Sulfate ♦ Brand Names: Sudafed (original formulation), Claritin-D (loratadine/pseudoephedrine), Zyrtec-D (cetirizine/pseudoephedrine), Allegra-D (fexofenadine/pseudoephedrine), Pseudoephedrine (generic)
Pharmaceutical Forms & Appearance	Pseudoephedrine is available as oral tablets, extended-release tablets, chewable tablets, oral liquids/syrups, and oral drops. Tablets are typically white, round, or oval, and may be imprinted. Extended-release tablets vary in appearance. Oral liquids are clear, often flavored.
Dosage & Administration	Dosage varies by age, formulation, and product. For adults and children 12 years and older, typical immediate-release doses are 30 mg to 60 mg orally every 4-6 hours, not exceeding 240 mg in 24 hours. Extended-release forms are typically taken once or twice daily. For younger children, doses are weight-based and specific pediatric formulations (liquids, drops) should be used. Take with or without food. Do not crush or chew extended-release tablets.
Supplied As	Pseudoephedrine is supplied as: oral tablets (e.g., 30 mg, 60 mg), oral extended-release tablets (e.g., 120 mg, 240 mg), chewable tablets (e.g., 15 mg, 30 mg), oral liquids/syrups (e.g., 15 mg/5 mL, 30 mg/5 mL), and oral drops (e.g., 7.5 mg/0.8 mL).
Contraindications	Pseudoephedrine is contraindicated in patients with known hypersensitivity to pseudoephedrine or other sympathomimetics. It is also contraindicated in patients with severe hypertension, severe coronary artery disease, narrow-angle glaucoma, and urinary retention. Concomitant use or use within 14 days of discontinuing a monoamine oxidase inhibitor (MAOI) is strictly contraindicated due to the risk of hypertensive crisis.
Storage & Expiry	Pseudoephedrine products should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture and excessive heat. Keep in tightly closed, child-resistant containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nervousness, restlessness, insomnia (difficulty sleeping), headache, dizziness, and mild tremors. Cardiovascular effects such as increased heart rate (tachycardia) and elevated blood pressure can also occur. Less common but more serious side effects include hallucinations, arrhythmias, and seizures (especially with overdose).
Warnings & Precautions	♦ Cardiovascular Effects: Use with caution in patients with hypertension, heart disease (e.g., coronary artery disease, arrhythmias), hyperthyroidism, or diabetes, as pseudoephedrine can increase blood pressure and heart rate. ♦ CNS Stimulation: Can cause excitability, especially in children, nervousness, restlessness, and insomnia. Avoid taking close to bedtime. ♦ Urinary Retention: Use with caution in patients with prostatic enlargement or urinary retention, as it can worsen these conditions. ♦ Glaucoma: Use with caution in patients with glaucoma, particularly narrow-angle glaucoma. ♦ Seizures: Use with caution in patients with seizure disorders. ♦ Drug Abuse Potential: Pseudoephedrine is a precursor for illicit methamphetamine synthesis, leading to restrictions on its sale in many regions. ♦ Phenylketonuria (PKU): Some chewable tablets or liquids may contain phenylalanine. ♦ Not for Self-Treatment of Chronic Conditions: Not intended for prolonged use without medical advice. Consult a doctor if symptoms persist or worsen.
Missed Dose Instructions	Pseudoephedrine is typically used on an as-needed basis for symptom relief. If a scheduled dose is missed, take it as soon as remembered if symptoms are present. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Adhere to the recommended dosing interval and maximum daily dose.
Overdose Instructions	Overdose symptoms are an exaggeration of side effects and primarily involve central nervous system (CNS) stimulation and cardiovascular effects. These can include severe nervousness, restlessness, insomnia, tremors, hallucinations, seizures, severe headache, palpitations, tachycardia, hypertension, and arrhythmias. In severe cases, respiratory depression, circulatory collapse, and coma can occur. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral overdose. Control seizures with benzodiazepines. Manage hypertension and arrhythmias as needed. Seek immediate emergency medical help.
Medicine Interactions	♦ Monoamine Oxidase Inhibitors (MAOIs): Contraindicated: Concomitant use or use within 14 days of discontinuing an MAOI can lead to severe, potentially fatal hypertensive crisis (e.g., phenelzine, tranylcypromine, isocarboxazid, selegiline). ♦ Other Sympathomimetics (e.g., other decongestants, appetite suppressants, amphetamines): Additive stimulant and cardiovascular effects, increasing the risk of adverse reactions. Avoid concomitant use. ♦ Beta-blockers (e.g., propranolol): Pseudoephedrine may reduce the antihypertensive effect of beta-blockers. ♦ Tricyclic Antidepressants (TCAs): Can increase the pressor effect of pseudoephedrine. Use with caution. ♦ Digoxin: Increased risk of arrhythmias due to pseudoephedrine's cardiac effects. ♦ Methyldopa, Guanethidine, Reserpine: Pseudoephedrine may antagonize the antihypertensive effects of these medications. ♦ Caffeine and other CNS stimulants: Additive stimulant effects, increasing risk of nervousness, insomnia, and palpitations.

Pyrazinamide (Tebrazid)

Purpose/Indication	Pyrazinamide is an antitubercular agent used as a crucial component of multi-drug regimens for the treatment of active tuberculosis (TB), particularly during the initial intensive phase. Its purpose is to kill the Mycobacterium tuberculosis bacteria, especially those residing within macrophages and acidic environments, contributing to shortening the duration of TB treatment and preventing the emergence of drug resistance. It is not used as a single agent.
Method of Action	Pyrazinamide is a prodrug that is converted to its active form, pyrazinoic acid, by the mycobacterial enzyme pyrazinamidase, which is found in the susceptible Mycobacterium tuberculosis bacteria. Pyrazinoic acid is thought to act primarily in the acidic environment of lysosomes and macrophages, which is where M. tuberculosis often resides. Its exact mechanism is complex and not fully elucidated, but it is believed to inhibit mycobacterial fatty acid synthase I (FAS I), disrupt mycobacterial cell membrane energy metabolism, and lower intracellular pH, leading to bactericidal activity against slow-growing bacteria.
Medication Name & Brand Names	♦ Medication Name: Pyrazinamide ♦ Brand Names: Rifater (combination with rifampin and isoniazid - regional), Pyrazinamide (generic)
Pharmaceutical Forms & Appearance	Pyrazinamide is available as oral tablets. Tablets are typically white or off-white, round, and may be scored, with specific imprints indicating strength (e.g., 500 mg).
Dosage & Administration	Dosage is individualized based on the patient's body weight and is typically administered orally once daily. For adults, common doses range from 15-30 mg/kg per day, usually up to a maximum of 2 grams per day, as part of a multi-drug regimen (e.g., with isoniazid, rifampin, and ethambutol) for the initial 2 months of TB treatment. It can be taken with or without food. Adherence to the full prescribed regimen is critical for successful TB treatment.
Supplied As	Pyrazinamide is supplied as: oral tablets (e.g., 500 mg).
Contraindications	Pyrazinamide is contraindicated in patients with known hypersensitivity to pyrazinamide. It is also strictly contraindicated in patients with acute gout or severe liver damage, as it can exacerbate gout and cause hepatotoxicity.
Storage & Expiry	Pyrazinamide tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	The most significant and common serious side effect is hepatotoxicity (liver damage), which can range from asymptomatic elevations in liver enzymes to severe, potentially fatal hepatic necrosis. Other common side effects include arthralgia (joint pain) and hyperuricemia (increased uric acid levels, which can precipitate gout attacks). Less common effects include gastrointestinal upset (nausea, vomiting, loss of appetite), rash, and photosensitivity.
Warnings & Precautions	♦ Hepatotoxicity: Pyrazinamide can cause severe and potentially fatal hepatotoxicity. Liver function tests (ALT, AST, bilirubin) must be performed prior to and regularly throughout therapy, typically every 2-4 weeks. Discontinue if signs of liver damage appear. Alcohol consumption significantly increases the risk of hepatotoxicity. ♦ Hyperuricemia & Gout: Almost all patients treated with pyrazinamide develop hyperuricemia due to inhibition of uric acid excretion. This can precipitate acute gouty arthritis attacks. Monitor uric acid levels and manage symptoms if they occur. ♦ Renal Impairment: Use with caution and consider dose adjustment in patients with renal impairment, as accumulation may occur. ♦ Diabetes Mellitus: May make diabetes more difficult to control. Monitor blood glucose. ♦ Gastrointestinal Irritation: May cause nausea, vomiting, or loss of appetite. Taking with food may help. ♦ History of Gout: Contraindicated in patients with acute gout; use with extreme caution in those with a history of gout. ♦ Photosensitivity: May increase sensitivity to sunlight. Advise patients to use sun protection. ♦ Drug Resistance: Pyrazinamide should always be used in combination with other anti-TB drugs to prevent the development of drug resistance.
Missed Dose Instructions	Given that Pyrazinamide is a critical component of TB treatment, adherence is paramount. If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Any missed doses should be discussed with the healthcare provider, as consistent dosing is essential for treatment success and preventing drug resistance.
Overdose Instructions	Overdose symptoms are primarily related to hepatotoxicity (liver damage), which may manifest as nausea, vomiting, abdominal pain, jaundice, and elevated liver enzymes. Acute overdose can also lead to hyperuricemia and symptoms of gout. There is no specific antidote for pyrazinamide overdose. Treatment is supportive and symptomatic, focusing on liver protection. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Close monitoring of liver function and uric acid levels is essential. Seek immediate emergency medical help.
Medicine Interactions	♦ Drugs that cause Hepatotoxicity (e.g., alcohol, rifampin, isoniazid, acetaminophen at high doses): Concomitant use increases the risk of liver damage. Avoid or use with extreme caution and frequent liver function monitoring. ♦ Drugs for Gout (e.g., allopurinol, probenecid, colchicine): Pyrazinamide increases uric acid levels, which may necessitate dose adjustments of anti-gout medications or worsen gout symptoms. Probenecid may inhibit pyrazinamide excretion. ♦ Other Antitubercular Drugs: Pyrazinamide is always used in combination with other anti-TB drugs (e.g., isoniazid, rifampin, ethambutol). These combinations are often synergistic but also contribute to the overall risk of side effects. ♦ Diabetes Medications: May make blood glucose control more difficult. Monitor blood glucose and adjust antidiabetic medication as needed.

Quetiapine (Seroquel)

Purpose/Indication	Quetiapine is an atypical antipsychotic medication used to treat various mental health conditions. Its primary indications include schizophrenia, bipolar disorder (manic, depressive, or mixed episodes, and maintenance treatment), and as an adjunctive treatment for major depressive disorder (MDD). It helps to manage symptoms like hallucinations, delusions, mood swings, and severe depression.
Method of Action	Quetiapine is an atypical antipsychotic that acts as a potent antagonist at various neurotransmitter receptors in the brain. It has high affinity for serotonin 5-$HT2A anddopamine D2 receptors, with a higher affinity for HT2A receptors. It also antagonizes histamine H1$ and alpha-1 (a1) adrenergic receptors, which contribute to its sedative and orthostatic hypotensive effects, respectively. Its precise mechanism in treating psychosis and mood disorders is complex, but it is thought to involve a balance of dopamine and serotonin receptor blockade.
Medication Name & Brand Names	♦ Medication Name: Quetiapine Fumarate ♦ Brand Names: Seroquel (immediate-release tablets), Seroquel XR (extended-release tablets), Quetiapine (generic)
Pharmaceutical Forms & Appearance	Quetiapine is available as immediate-release (IR) tablets and extended-release (XR) tablets. IR tablets are typically round, biconvex, and film-coated, varying in color and imprint depending on strength (e.g., white, peach, yellow). XR tablets are often capsule-shaped or oval and also vary in color and imprint (e.g., white to yellowish-white).

Dosage & Administration	Dosage is highly individualized and titrated gradually based on the patient's condition, response, and tolerability. For schizophrenia, initial doses might be 25-50 mg daily, increasing to 300-800 mg/day in divided doses (IR) or once daily (XR). For bipolar disorder and MDD, doses vary significantly. IR tablets are typically taken twice or thrice daily. XR tablets are taken once daily, usually in the evening without food or with a light meal. Do not chew, crush, or split XR tablets.
Supplied As	Quetiapine is supplied as: oral immediate-release tablets (e.g., 25 mg, 50 mg, 100 mg, 200 mg, 300 mg, 400 mg) and oral extended-release tablets (e.g., 50 mg, 150 mg, 200 mg, 300 mg, 400 mg).
Contraindications	Quetiapine is contraindicated in patients with known hypersensitivity to quetiapine or any component of the formulation. Concomitant use with potent CYP3A4 inhibitors is generally contraindicated (see interactions).
Storage & Expiry	Quetiapine tablets (IR and XR) should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include drowsiness/sedation, dizziness, dry mouth, weight gain, constipation, orthostatic hypotension (drop in blood pressure upon standing), and increased appetite. More serious side effects can include metabolic changes (hyperglycemia, dyslipidemia), tardive dyskinesia (involuntary movements), neuroleptic malignant syndrome (NMS), seizures, QT prolongation, and falls.
Warnings & Precautions	♦ BLACK BOX WARNINGS: Elderly Patients with Dementia-Related Psychosis: Increased risk of death, primarily from cardiovascular events (e.g., heart failure, sudden death) or infections. Quetiapine is not approved for this use. ♦ BLACK BOX WARNINGS: Suicidality: Increased risk of suicidal thoughts and behavior in children, adolescents, and young adults (up to 24 years of age) with major depressive disorder and other psychiatric disorders. Monitor closely for clinical worsening and suicidality. ♦ Orthostatic Hypotension/Syncope: Can cause orthostatic hypotension, dizziness, and syncope, especially during initial dose titration. Use with caution in patients with cardiovascular disease, cerebrovascular disease, or conditions predisposing to hypotension. ♦ Neuroleptic Malignant Syndrome (NMS): Rare but potentially fatal idiosyncratic reaction. Discontinue immediately if NMS is suspected (fever, muscle rigidity, altered mental status, autonomic instability). ♦ Tardive Dyskinesia: Involuntary, repetitive movements, primarily of the face and tongue. May develop during treatment or after discontinuation. Discontinue if signs appear. ♦ Metabolic Changes: Risk of hyperglycemia/diabetes mellitus (sometimes severe and leading to ketoacidosis/coma/death), dyslipidemia (elevated cholesterol and triglycerides), and weight gain. Monitor regularly. ♦ QT Prolongation: Can prolong the QT interval, increasing risk of arrhythmias. Use with caution in patients with known cardiovascular disease, family history of QT prolongation, hypokalemia, or concomitant use of other QT-prolonging drugs. ♦ Seizures: Use with caution in patients with a history of seizures. ♦ Cataracts: Lens changes (cataracts) have been observed in animal studies. Routine eye examinations are recommended. ♦ Hypothyroidism: Can cause dose-related decreases in thyroid hormone levels. Monitor thyroid function. ♦ Leukopenia/Neutropenia/Agranulocytosis: Can occur. Monitor complete blood counts during the first few months of therapy in patients with pre-existing low WBC/ANC. ♦ Dysphagia: Esophageal dysmotility and aspiration risk. Use with caution in patients at risk for aspiration pneumonia. ♦ Withdrawal Symptoms: Abrupt discontinuation can cause withdrawal symptoms (e.g., insomnia, nausea, vomiting, headache, diarrhea, dizziness, irritability). Taper gradually. ♦ Controlled Substance: Potential for misuse or abuse, particularly for sedative effects.
Missed Dose Instructions	If a dose of Quetiapine (immediate-release) is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For extended-release tablets, if a dose is missed, take it as soon as remembered; if more than 6-12 hours late, skip and take the next dose as scheduled. Consult the prescriber about specific instructions for missed doses, as consistency is important. Do not abruptly stop taking quetiapine.
Overdose Instructions	Overdose symptoms are primarily an exaggeration of known pharmacological effects: severe sedation, somnolence, tachycardia, hypotension, dry mouth, and anticholinergic effects. More serious effects can include coma, seizures, QTc prolongation, and arrhythmias. There is no specific antidote. Treatment is supportive and symptomatic, maintaining airway, breathing, and circulation. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Continuous cardiovascular monitoring (including ECG) is essential. Seek immediate emergency medical help.
Medicine Interactions	♦ CNS Depressants (e.g., alcohol, benzodiazepines, opioids, sedatives, hypnotics): Additive CNS depressant effects leading to increased sedation, drowsiness, and respiratory depression. Avoid or use with extreme caution. ♦ Antihypertensives: Additive hypotensive effects; monitor blood pressure. ♦ CYP3A4 Inducers (e.g., carbamazepine, phenytoin, rifampin, phenobarbital, St. John's Wort): Significantly increase the metabolism of quetiapine, reducing its plasma levels and potentially leading to loss of efficacy. Increased quetiapine dose may be necessary. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, erythromycin, clarithromycin, ritonavir, grapefruit juice): Significantly inhibit the metabolism of quetiapine, increasing its plasma levels and risk of side effects. Reduced quetiapine dose may be necessary or concomitant use may be contraindicated. ♦ Drugs that Prolong QT Interval (e.g., certain antiarrhythmics, tricyclic antidepressants, some antipsychotics, moxifloxacin): Increased risk of arrhythmias. Use with caution. ♦ Anticholinergic Agents: Additive anticholinergic effects (e.g., dry mouth, constipation, urinary retention, blurred vision). ♦ Thioridazine: Concomitant use is generally not recommended due to increased risk of QT prolongation and arrhythmias. ♦ Lithium: May alter lithium levels or effects, monitor.

Quinine (Qualaquin)

Purpose/Indication	Quinine is an antimalarial drug primarily used for the treatment of uncomplicated Plasmodium falciparum malaria, especially in regions where chloroquine resistance is high. Due to its significant side effects and the availability of newer, safer antimalarials, its use is typically reserved for cases where other agents are not effective or available. It may also be used in combination with other antimalarials. Historically, it was also used off-label for nocturnal leg cramps, but this use is generally discouraged due to safety concerns.
Method of Action	Quinine's antimalarial action is thought to occur by inhibiting the parasite's ability to detoxify heme, a byproduct of hemoglobin digestion within the red blood cells. Malaria parasites digest hemoglobin and convert toxic heme into non-toxic hemozoin. Quinine interferes with this process, allowing toxic heme to accumulate, which is lethal to the parasite. It also has schizonticidal activity, meaning it kills the asexual blood forms of the parasite. Additionally, quinine has muscle relaxant properties, affecting the excitability of muscle fibers, which may explain its historical use for leg cramps.
Medication Name & Brand Names	♦ Medication Name: Quinine Sulfate ♦ Brand Names: Qualaquin, Quinacrine (different drug), Quinine (generic)
Pharmaceutical Forms & Appearance	Quinine is primarily available as oral capsules or tablets. Capsules are typically hard gelatin capsules, varying in color and size depending on strength, often with specific imprints. Tablets are usually round or oval and white. It may also be found in some IV formulations for severe malaria in certain regions.
Dosage & Administration	Dosage and duration vary depending on the indication and severity of malaria. For uncomplicated P. falciparum malaria, a common adult oral dose is 648 mg (or 600 mg salt) every 8 hours for 3-7 days, typically in combination with a second antimalarial drug (e.g., doxycycline, clindamycin) to ensure radical cure and prevent resistance. It should be taken with food to minimize gastrointestinal upset.
Supplied As	Quinine is supplied as: oral capsules (e.g., 324 mg), oral tablets (e.g., 300 mg, 600 mg).

Contraindications	Quinine is contraindicated in patients with known hypersensitivity to quinine or mefloquine (due to cross-sensitivity). It is also contraindicated in patients with tinnitus, optic neuritis, glucose-6-phosphate dehydrogenase (G6PD) deficiency (risk of hemolytic anemia), myasthenia gravis (may worsen muscle weakness), and in patients with a history of blackwater fever associated with quinine use.
Storage & Expiry	Quinine tablets and capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	The most common side effects are collectively known as "cinchonism" and include tinnitus (ringing in ears), headache, nausea, vomiting, dizziness, blurred vision, and flushing. More serious side effects include hypersensitivity reactions (rash, angioedema), severe hypoglycemia (low blood sugar), hemolytic anemia (especially in G6PD deficiency), thrombocytopenia (low platelets), QT prolongation leading to arrhythmias (e.g., Torsades de Pointes), and rarely, acute renal failure.
Warnings & Precautions	♦ Cinchonism: A common syndrome of adverse effects (tinnitus, headache, nausea, visual disturbances, dizziness) that can occur even at therapeutic doses. Symptoms are usually reversible upon discontinuation. ♦ Hypoglycemia: Can cause severe hypoglycemia, especially in pregnant women and children, by stimulating insulin release. Monitor blood glucose closely. ♦ Hematologic Effects: Risk of hemolytic anemia (especially in G6PD deficiency), thrombocytopenia, and agranulocytosis. Test for G6PD deficiency before use if possible. ♦ Cardiac Effects: Can prolong the QT interval and increase the risk of serious ventricular arrhythmias (e.g., Torsades de Pointes). Avoid use in patients with known QT prolongation, uncorrected hypokalemia/hypomagnesemia, or concomitant use of other QT-prolonging drugs. Use with caution in patients with heart disease. ♦ Hypersensitivity Reactions: Severe and potentially fatal hypersensitivity reactions (e.g., rash, anaphylaxis, angioedema) can occur. ♦ Neuromuscular Blocking Agents: May potentiate the effects of neuromuscular blocking agents. ♦ Myasthenia Gravis: Can exacerbate muscle weakness. ♦ Renal/Hepatic Impairment: Use with caution and consider dose adjustment in patients with significant renal or hepatic impairment, as elimination may be reduced. ♦ Off-label Use (Leg Cramps): Due to risk of serious side effects, regulatory bodies in some regions (e.g., FDA) advise against its use for nocturnal leg cramps.
Missed Dose Instructions	If a dose of Quinine is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Adherence to the full prescribed course is crucial for effective malaria treatment and preventing the development of drug resistance.
Overdose Instructions	Overdose symptoms are typically severe cinchonism (pronounced tinnitus, severe headache, confusion, visual disturbances, deafness), profound hypotension, cardiac arrhythmias (especially QT prolongation and Torsades de Pointes), severe hypoglycemia, gastrointestinal distress, and CNS depression (coma, convulsions). Acute renal failure and respiratory depression can also occur. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Correct hypoglycemia immediately. Manage cardiac arrhythmias and hypotension. Hemodialysis is generally not effective. Seek immediate emergency medical help.
Medicine Interactions	♦ QT-Prolonging Drugs (e.g., amiodarone, sotalol, quinidine, some antipsychotics, macrolide antibiotics like erythromycin, fluoroquinolones like moxifloxacin): Concomitant use significantly increases the risk of serious ventricular arrhythmias, including Torsades de Pointes. Avoid concurrent use. ♦ Anticoagulants (e.g., warfarin): Quinine can potentiate the anticoagulant effect of warfarin, increasing bleeding risk. Monitor INR closely. ♦ Digoxin: Quinine can increase digoxin levels. Monitor digoxin levels. ♦ Mefloquine: Concomitant use increases the risk of seizures and cardiac arrhythmias; avoid or use with extreme caution. Avoid mefloquine for at least 12 hours after last quinine dose. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, phenobarbital): Can increase the metabolism of quinine, reducing its plasma levels and efficacy. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, ritonavir, clarithromycin, grapefruit juice): Can decrease the metabolism of quinine, increasing its plasma levels and risk of toxicity. ♦ Antacids (containing aluminum or magnesium): Can decrease the absorption of quinine. Separate administration. ♦ Cimetidine: May increase quinine levels. ♦ Neuromuscular Blocking Agents: May enhance the effect of neuromuscular blockers. ♦ Grapefruit juice: May inhibit quinine metabolism and increase its levels.

R - Z

Any medications starting with R through to Z.

Raloxifene (Evista)

Purpose/Indication	Raloxifene is a selective estrogen receptor modulator (SERM) primarily used for the prevention and treatment of osteoporosis in postmenopausal women. It is also indicated to reduce the risk of invasive breast cancer in postmenopausal women at high risk for invasive breast cancer, and in postmenopausal women with osteoporosis. It offers bone-preserving benefits without stimulating breast or uterine tissue.
Method of Action	Raloxifene selectively binds to estrogen receptors, acting as an estrogen agonist in some tissues (like bone) and an estrogen antagonist in others (like breast and uterine tissue). In bone, it mimics estrogen's effects by decreasing bone resorption and increasing bone mineral density, thus reducing the risk of vertebral fractures. In breast tissue, it antagonizes estrogen's effects, which is thought to contribute to its breast cancer risk reduction. Its selective action differentiates it from traditional estrogen replacement therapy.
Medication Name & Brand Names	♦ Medication Name: Raloxifene Hydrochloride ♦ Brand Names: Evista, Raloxifene (generic)
Pharmaceutical Forms & Appearance	Raloxifene is available as oral tablets. Tablets are typically white, oval-shaped, and film-coated, with specific imprints indicating strength (e.g., "ELI LILLY 4165" or generic equivalent).
Dosage & Administration	The typical adult oral dosage for both osteoporosis and breast cancer risk reduction is 60 mg once daily. It can be taken with or without food. Patients should also receive adequate calcium and vitamin D supplementation, and consider weight-bearing exercise. It is important to discontinue raloxifene at least 72 hours (3 days) prior to and during prolonged immobilization (e.g., after surgery) due to the increased risk of thromboembolism.
Supplied As	Raloxifene is supplied as: oral tablets (e.g., 60 mg).
Contraindications	Raloxifene is contraindicated in women who are pregnant or may become pregnant (Pregnancy Category X). It is also contraindicated in women with active or a history of venous thromboembolic events, including deep vein thrombosis (DVT), pulmonary embolism (PE), and retinal vein thrombosis. Additionally, it is contraindicated in patients with known hypersensitivity to raloxifene or any component of the formulation.
Storage & Expiry	Raloxifene tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.

Side Effects	Common side effects include hot flashes/flushes, leg cramps, peripheral edema (swelling), flu-like syndrome, and arthralgia (joint pain). The most serious and significant side effect is an increased risk of venous thromboembolic events (DVT, PE, retinal vein thrombosis), especially during the first few months of therapy. Other rare but serious effects include stroke.
Warnings & Precautions	♦ BLACK BOX WARNING: Increased Risk of Venous Thromboembolism (VTE) and Stroke: Raloxifene increases the risk of VTE (DVT, PE, retinal vein thrombosis), particularly during the first 4 months of treatment. Risk is higher in women with a history of VTE. Discontinue at least 72 hours prior to and during prolonged immobilization. Increased risk of death due to stroke has also been observed in clinical trials. ♦ History of Stroke: Use with caution in women with a history of stroke or transient ischemic attack (TIA) due to increased risk of stroke. ♦ Immobilization: Discontinue raloxifene during prolonged periods of immobilization (e.g., after surgery or prolonged bed rest) due to increased VTE risk. Resume only after the patient is fully ambulatory. ♦ Hepatic Impairment: Not recommended for use in patients with hepatic impairment, as it is extensively metabolized by the liver. ♦ Estrogen Use: Should not be used with systemic estrogens. ♦ Hypertriglyceridemia: Use with caution in women with a history of estrogen-induced severe hypertriglyceridemia, as raloxifene may exacerbate this condition. ♦ Breast/Uterine Cancer: While it reduces the risk of invasive breast cancer, it does not prevent all types of breast cancer (e.g., non-invasive lobular or ductal carcinoma) and has no effect on endometrial cancer risk. ♦ Cholesterol: Can decrease total and LDL cholesterol but has no effect on HDL cholesterol or triglycerides.
Missed Dose Instructions	If a dose of Raloxifene is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining the bone and breast cancer risk reduction benefits.
Overdose Instructions	Limited experience with raloxifene overdose. Symptoms following large doses have included leg cramps and dizziness. There is no specific antidote for raloxifene overdose. Treatment should be supportive and symptomatic. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Warfarin & other Coumarin Anticoagulants: Raloxifene can decrease prothrombin time, potentially enhancing the anticoagulant effect of warfarin. Monitor INR closely, especially when initiating or discontinuing raloxifene. ♦ Systemic Estrogens (e.g., hormone replacement therapy): Concomitant use with systemic estrogens is not recommended due to lack of evidence for added benefit and potential for increased adverse effects. ♦ Cholestyramine & other Bile Acid Sequestrants: Can significantly reduce the absorption and enterohepatic recirculation of raloxifene, leading to reduced plasma levels. Avoid concomitant use. ♦ Highly Protein-Bound Drugs (e.g., ibuprofen, diazepam, indomethacin, diclofenac): While in vitro studies suggest potential displacement, clinically significant interactions are generally not observed. However, use caution. ♦ Ampicillin: Oral ampicillin can decrease raloxifene concentrations, though the clinical significance is generally not considered major. ♦ Thyroid Hormones: No significant interaction; absorption and metabolism of thyroid hormones are not affected.

Ramipril (Altace)

Purpose/Indication	Ramipril is an angiotensin-converting enzyme (ACE) inhibitor primarily used to treat hypertension (high blood pressure) and to reduce the risk of cardiovascular events. It is indicated for reducing the risk of myocardial infarction, stroke, and cardiovascular death in patients aged 55 years or older at high risk (e.g., with coronary artery disease, history of stroke/MI, or diabetes with at least one cardiovascular risk factor). It is also used to treat symptomatic congestive heart failure and to reduce the risk of major cardiovascular events in patients with clinically evident cardiovascular disease.
Method of Action	Ramipril is a prodrug that is converted in the liver to its active metabolite, ramiprilat. Ramiprilat works by inhibiting the angiotensin-converting enzyme (ACE), which is responsible for converting angiotensin I to angiotensin II. Angiotensin II is a potent vasoconstrictor and also stimulates aldosterone secretion. By blocking its formation, ramiprilat causes vasodilation (widening of blood vessels), reduces aldosterone-mediated sodium and water retention, and decreases systemic vascular resistance, leading to lower blood pressure and reduced cardiac workload.
Medication Name & Brand Names	♦ Medication Name: Ramipril ♦ Brand Names: Altace, Ramipril (generic)
Pharmaceutical Forms & Appearance	Ramipril is available as oral capsules and oral solution. Capsules are typically hard gelatin capsules, varying in color depending on the strength, and may have specific imprints. The oral solution is usually a clear, colorless liquid.
Dosage & Administration	Dosage is highly individualized based on the patient's condition, response, and renal function. For hypertension, initial adult oral doses are typically 2.5 mg once daily, adjusted based on blood pressure response, up to a maximum of 20 mg once daily. For cardiovascular risk reduction, the typical target dose is 10 mg once daily. For heart failure, lower initial doses (e.g., 1.25 mg) are often used, titrating upwards. Take with or without food.
Supplied As	Ramipril is supplied as: oral capsules (e.g., 1.25 mg, 2.5 mg, 5 mg, 10 mg) and oral solution (e.g., 1 mg/mL).
Contraindications	Ramipril is contraindicated in patients with known hypersensitivity to ramipril or any other ACE inhibitor. It is also contraindicated in patients with a history of angioedema (swelling of the face, lips, tongue, throat) related to previous ACE inhibitor treatment, hereditary or idiopathic angioedema, or concomitant use with sacubitril/valsartan. Concomitant use with aliskiren is contraindicated in patients with diabetes mellitus or renal impairment.
Storage & Expiry	Ramipril capsules and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dry cough (persistent, non-productive), dizziness, fatigue, and headache. More serious but less common side effects include angioedema (swelling of the face, lips, tongue, throat, potentially life-threatening), hypotension (low blood pressure), hyperkalemia (high potassium levels), renal impairment, and hepatic dysfunction.
Warnings & Precautions	♦ BLACK BOX WARNING (in some regions/products): Fetal Toxicity: Use of ACE inhibitors during the second and third trimesters of pregnancy can cause injury and death to the developing fetus. Discontinue as soon as pregnancy is detected. ♦ Angioedema: Can cause angioedema, which may occur at any time during treatment, particularly early on. If laryngeal stridor or angioedema of the face, extremities, lips, tongue, glottis, or larynx occurs, discontinue ramipril immediately and provide appropriate medical therapy. Higher risk in Black patients. ♦ Hypotension: May cause symptomatic hypotension, especially in volume-depleted patients (e.g., those on diuretics, dialysis) or severe heart failure. Initiate with low doses and monitor. ♦ Hyperkalemia: Can cause hyperkalemia, especially in patients with renal impairment, diabetes, or those taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium. ♦ Renal Impairment: Can cause acute renal failure, particularly in patients with pre-existing renal insufficiency, severe congestive heart failure, or bilateral renal artery stenosis. Monitor renal function regularly. ♦ Dual Blockade of RAAS: Dual blockade of the renin-angiotensin-aldosterone system (RAAS) with ACE inhibitors, ARBs, or aliskiren is associated with increased risks of hypotension, hyperkalemia, and renal function changes; generally avoid. ♦ Cough: Persistent, non-productive cough is common and resolves upon discontinuation.

	♦ Hepatic Failure: Rarely associated with a syndrome of cholestatic jaundice progressing to fulminant hepatic necrosis, sometimes fatal. Discontinue if jaundice or marked elevations of hepatic enzymes occur. ♦ Surgery/Anesthesia: May cause hypotension during major surgery or anesthesia due to enhanced effects of hypotensive agents. ♦ Neutropenia/Agranulocytosis: Rare, but monitor white blood cell counts in high-risk patients.
Missed Dose Instructions	If a dose of Ramipril is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for blood pressure control and cardiovascular protection.
Overdose Instructions	Overdose symptoms are primarily severe hypotension, shock, bradycardia, electrolyte disturbances (hyperkalemia), and renal failure. Treatment is supportive and symptomatic. Maintain fluid and electrolyte balance. Lay the patient supine with legs elevated. IV fluid infusion and vasopressors may be needed for hypotension. Hemodialysis is effective in removing ramiprilat. Seek immediate emergency medical help.
Medicine Interactions	♦ Potassium-Sparing Diuretics (e.g., spironolactone, amiloride, triamterene) & Potassium Supplements: Significant risk of severe hyperkalemia. Avoid concomitant use or monitor potassium levels very closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs, including selective COX-2 inhibitors): May reduce the antihypertensive effect of ACE inhibitors and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Use with caution. ♦ Lithium: ACE inhibitors can reduce the renal clearance of lithium, leading to increased serum lithium levels and toxicity. Monitor lithium levels closely. ♦ Diuretics: Enhanced hypotensive effect, especially with the first dose. Consider withholding diuretics prior to initiating ramipril. ♦ Aliskiren: Contraindicated in patients with diabetes or renal impairment due to increased risk of hypotension, hyperkalemia, and renal impairment. ♦ Sacubitril/Valsartan (Neprilysin Inhibitor): Concomitant use is contraindicated due to increased risk of angioedema. A washout period (e.g., 36 hours) is required between stopping an ACE inhibitor and starting sacubitril/valsartan. ♦ mTOR Inhibitors (e.g., sirolimus, everolimus, temsirolimus) and Vildagliptin: Increased risk of angioedema. Use with caution. ♦ Racecadotril: Increased risk of angioedema. ♦ Gold (parenteral): Nitritoid reactions (facial flushing, nausea, vomiting, hypotension) have been reported rarely in patients on concurrent gold therapy and ACE inhibitors. ♦ Insulin/Oral Hypoglycemics: Increased risk of hypoglycemia, particularly at the initiation of ACE inhibitor therapy. Monitor blood glucose.

Rifampin (Rifadin)

Purpose/Indication	Rifampin is a broad-spectrum antibiotic primarily used in combination with other drugs for the treatment of active tuberculosis (TB), including drug-resistant strains. It is also indicated for the treatment of latent TB infection (as monotherapy or in combination), and for the eradication of meningococcal carriers (to prevent meningococcal meningitis outbreaks). Less commonly, it's used for severe staphylococcal infections (e.g., endocarditis, osteomyelitis) when combined with other agents, due to its ability to penetrate biofilms.
Method of Action	Rifampin exerts its bactericidal effect by inhibiting bacterial RNA synthesis. It specifically binds to the beta-subunit of bacterial DNA-dependent RNA polymerase, thereby preventing the initiation of RNA transcription. This action selectively affects bacterial cells because mammalian RNA polymerase is not significantly inhibited by rifampin. Its unique mechanism allows it to kill rapidly growing and semi-dormant Mycobacterium tuberculosis bacilli.
Medication Name & Brand Names	♦ Medication Name: Rifampin, Rifampicin (international non-proprietary name) ♦ Brand Names: Rifadin, Rimactane, Rifamate (combination with isoniazid), Rifater (combination with isoniazid and pyrazinamide), Rifampin (generic)
Pharmaceutical Forms & Appearance	Rifampin is available as oral capsules and as a powder for oral suspension or intravenous (IV) injection. Oral capsules are typically opaque, reddish-brown, and may be imprinted. The powder for oral suspension is usually orange to red-brown. The powder for IV injection is a red-brown lyophilized powder for reconstitution. Due to its color, it can stain urine, sweat, tears, and other bodily fluids orange-red.
Dosage & Administration	Dosage varies significantly by indication and patient weight, and it is almost always used in combination with other anti-infective agents. For tuberculosis, typical adult oral doses are 10 mg/kg once daily (up to 600 mg daily), or 10 mg/kg two or three times weekly, depending on the regimen, for several months. For meningococcal carriers, the dose is typically 600 mg twice daily for 2 days. Take on an empty stomach (1 hour before or 2 hours after a meal) for optimal absorption. Oral suspension can be given via nasogastric tube.
Supplied As	Rifampin is supplied as: oral capsules (e.g., 150 mg, 300 mg), powder for oral suspension (e.g., 10 mg/mL after reconstitution), and powder for intravenous injection (e.g., 600 mg per vial).
Contraindications	Rifampin is contraindicated in patients with known hypersensitivity to rifampin or any rifamycin. It is also contraindicated in patients with severe liver disease or active hepatitis. Concomitant use with ritonavir-boosted saquinavir (and potentially other protease inhibitors) is contraindicated due to increased risk of hepatotoxicity.
Storage & Expiry	Rifampin capsules and powder for oral suspension (unreconstituted) should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Once reconstituted, the oral suspension should be stored at room temperature and typically used within a few weeks (check label). Reconstituted IV solution should be used promptly. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal upset (nausea, vomiting, diarrhea, abdominal pain), rash, and flu-like symptoms. The most significant and common serious side effect is hepatotoxicity (liver damage), which can range from asymptomatic elevations in liver enzymes to severe, potentially fatal hepatic necrosis. Other serious effects include thrombocytopenia (low platelets), hemolytic anemia, acute renal failure (rare), and discoloration of body fluids (orange-red urine, sweat, tears, saliva).
Warnings & Precautions	♦ Hepatotoxicity: Can cause severe and potentially fatal hepatotoxicity. Liver function tests (ALT, AST, bilirubin) must be performed prior to and regularly throughout therapy. Discontinue if signs of liver damage appear. The risk is increased with concomitant use of other hepatotoxic drugs (e.g., isoniazid, pyrazinamide), pre-existing liver disease, or chronic alcohol consumption. ♦ Drug Interactions: Rifampin is a potent inducer of many cytochrome P450 enzymes, leading to numerous significant drug interactions (see below). ♦ Discoloration of Body Fluids: Patients should be advised that rifampin will turn urine, sweat, tears, saliva, and contact lenses (soft) an orange-red color. This is harmless but permanent staining of soft contact lenses can occur. ♦ Hypersensitivity Reactions: Can cause various hypersensitivity reactions, including rash, fever, and flu-like syndrome. ♦ Hematologic Effects: Can cause thrombocytopenia, leukopenia, and hemolytic anemia, especially with intermittent dosing or if therapy is resumed after a break. Monitor blood counts. ♦ Renal Impairment: Rarely associated with acute renal failure. Monitor renal function. ♦ Intermittent Dosing: Risk of severe adverse reactions (flu-like syndrome, thrombocytopenia, hemolytic anemia) is increased with intermittent use (e.g., once or twice weekly) compared to daily dosing. ♦ Pseudomembranous Colitis: Can occur with nearly all antibacterial agents. ♦ Pregnancy: Use with caution; may interfere with vitamin K-dependent clotting factors in mother and infant. Administer vitamin K to mother before delivery and to infant.
Missed Dose Instructions	Given that Rifampin is a critical component of anti-tuberculosis therapy and prophylaxis, adherence is paramount to prevent drug resistance and treatment failure. If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Any missed doses should be discussed with the healthcare provider, as consistency is essential for treatment success.

Overdose Instructions	Overdose symptoms are typically related to hepatotoxicity (liver damage), which may manifest as nausea, vomiting, abdominal pain, jaundice, and elevated liver enzymes. Characteristic orange-red discoloration of skin, urine, sweat, and other bodily fluids is often pronounced. In severe cases, unconsciousness, convulsions, and cardiac arrhythmias may occur. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Close monitoring of liver function, renal function, and blood counts is essential. Seek immediate emergency medical help.
Medicine Interactions	♦ Potent CYP Enzyme Inducer: Rifampin is a strong inducer of numerous cytochrome P450 enzymes and transporter proteins. This leads to significantly reduced plasma concentrations and efficacy of many co-administered drugs. Numerous interactions require dose adjustments or alternative therapies. Key interactions include: ♦ Oral Contraceptives: Significantly reduces effectiveness, leading to unintended pregnancy. Advise alternative, reliable contraception. ♦ Warfarin & other Anticoagulants: Significantly reduces anticoagulant effect. Monitor INR very closely and adjust warfarin dose as needed. ♦ Anti-HIV Drugs (e.g., protease inhibitors, NNRTIs): Most anti-HIV drugs are significantly affected. Concomitant use often contraindicated or requires substantial dose adjustments or alternative anti-TB drugs. ♦ Corticosteroids: Reduces corticosteroid levels. Increased steroid dose may be needed. ♦ Oral Hypoglycemics (e.g., sulfonylureas): Reduces efficacy, potentially leading to hyperglycemia. Monitor blood glucose. ♦ Digoxin: Reduces digoxin levels. ♦ Cardiac Drugs (e.g., antiarrhythmics like quinidine, propafenone; calcium channel blockers like verapamil, diltiazem, nifedipine; beta-blockers like propranolol): Reduced efficacy of these drugs. Dose adjustments or alternative agents may be needed. ♦ Statins: Reduces levels of many statins. ♦ Immunosuppressants (e.g., cyclosporine, tacrolimus, sirolimus): Significantly reduces levels of immunosuppressants, leading to risk of transplant rejection. Monitor drug levels and adjust immunosuppressant dose significantly. ♦ Thyroid Hormones: Reduces levothyroxine levels. ♦ Methadone: Can cause withdrawal symptoms due to reduced

Risedronate (Actonel)

Purpose/Indication	Risedronate is a bisphosphonate medication primarily used for the treatment and prevention of osteoporosis in postmenopausal women, and for the treatment of osteoporosis in men. It is also indicated for the treatment of glucocorticoid-induced osteoporosis in men and women, and for the treatment of Paget's disease of bone. Its purpose is to increase bone mineral density and significantly reduce the risk of vertebral and non-vertebral fractures.
Method of Action	Risedronate is a nitrogen-containing bisphosphonate that specifically inhibits bone resorption by binding to hydroxyapatite crystals in bone and being taken up by osteoclasts (cells responsible for bone breakdown). Once internalized, risedronate interferes with the mevalonate pathway, an essential metabolic pathway in osteoclasts, leading to impaired osteoclast function, reduced osteoclast numbers, and ultimately, a decrease in bone turnover. This allows osteoblasts (bone-forming cells) to continue building new bone, leading to a net gain in bone mass and strength.
Medication Name & Brand Names	♦ Medication Name: Risedronate Sodium ♦ Brand Names: Actonel, Atelvia (delayed-release), Risedronate (generic)
Pharmaceutical Forms & Appearance	Risedronate is available as oral tablets (immediate-release and delayed-release). Immediate-release tablets are typically round or oval, white to off-white, and may be imprinted with strength and/or a company logo. Delayed-release tablets are often coated and may have a specific shape or color.
Dosage & Administration	Dosage varies by indication. For osteoporosis (treatment/prevention), common regimens are 5 mg daily, 35 mg once weekly, 75 mg on two consecutive days each month, or 150 mg once monthly. For Paget's disease, it's typically 30 mg once daily for 2 months. It is crucial to take risedronate on an empty stomach (at least 30-60 minutes before the first food, drink, or other medication of the day), with a full glass of plain water (not mineral water or juice), and remain upright for at least 30-60 minutes after taking the dose to prevent esophageal irritation. Do not chew or suck tablets.
Supplied As	Risedronate is supplied as: oral immediate-release tablets (e.g., 5 mg, 35 mg, 75 mg, 150 mg) and oral delayed-release tablets (e.g., 35 mg).
Contraindications	Risedronate is contraindicated in patients with known hypersensitivity to risedronate or any component of the formulation. It is strictly contraindicated in patients with hypocalcemia (low blood calcium levels), severe renal impairment (creatinine clearance less than 30 mL/min), or abnormalities of the esophagus that delay esophageal emptying (e.g., stricture or achalasia) due to the risk of esophageal adverse events. Patients unable to stand or sit upright for at least 30-60 minutes should also not take risedronate.
Storage & Expiry	Risedronate tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal issues such as abdominal pain, dyspepsia (indigestion), nausea, diarrhea, and constipation. Esophageal adverse events (e.g., esophagitis, esophageal ulcers, erosions) are also a significant concern, especially if not taken correctly. Musculoskeletal pain is also reported. More serious but rare side effects include osteonecrosis of the jaw (ONJ), atypical femoral fractures, and severe bone, joint, and/or muscle pain.
Warnings & Precautions	♦ Esophageal Adverse Reactions: Can cause severe esophageal irritation, including esophagitis, ulcers, and erosions, which can be severe and require hospitalization. Strict adherence to administration instructions is crucial. Do not chew or suck tablets; take with plain water; remain upright for 30-60 min; avoid taking with food, drinks (other than plain water), or other medications. Discontinue if new or worsening dysphagia, painful swallowing, or retrosternal pain occurs. ♦ Osteonecrosis of the Jaw (ONJ): Rare but serious adverse event, particularly in cancer patients receiving IV bisphosphonates, but also reported with oral bisphosphonates (including risedronate). Risk factors include cancer, concomitant therapies (chemotherapy, corticosteroids, anti-angiogenic agents), poor oral hygiene, pre-existing dental disease, and invasive dental procedures. A dental exam should be considered prior to initiation, especially for patients with risk factors. ♦ Atypical Femoral Fractures: Low-trauma subtrochanteric and diaphyseal femoral fractures have been reported with bisphosphonate use. Evaluate new thigh, hip, or groin pain. ♦ Musculoskeletal Pain: Severe and occasionally incapacitating bone, joint, and/or muscle pain has been reported. Discontinue if pain develops. ♦ Hypocalcemia: Must be corrected before initiating risedronate. Monitor calcium and vitamin D levels. Ensure adequate calcium and vitamin D intake. ♦ Renal Impairment: Use with caution and contraindicated in severe renal impairment. ♦ Hypersensitivity Reactions: Allergic reactions, including angioedema and severe skin reactions, have been reported. ♦ Existing GI Disorders: Use with caution in patients with active upper GI problems (e.g., dysphagia, peptic ulcer, active GI bleeding).
Missed Dose Instructions	For once-weekly dosing (35 mg): If a dose is missed, take one tablet on the morning after it is remembered, then return to taking one tablet once a week on your chosen day. Do not take two tablets on the same day. For monthly dosing (150 mg, or 75 mg x 2): If a dose is missed and the next scheduled monthly dose is more than 7 days away, take the missed dose the next morning. If the next scheduled monthly dose is within 7 days, skip the missed dose and resume your regular schedule. Do not take more than one risedronate tablet in a single week. For daily dosing (5 mg): If a dose is missed, skip the missed dose and take the next dose at the regular time. Do not take two doses on the same day. Always adhere strictly to administration instructions to minimize esophageal risk.

Overdose Instructions	Overdose of risedronate can lead to hypocalcemia, hypophosphatemia, and upper gastrointestinal adverse events (e.g., stomach upset, heartburn, esophagitis). Management includes administering milk or antacids containing calcium to bind the risedronate and relieve GI irritation. Do not induce vomiting. Patients should remain upright. Monitor serum calcium and phosphorus levels. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Calcium-Containing Products (e.g., antacids, calcium supplements, dairy products): Significantly interfere with the absorption of risedronate. Must be administered at least 30-60 minutes after risedronate. ♦ Multivitamins, Iron, Magnesium, Aluminum-containing preparations: These can also interfere with absorption. Administer at least 30-60 minutes after risedronate. ♦ Proton Pump Inhibitors (PPIs) and H2-blockers: Prolonged use of these acid-suppressing medications may potentially reduce the efficacy of bisphosphonates by affecting gastric pH, though clinical significance with risedronate is debated. Consider delayed-release formulations of risedronate (e.g., Atelvia) which are designed to be less affected by gastric pH. ♦ Aspirin/NSAIDs: Concomitant use with bisphosphonates may increase the risk of upper GI adverse events. Use with caution.

Rivaroxaban (Xarelto)

Purpose/Indication	Rivaroxaban is an oral anticoagulant used to prevent and treat various thromboembolic conditions. It is indicated for the prevention of stroke and systemic embolism in patients with non-valvular atrial fibrillation, for the treatment of deep vein thrombosis (DVT) and pulmonary embolism (PE), and for the prevention of recurrent DVT and PE. It is also used for prophylaxis of DVT and PE in patients undergoing hip or knee replacement surgery.
Method of Action	Rivaroxaban is a highly selective direct factor Xa (FXa) inhibitor. Factor Xa is a crucial enzyme in the coagulation cascade that converts prothrombin to thrombin. By directly and reversibly inhibiting both free and clot-bound FXa, rivaroxaban effectively blocks the formation of thrombin, thereby inhibiting both the intrinsic and extrinsic pathways of the coagulation cascade. This action prevents the formation of blood clots, without requiring a cofactor like antithrombin.
Medication Name & Brand Names	♦ Medication Name: Rivaroxaban ♦ Brand Names: Xarelto, Rivaroxaban (generic)
Pharmaceutical Forms & Appearance	Rivaroxaban is available as oral film-coated tablets. Tablets are typically round, biconvex, and may vary in color and imprint depending on strength (e.g., light yellow, red-brown, yellow). They often have a triangle with the strength embossed on one side.
Dosage & Administration	Dosage varies significantly by indication. For non-valvular atrial fibrillation, doses range from 15 mg or 20 mg once daily with the evening meal. For DVT/PE treatment, an initial higher dose (e.g., 15 mg twice daily for 21 days) is followed by a maintenance dose (e.g., 20 mg once daily). For DVT/PE prophylaxis after hip/knee surgery, it's typically 10 mg once daily. Tablets should be taken with food, especially for doses of 15 mg or 20 mg, as food enhances absorption. Patients unable to swallow whole tablets may crush them and mix with water or applesauce immediately before administration.
Supplied As	Rivaroxaban is supplied as: oral film-coated tablets (e.g., 2.5 mg, 10 mg, 15 mg, 20 mg).
Contraindications	Rivaroxaban is strictly contraindicated in patients with active pathological bleeding (e.g., gastrointestinal bleeding, intracranial hemorrhage). It is also contraindicated in patients with known hypersensitivity to rivaroxaban or any component of the formulation. Not recommended in patients with prosthetic heart valves or severe hepatic disease associated with coagulopathy. Concomitant use of other anticoagulants is generally contraindicated.
Storage & Expiry	Rivaroxaban tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original packaging or a tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	The most significant side effect is bleeding, which can range from minor (e.g., nosebleeds, bruising, gum bleeding) to serious or even fatal (e.g., gastrointestinal bleeding, intracranial hemorrhage). Other common side effects include nausea, abdominal pain, dyspepsia, and elevated liver enzymes. Less common effects include allergic reactions and skin rash.
Warnings & Precautions	♦ BLACK BOX WARNINGS: Premature Discontinuation: Discontinuation of rivaroxaban, in the absence of adequate alternative anticoagulation, increases the risk of thrombotic events. ♦ BLACK BOX WARNINGS: Spinal/Epidural Hematoma: Patients treated with rivaroxaban who are receiving neuraxial anesthesia (epidural/spinal anesthesia) or undergoing spinal puncture are at risk of developing an epidural or spinal hematoma, which can result in long-term or permanent paralysis. Factors increasing risk include traumatic or repeated punctures, concomitant use of drugs affecting hemostasis (e.g., NSAIDs, antiplatelet agents), and history of spinal deformity or surgery. ♦ Bleeding Risk: Increased risk of bleeding, which can be severe and life-threatening. Monitor for signs of bleeding. No routine monitoring of INR is required, but specific coagulation tests (anti-Factor Xa activity) may be used if needed. ♦ Reversal Agent: An antidote (andexanet alfa) is available to reverse the anti-Factor Xa activity of rivaroxaban in situations of life-threatening or uncontrolled bleeding. ♦ Renal Impairment: Dose adjustments are necessary for patients with moderate to severe renal impairment. Avoid in severe renal impairment (CrCl < 15 mL/min) or end-stage renal disease (ESRD). ♦ Hepatic Impairment: Avoid in patients with moderate to severe hepatic impairment or liver disease associated with coagulopathy due to increased bleeding risk. ♦ Prosthetic Heart Valves: Not recommended for use in patients with prosthetic heart valves due to increased risk of thrombotic events. ♦ Acute PE with Hemodynamic Instability: Not recommended for patients with PE who are hemodynamically unstable or who may
Missed Dose Instructions	For doses of 15 mg twice daily: If a dose is missed during the day, the patient may take two 15 mg tablets at the next scheduled time to ensure 30 mg is taken over 24 hours. For doses of 2.5 mg, 10 mg, or 20 mg once daily: If a dose is missed, the patient should take the next dose at the regularly scheduled time. Do not take a double dose to make up for a missed one. Consistency is crucial for maintaining effective anticoagulation.
Overdose Instructions	Overdose of rivaroxaban increases the risk of bleeding. Symptoms may include visible bleeding (e.g., nosebleeds, bruising, blood in urine or stools) or internal bleeding (e.g., severe abdominal pain, signs of stroke from intracranial hemorrhage). Treatment includes discontinuing rivaroxaban and managing bleeding. An antidote, andexanet alfa, is available for reversal of anti-Factor Xa activity in cases of severe, uncontrolled bleeding. Supportive care, including pressure on bleeding sites, surgical intervention, and administration of blood products, may be necessary. Activated charcoal may be considered if ingestion was very recent. Hemodialysis is not expected to be effective. Seek immediate emergency medical help.
Medicine Interactions	♦ Strong CYP3A4 and P-glycoprotein (P-gp) Inhibitors (e.g., ketoconazole, itraconazole, posaconazole, voriconazole, ritonavir, lopinavir/ritonavir, cobicistat): Significantly increase rivaroxaban exposure, leading to a greatly increased bleeding risk. Concomitant use should generally be avoided. ♦ Strong CYP3A4 and P-gp Inducers (e.g., rifampin, phenytoin, carbamazepine, phenobarbital, St. John's Wort): Significantly decrease rivaroxaban exposure, leading to a reduced anticoagulant effect and increased risk of thrombotic events. Avoid concomitant use. ♦ Other Anticoagulants (e.g., warfarin, heparin, other direct oral anticoagulants): Concomitant use is generally contraindicated due to a significantly increased risk of bleeding. ♦ Antiplatelet Agents (e.g., aspirin, clopidogrel, prasugrel, ticagrelor): Concomitant use increases the risk of bleeding. Use with caution; benefits should outweigh risks. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs): Concomitant use increases the risk of bleeding. Use with caution. ♦ SSRIs/SNRIs: Concomitant use may increase the risk of bleeding, particularly GI bleeding.

Rosuvastatin (Crestor)

Purpose/Indication	Rosuvastatin is an HMG-CoA reductase inhibitor, commonly known as a statin, used to lower elevated cholesterol levels and reduce the risk of cardiovascular disease. It is indicated for treating primary hypercholesterolemia (including heterozygous familial hypercholesterolemia), mixed dyslipidemia, homozygous familial hypercholesterolemia, and for slowing the progression of atherosclerosis. It also reduces the risk of major cardiovascular events (myocardial infarction, stroke, arterial revascularization) in patients at increased risk.
Method of Action	Rosuvastatin works by competitively inhibiting 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, an enzyme crucial for the synthesis of cholesterol in the liver. By blocking this rate-limiting step, rosuvastatin reduces the production of cholesterol. This leads to an upregulation of LDL receptors on the surface of liver cells, which increases the uptake and catabolism of LDL (low-density lipoprotein) cholesterol from the bloodstream, thereby lowering total cholesterol, LDL-C, and triglycerides, and increasing HDL-C (high-density lipoprotein cholesterol).
Medication Name & Brand Names	♦ Medication Name: Rosuvastatin Calcium ♦ Brand Names: Crestor, Rosuvastatin (generic)
Pharmaceutical Forms & Appearance	Rosuvastatin is available as oral film-coated tablets. Tablets are typically round, biconvex, and may vary in color and imprint depending on strength (e.g., white, pink, yellow). They often have imprints like "ZD" followed by the strength (e.g., ZD40) or other identifying marks.
Dosage & Administration	Dosage is highly individualized and depends on the patient's cholesterol levels, cardiovascular risk, and response to therapy. Initial adult doses range from 5 mg to 20 mg orally once daily, typically in the evening, as cholesterol synthesis is highest at night. Doses can be adjusted after 2-4 weeks, up to a maximum of 40 mg once daily. It can be taken with or without food. Continue a cholesterol-lowering diet throughout treatment.
Supplied As	Rosuvastatin is supplied as: oral film-coated tablets (e.g., 5 mg, 10 mg, 20 mg, 40 mg).
Contraindications	Rosuvastatin is contraindicated in patients with known hypersensitivity to rosuvastatin or any component of the formulation. It is also contraindicated in patients with active liver disease, including unexplained persistent elevations of serum transaminases. Concomitant use with cyclosporine is contraindicated. It is contraindicated in pregnancy and lactation due to the potential for fetal harm.
Storage & Expiry	Rosuvastatin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include headache, muscle pain (myalgia), abdominal pain, nausea, asthenia (weakness), and constipation. More serious but rare side effects include myopathy (muscle disease) and rhabdomyolysis (severe muscle breakdown, potentially leading to kidney failure), liver dysfunction (elevated liver enzymes), and new-onset diabetes mellitus. Allergic reactions and peripheral neuropathy can also occur.
Warnings & Precautions	♦ Myopathy/Rhabdomyolysis: Statins, including rosuvastatin, can cause myopathy and rhabdomyolysis, which can be severe and lead to acute renal failure. Risk factors include higher doses (especially 40 mg), advanced age, renal impairment, hypothyroidism, and concomitant use of certain interacting drugs. Advise patients to report unexplained muscle pain, tenderness, or weakness, especially if accompanied by malaise or fever. Creatine kinase (CK) levels should be monitored if muscle symptoms occur. Discontinue if CK levels are markedly elevated or rhabdomyolysis is diagnosed. ♦ Liver Dysfunction: Can cause elevations in serum transaminases. Liver function tests (LFTs) should be performed before initiating therapy and as clinically indicated thereafter. Discontinue if persistent elevations occur. Use with caution in patients who consume substantial quantities of alcohol or have a history of liver disease. ♦ Diabetes Mellitus: Statins may increase HbA1c and fasting serum glucose levels. Monitor blood glucose in patients at risk for diabetes. ♦ Renal Impairment: Increased risk of myopathy/rhabdomyolysis, particularly at higher doses. Dose adjustments are necessary; avoid 40 mg dose in patients with moderate to severe renal impairment. ♦ Hypothyroidism: Must be adequately treated before initiating rosuvastatin, as untreated hypothyroidism increases the risk of myopathy. ♦ Asian Patients: Increased systemic exposure to rosuvastatin has been observed in Asian individuals. A lower starting dose (e.g., 5 mg) should be considered, and the 40 mg dose is generally not recommended unless the patient has not achieved desired lipid levels with lower doses. ♦ Pregnancy & Lactation: Contraindicated in pregnancy and lactation due to potential harm to the fetus/infant. ♦ Neurocognitive Effects: Rare reports of cognitive impairment (e.g., memory loss, confusion) have been associated with statin use. Symptoms are generally reversible upon discontinuation.
Missed Dose Instructions	If a dose of Rosuvastatin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for effective cholesterol management and cardiovascular risk reduction.
Overdose Instructions	There is no specific treatment for rosuvastatin overdose. Overdose symptoms are generally an exaggeration of known side effects, particularly muscle pain, gastrointestinal upset, and liver enzyme elevations. In severe cases, rhabdomyolysis with acute renal failure could occur. Treatment is supportive and symptomatic. Hemodialysis is not expected to be beneficial due to extensive protein binding. Monitor liver function and CK levels. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Cyclosporine: Concomitant use with rosuvastatin is contraindicated due to significantly increased rosuvastatin exposure and greatly increased risk of myopathy/rhabdomyolysis. ♦ Gemfibrozil & other Fibrates (e.g., fenofibrate): Increased risk of myopathy/rhabdomyolysis. Avoid concomitant use with gemfibrozil. Use with caution and monitor with other fibrates. ♦ Niacin (Lipid-lowering doses, ≥1 g/day): Increased risk of muscle adverse events (myopathy/rhabdomyolysis). Use with caution. ♦ Colchicine: Cases of myopathy/rhabdomyolysis have been reported with co-administration. Use with caution. ♦ Strong CYP3A4 Inhibitors (e.g., clarithromycin, erythromycin, azole antifungals like itraconazole, protease inhibitors like ritonavir/lopinavir): Rosuvastatin is a substrate of CYP2C9 and CYP2C19, but also marginally CYP3A4. Strong inhibitors of CYP3A4 can increase rosuvastatin levels. Refer to specific drug-drug interaction guidelines, as some combinations are contraindicated or require dose adjustment. ♦ Coumarin Anticoagulants (e.g., warfarin): Rosuvastatin can potentiate the anticoagulant effect of warfarin, increasing bleeding risk. Monitor INR closely, especially when initiating or discontinuing rosuvastatin. ♦ Antacids (containing aluminum or magnesium hydroxide): Can decrease the plasma concentration of rosuvastatin. Administer antacids at least 2 hours after rosuvastatin. ♦ Ezetimibe: Concomitant use may increase the risk of muscle adverse events. ♦ Regorafenib: Significantly increases rosuvastatin exposure, increasing risk of myopathy. Avoid concomitant use.

Sertraline (Zoloft)

Purpose/Indication	Sertraline is a selective serotonin reuptake inhibitor (SSRI) antidepressant used to treat a range of mental health conditions. Its primary indications include major depressive disorder (MDD), obsessive-compulsive disorder (OCD), panic disorder, post-traumatic stress disorder (PTSD), social anxiety disorder (social phobia), and premenstrual dysphoric disorder (PMDD). It helps to improve mood, reduce anxiety, and alleviate symptoms associated with these conditions.

Method of Action	Sertraline works by selectively inhibiting the reuptake of serotonin (5-HT) into presynaptic neurons in the central nervous system. By blocking the reabsorption of serotonin, it increases the concentration of serotonin in the synaptic cleft, leading to enhanced serotonergic neurotransmission. This prolonged availability of serotonin is thought to be responsible for its antidepressant, anxiolytic, and anti-obsessive effects, although the full therapeutic effects typically take several weeks to manifest.
Medication Name & Brand Names	♦ Medication Name: Sertraline Hydrochloride ♦ Brand Names: Zoloft, Lustral (regional), Sertraline (generic)
Pharmaceutical Forms & Appearance	Sertraline is available as oral tablets and oral concentrated solution. Tablets are typically film-coated, often oval or capsule-shaped, and may vary in color and imprint depending on strength (e.g., white, blue, green). The oral concentrated solution is a clear, colorless liquid.
Dosage & Administration	Dosage is highly individualized and titrated gradually to minimize side effects, starting with lower doses. For MDD and OCD, typical initial adult oral doses are 25 mg or 50 mg once daily, usually in the morning or evening. Doses can be gradually increased, generally up to a maximum of 200 mg daily. For panic disorder, PTSD, and social anxiety disorder, a lower initial dose (e.g., 25 mg once daily) is often used due to increased sensitivity to activating side effects. The oral concentrated solution must be diluted before use. Take with or without food. Avoid abrupt discontinuation.
Supplied As	Sertraline is supplied as: oral tablets (e.g., 25 mg, 50 mg, 100 mg) and oral concentrated solution (e.g., 20 mg/mL).
Contraindications	Sertraline is contraindicated in patients with known hypersensitivity to sertraline or any component of the formulation. It is strictly contraindicated in patients taking or within 14 days of discontinuing a monoamine oxidase inhibitor (MAOI) due to the risk of serotonin syndrome. Concomitant use with pimozide is also contraindicated. Disulfiram is contraindicated with sertraline oral solution due to its alcohol content.
Storage & Expiry	Sertraline tablets and oral concentrated solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging. Once the oral solution is diluted, it typically needs to be used within a short period (e.g., 24 hours).
Side Effects	Common side effects include nausea, diarrhea, dry mouth, insomnia, somnolence (drowsiness), dizziness, tremor, sweating, and sexual dysfunction (e.g., ejaculatory delay, decreased libido). More serious but less common side effects include serotonin syndrome, suicidal thoughts or behavior, activation of mania/hypomania, hyponatremia, and abnormal bleeding.
Warnings & Precautions	♦ BLACK BOX WARNING: Suicidality: Antidepressants increase the risk of suicidal thoughts and behavior in children, adolescents, and young adults (up to 24 years of age) with major depressive disorder and other psychiatric disorders. Closely monitor patients for clinical worsening and suicidality, especially at the beginning of treatment or during dose changes. ♦ Serotonin Syndrome: Potentially life-threatening condition that can occur with SSRIs, particularly with concomitant use of other serotonergic drugs (e.g., MAOIs, triptans, fentanyl, lithium, tramadol, St. John's Wort). Symptoms include mental status changes (agitation, hallucinations, coma), autonomic instability (tachycardia, labile blood pressure, hyperthermia), neuromuscular aberrations (hyperreflexia, incoordination), and GI symptoms. Discontinue immediately if suspected. ♦ Activation of Mania/Hypomania: Can precipitate manic or hypomanic episodes in patients with bipolar disorder. Screen for bipolar disorder before initiating therapy. ♦ Hyponatremia: Clinically significant hyponatremia (low sodium) can occur, especially in elderly patients, those on diuretics, or volume-depleted patients. ♦ Abnormal Bleeding: SSRIs may increase the risk of bleeding events, especially gastrointestinal bleeding, in patients taking antiplatelet agents, anticoagulants, or NSAIDs. ♦ Seizures: Use with caution in patients with a history of seizure disorder. ♦ Sexual Dysfunction: Common side effect, including decreased libido, delayed ejaculation, and anorgasmia. ♦ Discontinuation Syndrome: Abrupt discontinuation can lead to withdrawal symptoms (e.g., dizziness, sensory disturbances like paresthesias, anxiety, agitation, tremor, nausea, sweating). Taper dose gradually over weeks to months. ♦ Glaucoma: May cause mydriasis (pupil dilation), potentially triggering an acute angle-closure attack in predisposed individuals. Use with caution. ♦ Renal/Hepatic Impairment: Use with caution and consider dose adjustment in patients with significant hepatic or renal impairment. ♦ Oral Solution: Contains alcohol; avoid in patients taking disulfiram or who are sensitive to alcohol.
Missed Dose Instructions	If a dose of Sertraline is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining therapeutic effect and preventing withdrawal symptoms.
Overdose Instructions	Overdose symptoms are typically mild to moderate and include somnolence, vomiting, tachycardia, nausea, dizziness, agitation, tremor, and mydriasis. More serious effects can occur, especially with co-ingestion of other drugs or alcohol, including altered mental status, seizures, and prolonged QT interval leading to arrhythmias. There is no specific antidote. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Monitor cardiac and vital signs. Seek immediate emergency medical help.
Medicine Interactions	♦ Monoamine Oxidase Inhibitors (MAOIs, e.g., selegiline, phenelzine, tranylcypromine, linezolid, methylene blue): Contraindicated. Concomitant use or use within 14 days of stopping an MAOI can lead to life-threatening serotonin syndrome. ♦ Pimozide: Contraindicated due to increased pimozide levels and risk of QT prolongation and arrhythmias. ♦ Other Serotonergic Drugs (e.g., triptans, tramadol, fentanyl, lithium, St. John's Wort, dextromethorphan, buspirone, other SSRIs/SNRIs, TCAs): Increased risk of serotonin syndrome. Use with caution, monitor symptoms. ♦ Warfarin & other Anticoagulants: Increased risk of bleeding due to sertraline's effect on platelet aggregation. Monitor INR closely. ♦ NSAIDs & Antiplatelet Agents (e.g., aspirin, clopidogrel): Increased risk of gastrointestinal bleeding. ♦ Diuretics: Increased risk of hyponatremia. ♦ CYP2D6 Substrates (e.g., tricyclic antidepressants like imipramine, desipramine; antipsychotics like risperidone; antiarrhythmics like propafenone, flecainide): Sertraline is a moderate inhibitor of CYP2D6; may increase levels of drugs metabolized by CYP2D6. Monitor and adjust doses. ♦ Cimetidine: May increase sertraline levels due to inhibition of metabolism. ♦ Digoxin & Atenolol: No significant interaction. ♦ Oral Solution: Contains alcohol; avoid with disulfiram.

Sildenafil (Viagra)

Purpose/Indication	Sildenafil is a phosphodiesterase-5 (PDE5) inhibitor primarily used for the treatment of erectile dysfunction (ED) in men. It helps to achieve and maintain an erection sufficient for sexual activity. It is also indicated for the treatment of pulmonary arterial hypertension (PAH) to improve exercise capacity and delay clinical worsening, marketed under a different brand name and typically at a lower dose.
Method of Action	Sildenafil works by inhibiting phosphodiesterase type 5 (PDE5), an enzyme that is abundant in the corpus cavernosum of the penis and in the pulmonary vasculature. In erectile dysfunction, sexual stimulation leads to the local release of nitric oxide (NO), which activates guanylate cyclase, increasing levels of cyclic guanosine monophosphate (cGMP). cGMP causes smooth muscle relaxation, leading to increased blood flow into the penis. Sildenafil enhances this effect by preventing the breakdown of cGMP by PDE5, thus facilitating an erection. In PAH, it similarly causes vasodilation in the pulmonary arteries, reducing pulmonary arterial pressure.
Medication Name & Brand Names	♦ Medication Name: Sildenafil Citrate ♦ Brand Names: Viagra (for ED), Revatio (for PAH), Sildenafil (generic)

Pharmaceutical Forms & Appearance	Sildenafil is available as oral tablets, oral suspension, and solution for intravenous (IV) injection. Viagra tablets are typically blue, film-coated, diamond-shaped, and imprinted with "Pfizer" on one side and "VGR" followed by the strength (e.g., VGR 50) on the other. Revatio tablets are white, round, and film-coated, often with "REV" and strength imprinted. The oral suspension is a white to off-white suspension after reconstitution.
Dosage & Administration	Dosage varies significantly by indication. For erectile dysfunction (ED), the typical adult oral dose is 50 mg taken approximately 30 minutes to 4 hours before sexual activity (usually 1 hour before). Doses can range from 25 mg to 100 mg per day. It should not be taken more than once daily. For pulmonary arterial hypertension (PAH), the typical adult oral dose is 20 mg three times daily, taken approximately 4-6 hours apart. It can be taken with or without food.
Supplied As	Sildenafil is supplied as: oral tablets (e.g., 20 mg, 25 mg, 50 mg, 100 mg), powder for oral suspension (e.g., 10 mg/mL after reconstitution), and solution for intravenous injection (e.g., 10 mg/12.5 mL).
Contraindications	Sildenafil is strictly contraindicated in patients taking nitrates (e.g., nitroglycerin, isosorbide dinitrate) in any form, as this can lead to a dangerous and potentially fatal drop in blood pressure. It is also contraindicated in patients with known hypersensitivity to sildenafil or any component of the formulation. Concomitant use with guanylate cyclase stimulators (e.g., riociguat) is also contraindicated.
Storage & Expiry	Sildenafil tablets and powder for oral suspension (unreconstituted) should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Once reconstituted, the oral suspension should be stored refrigerated and used within a specific timeframe (e.g., 60 days). Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, flushing (redness of face), dyspepsia (indigestion), nasal congestion, visual disturbances (e.g., blurred vision, bluish tinge to vision), and dizziness. More serious but rare side effects include priapism (prolonged erection lasting >4 hours), sudden decrease or loss of vision (NAION), sudden hearing loss, and cardiovascular events (MI, stroke, arrhythmias) in patients with pre-existing heart conditions.
Warnings & Precautions	♦ Nitrate Co-administration: STRICTLY CONTRAINDICATED with nitrates in any form (oral, sublingual, transdermal, spray, IV) due to potentiation of hypotensive effects, leading to a profound and potentially fatal drop in blood pressure. ♦ Alpha-Blockers: Use with caution, as concomitant use can lead to symptomatic hypotension. Start sildenafil at the lowest dose and ensure patient is stable on alpha-blocker therapy. ♦ Cardiovascular Risk: Patients should have their cardiovascular status assessed before initiating sildenafil for ED, as there is a degree of cardiac risk associated with sexual activity. Use with caution in patients with pre-existing cardiovascular disease. ♦ Priapism: Rare but serious adverse effect; prolonged erection (more than 4 hours) or painful erection (more than 6 hours) requires immediate medical attention to avoid permanent damage. ♦ Non-Arteritic Anterior Ischemic Optic Neuropathy (NAION): Rare but serious eye condition leading to sudden decrease or loss of vision. Risk factors include underlying cardiovascular disease, diabetes, hypertension, and smoking. Advise patients to seek immediate medical attention if sudden vision loss occurs. ♦ Sudden Hearing Loss: Rare reports of sudden decrease or loss of hearing, sometimes with tinnitus and dizziness. Seek immediate medical attention. ♦ Renal/Hepatic Impairment: Use with caution and consider dose adjustment in patients with severe renal or hepatic impairment. ♦ Concomitant use with other PDE5 Inhibitors or ED treatments: Not recommended. ♦ Bleeding Disorders/Active Peptic Ulceration: Use with caution due to antiplatelet effects. ♦ Anatomical Deformation of the Penis: Use with caution in patients with Peyronie's disease or other anatomical deformities, or conditions predisposing to priapism (e.g., sickle cell anemia, multiple myeloma, leukemia).
Missed Dose Instructions	For erectile dysfunction: Sildenafil is taken on an as-needed basis before sexual activity. If a planned dose is missed, simply take it when ready for sexual activity, ensuring not to exceed one dose per 24 hours. For pulmonary arterial hypertension (PAH): If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent dosing is important for PAH management.
Overdose Instructions	Overdose symptoms are typically an exaggeration of common side effects, including severe headache, flushing, dizziness, dyspepsia, and nasal congestion. Hypotension may be more pronounced. There is no specific antidote for sildenafil overdose. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Monitor blood pressure and cardiac status. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Nitrates (e.g., nitroglycerin, isosorbide dinitrate, amyl nitrite/poppers): STRICTLY CONTRAINDICATED due to dangerous potentiation of hypotensive effects. ♦ Guanylate Cyclase Stimulators (e.g., riociguat): Contraindicated due to risk of severe hypotension. ♦ Alpha-Blockers (e.g., doxazosin, tamsulosin, alfuzosin): Concomitant use can cause symptomatic hypotension. Initiate sildenafil at the lowest dose and only in hemodynamically stable patients on alpha-blocker. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, erythromycin, clarithromycin, cimetidine, ritonavir, other protease inhibitors, grapefruit juice): Significantly increase sildenafil plasma levels, leading to increased side effects. Lower starting doses of sildenafil may be required. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, phenobarbital, St. John's Wort): Can decrease sildenafil plasma levels, reducing efficacy. ♦ Other PDE5 Inhibitors (e.g., tadalafil, vardenafil, avanafil): Concomitant use is generally not recommended due to increased risk of adverse effects. ♦ Alcohol: Excessive alcohol consumption can impair erectile function and potentially increase the risk of orthostatic hypotension with sildenafil.

Silver Sulfadiazine (Silvadene)

Purpose/Indication	Silver sulfadiazine is a topical antimicrobial agent primarily used for the prevention and treatment of wound infections in patients with second- and third-degree burns. Its purpose is to reduce the bacterial load in burn wounds, thereby preventing sepsis and facilitating wound healing. It is effective against a broad spectrum of Gram-positive and Gram-negative bacteria, as well as some fungi, commonly found in burn wounds.
Method of Action	Silver sulfadiazine exerts its antimicrobial action through a dual mechanism involving both the silver ion (Ag^+) and the sulfadiazine component. The silver component is released slowly from the cream and acts on the bacterial cell wall and membrane, disrupting its integrity, impairing cellular respiration, and interfering with bacterial DNA and RNA. The sulfadiazine component, a sulfonamide antibiotic, inhibits bacterial dihydrofolate reductase, an enzyme essential for bacterial folic acid synthesis, thereby inhibiting bacterial growth. This dual action provides broad-spectrum coverage and helps prevent resistance.
Medication Name & Brand Names	♦ Medication Name: Silver Sulfadiazine ♦ Brand Names: Silvadene, SSD Cream, Thermazene, Silver Sulfadiazine (generic)
Pharmaceutical Forms & Appearance	Silver sulfadiazine is available as a topical cream. It is typically a white, smooth, hydrophilic cream.
Dosage & Administration	Silver sulfadiazine cream is typically applied topically to the affected areas once or twice daily, to a thickness of approximately 1-2 mm. The burn wound should be cleaned and debrided prior to application. The cream should be applied with a sterile gloved hand. The burned area should be continuously covered with cream; if removed by activity, reapply. Dressings are generally not required but may be used. Treatment is continued until satisfactory healing occurs or the burn site is ready for grafting.

Supplied As	Silver sulfadiazine is supplied as: topical cream (e.g., 1% silver sulfadiazine, in various tube or jar sizes like 20 g, 50 g, 400 g).
Contraindications	Silver sulfadiazine is contraindicated in patients with known hypersensitivity to silver sulfadiazine, other sulfonamides, or any component of the formulation. It is also contraindicated in premature and full-term infants less than 2 months of age due to the risk of kernicterus (a form of brain damage). Use is generally not recommended in pregnant women near term, or breastfeeding mothers of infants less than 2 months old, due to the risk of kernicterus in the infant.
Storage & Expiry	Silver sulfadiazine cream should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and excessive heat. Keep the tube or jar tightly closed. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally local and include transient pain or burning sensation upon application, itching, and rash. Discoloration of the skin (argyria, a permanent grayish-blue discoloration) can occur with prolonged or extensive use. Systemic absorption can lead to sulfonamide-related systemic side effects, though less common with topical use, such as leukopenia (low white blood cell count), allergic reactions (e.g., rash, fever), methemoglobinemia, and rarely, renal dysfunction or hepatic dysfunction.
Warnings & Precautions	♦ Systemic Absorption & Sulfonamide-Related Effects: Although topical, significant systemic absorption of sulfadiazine can occur, especially with extensive burn areas or prolonged use. This can lead to sulfonamide-related systemic adverse reactions, including: ♦ Hematologic Reactions: Leukopenia (neutropenia) is the most common, usually self-limiting. Agranulocytosis, aplastic anemia, and hemolytic anemia (especially in G6PD deficiency) can occur. Monitor blood counts, particularly in large burns or prolonged use. ♦ Renal Impairment: Use with caution in patients with renal impairment, as sulfadiazine is primarily excreted renally. Crystalluria or renal tubular necrosis may occur. ♦ Hepatic Impairment: Use with caution in patients with hepatic impairment. ♦ Hypersensitivity Reactions: Allergic reactions, including severe dermatologic reactions (e.g., Stevens-Johnson Syndrome, toxic epidermal necrolysis), can occur. Discontinue at first sign of rash. ♦ G6PD Deficiency: Use with extreme caution in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency due to the risk of hemolytic anemia. ♦ Kernicterus: Contraindicated in infants less than 2 months of age due to the risk of kernicterus from displacement of bilirubin. ♦ Porphyria: Sulfonamides may precipitate an acute attack of porphyria. ♦ Discoloration (Argyria): Prolonged or extensive use may lead to a permanent grayish-blue discoloration of the skin due to silver deposition. ♦ Not for Eye Use: Do not apply to the eyes.
Missed Dose Instructions	Silver sulfadiazine is typically applied on a continuous basis for burn wounds. If a scheduled application is missed, apply it as soon as remembered. Then, resume the regular application schedule (e.g., once or twice daily). It is important to maintain continuous coverage of the burn wound to prevent bacterial proliferation. Do not apply a double amount to make up for a missed dose.
Overdose Instructions	Overdose with topical silver sulfadiazine is primarily associated with excessive systemic absorption of the sulfadiazine component, particularly with large burn areas or prolonged use. Symptoms of systemic toxicity may include nausea, vomiting, diarrhea, crystalluria, renal dysfunction, hepatic dysfunction, and hematologic abnormalities (e.g., leukopenia, thrombocytopenia). Permanent skin discoloration (argyria) can result from prolonged, extensive use. Treatment is supportive and symptomatic. Discontinue the cream. Maintain hydration to prevent crystalluria. Monitor renal function, liver function, and blood counts. Forced diuresis may be considered. There is no specific antidote. Seek medical attention if systemic signs of overdose occur.
Medicine Interactions	♦ Enzymatic Debriding Agents (e.g., collagenase, papain-urea): Silver can inactivate some enzymatic debriding agents. Avoid concomitant use, or ensure adequate removal of silver sulfadiazine before applying enzymatic debridement. ♦ Cimetidine: Concomitant systemic cimetidine may increase the risk of leukopenia/neutropenia when used with silver sulfadiazine. Monitor white blood cell count. ♦ Systemic Sulfonamides: Additive risk of sulfonamide-related systemic adverse effects (e.g., hematologic, renal, allergic reactions) if significant systemic absorption occurs from silver sulfadiazine. ♦ Oral Hypoglycemics (sulfonylureas) and Anticoagulants (warfarin): Theoretically, absorbed sulfadiazine could potentiate the effects of these agents, similar to systemic sulfonamides. Monitor blood glucose and INR if extensive application is used in patients on these medications.

Simvastatin (Zocor)

Purpose/Indication	Simvastatin is an HMG-CoA reductase inhibitor, commonly known as a statin, used to lower elevated cholesterol levels and reduce the risk of cardiovascular disease. It is indicated for treating primary hypercholesterolemia, mixed dyslipidemia, homozygous familial hypercholesterolemia (as an adjunct to other lipid-lowering treatments), and for slowing the progression of atherosclerosis. It also significantly reduces the risk of major cardiovascular events (coronary death, nonfatal myocardial infarction, stroke, revascularization procedures) in patients with coronary heart disease or at high risk for it.
Method of Action	Simvastatin is a prodrug that is converted in the liver to its active beta-hydroxyacid form. This active metabolite competitively inhibits 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, an enzyme essential for cholesterol synthesis in the liver. By blocking this rate-limiting step, simvastatin reduces the production of cholesterol. This leads to an upregulation of LDL receptors on the surface of liver cells, which increases the uptake and catabolism of LDL (low-density lipoprotein) cholesterol from the bloodstream, thereby lowering total cholesterol, LDL-C, and triglycerides, and increasing HDL-C (high-density lipoprotein cholesterol).
Medication Name & Brand Names	♦ Medication Name: Simvastatin ♦ Brand Names: Zocor, Lipex (regional), Simvastatin (generic)
Pharmaceutical Forms & Appearance	Simvastatin is available as oral film-coated tablets. Tablets are typically round or oval, film-coated, and may vary in color and imprint depending on strength (e.g., peach, light brown, tan). They often have specific imprints indicating strength and/or a company logo.
Dosage & Administration	Dosage is highly individualized and depends on the patient's cholesterol levels, cardiovascular risk, and response to therapy. Initial adult doses typically range from 10 mg to 20 mg orally once daily, usually in the evening, as cholesterol synthesis is highest at night. Doses can be adjusted after 4 weeks, up to a maximum of 40 mg once daily. For certain high-risk patients, the 40 mg dose may be used. The 80 mg dose is generally reserved for patients who have been on 80 mg for a year or more without myopathy, or where benefits outweigh risks. Take with or without food. Continue a cholesterol-lowering diet throughout treatment.
Supplied As	Simvastatin is supplied as: oral film-coated tablets (e.g., 5 mg, 10 mg, 20 mg, 40 mg, 80 mg).
Contraindications	Simvastatin is contraindicated in patients with known hypersensitivity to simvastatin or any component of the formulation. It is strictly contraindicated in patients with active liver disease, including unexplained persistent elevations of serum transaminases. It is also contraindicated in pregnancy and lactation due to the potential for fetal harm. Concomitant use with strong CYP3A4 inhibitors (e.g., azole antifungals, macrolide antibiotics, HIV protease inhibitors) and grapefruit juice is contraindicated due to increased risk of myopathy.
Storage & Expiry	Simvastatin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.

Side Effects	Common side effects are generally mild and include headache, muscle pain (myalgia), abdominal pain, constipation, and nausea. More serious but rare side effects include myopathy (muscle disease) and rhabdomyolysis (severe muscle breakdown, potentially leading to kidney failure), liver dysfunction (elevated liver enzymes), and new-onset diabetes mellitus. Allergic reactions, peripheral neuropathy, and memory impairment can also occur.
Warnings & Precautions	♦ BLACK BOX WARNING (in some regions/products): Myopathy/Rhabdomyolysis: Statins, including simvastatin, can cause myopathy and rhabdomyolysis, which can be severe and lead to acute renal failure. Risk factors include higher doses (especially 80 mg), advanced age, renal impairment, hypothyroidism, and concomitant use of certain interacting drugs (see interactions). Advise patients to report unexplained muscle pain, tenderness, or weakness, especially if accompanied by malaise or fever. Creatine kinase (CK) levels should be monitored if muscle symptoms occur. Discontinue if CK levels are markedly elevated or rhabdomyolysis is diagnosed. ♦ Liver Dysfunction: Can cause elevations in serum transaminases. Liver function tests (LFTs) should be performed before initiating therapy and as clinically indicated thereafter. Discontinue if persistent elevations occur. Use with caution in patients who consume substantial quantities of alcohol or have a history of liver disease. ♦ Diabetes Mellitus: Statins may increase HbA1c and fasting serum glucose levels. Monitor blood glucose in patients at risk for diabetes. ♦ Renal Impairment: Use with caution, as accumulation may occur. The 80 mg dose is generally not recommended in patients with renal impairment. ♦ Hypothyroidism: Must be adequately treated before initiating simvastatin, as untreated hypothyroidism increases the risk of myopathy. ♦ Pregnancy & Lactation: Contraindicated in pregnancy and lactation due to potential harm to the fetus/infant. ♦ Neurocognitive Effects: Rare reports of cognitive impairment (e.g., memory loss, confusion) have been associated with statin use. Symptoms are generally reversible upon discontinuation. ♦ Interactions with strong CYP3A4 inhibitors (e.g., grapefruit juice, certain antibiotics/antifungals/HIV drugs): Concomitant use is contraindicated due to a significantly increased risk of myopathy/rhabdomyolysis.
Missed Dose Instructions	If a dose of Simvastatin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for effective cholesterol management and cardiovascular risk reduction.
Overdose Instructions	There is no specific treatment for simvastatin overdose. Overdose symptoms are generally an exaggeration of known side effects, particularly muscle pain, gastrointestinal upset, and liver enzyme elevations. In severe cases, rhabdomyolysis with acute renal failure could occur. Treatment is supportive and symptomatic. Hemodialysis is not expected to be beneficial due to extensive protein binding. Monitor liver function and CK levels. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Strong CYP3A4 inhibitors (e.g., itraconazole, ketoconazole, posaconazole, voriconazole, erythromycin, clarithromycin, telithromycin, HIV protease inhibitors like nelfinavir, ritonavir, boceprevir, telaprevir, cobicistat-containing products): STRICTLY CONTRAINDICATED due to significantly increased simvastatin exposure and greatly increased risk of myopathy/rhabdomyolysis. ♦ Gemfibrozil & other Fibrates (e.g., fenofibrate): Increased risk of myopathy/rhabdomyolysis. Avoid concomitant use with gemfibrozil. Use with caution and monitor with other fibrates. ♦ Niacin (Lipid-lowering doses, ≥1 g/day): Increased risk of muscle adverse events (myopathy/rhabdomyolysis). Avoid doses of simvastatin >10 mg daily with lipid-modifying doses of niacin. ♦ Colchicine: Cases of myopathy/rhabdomyolysis have been reported with co-administration. Use with caution. ♦ Amiodarone, Amlodipine, Ranolazine, Diltiazem, Verapamil: These drugs can increase simvastatin exposure, increasing the risk of myopathy. Dose limitations for simvastatin may apply (e.g., not exceeding 20 mg or 40 mg daily with these drugs). Consult specific guidelines. ♦ Grapefruit Juice: Contraindicated with simvastatin, as it is a strong CYP3A4 inhibitor and significantly increases simvastatin exposure, raising the risk of myopathy/rhabdomyolysis. ♦ Coumarin Anticoagulants (e.g., warfarin): Simvastatin can potentiate the anticoagulant effect of warfarin, increasing bleeding risk. Monitor INR closely, especially when initiating or discontinuing simvastatin. ♦ Cyclosporine: Concomitant use greatly increases simvastatin exposure and risk of myopathy/rhabdomyolysis. Avoid simvastatin with cyclosporine. ♦ Daptomycin: Cases of myopathy/rhabdomyolysis

Sitagliptin (Januvia)

Purpose/Indication	Sitagliptin is an oral antihyperglycemic agent from the dipeptidyl peptidase-4 (DPP-4) inhibitor class, used to improve glycemic control in adults with type 2 diabetes mellitus. It is used as an adjunct to diet and exercise, either as monotherapy or in combination with other antidiabetic medications (e.g., metformin, sulfonylureas, thiazolidinediones, insulin) when those agents alone do not provide adequate blood glucose control.
Method of Action	Sitagliptin works by selectively inhibiting the enzyme dipeptidyl peptidase-4 (DPP-4). DPP-4 is responsible for the rapid degradation of incretin hormones, primarily glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP). By inhibiting DPP-4, sitagliptin increases the levels of active incretin hormones in the body. These elevated incretin levels enhance glucose-dependent insulin release from pancreatic beta cells and decrease glucagon secretion from pancreatic alpha cells, especially during hyperglycemia, leading to improved blood glucose control.
Medication Name & Brand Names	♦ Medication Name: Sitagliptin ♦ Brand Names: Januvia, Tesavel (regional), Sitagliptin (generic) ♦ Combination Products: Janumet (sitagliptin/metformin), Janumet XR (sitagliptin/metformin extended-release), Eucreas (sitagliptin/vildagliptin - regional), Combinational products (e.g., with pioglitazone or dapagliflozin - regional)
Pharmaceutical Forms & Appearance	Sitagliptin is available as oral film-coated tablets. Tablets are typically round, film-coated, and may vary in color depending on the strength, with specific imprints indicating the dose or manufacturer (e.g., 100 mg tablets are typically beige-orange, 50 mg light beige, 25 mg light pink).
Dosage & Administration	The typical adult oral dosage for type 2 diabetes mellitus is 100 mg once daily. It can be taken with or without food. For patients with moderate or severe renal impairment, or end-stage renal disease (ESRD) requiring hemodialysis or peritoneal dialysis, the dose must be adjusted (e.g., 50 mg daily for moderate impairment, 25 mg daily for severe impairment/ESRD).
Supplied As	Sitagliptin is supplied as: oral film-coated tablets (e.g., 25 mg, 50 mg, 100 mg).
Contraindications	Sitagliptin is contraindicated in patients with known hypersensitivity to sitagliptin or any component of the formulation. It should not be used in patients with type 1 diabetes mellitus or for the treatment of diabetic ketoacidosis.
Storage & Expiry	Sitagliptin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and include upper respiratory tract infection, nasopharyngitis, headache, and rarely, hypoglycemia (especially when used with sulfonylureas or insulin). More serious but rare side effects include pancreatitis (sometimes fatal), severe hypersensitivity reactions (anaphylaxis, angioedema, Stevens-Johnson Syndrome), bullous pemphigoid, and joint pain.

Warnings & Precautions	♦ Pancreatitis: Postmarketing reports of acute pancreatitis, including fatal and non-fatal hemorrhagic or necrotizing pancreatitis. If pancreatitis is suspected (e.g., persistent severe abdominal pain, radiating to the back, with or without vomiting), discontinue sitagliptin and other potentially causative agents. ♦ Hypersensitivity Reactions: Serious hypersensitivity reactions, including anaphylaxis, angioedema, and exfoliative skin conditions (e.g., Stevens-Johnson Syndrome), have been reported. If such reactions occur, discontinue sitagliptin and initiate appropriate treatment. ♦ Joint Pain (Arthralgia): Severe and disabling arthralgia has been reported. Consider sitagliptin as a possible cause and discontinue if appropriate. ♦ Bullous Pemphigoid: Postmarketing cases of bullous pemphigoid requiring hospitalization have been reported. If bullous pemphigoid is suspected, discontinue sitagliptin. ♦ Renal Impairment: Dose adjustments are necessary for patients with moderate to severe renal impairment and end-stage renal disease. Renal function should be assessed prior to initiation and periodically thereafter. ♦ Heart Failure: Some post-marketing reports suggest an increased risk of heart failure hospitalization with other DPP-4 inhibitors in certain patient populations; however, sitagliptin's cardiovascular safety data has generally been favorable. Use with caution in patients with a history of heart failure. ♦ Hypoglycemia: When used in combination with a sulfonylurea or insulin, the risk of hypoglycemia is increased. A lower dose of the sulfonylurea or insulin may be required. ♦ Type 1 Diabetes/Diabetic Ketoacidosis: Not effective in these conditions; do not use.
Missed Dose Instructions	If a dose of Sitagliptin is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for maintaining glycemic control.
Overdose Instructions	In clinical trials, single doses of up to 800 mg and multiple doses of up to 600 mg/day for 10 days were well-tolerated. The most common adverse event in overdose was mild gastrointestinal discomfort. There is no specific antidote for sitagliptin overdose. Treatment is supportive and symptomatic. Sitagliptin is modestly dialyzable (approximately 13.5% removed over 3-4 hours of dialysis). Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Digoxin: Sitagliptin can cause a slight increase in digoxin levels, but this is generally not considered clinically significant and dose adjustment of digoxin is usually not required. However, monitor digoxin levels if co-administered. ♦ Cyclosporine: Concomitant use with cyclosporine (a potent P-glycoprotein inhibitor) slightly increases sitagliptin exposure, but this is not considered clinically significant and no dose adjustment for sitagliptin is needed. ♦ Metformin, Sulfonylureas, Thiazolidinediones, Insulin: Sitagliptin is often used in combination with these agents, and while it generally does not cause hypoglycemia as monotherapy, the risk of hypoglycemia increases when combined with sulfonylureas or insulin. Dose adjustments of the sulfonylurea or insulin may be necessary. ♦ Other Antidiabetic Agents: No significant pharmacokinetic interactions with most other commonly used antidiabetic medications. ♦ No significant interaction with strong CYP3A4 inhibitors or inducers. Sitagliptin is primarily eliminated renally with minimal metabolism.

Spinosad (Natroba)

Purpose/Indication	Spinosad is a topical pediculicide used for the treatment of head lice infestations in individuals 6 months of age and older. It is an effective treatment for eliminating both lice and nits (lice eggs). Its unique mechanism of action makes it a valuable option, particularly in cases of resistance to other common pediculicides.
Method of Action	Spinosad is a naturally derived insecticidal agent that works by causing hyperexcitation of the insect's nervous system. It achieves this by activating nicotinic acetylcholine receptors and affecting gamma-aminobutyric acid (GABA) gated chloride channels in the insect, leading to involuntary muscle contractions, tremors, and ultimately paralysis and death of the lice. It is ovicidal (kills nits) as well as lousicidal (kills lice).
Medication Name & Brand Names	♦ Medication Name: Spinosad ♦ Brand Names: Natroba, Spinosad (generic)
Pharmaceutical Forms & Appearance	Spinosad is available as a topical suspension for external use. It is typically a white to off-white, slightly viscous liquid.
Dosage & Administration	For the treatment of head lice, apply enough spinosad topical suspension to cover dry scalp and hair. Typically, this means applying to scalp first, then working it through the hair to ensure all hair is saturated. Leave on for 10 minutes, then rinse thoroughly with warm water. Repeat treatment may be needed if live lice are seen 7 days after the first application; however, a second treatment is generally not required for most individuals. Only for topical use.
Supplied As	Spinosad is supplied as: topical suspension (e.g., 0.9% spinosad, in bottles containing 118 mL).
Contraindications	Spinosad is contraindicated in infants younger than 6 months of age. This is due to its benzyl alcohol content, which has been associated with serious adverse reactions, including "gasping syndrome," in neonates and low birth weight infants. It is also contraindicated in patients with known hypersensitivity to spinosad or any component of the formulation.
Storage & Expiry	Spinosad topical suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and excessive heat. Do not freeze. Keep the bottle tightly closed. Always check the specific expiry date on the packaging.
Side Effects	Common side effects are generally mild and local, including application site irritation, redness, dryness, or itching of the scalp. Eye irritation can occur if the product gets into the eyes.
Warnings & Precautions	♦ Not for Oral, Ophthalmic, or Intravaginal Use: Spinosad topical suspension is for external use on hair and scalp only. Avoid contact with eyes, mouth, nose, and other mucous membranes. Rinse thoroughly with water if contact occurs. ♦ Benzyl Alcohol Content: Contains benzyl alcohol. While systemic absorption is minimal with typical use, it is contraindicated in infants less than 6 months of age due to the risk of "gasping syndrome." Use with caution in older children and adults with impaired skin barrier or extensive application. ♦ Skin Irritation: May cause local irritation. If irritation persists or worsens, discontinue use and consult a healthcare professional. ♦ Flammability: Spinosad is flammable. Keep away from heat and open flame. ♦ Resistance: As with all pediculicides, resistance can develop over time. If the infestation persists after a second treatment, consider alternative therapies. ♦ Allergic Reactions: Rare hypersensitivity reactions may occur.
Missed Dose Instructions	Spinosad is typically a single-application treatment. If a second application is deemed necessary (e.g., if live lice are still observed 7 days after the first treatment), ensure it is applied as instructed. There isn't a "missed dose" concept as it's not a regularly scheduled medication.
Overdose Instructions	Overdose with topical spinosad is unlikely with normal use due to minimal systemic absorption. Ingesting the product could lead to gastrointestinal upset. There is no specific antidote. Treatment would be supportive and symptomatic. If swallowed, contact a poison control center or seek medical attention. If excessive topical application leads to significant skin irritation, wash the area thoroughly.

Medicine Interactions	♦ No significant drug interactions are known or expected with topical spinosad due to its minimal systemic absorption. Systemic interactions are unlikely.

Streptomycin (Streptomycin Sulfate)

Purpose/Indication	Streptomycin is an aminoglycoside antibiotic primarily used in multi-drug regimens for the treatment of severe bacterial infections, particularly tuberculosis (TB), especially in cases of multidrug-resistant TB (MDR-TB) or severe forms of the disease. It is also indicated for certain non-tubercular infections such as plague, tularemia, brucellosis, and bacterial endocarditis (in combination with penicillin or vancomycin), when other less toxic agents are ineffective or contraindicated. Its use is generally limited due to its toxicity profile.
Method of Action	Streptomycin exerts its bactericidal effect by irreversibly binding to the 30S ribosomal subunit of susceptible bacteria. This binding interferes with the initiation complex of protein synthesis, causes misreading of the mRNA template during translation, and prematurely terminates polypeptide chain elongation. This disruption of protein synthesis leads to the production of non-functional proteins and ultimately bacterial cell death. Its action is concentration-dependent.
Medication Name & Brand Names	♦ Medication Name: Streptomycin Sulfate ♦ Brand Names: Streptomycin (generic)
Pharmaceutical Forms & Appearance	Streptomycin is primarily available as a powder for injection, which is reconstituted to form a solution for intramuscular (IM) or intravenous (IV) administration. The powder is typically white to off-white, and the reconstituted solution is clear and colorless to pale yellow. It is not available in oral form as it is poorly absorbed from the gastrointestinal tract.
Dosage & Administration	Dosage is individualized based on the patient's weight, renal function, severity of infection, and specific indication. For tuberculosis, typical adult doses are 15 mg/kg (up to 1 gram) administered intramuscularly or intravenously once daily or 2-3 times weekly, as part of a multi-drug regimen. Dosing frequency and duration are adjusted for renal impairment. It must be administered by a healthcare professional.
Supplied As	Streptomycin is supplied as: sterile powder for injection (e.g., 1 gram or 5 grams per vial).
Contraindications	Streptomycin is strictly contraindicated in patients with known hypersensitivity to streptomycin or any other aminoglycoside antibiotic. It is also contraindicated in patients with myasthenia gravis or other conditions that impair neuromuscular transmission due to the risk of exacerbating muscle weakness and respiratory depression. Use in pregnant women is contraindicated due to the risk of fetal ototoxicity.
Storage & Expiry	Streptomycin powder for injection should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Once reconstituted, the solution should be used promptly (e.g., within 24 hours), or stored refrigerated for a short period (check specific product information). Always check the specific expiry date on the packaging.
Side Effects	The most significant and common serious side effects are ototoxicity (damage to hearing and/or balance, which can be irreversible) and nephrotoxicity (kidney damage). Ototoxicity manifests as tinnitus, vertigo, dizziness, and hearing loss. Other side effects include local pain at the injection site, rash, fever, and neuromuscular blockade leading to respiratory depression.
Warnings & Precautions	♦ BLACK BOX WARNINGS: Neurotoxicity (Ototoxicity & Vestibulotoxicity): Streptomycin can cause irreversible vestibular damage (dizziness, vertigo, ataxia) and auditory damage (hearing loss). The risk is dose-related and increased with prolonged use, higher doses, concomitant ototoxic drugs, and renal impairment. Audiometric and vestibular function tests should be performed before and periodically during therapy. ♦ BLACK BOX WARNINGS: Nephrotoxicity: Can cause acute tubular necrosis, leading to renal impairment. The risk is increased with pre-existing renal dysfunction, higher doses, prolonged therapy, and concomitant nephrotoxic drugs. Monitor renal function (serum creatinine, BUN) frequently. ♦ Neuromuscular Blockade & Respiratory Depression: Can cause neuromuscular blockade and respiratory paralysis, especially in patients with pre-existing neuromuscular disorders (e.g., myasthenia gravis, Parkinsonism), those receiving neuromuscular blocking agents, or those receiving large, rapid intravenous doses. Have calcium salts (e.g., calcium gluconate) available for emergency reversal. ♦ Fetal Harm: Contraindicated in pregnancy due to risk of congenital deafness in the fetus. ♦ Hypersensitivity Reactions: Allergic reactions can occur, ranging from rash to anaphylaxis. ♦ Renal Impairment: Dose adjustment is mandatory for patients with impaired renal function to prevent accumulation and increased toxicity. ♦ Concurrent Use with other Aminoglycosides or Nephrotoxic/Ototoxic Drugs: Avoid or use with extreme caution due to additive toxicity. ♦ Optic Nerve Toxicity: Rare reports of optic nerve damage
Missed Dose Instructions	Streptomycin is administered by a healthcare professional, typically in a hospital or clinic setting, due to its administration route and toxicity profile. Strict adherence to the prescribed dosing schedule is critical for efficacy and to minimize the development of drug resistance, particularly in TB treatment. If a dose is missed, it should be reported immediately to the prescribing healthcare professional, who will determine the appropriate course of action, possibly rescheduling the dose or adjusting the regimen.
Overdose Instructions	Overdose symptoms are primarily severe neurotoxicity (profound ototoxicity, vestibular dysfunction, neuromuscular blockade leading to respiratory paralysis) and severe nephrotoxicity (acute renal failure). Other symptoms may include nausea, vomiting, rash, and paresthesias. There is no specific antidote for streptomycin. Treatment is supportive and symptomatic. Hemodialysis or peritoneal dialysis can aid in the removal of streptomycin from the blood. Calcium salts (e.g., calcium gluconate) may be administered for neuromuscular blockade. Mechanical ventilation may be required for respiratory depression. Seek immediate emergency medical help.
Medicine Interactions	♦ Other Ototoxic Drugs (e.g., loop diuretics like furosemide, ethacrynic acid; cisplatin; vancomycin): Concomitant use significantly increases the risk of ototoxicity. Avoid or use with extreme caution. ♦ Other Nephrotoxic Drugs (e.g., cyclosporine, amphotericin B, NSAIDs, platinum compounds like cisplatin, other aminoglycosides): Concomitant use significantly increases the risk of nephrotoxicity. Avoid or use with extreme caution. ♦ Neuromuscular Blocking Agents (e.g., succinylcholine, rocuronium, vecuronium): Streptomycin can potentiate and prolong the neuromuscular blocking effects, leading to profound respiratory depression or paralysis. Use with extreme caution. ♦ Polymyxins (e.g., polymyxin B, colistin): Increased risk of neuromuscular blockade and nephrotoxicity. ♦ Bisphosphonates (e.g., zoledronic acid): May increase the risk of hypocalcemia. ♦ Myasthenia Gravis Medications: Streptomycin can exacerbate muscle weakness in myasthenia gravis, potentially leading to respiratory crisis. ♦ Digoxin: Some anecdotal reports of reduced digoxin absorption, though generally not considered clinically significant.

Sumatriptan (Imitrex)

Purpose/Indication	Sumatriptan is a selective serotonin (5-HT1B/1D) receptor agonist, commonly known as a triptan, used for the acute treatment of migraine attacks with or without aura, and for the acute treatment of cluster headache. It is not indicated for the prophylactic (preventive) treatment of migraine or for the management of hemiplegic or basilar migraine. Its purpose is to relieve the pain and associated symptoms of migraine and cluster headache once they have started.

Method of Action	Sumatriptan's therapeutic effect is primarily attributed to its agonistic action on 5-HT1B and 5-HT1D serotonin receptors. This leads to three main actions: 1) Cranial Vasoconstriction: Selective constriction of intracranial blood vessels that are dilated during a migraine attack. 2) Inhibition of Neuropeptide Release: Reduces the release of pro-inflammatory neuropeptides (e.g., substance P, CGRP) from trigeminal nerve endings. 3) Inhibition of Pain Signal Transmission: Modulates pain signals transmitted through the trigeminal pathway. These combined actions help to reverse the physiological changes associated with migraine and cluster headache.
Medication Name & Brand Names	♦ Medication Name: Sumatriptan Succinate ♦ Brand Names: Imitrex, Imigran (regional), Sumatriptan (generic), Onzetra Xsail (nasal powder), Tosymra (nasal spray), Zembrace SymTouch (injection)
Pharmaceutical Forms & Appearance	Sumatriptan is available in various forms for acute administration: oral tablets, nasal spray, subcutaneous (SC) injection, and a nasal powder. Oral tablets are typically film-coated, often oblong, and vary in color and imprint. The nasal spray is a clear solution. The subcutaneous injection is a clear solution in prefilled syringes or auto-injectors. Nasal powder is a fine white to off-white powder.
Dosage & Administration	Dosage varies by form and individual response. For oral tablets, typical adult doses are 25 mg, 50 mg, or 100 mg taken at the first sign of migraine pain. A second dose can be taken after 2 hours if needed, not exceeding 200 mg in 24 hours. For subcutaneous injection, 6 mg is a common dose, which can be repeated once after 1 hour, not exceeding 12 mg in 24 hours. For nasal spray, 5 mg, 10 mg, or 20 mg in one nostril, which can be repeated after 2 hours, not exceeding 40 mg in 24 hours. Administer at the onset of headache, but not during the aura phase.
Supplied As	Sumatriptan is supplied as: oral tablets (e.g., 25 mg, 50 mg, 100 mg), nasal spray (e.g., 5 mg, 10 mg, 20 mg per spray device), subcutaneous injection (e.g., 6 mg/0.5 mL in vials, prefilled syringes, or auto-injectors), and nasal powder (e.g., 11 mg per single-dose device).
Contraindications	Sumatriptan is strictly contraindicated in patients with known hypersensitivity to sumatriptan or any component. It is contraindicated in patients with a history of ischemic heart disease (e.g., angina pectoris, myocardial infarction), Prinzmetal's angina, uncontrolled hypertension, or other significant cardiovascular disease. It is also contraindicated in patients with a history of stroke or transient ischemic attack (TIA), peripheral vascular disease, severe hepatic impairment, and in concurrent use with MAOIs (or within 2 weeks of stopping MAOIs), ergotamine-containing medications, or other 5-HT1 agonists (triptans).
Storage & Expiry	Sumatriptan tablets, nasal spray, and injections should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Keep in the original packaging. Do not freeze injections. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include sensations of tingling, warmth, flushing, dizziness, drowsiness, weakness, and pain/pressure/tightness in the chest, throat, or jaw (often non-cardiac). Injection site reactions are common with SC forms. Nausea and vomiting may also occur. More serious but less common side effects include coronary artery vasospasm (leading to angina or MI), stroke, serotonin syndrome, and severe hypersensitivity reactions.
Warnings & Precautions	♦ Cardiovascular Risk: Can cause coronary artery vasospasm, leading to myocardial ischemia and infarction, even in patients with no history of coronary artery disease (CAD). Contraindicated in patients with known or suspected CAD or uncontrolled hypertension. Perform cardiovascular evaluation prior to use in patients with risk factors for CAD. ♦ Cerebrovascular Events: Rare but serious cerebrovascular events (e.g., stroke, TIA) have been reported. ♦ Serotonin Syndrome: Potentially life-threatening condition that can occur with concomitant use of other serotonergic drugs (e.g., SSRIs, SNRIs, MAOIs - contraindicated, TCAs, tramadol, lithium). Symptoms include mental status changes, autonomic instability, neuromuscular aberrations, and GI symptoms. Seek immediate medical attention if suspected. ♦ Hypertension: Can cause significant increases in blood pressure, including hypertensive crisis. Monitor blood pressure. ♦ Drug Overuse Headache (MOH): Prolonged or frequent use of triptans for acute treatment can lead to medication overuse headache. Limit use to no more than 10 days per month. ♦ Vasospasm Risk: Caution in patients with Raynaud's phenomenon or other peripheral vascular diseases. ♦ Seizures: Use with caution in patients with a history of seizures or conditions that lower the seizure threshold. ♦ Hepatic Impairment: Use with caution and consider lower doses in patients with mild to moderate hepatic impairment. Contraindicated in severe hepatic impairment. ♦ Renal Impairment: No specific dose adjustment generally needed. ♦ Anaphylaxis: Rare but severe hypersensitivity reactions can occur. ♦ Driving/Operating Machinery: May cause drowsiness or dizziness; advise caution. ♦ Specific Formulations: Nasal spray/powder for unilateral nostril use. SC injection has fastest onset but higher incidence of injection site reactions and chest sensations.
Missed Dose Instructions	Sumatriptan is an acute treatment for migraine or cluster headache and is taken only when an attack occurs. There is no concept of a "missed dose" in a regular dosing schedule. If a dose was taken and the headache returns or symptoms are not fully relieved, a second dose may be taken after the recommended interval (e.g., 2 hours for oral, 1 hour for SC), provided the maximum daily dose is not exceeded. Do not take if symptoms are mild or if it is for prevention.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including severe drowsiness, vomiting, dizziness, flushing, hypotension or hypertension, tachycardia, and potentially seizures or more severe cardiovascular events (e.g., vasospasm, MI). There is no specific antidote for sumatriptan. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Monitor cardiac and respiratory function closely. Provide oxygen if needed. Seek immediate emergency medical help.
Medicine Interactions	♦ MAOIs (Monoamine Oxidase Inhibitors, e.g., phenelzine, tranylcypromine, selegiline, linezolid, methylene blue): STRICTLY CONTRAINDICATED. Concomitant use or use within 14 days of stopping an MAOI can lead to severe serotonin syndrome and increased sumatriptan exposure. ♦ Ergot-containing Medications (e.g., ergotamine, dihydroergotamine): Concomitant use is CONTRAINDICATED due to additive vasoconstrictive effects, increasing the risk of vasospastic reactions. Do not use within 24 hours of each other. ♦ Other 5-HT1 Agonists/Triptans (e.g., zolmitriptan, rizatriptan): Concomitant use is CONTRAINDICATED due to additive vasoconstrictive effects and increased risk of adverse events. Do not use within 24 hours of each other. ♦ SSRIs (Selective Serotonin Reuptake Inhibitors, e.g., fluoxetine, sertraline) & SNRIs (Serotonin-Norepinephrine Reuptake Inhibitors, e.g., venlafaxine, duloxetine): Increased risk of serotonin syndrome. Use with caution; monitor for symptoms. ♦ Alcohol: May exacerbate CNS depressant effects. ♦ St. John's Wort: May increase the risk of serotonin syndrome. ♦ Cimetidine: May increase sumatriptan levels. ♦ Propoxyphene: May decrease sumatriptan clearance. ♦ Tobacco Smoking: May reduce overall exposure to sumatriptan.

Tadalafil (Cialis)

Purpose/Indication	Tadalafil is a phosphodiesterase-5 (PDE5) inhibitor primarily used for the treatment of erectile dysfunction (ED) in men, distinguished by its longer duration of action allowing for more spontaneity. It is also indicated for the treatment of benign prostatic hyperplasia (BPH) signs and symptoms, and for pulmonary arterial hypertension (PAH) to improve exercise capacity, marketed under different brand names and dosing.

MEDICATION | Medication | List | R - Z | Tadalafil (Cialis)

Method of Action	Tadalafil works by selectively inhibiting phosphodiesterase type 5 (PDE5), an enzyme concentrated in the corpus cavernosum of the penis, prostate, bladder, and pulmonary vasculature. In erectile dysfunction, sexual stimulation triggers nitric oxide (NO) release, activating guanylate cyclase and increasing cyclic guanosine monophosphate (cGMP) levels. cGMP leads to smooth muscle relaxation and increased blood flow for an erection. Tadalafil enhances this effect by preventing cGMP breakdown. In BPH, it relaxes smooth muscle in the prostate and bladder, improving urinary flow. In PAH, it causes vasodilation in the pulmonary arteries.
Medication Name & Brand Names	♦ Medication Name: Tadalafil ♦ Brand Names: Cialis (for ED/BPH), Adcirca (for PAH), Tadalafil (generic)
Pharmaceutical Forms & Appearance	Tadalafil is available as oral film-coated tablets. Cialis tablets are typically yellow, almond-shaped, and film-coated, with specific imprints indicating strength (e.g., "C" followed by the strength). Adcirca tablets are typically orange, oval, and film-coated.
Dosage & Administration	Dosage varies significantly by indication. For erectile dysfunction (ED), it can be taken as needed (e.g., 10 mg or 20 mg before sexual activity, effective for up to 36 hours), or as a daily dose (2.5 mg or 5 mg). For benign prostatic hyperplasia (BPH) or ED with BPH, the daily dose is typically 5 mg. For pulmonary arterial hypertension (PAH), the typical adult oral dose is 40 mg once daily. It can be taken with or without food. Do not take more than once daily for ED/BPH.
Supplied As	Tadalafil is supplied as: oral film-coated tablets (e.g., 2.5 mg, 5 mg, 10 mg, 20 mg, 40 mg).
Contraindications	Tadalafil is strictly contraindicated in patients taking nitrates (e.g., nitroglycerin, isosorbide dinitrate) in any form due to the risk of dangerous and potentially fatal hypotension. It is also contraindicated in patients with known hypersensitivity to tadalafil or any component of the formulation. Concomitant use with guanylate cyclase stimulators (e.g., riociguat) is also contraindicated.
Storage & Expiry	Tadalafil tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include headache, dyspepsia (indigestion), back pain, muscle aches (myalgia), flushing, and nasal congestion. Back pain and myalgia are more common with tadalafil due to its longer half-life. More serious but rare side effects include priapism (prolonged erection lasting >4 hours), sudden decrease or loss of vision (NAION), sudden hearing loss, and cardiovascular events (MI, stroke, arrhythmias) in patients with pre-existing heart conditions.
Warnings & Precautions	♦ Nitrate Co-administration: STRICTLY CONTRAINDICATED with nitrates in any form (oral, sublingual, transdermal, spray, IV) due to potentiation of hypotensive effects, leading to a profound and potentially fatal drop in blood pressure. ♦ Alpha-Blockers: Use with caution, as concomitant use can lead to symptomatic hypotension. Start tadalafil at the lowest dose and ensure patient is stable on alpha-blocker therapy. ♦ Cardiovascular Risk: Patients should have their cardiovascular status assessed before initiating tadalafil, especially for ED, as there is a degree of cardiac risk associated with sexual activity. Use with caution in patients with pre-existing cardiovascular disease. ♦ Priapism: Rare but serious adverse effect; prolonged erection (more than 4 hours) or painful erection (more than 6 hours) requires immediate medical attention to avoid permanent damage. ♦ Non-Arteritic Anterior Ischemic Optic Neuropathy (NAION): Rare but serious eye condition leading to sudden decrease or loss of vision. Risk factors include underlying cardiovascular disease, diabetes, hypertension, and smoking. Advise patients to seek immediate medical attention if sudden vision loss occurs. ♦ Sudden Hearing Loss: Rare reports of sudden decrease or loss of hearing, sometimes with tinnitus and dizziness. Seek immediate medical attention. ♦ Renal/Hepatic Impairment: Use with caution and consider dose adjustment in patients with moderate to severe renal or hepatic impairment. Avoid in severe renal impairment if taking for PAH. ♦ Concomitant use with other PDE5 Inhibitors or ED treatments: Not recommended. ♦ Bleeding Disorders/Active Peptic Ulceration: Use with caution due to antiplatelet effects. ♦ Anatomical Deformation of the Penis: Use with caution in patients with Peyronie's disease or other anatomical deformities, or conditions predisposing to priapism (e.g., sickle cell anemia, multiple myeloma, leukemia).
Missed Dose Instructions	For as-needed ED dosing: Tadalafil is taken before anticipated sexual activity. If a planned dose is missed, simply take it when ready, ensuring not to exceed one dose within 24-36 hours depending on the prescribed frequency. For daily ED/BPH dosing: If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For PAH dosing: If a dose is missed, take it as soon as remembered, and then take the next dose at the regular time. Do not take a double dose.
Overdose Instructions	Overdose symptoms are typically an exaggeration of common side effects, including severe headache, dyspepsia, back pain, muscle aches, flushing, and nasal congestion. Hypotension may be more pronounced. There is no specific antidote for tadalafil overdose. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Monitor blood pressure and cardiac status. Hemodialysis is not expected to be effective. Seek immediate emergency medical help.
Medicine Interactions	♦ Nitrates (e.g., nitroglycerin, isosorbide dinitrate, amyl nitrite/poppers): STRICTLY CONTRAINDICATED due to dangerous potentiation of hypotensive effects. ♦ Guanylate Cyclase Stimulators (e.g., riociguat): Contraindicated due to risk of severe hypotension. ♦ Alpha-Blockers (e.g., doxazosin, tamsulosin, alfuzosin): Concomitant use can cause symptomatic hypotension. Initiate tadalafil at the lowest dose and only in hemodynamically stable patients on alpha-blocker. ♦ Strong CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, erythromycin, saquinavir, ritonavir, other protease inhibitors, grapefruit juice): Significantly increase tadalafil plasma levels, leading to increased side effects. Lower starting doses or reduced frequency of tadalafil may be required. ♦ Strong CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, phenobarbital): Can decrease tadalafil plasma levels, reducing efficacy. Avoid concomitant use. ♦ Antacids (containing magnesium hydroxide/aluminum hydroxide): May reduce the absorption rate of tadalafil. ♦ Other PDE5 Inhibitors (e.g., sildenafil, vardenafil, avanafil): Concomitant use is generally not recommended due to increased risk of adverse effects. ♦ Alcohol: Excessive alcohol consumption can increase the risk of orthostatic hypotension with tadalafil.

Telmisartan (Micardis)

Purpose/Indication	Telmisartan is an angiotensin II receptor blocker (ARB) primarily used for the treatment of hypertension (high blood pressure). It is also indicated to reduce the risk of myocardial infarction, stroke, or death from cardiovascular causes in patients 55 years of age or older at high risk (e.g., with coronary artery disease, peripheral arterial disease, history of stroke, or diabetes with end-organ damage). Its purpose is to lower blood pressure and provide cardiovascular protection.
Method of Action	Telmisartan works by selectively blocking the binding of angiotensin II to the angiotensin II type 1 (AT1) receptor in various tissues, including vascular smooth muscle and the adrenal gland. Angiotensin II is a potent vasoconstrictor and also stimulates aldosterone secretion, leading to sodium and water retention. By blocking AT1 receptors, telmisartan causes vasodilation, reduces aldosterone-mediated effects, and ultimately lowers blood pressure. It does not inhibit ACE, so it does not cause the dry cough associated with ACE inhibitors.
Medication Name & Brand Names	♦ Medication Name: Telmisartan ♦ Brand Names: Micardis, Telmisartan (generic) ♦ Combination Products: Micardis Plus (telmisartan/hydrochlorothiazide), Twynsta (telmisartan/amlodipine)

Pharmaceutical Forms & Appearance	Telmisartan is available as oral tablets. Tablets are typically oblong, biconvex, and may vary in color and imprint depending on strength (e.g., white, off-white, yellowish). They often have specific imprints indicating strength and/or a company logo.
Dosage & Administration	Dosage is individualized based on the patient's blood pressure response and renal function. For hypertension, the typical adult oral dose is 40 mg once daily. The dosage can be adjusted from 20 mg to 80 mg once daily. For cardiovascular risk reduction, the typical dose is 80 mg once daily. It can be taken with or without food. Maximum antihypertensive effect is generally achieved after 4-8 weeks of therapy.
Supplied As	Telmisartan is supplied as: oral tablets (e.g., 20 mg, 40 mg, 80 mg).
Contraindications	Telmisartan is contraindicated in patients with known hypersensitivity to telmisartan or any component of the formulation. It is strictly contraindicated in pregnancy due to the risk of fetal injury or death. Concomitant use with aliskiren is contraindicated in patients with diabetes mellitus or renal impairment (eGFR < 60 mL/min/1.73m2). It is also contraindicated in patients with biliary obstructive disorders or severe hepatic impairment.
Storage & Expiry	Telmisartan tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly sealed blister packaging or container, as the tablets are sensitive to humidity. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include back pain, sinusitis, dizziness, and diarrhea. More serious but less common side effects include hypotension (low blood pressure), hyperkalemia (high potassium levels), renal impairment, and rarely, angioedema (swelling of the face, lips, tongue, throat), although less frequent than with ACE inhibitors.
Warnings & Precautions	♦ BLACK BOX WARNING: Fetal Toxicity: Use of drugs that act on the renin-angiotensin system during the second and third trimesters of pregnancy can cause injury and death to the developing fetus. Discontinue as soon as pregnancy is detected. ♦ Hypotension: May cause symptomatic hypotension, especially in volume-depleted patients (e.g., those on high-dose diuretics, dialysis) or severe heart failure. Initiate with low doses and monitor. ♦ Hyperkalemia: Can cause hyperkalemia, especially in patients with renal impairment, diabetes, or those taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium closely. ♦ Renal Impairment: Can cause acute renal failure, particularly in patients with pre-existing renal insufficiency, severe congestive heart failure, or bilateral renal artery stenosis. Monitor renal function regularly. ♦ Dual Blockade of RAAS: Dual blockade of the renin-angiotensin-aldosterone system (RAAS) with ARBs, ACE inhibitors, or aliskiren is associated with increased risks of hypotension, hyperkalemia, and renal function changes; generally avoid. ♦ Hepatic Impairment: Use with caution in patients with mild to moderate hepatic impairment, as telmisartan is eliminated primarily by biliary excretion. Contraindicated in severe hepatic impairment or biliary obstructive disorders. ♦ Angioedema: Rare cases of angioedema have been reported. If laryngeal stridor or angioedema of the face, extremities, lips, tongue, glottis, or larynx occurs, discontinue telmisartan immediately. ♦ Aortic/Mitral Valve Stenosis or Hypertrophic Obstructive Cardiomyopathy: Use with caution.
Missed Dose Instructions	If a dose of Telmisartan is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for effective blood pressure control and cardiovascular protection.
Overdose Instructions	Overdose symptoms are primarily severe hypotension, dizziness, and tachycardia (rapid heart rate). Bradycardia (slow heart rate) may also occur. There is no specific antidote for telmisartan overdose. Treatment is supportive and symptomatic. Maintain fluid and electrolyte balance. If ingestion was recent, gastric lavage and activated charcoal may be considered. Lay the patient supine with legs elevated. IV fluid infusion and vasopressors may be needed for hypotension. Telmisartan is not removed by hemodialysis. Seek immediate emergency medical help.
Medicine Interactions	♦ Aliskiren: Contraindicated in patients with diabetes mellitus or renal impairment due to increased risk of hypotension, hyperkalemia, and renal impairment. ♦ Potassium-Sparing Diuretics (e.g., spironolactone, amiloride, triamterene) & Potassium Supplements: Significant risk of severe hyperkalemia. Avoid concomitant use or monitor potassium levels very closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs, including selective COX-2 inhibitors): May reduce the antihypertensive effect of ARBs and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Use with caution. ♦ Lithium: ARBs can reduce the renal clearance of lithium, leading to increased serum lithium levels and toxicity. Monitor lithium levels closely. ♦ Digoxin: Telmisartan can increase mean trough digoxin plasma concentrations. Monitor digoxin levels. ♦ Diuretics: Enhanced hypotensive effect, especially with the first dose. Consider withholding diuretics prior to initiating telmisartan. ♦ Ramipril (or other ACE inhibitors): Dual blockade of RAAS with an ARB and an ACE inhibitor is generally not recommended due to increased risk of adverse events. ♦ Metformin: No clinically significant interaction with telmisartan. ♦ Warfarin: No clinically significant interaction with telmisartan.

Temazepam (Restoril)

Purpose/Indication	Temazepam is a benzodiazepine medication primarily indicated for the short-term treatment of insomnia. It is used to help patients fall asleep and stay asleep for a sufficient duration, especially when insomnia is severe, debilitating, or causing extreme distress. Due to the risk of dependence and withdrawal, its use is generally limited to 7-10 consecutive nights.
Method of Action	Temazepam, like other benzodiazepines, works by enhancing the activity of gamma-aminobutyric acid (GABA), the primary inhibitory neurotransmitter in the brain. It binds specifically to benzodiazepine receptors on the GABA-A receptor complex, leading to an increased frequency of chloride channel opening. This influx of chloride ions hyperpolarizes the neuron, making it less excitable and resulting in central nervous system depression, which manifests as sedative, hypnotic, anxiolytic, anticonvulsant, and muscle relaxant effects.
Medication Name & Brand Names	♦ Medication Name: Temazepam ♦ Brand Names: Restoril, Temaze (regional), Normison (regional), Temazepam (generic)
Pharmaceutical Forms & Appearance	Temazepam is primarily available as oral capsules or tablets. Capsules are typically hard gelatin capsules, varying in color depending on the strength, and may have specific imprints. Tablets are usually round or oval and may also be imprinted.
Dosage & Administration	The typical adult oral dosage for insomnia is 7.5 mg to 30 mg, taken once daily at bedtime. The lowest effective dose should be used, especially in elderly or debilitated patients, to minimize the risk of oversedation and adverse effects. It should be taken immediately before going to bed, and only when the patient has sufficient time for a full night's sleep (7-8 hours) to minimize residual drowsiness the next morning. Its use should be short-term.
Supplied As	Temazepam is supplied as: oral capsules (e.g., 7.5 mg, 15 mg, 30 mg) or oral tablets (e.g., 10 mg, 20 mg - regional variations).
Contraindications	Temazepam is contraindicated in patients with known hypersensitivity to temazepam or any other benzodiazepine. It is also contraindicated in patients with severe respiratory insufficiency (e.g., severe COPD, sleep apnea) due to the risk of respiratory depression, or in patients with severe hepatic insufficiency. Concomitant use with opioids is a strong caution (see warnings).
Storage & Expiry	Temazepam capsules/tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers and keep out of reach of children. Always check the specific expiry date on the packaging.

Side Effects	Common side effects include drowsiness, dizziness, fatigue, headache, and impaired coordination. Residual sedation ("hangover" effect) can occur the next day. More serious but less common side effects include paradoxical reactions (e.g., agitation, hallucinations, aggression, disinhibition), anterograde amnesia, respiratory depression, and dependence/withdrawal symptoms upon discontinuation.
Warnings & Precautions	♦ CNS Depression & Impaired Alertness: Can cause profound sedation, dizziness, and impaired motor coordination, affecting ability to drive or operate machinery. Avoid activities requiring mental alertness. ♦ Concomitant Opioid Use: BLACK BOX WARNING (in some regions/products): Concomitant use of benzodiazepines and opioids may result in profound sedation, respiratory depression, coma, and death. Reserve concomitant prescribing for patients for whom alternative treatment options are inadequate. Limit dosages and durations. ♦ Abuse, Misuse, Addiction: Benzodiazepines carry a risk of abuse, misuse, and addiction, which can lead to overdose or death. The risk is increased with higher doses, longer duration of use, and in patients with a history of substance abuse. ♦ Dependence & Withdrawal: Can cause physical dependence. Abrupt discontinuation or rapid dose reduction, especially after prolonged use, can lead to severe withdrawal symptoms (e.g., seizures, tremors, anxiety, insomnia, delirium, hallucinations). Taper dose gradually when discontinuing. ♦ Respiratory Depression: Use with extreme caution in patients with respiratory compromise (e.g., COPD, sleep apnea) due to the risk of exacerbating respiratory depression. ♦ Anterograde Amnesia: Can cause dose-related anterograde amnesia (difficulty remembering events after drug administration). Patients should ensure they have 7-8 hours of uninterrupted sleep. ♦ Paradoxical Reactions: Rarely, benzodiazepines can cause paradoxical excitement, aggression, agitation, or hallucinations, particularly in elderly or psychiatric patients. Discontinue if these occur. ♦ Hepatic/Renal Impairment: Use with caution and consider dose reduction in patients with hepatic or severe renal impairment. ♦ Elderly Patients: Highly susceptible to CNS depressant effects; use lower starting doses and monitor closely to avoid falls and cognitive impairment. ♦ Depression/Suicidality: Use with caution in patients with depression; may be associated with increased risk of suicidal ideation. ♦ Complex Sleep Behaviors: Rarely reported, including "sleep-driving" or preparing food and eating while not fully awake, with no memory of the event.
Missed Dose Instructions	Temazepam is an as-needed medication for insomnia, taken right before bedtime. If a dose is missed (e.g., you forget to take it before going to sleep and wake up later), do not take it in the middle of the night or if you do not have a full 7-8 hours available for sleep before you need to be awake. Taking it too late can lead to next-day drowsiness and impaired function. Do not take a double dose.
Overdose Instructions	Overdose symptoms are typically central nervous system depression, ranging from somnolence to coma, with respiratory depression. Other symptoms may include confusion, impaired coordination, diminished reflexes, slurred speech, and hypotension. Severe consequences (coma, death) are more likely with co-ingestion of other CNS depressants, especially alcohol or opioids. There is a specific benzodiazepine receptor antagonist, flumazenil, which can reverse the sedative effects, but it should be used with caution due to the risk of seizures in patients dependent on benzodiazepines or those with mixed overdoses. Treatment is supportive and symptomatic, focusing on maintaining an open airway, ventilation, and cardiovascular support. Seek immediate emergency medical help.
Medicine Interactions	♦ Opioids (e.g., morphine, oxycodone, hydrocodone): BLACK BOX WARNING: Concomitant use significantly increases the risk of profound sedation, respiratory depression, coma, and death. Avoid concomitant use or limit dosages and durations if absolutely necessary. ♦ Other CNS Depressants (e.g., alcohol, other hypnotics, sedatives, antidepressants, antipsychotics, antihistamines, muscle relaxants, general anesthetics): Additive CNS depressant effects. Avoid or use with extreme caution. ♦ CYP450 Inhibitors (e.g., azole antifungals, macrolide antibiotics, HIV protease inhibitors, cimetidine, grapefruit juice): May inhibit the metabolism of temazepam (though temazepam is less prone to significant CYP interactions than some other benzodiazepines, primarily undergoing glucuronidation), potentially increasing its levels and effects. ♦ Phenytoin: May alter phenytoin levels. ♦ Theophylline/Aminophylline: May reduce the sedative effects of benzodiazepines. ♦ Disulfiram: May inhibit temazepam metabolism, leading to increased levels. ♦ Smoking: May decrease temazepam levels.

Tenofovir (Viread)

Purpose/Indication	Tenofovir is a nucleotide reverse transcriptase inhibitor (NtRTI) primarily used in combination with other antiretroviral agents for the treatment of human immunodeficiency virus type 1 (HIV-1) infection in adults and pediatric patients. It is also indicated for the treatment of chronic hepatitis B virus (HBV) infection in adults and, for some formulations, in pediatric patients, including those with compensated and decompensated liver disease. It helps to suppress viral replication, improve immune function, and reduce disease progression in both HIV and HBV.
Method of Action	Tenofovir disoproxil fumarate (TDF) is a prodrug that is converted intracellularly to tenofovir diphosphate, the active metabolite. Tenofovir diphosphate then competitively inhibits reverse transcriptase, an enzyme essential for HIV replication, and DNA polymerase, an enzyme essential for HBV replication. By acting as a chain terminator during viral DNA synthesis, tenofovir diphosphate prevents the transcription of viral RNA into DNA, thereby blocking viral replication. Tenofovir alafenamide (TAF) is also a prodrug, more efficiently delivering tenofovir to target cells.
Medication Name & Brand Names	♦ Medication Name: Tenofovir (available as Tenofovir Disoproxil Fumarate - TDF, and Tenofovir Alafenamide - TAF) ♦ Brand Names: Viread (TDF), Vemlidy (TAF for HBV only), Descovy (TAF/emtricitabine for HIV/PrEP), Genvoya (elvitegravir/cobicistat/emtricitabine/TAF), Odefsey (emtricitabine/rilpivirine/TAF), Biktarvy (bictegravir/emtricitabine/TAF), Symtuza (darunavir/cobicistat/emtricitabine/TAF), Tenofovir (generic TDF)
Pharmaceutical Forms & Appearance	Tenofovir is available as oral tablets. TDF tablets (Viread) are typically almond-shaped and light blue, often with strength imprints. TAF tablets (Vemlidy, or in combination products) are generally smaller, often round or oval, and may vary in color depending on strength or combination.
Dosage & Administration	Dosage varies by formulation, indication, and patient renal function. For HIV-1 (TDF), the typical adult oral dose is 300 mg once daily, usually in combination with other antiretrovirals. For chronic HBV (TDF), 300 mg once daily. For chronic HBV (TAF), 25 mg once daily. TDF can be taken with or without food. TAF should be taken with food. Dose adjustments for TDF are necessary for patients with renal impairment; TAF generally requires less frequent adjustment for moderate renal impairment.
Supplied As	Tenofovir is supplied as: oral tablets (TDF: 150 mg, 200 mg, 250 mg, 300 mg; TAF: 25 mg in combination products or 25 mg as Vemlidy).
Contraindications	Tenofovir is contraindicated in patients with known hypersensitivity to tenofovir or any component of the formulation. It is not approved for use as monotherapy for HIV, as this can lead to the development of drug resistance.
Storage & Expiry	Tenofovir tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects for TDF include nausea, vomiting, diarrhea, abdominal pain, headache, and dizziness. More significant side effects unique to TDF include renal impairment (nephrotoxicity) and decreased bone mineral density (bone loss). Common side effects for TAF (which generally has better renal and bone safety) include nausea, abdominal pain, and headache. Both can rarely cause lactic acidosis with severe hepatomegaly with steatosis.

Warnings & Precautions	♦ BLACK BOX WARNING (for TDF): Lactic Acidosis/Severe Hepatomegaly with Steatosis. Fatal cases have been reported with nucleoside analogs, including TDF. Use with caution in patients with risk factors for liver disease. ♦ BLACK BOX WARNING (for TDF): Post-Treatment Exacerbation of HBV: Severe acute exacerbations of hepatitis B have been reported in HBV-infected patients discontinuing TDF or TAF. Monitor liver function closely for several months after stopping. ♦ Renal Impairment (TDF): TDF can cause or worsen renal impairment, including acute renal failure and Fanconi syndrome. Monitor serum creatinine, phosphorus, and urinalysis (proteinuria, glycosuria) before and during therapy. Dose adjustment is required for renal impairment. ♦ Bone Mineral Density (TDF): TDF is associated with decreases in bone mineral density (BMD), particularly in younger patients. Consider calcium and vitamin D supplementation. Monitor BMD in patients with a history of fracture or osteoporosis risk. ♦ TAF generally has improved renal and bone safety profiles compared to TDF. ♦ HIV/HBV Co-infection: Patients with HIV/HBV co-infection must receive TDF or TAF as part of an appropriate anti-HIV regimen to prevent HIV resistance. Monotherapy for HBV in co-infected patients is not recommended. ♦ Immune Reconstitution Inflammatory Syndrome (IRIS): Can occur in HIV-infected patients during initial phases of antiretroviral treatment, leading to inflammation or worsening of opportunistic infections. ♦ Drug Interactions: Numerous drug interactions due to metabolism or renal excretion (see below). ♦ Lipids: TAF-containing regimens may lead to greater increases in total cholesterol and LDL-C compared
Missed Dose Instructions	If a dose of Tenofovir is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is crucial for suppressing viral replication and preventing the development of drug resistance in both HIV and HBV. If more than one dose is missed, consult a healthcare professional.
Overdose Instructions	Limited data on overdose of tenofovir. Overdose symptoms are generally not well-established, but exaggerated side effects such as gastrointestinal upset or renal impairment could occur. There is no specific antidote for tenofovir. Treatment is supportive and symptomatic. Hemodialysis can remove tenofovir, but its utility in overdose is unknown. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Drugs Affecting Renal Function (e.g., NSAIDs, aminoglycosides, high-dose vancomycin, cisplatin, cidofovir, adefovir): Concomitant use with TDF can increase serum concentrations of tenofovir and/or increase the risk of renal toxicity. Monitor renal function closely. ♦ Ledipasvir/Sofosbuvir, Sofosbuvir/Velpatasvir, Sofosbuvir/Velpatasvir/Voxilaprevir: Can increase tenofovir (TAF) levels, especially in combination with other antivirals that include cobicistat. Monitor for tenofovir-related adverse effects. ♦ Atazanavir/Ritonavir and Lopinavir/Ritonavir: These ritonavir-boosted protease inhibitors can significantly increase tenofovir (TDF) exposure, requiring careful renal monitoring or consideration of alternative regimens. With TAF, the interaction is less pronounced. ♦ Didanosine (ddI): Concomitant use with TDF can increase ddI concentrations, leading to ddI-related adverse events (e.g., pancreatitis, neuropathy). Co-administration is generally not recommended or requires ddI dose reduction. ♦ Drugs Highly Protein-Bound: Tenofovir is not highly protein-bound, so significant interactions related to protein binding displacement are unlikely. ♦ Statins (e.g., atorvastatin): No significant interaction.

Terbinafine (Lamisil)

Purpose/Indication	Terbinafine is an antifungal medication used to treat various fungal infections. Oral terbinafine is primarily indicated for the treatment of onychomycosis (fungal infections of the fingernails and toenails) due to dermatophytes, and severe tinea capitis (ringworm of the scalp). Topical formulations are used for superficial fungal skin infections like tinea pedis (athlete's foot), tinea corporis (ringworm of the body), and tinea cruris (jock itch), and sometimes for cutaneous candidiasis.
Method of Action	Terbinafine is an allylamine antifungal that selectively inhibits squalene epoxidase, a key enzyme in the fungal ergosterol biosynthesis pathway. By blocking squalene epoxidase, terbinafine causes an accumulation of squalene within the fungal cell and a deficiency of ergosterol, which is a vital component of the fungal cell membrane. The accumulation of squalene is toxic to the fungal cell, leading to increased cell membrane permeability and ultimately fungal cell death (fungicidal action).
Medication Name & Brand Names	♦ Medication Name: Terbinafine Hydrochloride ♦ Brand Names: Lamisil (oral tablets, topical cream/gel/spray), Lamisil AT (topical), Terbinafine (generic)
Pharmaceutical Forms & Appearance	Terbinafine is available as oral tablets, and various topical formulations including creams, gels, and sprays. Oral tablets are typically white to off-white, round, biconvex, and may be scored. Topical creams are white, smooth, and homogeneous. Gels and sprays are clear or translucent.
Dosage & Administration	Dosage varies significantly by formulation and indication. For oral onychomycosis, the typical adult oral dose is 250 mg once daily for 6 weeks for fingernail infections and 12 weeks for toenail infections. For tinea capitis (in children), doses are weight-based. For topical skin infections, the cream/gel/spray is applied once or twice daily to the affected area and surrounding skin for 1-4 weeks, depending on the infection type. Oral tablets can be taken with or without food. Complete the full course of treatment to prevent recurrence.
Supplied As	Terbinafine is supplied as: oral tablets (e.g., 250 mg), topical cream (e.g., 1%), topical gel (e.g., 1%), and topical solution/spray (e.g., 1%).
Contraindications	Terbinafine is contraindicated in patients with known hypersensitivity to terbinafine or any component of the formulation. Oral terbinafine is also contraindicated in patients with chronic or active liver disease, as it can cause significant hepatic dysfunction.
Storage & Expiry	Terbinafine oral tablets and topical formulations should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects for oral terbinafine include gastrointestinal disturbances (diarrhea, dyspepsia, abdominal pain, nausea), headache, rash, and taste disturbance (dysgeusia), which can be severe and prolonged. Serious but less common side effects include hepatotoxicity (liver damage), neutropenia (low white blood cell count), Stevens-Johnson Syndrome, and toxic epidermal necrolysis. Common side effects for topical terbinafine are usually mild and local, such as irritation, burning, stinging, or redness at the application site.
Warnings & Precautions	♦ Hepatotoxicity (Oral): Oral terbinafine can cause liver dysfunction, including cholestasis, hepatitis, and liver failure (rarely fatal). Liver function tests (ALT, AST) should be performed prior to initiating treatment and periodically during therapy (e.g., at 4-6 weeks) or if signs/symptoms of liver dysfunction occur. Discontinue if liver enzymes are significantly elevated or if clinical signs of liver disease develop. Contraindicated in active or chronic liver disease. ♦ Taste Disturbance/Loss of Taste (Oral): Can cause persistent or severe taste disturbance, including taste loss, which may sometimes be irreversible. This can lead to decreased appetite and weight loss. ♦ Hematologic Effects (Oral): Rare cases of neutropenia, agranulocytosis, thrombocytopenia, and pancytopenia have been reported. Monitor blood counts if signs of blood dyscrasias occur. ♦ Skin Reactions (Oral): Rare but severe skin reactions (e.g., Stevens-Johnson Syndrome, toxic epidermal necrolysis) have been reported. Discontinue at the first sign of progressive skin rash. ♦ Lupus Erythematosus: May exacerbate or precipitate cutaneous and systemic lupus erythematosus. ♦ Renal Impairment (Oral): Use with caution and consider dose reduction in patients with renal impairment (CrCl < 50 mL/min). ♦ Pregnancy & Lactation: Use during pregnancy and lactation is generally not recommended unless benefits outweigh risks, as it is excreted in breast milk. ♦ Depression: Rare reports of depression with oral terbinafine.

Missed Dose Instructions	For oral terbinafine: If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course is crucial for successful treatment and preventing relapse of fungal infections. For topical terbinafine: If a dose is missed, apply it as soon as remembered, then resume the regular application schedule.
Overdose Instructions	Overdose with oral terbinafine is uncommon. Symptoms are generally an exaggeration of known side effects, including severe gastrointestinal upset (nausea, vomiting, abdominal pain), headache, and dizziness. There is no specific antidote for terbinafine overdose. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Monitor liver function. Seek medical attention if a large amount is ingested or severe symptoms develop. Topical overdose is unlikely to cause systemic toxicity but may lead to increased local irritation.
Medicine Interactions	♦ CYP2D6 Inhibitors (e.g., cimetidine, fluconazole, amiodarone, selective serotonin reuptake inhibitors - SSRIs like fluoxetine, paroxetine): Can significantly increase plasma concentrations of oral terbinafine, leading to increased side effects. Dose adjustment of terbinafine may be necessary. ♦ CYP2D6 Substrates (e.g., tricyclic antidepressants - TCAs like desipramine, clomipramine; beta-blockers like metoprolol; selective serotonin reuptake inhibitors - SSRIs like fluoxetine, paroxetine): Terbinafine is a strong inhibitor of CYP2D6, potentially increasing the levels and toxicity of drugs metabolized by this enzyme. Monitor and adjust doses of co-administered CYP2D6 substrates. ♦ Caffeine: Terbinafine may reduce caffeine clearance, potentially leading to increased caffeine effects. ♦ Rifampin (a CYP inducer): Can decrease terbinafine levels, potentially reducing its efficacy. ♦ Warfarin: Rare reports of altered INR/PT with concomitant use. Monitor INR closely. ♦ Oral Contraceptives: Rare reports of menstrual irregularities, though causality is not firmly established.

Tetracycline (Sumycin)

Purpose/Indication	Tetracycline is a broad-spectrum antibiotic used to treat a wide range of bacterial infections, including respiratory tract infections, urinary tract infections, skin infections, and certain sexually transmitted infections like chlamydia and gonorrhea (when penicillin is contraindicated). It is also effective against atypical organisms such as Mycoplasma pneumoniae, Chlamydia psittaci (psittacosis), Rickettsiae (Rocky Mountain spotted fever, typhus), and in conditions like acne vulgaris, cholera, and Lyme disease.
Method of Action	Tetracycline acts by reversibly binding to the 30S ribosomal subunit of susceptible bacteria, thereby inhibiting bacterial protein synthesis. This prevents the attachment of aminoacyl transfer RNA (tRNA) to the ribosomal A site, effectively blocking the elongation of the polypeptide chain and ultimately inhibiting bacterial growth (bacteriostatic action). This mechanism allows it to exert its antimicrobial effects against a wide variety of Gram-positive and Gram-negative bacteria, as well as some other microorganisms.
Medication Name & Brand Names	♦ Medication Name: Tetracycline Hydrochloride ♦ Brand Names: Sumycin, Achromycin V, Tetracyn (regional), Tetracycline (generic)
Pharmaceutical Forms & Appearance	Tetracycline is available as oral capsules or tablets, and also as a topical ointment/solution for skin infections and an ophthalmic ointment for eye infections. Oral capsules are typically hard gelatin capsules, often yellow, with specific imprints. Tablets are usually film-coated. The topical and ophthalmic preparations are typically yellow.
Dosage & Administration	Dosage varies by indication and patient age. For adults, typical oral doses are 250 mg to 500 mg every 6 hours (four times daily). For acne, lower doses (e.g., 250 mg once or twice daily) may be used long-term. It is crucial to take oral tetracycline on an empty stomach, at least 1 hour before or 2 hours after meals, and with a full glass of water. Avoid taking it with milk, dairy products, antacids, or iron supplements due to significant absorption interference. Complete the full prescribed course of treatment.
Supplied As	Tetracycline is supplied as: oral capsules (e.g., 250 mg, 500 mg), oral tablets (e.g., 250 mg, 500 mg), topical ointment/solution, and ophthalmic ointment.
Contraindications	Tetracycline is strictly contraindicated in pregnancy and in children under 8 years of age due to the risk of permanent tooth discoloration (yellow-gray-brown) and inhibition of bone growth. It is also contraindicated in patients with known hypersensitivity to tetracycline or any other tetracycline antibiotic. Use in severe renal impairment may also be a contraindication or require extreme caution.
Storage & Expiry	Tetracycline capsules/tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging. Degradation products of tetracycline can be nephrotoxic, so expired tetracycline should not be used.
Side Effects	Common side effects include gastrointestinal disturbances (nausea, vomiting, diarrhea, abdominal pain), photosensitivity (increased sensitivity to sunlight, leading to severe sunburn), and tooth discoloration (in children under 8). More serious but less common side effects include esophageal irritation/ulceration (if taken without sufficient water or lying down), liver toxicity, renal dysfunction, benign intracranial hypertension (pseudotumor cerebri), and superinfections (e.g., Clostridioides difficile-associated diarrhea).
Warnings & Precautions	♦ Tooth Discoloration & Bone Effects: Contraindicated in children under 8 years of age and during pregnancy/lactation due to irreversible tooth discoloration and potential inhibition of bone growth. ♦ Photosensitivity: Can cause severe sunburn-like reactions. Advise patients to avoid prolonged sun exposure, use sunscreen, and wear protective clothing. Discontinue at the first sign of erythema. ♦ Esophageal Irritation/Ulceration: Can cause severe esophageal irritation, especially if taken without sufficient water or lying down immediately after ingestion. Advise patients to take with a full glass of water and remain upright for at least 30 minutes to 1 hour. ♦ Renal Impairment: Use with caution in patients with renal impairment; higher doses may lead to excessive systemic accumulation and liver toxicity. Some formulations (e.g., doxycycline) are preferred. ♦ Hepatic Impairment: Use with caution; can cause liver toxicity, especially in high doses or in patients with pre-existing liver disease. ♦ Benign Intracranial Hypertension (Pseudotumor Cerebri): Can cause increased intracranial pressure with symptoms like headache, blurred vision, or papilledema. Discontinue if symptoms occur. ♦ Superinfection: Prolonged use can lead to overgrowth of non-susceptible organisms, including fungi and Clostridioides difficile (leading to C. diff-associated diarrhea). ♦ Myasthenia Gravis: Use with caution as it may exacerbate muscle weakness. ♦ Drug Resistance: Use responsibly to prevent the development of antibiotic resistance. ♦ Oral Absorption: Very susceptible to chelation; must be taken on an empty stomach and separated from interacting substances.
Missed Dose Instructions	If a dose of Tetracycline is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course is crucial for successful bacterial eradication and preventing the development of antibiotic resistance.
Overdose Instructions	Overdose symptoms are primarily an exaggeration of known side effects, including severe gastrointestinal upset (nausea, vomiting, diarrhea), potential liver toxicity, and renal impairment. There is no specific antidote for tetracycline overdose. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion to reduce absorption. Hemodialysis is generally not effective for removing tetracycline. Monitor liver and kidney function. Seek medical attention if a large amount is ingested or severe symptoms develop.

Medicine Interactions	♦ Antacids (containing aluminum, calcium, magnesium), Iron Supplements, Zinc, Bismuth Subsalicylate: Significantly chelate tetracycline, forming insoluble complexes and reducing its absorption. Administer tetracycline at least 2 hours before or 4-6 hours after these agents. ♦ Dairy Products (Milk, Cheese, Yogurt): Contain calcium, which also chelates tetracycline and reduces absorption. Avoid taking tetracycline with dairy products. ♦ Oral Contraceptives: Tetracyclines may reduce the effectiveness of oral contraceptives, increasing the risk of unintended pregnancy. Advise alternative birth control methods. ♦ Warfarin & other Anticoagulants: May potentiate the anticoagulant effect, increasing bleeding risk by altering gut flora and vitamin K synthesis. Monitor INR closely. ♦ Penicillins: Tetracycline is bacteriostatic, and can interfere with the bactericidal action of penicillins. Avoid concomitant use when the bactericidal effect of penicillin is crucial. ♦ Methoxyflurane: Concomitant use with tetracyclines has been associated with fatal renal toxicity. Avoid. ♦ Ergot Alkaloids: Increased risk of ergotism. ♦ Retinoids (e.g., isotretinoin, acitretin): Concomitant use increases the risk of benign intracranial hypertension (pseudotumor cerebri). Avoid concomitant use. ♦ Digoxin: May increase digoxin absorption due to altered gut flora. Monitor digoxin levels.

Tinidazole (Tindamax)

Purpose/Indication	Tinidazole is an antimicrobial agent primarily used to treat various anaerobic bacterial and protozoal infections. It is indicated for trichomoniasis (a sexually transmitted infection), giardiasis, amebiasis (intestinal and hepatic), and bacterial vaginosis. It is also used in combination regimens for the eradication of Helicobacter pylori (associated with peptic ulcers).
Method of Action	Tinidazole is a nitroimidazole antimicrobial that works by being selectively activated within anaerobic bacteria and protozoa. Once inside the organism, its nitro group is reduced by microbial enzymes, forming reactive nitro radicals. These highly reactive intermediates damage the organism's DNA, causing strand breaks and inhibiting nucleic acid synthesis, which leads to cell death. This selective activation mechanism is crucial for its efficacy against anaerobic pathogens while having less effect on aerobic host cells.
Medication Name & Brand Names	♦ Medication Name: Tinidazole ♦ Brand Names: Tindamax, Fasigyn (regional), Tinidazole (generic)
Pharmaceutical Forms & Appearance	Tinidazole is available as oral tablets. Tablets are typically film-coated, round or oval, and may vary in color (e.g., white to off-white). They often have specific imprints indicating strength or manufacturer.
Dosage & Administration	Dosage varies significantly by indication and can often involve single doses or short courses. For trichomoniasis and bacterial vaginosis, a common adult dose is a single 2 gram oral dose. For giardiasis and amebiasis, doses vary from a single 2 gram dose to 2 grams daily for 2-3 days. For H. pylori eradication, it's usually 500 mg twice daily for 7-14 days as part of a multi-drug regimen. Tablets should be taken with food to minimize gastrointestinal upset.
Supplied As	Tinidazole is supplied as: oral tablets (e.g., 250 mg, 500 mg).
Contraindications	Tinidazole is contraindicated in patients with known hypersensitivity to tinidazole or any other nitroimidazole derivative (e.g., metronidazole). It is also contraindicated during the first trimester of pregnancy due to potential fetal harm, and in breastfeeding mothers during and for 3 days after treatment. It should not be used in patients with active neurological disorders or a history of blood dyscrasias.
Storage & Expiry	Tinidazole tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances (nausea, metallic taste, vomiting, diarrhea, abdominal pain), dizziness, and headache. More serious but less common side effects include seizures, peripheral neuropathy (numbness, tingling), transient leukopenia (low white blood cell count), and allergic reactions (rash, itching). A disulfiram-like reaction (flushing, palpitations, nausea, vomiting) can occur with alcohol consumption.
Warnings & Precautions	♦ Alcohol Interaction: Can cause a disulfiram-like reaction (e.g., abdominal cramps, nausea, vomiting, headaches, flushing) if alcohol is consumed during therapy and for at least 3 days after stopping tinidazole. Advise patients to avoid all alcohol-containing products. ♦ Neurological Effects: Rare but serious adverse neurological reactions, including seizures and peripheral neuropathy (e.g., numbness, paresthesia, weakness), have been reported. Discontinue if abnormal neurological symptoms develop. ♦ Blood Dyscrasias: Transient leukopenia and neutropenia have been observed. Use with caution in patients with a history of blood dyscrasias. ♦ Vaginal Candidiasis: Treatment for trichomoniasis can lead to the development of candidiasis, requiring antifungal treatment. ♦ Hepatic Impairment: Use with caution in patients with severe hepatic impairment as tinidazole is metabolized in the liver. ♦ Pregnancy & Lactation: Contraindicated in the first trimester of pregnancy due to potential genotoxicity. Avoid during breastfeeding and for 3 days after the last dose due to excretion into breast milk. ♦ Drug Resistance: Use responsibly to prevent the development of drug resistance.
Missed Dose Instructions	Tinidazole regimens often involve single doses or short courses. If a scheduled dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose (for multi-dose regimens), skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course is crucial for effective eradication of the infection.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset (nausea, vomiting, abdominal pain) and potential neurological effects (dizziness, headache, peripheral neuropathy, seizures). There is no specific antidote for tinidazole overdose. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Hemodialysis can remove tinidazole from the blood and may be beneficial in severe overdose. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Alcohol: STRICTLY AVOID during therapy and for at least 3 days after stopping tinidazole due to the risk of disulfiram-like reaction. ♦ Oral Anticoagulants (e.g., warfarin): Tinidazole may potentiate the anticoagulant effect of warfarin, increasing the risk of bleeding. Monitor INR closely, especially when initiating or discontinuing tinidazole. ♦ Lithium: May increase serum lithium concentrations and the risk of lithium toxicity. Monitor lithium levels closely. ♦ Phenytoin/Fosphenytoin: May increase phenytoin levels. ♦ Cyclosporine: May increase cyclosporine levels. ♦ Cimetidine: May prolong the half-life of tinidazole, increasing its exposure. ♦ Phenobarbital & Rifampin (CYP Inducers): May decrease tinidazole levels, potentially reducing its efficacy. ♦ Fluorouracil: May increase the toxicity of fluorouracil.

Tramadol (Ultram)

Purpose/Indication	Tramadol is an opioid analgesic indicated for the management of moderate to moderately severe pain in adults. It can be used for acute pain, chronic pain, and sometimes for neuropathic pain. It is often considered a weaker opioid but still carries risks associated with opioid use.

Method of Action	Tramadol has a dual mechanism of action. It acts as a weak opioid agonist, binding to mu-opioid receptors in the central nervous system, thereby inhibiting pain transmission. Additionally, it inhibits the reuptake of norepinephrine and serotonin, which enhances descending inhibitory pain pathways and contributes to its analgesic effects. This dual action provides a synergistic effect in pain relief.
Medication Name & Brand Names	♦ Medication Name: Tramadol Hydrochloride ♦ Brand Names: Ultram, Conzip (extended-release), Ryzolt (extended-release), Tramal (regional), Tramacet (tramadol/paracetamol combination - regional), Tramadol (generic)
Pharmaceutical Forms & Appearance	Tramadol is available as oral tablets (immediate-release and extended-release), oral capsules (immediate-release and extended-release), and oral drops/solution. Tablets and capsules vary in color, shape, and imprint depending on strength and manufacturer. Extended-release formulations are designed for once-daily dosing.
Dosage & Administration	Dosage is individualized based on pain severity, patient response, and tolerance. For immediate-release tablets/capsules, typical adult oral doses start at 50 mg every 4-6 hours as needed, with a maximum generally not exceeding 400 mg per day. For extended-release formulations, doses usually range from 100 mg to 300 mg once daily. It can be taken with or without food. Dosage should be tapered gradually upon discontinuation to avoid withdrawal symptoms.
Supplied As	Tramadol is supplied as: oral immediate-release tablets (e.g., 50 mg), oral extended-release tablets/capsules (e.g., 100 mg, 150 mg, 200 mg, 300 mg), and oral drops/solution (e.g., 100 mg/mL - regional).
Contraindications	Tramadol is strictly contraindicated in patients with known hypersensitivity to tramadol, opioids, or any component of the formulation. It is contraindicated in situations where opioids are contraindicated, such as acute or severe bronchial asthma in an unmonitored setting, significant respiratory depression, or paralytic ileus. It is also contraindicated in patients who have consumed significant amounts of alcohol, hypnotics, analgesics, or psychotropic drugs. Concomitant use with MAOIs is strictly contraindicated.
Storage & Expiry	Tramadol tablets, capsules, and oral solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed, child-resistant containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, constipation, dizziness, headache, drowsiness, vomiting, and sweating. More serious but less common side effects include seizures, serotonin syndrome, respiratory depression, opioid dependence/addiction, withdrawal symptoms, and anaphylactoid reactions.
Warnings & Precautions	♦ BLACK BOX WARNING: Addiction, Abuse, and Misuse: Tramadol exposes patients and other users to the risks of opioid addiction, abuse, and misuse, which can lead to overdose and death. Assess each patient's risk prior to prescribing and monitor regularly. ♦ BLACK BOX WARNING: Respiratory Depression: Serious, life-threatening, or fatal respiratory depression may occur. Monitor closely, especially during initiation or after a dose increase. ♦ BLACK BOX WARNING: Accidental Ingestion: Accidental ingestion of even one dose, especially by children, can result in a fatal overdose. ♦ BLACK BOX WARNING: Neonatal Opioid Withdrawal Syndrome: Prolonged use during pregnancy can result in neonatal opioid withdrawal syndrome, which may be life-threatening if not recognized and treated. ♦ BLACK BOX WARNING: CYP2D6 Ultrarapid Metabolizers: Life-threatening respiratory depression or death can occur in children who are ultrarapid metabolizers of codeine into morphine. Tramadol is not recommended for pediatric patients younger than 12 years of age. Avoid in adolescents 12 to 18 years of age who are obese or have sleep apnea or severe lung disease. ♦ Seizures: Can lower the seizure threshold. The risk is increased with higher doses, concomitant use of SSRIs/SNRIs, tricyclic antidepressants, antipsychotics, and other drugs that lower the seizure threshold. Use with caution in patients with epilepsy or a history of seizures. ♦ Serotonin Syndrome: Potentially life-threatening condition that can occur with concomitant use of other serotonergic drugs (e.g., SSRIs, SNRIs, MAOIs, tricyclic antidepressants, lithium, triptans, St. John's Wort). Symptoms include mental status changes, autonomic instability, neuromuscular aberrations, and GI symptoms. Discontinue immediately if suspected. ♦ Suicidal Risk: Increased risk of suicidal thoughts and behavior, particularly in patients with depression or a history of suicidal ideation. ♦ Adrenal Insufficiency: May occur with opioid use. ♦ Androgen Deficiency: Long-term opioid use may result in decreased fertility and sexual dysfunction. ♦ Concomitant CNS Depressants (e.g., alcohol, benzodiazepines): Potentiates CNS depression and respiratory depression. Use with extreme caution. ♦ Renal/Hepatic Impairment: Use with caution and reduce dose due to decreased clearance. ♦ Driving/Operating Machinery: Impairs mental and physical abilities; avoid dangerous activities. ♦ Withdrawal Symptoms: Avoid abrupt discontinuation; taper dose gradually.
Missed Dose Instructions	If a dose of Tramadol is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For extended-release formulations, do not take a missed dose if it's close to the next scheduled dose; maintain the once-daily rhythm. Consistency is important for chronic pain management.
Overdose Instructions	Overdose symptoms are similar to other opioids and include severe respiratory depression, somnolence progressing to stupor or coma, skeletal muscle flaccidity, cold and clammy skin, constricted pupils, bradycardia, and hypotension. In severe cases, circulatory collapse, cardiac arrest, and death can occur. Seizures may also occur. There is a specific opioid antagonist, naloxone, which can reverse respiratory depression, but it may not fully reverse the non-opioid components of tramadol's toxicity (e.g., serotonin reuptake inhibition) and may precipitate withdrawal. Treatment is supportive and symptomatic, focusing on maintaining an open airway, ventilation, and cardiovascular support. Seek immediate emergency medical help.
Medicine Interactions	♦ MAOIs (Monoamine Oxidase Inhibitors, e.g., phenelzine, tranylcypromine, selegiline, linezolid, methylene blue): STRICTLY CONTRAINDICATED. Concomitant use or use within 14 days of stopping an MAOI can lead to severe adverse reactions, including serotonin syndrome and hypertensive crisis. ♦ Other CNS Depressants (e.g., alcohol, benzodiazepines, other opioids, sedatives, hypnotics, anxiolytics, general anesthetics, phenothiazines, skeletal muscle relaxants): Additive CNS and respiratory depressant effects. Concomitant use of benzodiazepines and opioids may result in profound sedation, respiratory depression, coma, and death (BLACK BOX WARNING for many opioids). Avoid or limit dosages and durations. ♦ Serotonergic Drugs (e.g., SSRIs, SNRIs, TCAs, triptans, lithium, St. John's Wort, buspirone, fentanyl, dextromethorphan): Increased risk of serotonin syndrome. Use with caution; monitor for symptoms. ♦ CYP2D6 Inhibitors (e.g., quinidine, fluoxetine, paroxetine, cimetidine, amiodarone): Can inhibit the metabolism of tramadol to its active O-desmethyltramadol metabolite, potentially reducing analgesic efficacy. ♦ CYP3A4 Inducers (e.g., carbamazepine, rifampin, phenytoin, St. John's Wort): Can decrease tramadol levels, potentially reducing efficacy. Carbamazepine also increases tramadol metabolism, which can reduce its analgesic effect and increase the risk of seizures. Concomitant use with carbamazepine is generally not recommended. ♦ Warfarin: Rare reports of increased INR and bleeding. Monitor INR closely. ♦ Digoxin: Rare reports of digoxin toxicity. ♦ Naloxone: Will reverse opioid effects but may not fully reverse serotonin reuptake inhibition effects, and may precipitate

Tretinoin (Retin-A)

Purpose/Indication	Tretinoin is a retinoid medication primarily used topically for the treatment of acne vulgaris and to reduce the appearance of fine wrinkles, mottled hyperpigmentation, and tactile roughness associated with photodamage. Oral tretinoin is specifically indicated for the induction of remission in acute promyelocytic leukemia (APL). Its various formulations target different conditions by influencing cellular growth and differentiation.

Method of Action	Tretinoin (all-trans retinoic acid) works by binding to specific retinoic acid receptors (RARs) found in the nucleus of cells, which then bind to DNA and regulate gene expression. For acne, this leads to increased cell turnover in the follicular epithelium, preventing the formation of new comedones (blackheads and whiteheads), and promoting the expulsion of existing ones. It also has anti-inflammatory properties. For photodamage, it influences epidermal cell differentiation and proliferation, and promotes collagen synthesis in the dermis. For APL, it induces terminal differentiation of promyelocytes, leading to their maturation and preventing uncontrolled proliferation.
Medication Name & Brand Names	♦ Medication Name: Tretinoin ♦ Brand Names: Retin-A, Renova, Tretinoin (generic), Atralin, Altreno, Refissa, Vesanoid (oral for APL)
Pharmaceutical Forms & Appearance	Tretinoin is available in various topical forms including creams, gels, and solutions, and as oral capsules for specific systemic indications. Topical creams are typically white to yellowish, gels are translucent or yellowish, and solutions are clear. Oral capsules (for APL) are usually soft gelatin capsules, brown-orange.
Dosage & Administration	Dosage and administration vary significantly by formulation and indication. For topical acne/photodamage, a thin layer of cream, gel, or solution is applied to the affected areas once daily, usually in the evening, after washing and drying the skin. Start with lower concentrations (e.g., 0.025%) and gradually increase as tolerated. For oral APL, the typical adult dose is 45 mg/m2/day divided into two equally daily doses, taken with food, until complete remission or for a maximum of 90 days. Topical use should be gradual to avoid irritation; oral use requires specialized medical supervision.
Supplied As	Tretinoin is supplied as: topical creams (e.g., 0.025%, 0.05%, 0.1%), topical gels (e.g., 0.01%, 0.025%, 0.05%), topical solutions (e.g., 0.05%), and oral capsules (e.g., 10 mg for APL).
Contraindications	Topical tretinoin is generally contraindicated in patients with known hypersensitivity to tretinoin or any component of the formulation. Oral tretinoin for APL has fewer absolute contraindications due to the severity of the disease, but caution is used. Both topical and oral forms are contraindicated in pregnancy due to significant teratogenic risk. Oral tretinoin is also contraindicated in breastfeeding mothers.
Storage & Expiry	Topical tretinoin creams/gels/solutions should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and excessive heat. Keep tubes/bottles tightly closed. Oral tretinoin capsules should be stored refrigerated (2°C to 8°C or 36°F to 46°F) and protected from light. Always check the specific expiry date on the packaging.
Side Effects	Common side effects for topical tretinoin include local skin irritation (redness, dryness, peeling, stinging, burning), increased sensitivity to sunlight, and initial worsening of acne ("purging"). Common side effects for oral tretinoin (for APL) are more severe and include "retinoic acid syndrome" (fever, dyspnea, weight gain, pleural/pericardial effusion), headache, dry skin/mucous membranes, cheilitis, rash, bone pain, and elevated liver enzymes.
Warnings & Precautions	♦ Teratogenicity (Pregnancy Risk): STRICT BLACK BOX WARNING (for oral tretinoin, and strong warning for topical). Tretinoin is a potent teratogen and can cause severe birth defects. It is absolutely contraindicated in pregnancy. Females of reproductive potential must use two reliable forms of contraception and have negative pregnancy tests before, during, and after treatment (for oral). Topical absorption is minimal but still carries a theoretical risk, so avoid in pregnancy. ♦ Photosensitivity: Both topical and oral forms increase sensitivity to sunlight and artificial UV light. Advise patients to use sunscreen, wear protective clothing, and avoid excessive sun exposure. ♦ Skin Irritation (Topical): Initial irritation (redness, peeling, burning) is common. Reduce frequency or concentration if severe. Avoid contact with eyes, mouth, nose, and mucous membranes. ♦ Retinoic Acid Syndrome (Oral APL): A potentially life-threatening complication characterized by fever, dyspnea, acute respiratory distress, weight gain, pleural/pericardial effusions, and hypotension. Requires immediate medical attention and often treatment with corticosteroids. ♦ Leukocytosis (Oral APL): Rapid increase in white blood cell count. ♦ Pseudotumor Cerebri/Benign Intracranial Hypertension (Oral): Can occur, especially in children. Monitor for symptoms (headache, visual disturbances). ♦ Lipid Abnormalities (Oral): Can cause hypertriglyceridemia and hypercholesterolemia. Monitor lipid profiles. ♦ Liver Dysfunction (Oral): Can cause elevated liver enzymes. Monitor LFTs. ♦ Special Populations (Oral APL): Use with caution in patients with hepatic or renal impairment.
Missed Dose Instructions	For topical tretinoin: If a dose is missed, apply it as soon as remembered. However, if it's nearly time for the next scheduled application, skip the missed dose and apply the next one at the regular time. Do not apply a double amount. Consistency is important, but excessive application can increase irritation. For oral tretinoin (APL): This is a critical medication for a serious condition, administered under strict medical supervision. If a dose is missed, contact the treating physician or healthcare team immediately for instructions, as adherence is paramount for treatment success.
Overdose Instructions	Topical Overdose: Excessive application of topical tretinoin will not yield faster or better results but will significantly increase local irritation (redness, peeling, discomfort). Systemic absorption from topical overdose is unlikely to cause systemic toxicity. Wash off excess product. Treat irritation symptomatically. Oral Overdose (APL): Overdose symptoms are generally an exaggeration of common side effects, including severe headache, nausea, vomiting, skin and mucosal dryness, cheilitis, and abdominal discomfort. More severe effects like pseudotumor cerebri, hyperlipidemia, and liver enzyme elevations could occur. There is no specific antidote. Treatment is supportive and symptomatic. Gastric lavage may be considered if recent. Monitor for signs of retinoic acid syndrome and manage accordingly. Seek immediate emergency medical help.
Medicine Interactions	♦ Topical Preparations: ♦ Abrasive Soaps/Cleansers, Astringents, Alcohol-containing Products: May cause additive irritation, dryness, or peeling when used concurrently with topical tretinoin. ♦ Medicated Soaps/Cleansers/Cosmetics: Use with caution. ♦ Photosensitizing Drugs (e.g., thiazides, tetracyclines, sulfonamides, phenothiazines): May increase photosensitivity risk when used with topical tretinoin. ♦ Oral Preparations (for APL): ♦ CYP3A4 Inducers (e.g., rifampin, phenytoin, carbamazepine, phenobarbital): Can decrease plasma concentrations of oral tretinoin, potentially reducing its efficacy. Dose adjustment of tretinoin may be needed. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, erythromycin, diltiazem, verapamil): May increase plasma concentrations of oral tretinoin, potentially increasing toxicity. ♦ Fibrates/Statins: Increased risk of myalgia or rhabdomyolysis when used with oral tretinoin, possibly due to exacerbation of hypertriglyceridemia. ♦ Vitamin A Supplements: Avoid high doses due to potential additive toxicity (hypervitaminosis A syndrome). ♦ Other Retinoids: Avoid concomitant use due to additive toxicity.

Trimethoprim (Primsol)

Purpose/Indication	Trimethoprim is an antibiotic primarily used for the treatment of uncomplicated urinary tract infections (UTIs) caused by susceptible organisms. It is also used in combination with sulfamethoxazole (as co-trimoxazole or trimethoprim/sulfamethoxazole) for a broader range of infections, including respiratory tract infections, otitis media, gastrointestinal infections, and Pneumocystis jirovecii pneumonia (PJP). When used alone, its indication is generally limited to UTIs.
Method of Action	Trimethoprim exerts its antibacterial effect by selectively inhibiting bacterial dihydrofolate reductase (DHFR). This enzyme is crucial for the synthesis of tetrahydrofolic acid, a necessary cofactor in the bacterial synthesis of purines, thymidine, and ultimately DNA and RNA. By inhibiting DHFR, trimethoprim blocks bacterial nucleic acid and protein synthesis, leading to bacteriostatic action. When combined with sulfamethoxazole, a synergistic bactericidal effect is achieved as sulfamethoxazole inhibits an earlier step in the folate synthesis pathway.
Medication Name & Brand Names	♦ Medication Name: Trimethoprim ♦ Brand Names: Primsol (oral solution - regional), Trimpex (regional), Monoprim (regional), Trimethoprim (generic) ♦ Combination Products: Bactrim, Septra, Co-trimoxazole (trimethoprim/sulfamethoxazole)

Pharmaceutical Forms & Appearance	Trimethoprim is available as oral tablets and an oral solution. Tablets are typically white, round or oval, and may be scored with specific imprints. The oral solution is usually clear and colorless to pale yellow, often with a fruity flavor.
Dosage & Administration	Dosage varies by indication and patient factors. For uncomplicated urinary tract infections, the typical adult oral dose is 100 mg twice daily for 3-10 days, or 200 mg once daily for 3-5 days. It can be taken with or without food. Ensure adequate fluid intake during treatment. Dose adjustments are necessary for patients with renal impairment.
Supplied As	Trimethoprim is supplied as: oral tablets (e.g., 100 mg, 200 mg) and oral solution (e.g., 50 mg/5 mL).
Contraindications	Trimethoprim is contraindicated in patients with known hypersensitivity to trimethoprim or any component of the formulation. It is also contraindicated in patients with documented megaloblastic anemia due to folate deficiency, or in patients with severe renal impairment (CrCl < 15 mL/min) if unable to be monitored closely. Its use in infants less than 2 months of age is generally not recommended due to theoretical risk of kernicterus.
Storage & Expiry	Trimethoprim tablets and oral solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include gastrointestinal disturbances (nausea, vomiting, diarrhea, abdominal pain), rash, pruritus (itching), and headache. More serious but less common side effects include hyperkalemia (high potassium levels), bone marrow suppression (e.g., megaloblastic anemia, leukopenia, thrombocytopenia), kidney dysfunction, and severe skin reactions (e.g., Stevens-Johnson Syndrome).
Warnings & Precautions	♦ Hematologic Effects/Bone Marrow Suppression: Trimethoprim can interfere with folate metabolism, leading to megaloblastic anemia, leukopenia, or thrombocytopenia, especially in patients with pre-existing folate deficiency (e.g., elderly, chronic alcoholics, malnourished, or those on anticonvulsants), or long-term high-dose therapy. Monitor complete blood counts (CBC) periodically, especially with prolonged use or in at-risk patients. Administering folinic acid (leucovorin) can mitigate these effects. ♦ Hyperkalemia: Can cause hyperkalemia, particularly in elderly patients, those with renal impairment, or those receiving high doses or concomitant potassium-sparing diuretics. Monitor serum potassium levels. ♦ Renal Impairment: Use with caution and dose adjust in patients with renal impairment. Can cause transient increases in serum creatinine without affecting glomerular filtration rate. ♦ Allergic Reactions/Skin Reactions: Rash is common. Severe cutaneous adverse reactions (e.g., Stevens-Johnson Syndrome, toxic epidermal necrolysis) are rare but serious. Discontinue at first sign of rash. ♦ Folice Deficiency: Use with caution in patients with potential folate deficiency. ♦ Pregnancy & Lactation: Should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus, as it is a folate antagonist. It is excreted in breast milk. ♦ Liver Dysfunction: Use with caution in patients with severe hepatic impairment. ♦ Driving/Operating Machinery: May cause dizziness; advise caution.
Missed Dose Instructions	If a dose of Trimethoprim is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course of antibiotics is crucial for effective bacterial eradication and preventing the development of drug resistance.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including acute (nausea, vomiting, diarrhea, headache, dizziness) and chronic (bone marrow depression leading to megaloblastic anemia, leukopenia, thrombocytopenia). There is no specific antidote for trimethoprim. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Folinic acid (leucovorin) can be administered to counteract bone marrow depression. Forced diuresis may increase excretion. Hemodialysis is modestly effective. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Potassium-Sparing Diuretics (e.g., spironolactone, amiloride, triamterene): Increased risk of severe hyperkalemia. Monitor serum potassium closely. ♦ Digoxin: Trimethoprim can increase serum digoxin concentrations, especially in elderly patients, increasing the risk of digoxin toxicity. Monitor digoxin levels. ♦ Warfarin: May potentiate the anticoagulant effect of warfarin, increasing the risk of bleeding. Monitor INR closely. ♦ Phenytoin: May increase phenytoin levels. ♦ Methotrexate: Concomitant use can lead to increased bone marrow suppression due to additive folate antagonism. Avoid or use with extreme caution, and consider folinic acid supplementation. ♦ Pyrimethamine: Increased risk of megaloblastic anemia. ♦ ACE Inhibitors/ARBs: Increased risk of hyperkalemia. ♦ Procainamide: May increase procainamide levels. ♦ Lamivudine, Zidovudine: Potential for interaction with their renal elimination. ♦ Rifampin: Can affect trimethoprim levels.

Trimethoprim/Sulfamethoxazole (TMP/SMX) (Bactrim)

Purpose/Indication	Trimethoprim/Sulfamethoxazole (TMP/SMX), also known as co-trimoxazole, is a synergistic antibacterial combination used to treat a wide range of infections. It is commonly indicated for urinary tract infections, respiratory tract infections (including exacerbations of chronic bronchitis), otitis media, traveler's diarrhea, and specific serious infections like Pneumocystis jirovecii pneumonia (PJP), nocardiosis, and toxoplasmosis. Its broad spectrum and dual mechanism make it effective against many Gram-positive and Gram-negative bacteria.
Method of Action	This combination works by sequentially blocking two different steps in the bacterial folic acid synthesis pathway, leading to a synergistic bactericidal effect. Sulfamethoxazole, a sulfonamide, inhibits the incorporation of para-aminobenzoic acid (PABA) into dihydrofolic acid. Trimethoprim then inhibits bacterial dihydrofolate reductase, an enzyme responsible for converting dihydrofolic acid to tetrahydrofolic acid. By disrupting two essential steps in bacterial folate metabolism, both DNA and protein synthesis are halted, leading to effective bacterial eradication.
Medication Name & Brand Names	♦ Medication Name: Trimethoprim/Sulfamethoxazole (Co-trimoxazole) ♦ Brand Names: Bactrim, Septra, Resprim (regional), Co-trimoxazole (generic)
Pharmaceutical Forms & Appearance	Trimethoprim/Sulfamethoxazole is available as oral tablets (both regular and double strength), an oral suspension, and an intravenous (IV) infusion. Oral tablets are typically white, round or oval, and may be scored. The oral suspension is usually white to off-white. The IV solution is clear and colorless to yellowish.
Dosage & Administration	Dosage varies widely depending on the indication, patient's age, weight, and renal function. For uncomplicated urinary tract infections, a common adult oral dose is 160 mg TMP/800 mg SMX (double strength tablet) every 12 hours for 3-10 days. For PJP treatment, much higher doses (e.g., 15-20 mg/kg/day TMP and 75-100 mg/kg/day SMX, divided into 3-4 doses) are used. IV infusion must be diluted before administration. It can be taken with or without food, but taking it with food may reduce gastrointestinal upset. Adequate hydration is important to prevent crystalluria.
Supplied As	Trimethoprim/Sulfamethoxazole is supplied as: oral tablets (e.g., 80 mg TMP/400 mg SMX; 160 mg TMP/800 mg SMX), oral suspension (e.g., 40 mg TMP/200 mg SMX per 5 mL), and concentrate for intravenous infusion (e.g., 80 mg TMP/400 mg SMX per 5 mL vial).
Contraindications	Trimethoprim/Sulfamethoxazole is strictly contraindicated in patients with known hypersensitivity to trimethoprim or sulfonamides, or any component of the formulation. It is also contraindicated in infants less than 2 months of age (due to risk of kernicterus), during pregnancy (especially near term), in breastfeeding mothers of infants less than 2 months old, and in patients with documented megaloblastic anemia due to folate deficiency. Severe hepatic impairment or marked renal impairment (CrCl < 15 mL/min) without close monitoring are also contraindications.

Storage & Expiry	Trimethoprim/Sulfamethoxazole tablets and oral suspension should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light. Oral suspension should not be refrigerated. IV concentrate should be stored at room temperature. Always check the specific expiry date on the packaging. Once reconstituted or diluted (for IV), use promptly according to specific product instructions.
Side Effects	Common side effects include gastrointestinal disturbances (nausea, vomiting, diarrhea, abdominal pain), rash, pruritus (itching), and headache. More serious side effects can include severe skin reactions (e.g., Stevens-Johnson Syndrome, toxic epidermal necrolysis), hyperkalemia (high potassium), bone marrow suppression (e.g., megaloblastic anemia, leukopenia, thrombocytopenia), liver injury, acute kidney injury, and crystalluria.
Warnings & Precautions	♦ Severe Hypersensitivity Reactions/Skin Reactions: Can cause severe, life-threatening, or fatal cutaneous adverse reactions (e.g., Stevens-Johnson Syndrome, toxic epidermal necrolysis, DRESS syndrome). Discontinue at the first appearance of skin rash. ♦ Hematologic Effects/Bone Marrow Suppression: Can cause bone marrow depression (e.g., megaloblastic anemia, leukopenia, neutropenia, thrombocytopenia) by interfering with folate metabolism. Risk is increased with high doses, prolonged therapy, elderly patients, or pre-existing folate deficiency. Monitor complete blood counts (CBC) regularly. Folinic acid (leucovorin) may be given to counteract this. ♦ Hyperkalemia: Can cause hyperkalemia, especially in elderly patients, those with renal impairment, or those receiving high doses or concomitant potassium-sparing diuretics. Monitor serum potassium levels. ♦ Renal Impairment & Crystalluria: Can cause acute kidney injury or crystalluria. Maintain adequate hydration during treatment to prevent crystalluria. Dose adjustment is mandatory for patients with renal impairment. ♦ Hepatic Impairment: Cases of liver injury, including fatal hepatic necrosis, have been reported. Use with caution in patients with hepatic impairment. ♦ Fetal Toxicity: Contraindicated in pregnancy, especially near term, due to risk of kernicterus in the infant and folate antagonism. ♦ G6PD Deficiency: Can cause hemolytic anemia in glucose-6-phosphate dehydrogenase (G6PD) deficient patients. Avoid or use with extreme caution. ♦ Hypoglycemia: Rare cases of hypoglycemia, especially in patients with impaired renal function, liver disease, or malnutrition. ♦ Clostridioides difficile-associated Diarrhea (CDAD): Can occur with nearly all antibacterial agents, including TMP/SMX. ♦ Photosensitivity: Can cause photosensitivity reactions. Advise patients to avoid prolonged sun exposure. ♦ Porphyria: May exacerbate acute intermittent porphyria.
Missed Dose Instructions	If a dose of Trimethoprim/Sulfamethoxazole is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Completing the full prescribed course of antibiotics is crucial for effective bacterial eradication and preventing the development of drug resistance and relapse of infection.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, including acute (nausea, vomiting, diarrhea, headache, dizziness) and chronic (bone marrow depression leading to megaloblastic anemia, leukopenia, thrombocytopenia; severe skin reactions; hyperkalemia; kidney dysfunction). There is no specific antidote for TMP/SMX overdose. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Administer folinic acid (leucovorin) to counteract bone marrow depression. Maintain hydration to prevent crystalluria. Acidification of urine can enhance sulfamethoxazole excretion, but alkalinization is sometimes preferred to prevent crystalluria. Hemodialysis is modestly effective. Seek immediate emergency medical help.
Medicine Interactions	♦ Warfarin: Potentiates the anticoagulant effect of warfarin significantly, increasing the risk of bleeding. Monitor INR closely, especially when initiating or discontinuing TMP/SMX. ♦ Methotrexate: Concomitant use can lead to increased bone marrow suppression due to additive folate antagonism. Avoid or use with extreme caution, and consider folinic acid supplementation. ♦ Potassium-Sparing Diuretics (e.g., spironolactone, amiloride, triamterene), ACE Inhibitors, ARBs, Eplerenone: Increased risk of severe hyperkalemia. Monitor serum potassium closely. ♦ Phenytoin: May increase phenytoin levels, increasing the risk of toxicity. Monitor phenytoin levels. ♦ Digoxin: May increase serum digoxin concentrations, especially in elderly patients, increasing the risk of digoxin toxicity. Monitor digoxin levels. ♦ Cyclosporine: May lead to increased risk of nephrotoxicity and decreased cyclosporine levels. ♦ Oral Hypoglycemics (sulfonylureas, e.g., glipizide, glyburide): May potentiate hypoglycemic effect. Monitor blood glucose. ♦ Lamivudine, Zidovudine: Potential for interaction with their renal elimination. ♦ Amiodarone: Increased risk of QT prolongation and torsades de pointes. ♦ Antacids (containing aluminum, magnesium): May decrease absorption of sulfamethoxazole.

Valacyclovir (Valtrex)

Purpose/Indication	Valacyclovir is an antiviral medication used to treat various herpes virus infections. It is indicated for the treatment of herpes zoster (shingles), genital herpes (initial and recurrent episodes, and for suppression of recurrent episodes), and herpes labialis (cold sores). It is also used to reduce the risk of transmission of genital herpes to uninfected partners when used as suppressive therapy.
Method of Action	Valacyclovir is a prodrug of acyclovir. After oral administration, it is rapidly and extensively converted to acyclovir by first-pass intestinal and hepatic metabolism. Acyclovir then enters herpesvirus-infected cells, where it is selectively phosphorylated by viral thymidine kinase to acyclovir monophosphate, which is then further phosphorylated by cellular kinases to acyclovir triphosphate. Acyclovir triphosphate competitively inhibits viral DNA polymerase and is incorporated into viral DNA, leading to chain termination and inhibition of viral DNA replication. This selective activation mechanism ensures its antiviral activity is primarily directed at virus-infected cells.
Medication Name & Brand Names	♦ Medication Name: Valacyclovir Hydrochloride ♦ Brand Names: Valtrex, Valacyclovir (generic)
Pharmaceutical Forms & Appearance	Valacyclovir is available as oral film-coated tablets. Tablets are typically white, caplet-shaped, and film-coated, with specific imprints indicating strength and/or manufacturer.
Dosage & Administration	Dosage varies significantly by indication and patient renal function. For herpes zoster (shingles), the typical adult oral dose is 1 gram three times daily for 7 days. For genital herpes (initial episode), 1 gram twice daily for 7-10 days. For recurrent genital herpes, 500 mg twice daily for 3 days. For suppression of recurrent genital herpes, 1 gram once daily (or 500 mg once daily for some patients). For herpes labialis (cold sores), 2 grams twice daily for 1 day. Dosage adjustments are necessary for patients with renal impairment. Can be taken with or without food. Start treatment at the first sign or symptom of infection.
Supplied As	Valacyclovir is supplied as: oral film-coated tablets (e.g., 500 mg, 1 gram).
Contraindications	Valacyclovir is contraindicated in patients with known hypersensitivity to valacyclovir, acyclovir, or any component of the formulation.
Storage & Expiry	Valacyclovir tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.

Side Effects	Common side effects include headache, nausea, abdominal pain, and fatigue. More serious but less common side effects, particularly with high doses or in patients with renal impairment, include central nervous system effects (e.g., confusion, hallucinations, agitation, dizziness, seizures), and acute kidney injury. Thrombotic thrombocytopenic purpura/hemolytic uremic syndrome (TTP/HUS) is a rare but life-threatening complication reported in immunocompromised patients, especially those with severe HIV or post-renal transplant.
Warnings & Precautions	♦ Renal Impairment: Dose adjustment is necessary for patients with renal impairment to prevent acyclovir accumulation and increased risk of adverse effects, especially CNS effects and nephrotoxicity. Maintain adequate hydration during treatment. ♦ CNS Effects: Can cause neurological symptoms, including confusion, agitation, dizziness, hallucinations, and seizures, especially in elderly patients or those with renal impairment. Monitor for these symptoms. ♦ Immunocompromised Patients: Patients with advanced HIV disease or those who have undergone bone marrow or renal transplantation may be at increased risk of TTP/HUS (Thrombotic Thrombocytopenic Purpura/Hemolytic Uremic Syndrome), a rare but potentially fatal complication. Use with caution in these populations. ♦ Hydration: Ensure adequate hydration during therapy, particularly when taking high doses or in patients with renal impairment, to prevent renal tubular crystallization. ♦ Transmission of Genital Herpes: Valacyclovir suppressive therapy reduces but does not eliminate the risk of genital herpes transmission. Patients should still be advised to practice safe sex. ♦ Elderly Patients: More likely to have impaired renal function; dose adjustment and close monitoring for adverse effects are crucial. ♦ Driving/Operating Machinery: May cause dizziness or CNS effects; advise caution.
Missed Dose Instructions	If a dose of Valacyclovir is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For optimal antiviral effect, especially in acute infections, adhering to the prescribed dosing schedule is important.
Overdose Instructions	Overdose symptoms are generally an exaggeration of known side effects, primarily gastrointestinal upset (nausea, vomiting), headache, and neurological symptoms (dizziness, confusion, hallucinations). Acute renal failure is a potential serious complication, especially with large doses. Hemodialysis can significantly remove acyclovir from the blood and may be beneficial in cases of severe overdose or acute renal failure. Treatment is supportive and symptomatic. Maintain hydration. Seek medical attention if a large amount is ingested or severe symptoms develop.
Medicine Interactions	♦ Nephrotoxic Drugs (e.g., NSAIDs, aminoglycosides, cyclosporine, tacrolimus, cisplatin): Concomitant use with valacyclovir may increase the risk of renal dysfunction due to additive nephrotoxicity. Monitor renal function closely. ♦ Cimetidine & Probenecid: Both drugs can increase acyclovir plasma concentrations by reducing its renal clearance, potentially increasing the risk of acyclovir-related toxicity. Co-administration should be with caution, and dose reduction of valacyclovir may be necessary, especially in patients with renal impairment. ♦ Mycophenolate Mofetil (MMF): Concomitant use with valacyclovir may increase plasma concentrations of both drugs due to competition for renal tubular secretion. Monitor patients closely. ♦ No significant interactions with most other commonly used medications are expected due to valacyclovir's rapid conversion to acyclovir and acyclovir's primary renal excretion with minimal hepatic metabolism.

Valsartan (Diovan)

Purpose/Indication	Valsartan is an angiotensin II receptor blocker (ARB) primarily used for the treatment of hypertension (high blood pressure). It is also indicated for heart failure to reduce cardiovascular mortality and morbidity, and to reduce cardiovascular mortality in clinically stable patients with left ventricular failure or left ventricular dysfunction following myocardial infarction. Its purpose is to lower blood pressure, improve cardiac function, and provide cardiovascular protection.
Method of Action	Valsartan works by selectively blocking the binding of angiotensin II to the angiotensin II type 1 (AT1) receptor in various tissues, including vascular smooth muscle, the adrenal gland, and the heart. Angiotensin II is a potent vasoconstrictor and also stimulates aldosterone secretion, leading to sodium and water retention, and promotes cardiac remodeling. By blocking AT1 receptors, valsartan causes vasodilation, reduces aldosterone-mediated effects, and ultimately lowers blood pressure and reduces cardiac workload without affecting ACE.
Medication Name & Brand Names	♦ Medication Name: Valsartan ♦ Brand Names: Diovan, Valsartan (generic) ♦ Combination Products: Diovan HCT (valsartan/hydrochlorothiazide), Entresto (valsartan/sacubitril), Exforge (valsartan/amlodipine), Exforge HCT (valsartan/amlodipine/hydrochlorothiazide)
Pharmaceutical Forms & Appearance	Valsartan is available as oral film-coated tablets. Tablets are typically round or oval, film-coated, and may vary in color and imprint depending on strength (e.g., yellowish-white to red-brown, with specific imprints indicating dose).
Dosage & Administration	Dosage is individualized based on the patient's condition, blood pressure response, and renal function. For hypertension, the typical adult oral dose is 80 mg to 160 mg once daily. The dose can be adjusted from 40 mg to 320 mg once daily. For heart failure and post-MI, the typical starting dose is 20 mg or 40 mg twice daily, titrated up to a target dose of 160 mg twice daily as tolerated. It can be taken with or without food.
Supplied As	Valsartan is supplied as: oral film-coated tablets (e.g., 40 mg, 80 mg, 160 mg, 320 mg).
Contraindications	Valsartan is strictly contraindicated in patients with known hypersensitivity to valsartan or any component of the formulation. It is strictly contraindicated in pregnancy due to the risk of fetal injury or death. Concomitant use with aliskiren is contraindicated in patients with diabetes mellitus or renal impairment (eGFR < 60 mL/min/1.73m2).
Storage & Expiry	Valsartan tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from moisture. Keep in the original tightly closed container. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include dizziness, headache, fatigue, and orthostatic hypotension. More serious but less common side effects include hyperkalemia (high potassium levels), renal impairment, hypotension, and rarely, angioedema (swelling of the face, lips, tongue, throat), though less frequent than with ACE inhibitors.
Warnings & Precautions	♦ BLACK BOX WARNING: Fetal Toxicity: Use of drugs that act on the renin-angiotensin system during the second and third trimesters of pregnancy can cause injury and death to the developing fetus. Discontinue as soon as pregnancy is detected. ♦ Hypotension: May cause symptomatic hypotension, especially in volume-depleted patients (e.g., those on high-dose diuretics), or in severe heart failure. Initiate with low doses and monitor. ♦ Hyperkalemia: Can cause hyperkalemia, especially in patients with renal impairment, diabetes, or those taking potassium-sparing diuretics, potassium supplements, or other drugs that increase potassium. Monitor serum potassium closely. ♦ Renal Impairment: Can cause acute renal failure, particularly in patients with pre-existing renal insufficiency, severe congestive heart failure, or bilateral renal artery stenosis. Monitor renal function regularly. ♦ Dual Blockade of RAAS: Dual blockade of the renin-angiotensin-aldosterone system (RAAS) with ARBs, ACE inhibitors, or aliskiren is associated with increased risks of hypotension, hyperkalemia, and renal function changes; generally avoid. (Contraindicated with aliskiren in diabetes/renal impairment). ♦ Angioedema: Rare cases of angioedema have been reported. If laryngeal stridor or angioedema of the face, extremities, lips, tongue, glottis, or larynx occurs, discontinue valsartan immediately. ♦ Aortic/Mitral Valve Stenosis or Hypertrophic Obstructive Cardiomyopathy: Use with caution.

MEDICATION

Medication

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Missed Dose Instructions	If a dose of Valsartan is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. Consistent daily dosing is important for effective blood pressure control and cardiovascular protection, especially in conditions like heart failure.
Overdose Instructions	Overdose symptoms are primarily severe hypotension, dizziness, and tachycardia (rapid heart rate). Bradycardia (slow heart rate) may also occur. There is no specific antidote for valsartan. Treatment is supportive and symptomatic. Maintain fluid and electrolyte balance. If ingestion was recent, gastric lavage and activated charcoal may be considered. Lay the patient supine with legs elevated. IV fluid infusion and vasopressors may be needed for hypotension. Valsartan is not removed by hemodialysis. Seek immediate emergency medical help.
Medicine Interactions	♦ Aliskiren: Contraindicated in patients with diabetes mellitus or renal impairment due to increased risk of hypotension, hyperkalemia, and renal impairment. ♦ Potassium-Sparing Diuretics (e.g., spironolactone, amiloride, triamterene) & Potassium Supplements: Significant risk of severe hyperkalemia. Avoid concomitant use or monitor potassium levels very closely. ♦ NSAIDs (Non-Steroidal Anti-inflammatory Drugs, including selective COX-2 inhibitors): May reduce the antihypertensive effect of ARBs and increase the risk of renal impairment, especially in elderly, volume-depleted, or renally impaired patients. Use with caution. ♦ Lithium: ARBs can reduce the renal clearance of lithium, leading to increased serum lithium levels and toxicity. Monitor lithium levels closely. ♦ Diuretics: Enhanced hypotensive effect, especially with the first dose. Consider withholding diuretics prior to initiating valsartan. ♦ ACE Inhibitors (e.g., enalapril, lisinopril): Dual blockade of RAAS with an ARB and an ACE inhibitor is generally not recommended due to increased risk of adverse events. ♦ Sacubitril (in Entresto): Used in combination to enhance effects in heart failure; specific contraindications and warnings apply for this combination. ♦ No significant interactions with cytochrome P450 enzymes.

Vancomycin (Vancocin)

Purpose/Indication	Vancomycin is a glycopeptide antibiotic primarily used to treat serious and life-threatening infections caused by Gram-positive bacteria, especially methicillin-resistant Staphylococcus aureus (MRSA) and Clostridioides difficile infection (CDI) in its oral form. Intravenous vancomycin is indicated for conditions like complicated skin and soft tissue infections, bloodstream infections, endocarditis, osteomyelitis, and pneumonia, particularly when caused by multidrug-resistant Gram-positive pathogens. Oral vancomycin is used exclusively for CDI.
Method of Action	Vancomycin exerts its bactericidal effect by inhibiting bacterial cell wall synthesis. It binds to the D-Ala-D-Ala terminus of peptidoglycan precursors, preventing the incorporation of these building blocks into the growing cell wall. This action weakens the bacterial cell wall, leading to increased permeability, osmotic lysis, and ultimately bacterial cell death. Its unique mechanism of action makes it effective against many Gram-positive bacteria, including those resistant to beta-lactam antibiotics.
Medication Name & Brand Names	♦ Medication Name: Vancomycin Hydrochloride ♦ Brand Names: Vancocin (oral capsules), Firvanq (oral solution), Vanco (generic for IV and oral)
Pharmaceutical Forms & Appearance	Vancomycin is available as a powder for injection (for intravenous or oral reconstitution), and oral capsules or an oral solution. The powder for injection is typically white to off-white, and the reconstituted solution is clear and colorless to pale yellow. Oral capsules are typically white to off-white, and the oral solution is generally clear.
Dosage & Administration	Dosage varies significantly by indication, patient weight, renal function, and therapeutic drug monitoring. For intravenous systemic infections, typical adult doses are 15-20 mg/kg (up to 1-2 grams) every 8-12 hours, adjusted to achieve target trough levels (e.g., 10-20 mcg/mL). For oral Clostridioides difficile infection, typical adult doses are 125 mg to 500 mg orally four times daily for 10-14 days. IV vancomycin must be infused slowly over at least 60 minutes to avoid "red man syndrome." Oral vancomycin is not absorbed systemically and is used only for gut infections.
Supplied As	Vancomycin is supplied as: sterile powder for injection (e.g., 500 mg, 1 gram, 10 grams per vial), oral capsules (e.g., 125 mg, 250 mg), and powder for oral solution.
Contraindications	Vancomycin is contraindicated in patients with known hypersensitivity to vancomycin. Intravenous vancomycin is generally not indicated for mild infections or as a first-line agent where less toxic antibiotics are effective. Oral vancomycin is not for systemic infections.
Storage & Expiry	Vancomycin powder for injection should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F). Once reconstituted, the solution stability varies by concentration and diluent (check specific product information, often stable for 24 hours at room temperature or longer refrigerated). Oral capsules should be stored at room temperature. Oral solution, once prepared, typically requires refrigeration and has a limited shelf life (e.g., 14 days). Always check the specific expiry date on the packaging.
Side Effects	The most significant side effects are nephrotoxicity (kidney damage) and ototoxicity (hearing loss, tinnitus, vertigo). Other common side effects include "red man syndrome" (a non-IgE mediated infusion-related reaction with flushing, rash, itching, and hypotension due to rapid IV infusion), phlebitis at the infusion site, and gastrointestinal upset with oral use.
Warnings & Precautions	♦ BLACK BOX WARNING (in some regions/products): Nephrotoxicity & Ototoxicity: Vancomycin can cause both nephrotoxicity and ototoxicity, which may be irreversible. The risk is increased with higher doses, prolonged therapy, pre-existing renal impairment, and concomitant use of other nephrotoxic or ototoxic drugs. Monitor serum creatinine and vancomycin trough levels frequently. Perform audiometric testing for high-risk patients or those on prolonged therapy. ♦ Red Man Syndrome (Infusion-Related Reactions): Occurs with rapid intravenous infusion. Characterized by flushing, rash (erythematous or urticarial), pruritus, hypotension, and sometimes angioedema or chest pain. Prevent by infusing over at least 60 minutes (or longer for larger doses) and by premedicating with antihistamines. ♦ Oral Use for CDI: Oral vancomycin is not absorbed systemically and is not effective for systemic infections; it is only for Clostridioides difficile infection. ♦ Superinfection: Prolonged use can lead to overgrowth of non-susceptible organisms. ♦ Neutropenia/Thrombocytopenia: Rare reports of transient neutropenia or thrombocytopenia, especially with high doses or prolonged use. Monitor blood counts. ♦ Pseudomembranous Colitis: Although used to treat CDI, it can rarely cause or exacerbate it if a different pathogen causes the colitis. ♦ Allergic Reactions: Rare severe hypersensitivity reactions (e.g., anaphylaxis).
Missed Dose Instructions	Vancomycin is typically administered by healthcare professionals in a controlled setting (e.g., hospital) for IV use, or strict adherence for oral CDI treatment. For IV vancomycin, adherence to the prescribed dosing schedule and therapeutic drug monitoring (trough levels) is crucial for efficacy and safety. If a dose is missed, it should be reported immediately to the prescribing healthcare professional, who will determine the appropriate course of action based on the patient's condition, renal function, and upcoming trough level measurements. For oral vancomycin (CDI), take the missed dose as soon as remembered. If it is almost time for the next dose, skip the missed dose and continue with the regular schedule. Do not take a double dose.

Vancomycin (Vancocin)	
Overdose Instructions	Overdose symptoms are primarily severe nephrotoxicity (acute renal failure) and ototoxicity (hearing loss, tinnitus, vertigo). Other symptoms may include hypotension, profound "red man syndrome" if IV infused, and potential for more generalized toxicity. There is no specific antidote for vancomycin. Treatment is supportive and symptomatic. Hemodialysis or hemofiltration can significantly remove vancomycin from the blood and may be beneficial in severe overdose or acute renal failure. Maintain hydration and monitor renal function, hearing, and vital signs closely. Seek immediate emergency medical help.
Medicine Interactions	♦ Other Nephrotoxic Drugs (e.g., aminoglycosides like gentamicin, amikacin; amphotericin B; cisplatin; cyclosporine; NSAIDs): Concomitant use significantly increases the risk of nephrotoxicity. Avoid or use with extreme caution and monitor renal function very closely. ♦ Other Ototoxic Drugs (e.g., aminoglycosides like gentamicin, amikacin; loop diuretics like furosemide; cisplatin): Concomitant use significantly increases the risk of ototoxicity. Avoid or use with extreme caution. ♦ Anesthetic Agents: Concomitant use of IV vancomycin with anesthetic agents has been associated with increased incidence of infusion-related reactions (e.g., hypotension, flushing, erythema, urticaria, bronchospasm) when administered prior to anesthesia. Infuse vancomycin slowly. ♦ Neuromuscular Blocking Agents (e.g., succinylcholine, rocuronium): Vancomycin can prolong the neuromuscular blocking effects. Monitor for prolonged respiratory depression. ♦ Cholestyramine (for oral vancomycin): May bind to oral vancomycin and reduce its efficacy. Administer several hours apart. ♦ No significant interactions with cytochrome P450 enzymes.

Venlafaxine (Effexor)

Venlafaxine (Effexor)	
Purpose/Indication	Venlafaxine is a serotonin-norepinephrine reuptake inhibitor (SNRI) antidepressant primarily used for the treatment of major depressive disorder (MDD). It is also indicated for generalized anxiety disorder (GAD), social anxiety disorder (SAD), and panic disorder (PD). Its purpose is to alleviate symptoms of depression and anxiety by restoring the balance of certain neurotransmitters in the brain.
Method of Action	Venlafaxine and its active metabolite, O-desmethylvenlafaxine (desvenlafaxine), work by potently inhibiting the reuptake of both serotonin and norepinephrine in the central nervous system. At lower doses, it primarily affects serotonin reuptake, while at higher doses, it also significantly inhibits norepinephrine reuptake. This dual reuptake inhibition leads to increased concentrations of these neurotransmitters in the synaptic cleft, enhancing their activity and thereby exerting antidepressant and anxiolytic effects. It has a weak inhibitory effect on dopamine reuptake.
Medication Name & Brand Names	♦ Medication Name: Venlafaxine Hydrochloride ♦ Brand Names: Effexor (immediate-release), Effexor XR (extended-release), Venlafaxine (generic)
Pharmaceutical Forms & Appearance	Venlafaxine is available as oral tablets (immediate-release) and extended-release capsules or tablets. Immediate-release tablets are typically round or oval, and may vary in color. Extended-release capsules often contain beads, and can vary in color and size. Extended-release tablets are often film-coated and may be oblong.
Dosage & Administration	Dosage is individualized based on the patient's condition and response, starting with a low dose and gradually titrating upwards. For MDD, typical adult oral starting doses are 75 mg/day (for extended-release) or 37.5 mg twice daily (for immediate-release), often increasing to 75-225 mg/day. Doses can be up to 375 mg/day for severe depression in hospitalized patients. Extended-release forms are taken once daily. It should be taken with food. Dosage should be tapered gradually upon discontinuation to avoid withdrawal symptoms.
Supplied As	Venlafaxine is supplied as: oral immediate-release tablets (e.g., 25 mg, 37.5 mg, 50 mg, 75 mg, 100 mg), and oral extended-release capsules (e.g., 37.5 mg, 75 mg, 150 mg, 225 mg) or tablets.
Contraindications	Venlafaxine is strictly contraindicated in patients with known hypersensitivity to venlafaxine or any component of the formulation. It is absolutely contraindicated in patients taking monoamine oxidase inhibitors (MAOIs) or within 14 days of stopping an MAOI, due to the significant risk of serotonin syndrome. Conversely, an MAOI should not be started within at least 7 days of stopping venlafaxine.
Storage & Expiry	Venlafaxine tablets and capsules should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include nausea, headache, insomnia, dizziness, sweating, dry mouth, constipation, nervousness, and sexual dysfunction. More serious but less common side effects include elevated blood pressure, serotonin syndrome, seizures, increased risk of suicidal thoughts and behavior (especially in young adults), hyponatremia, and withdrawal symptoms upon abrupt discontinuation.
Warnings & Precautions	♦ BLACK BOX WARNING: Suicidality: Antidepressants increase the risk of suicidal thoughts and behavior in children, adolescents, and young adults (up to age 24) with major depressive disorder and other psychiatric disorders. Monitor patients closely for clinical worsening, suicidality, or unusual changes in behavior. ♦ Serotonin Syndrome: Potentially life-threatening condition that can occur with concomitant use of other serotonergic drugs (e.g., MAOIs - contraindicated, SSRIs, triptans, lithium, tramadol, St. John's Wort). Symptoms include mental status changes, autonomic instability, neuromuscular aberrations, and GI symptoms. Discontinue immediately if suspected. ♦ Elevated Blood Pressure: Can cause sustained dose-related increases in blood pressure. Monitor blood pressure regularly, especially with dose increases. Pre-existing hypertension should be controlled before starting venlafaxine. ♦ Withdrawal Symptoms: Abrupt discontinuation or rapid dose reduction, especially after prolonged use, can lead to severe withdrawal symptoms (e.g., dizziness, headache, nausea, paresthesia, anxiety, dysphoria, insomnia). Taper dose gradually over weeks to months. ♦ Seizures: Can lower the seizure threshold. Use with caution in patients with a history of seizures. ♦ Mania/Hypomania Activation: Can precipitate a manic or hypomanic episode in patients with bipolar disorder. Screen for bipolar disorder before initiating. ♦ Hyponatremia: Can cause hyponatremia (low sodium levels), especially in elderly or volume-depleted patients. ♦ Abnormal Bleeding: May increase the risk of bleeding, especially with concomitant use of antiplatelet agents or anticoagulants. ♦ Angle-Closure Glaucoma: Can cause mydriasis (pupil dilation), potentially triggering an acute angle-closure glaucoma attack. Use with caution in patients with a history of glaucoma. ♦ Renal/Hepatic Impairment: Use with caution and reduce dose in patients with renal or hepatic impairment. ♦ Sexual Dysfunction: Common side effect. ♦ Driving/Operating Machinery: May impair judgment, thinking, or motor skills.
Missed Dose Instructions	If a dose of Venlafaxine (immediate-release) is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For extended-release (XR) formulations, if a dose is missed, take it as soon as remembered if it's within the same day. If it's the next day, skip the missed dose and resume your regular once-daily schedule. Do not take two doses at once. Consistent daily dosing is important for maintaining stable drug levels and therapeutic effect.

Overdose Instructions	Overdose symptoms range from mild (somnolence, nausea, vomiting, dizziness, tachycardia) to severe (seizures, serotonin syndrome, QTc prolongation, ventricular arrhythmias, respiratory depression, coma). Fatal outcomes have been reported, especially in mixed overdoses. There is no specific antidote for venlafaxine overdose. Treatment is supportive and symptomatic. Focus on maintaining an open airway, ventilation, and cardiovascular support. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Continuous monitoring of cardiac rhythm and vital signs is essential. Dialysis is generally not effective due to the high volume of distribution. Seek immediate emergency medical help.
Medicine Interactions	♦ MAOIs (Monoamine Oxidase Inhibitors, e.g., phenelzine, tranylcypromine, selegiline, linezolid, methylene blue): STRICTLY CONTRAINDICATED. Concomitant use or use within 14 days of stopping an MAOI (or MAOI within 7 days of stopping venlafaxine) can lead to severe, potentially fatal serotonin syndrome. ♦ Other Serotonergic Drugs (e.g., SSRIs, SNRIs, triptans, tramadol, lithium, buspirone, fentanyl, St. John's Wort, dextromethorphan): Increased risk of serotonin syndrome. Use with caution; monitor for symptoms. ♦ Drugs that Affect Blood Pressure (e.g., alpha-blockers, beta-blockers): Venlafaxine can increase blood pressure; monitor concomitant use. ♦ Drugs that Lower Seizure Threshold (e.g., TCAs, other antidepressants, antipsychotics, bupropion, tramadol): Increased risk of seizures. Use with caution. ♦ Anticoagulants (e.g., warfarin) & Antiplatelet Agents (e.g., aspirin, NSAIDs): Increased risk of bleeding. Monitor INR closely for warfarin. ♦ Cimetidine: Can inhibit venlafaxine metabolism, increasing its levels. ♦ Haloperidol, Risperidone, Metoprolol: Venlafaxine can increase plasma levels of these drugs due to CYP2D6 inhibition. Monitor and adjust doses. ♦ Alcohol: Potentiates CNS depressant effects; avoid. ♦ CYP2D6 Inhibitors (e.g., fluoxetine, paroxetine, quinidine): May increase levels of venlafaxine, but decrease levels of its active metabolite, O-desmethylvenlafaxine. Overall, the ratio of active compounds remains similar, but caution is still advised. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, erythromycin, clarithromycin, indinavir): Can increase venlafaxine and O-desmethylvenlafaxine levels. Use with caution.

Verapamil (Calan)

Purpose/Indication	Verapamil is a non-dihydropyridine calcium channel blocker primarily used for the management of hypertension (high blood pressure), angina pectoris (chest pain due to reduced blood flow to the heart), and certain supraventricular tachyarrhythmias (abnormally fast heart rhythms originating above the ventricles, such as atrial fibrillation, atrial flutter, and paroxysmal supraventricular tachycardia - PSVT). It helps to relax blood vessels, reduce heart rate, and decrease the heart's workload.
Method of Action	Verapamil works by inhibiting the influx of extracellular calcium ions across the cell membranes of cardiac and vascular smooth muscle cells. This action leads to several physiological effects: 1) Vasodilation: Decreases peripheral vascular resistance, lowering blood pressure. 2) Negative Chronotropic Effect: Slows the heart rate by depressing sinus node automaticity and slowing conduction through the atrioventricular (AV) node. 3) Negative Inotropic Effect: Reduces myocardial contractility, decreasing the heart's workload. These combined effects contribute to its anti-hypertensive, anti-anginal, and anti-arrhythmic properties.
Medication Name & Brand Names	♦ Medication Name: Verapamil Hydrochloride ♦ Brand Names: Calan, Isoptin, Verelan (extended-release), Verelan PM (extended-release), Covera-HS (extended-release), Verapamil (generic)
Pharmaceutical Forms & Appearance	Verapamil is available as oral immediate-release tablets, oral extended-release tablets/capsules, and as an intravenous (IV) injection. Oral tablets are typically round or oval, and may be film-coated or sugar-coated, varying in color and imprint. Extended-release formulations are designed to be taken once or twice daily. The IV solution is clear and colorless.
Dosage & Administration	Dosage varies significantly by indication, patient response, and formulation. For oral hypertension, typical adult immediate-release doses are 80-120 mg three times daily, or extended-release 180-480 mg once daily. For angina, immediate-release doses typically range from 80-120 mg three times daily. For arrhythmias, doses are often individualized, starting with smaller oral doses (e.g., 40-80 mg 3-4 times daily) or IV bolus (e.g., 2.5-10 mg over 2 minutes). Oral forms can be taken with food. IV administration requires careful monitoring.
Supplied As	Verapamil is supplied as: oral immediate-release tablets (e.g., 40 mg, 80 mg, 120 mg), oral extended-release tablets/capsules (e.g., 120 mg, 180 mg, 240 mg, 360 mg), and solution for intravenous injection (e.g., 2.5 mg/mL).
Contraindications	Verapamil is strictly contraindicated in patients with known hypersensitivity to verapamil. It is also contraindicated in severe left ventricular dysfunction, hypotension (systolic BP < 90 mmHg), cardiogenic shock, sick sinus syndrome (unless a functional pacemaker is in place), second- or third-degree AV block (unless a functional pacemaker is in place), and in patients with atrial flutter or atrial fibrillation and an accessory bypass tract (e.g., Wolff-Parkinson-White or Lown-Ganong-Levine syndromes) due to risk of dangerously fast ventricular rates. Concomitant IV beta-blocker use is also a contraindication due to risk of severe bradycardia and asystole.
Storage & Expiry	Verapamil tablets, capsules, and IV solution should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers. Do not freeze the IV solution. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include constipation (very common with oral forms), headache, dizziness, fatigue, nausea, and peripheral edema (swelling of ankles/feet). More serious but less common side effects include bradycardia (slow heart rate), AV block, hypotension, worsening of heart failure, and elevated liver enzymes.
Warnings & Precautions	♦ Cardiac Effects: Can cause bradycardia, AV block (potentially leading to asystole), and hypotension, especially with IV administration or in patients with pre-existing conduction abnormalities. Use with extreme caution in patients with heart failure or reduced left ventricular function as it can worsen cardiac output. ♦ Concomitant Beta-Blockers: Concomitant use (especially IV) with beta-blockers is generally contraindicated due to the additive effects on heart rate, AV conduction, and cardiac contractility, which can lead to severe bradycardia, AV block, and hypotension. Oral combination should be with caution. ♦ Hypotension: May cause symptomatic hypotension. Monitor blood pressure closely. ♦ Liver Dysfunction: Verapamil is extensively metabolized in the liver. Use with caution and consider dose reduction in patients with hepatic impairment, as drug levels can increase significantly. ♦ Kidney Dysfunction: Use with caution in patients with renal impairment; however, dose adjustment is usually not necessary unless severe. ♦ Geriatric Use: Elderly patients are more likely to experience adverse effects, especially bradycardia, constipation, and hypotension. Use lower starting doses. ♦ Grapefruit Juice: Can increase verapamil levels, potentially increasing side effects. Advise patients to avoid grapefruit juice. ♦ Neuromuscular Transmission: Has been reported to potentiate the effects of neuromuscular blocking agents. ♦ Digoxin: Can increase serum digoxin levels. Monitor digoxin levels and reduce digoxin dose if necessary. ♦ Constipation: A very common and often troublesome side effect; advise on dietary measures or laxatives.
Missed Dose Instructions	For oral immediate-release Verapamil: If a dose is missed, take it as soon as remembered. However, if it is almost time for the next scheduled dose, skip the missed dose and continue with the regular schedule. Do not take a double dose. For oral extended-release Verapamil: If a dose is missed, take it as soon as remembered if it's within several hours of the usual time. Otherwise, skip the missed dose and take the next one at the regular time. Do not take a double dose. Consistency is important for blood pressure and heart rate control.
Overdose Instructions	Overdose symptoms are typically profound hypotension, severe bradycardia, AV block (including complete heart block), asystole, reduced cardiac contractility, and metabolic acidosis. Non-cardiac effects may include hyperglycemia and confusion. There is no specific antidote for verapamil. Treatment is supportive and symptomatic. Gastric lavage and activated charcoal may be considered for recent oral ingestion. Intravenous calcium gluconate or calcium chloride can help reverse some cardiac depression. Other treatments include vasopressors (e.g., norepinephrine), atropine, glucagon, and inotropic agents (e.g., dopamine, dobutamine). Pacemaker insertion may be required for severe bradycardia/heart block. Hemodialysis is not effective. Seek immediate emergency medical help.

Medicine Interactions	♦ Beta-Blockers (e.g., metoprolol, propranolol): IV concomitant use is CONTRAINDICATED. Oral co-administration requires extreme caution due to additive negative effects on heart rate, AV conduction, and myocardial contractility, leading to severe bradycardia, heart block, and hypotension. ♦ Digoxin: Verapamil can increase serum digoxin levels by inhibiting its renal and biliary clearance. Monitor digoxin levels and reduce digoxin dose as needed. ♦ Antiarrhythmics (e.g., flecainide, disopyramide, quinidine, amiodarone): Increased risk of adverse cardiac effects due to additive effects on contractility, conduction, and heart rate. Avoid or use with extreme caution. ♦ Statins (especially simvastatin, lovastatin, atorvastatin): Verapamil inhibits CYP3A4, which metabolizes many statins, leading to increased statin levels and increased risk of myopathy/rhabdomyolysis. Consider lower statin doses or use statins not metabolized by CYP3A4 (e.g., pravastatin, rosuvastatin). ♦ Grapefruit Juice: Inhibits CYP3A4, increasing oral verapamil bioavailability and plasma levels, potentially increasing side effects. Advise patients to avoid. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenobarbital, phenytoin, St. John's Wort): Can decrease verapamil levels, reducing efficacy. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, erythromycin, ritonavir): Can increase verapamil levels, increasing toxicity. ♦ Alpha-Blockers (e.g., prazosin, doxazosin): Increased risk of hypotension. ♦ Lithium: May alter lithium levels. ♦ Neuromuscular Blocking Agents: May potentiate their effects. ♦ Aspirin: No significant interaction

Warfarin (Coumadin)

Purpose/Indication	Warfarin is an oral anticoagulant used to prevent and treat various thromboembolic conditions. It is indicated for the prophylaxis and treatment of venous thrombosis and its extension (e.g., deep vein thrombosis - DVT, pulmonary embolism - PE), prophylaxis and treatment of thromboembolic complications associated with atrial fibrillation and/or cardiac valve replacement, and to reduce the risk of death, recurrent myocardial infarction, and thromboembolic events after myocardial infarction. Its purpose is to thin the blood and prevent harmful blood clots.
Method of Action	Warfarin acts as a vitamin K antagonist. It inhibits the synthesis of vitamin K-dependent clotting factors (Factors II, VII, IX, X) and anticoagulant proteins C and S, which are produced in the liver. It does this by inhibiting vitamin K epoxide reductase (VKORC1), an enzyme essential for the recycling of oxidized vitamin K back to its reduced form, which is required for the carboxylation (activation) of these clotting factors. This leads to a dose-dependent decrease in the synthesis of functional clotting factors, resulting in an anticoagulant effect.
Medication Name & Brand Names	♦ Medication Name: Warfarin Sodium ♦ Brand Names: Coumadin, Jantoven, Marevan (regional), Warfarin (generic)
Pharmaceutical Forms & Appearance	Warfarin is available as oral tablets, and also as a powder for injection (for intravenous use, though less common than oral). Oral tablets are typically round, scored, and come in various colors to denote different strengths (e.g., pink-2.5mg, peach-3mg, yellow-5mg, lavender-6mg, green-7.5mg, white-10mg).
Dosage & Administration	Dosage is highly individualized and is guided by regular monitoring of the International Normalized Ratio (INR), a measure of blood clotting time. Initial adult oral doses often range from 2 mg to 5 mg once daily, adjusted based on INR response. The therapeutic INR target range typically falls between 2.0 and 3.0 for most indications, but higher for mechanical heart valves (e.g., 2.5-3.5). It should be taken once daily at the same time each day, with or without food. Compliance is crucial, and dose adjustments should only be made by a healthcare professional.
Supplied As	Warfarin is supplied as: oral tablets (e.g., 1 mg, 2 mg, 2.5 mg, 3 mg, 4 mg, 5 mg, 6 mg, 7.5 mg, 10 mg) and powder for intravenous injection (e.g., 5 mg per vial).
Contraindications	Warfarin is strictly contraindicated in pregnancy (except for women with mechanical heart valves at high risk for thromboembolism for whom the benefits may outweigh the risks), as it is a potent teratogen causing fetal bleeding and malformations (warfarin embryopathy). It is also contraindicated in patients with active bleeding, hemorrhagic tendencies (e.g., hemophilia, thrombocytopenia), recent or anticipated surgery with a high risk of bleeding, severe uncontrolled hypertension, recent hemorrhagic stroke, and conditions with high risk of hemorrhage (e.g., aortic aneurysm, severe liver disease, infectious endocarditis, active peptic ulcer disease).
Storage & Expiry	Warfarin tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed, original containers. Always check the specific expiry date on the packaging.
Side Effects	The most significant side effect is bleeding, which can range from minor (bruising, nosebleeds) to severe and life-threatening (e.g., gastrointestinal bleeding, intracranial hemorrhage). Other side effects include skin necrosis (rare, early in therapy), purple toe syndrome (rare), nausea, diarrhea, and abdominal pain.
Warnings & Precautions	♦ BLACK BOX WARNING: Fatal Bleeding: Warfarin can cause major or fatal bleeding. Regular monitoring of INR is essential to optimize therapy. Factors increasing bleeding risk include high intensity of anticoagulation (INR > 4.0), age 65 or older, history of GI bleeding, uncontrolled hypertension, history of stroke/TIA, serious heart disease, anemia, trauma, renal insufficiency, concomitant drugs. ♦ Pregnancy (Teratogenicity): STRICTLY CONTRAINDICATED in pregnancy (except for mechanical heart valves where benefit outweighs risk) due to severe birth defects (warfarin embryopathy) and fetal hemorrhage. Discuss risks and benefits with reproductive-aged women. ♦ INR Monitoring: Regular and frequent INR monitoring is crucial to ensure therapeutic anticoagulation and minimize bleeding risk. INR should be checked more frequently when starting or stopping medications, or with dietary changes. ♦ Dietary Vitamin K: Consistent daily intake of vitamin K (found in leafy green vegetables, certain oils) is important, as large fluctuations can affect INR. Avoid drastic changes in diet. ♦ Drug Interactions: Warfarin has numerous significant drug and herbal interactions (see below) that can dramatically alter its anticoagulant effect. Always inform healthcare providers about all medications, supplements, and herbal products. ♦ Liver Disease: Impaired liver function can reduce clotting factor synthesis, increasing warfarin's effect. Use with extreme caution and monitor INR closely. ♦ Renal Disease: May increase bleeding risk. ♦ Skin Necrosis/Gangrene: Rare but serious complication (usually within days of starting), typically in patients with protein C or S deficiency. ♦ Purple Toe Syndrome: Rare cholesterol microemboli. ♦ Falls: Increased risk of serious bleeding with falls, especially in elderly. ♦ Alcohol: Acute binge drinking may increase INR, chronic heavy drinking may decrease INR. Advise moderation or avoidance. ♦ Dental Procedures/Surgery: Patients must inform their dentist/surgeon they are on warfarin. Management (e.g., temporary discontinuation) should be guided by INR and procedural bleeding risk.
Missed Dose Instructions	If a dose of Warfarin is missed, take it as soon as remembered on the same day. However, if it's the next day, do not take a double dose to make up for a missed dose. Instead, take the regular dose and inform your healthcare provider that a dose was missed, as your INR may need to be checked sooner. Never adjust your dose without consulting your doctor.
Overdose Instructions	Overdose symptoms are primarily related to bleeding, ranging from minor bruising, nosebleeds, and blood in urine/stool to severe, life-threatening hemorrhage (e.g., intracranial, GI bleeding, retroperitoneal). The INR will be significantly elevated. Treatment involves stopping warfarin and administering vitamin K (oral or IV) to reverse its effects. In severe bleeding or dangerously high INR, fresh frozen plasma (FFP) or prothrombin complex concentrate (PCC) may be given to rapidly replenish clotting factors. Seek immediate emergency medical help.

Medicine Interactions	♦ NSAIDS (Non-Steroidal Anti-Inflammatory Drugs, e.g., ibuprofen, naproxen), Aspirin, Antiplatelet Agents (e.g., clopidogrel, ticagrelor), other Anticoagulants (e.g., heparin, DOACs): Significantly increase the risk of bleeding due to additive antiplatelet/anticoagulant effects or GI irritation. Concomitant use should be with extreme caution and frequent INR monitoring. ♦ CYP2C9 Inhibitors (e.g., amiodarone, fluconazole, metronidazole, fluoxetine, cimetidine, trimethoprim/sulfamethoxazole): Inhibit the metabolism of warfarin, leading to increased warfarin levels and greatly enhanced anticoagulant effect (increased INR). Dose reduction of warfarin often necessary; monitor INR very closely. ♦ CYP2C9 Inducers (e.g., rifampin, carbamazepine, phenobarbital, phenytoin, St. John's Wort): Increase the metabolism of warfarin, leading to decreased warfarin levels and reduced anticoagulant effect (decreased INR). Dose increase of warfarin often necessary; monitor INR very closely. ♦ Vitamin K Supplements/Foods High in Vitamin K (e.g., leafy green vegetables like spinach, kale, broccoli): Can reduce warfarin's anticoagulant effect. Maintain consistent dietary intake; avoid large fluctuations. ♦ Thyroid Hormones: Can increase warfarin's effect. ♦ Antibiotics (broad-spectrum): Can enhance warfarin's effect by altering gut flora (reducing vitamin K-producing bacteria). Monitor INR. ♦ Alcohol: Acute binge drinking can increase INR; chronic heavy drinking can decrease INR. ♦ Herbal Products (e.g., Ginkgo biloba, Garlic, Ginseng, Dong Quai, Feverfew): Many herbal products can interact with warfarin, either increasing bleeding risk or altering INR. Advise patients to avoid or consult a healthcare

Zolpidem (Ambien)

Purpose/Indication	Zolpidem is a sedative-hypnotic medication primarily indicated for the short-term treatment of insomnia, characterized by difficulties with sleep initiation. It helps patients fall asleep more quickly and maintain sleep, but its use is generally limited to short durations (e.g., 7-10 days) due to the risk of dependence and other adverse effects. Specific formulations (e.g., extended-release) also help with sleep maintenance.
Method of Action	Zolpidem is a non-benzodiazepine hypnotic that acts as a selective agonist at the benzodiazepine 1 (BZ1) receptor subtype of the gamma-aminobutyric acid (GABA)-A receptor complex in the brain. This selective binding enhances the inhibitory effects of GABA, leading to chloride ion influx, hyperpolarization of neurons, and resulting in sedative, hypnotic, and to a lesser extent, anxiolytic, muscle relaxant, and anticonvulsant effects. Its selective action on BZ1 receptors contributes to its more specific hypnotic profile compared to classic benzodiazepines.
Medication Name & Brand Names	♦ Medication Name: Zolpidem Tartrate ♦ Brand Names: Ambien (immediate-release), Ambien CR (extended-release), Edluar (sublingual), Intermezzo (sublingual for middle-of-the-night awakening), Stilnox (regional), Zolpidem (generic)
Pharmaceutical Forms & Appearance	Zolpidem is available as oral tablets (immediate-release and extended-release), and sublingual tablets. Immediate-release tablets are typically oval, film-coated, and vary in color depending on strength (e.g., white, pink). Extended-release tablets are often bilayered for immediate and sustained release. Sublingual tablets are designed to dissolve under the tongue.
Dosage & Administration	Dosage is individualized, with the lowest effective dose for the shortest duration. For immediate-release oral tablets, the typical adult dose is 5 mg or 10 mg taken once immediately before bedtime. For extended-release oral tablets, the typical adult dose is 6.25 mg or 12.5 mg once immediately before bedtime. The lowest dose should be used in elderly or debilitated patients. It should be taken on an empty stomach for faster onset, but for extended-release or if stomach upset occurs, it can be taken with a light meal. It should only be taken when the patient can get a full night's sleep (7-8 hours) to minimize next-day impairment.
Supplied As	Zolpidem is supplied as: oral immediate-release tablets (e.g., 5 mg, 10 mg), oral extended-release tablets (e.g., 6.25 mg, 12.5 mg), and sublingual tablets (e.g., 1.75 mg, 3.5 mg, 5 mg, 10 mg).
Contraindications	Zolpidem is contraindicated in patients with known hypersensitivity to zolpidem or any component of the formulation. It is also contraindicated in patients with known complex sleep behaviors after zolpidem use. Due to the risk of respiratory depression, it should be used with extreme caution or avoided in patients with severe respiratory insufficiency (e.g., severe COPD, sleep apnea).
Storage & Expiry	Zolpidem tablets should be stored at room temperature (typically 20°C to 25°C or 68°F to 77°F), protected from light and moisture. Keep in tightly closed containers and keep out of reach of children. Always check the specific expiry date on the packaging.
Side Effects	Common side effects include drowsiness, dizziness, headache, fatigue, nausea, and diarrhea. More serious but less common side effects include complex sleep behaviors (e.g., sleep-driving, making phone calls, preparing and eating food while not fully awake with no memory of the event), anterograde amnesia, hallucinations, agitation, dependence, and withdrawal symptoms upon abrupt discontinuation.
Warnings & Precautions	♦ Complex Sleep Behaviors: Can cause potentially dangerous complex sleep behaviors, including "sleep-driving" (driving while not fully awake with no memory of the event), making phone calls, or preparing and eating food. These events can occur after the first dose. Discontinue if a patient experiences such an episode. ♦ CNS Depression & Impaired Alertness: Can cause profound sedation, dizziness, and impaired motor coordination, affecting ability to drive or operate machinery the next day. The risk is dose-dependent and higher with inadequate sleep duration. ♦ Concomitant Opioid Use: BLACK BOX WARNING (in some regions/products): Concomitant use of sedative-hypnotics like zolpidem and opioids may result in profound sedation, respiratory depression, coma, and death. Reserve concomitant prescribing for patients for whom alternative treatment options are inadequate. Limit dosages and durations. ♦ Abuse, Misuse, Addiction: Zolpidem carries a risk of abuse, misuse, and addiction, which can lead to overdose or death. The risk is increased with higher doses, longer duration of use, and in patients with a history of substance abuse. ♦ Dependence & Withdrawal: Can cause physical dependence. Abrupt discontinuation or rapid dose reduction after prolonged use can lead to severe withdrawal symptoms (e.g., insomnia, anxiety, dysphoria, seizures, tremors, abdominal cramps). Taper dose gradually when discontinuing. ♦ Respiratory Depression: Use with caution in patients with compromised respiratory function (e.g., COPD, sleep apnea) due to the risk of exacerbating respiratory depression. ♦ Anterograde Amnesia: Can cause dose-related anterograde amnesia (difficulty remembering events after drug administration). Patients should ensure they have 7-8 hours of uninterrupted sleep. ♦ Paradoxical Reactions: Rarely, can cause paradoxical excitement, aggression, or hallucinations, particularly in elderly or psychiatric patients. Discontinue if these occur. ♦ Hepatic Impairment: Use with caution and consider dose reduction in patients with hepatic impairment, as zolpidem is extensively metabolized in the liver. ♦ Elderly Patients: Highly susceptible to CNS depressant effects; use lower starting doses (e.g., 5 mg for immediate-release) to minimize risk of falls and cognitive impairment. ♦ Depression/Suicidality: Use with caution in patients with depression; may be associated with increased risk of suicidal ideation. ♦ Tolerance: Develops with prolonged use, requiring higher doses to achieve the same effect. ♦ Duration of Use: Limit to short-term (7-10 nights) as efficacy beyond this period has not been established and risks increase.
Missed Dose Instructions	Zolpidem is an as-needed medication for sleep, taken right before bedtime. If a dose is missed (e.g., you forget to take it before going to sleep and wake up later), do not take it in the middle of the night or if you do not have a full 7-8 hours available for sleep before you need to be awake. Taking it too late can lead to next-day drowsiness and impaired function. Do not take a double dose.
Overdose Instructions	Overdose symptoms are typically central nervous system depression, ranging from somnolence to coma, with respiratory depression. Other symptoms may include confusion, impaired coordination, diminished reflexes, slurred speech, and hypotension. Severe consequences (coma, death) are more likely with co-ingestion of other CNS depressants, especially alcohol or opioids. There is a specific benzodiazepine receptor antagonist, flumazenil, which can reverse the sedative effects, but it should be used with caution due to the risk of seizures in patients dependent on zolpidem or those with mixed overdoses. Treatment is supportive and symptomatic, focusing on maintaining an open airway, ventilation, and cardiovascular support. Seek immediate emergency medical help.

R	Zolpidem (Ambien)	**Medicine Interactions**	♦ Alcohol: STRICTLY AVOID concomitant use due to additive CNS depressant effects, leading to profound sedation, respiratory depression, coma, and potentially death. ♦ Opioids (e.g., morphine, oxycodone, hydrocodone): BLACK BOX WARNING: Concomitant use significantly increases the risk of profound sedation, respiratory depression, coma, and death. Avoid concomitant use or limit dosages and durations if absolutely necessary. ♦ Other CNS Depressants (e.g., other hypnotics, sedatives, anxiolytics, antidepressants, antipsychotics, antihistamines, muscle relaxants, general anesthetics): Additive CNS depressant effects. Avoid or use with extreme caution. ♦ CYP3A4 Inhibitors (e.g., ketoconazole, itraconazole, clarithromycin, erythromycin, ritonavir, grapefruit juice): Can significantly inhibit zolpidem metabolism, leading to increased zolpidem levels and enhanced CNS depressant effects. Dose reduction of zolpidem may be necessary. ♦ CYP3A4 Inducers (e.g., rifampin, carbamazepine, phenytoin, phenobarbital, St. John's Wort): Can increase zolpidem metabolism, leading to decreased zolpidem levels and reduced efficacy. Avoid concomitant use if possible. ♦ Imipramine/Chlorpromazine: May decrease zolpidem's plasma levels. ♦ Sertraline: No significant interaction.

Illness

Common illnesses and how to treat them

"Never let the things you cannot do
prevent you from doing the things you can."
John Wooden

Introduction

A category listing the symptoms, identification methods, prevention methods and the treatment of common illnesses.

Purpose	The aim of ILLNESS is to inform the reader on the causes, symptoms, prevention techniques and treatments of the most common illnesses you're likely to pick up in a disaster.
Lost?	***** **QUICK TRIAGE (If you're injured or sick and looking for the correct section)** ***** ● **Sections under ILLNESS:** Radiation Sickness, Parasitic Infections, Bacterial Infections, Viral Infections, Fungal Infections, Altitude Sickness, Poisoning, Chemical Agents, Biological Agents. ● **Sections under INJURY:** Surface Wound & Bruises, Internal Injuries (Back Pain, Cerebral Hemorrhage, Bone Fractures, Dislocation, Concussion) Open Wounds, Avulsion, Burns, Environmental (Anaphylaxis, Heat Stroke, Hypothermia, Hyperthermia, Motion Sickness, Aero-otitis Media), Atmosphere (Asphyxiation, Drowning, Choking, Hypoxia, Carbon Monoxide Poisoning), Animal & Plant (Bites and Stings), Childbirth, Toothaches. ● **Sections under EMOTIONAL:** Depression, Anxiety, Stress, Confidence, Relaxation, Memory & Dementia, Grief & Loss, Postnatal Depression, New Parents, Body Image, Family & Friends and Healthy Living.

● For medications and recommended doses, see the MEDICATION section.
● For curing ailments naturally and herbal remedies, see the NATURAL REMEDIES section.
● For eating disorders, see the HEALTH > Nutrients section.

Contents

1 Parasitic

In evolutionary biology, parasitism is a relationship between species, where one organism, the parasite, lives on or in another organism, the host, causing it some harm, and is adapted structurally to this way of life. The entomologist E. O. Wilson has characterised parasites as "predators that eat prey in units of less than one". Parasites include protozoans such as the agents of malaria, sleeping sickness, and amoebic dysentery; animals such as hookworms, lice, mosquitoes, and vampire bats; fungi such as honey fungus and the agents of ringworm; and plants such as mistletoe, dodder, and the broomrapes.

ILLNESS

Parasitic

Parasites Overview	**Parasites** ● Ticks ● Fleas ● Louse ● Tapeworms ● Pinworms ● Roundworms	**Symptoms** Intestinal pain, alternating bouts of diarrhoea and constipation, bloating, excessive flatulence, irritable bowel syndrome, constant tiredness and fatigue, increasing allergies and a general decrease in immunity.	**Contamination** May enter body through contaminated water or food (particularly under cooked pork, beef and fish), mosquito bites, touching pets and other animals or any infected surface and then touching your nose or mouth.	**Treatment** Fresh Green Black Walnut Wormwood Complex - Take in the morning before any food and don't eat for an hour.

Incubation Period
The delay between consumption of a contaminated food and appearance of the first symptoms of illness is called the incubation period. This ranges from hours to days depending on the agent, and on how much was consumed. If symptoms occur within 1-6 hours after eating the food, it suggests that it is caused by a bacterial toxin or a chemical rather than live bacteria.

The long incubation period of many foodborne illnesses tends to cause sufferers to attribute their symptoms to gastroenteritis. During the incubation period, microbes pass through the stomach into the intestine, attach to the cells lining the intestinal walls, and begin to multiply there. Some types of microbes stay in the intestine, some produce a toxin that is absorbed into the bloodstream, and some can directly invade the deeper body tissues. The symptoms produced depend on the type of microbe.

Infectious Dose
The infectious dose is the amount of agent that must be consumed to give rise to symptoms of foodborne illness, and varies according to the agent and the consumer's age and overall health. Pathogens vary in minimum infectious dose; for example, Shigella sonnei has a low estimated minimum dose of < 500 colony-forming units (CFU) while Staphylococcus aureus has a relatively high estimate.

In the case of Salmonella a relatively large inoculum of 1 million to 1 billion organisms is necessary to produce symptoms in healthy human volunteers, as Salmonellae are very sensitive to acid. An unusually high stomach pH level (low acidity) greatly reduces the number of bacteria required to cause symptoms by a factor of between 10 and 100.

Most Common Foodborne Illnesses	**Highest Death Causes**		
Novovirus - 5.46m cases Salmonella - 1.02m cases Clostridium Perfringes - 965k cases Campylobacter - 845k cases	Salmonella - 0.126% Toxoplasma Gondii - 0.109% Listeria - 0.085% Norovirus - 0.050%		

Subheadings

1. Tick	2. Bedbug	3. Flea	4. Chiggers
5. Scabies	6. Demodex	7. Head Louse	8. Crab Louse
9. Body Louse	10. Protozoan Organisms	11. Worms	

1 Tick

ILLNESS Parasitic Tick

Ticks are small arachnids, typically 3 to 5 mm long, part of the order Parasitiformes. Along with mites, they constitute the subclass Acari. Ticks are ectoparasites (external parasites), living by feeding on the blood of mammals, birds, and sometimes reptiles and amphibians. Ticks are widely distributed around the world, especially in warm, humid climates. Almost all ticks belong to one of two major families, the Ixodidae or hard ticks, and the Argasidae or soft ticks. Adults have ovoid or pear-shaped bodies which become engorged with blood when they feed, and eight legs. As well as having a hard shield on their dorsal surfaces, hard ticks have a beak-like structure at the front containing the mouthparts whereas soft ticks have their mouthparts on the underside of the body. Both families locate a potential host by odour or from changes in the environment. Ticks have four stages to their lifecycle, namely egg, larva, nymph, and adult. Ixodid ticks have three hosts, taking at least a year to complete their lifecycle. Argasid ticks have up to seven nymphal stages (instars), each one requiring a blood meal. Because of their habit of ingesting blood, ticks are vectors of at least twelve diseases that affect humans and other animals.

Tick

There are four stages in the life cycle of a tick; the egg, larvae (around 1mm and light brown in colour when not full of blood), nymph (around 2mm and pale brown) and the adults (4–5mm in length, without blood). ^The Paralysis Tick needs to feed on blood to develop through its lifecycle from the larvae stage to a nymph and to an adult. The adult female takes blood to obtain protein for the laying of eggs. When fully engorged it is grey-blue in colour up to around 1cm in length. Paralysis Ticks are not particularly mobile, and rely on passing animals for a blood meal.

The Paralysis Tick will crawl up the stems of grasses or along branches and 'perch' ready to latch on to a passing animal, including humans. They rarely climb higher than 50cm in their habitat, so do not drop out of trees, despite this common belief. However, after landing on a person or animal they can walk up the body and attach to the head area. A tick attaches itself by piercing its sharp mouthparts into skin. It then injects an anticoagulant (a substance that prevents blood from forming clots) saliva which allows it to feed without the blood clotting. In the case of the Paralysis Tick, the saliva may be highly toxic to some animals and, potentially, humans.

Life Cycle
- Eggs - Summer
- Larvae - Autumn (Fall)
- Nymph - Winter
- Adult - Spring

ILLNESS Tick

Most tick bites pose no medical problems apart from some localised swelling and redness at the bite site if the tick is removed promptly. However, in some cases people can experience more severe conditions such as tick paralysis or allergic reactions including anaphylactic shock. Early symptoms of tick paralysis may include rashes, headache, fever, influenza like symptoms, tenderness of lymph nodes, unsteady gait, intolerance to bright light, increased weakness of the limbs and partial facial paralysis. Tick paralysis, while rare, is usually seen in children rather than adults.

Parasitic Tick

Allergic reactions can result in swelling of the throat, and may lead to breathing difficulties or collapse. It is important to seek medical attention quickly if such symptoms occur. If you have had similar symptoms in the past after being bitten by a tick, then it is a good idea to always be prepared. Some serious tick-borne diseases also occur in Australia including, Queensland tick typhus and Flinders Island spotted fever. There are concerns that other serious illnesses, such as a Lyme disease-like syndrome, may be caused by exposure to Australian ticks, however there is no evidence yet this is the case (Lyme Disease).

ILLNESS Parasitic Tick

Tick (Australia Specific)
Ticks are parasites that feed on animal and human blood. There are more than 800 species of ticks around the world, with 70 found in Australia and 16 species have been reported as feeding on humans. The most important tick in Australia is the Paralysis Tick, Ixodes holocyclus, and over 95% of tick bites in Eastern Australia are due to this species. Most tick-borne illnesses are due to this species. The Paralysis Tick, Ixodes holocyclus, is found along the eastern seaboard of Australia east of the Great Dividing Range, and possibly into Tasmania.

It is commonly referred to as the grass tick, seed tick and bush tick depending upon its stage of development. It is not known to occur in South Australia, Western Australia or the Northern Territory. While I. holocyclus is the most common, there are two other Ixodes species in Australia which cause paralysis: I. hirsti, which occurs in South Australia and also has been documented in NSW and Tasmania, and I. cornuatus, which occurs in Tasmania and Victoria.

Range / Habitat
Tick species are widely distributed around the world, but they tend to flourish more in countries with warm, humid climates, because they require a certain amount of moisture in the air to undergo metamorphosis, and because low temperatures inhibit their development from egg to larva. Ticks are also widely distributed among host taxa, which include marsupial and placental mammals, birds, reptiles such as snakes, iguanas and lizards, and amphibians. Ticks of domestic animals cause considerable harm to livestock by transmission of many species of pathogen, as well as causing anaemia and damaging wool and hides.

Some of the most debilitating species occur in tropical countries. Tropical bont ticks affect most domestic animals and occur in Africa and the Caribbean. The spinose ear tick has a worldwide distribution, the young feeding inside the ears of cattle and wild animals. In general, ticks are to be found wherever their host species occur. Migrating birds carry ticks with them on their journeys; a study of migratory birds passing through Egypt found more than half the bird species examined were carrying ticks.

The species of tick often differed between the autumn and spring migrations, probably because of the seasonal periodicities of the different species. For an ecosystem to support ticks, it must satisfy two requirements: the population density of host species in the area must be high enough, and humidity must be high enough for ticks to remain hydrated.

Due to their role in transmitting Lyme disease, ixodid ticks, particularly the North American I. scapularis, have been studied using geographic information systems to develop predictive models for ideal tick habitats. According to these studies, certain features of a given microclimate – such as sandy soil, hardwood trees, rivers, and the presence of deer – were determined to be good predictors of dense tick populations.

Diet / Feeding
Ticks satisfy all of their nutritional requirements as ectoparasites, feeding on a diet of blood. They are obligate hematophages, needing blood to survive and move from one stage of life to another. Ticks can fast for long periods but eventually die if unable to find a host. This behaviour evolved approximately 120 million years ago through adaptation to blood-feeding. The behaviour evolved independently in the separate tick families, with differing host-tick interactions driving the evolutionary change.

Some ticks attach quickly while others wander around looking for thinner skin such as is found on the ears of mammals. Depending on the species and the life stage, preparing to feed can take from ten minutes to two hours. On locating a suitable feeding spot, the tick grasps the host's skin and cuts into the surface. They extract blood by cutting a hole in the host's epidermis, into which they insert their hypostome, and keep the blood from clotting by excreting an anticoagulant or platelet aggregation inhibitor.

Ticks find their hosts by detecting animals' breath and body odours, or by sensing body heat, moisture and vibrations. They are incapable of flying or jumping, but many tick species, particularly Ixodidae, lie in wait in a position known as "questing". While questing, ticks cling to leaves and grasses by their third and fourth pairs of legs. They hold the first pair of legs outstretched, waiting to grasp and climb on to any passing host. Tick questing heights tend to be correlated with the size of the desired host; nymphs and small species tend to quest close to the ground where they may encounter small mammalian or bird hosts; adults climb higher into the vegetation where larger hosts may be encountered. Some species are hunters and lurk near places where hosts may rest. On receiving an olfactory or other stimulus, they crawl or run across the intervening surface.

Hypostome
The hypostome is a calcified harpoon-like structure near the mouth area of certain parasitic arthropods including ticks, that allows them to anchor themselves firmly in place on a host mammal while sucking blood. This mechanism is normally so strong that removal of a lodged tick requires two actions: One to remove the tick, and one to remove the remaining head section of the tick.

Diet / Feeding
Other ticks, mainly the Argasidae, are "nidicolous", finding hosts in their nests or burrows, and in caves in the case of bats. They use the same stimuli as non-nidicolous species to identify hosts, with body heat and odours often being the main factors. Many of them feed primarily on birds, though some Ornithodoros, for example, feed on mammals. Both groups feed rapidly, typically biting painfully and drinking their fill within minutes. None of the species stick to the host in the way that hard ticks do. Unlike the Ixodidae that have no fixed dwelling place except on the host, they live in sand or in crevices near animal dens or nests, or in human dwellings where they come out nightly to attack roosting birds, or emerge when they detect carbon dioxide in the breath of their hosts. In the Ixodidae, the tick stays in place until it is completely engorged.

Its weight may increase by 200 to 600 times as compared to its weight before it started feeding. To accommodate this large expansion, cell division takes place and its cuticle grows larger; the tick may remain attached for days or weeks, depending on species, life stage and host. In the Argasidae, the tick's cuticle stretches to accommodate the fluid ingested but does not grow new cells, the weight of the tick increasing five to tenfold over the unfed state. The tick then drops off the host and typically remains in the nest or burrow until its host returns to provide its next meal.

Population Control
With the possible exception of widespread DDT use in the Soviet Union, attempts to limit the population or distribution of disease-causing ticks have been quite unsuccessful. The parasitoid chalcid wasp Ixodiphagus hookeri has been investigated for its potential to control tick populations. It lays its eggs into ticks; the hatching wasps kill their hosts. Another natural form of control for ticks is the guineafowl, a bird species which consumes mass quantities of ticks. Topical tick medicines may be toxic to animals and humans. The synthetic pyrethroid insecticide Phenothrin in combination with the hormone analogue methoprene was a popular topical flea and tick therapy for felines. Phenothrin kills adult ticks, while methoprene kills eggs. However, some products have been withdrawn, while others are known to cause adverse reactions.

Identification

There are two major groups of ticks: hard ticks and soft ticks.	**Hard Ticks (family: Ixodidae)** Have a hard flat body and elongated mouthparts with rows of backward pointing teeth. This group includes the most important species that bite humans.	**Soft Ticks (family: Argasidae)** Have a wrinkled leathery appearance. Only a few species of this type are found in Australia and they rarely come into contact with people.

Below are pictures and descriptions of the different types of ticks you can find.

Ixodes Scapularis (Blacklegged ticks / Deer Ticks)		**Ixodes Scapularis** **(Blacklegged ticks / Deer Ticks)** Blacklegged ticks (a.k.a Deer ticks) take 2 years to complete their life cycle and are found predominately in deciduous forest. Their distribution relies greatly on the distribution of its reproductive host, white-tailed deer. Both nymph and adult stages transmit diseases such as Lyme disease, Babesiosis, and Anaplasmosis.
Dermacentor Variabilis (American Dog Ticks)		**Dermacentor Variabilis** **(American Dog Ticks)** American Dog ticks are found predominantly in areas with little or no tree cover, such as grassy fields and scrubland, as well as along walkways and trails. They feed on a variety of hosts, ranging in size from mice to deer, and nymphs and adults can transmit diseases such as Rocky Mountain Spotted Fever and Tularemia. American dog ticks can survive for up to 2 years at any given stage if no host is found. Females can be identified by their large off-white scutum against a dark brown body.
Amblyomma Americanum (Lone Star Ticks)		**Amblyomma Americanum** **(Lone Star Ticks)** Lone Star ticks are found mostly in woodlands with dense undergrowth and around animal resting areas. The larvae do not carry disease, but the nymphal and adult stages can transmit the pathogens causing Monocytic Ehrlichiosis, Rocky Mountain Spotted Fever and 'Stari' borreliosis. Lone Star ticks are notorious pests, and all stages are aggressive human biters.
Rhipicephalus Sanguineus (Brown Dog Tick)		**Rhipicephalus Sanguineus** **(Brown Dog Tick)** Brown Dog Ticks have a world-wide distribution, and can be found throughout the United States, although they are encountered more frequently in the southern tier of states. All life stages of this tick can transmit Rocky Mountain Spotted Fever rickettsia (Rickettsia rickettsia) to dogs, and rarely to humans. Both nymphal and adult stages can transmit the agents of canine ehrlichiosis (Ehrlichia canis) and canine babesiosis (Babesia canis vogeli and Babesia gibsoni-like) to dogs.
Dermacentor Andersoni (Rocky Mountain Wood Ticks)		**Dermacentor Andersoni** **(Rocky Mountain Wood Ticks)** Rocky Mountain Wood ticks are found predominantly in shrublands, lightly wooded areas, open grasslands, and along trails, mainly at lower elevations. All life stages of this tick can transmit Colorado tick fever virus (CTFV) to humans, and Rocky Mountain spotted fever (RMSF) rickettsia (Rickettsia rickettsii) to humans, cats, and dogs. Rocky Mountain wood tick saliva contains a neurotoxin that can occasionally cause tick paralysis in humans and pets; usually a bite from an adult female induces an ascending paralysis that dissipates within 24-72 hrs after tick removal.
Amblyomma Maculatum (Gulf Coast Tick)		**Amblyomma Maculatum** **(Gulf Coast Tick)** o
Dermacentor Occidentalis (Pacific Coast Tick)		**Dermacentor Occidentalis** **(Pacific Coast Tick)** o
Ixodes Pacificus (Western-Blacklegged Tick)		**Ixodes Pacificus** **(Western-Blacklegged Tick)** o
Amblyomma Cajennense (Cayenne Tick)		**Amblyomma Cajennense** **(Cayenne Tick)** o

Treatment

Removal
1. Use fine-tipped tweezers to grasp the tick as close to the skin's surface as possible.
2. Pull upward with steady, even pressure. Don't twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin. If this happens, remove the mouth-parts with tweezers. If you are unable to remove the mouth easily with clean tweezers, leave it alone and let the skin heal.
3. After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol or soap and water.
4. Never crush a tick with your fingers. Dispose of a live tick by putting it in alcohol, placing it in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet.

Avoid folklore remedies such as "painting" the tick with nail polish or petroleum jelly, or using heat to make the tick detach from the skin. Your goal is to remove the tick as quickly as possible–not waiting for it to detach. If you suspect an infection, keep the tick in a small jar or vial for testing.

Mouthparts
It is not uncommon for the tick's mouthparts to break off, with some part of them being left behind in the skin. However, the saliva glands that hold the tick's toxin and potential allergens (substances that can cause an allergic reaction) are actually located in the body of the tick, so the mouthparts on their own are not dangerous. The mouthparts usually come out on their own with natural skin shedding.

Do Not
● Avoid applying methylated spirits, kerosene, petroleum jelly, nail polish, oil or alcohol to the tick. These chemicals are generally ineffective in getting the tick to detach from the skin, and may even cause the tick to burrow deeper into the skin and inject more toxins.
● Don't use a lighted match or other hot object to try and kill the tick or detach it. Aside from the risk of burning yourself, this method does not effectively remove ticks.
● Don't use blunt-nosed household tweezers to remove a tick as they are more likely to squeeze the body of the tick.
Do Not
● Don't handle a tick with bare hands as infective agents or allergens can enter your body through breaks in your skin or by rubbing your eyes. Wash your hands with soap and water if you have touched or handled a tick.

Prevention

Ticks tend to be more active during warmer months, though this varies by geographic region and climate. Areas with woods, bushes, high grass, or leaf litter are likely to have more ticks. Those bitten commonly experience symptoms such as body aches, fever, fatigue, joint pain, or rashes. People can limit their exposure to tick bites by wearing light-coloured clothing (including pants and long sleeves), using insect repellent with 20%–30% DEET, tucking their pants legs into their socks, checking for ticks frequently, and washing and drying their clothing (in a hot dryer).

Avoiding Areas	Avoid known tick-infested areas and areas of tall grass. Try not to let much foliage brush against you.
Avoid Bushland	Avoid bushland areas and long grass, especially after rain. Keeping your lawns mowed short can help to reduce risk of ticks.
Covering Clothes	Wear clothes that fully cover your arms and legs. Choose light-coloured clothes so that you can spot any ticks more easily.
Tuck Clothes In	Tuck your trousers into your socks, and your shirt into your trousers to reduce the amount of skin that is exposed.
Wide Hat	Wear a wide-brimmed hat.
Wear Repellent	Apply insect repellent that contains DEET (e.g. RID, Heavy Duty Aerogard, Tropical Aerogard or Bushman) or picaridin (e.g. Aerogard) to your skin, clothes and hats. Make sure you follow the instructions on the product.
Wear Insecticides	Apply an insecticide containing permethrin to your clothes (e.g. Equip Debugger). These are available from outdoor and camping shops.
Brush Off Clothes	When returning from the outdoors, brush off your clothes to remove any ticks before going inside.
Shower	Shower and check for ticks (including adult ticks and ticks in the larval and nymphal stages) soon after being outdoors in areas known to have ticks.
Heat Clothes	Clothes that have been worn outside in tick-infested areas can be placed in a hot dryer for at least 20 minutes to kill any ticks that may be on the clothes.
Check Thoroughly	The entire body should be then checked for ticks of all sizes and stages, paying particular attention to areas behind the ears and the back of the head or neck, especially on children.
Regular Checks	Check yourself regularly when hiking through tick prone areas or have a friend to check each other every 15 minutes.

Tick-Borne Diseases

Ticks are implicated in the transmission of a number of infections caused by pathogens such as bacteria, viruses and protozoa. Sometimes the tick harbours more than one type of pathogen, making diagnosis of the infection more difficult. Species of the bacterium Rickettsia are responsible for typhus, rickettsialpox, Boutonneuse fever, African tick bite fever, Rocky Mountain spotted fever, Flinders Island spotted fever and Queensland tick typhus (Australian tick typhus). Some species, notably the Australian paralysis tick, are also intrinsically venomous and can cause tick paralysis. Eggs can become infected with pathogens inside a female tick's ovaries, in which case the larval ticks are infectious immediately at hatching, before feeding on their first host. Tropical bont ticks transmit the rickettsial disease heartwater which can be particularly devastating in cattle. The ticks carried by migratory birds may act as reservoirs and vectors of infectious diseases. Over twenty strains of pathogenic virus were found in the autumn in the Egyptian migratory bird study.

Not all ticks in an infective area are infected with pathogens, and both attachment of the tick and a long-feeding session seem to be necessary for transmission of these diseases to take place. Thus tick bites often do not lead to infection, especially if the ticks are removed within 36 hours. Adult ticks can be removed with fine-tipped tweezers or proprietary tick removal tools, disinfecting the wound. It is also possible to freeze them off with a medical wart remover. If the tick's head and mouthparts break off during removal, they can be removed with tweezers like a splinter. Tick-borne diseases, which afflict humans and other animals, are caused by infectious agents transmitted by tick bites. Tick-borne illnesses are caused by infection with a variety of pathogens, including rickettsia and other types of bacteria, viruses, and protozoa. Because individual ticks can harbor more than one disease-causing agent, patients can be infected with more than one pathogen at the same time, compounding the difficulty in diagnosis and treatment.

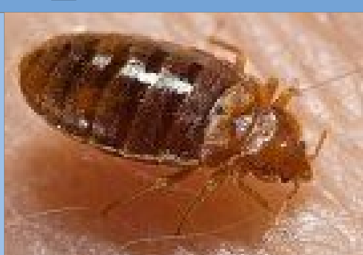
Bacterial Illnesses

Lyme Disease / Borreliosis	Lyme disease, also known as Lyme borreliosis, is an infectious disease caused by a bacteria named Borrelia spread by ticks. The most common sign of infection is an expanding area of redness on the skin, known as erythema migrans, that appears at the site of the tick bite about a week after it occurred.
Relapsing Fever	Relapsing fever is a vector-born disease caused by infection with certain bacteria in the genus Borrelia, which are transmitted through the bites of lice or soft-bodied ticks (genus Ornithodoros).
Typhus	Typhus, also known as typhus fever, is a group of infectious diseases that include epidemic typhus, scrub typhus and murine typhus. Common symptoms include fever, headache, and a rash. Typically these begin one to two weeks after exposure.
Rocky Mountain Spotted Fever	Rocky Mountain spotted fever (RMSF) is the most lethal and most frequently reported rickettsial illness in the United States. Initial signs and symptoms of the disease include sudden onset of fever, headache, and muscle pain, followed by development of rash.
Helvetica Spotted Fever	Rickettsia helvetica, previously known as the Swiss Agent, is a bacterium found in Dermacentor reticulatus and other ticks which has been implicated as a suspected but unconfirmed human pathogen.
Ehrlichiosis Anaplasmosis	Ehrlichiosis is a tickborne bacterial infection, caused by bacteria of the family Anaplasmataceae, genera Ehrlichia and Anaplasma. These obligate intracellular bacteria infect and kill white blood cells.

Bartonella	Bartonella is a genus of Gram-negative bacteria. It is the only genus in the family Bartonellaceae. Facultative intracellular parasites, Bartonella species can infect healthy people, but are considered especially important as opportunistic pathogens.
Tularemia	Tularemia, also known as rabbit fever, is an infectious disease caused by the bacterium Francisella tularensis. Symptoms may include fever, skin ulcer, and enlarged lymph nodes. Occasionally, a form that results in pneumonia or a throat infection may occur.
Viral Illnesses	
Tick-Borne Meningoencephalitis	Tick-borne encephalitis (TBE) is a viral infectious disease involving the central nervous system. The disease most often manifests as meningitis, encephalitis, or meningoencephalitis. Although TBE is most commonly recognized as a neurological disorder, mild fever can also occur.
Powassan Virus/Deer Tick Virus	Powassan virus is a flavivirus transmitted by ticks, found in North America and in the Russian Far East. It is named after the town of Powassan, Ontario, where it was identified in a young boy who eventually died from it. It can cause encephalitis, an infection of the brain. No vaccine or antiviral drug exists. Prevention of tick bites is the best precaution.
Colorado Tick Fever	Colorado tick fever (CTF) (also called mountain tick fever, American tick fever, and American mountain tick fever) is a viral infection (Coltivirus) transmitted from the bite of an infected Rocky Mountain wood tick (Dermacentor andersoni). It should not be confused with the bacterial tick-borne infection, Rocky Mountain spotted fever.
Crimean-Congo Hemorrhagic Fever	Crimean–Congo hemorrhagic fever (CCHF) is a viral disease. Symptoms of CCHF may include fever, muscle pains, headache, vomiting, diarrhoea, and bleeding into the skin. Onset of symptoms is less than two weeks following exposure. Complications may include liver failure. In those who survive, recovery generally occurs around two weeks after onset.
Severe Febrile Illness	Organism: Heartland virus, a phlebovirus, from the Bunyaviridae Vector: Lone star tick (Amblyomma americanum) Region: Missouri and Tennessee, United States
Protozoan Illnesses	
Babesiosis	Babesiosis is a malaria-like parasitic disease caused by infection with Babesia, a type of Apicomplexa. Human babesiosis transmission via tick bite is most common in the North-eastern and Midwestern United States and parts of Europe, and sporadic throughout the rest of the world.
Cytauxzoonosis	Cytauxzoon felis is a protozoal organism transmitted to domestic cats by tick bites, and whose natural reservoir host is the bobcat. C. felis has been found in other wild felid species such as Florida bobcat, eastern bobcat, Texas cougar, and a white tiger in captivity.

Tick Paralysis
Tick paralysis is the only tick-borne disease that is not caused by an infectious organism. The illness is caused by a neurotoxin produced in the tick's salivary gland. After prolonged attachment, the engorged tick transmits the toxin to its host. The incidence of tick paralysis is unknown. Patients can experience severe respiratory distress (similar to anaphylaxis).

2 Bedbug



Bed bugs are a type of insect that feed on human blood, usually at night. Their bites can result in a number of health effects including skin rashes, psychological effects and allergic symptoms. Bed bug bites may lead to skin changes ranging from invisible to prominent blisters. Symptoms may take between minutes to days to appear. Itchiness is common, while some may feel tired or have a fever. Typically, uncovered areas of the body are affected and three bites occur in a row.

Bed bugs bites are not known to transmit any infectious disease. Bed bug bites are caused primarily by two species of the insect Cimex: Cimex lectularius (the common bed bug) and Cimex hemipterus. Their size ranges between 1 and 7 mm. They spread by crawling between nearby locations or by being carried within personal items. Infestation is rarely due to a lack of hygiene but is more common in high-density areas. Diagnosis involves both finding the bugs and the occurrence of compatible symptoms. Bed bugs spend much of their time in dark, hidden locations like mattress seams or cracks in the wall.

Signs & Symptoms
On the skin, individual responses to bites vary, ranging from no visible effect (in about 20–70%), to small macular spots, to prominent wheals and bullae formations along with intense itching that may last several days. The bites often occur in a line. A central spot of bleeding may also occur due to the release of anticoagulants in the bug's saliva. Symptoms may not appear until some days after the bites have occurred. Reactions often become more brisk after multiple bites due to possible sensitization to the salivary proteins of the bed bug. The skin reaction usually occurs in the area of the bite which is most commonly the arms, shoulders and legs as they are more frequently exposed at night. Numerous bites may lead to an erythematous rash or urticaria.

Treatment
Treatment is symptomatic. Eliminating bed bugs from the home is often difficult, partly because bed bugs can survive up to a year without feeding. Repeated treatments of a home may be required. These treatments may include heating the room to 50 °C (122 °F) for more than 90 minutes, frequent vacuuming, washing clothing at high temperatures, and the use of various pesticides.

3 Flea

Fleas are small flightless insects that form the order Siphonaptera. As external parasites of mammals and birds, they live by consuming the blood of their hosts. Adults are up to about 3 mm (0.12 in) long and usually brown. Bodies flattened sideways enable them to move through their host's fur or feathers; strong claws prevent them from being dislodged.

They lack wings, and have mouthparts adapted for piercing skin and sucking blood and hind legs adapted for jumping. The latter enable them to leap a distance of some 50 times their body length, a feat second only to jumps made by froghoppers. Larvae are worm-like with no limbs; they have chewing mouthparts and feed on organic debris.

ILLNESS Parasitic Flea

Morphology

Fleas are wingless insects, 1/16 to 1/8-inch (1.5 to 3.3 mm) long, that are agile, usually dark collared (for example, the reddish-brown of the cat flea), with a proboscis, or stylet, adapted to feeding by piercing the skin and sucking their host's blood through their epipharynx. Flea legs end in strong claws that are adapted to grasp a host. Unlike other insects, fleas do not possess compound eyes but instead only have simple eyespots with a single biconvex lens; some species lack eyes altogether. Their bodies are laterally compressed, permitting easy movement through the hairs or feathers on the host's body (or in the case of humans, under clothing).

The flea body is covered with hard plates called sclerites. These sclerites are covered with many hairs and short spines directed backward, which also assist its movements on the host. The tough body is able to withstand great pressure, likely an adaptation to survive attempts to eliminate them by scratching. Fleas lay tiny, white, oval eggs. The larvae are small and pale, have bristles covering their worm-like bodies, lack eyes, and have mouth parts adapted to chewing. The larvae feed on organic matter, especially the faeces of mature fleas, which contain dried blood. Adults feed only on fresh blood.

Their legs are long, the hind pair well adapted for jumping; a flea can jump vertically up to 7 in (18 cm) and horizontally up to 13 in (33 cm), making the flea one of the best jumpers of all known animals (relative to body size), second only to the froghopper. The flea jump is so rapid and forceful that it exceeds the capabilities of muscle, and instead of relying on direct muscle power, fleas store muscle energy in a pad of the elastic protein named resilin before releasing it rapidly (like a human using a bow and arrow). Immediately before the jump, muscles contract and deform the resilin pad, slowly storing energy which can then be released extremely rapidly to power leg extension for propulsion.

To prevent premature release of energy or motions of the leg, the flea employs a "catch mechanism". Early in the jump, the tendon of the primary jumping muscle passes slightly behind the coxa-trochanter joint, generating a torque which holds the joint closed with the leg close to the body. To trigger jumping, another muscle pulls the tendon forward until it passes the joint axis, generating the opposite torque to extend the leg and power the jump by release of stored energy. The actual take off has been shown by high-speed video to be from the tibiae and tarsi rather than from the trochantera (knees).

Life Cycle

Fleas are holometabolous insects, going through the four lifecycle stages of egg, larva, pupa, and imago (adult). In most species, neither female nor male fleas are fully mature when they first emerge but must feed on blood before they become capable of reproduction. The first blood meal triggers the maturation of the ovaries in females and the dissolution of the testicular plug in males, and copulation soon follows. Some species breed all year round while others synchronise their activities with their hosts' life cycles or with local environmental factors and climatic conditions. Flea populations consist of roughly 50% eggs, 35% larvae, 10% pupae, and 5% adults.

Egg	The number of eggs laid depends on species, with batch sizes ranging from two to several dozen. The total number of eggs produced in a female's lifetime (fecundity) varies from around one hundred to several thousand. In some species, the flea lives in the nest or burrow and the eggs are deposited on the substrate, but in others, the eggs are laid on the host itself and can easily fall off onto the ground. Because of this, areas where the host rests and sleeps become one of the primary habitats of eggs and developing larvae. The eggs take around two days to two weeks to hatch. Experiments have shown that fleas lay more eggs on hosts which have limited food intakes, and that eggs and larvae survive better under these conditions, perhaps because the host's immune system is compromised.
Larva	Flea larvae emerge from the eggs to feed on any available organic material such as dead insects, faeces, conspecific eggs, and vegetable matter. In laboratory studies, some dietary diversity seems necessary for proper larval development. Blood-only diets allow only 12% of larvae to mature, whereas blood and yeast or dog chow diets allow almost all larvae to mature. Another study also showed that 90% of larvae matured into adults when the diet included nonviable eggs. They are blind and avoid sunlight, keeping to dark, humid places such as sand or soil, cracks and crevices, under carpets and in bedding.
Pupa	Given an adequate supply of food, larvae pupate and weave silken cocoons after three larval stages. Within the cocoon, the larva moults for a final time and undergoes metamorphosis into the adult form. This can take just four days, but may take much longer under adverse conditions, and there follows a variable-length stage during which the pre-emergent adult awaits a suitable opportunity to emerge. Trigger factors for emergence include vibrations (including sound), heat (in warm-blooded hosts), and increased levels of carbon dioxide, all of which stimuli may indicate the presence of a suitable host. Large numbers of pre-emergent fleas may be present in otherwise flea-free environments, and the introduction of a suitable host may trigger a mass emergence.
Adult	Once the flea reaches adulthood, its primary goal is to find blood and then to reproduce. Female fleas can lay 5000 or more eggs over their life, permitting rapid increase in numbers. Generally speaking, an adult flea only lives for 2 or 3 months. Without a host to provide a blood meal, a flea's life can be as short as a few days. Under ideal conditions of temperature, food supply, and humidity, adult fleas can live for up to a year and a half. Completely developed adult fleas can live for several months without eating, so long as they do not emerge from their puparia. Optimum temperatures for the flea's life cycle are 21 °C to 30 °C (70 °F to 85 °F) and optimum humidity is 70%.

Host Relationship

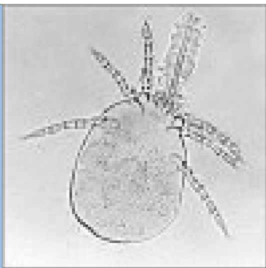
Fleas feed on a wide variety of warm-blooded vertebrates including humans, dogs, cats, rabbits, squirrels, ferrets, rats, mice and birds. Fleas normally specialise in one host species or group of species, but can often feed but not reproduce on other species. Ceratophyllus gallinae affects poultry as well as wild birds. As well as the degree of relatedness of a potential host to the flea's original host, it has been shown that avian fleas that exploit a range of hosts, only parasitise species with low immune responses. In general, host specificity decreases as the size of the host species decreases. Another factor is the opportunities available to the flea to change host species; this is smaller in colonially nesting birds, where the flea may never encounter another species, than it is in solitary nesting birds. A large, long-lived host provides a stable environment that favours host-specific parasites. One theory of human hairlessness is that the loss of hair helped humans to reduce their burden of fleas and other ectoparasites.

Bite Effects

In many species, fleas are principally a nuisance to their hosts, causing an itching sensation which in turn causes the host to try to remove the pest by biting, pecking or scratching. Fleas are not simply a source of annoyance, however. Flea bites cause a slightly raised, swollen itching spot to form; this has a single puncture point at the centre, like a mosquito bite. Besides this, the eczematous itchy skin disease flea allergy dermatitis is common in many host species, including dogs and cats. The bites often appear in clusters or lines of two bites, and can remain itchy and inflamed for up to several weeks afterwards. Fleas can lead to hair loss as a result of frequent scratching and biting by the animal, and can cause anaemia in extreme cases.

Fleas are vectors for viral, bacterial and rickettsial diseases of humans and other animals, as well as of protozoan and helminth parasites. Bacterial diseases carried by fleas include murine or endemic typhus and bubonic plague. Fleas can transmit Rickettsia typhi, Rickettsia felis, Bartonella henselae, and the myxomatosis virus. They can carry Hymenolepiasis tapeworms and Trypanosome protozoans. The chigoe flea or jigger (Tunga penetrans) causes the disease tungiasis, a major public health problem around the world. Fleas that specialize as parasites on specific mammals may use other mammals as hosts; thus, humans may be bitten by cat and dog fleas.

4 Chiggers (Trombiculidae)



Trombiculidae are a family of mites. The best known of the Trombiculidae are the chiggers. The two widely recognized definitions of "chigger" are the scientific (or taxonomic) and the common, the latter of which can be found in English and medical dictionaries. According to most dictionaries, the several species of Trombiculidae that bite their host in their larval stage and cause "intense irritation" or "a wheal, usually with severe itching and dermatitis", are called chiggers. The scientific definition seemingly includes many more, but not all species of Trombiculidae. Trombiculidae live in forests and grasslands and are also found in the vegetation of low, damp areas such as woodlands, berry bushes, orchards, along lakes and streams, and even in drier places where vegetation is low, such as lawns, golf courses, and parks. They are most numerous in early summer when grass, weeds, and other vegetation are heaviest. In their larval stage, they attach to various animals, including humans, and feed on skin, often causing itching. These relatives of ticks are nearly microscopic, measuring 0.4 mm (1/60 of an inch) and have a chrome-orange hue. There is a marked constriction in the front part of the body in the nymph and adult stages.

The best known species of chigger in North America is the hard-biting Trombicula alfreddugesi of the south-eastern United States, humid Midwest and Mexico; in the UK, the most prevalent chigger, called the "harvest mite", is Trombicula autumnalis, with distribution through Western Europe to Eastern Asia. Trombiculid mites go through a lifecycle of egg, larva, nymph, and adult. The larval mites feed on the skin cells of animals. The six-legged parasitic larva feeds on a large variety of creatures, including humans, rabbits, toads, box turtles, quail, and even some insects. After crawling onto their hosts, they inject digestive enzymes into the skin that break down skin cells. They do not actually "bite", but instead form a hole in the skin called a stylostome and chew up tiny parts of the inner skin, thus causing severe irritation and swelling. The severe itching is accompanied by red, pimple-like bumps (papules) or hives and skin rash or lesions on a sun-exposed area. For humans, itching usually occurs after the larvae detach from the skin. After feeding on their hosts, the larvae drop to the ground and become nymphs, then mature into adults which have eight legs and are harmless to humans. In the postlarval stage, they are not parasitic and feed on plant material. The females lay three to eight eggs in a clutch, usually on a leaf or under the roots of a plant, and die by autumn.

Life Cycle
The length of the mite's cycle depends on species and environment but normally lasts two to 12 months. The number of cycles in a year depends on the region. For example, in a temperate region, there might only be three per year, but in tropical regions the cycle might be continuous all year long. Adult harvest mites winter in protected places such as slightly below the soil. Females become active in the spring, and once the ground temperature is regularly above 60°F (16°C), she lays eggs in vegetation, up to 15 eggs per day. The eggs are round and are dormant for about six days, after which the nonfeeding prelarvae emerge, with only three pairs of legs. After about six days, the prelarva grows into its larval stage.

Larva
The larvae, commonly called chiggers, are about 0.17–0.21 mm (0.007–0.008 in) in diameter, normally light red in colour, and covered in hairs; they move quickly relative to size. The larvae congregate in groups on small clods of soil, in matted vegetation, and even on low bushes and plants, where they have more access to prospective hosts. The larval stage is the only parasitic stage of the mite's lifecycle. They are parasites on many animals.

About 30 of the many species in this family, in their larval stage, attach to various animals and feed on skin. This often causes an intensely itchy, red bump in humans. Chiggers attach to the host, pierce the skin, inject enzymes into the bite wound that digest cellular contents, and then suck up the digested tissue through a tube formed by hardened skin cells called a stylostome. They do not burrow into the skin or suck blood, as is commonly assumed.

Itching from a chigger bite may not develop until 24–48 hours after the bite, so the victim may not associate the specific exposure with the bite itself. The red welt/bump on the skin is not where a chigger laid eggs, as is sometimes believed. The larva remains attached to a suitable host for three to five days before dropping off to begin its nymphal stage. They tend to attach where clothing have restrictions, such as belt lines, or behind the knees when wearing jeans. During the wet season, chiggers are usually found in tall grass and other vegetation. During dry seasons, chiggers are mostly found underneath brush and shady areas. Standing still or lying in tall grass gives them more time to climb onto a person.

Nymph
Once the larva has engorged itself on skin and has fallen off its host, it develops to its nymph stage. The nymphs are sexually immature, but more closely resemble the adult. This stage consists of three phases, the protonymph, deutonymph, and tritonymph. The protonymph and tritonymph morphologies are unusual in species of Trombiculidae. The protonymph phase combines larval and protonymph characteristics with deutonymph and tritonymph morphology. The protonymph is an inactive transitional stage. The active deutonymph develops an additional pair of legs (for a total of eight). Lastly, it re-enters inactivity during its transitional tritonymph phase before growing to adulthood.

Adult
As deutonymphs and adults, trombiculid mites are independent predators that feed on small arthropods and their eggs, and are also found to eat plant material. They live in soil, and are often found when digging in yards or gardens or in compost bins.

5 Scabies

Scabies, also known as the seven-year itch, is a contagious skin infestation by the mite Sarcoptes scabiei. The most common symptoms are severe itchiness and a pimple-like rash. Occasionally, tiny burrows may be seen in the skin. In a first-ever infection a person will usually develop symptoms in between two and six weeks. During a second infection symptoms may begin in as little as 24 hours. These symptoms can be present across most of the body or just certain areas such as the wrists, between fingers, or along the waistline.

The head may be affected, but this is typically only in young children. The itch is often worse at night. Scratching may cause skin breakdown and an additional bacterial infection of the skin. Scabies is caused by infection with the female mite Sarcoptes scabiei var. hominis, an ectoparasite. The mites burrow into the skin to live and deposit eggs. The symptoms of scabies are due to an allergic reaction to the mites. Often, only between 10 and 15 mites are involved in an infection.

Scabies is most often spread during a relatively long period of direct skin contact with an infected person (at least 10 minutes) such as that which may occur during sex or living together. Spread of disease may occur even if the person has not developed symptoms yet. Crowded living conditions, such as those found in child-care facilities, group homes, and prisons, increase the risk of spread. Areas with a lack of access to water also have higher rates of disease. Crusted scabies is a more severe form of the disease.

It typically only occurs in those with a poor immune system and people may have millions of mites, making them much more contagious. In these cases, spread of infection may occur during brief contact or by contaminated objects. The mite is very small and usually not directly visible. Diagnosis is based on the signs and symptoms. A number of medications are available to treat those infected, including permethrin, crotamiton, and lindane creams and ivermectin pills. Sexual contacts within the last month and people who live in the same house should also be treated at the same time. Bedding and clothing used in the last three days should be washed in hot water and dried in a hot dryer.

As the mite does not live for more than three days away from human skin, more washing is not needed. Symptoms may continue for two to four weeks following treatment. If after this time symptoms continue, retreatment may be needed. Scabies is one of the three most common skin disorders in children, along with ringworm and bacterial skin infections. As of 2015, it affects about 204 million people (2.8% of the world population).

It is equally common in both sexes. The young and the old are more commonly affected. It also occurs more commonly in the developing world and tropical climates. The word scabies is from Latin: scabere, "to scratch". Other animals do not spread human scabies. Infection in other animals is typically caused by slightly different but related mites and is known as sarcoptic mange.

Signs & Symptoms
The characteristic symptoms of a scabies infection include intense itching and superficial burrows. The burrow tracks are often linear, to the point that a neat "line" of four or more closely placed and equally developed mosquito-like "bites" is almost diagnostic of the disease. Because the host develops the symptoms as a reaction to the mites' presence over time, typically a delay of four to six weeks occurs between the onset of infestation and the onset of itching. Similarly, symptoms often persist for one to several weeks after successful eradication of the mites. As noted, those re-exposed to scabies after successful treatment may exhibit symptoms of the new infestation in a much shorter period—as little as one to four days.

Itching	In the classic scenario, the itch is made worse by warmth, and is usually experienced as being worse at night, possibly because distractions are fewer. As a symptom, it is less common in the elderly.
Rash	The superficial burrows of scabies usually occur in the area of the finger webs, feet, ventral wrists, elbows, back, buttocks, and external genitals. Except in infants and the immunosuppressed, infection generally does not occur in the skin of the face or scalp. The burrows are created by excavation of the adult mite in the epidermis. In most people, the trails of the burrowing mites are linear or S-shaped tracks in the skin often accompanied by rows of small, pimple-like mosquito or insect bites. These signs are often found in crevices of the body, such as on the webs of fingers and toes, around the genital area, in stomach folds of the skin, and under the breasts of women. Symptoms typically appear two to six weeks after infestation for individuals never before exposed to scabies. For those having been previously exposed, the symptoms can appear within several days after infestation. However, symptoms may appear after several months or years. Acropustulosis, or blisters and pustules on the palms and soles of the feet, are characteristic symptoms of scabies in infants.
Crusted Scabies	The elderly, disabled, and people with an impaired immune system, such as HIV, cancer, or those on immunosuppressive medications, are susceptible to crusted scabies (also called Norwegian scabies). On those with weaker immune systems, the host becomes a more fertile breeding ground for the mites, which spread over the host's body, except the face. The mites in crusted scabies are not more virulent than in noncrusted scabies; however, they are much more numerous (up to two million). People with crusted scabies exhibit scaly rashes, slight itching, and thick crusts of skin that contain the large numbers of scabies mites. Due to being infected thus, persons with crusted scabies are more contagious to other persons. Such areas make eradication of mites particularly difficult, as the crusts protect the mites from topical miticides/scabicides, necessitating prolonged treatment of these areas.

6 Demodex

Demodex is a genus of tiny mites that live in or near hair follicles of mammals.
Around 65 species of Demodex are known. Two species live on humans: Demodex folliculorum and Demodex brevis, both frequently referred to as eyelash mites. Different species of animals host different species of Demodex. Demodex canis lives on the domestic dog. Infestation with Demodex is common and usually does not cause any symptoms, although occasionally some skin diseases can be caused by the mites. Older people are much more likely to carry the mites; about a third of children and young adults, half of adults, and two-thirds of elderly people carried them. The lower rate in children may be because children produce less sebum.

Recently, a study of 29 adults (18 and over) in North Carolina, US, found that 70% of those under 18 years of age carried mites, and that all adults over 18 (n = 19) carried them. Demodex were considered commensals but are now considered parasitic. However, in the vast majority of cases the mites go unobserved without any adverse symptoms, though in certain cases (usually related to a suppressed immune system, caused by stress or illness), mite populations can dramatically increase. This results in a condition known as demodicosis or Demodex mite bite, characterised by itching, inflammation, and other skin disorders. Blepharitis (inflammation of the eyelids) can be also caused by Demodex mites. The natural host of Demodex canis is the domestic dog. Although it can temporarily infect humans, D. canis mites cannot survive on the human skin and therefore will die shortly after exposure and are considered not to be zoonotic.

7 Head Louse

The head louse (Pediculus humanus capitis) is an obligate ectoparasite of humans that causes head lice infestation (pediculosis capitis). Head lice are wingless insects spending their entire lives on the human scalp and feeding exclusively on human blood. Humans are the only known hosts of this specific parasite, while chimpanzees host a closely related species, Pediculus schaeffi. Other species of lice infest most orders of mammals and all orders of birds, as well as other parts of the human body. Lice differ from other hematophagic ectoparasites such as fleas in spending their entire lifecycle on a host. Head lice cannot fly, and their short, stumpy legs render them incapable of jumping, or even walking efficiently on flat surfaces. The nondisease-carrying head louse differs from the related disease-carrying body louse (Pediculus humanus humanus) in preferring to attach eggs to scalp hair rather than to clothing. The two subspecies are morphologically almost identical, but do not normally interbreed, although they will do so in laboratory conditions.

A much more distantly related species of hair-clinging louse, the pubic or crab louse (Pthirus pubis), also infests humans. It is visually different from the other two species and is much closer in appearance to the lice which infest other primates. Head lice (especially in children) have been, and still are, subject to various eradication campaigns. Unlike body lice, head lice are not the vectors of any known diseases. Except for rare secondary infections that result from scratching at bites, head lice are harmless, and they have been regarded by some as essentially a cosmetic rather than a medical problem. Head lice infestations might be beneficial in helping to foster a natural immune response against lice which helps humans in defence against the far more dangerous body louse, which is capable of transmission of dangerous diseases.

Like other insects of the suborder Anoplura, adult head lice are small (2.5–3 mm long), dorsoventrally flattened (see anatomical terms of location), and entirely wingless. The thoracic segments are fused, but otherwise distinct from the head and abdomen, the latter being composed of seven visible segments. Head lice are grey in general, but their precise colour varies according to the environment in which they were raised. After feeding, consumed blood causes the louse body to take on a reddish colour.

Head	One pair of antennae, each with five segments, protrudes from the insect's head. Head lice also have one pair of eyes. Eyes are present in all species within the Pediculidae (the family of which the head louse is a member), but are reduced or absent in most other members of the Anoplura suborder. Like other members of the Anoplura, head lice mouth parts are highly adapted for piercing skin and sucking blood. These mouth parts are retracted into the insect's head except during feeding.
Thorax	Six legs project from the fused segments of the thorax. As is typical in the Anoplura, these legs are short and terminate with a single claw and opposing "thumb". Between its claw and thumb, the louse grasps the hair of its host. With their short legs and large claws, lice are well adapted to clinging to the hair of their host. These adaptations leave them incapable of jumping, or even walking efficiently on flat surfaces. Lice can climb up strands of hair very quickly, allowing them to move quickly and reach another host.
Abdomen	Seven segments of the louse abdomen are visible. The first six segments each have a pair of spiracles through which the insect breathes. The last segment contains the anus and (separately) the genitalia.

Louse Eggs	Like most insects, head lice are oviparous. Females lay about three or four eggs per day. Louse eggs are attached near the base of a host hair shaft. Egg-laying behaviour is temperature dependent and likely seeks to place the egg in a location that will be conducive to proper embryo development. In cool climates, eggs are generally laid within 3–5 mm of the scalp surface. In warm climates, and especially the tropics, eggs may be laid 6 inches (15 cm) or more down the hair shaft. Each egg is oval-shaped and about 0.8 mm in length. They are bright, transparent, and tan to coffee-collared so long as they contain an embryo, but appear white after hatching. Head lice hatch typically six to nine days after oviposition.

8 Crab Louse

The crab louse or pubic louse (Pthirus pubis) is an insect that is an obligate ectoparasite of humans, feeding exclusively on blood. The crab louse usually is found in the person's pubic hair. Although the louse cannot jump, it can also live in other areas of the body that are covered with coarse hair, such as the eyelashes. It is of the order Psocodea. Humans are the only known hosts of the crab louse, although a closely related species, Pthirus gorillae, infects gorilla populations.

The human parasite diverged from Pthirus gorillae approximately 3.3 million years ago. An adult crab louse is about 1.3–2 mm long (slightly smaller than the body louse and head louse), and can be distinguished from those other species by its almost round body. Another distinguishing feature is that the rearmost two pairs of legs of a crab louse are much thicker than the front legs and have large claws.

Infestations of crab lice are known as pediculosis pubis or phthiriasis pubis (which, unlike the generic name of the louse, is spelled with a phth). Infestation of the eyelashes is referred to as pediculosis ciliaris or phthiriasis palpebrarum. The main symptom of infestation with crab lice is itching, usually in the pubic-hair area, resulting from hypersensitivity to louse saliva, which can become stronger over two or more weeks following initial infestation. Crab lice usually infect a new host only by close contact between individuals, usually through sexual intercourse.

Adults are more frequently infested than children. Non-sexual transmissions may occur among family and roommates through the use of shared towels, clothing, beds or closets. Pubic lice are not known to transmit disease. Adult pubic lice are 1.1–1.8 mm in length. The pubic hair can typically host up to a dozen on average. Pubic lice typically are found attached to hair in the pubic area but sometimes are found on coarse hair elsewhere on the body (for example, eyebrows, eyelashes, beard, mustache, chest, armpits, etc.).

Crab lice attach to pubic hair that is thicker than other body hair because their claws are adapted to the specific diameter of pubic hair. Pubic lice infestations (pthiriasis) are usually spread through sexual contact. The crab louse can travel up to 10 inches on the body. Pubic lice infestation is found worldwide and occurs in all races and ethnic groups and in all economic levels. Pubic lice usually are spread through sexual contact and are most common in adults.

Occasionally pubic lice may be spread by close personal contact or contact with articles such as clothing, bed linens, and towels that have been used by an infested person. Pubic lice found on the head or eyelashes of children may be an indication of sexual exposure or abuse. Pubic lice do not transmit disease; however, secondary bacterial infection can occur from scratching of the skin. They are much broader in comparison to head and body lice. Adults are found only on the human host and require human blood to survive. If adults are forced off the host, they will die within 24–48 hours without a blood feeding.

Life Cycle
The eggs of the crab louse are laid usually on the coarse hairs of the genital and perianal regions of the human body. Crab lice may also be found on other areas of the body that have coarse and relatively sparse coverings of hair, such as the beard, moustache, eyelashes, and underneath the arms. They do not generally occur on the finer hair of the scalp. The female lays about three eggs a day. The eggs take 6–8 days to hatch, and there are three nymphal stages which together take 10–17 days before the adult develops, making a total life cycle from egg to adult of 16–25 days. Adults live for up to 30 days. Crab lice feed exclusively on blood, and take a blood meal 4–5 times daily. Adults are 1.5–2.0 mm long and flattened. They are much broader in comparison to head and body lice. Adults are found only on the human host and require human blood to survive. If adults are forced off the host, they will die within 24–48 hours without a blood feeding. Pubic lice are transmitted from person to person most-commonly via sexual contact, although fomites (bedding, clothing) may play a minor role in their transmission.

9 Body Louse

The body louse (Pediculus humanus humanus, sometimes called Pediculus humanus corporis) is a louse that infests humans. The condition of being infested with head lice, body lice, or pubic lice is known as pediculosis. Body lice are vectors for the transmission of the human diseases epidemic typhus, trench fever, and relapsing fever.

Life Cycle
Pediculus humanus humanus (the body louse) is indistinguishable in appearance from Pediculus humanus capitis (the head louse) but will interbreed only under laboratory conditions. In their natural state, they occupy different habitats and do not usually meet. In particular, body lice have evolved to attach their eggs to clothes, whereas head lice attach their eggs to the base of hairs. The life cycle of the body louse consists of three stages: egg (also called a nit), nymph, and adult.

1	Nits are louse eggs. They are generally easy to see in the seams of an infested person's clothing, particularly around the waistline, under armpits or even in body hair. They are oval and usually yellow to white in colour. Body lice nits may take 1–2 weeks to hatch.
2	A nymph is an immature louse that hatches from the nit (egg). A nymph looks like an adult body louse, but is smaller. Nymphs mature into adults about 9–12 days after hatching. To live, it must feed on blood.
3	The adult body louse is about the size of a sesame seed (2.5–3.5 mm), has six legs, and is tan to greyish-white. Females lay eggs. To live, lice must feed on blood. If separated from their hosts, lice die.

10 Protozoan Organisms

Protozoa (also protozoan, plural protozoans) is an informal term for a group of single-celled eukaryotes, either free-living or parasitic, which feed on organic matter such as other microorganisms or organic tissues and debris.

Acanthamoeba keratitis (Eye Infection)

Acanthamoeba keratitis is a rare disease in which amoebae invade the cornea of the eye, and affects roughly 1.2 to 3 million people each year. Acanthamoeba are protozoa found nearly ubiquitously in soil and water, and can cause infections of the skin, eyes, and central nervous system. Infection of the cornea by Acanthamoeba is difficult to treat with conventional medications, and Acanthamoeba keratitis (AK) may cause permanent visual impairment or blindness, due to damage to the clear portion of the front of the eye (called the cornea) or through damage to other structures important to vision. The most common source of acanthamoeba keratitis is contact lenses cleaned with contaminated tap water.

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In the United States, Acanthamoeba keratitis is nearly always associated with soft contact lens use. Acanthamoeba spp. is most commonly introduced to the eye by contact lenses that have been exposed to the organism through the use of contaminated lens solution, using homemade saline-based solution or tap water, or from wearing contact lenses while bathing or swimming.

However, it may also be introduced to the eye by exposure to soil or vegetation, or by trauma. In fact, the first case of Acanthamoeba keratitis described was due to ocular trauma. Once on the contact lens, Acanthamoeba is able to survive in the space between the contact lens and the surface of the eye. Soft contact lenses are more adherent to the corneal surface than hard lenses, which allows the Acanthamoeba organism to bind to mannosylated glycoproteins on the corneal surface.

Expression of these proteins on the corneal surface is increased by contact lens use. This increase in glycoprotein content, along with microtrauma to the corneal epithelial surface due to contact lens use increases the risk for infection. Once the organism has gained access to the surface of the eye, it is able to invade through the epithelium and Bowman's layer. It some cases, the infection can then group around corneal nerves, producing radial deposits (radial keratoneuritis), and causing extreme pain.

The organism is also capable of invading deeper into the cornea; using metalloproteases it is able to penetrate deep into the stroma of the cornea. As the disease progresses, it may penetrate through cornea but very rarely causes infection inside the eye (endophthalmitis) due to a robust neutrophil response in the anterior chamber.

Granulomatous Amoebic Encephalitis (GAE)

Granulomatous amoebic encephalitis (GAE) is a central nervous system disease caused by certain species of free-living amoebae, especially species of Acanthamoeba and Balamuthia mandrillaris. GAE may present in numerous ways. There is no solid definition, as only a handful of patients have presented thus far with GAE. GAE can present with: focal paralysis, seizures, brainstem symptoms, and other neurological problems, some of which may mimic glioma (especially brainstem glioma), or other brain diseases, which may hamper timely diagnosis. These symptoms are caused by inflammatory necrosis of brain tissue brought on by amoebic infiltrates. Even with treatment, the condition is often fatal, and there are very few recorded survivors, almost all of whom suffered permanent neurocognitive deficits. Antifungal drugs including ketoconazole, miconazole, 5-flucytosine and pentamidine have been shown to be effective against GAE-causing organisms in laboratory tests. Source: Via inhalation or skin lesion

Babesiosis

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Babesiosis is a malaria-like parasitic disease caused by infection with Babesia, a type of Apicomplexa. Human babesiosis transmission via tick bite is most common in the North-eastern and Midwestern United States and parts of Europe, and sporadic throughout the rest of the world. It occurs in warm weather. People can get infected with Babesia parasites by the bite of an infected tick, by getting a blood transfusion from an infected donor of blood products, or by congenital transmission (an infected mother to her baby).

Ticks transmit the human strain of babesiosis, so it often presents with other tick-borne illnesses such as Lyme disease. After trypanosomes, Babesia is thought to be the second-most common blood parasite of mammals, and they can have a major impact on health of domestic animals in areas without severe winters. Half of all children and a quarter of previously healthy adults are asymptomatic with Babesia infection.

When people do develop symptoms, the most common are fever and hemolytic anaemia, symptoms that are similar to those of malaria. People with symptoms usually become ill 1 to 4 weeks after the bite, or 1 to 9 weeks after transfusion of contaminated blood products. A person infected with babesiosis gradually develops malaise and fatigue, followed by a fever. Hemolytic anaemia, in which red blood cells are destroyed and removed from the blood, also develops. Chills, sweats, and thrombocytopenia are also common symptoms. Symptoms may last from several days to several months. Source: Tick bites, e.g. Ixodes scapularis

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Less Common Symptoms ● Headache ● Muscle pain ● Anorexia ● Nonproductive cough (mucus is not coughed up) ● Arthralgias (noninflammatory joint pain, unlike arthritis, which is inflammatory)	● Nausea ● Vomiting ● Sore throat ● Abdominal pain ● Emotional lability ● Pink eye/Conjunctivitis	● Photophobia (abnormal intolerance to visual perception of light) ● Weight loss ● Depression ● Hyperesthesia (more sensitive to stimuli)	In more severe cases, symptoms similar to malaria occur, with fevers up to 40.5 °C (105 °F), shaking chills, and severe anaemia (hemolytic anaemia). Organ failure may follow, including adult respiratory distress syndrome.

Balantidiasis

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Balantidiasis is a protozoan infection caused by infection with Balantidium coli. Symptoms can be local due to involvement of the intestinal mucosa, or systemic in nature and include either diarrhoea or constipation. Balantidiasis is a zoonotic disease and is acquired by humans via the feco-oral route from the normal host, the pig, where it is asymptomatic. “Contaminated water is the most common mechanism of transmission. Equally dangerous, however, is the ingestion of contaminated food.” The diagnosis of balantidiasis can be an intricate process, partly because the related symptoms may or may not be present.

However, the diagnosis of balantidiasis can be considered when a patient has diarrhoea combined with a probable history of current exposure to amebiasis through travel, contact with infected persons, or anal intercourse. In addition, the diagnosis of balantidiasis can be made by microscopic examination of stool or tissue samples. Balantidiasis can be treated with tetracycline, carbarsone, metronidazole, or diiodohydroxyquin. Source: Ingestion of cyst, zoonotic infection acquired from pigs (faeces).

Preventative measures require effective personal and community hygiene. Some specific safeguards include the following:
● Purification of drinking water.
● Proper handling of food.
● Careful disposal of human faeces.
● Monitoring the contacts of balantidiasis patients.

Blastocystosis

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Blastocystosis refers to a medical condition caused by infection with Blastocystis. Blastocystis is a protozoal, single-celled parasite that inhabits the gastrointestinal tracts of humans and other animals. Many different types of Blastocystis exist, and they can infect humans, farm animals, birds, rodents, amphibians, reptiles, fish, and even cockroaches. Blastocystosis has been found to be a possible risk factor for development of irritable bowel syndrome. Source: Eating food contaminated with faeces from an infected human or animal.

Most Commonly Symptoms ● Abdominal pain ● Itching, usually anal itching ● Constipation ● Diarrhoea ● Watery or loose stools ● Weight loss ● Fatigue ● Flatulence	**Less Common Symptoms** ● Skin rash ● Headache, depression ● Arthritic symptoms and joint pain ● Intestinal inflammation		

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Researchers have sought to develop models to understand the variety of symptoms seen in humans. Some patients do not have symptoms, while others report severe diarrhoea and fatigue. Consumption of Untreated Water (well water): Many studies have linked Blastocystis infection with contaminated drinking water. Contaminated Food: Contamination of leafy vegetables has been implicated as a potential source for transmission of Blastocystis infection, as well as other gastrointestinal protozoa.

Cryptosporidiosis

ILLNESS Parasitic Protozoan Organisms Cryptosporidiosis

Cryptosporidiosis, also known as crypto, is a parasitic disease caused by Cryptosporidium, a genus of protozoan parasites in the phylum Apicomplexa. It affects the distal small intestine and can affect the respiratory tract in both immunocompetent (i.e., individuals with a normal functioning immune system) and immunocompromised (e.g., persons with HIV/AIDS or autoimmune disorders) individuals, resulting in watery diarrhea with or without an unexplained cough. In immunosuppressed individuals, the symptoms are particularly severe and can be fatal. It is primarily spread through the fecal-oral route, often through contaminated water; recent evidence suggests that it can also be transmitted via fomites in respiratory secretions.

Source
Collects on water filters and membranes that cannot be disinfected, human and animal faeces. Drinking water sources become contaminated when faeces containing the parasites are deposited or flushed into water. If treatment is inadequate, drinking water may contain sufficient numbers of parasites to cause illness.

Symptoms
Diarrhoea, Watery Stool, Stomach Cramps, Slight Fever. Watery diarrhoea, abdominal cramps, nausea, and headaches.
These symptoms occur within two to 25 days of infection and usually last one or two weeks; in some cases they persist for up to a month.

Treatment
Fluid Replacement, Wormwood, Colloidal Silver, Olive Leaf Extract. Most healthy people recover within two weeks without medical attention. Anti-motility agents. These medications slow down the movements of your intestines and increase fluid absorption to relieve diarrhoea and restore normal stools (Imodium).

Diagnosis
Identification under a microscope form stool sample or intestinal biopsy.

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Despite not being identified until 1976, it is one of the most common waterborne diseases and is found worldwide. The infection beings when a human consumes food or water containing cysts of the Cryptosporidium organism. Cryptosporidiosis may occur as an asymptomatic infection, an acute infection (i.e., duration shorter than 2 weeks), as recurrent acute infections in which symptoms reappear following a brief period of recovery for up to 30 days, and as a chronic infection (i.e., duration longer than 2 weeks) in which symptoms are severe and persistent. It may be fatal in individuals with a severely compromised immune system. Symptoms usually appear 5–10 days after infection (range: 2–28 days) and normally last for up to 2 weeks in immunocompetent individuals; symptoms are usually more severe and persist longer in immunocompromised individuals.

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Symptoms
Following the resolution of diarrhoea, symptoms can reoccur after several days or weeks due to reinfection. The likelihood of re-infection is high in immunocompromised adults, and low in those with normal immune systems

Common Symptoms
- Moderate to severe watery diarrhoea, sometimes contains mucus and rarely contains blood or leukocytes
- Low-grade fever
- Crampy abdominal pain
- Dehydration
- Weight loss
- Fatigue
- Nausea and vomiting
- Epigastric or right upper quadrant tenderness

Rare Symptoms
- Reactive arthritis
- Jaundice
- Ascites

Upper Respiratory Cryptosporidiosis
- Inflammation of the nasal mucosa, sinuses, larynx, or trachea
- Nasal discharge
- Voice change (e.g., hoarseness)

Lower Respiratory Cryptosporidiosis
- Cough
- Shortness of breath
- Fever
- Hypoxemia

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Cryptosporidiosis Transmission
Infection is through contaminated material such as earth, water, uncooked or cross-contaminated food that has been in contact with the faeces of an infected individual or animal. Contact must then be transferred to the mouth and swallowed. It is especially prevalent amongst those in regular contact with bodies of fresh water including recreational water such as swimming pools. Other potential sources include insufficiently treated water supplies, contaminated food, or exposure to faeces. The high resistance of Cryptosporidium oocysts to disinfectants such as chlorine bleach enables them to survive for long periods and still remain infective.

Some outbreaks have happened in day care related to diaper changes. Cases of cryptosporidiosis can occur even in cities that have a properly de-contaminated water supply. In a city with clean water, it may be that cases of cryptosporidiosis have other origins. Testing of water, as well as epidemiological study, are necessary to determine the sources of specific infections. Cryptosporidium is causing serious illness more frequently in immunocompromised than in apparently healthy individuals. It may chronically sicken some children, as well as adults who are exposed and immunocompromised.

Elevated Risks
- Child care workers
- Parents of infected children
- People who take care of other people with cryptosporidiosis
- International travellers
- Backpackers, hikers, and campers who drink unfiltered, untreated water
- People, including swimmers, who swallow water from contaminated sources
- People who handle infected cattle

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Cryptosporidiosis Prevention
Many treatment plants that take raw water from rivers, lakes, and reservoirs for public drinking water production use conventional filtration technologies. This involves a series of processes, including coagulation, flocculation, sedimentation, and filtration. Direct filtration, which is typically used to treat water with low particulate levels, includes coagulation and filtration, but not sedimentation. Other common filtration processes, including slow sand filters, diatomaceous earth filters and membranes will remove 99% of Cryptosporidium. Membranes and bag and cartridge filters remove Cryptosporidium product-specifically.

While Cryptosporidium is highly resistant to chlorine disinfection, with high enough concentrations and contact time, Cryptosporidium will be inactivated by chlorine dioxide and ozone treatment. The required levels of chlorine generally preclude the use of chlorine disinfection as a reliable method to control Cryptosporidium in drinking water. Ultraviolet light treatment at relatively low doses will inactivate Cryptosporidium. Water Research Foundation-funded research originally discovered UV's efficacy in inactivating Cryptosporidium. The most reliable way to decontaminate drinking water that may be contaminated by Cryptosporidium is to boil it.

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In the US the law requires doctors and labs to report cases of cryptosporidiosis to local or state health departments. These departments then report to the Centre for Disease Control and Prevention. The best way to prevent getting and spreading cryptosporidiosis is to have good hygiene and sanitation. An example would be hand-washing. Prevention is through washing hands carefully after going to the bathroom or contacting stool, and before eating. People should avoid contact with animal faeces.

They should also avoid possibly contaminated food and water. In addition, people should refrain from engaging in sexual activities that can expose them to faeces. Standard water filtration may not be enough to eliminate Cryptosporidium; boiling for at least 1 minute (3 minutes above 6,500 feet (2,000 m) of altitude) will decontaminate it. Heating milk at 71.7 °C (161 °F) for 15 seconds pasteurizes it and can destroy the oocysts' ability to infect. Water can also be made safe by filtering with a filter with pore size not greater than 1 micrometre, or by filters that have been approved for “cyst removal” by NSF International National Sanitation Foundation.

Bottled drinking water is less likely to contain Cryptosporidium, especially if the water is from an underground source. People with cryptosporidiosis should not swim in communal areas because the pathogen can reside in the anal and genital areas and be washed off. They should wait until at least two weeks after diarrhoea stops before entering public water sources, since oocysts can still be shed for a while. Also, they should stay away from immunosuppressed people.

Immunocompromised people should take care to protect themselves from water in lakes and streams. They should also stay away from animal stools and wash their hands after touching animals. To be safe, they should boil or filter their water. They should also wash and cook their vegetables. Soak contaminated surfaces for 20 minutes with a 3% hydrogen peroxide (99% kill rate) and then rinse them thoroughly.

Cryptosporidiosis Treatment
Symptomatic treatment primarily involves fluid rehydration, electrolyte replacement (sodium, potassium, bicarbonate, and glucose), and antimotility agents (e.g., loperamide). Supplemental zinc may improve symptoms, particularly in recurrent or persistent infections or in others at risk for zinc deficiency. Immunocompetent individuals with cryptosporidiosis typically suffer a short (i.e., duration of less than 2 weeks) self-limiting course of diarrhoea that may require symptomatic treatment and ends with spontaneous recovery; in some circumstances, antiparasitic medication may be required (e.g., recurrent, severe, or persistent symptoms); however reinfection frequently occurs. In immunocompromised individuals, such as AIDS patients, cryptosporidiosis resolves slowly or not at all, and frequently causes a particularly severe and persistent form of watery diarrhoea coupled with a greatly decreased ability to absorb key nutrients through the intestinal tract. As a result, infected individuals may experience severe dehydration, electrolyte imbalances, malnutrition, wasting, and potentially death. Cryptosporidiosis is found worldwide. It causes 50.8% of water-borne diseases that are attributed to parasites. In developing countries, 8–19% of diarrheal diseases can be attributed to Cryptosporidium. Ten percent of the population in developing countries excretes oocysts. In developed countries, the number is lower at 1–3%. The age group most affected are children from 1 to 9 years old. Roughly 30% of adults in the United States are seropositive for cryptosporidiosis, meaning that they contracted the infection at some point in their lives.

Cyclosporiasis

Cyclosporiasis is a disease caused by infection with Cyclospora cayetanensis, a pathogenic protozoan transmitted by faeces or faeces-contaminated food and water. Outbreaks have been reported due to contaminated fruits and vegetables. It is not spread from person to person, but can be a hazard for travellers as a cause of diarrhoea.

Sources
Sewage, non-treated drinking water.

Symptoms
Cramps, nausea, vomiting, muscle aches, fever, and fatigue.

Treatment
The infection is often treated with trimethaprim-sulfamethaxozol, also known as Bactrim or co-trimoxazole, because traditional anti-protozoal drugs are not sufficient. To prevent transmission, food should be cooked thoroughly and drinking water from streams should be avoided.

Dientamoebiasis

Dientamoebiasis is a medical condition caused by infection with Dientamoeba fragilis, a single-cell parasite that infects the lower gastrointestinal tract of humans. It is an important cause of traveler's diarrhea, chronic abdominal pain, chronic fatigue, and failure to thrive in children.

Symptoms
The most commonly reported symptoms in conjunction with infection with D. fragilis include abdominal pain (69%) and diarrhea (61%). Diarrhea may be intermittent and may not be present in all cases. It is often chronic, lasting over two weeks. The degree of symptoms may vary from asymptomatic to severe, and can include weight loss, vomiting, fever, and involvement of other digestive organs.

Symptoms
- Weight loss
- Fatigue
- Nausea and vomiting
- Fever
- Urticaria (skin rash)
- Pruritus (itchiness)
- Biliary infection

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Treatment
Concomitant pinworm infection should also be excluded, although the association has not been proven. Successful treatment of the infection with iodoquinol, doxycycline, metronidazole, paromomycin, and secnidazole has been reported. Resistance requires the use of combination therapy to eradicate the organism. All persons living in the same residence should be screened for D. fragilis, as asymptomatic carriers may provide a source of repeated infection. Paromomycin is an effective prophylactic for travellers who will encounter poor sanitation and unsafe drinking water.

Amoebiasis

Amoebiasis, also known amoebic dysentery, is an infection caused by any of the amobae of the Entamoeba group. Symptoms are most common during infection by Entamoeba histolytica. Amoebiasis can be present with no, mild, or severe symptoms. Symptoms may include abdominal pain, diarrhea, or bloody diarrhea. Complications can include inflammation and ulceration of the colon with tissue death or perforation, which may result in peritonitis. People affected may develop anemia due to loss of blood. Cysts of Entamoeba can survive for up to a month in soil or for up to 45 minutes under fingernails. Invasion of the intestinal lining results in bloody diarrhea.

If the parasite reaches the bloodstream it can spread through the body, most frequently ending up in the liver where it can cause amoebic liver abscesses. Prevention of amoebiasis is by improved sanitation, including separating food and water from faeces. There is no vaccine. There are two treatment options depending on the location of the infection. Amoebiasis in tissues is treated with either metronidazole, tinidazole, nitazoxanide, dehydroemetine or chloroquine, while luminal infection is treated with diloxanide furoate or iodoquinoline.

Effective treatment against all stages of the disease may require a combination of medications. Infections without symptoms do not require treatment but infected individuals can spread the parasite to others and treatment can be considered. Treatment of other Entamoeba infections apart from E. histolytica is not needed. Sources - Sewage, non-treated drinking water, flies in water supply. Symptoms - Abdominal discomfort, fatigue, weight loss, diarrhea, bloating, fever.

Most infected people, about 90%, are asymptomatic, but this disease has the potential to become serious. It is estimated that about 40,000 to 100,000 people worldwide die annually due to amoebiasis. Infections can sometimes last for years if there is no treatment. Symptoms take from a few days to a few weeks to develop and manifest themselves, but usually it is about two to four weeks. Symptoms can range from mild diarrhea to dysentery with blood, coupled with intense abdominal pains.

The blood comes from bleeding lesions created by the amoebae invading the lining of the colon. In about 10% of invasive cases the amoebae enter the bloodstream and may travel to other organs in the body. Most commonly this means the liver, as this is where blood from the intestine reaches first, but they can end up almost anywhere in the body. Onset time is highly variable and the average asymptomatic infection persists for over a year. It is theorized that the absence of symptoms or their intensity may vary with such factors as strain of amoeba, immune response of the host, and perhaps associated bacteria and viruses.

In asymptomatic infections, the amoeba lives by eating and digesting bacteria and food particles in the gut, a part of the gastrointestinal tract. It does not usually come in contact with the intestine itself due to the protective layer of mucus that lines the gut. Disease occurs when amoeba comes in contact with the cells lining the intestine. It then secretes the same substances it uses to digest bacteria, which include enzymes that destroy cell membranes and proteins. This process can lead to penetration and digestion of human tissues, resulting first in flask-shaped ulcerations in the intestine.

Transmission
Amoebiasis is usually transmitted by the fecal-oral route, but it can also be transmitted indirectly through contact with dirty hands or objects as well as by anal-oral contact. Infection is spread through ingestion of the cyst form of the parasite, a semi-dormant and hardy structure found in feces. Any non-encysted amoebae, or trophozoites, die quickly after leaving the body but may also be present in stool: these are rarely the source of new infections. Since amoebiasis is transmitted through contaminated food and water, it is often endemic in regions of the world with limited modern sanitation systems, including México, Central America, western South America, South Asia, and western and southern Africa. Amoebic dysentery is often confused with "traveler's diarrhea" because of its prevalence in developing nations. In fact, most traveler's diarrhea is bacterial or viral in origin.

Giardiasis

Sources: Untreated water, poor disinfection, pipe breaks, leaks, groundwater contamination, campgrounds where humans and wildlife use same source of water. Beavers and muskrats create ponds that act as reservoirs for Giardia.
Symptoms: Symptoms may present as early as one day after exposure, although it more commonly presents in one to two weeks. Patients complain of watery diarrhea, abdominal cramping, violent (often called "projectile") vomiting, and gas.
Treatment: Metronidazole is the drug of choice in conjunction with oral rehydration. Tinidazole, Nitazoxanide.
Notes: The most common disease-causing parasite in the world is the protozoa Giardia lamblia. It has even been found in backcountry waters in many national parks in the U.S.

Giardiasis, popularly known as beaver fever, is a parasitic disease caused by Giardia lamblia. About 10% of those infected have no symptoms. When symptoms occur they may include diarrhea, abdominal pain, and weight loss. Vomiting, blood in the stool, and fever are less common. Symptoms usually begin 1 to 3 weeks after exposure and without treatment may last up to six weeks. Giardia usually spreads when Giardia lamblia cysts within feces contaminate food or water which is then eaten or drunk. It may also spread between people and from other animals. Risk factors include travel in the developing world, changing diapers, eating food without cooking it, and owning a dog. Cysts may survive for nearly three months in cold water. Diagnosis is via stool tests. Prevention is typically by improved hygiene.

Those without symptoms do not usually need treatment. When symptoms are present treatment is typically with either tinidazole or metronidazole. People who are not already lactose intolerant may become so temporarily after an infection and therefore it is often recommended milk be avoided for a few weeks. Resistance to treatment may occur. Giardia is one of the most common parasitic human diseases globally. In 2013, there were about 280 million people worldwide with symptomatic giardiasis. Rates are as high as 7% in the developed world and 30% in the developing world. The World Health Organization classified it as a neglected disease.

Signs & Symptoms
Symptoms vary from none to severe diarrhea with poor absorption of nutrients. Symptoms typically develop 9–15 days after exposure, but may occur as early as one day. The most common and prominent symptom is chronic diarrhea which can occur for weeks or months if untreated. Diarrhea is often greasy and foul-smelling, with a tendency to float. This characteristic diarrhea is often accompanied by a number of other symptoms, including gas, abdominal cramps, and nausea or vomiting. Some people also experience itchy skin, hives, and swelling of the eyes and joints, although these are less common. Prolonged disease is often characterized by diarrhea along with malabsorption of nutrients in the intestine. This malabsorption results in fatty stools, substantial weight loss, and fatigue. Additionally, those suffering from giardiasis often have difficulty absorbing lactose, vitamin A, folate, and vitamin B12. In children, prolonged giardiasis can cause failure to thrive and may impair mental development. Symptomatic infections are well recognized as causing lactose intolerance, which, while usually temporary, may become permanent.

Prevention
The CDC recommends hand-washing and avoiding potentially contaminated food and untreated water. Boiling suspect water for one minute is the surest method to make water safe to drink and kill disease-causing microorganisms such as Giardia lamblia if in doubt about whether water is infected. Chemical disinfectants or filters may be used. Although the evidence linking the drinking of water in the North American wilderness and giardiasis has been questioned, a number of studies raise concern. Most if not all CDC verified backcountry giardiasis outbreaks have been attributed to water. Surveillance data (for 2013 and 2014) reports six outbreaks (96 cases) of waterborne giardiasis contracted from rivers, streams or springs and less than 1% of reported giardiasis cases are associated with outbreaks. Person-to-person transmission accounts for the majority of Giardia infections and is usually associated with poor hygiene and sanitation. Giardia is found on the surface of the ground, in the soil, in undercooked foods, and in water, and on hands without proper cleaning after handling infected feces. Water-borne transmission is associated with the ingestion of contaminated water. In the U.S., outbreaks typically occur in small water systems using inadequately treated surface water. Venereal transmission happens through fecal-oral contamination. Additionally, diaper changing and inadequate hand washing are risk factors for transmission from infected children. Lastly, food-borne epidemics of Giardia have developed through the contamination of food by infected food-handlers.

Treatment
Treatment is not always necessary as the infection usually resolves on its own. However, if the illness is acute or symptoms persist and medications are needed to treat it, a nitroimidazole medication is used such as metronidazole, tinidazole, secnidazole or ornidazole. The World Health Organization and Infectious Disease Society of America recommend metronidazole as first line therapy. The US CDC lists metronidazole, tinidazole, and nitazoxanide as effective first-line therapies; of these three, only nitazoxanide and tinidazole are approved for the treatment of giardiasis by the US FDA. Resistance has been seen clinically to both nitroimidazoles and albendazole, but not nitazoxanide, though nitazoxanide resistance has been induced in research laboratories so is theoretically possible. The exact mechanism of resistance to all of these medications is not well understood. In the case of nitroimidazole-resistant strains of Giardia, other drugs are available which have showed efficacy in treatment including quinacrine, nitazoxanide, bacitracin zinc, furazolidone and paromomycin.

Isosporiasis

Isosporiasis, also known as cystoisosporiasis, is a human intestinal disease caused by the parasite Isospora belli (now known as Cystoisospora belli). It is found worldwide, especially in tropical and subtropical areas. Infection often occurs in immuno-compromised individuals, notably AIDS patients, and outbreaks have been reported in institutionalized groups in the United States. It is usually spread indirectly, normally through contaminated food or water.

Signs & Symptoms
Infection causes acute, non-bloody diarrhea with crampy abdominal pain, which can last for weeks and result in malabsorption and weight loss. In immunodepressed patients, and in infants and children, the diarrhea can be severe.

Cause
The coccidian parasite Isospora belli infects the epithelial cells of the small intestine, and is the least common of the three intestinal coccidia that infect humans (Toxoplasma, Cryptosporidium, and Isospora).

Transmission
People become infected by swallowing the mature parasite; this normally occurs through the ingestion of contaminated food or water. The infected host then produces an immature form of the parasite in their feces, and when the parasite matures, it is capable of infecting its next host, via food or water containing the parasite.

Prevention
Avoiding food or water that may be contaminated with stool can help prevent the infection of Cystoisospora (Isosporiasis). Good hand-washing, and personal-hygiene practices should be used as well. One should wash their hands with soap and warm water after using the toilet, changing diapers, and before handling food (CDC.gov). It is also important to teach children the importance of washing their hands, and how to properly wash their hands.

Treatment
Isosporiasis is treated with prescription antibiotics, the treatment of choice is trimethoprim-sulfamethoxazole.

Leishmaniasis

Leishmaniasis is a disease caused by parasites of the Leishmania type. It is spread by the bite of certain types of sandflies. The disease can present in three main ways: cutaneous, mucocutaneous, or visceral leishmaniasis. The cutaneous form presents with skin ulcers, while the mucocutaneous form presents with ulcers of the skin, mouth, and nose, and the visceral form starts with skin ulcers and then later presents with fever, low red blood cells, and enlarged spleen and liver. Infections in humans are caused by more than 20 species of Leishmania. Risk factors include poverty, malnutrition, deforestation, and urbanization. All three types can be diagnosed by seeing the parasites under the microscope.

Additionally, visceral disease can be diagnosed by blood tests. Leishmaniasis can be partly prevented by sleeping under nets treated with insecticide. Other measures include spraying insecticides to kill sandflies and treating people with the disease early to prevent further spread. The treatment needed is determined by where the disease is acquired, the species of Leishmania, and the type of infection. Some possible medications used for visceral disease include liposomal amphotericin B, a combination of pentavalent antimonials and paromomycin, and miltefosine. For cutaneous disease, paromomycin, fluconazole, or pentamidine may be effective.

Signs & Symptoms
The symptoms of leishmaniasis are skin sores which erupt weeks to months after the person is bitten by infected sand flies. Leishmaniasis is considered one of the classic causes of a markedly enlarged (and therefore palpable) spleen; the organ, which is not normally felt during examination of the abdomen, may even become larger than the liver in severe cases.

Leishmaniasis may be divided into the following types:
● Cutaneous leishmaniasis is the most common form, which causes an open sore at the bite sites, which heals in a few months to a year and half, leaving an unpleasant-looking scar. Diffuse cutaneous leishmaniasis produces widespread skin lesions which resemble leprosy, and may not heal on its own.
● Mucocutaneous leishmaniasis causes both skin and mucosal ulcers with damage primarily of the nose and mouth.
● Visceral leishmaniasis or kala-azar ('black fever') is the most serious form, and is potentially fatal if untreated. Other consequences, which can occur a few months to years after infection, include fever, damage to the spleen and liver, and anemia.

Causes
Leishmaniasis is transmitted by the bite of infected female phlebotomine sandflies which can transmit the protozoa Leishmania. The sandflies inject the infective stage, metacyclic promastigotes, during blood meals (1). Metacyclic promastigotes that reach the puncture wound are phagocytized by macrophages (2) and transform into amastigotes (3). Amastigotes multiply in infected cells and affect different tissues, depending in part on which Leishmania species is involved (4). These differing tissue specificities cause the differing clinical manifestations of the various forms of leishmaniasis. Sandflies become infected during blood meals on infected hosts when they ingest macrophages infected with amastigotes (5,6). In the sandfly's midgut, the parasites differentiate into promastigotes (7), which multiply, differentiate into metacyclic promastigotes, and migrate to the proboscis (8). Risk Factors: Risk factors include poverty, malnutrition, deforestation, lack of sanitation and urbanization.

Diagnosis
Leishmaniasis is diagnosed in the hematology laboratory by direct visualization of the amastigotes (Leishman-Donovan bodies). Buffy-coat preparations of peripheral blood or aspirates from marrow, spleen, lymph nodes, or skin lesions should be spread on a slide to make a thin smear and stained with Leishman stain or Giemsa stain (pH 7.2) for 20 minutes. Amastigotes are seen within blood and spleen monocytes or, less commonly, in circulating neutrophils and in aspirated tissue macrophages. They are small, round bodies 2–4 μm in diameter with indistinct cytoplasm, a nucleus, and a small, rod-shaped kinetoplast. Occasionally, amastigotes may be seen lying free between cells. However, the retrieval of tissue samples is often painful for the patient and identification of the infected cells can be difficult. So, other indirect immunological methods of diagnosis are developed, including enzyme-linked immunosorbent assay, antigen-coated dipsticks, and direct agglutination test. Although these tests are readily available, they are not the standard diagnostic tests due to their insufficient sensitivity and specificity.

Prevention
Leishmaniasis can be partly prevented by using nets treated with insecticide while sleeping. To provide good protection against sandflies, fine mesh sizes of 0.6 mm or less are required, but a mosquito net with 1.2mm mesh will provide a limited reduction in the number of sandfly bites. Finer mesh sizes have the downside of higher cost and reduced air circulation which can cause overheating. Many Phlebotomine sandfly attacks occur at sunset rather than at night, so it may also be useful to put nets over doors and windows or to use insect repellents. Use of insecticide-impregnated dog collars and treatment or culling of infected dogs. Spraying houses and animal shelters with insecticides.

Treatment
The treatment is determined by where the disease is acquired, the species of Leishmania, and the type of infection. For visceral leishmaniasis in India, South America, and the Mediterranean, liposomal amphotericin B is the recommended treatment and is often used as a single dose. Rates of cure with a single dose of amphotericin have been reported as 95%. In India, almost all infections are resistant to pentavalent antimonials. In Africa, a combination of pentavalent antimonials and paromomycin is recommended. These, however, can have significant side effects. Miltefosine, an oral medication, is effective against both visceral and cutaneous leishmaniasis. Side effects are generally mild, though it can cause birth defects if taken within 3 months of getting pregnant. It does not appear to work for L. major or L. braziliensis. The evidence around the treatment of cutaneous leishmaniasis is poor. A number of topical treatments may be used for cutaneous leishmaniasis. Which treatments are effective depends on the strain, with topical paromomycin effective for L. major, L. tropica, L. mexicana, L. panamensis, and L. braziliensis. Pentamidine is effective for L. guyanensis.

Primary Amoebic Meningoencephalitis (PAM)

Naegleriasis (also known as primary amoebic meningoencephalitis) is an infection of the brain by the free-living unicellular Naegleria fowleri.
N. fowleri is typically found in warm bodies of fresh water, such as ponds, lakes, rivers, and hot springs. It is also found in soil, poorly maintained municipal water supplies, water heaters, near warm-water discharges of industrial plants, and in poorly chlorinated or unchlorinated swimming pools, in an amoeboid or temporary flagellate stage. There is no evidence of it living in salt water. As the disease is rare, it is often not considered. Symptoms are similar to those of meningitis. Although infection occurs rarely, it nearly always results in death, with a case fatality rate greater than 95%.

Signs & Symptoms
Onset of symptoms begins one to nine days following exposure (with an average of five). Initial symptoms include changes in taste and smell, headache, fever, nausea, vomiting, back pain, and a stiff neck. Secondary symptoms are also meningitis-like including confusion, hallucinations, lack of attention, ataxia, cramp and seizures. After the start of symptoms, the disease progresses rapidly over three to seven days, with death usually occurring anywhere from seven to fourteen days later, although it can take longer. In 2013, a man in Taiwan died twenty-five days after being infected by Naegleria fowleri. It affects healthy children or young adults who have recently been exposed to bodies of fresh water. Some people have presented with a clinical triad of edematous brain lesions, immune suppression, and fever.

Cause
N. fowleri invades the central nervous system via the nose, specifically through the olfactory mucosa of the nasal tissues. This usually occurs as the result of the introduction of water that has been contaminated with N. fowleri into the nose during activities such as swimming, bathing, or nasal irrigation. The organism then begins to consume cells of the brain, piecemeal, by means of an amoebostome, a unique actin-rich sucking apparatus extended from its cell surface. It then becomes pathogenic, causing primary amoebic meningoencephalitis (PAM or PAME).

Prevention
Wear nose-clips to prevent insufflation of contaminated water is effective protection against contracting PAM. Prevent fresh water from entering the nostrils and avoid putting their heads down into fresh water or stirring mud in the water with feet. When starting to suffer from fever, headache, nausea, or vomiting subsequent to any kind of exposure to fresh water even if the belief in none of the fresh water has traveled through nostrils, people with such conditions should be carried to hospital quickly and make sure doctors are well-informed about the history of exposure to fresh water.

Treatment
Treatment has often also used combination therapy with multiple other antimicrobials in addition to amphotericin, such as fluconazole, miconazole, rifampicin and azithromycin. They have shown limited success only when administered early in the course of an infection. Less than 1% of people with naegleriasis survive.

Malaria

Malaria is a mosquito-borne infectious disease affecting humans and other animals caused by parasitic single-celled microorganisms belonging to the Plasmodium group. Malaria causes symptoms that typically include fever, tiredness, vomiting, and headaches. In severe cases it can cause yellow skin, seizures, coma, or death. Symptoms usually begin ten to fifteen days after being bitten by an infected mosquito. If not properly treated, people may have recurrences of the disease months later. In those who have recently survived an infection, reinfection usually causes milder symptoms. This partial resistance disappears over months to years if the person has no continuing exposure to malaria.

The disease is most commonly transmitted by an infected female Anopheles mosquito. The mosquito bite introduces the parasites from the mosquito's saliva into a person's blood. The parasites travel to the liver where they mature and reproduce. Five species of Plasmodium can infect and be spread by humans. Most deaths are caused by P. falciparum because P. vivax, P. ovale, and P. malariae generally cause a milder form of malaria. The species P. knowlesi rarely causes disease in humans.

Malaria is typically diagnosed by the microscopic examination of blood using blood films, or with antigen-based rapid diagnostic tests. Methods that use the polymerase chain reaction to detect the parasite's DNA have been developed, but are not widely used in areas where malaria is common due to their cost and complexity.

The risk of disease can be reduced by preventing mosquito bites through the use of mosquito nets and insect repellents, or with mosquito control measures such as spraying insecticides and draining standing water. Several medications are available to prevent malaria in travellers to areas where the disease is common. Occasional doses of the combination medication sulfadoxine/pyrimethamine are recommended in infants and after the first trimester of pregnancy in areas with high rates of malaria.

Despite a need, no effective vaccine exists, although efforts to develop one are ongoing. The recommended treatment for malaria is a combination of antimalarial medications that includes an artemisinin. The second medication may be either mefloquine, lumefantrine, or sulfadoxine/pyrimethamine. Quinine along with doxycycline may be used if an artemisinin is not available. It is recommended that in areas where the disease is common, malaria is confirmed if possible before treatment is started due to concerns of increasing drug resistance.

Resistance among the parasites has developed to several antimalarial medications; for example, chloroquine-resistant P. falciparum has spread to most malarial areas, and resistance to artemisinin has become a problem in some parts of Southeast Asia. The disease is widespread in the tropical and subtropical regions that exist in a broad band around the equator.

Signs & Symptoms
The signs and symptoms of malaria typically begin 8–25 days following infection, but may occur later in those who have taken antimalarial medications as prevention. Initial manifestations of the disease—common to all malaria species—are similar to flu-like symptoms, and can resemble other conditions such as sepsis, gastroenteritis, and viral diseases. The presentation may include headache, fever, shivering, joint pain, vomiting, hemolytic anemia, jaundice, hemoglobin in the urine, retinal damage, and convulsions. The classic symptom of malaria is paroxysm—a cyclical occurrence of sudden coldness followed by shivering and then fever and sweating, occurring every two days (tertian fever) in P. vivax and P. ovale infections, and every three days (quartan fever) for P. malariae. P. falciparum infection can cause recurrent fever every 36–48 hours, or a less pronounced and almost continuous fever. Severe malaria is usually caused by P. falciparum (often referred to as falciparum malaria). Symptoms of falciparum malaria arise 9–30 days after infection. Individuals with cerebral malaria frequently exhibit neurological symptoms, including abnormal posturing, nystagmus, conjugate gaze palsy (failure of the eyes to turn together in the same direction), opisthotonus, seizures, or coma.

Causes
Malaria parasites belong to the genus Plasmodium (phylum Apicomplexa). In humans, malaria is caused by P. falciparum, P. malariae, P. ovale, P. vivax and P. knowlesi. Among those infected, P. falciparum is the most common species identified (~75%) followed by P. vivax (~20%). Although P. falciparum traditionally accounts for the majority of deaths, recent evidence suggests that P. vivax malaria is associated with potentially life-threatening conditions about as often as with a diagnosis of P. falciparum infection. P. vivax proportionally is more common outside Africa.

There have been documented human infections with several species of Plasmodium from higher apes; however, except for P. knowlesi—a zoonotic species that causes malaria in macaques—these are mostly of limited public health importance. Only female mosquitoes feed on blood; male mosquitoes feed on plant nectar and do not transmit the disease. Females of the mosquito genus Anopheles prefer to feed at night. They usually start searching for a meal at dusk and will continue throughout the night until taking a meal.

Malaria parasites can also be transmitted by blood transfusions, although this is rare. Symptoms of malaria can recur after varying symptom-free periods. Depending upon the cause, recurrence can be classified as either recrudescence, relapse, or reinfection. Recrudescence is when symptoms return after a symptom-free period. It is caused by parasites surviving in the blood as a result of inadequate or ineffective treatment. Relapse is when symptoms reappear after the parasites have been eliminated from blood but persist as dormant hypnozoites in liver cells.

Relapse commonly occurs between 8–24 weeks and is often seen in P. vivax and P. ovale infections. However, relapse-like P. vivax recurrences are probably being over-attributed to hypnozoite activation. Global climate change is likely to affect malaria transmission, but the degree of effect and the areas effected is uncertain. Greater rainfall in certain areas of India and following an El Nino event is associated with increased mosquito numbers.

Diagnosis
Owing to the non-specific nature of the presentation of symptoms, diagnosis of malaria in non-endemic areas requires a high degree of suspicion, which might be elicited by any of the following: recent travel history, enlarged spleen, fever, low number of platelets in the blood, and higher-than-normal levels of bilirubin in the blood combined with a normal level of white blood cells. Malaria is usually confirmed by the microscopic examination of blood films or by antigen-based rapid diagnostic tests (RDT). In some areas, RDTs need to be able to distinguish whether the malaria symptoms are caused by Plasmodium falciparum or by other species of parasites since treatment strategies could differ for non-P. falciparum infections. Malaria is classified into either "severe" or "uncomplicated" by the World Health Organization (WHO). It is deemed severe when any of the following criteria are present, otherwise it is considered uncomplicated. Cerebral malaria is defined as a severe P. falciparum-malaria presenting with neurological symptoms, including coma (with a Glasgow coma scale less than 11, or a Blantyre coma scale less than 3), or with a coma that lasts longer than 30 minutes after a seizure.

ILLNESS Parasitic Protozoan Organisms Malaria

Severe/Complicated Symptoms
- Decreased consciousness
- Significant weakness such that the person is unable to walk
- Inability to feed
- Two or more convulsions
- Low blood pressure (less than 70 mmHg in adults and 50 mmHg in children)
- Breathing problems
- Circulatory shock
- Kidney failure or hemoglobin in the urine
- Bleeding problems, or hemoglobin less than 50 g/L (5 g/dL)
- Pulmonary oedema
- Blood glucose less than 2.2 mmol/L (40 mg/dL)

Malaria Types This is a table of the different types of malaria and their effects.

Name	Pathogen	Notes
Algid Malaria	Plasmodium falciparum	Severe malaria affecting the cardiovascular system and causing chills and circulatory shock
Bilious Malaria	Plasmodium falciparum	Severe malaria affecting the liver and causing vomiting and jaundice
Cerebral Malaria	Plasmodium Falciparum	Severe malaria affecting the cerebrum
Congenital Malaria	Various Plasmodia	Plasmodium introduced from the mother via the fetal circulation
Falciparum Malaria, Plasmodium Falciparum Malaria, Pernicious Malaria	Plasmodium Falciparum	None
Ovale Malaria, Plasmodium Ovale Malaria	Plasmodium Ovale	None
Quartan Malaria, Malariae Malaria, Plasmodium Malariae Malaria	Plasmodium Malariae	Paroxysms every fourth day (quartan), counting the day of occurrence as the first day
Quotidian Malaria	Plasmodium Falciparum, Plasmodium Vivax	Paroxysms daily (quotidian)
Tertian Malaria	Plasmodium Falciparum, Plasmodium Ovale, Plasmodium Vivax	Paroxysms every third day (tertian), counting the day of occurrence as the first
Transfusion Malaria	Various Plasmodia	Plasmodium introduced by blood transfusion, needle sharing, or needlestick injury
Vivax Malaria, Plasmodium Vivax Malaria	Plasmodium Vivax	None

Malaria Prevention
Methods used to prevent malaria include medications, mosquito elimination and the prevention of bites. There is no vaccine for malaria. The presence of malaria in an area requires a combination of high human population density, high anopheles mosquito population density and high rates of transmission from humans to mosquitoes and from mosquitoes to humans. If any of these is lowered sufficiently, the parasite will eventually disappear from that area, as happened in North America, Europe and parts of the Middle East.

However, unless the parasite is eliminated from the whole world, it could become re-established if conditions revert to a combination that favors the parasite's reproduction. Furthermore, the cost per person of eliminating anopheles mosquitoes rises with decreasing population density, making it economically unfeasible in some areas.

Prevention of malaria may be more cost-effective than treatment of the disease in the long run, but the initial costs required are out of reach of many of the world's poorest people. There is a wide difference in the costs of control (i.e. maintenance of low endemicity) and elimination programs between countries. For example, in China—whose government in 2010 announced a strategy to pursue malaria elimination in the Chinese provinces—the required investment is a small proportion of public expenditure on health.

In contrast, a similar program in Tanzania would cost an estimated one-fifth of the public health budget. In areas where malaria is common, children under five years old often have anemia which is sometimes due to malaria. Giving children with anemia in these areas preventive antimalarial medication improves red blood cell levels slightly but did not affect the risk of death or need for hospitalization.

For individual protection, the most effective insect repellents are based on DEET or picaridin. Insecticide-treated mosquito nets (ITNs) and indoor residual spraying (IRS) have been shown to be highly effective in preventing malaria among children in areas where malaria is common. Mosquito nets help keep mosquitoes away from people and reduce infection rates and transmission of malaria.

Nets are not a perfect barrier and are often treated with an insecticide designed to kill the mosquito before it has time to find a way past the net. Insecticide-treated nets are estimated to be twice as effective as untreated nets and offer greater than 70% protection compared with no net. Most nets are impregnated with pyrethroids, a class of insecticides with low toxicity. They are most effective when used from dusk to dawn.

It is recommended to hang a large "bed net" above the center of a bed and either tuck the edges under the mattress or make sure it is large enough such that it touches the ground. Indoor residual spraying is the spraying of insecticides on the walls inside a home. After feeding, many mosquitoes rest on a nearby surface while digesting the bloodmeal, so if the walls of houses have been coated with insecticides, the resting mosquitoes can be killed before they can bite another person and transfer the malaria parasite.

Education can also inform people to cover over areas of stagnant, still water, such as water tanks that are ideal breeding grounds for the parasite and mosquito, thus cutting down the risk of the transmission between people. This is generally used in urban areas where there are large centers of population in a confined space and transmission would be most likely in these areas. There are a number of medications that can help prevent or interrupt malaria in travelers to places where infection is common.

Many of these medications are also used in treatment. In places where Plasmodium is resistant to one or more medications, three medications—mefloquine, doxycycline , or the combination of atovaquone/proguanil (Malarone)—are frequently used for prevention. Doxycycline and the atovaquone/proguanil are better tolerated while mefloquine is taken once a week. Areas of the world with chloroquine sensitive malaria are uncommon.

The protective effect does not begin immediately, and people visiting areas where malaria exists usually start taking the drugs one to two weeks before arriving and continue taking them for four weeks after leaving (except for atovaquone/proguanil, which only needs to be started two days before and continued for seven days afterward). The use of preventative drugs is often not practical for those who live in areas where malaria exists, and their use is usually only in pregnant women and short-term visitors.

This is due to the cost of the drugs, side effects from long-term use, and the difficulty in obtaining anti-malarial drugs outside of wealthy nations. During pregnancy, medication to prevent malaria has been found to improve the weight of the baby at birth and decrease the risk of anemia in the mother. The use of preventative drugs where malaria-bearing mosquitoes are present may encourage the development of partial resistance.

Malaria Treatment
Malaria is treated with antimalarial medications; the ones used depends on the type and severity of the disease. While medications against fever are commonly used, their effects on outcomes are not clear. Simple or uncomplicated malaria may be treated with oral medications. The most effective treatment for P. falciparum infection is the use of artemisinins in combination with other antimalarials (known as artemisinin-combination therapy, or ACT), which decreases resistance to any single drug component. These additional antimalarials include: amodiaquine, lumefantrine, mefloquine or sulfadoxine/pyrimethamine.

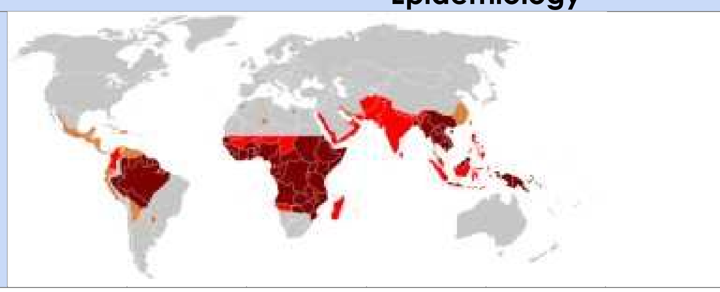
Another recommended combination is dihydroartemisinin and piperaquine. ACT is about 90% effective when used to treat uncomplicated malaria. To treat malaria during pregnancy, the WHO recommends the use of quinine plus clindamycin early in the pregnancy (1st trimester), and ACT in later stages (2nd and 3rd trimesters). In the 2000s (decade), malaria with partial resistance to artemisins emerged in Southeast Asia. Infection with P. vivax, P. ovale or P. malariae usually do not require hospitalization. Treatment of P. vivax requires both treatment of blood stages (with chloroquine or ACT) and clearance of liver forms with primaquine. Treatment with tafenoquine prevents relapses after confirmed P. vivax malaria.

Drug resistance poses a growing problem in 21st-century malaria treatment. Resistance is now common against all classes of antimalarial drugs apart from artemisinins. Treatment of resistant strains became increasingly dependent on this class of drugs. The cost of artemisinins limits their use in the developing world. Malaria strains found on the Cambodia–Thailand border are resistant to combination therapies that include artemisinins, and may, therefore, be untreatable. Exposure of the parasite population to artemisinin monotherapies in subtherapeutic doses for over 30 years and the availability of substandard artemisinins likely drove the selection of the resistant phenotype.

Resistance to artemisinin has been detected in Cambodia, Myanmar, Thailand, and Vietnam, and there has been emerging resistance in Laos. When properly treated, people with malaria can usually expect a complete recovery. However, severe malaria can progress extremely rapidly and cause death within hours or days. In the most severe cases of the disease, fatality rates can reach 20%, even with intensive care and treatment. Over the longer term, developmental impairments have been documented in children who have suffered episodes of severe malaria. Chronic infection without severe disease can occur in an immune-deficiency syndrome associated with a decreased responsiveness to Salmonella bacteria and the Epstein–Barr virus.

Epidemiology

Malaria Prevalence



Distribution of Malaria
Red - Occurrence of chloroquine-resistant malaria
Orange - No Plasmodium falciparum or chloroquine-resistance
Grey - No malaria

It's estimated that in 2015 there were 214 million new cases of malaria resulting in 438,000 deaths. Others have estimated the number of cases at between 350 and 550 million for falciparum malaria The majority of cases (65%) occur in children under 15 years old. About 125 million pregnant women are at risk of infection each year; in Sub-Saharan Africa, maternal malaria is associated with up to 200,000 estimated infant deaths yearly. There are about 10,000 malaria cases per year in Western Europe, and 1300–1500 in the United States. About 900 people died from the disease in Europe between 1993 and 2003. Both the global incidence of disease and resulting mortality have declined in recent years. According to the WHO and UNICEF, deaths attributable to malaria in 2015 were reduced by 60% from a 2000 estimate of 985,000, largely due to the widespread use of insecticide-treated nets and artemisinin-based combination therapies.

In 2012, there were 207 million cases of malaria. That year, the disease is estimated to have killed between 473,000 and 789,000 people, many of whom were children in Africa. Efforts at decreasing the disease in Africa since the turn of millennium have been partially effective, with rates of the disease dropping by an estimated forty percent on the continent. Malaria is presently endemic in a broad band around the equator, in areas of the Americas, many parts of Asia, and much of Africa; in Sub-Saharan Africa, 85–90% of malaria fatalities occur. The geographic distribution of malaria within large regions is complex, and malaria-afflicted and malaria-free areas are often found close to each other. Malaria is prevalent in tropical and subtropical regions because of rainfall, consistent high temperatures and high humidity, along with stagnant waters in which mosquito larvae readily mature, providing them with the environment they need for continuous breeding. In drier areas, outbreaks of malaria have been predicted with reasonable accuracy by mapping rainfall.

Rhinosporidiosis
Rhinosporidiosis is an infection caused by Rhinosporidium seeberi. This organism was previously considered to be a fungus, and rhinosporidiosis is classified as a fungal disease under ICD-10. It is now considered to be a protist classified under Mesomycetozoea. Authors of detailed studies have revealed superficial similarities between Dermocystidium and Rhinosporidium when using light microscopy, but substantial morphological differences between the groups exist. There is some evidence that DNA extracted from purified uncontaminated round bodies (Rhinosporidium seeberi) is of cyanobacterial origin. Rhinosporidiosis is a granulomatous disease affecting the mucous membrane of nasopharynx, oropharynx, conjunctiva, rectum and external genitalia. Though the floor of the nose and inferior turbinate are the most common sites, the lesions may appear elsewhere too. Traumatic inoculation from one site to others is common. Laryngeal rhinosporidiosis, too, has been described and may be due to inoculation from the nose during endotracheal intubation. After inoculation, the organism replicates locally, resulting in hyperplasia of host tissue and localised immune response.
● Infection of nose and nasopharynx - 70%
● Infection of palpebral conjunctiva - 15%

Treatment
● Surgical excision - wide excision with wide area electro-coagulation of the lesion base
● Medical treatment is not so effective but treatment with a year-long course of dapsone has been reported

Toxoplasma Gondii (Toxoplasmosis)

ILLNESS | Parasitic | Protozoan Organisms | Toxoplasmosis

Toxoplasmosis is a parasitic disease caused by Toxoplasma gondii. Infections with toxoplasmosis usually cause no obvious symptoms in adults. Occasionally, people may have a few weeks or months of mild, flu-like illness such as muscle aches and tender lymph nodes. In a small number of people, eye problems may develop. In those with a weak immune system, severe symptoms such as seizures and poor coordination may occur. If infected during pregnancy, a condition known as congenital toxoplasmosis may affect the child. Toxoplasmosis is usually spread by eating poorly cooked food that contains cysts, exposure to infected cat feces, and from a mother to a child during pregnancy if the mother becomes infected. Rarely, the disease may be spread by blood transfusion. It is not otherwise spread between people. The parasite is only known to reproduce sexually in the cat family. However, it can infect most types of warm-blooded animals, including humans. Diagnosis is typically by testing blood for antibodies or by testing amniotic fluid for the parasite's DNA. Prevention is by properly preparing and cooking food. Pregnant women are also recommended not to clean cat litter boxes. Treatment of otherwise healthy people is usually not needed. During pregnancy, spiramycin or pyrimethamine/sulfadiazine and folinic acid may be used for treatment. Up to half of the world's population is infected by toxoplasmosis, but have no symptoms. In the United States, about 23% are affected and in some areas of the world this is up to 95%.

Sources
The most common sources of toxoplasmosis, the disease caused by Toxoplasma, are undercooked meat, animal feces, and transmission from mother to unborn child. Toxoplasma from animal feces can contaminate soil or water. Cats commonly contribute to the spread of Toxoplasma infection by eating small animals carrying the parasite and passing it on through their feces.

Symptoms
Healthy individuals usually become infected with Toxoplasma without exhibiting any symptoms, as their immune systems are able to keep them from experiencing illness. If symptoms do occur, they generally take the form of mild "flu-like" symptoms, such as headache, muscle aches, fever and sore lymph nodes. These can last for several weeks.

Treatment
Most healthy people do not require treatment for toxoplasmosis. However, otherwise-healthy individuals who experience severe symptoms of the disease can be treated with drugs, including Daraprim, an antimalarial drug, or Sulfadiazine, an antibiotic. The same drugs can be used to treat those with compromised immune systems.

Notes
Toxoplasma gondii is one of the world's most common parasites. It is the second leading cause of deaths attributed to foodborne illness in the United States, and the third leading cause of foodborne illness hospitalizations. It is estimated that 22.5% of the population over the age of 12 has been infected with the Toxoplasma parasite. For some populations, this figure is as high as 95%.

Acute Toxoplasmosis
Acute toxoplasmosis is often asymptomatic in healthy adults. However, symptoms may manifest and are often influenza-like: swollen lymph nodes, headaches, fever, and fatigue, or muscle aches and pains that last for a month or more. Rarely will a human with a fully functioning immune system develop severe symptoms following infection.

People with weakened immune systems are likely to experience headache, confusion, poor coordination, seizures, lung problems that may resemble tuberculosis or Pneumocystis jiroveci pneumonia (a common opportunistic infection that occurs in people with AIDS), or blurred vision caused by severe inflammation of the retina (ocular toxoplasmosis). Young children and immunocompromised people, such as those with HIV/AIDS, those taking certain types of chemotherapy, or those who have recently received an organ transplant, may develop severe toxoplasmosis.

This can cause damage to the brain (encephalitis) or the eyes (necrotizing retinochoroiditis). Infants infected via placental transmission may be born with either of these problems, or with nasal malformations, although these complications are rare in newborns. The toxoplasmic trophozoites causing acute toxoplasmosis are referred to as tachyzoites, and are typically found in bodily fluids. Swollen lymph nodes are commonly found in the neck or under the chin, followed by the armpits and the groin.

Swelling may occur at different times after the initial infection, persist, and recur for various times independently of antiparasitic treatment. It is usually found at single sites in adults, but in children, multiple sites may be more common. Enlarged lymph nodes will resolve within 1-2 months in 60% of cases. However, a quarter of those affected take 2-4 months to return to normal, and 8% take 4-6 months. A substantial number (6%) do not return to normal until much later.

Latent Toxoplasmosis
Due to its asymptomatic nature, hosts easily become infected with T. gondii and develop toxoplasmosis without knowing it. Although mild, flu-like symptoms occasionally occur during the first few weeks following exposure, infection with T. gondii produces no readily observable symptoms in healthy human adults. In most immunocompetent people, the infection enters a latent phase, during which only bradyzoites (in tissue cysts) are present; these tissue cysts and even lesions can occur in the retinas, alveolar lining of the lungs (where an acute infection may mimic a Pneumocystis jirovecii infection), heart, skeletal muscle, and the central nervous system (CNS), including the brain. Cysts form in the CNS (brain tissue) upon infection with T. gondii and persist for the lifetime of the host. Most infants who are infected while in the womb have no symptoms at birth, but may develop symptoms later in life. Reviews of serological studies have estimated that 30–50% of the global population has been exposed to and may be chronically infected with latent toxoplasmosis, although infection rates differ significantly from country to country. This latent state of infection has recently been associated with numerous disease burdens, neural alterations, and subtle gender-dependent behavioral changes in immunocompetent humans.

Cutaneous Toxoplasmosis
While rare, skin lesions may occur in the acquired form of the disease, including roseola and erythema multiforme-like eruptions, prurigo-like nodules, urticaria, and maculopapular lesions. Newborns may have punctate macules, ecchymoses, or "blueberry muffin" lesions. Diagnosis of cutaneous toxoplasmosis is based on the tachyzoite form of T. gondii being found in the epidermis. It is found in all levels of the epidermis, is about 6 by 2 μm and bow-shaped, with the nucleus being one-third of its size. It can be identified by electron microscopy or by Giemsa staining tissue where the cytoplasm shows blue, the nucleus red.

Cause
In its lifecycle, T. gondii adopts several forms. Tachyzoites are responsible for acute infection; they divide rapidly and spread through the tissues of the body. Tachyzoites are also known as "tachyzoic merozoites", a descriptive term that conveys more precisely the parasitological nature of this stage. Toxoplasmosis is generally transmitted through the mouth when Toxoplasma gondii oocysts or tissue cysts are accidentally eaten. Congenital transmittance from mother to fetus can also occur. Transmission may also occur during the solid organ transplant process or hematogenous stem cell transplants. Cats excrete the pathogen in their feces for a number of weeks after contracting the disease, generally by eating an infected intermediate host that could include mammals (like rodents) or birds. Oocyst shedding usually starts from the third day after ingestion of infected intermediate hosts, and may continue for weeks. The oocysts are not infective when excreted. After about a day, the oocyst undergoes a process called sporulation and becomes potentially pathogenic. In addition to cats, birds and mammals including human beings are also intermediate host of the parasite and are involved in the transmission process.

Oral Transmission
● Ingestion of raw or partly cooked meat, especially pork, lamb, or venison containing Toxoplasma cysts: Infection prevalence in countries where undercooked meat is traditionally eaten has been related to this transmission method. Tissue cysts may also be ingested during hand-to-mouth contact after handling undercooked meat, or from using knives, utensils, or cutting boards contaminated by raw meat.
● Ingestion of unwashed fruit or vegetables that have been in contact with contaminated soil containing infected cat feces.
● Ingestion of cat feces containing oocysts: This can occur through hand-to-mouth contact following gardening, cleaning a cat's litter box, contact with children's sandpits; the parasite can survive in the environment for months.
● Ingestion of untreated, unfiltered water through direct consumption or utilization of water for food preparation.
● Ingestion of unpasteurized milk and milk products, particularly goat's milk.
● Ingestion of raw seafood.

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Treatment
Treatment is often only recommended for people with serious health problems, such as people with HIV whose CD4 counts are under 200 cells/mm3, because the disease is most serious when one's immune system is weak. Trimethoprim/sulfamethoxazole is the drug of choice to prevent toxoplasmosis, but not for treating active disease. A 2012 study shows a promising new way to treat the active and latent form of this disease using two endochin-like quinolones.

Acute
The medications prescribed for acute toxoplasmosis are the following:
- Pyrimethamine — an antimalarial medication
- Sulfadiazine — an antibiotic used in combination with pyrimethamine to treat toxoplasmosis
  - Combination therapy is usually given with folic acid supplements to reduce incidence of thrombocytopaenia.
  - Combination therapy is most useful in the setting of HIV.
- Clindamycin
- Spiramycin — an antibiotic used most often for pregnant women to prevent the infection of their children.

(other antibiotics, such as minocycline, have seen some use as a salvage therapy).
If infected during pregnancy, spiramycin is recommended in the first and early second trimesters while pyrimethamine/sulfadiazine and leucovorin is recommended in the late second and third trimesters.

Latent
In people with latent toxoplasmosis, the cysts are immune to these treatments, as the antibiotics do not reach the bradyzoites in sufficient concentration.
The medications prescribed for latent toxoplasmosis are:
- Atovaquone — an antibiotic that has been used to kill Toxoplasma cysts inside AIDS patients
- Clindamycin — an antibiotic that, in combination with atovaquone, seemed to optimally kill cysts in mice

Trichomoniasis

ILLNESS Parasitic Protozoan Organisms Trichomoniasis

Trichomoniasis (trich) is an infectious disease caused by the parasite Trichomonas vaginalis. About 70% of women and men do not have symptoms when infected. When symptoms do occur they typically begin 5 to 28 days after exposure. Symptoms can include itching in the genital area, a bad smelling thin vaginal discharge, burning with urination, and pain with sex. Having trichomoniasis increases the risk of getting HIV/AIDS. It may also cause complications during pregnancy. Trichomoniasis is a sexually transmitted infection (STI) which is most often spread through vaginal, oral, or anal sex. It can also spread through genital touching. People who are infected may spread the disease even when symptoms are not present. Diagnosis is by finding the parasite in the vaginal fluid using a microscope, culturing the vagina or urine, or testing for the parasite's DNA. If present other sexually transmitted infections should be tested for. Methods of prevention include not having sex, using condoms, not douching, and being tested for STIs before having sex with a new partner. Trichomoniasis can be cured with antibiotics, either metronidazole or tinidazole. Sexual partners should also be treated. About 20% of people get infected again within three months of treatment. There were about 122 million new cases of trichomoniasis in 2015. In the United States there are about 2 million women affected. It occurs more often in women than men. Trichomonas vaginalis was first identified in 1836 by Alfred Donné. It was first recognized as causing this disease in 1916.

Symptoms
Most people infected with trichomonas vaginalis do not have any symptoms and can be undetected for years. Symptoms experienced include pain, burning or itching in the penis, urethra (urethritis), or vagina (vaginitis). Discomfort for both sexes may increase during intercourse and urination. For women there may also be a yellow-green, itchy, frothy, foul-smelling ("fishy" smell) vaginal discharge. In rare cases, lower abdominal pain can occur. Symptoms usually appear within 5 to 28 days of exposure.

Causes
The human genital tract is the only reservoir for this species. Trichomonas is transmitted through sexual or genital contact.
The single-celled protozoan produces mechanical stress on host cells and then ingests cell fragments after cell death.

Prevention
Use of male condoms or female condoms may help prevent the spread of trichomoniasis, although careful studies have never been done that focus on how to prevent this infection. Infection with Trichomoniasis through water is unlikely because Trichomonas vaginalis dies in water after 45–60 minutes, in thermal water after 30 minutes to 3 hours and in diluted urine after 5–6 hours.

Treatment
Treatment for both pregnant and non-pregnant women is usually with metronidazole, by mouth once. Caution should be used in pregnancy, especially in the first trimester. Sexual partners, even if they have no symptoms, should also be treated. For 95-97% of cases, infection is resolved after one dose of metronidazole. Without treatment, trichomoniasis can persist for months to years in women, and is thought to improve without treatment in men.

Sleeping Sickness (African Trypanosomiasis)

ILLNESS Parasitic Protozoan Organisms Sleeping Sickness

African trypanosomiasis, also known as sleeping sickness, is an insect-borne parasitic disease of humans and other animals. It is caused by protozoa of the species Trypanosoma brucei. There are two types that infect humans, Trypanosoma brucei gambiense (TbG) and Trypanosoma brucei rhodesiense (TbR). TbG causes over 98% of reported cases. Both are usually transmitted by the bite of an infected tsetse fly and are most common in rural areas. Initially, in the first stage of the disease, there are fevers, headaches, itchiness and joint pains.

This begins one to three weeks after the bite. Weeks to months later the second stage begins with confusion, poor coordination, numbness, and trouble sleeping. Diagnosis is via finding the parasite in a blood smear or in the fluid of a lymph node. A lumbar puncture is often needed to tell the difference between first and second stage disease. Prevention of severe disease involves screening the population at risk with blood tests for TbG.

Treatment is easier when the disease is detected early and before neurological symptoms occur. Treatment of the first stage is with the medications pentamidine or suramin. Treatment of the second stage involves eflornithine or a combination of nifurtimox and eflornithine for TbG. While melarsoprol works for both stages, it is typically only used for TbR, due to serious side effects. Without treatment it typically results in death. The disease occurs regularly in some regions of sub-Saharan Africa with the population at risk being about 70 million in 36 countries. An estimated 11,000 people are currently infected with 2,800 new infections in 2015. It is classified as a neglected tropical disease. Other animals, such as cows, may carry the disease and become infected in which case it is known as animal trypanosomiasis.

Signs & Symptoms
African trypanosomiasis symptoms occur in two stages. The first stage, known as the hemolymphatic phase, is characterized by fever, headaches, joint pains, and itching. Fever is intermittent, with attacks lasting from a day to a week, separated by intervals of a few days to a month or longer. Invasion of the circulatory and lymphatic systems by the parasites is associated with severe swelling of lymph nodes, often to tremendous sizes. Winterbottom's sign, the tell-tale swollen lymph nodes along the back of the neck, may appear. Occasionally, a chancre (red sore) will develop at the location of the tsetse fly bite. If left untreated, the disease overcomes the host's defenses and can cause more extensive damage, broadening symptoms to include anemia, endocrine, cardiac, and kidney dysfunctions. The second phase of the disease, the neurological phase, begins when the parasite invades the central nervous system by passing through the blood–brain barrier. Disruption of the sleep cycle is a leading symptom of this stage and is the one that gave the disease the name 'sleeping sickness'.

ILLNESS Parasitic Protozoan Organisms Sleeping Sickness

Infected individuals experience a disorganized and fragmented 24-hour rhythm of the sleep-wake cycle, resulting in daytime sleep episodes and nighttime periods of wakefulness. Other neurological symptoms include confusion, tremor, general muscle weakness, hemiparesis, and paralysis of a limb. Parkinson-like movements might arise due to non-specific movement disorders and speech disorders. Individuals may also exhibit psychiatric symptoms such as irritability, psychotic reactions, aggressive behaviour, or apathy which can sometimes dominate the clinical diagnosis. Without treatment, the disease is invariably fatal, with progressive mental deterioration leading to coma, systemic organ failure, and death. An untreated infection with T. b. rhodesiense will cause death within months whereas an untreated infection with T. b. gambiense will cause death after several years. Damage caused in the neurological phase is irreversible.

Cause
Trypanosoma brucei gambiense accounts for the majority of African trypanosomiasis cases, with humans as the main reservoir needed for the transmission, while Trypanosoma brucei rhodesiense is mainly zoonotic, with the occasional human infection. African Trypanosomiasis is dependent on the interaction of the parasite (trypanosome) with the tsetse flies (vector), as well as the host (human for Trypanosoma brucei gambiense, and animals for Trypanosoma brucei rhodesiense). The risk of contracting African Trypanosomiasis is dependent on coming in contact with an infected tsetse fly.

Trypanosoma Brucei
There are two subspecies of the parasite that are responsible for starting the disease in humans. Trypanosoma brucei gambiense causes the diseases in west and central Africa, whereas Trypanosoma brucei rhodesiense has a limited geographical range and is responsible for causing the disease in east and southern Africa.

Vector
The tsetse fly (genus Glossina) is a large, brown, biting fly that serves as both a host and vector for the trypanosome parasites. While taking blood from a mammalian host, an infected tsetse fly injects metacyclic trypomastigotes into skin tissue. From the bite, parasites first enter the lymphatic system and then pass into the bloodstream. Inside the mammalian host, they transform into bloodstream trypomastigotes, and are carried to other sites throughout the body, reach other body fluids (e.g., lymph, spinal fluid), and continue to replicate by binary fission.

Prevention
Currently there are few medically related prevention options for African Trypanosomiasis (i.e. no vaccine exists for immunity). Although the risk of infection from a tsetse fly bite is minor (estimated at less than 0.1%), the use of insect repellants, wearing long-sleeved clothing, avoiding tsetse-dense areas, implementing bush clearance methods and wild game culling are the best options to avoid infection available for local residents of affected areas. Regular active surveillance, involving detection and prompt treatment of new infections, and tsetse fly control is the backbone of the strategy used to control sleeping sickness. Systematic screening of at-risk communities is the best approach, because case-by-case screening is not practical in endemic regions. Systematic screening may be in the form of mobile clinics or fixed screening centres where teams travel daily to areas of high infection rates. Such screening efforts are important because early symptoms are not evident or serious enough to warrant patients with gambiense disease to seek medical attention, particularly in very remote areas. Also, diagnosis of the disease is difficult and health workers may not associate such general symptoms with trypanosomiasis. Systematic screening allows early-stage disease to be detected and treated before the disease progresses, and removes the potential human reservoir. A single case of sexual transmission of West African sleeping sickness has been reported.

Treatment
First Stage
The current treatment for first-stage disease is intravenous or intramuscular pentamidine for T. b. gambiense or intravenous suramin for T. b. rhodesiense.

Second Stage
For T. b. gambiense a regimen involving the combination of nifurtimox and eflornithine, nifurtimox-eflornithine combination treatment (NECT), or eflornithine alone appear to be more effective and result in fewer side effects.

These treatments may replace melarsoprol when available with the combination being first line. NECT has the benefit of requiring less injections of eflornithine. Intravenous melarsoprol was previously the standard treatment for second-stage (neurological phase) disease and is effective for both types. Melarsoprol is the only treatment for second stage T. b. rhodesiense; however, it causes death in 5% of people who take it. Resistance to melarsoprol can occur. If untreated, T. b. gambiense almost always results in death, with only a few individuals shown in a long-term 15 year follow-up to have survived after refusing treatment. T. b. rhodesiense, being a more acute and severe form of the disease, is consistently fatal if not treated. Disease progression greatly varies depending on disease form. For individuals which are infected by T. b. gambiense, which accounts for 98% of all of the reported cases, a person can be infected for months or even years without signs or symptoms until the advanced disease stage, where it is too late to be treated successfully. For individuals affected by T. b. rhodesiense, which accounts for 2% of all reported cases, symptoms appear within weeks or months of the infection. Disease progression is rapid and invades the central nervous system, causing death within a short amount of time.

Chagas' Disease

ILLNESS Parasitic Protozoan Organisms Chagas' Disease

Chagas disease, also known as American trypanosomiasis, is a tropical parasitic disease caused by the protist Trypanosoma cruzi. It is spread mostly by insects known as Triatominae, or "kissing bugs". The symptoms change over the course of the infection. In the early stage, symptoms are typically either not present or mild, and may include fever, swollen lymph nodes, headaches, or local swelling at the site of the bite. After 8–12 weeks, individuals enter the chronic phase of disease and in 60–70% it never produces further symptoms.

The other 30–40% of people develop further symptoms 10–30 years after the initial infection, including enlargement of the ventricles of the heart in 20–30%, leading to heart failure. An enlarged esophagus or an enlarged colon may also occur in 10% of people. T. cruzi is commonly spread to humans and other mammals by the blood-sucking "kissing bugs" of the subfamily Triatominae.

The disease may also be spread through blood transfusion, organ transplantation, eating food contaminated with the parasites, and by vertical transmission (from a mother to her fetus). Diagnosis of early disease is by finding the parasite in the blood using a microscope. Prevention mostly involves eliminating kissing bugs and avoiding their bites. This may involve the use of insecticides or bed-nets. Other preventive efforts include screening blood used for transfusions. A vaccine has not been developed as of 2017.

Early infections are treatable with the medication benznidazole or nifurtimox. Medication nearly always results in a cure if given early, but becomes less effective the longer a person has had Chagas disease. When used in chronic disease, medication may delay or prevent the development of end–stage symptoms. Benznidazole and nifurtimox cause temporary side effects in up to 40% of people including skin disorders, brain toxicity, and digestive system irritation.

Signs & Symptoms
The human disease occurs in two stages: an acute stage, which occurs shortly after an initial infection, and a chronic stage that develops over many years. The acute phase lasts for the first few weeks or months of infection. It usually occurs unnoticed because it is symptom-free or exhibits only mild symptoms that are not unique to Chagas disease. These can include fever, fatigue, body aches, muscle pain, headache, rash, loss of appetite, diarrhea, nausea, and vomiting. The signs on physical examination can include mild enlargement of the liver or spleen, swollen glands, and local swelling (a chagoma) where the parasite entered the body. The most recognized marker of acute Chagas disease is called Romaña's sign, which includes swelling of the eyelids on the side of the face near the bite wound or where the bug feces were deposited or accidentally rubbed into the eye. Rarely, young children, or adults may die from the acute disease due to severe inflammation/infection of the heart muscle (myocarditis) or brain (meningoencephalitis). The acute phase also can be severe in people with weakened immune systems. If symptoms develop during the acute phase, they usually resolve spontaneously within three to eight weeks in approximately 90% of individuals. Although the symptoms resolve, even with treatment the infection persists and enters a chronic phase.

Of individuals with chronic Chagas disease, 60–80% will never develop symptoms (called indeterminate chronic Chagas disease), while the remaining 20–40% will develop life-threatening heart and/or digestive disorders during their lifetime (called determinate chronic Chagas disease). In 10% of individuals, the disease progresses directly from the acute form to a symptomatic clinical form of chronic Chagas disease. The symptomatic (determinate) chronic stage affects the nervous system, digestive system and heart. About two-thirds of people with chronic symptoms have cardiac damage, including dilated cardiomyopathy, which causes heart rhythm abnormalities and may result in sudden death.

About one-third of patients go on to develop digestive system damage, resulting in dilation of the digestive tract (megacolon and megaesophagus), accompanied by severe weight loss. Swallowing difficulties (secondary achalasia) may be the first symptom of digestive disturbances and may lead to malnutrition. 20–50% of individuals with intestinal involvement also exhibit cardiac involvement. Up to 10% of chronically infected individuals develop neuritis that results in altered tendon reflexes and sensory impairment. Isolated cases exhibit central nervous system involvement, including dementia, confusion, chronic encephalopathy and sensory and motor deficits.

Transmission
In Chagas-endemic areas, the main mode of transmission is through an insect vector called a triatomine bug. A triatomine becomes infected with T. cruzi by feeding on the blood of an infected person or animal. During the day, triatomines hide in crevices in the walls and roofs. The bugs emerge at night, when the inhabitants are sleeping. Because they tend to feed on people's faces, triatomine bugs are also known as "kissing bugs". After they bite and ingest blood, they defecate on the person.

Triatomines pass T. cruzi parasites (called trypomastigotes) in feces left near the site of the bite wound. Scratching the site of the bite causes the trypomastigotes to enter the host through the wound, or through intact mucous membranes, such as the conjunctiva. Once inside the host, the trypomastigotes invade cells, where they differentiate into intracellular amastigotes. The amastigotes multiply by binary fission and differentiate into trypomastigotes, which are then released into the bloodstream.

This cycle is repeated in each newly infected cell. Replication resumes only when the parasites enter another cell or are ingested by another vector. Chagas disease affects 8 to 10 million people living in endemic Latin American countries, with an additional 300,000–400,000 living in nonendemic countries, including Spain and the United States. An estimated 41,200 new cases occur annually in endemic countries, and 14,400 infants are born with congenital Chagas disease annually.

In 2010 it resulted in approximately 10,300 deaths up from 9,300 in 1990. The disease is present in 18 countries on the American continents, ranging from the southern United States to northern Argentina. Chagas exists in two different ecological zones. In the Southern Cone region, the main vector lives in and around human homes.

Prevention
There is currently no vaccine against Chagas disease. Prevention is generally focused on decreasing the numbers of the insect that spreads it (Triatoma) and decreasing their contact with humans. This is done by using sprays and paints containing insecticides (synthetic pyrethroids), and improving housing and sanitary conditions in rural areas. For urban dwellers, spending vacations and camping out in the wilderness or sleeping at hostels or mud houses in endemic areas can be dangerous; a mosquito net is recommended. Some measures of vector control include:
● A yeast trap can be used for monitoring infestations of certain species of triatomine bugs (Triatoma sordida, Triatoma brasiliensis, Triatoma pseudomaculata, and Panstrongylus megistus).
● Promising results were gained with the treatment of vector habitats with the fungus Beauveria bassiana.
● Targeting the symbionts of Triatominae through paratransgenesis can be done.

Management
There are two approaches to treating Chagas disease: antiparasitic treatment, to kill the parasite; and symptomatic treatment, to manage the symptoms and signs of the infection. Management uniquely involves addressing selective incremental failure of the parasympathetic nervous system. Autonomic disease imparted by Chagas may eventually result in megaesophagus, megacolon and accelerated dilated cardiomyopathy. The mechanisms that explain why Chagas targets the parasympathetic autonomic nervous system and spares the sympathetic autonomic nervous system remain poorly understood. Antiparasitic treatment is most effective early in the course of infection, but is not limited to cases in the acute phase. Drugs of choice include azole or nitro derivatives, such as benznidazole or nifurtimox. Both agents are limited in their capacity to completely eliminate T. cruzi from the body (parasitologic cure), especially in chronically infected patients, and resistance to these drugs has been reported. Studies suggest antiparasitic treatment leads to parasitological cure in more than 90% of infants but only about 60–85% of adults treated in the first year of acute phase Chagas disease. Children aged six to 12 years with chronic disease have a cure rate of about 60% with benznidazole. While the rate of cure declines the longer an adult has been infected with Chagas, treatment with benznidazole has been shown to slow the onset of heart disease in adults with chronic Chagas infections.

11 Worms

Helminths (Worms)

Tapeworm

Cestoda is a class of parasitic worms in the flatworm phylum (Platyhelminthes). Most of the species—and the best-known—are those in the subclass Eucestoda; they are ribbon-like worms as adults, known as tapeworms. Their bodies consist of many similar units, known as proglottids, which are essentially packages of eggs which are regularly shed into the environment to infect other organisms. Species of the other subclass, Cestodaria, are mainly fish parasites.

Symptoms
Like other species of mammal, humans can become infected with tapeworms. There may be few or no symptoms, and the first indication of the infection may be the presence of one or more proglottids in the stools. The proglottids appear as flat, rectangular, whitish objects about the size of a grain of rice, which may change size or move about. Bodily symptoms which are sometimes present include abdominal pain, nausea, diarrhea, increased appetite and weight loss.

Treatment
There are several classes of anthelminthic drugs, some effective against many kinds of parasite, others more specific; these can be used both preventatively and to treat infections. For example, praziquantel is an effective treatment for tapeworm infection, and is preferred over the older niclosamide. While accidental tapeworm infections in developed countries are quite rare, such infections are more likely to occur in countries with poor sanitation facilities or where food hygiene standards are low.

Diphyllobothriasis - Tapeworm

Diphyllobothriasis is the infection caused by tapeworms of the genus Diphyllobothrium (commonly D. latum and D. nihonkaiense).

Diphyllobothriasis mostly occurs in regions where raw fish is regularly consumed; those who consume raw fish are at risk of infection. The infection is often asymptomatic and usually presents only with mild symptoms, which may include gastrointestinal complaints, weight loss, and fatigue. Rarely, vitamin B12 deficiency (possibly leading to anaemia) and gastrointestinal obstructions may occur. Infection may be long-lasting in absence of treatment. Diphyllobothriasis is generally diagnosed by looking for eggs or tapeworm segments in passed stool. Treatment with antiparasitic medications is straightforward, effective, and safe.

Symptoms
Most infections (~80%) are asymptomatic. Infections may be long-lasting, persisting for many years or decades (up to 25 years) if untreated.
Symptoms (when present) are generally mild. Manifestations may include: abdominal pain and discomfort, diarrhoea, vomiting, constipation, weight loss, and fatigue. Additional symptoms have been reported/described, including: dyspepsia, abdominal distension (commonly as presenting complaint), headache, myalgia, and dizziness.

ILLNESS Parasitic Worms Helminths (Worms)

Treatment

- Praziquantel

The standard treatment for diphyllobothriasis (as well as many other tapeworm infections) is a single dose of praziquantel, 5–10 mg/kg orally once for both adults and children. Praziquantel is not FDA-approved for this indication. Praziquantel has few side effects, many of which are similar to the symptoms of diphyllobothriasis.

- Niclosamide

An alternative treatment is niclosamide, 2 g orally once for adults or 50 mg/kg (max 2 g) for children. Niclosamide is not available for human or even animal use in the United States. Side effects of niclosamide are very rare due to the fact that the medication is not absorbed in the gastrointestinal tract.

- Other

Reportedly, albendazole can also be effective. Gastrografin may be potentially used both as a diagnostic and therapeutic; when introduced into the duodenum it allows for the visualization of the parasite, and has also been shown to cause detachment and passing of the whole worm.

Echinococcosis - Tapeworm

Echinococcosis is a parasitic disease of tapeworms of the Echinococcus type. The two main types of the disease are cystic echinococcosis and alveolar echinococcosis. Less common forms include polycystic echinococcosis and unicystic echinococcosis. The disease often starts without symptoms and this may last for years. The symptoms and signs that occur depend on the cyst's location and size. Alveolar disease usually begins in the liver but can spread to other parts of the body, such as the lungs or brain. When the liver is affected the person may have abdominal pain, weight loss, and turn slightly yellow from jaundice. Lung disease may cause pain in the chest, shortness of breath and coughing.

The disease is spread when food or water that contains the eggs of the parasite is eaten or by close contact with an infected animal. The eggs are released in the stool of meat-eating animals that are infected by the parasite. Commonly infected animals include dogs, foxes and wolves. For these animals to become infected they must eat the organs of an animal that contains the cysts such as sheep or rodents. The type of disease that occurs in people depends on the type of Echinococcus causing the infection. Diagnosis is usually by ultrasound though computer tomography (CT) or magnetic resonance imaging (MRI) may also be used. Blood tests looking for antibodies against the parasite may be helpful as may biopsy.

Symptoms

In the human manifestation of the disease, E. granulosus, E. multilocularis, E. oligarthrus and E. vogeli are localized in the liver (in 75% of cases), the lungs (in 5–15% of cases) and other organs in the body such as the spleen, brain, heart, and kidneys (in 10–20% of cases). In people who are infected with E. granulosus and therefore have cystic echinococcosis, the disease develops as a slow-growing mass in the body. These slow-growing masses, often called cysts, are also found in people that are infected with alveolar and polycystic echinococcosis.

The cysts found in those with cystic echinococcosis are usually filled with a clear fluid called hydatid fluid, are spherical, and typically consist of one compartment and are usually only found in one area of the body. While the cysts found in those with alveolar and polycystic echinococcosis are similar to those found in those with cystic echinococcosis, the alveolar and polycystic echinococcosis cysts usually have multiple compartments and have infiltrative as opposed to expansive growth.

Depending on the location of the cyst in the body, the person could be asymptomatic even though the cysts have grown to be very large, or be symptomatic even if the cysts are absolutely tiny. If the person is symptomatic, the symptoms will depend largely on where the cysts are located. For instance, if the person has cysts in the lungs and is symptomatic, they will have a cough, shortness of breath and/or pain in the chest. On the other hand, if the person has cysts in the liver and is symptomatic, they will suffer from abdominal pain, abnormal abdominal tenderness, hepatomegaly with an abdominal mass, jaundice, fever and/or anaphylactic reaction.

In addition, if the cysts were to rupture while in the body, whether during surgical extraction of the cysts or by trauma to the body, the person would most likely go into anaphylactic shock and suffer from high fever, pruritus (itching), edema (swelling) of the lips and eyelids, dyspnea, stridor and rhinorrhea.

Treatment

Cystic - For simple cases of cystic echinococcosis, the most common form of treatment is open surgical removal of the cysts combined with chemotherapy using albendazole and/or mebendazole before and after surgery. However, if there are cysts in multiple organs or tissues, or the cysts are in risky locations, surgery becomes impractical.

For inoperable cases such as these, chemotherapy and/or PAIR (puncture-aspiration-injection-reaspiration) become alternative options of treatment. In the case of alternative treatment using just chemotherapy, albendazole is preferred twice a day for 1–5 months. An alternative to albendazole is mebendazole for at least 3 to 6 months.

Alveolar - For alveolar echinococcosis, surgical removal of cysts combined with chemotherapy (using albendazole and/or mebendazole) for up to two years after surgery is the only sure way to completely cure the disease. However, in inoperable cases, chemotherapy by itself can also be used. In treatment using just chemotherapy, one could use either mebendazole in three doses or albendazole in two doses.

Polycystic - Since polycystic echinococcosis is constrained to such a particular area of the world and is not well described or found in many people, treatment of polycystic echinococcosis is less defined than that of cystic and alveolar echinococcosis. While surgical removal of cysts was the treatment of choice for the previous two types of echinococcosis, chemotherapy is the recommended treatment approach for polycystic echinococcosis. While albendazole is the preferred drug, mebendazole can also be used if the treatment is to be for an extended period of time. Only if chemotherapy fails or if the lesions are very small is surgery advised.

Hymenolepiasis

Hymenolepiasis is infestation by one of two species of tapeworm: Hymenolepis nana or H. diminuta. Alternative names are dwarf tapeworm infection and rat tapeworm infection. The disease is a type of helminthiasis which is classified as a neglected tropical disease.

Symptoms

Hymenolepiasis does not always have symptoms, but they usually are described as abdominal pain, loss of appetite, itching around the anus, irritability, and diarrhea. However, in one study of 25 patients conducted in Peru, successful treatment of the infection made no significant difference to symptoms. Some authorities report that heavily infected cases are more likely to be symptomatic.

Symptoms in humans are due to allergic responses or systematic toxaemia caused by waste products of the tapeworm. Light infections are usually symptomless, whereas infection with more than 2000 worms can cause enteritis, abdominal pain, diarrhea, loss of appetite, restlessness, irritability, restless sleep, and anal and nasal pruritus. Rare symptoms include increased appetite, vomiting, nausea, bloody diarrhea, hives, extremity pain, headache, dizziness, and behavioral disturbances. Occasionally, epileptic seizures occur in infected children.

Examination of the stool for eggs and parasites confirms the diagnosis. The eggs and proglottids of H. nana are smaller than H. diminuta. Proglottids of both are relatively wide and have three testes. Identifying the parasites to the species level is often unnecessary from a medical perspective, as the treatment is the same for both.

Treatment
The two drugs that have been well-described for the treatment of hymenolepiasis are praziquantel and niclosamide. Praziquantel, which is parasiticidal in a single dose for all the stages of the parasite, is the drug of choice because it acts very rapidly against H. nana. Although structurally unrelated to other anthelminthics, it kills both adult worms and larvae. In vitro, the drug produces vacuolization and disruption of the tegument in the neck of the worms, but not in more posterior portions of the strobila. Praziquantel is well absorbed when taken orally, and it undergoes first-pass metabolism and 80% of the dose is excreted as metabolites in urine within 24 hours. Repeated treatment is required for H. nana at an interval of 7–10 days.

Praziquantel as a single dose (25 mg/kg) is the current treatment of choice for hymenolepiasis and has an efficacy of 96%. Single-dose albendazole (400 mg) is also very efficacious (>95%).

A three-day course of nitazoxanide is 75–93% efficacious. The dose is 1 g daily for adults and children over 12; 400 mg daily for children aged 4 to 11 years; and 200 mg daily for children aged 3 years or younger.

Beef Tapeworm (Taeniasis)

Taeniasis is an infection within the intestines by adult tapeworms belonging to the genus Taenia. There are generally no or only mild symptoms. Symptoms may occasionally include weight loss or abdominal pain. Segments of tapeworm may be seen in the stool. Complications of pork tapeworm may include cysticercosis.

Types of Taenia that cause infections in humans include Taenia solium (pork tapeworm), Taenia saginata (beef tapeworm), and Taenia asiatica (Asian tapeworm). Taenia saginata is due to eating contaminated undercooked beef while Taenia solium and Taenia asiatica is from contaminated undercooked pork. Diagnosis is by examination of stool samples.

Prevention is by properly cooking meat. Treatment is generally with praziquantel, though niclosamide may also be used. Together with cysticercosis, infections affect about 50 million people globally. The disease is most common in the developing world. In the United States less than 1,000 cases occur a year.

Symptoms
Taeniasis generally has few or no symptoms. It takes about 8 weeks from infection for adult worms to form and can last for years without treatment. Infection may be suspected when a portion of the worm is passed in the stool. It is not generally fatal.

Pork Tapeworm - Infection in the intestines by the adult T. solium worms is normally asymptomatic. Heavy infection can result in anaemia and indigestion.
Beef Tapeworm - Taenia saginata infection is asymptomatic, but heavy infection causes weight loss, dizziness, abdominal pain, diarrhea, headaches, nausea, constipation, chronic indigestion, and loss of appetite. It can cause antigen reaction that induce allergic reaction. It is also a rare cause of ileus, pancreatitis, cholecystitis, and cholangitis.
Asian Tapeworm - Taenia asiatica is also usually asymptomatic. It is unclear if T. asiatica can cause cysticercosis.

Treatment
Praziquantel is the treatment of choice. Usual treatments are with praziquantel (5–10 mg/kg, single-administration) or niclosamide (adults and children over 6 years: 2 g, single-administration after a light breakfast, followed after 2 hours by a laxative; children aged 2–6 years: 1 g; children under 2 years: 500 mg). Albendazole is also highly effective. Mepacrine is quite effective but has adverse effects in humans.

Pork Tapeworm (Cysticercosis)

The pork tapeworm, Taenia solium, belongs to the cyclophyllid cestode family Taeniidae. It is found throughout the world and is most common in countries where pork is eaten. It is a tapeworm which has humans as its definitive host and often pigs as intermediate or secondary host. It may be transmitted to pigs through human faeces contaminating their fodder, and back to humans through consumption of uncooked, or under-cooked, pork that contains tapeworm cysts. Pigs ingest tapeworm eggs, which develop into larvae, then into oncospheres, and ultimately into infective tapeworm cysts. An ingested tapeworm cyst grows into an adult worm in human small intestines.

There are two forms of human infection. One is "primary hosting", and is due to eating under-cooked pork that contains the cysts and results in adult worms in the intestines. This form generally is without symptoms; the infected person does not know they have tapeworms. This form is easily treated with medications which eliminate the tapeworm. The other form, "secondary hosting", is due to eating food, or drinking water, contaminated with feces from someone infected by the adult worms, thus ingesting the tapeworm eggs, instead of the cysts. The eggs go on to develop cysts primarily in the muscles, and usually with no symptoms. However some people suffer obvious symptoms, the most harmful and chronic form of which is when the cysts form in the brain. Treatment of this form is more difficult but possible.

Symptoms
Taeniasis is infection in the intestines by the adult T. solium. It generally has mild or non-specific symptoms. This may include abdominal pain, nausea, diarrhea and constipation. Such symptoms will arise when the tapeworm has fully developed in the intestine, this would be around eight weeks after the contraction (ingestion of meat containing cysticerci). These symptoms could continue until the tapeworm dies from the course of treatment but otherwise could continue for many years, as long as the worm lives. If untreated it is common that the infections with T. solium last for approximately 2–3 years. It is possible that infected people may show no symptoms for years.

Treatment
Treatment of cysticercosis must be carefully monitored for inflammation reactions to the dying worms, especially if they have moved into the brain. In some cases the worms can be surgically removed, and in others albendazole with steroids is given to reduce the inflammation.

A vaccine to prevent cysticercosis in pigs has been studied. The life-cycle of the parasite can be terminated in their intermediate host, pigs, thereby preventing further human infection. The large scale use of these vaccine, however, is still under consideration.

Bertielliasis

Bertielliasis is the infection of Bertiella, a cestode tapeworm parasite that primarily infects nonhuman primates, rodents and Australian marsupials. Occasionally, human infections have been documented by one of two species: Bertiella studeri, or Bertiella mucronata. Of 29 different Bertiella species, only these two can infect humans.

These infections present with symptoms similar to most tapeworm cases, and are frequently misdiagnosed. Bertiella transmission is through oribatid mites that are present in the soil of problem areas, and can be easily prevented by avoiding contact with nonhuman primates, rodents and soil in these areas.

Symptoms
Bertielliasis can be asymptomatic, or present with symptoms similar to many other tapeworms. These can include epigastric pain after meals accompanied by nausea, diarrhea, anorexia, loss of weight and, generally, a tender abdomen. Fever is not typically a symptom, but there are also reported cases of constipation. The symptoms may be intermittent or continuous and seem to be more common in children. There are rare cases where the abdominal pain and vomiting have became severe. The incubation period is unknown.

Treatment
Due to the low occurrence of this infection in humans, and non-lethal symptoms, it is not considered a public health crisis where large steps have to be taken toward prevention or the development of a vaccine. The most common way to prevent this infection in humans is to avoid contact with nonhuman primates and the soil in their proximity. In Mauritius and other similar regions, children (specifically) and adults are strongly discouraged from eating guavas that have fallen on the ground.

Sparganosis

ILLNESS Parasitic Worms Helminths (Worms)

Sparganosis is a parasitic infection caused by the plerocercoid larvae of the genus Spirometra including S. mansoni, S. ranarum, S. mansonoides and S. erinacei. It was first described by Patrick Manson from China in 1882, and the first human case was reported by Charles Wardell Stiles from Florida in 1908. The infection is transmitted by ingestion of contaminated water, ingestion of a second intermediate host such as a frog or snake, or contact between a second intermediate host and an open wound or mucous membrane. Humans are the accidental hosts in the life cycle, while dogs, cats, and other mammals are definitive hosts. Copepods (freshwater crustaceans) are the first intermediate hosts, and various amphibians and reptiles are second intermediate hosts.

Symptoms
Clinical presentation of sparganosis most often occurs after the larvae have migrated to a subcutaneous location. The destination of the larvae is often a tissue or muscle in the chest, abdominal wall, extremities, or scrotum, although other sites include the eyes, brain, urinary tract, pleura, pericardium, and spinal canal. The early stages of disease in humans are often asymptomatic, but the spargana typically cause a painful inflammatory reaction in the tissues surrounding the subcutaneous site as they grow. Discrete subcutaneous nodules develop that may appear and disappear over a period of time. The nodules usually itch, swell, turn red, and migrate, and are often accompanied by painful edema.

Seizures, hemiparesis, and headaches are also common symptoms of sparganosis, especially cerebral sparganosis, and eosinophilia is a common sign. Clinical symptoms also vary according to the location of the sparganum; possible symptoms include elephantiasis from location in the lymph channels, peritonitis from location in the intestinal perforation, and brain abscesses from location in the brain. In genital sparganosis, subcutaneous nodules are present in the groin, labia, or scrotum and may appear tumor-like.

Ocular sparganosis a particularly well-described type of sparganosis. Early signs of the ocular form include eye pain, epiphora (excessive watering of the eye), and/or ptosis (drooping of the upper eyelid). Other signs include periorbital edema and/or edematous swelling that resembles Romana's sign in Chagas disease, lacrimation, orbital cellulitis, exophthalmos (protrusion of the eyeball), and/or an exposed cornea ulcer. The most common sign at presentation is a mass lesion in the eye. If untreated, ocular sparganosis can lead to blindness. In one case of brain infestation by Spirometra erinaceieuropaei, a man sought treatment on suffering headaches, seizures, memory flashbacks and strange smells.

Treatment
One treatment for sparganosis is praziquantel, administered at a dose of 120 to 150 mg/kg body weight over 2 days; however, praziquantel has had limited success. In general, infestation by one or a few sparganum larvae is often best treated by surgical removal.

DNA analysis of rare worms removed surgically can provide genome information to identify and characterise each parasite; treatments for the more common tapeworms can be cross-checked to see whether they are also likely to be effective against the species in question.

Flukes

Clonorchiasis

Clonorchiasis is an infectious disease caused by the Chinese liver fluke, Clonorchis sinensis, and two related species. Clonorchiasis is a known risk factor for the development of cholangiocarcinoma, a neoplasm of the biliary system.

Symptoms of opisthorchiasis caused by Opisthorchis viverrini and by O. felineus are indistinguishable from clonorchiasis caused by Clonorchis sinensis, so the disease by these three parasites should be referred as clonorchiasis.

Symptoms
Adult C. sinensis worms can inhabit the bile ducts of humans for 20–25 years without any clear clinical symptoms. This, in addition to the nonspecific symptoms infected persons may develop, can lead to missed diagnoses.

Treatment
Praziquantel is the only medicine recommended by WHO for treatment of clonorchiasis. It should be administered at the dose of 25 mg/kg 3 times daily for 2–3 consecutive days or of 40 mg/kg, single administration.

Liver Fluke – Fasciolosis

Fasciolosis is a parasitic worm infection caused by the common liver fluke Fasciola hepatica as well as by Fasciola gigantica. The disease is a plant-borne trematode zoonosis, and is classified as a neglected tropical disease (NTD). It affects humans, but its main host is ruminants such as cattle and sheep. The disease progresses through four distinct phases; an initial incubation phase of between a few days up to three months with little or no symptoms; an invasive or acute phase which may manifest with: fever, malaise, abdominal pain, gastrointestinal symptoms, urticaria, anemia, jaundice, and respiratory symptoms. The disease later progresses to a latent phase with less symptoms and ultimately into a chronic or obstructive phase months to years later. In the chronic state the disease causes inflammation of the bile ducts, gall bladder and may cause gall stones as well as fibrosis. While chronic inflammation is connected to increased cancer rates, it is unclear whether fasciolosis is associated with increased cancer risk.

Symptoms
The course of fasciolosis in humans has 4 main phases:
1. Incubation phase: from the ingestion of metacercariae to the appearance of the first symptoms; time period: few days to 3 months; depends on number of ingested metacercariae and immune status of host.
2. Invasive or acute phase: fluke migration up to the bile ducts. This phase is a result of mechanical destruction of the hepatic tissue and the peritoneum by migrating juvenile flukes causing localized and or generalized toxic and allergic reactions. The major symptoms of this phase are:
● Fever: usually the first symptom of the disease; 40–42 °C (104–108 °F)
● Abdominal pain
● Gastrointestinal disturbances: loss of appetite, flatulence, nausea, diarrhea
● Urticaria
● Respiratory symptoms (very rare): cough, dyspnoea, chest pain, hemoptysis
● Hepatomegaly and splenomegaly
● Ascites
● Anaemia
● Jaundice
3. Latent phase: This phase can last for months or years. The proportion of asymptomatic subjects in this phase is unknown. They are often discovered during family screening after a patient is diagnosed.
4. Chronic or obstructive phase:
This phase may develop months or years after initial infection. Adult flukes in the bile ducts cause inflammation and hyperplasia of the epithelium. The resulting cholangitis and cholecystitis, combined with the large body of the flukes, are sufficient to cause mechanical obstruction of the biliary duct. In this phase, biliary colic, epigastric pain, fatty food intolerance, nausea, jaundice, pruritus, right upper-quadrant abdominal tenderness, etc., are clinical manifestations indistinguishable from cholangitis, cholecystitis and cholelithiasis of other origins. Hepatic enlargement may be associated with an enlarged spleen or ascites. In case of obstruction, the gall bladder is usually enlarged and edematous with thickening of the wall. Fibrous adhesions of the gall bladder to adjacent organs are common. Lithiasis of the bile duct or gall bladder is frequent and the stones are usually small and multiple.

ILLNESS Parasitic Worms Flukes

Treatment
Several drugs are effective for fascioliasis, both in humans and in domestic animals. The drug of choice in the treatment of fasciolosis is triclabendazole, a member of the benzimidazole family of anthelmintics. The drug works by preventing the polymerization of the molecule tubulin into the cytoskeletal structures, microtubules. Resistance of F. hepatica to triclabendazole has been recorded in Australia in 1995 and Ireland in 1998.

Praziquantel treatment is ineffective. There are case reports of nitazoxanide being successfully used in human fasciolosis treatment in Mexico. There are also reports of bithionol being used successfully.

Nitazoxanide has been found effective in trials, but is currently not recommended.

Fasciolopsiasis – Intestinal Fluke

Fasciolopsiasis results from an infection by the trematode Fasciolopsis buski, the largest intestinal fluke of humans (up to 7.5 cm in length).

Symptoms
Most infections are light, almost asymptomatic. In heavy infections, symptoms can include abdominal pain, chronic diarrhea, anemia, ascites, toxemia, allergic responses, sensitization caused by the absorption of the worms' allergenic metabolites (may eventually cause death of patient), and intestinal obstruction.

Treatment
Praziquantel is the drug of choice for treatment. Treatment is effective in early or light infections. Heavy infections are more difficult to treat. Studies of the effectiveness of various drugs for treatment of children with F. buski have shown tetrachloroethylene as capable of reducing faecal egg counts by up to 99%. Other anthelmintics that can be used include thiabendazole, mebendazole, levamisole and pyrantel pamoate. Oxyclozanide, hexachlorophene and nitroxynil are also highly effective.

Metagonimiasis – Intestinal Fluke

Metagonimiasis is a disease caused by an intestinal trematode, most commonly Metagonimus yokagawai, but sometimes by M. takashii or M. miyatai. The metagonimiasis-causing flukes are one of two minute flukes called the heterophyids. Metagonimiasis was described by Katsurasa in 1911–1913 when he first observed eggs of M. yokagawai in feces (date is disputed in various studies). M. takahashii was described later first by Suzuki in 1930 and then M. miyatai was described in 1984 by Saito.

Symptoms
The main symptoms are diarrhea and colicky abdominal pain. Because symptoms are often mild, infections can often be easily overlooked but diagnosis is important. Flukes attach to the wall of the small intestine, but are often asymptomatic unless in large numbers. Infection can occur from eating a single infected fish source. Peripheral eosinophilia is associated especially in early phase. When present in large numbers, can cause chronic intermittent diarrhea, nausea, and vague abdominal pains. Clinical complaints can also include lethargy and anorexia. In acute metagonimiasis, clinical manifestations are developed only 5–7 days after infection. Heavy infection has also been associated with epigastric distress, fatigue, and malaise.

Occasionally, flukes invade the mucosa and eggs deposited in tissue may gain access to circulation. This can then lead to eggs embolizing in the brain, spinal cord, or heart. Granulomas may form around eggs and can cause seizures, neurologic deficits, or cardiac insufficiency. An interesting case in Japan found diabetes mellitus (DM) to be a sign of chronic infection with intracerebral hemorrhages as the acute sign of aggravation. Two months after administering praziquantel, the hemorrhages were gone, as was the diabetes. This unique case shows the potential of additional symptoms associated with metagonimiasis that are still unknown.

Treatment
Praziquantel is recommended in both adult and pediatric cases with dosages of 75 mg/kg/d in 3 doses for 1 day. Praziquantel is a Praziniozoquinoline derivative that alters the calcium flux through the parasite tectum and causes muscular paralysis and detachment of the fluke. Prizaquantel should be taken with liquids during a meal and as provided commercially as Biltricide. Praziquantel is not approved by the U.S. Food and Drug Administration (FDA) for treatment of metagonimiasis, but is approved for use on other parasitic infections.

Praziquantel has some side effects but they are generally relatively mild and transient and a review of evidence shows it overall a well-tolerated drug. Possible side effects include abdominal pain, allergy, diarrhea, headache, liver problems, nausea or vomiting, exacerbation of porphyries, pruritis, rash, somnolence, vertigo, or dizziness. In fact, in 2002, the World Health Organization recommended the use of Praziquantel in pregnant and lactating women, though controlled trials are still needed to verify this.

Another possible drug option is Tetrachloroethylene, a chlorinated hydrocarbon, but its use has been superseded by new antihelminthic drugs (like Praziquantel). A 1978 study also looked at the efficacy of several drugs on metagonimiasis infection, including bithionol, niclosamide, nicoflan, and Praziquantel. All drugs showed lower prevalence of eggs in feces, however only Praziquantel showed complete radical cure. Therefore, the authors concluded Praziquantel was the most highly effective, was very well tolerated, and was the most promising drug against metagonimiasis.

Metorchiasis

Metorchis conjunctus, common name Canadian liver fluke, is a species of trematode parasite in the family Opisthorchiidae. It can infect mammals that eat raw fish in North America. The first intermediate host is a freshwater snail and the second is a freshwater fish.

Symptoms
After ingestion of fish infected with M. conjunctus, about 1–15 days are needed for symptoms to occur, namely for eggs to be detected in the stool (incubation period).

The acute phase consists of upper abdominal pain and low-grade fever. High concentrations of eosinophil granulocytes are in blood. Also, higher concentrations of liver enzymes are seen. When untreated, symptoms may last from 3 days to 4 weeks. Symptoms of chronic infection were not reported.

Treatment
Eggs of M. conjunctus can be found by stool analysis. Serologic analysis can be also used - ELISA test for IgG antibodies against antigens of M. conjunctus. Drugs used to treat infestation include praziquantel: 75 mg/kg in three doses per day (the same dosage applies for adults and for children).

Paragonimiasis, Lung Fluke

Paragonimiasis is a food-borne parasitic infection caused by the lung fluke, most commonly Paragonimus westermani. It infects an estimated 22 million people yearly worldwide. It is particularly common in East Asia. More than 30 species of trematodes (flukes) of the genus Paragonimus have been reported; among the more than 10 species reported to infect humans, and only 8 bringing about infections in humans, the most common is P. westermani, the oriental lung fluke.

Symptoms
The acute phase (invasion and migration) may be marked by diarrhea, abdominal pain, fever, cough, urticaria, hepatosplenomegaly, pulmonary abnormalities, and eosinophilia. During the chronic phase, pulmonary manifestations include cough, expectoration of discolored sputum containing clumps of eggs, hemoptysis, and chest radiographic abnormalities. Extrapulmonary locations of the adult worms result in more severe manifestations, especially when the brain is involved." "Diagnosis is based on microscopic demonstration of eggs in stool or sputum, but these are not present until 2 to 3 months after infection. (Eggs are also occasionally encountered in effusion fluid or biopsy material.) Concentration techniques may be necessary in patients with light infections. Biopsy may allow diagnostic confirmation and species identification when an adult or developing fluke is recovered.

Treatment
The drug of choice to treat paragonimiasis is praziquantel, although bithionol may also be used.

ILLNESS Parasitic Worms Flukes

Schistosomiasis (Bilharzia) (Snail Fever)

Schistosomiasis, also known as snail fever and bilharzia, is a disease caused by parasitic flatworms called schistosomes. The urinary tract or the intestines may be infected. Symptoms include abdominal pain, diarrhea, bloody stool, or blood in the urine. Those who have been infected for a long time may experience liver damage, kidney failure, infertility, or bladder cancer. In children, it may cause poor growth and learning difficulty. The disease is spread by contact with fresh water contaminated with the parasites.

These parasites are released from infected freshwater snails. The disease is especially common among children in developing countries, as they are more likely to play in contaminated water. Other high-risk groups include farmers, fishermen, and people using unclean water during daily living. It belongs to the group of helminth infections. Diagnosis is by finding eggs of the parasite in a person's urine or stool. It can also be confirmed by finding antibodies against the disease in the blood.

Methods to prevent the disease include improving access to clean water and reducing the number of snails. In areas where the disease is common, the medication praziquantel may be given once a year to the entire group. This is done to decrease the number of people infected, and consequently, the spread of the disease. Praziquantel is also the treatment recommended by the World Health Organization for those who are known to be infected. Schistosomiasis affected about 252 million people worldwide in 2015.

An estimated 4,400 to 200,000 people die from it each year. The disease is most commonly found in Africa, Asia, and South America. Around 700 million people, in more than 70 countries, live in areas where the disease is common. In tropical countries, schistosomiasis is second only to malaria among parasitic diseases with the greatest economic impact. Schistosomiasis is listed as a neglected tropical disease.

Symptoms
Many individuals do not experience symptoms. If symptoms do appear, they usually take 4–6 weeks from the time of infection. The first symptom of the disease may be a general feeling of illness. Within 12 hours of infection, an individual may complain of a tingling sensation or light rash, commonly referred to as "swimmer's itch", due to irritation at the point of entrance. The rash that may develop can mimic scabies and other types of rashes. Other symptoms can occur 2–10 weeks later and can include fever, aching, a cough, diarrhea, chills, or gland enlargement. These symptoms can also be related to avian schistosomiasis, which does not cause any further symptoms in humans.

The manifestations of schistosomal infection vary over time as the cercariae, and later adult worms and their eggs, migrate through the body. If eggs migrate to the brain or spinal cord, seizures, paralysis, or spinal-cord inflammation are possible.

Treatment
Two drugs, praziquantel and oxamniquine, are available for the treatment of schistosomiasis. They are considered equivalent in relation to efficacy against S. mansoni and safety. Because of praziquantel's lower cost per treatment, and oxaminiquine's lack of efficacy against the urogenital form of the disease caused by S. haematobium, in general praziquantel is considered the first option for treatment. The treatment objective is to cure the disease and to prevent the evolution of the acute to the chronic form of the disease. All cases of suspected schistosomiasis should be treated regardless of presentation because the adult parasite can live in the host for years. Schistosomiasis is treatable by taking by mouth a single dose of the drug praziquantel annually.

Intestinal Schistosomiasis

Schistosoma mansoni is a water-borne parasite of humans, and belongs to the group of blood flukes (Schistosoma). The adult lives in the blood vessels (mesenteric veins) near the human intestine. It causes intestinal schistosomiasis (similar to S. japonicum, S. mekongi, S. guineensis, and S. intercalatum). Clinical symptoms are caused by the eggs. As the leading cause of schistosomiasis in the world, it is the most prevalent parasite in humans. It is classified as a neglected tropical disease. As of 2016, 206.5 million people have schistosomiasis and S. mansoni is the major parasite. It is found in Africa, the Middle East, the Caribbean, Brazil, Venezuela and Suriname.

Symptoms
Symptoms and signs depend on the number and location of eggs trapped in the tissues. Initially, the inflammatory reaction is readily reversible. In the latter stages of the disease, the pathology is associated with collagen deposition and fibrosis, resulting in organ damage that may be only partially reversible.

Treatment
The standard drug for S. mansoni infection is praziquantel at a dose of 40 mg/kg. Oxamniquine is also used.

Swimmer's Itch

Swimmer's itch or cercarial dermatitis, is a short-term allergic immune reaction occurring in the skin of humans that have been infected by water-borne schistosomes. Cercarial dermatitis is common in freshwater, brackish and marine habitats worldwide. Incidence may be on the rise, although this may also be attributed to better monitoring. Nevertheless, the condition has been regarded as emerging infectious disease. There are no permanent effects to people from this condition.

Symptoms
Symptoms, which include itchy, raised papules, commonly occur within 1–2 days of infection and do not generally last more than 2–3 weeks. However, people repeatedly exposed to cercariae develop heavier symptoms with faster onset.

Treatment
Orally administered hydroxyzine, an antihistamine, is sometimes prescribed to treat swimmer's itch and similar dermal allergic reactions. In addition, bathing in oatmeal, baking soda, or Epsom salts can also provide relief of symptoms.

Roundworms

Ancylostomiasis / Hookworm

Ancylostomiasis is a hookworm disease caused by infection with Ancylostoma hookworms. The name is derived from Greek ancylos αγκύλος "crooked, bent" and stoma στόμα "mouth".

Ancylostomiasis is also known as miner's anaemia, tunnel disease, brickmaker's anaemia and Egyptian chlorosis. Helminthiasis may also refer to ancylostomiasis, but this term also refers to all other parasitic worm diseases as well. In the United Kingdom, if acquired in the context of working in a mine, the condition is eligible for Industrial Injuries Disability Benefit. It is a prescribed disease (B4) under the relevant legislation. Ancylostomiasis is caused when hookworms, present in large numbers, produce an iron deficiency anemia by sucking blood from the host's intestinal walls.

Symptoms
Depending on the organism, the signs and symptoms vary. Ancylostoma duodenale and Necator americanus can enter the blood stream while Ancylostoma braziliensis cannot. Signs and symptoms of Ancylostoma duodenale and Necator americanus are given in corresponding page.

In Ancylostoma braziliensis as the larvae are in an abnormal host, they do not mature to adults but instead migrate through the skin until killed by the host's inflammatory response. This migration causes local intense itching and a red serpiginous lesion. Treatment with a single dose of oral ivermectin results in cure rates of 94–100%.

ILLNESS Parasitic Worms Roundworms

Treatment
The drug of choice for the treatment of hookworm disease is mebendazole which is effective against both species, and in addition, will remove the intestinal worm Ascaris also, if present. The drug is very efficient, requiring only a single dose and is inexpensive. However, treatment requires more than giving the anthelmintic, the patient should also receive dietary supplements to improve their general level of health, in particular iron supplementation is very important. Iron is an important constituent of a multitude of enzyme systems involved in energy metabolism, DNA synthesis and drug detoxification.

An infection of N. americanus parasites can be treated by using benzimidazoles, albendazole, and mebendazole. A blood transfusion may be necessary in severe cases of anemia. Light infections are usually left untreated in areas where reinfection is common. Iron supplements and a diet high in protein will speed the recovery process. In a case study involving 56–60 men with Trichuris trichiura and/or N. americanus infections, both albendazole and mebendazole were 90% effective in curing T. trichiura. However, albendazole had a 95% cure rate for N. americanus, while mebendazole only had a 21% cure rate. This suggests albendazole is most effective for treating both T. trichiura and N. americanus.

Angiostrongyliasis

Angiostrongyliasis is an infection by a roundworm of the Angiostrongylus type. Symptoms may vary from none, to mild, to meningitis. Infection with Angiostrongylus cantonensis (rat lungworm) can occur after voluntarily or inadvertently consuming raw Giant African land snails, great grey slugs, or other mollusks and even unwashed fruits and vegetables.

In humans, Angiostrongylus is the most common cause of eosinophilic meningitis or meningoencephalitis. Frequently the infection will resolve without treatment or serious consequences, but in cases with a heavy load of parasites the infection can be so severe it can cause permanent damage to the central nervous system or death.

Symptoms
Infection first presents with severe abdominal pain, nausea, vomiting, and weakness, which gradually lessens and progresses to fever, and then to central nervous system (CNS) symptoms and severe headache and stiffness of the neck. CNS symptoms begin with mild cognitive impairment and slowed reactions, and in a very severe form often progress to unconsciousness. Patients may present with neuropathic pain early in the infection. Eventually, severe infection will lead to ascending weakness, quadriparesis, areflexia, respiratory failure, and muscle atrophy, and will lead to death if not treated. Symptoms of eye invasion include visual impairment, pain, keratitis, and retinal edema. Worms usually appear in the anterior chamber and vitreous and can sometimes be removed surgically. The incubation period in humans is usually from 1 week to 1 month after infection, and can be as long as 47 days. This interval varies, since humans are intermediate hosts and the life cycle does not continue predictably as it would in a rat.

Treatment
Treatment of angiostrongyliasis is not well defined, but most strategies include a combination of anti-parasitics to kill the worms, steroids to limit inflammation as the worms die, and pain medication to manage the symptoms of meningitis. Anthelmintics are often used to kill off the worms, however in some cases this may cause patients to worsen due to toxins released by the dying worms. Albendazole, ivermectin, mebendazole, and pyrantel are all commonly used, though albendazole is usually the drug of choice. Studies have shown that anthelmintic drugs may shorten the course of the disease and relieve symptoms. Anthelmintics should generally be paired with corticosteroids in severe infections to limit the inflammatory reaction to the dying parasites. Studies suggest that a two-week regimen of a combination of mebendazole and prednisolone significantly shortened the course of the disease and length of associated headaches without observed harmful side effects. Symptomatic treatment is indicated for symptoms such as nausea, vomiting, headache, and in some cases, chronic pain due to nerve damage or muscle atrophy.

Ascariasis (Roundworm Infection)

Anisakiasis is a human parasitic infection of the gastrointestinal tract caused by the consumption of raw or undercooked seafood containing larvae of the nematode Anisakis simplex. The first case of human infection by a member of the family Anisakidae was reported in the Netherlands by Van Thiel, who described the presence of a marine nematode in a patient suffering from acute abdominal pain. It is frequently reported in areas of the world where fish is consumed raw, lightly pickled, or salted. The areas of highest prevalence are Scandinavia (from cod livers), Japan (after eating sashimi), the Netherlands (by eating infected fermented herrings (maatjes)), Spain (from eating anchovies and other fish marinated in escabeche), and along the Pacific coast of South America (from eating ceviche). The frequency in the United States is unknown, because the disease is not reportable and can go undetected or be mistaken for other illnesses. Anisakiasis was first recognized in the 1960s. During the 1970s, about 10 cases per year were reported in the literature. The frequency is probably much higher, due to home preparation of raw or undercooked fish dishes. In Japan, more than 1,000 cases are reported annually. Development of better diagnostic tools and greater awareness has led to more frequent reporting of anisakiasis.

Symptoms
- Sudden, severe stomach pain
- Nausea
- Vomiting
- Spasmodic abdominal pain
- Fever

Treatment
For the worm, humans are a dead-end host. Anisakis and Pseudoterranova larvae cannot survive in humans, and eventually die. In some cases, the infection resolves with only symptomatic treatment. In other cases, however, infection can lead to small bowel obstruction, which may require surgery, although treatment with albendazole alone (avoiding surgery) has been reported to be successful. Intestinal perforation (an emergency) is also possible.

Roundworm – Parasitic Pneumonia

Parasitic pneumonia is an infection of the lungs by parasites. It is a rare cause of pneumonia, occurring almost exclusively in immunocompromised persons (persons with a weakened or absent immune system). This is a respiratory infection that may or may not be serious. There is a variety of parasites that can affect the lungs. In general, these parasites enter the body through the skin or by being swallowed. Once inside the body, these parasites travel to the lungs, most often through the blood. There, a similar combination of cellular destruction and immune response causes disruption of oxygen transportation. Depending on the type of parasite, antihelmynthic drugs can be prescribed.

Symptoms
o

Treatment
o

Roundworm – Baylisascariasis

Baylisascaris procyonis, common name raccoon roundworm, is a roundworm nematode, found ubiquitously in raccoons, the definitive hosts. It is named after H. A. Baylis, who studied them in the 1920s–30s, and Greek askaris (intestinal worm). Baylisascaris larvae in paratenic hosts can migrate, causing visceral larva migrans (VLM). Baylisascariasis as the zoonotic infection of humans is rare, though extremely dangerous due to the ability of the parasite's larvae to migrate into brain tissue and cause damage. Concern for human infection has been increasing over the years due to urbanization of rural areas resulting in the increase in proximity and potential human interaction with raccoons.

Symptoms
The potential for human infection was noted in 1969 by Paul C. Beaver, who studied infected mice, and the first case was reported 15 years later. Human infection with B. procyonis has been relatively rare, with about 30 cases reported since 1980. However, disease caused by this parasite can be extremely dangerous, causing death or severe symptoms. Reported disease has primarily afflicted children and almost all cases were a result of the ingestion of contaminated soil or feces. Even with treatment, prognosis is poor and patients in nearly all cases experience permanent neurological damage. Infection of the eyes may result in permanent visual damage and loss. The common antihelmintic medicines are able to treat adult worms living in the intestines, but are less effective against migrating larvae. Aggressive and early treatment with corticosteroids and albendazole have in a few instances resulted in complete recoveries. It is possible that human infection is more common than diagnosed and most cases do not reach a clinical stage. Antibodies to B. procyonis have been found in otherwise healthy individuals, suggesting subclinical infections.

Treatment
The fact that no commercial serologic test exists for the diagnosis of B. procyonis infection makes the diagnosis and treatment more difficult. Educating the public about the dangers of contact with raccoons or their feces is the most important preventive step. Parents should encourage their children to practice good hygiene; Hand-washing after outdoor play or contact with animals is very important. Fences can be used to prevent raccoons from visiting homes, garbage, or yards for food. Keeping raccoons as pets is strongly discouraged. Raccoon latrines in and around homes should be checked for and cleaned as soon as possible. Boiling water, steam-cleaning, flaming, or fire are highly effective and are easily accessible means to decontaminate household things or areas. Materials contaminated by B.procyonis should be incinerated. Contaminated areas can be cleaned with a xylene-ethanol mixture. Common chemical disinfectants are not effective against B.procyonis eggs. Disinfectants like 20% bleach (1% sodium hypochlorite) wash away the eggs but do not kill them. Since treatment is not very effective, the best way to escape this parasite is to practice the prevention methods.

Bioterrorism Threat
B. procyonis has become a concern for its potential use as an agent of bioterrorism. The fact that this parasite's eggs are easy to acquire, able to live for years, extremely resistant to many disinfectants, and cause serious infections in humans with poor treatment options could make it a dangerous weapon. Community water supplies are easily susceptible to contamination due to the lack of filtration and treatment methods to get rid of the eggs.

Guinea Worm – Dracunculiasis

Dracunculiasis, also called Guinea-worm disease (GWD), is a parasitic infection by the Guinea worm. A person becomes infected when they drink water that contains water fleas infected with guinea worm larvae. Initially there are no symptoms. About one year later, the female worm forms a painful blister in the skin, usually on a lower limb. Other symptoms at this time may include vomiting and dizziness. The worm then emerges from the skin over the course of a few weeks. During this time, it may be difficult to walk or work. It is very uncommon for the disease to cause death.

Symptoms
Dracunculiasis is diagnosed by seeing the worms emerging from the lesions on the legs of infected individuals and by microscopic examinations of the larvae.

As the worm moves downwards, usually to the lower leg, through the subcutaneous tissues, it leads to intense pain localized to its path of travel. The burning sensation experienced by infected people has led to the disease being called "the fiery serpent". Other symptoms include fever, nausea, and vomiting. Female worms cause allergic reactions during blister formation as they migrate to the skin, causing an intense burning pain. Such allergic reactions produce rashes, nausea, diarrhea, dizziness, and localized edema. When the blister bursts, allergic reactions subside, but skin ulcers form, through which the worm can protrude. Only when the worm is removed is healing complete. Death of adult worms in joints can lead to arthritis and paralysis in the spinal cord.

The pain caused by the worm's emergence—which typically occurs during planting and harvesting seasons—prevents many people from working or attending school for as long as three months. In heavily burdened agricultural villages fewer people are able to tend their fields or livestock, resulting in food shortages and lower earnings. A study in southeastern Nigeria, for example, found that rice farmers in a small area lost US$20 million in just one year due to outbreaks of Guinea worm disease.

Treatment
There is no vaccine or medicine to treat or prevent Guinea worm disease. Untreated cases can lead to secondary infections, disability and amputations. Once a Guinea worm begins emerging, the first step is to do a controlled submersion of the affected area in a bucket of water. This causes the worm to discharge many of its larvae, making it less infectious. The water is then discarded on the ground far away from any water source. Submersion results in subjective relief of the burning sensation and makes subsequent extraction of the worm easier. To extract the worm, a person must wrap the live worm around a piece of gauze or a stick.

The process may take several weeks. Gently massaging the area around the blister can help loosen the worm. Some people have said that extracting a Guinea worm feels like the afflicted area is on fire. However, if the infection is identified before an ulcer forms, the worm can also be surgically removed by a trained doctor in a medical facility. Although Guinea worm disease is usually not fatal, the wound where the worm emerges could develop a secondary bacterial infection such as tetanus, which may be life-threatening—a concern in endemic areas where there is typically limited or no access to health care.

Analgesics can be used to help reduce swelling and pain and antibiotic ointments can help prevent secondary infections at the wound site. At least in the Northern region of Ghana, the Guinea worm team found that antibiotic ointment on the wound site caused the wound to heal too well and too quickly making it more difficult to extract the worm and more likely that pulling would break the worm. The local team preferred to use something called "Tamale oil" (after the regional capital) which lubricated the worm and aided its extraction.

It is of great importance not to break the worm when pulling it out. Broken worms have a tendency to putrefy or petrify. Putrefaction leads to the skin sloughing off around the worm. Petrification is a problem if the worm is in a joint or wrapped around a vein or other important area. Use of metronidazole or thiabendazole may make extraction easier, but also may lead to migration of the worm to other parts of the body.

Pinworm – Enterobiasis

Pinworm infection, also known as enterobiasis, is a human parasitic disease caused by the pinworm. The most common symptom is itching in the anal area. This can make sleeping difficult. The period of time from swallowing eggs to the appearance of new eggs around the anus is 4 to 8 weeks. Some people who are infected do not have symptoms.

Symptoms
One-third of individuals with pinworm infection are totally asymptomatic. The main symptoms are itching in and around the anus and perineum. The itching occurs mainly during the night, and is caused by the female pinworms migrating to lay eggs around the anus. Both the migrating females and the clumps of eggs are irritating, but the mechanisms causing the intense pruritus have not been explained. The intensity of the itching varies, and it can be described as tickling, crawling sensations, or even acute pain.

The itching leads to continuously scratching the area around the anus, which can further result in tearing of the skin and complications such as secondary bacterial infections, including bacterial skin inflammation, and hair follicle inflammation. General symptoms are trouble sleeping, and restlessness. A considerable proportion of children suffer from loss of appetite, weight loss, irritability, emotional instability, and bed wetting.

Pinworms cannot damage the skin, and they do not normally migrate through tissues. However, they may move onto the vulva and into the vagina, from there moving to the external orifice of the uterus, and onwards to the uterine cavity, fallopian tubes, ovaries, and peritoneal cavity. This can cause inflammation of the vulva and vagina. This causes vaginal discharge and itchiness of the vulva. The pinworms can also enter the urethra, and presumably, they carry intestinal bacteria with them.

According to Gutierrez (2000), a statistically significant correlation between pinworm infection and urinary tract infections has been shown; however, Burkhart & Burkhart (2005) maintain that the incidence of pinworms as a cause of urinary tract infections remains unknown. One report indicated that 36% of young girls with a urinary tract infection also had pinworms. Painful urination has been associated with pinworm infection.

ILLNESS Parasitic Worms Roundworms

Treatment
Treatment is typically with two doses of the medications mebendazole, pyrantel pamoate, or albendazole two weeks apart. Everyone who lives with or takes care of an infected person should be treated at the same time. Washing personal items in hot water after each dose of medication is recommended. Good handwashing, daily bathing in the morning, and daily changing of underwear can help prevent reinfection.

Gnathostomiasis

Gnathostomiasis (also known as larva migrans profundus) is the human infection caused by the nematode (roundworm) Gnathostoma spinigerum and/or Gnathostoma hispidum, which infects vertebrates.

Symptoms
A few days after ingestion epigastric pain, fever, vomiting, and loss of appetite resulting from migration of larvae through intestinal wall to the abdominal cavity will appear in the patient. Migration in the subcutaneous tissues (under the skin) causes intermittent, migratory, painful, pruritic swellings (cutaneous larva migrans). Patches of edema appear after the above symptoms clear and are usually found on the abdomen. These lesions vary in size and can be accompanied by pruritus, rash, and stabbing pain. Swellings may last for 1 to 4 weeks in a given area and then reappear in a different location. Migration to other tissues (visceral larva migrans), can result in cough, hematuria, ocular (eye) involvement, meningitis, encephalitis and eosinophilia. Eosinophilic myeloencephalitis may also result from invasion of the central nervous system by the larvae.

Treatment
Surgical removal or treatment with albendazole or ivermectin is recommended. The most prescribed treatment for gnathostomiasis is surgical removal of the larvae but this is only effective when the worms are located in an accessible location. In addition to surgical excision, albendazole and ivermectin have been noted in their ability to eliminate the parasite. Albendazole is recommended to be administered at 400 mg daily for 21 days as an adjunct to surgical excision, while ivermectin is better tolerated as a single dose. Ivermectin can also serve as a replacement for those that can't handle albendazole 200 ug/kg p.o. as a single dose. However, ivermectin has been shown to be less effective than albendazole.

Loa Loa Filariasis, Calabar Swellings (Loiasis)

Loa loa filariasis is a skin and eye disease caused by the nematode worm Loa loa. Humans contract this disease through the bite of a deer fly or mango fly (Chrysops spp), the vectors for Loa loa. The adult Loa loa filarial worm migrates throughout the subcutaneous tissues of humans, occasionally crossing into subconjunctival tissues of the eye where it can be easily observed. Loa loa does not normally affect one's vision but can be painful when moving about the eyeball or across the bridge of the nose. The disease can cause red itchy swellings below the skin called "Calabar swellings". The disease is treated with the drug diethylcarbamazine (DEC), and when appropriate, surgical methods may be employed to remove adult worms from the conjunctiva. Loiasis belongs to the so-called neglected diseases.

Symptoms
A filariasis such as loiasis most often consists of asymptomatic microfilaremia. Some patients can develop lymphatic dysfunction causing lymphedema. Episodic angioedema (Calabar swellings) in the arms and legs, caused by immune reactions, are common. Calabar swellings are 3–10 cm in surface area, sometimes erythematous, and not pitting. When chronic, they can form cyst-like enlargements of the connective tissue around the sheaths of muscle tendons, becoming very painful when moved. The swellings may last for one to three days and may be accompanied by localized urticaria (skin eruptions) and pruritus (itching).

They reappear at referent locations at irregular time intervals. Subconjunctival migration of an adult worm to the eyes can also occur frequently, and this is the reason Loa loa is also called the "African eye worm." The passage over the eyeball can be sensed, but it usually takes less than 15 minutes. Eyeworms affect men and women equally, but advanced age is a risk factor. Eosinophilia is often prominent in filarial infections. Dead worms may cause chronic abscesses, which may lead to the formation of granulomatous reactions and fibrosis.

Treatment
Treatment of loiasis involves chemotherapy or, in some cases, surgical removal of adult worms followed by systemic treatment. The current drug of choice for therapy is diethylcarbamazine (DEC), though ivermectin use while not curative (i.e., it will not kill the adult worms) can substantially reduce the microfilarial load. The recommended dosage of DEC is 8–10 mg/kg/d taken three times daily for 21 days per CDC. The pediatric dose is the same. DEC is effective against microfilariae and somewhat effective against macrofilariae (adult worms).

The recommended dosage of ivermectin is 150 µg/kg in patients with a low microfilaria load (with densities less than 8000 mf/mL). In patients with high microfilaria load and/or the possibility of an onchocerciasis coinfection, treatment with DEC and/or ivermectin may be contraindicated or require a substantially lower initial dose, as the rapid microfilaricidal actions of the drugs can provoke encephalopathy. In these cases, initial albendazole administration has proved helpful (and is superior to ivermectin, which can also be risky despite its slower-acting microfilaricidal effects over DEC).
The CDC recommended dosage for albendazole is 200 mg taken twice a day for 21 days. Also, in cases where two or more DEC treatments have failed to provide a cure, subsequent albendazole treatment can be administered. Management of Loa loa infection in some instances can involve surgery, though the timeframe during which surgical removal of the worm must be carried out is very short. A detailed surgical strategy to remove an adult worm is as follows (from a real case in New York City).

The 2007 procedure to remove an adult worm from a male Gabonian immigrant employed proparacaine and povidone-iodine drops, a wire eyelid speculum, and 0.5 ml 2% lidocaine with epinephrine 1:100,000, injected superiorly. A 2-mm incision was made and the immobile worm was removed with forceps. Gatifloxacin drops and an eye-patch over ointment were utilized post surgery and there were no complications (unfortunately, the patient did not return for DEC therapy to manage the additional worm—and microfilariae—present in his body).

Filariasis / Mansonelliasis

Filariasis is a parasitic disease caused by an infection with roundworms of the Filarioidea type. These are spread by blood-feeding insects such as black flies and mosquitoes. They belong to the group of diseases called helminthiases.

Eight known filarial worms have humans as a definitive host. These are divided into three groups according to the part of the body they affect:
- Lymphatic filariasis is caused by the worms Wuchereria bancrofti, Brugia malayi, and Brugia timori. These worms occupy the lymphatic system, including the lymph nodes; in chronic cases, these worms lead to the syndrome of elephantiasis.
- Subcutaneous filariasis is caused by Loa loa (the eye worm), Mansonella streptocerca, and Onchocerca volvulus. These worms occupy the layer just under the skin. L. loa causes Loa loa filariasis, while O. volvulus causes river blindness.
- Serous cavity filariasis is caused by the worms Mansonella perstans and Mansonella ozzardi, which occupy the serous cavity of the abdomen. Dirofilaria immitis, the dog heartworm, rarely infects humans.

Symptoms
The most spectacular symptom of lymphatic filariasis is elephantiasis – edema with thickening of the skin and underlying tissues—which was the first disease discovered to be transmitted by mosquito bites. Elephantiasis results when the parasites lodge in the lymphatic system.

Elephantiasis affects mainly the lower extremities, while the ears, mucous membranes, and amputation stumps are affected less frequently. However, different species of filarial worms tend to affect different parts of the body; Wuchereria bancrofti can affect the legs, arms, vulva, breasts, and scrotum (causing hydrocele formation), while Brugia timori rarely affects the genitals. Those who develop the chronic stages of elephantiasis are usually free from microfilariae (amicrofilaraemic), and often have adverse immunological reactions to the microfilariae, as well as the adult worms.

The subcutaneous worms present with rashes, urticarial papules, and arthritis, as well as hyper- and hypopigmentation macules. Onchocerca volvulus manifests itself in the eyes, causing "river blindness" (onchocerciasis), one of the leading causes of blindness in the world. Serous cavity filariasis presents with symptoms similar to subcutaneous filariasis, in addition to abdominal pain, because these worms are also deep-tissue dwellers.

ILLNESS Parasitic Worms Roundworms

Treatment
The recommended treatment for people outside the United States is albendazole combined with ivermectin. A combination of diethylcarbamazine and albendazole is also effective. Side effects of the drugs include nausea, vomiting, and headaches. All of these treatments are microfilaricides; they have no effect on the adult worms. While the drugs are critical for treatment of the individual, proper hygiene is also required. There is good evidence that albendazole alone; or addition of albendazole to diethylcarbamazine or ivermectin, makes minimal difference in clearing microfilaria or adult worms from blood circulation. Diethylcarbamazine-medicated salt is effective in controlling lymphatic filariasis while maintaining its coverage at 90% in the community for six months.

Different trials were made to use the known drug at its maximum capacity in absence of new drugs. In a study from India, it was shown that a formulation of albendazole had better anti-filarial efficacy than albendazole itself. In 2003, the common antibiotic doxycycline was suggested for treating elephantiasis.

Onchocerciasis (River Blindness)

Onchocerciasis, also known as river blindness, is a disease caused by infection with the parasitic worm Onchocerca volvulus. Symptoms include severe itching, bumps under the skin, and blindness. It is the second-most common cause of blindness due to infection, after trachoma.

The parasite worm is spread by the bites of a black fly of the Simulium type. Usually, many bites are required before infection occurs. These flies live near rivers, hence the common name of the disease. Once inside a person, the worms create larvae that make their way out to the skin, where they can infect the next black fly that bites the person. There are a number of ways to make the diagnosis, including: placing a biopsy of the skin in normal saline and watching for the larva to come out, looking in the eye for larvae, and looking within the bumps under the skin for adult worms.

Symptoms
Skin involvement typically consists of intense itching, swelling, and inflammation. A grading system has been developed to categorize the degree of skin involvement:
- Acute papular onchodermatitis – scattered pruritic papules
- Chronic papular onchodermatitis – larger papules, resulting in hyperpigmentation
- Lichenified onchodermatitis – hyperpigmented papules and plaques, with edema, lymphadenopathy, pruritus and common secondary bacterial infections
- Skin atrophy – loss of elasticity, the skin resembles tissue paper, 'lizard skin' appearance
- Depigmentation – 'leopard skin' appearance, usually on anterior lower leg
- Glaucoma effect – eyes malfunction, begin to see shadows or nothing

Treatment
In mass drug administration (MDA) programmes, the treatment for onchocerciasis is ivermectin (trade name: Mectizan); infected people can be treated with two doses of ivermectin, six months apart, repeated every three years. The drug paralyses and kills the microfilariae causing fever, itching, and possibly oedema, arthritis and lymphadenopathy. Intense skin itching is eventually relieved, and the progression towards blindness is halted. In addition, while the drug does not kill the adult worms, it does prevent them for a limited time from producing additional offspring. The drug therefore prevents both morbidity and transmission for up to several months. For the treatment of individuals, doxycycline is used to kill the Wolbachia bacteria that live in adult worms. Ivermectin kills the parasite by interfering with the nervous system and muscle function, in particular, by enhancing inhibitory neurotransmission. Moxidectin was approved for onchocerciasis in 2018 for people over the age of 11 in the United States. The safety of multiple doses is unclear.

Strongyloidiasis – Parasitic Pneumonia

Strongyloidiasis is a human parasitic disease caused by the nematode called Strongyloides stercoralis, or sometimes S. fülleborni which is a type of helminth. It belongs to a group of nematodes called roundworms. This intestinal worm can cause a number of symptoms in people, principally skin symptoms, abdominal pain, diarrhea and weight loss, among many other specific and vague symptoms in disseminated disease, and severe life-threatening conditions through hyperinfection. In some people, particularly those who require corticosteroids or other immunosuppressive medication, Strongyloides can cause a hyperinfection syndrome that can lead to death if untreated. The diagnosis is made by blood and stool tests. The medication ivermectin is widely used to treat strongyloidiasis.

Symptoms
Strongyloides infection occurs in five forms. As the infection continues and the larvae matures, there may be respiratory symptoms (Löffler's syndrome). The infection may then become chronic with mainly digestive symptoms. On reinfection (when larvae migrate through the body) from the skin to the lungs and finally to the small intestine, there may be respiratory, skin and digestive symptoms. Finally, the hyperinfection syndrome causes symptoms in many organ systems, including the central nervous system.

Treatment
The consensus drug of choice for the treatment of uncomplicated strongyloidiasis is ivermectin. However, even if it is considered the main drug of choice, recent studies have illustrated the challenges in ivermectin curing strongyloidiasis. Ivermectin does not kill the Strongyloides larvae, only the adult worms, therefore repeat dosing may be necessary to properly eradicate the infection. Other drugs that can be effective are albendazole and thiabendazole (25 mg/kg twice daily for 5 days—400 mg maximum (generally)).

All patients who are at risk of disseminated strongyloidiasis should be treated. The optimal duration of treatment for patients with disseminated infections is not clear. Treatment of strongyloidiasis can be difficult and if ceasing treatment before being entirely cleared Strongyloides via the autoinfective cycle has been known to live in individuals for decades; even after initial or inadequate sustained treatment. Continued treatment, blood and stool monitoring thus may be necessary even if symptoms temporarily resolve.

Due to the fact that some infections are insidiously asymptomatic, and relatively expensive bloodwork is often inconclusive via false-positives or false-negatives, just as stool samples can be unreliable in diagnoses, there is yet unfortunately no real gold standard for proof of cure, mirroring the lack of an efficient and reliable methodology of diagnosis. An objective eradication standard for strongyloidiasis is elusive given the high degree of suspicion needed to even begin treatment, the sometimes difficulty of the only definitive diagnostic criteria of detecting and isolating larvae or adult strongyloides, the importance of early diagnosis, particularly before steroid treatments, and the very wide variability and exclusion/inclusion of differing collections of diffuse symptoms.

Disregarding mis-ascribing bonafide delusional parasitosis disorders, strongyloidiasis should be more well known among medical professionals and have serious consideration for broad educational campaigns in effected geographic locales both within the semi-tropical developed world and otherwise, as well as in the tropical developing world where, among many other neglected tropical diseases, it is endemic.

Thelaziasis

Thelaziasis is the term for infestation with parasitic nematodes of the genus Thelazia. The adults of all Thelazia species discovered so far inhabit the eyes and associated tissues (such as eyelids, tear ducts, etc.) of various mammal and bird hosts, including humans. Thelazia nematodes are often referred to as "eyeworms".

Symptoms
In animal and human hosts, infestation by Thelazia may be asymptomatic, though it frequently causes watery eyes (epiphora), conjunctivitis, corneal opacity, or corneal ulcers (ulcerative keratitis). Infested humans have also reported "foreign body sensation" – the feeling that something is in the eye.

Treatment
Because they live so close to the outside of the body, Thelazia is one of the few nematode infections which can be treated topically. Topical treatment of livestock, dogs and cats with organophosphates (such as ecothiopate iodide or isofluorophate) and systemic treatment with anthelmintics (such as ivermectin, levamisole, and doramectin) are recommended by the Merck Veterinary Manual. Other sources have reported positive results treating dogs with moxidectin, imidacloprid, or milbemycin oxime.

For the treatment of human cases, removal of the worm is suggested. Topical treatment with cocaine or thiabendazole have also been reported to kill the worms in human cases. Because most, if not all, species of Thelazia are spread by flies, sanitary practices which reduce the presence of flies will also reduce the spread of thelaziasis.

Toxocariasis

Toxocariasis is an illness of humans caused by larvae (immature worms) of either the dog roundworm (Toxocara canis), the cat roundworm (Toxocara cati) or the fox roundworm (Toxocara canis). Toxocariasis is often called visceral larva migrans (VLM). Depending on geographic location, degree of eosinophilia, eye and/or pulmonary signs, the terms ocular larva migrans (OLM), Weingarten's disease, Frimodt-Møller's syndrome, and eosinophilic pseudoleukemia are applied to toxocariasis. Other terms sometimes or rarely used include nematode ophthalmitis, toxocaral disease, toxocarose, and covert toxocariasis. This zoonotic, helminthic infection is a rare cause of blindness and may provoke rheumatic, neurologic, or asthmatic symptoms. Humans normally become infected by ingestion of embryonated eggs (each containing a fully developed second stage larva, L2) from contaminated sources (soil, undercooked meat, fresh or unwashed vegetables.)

Symptoms
Physiological reactions to Toxocara infection depend on the host's immune response and the parasitic load. Most cases of Toxocara infection are asymptomatic, especially in adults. When symptoms do occur, they are the result of migration of second stage Toxocara larvae through the body. Covert toxocariasis is the least serious of the three syndromes and is believed to be due to chronic exposure. Signs and symptoms of covert toxocariasis are coughing, fever, abdominal pain, headaches, and changes in behavior and ability to sleep. Upon medical examination, wheezing, hepatomegaly, and lymphadenitis are often noted.

High parasitic loads or repeated infection can lead to visceral larva migrans (VLM). VLM is primarily diagnosed in young children, because they are more prone to exposure and ingestion of infective eggs. Toxocara infection commonly resolves itself within weeks, but chronic eosinophilia may result. In VLM, larvae migration incites inflammation of internal organs and sometimes the central nervous system. Symptoms depend on the organ(s) affected. Patients can present with pallor, fatigue, weight loss, anorexia, fever, headache, skin rash, cough, asthma, chest tightness, increased irritability, abdominal pain, nausea, and vomiting. Sometimes the subcutaneous migration tracks of the larvae can be seen.

Patients are commonly diagnosed with pneumonia, bronchospasms, chronic pulmonary inflammation, hypereosinophilia, hepatomegaly, hypergammaglobulinaemia (IgM, IgG, and IgE classes), leukocytosis, and elevated anti-A and –B isohaemagglutinins. Severe cases have occurred in people who are hypersensitive to allergens; in rare cases, epilepsy, inflammation of the heart, pleural effusion, respiratory failure, and death have resulted from VLM.

Treatment
Toxocariasis will often resolve itself, because the Toxocara larvae cannot mature within human hosts. Corticosteroids are prescribed in severe cases of VLM or if the patient is diagnosed with OLM. Either albendazole (preferred) or mebendazole ("second line therapy") may be prescribed. Granulomas can be surgically removed, or laser photocoagulation and cryoretinopexy can be used to destroy ocular granulomas.

Visceral toxocariasis in humans can be treated with antiparasitic drugs such as albendazole or mebendazole, tiabendazole or diethylcarbamazine usually in combination with anti-inflammatory medications. Steroids have been utilized with some positive results. Anti-helminthic therapy is reserved for severe infections (lungs, brain) because therapy may induce, due to massive larval killing, a strong inflammatory response. Treatment of ocular toxocariasis is more difficult and usually consists of measures to prevent progressive damage to the eye.

Trichinosis

Trichinosis, also known as trichinellosis, is a parasitic disease caused by roundworms of the Trichinella type. During the initial infection, invasion of the intestines can result in diarrhea, abdominal pain, and vomiting. Migration of larvae to muscle, which occurs about a week after being infected, can cause swelling of the face, inflammation of the whites of the eyes, fever, muscle pains, and a rash. Minor infection may be without symptoms. Complications may include inflammation of heart muscle, central nervous system involvement, and inflammation of the lungs.

Trichinosis is mainly spread when undercooked meat containing Trichinella cysts is eaten. Most often this is pork, but infection can also occur from bear and dog meat. Several species of Trichinella can cause disease, with T. spiralis being the most common. After being eaten, the larvae are released from their cysts in the stomach. They then invade the wall of the small intestine, where they develop into adult worms. After one week, the females release new larvae that migrate to voluntarily controlled muscles, where they form cysts. The diagnosis is usually based on symptoms and confirmed by finding specific antibodies in the blood, or larvae on tissue biopsy.

Symptoms
The great majority of trichinosis infections have either minor or no symptoms and no complications. The two main phases for the infection are enteral (affecting the intestines) and parenteral (outside the intestines). The symptoms vary depending on the phase, species of Trichinella, quantity of encysted larvae ingested, age, sex, and host immunity.

● Enteral phase - A large burden of adult worms in the intestines promotes symptoms such as nausea, heartburn, dyspepsia, and diarrhea from two to seven days after infection, while small worm burdens generally are asymptomatic. Eosinophilia presents early and increases rapidly.

● Parenteral phase - The severity of symptoms caused by larval migration from the intestines depends on the number of larvae produced. As the larvae migrate through tissue and vessels, the body's inflammatory response results in edema, muscle pain, fever, and weakness. A classic sign of trichinosis is periorbital edema, swelling around the eyes, which may be caused by vasculitis. Splinter hemorrhage in the nails is also a common symptom. They may very rarely cause enough damage to produce serious neurological deficits (such as ataxia or respiratory paralysis) from worms entering the central nervous system (CNS), which is compromised by trichinosis in 10–24% of reported cases of cerebral venous sinus thrombosis, a very rare form of stroke (three or four cases per million annual incidence in adults). Trichinosis can be fatal depending on the severity of the infection; death can occur 4–6 weeks after the infection, and is usually caused by myocarditis, encephalitis, or pneumonia.

Treatment
As is desirable with most diseases, early treatment is better and decreases the risk of developing disease. If larvae do encyst in skeletal muscle cells, they can remain infectious for months to years.

● Primary treatment - Early administration of anthelmintics, such as mebendazole or albendazole, decreases the likelihood of larval encystation, particularly if given within three days of infection. However, most cases are diagnosed after this time. In humans, mebendazole (200–400 mg three times a day for three days) or albendazole (400 mg twice a day for 8–14 days) is given to treat trichinosis. These drugs prevent newly hatched larvae from developing, but should not be given to pregnant women or children under two years of age.

● Secondary treatment - After infection, steroids, such as prednisone, may be used to relieve muscle pain associated with larval migration.

Trichinella Spiralis (Nematode)

Trichinella spiralis is a viviparous nematode parasite, occurring in rodents, pigs, bears, hyenas and humans, and is responsible for the disease trichinosis. It is sometimes referred to as the "pork worm" due to it being typically encountered in undercooked pork products. It should not be confused with the distantly related pork tapeworm.

Sources
Trichinosis is caused by the parasitic roundworm Trichinella in undercooked meat, mostly from domesticated pigs.

Symptoms
Trichinosis causes diarrhea and other intestinal symptoms, usually starting one to two days after exposure. Fever, headache, itchiness, muscle pains, and swelling around the eyes occur up to 2 weeks later. Recovery is usually slow, even with treatment.

Treatment
Recovery is usually slow, even with treatment with the anti-helminthic (anti-worm) drugs Mebendazole and Albendazole (Albenza).

Whipworm

Trichuris trichiura, Trichocephalus trichiuris or whipworm, is a parasitic roundworm (a type of helminth) that causes trichuriasis (a type of helminthiasis which is one of the neglected tropical diseases) when it infects a human large intestine. It is commonly known as the whipworm which refers to the shape of the worm; it looks like a whip with wider "handles" at the posterior end.

Symptoms
Trichuris trichiura can cause the serious disease Trichuris dysentery syndrome (TDS), with chronic dysentery, anemia, rectal prolapse, and poor growth. TDS is treated with anthelminthics as well as iron supplementation for anemia. Whipworm commonly infects patients also infected with Giardia, Entamoeba histolytica, Ascaris lumbricoides, and hookworms.

Treatment
Trichuris trichiura can be treated with a single dose of albendazole. In Kenya, half of a group of children who had Trichuris trichiura were given albendazole, while the other half of the children received placebos. It was found that the children who received the drug grew significantly better than the group of children who did not receive the treatment. Another treatment that can be used is mebendazole. These medication have been shown to lessen the infection by this parasite through paralyzation. The medication interferes with the parasite's nutrient intake, which eventually leads to death.

Elephantiasis – Lymphatic Filariasis

Lymphatic filariasis is a human disease caused by parasitic worms known as filarial worms. Most cases of the disease have no symptoms. Some people, however, develop a syndrome called elephantiasis, which is marked by severe swelling in the arms, legs, breasts, or genitals. The skin may become thicker as well, and the condition may become painful. The changes to the body have the potential to harm the person's social and economic situation.

The worms are spread by the bites of infected mosquitoes. Three types of worms are known to cause the disease: Wuchereria bancrofti, Brugia malayi, and Brugia timori, with Wuchereria bancrofti being the most common. These worms damage the lymphatic system. The disease is diagnosed by microscopic examination of blood collected during the night. The blood is typically examined as a smear after being stained with Giemsa stain. Testing the blood for antibodies against the disease may also permit diagnosis. Other roundworms from the same family are responsible for river blindness.

Symptoms
The most spectacular symptom of lymphatic filariasis is elephantiasis, a stage 3 lymphedema with thickening of the skin and underlying tissues. This was the first mosquito-borne disease to be discovered. Elephantiasis results when the parasites lodge in the lymphatic system and cause blockages to the flow of lymph. Infections usually begin in childhood. The skin condition the disease causes is called "elephantiasis tropica" (also known as "elephantiasis arabum").

Elephantiasis mainly affects the lower extremities; the ears, mucous membranes, and amputation stumps are affected less frequently. However, various species of filarial worms tend to affect different parts of the body: Wuchereria bancrofti can affect the arms, breasts, legs, scrotum, and vulva (causing hydrocele formation), while Brugia timori rarely affects the genitals. Those who develop the chronic stages of elephantiasis are usually amicrofilaraemic and often have adverse immunological reactions to the microfilariae as well as the adult worms.

The subcutaneous worms present with skin rashes, urticarial papules, and arthritis, as well as hyper- and hypopigmentation macules. The related Onchocerca volvulus manifests itself in the eyes, causing "river blindness" (onchocerciasis), one of the leading causes of blindness in the world. Serous cavity filariasis presents with symptoms similar to subcutaneous filariasis; it may also be associated with ascites following the severe inflammatory reaction in the lymphatics. Elephantiasis leads to marked swelling of the lower half of the body and thickening of the skin, making it look like that of an elephant, a term called "pachyderm".

Treatment
Prevention can be achieved by treating entire groups in which the disease exists, known as mass deworming. This is done every year for about six years, in an effort to rid a population of the disease entirely. Medications used include antiparasitics such as albendazole with ivermectin, or albendazole with diethylcarbamazine. The medications do not kill the adult worms but prevent further spread of the disease until the worms die on their own. Efforts to prevent mosquito bites are also recommended, including reducing the number of mosquitoes and promoting the use of bed nets.

Other Organisms

Myiasis

Myiasis is the parasitic infestation of the body of a live animal by fly larvae (maggots) which grow inside the host while feeding on its tissue. Although flies are most commonly attracted to open wounds and urine- or feces-soaked fur, some species (including the most common myiatic flies—the botfly, blowfly, and screwfly) can create an infestation even on unbroken skin and have been known to use moist soil and non-myiatic flies (such as the common housefly) as vector agents for their parasitic larvae.

Symptoms
How myiasis affects the human body depends on where the larvae are located. Larvae may infect dead, necrotic (prematurely dying) or living tissue in various sites: the skin, eyes, ears, stomach and intestinal tract, or in genitourinary sites. They may invade open wounds and lesions or unbroken skin. Some enter the body through the nose or ears. Larvae or eggs can reach the stomach or intestines if they are swallowed with food and cause gastric or intestinal myiasis.

Syndrome	Symptoms
Cutaneous myiasis	Painful, slow-developing ulcers or furuncle- (boil-) like sores that can last for a prolonged period
Nasal myiasis	Obstruction of nasal passages and severe irritation. In some cases facial edema and fever can develop. Death is not uncommon.
Aural myiasis	Crawling sensations and buzzing noises. Smelly discharge is sometimes present. If located in the middle ear, larvae may get to the brain.

Ophthalmomyiasis	Fairly common, this causes severe irritation, edema, and pain

● Wound
Wound myiasis occurs when fly larvae infest open wounds. It has been a serious complication of war wounds in tropical areas, and is sometimes seen in neglected wounds in most parts of the world. Predisposing factors include poor socioeconomic conditions, extremes of age, neglect, mental disability, psychiatric illness, alcoholism, diabetes, and vascular occlusive disease.

● Eye
Myiasis of the human eye or ophthalmomyiasis can be caused by Hypoderma tarandi, a parasitic botfly of caribou. It is known to lead to uveitis, glaucoma, and retinal detachment. Human ophthalmomyiasis, both external and internal, has been caused by the larvae of the botfly.

Treatment
This applies once an infestation is established. In many circles the first response to cutaneous myiasis once the breathing hole has formed, is to cover the air hole thickly with petroleum jelly. Lack of oxygen then forces the larva to the surface, where it can more easily be dealt with. In a clinical or veterinary setting there may not be time for such tentative approaches, and the treatment of choice might be more direct, with or without an incision. First the larva must be eliminated through pressure around the lesion and the use of forceps. Secondly the wound must be cleaned and disinfected. Further control is necessary to avoid further reinfestation. Livestock may be treated prophylactically with slow release boluses containing ivermectin which can provide long-term protection against the development of the larvae. Sheep also may be dipped, a process which involves drenching the animals in persistent insecticide to poison the larvae before they develop into a problem.

Cochliomyia (Screwworm)

Cochliomyia is a genus in the family Calliphoridae, known as blowflies, in the order Diptera. Cochliomyia is commonly referred to as the New World screwworm flies, as distinct from Old World screwworm flies. Four species are in this genus: C. macellaria, C. hominivorax, C. aldrichi, and C. minima. C. hominivorax is known as the primary screwworm because its larvae produce myiasis and feed on living tissue. This feeding causes deep, pocket-like lesions in the skin, which can be very damaging to the host. C. macellaria is known as the secondary screwworm because its larvae produce myiasis, but feed only on necrotic tissue. Both C. hominivorax and C. macellaria thrive in warm, tropical areas.

Symptoms
The primary screwworm, C. hominivorax, is a parasitic species, whose larvae are renowned for eating and infesting the flesh of living organisms, primarily warm-blooded animals such as cattle and other livestock. Their larvae cause myiasis ("flystrike"), an infestation of maggots in lesions or other wounds and injuries that the host may have. C. hominivorax tends to reproduce only on the flesh of a living host. Unlike most other maggots, these maggots attack and consume healthy living tissue along with decaying tissue (hominivorax literally translates to "man-eating"). The larvae are responsible for their common name, the screwworm, because they possess small spines on each body segment that resemble a screw's threads. After the larvae hatch, they dive into the wound and burrow deeper, perpendicular to the skin surface, eating into live flesh, again resembling a screw being driven into an object. The larvae then continue to feed on the wound fluids and the tissue.

Treatment
Treatment of the victim can be time-consuming and, due to the high incidence of secondary infection, frustrating, but with decisive treatment, a surprisingly positive result is often achieved in all but the worst cases. The obvious first step is the manual removal of the maggots, generally using tweezers or forceps to seize the larva at the posterior end as the spiracles emerge to allow respiration. Once all larvae have been removed, a topical antibiotic smear is applied, often with an oral antibiotic accompaniment. Necrotic tissue may need to be debrided, which can be a painful process. A loose dressing is essential to allow continued fluid drainage from the wound.

2 Bacterial

Bacteria common noun bacteria, singular bacterium) are a type of biological cell. They constitute a large domain of prokaryotic microorganisms. Typically a few micrometres in length, bacteria have a number of shapes, ranging from spheres to rods and spirals. Bacteria were among the first life forms to appear on Earth, and are present in most of its habitats. Bacteria inhabit soil, water, acidic hot springs, radioactive waste, and the deep biosphere of the earth's crust. Bacteria also live in symbiotic and parasitic relationships with plants and animals.

Most bacteria have not been characterised, and only about 27 percent of the bacterial phyla have species that can be grown in the laboratory. The study of bacteria is known as bacteriology, a branch of microbiology. Virtually all animal life on earth is dependent on bacteria for their survival as only bacteria and some archea possess the genes and enzymes necessary to synthesize vitamin B12, also known as cobalamin, and provide it through the food chain. Vitamin B12 is a water-soluble vitamin that is involved in the metabolism of every cell of the human body.

It is a cofactor in DNA synthesis, and in both fatty acid and amino acid metabolism. It is particularly important in the normal functioning of the nervous system via its role in the synthesis of myelin. There are typically 40 million bacterial cells in a gram of soil and a million bacterial cells in a millilitre of fresh water. There are approximately 5×1030 bacteria on Earth, forming a biomass which exceeds that of all plants and animals. Bacteria are vital in many stages of the nutrient cycle by recycling nutrients such as the fixation of nitrogen from the atmosphere. The nutrient cycle includes the decomposition of dead bodies; bacteria are responsible for the putrefaction stage in this process. In the biological communities surrounding hydrothermal vents and cold seeps, extremophile bacteria provide the nutrients needed to sustain life by converting dissolved compounds, such as hydrogen sulphide and methane, to energy.

Subheadings

1. Botulism	**2. Campylobacteriosis**	**3. Cholera**	**4. Mycobact. Marinum**
5. Dysentery	**6. Legionnaires' Disease**	**7. Lyme Disease**	**8. Leptospirosis**
9. Otitis Externa	**10. Salmonellosis**	**11. Typhus**	**12. Typhoid Fever**
13. Vibrio Cholerae	**14. Clostridium Perfringens**	**15. Escherichia Coli**	**16. Shigella**
17. Staph. Aureus	**18. Staph. Enteritis**	**19. MRSA**	**20. Strep Throat**
21. Vibrio Parahaemol…	**22. Vibrio Vulnificus**	**23. Listeria**	**24. Bacillus Cereus**
25. Anthrax	**26. Brucellosis**	**27. Bubonic Plague**	**28. Pneumonic Plague**
29. Diphtheria	**30. Meningococcal**	**31. Pertussis**	**32. Scarlet Fever**
33. Shigellosis	**34. Tuberculosis**	**35. Meningitis**	**35. Tetanus**

1 Botulism

ILLNESS Bacterial Botulism

Botulism is a rare and potentially fatal illness caused by a toxin produced by the bacterium Clostridium botulinum. The disease begins with weakness, blurred vision, feeling tired, and trouble speaking. This may then be followed by weakness of the arms, chest muscles, and legs. Vomiting, swelling of the abdomen, and diarrhea may also occur. The disease does not usually affect consciousness or cause a fever. Botulism can be spread in several ways. The bacterial spores which cause it are common in both soil and water.

They produce the botulinum toxin when exposed to low oxygen levels and certain temperatures. Foodborne botulism happens when food containing the toxin is eaten. Infant botulism happens when the bacteria develops in the intestines and releases the toxin. This typically only occurs in children fewer than six months old, as protective mechanisms develop after that time.

Wound botulism is found most often among those who inject street drugs. In this situation, spores enter a wound, and in the absence of oxygen, release the toxin. It is not passed directly between people. The diagnosis is confirmed by finding the toxin or bacteria in the person in question. Prevention is primarily by proper food preparation. The toxin, though not the organism, is destroyed by heating it to more than 85 °C (185 °F) for longer than 5 minutes. Honey can contain the organism, and for this reason, honey should not be fed to children under 12 months.

Treatment is with an antitoxin. In those who lose their ability to breathe on their own, mechanical ventilation may be necessary for months. Antibiotics may be used for wound botulism. Death occurs in 5 to 10% of people. Botulism also affects many other animals. The word is from Latin, botulus, meaning sausage. Early descriptions of botulism date from at least as far back as 1793 in Germany.

Sources

Botulism is a rare but potentially life-threatening bacterial illness. Clostridium Botulinum bacteria grows on food and produces toxins that, when ingested, cause paralysis. Botulism poisoning is extremely rare, but so dangerous that each case is considered a public health emergency. Studies have shown that there is a 35 to 65 percent chance of death for patients who are not treated immediately and effectively with botulism antitoxin.

Symptoms

The muscle weakness of botulism characteristically starts in the muscles supplied by the cranial nerves—a group of twelve nerves that control eye movements, the facial muscles and the muscles controlling chewing and swallowing. Double vision, drooping of both eyelids, loss of facial expression and swallowing problems may therefore occur. In addition to affecting the voluntary muscles, it can also cause disruptions in the autonomic nervous system.

This is experienced as a dry mouth and throat (due to decreased production of saliva), postural hypotension (decreased blood pressure on standing, with resultant lightheadedness and risk of blackouts), and eventually constipation (due to decreased forward movement of intestinal contents). Some of the toxins (B and E) also precipitate nausea, vomiting, and difficulty with talking. The weakness then spreads to the arms (starting in the shoulders and proceeding to the forearms) and legs (again from the thighs down to the feet).

Severe botulism leads to reduced movement of the muscles of respiration, and hence problems with gas exchange. This may be experienced as dyspnea (difficulty breathing), but when severe can lead to respiratory failure, due to the buildup of unexhaled carbon dioxide and its resultant depressant effect on the brain. This may lead to respiratory compromise and death if untreated.

Clinicians frequently think of the symptoms of botulism in terms of a classic triad: bulbar palsy and descending paralysis, lack of fever, and clear senses and mental status ("clear sensorium").

Prevention

Since botulism poisoning most commonly comes from foods improperly canned at home, the most important step in preventing botulism is to follow proper canning procedure. Further botulism prevention techniques include:

- Not eating canned food if the container is bulging or if it smells bad, although not all strains on Clostridium Botulinum smell
- Storing garlic or herb-infused oil in the refrigerator
- Not storing baked potatoes at room temperature

Treatment

Botulism is generally treated with botulism antitoxin and supportive care.

Supportive care for botulism includes monitoring of respiratory function. Respiratory failure due to paralysis may require mechanical ventilation for 2 to 8 weeks, plus intensive medical and nursing care. After this time, paralysis generally improves as new neuromuscular connections are formed.

In some abdominal cases, physicians may try to remove contaminated food still in the digestive tract by inducing vomiting or using enemas. Wounds should be treated, usually surgically, to remove the source of the toxin-producing bacteria.

2 Campylobacteriosis

Campylobacteriosis is an infection by the Campylobacter bacterium, most commonly C. jejuni. It is among the most common bacterial infections of humans, often a foodborne illness. It produces an inflammatory, sometimes bloody, diarrhea or dysentery syndrome, mostly including cramps, fever and pain.

Sources

Drinking water contaminated with feces. This bacteria resides in the intestinal tract of chickens and causes sickness when meat is undercooked or improperly processed.

Symptoms

The prodromal symptoms are fever, headache, and myalgia, which can be severe, lasting as long as 24 hours. After 1–5 days, typically, these are followed by diarrhea (as many as 10 watery, frequently bloody, bowel movements per day) or dysentery, cramps, abdominal pain, and fever as high as 40 °C (104 °F). In most people, the illness lasts for 2–10 days. It is classified as invasive/inflammatory diarrhea, also described as bloody diarrhea or dysentery.

Prevention

ILLNESS Bacterial Campylobacteriosis Prevention

- Pasteurization of milk and chlorination of drinking water destroys the organisms.
- Treatment with antibiotics can reduce fecal excretion.
- Infected health care workers should not provide direct patient care.
- Separate cutting boards should be used for foods of animal origin and other foods.
- Contact with pet saliva and feces should be avoided.
- Food should be properly cooked and hot when served.
- Consume only pasteurized or boiled milk and milk products, never raw milk products.
- Make sure that ice is from safe water.
- If you are not sure of the safety of drinking water, boil it, or disinfect it with chemical disinfectant.
- Wash hands thoroughly and frequently with soap, especially after using the toilet and after contact with pets and farm animals.
- Wash fruits and vegetables thoroughly, especially if they are to be eaten raw. Peel fruits and vegetables whenever possible.

- Food handlers, professionals and at home, should observe hygienic rules during food preparation.
- Professional food handlers should immediately report to their employer any fever, diarrhea, vomiting or visible infected skin lesions.

ILLNESS Bacterial Campylobacteriosis Treatment

Treatment

The infection is usually self-limiting, and in most cases, symptomatic treatment by liquid and electrolyte replacement is enough in human infections.

Antibiotics
Antibiotic treatment only has a marginal effect on the duration of symptoms, and its use is not recommended except in high-risk patients with clinical complications.

Erythromycin can be used in children, and tetracycline in adults. Some studies show, however, that erythromycin rapidly eliminates Campylobacter from the stool without affecting the duration of illness. Nevertheless, children with dysentery due to C. jejuni benefit from early treatment with erythromycin. Treatment with antibiotics, therefore, depends on the severity of symptoms. Quinolones are effective if the organism is sensitive, but high rates of quinolone use in livestock means that quinolones are now largely ineffective. Antimotility agents, such as loperamide, can lead to prolonged illness or intestinal perforation in any invasive diarrhea, and should be avoided. Trimethoprim/sulfamethoxazole and ampicillin are ineffective against Campylobacter.

Notes

Campylobacter jejuni is the second most common cause of food poisoning in the United States and in Europe after Salmonella. The vast majority of cases occur as isolated events, not as part of recognized outbreaks.

ILLNESS Bacterial Cholera

3 Cholera

Cholera is an infection of the small intestine by some strains of the bacterium Vibrio cholerae. Symptoms may range from none, to mild, to severe. The classic symptom is large amounts of watery diarrhea that lasts a few days. Vomiting and muscle cramps may also occur. Diarrhea can be so severe that it leads within hours to severe dehydration and electrolyte imbalance. This may result in sunken eyes, cold skin, decreased skin elasticity, and wrinkling of the hands and feet.

Dehydration can cause the skin to turn bluish. Symptoms start two hours to five days after exposure. Cholera is caused by a number of types of Vibrio cholerae, with some types producing more severe disease than others. It is spread mostly by unsafe water and unsafe food that has been contaminated with human feces containing the bacteria. Undercooked seafood is a common source.

Humans are the only animal affected. Risk factors for the disease include poor sanitation, not enough clean drinking water, and poverty. There are concerns that rising sea levels will increase rates of disease. Cholera can be diagnosed by a stool test. A rapid dipstick test is available but is not as accurate. Prevention methods against cholera include improved sanitation and access to clean water. Cholera vaccines that are given by mouth provide reasonable protection for about six months. They have the added benefit of protecting against another type of diarrhea caused by E. coli. The primary treatment is oral rehydration therapy—the replacement of fluids with slightly sweet and salty solutions.

Sources

Drinking water contaminated with the bacterium.

ILLNESS Bacterial Cholera Symptoms

Symptoms

The primary symptoms of cholera are profuse diarrhea and vomiting of clear fluid. These symptoms usually start suddenly, half a day to five days after ingestion of the bacteria. The diarrhea is frequently described as "rice water" in nature and may have a fishy odor. An untreated person with cholera may produce 10 to 20 litres (3 to 5 US gal) of diarrhea a day. Severe cholera, without treatment, kills about half of affected individuals. If the severe diarrhea is not treated, it can result in life-threatening dehydration and electrolyte imbalances. Estimates of the ratio of asymptomatic to symptomatic infections have ranged from 3 to 100. Cholera has been nicknamed the "blue death" because a person's skin may turn bluish-gray from extreme loss of fluids.

Fever is rare and should raise suspicion for secondary infection. Patients can be lethargic and might have sunken eyes, dry mouth, cold clammy skin, or wrinkled hands and feet. Kussmaul breathing, a deep and labored breathing pattern, can occur because of acidosis from stool bicarbonate losses and lactic acidosis associated with poor perfusion. Blood pressure drops due to dehydration, peripheral pulse is rapid and thready, and urine output decreases with time. Muscle cramping and weakness, altered consciousness, seizures, or even coma due to electrolyte imbalances are common, especially in children.

Prevention

Although cholera may be life-threatening, prevention of the disease is normally straightforward if proper sanitation practices are followed. In developed countries, due to nearly universal advanced water treatment and sanitation practices present there, cholera is rare. For example, the last major outbreak of cholera in the United States occurred in 1910–1911. Cholera is mainly a risk in developing countries. Effective sanitation practices, if instituted and adhered to in time, are usually sufficient to stop an epidemic. There are several points along the cholera transmission path at which its spread may be halted:

ILLNESS Bacterial Cholera Prevention

● Sterilization: Proper disposal and treatment of all materials that may have come into contact with cholera victims' feces (e.g., clothing, bedding, etc.) are essential. These should be sanitized by washing in hot water, using chlorine bleach if possible. Hands that touch cholera patients or their clothing, bedding, etc., should be thoroughly cleaned and disinfected with chlorinated water or other effective antimicrobial agents.
● Sewage and fecal sludge management: In cholera-affected areas, sewage and fecal sludge need to be treated and managed carefully in order to stop the spread of this disease via human excreta. Provision of sanitation and hygiene is an important preventative measure.
● Sources: Warnings about possible cholera contamination should be posted around contaminated water sources.
● Water purification: All water used for drinking, washing, or cooking should be sterilized by either boiling, chlorination, ozone water treatment, ultraviolet light sterilization (e.g., by solar water disinfection), or antimicrobial filtration in any area where cholera may be present. Cloth filters or sari filtration, though very basic, have significantly reduced the occurrence of cholera when used in poor villages in Bangladesh that rely on untreated surface water. Better antimicrobial filters, like those present in advanced individual water treatment hiking kits, are most effective.

Treatment

Aggressive efforts to rehydrate the patient, drops the death rate to only one per cent. Antibiotic therapy with doxycycline or tetracycline seems to shorten the duration of the illness.

Antibiotic treatments for one to three days shorten the course of the disease and reduce the severity of the symptoms. Use of antibiotics also reduces fluid requirements. People will recover without them, however, if sufficient hydration is maintained. The WHO only recommends antibiotics in those with severe dehydration.

Doxycycline is typically used first line, although some strains of V. cholerae have shown resistance. Testing for resistance during an outbreak can help determine appropriate future choices. Other antibiotics proven to be effective include cotrimoxazole, erythromycin, tetracycline, chloramphenicol, and furazolidone. Fluoroquinolones, such as ciprofloxacin, also may be used, but resistance has been reported. Antibiotics improve outcomes in those who are both severely and not severely dehydrated. Azithromycin and tetracycline may work better than doxycycline or ciprofloxacin.

Notes

Caused by the marine and freshwater bacterium Vibrio cholera, Cholera has been the cause of many deaths in both the distant and recent past. It may, once again, be an issue in the uncertain future. Cholera toxins produce a rapid onset of diarrhea and vomiting within a few hours to 2 days of infection. Victims often complain of leg cramps. The body water loss with untreated cholera is associated with a sixty per cent death rate.

ILLNESS Bacterial Mycobacterium marinum

4 Mycobacterium Marinum

Mycobacterium marinum (formerly M. balnei) is a free-living bacterium, which causes opportunistic infections in humans. M. marinum sometimes causes a rare disease known as aquarium granuloma, which typically affects individuals who work with fish or keep home aquariums.

Sources

Naturally occurs in water, most cases from exposure in swimming pools or more frequently aquariums; rare infection since it mostly infects immunocompromised individuals.

Symptoms

Symptoms include lesions typically located on the elbows, knees, and feet (from swimming pools) or lesions on the hands (aquariums). Lesions may be painless or painful.

Prevention

Treatment

The management of M. marinum infections depends on the severity of the infection. A prolonged course of antibiotic therapy is curative in most superficial cases but adjunctive surgical intervention is sometimes indicated in extensive and deep infections. M. marinum is heat sensitive and very hot compresses applied directly to the infected area have been effective in eradicating the bacterium. (The compress should be as hot as can be safely tolerated and the surrounding skin should be protected.) Use of minocycline, clarithromycin, and ethambutol has been described.

ILLNESS Bacterial Dysentery

5 Dysentery

Dysentery is a type of gastroenteritis that results in diarrhea with blood. Other symptoms may include fever, abdominal pain, and a feeling of incomplete defecation. Complications may include dehydration. The cause is usually Shigella, in which case it is known as shigellosis, or Entamoeba histolytica. Other causes may include certain chemicals, other bacteria, other protozoa, or parasitic worms. It may spread between people. Risk factors include contamination of food and water with feces due to poor sanitation.

The underlying mechanism involves inflammation of the intestine, especially of the colon. Efforts to prevent dysentery include hand washing and food safety measures while traveling in areas of high risk. While the condition generally resolves on its own within a week, drinking sufficient fluids such as oral rehydration solution is important. Antibiotics such as azithromycin may be used to treat cases associated with travelling in the developing world. While medications used to decrease diarrhea such as loperamide are not recommended on their own, they may be used together with antibiotics.

Sources

Water contaminated with the bacterium. It is spread through contaminated food and water, and crowded unsanitary conditions.

Symptoms

The most common form of dysentery is bacillary dysentery, which is typically a mild sickness, causing symptoms normally consisting of mild gut pains and frequent passage of stool or diarrhea. Symptoms normally present themselves after 1–3 days, and are usually no longer present after a week. The frequency of urges to defecate, the large volume of liquid feces ejected, and the presence of blood, mucus, or pus depends on the pathogen causing the disease. Temporary lactose intolerance can occur, as well. In some caustic occasions, severe abdominal cramps, fever, shock, and delirium can all be symptoms.

In extreme cases, people may pass more than one liter of fluid per hour. More often, individuals will complain of diarrhea with blood, accompanied by abdominal pain, rectal pain and a low-grade fever. Rapid weight loss and muscle aches sometimes also accompany dysentery, while nausea and vomiting are rare. On rare occasions, the amoebic parasite will invade the body through the bloodstream and spread beyond the intestines. In such cases, it may more seriously infect other organs such as the brain, lungs, and most commonly the liver.

Prevention

Efforts to prevent dysentery include hand washing and food safety measures while traveling in areas of high risk.

Treatment

Dysentery is managed by maintaining fluids using oral rehydration therapy. If this treatment cannot be adequately maintained due to vomiting or the profuseness of diarrhea, hospital admission may be required for intravenous fluid replacement. In ideal situations, no antimicrobial therapy should be administered until microbiological microscopy and culture studies have established the specific infection involved. When laboratory services are not available, it may be necessary to administer a combination of drugs, including an amoebicidal drug to kill the parasite, and an antibiotic to treat any associated bacterial infection.

If shigellosis is suspected and it is not too severe, letting it run its course may be reasonable — usually less than a week. If the case is severe, antibiotics such as ciprofloxacin or TMP-SMX may be useful. However, many strains of Shigella are becoming resistant to common antibiotics, and effective medications are often in short supply in developing countries. If necessary, a doctor may have to reserve antibiotics for those at highest risk for death, including young children, people over 50, and anyone suffering from dehydration or malnutrition. Amoebic dysentery is often treated with two antimicrobial drugs such as metronidazole and paromomycin or iodoquinol.

6 Legionnaires' Disease (Legionellosis)

Legionnaires' disease, also known as legionellosis, is a form of atypical pneumonia caused by any type of Legionella bacteria. Signs and symptoms include cough, shortness of breath, high fever, muscle pains, and headaches. Nausea, vomiting, and diarrhea may also occur. This often begins 2–10 days after exposure. The bacterium is found naturally in fresh water. It can contaminate hot water tanks, hot tubs, and cooling towers of large air conditioners. It is usually spread by breathing in mist that contains the bacteria. It can also occur when contaminated water is aspirated. It typically does not spread directly between people, and most people who are exposed do not become infected. Risk factors for infection include older age, a history of smoking, chronic lung disease, and poor immune function. Those with severe pneumonia and those with pneumonia and a recent travel history should be tested for the disease. Diagnosis is by a urinary antigen test and sputum culture.

Sources

Legionella is a very common organism that reproduces to high numbers in warm water; but only causes severe disease when aerosolized.

Symptoms

The length of time between exposure to the bacteria and the appearance of symptoms (incubation period) is generally 2–10 days, but can rarely extend to as long as 20 days. For the general population, among those exposed, between 0.1 and 5.0% develop the disease, while among those in hospital, between 0.4 and 14% develop the disease.

Those with Legionnaires' disease usually have fever, chills, and a cough, which may be dry or may produce sputum. Almost all experience fever, while around half have cough with sputum, and one-third cough up blood or bloody sputum. Some also have muscle aches, headache, tiredness, loss of appetite, loss of coordination (ataxia), chest pain, or diarrhea and vomiting. Up to half of those with Legionnaires' disease have gastrointestinal symptoms, and almost half have neurological symptoms, including confusion and impaired cognition. "Relative bradycardia" may also be present, which is low to normal heart rate despite the presence of a fever.

Prevention

Although the risk of Legionnaires' disease being spread by large-scale water systems cannot be eliminated, it can be greatly reduced by writing and enforcing a highly detailed, systematic water safety plan appropriate for the specific facility involved (office building, hospital, hotel, spa, cruise ship, etc.) Some of the elements that such a plan may include are:

● Keep water temperature either above or below the 20–50 °C (68–122 °F) range in which the Legionella bacterium thrives.
● Prevent stagnation, for example, by removing from a network of pipes any sections that have no outlet (dead ends). Where stagnation is unavoidable, as when a wing of a hotel is closed for the off-season, systems must be thoroughly disinfected just prior to resuming normal operation.
● Prevent the buildup of biofilm, for example, by not using (or by replacing) construction materials that encourage its development, and by reducing the quantity of nutrients for bacterial growth that enter the system.
● Periodically disinfect the system, by high heat or a chemical biocide, and use chlorination where appropriate. Treatment of water with copper-silver ionization or ultraviolet light may also be effective.
● System design (or renovation) can reduce the production of aerosols and reduce human exposure to them, by directing them well away from building air intakes.

Treatment

Effective antibiotics include most macrolides, tetracyclines, ketolides, and quinolones. Legionella spp. multiply within the cell, so any effective treatment must have excellent intracellular penetration. Current treatments of choice are the respiratory tract quinolones (levofloxacin, moxifloxacin, gemifloxacin) or newer macrolides (azithromycin, clarithromycin, roxithromycin). The antibiotics used most frequently have been levofloxacin, doxycycline, and azithromycin.

Macrolides (azithromycin) are used in all age groups, while tetracyclines (doxycycline) are prescribed for children above the age of 12 and quinolones (levofloxacin) above the age of 18. Rifampicin can be used in combination with a quinolone or macrolide. Whether rifampicin is an effective antibiotic to take for treatment is uncertain. The Infectious Diseases Society of America does not recommend the use of rifampicin with added regimens. Tetracyclines and erythromycin led to improved outcomes compared to other antibiotics in the original American Legion outbreak.

These antibiotics are effective because they have excellent intracellular penetration in Legionella-infected cells. The recommended treatment is 5–10 days of levofloxacin or 3–5 days of azithromycin, but in people who are immunocompromised, have severe disease, or other pre-existing health conditions, longer antibiotic use may be necessary. During outbreaks, prophylactic antibiotics have been used to prevent Legionnaires' disease in high-risk individuals who have possibly been exposed.

7 Lyme Disease

ILLNESS Bacterial Lyme Disease

Lyme disease, also known as Lyme borreliosis, is an infectious disease caused by bacteria of the Borrelia type which is spread by ticks. The most common sign of infection is an expanding area of redness on the skin, known as erythema migrans, that begins at the site of a tick bite about a week after it has occurred. In most cases, the tick must be attached 36-48 hours to spread Lyme disease. A circular, red, expanding rash (erythema migrans, or a “bullseye” rash) is one of the first symptoms of Lyme disease. Other symptoms include fatigue, chills, fever, headache, muscle and joint aches, and swollen lymph nodes. Treatment in the early stages with antibiotics is generally effective.

Sources

Spread by ticks. The risk of infectious transmission increases with the duration of tick attachment. It requires between 36 and 48 hours of attachment for the bacteria that causes Lyme to travel from within the tick into its saliva.

Symptoms

Lyme disease can affect multiple body systems and produce a broad range of symptoms. Not everyone with Lyme disease has all of the symptoms, and many of the symptoms are not specific to Lyme disease but can occur with other diseases, as well.

The incubation period from infection to the onset of symptoms is usually one to two weeks, but can be much shorter (days), or much longer (months to years). Lyme symptoms most often occur from May to September, because the nymphal stage of the tick is responsible for most cases. Asymptomatic infection exists, but occurs in less than 7% of infected individuals in the United States. Asymptomatic infection may be much more common among those infected in Europe.

Prevention

Tick bites may be prevented by avoiding or reducing time in likely tick habitats and taking precautions while in and when getting out of one. As a precaution, CDC recommends soaking or spraying clothes, shoes, and camping gear such as tents, backpacks and sleeping bags with 0.5% permethrin solution and hanging them to dry before use. Permethrin is odorless and safe for humans but highly toxic to ticks. After crawling on permethrin-treated fabric for as few as 10–20 seconds, tick nymphs become irritated and fall off or die. Permethrin-treated closed-toed shoes and socks reduce by 74 times the number of bites from nymphs that make first contact with a shoe of a person also wearing treated shorts (because nymphs usually quest near the ground, this is a typical contact scenario).

Better protection can be achieved by tucking permethrin-treated trousers (pants) into treated socks and a treated long-sleeve shirt into the trousers so as to minimize gaps through which a tick might reach the wearer's skin. Light-colored clothing may make it easier to see ticks and remove them before they bite. Military and outdoor workers' uniforms treated with permethrin have been found to reduce the number of bite cases by 80-95%. Permethrin protection lasts several weeks of wear and washings in customer-treated items and up to 70 washings for factory-treated items. Permethrin should not be used on human skin, underwear or cats.

Treatment

Tick Removal
Attached ticks should be removed promptly. Risk of infection increases with time of attachment, but in North America risk of Lyme disease is small if the tick is removed within 36 hours. CDC recommends inserting a fine-tipped tweezer between the skin and the tick, grasping very firmly, and pulling the closed tweezer straight away from the skin without twisting, jerking, squeezing or crushing the tick. After tick removal, any tick parts remaining in the skin should be removed with the tweezer, if possible. Wound and hands should then be cleaned with alcohol or soap and water.

The tick may be disposed by placing it in a container with alcohol, sealed bag, tape or flushed down the toilet. The bitten person should write down where and when the bite happened so that this can be informed to a doctor if the person gets a rash or flu-like symptoms in the following several weeks. CDC recommends not using fingers, nail polish, petroleum jelly or heat on the tick to try to remove it.

In Australia, where the Australian paralysis tick is prevalent, the Australasian Society of Clinical Immunology and Allergy recommends not using tweezers to remove ticks, because if the person is allergic, anaphylaxis could result. Instead, a product should be sprayed on the tick to cause it to freeze and then drop off. A doctor would use liquid nitrogen, but products available from chemists for freezing warts can be used instead. Another method originating from Australia consists in using about 20 cm of dental floss or fishing line for slowly tying an overhand knot between the skin and the tick and then pulling it away from the skin.

Preventive Antibiotics
If a deer tick that is sufficiently likely to be carrying Borrelia is found attached to a person and removed, and if the tick has been attached for 36 hours or is engorged, a single dose of doxycycline administered within the 72 hours after removal may reduce the risk of Lyme disease. It is not generally recommended for all people bitten, as development of infection is rare: about 50 bitten people would have to be treated this way to prevent one case of erythema migrans (i.e. the typical rash found in about 70–80% of people infected).

8 Leptospirosis

Leptospirosis is an infection caused by corkscrew-shaped bacteria called Leptospira. Signs and symptoms can range from none to mild such as headaches, muscle pains, and fevers to severe with bleeding from the lungs or meningitis. If the infection causes the person to turn yellow, have kidney failure and bleeding, it is then known as Weil's disease. If it also causes bleeding into the lungs then it is known as severe pulmonary haemorrhage syndrome.

Up to ten different genetic types of Leptospira may cause disease in humans. It is transmitted by both wild and domestic animals. The most common animals that spread the disease are rodents. It is often transmitted by animal urine or by water or soil containing animal urine coming into contact with breaks in the skin, eyes, mouth, or nose. In the developing world the disease most commonly occurs in farmers and low-income people who live in cities. In the developed world it most commonly occurs in those involved in outdoor activities in warm and wet areas of the world. Diagnosis is typically by looking for antibodies against the bacterium or finding its DNA in the blood.

Sources

Water contaminated by the animal urine carrying the bacteria. The bacteria can be found in ponds, rivers, puddles, sewers, agricultural fields and moist soil. Pathogenic Leptospira have been found in the form of aquatic biofilms, which may aid survival in the environment.

Symptoms

The symptoms of leptospirosis usually appear one to two weeks after infection, but the incubation period can be as long as a month. As a biphasic disease, the first phase (acute or septic phase) ends after three to seven days of illness. The second phase (immune phase) starts with the resolution of symptoms and the appearance of antibodies. 90% of those infected experience mild symptoms while 10% experience severe leptospirosis.

Leptospiral infection in humans causes a range of symptoms, though some infected persons may have none. The disease begins suddenly with fever accompanied by chills, intense headache, severe muscle aches and abdominal pain. A headache brought on by leptospirosis causes throbbing pain and is characteristically located at the head's bilateral temporal or frontal regions. The person could also have pain behind the eyes and a sensitivity to light. Muscle pain usually involves the calf muscle and the lower back. The most characteristic feature of leptospirosis is the conjunctival suffusion (conjunctivitis without exudate) which is rarely found in other febrile illnesses. Other characteristic findings on the eye include subconjunctival bleeding and jaundice.

A rash is rarely found in leptospirosis. When one is found alternative diagnoses such as dengue fever and chikungunya fever should be considered. Dry cough is observed in 20–57% of people with leptospirosis. Thus, this clinical feature can mislead a doctor to diagnose the disease as a respiratory illness. Additionally, gastrointestinal symptoms such as nausea, vomiting, abdominal pain, and diarrhoea frequently occur. Vomiting and diarrhea may contribute to dehydration. The abdominal pain can be due to acalculous cholecystitis or inflammation of the pancreas. Rarely, the lymph nodes, liver, and spleen may be enlarged and palpable.

There will be a resolution of symptoms for one to three days. The immune phase starts after this and can last from four to 30 days and can be anything from brain to kidney complications. The hallmark of the second phase is inflammation of the membranes covering the brain. Signs and symptoms of meningitis include severe headache and neck stiffness. Kidney involvement is associated with reduced or absent urine output.

The classic form of severe leptospirosis, known as Weil's disease, is characterised by liver damage (causing jaundice), kidney failure, and bleeding, which happens in 5–10% of those infected. Lung and brain damage can also occur. For those with signs of inflammation of membranes covering the brain and the brain itself, altered level of consciousness can happen. A variety of neurological problems such as paralysis of half of the body, complete inflammation of a whole horizontal section of spinal cord, and muscle weakness due to immune damage of the nerves supplying the muscles are the complications. Signs of bleeding such as non-traumatic bruises at 1 mm (0.039 in), non-traumatic bruises more than 1 cm (0.39 in), nose bleeding, blackish stools due to bleeding in the stomach, vomiting blood and bleeding from the lungs can also be found.

Prolongation of prothrombin time in coagulation testing is associated with severe bleeding manifestation. However, low platelet count is not associated with severe bleeding. Pulmonary haemorrhage is alveolar haemorrhage (bleeding into the alveoli of the lungs) leading to massive coughing up of blood, and causing acute respiratory distress syndrome, where the risk of death is more than 50%. Rarely, inflammation of the heart muscles, inflammation of membranes covering the heart, abnormalities in the heart's natural pacemaker and abnormal heart rhythms may occur.

Prevention

Rates of leptospirosis can be reduced by improving housing, infrastructure, and sanitation standards. Rodent abatement efforts and flood mitigation projects can also help to prevent it. Proper use of personal protective equipment (PPE) by people who have a high risk of occupational exposure can prevent leptospirosis infections in most cases.

Treatment

Most leptospiral cases resolve spontaneously. Early initiation of antibiotics may prevent the progression to severe disease. Therefore, in resource-limited settings, antibiotics can be started once leptospirosis is suspected after history taking and examination.

For mild leptospirosis, antibiotic recommendations such as doxycycline, azithromycin, ampicillin and amoxicillin were based solely on in vitro testing. In 2001, the WHO recommended oral doxycycline (2 mg/kg up to 100 mg every 12 hours) for five to seven days for those with mild leptospirosis. Tetracycline, ampicillin, and amoxicillin can also be used in such cases. However, in areas where rickettsia and leptospirosis are both endemic, azithromycin and doxycycline are the drugs of choice.

9 Otitis Externa

Otitis externa, also called swimmer's ear, is inflammation of the ear canal. It often presents with ear pain, swelling of the ear canal, and occasionally decreased hearing. Typically there is pain with movement of the outer ear. A high fever is typically not present except in severe cases.

Otitis externa may be acute (lasting less than six weeks) or chronic (lasting more than three months). Acute cases are typically due to bacterial infection, and chronic cases are often due to allergies and autoimmune disorders. Risk factors for acute cases include swimming, minor trauma from cleaning, using hearing aids and ear plugs, and other skin problems, such as psoriasis and dermatitis. People with diabetes are at risk of a severe form of malignant otitis externa. Diagnosis is based on the signs and symptoms. Culturing the ear canal may be useful in chronic or severe cases.

Sources

Swimming in water contaminated by the responsible pathogens.

Symptoms

Ear pain is the predominant complaint and the only symptom directly related to the severity of acute external otitis. Unlike other forms of ear infections, the pain of acute external otitis is worsened when the outer ear is touched or pulled gently. Pushing the tragus, the tablike portion of the auricle that projects out just in front of the ear canal opening, also typically causes pain in this condition as to be diagnostic of external otitis on physical examination. People may also experience ear discharge and itchiness. When enough swelling and discharge in the ear canal is present to block the opening, external otitis may cause temporary conductive hearing loss.

Because the symptoms of external otitis lead many people to attempt to clean out the ear canal (or scratch it) with slim implements, self-cleaning attempts generally lead to additional traumas of the injured skin, so rapid worsening of the condition often occurs.

Prevention

Treatment

ILLNESS Bacterial Otitis Externa Treatment

Medications
Effective solutions for the ear canal include acidifying and drying agents, used either singly or in combination. When the ear canal skin is inflamed from the acute otitis externa, the use of dilute acetic acid may be painful.

Burow's solution is a very effective remedy against both bacterial and fungal external otitis. This is a buffered mixture of aluminum sulfate and acetic acid, and is available without prescription in the United States.

Ear drops are the mainstays of treatment for external otitis. Some contain antibiotics, either antibacterial or antifungal, and others are simply designed to mildly acidify the ear canal environment to discourage bacterial growth. Some prescription drops also contain anti-inflammatory steroids, which help to resolve swelling and itching. Although there is evidence that steroids are effective at reducing the length of treatment time required, fungal otitis externa (also called otomycosis) may be caused or aggravated by overly prolonged use of steroid-containing drops.

Antibiotics by mouth should not be used to treat uncomplicated acute otitis externa. Antibiotics by mouth are not a sufficient response to bacteria which cause this condition and have significant side effects including increased risk of opportunistic infection. In contrast, topical products can treat this condition. Oral anti-pseudomonal antibiotics can be used in case of severe soft tissue swelling extending into the face and neck and may hasten recovery.

Although the acute external otitis generally resolves in a few days with topical washes and antibiotics, complete return of hearing and cerumen gland function may take a few more days. Once healed completely, the ear canal is again self-cleaning. Until it recovers fully, it may be more prone to repeat infection from further physical or chemical insult.

Effective medications include ear drops containing antibiotics to fight infection, and corticosteroids to reduce itching and inflammation. In painful cases, a topical solution of antibiotics such as aminoglycoside, polymyxin or fluoroquinolone is usually prescribed. Antifungal solutions are used in the case of fungal infections. External otitis is almost always predominantly bacterial or predominantly fungal so that only one type of medication is necessary and indicated.

10 Salmonellosis (Salmonella)

Salmonellosis is a symptomatic infection caused by bacteria of the Salmonella type. The most common symptoms are diarrhea, fever, abdominal cramps, and vomiting. Symptoms typically occur between 12 hours and 36 hours after exposure, and last from two to seven days. Occasionally more significant disease can result in dehydration. The old, young, and others with a weakened immune system are more likely to develop severe disease. Specific types of Salmonella can result in typhoid fever or paratyphoid fever.

There are two species of Salmonella: Salmonella bongori and Salmonella enterica with many subspecies. Infection is usually spread by eating contaminated meat, eggs, or milk. Other foods may spread the disease if they have come into contact with manure. A number of pets including cats, dogs, and reptiles can also carry and spread the infection. Diagnosis is by a stool test or blood tests.

Sources

Drinking water contaminated with the bacteria. More common as a food borne illness. Salmonella infection usually occurs when a person eats food contaminated with the feces of animals or humans carrying the bacteria. Salmonella outbreaks are commonly associated with eggs, meat and poultry, but these bacteria can also contaminate other foods such as fruits and vegetables. Foods that are most likely to contain Salmonella include raw or undercooked eggs, raw milk, contaminated water, and raw or undercooked meats.

Symptoms

Symptoms of Salmonella infection, or Salmonellosis, range widely, and are sometimes absent altogether. The most common symptoms include diarrhea, abdominal cramps, and fever.

Typical Symptoms of Salmonella infection: Appear 6 to 72 hours after eating contaminated food and last for 3 to 7 days without treatment.

- Diarrhea
- Abdominal Cramps
- Fever of 100 F to 102 F
- Additional symptoms:
- Bloody diarrhea
- Vomiting
- Headache
- Body Aches

Enteritis
After a short incubation period of a few hours to one day, the bacteria multiply in the small intestine, causing an intestinal inflammation (enteritis). Most people with salmonellosis develop diarrhea, fever, vomiting, and abdominal cramps 12 to 72 hours after infection. Diarrhea is often watery and non-bloody but may be mucoid and bloody. In most cases, the illness lasts four to seven days, and does not require treatment. In some cases, though, the diarrhea may be so severe that the patient becomes dangerously dehydrated and must be hospitalized.

At the hospital, the patient may receive fluids intravenously to treat the dehydration, and may be given medications to provide symptomatic relief, such as fever reduction. In severe cases, the Salmonella infection may spread from the intestines to the blood stream, and then to other body sites, and can cause death, unless the person is treated promptly with antibiotics.

In otherwise healthy adults, the symptoms can be mild. Normally, no sepsis occurs, but it can occur exceptionally as a complication in the immunocompromised. However, in people at risk such as infants, small children, and the elderly, Salmonella infections can become very serious, leading to complications. In infants, dehydration can cause a state of severe toxicity. Extraintestinal localizations are possible, especially Salmonella meningitis in children, osteitis, etc. Children with sickle-cell anemia who are infected with Salmonella may develop osteomyelitis. Treatment of osteomyelitis, in this case, will be to use fluoroquinolones (ciprofloxacin, levofloxacin, etc., and nalidixic acid).

Typhoid Fever
Typhoid fever occurs when Salmonella bacteria enter the lymphatic system and cause a systemic form of salmonellosis. Endotoxins first act on the vascular and nervous apparatus, resulting in increased permeability and decreased tone of the vessels, upset thermal regulation, vomiting, and diarrhea. In severe forms of the disease, enough liquid and electrolytes are lost to upset the fluid balance, cause an electrolyte imbalance, decrease the circulating blood volume and arterial pressure, and cause hypovolemic shock. Septic shock may also develop. Shock of mixed character (with signs of both hypovolemic and septic shock) are more common in severe salmonellosis. Oliguria and azotemia develop in severe cases as a result of renal involvement due to hypoxia and toxemia.

Long-Term
Salmonellosis is associated with later irritable bowel syndrome and inflammatory bowel disease. Evidence however does not support it being a direct cause of the latter.

A small number of people afflicted with salmonellosis experience reactive arthritis, which can last months or years and can lead to chronic arthritis. In sickle-cell anemia, osteomyelitis due to Salmonella infection is much more common than in the general population. Though Salmonella infection is frequently the cause of osteomyelitis in people with sickle-cell, it is not the most common cause, which is Staphylococcus infection.

Those infected may become asymptomatic carriers, but this is relatively uncommon, with shedding observed in only 0.2 to 0.6% of cases after a year.

ILLNESS Bacterial Salmonellosis (Salmone

Prevention

The US Food and Drug Administration (FDA) has published guidelines to help reduce the chance of food-borne salmonellosis. Food must be cooked to 145–165 °F (63–74 °C), and liquids such as soups or gravies should be boiled when reheating. Freezing kills some Salmonella, but it is not sufficient to reliably reduce them below infectious levels. While Salmonella is usually heat-sensitive, it acquires heat-resistance in high-fat environments such as peanut butter.

Treatment

Salmonella infections generally last 3 to 7 days, and often do not require treatment. People with severe dehydration may need rehydration through an IV. Antibiotics are recommended for those at risk of invasive disease, including infants under three months old. Typhoid fever is treated with a 14-day course of antibiotics. Unfortunately, treatment of Salmonella has become more difficult as it has become more resistant to antibiotics. Finding the right antibiotic for a case of Salmonella is crucial to treating this bacterial infection.

11 Typhus

ILLNESS Bacterial Typhus

Typhus, also known as typhus fever, is a group of infectious diseases that include epidemic typhus, scrub typhus, and murine typhus. Common symptoms include fever, headache, and a rash. Typically these begin one to two weeks after exposure. The diseases are caused by specific types of bacterial infection. Epidemic typhus is due to Rickettsia prowazekii spread by body lice, scrub typhus is due to Orientia tsutsugamushi spread by chiggers, and murine typhus is due to Rickettsia typhi spread by fleas.

Currently no vaccine is commercially available. Prevention is by reducing exposure to the organisms that spread the disease. Treatment is with the antibiotic doxycycline. Epidemic typhus generally occurs in outbreaks when poor sanitary conditions and crowding are present. While once common, it is now rare. Scrub typhus occurs in Southeast Asia, Japan, and northern Australia. Murine typhus occurs in tropical and subtropical areas of the world

Sources

Typhus

Transmitted by fleas and ticks to humans in unsanitary surroundings.

Symptoms

Signs and symptoms begin with sudden onset of fever, and other flu-like symptoms about one to two weeks after being infected. Five to nine days after the symptoms have started, a rash typically begins on the trunk and spreads to the extremities. This rash eventually spreads over most of the body, sparing the face, palms, and soles. Signs of meningoencephalitis begin with the rash and continue into the second or third weeks. Other signs of meningoencephalitis include sensitivity to light (photophobia), altered mental status (delirium), or coma. Untreated cases are often fatal.

Prevention

Typhus

As of 2020, no vaccine is commercially available. A vaccine has been in development for scrub typhus known as the scrub typhus vaccine.

Treatment

Doxycycline is the drug of choice for this disease. The American Public Health Association recommends treatment based upon clinical findings and before culturing confirms the diagnosis. Without treatment, death may occur in 10% to 60% of people with epidemic typhus, with people over age 60 having the highest risk of death. In the antibiotic era, death is uncommon if doxycycline is given. In one study of 60 people hospitalized with epidemic typhus, no one died when given doxycycline or chloramphenicol. Some people also may need oxygen and intravenous fluids.

12 Typhoid Fever

ILLNESS Bacterial Typhoid Fever

Typhoid fever, also known simply as typhoid, is a bacterial infection due to a specific type of Salmonella that causes symptoms. Symptoms may vary from mild to severe, and usually begin 6 to 30 days after exposure. Often there is a gradual onset of a high fever over several days. This is commonly accompanied by weakness, abdominal pain, constipation, headaches, and mild vomiting. Some people develop a skin rash with rose colored spots. In severe cases, people may experience confusion. Without treatment, symptoms may last weeks or months. Diarrhea is uncommon. Other people may carry the bacterium without being affected; however, they are still able to spread the disease to others. Typhoid fever is a type of enteric fever, along with paratyphoid fever.

The cause is the bacterium Salmonella enterica subsp. enterica growing in the intestines and blood. Typhoid is spread by eating or drinking food or water contaminated with the feces of an infected person. Risk factors include poor sanitation and poor hygiene. Those who travel in the developing world are also at risk. Only humans can be infected. Symptoms are similar to those of many other infectious diseases. Diagnosis is by either culturing the bacteria or detecting their DNA in the blood, stool, or bone marrow. Culturing the bacterium can be difficult. Bone-marrow testing is the most accurate.

Infection with the bacteria Salmonella typhi is called "Typh-oid fever", because it is often confused with Typhus. Contamination with Salmonella in food occurs more often than with any other bacteria in the United States. In Typhoid fever, there is a gradual onset of high fevers over the course of several days. Abdominal pain, intestinal hemorrhage, weakness, headaches, constipation, and bloody diarrhea may occur. A number of people develop a spotty, rose-colored rash.

Sources

ILLNESS Bacterial Typhoid Fever Symptoms

Ingestion of water contaminated with feces of an infected person.

Symptoms

Characterized by sustained fever up to 40°C (104°F), profuse sweating; diarrhea may occur. Symptoms progress to delirium, and the spleen and liver enlarge if untreated. In this case it can last up to four weeks and cause death. Some people with typhoid fever develop a rash called "rose spots", small red spots on the abdomen and chest.

Classically, the progression of untreated typhoid fever is divided into four distinct stages, each lasting about a week. Over the course of these stages, the patient becomes exhausted and emaciated.

● In the first week, the body temperature rises slowly, and fever fluctuations are seen with relative bradycardia (Faget sign), malaise, headache, and cough. A bloody nose (epistaxis) is seen in a quarter of cases, and abdominal pain is also possible. A decrease in the number of circulating white blood cells (leukopenia) occurs with eosinopenia and relative lymphocytosis; blood cultures are positive for Salmonella enterica subsp. enterica serovar Typhi. The Widal test is usually negative in the first week.

● In the second week, the person is often too tired to get up, with high fever in plateau around 40 °C (104 °F) and bradycardia (sphygmothermic dissociation or Faget sign), classically with a dicrotic pulse wave. Delirium can occur, where the patient is often calm, but sometimes becomes agitated. This delirium has led to typhoid receiving the nickname "nervous fever". Rose spots appear on the lower chest and abdomen in around a third of patients. Rhonchi (rattling breathing sounds) are heard in the base of the lungs. The abdomen is distended and painful in the right lower quadrant, where a rumbling sound can be heard. Diarrhea can occur in this stage, but constipation is also common. The spleen and liver are enlarged (hepatosplenomegaly) and tender, and liver transaminases are elevated. The Widal test is strongly positive, with antiO and antiH antibodies. Blood cultures are sometimes still positive at this stage.

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ILLNESS Bacterial Typhoid Fever Symptoms

- In the third week of typhoid fever, a number of complications can occur:
  - Intestinal haemorrhage due to bleeding in congested Peyer's patches occurs; this can be very serious, but is usually not fatal.
  - Intestinal perforation in the distal ileum is a very serious complication and is frequently fatal. It may occur without alarming symptoms until septicaemia or diffuse peritonitis sets in.
  - Encephalitis
  - Respiratory diseases such as pneumonia and acute bronchitis
  - Neuropsychiatric symptoms (described as "muttering delirium" or "coma vigil"), with picking at bedclothes or imaginary objects
  - Metastatic abscesses, cholecystitis, endocarditis, and osteitis
  - The fever is still very high and oscillates very little over 24 hours. Dehydration ensues, and the patient is delirious (typhoid state). One-third of affected individuals develop a macular rash on the trunk.
  - Low platelet count (thrombocytopenia) can sometimes be seen.

ILLNESS Bacterial Typhoid Fever

Prevention

Sanitation and hygiene are important to prevent typhoid. It can only spread in environments where human feces are able to come into contact with food or drinking water. Careful food preparation and washing of hands are crucial to prevent typhoid. Industrialization, and in particular, the invention of the automobile, contributed greatly to the elimination of typhoid fever, as it eliminated the public-health hazards associated with having horse manure in public streets, which led to large number of flies, which are known as vectors of many pathogens, including Salmonella spp. According to statistics from the United States Centers for Disease Control and Prevention, the chlorination of drinking water has led to dramatic decreases in the transmission of typhoid fever in the United States.

ILLNESS Bacterial Typhoid Fever Treatment

Treatment

Ciprofloxacin is the antibiotic of choice but most victims improve with rehydration therapy.

Oral rehydration therapy
The rediscovery of oral rehydration therapy in the 1960s provided a simple way to prevent many of the deaths of diarrheal diseases in general.

Antibiotics
Where resistance is uncommon, the treatment of choice is a fluoroquinolone such as ciprofloxacin. Otherwise, a third-generation cephalosporin such as ceftriaxone or cefotaxime is the first choice. Cefixime is a suitable oral alternative. Typhoid fever, when properly treated, is not fatal in most cases. Antibiotics, such as ampicillin, chloramphenicol, trimethoprim-sulfamethoxazole, amoxicillin, and ciprofloxacin, have been commonly used to treat typhoid fever. Treatment of the disease with antibiotics reduces the case-fatality rate to about 1%.

Without treatment, some patients develop sustained fever, bradycardia, hepatosplenomegaly, abdominal symptoms, and occasionally, pneumonia. In white-skinned patients, pink spots, which fade on pressure, appear on the skin of the trunk in up to 20% of cases. In the third week, untreated cases may develop gastrointestinal and cerebral complications, which may prove fatal in up to 10–20% of cases. The highest case fatality rates are reported in children under 4 years. Around 2–5% of those who contract typhoid fever become chronic carriers, as bacteria persist in the biliary tract after symptoms have resolved.

ILLNESS Bacterial Vibrio Cholerae

13 Vibrio Cholerae

Vibrio cholerae is a Gram-negative, comma-shaped bacterium. The bacterium's natural habitat is brackish or saltwater and attach themselves easily to the chitin-containing shells of crabs, shrimps, and other shellfish. Some strains of V. cholerae cause the disease cholera, which can be derived from the consumption of undercooked or raw marine life species. V. cholerae is a facultative anaerobe and has a flagellum at one cell pole as well as pili. V. cholerae can undergo respiratory and fermentative metabolism. When ingested, V. cholerae can cause diarrhea and vomiting in a host within several hours to 2–3 days of ingestion. V. cholerae was first isolated as the cause of cholera by Italian anatomist Filippo Pacini in 1854, but his discovery was not widely known until Robert Koch, working independently 30 years later, publicized the knowledge and the means of fighting the disease.

Sources

Can enter wounds from contaminated water. Also acquired by drinking contaminated water or eating undercooked oysters.

Symptoms

Symptoms include abdominal tenderness, agitation, bloody stools, chills, confusion, difficulty paying attention (attention deficit), delirium, fluctuating mood, hallucination, nosebleeds, severe fatigue, slow, sluggish, lethargic feeling, weakness.

ILLNESS Bacterial Vibrio Cholerae

Prevention

When visiting areas with epidemic cholera, the following precautions should be observed: drink and use bottled water; frequently wash hands with soap and safe water; use chemical toilets or bury feces if no restroom is available; do not defecate in any body of water and cook food thoroughly. Supplying proper, safe water is important. A precaution to take is to properly sanitize. Hand hygiene is an essential in areas where soap and water is not available. When there is no sanitation available for hand washing, scrub hands with ash or sand and rinse with clean water. A single dose vaccine is available for those traveling to an area where cholera is common.

Treatment

The basic, overall treatment for Cholera is re-hydration, to replace the fluids that have been lost. Those with mild dehydration can be treated orally with an oral re hydration solution also known as, (ORS). When patients are severely dehydrated and unable to take in the proper amount of ORS, IV fluid treatment is generally pursued. Antibiotics are used in some cases, typically fluoroquinolones and tetracyclines.

ILLNESS Bacterial Clostridium Perfringens

14 Clostridium Perfringens

Clostridium perfringens (formerly known as C. welchii, or Bacillus welchii) is a Gram-positive, rod-shaped, anaerobic, spore-forming pathogenic bacterium of the genus Clostridium. C. perfringens is ever-present in nature and can be found as a normal component of decaying vegetation, marine sediment, the intestinal tract of humans and other vertebrates, insects, and soil. It has the shortest reported generation time of any organism at 6.3 minutes in thioglycolate medium. C. perfringens is one of the most common causes of food poisoning in the United States, alongside norovirus, Salmonella, Campylobacter, and Staphylococcus aureus. However, it can sometimes be ingested and cause no harm.

Infections due to C. perfringens show evidence of tissue necrosis, bacteremia, emphysematous cholecystitis, and gas gangrene, also known as clostridial myonecrosis. The specific name perfringens is derived from the Latin per (meaning through) and frango (burst), referring to the disruption of tissue that occurs during gas gangrene. The toxin involved in gas gangrene is α-toxin, which inserts into the plasma membrane of cells, producing gaps in the membrane that disrupt normal cellular function. C. perfringens can participate in polymicrobial anaerobic infections. It is commonly encountered in infections as a component of the normal flora. In this case, its role in disease is minor.

ILLNESS Bacterial Clostridium Perfringens

Sources

Beef, poultry, gravies, and dried or pre-cooked foods are common sources of C. perfringens infections. C. perfringens infection often occurs when foods are prepared in large quantities and kept warm for a long time before serving.

Symptoms

People infected with C. perfringens develop diarrhea and abdominal cramps within 6 to 24 hours (typically 8 to 12 hours). The illness usually begins suddenly and lasts for less than 24 hours. People infected with C. perfringens usually do not have fever or vomiting. The illness is not passed from one person to another.

Prevention

To prevent infection by Clostridium perfringens, follow the these tips: Cook foods containing meat thoroughly. If keeping foods out, make sure they maintain a temperature of 140 F (60 C). When storing food in the refrigerator, divide it into pieces with a thickness of three inches or less so that it cools faster. Reheat foods to at least 165°F (74°C).

Treatment

Recovery usually occurs within 24 hours. Keep well hydrated. The most important aspect of treatment is prompt and extensive surgical debridement of the involved area and excision of all devitalized tissue, in which the organisms are prone to grow. Administration of antimicrobial drugs, particularly penicillin, is begun at the same time. Hyperbaric oxygen may be of help in the medical management of clostridial tissue infections. It is said to "detoxify" patients rapidly.

ILLNESS Bacterial Escherichia Coli

15 Escherichia Coli

Escherichia coli, also known as E. coli, is a Gram-negative, facultative anaerobic, rod-shaped, coliform bacterium of the genus Escherichia that is commonly found in the lower intestine of warm-blooded organisms (endotherms). Most E. coli strains are harmless, but some serotypes can cause serious food poisoning in their hosts, and are occasionally responsible for product recalls due to food contamination. The harmless strains are part of the normal microbiota of the gut, and can benefit their hosts by producing vitamin K2, (which helps blood to clot when you have a cut to form a scab) and preventing colonisation of the intestine with pathogenic bacteria, having a symbiotic relationship. E. coli is expelled into the environment within fecal matter. The bacterium grows massively in fresh fecal matter under aerobic conditions for 3 days, but its numbers decline slowly afterwards.

Sources

E. coli O157:H7 is most commonly found in cows, although chickens, deer, sheep, and pigs have also been known to carry it. Meat becomes contaminated during slaughter, when infected animal intestines or feces come in contact with the carcass. Other foods that sometimes become contaminated with E. coli bacteria include unpasteurized milk and cheese, unpasteurized juices, alfalfa and radish sprouts, lettuce, spinach, and water.

Symptoms

E. coli symptoms change as the infection progresses. Symptoms usually begin two to five days after infection. The initial symptoms include the sudden onset of cramps and abdominal pain, followed by diarrhea within 24 hours. Diarrhea will become increasingly watery, and then noticeably bloody. People with E. coli infection also often feel nauseated and experience headaches. Less common symptoms include fever and chills.

Prevention

Proven prevention methods for E. coli transmission include handwashing and improved sanitation and drinking water, as transmission occurs through fecal contamination of food and water supplies. Additionally, thoroughly cooking meat and avoiding consumption of raw, unpasteurized beverages, such as juices and milk are other proven methods for preventing E.coli. Lastly, avoid cross-contamination of utensils and work spaces when preparing food.

ILLNESS Bacterial Escherichia Coli Treatment

Treatment

Illness from E. coli usually goes away within a week and does not cause any long-term problems. One should make sure to remain hydrated and get proper nutrition while sick. Antibiotics are not used as E. coli treatment, as they do not improve the illness, and some studies show that they can increase the risk of HUS.

Although the rate of resistance to commonly used antibiotics is increasing and they are generally not recommended. The antibiotic used depends upon susceptibility patterns in the particular geographical region. Currently, the antibiotics of choice are fluoroquinolones or azithromycin, with an emerging role for rifaximin. Oral rifaximin, a semisynthetic rifamycin derivative, is an effective and well-tolerated antibacterial for the management of adults with non-invasive traveller's diarrhea. Rifaximin was significantly more effective than placebo and no less effective than ciprofloxacin in reducing the duration of diarrhea. While rifaximin is effective in patients with E. coli-predominant traveller's diarrhea, it appears ineffective in patients infected with inflammatory or invasive enteropathogens.

ILLNESS Bacterial Shigella

16 Shigella

Shigella is a genus of bacteria that is Gram-negative, facultative anaerobic, non-spore-forming, nonmotile, rod-shaped and genetically closely related to E. coli. The genus is named after Kiyoshi Shiga, who first discovered it in 1897. The causative agent of human shigellosis, Shigella causes disease in primates, but not in other mammals. It is only naturally found in humans and gorillas. During infection, it typically causes dysentery.

Shigella is one of the leading bacterial causes of diarrhea worldwide, causing an estimated 80–165 million cases. The number of deaths it causes each year is estimated at between 74,000 and 600,000. It is one of the top four pathogens that cause moderate-to-severe diarrhea in African and South Asian children.

Sources

Shigella bacteria are generally transmitted through a fecal-oral route. Foods that come into contact with human or animal waste can transmit Shigella. Thus, handling toddlers' diapers, eating vegetables from a field contaminated with sewage, or drinking pool water are all activities that can lead to shigellosis.

Symptoms

ILLNESS Bacterial Shigella

Symptoms of Shigella poisoning most commonly develop one to three days after exposure to Shigella bacteria, and usually go away within five to seven days. It is also possible to get Shigella but experience no symptoms, and still be contagious to others, a condition known as being asymptomatic.

- Diarrhea: Diarrhea ranges from mild to severe. It is bloody in 25 to 50 percent of cases and usually contains mucus
- Fever
- Stomach cramps
- Rectal spasms

Prevention

Steps for Preventing the Spread of Shigella Infection:
- If a child in diapers has shigellosis, wash your hands after changing their diaper and wipe down the changing area with disinfectant.
- People with Shigella should not prepare food for others for at least two days after diarrhea has stopped.
- Drink only treated or boiled water while traveling and only eat fruits you peel yourself.
- Only swim in pools maintaining a chlorine level of 0.5 parts per million and stay clear of pools where children not yet toilet trained are swimming.

Treatment

A Shigella infection usually goes away on its own in five to seven days, although bowel movements may continue to be abnormal for up to a month following infection. Antibiotics, however, can shorten the course of the illness. A doctor can prescribe antibiotics after testing a stool sample for the presence of Shigella bacteria. Some strains of shigellosis are resistant to antibiotics, meaning that antibiotics might not always be an effective treatment. Antidiarrheal medication should be avoided, as it can actually make the illness worse.

17 Staphylococcus Aureus

ILLNESS Bacterial Staphylococcus Aureus

Staphylococcus aureus is a Gram-positive, round-shaped bacterium that is a member of the Firmicutes, and it is a usual member of the microbiota of the body, frequently found in the upper respiratory tract and on the skin. It is often positive for catalase and nitrate reduction and is a facultative anaerobe that can grow without the need for oxygen. Although S. aureus usually acts as a commensal of the human microbiota it can also become an opportunistic pathogen, being a common cause of skin infections including abscesses, respiratory infections such as sinusitis, and food poisoning. Pathogenic strains often promote infections by producing virulence factors such as potent protein toxins, and the expression of a cell-surface protein that binds and inactivates antibodies. The emergence of antibiotic-resistant strains of S. aureus such as methicillin-resistant S. aureus (MRSA) is a worldwide problem in clinical medicine. Despite much research and development, no vaccine for S. aureus has been approved.

Sources

S. aureus is also responsible for food poisoning. It is capable of generating toxins that produce food poisoning in the human body.

Symptoms

Prevention

Preventive measures one can take to help prevent the spread of the disease include washing hands thoroughly with soap and water before preparing food. Stay away from any food if ill, and wear gloves if any open wounds occur on hands or wrists while preparing food. If storing food for longer than 2 hours, keep the food below 5 or above 63 °C.

Treatment

ILLNESS Bacterial Staphylococcus Aureus Treatment

The treatment of choice for S. aureus infection is penicillin. An antibiotic derived from some Penicillium fungal species, penicillin inhibits the formation of peptidoglycan cross-linkages that provide the rigidity and strength in a bacterial cell wall. The four-membered β-lactam ring of penicillin is bound to enzyme DD-transpeptidase, an enzyme that when functional, cross-links chains of peptidoglycan that form bacterial cell walls. The binding of β-lactam to DD-transpeptidase inhibits the enzyme's functionality and it can no longer catalyze the formation of the cross-links. As a result, cell wall formation and degradation are imbalanced, thus resulting in cell death.

In most countries, however, penicillin resistance is extremely common, and first-line therapy is most commonly a penicillinase-resistant β-lactam antibiotic (for example, oxacillin or flucloxacillin, both of which have the same mechanism of action as penicillin). Combination therapy with gentamicin may be used to treat serious infections, such as endocarditis, but its use is controversial because of the high risk of damage to the kidneys. The duration of treatment depends on the site of infection and on severity. Adjunctive rifampicin has been historically used in the management of S aureus bacteraemia, but randomised controlled trial evidence has shown this to be of no overall benefit over standard antibiotic therapy.

18 Staphylococcal Enteritis

ILLNESS Bacterial Staphylococcal Enteritis

Staphylococcal enteritis is an inflammation that is usually caused by eating or drinking substances contaminated with staph enterotoxin. The toxin, not the bacterium, settles in the small intestine and causes inflammation and swelling. This in turn can cause abdominal pain, cramping, dehydration, diarrhea and fever.

Staphylococcus aureus is a Gram-positive, facultative anaerobe, coccal (round shaped) bacteria that appears in grape-like clusters that can thrive in high salt and low water activity habitats. S. aureus bacteria can live on the skin which is one of the primary modes of transmission. S. aureus can cause a range of illnesses from minor skin infections to Staphylococcus aureus food poisoning enteritis. Since humans are the primary source, cross-contamination is the most common way the microorganism is introduced into foods. Foods at high risks are those prepared in large quantities. Staphylococcus aureus is a true food poisoning organism. It produces a heat stable enterotoxin when allowed to grow for several hours in foods such as cream-filled baked goods, poultry meat, gravies, eggs, meat salads, puddings and vegetables. It is important to note that the toxins may be present in dangerous amounts in foods that have no signs of spoilage, such as a bad smell, any off color, odor, or textural or flavor change.

Sources

Symptoms

ILLNESS Bacterial

Common symptoms of Staphylococcus aureus food poisoning include: a rapid onset which is usually 1–6 hours, nausea, explosive vomiting for up to 24 hours, abdominal cramps/pain, headache, weakness, diarrhea and usually a subnormal body temperature. Symptoms usually start one to six hours after eating and last less than 12 hours. The duration of some cases may take two or more days to fully resolve.

ILLNESS Bacterial Staphylococcal Enteritis

Prevention

Staphylococcal enteritis may be avoided by using proper hygiene and sanitation with food preparation. This includes thoroughly cooking all meats. If food is to be stored longer than two hours, keep hot foods hot (over 140 °F) and cold foods cold (40 °F or under). Ensure to refrigerate leftovers promptly and store cooked food in a wide, shallow container and refrigerate as soon as possible. Sanitation is very important. Keep kitchens and food-serving areas clean and sanitized. Finally, as most staphylococcal food poisoning are the result of food handling, hand washing is critical. Food handlers should use hand sanitizers with alcohol or thorough hand washing with soap and water.

Treatment

Treatment is supportive and based upon symptoms, with fluid and electrolyte replacement as the primary goal. Dehydration caused by diarrhea and vomiting is the most common complication. To prevent dehydration, it is important to take frequent sips of a rehydration drink (like water) or try to drink a cup of water or rehydration drink for each large, loose stool.

Dietary management of enteritis consists of starting with a clear liquid diet until vomiting and diarrhea end and then slowly introduce solid foods. It is also important to avoid foods that are high in fiber or are possibly difficult to digest.

19 MRSA

Methicillin-resistant Staphylococcus aureus (MRSA) refers to a group of Gram-positive bacteria that are genetically distinct from other strains of Staphylococcus aureus. MRSA is responsible for several difficult-to-treat infections in humans. MRSA is any strain of S. aureus that has developed, through horizontal gene transfer and natural selection, multiple drug resistance to beta-lactam antibiotics. β-lactam antibiotics are a broad-spectrum group that include some penams (penicillin derivatives such as methicillin and oxacillin) and cephems such as the cephalosporins. Strains unable to resist these antibiotics are classified as methicillin-susceptible S. aureus, or MSSA.

MRSA is common in hospitals, prisons, and nursing homes, where people with open wounds, invasive devices such as catheters, and weakened immune systems are at greater risk of hospital-acquired infection. MRSA began as a hospital-acquired infection, but has become community-acquired, as well as livestock-acquired. The terms HA-MRSA (healthcare-associated or hospital-acquired MRSA), CA-MRSA (community-associated MRSA), and LA-MRSA (livestock-associated MRSA) reflect this.

Sources

While MRSA bacteria are usually carried on the human skin and in the nose, recent studies have shown that livestock also carry MRSA, and that it can be transmitted from these animals to farmers and veterinarians, who can then pass it on to other humans. MRSA bacteria have also been shown to be present in retail foods, including pork, beef, and dairy products, although MRSA outbreaks from food contamination are rare.

Symptoms

MRSA infections usually appear as skin or soft tissue infections, such as boils or abscesses. Some people report them looking like a spider bite: red and swollen. However, MRSA skin infections are also painful and can pus or drain. Symptoms of a MRSA infection from food generally resemble other food poisoning symptoms, including nausea, vomiting, and stomach cramps.

Prevention

The Centers for Disease Control and Prevention offers suggestions for preventing the contraction and spread of MRSA infection which are applicable to those in community settings, including incarcerated populations, childcare center employees, and athletes. To prevent the spread of MRSA, the recommendations are to wash hands thoroughly and regularly using soap and water or an alcohol-based sanitizer. Additional recommendations are to keep wounds clean and covered, avoid contact with other people's wounds, avoid sharing personal items such as razors or towels, shower after exercising at athletic facilities, and shower before using swimming pools or whirlpools.

Glycopeptides, cephalosporins, and in particular, quinolones are associated with an increased risk of colonisation of MRSA. Reducing use of antibiotic classes that promote MRSA colonisation, especially fluoroquinolones, is recommended in current guidelines.

Mathematical models describe one way in which a loss of infection control can occur after measures for screening and isolation seem to be effective for years, as happened in the UK. In the "search and destroy" strategy that was employed by all UK hospitals until the mid-1990s, all hospitalized people with MRSA were immediately isolated, and all staff were screened for MRSA and were prevented from working until they had completed a course of eradication therapy that was proven to work.

Loss of control occurs because colonised people are discharged back into the community and then readmitted; when the number of colonised people in the community reaches a certain threshold, the "search and destroy" strategy is overwhelmed. One of the few countries not to have been overwhelmed by MRSA is the Netherlands: an important part of the success of the Dutch strategy may have been to attempt eradication of carriage upon discharge from hospital.

Maintaining the necessary cleanliness may be difficult for people if they do not have access to facilities such as public toilets with handwashing facilities. In the United Kingdom, the Workplace (Health, Safety and Welfare) Regulations 1992 require businesses to provide toilets for their employees, along with washing facilities including soap or other suitable means of cleaning.

Guidance on how many toilets to provide and what sort of washing facilities should be provided alongside them is given in the Workplace (Health, Safety and Welfare) Approved Code of Practice and Guidance L24, available from Health and Safety Executive Books, but no legal obligations exist on local authorities in the United Kingdom to provide public toilets, and although in 2008, the House of Commons Communities and Local Government Committee called for a duty on local authorities to develop a public toilet strategy, this was rejected by the Government.

Treatment

Staph infections on the skin can be treated by being drained. A laboratory test may also determine that a specific antibiotic can be used to treat a case of MRSA.

ILLNESS Bacterial MRSA Treatment

Antibiotics
Treatment of MRSA infection is urgent and delays can be fatal. The location and history related to the infection determines the treatment. The route of administration of an antibiotic varies. Antibiotics effective against MRSA can be given by IV, oral, or a combination of both, and depend on the specific circumstances and patient characteristics. The use of concurrent treatment with vancomycin or other beta-lactam agents may have a synergistic effect.

Both CA-MRSA and HA-MRSA are resistant to traditional anti-staphylococcal beta-lactam antibiotics, such as cephalexin. CA-MRSA has a greater spectrum of antimicrobial susceptibility to sulfa drugs (like co-trimoxazole (trimethoprim/sulfamethoxazole), tetracyclines (like doxycycline and minocycline) and clindamycin (for osteomyelitis). MRSA can be eradicated with a regimen of linezolid, though treatment protocols vary and serum levels of antibiotics vary widely from person to person and may affect outcomes. The effective treatment of MRSA with linezolid has been successful in 87% of people. Linezolid is more effective in soft tissue infections than vancomycin. This is compared to eradication of infection in those with MRSA treated with vancomycin.

Treatment with vancomycin is successful in approximately 49% of people. Linezolid belongs to the newer oxazolidinone class of antibiotics which has been shown to be effective against both CA-MRSA and HA-MRSA. The Infectious Disease Society of America recommends vancomycin, linezolid, or clindamycin (if susceptible) for treating those with MRSA pneumonia. Ceftaroline, a fifth-generation cephalosporin, is the first beta-lactam antibiotic approved in the US to treat MRSA infections in skin and soft tissue or community-acquired pneumonia.

Vancomycin and teicoplanin are glycopeptide antibiotics used to treat MRSA infections. Teicoplanin is a structural congener of vancomycin that has a similar activity spectrum but a longer half-life. Because the oral absorption of vancomycin and teicoplanin is very low, these agents can be administered intravenously to control systemic infections. Treatment of MRSA infection with vancomycin can be complicated, due to its inconvenient route of administration. Moreover, the efficacy of vancomycin against MRSA is inferior to that of anti-staphylococcal beta-lactam antibiotics against methicillin-susceptible S. aureus (MSSA).

Skin and soft-tissue infections
In skin abscesses, the primary treatment recommended is removal of dead tissue, incision, and drainage. More information is needed to determine the effectiveness of specific antibiotics therapy in surgical site infections (SSIs). Examples of soft-tissue infections from MRSA include ulcers, impetigo, abscesses, and SSIs. In surgical wounds, evidence is weak (high risk of bias) that linezolid may be better than vancomycin to eradicate MRSA SSIs.

MRSA colonization is also found in nonsurgical wounds such as traumatic wounds, burns, and chronic ulcers (i.e.: diabetic ulcer, pressure ulcer, arterial insufficiency ulcer, venous ulcer). No conclusive evidence has been found about the best antibiotic regimen to treat MRSA colonization.

20 Strep Throat

Streptococcal pharyngitis, also known as strep throat, is an infection of the back of the throat including the tonsils caused by group A streptococcus (GAS). Common symptoms include fever, sore throat, red tonsils, and enlarged lymph nodes in the neck. A headache, and nausea or vomiting may also occur. Some develop a sandpaper-like rash which is known as scarlet fever. Symptoms typically begin one to three days after exposure and last seven to ten days.

Strep throat is spread by respiratory droplets from an infected person. It may be spread directly or by touching something that has droplets on it and then touching the mouth, nose, or eyes. Some people may carry the bacteria without symptoms. It may also be spread by skin infected with group A strep. The diagnosis is made based on the results of a rapid antigen detection test or throat culture in those who have symptoms.

Prevention is by washing hands and not sharing eating utensils. There is no vaccine for the disease. Treatment with antibiotics is only recommended in those with a confirmed diagnosis. Those infected should stay away from other people until fever is gone and for at least 12 hours after starting treatment. Pain can be treated with paracetamol (acetaminophen) and nonsteroidal anti-inflammatory drugs (NSAIDS) such as ibuprofen.

Strep throat is a common bacterial infection in children. It is the cause of 15–40% of sore throats among children and 5–15% among adults. Cases are more common in late winter and early spring. Potential complications include rheumatic fever and peritonsillar abscess.

Sources

It is spread by direct, close contact with an infected person; thus crowding, as may be found in the military and schools, increases the rate of transmission. Dried bacteria in dust are not infectious, although moist bacteria on toothbrushes or similar items can persist for up to fifteen days. Contaminated food can result in outbreaks, but this is rare. Of children with no signs or symptoms, 12% carry GAS in their pharynx, and, after treatment, approximately 15% of those remain positive, and are true "carriers".

Signs & Symptoms

The typical signs and symptoms of streptococcal pharyngitis are a sore throat, fever of greater than 38 °C (100 °F), tonsillar exudates (pus on the tonsils), and large cervical lymph nodes. Other symptoms include: headache, nausea and vomiting, abdominal pain, muscle pain, or a scarlatiniform rash or palatal petechiae, the latter being an uncommon but highly specific finding.

Symptoms typically begin one to three days after exposure and last seven to ten days. Strep throat is unlikely when any of the symptoms of red eyes, hoarseness, runny nose, or mouth ulcers are present. It is also unlikely when there is no fever.

Diagnosis

A number of scoring systems exist to help with diagnosis; however, their use is controversial due to insufficient accuracy. The modified Centor criteria are a set of five criteria; the total score indicates the probability of a streptococcal infection.

One point is given for each of the criteria:
- Absence of a cough
- Swollen and tender cervical lymph nodes
- Temperature >38.0 °C (100.4 °F)
- Tonsillar exudate or swelling
- Age less than 15 (a point is subtracted if age >44)

A score of one may indicate no treatment or culture is needed or it may indicate the need to perform further testing if other high risk factors exist, such as a family member having the disease.

Prevention

Tonsillectomy may be a reasonable preventive measure in those with frequent throat infections (more than three a year). However, the benefits are small and episodes typically lessen in time regardless of measures taken. Recurrent episodes of pharyngitis which test positive for GAS may also represent a person who is a chronic carrier of GAS who is getting recurrent viral infections. Treating people who have been exposed but who are without symptoms is not recommended. Treating people who are carriers of GAS is not recommended as the risk of spread and complications is low.

ILLNESS Bacterial Strep Throat Treatment

Treatment

Untreated streptococcal pharyngitis usually resolves within a few days. Treatment with antibiotics shortens the duration of the acute illness by about 16 hours. The primary reason for treatment with antibiotics is to reduce the risk of complications such as rheumatic fever and retropharyngeal abscesses. Antibiotics prevent acute rheumatic fever if given within 9 days of the onset of symptoms.

Pain Medication
Pain medication such as NSAIDs and paracetamol (acetaminophen) helps in the management of pain associated with strep throat. Viscous lidocaine may also be useful. While steroids may help with the pain, they are not routinely recommended. Aspirin may be used in adults but is not recommended in children due to the risk of Reye syndrome.

Antibiotics
The antibiotic of choice in the United States for streptococcal pharyngitis is penicillin V, due to safety, cost, and effectiveness. Amoxicillin is preferred in Europe. In India, where the risk of rheumatic fever is higher, intramuscular benzathine penicillin G is the first choice for treatment.

Appropriate antibiotics decrease the average 3–5 day duration of symptoms by about one day, and also reduce contagiousness. They are primarily prescribed to reduce rare complications such as rheumatic fever and peritonsillar abscess. The arguments in favor of antibiotic treatment should be balanced by the consideration of possible side effects, and it is reasonable to suggest that no antimicrobial treatment be given to healthy adults who have adverse reactions to medication or those at low risk of complications. Antibiotics are prescribed for strep throat at a higher rate than would be expected from how common it is.

Erythromycin and other macrolides or clindamycin are recommended for people with severe penicillin allergies. First-generation cephalosporins may be used in those with less severe allergies and some evidence supports cephalosporins as superior to penicillin. These late-generation antibiotics show a similar effect when prescribed for 3–7 days in comparison to the standard 10-days of penicillin when used in areas of low rheumatic heart disease. Streptococcal infections may also lead to acute glomerulonephritis; however, the incidence of this side effect is not reduced by the use of antibiotics.

Prognosis

The symptoms of strep throat usually improve within three to five days, irrespective of treatment. Treatment with antibiotics reduces the risk of complications and transmission; children may return to school 24 hours after antibiotics are administered. The risk of complications in adults is low. In children, acute rheumatic fever is rare in most of the developed world. It is, however, the leading cause of acquired heart disease in India, sub-Saharan Africa, and some parts of Australia.

● Acute Fheumatic Fever ● Scarlet Fever ● Streptococcal Toxic Shock Syndrome	● PANDAS Syndrome ● Peritonsillar Abscess ● Cervical Lymphadenitis	● Glomerulonephritis ● Mastoiditis

21 Vibrio Parahaemolyticus

Vibrio parahaemolyticus is a curved, rod-shaped, Gram-negative bacterium found in brackish, saltwater, which, when ingested, causes gastrointestinal illness in humans. V. parahaemolyticus is oxidase positive, facultatively aerobic, and does not form spores. Like other members of the genus Vibrio, this species is motile, with a single, polar flagellum.

Sources

Vibrio parahaemolyticus infection can be acquired by eating raw or undercooked shellfish or drinking contaminated water. Eating raw oysters is the most common way the infection is spread as the organism naturally lives in the warm tidal waters where oysters grow.

Symptoms

Vibrio parahaemolyticus infection causes symptoms of gastro including: Watery diarrhoea (occasionally bloody diarrhoea), Abdominal cramps, Nausea, Vomiting, Fever, Headache. Usually symptoms are mild to moderate in severity and lasts around 3 days (range from 8 hours to 12 days). However, the infection can be severe in people with immunosuppression, such as people receiving cancer treatment.

Prevention

Treatment

Antibiotic treatment is not usually needed for V. parahaemolytiticus gastro, however, in cases with prolonged diarrhoea, antibiotic therapy may be needed. The following are general recommendations for the treatment of gastro: Give plenty of fluids. Oral rehydration solution is highly recommended for children and adults with mild to moderate dehydration. It is available at pharmacies and should be administered following the instructions on the packaging.

22 Vibrio Vulnificus

Vibrio vulnificus is a species of Gram-negative, motile, curved rod-shaped (bacillus), pathogenic bacteria of the genus Vibrio. Present in marine environments such as estuaries, brackish ponds, or coastal areas, V. vulnificus is related to V. cholerae, the causative agent of cholera.

Sources

Symptoms

V. vulnificus is an extremely virulent bacterium that can cause three types of infections:
● Acute gastroenteritis from eating raw or undercooked shellfish: V. vulnificus causes an infection often incurred after eating seafood, especially raw or undercooked oysters. It does not alter the appearance, taste, or odor of oysters. Symptoms include vomiting, diarrhea, and abdominal pain.
● Necrotizing wound infections can occur in injured skin exposed to contaminated marine water. V. vulnificus bacteria can enter the body through open wounds when swimming or wading in infected waters, or by puncture wounds from the spines of fishes such as stingrays. People may develop a blistering dermatitis sometimes mistaken for pemphigus or pemphigoid.
● Invasive sepsis can occur after eating raw or undercooked shellfish, especially oysters. V. vulnificus is 80 times more likely to spread into the bloodstream in people with compromised immune systems, especially those with chronic liver disease. When this happens, severe symptoms including blistering skin lesions and septic shock can sometimes lead to death. This severe infection may occur regardless of whether the infection began from contaminated food or an open wound.

ILLNESS Bacterial Vibrio Vulnificus

Among healthy people, ingestion of V. vulnificus can cause vomiting, diarrhea, and abdominal pain. In someone with a compromised immune system, particularly those with chronic liver disease, it can infect the bloodstream, causing a severe and life-threatening illness characterized by fever and chills, decreased blood pressure (septic shock), and blistering skin lesions. While men have been shown to be more at risk from this infection than women, co-morbidities such as alcoholic cirrhosis and diseases affecting the endocrine system (diabetes, rheumatoid arthritis, etc.) put a person far more at risk to develop infection from V. vulnificus.

Prevention

Treatment

V. vulnificus wound infections have a mortality rate around 25%. In people in whom the infection worsens into sepsis, typically following ingestion, the mortality rate rises to 50%. The majority of these people die within the first 48 hours of infection. The optimal treatment is not known, but in one retrospective study of 93 people in Taiwan, use of a third-generation cephalosporin and a tetracycline (e.g., ceftriaxone and doxycycline, respectively) was associated with an improved outcome. Prospective clinical trials are needed to confirm this finding, but in vitro data support the supposition that this combination is synergistic against V. vulnificus. Likewise, the American Medical Association and the Centers for Disease Control and Prevention (CDC) recommend treating the person with a quinolone or intravenous doxycycline with ceftazidime. The first successful documented treatment of fulminant V. vulnificus sepsis was in 1995. Treatment was ceftazidime and intravenous (IV) ciprofloxacin and IV doxycycline, which proved successful. Prevention of secondary infections from respiratory failure and acute renal failure is crucial. Key to the diagnosis and treatment were the early recognition of bullae in an immunocompromised person with liver cirrhosis and oyster ingestion within the previous 48 hours, and the request by the physician for STAT Gram staining and blood cultures for V. vulnificus. V. vulnificus often causes large, disfiguring ulcers that require extensive debridement or even amputation.

23 Listeria (Listeriosis)

Listeriosis is a bacterial infection most commonly caused by Listeria monocytogenes, although L. ivanovii and L. grayi have been reported in certain cases. Listeriosis can cause severe illness, including severe sepsis, meningitis, or encephalitis, sometimes resulting in lifelong harm and even death. Those at risk of severe illness are the elderly, unborn babies, newborns and those who are immunocompromised. In pregnant women it may cause stillbirth or spontaneous abortion, and preterm birth is common. Listeriosis may cause mild, self-limiting gastroenteritis and fever in anyone.

Listeria is ubiquitous and is primarily transmitted via the oral route after ingestion of contaminated food products, after which the bacteria penetrates the intestinal tract to cause systemic infections. The diagnosis of listeriosis requires the isolation of the causative bacteria from the blood and/or the cerebrospinal fluid. Treatment includes prolonged administration of antibiotics, primarily ampicillin and gentamicin, to which the organism is usually susceptible.

Listeria is unlike many other germs because it can grow even in the cold temperature of the refrigerator. Listeria is killed by cooking and pasteurization.

Sources

Listeria monocytogenes is ubiquitous in the environment. Listeria is found in soil and water and some animals, including poultry and cattle. It can be present in raw milk and foods made from raw milk. It can also live in food processing plants and contaminate a variety of processed meats. Ready-to-eat deli meats and hot dogs, Refrigerated pâtés or meat spreads, Unpasteurized (raw) milk and dairy products, Soft cheese made with unpasteurized milk, such as queso fresco, Feta, Brie, Camembert, Refrigerated smoked seafood and Raw sprouts.

Symptoms

The disease primarily affects older adults, persons with weakened immune systems, pregnant women, and newborns. Rarely, people without these risk factors can also be affected. A person with listeriosis usually has fever and muscle aches, often preceded by diarrhea or other gastrointestinal symptoms. Almost everyone who is diagnosed with listeriosis has invasive infection (meaning that the bacteria spread from their intestines to their bloodstream or other body sites). Disease may occur as much as two months after eating contaminated food.

The symptoms vary with the infected person:
● High-risk people other than pregnant women: Symptoms can include fever, muscle aches, headache, stiff neck, confusion, loss of balance, and convulsions.
● Pregnant women: Pregnant women typically experience only a mild, flu-like illness. However, infections during pregnancy can lead to miscarriage, stillbirth, premature delivery, or life-threatening infection of the newborn.
● Previously healthy people: People who were previously healthy but were exposed to a very large dose of Listeria can develop a non-invasive illness (meaning that the bacteria have not spread into their blood stream or other body sites). Symptoms can include diarrhea and fever.

If an animal has eaten food contaminated with Listeria and does not have any symptoms, most experts believe that no tests or treatment are needed, even for people at high risk for listeriosis.

Prevention

The main means of prevention is through the promotion of safe handling, cooking and consumption of food. This includes washing raw vegetables and cooking raw food thoroughly, as well as reheating leftover or ready-to-eat foods like hot dogs until steaming hot.

Another aspect of prevention is advising high-risk groups such as pregnant women and immunocompromised patients to avoid unpasteurized pâtés and foods such as soft cheeses like feta, Brie, Camembert cheese, and bleu. Cream cheeses, yogurt, and cottage cheese are considered safe. In the United Kingdom, advice along these lines from the Chief Medical Officer posted in maternity clinics led to a sharp decline in cases of listeriosis in pregnancy in the late 1980s.

Treatment

Bacteremia should be treated for 2 weeks, meningitis for 3 weeks, and brain abscess for at least 6 weeks. Ampicillin generally is considered antibiotic of choice; gentamicin is added frequently for its synergistic effects. Overall mortality rate is 20–30%; of all pregnancy-related cases, 22% resulted in fetal loss or neonatal death, but mothers usually survive. Try activated charcoal, syrup of ipecac, garlic, and/or alcohol-free goldenseal to treat food poisoning in general.

24 Bacillus Cereus

Bacillus cereus is a Gram-positive, rod-shaped, facultatively anaerobic, motile, beta-hemolytic, spore forming bacterium commonly found in soil and food. The specific name, cereus, meaning "waxy" in Latin, refers to the appearance of colonies grown on blood agar. Some strains are harmful to humans and cause foodborne illness, while other strains can be beneficial as probiotics for animals. The bacteria is classically contracted from fried rice dishes that have been sitting at room temperature for hours. B. cereus bacteria are facultative anaerobes, and like other members of the genus Bacillus, can produce protective endospores. Its virulence factors include cereolysin and phospholipase C.

Sources

A variety of foods, particularly rice and leftovers, as well as sauces, soups, and other prepared foods that have sat out too long at room temperature. B. cereus is responsible for a minority of foodborne illnesses (2–5%), causing severe nausea, vomiting, and diarrhea.

Symptoms

- Diarrheal: Watery diarrhea and abdominal cramps
- Emetic (vomiting): Nausea and vomiting

Prevention

Bacillus foodborne illnesses occur due to survival of the bacterial endospores when infected food is not, or inadequately, cooked. Cooking temperatures less than or equal to 100°C (212°F) allow some B. cereus spores to survive. This problem is compounded when food is then improperly refrigerated, allowing the endospores to germinate. Cooked foods not meant for either immediate consumption or rapid cooling and refrigeration should be kept at temperatures below 10°C (50°F) or above 50°C (122°F). Germination and growth generally occur between 10°C and 50°C, though some strains can grow at low temperatures. Bacterial growth results in production of enterotoxins, one of which is highly resistant to heat and acids (pH levels between 2 and 11); ingestion leads to two types of illness: diarrheal and emetic (vomiting) syndrome.

Treatment

Drink plenty of fluids and get rest. If you cannot drink enough fluids to prevent dehydration, call your doctor.

25 Anthrax

Anthrax is an infection caused by the bacterium Bacillus anthracis. It can occur in four forms: skin, lungs, intestinal, and injection. Symptoms begin between one day and two months after the infection is contracted. The skin form presents with a small blister with surrounding swelling that often turns into a painless ulcer with a black center. The inhalation form presents with fever, chest pain, and shortness of breath. The intestinal form presents with diarrhea which may contain blood, abdominal pains, and nausea and vomiting. The injection form presents with fever and an abscess at the site of drug injection.

Anthrax is spread by contact with the bacterium's spores, which often appear in infectious animal products. Contact is by breathing, eating, or through an area of broken skin. It does not typically spread directly between people. Risk factors include people who work with animals or animal products, travelers, postal workers, and military personnel. Diagnosis can be confirmed based on finding antibodies or the toxin in the blood or by culture of a sample from the infected site.

Sources

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Symptoms

Skin
Cutaneous anthrax, also known as hide-porter's disease, is when anthrax occurs on the skin. It is the most common form (>90% of anthrax cases). It is also the least dangerous form (low mortality with treatment, 20% mortality without). Cutaneous anthrax presents as a boil-like skin lesion that eventually forms an ulcer with a black center (eschar). The black eschar often shows up as a large, painless, necrotic ulcer (beginning as an irritating and itchy skin lesion or blister that is dark and usually concentrated as a black dot, somewhat resembling bread mold) at the site of infection. In general, cutaneous infections form within the site of spore penetration between two and five days after exposure. Unlike bruises or most other lesions, cutaneous anthrax infections normally do not cause pain. Nearby lymph nodes may become infected, reddened, swollen, and painful. A scab forms over the lesion soon, and falls off in a few weeks. Complete recovery may take longer. Cutaneous anthrax is typically caused when B. anthracis spores enter through cuts on the skin. This form is found most commonly when humans handle infected animals and/or animal products. Cutaneous anthrax is rarely fatal if treated, because the infection area is limited to the skin, preventing the lethal factor, edema factor, and protective antigen from entering and destroying a vital organ. Without treatment, about 20% of cutaneous skin infection cases progress to toxemia and death.

Lungs
Inhalation anthrax usually develops within a week after exposure, but may take up to 2 months. During the first few days of illness, most people have fever, chills, and fatigue. These symptoms may be accompanied by cough, shortness of breath, chest pain, and nausea or vomiting, making inhalation anthrax difficult to distinguish from influenza and community-acquired pneumonia. This is often described as the prodromal period.

Over the next day or so, shortness of breath, cough, and chest pain become more common, and complaints not involving the chest such as nausea, vomiting, altered mental status, sweats, and headache develop in one-third or more of people. Upper respiratory tract symptoms occur in only a quarter of people, and muscle pains are rare. Altered mental status or shortness of breath generally brings people to healthcare and marks the fulminant phase of illness. Before 2001, fatality rates for inhalation anthrax were 90%; since then, they have fallen to 45%.

It infects the lymph nodes in the chest first, rather than the lungs themselves, a condition called hemorrhagic mediastinitis, causing bloody fluid to accumulate in the chest cavity, therefore causing shortness of breath. The second (pneumonia) stage occurs when the infection spreads from the lymph nodes to the lungs. Symptoms of the second stage develop suddenly after hours or days of the first stage. Symptoms include high fever, extreme shortness of breath, shock, and rapid death within 48 hours in fatal cases.

Gastrointestinal
Gastrointestinal (GI) infection is most often caused by consuming anthrax-infected meat and is characterized by diarrhea, potentially with blood, abdominal pains, acute inflammation of the intestinal tract, and loss of appetite. Occasional vomiting of blood can occur. Lesions have been found in the intestines and in the mouth and throat. After the bacterium invades the gastrointestinal system, it spreads to the bloodstream and throughout the body, while continuing to make toxins. GI infections can be treated, but usually result in fatality rates of 25% to 60%, depending upon how soon treatment commences. This form of anthrax is the rarest.

Prevention

Precautions are taken to avoid contact with the skin and any fluids exuded through natural body openings of a deceased body that is suspected of harboring anthrax. The body should be put in strict quarantine. A blood sample is collected and sealed in a container and analyzed in an approved laboratory to ascertain if anthrax is the cause of death. The body should be sealed in an airtight body bag and incinerated to prevent transmission of anthrax spores. Microscopic visualization of the encapsulated bacilli, usually in very large numbers, in a blood smear stained with polychrome methylene blue (McFadyean stain) is fully diagnostic, though culture of the organism is still the gold standard for diagnosis. Full isolation of the body is important to prevent possible contamination of others.

Protective, impermeable clothing and equipment such as rubber gloves, rubber apron, and rubber boots with no perforations are used when handling the body. No skin, especially if it has any wounds or scratches, should be exposed. Disposable personal protective equipment is preferable, but if not available, decontamination can be achieved by autoclaving. Used disposable equipment is burned and/or buried after use. All contaminated bedding or clothing is isolated in double plastic bags and treated as biohazard waste. Respiratory equipment capable of filtering small particles, such the US National Institute for Occupational Safety and Health- and Mine Safety and Health Administration-approved high-efficiency respirator, is worn.

Antibiotics
Preventive antibiotics are recommended in those who have been exposed. Early detection of sources of anthrax infection can allow preventive measures to be taken. In response to the anthrax attacks of October 2001, the United States Postal Service (USPS) installed biodetection systems (BDSs) in their large-scale mail processing facilities. BDS response plans were formulated by the USPS in conjunction with local responders including fire, police, hospitals, and public health. Employees of these facilities have been educated about anthrax, response actions, and prophylactic medication. Because of the time delay inherent in getting final verification that anthrax has been used, prophylactic antibiotic treatment of possibly exposed personnel must be started as soon as possible.

Treatment

Anthrax cannot be spread directly from person to person, but a person's clothing and body may be contaminated with anthrax spores. Effective decontamination of people can be accomplished by a thorough wash-down with antimicrobial soap and water. Waste water is treated with bleach or another antimicrobial agent. Effective decontamination of articles can be accomplished by boiling them in water for 30 minutes or longer. Chlorine bleach is ineffective in destroying spores and vegetative cells on surfaces, though formaldehyde is effective. Burning clothing is very effective in destroying spores. After decontamination, there is no need to immunize, treat, or isolate contacts of persons ill with anthrax unless they were also exposed to the same source of infection.

Antibiotics
Early antibiotic treatment of anthrax is essential; delay significantly lessens chances for survival. Treatment for anthrax infection and other bacterial infections includes large doses of intravenous and oral antibiotics, such as fluoroquinolones (ciprofloxacin), doxycycline, erythromycin, vancomycin, or penicillin. FDA-approved agents include ciprofloxacin, doxycycline, and penicillin. In possible cases of pulmonary anthrax, early antibiotic prophylaxis treatment is crucial to prevent possible death. Many attempts have been made to develop new drugs against anthrax, but existing drugs are effective if treatment is started soon enough.

26 Brucellosis

Brucellosis is a highly contagious zoonosis caused by ingestion of unpasteurized milk or undercooked meat from infected animals, or close contact with their secretions. It is also known as undulant fever, Malta fever, and Mediterranean fever.

Brucella species are small, Gram-negative, nonmotile, nonspore-forming, rod-shaped (coccobacilli) bacteria. They function as facultative intracellular parasites, causing chronic disease, which usually persists for life. Four species infect humans: B. abortus, B. canis, B. melitensis, and B. suis. B. abortus is less virulent than B. melitensis and is primarily a disease of cattle. B. canis affects dogs. B. melitensis is the most virulent and invasive species; it usually infects goats and occasionally sheep. B. suis is of intermediate virulence and chiefly infects pigs. Symptoms include profuse sweating and joint and muscle pain. Brucellosis has been recognized in animals and humans since the 20th century.

Sources

Ingestion of unpasteurized milk or undercooked meat from infected animals, or close contact with their secretions.

Symptoms

The symptoms are like those associated with many other febrile diseases, but with emphasis on muscular pain and night sweats. The duration of the disease can vary from a few weeks to many months or even years. In the first stage of the disease, bacteremia occurs and leads to the classic triad of undulant fevers, sweating (often with characteristic foul, moldy smell sometimes likened to wet hay), and migratory arthralgia and myalgia (joint and muscle pain).

Blood tests characteristically reveal a low number of white blood cells and red blood cells, show some elevation of liver enzymes such as aspartate aminotransferase and alanine aminotransferase, and demonstrate positive Bengal rose and Huddleston reactions. Gastrointestinal symptoms occur in 70% of cases and include nausea, vomiting, decreased appetite, unintentional weight loss, abdominal pain, constipation, diarrhea, an enlarged liver, liver inflammation, liver abscess, and an enlarged spleen.

This complex is, at least in Portugal, Israel, Syria, and Jordan, known as Malta fever. During episodes of Malta fever, melitococcemia (presence of brucellae in the blood) can usually be demonstrated by means of blood culture in tryptose medium or Albini medium. If untreated, the disease can give origin to focalizations or become chronic.

The focalizations of brucellosis occur usually in bones and joints, and osteomyelitis or spondylodiscitis of the lumbar spine accompanied by sacroiliitis is very characteristic of this disease. Orchitis is also common in men. The consequences of Brucella infection are highly variable and may include arthritis, spondylitis, thrombocytopenia, meningitis, uveitis, optic neuritis, endocarditis, and various neurological disorders collectively known as neurobrucellosis.

Prevention

Surveillance using serological tests, as well as tests on milk such as the milk ring test, can be used for screening and play an important role in campaigns to eliminate the disease. Also, individual animal testing both for trade and for disease-control purposes is practiced. In endemic areas, vaccination is often used to reduce the incidence of infection. An animal vaccine is available that uses modified live bacteria. The World Organisation for Animal Health Manual of Diagnostic Test and Vaccines for Terrestrial Animals provides detailed guidance on the production of vaccines. As the disease is closer to being eliminated, a test and eradication program is required to completely eliminate it.

The main way of preventing brucellosis is by using fastidious hygiene in producing raw milk products, or by pasteurizing all milk that is to be ingested by human beings, either in its unaltered form or as a derivative, such as cheese.

Treatment

ILLNESS Bacterial Brucellosis Treatment

Antibiotics such as tetracyclines, rifampin, and the aminoglycosides streptomycin and gentamicin are effective against Brucella bacteria. However, the use of more than one antibiotic is needed for several weeks, because the bacteria incubate within cells.

The gold standard treatment for adults is daily intramuscular injections of streptomycin 1 g for 14 days and oral doxycycline 100 mg twice daily for 45 days (concurrently). Gentamicin 5 mg/kg by intramuscular injection once daily for 7 days is an acceptable substitute when streptomycin is not available or contraindicated. Another widely used regimen is doxycycline plus rifampin twice daily for at least 6 weeks. This regimen has the advantage of oral administration. A triple therapy of doxycycline, with rifampin and co-trimoxazole, has been used successfully to treat neurobrucellosis. Doxycycline plus streptomycin regimen (for 2 to 3 weeks) is more effective than doxycycline plus rifampicin regimen (for 6 weeks).

Doxycycline is able to cross the blood–brain barrier, but requires the addition of two other drugs to prevent relapse. Ciprofloxacin and co-trimoxazole therapy is associated with an unacceptably high rate of relapse. In brucellic endocarditis, surgery is required for an optimal outcome. Even with optimal antibrucellic therapy, relapses still occur in 5 to 10% of patients with Malta fever.

27 Bubonic Plague

ILLNESS Bacterial Bubonic Plague

Bubonic plague is one of three types of plague caused by bacterium Yersinia pestis. One to seven days after exposure to the bacteria, flu-like symptoms develop. These symptoms include fever, headaches, and vomiting. Swollen and painful lymph nodes occur in the area closest to where the bacteria entered the skin. Occasionally, the swollen lymph nodes may break open.

The three types of plague are the result of the route of infection: bubonic plague, septicemic plague, and pneumonic plague. Bubonic plague is mainly spread by infected fleas from small animals. It may also result from exposure to the body fluids from a dead plague-infected animal. In the bubonic form of plague, the bacteria enter through the skin through a flea bite and travel via the lymphatic vessels to a lymph node, causing it to swell. Diagnosis is made by finding the bacteria in the blood, sputum, or fluid from lymph nodes.

Sources

ILLNESS Bacterial Bubonic Plague Sources

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Bubonic plague is an infection of the lymphatic system, usually resulting from the bite of an infected flea, Xenopsylla cheopis (the rat flea). In very rare circumstances, as in the septicemic plague, the disease can be transmitted by direct contact with infected tissue or exposure to the cough of another human. The flea is parasitic on house and field rats, and seeks out other prey when its rodent hosts die. The bacteria remain harmless to the flea, allowing the new host to spread the bacteria. The bacteria form aggregates in the gut of infected fleas and this results in the flea regurgitating ingested blood, which is now infected, into the bite site of a rodent or human host. Once established, bacteria rapidly spread to the lymph nodes and multiply.

Symptoms

ILLNESS Bacterial Bubonic Plague Symptoms

The best-known symptom of bubonic plague is one or more infected, enlarged, and painful lymph nodes, known as buboes. After being transmitted via the bite of an infected flea, the Y. pestis bacteria become localized in an inflamed lymph node, where they begin to colonize and reproduce. Buboes associated with the bubonic plague are commonly found in the armpits, upper femoral, groin and neck region. Bubonic plague symptoms appear suddenly a few days after exposure to the bacterium. Symptoms include:
● Chills
● General ill feeling (malaise)
● High fever >39 °C (102.2 °F)
● Muscle cramps
● Seizures

● Smooth, painful lymph gland swelling called a bubo, commonly found in the groin, but may occur in the armpits or neck, most often near the site of the initial infection (bite or scratch)
● Pain may occur in the area before the swelling appears
● Gangrene of the extremities such as toes, fingers, lips, and tip of the nose.

Other symptoms include heavy breathing, continuous vomiting of blood (hematemesis), aching limbs, coughing, and extreme pain caused by the decay or decomposition of the skin while the person is still alive. Additional symptoms include extreme fatigue, gastrointestinal problems, lenticulae (black dots scattered throughout the body), delirium, coma, and death. Other forms of the disease include septicemic plague and pneumonic plague in which the bacterium reproduces in the persons blood and lungs respectively.

Prevention

Targeted chemoprophylaxis, sanitation, and vector control played a role in controlling the 2003 Oran outbreak of the bubonic plague.

Treatment

ILLNESS Bacterial Bubonic Plague Treatment

Several classes of antibiotics are effective in treating bubonic plague. These include aminoglycosides such as streptomycin and gentamicin, tetracyclines (especially doxycycline), and the fluoroquinolone ciprofloxacin. Mortality associated with treated cases of bubonic plague is about 1–15%, compared to a mortality of 40–60% in untreated cases.

People potentially infected with the plague need immediate treatment and should be given antibiotics within 24 hours of the first symptoms to prevent death. Other treatments include oxygen, intravenous fluids, and respiratory support. People who have had contact with anyone infected by pneumonic plague are given prophylactic antibiotics. Using the broad-based antibiotic streptomycin has proven to be dramatically successful against the bubonic plague within 12 hours of infection.

28 Pneumonic Plague

ILLNESS Pneumonic Plague

Pneumonic plague is a severe lung infection caused by the bacterium Yersinia pestis. Symptoms include fever, headache, shortness of breath, chest pain, and cough. They typically start about three to seven days after exposure. It is one of three forms of plague, the other two being septicemic plague and bubonic plague. The pneumonic form may occur following an initial bubonic or septicemic plague infection. It may also result from breathing in airborne droplets from another person or cat infected with pneumonic plague. The difference between the forms of plague is the location of infection; in pneumonic plague the infection is in the lungs, in bubonic plague the lymph nodes, and in septicemic plague within the blood. Diagnosis is by testing the blood, sputum, or fluid from a lymph node.

While vaccines are being worked on, in most countries they are not yet commercially available. Prevention is by avoiding contact with infected rodents, people, or cats. It is recommended that those infected be isolated from others. Treatment of pneumonic plague is with antibiotics.

Sources

Pneumonic plague can be caused in two ways: primary, which results from the inhalation of aerosolised plague bacteria, or secondary, when septicaemic plague spreads into lung tissue from the bloodstream. Pneumonic plague is not exclusively vector-borne like bubonic plague; instead it can be spread from person to person. There have been cases of pneumonic plague resulting from the dissection or handling of contaminated animal tissue. This is one of the types of the plague formerly known as the Black Death.

Symptoms

The most apparent symptom of pneumonic plague is coughing, often with hemoptysis (coughing up blood). With pneumonic plague, the first signs of illness are fever, headache, weakness and rapidly developing pneumonia with shortness of breath, chest pain, cough and sometimes bloody or watery sputum. The pneumonia progresses for two to four days and may cause respiratory failure and shock. Patients will die without early treatment, some within 36 hours.

Initial pneumonic plague symptoms can often include the following:
- Fever
- Weakness
- Headaches
- Nausea

Rapidly developing pneumonia with:
- Shortness of breath
- Chest pain
- Cough
- Bloody or watery sputum (saliva and discharge from respiratory passages).

Prevention

Treatment

Pneumonic plague is a very aggressive infection requiring early treatment. Antibiotics must be given within 24 hours of first symptoms to reduce the risk of death. Streptomycin, gentamicin, tetracyclines and chloramphenicol are all able to kill the causative bacterium. Antibiotic treatment for seven days will protect people who have had direct, close contact with infected patients. Wearing a close-fitting surgical mask also protects against infection. The mortality rate from untreated pneumonic plague approaches 100%.

29 Diphtheria

Diphtheria is an infection caused by the bacterium Corynebacterium diphtheriae. Signs and symptoms may vary from mild to severe. They usually start two to five days after exposure. Symptoms often come on fairly gradually, beginning with a sore throat and fever. In severe cases, a grey or white patch develops in the throat. This can block the airway and create a barking cough as in croup. The neck may swell in part due to enlarged lymph nodes. A form of diphtheria which involves the skin, eyes or genitals also exists. Complications may include myocarditis, inflammation of nerves, kidney problems, and bleeding problems due to low levels of platelets. Myocarditis may result in an abnormal heart rate and inflammation of the nerves may result in paralysis.

Diphtheria is usually spread between people by direct contact or through the air. It may also be spread by contaminated objects. Some people carry the bacterium without having symptoms, but can still spread the disease to others. The three main types of C. diphtheriae cause different severities of disease. The symptoms are due to a toxin produced by the bacterium. Diagnosis can often be made based on the appearance of the throat with confirmation by microbiological culture. Previous infection may not protect against future infection.

Sources

Diphtheria is usually spread between people by direct contact or through the air. It may also be spread by contaminated objects. Some people carry the bacterium without having symptoms, but can still spread the disease to others. Human-to-human transmission of diphtheria typically occurs through the air when an infected individual coughs or sneezes. Breathing in particles released from the infected individual leads to infection. Contact with any lesions on the skin can also lead to transmission of diphtheria, but this is uncommon. Indirect infections can occur, as well. If an infected individual touches a surface or object, the bacteria can be left behind and remain viable. Also, some evidence indicates diphtheria has the potential to be zoonotic, but this has yet to be confirmed. Corynebacterium ulcerans has been found in some animals, which would suggest zoonotic potential.

Symptoms

The symptoms of diphtheria usually begin two to seven days after infection. Symptoms of diphtheria include fever of 38 °C (100.4 °F) or above; chills; fatigue; bluish skin coloration (cyanosis); sore throat; hoarseness; cough; headache; difficulty swallowing; painful swallowing; difficulty breathing; rapid breathing; foul-smelling and bloodstained nasal discharge; and lymphadenopathy. Within two to three days, diphtheria may destroy healthy tissues in the respiratory system. The dead tissue forms a thick, gray coating that can build up in the throat or nose. This thick gray coating is called a "pseudomembrane". It can cover tissues in the nose, tonsils, voice box, and throat, making it very hard to breathe and swallow. Symptoms can also include cardiac arrhythmias, myocarditis, and cranial and peripheral nerve palsies.

Prevention

Quinvaxem is a widely administered pentavalent vaccine, which is a combination of five vaccines in one that protect babies from diphtheria, among other common childhood diseases. Diphtheria vaccine is usually combined at least with tetanus vaccine (Td) and often with pertussis (DTP, DTaP, TdaP, Tdap) vaccines, as well.

Treatment

The disease may remain manageable, but in more severe cases, lymph nodes in the neck may swell, and breathing and swallowing are more difficult. People in this stage should seek immediate medical attention, as obstruction in the throat may require intubation or a tracheotomy. Abnormal cardiac rhythms can occur early in the course of the illness or weeks later, and can lead to heart failure. Diphtheria can also cause paralysis in the eye, neck, throat, or respiratory muscles. Patients with severe cases are put in a hospital intensive care unit and given a diphtheria antitoxin (consisting of antibodies isolated from the serum of horses that have been challenged with diphtheria toxin). Since antitoxin does not neutralize toxin that is already bound to tissues, delaying its administration increases risk of death. Therefore, the decision to administer diphtheria antitoxin is based on clinical diagnosis, and should not await laboratory confirmation.

Antibiotics have not been demonstrated to affect healing of local infection in diphtheria patients treated with antitoxin. Antibiotics are used in patients or carriers to eradicate C. diphtheriae and prevent its transmission to others. The Centers for Disease Control and Prevention recommends either:

ILLNESS Diphtheria Treatment

- Metronidazole
- Erythromycin is given (orally or by injection) for 14 days (40 mg/kg per day with a maximum of 2 g/d), or
- Procaine penicillin G is given intramuscularly for 14 days (300,000 U/d for patients weighing <10 kg and 600,000 U/d for those weighing >10 kg); patients with allergies to penicillin G or erythromycin can use rifampin or clindamycin.

In cases that progress beyond a throat infection, diphtheria toxin spreads through the blood and can lead to potentially life-threatening complications that affect other organs, such as the heart and kidneys. Damage to the heart caused by the toxin affects the heart's ability to pump blood or the kidneys' ability to clear wastes. It can also cause nerve damage, eventually leading to paralysis. About 40% to 50% of those left untreated can die.

ILLNESS Bacterial

30 Meningococcal

Meningococcal

Neisseria meningitidis, often referred to as meningococcus, is a Gram-negative bacterium that can cause meningitis and other forms of meningococcal disease such as meningococcemia, a life-threatening sepsis. The bacterium is referred to as a coccus because it is round, and more specifically, diplococcus because of its tendency to form pairs. About 10% of adults are carriers of the bacteria in their nasopharynx. As an exclusively human pathogen it is the main cause of bacterial meningitis in children and young adults, causing developmental impairment and death in about 10% of cases. It causes the only form of bacterial meningitis known to occur epidemically, mainly Africa and Asia. It occurs worldwide in both epidemic and endemic form. N. meningitidis is spread through saliva and respiratory secretions during coughing, sneezing, kissing, chewing on toys and even through sharing a source of fresh water. It has also been reported to be transmitted through oral sex and cause urethritis in men. It infects its host cells by sticking to them with long thin extensions called pili and the surface-exposed proteins Opa and Opc and has several virulence factors.

Sources

N. meningitidis is a part of the normal nonpathogenic flora in the nasopharynx of up to 5–15% of adults. It colonizes and infects only humans, and has never been isolated from other animals. This is thought to stem from the bacterium's inability to get iron from sources other than human transferrin and lactoferrin.

ILLNESS Bacterial Meningococcal Symptoms

Symptoms

Meningococcus can cause meningitis and other forms of meningococcal disease. It initially produces general symptoms like fatigue, fever, and headache and can rapidly progress to neck stiffness, coma and death in 10% of cases. Petechiae occur in about 50% of cases. Chance of survival is highly correlated with blood cortisol levels, and so a reduction in cortisol can be used to determine likelihood of patient mortality. Symptoms of meningococcal meningitis are easily confused with those caused by other bacteria, such as Haemophilus influenzae and Streptococcus pneumoniae. Suspicion of meningitis is a medical emergency and immediate medical assessment is recommended.

Current guidance in the United Kingdom is that if a case of meningococcal meningitis or septicaemia (infection of the blood) is suspected, intravenous antibiotics should be given and the ill person admitted to the hospital. This means that laboratory tests may be less likely to confirm the presence of Neisseria meningitidis as the antibiotics will dramatically lower the number of bacteria in the body. The UK guidance is based on the idea that the reduced ability to identify the bacteria is outweighed by reduced chance of death.

ILLNESS Meningococcal Symptoms

Septicaemia caused by Neisseria meningitidis has received much less public attention than meningococcal meningitis even though septicaemia has been linked to infant deaths. Meningococcal septicaemia typically causes a purpuric rash, that does not lose its color when pressed with a glass slide ("non-blanching") and does not cause the classical symptoms of meningitis. This means the condition may be ignored by those not aware of the significance of the rash. Septicaemia carries an approximate 50% mortality rate over a few hours from initial onset.

Other severe complications include Waterhouse–Friderichsen syndrome, a massive, usually bilateral, hemorrhage into the adrenal glands caused by fulminant meningococcemia, adrenal insufficiency, and disseminated intravascular coagulation.

Not all instances of a purpura-like rash are due to meningococcal septicaemia; other possible causes, such as idiopathic thrombocytopenic purpura (ITP; a platelet disorder) and Henoch–Schönlein purpura, also need prompt investigation.

ILLNESS Bacterial Prevention

Prevention

All recent contacts of the infected patient over the 7 days before onset should receive medication to prevent them from contracting the infection. This especially includes young children and their child caregivers or nursery-school contacts, as well as anyone who had direct exposure to the patient through kissing, sharing utensils, or medical interventions such as mouth-to-mouth resuscitation. Anyone who frequently ate, slept or stayed at the patient's home during the 7 days before the onset of symptom, or those who sat beside the patient on an airplane flight or classroom for 8 hours or longer, should also receive chemoprophylaxis. The agent of choice is usually oral rifampicin for a few days.

Receiving a dose of the Meningococcal vaccine before traveling to a country in the "meningitis belt" or having a booster meningitis vaccine, normally five years apart could prevent someone from getting an infection from the pathogen.

Meningococcal Treatment

Treatment

Persons with confirmed N. meningitidis infection should be hospitalized immediately for treatment with antibiotics. Because meningococcal disease can disseminate very rapidly, a single dose of intramuscular antibiotic is often given at the earliest possible opportunity, even before hospitalization, if disease symptoms look suspicious enough. Third-generation cephalosporin antibiotics (i.e. cefotaxime, ceftriaxone) should be used to treat a suspected or culture-proven meningococcal infection before antibiotic susceptibility results are available. Empirical treatment should also be considered if a lumbar puncture, to collect CSF for laboratory testing, cannot be done within 30 minutes of admission to hospital. Antibiotic treatment may affect the results of microbiology tests, but a diagnosis may be made on the basis of blood-cultures and clinical examination.

ILLNESS Bacterial Pertussis (Whooping Cough)

31 Pertussis (Whooping Cough)

Whooping cough, also known as pertussis or 100-day cough, is a highly contagious bacterial disease. Initially, symptoms are usually similar to those of the common cold with a runny nose, fever, and mild cough. This is followed by weeks of severe coughing fits. Following a fit of coughing, a high-pitched whoop sound or gasp may occur as the person breathes in. The coughing may last for 10 or more weeks, hence the phrase "100-day cough". A person may cough so hard that they vomit, break ribs, or become very tired from the effort. Children less than one year old may have little or no cough and instead have periods where they do not breathe. The time between infection and the onset of symptoms is usually seven to ten days. Disease may occur in those who have been vaccinated, but symptoms are typically milder.

Pertussis is caused by the bacterium Bordetella pertussis. It is spread easily through the coughs and sneezes of an infected person. People are infectious from the start of symptoms until about three weeks into the coughing fits. Those treated with antibiotics are no longer infectious after five days. Diagnosis is by collecting a sample from the back of the nose and throat. This sample can then be tested by either culture or by polymerase chain reaction.

Sources

Symptoms

The classic symptoms of pertussis are a paroxysmal cough, inspiratory whoop, and fainting, or vomiting after coughing. The cough from pertussis has been documented to cause subconjunctival hemorrhages, rib fractures, urinary incontinence, hernias, and vertebral artery dissection. Violent coughing can cause the pleura to rupture, leading to a pneumothorax. Vomiting after a coughing spell or an inspiratory whooping sound on coughing, almost doubles the likelihood that the illness is pertussis. The absence of a paroxysmal cough or posttussive emesis, though, makes it almost half as likely. The illness usually starts with mild respiratory symptoms include mild coughing, sneezing, or a runny nose (known as the catarrhal stage). After one to two weeks, the coughing classically develops into uncontrollable fits, sometimes followed by a high-pitched "whoop" sound, as the person tries to inhale. About 50% of children and adults "whoop" at some point in diagnosed pertussis cases during the paroxysmal stage.

This stage usually lasts two to eight weeks, or sometimes longer. A gradual transition then occurs to the convalescent stage, which usually lasts one to four weeks. This stage is marked by a decrease in paroxysms of coughing, although paroxysms may occur with subsequent respiratory infection for many months after the onset of pertussis.

Symptoms of pertussis can be variable, especially between immunized and non-immunized people. Those that are immunized can present with a more mild infection; they may only have the paroxysmal cough for a couple of weeks, and it may lack the "whooping" characteristic. Although immunized people have a milder form of the infection, they can spread the disease to others who are not immune.

Prevention

The primary method of prevention for pertussis is vaccination. Evidence is insufficient to determine the effectiveness of antibiotics in those who have been exposed, but are without symptoms. Preventive antibiotics, however, are still frequently used in those who have been exposed and are at high risk of severe disease (such as infants).

Treatment

The antibiotics erythromycin, clarithromycin, or azithromycin are typically the recommended treatment. Newer macrolides are frequently recommended due to lower rates of side effects. Trimethoprim-sulfamethoxazole (TMP/SMX) may be used in those with allergies to first-line agents or in infants who have a risk of pyloric stenosis from macrolides.

A reasonable guideline is to treat people age >1 year within 3 weeks of cough onset and infants age <1 year and pregnant women within 6 weeks of cough onset. If the person is diagnosed late, antibiotics will not alter the course of the illness, and even without antibiotics, they should no longer be spreading pertussis. When used early, antibiotics decrease the duration of infectiousness, and thus prevent spread. Short-term antibiotics (azithromycin for 3–5 days) are as effective as long-term treatment (erythromycin 10–14 days) in eliminating B. pertussis with fewer and less severe side effects. People with pertussis are most infectious during the first two weeks following the onset of symptoms. Effective treatments of the cough associated with this condition have not been developed. The use of over the counter cough medications is discouraged and has not been found helpful.

32 Scarlet Fever

Scarlet fever is a disease which can occur as a result of a group A streptococcus (group A strep) infection, also known as Streptococcus pyogenes. The signs and symptoms include a sore throat, fever, headaches, swollen lymph nodes, and a characteristic rash. The rash is red and feels like sandpaper and the tongue may be red and bumpy. It most commonly affects children between five and 15 years of age.

Scarlet fever affects a small number of people who have strep throat or streptococcal skin infections. The bacteria are usually spread by people coughing or sneezing. It can also be spread when a person touches an object that has the bacteria on it and then touches their mouth or nose. The characteristic rash is due to the erythrogenic toxin, a substance produced by some types of the bacterium. The diagnosis is typically confirmed by culturing the throat.

Sources

Strep throat spreads by close contact among people, via respiratory droplets (for example, saliva or nasal discharge). A person in close contact with another person infected with group A streptococcal pharyngitis has a 35% chance of becoming infected. One in ten children who are infected with group A streptococcal pharyngitis will develop scarlet fever.

Symptoms

Rash which has a characteristic appearance, spreading pattern, and desquamating process "Strawberry tongue"
● The tongue initially has a white coating on it, while the papillae of the tongue are swollen and reddened. The protrusion of the red papillae through the white coating gives the tongue a "white strawberry" appearance.
● A few days later (following the desquamating process, or the shedding of the tissue which created the white coating), the whiteness disappears, and the red and enlarged papillae give the tongue the "red strawberry" appearance. The symptomatic appearance of the tongue is part of the rash that is characteristic of scarlet fever.
● Pastia's lines
● Lines of petechiae, which appear as pink/red areas located in arm pits and elbow pits
● Vomiting and abdominal pain

Strep throat
Typical symptoms of streptococcal pharyngitis (also known as strep throat):
● Sore throat, painful swallowing
● Fever - typically over 39 °C (102.2 °F)
● Fatigue
● Enlarged and reddened tonsils with yellow or white exudates present (this is typically an exudative pharyngitis)
● Enlarged and tender lymph nodes usually located on the front of the neck

The following symptoms will usually be absent: cough, hoarseness, runny nose, diarrhea, and conjunctivitis. Such symptoms indicate what is more likely a viral infection.

Rash
The rash begins 1–2 days following the onset of symptoms caused by the strep pharyngitis (sore throat, fever, fatigue). This characteristic rash has been denoted as "scarlatiniform," and it appears as a diffuse redness of the skin with small papules, or bumps, which resemble goose bumps. These bumps are what give the characteristic sandpaper texture to the rash. The reddened skin will blanch when pressure is applied to it. The skin may feel itchy, but it will not be painful. The rash generally starts at the flexion of the elbow and other surfaces. It appears next on the trunk and gradually spreads out to the arms and legs. The palms, soles and face are usually left uninvolved by the rash. The face, however, is usually flushed, most prominently in the cheeks, with a ring of paleness around the mouth. After the rash spreads, it becomes more pronounced in creases in the skin, such as the skin folds in the inguinal and axillary regions of the body. Also in those areas, Pastia's Lines may appear: petechiae arranged in a linear pattern. Within 1 week of onset, the rash begins to fade followed by a longer process of desquamation, or shedding of the outer layer of skin. This lasts several weeks. The desquamation process usually begins on the face and progresses downward on the body. After the desquamation, the skin will be left with a sunburned appearance.

Mouth
The streptococcal pharyngitis, which is the usual presentation of scarlet fever in combination with the characteristic rash, commonly involves the tonsils. The tonsils will appear swollen and reddened. The palate and uvula are also commonly affected by the infection. The involvement of the soft palate can be seen as tiny red and round spots known as Forchheimer spots.

Variable Presentations
The features of scarlet fever can differ depending on the age and race of the person. Children less than 5 years old can have atypical presentations. Children less than 3 years old can present with nasal congestion and a lower grade fever. Infants may present with symptoms of increased irritability and decreased appetite.

Children who have darker skin can have a different presentation, as the redness of the skin involved in the rash and the ring of paleness around the mouth can be less obvious. Suspicion based on accompanying symptoms and diagnostic studies are important in these cases.

Prevention

One method is long-term use of antibiotics to prevent future group A streptococcal infections. This method is only indicated for people who have had complications like recurrent attacks of acute rheumatic fever or rheumatic heart disease. Antibiotics are limited in their ability to prevent these infections since there are a variety of subtypes of group A streptococci that can cause the infection.

The vaccine approach has a greater likelihood of effectively preventing group A streptococcal infections because vaccine formulations can target multiple subtypes of the bacteria. A vaccine developed by George and Gladys Dick in 1924 was discontinued due to poor efficacy and the introduction of antibiotics. Difficulties in vaccine development include the considerable strain variety of group A streptococci present in the environment and the amount of time and number of people needed for appropriate trials for safety and efficacy of any potential vaccine. There have been several attempts to create a vaccine in the past few decades. These vaccines, which are still in the development phase, expose the person to proteins present on the surface of the group A streptococci to activate an immune response that will prepare the person to fight and prevent future infections. There used to be a diphtheria scarlet fever vaccine. It was, however, found not to be effective. This product was discontinued by the end of World War II.

Treatment

Antibiotics to combat the streptococcal infection are the mainstay of treatment for scarlet fever. Prompt administration of appropriate antibiotics decreases the length of illness. Peeling of the outer layer of skin, however, will happen despite treatment. One of the main goals of treatment is to prevent the child from developing one of the suppurative or nonsuppurative complications, especially acute rheumatic fever. As long as antibiotics are started within nine days, it is very unlikely for the child to develop acute rheumatic fever.

Antibiotic therapy has not been shown to prevent the development of post-streptococcal glomerulonephritis. Another important reason for prompt treatment with antibiotics is the ability to prevent transmission of the infection between children. An infected individual is most likely to pass on the infection to another person during the first 2 weeks. A child is no longer contagious (able to pass the infection to another child) after 24 hours of antibiotics.

The antibiotic of choice is penicillin V which is taken by mouth in pill form. Children who are not able to take pills can be given amoxicillin which comes in a liquid form and is equally effective. Duration of treatment is 10 days. Benzathine Penicillin G can be given as a one time intramuscular injection as another alternative if swallowing pills is not possible. If the person is allergic to the family of antibiotics which both penicillin and amoxicillin are a part of (beta-lactam antibiotics), a first generation cephalosporin is used.

Cephalosporin antibiotics, however, can still cause adverse reactions in people whose allergic reaction to penicillin is a Type 1 Hypersensitivity reaction. In those cases it is appropriate to choose clindamycin or erythromycin instead. Tonsillectomy, although once a reasonable treatment for recurrent streptococcal pharyngitis, is not indicate, as a person can still be infected with group A streptococcus without their tonsils.

33 Shigellosis (Shigella)

Shigella is a genus of bacteria that is Gram-negative, facultative anaerobic, non-spore-forming, nonmotile, rod-shaped and genetically closely related to E. coli. The genus is named after Kiyoshi Shiga, who first discovered it in 1897. The causative agent of human shigellosis, Shigella causes disease in primates, but not in other mammals. It is only naturally found in humans and gorillas. During infection, it typically causes dysentery.

Shigella is one of the leading bacterial causes of diarrhea worldwide, causing an estimated 80–165 million cases. The number of deaths it causes each year is estimated at between 74,000 and 600,000. It is one of the top four pathogens that cause moderate-to-severe diarrhea in African and South Asian children.

Sources

Symptoms

Signs and symptoms may range from mild abdominal discomfort to full-blown dysentery characterized by cramps, diarrhea, with slimy-consistent stools, fever, blood, pus, or mucus in stools or tenesmus. Onset time is 12 to 96 hours, and recovery takes 5 to 7 days. Infections are associated with mucosal ulceration, rectal bleeding, and drastic dehydration. Reactive arthritis and hemolytic uremic syndrome are possible sequelae that have been reported in the aftermath of shigellosis. The most common neurological symptom includes seizures.

Prevention

Simple precautions can be taken to prevent getting shigellosis: wash hands before handling food and thoroughly cook all food before eating. The primary prevention methods are improved sanitation and personal and food hygiene, but a low-cost and efficacious vaccine would complement these methods. Since shigellosis is spread very quickly among children, keeping infected children out of daycare for 24 hours after their symptoms have disappeared, will decrease the occurrence of shigellosis in daycares.

Treatment

Treatment consists mainly of replacing fluids and salts lost because of diarrhea. Replacement by mouth is satisfactory for most people, but some may need to receive fluids intravenously. Antidiarrheal drugs (such as diphenoxylate or loperamide) may prolong the infection and should not be used.

Antibiotics
Antibiotics should only be used in severe cases or for certain populations with mild symptoms (elderly, immunocompromised, food service industry workers, child care workers). For Shigella-associated diarrhea, antibiotics shorten the length of infection, but they are usually avoided in mild cases because many Shigella strains are becoming resistant to common antibiotics. Furthermore, effective medications are often in short supply in developing countries, which carry the majority of the disease burden from Shigella. Antidiarrheal agents may worsen the sickness, and should be avoided.

ILLNESS | Bacterial

In most cases, the disease resolves within four to eight days without antibiotics. Severe infections may last three to six weeks. Antibiotics, such as trimethoprim-sulfamethoxazole, ciprofloxacin may be given when the person is very young or very old, when the disease is severe, or when the risk of the infection spreading to other people is high. Additionally, ampicillin (but not amoxicillin) was effective in treating this disease previously, but now the first choice of drug is pivmecillinam.

34 Tuberculosis

Tuberculosis (TB) is an infectious disease usually caused by Mycobacterium tuberculosis (MTB) bacteria. Tuberculosis generally affects the lungs, but can also affect other parts of the body. Most infections do not have symptoms, in which case it is known as latent tuberculosis. About 10% of latent infections progress to active disease which, if left untreated, kills about half of those affected. The classic symptoms of active TB are a chronic cough with blood-containing mucus, fever, night sweats, and weight loss. It was historically called "consumption" due to the weight loss. Infection of other organs can cause a wide range of symptoms.

Tuberculosis is spread through the air when people who have active TB in their lungs cough, spit, speak, or sneeze. People with latent TB do not spread the disease. Active infection occurs more often in people with HIV/AIDS and in those who smoke. Diagnosis of active TB is based on chest X-rays, as well as microscopic examination and culture of body fluids. Diagnosis of latent TB relies on the tuberculin skin test (TST) or blood tests.

Sources

Tuberculosis is spread from one person to the next through the air when people who have active TB in their lungs cough, spit, speak, or sneeze. People with latent TB do not spread the disease. Active infection occurs more often in people with HIV/AIDS and in those who smoke.

Symptoms

Tuberculosis may infect any part of the body, but most commonly occurs in the lungs (known as pulmonary tuberculosis). Extrapulmonary TB occurs when tuberculosis develops outside of the lungs, although extrapulmonary TB may coexist with pulmonary TB. General signs and symptoms include fever, chills, night sweats, loss of appetite, weight loss, and fatigue. Significant nail clubbing may also occur.

Pulmonary
If a tuberculosis infection does become active, it most commonly involves the lungs (in about 90% of cases). Symptoms may include chest pain and a prolonged cough producing sputum. About 25% of people may not have any symptoms (i.e. they remain "asymptomatic"). Occasionally, people may cough up blood in small amounts, and in very rare cases, the infection may erode into the pulmonary artery or a Rasmussen's aneurysm, resulting in massive bleeding.

Tuberculosis may become a chronic illness and cause extensive scarring in the upper lobes of the lungs. The upper lung lobes are more frequently affected by tuberculosis than the lower ones. The reason for this difference is not clear. It may be due to either better air flow, or poor lymph drainage within the upper lungs.

Extrapulmonary
In 15–20% of active cases, the infection spreads outside the lungs, causing other kinds of TB. These are collectively denoted as "extrapulmonary tuberculosis". Extrapulmonary TB occurs more commonly in people with a weakened immune system and young children. In those with HIV, this occurs in more than 50% of cases.

Notable extrapulmonary infection sites include the pleura (in tuberculous pleurisy), the central nervous system (in tuberculous meningitis), the lymphatic system (in scrofula of the neck), the genitourinary system (in urogenital tuberculosis), and the bones and joints (in Pott disease of the spine), among others. A potentially more serious, widespread form of TB is called "disseminated tuberculosis", it is also known as miliary tuberculosis. Miliary TB currently makes up about 10% of extrapulmonary cases.

Prevention

Tuberculosis prevention and control efforts rely primarily on the vaccination of infants and the detection and appropriate treatment of active cases. The World Health Organization (WHO) has achieved some success with improved treatment regimens, and a small decrease in case numbers.

Treatment

Treatment of TB uses antibiotics to kill the bacteria. Effective TB treatment is difficult, due to the unusual structure and chemical composition of the mycobacterial cell wall, which hinders the entry of drugs and makes many antibiotics ineffective.

Active TB is best treated with combinations of several antibiotics to reduce the risk of the bacteria developing antibiotic resistance. The routine use of rifabutin instead of rifampicin in HIV-positive people with tuberculosis is of unclear benefit as of 2007

35 Meningitis (All Types)

Meningitis is an acute inflammation of the protective membranes covering the brain and spinal cord, known collectively as the meninges. The most common symptoms are fever, headache, and neck stiffness. Other symptoms include confusion or altered consciousness, vomiting, and an inability to tolerate light or loud noises. Young children often exhibit only nonspecific symptoms, such as irritability, drowsiness, or poor feeding. If a rash is present, it may indicate a particular cause of meningitis; for instance, meningitis caused by meningococcal bacteria may be accompanied by a characteristic rash.

The inflammation may be caused by infection with viruses, bacteria, or other microorganisms, and less commonly by certain drugs. Meningitis can be life-threatening because of the inflammation's proximity to the brain and spinal cord; therefore, the condition is classified as a medical emergency. A lumbar puncture, in which a needle is inserted into the spinal canal to collect a sample of cerebrospinal fluid (CSF), can diagnose or exclude meningitis.

Sources

Meningitis is typically caused by an infection with microorganisms. Most infections are due to viruses, with bacteria, fungi, and protozoa being the next most common causes. It may also result from various non-infectious causes. The term aseptic meningitis refers to cases of meningitis in which no bacterial infection can be demonstrated. This type of meningitis is usually caused by viruses but it may be due to bacterial infection that has already been partially treated, when bacteria disappear from the meninges, or pathogens infect a space adjacent to the meninges (e.g. sinusitis).

Endocarditis (an infection of the heart valves which spreads small clusters of bacteria through the bloodstream) may cause aseptic meningitis. Aseptic meningitis may also result from infection with spirochetes, a group of bacteria that includes Treponema pallidum (the cause of syphilis) and Borrelia burgdorferi (known for causing Lyme disease). Meningitis may be encountered in cerebral malaria (malaria infecting the brain) or amoebic meningitis, meningitis due to infection with amoebae such as Naegleria fowleri, contracted from freshwater sources.

Bacterial
In premature babies and newborns up to three months old, common causes are group B streptococci (subtypes III which normally inhabit the vagina and are mainly a cause during the first week of life) and bacteria that normally inhabit the digestive tract such as Escherichia coli (carrying the K1 antigen). Listeria monocytogenes (serotype IVb) is transmitted by the mother before birth and may cause meningitis in the newborn.
Older children are more commonly affected by Neisseria meningitidis (meningococcus) and Streptococcus pneumoniae (serotypes 6, 9, 14, 18 and 23) and those under five by Haemophilus influenzae type B (in countries that do not offer vaccination).

In adults, Neisseria meningitidis and Streptococcus pneumoniae together cause 80% of bacterial meningitis cases. Risk of infection with Listeria monocytogenes is increased in persons over 50 years old. The introduction of pneumococcal vaccine has lowered rates of pneumococcal meningitis in both children and adults.

Recent skull trauma potentially allows nasal cavity bacteria to enter the meningeal space. Similarly, devices in the brain and meninges, such as cerebral shunts, extraventricular drains or Ommaya reservoirs, carry an increased risk of meningitis. In these cases, the persons are more likely to be infected with Staphylococci, Pseudomonas, and other Gram-negative bacteria. These pathogens are also associated with meningitis in people with an impaired immune system. An infection in the head and neck area, such as otitis media or mastoiditis, can lead to meningitis in a small proportion of people. Recipients of cochlear implants for hearing loss are more at risk for pneumococcal meningitis.

Tuberculous meningitis, which is meningitis caused by Mycobacterium tuberculosis, is more common in people from countries in which tuberculosis is endemic, but is also encountered in persons with immune problems, such as AIDS.

Recurrent bacterial meningitis may be caused by persisting anatomical defects, either congenital or acquired, or by disorders of the immune system. Anatomical defects allow continuity between the external environment and the nervous system. The most common cause of recurrent meningitis is a skull fracture, particularly fractures that affect the base of the skull or extend towards the sinuses and petrous pyramids.

Approximately 59% of recurrent meningitis cases are due to such anatomical abnormalities, 36% are due to immune deficiencies (such as complement deficiency, which predisposes especially to recurrent meningococcal meningitis), and 5% are due to ongoing infections in areas adjacent to the meninges.

Viral
Viruses that cause meningitis include enteroviruses, herpes simplex virus (generally type 2, which produces most genital sores; less commonly type 1), varicella zoster virus (known for causing chickenpox and shingles), mumps virus, HIV, LCMV, Arboviruses (acquired from a mosquito or other insect), and the Influenza virus. Mollaret's meningitis is a chronic recurrent form of herpes meningitis; it is thought to be caused by herpes simplex virus type 2.

Fungal
There are a number of risk factors for fungal meningitis, including the use of immunosuppressants (such as after organ transplantation), HIV/AIDS, and the loss of immunity associated with aging. It is uncommon in those with a normal immune system but has occurred with medication contamination. Symptom onset is typically more gradual, with headaches and fever being present for at least a couple of weeks before diagnosis. The most common fungal meningitis is cryptococcal meningitis due to Cryptococcus neoformans. In Africa, cryptococcal meningitis is now the most common cause of meningitis in multiple studies, and it accounts for 20–25% of AIDS-related deaths in Africa. Other less common fungal pathogens which can cause meningitis include: Coccidioides immitis, Histoplasma capsulatum, Blastomyces dermatitidis, and Candida species.

Parasitic
A parasitic cause is often assumed when there is a predominance of eosinophils (a type of white blood cell) in the CSF. The most common parasites implicated are Angiostrongylus cantonensis, Gnathostoma spinigerum, Schistosoma, as well as the conditions cysticercosis, toxocariasis, baylisascariasis, paragonimiasis, and a number of rarer infections and noninfective conditions.

Non-Infectious
Meningitis may occur as the result of several non-infectious causes: spread of cancer to the meninges (malignant or neoplastic meningitis) and certain drugs (mainly non-steroidal anti-inflammatory drugs, antibiotics and intravenous immunoglobulins). It may also be caused by several inflammatory conditions, such as sarcoidosis (which is then called neurosarcoidosis), connective tissue disorders such as systemic lupus erythematosus, and certain forms of vasculitis (inflammatory conditions of the blood vessel wall), such as Behçet's disease. Epidermoid cysts and dermoid cysts may cause meningitis by releasing irritant matter into the subarachnoid space. Rarely, migraine may cause meningitis, but this diagnosis is usually only made when other causes have been eliminated.

Symptoms

In adults, the most common symptom of meningitis is a severe headache, occurring in almost 90% of cases of bacterial meningitis, followed by neck stiffness (the inability to flex the neck forward passively due to increased neck muscle tone and stiffness). The classic triad of diagnostic signs consists of neck stiffness, sudden high fever, and altered mental status; however, all three features are present in only 44–46% of bacterial meningitis cases. If none of the three signs are present, acute meningitis is extremely unlikely. Other signs commonly associated with meningitis include photophobia (intolerance to bright light) and phonophobia (intolerance to loud noises). Small children often do not exhibit the aforementioned symptoms, and may only be irritable and look unwell. The fontanelle (the soft spot on the top of a baby's head) can bulge in infants aged up to 6 months. Other features that distinguish meningitis from less severe illnesses in young children are leg pain, cold extremities, and an abnormal skin color.

Nuchal rigidity occurs in 70% of bacterial meningitis in adults. Other signs include the presence of positive Kernig's sign or Brudziński sign. Kernig's sign is assessed with the person lying supine, with the hip and knee flexed to 90 degrees. In a person with a positive Kernig's sign, pain limits passive extension of the knee. A positive Brudzinski's sign occurs when flexion of the neck causes involuntary flexion of the knee and hip. Although Kernig's sign and Brudzinski's sign are both commonly used to screen for meningitis, the sensitivity of these tests is limited. They do, however, have very good specificity for meningitis: the signs rarely occur in other diseases. Another test, known as the "jolt accentuation maneuver" helps determine whether meningitis is present in those reporting fever and headache. A person is asked to rapidly rotate the head horizontally; if this does not make the headache worse, meningitis is unlikely.

Other problems can produce symptoms similar to those above, but from non-meningitic causes. This is called meningism or pseudomeningitis.

Prevention

For some causes of meningitis, protection can be provided in the long term through vaccination, or in the short term with antibiotics. Some behavioral measures may also be effective. Bacterial and viral meningitis are contagious, but neither is as contagious as the common cold or flu. Both can be transmitted through droplets of respiratory secretions during close contact such as kissing, sneezing or coughing on someone, but cannot be spread by only breathing the air where a person with meningitis has been. Viral meningitis is typically caused by enteroviruses, and is most commonly spread through fecal contamination. The risk of infection can be decreased by changing the behavior that led to transmission.

Treatment

Antibiotics
Short-term antibiotic prophylaxis is another method of prevention, particularly of meningococcal meningitis. In cases of meningococcal meningitis, preventative treatment in close contacts with antibiotics (e.g. rifampicin, ciprofloxacin or ceftriaxone) can reduce their risk of contracting the condition, but does not protect against future infections. Resistance to rifampicin has been noted to increase after use, which has caused some to recommend considering other agents. While antibiotics are frequently used in an attempt to prevent meningitis in those with a basilar skull fracture there is not enough evidence to determine whether this is beneficial or harmful. This applies to those with or without a CSF leak.

Management
Meningitis is potentially life-threatening and has a high mortality rate if untreated; delay in treatment has been associated with a poorer outcome. Thus, treatment with wide-spectrum antibiotics should not be delayed while confirmatory tests are being conducted. If meningococcal disease is suspected in primary care, guidelines recommend that benzylpenicillin be administered before transfer to hospital. Intravenous fluids should be administered if hypotension (low blood pressure) or shock are present.

It is not clear whether intravenous fluid should be given routinely or whether this should be restricted. Given that meningitis can cause a number of early severe complications, regular medical review is recommended to identify these complications early and to admit the person to an intensive care unit if deemed necessary.

Mechanical ventilation may be needed if the level of consciousness is very low, or if there is evidence of respiratory failure. If there are signs of raised intracranial pressure, measures to monitor the pressure may be taken; this would allow the optimization of the cerebral perfusion pressure and various treatments to decrease the intracranial pressure with medication (e.g. mannitol).

Seizures are treated with anticonvulsants. Hydrocephalus (obstructed flow of CSF) may require insertion of a temporary or long-term drainage device, such as a cerebral shunt. The osmotic therapy, glycerol, has an unclear effect on mortality but may decrease hearing problems.

36 Tetanus (Lockjaw)

Tetanus, also known as lockjaw, is a bacterial infection characterized by muscle spasms. In the most common type, the spasms begin in the jaw and then progress to the rest of the body. Each spasm usually lasts a few minutes. Spasms occur frequently for three to four weeks. Some spasms may be severe enough to fracture bones. Other symptoms of tetanus may include fever, sweating, headache, trouble swallowing, high blood pressure, and a fast heart rate. Onset of symptoms is typically three to twenty-one days following infection. Recovery may take months. About ten percent of cases prove fatal.

Tetanus is caused by an infection with the bacterium Clostridium tetani, which is commonly found in soil, saliva, dust, and manure. The bacteria generally enter through a break in the skin such as a cut or puncture wound by a contaminated object. They produce toxins that interfere with normal muscle contractions. Diagnosis is based on the presenting signs and symptoms. The disease does not spread between people.

Tetanus can be prevented by immunization with the tetanus vaccine. In those who have a significant wound and have had fewer than three doses of the vaccine, both vaccination and tetanus immune globulin are recommended. The wound should be cleaned and any dead tissue should be removed. In those who are infected, tetanus immune globulin or, if unavailable, intravenous immunoglobulin (IVIG) is used. Muscle relaxants may be used to control spasms. Mechanical ventilation may be required if a person's breathing is affected.

Tetanus occurs in all parts of the world but is most frequent in hot and wet climates where the soil has a high organic content. In 2015 there were about 209,000 infections and about 59,000 deaths globally. This is down from 356,000 deaths in 1990.

Signs and Symptoms

Tetanus often begins with mild spasms in the jaw muscles—also known as lockjaw or trismus. The spasms can also affect the facial muscles resulting in an appearance called risus sardonicus. Chest, neck, back, abdominal muscles, and buttocks may be affected. Back muscle spasms often cause arching, called opisthotonos. Sometimes the spasms affect muscles that help with breathing, which can lead to breathing problems.

Prolonged muscular action causes sudden, powerful, and painful contractions of muscle groups, which is called "tetany". These episodes can cause fractures and muscle tears. Other symptoms include fever, headache, restlessness, irritability, feeding difficulties, breathing problems, burning sensation during urination, urinary retention and loss of stool control.

Even with treatment, about 10% of people who contract tetanus die. The mortality rate is higher in unvaccinated people and people over 60 years of age.

Incubation Period
The incubation period of tetanus may be up to several months, but is usually about ten days. In general, the farther the injury site is from the central nervous system, the longer the incubation period. The shorter the incubation period, the more severe the symptoms. In neonatal tetanus (trismus nascentium), symptoms usually appear from 4 to 14 days after birth, averaging about 7 days. On the basis of clinical findings, four different forms of tetanus have been described.

Generalized Tetanus
Generalized tetanus is the most common type of tetanus, representing about 80% of cases. The generalized form usually presents with a descending pattern. The first sign is trismus, or lockjaw, and the facial spasms called risus sardonicus, followed by stiffness of the neck, difficulty in swallowing, and rigidity of pectoral and calf muscles. Other symptoms include elevated temperature, sweating, elevated blood pressure, and episodic rapid heart rate. Spasms may occur frequently and last for several minutes with the body shaped into a characteristic form called opisthotonos. Spasms continue for up to four weeks, and complete recovery may take months.

Neonatal Tetanus
Neonatal tetanus (trismus nascentium) is a form of generalized tetanus that occurs in newborns, usually those born to mothers who themselves have not been vaccinated. If the mother has been vaccinated against tetanus, the infants acquire passive immunity and are thus protected. It usually occurs through infection of the unhealed umbilical stump, particularly when the stump is cut with a non-sterile instrument. As of 1998 neonatal tetanus was common in many developing countries and was responsible for about 14% (215,000) of all neonatal deaths. In 2010 the worldwide death toll was 58,000 newborns. As the result of a public health campaign, the death toll from neonatal tetanus was reduced by 90% between 1990 and 2010, and by 2013 the disease had been largely eliminated from all but 25 countries. Neonatal tetanus is rare in developed countries.

Local Tetanus
Local tetanus is an uncommon form of the disease, in which people have persistent contraction of muscles in the same anatomic area as the injury. The contractions may persist for many weeks before gradually subsiding. Local tetanus is generally milder; only about 1% of cases are fatal, but it may precede the onset of generalized tetanus.

Tetanus (Lockjaw) Sources

Cephalic Tetanus
Cephalic tetanus is the rarest form of the disease (0.9–3% of cases) and is limited to muscles and nerves in the head. It usually occurs after trauma to the head area, including skull fracture, laceration, eye injury, dental extraction, and otitis media, but it has been observed from injuries to other parts of the body. Paralysis of the facial nerve is most frequently implicated, which may cause lockjaw, facial palsy, or ptosis, but other cranial nerves can also be affected. Cephalic tetanus may progress to a more generalized form of the disease. Due to its rarity, clinicians may be unfamiliar with the clinical presentation and may not suspect tetanus as the illness. Treatment can be complicated as symptoms may be concurrent with the initial injury that caused the infection. Cephalic tetanus is more likely than other forms of tetanus to be fatal, with the progression to generalized tetanus carrying a 15–30% case fatality rate.

Cause

Tetanus is caused by the tetanus bacterium Clostridium tetani. Tetanus is an international health problem, as C. tetani endospores are ubiquitous. Endospores can be introduced into the body through a puncture wound (penetrating trauma). Due to C. tetani being an anaerobic bacterium, it and its endospores thrive in environments that lack oxygen, such as a puncture wound. With the changes in oxygen levels, the drum stick-shaped endospore can result in quick spread.

The disease occurs almost exclusively in persons inadequately immunized. It is more common in hot, damp climates with soil rich in organic matter. Manure-treated soils may contain spores, as they are widely distributed in the intestines and feces of many animals such as horses, sheep, cattle, dogs, cats, rats, guinea pigs, and chickens. In agricultural areas, a significant number of human adults may harbor the organism.

The spores can also be found on skin surfaces and in contaminated heroin. Heroin users, particularly those who inject the drug subcutaneously, appear to be at high risk of contracting tetanus. Rarely, tetanus can be contracted through surgical procedures, intramuscular injections, compound fractures, and dental infections. Animal bites can transmit tetanus.

Tetanus is often associated with rust, especially rusty nails. Although rust itself does not cause tetanus, objects that accumulate rust are often found outdoors or in places that harbor anaerobic bacteria. Additionally, the rough surface of rusty metal provides crevices for dirt containing C. tetani, while a nail affords a means to puncture skin and deliver endospores deep within the body at the site of the wound. An endospore is a non-metabolizing survival structure that begins to metabolize and cause infection once in an adequate environment. Hence, stepping on a nail (rusty or not) may result in a tetanus infection, as the low-oxygen (anaerobic) environment may exist under the skin, and the puncturing object can deliver endospores to a suitable environment for growth. It is a common misconception that rust itself is the cause and that a puncture from a rust-free nail is not a risk.

Prevention

Unlike many infectious diseases, recovery from naturally acquired tetanus does not usually result in immunity to tetanus. This is due to the extreme potency of the tetanospasmin toxin. Tetanospasmin will likely be lethal before it will provoke an immune response.

Tetanus can be prevented by vaccination with tetanus toxoid. The CDC recommends that adults receive a booster vaccine every ten years, and standard care practice in many places is to give the booster to any person with a puncture wound who is uncertain of when he or she was last vaccinated, or if he or she has had fewer than three lifetime doses of the vaccine. The booster may not prevent a potentially fatal case of tetanus from the current wound, however, as it can take up to two weeks for tetanus antibodies to form.

In children under the age of seven, the tetanus vaccine is often administered as a combined vaccine, DPT/DTaP vaccine, which also includes vaccines against diphtheria and pertussis. For adults and children over seven, the Td vaccine (tetanus and diphtheria) or Tdap (tetanus, diphtheria, and acellular pertussis) is commonly used.

Treatment

Mild Tetanus
Mild cases of tetanus can be treated with:
- Tetanus immunoglobulin (TIG), also called tetanus antibodies or tetanus antitoxin. It can be given as intravenous therapy or by intramuscular injection.
- Antibiotic therapy to reduce toxin production. Metronidazole IV is a preferred treatment.
- Benzodiazepines can be used to control muscle spasms. Options include diazepam and lorazepam, oral or IV.

Severe Tetanus
Severe cases will require admission to intensive care. In addition to the measures listed above for mild tetanus:
- Human tetanus immunoglobulin injected intrathecally (increases clinical improvement from 4% to 35%)
- Tracheotomy and mechanical ventilation for 3 to 4 weeks. Tracheotomy is recommended for securing the airway because the presence of an endotracheal tube is a stimulus for spasm
- Magnesium sulfate, as an intravenous (IV) infusion, to control spasm and autonomic dysfunction
- Diazepam as a continuous IV infusion
- The autonomic effects of tetanus can be difficult to manage (alternating hyper- and hypotension hyperpyrexia/hypothermia) and may require IV labetalol, magnesium, clonidine, or nifedipine

Drugs such as diazepam or other muscle relaxants can be given to control the muscle spasms. In extreme cases it may be necessary to paralyze the person with curare-like drugs and use a mechanical ventilator.

In order to survive a tetanus infection, the maintenance of an airway and proper nutrition are required. An intake of 3,500 to 4,000 calories and at least 150 g of protein per day is often given in liquid form through a tube directly into the stomach (percutaneous endoscopic gastrostomy), or through a drip into a vein (parenteral nutrition). This high-caloric diet maintenance is required because of the increased metabolic strain brought on by the increased muscle activity. Full recovery takes 4 to 6 weeks because the body must regenerate destroyed nerve axon terminals.

The antibiotic of choice is metronidazole. It can be given as intravenously, by mouth, or by rectum. Of likewise efficiency is penicillin, but some raise the concern of provoking spasms because it inhibits GABA receptor, which is already affected by tetanospasmin.

3 Viral

A virus is a small infectious agent that replicates only inside the living cells of an organism. Viruses can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea. There are millions of types of viruses. They can be found in almost every ecosystem on Earth and are the most numerous type of biological entity. While not inside an infected cell or in the process of infecting a cell, viruses exist in the form of independent particles, or virions, consisting of:
- **(i)** the genetic material, long molecules of DNA or RNA that encode the structure of the proteins by which the virus acts;
- **(ii)** a protein coat, the capsid, which surrounds and protects the genetic material; and in some cases
- **(iii)** an outside envelope of lipids. The shapes of these virus particles range from simple helical and icosahedral forms for some species to more complex structures for others. Most virus species have virions too small to be seen with an optical microscope, about one hundredth the size of most bacteria.

These are some tips on what to do when you have a virus.

- Let the fever do it's work but ensure it's under 39.5°C (103.1°F)
- Wear wet cotton socks overnight to stimulate increased circulation
- Rest and conserve energy
- Eat light, simple foods that are easily digested
- Eat a lot of Vitamin C, Zinc and protein foods
- Drink plenty of water

Thieves oil is a mix of essential oils which supposedly helps prevent (and kill) viruses. It was used in the 14th century to protect the user from the black plague.

Thieves Oil
- Clove Oil
- Cinnamon Bark Oil
- Eucalyptus Oil
- Rosemary Oil
- Lemon Oil

Subheadings

1. SARS	**2. Poliomyelitis**	**3. Polyomavirus**	**4. Avian Influenza**
5. Chikungunya	**6. Hepatitis**	**7. Conjunctivitis**	**8. Ebola**
9. Gastroenteritis	**10. HFMD**	**11. HIV/AIDS**	**12. Hemorrhagic Fever**
13. Encephalitis B	**14. Influenza**	**15. Lassa Fever**	**16. Dengue Fever**
17. Measles	**18. Meningitis**	**19. Mumps**	**20. MERS**
21. MERS-CoV	**22. Monkeypox**	**23. Nipah Virus**	**24. Rabies**
25. Rubella	**26. Rift Valley Fever**	**27. Pappataci Fever**	**28. Swine Flu**
29. Tick-Borne Encephalitis	**30. Venezuelan H Fever**	**31. Varicella**	**32. West Nile Fever**
33. Yellow Fever	**34. Zika Virus**	**35. Norovirus**	**35. Rotavirus**
37. CCHF			

1 SARS (Severe Acute Respiratory Syndrome)

Severe acute respiratory syndrome (SARS) is a viral respiratory disease of zoonotic origin caused by the SARS coronavirus (SARS-CoV). Between November 2002 and July 2003, an outbreak of SARS in southern China caused an eventual 8,098 cases, resulting in 774 deaths reported in 37 countries, with the majority of cases in China and Hong Kong (9.6% fatality rate) according to the World Health Organization (WHO). No cases of SARS have been reported worldwide since 2004. In late 2017, Chinese scientists traced the virus through the intermediary of civets to cave-dwelling horseshoe bats in Yunnan province.

Sources

Manifests itself in improperly treated water.

Symptoms

Initial symptoms are flu-like and may include fever, muscle pain, lethargy symptoms, cough, sore throat, and other nonspecific symptoms. The only symptom common to all patients appears to be a fever above 38 °C (100 °F). SARS may eventually lead to shortness of breath and pneumonia; either direct viral pneumonia or secondary bacterial pneumonia. The average incubation period for SARS is 4–6 days, although rarely it could be as short as 1 day or as long as 14 days.

Prevention

There is no vaccine for SARS, although immunologist Anthony Fauci mentioned that the CDC developed one and placed it in the US national stockpile. That vaccine, however, is a prototype and not field-ready as of March 2020. Clinical isolation and quarantine remain the most effective means to prevent the spread of SARS. Other preventive measures include:
- Hand-washing with soap and water, or use of alcohol-based hand sanitizer
- Disinfection of surfaces of fomites to remove viruses
- Avoiding contact with bodily fluids
- Washing the personal items of someone with SARS in hot, soapy water (eating utensils, dishes, bedding, etc.)
- Keeping children with symptoms home from school
- Simple hygiene measures
- Isolating oneself as much as possible to minimize the chances of transmission of the virus

Treatment

As SARS is a viral disease, antibiotics do not have direct effect but may be used against bacterial secondary infection. Treatment of SARS is mainly supportive with antipyretics, supplemental oxygen and mechanical ventilation as needed. While Ribavirin is commonly used to treat SARS, there seems to have little to no effect on SARS-CoV, and no impact on patient's outcomes. There is currently no proven antiviral therapy. Tested substances, include ribavirin, lopinavir, ritonavir, type I interferon, that have thus far shown no conclusive contribution to the disease's course. Administration of corticosteroids, is recommended by the British Thoracic Society/British Infection Society/Health Protection Agency in patients with severe disease and O2 saturation of <90%.

People with SARS-CoV must be isolated, preferably in negative-pressure rooms, with complete barrier nursing precautions taken for any necessary contact with these patients, to limit the chances of medical personnel becoming infected. In certain cases, natural ventilation by opening doors and windows is documented to help decreasing indoor concentration of virus particles.

Some of the more serious damage caused by SARS may be due to the body's own immune system reacting in what is known as cytokine storm.

ILLNESS

Viral

Poliomyelitis (Polio)

2 Poliomyelitis (Polio)

Polio, short for poliomyelitis, or infantile paralysis, is an infectious disease caused by the poliovirus. In about 0.5 percent of cases, there is muscle weakness resulting in an inability to move. This can occur over a few hours to a few days. The weakness most often involves the legs, but may less commonly involve the muscles of the head, neck and diaphragm. Many people fully recover. In those with muscle weakness, about 2 to 5 percent of children and 15 to 30 percent of adults die. Another 25 percent of people have minor symptoms such as fever and a sore throat, and up to 5 percent have headache, neck stiffness and pains in the arms and legs.

These people are usually back to normal within one or two weeks. In up to 70 percent of infections there are no symptoms. Years after recovery, post-polio syndrome may occur, with a slow development of muscle weakness similar to that which the person had during the initial infection. Poliovirus is usually spread from person to person through infected fecal matter entering the mouth. It may also be spread by food or water containing human feces and less commonly from infected saliva. Those who are infected may spread the disease for up to six weeks even if no symptoms are present. The disease may be diagnosed by finding the virus in the feces or detecting antibodies against it in the blood. The disease only occurs naturally in humans.

Sources

Enters water through the feces of infected individuals.

Poliomyelitis is caused by infection with a member of the genus Enterovirus known as poliovirus (PV). This group of RNA viruses colonize the gastrointestinal tract – specifically the oropharynx and the intestine. The incubation time (to the first signs and symptoms) ranges from three to 35 days, with a more common span of six to 20 days. PV infects and causes disease in humans alone. Its structure is very simple, composed of a single (+) sense RNA genome enclosed in a protein shell called a capsid.

In addition to protecting the virus' genetic material, the capsid proteins enable poliovirus to infect certain types of cells. Three serotypes of poliovirus have been identified – poliovirus type 1 (PV1), type 2 (PV2), and type 3 (PV3) – each with a slightly different capsid protein. All three are extremely virulent and produce the same disease symptoms. PV1 is the most commonly encountered form, and the one most closely associated with paralysis.

Individuals who are exposed to the virus, either through infection or by immunization with polio vaccine, develop immunity. In immune individuals, IgA antibodies against poliovirus are present in the tonsils and gastrointestinal tract, and are able to block virus replication; IgG and IgM antibodies against PV can prevent the spread of the virus to motor neurons of the central nervous system. Infection or vaccination with one serotype of poliovirus does not provide immunity against the other serotypes, and full immunity requires exposure to each serotype.

Symptoms

90-95% of patients show no symptoms, 4-8% have minor symptoms (comparatively) with delirium, headache, fever, and occasional seizures, and spastic paralysis, 1% have symptoms of non-paralytic aseptic meningitis. The rest have serious symptoms resulting in paralysis or death.

The term "poliomyelitis" is used to identify the disease caused by any of the three serotypes of poliovirus. Two basic patterns of polio infection are described: a minor illness which does not involve the central nervous system (CNS), sometimes called abortive poliomyelitis, and a major illness involving the CNS, which may be paralytic or nonparalytic. In most people with a normal immune system, a poliovirus infection is asymptomatic. Rarely, the infection produces minor symptoms; these may include upper respiratory tract infection (sore throat and fever), gastrointestinal disturbances (nausea, vomiting, abdominal pain, constipation or, rarely, diarrhea), and influenza-like illness.

The virus enters the central nervous system in about 1 percent of infections. Most patients with CNS involvement develop nonparalytic aseptic meningitis, with symptoms of headache, neck, back, abdominal and extremity pain, fever, vomiting, lethargy, and irritability. About one to five in 1000 cases progress to paralytic disease, in which the muscles become weak, floppy and poorly controlled, and, finally, completely paralyzed; this condition is known as acute flaccid paralysis.

Depending on the site of paralysis, paralytic poliomyelitis is classified as spinal, bulbar, or bulbospinal. Encephalitis, an infection of the brain tissue itself, can occur in rare cases, and is usually restricted to infants. It is characterized by confusion, changes in mental status, headaches, fever, and, less commonly, seizures and spastic paralysis.

Prevention

In 1950, William Hammon at the University of Pittsburgh purified the gamma globulin component of the blood plasma of polio survivors. Hammon proposed the gamma globulin, which contained antibodies to poliovirus, could be used to halt poliovirus infection, prevent disease, and reduce the severity of disease in other patients who had contracted polio. The results of a large clinical trial were promising; the gamma globulin was shown to be about 80 percent effective in preventing the development of paralytic poliomyelitis. It was also shown to reduce the severity of the disease in patients who developed polio. Due to the limited supply of blood plasma gamma globulin was later deemed impractical for widespread use and the medical community focused on the development of a polio vaccine.

Treatment

There is no cure for polio. The focus of modern treatment has been on providing relief of symptoms, speeding recovery and preventing complications. Supportive measures include antibiotics to prevent infections in weakened muscles, analgesics for pain, moderate exercise and a nutritious diet. Treatment of polio often requires long-term rehabilitation, including occupational therapy, physical therapy, braces, corrective shoes and, in some cases, orthopedic surgery.

Portable ventilators may be required to support breathing. Historically, a noninvasive, negative-pressure ventilator, more commonly called an iron lung, was used to artificially maintain respiration during an acute polio infection until a person could breathe independently (generally about one to two weeks). Today, many polio survivors with permanent respiratory paralysis use modern jacket-type negative-pressure ventilators worn over the chest and abdomen. Other historical treatments for polio include hydrotherapy, electrotherapy, massage and passive motion exercises, and surgical treatments, such as tendon lengthening and nerve grafting.

3 Polyomavirus

Polyomaviridae is a family of viruses whose natural hosts are primarily mammals and birds. As of the most recent (2018) taxonomy release by the International Committee on Taxonomy of Viruses, there were 89 recognized species in this family contained within four genera, as well as 9 species that could not be assigned to a genus. 13 species are known to infect humans, while others, such as Simian Virus 40, have been identified in humans to a lesser extent. Most of these viruses are very common and typically asymptomatic in most human populations studied. BK virus is associated with nephropathy in renal transplant and non-renal solid organ transplant patients, JC virus with progressive multifocal leukoencephalopathy, and Merkel cell virus with Merkel cell cancer.

Sources

Very widespread, can manifest itself in water, ~80% of the population has antibodies to Polyomavirus.

ILLNESS

Viral

Polyomavirus

Symptoms

BK virus produces a mild respiratory infection and can infect the kidneys of immunosuppressed transplant patients. JC virus infects the respiratory system, kidneys or can cause progressive multifocal leukoencephalopathy in the brain (which is fatal).

Prevention

Treatment

4 Avian Influenza (H5 N1)

Avian Influenza (Flu)

Avian influenza—known informally as avian flu or bird flu is a variety of influenza caused by viruses adapted to birds. The type with the greatest risk is highly pathogenic avian influenza (HPAI). Bird flu is similar to swine flu, dog flu, horse flu and human flu as an illness caused by strains of influenza viruses that have adapted to a specific host. Out of the three types of influenza viruses (A, B, and C), influenza A virus is a zoonotic infection with a natural reservoir almost entirely in birds. Avian influenza, for most purposes, refers to the influenza A virus.

Though influenza A is adapted to birds, it can also stably adapt and sustain person-to person transmission. Recent influenza research into the genes of the Spanish flu virus shows it to have genes adapted from both human and avian strains. Pigs can also be infected with human, avian, and swine influenza viruses, allowing for mixtures of genes (reassortment) to create a new virus, which can cause an antigenic shift to a new influenza A virus subtype which most people have little to no immune protection against.

ILLNESS

Viral

Avian Influenza (Flu)

Sources

Sources

Mostly, the bird flu virus is only dangerous for other birds however it can offer health risks to the people. In 1997, the first case of a man who was infected by the bird flu came into limelight in Hong Kong. The bird flu is since then knowingly spreading in the birds of Asia, Africa and Europe.

Such infection in human beings is not very common but unfortunately the bird flu virus in birds can mutate to infect the humankind that can easily lead into a global illness or a pandemic. When bird flu outbreak, sickness prevails in people who are in direct contact of the birds. The bird flu can possibly spread on eating the improperly cooked meat of an infected animal or by coming into contact of another infected human being. No vaccine is found yet. The flu can either make people exceptionally sick or kill them. Until now the bird flu has resulted into the death of billions of domestic and wild birds and a fraction of human beings.

Symptoms

Headache, Fever, Cough, Nausea, Shortness of Breath and Muscle aches.

ILLNESS

Avian Influenza (Flu)

Prevention

Prevention

People who do not regularly come into contact with birds are not at high risk for contracting avian influenza. Those at high risk include poultry farm workers, animal control workers, wildlife biologists, and ornithologists who handle live birds. Organizations with high-risk workers should have an avian influenza response plan in place before any cases have been discovered. Biosecurity of poultry flocks is also important for prevention. Flocks should be isolated from outside birds, especially wild birds, and their waste; vehicles used around the flock should be regularly disinfected and not shared between farms; and birds from slaughter channels should not be returned to the farm.

With proper infection control and use of personal protective equipment (PPE), the chance for infection is low. Protecting the eyes, nose, mouth, and hands is important for prevention because these are the most common ways for the virus to enter the body. Appropriate personal protective equipment includes aprons or coveralls, gloves, boots or boot covers, and a head cover or hair cover. Disposable PPE is recommended. An N-95 respirator and unvented/indirectly vented safety goggles are also part of appropriate PPE. A powered air purifying respirator (PAPR) with hood or helmet and face shield is also an option.

Treatment

Many influenza viruses have become resistant to the effects of a category of antiviral drugs that includes amantadine and rimantadine (Flumadine). Health officials recommend the use of oseltamivir (Tamiflu) or, if oseltamivir can't be used, zanamivir (Relenza). These drugs must be taken within two days after the appearance of symptoms.

5 Chikungunya

ILLNESS

Viral

Chikungunya

Chikungunya is an infection caused by the chikungunya virus (CHIKV). Symptoms include fever and joint pain. These typically occur two to twelve days after exposure. Other symptoms may include headache, muscle pain, joint swelling, and a rash. Symptoms usually improve within a week; however, occasionally the joint pain may last for months or years. The risk of death is around 1 in 1,000. The very young, old, and those with other health problems are at risk of more severe disease.

The virus is spread between people by two types of mosquitos: Aedes albopictus and Aedes aegypti. They mainly bite during the day. The virus may circulate within a number of animals including birds and rodents. Diagnosis is by either testing the blood for the virus's RNA or antibodies to the virus. The symptoms can be mistaken for those of dengue fever and Zika fever. After a single infection it is believed most people become immune.

Sources

Symptoms

ILLNESS Viral Chikungunya Symptoms

The incubation period ranges from one to twelve days, and is most typically three to seven. The disease may be asymptomatic, but generally is not, as 72% to 97% of those infected will develop symptoms. Characteristic symptoms include sudden onset with high fever, joint pain, and rash. Other symptoms may occur, including headache, fatigue, digestive complaints, and conjunctivitis.

Information gained during recent epidemics suggests that chikungunya fever may result in a chronic phase as well as the phase of acute illness. Within the acute phase, two stages have been identified: a viral stage during the first five to seven days, during which viremia occurs, followed by a convalescent stage lasting approximately ten days, during which symptoms improve and the virus cannot be detected in the blood. Typically, the disease begins with a sudden high fever that lasts from a few days to a week, and sometimes up to ten days. The fever is usually above 39 °C (102 °F) and sometimes reaching 40 °C (104 °F) and may be biphasic—lasting several days, breaking, and then returning. Fever occurs with the onset of viremia, and the level of virus in the blood correlates with the intensity of symptoms in the acute phase. When IgM, an antibody that is a response to the initial exposure to an antigen, appears in the blood, viremia begins to diminish. However, headache, insomnia and an extreme degree of exhaustion remain, usually about five to seven days.

Prevention

Chikungunya Prevention

Because no approved vaccine exists, the most effective means of prevention are protection against contact with the disease-carrying mosquitoes and controlling mosquito populations by limiting their habitat. Mosquito control focuses on eliminating the standing water where mosquitos lay eggs and develop as larva; if elimination of the standing water is not possible, insecticides or biological control agents can be added. Methods of protection against contact with mosquitos include using insect repellents with substances such as DEET, icaridin, PMD (p-menthane-3,8-diol, a substance derived from the lemon eucalyptus tree), or ethyl butylacetylaminopropionate (IR3535). However, increasing insecticide resistance presents a challenge to chemical control methods.

Wearing bite-proof long sleeves and trousers also offers protection, and garments can be treated with pyrethroids, a class of insecticides that often has repellent properties. Vaporized pyrethroids (for example in mosquito coils) are also insect repellents. As infected mosquitoes often feed and rest inside homes, securing screens on windows and doors will help to keep mosquitoes out of the house. In the case of the day-active A. aegypti and A. albopictus, however, this will have only a limited effect, since many contacts between the mosquitoes and humans occur outdoors.

Treatment

ILLNESS Viral Chikungunya Treatment

Currently, no specific treatment for chikungunya is available. Supportive care is recommended, and symptomatic treatment of fever and joint swelling includes the use of nonsteroidal anti-inflammatory drugs such as naproxen, non-aspirin analgesics such as paracetamol (acetaminophen) and fluids. Aspirin is not recommended due to the increased risk of bleeding. Despite anti-inflammatory effects, corticosteroids are not recommended during the acute phase of disease, as they may cause immunosuppression and worsen infection.

Passive immunotherapy has potential benefit in treatment of chikungunya. Studies in animals using passive immunotherapy have been effective, and clinical studies using passive immunotherapy in those particularly vulnerable to severe infection are currently in progress. Passive immunotherapy involves administration of anti-CHIKV hyperimmune human intravenous antibodies (immunoglobulins) to those exposed to a high risk of chikungunya infection. No antiviral treatment for Chikungunya virus is currently available, though testing has shown several medications to be effective in vitro.

Chronic Arthritis
In those who have more than two weeks of arthritis, ribavirin may be useful. The effect of chloroquine is not clear. It does not appear to help acute disease, but tentative evidence indicates it might help those with chronic arthritis. Steroids do not appear to be an effective treatment. NSAIDs and simple analgesics can be used to provide partial symptom relief in most cases. Methotrexate, a drug used in the treatment of rheumatoid arthritis, has been shown to have benefit in treating inflammatory polyarthritis resulting from chikungunya, though the drug mechanism for improving viral arthritis is unclear.

6 Hepatitis

Hepatitis A

ILLNESS Hepatitis Hepatitis A

Hepatitis A is an infectious disease of the liver caused by Hepatovirus A (HAV). Many cases have few or no symptoms, especially in the young. The time between infection and symptoms, in those who develop them, is between two and six weeks. When symptoms occur, they typically last eight weeks and may include nausea, vomiting, diarrhea, jaundice, fever, and abdominal pain. Around 10–15% of people experience a recurrence of symptoms during the six months after the initial infection. Acute liver failure may rarely occur, with this being more common in the elderly.

It is usually spread by eating food or drinking water contaminated with infected feces. Shellfish which have not been sufficiently cooked are a relatively common source. It may also be spread through close contact with an infectious person. While children often do not have symptoms when infected, they are still able to infect others. After a single infection, a person is immune for the rest of his or her life. Diagnosis requires blood testing, as the symptoms are similar to those of a number of other diseases. It is one of five known hepatitis viruses: A, B, C, D, and E.

Sources

ILLNESS Viral Hepatitis Hepatitis A

Hepatitis A is a contagious disease. It travels in feces, and can spread from person to person, or can be contracted from food or water. In cases of contaminated food, it is usually the person preparing the food who contaminates it. The food handler will probably not know they have the virus, since the virus is most likely to be passed on in the first two weeks of illness, before a person begins to show symptoms.

Symptoms

Symptoms of hepatitis A usually appear around 28 days after infection, but can start as early as two weeks after catching the virus. Only 30 percent of children with the virus actually develop symptoms. Early symptoms of this hepatitis virus include: Muscle aches, Headache, Loss of appetite, Abdominal discomfort, Fever, Weakness and fatigue. After a few days of experiencing these symptoms, 70 percent of patients develop jaundice, a yellowing of the skin, eyes, and mucous membranes. Jaundice also causes dark urine and light, clay-colored feces.

Prevention

Hepatitis Hepatitis A

Hepatitis A is completely avoidable, since a hepatitis A vaccine exists to prevent it. However, since the vaccine only became recommended for all children in 2006, many people are not vaccinated. Hepatitis transmission is still possible, and prevention techniques are still important. Food handlers should always wash hands after using the bathroom or changing a diaper and before preparing food.

Treatment

Once the symptoms for hepatitis A appear, there is no direct treatment for the virus. Patients should rest according to how tired they feel, and should receive enough nutrition either by eating or through fluids, since the disease can cause a lack of appetite.

Hepatitis B

Hepatitis B (HB) is an infectious disease caused by the hepatitis B virus (HBV) that affects the liver. It can cause both acute and chronic infections. Many people have no symptoms during the initial infection. Some develop a rapid onset of sickness with vomiting, yellowish skin, tiredness, dark urine and abdominal pain. Often these symptoms last a few weeks and rarely does the initial infection result in death. It may take 30 to 180 days for symptoms to begin. In those who get infected around the time of birth 90% develop chronic hepatitis B while less than 10% of those infected after the age of five do.

Most of those with chronic disease have no symptoms; however, cirrhosis and liver cancer may eventually develop. Cirrhosis or liver cancer occur in about 25% of those with chronic disease. The virus is transmitted by exposure to infectious blood or body fluids. Infection around the time of birth or from contact with other people's blood during childhood is the most frequent method by which hepatitis B is acquired in areas where the disease is common. In areas where the disease is rare, intravenous drug use and sexual intercourse are the most frequent routes of infection.

Other risk factors include working in healthcare, blood transfusions, dialysis, living with an infected person, travel in countries where the infection rate is high, and living in an institution. Tattooing and acupuncture led to a significant number of cases in the 1980s; however, this has become less common with improved sterilization. The hepatitis B viruses cannot be spread by holding hands, sharing eating utensils, kissing, hugging, coughing, sneezing, or breastfeeding. The infection can be diagnosed 30 to 60 days after exposure. The diagnosis is usually confirmed by testing the blood for parts of the virus and for antibodies against the virus. It is one of five main hepatitis viruses: A, B, C, D, and E.

Sources

Symptoms

Acute infection with hepatitis B virus is associated with acute viral hepatitis, an illness that begins with general ill-health, loss of appetite, nausea, vomiting, body aches, mild fever, and dark urine, and then progresses to development of jaundice. The illness lasts for a few weeks and then gradually improves in most affected people. A few people may have a more severe form of liver disease known as fulminant hepatic failure and may die as a result. The infection may be entirely asymptomatic and may go unrecognized.

Chronic infection with hepatitis B virus either may be asymptomatic or may be associated with a chronic inflammation of the liver (chronic hepatitis), leading to cirrhosis over a period of several years. This type of infection dramatically increases the incidence of hepatocellular carcinoma (HCC; liver cancer). Across Europe, hepatitis B and C cause approximately 50% of hepatocellular carcinomas. Chronic carriers are encouraged to avoid consuming alcohol as it increases their risk for cirrhosis and liver cancer. Hepatitis B virus has been linked to the development of membranous glomerulonephritis (MGN).

Symptoms outside of the liver are present in 1–10% of HBV-infected people and include serum-sickness–like syndrome, acute necrotizing vasculitis (polyarteritis nodosa), membranous glomerulonephritis, and papular acrodermatitis of childhood (Gianotti–Crosti syndrome). The serum-sickness–like syndrome occurs in the setting of acute hepatitis B, often preceding the onset of jaundice. The clinical features are fever, skin rash, and polyarteritis. The symptoms often subside shortly after the onset of jaundice but can persist throughout the duration of acute hepatitis B. About 30–50% of people with acute necrotizing vasculitis (polyarteritis nodosa) are HBV carriers.

HBV-associated nephropathy has been described in adults but is more common in children. Membranous glomerulonephritis is the most common form. Other immune-mediated hematological disorders, such as essential mixed cryoglobulinemia and aplastic anemia have been described as part of the extrahepatic manifestations of HBV infection, but their association is not as well-defined; therefore, they probably should not be considered etiologically linked to HBV.

Prevention

Vaccines for the prevention of hepatitis B have been routinely recommended for babies since 1991 in the United States. The first dose is generally recommended within a day of birth. The hepatitis B vaccine was the first vaccine capable of preventing cancer, specifically liver cancer.

Most vaccines are given in three doses over a course of months. A protective response to the vaccine is defined as an anti-HBs antibody concentration of at least 10 mIU/ml in the recipient's serum. The vaccine is more effective in children and 95 percent of those vaccinated have protective levels of antibody. This drops to around 90% at 40 years of age and to around 75 percent in those over 60 years. The protection afforded by vaccination is long lasting even after antibody levels fall below 10 mIU/ml. For newborns of HBsAg-positive mothers: hepatitis B vaccine alone, hepatitis B immunoglobulin alone, or the combination of vaccine plus hepatitis B immunoglobulin, all prevent hepatitis B occurrence. Furthermore, the combination of vaccine plus hepatitis B immunoglobulin is superior to vaccine alone. This combination prevents HBV transmission around the time of birth in 86% to 99% of cases.

Treatment

Acute hepatitis B infection does not usually require treatment and most adults clear the infection spontaneously. Early antiviral treatment may be required in fewer than 1% of people, whose infection takes a very aggressive course (fulminant hepatitis) or who are immunocompromised. On the other hand, treatment of chronic infection may be necessary to reduce the risk of cirrhosis and liver cancer. Chronically infected individuals with persistently elevated serum alanine aminotransferase, a marker of liver damage, and HBV DNA levels are candidates for therapy. Treatment lasts from six months to a year, depending on medication and genotype. Treatment duration when medication is taken by mouth, however, is more variable and usually longer than one year.

Although none of the available medications can clear the infection, they can stop the virus from replicating, thus minimizing liver damage. As of 2018, there are eight medications licensed for the treatment of hepatitis B infection in the United States. These include antiviral medications lamivudine, adefovir, tenofovir disoproxil, tenofovir alafenamide, telbivudine, and entecavir, and the two immune system modulators interferon alpha-2a and PEGylated interferon alpha-2a. In 2015 the World Health Organization recommended tenofovir or entecavir as first-line agents. Those with current cirrhosis are in most need of treatment.

Hepatitis C

Hepatitis C is an infectious disease caused by the hepatitis C virus (HCV) that primarily affects the liver. During the initial infection people often have mild or no symptoms. Occasionally a fever, dark urine, abdominal pain, and yellow tinged skin occurs. The virus persists in the liver in about 75% to 85% of those initially infected. Early on chronic infection typically has no symptoms. Over many years however, it often leads to liver disease and occasionally cirrhosis. In some cases, those with cirrhosis will develop serious complications such as liver failure, liver cancer, or dilated blood vessels in the esophagus and stomach.

HCV is spread primarily by blood-to-blood contact associated with intravenous drug use, poorly sterilized medical equipment, needlestick injuries in healthcare, and transfusions. Using blood screening, the risk from a transfusion is less than one per two million. It may also be spread from an infected mother to her baby during birth. It is not spread by superficial contact. It is one of five known hepatitis viruses: A, B, C, D, and E. Diagnosis is by blood testing to look for either antibodies to the virus or its RNA. Testing is recommended in all people who are at risk.

Sources

The primary route of transmission in the developed world is intravenous drug use (IDU), while in the developing world the main methods are blood transfusions and unsafe medical procedures. The cause of transmission remains unknown in 20% of cases; however, many of these are believed to be accounted for by IDU.

Symptoms

Acute Infection
Acute symptoms develop in some 20–30% of those infected. When this occurs, it is generally 4–12 weeks following infection (but it may take from 2 weeks to 6 months for acute symptoms to appear).

Symptoms are generally mild and vague, and may include fatigue, nausea and vomiting, fever, muscle or joint pains, abdominal pain, decreased appetite and weight loss, jaundice (occurs in ~25% of those infected), dark urine, and clay-coloured stools. There is no evidence that acute hepatitis C can alone cause acute liver failure, though liver injury and elevated liver enzymes may occur. Symptoms and laboratory findings suggestive of liver disease should prompt further tests and can thus help establish a diagnosis of hepatitis C infection early on.

Following the acute phase, the infection may resolve spontaneously in 10–50% of affected people; this occurs more frequently in young people, and females.

Chronic Infection
About 80% of those exposed to the virus develop a chronic infection. This is defined as the presence of detectable viral replication for at least six months. Most experience minimal or no symptoms during the initial few decades of the infection. Chronic hepatitis C can be associated with fatigue and mild cognitive problems. Chronic infection after several years may cause cirrhosis or liver cancer. The liver enzymes are normal in 7–53%. Late relapses after apparent cure have been reported, but these can be difficult to distinguish from reinfection.

Fatty changes to the liver occur in about half of those infected and are usually present before cirrhosis develops. Usually (80% of the time) this change affects less than a third of the liver. Worldwide hepatitis C is the cause of 27% of cirrhosis cases and 25% of hepatocellular carcinoma. About 10–30% of those infected develop cirrhosis over 30 years. Cirrhosis is more common in those also infected with hepatitis B, schistosoma, or HIV, in alcoholics and in those of male sex. In those with hepatitis C, excess alcohol increases the risk of developing cirrhosis 100-fold. Those who develop cirrhosis have a 20-fold greater risk of hepatocellular carcinoma. This transformation occurs at a rate of 1–3% per year. Being infected with hepatitis B in addition to hepatitis C increases this risk further.

Liver cirrhosis may lead to portal hypertension, ascites (accumulation of fluid in the abdomen), easy bruising or bleeding, varices (enlarged veins, especially in the stomach and esophagus), jaundice, and a syndrome of cognitive impairment known as hepatic encephalopathy. Ascites occurs at some stage in more than half of those who have a chronic infection.

Prevention

As of 2016, no approved vaccine protects against contracting hepatitis C. A combination of harm reduction strategies, such as the provision of new needles and syringes and treatment of substance use, decreases the risk of hepatitis C in intravenous drug users by about 75%. The screening of blood donors is important at a national level, as is adhering to universal precautions within healthcare facilities. In countries where there is an insufficient supply of sterile syringes, medications should be given orally rather than via injection (when possible).

Treatment

Those with chronic hepatitis C are advised to avoid alcohol and medications toxic to the liver. They should also be vaccinated against hepatitis A and hepatitis B due to the increased risk if also infected. Use of acetaminophen is generally considered safe at reduced doses. Nonsteroidal anti-inflammatory drugs (NSAIDs) are not recommended in those with advanced liver disease due to an increased risk of bleeding. Ultrasound surveillance for hepatocellular carcinoma is recommended in those with accompanying cirrhosis. Coffee consumption has been associated with a slower rate of liver scarring in those infected with HCV.

Medications
Approximately 90% of chronic cases clear with treatment. Treatment with antiviral medication is recommended in all people with proven chronic hepatitis C who are not at high risk of dying from other causes. People with the highest complication risk should be treated first, with the risk of complications based on the degree of liver scarring. The initial recommended treatment depends on the type of hepatitis C virus, if the person has received previous hepatitis C treatment, and whether or not a person has cirrhosis. Direct-acting antivirals (DAAs) may reduce the number of the infected people.

Hepatitis D

Hepatitis D (hepatitis delta) is a disease caused by the hepatitis D virus (HDV), a small spherical enveloped virusoid. This is one of five known hepatitis viruses: A, B, C, D, and E. HDV is considered to be a subviral satellite because it can propagate only in the presence of the hepatitis B virus (HBV). Transmission of HDV can occur either via simultaneous infection with HBV (coinfection) or superimposed on chronic hepatitis B or hepatitis B carrier state (superinfection).

Both superinfection and coinfection with HDV result in more severe complications compared to infection with HBV alone. These complications include a greater likelihood of experiencing liver failure in acute infections and a rapid progression to liver cirrhosis, with an increased risk of developing liver cancer in chronic infections. In combination with hepatitis B virus, hepatitis D has the highest fatality rate of all the hepatitis infections, at 20%.

Sources

The routes of transmission of hepatitis D are similar to those for hepatitis B. Infection is largely restricted to persons at high risk of hepatitis B infection, particularly injecting drug users and persons receiving clotting factor concentrates. Worldwide more than 15 million people are co-infected. HDV is rare in most developed countries, and is mostly associated with intravenous drug use. However, HDV is much more common in the immediate Mediterranean region, sub-Saharan Africa, the Middle East, and the northern part of South America. In all, about 20 million people may be infected with HDV.

Symptoms

Feeling tired, nausea and vomiting.

Prevention

The vaccine for hepatitis B protects against hepatitis D virus because of the latter's dependence on the presence of hepatitis B virus for it to replicate.
In absence of a specific vaccine against delta virus, the vaccine against HBV must be given soon after birth in risk groups.

Treatment

Hepatitis D is generally considered the dominant virus over hepatitis B except in rare instances. Current established treatments for chronic hepatitis D include conventional or pegylated interferon alpha therapy. Latest evidence suggests that pegylated interferon alpha is effective in reducing the viral load and the effect of the disease during the time the drug is given, but the benefit generally stops if the drug is discontinued. The efficiency of this treatment does not usually exceed ~20%, and late relapse after therapy has been reported.

Hepatitis E

ILLNESS Viral Hepatitis Hepatitis E

Hepatitis E is inflammation of the liver caused by infection with the hepatitis E virus (HEV). Hepatitis E has mainly a fecal-oral transmission route that is similar to hepatitis A, but the viruses are unrelated. In retrospect, the earliest known epidemic of hepatitis E occurred in 1955 in New Delhi, but the virus was not isolated until 1983, by Russian scientists investigating an outbreak in Afghanistan. One of five known human hepatitis viruses: hepatitis A, B, C, D, and E, HEV is a positive-sense, single-stranded, nonenveloped, RNA icosahedral virus.

Like hepatitis A, hepatitis E usually follows an acute and self-limiting course of illness (the condition is temporary and the individual recovers) with low death rates in resource-rich areas; however, it can be more severe in pregnant women and people with a weakened immune system, with substantially higher death rates. In pregnant women, especially in the third trimester, the disease is more often severe and is associated with a clinical syndrome called fulminant liver failure, with death rates around 20%. Whereas pregnant women may have a rapid and severe course, organ transplant recipients who receive medications to weaken the immune system and prevent organ rejection can develop a slower and more persistent form called chronic hepatitis E, which is so diagnosed after 3 months of continuous viremia. HEV can be clustered genetically into 8 genotypes, and genotypes 3 and 4 tend to be the ones that cause chronic hepatitis in the immunosuppressed.

Sources

Hepatitis E is transmitted via the faecal-oral route and can be spread by eating or drinking contaminated food or water. The highest rates of hepatitis E infection occur in regions where there is poor sanitation and sewage management that promotes the transmission of the virus.

Symptoms

The time between infection with hepatitis E and development of symptoms ranges from 15 to 60 days, with an average of 40 days. Common symptoms of acute hepatitis E are similar to those of other types of viral hepatitis and include: Fever, Weakness, Fatigue, Loss of Appetite, Nausea, Vomiting, Jaundice (yellowish eyes and skin, dark urine and pale-coloured faeces).

Prevention

As hepatitis E is spread through the faecal-oral route, prevention of hepatitis E relies primarily on the provision of clean drinking water and good personal hygiene. Travellers to developing countries are advised to take precautions against drinking contaminated water (including beverages with ice), eating uncooked shellfish and uncooked fruits and vegetables that are not peeled or prepared by the traveller.

Treatment

There is no treatment for hepatitis E. Hepatitis E is caused by a virus, therefore, antibiotics are of no value in the treatment of the infection. Treatment of hepatitis E infection is supportive and involves bed rest and fluid replacement.

7 Conjunctivitis (Pink Eye)

ILLNESS Viral Conjunctivitis (Pink Eye)

Conjunctivitis, also known as pink eye, is inflammation of the outermost layer of the white part of the eye and the inner surface of the eyelid. It makes the eye appear pink or reddish. Pain, burning, scratchiness, or itchiness may occur. The affected eye may have increased tears or be "stuck shut" in the morning. Swelling of the white part of the eye may also occur. Itching is more common in cases due to allergies. Conjunctivitis can affect one or both eyes. The most common infectious causes are viral followed by bacterial. The viral infection may occur along with other symptoms of a common cold. Both viral and bacterial cases are easily spread between people. Allergies to pollen or animal hair are also a common cause. Diagnosis is often based on signs and symptoms. Occasionally, a sample of the discharge is sent for culture.

Prevention is partly by handwashing. Treatment depends on the underlying cause. In the majority of viral cases, there is no specific treatment. Most cases due to a bacterial infection also resolve without treatment; however, antibiotics can shorten the illness. People who wear contact lenses and those whose infection is caused by gonorrhea or chlamydia should be treated. Allergic cases can be treated with antihistamines or mast cell inhibitor drops.

Sources

Infective conjunctivitis is most commonly caused by a virus. Bacterial infections, allergies, other irritants, and dryness are also common causes. Both bacterial and viral infections are contagious, passing from person to person or spread through contaminated objects or water. Contact with contaminated fingers is a common cause of conjunctivitis. Bacteria may also reach the conjunctiva from the edges of the eyelids and the surrounding skin, from the nasopharynx, from infected eye drops or contact lenses, from the genitals or the bloodstream. Infection by human adenovirus accounts for 65% to 90% of cases of viral conjunctivitis.

Symptoms

Red eye, swelling of the conjunctiva, and watering of the eyes are symptoms common to all forms of conjunctivitis. However, the pupils should be normally reactive, and the visual acuity normal. Conjunctivitis is identified by irritation and redness of the conjunctiva. Except in obvious pyogenic or toxic/chemical conjunctivitis, a slit lamp (biomicroscope) is needed to confirm the diagnosis. Examination of the eyelid conjunctiva is usually more diagnostic than examination of the scleral conjunctiva.

Prevention

The most effective prevention is good hygiene, especially avoiding rubbing the eyes with infected hands. Vaccination against adenovirus, Haemophilus influenzae, pneumococcus, and Neisseria meningitidis is also effective. Povidone-iodine eye solution has been found to prevent neonatal conjunctivitis. It is becoming more commonly used globally because of its low cost.

Treatment

Conjunctivitis resolves in 65% of cases without treatment, within 2–5 days. The prescription of antibiotics is not necessary in most cases.

Viral
Viral conjunctivitis usually resolves on its own and does not require any specific treatment. Antihistamines (e.g., diphenhydramine) or mast cell stabilizers (e.g., cromolyn) may be used to help with the symptoms. Povidone-iodine has been suggested as a treatment, but as of 2008, evidence to support it was poor.

Allergic
For allergic conjunctivitis, cool water poured over the face with the head inclined downward constricts capillaries, and artificial tears sometimes relieve discomfort in mild cases. In more severe cases, nonsteroidal anti-inflammatory medications and antihistamines may be prescribed. Persistent allergic conjunctivitis may also require topical steroid drops.

Viral

Conjunctivitis (Pink

Treatment

Bacterial
Bacterial conjunctivitis usually resolves without treatment. Topical antibiotics may be needed only if no improvement is observed after 3 days. No serious effects were noted either with or without treatment. Because antibiotics do speed healing in bacterial conjunctivitis, their use may be considered. Antibiotics are also recommended for those who wear contact lenses, are immunocompromised, have disease which is thought to be due to chlamydia or gonorrhea, have a fair bit of pain, or have copious discharge. Gonorrheal or chlamydial infections require both oral and topical antibiotics. The choice of antibiotic varies based on the strain or suspected strain of bacteria causing the infection. Fluoroquinolones, sodium sulfacetamide, or trimethoprim/polymyxin may be used, typically for 7–10 days. Cases of meningococcal conjunctivitis can also be treated with systemic penicillin, as long as the strain is sensitive to penicillin.

When investigated as a treatment, povidone-iodine ophthalmic solution has also been observed to have some effectiveness against bacterial and chlamydial conjunctivitis, with a possible role suggested in locations where topical antibiotics are unavailable or costly.

ILLNESS

8 Ebola

Ebola

Ebola virus disease (EVD), also known as Ebola hemorrhagic fever (EHF) or simply Ebola, is a viral hemorrhagic fever of humans and other primates caused by ebolaviruses. Signs and symptoms typically start between two days and three weeks after contracting the virus with a fever, sore throat, muscular pain, and headaches. Vomiting, diarrhea and rash usually follow, along with decreased function of the liver and kidneys. At this time, some people begin to bleed both internally and externally. The disease has a high risk of death, killing 25% to 90% of those infected, with an average of about 50%. This is often due to low blood pressure from fluid loss, and typically follows 6 to 16 days after symptoms appear.

The virus spreads through direct contact with body fluids, such as blood from infected humans or other animals. Spread may also occur from contact with items recently contaminated with bodily fluids. Spread of the disease through the air between primates, including humans, has not been documented in either laboratory or natural conditions. Semen or breast milk of a person after recovery from EVD may carry the virus for several weeks to months. Fruit bats are believed to be the normal carrier in nature, able to spread the virus without being affected by it. Other diseases such as malaria, cholera, typhoid fever, meningitis and other viral hemorrhagic fevers may resemble EVD. Blood samples are tested for viral RNA, viral antibodies or for the virus itself to confirm the diagnosis.

ILLNESS

Viral

Ebola

Sources

The virus spreads through direct contact with body fluids, such as blood from infected humans or other animals. Spread may also occur from contact with items recently contaminated with bodily fluids. Spread of the disease through the air between primates, including humans, has not been documented in either laboratory or natural conditions. Semen or breast milk of a person after recovery from EVD may carry the virus for several weeks to months. Fruit bats are believed to be the normal carrier in nature, able to spread the virus without being affected by it.

Symptoms

Ebola

Symptoms

Onset
The length of time between exposure to the virus and the development of symptoms (incubation period) is between two and 21 days, and usually between four and ten days. However, recent estimates based on mathematical models predict that around 5% of cases may take greater than 21 days to develop.

Symptoms usually begin with a sudden influenza-like stage characterised by feeling tired, fever, weakness, decreased appetite, muscular pain, joint pain, headache, and sore throat. The fever is usually higher than 38.3°C (101°F). This is often followed by nausea, vomiting, diarrhoea, abdominal pain, and sometimes hiccups. The combination of severe vomiting and diarrhoea often leads to severe dehydration. Next, shortness of breath and chest pain may occur, along with swelling, headaches, and confusion. In about half of the cases, the skin may develop a maculopapular rash, a flat red area covered with small bumps, five to seven days after symptoms begin.

ILLNESS

Bleeding
In some cases, internal and external bleeding may occur. This typically begins five to seven days after the first symptoms. All infected people show some decreased blood clotting. Bleeding from mucous membranes or from sites of needle punctures has been reported in 40–50% of cases. This may cause vomiting blood, coughing up of blood, or blood in stool. Bleeding into the skin may create petechiae, purpura, ecchymoses or haematomas (especially around needle injection sites). Bleeding into the whites of the eyes may also occur. Heavy bleeding is uncommon; if it occurs, it is usually in the gastrointestinal tract. The incidence of bleeding into the gastrointestinal tract was reported to be ~58% in the 2001 outbreak in Gabon, but in the 2014-15 outbreak in the US it was ~18%, possibly due to improved prevention of disseminated intravascular coagulation.

Viral

Ebola

Symptoms

Recovery and Death
Recovery may begin between seven and 14 days after first symptoms. Death, if it occurs, follows typically six to sixteen days from first symptoms and is often due to low blood pressure from fluid loss. In general, bleeding often indicates a worse outcome, and blood loss may result in death. People are often in a coma near the end of life.

Those who survive often have ongoing muscular and joint pain, liver inflammation, and decreased hearing, and may have continued tiredness, continued weakness, decreased appetite, and difficulty returning to pre-illness weight. Problems with vision may develop.

Survivors develop antibodies against Ebola that last at least 10 years, but it is unclear whether they are immune to additional infections.

Prevention

Ebola

ILLNESS

Vaccines
An Ebola vaccine, rVSV-ZEBOV, was approved in the United States in December 2019. It appears to be fully effective ten days after being given. It was studied in Guinea between 2014, and 2016. More than 100,000 people have been vaccinated against Ebola as of 2019.

Ebola

Prevention

Infection Control
People who care for those infected with Ebola should wear protective clothing including masks, gloves, gowns and goggles. The U.S. Centers for Disease Control (CDC) recommend that the protective gear leaves no skin exposed. These measures are also recommended for those who may handle objects contaminated by an infected person's body fluids. In 2014, the CDC began recommending that medical personnel receive training on the proper suit-up and removal of personal protective equipment (PPE); in addition, a designated person, appropriately trained in biosafety, should be watching each step of these procedures to ensure they are done correctly. In Sierra Leone, the typical training period for the use of such safety equipment lasts approximately 12 days.

Patients and Household Members
The infected person should be in barrier-isolation from other people. All equipment, medical waste, patient waste and surfaces that may have come into contact with body fluids need to be disinfected. During the 2014 outbreak, kits were put together to help families treat Ebola disease in their homes, which included protective clothing as well as chlorine powder and other cleaning supplies. Education of caregivers in these techniques, and providing such barrier-separation supplies has been a priority of Doctors Without Borders.

al

ILLNESS Viral Ebola Prevention

Disinfection
Ebolaviruses can be eliminated with heat (heating for 30 to 60 minutes at 60 °C or boiling for five minutes). To disinfect surfaces, some lipid solvents such as some alcohol-based products, detergents, sodium hypochlorite (bleach) or calcium hypochlorite (bleaching powder), and other suitable disinfectants may be used at appropriate concentrations.

Corpses, Burial
If a person with Ebola disease dies, direct contact with the body should be avoided. Certain burial rituals, which may have included making various direct contacts with a dead body, require reformulation so that they consistently maintain a proper protective barrier between the dead body and the living. Social anthropologists may help find alternatives to traditional rules for burials.

Treatment

ILLNESS Viral Ebola Treatment

While there is no approved treatment for Ebola as of 2019, two treatments (REGN-EB3 and mAb114) are associated with improved outcomes. The U.S. Food and Drug Administration (FDA) advises people to be careful of advertisements making unverified or fraudulent claims of benefits supposedly gained from various anti-Ebola products.

Standard Support
Treatment is primarily supportive in nature. Early supportive care with rehydration and symptomatic treatment improves survival. Rehydration may be via the oral or intravenous route. These measures may include pain management, and treatment for nausea, fever, and anxiety. The World Health Organization (WHO) recommends avoiding aspirin or ibuprofen for pain management, due to the risk of bleeding associated with these medications.

Blood products such as packed red blood cells, platelets, or fresh frozen plasma may also be used. Other regulators of coagulation have also been tried including heparin in an effort to prevent disseminated intravascular coagulation and clotting factors to decrease bleeding. Antimalarial medications and antibiotics are often used before the diagnosis is confirmed, though there is no evidence to suggest such treatment helps. Several experimental treatments are being studied. Where hospital care is not possible, the WHO's guidelines for home care have been relatively successful. Recommendations include using towels soaked in a bleach solution when moving infected people or bodies and also applying bleach on stains. It is also recommended that the caregivers wash hands with bleach solutions and cover their mouth and nose with a cloth.

Notes

ILLNESS Ebola Notes

EVD has a risk of death in those infected of between 25% and 90%. As of September 2014, the average risk of death among those infected is 50%. The highest risk of death was 90% in the 2002–2003 Republic of the Congo outbreak. Death, if it occurs, follows typically six to sixteen days after symptoms appear and is often due to low blood pressure from fluid loss. Early supportive care to prevent dehydration may reduce the risk of death.

If an infected person survives, recovery may be quick and complete. Prolonged cases are often complicated by the occurrence of long-term problems, such as inflammation of the testicles, joint pains, fatigue, hearing loss, mood and sleep disturbances, muscular pain, abdominal pain, menstrual abnormalities, miscarriages, skin peeling, or hair loss. Inflammation and swelling of the uveal layer of the eye is the most common eye complication in survivors of Ebola virus disease. Eye symptoms, such as light sensitivity, excess tearing, and vision loss have been described.

Ebola can stay in some body parts like the eyes, breasts, and testicles after infection. Sexual transmission after recovery has been suspected. If sexual transmission occurs following recovery it is believed to be a rare event. One case of a condition similar to meningitis has been reported many months after recovery, as of October 2015. A study of 44 survivors of the Ebola virus in Sierra Leone reported musculoskeletal pain in 70%, headache in 48%, and eye problems in 14%.

9 Gastroenteritis

ILLNESS Viral Gastroenteritis

Gastroenteritis, also known as infectious diarrhea, is inflammation of the gastrointestinal tract—the stomach and small intestine. Symptoms may include diarrhea, vomiting and abdominal pain. Fever, lack of energy and dehydration may also occur. This typically lasts less than two weeks. It is not related to influenza, though it has erroneously been called the "stomach flu". Gastroenteritis is usually caused by viruses. However, bacteria, parasites, and fungus can also cause gastroenteritis.

In children, rotavirus is the most common cause of severe disease. In adults, norovirus and Campylobacter are common causes. Eating improperly prepared food, drinking contaminated water or close contact with a person who is infected can spread the disease. Treatment is generally the same with or without a definitive diagnosis, so testing to confirm is usually not needed.

Prevention includes hand washing with soap, drinking clean water, proper disposal of human waste and breastfeeding babies instead of using formula. The rotavirus vaccine is recommended as a prevention for children. Treatment involves getting enough fluids. For mild or moderate cases, this can typically be achieved by drinking oral rehydration solution (a combination of water, salts and sugar).

In those who are breastfed, continued breastfeeding is recommended. For more severe cases, intravenous fluids may be needed. Fluids may also be given by a nasogastric tube. Zinc supplementation is recommended in children. Antibiotics are generally not needed. However, antibiotics are recommended for young children with a fever and bloody diarrhea.

Sources

ILLNESS Gastroenteritis

Viruses (particularly rotavirus) and the bacteria Escherichia coli and Campylobacter species are the primary causes of gastroenteritis. There are, however, many other infectious agents that can cause this syndrome including parasites and fungus. Non-infectious causes are seen on occasion, but they are less likely than a viral or bacterial cause. Risk of infection is higher in children due to their lack of immunity. Children are also at higher risk because they are less likely to practice good hygiene habits. Children living in areas without easy access to water and soap are especially vulnerable.

Symptoms

ILLNESS Viral Gastroenteritis Symptoms

Gastroenteritis usually involves both diarrhea and vomiting. Sometimes, only one or the other is present. This may be accompanied by abdominal cramps. Signs and symptoms usually begin 12–72 hours after contracting the infectious agent. If due to a virus, the condition usually resolves within one week. Some viral infections also involve fever, fatigue, headache and muscle pain. If the stool is bloody, the cause is less likely to be viral and more likely to be bacterial. Some bacterial infections cause severe abdominal pain and may persist for several weeks.

Children infected with rotavirus usually make a full recovery within three to eight days. However, in poor countries treatment for severe infections is often out of reach and persistent diarrhea is common. Dehydration is a common complication of diarrhea. Severe dehydration in children may be recognized if the skin color and position returns slowly when pressed. This is called "prolonged capillary refill" and "poor skin turgor". Abnormal breathing is another sign of severe dehydration. Repeat infections are typically seen in areas with poor sanitation, and malnutrition. Stunted growth and long-term cognitive delays can result.

Reactive arthritis occurs in 1% of people following infections with Campylobacter species. Guillain–Barré syndrome occurs in 0.1%. Hemolytic uremic syndrome (HUS) may occur due to infection with Shiga toxin-producing Escherichia coli or Shigella species. HUS causes low platelet counts, poor kidney function, and low red blood cell count (due to their breakdown). Children are more predisposed to getting HUS than adults. Some viral infections may produce benign infantile seizures.

Prevention

A supply of easily accessible uncontaminated water and good sanitation practices are important for reducing rates of infection and clinically significant gastroenteritis. Personal measures (such as hand washing with soap) have been found to decrease rates of gastroenteritis in both the developing and developed world by as much as 30%. Alcohol-based gels may also be effective. Food or drink that is thought to be contaminated should be avoided. Breastfeeding is important, especially in places with poor hygiene, as is improvement of hygiene generally. Breast milk reduces both the frequency of infections and their duration.

Treatment

Gastroenteritis is usually an acute and self-limiting disease that does not require medication. The preferred treatment in those with mild to moderate dehydration is oral rehydration therapy (ORT). For children at risk of dehydration from vomiting, taking a single dose of the anti vomiting medication metoclopramide or ondansetron, may be helpful, and butylscopolamine is useful in treating abdominal pain.

Rehydration
The primary treatment of gastroenteritis in both children and adults is rehydration. This is preferably achieved by drinking rehydration solution, although intravenous delivery may be required if there is a decreased level of consciousness or if dehydration is severe. Drinking replacement therapy products made with complex carbohydrates (i.e. those made from wheat or rice) may be superior to those based on simple sugars. Drinks especially high in simple sugars, such as soft drinks and fruit juices, are not recommended in children under 5 years of age as they may increase diarrhea. Plain water may be used if more specific ORT preparations are unavailable or the person is not willing to drink them. A nasogastric tube can be used in young children to administer fluids if warranted. In those who require intravenous fluids, one to four hours' worth is often sufficient.

Dietary
It is recommended that breast-fed infants continue to be nursed in the usual fashion, and that formula-fed infants continue their formula immediately after rehydration with ORT. Lactose-free or lactose-reduced formulas usually are not necessary. Children should continue their usual diet during episodes of diarrhea with the exception that foods high in simple sugars should be avoided. The BRAT diet (bananas, rice, applesauce, toast and tea) is no longer recommended, as it contains insufficient nutrients and has no benefit over normal feeding.

Some probiotics have been shown to be beneficial in reducing both the duration of illness and the frequency of stools. They may also be useful in preventing and treating antibiotic associated diarrhea. Fermented milk products (such as yogurt) are similarly beneficial. Zinc supplementation appears to be effective in both treating and preventing diarrhea among children in the developing world.

Antiemetics
Antiemetic medications may be helpful for treating vomiting in children. Ondansetron has some utility, with a single dose being associated with less need for intravenous fluids, fewer hospitalizations, and decreased vomiting. Metoclopramide might also be helpful. However, the use of ondansetron might possibly be linked to an increased rate of return to hospital in children. The intravenous preparation of ondansetron may be given orally if clinical judgment warrants. Dimenhydrinate, while reducing vomiting, does not appear to have a significant clinical benefit.

Antibiotics
Antibiotics are not usually used for gastroenteritis, although they are sometimes recommended if symptoms are particularly severe or if a susceptible bacterial cause is isolated or suspected. If antibiotics are to be employed, a macrolide (such as azithromycin) is preferred over a fluoroquinolone due to higher rates of resistance to the latter. Pseudomembranous colitis, usually caused by antibiotic use, is managed by discontinuing the causative agent and treating it with either metronidazole or vancomycin. Bacteria and protozoans that are amenable to treatment include Shigella Salmonella typhi, and Giardia species. In those with Giardia species or Entamoeba histolytica, tinidazole treatment is recommended and superior to metronidazole. The World Health Organization (WHO) recommends the use of antibiotics in young children who have both bloody diarrhea and fever.

10 HFMD (Hand Foot and Mouth Disease)

Hand, foot, and mouth disease (HFMD) is a common infection caused by a group of viruses. It typically begins with a fever and feeling generally unwell. This is followed a day or two later by flat discolored spots or bumps that may blister, on the hands, feet and mouth and occasionally buttocks and groin. Signs and symptoms normally appear 3–6 days after exposure to the virus. The rash generally resolves on its own in about a week. Fingernail and toenail loss may occur a few weeks later, but they will regrow with time.

The viruses that cause HFMD are spread through close personal contact, through the air from coughing and the feces of an infected person. Contaminated objects can also spread the disease. Coxsackievirus A16 is the most common cause, and enterovirus 71 is the second-most common cause. Other strains of coxsackievirus and enterovirus can also be responsible. Some people may carry and pass on the virus despite having no symptoms of disease. Other animals are not involved. Diagnosis can often be made based on symptoms. Occasionally, a throat or stool sample may be tested for the virus.

Sources

The viruses that cause the disease are of the Picornaviridae family. Coxsackievirus A16 is the most common cause of HFMD. Enterovirus 71 (EV-71) is the second-most common cause. Many other strains of coxsackievirus and enterovirus can also be responsible. HFMD is highly contagious and is transmitted by nasopharyngeal secretions such as saliva or nasal mucus, by direct contact, or by fecal-oral transmission. It is possible to be infectious for days to weeks after the symptoms have resolved.

Symptoms

Common constitutional signs and symptoms of the HFMD include fever, nausea, vomiting, feeling tired, generalized discomfort, loss of appetite, and irritability in infants and toddlers. Skin lesions frequently develop in the form of a rash of flat discolored spots and bumps which may be followed by vesicular sores with blisters on palms of the hands, soles of the feet, buttocks, and sometimes on the lips. The rash is rarely itchy for children, but can be extremely itchy for adults. Painful facial ulcers, blisters, or lesions may also develop in or around the nose or mouth. HFMD usually resolves on its own after 7–10 days. Most cases of the disease are relatively harmless, but complications including encephalitis, meningitis, and paralysis that mimics the neurological symptoms of polio can occur.

Prevention

Preventive measures include avoiding direct contact with infected individuals (including keeping infected children home from school), proper cleaning of shared utensils, disinfecting contaminated surfaces, and proper hand hygiene. These measures have been shown to be effective in decreasing the transmission of the viruses responsible for HFMD.

Protective habits include hand washing and disinfecting surfaces in play areas. Breast-feeding has also shown to decrease rates of severe HFMD, though does not reduce the risk for the infection of the disease.

Treatment

ILLNESS Viral HFMD (Ha Treatment

Medications are usually not needed as hand, foot, and mouth disease is a viral disease that typically resolves on its own. Currently, there is no specific curative treatment for hand, foot and mouth disease. Disease management typically focuses on achieving symptomatic relief. Pain from the sores may be eased with the use of analgesic medications. Infection in older children, adolescents, and adults is typically mild and lasts approximately 1 week, but may occasionally run a longer course. Fever reducers and lukewarm baths can help decrease body temperature.

A minority of individuals with hand, foot and mouth disease may require hospital admission due to complications such as inflammation of the brain, inflammation of the meninges, or acute flaccid paralysis. Non-neurologic complications such as inflammation of the heart, fluid in the lungs, or bleeding into the lungs may also occur.

11 HIV/AIDS

ILLNESS Viral HIV/AIDS

Human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) is a spectrum of conditions caused by infection with the human immunodeficiency virus (HIV). Following initial infection a person may not notice any symptoms, or may experience a brief period of influenza-like illness. Typically, this is followed by a prolonged period with no symptoms.

As the infection progresses, it interferes more with the immune system, increasing the risk of developing common infections such as tuberculosis, as well as other opportunistic infections, and tumors which are otherwise rare in people who have normal immune function. These late symptoms of infection are referred to as acquired immunodeficiency syndrome (AIDS). This stage is often also associated with unintended weight loss.

HIV is spread primarily by unprotected sex (including anal and oral sex), contaminated blood transfusions, hypodermic needles, and from mother to child during pregnancy, delivery, or breastfeeding. Some bodily fluids, such as saliva, sweat and tears, do not transmit the virus. HIV is a member of the group of viruses known as retroviruses. Methods of prevention include safe sex, needle exchange programs, treating those who are infected, pre- and post-exposure prophylaxis, and male circumcision.

Disease in a baby can often be prevented by giving both the mother and child antiretroviral medication. There is no cure or vaccine; however, antiretroviral treatment can slow the course of the disease and may lead to a near-normal life expectancy. Treatment is recommended as soon as the diagnosis is made. Without treatment, the average survival time after infection is 11 years.

Sources

ILLNESS HIV/AIDS

HIV is spread by three main routes: sexual contact, significant exposure to infected body fluids or tissues, and from mother to child during pregnancy, delivery, or breastfeeding (known as vertical transmission). There is no risk of acquiring HIV if exposed to feces, nasal secretions, saliva, sputum, sweat, tears, urine, or vomit unless these are contaminated with blood. It is also possible to be co-infected by more than one strain of HIV—a condition known as HIV superinfection.

Symptoms

Viral HIV/AIDS Symptoms

There are three main stages of HIV infection: acute infection, clinical latency, and AIDS.

Acute Infection
The initial period following the contraction of HIV is called acute HIV, primary HIV or acute retroviral syndrome. Many individuals develop an influenza-like illness or a mononucleosis-like illness 2–4 weeks after exposure while others have no significant symptoms. Symptoms occur in 40–90% of cases and most commonly include fever, large tender lymph nodes, throat inflammation, a rash, headache, tiredness, and/or sores of the mouth and genitals. The rash, which occurs in 20–50% of cases, presents itself on the trunk and is maculopapular, classically. Some people also develop opportunistic infections at this stage. Gastrointestinal symptoms, such as vomiting or diarrhea may occur. Neurological symptoms of peripheral neuropathy or Guillain–Barré syndrome also occurs. The duration of the symptoms varies, but is usually one or two weeks.

Owing to their nonspecific character, these symptoms are not often recognized as signs of HIV infection. Even cases that do get seen by a family doctor or a hospital are often misdiagnosed as one of the many common infectious diseases with overlapping symptoms. Thus, it is recommended that HIV be considered in people presenting with an unexplained fever who may have risk factors for the infection.

ILLNESS HIV/AIDS Symptoms

Clinical Latency
The initial symptoms are followed by a stage called clinical latency, asymptomatic HIV, or chronic HIV. Without treatment, this second stage of the natural history of HIV infection can last from about three years to over 20 years (on average, about eight years). While typically there are few or no symptoms at first, near the end of this stage many people experience fever, weight loss, gastrointestinal problems and muscle pains. Between 50% and 70% of people also develop persistent generalized lymphadenopathy, characterized by unexplained, non-painful enlargement of more than one group of lymph nodes (other than in the groin) for over three to six months.

Although most HIV-1 infected individuals have a detectable viral load and in the absence of treatment will eventually progress to AIDS, a small proportion (about 5%) retain high levels of CD4+ T cells (T helper cells) without antiretroviral therapy for more than five years. These individuals are classified as "HIV controllers" or long-term nonprogressors (LTNP). Another group consists of those who maintain a low or undetectable viral load without anti-retroviral treatment, known as "elite controllers" or "elite suppressors". They represent approximately 1 in 300 infected persons.

ILLNESS Viral HIV/AIDS Symptoms

The World Health Organization first proposed a definition for AIDS in 1986. Since then, the WHO classification has been updated and expanded several times, with the most recent version being published in 2007. The WHO system uses the following categories:
● Primary HIV infection: May be either asymptomatic or associated with acute retroviral syndrome
● Stage I: HIV infection is asymptomatic with a CD4+ T cell count (also known as CD4 count) greater than 500 per microlitre (µl or cubic mm) of blood. May include generalized lymph node enlargement.
● Stage II: Mild symptoms, which may include minor mucocutaneous manifestations and recurrent upper respiratory tract infections. A CD4 count of less than 500/µl
● Stage III: Advanced symptoms, which may include unexplained chronic diarrhea for longer than a month, severe bacterial infections including tuberculosis of the lung, and a CD4 count of less than 350/µl
● Stage IV or AIDS: severe symptoms, which include toxoplasmosis of the brain, candidiasis of the esophagus, trachea, bronchi, or lungs, and Kaposi's sarcoma. A CD4 count of less than 200/µl

Prevention

Sexual Contact
Consistent condom use reduces the risk of HIV transmission by approximately 80% over the long term. When condoms are used consistently by a couple in which one person is infected, the rate of HIV infection is less than 1% per year. There is some evidence to suggest that female condoms may provide an equivalent level of protection. Application of a vaginal gel containing tenofovir (a reverse transcriptase inhibitor) immediately before sex seems to reduce infection rates by approximately 40% among African women. By contrast, use of the spermicide nonoxynol-9 may increase the risk of transmission due to its tendency to cause vaginal and rectal irritation.

Circumcision in Sub-Saharan Africa "reduces the acquisition of HIV by heterosexual men by between 38% and 66% over 24 months". Owing to these studies, both the World Health Organization and UNAIDS recommended male circumcision in 2007 as a method of preventing female-to-male HIV transmission in areas with high rates of HIV. However, whether it protects against male-to-female transmission is disputed, and whether it is of benefit in developed countries and among men who have sex with men is undetermined. The International Antiviral Society, however, does recommend it for all sexually active heterosexual males and that it be discussed as an option with men who have sex with men. Some experts fear that a lower perception of vulnerability among circumcised men may cause more sexual risk-taking behavior, thus negating its preventive effects.

Treatment

There is currently no cure, nor an effective HIV vaccine. Treatment consists of highly active antiretroviral therapy (HAART) which slows progression of the disease. As of 2010 more than 6.6 million people were receiving this in low- and middle-income countries. Treatment also includes preventive and active treatment of opportunistic infections. As of March 2020, two persons have been successfully cleared of HIV. Rapid initiation of anti-retroviral therapy within one week of diagnosis appear to improve treatment outcomes in low and medium-income settings.

Antiviral Therapy
A white prescription bottle with the label Stribild. Next to it are ten green oblong pills with the marking 1 on one side and GSI on the other.
Stribild – a common once-daily ART regime consisting of elvitegravir, emtricitabine, tenofovir and the booster cobicistat
Current HAART options are combinations (or "cocktails") consisting of at least three medications belonging to at least two types, or "classes", of antiretroviral agents.

12 Hemorrhagic Fever

Viral hemorrhagic fevers (VHFs) are a diverse group of animal and human illnesses in which fever and hemorrhage are caused by a viral infection. VHFs may be caused by five distinct families of RNA viruses: the families Arenaviridae, Filoviridae, Bunyaviridae, Flaviviridae, and Rhabdoviridae. All types of VHF are characterized by fever and bleeding disorders and all can progress to high fever, shock and death in many cases. Some of the VHF agents cause relatively mild illnesses, such as the Scandinavian nephropathia epidemica (a hantavirus), while others, such as Ebola virus, can cause severe, life-threatening disease.

Sources

Five families of RNA viruses have been recognised as being able to cause hemorrhagic fevers.
- The family Arenaviridae include the viruses responsible for Lassa fever (Lassa virus), Lujo virus, Argentine (Junin virus), Bolivian (Machupo virus), Brazilian (Sabiá virus), Chapare hemorrhagic fever (Chapare virus), Venezuelan (Guanarito virus) and Whitewater Arroyo virus hemorrhagic fevers.
- The family Bunyaviridae include the causative agents of Hantavirus hemorrhagic fever with renal syndrome (HV-HFRS), the Crimean-Congo hemorrhagic fever (CCHF) virus from the genus Nairovirus, Garissa virus and Ilesha virus from the Orthobunyavirus and the Rift Valley fever (RVF) virus from the genus Phlebovirus.
- The family Filoviridae include Ebola virus and Marburg virus.
- The family Flaviviridae include dengue, yellow fever, and two viruses in the tick-borne encephalitis group that cause VHF: Omsk hemorrhagic fever virus and Kyasanur Forest disease virus.
- In September 2012 scientists writing in the journal PLOS Pathogens reported the isolation of a member of the Rhabdoviridae responsible for 2 fatal and 2 non-fatal cases of hemorrhagic fever in the Bas-Congo district of the Democratic Republic of Congo. The virus was named Bas-Congo virus. The non-fatal cases occurred in healthcare workers involved in the treatment of the other two, suggesting the possibility of person-to-person transmission. This virus is related to the Ephemerovirus and Tibrovirus genera.

Symptoms

Signs and symptoms of VHFs include (by definition) fever and bleeding. Manifestations of VHF often also include flushing of the face and chest, small red or purple spots (petechiae), bleeding, swelling caused by edema, low blood pressure (hypotension), and shock. Malaise, muscle pain, headache, vomiting, and diarrhea occur frequently. The severity of symptoms varies with the type of virus. The "VHF syndrome" (capillary leak, bleeding diathesis, and circulatory compromise leading to shock) appears in a majority of people with filovirus hemorrhagic fevers (e.g., Ebola and Marburg virus), Crimean–Congo hemorrhagic fever (CCHF), and the South American hemorrhagic fevers caused by arenaviruses, but only in a small minority of patients with dengue, Rift Valley fever, and Lassa fever.

Prevention

With the exception of yellow fever vaccine neither vaccines nor experimental vaccines are readily available. Prophylactic (preventive) ribavirin may be effective for some bunyavirus and arenavirus infections (available only as an investigational new drug (IND)).

VHF isolation guidelines dictate that all VHF patients (with the exception of dengue patients) should be cared for using strict contact precautions, including hand hygiene, double gloves, gowns, shoe and leg coverings, and face shield or goggles. Lassa, CCHF, Ebola, and Marburg viruses may be particularly prone to nosocomial (hospital-based) spread. Airborne precautions should be utilized including, at a minimum, a fit-tested, HEPA filter-equipped respirator (such as an N-95 mask), a battery-powered, air-purifying respirator, or a positive pressure supplied air respirator to be worn by personnel coming within 1,8 meter (six feet) of a VHF patient. Groups of patients should be cohorted (sequestered) to a separate building or a ward with an isolated air-handling system. Environmental decontamination is typically accomplished with hypochlorite (e.g. bleach) or phenolic disinfectants.

Treatment

Medical management of VHF patients may require intensive supportive care. Antiviral therapy with intravenous ribavirin may be useful in Bunyaviridae and Arenaviridae infections (specifically Lassa fever, RVF, CCHF, and HFRS due to Old World Hantavirus infection) and can be used only under an experimental protocol as IND approved by the U.S. Food and Drug Administration (FDA). Interferon may be effective in Argentine or Bolivian hemorrhagic fevers (also available only as IND).

13 Encephalitis B (Japanese Encephalitis)

Japanese encephalitis (JE) is an infection of the brain caused by the Japanese encephalitis virus (JEV). While most infections result in little or no symptoms, occasional inflammation of the brain occurs. In these cases, symptoms may include headache, vomiting, fever, confusion and seizures. This occurs about 5 to 15 days after infection. JEV is generally spread by mosquitoes, specifically those of the Culex type. Pigs and wild birds serve as a reservoir for the virus. The disease mostly occurs outside of cities. Diagnosis is based on blood or cerebrospinal fluid testing.

Prevention is generally with the Japanese encephalitis vaccine, which is both safe and effective. Other measures include avoiding mosquito bites. Once infected, there is no specific treatment, with care being supportive. This is generally carried out in hospital. Permanent problems occur in up to half of people who recover from JE. The disease occurs in Southeast Asia and the Western Pacific. About 3 billion people live in areas where the disease occurs. About 68,000 symptomatic cases occur a year, with about 17,000 deaths.

ILLNESS | Viral | Encephalitis B (Japanese Encephalitis)

Sources

It is a disease caused by the mosquito-borne Japanese encephalitis virus (JEV).

Symptoms

The Japanese encephalitis virus (JEV) has an incubation period of 2 to 26 days. The vast majority of infections are asymptomatic: only 1 in 250 infections develop into encephalitis. Severe rigors may mark the onset of this disease in humans. Fever, headache and malaise are other non-specific symptoms of this disease which may last for a period of between 1 and 6 days. Signs which develop during the acute encephalitic stage include neck rigidity, cachexia, hemiparesis, convulsions and a raised body temperature between 38–41 °C (100.4–105.8 °F).

Mental retardation is usually developed.Mortality of this disease varies but is generally higher in children. Transplacental spread has been noted. Lifelong neurological defects such as deafness, emotional lability and hemiparesis may occur in those who have had central nervous system involvement. In known cases, some effects also include nausea, headache, fever, and vomiting.

Increased microglial activation following Japanese Encephalitis infection has been found to influence the outcome of viral pathogenesis. Microglia are the resident immune cells of the central nervous system (CNS) and have a critical role in host defense against invading microorganisms. Activated microglia secrete cytokines, such as interleukin-1 (IL-1) and tumor necrosis factor alpha (TNF-α), which can cause toxic effects in the brain. Additionally, other soluble factors such as neurotoxins, excitatory neurotransmitters, prostaglandin, reactive oxygen, and nitrogen species are secreted by activated microglia.

Prevention

Infection with Japanese encephalitis confers lifelong immunity. There are currently three vaccines available: SA14-14-2, IXIARO (IC51, also marketed in Australia, New Zealand as JESPECT and India as JEEV) and ChimeriVax-JE (marketed as IMOJEV). All current vaccines are based on the genotype III virus.

A formalin-inactivated mouse-brain derived vaccine was first produced in Japan in the 1930s and was validated for use in Taiwan in the 1960s and in Thailand in the 1980s. The widespread use of vaccine and urbanization has led to control of the disease in Japan, Korea, Taiwan, and Singapore. The high cost of this vaccine, which is grown in live mice, means that poorer countries have not been able to afford to give it as part of a routine immunization program.

The most common adverse effects are redness and pain at the injection site. Uncommonly, an urticarial reaction can develop about four days after injection. Vaccines produced from mouse brain have a risk of autoimmune neurological complications of around 1 per million vaccinations. However where the vaccine is not produced in mouse brains but in vitro using cell culture there is little adverse effects compared to placebo, the main side effects are headache and myalgia.

The neutralizing antibody persists in the circulation for at least two to three years, and perhaps longer. The total duration of protection is unknown, but because there is no firm evidence for protection beyond three years, boosters are recommended every three years for people who remain at risk. Furthermore, there is also no data available regarding the interchangeability of other JE vaccines and IXIARO.

Treatment

There is no specific treatment for Japanese encephalitis and treatment is supportive, with assistance given for feeding, breathing or seizure control as required. Raised intracranial pressure may be managed with mannitol. There is no transmission from person to person and therefore patients do not need to be isolated.

A breakthrough in the field of Japanese encephalitis therapeutics is the identification of macrophage receptor involvement in the disease severity. A recent report of an Indian group demonstrates the involvement of monocyte and macrophage receptor CLEC5A in severe inflammatory response in Japanese Encephalitis infection of the brain. This transcriptomic study provides a hypothesis of neuroinflammation and a new lead in development of appropriate therapeutic against Japanese encephalitis.

The effectiveness of intravenous immunoglobulin for the management of encephalitis is unclear due to a lack of evidence. Intravenous immunoglobulin for Japanese encephalitis appeared to have no benefit.

14 Influenza

Sources

Strains of all subtypes of influenza A virus have been isolated from wild birds, although disease is uncommon. Some isolates of influenza A virus cause severe disease both in domestic poultry and, rarely, in humans. Occasionally, viruses are transmitted from wild aquatic birds to domestic poultry, and this may cause an outbreak or give rise to human influenza pandemics.

Symptoms

Approximately 33% of people with influenza are asymptomatic. Symptoms of influenza can start quite suddenly one to two days after infection. Usually the first symptoms are chills and body aches, with fever also common early in the infection, with body temperatures ranging from 38 to 39°C (approximately 100 to 103°F). Many people are so ill that they are confined to bed for several days, with aches and pains throughout their bodies, which are worse in their backs and legs.

It can be difficult to distinguish between the common cold and influenza in the early stages of these infections. Influenza symptoms are a mixture of symptoms of common cold and pneumonia, body ache, headache, and fatigue. Diarrhea is not usually a symptom of influenza in adults, although it has been seen in some human cases of the H5N1 "bird flu" and can be a symptom in children. The symptoms most reliably seen in influenza are shown in the adjacent table.

The specific combination of fever and cough has been found to be the best predictor; diagnostic accuracy increases with a body temperature above 38 °C (100.4 °F). Two decision analysis studies suggest that during local outbreaks of influenza, the prevalence will be over 70%. Even in the absence of a local outbreak, diagnosis may be justified in the elderly during the influenza season as long as the prevalence is over 15%.

- Fever and chills
- Cough
- Nasal congestion
- Runny nose
- Sore throat
- Hoarseness
- Earache
- Muscle pains
- Fatigue
- Headache
- Irritated, watering eyes
- Reddened eyes, skin (especially face), mouth, throat and nose
- Petechial rash
- In children, gastrointestinal symptoms such as vomiting, diarrhea, and abdominal pain (may be severe in children with influenza B)

Prevention

Infection Control
These are the main ways that influenza spreads
- By direct transmission (when an infected person sneezes mucus directly into the eyes, nose or mouth of another person);
- The airborne route (when someone inhales the aerosols produced by an infected person coughing, sneezing or spitting);
- Through hand-to-eye, hand-to-nose, or hand-to-mouth transmission, either from contaminated surfaces or from direct personal contact such as a hand-shake.

When vaccines and antiviral medications are limited, non-pharmaceutical interventions are essential to reduce transmission and spread. The lack of controlled studies and rigorous evidence of the effectiveness of some measures has hampered planning decisions and recommendations. Nevertheless, strategies endorsed by experts for all phases of flu outbreaks include hand and respiratory hygiene, self-isolation by symptomatic individuals and the use of face masks by them and their caregivers, surface disinfection, rapid testing and diagnosis, and contact tracing. In some cases, other forms of social distancing including school closures and travel restrictions are recommended.

Reasonably effective ways to reduce the transmission of influenza include good personal health and hygiene habits such as: not touching the eyes, nose or mouth; frequent hand washing (with soap and water, or with alcohol-based hand rubs); covering coughs and sneezes with a tissue or sleeve; avoiding close contact with sick people; and staying home when sick. Avoiding spitting is also recommended. Although face masks might help prevent transmission when caring for the sick, there is mixed evidence on beneficial effects in the community. Smoking raises the risk of contracting influenza, as well as producing more severe disease symptoms.

Since influenza spreads through both aerosols and contact with contaminated surfaces, surface sanitizing may help prevent some infections. Alcohol is an effective sanitizer against influenza viruses, while quaternary ammonium compounds can be used with alcohol so that the sanitizing effect lasts for longer. In hospitals, quaternary ammonium compounds and bleach are used to sanitize rooms or equipment that have been occupied by people with influenza symptoms. At home, this can be done effectively with a diluted chlorine bleach.

Social distancing strategies used during past pandemics, such as quarantines, travel restrictions, and the closing of schools, churches and theaters, have been employed to slow the spread of influenza viruses. Researchers have estimated that such interventions during the 1918 Spanish flu pandemic in the US reduced the peak death rate by up to 50%, and the overall mortality by about 10–30%, in areas where multiple interventions were implemented. The more moderate effect on total deaths was attributed to the measures being employed too late, or lifted too early, most after six weeks or less.

For typical flu outbreaks, routine cancellation of large gatherings or mandatory travel restrictions have received little agreement, particularly as they may be disruptive and unpopular. School closures have been found by most empirical studies to reduce community spread, but some findings have been contradictory. Recommendations for these community restrictions are usually on a case-by-case basis.

Treatment

People with the flu are advised to get plenty of rest, drink plenty of liquids, avoid using alcohol and tobacco and, if necessary, take medications such as acetaminophen (paracetamol) to relieve the fever and muscle aches associated with the flu. In contrast, there is not enough evidence to support corticosteroids as additional therapy for influenza. It is advised to avoid close contact with others to prevent spread of infection. Children and teenagers with flu symptoms (particularly fever) should avoid taking aspirin during an influenza infection (especially influenza type B), because doing so can lead to Reye's syndrome, a rare but potentially fatal disease of the liver.

Since influenza is caused by a virus, antibiotics have no effect on the infection; unless prescribed for secondary infections such as bacterial pneumonia. Antiviral medication may be effective, if given early (within 48 hours to first symptoms), but some strains of influenza can show resistance to the standard antiviral medications and there is concern about the quality of the research. High-risk individuals such as young children, pregnant women, the elderly, and those with compromised immune systems should visit the doctor for antiviral medications. Those with the emergency warning signs should visit the emergency room at once.

Antivirals
The two classes of antiviral medications used against influenza are neuraminidase inhibitors (oseltamivir, zanamivir, laninamivir and peramivir) and M2 protein inhibitors (adamantane derivatives). In Russia, umifenovir is sold for treatment of influenza and in the first quarter of 2020 had a 16 percent share in the antiviral market.

Notes

Seasonal Variations
Seasonal risk areas for influenza: November–April (blue), April–November (red), and year-round (yellow).
Influenza reaches peak prevalence in winter, and because the Northern and Southern Hemispheres have winter at different times of the year, there are actually two different flu seasons each year. This is why the World Health Organization (assisted by the National Influenza Centers) makes recommendations for two different vaccine formulations every year; one for the Northern, and one for the Southern Hemisphere.

A long-standing puzzle has been why outbreaks of the flu occur seasonally rather than uniformly throughout the year. One possible explanation is that, because people are indoors more often during the winter, they are in close contact more often, and this promotes transmission from person to person. Increased travel due to the Northern Hemisphere winter holiday season may also play a role. Another factor is that cold temperatures lead to drier air, which may dehydrate mucus particles. Dry particles are lighter and can thus remain airborne for a longer period. The virus also survives longer on surfaces at colder temperatures and aerosol transmission of the virus is highest in cold environments (less than 5 °C) with low relative humidity. The lower air humidity in winter seems to be the main cause of seasonal influenza transmission in temperate regions.

However, seasonal changes in infection rates also occur in tropical regions, and in some countries these peaks of infection are seen mainly during the rainy season. Seasonal changes in contact rates from school terms, which are a major factor in other childhood diseases such as measles and pertussis, may also play a role in the flu. A combination of these small seasonal effects may be amplified by dynamical resonance with the endogenous disease cycles. H5N1 exhibits seasonality in both humans and birds.

An alternative hypothesis to explain seasonality in influenza infections is an effect of vitamin D levels on immunity to the virus. This idea was first proposed by Robert Edgar Hope-Simpson in 1981. He proposed that the cause of influenza epidemics during winter may be connected to seasonal fluctuations of vitamin D, which is produced in the skin under the influence of solar (or artificial) UV radiation. This could explain why influenza occurs mostly in winter and during the tropical rainy season, when people stay indoors, away from the sun, and their vitamin D levels fall.

Influenza A (The Flu)

Influenza A virus causes influenza in birds and some mammals, and is the only species of the genus Alphainfluenzavirus of the virus family Orthomyxoviridae. Strains of all subtypes of influenza A virus have been isolated from wild birds, although disease is uncommon. Some isolates of influenza A virus cause severe disease both in domestic poultry and, rarely, in humans. Occasionally, viruses are transmitted from wild aquatic birds to domestic poultry, and this may cause an outbreak or give rise to human influenza pandemics.

Influenza B (The Flu)

Influenza B virus is the only species in the genus Betainfluenzavirus in the virus family Orthomyxoviridae. Influenza B virus is only known to infect humans and seals with influenza. This limited host range is apparently responsible for the lack of associated influenza pandemics in contrast with those caused by the morphologically similar influenza A virus as both mutate by both antigenic drift and reassortment. There are two known circulating lineages of Influenza B virus based on the antigenic properties of the surface glycoprotein hemagglutinin. The lineages are termed B/Yamagata/16/88-like and B/Victoria/2/87-like viruses. The quadrivalent influenza vaccine licensed by the CDC is currently designed to protect against both co-circulating lineages and has been shown to have greater effectiveness in prevention of influenza caused by Influenza B virus than the previous trivalent vaccine.

Further diminishing the impact of this virus, "in humans, influenza B viruses evolve slower than A viruses and faster than C viruses". Influenzavirus B mutates at a rate 2 to 3 times slower than type A. Nevertheless, it is accepted that Influenza B virus cause significant morbidity and mortality worldwide, and significantly impacts adolescents and schoolchildren.

Influenza C (The Flu)

Influenza C virus is the species in the genus Influenzavirus C, in the virus family Orthomyxoviridae, which like other influenza viruses, causes influenza. Influenza C viruses are known to infect humans and pigs. Flu due to the Type A species is rare compared to Types B or C, but can be severe and can cause local epidemics. Type C has 7 RNA segments and encodes 9 proteins, while Types A and B have 8 RNA segments and encode at least 10 proteins.

Influenza D (The Flu)

Influenza D virus is a species in the virus genus Deltainfluenzavirus, in the family Orthomyxoviridae, that causes influenza. Influenza D viruses are known to infect pigs and cattle; no human infections from this virus have been observed. First isolated from pigs in 2011, the virus was categorized as a new genus of Orthomyxoviridae in 2016, distinct from the previously-known Influenzavirus C genus; before then, Influenza D virus was thought to be a subtype of Influenzavirus C.

Cases of infections from the Type D virus are rare compared to Types A, B, and C. Similar to Type C, Type D has 7 RNA segments and encodes 9 proteins, while Types A and B have 8 RNA segments and encode at least 10 proteins.

15 Lassa Fever

Lassa fever, also known as Lassa hemorrhagic fever (LHF), is a type of viral hemorrhagic fever caused by the Lassa virus. Many of those infected by the virus do not develop symptoms. When symptoms occur they typically include fever, weakness, headaches, vomiting, and muscle pains. Less commonly there may be bleeding from the mouth or gastrointestinal tract. The risk of death once infected is about one percent and frequently occurs within two weeks of the onset of symptoms. Among those who survive about a quarter have hearing loss, which improves within three months in about half of these cases.

The disease is usually initially spread to people via contact with the urine or feces of an infected multimammate mouse. Spread can then occur via direct contact between people. Diagnosis based on symptoms is difficult. Confirmation is by laboratory testing to detect the virus's RNA, antibodies for the virus, or the virus itself in cell culture. Other conditions that may present similarly include Ebola, malaria, typhoid fever, and yellow fever. The Lassa virus is a member of the Arenaviridae family of viruses.

Sources

Lassa virus commonly spreads to humans from other animals, specifically the natal multimammate mouse or African rat, also called the natal multimammate rat (Mastomys natalensis). This is probably the most common mouse in equatorial Africa, common in human households and eaten as a delicacy in some areas. The multimammate mouse can quickly produce a large number of offspring, tends to colonize human settlements increasing the risk of rodent-human contact, and is found throughout the west, central and eastern parts of the African continent. Once the mouse has become a carrier, it will excrete the virus throughout the rest of its lifetime through feces and urine creating ample opportunity for exposure. The virus is probably transmitted by contact with the feces or urine of animals accessing grain stores in residences. No study has proven presence in breast milk, but the high level of viremia suggests it may be possible.

Symptoms

Onset of symptoms is typically 7 to 21 days after exposure. In 80% of those who are infected little or no symptoms occur. These mild symptoms may include fever, tiredness, weakness, and headache. In 20% of people more severe symptoms such as bleeding gums, breathing problems, vomiting, chest pain, or dangerously low blood pressure may occur. Long term complications may include hearing loss. In those who are pregnant, miscarriage may occur in 95%.

In cases in which death occurs, this typically occurs within 14 days of onset. About 1% of all Lassa virus infections result in death. Approximately 15%-20% of those who have required hospitalization for Lassa fever die. The risk of death is greater in those who are pregnant. A "Swollen baby syndrome" may occur in newborns, infants and toddlers with pitting edema, abdominal distension and bleeding.

Prevention

Control of the Mastomys rodent population is impractical, so measures focus on keeping rodents out of homes and food supplies, encouraging effective personal hygiene, storing grain and other foodstuffs in rodent-proof containers, and disposing of garbage far from the home to help sustain clean households. Gloves, masks, laboratory coats, and goggles are advised while in contact with an infected person, to avoid contact with blood and body fluids. These issues in many countries are monitored by a department of public health. In less developed countries, these types of organizations may not have the necessary means to effectively control outbreaks.

Treatment

Treatment is directed at addressing dehydration and improving symptoms. All persons suspected of Lassa fever infection should be admitted to isolation facilities and their body fluids and excreta properly disposed of.

Medications
The antiviral medication ribavirin has been recommended, but evidence to support its use is weak. Some evidence has found that it may worsen outcomes in certain cases. Fluid replacement, blood transfusions, and medication for low blood pressure may be required. Intravenous interferon therapy has also been used.

Pregnancy
When Lassa fever infects pregnant women late in their third trimester, inducing delivery is necessary for the mother to have a good chance of survival. This is because the virus has an affinity for the placenta and other highly vascular tissues. The fetus has only a one in ten chance of survival no matter what course of action is taken; hence, the focus is always on saving the life of the mother. Following delivery, women should receive the same treatment as other people with Lassa fever.

Notes

About 15–20% of hospitalized people with Lassa fever will die from the illness. The overall case fatality rate is estimated to be 1%, but during epidemics, mortality can climb as high as 50%. The mortality rate is greater than 80% when it occurs in pregnant women during their third trimester; fetal death also occurs in nearly all those cases. Abortion decreases the risk of death to the mother. Some survivors experience lasting effects of the disease, and can include partial or complete deafness. Because of treatment with ribavirin, fatality rates have declined.

16 Dengue Fever

Dengue fever is a mosquito-borne tropical disease caused by the dengue virus. Symptoms typically begin three to fourteen days after infection. These may include a high fever, headache, vomiting, muscle and joint pains, and a characteristic skin rash. Recovery generally takes two to seven days. In a small proportion of cases, the disease develops into severe dengue, also known as dengue hemorrhagic fever, resulting in bleeding, low levels of blood platelets and blood plasma leakage, or into dengue shock syndrome, where dangerously low blood pressure occurs.

Dengue is spread by several species of female mosquitoes of the Aedes type, principally A. aegypti. The virus has five types; infection with one type usually gives lifelong immunity to that type, but only short-term immunity to the others. Subsequent infection with a different type increases the risk of severe complications. A number of tests are available to confirm the diagnosis including detecting antibodies to the virus or its RNA.

A vaccine for dengue fever has been approved and is commercially available in a number of countries. The vaccine, however, is only recommended in those who have been previously infected. Other methods of prevention include reducing mosquito habitat and limiting exposure to bites. This may be done by getting rid of or covering standing water and wearing clothing that covers much of the body. Treatment of acute dengue is supportive and includes giving fluid either by mouth or intravenously for mild or moderate disease.

For more severe cases, blood transfusion may be required. About half a million people require hospital admission every year. Paracetamol (acetaminophen) is recommended instead of nonsteroidal anti-inflammatory drugs (NSAIDs) for fever reduction and pain relief in dengue due to an increased risk of bleeding from NSAID use.

Sources

Dengue virus is primarily transmitted by Aedes mosquitos, particularly A. aegypti. These mosquitos usually live between the latitudes of 35° North and 35° South below an elevation of 1,000 metres (3,300 ft). They typically bite during the early morning and in the evening, but they may bite and thus spread infection at any time of day. Other Aedes species that transmit the disease include A. albopictus, A. polynesiensis and A. scutellaris. Humans are the primary host of the virus, but it also circulates in nonhuman primates.

An infection can be acquired via a single bite. A female mosquito that takes a blood meal from a person infected with dengue fever, during the initial 2- to 10-day febrile period, becomes itself infected with the virus in the cells lining its gut. About 8–10 days later, the virus spreads to other tissues including the mosquito's salivary glands and is subsequently released into its saliva. The virus seems to have no detrimental effect on the mosquito, which remains infected for life. Aedes aegypti is particularly involved, as it prefers to lay its eggs in artificial water containers, to live in close proximity to humans, and to feed on people rather than other vertebrates.

Dengue can also be transmitted via infected blood products and through organ donation. In countries such as Singapore, where dengue is endemic, the risk is estimated to be between 1.6 and 6 per 10,000 transfusions. Vertical transmission (from mother to child) during pregnancy or at birth has been reported. Other person-to-person modes of transmission, including sexual transmission, have also been reported, but are very unusual. The genetic variation in dengue viruses is region specific, suggestive that establishment into new territories is relatively infrequent, despite dengue emerging in new regions in recent decades.

Symptoms

Typically, people infected with dengue virus are asymptomatic (80%) or have only mild symptoms such as an uncomplicated fever. Others have more severe illness (5%), and in a small proportion it is life-threatening. The incubation period (time between exposure and onset of symptoms) ranges from 3 to 14 days, but most often it is 4 to 7 days. Therefore, travelers returning from endemic areas are unlikely to have dengue fever if symptoms start more than 14 days after arriving home. Children often experience symptoms similar to those of the common cold and gastroenteritis (vomiting and diarrhea) and have a greater risk of severe complications, though initial symptoms are generally mild but include high fever.

Prevention

Prevention depends on control of and protection from the bites of the mosquito that transmits it. The World Health Organization recommends an Integrated Vector Control program consisting of five elements:

1. Advocacy, social mobilization and legislation to ensure that public health bodies and communities are strengthened;
2. Collaboration between the health and other sectors (public and private);
3. An integrated approach to disease control to maximize the use of resources;
4. Evidence-based decision making to ensure any interventions are targeted appropriately; and
5. Capacity-building to ensure an adequate response to the local situation.

The primary method of controlling A. aegypti is by eliminating its habitats. This is done by getting rid of open sources of water, or if this is not possible, by adding insecticides or biological control agents to these areas. Generalized spraying with organophosphate or pyrethroid insecticides, while sometimes done, is not thought to be effective. Reducing open collections of water through environmental modification is the preferred method of control, given the concerns of negative health effects from insecticides and greater logistical difficulties with control agents.

People can prevent mosquito bites by wearing clothing that fully covers the skin, using mosquito netting while resting, and/or the application of insect repellent (DEET being the most effective). While these measures can be an effective means of reducing an individual's risk of exposure, they do little in terms of mitigating the frequency of outbreaks, which appear to be on the rise in some areas, probably due to urbanization increasing the habitat of A. aegypti. The range of the disease also appears to be expanding possibly due to climate change.

Treatment

There are no specific antiviral drugs for dengue; however, maintaining proper fluid balance is important. Treatment depends on the symptoms. Those who can drink, are passing urine, have no "warning signs" and are otherwise healthy can be managed at home with daily follow-up and oral rehydration therapy. Those who have other health problems, have "warning signs", or cannot manage regular follow-up should be cared for in hospital. In those with severe dengue care should be provided in an area where there is access to an intensive care unit.

Intravenous hydration, if required, is typically only needed for one or two days. In children with shock due to dengue a rapid dose of 20 mL/kg is reasonable. The rate of fluid administration is then titrated to a urinary output of 0.5–1 mL/kg/h, stable vital signs and normalization of hematocrit. The smallest amount of fluid required to achieve this is recommended.

Notes

Most people with dengue recover without any ongoing problems. The risk of death among those with severe dengue is 0.8% to 2.5%, and with adequate treatment this is less than 1%. However, those who develop significantly low blood pressure may have a fatality rate of up to 26%. The risk of death among children less than five years old is four times greater than among those over the age of 10. Elderly people are also at higher risk of a poor outcome

17 Measles

Measles is a highly contagious infectious disease caused by the measles virus. Symptoms usually develop 10–12 days after exposure to an infected person and last 7–10 days. Initial symptoms typically include fever, often greater than 40 °C (104 °F), cough, runny nose, and inflamed eyes. Small white spots known as Koplik's spots may form inside the mouth two or three days after the start of symptoms. A red, flat rash which usually starts on the face and then spreads to the rest of the body typically begins three to five days after the start of symptoms. Common complications include diarrhea (in 8% of cases), middle ear infection (7%), and pneumonia (6%). These occur in part due to measles-induced immunosuppression.

Less commonly seizures, blindness, or inflammation of the brain may occur. Other names include morbilli, rubeola, red measles, and English measles. Both rubella, also known as "German measles", and roseola are different diseases caused by unrelated viruses. Measles is an airborne disease which spreads easily through the coughs and sneezes of infected people. It may also be spread through direct contact with mouth or nasal secretions. It is extremely contagious–nine out of ten people who are not immune and share living space with an infected person will be infected. People are infectious to others from four days before to four days after the start of the rash. Most people do not get the disease more than once. Testing for the measles virus in suspected cases is important for public health efforts.

Sources

Measles is caused by the measles virus, a single-stranded, negative-sense, enveloped RNA virus of the genus Morbillivirus within the family Paramyxoviridae.

The virus is highly contagious and is spread by coughing and sneezing via close personal contact or direct contact with secretions. Measles is the most contagious transmissible virus known. It remains infective for up to two hours in that airspace or nearby surfaces. Measles is so contagious that if one person has it, 90% of nearby non-immune people will also become infected. Humans are the only natural hosts of the virus, and no other animal reservoirs are known to exist.

Risk factors for measles virus infection include immunodeficiency caused by HIV or AIDS, immunosuppression following receipt of an organ or a stem cell transplant, alkylating agents, or corticosteroid therapy, regardless of immunization status; travel to areas where measles commonly occurs or contact with travelers from such an area; and the loss of passive, inherited antibodies before the age of routine immunization.

Symptoms

Symptoms typically begin 10–14 days after exposure. The classic symptoms include a four-day fever (the 4 D's) and the three C's—cough, coryza (head cold, fever, sneezing), and conjunctivitis (red eyes)—along with a maculopapular rash. Fever is common and typically lasts for about one week; the fever seen with measles is often as high as 40 °C (104 °F).

Koplik's spots seen inside the mouth are diagnostic for measles, but are temporary and therefore rarely seen. Koplik spots are small white spots that are commonly seen on the inside of the cheeks opposite the molars. They appear as "grains of salt on a reddish background." Recognizing these spots before a person reaches their maximum infectiousness can help reduce the spread of the disease.

The characteristic measles rash is classically described as a generalized red maculopapular rash that begins several days after the fever starts. It starts on the back of the ears and, after a few hours, spreads to the head and neck before spreading to cover most of the body, often causing itching. The measles rash appears two to four days after the initial symptoms and lasts for up to eight days. The rash is said to "stain", changing color from red to dark brown, before disappearing. Overall, measles usually resolves after about three weeks.

Prevention

Mothers who are immune to measles pass antibodies to their children while they are still in the womb, especially if the mother acquired immunity through infection rather than vaccination. Such antibodies will usually give newborn infants some immunity against measles, but these antibodies are gradually lost over the course of the first nine months of life.Infants under one year of age whose maternal anti-measles antibodies have disappeared become susceptible to infection with the measles virus.

In developed countries, it is recommended that children be immunized against measles at 12 months, generally as part of a three-part MMR vaccine (measles, mumps, and rubella). The vaccine is generally not given before this age because such infants respond inadequately to the vaccine due to an immature immune system. A second dose of the vaccine is usually given to children between the ages of four and five, to increase rates of immunity. Measles vaccines have been given to over a billion people. Vaccination rates have been high enough to make measles relatively uncommon. Adverse reactions to vaccination are rare, with fever and pain at the injection site being the most common. Life-threatening adverse reactions occur in less than one per million vaccinations (<0.0001%).

ILLNESS | Viral | Measles | Prevention

In developing countries where measles is common, the World Health Organization (WHO) recommends two doses of vaccine be given, at six and nine months of age. The vaccine should be given whether the child is HIV-infected or not. The vaccine is less effective in HIV-infected infants than in the general population, but early treatment with antiretroviral drugs can increase its effectiveness. Measles vaccination programs are often used to deliver other child health interventions as well, such as bed nets to protect against malaria, antiparasite medicine and vitamin A supplements, and so contribute to the reduction of child deaths from other causes. The Advisory Committee on Immunization Practices (ACIP) recommends that all adult international travelers who do not have positive evidence of previous measles immunity receive two doses of MMR vaccine before traveling. Those born in the United States before 1957 are presumed to be immune because they would have had the disease in their childhood before any vaccination was available.

There have been false claims of an association between the measles vaccine and autism; this incorrect concern has reduced the rate of vaccination and increased the number of cases of measles where immunization rates became too low to maintain herd immunity. Additionally, there have been false claims that measles infection protects against cancer. A form of passive immunization could be effective up to the seventh day after exposure. Compared to no treatment, the risk of infection was reduced by 76%; however, the effectiveness is not clear in comparison to active measles vaccine.

Treatment

There is no specific antiviral treatment if measles develops. Instead the medications are generally aimed at treating superinfections, maintaining good hydration with adequate fluids, and pain relief. Some groups, like young children and the severely malnourished, are also given vitamin A, which act as an immunomodulator that boosts the antibody responses to measles and decreases the risk of serious complications.

Medications
Treatment is supportive, with ibuprofen or paracetamol (acetaminophen) to reduce fever and pain and, if required, a fast-acting medication to dilate the airways for cough. As for aspirin, some research has suggested a correlation between children who take aspirin and the development of Reye syndrome.

The use of vitamin A during treatment is recommended to decrease the risk of blindness; however, it does not prevent or cure the disease. A systematic review of trials into its use found no reduction in overall mortality, but two doses (200 000 IU) of vitamin A was shown to reduce mortality for measles in children younger than two years of age. It is unclear if zinc supplementation in children with measles affects outcomes as it has not been sufficiently studied.

Notes

Most people survive measles, though in some cases, complications may occur. About 1 in 4 individuals will be hospitalized and 1–2 in 1000 will die. Complications are more likely in children under age 5 and adults over age 20. Pneumonia is the most common fatal complication of measles infection and accounts for 56-86% of measles-related deaths.

Possible consequences of measles virus infection include laryngotracheobronchitis, sensorineural hearing loss, and—in about 1 in 10,000 to 1 in 300,000 cases—panencephalitis, which is usually fatal. Acute measles encephalitis is another serious risk of measles virus infection. It typically occurs two days to one week after the measles rash breaks out and begins with very high fever, severe headache, convulsions and altered mentation. A person with measles encephalitis may become comatose, and death or brain injury may occur. For people having had measles, it is rare to ever have a symptomatic reinfection.

The measles virus can kill cells that make antibodies, and thus weakens the immune system which can cause deaths from other diseases. Suppression of the immune system by measles lasts about two years and has been epidemiologically implicated in up to 90% of childhood deaths in third world countries, and historically may have caused rather more deaths in the United States, the UK and Denmark than were directly caused by measles.

18 Meningitis (Viral)

See the full meningitis section in 'Bacterial'.

19 Mumps

Mumps is a viral disease caused by the mumps virus. Initial signs and symptoms often include fever, muscle pain, headache, poor appetite, and feeling generally unwell. This is then usually followed by painful swelling of one or both parotid salivary glands. Symptoms typically occur 16 to 18 days after exposure and resolve after 7 to 10 days. Symptoms are often more severe in adults than in children. About a third of people have mild or no symptoms. Complications may include meningitis (15%), pancreatitis (4%), inflammation of the heart, permanent deafness, and testicular inflammation, which uncommonly results in infertility. Women may develop ovarian swelling, but this does not increase the risk of infertility.

Mumps is highly contagious and spreads rapidly among people living in close quarters. The virus is transmitted by respiratory droplets or direct contact with an infected person. Only humans get and spread the disease. People are infectious from about 7 days before onset of parotid inflammation to about 8 days after. Once an infection has run its course, a person is typically immune for life. Reinfection is possible, but the ensuing infection tends to be mild. Diagnosis is usually suspected due to parotid swelling and can be confirmed by isolating the virus on a swab of the parotid duct. Testing for IgM antibodies in the blood is simple and may be useful; however, it can be falsely negative in those who have been immunized.

Sources

The mumps virus is an enveloped, single-stranded, linear negative-sense RNA virus of the genus Orthorubulavirus and family Paramyxovirus. The genome consists of 15,384 bases encoding nine proteins. Proteins involved in viral replication are the nucleoprotein, phosphoprotein, and polymerase protein while the genomic RNA forms the ribonucleocapsid. Humans are the only natural host for the virus.

Mumps is spread from person to person through contact with respiratory secretions, such as saliva from an infected person. When an infected person coughs or sneezes, the droplets aerosolize and can enter the eyes, nose, or mouth of another person. Mumps can also be spread by sharing eating utensils or cups. The virus can also survive on surfaces and then be spread after contact in a similar manner. A person infected with mumps is contagious from around 7 days before the onset of symptoms until about 8 days after symptoms start. The incubation period (time until symptoms begin) can be from 12–25 days, but is typically 16–18 days. About 20-40% of persons infected with the mumps virus do not show symptoms, so being infected and spreading the virus without knowing it is possible.

Symptoms

Mumps is usually preceded by a set of prodromal symptoms, including low-grade fever, headache, and feeling generally unwell. This is followed by progressive swelling of one or both parotid glands. Parotid gland swelling usually lasts about a week. Other symptoms of mumps can include dry mouth, sore face and/or ears, and difficulty speaking.

ILLNESS | Viral | Mumps | Symptoms

Complications

- Painful testicular inflammation develops in 15–40% of men who have completed puberty and contract the mumps virus. This testicular inflammation is generally one-sided (both testicles are swollen in 15–30% of mumps orchitis cases) and typically occurs about 10 days after the parotid gland becomes inflamed. Testicular swelling has been documented as late as 6 weeks after parotid-gland swelling. Decreased fertility is an uncommon consequence of testicular inflammation from mumps and infertility is rare.
- Studies have reached differing conclusions regarding whether infection with the mumps virus during pregnancy leads to an increased rate of spontaneous abortion.
- Before vaccination, about 10% of cases of aseptic meningitis were due to mumps. The symptoms generally resolve within 10 days. Infection of the brain itself (encephalitis) occurs in between 0.02 and 0.3% of cases.
- Ovarian inflammation occurs in about 5% percent of adolescent and adult females.

- Deafness is one of the most serious complications of mumps and occurs in 4% of cases. Profound (91 decibel or more) but rare sensorineural hearing loss can occur, which can affect one or both ears. Deafness affecting only one ear occurs in about 0.005% of cases.
- Acute pancreatic inflammation occurs in about 4% of cases, manifesting as abdominal pain and vomiting.
- Brain inflammation is very rare, and fatal in about 1% of the cases when it occurs.

Prevention

ILLNESS | Viral | Mumps | Prevention

The most common preventive measure against mumps is a vaccination with a mumps vaccine, developed by American microbiologist Maurice Hilleman at Merck. The vaccine may be given separately or as part of the MMR vaccine or MMRV vaccine. The World Health Organization (WHO) recommends the use of mumps vaccines in all countries with well-functioning childhood vaccination programmes. In the United Kingdom, they are routinely given to children at age 13 months with a booster at 3–5 years (preschool). The American Academy of Pediatrics recommends the routine administration of MMR vaccine at ages 12–15 months and at 4–6 years.

In some locations, the vaccine is given again between 4 and 6 years of age, or between 11 and 12 years of age if not previously given. The efficacy of the vaccine depends on its strain, but is usually around 80%. The Jeryl Lynn strain is most commonly used in developed countries, but has been shown to have reduced efficacy in epidemic situations. The Leningrad-Zagreb strain commonly used in developing countries appears to have superior efficacy in epidemic situations.

Because of the outbreaks within college and university settings, many governments have established vaccination programs to prevent large-scale outbreaks. In Canada, provincial governments and the Public Health Agency of Canada have all participated in awareness campaigns to encourage students ranging from grade one to college and university to get vaccinated.

Treatment

ILLNESS | Mumps | Treatment

The treatment of mumps is supportive. Symptoms may be relieved by the application of intermittent ice or heat to the affected neck/testicular area and by acetaminophen for pain relief. Warm saltwater gargles, soft foods, and extra fluids may also help relieve symptoms. Acetylsalicylic acid (aspirin) is not used to treat children due to the risk of Reye syndrome.

No effective postexposure recommendation is made to prevent secondary transmission, nor is the postexposure use of vaccine or immunoglobulin effective. Also, no available evidence regarding the Chinese herbal medicine.

Mumps is considered most contagious in the 5 days after the onset of symptoms, and isolation is recommended during this period. In someone who has been admitted to the hospital, standard and droplet precautions are needed. People who work in healthcare cannot work for 5 days.

20 MERS

ILLNESS | Viral | MERS

Middle East respiratory syndrome (MERS), also known as camel flu, is a viral respiratory infection caused by the MERS-coronavirus (MERS-CoV). Symptoms may range from mild to severe. They include fever, cough, diarrhea, and shortness of breath. Disease is typically more severe in those with other health problems. Mortality is about one-third of diagnosed cases.

MERS-CoV is a betacoronavirus derived from bats. Camels have been shown to have antibodies to MERS-CoV but the exact source of infection in camels has not been identified. Camels are believed to be involved in its spread to humans but it is unclear how. Spread between humans typically requires close contact with an infected person. Its spread is uncommon outside of hospitals. Thus, its risk to the global population is currently deemed to be fairly low. As of 2019 there was no specific vaccine or treatment for the disease; a number of antiviral medications were being studied. The World Health Organization recommends that those who come in contact with camels wash their hands frequently and do not touch sick camels, and that camel-based food products be appropriately cooked. Treatments that help with the symptoms may be given to those infected.

Sources

ILLNESS | MERS | Sources

Middle East respiratory syndrome is caused by the MERS coronavirus (MERS-CoV), a species with single-stranded RNA belonging to the genus betacoronavirus which is distinct from SARS coronavirus and the common-cold coronavirus. Its genomes are phylogenetically classified into two clades, Clades A and B. Early cases of MERS were of Clade A clusters (EMC/2012 and Jordan-N3/2012) while new cases are genetically different in general (Clade B). The virus grows readily on Vero cells and LLC-MK2 cells. In November 2012, Egyptian virologist Dr. Ali Zaki sent a virus sample from the first confirmed case in Saudi Arabia to virologist Ron Fouchier, a leading coronavirus researcher at the Erasmus Medical Center (EMC) in Rotterdam, The Netherlands. The second laboratory-proven case was in London, confirmed by the UK Health Protection Agency (HPA). The HPA named the virus the London1_novel CoV 2012.

ILLNESS | MERS | Sources

Camels

A study performed between 2010 and 2013, in which the incidence of MERS was evaluated in 310 dromedary camels, revealed high titers of neutralizing antibodies to MERS-CoV in the blood serum of these animals. A further study sequenced MERS-CoV from nasal swabs of dromedary camels in Saudi Arabia and found they had sequences identical to previously sequenced human isolates. Some individual camels were also found to have more than one genomic variant in their nasopharynx. There is also a report of a Saudi Arabian man who became ill seven days after applying topical medicine to the noses of several sick camels and later he and one of the camels were found to have identical strains of MERS-CoV. It is still unclear how the virus is transmitted from camels to humans. The World Health Organization advises avoiding contact with camels and to eat only fully cooked camel meat, pasteurized camel milk, and to avoid drinking camel urine. The Saudi Ministry of Agriculture has advised people to avoid contact with camels or wear breathing masks when around them. In response "some people have refused to listen to the government's advice" and kiss their camels in defiance of their government's advice.

ILLNESS | Viral | MERS

Between People

There has been evidence of limited, but not sustained spread of MERS-CoV from person to person, both in households as well as in health care settings like hospitals. Most transmission has occurred "in the circumstances of close contact with severely ill persons in healthcare or household settings" and there is no evidence of transmission from asymptomatic cases. Cluster sizes have ranged from 1 to 26 people, with an average of 2.7.

Symptoms

ILLNESS Viral MERS Symptoms

Early reports compared the viruses to severe acute respiratory syndrome (SARS), and it has been referred to as Saudi Arabia's SARS-like virus. The first person, in June 2012, had a fever, cough, expectoration, and shortness of breath. One review of 47 laboratory confirmed cases in Saudi Arabia gave the most common presenting symptoms as fever in 98%, cough in 83%, shortness of breath in 72% and myalgia in 32% of people. There were also frequent gastrointestinal symptoms with diarrhea in 26%, vomiting in 21%, abdominal pain in 17% of people. 72% of people required mechanical ventilation. There were also 3.3 males for every female. One study of a hospital-based outbreak of MERS had an estimated incubation period of 5.5 days (95% confidence interval 1.9 to 14.7 days). MERS can range from asymptomatic disease to severe pneumonia leading to acute respiratory distress syndrome (ARDS). Kidney failure, disseminated intravascular coagulation (DIC), and pericarditis have also been reported.

Prevention

While the mechanism of spread of MERS-CoV is currently not known, based on experience with prior coronaviruses, such as SARS, the WHO currently recommends that all individuals coming into contact with MERS suspects should (in addition to standard precautions):
● Wear a medical mask
● Wear eye protection (i.e. goggles or a face shield)
● Wear a clean, non sterile, long sleeved gown; and gloves (some procedures may require sterile gloves)
● Perform hand hygiene before and after contact with the person and his or her surroundings and immediately after removal of personal protective equipment (PPE)

For procedures which carry a risk of aerosolization, such as intubation, the WHO recommends that care providers also:
● Wear a particulate respirator and, when putting on a disposable particulate respirator, always check the seal
● Wear eye protection (i.e. goggles or a face shield)
● Wear a clean, non-sterile, long-sleeved gown and gloves (some of these procedures require sterile gloves)
● Wear an impermeable apron for some procedures with expected high fluid volumes that might penetrate the gown
● Perform procedures in an adequately ventilated room; i.e. minimum of 6 to 12 air changes per hour in facilities with a mechanically ventilated room and at least 60 liters/second/patient in facilities with natural ventilation
● Limit the number of persons present in the room to the absolute minimum required for the person's care and support
● Perform hand hygiene before and after contact with the person and his or her surroundings and after PPE removal.

The duration of infectivity is also unknown so it is unclear how long people must be isolated, but current recommendations are for 24 hours after resolution of symptoms. In the SARS outbreak the virus was not cultured from people after the resolution of their symptoms.

Treatment

As of 2020 there is no specific vaccine or treatment for the disease. Using extra-corporeal membrane oxygenation (ECMO) seems to improve outcomes significantly. Neither the combination of antivirals and interferons (ribavirin + interferon alfa-2a or interferon alfa-2b) nor corticosteroids improved outcomes.

21 MERS-CoV

ILLNESS Viral MERS-CoV

Middle East respiratory syndrome-related coronavirus (MERS-CoV), or EMC/2012 (HCoV-EMC/2012), is a novel positive-sense, single-stranded RNA virus of the genus Betacoronavirus. Initially called novel coronavirus 2012 or simply novel coronavirus, it was first reported in 2012 after genome sequencing of a virus isolated from sputum samples from a person who fell ill in a 2012 outbreak of a new flu.

As of July 2015, MERS-CoV cases have been reported in over 21 countries, including Saudi Arabia, Jordan, Qatar, Egypt, the United Arab Emirates, Kuwait, Turkey, Oman, Algeria, Bangladesh, Indonesia (none were confirmed), Austria, the United Kingdom, South Korea, the United States, Mainland China, Thailand, and the Philippines. MERS-CoV is one of several viruses identified by WHO as a likely cause of a future epidemic. They list it for urgent research and development.

Sources

The virus appears to have originated in bats. The virus itself has been isolated from a bat. This virus is closely related to the Tylonycteris bat coronavirus HKU4 and Pipistrellus bat coronavirus HKU5. Serological evidence shows that these viruses have infected camels for at least 20 years. The most recent common ancestor of several human strains has been dated to March 2012 (95% confidence interval December 2011 to June 2012).

It is thought that the viruses have been present in bats for some time and had spread to camels by the mid-1990s. The viruses appear to have spread from camels to humans in the early 2010s. The original bat host species and the time of initial infection in this species has yet to be determined. Examination of the sequences of 238 isolates suggested that this virus has evolved into three clades differing in codon usage, host, and geographic distribution.

Symptoms

It is possible for MERS to be symptomless, and early research has shown that up to 20% of cases show no signs of active infection but have MERS-CoV antibodies in their blood.

Prevention

● Wash your hands often with soap and water for at least 20 seconds, and help young children do the same. If soap and water are not available, use an alcohol-based hand sanitizer.
● Cover your nose and mouth with a tissue when you cough or sneeze, then throw the tissue in the trash.
● Avoid touching your eyes, nose, and mouth with unwashed hands.
● Avoid personal contact, such as kissing, or sharing cups or eating utensils, with sick people.
● Clean and disinfect frequently touched surfaces and objects, such as doorknobs.

Treatment

Treatment includes rest, fluids, pain relievers and oxygen therapy in severe cases. Analgesics.

22 Monkeypox

Monkeypox is an infectious disease caused by the monkeypox virus that can occur in certain animals including humans. Symptoms begin with fever, headache, muscle pains, swollen lymph nodes, and feeling tired. This is followed by a rash that forms blisters and crusts over. The time from exposure to onset of symptoms is around 10 days. The duration of symptoms is typically 2 to 5 weeks.

Monkeypox may be spread from handling bush meat, an animal bite or scratch, body fluids, contaminated objects, or close contact with an infected person. The virus is believed to normally circulate among certain rodents in Africa. Diagnosis can be confirmed by testing a lesion for the virus's DNA. The disease can appear similar to chickenpox.

The smallpox vaccine is believed to prevent infection. In 2019 a vaccine was approved for the disorder in the United States. There is no known cure. Cidofovir or brincidofovir may be useful. The risk of death in those infected is up to 10%.

Sources

Monkeypox virus causes the disease in both humans and animals. It was first identified in 1958 as a pathogen of crab-eating macaque monkeys (Macaca fascicularis) being used as laboratory animals. The crab-eating macaque is often used for neurological experiments. Monkeypox virus is an Orthopoxvirus, a genus of the family Poxviridae that contains other viral species that target mammals. The virus is found mainly in tropical rainforest regions of Central and West Africa. The virus was first discovered in monkeys (hence the name) in 1958, and in humans in 1970. Between 1970 and 1986, over 400 cases in humans were reported.

Small viral outbreaks with a death rate in the range of 10% and a secondary human-to-human infection rate of about the same amount occur routinely in equatorial Central and West Africa. The primary route of infection is thought to be contact with the infected animals or their bodily fluids. The first reported outbreak outside of the African continent occurred in the United States in 2003 in the Midwestern states of Illinois, Indiana, and Wisconsin, with one occurrence in New Jersey. The outbreak was traced to a prairie dog infected from an imported Gambian pouch rat. No deaths occurred.

Humans can be infected by an animal via a bite, or by direct contact with an infected animal's bodily fluids. The virus can also spread from human to human, by respiratory (airborne) contact or by contact with an infected person's bodily fluids. Risk factors for transmission include sharing a bed or room, or using the same utensils as an infected person. An increased transmission risk is associated with factors involving introduction of virus to the oral mucosa. The incubation period is 10–14 days.

Prodromal symptoms include swelling of lymph nodes, muscle pain, headache, and fever prior to the emergence of the rash. The rash is usually only present on the trunk, but may spread to the palms and soles of the feet in a centrifugal distribution. The initial macular lesions exhibit a papular, then vesicular and pustular appearance.

Symptoms

Monkeypox is similar to smallpox, although it is often milder. Limited person-to-person spread of infection has been reported in disease-endemic areas in Africa.

Prevention

The smallpox vaccine is the only known way to prevent smallpox in an exposed person. If given within 4 days of viral exposure, the vaccine can prevent or significantly lessen the severity of smallpox symptoms. Vaccination 4-7 days after exposure may offer some protection from the disease and may lessen its severity. Vaccination against smallpox is assumed to provide protection against human monkeypox infection, because they are closely related viruses and the vaccine protects animals from experimental lethal monkeypox challenge. This has not been conclusively demonstrated in humans, because routine smallpox vaccination was discontinued following the apparent eradication of smallpox and owing to safety concerns with the vaccine.

Smallpox vaccine has been reported to reduce the risk of monkeypox among previously vaccinated persons in Africa. The decrease in immunity to poxviruses in exposed populations is a factor in the prevalence of monkeypox. It is attributed both to waning cross-protective immunity among those vaccinated before 1980 when mass smallpox vaccinations were discontinued, and to the gradually increasing proportion of unvaccinated individuals.

The United States Centers for Disease Control and Prevention (CDC) recommends that persons investigating monkeypox outbreaks and involved in caring for infected individuals or animals should receive a smallpox vaccination to protect against monkeypox. Persons who have had close or intimate contact with individuals or animals confirmed to have monkeypox should also be vaccinated. The CDC does not recommend pre-exposure vaccination for unexposed veterinarians, veterinary staff, or animal control officers, unless such persons are involved in field investigations.

Treatment

Currently, no treatment for monkeypox has been shown to be effective or safe. A number of measures may be used to try to decrease spread of the disease including the smallpox vaccine, cidofovir, and vaccinia immune globulin (VIG).

23 Nipah Virus

Nipah virus infection is a viral infection caused by the Nipah virus. Symptoms from infection vary from none to fever, cough, headache, shortness of breath, and confusion. This may worsen into a coma over a day or two. Complications can include inflammation of the brain and seizures following recovery. The Nipah virus is a type of RNA virus in the genus Henipavirus. It can both spread between people and from other animals to people. Spread typically requires direct contact with an infected source. The virus normally circulates among specific types of fruit bats. Diagnosis is based on symptoms and confirmed by laboratory testing.

Management involves supportive care. As of 2018 there is no vaccine or specific treatment. Prevention is by avoiding exposure to bats and sick pigs and not drinking raw date palm sap. As of May 2018 about 700 human cases of Nipah virus are estimated to have occurred and 50 to 75 percent of those who were infected died.

Sources

Nipah virus has been isolated from Lyle's flying fox (Pteropus lylei) in Cambodia and viral RNA found in urine and saliva from P. lylei and Horsfield's roundleaf bat (Hipposideros larvatus) in Thailand. Infective virus has also been isolated from environmental samples of bat urine and partially eaten fruit in Malaysia. Antibodies to henipaviruses have also been found in fruit bats in Madagascar (Pteropus rufus, Eidolon dupreanum) and Ghana (Eidolon helvum) indicating a wide geographic distribution of the viruses. No infection of humans or other species have been observed in Cambodia, Thailand or Africa as of May 2018.

Symptoms

Infected people initially develop symptoms including fever, headaches, myalgia (muscle pain), vomiting and sore throat. This can be followed by dizziness, drowsiness, altered consciousness, and neurological signs that indicate acute encephalitis.

Prevention

ILLNESS Viral Nipah Virus

- Practice handwashing regularly with soap and water.
- Avoid contact with sick bats or pigs.
- Avoid areas where bats are known to roost.
- Avoid consumption of raw date palm sap.
- Avoid consumption of fruits that may be contaminated by bats.
- Avoid contact with the blood or body fluids of any person known to be infected with NiV.

Treatment

Currently there are no licensed treatments available for Nipah virus (NiV) infection. Treatment is limited to supportive care, including rest, hydration, and treatment of symptoms as they occur.

24 Rabies

Rabies is a viral disease that causes inflammation of the brain in humans and other mammals. Early symptoms can include fever and tingling at the site of exposure. These symptoms are followed by one or more of the following symptoms: violent movements, uncontrolled excitement, fear of water, an inability to move parts of the body, confusion, and loss of consciousness. Once symptoms appear, the result is nearly always death. The time period between contracting the disease and the start of symptoms is usually one to three months, but can vary from less than one week to more than one year. The time depends on the distance the virus must travel along peripheral nerves to reach the central nervous system.

Rabies is caused by lyssaviruses, including the rabies virus and Australian bat lyssavirus. It is spread when an infected animal scratches or bites a human or other animal. Saliva from an infected animal can also transmit rabies if the saliva comes into contact with the eyes, mouth, or nose. Globally, dogs are the most common animal involved. In countries where dogs commonly have the disease, more than 99% of rabies cases are the direct result of dog bites. In the Americas, bat bites are the most common source of rabies infections in humans, and less than 5% of cases are from dogs. Rodents are very rarely infected with rabies. The disease can be diagnosed only after the start of symptoms.

Sources

Rabies is caused by a number of lyssaviruses including the rabies virus and Australian bat lyssavirus. Duvenhage lyssavirus may cause a rabies-like infection. All warm-blooded species, including humans, may become infected with the rabies virus and develop symptoms. Birds were first artificially infected with rabies in 1884; however, infected birds are largely, if not wholly, asymptomatic, and recover. Other bird species have been known to develop rabies antibodies, a sign of infection, after feeding on rabies-infected mammals.

The virus has also adapted to grow in cells of cold-blooded vertebrates. Most animals can be infected by the virus and can transmit the disease to humans. Infected bats, monkeys, raccoons, foxes, skunks, cattle, wolves, coyotes, dogs, cats, and mongooses (normally either the small Asian mongoose or the yellow mongoose) present the greatest risk to humans.

Rabies may also spread through exposure to infected bears, domestic farm animals, groundhogs, weasels, and other wild carnivorans. However, lagomorphs, such as hares and rabbits, and small rodents such as chipmunks, gerbils, guinea pigs, hamsters, mice, rats, and squirrels, are almost never found to be infected with rabies and are not known to transmit rabies to humans. Bites from mice, rats, or squirrels rarely require rabies prevention because these rodents are typically killed by any encounter with a larger, rabid animal, and would, therefore, not be carriers. The Virginia opossum is resistant but not immune to rabies.

The virus is usually present in the nerves and saliva of a symptomatic rabid animal. The route of infection is usually, but not always, by a bite. In many cases, the infected animal is exceptionally aggressive, may attack without provocation, and exhibits otherwise uncharacteristic behavior. This is an example of a viral pathogen modifying the behavior of its host to facilitate its transmission to other hosts. After a typical human infection by bite, the virus enters the peripheral nervous system.

It then travels along the afferent nerves toward the central nervous system. During this phase, the virus cannot be easily detected within the host, and vaccination may still confer cell-mediated immunity to prevent symptomatic rabies. When the virus reaches the brain, it rapidly causes encephalitis, the prodromal phase, which is the beginning of the symptoms. Once the patient becomes symptomatic, treatment is almost never effective and mortality is over 99%. Rabies may also inflame the spinal cord, producing transverse myelitis.

Although it is theoretically possible for rabies-infected humans to transmit it to others by biting or otherwise, no such cases have ever been documented, since infected humans are usually hospitalized and necessary precautions taken. Casual contact, such as touching a person with rabies or contact with non-infectious fluid or tissue (urine, blood, feces) does not constitute an exposure and does not require post-exposure prophylaxis. But as the virus is present in sperm and vaginal secretions, it might be possible for rabies to spread through sex. There are only a handful of recorded cases of human-to-human transmission of rabies, and all occurred through organ transplants from infected donors.

Symptoms

The period between infection and the first symptoms (incubation period) is typically 1–3 months in humans. This period may be as short as four days or longer than six years, depending on the location and severity of the wound and the amount of virus introduced. Initial symptoms of rabies are often nonspecific such as fever and headache. As rabies progresses and causes inflammation of the brain and meninges, symptoms can include slight or partial paralysis, anxiety, insomnia, confusion, agitation, abnormal behavior, paranoia, terror, and hallucinations. The person may also have fear of water.

The symptoms eventually progress to delirium, and coma. Death usually occurs 2 to 10 days after first symptoms. Survival is almost unknown once symptoms have presented, even with intensive care.

Fear of Water
Hydrophobia ("fear of water") is the historic name for rabies. It refers to a set of symptoms in the later stages of an infection in which the person has difficulty swallowing, shows panic when presented with liquids to drink, and cannot quench their thirst. Any mammal infected with the virus may demonstrate hydrophobia. Saliva production is greatly increased, and attempts to drink, or even the intention or suggestion of drinking, may cause excruciatingly painful spasms of the muscles in the throat and larynx. Since the infected individual cannot swallow saliva and water, the virus has a much higher chance of being transmitted, since it multiplies and assimilates in the salivary glands and is transmitted through biting. Hydrophobia is commonly associated with furious rabies, which affects 80% of rabies-infected people. The remaining 20% may experience a paralytic form of rabies that is marked by muscle weakness, loss of sensation, and paralysis; this form of rabies does not usually cause fear of water.

Prevention

Almost all human exposure to rabies was fatal until a vaccine was developed in 1885 by Louis Pasteur and Émile Roux. Their original vaccine was harvested from infected rabbits, from which the virus in the nerve tissue was weakened by allowing it to dry for five to ten days. Similar nerve tissue-derived vaccines are still used in some countries, as they are much cheaper than modern cell culture vaccines.

The human diploid cell rabies vaccine was started in 1967. Less expensive purified chicken embryo cell vaccine and purified vero cell rabies vaccine are now available. A recombinant vaccine called V-RG has been used in Belgium, France, Germany, and the United States to prevent outbreaks of rabies in undomesticated animals. Immunization before exposure has been used in both human and nonhuman populations, where, as in many jurisdictions, domesticated animals are required to be vaccinated.

The Missouri Department of Health and Senior Services Communicable Disease Surveillance 2007 Annual Report states the following can help reduce the risk of contracting rabies:
- Vaccinating dogs, cats, and ferrets against rabies
- Keeping pets under supervision
- Not handling wild animals or strays
- Contacting an animal control officer upon observing a wild animal or a stray, especially if the animal is acting strangely
- If bitten by an animal, washing the wound with soap and water for 10 to 15 minutes and contacting a healthcare provider to determine if post-exposure prophylaxis is required

Treatment

After Exposure
Treatment after exposure can prevent the disease if given within 10 days. The rabies vaccine is 100% effective if given early, and still has a chance of success if delivery is delayed. Every year, more than 15 million people get vaccination after potential exposure. While this works well, the cost is significant. In the US it is recommended people receive one dose of human rabies immunoglobulin (HRIG) and four doses of rabies vaccine over a 14-day period. HRIG is expensive and makes up most of the cost of post exposure treatment, ranging as high as several thousand dollars. As much as possible of this dose should be injected around the bites, with the remainder being given by deep intramuscular injection at a site distant from the vaccination site.

People who have previously been vaccinated against rabies do not need to receive the immunoglobulin, only the postexposure vaccinations on days 0 and 3. The side effects of modern cell-based vaccines are similar to flu shots. The old nerve-tissue-based vaccination required multiple injections into the abdomen with a large needle but is inexpensive. It is being phased out and replaced by affordable World Health Organization intradermal-vaccination regimens.

Intramuscular vaccination should be given into the deltoid, not the gluteal area, which has been associated with vaccination failure due to injection into fat rather than muscle. In children less than a year old, the lateral thigh is recommended. Thoroughly washing the wound as soon as possible with soap and water for approximately five minutes is effective in reducing the number of viral particles. Povidone-iodine or alcohol is then recommended to reduce the virus further.

Awakening to find a bat in the room, or finding a bat in the room of a previously unattended child or mentally disabled or intoxicated person, is an indication for post-exposure prophylaxis (PEP). The recommendation for the precautionary use of PEP in bat encounters where no contact is recognized has been questioned in the medical literature, based on a cost–benefit analysis. However, a 2002 study has supported the protocol of precautionary administering of PEP where a child or mentally compromised individual has been alone with a bat, especially in sleep areas, where a bite or exposure may occur with the victim being unaware.

After Onset
A treatment known as the Milwaukee protocol, which involves putting a person into a chemically induced coma and using antiviral medications, has been proposed but subsequently found not to be useful. It initially came into use in 2003, following Jeanna Giese, a teenager from Wisconsin, becoming the first person known to have survived rabies without preventive treatments before symptom onset. She, however, already had antibodies against rabies when she initially arrived at hospital. While this treatment has been tried multiple times more, there have been no further cases of survival. The protocol has since been assessed as an ineffective treatment with concerns related to the costs and ethics of its use.

25 Rubella (German Measles)

Rubella, also known as German measles or three-day measles, is an infection caused by the rubella virus. This disease is often mild with half of people not realizing that they are infected. A rash may start around two weeks after exposure and last for three days. It usually starts on the face and spreads to the rest of the body. The rash is sometimes itchy and is not as bright as that of measles. Swollen lymph nodes are common and may last a few weeks. A fever, sore throat, and fatigue may also occur. In adults joint pain is common.

Complications may include bleeding problems, testicular swelling, and inflammation of nerves. Infection during early pregnancy may result in a child born with congenital rubella syndrome (CRS) or miscarriage. Symptoms of CRS include problems with the eyes such as cataracts, ears such as deafness, heart, and brain. Problems are rare after the 20th week of pregnancy.

Rubella is usually spread through the air via coughs of people who are infected. People are infectious during the week before and after the appearance of the rash. Babies with CRS may spread the virus for more than a year. Only humans are infected. Insects do not spread the disease. Once recovered, people are immune to future infections. Testing is available that can verify immunity. Diagnosis is confirmed by finding the virus in the blood, throat, or urine. Testing the blood for antibodies may also be useful.

Sources

The disease is caused by rubella virus, a togavirus that is enveloped and has a single-stranded RNA genome. The virus is transmitted by the respiratory route and replicates in the nasopharynx and lymph nodes. The virus is found in the blood 5 to 7 days after infection and spreads throughout the body. The virus has teratogenic properties and is capable of crossing the placenta and infecting the fetus where it stops cells from developing or destroys them. During this incubation period, the patient is contagious typically for about one week before he/she develops a rash and for about one week thereafter.

Increased susceptibility to infection might be inherited as there is some indication that HLA-A1 or factors surrounding A1 on extended haplotypes are involved in virus infection or non-resolution of the disease.

Symptoms

ILLNESS Viral Rubella (German Measles) Symptoms

Rubella has symptoms that are similar to those of flu. However, the primary symptom of rubella virus infection is the appearance of a rash (exanthem) on the face which spreads to the trunk and limbs and usually fades after three days (that is why it is often referred to as three-day measles). The facial rash usually clears as it spreads to other parts of the body. Other symptoms include low grade fever, swollen glands (sub-occipital and posterior cervical lymphadenopathy), joint pains, headache, and conjunctivitis.

The swollen glands or lymph nodes can persist for up to a week and the fever rarely rises above 38 °C (100.4 °F). The rash of rubella is typically pink or light red. The rash causes itching and often lasts for about three days. The rash disappears after a few days with no staining or peeling of the skin. When the rash clears up, the skin might shed in very small flakes where the rash covered it. Forchheimer's sign occurs in 20% of cases, and is characterized by small, red papules on the area of the soft palate.

Rubella can affect anyone of any age. Adult women are particularly prone to arthritis and joint pains.
In children rubella normally causes symptoms which last two days and include:
- Rash beginning on the face which spreads to the rest of the body.
- Low fever of less than 38.3 °C (101 °F).
- Posterior cervical lymphadenopathy.

In older children and adults additional symptoms may be present including:
- Swollen glands
- Coryza (cold-like symptoms)
- Aching joints (especially in young women)

Severe complications of rubella include:
- Brain inflammation (encephalitis)
- Low platelet count
- Ear infection

Prevention

Rubella infections are prevented by active immunisation programs using live attenuated virus vaccines. Two live attenuated virus vaccines, RA 27/3 and Cendehill strains, were effective in the prevention of adult disease. However their use in prepubertal females did not produce a significant fall in the overall incidence rate of CRS in the UK. Reductions were only achieved by immunisation of all children. The vaccine is now usually given as part of the MMR vaccine. The WHO recommends the first dose be given at 12 to 18 months of age with a second dose at 36 months. Pregnant women are usually tested for immunity to rubella early on. Women found to be susceptible are not vaccinated until after the baby is born because the vaccine contains live virus.

The immunisation program has been quite successful. Cuba declared the disease eliminated in the 1990s, and in 2004 the Centers for Disease Control and Prevention announced that both the congenital and acquired forms of rubella had been eliminated from the United States. The World Health Organisation declared Australia rubella free in October 2018. Screening for rubella susceptibility by history of vaccination or by serology is recommended in the United States for all women of childbearing age at their first preconception counseling visit to reduce incidence of congenital rubella syndrome (CRS).

It is recommended that all susceptible non-pregnant women of childbearing age should be offered rubella vaccination. Due to concerns about possible teratogenicity, use of MMR vaccine is not recommended during pregnancy. Instead, susceptible pregnant women should be vaccinated as soon as possible in the postpartum period.

In susceptible people passive immunization, in the form of Polyclonal immunoglobulins appears effective up to the fifth day post-exposure.

Treatment

There is no specific treatment for rubella; however, management is a matter of responding to symptoms to diminish discomfort. Treatment of newborn babies is focused on management of the complications. Congenital heart defects and cataracts can be corrected by direct surgery.

Management for ocular congenital rubella syndrome (CRS) is similar to that for age-related macular degeneration, including counseling, regular monitoring, and the provision of low vision devices, if required.

26 Rift Valley Fever

Rift Valley fever (RVF) is a viral disease that can cause mild to severe symptoms. The mild symptoms may include: fever, muscle pains, and headaches which often last for up to a week. The severe symptoms may include: loss of sight beginning three weeks after the infection, infections of the brain causing severe headaches and confusion, and bleeding together with liver problems which may occur within the first few days. Those who have bleeding have a chance of death as high as 50%.

The disease is caused by the RVF virus, which is of the Phlebovirus type. It is spread by either touching infected animal blood, breathing in the air around an infected animal being butchered, drinking raw milk from an infected animal, or the bite of infected mosquitoes. Animals such as cows, sheep, goats, and camels may be affected. In these animals it is spread mostly by mosquitoes. It does not appear that one person can infect another person. The disease is diagnosed by finding antibodies against the virus or the virus itself in the blood.

Prevention of the disease in humans is accomplished by vaccinating animals against the disease. This must be done before an outbreak occurs because if it is done during an outbreak it may worsen the situation. Stopping the movement of animals during an outbreak may also be useful, as may decreasing mosquito numbers and avoiding their bites. There is a human vaccine; however, as of 2010 it is not widely available. There is no specific treatment and medical efforts are supportive

Sources

The virus is transmitted through mosquito vectors, as well as through contact with the tissue of infected animals. Two species—Culex tritaeniorhynchus and Aedes vexans—are known to transmit the virus. Other potential vectors include Aedes caspius, Aedes mcintosh, Aedes ochraceus, Culex pipiens, Culex antennatus, Culex perexiguus, Culex zombaensis and Culex quinquefasciatus. Contact with infected tissue is considered to be the main source of human infections. The virus has been isolated from two bat species: the Peter's epauletted fruit bat (Micropteropus pusillus) and the aba roundleaf bat (Hipposideros abae), which are believed to be reservoirs for the virus.

Symptoms

ILLNESS | Viral | Rift Valley Fever | Symptoms

In humans, the virus can cause several syndromes. Usually, sufferers have either no symptoms or only a mild illness with fever, headache, muscle pains, and liver abnormalities. In a small percentage of cases (< 2%), the illness can progress to hemorrhagic fever syndrome, meningoencephalitis (inflammation of the brain and tissues lining the brain), or affect the eye. Patients who become ill usually experience fever, generalised weakness, back pain, dizziness, and weight loss at the onset of the illness. Typically, people recover within two to seven days after onset.About 1% of people with the disease die of it. In livestock, the fatality level is significantly higher. Pregnant livestock infected with RVF abort virtually 100% of foetuses. An epizootic (animal disease epidemic) of RVF is usually first indicated by a wave of unexplained abortions.

Other signs in livestock include vomiting and diarrhoea, respiratory disease, fever, lethargy, anorexia and sudden death in young animals.

Prevention

A person's chances of becoming infected can be reduced by taking measures to decrease contact with blood, body fluids, or tissues of infected animals and protection against mosquitoes and other bloodsucking insects. Use of mosquito repellents and bed nets are two effective methods. For persons working with animals in RVF-endemic areas, wearing protective equipment to avoid any exposure to blood or tissues of animals that may potentially be infected is an important protective measure. Potentially, establishing environmental monitoring and case surveillance systems may aid in the prediction and control of future RVF outbreaks.

No vaccines are currently available for humans. While a vaccines have been developed for humans, it has only been used experimentally for scientific personnel in high-risk environments. Trials of a number of vaccines, such as NDBR-103 and TSI-GSD 200, are ongoing. Different types of vaccines for veterinary use are available. The killed vaccines are not practical in routine animal field vaccination because of the need of multiple injections. Live vaccines require a single injection but are known to cause birth defects and abortions in sheep and induce only low-level protection in cattle.

The live-attenuated vaccine, MP-12, has demonstrated promising results in laboratory trials in domesticated animals, but more research is needed before the vaccine can be used in the field. The live-attenuated clone 13 vaccine was recently registered and used in South Africa. Alternative vaccines using molecular recombinant constructs are in development and show promising results. A vaccine has been conditionally approved for use in animals in the US. It has been shown that knockout of the NSs and NSm nonstructural proteins of this virus produces an effective vaccine in sheep as well.

Treatment

There are no FDA-approved treatments for Rift Valley Fever. Because most cases of RVF are mild and self-limiting, a specific treatment for RVF has not been established. Symptoms of mild illness such as fever and body aches can be managed with standard over-the-counter medications.

27 Pappataci Fever (Sandfly Fever)

ILLNESS | Viral | Pappataci Fever (Sandfly Fever) (Phlebotomus Fever)

Pappataci fever (also known as Phlebotomus fever and, somewhat confusingly, sandfly fever and three-day fever) is a vector-borne febrile arboviral infection caused by three serotypes of Phlebovirus. It occurs in subtropical regions of the Eastern Hemisphere. The name, pappataci fever, comes from the Italian word for sandfly, it is the union of the word "pappa" (food) and taci (silent) which distinguishes these insects from blood-feeding mosquitoes, which produce a typical noise while flying.

Sources

Three serotypes of Phlebovirus are known as the causative agents: Naples virus, Sicilian virus and Toscana virus.

Symptoms

A few days after the infective bite, a feeling of lassitude, abdominal distress and chills develop followed by fever of 39 °C to 40 °C, severe frontal headaches, muscle and joint aches, flushing of the face and a fast heart rate. After two days the fever begins to subside and the temperature returns to normal. Fatigue, a slow heart rate and low blood pressure may persist from few days to several weeks but complete recovery is the rule.

Prevention

Prevention of sandfly bites, and control of sandflies and their breeding grounds with insecticides are the principal methods for prevention. Mosquito nets may not be sufficient to prevent sandfly bites.

Treatment

There is no specific treatment for the disease. Pain killers and fluid replacement may be useful.

28 Swine Flu

ILLNESS | Viral | Swine Flu

Swine influenza is an infection caused by any one of several types of swine influenza viruses. Swine influenza virus (SIV) or swine-origin influenza virus (S-OIV) is any strain of the influenza family of viruses that is endemic in pigs. As of 2009, the known SIV strains include influenza C and the subtypes of influenza A known as H1N1, H1N2, H2N1, H3N1, H3N2, and H2N3. The Swine flu was initially seen in humans in Mexico in 2009, where the strain of the particular virus was a mixture from 3 types of strains. Six of the genes are very similar to the H1N2 influenza virus that was found in pigs around 2000. Swine influenza virus is common throughout pig populations worldwide. Transmission of the virus from pigs to humans is not common and does not always lead to human flu, often resulting only in the production of antibodies in the blood. If transmission does cause human flu, it is called zoonotic swine flu. People with regular exposure to pigs are at increased risk of swine flu infection.

Sources

People who work with poultry and swine, especially those with intense exposures, are at increased risk of zoonotic infection with influenza virus endemic in these animals, and constitute a population of human hosts in which zoonosis and reassortment can co-occur. Vaccination of these workers against influenza and surveillance for new influenza strains among this population may therefore be an important public health measure. Transmission of influenza from swine to humans who work with swine was documented in a small surveillance study performed in 2004 at the University of Iowa. This study, among others, forms the basis of a recommendation that people whose jobs involve handling poultry and swine be the focus of increased public health surveillance. Other professions at particular risk of infection are veterinarians and meat processing workers, although the risk of infection for both of these groups is lower than that of farm workers.

Symptoms

Direct transmission of a swine flu virus from pigs to humans is occasionally possible (zoonotic swine flu). In all, 50 cases are known to have occurred since the first report in medical literature in 1958, which have resulted in a total of six deaths. Of these six people, one was pregnant, one had leukemia, one had Hodgkin's lymphoma and two were known to be previously healthy. One of these had unknown whereabouts. Despite these apparently low numbers of infections, the true rate of infection may be higher, since most cases only cause a very mild disease, and will probably never be reported or diagnosed.

According to the United States Centers for Disease Control and Prevention (CDC), in humans the symptoms of the 2009 "swine flu" H1N1 virus are similar to influenza and influenza-like illness in general. Symptoms include fever, cough, sore throat, watery eyes, body aches, shortness of breath, headache, weight loss, chills, sneezing, runny nose, coughing, dizziness, abdominal pain, lack of appetite, and fatigue. The 2009 outbreak showed an increased percentage of patients reporting diarrhea and vomiting as well. The 2009 H1N1 virus is not zoonotic swine flu, as it is not transmitted from pigs to humans, but from person to person through airborne droplets.

Because these symptoms are not specific to swine flu, a differential diagnosis of probable swine flu requires not only symptoms, but also a high likelihood of swine flu due to the person's recent and past medical history. For example, during the 2009 swine flu outbreak in the United States, the CDC advised physicians to "consider swine influenza infection in the differential diagnosis of patients with acute febrile respiratory illness who have either been in contact with persons with confirmed swine flu, or who were in one of the five U.S. states that have reported swine flu cases or in Mexico during the seven days preceding their illness onset." A diagnosis of confirmed swine flu requires laboratory testing of a respiratory sample (a simple nose and throat swab).

The most common cause of death is respiratory failure. Other causes of death are pneumonia (leading to sepsis), high fever (leading to neurological problems), dehydration (from excessive vomiting and diarrhea), electrolyte imbalance and kidney failure. Fatalities are more likely in young children and the elderly.

Prevention

Prevention of swine influenza has three components: prevention in pigs, prevention of transmission to humans, and prevention of its spread among humans. Proper hand washing techniques can prevent the virus from spreading. Avoid touching the eyes, nose, or mouth. Stay away from others who display symptoms of the cold or flu and avoid contact with others when displaying symptoms.

Prevention of Pig-to-Human Transmission
Swine can be infected by both avian and human flu strains of influenza, and therefore are hosts where the antigenic shifts can occur that create new influenza strains.

The transmission from swine to humans is believed to occur mainly in swine farms, where farmers are in close contact with live pigs. Although strains of swine influenza are usually not able to infect humans, it may occasionally happen, so farmers and veterinarians are encouraged to use face masks when dealing with infected animals. The use of vaccines on swine to prevent their infection is a major method of limiting swine-to-human transmission. Risk factors that may contribute to swine-to-human transmission include smoking and, especially, not wearing gloves when working with sick animals, thereby increasing the likelihood of subsequent hand-to-eye, hand-to-nose, or hand-to-mouth transmission.

Prevention of Human-to-Human Transmission
Influenza spreads between humans when infected people cough or sneeze, then other people breathe in the virus or touch something with the virus on it and then touch their own face. "Avoid touching your eyes, nose or mouth. Germs spread this way." Swine flu cannot be spread by pork products, since the virus is not transmitted through food. The swine flu in humans is most contagious during the first five days of the illness, although some people, most commonly children, can remain contagious for up to ten days. Diagnosis can be made by sending a specimen, collected during the first five days, for analysis.

Recommendations to prevent spread of the virus among humans include using standard infection control, which includes frequent washing of hands with soap and water or with alcohol-based hand sanitizers, especially after being out in public. Chance of transmission is also reduced by disinfecting household surfaces, which can be done effectively with a diluted chlorine bleach solution.

Experts agree hand-washing can help prevent viral infections, including ordinary and swine flu infections. Also, avoiding touching one's eyes, nose, or mouth with one's hands helps to prevent the flu. Influenza can spread in coughs or sneezes, but an increasing body of evidence shows small droplets containing the virus can linger on tabletops, telephones, and other surfaces and be transferred via the fingers to the eyes, nose, or mouth. Alcohol-based gel or foam hand sanitizers work well to destroy viruses and bacteria. Anyone with flu-like symptoms, such as a sudden fever, cough, or muscle aches, should stay away from work or public transportation and should contact a doctor for advice.

Social distancing, another tactic, is staying away from other people who might be infected, and can include avoiding large gatherings, spreading out a little at work, or perhaps staying home and lying low if an infection is spreading in a community. Public health and other responsible authorities have action plans which may request or require social distancing actions, depending on the severity of the outbreak.

Treatment

If a person becomes sick with swine flu, antiviral drugs can make the illness milder and make the patient feel better faster. They may also prevent serious flu complications. For treatment, antiviral drugs work best if started soon after getting sick (within two days of symptoms). Beside antivirals, supportive care at home or in a hospital focuses on controlling fevers, relieving pain and maintaining fluid balance, as well as identifying and treating any secondary infections or other medical problems. The U.S. Centers for Disease Control and Prevention recommends the use of oseltamivir (Tamiflu) or zanamivir (Relenza) for the treatment and/or prevention of infection with swine influenza viruses; however, the majority of people infected with the virus make a full recovery without requiring medical attention or antiviral drugs. The virus isolated in the 2009 outbreak have been found resistant to amantadine and rimantadine.

In the U.S., on April 27, 2009, the FDA issued Emergency Use Authorizations to make available Relenza and Tamiflu antiviral drugs to treat the swine influenza virus in cases for which they were currently unapproved. The agency issued these EUAs to allow treatment of patients younger than the current approval allows and to allow the widespread distribution of the drugs, including by volunteers.

29 Tick-Borne Encephalitis

Tick-borne encephalitis (TBE) is a viral infectious disease involving the central nervous system. The disease most often manifests as meningitis, encephalitis, or meningoencephalitis. Long-lasting or permanent neuropsychiatric consequences are observed in 10 to 20% of infected patients. The number of reported cases has been increasing in most countries. TBE is posing a concerning health challenge to Europe, as the number of reported human cases of TBE in all endemic regions of Europe have increased by almost 400% within the last three decades. The tick-borne encephalitis virus is known to infect a range of hosts including ruminants, birds, rodents, carnivores, horses, and humans. The disease can also be spread from animals to humans, with ruminants and dogs providing the principal source of infection for humans.

Sources

TBE is caused by tick-borne encephalitis virus, a member of the genus Flavivirus in the family Flaviviridae. It was first isolated in 1937. Three virus sub-types also exist: European or Western tick-borne encephalitis virus (transmitted by Ixodes ricinus), Siberian tick-borne encephalitis virus (transmitted by I. persulcatus), and Far-Eastern tick-borne encephalitis virus, formerly known as Russian spring summer encephalitis virus (transmitted by I. persulcatus).

Russia and Europe report about 5,000–7,000 human cases annually. The former Soviet Union conducted research on tick-borne diseases, including the TBE viruses.

Symptoms

The disease typically follows a biphasic pattern in 72–87% of patients and the median incubation period is 8 days (range, 4–28 days) after tick bite. Non-specific symptoms of mild fever, malaise, headache, nausea, vomiting and myalgias may be present as first manifestation of the disease and spontaneously resolve within 1 week. After another week the patient may develop neurological symptoms. The virus can result in long neurological symptoms, infecting the brain (encephalitis), the meninges (meningitis) or both (meningoencephalitis). In general, mortality is 1% to 2%, with deaths occurring 5 to 7 days after the onset of neurologic signs.

Prevention

Prevention includes non-specific (tick-bite prevention, tick checks) and specific prophylaxis in the form of a vaccination. Tick-borne encephalitis vaccines are very effective and available in many disease endemic areas and in travel clinics. Trade names are Encepur N and FSME-Immun CC.

Treatment

There is no specific antiviral treatment for TBE. Symptomatic brain damage requires hospitalization and supportive care based on syndrome severity. Anti-inflammatory drugs, such as corticosteroids, may be considered under specific circumstances for symptomatic relief. Tracheal intubation and respiratory support may be necessary.

Notes

In Germany, during the 2010s, there have been a minimum of 95 (2012) and a maximum of 584 cases (2018) of TBE (or FSME as it is known in German). More than half of the reported cases from 2019 had meningitis, encephalitis or myelitis. The risk of infection was noted to be increasing with age, especially in people older than 40 years and it was greater in men than women. Most cases were acquired in Bavaria (46 %) and Baden-Württemberg (37%), much less in Saxonia, Hesse, Niedersachsen and other states. Altogether 164 Landkreise are designated FSME-risk areas, including all of Baden-Württemberg except for the city of Heilbronn.

30 Venezuelan Hemorrhagic Fever

Venezuelan hemorrhagic fever (VHF) is a zoonotic human illness first identified in 1989. The disease is most prevalent in several rural areas of central Venezuela and is caused by Guanarito mammarenavirus (GTOV) which belongs to the Arenaviridae family. The short-tailed cane mouse (Zygodontomys brevicauda) is the main host for GTOV which is spread mostly by inhalation of aerosolized droplets of saliva, respiratory secretions, urine, or blood from infected rodents. Person-to-person spread is possible, but uncommon.

Sources

The short-tailed cane mouse, the main host of GTOV, is native to western Venezuela and resides in large numbers in tall grass, cultivated agricultural fields, human homes, and outbuildings. It is speculated that demographic and ecological changes in the rural areas increased the frequency of contact between humans and infected rodents such that VHF emerged.

Symptoms

VHF has many similarities to Lassa fever and to the arenavirus hemorrhagic fevers that occur in Argentina and Bolivia. It causes fever and malaise followed by hemorrhagic manifestations and convulsions. Some presentations of the virus are also characterized by vascular damage, bleeding diathesis, fever, and multiple organ involvement. Clinical diagnosis of VHF has proven to be difficult based on the nonspecific symptoms. The disease is fatal in 30% of cases and is endemic to Portuguesa state and Barinas state in Venezuela.

Prevention

Treatment and prevention for the VHF virus are limited and there are currently no licensed vaccines available that can act to prevent the disease.

Treatment

Treatment and prevention for the VHF virus are limited and there are currently no licensed vaccines available that can act to prevent the disease. However, once infected, ribavirin, an anti-viral drug given intravenously, is one way to treat VHF.

31 Varicella (Chicken Pox)

Chickenpox, also known as varicella, is a highly contagious disease caused by the initial infection with varicella zoster virus (VZV). The disease results in a characteristic skin rash that forms small, itchy blisters, which eventually scab over. It usually starts on the chest, back, and face. It then spreads to the rest of the body. Other symptoms may include fever, tiredness, and headaches. Symptoms usually last five to seven days. Complications may occasionally include pneumonia, inflammation of the brain, and bacterial skin infections. The disease is often more severe in adults than in children. Symptoms begin 10 to 21 days after exposure to the virus.

Chickenpox is an airborne disease which spreads easily through the coughs and sneezes of an infected person. It may be spread from one to two days before the rash appears until all lesions have crusted over. It may also spread through contact with the blisters. Those with shingles may spread chickenpox to those who are not immune through contact with the blisters. The disease can usually be diagnosed based on the presenting symptom; however, in unusual cases it may be confirmed by polymerase chain reaction (PCR) testing of the blister fluid or scabs. Testing for antibodies may be done to determine if a person is or is not immune. People usually only get chickenpox once. Although reinfections by the virus occur, these reinfections usually do not cause any symptoms.

Sources

Chickenpox is an airborne disease which spreads easily from one person to the next through the coughs and sneezes of an infected person. It may be spread from one to two days before the rash appears until all lesions have crusted over. It may also spread through contact with the blisters. Those with shingles may spread chickenpox to those who are not immune through contact with the blisters.

Symptoms

ILLNESS Viral Varicella (Chicken Pox) Symptoms

The early (prodromal) symptoms in adolescents and adults are nausea, loss of appetite, aching muscles, and headache. This is followed by the characteristic rash or oral sores, malaise, and a low-grade fever that signal the presence of the disease. Oral manifestations of the disease (enanthem) not uncommonly may precede the external rash (exanthem). In children the illness is not usually preceded by prodromal symptoms, and the first sign is the rash or the spots in the oral cavity. The rash begins as small red dots on the face, scalp, torso, upper arms and legs; progressing over 10–12 hours to small bumps, blisters and pustules; followed by umbilication and the formation of scabs.

At the blister stage, intense itching is usually present. Blisters may also occur on the palms, soles, and genital area. Commonly, visible evidence of the disease develops in the oral cavity and tonsil areas in the form of small ulcers which can be painful or itchy or both; this enanthem (internal rash) can precede the exanthem (external rash) by 1 to 3 days or can be concurrent. These symptoms of chickenpox appear 10 to 21 days after exposure to a contagious person. Adults may have a more widespread rash and longer fever, and they are more likely to experience complications, such as varicella pneumonia.

Because watery nasal discharge containing live virus usually precedes both exanthem (external rash) and enanthem (oral ulcers) by 1 to 2 days, the infected person actually becomes contagious one to two days before recognition of the disease. Contagiousness persists until all vesicular lesions have become dry crusts (scabs), which usually entails four or five days, by which time nasal shedding of live virus ceases. The condition usually resolves by itself within a week or two. The rash may, however, last for up to one month.

Chickenpox is rarely fatal, although it is generally more severe in adult men than in women or children. Non-immune pregnant women and those with a suppressed immune system are at highest risk of serious complications. Arterial ischemic stroke (AIS) associated with chickenpox in the previous year accounts for nearly one third of childhood AIS. The most common late complication of chickenpox is shingles (herpes zoster), caused by reactivation of the varicella zoster virus decades after the initial, often childhood, chickenpox infection.

Prevention

ILLNESS Viral Varicella (Chicken Pox) Prevention

Hygiene Measures

The spread of chickenpox can be prevented by isolating affected individuals. Contagion is by exposure to respiratory droplets, or direct contact with lesions, within a period lasting from three days before the onset of the rash, to four days after the onset of the rash. The chickenpox virus is susceptible to disinfectants, notably chlorine bleach (i.e., sodium hypochlorite). Like all enveloped viruses, it is sensitive to drying, heat and detergents.

Vaccine

The varicella vaccine is recommended in many countries. Some countries require the varicella vaccination or an exemption before entering elementary school. A second dose is recommended five years after the initial immunization. A vaccinated person is likely to have a milder case of chickenpox if they become infected. Immunization within three days following household contact reduces infection rates and severity in children.

It is part of the routine immunization schedule in the US. Some European countries include it as part of universal vaccinations in children, but not all countries provide the vaccine. In the UK as of 2014, the vaccine is only recommended in people who are particularly vulnerable to chickenpox. This is to keep the virus in circulation thereby exposing the population to the virus at an early age, when it is less harmful, and to reduce the occurrence of shingles in those who have already had chickenpox by repeated exposure to the virus later in life. In populations that have not been immunized or if immunity is questionable, a clinician may order an enzyme immunoassay. An immunoassay measures the levels of antibodies against the virus that give immunity to a person. If the levels of antibodies are low (low titer) or questionable, reimmunization may be done.

Treatment

ILLNESS Viral Varicella (Chicken Pox) Treatment

Treatment mainly consists of easing the symptoms. As a protective measure, people are usually required to stay at home while they are infectious to avoid spreading the disease to others. Cutting the nails short or wearing gloves may prevent scratching and minimize the risk of secondary infections.

Although there have been no formal clinical studies evaluating the effectiveness of topical application of calamine lotion (a topical barrier preparation containing zinc oxide, and one of the most commonly used interventions), it has an excellent safety profile. It is important to maintain good hygiene and daily cleaning of skin with warm water to avoid secondary bacterial infection. Scratching may also increase the risk of secondary infection.

Paracetamol (acetaminophen) but not aspirin may be used to reduce fever. Aspirin use by someone with chickenpox may cause serious, sometimes fatal disease of the liver and brain, Reye syndrome. People at risk of developing severe complications who have had significant exposure to the virus may be given intra-muscular varicella zoster immune globulin (VZIG), a preparation containing high titres of antibodies to varicella zoster virus, to ward off the disease.

Antivirals are sometimes used.

32 West Nile Fever

ILLNESS Viral West Nile

West Nile fever is an infection by the West Nile virus, which is typically spread by mosquitoes. In about 80% of infections people have few or no symptoms. About 20% of people develop a fever, headache, vomiting, or a rash. In less than 1% of people, encephalitis or meningitis occurs, with associated neck stiffness, confusion, or seizures. Recovery may take weeks to months. The risk of death among those in whom the nervous system is affected is about 10%. West Nile virus (WNV) is usually spread by infected mosquitoes. Mosquitoes become infected when they feed on infected birds, which often carry the disease. Rarely the virus is spread through blood transfusions, organ transplants, or from mother to baby during pregnancy, delivery, or breastfeeding. It otherwise does not spread directly between people.

Risks for severe disease include being over 60 years old and having other health problems. Diagnosis is typically based on symptoms and blood tests. There is no human vaccine. The best way to reduce the risk of infection is to avoid mosquito bites. Mosquito populations may be reduced by eliminating standing pools of water, such as in old tires, buckets, gutters, and swimming pools. When mosquitoes cannot be avoided, mosquito repellent, window screens, and mosquito nets reduce the likelihood of being bitten. There is no specific treatment for the disease; pain medications may reduce symptoms.

Sources

ILLNESS Viral West Nile Fever Sources

The prime method of spread of the West Nile virus (WNV) is the female mosquito. In Europe, cats were identified as being hosts for West Nile virus. The important mosquito vectors vary according to area; in the United States, Culex pipiens (Eastern United States, and urban and residential areas of the United States north of 36–39°N), Culex tarsalis (Midwest and West), and Culex quinquefasciatus (Southeast) are the main vector species.

The mosquito species that are most frequently infected with WNV feed primarily on birds. Different species of mosquitos take a blood meal from different types of vertebrate hosts, Mosquitoes show further selectivity, exhibiting preference for different species of birds. In the United States, WNV mosquito vectors feed preferentially on members of the Corvidae and thrush family. Among the preferred species within these families are the American crow, a corvid, and the American robin (Turdus migratorius).

Some species of birds develop sufficient viral levels (>~104.2 log PFU/ml;) after being infected to transmit the infection to biting mosquitoes that in turn go on to infect other birds. In birds that die from WNV, death usually occurs after 4 to 6 days. In mammals and several species of birds, the virus does not multiply as readily and so does not develop high viremia during infection. Mosquitoes biting such hosts are not believed to ingest sufficient virus to become infected, making them so-called dead-end hosts. As a result of the differential infectiousness of hosts, the feeding patterns of mosquitoes play an important role in WNV transmission, and they are partly genetically controlled, even within a species.

Direct human-to-human transmission initially was believed to be caused only by occupational exposure, such as in a laboratory setting, or conjunctival exposure to infected blood. The US outbreak identified additional transmission methods through blood transfusion, organ transplant, intrauterine exposure, and breast feeding. Since 2003, blood banks in the United States routinely screen for the virus among their donors.

As a precautionary measure, the UK's National Blood Service initially ran a test for this disease in donors who donate within 28 days of a visit to the United States, Canada, or the northeastern provinces of Italy, and the Scottish National Blood Transfusion Service asks prospective donors to wait 28 days after returning from North America or the northeastern provinces of Italy before donating. There also have been reports of possible transmission of the virus from mother to child during pregnancy or breastfeeding or exposure to the virus in a lab, but these are rare cases and not conclusively confirmed.

Recently, the potential for mosquito saliva to affect the course of WNV disease was demonstrated. Mosquitoes inoculate their saliva into the skin while obtaining blood. Mosquito saliva is a pharmacological cocktail of secreted molecules, principally proteins, that can affect vascular constriction, blood coagulation, platelet aggregation, inflammation, and immunity. It clearly alters the immune response in a manner that may be advantageous to a virus. Studies have shown it can specifically modulate the immune response during early virus infection, and mosquito feeding can exacerbate WNV infection, leading to higher viremia and more severe forms of disease.

Symptoms

About 80% of those infected with West Nile virus (WNV) show no symptoms and go unreported. About 20% of infected people develop symptoms. These vary in severity, and begin 3 to 14 days after being bitten. Most people with mild symptoms of WNV recover completely, though fatigue and weakness may last for weeks or months. Symptoms may range from mild, such as fever, to severe, such as paralysis and meningitis. A severe infection can last weeks and can, rarely, cause permanent brain damage. Death may ensue if the central nervous system is affected. Medical conditions such as cancer and diabetes, and age over 60 years, increase the risk of developing severe symptoms.

Headache can be a prominent symptom of WNV fever, meningitis, encephalitis, meningoencephalitis, and it may or may not be present in poliomyelitis-like syndrome. Thus, headache is not a useful indicator of neuroinvasive disease.

- West Nile fever (WNF), which occurs in 20 percent of cases, is a febrile syndrome that causes flu-like symptoms. Most characterizations of WNF describe it as a mild, acute syndrome lasting 3 to 6 days after symptom onset. Systematic follow-up studies of patients with WNF have not been done, so this information is largely anecdotal. Possible symptoms include high fever, headache, chills, excessive sweating, weakness, fatigue, swollen lymph nodes, drowsiness, pain in the joints and flu-like symptoms. There may be gastrointestinal symptoms including nausea, vomiting, loss of appetite, and diarrhea. Fewer than one-third of patients develop a rash.
- West Nile neuroinvasive disease (WNND), which occurs in less than 1 percent of cases, is when the virus infects the central nervous system resulting in meningitis, encephalitis, meningoencephalitis or a poliomyelitis-like syndrome. Many patients with WNND have normal neuroimaging studies, although abnormalities may be present in various cerebral areas including the basal ganglia, thalamus, cerebellum, and brainstem.

- West Nile virus encephalitis (WNE) is the most common neuroinvasive manifestation of WNND. WNE presents with similar symptoms to other viral encephalitis with fever, headaches, and altered mental status. A prominent finding in WNE is muscular weakness (30 to 50 percent of patients with encephalitis), often with lower motor neuron symptoms, flaccid paralysis, and hyporeflexia with no sensory abnormalities.
- West Nile meningitis (WNM) usually involves fever, headache, stiff neck and pleocytosis, an increase of white blood cells in cerebrospinal fluid. Changes in consciousness are not usually seen and are mild when present.
- West Nile meningoencephalitis is inflammation of both the brain (encephalitis) and meninges (meningitis).
- West-Nile reversible paralysis, Like WNP, the weakness or paralysis is asymmetric Reported cases have been noted to have an initial preservation of deep tendon reflexes, which is not expected for a pure anterior horn involvement. Disconnect of upper motor neuron influences on the anterior horn cells possibly by myelitis or glutamate excitotoxicity have been suggested as mechanisms. The prognosis for recovery is excellent.
- Nonneurologic complications of WNV infection that may rarely occur include fulminant hepatitis, pancreatitis, myocarditis, rhabdomyolysis, orchitis, nephritis, optic neuritis and cardiac dysrhythmias and hemorrhagic fever with coagulopathy. Chorioretinitis may also be more common than previously thought.

- West Nile poliomyelitis (WNP), an acute flaccid paralysis syndrome associated with WNV infection, is less common than WNM or WNE. This syndrome is generally characterized by the acute onset of asymmetric limb weakness or paralysis in the absence of sensory loss. Pain sometimes precedes the paralysis. The paralysis can occur in the absence of fever, headache, or other common symptoms associated with WNV infection. Involvement of respiratory muscles, leading to acute respiratory failure, sometimes occurs.
- Skin manifestations, specifically rashes, are common; however, there are few detailed descriptions in case reports, and few images are available. Punctate erythematous, macular, and papular eruptions, most pronounced on the extremities have been observed in WNV cases and in some cases histopathologic findings have shown a sparse superficial perivascular lymphocytic infiltrate, a manifestation commonly seen in viral exanthems. A literature review provides support that this punctate rash is a common cutaneous presentation of WNV infection.

Prevention

Many of the guidelines for preventing occupational West Nile virus exposure are common to all mosquito-borne diseases. Public health measures include taking steps to reduce mosquito populations. Personal recommendations are to reduce the likelihood of being bitten. General measures to avoid bites include:

- Using insect repellent on exposed skin to repel mosquitoes. Repellents include products containing DEET and picaridin. DEET concentrations of 30% to 50% are effective for several hours. Picaridin, available at 7% and 15% concentrations, needs more frequent application. DEET formulations as high as 30% are recommended for children over two months of age. The CDC also recommends the use of: IR3535, oil of lemon eucalyptus, para-menthane-diol, or 2-undecanone. Protect infants less than two months of age by using a carrier draped with mosquito netting with an elastic edge for a tight fit.
- When using sunscreen, apply sunscreen first and then repellent. Repellent should be washed off at the end of the day before going to bed.
- Wear long-sleeve shirts, which should be tucked in, long trousers, socks, and hats to cover exposed skin (although most fabrics do not totally protect against bites). Insect repellents should be applied over top of protective clothing for greater protection. Do not apply insect repellents underneath clothing.

- Repellents containing permethrin (e.g., Permanone) or other insect repellents may be applied to clothing, shoes, tents, mosquito nets, and other gear. (Permethrin is not suitable for use directly on skin.) Most repellent is generally removed from clothing and gear by a single washing, but permethrin-treated clothing is effective for up to five washings.
- Most mosquitoes that transmit disease are most active at dawn and in the evening dusk. A notable exception is the Asian tiger mosquito, which is a daytime feeder and is more apt to be found in, or on the periphery of, shaded areas with heavy vegetation. They are now widespread in the United States, and in Florida they have been found in all 67 counties.
- In an at-risk area, staying in air-conditioned or well-screened room, or sleeping under an insecticide-treated bed net is recommended. Bed nets should be tucked under mattresses, and can be sprayed with a repellent if not already treated with an insecticide.

Treatment

There is no human vaccine. The best way to reduce the risk of infection is to avoid mosquito bites. Mosquito populations may be reduced by eliminating standing pools of water, such as in old tires, buckets, gutters, and swimming pools. When mosquitoes cannot be avoided, mosquito repellent, window screens, and mosquito nets reduce the likelihood of being bitten. There is no specific treatment for the disease; pain medications may reduce symptoms.

33 Yellow Fever

Yellow fever is a viral disease of typically short duration. In most cases, symptoms include fever, chills, loss of appetite, nausea, muscle pains particularly in the back, and headaches. Symptoms typically improve within five days. In about 15% of people, within a day of improving the fever comes back, abdominal pain occurs, and liver damage begins causing yellow skin. If this occurs, the risk of bleeding and kidney problems is increased. The disease is caused by yellow fever virus and is spread by the bite of an infected female mosquito. It infects only humans, other primates, and several types of mosquitoes. In cities, it is spread primarily by Aedes aegypti, a type of mosquito found throughout the tropics and subtropics.

The virus is an RNA virus of the genus Flavivirus. The disease may be difficult to tell apart from other illnesses, especially in the early stages. To confirm a suspected case, blood-sample testing with polymerase chain reaction is required. A safe and effective vaccine against yellow fever exists, and some countries require vaccinations for travelers. Other efforts to prevent infection include reducing the population of the transmitting mosquitoes. In areas where yellow fever is common, early diagnosis of cases and immunization of large parts of the population are important to prevent outbreaks. Once infected, management is symptomatic with no specific measures effective against the virus. Death occurs in up to half of those who get severe disease.

Sources

Yellow fever virus is mainly transmitted through the bite of the yellow fever mosquito Aedes aegypti, but other mostly Aedes mosquitoes such as the tiger mosquito (Aedes albopictus) can also serve as a vector for this virus. Like other arboviruses, which are transmitted by mosquitoes, yellow fever virus is taken up by a female mosquito when it ingests the blood of an infected human or another primate. Viruses reach the stomach of the mosquito, and if the virus concentration is high enough, the virions can infect epithelial cells and replicate there.

Symptoms

Yellow fever begins after an incubation period of three to six days. Most cases only cause a mild infection with fever, headache, chills, back pain, fatigue, loss of appetite, muscle pain, nausea, and vomiting. In these cases, the infection lasts only three to four days. In 15% of cases, though, people enter a second, toxic phase of the disease with recurring fever, this time accompanied by jaundice due to liver damage, as well as abdominal pain. Bleeding in the mouth, nose, the eyes, and the gastrointestinal tract cause vomit containing blood, hence the Spanish name for yellow fever, vómito negro ("black vomit"). There may also be kidney failure, hiccups, and delirium.

Among those who develop jaundice, the fatality rate is 20 to 50%, while the overall fatality rate is about 3 to 7.5%. Severe cases may have a mortality greater than 50%. Surviving the infection provides lifelong immunity, and normally no permanent organ damage results.

Prevention

Personal prevention of yellow fever includes vaccination and avoidance of mosquito bites in areas where yellow fever is endemic. Institutional measures for prevention of yellow fever include vaccination programmes and measures to control mosquitoes. Programmes for distribution of mosquito nets for use in homes produce reductions in cases of both malaria and yellow fever. Use of EPA-registered insect repellent is recommended when outdoors. Exposure for even a short time is enough for a potential mosquito bite. Long-sleeved clothing, long pants, and socks are useful for prevention. The application of larvicides to water-storage containers can help eliminate potential mosquito breeding sites. EPA-registered insecticide spray decreases the transmission of yellow fever.

- Use insect repellent when outdoors such as those containing DEET, picaridin, ethyl butylacetylaminopropionate (IR3535), or oil of lemon eucalyptus on exposed skin.
- Wear proper clothing to reduce mosquito bites. When weather permits, wear long sleeves, long pants, and socks when outdoors. Mosquitoes may bite through thin clothing, so spraying clothes with repellent containing permethrin or another EPA-registered repellent gives extra protection. Clothing treated with permethrin is commercially available. Mosquito repellents containing permethrin are not approved for application directly to the skin.
- The peak biting times for many mosquito species are dusk to dawn. However, A. aegypti, one of the mosquitoes that transmits yellow fever virus, feeds during the daytime. Staying in accommodations with screened or air-conditioned rooms, particularly during peak biting times, also reduces the risk of mosquito bites.

Vaccination is recommended for those traveling to affected areas, because non-native people tend to develop more severe illness when infected. Protection begins by the 10th day after vaccine administration in 95% of people, and had been reported to last for at least 10 years. The World Health Organization (WHO) now states that a single dose of vaccine is sufficient to confer lifelong immunity against yellow fever disease." The attenuated live vaccine stem 17D was developed in 1937 by Max Theiler. The WHO recommends routine vaccination for people living in affected areas between the 9th and 12th month after birth.

Up to one in four people experience fever, aches, and local soreness and redness at the site of injection. In rare cases (less than one in 200,000 to 300,000), the vaccination can cause yellow fever vaccine-associated viscerotropic disease, which is fatal in 60% of cases. It is probably due to the genetic morphology of the immune system. Another possible side effect is an infection of the nervous system, which occurs in one in 200,000 to 300,000 cases, causing yellow fever vaccine-associated neurotropic disease, which can lead to meningoencephalitis and is fatal in less than 5% of cases.

Treatment

As with other Flavivirus infections, no cure is known for yellow fever. Hospitalization is advisable and intensive care may be necessary because of rapid deterioration in some cases. Certain acute treatment methods lack efficacy: passive immunization after the emergence of symptoms is probably without effect; ribavirin and other antiviral drugs, as well as treatment with interferons, are ineffective in yellow fever patients. Symptomatic treatment includes rehydration and pain relief with drugs such as paracetamol. Acetylsalicylic acid (aspirin) should not be given because of its anticoagulant effect, which can be devastating in the case of internal bleeding that may occur with yellow fever.

Notes

Yellow fever is common in tropical and subtropical areas of South America and Africa. Worldwide, about 600 million people live in endemic areas. The WHO estimates that 200,000 cases of disease and 30,000 deaths a year occur, but the number of officially reported cases is far lower.

34 Zika Virus

ILLNESS Viral Zika Virus

Zika virus (ZIKV) is a member of the virus family Flaviviridae. It is spread by daytime-active Aedes mosquitoes, such as A. aegypti and A. albopictus. Its name comes from the Ziika Forest of Uganda, where the virus was first isolated in 1947. Zika virus is related to the dengue, yellow fever, Japanese encephalitis, and West Nile viruses. Since the 1950s, it has been known to occur within a narrow equatorial belt from Africa to Asia. From 2007 to 2016, the virus spread eastward, across the Pacific Ocean to the Americas, leading to the 2015–16 Zika virus epidemic. The infection, known as Zika fever or Zika virus disease, often causes no or only mild symptoms, similar to a very mild form of dengue fever. While there is no specific treatment, paracetamol (acetaminophen) and rest may help with the symptoms. As of 2016, the illness cannot be prevented by medications or vaccines. Zika can spread from a pregnant woman to her baby. This can result in microcephaly, severe brain malformations, and other birth defects. Zika infections in adults may result rarely in Guillain–Barré syndrome.

Sources

Zika is primarily spread by the female Aedes aegypti mosquito, which is active mostly in the daytime. The mosquitos must feed on blood to lay eggs.

Sexual
Zika can be transmitted from men and women to their sexual partners; most known cases involve transmission from symptomatic men to women. As of April 2016, sexual transmission of Zika has been documented in six countries – Argentina, Australia, France, Italy, New Zealand, and the United States – during the 2015 outbreak.

Pregnancy
Zika virus can spread by vertical (or "mother-to-child") transmission, during pregnancy or at delivery. An infection during pregnancy has been linked to changes in neuronal development of the unborn child.

Blood Transfusion
As of April 2016, two cases of Zika transmission through blood transfusions have been reported globally, both from Brazil, after which the US Food and Drug Administration (FDA) recommended screening blood donors and deferring high-risk donors for 4 weeks. A potential risk had been suspected based on a blood-donor screening study during the French Polynesian Zika outbreak, in which 2.8% (42) of donors from November 2013 and February 2014 tested positive for Zika RNA and were all asymptomatic at the time of blood donation. Eleven of the positive donors reported symptoms of Zika fever after their donation, but only three of 34 samples grew in culture.

Symptoms

Zika fever (also known as Zika virus disease) is an illness caused by Zika virus. Most cases have no symptoms, but when present they are usually mild and can resemble dengue fever. Symptoms may include fever, red eyes, joint pain, headache, and a maculopapular rash. Symptoms generally last less than seven days. It has not caused any reported deaths during the initial infection. Infection during pregnancy causes microcephaly and other brain malformations in some babies. Infection in adults has been linked to Guillain–Barré syndrome (GBS) and Zika virus has been shown to infect human Schwann cells.

Prevention

Prevention involves decreasing mosquito bites in areas where the disease occurs, and proper use of condoms. Efforts to prevent bites include the use of insect repellent, covering much of the body with clothing, mosquito nets, and getting rid of standing water where mosquitoes reproduce. There is no vaccine. Health officials recommended that women in areas affected by the 2015–2016 Zika outbreak consider putting off pregnancy and that pregnant women not travel to these areas. While no specific treatment exists, paracetamol (acetaminophen) and rest may help with the symptoms. Admission to a hospital is rarely necessary.

Treatment

While there is no specific treatment, paracetamol (acetaminophen) and rest may help with the symptoms. As of April 2019, no vaccines have been approved for clinical use, however a number of vaccines are currently in clinical trials.

35 Norovirus

Norovirus, sometimes referred to as the winter vomiting bug, is the most common cause of gastroenteritis. Infection is characterized by diarrhea, vomiting, and stomach pain. Blood is not usually present. Fever or headaches may also occur. This usually develops 12 to 48 hours after being exposed. Recovery typically occurs within 1 to 3 days. Complications may include dehydration. The virus is usually spread by the fecal–oral route. This may be by contaminated food or water or person-to-person contact. It may also spread via contaminated surfaces or through the air. Risk factors include unsanitary food preparation and sharing close quarters. Diagnosis is generally based on symptoms. Confirmatory testing may be done for public health purposes. Prevention involves proper hand washing and disinfection of contaminated surfaces. Alcohol-based hand sanitizers are less effective. A vaccine does not exist. There is no specific treatment. Efforts involve supportive care such as drinking sufficient fluids or intravenous fluids. Oral rehydration solutions are the preferred fluids to drink, although other drinks without caffeine or alcohol can help.

Sources

Infected food workers are frequently the source of the outbreaks, often by touching ready-to-eat foods, such as raw fruits and vegetables, with their bare hands before serving them. However, any food served raw or handled after being cooked can get contaminated with norovirus.

Symptoms

The symptoms of the stomach flu include nausea and vomiting, watery diarrhea, and (sometimes severe) abdominal pain, usually within 12 to 48 hours of exposure. Along with this, muscle aches, headache, and fever may be seen. Luckily, life-threatening illness is rare, with dehydration being the main danger in those infected with the virus.

Prevention

After infection, immunity to the same strain of the virus – the genotype – protects against reinfection for between 6 months to 2 years. This immunity does not fully protect against infection with the other diverse genotypes of the virus.

In Canada, norovirus is a notifiable disease. In both the US and the UK it is not notifiable.

Hand Washing and Disinfectants
Hand washing with soap and water is an effective method for reducing the transmission of norovirus pathogens. Alcohol rubs (≥62% isopropyl alcohol) may be used as an adjunct, but are less effective than hand-washing, as norovirus lacks a lipid viral envelope. Surfaces where norovirus particles may be present can be sanitised with a solution of 1.5% to 7.5% of household bleach in water, or other disinfectants effective against norovirus.

Persistence
The norovirus can survive for long periods outside a human host depending on the surface and temperature conditions: it can survive for weeks on hard and soft surfaces, and it can survive for months, maybe even years in contaminated still water. A 2006 study found the virus remained on surfaces used for food preparation seven days after contamination.

Treatment

There is no specific medicine to treat people with norovirus illness. Norovirus infection cannot be treated with antibiotics because it is not a bacterial infection. Treatments aim to avoid complications by measures such as the management of dehydration caused by fluid loss in vomiting and diarrhea, and to mitigate symptoms using antiemetics (Ondansetron (Zofran))and antidiarrheals (loperamide (Imodium)).

Notes

Norovirus is the most common cause of viral gastroenteritis in humans. It was originally called “Norwalk Virus”, after the area where it was first identified in the 1960s. Since then, it’s been blamed for 50% of all gastroenteritis in the U.S. Worldwide, there are more than 200 million cases of norovirus infection a year. It affects people of all ages, but it’s particularly dangerous in the elderly, the very young, and those with weakened immune systems. Winter is the most common time for outbreaks. Norovirus is very contagious (just 5-20 viral particles can cause illness) and is easily transmitted through contaminated food or water, close personal contact, and by air droplets from vomit, contaminated food counters, and even toilet flushes. Infection can be passed from person to person for a time even after apparent recovery. Norovirus is a hardy microbe, and is known to survive for long periods outside a human host. It can live for weeks on countertops and up to twelve days on clothes. It can survive for months in still water. Disinfectants containing chlorine, however, like bleach will quickly eliminate it, as will sufficient heat.

36 Rotavirus

Rotavirus is a genus of double-stranded RNA viruses in the family Reoviridae. Rotaviruses are the most common cause of diarrhoeal disease among infants and young children. Nearly every child in the world is infected with a rotavirus at least once by the age of five. Immunity develops with each infection, so subsequent infections are less severe; adults are rarely affected. There are nine species of the genus, referred to as A, B, C, D, E, F, G, H and I. Rotavirus A, the most common species, causes more than 90% of rotavirus infections in humans. The virus is transmitted by the faecal-oral route. It infects and damages the cells that line the small intestine and causes gastroenteritis (which is often called "stomach flu" despite having no relation to influenza). Although Rotavirus was discovered in 1973 by Ruth Bishop and her colleagues by electron micrograph images and accounts for approximately one third of hospitalisations for severe diarrhoea in infants and children, its importance has historically been underestimated within the public health community, particularly in developing countries. In addition to its impact on human health, rotavirus also infects animals, and is a pathogen of livestock.

Sources

Rotaviruses are transmitted by the fæcal-oral route, via contact with contaminated hands, surfaces and objects, and possibly by the respiratory route. Viral diarrhoea is highly contagious. The faeces of an infected person can contain more than 10 trillion infectious particles per gram; fewer than 100 of these are required to transmit infection to another person.

Rotaviruses are stable in the environment and have been found in estuary samples at levels up to 1–5 infectious particles per US gallon. The viruses survive between 9 and 19 days. Sanitary measures adequate for eliminating bacteria and parasites seem to be ineffective in control of rotavirus, as the incidence of rotavirus infection in countries with high and low health standards is similar.

Symptoms

The main symptoms are vomiting, fever and watery diarrhoea. Symptoms can be mild, but some children, especially those under 2 years, can require hospital treatment for dehydration. Onset is often sudden. The illness mainly affects infants and young children under 3 years of age. The time from contact with the virus to the development of symptoms is usually between 24 and 72 hours. The diarrhoea usually lasts from 2 to 5 days.

Prevention

Rotaviruses are highly contagious and cannot be treated with antibiotics or other drugs. Because improved sanitation does not decrease the prevalence of rotaviral disease, and the rate of hospitalisations remains high despite the use of oral rehydrating medicines, the primary public health intervention is vaccination. In 1998, a rotavirus vaccine was licensed for use in the United States. Clinical trials in the United States, Finland, and Venezuela had found it to be 80 to 100% effective at preventing severe diarrhoea caused by rotavirus A, and researchers had detected no statistically significant serious adverse effects. The manufacturer, however, withdrew it from the market in 1999, after it was discovered that the vaccine may have contributed to an increased risk for intussusception, a type of bowel obstruction, in one of every 12,000 vaccinated infants. The experience provoked intense debate about the relative risks and benefits of a rotavirus vaccine. In 2006, two new vaccines against rotavirus A infection were shown to be safe and effective in children, and in 2009, the WHO recommended that rotavirus vaccine be included in all national immunisation programmes.

Treatment

A child with vomiting and diarrhoea should be taken to the doctor who will advise if treatment is needed. Most rotavirus infections resolve without treatment. It is very important for the child to drink plenty of fluids to avoid dehydration. Rehydration with oral glucose/electrolyte solution is particularly effective. If children refuse this solution, or it is unavailable, diluted fruit juice or soft drinks may be given (1 part juice/soft drink to 3 parts water).

37 CCHF (Crimean-Congo Hemorrhagic Fever)

Crimean–Congo hemorrhagic fever (CCHF) is a viral disease. Symptoms of CCHF may include fever, muscle pains, headache, vomiting, diarrhea, and bleeding into the skin. Onset of symptoms is less than two weeks following exposure. Complications may include liver failure. In those who survive, recovery generally occurs around two weeks after onset. The CCHF virus is typically spread by tick bites or contact with livestock carrying the disease. Those affected are often farmers or work in slaughterhouses. The virus can also spread between people via body fluids. Diagnosis is by detecting antibodies, the virus's RNA, or the virus itself. It is a type of viral hemorrhagic fever. Prevention involves avoiding tick bites. A vaccine is not commercially available. Treatment is typically with supportive care. The medication ribavirin may also help. It occurs in Africa, the Balkans, the Middle East, and Asia. Often it occurs in outbreaks. In 2013 Iran, Russia, Turkey, and Uzbekistan documented more than fifty cases. The risk of death among those affected is between 10 and 40%. It was first detected in the 1940s.

Sources

The CCHF virus is typically spread by tick bites or contact with livestock carrying the disease. Groups that are at high risk of infection are farmers and those who work in slaughterhouses. The virus can also spread between people via body fluids.

Symptoms

Symptoms of CCHF may include fever, muscle pains, headache, vomiting, diarrhea, and bleeding into the skin. Onset of symptoms is less than two weeks following exposure. Complications may include liver failure. In those who survive, recovery generally occurs around two weeks after onset.

Prevention

Prevention involves avoiding tick bites. A vaccine is not commercially available.

Treatment

Treatment is typically with supportive care. The medication ribavirin may also help.

Notes

It occurs in Africa, the Balkans, the Middle East, and Asia. Often it occurs in outbreaks. In 2013 Iran, Russia, Turkey, and Uzbekistan documented more than fifty cases. The risk of death among those affected is between 10 and 40%. It was first detected in the 1940s.

4 Fungal

Fungal infections of the skin are very common and include athlete's foot, jock itch, ringworm, and yeast infections.

Subheadings

		1. Athlete's Foot	**2. Ringworm**	**3. Tinea Capitis**	**4. Onychomycosis**		
		5. Tinea Versicolor	**6. Cutaneous Candidiasis**				

1 Athlete's Foot

Athlete's foot, known medically as tinea pedis, is a common skin infection of the feet caused by fungus. Signs and symptoms often include itching, scaling, cracking and redness. In rare cases the skin may blister. Athlete's foot fungus may infect any part of the foot, but most often grows between the toes. The next most common area is the bottom of the foot. The same fungus may also affect the nails or the hands. It is a member of the group of diseases known as tinea. Athlete's foot is caused by a number of different fungi, including species of Trichophyton, Epidermophyton, and Microsporum.

Sources

The condition is typically acquired by coming into contact with infected skin, or fungus in the environment. Common places where the fungi can survive are around swimming pools and in locker rooms. They may also be spread from other animals. Usually diagnosis is made based on signs and symptoms; however, it can be confirmed either by culture or seeing hyphae using a microscope.

Symptoms

Signs and symptoms often include itching, scaling, and redness. In rare cases the skin may blister. Athlete's foot fungus may infect any part of the foot, but most often grows between the toes. The next most common area is the bottom of the foot.

Prevention

Some methods of prevention include avoiding walking barefoot in public showers, keeping the toenails short, wearing big enough shoes, and changing socks daily.

Treatment

When infected, the feet should be kept dry and clean and wearing sandals may help. Treatment can be either with antifungal medication applied to the skin such as clotrimazole or for persistent infections antifungal medication that are taken by mouth such as terbinafine. The use of the cream is typically recommended for four weeks.

2 Ringworm (Tinea Corporis)

Tinea corporis, also known as ringworm, is a superficial fungal infection (dermatophytosis) of the arms and legs, especially on glabrous skin; however, it may occur on any part of the body. It is similar to other forms of tinea.

Sources

Tinea corporis is caused by a tiny fungus known as dermatophyte. These tiny organisms normally live on the superficial skin surface, and when the opportunity is right, they can induce a rash or infection.

The disease can also be acquired by person-to-person transfer usually via direct skin contact with an infected individual. Animal-to-human transmission is also common. Ringworm commonly occurs on pets (dogs, cats) and the fungus can be acquired while petting or grooming an animal. Ringworm can also be acquired from other animals such as horses, pigs, ferrets and cows. The fungus can also be spread by touching inanimate objects like personal care products, bed linen, combs, athletic gear, or hair brushes contaminated by an affected person.

Individuals at high risk of acquiring ringworm include those who:
● Live in crowded, humid conditions.
● Sweat excessively, as sweat can produce a humid wet environment where the pathogenic fungi can thrive. This is most common in the armpits, groin creases and skin folds of the abdomen.
● Participate in close contact sports like soccer, rugby, or wrestling.
● Wear tight, constrictive clothing with poor aeration.
● Have a weakened immune system (e.g., those infected with HIV or taking immunosuppressive drugs).

Symptoms

ILLNESS Fungal Ringworm (Tinea Corporis) Symptoms

It may have a variety of appearances; most easily identifiable are the enlarging raised red rings with a central area of clearing (ringworm). The same appearances of ringworm may also occur on the scalp (tinea capitis), beard area (tinea barbae) or the groin (tinea cruris, known as jock itch or dhobi itch).

Other classic features of tinea corporis include:
- Itching occurs on infected area.
- The edge of the rash appears elevated and is scaly to touch.
- Sometimes the skin surrounding the rash may be dry and flaky.
- Almost invariably, there will be hair loss in areas of the infection.

Prevention

Because fungi prefer warm, moist environments, preventing ringworm involves keeping skin dry and avoiding contact with infectious material. Basic prevention measures include:
- Washing hands after handling animals, soil, and plants.
- Avoiding touching characteristic lesions on other people.
- Wearing loose-fitting clothing.
- Practicing good hygiene when participating in sports that involve physical contact with other people.

Treatment

Most cases are treated by application of topical antifungal creams to the skin, but in extensive or difficult to treat cases, systemic treatment with oral medication may be required. The over-the-counter options include tolnaftate, as well as ketoconazole (available as Nizoral shampoo that can be applied topically). Among the available prescription drugs, the evidence is best for terbinafine and naftifine, but other agents may also work.

Topical antifungals are applied to the lesion twice a day for at least 3 weeks. The lesion usually resolves within 2 weeks, but therapy should be continued for another week to ensure the fungus is completely eradicated. If there are several ringworm lesions, the lesions are extensive, complications such as secondary infection exist, or the patient is immunocompromised, oral antifungal medications can be used. Oral medications are taken once a day for 7 days and result in higher clinical cure rates. The antifungal medications most commonly used are itraconazole, terbinafine, and ketoconazole.

The benefits of the use of topical steroids in addition to an antifungal is unclear. There might be a greater cure rate but no guidelines currently recommend its addition. The effect of Whitfield's ointment is also unclear.

3 Tinea Capitis

Tinea capitis (also known as "herpes tonsurans", "ringworm of the hair", "ringworm of the scalp", "scalp ringworm", and "tinea tonsurans") is a cutaneous fungal infection (dermatophytosis) of the scalp. The disease is primarily caused by dermatophytes in the genera Trichophyton and Microsporum that invade the hair shaft. The clinical presentation is typically single or multiple patches of hair loss, sometimes with a 'black dot' pattern (often with broken-off hairs), that may be accompanied by inflammation, scaling, pustules, and itching. Uncommon in adults, tinea capitis is predominantly seen in pre-pubertal children, more often boys than girls. At least eight species of dermatophytes are associated with tinea capitis. Cases of Trichophyton infection predominate from Central America to the United States and in parts of Western Europe. Infections from Microsporum species are mainly in South America, Southern and Central Europe, Africa and the Middle East. The disease is infectious and can be transmitted by humans, animals, or objects that harbor the fungus. The fungus can also exist in a carrier state on the scalp, without clinical symptomatology. Treatment of tinea capitis requires an oral antifungal agent; griseofulvin is the most commonly used drug, but other newer antimycotic drugs, such as terbinafine, itraconazole, and fluconazole have started to gain acceptance.

Sources

The disease is primarily caused by dermatophytes in the genera Trichophyton and Microsporum that invade the hair shaft.

Symptoms

It may appear as thickened, scaly, and sometimes boggy swellings, or as expanding raised red rings (ringworm). Common symptoms are severe itching of the scalp, dandruff, and bald patches where the fungus has rooted itself in the skin. It often presents identically to dandruff or seborrheic dermatitis. The highest incidence in the United States of America is in American boys of school age.

There are three type of tinea capitis, microsporosis, trichophytosis, and favus; these are based on the causative microorganism, and the nature of the symptoms. In microsporosis, the lesion is a small red papule around a hair shaft that later becomes scaly; eventually the hairs break off 1–3 mm above the scalp. This disease used to be caused primarily by Microsporum audouinii, but in Europe, M. canis is more frequently the causative fungus. The source of this fungus is typically sick cats and kittens; it may be spread through person to person contact, or by sharing contaminated brushes and combs. In the United States, Trichophytosis is usually caused by Trichophyton tonsurans, while T. violaceum is more common in Eastern Europe, Africa, and India. This fungus causes dry, non-inflammatory patches that tend to be angular in shape.

When the hairs break off at the opening of the follicle, black dots remain. Favus is caused by T. schoenleinii, and is endemic in South Africa and the Middle East. It is characterized by a number of yellowish, circular, cup-shaped crusts (scutula) grouped in patches like a piece of honeycomb, each about the size of a split pea, with a hair projecting in the center. These increase in size and become crusted over, so that the characteristic lesion can only be seen around the edge of the scab.

Prevention

Tinea capitis rarely occurs in adults, so adults in the home, who do not have tinea capitis, do not need to use the shampoo. No one should share towels, combs, hairbrushes, hats or pillowcases with other family members, friends or visitors. Wash the towels in warm, soapy water after each use. Rinse and dry.

Treatment

The treatment of choice by dermatologists is a safe and inexpensive oral medication, griseofulvin, a secondary metabolite of the fungus Penicillium griseofulvin. This compound is fungistatic (inhibiting the growth or reproduction of fungi) and works by affecting the microtubular system of fungi, interfering with the mitotic spindle and cytoplasmic microtubules. The recommended pediatric dosage is 10 mg/kg/day for 6–8 weeks, although this may be increased to 20 mg/kg/d for those infected by T. tonsurans, or those who fail to respond to the initial 6 weeks of treatment. Unlike other fungal skin infections that may be treated with topical therapies like creams applied directly to the afflicted area, griseofulvin must be taken orally to be effective; this allows the drug to penetrate the hair shaft where the fungus lives.

The effective therapy rate of this treatment is generally high, in the range of 88–100%. Other oral antifungal treatments for tinea capitis also frequently reported in the literature include terbinafine, itraconazole, and fluconazole; these drugs have the advantage of shorter treatment durations than griseofulvin. On September 28, 2007, the U.S. Food and Drug Administration stated that Lamisil (Terbinafine hydrochloride, by Novartis AG) is a new treatment approved for use by children aged 4 years and older. The antifungal granules can be sprinkled on a child's food to treat the infection. Lamisil carries hepatotoxic risk, and can cause a metallic taste in the mouth.

4 Onychomycosis

Onychomycosis, also known as tinea unguium, is a fungal infection of the nail. Symptoms may include white or yellow nail discoloration, thickening of the nail, and separation of the nail from the nail bed. Toenails or fingernails may be affected, but it is more common for toenails to be affected. Complications may include cellulitis of the lower leg. A number of different types of fungus can cause onychomycosis including dermatophytes and Fusarium. Risk factors include athlete's foot, other nail diseases, exposure to someone with the condition, peripheral vascular disease, and poor immune function. The diagnosis is generally suspected based on the appearance and confirmed by laboratory testing.

Onychomycosis does not necessarily require treatment. The antifungal medication, terbinafine, taken by mouth appears to be the most effective but is associated with liver problems. Trimming the affected nails when on treatment also appears useful. There is a ciclopirox-containing nail polish, but it does not work as well. The condition returns in up to half of cases following treatment. Not using old shoes after treatment may decrease the risk of recurrence.

Sources

The causative pathogens of onychomycosis are all in the fungus kingdom and include dermatophytes, Candida (yeasts), and nondermatophytic molds. Dermatophytes are the fungi most commonly responsible for onychomycosis in the temperate western countries; while Candida and nondermatophytic molds are more frequently involved in the tropics and subtropics with a hot and humid climate.

Symptoms

The most common symptom of a fungal nail infection is the nail becoming thickened and discoloured: white, black, yellow or green. As the infection progresses the nail can become brittle, with pieces breaking off or coming away from the toe or finger completely. If left untreated, the skin underneath and around the nail can become inflamed and painful. There may also be white or yellow patches on the nailbed or scaly skin next to the nail, and a foul smell. There is usually no pain or other bodily symptoms, unless the disease is severe.

People with onychomycosis may experience significant psychosocial problems due to the appearance of the nail, particularly when fingers – which are always visible – rather than toenails are affected. Dermatophytids are fungus-free skin lesions that sometimes form as a result of a fungus infection in another part of the body. This could take the form of a rash or itch in an area of the body that is not infected with the fungus. Dermatophytids can be thought of as an allergic reaction to the fungus.

Prevention

● Keep your hands and feet clean and dry.
● Clip your fingernails and toenails short and keep them clean.
● Don't walk barefoot in areas like locker rooms or public showers.
● Don't share nail clippers with other people.
● When visiting a nail salon, choose a salon that is clean and licensed by your state's cosmetology board. Make sure the salon sterilizes its instruments (nail clippers, scissors, etc.) after each use, or, you can bring your own.

Treatment

Medications
Most treatments are with antifungal medications either topically or by mouth. Avoiding use of antifungal therapy by mouth (e.g. terbinafine) in persons without a confirmed infection is recommended because of the possible side effects of that treatment.

Topical agents include ciclopirox nail paint, amorolfine, and efinaconazole. Some topical treatments need to be applied daily for prolonged periods (at least 1 year). Topical amorolfine is applied weekly. Topical ciclopirox results in a cure in 6% to 9% of cases; amorolfine might be more effective. Ciclopirox when used with terbinafine appears to be better than either agent alone. In trials, about 17% of people were cured using efinaconazole as opposed to 4% of people using placebo. Although eficonazole, P-3051 (ciclopirox 8% hydrolacquer), and tavaborole are effective at treating fungal infection of toenails, complete cure rates are low.

Medications that may be taken by mouth include terbinafine (76% effective), itraconazole (60% effective) and fluconazole (48% effective). They share characteristics that enhance their effectiveness: prompt penetration of the nail and nail bed, and persistence in the nail for months after discontinuation of therapy. Ketoconazole by mouth is not recommended due to side effects. Oral terbinafine is better tolerated than itraconazole. For superficial white onychomycosis, systemic rather than topical antifungal therapy is advised.

5 Tinea Versicolor

Tinea versicolor is a condition characterized by a skin eruption on the trunk and proximal extremities. The majority of tinea versicolor is caused by the fungus Malassezia globosa, although Malassezia furfur is responsible for a small number of cases. These yeasts are normally found on the human skin and become troublesome only under certain circumstances, such as a warm and humid environment, although the exact conditions that cause initiation of the disease process are poorly understood. The condition pityriasis versicolor was first identified in 1846. Versicolor comes from the Latin, from versāre to turn + color. It is also commonly referred to as Peter Elam's disease in many parts of South Asia.

Sources

The fungus that causes tinea versicolor can be found on healthy skin. It only starts causing problems when the fungus overgrows. A number of factors may trigger this growth, including:
● Hot, humid weather
● Oily skin
● Hormonal changes
● Weakened immune system

Symptoms

ILLNESS Fungal Tinea Versicolor Symptoms

The symptoms of this condition include:
- Occasional fine scaling of the skin producing a very superficial ash-like scale
- Pale, dark tan, or pink in color, with a reddish undertone that can darken when the patient is overheated, such as in a hot shower or during/after exercise. Tanning typically makes the affected areas contrast more starkly with the surrounding skin.
- Sharp border

Pityriasis versicolor is more common in hot, humid climates or in those who sweat heavily, so it may recur each summer. The yeasts can often be seen under the microscope within the lesions and typically have a so-called "spaghetti and meatball appearance" as the round yeasts produce filaments. In people with dark skin tones, pigmentary changes such as hypopigmentation (loss of color) are common, while in those with lighter skin color, hyperpigmentation (increase in skin color) is more common. These discolorations have led to the term "sun fungus".

Prevention

To help prevent tinea versicolor from returning, your doctor can prescribe a skin or oral treatment that you use once or twice a month. You may need to use these just during warm and humid months. Preventive treatments include:
- Selenium sulfide (Selsun) 2.5 percent lotion or shampoo
- Ketoconazole (Ketoconazole, Nizoral, others) cream, gel or shampoo
- Itraconazole (Onmel, Sporanox) tablets, capsules or oral solution
- Fluconazole (Diflucan) tablets or oral solution

Treatment

Treatments for tinea versicolor include:
- Topical antifungal medications containing selenium sulfide are often recommended. Ketoconazole (Nizoral ointment and shampoo) is another treatment. It is normally applied to dry skin and washed off after 10 minutes, repeated daily for two weeks. Ciclopirox (Ciclopirox olamine) is an alternative treatment to ketoconazole, as it suppresses growth of the yeast Malassezia furfur. Initial results show similar efficacy to ketoconazole with a relative increase in subjective symptom relief due to its inherent anti-inflammatory properties. Other topical antifungal agents such as clotrimazole, miconazole, terbinafine, or zinc pyrithione can lessen symptoms in some patients. Additionally, hydrogen peroxide has been known to lessen symptoms and, on certain occasions, remove the problem, although permanent scarring has occurred with this treatment in some sufferers. Clotrimazole is also used combined with selenium sulfide.
- Oral antifungals including ketoconazole or fluconazole in a single dose, or ketoconazole for seven days, or itraconazole can be used. The single-dose regimens, or pulse therapy regimens, can be made more effective by having the patient exercise 1–2 hours after the dose, to induce sweating. The sweat is allowed to evaporate, and showering is delayed for a day, leaving a film of the medication on the skin.

Notes

This skin disease commonly affects adolescents and young adults, especially in warm and humid climates. The yeast is thought to feed on skin oils (lipids), as well as dead skin cells. Infections are more common in people who have seborrheic dermatitis, dandruff, and hyperhidrosis.

6 Cutaneous Candidiasis

Candidiasis is a fungal infection due to any type of Candida (a type of yeast). When it affects the mouth, it is commonly called thrush. Signs and symptoms include white patches on the tongue or other areas of the mouth and throat. Other symptoms may include soreness and problems swallowing. When it affects the vagina, it is commonly called a yeast infection. Signs and symptoms include genital itching, burning, and sometimes a white "cottage cheese-like" discharge from the vagina. Yeast infections of the penis are less common and typically present with an itchy rash. Very rarely, yeast infections may become invasive, spreading to other parts of the body. This may result in fevers along with other symptoms depending on the parts involved. More than 20 types of Candida can cause infection with Candida albicans being the most common.

Infections of the mouth are most common among children less than one month old, the elderly, and those with weak immune systems. Conditions that result in a weak immune system include HIV/AIDS, the medications used after organ transplantation, diabetes, and the use of corticosteroids. Other risks include dentures, following antibiotic therapy, and breastfeeding. Vaginal infections occur more commonly during pregnancy, in those with weak immune systems, and following antibiotic use. Individuals at risk for invasive candidiasis include low birth weight babies, people recovering from surgery, people admitted to an intensive care units, and those with an otherwise compromised immune systems.

Sources

Candida yeasts are generally present in healthy humans, frequently part of the human body's normal oral and intestinal flora, and particularly on the skin; however, their growth is normally limited by the human immune system and by competition of other microorganisms, such as bacteria occupying the same locations in the human body. Candida requires moisture for growth, notably on the skin. For example, wearing wet swimwear for long periods of time is believed to be a risk factor. Additionally, candida can also cause diaper rashes in babies. In extreme cases, superficial infections of the skin or mucous membranes may enter into the bloodstream and cause systemic Candida infections.

Factors that increase the risk of candidiasis include HIV/AIDS, mononucleosis, cancer treatments, steroids, stress, antibiotic usage, diabetes, and nutrient deficiency. Hormone replacement therapy and infertility treatments may also be predisposing factors. Use of inhaled corticosteroids increases risk of candidiasis of the mouth. Inhaled corticosteroids with other risk factors such as antibiotics, oral glucocorticoids, not rinsing mouth after use of inhaled corticosteroids or high dose of inhaled corticosteroids put people at even higher risk.

Treatment with antibiotics can lead to eliminating the yeast's natural competitors for resources in the oral and intestinal flora; thereby increasing the severity of the condition. A weakened or undeveloped immune system or metabolic illnesses are significant predisposing factors of candidiasis. Almost 15% of people with weakened immune systems develop a systemic illness caused by Candida species. Diets high in simple carbohydrates have been found to affect rates of oral candidiases.

Symptoms

Signs and symptoms of candidiasis vary depending on the area affected. Most candidal infections result in minimal complications such as redness, itching, and discomfort, though complications may be severe or even fatal if left untreated in certain populations. In healthy (immunocompetent) persons, candidiasis is usually a localized infection of the skin, fingernails or toenails (onychomycosis), or mucosal membranes, including the oral cavity and pharynx (thrush), esophagus, and the genitalia (vagina, penis, etc.); less commonly in healthy individuals, the gastrointestinal tract, urinary tract, and respiratory tract are sites of candida infection.

In immunocompromised individuals, Candida infections in the esophagus occur more frequently than in healthy individuals and have a higher potential of becoming systemic, causing a much more serious condition, a fungemia called candidemia. Symptoms of esophageal candidiasis include difficulty swallowing, painful swallowing, abdominal pain, nausea, and vomiting.

Mouth
Infection in the mouth is characterized by white discolorations in the tongue, around the mouth, and throat. Irritation may also occur, causing discomfort when swallowing. Thrush is commonly seen in infants. It is not considered abnormal in infants unless it lasts longer than a few weeks.

Genitals
Infection of the vagina or vulva may cause severe itching, burning, soreness, irritation, and a whitish or whitish-gray cottage cheese-like discharge. Symptoms of infection of the male genitalia (balanitis thrush) include red skin around the head of the penis, swelling, irritation, itchiness and soreness of the head of the penis, thick, lumpy discharge under the foreskin, unpleasant odour, difficulty retracting the foreskin (phimosis), and pain when passing urine or during sex.

Skin
Signs and symptoms of candidiasis in the skin include itching, irritation, and chafing or broken skin.

Invasive Infection
Common symptoms of gastrointestinal candidiasis in healthy individuals are anal itching, belching, bloating, indigestion, nausea, diarrhea, gas, intestinal cramps, vomiting, and gastric ulcers. Perianal candidiasis can cause anal itching; the lesion can be red, papular, or ulcerative in appearance, and it is not considered to be a sexually transmissible disease. Abnormal proliferation of the candida in the gut may lead to dysbiosis. While it is not yet clear, this alteration may be the source of symptoms generally described as the irritable bowel syndrome, and other gastrointestinal diseases.

Prevention

A diet that supports the immune system and is not high in simple carbohydrates contributes to a healthy balance of the oral and intestinal flora. While yeast infections are associated with diabetes, the level of blood sugar control may not affect the risk. Wearing cotton underwear may help to reduce the risk of developing skin and vaginal yeast infections, along with not wearing wet clothes for long periods of time. For women who experience recurrent yeast infections, there is limited evidence that oral or intravaginal probiotics help to prevent future infections. This includes either as pills or as yogurt.

Oral hygiene can help prevent oral candidiasis when people have a weakened immune system. For people undergoing cancer treatment, chlorhexidine mouthwash can prevent or reduce thrush. People who use inhaled corticosteroids can reduce the risk of developing oral candidiasis by rinsing the mouth with water or mouthwash after using the inhaler. People with dentures should also disinfect their dentures regularly to prevent oral candidiasis.

Treatment

Candidiasis is treated with antifungal medications; these include clotrimazole, nystatin, fluconazole, voriconazole, amphotericin B, and echinocandins. Intravenous fluconazole or an intravenous echinocandin such as caspofungin are commonly used to treat immunocompromised or critically ill individuals.

The 2016 revision of the clinical practice guideline for the management of candidiasis lists a large number of specific treatment regimens for Candida infections that involve different Candida species, forms of antifungal drug resistance, immune statuses, and infection localization and severity. Gastrointestinal candidiasis in immunocompetent individuals is treated with 100–200 mg fluconazole per day for 2–3 weeks.

Localized Infection
Mouth and throat candidiasis are treated with antifungal medication. Oral candidiasis usually responds to topical treatments; otherwise, systemic antifungal medication may be needed for oral infections. Candidal skin infections in the skin folds (candidal intertrigo) typically respond well to topical antifungal treatments (e.g., nystatin or miconazole). For breastfeeding mothers topical miconazole is the most effective treatment for treating candidiasis on the breasts. Gentian violet can be used for thrush in breastfeeding babies. Systemic treatment with antifungals by mouth is reserved for severe cases or if treatment with topical therapy is unsuccessful. Candida esophagitis may be treated orally or intravenously; for severe or azole-resistant esophageal candidiasis, treatment with amphotericin B may be necessary.

Vaginal yeast infections are typically treated with topical antifungal agents. A one-time dose of fluconazole by mouth is 90% effective in treating a vaginal yeast infection. For severe nonrecurring cases, several doses of fluconazole is recommended.

Local treatment may include vaginal suppositories or medicated douches. Other types of yeast infections require different dosing. C. albicans can develop resistance to fluconazole, this being more of an issue in those with HIV/AIDS who are often treated with multiple courses of fluconazole for recurrent oral infections. For vaginal yeast infection in pregnancy, topical imidazole or triazole antifungals are considered the therapy of choice owing to available safety data. Systemic absorption of these topical formulations is minimal, posing little risk of transplacental transfer. In vaginal yeast infection in pregnancy, treatment with topical azole antifungals is recommended for 7 days instead of a shorter duration.

For vaginal yeast infections, many complementary treatments are proposed, however a number have side effects. No benefit from probiotics has been found for active infections.

Blood Infection
Treatment typically consists of oral or intravenous antifungal medications. In candidal infections of the blood, intravenous fluconazole or an echinocandin such as caspofungin may be used. Amphotericin B is another option.

5 Environmental

These are any illnesses caused by environmental conditions such as altitude sickness.

Acute Radiation Syndrome

Acute radiation syndrome (ARS) is a collection of health effects of radiation that are present within 24 hours of exposure to high amounts. The ionizing radiation causes cellular degradation due to damage to DNA and other key molecular structures within the cells in various tissues. This destruction, particularly because it affects the ability of cells to divide normally, in turn causes the symptoms. The symptoms can begin within one or two hours and may last for several months. The terms refer to acute medical problems rather than ones that develop after a prolonged period. The onset and type of symptoms depends on the radiation exposure. Relatively smaller doses result in gastrointestinal effects, such as nausea and vomiting, and symptoms related to falling blood counts, and predisposition to infection and bleeding. Relatively larger doses can result in neurological effects, including but not limited to seizures, tremors, lethargy, and rapid death. Treatment of acute radiation syndrome is generally supportive with blood transfusions and antibiotics, with some more aggressive treatments, such as bone marrow transfusions, being required in extreme cases.

Symptoms
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Treatment

Treatment of acute radiation syndrome is generally supportive with blood transfusions and antibiotics, with some more aggressive treatments, such as bone marrow transfusions, being required in extreme cases. Similar symptoms may appear months to years after exposure as chronic radiation syndrome when the dose rate is too low to cause the acute form. Radiation exposure can also increase the probability of developing some other diseases, mainly different types of cancers. These diseases are sometimes referred to as radiation sickness, but they are never included in the term acute radiation syndrome.

Gray

The gray (symbol: Gy) is a derived unit of ionizing radiation dose in the International System of Units (SI). It is defined as the absorption of one joule of radiation energy per kilogram of matter.

Radiation Beta Burn

Minor burn: Also known as a Beta burn (though it may be from other particles). Immerse Beta burns in cold water until the pain subsides (usually 5 minutes). If skin starts to blister, char or break; wash it with cold water to remove contaminants, then cover with a sterile compress to prevent infection. Do not break the blisters! If the skin does not blister, char or break; don't cover it, even if it covers a large portion of the body (almost like sunburn). Instead, wash the area and cover it with Vaseline or a solution of baking powder and water if available. But, moist (uncontaminated) earth will do.

Thermal Burn

Comes mostly from the high intensity blast heat, rather than ionizing particles, though it can be from the latter. This can be life threatening; everything becomes a factor: water loss, shock, lung damage, infection, etc. Follow these steps to treat a severe burn. Protect burns from further contamination. If clothing covers the burn area, gently cut and remove the cloth from the burn. DO NOT try to remove cloth which has stuck or fused onto the burn. DO NOT try to pull clothes over the burn. DO NOT put any ointment on the burn.

Or better call the Medical Therapy Unit. Gently wash the burned area with water ONLY. Do NOT apply creams or ointments. Do NOT use a normal sterile medical dressing not specifically intended for burns. As non-adhesive burn dressings (and all other medical supplies) are likely to be in short supply, an expedient alternative is to use plastic wrap (also known as saran wrap, food wrap, and cling film), which is sterile, does not stick to burns, and is readily available.

Prevent shock. Shock is the inadequate flow of blood to the vital tissues and organs. If untreated, it can be fatal. Shock results from excessive blood loss, deep burns, or reactions to the sight of a wound or blood. The signs are restlessness, thirst, pale skin and rapid heartbeat. Sweating may occur even if the skin feels cool and clammy. As it worsens, they breathe short fast gasps, with a vacant stare. To treat: maintain proper heartbeat and respiration by massaging the chest and positioning the person for adequate respiration. Loosen any constrictive clothing and reassure the person. Be firm yet gentle with self confidence.

Absorbed Dose Effect (Gray)

Phase	Symptom	1-2 Gy	2-6 Gy	6-8 Gy	8-30 Gy	>30 Gy
Immediate	Nausea and Vomiting	5–50%	50–100%	75–100%	90–100%	100%
	Time of Onset	2–6 h	1–2 h	10–60 min	< 10 min	Minutes
	Duration	< 24 h	24–48 h	< 48 h	< 48 h	N/A (patients die in < 48 h)
	Diarrhoea	None	None to mild (< 10%)	Heavy (> 10%)	Heavy (> 95%)	Heavy (100%)
	Time of Onset	—	3–8 h	1–3 h	< 1 h	< 1 h
	Headache	Slight	Mild to moderate (50%)	Moderate (80%)	Severe (80–90%)	Severe (100%)
	Time of Onset	—	4–24 h	3–4 h	1–2 h	< 1 h
	Fever	None	Moderate increase (10–100%)	Moderate to severe (100%)	Severe (100%)	Severe (100%)
	Time of Onset	—	1–3 h	< 1 h	< 1 h	< 1 h
	CNS function	No impairment	Cognitive impairment 6–20 h	Cognitive impairment > 24 h	Rapid incapacitation	Seizures, tremor, ataxia, lethargy
Latent Period		28–31 days	7–28 days	< 7 days	None	None
Illness		Mild to moderate Leukopenia Fatigue Weakness	Moderate to severe Leukopenia Purpura Haemorrhage Infections Alopecia after 3 Gy	Severe leukopenia High fever Diarrhoea Vomiting Dizziness and disorientation Hypotension Electrolyte disturbance	Nausea Vomiting Severe diarrhoea High fever Electrolyte disturbance Shock	N/A (patients die in < 48h)
Mortality	Without Care	0–5%	5–95%	95–100%	100%	100%
	With Care	0–5%	5–50%	50–100%	99–100%	100%
	Death	6–8 weeks	4–6 weeks	2–4 weeks	2 days – 2 weeks	1–2 days

Altitude Sickness

- **Symptoms:** Headache, vomiting, feeling tired, trouble sleeping, dizziness.
- **Complications:** High altitude pulmonary edema (HAPE), High altitude cerebral edema (HACE).
- **Usual Onset:** Within 24 hours.
- **Types:** Acute mountain sickness, high altitude pulmonary edema, high altitude cerebral edema, chronic mountain sickness.
- **Causes:** Low amounts of oxygen at high elevation.
- **Risk Factors:** Prior episode, high degree of activity, rapid increase in elevation.
- **Diagnostic Method:** Based on symptoms.
- **Differential Diagnosis:** Exhaustion, viral infection, hangover, dehydration, carbon monoxide poisoning.
- **Prevention:** Gradual ascent.
- **Treatment:** Descent to lower altitude, sufficient fluids.
- **Medication:** Ibuprofen, acetazolamide, dexamethasone, oxygen therapy.

Altitude sickness, the mildest form being acute mountain sickness (AMS), is the negative health effect of high altitude, caused by rapid exposure to low amounts of oxygen at high elevation. Symptoms may include headaches, vomiting, tiredness, trouble sleeping, and dizziness. Acute mountain sickness can progress to high altitude pulmonary edema (HAPE) with associated shortness of breath or high altitude cerebral edema (HACE) with associated confusion. Chronic mountain sickness may occur after long term exposure to high altitude. Altitude sickness typically occurs only above 2,500 metres (8,000 ft), though some are affected at lower altitudes.

Risk factors include a prior episode of altitude sickness, a high degree of activity, and a rapid increase in elevation. Diagnosis is based on symptoms and is supported in those who have more than a minor reduction in activities. It is recommended that at high-altitude any symptoms of headache, nausea, shortness of breath, or vomiting be assumed to be altitude sickness. Prevention is by gradually increasing elevation by no more than 300 metres (1,000 ft) per day. Being physically fit does not decrease the risk. Treatment is generally by descending to a lower altitude and sufficient fluids. Mild cases may be helped by ibuprofen, acetazolamide, or dexamethasone.

Severe cases may benefit from oxygen therapy and a portable hyperbaric bag may be used if descent is not possible. Treatment efforts, however, have not been well studied. AMS occurs in about 20% of people after rapidly going to 2,500 metres (8,000 ft) and 40% of people going to 3,000 metres (10,000 ft). While AMS and HACE occurs equally frequently in males and females, HAPE occurs more often in males. The earliest description of altitude sickness is attributed to a Chinese text from around 30 BCE which describes "Big Headache Mountains" possibly referring to the Karakoram Mountains around Kilik Pass.

Signs & Symptoms

People have different susceptibilities to altitude sickness; for some otherwise healthy people, acute altitude sickness can begin to appear at around 2,000 metres (6,600 ft) above sea level, such as at many mountain ski resorts, equivalent to a pressure of 80 kilopascals (0.79 atm). This is the most frequent type of altitude sickness encountered. Symptoms often manifest themselves six to ten hours after ascent and generally subside in one to two days, but they occasionally develop into the more serious conditions.

Symptoms include headache, fatigue, stomach illness, dizziness, and sleep disturbance. Exertion aggravates the symptoms. Those individuals with the lowest initial partial pressure of end-tidal pCO2 (the lowest concentration of carbon dioxide at the end of the respiratory cycle, a measure of a higher alveolar ventilation) and corresponding high oxygen saturation levels tend to have a lower incidence of acute mountain sickness than those with high end-tidal pCO2 and low oxygen saturation levels.

Primary Symptoms
Headaches are the primary symptom used to diagnose altitude sickness, although a headache is also a symptom of dehydration. A headache occurring at an altitude above 2,400 metres (7,900 ft) – a pressure of 76 kilopascals (0.75 atm) – combined with any one or more of the following symptoms, may indicate altitude sickness:

Gastrointestinal: Loss of appetite, nausea, or vomiting, excessive flatulation
Nervous: Fatigue or weakness, headache with or without dizziness or lightheadedness, insomnia, "pins and needles" sensation
Locomotory: Peripheral edema (swelling of hands, feet, and face)
Respiratory: Nose bleeding, shortness of breath upon exertion
Cardiovascular: Persistent rapid pulse
Other: General malaise

Severe Symptoms
Pulmonary edema (fluid in the lungs)
● Symptoms similar to bronchitis
● Persistent dry cough
● Fever
● Shortness of breath even when resting

Cerebral edema (swelling of the brain)
● Headache that does not respond to analgesics
● Unsteady gait
● Gradual loss of consciousness
● Increased nausea and vomiting
● Retinal hemorrhage

The most serious symptoms of altitude sickness arise from edema (fluid accumulation in the tissues of the body). At very high altitude, humans can get either high altitude pulmonary edema (HAPE), or high altitude cerebral edema (HACE). The physiological cause of altitude-induced edema is not conclusively established. It is currently believed, however, that HACE is caused by local vasodilation of cerebral blood vessels in response to hypoxia, resulting in greater blood flow and, consequently, greater capillary pressures. On the other hand, HAPE may be due to general vasoconstriction in the pulmonary circulation (normally a response to regional ventilation-perfusion mismatches) which, with constant or increased cardiac output, also leads to increases in capillary pressures.

For those suffering HACE, dexamethasone may provide temporary relief from symptoms in order to keep descending under their own power. HAPE can progress rapidly and is often fatal. Symptoms include fatigue, severe dyspnea at rest, and cough that is initially dry but may progress to produce pink, frothy sputum. Descent to lower altitudes alleviates the symptoms of HAPE. HACE is a life-threatening condition that can lead to coma or death. Symptoms include headache, fatigue, visual impairment, bladder dysfunction, bowel dysfunction, loss of coordination, paralysis on one side of the body, and confusion. Descent to lower altitudes may save those afflicted with HACE.

Cause

Altitude sickness can first occur at 1,500 metres, with the effects becoming severe at extreme altitudes (greater than 5,500 metres). Only brief trips above 6,000 metres are possible and supplemental oxygen is needed to avert sickness. As altitude increases, the available amount of oxygen to sustain mental and physical alertness decreases with the overall air pressure, though the relative percentage of oxygen in air, at about 21%, remains practically unchanged up to 21,000 metres (70,000 ft). The RMS velocities of diatomic nitrogen and oxygen are very similar and thus no change occurs in the ratio of oxygen to nitrogen until stratospheric heights. Dehydration due to the higher rate of water vapor lost from the lungs at higher altitudes may contribute to the symptoms of altitude sickness. The rate of ascent, altitude attained, amount of physical activity at high altitude, as well as individual susceptibility, are contributing factors to the onset and severity of high-altitude illness. Altitude sickness usually occurs following a rapid ascent and can usually be prevented by ascending slowly. In most of these cases, the symptoms are temporary and usually abate as altitude acclimatization occurs. However, in extreme cases, altitude sickness can be fatal.

High Altitude
At high altitude, 1,500 to 3,500 metres (4,900 to 11,500 ft), the onset of physiological effects of diminished inspiratory oxygen pressure (PiO2) includes decreased exercise performance and increased ventilation (lower arterial partial pressure of carbon dioxide: PCO2). While arterial oxygen transport may be only slightly impaired the arterial oxygen saturation (SaO2) generally stays above 90%. Altitude sickness is common between 2,400 and 4,000m because of the large number of people who ascend rapidly to these altitudes.

Very High Altitude
At very high altitude, 3,500 to 5,500 metres (11,500 to 18,000 ft), maximum SaO2 falls below 90% as the arterial PO2 falls below 60mmHg. Extreme hypoxemia may occur during exercise, during sleep, and in the presence of high altitude pulmonary edema or other acute lung conditions. Severe altitude illness occurs most commonly in this range.

Extreme Altitude
Above 5,500 metres (18,000 ft), marked hypoxemia, hypocapnia, and alkalosis are characteristic of extreme altitudes. Progressive deterioration of physiologic function eventually outstrips acclimatization. As a result, no permanent human habitation occurs above 6,000 metres (20,000 ft). A period of acclimatization is necessary when ascending to extreme altitude; abrupt ascent without supplemental oxygen for other than brief exposures invites severe altitude sickness.

Prevention

Ascending slowly is the best way to avoid altitude sickness. Avoiding strenuous activity such as skiing, hiking, etc. in the first 24 hours at high altitude reduces the symptoms of AMS. Alcohol and sleeping pills are respiratory depressants, and thus slow down the acclimatization process and should be avoided. Alcohol also tends to cause dehydration and exacerbates AMS. Thus, avoiding alcohol consumption in the first 24–48 hours at a higher altitude is optimal. Pre-acclimatization is when the body develops tolerance to low oxygen concentrations before ascending to an altitude. It significantly reduces risk because less time has to be spent at altitude to acclimatize in the traditional way. Additionally, because less time has to be spent on the mountain, less food and supplies have to be taken up. Several commercial systems exist that use altitude tents, so called because they mimic altitude by reducing the percentage of oxygen in the air while keeping air pressure constant to the surroundings.

Altitude acclimatization is the process of adjusting to decreasing oxygen levels at higher elevations, in order to avoid altitude sickness. Once above approximately 3,000 metres (10,000 ft) – a pressure of 70 kilopascals (0.69 atm) – most climbers and high-altitude trekkers take the "climb-high, sleep-low" approach. For high-altitude climbers, a typical acclimatization regimen might be to stay a few days at a base camp, climb up to a higher camp (slowly), and then return to base camp. A subsequent climb to the higher camp then includes an overnight stay. This process is then repeated a few times, each time extending the time spent at higher altitudes to let the body adjust to the oxygen level there, a process that involves the production of additional red blood cells. Once the climber has acclimatized to a given altitude, the process is repeated with camps placed at progressively higher elevations. The rule of thumb is to ascend no more than 300 m (1,000 ft) per day to sleep.

That is, one can climb from 3,000 m (9,800 ft) (70 kPa or 0.69 atm) to 4,500 m (15,000 ft) (58 kPa or 0.57 atm) in one day, but one should then descend back to 3,300 m (10,800 ft) (67.5 kPa or 0.666 atm) to sleep. This process cannot safely be rushed, and this is why climbers need to spend days (or even weeks at times) acclimatizing before attempting to climb a high peak. Simulated altitude equipment such as altitude tents provide hypoxic (reduced oxygen) air, and are designed to allow partial pre-acclimation to high altitude, reducing the total time required on the mountain itself. Altitude acclimatization is necessary for some people who move rapidly from lower altitudes to intermediate altitudes (e.g., by aircraft and ground transportation over a few hours), such as from sea level to 8,000 feet (2,400 m) as in many Colorado, USA mountain resorts. Stopping at an intermediate altitude overnight (for example, staying overnight when arriving through Denver, at 5,500 feet (1,700 m), when traveling to the aforementioned Colorado resorts) can alleviate or eliminate occurrences of AMS.

Medications

The drug acetazolamide (trade name Diamox) may help some people making a rapid ascent to sleeping altitude above 2,700 metres (9,000 ft), and it may also be effective if started early in the course of AMS. Acetazolamide can be taken before symptoms appear as a preventive measure at a dose of 125 mg twice daily. The Everest Base Camp Medical Centre cautions against its routine use as a substitute for a reasonable ascent schedule, except where rapid ascent is forced by flying into high altitude locations or due to terrain considerations. The Centre suggests a dosage of 125 mg twice daily for prophylaxis, starting from 24 hours before ascending until a few days at the highest altitude or on descending; with 250 mg twice daily recommended for treatment of AMS.

The Centers for Disease Control and Prevention (CDC) suggest the same dose for prevention of 125 mg acetazolamide every 12 hours. Acetazolamide, a mild diuretic, works by stimulating the kidneys to secrete more bicarbonate in the urine, thereby acidifying the blood. This change in pH stimulates the respiratory center to increase the depth and frequency of respiration, thus speeding the natural acclimatization process. An undesirable side-effect of acetazolamide is a reduction in aerobic endurance performance. Other minor side effects include a tingle-sensation in hands and feet.

Although a sulfonamide; acetazolamide is a non-antibiotic and has not been shown to cause life-threatening allergic cross-reactivity in those with a self-reported sulfonamide allergy. Dosage of 1000 mg/day will produce a 25% decrease in performance, on top of the reduction due to high-altitude exposure.

The CDC advises that Dexamethasone be reserved for treatment of severe AMS and HACE during descents, and notes that Nifedipine may prevent HAPE. Prior to the onset of altitude sickness, ibuprofen is a suggested non-steroidal anti-inflammatory and painkiller that can help alleviate both the headache and nausea associated with AMS. It has not been studied for the prevention of cerebral edema (swelling of the brain) associated with extreme symptoms of AMS. For centuries, indigenous peoples of the Americas such as the Aymaras of the Altiplano, have chewed coca leaves to try to alleviate the symptoms of mild altitude sickness. In Chinese and Tibetan traditional medicine, an extract of the root tissue of Radix rhodiola is often taken in order to prevent the same symptoms, though neither of these therapies has been proven effective in clinical study. Increased water intake may also help in acclimatization to replace the fluids lost through heavier breathing in the thin, dry air found at altitude, although consuming excessive quantities ("over-hydration") has no benefits and may cause dangerous hyponatremia.

In high-altitude conditions, oxygen enrichment can counteract the hypoxia related effects of altitude sickness. A small amount of supplemental oxygen reduces the equivalent altitude in climate-controlled rooms. At 3,400 metres (11,200 ft) (67 kPa or 0.66 atm), raising the oxygen concentration level by 5% via an oxygen concentrator and an existing ventilation system provides an effective altitude of 3,000 m (10,000 ft) (70 kPa or 0.69 atm), which is more tolerable for those unaccustomed to high altitudes. Oxygen from gas bottles or liquid containers can be applied directly via a nasal cannula or mask. Oxygen concentrators based upon pressure swing adsorption (PSA), VSA, or vacuum-pressure swing adsorption (VPSA) can be used to generate the oxygen if electricity is available.

Stationary oxygen concentrators typically use PSA technology, which has performance degradations at the lower barometric pressures at high altitudes. One way to compensate for the performance degradation is to utilize a concentrator with more flow capacity. There are also portable oxygen concentrators that can be used on vehicular DC power or on internal batteries, and at least one system commercially available measures and compensates for the altitude effect on its performance up to 4,000 m (13,000 ft). The application of high-purity oxygen from one of these methods increases the partial pressure of oxygen by raising the FiO2 (fraction of inspired oxygen).

Treatment

The only reliable treatment, and in many cases the only option available, is to descend. Attempts to treat or stabilize the patient in situ (at altitude) are dangerous unless highly controlled and with good medical facilities. However, the following treatments have been used when the patient's location and circumstances permit:

- Oxygen may be used for mild to moderate AMS below 3,700 metres (12,000 ft) and is commonly provided by physicians at mountain resorts. Symptoms abate in 12 to 36 hours without the need to descend.
- For more serious cases of AMS, or where rapid descent is impractical, a Gamow bag, a portable plastic hyperbaric chamber inflated with a foot pump, can be used to reduce the effective altitude by as much as 1,500 m (5,000 ft). A Gamow bag is generally used only as an aid to evacuate severe AMS patients, not to treat them at altitude.
- Acetazolamide 250 mg twice daily dosing assists in AMS treatment by quickening altitude acclimatization. A study by the Denali Medical Research Project concluded: "In established cases of acute mountain sickness, treatment with acetazolamide relieves symptoms, improves arterial oxygenation, and prevents further impairment of pulmonary gas exchange."
- The folk remedy for altitude sickness in Ecuador, Peru and Bolivia is a tea made from the coca plant. See mate de coca.
- Steroids can be used to treat the symptoms of pulmonary or cerebral edema, but do not treat the underlying AMS.

- Two studies in 2012 showed that Ibuprofen 600 milligrams three times daily was effective at decreasing the severity and incidence of AMS; it was not clear if HAPE or HACE was affected.
- Paracetamol (acetaminophen) has also shown to be as good as ibuprofen for altitude sickness when tested on climbers ascending Everest.

Other Poisonings

Shellfish Poisoning

Description	
Sources	Shellfish poisoning is caused by eating shellfish contaminated with bacteria or, more commonly, viruses. Contaminated shellfish include shrimp, crabs, clams, oysters, dried fish, and salted raw fish. Contaminated fish may have a tainted odor or taste.

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Symptoms	Symptoms of shellfish poisoning begin 4-48 hours after eating and include: ● Nausea ● Vomiting ● Diarrhea ● Abdominal pain ● Cramps
Prevention	Avoid eating foul tasting or foul smelling shellfish.
Treatment	Follow these steps for someone with shellfish poisoning: ● Do not induce vomiting. ● Help the person stay well-hydrated. ○ Encourage the person to drink frequent sips of clear fluids. ○ IV fluids may be necessary if nausea and vomiting cannot be controlled. There is no specific cure available for shellfish poisoning, and antibiotics do not shorten the illness. Drugs used to control diarrhea, vomiting, and stomach cramps should not be used except for bismuth (Pepto-Bismol). These drugs are referred to as antimotility drugs since they decrease stomach and intestine motion. Antimotility drugs other than bismuth preparations can worsen or lengthen the illness because the infectious agent is not expelled from the body as rapidly.

Amnesic Shellfish Poisoning (ASP)

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Description	Amnesic shellfish poisoning (ASP) is an illness caused by consumption of the marine biotoxin called domoic acid. In mammals, including humans, domoic acid acts as a neurotoxin, causing permanent short-term memory loss, brain damage, and death in severe cases. This toxin is produced naturally by marine diatoms belonging to the genus Pseudo-nitzschia and the species Nitzschia navis-varingica. When accumulated in high concentrations by shellfish during filter feeding, domoic acid can then be passed on to birds, marine mammals, and humans by consumption of the contaminated shellfish.
Sources	
Symptoms	In the brain, domoic acid especially damages the hippocampus and amygdaloid nucleus. It damages the neurons by activating AMPA and kainate receptors, causing an influx of calcium. Although calcium flowing into cells is a normal event, the uncontrolled increase of calcium causes the cell to degenerate. Gastrointestinal symptoms can appear 24 hours after ingestion of affected molluscs. They may include vomiting, nausea, diarrhea, abdominal cramps, and haemorrhagic gastritis. In more severe cases, neurological symptoms can take several hours or up to 3 days to develop. These include headache, dizziness, disorientation, vision disturbances, loss of short-term memory, motor weakness, seizures, profuse respiratory secretions, hiccups, unstable blood pressure, abnormal heart rhythms, and coma. People poisoned with very high doses of the toxin or displaying risk factors such as old age and kidney failure can die. Death has occurred in four of 107 confirmed cases. In a few cases, permanent sequelae included short-term memory loss and peripheral polyneuropathy.
Prevention	
Treatment	No antidote for domoic acid is known, so if symptoms fit the description, immediate medical attention is advised. Cooking or freezing affected fish or shellfish tissue does not lessen the toxicity. Domoic acid is a heat-resistant and very stable toxin which can damage kidneys at concentrations that are 1/100th of those that cause neurological effects.

Diarrheal Shellfish Poisoning (DSP)

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Description	Diarrhetic shellfish poisoning (DSP) is one of the four recognized symptom types of shellfish poisoning, the others being paralytic shellfish poisoning, neurotoxic shellfish poisoning and amnesic shellfish poisoning. As the name suggests, this syndrome manifests itself as intense diarrhea and severe abdominal pains. Nausea and vomiting may sometimes occur too.
Sources	
Symptoms	DSP and its symptoms usually set in within about half an hour of ingesting infected shellfish, and last for about one day. A recent case in France, though, with 20 people consuming oysters manifested itself after 36 hours. The causative poison is okadaic acid, which inhibits intestinal cellular de-phosphorylation. This causes the cells to become very permeable to water and causes profuse, intense diarrhea with a high risk of dehydration. As no life-threatening symptoms generally emerge from this, no fatalities from DSP have ever been recorded.
Prevention	
Treatment	

Neurotoxic Shellfish Poisoning (NSP)

ILLNESS | Environmental | Other Poisonings | ... poisoning (NSP)

Description	Neurotoxic shellfish poisoning (NSP) is a term used to describe the disease caused by consumption of brevetoxins, which are marine toxins produced by the dinoflagellate Karenia brevis (among several others). These toxins can produce a series of gastrointestinal and neurological effects. Outbreaks of NSP commonly take place following harmful algal bloom (HAB) events, commonly referred to as "Florida red tide" (given that blooms are more commonplace along the coasts of Florida and Texas, especially during late summer and early fall).
Sources	Humans are typically exposed to these potent natural toxins via filter-feeding mollusks (i.e., shellfish), because shellfish accumulate biotoxins in their flesh due to the way that they feed. Human exposure seems to be most common via consumption of commonly harvested shellfish such as clams, oysters, and mussels, although it has been proposed that exposure to lower levels of brevetoxins can take place following the consumption of certain planktivorous fish. Toxins will typically be found in the flesh of shellfish for up to 2–8 weeks following a HAB event, however there have been reports of toxin retention for nearly one year post-bloom. Notably, brevetoxins are tasteless and odorless and cannot be eradicated by rinsing, cleaning, cooking, freezing, or application of acid. To date, there is no reasonable means of preventing the uptake of toxins by shellfish, nor of removing the toxins from shellfish after harvest.

Symptoms	Diagnosis of NSP is made based on clinical presentation as well as history findings including recent consumption of shellfish. On average, symptoms begin 3-4 hours after consumption, but can begin anywhere from several minutes to 18 hours afterward. Symptoms typically include neurologic and gastrointestinal issues including: ● Nausea ● Vomiting ● Diarrhea ● Numbness and tingling in the lips, mouth, face, and extremities The latter has been described as “nerves being on fire” or “ants crawling and biting all over”.

Other less common symptoms can include:
● Ataxia
● Loss of coordination
● Limb paralysis
● Reversal of hot and cold sensations
● Slurred speech
● Headache
● Pupil dilation
● Generalized fatigue

Patients may be thought to be disoriented or intoxicated. Rarely, patients may experience respiratory distress requiring ventilatory support. Despite this seemingly severe constellation of symptoms, there have been no documented deaths due to NSP. NSP can present similar to other disorders such as:
● Common food poisoning
● Seafood allergy
● Paralytic shellfish poisoning
● Ciguatera fish poisoning
● Pesticide poisoning
● Alcohol intoxication
● Certain psychiatric disorders.
Due to the extensive list of disorders with similar symptoms, a detailed food history is necessary to make the diagnosis.

Prevention	
Treatment	Treatment for NSP is mostly supportive with monitoring and symptom management. Intravenous fluids and observation of respiratory function are the mainstay of treatment along with pain control. Activated charcoal can be given if the patient presents within four hours of consumption to decontaminate the gastrointestinal tract. Currently, there is no specific antidote for brevetoxins, however there may be a role for mannitol (the primary treatment for ciguatoxin, a dinoflagellate-produced toxin found in some species of fish) or brevatal, a natural antagonist of brevetoxin produced by K. brevis.

Paralytic Shellfish Poisoning (PSP)

Description	Paralytic shellfish poisoning (PSP) is one of the four recognized syndromes of shellfish poisoning, which share some common features and are primarily associated with bivalve mollusks (such as mussels, clams, oysters and scallops). These shellfish are filter feeders and accumulate neurotoxins, chiefly saxitoxin, produced by microscopic algae, such as dinoflagellates, diatoms, and cyanobacteria. Some pufferfish, including the chamaeleon puffer, contain saxitoxin, making their consumption hazardous.
Sources	
Symptoms	
Prevention	
Treatment	
Notes	The toxins responsible for most shellfish poisonings are water insoluble, heat and acid-stable, and ordinary cooking methods do not eliminate the toxins. The principal toxin responsible for PSP is saxitoxin. Some shellfish can store this toxin for several weeks after a harmful algal bloom passes, but others, such as butter clams, are known to store the toxin for up to two years. Additional toxins are found, such as neosaxitoxin and gonyautoxins I to IV. All of them act primarily on the nervous system. PSP can be fatal in extreme cases, particularly in immunocompromised individuals. Children are more susceptible. PSP affects those who come into contact with the affected shellfish by ingestion. Symptoms can appear ten to 30 minutes after ingestion, and include nausea, vomiting, diarrhea, abdominal pain, tingling or burning lips, gums, tongue, face, neck, arms, legs, and toes. Shortness of breath, dry mouth, a choking feeling, confused or slurred speech, and loss of coordination are also possible.

Scombroid Poisoning

Description	Scombroid food poisoning, also known as simple scombroid, is a foodborne illness that typically results from eating spoiled fish. Symptoms may include flushed skin, headache, itchiness, blurred vision, abdominal cramps, and diarrhea. Onset of symptoms is typically 10 to 60 minutes after eating and can last for up to two days. Rarely, breathing problems or an irregular heartbeat may occur.
Sources	Scombroid occurs from eating fish high in histamine due to inappropriate storage or processing. Fish commonly implicated include tuna, mackerel, mahi mahi, sardine, anchovy, herring, bluefish, amberjack, and marlin. These fish naturally have high levels of histidine, which is converted to histamine when bacterial growth occurs during improper storage. Subsequent cooking, smoking, or freezing does not eliminate the histamine. Diagnosis is typically based on the symptoms and may be supported by a normal blood tryptase. If a number of people who eat the same fish develop symptoms, the diagnosis is more likely. Unlike many types of food poisoning, scombroid form is not brought about by ingestion of a pathogen. Histidine is an amino acid that exists naturally in many types of food, including fish. At temperatures above 16 °C (60 °F), histidine is converted to the biogenic amine histamine via the enzyme histidine decarboxylase produced by symbiotic bacteria such as Morganella morganii (this is one reason why fish should be stored in the freezer).

Histamine is not destroyed by normal cooking temperatures, so even properly cooked fish can still result in poisoning. Histamine is the main natural chemical responsible for true allergic reactions, so the symptoms produced are almost identical to a food allergy. Rarely cheese may be involved.

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Symptoms	Symptoms typically occur within 10–30 minutes of ingesting the fish and generally are self-limited. People with asthma are more vulnerable to respiratory problems such as wheezing or bronchospasms. However, symptoms may show over two hours after eating a spoiled dish. They usually last for about 10 to 14 hours, and rarely exceed one to two days.

Initial The first signs of poisoning suggest an allergic reaction with these symptoms: ● Facial flushing/sweating ● Burning-peppery taste sensations in the mouth and throat ● Dizziness ● Nausea ● Headache ● Tachycardia ● Cold-like symptoms	**Additional Symptoms** The above symptoms can advance to: ● Facial rash (intense itching may accompany the rash) ● Torso or body rash: The rash associated with scombroid poisoning is a form of urticaria, but most commonly does not include wheals (patchy areas of skin-swelling also known as hives) that may be seen in true allergies. ● Edema (generalized if it occurs at all) ● Short-term diarrhea ● Abdominal cramps	**Severe** In the worst cases, the poisoning may cause: ● Blurred vision ● Respiratory distress ● Swelling of the tongue In rare cases, the poisoning may result in death.

Prevention	Prevention is by refrigerating or freezing fish right after it is caught. Treatment is generally with antihistamines such as diphenhydramine and ranitidine. Epinephrine may be used for severe symptoms. Along with ciguatera fish poisoning, it is one of the most common type of seafood poisoning. It occurs globally in both temperate and tropical waters. Only one death has been reported. The condition was first described in 1799.
Treatment	Treatment is in the form of supportive care. If light-headedness occurs, a person should lie with feet partly elevated. Antihistamines such as diphenhydramine (H1 blockade) and ranitidine (H2 blockade) together with intravenous fluids may help with mild to moderate symptoms. Epinephrine combined with a steroid may be used for severe symptoms.

Shellfish Toxin (Ciguatera)

Description	Ciguatera fish poisoning (CFP), also known simply as ciguatera, is a foodborne illness caused by eating reef fish whose flesh is contaminated with certain toxins. Such individual fish are said to be ciguatoxic. Symptoms may include diarrhea, vomiting, numbness, itchiness, sensitivity to hot and cold, dizziness, and weakness. The onset of symptoms varies with the amount of toxin eaten from half an hour to up to two days. The diarrhea may last for up to four days. Some symptoms typically remain for a few weeks to months. Heart difficulties such as slow heart rate and low blood pressure may also occur.
Sources	The specific toxins involved are ciguatoxin and maitotoxin. They are originally made by a small marine organism, Gambierdiscus toxicus, that grows on and around coral reefs in tropical and subtropical waters. These are eaten by herbivorous fish which in turn are eaten by larger carnivorous fish. The toxins become more concentrated as they move up the food chain. The fish most often implicated include barracuda, grouper, moray eel, amberjack, sea bass, and sturgeon.
Symptoms	Hallmark symptoms of ciguatera in humans include gastrointestinal, cardiovascular, and neurological effects. Gastrointestinal symptoms include nausea, vomiting, and diarrhea, usually followed by neurological symptoms such as headaches, muscle aches, paresthesia, numbness of extremities, mouth and lips, reversal of hot and cold sensation, ataxia, vertigo, and hallucinations. Severe cases of ciguatera can also result in cold allodynia, which is a burning sensation on contact with cold. Neurological symptoms can persist and ciguatera poisoning is occasionally misdiagnosed as multiple sclerosis. Cardiovascular symptoms include bradycardia, tachycardia, hypotension, hypertension, orthostatic tachycardia, exercise intolerance, and rhythm disorders. Death from the condition can occur, but is very rare. Dyspareunia and other ciguatera symptoms have developed in otherwise healthy males and females following sexual intercourse with partners suffering ciguatera poisoning, signifying that the toxin may be sexually transmitted. Diarrhea and facial rashes have been reported in breastfed infants of poisoned mothers, suggesting that ciguatera toxins migrate into breast milk. The symptoms can last from weeks to years, and in extreme cases as long as 20 years, often leading to long-term disability. Most people do recover slowly over time.
Prevention	Preventive efforts include not eating reef fish, not eating high-risk fish such as barracuda, and not eating fish liver, roe, or fish heads. Ciguatoxin has no taste or smell, and cannot be destroyed by conventional cooking. There is no specific treatment for ciguatera fish poisoning once it occurs. Mannitol may be considered, but the evidence supporting its use is not very strong. Gabapentin or amitriptyline may be used to treat some of the symptoms.
Treatment	There is no effective treatment or antidote for ciguatera poisoning. The mainstay of treatment is supportive care. There is some evidence that calcium channel blockers like nifedipine and verapamil are effective in treating some of the symptoms that remain after the initial sickness passes, such as poor circulation and shooting pains through the chest. These symptoms are due to vasoconstriction caused by maitotoxin. Ciguatoxin lowers the threshold for opening voltage-gated sodium channels in synapses of the nervous system. Opening a sodium channel causes depolarization, which could sequentially cause paralysis, heart contraction, and changing the senses of hot and cold. Some medications such as amitriptyline may reduce some symptoms, such as fatigue and paresthesia, although benefit does not occur in every case.

Hemlock Poisoning (Conium Maculatum)

Description	Conium maculatum, the hemlock or poison hemlock, is a highly poisonous biennial herbaceous flowering plant in the carrot family Apiaceae, native to Europe and North Africa. A hardy plant capable of living in a variety of environments, hemlock is widely naturalized in locations outside its native range, such as parts of North and South America, Australia and West Asia, to which it has been introduced.

Conium maculatum is a herbaceous biennial flowering plant that grows to 1.5–2.5 m (5–8 ft) tall, with a smooth, green, hollow stem, usually spotted or streaked with red or purple on the lower half of the stem. All parts of the plant are hairless (glabrous); the leaves are two- to four-pinnate, finely divided and lacy, overall triangular in shape, up to 50 cm (20 in) long and 40 cm (16 in) broad. Hemlock's flower is small and white; they are loosely clustered and each flower has five petals. The plant looks like the wild carrot plant (Daucus carota). One can distinguish the two from each other by hemlock's smooth texture, mid-green, quite vivid, color and typical height of large clumps being least 1.5 metres, twice the maximum of wild carrot. Carrots have hairy stems that lack the purple blotches. It can be confused with harmless cow parsley (Anthriscus sylvestris).

The hemlock plant is native to Europe and the Mediterranean region. It exists in some woodland (and elsewhere) in most British Isles counties; in Ulster these are particularly Down, Antrim and Londonderry. It has become naturalised in Asia, North America, Australia and New Zealand. It is introduced in 12 U.S. states. It is sometimes encountered around rivers in southeast Australia and Tasmania.

Sources	

Symptoms	A short time after ingestion, the alkaloids produce potentially fatal neuromuscular dysfunction due to failure of the respiratory muscles. Acute toxicity, if not lethal, may resolve in spontaneous recovery, provided further exposure is avoided. Since no specific antidote is available, prevention is the only way to deal with the production losses caused by the plant. It is a common myth that C. maculatum alkaloids can enter the human food chain via milk and fowl, but scientific studies have disproven these claims.
Prevention	Control with herbicides and grazing with less-susceptible animals (such as sheep) have been suggested.
Treatment	No antidote is available.
Notes	The plant is often found in poorly drained soil, particularly near streams, ditches and other watery surfaces. It also appears on roadsides, edges of cultivated fields and waste areas Conium maculatum grows in quite damp soil, but also on drier rough grassland, roadsides and disturbed ground. It is used as a food plant by the larvae of some lepidoptera, including silver-ground carpet moths and particularly the poison hemlock moth (Agonopterix alstroemeriana). The latter has been widely used as a biological control agent for the plant. Poison hemlock grows in the spring, when much undergrowth is not in flower and may not be in leaf. All plant parts are poisonous.

Ingesting less than a tenth of a gram of coniine, approximately equivalent to six to eight hemlock leaves, can be fatal for adult humans. The seeds and roots are also toxic, more so than the leaves. While hemlock toxicity primarily results from consumption, poisoning can also result from inhalation, and from skin contact. Farmers also need to be careful that the hay fed to animals does not contain hemlock. Poison hemlock is most poisonous in the spring when the concentration of γ-coniceine (the precursor to other toxins) is at its peak.

Poison hemlock grows quite tall, reaching heights of up to twelve feet (3.6 meters). The stalk of hemlock is green with purple spots and completely lacks hair. A biennial plant, hemlock produces leaves at its base the first year but no flowers. In its second year it produces white flowers in umbrella shaped clusters. Hemlock can be confused with the wild carrot plant; however, this plant has a hairy stem without purple markings, grows less than three feet tall, and does not have clustered flowers.

Mushroom Poisoning

Description	Mushroom poisoning refers to harmful effects from ingestion of toxic substances present in a mushroom. These symptoms can vary from slight gastrointestinal discomfort to death in about 10 days. The toxins present are secondary metabolites produced by the fungus. Mushroom poisoning is usually the result of ingestion of wild mushrooms after misidentification of a toxic mushroom as an edible species. The most common reason for this misidentification is close resemblance in terms of colour and general morphology of the toxic mushrooms species with edible species. To prevent mushroom poisoning, mushroom gatherers familiarize themselves with the mushrooms they intend to collect, as well as with any similar-looking toxic species. The safety of eating wild mushrooms may depend on methods of preparation for cooking.
Sources	Mushrooms.
Symptoms	Poisonous mushrooms contain a variety of different toxins that can differ markedly in toxicity. Symptoms of mushroom poisoning may vary from gastric upset to organ failure resulting in death. Serious symptoms do not always occur immediately after eating, often not until the toxin attacks the kidney or liver, sometimes days or weeks later. The most common consequence of mushroom poisoning is simply gastrointestinal upset. Most "poisonous" mushrooms contain gastrointestinal irritants that cause vomiting and diarrhea (sometimes requiring hospitalization), but usually no long-term damage. However, there are a number of recognized mushroom toxins with specific, and sometimes deadly, effects:

Toxin	Toxicity	Effects
Alpha-amanitin	Deadly	Causes often fatal liver damage 1–3 days after ingestion. Principal toxin in the death cap.
Phallotoxin	Non-lethal	Causes extreme gastrointestinal upset. Found in various mushrooms.
Orellanine	Deadly	Redox cycler similar to paraquat. Causes kidney failure within three weeks after ingestion. Principal toxin in genus Cortinarius.
Muscarine	Potentially deadly	Causes SLUDGE syndrome. Found in various mushrooms. Antidote is atropine.
Monomethylhydrazine (MMH)	Deadly	Causes brain damage, seizures, gastrointestinal upset, and hemolysis. Metabolic poison. Principal toxin in genus Gyromitra. Antidote is large doses of intravenous pyridoxine hydrochloride
Coprine	Non-lethal	Causes illness when consumed with alcohol. Principal toxin in genus Coprinus.
Ibotenic acid	Potentially deadly	Excitotoxin. Principal toxin in Amanita muscaria, A. pantherina, and A. gemmata.
Muscimol	Potentially deadly	Causes CNS depression and hallucinations. Principal toxin in Amanita muscaria, A. pantherina, and A. gemmata.
Arabitol	Non-lethal	Causes diarrhea in some people.
Bolesatine	Non-lethal	Causes gastrointestinal irritation, vomiting, nausea.
Ergotamine	Deadly	Affects the vascular system and can lead to loss of limbs and/or cardiac arrest. Found in genus Claviceps.

Prevention	Avoid eating mushrooms.
Treatment	Some mushrooms contain less toxic compounds and, therefore, are not severely poisonous. Poisonings by these mushrooms may respond well to treatment. However, certain types of mushrooms contain very potent toxins and are very poisonous; so even if symptoms are treated promptly, mortality is high. With some toxins, death can occur in a week or a few days. Although a liver or kidney transplant may save some patients with complete organ failure, in many cases there are no organs available. Patients hospitalized and given aggressive support therapy almost immediately after ingestion of amanitin-containing mushrooms have a mortality rate of only 10%, whereas those admitted 60 or more hours after ingestion have a 50–90% mortality rate.
Notes	New species of fungi are continuing to be discovered, with an estimated number of 800 new species registered annually. This, added to the fact that many investigations have recently reclassified some species of mushrooms from edible to poisonous has made older classifications insufficient at describing what now is known about the different species of fungi that are harmful to humans. Thus, contrary to what older registers state, it is now thought that of the approximately 100,000 known fungi species found worldwide, about 100 of them are poisonous to humans. However, by far the majority of mushroom poisonings are not fatal, and the majority of fatal poisonings are attributable to the Amanita phalloides mushroom.

A majority of these cases are due to mistaken identity. This is a common occurrence with A. phalloides in particular, due to its resemblance to the Asian paddy-straw mushroom, Volvariella volvacea. Both are light-colored and covered with a universal veil when young. Amanitas can be mistaken for other species, as well, in particular when immature. On at least one occasion they have been mistaken for Coprinus comatus. In this case, the victim had some limited experience in identifying mushrooms, but did not take the time to correctly identify these particular mushrooms until after he began to experience symptoms of mushroom poisoning.

The author of Mushrooms Demystified, David Arora cautions puffball-hunters to beware of Amanita "eggs", which are Amanitas still entirely encased in their universal veil. Amanitas at this stage are difficult to distinguish from puffballs. Foragers are encouraged to always cut the fruiting bodies of suspected puffballs in half, as this will reveal the outline of a developing Amanita should it be present within the structure. A majority of mushroom poisonings in general are the result of small children, especially toddlers in the "grazing" stage, ingesting mushrooms found in the lawn. While this can happen with any mushroom, Chlorophyllum molybdites is often implicated due to its preference for growing in lawns. C. molybdites causes severe gastrointestinal upset but is not considered deadly poisonous.

A few poisonings are the result of misidentification while attempting to collect hallucinogenic mushrooms for recreational use. In 1981, one fatality and two hospitalizations occurred following consumption of Galerina marginata, mistaken for a Psilocybe species. Galerina and Psilocybe species are both small, brown, and sticky, and can be found growing together. However, Galerina contains amatoxins, the same poison found in the deadly Amanita species. Another case reports kidney failure following ingestion of Cortinarius orellanus, a mushroom containing orellanine.

It is natural that accidental ingestion of hallucinogenic species also occurs, but is rarely harmful when ingested in small quantities. Cases of serious toxicity have been reported in small children. Amanita pantherina, while containing the same hallucinogens as Amanita muscaria (e.g., ibotenic acid and muscimol), has been more commonly associated with severe gastrointestinal upset than its better-known counterpart.

6 Chemical

A chemical weapon (CW) is a specialized munition that uses chemicals formulated to inflict death or harm on humans. The term chemical weapon may also be applied to any toxic chemical or its precursor that can cause death, injury, temporary incapacitation or sensory irritation through its chemical action. Chemical weapons are classified as weapons of mass destruction (WMDs), though they are distinct from nuclear weapons, biological weapons, and radiological weapons.

All may be used in warfare and are known by the military acronym NBC (for nuclear, biological, and chemical warfare). Weapons of mass destruction are distinct from conventional weapons, which are primarily effective due to their explosive, kinetic, or incendiary potential. Chemical weapons can be widely dispersed in gas, liquid and solid forms, and may easily afflict others than the intended targets. Nerve gas, tear gas and pepper spray are three modern examples of chemical weapons.

Subheadings

1. Blood Agent	2. Blister Agent	3. Nerve Agent	4. Nettle Agent
5. Choking Agent	6. Vomiting Agent	7. Incapacitating Agent	8. Riot Control Agent

1 Blood Agent

A blood agent is a toxic chemical agent that affects the body by being absorbed into the blood. Blood agents are fast-acting, potentially lethal poisons that typically manifest at room temperature as volatile colorless gases with a faint odor. They are either cyanide- or arsenic-based.

Sources	Blood agents work through inhalation or ingestion. As chemical weapons, blood agents are typically disseminated as aerosols and take effect through inhalation. Due to their volatility, they are more toxic in confined areas than in open areas.
Symptoms	Cyanide-based blood agents irritate the eyes and the respiratory tract, while arsine is nonirritating. Exposure to small amounts of cyanide has no effect. Higher concentrations cause dizziness, weakness and nausea, which cease with the exposure, but long-time exposure can cause mild symptoms followed by permanent brain damage and muscle paralysis. Moderate exposure causes stronger and longer-lasting symptoms, including headache, that can be followed by convulsions and coma. Stronger or longer exposure will also lead to convulsions and coma. Very strong exposure causes severe toxic effects within seconds, and rapid death. The blood of people killed by blood agents is bright red, because the agents inhibit the use of the oxygen in it by the body's cells. Cyanide poisoning can be detected by the presence of thiocyanate or cyanide in the blood, a smell of bitter almonds, or respiratory tract inflammations and congestions in the case of cyanogen chloride poisoning. There is no specific test for arsine poisoning, but it may leave a garlic smell on the victim's breath.
Effects	At sufficient concentrations, blood agents can quickly saturate the blood and cause death in a matter of minutes or seconds. They cause powerful gasping for breath, violent convulsions and a painful death that can take several minutes. The immediate cause of death is usually respiratory failure. Blood agents work at the cellular level by preventing the exchange of oxygen and carbon dioxide between the blood and the body's cells. This causes the cells to suffocate from lack of oxygen. Cyanide-based agents do so by interrupting the electron transport chain in the inner membranes of mitochondria. Arsine damages the red blood cells which deliver oxygen throughout the body.
Detection	Chemical detection methods, in the form of kits or testing strips, exist for hydrogen cyanide.
Prevention	Ordinary clothing provides some protection, but proper protective clothing and masks are recommended. Mask filters containing only charcoal are ineffective, and effective filters are quickly saturated.
Treatment	Due to their high volatility, cyanide agents generally need no decontamination. In enclosed areas, fire extinguishers spraying sodium carbonate can decontaminate hydrogen cyanide, but the resulting metal salts remain poisonous on contact. Liquid hydrogen cyanide can be flushed with water. Cyanide poisoning can be treated with antidotes; see the corresponding article.

Blood Agents

Hydrogen Cyanide	• Effectiveness - 10 • Persistence Open - 2 • Persistance Enclosed - 9 • Field Stability - 10 • Storage Stability - 8 • Toxicity - 10	Colorless gas or liquid, faint almond odor, burns with a bluish flame.

ILLNESS | Chemical | Blood Agent | Blood Agents

Cyanogen	• Effectiveness - 9 • Persistence Open - 2 • Persistance Enclosed - 9 • Field Stability - 8 • Storage Stability - 7 • Toxicity - 9	Colorless gas, almond odor, burns with a pinkish flame having a blue border.
Cyanogen Chloride	• Effectiveness - 8 • Persistence Open - 3 • Persistance Enclosed - 9 • Field Stability - 9 • Storage Stability - 9 • Toxicity - 8	Colorless gas or liquid, pungent and biting odor, soluble in water and alcohol.
Cyanogen Bromide	• Effectiveness - 9 • Persistence Open - 5 • Persistance Enclosed - 8 • Field Stability - 5 • Storage Stability - 6 • Toxicity - 8	Colorless needle-shaped or cubic crystals, tending to volatize on standing, hence of limited usefulness as a weapon.
Arsine	• Effectiveness - 9 • Persistence Open - 3 • Persistance Enclosed - 8 • Field Stability - 5 • Storage Stability - 9 • Toxicity - 9	Colorless gas, garlic-like odor, slightly soluble in water.
Vinyl Arsine	• Effectiveness - 7 • Persistence Open - 7 • Persistance Enclosed - 9 • Field Stability - 8 • Storage Stability - 9 • Toxicity - 6	Colorless liquid, irritating and bitter odor, slightly soluble in water, also acts as a blister agent.
Phosgene	• Effectiveness - 10 • Persistence Open - 6 • Persistance Enclosed - 9 • Field Stability - 5 • Storage Stability - 8 • Toxicity - 6	Colorless gas and slightly yellow liquid, moldy hay odor, slightly soluble in water and soluble in most solvents, also acts as a choking agent.

2 Blister Agent

ILLNESS | Chemical | Blister Agent

A blister agent, or vesicant, is a chemical compound that causes severe skin, eye and mucosal pain and irritation. They are named for their ability to cause severe chemical burns, resulting in painful water blisters on the bodies of those affected.

Types
- Sulfur mustards – A family of sulfur-based agents, including mustard gas.
- Nitrogen mustards – A family of agents similar to the sulfur mustards, but based on nitrogen instead of sulfur.
- Lewisite – An early blister agent that was developed, but not used, during World War I. It was effectively rendered obsolete with the development of British anti-Lewisite in the 1940s.

Sources	
Symptoms	• Severe skin, eye and mucosal pain and irritation • Skin erythema with large fluid blisters that heal slowly and may become infected • Tearing, conjunctivitis, corneal damage • Mild respiratory distress to marked airway damage
Prevention	Avoid exposure to blister agents.
Treatment	
Natural Remedy	

ILLNESS | Chemical | Blister Agent | Blister

Blister Agents

Sulfur Mustards	A family of sulfur-based agents, including mustard gas.
Nitrogen Mustards	A family of agents similar to the sulfur mustards, but based on nitrogen instead of sulfur.
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3 Nerve Agent

ILLNESS | Chemical | Nerve Agent

Nerve agents are a class of organic chemicals that disrupt the mechanisms by which nerves transfer messages to organs. The disruption is caused by the blocking of acetylcholinesterase, an enzyme that catalyzes the breakdown of acetylcholine, a neurotransmitter.

Sources	Chemical compound created for military use. Nerve Agents can be aerosolised, liquified or grains/powder. Some countries known to possess VX are the United States, the United Kingdom, Russia, North Korea, Israel, and Syria.
Symptoms	Poisoning by a nerve agent leads to contraction of pupils, profuse salivation, convulsions, and involuntary urination and defecation, with the first symptoms appearing in seconds after exposure. Death by asphyxiation or cardiac arrest may follow in minutes due to the loss of the body's control over respiratory and other muscles.

ILLNESS Chemical Nerve Agent

Symptoms of Exposure	Early symptoms of percutaneous exposure (skin contact) include local sweating and muscular twitching at the area of exposure, followed by nausea or vomiting. Early symptoms of exposure to VX vapor include rhinorrhea (runny nose) and/or tightness in the chest with shortness of breath (bronchial constriction). Miosis (pinpointing of the pupils) may be an early sign of agent exposure, but is not usually used as the only indicator of exposure.
Prevention	Nerve agents can also be absorbed through the skin, requiring that those likely to be subjected to such agents wear a full body suit in addition to a respirator. Butyrylcholinesterase is a prophylactic countermeasure against organophosphate nerve agents. It binds nerve agent in the bloodstream before it can exert effects in the nervous system. Because it is a biological scavenger (and universal target), it is currently the only therapeutic agent effective in providing complete stoichiometric protection against the entire spectrum of organophosphate nerve agents.
Treatment	Atropine and related anticholinergic drugs act as antidotes to nerve agent poisoning because they block acetylcholine receptors, but they are poisonous in their own right. Some synthetic anticholinergics, such as biperiden, may counteract the central symptoms of nerve agent poisoning better than atropine, since they pass the blood–brain barrier better than atropine. While these drugs will save the life of a person affected by nerve agents, that person may be incapacitated briefly or for an extended period, depending on the extent of exposure. The endpoint of atropine administration is the clearing of bronchial secretions. Atropine for field use by military personnel is often loaded in an autoinjector, for ease of use in stressful conditions. Pralidoxime chloride, also known as 2-PAM chloride, is also used as an antidote. Rather than counteracting the initial effects of the nerve agent on the nervous system as does atropine, pralidoxime chloride reactivates the poisoned enzyme (acetylcholinesterase) by scavenging the phosphoryl group attached on the functional hydroxyl group of the enzyme. Though safer to use than atropine, it takes longer to act.
Spreading	● Uncontrolled aerosol munitions ● Smoke generation ● Explosive dissemination ● Atomizers, humidifiers and foggers
Exposure	On such exposure, these agents severely disrupt the body's signaling between the nervous and muscular systems, leading to a prolonged neuromuscular blockade, flaccid paralysis of all the muscles in the body including the diaphragm, and death by asphyxiation.

Nerve Agent G Series

The G-series is thus named because German scientists first synthesized them. G series agents are known as non-persistent, while the V series are persistent. All of the compounds in this class were discovered and synthesized during or prior to World War II.

Tabun (GA)	Extremely toxic chemical substance. Tabun or GA is an extremely toxic chemical substance. It is a clear, colorless, and tasteless liquid with a faint fruity odor. Tabun can be destroyed with bleaching powder (calcium hypochlorite), though the poisonous gas cyanogen chloride is produced.
Sarin (GB)	Highly toxic synthetic compound. Exposure is lethal even at very low concentrations, where death can occur within one to ten minutes after direct inhalation of a lethal dose. Death will usually occur as a result of asphyxia due to the inability to control the muscles.
Soman (GD)	It is a volatile, corrosive, and colorless liquid with a faint odor when pure. More commonly, it is a yellow to brown color and has a strong odor described as similar to camphor. t is both more lethal and more persistent than sarin or tabun, but less so than cyclosarin.
Cyclosarin (GF)	The original agent, tabun, was discovered in Germany in 1936 in the process of work on insecticides. Next came sarin, soman and finally the most toxic, cyclosarin. At room temperature, cyclosarin is a colorless liquid whose odor has been variously described as sweet and musty, or resembling peaches or shellac.
GV	It is a potent acetylcholinesterase inhibitor with properties similar to other nerve agents, being a highly poisonous vapour. Treatment for poisoning with GV involves drugs such as atropine, benactyzine, obidoxime, and HI-6.

Nerve Agent V Series

The V-series is the second family of nerve agents and contains five well known members: VE, VG, VM, VR, and VX, along with several more obscure analogues. This class of compounds is also sometimes known as Tammelin's esters

VE	They have similar lethal dose levels to VX (between 10–50 mg) and have similar symptoms and method of action to other nerve agents that act on cholinesterase, and treatment remains the same, but the window for effectively treating second generation V series seizures is shorter. In addition to the standard seizures, some of the second generation V series agents are known to cause comas.
VG	With a toxicity of about 1/10 that of VX, i.e. similar to that of sarin. It is thought that North Korea may have military stockpiles of this chemical.
VM	Little is known about this chemical compound other than its chemical formula. They have similar lethal dose levels to VX (between 10 and 50 mg) and have similar symptoms and method of action to other nerve agents that act on cholinesterase. The treatment remains the same, but the window for effectively treating second generation V series seizures is shorter.
VR	VR has similar lethal dose levels to VX (between 10–50 mg) and has similar symptoms and method of action to other nerve agents that act on cholinesterase, and treatment remains the same. However, the window for effectively treating second generation V series seizures is shorter, as they rapidly denature the acetylcholinesterase protein in a similar manner to soman, making treatment with the standard nerve gas antidote pralidoxime ineffective unless it is given very soon after exposure. Pre-treatment with pyridostigmine prior to exposure, and treatment with other drugs such as atropine and diazepam after exposure, will reduce symptoms of nerve agent toxicity but may not be sufficient to prevent death if a large dose of nerve agent has been absorbed. In addition to the standard seizures, some of the second generation V series agents are known to cause comas.
VX **(Venomous Agent X)**	Because of its low volatility, VX persists in environments where it is dispersed. VX fatalities occur with exposure to tens of milligram quantities via inhalation or absorption through skin; VX is thus more potent than sarin, another nerve agent with a similar mechanism of action.

4 Nettle Agent

Nettle agents (named after stinging nettles) or urticants are a variety of chemical warfare agents that produce corrosive skin and tissue injury upon contact, resulting in erythema, urticaria, intense itching, and a hive-like rash. Most nettle agents, such as the best known and studied nettle agent, phosgene oxime, are often grouped with the vesicant (blister agent) chemical agents. However, because nettle agents do not cause blisters, they are not true vesicants.

5 Choking Agent (Pulmonary Agent)

A pulmonary agent, or choking agent, is a chemical weapon agent designed to impede a victim's ability to breathe. They operate by causing a build-up of fluids in the lungs, which then leads to suffocation. Exposure to the eyes and skin tends to be corrosive, causing blurred vision and severe deep burns. Inhalation of these agents cause burning of the throat, coughing, vomiting, headache, pain in chest, tightness in chest, and respiratory and circulatory failure.

Chlorine Gas

Chlorine is a toxic gas that attacks the respiratory system, eyes, and skin. Because it is denser than air, it tends to accumulate at the bottom of poorly ventilated spaces. Chlorine gas is a strong oxidizer, which may react with flammable materials.

Chlorine is detectable with measuring devices in concentrations as low as 0.2 parts per million (ppm), and by smell at 3 ppm. Coughing and vomiting may occur at 30 ppm and lung damage at 60 ppm. About 1000 ppm can be fatal after a few deep breaths of the gas. The IDLH (immediately dangerous to life and health) concentration is 10 ppm. Breathing lower concentrations can aggravate the respiratory system and exposure to the gas can irritate the eyes. The toxicity of chlorine comes from its oxidizing power. When chlorine is inhaled at concentrations greater than 30 ppm, it reacts with water and cellular fluid, producing hydrochloric acid (HCl) and hypochlorous acid (HClO).

Signs and Symptoms
Chlorine gas, also known as bertholite, was first used as a weapon in World War I by Germany on April 22, 1915, in the Second Battle of Ypres. As described by the soldiers, it had the distinctive smell of a mixture of pepper and pineapple. It also tasted metallic and stung the back of the throat and chest. Chlorine reacts with water in the mucosa of the lungs to form hydrochloric acid, destructive to living tissue and potentially lethal. Human respiratory systems can be protected from chlorine gas by gas masks with activated charcoal or other filters, which makes chlorine gas much less lethal than other chemical weapons. It was pioneered by a German scientist later to be a Nobel laureate, Fritz Haber of the Kaiser Wilhelm Institute in Berlin, in collaboration with the German chemical conglomerate IG Farben, which developed methods for discharging chlorine gas against an entrenched enemy. After its first use, both sides in the conflict used chlorine as a chemical weapon, but it was soon replaced by the more deadly phosgene and mustard gas.

Treatment
There is no antidote for chlorine poisoning; management is supportive after evacuating people from the site of exposure and flushing exposed tissues. For lung damage caused by inhalation, oxygen and bronchodilators may be administered. There is no way to predict outcomes. Most people with mild to moderate exposure generally recover fully in three to five days, but some develop chronic problems such as reactive airway disease. Smoking or pre-existing lung conditions like asthma appear to increase the risk of long term complications.

Chloropicrin (PS)

Chloropicrin, also known as PS and nitrochloroform, is a chemical compound currently used as a broad-spectrum antimicrobial, fungicide, herbicide, insecticide, and nematicide. Chloropicrin is harmful to humans. It can be absorbed systemically through inhalation, ingestion, and the skin. At high concentrations it is severely irritating to the lungs, eyes, and skin. In World War I German forces used concentrated chloropicrin against Allied forces as a tear gas. While not as lethal as other chemical weapons, it caused vomiting and forced Allied soldiers to remove their masks to vomit, exposing them to other, more toxic chemical gases used as weapons during the war. Smells like 'flypaper'.

Diphosgene (DP)

Diphosgene was originally developed as a pulmonary agent for chemical warfare, a few months after the first use of phosgene. It was used as a poison gas in artillery shells by Germany during World War I. The first recorded battlefield use was in May 1916. Diphosgene was developed because the vapors could destroy the filters in gas masks in use at the time.

Phosgene (CG)

It is very poisonous and was used as a chemical weapon during World War I, when it was responsible for 85,000 deaths. Although less toxic than many other chemical weapons such as sarin, phosgene is still regarded as a viable chemical warfare agent because of its simpler manufacturing requirements when compared to that of more technically advanced chemical weapons such as the first-generation nerve agent tabun.

Phosgene was first deployed as a chemical weapon by the French in 1915 in World War I. It was also used in a mixture with an equal volume of chlorine, with the chlorine helping to spread the denser phosgene. Phosgene was more potent than chlorine, though some symptoms took 24 hours or more to manifest. Following the extensive use of phosgene during World War I, it was stockpiled by various countries. Smells like 'musty hay'.

Disulfur Decafluoride

S_2F_{10} was considered a potential chemical warfare pulmonary agent in World War II because it does not produce lacrimation or skin irritation, thus providing little warning of exposure. Disulfur decafluoride is a colorless gas or liquid with a SO_2-like odor. It is about 4 times as poisonous as phosgene. Its toxicity is thought to be caused by its disproportionation in the lungs into SF_6, which is inert, and SF_4, which reacts with moisture to form sulfurous acid and hydrofluoric acid. Disulfur decafluoride itself is not toxic due to hydrolysis products, since it is hardly hydrolysed by water and most aqueous solutions. It is a colorless liquid with a burnt match smell similar to sulfur dioxide.

Perfluoroisobutene

An alkene, it is a colorless gas that it is notable as a highly toxic perfluoroalkene.

Acrolein

Acrolein is toxic and is a strong irritant for the skin, eyes, and nasal passages. The main metabolic pathway for acrolein is the alkylation of glutathione. The WHO suggests a "tolerable oral acrolein intake" of 7.5 μg per day per kg of body weight.

Diphenylcyanoarsine

ILLNESS Chemical

Diphenylcyanoarsine, also called Clark 2 (Chlor-Arsen-Kampfstoff 2, being the successor of Clark 1) by the Germans, was discovered in 1918 by Sturniolo and Bellinzoni and shortly thereafter used like the related Clark 1 gas by the Germans for chemical warfare in the First World War. The substance causes nausea, vomiting and headaches. It can subsequently lead to e.g. pulmonary edema (fluid in the lungs).

6 Vomiting Agent

Vomiting agents are chemical weapon agents causing vomiting. Prolonged exposure can be lethal. They were used for the first time during WWI.

ILLNESS Chemical Incapacitating Agent

7 Incapacitating Agent

The term incapacitating agent is defined by the U.S. Department of Defense as:
"An agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties." It describes an agent which renders a person unable to harm themselves or others, regardless of consciousness.
Lethal agents are primarily intended to kill, but incapacitating agents can also kill if administered in a potent enough dose, or in certain scenarios.

The term "incapacitation," when used in a general sense, is not equivalent to the term "disability" as used in occupational medicine and denotes the inability to perform a task because of a quantifiable physical or mental impairment. In this sense, any of the chemical warfare agents may incapacitate a victim; however, by the military definition of this type of agent, incapacitation refers to impairments that are temporary and nonlethal. Thus, riot-control agents are incapacitating because they cause temporary loss of vision due to blepharospasm, but they are not considered military incapacitants because the loss of vision does not last long. Although incapacitation may result from physiological changes such as mucous membrane irritation, diarrhea, or hyperthermia, the term "incapacitating agent" as militarily defined refers to a compound that produces temporary and nonlethal impairment of military performance by virtue of its psychobehavioral or CNS effects.

In biological warfare, a distinction is also made between bio-agents as Lethal Agents (e.g., Bacillus anthracis, Francisella tularensis, Botulinum toxin) or Incapacitating Agents (e.g., Brucella suis, Coxiella burnetii, Venezuelan equine encephalitis virus, Staphylococcal enterotoxin B).

ILLNESS Chemical Riot Control Agent

8 Riot Control Agent (RCA)

Riot control agents (sometimes called RCAs) are non-lethal lachrymatory agents used for riot control. Most commonly used riot control agents are pepper spray and various kinds of tear gas. These chemicals disperse a crowd that could be protesting or rioting, or to clear a building. They can rapidly produce sensory irritation or disabling physical effects which usually disappear within 15 minutes (for tear gas) and up to 2 hours (for pepper spray) following termination of exposure. They can also be used for chemical warfare defense training, although their use in warfare itself is a violation of Article I.5 of the Chemical Weapons Convention. Article II.9 of the CWC specifically authorizes their use for civilian law enforcement.

Pepper Spray

Pepper Spray

The active ingredient in pepper-spray is capsaicin, which is a chemical derived from the fruit of plants in the Capsicum genus, including chilies. A synthetic analogue of capsaicin, pelargonic acid vanillylamide (desmethyldihydrocapsaicin), is used in another version of pepper spray known as PAVA spray which is used in the United Kingdom. Another synthetic counterpart of pepper spray, pelargonic acid morpholide, was developed and is widely used in Russia. Its effectiveness compared to natural pepper spray is uncertain and it reportedly has caused some injuries. When undesirables threaten an area, such as a riot after a soccer game, riot police are called in to subdue them. In these situations, the police may use pepper spray, or water cannons to neutralize the threat.

Pepper spray typically comes in canisters, which are often small enough to be carried or concealed in a pocket or purse. Pepper spray can also be bought concealed in items such as rings. There are also pepper spray projectiles available, which can be fired from a paintball gun. Having been used for years against demonstrators, it is increasingly being used by police in routine interventions.

ILLNESS Chemical Riot Control Agent Tear Gas

Tear Gas

Tear gas is a non-specific term for any chemical that is used to temporarily incapacitate through irritation of eyes and/or respiratory system. It is used as a hand-held spray or can be fired in canisters that heat up spewing out an aerosol cloud at a steady rate. Whilst the use of tear gas in warfare is prohibited by various international treaties that most states have signed, police and private self-defense use is not banned in the same manner.

Popular tear gases include the eye irritants ortho-chlorobenzylidene-malononitrile (CS gas), chloroacetophenone (CN gas), and dibenz (b,f)-1,4-oxazepine (CR gas). Among a long list of substances, these three have become of greater importance than the others because of their effectiveness and low risks when used. Today, CS has largely replaced CN as the most widely used tear gas internationally.

Decontamination
At room temperature, tear gases are white solids. They are stable when heated and have low vapor pressure. Consequently, they are usually dispersed as aerosols. All of them have low solubility in water but can be dissolved in several organic solvents. Hydrolysis of CN is very slow in a water solution, especially if alkali is added. CS is rapidly hydrolyzed in water solution (half-life at pH 7 is about 15 min. at room temperature) and extremely rapid when alkali is added (half-life at pH 9 is about 1 min.). CR is hydrolyzed only to a negligible extent in water solution.

CN and CR are, thus, difficult to decompose under practical conditions, whereas CS can easily be inactivated by means of a water solution. Skin is suitably decontaminated of CS and CN gas by thorough washing with soap and water. CS is then decomposed, whereas CN is only removed via soap and water. The effects of CR gas are greatly increased by water, causing any attempt to DECON CR via soap and water to increase the severity and duration of the effects. When decontamination of CR is attempted with soap and water the effects of CR can last up to 48 hours

Chemical Riot Control Agent Tear Gas

Decontamination of material after contamination with CR gas is not possible for up to 45 days. CS can be decontaminated l with a 5–10 percent soda solution or 2 percent alkaline solution. If this type of decontamination cannot be accomplished (e.g., contaminated rooms and furniture), then the only other means is by intensive air exchange—preferably with hot air.

Exposed streets and sidewalks will have toxic and irritating CS powder that will be stirred into the air by traffic and pedestrians long after the cloud has dissipated, and should be washed away with water. In contrast to human beings, domesticated animals generally have lower sensitivity to tear gases. Dogs and horses can therefore be used by police for riot control even when tear gas is used.

ILLNESS

7 Biological

ILLNESS Biological

A biological agent (also called bio-agent, biological threat agent, biological warfare agent, biological weapon, or bioweapon) is a bacterium, virus, protozoan, parasite, or fungus that can be used purposefully as a weapon in bioterrorism or biological warfare (BW). In addition to these living or replicating pathogens, toxins and biotoxins are also included among the bio-agents. More than 1,200 different kinds of potentially weaponizable bio-agents have been described and studied to date.

Biological agents have the ability to adversely affect human health in a variety of ways, ranging from relatively mild allergic reactions to serious medical conditions, including serious injury, as well as serious or permanent disability or even death. Many of these organisms are ubiquitous in the natural environment where they are found in water, soil, plants, or animals. Bio-agents may be amenable to "weaponization" to render them easier to deploy or disseminate. Genetic modification may enhance their incapacitating or lethal properties, or render them impervious to conventional treatments or preventives. Since many bio-agents reproduce rapidly and require minimal resources for propagation, they are also a potential danger in a wide variety of occupational settings.

Biological warfare (BW)—also known as germ warfare—is the use of biological toxins or infectious agents such as bacteria, viruses, insects, and fungi with the intent to kill, harm or incapacitate humans, animals or plants as an act of war. Biological weapons (often termed "bio-weapons", "biological threat agents", or "bio-agents") are living organisms or replicating entities (i.e. viruses, which are not universally considered "alive"). Entomological (insect) warfare is a subtype of BW.

Offensive biological warfare is prohibited under customary international humanitarian law and several international treaties. In particular, the 1972 Biological Weapons Convention (BWC) bans the development, production, acquisition, transfer, stockpiling and use of biological weapons. Therefore, the use of biological agents in armed conflict is a war crime. In contrast, defensive biological research for prophylactic, protective or other peaceful purposes is not prohibited by the BWC.

Biological warfare is distinct from warfare involving other types of weapons of mass destruction (WMD), including nuclear warfare, chemical warfare, and radiological warfare. None of these are considered conventional weapons, which are deployed primarily for their explosive, kinetic, or incendiary potential. Biological weapons may be employed in various ways to gain a strategic or tactical advantage over the enemy, either by threats or by actual deployments. Like some chemical weapons, biological weapons may also be useful as area denial weapons. These agents may be lethal or non-lethal, and may be targeted against a single individual, a group of people, or even an entire population. They may be developed, acquired, stockpiled or deployed by nation states or by non-national groups. In the latter case, or if a nation-state uses it clandestinely, it may also be considered bioterrorism.

Biological warfare and chemical warfare overlap to an extent, as the use of toxins produced by some living organisms is considered under the provisions of both the BWC and the Chemical Weapons Convention. Toxins and psychochemical weapons are often referred to as midspectrum agents. Unlike bioweapons, these midspectrum agents do not reproduce in their host and are typically characterized by shorter incubation periods.

Biological Agents

Bacterial Bio-Agents

Disease	Causative Agent
Anthrax	Bacillus anthracis (N or TR)
Brucellosis (bovine)	Brucella abortus
Brucellosis (caprine)	Brucella melitensis (AM or BX)
Brucellosis (porcine)	Brucella suis (US, AB or NX)
Cholera	Vibrio cholerae (HO)
Diphtheria	Corynebacterium diphtheriae (DK)
Dysentery (bacterial)	Shigella dysenteriae, some species of Escherichia coli (Y)
Glanders	Burkholderia mallei (LA)
Listeriosis	Listeria monocytogenes (TQ)
Melioidosis	Burkholderia pseudomallei (HI)
Plague	Yersinia pestis (LE)
Tularemia	Francisella tularensis (SR or JT)

Chlamydial Bio-Agents

Disease	Causative Agent
Psittacosis	Chlamydophila psittaci (SI)

Rickettsial Bio-Agents

Disease	Causative Agent
Q Fever	Coxiella burnetii (OU)
Rocky Mountain spotted fever	Rickettsia rickettsii (RI or UY)
Typhus (human)	Rickettsia prowazekii (YE)
Typhus (murine)	Rickettsia typhi (AV)

Viral Bio-Agents

Disease	Causative Agent
Equine Encephalitis (Eastern)	Eastern equine encephalitis virus (ZX)
Equine Encephalitis (Venezuelan)	Venezuelan Equine Encephalomyelitis virus (FX)
Equine Encephalitis (Western)	Western equine encephalitis virus (EV)
Japanese B encephalitis	Japanese encephalitis virus (AN)
Marburg Hemorrhagic Fever (Marburg HF)	Marburg Virus (MARV)
Rift Valley fever	Rift Valley fever virus (FA)
Smallpox	Variola virus (ZL)
Yellow fever	Yellow fever virus (OJ or LU)

Mycotic Bio-Agents

Disease	Causative Agent
Coccidiomycosis	Coccidioides immitis (OC)

Biological Toxins

Disease	Causative Agent

ILLNESS	Biological	Biological Agents	Biological To[xins]	
			Abrin	Rosary pea (Abrus precatorius)
			Botulinum toxins (A through G)	Clostridium botulinum bacteria or spores, and several other Clostridial species. (X or XR)
			Ricin	Castor bean (Ricinus communis) (W or WA)
			Saxitoxin	Various marine and brackish cyanobacteria, such as Anabaena, Aphanizomenon, Lyngbya, and Cylindrospermopsis (TZ)
			Staphyloccocal enterotoxin B	Staphylococcus aureus (UC or PG)
			Tetrodotoxin	Various marine bacteria, including Vibrio alginolyticus, Pseudoalteromonas tetraodonis (PP)
			Trichothecene mycotoxins	Various species of fungi, including Fusarium, Trichoderma, and Stachybotrys

Biological Vectors

Disease	Causative Agent
Mosquito (Aedes aegypti) (AP)	Malaria, Dengue fever, Chikungunya, Yellow fever, other Arboviruses
Oriental rat flea (Xenopsylla cheopis)	Plague, Murine typhus

Injury

Common types of injuries and how to treat them

"An injury is not just a process of recovery it's a process of discovery."
Conor McGregor

Introduction

This category lists any injuries that can be sustained to the body and how to remedy them.

Purpose	The aim of INJURY is to inform the reader on the causes, symptoms, prevention techniques and treatments of the most likely injuries you'll sustain in a disaster.
Lost?	***** **QUICK TRIAGE (If you're injured or sick and looking for the correct section)** ***** ● **Sections under ILLNESS:** Radiation Sickness, Parasitic Infections, Bacterial Infections, Viral Infections, Fungal Infections, Altitude Sickness, Poisoning, Chemical Agents, Biological Agents. ● **Sections under INJURY:** Surface Wound & Bruises, Internal Injuries (Back Pain, Cerebral Hemorrhage, Bone Fractures, Dislocation, Concussion) Open Wounds, Avulsion, Burns, Environmental (Anaphylaxis, Heat Stroke, Hypothermia, Hyperthermia, Motion Sickness, Aero-otitis Media), Atmosphere (Asphyxiation, Drowning, Choking, Hypoxia, Carbon Monoxide Poisoning), Animal & Plant (Bites and Stings), Childbirth, Toothaches. ● **Sections under EMOTIONAL:** Depression, Anxiety, Stress, Confidence, Relaxation, Memory & Dementia, Grief & Loss, Postnatal Depression, New Parents, Body Image, Family & Friends and Healthy Living.

● For medications and recommended doses, see the MEDICATION section.
● For curing ailments naturally and herbal remedies, see the NATURAL REMEDIES section.
● For eating disorders, see the HEALTH > Nutrients section.

Contents

1 Surface Wound & Bruise

Where the skin membrane has been removed or marked or scraped.

Subheadings

		1. Friction Burn	2. Blisters	3. Bruises			

1 Friction Burn

A friction burn is a form of abrasion caused by the friction of skin rubbing against a surface. A friction burn may also be referred to as skinning, chafing, or a term named for the surface causing the burn such as rope burn, carpet burn or rug burn. Because friction generates heat, extreme cases of chafing may result in genuine burning of the outer layers of skin. The dermal papillae may be exposed after top layers of the dermis (stratum corneum, stratum granulosum, stratum spinosum and stratum basale) have been removed. This is often uncomfortable and even painful, but rarely results in bleeding. A person's own skin (or the skin of another person) may be sufficient to act as an abrasive surface to cause friction burn.

More commonly, friction with abrasive surfaces, including clothing, carpet, or rope, can lead to a friction burn. Common places at which skin-to-skin chafing can occur are between the thighs and under the armpits. Friction burns are very common with clothing such as trousers on the knees caused by playing sport or sliding on wooden surfaces. Less dangerous friction burns can occur frequently on sensitive skin surfaces such as the genitals, such as during sexual intercourse or masturbation. The risks of a friction burn include infection and temporary or permanent scarring.

Treatment
Most minor cases of a friction burn require little to no treatment; as a specific case of allergy might aggravate. Treatments for friction burns usually involve application of an anti-inflammatory cream. Pain relieving medication may also be taken.

2 Blisters

A blister is a small pocket of body fluid within the upper layers of the skin, typically caused by forceful rubbing (friction), burning, freezing, chemical exposure or infection. Most blisters are filled with a clear fluid, either serum or plasma. However, blisters can be filled with blood (known as "blood blisters") or with pus (for instance, if they become infected). To heal properly, a blister should not be popped unless medically necessary. If popped, the excess skin should not be removed because the skin underneath needs that top layer to heal properly. A blister may form when the skin has been damaged by friction or rubbing, heat, cold or chemical exposure. Fluid collects between the upper layers of Skin (the epidermis) and the layers below (the dermis). This fluid cushions the tissue underneath, protecting it from further damage and allowing it to heal.

Friction & Rubbing
Intense rubbing can cause a blister, as can any friction on the skin if continued long enough. This kind of blister is most common after walking long distances or by wearing old or poorly fitting shoes. Blisters are most common on the hands and feet, as these extremities are susceptible while walking, running, or performing repetitive motions, such as joystick manipulation whilst playing certain video games, digging with a shovel, playing guitar, etc. Blisters form more easily on damp skin than on dry or soaked skin, and are more common in warm conditions. Less-aggressive rubbing over long periods of time may cause calluses to form rather than a blister. Both blisters and calluses can lead to more serious complications, such as foot ulceration and infection, particularly when sensation or circulation is impaired, as in the case of diabetes, neuropathy or peripheral artery disease (PAD).

Friction blisters are caused by excess shear stress between the surface of the skin and the body. The strata of skin around the Stratum spinosum are most susceptible to shear. As the Stratum spinosum tears away from the connecting tissues below, plasma from the cells diffuses out. This plasma solution helps new cells divide and grow into new connective tissues and epidermal layers. The clear fluid will be reabsorbed as new cells develop and the swollen appearance will subside. Painful blisters located on hands (palmar surface) and feet (plantar surface) are due to tissue shearing deeper in the epidermis, near nerve endings. Lower tissues are more susceptible to infection.

Extreme Temperature
This type of blistering is one of the tools used to determine the degree of burns sustained. First and second degree burns may result in blistered skin; however, it is characteristic of second degree burns to blister immediately, whereas first degree burns can have blisters after a couple of days. Blisters can also form on the hands and feet as a result of tissue damage incurred by frostbite.

Chemical Exposure
Sometimes, the skin will blister when it comes into contact with a cosmetic, detergent, solvent, or other chemical such as nickel sulphate, Balsam of Peru, or urushiol (poison ivy, poison oak, poison sumac). This is known as contact dermatitis. Blisters can also develop as a result of an allergic reaction to an insect bite or sting. Some chemical warfare agents, known as blister agents or vesicants, cause large, painful blisters wherever they contact skin; an example is mustard gas.

Crushing / Pinching
A blood blister usually forms when a minute blood vessel close to the surface of the skin ruptures (breaks), and blood leaks into a tear between the layers of skin. This can happen if the skin is crushed, pinched or aggressively squeezed.

Medical Conditions
There are also a number of medical conditions that cause blisters. The most common are chickenpox, herpes, impetigo, and a form of eczema called dyshidrosis. Other, much rarer conditions that cause blisters include:

- Bullous Pemphigoid: a skin disease that causes large, tightly filled blisters to develop, usually affecting people over the age of 60.
- Pemphigus: a serious skin disease in which blisters develop if pressure is applied to the skin; the blisters burst easily, leaving raw areas that can become infected.
- Dermatitis Herpetiformis: a skin disease that causes intensely itchy blisters, usually on the elbows, knees, back and buttocks. The blisters usually develop in patches of the same shape and size on both sides of the body.
- Chronic Bullous Dermatosis: a disease that causes clusters of blisters on the face, mouth or genitals.
- Cutaneous Radiation Syndrome
- Epidermolysis Bullosa

Prevention
Friction blisters, caused by rubbing against the skin, can be prevented by reducing the friction to a level where blisters will not form. This can be accomplished in a variety of ways. Blisters on the feet can be prevented by wearing comfortable, well-fitting shoes and clean socks. Inherently ill-fitting or stiffer shoes, such as high heels and dress shoes, present a larger risk of blistering. Blisters are more likely to develop on skin that is moist, so socks that manage moisture or frequent sock changes will aid those with particularly sweaty feet. While exercising or playing sports, special sports socks can help keep feet drier and reduce the chance of blisters.

Before going for a long walk, it is also important to ensure that shoes or hiking boots have been properly broken in. Even before a "hot" or irritated area on the foot is felt, taping a protective layer of padding or a friction-reducing interface between the affected area and the footwear can prevent the formation of a blister. Bandages, moleskin and tapes generally must be applied to the foot daily, and most have a very high coefficient of friction (COF), but a friction-management patch applied to the shoe will remain in place much longer, throughout many changes of socks and insoles.
This type of intervention may be used with footwear that is worn daily, with specialty shoes and boots like hockey skates, ice skates, inline skates, ski boots and cleats, or even with orthotic braces and splints. For periods of sustained use such as hiking and trail running, especially where water ingress or moisture build up in the shoe or boot can occur, moisture wicking liner socks can provide the required friction protection.

To avoid friction blisters on the hands, gloves should be worn when using tools such as a shovel or pickaxe, doing manual work such as gardening, or using sports equipment like golf clubs or baseball bats. Oars used for competitive rowing are known for causing frequent blisters on the hands of oarsmen. Weightlifters are also prone to blisters as are gymnasts from the friction developed by the rubbing against the bars. To further reduce the occurrence one can tape the hands, and there are also a number of products on the market that claim to reduce the occurrence of blisters.

These are all intended to be worn as a liner underneath a glove. The majority of these offerings simply add padding and create a layer that reduces the coefficient of friction between the skin and the glove. A lubricant, typically talcum powder, can be used to reduce friction between skin and apparel in the short term. People put talcum powder inside gloves or shoes for this purpose, although this type of lubricant will increase the friction in the long term, as it absorbs moisture. Increased friction makes blisters more likely.

Sunscreen and protective clothing should also be used during the hottest part of the day to avoid blisters from sunburn. Avoiding sunlight during midday is the best way to avoid blisters from sunburn. Protective gloves should be worn when handling detergents, cleaning products, solvents and other chemicals.

3 Bruises

A contusion, commonly known as a bruise, is a type of hematoma of tissue in which capillaries and sometimes venules are damaged by trauma, allowing blood to seep, haemorrhage, or extravasate into the surrounding interstitial tissues. Most bruises are not very deep under the skin so that the bleeding causes a visible discoloration. The bruise then remains visible until the blood is either absorbed by tissues or cleared by immune system action. Bruises, which do not blanch under pressure, can involve capillaries at the level of skin, subcutaneous tissue, muscle, or bone.

Bruises are not to be confused with other similar-looking lesions primarily distinguished by their diameter or causation. These lesions include petechia (< 3 mm result from numerous and diverse etiologies such as adverse reactions from medications such as warfarin, straining, asphyxiation, platelet disorders and diseases such as cytomegalovirus), purpura (3 mm to 1 cm, classified as palpable purpura or non-palpable purpura and indicates various pathologic conditions such as thrombocytopenia), and ecchymosis (>1 cm caused by blood dissecting through tissue planes and settled in an area remote from the site of trauma or pathology such as periorbital ecchymosis, e.g., "raccoon eyes", arising from a basilar skull fracture or from a neuroblastoma). As a type of hematoma, a bruise is always caused by internal bleeding into the interstitial tissues which does not break through the skin, usually initiated by blunt trauma, which causes damage through physical compression and deceleration forces. Trauma sufficient to cause bruising can occur from a wide variety of situations including accidents, falls, and surgeries.

Disease states such as insufficient or malfunctioning platelets, other coagulation deficiencies, or vascular disorders, such as venous blockage associated with severe allergies can lead to the formation of purpura which is not to be confused with trauma-related bruising/contusion. If the trauma is sufficient to break the skin and allow blood to escape the interstitial tissues, the injury is not a bruise but bleeding, a different variety of haemorrhage. Such injuries may be accompanied by bruising elsewhere. Bruises often induce pain immediately after the trauma that results in their formation, but small bruises are not normally dangerous alone. Sometimes bruises can be serious, leading to other more life-threatening forms of hematoma, such as when associated with serious injuries, including fractures and more severe internal bleeding. The likelihood and severity of bruising depends on many factors, including type and healthiness of affected tissues. Minor bruises may be easily recognized in people with light skin colour by characteristic blue or purple appearance in the days following the injury.

Cause
The presence of bruises may be seen in patients with platelet or coagulation disorders, or those who are being treated with an anticoagulant. Unexplained bruising may be a warning sign of child abuse, domestic abuse, or serious medical problems such as leukaemia or meningococcal infection. Unexplained bruising can also indicate internal bleeding or certain types of cancer. Long-term glucocorticoid therapy can cause easy bruising. Bruising present around the navel (belly button) with severe abdominal pain suggests acute pancreatitis. Connective tissue disorders such as Ehlers-Danlos syndrome may cause relatively easy or spontaneous bruising depending on the severity. During an autopsy, bruises accompanying abrasions indicate the abrasions occurred while the individual was alive, as opposed to damage incurred post mortem.

Size / Shape
Bruise shapes may correspond directly to the instrument of injury or be modified by additional factors. Bruises often become more prominent as time lapses, resulting in additional size and swelling, and may grow to a large size over the course of the hours after the injury that caused the bruise was inflicted. As stated above, bruising present in a different location than the site of impact is called ecchymosis and generally occurs when the tissue at the site of injury is loose, allowing blood to travel under the skin to another location due to gravity or other forces, such as in a black eye.

Size / Shape
● Condition and type of tissue: In soft tissues, a larger area is bruised than would be in firmer tissue due to ease of blood to invade tissue.
● Age: elderly skin and other tissues are often thinner and less elastic and thus more prone to bruising.
● Gender: More bruising occurs in females due to increased subcutaneous fat.
● Skin tone: Discoloration caused by bruises is more prominent in lighter complexions.
● Diseases: Coagulation, platelet and blood vessel diseases or deficiencies can increase bruising due to more bleeding.
● Location: More extensive vascularity causes more bleeding. Areas such as the arms, knees, shins and the facial area are especially common bruise sites.
● Forces: Greater striking forces cause greater bruising.
● Genes: Despite having completely normal coagulation factors, natural redheads have been shown to bruise more, although this may just be due to greater visibility on commonly associated lighter complexion.

Severity
Bruises can be scored on a scale from 0-5 to categorize the severity and danger of the injury.

	0	1	2	3	4	5
Severity	Light Bruise	Mild Bruise	Moderate Bruise	Serious Bruise	Extremely Serious Bruise	Critical Bruise
Effects	No Damage	Damage	Some Damage	Dangerous	Dangerous	Risk of Death

The harm score is determined by the extent and severity of the injuries to the organs and tissues causing the bruising, in turn depending on multiple factors. For example, a contracted muscle will bruise more severely, as will tissues crushed against underlying bone. Capillaries vary in strength, stiffness and toughness, which can also vary by age and medical conditions. Low levels of damaging forces produce small bruises and generally cause the individual to feel minor pain straight away.

Repeated impacts worsen bruises, increasing the harm level. Normally, light bruises heal nearly completely within two weeks, although duration is affected by variation in severity and individual healing processes; generally, more severe or deeper bruises take somewhat longer. Severe bruising (harm score 2–3) may be dangerous or cause serious complications. Further bleeding and excess fluid may accumulate causing a hard, fluctuating lump or swelling hematoma. This has the potential to cause compartment syndrome in which the swelling cuts off blood flow to the tissues.

The trauma that induced the bruise may also have caused other severe and potentially fatal harm to internal organs. For example, impacts to the head can cause traumatic brain injury: bleeding, bruising and massive swelling of the brain with the potential to cause concussion, coma and death. Treatment for brain bruising may involve emergency surgery to relieve the pressure on the brain.

Damage that causes bruising can also cause bones to be broken, tendons or muscles to be strained, ligaments to be sprained, or other tissue to be damaged. The symptoms and signs of these injuries may initially appear to be those of simple bruising. Abdominal bruising or severe injuries that cause difficulty in moving a limb or the feeling of liquid under the skin may indicate life-threatening injury and require the attention of a physician.

Treatment

Treatment for light bruises is minimal and may include RICE (rest, immobilize, cold, elevate), painkillers (particularly NSAIDs) and, later in recovery, light stretching exercises. Particularly, immediate application of ice while elevating the area may reduce or completely prevent swelling by restricting blood flow to the area and preventing internal bleeding. Rest and preventing re-injury is essential for rapid recovery. Very gently massaging the area and applying heat may encourage blood flow and relieve pain according to the gate control theory of pain, although causing additional pain may indicate the massage is exacerbating the injury.

As for most injuries, these techniques should not be applied until at least three days following the initial damage to ensure all internal bleeding has stopped, because although increasing blood flow will allow more healing factors into the area and encourage drainage, if the injury is still bleeding this will allow more blood to seep out of the wound and cause the bruise to become worse. In most cases hematomas spontaneously revert, but in cases of large hematomas or those localized in certain organs (e.g., the brain), the physician may perform a puncture of the hematoma to allow blood to exit.

2 Internal Injury

Injuries which are inside the body such as cramps and dislocation.

Subheadings

1 Back Pain

Back pain is pain felt in the back. It is divided into neck pain (cervical), middle back pain (thoracic), lower back pain (lumbar) or coccydynia (tailbone or sacral pain) based on the segment affected. The lumbar area is the most common area for pain, as it supports most of the weight in the upper body. Episodes of back pain may be acute, sub-acute, or chronic depending on the duration.

The pain may be characterized as a dull ache, shooting or piercing pain, or a burning sensation. Discomfort can radiate into the arms and hands as well as the legs or feet, and may include numbness, or weakness in the legs and arms. Back pain typically originates from degenerative or traumatic changes to the disks and facets joints, which can then cause secondary pain in the muscles, and nerves, and referred pain to the bones, joints and extremities.

Diseases and inflammation of the gallbladder, pancreas, aorta, and kidneys may also cause referred pain in the back. Tumours of the verteba, neural tissues and adjacent structures can also manifest as back pain. Back pain is common, with about nine out of ten adults experiencing it at some point in their life, and five out of ten working adults having it every year. Some estimate up to 95% of Americans will experience back pain at some point in their lifetime. It is the most common cause of chronic pain, and is a major contributor of missed work and disability.

However, it is rare for back pain to be permanently disabling. In most cases of herniated disks and stenosis, rest, injections or surgery have similar general pain resolution outcomes on average after one year. In the United States, acute low back pain is the fifth most common reason for physician visits and causes 40% of missed days off work. Additionally, it is the single leading cause of disability worldwide.

Causes

There are many causes of back pain, including blood vessels, internal organs, infections, mechanical, and autoimmune causes. The spinal cord, nerve roots, vertebral column, can all be sources of back pain, but primary muscle problems are rarely the cause. The anterior ligaments of the intervertebral disc are extremely sensitive, and even the slightest injury can cause significant pain. In osteoporosis, the bones become weaker and can develop small cracks, or fractures, in the bones, resulting in pain.

Arthritis in the joints of the back can also result in discomfort. The synovial joints of the spine (e.g. zygapophysial joints/facet joints) have been identified as the primary source of the pain in approximately one third of people with chronic low back pain, and in most people with neck pain following whiplash. Approximately 98 percent of people with back pain are diagnosed with nonspecific acute back pain in which there is no serious underlying pathology. Less than 2 percent are attributed to secondary factors, with metastatic cancers and serious infections, such as spinal osteomyelitis and epidural abscesses, accounting for around 1 percent. Back pain can be divided into non-radicular pain and radiculopathy.

Radiculopathy occurs when there is irritation in the nerve root, causing neurologic symptoms, such as numbness and tingling. Disk herniation and foraminal stenosis are the most common causes of radiculopathy. Non-radicular back pain is most commonly caused by injury to the spinal muscles or ligaments, degenerative spinal disease, or a herniated disk. Spondylosis, or spinal degeneration, occurs when the intervertebral disc undergoes degenerative changes, causing the disc to fail at cushioning the vertebrae. There is an association between intervertebral disc space narrowing and lumbar spine pain.

The space between the vertebrae becomes more narrow, resulting in compression and irritation of the nerves. There is a weak association between low back pain and facet osteoarthritis, which has been considered as a primary reason for compression of spine nerve roots as they exit the intervertebral foramen. Back pain can also be due to referred pain from another source. Referred pain occurs when pain is felt at a location different from the source of the pain.

An abdominal aortic aneurysm and ureteral colic can both result in pain felt in the back. Another possible cause of chronic back pain in people with otherwise normal scans is central sensitization, where an initial injury or infection causes a longer-lasting state of heightened sensitivity to pain. This persistent state maintains pain even after the initial injury has healed. Treatment of sensitization typically involves low doses of anti-depressants. Obesity, sedentary lifestyle, and lack of exercise can increase a person's risk of back pain.

People who smoke are more likely to experience back pain than others. Poor posture and weight gain in pregnancy are also risk factors for back pain. In general, fatigue can worsen pain. A few studies suggest that psychosocial factors such as on-the-job stress and dysfunctional family relationships may correlate more closely with back pain than structural abnormalities revealed in X-rays and other medical imaging scans.

Management

INJURY Internal Injury Back Pain Management

The management goals when treating back pain are to achieve maximal reduction in pain intensity as rapidly as possible, to restore the individual's ability to function in everyday activities, to help the patient cope with residual pain, to assess for side-effects of therapy, and to facilitate the patient's passage through the legal and socioeconomic impediments to recovery. For many, the goal is to keep the pain to a manageable level to progress with rehabilitation, which then can lead to long-term pain relief.

Also, for some people the goal is to use non-surgical therapies to manage the pain and avoid major surgery, while for others surgery may be the quickest way to feel better. Not all treatments work for all conditions or for all individuals with the same condition, and many find that they need to try several treatment options to determine what works best for them. The present stage of the condition (acute or chronic) is also a determining factor in the choice of treatment. Only a minority of people with back pain (most estimates are 1% - 10%) require surgery.

Management (Non Medical)
Back pain is generally treated with non-pharmacological therapy first, as it typically resolves without the use of medication. Superficial heat and massage, acupuncture, and spinal manipulation therapy may be recommended.

- Heat therapy is useful for back spasms or other conditions. A review concluded that heat therapy can reduce symptoms of acute and sub-acute low-back pain.
- Regular activity and gentle stretching exercises is encouraged in uncomplicated back pain, and is associated with better long-term outcomes. Physical therapy to strengthen the muscles in the abdomen and around the spine may also be recommended. These exercises are associated with better patient satisfaction, although it has not been shown to provide functional improvement. However, one study found that exercise is effective for chronic back pain, but not for acute pain. If used, they should be performed under supervision of a licensed health professional.
- Massage therapy may give short-term pain relief, but not functional improvement, for those with acute lower back pain. It may also give short-term pain relief and functional improvement for those with long-term (chronic) and sub-acute lower pack pain, but this benefit does not appear to be sustained after 6 months of treatment. There does not appear to be any serious adverse effects associated with massage.
- Acupuncture may provide some relief for back pain. However, further research with stronger evidence needs to be done.
- Spinal manipulation is a widely-used method of treating back pain. Immediate benefits can be significant, but long-term benefits can be variable.
- "Back school" is an intervention that consists of both education and physical exercises. A 2016 Cochrane review found the evidence concerning back school to be very low quality and was not able to make generalizations as to whether back school is effective or not.

Management(Medication)
If non-pharmacological measures are not effective, medications may be tried.
- Non-steroidal anti-inflammatory drugs (NSAIDs) are typically tried first. NSAIDs have been shown to be more effective than placebo, and are usually more effective than paracetamol (acetaminophen).
- Long-term use of opioids has not been tested in order to determine if it is effective or safe for treating chronic lower back pain. For severe back pain not relieved by NSAIDs or acetaminophen, opioids may be used. Opioids may not be better than NSAIDs or antidepressants for chronic back pain with regards to pain relief and gain of function.
- Skeletal muscle relaxers may also be used. Their short term use has been shown to be effective in the relief of acute back pain. However, the evidence of this effect has been disputed, and these medications do have negative side-effects.
- In people with nerve root pain and acute radiculopathy, there is evidence that a single dose of steroids, such as dexamethasone, may provide pain relief.
- Epidural corticosteroid injection (ESI) is a procedure in which steroid medications are injected into the epidural space. The steroid medications reduce inflammation and thus decrease pain and improve function. ESI has long been used to both diagnose and treat back pain, although recent studies have shown a lack of efficacy in treating low back pain.

Pregnancy

About 50% of women experience low back pain during pregnancy. Some studies have suggested women who have experienced back pain before pregnancy are at a higher risk of having back pain during pregnancy. It may be severe enough to cause significant pain and disability in up to a third of pregnant women. Back pain typically begins at around 18 weeks gestation, and peaks between 24 and 36 weeks gestation. Approximately 16% of women who experienced back pain during pregnancy report continued back pain years after pregnancy, indicating those with significant back pain are at greater risk of back pain following pregnancy.

Biomechanical factors of pregnancy shown to be associated with back pain include increased curvature of the lower back, or lumbar lordosis, to support the added weight on the abdomen. Also, a hormone called relaxin is released during pregnancy that softens the structural tissues in the pelvis and lower back to prepare for vaginal delivery. This softening and increased flexibility of the ligaments and joints in the lower back can result in pain. Back pain in pregnancy is often accompanied by radicular symptoms, suggested to be caused by the fetus pressing on the sacral plexus and lumbar plexus in the pelvis.

Typical factors aggravating the back pain of pregnancy include standing, sitting, forward bending, lifting, and walking. Back pain in pregnancy may also be characterized by pain radiating into the thigh and buttocks, night-time pain severe enough to wake the patient, pain that is increased during the night-time, or pain that is increased during the day-time. Local heat, acetaminophen (paracetamol), and massage can be used to help relieve the pain. Avoiding standing for prolonged periods of time is also suggested.

2 Ankle Sprain

A sprained ankle, also known as a twisted ankle or rolled ankle, is a common injury where sprain occurs on one or more ligaments of the ankle.

3 Intercranial Injury (Traumatic Brain Injury)

INJURY Internal Injury Intercranial Injuries

Traumatic injuries to the cranium or skull and the structures within. Traumatic brain injury (TBI), also known as intracranial injury, occurs when an external force injures the brain. TBI can be classified based on severity, mechanism (closed or penetrating head injury), or other features (e.g., occurring in a specific location or over a widespread area). Head injury is a broader category that may involve damage to other structures such as the scalp and skull. TBI can result in physical, cognitive, social, emotional, and behavioural symptoms, and outcome can range from complete recovery to permanent disability or death.

Causes include falls, vehicle collisions, and violence. Brain trauma occurs as a consequence of a sudden acceleration or deceleration within the cranium or by a complex combination of both movement and sudden impact. In addition to the damage caused at the moment of injury, a variety of events following the injury may result in further injury. These processes include alterations in cerebral blood flow and the pressure within the skull. Some of the imaging techniques used for diagnosis include computed tomography and magnetic resonance imaging (MRIs).

Prevention measures include use of protective technology in vehicles, such as seat belts and sports or motorcycle helmets, as well as efforts to reduce the number of collisions, such as safety education programs and enforcement of traffic laws. Depending on the injury, treatment required may be minimal or may include interventions such as medications, emergency surgery or surgery years later. Physical therapy, speech therapy, recreation therapy, occupational therapy and vision therapy may be employed for rehabilitation.

Classification
Traumatic brain injury is defined as damage to the brain resulting from external mechanical force, such as rapid acceleration or deceleration, impact, blast waves, or penetration by a projectile. Brain function is temporarily or permanently impaired and structural damage may or may not be detectable with current technology. TBI is one of two subsets of acquired brain injury (brain damage that occur after birth); the other subset is non-traumatic brain injury, which does not involve external mechanical force (examples include stroke and infection). All traumatic brain injuries are head injuries, but the latter term may also refer to injury to other parts of the head. However, the terms head injury and brain injury are often used interchangeably. Similarly, brain injuries fall under the classification of central nervous system injuries and neurotrauma. In neuropsychology research literature, in general the term "traumatic brain injury" is used to refer to non-penetrating traumatic brain injuries. TBI is usually classified based on severity, anatomical features of the injury, and the mechanism (the causative forces). Mechanism-related classification divides TBI into closed and penetrating head injury. A closed (also called nonpenetrating, or blunt) injury occurs when the brain is not exposed. A penetrating, or open, head injury occurs when an object pierces the skull and breaches the dura mater, the outermost membrane surrounding the brain.

Severity

Brain injuries can be classified into mild, moderate, and severe categories. The Glasgow Coma Scale (GCS), the most commonly used system for classifying TBI severity, grades a person's level of consciousness on a scale of 3–15 based on verbal, motor, and eye-opening reactions to stimuli. In general, it is agreed that a TBI with a GCS of 13 or above is mild, 9–12 is moderate, and 8 or below is severe. Similar systems exist for young children. However, the GCS grading system has limited ability to predict outcomes. Because of this, other classification systems such as the one shown in the table are also used to help determine severity. A current model developed by the Department of Defence and Department of Veterans Affairs uses all three criteria of GCS after resuscitation, duration of post-traumatic amnesia (PTA), and loss of consciousness (LOC). It also has been proposed to use changes that are visible on neuroimaging, such as swelling, focal lesions, or diffuse injury as method of classification. Grading scales also exist to classify the severity of mild TBI, commonly called concussion; these use duration of LOC, PTA, and other concussion symptoms.

Severity	GCS	PTA	LOC
Mild	13-15	< 1 Day	0-30 Minutes
Moderate	9-12	1-7 Days	30 Mins - 24 Hours
Severe	3-8	Over 7 Days	Over 24 Hours

Glasgow Coma Scale (GCS)
The Glasgow Coma Scale (GCS) is a neurological scale which aims to give a reliable and objective way of recording the conscious state of a person for initial as well as subsequent assessment. A patient is assessed against the criteria of the scale, and the resulting points give a patient score between 3 (indicating deep unconsciousness) and either 14 (original scale) or 15 (more widely used modified or revised scale). GCS was initially used to assess a patient's level of consciousness after a head injury, and the scale is now used by first responders, EMS, nurses, and doctors as being applicable to all acute medical and trauma patients. In hospitals it is also used in monitoring chronic patients in intensive care.

Post-Traumatic Amnesia (PTA)
Post-traumatic amnesia (PTA) is a state of confusion that occurs immediately following a traumatic brain injury (TBI) in which the injured person is disoriented and unable to remember events that occur after the injury. The person may be unable to state their name, where they are, and what time it is. When continuous memory returns, PTA is considered to have resolved. While PTA lasts, new events cannot be stored in the memory. About a third of patients with mild head injury are reported to have "islands of memory", in which the patient can recall only some events. During PTA, the patient's consciousness is "clouded". Because PTA involves confusion in addition to the memory loss typical of amnesia, the term "post-traumatic confusional state" has been proposed as an alternative. There are two types of amnesia: retrograde amnesia (loss of memories that were formed shortly before the injury) and anterograde amnesia (problems with creating new memories after the injury has taken place). Both retrograde and anterograde forms may be referred to as PTA, or the term may be used to refer only to anterograde amnesia. A common example in sports concussion is the quarterback who was able to conduct the complicated mental tasks of leading a football team after a concussion, but has no recollection the next day of the part of the game that took place after the injury. Retrograde amnesia sufferers may partially regain memory later, but memories are not regained with anterograde amnesia because they were not encoded properly.

Loss of Consciousness (LOC)
Unconsciousness is a state which occurs when the ability to maintain an awareness of self and environment is lost. It involves a complete or near-complete lack of responsiveness to people and other environmental stimuli. Loss of consciousness should not be confused with the notion of the psychoanalytic unconscious or cognitive processes (e.g., implicit cognition) that take place outside awareness, and with altered states of consciousness, such as delirium (when the person is confused and only partially responsive to the environment), normal sleep, hypnosis, and other altered states in which the person responds to stimuli. Unconsciousness may occur as the result of traumatic brain injury, brain hypoxia (e.g., due to a brain infarction or cardiac arrest), severe poisoning with drugs that depress the activity of the central nervous system (e.g., alcohol and other hypnotic or sedative drugs), severe fatigue, anaesthesia, and other causes.

Signs and Symptoms

Symptoms are dependent on the type of TBI (diffuse or focal) and the part of the brain that is affected. Unconsciousness tends to last longer for people with injuries on the left side of the brain than for those with injuries on the right. Symptoms are also dependent on the injury's severity. With mild TBI, the patient may remain conscious or may lose consciousness for a few seconds or minutes. Other symptoms of mild TBI include headache, vomiting, nausea, lack of motor coordination, dizziness, difficulty balancing, lightheadedness, blurred vision or tired eyes, ringing in the ears, bad taste in the mouth, fatigue or lethargy, and changes in sleep patterns. Cognitive and emotional symptoms include behavioural or mood changes, confusion, and trouble with memory, concentration, attention, or thinking. Mild TBI symptoms may also be present in moderate and severe injuries. A person with a moderate or severe TBI may have a headache that does not go away, repeated vomiting or nausea, convulsions, an inability to awaken, dilation of one or both pupils, slurred speech, aphasia (word-finding difficulties), dysarthria (muscle weakness that causes disordered speech), weakness or numbness in the limbs, loss of coordination, confusion, restlessness, or agitation. Common long-term symptoms of moderate to severe TBI are changes in appropriate social behaviour, deficits in social judgment, and cognitive changes, especially problems with sustained attention, processing speed, and executive functioning. Alexithymia, a deficiency in identifying, understanding, processing, and describing emotions occurs in 60.9% of individuals with TBI.

Cognitive and social deficits have long-term consequences for the daily lives of people with moderate to severe TBI, but can be improved with appropriate rehabilitation. When the pressure within the skull (intracranial pressure, abbreviated ICP) rises too high, it can be deadly. Signs of increased ICP include decreasing level of consciousness, paralysis or weakness on one side of the body, and a blown pupil, one that fails to constrict in response to light or is slow to do so. Cushing's triad, a slow heart rate with high blood pressure and respiratory depression is a classic manifestation of significantly raised ICP. Anisocoria, unequal pupil size, is another sign of serious TBI. Abnormal posturing, a characteristic positioning of the limbs caused by severe diffuse injury or high ICP, is an ominous sign. Small children with moderate to severe TBI may have some of these symptoms but have difficulty communicating them. Other signs seen in young children include persistent crying, inability to be consoled, listlessness, refusal to nurse or eat, and irritability.

Causes
The most common causes of TBI in the U.S. include violence, transportation accidents, construction, and sports. Motor bikes are major causes, increasing in significance in developing countries as other causes reduce. The estimates that between 1.6 and 3.8 million traumatic brain injuries each year are a result of sports and recreation activities in the US. In children aged two to four, falls are the most common cause of TBI, while in older children traffic accidents compete with falls for this position. TBI is the third most common injury to result from child abuse. Abuse causes 19% of cases of paediatric brain trauma, and the death rate is higher among these cases. Although men are twice as likely to have a TBI. Domestic violence is another cause of TBI, as are work-related and industrial accidents. Firearms and blast injuries from explosions are other causes of TBI, which is the leading cause of death and disability in war zones. According to Representative Bill Pascrell (Democrat, NJ), TBI is "the signature injury of the wars in Iraq and Afghanistan." There is a promising technology called activation database-guided EEG biofeedback, which has been documented to return a TBI's auditory memory ability to above the control group's performance.

Treatment

It is important to begin emergency treatment within the so-called "golden hour" following the injury. People with moderate to severe injuries are likely to receive treatment in an intensive care unit followed by a neurosurgical ward. Treatment depends on the recovery stage of the patient. In the acute stage the primary aim of the medical personnel is to stabilize the patient and focus on preventing further injury because little can be done to reverse the initial damage caused by trauma. Rehabilitation is the main treatment for the subacute and chronic stages of recovery. International clinical guidelines have been proposed with the aim of guiding decisions in TBI treatment, as defined by an authoritative examination of current evidence.

Treatment Acute Stage

Certain facilities are equipped to handle TBI better than others; initial measures include transporting patients to an appropriate treatment centre. Both during transport and in hospital the primary concerns are ensuring proper oxygen supply, maintaining adequate blood flow to the brain, and controlling raised intracranial pressure (ICP), since high ICP deprives the brain of badly needed blood flow and can cause deadly brain herniation. Other methods to prevent damage include management of other injuries and prevention of seizures.

Some data supports the use of hyperbaric oxygen therapy to improve outcomes. Neuroimaging is helpful but not flawless in detecting raised ICP. A more accurate way to measure ICP is to place a catheter into a ventricle of the brain, which has the added benefit of allowing cerebrospinal fluid to drain, releasing pressure in the skull. Treatment of raised ICP may be as simple as tilting the person's bed and straightening the head to promote blood flow through the veins of the neck.

Sedatives, analgesics and paralytic agents are often used. Hypertonic saline can improve ICP by reducing the amount of cerebral water (swelling), though it is used with caution to avoid electrolyte imbalances or heart failure. Mannitol, an osmotic diuretic, appears to be equally effective at reducing ICP. Some concerns; however, have been raised regarding some of the studies performed.

Diuretics, drugs that increase urine output to reduce excessive fluid in the system, may be used to treat high intracranial pressures, but may cause hypovolemia (insufficient blood volume). Hyperventilation (larger and/or faster breaths) reduces carbon dioxide levels and causes blood vessels to constrict; this decreases blood flow to the brain and reduces ICP, but it potentially causes ischemia and is, therefore, used only in the short term. Giving corticosteroids is associated with an increased risk of death, and so their routine use is not recommended.

Endotracheal intubation and mechanical ventilation may be used to ensure proper oxygen supply and provide a secure airway. Hypotension (low blood pressure), which has a devastating outcome in TBI, can be prevented by giving intravenous fluids to maintain a normal blood pressure. Failing to maintain blood pressure can result in inadequate blood flow to the brain.

Blood pressure may be kept at an artificially high level under controlled conditions by infusion of norepinephrine or similar drugs; this helps maintain cerebral perfusion. Body temperature is carefully regulated because increased temperature raises the brain's metabolic needs, potentially depriving it of nutrients. Seizures are common. While they can be treated with benzodiazepines, these drugs are used carefully because they can depress breathing and lower blood pressure.

People with TBI are more susceptible to side effects and may react adversely or be inordinately sensitive to some pharmacological agents. During treatment monitoring continues for signs of deterioration such as a decreasing level of consciousness. Traumatic brain injury may cause a range of serious coincidental complications that include cardiac arrhythmias and neurogenic pulmonary edema. These conditions must be adequately treated and stabilised as part of the core care.

Chronic Stage

Once medically stable, people may be transferred to a subacute rehabilitation unit of the medical centre or to an independent rehabilitation hospital. Rehabilitation aims to improve independent function at home and in society and to help adapt to disabilities and has demonstrated its general effectiveness, when conducted by a team of health professionals who specialise in head trauma. As for any person with neurologic deficits, a multidisciplinary approach is key to optimising outcome. Physiatrists or neurologists are likely to be the key medical staff involved, but depending on the person, doctors of other medical specialties may also be helpful.

Allied health professions such as physiotherapy, speech and language therapy, cognitive rehabilitation therapy, and occupational therapy will be essential to assess function and design the rehabilitation activities for each person. Treatment of neuropsychiatric symptoms such as emotional distress and clinical depression may involve mental health professionals such as therapists, psychologists, and psychiatrists, while neuropsychologists can help to evaluate and manage cognitive deficits. After discharge from the inpatient rehabilitation treatment unit, care may be given on an outpatient basis. Community-based rehabilitation will be required for a high proportion of people, including vocational rehabilitation; this supportive employment matches job demands to the worker's abilities.

People with TBI who cannot live independently or with family may require care in supported living facilities such as group homes. Respite care, including day centres and leisure facilities for the disabled, offers time off for caregivers, and activities for people with TBI. Pharmacological treatment can help to manage psychiatric or behavioural problems. Medication is also used to control post-traumatic epilepsy; however the preventive use of anti-epileptics is not recommended. In those cases where the person is bedridden due to a reduction of consciousness, has to remain in a wheelchair because of mobility problems, or has any other problem heavily impacting self-caring capacities, caregiving and nursing are critical.

The most effective research documented intervention approach is the activation database guided EEG biofeedback approach, which has shown significant improvements in memory abilities of the TBI subject that are far superior than traditional approaches (strategies, computers, medication intervention). Gains of 2.61 standard deviations have been documented. The TBI's auditory memory ability was superior to the control group after the treatment.

Prognosis

Prognosis worsens with the severity of injury. Most TBIs are mild and do not cause permanent or long-term disability; however, all severity levels of TBI have the potential to cause significant, long-lasting disability. Permanent disability is thought to occur in 10% of mild injuries, 66% of moderate injuries, and 100% of severe injuries. Most mild TBI is completely resolved within three weeks, and almost all people with mild TBI are able to live independently and return to the jobs they had before the injury, although a portion have mild cognitive and social impairments. Over 90% of people with moderate TBI are able to live independently, although a portion require assistance in areas such as physical abilities, employment, and financial managing.

Most people with severe closed head injury either die or recover enough to live independently; middle ground is less common. Coma, as it is closely related to severity, is a strong predictor of poor outcome. Prognosis differs depending on the severity and location of the lesion, and access to immediate, specialised acute management. Subarachnoid haemorrhage approximately doubles mortality. Subdural hematoma is associated with worse outcome and increased mortality, while people with epidural hematoma are expected to have a good outcome if they receive surgery quickly. Diffuse axonal injury may be associated with coma when severe, and poor outcome.

Following the acute stage, prognosis is strongly influenced by the patient's involvement in activity that promote recovery, which for most patients requires access to a specialised, intensive rehabilitation service. The Functional Independence Measure is a way to track progress and degree of independence throughout rehabilitation. Medical complications are associated with a bad prognosis. Examples are hypotension (low blood pressure), hypoxia (low blood oxygen saturation), lower cerebral perfusion pressures and longer times spent with high intracranial pressures. Patient characteristics also influence prognosis.

Factors thought to worsen it include abuse of substances such as illicit drugs and alcohol and age over sixty or under two years (in children, younger age at time of injury may be associated with a slower recovery of some abilities). Other influences that may affect recovery include pre-injury intellectual ability, coping strategies, personality traits, family environment, social support systems and financial circumstances. Life satisfaction has been known to decrease for individuals with TBI immediately following the trauma, but evidence has shown that life roles, age, and depressive symptoms influence the trajectory of life satisfaction as time passes.

Complications

INJURY Internal Injury Intercranial Injuries Complications

Improvement of neurological function usually occurs for two or more years after the trauma. For many years it was believed that recovery was fastest during the first six months, but there is no evidence to support this. It may be related to services commonly being withdrawn after this period, rather than any physiological limitation to further progress. Children recover better in the immediate time frame and improve for longer periods. Complications are distinct medical problems that may arise as a result of the TBI. The results of traumatic brain injury vary widely in type and duration; they include physical, cognitive, emotional, and behavioural complications. TBI can cause prolonged or permanent effects on consciousness, such as coma, brain death, persistent vegetative state (in which patients are unable to achieve a state of alertness to interact with their surroundings), and minimally conscious state (in which patients show minimal signs of being aware of self or environment).

Lying still for long periods can cause complications including pressure sores, pneumonia or other infections, progressive multiple organ failure, and deep venous thrombosis, which can cause pulmonary embolism. Infections that can follow skull fractures and penetrating injuries include meningitis and abscesses. Complications involving the blood vessels include vasospasm, in which vessels constrict and restrict blood flow, the formation of aneurysms, in which the side of a vessel weakens and balloons out, and stroke.
Movement disorders that may develop after TBI include tremor, ataxia (uncoordinated muscle movements), myoclonus (shock-like contractions of muscles), and loss of movement range and control (in particular with a loss of movement repertoire). The risk of post-traumatic seizures increases with severity of trauma (image at right) and is particularly elevated with certain types of brain trauma such as cerebral contusions or hematomas.

People with early seizures, those occurring within a week of injury, have an increased risk of post-traumatic epilepsy (recurrent seizures occurring more than a week after the initial trauma). People may lose or experience altered vision, hearing, or smell. Hormonal disturbances may occur secondary to hypopituitarism, occurring immediately or years after injury in 10 to 15% of TBI patients. Development of diabetes insipidus or an electrolyte abnormality acutely after injury indicate need for endocrinologic work up.

Signs and symptoms of hypopituitarism may develop and be screened for in adults with moderate TBI and in mild TBI with imaging abnormalities. Children with moderate to severe head injury may also develop hypopituitarism. Screening should take place 3 to 6 months, and 12 months after injury, but problems may occur more remotely.

Cognitive deficits that can follow TBI include impaired attention; disrupted insight, judgement, and thought; reduced processing speed; distractibility; and deficits in executive functions such as abstract reasoning, planning, problem-solving, and multitasking. Memory loss, the most common cognitive impairment among head-injured people, occurs in 20–79% of people with closed head trauma, depending on severity.

People who have suffered TBI may also have difficulty with understanding or producing spoken or written language, or with more subtle aspects of communication such as body language. Post-concussion syndrome, a set of lasting symptoms experienced after mild TBI, can include physical, cognitive, emotional and behavioral problems such as headaches, dizziness, difficulty concentrating, and depression. Multiple TBIs may have a cumulative effect.

A young person who receives a second concussion before symptoms from another one have healed may be at risk for developing a very rare but deadly condition called second-impact syndrome, in which the brain swells catastrophically after even a mild blow, with debilitating or deadly results. About one in five career boxers is affected by chronic traumatic brain injury (CTBI), which causes cognitive, behavioral, and physical impairments. Dementia pugilistica, the severe form of CTBI, affects primarily career boxers years after a boxing career. It commonly manifests as dementia, memory problems, and parkinsonism (tremors and lack of coordination).

TBI may cause emotional, social, or behavioral problems and changes in personality. These may include emotional instability, depression, anxiety, hypomania, mania, apathy, irritability, problems with social judgment, and impaired conversational skills. TBI appears to predispose survivors to psychiatric disorders including obsessive compulsive disorder, substance abuse, dysthymia, clinical depression, bipolar disorder, and anxiety disorders. In patients who have depression after TBI, suicidal ideation is not uncommon; the suicide rate among these persons is increased 2- to 3-fold.

Social and behavioral symptoms that can follow TBI include disinhibition, inability to control anger, impulsiveness, lack of initiative, inappropriate sexual activity, asociality and social withdrawal, and changes in personality. TBI also has a substantial impact on the functioning of family systems Caregiving family members and TBI survivors often significantly alter their familial roles and responsibilities following injury, creating significant change and strain on a family system.

Typical challenges identified by families recovering from TBI include: frustration and impatience with one another, loss of former lives and relationships, difficulty setting reasonable goals, inability to effectively solve problems as a family, increased level of stress and household tension, changes in emotional dynamics, and overwhelming desire to return to pre-injury status. In addition, families may exhibit less effective functioning in areas including coping, problem solving and communication. Psychoeducation and counseling models have been demonstrated to be effective in minimizing family disruption.

INJURY Internal Injury Cerebral Hemorrhage

4 Cerebral Hemorrhage

Intracerebral hemorrhage (ICH), also known as cerebral bleed, is a type of intracranial bleed that occurs within the brain tissue or ventricles. Symptoms can include headache, one-sided weakness, vomiting, seizures, decreased level of consciousness, and neck stiffness. Often symptoms get worse over time. Fever is also common. In many cases bleeding is present in both the brain tissue and the ventricles. Causes include brain trauma, aneurysms, arteriovenous malformations, and brain tumors.

The largest risk factors for spontaneous bleeding are high blood pressure and amyloidosis. Other risk factors include alcoholism, low cholesterol, blood thinners, and cocaine use. Diagnosis is typically by CT scan. Other conditions that may present similarly include ischemic stroke. Treatment should typically be carried out in an intensive care unit. Guidelines recommended decreasing the blood pressure to a systolic of 140 mmHg. Blood thinners should be reversed if possible and blood sugar kept in the normal range Surgery to place a ventricular drain may be used to treat hydrocephalus but corticosteroids should not be used.

Signs & Symptoms
People with intracerebral bleeding have symptoms that correspond to the functions controlled by the area of the brain that is damaged by the bleed. Other symptoms include those that indicate a rise in intracranial pressure caused by a large mass putting pressure on the brain. Intracerebral bleeds are often misdiagnosed as subarachnoid hemorrhages due to the similarity in symptoms and signs. A severe headache followed by vomiting is one of the more common symptoms of intracerebral hemorrhage. Another common symptom is a patient can collapse. Some people may experience continuous bleeding from the ear. Some patients may also go into a coma before the bleed is noticed.

Causes
Intracerebral bleeds are the second most common cause of stroke, accounting for 10% of hospital admissions for stroke. High blood pressure raises the risks of spontaneous intracerebral hemorrhage by two to six times. More common in adults than in children, intraparenchymal bleeds are usually due to penetrating head trauma, but can also be due to depressed skull fractures. Acceleration-deceleration trauma, rupture of an aneurysm or arteriovenous malformation (AVM), and bleeding within a tumor are additional causes. Amyloid angiopathy is a not uncommon cause of intracerebral hemorrhage in patients over the age of 55. A very small proportion is due to cerebral venous sinus thrombosis. Traumautic intracerebral hematomas are divided into acute and delayed. Acute intracerebral hematomas occur at the time of the injury while delayed intracerebral hematomas have been reported from as early as 6 hours post injury to as long as several weeks.

Risk factors for ICH
- Hypertension (high blood pressure)
- Diabetes mellitus
- Menopause
- Cigarette smoking
- Excessive alcohol consumption
- Severe migraine

Treatment Treatment depends substantially on the type of ICH. Rapid CT scan and other diagnostic measures are used to determine proper treatment, which may include both medication and surgery.	● Tracheal intubation is indicated in people with decreased level of consciousness or other risk of airway obstruction. ● IV fluids are given to maintain fluid balance, using isotonic rather than hypotonic fluids. ● Frozen plasma, vitamin K, protamine, or platelet transfusions may be given in case of a coagulopathy. Platelets however appear to worsen outcomes in those with spontaneous intracerebral bleeding on antiplatelet medication.	Surgery is required if the hematoma is greater than 3 cm (1 in), if there is a structural vascular lesion or lobar hemorrhage in a young patient.	● A catheter may be passed into the brain vasculature to close off or dilate blood vessels, avoiding invasive surgical procedures. ● A craniectomy may take place, where part of the skull is removed to allow a swelling brain room to expand without being squeezed.

Prognosis
The risk of death from an intraparenchymal bleed in traumatic brain injury is especially high when the injury occurs in the brain stem. Intraparenchymal bleeds within the medulla oblongata are almost always fatal, because they cause damage to cranial nerve X, the vagus nerve, which plays an important role in blood circulation and breathing. This kind of hemorrhage can also occur in the cortex or subcortical areas, usually in the frontal or temporal lobes when due to head injury, and sometimes in the cerebellum. For spontaneous ICH seen on CT scan, the death rate (mortality) is 34–50% by 30 days after the insult, and half of the deaths occur in the first 2 days. Even though the majority of deaths occurs in the first days after ICH, survivors have a long term excess mortality of 27% compared to the general population.

5 Spinal Cord Injury

A spinal cord injury (SCI) is damage to the spinal cord that causes temporary or permanent changes in its function. Symptoms may include loss of muscle function, sensation, or autonomic function in the parts of the body served by the spinal cord below the level of the injury. Injury can occur at any level of the spinal cord and can be complete injury, with a total loss of sensation and muscle function, or incomplete, meaning some nervous signals are able to travel past the injured area of the cord. Depending on the location and severity of damage, the symptoms vary, from numbness to paralysis to incontinence. Long term outcomes also range widely, from full recovery to permanent tetraplegia (also called quadriplegia) or paraplegia. Complications can include muscle atrophy, pressure sores, infections, and breathing problems.

In the majority of cases the damage results from physical trauma such as car accidents, gunshot wounds, falls, or sports injuries, but it can also result from nontraumatic causes such as infection, insufficient blood flow, and tumors. Just over half of injuries affect the cervical spine, while 15% occur in each of the thoracic spine, border between the thoracic and lumbar spine, and lumbar spine alone. Diagnosis is typically based on symptoms and medical imaging.

Efforts to prevent SCI include individual measures such as using safety equipment, societal measures such as safety regulations in sports and traffic, and improvements to equipment. Treatment starts with restricting further motion of the spine and maintaining adequate blood pressure. Corticosteroids have not been found to be useful. Other interventions vary depending on the location and extent of the injury, from bed rest to surgery. In many cases, spinal cord injuries require long-term physical and occupational therapy, especially if it interferes with activities of daily living.

Types

Spinal cord injury can be traumatic or nontraumatic, and can be classified into three types based on cause: mechanical forces, toxic, and ischemic (from lack of blood flow). The damage can also be divided into primary and secondary injury: the cell death that occurs immediately in the original injury, and biochemical cascades that are initiated by the original insult and cause further tissue damage. These secondary injury pathways include the ischemic cascade, inflammation, swelling, cell suicide, and neurotransmitter imbalances. They can take place for minutes or weeks following the injury.

At each level of the spinal column, spinal nerves branch off from either side of the spinal cord and exit between a pair of vertebrae, to innervate a specific part of the body. The area of skin innervated by a specific spinal nerve is called a dermatome, and the group of muscles innervated by a single spinal nerve is called a myotome. The part of the spinal cord that was damaged corresponds to the spinal nerves at that level and below. Injuries can be cervical 1–8 (C1–C8), thoracic 1–12 (T1–T12), lumbar 1–5 (L1–L5), or sacral (S1–S5). A person's level of injury is defined as the lowest level of full sensation and function. Paraplegia occurs when the legs are affected by the spinal cord damage (in thoracic, lumbar, or sacral injuries), and tetraplegia occurs when all four limbs are affected (cervical damage).

Muscle Strength		ASIA Impairment Scale for classifying spinal cord injury	
Grade	**Muscle function**	**Grade**	**Description**
0	No muscle contraction	**A**	**Complete injury.** No motor or sensory function is preserved in the sacral segments S4 or S5.
1	Muscle flickers	**B**	**Sensory incomplete.** Sensory but not motor function is preserved below the level of injury, including the sacral segments.
2	Full range of motion, gravity eliminated	**C**	**Motor incomplete.** Motor function is preserved below the level of injury, and more than half of muscles tested below the level of injury have a muscle grade less than 3 (see muscle strength scores, left).
3	Full range of motion, against gravity	**D**	**Motor incomplete.** Motor function is preserved below the level of injury and at least half of the key muscles below the neurological level have a muscle grade of 3 or more.
4	Full range of motion against resistance	**E**	**Normal.** No motor or sensory deficits, but deficits existed in the past.
5	Normal strength		

Complete and Incomplete Injuries
In a "complete" spinal injury, all functions below the injured area are lost, whether or not the spinal cord is severed. An "incomplete" spinal cord injury involves preservation of motor or sensory function below the level of injury in the spinal cord. To be classed as incomplete, there must be some preservation of sensation or motion in the areas innervated by S4 to S5, e.g. voluntary external anal sphincter contraction. The nerves in this area are connected to the very lowest region of the spinal cord, and retaining sensation and function in these parts of the body indicates that the spinal cord is only partially damaged.

Incomplete injury by definition includes a phenomenon known as sacral sparing: some degree of sensation is preserved in the sacral dermatomes, even though sensation may be more impaired in other, higher dermatomes below the level of the lesion. Sacral sparing has been attributed to the fact that the sacral spinal pathways are not as likely as the other spinal pathways to become compressed after injury due to the lamination of fibers within the spinal cord.

Signs & Symptoms

Signs (observed by a clinician) and symptoms (experienced by a patient) vary depending on where the spine is injured and the extent of the injury. A section of skin innervated through a specific part of the spine is called a dermatome, and injury to that part of the spine can cause pain, numbness, or a loss of sensation in the related areas. Paraesthesia, a tingling or burning sensation in affected areas of the skin, is another symptom. A person with a lowered level of consciousness may show a response to a painful stimulus above a certain point but not below it. A group of muscles innervated through a specific part of the spine is called a myotome, and injury to that part of the spinal cord can cause problems with movements that involve those muscles. The muscles may contract uncontrollably (spasticity), become weak, or be completely paralysed. Spinal shock, loss of neural activity including reflexes below the level of injury, occurs shortly after the injury and usually goes away within a day. Priapism, an erection of the penis may be a sign of acute spinal cord injury.

The specific parts of the body affected by loss of function are determined by the level of injury. Some signs, such as bowel and bladder dysfunction can occur at any level. Neurogenic bladder involves a compromised ability to empty the bladder and is a common symptom of spinal cord injury. This can lead to high pressures in the bladder that can damage the kidneys.

Actions of the Spinal Nerves

Level	Motor Function
C1-C6	Neck flexors
C1-T1	Neck extensors
C3, C4, C5	Supply diaphragm (mostly C4)
C5, C6	Move shoulder, raise arm (deltoid); flex elbow (biceps)
C6	Externally rotate (supinate) the arm
C6, C7	Extend elbow and wrist (triceps and wrist extensors); pronate wrist
C7, T1	Flex wrist; supply small muscles of the hand
T1-T6	Intercostals and trunk above the waist
T7-L1	Abdominal muscles
L1-L4	Flex thigh
L2, L3, L4	Adduct thigh; Extend leg at the knee (quadriceps femoris)
L4, L5, S1	Abduct thigh; Flex leg at the knee (hamstrings); Dorsiflex foot (tibialis anterior); Extend toes
L5, S1, S2	Extend leg at the hip (gluteus maximus); Plantar flex foot and flex toes

Lumbosacral
The effects of injuries at or above the lumbar or sacral regions of the spinal cord (lower back and pelvis) include decreased control of the legs and hips, genitourinary system, and anus. People injured below level L2 may still have use of their hip flexor and knee extensor muscles. Bowel and bladder function are regulated by the sacral region. It is common to experience sexual dysfunction after injury, as well as dysfunction of the bowel and bladder, including fecal and urinary incontinence.

Thoracic
In addition to the problems found in lower-level injuries, thoracic (chest height) spinal lesions can affect the muscles in the trunk. Injuries at the level of T1 to T8 result in inability to control the abdominal muscles. Trunk stability may be affected; even more so in higher level injuries. The lower the level of injury, the less extensive its effects. Injuries from T9 to T12 result in partial loss of trunk and abdominal muscle control. Thoracic spinal injuries result in paraplegia, but function of the hands, arms, and neck are not affected.

One condition that occurs typically in lesions above the T6 level is autonomic dysreflexia (AD), in which the blood pressure increases to dangerous levels, high enough to cause potentially deadly stroke. It results from an overreaction of the system to a stimulus such as pain below the level of injury, because inhibitory signals from the brain cannot pass the lesion to dampen the excitatory sympathetic nervous system response. Signs and symptoms of AD include anxiety, headache, nausea, ringing in the ears, blurred vision, flushed skin, and nasal congestion. It can occur shortly after the injury or not until years later.

Other autonomic functions may also be disrupted. For example, problems with body temperature regulation mostly occur in injuries at T8 and above. Another serious complication that can result from lesions above T6 is neurogenic shock, which results from an interruption in output from the sympathetic nervous system responsible for maintaining muscle tone in the blood vessels. Without the sympathetic input, the vessels relax and dilate. Neurogenic shock presents with dangerously low blood pressure, low heart rate, and blood pooling in the limbs—which results in insufficient blood flow to the spinal cord and potentially further damage to it.

Cervical
Spinal cord injuries at the cervical (neck) level result in full or partial tetraplegia (also called quadriplegia). Depending on the specific location and severity of trauma, limited function may be retained. Additional symptoms of cervical injuries include low heart rate, low blood pressure, problems regulating body temperature, and breathing dysfunction. If the injury is high enough in the neck to impair the muscles involved in breathing, the person may not be able to breathe without the help of an endotracheal tube and mechanical ventilator.

Function after Complete Cervical Spinal Cord Injury

Level	Motor Function	Respiratory Function
C1-C4	Full paralysis of the limbs	Cannot breathe without mechanical ventilation
C5	Paralysis of the wrists, hands, and triceps	Difficulty coughing, may need help clearing secretions
C6	Paralysis of the wrist flexors, triceps, and hands	Difficulty coughing, may need help clearing secretions
C7-C8	Some hand muscle weakness, difficulty grasping and releasing	Difficulty coughing, may need help clearing secretions

Complications of spinal cord injuries include pulmonary edema, respiratory failure, neurogenic shock, and paralysis below the injury site. In the long term, the loss of muscle function can have additional effects from disuse, including atrophy of the muscle. Immobility can lead to pressure sores, particularly in bony areas, requiring precautions such as extra cushioning and turning in bed every two hours (in the acute setting) to relieve pressure.

In the long term, people in wheelchairs must shift periodically to relieve pressure. Another complication is pain, including nociceptive pain (indication of potential or actual tissue damage) and neuropathic pain, when nerves affected by damage convey erroneous pain signals in the absence of noxious stimuli.

Spasticity, the uncontrollable tensing of muscles below the level of injury, occurs in 65–78% of chronic SCI. It results from lack of input from the brain that quells muscle responses to stretch reflexes. It can be treated with drugs and physical therapy. Spasticity increases the risk of contractures (shortening of muscles, tendons, or ligaments that result from lack of use of a limb); this problem can be prevented by moving the limb through its full range of motion multiple times a day.

Another problem lack of mobility can cause is loss of bone density and changes in bone structure. Loss of bone density (bone demineralization), thought to be due to lack of input from weakened or paralysed muscles, can increase the risk of fractures. Conversely, a poorly understood phenomenon is the overgrowth of bone tissue in soft tissue areas, called heterotopic ossification. It occurs below the level of injury, possibly as a result of inflammation, and happens to a clinically significant extent in 27% of people.

Causes

Spinal cord injuries are most often caused by physical trauma. Forces involved can be hyperflexion (forward movement of the head); hyperextension (backward movement); lateral stress (sideways movement); rotation (twisting of the head); compression (force along the axis of the spine downward from the head or upward from the pelvis); or distraction (pulling apart of the vertebrae). Traumatic SCI can result in contusion, compression, or stretch injury. It is a major risk of many types of vertebral fracture. Pre-existing asymptomatic congenital anomalies can cause major neurological deficits, such as hemiparesis, to result from otherwise minor trauma.

In the US, Motor vehicle accidents are the most common cause of SCIs; second are falls, then violence such as gunshot wounds, then sports injuries. In some countries falls are more common, even surpassing vehicle crashes as the leading cause of SCI. The rates of violence-related SCI depend heavily on place and time. Of all sports-related SCIs, shallow water dives are the most common cause; winter sports and water sports have been increasing as causes while association football and trampoline injuries have been declining. Hanging can cause injury to the cervical spine, as may occur in attempted suicide. Military conflicts are another cause, and when they occur they are associated with increased rates of SCI. Another potential cause of SCI is iatrogenic injury, caused by an improperly done medical procedure such as an injection into the spinal column.

SCI can also be of a nontraumatic origin. Nontraumatic lesions cause anywhere from 30 to 80% of all SCI; the percentage varies by locale, influenced by efforts to prevent trauma. Developed countries have higher percentages of SCI due to degenerative conditions and tumors than developing countries. In developed countries, the most common cause of nontraumatic SCI is degenerative diseases, followed by tumors; in many developing countries the leading cause is infection such as HIV and tuberculosis. SCI may occur in intervertebral disc disease, and spinal cord vascular disease. Spontaneous bleeding can occur within or outside of the protective membranes that line the cord, and intervertebral disks can herniate.

Damage can result from dysfunction of the blood vessels, as in arteriovenous malformation, or when a blood clot becomes lodged in a blood vessel and cuts off blood supply to the cord. When systemic blood pressure drops, blood flow to the spinal cord may be reduced, potentially causing a loss of sensation and voluntary movement in the areas supplied by the affected level of the spinal cord. Congenital conditions and tumors that compress the cord can also cause SCI, as can vertebral spondylosis and ischemia. Multiple sclerosis is a disease that can damage the spinal cord, as can infectious or inflammatory conditions such as tuberculosis, herpes zoster or herpes simplex, meningitis, myelitis, and syphilis.

Management

Prehospital Treatment
The first stage in the management of a suspected spinal cord injury is geared toward basic life support and preventing further injury: maintaining airway, breathing, and circulation and restricting further motion of the spine. In the emergency setting, most people who has been subjected to forces strong enough to cause SCI are treated as though they have instability in the spinal column and have spinal motion restricted to prevent damage to the spinal cord. Injuries or fractures in the head, neck, or pelvis as well as penetrating trauma near the spine and falls from heights are assumed to be associated with an unstable spinal column until it is ruled out in the hospital. High-speed vehicle crashes, sports injuries involving the head or neck, and diving injuries are other mechanisms that indicate a high SCI risk. Since head and spinal trauma frequently coexist, anyone who is unconscious or has a lowered level of consciousness as a result of a head injury is spinal motion restricted.

A rigid cervical collar is applied to the neck, and the head is held with blocks on either side and the person is strapped to a backboard. Extrication devices are used to move people without excessively moving the spine if they are still inside a vehicle or other confined space. The use of a cervical collar has been shown to increase mortality in people with penetrating trauma and is thus not routinely recommended in this group.

Modern trauma care includes a step called clearing the cervical spine, ruling out spinal cord injury if the patient is fully conscious and not under the influence of drugs or alcohol, displays no neurological deficits, has no pain in the middle of the neck and no other painful injuries that could distract from neck pain. If these are all absent, no spinal motion restriction is necessary.

If an unstable spinal column injury is moved, damage may occur to the spinal cord. Between 3 and 25% of SCIs occur not at the time of the initial trauma but later during treatment or transport. While some of this is due to the nature of the injury itself, particularly in the case of multiple or massive trauma, some of it reflects the failure to adequately restrict motion of the spine. SCI can impair the body's ability to keep warm, so warming blankets may be needed.

Early Hospital Treatment
Initial care in the hospital, as in the prehospital setting, aims to ensure adequate airway, breathing, cardiovascular function, and spinal motion restriction. Imaging of the spine to determine the presence of a SCI may need to wait if emergency surgery is needed to stabilize other life-threatening injuries. Acute SCI merits treatment in an intensive care unit, especially injuries to the cervical spinal cord. People with SCI need repeated neurological assessments and treatment by neurosurgeons. People should be removed from the spine board as rapidly as possible to prevent complications from its use.

If the systolic blood pressure falls below 90 mmHg within days of the injury, blood supply to the spinal cord may be reduced, resulting in further damage. Thus it is important to maintain the blood pressure which may be done using intravenous fluids and vasopressors. Vasopressors used include phenylephrine, dopamine, or norepinephrine. Mean arterial blood pressure is measured and kept at 85 to 90 mmHg for seven days after injury. The treatment for shock from blood loss is different from that for neurogenic shock, and could harm people with the latter type, so it is necessary to determine why someone is in shock.

However it is also possible for both causes to exist at the same time. Another important aspect of care is prevention of insufficient oxygen in the bloodstream, which could deprive the spinal cord of oxygen. People with cervical or high thoracic injuries may experience a dangerously slowed heart rate; treatment to speed it may include atropine.

The corticosteroid medication methylprednisolone has been studied for use in SCI with the hope of limiting swelling and secondary injury. As there does not appear to be long term benefits and the medication is associated with risks such as gastrointestinal bleeding and infection its use is not recommended as of 2018. Its use in traumatic brain injury is also not recommended.

Surgery may be necessary, e.g. to relieve excess pressure on the cord, to stabilize the spine, or to put vertebrae back in their proper place. In cases involving instability or compression, failing to operate can lead to worsening of the condition. Surgery is also necessary when something is pressing on the cord, such as bone fragments, blood, material from ligaments or intervertebral discs, or a lodged object from a penetrating injury.

Although the ideal timing of surgery is still debated, studies have found that earlier surgical intervention (within 24 hours of injury) is associated with better outcomes. Sometimes a patient has too many other injuries to be a surgical candidate this early. Surgery is controversial because it has potential complications (such as infection), so in cases where it is not clearly needed (e.g. the cord is being compressed), doctors must decide whether to perform surgery based on aspects of the patient's condition and their own beliefs about its risks and benefits.

In cases where a more conservative approach is chosen, bed rest, cervical collars, motion restriction devices, and optionally traction are used. Surgeons may opt to put traction on the spine to remove pressure from the spinal cord by putting dislocated vertebrae back into alignment, but herniation of intervertebral disks may prevent this technique from relieving pressure.

Prognosis

Spinal cord injuries generally result in at least some incurable impairment even with the best possible treatment. The best predictor of prognosis is the level and completeness of injury, as measured by the ASIA impairment scale. The neurological score at the initial evaluation done 72 hours after injury is the best predictor of how much function will return. Most people with ASIA scores of A (complete injuries) do not have functional motor recovery, but improvement can occur. Most patients with incomplete injuries recover at least some function. Chances of recovering the ability to walk improve with each AIS grade found at the initial examination; e.g. an ASIA D score confers a better chance of walking than a score of C. The symptoms of incomplete injuries can vary and it is difficult to make an accurate prediction of the outcome. A person with a mild, incomplete injury at the T5 vertebra will have a much better chance of using his or her legs than a person with a severe, complete injury at exactly the same place. Of the incomplete SCI syndromes, Brown-Séquard and central cord syndromes have the best prognosis for recovery and anterior cord syndrome has the worst.

People with nontraumatic causes of SCI have been found to be less likely to suffer complete injuries and some complications such as pressure sores and deep vein thrombosis, and to have shorter hospital stays. Their scores on functional tests were better than those of people with traumatic SCI upon hospital admission, but when they were tested upon discharge, those with traumatic SCI had improved such that both groups' results were the same. In addition to the completeness and level of the injury, age and concurrent health problems affect the extent to which a person with SCI will be able to live independently and to walk. However, in general people with injuries to L3 or below will likely be able to walk functionally, T10 and below to walk around the house with bracing, and C7 and below to live independently. New therapies are beginning to provide hope for better outcomes in patients with SCI, but most are in the experimental/translational stage.

One important predictor of motor recovery in an area is presence of sensation there, particularly pain perception. Most motor recovery occurs in the first year post-injury, but modest improvements can continue for years; sensory recovery is more limited. Recovery is typically quickest during the first six months. Spinal shock, in which reflexes are suppressed, occurs immediately after the injury and resolves largely within three months but continues resolving gradually for another 15.

Sexual dysfunction after spinal injury is common. Problems that can occur include erectile dysfunction, loss of ability to ejaculate, insufficient lubrication of the vagina, and reduced sensation and impaired ability to orgasm. Despite this, many people learn ways to adapt their sexual practices so they can lead satisfying sex lives.

Although life expectancy has improved with better care options, it is still not as good as the uninjured population. The higher the level of injury, and the more complete the injury, the greater the reduction in life expectancy. Mortality is very elevated within a year of injury.

6 Nerve Injury (Except Spinal)

Nerve injury is injury to nervous tissue. There is no single classification system that can describe all the many variations of nerve injury.

Types

Neurapraxia
Neurapraxia is the least severe form of nerve injury, with complete recovery. In this case, the axon remains intact, but there is myelin damage causing an interruption in conduction of the impulse down the nerve fiber. Most commonly, this involves compression of the nerve or disruption to the blood supply (ischemia). There is a temporary loss of function which is reversible within hours to months of the injury (the average is 6–8 weeks). Wallerian degeneration does not occur, so recovery does not involve actual regeneration. There is frequently greater involvement of motor than sensory function with autonomic function being retained. In electrodiagnostic testing with nerve conduction studies, there is a normal compound motor action potential amplitude distal to the lesion at day 10, and this indicates a diagnosis of mild neurapraxia instead of axonotmesis or neurotmesis.

Axonotmesis
This is a more severe nerve injury with disruption of the neuronal axon, but with maintenance of the epineurium. This type of nerve damage may cause paralysis of the motor, sensory, and autonomic. Mainly seen in crush injury. If the force creating the nerve damage is removed in a timely fashion, the axon may regenerate, leading to recovery. Electrically, the nerve shows rapid and complete degeneration, with loss of voluntary motor units. Regeneration of the motor end plates will occur, as long as the endoneural tubules are intact.

Axonotmesis involves the interruption of the axon and its covering of myelin but preservation of the connective tissue framework of the nerve (the encapsulating tissue, the epineurium and perineurium, are preserved). Because axonal continuity is lost, Wallerian degeneration occurs. Electromyography (EMG) performed 2 to 4 weeks later shows fibrillations and denervation potentials in musculature distal to the injury site. Loss in both motor and sensory spines is more complete with axonotmesis than with neurapraxia, and recovery occurs only through regenerations of the axons, a process requiring time. Axonotmesis is usually the result of a more severe crush or contusion than neurapraxia, but can also occur when the nerve is stretched (without damage to the epineurium).

There is usually an element of retrograde proximal degeneration of the axon, and for regeneration to occur, this loss must first be overcome. The regeneration fibers must cross the injury site and regeneration through the proximal or retrograde area of degeneration may require several weeks. Then the neuritis tip progresses down the distal site, such as the wrist or hand. Proximal lesion may grow distally as fast as 2 to 3 mm per day and distal lesion as slowly as 1.5 mm per day. Regeneration occurs over weeks to years.

Neurotmesis
Neurotmesis is the most severe lesion with no potential of full recovery. It occurs on severe contusion, stretch, or laceration. The axon and encapsulating connective tissue lose their continuity. The last (extreme) degree of neurotmesis is transsection, but most neurotmetic injuries do not produce gross loss of continuity of the nerve but rather internal disruption of the architecture of the nerve sufficient to involve perineurium and endoneurium as well as axons and their covering. Denervation changes recorded by EMG are the same as those seen with axonotmetic injury. There is a complete loss of motor, sensory and autonomic function. If the nerve has been completely divided, axonal regeneration causes a neuroma to form in the proximal stump. For neurotmesis, it is better to use a new more complete classification called the Sunderland System.

7 Traumatic Injury

Traumatic Injury to Muscle, Tendons, Ligaments, Joints

8 Bone Fracture

A bone fracture (sometimes abbreviated FRX or Fx, Fx, or #) is a medical condition in which there is a partial or complete break in the continuity of the bone. In more severe cases, the bone may be broken into several pieces. A bone fracture may be the result of high force impact or stress, or a minimal trauma injury as a result of certain medical conditions that weaken the bones, such as osteoporosis, osteopenia, bone cancer, or osteogenesis imperfecta, where the fracture is then properly termed a pathologic fracture.

Signs & Symptoms

Although bone tissue itself contains no nociceptors, bone fracture is painful for several reasons:
- Breaking in the continuity of the periosteum, with or without similar discontinuity in endosteum, as both contain multiple pain receptors.
- Edema and hematoma of nearby soft tissues caused by ruptured bone marrow evokes pressure pain.
- Involuntary muscle spasms trying to hold bone fragments in place.

Damage to adjacent structures such as nerves, muscles or blood vessels, spinal cord, and nerve roots (for spine fractures), or cranial contents (for skull fractures) may cause other specific signs and symptoms.

INJURY | Internal Injury | Bone Fracture | Signs & Symptoms

Complications
Some fractures may lead to serious complications including a condition known as compartment syndrome. If not treated, eventually, compartment syndrome may require amputation of the affected limb. Other complications may include non-union, where the fractured bone fails to heal or mal-union, where the fractured bone heals in a deformed manner. One form of malunion is the malrotation of a bone, which is especially common after femoral and tibial fractures.

Complications of fractures may be classified into three broad groups, depending upon their time of occurrence. These are as follows –
1. Immediate complications – occurs at the time of the fracture.
2. Early complications – occurring in the initial few days after the fracture.
3. Late complications – occurring a long time after the fracture.

Immediate complications	Early complications	Late complications
Systemic ● Hypovolaemic shock	**Systemic** ● Hypovolaemic shock ● ARDS – Adult respiratory distress syndrome ● Fat embolism syndrome ● Deep vein thrombosis ● Pulmonary syndrome ● Aseptic traumatic fever ● Sepsis (in open fracture) ● Crush syndrome	**Imperfect union of the fracture** ● Delayed union ● Non union ● Mal union ● Cross union
Local ● Injury to major vessels ● Injury to muscles and tendons ● Injury to joints ● Injury to viscera	**Local** ● Infection ● Compartment syndrome	**Others** ● Avascular necrosis ● Shortening ● Joint stiffness ● Sudeck's dystrophy ● Osteomyelitis ● Ischaemic contracture ● Myositis ossificans ● Osteoarthritis

Pathophysiology

The natural process of healing a fracture starts when the injured bone and surrounding tissues bleed, forming a fracture hematoma. The blood coagulates to form a blood clot situated between the broken fragments. Within a few days, blood vessels grow into the jelly-like matrix of the blood clot. The new blood vessels bring phagocytes to the area, which gradually removes the non-viable material. The blood vessels also bring fibroblasts in the walls of the vessels and these multiply and produce collagen fibres. In this way, the blood clot is replaced by a matrix of collagen. Collagen's rubbery consistency allows bone fragments to move only a small amount unless severe or persistent force is applied.

At this stage, some of the fibroblasts begin to lay down bone matrix in the form of collagen monomers. These monomers spontaneously assemble to form the bone matrix, for which bone crystals (calcium hydroxyapatite) are deposited in amongst, in the form of insoluble crystals. This mineralization of the collagen matrix stiffens it and transforms it into bone. In fact, bone is a mineralized collagen matrix; if the mineral is dissolved out of bone, it becomes rubbery. Healing bone callus on average is sufficiently mineralized to show up on X-ray within 6 weeks in adults and less in children. This initial "woven" bone does not have the strong mechanical properties of mature bone. By a process of remodelling, the woven bone is replaced by mature "lamellar" bone. The whole process may take up to 18 months, but in adults, the strength of the healing bone is usually 80% of normal by 3 months after the injury.
Several factors may help or hinder the bone healing process. For example, tobacco smoking hinders the process of bone healing, and adequate nutrition (including calcium intake) will help the bone healing process. Weight-bearing stress on bone, after the bone has healed sufficiently to bear the weight, also builds bone strength.

Although there are theoretical concerns about NSAIDs slowing the rate of healing, there is not enough evidence to warrant withholding the use of this type analgesic in simple fractures.

Smokers generally have lower bone density than non-smokers, so they have a much higher risk of fractures. There is also evidence that smoking delays bone healing.

Classification

A bone fracture may be diagnosed based on the history given and the physical examination performed. Radiographic imaging often is performed to confirm the diagnosis. Under certain circumstances, radiographic examination of the nearby joints is indicated in order to exclude dislocations and fracture-dislocations. In situations where projectional radiography alone is insufficient, Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) may be indicated.

In orthopedic medicine, fractures are classified in various ways. Historically they are named after the physician who first described the fracture conditions, however, there are more systematic classifications as well.

They may be divided into stable versus unstable depending on the likelihood that they may shift further.

Mechanism
● Traumatic fracture – a fracture due to sustained trauma. e.g., fractures caused by a fall, road traffic accident, fight, etc.
● Pathologic fracture – a fracture through a bone that has been made weak by some underlying disease is called pathological fracture. e.g., a fracture through a bone weakened by metastasis. Osteoporosis is the most common cause of pathological fracture.
● Periprosthetic fracture – a fracture at the point of mechanical weakness at the end of an implant

Soft-tissue Involvement
● Closed fractures are those in which the overlying skin is intact
● Open/compound fractures involve wounds that communicate with the fracture, or where fracture hematoma is exposed, and may thus expose bone to contamination. Open injuries carry a higher risk of infection.
  ○ Clean fracture
  ○ Contaminated fracture

Displacement
● Non-displaced
● Displaced
  ○ Translated, or ad latus, with sideways displacement.
  ○ Angulated
  ○ Rotated
  ○ Shortened, a reduction in overall bone length when displaced fracture fragments overlap

Fracture Pattern
- Linear fracture: a fracture that is parallel to the bone's long axis
- Transverse fracture: a fracture that is at a right angle to the bone's long axis
- Oblique fracture: a fracture that is diagonal to a bone's long axis (more than 30°)
- Spiral fracture: a fracture where at least one part of the bone has been twisted
- Compression fracture/wedge fracture: usually occurs in the vertebrae, for example when the front portion of a vertebra in the spine collapses due to osteoporosis (a medical condition which causes bones to become brittle and susceptible to fracture, with or without trauma)
- Impacted fracture: a fracture caused when bone fragments are driven into each other
- Avulsion fracture: a fracture where a fragment of bone is separated from the main mass

Fragments
- Incomplete fracture: a fracture in which the bone fragments are still partially joined, in such cases, there is a crack in the osseous tissue that does not completely traverse the width of the bone.
- Complete fracture: a fracture in which bone fragments separate completely.
- Comminuted fracture: a fracture in which the bone has broken into several pieces.

Anatomical Location

An anatomical classification may begin with specifying the involved body part, such as the head or arm, followed with more specific localization. Fractures that have additional definition criteria than merely localization often may be classified as subtypes of fractures, such as a Holstein-Lewis fracture being a subtype of a humerus fracture. Most typical examples in an orthopaedic classification given in the previous section cannot be classified appropriately into any specific part of an anatomical classification, however, as they may apply to multiple anatomical fracture sites.

- Skull fracture
    - Basilar skull fracture
    - Blowout fracture – a fracture of the walls or floor of the orbit
    - Mandibular fracture
    - Nasal fracture
    - Le Fort fracture of skull – facial fractures involving the maxillary bone and surrounding structures in a usually bilateral and either horizontal, pyramidal, or transverse way.

- Spinal fracture
    - Cervical fracture
        - Fracture of C1, including Jefferson fracture
        - Fracture of C2, including Hangman's fracture
        - Flexion teardrop fracture – a fracture of the anteroinferior aspect of a cervical vertebral
    - Clay-shoveler fracture – fracture through the spinous process of a vertebra occurring at any of the lower cervical or upper thoracic vertebrae
    - Burst fracture – in which a vertebra breaks from a high-energy axial load
    - Compression fracture – a collapse of a vertebra, often in the form of wedge fractures due to larger compression anteriorly
    - Chance fracture – compression injury to the anterior portion of a vertebral body with concomitant distraction injury to posterior elements
    - Holdsworth fracture – an unstable fracture dislocation of the thoracolumbar junction of the spine

- Rib fracture
- Sternal fracture
- Shoulder fracture
    - Clavicle fracture
    - Scapular fracture

- Arm fracture
    - Humerus fracture (fracture of upper arm)
        - Supracondylar fracture
        - Holstein-Lewis fracture – a fracture of the distal third of the humerus resulting in entrapment of the radial nerve
    - Forearm fracture
        - Ulnar fracture
            - Monteggia fracture – a fracture of the proximal third of the ulna with the dislocation of the head of the radius
            - Hume fracture – a fracture of the olecranon with an associated anterior dislocation of the radial head

        - Radius fracture
            - Essex-Lopresti fracture – a fracture of the radial head with concomitant dislocation of the distal radio-ulnar joint
            - Distal radius fracture
                - Galeazzi fracture – a fracture of the radius with dislocation of the distal radioulnar joint
                - Colles' fracture – a distal fracture of the radius with dorsal (posterior) displacement of the wrist and hand
                - Smith's fracture – a distal fracture of the radius with volar (ventral) displacement of the wrist and hand
                - Barton's fracture – an intra-articular fracture of the distal radius with dislocation of the radiocarpal joint

- Hand fracture
    - Scaphoid fracture
    - Rolando fracture – a comminuted intra-articular fracture through the base of the first metacarpal bone
    - Bennett's fracture – a fracture of the base of the first metacarpal bone which extends into the carpometacarpal (CMC) joint
    - Boxer's fracture – a fracture at the neck of a metacarpal
- Pelvic fracture
    - Fracture of the hip bone
    - Duverney fracture – an isolated pelvic fracture involving only the iliac wing
- Femoral fracture
    - Hip fracture (anatomically a fracture of the femur bone and not the hip bone)
- Patella fracture
- Crus fracture (A crus fracture is a fracture of the lower legs bones meaning either or both of the tibia and fibula)
    - Tibia fracture
        - Pilon fracture
        - Tibial plateau fracture
        - Bumper fracture – a fracture of the lateral tibial plateau caused by a forced valgus applied to the knee
        - Segond fracture – an avulsion fracture of the lateral tibial condyle
        - Gosselin fracture – a fractures of the tibial plafond into anterior and posterior fragments
        - Toddler's fracture – an undisplaced and spiral fracture of the distal third to distal half of the tibia
    - Fibular fracture
        - Maisonneuve fracture
        - Le Fort fracture of ankle – a vertical fracture of the antero-medial part of the distal fibula with avulsion of the anterior tibiofibular ligament
        - Bosworth fracture – a fracture with an associated fixed posterior dislocation of the distal fibular fragment that becomes trapped

- Combined tibia and fibula fracture
    - Trimalleolar fracture – involving the lateral malleolus, medial malleolus, and the distal posterior aspect of the tibia
    - Bimalleolar fracture – involving the lateral malleolus and the medial malleolus
    - Pott's fracture

- Foot fracture
  - Lisfranc fracture – in which one or all of the metatarsals are displaced from the tarsus
  - Jones fracture – a fracture of the proximal end of the fifth metatarsal
  - March fracture – a fracture of the distal third of one of the metatarsals occurring because of recurrent stress
  - Calcaneal fracture - a fracture of the calcaneus (heel bone)

Prevention

Both high- and low-force trauma can cause bone fracture injuries. Preventive efforts to reduce motor vehicle crashes, the most common cause of high-force trauma, include reducing distractions while driving. Common distractions are driving under the influence and texting or calling while driving, both of which lead to an approximate 6-fold increase in crashes. Wearing a seatbelt can also reduce the likelihood of injury in a collision.

A common cause of low-force trauma is an at-home fall. When considering preventative efforts, the National Institute of Health (NIH) examines ways to reduce the likelihood of falling, the force of the fall, and bone fragility. To prevent at-home falls they suggest keeping cords out of high-traffic areas where someone could trip, installing handrails and keeping stairways well-lit, and installing an assistive bar near the bathtub in the washroom for support. To reduce the impact of a fall the NIH recommends to try falling straight down on your buttocks or onto your hands. Finally, taking calcium vitamin D supplements can help strengthen your bones.

Treatment

Treatment of bone fractures are broadly classified as surgical or conservative, the latter basically referring to any non-surgical procedure, such as pain management, immobilization or other non-surgical stabilization. A similar classification is open versus closed treatment, in which open treatment refers to any treatment in which the fracture site is opened surgically, regardless of whether the fracture is an open or closed fracture.

Pain Management
In arm fractures in children, ibuprofen has been found to be as effective as a combination of acetaminophen and codeine.

Immobilization
Since bone healing is a natural process that will occur most often, fracture treatment aims to ensure the best possible function of the injured part after healing. Bone fractures typically are treated by restoring the fractured pieces of bone to their natural positions (if necessary), and maintaining those positions while the bone heals. Often, aligning the bone, called reduction, in a good position and verifying the improved alignment with an X-ray is all that is needed. This process is extremely painful without anaesthesia, about as painful as breaking the bone itself.

To this end, a fractured limb usually is immobilized with a plaster or fibreglass cast or splint that holds the bones in position and immobilizes the joints above and below the fracture. When the initial post-fracture oedema or swelling goes down, the fracture may be placed in a removable brace or orthosis. If being treated with surgery, surgical nails, screws, plates, and wires are used to hold the fractured bone together more directly. Alternatively, fractured bones may be treated by the Ilizarov method which is a form of an external fixator.

Occasionally smaller bones, such as phalanges of the toes and fingers, may be treated without the cast, by buddy wrapping them, which serves a similar function to making a cast. A device called a Suzuki frame may be used in cases of deep, complex intra-articular digit fractures. By allowing only limited movement, immobilization helps preserve anatomical alignment while enabling callus formation, toward the target of achieving union.

Splinting results in the same outcome as casting in children who have a distal radius fracture with little shifting.

Surgery
Surgical methods of treating fractures have their own risks and benefits, but usually surgery is performed only if conservative treatment has failed, is very likely to fail, or likely to result in a poor functional outcome. With some fractures such as hip fractures (usually caused by osteoporosis), surgery is offered routinely because non-operative treatment results in prolonged immobilisation, which commonly results in complications including chest infections, pressure sores, deconditioning, deep vein thrombosis (DVT), and pulmonary embolism, which are more dangerous than surgery. When a joint surface is damaged by a fracture, surgery is also commonly recommended to make an accurate anatomical reduction and restore the smoothness of the joint.

Infection is especially dangerous in bones, due to the recrudescent nature of bone infections. Bone tissue is predominantly extracellular matrix, rather than living cells, and the few blood vessels needed to support this low metabolism are only able to bring a limited number of immune cells to an injury to fight infection. For this reason, open fractures and osteotomies call for very careful antiseptic procedures and prophylactic use of antibiotics. Occasionally, bone grafting is used to treat a fracture. Sometimes bones are reinforced with metal. These implants must be designed and installed with care. Stress shielding occurs when plates or screws carry too large of a portion of the bone's load, causing atrophy.

This problem is reduced, but not eliminated, by the use of low-modulus materials, including titanium and its alloys. The heat generated by the friction of installing hardware can accumulate easily and damage bone tissue, reducing the strength of the connections. If dissimilar metals are installed in contact with one another (i.e., a titanium plate with cobalt-chromium alloy or stainless steel screws), galvanic corrosion will result. The metal ions produced can damage the bone locally and may cause systemic effects as well.

9 Cramp

A cramp is a sudden, involuntary muscle contraction or over-shortening; while generally temporary and non-damaging, they can cause significant pain, and a paralysis-like immobility of the affected muscle. Onset is usually sudden, and it resolves on its own over a period of several seconds, minutes or hours. Cramps may occur in a skeletal muscle or smooth muscle. Skeletal muscle cramps may be caused by muscle fatigue or a lack of electrolytes such as low sodium, low potassium or low magnesium. Cramps of smooth muscle may be due to menstruation or gastroenteritis.

Differential Diagnosis

Causes of cramping include hyperflexion, hypoxia, exposure to large changes in temperature, dehydration, or low blood salt. Muscle cramps can also be a symptom or complication of pregnancy; kidney disease; thyroid disease; hypokalemia, hypomagnesemia, or hypocalcaemia (as conditions); restless legs syndrome; varicose veins; and multiple sclerosis. As early as 1965, researchers observed that leg cramps and restless legs syndrome can result from excess insulin, sometimes called hyperinsulinemia.

Skeletal Muscle Cramps
Under normal circumstances, skeletal muscles can be voluntarily controlled. Skeletal muscles that cramp the most often are the calves, thighs, and arches of the foot, and are sometimes called a "Charley horse" or a "corky". Such cramping is associated with strenuous physical activity and can be intensely painful; however, they can even occur while inactive and relaxed. Around 40% of people who experience skeletal cramps are likely to endure extreme muscle pain, and may be unable to use the entire limb that contains the "locked-up" muscle group. It may take up to seven days for the muscle to return to a pain-free state.

INJURY Internal Injury Cramps Differential Diagnosis

Nocturnal Leg Cramps
Nocturnal leg cramps are involuntary muscle contractions that occur in the calves, soles of the feet, or other muscles in the body during the night or (less commonly) while resting. The duration of nocturnal leg cramps is variable, with cramps lasting anywhere from a few seconds to several minutes. Muscle soreness may remain after the cramp itself ends. These cramps are more common in older people. They happen quite frequently in teenagers and in some people while exercising at night. Besides being painful, a nocturnal leg cramp can cause much distress and anxiety. The precise cause of these cramps is unclear. Potential contributing factors include dehydration, low levels of certain minerals (magnesium, potassium, calcium, and sodium, although the evidence has been mixed), and reduced blood flow through muscles attendant in prolonged sitting or lying down. Nocturnal leg cramps (almost exclusively calf cramps) are considered "normal" during the late stages of pregnancy. They can, however, vary in intensity from mild to extremely painful.

Nocturnal Leg Cramps
A lactic acid buildup around muscles can trigger cramps; however, these happen during anaerobic respiration when a person is exercising or engaging in an activity where the heartbeat speeds up. Medical conditions associated with leg cramps are cardiovascular disease, hemodialysis, cirrhosis, pregnancy, and lumbar canal stenosis. Differential diagnoses include restless legs syndrome, claudication, myositis, peripheral neuropathy. All of these can be differentiated through careful history and physical examination. Gentle stretching and massage, putting some pressure on the affected leg by walking or standing, or taking a warm bath or shower may help to end the cramp. If the cramp is in the calf muscle, pulling the big toe gently backwards will stretch the muscle and, in some cases, cause almost immediate relief. There is limited evidence supporting the use of magnesium, calcium channel blockers, carisoprodol, and vitamin B12. Quinine is no longer recommended for treatment of nocturnal leg cramps due to potential fatal hypersensitivity reactions and thrombocytopenia. Arrhythmias, cinchonism, hemolytic uremic syndrome can also occur at higher dosages.

Smooth Muscle Cramps
Smooth muscle contractions may be symptomatic of endometriosis or other health problems. Menstrual cramps may also occur during a menstrual cycle.

INJURY Internal Injury Cramps

Treatment
Stretching, massage and drinking plenty of liquids, such as water, may be helpful in treating simple muscle cramps. With exertional heat cramps due to electrolyte abnormalities (primarily sodium loss and not calcium, magnesium, and potassium), appropriate fluids and sufficient salt improves symptoms.

Prevention
Adequate conditioning, stretching, mental preparation, hydration, and electrolyte balance are likely helpful in preventing muscle cramps.

10 Dislocation

INJURY Internal Injury Dislocation

A joint dislocation, also called luxation, occurs when there is an abnormal separation in the joint, where two or more bones meet. A partial dislocation is referred to as a subluxation. Dislocations are often caused by sudden trauma on the joint like an impact or fall. A joint dislocation can cause damage to the surrounding ligaments, tendons, muscles, and nerves. Dislocations can occur in any joint major (shoulder, knees, etc.) or minor (toes, fingers, etc.). The most common joint dislocation is a shoulder dislocation. Treatment for joint dislocation is usually by closed reduction, that is, skilled manipulation to return the bones to their normal position. Reduction should only be performed by trained medical professionals, because it can cause injury to soft tissue and/or the nerves and vascular structures around the dislocation.

Signs & Symptoms

INJURY Internal Injury Dislocation Signs &

- Intense pain
- Joint instability
- Deformity of the joint area
- Reduced muscle strength
- Bruising or redness of joint area
- Difficulty moving joint
- Stiffness

Causes

Causes

Joint dislocations are caused by trauma to the joint or when an individual falls on a specific joint. Great and sudden force applied, by either a blow or fall, to the joint can cause the bones in the joint to be displaced or dislocated from normal position. With each dislocation, the ligaments keeping the bones fixed in the correct position can be damaged or loosened, making it easier for the joint to be dislocated in the future. Some individuals are prone to dislocations due to congenital conditions, such as hypermobility syndrome and Ehlers-Danlos Syndrome. Hypermobility syndrome is genetically inherited disorder that is thought to affect the encoding of the connective tissue protein's collagen in the ligament of joints. The loosened or stretched ligaments in the joint provide little stability and allow for the joint to be easily dislocated.

Diagnosis

INJURY Internal Injury Dislocation

Initial evaluation of a suspected joint dislocation should begin with a thorough patient history, including mechanism of injury, and physical examination. Special attention should be focused on the neurovascular exam both before and after reduction, as injury to these structures may occur during the injury or during the reduction process. Subsequent imaging studies are frequently obtained to assist with diagnosis.

Treatment

INJURY Internal Injury Dislocation Treatment

A dislocated joint usually can be successfully reduced into its normal position only by a trained medical professional. Trying to reduce a joint without any training could substantially worsen the injury. X-rays are usually taken to confirm a diagnosis and detect any fractures which may also have occurred at the time of dislocation. A dislocation is easily seen on an X-ray. Once a diagnosis is confirmed, the joint is usually manipulated back into position. This can be a very painful process, therefore this is typically done either in the emergency department under sedation or in an operating room under a general anaesthetic.

It is important the joint is reduced as soon as possible, as in the state of dislocation, the blood supply to the joint (or distal anatomy) may be compromised. This is especially true in the case of a dislocated ankle, due to the anatomy of the blood supply to the foot. Shoulder injuries can also be surgically stabilized, depending on the severity, using arthroscopic surgery. The most common treatment method for a dislocation of the Glenohumeral Joint (GH Joint/Shoulder Joint) is exercise based management. Another method of treatment is to place the injured arm in a sling or in another immobilizing device in order to keep the joint stable.

Some joints are more at risk of becoming dislocated again after an initial injury. This is due to the weakening of the muscles and ligaments which hold the joint in place. The shoulder is a prime example of this. Any shoulder dislocation should be followed up with thorough physiotherapy. On field reduction is crucial for joint dislocations. As they are extremely common in sports events, managing them correctly at the game at the time of injury, can reduce long term issues. They require prompt evaluation, diagnosis, reduction, and postreduction management before the person can be evaluated at a medical facility.

INJURY Internal Injury Dislocation Treatment

After Care
After a dislocation, injured joints are usually held in place by a splint (for straight joints like fingers and toes) or a bandage (for complex joints like shoulders). Additionally, the joint muscles, tendons and ligaments must also be strengthened. This is usually done through a course of physiotherapy, which will also help reduce the chances of repeated dislocations of the same joint. For glenohumeral instability, the therapeutic program depends on specific characteristics of the instability pattern, severity, recurrence and direction with adaptations made based on the needs of the patient. In general, the therapeutic program should focus on restoration of strength, normalization of range of motion and optimization of flexibility and muscular performance. Throughout all stages of the rehabilitation program, it is important to take all related joints and structures into consideration.

Epidemiology

Each joint in the body can be dislocated, however, there are common sites where most dislocations occur. The following structures are the most common sites of joint dislocations:

Shoulder
Shoulder dislocations account for 45% of all dislocation visits to the emergency room. Anterior shoulder dislocation, the most common type of shoulder dislocation (96-98% of the time) occurs when the arm is in external rotation and abduction (away from the body) produces a force that displaces the humeral head anteriorly and downwardly. Vessel and nerve injuries during a shoulder dislocation is rare, but can cause many impairments and requires a longer recovery process. There is a 39% average rate of recurrence of anterior shoulder dislocation, with age, sex, hyperlaxity and greater tuberosity fractures being the key risk factors.

Knee (Patellar Dislocation)
Many different knee injuries can happen. Three percent of knee injuries are acute traumatic patellar dislocations. Because dislocations make the knee unstable, 15% of patellas will re-dislocate. Patellar dislocations occur when the knee is in full extension and sustains a trauma from the lateral to medial side.

Elbow (Posterior Dislocation)
90% of all elbow dislocations.

Wrist
Lunate and Perilunate dislocation most common.

Finger
Interphalangeal (IP) or metacarpophalangeal (MCP) joint dislocations. In the United States, men are most likely to sustain a finger dislocation with an incidence rate of 17.8 per 100,000 person-years. Women have an incidence rate of 4.65 per 100,000 person-years. The average age group that sustain a finger dislocation are between 15 and 19 years old.

Hip
Posterior and Anterior Dislocation of Hip. Anterior dislocations are less common than posterior dislocations. 10% of all dislocations are anterior and this is broken down into superior and inferior types. Superior dislocations account for 10% of all anterior dislocations, and inferior dislocations account for 90%. 16-40 year old males are more likely to receive dislocations due to a car accident. When an individual receives a hip dislocation, there is an incidence rate of 95% that they will receive an injury to another part of their body as well. 46–84% of hip dislocations occur secondary to traffic accidents, the remaining percentage is due based on falls, industrial accidents or sporting injury.

Foot & Ankle
Lisfranc injury is a dislocation or fracture-dislocation injury at the tarsometatarsal joints. Subtalar dislocation, or talocalcaneonavicular dislocation, is a simultaneous dislocation of the talar joints at the talocalcaneal and talonavicular levels. Subtalar dislocations without associated fractures represent about 1% of all traumatic injuries of the foot and 1-2 % of all dislocations, and they are associated with high energy trauma. Early closed reduction is recommended, otherwise open reduction without further delay. Total talar dislocation is very rare and has very high rates of complications. Ankle Sprains primarily occur as a result of tearing the ATFL (anterior talofibular ligament) in the Talocrural Joint. The ATFL tears most easily when the foot is in plantarflexion and inversion. Ankle dislocation without fracture is rare.

11 Concussion

Concussion, also known as mild traumatic brain injury (mTBI), is typically defined as a head injury that temporarily affects brain functioning. Symptoms may include headaches, trouble with thinking, memory or concentration, nausea, blurry vision, sleep disturbances or mood changes. Some symptoms may begin immediately, while others may appear days after the injury. Fewer than 10% of sports-related concussions among children are associated with loss of consciousness. It is not unusual for symptoms to last up to four weeks. Common causes include motor vehicle collisions, falls, sports injuries and bicycle accidents.

Risk factors include drinking alcohol. The mechanism may involve either a direct blow to the head or forces elsewhere on the body that are transmitted to the head. This is believed to result in neuron dysfunction, as there is increased glucose requirements but insufficient blood supply. Diagnosis requires less than 30 minutes of loss of consciousness, memory loss of less than 24 hours and a Glasgow Coma Scale score of 13 to 15. Otherwise, it is considered a moderate or severe traumatic brain injury. Efforts to prevent the condition includes the use of helmets when bicycling or motorbiking. Treatment generally involves physical and cognitive rest for a day or two, with a gradual return to activities. Prolonged periods of rest may worsen outcomes. Paracetamol (acetaminophen) or NSAIDs may be recommended. Physiotherapy may be useful for persistent balance problems while cognitive behavioral therapy may be useful for mood changes. Evidence to support the use of hyperbaric oxygen therapy and chiropractic therapy is lacking. Concussions are estimated to affect more than 6 per 1,000 people a year. It is the most common type of traumatic brain injury. Males and young adults are most commonly affected. Outcomes are generally good. Another concussion before the symptoms of a prior concussion have resolved is associated with worse outcomes. Repeated concussions may also increase the risk in later life of chronic traumatic encephalopathy, Parkinson's disease or depression.

Signs & Symptoms

Signs & Symptoms
Concussions are associated with a variety of symptoms, which typically occur rapidly after the injury. Early symptoms usually subside within days or weeks. The number and type of symptoms any one individual suffer varies widely. Headaches are the most common mTBI symptom. Others include dizziness, vomiting, nausea, lack of motor coordination, difficulty balancing, or other problems with movement or sensation. Visual symptoms include light sensitivity, seeing bright lights, blurred vision, and double vision. Tinnitus, or a ringing in the ears, is also commonly reported. In one in about seventy concussions, concussive convulsions occur, but seizures that take place during or immediately after a concussion are not "post-traumatic seizures", and, unlike post-traumatic seizures, are not predictive of post-traumatic epilepsy, which requires some form of structural brain damage, not just a momentary disruption in normal brain functioning. Concussive convulsions are thought to result from temporary loss or inhibition of motor function and are not associated either with epilepsy or with more serious structural damage. They are not associated with any particular sequelae and have the same high rate of favorable outcomes as concussions without convulsions.

Cognitive symptoms include confusion, disorientation, and difficulty focusing attention. Loss of consciousness may occur, but is not necessarily correlated with the severity of the concussion if it is brief. Post-traumatic amnesia, in which events following the injury cannot be recalled, is a hallmark of concussions. Confusion, another concussion hallmark, may be present immediately or may develop over several minutes. A person may repeat the same questions, be slow to respond to questions or directions, have a vacant stare, or have slurred or incoherent speech. Other MTBI symptoms include changes in sleeping patterns and difficulty with reasoning, concentrating, and performing everyday activities. A concussion can result in changes in mood including crankiness, loss of interest in favorite activities or items, tearfulness, and displays of emotion that are inappropriate to the situation. Common symptoms in concussed children include restlessness, lethargy, and irritability.

Mechanism
The brain is surrounded by cerebrospinal fluid, which protects it from light trauma. More severe impacts, or the forces associated with rapid acceleration, may not be absorbed by this cushion. Concussion may be caused by impact forces, in which the head strikes or is struck by something, or impulsive forces, in which the head moves without itself being subject to blunt trauma (for example, when the chest hits something and the head snaps forward). Forces may cause linear, rotational, or angular movement of the brain or a combination of them. In rotational movement, the head turns around its center of gravity and in angular movement, it turns on an axis, not through its center of gravity. The amount of rotational force is thought to be the major component in concussion and its severity. Studies with athletes have shown that the amount of force and the location of the impact are not necessarily correlated with the severity of the concussion or its symptoms, and have called into question the threshold for concussion previously thought to exist at around 70–75 g. The parts of the brain most affected by rotational forces are the midbrain and diencephalon. It is thought that the forces from the injury disrupt the normal cellular activities in the reticular activating system located in these areas and that this disruption produces the loss of consciousness often seen in concussion. Other areas of the brain that may be affected include the upper part of the brain stem, the fornix, the corpus callosum, the temporal lobe, and the frontal lobe. Angular accelerations of 4600, 5900, or 7900 rad/s2 are estimated to have 25, 50, or 80% risk of MTBI respectively.

Diagnosis

Head trauma recipients are initially assessed to exclude a more severe emergency such as an intracranial hemorrhage. This includes the "ABCs" (airway, breathing, circulation) and stabilization of the cervical spine which is assumed to be injured in any athlete who is found to be unconscious after head or neck injury. Indications that screening for more serious injury is needed include worsening of symptoms such as headaches, persistent vomiting, increasing disorientation or a deteriorating level of consciousness, seizures, and unequal pupil size. Those with such symptoms, or those who are at higher risk of a more serious brain injury, may undergo brain imaging to detect lesions and are frequently observed for 24–48 hours. A brain CT or brain MRI should be avoided unless there are progressive neurological symptoms, focal neurological findings or concern of skull fracture on exam. Diagnosis of MTBI is based on physical and neurological examination findings, duration of unconsciousness (usually less than 30 minutes) and post-traumatic amnesia (PTA; usually less than 24 hours), and the Glasgow Coma Scale (MTBI sufferers have scores of 13 to 15). Neuropsychological tests exist to measure cognitive function and the international consensus meeting in Zurich recommended the use of the SCAT2 test. Such tests may be administered hours, days, or weeks after the injury, or at different times to demonstrate any trend. Increasingly, athletes are also being tested pre-season to provide a baseline for comparison in the event of an injury, though this may not reduce risk or affect return to play.

If the Glasgow Coma Scale is less than 15 at two hours or less than 14 at any time, a CT is recommended. In addition, a CT scan is more likely to be performed if observation after discharge is not assured or intoxication is present, there is suspected increased risk for bleeding, age greater than 60, or less than 16. Most concussions, without complication, cannot be detected with MRI or CT scans. However, changes have been reported on MRI and SPECT imaging in those with concussion and normal CT scans, and post-concussion syndrome may be associated with abnormalities visible on SPECT and PET scans. Mild head injury may or may not produce abnormal EEG readings. A blood test known as the Brain Trauma Indicator was approved in the United States in 2018 and may be able to rule out the risk of intracranial bleeding and thus the need for a CT scan. Concussion may be under-diagnosed because of the lack of the highly noticeable signs and symptoms while athletes may minimize their injuries to remain in the competition. A retrospective survey in 2005 suggested that more than 88% of concussions are unrecognized. Diagnosis can be complex because concussion shares symptoms with other conditions. For example, post-concussion symptoms such as cognitive problems may be misattributed to brain injury when, in fact, due to post-traumatic stress disorder (PTSD).

Grading Systems

Three grading systems have been most widely followed: by Robert Cantu, the Colorado Medical Society, and the American Academy of Neurology. Each employs three grades, as summarized in the following table:

Guidelines	Grade I	Grade II	Grade III
Cantu	Post-traumatic amnesia <30 minutes, no loss of consciousness	Loss of consciousness <5 minutes or amnesia lasting 30 minutes–24 hours	Loss of consciousness >5 minutes or amnesia >24 hours
Colorado Medical Society	Confusion, no loss of consciousness	Confusion, post-traumatic amnesia, no loss of consciousness	Any loss of consciousness
American Academy of Neurology	Confusion, symptoms last <15 minutes, no loss of consciousness	Symptoms last >15 minutes, no loss of consciousness	Loss of consciousness (IIIa, coma lasts seconds, IIIb for minutes)

Prevention

Prevention of MTBI involves general measures such as wearing seat belts and using airbags in cars. Older people are encouraged to reduce fall risk by keeping floors free of clutter and wearing thin, flat, shoes with hard soles that do not interfere with balance. Protective equipment such as headgear has been found to reduce the number of concussions in athletes and improvements in the design of helmets may decrease the number and severity further. New "Head Impact Telemetry System" technology is being placed in helmets to study injury mechanisms and may generate knowledge that will potentially help reduce the risk of concussions among American Football players. Self-reported concussion rates among U-20 and elite rugby union players in Ireland are 45–48%. Half of these injuries go unreported. Changes to the rules or enforcing existing rules in sports, such as those against "head-down tackling", or "spearing", which is associated with a high injury rate, may also prevent concussions.

Treatment

After exclusion of neck injury, observation should be continued for several hours. If repeated vomiting, worsening headache, dizziness, seizure activity, excessive drowsiness, double vision, slurred speech, unsteady walk, or weakness or numbness in arms or legs, or signs of basilar skull fracture develop, immediate assessment in an emergency department is warranted. After this initial period has passed, there is debate as to whether it is necessary to awaken the person several times during the first night, as has traditionally been done, or whether there is more benefit from uninterrupted sleep.

Physical and cognitive rest should be continued until all symptoms have resolved with most (80–90%) concussions resolving in seven to ten days, although the recovery time may be longer in children and adolescents. Cognitive rest includes reducing activities which require concentration and attention such as school work, video games, and text messaging.

It has been suggested that even leisure reading can commonly worsen symptoms in children and adolescents and proposals include time off from school and attending partial days. Since students may appear 'normal', continuing education of relevant school personnel may be needed. Those with concussion are generally prescribed rest, including adequate nighttime sleep as well as daytime rest. Rest includes both physical and cognitive rest until symptoms clear and a gradual return to normal activities at a pace that does not cause symptoms to worsen is recommended. Education about symptoms, their management, and their normal time course, can lead to an improved outcome.

For persons participating in athletics, the 2008 Zurich Consensus Statement on Concussion in Sport recommends that participants be symptom-free before restarting and then progress through a series of graded steps. These steps include:	● Complete physical and cognitive rest ● Light aerobic activity (less than 70% of maximum heart rate) ● Sport-specific activities such as running drills and skating drills ● Non-contact training drills (exercise, coordination, and cognitive load) ● Full-contact practice ● Full-contact games.	Only when symptom-free for 24 hours, should progression to the next step occur. If symptoms occur, the person should drop back to the previous asymptomatic level for at least another 24 hours. The emphasis is on remaining symptom-free and taking it in medium steps, not on the steps themselves.

Medications may be prescribed to treat sleep problems and depression. Analgesics such as ibuprofen can be taken for headaches, but paracetamol (acetaminophen) is preferred to minimize the risk of intracranial hemorrhage. Concussed individuals are advised not to use alcohol or other drugs that have not been approved by a doctor as they can impede healing. Activation database-guided EEG biofeedback has been shown to return the memory abilities of the concussed individual to levels better than the control group. About one percent of people who receive treatment for MTBI need surgery for a brain injury. Observation to monitor for worsening condition is an important part of treatment.

Health care providers recommend that those suffering from concussion return for further medical care and evaluation 24 to 72 hours after the concussive event if the symptoms worsen. Athletes, especially intercollegiate or professional, are typically followed closely by team athletic trainers during this period but others may not have access to this level of health care and may be sent home with minimal monitoring. People may be released after assessment from hospital or emergency room to the care of a trusted person with instructions to return if they display worsening symptoms or those that might indicate an emergent condition such as change in consciousness, convulsions, severe headache, extremity weakness, vomiting, new bleeding or deafness in either or both ears.

Prognosis

People who have had a concussion seem more susceptible to another one, particularly if the new injury occurs before symptoms from the previous concussion have completely gone away. It is also a negative process if smaller impacts cause the same symptom severity. Repeated concussions may increase a person's risk in later life for dementia, Parkinson's disease, and depression. MTBI has a mortality rate of almost zero. The symptoms of most concussions resolve within weeks, but problems may persist. These are seldom permanent, and the outcome is usually excellent. About 75% of children recover within three months. The overall prognosis for recovery may be influenced by a variety of factors that include age at the time of injury, intellectual abilities, family environment, social support system, occupational status, coping strategies, and financial circumstances. People over age 55 may take longer to heal from MTBI or may heal incompletely. Similarly, factors such as a previous head injury or a coexisting medical condition have been found to predict longer-lasting post-concussion symptoms.

Other factors that may lengthen recovery time after MTBI include psychological problems such as substance abuse or clinical depression, poor health before the injury or additional injuries sustained during it, and life stress. Longer periods of amnesia or loss of consciousness immediately after the injury may indicate longer recovery times from residual symptoms. For unknown reasons, having had one concussion significantly increases a person's risk of having another. Having previously sustained a sports concussion has been found to be a strong factor increasing the likelihood of a concussion in the future. Other strong factors include participation in a contact sport and body mass size. The prognosis may differ between concussed adults and children; little research has been done on concussion in the pediatric population, but concern exists that severe concussions could interfere with brain development in children. A 2009 study found that individuals with a history of concussions might demonstrate a decline in both physical and mental performance for longer than 30 years. Compared to their peers with no history of brain trauma, sufferers of concussion exhibited effects including loss of episodic memory and reduced muscle speed.

Post-Concussion Syndrome

In post-concussion syndrome, symptoms do not resolve for weeks, months, or years after a concussion, and may occasionally be permanent. About 10% to 20% of people have post-concussion syndrome for more than a month. Symptoms may include headaches, dizziness, fatigue, anxiety, memory and attention problems, sleep problems, and irritability. There is no established treatment, and rest, a recommended recovery technique, has limited effectiveness. Symptoms usually go away on their own within months but may last for years. The question of whether the syndrome is due to structural damage or other factors such as psychological ones, or a combination of these, has long been the subject of debate.

3 Open Wound

A wound which is exposed to the outside world such as a cut or laceration. Gunshot wounds can be found under "Foreign Bodies".

Subheadings

1. Minor Cuts	2. Open Wound	3. Multiple Open Wounds	4. Avulsion
5. Enucleations	6. Amputation		

1 Minor Cuts

Minor cuts are small breaks in the skin such as a shallow cut with a knife or other sharp object. Minor cuts don't require stitches and are easily treatable yourself. This is the most common type of injury, therefore it's recommended that you have a lot of small bandages, Band-Aids and sterilizing wipes in your BOB.

Treatment

Sterilize the wound and apply a bangade or Band-Aid ensuring the enture wound is covered. All minor injuries should be taken care of immediately before they become infected. Some alcoholic beverages can sterilize wounds if theey are 40% alcohol content or more and 60% for Surgical Alcohol for use during an operation. Use isopropyl, hydrogen peroxide and iodine to clean the wound. Only hydrogen peroxide can be used inside the wound.

2 Open Wound

Open wounds are much more severe than minor cuts and typically require more attention and equipment such as a staple gun or stitches. You may also be able to see parts of bone showing in the wound, however the bones aren't broken damaged in an open wound.

Treatment

If the wound is over 2.5cm (1in) Sterilize and attempt to close the wound with tight wrappings or duct tape if a suture kit isn't available.

3 Multiple Open Wounds

The same type of open wounds mentioned above but multiple skin breaks around the location instead of just one.

INJURY Open Wound Avulsions

4 Avulsion

The ripping or tearing away of a body part or nerve without bone loss. The term most commonly refers to a surface trauma where all layers of the skin have been torn away, exposing the underlying structures (i.e., subcutaneous tissue, muscle, tendons, or bone). This is similar to an abrasion but more severe, as body parts such as an eyelid or an ear can be partially or fully detached from the body.

Skin Avulsions	The most common avulsion injury, skin avulsions usually occur during motor vehicle collisions. The severity of avulsion ranges from skin flaps (minor) to degloving (moderate) and amputation of a finger or limb (severe). Suprafascial avulsions are those in which the depth of the removed skin reaches the subcutaneous tissue layer, while subfascial avulsions extend deeper than the subcutaneous layer. Small suprafascial avulsions can be repaired by suturing, but most avulsions require skin grafts or reconstructive surgery.
Ear Avulsions	The ear is particularly vulnerable to avulsion injuries because of its position on the side of the head. The most common cause of ear avulsions is human bites, followed by falls, motor vehicle collisions, and dog bites. A partially avulsed ear can be reattached through suturing or microvascular surgery, depending on the severity of the injury. Microvascular surgery can also be used to reattach a completely avulsed ear, but its success rate is lower because of the need for venous drainage. The ear can also be reconstructed with cartilage and skin grafts or an external ear prosthesis can be made by an anaplastologist.
Eyelid Avulsions	Eyelid avulsions are uncommon, but can be caused by motor vehicle collisions, dog bites, or human bites. Eyelid avulsions are repaired by suturing after a CT scan is performed to determine where damage to the muscles, nerves, and blood vessels of the eyelid has occurred. More severe injuries require reconstruction, however, this usually results in some loss of function and subsequent surgeries may be necessary to improve structure and function. Microvascular surgery is another method of repair but is rarely used to treat eye avulsions. Sometimes botulinum toxin is injected into the eyelid to paralyze the muscles while the eyelid heals.
Nail Avulsions	Trauma to the nail can cause the nail plate to be torn from the nail bed. Unlike other types of avulsion, when a nail is lost, it is not typically reattached. Following the loss of the nail, the nail bed forms a germinal layer which hardens as the cells acquire keratin and becomes a new nail. Until this layer has formed, the exposed nail bed is highly sensitive, and is typically covered with a non-adherent dressing, as an ordinary dressing will stick to the nail bed and cause pain upon removal. In the average person, fingernails require 3 to 6 months to regrow completely, while toenails require 12 to 18 months.
Brachial Plexus Avulsions	In brachial plexus avulsions, the brachial plexus (a bundle of nerves that communicates signals between the spine and the arms, shoulders, and hands) is torn from its attachment to the spinal cord. One common cause of brachial plexus avulsions is when a baby's shoulders rotate in the birth canal during delivery, which causes the brachial plexus to stretch and tear. It occurs in 1-2 out of every 1,000 births. Shoulder trauma during motor vehicle collisions is another common cause of brachial plexus avulsions. Detachment of the nerves can cause pain and loss of function in the arms, shoulders, and hands. Neuropathic pain can be treated with medication, but it is only through surgical reattachment or nerve grafts that function can be restored. For intractable pain, a procedure called dorsal root entry zone (DREZ) lesioning can be effective.
Tooth Avulsions	During a tooth avulsion, a tooth is completely or partially (such that the dental pulp is exposed) detached from its socket. Secondary (permanent) teeth can be replaced and stabilised by a dentist. Primary (baby) teeth are not replaced because they tend to become infected and to interfere with the growth of the secondary teeth. A completely avulsed tooth that is replaced within one hour of the injury can be permanently retained. The long-term retention rate decreases as the time that the tooth is detached increases, and eventually root resorption makes replacement of the tooth impossible. To minimize damage to the root, the tooth should be kept in milk or sterile saline while it is outside the mouth.

5 Enucleations

A enucleation is the traumatic removal of an organ such as en eyeball in it's entirety.

INJURY Open Wound Amputations

6 Amputation

Amputation is the removal of a limb by trauma, medical illness, or surgery. As a surgical measure, it is used to control pain or a disease process in the affected limb, such as malignancy or gangrene. In some cases, it is carried out on individuals as a preventative surgery for such problems. A special case is that of congenital amputation, a congenital disorder, where fetal limbs have been cut off by constrictive bands. In some countries, amputation of the hands, feet or other body parts is or was used as a form of punishment for people who committed crimes.

Amputation has also been used as a tactic in war and acts of terrorism; it may also occur as a war injury. In some cultures and religions, minor amputations or mutilations are considered a ritual accomplishment. When done by a person, the person executing the amputation is an amputator. The amputated person is called an amputee.

Leg	Lower limb, or leg, amputations can be divided into two broad categories - minor amputations and major amputations, Minor amputations generally refers to the amputation of digits. Major amputations are commonly referred to as below-knee amputation, above-knee amputation and so forth. To avoid ambiguity the correct terminology for major amputations is:	● Partial foot amputation - amputation of the lower limb distal to the ankle joint. ● Ankle disarticulation - amputation of the lower limb at the ankle joint. ● Trans-tibial amputation - amputation of the lower limb between the knee joint and the ankle joint, commonly referred to as a below-knee amputation. ● Knee disarticulation - amputation of the lower limb at the knee joint. ● Trans-femoral amputation - amputation of the lower limb between the hip joint and the knee joint, commonly referred to an above-knee amputation. ● Hip disarticulation - amputation of the lower limb at the hip joint. ● Trans-pelvic disarticulation- amputation of the whole lower limb together with all or part of the pelvis. This is also known as a hemipelvectomy or hindquarter amputation.	
Arm	The correct terminology for arm, or upper-limb amputations is also described in ISO 8549-2:1989, these being:	● Partial hand amputation ● Wrist disarticulation ● Trans-radial amputation, commonly referred to as below-elbow or forearm amputation ● Elbow disarticulation ● Trans-humeral amputation, commonly referred to as above-elbow amputation ● Shoulder disarticulation ● Forequarter amputation	A variant of the trans-radial amputation is the Krukenberg procedure in which the radius and ulna are used to create a stump capable of a pincer action.

Other	**Face** Many of these facial disfigurings were and still are done in some parts of the world as punishment for some crimes, and as individual shame and population terror practices. ● Amputation of the ears ● Amputation of the nose (rhinotomy) ● Amputation of the tongue (glossectomy). ● Amputation of the eyes (enucleation). ● Amputation of the teeth. Removal of teeth, mainly incisors.	**Breasts & Genitals** ● Amputation of the breasts (mastectomy). ● Amputation of the testicles (castration). ● Amputation of the penis (penectomy). ● Amputation of the foreskin (circumcision). ● Amputation of the clitoris (clitoridectomy).	Hemicorporectomy, or amputation at the waist, and decapitation, or amputation at the neck, are the most radical amputations. Genital modification and mutilation may involve amputating tissue, although not necessarily as a result of injury or disease.

Self-Amputation
In some rare cases when a person has become trapped in a deserted place, with no means of communication or hope of rescue, the victim has amputated his or her own limb. The most notable case of this is Aron Ralston, a hiker who amputated his own right forearm after it was pinned by a boulder in a hiking accident and he was unable to free himself for over five days. Body integrity identity disorder is a psychological condition in which an individual feels compelled to remove one or more of their body parts, usually a limb. In some cases, that individual may take drastic measures to remove the offending appendages, either by causing irreparable damage to the limb so that medical intervention cannot save the limb, or by causing the limb to be severed.

Athletic Performance Sometimes professional athletes may choose to have a non-essential digit amputated to relieve chronic pain and impaired performance.	**Legal Punishment** ● Amputation is used as a legal punishment in a number of countries, among them Saudi Arabia, Yemen, United Arab Emirates, and Iran.

Surgery
The first step is ligating the supplying artery and vein, to prevent hemorrhage (bleeding). The muscles are transected, and finally, the bone is sawed through with an oscillating saw. Sharp and rough edges of the bone(s) are filed down, skin and muscle flaps are then transposed over the stump, occasionally with the insertion of elements to attach a prosthesis. Distal stabilisation of muscles is recommended. This allows effective muscle contraction which reduces atrophy, allows functional use of the stump and maintains soft tissue coverage of the remnant bone. The preferred stabilisation technique is myodesis where the muscle is attached to the bone or its periostium. In joint disarticulation amputations tenodesis may be used where the muscle tendon is attached to the bone. Muscles should be attached under similar tension to normal physiological conditions.

Post-Operative Management
The use of rigid removable dressings (RRD's) in trans-tibial (below knee) amputations, rather than soft bandaging has been shown to improve healing time, reduce edema, prevent knee flexion contractures and reduce complications, including further amputation, from external trauma such as falls onto the stump and should be considered standard practice. Post-operative management, in addition to wound healing, should consider maintenance of limb strength, joint range, edema management, preservation of the intact limb (if applicable) and stump desensitisation.

Trauma
Traumatic amputation is the partial or total avulsion of a part of a body during a serious accident, like traffic, labor, or combat. Traumatic amputation of a human limb, either partial or total, creates the immediate danger of death from blood loss. Orthopedic surgeons often assess the severity of different injuries using the Mangled Extremity Severity Score. Given different clinical and situational factors, they can predict the likelihood of amputation. This is especially useful for emergency physicians to quickly evaluate patients and decide on consultations.

Causes Traumatic amputation is uncommon in humans (1 per 20,804 population per year). Loss of limb usually happens immediately during the accident, but sometimes a few days later after medical complications. Statistically the most common causes of traumatic amputations are:	● Traffic accidents (cars, motorcycles, bicycles, trains, etc.) ● Labor accidents (equipment, instruments, cylinders, chainsaws, press machines, meat machines, wood machines, etc.) ● Agricultural accidents, with machines and mower equipment ● Electric shock hazards ● Firearms, bladed weapons, explosives ● Violent rupture of ship rope or industry wire rope ● Ring traction (ring amputation, de-gloving injuries) ● Building doors and car doors ● Gas cylinder explosions ● Other rare accidents

Circulatory Disorders ● Diabetic foot infection or gangrene (the most frequent reason for infection-related amputations) ● Sepsis with peripheral necrosis	**Neoplasm** ● Cancerous bone or soft tissue tumors (e.g. osteosarcoma, chondrosarcoma, fibrosarcoma, epithelioid sarcoma, Ewing's sarcoma, synovial sarcoma, sacrococcygeal teratoma, liposarcoma) ● Melanoma	**Infection** ● Bone infection (osteomyelitis) ● Diabetes ● Frostbite	**Deformities** ● Deformities of digits and/or limbs (e.g., proximal femoral focal deficiency, Fibular hemimelia) ● Extra digits and/or limbs (e.g., polydactyly)	**Trauma** ● Severe limb injuries in which the limb cannot be saved or efforts to save the limb fail. ● Traumatic amputation (an unexpected amputation that occurs at the scene of an accident, where the limb is partially or entirely severed as a direct result of the accident, for example, a finger that is severed from the blade of a table saw)

Treatment The development of the science of microsurgery over last 40 years has provided several treatment options for a traumatic amputation, depending on the patient's specific trauma and clinical situation:	**1st Choice** Surgical amputation - break - prosthesis	**2nd Choice** Surgical amputation - transplantation of other tissue - plastic reconstruction.	**3rd Choice** Replantation - reconnection - revascularisation of amputated limb, by microscope (after 1969)	**4th Choice** Transplantation of cadaveric hand (after 2000)

Prognosis
The individual may experience psychological trauma and emotional discomfort. The stump will remain an area of reduced mechanical stability. Limb loss can present significant or even drastic practical limitations. A large proportion of amputees (50–80%) experience the phenomenon of phantom limbs; they feel body parts that are no longer there. These limbs can itch, ache, burn, feel tense, dry or wet, locked in or trapped or they can feel as if they are moving. Some scientists believe it has to do with a kind of neural map that the brain has of the body, which sends information to the rest of the brain about limbs regardless of their existence. Phantom sensations and phantom pain may also occur after the removal of body parts other than the limbs, e.g. after amputation of the breast, extraction of a tooth (phantom tooth pain) or removal of an eye (phantom eye syndrome). A similar phenomenon is unexplained sensation in a body part unrelated to the amputated limb.

It has been hypothesized that the portion of the brain responsible for processing stimulation from amputated limbs, being deprived of input, expands into the surrounding brain, (Phantoms in the Brain: V.S. Ramachandran and Sandra Blakeslee) such that an individual who has had an arm amputated will experience unexplained pressure or movement on his face or head. In many cases, the phantom limb aids in adaptation to a prosthesis, as it permits the person to experience proprioception of the prosthetic limb. To support improved resistance or usability, comfort or healing, some type of stump socks may be worn instead of or as part of wearing a prosthesis.

Another side effect can be heterotopic ossification, especially when a bone injury is combined with a head injury. The brain signals the bone to grow instead of scar tissue to form, and nodules and other growth can interfere with prosthetics and sometimes require further operations. This type of injury has been especially common among soldiers wounded by improvised explosive devices in the Iraq War. Nearly half of the individuals who have an amputation due to vascular disease will die within 5 years. This is higher than the five year mortality rates for breast cancer, colon cancer, and prostate cancer. Of persons with diabetes who have a lower extremity amputation, up to 55% will require amputation of the second leg within two to three years.

4 Burns

A burn is a type of injury to skin, or other tissues, caused by heat, cold, electricity, chemicals, friction, or radiation. Most burns are due to heat from hot liquids, solids, or fire.

The characteristics of a burn depend upon its depth. Superficial burns cause pain lasting two or three days, followed by peeling of the skin over the next few days. Individuals suffering from more severe burns may indicate discomfort or complain of feeling pressure rather than pain. Full-thickness burns may be entirely insensitive to light touch or puncture. While superficial burns are typically red in color, severe burns may be pink, white or black. Burns around the mouth or singed hair inside the nose may indicate that burns to the airways have occurred, but these findings are not definitive. More worrisome signs include: shortness of breath, hoarseness, and stridor or wheezing. Itchiness is common during the healing process, occurring in up to 90% of adults and nearly all children. Numbness or tingling may persist for a prolonged period of time after an electrical injury. Burns may also produce emotional and psychological distress.

Type	Layers Involved	Appearance	Texture	Sensation	Healing Time	Prognosis
Superficial (first-degree)	Epidermis	Red without blisters	Dry	Painful	5–10 days	Heals well. Repeated sunburns increase the risk of skin cancer later in life.
Superficial partial thickness (second-degree)	Extends into superficial (papillary) dermis	Redness with clear blister. Blanches with pressure.	Moist	Very painful	2–3 weeks	Local infection (cellulitis) but no scarring typically
Deep partial thickness (second-degree)	Extends into deep (reticular) dermis	Yellow or white. Less blanching. May be blistering.	Fairly dry	Pressure and discomfort	3–8 weeks	Scarring, contractures (may require excision and skin grafting)
Full thickness (third-degree)	Extends through entire dermis	Stiff and white/brown. No blanching.	Leathery	Painless	Prolonged (months) and incomplete	Scarring, contractures, amputation (early excision recommended)
Fourth-degree	Extends through entire skin, and into underlying fat, muscle and bone	Black; charred with eschar	Dry	Painless	Requires excision	Amputation, significant functional impairment and in some cases, death.

Cause

Burns are caused by a variety of external sources classified as thermal (heat-related), chemical, electrical, and radiation. In the United States, the most common causes of burns are: fire or flame (44%), scalds (33%), hot objects (9%), electricity (4%), and chemicals (3%). Most (69%) burn injuries occur at home or at work (9%), and most are accidental, with 2% due to assault by another, and 1–2% resulting from a suicide attempt. These sources can cause inhalation injury to the airway and/or lungs, occurring in about 6%.

Burn injuries occur more commonly among the poor. Smoking and alcoholism are other risk factors. Fire-related burns are generally more common in colder climates. Specific risk factors in the developing world include cooking with open fires or on the floor as well as developmental disabilities in children and chronic diseases in adults.

Subheadings

1. Sunburn	**2. Minor Burn**	**3. Major Burn**	**4. Chemical Burn**
5. Electrical Burn	**6. Heat Burns & Scald**		

1 Sunburn

Sunburn is a form of radiation burn that affects living tissue, such as skin, that results from an overexposure to ultraviolet (UV) radiation, commonly from the sun. Common symptoms in humans and other animals include red or reddish skin that is hot to the touch, pain, general fatigue, and mild dizziness. An excess of UV radiation can be life-threatening in extreme cases. Excessive UV radiation is the leading cause of primarily non-malignant skin tumors. Sunburn is an inflammatory response in the skin triggered by direct DNA damage by UV radiation. When the skin cells' DNA is overly damaged by UV radiation, type I cell-death is triggered and the skin is replaced. Sun protective measures including sunscreen and sun protective clothing are widely accepted to prevent sunburn and some types of skin cancer. Special populations including children are especially susceptible to sunburn and protective measures should be used.

Signs & Symptoms

Typically, there is initial redness (erythema), followed by varying degrees of pain, proportional in severity to both the duration and intensity of exposure. Other symptoms can include blistering, swelling (edema), pruritus (itching), peeling skin, rash, nausea, fever, chills, and fainting (syncope). Also, a small amount of heat is given off from the burn, caused by the concentration of blood in the healing process, giving a warm feeling to the affected area. Sunburns may be classified as superficial, or partial thickness burns. Blistering is a sign of second degree sunburn.

Variations	Minor sunburns typically cause nothing more than slight redness and tenderness to the affected areas. In more serious cases, blistering can occur. Extreme sunburns can be painful to the point of debilitation and may require hospital care.
Duration	Sunburn can occur in less than 15 minutes, and in seconds when exposed to non-shielded welding arcs or other sources of intense ultraviolet light. Nevertheless, the inflicted harm is often not immediately obvious. After the exposure, skin may turn red in as little as 30 minutes but most often takes 2 to 6 hours. Pain is usually strongest 6 to 48 hours after exposure. The burn continues to develop for 1 to 3 days, occasionally followed by peeling skin in 3 to 8 days. Some peeling and itching may continue for several weeks.
Skin Cancer	Ultraviolet radiation causes sunburns and increases the risk of three types of skin cancer: melanoma, basal-cell carcinoma and squamous-cell carcinoma. Of greatest concern is that the melanoma risk increases in a dose-dependent manner with the number of a person's lifetime cumulative episodes of sunburn. It has been estimated that over 1/3 of melanomas in the United States and Australia could be prevented with regular sunscreen use.

Biological	Sunburn is caused by UV radiation, either from the sun or from artificial sources, such as tanning lamps, welding arcs, or ultraviolet germicidal irradiation. It is a reaction of the body to direct DNA damage from UVB light. This damage is mainly the formation of a thymine dimer. The damage is recognized by the body, which then triggers several defense mechanisms, including DNA repair to revert the damage, apoptosis and peeling to remove irreparably damaged skin cells, and increased melanin production to prevent future damage. Melanin readily absorbs UV wavelength light, acting as a photoprotectant. By preventing UV photons from disrupting chemical bonds, melanin inhibits both the direct alteration of DNA and the generation of free radicals, thus indirect DNA damage. Sunburn causes an inflammation process, including production of prostanoids and bradykinin. These chemical compounds increase sensitivity to heat by reducing the threshold of heat receptor (TRPV1) activation from 109 °F (43 °C) to 85 °F (29 °C). The pain may be caused by overproduction of a protein called CXCL5, which activates nerve fibres. Skin type determines the ease of sunburn. In general, people with lighter skin tone and limited capacity to develop a tan after UV radiation exposure have a greater risk of sunburn. The Fitzpatrick's Skin phototypes classification describes the normal variations of skin responses to UV radiation. Persons with type I skin have the greatest capacity to sunburn and type VI have the least capacity to burn. However, all skin types can develop sunburn.

Fitzpatrick's Skin Phototypes
- Type I: Pale white skin, burns easily, does not tan
- Type II: White skin, burns easily, tans with difficulty
- Type III: White skin, may burn but tans easily
- Type IV: Light brown/olive skin, hardly burns, tans easily
- Type V: Brown skin, usually does not burn, tans easily
- Type VI: Black skin, very unlikely to burn, becomes darker with UV radiation exposure

UV Intensity The UV Index indicates the risk of getting a sunburn at a given time and location. Contributing factors include:	1. The time of day. In most locations, the sun's rays are strongest between approximately 10am and 4pm daylight saving time. 2. Cloud cover. UV is partially blocked by clouds; but even on an overcast day, a significant percentage of the sun's damaging UV radiation can pass through clouds. 3. Proximity to reflective surfaces, such as water, sand, concrete, snow, and ice. All of these reflect the sun's rays and can cause sunburns. 4. The season of the year. The position of the sun in late spring and early summer can cause a more-severe sunburn. 5. Altitude. At a higher altitude it is easier to become burnt, because there is less of the earth's atmosphere to block the sunlight. UV exposure increases about 4% for every 1000 ft (305 m) gain in elevation. 6. Proximity to the equator (latitude). Between the polar and tropical regions, the closer to the equator, the more direct sunlight passes through the atmosphere over the course of a year. For example, the southern United States gets fifty percent more sunlight than the northern United States.

Because of variations in the intensity of UV radiation passing through the atmosphere, the risk of sunburn increases with proximity to the tropic latitudes, located between 23.5° north and south latitude. All else being equal (e.g., cloud cover, ozone layer, terrain, etc.), over the course of a full year, each location within the tropic or polar regions receives approximately the same amount of UV radiation. In the temperate zones between 23.5° and 66.5°, UV radiation varies substantially by latitude and season. The higher the latitude, the lower the intensity of the UV rays. Intensity in the northern hemisphere is greatest during the months of May, June and July — and in the southern hemisphere, November, December and January. On a minute-by-minute basis, the amount of UV radiation is dependent on the angle of the sun. This is easily determined by the height ratio of any object to the size of its shadow. The greatest risk is at solar noon, when shadows are at their minimum and the sun's radiation passes most directly through the atmosphere. Regardless of one's latitude (assuming no other variables), equal shadow lengths mean equal amounts of UV radiation.

Diagnosis

Diagnosis
The differential diagnosis of sunburn includes other skin pathology induced by UV radiation including photoallergic reactions, phototoxic reactions to topical or systemic medications, and other dermatologic disorders that are aggravated by exposure to sunlight. Considerations for diagnosis include duration and intensity of UV exposure, use of topical or systemic medications, history of dermatologic disease, and nutritional status.

- Phototoxic reactions: Non-immunological response to sunlight interacting with certain drugs and chemicals in the skin which resembles an exaggerated sunburn. Common drugs that may cause a phototoxic reaction include amiodarone, dacarbazine, fluoroquinolones, 5-fluorouracil, furosemide, nalidixic acid, phenothiazines, psoralens, retinoids, sulfonamides, sulfonylureas, tetracyclines, thiazides, and vinblastine.
- Photoallergic reactions: Uncommon immunological response to sunlight interacting with certain drugs and chemicals in the skin. When in excited state by UVR, these drugs and chemicals form free radicals that react to form functional antigens and induce a Type IV hypersensitivity reaction. These drugs include 6-methylcoumarin, aminobenzoic acid and esters, chlorpromazine, promethazine, diclofenac, sulfonamides, and sulfonylureas. Unlike phototoxic reactions which resemble exaggerated sunburns, photoallergic reactions can cause intense itching and can lead to thickening of the skin.
- Phytophotodermatitis: UV radiation induces inflammation of the skin after contact with certain plants (including limes, celery, and meadow grass). Causes pain, redness, and blistering of the skin in the distribution of plant exposure.
- Polymorphic light eruption: Recurrent abnormal reaction to UVR. It can present in various ways including pink-to-red bumps, blisters, plaques and urticaria.

- Solar urticaria: UVR-induced wheals that occurs within minutes of exposure and fades within hours.
- Other skin diseases exacerbated by sunlight: Several dermatologic conditions can increase in severity with exposure to UVR. These include systemic lupus erythematosus (SLE), dermatomyositis, acne, atopic dermatitis, and rosacea.

Prevention

Skin	The most effective way to prevent sunburn is to reduce the amount of UV radiation reaching the skin. The World Health Organization, American Academy of Dermatology, and Skin Cancer Foundation recommend the following measures to prevent excessive UV exposure and skin cancer.	● Limit sun exposure between the hours of 10am and 4pm, when UV rays are the strongest ● Seek shade when UV rays are most intense ● Wear sun-protective clothing including a wide brim hat, sunglasses, and tightly-woven, loose-fitting clothing ● Use sunscreen ● Avoid tanning beds and artificial UV exposure
UV Intensity	The strength of sunlight is published in many locations as a UV Index. Sunlight is generally strongest when the sun is close to the highest point in the sky. Due to time zones and daylight saving time, this is not necessarily at 12 noon, but often one to two hours later. Seeking shade including using umbrellas and canopies can reduce the amount of UV exposure, but does not block all UV rays. The WHO recommends following the shadow rule: "Watch your shadow – Short shadow, seek shade!"	

INJURY Burns Sunburns Prevention

Sunscreen	Commercial preparations are available that block UV light, known as sunscreens or sunblocks. They have a sun protection factor (SPF) rating, based on the sunblock's ability to suppress sunburn: The higher the SPF rating, the lower the amount of direct DNA damage. The stated protection factors are correct only if 2 mg of sunscreen is applied per square cm of exposed skin. This translates into about 28 mL (1 oz) to cover the whole body of an adult male, which is much more than many people use in practice. Sunscreens function as chemicals such as oxybenzone and dioxybenzone that absorb UV radiation (chemical sunscreens) or opaque materials such as zinc oxide or titanium oxide to physically block UV radiation (physical sunscreens). Chemical and mineral sunscreens vary in the wavelengths of UV radiation blocked. Broad-spectrum sunscreens contain filters that protect against UVA radiation as well as UVB. Although UVA radiation does not primarily cause sunburn, it does contribute to skin aging and an increased risk of skin cancer. Sunscreen is effective and thus recommended for preventing melanoma and squamous cell carcinoma. There is little evidence that it is effective in preventing basal cell carcinoma. Typical use of sunscreen does not usually result in vitamin D deficiency, but extensive usage may. Research has shown that the best sunscreen protection is achieved by application 15 to 30 minutes before exposure, followed by one reapplication 15 to 30 minutes after exposure begins. Further reapplication is necessary only after activities such as swimming, sweating, and rubbing.	
Sunscreen	This varies based on the indications and protection shown on the label — from as little as 80 minutes in water to a few hours, depending on the product selected. The American Academy of Dermatology recommends the following criteria in selecting a sunscreen:	• Broad spectrum: protects against both UVA and UVB rays • SPF 30 or higher • Water resistant: sunscreens are classified as water resistant based on time, either 40 minutes, 80 minutes, or not water resistant
Eyes	The eyes are also sensitive to sun exposure at about the same UV wavelengths as skin; snow blindness is essentially sunburn of the cornea. Wrap-around sunglasses or the use by spectacle-wearers of glasses that block UV light reduce the harmful radiation. UV light has been implicated in the development of age-related macular degeneration, pterygium and cataract. Concentrated clusters of melanin, commonly known as freckles, are often found within the iris.	
Diet	Dietary factors influence susceptibility to sunburn, recovery from sunburn, and risk of secondary complications from sunburn. Several dietary antioxidants, including essential vitamins, have been shown to have some effectiveness for protecting against sunburn and skin damage associated with ultraviolet radiation, in both human and animal studies. Supplementation with Vitamin C and Vitamin E was shown in one study to reduce the amount of sunburn after a controlled amount of UV exposure. A review of scientific literature through 2007 found that beta carotene (Vitamin A) supplementation had a protective effect against sunburn, but that the effects were only evident in the long-term, with studies of supplementation for periods less than 10 weeks in duration failing to show any effects. There is also evidence that common foods may have some protective ability against sunburn if taken for a period before the exposure.	
Protecting Children	Babies and children are particularly susceptible to UV damage which increases their risk of both melanoma and non-melanoma skin cancers later in life. Children should not sunburn at any age and protective measures can ensure their future risk of skin cancer is reduced.	• Infants 0-6 months: Children under 6mo generally have skin too sensitive for sunscreen and protective measures should focus on avoiding excessive UV exposure by using window mesh covers, wide brim hats, loose clothing that covers skin, and reducing UV exposure between the hours of 10am and 4pm. • Infants 6-12 months: Sunscreen can safely be used on infants this age. It is recommended to apply a broad-spectrum, water-resistant SPF 30+ sunscreen to exposed areas as well as avoid excessive UV exposure by using wide-brim hats and protective clothing. • Toddlers and Preschool-aged children: Apply a broad-spectrum, water-resistant SPF 30+ sunscreen to exposed areas, use wide-brim hats and sunglasses, avoid peak UV intensity hours of 10am-4pm and seek shade. Sun protective clothing with a SPF rating can also provide additional protection.

Treatment

INJURY Burns Sunburns Treatment

The primary measure is avoiding further exposure to the sun. The best treatment for most sunburns is time. Most sunburns heal completely within a few weeks. The American Academy of Dermatology recommends the following for treatment of sunburn:	• For pain relief, take cool baths or showers frequently. • Use soothing moisturizers that contain aloe vera or soy. Hydrocortisone creams that can be purchased over-the-counter can also be used on areas that are painful, however avoid creams that end in "caine" as these can be more irritating. • Anti-inflammatory medications such as ibuprofen or aspirin can help with pain. • Keep hydrated and drink extra water. • Do not pop blisters on a sunburn. Instead, let them heal on their own. • Protect sunburned skin with loose clothing when going outside to prevent further damage.

Non-steroidal anti-inflammatory drugs (such as ibuprofen or naproxen), and aspirin may decrease redness and pain. Local anesthetics such as benzocaine, however, are contraindicated. Schwellnus et al. states that topical steroids (such as hydrocortisone cream) do not help with sunburns, although the American Academy of Dermatology says they can be used on especially sore areas. While lidocaine cream is often used as a sunburn treatment, there is little evidence for the effectiveness of such use. Home treatments that may help the discomfort include using cool and wet cloths on the sunburned areas. Applying soothing lotions that contain aloe vera to the sunburn areas was supported by one review. Others have found aloe vera to have no effect. Aloe vera has no ability to protect people from sunburns. Another treatment includes using a moisturizer that contains soy. A sunburn draws fluid to the skin's surface and away from the rest of the body. Drinking extra water is recommended to help prevent dehydration.

2 Minor Burn

INJURY Burns Minor Burns

A minor burn is considered to be a first-degree or second-degree burn. If you are unfamiliar with the degrees see the main Burns heading above.

Treatment

Treatment

Early cooling (within 30 minutes of the burn) reduces burn depth and pain, but care must be taken as over-cooling can result in hypothermia. It should be performed with cool water 10–25 °C (50.0–77.0 °F) and not ice water as the latter can cause further injury. Cleaning with soap and water, removal of dead tissue, and application of dressings are important aspects of wound care. If intact blisters are present, it is not clear what should be done with them. Some tentative evidence supports leaving them intact. Second-degree burns should be re-evaluated after two days.

In the management of first and second-degree burns, little quality evidence exists to determine which dressing type to use. It is reasonable to manage first-degree burns without dressings. While topical antibiotics are often recommended, there is little evidence to support their use. Silver sulfadiazine (a type of antibiotic) is not recommended as it potentially prolongs healing time. There is insufficient evidence to support the use of dressings containing silver or negative-pressure wound therapy. Silver sulfadiazine does not appear to differ from silver containing foam dressings with respect to healing.

Medication
Burns can be very painful and a number of different options may be used for pain management. These include simple analgesics (such as ibuprofen and acetaminophen) and opioids such as morphine. Benzodiazepines may be used in addition to analgesics to help with anxiety. During the healing process, antihistamines, massage, or transcutaneous nerve stimulation may be used to aid with itching. Antihistamines, however, are only effective for this purpose in 20% of people. There is tentative evidence supporting the use of gabapentin and its use may be reasonable in those who do not improve with antihistamines. Intravenous lidocaine requires more study before it can be recommended for pain.

INJURY Burns Minor Burns Treatment

Intravenous antibiotics are recommended before surgery for those with extensive burns (>60% TBSA). As of 2008, guidelines do not recommend their general use due to concerns regarding antibiotic resistance and the increased risk of fungal infections. Tentative evidence, however, shows that they may improve survival rates in those with large and severe burns. Erythropoietin has not been found effective to prevent or treat anemia in burn cases. In burns caused by hydrofluoric acid, calcium gluconate is a specific antidote and may be used intravenously and/or topically. Recombinant human growth hormone (rhGH) in those with burns that involve more than 40% of their body appears to speed healing without affecting the risk of death. The use of steroids is of unclear evidence.

Alternative Medicine
Honey has been used since ancient times to aid wound healing and may be beneficial in first- and second-degree burns. There is moderate evidence that honey helps heal partial thickness burns. The evidence for aloe vera is of poor quality. While it might be beneficial in reducing pain, and a review from 2007 found tentative evidence of improved healing times, a subsequent review from 2012 did not find improved healing over silver sulfadiazine. There were only three randomized controlled trials for the use of plants for burns, two for aloe vera and one for oatmeal.

There is little evidence that vitamin E helps with keloids or scarring. Butter is not recommended. In low income countries, burns are treated up to one-third of the time with traditional medicine, which may include applications of eggs, mud, leaves or cow dung. Surgical management is limited in some cases due to insufficient financial resources and availability. There are a number of other methods that may be used in addition to medications to reduce procedural pain and anxiety including: virtual reality therapy, hypnosis, and behavioral approaches such as distraction techniques.

3 Major Burn

A major burn is considered to be a third-degree or fourth-degree burn. If you are unfamiliar with the degrees see the main Burns heading above.

Treatment

Early cooling (within 30 minutes of the burn) reduces burn depth and pain, but care must be taken as over-cooling can result in hypothermia. It should be performed with cool water 10–25 °C (50.0–77.0 °F) and not ice water as the latter can cause further injury. Cleaning with soap and water, removal of dead tissue, and application of dressings are important aspects of wound care. If intact blisters are present, it is not clear what should be done with them. Some tentative evidence supports leaving them intact. Second-degree burns should be re-evaluated after two days.

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Surgery
Wounds requiring surgical closure with skin grafts or flaps (typically anything more than a small full thickness burn) should be dealt with as early as possible. Circumferential burns of the limbs or chest may need urgent surgical release of the skin, known as an escharotomy. This is done to treat or prevent problems with distal circulation, or ventilation. It is uncertain if it is useful for neck or digit burns. Fasciotomies may be required for electrical burns.

Skin grafts can involve temporary skin substitute, derived from animal (human donor or pig) skin or synthesized. They are used to cover the wound as a dressing, preventing infection and fluid loss, but will eventually need to be removed. Alternatively, human skin can be treated to be left on permanently without rejection.

Prognosis

The prognosis is worse in those with larger burns, those who are older, and those who are females. The presence of a smoke inhalation injury, other significant injuries such as long bone fractures, and serious co-morbidities (e.g. heart disease, diabetes, psychiatric illness, and suicidal intent) also influence prognosis. On average, of those admitted to United States burn centers, 4% die, with the outcome for individuals dependent on the extent of the burn injury. For example, admittees with burn areas less than 10% TBSA had a mortality rate of less than 1%, while admittees with over 90% TBSA had a mortality rate of 85%. In Afghanistan, people with more than 60% TBSA burns rarely survive. The Baux score has historically been used to determine prognosis of major burns. However, with improved care, it is no longer very accurate. The score is determined by adding the size of the burn (% TBSA) to the age of the person, and taking that to be more or less equal to the risk of death. Burns in 2013 resulted in 1.2 million years lived with disability and 12.3 million disability adjusted life years.

Complications
A number of complications may occur, with infections being the most common. In order of frequency, potential complications include: pneumonia, cellulitis, urinary tract infections and respiratory failure. Risk factors for infection include: burns of more than 30% TBSA, full-thickness burns, extremes of age (young or old), or burns involving the legs or perineum. Pneumonia occurs particularly commonly in those with inhalation injuries.

Anemia secondary to full thickness burns of greater than 10% TBSA is common. Electrical burns may lead to compartment syndrome or rhabdomyolysis due to muscle breakdown. Blood clotting in the veins of the legs is estimated to occur in 6 to 25% of people. The hypermetabolic state that may persist for years after a major burn can result in a decrease in bone density and a loss of muscle mass. Keloids may form subsequent to a burn, particularly in those who are young and dark skinned. Following a burn, children may have significant psychological trauma and experience post-traumatic stress disorder. Scarring may also result in a disturbance in body image. In the developing world, significant burns may result in social isolation, extreme poverty and child abandonment.

4 Chemical Burn

5 Electrical Burn

An electrical burn is a burn that results from electricity passing through the body causing rapid injury. Electrical burns differ from thermal or chemical burns in that they cause much more subdermal damage. They can exclusively cause surface damage, but more often tissues deeper underneath the skin have been severely damaged. As a result, electrical burns are difficult to accurately diagnose, and many people underestimate the severity of their burn. In extreme cases, electricity can cause shock to the brain, strain to the heart, and injury to other organs. For a burn to be classified as electrical, electricity must be the direct cause.

For example, burning a finger on a hot electric steam iron would be thermal, not electrical. According to Joule's first law: electricity passing through resistance creates heat, so there is no current entering the body in this type of burn. Likewise, a fire that is ruled to be "electrical" in origin, does not necessarily mean that any injuries or deaths are due to electrical burns. Unless someone was injured at the exact moment that the fire began, it is unlikely that any electrical burns would occur.

Causes

Causes

Electrical burns can be caused by a variety of ways such as touching or grasping electrically live objects, short-circuiting, inserting fingers into electrical sockets, and falling into electrified water. Lightning strikes are also a cause of electrical burns, but this is a less common event. With the advances in technology, electrical injuries are becoming more common and are the fourth leading cause of work-related traumatic death. One third of all electrical traumas and most high-voltage injuries are job related, and more than 50% of these injuries result from power line contact.

Categorization

Electrical burns can be classified into six categories, and any combination of these categories may be present on an electrical burn victim:
- **Low Voltage Burn:** A burn produced by contact with a power source of 500 volts or less is classified as a low-voltage burn. The current at this voltage is not enough to cause tissue damage along its path except at the contact site. This type of burn may be mild, superficial, or severe depending on the contact time.
- **High Voltage Burn:** This burn is very severe as the victim makes direct contact with the high voltage supply and the damage runs its course throughout the body. Exterior injuries are misleading as most of the damage occurs underneath the skin. In this case, subdermal tissues are severely damaged.
- **Arc Burn:** This type of burn occurs when electrical energy passes from a high-resistance area to a low-resistance area. No contact is required with an arc burn as the electricity ionizes air particles to complete the circuit. The heat generated can be as high as 4,000°C - hot enough to vaporize metal and ignite a victim's clothing. A form of explosion dissipates excess energy from the arc. In addition, a high-current arc can produce a pressure wave blast in excess of 1000 pounds per square inch of pressure. This can throw the victim and cause severe injuries.

- **Flash Burn:** Flash burns are caused by electrical arcs that pass over the skin. The intense heat and light of an arc flash can cause severe burns in a fraction of a second. Although the burns on the skin are largely superficial and cover a large area, tissues beneath the skin are generally undamaged and unaffected. This typically occurs when the frequency of the AC current is significantly higher than the 50 or 60 Hz used in land-based electrical distribution systems (such as in aircraft).
- **Flame Burn:** Flame burns are caused by contact to objects that were ignited by an electrical source when associated with flash and arc burns.
- **Oral Burn:** This is caused by biting or sucking on electrical cords, and it most commonly happens to children. Electric current typically passes from one side of the child's mouth to the other, possibly causing deformity.

Pathophysiology

Four electrical factors determine the severity of the damage caused by electrical burns: voltage, current, resistance, and frequency. The severity of the burn also depends on the pathway the current takes through the body. Generally, the pathway of the current will follow the course of the least resistant tissues: firstly blood vessels, nerves, and muscle, then skin, tendon, fat, and bone. Most commonly, electric injuries primarily damage the outer limbs, but more critical portions of the body may be affected as well causing severe complications. As the body comes into contact with an electrical source, it becomes part of the electrical circuit. As such, the current has a point of entry and an exit at two different points on the body. The point of entry tends to be depressed and leathery whereas the exit wound is typically more extensive and explosive. It is hard to accurately diagnose an electrical burn because only the entry and exit wounds are visible and the internal damage is not.

Prevention

The following are some examples of unsafe practices which could lead to electric injury (cannot cover every possible scenario):

- Using electrical appliances while wet (showering, bathing, etc.) as plumbing is often connected to electrical ground, and wet skin loses much of its resistance. Exception for newer quality appliances intended for the bathroom when not simultaneously showering, bathing, being in a path of water going to plumbing, or touching bare concrete or sheet metal. Standing on a dry carpet or rug is ideal.
- All power mains outlets should have a wall cover to avoid accidentally touching the electrified sides between the wall and outlet. This is especially important for children, as their small fingers can easily reach into this gap along the sides.
- Using AC electrical appliances around bathtubs, swimming pools, hot tubs, etc. with the risk that the appliance may fall into the water and cause electrocution. Only battery-operated devices are safe.
- Adjusting prongs of an electrical cord that are too wide or narrow them with your fingertips while simultaneously plugging the cord into the power mains. The power plug used in the UK and some Commonwealth countries provides limited protection (Type G, with the lower half of the live prongs insulated), but all others do not.

- Failure to use child safety plugs in all outlets, and keeping children away from electrical cords.
- Not following manufacturer safety instructions for electrical appliances. This includes not using and immediately unplugging any appliance with a damaged electrical cord. If this cannot be done safely (i.e. damage is too close to the plug), the circuit breaker should be turned off beforehand.
- Touching metallic areas of an AC electrical appliance while also simultaneously touching faucets, water pipes, another metallic AC appliance, or being even partly immersed in water (including wet feet). This could ground the body through metal or water, with the risk that a faulty appliance is electrically "hot" on its outside cover or chassis.
- Not installing Ground Fault Circuit Interrupter (GFCI) outlets or circuit breakers in all areas with plumbing, bare concrete flooring, exposed to the elements, or outdoors by a qualified electrician. (Many newer homes already have these devices pre-installed.) Running an extension cord from non-GFCI areas such as bedrooms and hallways defeats this safety feature. Oral burns (above) cannot be prevented by GFCI.
- At poolside, not having a non-metallic fiberglass pole or net on hand to pull someone to safety in case the pool water is electrified, and the victim is still conscious. Furthermore, to not know where the circuit breakers for the pool are located.

- Using an ordinary vacuum cleaner in wet or damp areas. Only a "wet vac" is suitable for this purpose. Overfilling its collection container is also unsafe.
- Going near or under a downed power line, even if there's no direct contact with the wire. Also, not remaining inside your vehicle and waiting for rescue should a power line fall on it.
- Not double checking polarity before doing a jump start, or attempting a jump on a frozen battery. Although 12-volt batteries used in vehicles are at a safe voltage, a short circuit can still cause various types of burns and an explosion.
- Failure to replace high-risk appliances of decades past with new ones (hand-held corded electric drills, blow dryers, etc.)

Treatment

First Aid
An electrically burned patient should not be touched or treated until the source of electricity has been removed. Electrical injuries often extend beyond burns and include cardiac arrhythmia, such as ventricular fibrillation. First aid treatments include assessment of consciousness of the victim, evaluation of pulse and circulation, and treatment of burns.

These injuries must be treated in addition to the burns themselves. In very rare instances, a high voltage electric shock can cause cataracts in the lens of the eyes, and detachment of the retina. This may be delayed for some days or weeks after the initial injury.

Hospitalization
Typically, an electrical burn patient has a lower affected body surface area than other burn patients, yet complication risks are much higher due to internal injury. Often, the damaged internal tissue demands hospitalization. If not treated, this damaged tissue can cause complications (such as gaseous gangrene from dead tissue or loss of blood flow to limbs) and the damaged body parts may need to be amputated. Repeated removal of the damaged tissue and extensive rehabilitation are common while limb amputation rates for victims who experience direct electrical contact can be as high as 75%. Burn treatment for severe wounds may require skin grafting, debridement, excision of dead tissue, and repair of damaged organs.

Rehabilitation Electrical burning has an effect on most vital body functions and is accompanied by several other electrical related injuries:	● Damage to the veins and arteries which can cause ischaemic necrosis. ● Involuntary contraction of muscles due to electrical interference which can cause bone fractures and dislocations. ● Interference with the electrical conductivity of organs such as the heart and nerves. This can lead to seizures, lung injury due to severe central nervous system damage, and cardiac arrest. ● Forceful propulsion of the body, producing such injuries as spinal and limb fractures.	These injuries must be treated in addition to the burns themselves. In very rare instances, a high voltage electric shock can cause cataracts in the lens of the eyes, and detachment of the retina. This may be delayed for some days or weeks after the initial injury.

6 Heat Burns & Scald

5 Environmental

Any injury you can get from environmental factors such as the sun or water but excluding air injuries such as suffocation.

Subheadings

1. Anaphylaxis	**2. Heatstroke**	**3. Heat Syncope**	**4. Heat Fatigue**
5. Heat Edema	**6. Frostbite**	**7. Hypothermia**	**8. Hyperthermia**
9. Trench Foot	**10. Seasickness**	**11. Aero-otitis Media**	**12. Aerosinusitis**

1 Anaphylaxis

Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death. It typically causes more than one of the following: an itchy rash, throat or tongue swelling, shortness of breath, vomiting, lightheadedness, and low blood pressure. These symptoms typically come on over minutes to hours.

Common causes include insect bites and stings, foods, and medications. Other causes include latex exposure and exercise. Additionally, cases may occur without an obvious reason. The mechanism involves the release of mediators from certain types of white blood cells triggered by either immunologic or non-immunologic mechanisms. Diagnosis is based on the presenting symptoms and signs after exposure to a potential allergen.

The primary treatment of anaphylaxis is epinephrine injection into a muscle, intravenous fluids, and positioning the person flat. Additional doses of epinephrine may be required. Other measures, such as antihistamines and steroids, are complementary. Carrying an epinephrine autoinjector and identification regarding the condition is recommended in people with a history of anaphylaxis.

Worldwide, 0.05–2% of the population is estimated to experience anaphylaxis at some point in life. Rates appear to be increasing. It occurs most often in young people and females. Of people who go to a hospital with anaphylaxis in the United States about 99.7% survive.

There are three main classifications of anaphylaxis. Anaphylactic shock is associated with systemic vasodilation that causes low blood pressure which is by definition 30% lower than the person's baseline or below standard values. Biphasic anaphylaxis is the recurrence of symptoms within 1–72 hours with no further exposure to the allergen. Reports of incidence vary, with some studies claiming as many as 20% of cases. The recurrence typically occurs within 8 hours. It is managed in the same manner as anaphylaxis. Pseudoanaphylaxis or anaphylactoid reactions are a type of anaphylaxis that does not involve an allergic reaction but is due to direct mast cell degranulation. Non-immune anaphylaxis is the current term used by the World Allergy Organization with some recommending that the old terminology no longer be used.

Signs & Symptoms

Anaphylaxis typically presents many different symptoms over minutes or hours with an average onset of 5 to 30 minutes if exposure is intravenous and 2 hours if from eating food. The most common areas affected include: skin (80–90%), respiratory (70%), gastrointestinal (30–45%), heart and vasculature (10–45%), and central nervous system (10–15%) with usually two or more being involved.

Skin	Symptoms typically include generalized hives, itchiness, flushing, or swelling (angioedema) of the afflicted tissues. Those with angioedema may describe a burning sensation of the skin rather than itchiness. Swelling of the tongue or throat occurs in up to about 20% of cases. Other features may include a runny nose and swelling of the conjunctiva. The skin may also be blue tinged because of lack of oxygen.
Respiratory	Respiratory symptoms and signs that may be present include shortness of breath, wheezes, or stridor. The wheezing is typically caused by spasms of the bronchial muscles while stridor is related to upper airway obstruction secondary to swelling. Hoarseness, pain with swallowing, or a cough may also occur.

Cardiovascular	While a fast heart rate caused by low blood pressure is more common, a Bezold–Jarisch reflex has been described in 10% of people, where a slow heart rate is associated with low blood pressure. A drop in blood pressure or shock (either distributive or cardiogenic) may cause the feeling of lightheadedness or loss of consciousness. Rarely very low blood pressure may be the only sign of anaphylaxis. Coronary artery spasm may occur with subsequent myocardial infarction, dysrhythmia, or cardiac arrest. Those with underlying coronary disease are at greater risk of cardiac effects from anaphylaxis. The coronary spasm is related to the presence of histamine-releasing cells in the heart.
Other	Gastrointestinal symptoms may include crampy abdominal pain, diarrhea, and vomiting. There may be confusion, a loss of bladder control or pelvic pain similar to that of uterine cramps. Dilation of blood vessels around the brain may cause headaches. A feeling of anxiety or of "impending doom" has also been described.

Causes

Anaphylaxis can occur in response to almost any foreign substance. Common triggers include venom from insect bites or stings, foods, and medication. Foods are the most common trigger in children and young adults while medications and insect bites and stings are more common in older adults. Less common causes include: physical factors, biological agents such as semen, latex, hormonal changes, food additives such as monosodium glutamate and food colors, and topical medications. Physical factors such as exercise (known as exercise-induced anaphylaxis) or temperature (either hot or cold) may also act as triggers through their direct effects on mast cells.

Events caused by exercise are frequently associated with the ingestion of certain foods. During anesthesia, neuromuscular blocking agents, antibiotics, and latex are the most common causes. The cause remains unknown in 32–50% of cases, referred to as "idiopathic anaphylaxis." Six vaccines (MMR, varicella, influenza, hepatitis B, tetanus, meningococcal) are recognized as a cause for anaphylaxis, and HPV may cause anaphylaxis as well. Physical exercise is an uncommon cause of anaphylaxis; in about a third of such cases there is a co-factor like taking an NSAID or eating a specific food prior to exercising.

Food	Many foods can trigger anaphylaxis; this may occur upon the first known ingestion. Common triggering foods vary around the world. In Western cultures, ingestion of or exposure to peanuts, wheat, nuts, certain types of seafood like shellfish, milk, and eggs are the most prevalent causes. Sesame is common in the Middle East, while rice and chickpeas are frequently encountered as sources of anaphylaxis in Asia. Severe cases are usually caused by ingesting the allergen, but some people experience a severe reaction upon contact. Children can outgrow their allergies. By age 16, 80% of children with anaphylaxis to milk or eggs and 20% who experience isolated anaphylaxis to peanuts can tolerate these foods.
Medication	Any medication may potentially trigger anaphylaxis. The most common are β-lactam antibiotics (such as penicillin) followed by aspirin and NSAIDs. Other antibiotics are implicated less frequently. Anaphylactic reactions to NSAIDs are either agent specific or occur among those that are structurally similar meaning that those who are allergic to one NSAID can typically tolerate a different one or different group of NSAIDs. Other relatively common causes include chemotherapy, vaccines, protamine and herbal preparations. Some medications (vancomycin, morphine, x-ray contrast among others) cause anaphylaxis by directly triggering mast cell degranulation. The frequency of a reaction to an agent partly depends on the frequency of its use and partly on its intrinsic properties. Anaphylaxis to penicillin or cephalosporins occurs only after it binds to proteins inside the body with some agents binding more easily than others. Anaphylaxis to penicillin occurs once in every 2,000 to 10,000 courses of treatment, with death occurring in fewer than one in every 50,000 courses of treatment. Anaphylaxis to aspirin and NSAIDs occurs in about one in every 50,000 persons. If someone has a reaction to penicillins, his or her risk of a reaction to cephalosporins is greater but still less than one in 1,000.
Venom	Venom from stinging or biting insects such as Hymenoptera (ants, bees, and wasps) or Triatominae (kissing bugs) may cause anaphylaxis in susceptible people. Previous reactions, that are anything more than a local reaction around the site of the sting, are a risk factor for future anaphylaxis; however, half of fatalities have had no previous systemic reaction.
Risk Factors	People with atopic diseases such as asthma, eczema, or allergic rhinitis are at high risk of anaphylaxis from food, latex, and radiocontrast agents but not from injectable medications or stings. One study in children found that 60% had a history of previous atopic diseases, and of children who die from anaphylaxis, more than 90% have asthma. Those with mastocytosis or of a higher socioeconomic status are at increased risk. The longer the time since the last exposure to the agent in question, the lower the risk.

Prevention

Avoidance of the trigger of anaphylaxis is recommended. In cases where this may not be possible, desensitization may be an option. Immunotherapy with Hymenoptera venoms is effective at desensitizing 80–90% of adults and 98% of children against allergies to bees, wasps, hornets, yellowjackets, and fire ants. Oral immunotherapy may be effective at desensitizing some people to certain food including milk, eggs, nuts and peanuts; however, adverse effects are common. For example, many people develop an itchy throat, cough, or lip swelling during immunotherapy. Desensitization is also possible for many medications, however it is advised that most people simply avoid the agent in question. In those who react to latex it may be important to avoid cross-reactive foods such as avocados, bananas, and potatoes among others.

Management

Anaphylaxis is a medical emergency that may require resuscitation measures such as airway management, supplemental oxygen, large volumes of intravenous fluids, and close monitoring. Passive leg raise may also be helpful in the emergency management.

Administration of epinephrine is the treatment of choice with antihistamines and steroids (for example, dexamethasone) often used as adjuncts. A period of in-hospital observation for between 2 and 24 hours is recommended for people once they have returned to normal due to concerns of biphasic anaphylaxis.

Epinephrine	Epinephrine (adrenaline) is the primary treatment for anaphylaxis with no absolute contraindication to its use. It is recommended that an epinephrine solution be given intramuscularly into the mid anterolateral thigh as soon as the diagnosis is suspected. The injection may be repeated every 5 to 15 minutes if there is insufficient response. A second dose is needed in 16–35% of episodes with more than two doses rarely required. The intramuscular route is preferred over subcutaneous administration because the latter may have delayed absorption. Minor adverse effects from epinephrine include tremors, anxiety, headaches, and palpitations. People on β-blockers may be resistant to the effects of epinephrine. In this situation if epinephrine is not effective intravenous glucagon can be administered which has a mechanism of action independent of β-receptors. If necessary, it can also be given intravenously using a dilute epinephrine solution. Intravenous epinephrine, however, has been associated both with dysrhythmia and myocardial infarction. Epinephrine autoinjectors used for self-administration typically come in two doses, one for adults or children who weigh more than 25 kg and one for children who weigh 10 to 25 kg.

Adjuncts	Antihistamines (both H1 and H2), while commonly used and assumed effective based on theoretical reasoning, are poorly supported by evidence. A 2007 Cochrane review did not find any good-quality studies upon which to base recommendations and they are not believed to have an effect on airway edema or spasm. Corticosteroids are unlikely to make a difference in the current episode of anaphylaxis, but may be used in the hope of decreasing the risk of biphasic anaphylaxis. Their prophylactic effectiveness in these situations is uncertain. Nebulized salbutamol may be effective for bronchospasm that does not resolve with epinephrine. Methylene blue has been used in those not responsive to other measures due to its presumed effect of relaxing smooth muscle.
Preparedness	People prone to anaphylaxis are advised to have an "allergy action plan." Parents are advised to inform schools of their children's allergies and what to do in case of an anaphylactic emergency. The action plan usually includes use of epinephrine autoinjectors, the recommendation to wear a medical alert bracelet, and counseling on avoidance of triggers. Immunotherapy is available for certain triggers to prevent future episodes of anaphylaxis. A multi-year course of subcutaneous desensitization has been found effective against stinging insects, while oral desensitization is effective for many foods.

Prognosis

In those in whom the cause is known and prompt treatment is available, the prognosis is good. Even if the cause is unknown, if appropriate preventative medication is available, the prognosis is generally good. If death occurs, it is usually due to either respiratory (typically asphyxia) or cardiovascular causes (shock), with 0.7–20% of cases causing death. There have been cases of death occurring within minutes. Outcomes in those with exercise-induced anaphylaxis are typically good, with fewer and less severe episodes as people get older.

2 Heatstroke

Heat stroke, also known as sun stroke, is a type of severe heat illness that results in a body temperature greater than 40.0 °C (104.0 °F) and confusion. Other symptoms include red skin, headache, and dizziness. There is generally a lack of sweating in classic heat stroke while sweating is generally present in exertional heatstroke. Onset can be sudden or gradual. Complications may include seizures, rhabdomyolysis, or kidney failure.

Heat stroke occurs because of high external temperatures or physical exertion. Risk factors include heat waves, high humidity, certain drugs such as diuretics, beta blockers, or alcohol, heart disease, and skin disorders. Cases not associated with physical exertion typically occur in those at the extremes of age or with long term health problems. Diagnosis is based on symptoms. It is a type of hyperthermia. It is distinct from a fever, where there is a physiological increase in the temperature set point.

Preventive measures include drinking sufficient fluids and avoiding excessive heat. Treatment is by rapid physical cooling of the body and supportive care. Recommended methods include spraying the person with water and using a fan, putting the person in ice water, or giving cold intravenous fluids. While it is reasonable to add ice packs around a person, this by itself is not routinely recommended.

Signs & Symptoms

Heat stroke generally presents with a hyperthermia of greater than 40.6 °C (105.1 °F) in combination with disorientation. There is generally a lack of sweating in classic heatstroke, while sweating is generally present in exertional heatstroke.

Before a heat stroke occurs, people show signs of heat exhaustion such as dizziness, mental confusion, headaches, and weakness; if a heat stroke occurs when the person is asleep, symptoms may be harder to notice. However, in exertional heat stroke, the affected person may sweat excessively. Young children, in particular, may have seizures. Eventually, unconsciousness, organ failure, and death will result.

Causes

Heat stroke occurs when thermoregulation is overwhelmed by a combination of excessive metabolic production of heat (exertion), excessive environmental heat, and insufficient or impaired heat loss, resulting in an abnormally high body temperature. Substances that inhibit cooling and cause dehydration such as alcohol, stimulants, medications, and age-related physiological changes predispose to so-called "classic" or non-exertional heat stroke (NEHS), most often in elderly and infirm individuals in summer situations with insufficient ventilation. Exertional heat stroke (EHS) can happen in young people without health problems or medications – most often in athletes, outdoor laborers, or military personnel engaged in strenuous hot-weather activity or in certified first responders wearing heavy personal protective equipment. In environments that are not only hot but also humid, it is important to recognize that humidity reduces the degree to which the body can cool itself by perspiration and evaporation. For humans and other warm-blooded animals, excessive body temperature can disrupt enzymes regulating biochemical reactions that are essential for cellular respiration and the functioning of major organs.

Cars	When the outside temperature is 21 °C (70 °F), the temperature inside a car parked in direct sunlight can quickly exceed 49 °C (120 °F). Young children or elderly adults left alone in a vehicle are at particular risk of succumbing to heat stroke. "Heat stroke in children and in the elderly can occur within minutes, even if a car window is opened slightly." As these groups of individuals may not be able to open car doors or to express discomfort verbally (or audibly, inside a closed car), their plight may not be immediately noticed by others in the vicinity. Dogs are even more susceptible than humans to heat stroke in cars, as they cannot produce whole-body sweat to cool themselves. Leaving the dog at home with plenty of water on hot days is recommended instead, or, if a dog must be brought along, it can be tied up in the shade outside the destination and provided with a full water bowl.

Prevention

The risk of heat stroke can be reduced by observing precautions to avoid overheating and dehydration. Light, loose-fitting clothes will allow perspiration to evaporate and cool the body. Wide-brimmed hats in light colors help prevent the sun from warming the head and neck. Vents on a hat will help cool the head, as will sweatbands wetted with cool water. Strenuous exercise should be avoided during hot weather, especially in the sun peak hours as well as avoiding confined spaces (such as automobiles) without air-conditioning or adequate ventilation.

In hot weather, people need to drink plenty of cool liquids and mineral salts to replace fluids lost from sweating. Thirst is not a reliable sign that a person needs fluids. A better indicator is the color of urine. A dark yellow color may indicate dehydration.

The Occupational Safety and Health Administration in the United States publishes a QuickCard with a checklist designed to help protect workers from heat stress:

- Know signs/symptoms of heat-related illnesses.
- Block out direct sun and other heat sources.
- Drink fluids often, and before you are thirsty.
- Wear lightweight, light-colored, loose-fitting clothes.
- Avoid beverages containing alcohol or caffeine.

Treatment

Treatment of heat stroke involves rapid mechanical cooling along with standard resuscitation measures. The body temperature must be lowered quickly. The person should be moved to a cool area (indoors, or at least in the shade) and clothing removed to promote heat loss (passive cooling). Active cooling methods should also be used, if possible: The person is bathed in cold water, or a hyperthermia vest can be applied. (However, wrapping the person in wet towels or clothes can actually act as insulation and increase the body temperature.) Cold compresses to the torso, head, neck, and groin will help cool the victim. A fan or dehumidifying air-conditioning unit may be used to aid in evaporation of the water (evaporative method).

Immersing a person into a tub of cold water (immersion method) is a widely recognized method of cooling. This method may require the effort of several people and the person should be monitored carefully during the treatment process. Immersion should be avoided for an unconscious person, but if there is no alternative, the person's head must be held above water.

Immersion in very cold water was once thought to be counterproductive by reducing blood flow to the skin and thereby preventing heat from escaping the body core. However, this hypothesis has been challenged in experimental studies, as well as by systematic reviews of the clinical data, indicating that cutaneous vasoconstriction and shivering thermogenesis do not play a dominant role in the decrease in core body temperature brought on by cold water immersion.

This can be seen in the effect of submersion hypothermia, where the body temperature decrease is directly related to environmental temperature, and though bodily defenses slow the decrease in temperature for a time, they ultimately fail to maintain endothermic homeostasis. Dantrolene, a direct-acting paralytic which abolishes shuddering and is effective in many other forms of hyperthermia, including centrally-, peripherally- and cellularly-mediated thermogenesis, has no individual or additive effects to cooling in the context of heat stroke, showing a lack of endogenous thermogenic response to cold water immersion. Thus, aggressive ice-water immersion remains the gold standard for life-threatening heat stroke.

Hydration is important in cooling the person. In mild cases of concomitant dehydration, this can be achieved by drinking water, or commercial isotonic sports drinks may be used as a substitute. In either exercise- or heat-induced dehydration, electrolyte imbalance can result, and can be worsened by excess consumption of water. Hyponatremia can be corrected by intake of hypertonic fluids. Absorption is rapid and complete in most people but if the person is confused, unconscious, or unable to tolerate oral fluid, then an intravenous drip may be necessary for rehydration and electrolyte replacement.

Heatstroke is also covered in the SURVIVAL section.

3 Heat Syncope

Heat syncope is fainting or dizziness as a result of overheating (syncope is the medical term for fainting). It is a type of heat illness. The basic symptom of heat syncope is fainting, with or without mental confusion. Heat syncope is caused by peripheral vessel dilation, resulting in diminished blood flow to the heart and dehydration.

Causes

Heat syncope occurs in a warm environment when blood pressure is lowered as the body dilates (widens) arterioles (small blood vessels) in the skin to radiate heat. This condition occurs within five days of heat acclimatization, before the blood volume expands. The result is less blood to the brain, causing light-headedness and fainting when a person stands up quickly or stands for a long period of time. Those who perform strenuous work outside in warm climates are at particular risk.

Signs & Symptoms

Faintness, dizziness, headache, increased pulse, restlessness, nausea, vomiting, and brief loss of consciousness.

Diagnosis

The diagnosis of heat syncope is done during a physical examination. During the physical exam the practitioner will test the blood pressure of the patient, and the pulse. If the patient is experiencing heat syncope the blood pressure will be low, and the pulse will be elevated. Observation of excess sweating will also be a key sign. Finally, the practitioner will ask questions figuring out the history of the patient's symptoms. If the patient developed symptoms while engaging in physical activity and high temperatures it will then be a true case of heat syncope.

Treatment

The basic treatment for heat syncope is like that for other types of fainting: the patient is positioned in a seating or supine position with legs raised. Water containing salt, or another drink containing electrolytes, is administered slowly, and the patient is moved to a cooler area, such as the shade. The affected person should rest and recover, because heat syncope can lead to heat stroke or heat exhaustion.

Prevention

Physical activity in extremely hot weather should be avoided. If a person starts to experience over heating, and symptoms of heat syncope, they should move or be moved to a shaded or cool area. It is also recommended to avoid alcoholic beverages in hot weather, because they cause dehydration which may worsen symptoms. Finally, drinking plenty of water with electrolytes is imperative when engaging in physical activity in hot weather.

Heat Syncope is also covered in the SURVIVAL section.

4 Heat Fatigue (Heat Exhaustion)

Heat exhaustion is a severe form of heat illness. It is a medical emergency. Heat exhaustion is caused by the loss of water and electrolytes through sweating.

Causes

Common causes of heat exhaustion include:
- Hot, sunny, humid weather
- Physical exertion, especially in hot, humid weather
- Due to impaired thermoregulation, elderly people and infants can get serious heat illness even at rest, if the weather outside is hot and humid, and they are not getting enough cool air.
- Some drugs, such as diuretics, antihistamines, beta-blockers, alcohol, ecstasy, and amphetamines can cause an increase in the risk of heat exhaustion.

Especially during physical exertion, risk factors for heat exhaustion include:
- Wearing dark, padded, or insulated clothing; hats; and/or helmets (for example, football pads or turnout gear)
- Having a higher percentage of body fat
- Dehydration
- Fever
- Some medications, like beta blockers and antipsychotic medicines

Signs & Symptoms

Symptoms of heat exhaustion include nausea, dizziness, irritability, headache, thirst, weakness, high body temperature, excessive sweating, and decreased urine output.

Treatment

INJURY Environmental Heat Fatigue Treatment

First aid for heat exhaustion includes:
- Moving the person to a cool place
- Having the patient take off extra layers of clothes
- Cooling the patient down by fanning them and putting wet towels on their body
- Having them lie down and put their feet up if they are feeling dizzy
- Having them drink water or sports drinks – but only if they are awake, not confused nor vomiting
- Turning the person on their side if they are vomiting

Emergency Medical Treatment
If a person with heat exhaustion gets medical treatment, Emergency Medical Technicians (EMTs) or doctors and/or nurses may also:
- Give them supplemental oxygen
- Give them intravenous fluids and electrolytes if they are too confused to drink and/or are vomiting

Heat Fatigue is also covered in the SURVIVAL section.

5 Heat Edema

Heat edema is a cutaneous condition characterized by dependent edema from vasodilatory pooling. Heat causes the blood vessels to expand (dilate), so body fluid moves into the hands or legs by gravity. The balance of salt in the body is also a risk factor for heat edema. If salt loss is less than normal, the increased salt level draws fluid into the hands and legs. Older adults have an increased risk of heat edema, especially if they have other medical conditions that affect their circulation. People visiting hot climates from colder climates may also have an increased risk of heat edema.

Heat Edema is also covered in the SURVIVAL section.

6 Frostbite

Frostbite occurs when exposure to low temperatures causes freezing of the skin or other tissues. The initial symptom is typically numbness. This may be followed by clumsiness with a white or bluish color to the skin. Swelling or blistering may occur following treatment. The hands, feet, and face are most commonly affected. Complications may include hypothermia or compartment syndrome. People who are exposed to low temperatures for prolonged periods, such as winter sports enthusiasts, military personnel, and homeless individuals, are at greatest risk.

Other risk factors include drinking alcohol, smoking, mental health problems, certain medications, and prior injuries due to cold. The underlying mechanism involves injury from ice crystals and blood clots in small blood vessels following thawing. Diagnosis is based on symptoms. Severity may be divided into superficial (1st and 2nd degree) or deep (3rd and 4th degree).

A bone scan or MRI may help in determining the extent of injury. Prevention is through wearing proper clothing, maintaining hydration and nutrition, avoiding low temperatures, and staying active without becoming exhausted. Treatment is by rewarming. This should be done only when refreezing is not a concern. Rubbing or applying snow to the affected part is not recommended. The use of ibuprofen and tetanus toxoid is typically recommended. For severe injuries iloprost or thrombolytics may be used. Surgery is sometimes necessary. Amputation, however, should generally be delayed for a few months to allow determination of the extent of injury.

Signs & Symptoms

Areas that are usually affected include cheeks, ears, nose and fingers and toes. Frostbite is often preceded by frostnip. The symptoms of frostbite progress with prolonged exposure to cold. Historically, frostbite has been classified by degrees according to skin and sensation changes, similar to burn classifications. However, the degrees do not correspond to the amount of long term damage. A simplification of this system of classification is superficial (first or second degree) or deep injury (third or fourth degree).

First Degree	• First degree frostbite is superficial, surface skin damage that is usually not permanent. • Early on, the primary symptom is loss of feeling in the skin. In the affected areas, the skin is numb, and possibly swollen, with a reddened border. • In the weeks after injury, the skin's surface may slough off.
Second Degree	• In second degree frostbite, the skin develops clear blisters early on, and the skin's surface hardens. • In the weeks after injury, this hardened, blistered skin dries, blackens, and peels. • At this stage, lasting cold sensitivity and numbness can develop.
Third Degree	• In third degree frostbite, the layers of tissue below the skin freeze. • Symptoms include blood blisters and "blue-grey discoloration of the skin". • In the weeks after injury, pain persists and a blackened crust (eschar) develops. • There can be longterm ulceration and damage to growth plates.
Fourth Degree	• In fourth degree frostbite, structures below the skins are involved like muscles, tendon, and bone. • Early symptoms include a colorless appearance of the skin, a hard texture, and painless rewarming. • Later, the skin becomes black and mummified. The amount of permanent damage can take one month or more to determine. Autoamputation can occur after two months.

Causes

The major risk factor for frostbite is exposure to cold through geography, occupation and/or recreation. Inadequate clothing and shelter are major risk factors. Frostbite is more likely when the body's ability to produce or retain heat is impaired. Physical, behavioral, and environmental factors can all contribute to the development of frostbite. Immobility and physical stress (such as malnutrition or dehydration) are also risk factors. Disorders and substances that impair circulation contribute, including diabetes, Raynaud's phenomenon, tobacco and alcohol use. Homeless individuals and individuals with some mental illnesses may be at higher risk.

Mechanism

Freezing
In frostbite, cooling of the body causes narrowing of the blood vessels (vasoconstriction). Temperatures below −4 °C are required to form ice crystals in the tissues. The process of freezing causes ice crystals to form in the tissue, which in turn causes damage at the cellular level. Ice crystals can damage cell membranes directly. In addition, ice crystals can damage small blood vessels at the site of injury. Scar tissue forms when fibroblasts replace the dead cells.

Rewarming
Rewarming causes tissue damage through reperfusion injury, which involves vasodilation, swelling (edema), and poor blood flow (stasis). Platelet aggregation is another possible mechanism of injury. Blisters and spasm of blood vessels (vasospasm) can develop after rewarming.

Non-Freezing Cold Injury
The process of frostbite differs from the process of non-freezing cold injury (NFCI). In NFCI, temperature in the tissue decreases gradually. This slower temperature decrease allows the body to try to compensate through alternating cycles of closing and opening blood vessels (vasoconstriction and vasodilation). If this process continues, inflammatory mast cells act in the area. Small clots (microthrombi) form and can cut off blood to the affected area (known as ischemia) and damage nerve fibers. Rewarming causes a series of inflammatory chemicals such as prostaglandins to increase localized clotting.

Pathophysiology The pathological mechanism by which frostbite causes body tissue injury can be characterized by four stages: Prefreeze, freeze-thaw, vascular stasis, and the late ischemic stage.	1. Prefreeze phase: involves the cooling of tissues without ice crystal formation. 2. Freeze-thaw phase: ice-crystals form, resulting in cellular damage and death. 3. Vascular stasis phase: marked by blood coagulation or the leaking of blood out of the vessels. 4. Late ischemic phase: characterized by inflammatory events, ischemia and tissue death.

Diagnosis

Frostbite is diagnosed based on signs and symptoms as described above, and by patient history. Other conditions that can have a similar appearance or occur at the same time include:	● Frostnip is similar to frostbite, but without ice crystal formation in the skin. Whitening of the skin and numbness reverse quickly after rewarming. ● Trench foot is damage to nerves and blood vessels that results exposure to wet, cold (non-freezing) conditions. This is reversible if treated early. ● Pernio or chillbains are inflammation of the skin from exposure to wet, cold (non-freezing) conditions. They can appear as various types of ulcers and blisters. ● Bullous pemphigoid is a condition that causes itchy blisters over the body that can mimic frostbite. It does not require exposure to cold to develop. ● Levamisole toxicity is a vasculitis that can appear similar to frostbite. It is caused by contamination of cocaine by levamisole. Skin lesions can look similar those of frostbite, but do not require cold exposure to occur.	People who have hypothermia often have frostbite as well. Since hypothermia is life-threatening this should be treated first. Technetium-99 or MR scans are not required for diagnosis, but might be useful for prognostic purposes.

Prevention

The Wilderness Medical Society recommends covering the skin and scalp, taking in adequate nutrition, avoiding constrictive footwear and clothing, and remaining active without causing exhaustion. Supplemental oxygen might also be of use at high elevations. Repeated exposure to cold water makes people more susceptible to frostbite. Additional measures to prevention frostbite include:	● Avoiding temperatures below −15 °C ● Avoiding moisture, including in the form of sweat and/or skin emollients ● Avoiding alcohol and drugs that impair circulation or natural protective responses ● Layering clothing ● Using chemical or electric warming devices ● Recognizing early signs of frostnip and frostbite

Treatment

Individuals with frostbite or potential frostbite should go to a protected environment and get warm fluids. If there is no risk of re-freezing, the extremity can be exposed and warmed in the groin or underarm of a companion. If the area is allowed to refreeze, there can be worse tissue damage. If the area cannot be reliably kept warm, the person should be brought to a medical facility without rewarming the area. Rubbing the affected area can also increase tissue damage.

Aspirin and ibuprofen can be given in the field to prevent clotting and inflammation. Ibuprofen is often preferred to aspirin because aspirin may block a subset of prostaglandins that are important in injury repair. The first priority in people with frostbite should be to assess for hypothermia and other life-threatening complications of cold exposure. Before treating frostbite, the core temperature should be raised above 35C. Oral or intravenous (IV) fluids should be given.

Other considerations for standard hospital management include:
● Wound care: blisters can be drained by needle aspiration, unless they are bloody (hemorrhagic). Aloe vera gel can be applied before breathable, protective dressings or bandages are put on.
● Antibiotics: if there is trauma, skin infection (cellulitis) or severe injury
● Tetanus toxoid: should be administered according to local guidelines. Uncomplicated frostbite wounds are not known to encourage tetanus.
● Pain control: NSAIDs or opioids are recommended during the painful rewarming process.

Rewarming
If the area is still partially or fully frozen, it should be rewarmed in the hospital with a warm bath with povidone iodine or chlorhexidine antiseptic. Active rewarming seeks to warm the injured tissue as quickly as possible without burning. The faster tissue is thawed, the less tissue damage occurs. According to Handford and colleagues, "The Wilderness Medical Society and State of Alaska Cold Injury Guidelines recommend a temperature of 37–39 °C, which decreases the pain experienced by the patient whilst only slightly slowing rewarming time." Warming takes 15 minutes to 1 hour. Rewarming can be very painful, so pain management is important.

Medications
People with potential for large amputations and who present within 24 hours of injury can be given TPA with heparin. These medications should be withheld if there are any contraindications. Bone scans or CT angiography can be done to assess damage. Blood vessel dilating medications such as iloprost may prevent blood vessel blockage. This treatment might be appropriate in grades 2–4 frostbite, when people get treatment within 48 hours. In addition to vasodilators, sympatholytic drugs can be used to counteract the detrimental peripheral vasoconstriction that occurs during frostbite.

Surgery
Various types of surgery might be indicated in frostbite injury, depending on the type and extent of damage. Debridement or amputation of necrotic tissue is usually delayed unless there is gangrene or systemic infection (sepsis). This has led to the adage "Frozen in January, amputate in July". If symptoms of compartment syndrome develop, fasciotomy can be done to attempt to preserve blood flow.

Prognosis
Tissue loss and autoamputation are potential consequences of frostbite. Permanent nerve damage including loss of feeling can occur. It can take several weeks to know what parts of the tissue will survive. Time of exposure to cold is more predictive of lasting injury than temperature the individual was exposed to. The classification system of grades, based on the tissue response to initial rewarming and other factors is designed to predict degree of longterm recovery. A number of long term sequelae can occur after frostbite. These include transient or permanent changes in sensation, paresthesia, increased sweating, cancers, and bone destruction/arthritis in the area affected.

● **Grade 1:** If there is no initial lesion on the area, no amputation or lasting effects are expected.
● **Grade 2:** If there is a lesion on the distal body part, tissue and fingernails can be destroyed.
● **Grade 3:** If there is a lesion on the intermediate or near body part, autoamputation and loss of function can occur.
● **Grade 4:** If there is a lesion very near the body (such as the carpals of the hand), the limb can be lost. Sepsis and/or other systemic problems are expected.

7 Hypothermia

Drink a lot of water, the heat generation system uses water to run. The basic principles of rewarming a hypothermic victim are to conserve the heat they have and replace the body fuel they are burning up to generate that heat. If a person is shivering, they have the ability to rewarm themselves at a rate of 2°C per hour.

Treatment

Treatment - Mild

INJURY Environmental Hypothermia Treatment

1. Reduce Heat Loss
- Additional layers of clothing
- Dry clothing
- Increased physical activity
- Shelter

2. Add Fuel & Fluids
It is essential to keep a hypothermic person adequately hydrated and fueled.

Food Types
- Carbohydrates - 5 calories/gram - quickly released into blood stream for sudden brief heat surge - these are the best to use for quick energy intake especially for mild cases of hypothermia
- Proteins - 5 calories/gram - slowly released - heat given off over a longer period
- Fats - 9 calories/gram - slowly released but are good because they release heat over a long period, however, it takes more energy to break fats down into glucose - also takes more water to break down fats leading to increased fluid loss

Food Intake ● Hot liquids - calories plus heat source ● Sugars (kindling) ● GORP - has both carbohydrates (sticks) and proteins/fats (logs)	**Things to Avoid** ● Alcohol - a vasodilator - increases peripheral heat loss ● Caffeine - a diuretic - causes water loss increasing dehydration ● Tobacco/nicotine - a vasoconstrictor, increases risk of frostbite	**Add Heat** ● Fire or other external heat source ● Body to body contact. Get into a sleeping back, in dry clothing with a normothermic person in lightweight dry clothing

Treatment - Severe

Reduce Heat Loss
Hypothermia Wrap: The idea is to provide a shell of total insulation for the patient. No matter how cold, patients can still internally rewarm themselves much more efficiently than any external rewarming. Make sure the patient is dry, and has a polypropylene layer to minimize sweating on the skin. The person must be protected from any moisture in the environment. Use multiple sleeping bags, wool blankets, wool clothing, Ensolite pads to create a minimum of 4" of insulation all the way around the patient, especially between the patient and the ground. Include an aluminum "space" blanket to help prevent radiant heat loss, and wrap the entire ensemble in plastic to protect from wind and water. If someone is truly hypothermic, don't put him/her naked in a sleeping bag with another person.

Add Fuel & Fluids
Warm Sugar Water - for people in severe hypothermia, the stomach has shut down and will not digest solid food but can absorb water and sugars. Give a dilute mixture of warm water with sugar every 15 minutes. Dilute Jello works best since it is part sugar and part protein. This will be absorbed directly into the blood stream providing the necessary calories to allow the person to rewarm themselves. One box of Jello = 500 Kilocalories of heat energy. Do not give full strength Jello even in liquid form, it is too concentrated and will not be absorbed. Urination - people will have to urinate from cold diuresis. Vasoconstriction creates greater volume pressure in the blood stream. The kidneys pull off excess fluid to reduce the pressure. A full bladder results in body heat being used to keep urine warm rather than vital organs. Once the person has urinated, it precious body heat will be used to maintain the temperature of vital organs. So in the end urinating will help conserve heat. You will need to help the person urinate. Open up the Hypothermia Wrap enough to do this and then cover them back up. You will need to keep them hydrated with the dilute Jello solution described above.

Add Heat
Heat can be applied to transfer heat to major arteries - at the neck for the carotid, at the armpits for the brachial, at the groin for the femoral, at the palms of the hands for the arterial arch.

- Chemical heat packs such as the Heat Wave™ provides 110°F for 6-10 hours.
- Hot water bottles, warm rocks, towels, compresses
- For a severely hypothermic person, rescue breathing can increase oxygen and provide internal heat.

Afterdrop
Is a situation in which the core temperature actually decreases during rewarming. This is caused by peripheral vessels in the arms and legs dilating if they are rewarmed. This dilation sends this very cold, stagnate blood from the periphery to the core further decreasing core temperature which can lead to death. In addition, this blood also is very acetic which may lead to cardiac arrythmias and death. Afterdrop can best be avoided by not rewarming the periphery. Rewarm the core only! Do not expose a severely hypothermic victim to extremes of heat.

CPR & Hypothermia
When a person is in severe hypothermia they may demonstrate all the accepted clinical signs of death:
- Cold
- Blue skin
- Fixed and dilated pupils
- No discernable pulse
- No discernable breathing
- Comatose & unresponsive to any stimuli
- Rigid muscles

But they still may be alive in a "metabolic icebox" and can be revived. You job as a rescuer is to rewarm the person and do CPR if indicated. A hypothermia victim is never cold and dead only warm and dead. During severe hypothermia the heart is hyperexcitable and mechanical stimulation (such as CPR, moving them or Afterdrop) may result in fibrillation leading to death.

As a result CPR may be contraindicated for some hypothermia situations:
1. Make sure you do a complete assessment of heart rate before beginning CPR. Remember, the heart rate may be 2-3/minute and the breathing rate 1/30 seconds. Instituting cardiac compressions at this point may lead to life-threatening arrythmias. Check the carotid pulse for a longer time period (up to a minute) to ascertain if there is some slow heartbeat. Also, even though the heart is beating very slowly, it is filling completely and distributing blood fairly effectively. External cardiac compressions only are 20-30% effective. Thus, with its severely decreased demands, the body may be able to satisfy its circulatory needs with only 2-3 beats per minute. Be sure the pulse is absent before beginning CPR. You will need to continue to do CPR as you rewarm the person.

2. Ventilation may have stopped but respiration may continue - the oxygen demands for the body have been so diminished with hypothermia that the body may be able to survive for some time using only the oxygen that is already in the body. If ventilation has stopped, artificial ventilation may be started to increase available oxygen. In addition, blowing warm air into the persons lungs may assist in internal rewarming.

3. CPR Procedures
- Check radial pulse, between 33-30°C (91.4-86°F) this pulse disappears
- Check for carotid pulse - wait at least a full minute to check for very slow heartbeat
- If pulse but not breathing or slow breathing, give rescue breathing (also adds heat).
- If no discernible heartbeat begin CPR and be prepared to continue - persons with hypothermia have been given CPR for up to 3.5 hours and have recovered with no neurological damage
- Begin active rewarming

Cold Injuries

Tissue temperature in cold weather is regulated by two factors, the external temperature and the internal heat flow. All cold injuries described below are intimately connected with the degree of peripheral circulation. As peripheral circulation is reduced to prevent heat loss to the core these conditions are more likely to occur.

1

Factors influencing cold injuries
- Low ambient temperature
- Wind chill - increases rate of freezing dramatically
- Moisture - wet skin freezes at a higher temp than dry
- Insulation
- Contact with metal or supercooled liquids (white gas)
- Exposed skin
- Vasodilation
- Vasoconstriction
- Previous cold injuries
- Constricting garments
- Local pressure
- Cramped position
- Body type
- Dehydration
- Women do better in cold than men (greater subcutaneous body fat)
- Caloric intake
- Diabetes, some medications
- Alcohol
- Caffeine, nicotine

2

Cold-induced Vasodilation
When a hand or foot is cooled to 59°F, maximal vasoconstriction and minimal blood flow occur. If cooling continues to 50°F, vasoconstriction is interrupted by periods of vasodilation with an increase in blood and heat flow. This "hunting" response recurs in 5-10 minute cycles to provide some protection from cold. Prolonged, repeated exposure increases this response and offers some degree of acclimatization. Ex. Eskimos have a strong response with short intervals in between.

3

Pathophysiology of Tissue Freezing
As tissue begins to freeze, ice crystals are formed within the cells. As intracellular fluids freeze, extracellular fluid enters the cell and there is an increase in the levels of extracellular salts due to the water transfer. Cells may rupture due to the increased water and/or from tearing by the ice crystals. Do not rub tissue; it causes cell tearing from the ice crystals. As the ice melts there is an influx of salts into the tissue further damaging the cell membranes. Cell destruction results in tissue death and loss of tissue. Tissue can't freeze if the temperature is above 32°F. It has to be below 28°F because of the salt content in body fluids. Distal areas of the body and areas with a high surface to volume ratio are the most susceptible (e.g ears, nose, fingers and toes - this little rhyme should help remind you what to watch out for in yourself and others).

- Surface frostbite generally involves destruction of skin layers resulting in blistering and minor tissue loss. Blisters are formed from the cellular fluid released when cells rupture.
- Deep frostbite can involve muscle and bone

Visual Cold Table	Cold Response	Mild Frostnip	Superficial Frostbite	Deep Frostbite
Sensation	Painful	Possible Sensation	Numb	Numb
Feels	Normal	Normal	Soft	Hard
Color	Red	White	White	White

4

Cold Response
- Circulation is reduce to the are to prevent heat loss.
- The area may be pale, cold.
- It may have sensation or be numb.

5

Frostnip
- Freezing of top layers of skin tissue
- It is generally reversible
- White, waxy skin, top layer feels hard, rubbery but deeper tissue is still soft
- Numbness
- Most typically seen on cheeks, earlobes, fingers, and toes

Treatment
- Rewarm the area gently, generally by blowing warm air on it or placing the area against a warm body part (partner's stomach or armpit)
- Do not rub the area - this can damage the affected tissue by having ice crystals tear the cell

6

Frostbite
- Skin is white and "wooden" feel all the way through
- Superficial frostbite includes all layers of skin
- Numbness, possible anesthesia
- Deep frostbite can include freezing of muscle and/or bone, it is very difficult to rewarm the appendage without some damage occurring

Treatment
Superficial frostbite may be rewarmed as frostnip if only a small area is involved
If deep frostbite, see below for rewarming technique

7

Rewarming of Frostbite
- Rewarming is accomplished by immersion of the effected part into a water bath of 105-110°F. No hotter or additional damage will result. This is the temperature which is warm to your skin. Monitor the temperature carefully with a thermometer. Remove constricting clothing. Place the appendage in the water and continue to monitor the water temperature. This temperature will drop so that additional warm water will need to be added to maintain the 105-110°F. Do not add this warm water directly to the injury. The water will need to be circulated fairly constantly to maintain even temperature. The effected appendage should be immersed for 25 - 40 minutes. Thawing is complete when the part is pliable and color and sensation has returned. Once the area is rewarmed, there can be significant pain. Discontinue the warm water bath when thawing is complete.
- Do not use dry heat to rewarm. It cannot be effectively maintained at 105-110°F and can cause burns further damaging the tissues.
- Once rewarming is complete the injured area should be wrapped in sterile gauze and protected from movement and further cold.

- Once a body part has been rewarmed it cannot be used for anything. Also it is essential that the part can be kept from refreezing. Refreezing after rewarming causes extensive tissue damage and may result in loss of tissue. If you cannot guarantee that the tissue will stay warm, do not rewarm it.
- Mountaineers have walked out on frozen feet to have them rewarmed after getting out with no tissue loss. Once the tissue is frozen the major harm has been done. Keeping it frozen will not cause significant additional damage.

8

Special Considerations for Frostbite
- If the person is hypothermic and frostbitten, the first concern is core rewarming. Do not rewarm the frostbitten areas until the core temp approaches 96°F.
- No alcohol - vasodilation may increase fluid buildup
- No smoking - nicotine as a vasoconstrictor may increase chances for developing frostbite
- Liquids such as white gas can "supercool" in the winter (drop below their freezing point but not freeze). White gas also evaporates quickly into the air. Spilling supercooled white gas on exposed skin leads to instant frostbite from evaporative cooling. Always were gloves when handling fuel.
- Touching metal with bare skin can cause the moisture on your skin to freeze to the metal. (In really cold conditions, metal glasses frames can be a problem). When you pull away, you may leave a layer of skin behind. Don't touch metal with bare skin.

INJURY Environmental Hypothermia Cold Injuries

9	**Trench Foot - Immersion Foot** Trench foot is a process similar to chilblains. It is caused by prolonged exposure of the feet to cool, wet conditions. This can occur at temperatures as high as 60°F if the feet are constantly wet. This can happen with wet feet in winter conditions or wet feet in much warmed conditions (ex. sea kayaking). The mechanism of injury is as follows: wet feet lose heat 25x faster than dry, therefore the body uses vasoconstriction to shut down peripheral circulation in the foot to prevent heat loss. Skin tissue begins to die because of lack of oxygen and nutrients and due to buildup of toxic products. The skin is initially reddened with numbness, tingling pain, and itching then becomes pale and mottled and finally dark purple, gray or blue. The effected tissue generally dies and sluffs off. In severe cases trench foot can involve the toes, heels, or the entire foot. If circulation is impaired for > 6 hours there will be permanent damage to tissue. If circulation is impaired for > 24 hours the victim may lose the entire foot. Trench Foot causes permanent damage to the circulatory system making the person more prone to cold related injuries in that area. A similar phenomenon can occur when hands are kept wet for long periods of time such as kayaking with wet gloves or pogies. The damage to the circulatory system is known as Reynaud's Phenomenon.

Treatment and Prevention of Trench foot

● Includes careful washing and drying of the feet, gentle rewarming and slight elevation. Since the tissue is not frozen as in severe frostbite it is more susceptible to damage by walking on it. Cases of trench foot should not walk out; they should be evacuated by litter. Pain and itching are common complaints. Give Ibuprofen or other pain medication.

Prevention is the best approach to dealing with trench foot. Keep feet dry by wearing appropriate footwear. Check your feet regularly to see if they are wet. If your feet get wet (through sweating or immersion), stop and dry your feet and put on dry socks. Periodic air drying, elevation, and massage will also help. Change socks at least once a day and do not sleep with wet socks. Be careful of tight socks which can further impair peripheral circulation. Foot powder with aluminum hydroxide can help. High altitude mountaineers will put antiperspirant on their feet for a week before the trip. The active ingredient, aluminum hydroxide will keep your feet from sweating for up to a month and their are no confirmed contraindications for wearing antiperspirant.

Vapor barrier socks may increase the possibility of trench foot. When you are active and you are wearing a vapor barrier sock, you must carefully monitor how you sweat. If you are someone who sweats a lot with activity, your foot and polypropylene liner sock may be totally soaked before the body shuts down sweating. Having this liquid water next to the skin is going to lead to increased heat loss. If you don't sweat much, your body may shut down perspiration at the foot before it gets actually wet. This is when the vapor barrier system is working. You must experiment to determine if vapor barrier systems will work for you.

10	**Chilblains** ● Caused by repeated exposure of bare skin to temperatures below 15.5°C (60°F) ● Redness and itching of the effected area ● Particularly found on cheeks and ears, fingers and toes ● Women and young children are the most susceptible ● The cold exposure causes damage to the peripheral capillary beds, this damage is permanent and the redness and itching will return with exposure		
11	**Avoiding Frostbite and Cold related Injuries** ● "Buddy system" - keep a regular watch on each other's faces, cheeks, ears for signs of frostnip/frostbite ● Keep a regular "self check" for cold areas, wet feet, numbness or anesthesia ● If at any time you discover a cold injury, stop and rewarm the area (unless doing so places you at greater risk).		
12	**Eye Injuries** **a. Freezing of Cornea** ● Caused by forcing the eyes open during strong winds without goggles ● Treatment is very controlled, rapid rewarming e.g. placing a warm hand or compress over the closed eye. After rewarming the eyes must be completely covered with patches for 24 - 48 hours.	**b. Eyelashes freezing together** ● Put hand over eye until ice melts, then you can open the eye.	**c. Snowblindness** ● Sunburn of the eyes ● Prevention by wearing good sunglasses with side shields or goggles. Eye protection from sun is just as necessary on cloudy or overcast days as it is in full sunlight when you are on snow. Snow blindness can even occur during a snow storm if the cloud cover is thin.

Symptoms ● Occur 8-12 hours after exposure ● Eyes feel dry and irritated, then feel as if they are full of sand, moving or blinking becomes extremely painful, exposure to light hurts the eyes, eyelids may swell, eye redness, and excessive tearing	**Treatment** ● Cold compresses and dark environment ● Do not rub eyes

Hypothermia is also touched on in the SURVIVAL section.

8 Hyperthermia

INJURY Environmental Hyperthermia

Hyperthermia is elevated body temperature due to failed thermoregulation that occurs when a body produces or absorbs more heat than it dissipates. Extreme temperature elevation then becomes a medical emergency requiring immediate treatment to prevent disability or death. The most common causes include heat stroke and adverse reactions to drugs. The former is an acute temperature elevation caused by exposure to excessive heat, or combination of heat and humidity, that overwhelms the heat-regulating mechanisms. The latter is a relatively rare side effect of many drugs, particularly those that affect the central nervous system. Malignant hyperthermia is a rare complication of some types of general anesthesia. Hyperthermia differs from fever in that the body's temperature set point remains unchanged. The opposite is hypothermia, which occurs when the temperature drops below that required to maintain normal metabolism.

Classification

In humans, hyperthermia is defined as a temperature greater than 37.5–38.3 °C (99.5–100.9 °F), depending on the reference used, that occurs without a change in the body's temperature set point. The normal human body temperature can be as high as 37.7 °C (99.9 °F) in the late afternoon. Hyperthermia requires an elevation from the temperature that would otherwise be expected. Such elevations range from mild to extreme; body temperatures above 40 °C (104 °F) can be life-threatening.

Signs & Symptoms

An early stage of hyperthermia can be "heat exhaustion" (or "heat prostration" or "heat stress"), whose symptoms include heavy sweating, rapid breathing and a fast, weak pulse. If the condition progresses to heat stroke, then hot, dry skin is typical as blood vessels dilate in an attempt to increase heat loss. An inability to cool the body through perspiration may cause the skin to feel dry. Other signs and symptoms vary. Accompanying dehydration can produce nausea, vomiting, headaches, and low blood pressure and the latter can lead to fainting or dizziness, especially if the standing position is assumed quickly. In severe heat stroke, there may be confused, hostile, or seemingly intoxicated behavior. Heart rate and respiration rate will increase (tachycardia and tachypnea) as blood pressure drops and the heart attempts to maintain adequate circulation. The decrease in blood pressure can then cause blood vessels to contract reflexively, resulting in a pale or bluish skin color in advanced cases. Young children, in particular, may have seizures. Eventually, organ failure, unconsciousness and death will result.

Causes

Heat stroke occurs when thermoregulation is overwhelmed by a combination of excessive metabolic production of heat (exertion), excessive environmental heat, and insufficient or impaired heat loss, resulting in an abnormally high body temperature. In severe cases, temperatures can exceed 40 °C (104 °F). Heat stroke may be non-exertional (classic) or exertional.

Exertional	Significant physical exertion in hot conditions can generate heat beyond the ability to cool, because, in addition to the heat, humidity of the environment may reduce the efficiency of the body's normal cooling mechanisms. Human heat-loss mechanisms are limited primarily to sweating (which dissipates heat by evaporation, assuming sufficiently low humidity) and vasodilation of skin vessels (which dissipates heat by convection proportional to the temperature difference between the body and its surroundings, according to Newton's law of cooling). Other factors, such as insufficient water intake, consuming alcohol, or lack of air conditioning, can worsen the problem. The increase in body temperature that results from a breakdown in thermoregulation affects the body biochemically. Enzymes involved in metabolic pathways within the body such as cellular respiration fail to work effectively at higher temperatures, and further increases can lead them to denature, reducing their ability to catalyse essential chemical reactions. This loss of enzymatic control affects the functioning of major organs with high energy demands such as the heart and brain.
Situational	Situational heat stroke occurs in the absence of exertion. It mostly affects the young and elderly. In the elderly in particular, it can be precipitated by medications that reduce vasodilation and sweating, such as anticholinergic drugs, antihistamines, and diuretics. In this situation, the body's tolerance for high environmental temperature may be insufficient, even at rest. Heat waves are often followed by a rise in the death rate, and these 'classical hyperthermia' deaths typically involve the elderly and infirm. This is partly because thermoregulation involves cardiovascular, respiratory and renal systems which may be inadequate for the additional stress because of the existing burden of aging and disease, further compromised by medications. During the July 1995 heat wave in Chicago, there were at least 700 heat-related deaths. The strongest risk factors were being confined to bed, and living alone, while the risk was reduced for those with working air conditioners and those with access to transportation. Even then, reported deaths may be underestimates as diagnosis can be misclassified as stroke or heart attack.
Drugs	Some drugs cause excessive internal heat production. The rate of drug-induced hyperthermia is higher where use of these drugs is higher. ● Many psychotropic medications, such as selective serotonin reuptake inhibitors (SSRIs), monoamine oxidase inhibitors (MAOIs), and tricyclic antidepressants, can cause hyperthermia. Serotonin syndrome is a rare adverse reaction to overdose of these medications or the use of several simultaneously. Similarly, neuroleptic malignant syndrome is an uncommon reaction to neuroleptic agents. These syndromes are differentiated by other associated symptoms, such as tremor in serotonin syndrome and "lead-pipe" muscle rigidity in neuroleptic malignant syndrome. ● Various stimulant drugs, including amphetamines and cocaine, and hallucinogenic drugs, including PCP, LSD, and MDMA can produce hyperthermia as an adverse effect. ● Malignant hyperthermia is a rare reaction to common anesthetic agents (such as halothane) or the paralytic agent succinylcholine. Those who have this reaction, which is potentially fatal, have a genetic predisposition.

● The use of anticholinergics, more specifically muscarinic antagonists are thought to cause mild hyperthermic episodes due to its parasympatholytic effects. The sympathetic nervous system a.k.a. the "Fight or Flight Response" dominates by raising catecholamine levels by the blocked action of the Rest and Digest System.
● Drugs that decouple oxidative phosphorylation may also cause hyperthermia. From this group of drugs the most well known is 2,4-Dinitrophenol which was used as a weight loss drug until dangers from its use became apparent.

Personal Protective Equipment	Those working in industry, in the military, or as first responders may be required to wear personal protective equipment (PPE) against hazards such as chemical agents, gases, fire, small arms and even Improvised Explosive Devices (IEDs). PPE includes a range of hazmat suits, firefighting turnout gear, body armor and bomb suits, among others. Depending on design, the wearer may be encapsulated in a microclimate, due to an increase in thermal resistance and decrease in vapor permeability. As physical work is performed, the body's natural thermoregulation (i.e., sweating) becomes ineffective. This is compounded by increased work rates, high ambient temperature and humidity levels, and direct exposure to the sun. The net effect is that desired protection from some environmental threats inadvertently increases the threat of heat stress. The effect of PPE on hyperthermia has been noted in fighting the 2014 Ebola virus epidemic in Western Africa. Doctors and healthcare workers were only able to work 40 minutes at a stretch in their protective suits, fearing heat strokes.
Other	Other rare causes of hyperthermia include thyrotoxicosis and an adrenal gland tumor, called pheochromocytoma, both of which can cause increased heat production. Damage to the central nervous system, from brain hemorrhage, status epilepticus, and other kinds of injury to the hypothalamus can also cause hyperthermia.

Hyperthermia is also touched on in the SURVIVAL section.

9 Trench Foot

Trench foot is a medical condition caused by prolonged exposure of the feet to damp, unsanitary, and cold conditions. It is one of many immersion foot syndromes. The use of the word trench in the name of this condition is a reference to trench warfare, mainly associated with World War I.

Signs & Symptoms

Affected feet may become numb, by erythema (turning red) or cyanosis (turning blue) as a result of poor blood supply, and may begin emanating a decaying odor if the early stages of necrosis (tissue death) set in. As the condition worsens, feet may also begin to swell. Advanced trench foot often involves blisters and open sores, which lead to fungal infections; this is sometimes called tropical ulcer (jungle rot). If left untreated, trench foot usually results in gangrene, which may require amputation. If trench foot is treated properly, complete recovery is normal, though it is marked by severe short-term pain when feeling returns.

Causes

Unlike frostbite, trench foot does not require freezing temperatures; it can occur in temperatures up to 16° Celsius (about 60° Fahrenheit) and within as little as 13 hours. Exposure to these environmental conditions causes deterioration and destruction of the capillaries and leads to morbidity of the surrounding flesh. Excessive sweating (hyperhidrosis) has long been regarded as a contributory cause; unsanitary, cold, and wet conditions can also cause trench foot.

Prevention

Trench foot can be prevented by keeping the feet clean, warm, and dry. It was also discovered in World War I that a key preventive measure was regular foot inspections; soldiers would be paired and each made responsible for the feet of the other, and they would generally apply whale oil to prevent trench foot. If left to their own devices, soldiers might neglect to take off their own boots and socks to dry their feet each day, but if it were the responsibility of another, this became less likely. Later on in the war, instances of trench foot began to decrease, probably as a result of the introduction of the aforementioned measures; of wooden duckboards to cover the muddy, wet, cold ground of the trenches; and of the increased practice of troop rotation, which kept soldiers from prolonged time at the front.

Treatment

The mainstay of treatment, like the treatment of gangrene, is surgical debridement, and often includes amputation. Self-treatment consists of changing socks two or three times a day and usage of plenty of talcum powder. Wherever possible, shoes and socks should be taken off, feet bathed for five minutes, patted dry, talcum powder applied and feet elevated to let air get to them.

10 Seasickness (Motion Sickness)

Motion sickness is a condition in which a disagreement exists between visually perceived movement and the vestibular system's sense of movement. Depending on the cause, it can also be referred to as seasickness, car sickness, simulation sickness or airsickness. Symptoms include dizziness, fatigue, vertigo, depressed appetite, nonspecific malaise, gastrointestinal discomfort, (most commonly) nausea, and nausea-caused vomiting. If the cause of the nausea is not resolved, the sufferer will usually vomit, but vomiting may not relieve the feeling of weakness and nausea, which means the person might continue to vomit until the underlying cause of the nausea is resolved. A kind of motion sickness with similar symptoms but a possibly different etiology is known as space adaptation syndrome or space motion sickness.

Cause

At present a "fully adequate theory of motion sickness is not presently available" but contemporary sensory conflict theory, referring to "a discontinuity between either visual, proprioceptive, and somatosensory input, or semicircular canal and otolith input", is probably the most thoroughly studied. According to this theory, when the brain presents the mind with two incongruous states of motion; the result is often nausea and other symptoms of disorientation known as motion sickness. Such conditions happen when the vestibular system and the visual system do not present a synchronized and unified representation of one's body and surroundings. According to sensory conflict theory, the cause of terrestrial motion sickness is the opposite of the cause of space motion sickness. The former occurs when one perceives visually that one's surroundings are relatively immobile while the vestibular system reports that one's body is in motion relative to its surroundings. The latter can occur when the visual system perceives that one's surroundings are in motion while the vestibular system reports relative bodily immobility (as in zero gravity.) A variation of the sensory conflict theory is known as neural mismatch, implying a mismatch occurring between ongoing sensory experience and long-term memory rather than between components of the vestibular and visual systems. This theory emphasizes "the limbic system in the integration of sensory information and long-term memory, in the expression of the symptoms of motion sickness, and the impact of anti-motion-sickness drugs and stress hormones on limbic system function. The limbic system may be the neural mismatch center of the brain."

A very different alternate is the defense mechanism theory holding that motion sickness functions as a defense mechanism against neurotoxins. The area postrema in the brain is responsible for inducing vomiting when poisons are detected, and for resolving conflicts between vision and balance. When feeling motion but not seeing it (for example, in the cabin of a ship with no portholes), the inner ear transmits to the brain that it senses motion, but the eyes tell the brain that everything is still. As a result of the incongruity, the brain concludes that the individual is hallucinating and further concludes that the hallucination is due to poison ingestion. The brain responds by inducing vomiting, to clear the supposed toxin.

Treisman's indirect argument has recently been questioned via an alternative direct evolutionary hypothesis, as well as modified and extended via a direct poison hypothesis. The direct evolutionary hypothesis essentially argues that there are plausible means by which ancient real or apparent motion could have contributed directly to the evolution of aversive reactions, without the need for the co-opting of a poison response as posited by Treisman. Nevertheless, the direct poison hypothesis argues that there still are plausible ways in which the body's poison response system may have played a role in shaping the evolution of some of the signature symptoms that characterize motion sickness.

Yet another theory, also as the nystagmus hypothesis, has been proposed based on stimulation of the vagus nerve resulting from the stretching or traction of extra-ocular muscles co-occurring with eye movements caused by vestibular stimulation. There are three critical aspects to the theory: first is the close linkage between activity in the vestibular system, i.e., semicircular canals and otolith organs, and a change in tonus among various of each eye's six extra-ocular muscles. Thus, with the exception of voluntary eye movements, the vestibular and oculomotor systems are thoroughly linked. Second is the operation of Sherrington's Law describing reciprocal inhibition between agonist-antagonist muscle pairs, and by implication the stretching of extraocular muscle that must occur whenever Sherrington's Law is made to fail, thereby causing an unrelaxed (contracted) muscle to be stretched. Finally, there is the critical presence of afferent output to the Vagus nerves as a direct result of eye muscle stretch or traction. Thus, 10th nerve stimulation resulting from eye muscle stretch is proposed as the cause of motion sickness.

The theory explains why labyrinthine-defective individuals are immune to motion sickness; why symptoms emerge when undergoing various body-head accelerations; why combinations of voluntary and reflexive eye movements may challenge the proper operation of Sherrington's Law, and why many drugs that suppress eye movements also serve to suppress motion sickness symptoms. A recent theory argues that the main reason motion sickness occurs is due to an imbalance in vestibular outputs favoring the semicircular canals (nauseogenic) vs. otolith organs (anti-nauseogenic). This theory attempts to integrate previous theories of motion sickness. For example, there are many sensory conflicts that are associated with motion sickness and many that are not, but those in which canal stimulation occurs in the absence of normal otolith function (e.g., 0-g) are the most provocative. The vestibular imbalance theory is also tied to the different roles of the otoliths and canals in autonomic arousal (otolith output more sympathetic).

Susceptibility

Roughly one-third of the population is highly susceptible to motion sickness, and most of the rest may get motion sickness under extreme conditions. The incidence of space motion sickness has been estimated over the years at between forty and eighty percent of those who have entered weightless orbit. Several factors influence susceptibility to motion sickness, including sleep deprivation and the cubic footage allocated to each space traveler. Statistics indicate that women are more likely to be affected than men, and that the risk decreases with advancing age. There is some evidence that people with Asian ancestry may suffer motion sickness more frequently compared with people of European ancestry, and there are situational and behavioral factors, such as whether a passenger has a view of the road ahead, and diet and eating behaviors.

Types

Motion sickness can be divided into three categories:
1. Motion sickness caused by motion that is felt but not seen, as in terrestrial motion sickness;
2. Motion sickness caused by motion that is seen but not felt, as in space motion sickness;
3. Motion sickness caused when both systems detect motion but they do not correspond, as in either terrestrial or space motion sickness.

Carsickness	A specific form of terrestrial motion sickness, being carsick is quite common and evidenced by disorientation while reading a map, a book, or a small screen during travel. Carsickness results from the sensory conflict arising in the brain from differing sensory inputs. Motion sickness is caused by a conflict between signals arriving in the brain from the inner ear, which forms the base of the vestibular system, the sensory apparatus that deals with movement and balance, and which detects motion mechanically. If someone is looking at a stationary object within a vehicle, such as a magazine, their eyes will inform their brain that what they are viewing is not moving. Their inner ears, however, will contradict this by sensing the motion of the vehicle. Varying theories exist as to cause. The sensory conflict theory notes that the eyes view motion while riding in the moving vehicle while other body sensors sense stillness, creating conflict between the eyes and inner ear. Another suggests the eyes mostly see the interior of the car which is motionless while the vestibular system of the inner ear senses motion as the vehicle goes around corners or over hills and even small bumps.

Therefore, the effect is worse when looking down but may be lessened by looking outside of the vehicle. In the early 20th century, Austro-Hungarian scientist Robert Barany observed the back and forth movement of the eyes of railroad passengers as they looked out the side windows at the scenery whipping by. He called it "railway nystagmus." Also called "optokinetic nystagmus." It causes nausea and vomiting. His findings were published in the journal Laeger, 83:1516, Nov.17, 1921.

Airsickness	Air sickness is a kind of terrestrial motion sickness induced by certain sensations of air travel. It is a specific form of motion sickness and is considered a normal response in healthy individuals. It is essentially the same as carsickness but occurs in an airplane. An airplane may bank and tilt sharply, and unless passengers are sitting by a window, they are likely to see only the stationary interior of the plane due to the small window sizes and during flights at night. Another factor is that while in flight, the view out of windows may be blocked by clouds, preventing passengers from seeing the moving ground or passing clouds.
Seasickness	Seasickness is a form of terrestrial motion sickness characterized by a feeling of nausea and, in extreme cases, vertigo experienced after spending time on a watercraft such as a boat or ship. It is essentially the same as carsickness, though the motion of a watercraft tends to be more regular. It is typically brought on by the rocking motion of the craft or movement while the craft is immersed in water. As with airsickness, it can be difficult to visually detect motion even if one looks outside the boat since water does not offer fixed points with which to visually judge motion. Poor visibility conditions, such as fog, may worsen seasickness. The greatest contributor to seasickness is the tendency for people being affected by the rolling or surging motions of the craft to seek refuge below decks, where they are unable to relate themselves to the boat's surroundings and consequent motion. Some sufferers of carsickness are resistant to seasickness and vice versa. Adjusting to the craft's motion at sea is called "gaining one's sea legs"; it can take a significant portion of the time spent at sea after disembarking to regain a sense of stability "post-sea legs".
Centrifuge Motion Sickness	Rotating devices such as centrifuges used in astronaut training and amusement park rides such as the Rotor, Mission: Space and the Gravitron can cause motion sickness in many people. While the interior of the centrifuge does not appear to move, one will experience a sense of motion. In addition, centrifugal force can cause the vestibular system to give one the sense that downward is in the direction away from the center of the centrifuge rather than the true downward direction.
Dizziness Due to Spinning	When one spins and stops suddenly, fluid in the inner ear continues to rotate causing a sense of continued spinning while one's visual system no longer detects motion.
Virtual Reality Disorientation	Usually, VR programs would detect the motion of the user's head and abject the rotation of vision to avoid dizziness. However, some cases such as system lagging or software crashing could cause lags in the screen updates. In such cases, even some small head motions could trigger the motion sickness.

Treatment

Devices	A motion blocking eyewear device was patented (US patent 6,275,998) to prevent carsickness-related terrestrial motion sickness. Visual cues are an important contributor to land-based vehicular travel in addition to vestibular (inner ear) input. The eyewear device limits what the wearer sees outside the moving vehicle by use of an opaque shield. By removing visual cues outside the vehicle, the device normalizes the visual input dimension involved in sensory conflict, a leading theory behind motion sickness. No evidence exists that motion blocking eyewear alters or eliminates vestibular input or that of other bodily receptors. Carsickness is the most common type of motion sickness given the number of travelers traveling over land versus those traveling by air or sea. A head-worn, computer device with a transparent display can be used to mitigate the effects of motion sickness (and spatial disorientation) if visual indicators of the wearer's head position are shown. Such a device functions by providing the wearer with digital reference lines in their field of vision that indicate the horizon's position relative to the user's head. This is accomplished by combining readings from accelerometers and gyroscopes mounted in the device (US Patent 5,966,680). This technology has been implemented in both standalone devices and Google Glass. In two NIH-backed studies, greater than 90% of patients experienced a reduction in the symptoms of motion sickness while using this technology.
Activity	One common suggestion is to simply look out the window of the moving vehicle and to gaze towards the horizon in the direction of travel. This helps to re-orient the inner sense of balance by providing a visual reaffirmation of motion. In the night, or in a ship without windows, it is helpful to simply close one's eyes, or if possible, take a nap. This resolves the sensory conflict between the eyes and the inner ear. Napping also helps prevent psychogenic effects (i.e. the effect of sickness being magnified by thinking about it). Fresh, cool air can also relieve motion sickness slightly, although it is likely this is related to avoiding foul odors which can worsen nausea. While playing computer games, and mainly in first-person shooter games, some cases of simulation sickness can be resolved by changing the field of view in the game. Some games have a default setting which places a player's vision a small distance ahead of the actual object controlled, which will most likely trigger simulation sickness.
Medication	Over-the-counter and prescription medications are readily available, such as dimenhydrinate, scopolamine, meclizine, promethazine, cyclizine, and cinnarizine. Cinnarizine is not available in the United States, as it is not approved by the FDA. As these medications often have side effects, anyone involved in high-risk activities while at sea (such as SCUBA divers) must evaluate the risks versus the benefits. Promethazine is especially known to cause drowsiness, which is often counteracted by ephedrine in a combination known as "the Coast Guard cocktail." There are special considerations to be aware of when the common anti-motion sickness medications are used in the military setting where performance must be maintained at a high level. Scopolamine is effective and is sometimes used in the form of transdermal patches (1.5 mg) or as a newer tablet form (0.4 mg). The selection of a transdermal patch or scopolamine tablet is determined by a doctor after consideration of the patient's age, weight, and length of treatment time required. Many pharmacological treatments which are effective for nausea and vomiting in some medical conditions may not be effective for motion sickness.

For example, metoclopramide and prochlorperazine, although widely used for nausea, are ineffective for motion-sickness prevention and treatment. This is due to the physiology of the CNS vomiting centre and its inputs from the chemoreceptor trigger zone versus the inner ear. Sedating anti-histamine medications such as promethazine work quite well for motion sickness, although they can cause significant drowsiness. Ginger root is commonly thought to be an effective anti-emetic, but it is ineffective in treating motion sickness.

Electronic	As astronauts frequently have motion sickness, NASA has done extensive research on the causes of and treatments for motion sickness. One very promising looking treatment is for the person suffering from motion sickness to wear LCD shutter glasses that create a stroboscopic vision of 4 Hz with a dwell of 10 milliseconds.

11 Aero-otitis Media

The traumatic inflammation of the middle ear resulting from differences between atmospheric pressure and pressure in the middle ear and occurring in high-altitude flyers, caisson or tunnel workers, and deep-sea divers. AOM is an infection of rapid onset that usually presents with ear pain. In young children this may result in pulling at the ear, increased crying, and poor sleep. Decreased eating and a fever may also be present. OME is typically not associated with symptoms. Occasionally a feeling of fullness is described. It is defined as the presence of non-infectious fluid in the middle ear for more than three months. Chronic suppurative otitis media (CSOM) is middle ear inflammation of greater than two weeks that results in episodes of discharge from the ear. It may be a complication of acute otitis media. Pain is rarely present. All three may be associated with hearing loss. The hearing loss in OME, due to its chronic nature, may affect a child's ability to learn.

The cause of AOM is related to childhood anatomy and immune function. Either bacteria or viruses may be involved. Risk factors include exposure to smoke, use of pacifiers, and attending daycare. It occurs more commonly among Indigenous peoples and those who have Down syndrome. OME frequently occurs following AOM and may be related to viral upper respiratory infections, irritants such as smoke, or allergies. Looking at the eardrum is important for making the correct diagnosis.

INJURY Environmental Aero-otitis Media

Signs of AOM include bulging or a lack of movement of the tympanic membrane from a puff of air. New discharge not related to otitis externa also indicates the diagnosis. A number of measures decrease the risk of otitis media including pneumococcal and influenza vaccination, breastfeeding, and avoiding tobacco smoke. The use of pain medications for AOM is important. This may include paracetamol (acetaminophen), ibuprofen, benzocaine ear drops, or opioids. In AOM, antibiotics may speed recovery but may result in side effects.

Antibiotics are often recommended in those with severe disease or under two years old. In those with less severe disease they may only be recommended in those who do not improve after two or three days. The initial antibiotic of choice is typically amoxicillin. In those with frequent infections tympanostomy tubes may decrease recurrence. In children with otitis media with effusion antibiotics may increase resolution of symptoms, but may cause diarrhoea, vomiting and skin rash. Worldwide AOM affects about 11% of people a year (about 325 to 710 million cases). Half the cases involve children less than five years of age and it is more common among males.

Signs & Symptoms

An integral symptom of acute otitis media is ear pain; other possible symptoms include fever, and irritability (in infants). Since an episode of otitis media is usually precipitated by an upper respiratory tract infection (URTI), there are often accompanying symptoms like a cough and nasal discharge. Discharge from the ear can be caused by acute otitis media with perforation of the ear drum, chronic suppurative otitis media, tympanostomy tube otorrhea, or acute otitis externa. Trauma, such as a basilar skull fracture, can also lead to discharge from the ear due to cerebral spinal drainage from the brain and its covering (meninges).

Causes

The common cause of all forms of otitis media is dysfunction of the Eustachian tube. This is usually due to inflammation of the mucous membranes in the nasopharynx, which can be caused by a viral upper respiratory tract infection (URTI), strep throat, or possibly by allergies. By reflux or aspiration of unwanted secretions from the nasopharynx into the normally sterile middle-ear space, the fluid may then become infected — usually with bacteria. The virus that caused the initial upper respiratory infection can itself be identified as the pathogen causing the infection.

Diagnosis

As its typical symptoms overlap with other conditions, such as acute external otitis, clinical history alone is not sufficient to predict whether acute otitis media is present; it has to be complemented by visualization of the tympanic membrane. Examiners use a pneumatic otoscope with a rubber bulb attached to assess the mobility of the tympanic membrane. In more severe cases, such as those with associated hearing loss or high fever, audiometry, tympanogram, temporal bone CT and MRI can be used to assess for associated complications, such as mastoid effusion, subperiosteal abscess formation, bony destruction, venous thrombosis or meningitis. Acute otitis media in children with moderate to severe bulging of the tympanic membrane or new onset of otorrhea (drainage) is not due to external otitis. Also, the diagnosis may be made in children who have mild bulging of the ear drum and recent onset of ear pain (less than 48 hours) or intense erythema (redness) of the ear drum.

To confirm the diagnosis, middle-ear effusion and inflammation of the eardrum have to be identified; signs of these are fullness, bulging, cloudiness and redness of the eardrum. It is important to attempt to differentiate between acute otitis media and otitis media with effusion (OME), as antibiotics are not recommended for OME. It has been suggested that bulging of the tympanic membrane is the best sign to differentiate AOM from OME, with a bulging of the membrane suggesting AOM rather than OME. Viral otitis may result in blisters on the external side of the tympanic membrane, which is called bullous myringitis (myringa being Latin for "eardrum"). However, sometimes even examination of the eardrum may not be able to confirm the diagnosis, especially if the canal is small. If wax in the ear canal obscures a clear view of the eardrum it should be removed using a blunt cerumen curette or a wire loop. Also, an upset young child's crying can cause the eardrum to look inflamed due to distension of the small blood vessels on it, mimicking the redness associated with otitis media.

Acute Otitis Media	The most common bacteria isolated from the middle ear in AOM are Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, and Staphylococcus aureus.
Otitis Media with Effusion	Otitis media with effusion (OME), also known as serous otitis media (SOM) or secretory otitis media (SOM), and colloquially referred to as 'glue ear,' is fluid accumulation that can occur in the middle ear and mastoid air cells due to negative pressure produced by dysfunction of the Eustachian tube. This can be associated with a viral URI or bacterial infection such as otitis media. An effusion can cause conductive hearing loss if it interferes with the transmission of vibrations of middle ear bones to the vestibulocochlear nerve complex that are created by sound waves. Early-onset OME is associated with feeding of infants while lying down, early entry into group child care, parental smoking, lack, or too short a period of breastfeeding and greater amounts of time spent in group child care, particularly those with a large number of children. These risk factors increase the incidence and duration of OME during the first two years of life.
Chronic Suppurative Otitis Media	Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear and mastoid cavity that is characterised by discharge from the middle ear through a perforated tympanic membrane for at least 6 weeks. CSOM occurs following an upper respiratory tract infection that has led to acute otitis media. This progresses to a prolonged inflammatory response causing mucosal (middle ear) oedema, ulceration and perforation. The middle ear attempts to resolve this ulceration by production of granulation tissue and polyp formation. This can lead to increased discharge and failure to arrest the inflammation, and to development of CSOM, which is also often associated with cholesteatoma. There may be enough pus that it drains to the outside of the ear (otorrhea), or the pus may be minimal enough to be seen only on examination with an otoscope or binocular microscope. Hearing impairment often accompanies this disease. People are at increased risk of developing CSOM when they have poor eustachian tube function, a history of multiple episodes of acute otitis media, live in crowded conditions, and attend paediatric day care facilities. Those with craniofacial malformations such as cleft lip and palate, Down syndrome, and microcephaly are at higher risk. Worldwide approximately 11% of the human population is affected by AOM every year, or 709 million cases. About 4.4% of the population develop CSOM. According to the World Health Organization, CSOM is a primary cause of hearing loss in children. Adults with recurrent episodes of CSOM have a higher risk of developing permanent conductive and sensorineural hearing loss.
Adhesive Otitis Media	Adhesive otitis media occurs when a thin retracted ear drum becomes sucked into the middle-ear space and stuck (i.e., adherent) to the ossicles and other bones of the middle ear.

Prevention

AOM is far less common in breastfed infants than in formula-fed infants, and the greatest protection is associated with exclusive breastfeeding (no formula use) for the first six months of life. A longer duration of breastfeeding is correlated with a longer protective effect. Pneumococcal conjugate vaccines (PCV) in early infancy decrease the risk of acute otitis media in healthy infants. PCV is recommended for all children, and, if implemented broadly, PCV would have a significant public health benefit.

Influenza vaccine is recommended annually for all children. PCV does not appear to decrease the risk of otitis media when given to high-risk infants or for older children who have previously experienced otitis media. Risk factors such as season, allergy predisposition and presence of older siblings are known to be determinants of recurrent otitis media and persistent middle-ear effusions (MEE). History of recurrence, environmental exposure to tobacco smoke, use of daycare, and lack of breastfeeding have all been associated with increased risk of development, recurrence, and persistent MEE.

Pacifier use has been associated with more frequent episodes of AOM. Long-term antibiotics, while they decrease rates of infection during treatment, have an unknown effect on long-term outcomes such as hearing loss. This method of prevention has been associated with emergence of antibiotic-resistant otitic bacteria. They are thus not recommended. There is moderate evidence that the sugar substitute xylitol may reduce infection rates in those who go to daycare. Evidence does not support zinc supplementation as an effort to reduce otitis rates except maybe in those with severe malnutrition such as marasmus.

Management

Oral and topical pain killers are effective to treat the pain caused by otitis media. Oral agents include ibuprofen, paracetamol (acetaminophen), and opiates. Topical agents shown to be effective include antipyrine and benzocaine ear drops. Decongestants and antihistamines, either nasal or oral, are not recommended due to the lack of benefit and concerns regarding side effects. Half of cases of ear pain in children resolve without treatment in three days and 90% resolve in seven or eight days. The use of steroids is not supported by the evidence for acute otitis media.

Antibiotics
It is important to weigh the benefits and harms before using antibiotics for acute otitis media. As over 82% of acute episodes settle without treatment, about 20 children must be treated to prevent one case of ear pain, 33 children to prevent one perforation, and 11 children to prevent one opposite-side ear infection. For every 14 children treated with antibiotics, one child has an episode of either vomiting, diarrhea or a rash. If pain is present, pain medications may be used. For bilateral acute otitis media in infants younger than 24 months of age, there is evidence that the benefits of antibiotics outweigh the harms. A 2015 Cochrane review concluded that watchful waiting is the preferred approach for children over six months with non severe acute otitis media.

Antibiotics Table	Outcome	Findings	Findings in Numbers	Quality of Evidence
Pain				
	Pain at 24 hours	Antibiotics causes little or no reduction to the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.89 (0.78 to 1.01)	High
	Pain at 2 to 3 days	Antibiotics slightly reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.70 (0.57 to 0.86)	High
	Pain at 4 to 7 days	Antibiotics slightly reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.76 (0.63 to 0.91)	High
	Pain at 10 to 12 days	Antibiotics probably reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on moderate quality evidence.	RR 0.33 (0.17 to 0.66)	Moderate
Abnormal Tympanometry				
	2 to 4 weeks	Antibiotics slightly reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.82 (0.74 to 0.90)	High
	3 months	Antibiotics causes little or no reduction to the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.97 (0.76 to 1.24)	High
Vomiting				
	Diarrhoea or rash	Antibiotics slightly increases the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 1.38 (1.19 to 1.59)	High

Summary
The evidence indicates that most children older than 6 months of age who have acute otitis media do not benefit from treatment with antibiotics. If antibiotics are used, amoxicillin is generally recommended. If there is resistance or use of amoxicillin in the last 30 days then amoxicillin-clavulanate or another penicillin derivative plus beta lactamase inhibitor is recommended. Taking amoxicillin once a day may be as effective as twice or three times a day. While less than 7 days of antibiotics have fewer side effects, more than seven days appear to be more effective. If there is no improvement after 2–3 days of treatment a change in therapy may be considered. A treatment option for chronic suppurative otitis media with discharge is topical antibiotics. A Cochrane review found that topical quinolone antibiotics can improve discharge better than oral antibiotics. Safety is not really clear.

Tympanostomy Tube
Tympanostomy tubes (also called "grommets") are recommended with three or more episodes of acute otitis media in 6 months or four or more in a year, with at least one episode or more attacks in the preceding 6 months. There is tentative evidence of reduced recurrence rates in the 6 months after placement. Evidence does not support an effect on long-term hearing or language development. A common complication of having a tympanostomy tube is otorrhea, which is a discharge from the ear. Oral antibiotics should not be used to treat uncomplicated acute tympanostomy tube otorrhea. Oral antibiotics are not a sufficient response to bacteria that cause this condition and have significant side effects including increased risk of opportunistic infection. In contrast, topical antibiotic eardrops can treat this condition.

Otitis Media with Effusion
The decision to treat is usually made after a combination of physical exam and laboratory diagnosis, with additional testing including audiometry, tympanogram, temporal bone CT and MRI. Decongestants, glucocorticoids, and topical antibiotics are generally not effective as treatment for non-infectious, or serous, causes of mastoid effusion. Moreover, it is recommended against using antihistamines and decongestants in children with OME. In less severe cases or those without significant hearing impairment, the effusion can resolve spontaneously or with more conservative measures such as autoinflation. In more severe cases, tympanostomy tubes can be inserted, possibly with adjuvant adenoidectomy as it shows a significant benefit as far as the resolution of middle ear effusion in children with OME is concerned.

Alternative Medicine
Complementary and alternative medicine is not recommended for otitis media with effusion because there is no evidence of benefit. Homeopathic treatments have not been proven to be effective for acute otitis media in a study with children. An osteopathic manipulation technique called the Galbreath technique was evaluated in one randomized controlled clinical trial; one reviewer concluded that it was promising, but a 2010 evidence report found the evidence inconclusive.

Outcomes
Complications of acute otitis media consists of perforation of the ear drum, infection of the mastoid space behind the ear (mastoiditis), and more rarely intracranial complications can occur, such as bacterial meningitis, brain abscess, or dural sinus thrombosis. It is estimated that each year 21,000 people die due to complications of otitis media.

Membrane Rupture
In severe or untreated cases, the tympanic membrane may perforate, allowing the pus in the middle-ear space to drain into the ear canal. If there is enough, this drainage may be obvious. Even though the perforation of the tympanic membrane suggests a highly painful and traumatic process, it is almost always associated with a dramatic relief of pressure and pain. In a simple case of acute otitis media in an otherwise healthy person, the body's defenses are likely to resolve the infection and the ear drum nearly always heals. An option for severe acute otitis media in which analgesics are not controlling ear pain is to perform a tympanocentesis, i.e., needle aspiration through the tympanic membrane to relieve the ear pain and to identify the causative organism(s).

Hearing Loss
Children with recurrent episodes of acute otitis media and those with otitis media with effusion or chronic suppurative otitis media have higher risks of developing conductive and sensorineural hearing loss. Globally approximately 141 million people have mild hearing loss due to otitis media (2.1% of the population). This is more common in males (2.3%) than females (1.8%). This hearing loss is mainly due to fluid in the middle ear or rupture of the tympanic membrane. Prolonged duration of otitis media is associated with ossicular complications and, together with persistent tympanic membrane perforation, contributes to the severity of the disease and hearing loss. When a cholesteatoma or granulation tissue is present in the middle ear, the degree of hearing loss and ossicular destruction is even greater.

Epidemiology
Acute otitis media is very common in childhood. It is the most common condition for which medical care is provided in children under five years of age in the US. Acute otitis media affects 11% of people each year (709 million cases) with half occurring in those below five years. Chronic suppurative otitis media affects about 5% or 31 million of these cases with 22.6% of cases occurring annually under the age of five years. Otitis media resulted in 2,400 deaths in 2013—down from 4,900 deaths in 1990.

12 Aerosinusitis

Aerosinusitis, also called barosinusitis, sinus squeeze or sinus barotrauma is a painful inflammation and sometimes bleeding of the membrane of the paranasal sinus cavities, normally the frontal sinus. It is caused by a difference in air pressures inside and outside the cavities.

Signs & Symptoms

Typically, sinus barotrauma is preceded by an upper respiratory tract infection or allergy. The affected person suffers a sudden sharp facial pain or headache during descent, which increases as the aircraft approaches ground level. The pain can ultimately become disabling unless the ambient pressure is reversed.

The pressure difference causes the mucosal lining of the sinuses to become swollen and submucosal bleeding follows with further difficulties ventilating the sinus, especially if the orifices are involved. Ultimately fluid or blood will fill the space.

In most cases of sinus barotrauma, localized pain to the frontal area is the predominant symptom. This is due to pain originating from the frontal sinus, it being above the brow bones. Less common is pain referred to the temporal, occipital, or retrobulbar region. Epistaxis or serosanguineous secretion from the nose may occur. Neurological symptoms may affect the adjacent fifth cranial nerve and especially the infraorbital nerve.

Most cases occur in scuba divers and fliers, and is easily diagnosed when presented to physicians immediately after exposure. On the other hand, the problem may remain undiagnosed when the history fails to relate the symptoms to exposure to environmental pressure changes or if the focus is on other etiologies.

Weissman defined three grades of sinus barotraumas according to symptomatology.
- Grade I includes cases with mild transient sinus discomfort without changes visible on X-ray.
- Grade II is characterized by severe pain for up to 24 h, with some mucosal thickening on X-ray.
- Patients with grade III have severe pain lasting for more than 24 h and X-ray shows severe mucosal thickening or opacification of the affected sinus; epistaxis or subsequent sinusitis may be observed.

Causes

Diagnosis

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Prevention

Treatment

Mild cases of barotrauma are readily treated by topical decongestants and painkillers. In severe cases or cases resistant to local treatment, functional endoscopic sinus surgery is indicated in order to re-establish drainage and ventilation of the sinuses. This treatment has shown good results in aviators suffering from recurrent sinus barotrauma. Computer-aided surgery has re-established the drainage of affected sinuses, especially with regard to the sphenoid sinuses. When the sphenoids were entered endoscopically, mucosal petechia and hematoma were clearly seen.

6 Atmosphere & Air

Any injuries that can happen due to air, atmosphere or lack of air.

Subheadings

1. Suffocation	2. Drowning	3. Choking	4. Barotrauma
5. Compression Arthralgia	6. Decompression Sickness	7. Dysbaric Osteonecrosis	8. High Pressure Syndrome
9. Nitrogen Narcosis	10. Oxygen Toxicity	11. Hypoxia	12. Swimming Edema
13. Immersion Diuresis	14. Hypercapnia	15. Monoxide Poisoning	16. Lipid Pneumonia

1 Asphyxiation & Suffocation

Asphyxia or asphyxiation is a condition of deficient supply of oxygen to the body that arises from abnormal breathing. An example of asphyxia is choking. Asphyxia causes generalized hypoxia, which affects primarily the tissues and organs. There are many circumstances that can induce asphyxia, all of which are characterized by an inability of an individual to acquire sufficient oxygen through breathing for an extended period of time. Asphyxia can cause coma or death.

Signs & Symptoms

Causes

Situations that can cause asphyxia include but are not limited to: the constriction or obstruction of airways, such as from asthma, laryngospasm, or simple blockage from the presence of foreign materials; from being in environments where oxygen is not readily accessible: such as underwater, in a low oxygen atmosphere, or in a vacuum; environments where sufficiently oxygenated air is present, but cannot be adequately breathed because of air contamination such as excessive smoke.

Other causes of oxygen deficiency include but are not limited to:

- Acute respiratory distress syndrome
- Carbon monoxide inhalation, such as that from a car exhaust and the smoke's emission from a lighted cigarette: carbon monoxide has a higher affinity than oxygen to the hemoglobin in the blood's red blood corpuscles, bonding with it tenaciously, and, in the process, displacing oxygen and preventing the blood from transporting oxygen around the body
- Contact with certain chemicals, including pulmonary agents (such as phosgene) and blood agents (such as hydrogen cyanide)
- Drowning
- Drug overdose
- Exposure to extreme low pressure or vacuum from spacesuit damage (see space exposure)
- Hanging, whether suspension or short drop hanging
- Self-induced hypocapnia by hyperventilation, as in shallow water or deep water blackout and the choking game
- Inert gas asphyxiation
- Congenital central hypoventilation syndrome, or primary alveolar hypoventilation, a disorder of the autonomic nervous system in which a patient must consciously breathe; although it is often said that persons with this disease will die if they fall asleep, this is not usually the case
- Respiratory diseases
- Sleep apnea
- A seizure which stops breathing activity
- Strangling
- Breaking the wind pipe
- Prolonged exposure to chlorine gas

Diagnosis

Prevention

Treatment

2 Drowning

Drowning is defined as respiratory impairment as a result of being in or under a liquid. Drowning typically occurs silently, with only a few people able to wave their hands or call for help. Symptoms following rescue may include breathing problems, vomiting, confusion, or unconsciousness. Occasionally symptoms may not appear until up to six hours afterwards. Drowning may be complicated by low body temperature, aspiration of vomit, or acute respiratory distress syndrome.

Signs & Symptoms

Drowning is most often quick and unspectacular. Its media depictions as a loud, violent struggle have much more in common with distressed non-swimmers, who may well drown but have not yet begun to do so. In particular, an asphyxiating person is seldom able to call for help. The instinctive drowning response covers many signs or behaviors associated with drowning or near-drowning:

- Head low in the water, mouth at water level
- Head tilted back with mouth open
- Eyes glassy and empty, unable to focus
- Eyes open, with fear evident on the face
- Hyperventilating or gasping
- Trying to swim in a particular direction but not making headway
- Trying to roll over on the back to float
- Uncontrollable movement of arms and legs, rarely out of the water.

Drowning begins at the point a person is unable to keep their mouth above water; inhalation of water takes place at a later stage. Most people demonstrating the instinctive drowning response do not show obvious prior evidence of distress.

A person drowning is generally unable to call for help, or seek attention, as they cannot obtain enough air. The instinctive drowning response is the final set of autonomic reactions in the 20–60 seconds before sinking underwater, and to the untrained eye can look similar to calm safe behavior. Lifeguards and other persons trained in rescue learn to recognize drowning people by watching for these movements.

Causes

Drowning mainly happens due to the inability to swim in a circumstance: lack of skill, state of the waters, physical condition, loss of consciousness, and others. Anxiety can lead to exhaustion, precipitating the drowning.

Approximately 90% of drownings take place in freshwater (rivers, lakes and swimming pools) and 10% in seawater. Drownings in other fluids are rare, and often relate to industrial accidents. In New Zealand's early colonial history, so many settlers died while trying to cross rivers that drowning was known as "The New Zealand death".

People have drowned in as little as 30 mm of water lying face down. Children have drowned in baths, buckets and toilets; inebriates or those under the influence of drugs have died in puddles.

Drowning can also happen after the drowning incident itself, due to further complications. The inhaled fluid can act as an irritant inside the lungs. Physiological responses to even small quantities include the extrusion of liquid into the lungs (pulmonary edema) over the following hours, but this reduces the ability to exchange air and can lead to a person "drowning in their own body fluid". Certain poisonous vapors or gases (as for example in chemical warfare), or vomit can have a similar effect. The reaction can take place up to 72 hours after the drowning incident, and may lead to a serious condition or death.

Many factors, behavioral and physical, are related to drowning:
● Worldwide, drowning is the most common cause of death for persons with seizure disorders, largely in the bathtub (by unintentional injury). People with epilepsy are more likely to die due to accidents such as drowning. However, this risk is especially elevated in low- and middle-income countries compared to high-income countries.
● The use of alcohol increases the risk for drowning across developed and developing nations. Alcohol is involved in approximately 50% of fatal drownings, and 35% of non-fatal drownings. Among adolescents and adults, alcohol use is involved in almost a quarter of emergency department visits for drowning.
● Inability to swim: Participation in formal swimming lessons can reduce the risk of drowning. The optimal age to start the lessons is childhood, between 1 and 4 years old.

● Feeling too tired reduces the swimming performance. This exhaustion can appear because of the anxious movements motivated by fear during drowning. Otherwise, a bad calculation of the own physical capabilities can leave oneself exhausted before reaching the shore.
● Free access to water: Effective barriers prevent young children from gaining access to the water.
● Ineffective supervision: Drowning can occur anywhere there is water, and even in the presence of lifeguards.
● Risk can vary with location depending on age. Children between 1 and 4 usually drown in home swimming pools. Drownings in natural water settings increase with age. More than half of drownings among those 15 years and older occurred in natural water environments.
● Failure to wear life jackets or personal flotation devices was implicated in 88% of the boating related drownings in the US during 2010.

Population groups at risk in the US are:
● Children and young adults: Drowning rates are highest for children under 5 years of age and persons 15–24 years of age.
● Males: Nearly 80% of people who die from drowning are male.
● Minorities: The fatal unintentional drowning rate for African Americans between 2005 and 2009 was significantly higher than that of whites across all ages. The fatal drowning rate of African American children of ages from 5 to 14 is almost three times that of white children in the same age range, and 5.5 times higher in swimming pools. These disparities might be associated with lack of basic swimming skills in some minority populations.

Freediving
Some special causes of drowning can also happen during freediving activities:
● Ascent blackout, also called deep water blackout – caused by latent hypoxia during ascent from depth, where the partial pressure of oxygen in the lungs under pressure at the bottom of a deep freedive is adequate to support consciousness but drops below the blackout threshold as the water pressure decreases on the ascent. It usually strikes upon arriving near the surface as the pressure approaches normal atmospheric pressure.
● Shallow water blackout – caused by hyperventilation prior to swimming or diving. The primary urge to breathe is triggered by rising carbon dioxide (CO2) levels in the bloodstream. The body detects CO2 levels very accurately and relies on this to control breathing. Hyperventilation reduces the carbon dioxide content of the blood but leaves the diver susceptible to sudden loss of consciousness without warning from hypoxia. There is no bodily sensation that warns a diver of an impending blackout, and people (often capable swimmers swimming under the surface in shallow water) become unconscious and drown quietly without alerting anyone to the fact that there is a problem; they are typically found on the bottom.

Oxygen Deprivation
A conscious person will hold his or her breath (see Apnea) and will try to access air, often resulting in panic, including rapid body movement. This uses up more oxygen in the blood stream and reduces the time to unconsciousness. The person can voluntarily hold his or her breath for some time, but the breathing reflex will increase until the person tries to breathe, even when submerged.

The breathing reflex in the human body is weakly related to the amount of oxygen in the blood but strongly related to the amount of carbon dioxide (see Hypercapnia). During apnea, the oxygen in the body is used by the cells, and excreted as carbon dioxide. Thus, the level of oxygen in the blood decreases, and the level of carbon dioxide increases. Increasing carbon dioxide levels lead to a stronger and stronger breathing reflex, up to the breath-hold breakpoint, at which the person can no longer voluntarily hold his or her breath. This typically occurs at an arterial partial pressure of carbon dioxide of 55 mm Hg, but may differ significantly between people.

The breath-hold break point can be suppressed or delayed either intentionally or unintentionally. Hyperventilation before any dive, deep or shallow, flushes out carbon dioxide in the blood resulting in a dive commencing with an abnormally low carbon dioxide level; a potentially dangerous condition known as hypocapnia. The level of carbon dioxide in the blood after hyperventilation may then be insufficient to trigger the breathing reflex later in the dive and a blackout may occur without warning and before the diver feels any urgent need to breathe. This can occur at any depth and is common in distance breath-hold divers in swimming pools.

Hyperventilation is often used by both deep and distance free-divers to flush out carbon dioxide from the lungs to suppress the breathing reflex for longer. It is important not to mistake this for an attempt to increase the body's oxygen store. The body at rest is fully oxygenated by normal breathing and cannot take on any more. Breath holding in water should always be supervised by a second person, as by hyperventilating, one increases the risk of shallow water blackout because insufficient carbon dioxide levels in the blood fail to trigger the breathing reflex.

A continued lack of oxygen in the brain, hypoxia, will quickly render a person unconscious usually around a blood partial pressure of oxygen of 25–30 mmHg. An unconscious person rescued with an airway still sealed from laryngospasm stands a good chance of a full recovery. Artificial respiration is also much more effective without water in the lungs. At this point the person stands a good chance of recovery if attended to within minutes. More than 10% of drownings may involve laryngospasm, but the evidence suggests that it is not usually effective at preventing water from entering the trachea. The lack of water found in lungs during autopsy does not necessarily mean there was no water at the time of drowning, as small amounts of freshwater are readily absorbed into the bloodstream. Hypercarbia and hypoxia both contribute to laryngeal relaxation, after which the airway is effectively open through the trachea. There is also bronchospasm and mucous production in the bronchi associated with laryngospasm, and these may prevent water entry at terminal relaxation.

The hypoxemia and acidosis caused by asphyxia in drowning affect various organs. There can be central nervous system damage, cardiac arhythmias, pulmonary injury, reperfusion injury, and multiple-organ secondary injury with prolonged tissue hypoxia.

A lack of oxygen or chemical changes in the lungs may cause the heart to stop beating. This cardiac arrest stops the flow of blood and thus stops the transport of oxygen to the brain. Cardiac arrest used to be the traditional point of death but at this point there is still a chance of recovery. The brain cannot survive long without oxygen and the continued lack of oxygen in the blood combined with the cardiac arrest will lead to the deterioration of brain cells causing first brain damage and eventually brain death from which recovery is generally considered impossible. The brain will die after approximately six minutes without oxygen at normal body temperature, but hypothermia of the central nervous system may prolong this.

The extent of central nervous system injury to a large extent determines the survival and long term consequences of drowning, In the case of children, most survivors are found within 2 minutes of immersion, and most fatalities are found after 10 minutes or more.

Water Aspiration
If water enters the airways of a conscious person, the person will try to cough up the water or swallow it, often inhaling more water involuntarily. When water enters the larynx or trachea, both conscious and unconscious persons experience laryngospasm, in which the vocal cords constrict, sealing the airway. This prevents water from entering the lungs. Because of this laryngospasm, in the initial phase of drowning, water generally enters the stomach and very little water enters the lungs. Though laryngospasm prevents water from entering the lungs, it also interferes with breathing. In most persons, the laryngospasm relaxes some time after unconsciousness and water can then enter the lungs causing a "wet drowning". However, about 7–10% of people maintain this seal until cardiac arrest. This has been called "dry drowning", as no water enters the lungs. In forensic pathology, water in the lungs indicates that the person was still alive at the point of submersion. Absence of water in the lungs may be either a dry drowning or indicates a death before submersion.

Aspirated water that reaches the alveoli destroys the pulmonary surfactant, which causes pulmonary oedema and decreased lung compliance which compromises oxygenation in affected parts of the lungs. This is associated with metabolic acidosis, and secondary fluid and electrolyte shifts. During alveolar fluid exchange, diatoms present in the water may pass through the alveolar wall into the capillaries to be carried to internal organs. Presence of these diatoms may be diagnostic of drowning.

Of people who have survived drowning, almost one third will experience complications such as acute lung injury (ALI) or acute respiratory distress syndrome (ARDS). ALI/ARDS can be triggered by pneumonia, sepsis and water aspiration and are life-threatening disorders that can result in death if not treated promptly. During drowning, aspirated water enters the lung tissues, causes a reduction in alveolar surfactant, obstructs ventilation and triggers a release of inflammatory mediators which ultimately results in hypoxia.

Specifically, upon reaching the alveoli, hypotonic liquid found in fresh water dilutes pulmonary surfactant, destroying the substance. Comparatively, aspiration of hypertonic seawater draws liquid from the plasma into the alveoli and similarly causes damage to surfactant by disrupting the alveolar-capillary membrane. Still, there is no clinical difference between salt and freshwater drowning. Once someone has reached definitive care, supportive care strategies such as mechanical ventilation can help to reduce the complications of ALI/ARDS.

Whether a person drowns in fresh water versus salt water makes no difference in the respiratory management or the outcome of the person. People who drown in fresh water may experience worse hypoxemia early in their treatment, however, this initial difference is short-lived and the management of both fresh water and salt water drowning is essentially the same.

Cold Water Immersion
Submerging the face in water cooler than about 21°C (70°F) triggers the diving reflex, common to air-breathing vertebrates, especially marine mammals such as whales and seals. This reflex protects the body by putting it into energy saving mode to maximize the time it can stay under water. The strength of this reflex is greater in colder water and has three principal effects:

● Bradycardia, a slowing of the heart rate by up to 50% in humans.
● Peripheral vasoconstriction, the restriction of the blood flow to the extremities to increase the blood and oxygen supply to the vital organs, especially the brain.
● Blood Shift, the shifting of blood to the thoracic cavity, the region of the chest between the diaphragm and the neck, to avoid the collapse of the lungs under higher pressure during deeper dives.

The reflex action is automatic and allows both a conscious and an unconscious person to survive longer without oxygen under water than in a comparable situation on dry land. The exact mechanism for this effect has been debated and may be a result of brain cooling similar to the protective effects seen in people who are treated with deep hypothermia.

The actual cause of death in cold or very cold water is usually lethal bodily reactions to increased heat loss and to freezing water, rather than any loss of core body temperature. Of those who die after plunging into freezing seas, around 20% die within 2 minutes from cold shock (uncontrolled rapid breathing and gasping causing water inhalation, massive increase in blood pressure and cardiac strain leading to cardiac arrest, and panic), another 50% die within 15 – 30 minutes from cold incapacitation (loss of use and control of limbs and hands for swimming or gripping, as the body 'protectively' shuts down the peripheral muscles of the limbs to protect its core), and exhaustion and unconsciousness cause drowning, claiming the rest within a similar time. A notable example of this occurred during the sinking of the Titanic, in which most people who entered the −2 °C (28 °F) water died within 15–30 minutes.

Submersion into cold water can induce cardiac arrhythmias (abnormal heart rates) in healthy people, sometimes causing strong swimmers to drown. The physiological effects caused by the diving reflex conflict with the body's cold shock response, which includes a gasp and uncontrollable hyperventilation leading to aspiration of water. While breath-holding triggers a slower heart rate, cold shock activates tachycardia, an increase in heart rate. It is thought that this conflict of these nervous system responses may account for the arrhythmias of cold water submersion.

Heat transfers very well into water, and body heat is therefore lost extremely quickly in water compared to air, even in merely 'cool' swimming waters around 70F (~20C). A water temperature of 10 °C (50 °F) can lead to death in as little as one hour, and water temperatures hovering at freezing can lead to death in as little as 15 minutes. This is because cold water can have other lethal effects on the body, so hypothermia is not usually a reason for drowning or the clinical cause of death for those who drown in cold water.

Upon submersion into cold water, remaining calm and preventing loss of body heat is paramount. While awaiting rescue, swimming or treading water should be limited to conserve energy and the person should attempt to remove as much of the body from the water as possible; attaching oneself to a buoyant object can improve the chance of survival should unconsciousness occur.

Hypothermia (and also cardiac arrest) present a risk for survivors of immersion, as for survivors of exposure; in particular the risk increases if the survivor, feeling well again, tries to get up and move, not realizing their core body temperature is still very low and will take a long time to recover.

Most people who experience cold-water drowning do not develop hypothermia quickly enough to decrease cerebral metabolism before ischemia and irreversible hypoxia occur. The neuroprotective effects appear to require water temperatures below about 5 °C.

Diagnosis

Drowning can be considered as going through four stages:
1. Breath-hold under voluntary control until the urge to breathe due to hypercapnia becomes overwhelming
2. Fluid is aspirated into the airways and/or swallowed
3. Cerebral anoxia stops breathing and aspiration
4. Cerebral injury due to anoxia becomes irreversible

Generally, in the early stages of drowning a person holds their breath to prevent water from entering their lungs. When this is no longer possible a small amount of water entering the trachea causes a muscular spasm that seals the airway and prevents further passage of water. If the process is not interrupted, loss of consciousness due to hypoxia is followed rapidly by cardiac arrest.

Experts differentiate between distress and drowning.
- Distress – people in trouble, but who still have the ability to keep afloat, signal for help and take actions.
- Drowning – people suffocating and in imminent danger of death within seconds.

Prevention

It is estimated that more than 85% of drownings could be prevented by supervision, training in water skills, normatives, technology, and public education.

Surveillance of the Swimmers	Watching the swimmers is a basic task, especially in the case of children. More than 500 children die from drowning each day. Young children must be supervised, regardless of if they can already swim. The danger increases when they are alone. A baby can drown in the bathtub, in the toilet, and even in a small bucket filled with less than an inch of water. It only takes around 2 minutes underwater for an adult to lose consciousness, and only between 30 seconds and 2 minutes for a small child to die. Choosing supervised swimming places is safer. Many pools and bathing areas either have lifeguards or a pool safety camera system for local or remote monitoring. Some others have a computer-aided drowning detection. However, normal bystanders can also play an important role in drowning detection, and in performing an intervention or notification to lifeguards or any other authority by any method (phone, alarm, etc.) Lifeguards may be unaware of a drowning due to "the intrusion of non-lifeguard duties upon lifeguards' primary task: preventive lifeguarding" and because of "the distraction from surveillance duties". For example, they could be diverted by using the mobile phone for leisure purposes upon the watching operations. About the alarms in pools, evidence shows that they are poor for any utility. The World Health Organization recommends to analyze what are the most crowded hours in the swimming zones, to increase the number of lifeguards at those moments (the more people is swimming, the more work is distributed to each lifeguard.)
Learning to Swim	Being able to swim is one of the best defenses against drowning. The studies recommend that children learn to swim when they are between 1 and 4 years old, but in a safe environment and being supervised. Learning to swim is also possible in adults, equally taking the classes in a safe environment and under supervision. After being able to swim, it's still possible to drown (because of the state of the water and other circumstances), so it is recommended to choose swimming places that are safe and kept under surveillance.
Additional Education	The WHO recommends to train the general public in first-aid for the drowned, cardiopulmonar resuscitation (CPR), and to behave in a safe manner when being in the water. In addition, it is convenient to give some advices to the minors so they avoid drowning. If they can not swim, it is recommended to teach them to keep themselves away from deep waters.
Fencing the Pools	Every swimming pool, private or public, should be fenced and enclosed, on every side, so no child nor any other person can access inside. The "Raffarin law", applied in France in 2003, that forced to fence any pool, reduced the drowning of children by 75%. It is also convenient to check that there are no objects left on the surface of the pools, so children don't approach attracted by them.
Absorbed by Pool Drains	Swimming pools usually have drainage systems to absorb and beam the water. If they work badly, they can drain to the swimmers themselves, causing injuries or even trapping their hair or any extremity, which could lead to immobilize and drown them. To avoid it, drainage holes and sumps are covered with grates and lids (according to the case), and, besides, they must suction with not too much strength. This require to make a good installation of the pool, and to check it, and to review it periodically. It is also recommended that the pool has many drainage holes, small and spaced, instead of only a big one, but the most important factor is that the system work well.
Caution in Problematic Diseases	Some illnesses require prudence when water is near. Epilepsy and all seizure disorders are problematic to swim, dive and bathe because of the possibility of drowning during a convulsion. Moreover, drowning is the most common cause of unintentional death for the people which suffers from that sort of diseases. For the epileptics, it is recommended to take showers rather than using a bath tub for bathing.
Alcohol or Drugs	Alcohol and drugs increase the probability of drowning. This danger is greater in the bars located near the water, in the parties of boat-clubs, etc.
Use of Lifejacket	The children that can not swim, the disabled, an other people in risk of drowning, would have to wear a fastened lifejacket when they are in the water, and even near the water. There exist some other floating devices (inflatable inner tubes, arm floaties -water wings-, foam tubes, etc.) which can be more or less useful (depending of how is each one of them); however they are not considerated safety instruments by the institutions, but "toys". The instrument that is considerated safe to float on water is the lifejacket, when is homologated and well fastened around the body. Besides, there are some other flotation instruments that are considerated safe: the professional circle-shaped lifebuoy (hoop-buoy, ring-buoy, life-ring, life-donut, lifesaver or lifepreserver), which is mainly designed to be thrown, and some other professional variants that are designed to be used by lifeguards in their rescues.
Keeping Calm in Water	This is to avoid getting tired, because it difficults swimming. Exhaustion can appear because of the anxious movements motivated by fear during drowning. In other sense, a bad calculation of the own physical capabilities can leave oneself exhausted before reaching the water's edge. Lowering the rhythm helps to reduce exhaustion. In case of suffering a tug, cramp or contracture (muscle spasm), it is useful to keep calm and swimming towards the shore, asking for help if necessary. If oneself is stung by a jellyfish, it is possible to get out of the water without major problems even with some itching or pain. When a problem makes swimming more difficult, it is possible to float by laying on the own back (in a completely horizontal position face up), because that position allows to float without effort.
Not to Jump into Water before Knowing the Depth	It is convenient to know if there are, or could be, rocks that stand out too much. Headfirst jumps cause more than 70% of all spinal injuries related to sports and recreational activities. A fall from a great height on shallow water (in a swimming pool or in the sea) can cause a serious impact against the bottom. This could kill the person immediately, or later, in case of suffering a brain or body injury followed by drowning. If the person does not die, the injury could cause a permanent paralysis.
Avoid Dangerous Waters	Avoid swimming in turbulent waters, with very large waves, with dangerous animals, and in those that are too cold. Also avoid dragging currents. These currents may have any characteristic that allows to recognize them, such as being more turbulent, more foamy, dragging things or debris, etc. In case of being caught by one of these currents, swim out from it (it is possible to move out gradually, in a diagonal direction until arriving to the shore).

Navigating Safely	Many people who die by drowning die in navigation accidents. A safe navigation includes being informed of the state of the sea, and equipping the boat with regulatory instruments to keep people afloat. These instruments are lifejackets (see above) and professional lifebuoys with the shape of a circle (ring-buoy, hoop-buoy, life-ring, life-donut, lifesaver or lifepreserver).
Use the "Buddy System"	It consists in not to swim alone, but near a buddy, who can help in case of any problem.
Heed the Rules	Most people who drown did not follow the safety normatives. It is important to pay attention to the banners, the flags that indicate if swimming is possible and the indications of the authorities (lifeguards, coastguards, etc.).

Treatment

Rescue

Many people who are drowning manage to save themselves, or are assisted by bystanders or professional rescuers. Less than 6% of people rescued by lifeguards need medical attention, and only 0.5% need CPR. The statistics are not as good for rescue by bystanders, but even there, a minority require CPR.

When a drowning occurs, or a swimmer becomes missing, bystanders should immediately call for help. A lifeguard should be called, if present. If not, emergency medical services and paramedics should be contacted as soon as possible. Rescue, and where necessary, resuscitation, should be started as early as possible. So the person should be taken out of the water as soon as possible.

Rescuers should avoid endangering themselves unnecessarily and, when possible, should assist from a safe position (such as a boat or the shore). This assistance usually consists in throwing with precision a flotation instrument (as a hoop-shaped lifebuoy). In other cases, the manner to help could be by holding out an object (as a rope or pole, even the own arm. etc.) towards the person, but, doing this, the rescuer's body should be laying down, well secured to the ground, to avoid falling to the water too.

In a direct swimming rescue, the initial grasp is important and must be well managed by the rescuer. If something goes wrong, it could happen that an anxious drowning person clings to the rescuer to stand out of the water, submerging the rescuer in the process. To avoid this, it is recommended that the rescuer approaches to the panicking person with a buoyant object, or offering one hand, or even from behind and bending the person's arm against the back to restrict movement.

Anyway, if the person pushes the rescuer towards below the water, the rescuer can usually escape diving downwards (because people who are unable to swim tend to move up, searching the water surface). After escaping in that manner, it is possible to come back and try a new approach to the drowning person. When the rescuer accomplishes a successful approach, the negatively buoyant objects (used in diving, such the weight belt) should be removed. Next, the priority is to transport the person to the water's edge using a tow maneuver. The rescuer usually approaches to the drowning person from behind, and then the person's body is turned face up, and grasped with a secure grip.

There are many grips that can be used, but it is common that they grasp the person around the jaw area. The person's mouth and nose must be kept above the water surface. If the person is cooperative, the towing may be in a similar fashion held at the armpits. Unconscious people may be pulled in another similar fashion held at the chin and cheeks, and ensuring that the mouth and nose are well kept above the water. Special care has to be taken for people with suspected spinal injuries, they can require a more specific grip, and a back board (spinal board) may be needed for their rescue.

In unconscious people, an in-water resuscitation could increase the chances of survival by a factor of about three, but this procedure require both medical and swimming skills, and only the breaths of the rescue ventilation are practicable in the water. Chest compressions require a suitable platform, so in-water assessment of circulation is pointless. If the person does not respond after a few breaths, cardiac arrest may be assumed, and getting them out of the water becomes the priority.

First Aid

The checks for responsiveness and breathing are carried out with the person horizontally supine. If unconscious but breathing, the recovery position is appropriate.

If not breathing, rescue ventilation is necessary. Drowning can produce a gasping pattern of apnea while the heart is still beating, and ventilation alone may be sufficient. The airway-breathing-circulation (ABC) sequence should be followed, rather than starting with compressions as is typical in cardiac arrest, because the basic problem is lack of oxygen.

Five initial breaths are recommended, as the initial ventilation may be difficult because of water in the airways which can interfere with effective alveolar inflation. Thereafter a continual sequence of 2 breaths and 30 chest compressions is recommended. This alternance is repeated until vital signs are re-established, the rescuers are unable to continue, or advanced life support is available. For babies (very small sized infants), the procedure is slightly modified. In the rescue breaths, the rescuer's mouth covers the baby's mouth and nose at the same time (because a baby's face is too small). Besides, the chest compressions are applied pressing with only with two fingers (due to the body of the babies is more fragile) on the chest bone (approximately on the lower part).

Attempts to actively expel water from the airway by abdominal thrusts, Heimlich maneuver or positioning head downwards should be avoided as there is no obstruction by solids, and they delay the start of ventilation and increase the risk of vomiting, with a significantly increased risk of death, as aspiration of stomach contents is a common complication of resuscitation efforts.

Treatment for hypothermia may also be necessary. However, in those who are unconscious, it is recommended their temperature not be increased above 34 degrees C. Because of the diving reflex, people submerged in cold water and apparently drowned may revive after a relatively long period of immersion. Rescuers retrieving a child from water significantly below body temperature should attempt resuscitation even after protracted immersion.

Medical Care

People with a near-drowning experience who have normal oxygen levels and no respiratory symptoms should be observed in a hospital environment for a period of time to ensure there are no delayed complications. The target of ventilation is to achieve 92% to 96% arterial saturation and adequate chest rise. Positive end-expiratory pressure will generally improve oxygenation. Drug administration via peripheral veins is preferred over endotracheal administration. Hypotension remaining after oxygenation may be treated by rapid crystalloid infusion. Cardiac arrest in drowning usually presents as asystole or pulseless electrical activity. Ventricular fibrillation is more likely to be associated with complications of pre-existing coronary artery disease, severe hypothermia, or the use of epinephrine or norepinephrine.

While surfactant may be used no high quality evidence exist that looks at this practice. Extracorporeal membrane oxygenation may be used in those who cannot be oxygenated otherwise. Steroids are not recommended.

Prognosis

People who have drowned who arrive at a hospital with spontaneous circulation and breathing usually recover with good outcomes. Early provision of basic and advanced life support improve probability of positive outcome. Longer duration of submersion is associated with lower probability of survival and higher probability of permanent neurological damage. Contaminants in the water can cause bronchospasm and impaired gas exchange, and can cause secondary infection with delayed severe respiratory compromise.

Low water temperature can cause ventricular fibrillation, but hypothermia during immersion can also slow the metabolism, allowing a longer hypoxia before severe damage occurs. Hypothermia which reduces brain temperature significantly can improve outcome. A reduction of brain temperature by 10 °C decreases ATP consumption by approximately 50%, which can double the time that the brain can survive.

The younger the person, the better the chances of survival. In one case, a child submerged in cold (37 °F (3 °C)) water for 66 minutes was resuscitated without apparent neurological damage. However, over the long term significant deficits were noted, including a range of cognitive difficulties, particularly general memory impairment, although recent magnetic resonance imaging (MRI) and magnetoencephalography (MEG) were within normal range.

3 Choking

Choking is a life-threatening medical emergency characterized by the blockage of air passage into the lungs secondary to the inhalation or ingestion of food or another object. Choking is caused by a mechanical obstruction of the airway that prevents normal breathing.

Signs & Symptoms

Causes

Choking is often caused by an object from outside the body, also called a foreign body, blocking the airway. The object can block the upper or lower airway passages. The airway obstruction is usually partial, but can also be complete.

Among children, the most common causes of choking are food, coins, toys, and balloons. In one study, peanuts were the most common object found in the airway of children evaluated for suspected foreign body aspiration. Foods that pose a high risk of choking include hot dogs, hard candy, nuts, seeds, whole grapes, raw carrots, apples, popcorn, peanut butter, marshmallows, chewing gum, and sausages. The most common cause of choking death in children is latex balloons. Small, round non-food objects such as balls, marbles, toys, and toy parts are also associated with a high risk of choking death because of their potential to completely block a child's airway.

Children younger than age three are especially at risk of choking because they explore their environment by putting objects in their mouth. Also, young children are still developing the ability to chew food completely. Molar teeth, which come in around 1.5 years of age, are necessary for grinding food. Even after molar teeth are present, children continue developing the ability to chew food completely and swallow throughout early childhood. In addition, a child's airway is smaller in diameter than an adult's airway, which means that smaller objects can cause an airway obstruction in children. Infants and young children generate a less forceful cough than adults, so coughing may not be as effective in relieving an airway obstruction. Finally, children with neuromuscular disorders, developmental delay, traumatic brain injury, and other conditions that affect swallowing are at an increased risk of choking.

In adults, choking often involves food blocking the airway. Risk factors include using alcohol or sedatives, undergoing a procedure involving the oral cavity or pharynx, wearing oral appliances, or having a medical condition that causes difficulty swallowing or impairs the cough reflex. Conditions that can cause difficulty swallowing and/or impaired coughing include neurological conditions such as strokes, Alzheimer's disease, or Parkinson's disease. In older adults, risk factors also include living alone, wearing dentures, and having difficulty swallowing.

Children and adults with neurological, cognitive, or psychiatric disorders may experience a delay in diagnosis because there may not be a known history of a foreign body entering the airway.

Prevention

In choking, the time to react is quite short, and the worst cases are deadly. For these reasons, it is convenient to prevent it, so it does not even happen.

Basic Prevention
Choking typically happens when swallowing too large or too abundant mouthfuls that are badly chewed. This risk disappears when one obtains the discipline to split the food in pieces of moderated size, and to chew them completely, not swallowing them before. If a food can be chewed, it must be chewed, whatever it is, even if it is very soft or gelatinous, such as spreads and soft desserts. Eating in handfuls (it can happen with foods as popcorn, different peeled nuts, etc.), requires to chew with more control than normal, and not exceeding in the amounts that enter into the mouth. Having at hand some liquid to drink is useful to help to finish swallowing (before the choking has happened).To swallow well, it is recommended that the neck is in a normal position, straight for the eater's body, with the head looking forward, being seated or standing up (not lying or too reclined).

Dangerous Foods
The foods that produce the most complicated choking are those whose shape adapts to the shape of the pharynx or trachea: hot dogs and sausages, bananas, food in blocks, etc. It is easier to choke on foods that dry the mouth (overcooked meat, sponge cake, cold pizza, etc.), which require the help of drinking liquid, or to be accompanied of purees or sauces. It is also easier to choke on foods that are tough (meat of octopus or cuttlefish, major size animals, some reptiles, etc.), they may need to be eaten together with something that helps the teeth to grind them (as loaf bread), or any concrete way to be prepared or cooked.

Groups of Risk
Some population groups have a higher choking risk, as: the elderly, the children, the disabled (physically or mentally), people under the effects of alcohol or drugs, people who have taken medications that seriously reduce the ability to salivate or react, patients with difficulties to swallow (dysphagia), suicidal people, epileptics, people on the autism spectrum, individuals with disorders such as pica that lead them to consume inedible objects, etc. They may require more assistance to feed themselves and it may be necessary to supervise them while they eat. If they are unable to chew properly, their food can not be hard nor tough. If they have difficulty eating normally, it is not recommended to give them food that may cause issues, or to separate it into very small pieces. In cases where a person is unable to safely eat, food can be supplied by feeding syringes that pour a liquid content into the patient's mouth. If the problem is that they have taken any medication or substance that reduces saliva, they cannot eat solid food until their salivation is restored.

Prevention in Babies and Children
All little children require care in eating. They must learn to chew their food completely to avoid choking. Feeding them while they do another activity (when they run, play, laugh, etc.) increases the risk of choking. Caregivers can supervise children while eating or playing. Providers such as pediatricians and dentists can provide information to parents and caregivers about what food and toys are appropriate by age to prevent choking. The American Academy of Pediatricians recommends waiting until 6 months of age before introducing solid foods to infants. Caregivers can avoid giving children, when they are younger than 5 years-old, foods that pose a high risk of choking such as hot dog pieces, bananas, cheese sticks, cheese chunks, hard candy, nuts, grapes, marshmallows or popcorn. Later, when they are accustomed to these foods, it is normal to give them split into small pieces. For example: if they are going to eat hot dogs, it is possible to split the sausage lengthwise, sliced, or both. And the same in the case of bananas, grapes, grains, etc. Parents, teachers, child care providers and other caregivers for children are advised to be trained in choking first-aid and cardiopulmonary resuscitation (CPR).

Children can put small objects into their mouths (deflated balloons, marbles, small pieces, buttons, coins, button batteries, etc.), which could lead to the child swallowing or choking on them. When babies choke on deflated balloons or plastic bags (as the sacks for wrapping the dirty diapers, the nappy sacks, which are a sort of bag sometimes dangerously placed near the babies), it produces a complicated obstruction that would require it to be directly removed with the fingers, if it is visible. To prevent children from swallowing things, it is needed to take precautions on their environment by placing dangerous objects out of their reach. Besides, they must be supervised, paying enough attention to what they do. It is necessary to teach the children to avoid putting things into their mouths. They may try to eat small pieces of toys. Toys and games may indicate on their packages the ages for which they are safe. In the US, manufacturers of children's toys and products are required by law to apply appropriate warning labels to their packaging. However, toys that are resold may not be marked with warning labels. Caregivers can try to prevent choking by considering the features of a toy (such as size, shape, consistency, small parts) before giving it to a child. Children's products that are found to pose a choking risk can be taken off the market.

Treatment

Choking is treated with a number of different procedures, which form the airway management. This consist in basic techniques available for first aiders and more advanced techniques available for health professionals.

Basic Treatment (First-Aid)
Basic treatment of choking includes a number of non-invasive techniques to help remove foreign bodies from the airways. Most modern protocols, including those of the American Heart Association and the American Red Cross, recommend several stages, designed to apply increasingly more pressure. For the conscious choking victim, most protocols recommend encouraging the victim to cough, followed by hard back slaps and, if none of these things work, abdominal thrusts (Heimlich maneuver) or chest thrusts. Once the choking victims loses consciousness, initiating CPR is recommended.

Cough
If the choking individual is conscious and coughing, the American Red Cross recommends encouraging the individual to stay calm and continue coughing freely, and it may be easier to take air through the nose to refill the lungs. If the person choking is unable to cough or if coughing is not effective, the American Red Cross recommends to move onto other methods, detailed below.

Back Blows (Back Slaps)
Many associations, as the American Red Cross and the Mayo Clinic, recommend the use of back blows (back slaps) to aid in the rescue of choking victims. This technique starts by bending the choking victim forward as much as possible, even trying to place his head lower than the chest, to avoid the risk of the slaps could drive the object deeper into the person's throat. The bending is in the back, the neck should not be excessively bent. Back blows are performed by delivering forceful slaps with the heel of the hand on the victim's back, between the shoulder blades.

The back slaps push behind the blockage, being able to dislodge the foreign object. In some cases, the physical vibration of the action may cause enough movement of the object to assist the patient in clearing the airway.

Abdominal Thrusts (Heimlich Maneuver)
Abdominal thrusts are performed with the rescuer standing behind the choking victim. The rescuer closes his skillful hand, grasps it with the other hand, and presses forcefully inwards and upwards with both of them on the area located between the chest and the belly button of the victim. The pressure is not focused directly against the ribs, to avoid breaking any of them. If the first thrust doesn't solve the choking, it can be repeated several times. Usage of abdominal thrusts is not recommended in infants under 1 year of age due to risk of causing injury; there exist adapted techniques for them (see more further below). Abdominal thrusts should not be used, either, when the patient's abdomen presents problems to receive them, like pregnancy or excessive size; then chest thrusts are advised (see further below).

The purpose of abdominal thrusts is to create a pressure capable to expel the object lodged upwards in the airway, relieving the obstruction. This method was discovered by Dr. Henry Heimlich in 1974, so it is referred to as "The Heimlich Maneuver." Dr. Henry Heimlich claimed that his maneuver was better than the back blows, arguing that back blows could cause the obstruction to become more deeply lodged in the victim's airway. That claim started a debate into the medical community, that ended up with the recommendation of alternating both techniques, but making the patient to bend the back before receiving the slaps. So the Heimlich Maneuver itself uses only abdominal thrusts, but is also part of anti-choking protocols that include the back blows (back slaps) technique.

Chest Thrusts
When abdominal thrusts can not be performed on the victim (in case of pregnant or too obese victims, and others) chest thrusts are advised instead. Chest thrusts are performed with the rescuer standing behind the choking victim. The rescuer closes his skillful hand and grasp it with the other hand. This can produce several kinds of fists, but any of them can be valid if it can be placed on the chest of the victim without sinking there a knuckle too painfully. Keeping the fist with both hands, the rescuer uses it to press forcefully inwards on the lower half of the chest bone (approximately), but not in the very endpoint (which is the xiphoid process). It can be noted, as a general reference, that, when the victim is a woman, the zone of pressure of the chest thrusts would be normally upper than the level of the breasts. The pressure is not focused against the xiphoid process, to avoid breaking it. If the first thrust doesn't solve the choking, it can be repeated several times.

"**Five and Five" Strategy**
The American Red Cross recommends a protocol of alternating five back blows and five abdominal thrusts for conscious choking victims until the object blocking the airway is dislodged. For pregnant or too obese victims, the protocol is the same, but chest thrusts are advised instead of the abdominal ones. If the victim becomes unconscious, basic CPR is recommended. Anyway, it's convenient to make someone call to emergency medical services before it happens.

The Red Cross does not specifically refer to its choking victim protocol as the "Five and Five Technique", and it differs from the Heimlich Maneuver since it includes administering back blows to the victim, contrary to Dr. Heimlich's procedure which specifically omitted back blows and was based only on his technique.

Anti-choking Devices
During the 2010-2020 decade, some effective anti-choking devices have been developed and released to the market. They have superseded primitive inventions appeared during the 20th century. The current anti-choking devices have some advantages compared with manual techniques. The usage of these devices is always quite easy. They can be especially useful in difficult cases, like disabled patients, elderly people, unconscious victims or when the victim is oneself. Also, they can be helpful in public places and crowded events. And, finally, they achieve levels of pressure in suction that can not be matched by manual methods. In the worst choking cases, no manual technique would dislodge the foreign object, being necessary the usage of one of these devices or a sort of surgery. That's why physicians recommend to put some care in eating.

The design of these devices is based in a vacuum mechanical effect, with no need of batteries or electric current. They usually present an attached mask, in order to make a vacuum from the patient's nose and mouth. The current models of anti-choking devices are quite similar: a direct plunger tool (LifeVac), or a vacuum syringe (backward syringe) that keeps the tongue in place by inserting a tube in the mouth (Dechoker). Both have received certifications and have been proven effective in many real cases reported by the media. Some other mechanical models are in development, this is the case of Lifewand (now being released to market), which makes the vacuum by direct pressure against patient's face, and the prototype of Dr. De Luca (now seeking funds), which uses a button. The challenges for the future of the anti-choking inventions are just to improve their portability reducing more their size and to develop a device that specifically works in babies (despite all the previous ones have any model for little children).

Unconscious Victims
When a choking victim becomes unconscious, it's mandatory to call to emergency medical services if this has not been done yet. For the rest, an unconscious choking victim should receive a first-aid treatment that is similar to the case of any other non-breathing patient: a cardiopulmonary resuscitation (CPR), alternating series of around 30 compressions (on the lower half of the chest bone) with series of 2 rescue breaths (pinching the victim's nose and puffing air inside of the mouth; it's also possible to tilt the victim's head up or down and give 2 additional breaths, so the air could find an entrance through the blockage).

The difference between CPR in choking victims and a normal CPR is that CPR in choking victims includes an attempt to remove the obstructing object (mainly using finger sweeping when the object is already visible) at the end of each compressions serie. The chest compressions of cardiopulmonary resuscitation (CPR) produce coincidentally the same anti-choking effect than the chest thrusts technique, so the CPR itself could expel the object. If the object is expelled and followingly removed, CPR must continue until the victim recovers breathing. Babies (infants under 1 year old) require a special adaptation of the procedure (described further below).

An anti-choking device can unblock the airway on unconscious victims, but not necessarily can take the obstructing object out of the mouth (it may need a manual removal). Anyway, the victim will require cardiopulmonary resuscitation (CPR) after that, as it has been described above, but only alternating the 30 compressions and the 2 rescue breaths.

The Finger Sweeping in Unconscious Victims
In unconscious victims of choking, the American Medical Association advocates sweeping the fingers across the back of the throat to attempt to dislodge airway obstructions. However, many modern protocols recommend against the use of the finger sweep. Red Cross procedures specifically direct rescuers not to perform a finger sweep unless an object can be clearly seen in the victim's mouth due to the risk of driving the obstruction deeper into the victim's airway. Other protocols suggest that if the patient is conscious they will be able to remove the foreign object themselves, or if they are unconscious, the rescuer should simply place them in the recovery position as this allows (to a certain extent) the drainage of fluids out of the mouth instead of down the trachea due to gravity. There is also a risk of causing further damage (for instance inducing vomiting) by using a finger sweep technique. There are no studies that have examined the usefulness of the finger sweep technique when there is no visible object in the airway. Recommendations for the use of the finger sweep have been based on anecdotal evidence.

Babies (under 1 year old)
For babies (infants under 1 year old), the American Heart Association recommends to perform cycles of back blows (5 back slaps) followed by chest thrusts (5 chest compressions, that are adapted).

In the back blows, it's recommended that, before applying them, the baby is slightly leaned upside-down, being supported by a forearm of the rescuer and its respective hand (the baby's head must be carefully held in this maneuver, usually from the jaw). To achieve this position, the rescuer can sit down on any seat with the baby, so the baby's body (supported by the forearm and hand of the rescuer) can be leaned along the rescuer's thighs. As an alternative to this (in case of the baby is too big or any other problem), the rescuer can sit on a bed or sofa, or even on the floor (when no seat is near), supporting on the lap the baby's body, to make the upside-down leaning from the lap, at the right or at the left. If the rescuer can not sit down, at least could try to do the maneuver low over a soft surface (to reduce a possible fall). In case of the previous options are not possible, but the rescuer is skillful enough, the rescuer can still kneel on a knee, and place the baby's body along the thigh that is higher (with the forearm still supporting between the thigh and the baby), so the baby can be leaned a bit moving forward that thigh. When the baby is already leaned (using any of the systems), the rescuer applies the slaps.

In the chest thrusts maneuver, the baby's body is placed laying. Then the rescuer does the compressions on the chest bone, pressing with only two fingers on its lower half (the nearer to the abdomen). Abdominal thrusts are not recommended in children less than 1 year, because they can cause liver damage. The cycles of 5 back blows and 5 chest compressions are alternated until the object comes out of the infant's airway or until the infant becomes unconscious.

If the infant becomes unconscious, the American Heart Association recommends starting a cardiopulmonary resuscitation (CPR), which must be adapted to babies. In that procedure, the baby is placed face up on a horizontal surface, with the head in straight position (tilting too much a baby's head backwards can close the access to the trachea). Then it must be applied an alternating cycle of 30 chest compressions (but modified: the rescuer presses with only two fingers in the lower part of the chest bone), and 2 rescue breaths (also modified: the rescuer's mouth puffs air covering the baby's mouth and nose at the same time). Between chest compressions and rescue breaths, the rescuer looks into the mouth searching if the obstructing object has come out (because of the effect of the compressions) and, if it is visible, attempts to extract it (mainly using a finger sweeping). If the object is extracted, the cardiopulmonary resuscitation continues until the baby's breath is successfully recovered or until medical services arrive.

Pregnant or Too Obese People
The American Heart Association recommends the chest thrusts rather than the abdominal thrusts for pregnant or too obese persons who are choking. Chest thrusts are performed in a similar way to the abdominal thrusts, but with the hands placed on the lower part of the choking victim's chest, at the lower half of the breast bone (sternum), rather than over the middle of the abdomen, as in the traditional abdominal thrusts. Strong inward thrusts are then applied. As a reference, in women, the zone of pressure of the chest thrusts (the lower half of sternum) would be normally upper than the level of the breasts. The chest thrusts can be alternated with back blows (back slaps), which are applied on the back of the victim when it is very bent forward.

Disabled People in Wheelchair
If the choking victim is a disabled person and is using a wheelchair, the first-aid procedure is quite similar than in the case of the other victims. The difference is in trying to apply the techniques directly, while the victim is still seated on the wheelchair.

The back blows (back slaps) can be used after bending forward the back of the victim very much, as much as possible. To perform the abdominal thrusts (Heimlich maneuver), the back of the victim must be bent too, and the rescuer has to get behind the wheelchair. Then, the rescuer can embrace the victim's abdomen from behind and up, leaning over the top of the wheelchair's backrest. If this is too difficult, the rescuer can get down to embrace the victim's abdomen and the wheelchair's backrest all together. The same can be tried from a side or in another way. Finally, the rescuer has to apply the sudden inward and upward pressures on the abdomen. It must be remembered that, if the victim can not receive abdominal thrusts (this is the case of the pregnant or too obese people), chest thrusts must be used instead. They are applied while the victim is in the wheelchair too, but making sudden inward pressures on the lower part of the chest bone against the wheelchair's backrest and the rescuer's body. If there are difficulties for this, the same maneuver can be tried from a side or in another way.

Due to the additional difficulties in helping to the disabled, it is convenient to avoid placing them in too narrow and encased spaces at the mealtimes. The opened spaces give an easier access to them for the rescuers. The presence of an anti-choking device at hand can be specially useful when a disabled person is near.

Self-Treatment
The Heimlich Maneuver (abdominal thrusts) can be performed or can be self-administered. Self-administration of this maneuver requires positioning of one's own abdomen over a chair, railing, or countertop and driving the abdomen upon the object with sharp, upward thrust. This serves as a substitute for thrusts made with the hands by another person. One study showed that these self-administered abdominal thrusts were just as effective as those performed by another person, although obese individuals were not included in the study. Alternatively, multiple sources of evidence suggest that one of promising approaches for self treatment during choking could be by applying the head-down (inverse) position.

On the other hand, using a modern anti-choking device is one the best, and most realistic, options for self-treatment in case of suffering a serious choking episode.

Advanced Treatment
There are many advanced medical treatments to relieve choking or airway obstruction. These include inspection of the airway with a laryngoscope or bronchoscope and removal of the object under direct vision. Severe cases where there is an inability to remove the object may require cricothyrotomy (emergency tracheostomy). Cricothyrotomy involves making an incision in a patient's neck and inserting a tube into the trachea in order to bypass the upper airways. The procedure is usually only performed when other methods have failed. In many cases, an emergency tracheostomy can save a patient's life, but if performed incorrectly, it may end the patient's life.

4 Barotrauma

Barotrauma is physical damage to body tissues caused by a difference in pressure between a gas space inside, or in contact with the body, and the surrounding gas or fluid.

Signs & Symptoms

Examples of organs or tissues easily damaged by barotrauma are:
- Middle ear (barotitis or aerotitis)
- Paranasal sinuses (causing aerosinusitis)
- Lungs
- Eyes (the under-pressure air space is inside the diving mask)
- Skin (when wearing a diving suit which creates an air space)
- Brain and cranium (temporal lobe injury secondary to temporal bone rupture)
- Teeth (causing Barodontalgia, i.e., barometric pressure related dental pain, or dental fractures)
- Genital (squeeze and associated complications of P-valve use)

Causes

Pressure Differences while Diving	When diving, the pressure differences which cause the barotrauma are changes in hydrostatic pressure: There are two components to the surrounding pressure acting on the diver: the atmospheric pressure and the water pressure. A descent of 10 metres (33 feet) in water increases the ambient pressure by an amount approximately equal to the pressure of the atmosphere at sea level. So, a descent from the surface to 10 metres (33 feet) underwater results in a doubling of the pressure on the diver. This pressure change will reduce the volume of a gas filled space by half. Boyle's law describes the relationship between the volume of the gas space and the pressure in the gas.

Barotraumas of descent are caused by preventing the free change of volume of the gas in a closed space in contact with the diver, resulting in a pressure difference between the tissues and the gas space, and the unbalanced force due to this pressure difference causes deformation of the tissues resulting in cell rupture. Barotraumas of ascent are also caused when the free change of volume of the gas in a closed space in contact with the diver is prevented. In this case the pressure difference causes a resultant tension in the surrounding tissues which exceeds their tensile strength. Besides tissue rupture, the overpressure may cause ingress of gases into the tissues and further afield through the circulatory system.

This pulmonary barotrauma (PBt) of ascent is also known as pulmonary over-inflation syndrome (POIS), lung over-pressure injury (LOP) and burst lung. Consequent injuries may include arterial gas embolism, pneumothorax, mediastinal, interstitial and subcutaneous emphysemas, not usually all at the same time.

Breathing gas at depth from underwater breathing apparatus results in the lungs containing gas at a higher pressure than atmospheric pressure. So a free-diver can dive to 10 metres (33 feet) and safely ascend without exhaling, because the gas in the lungs had been inhaled at atmospheric pressure, whereas a diver who inhales at 10 metres and ascends without exhaling has lungs containing twice the amount of gas at atmospheric pressure and is very likely to suffer life-threatening lung damage.

Explosive decompression of a hyperbaric environment can produce severe barotrauma, followed by severe decompression bubble formation and other related injury. The Byford Dolphin incident is an example.

Blast-Induced Barotrauma	An explosive blast and explosive decompression create a pressure wave that can induce barotrauma. The difference in pressure between internal organs and the outer surface of the body causes injuries to internal organs that contain gas, such as the lungs, gastrointestinal tract, and ear. Lung injuries can also occur during rapid decompression, although the risk of injury is lower than with explosive decompression.
Ventilator-Induced Barotrauma	Mechanical ventilation can lead to barotrauma of the lungs. This can be due to either: ● Absolute pressures used in order to ventilate non-compliant lungs. ● Shearing forces, particularly associated with rapid changes in gas velocity. The resultant alveolar rupture can lead to pneumothorax, pulmonary interstitial emphysema (PIE) and pneumomediastinum. Barotrauma is a recognised complication of mechanical ventilation that can occur in any patient receiving mechanical ventilation, but is most commonly associated with acute respiratory distress syndrome. It used to be the most common complication of mechanical ventilation but can usually be avoided by limiting tidal volume and plateau pressure to less than 30 to 50 cm water column (30 to 50 mb). As an indicator of transalveolar pressure, which predicts alveolar distention, plateau pressure or peak airway pressure (PAP) may be the most effective predictor of risk, but there is no generally accepted safe pressure at which there is no risk.

Risk also appears to be increased by aspiration of stomach contents and pre-existing disease such as necrotising pneumonia and chronic lung disease. Status asthmaticus is a particular problem as it requires relatively high pressures to overcome bronchial obstruction. When lung tissues are damaged by alveolar over-distension, the injury may be termed volutrauma, but volume and transpulmonary pressure are closely related. Ventilator induced lung injury is often associated with high tidal volumes (Vt).

Use of a Hyperbaric Chamber	Patients undergoing hyperbaric oxygen therapy must equalize their ears to avoid barotrauma. High risk of otic barotrauma is associated with unconscious patients.

Diagnosis

Ear Barotrauma	Barotrauma can affect the external, middle, or inner ear. Middle ear barotrauma (MEBT) is the most common being experienced by between 10% and 30% of divers and is due to insufficient equilibration of the middle ear. External ear barotrauma may occur on ascent if high pressure air is trapped in the external auditory canal either by tight fitting diving equipment or ear wax. Inner ear barotrauma (IEBT), though much less common than MEBT, shares a similar mechanism. Mechanical trauma to the inner ear can lead to varying degrees of conductive and sensorineural hearing loss as well as vertigo. It is also common for conditions affecting the inner ear to result in auditory hypersensitivity.
Barosinusitis	The sinuses similar to other air-filled cavities are susceptible to barotrauma if their openings become obstructed. This can result in pain as well as epistaxis (nosebleed).
Mask Squeeze	If a diver's mask is not equalized during descent the relative negative pressure can produce petechial hemorrhages in the area covered by the mask along with subconjunctival hemorrhages.
Helmet Squeeze	A problem mostly of historical interest, but still relevant to surface supplied divers who dive with the helmet sealed to the dry suit. If the air supply hose is ruptured near or above the surface, the pressure difference between the water around the diver and the air in the hose can be several bar. The non-return valve at the connection to the helmet will prevent backflow if it is working correctly, but if absent, as in the early days of helmet diving, or if it fails, the pressure difference will tend to squeeze the diver into the rigid helmet, which can result in severe trauma. The same effect can result from a large and rapid increase in depth if the air supply is insufficient to keep up with the increase in ambient pressure.

Pulmonary Barotrauma	Lung over-pressure injury in ambient pressure divers using underwater breathing apparatus is usually caused by breath-holding on ascent. The compressed gas in the lungs expands as the ambient pressure decreases causing the lungs to over-expand and rupture unless the diver allows the gas to escape by maintaining an open airway, as in normal breathing. The lungs do not sense pain when over-expanded giving the diver little warning to prevent the injury. This does not affect breath-hold divers as they bring a lungful of air with them from the surface, which merely re-expands safely to near its original volume on ascent. The problem only arises if a breath of ambient pressure gas is taken at depth, which may then expand on ascent to more than the lung volume. Pulmonary barotrauma may also be caused by explosive decompression of a pressurised aircraft.

Prevention

In Divers	Barotrauma may be caused when diving, either from being crushed, or squeezed, on descent or by stretching and bursting on ascent; both can be avoided by equalising the pressures. A negative, unbalanced pressure is known as a squeeze, crushing eardrums, dry suit, lungs or mask inwards and can be equalised by putting air into the squeezed space. A positive unbalanced pressure expands internal spaces rupturing tissue and can be equalised by letting air out, for example by exhaling. Both may cause barotrauma. There are a variety of techniques depending on the affected area and whether the pressure inequality is a squeeze or an expansion:

● Ears and sinuses: There is a risk of stretched or burst eardrums, usually crushed inwards during descent but sometimes stretched outwards on ascent. The diver can use a variety of methods to let air into or out of the middle ears via the Eustachian tubes. Sometimes swallowing will open the Eustachian tubes and equalise the ears.

● Lungs: There is a risk of pneumothorax, arterial gas embolism, and mediastinal and subcutanous emphysemas during ascent, which are commonly called burst lung or lung overpressure injury by divers. To equalise the lungs, all that is necessary is not to hold the breath during ascent. This risk does not occur when breath-hold diving from the surface, unless the diver breathes from an ambient pressure gas source underwater; breath-hold divers do suffer squeezed lungs on descent, crushing in the chest cavity, but, while uncomfortable, this rarely causes lung injury and returns to normal at the surface. Some people have pathologies of the lung which prevent rapid flow of excess air through the passages, which can lead to lung barotrauma even if the breath is not held during rapid depressurisation. These people should not dive as the risk is unacceptably high. Most commercial or military diving medical examinations will look specifically for signs of this pathology.

● Diving mask squeeze enclosing the eyes and nose: The main risk is rupture of the capillaries of the eyes and facial skin because of the negative pressure difference between the gas space and blood pressure, or orbital emphysema from higher pressures. This can be avoided by breathing air into the mask through the nose. Goggles covering only the eyes are not suitable for deep diving as they cannot be equalised.

● Dry suit squeeze. The main risk is skin getting pinched and bruised by folds of the dry suit when squeezed on descent. Most dry suits can be equalised against squeeze via a manually operated valve fed from a low pressure gas supply. Air must be manually injected during the descent to avoid squeeze and is manually or automatically vented on the ascent to maintain buoyancy control.

● Diving helmet squeeze: Helmet squeeze will occur if the gas supply hose is severed above the diver and the non-return valve at the helmet gas inlet fails or is not fitted. Severity will depend on the hydrostatic pressure difference. A very rapid descent, usually by accident, may exceed the rate at which the breathing gas supply can equalise the pressure causing a temporary squeeze. The introduction of the non-return valve and high maximum gas supply flow rates have all but eliminated both these risks. In helmets fitted with a neck dam, the dam will admit water into the helmet if the internal pressure gets too low; this is less of a problem than helmet squeeze but the diver may drown if the gas supply is not reinstated quickly. This form of barotrauma is avoidable by controlled descent rate, which is standard practice for commercial divers, who will use shotlines, diving stages and wet bells to control descent and ascent rates.

Professional divers are screened for risk factors during initial and periodical medical examination for fitness to dive. In most cases recreational divers are not medically screened, but are required to provide a medical statement before acceptance for training in which the most common and easy to identify risk factors must be declared. If these factors are declared, the diver may be required to be examined by a medical practitioner, and may be disqualified from diving if the conditions indicate.

Asthma, Marfan syndrome, and COPD pose a very high risk of pneumothorax. In some countries these may be considered absolute contraindications, while in others the severity may be taken into consideration. Asthmatics with a mild and well controlled condition may be permitted to dive under restricted circumstances.

A significant part of entry level diver training is focused on understanding the risks and procedural avoidance of barotrauma. Professional divers and recreational divers with rescue training are trained in the basic skills of recognizing and first aid management of diving barotrauma.

In Mechanical Ventilation	Isolated mechanical forces may not adequately explain ventilator induced lung injury (VILI). The damage is affected by the interaction of these forces and the pre-existing state of the lung tissues, and dynamic changes in alveolar structure may be involved. Factors such as plateau pressure and positive end-expiratory pressure (PEEP) alone do not adequately predict injury. Cyclic deformation of lung tissue may play a large part in the cause of VILI, and contributory factors probably include tidal volume, positive end-expiratory pressure and respiratory rate. There is no protocol guaranteed to avoid all risk in all applications.

Treatment

Treatment of diving barotrauma depends on the symptoms. Lung over-pressure injury may require a chest drain to remove air from the pleura or mediastinum. Recompression with hyperbaric oxygen therapy is the definitive treatment for arterial gas embolism, as the raised pressure reduces bubble size, low inert gas partial pressure accelerates inert gas solution and high oxygen partial pressure helps oxygenate tissues compromised by the emboli. Care must be taken when recompressing to avoid a tension pneumothorax. Barotraumas that do not involve gas in the tissues are generally treated according to severity and symptoms for similar trauma from other causes.

First Aid	Pre-hospital care for lung barotrauma includes basic life support of maintaining adequate oxygenation and perfusion, assessment of airway, breathing and circulation, neurological assessment, and managing any immediate life-threatening conditions. High-flow oxygen up to 100% is considered appropriate for diving accidents. Large-bore venous access with isotonic fluid infusion is recommended to maintain blood pressure and pulse.
Emergency Treatment	**Pulmonary Barotrauma:** ● Endotracheal intubation may be required if the airway is unstable or hypoxia persists when breathing 100% oxygen. ● Needle decompression or tube thoracostomy may be necessary to drain a pneumothorax or haemothorax ● Foley catheterization may be necessary for spinal cord AGE if the person is unable to urinate. ● Intravenous hydration may be required to maintain adequate blood pressure. ● Therapeutic recompression is indicated for severe AGE. The diving medical practitioner will need to know the vital signs and relevant symptoms, along with the recent pressure exposure and breathing gas history of the patient. Air transport should be below 1,000 feet (300 m) if possible, or in a pressurized aircraft which should be pressurised to as low an altitude as reasonably possible. Sinus squeeze and middle ear squeeze are generally treated with decongestants to reduce the pressure differential, with anti-inflammatory medications to treat the pain. For severe pain, narcotic analgesics may be appropriate. Suit, helmet and mask squeeze are treated as trauma according to symptoms and severity.
Medication	The primary medications for lung barotrauma are oxygen, oxygen-helium or nitrox, isotonic fluids, anti-inflammatory medications, decongestants, and analgesics.
Outcomes	Following barotrauma of the ears or lungs from diving the diver should not dive again until cleared by a diving doctor. After ear injury examination will include a hearing test and a demonstration that the middle ear can be autoinflated. Recovery can take weeks to months.

5 Compression Arthralgia

Compression arthralgia is pain in the joints caused by exposure to high ambient pressure at a relatively high rate of compression, experienced by underwater divers. Also referred to in the US Navy diving Manual as compression pains.

Signs & Symptoms

Compression arthralgia has been recorded as deep aching pain in the knees, shoulders, fingers, back, hips, neck and ribs. Pain may be sudden and intense in onset and may be accompanied by a feeling of roughness in the joints.

Onset commonly occurs around 60 msw (meters of sea water), and symptoms are variable depending on depth, compression rate and personal susceptibility. Intensity increases with depth and may be aggravated by exercise. Compression arthralgia is generally a problem of deep diving, particularly deep saturation diving, where at sufficient depth even slow compression may produce symptoms. Peter B. Bennett et al. showed that the use of trimix could reduce the symptoms.

Causes

Fast compression (descent) may produce symptoms as shallow as 30 msw. Saturation divers generally compress much more slowly, and symptoms are unlikely at less than around 90 msw. At depths beyond 180m even very slow compression may produce symptoms. Spontaneous improvement may occur over time at depth, but this is unpredictable, and pain may persist into decompression. They may be distinguished from decompression sickness as they are present before starting decompression, and resolve with decreasing pressure, the opposite of decompression sickness. The pain may be sufficiently severe to limit the diver's capacity for work, and may also limit travel rate and depth of downward excursions.

Prevention

A slow descent when diving.

Treatment

The symptoms generally resolve during decompression and require no further treatment.

6 Decompression Sickness

Decompression sickness (DCS; also known as divers' disease, the bends, aerobullosis, or caisson disease) describes a condition arising from dissolved gases coming out of solution into bubbles inside the body on depressurisation. DCS most commonly refers to problems arising from underwater diving decompression (i.e., during ascent), but may be experienced in other depressurisation events such as emerging from a caisson, flying in an unpressurised aircraft at altitude, and extravehicular activity from spacecraft. DCS and arterial gas embolism are collectively referred to as decompression illness.

Since bubbles can form in or migrate to any part of the body, DCS can produce many symptoms, and its effects may vary from joint pain and rashes to paralysis and death. Individual susceptibility can vary from day to day, and different individuals under the same conditions may be affected differently or not at all. The classification of types of DCS by its symptoms has evolved since its original description over a hundred years ago. The severity of symptoms varies from barely noticeable to rapidly fatal.

Risk of DCS caused by diving can be managed through proper decompression procedures and contracting it is now uncommon. Its potential severity has driven much research to prevent it and divers almost universally use dive tables or dive computers to limit their exposure and to control their ascent speed. If DCS is suspected, it is treated by hyperbaric oxygen therapy in a recompression chamber. Diagnosis is confirmed by a positive response to the treatment. If treated early, there is a significantly higher chance of successful recovery.

Signs & Symptoms

While bubbles can form anywhere in the body, DCS is most frequently observed in the shoulders, elbows, knees, and ankles. Joint pain ("the bends") accounts for about 60% to 70% of all altitude DCS cases, with the shoulder being the most common site for altitude and bounce diving, and the knees and hip joints for saturation and compressed air work. Neurological symptoms are present in 10% to 15% of DCS cases with headache and visual disturbances being the most common symptom. Skin manifestations are present in about 10% to 15% of cases. Pulmonary DCS ("the chokes") is very rare in divers and has been observed much less frequently in aviators since the introduction of oxygen pre-breathing protocols. The table below shows symptoms for different DCS types.

Signs and symptoms of decompression sickness:

DCS type	Bubble Location	Signs & Symptoms (clinical manifestations)
Musculoskeletal	Mostly large joints of the limbs (elbows, shoulders, hip, wrists, knees, ankles)	● Localized deep pain, ranging from mild to excruciating. Sometimes a dull ache, more rarely a sharp pain. ● Active and passive motion of the joint may aggravate the pain. ● The pain may be reduced by bending the joint to find a more comfortable position. ● If caused by altitude, pain can occur immediately or up to many hours later.
Cutaneous	Skin	● Itching, usually around the ears, face, neck, arms, and upper torso ● Sensation of tiny insects crawling over the skin (formication) ● Mottled or marbled skin usually around the shoulders, upper chest and abdomen, with itching (cutis marmorata) ● Swelling of the skin, accompanied by tiny scar-like skin depressions (pitting edema)
Neurologic	Brain	● Altered sensation, tingling or numbness (paresthesia), increased sensitivity (hyperesthesia) ● Confusion or memory loss (amnesia) ● Visual abnormalities ● Unexplained mood or behaviour changes ● Seizures, unconsciousness

Neurologic	Spinal cord	● Ascending weakness or paralysis in the legs ● Urinary incontinence and fecal incontinence ● Girdling (also referred to as girdle, banding, or tightening feeling) around the abdominal region and/or chest
Constitutional	Whole body	● Headache ● Unexplained fatigue ● Generalised malaise, poorly localised aches
Audiovestibular	Inner Ear	● Loss of balance ● Dizziness, vertigo, nausea, vomiting ● Hearing loss
Pulmonary	Lungs	● Dry persistent cough ● Burning chest pain under the sternum, aggravated by breathing ● Shortness of breath

Frequency
The relative frequencies of different symptoms of DCS observed by the U.S. Navy are as follows:

Symptoms - Frequency
- Local Joint Pain 89%
- Arm Symptoms 70%
- Leg Symptoms 30%
- Dizziness 5.3%
- Paralysis 2.3%
- Shortness of Breath 1.6%
- Extreme Fatigue 1.3%
- Collapse/Unconsciousness 0.5%

Onset
Although onset of DCS can occur rapidly after a dive, in more than half of all cases symptoms do not begin to appear for at least an hour. In extreme cases, symptoms may occur before the dive has been completed. The U.S. Navy and Technical Diving International, a leading technical diver training organization, have published a table that documents time to onset of first symptoms. The table does not differentiate between types of DCS, or types of symptom.

Onset of DCS symptoms
Time to onset - Percentage of cases
- within 1 hour 42%
- within 3 hours 60%
- within 8 hours 83%
- within 24 hours 98%
- within 48 hours 100%

Causes

DCS is caused by a reduction in ambient pressure that results in the formation of bubbles of inert gases within tissues of the body. It may happen when leaving a high-pressure environment, ascending from depth, or ascending to altitude.

Ascent from Depth

DCS is best known as a diving disorder that affects divers having breathed gas that is at a higher pressure than the surface pressure, owing to the pressure of the surrounding water. The risk of DCS increases when diving for extended periods or at greater depth, without ascending gradually and making the decompression stops needed to slowly reduce the excess pressure of inert gases dissolved in the body.

The specific risk factors are not well understood and some divers may be more susceptible than others under identical conditions. DCS has been confirmed in rare cases of breath-holding divers who have made a sequence of many deep dives with short surface intervals; and it may be the cause of the disease called taravana by South Pacific island natives who for centuries have dived by breath-holding for food and pearls.

Two principal factors control the risk of a diver suffering DCS:
1. The rate and duration of gas absorption under pressure – the deeper or longer the dive the more gas is absorbed into body tissue in higher concentrations than normal (Henry's Law);
2. The rate and duration of outgassing on depressurization – the faster the ascent and the shorter the interval between dives the less time there is for absorbed gas to be offloaded safely through the lungs, causing these gases to come out of solution and form "micro bubbles" in the blood. Even when the change in pressure causes no immediate symptoms, rapid pressure change can cause permanent bone injury called dysbaric osteonecrosis (DON). DON can develop from a single exposure to rapid decompression.

Leaving a high-Pressure Environment

When workers leave a pressurized caisson or a mine that has been pressurized to keep water out, they will experience a significant reduction in ambient pressure. A similar pressure reduction occurs when astronauts exit a space vehicle to perform a space-walk or extra-vehicular activity, where the pressure in their spacesuit is lower than the pressure in the vehicle.

The original name for DCS was "caisson disease". This term was introduced in the 19th century, when caissons under pressure were used to keep water from flooding large engineering excavations below the water table, such as bridge supports and tunnels. Workers spending time in high ambient pressure conditions are at risk when they return to the lower pressure outside the caisson if the pressure is not reduced slowly. DCS was a major factor during construction of Eads Bridge, when 15 workers died from what was then a mysterious illness, and later during construction of the Brooklyn Bridge, where it incapacitated the project leader Washington Roebling. On the other side of the Manhattan island during construction of the Hudson River Tunnel contractor's agent Ernest William Moir noted in 1889 that workers were dying due to decompression sickness and pioneered the use of an airlock chamber for treatment.

Ascent to Altitude

The most common health risk on ascent to altitude is not decompression sickness but altitude sickness, or acute mountain sickness (AMS), which has an entirely different and unrelated set of causes and symptoms. AMS results not from the formation of bubbles from dissolved gasses in the body but from exposure to a low partial pressure of oxygen and alkalosis. However, passengers in unpressurized aircraft at high altitude may also be at some risk of DCS. Altitude DCS became a problem in the 1930s with the development of high-altitude balloon and aircraft flights but not as great a problem as AMS, which drove the development of pressurized cabins, which coincidentally controlled DCS. Commercial aircraft are now required to maintain the cabin at or below a pressure altitude of 2,400 m (7,900 ft) even when flying above 12,000 m (39,000 ft). Symptoms of DCS in healthy individuals are subsequently very rare unless there is a loss of pressurization or the individual has been diving recently. Divers who drive up a mountain or fly shortly after diving are at particular risk even in a pressurized aircraft because the regulatory cabin altitude of 2,400 m (7,900 ft) represents only 73% of sea level pressure.

INJURY Air & Atmosphere Decompression Sickness Causes

Ascent to Altitude	Generally, the higher the altitude the greater the risk of altitude DCS but there is no specific, maximum, safe altitude below which it never occurs. There are very few symptoms at or below 5,500 m (18,000 ft) unless patients had predisposing medical conditions or had dived recently. There is a correlation between increased altitudes above 5,500 m (18,000 ft) and the frequency of altitude DCS but there is no direct relationship with the severity of the various types of DCS. A US Air Force study reports that there are few occurrences between 5,500 m (18,000 ft) and 7,500 m (24,600 ft) and 87% of incidents occurred at or above 7,500 m (24,600 ft). High altitude parachutists may reduce the risk of altitude DCS if they flush nitrogen from the body by pre-breathing pure oxygen.

Predisposing Factors

INJURY Air & Atmosphere Decompression Sickness Predisposing Factors

Although the occurrence of DCS is not easily predictable, many predisposing factors are known. They may be considered as either environmental or individual. Decompression sickness and arterial gas embolism in recreational diving are associated with certain demographic, environmental, and dive style factors. A statistical study published in 2005 tested potential risk factors: age, gender, body mass index, smoking, asthma, diabetes, cardiovascular disease, previous decompression illness, years since certification, dives in the last year, number of diving days, number of dives in a repetitive series, last dive depth, nitrox use, and drysuit use.

No significant associations with risk of decompression sickness or arterial gas embolism were found for asthma, diabetes, cardiovascular disease, smoking, or body mass index. Increased depth, previous DCI, larger number of consecutive days diving, and being male were associated with higher risk for decompression sickness and arterial gas embolism. Nitrox and drysuit use, greater frequency of diving in the past year, increasing age, and years since certification were associated with lower risk, possibly as indicators of more extensive training and experience.

Environmental
The following environmental factors have been shown to increase the risk of DCS:
● The magnitude of the pressure reduction ratio – a large pressure reduction ratio is more likely to cause DCS than a small one.
● Repetitive exposures – repetitive dives within a short period of time (a few hours) increase the risk of developing DCS. Repetitive ascents to altitudes above 5,500 metres (18,000 ft) within similar short periods increase the risk of developing altitude DCS.
● The rate of ascent – the faster the ascent the greater the risk of developing DCS. The U.S. Navy Diving Manual indicates that ascent rates greater than about 20 m/min (66 ft/min) when diving increase the chance of DCS, while recreational dive tables such as the Bühlmann tables require an ascent rate of 10 m/min (33 ft/min) with the last 6 m (20 ft) taking at least one minute. An individual exposed to a rapid decompression (high rate of ascent) above 5,500 metres (18,000 ft) has a greater risk of altitude DCS than being exposed to the same altitude but at a lower rate of ascent.
● The duration of exposure – the longer the duration of the dive, the greater is the risk of DCS. Longer flights, especially to altitudes of 5,500 m (18,000 ft) and above, carry a greater risk of altitude DCS.

INJURY Air & Atmosphere Decompression Sickness Predisposing Factors

● Underwater diving before flying – divers who ascend to altitude soon after a dive increase their risk of developing DCS even if the dive itself was within the dive table safe limits. Dive tables make provisions for post-dive time at surface level before flying to allow any residual excess nitrogen to outgas. However, the pressure maintained inside even a pressurized aircraft may be as low as the pressure equivalent to an altitude of 2,400 m (7,900 ft) above sea level. Therefore, the assumption that the dive table surface interval occurs at normal atmospheric pressure is invalidated by flying during that surface interval, and an otherwise-safe dive may then exceed the dive table limits.
● Diving before travelling to altitude – DCS can occur without flying if the person moves to a high-altitude location on land immediately after diving, for example, scuba divers in Eritrea who drive from the coast to the Asmara plateau at 2,400 m (7,900 ft) increase their risk of DCS.
● Diving at altitude – diving in water whose surface altitude is above 300 m (980 ft) — for example, Lake Titicaca is at 3,800 m (12,500 ft) — without using versions of decompression tables or dive computers that are modified for high-altitude.

INJURY Air & Atmosphere Decompression Sickness Predisposing Factors

Individual
The following individual factors have been identified as possibly contributing to increased risk of DCS:
● Dehydration – Studies by Walder concluded that decompression sickness could be reduced in aviators when the serum surface tension was raised by drinking isotonic saline, and the high surface tension of water is generally regarded as helpful in controlling bubble size. Maintaining proper hydration is recommended.
● Patent foramen ovale – a hole between the atrial chambers of the heart in the fetus is normally closed by a flap with the first breaths at birth. In about 20% of adults the flap does not completely seal, however, allowing blood through the hole when coughing or during activities that raise chest pressure. In diving, this can allow venous blood with microbubbles of inert gas to bypass the lungs, where the bubbles would otherwise be filtered out by the lung capillary system, and return directly to the arterial system (including arteries to the brain, spinal cord and heart). In the arterial system, bubbles (arterial gas embolism) are far more dangerous because they block circulation and cause infarction (tissue death, due to local loss of blood flow). In the brain, infarction results in stroke, and in the spinal cord it may result in paralysis.
● A person's age – there are some reports indicating a higher risk of altitude DCS with increasing age.

● Previous injury – there is some indication that recent joint or limb injuries may predispose individuals to developing decompression-related bubbles.
● Ambient temperature – there is some evidence suggesting that individual exposure to very cold ambient temperatures may increase the risk of altitude DCS. Decompression sickness risk can be reduced by increased ambient temperature during decompression following dives in cold water.
● Body type – typically, a person who has a high body fat content is at greater risk of DCS. This is due to nitrogen's five times greater solubility in fat than in water, leading to greater amounts of total body dissolved nitrogen during time at pressure. Fat represents about 15–25 percent of a healthy adult's body, but stores about half of the total amount of nitrogen (about 1 litre) at normal pressures.
● Alcohol consumption – although alcohol consumption increases dehydration and therefore may increase susceptibility to DCS, a 2005 study found no evidence that alcohol consumption increases the incidence of DCS.

Diagnosis

INJURY Air & Atmosphere Decompression Sickness Diagnosis

Decompression sickness should be suspected if any of the symptoms associated with the condition occurs following a drop in pressure, in particular, within 24 hours of diving. In 1995, 95% of all cases reported to Divers Alert Network had shown symptoms within 24 hours. This window can be extended to 36 hours for ascent to altitude and 48 hours for prolonged exposure to altitude following diving. An alternative diagnosis should be suspected if severe symptoms begin more than six hours following decompression without an altitude exposure or if any symptom occurs more than 24 hours after surfacing. The diagnosis is confirmed if the symptoms are relieved by recompression. Although MRI or CT can frequently identify bubbles in DCS, they are not as good at determining the diagnosis as a proper history of the event and description of the symptoms.

Symptoms of DCS and arterial gas embolism can be virtually indistinguishable. The most reliable way to tell the difference is based on the dive profile followed, as the probability of DCS depends on duration of exposure and magnitude of pressure, whereas AGE depends entirely on the performance of the ascent. In many cases it is not possible to distinguish between the two, but as the treatment is the same in such cases it does not usually matter.

Other conditions which may be confused with DCS include skin symptoms cutis marmorata due to DCS and skin barotrauma due to dry suit squeeze, for which no treatment is necessary. Dry suit squeeze produces lines of redness with possible bruising where the skin was pinched between folds of the suit, while the mottled effect of cutis marmorata is usually on skin where there is subcutaneous fat, and has no linear pattern.

Transient episodes of severe neurological incapacitation with rapid spontaneous recovery shortly after a dive may be attributed to hypothermia, but may be symptomatic of short term CNS involvement, which may have residual problems or relapses. These cases are thought to be under-diagnosed.

Inner ear DCS can be confused with alternobaric vertigo and reverse squeeze. The history of difficulty in equalising during the dive makes ear barotrauma more likely, but does not always eliminate the possibility of inner ear DCS, which is associated with deep, mixed gas dives with decompression stops. Numbness and tingling are associated with spinal DCS, but can also be caused by pressure on nerves (compression neurapraxia). In DCS the numbness or tingling is generally confined to one or a series of dermatomes, while pressure on a nerve tends to produce characteristic areas of numbness associated with the specific nerve on only one side of the body distal to the pressure point. A loss of strength or function is likely to be a medical emergency. A loss of feeling that lasts more than a minute or two indicates a need for immediate medical attention. It is only partial sensory changes, or paraesthesias, where this distinction between trivial and more serious injuries applies.

Large areas of numbness with associated weakness or paralysis, especially if a whole limb is affected, are indicative of probable brain involvement and require urgent medical attention. Paraesthesias or weakness involving a dermatome indicate probable spinal cord or spinal nerve root involvement. Although it is possible that this may have other causes, such as an injured intervertebral disk, these symptoms indicate an urgent need for medical assessment. In combination with weakness, paralysis or loss of bowel or bladder control, they indicate a medical emergency.

Prevention

Underwater Diving

To prevent the excess formation of bubbles that can lead to decompression sickness, divers limit their ascent rate—the recommended ascent rate used by popular decompression models is about 10 metres (33 ft) per minute—and carry out a decompression schedule as necessary. This schedule requires the diver to ascend to a particular depth, and remain at that depth until sufficient gas has been eliminated from the body to allow further ascent. Each of these is termed a "decompression stop", and a schedule for a given bottom time and depth may contain one or more stops, or none at all. Dives that contain no decompression stops are called "no-stop dives", but divers usually schedule a short "safety stop" at 3 m (10 ft), 4.6 m (15 ft), or 6 m (20 ft), depending on the training agency.

The decompression schedule may be derived from decompression tables, decompression software, or from dive computers, and these are commonly based upon a mathematical model of the body's uptake and release of inert gas as pressure changes. These models, such as the Bühlmann decompression algorithm, are designed to fit empirical data and provide a decompression schedule for a given depth and dive duration.

Since divers on the surface after a dive still have excess inert gas in their bodies, decompression from any subsequent dive before this excess is fully eliminated needs to modify the schedule to take account of the residual gas load from the previous dive. This will result in a shorter allowable time under water without obligatory decompression stops, or an increased decompression time during the subsequent dive. The total elimination of excess gas may take many hours, and tables will indicate the time at normal pressures that is required, which may be up to 18 hours.

Decompression time can be significantly shortened by breathing mixtures containing much less inert gas during the decompression phase of the dive (or pure oxygen at stops in 6 metres (20 ft) of water or less). The reason is that the inert gas outgases at a rate proportional to the difference between the partial pressure of inert gas in the diver's body and its partial pressure in the breathing gas; whereas the likelihood of bubble formation depends on the difference between the inert gas partial pressure in the diver's body and the ambient pressure. Reduction in decompression requirements can also be gained by breathing a nitrox mix during the dive, since less nitrogen will be taken into the body than during the same dive done on air.

Following a decompression schedule does not completely protect against DCS. The algorithms used are designed to reduce the probability of DCS to a very low level, but do not reduce it to zero. The mathematical implications of all current decompression models are that provided that no tissue is ingassing, longer decompression stops will decrease decompression risk, or at worst not increase it.

Exposure to Altitude

One of the most significant breakthroughs in the prevention of altitude DCS is oxygen pre-breathing. Breathing pure oxygen significantly reduces the nitrogen loads in body tissues by reducing the partial pressure of nitrogen in the lungs, which induces diffusion of nitrogen from the blood into the breathing gas, and this effect eventually lowers the concentration of nitrogen in the other tissues of the body. If continued for long enough, and without interruption, this provides effective protection upon exposure to low-barometric pressure environments. However, breathing pure oxygen during flight alone (ascent, en route, descent) does not decrease the risk of altitude DCS as the time required for ascent is generally not sufficient to significantly desaturate the slower tissues.

Pure aviator oxygen which has moisture removed to prevent freezing of valves at altitude is readily available and routinely used in general aviation mountain flying and at high altitudes. Most small general aviation aircraft are not pressurized, therefore oxygen use is an FAA requirement at higher altitudes.

Although pure oxygen pre-breathing is an effective method to protect against altitude DCS, it is logistically complicated and expensive for the protection of civil aviation flyers, either commercial or private. Therefore, it is currently used only by military flight crews and astronauts for protection during high-altitude and space operations. It is also used by flight test crews involved with certifying aircraft, and may also be used for high-altitude parachute jumps.

Astronauts aboard the International Space Station preparing for extra-vehicular activity (EVA) "camp out" at low atmospheric pressure, 10.2 psi (0.70 bar), spending eight sleeping hours in the Quest airlock chamber before their spacewalk. During the EVA they breathe 100% oxygen in their spacesuits, which operate at 4.3 psi (0.30 bar), although research has examined the possibility of using 100% O_2 at 9.5 psi (0.66 bar) in the suits to lessen the pressure reduction, and hence the risk of DCS.

Treatment

All cases of decompression sickness should be treated initially with 100% oxygen until hyperbaric oxygen therapy (100% oxygen delivered in a high-pressure chamber) can be provided. Mild cases of the "bends" and some skin symptoms may disappear during descent from high altitude; however, it is recommended that these cases still be evaluated. Neurological symptoms, pulmonary symptoms, and mottled or marbled skin lesions should be treated with hyperbaric oxygen therapy if seen within 10 to 14 days of development.

Recompression on air was shown to be an effective treatment for minor DCS symptoms by Keays in 1909. Evidence of the effectiveness of recompression therapy utilizing oxygen was first shown by Yarbrough and Behnke, and has since become the standard of care for treatment of DCS. Recompression is normally carried out in a recompression chamber. At a dive site, a riskier alternative is in-water recompression.

Oxygen first aid has been used as an emergency treatment for diving injuries for years. If given within the first four hours of surfacing, it increases the success of recompression therapy as well as decreasing the number of recompression treatments required. Most fully closed-circuit rebreathers can deliver sustained high concentrations of oxygen-rich breathing gas and could be used as a means of supplying oxygen if dedicated equipment is not available.

It is beneficial to give fluids, as this helps reduce dehydration. It is no longer recommended to administer aspirin, unless advised to do so by medical personnel, as analgesics may mask symptoms. People should be made comfortable and placed in the supine position (horizontal), or the recovery position if vomiting occurs. In the past, both the Trendelenburg position and the left lateral decubitus position (Durant's maneuver) have been suggested as beneficial where air emboli are suspected, but are no longer recommended for extended periods, owing to concerns regarding cerebral edema.

Treatment

The duration of recompression treatment depends on the severity of symptoms, the dive history, the type of recompression therapy used and the patient's response to the treatment. One of the more frequently used treatment schedules is the US Navy Table 6, which provides hyperbaric oxygen therapy with a maximum pressure equivalent to 60 feet (18 m) of seawater for a total time under pressure of 288 minutes, of which 240 minutes are on oxygen and the balance are air breaks to minimise the possibility of oxygen toxicity.

A multiplace chamber is the preferred facility for treatment of decompression sickness as it allows direct physical access to the patient by medical personnel, but monoplace chambers are more widely available and should be used for treatment if a multiplace chamber is not available or transportation would cause significant delay in treatment, as the interval between onset of symptoms and recompression is important to the quality of recovery. It may be necessary to modify the optimum treatment schedule to allow use of a monoplace chamber, but this is usually better than delaying treatment. A US Navy treatment table 5 can be safely performed without air breaks if a built-in breathing system is not available. In most cases the patient can be adequately treated in a monoplace chamber at the receiving hospital.

Prognosis

Immediate treatment with 100% oxygen, followed by recompression in a hyperbaric chamber, will in most cases result in no long-term effects. However, permanent long-term injury from DCS is possible. Three-month follow-ups on diving accidents reported to DAN in 1987 showed 14.3% of the 268 divers surveyed had ongoing symptoms of Type II DCS, and 7% from Type I DCS. Long-term follow-ups showed similar results, with 16% having permanent neurological sequelae.

Long term effects are dependent on both initial injury, and treatment. While almost all cases will resolve more quickly with treatment, milder cases may resolve adequately over time without recompression, where the damage is minor and the damage is not significantly aggravated by lack of treatment. In some cases the cost, inconvenience, and risk to the patient may make it appropriate not to evacuate to a hyperbaric treatment facility. These cases should be assessed by a specialist in diving medicine, which can generally be done remotely by telephone or internet.

For joint pain, the likely tissues affected depend on the symptoms, and the urgency of hyperbaric treatment will depend largely on the tissues involved.

- Sharp, localised pain that is affected by movement suggests tendon or muscle injury, both of which will usually fully resolve with oxygen and anti-inflammatory medication.
- Sharp, localised pain that is not affected by movement suggests local inflammation, which will also usually fully resolve with oxygen and anti-inflammatory medication.
- Deep, non-localised pain affected by movement suggests joint capsule tension, which is likely to fully resolve with oxygen and anti-inflammatory medication, though recompression will help it to resolve faster.
- Deep, non-localised pain not affected by movement suggests bone medulla involvement, with ischaemia due to blood vessel blockage and swelling inside the bone, which is mechanistically associated with osteonecrosis, and therefore it has been strongly recommended that these symptoms are treated with hyperbaric oxygen.

7 Dysbaric Osteonecrosis

Dysbaric osteonecrosis or DON is a form of avascular necrosis where there is death of a portion of the bone that is thought to be caused by nitrogen embolism (blockage of the blood vessels by a bubble of nitrogen coming out of solution) in divers.

Signs & Symptoms

The lesion begins as a localised area of infarction, usually without symptoms. Early identification of lesions by radiography is not possible, but over time areas of radiographic opacity develop in association with the damaged bone. Symptomatic lesions usually involve joint surfaces, and fracture where attempted healing occurs. This process takes place over months to years and eventually causes disabling arthritis, particularly of the femoral head (hip).

Dysbaric osteonecrosis lesions are typically bilateral and usually occur at both ends of the femur and at the proximal end of the humerus Symptoms are usually only present when a joint surface is involved, which typically does not occur until a long time after the causative exposure to a hyperbaric environment. The initial damage is attributed to the formation of bubbles, and one episode can be sufficient, however incidence is sporadic and generally associated with relatively long periods of hyperbaric exposure and aetiology is uncertain.

Causes

Although the definitive pathologic process is poorly understood, there are several hypotheses:
- Intra- or extravascular nitrogen in bones, "nitrogen embolism".
- Osmotic gas effects due to intramedullary pressure effects.
- Fat embolism
- Hemoconcentration and increased coagulability.

Diagnosis

The diagnosis is made by x-ray/MRI appearance and has five juxta-articular classifications and forehead, neck, and shaft classifications indicating early radiological signs.

Early on there is flattening of articular surfaces, thinning of cartilage with osteophyte (spur) formation. In juxta-articular lesions without symptoms, there is dead bone and marrow separated from living bone by a line of dense collagen. Microscopic cysts form, fill with necrotic material and there is massive necrosis with replacement by cancellous bone with collapse of the lesions.

The following staging system is sometimes useful when managing lesions.
- Stage 0 - Intravascular coagulation
- Stage 1 - Dead Bone without repair
- Stage 2 - Dead Bone with repair but without collapse
- Stage 3 - Dead Bone with repair and with collapse
- Stage 4 - Secondary degenerative arthritis

In a study of bone lesions in 281 compressed air workers done by Walder in 1969, 29% of the lesions were in the humeral head (shoulder), 16% in the femoral head (hip), 40% in the lower end of the femur (lower thigh at the knee) and 15% in the upper tibia (knee below the knee cap).

Worsening of the condition from continued decompression in an asymptomatic x-ray finding may occur.

Prevention

Prevention is a more successful strategy than treatment. By using the most conservative decompression schedule reasonably practicable, and by minimizing the number of major decompression exposures, the risk of DON may be reduced. Prompt treatment of any symptoms of decompression sickness (DCS) with recompression and hyperbaric oxygen also reduce the risk of subsequent DON.

Treatment

Treatment is difficult, often requiring a joint replacement. Spontaneous improvement occasionally happens and some juxta-articular lesions do not progress to collapse. Other treatments include immobilization and osteotomy of the femur.

Prognosis

If the diver has not been exposed to excessive depth and decompression and presents as DON, there may be a predisposition for the condition. Diving should be restricted to shallow depths. Divers who have suffered from DON are at increased risk of future fracture of a juxta-articular lesion during a dive, and may face complications with future joint replacements. Because of the young age of the population normally affected, little data is available regarding joint replacement complications.

There is the potential for worsening of DON for any diving where there might be a need for decompression, experimental or helium diving. Physically stressful diving should probably be restricted, both in sport diving and work diving due to the possibility of unnecessary stress to the joint. Any diving should be less than 40 feet/12 meters. These risks are affected by the degree of disability and by the type of lesion (juxta-articular or shaft).

8 High Pressure Nervous Syndrome

High-pressure nervous syndrome (HPNS – also known as high-pressure neurological syndrome) is a neurological and physiological diving disorder that results when a diver descends below about 500 feet (150 m) using a breathing gas containing helium.

Signs & Symptoms

Symptoms of HPNS include tremors, myoclonic jerking, somnolence, EEG changes, visual disturbance, nausea, dizziness, and decreased mental performance.

Causes

HPNS has two components, one resulting from the speed of compression and the other from the absolute pressure. The compression effects may occur when descending below 500 feet (150 m) at rates greater than a few metres per minute, but reduce within a few hours once the pressure has stabilised. The effects from depth become significant at depths exceeding 1,000 feet (300 m) and remain regardless of the time spent at that depth. All of the effects are completely reversible on ascent to shallower depths. The susceptibility of divers and animals to HPNS varies over a wide range depending on the individual, but has little variation between different dives by the same diver.

The effect of dissolved helium on an embedded trans-membrane channel has also been studied by molecular modeling tools. Those suggest that helium might cause substantial lipid membrane distortion. The high hydrostatic pressure itself has a less damaging influence on the membrane, reducing molecular volumes, but leaving the molecular boundary intact.

Diagnosis

Prevention

It is likely that HPNS cannot be entirely prevented but there are effective methods to delay or change the development of the symptoms. Utilizing slow rates of compression or adding stops to the compression have been found to prevent large initial decrements in performance.

Including other gases in the helium–oxygen mixture, such as nitrogen (creating trimix) or hydrogen (producing hydreliox) suppresses the neurological effects. Alcohol, anesthetics and anticonvulsant drugs have had varying results in suppressing HPNS with animals. None are currently in use for humans.

Treatment

9 Nitrogen Narcosis

Narcosis while diving (also known as nitrogen narcosis, inert gas narcosis, raptures of the deep, Martini effect) is a reversible alteration in consciousness that occurs while diving at depth. It is caused by the anesthetic effect of certain gases at high pressure. Narcosis produces a state similar to drunkenness (alcohol intoxication), or nitrous oxide inhalation. It can occur during shallow dives, but does not usually become noticeable at depths less than 30 meters (100 ft).

Signs & Symptoms

Due to its perception-altering effects, the onset of narcosis may be hard to recognize. At its most benign, narcosis results in relief of anxiety – a feeling of tranquility and mastery of the environment. These effects are essentially identical to various concentrations of nitrous oxide. They also resemble (though not as closely) the effects of alcohol or cannabis and the familiar benzodiazepine drugs such as diazepam and alprazolam. Such effects are not harmful unless they cause some immediate danger to go unrecognized and unaddressed. Once stabilized, the effects generally remain the same at a given depth, only worsening if the diver ventures deeper.

The most dangerous aspects of narcosis are the impairment of judgement, multi-tasking and coordination, and the loss of decision-making ability and focus. Other effects include vertigo and visual or auditory disturbances. The syndrome may cause exhilaration, giddiness, extreme anxiety, depression, or paranoia, depending on the individual diver and the diver's medical or personal history. When more serious, the diver may feel overconfident, disregarding normal safe diving practices.

Slowed mental activity, as indicated by increased reaction time and increased errors in cognitive function, are effects which increase the risk of a diver mismanaging an incident. Narcosis reduces both the perception of cold discomfort and shivering and thereby affects the production of body heat and consequently allows a faster drop in the core temperature in cold water, with reduced awareness of the developing problem.

The relation of depth to narcosis is sometimes informally known as "Martini's law", the idea that narcosis results in the feeling of one martini for every 10 m (33 ft) below 20 m (66 ft) depth. Professional divers use such a calculation only as a rough guide to give new divers a metaphor, comparing a situation they may be more familiar with. Reported signs and symptoms are summarized against typical depths in meters and feet of sea water in the following table, closely adapted from Deeper into Diving by Lippman and Mitchell:

Pressure (bar)	Depth (m)	Depth (ft)	Comments
1–2	0–10	0–33	• Unnoticeable minor symptoms, or no symptoms at all
2–4	10–30	33–100	• Mild impairment of performance of unpracticed tasks • Mildly impaired reasoning • Mild euphoria possible
4–6	30–50	100–165	• Delayed response to visual and auditory stimuli • Reasoning and immediate memory affected more than motor coordination • Calculation errors and wrong choices • Idea fixation • Over-confidence and sense of well-being • Laughter and loquacity (in chambers) which may be overcome by self-control • Anxiety (common in cold murky water)
6–8	50–70	165–230	• Sleepiness, impaired judgment, confusion • Hallucinations • Severe delay in response to signals, instructions and other stimuli • Occasional dizziness • Uncontrolled laughter, hysteria (in chamber) • Terror in some
8–10	70–90	230–300	• Poor concentration and mental confusion • Stupefaction with some decrease in dexterity and judgment • Loss of memory, increased excitability
10+	90+	300+	• Hallucinations • Increased intensity of vision and hearing • Sense of impending blackout or of levitation • Dizziness, euphoria, manic or depressive states • Disorganization of the sense of time, changes in facial appearance • Unconsciousness, (approximate inspired partial pressure of nitrogen for anaesthesia is 33 atm) • Death

Causes

The cause of narcosis is related to the increased solubility of gases in body tissues, as a result of the elevated pressures at depth (Henry's law). Modern theories have suggested that inert gases dissolving in the lipid bilayer of cell membranes cause narcosis. More recently, researchers have been looking at neurotransmitter receptor protein mechanisms as a possible cause of narcosis. The breathing gas mix entering the diver's lungs will have the same pressure as the surrounding water, known as the ambient pressure. After any change of depth, the pressure of gases in the blood passing through the brain catches up with ambient pressure within a minute or two, which results in a delayed narcotic effect after descending to a new depth. Rapid compression potentiates narcosis owing to carbon dioxide retention.

A divers' cognition may be affected on dives as shallow as 10 m (33 ft), but the changes are not usually noticeable. There is no reliable method to predict the depth at which narcosis becomes noticeable, or the severity of the effect on an individual diver, as it may vary from dive to dive even on the same day.

Significant impairment due to narcosis is an increasing risk below depths of about 30 m (100 ft), corresponding to an ambient pressure of about 4 bar (400 kPa). Most sport scuba training organizations recommend depths of no more than 40 m (130 ft) because of the risk of narcosis. When breathing air at depths of 90 m (300 ft) – an ambient pressure of about 10 bar (1,000 kPa) – narcosis in most divers leads to hallucinations, loss of memory, and unconsciousness. A number of divers have died in attempts to set air depth records below 120 m (400 ft). Because of these incidents, Guinness World Records no longer reports on this figure.

Narcosis has been compared with altitude sickness regarding its variability of onset (though not its symptoms); its effects depend on many factors, with variations between individuals. Thermal cold, stress, heavy work, fatigue, and carbon dioxide retention all increase the risk and severity of narcosis. Carbon dioxide has a high narcotic potential and also causes increased blood flow to the brain, increasing the effects of other gases. Increased risk of narcosis results from increasing the amount of carbon dioxide retained through heavy exercise, shallow or skip breathing, or because of poor gas exchange in the lungs.

Narcosis is known to be additive to even minimal alcohol intoxication. Other sedative and analgesic drugs, such as opiate narcotics and benzodiazepines, add to narcosis.

Diagnosis

Prevention

The most straightforward way to avoid nitrogen narcosis is for a diver to limit the depth of dives. Since narcosis becomes more severe as depth increases, a diver keeping to shallower depths can avoid serious narcosis. Most recreational dive schools will only certify basic divers to depths of 18 m (60 ft), and at these depths narcosis does not present a significant risk. Further training is normally required for certification up to 30 m (100 ft) on air, and this training should include a discussion of narcosis, its effects, and cure. Some diver training agencies offer specialized training to prepare recreational divers to go to depths of 40 m (130 ft), often consisting of further theory and some practice in deep dives under close supervision.

Scuba organizations that train for diving beyond recreational depths, may forbid diving with gases that cause too much narcosis at depth in the average diver, and strongly encourage the use of other breathing gas mixes containing helium in place of some or all of the nitrogen in air – such as trimix and heliox – because helium has no narcotic effect. The use of these gases forms part of technical diving and requires further training and certification.

While the individual diver cannot predict exactly at what depth the onset of narcosis will occur on a given day, the first symptoms of narcosis for any given diver are often more predictable and personal. For example, one diver may have trouble with eye focus (close accommodation for middle-aged divers), another may experience feelings of euphoria, and another feelings of claustrophobia. Some divers report that they have hearing changes, and that the sound their exhaled bubbles make becomes different. Specialist training may help divers to identify these personal onset signs, which may then be used as a signal to ascend to avoid the narcosis, although severe narcosis may interfere with the judgement necessary to take preventive action.

Deep dives should be made only after a gradual training to test the individual diver's sensitivity to increasing depths, with careful supervision and logging of reactions. Scientific evidence does not show that a diver can train to overcome any measure of narcosis at a given depth or become tolerant of it.

Treatment

Narcosis may be completely reversed in a few minutes by ascending to a shallower depth, with no long-term effects. Thus narcosis while diving in open water rarely develops into a serious problem as long as the divers are aware of its symptoms, and are able to ascend to manage it. Diving much beyond 40 m (130 ft) is generally considered outside the scope of recreational diving.

10 Oxygen Toxicity

Oxygen toxicity is a condition resulting from the harmful effects of breathing molecular oxygen (O2) at increased partial pressures. It is also known as oxygen toxicity syndrome, oxygen intoxication, and oxygen poisoning. Severe cases can result in cell damage and death, with effects most often seen in the central nervous system, lungs, and eyes. Historically, the central nervous system condition was called the Paul Bert effect, and the pulmonary condition the Lorrain Smith effect, after the researchers who pioneered the discoveries and descriptions in the late 19th century. Oxygen toxicity is a concern for underwater divers, those on high concentrations of supplemental oxygen (particularly premature babies), and those undergoing hyperbaric oxygen therapy.

Signs & Symptoms

Central Nervous System
Central nervous system oxygen toxicity manifests as symptoms such as visual changes (especially tunnel vision), ringing in the ears (tinnitus), nausea, twitching (especially of the face), behavioural changes (irritability, anxiety, confusion), and dizziness. This may be followed by a tonic–clonic seizure consisting of two phases: intense muscle contraction occurs for several seconds (tonic phase); followed by rapid spasms of alternate muscle relaxation and contraction producing convulsive jerking (clonic phase). The seizure ends with a period of unconsciousness (the postictal state). The onset of seizure depends upon the partial pressure of oxygen in the breathing gas and exposure duration. However, exposure time before onset is unpredictable, as tests have shown a wide variation, both amongst individuals, and in the same individual from day to day. In addition, many external factors, such as underwater immersion, exposure to cold, and exercise will decrease the time to onset of central nervous system symptoms. Decrease of tolerance is closely linked to retention of carbon dioxide. Other factors, such as darkness and caffeine, increase tolerance in test animals, but these effects have not been proven in humans.

Lungs
Pulmonary toxicity symptoms result from an inflammation that starts in the airways leading to the lungs and then spreads into the lungs (tracheobronchial tree). The symptoms appear in the upper chest region (substernal and carinal regions). This begins as a mild tickle on inhalation and progresses to frequent coughing. If breathing increased partial pressures of oxygen continues, patients experience a mild burning on inhalation along with uncontrollable coughing and occasional shortness of breath (dyspnoea). Physical findings related to pulmonary toxicity have included bubbling sounds heard through a stethoscope (bubbling rales), fever, and increased blood flow to the lining of the nose (hyperaemia of the nasal mucosa). X-rays of the lungs show little change in the short term, but extended exposure leads to increasing diffuse shadowing throughout both lungs. Pulmonary function measurements are reduced, as noted by a reduction in the amount of air that the lungs can hold (vital capacity) and changes in expiratory function and lung elasticity. Tests in animals have indicated a variation in tolerance similar to that found in central nervous system toxicity, as well as significant variations between species. When the exposure to oxygen above 0.5 bar (50 kPa) is intermittent, it permits the lungs to recover and delays the onset of toxicity.

Eyes
In premature babies, signs of damage to the eye (retinopathy of prematurity, or ROP) are observed via an ophthalmoscope as a demarcation between the vascularised and non-vascularised regions of an infant's retina. The degree of this demarcation is used to designate four stages: (I) the demarcation is a line; (II) the demarcation becomes a ridge; (III) growth of new blood vessels occurs around the ridge; (IV) the retina begins to detach from the inner wall of the eye (choroid).

Oxygen poisoning at 90 feet (27 m) in the dry in 36 subjects in order of performance

Exposure (mins.)	Num. of subjects	Symptoms
96	1	Prolonged dazzle; severe spasmodic vomiting
60–69	3	Severe lip-twitching; Euphoria; Nausea and vertigo; arm twitch
50–55	4	Severe lip-twitching; Dazzle; Blubbering of lips; fell asleep; Dazed
31–35	4	Nausea, vertigo, lip-twitching; Convulsed
21–30	6	Convulsed; Drowsiness; Severe lip-twitching; epigastric aura; twitch L arm; amnesia
16–20	8	Convulsed; Vertigo and severe lip twitching; epigastric aura; spasmodic respiration;
11–15	4	Inspiratory predominance; lip-twitching and syncope; Nausea and confusion
6–10	6	Dazed and lip-twitching; paraesthesiae; vertigo; "Diaphragmatic spasm"; Severe nausea

Causes

Oxygen toxicity is caused by exposure to oxygen at partial pressures greater than those to which the body is normally exposed. This occurs in three principal settings: underwater diving, hyperbaric oxygen therapy, and the provision of supplemental oxygen, particularly to premature infants. In each case, the risk factors are markedly different.

Central Nervous System Toxicity
Exposures, from minutes to a few hours, to partial pressures of oxygen above 1.6 bars (160 kPa)—about eight times normal atmospheric partial pressure—are usually associated with central nervous system oxygen toxicity and are most likely to occur among patients undergoing hyperbaric oxygen therapy and divers. Since sea level atmospheric pressure is about 1 bar (100 kPa), central nervous system toxicity can only occur under hyperbaric conditions, where ambient pressure is above normal. Divers breathing air at depths beyond 60 m (200 ft) face an increasing risk of an oxygen toxicity "hit" (seizure). Divers breathing a gas mixture enriched with oxygen, such as nitrox, can similarly suffer a seizure at shallower depths, should they descend below the maximum operating depth allowed for the mixture.

INJURY Atmosphere & Air Oxygen Toxicity Causes

Lung Toxicity
The lungs and the remainder of the respiratory tract are exposed to the highest concentration of oxygen in the human body and are therefore the first organs to show toxicity. Pulmonary toxicity occurs only with exposure to partial pressures of oxygen greater than 0.5 bar (50 kPa), corresponding to an oxygen fraction of 50% at normal atmospheric pressure.

The earliest signs of pulmonary toxicity begin with evidence of tracheobronchitis, or inflammation of the upper airways, after an asymptomatic period between 4 and 22 hours at greater than 95% oxygen, with some studies suggesting symptoms usually begin after approximately 14 hours at this level of oxygen.

At partial pressures of oxygen of 2 to 3 bar (200 to 300 kPa)—100% oxygen at 2 to 3 times atmospheric pressure—these symptoms may begin as early as 3 hours after exposure to oxygen. Experiments on rats breathing oxygen at pressures between 1 and 3 bars (100 and 300 kPa) suggest that pulmonary manifestations of oxygen toxicity may not be the same for normobaric conditions as they are for hyperbaric conditions.

Evidence of decline in lung function as measured by pulmonary function testing can occur as quickly as 24 hours of continuous exposure to 100% oxygen, with evidence of diffuse alveolar damage and the onset of acute respiratory distress syndrome usually occurring after 48 hours on 100% oxygen. Breathing 100% oxygen also eventually leads to collapse of the alveoli (atelectasis), while—at the same partial pressure of oxygen—the presence of significant partial pressures of inert gases, typically nitrogen, will prevent this effect.

Preterm newborns are known to be at higher risk for bronchopulmonary dysplasia with extended exposure to high concentrations of oxygen. Other groups at higher risk for oxygen toxicity are patients on mechanical ventilation with exposure to levels of oxygen greater than 50%, and patients exposed to chemicals that increase risk for oxygen toxicity such the chemotherapeutic agent bleomycin. Therefore, current guidelines for patients on mechanical ventilation in intensive care recommends keeping oxygen concentration less than 60%. Likewise, divers who undergo treatment of decompression sickness are at increased risk of oxygen toxicity as treatment entails exposure to long periods of oxygen breathing under hyperbaric conditions, in addition to any oxygen exposure during the dive.

Ocular Toxicity
Prolonged exposure to high inspired fractions of oxygen causes damage to the retina. Damage to the developing eye of infants exposed to high oxygen fraction at normal pressure has a different mechanism and effect from the eye damage experienced by adult divers under hyperbaric conditions. Hyperoxia may be a contributing factor for the disorder called retrolental fibroplasia or retinopathy of prematurity (ROP) in infants. In preterm infants, the retina is often not fully vascularised. Retinopathy of prematurity occurs when the development of the retinal vasculature is arrested and then proceeds abnormally. Associated with the growth of these new vessels is fibrous tissue (scar tissue) that may contract to cause retinal detachment. Supplemental oxygen exposure, while a risk factor, is not the main risk factor for development of this disease. Restricting supplemental oxygen use does not necessarily reduce the rate of retinopathy of prematurity, and may raise the risk of hypoxia-related systemic complications.

Hyperoxic myopia has occurred in closed circuit oxygen rebreather divers with prolonged exposures. It also occurs frequently in those undergoing repeated hyperbaric oxygen therapy. This is due to an increase in the refractive power of the lens, since axial length and keratometry readings do not reveal a corneal or length basis for a myopic shift. It is usually reversible with time.

Diagnosis

Diagnosis of central nervous system oxygen toxicity in divers prior to seizure is difficult as the symptoms of visual disturbance, ear problems, dizziness, confusion and nausea can be due to many factors common to the underwater environment such as narcosis, congestion and coldness. However, these symptoms may be helpful in diagnosing the first stages of oxygen toxicity in patients undergoing hyperbaric oxygen therapy. In either case, unless there is a prior history of epilepsy or tests indicate hypoglycaemia, a seizure occurring in the setting of breathing oxygen at partial pressures greater than 1.4 bar (140 kPa) suggests a diagnosis of oxygen toxicity.

Prevention

The prevention of oxygen toxicity depends entirely on the setting. Both underwater and in space, proper precautions can eliminate the most pernicious effects. Premature infants commonly require supplemental oxygen to treat complications of preterm birth. In this case prevention of bronchopulmonary dysplasia and retinopathy of prematurity must be carried out without compromising a supply of oxygen adequate to preserve the infant's life.

Underwater
Oxygen toxicity is a catastrophic hazard in diving, because a seizure results in near certain death by drowning. The seizure may occur suddenly and with no warning symptoms. The effects are sudden convulsions and unconsciousness, during which victims can lose their regulator and drown. One of the advantages of a full-face diving mask is prevention of regulator loss in the event of a seizure. As there is an increased risk of central nervous system oxygen toxicity on deep dives, long dives and dives where oxygen-rich breathing gases are used, divers are taught to calculate a maximum operating depth for oxygen-rich breathing gases, and cylinders containing such mixtures must be clearly marked with that depth.

In some diver training courses for these types of diving, divers are taught to plan and monitor what is called the oxygen clock of their dives. This is a notional alarm clock, which ticks more quickly at increased oxygen pressure and is set to activate at the maximum single exposure limit recommended in the National Oceanic and Atmospheric Administration Diving Manual.

For the following partial pressures of oxygen the limits are: 45 minutes at 1.6 bar (160 kPa), 120 minutes at 1.5 bar (150 kPa), 150 minutes at 1.4 bar (140 kPa), 180 minutes at 1.3 bar (130 kPa) and 210 minutes at 1.2 bar (120 kPa), but it is impossible to predict with any reliability whether or when toxicity symptoms will occur. Many nitrox-capable dive computers calculate an oxygen loading and can track it across multiple dives.

The aim is to avoid activating the alarm by reducing the partial pressure of oxygen in the breathing gas or by reducing the time spent breathing gas of greater oxygen partial pressure. As the partial pressure of oxygen increases with the fraction of oxygen in the breathing gas and the depth of the dive, the diver obtains more time on the oxygen clock by diving at a shallower depth, by breathing a less oxygen-rich gas, or by shortening the duration of exposure to oxygen-rich gases.

Diving below 56 m (184 ft) on air would expose a diver to increasing danger of oxygen toxicity as the partial pressure of oxygen exceeds 1.4 bar (140 kPa), so a gas mixture must be used which contains less than 21% oxygen (a hypoxic mixture). Increasing the proportion of nitrogen is not viable, since it would produce a strongly narcotic mixture. However, helium is not narcotic, and a usable mixture may be blended either by completely replacing nitrogen with helium (the resulting mix is called heliox), or by replacing part of the nitrogen with helium, producing a trimix.

Pulmonary oxygen toxicity is an entirely avoidable event while diving. The limited duration and naturally intermittent nature of most diving makes this a relatively rare (and even then, reversible) complication for divers. Established guidelines enable divers to calculate when they are at risk of pulmonary toxicity.

Treatment

INJURY Atmosphere & Air Oxygen Toxicity Treatment

During hyperbaric oxygen therapy, the patient will usually breathe 100% oxygen from a mask while inside a hyperbaric chamber pressurised with air to about 2.8 bar (280 kPa). Seizures during the therapy are managed by removing the mask from the patient, thereby dropping the partial pressure of oxygen inspired below 0.6 bar (60 kPa).

A seizure underwater requires that the diver be brought to the surface as soon as practicable. Although for many years the recommendation has been not to raise the diver during the seizure itself, owing to the danger of arterial gas embolism (AGE), there is some evidence that the glottis does not fully obstruct the airway. This has led to the current recommendation by the Diving Committee of the Undersea and Hyperbaric Medical Society that a diver should be raised during the seizure's clonic (convulsive) phase if the regulator is not in the diver's mouth – as the danger of drowning is then greater than that of AGE – but the ascent should be delayed until the end of the clonic phase otherwise. Rescuers ensure that their own safety is not compromised during the convulsive phase. They then ensure that where the victim's air supply is established it is maintained, and carry out a controlled buoyant lift. Lifting an unconscious body is taught by most diver training agencies.

Upon reaching the surface, emergency services are always contacted as there is a possibility of further complications requiring medical attention. The U.S. Navy has procedures for completing the decompression stops where a recompression chamber is not immediately available.

The occurrence of symptoms of bronchopulmonary dysplasia or acute respiratory distress syndrome is treated by lowering the fraction of oxygen administered, along with a reduction in the periods of exposure and an increase in the break periods where normal air is supplied. Where supplemental oxygen is required for treatment of another disease (particularly in infants), a ventilator may be needed to ensure that the lung tissue remains inflated. Reductions in pressure and exposure will be made progressively, and medications such as bronchodilators and pulmonary surfactants may be used.

Retinopathy of prematurity may regress spontaneously, but should the disease progress beyond a threshold (defined as five contiguous or eight cumulative hours of stage 3 retinopathy of prematurity), both cryosurgery and laser surgery have been shown to reduce the risk of blindness as an outcome. Where the disease has progressed further, techniques such as scleral buckling and vitrectomy surgery may assist in re-attaching the retina.

11 Hypoxia

Hypoxia is a condition in which the body or a region of the body is deprived of adequate oxygen supply at the tissue level. Hypoxia may be classified as either generalized, affecting the whole body, or local, affecting a region of the body.

Hypoxia differs from hypoxemia and anoxemia in that hypoxia refers to a state in which oxygen supply is insufficient, whereas hypoxemia and anoxemia refer specifically to states that have low or zero arterial oxygen supply. Hypoxia in which there is complete deprivation of oxygen supply is referred to as anoxia.

Generalized hypoxia occurs in healthy people when they ascend to high altitude, where it causes altitude sickness leading to potentially fatal complications: high altitude pulmonary edema (HAPE) and high altitude cerebral edema (HACE). Hypoxia also occurs in healthy individuals when breathing mixtures of gases with a low oxygen content, e.g. while diving underwater especially when using closed-circuit rebreather systems that control the amount of oxygen in the supplied air. Mild, non-damaging intermittent hypoxia is used intentionally during altitude training to develop an athletic performance adaptation at both the systemic and cellular level.

Hypoxia is a common complication of preterm birth in newborn infants. Because the lungs develop late in pregnancy, premature infants frequently possess underdeveloped lungs. To improve lung function, doctors frequently place infants at risk of hypoxia inside incubators (also known as humidicribs) that provide warmth, humidity, and oxygen. More serious cases are treated with continuous positive airway pressure.

Signs & Symptoms

Generalized Hypoxia
The symptoms of generalized hypoxia depend on its severity and acceleration of onset. In the case of altitude sickness, where hypoxia develops gradually, the symptoms include fatigue, numbness / tingling of extremities, nausea, and cerebral anoxia. These symptoms are often difficult to identify, but early detection of symptoms can be critical. In severe hypoxia, or hypoxia of very rapid onset, ataxia, confusion / disorientation / hallucinations / behavioral change, severe headaches / reduced level of consciousness, papilloedema, breathlessness, pallor, tachycardia, and pulmonary hypertension eventually leading to the late signs cyanosis, slow heart rate / cor pulmonale, and low blood pressure followed by heart failure eventually leading to shock and death.

Because hemoglobin is a darker red when it is not bound to oxygen (deoxyhemoglobin), as opposed to the rich red color that it has when bound to oxygen (oxyhemoglobin), when seen through the skin it has an increased tendency to reflect blue light back to the eye. In cases where the oxygen is displaced by another molecule, such as carbon monoxide, the skin may appear 'cherry red' instead of cyanotic. Hypoxia can cause premature birth, and injure the liver, among other deleterious effects.

Local Hypoxia
If tissue is not being perfused properly, it may feel cold and appear pale; if severe, hypoxia can result in cyanosis, a blue discoloration of the skin. If hypoxia is very severe, a tissue may eventually become gangrenous. Extreme pain may also be felt at or around the site.

Tissue hypoxia from low oxygen delivery may be due to low haemoglobin concentration (anaemic hypoxia), low cardiac output (stagnant hypoxia) or low haemoglobin saturation (hypoxic hypoxia). The consequence of oxygen deprivation in tissues is a switch to anaerobic metabolism at the cellular level. As such, reduced systemic blood flow may result in increased serum lactate. Serum lactate levels have been correlated with illness severity and mortality in critically ill adults and in ventilated neonates with respiratory distress.

Causes

Oxygen passively diffuses in the lung alveoli according to a pressure gradient. Oxygen diffuses from the breathed air, mixed with water vapour, to arterial blood, where its partial pressure is around 100 mmHg (13.3 kPa). In the blood, oxygen is bound to hemoglobin, a protein in red blood cells. The binding capacity of hemoglobin is influenced by the partial pressure of oxygen in the environment, as described in the oxygen–hemoglobin dissociation curve. A smaller amount of oxygen is transported in solution in the blood.

In peripheral tissues, oxygen again diffuses down a pressure gradient into cells and their mitochondria, where it is used to produce energy in conjunction with the breakdown of glucose, fats, and some amino acids.

Hypoxia can result from a failure at any stage in the delivery of oxygen to cells. This can include decreased partial pressures of oxygen, problems with diffusion of oxygen in the lungs, insufficient available hemoglobin, problems with blood flow to the end tissue, and problems with breathing rhythm.

Experimentally, oxygen diffusion becomes rate limiting (and lethal) when arterial oxygen partial pressure falls to 60 mmHg (5.3 kPa) or below.

Almost all the oxygen in the blood is bound to hemoglobin, so interfering with this carrier molecule limits oxygen delivery to the periphery. Hemoglobin increases the oxygen-carrying capacity of blood by about 40-fold, with the ability of hemoglobin to carry oxygen influenced by the partial pressure of oxygen in the environment, a relationship described in the oxygen–hemoglobin dissociation curve. When the ability of hemoglobin to carry oxygen is interfered with, a hypoxic state can result.

Ischemia
Ischemia, meaning insufficient blood flow to a tissue, can also result in hypoxia. This is called 'ischemic hypoxia'. This can include an embolic event, a heart attack that decreases overall blood flow, or trauma to a tissue that results in damage. An example of insufficient blood flow causing local hypoxia is gangrene that occurs in diabetes.

Diseases such as peripheral vascular disease can also result in local hypoxia. For this reason, symptoms are worse when a limb is used. Pain may also be felt as a result of increased hydrogen ions leading to a decrease in blood pH (acidity) created as a result of anaerobic metabolism.

Hypoxemic Hypoxia
This refers specifically to hypoxic states where the arterial content of oxygen is insufficient. This can be caused by alterations in respiratory drive, such as in respiratory alkalosis, physiological or pathological shunting of blood, diseases interfering in lung function resulting in a ventilation-perfusion mismatch, such as a pulmonary embolus, or alterations in the partial pressure of oxygen in the environment or lung alveoli, such as may occur at altitude or when diving.

Carbon Monoxide Poisoning
Carbon monoxide competes with oxygen for binding sites on hemoglobin molecules. As carbon monoxide binds with hemoglobin hundreds of times tighter than oxygen, it can prevent the carriage of oxygen. Carbon monoxide poisoning can occur acutely, as with smoke intoxication, or over a period of time, as with cigarette smoking. Due to physiological processes, carbon monoxide is maintained at a resting level of 4–6 ppm. This is increased in urban areas (7–13 ppm) and in smokers (20–40 ppm). A carbon monoxide level of 40 ppm is equivalent to a reduction in hemoglobin levels of 10 g/L.

Altitude (See: Altitude Sickness)
Atmospheric pressure reduces with altitude and with it, the amount of oxygen. The reduction in the partial pressure of inspired oxygen at higher altitudes lowers the oxygen saturation of the blood, ultimately leading to hypoxia. The clinical features of altitude sickness include: sleep problems, dizziness, headache and oedema.

Hypoxic Breathing Gases
The breathing gas in underwater diving may contain an insufficient partial pressure of oxygen, particularly in malfunction of rebreathers. Such situations may lead to unconsciousness without symptoms since carbon dioxide levels are normal and the human body senses pure hypoxia poorly. Hypoxic breathing gases can be defined as mixtures with a lower oxygen fraction than air, though gases containing sufficient oxygen to reliably maintain consciousness at normal sea level atmospheric pressure may be described as normoxic even when slightly hypoxic. Hypoxic mixtures in this context are those which will not reliably maintain consciousness at sea level pressure. Gases with as little as 2% oxygen by volume in a helium diluent are used for deep diving operations. The ambient pressure at 190 msw is sufficient to provide a partial pressure of about 0.4 bar, which is suitable for saturation diving. As the divers are decompressed, the breathing gas must be oxygenated to maintain a breathable atmosphere.

Inert gas asphyxiation may be deliberate with use of a suicide bag. Accidental death has occurred in cases where concentrations of nitrogen in controlled atmospheres, or methane in mines, has not been detected or appreciated.

Anemia
Hemoglobin plays a substantial role in carrying oxygen throughout the body, and when it is deficient, anemia can result, causing 'anaemic hypoxia' if tissue perfusion is decreased. Iron deficiency is the most common cause of anemia. As iron is used in the synthesis of hemoglobin, less hemoglobin will be synthesised when there is less iron, due to insufficient intake, or poor absorption.

Anemia is typically a chronic process that is compensated over time by increased levels of red blood cells via upregulated erythropoetin. A chronic hypoxic state can result from a poorly compensated anaemia.

Cyanide Poisoning
Histotoxic hypoxia results when the quantity of oxygen reaching the cells is normal, but the cells are unable to use the oxygen effectively as a result of disabled oxidative phosphorylation enzymes. This may occur in cyanide poisoning.

Diagnosis

Prevention

Ensure an adequate air supply. Do not use carbon monxide generating machines such as generators in enclosed spaces.

Treatment

To counter the effects of high-altitude diseases, the body must return arterial pO2 toward normal. Acclimatization, the means by which the body adapts to higher altitudes, only partially restores pO2 to standard levels. Hyperventilation, the body's most common response to high-altitude conditions, increases alveolar pO2 by raising the depth and rate of breathing.

However, while pO2 does improve with hyperventilation, it does not return to normal. Studies of miners and astronomers working at 3000 meters and above show improved alveolar pO2 with full acclimatization, yet the pO2 level remains equal to or even below the threshold for continuous oxygen therapy for patients with chronic obstructive pulmonary disease (COPD). In addition, there are complications involved with acclimatization. Polycythemia, in which the body increases the number of red blood cells in circulation, thickens the blood, raising the danger that the heart can't pump it.

In high-altitude conditions, only oxygen enrichment can counteract the effects of hypoxia. By increasing the concentration of oxygen in the air, the effects of lower barometric pressure are countered and the level of arterial pO2 is restored toward normal capacity. A small amount of supplemental oxygen reduces the equivalent altitude in climate-controlled rooms. At 4000 m, raising the oxygen concentration level by 5 percent via an oxygen concentrator and an existing ventilation system provides an altitude equivalent of 3000 m, which is much more tolerable for the increasing number of low-landers who work in high altitude.

In a study of astronomers working in Chile at 5050 m, oxygen concentrators increased the level of oxygen concentration by almost 30 percent (that is, from 21 percent to 27 percent). This resulted in increased worker productivity, less fatigue, and improved sleep.

Oxygen concentrators are uniquely suited for this purpose. They require little maintenance and electricity, provide a constant source of oxygen, and eliminate the expensive, and often dangerous, task of transporting oxygen cylinders to remote areas. Offices and housing already have climate-controlled rooms, in which temperature and humidity are kept at a constant level. Oxygen can be added to this system easily and relatively cheaply.

A prescription renewal for home oxygen following hospitalization requires an assessment of the patient for ongoing hypoxemia.

12 Swimming Induced Pulmonary Edema

Swimming induced pulmonary edema (SIPE), also known as immersion pulmonary edema, occurs when fluids from the blood leak abnormally from the small vessels of the lung (pulmonary capillaries) into the airspaces (alveoli).

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

13 Immersion Diuresis

Immersion diuresis is caused by immersion of the body in water (or equivalent liquid). It is mainly caused by lower temperature and by pressure.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

14 Hypercapnia

Hypercapnia, also known as hypercarbia and CO2 retention, is a condition of abnormally elevated carbon dioxide (CO2) levels in the blood.

Signs & Symptoms

Causes

Diagnosis

INJURY Atmosphere & Air Hypercapnia

Prevention

Treatment

15 Carbon Monoxide Poisoning

Carbon monoxide poisoning typically occurs from breathing in too much carbon monoxide (CO). Symptoms are often described as "flu-like" and commonly include headache, dizziness, weakness, vomiting, chest pain, and confusion. Large exposures can result in loss of consciousness, arrhythmias, seizures, or death. Breathing air with more than 3% CO2 can quickly lead to headaches, dizziness, increased heart rate and difficulty breathing. At mixing ratios exceeding about 15%, carbon dioxide quickly causes unconsciousness and death.

Carbon monoxide poisoning can occur accidentally, as an attempt to end one's own life, or as an attempt to end another's life. CO is a colorless and odorless gas which is initially non-irritating. It is produced during incomplete burning of organic matter. This can occur from motor vehicles, heaters, or cooking equipment that run on carbon-based fuels. It can also occur from exposure to methylene chloride. Carbon monoxide primarily causes adverse effects by combining with hemoglobin to form carboxyhemoglobin (HbCO) preventing the blood from carrying oxygen. Additionally, myoglobin and mitochondrial cytochrome oxidase are affected. Diagnosis is based on a HbCO level of more than 3% among nonsmokers and more than 10% among smokers.

Efforts to prevent poisoning include carbon monoxide detectors, proper venting of gas appliances, keeping chimneys clean, and keeping exhaust systems of vehicles in good repair. Treatment of poisoning generally consists of giving 100% oxygen along with supportive care. This should generally be carried out until symptoms are no longer present and the HbCO level is less than 10%. While hyperbaric oxygen therapy is used for severe poisonings, the benefit over standard oxygen delivery is unclear. The risk of death among those affected is between 1 and 30%.

Signs & Symptoms

Carbon monoxide is not toxic to all forms of life. Its harmful effects are due to binding with hemoglobin so its danger to organisms that do not use this compound is doubtful. It thus has no effect on photosynthesising plants. It is easily absorbed through the lungs. Inhaling the gas can lead to hypoxic injury, nervous system damage, and even death. Different people and populations may have different carbon monoxide tolerance levels. On average, exposures at 100 ppm or greater is dangerous to human health. In the United States, the OSHA limits long-term workplace exposure levels to less than 50 ppm averaged over an 8-hour period; in addition, employees are to be removed from any confined space if an upper limit ("ceiling") of 100 ppm is reached. Carbon monoxide exposure may lead to a significantly shorter life span due to heart damage. The carbon monoxide tolerance level for any person is altered by several factors, including activity level, rate of ventilation, a pre-existing cerebral or cardiovascular disease, cardiac output, anemia, sickle cell disease and other hematological disorders, barometric pressure, and metabolic rate.

Concentration	Symptoms
35 ppm (0.0035%), (0.035‰)	Headache and dizziness within six to eight hours of constant exposure
100 ppm (0.01%), (0.1‰)	Slight headache in two to three hours
200 ppm (0.02%), (0.2‰)	Slight headache within two to three hours; loss of judgment
400 ppm (0.04%), (0.4‰)	Frontal headache within one to two hours
800 ppm (0.08%), (0.8‰)	Dizziness, nausea, and convulsions within 45 min; insensible within 2 hours
1,600 ppm (0.16%), (1.6‰)	Headache, increased heart rate, dizziness, and nausea within 20 min; death in less than 2 hours
3,200 ppm (0.32%), (3.2‰)	Headache, dizziness and nausea in five to ten minutes. Death within 30 minutes.
6,400 ppm (0.64%), (6.4‰)	Headache and dizziness in one to two minutes. Convulsions, respiratory arrest, and death in less than 20 minutes.
12,800 ppm (1.28%), (12.8‰)	Unconsciousness after 2–3 breaths. Death in less than three minutes.

Acute Poisoning
The main manifestations of carbon monoxide poisoning develop in the organ systems most dependent on oxygen use, the central nervous system and the heart. The initial symptoms of acute carbon monoxide poisoning include headache, nausea, malaise, and fatigue. These symptoms are often mistaken for a virus such as influenza or other illnesses such as food poisoning or gastroenteritis. Headache is the most common symptom of acute carbon monoxide poisoning; it is often described as dull, frontal, and continuous. Increasing exposure produces cardiac abnormalities including fast heart rate, low blood pressure, and cardiac arrhythmia; central nervous system symptoms include delirium, hallucinations, dizziness, unsteady gait, confusion, seizures, central nervous system depression, unconsciousness, respiratory arrest, and death. Less common symptoms of acute carbon monoxide poisoning include myocardial ischemia, atrial fibrillation, pneumonia, pulmonary edema, high blood sugar, lactic acidosis, muscle necrosis, acute kidney failure, skin lesions, and visual and auditory problems.

One of the major concerns following acute carbon monoxide poisoning is the severe delayed neurological manifestations that may occur. Problems may include difficulty with higher intellectual functions, short-term memory loss, dementia, amnesia, psychosis, irritability, a strange gait, speech disturbances, Parkinson's disease-like syndromes, cortical blindness, and a depressed mood. Depression may occur in those who did not have pre-existing depression. These delayed neurological sequelae may occur in up to 50% of poisoned people after 2 to 40 days. It is difficult to predict who will develop delayed sequelae; however, advanced age, loss of consciousness while poisoned, and initial neurological abnormalities may increase the chance of developing delayed symptoms.

One classic sign of carbon monoxide poisoning is more often seen in the dead rather than the living – people have been described as looking red-cheeked and healthy. However, since this "cherry-red" appearance is more common in the dead, it is not considered a useful diagnostic sign in clinical medicine. In autopsy examinations, the ruddy appearance of carbon monoxide poisoning is notable because unembalmed dead persons are normally bluish and pale, whereas dead carbon-monoxide poisoned people may appear unusually lifelike in coloration. The colorant effect of carbon monoxide in such postmortem circumstances is thus analogous to its use as a red colorant in the commercial meat-packing industry.

Chronic Poisoning
Chronic exposure to relatively low levels of carbon monoxide may cause persistent headaches, lightheadedness, depression, confusion, memory loss, nausea, hearing disorders and vomiting. It is unknown whether low-level chronic exposure may cause permanent neurological damage. Typically, upon removal from exposure to carbon monoxide, symptoms usually resolve themselves, unless there has been an episode of severe acute poisoning. However, one case noted permanent memory loss and learning problems after a three-year exposure to relatively low levels of carbon monoxide from a faulty furnace. Chronic exposure may worsen cardiovascular symptoms in some people. Chronic carbon monoxide exposure might increase the risk of developing atherosclerosis. Long-term exposures to carbon monoxide present the greatest risk to persons with coronary heart disease and in females who are pregnant. In experimental animals, carbon monoxide appears to worsen noise-induced hearing loss at noise exposure conditions that would have limited effects on hearing otherwise. In humans, hearing loss has been reported following carbon monoxide poisoning. Unlike the findings in animal studies, noise exposure was not a necessary factor for the auditory problems to occur.

Causes

Carbon monoxide is a product of combustion of organic matter under conditions of restricted oxygen supply, which prevents complete oxidation to carbon dioxide (CO_2). Sources of carbon monoxide include cigarette smoke, house fires, faulty furnaces, heaters, wood-burning stoves, internal combustion vehicle exhaust, electrical generators, propane-fueled equipment such as portable stoves, and gasoline-powered tools such as leaf blowers, lawn mowers, high-pressure washers, concrete cutting saws, power trowels, and welders. Exposure typically occurs when equipment is used in buildings or semi-enclosed spaces.

Riding in the back of pickup trucks has led to poisoning in children. Idling automobiles with the exhaust pipe blocked by snow has led to the poisoning of car occupants. Any perforation between the exhaust manifold and shroud can result in exhaust gases reaching the cabin. Generators and propulsion engines on boats, especially houseboats, has resulted in fatal carbon monoxide exposures.

Poisoning may also occur following the use of a self-contained underwater breathing apparatus (SCUBA) due to faulty diving air compressors.

In caves carbon monoxide can build up in enclosed chambers due to the presence of decomposing organic matter. In coal mines incomplete combustion may occur during explosions resulting in the production of afterdamp. The gas is up to 3% CO and may be fatal after just a single breath. Following an explosion in a colliery, adjacent interconnected mines may become dangerous due to the afterdamp leaking from mine to mine. Such an incident followed the Trimdon Grange explosion which killed men in the Kelloe mine.

Another source of poisoning is exposure to the organic solvent dichloromethane, also known as methylene chloride, found in some paint strippers, as the metabolism of dichloromethane produces carbon monoxide. In November 2019, an EPA ban on dichloromethane in paint strippers for consumer use took effect in the United States.

Diagnosis

As many symptoms of carbon monoxide poisoning also occur with many other types of poisonings and infections (such as the flu), the diagnosis is often difficult. A history of potential carbon monoxide exposure, such as being exposed to a residential fire, may suggest poisoning, but the diagnosis is confirmed by measuring the levels of carbon monoxide in the blood. This can be determined by measuring the amount of carboxyhemoglobin compared to the amount of hemoglobin in the blood.

The ratio of carboxyhemoglobin to hemoglobin molecules in an average person may be up to 5%, although cigarette smokers who smoke two packs per day may have levels up to 9%. In symptomatic poisoned people they are often in the 10–30% range, while persons who die may have postmortem blood levels of 30–90%.

As people may continue to experience significant symptoms of CO poisoning long after their blood carboxyhemoglobin concentration has returned to normal, presenting to examination with a normal carboxyhemoglobin level (which may happen in late states of poisoning) does not rule out poisoning.

There are many conditions to be considered in the differential diagnosis of carbon monoxide poisoning. The earliest symptoms, especially from low level exposures, are often non-specific and readily confused with other illnesses, typically flu-like viral syndromes, depression, chronic fatigue syndrome, chest pain, and migraine or other headaches. Carbon monoxide has been called a "great mimicker" due to the presentation of poisoning being diverse and nonspecific. Other conditions included in the differential diagnosis include acute respiratory distress syndrome, altitude sickness, lactic acidosis, diabetic ketoacidosis, meningitis, methemoglobinemia, or opioid or toxic alcohol poisoning.

Prevention

Detectors
Prevention remains a vital public health issue, requiring public education on the safe operation of appliances, heaters, fireplaces, and internal-combustion engines, as well as increased emphasis on the installation of carbon monoxide detectors. Carbon monoxide is tasteless, odourless, and colourless, and therefore can not be detected by visual cues or smell.

The United States Consumer Product Safety Commission has stated, "carbon monoxide detectors are as important to home safety as smoke detectors are," and recommends each home have at least one carbon monoxide detector, and preferably one on each level of the building. These devices, which are relatively inexpensive and widely available, are either battery- or AC-powered, with or without battery backup. In buildings, carbon monoxide detectors are usually installed around heaters and other equipment. If a relatively high level of carbon monoxide is detected, the device sounds an alarm, giving people the chance to evacuate and ventilate the building. Unlike smoke detectors, carbon monoxide detectors do not need to be placed near ceiling level.

The use of carbon monoxide detectors has been standardized in many areas. In the US, NFPA 720-2009, the carbon monoxide detector guidelines published by the National Fire Protection Association, mandates the placement of carbon monoxide detectors/alarms on every level of the residence, including the basement, in addition to outside sleeping areas. In new homes, AC-powered detectors must have battery backup and be interconnected to ensure early warning of occupants at all levels. NFPA 720-2009 is the first national carbon monoxide standard to address devices in non-residential buildings. These guidelines, which now pertain to schools, healthcare centers, nursing homes and other non-residential buildings, include three main points:

1. A secondary power supply (battery backup) must operate all carbon monoxide notification appliances for at least 12 hours,
2. Detectors must be on the ceiling in the same room as permanently installed fuel-burning appliances, and
3. Detectors must be located on every habitable level and in every HVAC zone of the building.

Gas organizations will often recommend to get gas appliances serviced at least once a year.

Treatment

Initial treatment for carbon monoxide poisoning is to immediately remove the person from the exposure without endangering further people. Those who are unconscious may require CPR on site. Administering oxygen via non-rebreather mask shortens the half-life of carbon monoxide from 320 minutes, when breathing normal air, to only 80 minutes. Oxygen hastens the dissociation of carbon monoxide from carboxyhemoglobin, thus turning it back into hemoglobin. Due to the possible severe effects in the baby, pregnant women are treated with oxygen for longer periods of time than non-pregnant people.

Hyperbaric Oxygen
Hyperbaric oxygen is also used in the treatment of carbon monoxide poisoning, as it may hasten dissociation of CO from carboxyhemoglobin and cytochrome oxidase to a greater extent than normal oxygen. Hyperbaric oxygen at three times atmospheric pressure reduces the half life of carbon monoxide to 23 (~80/3 minutes) minutes, compared to 80 minutes for oxygen at regular atmospheric pressure. It may also enhance oxygen transport to the tissues by plasma, partially bypassing the normal transfer through hemoglobin. However, it is controversial whether hyperbaric oxygen actually offers any extra benefits over normal high flow oxygen, in terms of increased survival or improved long-term outcomes. There have been randomized controlled trials in which the two treatment options have been compared; of the six performed, four found hyperbaric oxygen improved outcome and two found no benefit for hyperbaric oxygen. Some of these trials have been criticized for apparent flaws in their implementation. A review of all the literature concluded that the role of hyperbaric oxygen is unclear and the available evidence neither confirms nor denies a medically meaningful benefit. The authors suggested a large, well designed, externally audited, multicentre trial to compare normal oxygen with hyperbaric oxygen.

Other
Further treatment for other complications such as seizure, hypotension, cardiac abnormalities, pulmonary edema, and acidosis may be required. Increased muscle activity and seizures should be treated with dantrolene or diazepam; diazepam should only be given with appropriate respiratory support. Hypotension requires treatment with intravenous fluids; vasopressors may be required to treat myocardial depression. Cardiac dysrhythmias are treated with standard advanced cardiac life support protocols. If severe, metabolic acidosis is treated with sodium bicarbonate. Treatment with sodium bicarbonate is controversial as acidosis may increase tissue oxygen availability. Treatment of acidosis may only need to consist of oxygen therapy. The delayed development of neuropsychiatric impairment is one of the most serious complications of carbon monoxide poisoning. Brain damage is confirmed following MRI or CAT scans. Extensive follow up and supportive treatment is often required for delayed neurological damage. Outcomes are often difficult to predict following poisoning, especially people who have symptoms of cardiac arrest, coma, metabolic acidosis, or have high carboxyhemoglobin levels. One study reported that approximately 30% of people with severe carbon monoxide poisoning will have a fatal outcome. It has been reported that electroconvulsive therapy (ECT) may increase the likelihood of delayed neuropsychiatric sequelae (DNS) after carbon monoxide (CO) poisoning. A device that also provides some carbon dioxide to stimulate faster breathing (sold under the brand name ClearMate) may also be used.

16 Lipid Pneumonia

Lipid pneumonia is a specific form of lung inflammation (pneumonia) that develops when lipids enter the bronchial tree.

Signs & Symptoms

The pneumonia presents as a foreign body reaction causing cough, dyspnea, and often fever. Hemoptysis has also been reported.

Causes

Sources of such lipids could be either exogenous or endogenous.

Exogenous: from outside the body. For example, inhaled nose drops with an oil base, or accidental inhalation of cosmetic oil. Amiodarone is an anti-arrythmic known to cause this condition. Oil pulling has also been shown to be a cause. Fire breather's pneumonia from the inhalation of hydrocarbon fuel is a specific variant. At risk populations include the elderly, developmentally delayed or persons with gastroesophageal reflux. Switching to water-soluble alternatives may be helpful in some situations.

Endogenous: from the body itself, for example, when an airway is obstructed, it is often the case that distal to the obstruction, lipid-laden macrophages and giant cells fill the lumen of the disconnected airspace.

Diagnosis

The gross appearance of a lipid pneumonia is that in which there is an ill-defined, pale yellow area on the lung. This yellow appearance explains the colloquial term "golden" pneumonia. At the microscopic scale foamy macrophages and giant cells are seen in the airways, and the inflammatory response is visible in the parenchyma.

Prevention

Treatment

Treatment is with corticosteroids and possibly intravenous immunoglobulins.

7 Animal & Plant

This section includes all the unique stings and bites from animals and plants.

Subheadings

1. Ant Bites	**2. Bee Stings**	**3. Wasp Stings**	**4. Caterpillar Stings**
5. Scorpion Stings	**6. Snake Bites**	**7. Spider Bites**	**8. Plant Stings**

1 Ant Bites

If attacked by fire ants, treat the bites by washing the affected area with soap and water. You can also apply ice to reduce the swelling and pain or use topical over-the-counter steroid or aloe vera-based creams. Antihistamines can help reduce the itching sensation and lessen the reaction to the bite. Avoid scratching, though, as doing so can cause bites to become infected. If left alone, bites should heal in about a week's time. Signs of a dangerous allergic reaction include difficulty breathing and swallowing, nausea and dizziness. These symptoms will develop quickly after bitten. If you or a family member is experiencing such symptoms, seek medical attention immediately.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

2 Bee Stings

A bee sting is a wound caused by the stinger from a bee (honey bee, bumblebee, sweat bee, etc.) being injected into one's flesh. The stings of most of these species can be quite painful, and are therefore keenly avoided by many people.

Bee stings differ from insect bites, and the venom or toxin of stinging insects is quite different. Therefore, the body's reaction to a bee sting may differ significantly from one species to another. In particular, bee stings are acidic, whereas wasp stings are alkaline, so the body's reaction to a bee sting may be very different from its reaction to a wasp sting.

The most aggressive stinging insects are vespid wasps (including bald-faced hornets and other yellowjackets) and hornets (especially the Asian giant hornet). All of these insects aggressively defend their nests. Although for most people a bee sting is painful but otherwise relatively harmless, in people with insect sting allergy, stings may trigger a dangerous anaphylactic reaction that is potentially deadly. Additionally, honey bee stings release pheromones that prompt other nearby bees to attack.

Signs & Symptoms

Causes

A honey bee that is away from the hive foraging for nectar or pollen will rarely sting, except when stepped on or roughly handled. Honey bees will actively seek out and sting when they perceive the hive to be threatened, often being alerted to this by the release of attack pheromones (below).

Although it is widely believed that a worker honey bee can sting only once, this is a partial misconception: although the stinger is in fact barbed so that it lodges in the victim's skin, tearing loose from the bee's abdomen and leading to its death in minutes, this only happens if the skin of the victim is sufficiently thick, such as a mammal's. Honey bees are the only hymenoptera with a strongly barbed sting, though yellow jackets and some other wasps have small barbs.

Bees with barbed stingers can often sting other insects without harming themselves. Queen honeybees and bees of many other species, including bumblebees and many solitary bees, have smoother stingers with smaller barbs, and can sting mammals repeatedly.

The sting's injection of apitoxin into the victim is accompanied by the release of alarm pheromones, a process which is accelerated if the bee is fatally injured. The release of alarm pheromones near a hive may attract other bees to the location, where they will likewise exhibit defensive behaviors until there is no longer a threat, typically because the victim has either fled or been killed. (Note: A bee swarm, seen as a mass of bees flying or clumped together, is generally not hostile; it has deserted its hive and has no comb or young to defend.) These pheromones do not dissipate or wash off quickly, and if their target enters water, bees will resume their attack as soon as it leaves the water. The alarm pheromone emitted when a bee stings another animal smells like a banana.

Drone bees, the males, are larger and do not have stingers. The female bees (worker bees and queens) are the only ones that can sting, and their stinger is a modified ovipositor. The queen bee has a barbed but smoother stinger and can, if need be, sting skin-bearing creatures multiple times, but the queen does not leave the hive under normal conditions. Her sting is not for defense of the hive; she only uses it for dispatching rival queens, ideally before they can emerge from their cells. Queen breeders who handle multiple queens and have the queen odor on their hands are sometimes stung by a queen.

The main component of bee venom responsible for pain in vertebrates is the toxin melittin; histamine and other biogenic amines may also contribute to pain and itching. In one of the alternative medical uses of honey bee products, apitherapy, bee venom has been used to treat arthritis and other painful conditions. All currently available evidence supporting this practice is either anecdotal, animal studies, or preliminary evidence, most of which has poor methodology. While a preliminary, in-vitro proof of concept has demonstrated that isolated melittin may attenuate the infectivity of two specific HIV strains, apitherapy is not currently accepted as a viable medical treatment for any condition or disease; the risk of allergic reaction and anaphylaxis outweighs any benefits.

The stinger consists of three parts: a stylus and two barbed slides (or lancets), one on either side of the stylus. The bee does not push the stinger in but it is drawn in by the barbed slides. The slides move alternately up and down the stylus so when the barb of one slide has caught and retracts, it pulls the stylus and the other barbed slide into the wound. When the other barb has caught, it also retracts up the stylus pulling the sting further in. This process is repeated until the sting is fully in and even continues after the sting and its mechanism is detached from the bee's abdomen.

When a honey bee stings a person, it cannot pull the barbed stinger back out. It leaves behind not only the stinger, but also part of its abdomen and digestive tract, plus muscles and nerves. This massive abdominal rupture kills the honey bee. Honey bees are the only bees to die after stinging.

Diagnosis

Prevention

Treatment

The first step in treatment following a honey bee sting is removal of the stinger itself. The stinger should be removed as quickly as possible without regard to method: a study has shown the amount of venom delivered does not differ whether the sting is pinched or scraped off and even a delay of a few seconds leads to more venom being injected. Once the stinger is removed, pain and swelling should be reduced with a cold compress. A topical anesthetic containing benzocaine will kill pain quickly and menthol is an effective anti-itch treatment. Itching can also be relieved by antihistamine or by a steroid cream.

Many traditional remedies have been suggested for bee stings including damp pastes of tobacco, salt, baking soda, papain, toothpaste, clay, garlic, urine, onions, aspirin or even application of copper coins. As with jellyfish stings, ammonia and ammonia-containing liquids, such as window cleaner, are often suggested as a way to immediately cleanse the skin and remove excess venom, and sweat itself (which also contains small amounts of ammonia) may provide some small relief.

Bee venom is acidic, and these interventions are often recommended to neutralize the venom; however, neutralizing a sting is unlikely to be effective as the venom is injected under the skin and deep into the tissues, where a topically applied alkali is unable to reach, so neutralization is unlikely to occur. In any case, the amount of venom injected is typically very small (between 5 and 50 micrograms of fluid) and placing large amounts of alkali near the sting site is unlikely to produce a perfectly neutral pH to stop the pain. Many people do claim benefit from these home remedies but it is doubtful they have any real physical effect on how much a sting hurts or continues hurting.

The effect is probably related to rubbing the area or the mind perceiving benefit. Furthermore, none of these interventions have been proven to be effective in scientific studies and a randomized trial of aspirin paste and topical ice packs showed that aspirin was not effective in reducing the duration of swelling or pain in bee and wasp stings, and significantly increased the duration of redness. The study concluded that ice alone is a better treatment for bee and wasp stings than aspirin.

The sting may be painful for a few hours. Swelling and itching may persist for a week. The area should not be scratched as it will only increase the itching and swelling. If swelling persists for over a week or covers an area greater than 7–10 cm (3–4 inches), medical attention should be sought. Doctors often recommend a tetanus immunization. For about 2 percent of people, a hypersensitivity can develop after being stung, creating a more severe reaction when stung again later. This sensitisation may happen after a single sting, or after a series of stings where they reacted normally. A highly allergic person may suffer anaphylactic shock from certain proteins in the venom, which can be life-threatening and requires emergency treatment. People known to be highly allergic may carry around epinephrine (adrenaline) in the form of a self-injectable EpiPen for the treatment of an anaphylactic shock.

For patients who experience severe or life-threatening reactions to insect stings, allergy injections composed of increasing concentrations of naturally occurring venom may provide protections against future insect stings.

3 Wasp Stings

A sting or multiple stings from a wasp.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

4 Caterpillar Stings

A sting from a caterpillar.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

5 Scorpion Stings

A sting from a scorpion's tail.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

6 Snake Bites

A bite from any snake.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

7 Spider Bites

A bite from any type of spider.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

8 Plant Stings

A sting from a plant.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

8 Foreign Bodies

Any kind of wound where an external object enters the body such as a bullet or a nail.

Splinters

A splinter is a fragment of a larger object (especially wood), or a foreign body that penetrates or is purposely injected into a body. The foreign body must be lodged inside tissue to be considered a splinter.

According to the AAFP, the most common foreign bodies contracted by people fall into two official classes: biological splinters, and nonbiological splinters. In the biological class, splinters include bone, fish spines, teeth, and wood. In the nonbiological class, common splinters contracted are glass, metal, aluminum, fishhooks, pencil graphite, and plastic. Rarely, people may become infected with splinters from more unusual sources. Common cases of exotic foreign bodies include sea urchins, insect stings, stingray spines, and even grenade shrapnel.

Signs & Symptoms

Generally, a splinter causes an initial feeling of pain as the sharp object makes its initial penetration through the body. Through this penetration, the object cuts through the cutaneous layer of the skin, and settles in the subcutaneous layer of the skin, and can even penetrate further down, breaking the sub-cutaneous layer, settling in muscle tissue, or even the bone. Some splinters will remain in place, but most will continue to migrate through the body, further damaging their surroundings.

Causes

Common splinter types:

Wood	This type of splinter is contracted from lumber or other vegetative materials. Wood splinters must be removed from wounds because they are associated with inflammation and risk of infection. Larger or deeper splinters can result in difficult removal, or localization of the foreign body.
Fishhooks	Fishhooks that become lodged in the skin are problematic because of the barbs found on the ends of most fishhooks. These barbs are designed to make removal difficult, and if care is not taken, the victim can experience tearing of not only the flesh, but the muscle as well. The most common injuries caused by fishhooks occur in the hand, face, scalp, foot, and eye.
Glass	One study found that patients were more likely to feel sensations from glass present in their skin than from any other kind of splinter. Though glass is generally detectable by radiography and is radiopaque, there is limited ability for radiography to detect glass fragments smaller than 2mm. Most glass splinters are inert, and generally lack the ability to migrate to other regions of the body.
Other	Pencil lead and other graphite foreign bodies, once lodged in the cutaneous layer of the skin, can cause permanent pigment tattooing if not removed immediately. Metallic bodies range from BB pellets to grenade shrapnel. Smaller objects can be removed without much difficulty if the depth of the wound remains superficial, but if the wound does not protrude past the subcutaneous layers of the skin, and remains inert, the object can actually remain in place. In larger objects, fragments that remain superficial in one's body may be removed without much trouble, but if wounds protrude past the subcutaneous layers of the skin and even into the muscular area or near vital organs, such objects must be left alone and immediate medical attention must be sought.
Hair	Short lengths of hair, especially stiff hair such as trimmed beard hair or pet hair, can work its way under the skin of the feet or hands. So-called "hair splinters" are commonly experienced by hairdressers and dog groomers. This is distinct from an ingrown hair, where a hair still attached to its follicle grows back under (or fails to emerge from) the skin.

Diagnosis

Signs of a hidden foreign body
- Puncture wound
- Blood-stained injury track of a fresh wound
- Sharp pain with deep palpation over a puncture wound
- Discoloration beneath the epidermis
- Wound that elicits pain with movement
- Wound that fails to heal
- Abscess (with sterile culture)
- Pain associated with a mass
- Mass under the epidermis
- Chronically draining purulent wound
- Cyst
- Granuloma formation
- Sterile monoarticular arthritis
- Periosteal reactions
- Osteomyelitis
- Pseudo tumors of bone
- Delayed tendon or nerve injury

Prevention

Wear gloves and other protective equipment.

INJURY Foreign Body Splinters

Treatment

There are many medical techniques to remove splinters safely. Common medical techniques include the Elliptical Technique and the String Technique. In the elliptical technique the surrounding area of the splinter is sliced in an elliptical formation. From there the flesh in the elliptical area is cut (in the shape of an upside-down cone) and the whole chunk of flesh containing the splinter is removed. The Needle Cover Technique is limited to fishhook removal. A string is looped around the base of the hook, and as the hook is pressed further into the skin, the string is pulled, allowing the barbs to be unhooked from muscle and follow the path of the rest of the hook out of the body without snagging any additional flesh.

Since the splinter has penetrated through a physical barrier of the body it allows for an individual to get an infection. The opening from the splinter will make it easier for bacteria to get into the body. It is strongly encourage for the removal or a splinter before falling victim to an Infection.

Infection
Infection is usually determined by the duration of time that the foreign object remains lodged in the human body. Objects that have included poison, deep penetration, dirt, or bite injuries generally result in a shorter time until infection is notable. According to the AAFP patients that are older, or have diabetes, or have wounds that are longer, wider, more jagged or deeper, have a much higher risk of infection. Simply the easiest way to avoid infection is to completely remove the splinters or foreign body as soon as possible. Though infection is generally the largest complication encountered with splinters, ranging from 1.1 to 12 percent presence, the use of antibiotics in non-bite cases is generally deemed unnecessary by the medical community. Though cases are rare, infection of foreign body wounds can result in cases of tetanus.

Since splinters are made of organic matter, they are much more dangerous than other types of things puncturing the body. Splinters are usually infected with many bacteria which then turn into an infection such as tetanus. Due to a splinter being made of organic matter, it makes it much more difficult for the body to get rid of it.

Impalement & Piercing

Impalement is the penetration of a human by an object such as a stake, pole, spear, or hook, often by complete or partial perforation of the torso.

Signs & Symptoms

Causes

Diagnosis

Prevention

Treatment

Gunshot Wound

A gunshot wound (GSW), also known as ballistic trauma, is a form of physical trauma sustained from the discharge of arms or munitions. Damage may include bleeding, broken bones, organ damage, infection of the wound, or loss of the ability to move part of the body. Damage depends on the part of the body hit, the path the bullet follows through the body, and the type and speed of the bullet. Long-term complications can include lead poisoning and post traumatic stress disorder (PTSD).

Signs & Symptoms

Trauma from a gunshot wound varies widely based on the bullet, velocity, mass, entry point, trajectory, and affected anatomy. Gunshot wounds can be particularly devastating compared to other penetrating injuries because the trajectory and fragmentation of bullets can be unpredictable after entry. Additionally, gunshot wounds typically involve a large degree of nearby tissue disruption and destruction due to the physical effects of the projectile correlated with the bullet velocity classification.

The immediate damaging effect of a gunshot wound is typically severe bleeding, and with it the potential for hypovolemic shock, a condition characterized by inadequate delivery of oxygen to vital organs. In the case of traumatic hypovolemic shock, this failure of adequate oxygen delivery is due to blood loss, as blood is the means of delivering oxygen to the body's constituent parts. Devastating effects can result when a bullet strikes a vital organ such as the heart, lungs or liver, or damages a component of the central nervous system such as the spinal cord or brain.

Common causes of death following gunshot injury include bleeding, low oxygen caused by pneumothorax, catastrophic injury to the heart and major blood vessels, and damage to the brain or central nervous system. Non-fatal gunshot wounds frequently have mild to severe long-lasting effects, typically some form of major disfigurement such as amputation due to a severe bone fracture, and may cause permanent disability.

Causes

Diagnosis

Classification

Gunshot wounds are classified according to the speed of the projectile:

- Low-velocity: < 1,100 ft/s (340 m/s)
- Medium-velocity: 1,100 ft/s (340 m/s) to 2,000 ft/s (610 m/s)
- High-velocity: 2,000 ft/s (610 m/s) to 3,500 ft/s (1,100 m/s)
- Hyper velocity: > 3,500 ft/s (1,100 m/s)

Bullets from handguns are sometimes less than 1,000 ft/s (300 m/s) but with modern pistol loads, they usually are slightly above 1,000 ft/s (300 m/s), while bullets from most modern rifles exceed 2,500 ft/s (760 m/s). One recently developed class of firearm projectiles is the hyper-velocity bullet, such cartridges are usually either wildcats made for achieving such high speed or purpose built factory ammunition with the same goal in mind. Examples of hyper velocity cartridges include the .220 Swift, .17 Remington and .17 Mach IV cartridges. The US military commonly uses 5.56mm bullets, which have a relatively low mass as compared with other bullets (40-62 grains); however, the speed of these bullets is relatively fast (Approximately 2,800 ft/s (850 m/s), placing them in the high velocity category). As a result, they produce a larger amount of kinetic energy, which is transmitted to the tissues of the target.

However, one must remember that high kinetic energy does not necessarily equate to high stopping power, as incapacitation usually results from remote wounding effects such as bleeding, rather than raw energy transfer. High energy does indeed result in more tissue disruption, which plays a role in incapacitation, but other factors such as wound size and shot placement play as big of, if not a bigger role in stopping power and thus, effectiveness. Muzzle velocity does not consider the effect of aerodynamic drag on the flight of the bullet for the sake of ease of comparison.

Prevention

Medical organizations in the United States recommend criminal background check before people can buy a gun and those who are guilty of crimes of violence should be prevented from buying them. Safe storage of firearms is also recommended as is better mental health care and removal of guns from those at risk of suicide. In an effort to prevent mass shootings greater regulations on guns that can rapidly fire many bullets is recommended.

Treatment

Before management begins it should be verified the area is safe. This is followed by stopping major bleeding, then assessing and supporting the airway, breathing, and circulation. Firearm laws, particularly background checks and permit to purchase, decrease the risk of death from firearms. Safer firearm storage may decrease the risk of firearm-related deaths in children.

Initial assessment for a gunshot wound is approached in the same way as other acute trauma using the advanced trauma life support (ATLS) protocol. These include:

A) Airway - Assess and protect airway and potentially the cervical spine
B) Breathing - Maintain adequate ventilation and oxygenation
C) Circulation - Assess for and control bleeding to maintain organ perfusion including focused assessment with sonography for trauma (FAST)
D) Disability - Perform basic neurological exam including Glasgow Coma Scale (GCS)
E) Exposure - Expose entire body and search for any missed injuries, entry points, and exit points while maintaining body temperature

Depending on the extent of injury, management can range from urgent surgical intervention to observation. As such, any history from the scene such as gun type, shots fired, shot direction and distance, blood loss on scene, and pre-hospital vitals signs can be very helpful in directing management. Unstable people with signs of bleeding that cannot be controlled during the initial evaluation require immediate surgical exploration in the operating room. Otherwise, management protocols are generally dictated by anatomic entry point and anticipated trajectory.

Neck

A gunshot wound to the neck can be particularly dangerous because of the high number of vital anatomical structures contained within a small space. The neck contains the larynx, trachea, pharynx, esophagus, vasculature (carotid, subclavian, and vertebral arteries; jugular, brachiocephalic, and vertebral veins; thyroid vessels), and nervous system anatomy (spinal cord, cranial nerves, peripheral nerves, sympathetic chain, brachial plexus). Gunshots to the neck can thus cause severe bleeding, airway compromise, and nervous system injury.

Initial assessment of a gunshot wound to the neck involves non-probing inspection of whether the injury is a penetrating neck injury (PNI), classified by violation of the platsyma muscle. If the platsyma is intact, the wound is considered superficial and only requires local wound care. If the injury is a PNI, surgery should be consulted immediately while the case is being managed. Of note, wounds should not be explored on the field or in the emergency department given the risk of exacerbating the wound.

Due to the advances in diagnostic imaging, management of PNI has been shifting from a "zone-based" approach, which uses anatomical site of injury to guide decisions, to a "no-zone" approach which uses a symptom-based algorithm. The no-zone approach uses a hard signs and imaging system to guide next steps. Hard signs include airway compromise, unresponsive shock, diminished pulses, uncontrolled bleeding, expanding hematoma, bruits/thrill, air bubbling from wound or extensive subcutaneous air, stridor/hoarseness, neurological deficits.

If any hard signs are present, immediate surgical exploration and repair is pursued alongside airway and bleeding control. If there are no hard signs, the person receives a multi-detector CT angiography for better diagnosis. A directed angiography or endoscopy may be warranted in a high-risk trajectory for the gunshot. A positive finding on CT leads to operative exploration. If negative, the person may be observed with local wound care.

Chest

Important anatomy in the chest includes the chest wall, ribs, spine, spinal cord, intercostal neurovascular bundles, lungs, bronchi, heart, aorta, major vessels, esophagus, thoracic duct, and diaphragm. Gunshots to the chest can thus cause severe bleeding (hemothorax), respiratory compromise (pneumothorax, hemothorax, pulmonary contusion, tracheobronchial injury), cardiac injury (pericardial tamponade), esophageal injury, and nervous system injury.

Initial workup as outlined in the Workup section is particularly important with gunshot wounds to the chest because of the high risk for direct injury to the lungs, heart, and major vessels. Important notes for the initial workup specific for chest injuries are as follows. In people with pericardial tamponade or tension pneumothorax, the chest should be evacuated or decompressed if possible prior to attempting tracheal intubation because the positive pressure ventilation can cause hypotention or cardiovascular collapse. Those with signs of a tension pneumothorax (asymmetric breathing, unstable blood flow, respiratory distress) should immediately receive a chest tube (> French 36) or needle decompression if chest tube placement is delayed. FAST exam should include extended views into the chest to evaluate for hemopericardium, pneumothorax, hemothorax, and peritoneal fluid.

Those with cardiac tamponade, uncontrolled bleeding, or a persistent air leak from a chest tube all require surgery. Cardiac tamponade can be identified on FAST exam. Blood loss warranting surgery is 1–1.5 L of immediate chest tube drainage or ongoing bleeding of 200-300 mL/hr. Persistent air leak is suggestive of tracheobronchial injury which will not heal without surgical intervention. Depending on the severity of the person's condition and if cardiac arrest is recent or imminent, the person may require surgical intervention in the emergency department, otherwise known as an emergency department thoracotomy (EDT).

However, not all gunshot to the chest require surgery. Asymptomatic people with a normal chest X-ray can be observed with a repeat exam and imaging after 6 hours to ensure no delayed development of pneumothorax or hemothorax. If a person only has a pneumothorax or hemothorax, a chest tube is usually sufficient for management unless there is large volume bleeding or persistent air leak as noted above. Additional imaging after initial chest X-ray and ultrasound can be useful in guiding next steps for stable people. Common imaging modalities include chest CT, formal echocardiography, angiography, esophagoscopy, esophagography, and bronchoscopy depending on the signs and symptoms.

Abdomen

Important anatomy in the abdomen includes the stomach, small bowel, colon, liver, spleen, pancreas, kidneys, spine, diaphragm, descending aorta, and other abdominal vessels and nerves. Gunshots to the abdomen can thus cause severe bleeding, release of bowel contents, peritonitis, organ rupture, respiratory compromise, and neurological deficits.

The most important initial evaluation of a gunshot wound to the abdomen is whether there is uncontrolled bleeding, inflammation of the peritoneum, or spillage of bowel contents. If any of these are present, the person should be transferred immediately to the operating room for laparotomy. If it is difficult to evaluate for those indications because the person is unresponsive or incomprehensible, it is up to the surgeon's discretion whether to pursue laparotomy, exploratory laparoscopy, or alternative investigative tools.

Although all people with abdominal gunshot wounds were taken to the operating room in the past, practice has shifted in recent years with the advances in imaging to non-operative approaches in more stable people. If the person's vital signs are stable without indication for immediate surgery, imaging is done to determine the extent of injury.

Ultrasound (FAST) and help identify intra-abdominal bleeding and X-rays can help determine bullet trajectory and fragmentation. However, the best and preferred mode of imaging is high-resolution multi-detector CT (MDCT) with IV, oral, and sometimes rectal contrast. Severity of injury found on imaging will determine whether the surgeon takes an operative or close observational approach.

Extremities

The four main components of extremities are bones, vessels, nerves, and soft tissues. Gunshot wounds can thus cause severe bleeding, fractures, nerve deficits, and soft tissue damage. The Mangled Extremity Severity Score (MESS) is used to classify the severity of injury and evaluates for severity of skeletal and/or soft tissue injury, limb ischemia, shock, and age. Depending on the extent of injury, management can range from superficial wound care to limb amputation.

Vital sign stability and vascular assessment are the most important determinants of management in extremity injuries. As with other traumatic cases, those with uncontrolled bleeding require immediate surgical intervention. If surgical intervention is not readily available and direct pressure is insufficient to control bleeding, tourniquets or direct clamping of visible vessels may be used temporarily to slow active bleeding. People with hard signs of vascular injury also require immediate surgical intervention. Hard signs include active bleeding, expanding or pulsatile hematoma, bruit/thrill, absent distal pulses and signs of extremity ischemia.

For stable people without hard signs of vascular injury, an injured extremity index (IEI) should be calculated by comparing the blood pressure in the injured limb compared to an uninjured limb in order to further evaluate for potential vascular injury. If the IEI or clinical signs are suggestive of vascular injury, the person may undergo surgery or receive further imaging including CT angiography or conventional arteriography.

In addition to vascular management, people must be evaluated for bone, soft tissue, and nerve injury. Plain films can be used for fractures alongside CTs for soft tissue assessment. Fractures must be debrided and stabilized, nerves repaired when possible, and soft tissue debrided and covered. This process can often require multiple procedures over time depending on the severity of injury.

9 Poisoning

Poisoning is a condition or a process in which an organism becomes chemically harmed severely (poisoned) by a toxic substance or venom of an animal. In biology, poisons are substances that cause disturbances in organisms, usually by chemical reaction or other activity on the molecular scale, when an organism absorbs a sufficient quantity. The fields of medicine (particularly veterinary) and zoology often distinguish a poison from a toxin, and from a venom. Toxins are poisons produced by organisms in nature, and venoms are toxins injected by a bite or sting (this is exclusive to animals). The difference between venom and other poisons is the delivery method. Industry, agriculture, and other sectors use poisons for reasons other than their toxicity. Pesticides are one group of substances whose toxicity to various insects and other animals deemed to be pests (e.g., rats and cockroaches) is their prime purpose. Acute poisoning is exposure to a poison on one occasion or during a short period of time. Symptoms develop in close relation to the exposure. Absorption of a poison is necessary for systemic poisoning. In contrast, substances that destroy tissue but do not absorb, such as lye, are classified as corrosives rather than poisons.

Types

Hemlock	The plant is poisonous to animals that graze on it. Studies have reported cases of intoxication in cattle, pigs, sheep, goats, donkeys, rabbits, and horses. A short time after ingestion, the alkaloids produce potentially fatal neuromuscular dysfunction due to failure of the respiratory muscles. Acute toxicity, if not lethal, may resolve in spontaneous recovery, provided further exposure is avoided. The onset of symptoms is similar to that caused by curare, with an ascending muscular paralysis leading to paralysis of the respiratory muscles, causing death from oxygen deprivation. Death can be prevented by artificial ventilation until the effects have worn off 48–72 hours later. For an adult, the ingestion of more than 100 mg (0.1 gram) of coniine (about six to eight fresh leaves, or a smaller dose of the seeds or root) may be fatal. Since no specific antidote is available, prevention is the only way to deal with the production losses caused by the plant. Control with herbicides and grazing with less-susceptible animals (such as sheep) have been suggested. It is a common myth that C. maculatum alkaloids can enter the human food chain via milk and fowl, but scientific studies have disproven these claims.
Aconite	
Belladonna	
Dimethylmercury	
Tetrodotoxin	
Polonium	The element polonium is the ultimate poison and has been linked to the deaths of infamous people. It is intensely toxic to living things and as such has no known biological role. In its commonest form, Polonium 210 it is reportedly 250,000 times more toxic than hydrogen cyanide. This toxicity is radioactive in nature and caused by the release of alpha particles which damage organic tissue. Alpha particles cannot penetrate the skin but if the polonium is ingested, inhaled or injected it is lethal in the tiniest of doses. In theory a single gram of polonium 210 could kill 10 million people. If the acute effects of radiation poisoning don't kill you then some form of cancer probably will.
Mercury	

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Cyanide	Cyanide works by preventing cellular respiration; i.e. the body stops producing energy at the very lowest level causing what is termed "internal asphyxia". This manifests itself in rapid breathing, dizziness, nausea, headache and ultimately convulsions. Cyanide comes in two main forms hydrogen cyanide which is a gas and potassium cyanide which is a white powder. It occurs naturally in the stones of apricots, several plants and even apple pips. Whatever the source it is recognisable by a bitter-almond smell.
Botulinum Toxin	It is impractical to kill using isolated botulinum toxin. It is the most poisonous substance known to man. It is estimated that a single teaspoon of botulinum toxin would be sufficient to kill over 1 billion people. The toxin is produced by the bacterium Clostridium botulinum which can be found worldwide. In its lethal form it is most commonly encountered as botulism occurring when food contaminated with the bacteria is consumed. This form of food poisoning has killed countless people over the ages but is easily avoided by heating the food to over 100°C for a minute.
Arsenic	The superficial effects of arsenic poisoning are jaundice and a skin rash, but this tends to be after a long build up. Acute poisoning from a high dose results in intense gastric distress – basically everything goes wrong with your gut causing vomiting, diarrhea and bleeding, along with pain. Death follows convulsions and coma with circulatory failure being the ultimate cause. This may happen within a few hours of ingestion.
Strychnine	
Ricin	

Animal Poisons

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Arrow Poison Frog	

Poisoning Treatment

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Poisoning Treatment

Treatment of a recently ingested poison may involve gastric decontamination to decrease absorption.

Activated Charcoal	Treatment of choice to prevent poison absorption. Usually administered in an emergency room or by a trained Paramedic or EMT. Charcoal is ineffective against metals such as sodium, potassium, and lithium, and alcohols and glycols; it is also not recommended for ingestion of corrosive chemicals such as acids and alkalis.
Cathartics	Postulated to decrease absorption by increasing the expulsion of the poison from the gastrointestinal tract. There are two types of cathartics used in poisoned patients; saline cathartics (sodium sulfate, magnesium citrate, magnesium sulfate) and saccharide cathartics (sorbitol). They do not appear to improve patient outcome and are no longer recommended.
Emesis	(i.e. induced by ipecac) is no longer recommended in poisoning situations, because vomiting is ineffective at removing poisons.
Gastric Lavage	Commonly known as a stomach pump, is the insertion of a tube into the stomach, followed by administration of water or saline down the tube. The liquid is then removed along with the contents of the stomach. Lavage has been used for many years as a common treatment for poisoned patients. However, a recent review of the procedure in poisonings suggests no benefit. Whole bowel irrigation cleanses the bowel. This is achieved by giving the patient large amounts of a polyethylene glycol solution. The osmotically balanced polyethylene glycol solution is not absorbed into the body, having the effect of flushing out the entire gastrointestinal tract. Its major uses are to treat ingestion of sustained release drugs, toxins not absorbed by activated charcoal (e.g. lithium, iron), and for removal of ingested drug packets.

Antidotes

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Antidotes

This is a list of antidotes to common poisons and toxins.

Poison	Antidote
Many Oral Toxins	Activated Charcoal (Or Regular Charcoal) with Sorbitol
Adenosine Poisoning	Theophylline
Organophosphate and carbamate insecticides, nerve agents, some poison mushrooms	Atropine
Theophylline	Beta Blocker
Calcium channel blockers, black widow spider bites	Calcium Chloride
Hydrofluoric Acid	Calcium Gluconate
Heavy Metal Poisoning	Chelators such as EDTA, dimercaprol (BAL), penicillamine, and 2,3-dimercaptosuccinic acid (DMSA, succimer)
Cyanide Poisoning	Cyanide antidote (hydroxocobalamin, amyl nitrite, sodium nitrite, or thiosulfate)
Serotonin Syndrome	Cyproheptadine
Iron Poisoning	Deferoxamine Mesylate
Digoxin Poisoning	Digoxin Immune Fab antibody (Digibind and Digifab)
Extrapyramidal reactions associated with antipsychotic	Diphenhydramine hydrochloride and benztropine mesylate
Ethylene glycol poisoning and methanol poisoning	Ethanol or Fomepizole
Benzodiazepine Overdose	Flumazenil
Beta blocker poisoning and calcium channel blocker poisoning	Glucagon
Carbon monoxide poisoning and cyanide poisoning	100% oxygen or hyperbaric oxygen therapy (HBOT)
Reversal of dabigatran etexilate, an anticoagulant	Idarucizumab
Beta blocker poisoning and calcium channel blocker poisoning	Insulin with Glucagon
Methotrexate and Trimethoprim	Leucovorin

Treatment of conditions that cause methemoglobinemia	Methylene Blue
Opioid Overdose	Naloxone Hydrochloride
Paracetamol (acetaminophen) Poisoning	N-acetylcysteine
Oral Hypoglycemic Agents	Octreotide
Organophosphate insecticides, followed after atropine	Pralidoxime Chloride (2-PAM)
Heparin Poisoning	Protamine Sulfate
Thallium Poisoning	Prussian Blue
Anticholinergic Poisoning	Physostigmine Sulfate
Isoniazid poisoning, ethylene glycol	Pyridoxine
Warfarin poisoning and indanedione	Phytomenadione (vitamin K) and fresh frozen plasma
Aspirin, TCAs with a wide QRS	Sodium Bicarbonate
Lead Poisoning	Succimer, chemical name Dimercaptosuccinic acid (DMSA)

10 Other

Any other kind of wounds or injuries such as a stroke, seizure or childbirth.

Subheadings

1. Electrocution	**2. Cardiac Arrest**	**3. Stroke**	**4. Seizure**
5. Childbirth	**6. Hyperglycemia**	**7. Hypoglycemia**	**8. Toothache**

1 Electrical Injury & Electrocution

Electrical injury is a physiological reaction caused by electric current passing through the body. Electric shock occurs upon contact of a (human) body part with any source of electricity that causes a sufficient magnitude of current to pass through the victim's flesh, viscera or hair. Electrocution is death or serious injury caused by electric shock, electric current passing through the body.

Signs & Symptoms

Burns	Heating due to resistance can cause extensive and deep burns. When applied to the hand, electricity can cause involuntary muscle contraction, producing the "no-let-go" phenomenon, and increasing the risk for serious burns. Voltage levels of 500 to 1000 volts tend to cause internal burns due to the large energy (which is proportional to the duration multiplied by the square of the voltage divided by resistance) available from the source. Damage due to current is through tissue heating and/or electroporation injury. For most cases of high-energy electrical trauma, the Joule heating in the deeper tissues along the extremity will reach damaging temperatures in a few seconds.
Ventricular Fibrillation	A domestic power supply voltage (110 or 230 V), 50 or 60 Hz alternating current (AC) through the chest for a fraction of a second may induce ventricular fibrillation at currents as low as 30 milliamperes (mA). With direct current (DC), 300 to 500 mA is required. If the current has a direct pathway to the heart (e.g., via a cardiac catheter or other kind of electrode), a much lower current of less than 1 mA (AC or DC) can cause fibrillation. If not immediately treated by defibrillation, fibrillation is usually lethal because all of the heart muscle fibres move independently instead of in the coordinated pulses needed to pump blood and maintain circulation. Above 200 mA, muscle contractions are so strong that the heart muscles cannot move at all, but these conditions prevent fibrillation.
Neurological Effects	Electrical current can cause interference with nervous control, especially over the heart and lungs. electric shock which does not lead to death has been shown to cause neuropathy at the site where the current entered the body. The neurologic symptoms of electrical injury may occur immediately, which traditionally have a higher likelihood for healing, though they may also be delayed by days to years. The delayed neurologic consequences of electrical injury have a worse prognosis. When the patch of electrical current proceeds through the head, it appears that, with sufficient current applied, loss of consciousness almost always occurs swiftly. (This is borne out by some limited self-experimentation by early designers of the electric chair and by research from the field of animal husbandry, where electric stunning has been extensively studied). If ventricular fibrillation occurs (as above), the blood supply to the brain is diminished, which may cause cerebral hypoxia (and its associated neurologic consequences).
Psychiatric Effects	There are a variety of psychiatric effects that may occur due to electrical injuries. Recent research has found that functional differences in neural activation during spatial working memory and implicit learning oculomotor tasks have been identified in electrical shock victims. Frank behavioral changes can occur as well, even if the path of electrical current did not proceed through the head. Symptoms may include: ● Depression, including feelings of low self-esteem and guilt ● Anxiety spectrum disorders, including posttraumatic stress disorder and fear of electricity ● Moodiness, including a lower threshold for frustration and "losing one's temper" ● Memory loss, decreased attention span, and difficulty learning
Arc-Flash Hazards	OSHA found that up to 80 percent of its electrical injuries involve thermal burns due to arcing faults. The arc flash in an electrical fault produces the same type of light radiation from which electric welders protect themselves using face shields with dark glass, heavy leather gloves, and full-coverage clothing. The heat produced may cause severe burns, especially on unprotected flesh. The arc blast produced by vaporizing metallic components can break bones and damage internal organs. The degree of hazard present at a particular location can be determined by a detailed analysis of the electrical system, and appropriate protection worn if the electrical work must be performed with the electricity on.

Causes

Physical contact with energized wiring or devices is the most common cause of an electric shock. In cases of exposure to high voltages, such as on a power transmission tower, physical contact with energized wiring or objects may not be necessary to cause electric shock, as the voltage may be sufficient to "jump" the air gap between the electrical device and the victim. The United States National Library of Medicine states: "Contact with 20 mA of current can be fatal".

The minimum current a human can feel depends on the current type (AC or DC) as well as frequency for AC. A person can feel at least 1 mA (rms) of AC at 60 Hz, while at least 5 mA for DC. At around 10 mA, AC current passing through the arm of a 68-kilogram (150 lb) human can cause powerful muscle contractions; the victim is unable to voluntarily control muscles and cannot release an electrified object. This is known as the "let go threshold" and is a criterion for shock hazard in electrical regulations.

The current may, if it is high enough and is delivered at sufficient voltage, cause tissue damage or fibrillation which can cause cardiac arrest; more than 30 mA of AC (rms, 60 Hz) or 300 – 500 mA of DC at high voltage can cause fibrillation. A sustained electric shock from AC at 120 V, 60 Hz is an especially dangerous source of ventricular fibrillation because it usually exceeds the let-go threshold, while not delivering enough initial energy to propel the person away from the source. However, the potential seriousness of the shock depends on paths through the body that the currents take.

If the voltage is less than 200 V, then the human skin, more precisely the stratum corneum, is the main contributor to the impedance of the body in the case of a macroshock—the passing of current between two contact points on the skin. The characteristics of the skin are non-linear however. If the voltage is above 450–600 V, then dielectric breakdown of the skin occurs. The protection offered by the skin is lowered by perspiration, and this is accelerated if electricity causes muscles to contract above the let-go threshold for a sustained period of time.

Point of Entry
Macroshock: Current across intact skin and through the body. Current from arm to arm, or between an arm and a foot, is likely to traverse the heart, therefore it is much more dangerous than current between a leg and the ground. This type of shock by definition must pass into the body through the skin.
Microshock: Very small current source with a pathway directly connected to the heart tissue. The shock is required to be administered from inside the skin, directly to the heart i.e. a pacemaker lead, or a guide wire, conductive catheter etc. connected to a source of current. This is a largely theoretical hazard as modern devices used in these situations include protections against such currents.

Diagnosis

Prevention

Treatment

2 Cardiac Arrest

Cardiac arrest is a sudden loss of blood flow resulting from the failure of the heart to effectively pump. Symptoms include loss of consciousness and abnormal or absent breathing.

Signs & Symptoms

Cardiac arrest is preceded by no warning symptoms in approximately 50 percent of people. For those who do experience symptoms, they will be non-specific, such as new or worsening chest pain, fatigue, blackouts, dizziness, shortness of breath, weakness and vomiting. When cardiac arrest occurs, the most obvious sign of its occurrence will be the lack of a palpable pulse in the victim. Also, as a result of loss of cerebral perfusion (blood flow to the brain), the victim will rapidly lose consciousness and will stop breathing. The main criterion for diagnosing a cardiac arrest, as opposed to respiratory arrest, which shares many of the same features, is lack of circulation; however, there are a number of ways of determining this. Near-death experiences are reported by 10 to 20 percent of people who survived cardiac arrest.

Certain types of prompt intervention can often reverse a cardiac arrest, but without such intervention, death is all but certain. In certain cases, cardiac arrest is an anticipated outcome of a serious illness where death is expected.

Causes

The most common cause of cardiac arrest is coronary artery disease. Less common causes include major blood loss, lack of oxygen, very low potassium, heart failure, and intense physical exercise. A number of inherited disorders may also increase the risk including long QT syndrome. The initial heart rhythm is most often ventricular fibrillation. The diagnosis is confirmed by finding no pulse. While a cardiac arrest may be caused by heart attack or heart failure, these are not the same.

Sudden cardiac arrest (SCA) and sudden cardiac death (SCD) occur when the heart abruptly begins to beat in an abnormal or irregular rhythm (arrhythmia). Without organized electrical activity in the heart muscle, there is no consistent contraction of the ventricles, which results in the heart's inability to generate an adequate cardiac output (forward pumping of blood from heart to rest of the body). There are many different types of arrhythmias, but the ones most frequently recorded in SCA and SCD are ventricular tachycardia (VT) or ventricular fibrillation (VF). Less common causes of dysrhythmias in cardiac arrest include pulseless electrical activity (PEA) or asystole. Such rhythms are seen when there is prolonged cardiac arrest, progression of ventricular fibrillation, or due to efforts such as defibrillation to resuscitate the person.

Sudden cardiac arrest can result from cardiac and non-cardiac causes including the following:

Coronary Artery Disease	Coronary artery disease (CAD), also known as ischemic heart disease, is responsible for 62 to 70 percent of all SCDs. CAD is a much less frequent cause of SCD in people under the age of 40. Cases have shown that the most common finding at postmortem examination of sudden cardiac death (SCD) is chronic high-grade stenosis of at least one segment of a major coronary artery, the arteries that supply the heart muscle with its blood supply.
Structural Heart Disease	Structural heart diseases not related to CAD account for 10% of all SCDs. Examples of these include: cardiomyopathies (hypertrophic, dilated, or arrythmogenic), cardiac rhythm disturbances, congenital coronary artery anomalies, myocarditis, hypertensive heart disease, and congestive heart failure. Left ventricular hypertrophy is thought to be a leading cause of SCD in the adult population. This is most commonly the result of longstanding high blood pressure which has caused secondary damage to the wall of the main pumping chamber of the heart, the left ventricle. A 1999 review of SCDs in the United States found that this accounted for over 30% of SCDs for those under 30 years. A study of military recruits age 18-35 found that this accounted for over 40% of SCDs. Congestive heart failure increases the risk of SCD fivefold.

Inherited Arrhythmia Syndromes	Arrhythmias that are not due to structural heart disease account for 5 to 10% of sudden cardiac arrests. These are frequently caused by genetic disorders that lead to abnormal heart rhythms. The genetic mutations often affect specialised proteins known as ion channels that conduct electrically charged particles across the cell membrane, and this group of conditions are therefore often referred to as channelopathies. Examples of these inherited arrhythmia syndromes include Long QT syndrome, Brugada Syndrome, Catecholaminergic polymorphic ventricular tachycardia, and Short QT syndrome. Other conditions that promote arrhythmias but are not caused by genetic mutations include Wolff-Parkinson-White syndrome. Long QT syndrome, a condition often mentioned in young people's deaths, occurs in one of every 5000 to 7000 newborns and is estimated to be responsible for 3000 deaths each year compared to the approximately 300,000 cardiac arrests seen by emergency services. These conditions are a fraction of the overall deaths related to cardiac arrest but represent conditions which may be detected prior to arrest and may be treatable.

Non-Cardiac Causes
SCA due to non-cardiac causes accounts for the remaining 15 to 25%. The most common non-cardiac causes are trauma, major bleeding (gastrointestinal bleeding, aortic rupture, or intracranial hemorrhage), hypovolemic shock, overdose, drowning, and pulmonary embolism. Cardiac arrest can also be caused by poisoning (for example, by the stings of certain jellyfish), or through electrocution, lightning.

Mnemonic for Reversible Causes
"Hs and Ts" is the name for a mnemonic used to aid in remembering the possible treatable or reversible causes of cardiac arrest:

Hs
- **H**ypovolemia – A lack of blood volume
- **H**ypoxia – A lack of oxygen
- **H**ydrogen ions (Acidosis) – An abnormal pH in the body
- **H**yperkalemia or **H**ypokalemia – Both increased or decreased potassium can be life-threatening.
- **H**ypothermia – A low core body temperature
- **H**ypoglycemia or **H**yperglycemia – Low or high blood glucose

Ts
- **T**ablets or Toxins such as drug overdose
- Cardiac **T**amponade – Fluid building up around the heart
- **T**ension pneumothorax – A collapsed lung
- **T**hrombosis (Myocardial infarction) – Heart attack
- **T**hromboembolism (Pulmonary embolism) – A blood clot in the lung
- **T**raumatic cardiac arrest

Diagnosis

Cardiac arrest is synonymous with clinical death. Historical information and a physical exam diagnosis cardiac arrest, as well as provides information regarding the potential cause and the prognosis. The history should aim to determine if the episode was observed by anyone else, what time the episode took place, what the person was doing (in particular if there was any trauma), and involvement of drugs.

The physical examination portion of diagnosis cardiac arrest focuses on the absence of a pulse clinically. In many cases lack of carotid pulse is the gold standard for diagnosing cardiac arrest, as lack of a pulse (particularly in the peripheral pulses) may result from other conditions (e.g. shock), or simply an error on the part of the rescuer. Nonetheless, studies have shown that rescuers often make a mistake when checking the carotid pulse in an emergency, whether they are healthcare professionals or lay persons.

Owing to the inaccuracy in this method of diagnosis, some bodies such as the European Resuscitation Council (ERC) have de-emphasised its importance. The Resuscitation Council (UK), in line with the ERC's recommendations and those of the American Heart Association, have suggested that the technique should be used only by healthcare professionals with specific training and expertise, and even then that it should be viewed in conjunction with other indicators such as agonal respiration.

Various other methods for detecting circulation have been proposed. Guidelines following the 2000 International Liaison Committee on Resuscitation (ILCOR) recommendations were for rescuers to look for "signs of circulation", but not specifically the pulse. These signs included coughing, gasping, colour, twitching, and movement. However, in face of evidence that these guidelines were ineffective, the current recommendation of ILCOR is that cardiac arrest should be diagnosed in all casualties who are unconscious and not breathing normally. Another method is to use molecular autopsy or postmortem molecular testing which uses a set of molecular techniques to find the ion channels that are cardiac defective.

Location	Findings	Possible Causes
General	Pale skin	• Hemorrhage
General	Decreased body temperature	• Hypothermia
Airway	Presence of secretions, vomit, blood	• Aspiration
Airway	Inability to provide positive pressure ventilation	• Tension pneumothorax • Airway obstruction
Neck	Distension of the neck veins	• Tension pneumothorax • Cardiac tamponade • Pulmonary embolism
Chest	Trachea shifted to one side	• Tension pneumothorax
Chest	Scar in the middle of the sternum	• Cardiac disease • Tension pneumothorax
Chest	No breath sounds or distant breath sounds	• Esophageal intubation • Airway obstruction
Chest	Wheezing	• Aspiration • Bronchospasm • Pulmonary edema
Chest	Rales	• Aspiration • Pulmonary edema • Pneumonia
Heart	Decreased heart sounds	• Cardiac tamponade • Tension pneumothorax • Pulmonary embolus
Abdomen	Distended and dull	• Ruptured abdominal aortic aneurysm • Ruptured ectopic pregnancy
Abdomen	Distended and tympanic	• Esophageal intubation
Rectal	Blood present	• Gastrointestinal hemorrhage

Extremities	Asymmetrical pulses	• Aortic dissection
Skin	Needle tracks	• Drug abuse

Prevention

With positive outcomes following cardiac arrest unlikely, an effort has been spent in finding effective strategies to prevent cardiac arrest. With the prime causes of cardiac arrest being ischemic heart disease, efforts to promote a healthy diet, exercise, and smoking cessation are important. For people at risk of heart disease, measures such as blood pressure control, cholesterol lowering, and other medico-therapeutic interventions are used. A Cochrane review published in 2016 found moderate-quality evidence to show that blood pressure-lowering drugs do not appear to reduce sudden cardiac death.

Implantable Cardioverter Defibrillator	An implantable cardioverter defibrillator (ICD) is a battery-powered device that monitors electrical activity in the heart and when an arrhythmia or asystole is detected is able to deliver an electrical shock to terminate the abnormal rhythm. ICDs are used to prevent sudden cardiac death (SCD) in those that have survived a prior episode of sudden cardiac arrest (SCA) due to ventricular fibrillation or ventricular tachycardia (secondary prevention). ICD's are also used prophylactically to prevent sudden cardiac death in certain high risk patient populations (primary prevention). Numerous studies have been conducted on the use of ICDs for the secondary prevention of SCD. These studies have shown improved survival with ICD's compared to the use of anti-arrhythmic drugs. ICD therapy is associated with a 50% relative risk reduction in death caused by an arrhythmia and a 25% relative risk reduction in all cause mortality.
Diet	Marine-derived omega-3 polyunsaturated fatty acids (PUFAs) have been promoted for the prevention of sudden cardiac death due to their postulated ability to lower triglyceride levels, prevent arrhythmias, decrease platelet aggregation, and lower blood pressure. However, according to a recent systematic review, omega-3 PUFA supplementation are not being associated with a lower risk of sudden cardiac death.
Risk Factors	The risk factors for SCD are similar to those of coronary artery disease and include age, cigarette smoking, high blood pressure, high cholesterol, lack of physical exercise, obesity, diabetes, and family history. A prior episode of sudden cardiac arrest also increases the risk of future episodes. Air pollution is also associated with the risk of cardiac arrest. Current cigarette smokers with coronary artery disease were found to have a two to threefold increase in the risk of sudden death between ages 30 and 59. Furthermore, it was found that former smokers' risk was closer to that of those who had never smoked.

Treatment

Sudden cardiac arrest may be treated via attempts at resuscitation. This is usually carried out based upon basic life support, advanced cardiac life support (ACLS), pediatric advanced life support (PALS), or neonatal resuscitation program (NRP) guidelines.

Cardiopulmonary Resuscitation
Early cardiopulmonary resuscitation (CPR) is essential to surviving cardiac arrest with good neurological function. It is recommended that it be started as soon as possible with minimal interruptions once begun. The components of CPR that make the greatest difference in survival are chest compressions and defibrillating shockable rhythms. After defibrillation, chest compressions should be continued for two minutes before a rhythm check is again done. This is based off a compression rate of 100-120 compressions per minute, a compression depth of 5–6 centimeters into the chest, full chest recoil, and a ventilation rate of 10 breath ventilations per minute. Correctly performed bystander CPR has been shown to increase survival; however, it is performed in less than 30% of out of hospital arrests as of 2007. If high-quality CPR has not resulted in return of spontaneous circulation and the person's heart rhythm is in asystole, discontinuing CPR and pronouncing the person's death is reasonable after 20 minutes. Exceptions to this include certain cases with hypothermia or who have drowned. Some of these cases should have longer and more sustained CPR until they are nearly normothermic. Longer durations of CPR may be reasonable in those who have cardiac arrest while in hospital. Bystander CPR, by the lay public, before the arrival of EMS also improves outcomes.

Either a bag valve mask or an advanced airway may be used to help with breathing. High levels of oxygen are generally given during CPR. Tracheal intubation has not been found to improve survival rates or neurological outcome in cardiac arrest and in the prehospital environment may worsen it. Endotracheal tube and supraglottic airways appear equally useful. When done by EMS 30 compressions followed by two breaths appear better than continuous chest compressions and breaths being given while compressions are ongoing.

For bystanders, CPR which involves only chest compressions results in better outcomes as compared to standard CPR for those who have gone into cardiac arrest due to heart issues. Mechanical chest compressions (as performed by a machine) are no better than chest compressions performed by hand. It is unclear if a few minutes of CPR before defibrillation results in different outcomes than immediate defibrillation. If cardiac arrest occurs after 20 weeks of pregnancy someone should pull or push the uterus to the left during CPR. If a pulse has not returned by four minutes emergency Cesarean section is recommended.

Defibrillation
In addition, there is increasing use of public access defibrillation. This involves placing an automated external defibrillator in public places, and training staff in these areas how to use them. This allows defibrillation to take place prior to the arrival of emergency services and has been shown to lead to increased chances of survival. Some defibrillators even provide feedback on the quality of CPR compressions, encouraging the lay rescuer to press the person's chest hard enough to circulate blood. In addition, it has been shown that those who have arrests in remote locations have worse outcomes following cardiac arrest.

Defibrillation is indicated if a shockable rhythm is present. The two shockable rhythms are ventricular fibrillation and pulseless ventricular tachycardia. In children 2 to 4 J/Kg is recommended.

Medications
As of 2016, medications other than epinephrine (adrenaline), while included in guidelines, have not been shown to improve survival to hospital discharge following out-of-hospital cardiac arrest. This includes the use of atropine, lidocaine, and amiodarone. Epinephrine in adults, as of 2019, appears to improve survival but does not appear to improve neurologically normal survival. It is generally recommended every five minutes. Vasopressin overall does not improve or worsen outcomes compared to epinephrine. The combination of epinephrine, vasopressin, and methylprednisolone appears to improve outcomes. Some of the lack of long-term benefit may be related to delays in epinephrine use. While evidence does not support its use in children, guidelines state its use is reasonable. Lidocaine and amiodarone are also deemed reasonable in children with cardiac arrest who have a shockable rhythm. The general use of sodium bicarbonate or calcium is not recommended. The use of calcium in children has been associated with poor neurological function as well as decreased survival. Correct dosing of medications in children is dependent on weight. To minimize time spent calculating medication doses, the use of a Broselow tape is recommended.

The 2010 guidelines from the American Heart Association no longer contain the recommendation for using atropine in pulseless electrical activity and asystole for want of evidence for its use. Neither lidocaine nor amiodarone, in those who continue in ventricular tachycardia or ventricular fibrillation despite defibrillation, improves survival to hospital discharge but both equally improve survival to hospital admission.

Thrombolytics when used generally may cause harm but may be of benefit in those with a confirmed pulmonary embolism as the cause of arrest. Evidence for use of naloxone in those with cardiac arrest due to opioids is unclear but it may still be used. In those with cardiac arrest due to local anesthetic, lipid emulsion may be used.

Targeted Temperature Management
Cooling adults after cardiac arrest who have a return of spontaneous circulation (ROSC) but no return of consciousness improves outcomes. This procedure is called targeted temperature management (previously known as therapeutic hypothermia). People are typically cooled for a 24-hour period, with a target temperature of 32–36 °C (90–97 °F). There are a number of methods used to lower the body temperature, such as applying ice packs or cold-water circulating pads directly to the body, or infusing cold saline. This is followed by gradual rewarming over the next 12 to 24 hrs.

Recent meta-analysis found that the use of therapeutic hypothermia after out-of-hospital cardiac arrest is associated with improved survival rates and better neurological outcomes.

Chain of Survival
Several organizations promote the idea of a chain of survival. The chain consists of the following "links":
● Early recognition If possible, recognition of illness before the person develops a cardiac arrest will allow the rescuer to prevent its occurrence. Early recognition that a cardiac arrest has occurred is key to survival for every minute a patient stays in cardiac arrest, their chances of survival drop by roughly 10%.
● Early CPR improves the flow of blood and of oxygen to vital organs, an essential component of treating a cardiac arrest. In particular, by keeping the brain supplied with oxygenated blood, chances of neurological damage are decreased.
● Early defibrillation is effective for the management of ventricular fibrillation and pulseless ventricular tachycardia
● Early advanced care
● Early post-resuscitation care which may include percutaneous coronary intervention
If one or more links in the chain are missing or delayed, then the chances of survival drop significantly.

These protocols are often initiated by a code blue, which usually denotes impending or acute onset of cardiac arrest or respiratory failure, although in practice, code blue is often called in less life-threatening situations that require immediate attention from a physician.

Other
Resuscitation with extracorporeal membrane oxygenation devices has been attempted with better results for in-hospital cardiac arrest (29% survival) than out-of-hospital cardiac arrest (4% survival) in populations selected to benefit most. Cardiac catheterization in those who have survived an out-of-hospital cardiac arrest appears to improve outcomes although high quality evidence is lacking. It is recommended that it is done as soon as possible in those who have had a cardiac arrest with ST elevation due to underlying heart problems.

The precordial thump may be considered in those with witnessed, monitored, unstable ventricular tachycardia (including pulseless VT) if a defibrillator is not immediately ready for use, but it should not delay CPR and shock delivery or be used in those with unwitnessed out of hospital arrest.

Prognosis

The overall chance of survival among those who have cardiac arrest outside hospital is 10%. Among those who have an out-of-hospital cardiac arrest, 70% occur at home and their survival rate is 6%. For those who have an in-hospital cardiac arrest, the survival rate is estimated to be 24%. Among children rates of survival are 3 to 16% in North America. For in hospital cardiac arrest survival to discharge is around 22%. However, some may have neurological injury that can range from mild memory problems to coma.

Prognosis is typically assessed 72 hours or more after cardiac arrest. Rates of survival are better in those who someone saw collapse, got bystander CPR, or had either ventricular tachycardia or ventricular fibrillation when assessed. Survival among those with Vfib or Vtach is 15 to 23%. Women are more likely to survive cardiac arrest and leave hospital than men.

A 1997 review found rates of survival to discharge of 14% although different studies varied from 0 to 28%. In those over the age of 70 who have a cardiac arrest while in hospital, survival to hospital discharge is less than 20%. How well these individuals are able to manage after leaving hospital is not clear.

A study of survival rates from out-of-hospital cardiac arrest found that 14.6% of those who had received resuscitation by paramedics survived as far as admission to hospital. Of these, 59% died during admission, half of these within the first 24 hours, while 46% survived until discharge from hospital. This reflects an overall survival following cardiac arrest of 6.8%. Of these 89% had normal brain function or mild neurological disability, 8.5% had moderate impairment, and 2% had major neurological disability. Of those who were discharged from hospital, 70% were still alive four years later.

3 Stroke

A stroke is a medical condition in which poor blood flow to the brain results in cell death. There are two main types of stroke: ischemic, due to lack of blood flow, and hemorrhagic, due to bleeding. Both result in parts of the brain not functioning properly.

Signs & Symptoms

Stroke symptoms typically start suddenly, over seconds to minutes, and in most cases do not progress further. The symptoms depend on the area of the brain affected. The more extensive the area of the brain affected, the more functions that are likely to be lost. Some forms of stroke can cause additional symptoms. For example, in intracranial hemorrhage, the affected area may compress other structures. Most forms of stroke are not associated with a headache, apart from subarachnoid hemorrhage and cerebral venous thrombosis and occasionally intracerebral hemorrhage.

Early Recognition
Various systems have been proposed to increase recognition of stroke. Different findings are able to predict the presence or absence of stroke to different degrees. Sudden-onset face weakness, arm drift (i.e., if a person, when asked to raise both arms, involuntarily lets one arm drift downward) and abnormal speech are the findings most likely to lead to the correct identification of a case of stroke, increasing the likelihood by 5.5 when at least one of these is present. Similarly, when all three of these are absent, the likelihood of stroke is decreased (– likelihood ratio of 0.39). While these findings are not perfect for diagnosing stroke, the fact that they can be evaluated relatively rapidly and easily make them very valuable in the acute setting.

A mnemonic to remember the warning signs of stroke is FAST (facial droop, arm weakness, speech difficulty, and time to call emergency services), as advocated by the Department of Health (United Kingdom) and the Stroke Association, the American Stroke Association, the National Stroke Association (US), the Los Angeles Prehospital Stroke Screen (LAPSS) and the Cincinnati Prehospital Stroke Scale (CPSS). Use of these scales is recommended by professional guidelines. FAST is less reliable in the recognition of posterior circulation strokes.

Subtypes
If the area of the brain affected includes one of the three prominent central nervous system pathways—the spinothalamic tract, corticospinal tract, and the dorsal column–medial lemniscus pathway, symptoms may include:

● Hemiplegia and muscle weakness of the face
● Numbness
● Reduction in sensory or vibratory sensation
● Initial flaccidity (reduced muscle tone), replaced by spasticity (increased muscle tone), excessive reflexes, and obligatory synergies.

In most cases, the symptoms affect only one side of the body (unilateral). Depending on the part of the brain affected, the defect in the brain is usually on the opposite side of the body. However, since these pathways also travel in the spinal cord and any lesion there can also produce these symptoms, the presence of any one of these symptoms does not necessarily indicate a stroke. In addition to the above CNS pathways, the brainstem gives rise to most of the twelve cranial nerves. A brainstem stroke affecting the brainstem and brain, therefore, can produce symptoms relating to deficits in these cranial nerves:

INJURY | Other | Stroke | Signs & Symptoms

- Altered smell, taste, hearing, or vision (total or partial)
- Drooping of eyelid (ptosis) and weakness of ocular muscles
- Decreased reflexes: gag, swallow, pupil reactivity to light
- Decreased sensation and muscle weakness of the face
- Balance problems and nystagmus
- Altered breathing and heart rate
- Weakness in sternocleidomastoid muscle with inability to turn head to one side
- Weakness in tongue (inability to stick out the tongue or move it from side to side)

If the cerebral cortex is involved, the CNS pathways can again be affected, but also can produce the following symptoms:
- Aphasia (difficulty with verbal expression, auditory comprehension, reading and writing; Broca's or Wernicke's area typically involved)
- Dysarthria (motor speech disorder resulting from neurological injury)
- Apraxia (altered voluntary movements)
- Visual field defect
- Memory deficits (involvement of temporal lobe)
- Hemineglect (involvement of parietal lobe)
- Disorganized thinking, confusion, hypersexual gestures (with involvement of frontal lobe)
- Lack of insight of his or her, usually stroke-related, disability

If the cerebellum is involved, ataxia might be present and this includes:
- Altered walking gait
- Altered movement coordination
- Vertigo and or disequilibrium

Associated Symptoms
Loss of consciousness, headache, and vomiting usually occur more often in hemorrhagic stroke than in thrombosis because of the increased intracranial pressure from the leaking blood compressing the brain. If symptoms are maximal at onset, the cause is more likely to be a subarachnoid hemorrhage or an embolic stroke.

Causes

Thrombotic Stroke
In thrombotic stroke, a thrombus (blood clot) usually forms around atherosclerotic plaques. Since blockage of the artery is gradual, onset of symptomatic thrombotic strokes is slower than that of a hemorrhagic stroke. A thrombus itself (even if it does not completely block the blood vessel) can lead to an embolic stroke if the thrombus breaks off and travels in the bloodstream, at which point it is called an embolus. Two types of thrombosis can cause stroke:

- Large vessel disease involves the common and internal carotid arteries, the vertebral artery, and the Circle of Willis. Diseases that may form thrombi in the large vessels include (in descending incidence): atherosclerosis, vasoconstriction (tightening of the artery), aortic, carotid or vertebral artery dissection, various inflammatory diseases of the blood vessel wall (Takayasu arteritis, giant cell arteritis, vasculitis), noninflammatory vasculopathy, Moyamoya disease and fibromuscular dysplasia.
- Small vessel disease involves the smaller arteries inside the brain: branches of the circle of Willis, middle cerebral artery, stem, and arteries arising from the distal vertebral and basilar artery. Diseases that may form thrombi in the small vessels include (in descending incidence): lipohyalinosis (build-up of fatty hyaline matter in the blood vessel as a result of high blood pressure and aging) and fibrinoid degeneration (a stroke involving these vessels is known as a lacunar stroke) and microatheroma (small atherosclerotic plaques).

Sickle-cell anemia, which can cause blood cells to clump up and block blood vessels, can also lead to stroke. A stroke is the second leading cause of death in people under 20 with sickle-cell anemia. Air pollution may also increase stroke risk.

Embolic Stroke
An embolic stroke refers to an arterial embolism (a blockage of an artery) by an embolus, a traveling particle or debris in the arterial bloodstream originating from elsewhere. An embolus is most frequently a thrombus, but it can also be a number of other substances including fat (e.g., from bone marrow in a broken bone), air, cancer cells or clumps of bacteria (usually from infectious endocarditis).

Because an embolus arises from elsewhere, local therapy solves the problem only temporarily. Thus, the source of the embolus must be identified. Because the embolic blockage is sudden in onset, symptoms usually are maximal at the start. Also, symptoms may be transient as the embolus is partially resorbed and moves to a different location or dissipates altogether.

Emboli most commonly arise from the heart (especially in atrial fibrillation) but may originate from elsewhere in the arterial tree. In paradoxical embolism, a deep vein thrombosis embolizes through an atrial or ventricular septal defect in the heart into the brain.

Causes of stroke related to the heart can be distinguished between high and low-risk:
- High risk: atrial fibrillation and paroxysmal atrial fibrillation, rheumatic disease of the mitral or aortic valve disease, artificial heart valves, known cardiac thrombus of the atrium or ventricle, sick sinus syndrome, sustained atrial flutter, recent myocardial infarction, chronic myocardial infarction together with ejection fraction <28 percent, symptomatic congestive heart failure with ejection fraction <30 percent, dilated cardiomyopathy, Libman-Sacks endocarditis, Marantic endocarditis, infective endocarditis, papillary fibroelastoma, left atrial myxoma and coronary artery bypass graft (CABG) surgery.
- Low risk/potential: calcification of the annulus (ring) of the mitral valve, patent foramen ovale (PFO), atrial septal aneurysm, atrial septal aneurysm with patent foramen ovale, left ventricular aneurysm without thrombus, isolated left atrial "smoke" on echocardiography (no mitral stenosis or atrial fibrillation), complex atheroma in the ascending aorta or proximal arch.

Among those who have a complete blockage of one of the carotid arteries, the risk of stroke on that side is about one percent per year. A special form of embolic stroke is the embolic stroke of undetermined source (ESUS). This subset of cryptogenetic stroke is defined as a non-lacunar brain infarct without proximal arterial stenosis or cardioembolic sources. About one out of six ischemic strokes could be classified as ESUS.

Cerebral Hypoperfusion
Cerebral hypoperfusion is the reduction of blood flow to all parts of the brain. The reduction could be to a particular part of the brain depending on the cause. It is most commonly due to heart failure from cardiac arrest or arrhythmias, or from reduced cardiac output as a result of myocardial infarction, pulmonary embolism, pericardial effusion, or bleeding. Hypoxemia (low blood oxygen content) may precipitate the hypoperfusion. Because the reduction in blood flow is global, all parts of the brain may be affected, especially vulnerable "watershed" areas—border zone regions supplied by the major cerebral arteries. A watershed stroke refers to the condition when the blood supply to these areas is compromised. Blood flow to these areas does not necessarily stop, but instead it may lessen to the point where brain damage can occur.

Venous Thrombosis
Cerebral venous sinus thrombosis leads to stroke due to locally increased venous pressure, which exceeds the pressure generated by the arteries. Infarcts are more likely to undergo hemorrhagic transformation (leaking of blood into the damaged area) than other types of ischemic stroke.

Intracerebral Hemorrhage
It generally occurs in small arteries or arterioles and is commonly due to hypertension, intracranial vascular malformations (including cavernous angiomas or arteriovenous malformations), cerebral amyloid angiopathy, or infarcts into which secondary hemorrhage has occurred. Other potential causes are trauma, bleeding disorders, amyloid angiopathy, illicit drug use (e.g., amphetamines or cocaine).

The hematoma enlarges until pressure from surrounding tissue limits its growth, or until it decompresses by emptying into the ventricular system, CSF or the pial surface. A third of intracerebral bleed is into the brain's ventricles. ICH has a mortality rate of 44 percent after 30 days, higher than ischemic stroke or subarachnoid hemorrhage (which technically may also be classified as a type of stroke).

Other
Other causes may include spasm of an artery. This may occur due to cocaine.

Silent Stroke
A silent stroke is a stroke that does not have any outward symptoms, and the patients are typically unaware they have had a stroke. Despite not causing identifiable symptoms, a silent stroke still damages the brain and places the patient at increased risk for both transient ischemic attack and major stroke in the future. Conversely, those who have had a major stroke are also at risk of having silent strokes. In a broad study in 1998, more than 11 million people were estimated to have experienced a stroke in the United States.

Approximately 770,000 of these strokes were symptomatic and 11 million were first-ever silent MRI infarcts or hemorrhages. Silent strokes typically cause lesions which are detected via the use of neuroimaging such as MRI. Silent strokes are estimated to occur at five times the rate of symptomatic strokes. The risk of silent stroke increases with age, but may also affect younger adults and children, especially those with acute anemia.

Diagnosis

Stroke is diagnosed through several techniques: a neurological examination (such as the NIHSS), CT scans (most often without contrast enhancements) or MRI scans, Doppler ultrasound, and arteriography. The diagnosis of stroke itself is clinical, with assistance from the imaging techniques. Imaging techniques also assist in determining the subtypes and cause of stroke. There is yet no commonly used blood test for the stroke diagnosis itself, though blood tests may be of help in finding out the likely cause of stroke.

Physical Examination
A physical examination, including taking a medical history of the symptoms and a neurological status, helps giving an evaluation of the location and severity of a stroke. It can give a standard score on e.g., the NIH stroke scale.

Prevention

Given the disease burden of strokes, prevention is an important public health concern. Primary prevention is less effective than secondary prevention (as judged by the number needed to treat to prevent one stroke per year). Recent guidelines detail the evidence for primary prevention in stroke. In those who are otherwise healthy, aspirin does not appear beneficial and thus is not recommended. In people who have had a myocardial infarction or those with a high cardiovascular risk, it provides some protection against a first stroke. In those who have previously had a stroke, treatment with medications such as aspirin, clopidogrel, and dipyridamole may be beneficial. The U.S. Preventive Services Task Force (USPSTF) recommends against screening for carotid artery stenosis in those without symptoms.

Risk Factors
The most important modifiable risk factors for stroke are high blood pressure and atrial fibrillation although the size of the effect is small with 833 people have to be treated for 1 year to prevent one stroke. Other modifiable risk factors include high blood cholesterol levels, diabetes mellitus, cigarette smoking (active and passive), heavy alcohol use, drug use, lack of physical activity, obesity, processed red meat consumption, and unhealthy diet. Smoking just one cigarette per day increases the risk more than 30%.

Alcohol use could predispose to ischemic stroke, as well as intracerebral and subarachnoid hemorrhage via multiple mechanisms (for example, via hypertension, atrial fibrillation, rebound thrombocytosis and platelet aggregation and clotting disturbances). Drugs, most commonly amphetamines and cocaine, can induce stroke through damage to the blood vessels in the brain and acute hypertension. Migraine with aura doubles a person's risk for ischemic stroke. Untreated, celiac disease regardless of the presence of symptoms can be an underlying cause of stroke, both in children and adults.

High levels of physical activity reduce the risk of stroke by about 26%. There is a lack of high quality studies looking at promotional efforts to improve lifestyle factors. Nonetheless, given the large body of circumstantial evidence, best medical management for stroke includes advice on diet, exercise, smoking and alcohol use. Medication is the most common method of stroke prevention; carotid endarterectomy can be a useful surgical method of preventing stroke.

Blood Pressure
High blood pressure accounts for 35–50% of stroke risk. Blood pressure reduction of 10 mmHg systolic or 5 mmHg diastolic reduces the risk of stroke by ~40%. Lowering blood pressure has been conclusively shown to prevent both ischemic and hemorrhagic strokes. It is equally important in secondary prevention. Even patients older than 80 years and those with isolated systolic hypertension benefit from antihypertensive therapy. The available evidence does not show large differences in stroke prevention between antihypertensive drugs—therefore, other factors such as protection against other forms of cardiovascular disease and cost should be considered. The routine use of beta-blockers following a stroke or TIA has not been shown to result in benefits.

Blood Lipids
High cholesterol levels have been inconsistently associated with (ischemic) stroke. Statins have been shown to reduce the risk of stroke by about 15%. Since earlier meta-analyses of other lipid-lowering drugs did not show a decreased risk, statins might exert their effect through mechanisms other than their lipid-lowering effects.

Diabetes Mellitus
Diabetes mellitus increases the risk of stroke by 2 to 3 times. While intensive blood sugar control has been shown to reduce small blood vessel complications such as kidney damage and damage to the retina of the eye it has not been shown to reduce large blood vessel complications such as stroke.

Anticoagulation Drugs
Oral anticoagulants such as warfarin have been the mainstay of stroke prevention for over 50 years. However, several studies have shown that aspirin and other antiplatelets are highly effective in secondary prevention after a stroke or transient ischemic attack. Low doses of aspirin (for example 75–150 mg) are as effective as high doses but have fewer side effects; the lowest effective dose remains unknown.

Thienopyridines (clopidogrel, ticlopidine) might be slightly more effective than aspirin and have a decreased risk of gastrointestinal bleeding, but are more expensive. Both aspirin and clopidogrel may be useful in the first few weeks after a minor stroke or high risk TIA. Clopidogrel has less side effects than ticlopidine. Dipyridamole can be added to aspirin therapy to provide a small additional benefit, even though headache is a common side effect. Low-dose aspirin is also effective for stroke prevention after having a myocardial infarction.

INJURY Other Stroke Prevention

Those with atrial fibrillation have a 5% a year risk of stroke, and this risk is higher in those with valvular atrial fibrillation. Depending on the stroke risk, anticoagulation with medications such as warfarin or aspirin is useful for prevention. Except in people with atrial fibrillation, oral anticoagulants are not advised for stroke prevention—any benefit is offset by bleeding risk. In primary prevention, however, antiplatelet drugs did not reduce the risk of ischemic stroke but increased the risk of major bleeding. Further studies are needed to investigate a possible protective effect of aspirin against ischemic stroke in women.

Surgery
Carotid endarterectomy or carotid angioplasty can be used to remove atherosclerotic narrowing of the carotid artery. There is evidence supporting this procedure in selected cases. Endarterectomy for a significant stenosis has been shown to be useful in preventing further strokes in those who have already had one. Carotid artery stenting has not been shown to be equally useful. People are selected for surgery based on age, gender, degree of stenosis, time since symptoms and the person's preferences. Surgery is most efficient when not delayed too long—the risk of recurrent stroke in a patient who has a 50% or greater stenosis is up to 20% after 5 years, but endarterectomy reduces this risk to around 5%. The number of procedures needed to cure one patient was 5 for early surgery (within two weeks after the initial stroke), but 125 if delayed longer than 12 weeks.

Screening for carotid artery narrowing has not been shown to be a useful test in the general population. Studies of surgical intervention for carotid artery stenosis without symptoms have shown only a small decrease in the risk of stroke. To be beneficial, the complication rate of the surgery should be kept below 4%. Even then, for 100 surgeries, 5 patients will benefit by avoiding stroke, 3 will develop stroke despite surgery, 3 will develop stroke or die due to the surgery itself, and 89 will remain stroke-free but would also have done so without intervention.

Diet
Nutrition, specifically the Mediterranean-style diet, has the potential for decreasing the risk of having a stroke by more than half. It does not appear that lowering levels of homocysteine with folic acid affects the risk of stroke.

Women
A number of specific recommendations have been made for women including taking aspirin after the 11th week of pregnancy if there is a history of previous chronic high blood pressure and taking blood pressure medications during pregnancy if the blood pressure is greater than 150 mmHg systolic or greater than 100 mmHg diastolic. In those who have previously had preeclampsia other risk factors should be treated more aggressively.

Previous stroke or TIA
Keeping blood pressure below 140/90 mmHg is recommended. Anticoagulation can prevent recurrent ischemic strokes. Among people with nonvalvular atrial fibrillation, anticoagulation can reduce stroke by 60% while antiplatelet agents can reduce stroke by 20%. However, a recent meta-analysis suggests harm from anticoagulation started early after an embolic stroke. Stroke prevention treatment for atrial fibrillation is determined according to the CHA2DS2–VASc score. The most widely used anticoagulant to prevent thromboembolic stroke in patients with nonvalvular atrial fibrillation is the oral agent warfarin while a number of newer agents including dabigatran are alternatives which do not require prothrombin time monitoring.

Anticoagulants, when used following stroke, should not be stopped for dental procedures.

If studies show carotid artery stenosis, and the person has a degree of residual function on the affected side, carotid endarterectomy (surgical removal of the stenosis) may decrease the risk of recurrence if performed rapidly after stroke.

Treatment

Management

Ischemic Stroke
Aspirin reduces the overall risk of recurrence by 13% with greater benefit early on. Definitive therapy within the first few hours is aimed at removing the blockage by breaking the clot down (thrombolysis), or by removing it mechanically (thrombectomy). The philosophical premise underlying the importance of rapid stroke intervention was summed up as Time is Brain! in the early 1990s. Years later, that same idea, that rapid cerebral blood flow restoration results in fewer brain cells dying, has been proved and quantified.

Tight blood sugar control in the first few hours does not improve outcomes and may cause harm. High blood pressure is also not typically lowered as this has not been found to be helpful. Cerebrolysin, a mix of pig brain tissue used to treat acute ischemic stroke in many Asian and European countries, does not improve outcomes and may increase the risk of severe adverse events.

Thrombolysis
Thrombolysis, such as with recombinant tissue plasminogen activator (rtPA), in acute ischemic stroke, when given within three hours of symptom onset, results in an overall benefit of 10% with respect to living without disability. It does not, however, improve chances of survival. Benefit is greater the earlier it is used. Between three and four and a half hours the effects are less clear. The AHA/ASA recommend it for certain people in this time frame. A 2014 review found a 5% increase in the number of people living without disability at three to six months; however, there was a 2% increased risk of death in the short term. After four and a half hours thrombolysis worsens outcomes. These benefits or lack of benefits occurred regardless of the age of the person treated. There is no reliable way to determine who will have an intracranial bleed post-treatment versus who will not. In those with findings of savable tissue on medical imaging between 4.5 hours and 9 hours or who wake up with a stroke, alteplase results in some benefit.

Its use is endorsed by the American Heart Association, the American College of Emergency Physicians and the American Academy of Neurology as the recommended treatment for acute stroke within three hours of onset of symptoms as long as there are no other contraindications (such as abnormal lab values, high blood pressure, or recent surgery). This position for tPA is based upon the findings of two studies by one group of investigators which showed that tPA improves the chances for a good neurological outcome. When administered within the first three hours thrombolysis improves functional outcome without affecting mortality. 6.4% of people with large strokes developed substantial brain bleeding as a complication from being given tPA thus part of the reason for increased short term mortality. The American Academy of Emergency Medicine had previously stated that objective evidence regarding the applicability of tPA for acute ischemic stroke was insufficient. In 2013 the American College of Emergency Medicine refuted this position, acknowledging the body of evidence for the use of tPA in ischemic stroke; but debate continues. Intra-arterial fibrinolysis, where a catheter is passed up an artery into the brain and the medication is injected at the site of thrombosis, has been found to improve outcomes in people with acute ischemic stroke.

Endovascular Treatment
Mechanical removal of the blood clot causing the ischemic stroke, called mechanical thrombectomy, is a potential treatment for occlusion of a large artery, such as the middle cerebral artery. In 2015, one review demonstrated the safety and efficacy of this procedure if performed within 12 hours of the onset of symptoms. It did not change the risk of death, but reduced disability compared to the use of intravenous thrombolysis which is generally used in people evaluated for mechanical thrombectomy. Certain cases may benefit from thrombectomy up to 24 hours after the onset of symptoms.

Craniectomy
Strokes affecting large portions of the brain can cause significant brain swelling with secondary brain injury in surrounding tissue. This phenomenon is mainly encountered in strokes affecting brain tissue dependent upon the middle cerebral artery for blood supply and is also called "malignant cerebral infarction" because it carries a dismal prognosis. Relief of the pressure may be attempted with medication, but some require hemicraniectomy, the temporary surgical removal of the skull on one side of the head. This decreases the risk of death, although some people – who would otherwise have died – survive with disability.

Hemorrhagic Stroke
People with intracerebral hemorrhage require supportive care, including blood pressure control if required. People are monitored for changes in the level of consciousness, and their blood sugar and oxygenation are kept at optimum levels. Anticoagulants and antithrombotics can make bleeding worse and are generally discontinued (and reversed if possible). A proportion may benefit from neurosurgical intervention to remove the blood and treat the underlying cause, but this depends on the location and the size of the hemorrhage as well as patient-related factors, and ongoing research is being conducted into the question as to which people with intracerebral hemorrhage may benefit.

In subarachnoid hemorrhage, early treatment for underlying cerebral aneurysms may reduce the risk of further hemorrhages. Depending on the site of the aneurysm this may be by surgery that involves opening the skull or endovascularly (through the blood vessels).

Prognosis

Disability affects 75% of stroke survivors enough to decrease their employability. Stroke can affect people physically, mentally, emotionally, or a combination of the three. The results of stroke vary widely depending on size and location of the lesion. Dysfunctions correspond to areas in the brain that have been damaged.

Some of the physical disabilities that can result from stroke include muscle weakness, numbness, pressure sores, pneumonia, incontinence, apraxia (inability to perform learned movements), difficulties carrying out daily activities, appetite loss, speech loss, vision loss and pain. If the stroke is severe enough, or in a certain location such as parts of the brainstem, coma or death can result.

Emotional problems following a stroke can be due to direct damage to emotional centers in the brain or from frustration and difficulty adapting to new limitations. Post-stroke emotional difficulties include anxiety, panic attacks, flat affect (failure to express emotions), mania, apathy and psychosis. Other difficulties may include a decreased ability to communicate emotions through facial expression, body language and voice.

Disruption in self-identity, relationships with others, and emotional well-being can lead to social consequences after stroke due to the lack of ability to communicate. Many people who experience communication impairments after a stroke find it more difficult to cope with the social issues rather than physical impairments. Broader aspects of care must address the emotional impact speech impairment has on those who experience difficulties with speech after a stroke. Those who experience a stroke are at risk of paralysis which could result in a self disturbed body image which may also lead to other social issues.

30 to 50% of stroke survivors suffer post-stroke depression, which is characterized by lethargy, irritability, sleep disturbances, lowered self-esteem and withdrawal. Depression can reduce motivation and worsen outcome, but can be treated with social and family support, psychotherapy and, in severe cases, antidepressants. Psychotherapy sessions may have a small effect on improving mood and preventing depression after a stroke, however psychotherapy does not appear to be effective at treating depression after a stroke. Antidepressant medications may be useful for treating depression after a stroke.

Emotional lability, another consequence of stroke, causes the person to switch quickly between emotional highs and lows and to express emotions inappropriately, for instance with an excess of laughing or crying with little or no provocation. While these expressions of emotion usually correspond to the person's actual emotions, a more severe form of emotional lability causes the affected person to laugh and cry pathologically, without regard to context or emotion. Some people show the opposite of what they feel, for example crying when they are happy. Emotional lability occurs in about 20% of those who have had a stroke. Those with a right hemisphere stroke are more likely to have an empathy problems which can make communication harder.

Cognitive deficits resulting from stroke include perceptual disorders, aphasia, dementia, and problems with attention and memory. A stroke sufferer may be unaware of his or her own disabilities, a condition called anosognosia. In a condition called hemispatial neglect, the affected person is unable to attend to anything on the side of space opposite to the damaged hemisphere. Cognitive and psychological outcome after a stroke can be affected by the age at which the stroke happened, pre-stroke baseline intellectual functioning, psychiatric history and whether there is pre-existing brain pathology. Up to 10% of people following a stroke develop seizures, most commonly in the week subsequent to the event; the severity of the stroke increases the likelihood of a seizure.

4 Seizure

A seizure, formally known as an epileptic seizure, is a period of symptoms due to abnormally excessive or synchronous neuronal activity in the brain. Outward effects vary from uncontrolled shaking movements involving much of the body with loss of consciousness (tonic-clonic seizure), to shaking movements involving only part of the body with variable levels of consciousness (focal seizure), to a subtle momentary loss of awareness (absence seizure). Most of the time these episodes last less than 2 minutes and it takes some time to return to normal. Loss of bladder control may occur.

Seizures may be provoked and unprovoked. Provoked seizures are due to a temporary event such as low blood sugar, alcohol withdrawal, low blood sodium, fever, brain infection, or concussion. Unprovoked seizures occur without a known or fixable cause such that ongoing seizures are likely. Unprovoked seizures may be triggered by stress or sleep deprivation. Diseases of the brain, where there has been at least one seizure and a long term risk of further seizures, are collectively known as epilepsy. Conditions that look like epileptic seizures but are not include fainting, nonepileptic psychogenic event, and tremor.

A seizure that lasts for more than a brief period is a medical emergency. Any seizure lasting longer than 5 minutes should be treated as status epilepticus. A first seizure generally does not require long-term treatment with anti-seizure medications unless a specific problem is found on electroencephalogram (EEG) or brain imaging. Typically it is safe to complete the work-up following a single seizure as an outpatient. In many, with what appears to be a first seizure, other minor seizures have previously occurred.

Up to 10% of people have at least one epileptic seizure. Provoked seizures occur in about 3.5 per 10,000 people a year while unprovoked seizures occur in about 4.2 per 10,000 people a year. After one seizure, the chance of experiencing a second is about 50%. Epilepsy affects about 1% of the population at any given time with about 4% of the population affected at some point in time. Nearly 80% of those with epilepsy live in developing countries. Many places require people to stop driving until they have not had a seizure for a specific period.

Signs & Symptoms

The signs and symptoms of seizures vary depending on the type. The most common type of seizure is convulsive (60%). Two-thirds of these begin as focal seizures and become generalized while one third begin as generalized seizures. The remaining 40% of seizures are non-convulsive, an example of which is absence seizure.

Focal Seizures
Focal seizures often begin with certain experiences, known as an aura. These may include sensory, visual, psychic, autonomic, olfactory or motor phenomena. In a complex partial seizure a person may appear confused or dazed and can not respond to questions or direction. Focal seizure may become generalized.

Jerking activity may start in a specific muscle group and spread to surrounding muscle groups—known as a Jacksonian march. Unusual activities that are not consciously created may occur. These are known as automatisms and include simple activities like smacking of the lips or more complex activities such as attempts to pick something up.

Generalized Seizures
There are six main types of generalized seizures: tonic-clonic, tonic, clonic, myoclonic, absence, and atonic seizures. They all involve a loss of consciousness and typically happen without warning.

- Tonic-clonic seizures present with a contraction of the limbs followed by their extension, along with arching of the back for 10–30 seconds. A cry may be heard due to contraction of the chest muscles. The limbs then begin to shake in unison. After the shaking has stopped it may take 10–30 minutes for the person to return to normal.
- Tonic seizures produce constant contractions of the muscles. The person may turn blue if breathing is impaired.
- Clonic seizures involve shaking of the limbs in unison.
- Myoclonic seizures involve spasms of muscles in either a few areas or generalized through the body.
- Absence seizures can be subtle, with only a slight turn of the head or eye blinking. The person often does not fall over and may return to normal right after the seizure ends, though there may also be a period of post-ictal disorientation.
- Atonic seizures involve the loss of muscle activity for greater than one second. This typically occurs bilaterally (on both sides of the body)

Duration
A seizure can last from a few seconds to more than five minutes, at which point it is known as status epilepticus. Most tonic-clonic seizures last less than two or three minutes. Absence seizures are usually around 10 seconds in duration.

Postictal
After the active portion of a seizure, there is typically a period of confusion called the postictal period before a normal level of consciousness returns. This usually lasts 3 to 15 minutes but may last for hours. Other common symptoms include: feeling tired, headache, difficulty speaking, and abnormal behavior. Psychosis after a seizure is relatively common, occurring in between 6 and 10% of people. Often people do not remember what occurred during this time.

Causes

Seizures have a number of causes. Of those who have a seizure, about 25% have epilepsy. A number of conditions are associated with seizures but are not epilepsy including: most febrile seizures and those that occur around an acute infection, stroke, or toxicity. These seizures are known as "acute symptomatic" or "provoked" seizures and are part of the seizure-related disorders. In many the cause is unknown.

Different causes of seizures are common in certain age groups.
- Seizures in babies are most commonly caused by hypoxic ischemic encephalopathy, central nervous system (CNS) infections, trauma, congenital CNS abnormalities, and metabolic disorders.
- The most frequent cause of seizures in children is febrile seizures, which happen in 2–5% of children between the ages of six months and five years.
- During childhood, well-defined epilepsy syndromes are generally seen.
- In adolescence and young adulthood, non-compliance with the medication regimen and sleep deprivation are potential triggers.
- Pregnancy and labor and childbirth, and the post-partum, or post-natal period (after birth) can be at-risk times, especially if there are certain complications like pre-eclampsia.
- During adulthood, the likely causes are alcohol related, strokes, trauma, CNS infections, and brain tumors.
- In older adults, cerebrovascular disease is a very common cause. Other causes are CNS tumors, head trauma, and other degenerative diseases that are common in the older age group, such as dementia.

Metabolic
Dehydration can trigger epileptic seizures if it is severe enough. A number of disorders including: low blood sugar, low blood sodium, hyperosmolar nonketotic hyperglycemia, high blood sodium, low blood calcium and high blood urea levels may cause seizures. As may hepatic encephalopathy and the genetic disorder porphyria.

Structural
- Cavernoma or cavernous malformation is a treatable medical condition that can cause seizures, headaches, and brain hemorrhages.
- Arteriovenous malformation (AVM) is a treatable medical condition that can cause seizures, headaches, and brain hemorrhages.
- Space-occupying lesions in the brain (abscesses, tumours). In people with brain tumours, the frequency of epilepsy depends on the location of the tumor in the cortical region.

Medications
Both medication and drug overdoses can result in seizures, as may certain medication and drug withdrawal. Common drugs involved include: antidepressants, antipsychotics, cocaine, insulin, and the local anaesthetic lidocaine. Difficulties with withdrawal seizures commonly occurs after prolonged alcohol or sedative use, a condition known as delirium tremens.

Infections
- Infection with the pork tapeworm, which can cause neurocysticercosis, is the cause of up to half of epilepsy cases in areas of the world where the parasite is common.
- Parasitic infections such as cerebral malaria. In Nigeria this is one of the most common causes of seizures among children under 5 years of age.
- Infection, such as encephalitis or meningitis

Stress
Stress can induce seizures in people with epilepsy, and is a risk factor for developing epilepsy. Severity, duration, and time at which stress occurs during development all contribute to frequency and susceptibility to developing epilepsy. It is one of the most frequently self-reported triggers in patients with epilepsy.

Stress exposure results in hormone release that mediates its effects in the brain. These hormones act on both excitatory and inhibitory neural synapses, resulting in hyper-excitability of neurons in the brain. The hippocampus is known to be a region that is highly sensitive to stress and prone to seizures. This is where mediators of stress interact with their target receptors to produce effects.

Other
Seizures may occur as a result of high blood pressure, known as hypertensive encephalopathy, or in pregnancy as eclampsia when accompanied by either seizures or a decreased level of consciousness. Very high body temperatures may also be a cause. Typically this requires a temperature greater than 42 °C (107.6 °F).

- Head injury may cause non-epileptic post-traumatic seizures or post-traumatic epilepsy
- About 3.5 to 5.5% of people with celiac disease also have seizures.
- Seizures in a person with a shunt may indicate failure
- Hemorrhagic stroke can occasionally present with seizures, embolic strokes generally do not (though epilepsy is a common later complication); cerebral venous sinus thrombosis, a rare type of stroke, is more likely to be accompanied by seizures than other types of stroke
- Multiple sclerosis may cause seizures

Electroconvulsive therapy (ECT) deliberately sets out to induce a seizure for the treatment of major depression.

Diagnosis

Seizures may be divided into provoked and unprovoked. Provoked seizures may also be known as "acute symptomatic seizures" or "reactive seizures". Unprovoked seizures may also be known as "reflex seizures". Depending on the presumed cause blood tests and lumbar puncture may be useful. Hypoglycemia may cause seizures and should be ruled out. An electroencephalogram and brain imaging with CT scan or MRI scan is recommended in the work-up of seizures not associated with a fever.

Classification
Seizure types are organized by whether the source of the seizure is localized (focal seizures) or distributed (generalized seizures) within the brain. Generalized seizures are divided according to the effect on the body and include tonic-clonic (grand mal), absence (petit mal), myoclonic, clonic, tonic, and atonic seizures. Some seizures such as epileptic spasms are of an unknown type.

Focal seizures (previously called partial seizures) are divided into simple partial or complex partial seizure. Current practice no longer recommends this, and instead prefers to describe what occurs during a seizure.

Physical Examination
Most people are in a postictal state (drowsy or confused) following a seizure. They may show signs of other injuries. A bite mark on the side of the tongue helps confirm a seizure when present, but only a third of people who have had a seizure have such a bite. When present in people thought to have had a seizure, this physical sign tentatively increases the likelihood that a seizure was the cause.

Differential Diagnosis
Differentiating an epileptic seizure from other conditions such as syncope can be difficult. Other possible conditions that can mimic a seizure include: decerebrate posturing, psychogenic seizures, tetanus, dystonia, migraine headaches, and strychnine poisoning. In addition, 5% of people with a positive tilt table test may have seizure-like activity that seems due to cerebral hypoxia. Convulsions may occur due to psychological reasons and this is known as a psychogenic non-epileptic seizure. Non-epileptic seizures may also occur due to a number of other reasons.

Prevention

A number of measures have been attempted to prevent seizures in those at risk. Following traumatic brain injury anticonvulsants decrease the risk of early seizures but not late seizures. In those with a history of febrile seizures, medications (both antipyretics and anticonvulsants) have not been found effective for prevention. Some, in fact, may cause harm.

There is no clear evidence that antiepileptic drugs are effective or not effective at preventing seizures following a craniotomy, following subdural hematoma, after a stroke, or after subarachnoid haemorrhage, for both people who have had a previous seizure, and those who have not.

Management

Potentially sharp or dangerous objects should be moved from the area around a person experiencing a seizure, so that the individual is not hurt. After the seizure if the person is not fully conscious and alert, they should be placed in the recovery position. A seizure longer than five minutes, or two or more seizures occurring within the time of five minutes is a medical emergency known as status epilepticus. Contrary to a common misconception, bystanders should not attempt to force objects into the mouth of the person suffering a seizure, as doing so may cause injury to the teeth and gums.

Treatments of a person that is actively seizing follows a progression from initial response, through first line, second line, and third line treatments. The initial response involves ensuring the person is protected from potential harms (such as nearby objects) and managing their airway, breathing, and circulation. Airway management should include placing the person on their side, known as the recovery position, to prevent them from choking. If they are unable to breathe because something is blocking their airway, they may require treatments to open their airway.

Medication
The first line medication for an actively seizing person is a benzodiazepine, with most guidelines recommending lorazepam. Diazepam and midazolam are alternatives. This may be repeated if there is no effect after 10 minutes. If there is no effect after two doses, barbiturates or propofol may be used. Benzodiazepines given by a non-intravenous route appear better than those given by intravenous, as the intravenous takes longer to have an effect.

Second-line therapy for adults is phenytoin or fosphenytoin and phenobarbital for children. Third-line medications include phenytoin for children and phenobarbital for adults.

Ongoing anti-epileptic medications are not typically recommended after a first seizure except in those with structural lesions in the brain. They are generally recommended after a second one has occurred. Approximately 70% of people can obtain full control with continuous use of medication. Typically one type of anticonvulsant is preferred. Following a first seizure, while immediate treatment with an anti-seizure drug lowers the probability of seizure recurrence up to five years it does not change the risk of death and there are potential side effects.

In seizures related to toxins, up to two doses of benzodiazepines should be used. If this is not effective pyridoxine is recommended. Phenytoin should generally not be used. There is a lack of evidence for preventative anti-epileptic medications in the management of seizures related to intracranial venous thrombosis.

Other
Helmets may be used to provide protection to the head during a seizure. Some claim that seizure response dogs, a form of service dog, can predict seizures. Evidence for this, however, is poor. At present there is not enough evidence to support the use of cannabis for the management of seizures, although this is an ongoing area of research. There is low quality evidence that a ketogenic diet may help in those who have epilepsy and is reasonable in those who do not improve following typical treatments.

5 Childbirth

Childbirth, also known as labour and delivery, is the ending of a pregnancy by one or more babies leaving a woman's uterus by vaginal passage or Caesarean section.

The most common way of childbirth is a vaginal delivery. It involves three stages of labour: the shortening and opening of the cervix, descent and birth of the baby, and the delivery of the placenta. The first stage typically lasts 12 to 19 hours, the second stage 20 minutes to two hours, and the third stage five to 30 minutes. The first stage begins with crampy abdominal or back pain that last around half a minute and occur every 10 to 30 minutes. The pain becomes stronger and closer together over time. During the second stage, pushing with contractions may occur. In the third stage, delayed clamping of the umbilical cord is generally recommended. A number of methods can help with pain, such as relaxation techniques, opioids, and spinal blocks.

Most babies are born head first; however about 4% are born feet or buttock first, known as breech. Typically the head enters the pelvis facing to one side, and then rotates to face down. During labour, a woman can generally eat and move around as she likes. However, pushing is not recommended during the first stage or during delivery of the head, and enemas are not recommended. While making a cut to the opening of the vagina, known as an episiotomy, is common, it is generally not needed. In 2012, about 23 million deliveries occurred by Caesarean section, an operation on the abdomen. C-sections may be recommended for twins, signs of distress in the baby, or breech position. This method of delivery can take longer to heal from.

Each year, complications from pregnancy and childbirth result in about 500,000 maternal deaths, seven million women have serious long term problems, and 50 million women have negative health outcomes following delivery. Most of these occur in the developing world. Specific complications include obstructed labour, postpartum bleeding, eclampsia, and postpartum infection. Complications in the baby may include lack of oxygen at birth, birth trauma, prematurity, and infections.

Signs & Symptoms

The most prominent sign of labour is strong repetitive uterine contractions. The distress levels reported by labouring women vary widely. They appear to be influenced by fear and anxiety levels, experience with prior childbirth, cultural ideas of childbirth and pain, mobility during labour, and the support received during labour. Personal expectations, the amount of support from caregivers, quality of the caregiver-patient relationship, and involvement in decision-making are more important in women's overall satisfaction with the experience of childbirth than are other factors such as age, socioeconomic status, ethnicity, preparation, physical environment, pain, immobility, or medical interventions.

Descriptions
Pain in contractions has been described as feeling similar to very strong menstrual cramps. Women are often encouraged to refrain from screaming. However, moaning and grunting may be encouraged to help lessen pain. Crowning may be experienced as an intense stretching and burning. Even women who show little reaction to labour pains, in comparison to other women, show a substantially severe reaction to crowning (the appearance of the baby's head).

Back labour is a term for specific pain occurring in the lower back, just above the tailbone, during childbirth.

Psychological
During the later stages of gestation there is an increase in abundance of oxytocin, a hormone that is known to evoke feelings of contentment, reductions in anxiety, and feelings of calmness and security around the mate. Oxytocin is further released during labour when the fetus stimulates the cervix and vagina, and it is believed that it plays a major role in the bonding of a mother to her infant and in the establishment of maternal behavior. The act of nursing a child also causes a release of oxytocin.

Between 70% and 80% of mothers in the United States report some feelings of sadness or "baby blues" after giving birth. The symptoms normally occur for a few minutes up to few hours each day and they should lessen and disappear within two weeks after delivery. Postpartum depression may develop in some women; about 10% of mothers in the United States are diagnosed with this condition. Preventive group therapy has proven effective as a prophylactic treatment for postpartum depression.

Vaginal Birth

Humans are bipedal with an erect stance. The erect posture causes the weight of the abdominal contents to thrust on the pelvic floor, a complex structure which must not only support this weight but allow, in women, three channels to pass through it: the urethra, the vagina and the rectum. The infant's head and shoulders must go through a specific sequence of maneuvers in order to pass through the ring of the mother's pelvis.

Six phases of a typical vertex or cephalic (head-first presentation) delivery:
1. Engagement of the fetal head in the transverse position. The baby's head is facing across the pelvis at one or other of the mother's hips.
2. Descent and flexion of the fetal head.
3. Internal rotation. The fetal head rotates 90 degrees to the occipito-anterior position so that the baby's face is towards the mother's rectum.
4. Delivery by extension. The fetal head is bowed, chin on chest, so that the back or crown of its head leads the way through the birth canal, until the back of its neck presses against the pubic bone and its chin leaves its chest, extending the neck—as if to look up, and the rest of its head passes out of the birth canal.
5. Restitution. The fetal head turns through 45 degrees to restore its normal relationship with the shoulders, which are still at an angle.
6. External rotation. The shoulders repeat the corkscrew movements of the head, which can be seen in the final movements of the fetal head.

The vagina is called a 'birth canal' when the baby enters this passage.

Station refers to the relationship of the fetal presenting part to the level of the ischial spines. When the presenting part is at the ischial spines the station is 0 (synonymous with engagement). If the presenting fetal part is above the spines, the distance is measured and described as minus stations, which range from −1 to −4 cm. If the presenting part is below the ischial spines, the distance is stated as plus stations (+1 to +4 cm). At +3 and +4 the presenting part is at the perineum and can be seen.

The fetal head may temporarily change shape substantially (becoming more elongated) as it moves through the birth canal. This change in the shape of the fetal head is called molding and is much more prominent in women having their first vaginal delivery.

Cervical ripening is the physical and chemical changes in the cervix to prepare it for the stretching that will take place as the fetus moves out of the uterus and into the birth canal. A scoring system called a Bishop score can be used to judge the degree of cervical ripening in order to predict the timing of labor and delivery of the infant or for women at risk for preterm labor. It is also used to judge when a woman will respond to induction of labor for a postdate pregnancy or other medical reasons. There are several methods of inducing cervical ripening which will allow the uterine contractions to effectively dilate the cervix.

Onset of Labour
There are various definitions of the onset of labour, including:
- Regular uterine contractions at least every six minutes with evidence of change in cervical dilation or cervical effacement between consecutive digital examinations.
- Regular contractions occurring less than 10 minutes apart and progressive cervical dilation or cervical effacement.
- At least three painful regular uterine contractions during a 10-minute period, each lasting more than 45 seconds.

In order to avail for more uniform terminology, the first stage of labour is divided into "latent" and "active" phases, where the latent phase is sometimes included in the definition of labour, and sometimes not.

Common signs that labour, commonly spelled as labor, is about to begin may include "lightening". Lightening is the process of the baby moving down from the rib cage with the head of the baby engaging deep in the pelvis. The pregnant woman may then find breathing easier, since her lungs have more room for expansion, but pressure on her bladder may cause more frequent need to void (urinate). Lightening may occur a few weeks or a few hours before labour begins, or even not until labour has begun.

Some women also experience an increase in vaginal discharge several days before labour begins when the "mucus plug", a thick plug of mucus that blocks the opening to the uterus, is pushed out into the vagina. The mucus plug may become dislodged days before labour begins or not until the start of labour.

While inside the uterus the baby is enclosed in a fluid-filled membrane called the amniotic sac. Shortly before, at the beginning of, or during labor the sac ruptures. Once the sac ruptures, termed "the water breaks", the baby is at risk for infection and the mother's medical team will assess the need to induce labor if it has not started within the time they believe to be safe for the infant.

Many women are known to experience what has been termed the "nesting instinct". Women report a spurt of energy shortly before going into labour.

Folklore has long held that most babies are born in the late night or very early morning and recent (2018) research has found this to be correct in the US, but only for babies born at home or on Saturday or Sunday. All other births are most likely to occur between 8 a.m. and noon, a reflection of the fact that planned C-sections are generally scheduled for 8 a.m. Likewise, births from induced deliveries rose during the morning hours and peaked at 3 p.m. The most likely day of the week for a baby's birthday in the US is Monday, followed by Tuesday, likely related to scheduled deliveries as well.

First Stage: Latent Phase
The latent phase is generally defined as beginning at the point at which the woman perceives regular uterine contractions. In contrast, Braxton Hicks contractions, which are contractions that may start around 26 weeks gestation and are sometimes called "false labour", are infrequent, irregular, and involve only mild cramping.

Cervical effacement, which is the thinning and stretching of the cervix, and cervical dilation occur during the closing weeks of pregnancy. Effacement is usually complete or near complete and dilation is about 5 cm by the end of the latent phase. The degree of cervical effacement and dilation may be felt during a vaginal examination. The latent phase ends with the onset of the active first stage.

First Stage: Active Phase
The active stage of labour (or "active phase of first stage" if the previous phase is termed "latent phase of first stage") has geographically differing definitions. The World Health Organization describes the active first stage as "a period of time characterized by regular painful uterine contractions, a substantial degree of cervical effacement and more rapid cervical dilatation from 5 cm until full dilatation for first and subsequent labours. In the US, the definition of active labour was changed from 3 to 4 cm, to 5 cm of cervical dilation for multiparous women, mothers who had given birth previously, and at 6 cm for nulliparous women, those who had not given birth before. This was done in an effort to increase the rates of vaginal delivery.

Health care providers may assess a labouring mother's progress in labour by performing a cervical exam to evaluate the cervical dilation, effacement, and station. These factors form the Bishop score. The Bishop score can also be used as a means to predict the success of an induction of labour.

During effacement, the cervix becomes incorporated into the lower segment of the uterus. During a contraction, uterine muscles contract causing shortening of the upper segment and drawing upwards of the lower segment, in a gradual expulsive motion. The presenting fetal part then is permitted to descend. Full dilation is reached when the cervix has widened enough to allow passage of the baby's head, around 10 cm dilation for a term baby.

A standard duration of the latent first stage has not been established and can vary widely from one woman to another. However, the duration of active first stage (from 5 cm until full cervical dilatation) usually does not extend beyond 12 hours in first labours ("primiparae"), and usually does not extend beyond 10 hours in subsequent labours ("multiparae"). The median duration of active first stage is four hours in first labours and three hours in second and subsequent labours.

Dystocia of labor, also called "dysfunctional labor" or "failure to progress", is difficult labor or abnormally slow progress of labor, involving progressive cervical dilatation or lack of descent of the fetus. Friedman's Curve, developed in 1955, was for many years used to determine labor dystocia. However, more recent medical research suggests that the Friedman curve may not be currently applicable.

Second Stage: Fetal Expulsion
The expulsion stage begins when the cervix is fully dilated, and ends when the baby is born. As pressure on the cervix increases, women may have the sensation of pelvic pressure and an urge to begin pushing. At the beginning of the normal second stage, the head is fully engaged in the pelvis; the widest diameter of the head has passed below the level of the pelvic inlet. The fetal head then continues descent into the pelvis, below the pubic arch and out through the vaginal introitus (opening). This is assisted by the additional maternal efforts of "bearing down" or pushing. The appearance of the fetal head at the vaginal orifice is termed the "crowning". At this point, the woman will feel an intense burning or stinging sensation.

When the amniotic sac has not ruptured during labour or pushing, the infant can be born with the membranes intact. This is referred to as "delivery en caul". Complete expulsion of the baby signals the successful completion of the second stage of labour. The second stage varies from one woman to another. In first labours, birth is usually completed within three hours whereas in subsequent labours, birth is usually completed within two hours. Labours longer than three hours are associated with declining rates of spontaneous vaginal delivery and increasing rates of infection, perineal tears, and obstetric hemorrhage, as well as the need for intensive care of the neonate.

Third Stage: Placenta Delivery
The period from just after the fetus is expelled until just after the placenta is expelled is called the third stage of labour or the involution stage. Placental expulsion begins as a physiological separation from the wall of the uterus. The average time from delivery of the baby until complete expulsion of the placenta is estimated to be 10–12 minutes dependent on whether active or expectant management is employed. In as many as 3% of all vaginal deliveries, the duration of the third stage is longer than 30 minutes and raises concern for retained placenta.

Placental expulsion can be managed actively or it can be managed expectantly, allowing the placenta to be expelled without medical assistance. Active management is the administration of a uterotonic drug within one minute of fetal delivery, controlled traction of the umbilical cord and fundal massage after delivery of the placenta, followed by performance of uterine massage every 15 minutes for two hours. In a joint statement, World Health Organization, the International Federation of Gynaecology and Obstetrics and the International Confederation of Midwives recommend active management of the third stage of labour in all vaginal deliveries to help to prevent postpartum hemorrhage.

Delaying the clamping of the umbilical cord for at least one minute or until it ceases to pulsate, which may take several minutes, improves outcomes as long as there is the ability to treat jaundice if it occurs. For many years it was believed that late cord cutting led to a mother's risk of experiencing significant bleeding after giving birth, called postpartum bleeding. However a recent review found that delayed cord cutting in healthy full-term infants resulted in early haemoglobin concentration and higher birthweight and increased iron reserves up to six months after birth with no change in the rate of postpartum bleeding.

Fourth Stage
The "fourth stage of labour" is the period beginning immediately after the birth of a child and extending for about six weeks. The terms postpartum and postnatal are often used for this period. The woman's body, including hormone levels and uterus size, return to a non-pregnant state and the newborn adjusts to life outside the mother's body. The World Health Organization (WHO) describes the postnatal period as the most critical and yet the most neglected phase in the lives of mothers and babies; most deaths occur during the postnatal period.

Following the birth, if the mother had an episiotomy or a tearing of the perineum, it is stitched. The mother has regular assessments for uterine contraction and fundal height, vaginal bleeding, heart rate and blood pressure, and temperature, for the first 24 hours after birth. The first passing of urine should be documented within six hours. Afterpains (pains similar to menstrual cramps), contractions of the uterus to prevent excessive blood flow, continue for several days. Vaginal discharge, termed "lochia", can be expected to continue for several weeks; initially bright red, it gradually becomes pink, changing to brown, and finally to yellow or white. Some women experience an uncontrolled episode of shivering or postpartum chills, after the birth.

Most authorities suggest the infant be placed in skin-to-skin contact with the mother for 1–2 hours immediately after birth, putting routine cares off until later.

Until recently babies born in hospitals were removed from their mothers shortly after birth and brought to the mother only at feeding times. Mothers were told that their newborn would be safer in the nursery and that the separation would offer the mother more time to rest. As attitudes began to change, some hospitals offered a "rooming in" option wherein after a period of routine hospital procedures and observation, the infant could be allowed to share the mother's room. However, more recent information has begun to question the standard practice of removing the newborn immediately postpartum for routine postnatal procedures before being returned to the mother. Beginning around 2000, some authorities began to suggest that early skin-to-skin contact (placing the naked baby on the mother's chest) may benefit both mother and infant. Using animal studies that have shown that the intimate contact inherent in skin-to-skin contact promotes neurobehaviors that result in the fulfillment of basic biological needs as a model, recent studies have been done to assess what, if any, advantages may be associated with early skin-to-skin contact for human mothers and their babies.

A 2011 medical review looked at existing studies and found that early skin-to-skin contact, sometimes called kangaroo care, resulted in improved breastfeeding outcomes, cardio-respiratory stability, and a decrease in infant crying. A 2016 Cochrane review found that skin-to-skin contact at birth promotes the likelihood and effectiveness of breastfeeding.

As of 2014, early postpartum skin-to-skin contact is endorsed by all major organizations that are responsible for the well-being of infants, including the American Academy of Pediatrics. The World Health Organization (WHO) states that "the process of childbirth is not finished until the baby has safely transferred from placental to mammary nutrition." They advise that the newborn be placed skin-to-skin with the mother, postponing any routine procedures for at least one to two hours.

The WHO suggests that any initial observations of the infant can be done while the infant remains close to the mother, saying that even a brief separation before the baby has had its first feed can disturb the bonding process. They further advise frequent skin-to-skin contact as much as possible during the first days after delivery, especially if it was interrupted for some reason after the delivery. The National Institute for Health and Care Excellence also advises postponing procedures such as weighing, measuring, and bathing for at least one hour to insure an initial period of skin-to-skin contact between mother and infant.

Labour Induction and Elective Caesarean Section

In many cases and with increasing frequency, childbirth is achieved through induction of labour or caesarean section. Caesarean section is the removal of the neonate through a surgical incision in the abdomen, rather than through vaginal birth. Childbirth by C-Sections increased 50% in the US from 1996 to 2006. In 2011, 32.8 percent of births in the US were delivered by cesarean section. Induced births and elective cesarean before 39 weeks can be harmful to the neonate as well as harmful or without benefit to the mother. Therefore, many guidelines recommend against non-medically required induced births and elective cesarean before 39 weeks. The 2012 rate of labour induction in the United States was 23.3 percent, and has more than doubled from 1990 to 2010. Pitocin is commonly used to induce uterine contractions. A large review of methods of induction was published in 2011.

The American Congress of Obstetricians and Gynecologists (ACOG) guidelines recommend a full evaluation of the maternal-fetal status, the status of the cervix, and at least a 39 completed weeks (full term) of gestation for optimal health of the newborn when considering elective induction of labour. Per these guidelines, the following conditions may be an indication for induction, including:

- Abruptio placentae
- Chorioamnionitis
- Fetal compromise such as isoimmunization leading to hemolytic disease of the newborn or oligohydramnios
- Fetal demise
- Gestational hypertension
- Maternal conditions such as gestational diabetes or chronic kidney disease
- Preeclampsia or eclampsia

- Premature rupture of membranes
- Postterm pregnancy

Induction is also considered for logistical reasons, such as the distance from hospital or psychosocial conditions, but in these instances gestational age confirmation must be done, and the maturity of the fetal lung must be confirmed by testing. The ACOG also note that contraindications for induced labour are the same as for spontaneous vaginal delivery, including vasa previa, complete placenta praevia, umbilical cord prolapse or active genital herpes simplex infection.

Management

Deliveries are assisted by a number of professionals including: obstetricians, family physicians and midwives. For low risk pregnancies all three result in similar outcomes.

Preparation
Eating or drinking during labour is an area of ongoing debate. While some have argued that eating in labour has no harmful effects on outcomes, others continue to have concern regarding the increased possibility of an aspiration event (choking on recently eaten foods) in the event of an emergency delivery due to the increased relaxation of the esophagus in pregnancy, upward pressure of the uterus on the stomach, and the possibility of general anesthetic in the event of an emergency cesarean.

A 2013 Cochrane review found that with good obstetrical anaesthesia there is no change in harms from allowing eating and drinking during labour in those who are unlikely to need surgery. They additionally acknowledge that not eating does not mean there is an empty stomach or that its contents are not as acidic. They therefore conclude that "women should be free to eat and drink in labour, or not, as they wish."

At one time shaving of the area around the vagina, was common practice due to the belief that hair removal reduced the risk of infection, made an episiotomy (a surgical cut to enlarge the vaginal entrance) easier, and helped with instrumental deliveries. It is currently less common, though it is still a routine procedure in some countries even though a systematic review found no evidence to recommend shaving.

Side effects appear later, including irritation, redness, and multiple superficial scratches from the razor. Another effort to prevent infection has been the use of the antiseptic chlorhexidine or providone-iodine solution in the vagina. Evidence of benefit with chlorhexidine is lacking. A decreased risk is found with providone-iodine when a cesarean section is to be performed.

Active Management of Labour
A 2013 review of the active management in low-risk women found that when compared to routine care there were no differences in the use of medications for pain, maternal or neonatal complications, or rates of assisted vaginal deliveries. There was a slight reduction in the caesarean section rate, however active management was seen as "highly prescriptive and interventional."

The World Health Organization (WHO) states: "While augmentation of labour may be beneficial in preventing prolonged labour, its inappropriate use may cause harm." The WHO suggests to "avoid the systematic use of a package of interventions ("active management of labour") to prevent possible labour delay because it is highly prescriptive and can undermine women's choices and autonomy during care."

Active management of labour consists of a number of principles that aim to improve outcomes with prolonged labour. This include antenatal classes, early diagnosis of labour by senior midwives, amniotomy when membranes are intact before the onset of labour, selective use of oxytocin for slow progress (only in first time mothers), and one-to-one support from midwives and obstetricians.

There is some debate about the effectiveness of active management of labour on caesarean section rates. Active management of labour was first used in the 1960s at the Irish National Maternity Hospital in Dublin, Ireland, in what became known as "the Dublin experience".

Pain Control - Non pharmaceutical
Some women prefer to avoid analgesic medication during childbirth. Psychological preparation may be beneficial. Relaxation techniques, immersion in water, massage, and acupuncture may provide pain relief. Acupuncture and relaxation were found to decrease the number of caesarean sections required. Immersion in water has been found to relieve pain during the first stage of labor and to reduce the need for anesthesia and shorten the duration of labor, however the safety and efficacy of immersion during birth, water birth, has not been established or associated with maternal or fetal benefit.

Most women like to have someone to support them during labour and birth; such as a midwife, nurse, or doula; or a lay person such as the father of the baby, a family member, or a close friend. Studies have found that continuous support during labor and delivery reduce the need for medication and a caesarean or operative vaginal delivery, and result in an improved Apgar score for the infant

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Pain Control - Pharmaceutical
Different measures for pain control have varying degrees of success and side effects to the woman and her baby. In some countries of Europe, doctors commonly prescribe inhaled nitrous oxide gas for pain control, especially as 53% nitrous oxide, 47% oxygen, known as Entonox; in the UK, midwives may use this gas without a doctor's prescription. Opioids such as fentanyl may be used, but if given too close to birth there is a risk of respiratory depression in the infant.

Popular medical pain control in hospitals include the regional anesthetics epidurals (EDA), and spinal anaesthesia. Epidural analgesia is a generally safe and effective method of relieving pain in labour, but is associated with longer labour, more operative intervention (particularly instrument delivery), and increases in cost. However, a recent Cochrane review suggests that the new epidural techniques have no more effect on labour time and the used instruments. Generally, pain and stress hormones rise throughout labour for women without epidurals, while pain, fear, and stress hormones decrease upon administration of epidural analgesia, but rise again later. Medicine administered via epidural can cross the placenta and enter the bloodstream of the fetus. Epidural analgesia has no statistically significant impact on the risk of caesarean section, and does not appear to have an immediate effect on neonatal status as determined by Apgar scores.

Augmentation
Augmentation is the process of stimulating the uterus to increase the intensity and duration of contractions after labour has begun. Several methods of augmentation are commonly been used to treat slow progress of labour (dystocia) when uterine contractions are assessed to be too weak. Oxytocin is the most common method used to increase the rate of vaginal delivery. The World Health Organization recommends its use either alone or with amniotomy (rupture of the amniotic membrane) but advises that it must be used only after it has been correctly confirmed that labour is not proceeding properly if harm is to be avoided. The WHO does not recommend the use of antispasmodic agents for prevention of delay in labour.

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Episiotomy
Perineal tears can occur during childbirth, most often at the vaginal opening as the baby's head passes through, especially if the baby descends quickly. Tears can involve the perineal skin or extend to the muscles and the anal sphincter and anus. While making a cut to the opening of the vagina, known as an episiotomy is common, it is generally not needed. When needed, the midwife or obstetrician makes a surgical cut in the perineum to prevent severe tears that can be difficult to repair. A 2017 Cochrane review compared episiotomy as needed (restrictive) with routine episiotomy to determine the possible benefits and harms for mother and baby. The review found that restrictive episiotomy policies appeared to give a number of benefits compared with using routine episiotomy. Women experienced less severe perineal trauma, less posterior perineal trauma, less suturing and fewer healing complications at seven days with no difference in occurrence of pain, urinary incontinence, painful sex or severe vaginal/perineal trauma after birth.

Multiple births
In cases of a head first-presenting first twin, twins can often be delivered vaginally. In some cases twin delivery is done in a larger delivery room or in an operating theatre, in the event of complication e.g.

- Both twins born vaginally—this can occur both presented head first or where one comes head first and the other is breech and/or helped by a forceps/ventouse delivery
- One twin born vaginally and the other by caesarean section.
- If the twins are joined at any part of the body—called conjoined twins, delivery is mostly by caesarean section.

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Support
Baby on warming tray attended to by her father.
Obstetric care frequently subjects women to institutional routines, which may have adverse effects on the progress of labour. Supportive care during labour may involve emotional support, comfort measures, and information and advocacy which may promote the physical process of labour as well as women's feelings of control and competence, thus reducing the need for obstetric intervention. The continuous support may be provided either by hospital staff such as nurses or midwives, doulas, or by companions of the woman's choice from her social network. There is increasing evidence to show that the participation of the child's father in the birth leads to better birth and also post-birth outcomes, providing the father does not exhibit excessive anxiety.

Continuous labour support may help women to give birth spontaneously, i.e. without caesarean or vacuum or forceps, with slightly shorter labours, and to have more positive feelings regarding their experience of giving birth. Continuous labour support may also reduce women's use of pain medication during labour and reduce the risk of babies having low five-minute Agpar scores.

Complications

Labour and Delivery Complications

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Obstructed Labour
The second stage of labour may be delayed or lengthy due to poor or uncoordinated uterine action, an abnormal uterine position such as breech or shoulder dystocia, and cephalopelvic disproportion (a small pelvis or large infant). Prolonged labour may result in maternal exhaustion, fetal distress, and other complications including obstetric fistula.

Eclampsia
Eclampsia is the onset of seizures (convulsions) in a woman with pre-eclampsia. Pre-eclampsia is a disorder of pregnancy in which there is high blood pressure and either large amounts of protein in the urine or other organ dysfunction. Pre-eclampsia is routinely screened for during prenatal care. Onset may be before, during, or rarely, after delivery. Around one percent of women with eclampsia die.

Maternal Complications

A puerperal disorder or postpartum disorder is a complication which presents primarily during the puerperium, or postpartum period. The postpartum period can be divided into three distinct stages; the initial or acute phase, six to 12 hours after childbirth; subacute postpartum period, which lasts two to six weeks, and the delayed postpartum period, which can last up to six months. In the subacute postpartum period, 87% to 94% of women report at least one health problem. Long term health problems (persisting after the delayed postpartum period) are reported by 31 percent of women

INJURY Other Childbirth Complications

Postpartum Bleeding
Postpartum bleeding is the leading cause of death of birthing mothers in the world, especially in the developing world. Globally it occurs about 8.7 million times and results in 44,000 to 86,000 deaths per year. Uterine atony, the inability of the uterus to contract, is the most common cause of postpartum bleeding. Following delivery of the placenta, the uterus is left with a large area of open blood vessels which must be constricted to avoid blood loss. Retained placental tissue and infection may contribute to uterine atony. Heavy blood loss leads to hypovolemic shock, insufficient perfusion of vital organs and death if not rapidly treated.

Postpartum Infections
Postpartum infections, also known as childbed fever and puerperal fever, are any bacterial infections of the reproductive tract following childbirth or miscarriage. Signs and symptoms usually include a fever greater than 38.0 °C (100.4 °F), chills, lower abdominal pain, and possibly bad-smelling vaginal discharge. The infection usually occurs after the first 24 hours and within the first ten days following delivery. Infection remains a major cause of maternal deaths and morbidity in the developing world. The work of Ignaz Semmelweis was seminal in the pathophysiology and treatment of childbed fever and his work saved many lives.

INJURY Other Childbirth Complications

Psychological Complications
Childbirth can be an intense event and strong emotions, both positive and negative, can be brought to the surface. Abnormal and persistent fear of childbirth is known as tokophobia. The prevalence of fear of childbirth around the world ranges between 4–25%, with 3–7% of pregnant women having clinical fear of childbirth.

Most new mothers may experience mild feelings of unhappiness and worry after giving birth. Babies require a lot of care, so it is normal for mothers to be worried about, or tired from, providing that care. The feelings, often termed the "baby blues", affect up to 80 percent of mothers. They are somewhat mild, last a week or two, and usually go away on their own.

Postpartum depression is different from the "baby blues". With postpartum depression, feelings of sadness and anxiety can be extreme and might interfere with a woman's ability to care for herself or her family. Because of the severity of the symptoms, postpartum depression usually requires treatment. The condition, which occurs in nearly 15 percent of births, may begin shortly before or any time after childbirth, but commonly begins between a week and a month after delivery.
Childbirth-related posttraumatic stress disorder is a psychological disorder that can develop in women who have recently given birth. Causes include issues such as an emergency C-section, preterm labour, inadequate care during labour, lack of social support following childbirth, and others. Examples of symptoms include intrusive symptoms, flashbacks and nightmares, as well as symptoms of avoidance (including amnesia for the whole or parts of the event), problems in developing a mother-child attachment, and others similar to those commonly experienced in posttraumatic stress disorder (PTSD). Many women who are experiencing symptoms of PTSD after childbirth are misdiagnosed with postpartum depression or adjustment disorders. These diagnoses can lead to inadequate treatment.

Postpartum psychosis is a rare psychiatric emergency in which symptoms of high mood and racing thoughts (mania), depression, severe confusion, loss of inhibition, paranoia, hallucinations and delusions set in, beginning suddenly in the first two weeks after childbirth. The symptoms vary and can change quickly. It usually requires hospitalization. The most severe symptoms last from two to 12 weeks, and recovery takes six months to a year.

Fetal Complications

Five causes make up about 80 percent of newborn deaths. They include prematurity and low-birth-weight, infections, lack of oxygen at birth, and trauma during birth.

Stillbirth
Stillbirth is typically defined as fetal death at or after 20 to 28 weeks of pregnancy. It results in a baby born without signs of life.

Worldwide prevention of most stillbirths is possible with improved health systems. About half of stillbirths occur during childbirth, with this being more common in the developing than developed world. Otherwise depending on how far along the pregnancy is, medications may be used to start labor or a type of surgery known as dilation and evacuation may be carried out. Following a stillbirth, women are at higher risk of another one; however, most subsequent pregnancies do not have similar problems.

Worldwide in 2015 there were about 2.6 million stillbirths that occurred after 28 weeks of pregnancy (about 1 for every 45 births). They occur most commonly in the developing world, particularly South Asia and Sub-Saharan Africa. In the United States for every 167 births there is one stillbirth. Stillbirth rates have declined, though more slowly since the 2000s.

Preterm Birth
Preterm birth is the birth of an infant at fewer than 37 weeks gestational age. It is estimated that one in 10 babies are born prematurely. Premature birth is the leading cause of death in children under five years of age though many that survive experience disabilities including learning defects and visual and hearing problems. Causes for early birth may be unknown or may be related to certain chronic conditions such as diabetes, infections, and other known causes. The World Health Organization has developed guidelines with recommendations to improve the chances of survival and health outcomes for preterm infants.

Neonatal Infection
Newborns are prone to infection in the first month of life. The organism S. agalactiae (Group B Streptococcus) or (GBS) is most often the cause of these occasionally fatal infections. The baby contracts the infection from the mother during labor. In 2014 it was estimated that about one in 2000 newborn babies have GBS bacterial infections within the first week of life, usually evident as respiratory disease, general sepsis, or meningitis.

Untreated sexually transmitted infections (STIs) are associated with congenital and infections in newborn babies, particularly in the areas where rates of infection remain high. The majority of STIs have no symptoms or only mild symptoms that may not be recognized. Mortality rates resulting from some infections may be high, for example the overall perinatal mortality rate associated with untreated syphilis is 30 percent.

Perinatal Asphyxia
Perinatal asphyxia is the medical condition resulting from deprivation of oxygen to a newborn infant that lasts long enough during the birth process to cause physical harm, usually to the brain. Hypoxic damage can occur to most of the infant's organs (heart, lungs, liver, gut, kidneys), but brain damage is of most concern and perhaps the least likely to quickly or completely heal.

Mechanical Fetal Injury
Risk factors for fetal birth injury include fetal macrosomia (big baby), maternal obesity, the need for instrumental delivery, and an inexperienced attendant. Specific situations that can contribute to birth injury include breech presentation and shoulder dystocia. Most fetal birth injuries resolve without long term harm, but brachial plexus injury may lead to Erb's palsy or Klumpke's paralysis.

6 Hyperglycemia

Hyperglycemia, or high blood sugar (also spelled hyperglycaemia or hyperglycæmia) is a condition in which an excessive amount of glucose circulates in the blood plasma. This is generally a blood sugar level higher than 11.1 mmol/l (200 mg/dl), but symptoms may not start to become noticeable until even higher values such as 15–20 mmol/l (~250–300 mg/dl). A subject with a consistent range between ~5.6 and ~7 mmol/l (100–126 mg/dl) (American Diabetes Association guidelines) is considered slightly hyperglycemic, while above 7 mmol/l (126 mg/dl) is generally held to have diabetes.

Signs & Symptoms

The degree of hyperglycemia can change over time depending on the metabolic cause, for example, impaired glucose tolerance or fasting glucose, and it can depend on treatment. Temporary hyperglycemia is often benign and asymptomatic. Blood glucose levels can rise well above normal and cause pathological and functional changes for significant periods without producing any permanent effects or symptoms. During this asymptomatic period, an abnormality in carbohydrate metabolism can occur which can be tested by measuring plasma glucose.

Chronic hyperglycemia at above normal levels can produce a very wide variety of serious complications over a period of years, including kidney damage, neurological damage, cardiovascular damage, damage to the retina or damage to feet and legs. Diabetic neuropathy may be a result of long-term hyperglycemia. Impairment of growth and susceptibility to certain infection can occur as a result of chronic hyperglycemia.

Acute hyperglycemia involving glucose levels that are extremely high is a medical emergency and can rapidly produce serious complications (such as fluid loss through osmotic diuresis). It is most often seen in persons who have uncontrolled insulin-dependent diabetes.

The following symptoms may be associated with acute or chronic hyperglycemia, with the first three composing the classic hyperglycemic triad:
- Polyphagia – frequent hunger, especially pronounced hunger
- Polydipsia – frequent thirst, especially excessive thirst
- Polyuria – increased volume of urination (not an increased frequency, although it is a common consequence)
- Blurred vision
- Fatigue
- Restlessness
- Weight loss
- Poor wound healing (cuts, scrapes, etc.)
- Dry mouth
- Dry or itchy skin
- Tingling in feet or heels
- Erectile dysfunction
- Recurrent infections, external ear infections (swimmer's ear)
- Cardiac arrhythmia
- Stupor
- Coma
- Seizures

Frequent hunger without other symptoms can also indicate that blood sugar levels are too low. This may occur when people who have diabetes take too much oral hypoglycemic medication or insulin for the amount of food they eat. The resulting drop in blood sugar level to below the normal range prompts a hunger response. Polydipsia and polyuria occur when blood glucose levels rise high enough to result in excretion of excess glucose via the kidneys, which leads to the presence of glucose in the urine. This produces an osmotic diuresis.
Signs and symptoms of diabetic ketoacidosis may include:
- Ketoacidosis
- Kussmaul hyperventilation (deep, rapid breathing)
- Confusion or a decreased level of consciousness
- Dehydration due to glycosuria and osmotic diuresis
- Increased thirst
- 'Fruity' smelling breath odor
- Nausea and vomiting
- Impairment of cognitive function, along with increased sadness and anxiety
- Weight loss

Hyperglycemia causes a decrease in cognitive performance, specifically in processing speed, executive function, and performance. Decreased cognitive performance may cause forgetfulness and concentration loss,

Complications
In untreated hyperglycemia, a condition called ketoacidosis may develop because decreased insulin levels increase the activity of hormone sensitive lipase. The degradation of triacylglycerides by hormone-sensitive lipase produces free fatty acids that are eventually converted to acetyl-coA by beta-oxidation.

Ketoacidosis is a life-threatening condition which requires immediate treatment. Symptoms include: shortness of breath, breath that smells fruity (such as pear drops), nausea and vomiting, and very dry mouth. Chronic hyperglycemia (high blood sugar) injures the heart in patients without a history of heart disease or diabetes and is strongly associated with heart attacks and death in subjects with no coronary heart disease or history of heart failure.

Also, life-threatening consequences of hyperglycemia is nonketotic hyperosmolar syndrome. Perioperative hyperglycemia has been associated with immunosuppression, increased infections, osmotic diuresis, delayed wound healing, delayed gastric emptying, sympatho-adrenergic stimulation, and increased mortality. In addition, it reduces skin graft success, exacerbates brain, spinal cord, and renal damage by ischemia, worsens neurologic outcomes in traumatic head injuries, and is associated with postoperative cognitive dysfunction following CABG.

Causes

Diabetes Mellitus
Chronic hyperglycemia that persists even in fasting states is most commonly caused by diabetes mellitus. In fact, chronic hyperglycemia is the defining characteristic of the disease. Intermittent hyperglycemia may be present in prediabetic states. Acute episodes of hyperglycemia without an obvious cause may indicate developing diabetes or a predisposition to the disorder.

In diabetes mellitus, hyperglycemia is usually caused by low insulin levels (Diabetes mellitus type 1) and/or by resistance to insulin at the cellular level (Diabetes mellitus type 2), depending on the type and state of the disease. Low insulin levels and/or insulin resistance prevent the body from converting glucose into glycogen (a starch-like source of energy stored mostly in the liver), which in turn makes it difficult or impossible to remove excess glucose from the blood.

With normal glucose levels, the total amount of glucose in the blood at any given moment is only enough to provide energy to the body for 20–30 minutes, and so glucose levels must be precisely maintained by the body's internal control mechanisms. When the mechanisms fail in a way that allows glucose to rise to abnormal levels, hyperglycemia is the result.

Ketoacidosis may be the first symptom of immune-mediated diabetes, particularly in children and adolescents. Also, patients with immune-mediated diabetes, can change from modest fasting hyperglycemia to severe hyperglycemia and even ketoacidosis as a result of stress or an infection.

Insulin Resistance
Obesity has been contributing to increased insulin resistance due to the population's daily caloric intake rising. Insulin resistance increases hyperglycemia because the body becomes over saturated by glucose. Insulin resistance desensitizes insulin receptors, preventing insulin from lowering blood sugar levels.

The leading cause of hyperglycemia in type 2 diabetes is the failure of insulin to suppress glucose production by glycolysis and gluconeogenesis due to insulin resistance. Insulin normally inhibits glycogenolysis, but fails to do so in a condition of insulin resistance, resulting in increased glucose production. In the liver, FOXO6 normally promotes gluconeogenesis in the fasted state, but insulin blocks Fox06 upon feeding. In a condition of insulin resistance insulin fails to block FoxO6, resulting in continued gluconeogenesis even upon feeding.

Drugs
Certain medications increase the risk of hyperglycemia, including corticosteroids, octreotide, beta blockers, epinephrine, thiazide diuretics, statins, niacin, pentamidine, protease inhibitors, L-asparaginase, and antipsychotics. The acute administration of stimulants such as amphetamines typically produces hyperglycemia; chronic use, however, produces hypoglycemia. Some of the newer psychiatric medications, such as Zyprexa (Olanzapine) and Cymbalta (Duloxetine), can also cause significant hyperglycemia.

Thiazides are used to treat type 2 diabetes but it also causes severe hyperglycemia.

INJURY Other Hyperglycemia Causes

Critical Illness
The following conditions can also cause hyperglycemia in the absence of diabetes. 1) Dysfunction of the thyroid, adrenal, and pituitary glands 2) Numerous diseases of the pancreas 3) Severe increases in blood glucose may be seen in sepsis and certain infections 4) Intracranial diseases (frequently overlooked) can also cause hyperglycemia. Encephalitis, brain tumors (especially those located near the pituitary gland), brain bleeds, and meningitis are prime examples. 5) Mild to high blood sugar levels are often seen in convulsions and terminal stages of many diseases. Prolonged, major surgeries can temporarily increase glucose levels. Certain forms of severe stress and physical trauma can increase levels for a brief time as well yet rarely exceeds 6.6 mmol/l (120 mg/dl).

Stress
A high proportion of patients suffering an acute stress such as stroke or myocardial infarction may develop hyperglycemia, even in the absence of a diagnosis of diabetes. (Or perhaps stroke or myocardial infarction was caused by hyperglycemia and undiagnosed diabetes.) Human and animal studies suggest that this is not benign, and that stress-induced hyperglycemia is associated with a high risk of mortality after both stroke and myocardial infarction.

Somatostatinomas and aldosteronoma-induced hypokalemia can cause hyperglycemia but usually disappears after the removal of the tumour.

Mechanism
Hormones such as the growth hormone, glucagon, cortisol and catecholamines, can cause hyperglycemia when they are present in the body in excess amounts. Also, increased proinflammatory cytokines that interrupt carbohydrate metabolism, leading to excessive glucose production and reduced uptake in tissues, can cause hyperglycemia.

Environmental Factors
Hyperglycemia is lower in higher income groups since there is access to better education and resources. Low-middle income groups are more likely to develop hyperglycemia due education and access to food options. Living in warmer climates can reduce hyperglycemia due to increased physical activity while people are less active in colder climates.

Population
Hyperglycemia is one of the main symptoms of diabetes and it has substantially affected the population making it an epidemic due to the population's increased calorie consumption. Healthcare providers are trying to work more closely with people allowing them more freedom with interventions that suit their lifestyle. As physical inactivity and calorie consumption increases it makes individuals more susceptible to developing hyperglycemia. Hyperglycemia is caused by type 1 diabetes and non-whites have a higher susceptibility for it.

Diagnosis

Monitoring
It is critical for patients who monitor glucose levels at home to be aware of which units of measurement their testing kit uses. Glucose levels are measured in either:

1. Millimoles per liter (mmol/l) is the SI standard unit used in most countries around the world.
2. Milligrams per deciliter (mg/dl) is used in some countries such as the United States, Japan, France, Egypt and Colombia.

Scientific journals are moving towards using mmol/l; some journals now use mmol/l as the primary unit but quote mg/dl in parentheses.

Glucose levels vary before and after meals, and at various times of day; the definition of "normal" varies among medical professionals. In general, the normal range for most people (fasting adults) is about 4 to 6 mmol/l or 80 to 110 mg/dl. (where 4 mmol/l or 80 mg/dl is "optimal".) A subject with a consistent range above 7 mmol/l or 126 mg/dl is generally held to have hyperglycemia, whereas a consistent range below 4 mmol/l or 70 mg/dl is considered hypoglycemic. In fasting adults, blood plasma glucose should not exceed 7 mmol/l or 126 mg/dL. Sustained higher levels of blood sugar cause damage to the blood vessels and to the organs they supply, leading to the complications of diabetes.

Chronic hyperglycemia can be measured via the HbA1c test. The definition of acute hyperglycemia varies by study, with mmol/l levels from 8 to 15 (mg/dl levels from 144 to 270).

Defects in insulin secretion, insulin action, or both, results in hyperglycemia. Chronic hyperglycemia can be measured by Clinical urine tests which can detect sugar in the urine or microalbuminuria which could be a symptom of diabetes

Prevention

Treatment of hyperglycemia requires elimination of the underlying cause, such as diabetes. Acute hyperglycemia can be treated by direct administration of insulin in most cases. Severe hyperglycemia can be treated with oral hypoglycemic therapy and lifestyle modification.

In diabetes mellitus (by far the most common cause of chronic hyperglycemia), treatment aims at maintaining blood glucose at a level as close to normal as possible, in order to avoid serious long-term complications. This is done by a combination of proper diet, regular exercise, and insulin or other medication such as metformin, etc.

Those with hyperglycaemia can be treated using sulphonylureas or metformin or both. These drugs help by improving glycaemic control. Dipeptidyl peptidase 4 inhibitor alone or in combination with basal insulin can be used as a treatment for hyperglycemia with patients still in hospital.

Increasing aerobic exercise to at least 30 minutes will make better use of glucose accumulated in the body since glucose is being used for energy by the muscle. Calorie restriction would be one of the main lifestyle changes because it reduces over eating which contributes to hyperglycemia.

Diets higher in healthy saturated fats and whole wheat carbohydrates such as the Mediterranean diet can help reduce carbohydrate intake to better control hyperglycemia. Diets such as intermittent fasting and ketogenic diet help reduce calorie consumption which could significantly reduce hyperglycemia.

Carbohydrates are the main cause for hyperglycemia, whole wheat items should be substituted for non whole wheat items. Fruits are a part of a complete nutritious diet, but should be limited due to its high sugar content.

7 Hypoglycemia

Hypoglycemia, also known as low blood sugar, is when blood sugar decreases to below normal levels. This may result in a variety of symptoms including clumsiness, trouble talking, confusion, loss of consciousness, seizures or death. A feeling of hunger, sweating, shakiness and weakness may also be present. Symptoms typically come on quickly. The most common cause of hypoglycemia is medications used to treat diabetes mellitus such as insulin and sulfonylureas. Risk is greater in diabetics who have eaten less than usual, exercised more than usual or have drunk alcohol. Other causes of hypoglycemia include kidney failure, certain tumors, such as insulinoma, liver disease, hypothyroidism, starvation, inborn error of metabolism, severe infections, reactive hypoglycemia and a number of drugs including alcohol.

The glucose level that defines hypoglycemia is variable. In people with diabetes, levels below 3.9 mmol/L (70 mg/dL) are diagnostic. In adults without diabetes, symptoms related to low blood sugar, low blood sugar at the time of symptoms and improvement when blood sugar is restored to normal confirm the diagnosis. Otherwise, a level below 2.8 mmol/L (50 mg/dL) after not eating or following exercise may be used. In newborns, a level below 2.2 mmol/L (40 mg/dL), or less than 3.3 mmol/L (60 mg/dL) if symptoms are present, indicates hypoglycemia. Other tests that may be useful in determining the cause include insulin and C peptide levels in the blood.

Among people with diabetes, prevention is by matching the foods eaten with the amount of exercise and the medications used. When people feel their blood sugar is low, testing with a glucose monitor is recommended. Some people have few initial symptoms of low blood sugar, and frequent routine testing in this group is recommended. Treatment of hypoglycemia is by eating foods high in simple sugars or taking dextrose. If a person is not able to take food by mouth, glucagon by injection or in the nose may help. The treatment of hypoglycemia unrelated to diabetes includes treating the underlying problem as well and a healthy diet. The term "hypoglycemia" is sometimes incorrectly used to refer to idiopathic postprandial syndrome, a controversial condition with similar symptoms that occur following eating but with normal blood sugar levels.

Signs & Symptoms

Hypoglycemic symptoms and manifestations can be divided into those produced by the counterregulatory hormones (epinephrine/adrenaline and glucagon) triggered by the falling glucose, and the neuroglycopenic effects produced by the reduced brain sugar.
● Shakiness, anxiety, nervousness
● Palpitations, tachycardia
● Sweating, feeling of warmth (sympathetic muscarinic rather than adrenergic)
● Pallor, coldness, clamminess
● Dilated pupils (mydriasis)
● Hunger, borborygmus
● Nausea, vomiting, abdominal discomfort
● Headache

Central Nervous System
● Abnormal thinking, impaired judgment
● Nonspecific dysphoria, moodiness, depression, crying, exaggerated concerns
● Feeling of numbness, pins and needles (paresthesia)
● Negativism, irritability, belligerence, combativeness, rage
● Personality change, emotional lability
● Fatigue, weakness, apathy, lethargy, daydreaming, sleep
● Confusion, memory loss, lightheadedness or dizziness, delirium
● Staring, glassy look, blurred vision, double vision
● Flashes of light in the field of vision
● Automatic behavior, also known as automatism
● Difficulty speaking, slurred speech

● Ataxia, incoordination, sometimes mistaken for drunkenness
● Focal or general motor deficit, paralysis, hemiparesis
● Headache
● Stupor, coma, abnormal breathing
● Generalized or focal seizures

Not all of the above manifestations occur in every case of hypoglycemia. There is no consistent order to the appearance of the symptoms, if symptoms even occur. Specific manifestations may also vary by age, by severity of the hypoglycemia and the speed of the decline. In young children, vomiting can sometimes accompany morning hypoglycemia with ketosis.

In older children and adults, moderately severe hypoglycemia can resemble mania, mental illness, drug intoxication, or drunkenness. In the elderly, hypoglycemia can produce focal stroke-like effects or a hard-to-define malaise. The symptoms of a single person may be similar from episode to episode, but are not necessarily so and may be influenced by the speed at which glucose levels are dropping, as well as previous incidents.

In newborns, hypoglycemia can produce irritability, jitters, myoclonic jerks, cyanosis, respiratory distress, apneic episodes, sweating, hypothermia, somnolence, hypotonia, refusal to feed, and seizures or "spells." Hypoglycemia can resemble asphyxia, hypocalcemia, sepsis, or heart failure.

In both young and old people with hypoglycemia, the brain may habituate to low glucose levels, with a reduction of noticeable symptoms despite neuroglycopenic impairment. In insulin-dependent diabetic people this phenomenon is termed hypoglycemia unawareness and is a significant clinical problem when improved glycemic control is attempted. Another aspect of this phenomenon occurs in type I glycogenosis, when chronic hypoglycemia before diagnosis may be better tolerated than acute hypoglycemia after treatment is underway.

Hypoglycemic symptoms can also occur when one is sleeping. Examples of symptoms during sleep can include damp bed sheets or clothes from perspiration. Having nightmares or the act of crying out can be a sign of hypoglycemia. Once the individual is awake they may feel tired, irritable, or confused and these may be signs of hypoglycemia as well.

In nearly all cases, hypoglycemia that is severe enough to cause seizures or unconsciousness can be reversed without obvious harm to the brain. Cases of death or permanent neurological damage occurring with a single episode have usually involved prolonged, untreated unconsciousness, interference with breathing, severe concurrent disease, or some other type of vulnerability. Nevertheless, brain damage or death has occasionally resulted from severe hypoglycemia. Research in healthy adults shows that mental efficiency declines slightly but measurably as blood glucose falls below 3.6 mM (65 mg/dL).

Hormonal defense mechanisms (adrenaline and glucagon) are normally activated as it drops below a threshold level (about 55 mg/dL (3.0 mM) for most people), producing the typical hypoglycemic symptoms of shakiness and dysphoria. Obvious impairment may not occur until the glucose falls below 40 mg/dL (2.2 mM), and many healthy people may occasionally have glucose levels below 65 in the morning without apparent effects. Since the brain effects of hypoglycemia, termed neuroglycopenia, determine whether a given low glucose is a "problem" for that person, most doctors use the term hypoglycemia only when a moderately low glucose level is accompanied by symptoms or brain effects.

Determining the presence of both parts of this definition is not always straightforward, as hypoglycemic symptoms and effects are vague and can be produced by other conditions; people with recurrently low glucose levels can lose their threshold symptoms so that severe neuroglycopenic impairment can occur without much warning, and many measurement methods (especially glucose meters) are imprecise at low levels.

It may take longer to recover from severe hypoglycemia with unconsciousness or seizure even after restoration of normal blood glucose. When a person has not been unconscious, failure of carbohydrate to reverse the symptoms in 10–15 minutes increases the likelihood that hypoglycemia was not the cause of the symptoms. When severe hypoglycemia has persisted in a hospitalized person, the amount of glucose required to maintain satisfactory blood glucose levels becomes an important clue to the underlying cause. Glucose requirements above 10 mg/kg/minute in infants, or 6 mg/kg/minute in children and adults are strong evidence for hyperinsulinism. In this context this is referred to as the glucose infusion rate (GIR). Finally, the blood glucose response to glucagon given when the glucose is low can also help distinguish among various types of hypoglycemia. A rise of blood glucose by more than 30 mg/dL (1.70 mmol/l) suggests insulin excess as the probable cause of the hypoglycemia.

Long-Term Effects
Significant hypoglycemia appears to increase the risk of cardiovascular disease.

Causes

The most common cause of hypoglycemia is medications used to treat diabetes mellitus such as insulin, sulfonylureas, and biguanides. Risk is greater in diabetics who have eaten less than usual, exercised more than usual, or drunk alcohol. Other causes of hypoglycemia include kidney failure, certain tumors, liver disease, hypothyroidism, starvation, inborn errors of metabolism, severe infections, reactive hypoglycemia, and a number of drugs including alcohol. Low blood sugar may occur in babies who are otherwise healthy who have not eaten for a few hours. Inborn errors of metabolism may include the lack of an enzyme to make glycogen (glycogen storage type 0).

Serious Illness
Serious illness may result in low blood sugar. Severe disease of nearly all major organ systems can cause hypoglycemia as a secondary problem. Hospitalized persons, especially in intensive care units or those prevented from eating, can develop hypoglycemia from a variety of circumstances related to the care of their primary disease. Hypoglycemia in these circumstances is often multifactorial or caused by the healthcare. Once identified, these types of hypoglycemia are readily reversed and prevented, and the underlying disease becomes the primary problem.

Hormone Deficiency
Not enough cortisol, such as in Addison's disease, not enough glucagon, or not enough epinephrine can result in low blood sugar. This is a more common cause in children.

Diagnosis

The glucose level that defines hypoglycemia is variable. In diabetics a level below 3.9 mmol/L (70 mg/dL) is diagnostic. In adults without diabetes, symptoms related to low blood sugar, low blood sugar at the time of symptoms, and improvement when blood sugar is restored to normal confirm the diagnosis. This is known as the Whipple's triad. Otherwise a level below 2.8 mmol/L (50 mg/dL) after not eating or following exercise may be used. In newborns a level below 2.2 mmol/L (40 mg/dL) or less than 3.3 mmol/L (60 mg/dL) if symptoms are present indicates hypoglycemia. Other tests that may be useful in determining the cause include insulin and C peptide levels in the blood. Hyperglycemia, a high blood sugar, is the opposite condition.

Throughout a 24-hour period blood plasma glucose levels are generally maintained between 4–8 mmol/L (72 and 144 mg/dL).1 Although 3.3 or 3.9 mmol/L (60 or 70 mg/dL) is commonly cited as the lower limit of normal glucose, symptoms of hypoglycemia usually do not occur until 2.8 to 3.0 mmol/L (50 to 54 mg/dL).

In cases of recurrent hypoglycemia with severe symptoms, the best method of excluding dangerous conditions is often a diagnostic fast. This is usually conducted in the hospital, and the duration depends on the age of the person and response to the fast. A healthy adult can usually maintain a glucose level above 50 mg/dL (2.8 mM) for 72 hours, a child for 36 hours, and an infant for 24 hours. The purpose of the fast is to determine whether the person can maintain his or her blood glucose as long as normal, and can respond to fasting with the appropriate metabolic changes. At the end of the fast the insulin should be nearly undetectable and ketosis should be fully established. The person's blood glucose levels are monitored and a critical specimen is obtained if the glucose falls. Despite its unpleasantness and expense, a diagnostic fast may be the only effective way to confirm or refute a number of serious forms of hypoglycemia, especially those involving excessive insulin.

The precise level of glucose considered low enough to define hypoglycemia is dependent on (1) the measurement method, (2) the age of the person, (3) presence or absence of effects, and (4) the purpose of the definition. While there is no disagreement as to the normal range of blood sugar, debate continues as to what degree of hypoglycemia warrants medical evaluation or treatment, or can cause harm.

Deciding whether a blood glucose in the borderline range of 45–75 mg/dL (2.5–4.2 mM) represents clinically problematic hypoglycemia is not always simple. This leads people to use different "cutoff levels" of glucose in different contexts and for different purposes. Because of all the variations, the Endocrine Society recommends that a diagnosis of hypoglycemia as a problem for an individual be based on the combination of a low glucose level and evidence of adverse effects.

Glucose concentrations are expressed as milligrams per deciliter (mg/dL or mg/100 mL) in Lebanon, the United States, Japan, Portugal, Spain, France, Belgium, Egypt, Turkey, Saudi Arabia, Colombia, India and Israel, while millimoles per liter (mmol/L or mM) are the units used in most of the rest of the world. Glucose concentrations expressed as mg/dL can be converted to mmol/L by dividing by 18.0 g/dmol (the molar mass of glucose). For example, a glucose concentration of 90 mg/dL is 5.0 mmol/L or 5.0 mM.

The circumstances of hypoglycemia provide most of the clues to diagnosis. Circumstances include the age of the person, time of day, time since last meal, previous episodes, nutritional status, physical and mental development, drugs or toxins (especially insulin or other diabetes drugs), diseases of other organ systems, family history, and response to treatment.

When hypoglycemia occurs repeatedly, a record or "diary" of the spells over several months, noting the circumstances of each spell (time of day, relation to last meal, nature of last meal, response to carbohydrate, and so forth) may be useful in recognizing the nature and cause of the hypoglycemia.

Age
Children's blood sugar levels are often slightly lower than adults'. Overnight fasting glucose levels are below 70 mg/dL (3.9 mM) in 5% of healthy adults, but up to 5% of children can be below 60 mg/dL (3.3 mM) in the morning fasting state. As the duration of fasting is extended, a higher percentage of infants and children will have mildly low plasma glucose levels, typically without symptoms. The normal range of newborn blood sugars continues to be debated. It has been proposed that newborn brains are able to use alternate fuels when glucose levels are low more readily than adults. Experts continue to debate the significance and risk of such levels, though the trend has been to recommend maintenance of glucose levels above 60–70 mg/dL the first day after birth.

Diabetic hypoglycemia represents a special case with respect to the relationship of measured glucose and hypoglycemic symptoms for several reasons. First, although home glucose meter readings are often misleading, the probability that a low reading, whether accompanied by symptoms or not, represents real hypoglycemia is much higher in a person who takes insulin than in someone who does not.

Prevention

The most effective means of preventing further episodes of hypoglycemia depends on the cause. The risk of further episodes of diabetic hypoglycemia can often (but not always) be reduced by lowering the dose of insulin or other medications, or by more meticulous attention to blood sugar balance during unusual hours, higher levels of exercise, or decreasing alcohol intake.

Many of the inborn errors of metabolism require avoidance or shortening of fasting intervals, or extra carbohydrates. For the more severe disorders, such as type 1 glycogen storage disease, this may be supplied in the form of cornstarch every few hours or by continuous gastric infusion.

Several treatments are used for hyperinsulinemic hypoglycemia, depending on the exact form and severity. Some forms of congenital hyperinsulinism respond to diazoxide or octreotide. Surgical removal of the overactive part of the pancreas is curative with minimal risk when hyperinsulinism is focal or due to a benign insulin-producing tumor of the pancreas. When congenital hyperinsulinism is diffuse and refractory to medications, near-total pancreatectomy may be the treatment of last resort, but in this condition is less consistently effective and fraught with more complications.

Hypoglycemia due to hormone deficiencies such as hypopituitarism or adrenal insufficiency usually ceases when the appropriate hormone is replaced. Hypoglycemia due to dumping syndrome and other post-surgical conditions is best dealt with by altering diet. Including fat and protein with carbohydrates may slow digestion and reduce early insulin secretion. Some forms of this respond to treatment with an alpha-glucosidase inhibitor, which slows starch digestion.

Reactive hypoglycemia with demonstrably low blood glucose levels is most often a predictable nuisance which can be avoided by consuming fat and protein with carbohydrates, by adding morning or afternoon snacks, and reducing alcohol intake.

Idiopathic postprandial syndrome without demonstrably low glucose levels at the time of symptoms can be more of a management challenge. Many people find improvement by changing eating patterns (smaller meals, avoiding excessive sugar, mixed meals rather than carbohydrates by themselves), reducing intake of stimulants such as caffeine, or by making lifestyle changes to reduce stress. See the following section of this article.

Treatment

Treatment of some forms of hypoglycemia, such as in diabetes, involves immediately raising the blood sugar to normal through the eating of carbohydrates such as sugars, determining the cause, and taking measures to hopefully prevent future episodes. However, this treatment is not optimal in other forms such as reactive hypoglycemia, where rapid carbohydrate ingestion may lead to a further hypoglycemic episode.

Blood glucose can be raised to normal within minutes by taking (or receiving) 10–20 grams of carbohydrate. It can be taken as food or drink if the person is conscious and able to swallow. This amount of carbohydrate is contained in about 3–4 ounces (100–120 ml) of orange, apple, or grape juice although fruit juices contain a higher proportion of fructose which is more slowly metabolized than pure dextrose. Alternatively, about 4–5 ounces (120–150 ml) of regular (non-diet) soda may also work, as will about one slice of bread, about 4 crackers, or about 1 serving of most starchy foods. Starch is quickly digested to glucose (unless the person is taking acarbose), but adding fat or protein retards digestion. Symptoms should begin to improve within 5 minutes, though full recovery may take 10–20 minutes. Overfeeding does not speed recovery and if the person has diabetes will simply produce hyperglycemia afterwards. A mnemonic used by the American Diabetes Association and others is the "rule of 15" – consuming 15 grams of carbohydrate followed by a 15-minute wait, repeated if glucose remains low (variable by individual, sometimes 70 mg/dL).
If a person has such severe effects of hypoglycemia that they cannot (due to combativeness) or should not (due to seizures or unconsciousness) be given anything by mouth, medical personnel such as paramedics, or in-hospital personnel can establish IV access and give intravenous dextrose, concentrations varying depending on age (infants are given 2 ml/kg dextrose 10%, children are given dextrose 25%, and adults are given dextrose 50%). Care must be taken in giving these solutions because they can cause skin necrosis if the IV is infiltrated, sclerosis of veins, and many other fluid and electrolyte disturbances if administered incorrectly. If IV access cannot be established, the person can be given 1 to 2 milligrams of glucagon in an intramuscular injection. More treatment information can be found in the article diabetic hypoglycemia. If a person has less severe effects, and is conscious with the ability to swallow, medical personal may administer gelatinous oral glucose. The soft drink Lucozade has been used for hypoglycemia in the United Kingdom, however it has recently replaced much of its glucose with the artificial sugars, which do not treat hypoglycemia.

One situation where starch may be less effective than glucose or sucrose is when a person is taking acarbose. Since acarbose and other alpha-glucosidase inhibitors prevents starch and other sugars from being broken down into monosaccharides that can be absorbed by the body, people taking these medications should consume monosaccharide-containing foods such as glucose tablets, honey, or juice to reverse hypoglycemia.

8 Toothache

Toothache, also known as dental pain, is pain in the teeth or their supporting structures, caused by dental diseases or pain referred to the teeth by non-dental diseases. When severe it may impact sleep, eating, and other daily activities.

Common causes include inflammation of the pulp, usually in response to tooth decay, dental trauma, or other factors, dentin hypersensitivity, apical periodontitis (inflammation of the periodontal ligament and alveolar bone around the root apex), dental abscesses (localized collections of pus, alveolar osteitis ("dry socket", a possible complication of tooth extraction), acute necrotizing ulcerative gingivitis (a gum infection), temporomandibular disorder.

Pulpitis is reversible when the pain is mild to moderate and lasts for a short time after a stimulus (for instance cold); or irreversible when the pain is severe, spontaneous, and lasts a long time after a stimulus. Left untreated, pulpitis may become irreversible, then progress to pulp necrosis (death of the pulp) and apical periodontitis. Abscesses usually cause throbbing pain. The apical abscess usually occurs after pulp necrosis, the pericoronal abscess is usually associated with acute pericoronitis of a lower wisdom tooth, and periodontal abscesses usually represent a complication of chronic periodontitis (gum disease). Less commonly, non-dental conditions can cause toothache, such as maxillary sinusitis, which can cause pain in the upper back teeth, or angina pectoris, which can cause pain in the lower teeth. Correct diagnosis can sometimes be challenging.

Proper oral hygiene helps to prevent toothaches by preventing dental disease. The treatment of a toothache depends upon the exact cause, and may involve a filling, root canal treatment, extraction, drainage of pus, or other remedial action. The relief of toothache is considered one of the main responsibilities of dentists. Toothache is the most common type of pain in the mouth or face It is one of the most common reasons for emergency dental appointments.

Signs & Symptoms

The chief complaint, and the onset of the complaint, are usually important in the diagnosis of toothache. For example, the key distinction between reversible and irreversible pulpitis is given in the history, such as pain following a stimulus in the former, and lingering pain following a stimulus and spontaneous pain in the latter. History is also important in recent filling or other dental treatment, and trauma to the teeth. Based on the most common causes of toothache (dentin hypersensitivity, periodontitis, and pulpitis), the key indicators become localization of the pain (whether the pain is perceived as originating in a specific tooth), thermal sensitivity, pain on biting, spontaneity of the pain, and factors that make the pain worse.

The various qualities of the toothache, such as the effect of biting and chewing on the pain, the effect of thermal stimuli, and the effect of the pain on sleep, are verbally established by the clinician, usually in a systematic fashion, such as using the Socrates pain assessment method (see table).

From the history, indicators of pulpal, periodontal, a combination of both, or non-dental causes can be observed. Periodontal pain is frequently localized to a particular tooth, which is made much worse by biting on the tooth, sudden in onset, and associated with bleeding and pain when brushing. More than one factor may be involved in the toothache.

For example, a pulpal abscess (which is typically severe, spontaneous and localized) can cause periapical periodontitis (which results in pain on biting). Cracked tooth syndrome may also cause a combination of symptoms. Lateral periodontitis (which is usually without any thermal sensitivity and sensitive to biting) can cause pulpitis and the tooth becomes sensitive to cold.

Causes

Toothache may be caused by dental (odontogenic) conditions (such as those involving the dentin-pulp complex or periodontium), or by non-dental (non-odontogenic) conditions (such as maxillary sinusitis or angina pectoris). There are many possible non-dental causes, but the vast majority of toothache is dental in origin.

Both the pulp and periodontal ligament have nociceptors (pain receptors), but the pulp lacks proprioceptors (motion or position receptors) and mechanoreceptors (mechanical pressure receptors). Consequently, pain originating from the dentin-pulp complex tends to be poorly localized, whereas pain from the periodontal ligament will typically be well localized, although not always.

For instance, the periodontal ligament can detect the pressure exerted when biting on something smaller than a grain of sand (10–30 µm). When a tooth is intentionally stimulated, about 33% of people can correctly identify the tooth, and about 20% cannot narrow the stimulus location down to a group of three teeth. Another typical difference between pulpal and periodontal pain is that the latter is not usually made worse by thermal stimuli.

Dental

Pulpal
The majority of pulpal toothache falls into one of the following types; however, other rare causes (which do not always fit neatly into these categories) include galvanic pain and barodontalgia.

Pulpitis
Pulpitis (inflammation of the pulp) can be triggered by various stimuli (insults), including mechanical, thermal, chemical, and bacterial irritants, or rarely barometric changes and ionizing radiation. Common causes include tooth decay, dental trauma (such as a crack or fracture), or a filling with an imperfect seal.

Because the pulp is encased in a rigid outer shell, there is no space to accommodate swelling caused by inflammation. Inflammation therefore increases pressure in the pulp system, potentially compressing the blood vessels which supply the pulp. This may lead to ischemia (lack of oxygen) and necrosis (tissue death). Pulpitis is termed reversible when the inflamed pulp is capable of returning to a state of health, and irreversible when pulp necrosis is inevitable.

Reversible pulpitis is characterized by short-lasting pain triggered by cold and sometimes heat. The symptoms of reversible pulpitis may disappear, either because the noxious stimulus is removed, such as when dental decay is removed and a filling placed, or because new layers of dentin (tertiary dentin) have been produced inside the pulp chamber, insulating against the stimulus. Irreversible pulpitis causes spontaneous or lingering pain in response to cold.

Dentin Hypersensitivity
Dentin hypersensitivity is a sharp, short-lasting dental pain occurring in about 15% of the population, which is triggered by cold (such as liquids or air), sweet or spicy foods, and beverages. Teeth will normally have some sensation to these triggers, but what separates hypersensitivity from regular tooth sensation is the intensity of the pain. Hypersensitivity is most commonly caused by a lack of insulation from the triggers in the mouth due to gingival recession (receding gums) exposing the roots of the teeth, although it can occur after scaling and root planing or dental bleaching, or as a result of erosion. The pulp of the tooth remains normal and healthy in dentin hypersensitivity.

Many topical treatments for dentin hypersensitivity are available, including desensitizing toothpastes and protective varnishes that coat the exposed dentin surface. Treatment of the root cause is critical, as topical measures are typically short lasting. Over time, the pulp usually adapts by producing new layers of dentin inside the pulp chamber called tertiary dentin, increasing the thickness between the pulp and the exposed dentin surface and lessening the hypersensitivity.

Periodontal
In general, chronic periodontal conditions do not cause any pain. Rather, it is acute inflammation which is responsible for the pain.

Apical Periodontitis
Apical periodontitis is acute or chronic inflammation around the apex of a tooth caused by an immune response to bacteria within an infected pulp. It does not occur because of pulp necrosis, meaning that a tooth that tests as if it's alive (vital) may cause apical periodontitis, and a pulp which has become non-vital due to a sterile, non-infectious processes (such as trauma) may not cause any apical periodontitis. Bacterial cytotoxins reach the region around the roots of the tooth via the apical foramina and lateral canals, causing vasodilation, sensitization of nerves, osteolysis (bone resorption) and potentially abscess or cyst formation.

The periodontal ligament becomes inflamed and there may be pain when biting or tapping on the tooth. On an X-ray, bone resporption appears as a radiolucent area around the end of the root, although this does not manifest immediately. Acute apical periodontitis is characterized by well-localized, spontaneous, persistent, moderate to severe pain. The alveolar process may be tender to palpation over the roots. The tooth may be raised in the socket and feel more prominent than the adjacent teeth.

Food Impaction
Food impaction occurs when food debris, especially fibrous food such as meat, becomes trapped between two teeth and is pushed into the gums during chewing. The usual cause of food impaction is disruption of the normal interproximal contour or drifting of teeth so that a gap is created (an open contact). Decay can lead to collapse of part of the tooth, or a dental restoration may not accurately reproduce the contact point. Irritation, localized discomfort or mild pain and a feeling of pressure from between the two teeth results. The gingival papilla is swollen, tender and bleeds when touched. The pain occurs during and after eating, and may slowly disappear before being evoked again at the next meal, or relieved immediately by using a tooth pick or dental floss in the involved area. A gingival or periodontal abscess may develop from this situation.

Periodontal Abscess
A periodontal abscess (lateral abscess) is a collection of pus that forms in the gingival crevices, usually as a result of chronic periodontitis where the pockets are pathologically deepened greater than 3mm. A healthy gingival pocket will contain bacteria and some calculus kept in check by the immune system. As the pocket deepens, the balance is disrupted, and an acute inflammatory response results, forming pus. The debris and swelling then disrupt the normal flow of fluids into and out of the pocket, rapidly accelerating the inflammatory cycle. Larger pockets also have a greater likelihood of collecting food debris, creating additional sources of infection.

Periodontal abscesses are less common than apical abscesses, but are still frequent. The key difference between the two is that the pulp of the tooth tends to be alive, and will respond normally to pulp tests. However, an untreated periodontal abscess may still cause the pulp to die if it reaches the tooth apex in a periodontic-endodontic lesion.

A periodontal abscess can occur as the result of tooth fracture, food packing into a periodontal pocket (with poorly shaped fillings), calculus build-up, and lowered immune responses (such as in diabetes). Periodontal abscess can also occur after periodontal scaling, which causes the gums to tighten around the teeth and trap debris in the pocket. Toothache caused by a periodontal abscess is generally deep and throbbing. The oral mucosa covering an early periodontal abscess appears erythematous (red), swollen, shiny, and painful to touch.

A variant of the periodontal abscess is the gingival abscess, which is limited to the gingival margin, has a quicker onset, and is typically caused by trauma from items such as a fishbone, toothpick, or toothbrush, rather than chronic periodontitis. The treatment of a periodontal abscess is similar to the management of dental abscesses in general (see: Treatment). However, since the tooth is typically alive, there is no difficulty in accessing the source of infection and, therefore, antibiotics are more routinely used in conjunction with scaling and root planing. The occurrence of a periodontal abscess usually indicates advanced periodontal disease, which requires correct management to prevent recurrent abscesses, including daily cleaning below the gumline to prevent the buildup of subgingival plaque and calculus.

Acute Necrotizing Ulcerative Gingivitis

Common marginal gingivitis in response to subgingival plaque is usually a painless condition. However, an acute form of gingivitis/periodontitis, termed acute necrotizing ulcerative gingivitis (ANUG), can develop, often suddenly. It is associated with severe periodontal pain, bleeding gums, "punched out" ulceration, loss of the interdental papillae, and possibly also halitosis (bad breath) and a bad taste. Predisposing factors include poor oral hygiene, smoking, malnutrition, psychological stress, and immunosuppression. This condition is not contagious, but multiple cases may simultaneously occur in populations who share the same risk factors (such as students in a dormitory during a period of examination). ANUG is treated over several visits, first with debridement of the necrotic gingiva, homecare with hydrogen peroxide mouthwash, analgesics and, when the pain has subsided sufficiently, cleaning below the gumline, both professionally and at home. Antibiotics are not indicated in ANUG management unless there is underlying systemic disease.

Pericoronitis

Pericoronitis is inflammation of the soft tissues surrounding the crown of a partially erupted tooth. The lower wisdom tooth is the last tooth to erupt into the mouth, and is, therefore, more frequently impacted, or stuck, against the other teeth. This leaves the tooth partially erupted into the mouth, and there frequently is a flap of gum (an operculum), overlying the tooth. Bacteria and food debris accumulate beneath the operculum, which is an area that is difficult to keep clean because it is hidden and far back in the mouth. The opposing upper wisdom tooth also tends to have sharp cusps and over-erupt because it has no opposing tooth to bite into, and instead traumatizes the operculum further.

Periodontitis and dental caries may develop on either the third or second molars, and chronic inflammation develops in the soft tissues. Chronic pericoronitis may not cause any pain, but an acute pericoronitis episode is often associated with pericoronal abscess formation. Typical signs and symptoms of a pericoronal abscess include severe, throbbing pain, which may radiate to adjacent areas in the head and neck, redness, swelling and tenderness of the gum over the tooth. There may be trismus (difficulty opening the mouth), facial swelling, and rubor (flushing) of the cheek that overlies the angle of the jaw.

Persons typically develop pericoronitis in their late teens and early 20s, as this is the age that the wisdom teeth are erupting. Treatment for acute conditions includes cleaning the area under the operculum with an antiseptic solution, painkillers, and antibiotics if indicated. After the acute episode has been controlled, the definitive treatment is usually by tooth extraction or, less commonly, the soft tissue is removed (operculectomy). If the tooth is kept, good oral hygiene is required to keep the area free of debris to prevent recurrence of the infection.

Occlusal Trauma

Occlusal trauma results from excessive biting forces exerted on teeth, which overloads the periodontal ligament, causing periodontal pain and a reversible increase in tooth mobility. Occlusal trauma may occur with bruxism, the parafunctional (abnormal) clenching and grinding of teeth during sleep or while awake. Over time, there may be attrition (tooth wear), which may also cause dentin hypersensitivity, and possibly formation of a periodontal abscess, as the occlusal trauma causes adaptive changes in the alveolar bone.

Occlusal trauma often occurs when a newly placed dental restoration is built too "high", concentrating the biting forces on one tooth. Height differences measuring less than a millimeter can cause pain. Dentists, therefore, routinely check that any new restoration is in harmony with the bite and forces are distributed correctly over many teeth using articulating paper. If the high spot is quickly eliminated, the pain disappears and there is no permanent harm. Over-tightening of braces can cause periodontal pain and, occasionally, a periodontal abscess.

Alveolar Osteitis

Alveolar osteitis is a complication of tooth extraction (especially lower wisdom teeth) in which the blood clot is not formed or is lost, leaving the socket where the tooth used to be empty, and bare bone is exposed to the mouth. The pain is moderate to severe, and dull, aching, and throbbing in character. The pain is localized to the socket, and may radiate. It normally starts two to four days after the extraction, and may last 10–40 days. Healing is delayed, and it is treated with local anesthetic dressings, which are typically required for five to seven days. There is some evidence that chlorhexidine mouthwash used prior to extractions prevents alveolar osteitis.

Dental trauma and cracked tooth syndrome

Cracked tooth syndrome refers to a highly variable set of pain-sensitivity symptoms that may accompany a tooth fracture, usually sporadic, sharp pain that occurs during biting or with release of biting pressure, or relieved by releasing pressure on the tooth. The term is falling into disfavor and has given way to the more generalized description of fractures and cracks of the tooth, which allows for the wide variations in signs, symptoms, and prognosis for traumatized teeth. A fracture of a tooth can involve the enamel, dentin, and/or pulp, and can be orientated horizontally or vertically. Fractured or cracked teeth can cause pain via several mechanisms, including dentin hypersensitivity, pulpitis (reversible or irreversible), or periodontal pain. Accordingly, there is no single test or combination of symptoms that accurately diagnose a fracture or crack, although when pain can be stimulated by causing separation of the cusps of the tooth, it's highly suggestive of the disorder. Vertical fractures can be very difficult to identify because the crack can rarely be probed or seen on radiographs, as the fracture runs in the plane of conventional films (similar to how the split between two adjacent panes of glass is invisible when facing them).

Periodontic-Endodontic Lesion

Apical abscesses can spread to involve periodontal pockets around a tooth, and periodontal pockets cause eventual pulp necrosis via accessory canals or the apical foramen at the bottom of the tooth. Such lesions are termed periodontic-endodontic lesions, and they may be acutely painful, sharing similar signs and symptoms with a periodontal abscess, or they may cause mild pain or no pain at all if they are chronic and free-draining. Successful root canal therapy is required before periodonal treatment is attempted. Generally, the long-term prognosis of perio-endo lesions is poor.

Non-Dental

Non-dental causes of toothache are much less common as compared with dental causes. In a toothache of neurovascular origin, pain is reported in the teeth in conjunction with a migraine. Local and distant structures (such as ear, brain, carotid artery, or heart) can also refer pain to the teeth. Other non-dental causes of toothache include myofascial pain (muscle pain) and angina pectoris (which classically refers pain to the lower jaw). Very rarely, toothache can be psychogenic in origin.

Disorders of the maxillary sinus can be referred to the upper back teeth. The posterior, middle and anterior superior alveolar nerves are all closely associated with the lining of the sinus. The bone between the floor of the maxillary sinus and the roots of the upper back teeth is very thin, and frequently the apices of these teeth disrupt the contour of the sinus floor. Consequently, acute or chronic maxillary sinusitis can be perceived as maxillary toothache, and neoplasms of the sinus (such as adenoid cystic carcinoma) can cause similarly perceived toothache if malignant invasion of the superior alveolar nerves occurs. Classically, sinusitis pain increases upon Valsalva maneuvers or tilting the head forward.

Painful conditions which do not originate from the teeth or their supporting structures may affect the oral mucosa of the gums and be interpreted by the individual as toothache. Examples include neoplasms of the gingival or alveolar mucosa (usually squamous cell carcinoma), conditions which cause gingivostomatitis and desquamative gingivitis. Various conditions may involve the alveolar bone, and cause non-odontogenic toothache, such as Burkitt's lymphoma, infarcts in the jaws caused by sickle cell disease, and osteomyelitis. Various conditions of the trigeminal nerve can masquerade as toothache, including trigeminal zoster (maxillary or mandibular division), trigeminal neuralgia, cluster headache, and trigeminal neuropathies. Very rarely, a brain tumor might cause toothache. Another chronic facial pain syndrome which can mimic toothache is temporomandibular disorder (temporomandibular joint pain-dysfunction syndrome), which is very common. Toothache which has no identifiable dental or medical cause is often termed atypical odontalgia, which, in turn, is usually considered a type of atypical facial pain (or persistent idiopathic facial pain). Atypical odontalgia may give very unusual symptoms, such as pain which migrates from one tooth to another and which crosses anatomical boundaries (such as from the left teeth to the right teeth).

Establishing a diagnosis of nondental toothache is initially done by careful questioning about the site, nature, aggravating and relieving factors, and referral of the pain, then ruling out any dental causes. There are no specific treatments for nondental pain (each treatment is directed at the cause of the pain, rather than the toothache itself), but a dentist can assist in offering potential sources of the pain and direct the patient to appropriate care. The most critical nondental source is the radiation of angina pectoris into the lower teeth and the potential need for urgent cardiac care.

Diagnosis

The diagnosis of toothache can be challenging, not only because the list of potential causes is extensive, but also because dental pain may be extremely variable, and pain can be referred to and from the teeth. Dental pain can simulate virtually any facial pain syndrome. However, the vast majority of toothache is caused by dental, rather than non-dental, sources. Consequently, the saying "horses, not zebras" has been applied to the differential diagnosis of orofacial pain. That is, everyday dental causes (such as pulpitis) should always be considered before unusual, non-dental causes (such as myocardial infarction). In the wider context of orofacial pain, all cases of orofacial pain may be considered as having a dental origin until proven otherwise. The diagnostic approach for toothache is generally carried out in the following sequence: history, followed by examination, and investigations. All this information is then collated and used to build a clinical picture, and a differential diagnosis can be carried out.

Non-dental sources of pain often cause multiple teeth to hurt and have an epicenter that is either above or below the jaws. For instance, cardiac pain (which can make the bottom teeth hurt) usually radiates up from the chest and neck, and sinusitis (which can make the back top teeth hurt) is worsened by bending over. As all of these conditions may mimic toothache, it is possible that dental treatment, such as fillings, root canal treatment, or tooth extraction may be carried out unnecessarily by dentists in an attempt to relieve the individual's pain, and as a result the correct diagnosis is delayed. A hallmark is that there is no obvious dental cause, and signs and symptoms elsewhere in the body may be present. As migraines are typically present for many years, the diagnosis is easier to make. Often the character of the pain is the differentiator between dental and non-dental pain.

Irreversible pulpitis progresses to pulp necrosis, wherein the nerves are non-functional, and a pain-free period following the severe pain of irreversible pulpitis may be experienced. However, it is common for irreversible pulpitis to progress to apical periodontitis, including an acute apical abscess, without treatment. As irreversible pulpitis generates an apical abscess, the character of the toothache may simply change without any pain-free period. For instance, the pain becomes well localized, and biting on the tooth becomes painful. Hot drinks can make the tooth feel worse because they expand the gases and likewise, cold can make it feel better, thus some will sip cold water.

Differential Diagnoses:

Parameter	Dentin Hypersensitivity	Dentin Hypersensitivity	Irreversible Pulpitis	Pulp Necrosis	Apical Periodontitis	Periodontal Abscess	Pericoronitis	Myofascial Pain	Maxillary Sinusitis		
Site	Poorly localized	Poorly localized	Variable; localized or diffuse	No pain	Well localized	Usually well localized	Well localized, associated with partially impacted tooth	Diffuse, often over many muscles	Back teeth top jaw		
Onset	Gradual	Variable	Variable	From pain of reversible pulpitis to no pain in days	Gradual, typically follows weeks of thermal pain in tooth	Sudden, no episode of thermal sensitivity	Sudden	Very slow; weeks to months	Sudden		
Character	Sharp, quickly reversible	Sharp, shooting	Dull, continuous pain. Can also be sharp	No pain	Dull, continuous throbbing pain	Dull, continuous throbbing pain	Sharp, with continuous dull	Dull, aching	Dull, aching, occasional thermal sensitivity in back top teeth		
Radiation	Does not cross midline	Does not cross midline	Does not cross midline	N/A	Does not cross midline	Little, well localized	Moderate, into jaw/neck	Extensive, neck/temple	Moderate, into other facial sinus areas		
Associated Symptoms	Patient may complain of receding gums and/or toothbrush abrasion cavities	Can follow restorative dental work or trauma	Follows period of pain that does not linger	Follows period of spontaneous pain	Tooth may feel raised in socket	May follow report of something getting "stuck" in gum	Tooth eruption ("cutting") or impacted tooth	Tension headaches, neck pain, periods of stress or episode of mouth open for long period	Symptoms of URTI		
Time Pattern	Hypersensitivity as long as stimulus is applied; often worse in cold weather	Pain as long as stimulus is applied	Lingering pain to hot or cold or spontaneous pain	Absence of pain following days or weeks of intense, well localized pain	Pain on biting following constant dull, aching pain development	Dull ache with acute increase in pain when tooth is moved, minimal thermal sensitivity	Constant dull ache without stimulus	Spontaneous, worse with eating, chewing, or movement of jaw	Spontaneous, worse when head is tipped forward		
Exacerbating and Relieving Factors	Exacerbating: thermal, particularly cold	Exacerbating: thermal, sweet	Simple analgesics have little effect	Prolonged heat may elicit pain	Same as irreversible pulpitis, or no response to cold, lingering pain to hot, pain with biting or lying down	Tapping tooth makes worse, cleansing area may improve pain	Cleansing area can improve pain	Rest or ice makes pain better, movement and chewing make it worse	Tilting head forward, jarring movements (jumping) make pain worse		
Severity	Less severe than pulpitis	Severe, for short periods	Variable; pain dissipates until periapical tissue affected	Severe	Severe	Severe	Mild to severe	Mild to moderate	Mild to severe		
Effect on Sleep	None	None usually	Disrupts sleep	None	Disrupts sleep	Variable, can disrupt sleep	If moderate to severe, will disrupt	Unusual	Unusual		

Prevention

Since most toothache is the result of plaque-related diseases, such as tooth decay and periodontal disease, the majority of cases could be prevented by avoidance of a cariogenic diet and maintenance of good oral hygiene. That is, reduction in the number times that refined sugars are consumed per day and brushing the teeth twice a day with fluoride toothpaste and interdental cleaning. Regular visits to a dentist also increases the likelihood that problems are detected early and averted before toothache occurs. Dental trauma could also be significantly reduced by routine use of mouthguards in contact sports.

Management

There are many causes of toothache and its diagnosis is a specialist topic, meaning that attendance at a dentist is usually required. Since many cases of toothache are inflammatory in nature, over the counter non-steroidal anti-inflammatory drugs (NSAIDs) may help (unless contraindicated, such as with a peptic ulcer). Generally, NSAIDs are as effective as aspirin alone or in combination with codeine. However, simple analgesics may have little effect on some causes of toothache, and the severe pain can drive individuals to exceed the maximum dose. For example, when acetaminophen (paracetamol) is taken for toothache, an accidental overdose is more likely to occur when compared to people who are taking acetaminophen for other reasons. Another risk in persons with toothache is a painful chemical burn of the oral mucosa caused by holding a caustic substance such as aspirin tablets and toothache remedies containing eugenol (such as clove oil) against the gum. Although the logic of placing a tablet against the painful tooth is understandable, an aspirin tablet needs to be swallowed to have any pain-killing effect. Caustic toothache remedies require careful application to the tooth only, without coming into excessive contact with the soft tissues of the mouth.

For the dentist, the goal of treatment generally is to relieve the pain, and wherever possible to preserve or restore function. The treatment depends on the cause of the toothache, and frequently a clinical decision regarding the current state and long-term prognosis of the affected tooth, as well as the individual's wishes and ability to cope with dental treatment, will influence the treatment choice. Often, administration of an intra-oral local anesthetic such as lidocaine and epinephrine is indicated in order to carry out pain-free treatment. Treatment may range from simple advice, removal of dental decay with a dental drill and subsequent placement of a filling, to root canal treatment, tooth extraction, or debridement.

INJURY Other Toothache Management

Pulpitis and its sequalae

In pulpitis, an important distinction in regard to treatment is whether the inflammation is reversible or irreversible. Treatment of reversible pulpitis is by removing or correcting the causative factor. Usually, the decay is removed, and a sedative dressing is used to encourage the pulp to return to a state of health, either as a base underneath a permanent filling or as a temporary filling intended to last for a period while the tooth is observed to see if pulpitis resolves. Irreversible pulpitis and its sequalae pulp necrosis and apical periodontitis require treatment with root canal therapy or tooth extraction, as the pulp acts as a nidus of infection, which will lead to a chronic infection if not removed. Generally, there is no difference in outcomes between whether the root canal treatment is completed in one or multiple appointments. The field of regenerative endodontics is now developing ways to clean the pulp chamber and regenerate the soft and hard tissues to either regrow or simulate pulp structure. This has proved especially helpful in children where the tooth root has not yet finished developing and root canal treatments have lower success rates.

Reversible/irreversible pulpitis is a distinct concept from whether the tooth is restorable or unrestorable, e.g. a tooth may only have reversible pulpitis, but has been structurally weakened by decay or trauma to the point that it is impossible to restore the tooth in the long term.

Dental Abscesses

A general principle concerning dental abscesses is ubi pus, ibi evacua ("where there is pus, drain it"), which applies to any case where there is a collection of pus in the tissues (such as a periodontal abscess, pericoronal abscess, or apical abscess). The pus within the abscess is under pressure, and the surrounding tissues are deformed and stretched to accommodate the swelling. This leads to a sensation of throbbing (often in time with the pulse) and constant pain. Pus may be evacuated via the tooth by drilling into the pulp chamber (an endodontic access cavity). Such a treatment is sometimes termed open drainage. Drainage can also be performed via the tooth socket, once the causative tooth is extracted. If neither of those measures succeeds, or they are impossible, incision and drainage may be required, in which a small incision is made in the soft tissues directly over the abscess at the most dependent point. A surgical instrument such as a pair of tweezers is gently inserted into the incision and opened, while the abscess is massaged to encourage the pus to drain out. Usually, the reduction in pain when the pus drains is immediate and marked as the built up pressure is relieved. If the pus drains into the mouth, there is usually a bad or offensive taste.

Antibiotics

Antibiotics tend to be extensively used for emergency dental problems. As samples for microbiologic culture and sensitivity are hardly ever carried out in general dental practice, broad-spectrum antibiotics such as amoxicillin are typically used for a short course of about three to seven days. Antibiotics are seen as a "quick fix" by both dentists, who generally only have a very short time to manage dental emergencies, and by patients, who tend to want to avoid treatments (such as tooth extraction) which are perceived negatively. However, antibiotics typically only temporarily suppress an infection, and the need for definitive treatment is only postponed for an unpredictable length of time. An estimated 10% of all antibiotic prescriptions are made by dentists, a major factor in antibiotic resistance. They are often used inappropriately, in conditions for which they are ineffective, or their risks outweigh the benefits, such as irreversible pulpitis, apical abscess, dry socket, or mild pericoronitis. However, the reality is that antibiotics are rarely needed, and they should be used restrictively in dentistry. Local measures such as incision and drainage, and removal of the cause of the infection (such as a necrotic tooth pulp) have a greater therapeutic benefit and are much more important. If abscess drainage has been achieved, antibiotics are not usually necessary.

Antibiotics tend to be used when local measures cannot be carried out immediately. In this role, antibiotics suppress the infection until local measures can be carried out. Severe trismus may occur in when the muscles of mastication are involved in an odontogenic infection, making any surgical treatment impossible. Immunocompromised individuals are less able to fight off infections, and antibiotics are usually given. Evidence of systemic involvement (such as a fever higher than 38.5 °C, cervical lymphadenopathy, or malaise) also indicates antibiotic therapy, as do rapidly spreading infections, cellulitis, or severe pericoronitis. Drooling and difficulty swallowing are signs that the airway may be threatened, and may precede difficulty in breathing. Ludwig's angina and cavernous sinus thrombosis are rare but serious complications of odontogenic infections. Severe infections tend to be managed in hospital.

Prognosis

INJURY Other Toothache Prognosis

Most dental pain can be treated with routine dentistry. In rare cases, toothache can be a symptom representing a life-threatening condition, such as a deep neck infection (compression of the airway by a spreading odontogenic infection) or something more remote like a heart attack.

Dental caries, if left untreated, follows a predictable natural history as it nears the pulp of the tooth. First it causes reversible pulpitis, which transitions to irreversible pulpitis, then to necrosis, then to necrosis with periapical periodontitis and, finally, to necrosis with periapical abscess. Reversible pulpitis can be stopped by removal of the cavity and the placement of a sedative dressing of any part of the cavity that is near the pulp chamber. Irreversible pulpitis and pulp necrosis are treated with either root canal therapy or extraction. Infection of the periapical tissue will generally resolve with the treatment of the pulp, unless it has expanded to cellulitis or a radicular cyst. The success rate of restorative treatment and sedative dressings in reversible pulpitis, depends on the extent of the disease, as well as several technical factors, such as the sedative agent used and whether a rubber dam was used. The success rate of root canal treatment also depends on the degree of disease (root canal therapy for irreversible pulpitis has a generally higher success rate than necrosis with periapical abscess) and many other technical factors.

Emotional

Recovering from emotional problems and signs to look out for

"Instead of a sign that says 'Do Not Disturb', I need one that says: 'Already Disturbed, Proceed With Caution'."
Unknown

Introduction

Being emotionally healthy does not mean you are happy all the time. It means you are aware of your emotions. You can deal with them, whether they are positive or negative. Emotionally healthy people still feel stress, anger, and sadness. But they know how to manage their negative feelings. They can tell when a problem is more than they can handle on their own.

Purpose	The aim of EMOTIONAL is to help diagnose and treat any emotional related issuses you may face in a disaster. It includes information on depression, anxiety, stress, dementia and grief.
Lost?	***** **QUICK TRIAGE (If you're injured or sick and looking for the correct section)** ***** ● **Sections under ILLNESS:** Radiation Sickness, Parasitic Infections, Bacterial Infections, Viral Infections, Fungal Infections, Altitude Sickness, Poisoning, Chemical Agents, Biological Agents. ● **Sections under INJURY:** Surface Wound & Bruises, Internal Injuries (Back Pain, Cerebral Hemorrhage, Bone Fractures, Dislocation, Concussion) Open Wounds, Avulsion, Burns, Environmental (Anaphylaxis, Heat Stroke, Hypothermia, Hyperthermia, Motion Sickness, Aero-otitis Media), Atmosphere (Asphyxiation, Drowning, Choking, Hypoxia, Carbon Monoxide Poisoning), Animal & Plant (Bites and Stings), Childbirth, Toothaches. ● **Sections under EMOTIONAL:** Depression, Anxiety, Stress, Confidence, Relaxation, Memory & Dementia, Grief & Loss, Postnatal Depression, New Parents, Body Image, Family & Friends and Healthy Living.

● For medications and recommended doses, see the MEDICATION section.
● For curing ailments naturally and herbal remedies, see the NATURAL REMEDIES section.
● For eating disorders, see the HEALTH > Nutrients section.

Contents

1 Depression

Sometimes it is hard to know if what you are experiencing is sadness or depression. The symptoms, causes, management and treatment of depression are discussed along with how to get a mental health care plan from your doctor and tips on what to do if someone you know is depressed. Depression is the persistentance and extreme negative thoughts and feelings. It can stop you doing everyday activities including eating and sleeping. Depression is a serious and common illness that affects one in five people. Those with depression find it hard to function each day, physically, mentally and emotionally. Depression is different from sadness, stress, anxiety or even grief. What distinguishes depression is a combination of factors, including continuously feeling miserable or losing interest in things that you usually enjoy, to the point where you feel you are no longer functioning. While most people will experience some symptoms of depression at various stages of their life, people who are depressed experience many symptoms, often intensely. Depression significantly affects how people think, feel and act.

Symptoms	Symptoms	Thoughts	Behaviours
● Sleep disturbance: either not sleeping or 'over' sleeping ● Changes in eating: either not eating or 'over' eating ● Changes in weight: unanticipated loss or gain ● Not wanting to be intimate with others ● Empty and depressed mood most of the time ● Continuing feelings of sadness, unhappiness and tearfulness ● Irritability and/or agitation	● Loss of energy ● Tired all the time ● Tension pains ● Feelings of anxiety ● Feelings of heaviness ● Feelings of isolation ● Headaches ● Churning stomach ● Loss of motivation ● Loss of interest in sex	● "I'm a failure" ● "Everyone would be better off without me around" ● "I feel so guilty" ● '"It's all my fault" ● "Nothing good ever happens" ● "I'm worthless" ● "Life is not worth living"	● Withdrawal from social situations ● Less pleasure/interest in activities ● Loss of interest in personal appearance ● Drug and alcohol misuse ● Difficulty concentrating ● Panic attacks ● Hopelessness about yourself, the future and the world

Depression Causes

These are the most common causes of depression.

Biochemical Changes	Neurotransmitters (brain chemicals), which carry signals from one part of the brain to the next, can be disrupted and 'dull' how you feel, leading to depression.	
Hormones	Oestrogen, progesterone and testosterone may account for mood changes women can experience: ● With periods and PMS (premenstrual syndrome) ● With menopause (around 51 years) ● Postnatally	The exception to this is women who have a surgical or sudden menopause. The sudden and severe drop in hormones when menopause is induced increases the risk of developing depression.
Genetics	A family history of depression increases your risk of having depression. However, it does not automatically mean it will occur.	
Stress & Anxiety	If you have had high stress and anxiety over a long period of time this may lead to depression.	
Personality	Some personalities are more prone to depression such as being self-critical, having low self-esteem or worrying excessively.	
Traumatic Experiences	You may not feel depressed immediately after a traumatic event, but depression can build up and develop over time. This is known as post-traumatic stress disorder (PTSD).	
Health Status	Some illnesses and diseases are linked to depression, such as diabetes and cardiovascular disease. Having an illness or disease such as arthritis, breast cancer or stroke can make depression worse.	
Social Factors	Being lonely, isolated from friends and family, single, divorced or widowed can contribute to the development of depression. The experience of depression is often made worse if you are lonely or isolated. A 'cluster effect' means your mood is influenced by the mood of your social network. If someone very close to you is depressed for a long time, you are more likely to develop depression	
Cultural Expectations	Sometimes cultural expectations create added stress and if this continues for a long time, it can lead to depression.	
Lack of Daylight	During the winter months some people find they are more prone to Seasonal Affective Disorder (SAD) which is a depression caused by the impact on the brain of the lack of day and sunlight. This is more common in countries that experience long and harsh winters like Europe.	

Depression Treatment

It is important to know you can not just 'snap' out of it, nor can you just 'cheer up' or 'get over it' without help. Depression will not pass easily if ignored and may get worse, and the longer it continues without help, the more difficult it may be to shift.

Keep a Diary	Everyday write down your physical and emotional symptoms to help clarify: ● Whether the symptoms are related to your periods, menopause, anxiety and/or depression ● The things that trigger feelings of stress ● What creates positive or negative thoughts for you
Relaxation Techniques	Learn relaxation techniques to help you feel more calm through the day and to give you a coping skill in times of stress and distress.
Small Tasks/Achievements	Set small tasks so each day you feel you have achieved something. Remember the things you achieve each day – even the small ones are worth remembering.
Exercise	Exercise physically to stimulate endorphins (feel good hormones) in the brain because these can improve your mood and help you cope with stress.
Talk	Talk with trusted people if this helps to get things 'out' rather than bottling things inside.
Good Company	Spend time with the friends and family members who are easier to be with and make you feel more positive. It is okay to choose the people you want to spend time with.
Nutritious Food	Avoid the highs and lows of sugary and high carbohydrate foods.

Network	If you feel cut off from other people, try joining a sport group (e.g. Pilates, tennis, walking) or hobby group (e.g. pottery, bridge), or a book club, use the internet to connect via a reliable system such as email or Facebook or LinkedIn, volunteer with a local charity.
Herbs & Natural Remedies	Ask an accredited naturopath about some of the herbs and natural remedies that can help with depressive symptoms – these might include St John's wort, lavender, lemon balm or oat straw

Helping Someone with Depression
- Start a general conversation. Ask open-ended questions e.g. "Tell me what you have been doing lately?" Give them time to open up to you.
- Don't push them if they are not ready to talk. Offer to listen. Ask how you can help
- Ring, text or pop in. Be a presence. Encourage them to see a doctor
- Follow up with them. Reinforce any positive things they do. Try not to preach or lecture
- Look after your own wellbeing. Let them know you care
- Try to keep your own emotions in check – it can be easy to get overwhelmed; If you find you are not coping with what they are doing or how they are behaving, seek support for yourself.

2 Anxiety

Fear and anxiety are normal emotions that help alert us to, protect us from, and cause us to deal with danger. What is not healthy and not good for us is when these feelings become excessive, irrational, ongoing, distressing or interfere with daily life. Anxiety is an unpleasant feeling of nervousness, apprehension, distress and fear that something bad is happening or about to happen. You can feel anxious without necessarily having an anxiety disorder. If you would like to know if what you are experiencing is worry, anxiety or an anxiety disorder.

A variety of things can make you more at risk of developing an anxiety disorder and feeling more anxious than normal. These include:
- High stress levels
- Being physically tired or run-down
- Certain personality traits
- Experiencing lots of change
- Physical or emotional trauma
- Family history

Types

Anxiety Type: Generalised Anxiety Disorder (GAD)	GAD involves excessive, irrational and persistent anxiety or worry over common issues (eg family, work, finances or illness) This worry is out of proportion to the circumstances causing it. GAD can decrease the ability to do even the most basic everyday activities	**Symptoms** ● Excessive worry that is difficult to control ● Irritability ● Fatigue ● Restlessness	**Symptoms** ● Difficulty concentrating ● Muscle tension and pain ● Difficulty sleeping or unsatisfying sleep
Anxiety Type: Panic Disorder	A panic disorder occurs when the body's normal anxiety response to feared situations is not working properly and you: Experience frequent, unexpected panic attacks. Have a persistent concern about having more panic attacks.	**Symptoms** ● Increased heart rate ● Rapid breathing ● Tightness in the chest ● Feeling like you might faint	**Symptoms** ● Sudden intense feeling of terror ● Feeling like you are going to lose control ● Feeling like a catastrophe is about to happen
Anxiety Type: Phobias	A phobia develops when a specific fear becomes excessive or interferes with daily life. Phobias can develop from more common fears of spiders, airplanes, visits to the dentist, and social phobia. Social phobia is a fear of being embarrassed or judged negatively in social situations	**Symptoms** People who suffer from phobias: ● Avoid the feared situation ● Show obvious signs of distress at confronting it	**Symptoms** People with social phobia may fear activities where attention could be drawn to them, such as: ● Speaking in public ● Meeting new people ● Being watched whilst doing something Panic attacks may be an indicator that your fear of something has turned into a phobia.
Anxiety Type: Post-Traumatic Stress Disorder (PTSD)	PTSD can occur following a traumatic event – the event usually involves the person reacting with intense fear, horror or helplessness to actual or threatened death or injury.	These events can include: ● Car accidents ● Natural disasters ● Violence ● Assault ● Abuse ● Being diagnosed with a life threatening illness	**Symptoms** ● Nightmares, flashbacks or constant distressing thoughts relating to the traumatic event ● Avoidance of anything that triggers memories of the event ● Increased anxiety, irritability or anger ● Feeling emotionally withdrawn, sad or detached ● Difficulty concentrating ● Loss of interest in activities previously enjoyed
Anxiety Type: Obsessive Compulsive Disorder (OCD)	OCD occurs when a person cannot stop their obsessive thoughts followed by their compulsive behaviours. Whilst acting out these compulsions may temporarily relieve the anxiety of the sufferer, people with OCD often become quite distressed by the way they behave, and in time, without professional help, this anxiety develops into a disorder.		Feeling compelled to act in a certain way to ease the anxiety caused by these thoughts, for example: ● Cleaning something over and over again ● Needing to do the same task a number of times

Treatment

Medications similar to those used to treat depression may be recommended as a short–term solution. Studies have shown psychological therapies are more effective in the long–term. The following is a list of strategies or interventions recommended for the management and treatment of anxiety.

Cognitive behaviour therapy (CBT)	CBT is a psychological approach designed to help you: ● Understand the thoughts and behaviours contributing to your disorder ● Change negative thoughts into more useful ones ● Acquire coping strategies to better manage your anxiety
Challenging the way you think	To change the way you think, try to: ● Keep a diary to see what triggers your negative or irrational thoughts ● Challenge these thoughts by acknowledging they are not the whole story, they are the negative bits only ● Practise replacing the negative thoughts with more positive, supportive statements

Relaxation	When you are anxious, your body and mind become tense so releasing physical and mental tension can lower your anxiety. It is worth trying: ● Deep, slow breathing ● Controlled breathing and progressive muscle relaxation ● Listening to relaxing music ● Having a massage or a relaxing bath ● Taking time out to do something just for you
Healthy lifestyle It helps to:	● Eat a healthy diet including fresh fruit and vegetables, wholegrain foods and plenty of calcium. Calcium is a critical chemical involved in the release of neurotransmitters, chemicals that serve as messengers between cells within the nervous system ● Move as much as you can – aim for 30 minutes of moderate intensity physical activity over the day to stimulate endorphins (feel good hormones) in the brain as these can improve your mood and help you cope with stress ● Reduce your consumption of alcohol, caffeine and other stimulants.
Seek Support	Getting support is a big step towards taking control of your anxiety. Look for support from someone you feel comfortable with, such as a: ● Doctor and/or psychologist ● Friend or family member ● Support group For those experiencing social phobia, finding online support groups may be less daunting.

3 Stress

Stress occurs when you feel you are not coping with life. We all need a little stress to motivate us to achieve or get things done. However, too much stress, particularly over a long period of time, can take its toll on your health and sense of wellbeing. Extreme stress can be so overwhelming it causes physical reactions such as nausea, diarrhoea, over eating and under eating. There are many things you can do to manage stress; it is just about finding the right strategy for you.

Stress Symptoms

These are some of the symptoms of stress.

How you feel	Anxious, aggressive, apathetic, bored, tired, depressed, frustrated, guilty, irritable, tense, lonely, overwhelmed, unhappy, mood swings
How you think	Difficulty in making decisions, less creative in solving problems, forgetful, hypersensitive to criticism, poor concentration, negative or anxious thoughts, poor organisation (family, work, other interests) memory problems
How you behave	Restless, trembling, having accidents, drinking or smoking excessively, incoherent speech, eating too much or too little, nervous laughing, teary, increased use of alcohol, cigarettes or other drugs
What happens to your body	Increased heart rate, increased blood pressure, dry mouth, sweating, dilated pupils, hot and cold spells, lump in your throat, numbness, butterflies in the stomach, aches, pains, nausea, dizzy, chest tightness, increased frequency of colds and flu, changes in sleeping routine, changes in eating routine
What happens to your health	Dizziness, faintness, diarrhoea, asthma, chest and back pains, frequent urination, headaches or migraines, nightmares, loss of sexual interest, skin complaints, ulcers, coronary heart disease
How does your stress affect others around you	Increased arguments with family members, missing work, avoiding seeing friends. If these words describe what you are experiencing lately, it is likely that you are stressed. There are a number of things you can do to lessen the impact of stress on your life.

Stress Treatment

Ways you can deal with stress.

Learn what makes you stressed	List what you know causes you stress and what you suspect causes you stress – add new causes of stress if they happen Keep a diary of when you feel particularly stressed and see if there are any patterns to suggest something is causing you stress you hadn't realised was a stressor
Identify levels of stress	Rate how bad is it on a scale of 1-10 The higher the score you give to something, the more likely you need to do something about it
Challenge the strength of your stressors	Once you identify and rate your stressors, try challenging their strength: "I don't need to take that on board", "I can live with that", "I can live without that", "Is this worth getting stressed about", "I can do this" "I don't need to do that".
Get quality rest	It is important to have enough quality sleep because lack of sleep may lead to: ● Reduced alertness ● Shorter attention span ● Slower than normal reaction time ● Poorer judgment ● Which can all heighten stress levels.
Take a break	Have a mental break if you have been working for long periods – get up from your desk and move around for a few minutes. It will help to prevent stress building.
Slow down	Lighten your load of engagements where possible and give yourself a break. Each day make a list of things you want to get done, put the actions in order of priority and simply cross off the last half. Make the top half of your to do list achievable so you don't get disappointed or frustrated.
Reduce stimulants like caffeine	Caffeine stimulates the sympathetic nervous system causing stress: replace a caffeine drink with a glass of water or herbal tea.
Activity and exercise	Increase your physical activity. Moving your body, e.g. walking, increases the flow of feel good chemicals (endorphins) in your body to help you cope.

If possible, reduce working hours	Reduce the number of hours you spend at work or even prioritise your work tasks to help lighten your load.
Share your thoughts	Try to discuss the causes of your stress with people who understand your situation because they may be able to help you develop coping strategies. See a counselling psychologist if you become overwhelmed.

EMOTIONAL Confidence

4 Confidence

Confidence is believing in yourself – believing that you are capable of completing tasks and reaching goals. Confidence is knowing that you have skills and positive traits, that you are able to face challenges and deal with difficult circumstances; it is knowing that you are your best resource. Confidence levels can change throughout your life and across different areas of your life. Many things can influence your confidence levels such as your thoughts, feelings, actions and past experiences. When you feel confident you tend to make decisions that are good for you and your health. You are more likely to take care of yourself, get out and about, be active, and choose healthier foods. Confidence can also give you a positive outlook on life, increasing your mental and emotional wellbeing. However, when your confidence is low, your feelings of self-worth and self-respect may also suffer.

You may not care how others treat you or how you treat yourself. You may not care about what you eat or how you spend your time, and this can start to affect your health. It is important to remember that your confidence levels cannot be high across all areas of your life all the time. You can experience low levels of confidence at different times and in different areas of your life and sometimes it is hard to work out why. It is important to try and understand what affects your confidence because ongoing low confidence can affect your physical and emotional health, your relationships with others, and your work or school life.

Keeping your mind and brain healthy is an important part of building and maintaining confidence. Your mood, concentration levels, and memory can all affect your outlook on life so taking care of these areas is another way that can improve confidence. The wrong foods, not enough food or water, too little sleep and not being active can all affect your mind, making you depressed, sad, anxious, prone to stress, mood swings or unable to concentrate. Social connections are made up of the people you engage with and know, the friends you can confide in, the family you belong to and the community you work and live in.

Social support refers to the emotional, practical, advice, love, help, resources, information and empathy you give and receive among family, friends and community. Evidence indicates that social connectedness has an influence on physical and emotional wellbeing. Research shows that engaging with others and being part of a network, is seen as a reward by the brain and is associated with the release of one of the happiness hormones, dopamine.

Building Confidence

- Ask yourself – and list – what affects your confidence in different situations and at different times
- Focus on the things you do well and have achieved – not the things you don't do well
- Pick someone who you think is confident and list the things that you think make them confident. How do they act? What do they focus on? What words do they use to describe their successes?
- Fake it until you make it. Even women who appear confident don't feel that way all the time but they have learned ways to project the appearance of being self-confident
- Talk to other people about confidence – ask about what helps them and what is difficult for them too
- Accept compliments – this can be difficult for some people, but even saying 'thank you' is a great start
- Think of building confidence as a process. Small steps, practice and time are all part of learning to be more confident

Confidence and Social Connections
Your own level of confidence can affect whether you connect with others. You might feel shy around others and this can lower your confidence even further, particularly if it makes you feel inadequate.
The way other people have treated you in social situations can either lower or raise your confidence too. Having people in your life who are negative or who make you feel like you are not good enough can dent your confidence and make you want to hide away. Confidence to engage with others can be different for each person and change from day to day. Here are some tips to help you get social and engage:

- Be less critical of yourself and others in social situations
- Join a group or start one if there are none in your area and you have an idea for a group – this could be a book club, art group, discussion or walking group
- Try new experiences and gradually increase the amount of time you spend in building new social skills and making new connections
- Seek out groups on social media who share the same values, interests and ideas as you – Facebook, LinkedIn or Pinterest for example have lots of different groups you can join to share conversations with like-minded people
- Practise looking more confident in the mirror – eg practise maintaining eye contact
- Practise a few lines of conversation and think about a few topics of conversation before you arrive somewhere
- Volunteer to meet new people – this might be a committee, club, baking, driving older people to appointments or visiting lonely people; volunteering gives you meaning and supporting others can add to your confidence

5 Relaxation

Relax – to be calm, unwind, loosen up, de-stress, slow down, chill out. Relaxation can help increase your sense of calm and reduce anxiety and stress. Relaxation techniques can slow heart and breathing rates, reduce blood pressure and decrease muscle tension and is a good tool for stress management. Different techniques work for different people and can include anything from deep breathing, laughter, positive thinking, visualisation, meditation and mindfulness.

Practising Relaxation Can:
- Enhance energy
- Increase immunity
- Promote more restful sleep
- Increase concentration
- Lessen mood swings
- Help reduce anxiety and stress

Meditation	There is some evidence to suggest meditation may help reduce: ● Anxiety ● Stress ● Blood pressure ● Chronic pain ● Insomnia
Mindfulness	Mindfulness is about increasing your ability to stay calm and focused in the present moment rather than worrying about the past or future. Research has shown mindfulness to be effective in controlling stress and problems with mood. **Mindfulness Meditation** ● Slow breathing ● As an unhelpful thought comes into your head, you acknowledge this is a thought, nothing more, and let it go The aim is not to pay it loads of attention, rather to become an observer of your thoughts ● Thoughts will continue to flow into your head and the aim is to try and increase the time and space and time between the thoughts

Physical Activity	Research indicates that just 10 minutes of exercise is all that is needed to put people in a more positive mood. Exercise releases endorphins that give you a feeling of happiness, it keeps cortisol (a stress hormone) in check and helps your mind to relax. Rhythmic exercise such as running, walking, rowing or cycling is most effective at relieving stress and promoting relaxation because you can also focus on the repetition in your body's movement and also breath to match the movement.
Hobbies	Hobbies can offer distraction from daily routines and tensions and open your mind to life's possibilities. Become involved in a hobby like calligraphy, design, antique restoration, art galleries, archery, croquet, singing, chess, salsa dancing, camping, cycling, judo, cooking, film collecting – there are more possibilities than you might know!
Pleasure	Every day do something you enjoy and do something for someone else.Make time in your day for activities like reading, listening to music, gardening, sewing, taking a bath, lighting a candle, using a lovely hand cream, walking through a flower shop, taking a friend for coffee, giving a loved one a kiss.
Visualisation or Guided Imagery	This involves imagining a scene in which you feel at peace and are free to let go of tension and anxiety. Use each of your five senses and imagine: ● A beach, a forest, a hill, a retreat you have been to ● A candle and focus on the movement of the flame to anchor your thoughts and the scent to feel its warmth ● A river to visualise sending your worries downstream.
Relaxation Exercises	● Progressive muscle relaxation is about learning to feel the difference between tension and relaxation ● This awareness helps you to recognise and respond to the first signs of the muscular tension that accompanies stress ● Deep breathing is a simple but powerful relaxation technique that can be done anywhere, anytime ● In eastern philosophies, mastery of the breath is the key to controlling the body's life force energy With every inhalation, you draw energy into your body. With every exhalation, you let go of tension in your body. ● The technique involves methodically tensing and relaxing different muscle groups in the body ● A variation is to simply focus on the sensations in each part of your body so you become aware of where the tension is: the neck, shoulders, and head are common stress points ● Deep breathing helps focus you on the present moment by concentrating on the 'in and out' of your breaths ● Drop your shoulders and breathe in for 7 seconds and out for 11 seconds. ● Deep breathing can be combined with aromatherapy and music
Pets	Research indicates the following benefits of having a pet: ● A beautiful distraction ● Something to have and to hold ● Something to be responsible for ● A buddy to exercise with ● Do not overlook the benefit of touching and talking with your pet ● If you don't have a pet, offer to mind or walk one
Affirmations	Affirmations are positive statements you make to yourself. They need to be present tense, positive, personal and specific, e.g.: ● I can do this ● I am valuable ● I am loved ● My friends care ● It's okay to relax ● It's okay to care
Laughter	When you laugh, your body produces natural chemicals that: ● Lower blood pressure ● Lower heart rate ● Increase immune system function ● Reduce stress ● Browse through books at your local book shop ● See a show ● Laugh with your children, your family or your friends ● Get out a DVD such as Something's gotta give
Positive Thinking	Positive thinking and 'affirmations' can: ● Counter negative thoughts ● Improve confidence ● Help you to relax

6 Memory & Dementia

There are many causes of poor memory such as stress, ageing, illness, menopause or something more serious, like the onset of Alzheimer's and dementia. There are many strategies to help with memory including staying mentally and physically active, using organisational tools like a calendar or special notebook, and mnemonics – word plays and rhymes.

Memory Phases ● Encoding (filing information into your memory) ● Storing ● Retrieving Forgetting can be the result of a glitch at any one of these steps.	**Memory Health Affecters** ● Illness such as the flu ● Chronic conditions like diabetes, high blood pressure ● Vitamin B12 and folic acid deficiencies ● Smoking ● Alcohol abuse ● Lack of physical activity ● Lack of mental activity ● Stress ● Grief ● Depression and anxiety ● Social isolation	**Menopause & Memory** Perimenopause (when periods start to become irregular, and menopause symptoms begin) is known to be a time of memory lapses, poor concentration and 'foggy' thinking. Sixty per cent of women report memory complaints with menopause.

Some studies have linked a chemical imbalance (a drop in oestrogen) with memory and verbal function changes at this stage of a woman's life. However, there are many other potentially stressful issues happening at the same time that need to be considered. Coping with teenagers, ageing parents with health problems, work, hot flushes, disturbed sleep, lack of libido and the effects of that on your relationship. These are all part of the context of your life stage and can certainly affect your memory.

EMOTIONAL Memory & Dementia

Aging Memory
The ability to pay attention and focus on more than one thing at a time decreases with age. "With increasing age there are changes in the brain's blood supply and mass, as well as the richness of interconnections between nerve cells," senior lecturer of psychology at Adelaide University Lynn Ward explains. "These changes affect the speed of our mental operations. It takes more effort to learn new things and longer time to process and recall information."

Dementia

A change in your memory does not mean you have dementia. As the brain naturally ages it becomes more difficult to learn and retain new information, but most complex skills are not lost. Dementia is not a normal part of ageing. It is defined as an acquired global impairment of intellect, memory and personality without impairment of consciousness. Dementia is regarded as a syndrome and not a specific diagnosis in itself. Dementia is a collection of diseases affecting the brain. It is often seen just as a loss of memory but it can affect thinking, behaviour and ability to perform tasks. This can interfere with the normal social and working life. It is now the third leading cause of death in Australia, and as the population ages we will see more people with dementia. Dementia can happen to anybody, but is more common after the age of 65. Just because a parent has had dementia, it does not mean that you will too.

Alzheimer's Disease
- Alzheimer's disease is the most common cause of dementia
- It is a progressive, degenerative illness that attacks the brain
- It is a syndrome of unknown causes, usually presenting insidiously (gradual with few or no symptoms) and developing slowly over a period of years
- The most common early symptoms are short term memory loss, word finding difficulty and personality changes

Vascular Dementia
- Vascular dementia is the second most common form of dementia
- It is a type of dementia that is associated with problems with the flow of blood to the brain
- Many cases of vascular dementia are due to silent 'mini strokes' which are caused by high blood pressure, heart disease or smoking

Dementia with Lewy Bodies
- Not common
- It can come on quite quickly and change rapidly and is caused by the degeneration and death of nerve cells in the brain
- People with this type of dementia tend to see things (hallucinations), experience stiffness or shakiness (Parkinsonism)

Other Neurological Diseases Causing Dementia
- Parkinson's Disease- a progressive neurological disease
- Huntington's Chorea- an inherited disease
- FrontoTemporal Lobar degeneration
- Alcohol related dementia (Korsakoff's Syndrome)
- AIDS related dementia
- Brain Tumours

Signs

The early signs of dementia are often subtle and vague and can sometimes be confused for other conditions. The most obvious clue to dementia is increasingly frequent memory difficulties particularly with things you used to be good at. Some common symptoms are:

- Progressive and frequent memory loss
- Confusion
- Lack of interest and withdrawal
- Change in personality, such as becoming flat or aggressive
- Loss of ability to perform everyday tasks

Risk Factors for Dementia
The following may increase the chance of developing dementia:
- Heart disease
- Strokes
- Midlife Hypertension
- Smoking
- Diabetes
- High cholesterol
- Genetic disease
- Head injury

The following memory problems are not 'normal' and need to be investigated:
- A memory problem that affects daily living such as frequently:
- Forgetting where you are going while driving
- Losing common objects
- Putting common objects in odd places
- Progressively worsening memory
- Forgetting how to do familiar tasks
- Trouble learning new things
- Repeating phrases or stories within the same conversation
- Substituting forgotten words with inappropriate words
- Trouble making choices or handling money

- Inability to keep track of what happens each day, such as missing appointments
- Mood and personality changes

Memory Strategies

The best strategy to improve your memory and prevent memory loss is to do a range of things. Recent studies have shown activities that involve two or more components of physical, social and mental activity are better for your memory than doing one.

Stay Physically Active
Good for the heart = good for the brain.

Stay Mentally Active
Read books and newspapers, do puzzles, games and quizzes.

Stay Socially Active or Volunteer
- Socialise with friends and family
- If you are experiencing memory difficulties, socialising with just one person is better than group settings

Maintain Good Nutrition
In particular, eat 2-3 serves of fruit and 5-7 serves of vegetables daily, reduce saturated fats, increase omega 3 intake and eat foods rich in vitamin E, B12 and folate.

Start a New Hobby
This can strengthen your thinking but if you are already having memory difficulties, avoid doing dramatically new hobbies as this may make you feel frustrated.

Adopt a Positive Approach
- Don't be judgmental or hard on yourself
- Minimise stress
- Relax and take your time when you need to remember

Use Memory Strategies
Strategies to organise or categorise information can help, like using:

- Diaries
- Calendars
- Whiteboards
- Lists and reminder notes

Use Memory Strategies
- Mnemonics: word plays and rhymes
- e.g. Imogen is the one with the big imagination
- acronyms: a word formed from initial letters
- e.g. for a shopping list of bread, oranges, yoghurt and sugar: just remember BOYS
- imagery: use pictures to link objects with names
- e.g. James jumps up and down a lot
- association: linking to something you know
- e.g. Isabel is part of the local tennis club

7 Grief & Loss

EMOTIONAL Grief & Loss

There is no single way to grieve and deal with loss. How you respond is affected by the strength of your attachment to what you have lost and how that loss occurred. There are many types of loss including separation, illness, job loss and miscarriage. How you react to loss will be influenced by your personality, the way you think, your age and background. There are no rules when it comes to how you manage loss but it is important to know when to seek help.

The Language of Loss You may hear different words to describe loss and they each mean something slightly different.	● Mourning is a word used to describe the process someone goes through in adapting to the death of a person. Mourners need to understand that their feelings are not a sign of sickness or instability ● Bereavement defines the loss a person tries to adapt to and is a universal experience ● Grief is a term that can be applied to other losses like a job or relationship. Grief is a normal part of life, one that must be experienced and not denied

Types of Loss	● Separation or divorce ● Financial problems ● Life-changing events ● Career redundancies ● Significant illness or disability: ○ Disfigurement ○ Blindness/deafness ○ Amputation	● Betrayals and lost friendships ● Miscarriage ● Infertility ● Failing memory ● Loss of independence ● Unfulfilled potential ● Lost opportunities

Loss is usually complex and layered: a woman who experiences premature menopause may feel a loss of femininity, a loss of fertility, along with losses of time, choice or opportunity. Loss can be complicated if it can not be publicly acknowledged; for example a couple who keep their pregnancy secret and then experience a miscarriage. This unacknowledged loss is known as 'disenfranchised grief'.

Time Frame
There is no set time frame or order for the grieving process. Grief is individual, there's no 'normal' grieving timeframe. Acknowledging your grief is the important thing. Denying grief and loss or listening to well-meaning advice like 'get over it' is rarely useful. Instead, accepting that you'll continue to grieve at various times throughout your life can be a big relief.

Grief Affecters

Personality	People express grief and loss in different ways, some close down and need to shut themselves away and others will require action and busy-ness to help them through.
Thoughts & Beliefs	If loss can be understood as a part of the pattern or cycle of life, this can help with acceptance and recovery. This is a significant challenge, and can be a huge ask, that usually takes time and space to achieve.
Level of Attachment	Of course, the more attached you are to something the more you feel the loss. Sometimes you do not appreciate how important something is until it is lost and this can add shock to the grief.
Availability of Support	Loving friends, family and partners can help and so can grief counselling.
Age	The age and stage you are in life can affect how you view your loss and how you grieve. For example, an elderly couple may be more prepared for the death of their partner so that even though there is a loss, it is not as great a shock.
Culture	Some cultures have defined mourning periods and rituals which can help mark and support your movement through grief.
History of Loss	If you have experienced loss in your life before, it may feel a little easier compared to someone experiencing loss for the first time.
Experience of Loss	The way the loss occurred may affect how you react to it. Some people can grieve again for a past loss, when a new loss occurs. For example, a woman whose mother dies may grieve the death of her father 10 years before all over again and at the same time. She may then also grieve the loss of her identity as a daughter.

Stages of Grief

The five stages of grief model (or the Kübler-Ross model) postulates that those experiencing grief go through a series of five emotions:
● Denial
● Anger
● Bargaining
● Depression
● Acceptance

Although commonly referenced in popular culture, studies have not empirically demonstrated the existence of these stages, and the model is considered to be outdated, inaccurate, and unhelpful in explaining the grieving process.

Kübler-Ross originally developed stages to describe the process patients with terminal illness go through as they come to terms with their own deaths; it was later applied to grieving friends and family as well, who seemed to undergo a similar process. The stages, popularly known by the acronym DABDA, include:
1. Denial – The first reaction is denial. In this stage, individuals believe the diagnosis is somehow mistaken, and cling to a false, preferable reality.
2. Anger – When the individual recognizes that denial cannot continue, they become frustrated, especially at proximate individuals. Certain psychological responses of a person undergoing this phase would be: "Why me? It's not fair!"; "How can this happen to me?"; "Who is to blame?"; "Why would this happen?".
3. Bargaining – The third stage involves the hope that the individual can avoid a cause of grief. Usually, the negotiation for an extended life is made in exchange for a reformed lifestyle. People facing less serious trauma can bargain or seek compromise. Examples include the terminally ill person who "negotiates with God" to attend a daughter's wedding, an attempt to bargain for more time to live in exchange for a reformed lifestyle or a phrase such as "If I could trade their life for mine".

4. Depression – "I'm so sad, why bother with anything?"; "I'm going to die soon, so what's the point?"; "I miss my loved one; why go on?"
During the fourth stage, the individual despairs at the recognition of their mortality. In this state, the individual may become silent, refuse visitors and spend much of the time mournful and sullen.
5. Acceptance – "It's going to be okay."; "I can't fight it; I may as well prepare for it."
In this last stage, individuals embrace mortality or inevitable future, or that of a loved one, or other tragic event. People dying may precede the survivors in this state, which typically comes with a calm, retrospective view for the individual, and a stable condition of emotions.

In 2020, during the COVID-19 pandemic, Kessler applied the five stages to responses to the virus, saying: "It's not a map but it provides some scaffolding for this unknown world."

"There's denial, which we saw a lot of early on: This virus won't affect us. There's anger: You're making me stay home and taking away my activities. There's bargaining: Okay, if I social distance for two weeks everything will be better, right? There's sadness: I don't know when this will end. And finally there's acceptance. This is happening; I have to figure out how to proceed. Acceptance, as you might imagine, is where the power lies. We find control in acceptance. I can wash my hands. I can keep a safe distance. I can learn how to work virtually."

Criticisms of this five-stage model of grief center mainly on a lack of empirical research and empirical evidence supporting the stages as described by Kübler-Ross and, to the contrary, empirical support for other modes of the expression of grief. Moreover, Kübler-Ross' model is the product of a particular culture at a particular time and might not be applicable to people of other cultures. These points have been made by many experts, including Professor Robert J. Kastenbaum (1932–2013) who was a recognized expert in gerontology, aging, and death. In his writings, Kastenbaum raised the following points:

● The existence of these stages as such has not been demonstrated.
● No evidence has been presented that people actually do move from Stage 1 through Stage 5.
● The limitations of the method have not been acknowledged.
● The line is blurred between description and prescription.
● The resources, pressures, and characteristics of the immediate environment, which can make a tremendous difference, are not taken into account.

Grieving Pattern

There's no right or wrong way to grieve and no step–by–step process to follow. Your family has probably been your model. What do you remember about your mother or father's grieving? Was it secretive, did it turn into a sickness, did they ever get over their loss? Today we encourage you to be in the experience of it, know it for what it is and accept the process. The following list presents all normal reactions. You may feel some or all of the following, at any time, as a part of the grieving process:

Emotions and Feelings	● Sadness ● Anger ● Numbness ● Shock ● Irritability ● Disbelief	● Emptiness ● Hopelessness ● Despair ● Frustration ● Guilt ● Panic	● Denial ● Loneliness ● Helplessness ● Anxiety ● Relief ● Restlessness ● Depressed Mood
Physical Responses	● Decrease/increase in appetite ● Weight loss/gain ● Sleep changes ● Lack of energy or fatigue ● Nausea ● Panic attacks	● Headaches ● Stomach ache ● Difficulty breathing ● Trembling ● 'Knotting' or empty sensation in your stomach ● Muscle tension	
Thoughts	You may have thoughts like: ● 'I should have done more' ● 'It's my fault' ● 'I can't do this' ● 'This can't be happening' ● 'It's not fair' ● "I want to stop that moment from ever occurring"	Thoughts may also arise from a fear of losing control: ● 'I can't cope' ● 'I can't make it on my own'	Some people find it: ● Difficult to think ● Have repetitive thoughts ● Have thoughts of wanting to die or self-harm
Behaviours	● Withdrawing socially or from a relationship, shutting yourself away ● Transferring feelings: thinking everyone else around you is feeling sad when really you are ● Changing behaviours such as using alcohol or drugs (including prescription medications)	● Being angry at someone who doesn't deserve it ● Acting in ways that don't make sense ● Avoiding situations ● Crying	● Increasing 'risky' behaviours ● Withdrawing from personal interests ● Overeating ● Oversleeping ● Forgetfulness

Managing Grief

If you are an emotionally expressive person	You may benefit from talking to a friend or spending time with family. You may like to spend time with people who remind you that everything will be okay. Avoid people who exhaust you or who are uncomfortable talking about your grief. If you leave a conversation feeling bad or inadequate, it's time to seek other help.
If you are not an emotionally expressive person	You may prefer to spend time alone or become active and take control of other areas of your life. It's important to give yourself permission to cry, but it's also okay not to cry.
Find a private place	Some people find it useful to have a private place to sit and be. Allow yourself to cry or even wallow in your sadness. Then leave it there.
Look after yourself	Grief often leads to reduced immunity, so self-care is important. Eat and sleep as well as you can and do some exercise, even if it's a gentle, short walk. Avoid alcohol, recreational drugs and inappropriate use of prescription medications to numb the pain
Don't expect too much of yourself	There's no right or wrong time to return to work – a good indicator is to go back when it feels meaningful. Activities and distraction can help, as long as you aren't denying your loss.
Give yourself space	Give yourself space to grieve and adjust not only to your loss, but your changed life. Your changed life means a new identity, one you probably don't want and one you wonder and fear if you will be able to cope or survive with. A huge adjustment needs to occur and this takes time.
How do you know when you are getting through the grief	Although it never goes away completely, you will know you are through the grieving process when you can think and speak of the loss without enormous pain. Mourning is finished when you can reinvest your emotions into life and in the living.

Seeking Help

If you don't feel you are coping or you are suffering symptoms, seek help from your doctor and/or a psychologist. Counselling doesn't have to be long term – sometimes a few sessions are enough for someone to express their grief and find ways to cope with their grief. Psychologists can assist with short–term coping strategies and help couples if needed, as loss and grief can significantly affect relationships. It can be difficult to empathise and relate to a partner who is grieving the loss differently (or not at all). A psychologist can offer support to you both, and give couples permission to respond differently in a trusted space.

● You may feel comfortable talking with your doctor or religious adviser.
● Medicare rebates allow up to 10 visits with a psychologist, speak to your GP to get a referral.
● Community health centres may have a grief or support group. This is especially useful for people seeking support from others who have experienced a similar loss.

8 Postnatal Depression

Depression experienced after childbirth is called postnatal or postpartum depression also known as PND. About 10-13% of women experience depression when they are pregnant or after birth. Causes of PND are likely to include hormone changes, previous experience of depression and/or anxiety, personality, timing of pregnancy and many other factors.

Causes
There is debate about the causes of postnatal depression, but they are likely to include:
● Hormone changes of pregnancy and childbirth (which affect some women more than others)
● Personality
● Lack of social support
● Childhood abuse
● Timing of the pregnancy
● Previous experience of depression and anxiety
● Low income
● Low self-esteem
● Relationship quality
● Other life stressors

Recent research at Jean Hailes has found women with a partner who is caring, considerate and appreciative are less likely to have depression symptoms six months after the birth of their baby. But if they experience their partner to be very controlling and domineering then they are more likely to have symptoms at six months. The relationship is also important to getting better. "A woman's experience of the strength of the relationship with her intimate partner is closely related to recovery from the symptoms of postnatal depression," says Dr Sonia McCallum, a Research Fellow at the Jean Hailes Women's Mental Health Program. Couples also need to recognise the importance of communicating with each other at this time. Often if they sit down and talk there is a lot they didn't realise. Having a baby is a huge adjustment for both of them", says Dr McCallum. To improve maternal mental health in the postpartum (after birth) period, interventions need to address partner relationships and have to involve both partners. A lot of work in the past has focused on the mother, but this research highlights interventions need to focus on both parents.

Strategies and Support
● Know that everyone finds it challenging to learn how to care well for a baby and manage a home with a baby – you are not alone
● Ask a maternal and child health nurse for practical advice, such as how to establish a feed-play-sleep routine of care for your baby
● Talk to your partner about how to share the increased workload at home – avoid criticising each other
● Share baby tasks – babies benefits from receiving care, e.g. bathing, nappy changing and settling from both parents
● Accept practical help from friends and family if they offer
● Identify what you miss from how life used to be and work out how you can begin to replace that activity or interest, maybe in a changed way

Partners
● Be actively involved in caring for your baby
● Share increased household work in ways that feel fair
● Listen to each other's needs – be kind and encouraging
● Avoid criticism – it undermines confidence
● Help manage visitors keen to see you and meet your baby so you don't become overtired
● Support each other in having some time away from day-to-day responsibilities

Family & Friends
● Be upfront in offering help – most new parents find it difficult to ask for help with practical tasks
● Offer practical support e.g. pick up an older child from childcare, buy groceries, prepare a meal, hang out washing
● Invite them to tell you how they are finding things and help to work out solutions to difficulties
● Help them find ways to make new friends at the same life stage
● Give lots of praise and encouragement

9 New Parents

Adjusting to the changes of being a new parent can take a toll on your emotional wellbeing and your relationship. Communication, seeking help and learning strategies to cope with a new baby are important to getting through this time. If your partner is there with you:
Acknowledge the togetherness 'It's so good we've been through this together'
Thank each other often and communicate your feelings to each other:
● It's a miracle
● It's scary
● How do I know if I'm doing the right thing?
● I am bursting with joy and dying of tiredness
● I miss the 'us', don't let us lose the 'us' even though there are now three of us.

Many of us imagined that there would be more flexibility and leisure time after having a baby. For most women it's a shock to discover their unpaid work doesn't permit a lot of extra time to see friends, has no neat boundaries and may be quite lonely. Parents may also expect others will help more than they actually do. It may help to think about these sorts of questions before the birth of a baby:
● What help would I like?
● Who can I ask for help?
● Who will screen and/or time the visitors, so I can have my own time if I need it?

There is consistent evidence that the quality of a woman's relationship with her partner is associated with her mental health. Mental health is promoted when partners are empathetic, encouraging, supportive and actively involved in the care of the baby. In contrast, wellbeing is lowered if they experience criticism or irritability. When two people become a family of three, their needs as individuals and as a couple are changed. It can be helpful to think about what your needs are as an individual and as a couple. Your needs around who does an everyday task like cooking and paying the bills can change in the face of the demands of looking after your baby.

Your sex life is likely to change because you are tired, your body has changed and/or your relationship with your partner is in a state of flux as you adjust to life as a family. This can be demanding for both partners, particularly if you are not able to talk comfortably about these changes. It is true, in most instances, that a new mum will put the baby's needs before a partner's needs and even her own. It is common for partners to feel excluded in this new triangle. If this isn't discussed, it can lead to feeling of guilt and defensive behaviour. Pregnancy and childbirth are physically demanding and women have to adjust to changes in shape and appearance and also how their bodies now function (e.g. with breastfeeding). It can be more difficult to recover from a birth which has involved surgery and/or other intrusive procedures.

Having a baby means your identity, freedom and independence are changed forever. Some women experience the change as a loss. This feeling of loss can become more complex if you see your partner as not having suffered the same sort of loss.

While the work of mothering can be fulfilling, it can also feel repetitive, boring and isolating. You may find yourself coping with a huge change to your life about which you feel both joyful and appalled. Changeable emotions are a normal part of adjusting to such a major life change. Your feelings may become less changeable with time and a sense of coping. Increased familiarity about what to do and an increasingly responsive, healthy baby are key to adjusting to being parents and knowing the joy!

No matter how many books you read or classes you attend, having a baby is a change which brings unexpected emotional reactions. Use the list below to help you cope with a new baby:

- Identify and make a list of the changes that have happened to you and recognise the things that cause you the most distress – tackle these through discussions with your partner, family, friends, a doctor or a psychologist
- Recognise your losses (e.g. identity, leisure time, freedom) to help yourself adjust to your new life
- Name your needs (e.g. time alone, help with the 3am feed, someone else to cook dinner)
- If you have a partner, discuss how you plan to share the cleaning, the cooking, paying the bills and caring for the baby and make time to be alone and together
- Expect changes in your body's shape, appearance and functions
- Don't feel guilty for having negative thoughts and feelings – changeable emotions are a normal part of adjusting to a major life change

Research confirms a woman feels more capable if her baby quietens to her soothing, suckles easily, gains weight and smiles responsively. Her confidence is lower if her baby cries for long periods and is difficult to settle or feed. On top of this response, frequent overnight waking and insufficient sleep leads to fatigue, slower decision–making, poor concentration and poorer mental and emotional wellbeing.

"Unsettled" is the commonly-used term for babies (up to 12 months old) who:

- Cry for long periods
- Cry and cannot be soothed
- Have difficulties settling to sleep
- Wake after short sleeps
- Wake up often during the night

Coping with a Baby

At least one in four families experience infant crying and fussing behaviour that is distressing. Up to one in three families experiences a problem with infant sleep. Babies vary in the amount and intensity of crying in their first year. Parents most commonly assume crying means the baby is either hungry or in pain, but a lot of the time crying is difficult to explain. If you are struggling with a crying baby and feel at a loss as to what to do, seek support and help from a health professional rather than letting yourself get over tired and over stressed. Let other people, family or friends, help you. Let them in so you can rest, be by yourself in the garden or at a cafe or have time just with your partner.

10 Body Image

Many people are dissatisfied with the way they look and often say they feel guilty just for eating. Health problems, anxiety, depression, low self-esteem, and how people talk about your body can all make you feel negative about your body. It can be helpful to stop and think about how you view your own body and acknowledge it for all the wonderful things it is capable of instead of focusing on the negative parts.

Influences

- Personality
- Health
- Illness and disease
- Depression
- Anxiety
- Self-esteem (whether you value and respect yourself)

Influences

- Childhood experiences
- How important people in your life talk about and refer to your body (and their body too)
- Media
- Society and culture
- Self-talk – what are you saying or not saying to yourself about your body image (does it start with "I should"… "I ought"… "I must"… or "I wish"… ?)

Physical changes associated with menopause and ageing include changes in body shape. Shifting weight from the hips to the central tummy area, drier skin, decreased muscle tone and hot flushes change how you feel, how you think about and the actual shape of your body. Some women talk about losing control of the body they always thought they could control and rely on. Other women find greater confidence in who they are because they are less driven by worrying about whether their body is 'perfect' as they enter this stage – "I can let go of the need to be perfect, to compete with the youngies and just be me".

Body Thoughts

Do you:

- Feel proud of some aspect of your body: your hair, your eyes, your shape, your breasts, your legs, your hands?
- Focus on the parts you don't like so much: the wrinkles, the hairs, the sagging, the stretching, the bumps, the scars?
- Feel conscious of what your body can do: cycle, walk, run, swim, embrace and carry?
- Think about what you weigh, what is round, what is flat, what is large, what is small?

These questions might allow you to see whether you are negative or positive about your body. They might also allow you to see a mixture of reactions to your own body. The reality is that everyone can answer these questions and end up with both positive and negative responses. If your image of your own body is at odds with how others see you or you have an extreme view about yourself, then it is likely your body image is affecting your mental and emotional wellbeing.

You can ask your doctor about counselling to help you talk through how to have a more balanced view of your body. It is also important to focus on the physical health of your body and not compare it to others, so aim to be the healthiest you can possibly be. Treat it well.

11 Family & Friends

Social connections, friendships and relationships with others help shape who we are and how we behave. They are also one of the most significant influences on health and wellbeing. Good social support may offer greater protection from chronic disease and illness like cardiovascular disease, depression and anxiety. Sometimes it is hard to know if your relationship is healthy or when to let go of relationships, but talking to someone you trust or a health professional is important to both your physical and emotional wellbeing if you are worried. Research shows loneliness and social isolation negatively affect the health of patients with heart disease, diabetes, arthritis, liver disease, breast cancer and stroke. People who are divorced, widowed or single are often found to be more depressed than those who are in supportive relationships. The support of social networks may offer greater protection from chronic disease and illness.

EMOTIONAL Family & Friends

Apart from the effects of your own mood, the emotions of the people around you also impact on your health and wellbeing. The 'cluster effect' means your mood is influenced by the mood of your social network, so if your friends are happy, you are more likely to be happy too. If your partner is depressed for a long period of time, you are more likely to develop depression too. If you find yourself in a social network that is causing you distress or you find yourself thinking more negatively around some people, it may be time to think about connecting with people who are more positive and who share the same values as you. Often you stay in the same relationships because you think you should (for whatever reason) but if you think about the person or the group and ask yourself: 'Is this really good for me?', 'Can I give and take in this relationship or in the group? Is it a positive, authentic experience most of the time?' you may realise it is not, and it is time to move on.

Moving on means letting go and leaving a gap and then having to deal with the anxiety this may cause. Lots of relationships have a beginning, a middle and an end and so often you get stuck at the ending because it is too hard. Most people would choose and love to belong to a happy supportive family. However, you cannot choose your parents or the family to whom you marry or commit. If you are experiencing problems with your family, your awareness of the situation is the first step in managing your life in a healthier and more responsible way. It often takes time to act or change your behaviour in a positive way.

Being Connected
- Join or start a sports club or hobby group for like-minded people
- Both children and pets really help in making connections
- Play groups, pre-school and parks can help you meet new people – maybe you could suggest a coffee!
- Volunteer – not only will this get you out and connecting with others but you will also feel like you are making a difference in other people's lives
- If you have an illness or health problem, a support group offers a place to go to discuss your thoughts and feelings with people who are more likely to understand what you are going through
- Use the internet to connect with new and/or existing friends via sites such as Facebook, LinkedIn or Pinterest

EMOTIONAL Healthy

12 Healthy Living

EMOTIONAL Healthy Living

A nutritious, balanced diet and regular physical activity can positively influence your state of mind and emotional wellbeing as much as your physical wellbeing. Some herbs such as St John's wort, lavender and lemon balm may help with mental and emotional health. Also, participating in creative, spiritual and intellectual activities along with community involvement help to balance out a healthy lifestyle. While it can be difficult for people suffering from depression to feel motivated to be physically active, it can be beneficial – particularly in managing mild to moderate depression or anxiety.

Regular physical activity of light or moderate intensity can lead to a reduction in depression and anxiety symptoms of up to 50 per cent, especially in women. Becoming more active can help to block negative thoughts, distract you from daily stresses and, if you exercise with other people, the social contact can be invaluable. In a recent large population-based study assessing psychological health and exercise, young women who did not regularly exercise had higher levels of anxiety and/or depression compared to those that did.

Other research shows that walking groups have been associated with lowered postnatal depression scores and improved fitness in new mothers which is likely to impact on stress, coping strategies, confidence and sleeping patterns in a positive way. If you know you are not motivated to exercise, try things like asking a friend to join you, put your exercise gear out to wear and talk to yourself –"I want to feel better". Make sure you note how you feel after you exercise and reward your efforts with positive self talk – "I'm proud of myself". It can be helpful to regularly review these areas and give yourself a score out of 10 as to how you think you are going in them. Take time to sit and ask yourself where you want to be in relation to these areas. Do this exercise several times and listen to yourself. If you need more assistance with this you can speak to a therapist.

EMOTIONAL Healthy Living

Healthy Diet
A balanced and nutritious diet including vegetables, fruit and whole grains is as important to mental and emotional health as it is to your physical health. A nutritious breakfast can give you plenty of emotional and physical energy for the day. It can also help you to avoid the afternoon mood slump which may lead you to reach for a quick sugary fix. The highs and lows of sugary and high carbohydrate foods (such as biscuits, cakes and lollies) can cause mood swings.

Physical Activity & Exercise
- Regular exercise has been linked to improved mental and emotional health including:
- Reduced depressive symptoms
- Reduced symptoms of stress and anxiety
- Improved mood
- Improved self confidence

Alcohol
Drinking more than two standard alcoholic drinks a day puts your health at risk. While short-term affects include poor sleep, headaches, dehydration, potential for accidents and mood swings, long-term risks are worse for mental and emotional health and include:
- Depression
- Relationship problems
- Decrease in quality of life
- Dementia
- Inability to think clearly
- Alcohol dependence
- Low vitamin B, zinc and magnesium (which can affect mood as well as physical health)
- Increased risk of some cancers – particularly breast cancer

EMOTIONAL Healthy Living

Wellbeing
Lifestyle and living well requires more than a healthy diet and some exercise. Your involvement in the following areas is important also:
- Intellectual stimulation
- Psychological balance
- Relationships with others
- Creative pursuits
- Community involvement
- Spiritual involvement

Natural Remedies

Natural remedies and how to utilize raw healing plants

"An apple a day keeps the doctor away."
Spanish Proverb

Introduction

Natural medicines can be as effective as modern medicine, but they will be much more accessible in a disaster. The following section will guide you on what natural medicines are effective against various illnesses.

Purpose	The aim of NATURAL REMEDIES is to provide a list of plants which can be used to help alleviate common ailments. It goes into detail and lists all the potential advantages it could have as well as any side-effects that may present from its use. There is also a section on using essential oils for aromatherapy, topical uses and ingestion uses.
Lost?	● If you're looking for modern medications, see the MEDICATION section. ● If you want to find out more about the ailment, see either the ILLNESS, INJURY or EMOTIONAL categories. ● For general medical information and the bodies systems, see the MEDICAL section. ● For nutrition information and recommended intakes, see the HEALTH section. ● For growing your own herbs, see the GARDENING section. ● For eating disorders, see the HEALTH > Nutrients section.

Contents

1 Essential Oils

These are the different ways essential oils can be applied to the body.

Topically	Able to penetrate the skin and pass into the blood stream and into different areas of the body for internal therapeutic benefits.
Aromatically	Absorbed into the bloodstream when inhaled. The large amount of blood vessels in the lungs absorb the oils and then circulate them throughout the body.
Ingestion	Can be used as a powerful form of medicine. Most essential oils are safe for internal use but a little bit goes a long way. Usually 1-3 drops is plenty mixed with water.

Health Benefits: Different oils can be blended together to enhance each's energy or can be blended with a base oil to be used for massage, shower gels or body lotions.

Insect Repellants	Lemongrass, Eucalyptus, Citronella, Peppermint, Clove.
Antibacterial	Basil, Cassia, Cinnamon, Clove, Cypress, Eucalyptus, Geranium, Lavender, Lemon, Marjoram, Melaleuca, Myrrh, Orange, Oregano, Peppermint, Rosemary, Tea Tree, Thyme.

Antiviral	Basil, Cassia, Cinnamon, Eucalyptus, Frankincense, Lemon, Lemongrass, Marjoram, Melaleuca, Myrrh, Oregano, Thyme.

Essential Oil Benefits

These are the benefits of essential oils.

Basil	● Soothes sore muscles and joints ● Assists with clear breathing ● Acts as a cooling agent for the skin ● Promotes mental alertness and lessens anxious feelings
Bergamot	● Calming and soothing aroma ● Promotes healthy, clear skin ● Frequently used in massage therapy for its calming benefits
Cardamom	● Eases indigestion and maintains an optimal gastrointestinal balance ● Promotes clear breathing and respiratory health ● Calms stomach upset and uplifts mood ● Flavourful spice for cooking and baking
Cedarwood	● Supports and maintains healthy respiratory function ● Helps skin recover quickly ● Promotes clear, healthy skin ● Relaxing and soothing aroma is perfect for massage
Chamomile	● Has a therapeutic, calming effect on the skin, mind, and body ● Soothes the systems of the body ● May help support healthy immune system function
Clove	● Anti-bacterial, anti-parasitic and antioxidant protection. ● Powerful antioxidant properties ● Promotes circulation ● Supports cardiovascular health ● Helps soothe teeth and gums ● Promotes oral health ● Supports a healthy immune system
Cypress	● Improves circulation, reduces varicose veins, lifts confidence and can help heal broken bones. ● Assists with clear breathing ● Promotes healthy respiratory function ● Soothes tight, tense muscles ● Supports localized blood flow ● Beneficial for oily skin conditions
Eucalyptus	● Improves respiratory issues like bronchitis, sinusitis and allergies. Also invigorating and purifies the body. ● Assists with clear breathing ● Supports overall respiratory health ● Soothes tired, sore muscles ● Purifying and cleansing properties
Fennel	● Relieves indigestion and digestive troubles ● Eases monthly menstrual cycles ● Supports a healthy lymphatic system ● Calms minor skin irritation
Frankincense	● Builds immunity, reduces inflammation, heals age spots, supports brain and may help fight cancer. Anti-inflammatory, heal bruising, reduce scars, boost immunity and emotional well-being. ● Promotes cellular health ● Reduces the appearance of scars and stretch marks ● Calming and soothing to the skin
Helichrysum	● Skin Antibiotic and Antifungal ● Sunburn Relief and Skin Cancer Protector ● Acne Treatment ● Anti-Inflammatory That Helps Boost Heart Health ● Natural Digestive and Diuretic ● Liver Stimulator and Detoxifier ● Natural Cancer Protector ● Antiviral That Increases Immunity ● Pain Reliever
Lavender	● Helps with relaxation, headaches, stress, improves mood and heals burns, cuts, rashes, eczema, stings, reduce anxiety and insomnia. ● Massage 2-3 drops to forehead. ● Antioxidant Protection ● Diabetes Natural Treatment ● Improves Mood ● Reduces Stress ● Supports Brain Function ● Heals Burns and Cuts ● Relieves Headaches ● Improves Sleep and Insomnia ● Relieves Pain
Lemon	● Great to use in homemade cleaning products, improves lymph drainage and cleanses the body. ● Cleanses and purifies the air and surfaces ● Naturally cleanses the body and aids in digestion ● Supports healthy respiratory function ● Promotes a positive mood and cognitive ability

Melaleuca (Tea Tree)	● Anti-bacterial, anti-fungal, can be used to prevent and reduce infection and clean air of pathogens and allergens. ● Renowned for its cleansing and rejuvenating effect on the skin ● Promotes healthy immune function ● Protects against environmental and seasonal threats
Myrrh	● Natural anti-septic and can prevent or reduce infections. Also, supports beautiful skin, reducing stretch marks and hormone balance. ● Powerful cleansing properties, especially for the mouth and throat ● Soothing to the skin; promotes a smooth, youthful-looking complexio ● Promotes emotional balance and well-being
Oregano	● Powerful anti-microbial properties, can kill fungus and help you kick a cold fast. ● Used as a powerful cleansing and purifying agent ● Provides immune-enhancing benefits ● Supports healthy digestion and respiratory function ● Excellent source of antioxidants ● Can help to soften skin
Patchouli	● Grounding, balancing effect on emotions ● Promotes a smooth, glowing complexion ● Reduces the appearance of wrinkles, scars, and stretch marks
Peppermint	● Supports digestion, improves focus, boosts energy, fever reducer, headache and muscle pain relief, reduce fevers, colds/flu, nausea, flatulence, clear sinuses, improve asthma, bronchitis and relieve headaches. ● Promotes healthy respiratory function and clear breathing ● Alleviates stomach upset ● Frequently used in toothpaste and chewing gum for oral health
Rose	● Incredible for reducing skin inflammation and great for creating glowing skin. Add a few drops to your facial moisturizer. ● Helps balance moisture levels in the skin ● Reduces the appearance of skin imperfections ● Promotes an even skin tone and healthy complexion ● Emotionally uplifting
Rosemary	● Can naturally thicken hair so it is great to add to homemade shampoos. Also, it improves brain function and memory so it's great to used when working, reading or studying. ● Supports healthy digestion ● Supports healthy respiratory function ● Helps reduce nervous tension and fatigue
Geranium	● Promotes clear, healthy skin ● Helps calm nerves and lessen stress ● Promotes healthy hair
Ginger	● Reduces inflammation, supports joints, improves digestion and relieves nausea. ● Helps ease indigestion and nausea ● Promotes digestion ● Supports overall digestive health ● Warming to the body
Grapefruit	● Supports metabolism and cellulite reduction. Mix with coconut oil and rub on areas of cellulite or take a few drops internally with water. ● Cleanses and purifies ● Beneficial for oily skin issues Supports healthy metabolism ● Helps reduce mental and physical fatigue
Sandalwood	● Natural aphrodisiac that improves libido and can also improve energy. ● Promotes healthy, smooth skin ● Reduces the appearance of scars and blemishes ● Enhances mood ● Frequently used in meditation for its grounding and uplifting properties
Spearmint	● Diffuse to uplift mood ● Apply to toothbrush before brushing teeth for fresh breath ● Add a drop or two to any dessert, drink, salad, or entrée for flavouring and to promote digestion* ● For occasional stomach upset, add 1–2 drops to water and drink*
Valerian	● Treats Sleep Disorders ● Lowers Anxiety & Depression ● Improves Stomach Health ● Prevents Heart Palpitations ● Regulates Blood Pressure ● Improves Cognitive Abilities

Essential Oil Expiry

In general, shelf life is determined by the chemical composition of the essential oils, some of which oxidize or evaporate more quickly than others. Essential oils which contain a lot of monoterpenes or oxides have the shortest shelf life, of approximately 1-2 years. Essential oils which contain a lot of phenols may last up to 3 years. Essential oils which contain ketones, monoterpenols, and/or esters have a shelf life of 4-5 years. The potentially longest-lasting essential oils contain lots of sesquiterpenes and sesquiterpenols which can last up to 6 years. Store oils in a cool, dark and dry place. Keep the lids tightly closed. Store in the fridge if possible.

The following items cause essential oils to go bad.

Oxygen	Oxygen that gets into your bottle and reacts with some of the constituents is called oxidation. This oxidation can affect the therapeutic properties of the essential oil, as well as render it more hazardous (source). The biggest hazard is increased risk for sensitization.
Heat	Heat causes the more volatile constituents to evaporate more quickly. CO2 extracts are more prone to damage from heat than steam-distilled essential oils.

Light	Ultraviolet light promotes free radicals. Amber coloured bottles are best at keeping UV light out. Cobalt (blue being the opposite colour of brown) bottles do not do a very good job of keeping UV light out, but they allow the light to pass through the glass more readily, and therefore into the product.

Shelf Life

The following are estimates of the shelf life of essential oils. They should not be used topically after this point but may still be used aromatically for a while longer.	● Basil - 3y ● Bergamot - 3y ● Blue Tansy - 3y ● Cardamom - 4y ● Cedarwood - 6+y ● Chamomile - 4y ● Cinnamon Bark - 4y ● Clary Sage - 4y ● Clove - 3y ● Copaiba - 6y ● Cypress -2y	● Elemi - 3y ● Eucalyptus - 2y ● Fennel - 3y ● Frankincense - 2y ● Geranium - 4y ● Ginger - 6y ● Helichrysum - 4y ● Juniper Berry - 3y ● Lavender - 4y ● Lemon Citrus - 1y	● Lime Citrus - 2y ● Mandarin Citrus - 1y ● Melissa - 3y ● Myrrh - 6y ● Neroli - 3y ● Orange - 1y ● Oregano - 3y ● Patchouli - 10+y ● Pepper - 6y ● Peppermint - 4y	● Rosalina - 3y ● Rose - 6y ● Rosemary - 3y ● Sandalwood - 6+y ● Spearmint - 4y ● Tea Tree - 2y ● Valerian - 5y ● Vetiver - 6+y ● Wintergreen - 6y ● Ylang Ylang - 4y

Aroma	If you make yourself familiar with the aroma of the essential oil when it is fresh, you will begin to notice it smells "off" once it has oxidized. A change in smell can alert you that it may not be safe for topical applications.
Adverse Reactions	Once oxidized, the potential for the essential oil to cause redness, irritation, itching, etc., increases even when diluted. If this starts happening to you, stop using the essential oil topically. Continuing to use the oxidized essential oil in this way will greatly increase your risk for sensitization.

Oxidized Oils

Confirm Oxidization
Many companies do not provide a distillation date, which can be used to determine shelf life. If you are unsure when it was distilled, or bottled, you can keep track of when you purchase it. Keep in mind there could be several months or longer between when the essential oil was distilled or bottled, and when you make your purchase. If you are left in the dark, there are two ways to tell if your essential oil has been oxidized: aroma, and adverse reactions. Oxidized essential oils are not recommended for use on the skin, but they can be used for cleaning. It is not recommended they are diffused, either, in cause of mucous membrane irritation. Be sure you wear gloves when you use the essential oils in your cleaning recipes. If you want your essential oils to last longer, keep them closed tightly when not in use, keep them away from light, and store them in a cool place. The best place for essential oils is in the refrigerator.

These are some of the essential oils which should be avoided if oxidized. These are also the essential oils to prioritize for refrigerator space.

● Angelica Seed Angelica archangelica
● Anise (Star) Illicium verum
● Bergamot Citrus bergamia, Citrus aurantium
● Camphor (Borneo) Dryobalanops aromatica, Dryobalanops camphora
● Caraway Carum carvi
● Celery leaf, Celery seed Apium graveolens
● Clementine Citrus clementina
● Cypress Cupressus sempervirens
● Dill seed (European) Anethum graveolens
● Elemi Canarium luzonicum, Canarium vulgare
● Fennel (bitter, sweet) Foeniculum vulgare

● Fir Needle (Canadian) Abies balsamea
● Fir Needle (Himalayan) Abies spectabilis, Abies webbiana
● Fir Needle (Japanese) Abies sachalinensis
● Fir Needle (Siberian) Abies sibirica
● Fir Needle (Silver) Abies alba
● Fragonia Agonis fragrans
● Frankincense Boswellia frereana, Boswellia papyrifera, Boswellia sacra (Boswellia carteri), Boswellia serrata, Boswellia neglecta, Boswellia rivae
● Gingergrass Cymbopogon martinii var. sofia, Andropogon martinii var. sofia
● Grapefruit Citrus x paradisi

● Spruce (white) Picea glauca, Picea alba, Picea canadensis
● Tangerine Citrus reticulata, Citrus nobilis, Citrus tangerine
● Tea Tree Melaleuca alternifolia
● Thyme (limonene chemotype) Thymus vulgaris, Thymus serphyllum
● Verbena (white) Lippia alba, Lippia gerinata

● Juniper Berry Juniperus communis
● Lemon Citrus x limon, Citrus limonum
● Lemon Balm Eucalyptus staigeriana
● Lime Citrus x aurantifolia, Citrus x latifolia
● Mandarin Citrus reticulata, Citrus nobilis
● Orange (bitter) Citrus x aurantium
● Orange (sweet) Citrus sinensis, Citrus aurantium var. sinensis
● Palo Santo Bursera graveolens
● Pepper (black, white) Piper nigrum
● Pine (black) Pinus nigra
● Pine (dwarf) Pinus mugo

● Pine (grey) Pinus divaricata, Pinus banksiana
● Pine (red) Pinus resinosa
● Pine (Scots) Pinus sylvestris
● Pine (white) Pinus strobus
● Sage (blue mountain) Salvia stenophylla
● Spruce (black) Picea mariana, Picea nigra
● Spruce (hemlock) Tsuga canadensis, Pinus canadensis, Picea canadensis
● Spruce (Norway) Picea abies, Picea excelsa
● Spruce (red) Picea rubens

2 Natural Medication

Antibiotics

Garlic	Garlic is probably one of the very best natural antibiotics you can take because it kills pathogens as well as bacteria and viruses without doing any damage to the beneficial gut flora in your body. Garlic contains many vitamins, nutrients, and minerals and also contains phytochemical allicin which is effective against MRSA. It's even possible to infuse olive oil with garlic as a method for treating external infections such as ear infections. Best of all, unlike penicillin, garlic is simple and easy to grow. In fact, in a SHTF scenario, you can grow garlic using hydroponics or aquaponics.
Honey	Use of honey as an antibiotic dates back to ancient times. Honey contains both hydrogen peroxide and sugar which can help stop the growth of some bacteria. Raw or Manuka honey are the two forms that offer humans the most health benefits. You can't really "grow" your own honey, but you can raise bees and harvest honey from their hive. You can also opt to plant a few bee-friendly flowers in your survival garden to help support local hives. Many people recommend mixing honey with apple cider vinegar (another natural antibiotic) and water.

Ginger	Fresh ginger is particularly useful for preppers because it has been proven to have an antibiotic effect on food borne pathogens like salmonella. If food is scarce, you may have to resort to eating items that are a little risky and eating some ginger as well can help protect you from food borne illness.

Antibacterials

3 Herbs

This section contains a list of herbs and their benefits.

Subheadings

1. Acai	2. Atlantic Kelp	3. Alfalfa	4. Amla
5. Ashwaganda	6. Andrographis	7. Annatto	8. Bilberry
9. Baobab	10. Bacopa	11. Black Walnut	12. Bay Leaf
13. Blue Cohosh	14. Blue Flag	15. Black Cohosh	16. Bladderwrack
17. Brindle Berry Extract	18. Comfrey	19. Calendula	20. Chaste Tree Berry
21. Cat's Claw	22. Cordyceps	23. Cardamom	24. Cocoa
25. Coleus	26. Club Moss	27. Cassia Cinnamon	28. Chlorella
29. Camu Camu	30. Chickweed	31. Comfrey	32. Catnip
33. Chaga	34. Cascara Sagrada	35. Diatomaceous Earth	36. Devil's Claw
37. Dandelion	38. Damiana	39. Dong Quai	40. Euphorbia
41. Horny Goat Weed	42. Evodia	43. Goat's Rue	44. Ginko
45. Gotu Kola	46. Guarana	47. Graviola	48. American Ginseng
49. Bitter Melon	50. Horehound	51. Hops	52. Hydrangea
53. Horsetail	54. Horseradish	55. He Shou Wu (Fo-Ti)	56. Hypericum
57. Hawthorn	58. Jiaogulan	59. Kudzu	60. Myrtle
61. Alpine Lady's Mantle	62. Lotus	63. Milk Thistle	64. Moringa
65. Maitake Mushroom	66. Mugwort	67. Neem	68. Nigella Seed
69. Nettle Leaf	70. Sweet Orange	71. Oats	72. Paw Paw
73. Psyllium Husk	74. Panax Notoginseng	75. Muira Puama	76. Sage
77. Rehmannia	78. Raspberry Leaf	79. Reishi Mushroom	80. Rhubarb
81. Ruscus	82. Red Clover	83. Saw Palmetto	84. Senna
85. Slippery Elm	86. Shiitake Mushroom	87. Spirulina	88. Schisandra
89. Sorrel	90. Tribulus	91. Holy Basil (Tulsi)	92. Wild Yam
93. Witch Hazel	94. Willow Bark	95. Wheatgrass	96. Yarrow

1 Acai

Acai, pronounced AH-sigh-EE, is a palm tree that is widely distributed in the northern area of South America. Its berries are used to make medicine. Acai is most commonly used for arthritis, high cholesterol, erectile dysfunction (ED), weight loss and obesity, "detoxification," aging skin, metabolic syndrome, and for improving general health. But there is limited scientific evidence to support these uses. As a food, the acai berry is eaten raw and as a juice. The juice is also used commercially as a beverage and in ice cream, jelly, and liqueurs. In manufacturing, acai berry is used as a natural purple food colorant. Acai contains chemicals that are antioxidants. Antioxidants are thought to protect body cells from the damaging effects of chemical reactions with oxygen (oxidation). According to some research, acai has more antioxidant content than cranberry, raspberry, blackberry, strawberry, or blueberry. Chemicals in acai might also reduce swelling, lower blood sugar levels, and stimulate the immune system.

Uses

Insufficient Evidence

Metabolic Syndrome	Early research shows that eating 100 mg of acai pulp two times per day for one month reduces fasting blood sugar and total cholesterol in overweight people. But acai pulp doesn't appear to lower triglycerides or "bad" low-density lipoprotein (LDL) cholesterol, increase "good" high-density lipoprotein (HDL) cholesterol, or improve blood pressure and markers of swelling.

Arthritis, High cholesterol, Erectile dysfunction, Weight loss, Aging skin, Improving general health.

Dosing

The appropriate dose of acai depends on several factors such as the user's age, health, and several other conditions. At this time, there is not enough scientific information to determine an appropriate range of doses for acai. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

NATURAL REMEDIES

Herbs

2 Atlantic Kelp (Sea Kelp)

Sea kelp is a natural source of vitamins A, B1, B2, C, D and E, as well as minerals including zinc, iodine, magnesium, iron, potassium, copper and calcium. In fact it contains the highest natural concentration of calcium of any food - 10 times more than milk. Weight loss: Iodine is a trace mineral vital for the operation of the thyroid gland which plays an important part in body development and metabolism. It combines with tyrosine - an amino acid - to create T3 and T4, thyroid hormones that regulate metabolism and other physiological functions throughout the body. As sea kelp is the richest natural source of iodine it can help to regulate metabolism and in turn affect weight loss and gain. Anti-ageing: The iodine content of kelp also appears to have other benefits. A 2008 study showed that the form of iodine in kelp effectively removed free radicals - chemicals that accelerate ageing - from human blood cells.Try Montagne Jeunesse Dead Sea Mud Spa clay mask: therapeutic Dead Sea minerals and Dead Sea mud, nutrient-rich seaweed, and mineral-packed kelp to keep your skin nourished and moisturised. Hair growth - There's plenty of anecdotal evidence suggesting taking sea kelp supplements can boost hair growth. Whether or not it actually boosts growth, it contains nutrients involved in hair health and strength, so it may help reduce split ends and breakages.

Risks	As sea kelp contains so many minerals and nutrients in such high quantities it may pose health problems if consumed in an incorrect dosage or by those with particular health issues. Iodine: Sea kelp is rich in iodine as it rapidly absorbs the high iodine content of the sea, and you might find anecdotal advice to take it for iodine deficiency. In the developed world though this condition is rare, and even if you are a sufferer it's unlikely iodine supplements would be the recommended course of action. In fact, you'll probably already get between 160mcg and 600mcg of iodine from salt, and taking excess iodine can cause many health problems including hyperthyroidism, Grave's disease and thyroid cancers. Different forms of kelp can vary greatly in iodine content too; another reason to be cautious. For example, the iodine content of different products containing bladderwrack (or seawrack) - a type of kelp - may vary greatly. Heavy metals: Sea kelp grown in polluted waters may well absorb toxic heavy metals which if ingested can cause major health problems. The potential for this means it isn't recommended to be taken if pregnant or breastfeeding, or by children or people with health issues, especially liver or kidney problems. It should be possible however to make sure a particular supplement comes from kelp grown in clean waters. Unpredictability: There are a large number of sea kelp supplements available containing a variety of different types of algae that all come under the name 'kelp', which may affect your body in different ways.

3 Alfalfa

Alfalfa is a herb. People use the leaves, sprouts, and seeds to make medicine. Alfalfa is used for kidney conditions, bladder and prostate conditions, and to increase urine flow. It is also used for high cholesterol, asthma, osteoarthritis, rheumatoid arthritis, diabetes, upset stomach, and a bleeding disorder called thrombocytopenic purpura. People also take alfalfa as a source of vitamins A, C, E, and K4; and minerals calcium, potassium, phosphorous, and iron. Alfalfa seems to prevent cholesterol absorption in the gut.

Uses

Insufficient Evidence

High cholesterol	Taking alfalfa seeds seems to lower total cholesterol and “bad” low-density lipoprotein (LDL) cholesterol in people with high cholesterol levels.

Dosing

BY MOUTH
For high cholesterol: a typical dose is 5-10 grams of the herb, or as a steeped strained tea, three times a day. 5-10 mL of a liquid extract (1:1 in 25% alcohol) three times a day has also been used.

4 Amla (Indian Gooseberry)

Indian gooseberry is a tree that grows in India, the Middle East, and some southeast Asian countries. Indian gooseberry has been used in Ayurvedic medicine for thousands of years. Today people still use the fruit of the tree to make medicine. Indian gooseberry is taken by mouth for high cholesterol, "hardening of the arteries" (atherosclerosis), diabetes, pain and swelling of the pancreas (pancreatitis), cancer, upset stomach, eye problems, joint pain, diarrhea, bloody diarrhea (dysentery), osteoarthritis, obesity, "organ restoration", and for a skin disorder that causes unpigmented skin (vitiligo). It is also used to kill germs and reduce pain and swelling caused by the body's reaction to injury or illness (inflammation).

Uses

Insufficient Evidence

High cholesterol	Some early research shows that taking Indian gooseberry for 4 weeks decreases low-density lipoprotein (LDL, or "bad") cholesterol in people with high cholesterol. Other early research shows that taking Indian gooseberry extract for 12 weeks decreases LDL cholesterol in obese people.
Osteoarthritis	Research shows that taking two capsules of an Ayurvedic formula containing Indian gooseberry and several other ingredients three times daily for 24 weeks is as beneficial as taking glucosamine sulfate or the drug celecoxib for reducing pain in people with knee osteoarthritis. Skin disorder that causes unpigmented skin (vitiligo). Early research suggests that taking one tablet containing Indian gooseberry and other ingredients three times daily for 6 months along with standard treatment can increase skin repigmentation and reduce signs of inflammation better than standard treatment alone.
Skin disorder that causes unpigmented skin (vitiligo)	Early research suggests that taking one tablet containing Indian gooseberry and other ingredients three times daily for 6 months along with standard treatment can increase skin repigmentation and reduce signs of inflammation better than standard treatment alone.

Dosing

The appropriate dose of Indian gooseberry depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for Indian gooseberry. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

5 Ashwaganda

Ashwagandha is a plant. The root and berry are used to make medicine. Ashwagandha has a lot of uses. But so far, there isn't enough information to judge whether it is effective for any of them. Ashwagandha is used for arthritis, anxiety, bipolar disorder, attention deficit hyperactivity disorder (ADHD), balance, obsessive-compulsive dirorder (OCD), trouble sleeping (insomnia), tumors, tuberculosis, asthma, a skin condition marked by white patchiness (leukoderma), bronchitis, backache, fibromyalgia, menstrual problems, hiccups, Parkinson's disease, and chronic liver disease. It is also used to reduce side effects of medications used to treat cancer and schizophrenia. Ashwagandha is used to reduce levels of fat and sugar in the blood. Ashwagandha is also used as an "adaptogen" to help the body cope with daily stress, and as a general tonic. Some people also use ashwagandha for improving thinking ability, decreasing pain and swelling (inflammation), and preventing the effects of aging. It is also used for fertility problems in men and women and also to increase sexual desire.

Ashwagandha is applied to the skin for treating wounds, backache, and one-sided paralysis (hemiplegia). The name Ashwagandha is from the Sanskrit language and is a combination of the word ashva, meaning horse, and gandha, meaning smell. The root has a strong aroma that is described as "horse-like." In Ayurvedic, Indian, and Unani medicine, ashwagandha is described as "Indian ginseng." Ashwagandha is also used in traditional African medicine for a variety of ailments. Don't confuse ashwagandha with Physalis alkekengi. Both are known as winter cherry. Ashwagandha contains chemicals that might help calm the brain, reduce swelling (inflammation), lower blood pressure, and alter the immune system.

Uses

Possibly Effective

Stress	Taking a specific ashwagandha root extract (KSM66, Ixoreal Biomed) 300 mg twice daily after food for 60 days appears to improve symptoms of stress.

Insufficient Evidence

Reducing side effects associated with medications called antipsychotics.	Antipsychotics are used to treat schizophrenia but they can cause levels of fat and sugar in the blood to increase. Taking a specific ashwagandha extract (Cap Strelaxin, M/s Pharmanza Herbal Pvt. Ltd., Gujarat, India) 400 mg three times daily for one month might reduce levels of fat and sugar in the blood in people using these medications.
Anxiety	Some clinical research shows that taking ashwagandha can reduce some symptoms of anxiety or anxious mood.
Attention deficit-hyperactivity disorder (ADHD)	Some clinical research shows that a combination herbal product containing ashwagandha may improve attention and impulse control in children with ADHD. The effect of ashwagandha alone is unclear.
Bipolar disorder	Taking a specific ashwagandha extract (Sensoril, Natreon, Inc., New Bruswick, New Jersey) for 8 weeks might improve brain function in people being treated for bipolar disorder.
A brain condition called cerebellar ataxia.	Preliminary research shows that ashwagandha in combination with an alternative form of medicine known as Ayurvedic therapy might improve balance in people with cerebellar ataxia.
Fatigue in people treated for cancer (chemotherapy)	Early research suggests taking a specific ashwagandha extract 2,000 mg (Himalaya Drug Co, New Delhi, India) during chemotherapy treatment might reduce feelings of tiredness.
Diabetes	There is some evidence that ashwagandha might reduce blood sugar levels in people with diabetes.
High cholesterol	There is some evidence that ashwagandha might reduce cholesterol levels in patients with high cholesterol.
Male infertility	Some preliminary clinical evidence suggests that ashwagandha might improve sperm quality, but not sperm count, in infertile men. It is not known if taking ashwagandha can actually improve fertility.
Osteoarthritis	Early research shows that ashwagandha taken along with a zinc complex, guggul, and turmeric might improve arthritis symptoms. The impact of ashwagandha alone is unclear.
Obsessive-compulsive disorder (OCD)	Early research shows that ashwagandha root extract might reduce symptoms of OCD when taken with prescribed medications for 6 weeks better than taking the prescribed medication alone.
Parkinson's disease	Preliminary research suggests that a combination of herbs including ashwagandha improves Parkinson's symptoms. The effect of ashwagandha alone in Parkinson's is unknown.
Rheumatoid arthritis	Early research shows that ashwagandha powder taken for 3 weeks followed by 4 weeks of sidh makardhwaj (a mixture of gold, mercury, and sulfur) slightly improves symptoms in some people with RA. The impact of ashwagandha alone in RA is unclear.

Dosing

The appropriate dose of ashwagandha depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for ashwagandha. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

6 Andrographis

Andrographis is a plant that is native to South Asian countries such as India and Sri Lanka. The leaf and underground stem are used to make medicine. Andrographis is frequently used for preventing and treating the common cold and flu (influenza). Some people claim andrographis stopped the 1919 flu epidemic in India, although this has not been proven. Andrographis is also used for a wide assortment of other conditions. It is used for digestive complaints including diarrhea, constipation, intestinal gas, colic, and stomach pain; for liver conditions including an enlarged liver, jaundice, and liver damage due to medications; for infections including leprosy, pneumonia, tuberculosis, gonorrhea, syphilis, malaria, cholera, leptospirosis, rabies, sinusitis, and HIV/AIDS; and for skin conditions including wounds, ulcers and itchiness. Some people use andrographis for sore throat, coughs, swollen tonsils, bronchitis, and allergies. It is also used for "hardening of the arteries" (atherosclerosis), and prevention of heart disease and diabetes. Other uses include treatment of snake and insect bites, loss of appetite, kidney problems (pyelonephritis), hemorrhoids, and an inherited condition called familial Mediterranean fever. Andrographis is also used as an astringent, bacteria killing agent, painkiller, fever reducer, and treatment for worms. Some Internet vendors offer andrographis products that contain extra amounts of an active ingredient called andrographolide. Some of these products are almost 30% andrographolide. However, be careful; the safety and effectiveness of andrographis preparations with high andrographolide content are unknown. Andrographis might stimulate the immune system. It may improve the blood cell counts in people with HIV, and help with allergies.

Uses

Possibly Effective

NATURAL REMEDIES | Herbs | Andrographis | Uses

Common cold	Some research shows that taking a specific andrographis extract in combination with Siberian ginseng (Kan Jang, Swedish Herbal Institute) by mouth improves symptoms of the common cold when started within 72 hours of feeling sick. Some symptoms can improve after 2 days of treatment, but it usually takes 4-5 days of treatment before most symptoms go away. Some research suggests this combination of andrographis and Siberian ginseng relieves cold symptoms in children better than echinacea. Also, early research suggests that taking a specific andrographis extract (KalmCold) might help treat colds, while other research suggests that taking a specific andrographis product (Kan Jang, Swedish Herbal Institute) might help prevent colds.
Reducing the fever and sore throat due to tonsillitis	Some research shows that high dose andrographis (6 grams daily) works about as well as acetaminophen (Tylenol) after 3 to 7 days of treatment.
Inflammatory bowel disease (ulcerative colitis)	Early research suggests that taking andrographis extract daily for 8 weeks reduces symptoms of inflammatory bowel disease about as well as the drug mesalamine.

Insufficient Evidence

Familial Mediterranean Fever	Developing research suggests that a combination of andrographis, Siberian ginseng, schisandra, and licorice (ImmunoGuard, Inspired Nutritionals) reduces the length, number, and severity of attacks of familial Mediterranean fever in children.
Treating flu (Influenza)	There is some evidence that patients with flu who take a specific Andrographis extract in combination with Siberian ginseng (Kan Jang, Swedish Herbal Institute) feel better more quickly than patients taking amantadine, a drug approved by the federal Food and Drug Administration (FDA) to prevent Asian flu and treat Influenza A. Patients who take this herbal combination also seem to have fewer complications such as sinus pain, as well as breathing problems and coughing (bronchitis), after the flu.
Rheumatoid arthritis	Early research suggests that taking andrographis for 14 weeks reduces symptoms of rheumatoid arthritis when compared with pretreatment, but not when compared to another group of people taking just a sugar pill.

Dosing

BY MOUTH
For treating the common cold: a combination of a specific andrographis extract, standardized to contain 4-5.6 mg andrographolide, plus 400 mg Siberian ginseng (Kan Jang, Swedish Herbal Institute) three times daily.

For relieving fever and sore throat in tonsillitis: 3-6 grams daily.

7 Annatto

Annatto is a plant. The seed and leaf are used to make medicine. People take annatto for diabetes, diarrhea, fevers, fluid retention, heartburn, malaria, and hepatitis. They also use it as an antioxidant and bowel cleanser. Annatto is sometimes put directly on the affected area to treat burns and vaginal infections and to repel insects. In foods, annatto is used as a coloring agent.

Uses

Insufficient Evidence

Enlarged prostate (benign prostatic hyperplasia; BPH).	Early research suggests that taking annatto 250 mg three times daily for 12 months does not improve symptoms of BPH.

Dosing

The appropriate dose of annatto depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for annatto. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

8 Bilberry

Bilberry is a plant. The dried, ripe fruit and leaves are used to make medicine. Bilberry is used for improving eyesight, including night vision. In fact, during World War II, British pilots in the Royal Air Force ate bilberry jam to improve their night vision, but later research showed it probably didn't help. Bilberry is also used for treating eye conditions such as cataracts and disorders of the retina. There is some evidence that bilberry may help retinal disorders. Some people use bilberry for conditions of the heart and blood vessels including hardening of the arteries (atherosclerosis), varicose veins, decreased blood flow in the veins, and chest pain. Bilberry is also used for chronic fatigue syndrome (CFS), hemorrhoids, diabetes, osteoarthritis, gout, skin infections, gastrointestinal (GI) disorders, kidney disease, and urinary tract infections (UTIs). It is sometimes applied directly to the inside of the mouth for mild mouth and throat soreness. Bilberry contains chemicals called tannins that can help improve diarrhea, as well as mouth and throat irritation, by reducing swelling (inflammation). There is some evidence that the chemicals found in bilberry leaves can help lower blood sugar and cholesterol levels. Some researchers think that chemicals called flavonoids in bilberry leaf might also improve circulation in people with diabetes. Circulation problems can harm the retina of the eye.

Uses

Possibly Effective

Poor circulation that can cause the legs to swell (chronic venous insufficiency or CVI)	Some research suggests that taking bilberry extract by mouth can improve symptoms of swelling, pain, bruising, and burning in people with a circulation problem called chronic venous insufficiency (CVI).

Possibly Ineffective

Ability to see in low-light conditions	Most evidence suggests that bilberry is not effective for improving night vision.

Insufficient Evidence

Diabetes	Early research suggests that bilberry can lower blood sugar levels.
Vision problems in people with diabetes (diabetic retinopathy)	Eating bilberry fruit containing a high amount of a certain chemical, called anthocyanoside, seems to improve retina problems associated with diabetes.

Menstrual cramps (dysmenorrhea)	Early research suggests that taking bilberry twice daily 3 days before the beginning of the period and continuing for 8 days for a least two consecutive menstrual cycles reduces pain, nausea, vomiting and headache in women with painful menstruation.
Muscle soreness caused by exercise	Early research suggests that drinking bilberry juice might make muscle soreness worse in athletes after running a marathon.
A group of eye disorders that can lead to vision loss (glaucoma)	Early research suggests that taking 60 mg of a bilberry chemical, called anthocyanin, twice daily for at least 12 months improves vision in people with glaucoma.
Vision problems in people with high blood pressure (hypertensive retinopathy)	Eating bilberry fruit containing a high amount of a certain chemical, called anthocyanoside, seems to improve retina problems associated with high blood pressure.
A grouping of symptoms that increase the risk of diabetes, heart disease, and stroke (metabolic syndrome)	Some evidence suggests that eating 400 grams of fresh bilberries daily does not affect body weight, blood sugar, or cholesterol in people with metabolic syndrome.
Nearsightedness	Some early research suggests that eating fermented bilberry seems to improve the ability to focus and see objects that are far away.
A type of inflammatory bowel disease (ulcerative colitis)	Some early research shows that consuming 160 grams of bilberry daily for 6 weeks can lead to remission in some people with ulcerative colitis.
Obesity	Early research suggests that eating 100 grams of frozen, whole bilberries daily for about a month decreases weight and waist circumference in overweight and obese women.

Dosing

The typical dose of the dried, ripe berries: 20-60 grams daily. People also drink a type of tea made from 5-10 grams (1-2 teaspoons) of the mashed berries. A dose of 160 mg of bilberry extract taken twice daily has been used in people with diseased retinas. Bilberry leaf is commonly used as a tea. The tea is prepared by steeping 1 gram, 1-2 teaspoons, finely chopped dried leaf in 150 mL boiling water for 5-10 minutes, and then straining. Don't use bilberry leaf long-term.

9 Baobab

Baobab is a tree native to Africa, Madagascar, Australia, and Arabia. The tree is used as a source of water and food for indigenous people. Fruit and leaves of the tree are used medicinally for asthma, mosquito repellent, and for allergic skin conditions. Some people are calling the baobab fruit the next "super food" because of its exotic nature and rich nutrient profile. There is not enough scientific information to know how baobab might work for any medical condition. The fruit and leaves contain several nutrients and have some antioxidant properties.

Uses

Insufficient Evidence

Dosing

The appropriate dose of baobab depends on several factors such as the user's age, health, and several other conditions. At this time, there is not enough scientific information to determine an appropriate range of doses for baobab. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

10 Bacopa

Bacopa, also known as brahmi, is a plant that has been used in traditional Indian medicine (Ayurveda). Be careful not to confuse brahmi (Bacopa monnieri) with gotu kola and other natural medicines that are also sometimes called brahmi. Bacopa is commonly used for Alzheimer's disease, improving memory, anxiety, and attention deficit-hyperactivity disorder (ADHD) among many other uses. But there is limited scientific research to support these uses. Bacopa might increase certain brain chemicals that are involved in thinking, learning, and memory. Some research suggests that it might also protect brain cells from chemicals involved in Alzheimer's disease.

Uses

Possibly Ineffective

Irritable bowel syndrome (IBS)	Bacopa does not seem to help keep IBS symptoms from returning after they have gone away for a while.

Insufficient Evidence

Anxiety	Taking bacopa syrup daily for 4 weeks seems to reduce symptoms of anxiety, including nervousness, racing heart, trouble sleeping, headaches, tiredness, difficulty concentrating, and stomach discomfort in some people with anxiety.
Attention deficit-hyperactivity disorder (ADHD).	Taking bacopa for 6 months seems to improve ADHD symptoms such as restlessness and learning problems by 20% or more in some children with ADHD.
Improving memory	There is mixed evidence about bacopa for improving memory. Some research shows that bacopa extract taken for 12 weeks does not improve memory and attention. However, other research shows that taking bacopa improves some measure of memory in otherwise healthy older adults. Also, taking bacopa extract seems to improve some measures of memory and hand-eye coordination in children aged 6-8 years. It seems that some bacopa extracts can benefit memory while others do not.

Epilepsy (seizures)	Taking bacopa extract for 5 months might prevent seizures in some people with epilepsy.

Dosing

The appropriate dose of bacopa depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for bacopa. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

11 Black Walnut

Black walnut is a tree. People use the outer covering of the nut (the hull) to make medicine. Black walnut is used to treat parasitic worm infections and certain other infections including diphtheria and syphilis. It is also used for leukemia. Some people use black walnut as a gargle, apply it to the scalp as hair dye, or put it on the skin to treat wounds. Black walnut contains high concentrations of chemicals called tannins, which can reduce pain and swelling and dry up body fluids such as mucous.

Uses

Insufficient Evidence

Dosing

The appropriate dose of black walnut depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for black walnut. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

12 Bay Leaf

Sweet bay is an herb. The Greeks made it famous by crowning their heroes with wreathes made out of sweet bay leaves. In addition to decorative use, the leaves and oil are used to make medicine. Sweet bay is used to treat cancer and gas; stimulate bile flow; and cause sweating. Some people apply sweet bay to the scalp for dandruff. It is also put on the skin for pain, especially muscle and joint pain (rheumatism). The fruit and fatty oils of sweet bay are used on the skin to treat boils (furuncles) caused by infected hair follicles. Veterinarians use sweet bay as an udder ointment. In food, sweet bay is used as a seasoning in cooking and in processed foods. In manufacturing, the oil is used in cosmetics, soaps, and detergents. Sweet bay contains ingredients that might cause sleepiness and might act against some bacteria and fungi.

Uses

Insufficient Evidence

Diabetes	Early research suggests that taking ground bay leaf twice daily along with medication for diabetes can lower pre-meal blood sugar levels, as well as levels of cholesterol, “bad” low-density lipoprotein (LDL) cholesterol, and blood fats called triglycerides in people with diabetes. Also, taking ground bay leaf seems to increase “good” high-density lipoprotein (HDL) cholesterol levels in these people.

Dosing

The appropriate dose of sweet bay depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for sweet bay. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

13 Blue Cohosh

Blue cohosh is a plant. "Cohosh" is from the Algonquin Indian word meaning "rough," and it refers to the appearance of the roots. The root is used to make medicine. Blue cohosh is not a safe plant. However, it still is available as a supplement. Sometimes the supplements do not include warnings. Blue cohosh is used for stimulating the uterus and starting labor; starting menstruation; stopping muscle spasms; as a laxative; and for treating colic, sore throat, cramps, hiccups, epilepsy, hysterics, inflammation of the uterus, infection of the female organs (pelvic inflammatory disease), over-growth of uterine tissue (endometriosis), and joint conditions. In foods, the roasted seeds of blue cohosh are used as a coffee substitute. It is thought that blue cohosh might have effects similar to the hormone estrogen. It also may narrow the vessels that carry blood to the heart that can decrease oxygen in the heart.

Uses

Insufficient Evidence

Dosing

The appropriate dose of blue cohosh depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for blue cohosh. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

14 Blue Flag

Blue flag is a plant. People use the underground stem (rhizome) of blue flag to make medicine. Despite serious safety concerns, blue flag is used as a laxative and to relieve fluid retention and bloating. It is also used to treat swelling (inflammation) and skin conditions; and to prevent vomiting. Some people use it for liver problems and to increase bile production. There isn't enough information to know how blue flag works.

Uses

Insufficient Evidence

Dosing

The appropriate dose of blue flag depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for blue flag. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

15 Black Cohosh

Black cohosh is an herb. The root of this herb is used for medicinal purposes. Black cohosh was first used for medicinal purposes by Native American Indians, who introduced it to European colonists. Black cohosh became a popular treatment for women's health issues in Europe in the mid-1950s. Since that time, black cohosh has commonly been used to treat symptoms of menopause, premenstrual syndrome (PMS), painful menstruation, acne, weakened bones (osteoporosis), and for starting labor in pregnant women. Black cohosh has also been tried for a lot of additional uses, such as anxiety, rheumatism, fever, sore throat, and cough, but it is not often used for these purposes these days. Some people also apply black cohosh directly on the skin. This is because there was some thought that black cohosh would improve the skin's appearance. Similarly, people used black cohosh for other skin conditions such as acne, wart removal, and even the removal of moles, but this is seldom done anymore. Black cohosh also goes by the name "bugbane" because it was once used as an insect repellent. It is no longer used for this purpose. Frontiersmen had said that black cohosh was useful for rattlesnake bites, but no modern researchers have tested this. Do not confuse black cohosh with blue cohosh or white cohosh. These are unrelated plants. The blue and white cohosh plants do not have the same effects as black cohosh, and may not be safe.

The root of black cohosh is used for medicinal purposes. Black cohosh root contains several chemicals that might have effects in the body. Some of these chemicals work on the immune system and might affect the body's defenses against diseases. Some might help the body to reduce inflammation. Other chemicals in black cohosh root might work in nerves and in the brain. These chemicals might work similar to another chemical in the brain called serotonin. Scientists call this type of chemical a neurotransmitter because it helps the brain send messages to other parts of the body. Black cohosh root also seems to have some effects similar to the female hormone, estrogen. In some parts of the body, black cohosh might increase the effects of estrogen. In other parts of the body, black cohosh might decrease the effects of estrogen. Estrogen itself has various effects in different parts of the body. Estrogen also has different effects in people at different stages of life. Black cohosh should not be thought of as an "herbal estrogen" or a substitute for estrogen. It is more accurate to think of it as an herb that acts similar to estrogen in some people.

Uses

Possibly Effective

Menopausal symptoms	Research shows that taking some black cohosh products can reduce some symptoms of menopause. However, the benefits are only modest. Black cohosh might lessen the frequency of hot flashes. Most of this research is for a specific commercial black cohosh product, Remifemin. The benefits may not occur with all products that contain black cohosh. Research using black cohosh products other than Remifemin have not always shown benefits for menopausal symptoms. Some of these studies show that these other black cohosh products do not reduce hot flashes or menopausal symptoms any better than a sugar pill ("placebo"). Some women take black cohosh for hot flashes related to breast cancer treatment. Women with breast cancer should not use black cohosh without talking to their cancer specialist or other health provider. Some early research suggested that black cohosh might reduce hot flashes in breast cancer patients, but more recent and higher quality research shows that black cohosh does not reduce hot flashes in women with breast cancer. Also, there is some question as to whether black cohosh is safe for women with breast cancer. It is important for a woman with breastcancer to discuss any use of black cohosh with her health provider before using it.

Insufficient Evidence

Breast cancer	One study suggests that taking black cohosh supplements is linked to a deceased risk of breast cancer. However, other research has found no link. One study found that taking black cohosh might increase survival in women already diagnosed with breast cancer.
Heart disease	Early research shows that taking 40 mg of a specific black cohosh extract (CR BNO 1055) daily does not lower the risk of heart disease in postmenopausal women.
Mental function	Early research suggests that taking 128 mg of black cohosh daily for 12 months does not improve memory or attention in postmenopausal women.
Infertility	Some early research suggests that taking black cohosh plus clomiphene citrate can increase pregnancy rates in infertile women compared to clomiphene citrate alone. Other research shows that taking black cohosh with clomiphene results in pregnancy rates that are similar to those found when clomiphene is taken with another fertility drug.
Induction of labor	Some people report that black cohosh can help start labor. As many as 45% of nurse-midwives use black cohosh to start labor in pregnant women at term. Despite its common use, there is no reliable scientific evidence that black cohosh works for this purpose.
Migraine headache	Early research shows that taking 50 mg of black cohosh plus soy isoflavones and dong quai daily for 24 weeks can reduce the occurrence of menstrual migraines.
Osteoarthritis	Early research suggests that taking a specific product containing black cohosh (Reumalex) twice daily for 2 months improves pain, but not joint function, in people with osteoarthritis.
Weak bones (Osteoporosis)	Evidence regarding the benefit of black cohosh for treating or preventing osteoporosis is unclear. Some early research shows that taking a specific black cohosh product (CR BNO 1055, Klimadynon/Menofem, Bionorica AG) daily for 12 weeks increases markers of bone formation in postmenopausal women. However, other research shows that taking the same black cohosh extract does not improve bone mineral density. It is not known if these black cohosh products can reduce the risk of bone fractures.
Rheumatoid arthritis	Early evidence suggests that taking a specific product containing black cohosh (Reumalex) twice daily for 2 months improves pain, but not joint function, in people with rheumatoid arthritis.

Dosing

BY MOUTH
Menopausal symptoms: 20-80 mg once or twice daily.
Weak bones (Osteoporosis): 40 mg daily.

16 Bladderwrack

Bladderwrack is a type of seaweed. People use the whole plant to make medicine. Bladderwrack is used for many conditions, but, so far, there isn't enough scientific evidence to determine whether or not it is effective for any of them. It's also important to note that it's not safe to take bladderwrack by mouth. Bladderwrack is used for thyroid disorders including underactive thyroid (myxedema), over-sized thyroid gland (goiter), and iodine deficiency. It is also used for obesity, arthritis, joint pain, "hardening of the arteries" (arteriosclerosis), digestive disorders, heartburn, "blood cleansing," constipation, bronchitis, emphysema, urinary tract disorders, and anxiety. Other uses include boosting the immune system and increasing energy. Some people also apply bladderwrack to the skin for skin diseases, burns, aging skin, and insect bites. Don't confuse bladderwrack with bladderwort. Bladderwrack, like many sea plants, contains varying amounts of iodine, which is used to prevent or treat some thyroid disorders. Bladderwrack products may contain varying amounts of iodine, which makes it an inconsistent source of iodine. Bladderwrack also contains algin, which can act as a laxative to help the stool pass through the bowels.

Uses

Insufficient Evidence

Obesity	Early research suggests that bladderwrack, used along with lecithin and vitamins, doesn't help people lose weight and keep it off.

Dosing

The appropriate dose of bladderwrack depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for bladderwrack. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

17 Brindle Berry Extract (Garcinia)

Garcinia is a small to medium-sized tree that grows in India and Southeast Asia. The fruit rind contains the chemical hydroxycitric acid (HCA) and is used to make medicine. Don't confuse garcinia with Garcinia hanburyi (gamboge resin). People try garcinia for weight loss and exercise performance, but there is no strong evidence to support these uses and using it can be unsafe. Garcinia contains the chemical hydroxycitric acid (HCA). Some laboratory research suggests that HCA might prevent fat storage, control appetite, and increase exercise endurance, but whether these effects occur in humans is unclear.

Uses

Insufficient Evidence

Exercise performance	Garcinia contains a chemical called hydroxycitric acid (HCA). Taking HCA might increase how long untrained women are able to exercise. But it does not seem benefit men in the same way.
Weight loss	It's unclear if garcinia helps people lose weight. Some research shows that it has a small benefit. Other research shows it doesn't help.

Dosing

The appropriate dose of garcinia depends on several factors such as the user's age, health, and several other conditions. At this time, there is not enough scientific information to determine an appropriate range of doses for garcinia. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

18 Comfrey

Comfrey is a plant. Even though this plant contains poisonous chemicals called pyrrolizidine alkaloids (PAs), the leaf, root, and root-like stem (rhizome) are used to make medicine. The amount of PAs found in comfrey changes according to the time of harvesting and the age of the plant. The roots have 10 times higher amounts of PAs than the leaves. Some products labeled "common comfrey" or Symphytum officinale actually contain the more poisonous "prickly comfrey" (Symphytum asperum) or "Russian comfrey" (Symphytum x uplandicum) species. Comfrey is used as a tea for upset stomach, ulcers, heavy menstrual periods, diarrhea, bloody urine, persistent cough, painful breathing (pleuritis), bronchitis, cancer, and chest pain (angina). It is also used as a gargle for gum disease and sore throat. Comfrey is applied to the skin for ulcers, wounds, joint inflammation, bruises, rheumatoid arthritis, swollen veins (phlebitis), gout, and fractures. The chemicals in comfrey might have a healing effect and reduce inflammation when applied to the skin. However, comfrey contains toxic chemicals that can be absorbed through the skin.

Uses

Possibly Effective

Back pain	Applying a comfrey extract ointment to the affected area for 5 days seems to decrease lower or upper back pain. Also applying a cream containing comfrey extract plus methyl nicotinate to the affected area for 5 days seems to decrease back pain when resting or moving.
Osteoarthritis	Applying a comfrey extract ointment to the affected area for 3 weeks or applying a specific cream containing comfrey extract, tannic acid, Aloe vera gel, eucalyptus oil, and frankincense oil to the affected are for 6-12 weeks seems to decrease pain in people with knee osteoarthritis.
Sprains	Early research shows that applying comfrey ointment to the affected area for up to 2 weeks improves mobility, decreases pain, and reduces tenderness and swelling of sprains. The effect of comfrey ointment in relieving pain and reducing swelling seems to be comparable to the effects of diclofenac gel.

Insufficient Evidence

Bruises	Early research shows that applying comfrey directly to the skin for 2 weeks might decrease pain and tenderness of bruises.

Dosing

APPLIED TO THE SKIN
For back pain: About 4 grams of a specific ointment containing 35% comfrey root extract has been applied three times daily for 5 days. About 4 grams of another cream containing 35% comfrey plus 1.2% methyl nicotinate has also been applied three times daily for 5 days. For osteoarthritis: About 2 grams of a specific ointment containing 35% comfrey root extract has been applied to the knee three times daily for 3 weeks. Also, about 3.5 grams of a specific cream containing comfrey extract, tannic acid, aloe vera gel, eucalyptus oil, and frankincense oil has been applied to the knee three times daily for 6-12 weeks. For sprains: About 2 grams of a specific ointment containing 35% comfrey extract has been applied to ankle sprains four times daily for 8 days.

19 Calendula

Calendula is a plant. The flower is used to make medicine. Calendula flower is used to prevent muscle spasms, start menstrual periods, and reduce fever. It is also used for treating sore throat and mouth, menstrual cramps, cancer, and stomach and duodenal ulcers. Calendula has also been used for measles, smallpox, and jaundice. Calendula is applied to the skin to reduce pain and swelling (inflammation) and to treat poorly healing wounds and leg ulcers. It is also applied to the skin (used topically) for nosebleeds, varicose veins, hemorrhoids, inflammation of the rectum (proctitis), ear infection, gum disease, peeling lips (exfoliative cheilitis), diaper rash, vaginal yeast infection, and inflammation of the lining of the eyelid (conjunctivitis). Essential oil of calendula has been used as an insect repellant. Don't confuse calendula with ornamental marigolds of the Tagets genus, which are commonly grown in vegetable gardens. It is thought that the chemicals in calendula help new tissue grow in wounds and decrease swelling in the mouth and throat.

Uses

Insufficient Evidence

Anal tears (anal fissures)	Early research suggests that that applying calendula to the affected area may reduce pain in people with anal tears who do not respond to treatment with sitz baths and the medication nifedipine.
Diabetic foot ulcers	Early research shows that using a calendula spray in addition to standard care and hygiene might prevent infection and decrease odor in people with long-term foot ulcer from diabetes.
Diaper Rash	Some early research suggests that applying a calendula ointment to the skin for 10 days improves diaper rash compared to aloe gel. But other early research shows that applying calendula cream does not improve diaper rash as effectively as bentonite solution.
Peeling Lips (Exfoliative Cheilitis	Early research shows that using calendula ointment for 15 days might help stop peeling lips.
Gum inflammation	Early research shows that rinsing the mouth with a specific calendula tincture for 6 months might decrease plaque, gum inflammation, and bleeding by 10% to 18% compared to using water to rinse. Other early research shows that rinsing the mouth with a combination mouthwash containing calendula, rosemary, and ginger for 2 weeks decreases plaque, gum inflammation, and bleeding compared to placebo mouthwash. In fact, it the combination mouthwash seems to work as effectively as chlorhexidine mouthwash.
Insect repellant	Applying calendula essential oil to the skin does not seem to repel mosquitoes as effectively as applying DEET.
Ear infections (otitis media)	Early research shows that applying a specific product that contains mullein, garlic, calendula, and St. John's wort to the ear for 3 days reduces ear pain in children and teenagers with ear infections.
Pressure ulcers	Early research shows that using a specific calendula product might improve the healing of long-term pressure ulcers.
Skin inflammation due to radiation therapy (radiation dermatitis)	Early research suggests that applying calendula ointment on the skin might reduce radiation dermatitis in people receiving radiation therapy for breast cancer. However, other early research shows that using a calendula cream is no different than petroleum jelly for reducing radiation dermatitis.
Thinning of the wall of the vagina (vaginal atrophy)	Early research suggests that applying a gel containing calendula, Lactobacillus sporogenes, isoflavones, and lactic acid to the vagina for 4 weeks reduces symptoms of vaginal atrophy such as vaginal itching, burning, dryness, and pain during intercourse.
Vaginal yeast infection	Early research shows that applying calendula cream inside the vagina for 7 days does not treat yeast infections as effectively as using clotrimazole cream.
Leg ulcers	Early research shows that applying a calendula ointment to the skin speeds up the healing of leg ulcers caused by poor blood circulation.
Wound healing	Early research shows that applying calendula ointment along with routine care does not improve the healing of surgical cut of the vagina made during childbirth.

Dosing

The appropriate dose of calendula depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for calendula. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

20 Chaste Tree Berry (Vitex Agnus-Castus)

Vitex agnus-castus tree is a shrub that is native to the Mediterranean and Central Asia. The shrub has long, finger-shaped leaves, blue-violet flowers, and dark purple berries. The fruit and seed are used to make medicine. Vitex agnus-castus is commonly taken by mouth for conditions related to the menstrual cycle such as premenstrual syndrome and a more severe form called premenstrual dysphoric disorder. It is also used for "lumpy" breasts and and many other conditions. Vitex agnus-castus seems to affect many hormones that are involved in women's reproductive cycle.

Uses

Possibly Effective

Premenstrual dysphoric disorder	Some research shows that vitex agnus-castus might work about as well as the prescription drug fluoxetine (Prozac) for relieving symptoms of this condition. Vitex agnus-castus seems to be better for physical symptoms like breast tenderness, swelling, and cramps. Fluoxetine seems to be better for depressed mood, feeling nervous and feeling out of control.

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Premenstrual syndrome	Some research shows that taking vitex agnus-castus decreases some symptoms, especially breast pain or tenderness, depressed mood or moodiness, anger, and headache. But it does not seem to help for bloating.

Possibly Ineffective

Bone fractures	Taking vitex agnus-castus extract does not seem to improve the healing of broken bones.

Insufficient Evidence

Bleeding caused by an intrauterine device	Early research shows that taking vitex agnus-castus three times daily might reduce bleeding caused by an intrauterine device.
Infertility	The effects of vitex agnus-castus on fertility is not clear. Some early research shows that it does not improve the chance of becoming pregnant in women with infrequent menstrual bleeding, but it might help those who do not produce enough progesterone.
Repelling insects	Early research shows that vitex agnus-castus seed extract repels ticks and fleas for 6 hours, mosquitoes for 3 to 8 hours, and biting flies for 3 hours, when applied to the skin.
Breast pain	Early research shows that vitex agnus-castus) might relieve breast pain.

Dosing

BY MOUTH
For premenstrual dysphoric disorder (PMDD): 20-40 mg of vitex agnus-castus extract taken daily for 8 weeks has been used.

For premenstrual syndrome (PMS): A specific extract known as BNO 1095 (Agnucaston/Cyclodynon, Bionorica AG), which contains 4 mg of vitex agnus-castus extract has been taken daily for three menstrual cycles. Another specific extract known as Ze 440 (Prefemin, Max Zeller Sohne AG, Romanshorn, Switzerland) which contains 20 mg of vitex agnus-castus extract has been taken daily for three menstrual cycles. Another specific product (Femicur, Schaper & Brummer GmbH & Co. KG, Salzgitter, Germany) containing 6.4-12 mg of vitex agnus-castus extract has been taken daily in two divided doses for three menstrual cycles. Specific capsules (Agnolyt, Madaus AG, Cologne, Germany) containing 3.5-4.2 mg of vitex agnus-castus extract has been taken daily on days 16-35 over three menstrual cycles. Vitex agnus-castus extract, 40 drops added to one glass of fruit juice once daily before breakfast starting 6 days prior to menstrual bleeding and lasting until menstrual bleeding occurs, has been used for six cycles.

21 Cat's Claw

Cat's claw is a plant. Two species of cat's claw, Uncaria tomentosa and Uncaria guianensis, are of primary interest for use as medicine. Uncaria tomentosa is most commonly used in the U.S., and Uncaria guianensis is typically used in Europe. Medicine is made from the root and bark. Be careful not to confuse cat's claw with cat's foot. Cat's claw is most commonly used for improving symptoms of both osteoarthritis and rheumatoid arthritis. It is also used for various digestive system disorders including swelling and pain (inflammation) of the large intestine (diverticulitis), inflammation of the lower bowel (colitis), inflammation of the lining of the stomach (gastritis), stomach ulcers, hemorrhoids, and leaky bowel syndrome. Some people use cat's claw for viral infections including shingles (caused by herpeszoster), cold sores (caused by herpes simplex), and AIDS (caused by human immunodeficiency virus (HIV)). Cat's claw is also used for chronic fatigue syndrome (CFS), wound healing, parasites, Alzheimer's disease, asthma, hay fever, cancer (especially urinary tract cancer), a particular type of brain cancer called glioblastoma, gonorrhea, dysentery, birth control, bone pains, and "cleansing" the kidneys. Cat's claw contains chemicals that might stimulate the immune system, kill cancer cells, and fight viruses.

Uses

Possibly Effective

Reducing pain from osteoarthritis	Taking a specific freeze-dried cat's claw extract (Uncaria guianensis) by mouth appears to relieve knee pain related to physical activity within one week of treatment, but it does not decrease pain at rest or decrease knee swelling. Taking a specific combination supplement (Reparagen) containing cat's claw (Vincaria) and maca (RNI 249) for 8 weeks seems to reduce pain and stiffness, improve function, and reduce the need to use rescue medication as well as taking glucosamine sulfate. Improving symptoms of a kind of arthritis called rheumatoid arthritis (RA) when used with regular rheumatoid arthritis medications. Taking a specific cat's claw extract (Uncaria tomentosa) that contains chemicals called pentacyclic oxindole alkaloids but is free of other chemicals called tetracyclic oxindole alkaloids appears to improve symptoms of RA somewhat. Taken by mouth in combination with sulfasalazine or hydroxychloroquine for 24 weeks, cat's claw seems to reduce the number of painful and swollen joints.

Insufficient Evidence

Human papilloma virus (HPV)	Early research suggests that taking a specific supplement containing echinacea, andrographis, grapefruit, papaya, pau d'arco, and cat's claw three times daily for one month can reduce the recurrence of anal warts after surgical removal in people with HPV.

Dosing

BY MOUTH
For osteoarthritis of the knee: 100 mg daily of a specific freeze-dried cat's claw extract.

For rheumatoid arthritis: 60 mg daily in three divided doses of a specific cat's claw extract that contains no chemicals called tetracyclic oxindole alkaloids. These chemicals, while found naturally in some cat's claw, work against other chemicals in cat's claw that seem to help rheumatoid arthritis.

22 Cordyceps

Cordyceps is a fungus that lives on certain caterpillars in the high mountain regions of China. Natural cordyceps is hard to get and may be expensive. Most supplements are made with cordyceps grown in a laboratory. Cordyceps is most commonly used for kidney disorders and male sexual problems. It is also used after a kidney transplant. It is also used for liver problems, improving athletic performance, and many other conditions but there is no good scientific evidence to support these uses. Cordyceps might improve immunity by stimulating cells and specific chemicals in the immune system. It may also have activity against cancer cells and may shrink tumor size, particularly with lung or skin cancers.

Uses

Possibly Ineffective

Athletic performance	Several studies have shown that taking cordyceps or a combination of cordyceps and roseroot does not improve endurance in trained male cyclists.

Insufficient Evidence

Kidney damage caused by the drug amikracin	Early research shows that using cordyceps with the drug amikracin might reduce kidney damage caused by the drug in older people.
Asthma	Early research suggests that taking cordyceps alone can reduce asthma symptoms in adults. However, other early research suggests that taking cordyceps along with other herbs for 6 months does not reduce the need for medication or improve asthma symptoms in children.
Chemotherapy	Early evidence shows that taking cordyceps by mouth during or after chemotherapy might improve quality of life and improve tolerance to the treatments.
Chronic kidney disease (CKD)	Early research suggests that taking cordyceps along with standard therapy for chronic kidney disease may improve kidney function. However, most of these studies are low quality and were conducted for only 6 months or less.
Kidney damage caused by contrast dyes (Contrast induced nephropathy	Some early research shows that taking cordyceps while undergoing an exam using contrast dye reduces the chance of kidney damage caused by the dye. But other early research shows no benefit.
Kidney damage caused by the drug cyclosporine	There is early evidence that taking cordyceps with cyclosporine can reduce kidney damage caused by cyclosporine in people with kidney transplants.
Hepatitis B	Early evidence shows that taking cordyceps by mouth might improve liver function in people with hepatitis B. However, cordyceps seems to be less effective than the supplements astragalus and polygonum (fo-ti).
Sexual desire	Early research suggests that taking a specific cordyceps product (CordyMax Cs-4) daily for 40 days can improve sex drive in people with low sex drive.
Kidney transplant	Early research shows that taking cordyceps with low-dose cyclosporine can improve 1-year survival, prevent transplant rejection, and reduce the risk of infection similar to taking standard dose cyclosporine in people who received a kidney transplant. Also cordyceps seems to improve kidney transplant survival, kidney transplant rejection, and infection similar to azathioprine when taken with medications to prevent organ rejection. It might also reduce the risk of long-term impaired kidney function called chronic allograft nephropathy. This is the leading cause of kidney transplant failure.

Dosing

The appropriate dose of cordyceps depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for cordyceps. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

23 Cardamom

Cardamom is an herb. The seeds and oil from the seeds are used to make medicine. Cardamom is used for digestion problems including heartburn, intestinal spasms, irritable bowel syndrome (IBS), diarrhea, constipation, liver and gallbladder complaints, and loss of appetite. It is also used for common cold and other infections, cough, bronchitis, sore mouth and throat, urinary problems, epilepsy, headache, and high blood pressure. In foods, cardamom is used as a spice. It is also used in soaps, creams, and perfumes. Cardamom contains chemicals that might treat intestinal spasms, kill some bacteria, reduce swelling, and help the immune system.

Uses

Insufficient Evidence

High blood pressure	Early research shows that taking cardamom by mouth might help reduce blood pressure in people with newly-diagnosed, untreated high blood pressure.
Nausea and vomiting that can occur after surgery	Early research shows that applying a mixture of ginger, cardamom, and tarragon essential oils to the neck after anesthesia and surgery may help relieve nausea and prevent vomiting for up to 30 minutes in some people. However, the effect seems to vary depending on the number of vomit-causing drugs that were given during anesthesia or as pain relievers during and/or after surgery. In other research, breathing in a mixture of cardamom, ginger, spearmint, and peppermint from a gauze pad after minor surgery reduces nausea and the amount of medicine needed to control it.

Dosing

The appropriate dose of cardamom for use as treatment depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for cardamom. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

24 Cocoa

Cocoa is the plant from which chocolate is made. Bitter chocolate is produced by pressing roasted cocoa kernels (seeds) between hot rollers. Cocoa powder is produced by squeezing the fat (cocoa butter) from bitter chocolate and powdering the remaining material. Sweet chocolate is produced by adding sugar and vanilla to bitter chocolate. White chocolate contains sugar, cocoa butter, and milk solids. Long regarded as a food treat, cocoa is now used by some people as medicine. Cocoa is commonly used by mouth for heart disease and high blood pressure. There is some scientific research that supports these uses. Some people apply cocoa butter to the skin to prevent wrinkles and stretch marks or take cocoa orally to treat many other conditions, including liver, bladder, and kidney disease and memory loss. But there is limited scientific research to support these other uses. Cocoa contains a variety of chemicals, including antioxidants called flavonoids. It is not clear how these might work in the body, but they appear to cause relaxation of veins. This could lead to lower blood pressure. These compounds might also reduce the activity of chemicals in the body that promote inflammation or blockage of blood vessels.

Uses

Possibly Effective

Heart disease	Some research shows that eating cocoa lowers the chance of heart disease and death, possibly by lowering blood pressure and improving the function of blood vessels.
High blood pressure	Most research shows that eating dark chocolate or cocoa products for 2-18 weeks can lower the top number in a blood pressure reading (systolic blood pressure) by 2.8-4.7 mmHg and the lower number (diastolic blood pressure) by 1.9-2.8 mmHg in people with normal blood pressure or high blood pressure.

Possibly Ineffective

High cholesterol	Cocoa products do not seem to improve cholesterol levels in people with high cholesterol.

Insufficient Evidence

Aging skin	Some research suggests that taking cocoa extract alone or in combination with other ingredients might improve skin wrinkles, elasticity, and roughness.
Chronic fatigue syndrome	Early research suggests that consuming a large amount of cocoa daily can reduce fatigue, anxiety, and depression and increase the overall ability to function in people with chronic fatigue syndrome.
Cirrhosis	Research suggests that consuming a liquid meal plus dark chocolate can improve liver health in people with cirrhosis.
Mental function	Evidence on the effects of cocoa for improving mental function is mixed. Some research shows that cocoa might improve some aspects of mental function. Other research show no benefit.
Constipation	Early research suggests that taking cocoa daily might soften stools in children with constipation.
Diabetes	Early research suggests that cocoa might reduce insulin resistance and improve sensitivity. However, cocoa does not appear to affect blood sugar levels.
Insect repellant	Early research suggests that applying cocoa oil to the skin reduces black fly insect bites.
High blood pressure in which only the first number (systolic pressure) is too high (isolated systolic hypertension)	Early research suggests that eating 100 grams of dark chocolate that is rich in cocoa flavonoids daily might slightly reduce systolic and diastolic blood pressure in elderly people with isolated systolic hypertension.
Parkinson's disease	Early research suggests that eating 200 mg of dark chocolate does not improve movement in people with Parkinson's disease.
Weight loss	Early research suggests that following a reduced-calorie diet, eating two squares of dark chocolate, and drinking a sugar-free cocoa beverage daily for 18 weeks does not increase weight loss.

Dosing

BY MOUTH
For heart disease: Cocoa 19-54 grams daily, dark chocolate 46-100 grams daily, or cocoa products containing 16.6-1080 mg of cocoa polyphenols daily.

For high blood pressure: Chocolate or cocoa providing 25-1,080 mg of cocoa polyphenols daily.

25 Coleus

Forskolin is a chemical found in the roots of the plant Plectranthus barbatus (Coleus forskohlii). This plant has been used since ancient times to treat heart disorders such as high blood pressure and chest pain (angina), as well as respiratory disorders such as asthma. When taken by mouth, forskolin is also used to treat allergies, skin conditions such as eczema and psoriasis, obesity, painful menstrual periods, irritable bowel syndrome (IBS), urinary tract infections (UTI), bladder infections, advanced cancer, blood clots, sexual problems in men, trouble sleeping (insomnia), and convulsions. Healthcare providers sometimes give forskolin intravenously (by IV) for heart failure. Some people breathe in (inhale) forskolin powder for asthma. Forskolin drops are used in the eyes to treat glaucoma. Herbal product manufacturers are now producing Coleus forskohlii extracts that contain high levels of forskolin. These preparations are being promoted for the same conditions for which forskolin has been traditionally used. However, currently there is no reliable scientific information that shows Coleus forskohlii extracts taken by mouth are effective. Forskolin works on muscles in the heart and in the walls of the blood vessels. It produces a more powerful heartbeat and widening of the blood vessels, which lowers blood pressure.

Uses

Possibly Effective

A heart condition called idiopathic congestive cardiomyopathy	Some research shows that giving coleus intravenously (by IV) may improve the function of the heart in people with congestive cardiomyopathy.
Asthma	Some research shows that inhaling a single dose of coleus can improve symptoms of asthma.

Insufficient Evidence

Erectile dysfunction (ED)	Early research suggests that injecting coleus into the base of the penis along with the drugs phentolamine, papaverine, and prostaglandin E1 improves sexual function in men with ED.
Increased pressure in the eyes	Some early research suggests that using coleus eye drops can significantly decrease eye pressure in healthy people without eye disease. Coleus has not yet been tested in patients with glaucoma.

Dosing

INTRAVENOUS
Healthcare providers give forskolin intravenously (by IV) for a heart condition called idiopathic congestive cardiopathy.

INHALATION
Under medical supervision, people with asthma breathe in forskolin powder using a Spinhaler inhalator.

26 Club Moss

NATURAL REMEDIES | Herbs | Club Moss

Club moss is an herb. People use the whole plant to make medicine. Despite safety concerns, people use club moss for bladder and kidney disorders, and as a diuretic to increase urine. Don't confuse club moss with Chinese club moss. Only Chinese club moss contains huperzine A, a chemical which is thought to be helpful in dementia, memory loss, and myasthenia gravis. There isn't enough information available to know how club moss works.

Uses

Insufficient Evidence

Dosing

The appropriate dose of club moss depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for club moss. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

27 Cassia Cinnamon

Cassia cinnamon is a type of cinnamon. It is prepared from the dried inner bark of a certain evergreen tree. In addition to cassia cinnamon, Cinnamomum verum (Ceylon cinnamon) is commonly used. The cinnamon spice found in food stores might contain both of these types of cinnamon. But, the most common cinnamon sold in North America is cassia cinnamon. People take Cassia cinnamon by mouth for diabetes and prediabetes, gas (flatulence), muscle and stomach spasms, preventing nausea and vomiting, diarrhea, infections, the common cold, and loss of appetite. Some people use it for erectile dysfunction (ED), hernia, bed-wetting, joint pain, menopausal symptoms, menstrual problems, and to cause abortions. Cassia cinnamon is also used for chest pain, kidney disorders, high blood pressure, cramps, and cancer. People apply cassia cinnamon to the skin to repel mosquitos. In food and beverages, cassia cinnamon is used as a flavoring agent. Cassia cinnamon contains hydroxychalcone and similar chemicals. These chemicals seem to improve insulin sensitivity. Cassia cinnamon also contains chemicals that may activate blood proteins that increase blood sugar uptake. These effects may improve blood sugar control in patients with diabetes. Cassia cinnamon also contains cinnamaldehyde. This chemical might have activity against bacteria and fungi. It also seems to stop the growth of some types of solid tumor cells.

Uses

Insufficient Evidence

Prediabetes	One small study shows that taking cassia cinnamon for 3 months does not help to control blood sugar or lower cholesterol in people with prediabetes.
Mosquito repellent	Early research suggests that applying cassia cinnamon oil cream to the skin can protect against mosquito bites. But, it seems to decrease in effectiveness faster than creams containing citronella and geranium oils or DEET.

Dosing

The appropriate dose of cassia cinnamon depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for cassia cinnamon. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

28 Chlorella

Chlorella is a type of algae that grows in fresh water. The whole plant is used to make nutritional supplements and medicine. Most of the chlorella that is available in the U.S. is grown in Japan or Taiwan. It is processed and made into tablets and liquid extracts. These extracts contain "chlorella growth factor," which is described as a water-soluble extract of chlorella containing chemicals including amino acids, peptides, proteins, vitamins, sugars, and nucleic acids. Be aware that chlorella products can vary significantly depending on the way "the crop" used to make them was cultivated, harvested, and processed. Investigators have found that dried preparation of chlorella can contain from 7% to 88% protein, 6% to 38% carbohydrate, and 7% to 75% fat. Chlorella is a good source of protein, fats, carbohydrates, fiber, chlorophyll, vitamins, and minerals. It may act as an antioxidant and help to decrease cholesterol, but more research is still needed.

Uses

Possibly Effective

Iron deficiency during pregnancy	Early research shows that taking chlorella might reduce the risk of anemia caused by too little iron in the body when taken by women who are pregnant.

Possibly Ineffective

Pregnancy-induced high blood pressure	Early research shows that taking chlorella during pregnancy does not reduce the risk of high blood pressure (gestational hypertension).

Insufficient Evidence

Depression	Early research shows that taking chlorella extract tablets for 6 weeks, in addition to already prescribed antidepressant medications, may improve some symptoms of depression and anxiety in patients with major depression disorder.
Fibromyalgia	Some people with fibromyalgia say they feel better when they take chlorella tablets plus a liquid extract containing malic acid daily for 2 months.
Brain tumor (gilioma)	Early research shows that taking chlorella tablets plus chlorella liquid extract might help people with a type of brain cancer called glioma better tolerate chemotherapy and radiation treatments. However, chlorella does not seem to slow the progression of the cancer or improve survival.
Hepatitis C	Early research shows that taking chlorella for 12 weeks improves liver inflammation but does not decrease levels of the hepatitis C virus in the blood.
High cholesterol	Early research shows that taking chlorella for 4 weeks decreases total cholesterol and triglycerides but does not decrease LDL "bad" cholesterol or increase HDL "good" cholesterol.
High blood pressure	Early research shows that taking chlorella daily for 1-2 months does not reduce blood pressure in people with high blood pressure.

Metabolic syndrome	Early research shows that taking a product containing a combination of red yeast rice, bitter melon, chlorella, licorice, and soy protein for 12 weeks decreases total cholesterol, LDL "bad" cholesterol, and triglyceride levels, but does not improve waist circumference, HDL "good" cholesterol, or blood sugar levels.

Dosing

ADULTS
BY MOUTH
For iron deficiency during pregnancy: Chlorella (Sun Chlorella A by Sun Chlorella Corp.) 2 grams three times daily has been taken from the 12-18th week of gestation, until delivery.

29 Camu Camu

Camu camu is a shrub that grows in swampy or flooded areas of the Amazon rain forests of Peru, Brazil, Venezuela, and Colombia. The fruit and leaves are used as a medicine. Camu camu is used for viral infections including herpes, cold sores, shingles, and the common cold. It is also used for eye conditions including cataracts and glaucoma. Other uses include treatment of asthma, "hardening of the arteries" (atherosclerosis), chronic fatigue syndrome, depression, gum disease (gingivitis), headaches, and osteoarthritis. Some people use camu camu to increase energy and maintain healthy gums, eyes, and skin; and as an antioxidant and immune system stimulant. People eat the fruit as food. Camu camu fruit contains many nutrients including vitamin C, beta-carotene, fatty acids, protein, and others. It also contains other chemicals that might have an effect on the body. However, there is not enough information to know how camu camu might work for treating or preventing any medical condition.

Uses

Insufficient Evidence

Dosing

The appropriate dose of camu camu depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for camu camu. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

30 Chickweed

Chickweed is a plant. The leaf is used to make medicine. People take chickweed for constipation, stomach and bowel problems, blood disorders, asthma and other lung diseases, obesity, a vitamin C deficiency disease called scurvy, a skin condition called psoriasis, rabies, itching, and muscle and joint pain. Chickweed is sometimes applied directly to the skin for skin problems including boils, abscesses, and ulcers. In foods, chickweed is eaten in salads or served as cooked greens. There isn't enough information to know how chickweed might work. While some people try chickweed for a vitamin C deficiency disease called scurvy, the amount of vitamin C in chickweed is too small to be effective.

Uses

Insufficient Evidence

Dosing

The appropriate dose of chickweed depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for chickweed. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

31 Comfrey

Comfrey is a plant. Even though this plant contains poisonous chemicals called pyrrolizidine alkaloids (PAs), the leaf, root, and root-like stem (rhizome) are used to make medicine. The amount of PAs found in comfrey changes according to the time of harvesting and the age of the plant. The roots have 10 times higher amounts of PAs than the leaves. Some products labeled "common comfrey" or Symphytum officinale actually contain the more poisonous "prickly comfrey" (Symphytum asperum) or "Russian comfrey" (Symphytum x uplandicum) species. Comfrey is used as a tea for upset stomach, ulcers, heavy menstrual periods, diarrhea, bloody urine, persistent cough, painful breathing (pleuritis), bronchitis, cancer, and chest pain (angina). It is also used as a gargle for gum disease and sore throat. Comfrey is applied to the skin for ulcers, wounds, joint inflammation, bruises, rheumatoid arthritis, swollen veins (phlebitis), gout, and fractures. The chemicals in comfrey might have a healing effect and reduce inflammation when applied to the skin. However, comfrey contains toxic chemicals that can be absorbed through the skin.

Uses

Possibly Effective

Back pain	Applying a comfrey extract ointment to the affected area for 5 days seems to decrease lower or upper back pain. Also applying a cream containing comfrey extract plus methyl nicotinate to the affected area for 5 days seems to decrease back pain when resting or moving.
Osteoarthritis	Applying a comfrey extract ointment to the affected area for 3 weeks or applying a specific cream containing comfrey extract, tannic acid, Aloe vera gel, eucalyptus oil, and frankincense oil to the affected are for 6-12 weeks seems to decrease pain in people with knee osteoarthritis.
Sprains	Early research shows that applying comfrey ointment to the affected area for up to 2 weeks improves mobility, decreases pain, and reduces tenderness and swelling of sprains. The effect of comfrey ointment in relieving pain and reducing swelling seems to be comparable to the effects of diclofenac gel.

Insufficient Evidence

NATURAL REMEDIES | Herbs | Comfrey

Bruises	Early research shows that applying comfrey directly to the skin for 2 weeks might decrease pain and tenderness of bruises.

Dosing

APPLIED TO THE SKIN
For back pain: About 4 grams of a specific ointment containing 35% comfrey root extract has been applied three times daily for 5 days. About 4 grams of another cream containing 35% comfrey plus 1.2% methyl nicotinate has also been applied three times daily for 5 days.

For osteoarthritis: About 2 grams of a specific ointment containing 35% comfrey root extract has been applied to the knee three times daily for 3 weeks. Also, about 3.5 grams of a specific cream containing comfrey extract, tannic acid, aloe vera gel, eucalyptus oil, and frankincense oil has been applied to the knee three times daily for 6-12 weeks.

For sprains: About 2 grams of a specific ointment containing 35% comfrey extract has been applied to ankle sprains four times daily for 8 days.

32 Catnip

Catnip is a plant. The flowering tops are used to make medicine. Catnip is used for trouble sleeping (insomnia); anxiety; migraine and other headaches; cold and other upper respiratory infections; flu; swine flu; fever; hives; worms; and gastrointestinal (GI) upset, including indigestion, colic, cramping, and gas (flatulence). It is also used as a tonic, for increasing urination, and for starting menstrual periods in girls with delayed onset of menstruation. Some people apply catnip directly to the skin for arthritis, hemorrhoids, and as a compress to relieve swelling. Some people also smoke catnip medicinally for respiratory conditions and recreationally for a "high." In manufacturing, catnip is used as a pesticide and insecticide. It is thought that the chemicals in catnip have a calming effect.

Uses

Insufficient Evidence

Mosquito repellent	Early research suggests that applying catnip oil or certain catnip chemicals to the skin may help repel yellow fever mosquitos. However, the commercial insect repellents SS220 and DEET might work better.

Dosing

The appropriate dose of catnip depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for catnip. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

33 Chaga

Chaga is a fungus. It produces a woody growth, called a conk, which is used to make medicine. People take chaga by mouth for heart disease, diabetes, stomach and intestine cancer, liver disease, parasites, stomach pain, and tuberculosis. Chaga might stimulate the immune system. It contains some chemicals that have antioxidant effects. Chaga might lower blood sugar and cholesterol levels.

Uses

Insufficient Evidence

Dosing

The appropriate dose of chaga depends on several factors such is the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for chaga. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

34 Cascara Sagrada

Cascara sagrada is a shrub. The dried bark is used to make medicine. Cascara sagrada used to be approved by the U.S. Food and Drug Administration (FDA) as an over-the-counter (OTC) drug for constipation. However, over the years, concerns were raised about cascara sagrada's safety and effectiveness. The FDA gave manufacturers the chance to submit safety and effectiveness information to answer these concerns. But the companies decided the cost of conducting safety and effectiveness studies would likely be more than the profit they could expect from sales of cascara sagrada. So they didn't comply with the request. As a result, the FDA notified manufacturers to remove or reformulate all OTC laxative products containing cascara sagrada from the U.S. market by November 5, 2002. Today, you can buy cascara sagrada as a "dietary supplement," but not as a drug. "Dietary supplements" don't have to meet the standards that the FDA applies to OTC or prescription drugs. Cascara sagrada is commonly used by mouth as a laxative for constipation. In foods and beverages, a bitterless extract of cascara sagrada is sometimes used as a flavoring agent. In manufacturing, cascara sagrada is used in the processing of some sunscreens.

Uses

Possibly Effective

Constipation	Cascara sagrada has laxative effects and may help relieve constipation in some people.

Possibly Ineffective

Bowel preparation before colonoscopy	Most research shows that taking cascara sagradaalong with magnesium sulfate or milk of magnesia does not improve bowel cleansing in people who are undergoing a colonoscopy.

Dosing

The appropriate dose of cascara sagrada depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for cascara sagrada. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

NATURAL REMEDIES | Herbs

35 Diatomaceous Earth

Diatomaceous earth is a type of powder made from the sediment of fossilized algae found in bodies of water. Because the cells of these algae were high in a compound called silica, the dried sediment produced from these fossils are also very high in silica. These deposits are found all over the world. The ancient Greeks used diatomaceous earth to make building materials, like bricks and blocks. Later on it became popular in Europe for various industrial uses. When taken by mouth, diatomaceous earth is used as a source of silica, for treating high cholesterol levels, for treating constipation, and for improving the health of skin, nails, teeth, bones, and hair. When applied to the skin or teeth, diatomaceous earth is used to brush teeth or remove unwanted dead skin cells. Diatomaceous earth is also used in industry. It is used to remove unwanted material from drinking water. It is also used as a filler or to prevent formation of lumps in foods, medicine, paints and plastics, and pet litter. It is used to clean up spills or for insulation in industry, as well as to scrub things. Diatomaceous earth is used as part of various chemical tests. It is also used as an insecticide. Diatomaceous earth is a powder containing about 80%-90% silica. Diatomaceous earth is thought to kill insects by dehydrating them or drying them out. Also, the powder allows liquids to flow through while capturing unwanted material.

Uses

Insufficient Evidence

High cholesterol levels	Early research suggests taking diatomaceous earth might reduce levels of cholesterol in the blood patients with high cholesterol levels.

Dosing

The appropriate dose of diatomaceous earth depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for diatomaceous earth in children or adults. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

36 Devil's Claw

Devil's claw is an herb. The botanical name, Harpagophytum, means "hook plant" in Greek. This plant gets its name from the appearance of its fruit, which is covered with hooks meant to attach onto animals in order to spread the seeds. The roots and tubers of the plant are used to make medicine. Devil's claw is used for "hardening of the arteries" (atherosclerosis), arthritis, gout, muscle pain (myalgia), back pain, fibromyalgia, tendonitis, chest pain, gastrointestinal (GI) upset or heart burn, fever, and migraine headache. It is also used for difficulties in childbirth, menstrual problems, allergic reactions, loss of appetite, and kidney and bladder disease. Some people apply devil's claw to the skin for injuries and other skin conditions. Devil's claw contains chemicals that might decrease inflammation and swelling and resulting pain.

Uses

Possibly Effective

Back pain	Taking devil's claw by mouth seems to reduce low-back pain. Devil's claw seems to work about as well as some non-steroidal anti-inflammatory drugs (NSAIDs).
Osteoarthritis	Taking devil's claw alone or along with nonsteroidal anti-inflammatory drugs (NSAIDs) seems to help decrease osteoarthritis-related pain. Some evidence suggests that devil's claw works about as well as diacerhein (a slow-acting drug for osteoarthritis that is not available in the U.S.) for improving osteoarthritis pain in the hip and knee after 16 weeks of treatment. Some people taking devil's claw seem to be able to lower the dose of NSAIDs they need for pain relief.

Insufficient Evidence

Rheumatoid arthritis (RA)	Early research suggests that taking devil's claw extract by mouth might not improve RA.

Dosing

BY MOUTH
For osteoarthritis: 2-2.6 grams of devil's claw extract have been taken in up to three divided doses daily for up to 4 months. A specific combination product providing 600 mg of devil's claw, 400 mg of turmeric, and 300 mg of bromelain has been taken 2-3 three times daily for up to 2 months.

For back pain: 0.6-2.4 grams of devil's claw extract has been taken daily, usually in divided doses, for up to 1 year.

37 Dandelion

Dandelion is an herb. People use the above ground parts and root to make medicine. Dandelion is used for many conditions, but so far, there isn't enough scientific evidence to determine whether or not it is effective for any of them. Dandelion is used for loss of appetite, upset stomach, intestinal gas, gallstones, joint pain, muscle aches, eczema, and bruises. Dandelion is also used to increase urine production and as a laxative to increase bowel movements. It is also used as skin toner, blood tonic, and digestive tonic. Some people use dandelion to treat infection, especially viral infections, and cancer. In foods, dandelion is used as salad greens, and in soups, wine, and teas. The roasted root is used as a coffee substitute. Dandelion contains chemicals that may increase urine production and decrease swelling (inflammation).

Uses

Insufficient Evidence

Inflammation of the tonsils (Tonsillitis)	An early study found that people who had their tonsils removed recovered faster if they ate soup containing dandelion compared to those who ate soup without dandelion.
Preventing urinary tract infections (UTIs)	A specific combination of dandelion root and leaf extracts of another herb called uva ursi taken by mouth seems to help reduce the number of UTIs in women. In this combination, uva ursi is used because it seems to kill bacteria, and dandelion is used to increase urine flow. However, this combination should not be used long-term because it is not known if uva ursi is safe for extended use.

Dosing

The appropriate dose of dandelion depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for dandelion. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

38 Damiana

Damiana is a wild shrub that grows in Mexico, Central America, and the West Indies. The leaf and stem are used to make medicine. Historically, it was used mostly to increase sexual desire (as an aphrodisiac). Damiana is commonly used by mouth as an aphrodisiac and to treat sexual problems. It is also used to treat stomach complains such as dyspepsia, diarrhea, and constipation and to improve symptoms of menopause and premenstrual syndrome (PMS). But there is little scientific evidence to support its use for any of these conditions. Some people inhale damiana for a slight "high." Damiana contains chemicals that may affect the brain and nervous system.

Uses

Insufficient Evidence

Sexual problems	Early research suggests that taking a specific combination product containing damiana, L-arginine, American ginseng, Panax ginseng, ginkgo, vitamins, and minerals might improve sexual satisfaction, increase orgasm frequency, and reduce vaginal dryness in women with sexual problems who are interested in improving their sex lives.
Weight loss	Early research suggests that taking a specific combination product containing damiana, guarana, and yerba mate might reduce body weight in people who are overweight.

Dosing

The appropriate dose of damiana depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for damiana. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

39 Dong Quai

Dong quai is a plant. The root is used to make medicine. Dong quai is commonly taken by mouth for menopausal symptoms, menstrual cycle conditions such as migraines and many other conditions. Dong quai root has been shown to affect estrogen and other hormones in animals. It is not known if these same effects happen in humans.

Uses

Possibly Effective

Menopausal symptoms	Various combination products that contain dong quai seem to reduce menopausal symptoms. Taking a specific product containing dong quai and chamomile (Climex) seems to reduce hot flushes in menopausal women. Taking a specific product containing American ginseng, black cohosh, dong quai, milk thistle, red clover, and vitex agnus-castus (Phyto-Female complex) seems to reduce hot flushes and night sweats and improve sleep quality in pre- and post-menopausal women. Taking a product containing burdock root, licorice root, motherwort, dong quai, and Mexican wild yam root seems to reduce menopausal symptoms as well. However, some evidence suggests that taking dong quai alone does to improve symptoms of menopause.
Premature ejaculation	When applied directly to the skin of the penis in combination with other herbs. The other herbs are Panax ginseng root, Cistanches deserticola, Zanthoxyl species, Torlidis seed, clove flower, Asiasari root, cinnamon bark, and toad venom (SS Cream).

Insufficient Evidence

Heart disease	Some early research shows that a natural medicine containing dong quai and other herbs given by injection might reduce chest pain, and improve heart function in people with heart disease.
High blood pressure in arteries carrying blood from the heart to the lungs (pulmonary hypertension)	Some early research shows that dong quai given by injection might reduce blood pressure and improve blood flow in people with chronic obstructive pulmonary disorder (COPD) and pulmonary hypertension.
Menopausal symptoms	Some early research shows that taking dong quai does not reduce hot flashes.
Stroke	Some rarly research shows that dong quai given by injection for 20 days does not improve brain function in people who had a stroke.

Dosing

BY MOUTH
For menopausal symptoms: 15 chewable tablets of a product containing dong quai and chamomile (Climex) have been taken daily for 12 weeks. A specific product containing American ginseng, black cohosh, dong quai, milk thistle, red clover, and vitex agnus-castus (Phyto-Female Complex) has been taken twice daily for 3 months. A specific product containing burdock root, licorice root, motherwort, dong quai, and Mexican wild yam root has been taken three times daily for 3 months.

APPLIED TO THE SKIN
For early orgasm in men (premature ejaculation): A specific cream containing Panax ginseng root, dong quai, Cistanches deserticola, Zanthoxyl species, Torlidis seed, clove flower, Asiasari root, cinnamon bark, and toad venom (SS Cream) has been applied to the glans penis 1 hour before sex and washed off immediately before sex.

40 Euphorbia

Euphorbia is an herb. The parts of the plant that grow above the ground are used to make medicine. Euphorbia is used for breathing disorders including asthma, bronchitis, and chest congestion. It is also used for mucus in the nose and throat, throat spasms, hay fever, and tumors. Some people use it to cause vomiting. In India, it is also used for treating worms, severe diarrhea (dysentery), gonorrhea, and digestive problems. Some researchers have studied how euphorbia might work in animals, but there isn't enough information to know how euphorbia might work in people.

Uses

Insufficient Evidence

NATURAL REMEDIES
Herbs
Euphorbia

Dosing

The appropriate dose of euphorbia depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for euphorbia. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

41 Horny Goat Weed (Epimedium)

Horny goat weed is an herb. The leaves are used to make medicine. As many as 15 horny goat weed species are known as "yin yang huo" in Chinese medicine. Horny goat weed is commonly used by mouth for sexual performance problems, such as erectile dysfunction (ED) and low sexual desire. It is also used for weak back and knees, joint pain, arthritis, mental and physical fatigue, and memory loss along with many other conditions. But there is limited scientific research to support any of these uses. Horny goat weed contains chemicals which might help increase blood flow and improve sexual function. It also contains phytoestrogens, chemicals that act somewhat like the female hormone estrogen. This might reduce bone loss in postmenopausal women.

Uses

Insufficient Evidence

Osteoporosis	Taking a specific extract of horny goat weed for 24 months in combination with calcium supplements decreases bone loss of the spine and hip in women who have passed menopause better than taking calcium alone. Chemicals in the extract act somewhat like the hormone estrogen.
Postmenopausal conditions	Taking horny goat weed water extract for 6 months can decrease cholesterol and increase estrogen levels in postmenopausal women.

Dosing

The appropriate dose of horny goat weed depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for horny goat weed. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

42 Evodia

Evodia is a tree that is native to China and Korea. Evodia fruit, which has a strong bitter taste, is commonly used in Traditional Chinese Medicine. The fruit and root bark are also used as medicine in other herbal practice. Evodia is used for digestion problems including diarrhea, dysentery, nausea, vomiting, abdominal pain, gastroesophageal reflux disease (GERD), stomach ulcers, and lack of appetite. It is also used for obesity, headache, high blood pressure, congestive heart failure (CHF), infections caused by viruses, Alzheimer's disease, cancer, and fluid retention. Women use evodia to prevent pregnancy, start their periods, and treat bleeding after giving birth. Evodia root bark is used for infections caused by parasites such as tapeworm and pinworm. Chemicals contained in evodia might have several effects in the body. They might decrease pain and swelling (inflammation), decrease diarrhea, decrease blood pressure, stimulate the heart, and have many other effects. But these effects have only been shown in animals. There is not enough information to know if evodia has these effects in people.

Uses

Insufficient Evidence

Dosing

The appropriate dose of evodia depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for evodia. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

43 Goat's Rue

Goat's rue is a plant. The parts that grow above the ground are used to make medicine. Be careful not to confuse goat's rue (Galega officinalis) with rue (Ruta graveolens). Goat's rue is used along with conventional treatment for diabetes and as a diuretic. In combination with other herbs, goat's rue is used to stimulate the adrenal gland and pancreas; to protect the liver; for digestion problems; and to start the flow of breast milk. Some people use herbal combinations that include goat's rue as a tonic and for "blood purification." Goat's rue contains a chemical that may lower blood sugar in a test tube. But it is unclear if goat's rue has this effect when taken by people.

Uses

Insufficient Evidence

Dosing

The appropriate dose of goat's rue depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for goat's rue. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

44 Ginko

NATURAL REMEDIES Herbs Ginko

Ginkgo is a large tree with fan-shaped leaves. Although Ginkgo is a native plant to China, Japan, and Korea, it has been grown in Europe since around 1730 and in the United States since around 1784. The ginkgo tree is thought to be one of the oldest living trees, dating back to more than 200 million years. Ginkgo leaf is often taken by mouth for memory disorders including Alzheimer's disease. It is also used for conditions that seem to be due to reduced blood flow in the brain, especially in older people. These conditions include memory loss, dizziness, difficulty concentrating, and mood disturbances. Some people use it for leg pain when walking related to poor blood flow (claudication). The list of other uses of ginkgo is very long. This may be because this herb has been around for so long. Ginkgo biloba is one of the longest living tree species in the world. Ginkgo trees can live as long as a thousand years. Using ginkgo for asthma and bronchitis was described in 2600 BCE. In manufacturing, ginkgo leaf extract is used in cosmetics. In foods, roasted ginkgo seed, which has the pulp removed, is an edible delicacy in Japan and China. Ginkgo seems to improve blood circulation, which might help the brain, eyes, ears, and legs function better. It may act as an antioxidant to slow down Alzheimer's disease and interfere with changes in the brain that might cause problems with thinking. Ginkgo seeds contain substances that might kill the bacteria and fungi that cause infections in the body. The seeds also contain a toxin that can cause serious side effects like seizures and loss of consciousness.

Uses

Possibly Effective

Anxiety	Research shows that taking a ginkgo extract for 4 weeks can reduce symptoms of anxiety.
Dementia related to Alzheimer's disease	Some research shows that taking ginkgo for up to one year slightly improves some symptoms of Alzheimer's, vascular, or other dementias. Doses of 240 mg per day might work better than doses of 120 mg per day. However, there are concerns that findings from many of these studies may not be reliable. While most research shows that ginkgo helps for symptoms of Alzheimer's disease and other dementias, there are some conflicting findings. This makes it hard to determine which people might benefit. While ginkgo may help treat the symptoms of various types of dementia, ginkgo does not appear to help prevent dementia from developing. Also, it does not appear to prevent Alzheimer's related dementia from getting worse. Early research shows that taking a specific ginkgo leaf extract called EGb 761 (Dr. Willmar Schwabe Pharmaceuticals) daily for 22-24 weeks seems to be as effective as the drug donepezil (Aricept) for treating mild to moderate Alzheimer's disease. But, other research suggests that ginkgo leaf extract might be less effective than the conventional drugs donepezil (Aricept) and tacrine (Cognex). Taking ginkgo together with prescription medications like donepezil or rivastigmine does not appear to be better than taking the medication alone for the symptoms of Alzheimer's disease.
Vision problems in people with diabetes	There is some evidence that taking ginkgo leaf extract by mouth for 6 months can improve color vision in people with retinal damage caused by diabetes.
Vision loss related to glaucoma	Taking ginkgo leaf extract by mouth for up to 12.3 years seems to improve pre-existing damage to the visual field in some people with glaucoma. However, since conflicting research shows that ginkgo does not prevent glaucoma progression when taken for only 4 weeks, it may need to be taken for a longer time in order to see any improvement.
Leg pain when walking related to poor blood flow (peripheral vascular disease).	Some evidence shows that taking ginkgo leaf extract increases the distance people with poor blood circulation in their legs can walk without pain. Taking ginkgo might also reduce the chance of requiring surgery. However, people with this condition may need to take ginkgo for at least 24 weeks before they see improvement.
Premenstrual syndrome (PMS)	Taking ginkgo leaf extract by mouth seems to relieve breast tenderness and other symptoms associated with PMS when started during the 16th day of the menstrual cycle and continued until the 5th day of the following cycle.
Schizophrenia	Research shows that taking ginkgo daily in addition to conventional antipsychotic medications for 8-16 weeks can reduce symptoms of schizophrenia. It may also reduce some side effects like thirst and constipation and adverse effects associated with the antipsychotic medication, haloperidol.
A movement disorder called tardive dyskinesia. Tardive dyskinesia is a movement disorder that is caused by certain antipsychotic drugs.	Research shows that taking a specific ginkgo extract (EGb 761, Yi Kang Ning, Yang Zi Jiang Pharmaceuticals Ltd., Jiangsu, China) for 12 weeks can reduce the severity of tardive dyskinesia symptoms in people with schizophrenia who are taking antipsychotic drugs.
Dizziness (vertigo)	Taking ginkgo leaf extract by mouth seems to improve symptoms of dizziness and balance disorders.

Possibly Ineffective

Sexual dysfunction caused by antidepressant drugs	Although some early research suggests that taking ginkgo leaf extract by mouth might improve sexual problems caused by antidepressant drugs, more recent research suggests it is probably not effective.
Mental problems caused by chemotherapy.	Research shows that taking a specific ginkgo leaf extract called EGb 761 (Dr. Willmar Schwabe Pharmaceuticals) twice daily starting before the second cycle of chemotherapy and continuing until one month after chemotherapy treatment ends does not prevent mental problems caused by the chemotherapy in people being treated for breast cancer.
High blood pressure	Research shows that taking a specific ginkgo leaf extract (EGb 761) by mouth for up to 6 years does not reduce blood pressure in older people with high blood pressure.
Multiple sclerosis	Taking ginkgo leaf extract or ginkgolide B, a specific chemical found in ginkgo extract, does not improve mental function or disability in people with multiple sclerosis.
Seasonal depression (seasonal affective disorder)	Taking ginkgo leaf extract by mouth does not seem to prevent winter depression symptoms in people with seasonal depression.
Ringing in the ears (tinnitus)	Taking ginkgo leaf extract by mouth does not seem to improve ringing in the ears.

Likely Ineffective

Heart disease	Taking a specific ginkgo extract (EGb 761, Dr. Willmar Schwabe Pharmaceuticals) does not reduce the chance of having a heart attack, chest pain, or stroke in elderly people.

Insufficient Evidence

Age-related vison loss (age-related macular degeneration)	There is some early evidence that ginkgo leaf extract might improve symptoms and distance vision in people with age-related vision loss.
Hayfever (allergic rhinitis)	Early research shows that applying specific eye drops (Trium, SOOFT) that contain ginkgo extract and hylauronic acid three times daily for one month can reduce eye redness, swelling and discharge in people with swollen eyes due to seasonal allergies.

Altitude sickness	Research on the effects of ginkgo leaf extract on altitude sickness is inconsistent. Some research suggests that taking ginkgo leaf extract can reduce altitude sickness symptoms when taken 4 days before climbing. However, other research shows that using a specific ginkgo extract (GK501, Pharmaton Natural Health Products) for 1-2 days before climbing does not prevent altitude sickness.
Asthma	Research shows that taking two capsules of a specific product containing ginkgo extract, ginger, and Picrorhiza kurroa (AKL1, AKL International Ltd) twice daily for 12 weeks does not improve lung function or asthma symptoms in adults with asthma.
Attention deficit-hyperactivity disorder (ADHD)	The effect of ginkgo on symptoms related to ADHD is unclear. There is early evidence that a product containing ginkgo leaf extract and American ginseng might help improve ADHD symptoms such as anxiety, hyperactivity, and impulsiveness in children 3-17 years-old. But other research shows that taking ginkgo extract does not improve ADHD symptoms compared to methylphenidate, a drug used to treat ADHD, in children 6-14 years-old. Also, taking gingko extract along with methylphenidate does not seem to greatly improve parent or teacher reported ADHD symptoms compared to methylphenidate alone in children 6-12 years-old.
Autism	Research shows that taking a specific ginkgo extract (Ginko T.D. Tolidaru Pharmaceuticals) daily for 10 weeks along with conventional medication does not improve autism symptoms in children.
A lung disease called chronic obstructive pulmonary disease (COPD)	Research shows that taking a specific product that contains ginkgo extract, ginger, and Picrorhiza kurroa (AKL1, AKL International Ltd) twice daily for 8 weeks does not improve lung function in people with COPD.
Cocaine addiction	Research suggests that taking a ginkgo leaf extract called EGb 761 twice daily for 10 weeks does not help people with a cocaine addiction.
Mental function	The effect of gingko leaf extract on mental function and memory in healthy adults is not clear. Some research shows that ginkgo might improve memory, speed of thinking, and attention in healthy adults. But other research shows no benefit. More studies are needed to determine the effect of gingko on mental function in healthy adults.
Colorectal cancer	Early research suggests that using a specific ginkgo leaf extract (EGb 761, ONC) intravenously (by IV) together with anticancer drugs might benefit people with advanced colorectal cancer.
Dyslexia	Early research suggests that taking a specific ginkgo leaf extract (EGb 761) for about 30 days might reduce dyslexia in children aged 5-16 years.
Fibromyalgia	Early research suggests that taking specific ginkgo leaf extract tablets (Bio- Biloba, Pharma Nord) together with coenzyme Q-10 capsules (Bio Quinone Q10, Pharma Nord) by mouth for 84 days might increase feelings of wellness and perception of overall health and reduce pain in people with fibromyalgia.
Stomach cancer	Early research suggests that taking carbohydrates from the outer layer of the ginkgo fruit by mouth twice daily for 30 days might reduce tumor size in people with stomach cancer.
Hearing loss	There is some early evidence that taking ginkgo might help short-term hearing loss due to unknown causes. However, many of these people recover hearing on their own. It is hard to know if ginkgo has any effect.
Hemorrhoids	Early research suggests that taking a combination of ginkgo and certain conventional medications might decrease some symptoms of hemorrhoids, including bleeding and pain.
Headaches related to migraines	Early research shows that taking ginkgolide B, a chemical found in ginkgo leaf extract, might help prevent migraines in children and women.
Ovarian cancer	Evidence suggests that using ginkgo leaf extract for 6 months is associated with a decreased risk of developing ovarian cancer.
Pancreatic cancer	Early research suggests that taking a specific injectable form of ginkgo leaf extract (EGb 761) intravenously (by IV) together with anticancer drugs might slow the progression of pancreatic cancer in some people.
Quality of life	Early evidence suggests that taking ginkgo extract (LI 1370, Lichtwer Pharma) for 6 months might improve quality of life measures such as activities in daily living, mood, sleep, and alertness in older people.
Radiation exposure	Early research suggests that taking a specific ginkgo leaf extract (EGb 761, Tanakan Ipsen) might reduce some of the negative effects of radiation on the body.
Skin toxicity caused by radiation	Early research suggests that applying a specific cream product (Radioskin 2, Herbalab di Perazza Massimiliano Company) that contains ginkgo extract, Aloe vera, and metal esculetina along with another product (Radioskin 1, Herbalab di Perazza Massimiliano Company) might improve skin moisture and reduce skin adverse events in breast cancer patients receiving radiation treatments.
Blood vessel disorder (Raynaud's syndrome)	Some research suggests that taking ginkgo leaf extract for 10 weeks by mouth might decrease the number of painful attacks per week in people with a blood vessel disorder called Raynaud's syndrome. However, other research suggests that ginkgo is not beneficial or is less effective than drugs such as nifedipine.
Sexual dysfunction	Some research shows that taking ginkgo leaf extract daily for 8 weeks does not improve sexual function in women with sexual arousal disorder. However, taking a specific combination product containing ginkgo, ginseng, damiana, L-arginine, multivitamins, and minerals (ArginMax for Women) for 4 weeks appears to improve sexual satisfaction in women with sexual dysfunction.
Stroke	The effect of ginkgo on recovery in people who have had a stroke caused by blocked blood vessels is not clear. Some evidence suggests that people might improve more after a stroke when treated with ginkgo. However, higher quality research shows no benefit.
Skin discolorations (Vitiligo)	There is some early research that taking a specific ginkgo leaf extract (Ginkgo Plus, Seroyal) might decrease the size and spread of skin lesions.

Dosing

NATURAL REMEDIES | Herbs | Ginko | Dosing

BY MOUTH:

For anxiety: 80 mg or 160 mg of a ginkgo leaf extract called EGb 761 has been taken three times per day for 4 weeks.

For all uses, start at a lower dose of not more than 120 mg per day to avoid gastrointestinal (GI) side effects. Increase to higher doses indicated as needed. Dosing may vary depending on the specific formulation used. Most researchers used specific standardized Ginkgo biloba leaf extracts. Some people take 0.5 mL of a standard 1:5 tincture of the crude ginkgo leaf three times daily. You should avoid crude ginkgo plant parts. These can contain dangerous levels of the toxic chemicals found in the seed of the plant and elsewhere. These chemicals can cause severe allergic reactions.

For dementia	60-480 mg per day of ginkgo leaf extract ,divided in two or three doses, has been taken for up to one year. The most commonly studied dose is 120-240 mg per day with 240 mg possibly being more effective. Most of the clinical studies on the effectiveness of ginkgo leaf for dementia have used the standardized extracts EGb 761 (Dr. Willmar Schwabe Pharmaceuticals and Ipsen) and LI 1370 (Lichtwer Pharma).
For retinal damage caused by diabetes	120 mg of a ginkgo leaf extract called EGb 761 has been taken daily for 6 months.
For walking leg pain related to poor circulation (claudication, peripheral vascular disease)	120-240 mg per day of ginkgo leaf extract (EGb 761), divided into two or three doses, has been used for up to 6.1 years. The higher dose may be more effective.
For dizziness (vertigo)	160 mg of a ginkgo leaf extract called EGb 761 has been taken once daily or in two divided doses daily for 3 months.
For premenstrual syndrome (PMS)	80 mg of a ginkgo leaf extract called EGb 761 has been taken twice daily, starting on the sixteenth day of the menstrual cycle until the fifth day of the next cycle. Also 40 mg of a ginkgo leaf extract called Ginko T.D. has been taken three times daily starting on the sixteenth day of the menstrual cycle until the fifth day of the next cycle.
For vision loss related to glaucoma	120 to 160 mg of ginkgo leaf extract has been taken in two or three divided doses per day for up to 12.3 years.
For schizophrenia	120-360 mg of a ginkgo leaf extract called EGb 761 (Yi Kang Ning, Yang Zi Jiang Pharmaceuticals Ltd., Jiangsu, China) has been used daily for 8-16 weeks.
For the movement disorder called tardive dyskinesia	80 mg of a ginkgo leaf extract called EGb 761, three times daily for 12 weeks, has been used.

45 Gotu Kola

Gotu kola is an herb that is commonly used in Traditional Chinese and Ayurvedic medicine. The above-ground parts are used to make medicine. Gotu kola is used to treat bacterial, viral, or parastitic infections such as urinary tract infection (UTI), shingles, leprosy, cholera, dysentery, syphilis, the common cold, influenza, H1N1 (swine) flu, elephantiasis, tuberculosis, and schistosomiasis. Gotu kola is also used for fatigue, anxiety, depression, psychiatric disorders, Alzheimer's disease, and improving memory and intelligence. Other uses include wound healing, trauma, and circulation problems (venous insufficiency) including varicose veins, and blood clots in the legs. Some people use gotu kola for sunstroke, tonsillitis, fluid around the lungs (pleurisy), liver disease (hepatitis), jaundice, systemic lupus erythematosus (SLE), stomach pain, diarrhea, indigestion, stomach ulcers, epilepsy, asthma, "tired blood" (anemia), diabetes, and for helping them live longer. Some women use gotu kola for preventing pregnancy, absence of menstrual periods, and to arouse sexual desire. Gotu kola is sometimes applied to the skin for wound healing and reducing scars, includiung stretch marks caused by pregnancy. Gotu kola contains certain chemicals that seem to decrease inflammation and also decrease blood pressure in veins. Gotu kola also seems to increase collagen production, which is important for wound healing.

Uses

Possibly Effective

Decreased return of blood from the feet and legs back to the heart (venous insufficiency)	Taking gotu kola or a specific extract of gotu kola (Centellase) by mouth for 4-8 weeks seems to improve blood circulation and reduce swelling in people with poor blood circulation in the legs.

Insufficient Evidence

Hardening of the arteries (atherosclerosis)	People with atherosclerosis have fatty deposits called plagues along the lining of their blood vessels. There is some evidence that taking gotu kola for 12 months might help stabilize these plaques so they are less likely to break off and trigger clot formation, causing a heart attack or stroke.
Mental function	Early research suggests that taking a combination of gotu kola, ginkgo, and docosahexaenoic acid (DHA) for 4 months does not improve mental function in healthy elderly adults.
Preventing blood clots in the legs while flying	Gotu kola might help prevent blood clots related to long plane flights. Developing evidence suggests that gotu kola might decrease fluid and improve blood circulation in people traveling on airplanes for more than 3 hours. However, it is not known if this finding translates into fewer blood clots.
Increasing circulation in people with diabetes	Taking gotu kola for 6-12 months might help increase circulation and decrease fluid retention in people with diabetes whose small blood vessels have been damaged by their disease.
Poor brain function related to liver disease	Early research suggests that taking a specific product containing gotu kola, brahmi, ginkgo, cat's claw, and rosemary (CognoBlend) twice daily for 5 weeks, in addition to standard therapy, improves symptoms in people with poor brain function related to liver disease better than standard therapy.
Excess scar tissue (keloids)	There is some evidence that applying and extract of gotu kola known as madecassol to the skin might help reduce excess scar tissue.
Red, scaly skin (psoriasis)	Some evidence suggests that applying gotu kola on the skin might help reduce symptoms of psoriasis.
Scarring	Early research suggests that applying a specific gotu kola cream (Alpha centella, not available in the U.S.) to the skin twice daily for 6-8 weeks after the removal of stitches might help reduce scarring.
Schistosomiasis	There is some evidence that gotu kola injected by a healthcare provider might help bladder wounds caused by a parasitic infection called schistosomiasis.

Stretch marks associated with pregnancy	Early research suggests that applying a specific mixture of gotu kola, vitamin E, and a collagen compound in a cream (Trofolastin, not available in the U.S.) daily during the last 6 months of pregnancy might reduce stretch marks. There is also some evidence that another specific mixture of gotu kola, vitamin E, essential fatty acids, hyaluronic acid, elastin, and menthol in an ointment (Verum, not available in the U.S.) might help prevent stretch marks during pregnancy.
Wound healing	Some evidence suggests that applying gotu kola on the skin might help improve wound healing.

Dosing

BY MOUTH
For blood circulation problems in the legs (venous insufficiency): 60-180 mg daily of gotu kola extract.

46 Guarana

Guarana is a plant. It is named for the Guarani tribe in the Amazon, who used its seeds to brew a drink. Today, guarana seeds are still used as medicine. People take guarana for weight loss, athletic performance, mental performance, to increase energy, as an aphrodisiac, and for many other conditions, but there is no good scientific evidence to support these uses. Guarana can also be unsafe when taken long-term in large amounts. Guarana contains caffeine. Caffeine works by stimulating the central nervous system (CNS), heart, and muscles. Guarana also contains theophylline and theobromine, which are chemicals similar to caffeine.

Uses

Insufficient Evidence

Anxiety	Early research shows that taking a product containing hawthorn, black horehound, passionflower, valerian, cola nut, and guarana can reduce anxiety in some people. It is not clear if guarana alone is beneficial.
Lack of appetite in patients with cancer	Early research shows that taking guarana extract slightly improves appetite and prevents weight loss in people with cancer who have lost their appetite and are losing weight. But the benefit is very small.
Chemotherapy-related fatigue	Some research shows that taking guarana can reduce feelings of tiredness in some people undergoing chemotherapy. But conflicting results exist.
Mental performance	Early research in healthy people shows that taking a single dose of guarana extract can improve thinking speed and some aspects of memory. However, other research shows that taking guarana does not improve mental function in adults or older people.
Exercise tolerance	Research shows that taking a single dose of a product containing guarana, B vitamins, vitamin C, and minerals improves exercise tolerance in trained athletes by a very small amount. It is not clear if guarana alone is beneficial.
Weight loss	Taking guarana along with mate and damiana seems to increase weight loss. There is also developing evidence that taking a specific combination product containing guarana, ephedra, and 17 other vitamins, minerals, and supplements helps reduce weight by approximately 2.7 kg over 8 weeks when used with a low-fat diet and exercise. It is not clear if guarana alone is beneficial.
Feelings of well-being	Early research shows that taking guarana does not improve feelings of mood in healthy individuals.
Radiation sickness	Research shows that taking guarana does not improve symptoms of depression or tiredness in people undergoing radiation treatment.

Dosing

The appropriate dose of guarana depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for guarana. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

47 Graviola

Graviola is a small evergreen tree. The leaves, fruit, seeds, and stem are used to make medicine. Some people take graviola by mouth for infections caused by bacteria and parasites, cancer, diabetes, and to cause vomiting. Some people apply graviola directly to the skin for use as an insect repellent, but there is no good scientific evidence to support any of these uses. In foods, graviola is used in cooking and beverages. Graviola contains many chemicals that may be active against cancer, as well as disease-causing agents such as bacteria, viruses, and parasites.

Uses

Insufficient Evidence

Dosing

The appropriate dose of graviola depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for graviola. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

48 American Ginseng

American ginseng (Panax quinquefolis) is an herb that grows mainly in North America. Wild American ginseng is in such high demand that it has been declared a threatened or endangered species in some states in the United States. People take American ginseng by mouth for stress, to boost the immune system, and as a stimulant. American ginseng is often used to fight infections such as colds and flu. There is some evidence that it might help prevent colds and flu and make symptoms milder when infections do occur. American ginseng is used for other infections including HIV/AIDS, infections of the intestine (dysentery), and particular infections (Pseudomonas infections) that are common in people with cystic fibrosis. Some people use American ginseng to improve digestion and for loss of appetite, as well as for vomiting, inflammation of the colon (colitis), and inflammation of the lining of the stomach (gastritis).

American ginseng is also used for low iron in the blood (anemia), diabetes, insulin resistance related to HIV treatments, cancer-related fatigue, high blood pressure, trouble sleeping (insomnia), nerve pain, erectile dysfunction (ED), fever, hangover symptoms, attention deficit-hyperactivity disorder (ADHD), blood and bleeding disorders, breast cancer, dizziness, headaches, convulsions, fibromyalgia, "hardening of the arteries" (atherosclerosis), memory loss, rheumatoid arthritis, schizophrenia, improving athletic performance, improving mental performance, as an anti-aging aid, menopausal symptoms, complications during pregnancy or childbirth, and for nervous exhaustion (neurasthenia). You may also see American ginseng listed as an ingredient in some soft drinks. Oils and extracts made from American ginseng are used in soaps and cosmetics. Don't confuse American ginseng with Siberian ginseng (Eleutherococcus senticosus) or Asian ginseng (Panax ginseng). They have different medicinal effects. American ginseng contains chemicals called ginsenosides that seem to affect insulin levels in the body and lower blood sugar. Other chemicals, called polysaccharides, might affect the immune system.

Uses

Possibly Effective

Diabetes	Taking 3 grams of American ginseng by mouth, up to two hours before a meal, can lower blood sugar after a meal in patients with type 2 diabetes. However, larger doses do not seem to have a greater effect. Taking 100-200 mg of American ginseng by mouth for 8 weeks might also help lower pre-meal blood sugar levels in patients with type 2 diabetes. Different American ginseng products may have different effects. Researchers think that is because they contain different amounts of the active chemicals called ginsenosides.
Respiratory tract infections	Some research suggests that taking a specific American ginseng extract called CVT-E002 (Cold-FX, Afexa Life Sciences, Canada) 200 mg twice daily for 3-4 months during flu season might prevent cold or flu symptoms in adults between the ages of 18 and 65. People older than 65 seem to need a flu shot at month 2 along with this treatment in order to decrease their risk of getting the flu or colds. This extract also seems to help make symptoms milder and last a shorter length of time when infections do occur. Some evidence suggests that the extract might not reduce the chance of getting the first cold of a season, but it seems to reduce the risk of getting repeat colds in a season. However, it might not help prevent cold or flu-like symptoms in patients with weakened immune systems.

Possibly Ineffective

Athletic performance	Taking 1600 mg of American ginseng by mouth for 4 weeks does not seem to improve athletic performance. But it might decrease muscle damage during exercise.

Insufficient Evidence

Insulin resistance caused by HIV treatment	Early research shows that taking capsules containing 1 gram of American ginseng root three times daily for 14 days while receiving the drug indinavir, which is a type of HIV therapy, does not reduce insulin resistance caused by indinavir in healthy people.
Attention deficit-hyperactivity disorder (ADHD)	There is early evidence that a specific product (AD-fX, Afexa Life Sciences, Canada) containing American ginseng extract in combination with ginkgo leaf extract might help improve ADHD symptoms such as anxiety, hyperactivity, and impulsiveness in children aged 3-17 years.
Breast cancer	Some studies conducted in China suggest that breast cancer patients treated with any form of ginseng (American or Panax) do better and feel better. However, this may not be a result of taking the ginseng, because the patients in the study were also more likely to be treated with the prescription cancer drug tamoxifen. It is difficult to know how much of the benefit to attribute to ginseng.
Cancer-related fatigue	Research on the effects of American ginseng in people with fatigue related to cancer is not consistent. One study shows that taking 700-2000 mg of American ginseng daily for 8 weeks does not reduce fatigue in people with cancer. However, other research shows that taking 2000 mg of American ginseng in two doses daily for 8 weeks reduces fatigue by 51%. The conflicting results might be due to the different methods used to measure fatigue in the studies.
Mental performance	Some research suggests that taking one 100-400 mg dose of American ginseng (Cereboost, Naturex) 1-6 hours before mental tests improves short-term memory and reaction time in healthy people.
High blood pressure	Evidence on the effects of American ginseng in people with high blood pressure is not consistent. Some research shows that taking 1500 mg of American ginseng twice daily for 12 weeks does not reduce blood pressure. But other research shows that taking 1000 mg of American ginseng extract three times daily for 12 weeks lowers blood pressure in people with diabetes and high blood pressure. The differences in the research might be related to the amount of ginsenosides, the active chemical in American ginseng, that is contained in the products used.
Menopausal symptoms	Early research suggests that taking a product containing American ginseng, black cohosh, dong quai, milk thistle, red clover, and vitex agnus-castus (Phyto-Female Complex, SupHerb, Netanya, Israel) twice daily for 3 months reduces menopausal symptoms, including hot flashes, night sweats, and sleep quality. However, it is not clear if these effects are caused by American ginseng or the other ingredients in the product.
Schizophrenia	Early research shows that American ginseng might improve some mental symptoms associated with schizophrenia. Taking 100 mg of a specific American ginseng extract called HT1001 (Afexa Life Sciences, Canada) twice daily for 4 weeks improves the patient's ability to hold visual information in the mind short-term. This treatment might also reduce some physical side effects of antipsychotic drugs. However, it does not improve other mental symptoms.

Dosing

BY MOUTH
For reducing blood sugar in people with type 2 diabetes: 3 grams up to 2 hours before a meal. American ginseng should be taken within 2 hours of a meal. If it is taken too long before eating, the blood sugar might become too low.100-200 mg of American ginseng have been taken daily for up to 8 weeks.

For preventing upper respiratory tract infections such as the common cold or flu: a specific American ginseng extract called CVT-E002 (Cold-fX, Afexa Life Sciences, Canada) 200 mg twice daily for 3-4 months has been used.

49 Bitter Melon

NATURAL REMEDIES | Herbs | Bitter Melon

Bitter melon is a vegetable used in India and other Asian countries. The fruit and seeds are used to make medicine. People use bitter melon for diabetes, stomach and intestinal problems, to promote menstruation, and many other conditions, but there is no good scientific evidence to support these uses. Bitter melon contains a chemical that acts like insulin to help reduce blood sugar levels.

Uses

Insufficient Evidence

Diabetes	Research results so far are conflicting and inconclusive. Some research shows that taking bitter melon can reduce blood sugar levels and lower HbA1c (a measure of blood sugar control over time) in people with type 2 diabetes. But these studies have some flaws, and conflicting results exist. Higher quality studies are needed.

Dosing

The appropriate dose of bitter melon depends on several factors such as the user's age, health, and several other conditions. At this time, there is not enough scientific information to determine an appropriate range of doses for bitter melon. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

50 Horehound

White horehound is a plant. The parts that grow above the ground are used to make medicine. White horehound is used for digestion problems including diabetes, loss of appetite, indigestion, bloating, gas, diarrhea, constipation, and liver and gallbladder complaints. It is also used for lung and breathing problems including cough, whooping cough, asthma, tuberculosis, bronchitis, and swollen breathing passages. Women use white horehound for painful menstrual periods. People also use it for yellowed skin (jaundice), to kill parasitic worms, to cause sweating, and to increase urine production. White horehound is sometimes applied to the skin for skin damage, ulcers, and wounds. In manufacturing, the extracts of white horehound are used as flavoring in foods and beverages, and as expectorants in cough syrups and lozenges. Expectorants are ingredients that make it easier to cough up phlegm. The chemicals in white horehound can thin mucus secretions, reduce spasms in the stomach and intestines, and decrease swelling (inflammation).

Uses

Insufficient Evidence

Diabetes	Early research suggests that drinking tea prepared from white horehound before meals, in addition to taking medication for diabetes, for 3 weeks slightly slower blood sugar levels in people with type 2 diabetes. However, drinking tea prepared from guarumo for the same duration seems to have a greater blood sugar-lowering effect.

Dosing

The appropriate dose of white horehound depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for white horehound. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

51 Hops

Hops are the dried, flowering part of the hop plant. They are commonly used in brewing beer and as flavoring components in foods. Hops are also used to make medicine. Hops are commonly used orally for anxiety, sleep disorders such as the inability to sleep (insomnia) or disturbed sleep due to rotating or nighttime work hours (shift work disorder), restlessness, tension, excitability, attention deficit-hyperactivity disorder (ADHD), nervousness, irritability, and symptoms of menopause among other uses. But there is limited scientific evidence to support using hopes for any of these conditions. The chemicals in hops seem to have weak effects similar to the hormone estrogen. Some chemicals in hops also seem to reduce swelling, prevent infections, and cause sleepiness.

Uses

Insufficient Evidence

Body odor	Early research suggests that applying a deodorant that contains hops, zinc salt, aloe leaf juice, witch hazel, chamomile, vitamin C, lemon grass, and other ingredients to the underarm can reduce body odor.
Insomnia	Taking hops along with other herbs and supplements may improve some aspects of sleep in people with insomnia, but research is mixed. Additionally, there is no evidence that taking hops by itself helps with insomnia. Some research suggests that taking a combination of hops extract plus valerian extract at bedtime helps some people fall asleep faster. It appears to take 28 days of treatment to see these benefits. Also, taking a combination of valerian extract and hops extract seems to improve sleep quality similarly to bromazepam (Lexotanil) when taken for only 14 days. In addition, taking a specific combination product containing valerian extract, passionflower extract, and hops extract daily at bedtime for 2 weeks seems to increase total sleep time by 2.5 hours, decrease the number of nighttime awakenings by 50%, and reduce the amount of time it takes to fall asleep by about one hour compared in patients with mild insomnia. These improvements are similar to the effects of the sedative zolpidem. However, other research suggests that taking a combination of hops, soya oil, soya lecithin, and Cannabis sativa for one month does not improve sleep quality. Other early research suggests that taking a combination of hops and valerian doesn't improve the time it takes to fall asleep.
Menopausal symptoms	Early research suggests that taking a specific product containing hops extract daily does not improve menopausal symptoms such as hot flashes after 8-12 weeks of treatment.
Sleep disorder due to rotating or night shifts (shift work disorder)	Early research suggests that drinking non-alcoholic beer containing hops at dinner for two weeks can reduce the amount of time it takes to fall asleep by about 8 minutes in nurses working rotating or night shifts. It also seems to decrease total activity during the night and anxiety. However, it doesn't appear to increase the total amount of time slept.
Leg ulcers	Early research suggests that applying a cream containing bladderwrack, English ivy, horse chestnut, gotu kola, butcher's broom, horsetail, and hops, together with compression therapy, might help decrease pain and inflammation in people with leg ulcers and poor blood circulation in the legs.

Dosing

The appropriate dose of hops depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for hops. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

52 Hydrangea

Hydrangea is a plant. The root and rhizome (underground stem) are used to make medicine. Hydrangea is used for urinary tract problems such as infections of the bladder, urethra and prostate; enlarged prostate; and kidney stones. It is also used for hay fever. The chemicals in hydrangea may cause increased urine output, which could help some urinary tract problems.

Uses

Insufficient Evidence

Dosing

The appropriate dose of hydrangea depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for hydrangea. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

53 Horsetail

Horsetail is a plant. The above ground parts are used to make medicine. Horsetail is used for "fluid retention" (edema), kidney and bladder stones, urinary tract infections, the inability to control urination (incontinence), and general disturbances of the kidney and bladder. It is also used for balding; tuberculosis; jaundice; hepatitis; brittle fingernails; joint diseases; gout; osteoarthritis; weak bones (osteoporosis); high cholesterol levels; frostbite; weight loss; heavy menstrual periods; and uncontrolled bleeding (hemorrhage) of the nose, lung, or stomach. Horsetail is applied directly to the skin to treat wounds and burns. Horsetail is sometimes used in cosmetics and shampoos. The chemicals in horsetail may have antioxidant and anti-inflammatory effects. Horsetail contains chemicals that work like "water pills" (diuretics) and increase urine output.

Uses

Insufficient Evidence

Weak bones (osteoporosis)	Early research suggests that taking dry horsetail extract or a specific product containing horsetail extract and calcium can increase bone density in postmenopausal women with osteoporosis.

Dosing

The appropriate dose of horsetail depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for horsetail. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

54 Horseradish

Horseradish is a plant. It is frequently prepared as a condiment, but the roots are also used as medicine. Horseradish is used for urinary tract infections, kidney stones, fluid retention, cough, bronchitis, achy joints (rheumatism), gallbladder disorders, sciatic nerve pain, gout, colic, and intestinal worms in children. Some people apply horseradish directly to the skin for painful and swollen joints or tissues and for minor muscle aches. Horseradish might help fight bacteria and stop spasms.

Uses

Insufficient Evidence

Bronchitis	Early research shows that taking a specific product (Angocin Anti-Infekt N) containing horseradish root and nasturtium by mouth for about 7-14 days reduces symptoms of acute bronchitis as effectively as antibiotics.
Nasal swelling (sinusitis)	Early research shows that taking a specific product (Angocin Anti-Infekt N) containing horseradish root and nasturtium by mouth for about 7-14 days reduces symptoms of acute sinusitis as effectively as antibiotics.
Urinary tract infections (UTIs)	Early research shows that taking a specific product (Angocin Anti-Infekt N) containing horseradish root and nasturtium by mouth for about 7-14 days is less effective than antibiotics for reducing symptoms of UTIs.

Dosing

The appropriate dose of horseradish depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for horseradish. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

55 He Shou Wu (Fo-Ti)

Fo-ti is an herb. The processed (cured) root of the plant is used to make medicine. Fo-ti is commonly used by mouth to help treat or prevent conditions related to aging, including cancer, heart disease, and memory problems. Fo-ti is also applied directly to the skin for sores, carbuncles, skin eruptions, and itching. But there is limited scientific evidence to support these uses. In manufacturing, fo-ti extract is used as an ingredient in hair and skin care products. Don't confuse fo-ti with the commercial product Fo-ti-Teng that contains no fo-ti. Fo-ti cured root might affect the levels of various chemicals in the body which have been suggested to have anti-aging effects.

Uses

Insufficient Evidence

Age-related memory problems	Early research suggests taking fo-ti root along with Panax ginseng might improve memory in older people.

Dosing

The appropriate dose of fo-ti depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for fo-ti. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

56 Hypericum (St. John's Wort)

St. John's wort is a plant with yellow, star-shaped flowers and five petals that grows in Europe, North and South America, Australia, New Zealand, and Eastern Asia. The plant grows in sunny, well-drained areas. It grows to be 50-100 cm tall. St. John's wort might cause serious interactions with some medications. Because of this, France has banned the use of St. John's wort in products. In other countries St. John's wort is only available with a prescription. St. John's wort is most commonly used for "the blues" or depression and symptoms that sometimes go along with mood such as nervousness, tiredness, poor appetite, and trouble sleeping. There is some strong scientific evidence that it is effective for mild to moderate depression. St. John's wort is also used for symptoms of menopause such as hot flashes and mood changes. An oil can be made from St. John's wort. Some people apply this oil to their skin to treat wounds. Applying St. John's wort directly to the skin is risky. It can cause serious sensitivity to sunlight. For a long time, scientists thought a chemical in St. John's wort called hypericin was responsible for its effects on improving mood. More recent information suggests other chemicals like hyperforin may play a larger role. These chemicals act on messengers in the nervous system that regulate mood.

Uses

Likely Effective

Depression	Taking St. John's wort extracts by mouth improves mood and decreases nervousness and tiredness related to depression. It seems to be about as effective as many prescription drugs. The American College of Physicians-American Society of Internal Medicine guidelines suggest that St. John's wort can be considered an option along with prescription medications for short-term treatment of mild depression. However, since St. John's wort causes many drug interactions, the guidelines suggest it might not be a good choice for many people. St. John's wort might not be as effective for more severe cases of depression.

Possibly Effective

Symptoms related to menopause	Most research shows that taking St. John's wort by mouth can help reduce hot flashes and other symptoms of menopause. Some evidence suggests that specific combinations of St. John's wort plus black cohosh (Remifemin; Remifemin Plus; Gynoplus) can also improve some symptoms of menopause such as hot flashes and mood changes. But not all St. John's wort combination products seem to be beneficial.
The condition of mental feelings causing bodily symptoms (somatization disorder)	Treatment with a specific St. John's wort product (LI 160, Lichtwer Pharma) daily for 6 weeks seems to reduce symptoms of somatization disorder.
Wound healing	Applying an ointment containing St. John's wort three times daily for 16 days seems to improve wound healing and reduce scar formation after a Cesarean section (C-section).

Possibly Ineffective

Pain in the mouth (burning mouth syndrome)	Taking St. John's wort three times daily for 12 weeks does not reduce pain from burning mouth syndrome.
Hepatitis C infection	Taking St. John's wort by mouth does not seem to be effective for treating adults with hepatitis C infection.
HIV/AIDS	Taking St. John's work by mouth does not seem to be effective for treating HIV-infected adults.
Irritable bowel syndrome (IBS)	Early research shows that taking a specific St. John's wort extract (St. John's Wort Extract Extra Strength, Enzymatic Therapy) twice daily is not effective for reducing symptoms of IBS.
Nerve pain	Taking St. John's wort by mouth does not seem to relieve nerve pain in diabetic or non-diabetic people.
Social nervousness	Taking St. John's wort daily does not seem to improve social nervousness.

Insufficient Evidence

A procedure to widen blocked arteries (angioplasty).	Early research shows that in people who do not respond to a prescription blood thinner medication called clopidogrel or Plavix and aspirin, taking St. John's wort three times daily for 2 weeks after a procedure to clear blocked arteries might improve outcomes of the procedure. It is thought that St. John's wort might help the blood thinning medications work better in some people.
Anxiety	Some reports suggest that taking St. John's wort alone or together with valerian might improve nervousness. Taking one capsule of a specific product that contains St. John's wort and valerian root (Sedariston Concentrate, Aristo Pharma GmbH) by mouth daily for one week, then one or two capsules twice daily for another week, reduces nervousness more than the prescription medication diazepam.
The condition of difficulty paying attention and controlling behaviors (attention deficit-hyperactivity disorder or ADHD)	A report of 3 males aged 14-16 with ADHD showed that taking St. John's wort daily for 4 weeks might improve attention and activity. But other research shows that taking a St. John's wort extract for 8 weeks does not improve ADHD symptoms in children ages 6-17 years.
A genetic condition of that causes bilirubin to build up in the body	A case report shows that taking St. John's wort by mouth three times daily for two 8-week periods might decrease bilirubin levels, reduce jaundice, and improve fatigue in people with this condition.
Brain tumor	Early research shows that taking hypericin, a chemical in St. John's wort, by mouth for up to 3 months might reduce tumor size and improve the survival rate in people with brain tumors.

Herpes	Early research suggests that using a specific combination of St. John's wort and copper sulfate pentahydrate might help reduce symptoms, including stinging, burning and pain, in people with cold sores or genital herpes.
Migraine headache	Early research suggests that taking a specific St. John's wort product three times daily improves migraine pain but does not reduce how often migraines occur.
The condition of difficult to control thoughts and behaviors that are repeated (obsessive-compulsive disorder or OCD)	The evidence about the effectiveness of St. John's wort for OCD is not clear. Study results have been mixed.
Skin redness and irritation (plaque psoriasis)	Early research suggests that applying St. John's wort liquid or ointment to the skin decreases the severity and the size of psoriasis patches.
Premenstrual syndrome (PMS)	The evidence about the use of St. John's wort for treating PMS is not clear. Some early research suggests that St. John's wort might help reduce PMS symptoms, including sleeping problems, confusion, crying, headache, tiredness, food cravings and swelling, by as much as 50% in some women. However, other research shows that taking St. John's wort does not reduce nervousness or other PMS symptoms.
Mood condition related to changes in the season (seasonal affective disorder)	Early studies suggest that St. John's wort might help improve symptoms of nervousness, decreased sex drive, and sleep problems in people with seasonal mood changes. It is useful alone or in combination with light therapy.
Smoking cessation	Early research suggests that taking a St. John's wort extract once or twice daily starting one week before and continuing for 3 months after quitting smoking does not improve long-term quit rates.
Tooth pulling	Early research suggests that applying a homeopathic St. John's wort preparation does not improve dental pain after a tooth is pulled or after dental surgery.

Dosing

ADULTS
BY MOUTH
For mild to moderate low mood or depression:
- In most studies, St. John's wort extract was standardized to 0.3% hypericin content and used at doses of 300 mg 3 times daily.
- Some studies have used St. John's wort extract standardized to 0.2% hypericin at doses of 250 mg twice daily.
- St. John's wort extract standardized to 5% hyperforin has been used at doses of 300 mg 3 times daily.

Do not suddenly stop taking St. John's wort. This might cause unpleasant side effects. If you decide to stop taking St. John's wort, reduce the dose slowly over time.

For symptoms of menopause	• St. John's wort extract (Hypiran, Poursina Pharmaceutical Mfg. Co., Tehran, Iran) containing 0.2 mg/mL hypericin, taken in doses of 20 drops 3 times daily for 2 months has been used. • St. John's wort 300mg 3 times daily for 3-4 months has been used.
For the condition of mental feelings causing bodily symptoms (somatization disorder)	A specific extract (LI 160, Lichtwer Pharma) 600 mg/day has been used.
APPLIED TO THE SKIN For wound healing	An ointment containing a 5% St. John's wort extract applied three times daily beginning 24 hours after a C-section and continued for 16 days has been used.
CHILDREN BY MOUTH	For mild to moderate depression: 150-300 mg of St. John's wort three times daily for 8 weeks in children 6-17 years-old has been used. A specific St. John's wort extract (LI 160, Lichtwer, Pharma) 300-1800 mg in three divided doses daily for up to 6 weeks has been used.

57 Hawthorn

Hawthorn is a plant. The leaves, berries, and flowers of hawthorn are used to make medicine. Hawthorn is used for diseases of the heart and blood vessels such as congestive heart failure (CHF), chest pain, and irregular heartbeat. It is also used to treat both low blood pressure and high blood pressure, "hardening of the arteries" (atherosclerosis), and high cholesterol. So far, research suggests that hawthorn might be effective in treating congestive heart failure, but there hasn't been enough research on other heart-related uses to know if it is effective for them. Some people use hawthorn for digestive system complaints such as indigestion, diarrhea, and stomach pain. It is also used to reduce anxiety, as a sedative, to increase urine output, and for menstrual problems. Hawthorn is also used to treat tapeworm and other intestinal infections. Some people apply hawthorn to the skin for boils, sores, and ulcers. Hawthorn preparations are used as a wash for sores, itching, and frostbite. You will find hawthorn among the ingredients in candied fruit slices, jam, jelly, and wine.

Before taking hawthorn, talk with your healthcare professional if you take any medications. It has major interactions with several prescription medications. Hawthorn can help improve the amount of blood pumped out of the heart during contractions, widen the blood vessels, and increase the transmission of nerve signals. Hawthorn also seems to have blood pressure-lowering activity, according to early research. It seems to cause relaxing of the blood vessels farther from the heart. It seems that this effect is due to a component in hawthorn called proanthocyanidin. Research suggests that hawthorn can lower cholesterol, low density lipoprotein (LDL, or "bad cholesterol"), and triglycerides (fats in the blood). It seems to lower accumulation of fats in the liver and the aorta (the largest artery in the body, located near the heart). Hawthorn fruit extract may lower cholesterol by increasing the excretion of bile, reducing the formation of cholesterol, and enhancing the receptors for LDLs. It also seems to have antioxidant activity.

Uses

Possibly Effective

Heart failure	Some specific hawthorn products (Faros 300 by Lichtwer Pharma, Crataegutt forte by Wilmer Schwabe Pharmaceuticals, or HeartCare, Nature's Way) seem to improve some heart failure symptoms in some people with mild to moderate heart failure. However, other research shows that these products may actually worsen heart failure and increase the risk of death or hospitalization.

Insufficient Evidence

Anxiety	There is some evidence that hawthorn, combined with magnesium and California poppy (a product called Sympathyl, which is not available in the U.S.), might be useful in treating mild to moderate anxiety disorders.
Chest pain ("angina")	Some research suggests that taking hawthorn might reduce chest pain.

High blood pressure	Some research shows that hawthorn might reduce blood pressure, but other research shows no benefit.

Dosing

BY MOUTH
For heart failure, some specific hawthorn products (Faros 300 by Lichtwer Pharma, Crataegutt forte by Wilmer Schwabe Pharmaceuticals, or HeartCare, Nature's Way) have been used in doses of 160 mg to 1800 mg divided and taken in 2-3 doses daily. These doses have been shown to improve symptoms of heart failure in some people, but they have also been shown to increase the risk of death or being hospitalized due to heart failure.

58 Jiaogulan

Jiaogulan is a plant that grows wild in parts of Asia. The leaf is used to make medicine. Jiaogulan is sometimes referred to as "Southern Ginseng" because it grows primarily in south central China and is used in similar ways as ginseng. People commonly use jiaogulan by mouth for high cholesterol, diabetes, liver disease, obesity, and many other conditions, but there is no good scientific evidence supporting most of these uses. Jiaogulan contains substances that might help reduce cholesterol levels.

Uses

Possibly Effective

Diabetes	Drinking jiaogulan tea seems to reduce fasting blood sugar levels and improve how sensitive the body is to the effects of insulin in people with diabetes.
High cholesterol	Taking jiaogulan can decrease total cholesterol and increase the "good" high-density lipoprotein (HDL)/total cholesterol ratio in people with high cholesterol levels.

Insufficient Evidence

Liver disease (nonalcoholic fatty liver disease)	Taking jiaogulan by mouth does not seem to improve liver function, body mass index, cholesterol levels, kidney function, or blood sugar in people with a type of liver disease called nonalcoholic fatty liver disease.
Obesity	Taking jiaogulan by mouth seems to slightly decrease body weight in people who are obese.

Dosing

ADULTS
BY MOUTH
For diabetes: 3 grams of jiaogulan tea in 60 mL of water has been taken twice daily for up to 12 weeks.

For high cholesterol: 10 mg of jiaogulan extract has been taken three times daily.

59 Kudzu

Kudzu is a vine. Under the right growing conditions, it spreads easily, covering virtually everything that doesn't move out of its path. Kudzu was introduced in North America in 1876 in the southeastern U.S. to prevent soil erosion. But kudzu spread quickly and overtook farms and buildings, leading some to call to kudzu "the vine that ate the South." Kudzu's root, flower, and leaf are used to make medicine. People use kudzu to treat alcoholism and to reduce symptoms of alcohol hangover, including headache, upset stomach, dizziness, and vomiting. Kudzu is also used for heart and circulatory problems, including high blood pressure, irregular heartbeat, heart failure, and chest pain; for upper respiratory problems including sinus infections, the common cold, hay fever, flu, and swine flu; and for skin problems, including allergic skin rash, itchiness, and psoriasis. Some people use kudzu for menopause symptoms, weight loss, exercise performance, muscle pain, measles, dysentery, stomach pain (gastritis), fever, diarrhea, thirst, neck stiffness, and to promote sweating. Other oral uses include treatment of polio myelitis, encephalitis, migraine, deafness, diabetes, nerve pain and vision loss associated with diabetes, and traumatic injuries. Health providers in China sometimes give puerarin, a chemical in kudzu, intravenously (by IV) to treat stroke due to a blood clot, as well as for back pain, heart attacks, and to reduce cholesterol levels in people with heart disease. There is information that suggests kudzu contains ingredients that counteract alcohol. It might also have effects like estrogen. Chemicals in kudzu might also increase blood circulation in the heart and brain.

Uses

Possibly Effective

Alcoholism	Research suggests that heavy drinkers or binge drinkers who take kudzu consume less beer when given a chance to drink. But kudzu doesn't seem to decrease the craving for alcohol or improve sobriety in long-term alcoholics.

Insufficient Evidence

Chest pains	Some early research suggests that puerarin, a chemical in kudzu, might improve signs and symptoms of chest pain when taken by mouth or injected intravenously (by IV). Some evidence suggests that using IV puerarin along with usual treatment might be more effective than usual treatment alone. However, studies on puerarin are generally of poor quality and might not be reliable. Puerarin injection products are not available in North America.
Preventing chest pain during a procedure called percutaneous transluminal coronary angioplasty (PTCA)	Early research suggests that injecting 200 mL of puerarin, a chemical in kudzu, intravenously (by IV) one week before and immediately prior to PTCA might reduce episodes of chest pain. Puerarin injection products are not available in North America.
Coronary heart disease (CHD)	Early research suggests that injecting 500 mL of puerarin, a chemical in kudzu, intravenously (by IV) once daily for 3 weeks might reduce "bad" low-density lipoprotein (LDL) cholesterol, increase "good" high-density lipoprotein (HDL) cholesterol, and reduce pre-meal insulin levels in people with coronary heart disease. Puerarin injection products are not available in North America.
Diabetes	Early research suggests that taking puerarin, a chemical in kudzu, 750 mg daily by mouth along with the diabetes medication rosiglitazone (Avandia) reduces blood sugar in patients with type 2 diabetes. However, injecting puerarin intravenously (by IV) does not appear to reduce blood sugar. Puerarin injection products are not available in North America.
Kidney disease in people with diabetes (diabetic nephropathy)	Early research suggests that taking puerarin, a chemical in kudzu, 750 mg daily by mouth along with the diabetes medication rosiglitazone (Avandia) improves kidney function in people with diabetic nephropathy.

Problems with the retina of the eye in people with diabetes (diabetic retinopathy)	Some research suggests that injecting puerarin, a chemical in kudzu, intravenously (by IV) does not improve vision in people with diabetic retinopathy. Puerarin injection products are not available in North America.
Exercise performance	Early research suggests that taking a combination supplement containing kudzu isoflavones along with other ingredients might improve exercise performance in some people.
Heart failure	Early research suggests that taking puerarin, a chemical in kudzu, 400 mg/day by mouth for 10 days might improve heart function in people with heart failure.
High blood pressure	Early research shows that taking kudzu powder might decrease blood pressure in people with slightly high blood pressure.
Stroke	Some early research suggests that taking puerarin, a chemical in kudzu, alone or with aspirin, might improve brain function in some people after stroke. However, other research shows that injecting puerarin intravenously (by IV) does not reduce death or dependency after a stroke.
Low back pain	Early research suggests that injections of puerarin, a chemical in kudzu, might reduce pain in some people with low back pain. Puerarin injection products are not available in North America.
Symptoms of menopause	Research on kudzu for symptoms of menopause has been conflicting. Some research suggests that taking kudzu by mouth can reduce hot flashes and improve vaginal dryness in women going through menopause. Other research shows that taking kudzu does not affect sex hormone levels, blood fat levels, bone density, or other symptoms of menopause. However, it might have a positive effect on the mental abilities of postmenopausal women.
Heart attack (myocardial infarction)	Early research suggests that injecting puerarin, a chemical in kudzu, intravenously (by IV) along with usual treatment might help some people after a heart attack. Puerarin injection products are not available in North America.
Weight loss	Early research suggests that taking kudzu extract 300 mg by mouth for 12 weeks reduces body fat and body mass index (BMI) in people who are obese. However, taking kudzu extract 200 mg daily does not appear to have the same effects.

Dosing

BY MOUTH
For alcoholism: 1.5-3 grams of kudzu root extract has been taken in 3 divided doses per day for 1-4 weeks. A single dose of 2 gram of kudzu extract has also been taken before a drinking episode.

60 Myrtle

Myrtle is a plant. The leaves and branches are used to make medicine. People take myrtle for treating lung infections including bronchitis, whooping cough, and tuberculosis. They also take it for bladder conditions, diarrhea, and worms. Myrtle might help fight against fungus and bacteria.

Uses

Insufficient Evidence

Dosing

The appropriate dose of myrtle depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for myrtle. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

61 Alpine Lady's Mantle

Alpine lady's mantle is an herb. It is used to make medicine. People take alpine lady's mantle for fluid retention, spasms, heart conditions, and various "female complaints." Don't confuse alpine lady's mantle (Alchemilla alpina) with lady's mantle (Alchemilla xanthochlora). It is not known how alpine lady's mantle might work for medicinal uses.

Uses

Insufficient Evidence

Dosing

The appropriate dose of alpine lady's mantle depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for alpine lady's mantle. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

62 Lotus

Lotus is a plant. The flowers, seed, leaves, and parts of the underground stem (rhizome) are used to make medicine. Lotus flowers are used to stop bleeding. Lotus seeds are used for disorders of the digestive tract, including diarrhea. There is not enough information to know how lotus might work.

Uses

Insufficient Evidence

Dosing

The appropriate dose of lotus depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for lotus. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

63 Milk Thistle

Milk thistle is a plant that is native to Europe and was brought to North America by early colonists. Milk thistle is now found throughout the eastern United States, California, South America, Africa, Australia, and Asia. The plant grows up to 2 meters high and has large, bright purple flowers. Milk thistle gets its name from the milky sap that comes out of the leaves when they are broken. The leaves also have unique white markings that, according to legend, were the Virgin Mary's milk. The above ground parts and seeds are used to make medicine. The seeds are more commonly used. Milk thistle is taken by mouth most often for liver disorders, including liver damage caused by chemicals, alcohol, and chemotherapy, as well as liver damage caused by Amanita phalloides (death cap) mushroom poisoning, nonalcoholic fatty liver disease, chronic inflammatory liver disease, cirrhosis of the liver, and chronic hepatitis. Milk thistle is also taken by mouth for heartburn (dyspepsia), inflammatory bowel disease (ulcerative colitis), enlarged prostate (benign prostatic hyperplasia), a blood disorder called beta-thalassemia, and infertility.

Some people also take milk thistle by mouth for diabetes, kidney damage caused by diabetes or contrast media use, prostate cancer, to decrease the side effects of chemotherapy and radiation, uterine complaints, increasing breast milk flow, allergy symptoms, starting menstrual flow, obsessive-compulsive disorder (OCD), Alzheimer's disease, Parkinson's disease, multiple sclerosis (MS), high cholesterol, and menopausal symptoms. Some people apply milk thistle directly to the skin for skin toxicity caused by radiation. People use milk thistle intravenously (by IV) for Amanita phalloides (death cap) mushroom poisoning. In foods, milk thistle leaves and flowers are eaten as a vegetable for salads and a substitute for spinach. The seeds are roasted for use as a coffee substitute. Don't confuse milk thistle with blessed thistle (Cnicus benedictus). Milk thistle seed might protect liver cells from toxic chemicals and drugs. It also seems to have blood sugar-lowering, antioxidant, and anti-inflammatory effects.

Uses

Possibly Effective

Diabetes	Taking milk thistle extract along with antidiabetes drugs can decrease blood sugar levels before meals in people with diabetes. It also seems to decrease average blood sugar levels in these people. Taking a specific product containing milk thistle and tree turmeric (Berberol, PharmExtracta) also seems to lower blood sugar in people with diabetes that is not well controlled. But it might take more than 3 months for milk thistle products to show benefit.
Heartburn (dyspepsia)	When used daily for 4 weeks, a specific combination product (Iberogast by Medical Futures, Inc.) that contains milk thistle plus eight other ingredients seems to reduce the severity of acid reflux, stomach pain, cramping, nausea, and vomiting.

Insufficient Evidence

Liver disease caused by excessive use of alcohol	There is conflicting evidence about the effectiveness of milk thistle for treating alcohol-related liver disease. Early research shows that taking milk thistle by mouth might improve liver function and reduce risk of death. However, other research shows no benefit.
Seasonal allergies	Some research shows that taking milk thistle extract by mouth along with the allergy medication cetirizine (Zyrtec) reduces seasonal allergies more than taking cetirizine alone.
Alzheimer's disease	Early research shows that taking a combination supplement containing milk thistle extract improves mental function in people with Alzheimer' s disease.
Amanita mushroom poisoning	Early research shows that giving silibinin, a chemical found in milk thistle, intravenously (by IV) and then by mouth may lessen liver damage caused by Amanita phalloides mushroom (death cap) poisoning. However, it is hard to obtain silibinin in the US.
Enlarged prostate (benign prostatic hyperplasia)	Early research shows that taking a specific combination of milk thistle extract and selenium for 6 months might improve symptoms of enlarged prostate in men.
Blood disorder called beta-thalassemia	Early research in children with the blood disorder beta-thalassemia shows that taking a specific milk thistle extract for 6-9 months, along with conventional medicine, might decrease iron levels better than conventional medicine alone.
Hand-foot syndrome	Early research shows that applying a gel containing milk thistle extract to the hands and feet beginning on the first day of chemotherapy and continuing for 9 weeks decreases the severity of a complication of chemotherapy called hand-foot syndrome.
Chemotherapy toxicity	Early research shows that taking a specific milk thistle product containing the chemical silibinin beginning at the start of chemotherapy treatment does not significantly reduce liver toxicity caused by chemotherapy.
Kidney damage caused by the chemotherapy drug cisplatin	Early research shows that taking milk thistle extract beginning 24-48 hours before starting therapy with cisplatin, and continuing until the end of the treatment course, does not prevent or decrease the rates of kidney injury.
Liver scarring (cirrhosis)	Early research shows that milk thistle extract might reduce the risk of death and improve liver function in people with cirrhosis. However, milk thistle extract does not seem to benefit all patients with liver disease.
Kidney disease in people with diabetes	Early research shows that taking milk thistle extract together with conventional treatment might help treat kidney disease in people with diabetes.
Hepatitis	Research on the effects of milk thistle in people with hepatitis is not consistent. Some research shows that taking milk thistle extract by mouth for 4 weeks reduces hepatitis symptoms, such as dark urine and jaundice, but does not improve liver function tests. But taking product containing the milk thistle constituent silybin plus phosphatidylcholine by mouth for 2 weeks to 3 months might improve some liver function tests.
Hepatitis B	Research on the effects of milk thistle in people with hepatitis B is not consistent. Early research shows that taking milk thistle extract by mouth for up to one year, or taking a product containing the milk thistle constituent silybin plus phosphatidylcholine by mouth for 1 week, improves liver function tests. But other research shows no benefit.
Hepatitis C	Research on the effects of milk thistle in people with hepatitis C is inconsistent. Early research shows that taking milk thistle extract by mouth for up to one year, or taking a product containing the milk thistle constituent silybin plus phosphatidylcholine by mouth for 1 week, improves liver function tests. But other research shows no benefit.

High cholesterol	Taking milk thistle along with tree turmeric seems to prevent cholesterol levels from increasing in people with high cholesterol who are taking statins but who require their statin dose to be lowered. Taking this product also seems to help lower cholesterol when used alone or along with low-dose statins or ezetimibe in people with high cholesterol who can't tolerate high dose statin treatment. It's unclear if these benefits are due to milk thistle, tree turmeric, or the combination. There is also evidence that taking a similar product containing milk thistle, tree turmeric, and chemicals called monacolins also helps to lower cholesterol levels. Monacolins are chemicals similar to statin drugs. So, it's not clear if the cholesterol reduction is due to milk thistle or the statin-like chemicals.
High levels of fat particles (lipids) in the blood	Taking milk thistle doesn't seem to lower lipid levels in the blood in people with high levels due to liver disease.
Infertility	Early research shows that taking milk thistle extract along with fertility hormones might provide some benefits for women undergoing in vitro fertilization due to male infertility.
Low milk production	Early research shows that taking milk thistle extract for 4 weeks does not increase milk production in mothers of premature infants.
Menopausal symptoms	Research shows that taking a specific combination product containing milk thistle and other ingredients by mouth for 3 months reduces hot flashes by 73% and night sweats by 69% in people with menopausal symptoms. Sleep quality also improves. It' s not clear if these benefits are due to milk thistle or other ingredients.
Multiple sclerosis (MS)	Early research shows that taking a combination supplement containing milk thistle extract can improve mental function and increase disease stabilization in people with multiple sclerosis.
Liver disease not caused by alcohol (nonalcoholic fatty liver disease; NAFLD)	There is evidence that milk thistle extract improves markers of liver injury in people with NAFLD. But these markers aren't always linked with the NAFLD severity. Most experts recommend that people with NAFLD lose weight to reduce fat build-up in the liver and lower their cholesterol to reduce the risk of heart disease. Taking milk thistle does not seem to improve either of these outcomes. But there is some evidence that milk thistle might benefit people with a severe form of NAFLD called nonalcoholic steatohepatitis (NASH). While taking milk thistle doesn't seems to improve the overall severity of NASH, it does seem to reduce scarring of the liver.
Obsessive-compulsive disorder (OCD)	Early research shows that taking milk thistle leaf extract by mouth three times daily for 8 weeks has a limited effect on OCD symptoms. It does not appear to more beneficial than conventional medication.
Parkinson's disease	Early research shows that taking a combination supplement containing milk thistle extract improves mental function and increases disease stabilization in people with Parkinson's disease.
Prostate cancer	Prostate-specific antigen (PSA) is a protein in the blood that can be measured to diagnose and monitor prostate cancer. Early research shows that taking a supplement containing milk thistle extract, soy isoflavones, lycopene, vitamins, minerals and antioxidants by mouth daily can delay the rise in PSA levels in men with a history of prostate cancer. The effects of milk thistle alone are not clear.
Skin toxicity caused by radiation	Early research shows that applying a specific product containing the milk thistle extract reduces the effect of radiation on the skin in women being treated for breast cancer.
Inflammation and ulcers (mucositis) caused by radiation	Early research shows that taking milk thistle extract starting on the first day of radiation and continuing for 6 weeks thereafter decreases the severity of ulcers caused by radiation.
Liver damage caused by chemicals	The effect of milk thistle on liver damage caused by chemicals is inconsistent. Taking milk thistle by mouth helps the liver to function in people who have been exposed to the chemicals toluene or xylene or those taking drugs for tuberculosis. But taking milk thistle extract by mouth does not seem to prevent liver damage associated with the drug tacrine (Cognex) in people with Alzheimer's disease.
Inflammation of the digestive tract (ulcerative colitis)	Early research shows that taking milk thistle extract by mouth for 6 months, in addition to standard medications, decreases the symptoms of ulcerative colitis and helps maintain remission.

Dosing

ADULTS
BY MOUTH
For diabetes: 200 mg of milk thistle extract has been taken once daily or three times daily for 4 months to one year. A specific product (Berberol, PharmExtracta) containing 210 mg of milk thistle extract and 1176 mg of tree turmeric extract has been taken daily for 3-12 months.

For upset stomach (dyspepsia): 1 mL of a specific combination product (Iberogast by Medical Futures, Inc.) containing milk thistle and several other herbs has been used three times daily for 4 weeks.

64 Moringa

Moringa is a plant that is native to the sub-Himalayan areas of India, Pakistan, Bangladesh, and Afghanistan. It is also grown in the tropics. The leaves, bark, flowers, fruit, seeds, and root are used to make medicine. Moringa is used for "tired blood" (anemia); arthritis and other joint pain (rheumatism); asthma; cancer; constipation; diabetes; diarrhea; epilepsy; stomach pain; stomach and intestinal ulcers; intestinal spasms; headache; heart problems; high blood pressure; kidney stones; fluid retention; thyroid disorders; and bacterial, fungal, viral, and parasitic infections. Moringa is also used to reduce swelling, increase sex drive (as an aphrodisiac), prevent pregnancy, boost the immune system, and increase breast milk production. Some people use it as a nutritional supplement or tonic. Moringa is sometimes applied directly to the skin as a germ-killer or drying agent (astringent). It is also used topically for treating pockets of infection (abscesses), athlete's foot, dandruff, gum disease (gingivitis), snakebites, warts, and wounds. Oil from moringa seeds is used in foods, perfume, and hair care products, and as a machine lubricant. Moringa is an important food source in some parts of the world. Because it can be grown cheaply and easily, and the leaves retain lots of vitamins and minerals when dried, moringa is used in India and Africa in feeding programs to fight malnutrition. The immature green pods (drumsticks) are prepared similarly to green beans, while the seeds are removed from more mature pods and cooked like peas or roasted like nuts. The leaves are cooked and used like spinach, and they are also dried and powdered for use as a condiment. The seed cake remaining after oil extraction is used as a fertilizer and also to purify well water and to remove salt from seawater. Moringa contains proteins, vitamins, and minerals. As an antioxidant, it seems to help protect cells from damage.

Uses

Insufficient Evidence

Asthma	Early research shows that taking 3 grams of moringa twice daily for 3 weeks reduces the severity of asthma symptoms and improves lung function in adults with mild to moderate asthma.
Diabetes	The effect of moringa on diabetes control is unclear. Some early research shows that taking moringa tablets along with a type medicine called sulfonylureas does not improve blood sugar control as measured by hemoglobin A1C levels. But it does seem to reduce fasting and post-meal blood sugar levels compared to taking sulfonylureas alone in people with diabetes. Other research also shows that ttaking moringa drumstick leaves with meals might also reduce post-meal blood sugar levels in people with diabetes not taking medications for diabetes.

NATURAL REMEDIES | Herbs | Moringa

HIV/AIDS	Early research shows that taking moringa leaf powder with each meal for 6 months might increase body mass index (BMI) but does not appear to improve immune function.
High cholesterol	The effect of moringa on lowering cholesterol levels is not clear. Early research of poor quality shows mixed results. Additional research is needed.
Increasing breast milk production	Research regarding the effects of moringa for increasing breast milk production is conflicting. Some early research shows that moringa increases milk production, while other early research shows no benefit. An analysis of data from five clinical studies shows that moringa moderately increases milk product after one week of use when started on postpartum day 3. But it's not clear if moringa is beneficial when used for longer periods of time.
Malnutrition	Early research shows that adding moringa powder to food for 2 months helps improve weight in malnourished children.
Menopausal symptoms	Early research shows that adding fresh moringa leaves to food for 3 months improves menopausal symptoms such as hot flashes and sleeping problems in healthy, postmenopausal women.
Vitamin A deficiency	Early research shows that adding moringa powder to infant cereal doesn't improve vitamin A levels in infants with low levels of vitamin A.
Weight loss	Early research shows that taking a product containing moringa and other ingredients does not reduce weight. But it might improve body composition by reducing the amount of fat mass and increasing the amount of lean mass. The effect of moringa alone on weight loss is not known.

Dosing

The appropriate dose of moringa depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for moringa. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

65 Maitake Mushroom

Maitake is a type of mushroom. People use it to make medicine. Some people take maitake mushroom by mouth for infertility due to a condition called polycystic ovary syndrome (PCOS). It is also used to treat cancer and to relieve some of the side effects of chemotherapy. There is limited scientific evidence to support these and other uses. Maitake mushroom contains chemicals which might help fight tumors, stimulate the immune system, and lower blood sugar levels.

Uses

Insufficient Evidence

Diabetes	Early research shows that taking maitake mushroom polysaccharides (MMP) by mouth may lower blood sugar in people with diabetes.
An ovary disorder known as polycystic ovary syndrome (PCOS)	Early research shows that taking a specific dietary supplement containing maitake mushroom extract can improve ovulation in women whose periods have stopped due to PCOS. Maitake mushroom does not appear to be as effective as the drug clomiphene for PCOS, but the combination of these two agents may be more effective than either one alone for improving ovulation.

Dosing

The appropriate dose of maitake mushroom depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for maitake mushroom. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

66 Mugwort

Mugwort is a plant that grows in Asia, North America, and Northern Europe. The plant parts that grow above the ground and the root are used to make medicine. People take mugwort root as a "tonic" and to boost energy. People take the rest of the plant for stomach and intestinal conditions including colic, diarrhea, constipation, cramps, weak digestion, worm infestations, and persistent vomiting. Mugwort is also used to stimulate gastric juice and bile secretion. It is also used as a liver tonic; to promote circulation; and as a sedative. Other uses include treatment of hysteria, epilepsy, and convulsions in children. Women take mugwort for irregular periods and other menstrual problems. In combination with other ingredients, mugwort root is used for mental problems (psychoneuroses), ongoing fatigue and depression (neurasthenia), depression, preoccupation with illness (hypochondria), general irritability, restlessness, trouble sleeping (insomnia), and anxiety. Some people apply mugwort lotion directly to the skin to relieve itchiness caused by burn scars. The chemicals in mugwort might stimulate the uterus.

Uses

Insufficient Evidence

Itching caused by scars, when applied to the affected skin	Developing research suggests that applying a lotion containing mugwort and menthol directly to the skin relieves itching in severe burn victims.

Dosing

The appropriate dose of mugwort depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for mugwort. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

67 Neem

NATURAL REMEDIES | Herbs | Neem

Neem is a tree. The bark, leaves, and seeds are used to make medicine. Less often, the root, flower, and fruit are also used. Neem leaf is used for leprosy, eye disorders, bloody nose, intestinal worms, stomach upset, loss of appetite, skin ulcers, diseases of the heart and blood vessels (cardiovascular disease), fever, diabetes, gum disease (gingivitis), and liver problems. The leaf is also used for birth control and to cause abortions. The bark is used for malaria, stomach and intestinal ulcers, skin diseases, pain, and fever. The flower is used for reducing bile, controlling phlegm, and treating intestinal worms. The fruit is used for hemorrhoids, intestinal worms, urinary tract disorders, bloody nose, phlegm, eye disorders, diabetes, wounds, and leprosy. Neem twigs are used for cough, asthma, hemorrhoids, intestinal worms, low sperm levels, urinary disorders, and diabetes. People in the tropics sometimes chew neem twigs instead of using toothbrushes, but this can cause illness; neem twigs are often contaminated with fungi within 2 weeks of harvest and should be avoided.

The seed and seed oil are used for leprosy and intestinal worms. They are also used for birth control and to cause abortions. The stem, root bark, and fruit are used as a tonic and astringent. Some people apply neem directly to the skin to treat head lice, skin diseases, wounds, and skin ulcers; as a mosquito repellent; and as a skin softener. Inside the vagina, neem is used for birth control. Neem is also used as an insecticide. Neem contains chemicals that might help reduce blood sugar levels, heal ulcers in the digestive tract, prevent pregnancy, kill bacteria, and prevent plaque formation in the mouth.

Uses

Insufficient Evidence

Dental plaque	Early research suggests that applying a gel containing neem leaf extract to the teeth and gums twice daily for 6 weeks might reduce the amount of plaque on the teeth. It also might reduce the number of bacteria in the mouth that can cause plaque. It's unclear if using a mouth rinse containing neem reduces plaque. Some research shows that using a neem mouth rinse is beneficial, but other research shows no benefit.
Insect repellant	Early research shows that applying extract of neem root or leaf to the skin helps repel black flies. Also, applying neem oil cream to the skin seems to protect against some types of mosquitos.
Ulcers	Early research suggests that taking neem bark extract by mouth for 10 weeks might help heal ulcers in the stomach and intestines.
Psoriasis	Early research suggests that taking neem extract by mouth for 12 weeks, along with daily sun exposure and the application of a coal tar and salicylic acid cream, might make the symptoms of psoriasis less severe.

Dosing

The appropriate dose of neem depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for neem. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

68 Nigella Seed (Black Seed)

Black seed is a plant. People have used the seed to make medicine for over 2000 years. It was even discovered in the tomb of King Tut. Historically, black seed has been used for headache, toothache, nasal congestion, asthma, arthritis, and intestinal worms. It has also been used for "pink eye" (conjunctivitis), pockets of infection (abscesses), and parasites. Today, black seed is most commonly used for asthma, diabetes, hypertension, weight loss, and many other conditions. There is some scientific evidence to suggest that black seed might help boost the immune system, fight cancer, prevent pregnancy, reduce swelling, and lessen allergic reactions by acting as an antihistamine, but there isn't enough information in humans yet.

Uses

Possibly Effective

Asthma	Research shows that taking black seed by mouth along with asthma medicines can improve coughing, wheezing, and lung function in some people with asthma. But it seems to work only in people with very low lung function before treatment. And it does not seem to work as well as the drugs theophylline or salbutamol.
Diabetes	Early research shows that taking black seed powder can improve blood sugar levels in people with diabetes. Black seed might also improve levels of cholesterol in people with diabetes. Doses of 2 grams daily seem to be needed for any benefit.
High blood pressure	Research shows that taking black seed by mouth might reduce blood pressure by a small amount.
To improve sperm function	Research shows that taking black seed oil increases the number of sperm and how quickly they move in men with infertility.
Breast pain (mastalgia)	Research shows that applying a gel containing black seed oil to the breasts during the menstrual cycle reduces pain in women with breast pain.

Insufficient Evidence

Hay fever (allergic rhinitis)	Early research suggests that taking black seed oil by mouth daily might improve allergy symptoms in people with hay fever.
Itchy and inflamed skin (eczema)	Early research suggests that taking black seed oil by mouth might improve symptoms in people with itchy and inflamed skin. But applying black seed oil ointment to the skin does not seem to help.
A disease that attacks the thyroid (autoimmune thyroiditis)	Taking black seed might improve some but not all measures of thyroid function in people with a disease called Hashimoto's thyroiditis.
Damage to the immune system during cancer treatment	Early research shows that taking black seed ass part of the diet while undergoing cancer drug treatment might prevent fever episodes due to low white blood cell counts (neutropenia) in children.
Mental performance	Early research shows that black seed helps with some but not all measures of memory and attention in boys and men. It's unknown if black seed improves memory and thinking skills in girls and women.
Dry nose	Early research shows that using a nasal spray containing black seed oil can reduce dryness, blockage, and crusting of the nostrils in elderly patients with nasal irritation.
Indigestion	Taking a product containing black seed oil, honey, and water seems to reduce symptoms of indigestion. It's unclear if this improvement is due to black seed or other ingredients.
Seizures (epilepsy)	Early research shows that taking black seed extract by mouth reduces the number of seizures in children with epilepsy. But taking black seed oil does not seem to work.

Stomach ulcers caused by Helicobacter pylori (H pylori infectoin)	Some research shows that taking black seed powder along with the drug omeprazole might help eliminate a certain bacterium (H. pylori) in the stomach that can cause stomach ulcers. But not all doses seem to work.
Hepatitis C	Early research shows that taking black seed oil daily for 3 months reduces viral load in people with hepatitis C. It also seems to reduce lower limb swelling. But it doesn't seem to improve liver function.
High cholesterol	Some early research shows that taking crushed black seed increases "good" high-density lipoprotein (HDL) cholesterol and reduces total cholesterol, "bad" low-density lipoprotein (LDL) cholesterol, and blood fats called triglycerides in people with borderline high cholesterol. Other research shows that taking both crushed black seed and garlic oil in addition to other products that lower cholesterol, such as simvastatin, can lead to larger improvements in blood cholesterol and triglyceride levels than simvastatin alone. However, not all research agrees.
Leukemia	Taking black seed while being treated for a type of leukemia called acute lymphoblastic leukemia might increase the chances of staying cancer-free once treatment ends. But it doesn't improve overall survival.
Metabolic syndrome	Early research suggests that taking a specific black seed oil product twice daily for 6 weeks might reduce total cholesterol, "bad" low-density lipoprotein (LDL) cholesterol, and blood sugar levels in people with metabolic syndrome.
Reducing harmful effects of a medicine called methotrexate	Early research shows that taking black seed might reduce liver damage caused by a certain drug used to treat cancer in children with a type of leukemia.
Obesity	Some research shows that taking black seed oil or powder might improve weight loss by a small amount in people who are obese or overweight. But other research shows no benefit. Studies are generally small and low-quality, so more research is needed.
Relieving symptoms related to opioid withdrawal	Early research shows that taking black seed extract by mouth three times daily for 12 days might reduce symptoms of opioid withdrawal.
Osteoarthritis	Early research shows that applying black seed oil to the knee for 3 weeks can help relieve knee pain caused by osteoarthritis.
Rheumatoid arthritis	Early research shows that taking black seed oil improves pain and stiffness in people with rheumatoid arthritis who are already taking methotrexate.
Sore throat and swollen tonsils (tonsillopharyngitis)	Early research suggests that taking a combination of chanca piedra and black seed by mouth for 7 days relieves pain in people with sore throat and swollen tonsils.

Dosing

BY MOUTH
For asthma: 2 grams of ground black seed has been used daily for 12 weeks. Also, 500 mg of black seed oil has been taken twice daily for 4 weeks. In addition, 15 mL/kg of black seed extract has been used daily for 3 months. A single dose of 50-100 mg/kg has also been used.

For diabetes	1 gram of black seed powder has been used twice daily for up to 12 months.
For high blood pressure	0.5-2 grams of black seed powder has been taken daily for up to 12 weeks. Also, 100-200 mg or 2.5 mL of black seed oil has been used twice daily for 8 weeks.
To improve sperm function	2.5 mL of black seed oil has been used twice daily for 2 months.
ON THE SKIN: For breast pain	A gel containing 30% black seed oil has been applied to breasts every day for two menstrual cycles.

69 Nettle Leaf

Stinging nettle is a plant. People use the root and above ground parts as medicine. Stinging nettle is used for many conditions, but so far, there isn't enough scientific evidence to determine whether or not it is effective for any of them. Stinging nettle root is used for urination problems related to an enlarged prostate (benign prostatic hyperplasia (BPH)). These problems include nighttime urination, too frequent urination, painful urination, inability to urinate, and irritable bladder. Stinging nettle root is also used for joint ailments, as a diuretic, and as an astringent. Stinging nettle above ground parts are used along with large amounts of fluids in so-called "irrigation therapy" for urinary tract infections (UTI), urinary tract inflammation, and kidney stones (nephrolithiasis). The above-ground parts are also used for allergies, hayfever, and osteoarthritis.

Some people use the above ground parts of stinging nettle for internal bleeding, including uterine bleeding, nosebleeds, and bowel bleeding. The above ground parts are also used for anemia, poor circulation, an enlarged spleen, diabetes and other endocrine disorders, stomach acid, diarrhea and dysentery, asthma, lung congestion, rash and eczema, cancer, preventing the signs of aging, "blood purification," wound healing, and as a general tonic. Stinging nettle above ground parts are applied to the skin for muscle aches and pains, oily scalp, oily hair, and hair loss (alopecia). In foods, young stinging nettle leaves are eaten as a cooked vegetable. In manufacturing, stinging nettle extract is used as an ingredient in hair and skin products. Stinging nettle leaf has a long history of use. It was used primarily as a diuretic and laxative in ancient Greek times. Don't confuse stinging nettle (Uritica dioica) with white dead nettle (Lamium album). Stinging nettle contains ingredients that might decrease inflammation and increase urine output.

Uses

Possibly Effective

Osteoarthritis	There is evidence that taking stinging nettle by mouth or applying it to the skin might reduce pain in people with osteoarthritis. Research suggests that using stinging nettle might reduce the need for pain medications.

Insufficient Evidence

Hay fever	Early evidence suggests that using stinging nettle at the first signs of hay fever symptoms seems to help provide relief.

NATURAL REMEDIES | Herbs | Stinging Nettle | Uses

Benign prostatic hyperplasia (BPH)	There is contradictory evidence about the effectiveness of stinging nettle, taken alone or together with other ingredients, for improving symptoms of BPH. Early evidence suggests that taking 360 mg of stinging nettle for 6-24 months improves urinary tract symptoms associated with BPH. Many studies have looked at the effects of a combination product that contains both stinging nettle and saw palmetto. One particular product (PRO 160/120, Willmar Schwabe GmbH, Germany) containing a specific extract of stinging nettle (WS 1031) 120 mg plus a specific extract of saw palmetto (WS 1473) 160 mg seems to significantly improve urinary tract symptoms in men with BPH when taken twice daily for 24-48 weeks. This combination seems to be comparable to the prescription medication finasteride for relieving symptoms of BPH, and may be better tolerated. However, it is not known if this benefit is due to stinging nettle, saw palmetto, or both ingredients. On the other hand, another combination product containing 80 mg of stinging nettle root extract, 106 mg of saw palmetto lipoidal extract, 160 mg of pumpkin seed oil extract, 33 mg of lemon bioflavonoid extract, and 190 IU of vitamin A (100% as beta-carotene) does not significantly improve symptoms of BPH when taken three times daily for 6 months.
Bleeding	Some early research suggests that applying a specific product (Ankaferd blood stopper) containing alpinia, licorice, thyme, stinging nettle, and common grape vine to the skin reduces bleeding in surgery, but does not reduce time in surgery. Other early research suggests the same product reduces bleeding after dental surgery.
Diabetes	Early research suggests that taking stinging nettle daily for 8 weeks does not affect the control of blood sugar levels in people with diabetes who are taking antidiabetes drugs.
Gingivitis	Early research suggests that using a mouthwash containing stinging nettle, juniper, and yarrow twice daily for 3 months does not reduce plaque or bleeding in people with gingivitis.

Dosing

The appropriate dose of stinging nettle depends on several factors such as the user's age, health, and several other conditions. At this time, there is not enough scientific information to determine an appropriate range of doses for stinging nettle. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

70 Sweet Orange

Sweet orange is a fruit. The peel and juice are used to make medicine. Sweet orange is most commonly used for high cholesterol, high blood pressure, and stroke prevention. Some people use it in aromatherapy to help with anxiety, depression, and sleep. Sweet orange contains large amounts of vitamin C. Some researchers believe sweet orange might help asthma because of the antioxidant activity of vitamin C. Sweet orange also contains large amounts of potassium. There is evidence that potassium may help prevent high blood pressure and stroke. Sweet orange fruit and sweet orange juice are used to prevent kidney stones because they contain large amounts of a chemical called citrate. Citrate tends to bind with calcium before it can form kidney stones.

Uses

Possibly Effective

High cholesterol	Drinking sweet orange juice seems to help improve cholesterol levels. In large amounts (750 mL, or about three 8-oz glasses, per day for four weeks), sweet orange juice seems to increase "good" high-density lipoprotein and reduce the ratio of "bad" low-density lipoprotein (LDL) to HDL cholesterol in people with high cholesterol.
High blood pressure	Drinking sweet orange juice seems to help lower the risk of high blood pressure. The U.S. Food and Drug Administration (FDA) allows makers of sweet orange products that provide at least 350 mg of potassium per serving and are low in sodium, saturated fat, and cholesterol to make label claims that their product might reduce the risk of developing high blood pressure.
Stroke	Drinking sweet orange juice seems to help lower the risk of stroke. The U.S. Food and Drug Administration (FDA) allows makers of sweet orange products that provide at least 350 mg of potassium per serving and are low in sodium, saturated fat, and cholesterol to make label claims that their product might reduce the risk of stroke.

Possibly Ineffective

Prostate cancer	Higher dietary intake of sweet orange juice is not linked with a decreased risk of prostate cancer.

Insufficient Evidence

Asthma	There is some evidence that sweet orange and other fruits that are rich in vitamin C might improve lung function in people with asthma. But not all studies agree.
Colds	Some research shows that drinking 180 mL (about 6 ounces) of sweet orange juice daily might help prevent symptoms of the common cold.
Depression	Early research suggests that using sweet orange on the skin during massage, or in the air as aromatherapy, reduces depression in older adults.
Kidney stones (nephrolithiasis)	Some research reports that drinking 400 mL of sweet orange juice (about 13 ounces) increases the amount of citrate in the urine. This might help to prevent kidney stones that are made of calcium.
Obesity	Early research shows that drinking red sweet orange juice does not reduce body weight in overweight adults. Other research shows that taking a specific product containing sweet orange, blood orange, and grapefruit extracts seems to decrease body weight and body fat in overweight people. But it is not clear if this is from the sweet orange or from the other ingredients.
Sleep quality	Early research shows that inhaling sweet orange as aromatherapy might help people who are going through hemodialysis to sleep better and feel less tired.
Stress	Early research shows that smelling sweet orange essential oil during a stressful task might reduce anxiety and tension.

Dosing

NATURAL REMEDIES | Herbs | Sweet Orange | Dosing

BY MOUTH
For high cholesterol: 750 mL sweet orange juice per day.

For high blood pressure: Sweet orange juice products that provide at least 350 mg of potassium per serving and are low in sodium, saturated fat, and cholesterol are permitted by the FDA to make labeling claims that they might reduce the risk of developing high blood pressure.

For stroke: Sweet orange juice products that provide at least 350 mg of potassium per serving and are low in sodium, saturated fat, and cholesterol are permitted by the FDA to make labeling claims that they might reduce the risk of stroke.

71 Oats

Oat is a plant. People use the seed (oat), leaves and stem (oat straw), and bran (the outer layer of whole oats) to make medicine. Oat bran and whole oats are used for high blood pressure; high cholesterol; diabetes; and digestion problems including irritable bowel syndrome (IBS), diverticulosis, inflammatory bowel disease (IBD), diarrhea, and constipation. They are also used for preventing heart disease, gallstones, colon cancer, and stomach cancer. Oats are most commonly used to lower cholesterol and reduce the risk of heart disease. Oats might help reduce cholesterol and blood sugar levels and control appetite by causing a feeling of fullness. Oat bran might work by blocking the absorption from the gut of substances that contribute to heart disease, high cholesterol, and diabetes. When applied to the skin, oats appear to reduce swelling.

Uses

Likely Effective

Heart disease	Oat bran contains high amounts of fiber. Foods high in fiber can be used as part of a diet low in fat and cholesterol to prevent heart disease. In fact, food products containing whole oats that provide 750 mg of soluble fiber per serving can be labeled with the health claim that the product may reduce the risk of heart disease when included as part of a diet low in saturated fat and cholesterol.
Lowering cholesterol	Eating oats, oat bran, and other soluble fibers can modestly reduce total and "bad" low-density lipoprotein (LDL) cholesterol when consumed as part of a diet low in saturated fat. For each gram of soluble fiber (beta-glucan) consumed, total cholesterol decreases by about 1.42 mg/dL and LDL by about 1.23 mg/dL. Eating 3-10 grams of soluble fiber can reduce total cholesterol by about 4-14 mg/dL. But there's a limit. Doses of soluble fiber greater than 10 grams per day don't seem to increase effectiveness. Eating three bowls of oatmeal (28 gram servings) daily can decrease total cholesterol by about 5 mg/dL. Oat bran products (oat bran muffins, oat bran flakes, oat bran Os, etc.) may vary in their ability to lower cholesterol, depending on the total soluble fiber content. Whole oat products might be more effective in lowering LDL and total cholesterol than foods containing oat bran plus beta-glucan soluble fiber. The FDA recommends that approximately 3 grams of soluble fiber be taken daily to lower blood cholesterol levels. However, this recommendation doesn't match research findings; according to controlled clinical studies, at least 3.6 grams of soluble fiber daily is needed to lower cholesterol.

Possibly Effective

Reducing blood sugar levels in people with diabetes when oat bran is used in the diet.	Eating oats and oat bran for 6 weeks significantly decreases before-meal blood sugar, 24-hour blood sugar, and insulin levels in people with type 2 diabetes. There is some evidence that consuming 50 grams of oat bran daily, containing 25 grams of soluble fiber, might be more effective than the moderate fiber diet of 24 grams daily recommended by the American Diabetes Association.
Stomach cancer	People who eat high-fiber foods, such as oats and oat bran, seem to have a lower risk of stomach cancer.

Possibly Ineffective

Colon cancer	People who eat oat bran or oats don't seem to have a lower risk of colon cancer. Also, eating oat bran fiber isn't linked with a lower risk of colon tumor recurrence.
High blood pressure	Eating oats as oatmeal or oat cereal doesn't reduce blood pressure in men with slightly high blood pressure.

Insufficient Evidence

Dry skin	Applying a lotion that contains oats (Aveeno Active Naturals Skin Relief 24Hr Moisturizing Lotion) seems to reduce symptoms of dry skin.
Preventing fat redistribution syndrome in people with HIV disease	Eating a high-fiber diet, including oats, with adequate energy and protein might prevent fat accumulation in people with HIV. A one-gram increase in total dietary fiber may decrease the risk of fat accumulation by 7%.
Ulcerative colitis	Early research shows that taking a specific oat-based product (Profermin) by mouth can reduce symptoms and prevent recurrence of ulcerative colitis.
Itchy skin in people with kidney disease	Early research shows that applying lotion containing oats reduces skin itching in people with this condition. The lotion seems to work as well as taking the antihistamine hydroxyzine 10 mg.

Dosing

BY MOUTH
For high cholesterol: 56-150 grams of whole oat products such as oat bran or oatmeal, containing 3.6-10 grams of beta-glucan (soluble fiber) daily as part of a low-fat diet. One-half cup (40 grams) of Quaker oatmeal contains 2 grams of beta-glucan; one cup (30 grams) of Cheerios contains one gram of beta-glucan.

For lowering blood sugar levels in patients with type 2 diabetes: High fiber foods such as whole oat products containing up to 25 grams of soluble fiber are used daily. 38 grams of oat bran or 75 grams of dry oatmeal contains about 3 grams of beta-glucan.

72 Paw Paw

American pawpaw is a plant. The bark, leaf, and seed are used to make medicine. In homeopathy, American pawpaw is used for treating fever, vomiting, and pain and swelling (inflammation) of the mouth and throat. Homeopathy is an alternative treatment method that uses extreme dilutions of medicines. American pawpaw has chemicals that might have activity against certain lung and breast cancers.

Uses

Insufficient Evidence

Head lice	Early research suggests that applying a shampoo that contains American pawpaw, thymol, and tea tree oil to the head up to three times over 16 days can eliminate lice in adults and children.

Dosing

The appropriate dose of American pawpaw depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for American pawpaw. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

73 Psyllium Husk

Black psyllium is a plant. People use the seed to make medicine. Be careful not to confuse black psyllium with other forms of psyllium including blond psyllium. Black psyllium is used for chronic constipation and for softening stools in conditions such as hemorrhoids, cracks in the skin around the anus (anal fissures), surgery on the rectum, and pregnancy. It is also used for diarrhea, dysentery, irritable bowel syndrome (IBS), cancer, high cholesterol, and reducing the risk of coronary heart disease. Black psyllium adds bulk to the stool which might help with constipation, diarrhea, and irritable bowel syndrome. It also controls how quickly sugars are absorbed from the gut, which might help control blood sugar levels in people with diabetes.

Uses

Effective

Constipation	Black psyllium is safe and effective for short-term, over-the-counter use for treating constipation.

Likely Effective

Coronary heart disease	Foods containing black psyllium can help reduce the risk of coronary heart disease. The daily intake of psyllium must be at least 7 grams and it must be combined with a diet low in saturated fat and cholesterol.

Insufficient Evidence

Diabetes	Early research suggests that taking black psyllium by mouth might help control blood sugar in people with type 2 diabetes by reducing how quickly sugars are absorbed from food.
Obesity	Early research shows that taking black psyllium by mouth can slightly decrease body weight and body mass index in people with non-alcoholic fatty liver disease (NAFLD) who are overweight. But it doesn't work better than standard care for NAFLD.

Dosing

BY MOUTH
For constipation: The typical dose of black psyllium is 10-30 grams per day in divided amounts. Take each dose with plenty of water. 'Otherwise, black psyllium might cause choking. The FDA labeling recommends at least 8 ounces (a full glass) of water or other fluid with each dose.

For coronary heart disease: Black psyllium is added to a diet low in saturated fat and cholesterol in a dose of at least 7 grams daily.

For diabetes: Black psyllium has been used in a dose of 15 grams daily.

Black psyllium should be taken 30-60 minutes after taking other drugs.

74 Panax Notoginseng

Panax notoginseng is a plant. The leaves, fruit, and flowers are used to make medicine. However, the root is used the most commonly. Be careful not to confuse Panax notoginseng with other forms of ginseng, such as Panax ginseng, Panax pseudoginseng, or American ginseng. Panax notoginseng is used to stop or slow down bleeding. It is sometimes taken by people who have nosebleeds, vomit up or cough up blood, or find blood in their urine or feces. Panax notoginseng is also used to relieve pain; and to reduce swelling and blood pressure. It is also used for chest pain (angina), strokes and bleeding in the brain, build up of fat in the blood vessels, heart attacks, and some kinds of liver disease. It is also used to improve energy and ability to exercise, to reduce muscle soreness following exercise, and for osteoarthritis and rheumatoid arthritis. Some people apply Panax notoginseng directly to the skin to stop bleeding, help with bruising or swelling, and to improve blood movement in the muscles. Panax notoginseng might relax blood vessels. This would improve blood flow and reduce blood pressure. Some of the chemicals in Panax notoginseng might reduce swelling and protect the heart. There isn't enough information to know how Panax notoginseng might work for other conditions.

Uses

Possibly Effective

Chest pain (angina)	Research shows that Panax notoginseng, taken by mouth or given as an injection, seems to reduce symptoms of chest pain when used along with conventional medications. It might also reduce how often chest pain attacks occur and how long the attacks last when they do occur. These products are given by a doctor in countries like China.
Bleeding in the brain (intracranial hemorrhage)	Research shows that Panax notoginseng injections might improve recovery and reduce the risk of death in people that have had bleeding in the brain, usually because of a stroke. These products are given by a doctor in countries like China.
Stroke	Research shows that giving Panax notoginseng injections might increase the chance of a person improving or recovering after a stroke. These products are given by a doctor in countries like China.

Possibly Ineffective

Heart attack (myocardial infarction; MI)	Panax notoginseng does not seem to prevent heart attacks in people with heart disease when used along with conventional therapy.

Insufficient Evidence

Sore muscles a few days after exercise	Taking Panax notoginseng might reduce muscle soreness a few days after a downhill run. But the improvement is small.
Exercise performance	Early research shows that taking Panax notoginseng for 30 days might help non-athletes exercise longer.
Osteoarthritis	Some research shows that taking a combination of Panax notoginseng, Siberian ginseng, and rehmannia daily might help patients with osteoarthritis move better. However, it does not seem to help reduce pain or stiffness.

NATURAL REMEDIES | Herbs | Panax Notoginseng | Dosing

Dosing

ADULTS
BY MOUTH
For chest pain (angina): 200-400 mg of Panax notoginseng extract has been taken 2-3 times daily for 4-6 weeks. Also, 1 gram of Panax notoginseng powder has been taken 3 times daily.

For stroke	A specific extract of Panax notoginseng root (sanchitongtshu) has been taken three times daily for 28 days.
WITH A NEEDLE: For chest pain (angina)	400-500 mg of Panax notoginseng extract has been injected into the vein or given as a shot daily for 2-4 weeks.
For bleeding in the brain (intracranial hemorrhage)	140-800 mg of Panax notoginseng extract has been injected into the vein daily, usually for 2-4 weeks.
For stroke	Injections containing 200-600 mg of Panax notoginseng have been given daily for 2-4 weeks.

75 Muira Puama

Muira puama is a plant. The wood and root are used to make medicine. Muira puama is used for preventing sexual disorders and to increase interest in sexual activity (as an aphrodisiac). It is also used for upset stomach, menstrual disorders, joint pain (rheumatism), and paralysis caused by poliomyelitis; and as a general tonic and an appetite stimulant. Some people apply muira puama directly to the skin as an aphrodisiac and for rheumatism and muscle paralysis. In combination with other herbs, muira puama is used as a remedy for male sexual performance problems (erectile dysfunction, ED). The chemicals in muira puama have no known effects on the body.

Uses

Insufficient Evidence

Sexual disorders	Early research suggests that taking 2-6 tablets of a specific product (Herbal vX) containing muira puama extract and ginkgo extract modestly improves sexual desire and the frequency of sexual intercourse in women with a low sex drive.

Dosing

The appropriate dose of muira puama depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for muira puama. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

76 Sage

Sage is an herb. The leaf is used to make medicine. Sage is used for digestive problems, including loss of appetite, gas (flatulence), stomach pain (gastritis), diarrhea, bloating, and heartburn. It is also used for reducing overproduction of perspiration and saliva; and for depression, memory loss, and Alzheimer's disease. Women use sage for painful menstrual periods, to correct excessive milk flow during nursing, and to reduce hot flashes during menopause. Sage is applied directly to the skin for cold sores; gum disease (gingivitis); sore mouth, throat or tongue; and swollen, painful nasal passages. Some people inhale sage for asthma. In foods, sage is used as a commonly used spice. In manufacturing, sage is used as a fragrance component in soaps and cosmetics.

Uses

Possibly Effective

Alzheimer's disease	Taking extracts of two different sage species (Salvia officinalis and Salvia lavandulaefolia) for 4 months seems to improve learning, memory and information processing in people with mild to moderate Alzheimer's disease.
Mental performance	Taking a single dose of common sage (Salvia officinalis) or Spanish sage (Salvia lavandulaefolia) by mouth seems to improve memory, alertness, and attention in healthy adults. When used as aromatherapy, these sage species seem to improve alertness, but not attention and memory.
Cold sores when applied as a cream containing sage and rhubarb.	Applying a cream containing common sage (Salvia officinalis) and rhubarb (Rheum officinale and Rheum palmatum) to cold sores may be about as effective as acyclovir (Zovirax) cream. Acyclovir cream heals the cold sores in about 6 days; it takes the sage and rhubarb cream about 7 days to heal them. Sage and rhubarb together work faster than sage alone.
High cholesterol	Taking common sage (Salvia officinalis) three times per day for 2 months seems to reduce "bad" low-density lipoprotein (LDL) cholesterol and blood fats called triglycerides, and increase "good" high-density lipoprotein (HDL) cholesterol, in people with high cholesterol.
Memory	Taking a single dose of common sage (Salvia officinalis) or Spanish sage (Salvia lavandulaefolia) by mouth seems to improve memory in healthy adults. However, these sage species do not seem to improve memory when used as aromatherapy.
Menopausal symptoms	Early research suggests that taking extract of common sage (Sage Menopause, Bioforce AG) for 8 weeks improves symptoms of menopause, especially hot flashes. Also, other developing research suggests that taking a combination of common sage (Salvia officinalis) and alfalfa extract for 3 months reduces hot flashes and night sweats.

Insufficient Evidence

Lung cancer	People who regularly use sage as a spice seem to have a 54% lower chance of developing lung cancer compared to those who don't use sage.
Sore throat	People who regularly use sage as a spice seem to have a 54% lower chance of developing lung cancer compared to those who don't use sage.
Sore throat	Using a specific spray containing 15% common sage extract (Valverde Salvia Rachenspray) seems to reduce throat pain in people with a sore throat. However, sprays containing higher (30%) and lower (5%) amounts of common sage extract do not seem to reduce throat pain. Other early research suggests that spraying the throat with a specific product containing common sage and echinacea for up to 5 days improves sore throat symptoms similarly to a commonly used drug spray.

Pain after surgery	Early research suggests that taking common sage (Salvia officinalis) along with the drugs ibuprofen or diclofenac is less effective for reducing pain after surgery compared to using the drug benzydamine hydrochloride. Also, using common sage seems to increase the risk of infections after surgery compared to benzydamine hydrochloride.
Sunburn	Applying 2% common sage (Salvia officinalis) extract to the skin after UV exposure seems to reduce the development of skin redness.
Swelling of the tonsils (tonsillitis)	Early research suggests that spraying the throat with a specific product containing common sage and echinacea for up to 5 days improves symptoms of tonsillitis similarly to a commonly used drug

Dosing

BY MOUTH
For treating Alzheimer's disease: 1 gram of sage per day. A dose of sage extract, gradually increased over time to 2.5 mg three times daily, has also been used.

APPLIED TO THE SKIN
For treatment of herpes labialis (cold sores): A cream containing 23 mg/gram each of sage extract and rhubarb extract has been applied every 2 to 4 hours while awake, with treatment starting within 1 day of the first symptoms and continuing for 10 to 14 days.

77 Rehmannia

Rehmannia is a plant. The root and parts that grow above the ground are used to make medicine. Rehmannia is commonly found in herbal combinations used in Traditional Chinese Medicine and Japanese Medicine. Rehmannia is used for diabetes, "tired blood" (anemia), fever, weakened bones (osteoporosis), and allergies; and as a general tonic. There is not enough information to know how rehmannia might work for any medical condition. However, some chemicals in rehmannia seem to affect the immune system and might reduce pain and swelling. Some chemicals in rehmannia also seem to lower blood sugar levels.

Uses

Insufficient Evidence

Anemia caused by bone marrow failure (aplastic anemia)	Early research suggests that taking rehmannia along with the steroidal drug stanozolol might help improve symptoms of aplastic anemia better than stanozolol alone.
Chronic lung disease (chronic obstructive pulmonary disease, COPD)	Early research suggests that taking a Chinese herbal decoction containing rehmannia root and angelica (tongfei mixture) by mouth along with oxygen treatment might improve oxygen levels during the night better than oxygen treatment alone in people with COPD and low oxygen levels.

Dosing

The appropriate dose of rehmannia depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for rehmannia. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

78 Raspberry Leaf

Red raspberry is a plant that is the source of a widely eaten, tasty, sweet berry. However, red raspberry fruit and leaf have also been used as medicine for centuries. The therapeutic use of raspberry leaf was first described in 1597 in a book called "The Herbal," or "A General History of Plants." Today, red raspberry leaf and fruit are still used as medicine. Some people take red raspberry leaf by mouth for gastrointestinal (GI) tract disorders including diarrhea; for respiratory system disorders including flu and swine flu; and for heart problems including heart failure, high blood pressure, fever, diabetes, and vitamin deficiency. Some women take raspberry leaf by mouth for painful periods, heavy periods, morning sickness associated with pregnancy, preventing miscarriage, and easing labor and delivery. Red raspberry leaf is applied directly to the skin for sore throat and skin rash. In foods, red raspberry fruit is eaten and processed into jams and other foods. Red raspberry leaf in small quantities is a source of natural flavoring in Europe. The chemicals in red raspberry might have antioxidant effects and help relax blood vessels. They might also cause muscles to contract or relax, depending on the dose and the muscle involved. This is the theory behind red raspberry's use in easing labor and delivery.

Uses

Possibly Ineffective

Making labor and delivery easier	Taking red raspberry leaf does not seem to reduce the length of labor or decrease the need for pain-relieving medication around the time of delivery.

Dosing

The appropriate dose of red raspberry depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for red raspberry. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

79 Reishi Mushroom

Reishi mushroom is a fungus that some people describe as "tough" and "woody" with a bitter taste. The fruiting body (above-ground part) and mycelium (filaments connecting a group of mushrooms) are used as medicine. Reishi mushroom is used for boosting the immune system; viral infections such as the flu (influenza), swine flu, and avian flu; lung conditions including asthma and bronchitis; heart disease and contributing conditions such as high blood pressure and high cholesterol; kidney disease; cancer; and liver disease. It is also used for HIV/AIDS, altitude sickness, chronic fatigue syndrome (CFS), trouble sleeping (insomnia), stomach ulcers, poisoning, and herpes pain. Other uses include reducing stress and preventing fatigue. In combination with other herbs, reishi mushroom is used to treat prostate cancer. Reishi mushroom contains chemicals that seem to have a variety of potentially beneficial effects, including activity against tumors (cancer) and beneficial effects on the immune system.

Uses

Insufficient Evidence

NATURAL REMEDIES | Herbs | Reishi Mushroom | Uses

Noncancerous tumors in the colon and rectum (colorectal adenomas)	Early research suggests that taking reishi mushroom extract daily for 12 months reduces the number of tumors in people with colorectal adenomas.
Clogged arteries	Early research suggests that taking a specific reishi mushroom product (Ganopoly) reduces symptoms of clogged arteries, including chest pain and shortness of breath.
Diabetes	Early research suggests that taking a specific reishi mushroom product (Ganopoly) daily for 12 weeks reduces hemoglobin but not blood sugar levels in people with type 2 diabetes.
Hepatitis B	Early research suggests that taking a specific reishi mushroom product (Ganopoly) for 12 weeks reduces how much of the hepatitis B virus is circulating in the body. This product also seems to improve liver function in people with this condition.
High cholesterol	Early research suggests that taking reishi mushroom extract daily for 12 weeks does not affect cholesterol levels in people with high blood pressure and/or high cholesterol.
High blood pressure	There is inconsistent evidence about the effects of reishi mushroom on high blood pressure. Early research suggests that taking reishi mushroom extract daily for 12 weeks does not lower blood pressure in people with slightly high blood pressure. However, other research suggests that taking reishi mushroom lowers blood pressure in people with more severe high blood pressure.
Lung cancer	Early research suggests that taking reishi mushroom does not shrink lung tumors. However, it does appear to improve immune function and quality of life in people with lung cancer.
Shingles-related pain	Some people report that hot water extracts of reishi mushroom decreases pain when conventional treatment does not work.

Dosing

The appropriate dose of reishi mushroom depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for reishi mushroom. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

80 Rhubarb

Rhubarb is a plant. The root and underground stem (rhizome) are used to make medicine. The stem of rhubarb is also consumed as food. Traditional Chinese medicine commonly uses rhubarb alone or in combination with other ingredients. Rhubarb is used primarily for digestive complaints including constipation, diarrhea, heartburn, stomach pain, gastrointestinal (GI) bleeding, and preparation for certain GI diagnostic procedures. Some people use rhubarb to decrease the strain during bowel movements. Rhubarb is also used for gonorrhea, high levels of cholesterol in the blood, high blood pressure associated with pregnancy, and weight loss. Rhubarb is also used to improve symptoms associated with menopause or menstruation. It is also used to reduce pain associated with pancreas swelling (inflammation) or to slow down kidney disease. Rhubarb is used to reduce symptoms of stroke, sepsis (blood infection), or pesticide poisoning. It is also used for some types of cancer and for patients with nonalcoholic fatty liver disease (NAFLD). A mouth rinse containing rhubarb is used for gingivitis. Rhubarb is sometimes applied to the skin to treat cold sores. In food, rhubarb stems are eaten in pie and other recipes. Rhubarb is also used as a flavoring agent. Rhubarb contains several chemicals which might help heal cold sores and improve movement of the intestines. Some chemicals in rhubarb might reduce swelling. Rhubarb contains fiber that might reduce cholesterol levels.

Uses

Possibly Effective

Cold sores	Applying a cream containing rhubarb and sage to herpes cold sores seems to improve healing. It might be as effective as acyclovir (Zovirax) cream.
Menopause	Clinical research shows that taking a rhubarb root extract by mouth improves many symptoms of menopause, including hot flushes, sweating, sleep, mood, quality of life, fatigue, and sexual problems.
Pancreas inflammation (pancreatitis)	Rhubarb powder given through a tube directly into the intestines might help to reduce pain and other symptoms of pancreatitis. It might also decrease the length of a hospital stay for pancreatitis.

Insufficient Evidence

Painful menstruation (dysmenorrhea)	Early research suggests that taking rhubarb powder might reduce pain during menstruation.
Bleeding from the stomach and bowels	There is some evidence that taking rhubarb powder might be useful for treating gastrointestinal (GI) bleeding.
High cholesterol	Early research shows that eating ground rhubarb stalk for 4 weeks can lower total cholesterol and low-density lipoprotein (LDL or "bad") cholesterol in people with high cholesterol.
Kidney disease	There is not enough reliable information to know if rhubarb helps people with kidney disease. Most studies have measured the effects of rhubarb on markers of kidney disease and the progression of kidney disease to kidney failure. Results are conflicting. Nearly all of the studies are low quality and at high risk of bias.
Cancer affecting the area behind the nose (nasopharyngeal cancer)	Early research suggests that taking a specific Chinese herbal product (Shenlong) containing rhubarb and other herbs along with radiation therapy does not improve healing in people with nasopharyngeal cancer.
Nonalcoholic fatty liver disease (NAFLD)	Early research suggests that taking a specific Chinese herbal medicine (Danning Pian) containing rhubarb, giant knotweed, dried green orange peel, and dried old orange peel might improve liver function in people with non-alcoholic fatty liver disease. It's unknown if rhubarb helps if taken by itself.
Obesity	Some early research suggests that taking rhubarb extract 1-3 times daily for up to 3 months might reduce body weight in obese people. However, other research shows that taking rhubarb with other herbs does not reduce weight.
Poisoning	Exposure to large amounts of pesticides can result in poisoning. In people with pesticide poisoning, early research suggests that taking rhubarb or having rhubarb placed in the rectum as an enema, while also using regular treatments for poisoning, might reduce symptoms and maintain the function of the body.
Life-threatening infection (sepsis)	Early research suggests that using rhubarb along with standard treatments might help reduce the risk for certain complications from a life-threatening infection called sepsis. But rhubarb doesn't appear to reduce death due to this type of infection.

Stroke	Low-quality research suggests that using traditional Chinese medicine that contains rhubarb root and rhizome, in combination with regular stroke treatments, improves function and reduces damage to the brain better than the regular treatments alone in patients who have had a stroke. Higher-quality research is needed to confirm.

Dosing

BY MOUTH
For menopause: A specific rhubarb root dry extract (ERr 731, Anderson Global Group)) 4 mg per day for up to 2 years.

For swelling of the pancreas (pancreatitis): Rhubarb powder 15 grams in 100 mL warm water given by a healthcare provider through a tube going directly into the small intestine for up to one week.

APPLIED TO THE SKIN:
For cold sores: Cream containing rhubarb extract 23 mg and sage extract 23 mg in every gram of cream, applied every 2 to 4 hours while awake. Treatment starts within one day after symptoms appear and continues for 10 to 14 days.

81 Ruscus (Butcher's Broom)

Butcher's broom is a plant. The root is used to make medicine. Butcher's broom is used for hemorrhoids, gallstones, "hardening of the arteries" (atherosclerosis), and for symptoms of poor blood circulation such as pain, heaviness, leg cramps, leg swelling, varicose veins, itching, and swelling. Butcher's broom is also used as a laxative, as a diuretic to increase urine output, to reduce swelling, and to speed the healing of fractures. In some cultures, the roots are eaten in much the same way as asparagus. The chemicals in butcher's broom might cause the blood vessels to narrow or constrict. Butcher's broom might improve blood circulation in the legs by preventing blood from "pooling" in the veins.

Uses

Possibly Effective

Circulatory problems (chronic venous insufficiency)	Some research shows that taking butcher's broom by mouth, alone or in combination with vitamin C and hesperidin, seems to relieve the symptoms of poor circulation in the legs, such as pain, heaviness, cramps, itching, and swelling.

Insufficient Evidence

Vision problems caused by diabetes (diabetic retinopathy)	Early research suggests that taking a specific product containing butcher's broom extract (Fagorutin-Ruscus, Fink GmbH) by mouth for 3 months does not improve vision in people with diabetic retinopathy.
Swelling of the arms (lymphedema)	Early research suggests that taking a specific product (Cyclo 3 Fort) containing butcher's broom root extract, hesperidin methyl chalcone, and vitamin C by mouth for 90 days reduces swelling in the upper arm and forearm, and improves mobility and heaviness in women with swelling of the arm after breast cancer treatment.
Low blood pressure when getting up (orthostatic hypotension)	Some research suggests that taking butcher's broom by mouth might relieve the syndrome of low blood pressure upon getting up.

Dosing

BY MOUTH
For relieving symptoms of poor circulation (chronic venous insufficiency): 150 mg of butcher's broom root extract, combined with 150 mg of hesperidin and 100 mg of ascorbic acid twice daily.

82 Red Clover

Red clover is a plant. The flower tops are used to make medicine. Red clover is used for many conditions, but so far, there isn't enough scientific evidence to determine whether it is effective for any of them. It doesn't seem to work, though, for lowering cholesterol or controlling hot flashes in women. Red clover is used for cancer prevention, indigestion, high cholesterol, whooping cough, cough, asthma, bronchitis, and sexually transmitted diseases (STDs). Some women use red clover for symptoms of menopause such as hot flashes; for breast pain or tenderness (mastalgia); and for premenstrual syndrome (PMS). Red clover is applied to the skin for skin cancer, skin sores, burns, and chronic skin diseases including eczema and psoriasis. In foods and beverages, the solid extract of red clover is used as a flavoring ingredient. Red clover contains hormone-like chemicals called isoflavones that seem to cause reproductive problems in certain animals. Experts think a diet high in isoflavones may have been responsible for reports of reproductive failure and liver disease in cheetahs living in zoos. In large quantities, red clover can cause sterility in livestock. Red clover contains "isoflavones" which are changed in the body to "phytoestrogens" that are similar to the hormone estrogen.

Uses

Possibly Ineffective

High cholesterol in women	Research shows that taking red clover extracts by mouth for 3 months to a year does not seem reduce low-density lipoprotein (LDL or "bad") cholesterol or increase high-density lipoprotein (HDL or "good") cholesterol in women who have moderately elevated cholesterol levels.
Weak bones (osteoporosis)	Some early research suggests that taking red clover daily for 6 months increased bone mineral density and healthy postmenopausal women. However, most evidence suggests that taking red clover does not improve osteoporosis.

Insufficient Evidence

Hair loss (alopecia)	Early research shows that applying a combination product containing red clover flower extract increases hair growth in people with hair loss.
Symptoms of an enlarged prostate gland (benign prostatic hyperplasia)	Research suggests that red clover supplements might improve some symptoms of benign prostatic hyperplasia (BPH). It seems to decrease nighttime urination and improve the quality of life in men with BPH. However, red clover does not seem to affect urine flow rate, prostatic-specific antigen (PSA) values, or prostate size.
Breast cancer	Early evidence shows that taking a specific red clover extract (Promensil) daily for one year does not increase breast tissue density, suggesting that it might not affect breast cancer risk.
Cancer of the lining of the uterus (endometrial cancer)	Early research suggests that taking red clover supplements does not help prevent endometrial cancer.
Cyclical breast pain	There is some early evidence that red clover might relieve cyclic breast pain and tenderness.

Menopause symptoms	There are contradictory research findings about the effects of red clover on symptoms of menopause. Most research shows that taking red clover by mouth for up to a year does not reduce menopause symptoms such as hot flashes or night sweats, although some research shows that a specific red clover product (Promensil, Novogen) might reduce severity but not the frequency of hot flashes. However, other research shows that a different form of red clover (MF11RCE, Melbrosin International) might improve symptoms of menopause-related anxiety and depression.
Postmenopausal conditions	Some early evidence suggests that red clover may improve some secondary conditions associated with postmenopause. These effects include reducing blood pressure and improving cholesterol levels in postmenopausal women. However, red clover does not seem to improve thinking skills.

Dosing

The appropriate dose of red clover depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for red clover. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

83 Saw Palmetto

Saw palmetto is a tree. Its ripe fruit is used to make medicine. Saw palmetto is most commonly used for decreasing symptoms of an enlarged prostate called benign prostatic hypertrophy (BPH), but some scientific evidence shows that it does not work. Saw palmetto is also used to prevent complications from prostate surgery and for treating certain types of prostate conditions. Saw palmetto doesn't shrink the overall size of the prostate, but it seems to shrink the inner lining that puts pressure on the tubes that carry urine. Saw palmetto also might prevent testosterone from being converted to a more potent form of testosterone called dihydrotestosterone (DHT). It is thought that some types of hair loss are caused by increased sensitivity of hair follicles to DHT. Reduced levels of DHT may help prevent these types of hair loss.

Uses

Possibly Effective

Prostate surgery (transurethral resection of the prostate; TURP)	Research shows that taking 320 mg of saw palmetto daily for 2 months before prostate surgery can reduce the time spent in surgery, blood loss, the development of problems during surgery, and the total time spent in the hospital. However, one small study found that taking 160 mg of saw palmetto per day for 5 weeks before surgery does not lower the risk of problems during surgery.

Possibly Ineffective

Enlarged prostate (benign prostatic hyperplasia; BPH)	The effect of saw palmetto on prostate symptoms is conflicting. However, higher quality and more reliable research seems to indicate that saw palmetto has little or no benefit for reducing symptoms such as going to the bathroom at night or painful urination in men with BPH. Any benefit is modest at best. Also, saw palmetto does not seem to work as quickly or enhance the effects of certain drugs used to treat BPH.

Insufficient Evidence

Male and female pattern baldness (androgenic alopecia)	The effects of saw palmetto in people with male and female pattern baldness are conflicting. Some research shows that taking saw palmetto and beta-sitosterol by mouth improves the amount and quality of hair in men with male pattern baldness. However, taking saw palmetto by mouth does not appear to improve hair growth as well as the drug finasteride. Early research suggests that applying saw palmetto to the scalp may increase hair density in men and women who are balding. However, higher quality research is needed to confirm these results.
Underactive bladder (hypotonic bladder)	Underactive bladder is a condition in which the bladder can hold unusually large amounts of urine but does not empty completely upon urination. Early research suggests that taking 90-120 drops of a combination of echinacea and saw palmetto for 77 days improves the amount of urine the bladder can hold and the amount left in the bladder after urination in women with underactive bladder.
Prostate cancer	Taking saw palmetto doesn't seem to be linked with a reduced risk of prostate cancer. Also, taking saw palmetto during radiation for early prostate cancer doesn't seem to improve lower urinary tract symptoms. These symptoms are common in men undergoing radiation for prostate cancer.
Prostate swelling and chronic pelvic pain syndrome	Some early research shows that saw palmetto can improve symptoms in men with prostate swelling not caused by an infection. Other early research suggests that taking saw palmetto along with the drug prulifloxacin reduces pain and urinary symptoms better than taking prulifloxacin alone in men with prostate swelling caused by an infection. However, taking the combination doesn't appear to treat the infection or improve sexual function. Taking saw palmetto doesn't seem to improve prostate swelling and long-term pelvic pain syndrome better than the drug finasteride in people with prostate swelling but no infection. Some studies have researched saw palmetto in combination with other ingredients. Early research suggests that taking saw palmetto, selenium, and lycopene can improve symptoms of prostate swelling and chronic pelvic pain syndrome. However, taking saw palmetto alone doesn't seem to work. Other research suggests that taking certain herbal combinations containing saw palmetto and other ingredients can enhance the effects of sparfloxacin or prulifloxacin in treating prostate swelling symptoms caused by infection. However, it's not clear if the effects of these combinations are due to saw palmetto or other ingredients.

Dosing

ADULTS
BY MOUTH
Prostate surgery (transurethral resection of the prostate, TURP): 320 mg of saw palmetto extract daily for 2 months before surgery.

84 Senna

Senna is an herb. The leaves and the fruit of the plant are used to make medicine. Senna is an FDA-approved over-the-counter (OTC) laxative. A prescription is not required to purchase senna. It is used to treat constipation and also to clear the bowel before diagnostic tests such as colonoscopy. Senna is also used for irritable bowel syndrome (IBS), anal or rectal surgery, tears in the lining of the anus (anal fissures), hemorrhoids, and weight loss. Senna fruit seems to be gentler than senna leaf. This has led the American Herbal Products Association (AHPA) to warn against long-term use of senna leaf, but not senna fruit. The AHPA recommends that senna leaf products be labeled, "Do not use this product if you have abdominal pain or diarrhea. Consult a healthcare provider prior to use if you are pregnant or nursing. Discontinue use in the event of diarrhea or watery stools. Do not exceed recommended dose. Not for long-term use." Senna contains many chemicals called sennosides. Sennosides irritate the lining of the bowel, which causes a laxative effect.

Uses

Likely Effective

NATURAL REMEDIES | Herbs | Senna

Uses	
Constipation	Taking senna by mouth is effective for short-term treatment of constipation. Senna is an FDA-approved nonprescription drug for adults and children ages 2 years and older. However, in children ages 3-15 years, mineral oil and a medication called lactulose might be more effective than taking senna. Senna also appears to be effective for treating constipation when used in combination with psyllium or docusate sodium. In elderly people, senna plus psyllium is more effective than lactulose for treating ongoing constipation. Senna plus docusate sodium is effective for treating constipation in the elderly and in people who have undergone anorectal surgery. Taking senna appears to be as effective as lactulose, psyllium, and docusate for relieving constipation in people taking opioids or loperamide.
Possibly Effective	
Bowel preparation before colonoscopy	Taking senna by mouth is as effective as castor oil and bisocodyl for bowel preparation. Some evidence suggests that senna is also at least as effective as polyethylene glycol for bowel preparation. However, conflicting evidence exists. It is unclear if taking senna with polyethylene glycol is more effective than taking polyethylene glycol alone. Senna appears to be less effective than sodium phosphate for bowel cleansing. However, taking a combination of senna, sodium picosulfate, and polyethylene glycol appears to be more effective than sodium phosphate for bowel preparation prior to colonoscopy.
Possibly Ineffective	
Diagnostic imaging	Taking senna by mouth does not appear to improve imaging of abdominal organs.

Dosing

ADULTS
BY MOUTH
For constipation: For general constipation, the usual dose is 17.2 mg daily. Don't take more than 34.4 mg twice daily. In elderly people, 17 mg daily has been used. For constipation following pregnancy, 28 mg in 2 divided doses has been used.

For bowel preparation: Doses of senna containing 75 mg or sennosides taken the day before colonoscopy, or 120-150 mg taken once or twice the day before colonoscopy, have been used.

CHILDREN
BY MOUTH:
In children age 12 and over, the usual dose is 2 tablets, with 8.6 mg sennosides per tablet, once daily. The maximum dose is 4 tablets (34.4 mg sennosides) twice daily. In children ages 6 to 11 years, the usual dose is 1 tablet (8.6 mg sennosides) daily. The maximum dose is 2 tablets (17.2 mg sennosides) twice daily. In children ages 2 to 5 years, the usual dose is 1/2 tablet (4.3 mg sennosides) daily. The maximum dose is 1 tablet (8.6 mg sennosides) twice daily.

85 Slippery Elm

Slippery elm is a tree. The inner bark (not the whole bark) is used as medicine. People take slippery elm for coughs, sore throat, colic, diarrhea, constipation, hemorrhoids, irritable bowel syndrome (IBS), bladder and urinary tract infections, syphilis, herpes, and for expelling tapeworms. It is also used for protecting against stomach and duodenal ulcers, for colitis, diverticulitis, GI inflammation, and too much stomach acid. Slippery elm is also taken by mouth to cause an abortion. Slippery elm is applied to the skin for wounds, burns, gout, rheumatism, cold sores, boils, abscesses, ulcers, toothaches, sore throat, and as a lubricant to ease labor. In manufacturing, slippery elm is used in some baby foods and adult nutritionals, and in some oral lozenges used for soothing throat pain. Slippery elm contains chemicals that can help soothe sore throats. It can also cause mucous secretion which might be helpful for stomach and intestinal problems.

Uses

Possibly Effective	
Sore throat when added to lozenges.	Commercial lozenges containing slippery elm are preferred to the native herb when used for cough and sore throat. The lozenges prolong the pain-killing effect.
Insufficient Evidence	
Cancer	Early research suggests that a specific product containing burdock root, Indian rhubarb, sheep sorrel, and slippery elm bark does not improve quality of life in breast cancer patients.
Irritable bowel syndrome (IBS)	An early study shows that taking a specific product containing slippery elm bark, lactulose, oat bran, and licorice root can increase bowel movements and reduce stomach pain and bloating in people with IBS that is characterized by constipation. A different combination product containing slippery elm bark, bilberry, cinnamon, and agrimony can reduce stomach pain, bloating, and gas in people with IBS that is characterized by diarrhea.

Dosing

The appropriate dose of slippery elm depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for slippery elm. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

86 Shiitake Mushroom

Shiitake mushroom is a fungus. An extract made from this mushroom is used as medicine. Shiitake mushroom is used for boosting the immune system, HIV/AIDS, lowering blood cholesterol levels, hardening of the arteries, diabetes, eczema, colds and flu, treating prostate or breast cancer, and as an anti-aging agent. It is also used for hepatitis B, herpes, high blood pressure, and stomach ache. Shiitake mushroom is used in a mouth rinse for dental plaque. Shiitake mushroom is also eaten as food. Shiitake mushroom contains chemicals that might help lower cholesterol levels. It also contains very small amounts of a chemical that seems to keep tumors from getting bigger. This chemical might also stimulate the immune system.

Uses

Possibly Ineffective	
Dental plaque	Rinsing with liquid containing shiitake mushroom does not seem to reduce plaque (94250).
Insufficient Evidence	

Prostate cancer	Early research suggests that shiitake mushroom does not prevent prostate cancer from becoming worse.

Dosing

The appropriate dose of shiitake mushroom depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for shiitake mushroom. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

87 Spirulina (Blue Green Algae)

"Blue-green algae" describes a large and diverse group of simple, plant-like organisms found in salt water and some large fresh water lakes. Blue-green algae products are used for many conditions, but so far, there isn't enough scientific evidence to determine whether or not they are effective for any of them. Blue-green algae are used as a source of dietary protein, B-vitamins, and iron. They are also used for weight loss, attention deficit-hyperactivity disorder (ADHD), hayfever, diabetes, stress, fatigue, anxiety, depression, and premenstrual syndrome (PMS) and other women's health issues.

Some people use blue-green algae for treating precancerous growths inside the mouth, boosting the immune system, improving memory, increasing energy and metabolism, lowering cholesterol, preventing heart disease, healing wounds, and improving digestion and bowel health. Blue-green algae are commonly found in tropical or subtropical waters that have a high-salt content, but some types grow in large fresh water lakes. The natural color of these algae can give bodies of water a dark-green appearance. The altitude, temperature, and sun exposure where the blue-green algae are grown dramatically influence the types and mix of blue-green algae in the water. Some blue-green algae products are grown under controlled conditions. Others are grown in a natural setting, where they are more likely to be contaminated by bacteria, liver poisons (microcystins) produced by certain bacteria, and heavy metals. Choose only products that have been tested and found free of these contaminants.

You may have been told that blue-green algae are an excellent source of protein. But, in reality, blue-green algae is no better than meat or milk as a protein source and costs about 30 times as much per gram. Blue-green algae have a high protein, iron, and other mineral content which is absorbed when taken orally. Blue-green algae are being researched for their potential effects on the immune system, swelling (inflammation), and viral infections.

Uses

Insufficient Evidence

Seasonal allergies (hayfever)	Early research shows that taking 2 grams per day of blue-green algae by mouth for 6 months might relieve some allergy symptoms in adults.
Insulin resistance due to HIV medication	Early research shows that taking 19 grams per day of blue-green algae by mouth for 2 months increases insulin sensitivity in people with insulin resistance due to HIV medication.
Arsenic poisoning	Early research shows that taking 250 mg of blue-green algae and 2 mg of zinc by mouth twice daily for 16 weeks reduces arsenic levels and the effects of arsenic on the skin in people living in areas with high arsenic levels in the drinking water.
Attention deficit-hyperactivity disorder (ADHD)	Early research shows that dissolving 3 mL of a product containing blue-green algae, peony, ashwagandha, gotu kola, bacopa, and lemon balm (Nurture and Clarity, Tree of Healing-LD, Israel) into 50-60 mL of water and drinking three times daily for 4 months improves ADHD in children aged 6 years to 12 years who haven't taken other treatments for ADHD.
Tics or twitching of the eyelids (blepharospasm or Meige syndrome)	Early research shows that taking a specific blue-green algae product (Super Blue-Green Algae, Cell Tech, Klamath Falls, OR) at a dose of 1500 mg daily for 6 months does not reduce eyelid spasms in people with blepharospasm.
Diabetes	An early study shows that people with type 2 diabetes who take 1 gram of a blue-green algae product (Multinal, New Ambadi Estate Pvt. Ltd., Madras, India) by mouth twice daily for 2 mouths have lower blood sugar levels.
Exercise performance	An early study shows that men who jog regularly are able to sprint for longer periods of time before becoming tired when they take 2 grams of blue-green algae three times daily for 4 weeks.
Hepatitis C	Research on the effects of blue-green algae in people with chronic hepatitis C has been inconsistent. One study shows that taking 500 mg of spirulina blue-green algae by mouth three times daily for 6 months results in greater improvements in liver function compared to milk thistle in adults with hepatitis C who were not yet treated or were unresponsive to other treatments. However, another study shows that taking blue-green algae for one month worsens liver function in people with hepatitis C or hepatitis B.
HIV/AIDS	Research on the effects of blue-green algae in people with HIV/AIDS has been inconsistent. Some early research shows that taking 5 grams of blue-green algae by mouth daily for 3 months reduces the incidences of infections, stomach and intestinal problems, feelings of tiredness, and breathing problems in patients with HIV/AIDS. However, taking blue-green algae does not appear to improve CD4 cell counts or reduce viral load in HIV patients.
High cholesterol	Early research shows that blue-green algae lowers cholesterol in people with normal or slightly elevated cholesterol levels. However, the research findings have been somewhat inconsistent. In some studies, blue-green algae only lower low-density lipoprotein (LDL or "bad") cholesterol. In other studies, blue-green algae lower total cholesterol and LDL cholesterol, and increase high-density lipoprotein (HDL or "good") cholesterol.
High blood pressure	Early research shows that taking 4.5 grams per day of blue-green algae by mouth for 6 weeks reduces blood pressure in some people with high blood pressure.
Long-term fatigue	Early research shows that taking 1 gram per day of blue-green algae by mouth three times daily for 4 weeks does not improve fatigue in adults with long-term complaints of fatigue.
Malnutrition	Early research on the use of blue-green algae in combination with other dietary treatments for malnutrition in infants and children shows conflicting results. Weight gain was seen in undernourished children who were given spirulina blue-green algae with a combination of millet, soy and peanut for 8 weeks. However, in another study, children up to 3 years-old who were given 5 grams of blue-green algae daily for 3 months did not gain weight more than those given general treatments to improve nutrition alone.
Menopausal symptoms	An early study shows that taking 1.6 grams per day of a blue-green algae product by mouth daily for 8 weeks lowers anxiety and depression in women going through menopause. However, it doesn't appear to reduce symptoms such as hot flashes.
Obesity	Research on the effects of blue-green algae in people who are overweight or obese has been inconsistent. One early study shows that taking a specific blue-green algae product (Multinal, New Ambadi Estate Pvt. Ltd.) at a dose of 1 gram taken two or four times per day by mouth for 3 months slightly improve weight loss in overweight adults. However, another early study shows that taking 2.8 grams of spirulina by mouth three times per day for 4 weeks does not improve weight loss in obese adults who are also following a reduced-calorie diet.

Precancerous mouth sores (oral leukoplakia)	Early research shows that taking 1 gram of spirulina blue-green algae daily by mouth for 12 months reduces oral leukoplakia in people who chew tobacco.
Gum disease (periodontitis)	Early research shows that injecting a gel containing blue-green algae into the gums of adults with gum disease improves gum health.

Dosing

The appropriate dose of blue-green algae depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for blue-green algae. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

88 Schisandra

Schisandra is a plant. The fruit is used as food and also to make medicine. Schisandra is used as an "adaptogen" for increasing resistance to disease and stress, increasing energy, and increasing physical performance and endurance. Schisandra is also used for preventing early aging and increasing lifespan, normalizing blood sugar and blood pressure, stimulating the immune system, and speeding recovery after surgery. It is also used for treating liver disease (hepatitis) and protecting the liver from poisons. The Chinese have developed a liver-protecting drug called DBD that is made from schizandrin, one of the chemicals in schisandra. Other uses for schisandra include treatment of high cholesterol, pneumonia, coughs, asthma, sleep problems (insomnia), tiredness and irritability associated with emotional disturbance (neurasthenia), premenstrual syndrome (PMS), chronic diarrhea, dysentery, night sweats, spontaneous sweating, involuntary discharge of semen, thirst, erectile dysfunction (ED), physical exhaustion, excessive urination, depression, irritability, and memory loss. It is also used in children to reduce the frequency and severity of attacks of fever associated with an inherited disease called familial Mediterranean fever. Some people use schisandra for improving vision ad muscular activity, protecting against radiation, preventing motion sickness, preventing infection, boosting energy at the cellular level, and improving the health of the adrenal glands. Schisandra fruit is eaten as a food. The chemicals in schisandra improve liver function by stimulating enzymes (proteins that speed up biochemical reactions) in the liver and promoting liver cell growth.

Uses

Possibly Effective

Mental performance	Taking schisandra fruit extract by mouth, alone or in combination with rhodiola and Siberian ginseng, seems to improve concentration, attention, and speed of thinking.
Hepatitis	Schisandra fruit extracts reduce blood levels of an enzyme called glutamic-pyruvic transaminase (SGPT) in people with hepatitis. SGPT level is a marker for liver damage. A higher SGPT level means more damage; a lower SGPT means less damage.

Insufficient Evidence

Exercise performance	Taking schisandra fruit extract by mouth seems to improve coordination and endurance.
Inherited fever disorder (Familial Mediterranean fever)	Early research suggests that taking a combination product (ImmunoGuara, Inspired Nutritionals) containing andrographis, Siberian ginseng, schisandra, and licorice reduces the severity and frequency of familial Mediterranean fever attacks.
Nearsightedness	Early research suggests that applying a solution of schisandra for 20-24 days can improve vision in children with nearsightedness. However, schisandra does not improve vision in children with progressive nearsightedness.
Pneumonia	Early research suggests that taking a combination of rhodiola, schisandra, and Siberian ginseng (Chisan) twice daily for 10-15 days reduces the need for antibiotics and improves quality of life in people with pneumonia when taken along with standard care.

Dosing

BY MOUTH
For hepatitis: Schisandra extract standardized to 20 mg lignan content (equivalent to 1.5 grams crude schisandra) given daily.

For improving mental and physical performance: 500 mg to 2 grams of schisandra extract daily or 1.5-6 grams of crude schisandra daily. 5-15 grams daily of a boiled tea made from crude schisandra has also been used. People have also taken 100 mg of schisandra extract twice daily. Appropriate dosing may vary depending on extract type and the lignan content.

89 Sorrel

Sorrel is a plant. People use the above ground parts for medicine. Be careful not to confuse sorrel (Rumex acetosa) with roselle (Hibiscus sabdariffa), which is known as Jamaican sorrel or Guinea sorrel. People commonly take sorrel by mouth for reducing swelling (inflammation) of the nasal passages (sinusitis). It is also used to treat swelling of the respiratory tract (bronchitis). But there is limited scientific research to support this use. Sorrel is also used as an ingredient in sauces and soups.

Uses

Possibly Effective

Sinusitis (inflamed nasal passages)	Some research suggests that taking a specific product that contains sorrel, gentian root, European elderflower, verbena, and cowslip flower by mouth daily for up to 14 days improves symptoms of sinusitis, such as congestion and headache.

Insufficient Evidence

Breast cancer	Early research suggests that taking a specific product containing sorrel, burdock root, Indian rhubarb, and slippery elm by mouth does not improve quality of life or mood in people with breast cancer.
Bronchitis	Early research shows that taking a specific combination product containing sorrel, gentian root, European elderflower, verbena, and cowslip flower by mouth for 10 days improves cough and other symptoms of bronchitis.

Dosing

BY MOUTH
Sinusitis (inflamed nasal passages): A specific combination product containing 36 mg of sorrel, 12 mg of gentian root, and 36 mg each of European elder flower, verbena, and cowslip flower has been taken three times daily for up to 14 days.

NATURAL REMEDIES Herbs Tribulus

90 Tribulus

Tribulus is a plant that produces fruit covered with spines. Rumor has it that tribulus is also known as puncture vine because the spines are so sharp they can flatten bicycle tires. People use the fruit, leaf, and root as medicine. People use tribulus for conditions such as chest pain, eczema, enlarged prostate, sexual disorders, infertility, and many others, but there is no good scientific evidence to support these uses. Tribulus has chemicals that might increase levels of some hormones. However, it doesn't appear to increase male hormones (testosterone) in humans.

Uses

Possibly Ineffective

Enhancing athletic performance	Taking tribulus by mouth, alone or with other herbs and supplements, doesn't seem to enhance body composition or exercise performance in athletes.

Insufficient Evidence

Chest pain (angina pectoris)	Early research shows that taking tribulus extract by mouth might reduce symptoms of angina.
Eczema (atopic dermatitis)	Taking tribulus by mouth in combination with 9 other herbs might reduce redness and skin outbreaks in adults and children with a certain type of eczema. However, some research shows no benefit.
Enlarged prostate (Benign prostatic hyperplasia; BPH)	Early research shows that taking a supplement containing tribulus and curry leaf (Murraya koenigii) for 12 weeks improves symptoms similar to the prescription drug tamsulosin in men with an enlarged prostate. Other early research shows that taking a supplement containing tribulus, brown algae, chitosan, and saw palmetto for 2 months improves symptoms and quality of life in men with lower urinary tract symptoms, with or without BPH.
Erectile dysfunction (ED)	Some early research shows that taking tribulus for 3 months improves erections in men with a condition called partial androgen deficiency. Men with this condition often have ED. Other early research shows that taking a supplement containing tribulus, brown algae, and chitosan for 3 months improves sexual satisfaction, desire, ability to ejaculate, and sexual quality of life in men with ED. However, other research shows that taking tribulus for 30 days does not improve erections in men with ED.
Infertility	Research on tribulus for infertility is conflicting. Some early research shows that taking tribulus for 60 days does not improve sperm count in men with low sperm count. However, other research shows that taking a specific tribulus product for 30 days improves ejaculate volume, sperm concentration, and sperm movement in men with low sperm count and defective sperm movement. Other research shows that taking the same tribulus product for 1-2 months may increase sexual desire and erections in some men with infertility due to low levels of testosterone.
Sexual problems in women	Early research shows that taking tribulus for 4 weeks improves sexual desire, arousal, satisfaction, orgasm, pain, and lubrication in women with low sexual desire. Other early research shows that taking tribulus for 90 days improves sexual desire, arousal, sensation, lubrication, ability to reach orgasm, and sexual comfort in postmenopausal women with sexual problems.

Dosing

91 Holy Basil (Tulsi)

Holy basil is a plant. It is originally from India but now grows in Australia, West Africa, and some Middle Eastern countries. It is used in Ayurvedic medicine as an “adaptogen” to counter life’s stresses. It is considered a sacred plant by the Hindus and is often planted around Hindu shrines. The Hindu name for holy basil, Tulsi, means "the incomparable one." Medicine is made from the leaves, stems, and seeds. Holy basil is commonly used to help with anxiety and stress. But there is limited scientific research to support these and other uses. In cooking, holy basil is often added to stir-fry dishes and spicy soups because of its peppery taste. Cookbooks sometimes call it "hot basil." Chemicals in holy basil are thought to decrease pain and swelling (inflammation). Other chemicals might lower blood sugar in people with diabetes. There is interest in using holy basil seed oil for cancer. Early research suggests that the oil can slow progression and improve survival rate in animals with certain types of cancer. Researchers think this benefit may be explained by the oil’s ability to act as an antioxidant.

Uses

Insufficient Evidence

Anxiety	Early research suggests that taking holy basil leaf extract twice daily after meals reduces anxiety and associated stress and depression in people with anxiety.
Dental plaque	Some research shows that using mouthwash containing 4% holy basil leaf extract twice daily reduces plaque and gingivitis better than saline solution and similar to mouthwash containing 0.12% chlorhexidine. Chlorhexidine is considered to be the “gold standard” for reducing plaque.
Diabetes	Some early research suggests that a holy basil leaf extract might decrease blood sugar in people with type 2 diabetes.
Stress	Early research shows that taking holy basil extract by mouth in the morning and at night decreases symptoms of stress, including forgetfulness, sexual problems, exhaustion, and sleep problems.

Dosing

The appropriate dose of holy basil depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for holy basil. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

92 Wild Yam

NATURAL REMEDIES | Herbs | Wild Yam

Wild yam is a plant. It contains a chemical called diosgenin. This chemical can be made in the laboratory into various steroids, such as estrogen and dehydroepiandrosterone (DHEA). The root and the bulb of the plant are used as a source of diosgenin, which is prepared as an "extract," a liquid that contains concentrated diosgenin. There are over 600 species of wild yam. Some species are grown specifically as a source of diosgenin for laboratories to use in making steroids. These species are generally not eaten due to a bitter flavor. Only about 12 of the 600 species are considered edible. Diosgenin or wild yam is often promoted as a "natural alterative" to estrogen therapy, so you will see it used for estrogen replacement therapy, vaginal dryness in older women, PMS (premenstrual syndrome), menstrual cramps, weak bones (osteoporosis), increasing energy and sexual drive in men and women, and breast enlargement. Wild yam does seem to have some estrogen-like activity, but it is not actually converted into estrogen in the body. It takes a laboratory to do that. Similarly, you will also see wild yam and diosgenin promoted as a "natural DHEA." This is because in the laboratory DHEA is made from diosgenin, but this chemical reaction is not believed to occur in the human body. So taking wild yam extract will not increase DHEA levels in people. Individuals who are interested in taking DHEA should avoid wild yam products labeled as "natural DHEA." Wild yam is also used for treating a disorder of the intestines called diverticulosis, gallbladder pain, rheumatoid arthritis, and for increasing energy. Some women apply wild yam creams to the skin to reduce menopausal symptoms such as hot flashes. Wild yam contains a chemical that can be made into various steroids, such as estrogen, in the laboratory. However, the body can't change wild yam to estrogen.

Uses

Possibly Ineffective

Menopausal symptoms	Applying wild yam cream to the skin for 3 months does not seem to relieve menopausal symptoms such as hot flashes and night sweats. It also does not seem to affect levels of hormones that play a role in menopause.

Dosing

The appropriate dose of wild yam depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for wild yam. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

93 Witch Hazel

Witch hazel is a plant. The leaf, bark, and twigs are used to make medicine. You may see a product called witch hazel water (Hamamelis water, distilled witch hazel extract). This is a liquid that is distilled from dried leaves, bark, and partially dormant twigs of witch hazel. Witch hazel is taken by mouth for diarrhea, mucus colitis, vomiting blood, coughing up blood, tuberculosis, colds, fevers, tumors, and cancer. Some people apply witch hazel directly to the skin for itching, pain and swelling (inflammation), eye inflammation, skin injury, mucous membrane inflammation, varicose veins, hemorrhoids, bruises, insect bites, minor burns, acne, sensitive scalp, and other skin irritations. In manufacturing, witch hazel leaf extract, bark extract, and witch hazel water are used as astringents to tighten the skin. They are also included in some medications to give those products the ability to slow down or stop bleeding. Those medications are used for treating insect bites, stings, teething, hemorrhoids, itching, irritations, and minor pain. Witch hazel contains chemicals called tannins. When applied directly to the skin, witch hazel might help reduce swelling, help repair broken skin, and fight bacteria.

Uses

Possibly Effective

Hemorrhoids	Applying witch hazel water to the skin may help to temporarily relieve itching, discomfort, irritation, and burning from hemorrhoids and other anal disorders.
Minor bleeding	Applying witch hazel bark, leaf, or water to the skin reduces minor bleeding.
Skin irritation	Applying witch hazel cream seems to relieve mild skin irritation, but not as well as hydrocortisone. Other research shows that applying a specific witch hazel ointment (Hametum) to the skin appears to improve symptoms of skin injury or irritated skin as effectively as a dexpanthenol ointment in children.

Possibly Ineffective

Itchy and inflamed skin (eczema)	Applying a cream containing witch hazel to the skin for 14 days does not seem to improve itchy and inflamed skin in people with moderate eczema. Applying hydrocortisone cream seems to be a more effective treatment option.

Dosing

ADULTS
APPLIED TO THE SKIN: For skin irritation: An after sun lotion containing 10% witch hazel water has been used.
APPLIED TO THE ANUS: For itching and discomfort associated with hemorrhoids and other anal disorders: Witch hazel water has been applied up to 6 times per day or after every bowel movement. Suppositories have been placed in the anus 1-3 times per day.

CHILDREN
APPLIED TO THE SKIN: For skin irritation: An ointment containing witch hazel has been applied several times per day in children aged 2-11 years.

94 Willow Bark

Willow bark is the bark from several varieties of the willow tree, including white willow or European willow, black willow or pussy willow, crack willow, purple willow, and others. The bark is used to make medicine. Willow bark acts a lot like aspirin, so it is used for pain, including headache, muscle pain, menstrual cramps, rheumatoid arthritis (RA), osteoarthritis, gout, and a disease of the spine called ankylosing spondylitis. Willow barks pain relieving potential has been recognized throughout history. Willow bark was commonly used during the time of Hippocrates, when people were advised to chew on the bark to relieve pain and fever. Willow bark is also used for fever, the common cold, flu, and weight loss. Salicin, the active ingredient in willow bark, seems to have contributed to the death of the composer, Ludwig von Beethoven. Apparently, Beethoven ingested large amounts of salicin before he died. His autopsy report is the first recorded case of a particular type of kidney damage that can be caused by salicin. Willow bark contains a chemical called salicin that is similar to aspirin.

Uses

Possibly Effective

Treating lower back pain	Willow bark seems to reduce lower back pain. Higher doses seem to be more effective than lower doses. It can take up to a week for significant improvement in symptoms.

Insufficient Evidence

Weight loss	Early research suggests that taking willow bark in combination with ephedra and cola nut might cause slight weight loss in overweight and obese people. However, it is not wise to use this combination because of safety concerns about ephedra. Ephedra has been banned in the United States due to severe harmful side effects.

Osteoarthritis	Research on willow bark extract for osteoarthritis has produced conflicting results. Some research suggests it can reduce osteoarthritis pain, while other research shows no effect.
Rheumatoid arthritis (RA)	Early research suggests that willow bark extract is not effective for rheumatoid arthritis.

Dosing

BY MOUTH
For back pain: Willow bark extract providing 120-240 mg salicin has been used. The higher 240 mg dose might be more effective.

95 Wheatgrass

Wheatgrass is a kind of grass. The above-ground parts, roots, and rhizome are used to make medicine. Wheatgrass is primarily used as a concentrated source of nutrients. It contains vitamin A, vitamin C, and vitamin E, iron, calcium, magnesium, and amino acids. Wheatgrass is taken by mouth to increase production of hemoglobin, the chemical in red blood cells that carries oxygen, in patients with a blood disorder called beta-thalassemia. It is also commonly used for a variety of conditions including inflammatory bowel syndrome, diabetes, high cholesterol, and many more, but there is no good scientific evidence to support these uses. Wheatgrass juice is a popular health drink. It is thought to benefit health only when fresh and taken on an empty stomach immediately after being mixed. But there is no research to date that supports this. In foods and beverages, wheatgrass extracts are used as a flavoring component. Wheatgrass contains chemicals that might have antioxidant and anti-inflammatory (anti-swelling) activity. This is why some people think it might be helpful for conditions such as inflammatory bowel disease. It also contains a chemical that might fight bacterial infections.

Uses

Insufficient Evidence

Blood disorder called beta-thalassemia	Research evaluating wheatgrass for treating a blood disorder called beta-thalassemia shows conflicting results. Some early research suggests that drinking 100 mL of wheatgrass juice daily for 18 months or taking tablets containing 1-4 grams of wheatgrass daily for 12 months can reduce the need for blood transfusions in children with beta-thalassemia. However, other early research suggests that taking tablets containing 100-200 mg/kg of wheatgrass daily for 12 months does not reduce the need for blood transfusions in children and adults with beta-thalassemia. Larger, higher quality studies are needed to resolve these conflicting results.
Heel pain	Early research suggests that applying a wheatgrass cream to the bottom of the feet twice daily for 6 weeks does not reduce heel pain.
High cholesterol	Early research suggests that taking wheatgrass powder in a capsule daily for 10 weeks reduces total cholesterol and triglyceridecholesterol levels by a small amount in women with elevated cholesterol levels.
Inflammatory bowel disease (ulcerative colitis)	There is some early research that freshly extracted wheatgrass juice might reduce overall disease activity and the severity of rectal bleeding in people with ulcerative colitis.

Dosing

The appropriate dose of wheatgrass depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for wheatgrass. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

96 Yarrow

Yarrow is a plant. The above ground parts are used to make medicine. Yarrow is commonly used orally for diarrhea, gas, and other stomach issues. But there is limited scientific research to support these and other uses. In manufacturing, yarrow is used as a cosmetic cleanser and in shampoos.

Uses

Insufficient Evidence

Gum inflammation (gingivitis)	Early research shows that using a mouthwash containing yarrow and other ingredients doesn't reduce plaque build-up or swelling of the gums.
Irritable bowel syndrome (IBS)	Early research shows that taking a capsule containing yarrow, ginger, and boswellia three times daily for 30 days seems to improve pain and bloating symptoms in people with mild to moderate IBS. However, it's not clear if this is due to yarrow or the other ingredients.
Wound healing	Some women must have an incision made to the vagina during child birth. Early research shows that applying an ointment containing yarrow over the stitches from this incision helps to reduce pain and improve healing.

Dosing

The appropriate dose of yarrow depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for yarrow. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using.

4 Others

Other complexes and remedies not mentioned above.

Colloidal Silver

Fresh Green Black Walnut Wormwood

Meteorology

Types of weather, clouds, planets and space phenomena

"Wherever you go, no matter what the weather, always bring your own sunshine."
Anthony J. D'Angelo

Introduction

The weather is constantly changing and often requires constant attention to be able to predict what weather is likely to follow. Weather prediction is important in a survival situation where you have no shelter to shield yourself from the elements and where extra time can be the factor for life or death. This section contains ways to interpret, measure and read the tell-tale signs of weather.

Purpose	The aim of METEOROLOGY is to help the reader understand the different cycles that the earth goes through such as the day, seasons and lunar cycles. It also provides information on the different atmospheric layers from the ground level to the clouds to outer space and beyond. It finishes with the beaufort scale and details on how you can predict the weather using basic equipment.
Lost?	● For information on what lies below the surface see NATURAL DISASTERS > Earthquakes > Earth Composition ● For specific information on storms and other extreme weather, see the NATURAL DISASTERS section. ● For information on heat and cold related illnesses, see either the SURVIVAL, ILLNESS or NATURAL DISASTERS sections. ● For information on the common weather patterns for each region of the globe, see the GEOGRAPHY section.

Contents

1 Cycles

Listed are the benefits of each type of weather phenomenon.

Subheadings

1 Day Cycle

Day

A day is approximately the period of time during which the Earth completes one rotation around its axis. A solar day is the length of time which elapses between the Sun reaching its highest point in the sky two consecutive times. Days on other planets are defined similarly and vary in length due to differing rotation periods, that of Mars being slightly longer and sometimes called a sol.

In 1960, the second was redefined in terms of the orbital motion of the Earth in the year 1900, and was designated the SI base unit of time. The unit of measurement "day", was redefined as 86,400 SI seconds and symbolized d. In 1967, the second and so the day were redefined by atomic electron transition. A civil day is usually 24 hours, plus or minus a possible leap second in Coordinated Universal Time (UTC), and occasionally plus or minus an hour in those locations that change from or to daylight saving time.

Day can be defined as each of the twenty-four-hour periods, reckoned from one midnight to the next, into which a week, month, or year is divided, and corresponding to a rotation of the earth on its axis. However, its use depends on its context; for example, when people say 'day and night', 'day' will have a different meaning: the interval of light between two successive nights, the time between sunrise and sunset; the time of light between one night and the next.

For clarity when meaning 'day' in that sense, the word "daytime" may be used instead, though context and phrasing often makes the meaning clear. The word day may also refer to a day of the week or to a calendar date, as in answer to the question, "On which day?" The life patterns (circadian rhythms) of humans and many other species are related to Earth's solar day and the day-night cycle.

Day Benefits
- **Solar Electricity:** You can generate electricity from the sun during the day.
- **SODIS Disinfection:** You can use the sun to disinfect water.
- **Cooking Food:** The sun can be used to cook food.
- **Heating Water:** The sun can be used to heat water.
- **Greater Line of Sight:** You can see much further during the day than at night.
- **Less Threats:** There is generally less threats during the day as most dangerous animals come out and hunt at night.

Night

Night or nighttime (also spelled night-time or night time) is the period of ambient darkness from sunset to sunrise during each 24-hour day, when the Sun is below the horizon. The exact time when night begins and ends (equally true with evening) depends on the location and varies throughout the year. When night is considered as a period that which follows evening, it is usually considered to start around 8 pm and to last to about 4 am. Night ends with coming of morning at sunrise. The word can be used in a different sense as the time between bedtime and morning. In common communication, the word night is used as a farewell ("good night") and sometimes shortened to "night", mainly when someone is going to sleep or leaving. For example: "It was nice to see you. Good night!" Unlike "good morning", "good afternoon", and "good evening", "good night" (or "goodnight") is not used as a greeting.

Complete darkness or astronomical night is the period between astronomical dusk and astronomical dawn when the Sun is between 18 and 90 degrees below the horizon and does not illuminate the sky. As seen from latitudes between 48.5607189° and 65.7273855...° north or south of the Equator, complete darkness does not occur around the summer solstice because, although the Sun sets, it is never more than 18° below the horizon at lower culmination.

The opposite of night is day (or "daytime", to distinguish it from "day" referring to a 24-hour period). The start and end points of time for a night vary, based on factors such as season and latitude. Twilight is the period of night after sunset or before sunrise when the Sun still illuminates the sky when it is below the horizon. At any given time, one side of Earth is bathed in sunlight (the daytime) while the other side is in the shadow caused by Earth blocking the sunlight. The central part of the shadow is called the umbra.

Night Benefits
- **Radio Waves Travel Further:** You can receive radio signals from much further away as there's less interference from electromagnetic waves.
- **Easier to Move Undetected:** You can move much more stealthily at night.
- **Star Navigation:** You can use the stars to navigate by and tell the date from.
- **Less Fatigue:** You should be less fatigued at night than doing the same activity under the sun.

2 Seasons

A season is a division of the year marked by changes in weather, ecology, and the amount of daylight. On Earth, seasons are the result of Earth's orbit around the Sun and Earth's axial tilt relative to the ecliptic plane. In temperate and polar regions, the seasons are marked by changes in the intensity of sunlight that reaches the Earth's surface, variations of which may cause animals to undergo hibernation or to migrate, and plants to be dormant. Various cultures define the number and nature of seasons based on regional variations.

During May, June, and July, the Northern Hemisphere is exposed to more direct sunlight because the hemisphere faces the Sun. The same is true of the Southern Hemisphere in November, December, and January. It is Earth's axial tilt that causes the Sun to be higher in the sky during the summer months, which increases the solar flux. However, due to seasonal lag, June, July, and August are the warmest months in the Northern Hemisphere while December, January, and February are the warmest months in the Southern Hemisphere.

In temperate and sub-polar regions, four seasons based on the Gregorian calendar are generally recognized: spring, summer, autumn or fall, and winter. The definition of seasons is also cultural. In India from the ancient times, six seasons or Ritu based on south Asian religious or cultural calendars are recognised and identified even today for the purposes such as agriculture and trade. Ecologists often use a six-season model for temperate climate regions which are not tied to any fixed calendar dates: prevernal, vernal, estival, serotinal, autumnal, and hibernal. Many tropical regions have two seasons: the rainy, wet, or monsoon season and the dry season. Some have a third cool, mild, or harmattan season. Seasons often held special significance for agrarian societies, whose lives revolved around planting and harvest times, and the change of seasons was often attended by ritual.

Summer

Summer is the hottest of the four temperate seasons, falling after spring and before autumn. At or around the summer solstice (about 3 days before Midsummer Day), the earliest sunrise and latest sunset occurs, the days are longest and the nights are shortest, with day length decreasing as the season progresses after the solstice. The date of the beginning of summer varies according to climate, tradition, and culture. When it is summer in the Northern Hemisphere, it is winter in the Southern Hemisphere, and vice versa.

Summer Benefits	● **Easier to Keep Dry:** Clothes dry quickly. ● **Dry Firewood:** The heat dries out firewood quicker. ● **Longer Days:** The days are longer in summer. ● **Easier to Keep Clean:** It's easier to have a bath in warm water than cold water. ● **Easier to Start Fires:** o ● **Easier to find dry tinder:** o ● **Leaves:** Deciduous trees have leaves which help keep you hidden.

Fall / Autumn

Autumn, also known as fall in North American English, is one of the four temperate seasons. Autumn marks the transition from summer to winter, in September (Northern Hemisphere) or March (Southern Hemisphere), when the duration of daylight becomes noticeably shorter and the temperature cools considerably. One of its main features in temperate climates is the shedding of leaves from deciduous trees. Meteorologists (and most of the temperate countries in the southern hemisphere) use a definition based on Gregorian calendar months, with autumn being September, October, and November in the northern hemisphere, and March, April, and May in the southern hemisphere. Persians celebrate the beginning of the autumn as Mehregan to honor Mithra (Mehr).

In North America, autumn traditionally starts with the September equinox (21 to 24 September) and ends with the winter solstice (21 or 22 December). Popular culture in the United States associates Labor Day, the first Monday in September, as the end of summer and the start of autumn; certain summer traditions, such as wearing white, are discouraged after that date. As daytime and nighttime temperatures decrease, trees change color and then shed their leaves.

In traditional East Asian solar term, autumn starts on or around 8 August and ends on or about 7 November. In Ireland, the autumn months according to the national meteorological service, Met Éireann, are September, October and November. However, according to the Irish Calendar, which is based on ancient Gaelic traditions, autumn lasts throughout the months of August, September and October, or possibly a few days later, depending on tradition. In the Irish language, September is known as Meán Fómhair ("middle of autumn") and October as Deireadh Fómhair ("end of autumn").

Fall / Autumn Benefits	● **Easy Shelter Building:** An ample amount of leaves and sticks make shelter building faster and easier. ● **Nice Temperatures:** Fair temperatures, getting colder as the season progresses. ● **Fallen Leaves:** Can be used for tinder.

Winter

Winter is the coldest season of the year in polar and temperate zones (winter does not occur in most of the tropical zone). It occurs after autumn and before spring in each year. Winter is caused by the axis of the Earth in that hemisphere being oriented away from the Sun. Different cultures define different dates as the start of winter, and some use a definition based on weather. When it is winter in the Northern Hemisphere, it is summer in the Southern Hemisphere, and vice versa. In many regions, winter is associated with snow and freezing temperatures. The moment of winter solstice is when the Sun's elevation with respect to the North or South Pole is at its most negative value (that is, the Sun is at its farthest below the horizon as measured from the pole). The day on which this occurs has the shortest day and the longest night, with day length increasing and night length decreasing as the season progresses after the solstice. The earliest sunset and latest sunrise dates outside the polar regions differ from the date of the winter solstice, however, and these depend on latitude, due to the variation in the solar day throughout the year caused by the Earth's elliptical orbit (see earliest and latest sunrise and sunset).

Winter Benefits (Snow)	● **Keeps Food Cold Easily:** Perishable food can be kept much longer. ● **Hibernating Animals:** Most dangerous animals and creatures hibernate during winter. ● **Easier Tracking in Snow:** Tracking people and animals is easier when they leave tracks. ● **Less/No Vegetation:** There's less vegetation so you're able to see more. ● **Less Ticks/Leeches/Bugs:** A lot less or no annoying creatures and bugs. ● **Sled for Transport:** Moving gear is easier over snow with a sled. ● **Use Snow for Water:** Snow is 10% water so melting it will provide you with water. ● **Solar Efficiency:** Solar works better at a cooler temperature than in the heat. ● **Easy to Stay Cool:** It's easier to warm up than to cool down. ● **Frozen Water Travel:** You can travel over frozen water to cut down on travel time. ● **Cold Burns Calories:** Shivering burns calories.
Winter Benefits (No Snow)	● **Keeps Food Cold Easily:** Perishable food can be kept much longer. ● **Less Ticks/Leeches/Bugs:** A lot less or no annoying creatures and bugs. ● **Solar Efficiency:** Solar works better at a cooler temperature than in the heat. ● **Easy to Stay Cool:** It's easier to warm up than to cool down.

Spring

Spring, also known as springtime, is one of the four temperate seasons, succeeding winter and preceding summer. There are various technical definitions of spring, but local usage of the term varies according to local climate, cultures and customs. When it is spring in the Northern Hemisphere, it is autumn in the Southern Hemisphere and vice versa. At the spring (or vernal) equinox, days and nights are approximately twelve hours long, with daytime length increasing and nighttime length decreasing as the season progresses.

Spring and "springtime" refer to the season, and also to ideas of rebirth, rejuvenation, renewal, resurrection and regrowth. Subtropical and tropical areas have climates better described in terms of other seasons, e.g. dry or wet, monsoonal or cyclonic. Cultures may have local names for seasons which have little equivalence to the terms originating in Europe.

Spring Benefits	● **More Plant Life:** Plants grow back quickly after winter. ● **More Animal Life:** Animals are generally born in spring. ● **Nice Temperatures:** Fair temperatures, getting warmer as the season progresses.

3 Lunar Cycle

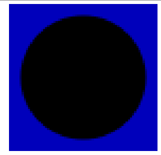
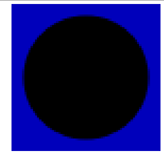
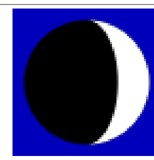
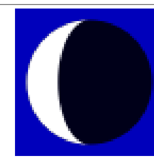
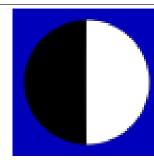
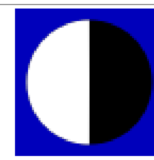
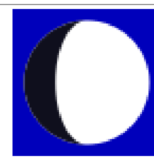
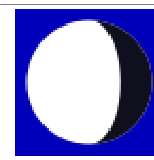
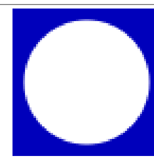
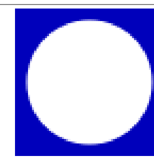
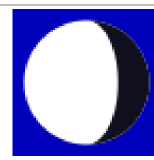
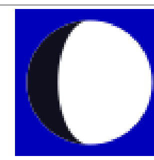
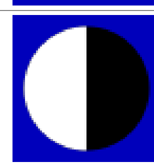
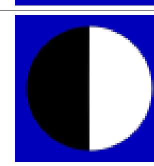
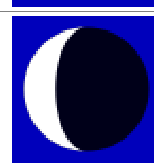
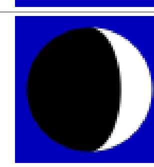
The lunar phase or Moon phase is the shape of the directly sunlit portion of the Moon as viewed from Earth. The lunar phases gradually change over the period of a synodic month (about 29.53 days), as the orbital positions of the Moon around Earth and of Earth around the Sun shift.

The Moon's rotation is tidally locked by Earth's gravity; therefore, most of the same lunar side always faces Earth. This near side is variously sunlit, depending on the position of the Moon in its orbit. Thus, the sunlit portion of this face can vary from 0% (at new moon) to 100% (at full moon). The lunar terminator is the boundary between the illuminated and darkened hemispheres.

Each of the four "intermediate" lunar phases is around 7.4 days, but this varies slightly due to the elliptical shape of the Moon's orbit. Aside from some craters near the lunar poles, such as Shoemaker, all parts of the Moon see around 13.77 days of daylight, followed by 13.77 days of "night". (The side of the Moon facing away from Earth is sometimes called the "dark side of the Moon", although that is a misnomer).

There are four principal lunar phases: new moon, first quarter, full moon, and last quarter (also known as third or final quarter), when the Moon's ecliptic longitude is at an angle to the Sun (as viewed from Earth) of 0°, 90°, 180°, and 270°, respectively. Each of these phases appear at slightly different times at different locations on Earth. During the intervals between principal phases are intermediate phases, during which the Moon's apparent shape is either crescent or gibbous. The intermediate phases last one-quarter of a synodic month, or 7.38 days, on average. The descriptor waxing is used for an intermediate phase when the Moon's apparent shape is thickening, from new to full moon, and waning when the shape is thinning. The longest duration between full moon to new moon (or new moon to full moon) lasts about 15 days and 14.5 hours, while the shortest duration between full moon to new moon (or new moon to full moon) lasts only about 13 days and 22.5 hours.

- New Moon appears higher on summer solstice than on winter solstice.
- First Quarter Moon appears higher on spring equinox than on autumnal (fall) equinox.
- Full Moon appears higher on winter solstice than on summer solstice.
- Last Quarter Moon appears higher on autumnal (fall) equinox than on spring equinox.
- Waxing Crescent Moon appears higher on mid-spring (May 5 in the Northern Hemisphere or November 7 in the Southern Hemisphere) than on mid-autumn (November 7 in the Northern Hemisphere or May 5 in the Southern Hemisphere).
- Waxing Gibbous Moon appears higher on mid-winter (February 4 in the Northern Hemisphere or August 7 in the Southern Hemisphere) than on mid-summer (August 7 in the Northern Hemisphere or February 4 in the Southern Hemisphere).
- Waning Gibbous Moon appears higher on mid-autumn (November 7 in the Northern Hemisphere or May 5 in the Southern Hemisphere) than on mid-spring (May 5 in the Northern Hemisphere or November 7 in the Southern Hemisphere).
- Waning Crescent Moon appears higher on mid-summer (August 7 in the Northern Hemisphere or February 4 in the Southern Hemisphere) than on mid-winter (February 4 in the Northern Hemisphere or August 7 in the Southern Hemisphere).

Moon Phase	Northern Hemisphere	Southern Hemisphere	Visibility	Average Moonrise Time	Min-phase Standard Time	Average Moonset Time	Northern Hemisphere Image	Southern Hemisphere Image
New Moon	Disc completely in Sun's shadow (lit by earthshine only)		Invisible (too close to Sun)	6 am	Noon	6 pm		
Waxing Crescent	Right side, 0.1%–49.9% lit disc	Left side, 0.1–49.9% lit disc	Late morning to post-dusk	9 am	3 pm	9 pm		
First Quarter	Right side, 50% lit disc	Left side, 50% lit disc	Afternoon and early evening	Noon	6 pm	Midnight		
Waxing Gibbous	Right side, 50.1%–99.9% lit disc	Left side, 50.1%–99.9% lit disc	Late afternoon and most of night 3	3 pm	9 pm	3 am		
Full Moon	100% illuminated disc		Sunset to sunrise (all night)	6 pm	Midnight	6 am		
Waning Gibbous	Left side, 99.9%–50.1% lit disc	Right side, 99.9%–50.1% lit dis	Most of night and early morning	9 pm	3 am	9 am		
Last Quarter	Left side, 50% lit disc	Right side, 50% lit disc	Late night and morning	Midnight	6 am	Noon		
Waning Crescent	Left side, 49.9%–0.1% lit disc	Right side, 49.9%–0.1% lit disc	Pre-dawn to early afternoon	3 am	9 am	3 pm		

4 Solar Cycle

The solar cycle or solar magnetic activity cycle is a nearly periodic 11-year change in the Sun's activity measured in terms of variations in the number of observed sunspots on the solar surface. Sunspots have been observed since the early 17th century and the sunspot time series is the longest continuously observed (recorded) time series of any natural phenomena. Accompanying the 11 year quasi-periodicity in sunspots, the large-scale dipolar (north-south) magnetic field component of the Sun also flips every 11 years, however, the peak in the dipolar field lags the peak in the sunspot number, with the former occurring at the minimum between two cycles.

Levels of solar radiation and ejection of solar material, the number and size of sunspots, solar flares, and coronal loops all exhibit a synchronized fluctuation, from active to quiet to active again, with a period of 11 years. This cycle has been observed for centuries by changes in the Sun's appearance and by terrestrial phenomena such as auroras. Solar activity, driven both by the sunspot cycle and transient aperiodic processes govern the environment of the Solar System planets by creating space weather and impact space- and ground-based technologies as well as the Earth's atmosphere and also possibly climate fluctuations on scales of centuries and longer.

5 Water Cycle

The water cycle, also known as the hydrologic cycle or the hydrological cycle, describes the continuous movement of water on, above and below the surface of the Earth. The mass of water on Earth remains fairly constant over time but the partitioning of the water into the major reservoirs of ice, fresh water, saline water and atmospheric water is variable depending on a wide range of climatic variables. The water moves from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere, by the physical processes of evaporation, condensation, precipitation, infiltration, surface runoff, and subsurface flow. In doing so, the water goes through different forms: liquid, solid (ice) and vapor.

The water cycle involves the exchange of energy, which leads to temperature changes. When water evaporates, it takes up energy from its surroundings and cools the environment. When it condenses, it releases energy and warms the environment. These heat exchanges influence climate.

The evaporative phase of the cycle purifies water which then replenishes the land with freshwater. The flow of liquid water and ice transports minerals across the globe. It is also involved in reshaping the geological features of the Earth, through processes including erosion and sedimentation. The water cycle is also essential for the maintenance of most life and ecosystems on the planet.

The sun, which drives the water cycle, heats water in oceans and seas. Water evaporates as water vapor into the air. Some ice and snow sublimates directly into water vapor. Evapotranspiration is water transpired from plants and evaporated from the soil. The water molecule H2O has smaller molecular mass than the major components of the atmosphere, nitrogen and oxygen, N2 and O2, hence is less dense. Due to the significant difference in density, buoyancy drives humid air higher. As altitude increases, air pressure decreases and the temperature drops (see Gas laws). The lower temperature causes water vapor to condense into tiny liquid water droplets which are heavier than the air, and fall unless supported by an updraft. A huge concentration of these droplets over a large space up in the atmosphere become visible as cloud. Some condensation is near ground level, and called fog.

Atmospheric circulation moves water vapor around the globe; cloud particles collide, grow, and fall out of the upper atmospheric layers as precipitation. Some precipitation falls as snow or hail, sleet, and can accumulate as ice caps and glaciers, which can store frozen water for thousands of years. Most water falls back into the oceans or onto land as rain, where the water flows over the ground as surface runoff.

A portion of runoff enters rivers in valleys in the landscape, with streamflow moving water towards the oceans. Runoff and water emerging from the ground (groundwater) may be stored as freshwater in lakes. Not all runoff flows into rivers; much of it soaks into the ground as infiltration. Some water infiltrates deep into the ground and replenishes aquifers, which can store freshwater for long periods of time.

Some infiltration stays close to the land surface and can seep back into surface-water bodies (and the ocean) as groundwater discharge. Some groundwater finds openings in the land surface and comes out as freshwater springs. In river valleys and floodplains, there is often continuous water exchange between surface water and ground water in the hyporheic zone. Over time, the water returns to the ocean, to continue the water cycle.

Processes

Precipitation	Condensed water vapor that falls to the Earth's surface. Most precipitation occurs as rain, but also includes snow, hail, fog drip, graupel, and sleet. Approximately 505,000 km3 (121,000 cu mi) of water falls as precipitation each year, 398,000 km3 (95,000 cu mi) of it over the oceans. The rain on land contains 107,000 km3 (26,000 cu mi) of water per year and a snowing only 1,000 km3 (240 cu mi). 78% of global precipitation occurs over the ocean.
Canopy Interception	The precipitation that is intercepted by plant foliage eventually evaporates back to the atmosphere rather than falling to the ground.
Snowmelt	The runoff produced by melting snow.
Runoff	The variety of ways by which water moves across the land. This includes both surface runoff and channel runoff. As it flows, the water may seep into the ground, evaporate into the air, become stored in lakes or reservoirs, or be extracted for agricultural or other human uses.
Infiltration	The flow of water from the ground surface into the ground. Once infiltrated, the water becomes soil moisture or groundwater. A recent global study using water stable isotopes, however, shows that not all soil moisture is equally available for groundwater recharge or for plant transpiration.
Subsurface Flow	The flow of water underground, in the vadose zone and aquifers. Subsurface water may return to the surface (e.g. as a spring or by being pumped) or eventually seep into the oceans. Water returns to the land surface at lower elevation than where it infiltrated, under the force of gravity or gravity induced pressures. Groundwater tends to move slowly and is replenished slowly, so it can remain in aquifers for thousands of years.
Evaporation	The transformation of water from liquid to gas phases as it moves from the ground or bodies of water into the overlying atmosphere. The source of energy for evaporation is primarily solar radiation. Evaporation often implicitly includes transpiration from plants, though together they are specifically referred to as evapotranspiration. Total annual evapotranspiration amounts to approximately 505,000 km3 (121,000 cu mi) of water, 434,000 km3 (104,000 cu mi) of which evaporates from the oceans. 86% of global evaporation occurs over the ocean.
Sublimation	The state change directly from solid water (snow or ice) to water vapor by passing the liquid state.
Deposition	This refers to changing of water vapor directly to ice.
Advection	The movement of water through the atmosphere. Without advection, water that evaporated over the oceans could not precipitate over land.
Condensation	The transformation of water vapor to liquid water droplets in the air, creating clouds and fog.
Transpiration	The release of water vapor from plants and soil into the air.
Percolation	Water flows vertically through the soil and rocks under the influence of gravity.
Plate Tectonics	Water enters the mantle via subduction of oceanic crust. Water returns to the surface via volcanism.

The water cycle involves many of these processes.

Effects on Climate
The water cycle is powered from solar energy. 86% of the global evaporation occurs from the oceans, reducing their temperature by evaporative cooling. Without the cooling, the effect of evaporation on the greenhouse effect would lead to a much higher surface temperature of 67 °C (153 °F), and a warmer planet. Aquifer drawdown or overdrafting and the pumping of fossil water increases the total amount of water in the hydrosphere, and has been postulated to be a contributor to sea-level rise.

6 Weather Types

The following shows the types of benefits for varying weather types.

Sunny	● **Solar Electricity:** Sun provides solar power. ● **Bacteria Killing Sunlight:** The UV content of sunlight kills bacteria. ● **SODIS Purification:** Purify water using sunlight. ● **Vitamin D:** Gain an essential vitamin for survival. ● **Longer Line of Sight:** The ability to see further when the weather is clear.
Cloudy	● **Cooler Temperatures:** A reprieve from direct sunlight in the form of clouds, but clouds may also hold in heat. ● **Soft Shadows:** Harder to detect people in sunlight when the shadows are soft.
Rainy	● **Fresh Water:** Rain can provide fresh water. ● **Stealth:** Stealthier movement due to lower LOS and dampened sound. ● **Easy to Clean:** o ● **Dynamo:** Electricity Generation From Rivers
Stormy	● **Fresh Water:** Rain can provide fresh water. ● **Stealth:** Much stealthier movement due to lower LOS and dampened sound. ● **Dynamo:** Electricity Generation From Wind and Rivers.
Windy	● **Electricity Generation:** Can generate electricity using the wind. ● **Dampened Sound:** You can move more stealthily.
Cyclone / Hurricane / Typhoon	● **Electricity Generation:** Can generate electricity using the wind. ● **Dampened Sound:** You can move more stealthily.
Dust / Sand Storm	● **Electricity Generation:** Can generate electricity using the wind. ● **Dampened Sound:** You can move more stealthily. ● **Less Visibility:** You can move more stealthily and remain hidden easier.
Snow Storm / Blizzard (Falling Snow)	● **Electricity Generation:** Can generate electricity using the wind. ● **Dampened Sound:** You can move more stealthily. ● **Less Visibility:** You can move more stealthily and remain hidden easier. ● **Water:** Melting hail can provide you with water.
Tornado	● **Electricity Generation:** Can generate electricity using the wind. ● **Dampened Sound:** You can move more stealthily.
Humid	● **Water:** Extractable moisture from the air.
Fog / Mist	● **Less Visibility:** You can move more stealthily and remain hidden easier. ● **Moisture:** Can extract moisture from the air
Snow / Sleet	● **Water:** Meltable Snow for Water ● **Stealth:** Stealthier movement due to lower LOS and dampened sound.
Thundersnow	● **Water:** Meltable Snow for Water ● **Stealth:** Stealthier movement due to lower LOS and dampened sound.
Hail	● **Water:** Melting hail can provide you with water. ● **Protection:** People generally won't be outside if the hail is large enough.
Drought	● **Few Mosquitos:** There will generally be a huge reduction in the mosquito population in a drought.
Wildfire	● **Clears Terrain:** Fires clear terrain of debris. ● **More Visibility:** You can see further with less vegetation around once the smoke clears.

2 Atmosphere

The atmosphere of Earth is the layer of gases, commonly known as air, that surrounds the planet Earth and is retained by Earth's gravity. The atmosphere of Earth protects life on Earth by creating pressure allowing for liquid water to exist on the Earth's surface, absorbing ultraviolet solar radiation, warming the surface through heat retention (greenhouse effect), and reducing temperature extremes between day and night (the diurnal temperature variation).

By volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide, and small amounts of other gases. Air also contains a variable amount of water vapour, on average around 1% at sea level, and 0.4% over the entire atmosphere. Air composition, temperature, and atmospheric pressure vary with altitude, and air suitable for use in photosynthesis by terrestrial plants and breathing of terrestrial animals is found only in Earth's troposphere and in artificial atmospheres.

The atmosphere has a mass of about 5.15×1018 kg, three quarters of which is within about 11 km (6.8 mi; 36,000 ft) of the surface. The atmosphere becomes thinner and thinner with increasing altitude, with no definite boundary between the atmosphere and outer space. The Kármán line, at 100 km (62 mi), or 1.57% of Earth's radius, is often used as the border between the atmosphere and outer space. Atmospheric effects become noticeable during atmospheric re-entry of spacecraft at an altitude of around 120 km (75 mi). Several layers can be distinguished in the atmosphere, based on characteristics such as temperature and composition.

The Atmosphere

Below the Surface
For information on what lies below the surface see NATURAL DISASTERS > Earthquakes > Earth Composition

Surface (Sea Level)

The total surface area of Earth is about 510 million km2 (197 million sq mi). Of this, 70.8%, or 361.13 million km2 (139.43 million sq mi), is below sea level and covered by ocean water. Below the ocean's surface are much of the continental shelf, mountains, volcanoes, oceanic trenches, submarine canyons, oceanic plateaus, abyssal plains, and a globe-spanning mid-ocean ridge system. The remaining 29.2%, or 148.94 million km2 (57.51 million sq mi), not covered by water has terrain that varies greatly from place to place and consists of mountains, deserts, plains, plateaus, and other landforms.

Tectonics and erosion, volcanic eruptions, flooding, weathering, glaciation, the growth of coral reefs, and meteorite impacts are among the processes that constantly reshape the Earth's surface over geological time. The elevation of the land surface varies from the low point of −418 m (−1,371 ft) at the Dead Sea, to a maximum altitude of 8,848 m (29,029 ft) at the top of Mount Everest. The mean height of land above sea level is about 797 m (2,615 ft).

Height 0 km	**Contains** ● Humanity	**Temperature** o			

Troposphere

The troposphere is the lowest layer of Earth's atmosphere. It extends from Earth's surface to an average height of about 12 km (7.5 mi; 39,000 ft), although this altitude varies from about 9 km (5.6 mi; 30,000 ft) at the geographic poles to 17 km (11 mi; 56,000 ft) at the Equator, with some variation due to weather. The troposphere is bounded above by the tropopause, a boundary marked in most places by a temperature inversion (i.e. a layer of relatively warm air above a colder one), and in others by a zone which is isothermal with height.

Although variations do occur, the temperature usually declines with increasing altitude in the troposphere because the troposphere is mostly heated through energy transfer from the surface. Thus, the lowest part of the troposphere (i.e. Earth's surface) is typically the warmest section of the troposphere. This promotes vertical mixing.

The troposphere contains roughly 80% of the mass of Earth's atmosphere. The troposphere is denser than all its overlying atmospheric layers because a larger atmospheric weight sits on top of the troposphere and causes it to be most severely compressed. Fifty percent of the total mass of the atmosphere is located in the lower 5.6 km (3.5 mi; 18,000 ft) of the troposphere. Nearly all atmospheric water vapour or moisture is found in the troposphere, so it is the layer where most of Earth's weather takes place.

It has basically all the weather-associated cloud genus types generated by active wind circulation, although very tall cumulonimbus thunder clouds can penetrate the tropopause from below and rise into the lower part of the stratosphere. Most conventional aviation activity takes place in the troposphere, and it is the only layer that can be accessed by propeller-driven aircraft.

Height 0 - 12 km (0 - 7.5 mi)	**Contains** ● Contrails ● Weather Balloons ● Cirrus Clouds ● Cumulonimbus Clouds ● Nacreous Clouds	**Temperature** 15 to -51°C (59 to -60°F)			

Tropopause

The tropopause is the boundary in the Earth's atmosphere between the troposphere and the stratosphere. It is a thermodynamic gradient stratification layer, marking the end of troposphere. It lies, on average, at 17 kilometres (11 mi) above equatorial regions, and above 9 kilometres (5.6 mi) over the polar regions. Most commercial aircraft are flown in the lower stratosphere, just above the tropopause, where clouds are usually absent, as are significant weather perturbations.

Height 12 km (7.5 mi)	**Contains** ●	**Temperature** -15 to -51°C (5°F to -60°F)			

Stratosphere

The stratosphere is the second-lowest layer of Earth's atmosphere. It lies above the troposphere and is separated from it by the tropopause. This layer extends from the top of the troposphere at roughly 12 km (7.5 mi; 39,000 ft) above Earth's surface to the stratopause at an altitude of about 50 to 55 km (31 to 34 mi; 164,000 to 180,000 ft). The atmospheric pressure at the top of the stratosphere is roughly 1/1000 the pressure at sea level. It contains the ozone layer, which is the part of Earth's atmosphere that contains relatively high concentrations of that gas. The stratosphere defines a layer in which temperatures rise with increasing altitude. This rise in temperature is caused by the absorption of ultraviolet radiation (UV) radiation from the Sun by the ozone layer, which restricts turbulence and mixing.

Although the temperature may be −60 °C (−76 °F; 210 K) at the tropopause, the top of the stratosphere is much warmer, and may be near 0 °C. The stratospheric temperature profile creates very stable atmospheric conditions, so the stratosphere lacks the weather-producing air turbulence that is so prevalent in the troposphere. Consequently, the stratosphere is almost completely free of clouds and other forms of weather. However, polar stratospheric or nacreous clouds are occasionally seen in the lower part of this layer of the atmosphere where the air is coldest. The stratosphere is the highest layer that can be accessed by jet-powered aircraft.

Height 12 - 50 km (7.5 - 31 mi)	**Contains** ● Commercial Aircraft ● Meteors	**Temperature** 0°C (32°F)			

Stratopause

Height 50 km (31 mi)	**Contains** ●	**Temperature** ○			

Mesosphere

The mesosphere is the third highest layer of Earth's atmosphere, occupying the region above the stratosphere and below the thermosphere. It extends from the stratopause at an altitude of about 50 km (31 mi; 160,000 ft) to the mesopause at 80–85 km (50–53 mi; 260,000–280,000 ft) above sea level. Temperatures drop with increasing altitude to the mesopause that marks the top of this middle layer of the atmosphere. It is the coldest place on Earth and has an average temperature around −85 °C (−120 °F; 190 K). Just below the mesopause, the air is so cold that even the very scarce water vapour at this altitude can be sublimated into polar-mesospheric noctilucent clouds. These are the highest clouds in the atmosphere and may be visible to the naked eye if sunlight reflects off them about an hour or two after sunset or a similar length of time before sunrise.

They are most readily visible when the Sun is around 4 to 16 degrees below the horizon. Lightning-induced discharges known as transient luminous events (TLEs) occasionally form in the mesosphere above tropospheric thunderclouds. The mesosphere is also the layer where most meteors burn up upon atmospheric entrance. It is too high above Earth to be accessible to jet-powered aircraft and balloons, and too low to permit orbital spacecraft. The mesosphere is mainly accessed by sounding rockets and rocket-powered aircraft.

Height 50 - 80 km (31 - 50 mi)	**Contains** ● Noctiluscent Cloud	**Temperature** -85°C (-121°F)			

Mesopause

Height 80 km (50 mi)	**Contains** ●	**Temperature** ○			

Thermosphere

The thermosphere is the second-highest layer of Earth's atmosphere. It extends from the mesopause (which separates it from the mesosphere) at an altitude of about 80 km (50 mi; 260,000 ft) up to the thermopause at an altitude range of 500–1000 km (310–620 mi; 1,600,000–3,300,000 ft). The height of the thermopause varies considerably due to changes in solar activity.

Because the thermopause lies at the lower boundary of the exosphere, it is also referred to as the exobase. The lower part of the thermosphere, from 80 to 550 kilometres (50 to 342 mi) above Earth's surface, contains the ionosphere. The temperature of the thermosphere gradually increases with height. Unlike the stratosphere beneath it, wherein a temperature inversion is due to the absorption of radiation by ozone, the inversion in the thermosphere occurs due to the extremely low density of its molecules.

The temperature of this layer can rise as high as 1,500 °C (2,700 °F), though the gas molecules are so far apart that its temperature in the usual sense is not very meaningful. The air is so rarefied that an individual molecule (of oxygen, for example) travels an average of 1 kilometre (0.62 mi; 3300 ft) between collisions with other molecules. Although the thermosphere has a high proportion of molecules with high energy, it would not feel hot to a human in direct contact, because its density is too low to conduct a significant amount of energy to or from the skin.

This layer is completely cloudless and free of water vapour. However, non-hydrometeorological phenomena such as the aurora borealis and aurora australis are occasionally seen in the thermosphere. The International Space Station orbits in this layer, between 350 and 420 km (220 and 260 mi).

Height 80 to (500-1,000) km (50 to (310-620) mi)	**Contains** ● International Space Station (330-410km) ● Auroras	**Temperature** 1,500 °C (2,700 °F)			

Thermopause (Exobase)

The thermopause is the atmospheric boundary of Earth's energy system, located at the top of the thermosphere. The temperature of the thermopause could range from nearly absolute zero to 987.548 °C (1,810 °F). Below this, the atmosphere is defined to be active on the insolation received, due to the increased presence of heavier gases such as monatomic oxygen. The solar constant is thus expressed at the thermopause. Beyond (above) this, the exosphere describes the thinnest remainder of atmospheric particles with large mean free path, mostly hydrogen and helium.

As a limit for the exosphere this boundary is also called exobase. The exact altitude varies by the energy inputs of location, time of day, solar flux, season, etc. and can be between 500 and 1,000 kilometres (310 and 620 mi) high at a given place and time because of these. A portion of the magnetosphere dips below this layer as well. Although these are all named layers of the atmosphere, the pressure is so negligible that the chiefly-used definitions of outer space are actually below this altitude. Orbiting satellites do not experience significant atmospheric heating, but their orbits do decay over time, depending on orbit altitude. Space missions such as the ISS, space shuttle, and Soyuz operate under this layer.

Height 500 - 1,000 km (310 - 620 mi)	**Contains** ●	**Temperature** -273 to 987 °C (-460 to 1,810 °F)			

Exosphere

The exosphere is the outermost layer of Earth's atmosphere (i.e. the upper limit of the atmosphere). It extends from the exobase, which is located at the top of the thermosphere at an altitude of about 700 km above sea level, to about 10,000 km (6,200 mi; 33,000,000 ft) where it merges into the solar wind. This layer is mainly composed of extremely low densities of hydrogen, helium and several heavier molecules including nitrogen, oxygen and carbon dioxide closer to the exobase. The atoms and molecules are so far apart that they can travel hundreds of kilometres without colliding with one another. Thus, the exosphere no longer behaves like a gas, and the particles constantly escape into space.

These free-moving particles follow ballistic trajectories and may migrate in and out of the magnetosphere or the solar wind. The exosphere is located too far above Earth for any meteorological phenomena to be possible. However, the aurora borealis and aurora australis sometimes occur in the lower part of the exosphere, where they overlap into the thermosphere. The exosphere contains most of the satellites orbiting Earth.

Height 700 - 10,000 km	**Contains** ● Satellites	**Temperature** - °C (- °F)			

The Solar System

The Sun

The Sun is the star at the centre of the Solar System. It is a nearly perfect sphere of hot plasma, with internal convective motion that generates a magnetic field via a dynamo process. It is by far the most important source of energy for life on Earth. Its diameter is about 1.39 million kilometres (864,000 miles), or 109 times that of Earth, and its mass is about 330,000 times that of Earth. It accounts for about 99.86% of the total mass of the Solar System. Roughly three quarters of the Sun's mass consists of hydrogen (~73%); the rest is mostly helium (~25%), with much smaller quantities of heavier elements, including oxygen, carbon, neon, and iron.

The Sun is roughly middle-aged. It currently fuses about 600 million tons of hydrogen into helium every second, converting 4 million tons of matter into energy every second as a result. This energy, which can take between 10,000 and 170,000 years to escape from its core, is the source of the Sun's light and heat.

The Sun								**Temperature** 5,778 °K 5,504 °C (9,940 °F)	**Diameter** 1,391,400 km (864,575.87 mi)

The Moon (Luna)

The Moon is an astronomical body that orbits planet Earth and is Earth's only permanent natural satellite. It is the fifth-largest satellite in the Solar System, and the largest among planetary satellites relative to the size of the planet that it orbits (its primary). The Moon is in synchronous rotation with Earth, and thus always shows the same side to Earth, the near side. The near side is marked by dark volcanic maria that fill the spaces between the bright ancient crustal highlands and the prominent impact craters. After the Sun, the Moon is the second-brightest regularly visible celestial object in Earth's sky.

Its surface is actually dark, although compared to the night sky it appears very bright, with a reflectance just slightly higher than that of worn asphalt. Its gravitational influence produces the ocean tides, body tides, and the slight lengthening of the day. The Moon's apparent size in the sky is almost the same as that of the Sun, since the star is about 400 times the lunar distance and diameter. Therefore, the Moon covers the Sun nearly precisely during a total solar eclipse. This matching of apparent visual size will not continue in the far future because the Moon's distance from Earth is gradually increasing.

The Moon								**Average Distance (Earth)** 384,400 km (238,900 mi) **Temperature** 127 °C (260 °F) With Sun -173 °C (-280 °F) No Sun	**Diameter** 2,474.2 km (1537.3 mi)

Mercury

Mercury is the closest planet to our Sun, at just 58 million km (36 million miles) or 0.39 Astronomical Unit (AU) out. Mercury is also the smallest planet in our Solar System, and is also smaller than its largest moon (Ganymede, which orbits Jupiter).

Mercury				**Distance to Sun** 58m Km (36m Mi)	**Avg Distance to Earth** 92m km	**Diameter** 4,879 km (3,032 mi)	**Mass** 3.3011 x 10^23 kg (0.055 Earths)	**Orbit Time** 87.97 Earth Days	**Day Length** 59 Earth Days	**Temperature Range** -173 - 427 °C (-279 - 801 °F)	**Moons** 0

Venus

Venus is the second closest planet to our Sun, orbiting at an average distance of 108 million km (67 million miles) or 0.72 AU. Venus is often called Earth's "sister planet," as it is just a little smaller than Earth. Venus is 81.5% as massive as Earth, and has 90% of its surface area and 86.6% of its volume. The surface gravity, which is 8.87 m/s², is equivalent to 0.904 g – roughly 90% of the Earth standard.

Venus				**Distance to Sun** 108m Km (67m Mi)	**Avg Distance to Earth** 42m km	**Diameter** 12,104 km (7,521 mi)	**Mass** 4.867 x 10^24 kg (0.815 Earth mass)	**Orbit Time** 225 Earth Days	**Day Length** 243 Earth Days	**Temperature Range** 462 °C (864 °F)	**Moons** 0

Earth

Earth is a terrestrial planet with an ever-changing surface, and 70 percent of the Earth's surface is covered in oceans.

Earth				**Distance to Sun** 150m Km (93m Mi)	**Avg Distance to Earth** 0 km	**Diameter** 12,760 km (7,926 mi)	**Mass** 5.97 x 10^24 kg	**Orbit Time** 365 Days	**Day Length** 24 hours (Precisely, 23h 56m 4s)	**Temperature Range** Average is 14°C, (57°F) -88 to 58°C (-126 to 136°F)	**Moons** 1

Mars

Mars is the fourth planet from the sun at a distance of about 228 million km (142 million miles) or 1.52 AU. It is also known as "the Red Planet" because of its reddish hue, which is due to the prevalence of iron oxide on its surface. In many ways, Mars is similar to Earth, which can be seen from its similar rotational period and tilt, which in turn produce seasonal cycles that are comparable to our own.

Mars				**Distance to Sun** 228m Km (142m Mi)	**Avg Distance to Earth** 78m km	**Diameter** 6,787 km (4,217 mi)	**Mass** 6.4171 x 10^23 kg (0.107 Earths)	**Orbit Time** 687 Earth Days	**Day Length** 24 Hours 37 Minutes	**Temperature Range** Avg -55 C (-67 F) -153 to 20 °C (-225 to +70 °F)	**Moons** 2

Jupiter

Jupiter is the fifth planet from the Sun, at a distance of about 778 million km (484 million miles) or 5.2 AU. Jupiter is also the most massive planet in our Solar System, being 317 times the mass of Earth, and two and half times larger than all the other planets combined. It is a gas giant, meaning that it is primarily composed of hydrogen and helium, with swirling clouds and other trace gases.

Jupiter				**Distance to Sun** 778m Km (484m Mi)	**Avg Distance to Earth** 628m km	**Diameter** 428,400 km (88,730 mi)	**Mass** 1.8986 × 10^27 kg (317.8 Earths)	**Orbit Time** 11.9 Earth Years	**Day Length** 9.8 Earth Hours	**Temperature Range** -148 °C (-234 °F)	**Moons** 67

Saturn

Saturn is the sixth planet from the Sun at a distance of about 1.4 billion km (886 million miles) or 9.5 AU. Like Jupiter, it is a gas giant, with layers of gaseous material surrounding a solid core. Saturn is most famous and most easily recognized for its spectacular ring system, which is made of seven rings with several gaps and divisions between them.

Saturn				**Distance to Sun** 1,400m Km (886m Mi)	**Avg Distance to Earth** 1,250m km	**Diameter** 120,500 km (74,900 mi)	**Mass** 5.6836 x 10^26 kg (95.159 Earths)	**Orbit Time** 29.5 Earth Years	**Day Length** 10.7 Earth Hours	**Temperature Range** -178 °C (-288 °F)	**Moons** 53

Uranus

Uranus is the seventh planet from the sun at a distance of about 2.9 billion km (1.8 billion miles) or 19.19 AU. Though it is classified as a "gas giant", it is often referred to as an "ice giant" as well, owing to the presence of ammonia, methane, water and hydrocarbons in ice form. The presence of methane ice is also what gives it its bluish appearance.

Uranus				**Distance to Sun** 2,900m Km (1,800m Mi)	**Avg Distance to Earth** 2,750	**Diameter** 51,120 km (31,763 mi)	**Mass** 8.681 × 10^25 kg (14.541 Earths)	**Orbit Time** 84 Earth Years	**Day Length** 18 Earth Hours	**Temperature Range** -216 °C (-357 °F)	**Moons** 27

Neptune

Neptune is the eighth and farthest planet from the Sun, at a distance of about 4.5 billion km (2.8 billion miles) or 30.07 AU. Like Jupiter, Saturn and Uranus, it is technically a gas giant, though it is more properly classified as an "ice giant" with Uranus.

Neptune				**Distance to Sun** 4,500m Km (2,800m Mi)	**Avg Distance to Earth** 4,350	**Diameter** 9,530 km (30,775 mi)	**Mass** 1.0243 x 10^26 kg (17 Earths)	**Orbit Time** 165 Earth Years	**Day Length** 16 Earth Hours	**Temperature Range** -214 °C (-353 °F)	**Moons** 14

Pluto

Pluto				**Distance to Sun** ○	**Avg Distance to Earth** ○	**Diameter** ○	**Mass** ○	**Orbit Time** ○	**Day Length** ○	**Temperature Range** ○	**Moons** ○

Milky Way

The Milky Way is the galaxy that contains our Solar System, with the name describing the galaxy's appearance from Earth: a hazy band of light seen in the night sky formed from stars that cannot be individually distinguished by the naked eye. The Milky Way is a barred spiral galaxy with a diameter between 150,000 and 200,000 light-years (ly). It is estimated to contain 100–400 billion stars and more than 100 billion planets. The Solar System is located at a radius of about 27,000 light-years from the Galactic Centre, on the inner edge of the Orion Arm, one of the spiral-shaped concentrations of gas and dust.

Outside the Galaxy

Our galaxy, the Milky Way, is only one out of a total of about 100 to 200 billion galaxies that astronomers estimate to be in the Universe. That's more than 10 times the total number of people on Earth. As well as stars, galaxies contain vast amounts of gas and dust. Galaxies come in a variety of shapes and sizes. The Milky Way is an average-sized spiral galaxy: it is 100 000 light years across and contains around 200 billion stars. Small galaxies may contain only a few million stars, while large galaxies can have several trillion stars. Our closest galaxy neighbour is called the Andromeda Galaxy. Andromeda is 2.5 million light years away from the Milky Way. If you wanted to travel to Andromeda and could travel as fast as light, it would still take you 2.5 million years to get there.

Cumulus Humilis

Cumuliform cloud with little vertical extent that is commonly referred to as "fair weather cumulus" and common in the summer. Though if they develop into cumulus mediocris cloud or the cumulus congestus cloud, thunderstorms could develop later in the day.

Forecast: If these clouds are present in the morning, it is a sign of an unstable atmosphere. Larger clouds and possibly thunderstorms could form throughout the day to cause bad or severe weather in the afternoon or evening. Cumulus humilis clouds aren't rain clouds but could show an impending storm in the future.

Cumulus Mediocris

It also may exhibit small protuberances from the top. It may or may not show the cauliflower form characteristic of cumulus clouds.

Forecast: These clouds don't generally produce precipitation of more than very light intensity. They can grow into larger clouds (Cumulus Congestus) which could bring rain, winds and in worse cases, thunder and lightning. If these clouds are present in the morning or early afternoon they show a significant instability in the atmosphere likely leading to storms later in the day.

Cumulus Congestus

Cumulus congestus clouds are characteristic of unstable areas of the atmosphere which are undergoing convection. They are often characterized by sharp outlines and great vertical development. Because they are produced by strong updrafts, they are typically taller than they are wide.

Forecast: Cumulus congestus will mature into cumulonimbus calvus under conditions of sufficient instability. This transformation can be seen by the presence of smooth, fibrous, or striated aspects assumed by the cloud's upper part. This cloud type produces precipitation, often in abundance.

Cumulonimbus

Cumulonimbus progress from overdeveloped cumulus congestus clouds and may further develop as part of a supercell. The cumulonimbus base may extend several miles across and occupy low to middle altitudes. Peaks typically reach to as much as 12,000m. Well-developed cumulonimbus clouds are characterized by a flat, anvil-like top (anvil dome), caused by wind shear or inversion near the tropopause.

Forecast: Dense, towering vertical cloud associated with thunderstorms and atmospheric instability. These clouds are capable of producing lightning and other dangerous severe weather, such as tornadoes.

Stratus

Low-level clouds. Stratus clouds look like featureless gray to white sheets of cloud.

Forecast: A stratus cloud can form from stratocumulus spreading out under an inversion, indicating a continuation of prolonged cloudy weather with drizzle for several hours and then an improvement as it breaks into stratocumulus. Stratus clouds can persist for days in anticyclone conditions.

Nimbostratus

Nimbostratus has a diffuse cloud base generally found anywhere from near surface in the low levels to about 3,000m in the middle level of the troposphere. Although usually dark at its base, it often appears illuminated from within to a surface observer.

Forecast: Nimbostratus is generally a sign of an approaching warm or occluded front producing steady moderate precipitation, as opposed to the shorter period of typically heavier precipitation released by a cold-frontal cumulonimbus cloud. Precipitation may last for several days, depending on the speed of the frontal system.

Altostratus

Middle altitude cloud genus belonging to the stratiform physical category characterized by a generally uniform gray to bluish-green and sheet or layer. It is lighter in colour than nimbostratus and darker than high cirrostratus. The sun can be seen through thin altostratus, but thicker layers can be quite opaque.

Forecast: Altostratus tends to form ahead of a warm or occluded front, the altostratus gradually thickening into rain bearing nimbostratus. However it can also occur together with cumulus congestus or cumulonimbus at a cold front.

Cirrostratus

Difficult to detect and is capable of forming halos when the cloud takes the form of thin cirrostratus nebulosus.

Forecast: Cirrostratus clouds sometimes signal the approach of a warm front if they form after cirrus and spread from one area across the sky, and thus may be signs that precipitation might follow in the next 12 to 24 hours or as soon as 6–8 hours if the front is fast moving.

Cirrus

Characterized by thin, wispy strands. This cloud can form at any altitude between 5.0 km and 14 km above sea level. The strands of cloud sometimes appear in tufts of a distinctive form referred to by the common name of "mares' tails".
Forms from tropical cyclones, and is seen fanning out from the eyewalls of hurricanes. Contrails are a manmade type of cirrus cloud from jet engines.

Forecast: Random, isolated cirrus do not have any particular significance. A large number of cirrus clouds can be a sign of an approaching frontal system or upper air disturbance. This signals a change in weather in the near future, which usually becomes stormier.

Stratocumulus

A stratocumulus cloud belongs to a genus-type of clouds characterized by large dark, rounded masses, usually in groups, lines, or waves, the individual elements being larger than those in altocumulus, and the whole being at a lower altitude.

Forecast: Most often, stratocumulus produce no precipitation, and when they do, it is generally only light rain or snow. However, these clouds are often seen at either the front or tail end of worse weather, so they may indicate storms to come, in the form of thunderheads or gusty winds.

Altocumulus

Middle-altitude cloud genus that belongs mainly to the stratocumuliform physical category characterized by globular masses or rolls in layers or patches, the individual elements being larger and darker than those of cirrocumulus and smaller than those of stratocumulus.

Forecast: Towering altocumulus frequently signals the development of thunderstorms later in the day, as it shows instability and convection in the middle levels of the troposphere (the lowest layer of the atmosphere), the area where towering cumulus clouds can turn into cumulonimbus. It is therefore one of three warning clouds often recorded by the aviation industry, the other two being towering cumulus and cumulonimbus.

Cirrocumulus

Cirrocumulus is a cloud of the stratocumuliform physical category that shows both stratiform and cumuliform characteristics and typically appears as white, patchy sheets with ripples or tufts without gray shading. Each cloudlet appears no larger than a finger held at arm's length. These often are organized in rows like other cumuliform and stratocumuliform clouds, but since they are so small, cirrocumulus patches take on a finer appearance.

Forecast: Cirrocumulus usually only forms in patches. If it forms in patches with cirrus or cirrostratus and the clouds spread across the sky, it usually means rain in 8–10 hours.

Noctilucent

Tenuous cloud-like phenomena in the upper atmosphere. They are made of ice crystals and are only visible in a deep twilight. They are most commonly observed in the summer months at latitudes between 50° and 70° north and south of the equator. These clouds can be observed only during local summer months and when the Sun is below the horizon for the observer, but while the clouds are still in sunlight.

Forecast: None

Polar Stratospheric

Clouds in the winter polar stratosphere at altitudes of 15,000–25,000 meters. They are best observed during civil twilight when the sun is between 1 and 6 degrees below the horizon as well as in winter and in more northerly latitudes.

Forecast: None

4 Weather Phenomenon

Atmospheric optics is "the study of the optical characteristics of the atmosphere or products of atmospheric processes .... (including) temporal and spatial resolutions beyond those discernible with the naked eye". Meteorological optics is "that part of atmospheric optics concerned with the study of patterns observable with the naked eye". Nevertheless, the two terms are sometimes used interchangeably. Meteorological optical phenomena, as described in this article, are concerned with how the optical properties of Earth's atmosphere cause a wide range of optical phenomena and visual perception phenomena.

Subheadings

1 Rainbow

A rainbow is a meteorological phenomenon that is caused by reflection, refraction and dispersion of light in water droplets resulting in a spectrum of light appearing in the sky. It takes the form of a multi-coloured circular arc. Rainbows caused by sunlight always appear in the section of sky directly opposite the sun. Rainbows can be full circles. However, the observer normally sees only an arc formed by illuminated droplets above the ground, and centred on a line from the sun to the observer's eye. In a primary rainbow, the arc shows red on the outer part and violet on the inner side. This rainbow is caused by light being refracted when entering a droplet of water, then reflected inside on the back of the droplet and refracted again when leaving it. In a double rainbow, a second arc is seen outside the primary arc, and has the order of its colours reversed, with red on the inner side of the arc. This is caused by the light being reflected twice on the inside of the droplet before leaving it.

A rainbow is not located at a specific distance from the observer, but comes from an optical illusion caused by any water droplets viewed from a certain angle relative to a light source. Thus, a rainbow is not an object and cannot be physically approached. Indeed, it is impossible for an observer to see a rainbow from water droplets at any angle other than the customary one of 42 degrees from the direction opposite the light source. Even if an observer sees another observer who seems "under" or "at the end of" a rainbow, the second observer will see a different rainbow—farther off—at the same angle as seen by the first observer. Rainbows span a continuous spectrum of colours. Any distinct bands perceived are an artefact of human colour vision, and no banding of any type is seen in a black-and-white photo of a rainbow, only a smooth gradation of intensity to a maximum, then fading towards the other side. For colours seen by the human eye, the most commonly cited and remembered sequence is Newton's sevenfold red, orange, yellow, green, blue, indigo and violet, remembered by the mnemonic Richard Of York Gave Battle In Vain (ROYGBIV). Rainbows can be caused by many forms of airborne water. These include not only rain, but also mist, spray, and airborne dew.

Visibility
Rainbows can be observed whenever there are water drops in the air and sunlight shining from behind the observer at a low altitude angle. Because of this, rainbows are usually seen in the western sky during the morning and in the eastern sky during the early evening. The most spectacular rainbow displays happen when half the sky is still dark with raining clouds and the observer is at a spot with clear sky in the direction of the sun. The result is a luminous rainbow that contrasts with the darkened background. During such good visibility conditions, the larger but fainter secondary rainbow is often visible. It appears about 10° outside of the primary rainbow, with inverse order of colours.

The rainbow effect is also commonly seen near waterfalls or fountains. In addition, the effect can be artificially created by dispersing water droplets into the air during a sunny day. Rarely, a moonbow, lunar rainbow or night-time rainbow, can be seen on strongly moonlit nights. As human visual perception for colour is poor in low light, moonbows are often perceived to be white. It is difficult to photograph the complete semicircle of a rainbow in one frame, as this would require an angle of view of 84°. For a 35 mm camera, a wide-angle lens with a focal length of 19 mm or less would be required.

From above the earth such as in an aeroplane, it is sometimes possible to see a rainbow as a full circle. This phenomenon can be confused with the glory phenomenon, but a glory is usually much smaller, covering only 5–20°. The sky inside a primary rainbow is brighter than the sky outside of the bow. This is because each raindrop is a sphere and it scatters light over an entire circular disc in the sky.

The radius of the disc depends on the wavelength of light, with red light being scattered over a larger angle than blue light. Over most of the disc, scattered light at all wavelengths overlaps, resulting in white light which brightens the sky. At the edge, the wavelength dependence of the scattering gives rise to the rainbow. Light of primary rainbow arc is 96% polarised tangential to the arch. Light of second arc is 90% polarised.

Colours
A spectrum obtained using a glass prism and a point source is a continuum of wavelengths without bands. The number of colours that the human eye is able to distinguish in a spectrum is in the order of 100. Accordingly, the Munsell colour system (a 20th-century system for numerically describing colours, based on equal steps for human visual perception) distinguishes 100 hues. The apparent discreteness of main colours is an artefact of human perception and the exact number of main colours is a somewhat arbitrary choice.

Colours
- Red
- Orange
- Yellow
- Green
- Blue
- Indigo
- Violet

Newton, who admitted his eyes were not very critical in distinguishing colours, originally (1672) divided the spectrum into five main colours: red, yellow, green, blue and violet. Later he included orange and indigo, giving seven main colours by analogy to the number of notes in a musical scale. Newton chose to divide the visible spectrum into seven colours out of a belief derived from the beliefs of the ancient Greek sophists, who thought there was a connection between the colours, the musical notes, the known objects in the Solar System, and the days of the week. Scholars have noted that what Newton regarded at the time as "blue" would today be regarded as cyan, and what Newton called "indigo" would today be considered blue.

Colours
- Red
- Orange
- Yellow
- Green
- Cyan
- Blue
- Violet

According to Isaac Asimov, "It is customary to list indigo as a colour lying between blue and violet, but it has never seemed to me that indigo is worth the dignity of being considered a separate colour. To my eyes it seems merely deep blue." The question of whether everyone sees seven colours in a rainbow is related to the idea of linguistic relativity. Suggestions have been made that there is universality in the way that a rainbow is perceived. However, more recent research suggests that the number of distinct colours observed and what these are called depend on the language that one uses with people whose language has fewer colour words seeing fewer discrete colour bands.

Explanation

When sunlight encounters a raindrop, part of the light is reflected and the rest enters the raindrop. The light is refracted at the surface of the raindrop. When this light hits the back of the raindrop, some of it is reflected off the back. When the internally reflected light reaches the surface again, once more some is internally reflected and some is refracted as it exits the drop. (The light that reflects off the drop, exits from the back, or continues to bounce around inside the drop after the second encounter with the surface, is not relevant to the formation of the primary rainbow.) The overall effect is that part of the incoming light is reflected back over the range of 0° to 42°, with the most intense light at 42°. This angle is independent of the size of the drop, but does depend on its refractive index. Seawater has a higher refractive index than rain water, so the radius of a "rainbow" in sea spray is smaller than a true rainbow. This is visible to the naked eye by a misalignment of these bows. The reason the returning light is most intense at about 42° is that this is a turning point – light hitting the outermost ring of the drop gets returned at less than 42°, as does the light hitting the drop nearer to its centre. There is a circular band of light that all gets returned right around 42°.

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The light at the back of the raindrop does not undergo total internal reflection, and some light does emerge from the back. However, light coming out the back of the raindrop does not create a rainbow between the observer and the sun because spectra emitted from the back of the raindrop do not have a maximum of intensity, as the other visible rainbows do, and thus the colours blend together rather than forming a rainbow. A rainbow does not exist at one particular location. Many rainbows exist; however, only one can be seen depending on the particular observer's viewpoint as droplets of light illuminated by the sun. All raindrops refract and reflect the sunlight in the same way, but only the light from some raindrops reaches the observer's eye. This light is what constitutes the rainbow for that observer. The whole system composed by the sun's rays, the observer's head, and the (spherical) water drops has an axial symmetry around the axis through the observer's head and parallel to the sun's rays. The rainbow is curved because the set of all the raindrops that have the right angle between the observer, the drop, and the sun, lie on a cone pointing at the sun with the observer at the tip. The base of the cone forms a circle at an angle of 40–42° to the line between the observer's head and their shadow but 50% or more of the circle is below the horizon, unless the observer is sufficiently far above the earth's surface to see it all, for example in an aeroplane (see above). Alternatively, an observer with the right vantage point may see the full circle in a fountain or waterfall spray

Variations

Double Rainbows	The term double rainbow is used when both the primary and secondary rainbows are visible. In theory, all rainbows are double rainbows, but since the secondary bow is always fainter than the primary, it may be too weak to spot in practice. Secondary rainbows are caused by a double reflection of sunlight inside the water droplets. Technically the secondary bow is centred on the sun itself, but since its angular size is more than 90° (about 127° for violet to 130° for red), it is seen on the same side of the sky as the primary rainbow, about 10° outside it at an apparent angle of 50–53°. As a result of the "inside" of the secondary bow being "up" to the observer, the colours appear reversed compared to those of the primary bow. The secondary rainbow is fainter than the primary because more light escapes from two reflections compared to one and because the rainbow itself is spread over a greater area of the sky. Each rainbow reflects white light inside its coloured bands, but that is "down" for the primary and "up" for the secondary. The dark area of unlit sky lying between the primary and secondary bows is called Alexander's band, after Alexander of Aphrodisias who first described it.
Twinned Rainbow	Unlike a double rainbow that consists of two separate and concentric rainbow arcs, the very rare twinned rainbow appears as two rainbow arcs that split from a single base. The colours in the second bow, rather than reversing as in a secondary rainbow, appear in the same order as the primary rainbow. A "normal" secondary rainbow may be present as well. Twinned rainbows can look similar to, but should not be confused with supernumerary bands. The two phenomena may be told apart by their difference in colour profile: supernumerary bands consist of subdued pastel hues (mainly pink, purple and green), while the twinned rainbow shows the same spectrum as a regular rainbow. The cause of a twinned rainbow is the combination of different sizes of water drops falling from the sky. Due to air resistance, raindrops flatten as they fall, and flattening is more prominent in larger water drops. When two rain showers with different-sized raindrops combine, they each produce slightly different rainbows which may combine and form a twinned rainbow. A numerical ray tracing study showed that a twinned rainbow on a photo could be explained by a mixture of 0.40 and 0.45 mm droplets. That small difference in droplet size resulted in a small difference in flattening of the droplet shape, and a large difference in flattening of the rainbow top. Meanwhile, the even rarer case of a rainbow split into three branches was observed and photographed in nature.
Full-Circle Rainbow	In theory, every rainbow is a circle, but from the ground, usually only its upper half can be seen. Since the rainbow's centre is diametrically opposed to the sun's position in the sky, more of the circle comes into view as the sun approaches the horizon, meaning that the largest section of the circle normally seen is about 50% during sunset or sunrise. Viewing the rainbow's lower half requires the presence of water droplets below the observer's horizon, as well as sunlight that is able to reach them. These requirements are not usually met when the viewer is at ground level, either because droplets are absent in the required position, or because the sunlight is obstructed by the landscape behind the observer. From a high viewpoint such as a high building or an aircraft, however, the requirements can be met and the full-circle rainbow can be seen. Like a partial rainbow, the circular rainbow can have a secondary bow or supernumerary bows as well. It is possible to produce the full circle when standing on the ground, for example by spraying a water mist from a garden hose while facing away from the sun. A circular rainbow should not be confused with the glory, which is much smaller in diameter and is created by different optical processes. In the right circumstances, a glory and a (circular) rainbow or fog bow can occur together. Another atmospheric phenomenon that may be mistaken for a "circular rainbow" is the 22° halo and is located around the sun (or moon), not opposite it.
Supernumerary Rainbows	In certain circumstances, one or several narrow, faintly coloured bands can be seen bordering the violet edge of a rainbow; i.e., inside the primary bow or, much more rarely, outside the secondary. These extra bands are called supernumerary rainbows or supernumerary bands; together with the rainbow itself the phenomenon is also known as a stacker rainbow. The supernumerary bows are slightly detached from the main bow, become successively fainter along with their distance from it, and have pastel colours (consisting mainly of pink, purple and green hues) rather than the usual spectrum pattern. The effect becomes apparent when water droplets are involved that have a diameter of about 1 mm or less; the smaller the droplets are, the broader the supernumerary bands become, and the less saturated their colours. Due to their origin in small droplets, supernumerary bands tend to be particularly prominent in fogbows. Supernumerary rainbows cannot be explained using classical geometric optics. The alternating faint bands are caused by interference between rays of light following slightly different paths with slightly varying lengths within the raindrops. Some rays are in phase, reinforcing each other through constructive interference, creating a bright band; others are out of phase by up to half a wavelength, cancelling each other out through destructive interference, and creating a gap. Supernumerary rainbows are clearest when raindrops are small and of uniform size.

Reflected Rainbow	When a rainbow appears above a body of water, two complementary mirror bows may be seen below and above the horizon, originating from different light paths. Their names are slightly different. A reflected rainbow may appear in the water surface below the horizon. The sunlight is first deflected by the raindrops, and then reflected off the body of water, before reaching the observer. The reflected rainbow is frequently visible, at least partially, even in small puddles. A reflection rainbow may be produced where sunlight reflects off a body of water before reaching the raindrops (see diagram and Reflection and reflected bows, Norway), if the water body is large, quiet over its entire surface, and close to the rain curtain. The reflection rainbow appears above the horizon. It intersects the normal rainbow at the horizon, and its arc reaches higher in the sky, with its centre as high above the horizon as the normal rainbow's centre is below it. Due to the combination of requirements, a reflection rainbow is rarely visible. Up to eight separate bows may be distinguished if the reflected and reflection rainbows happen to occur simultaneously: The normal (non-reflection) primary and secondary bows above the horizon (1, 2) with their reflected counterparts below it (3, 4), and the reflection primary and secondary bows above the horizon (5, 6) with their reflected counterparts below it (7, 8).
Monochrome Rainbow	Occasionally a shower may happen at sunrise or sunset, where the shorter wavelengths like blue and green have been scattered and essentially removed from the spectrum. Further scattering may occur due to the rain, and the result can be the rare and dramatic monochrome or red rainbow.
Higher-Order Rainbows	In addition to the common primary and secondary rainbows, it is also possible for rainbows of higher orders to form. The order of a rainbow is determined by the number of light reflections inside the water droplets that create it: One reflection results in the first-order or primary rainbow; two reflections create the second-order or secondary rainbow. More internal reflections cause bows of higher orders—theoretically unto infinity. As more and more light is lost with each internal reflection, however, each subsequent bow becomes progressively dimmer and therefore increasingly harder to spot. An additional challenge in observing the third-order (or tertiary) and fourth-order (quaternary) rainbows is their location in the direction of the sun (about 40° and 45° from the sun, respectively), causing them to become drowned in its glare. For these reasons, naturally occurring rainbows of an order higher than 2 are rarely visible to the naked eye. Nevertheless, sightings of the third-order bow in nature have been reported, and in 2011 it was photographed definitively for the first time. Shortly after, the fourth-order rainbow was photographed as well, and in 2014 the first ever pictures of the fifth-order (or quinary) rainbow, located in between the primary and secondary bows, were published. In a laboratory setting, it is possible to create bows of much higher orders.
Rainbows Under Moonlight	Like most atmospheric optical phenomena, rainbows can be caused by light from the Sun, but also from the Moon. In case of the latter, the rainbow is referred to as a lunar rainbow or moonbow. They are much dimmer and rarer than solar rainbows, requiring the Moon to be near-full in order for them to be seen. For the same reason, moonbows are often perceived as white and may be thought of as monochrome. The full spectrum is present, however, but the human eye is not normally sensitive enough to see the colours. Long exposure photographs will sometimes show the colour in this type of rainbow.
Fogbow	Fogbows form in the same way as rainbows, but they are formed by much smaller cloud and fog droplets that diffract light extensively. They are almost white with faint reds on the outside and blues inside; often one or more broad supernumerary bands can be discerned inside the inner edge. The colours are dim because the bow in each colour is very broad and the colours overlap. Fogbows are commonly seen over water when air in contact with the cooler water is chilled, but they can be found anywhere if the fog is thin enough for the sun to shine through and the sun is fairly bright. They are very large—almost as big as a rainbow and much broader. They sometimes appear with a glory at the bow's centre. Fog bows should not be confused with ice halos, which are very common around the world and visible much more often than rainbows (of any order), yet are unrelated to rainbows.
Circumhorizontal and Circumzenithal Arcs	The circumzenithal and circumhorizontal arcs are two related optical phenomena similar in appearance to a rainbow, but unlike the latter, their origin lies in light refraction through hexagonal ice crystals rather than liquid water droplets. This means that they are not rainbows, but members of the large family of halos. Both arcs are brightly coloured ring segments centred on the zenith, but in different positions in the sky: The circumzenithal arc is notably curved and located high above the Sun (or Moon) with its convex side pointing downwards (creating the impression of an "upside down rainbow"); the circumhorizontal arc runs much closer to the horizon, is more straight and located at a significant distance below the Sun (or Moon). Both arcs have their red side pointing towards the sun and their violet part away from it, meaning the circumzenithal arc is red on the bottom, while the circumhorizontal arc is red on top. The circumhorizontal arc is sometimes referred to by the misnomer "fire rainbow". In order to view it, the Sun or Moon must be at least 58° above the horizon, making it a rare occurrence at higher latitudes. The circumzenithal arc, visible only at a solar or lunar elevation of less than 32°, is much more common, but often missed since it occurs almost directly overhead.

2 Aurora

An aurora, sometimes referred to as polar lights, northern lights (aurora borealis), southern lights (aurora australis), is a natural light display in the Earth's sky, predominantly seen in the high-latitude regions (around the Arctic and Antarctic). Auroras are the result of disturbances in the magnetosphere caused by solar wind. These disturbances are regularly strong enough to alter the trajectories of charged particles in both solar wind and magnetospheric plasma. These particles, mainly electrons and protons, precipitate into the upper atmosphere (thermosphere/exosphere). The resulting ionization and excitation of atmospheric constituents emits light of varying colour and complexity. The form of the aurora, occurring within bands around both polar regions, is also dependent on the amount of acceleration imparted to the precipitating particles. Precipitating protons generally produce optical emissions as incident hydrogen atoms after gaining electrons from the atmosphere. Proton auroras are usually observed at lower latitudes. See LIGHT for information on the colours of auroras.

Occurrence
Most auroras occur in a band known as the "auroral zone", which is typically 3° to 6° wide in latitude and between 10° and 20° from the geomagnetic poles at all local times (or longitudes), most clearly seen at night against a dark sky. A region that currently displays an aurora is called the "auroral oval", a band displaced towards the night side of the Earth. Early evidence for a geomagnetic connection comes from the statistics of auroral observations. Elias Loomis (1860), and later Hermann Fritz (1881) and S. Tromholt (1882) in more detail, established that the aurora appeared mainly in the auroral zone. Day-to-day positions of the auroral ovals are posted on the Internet.

In northern latitudes, the effect is known as the aurora borealis or the northern lights. The former term was coined by Galileo in 1619, from the Roman goddess of the dawn and the Greek name for the north wind. The southern counterpart, the aurora australis or the southern lights, has features almost identical to the aurora borealis and changes simultaneously with changes in the northern auroral zone. The Aurora Australis is visible from high southern latitudes in Antarctica, Chile, Argentina, New Zealand, and Australia. A geomagnetic storm causes the auroral ovals (north and south) to expand, and bring the aurora to lower latitudes.

The instantaneous distribution of auroras is slightly different, being centred about 3–5° nightward of the magnetic pole, so that auroral arcs reach furthest toward the equator when the magnetic pole in question is in between the observer and the Sun. The aurora can be seen best at this time, which is called magnetic midnight. Auroras seen within the auroral oval may be directly overhead, but from farther away, they illuminate the poleward horizon as a greenish glow, or sometimes a faint red, as if the Sun were rising from an unusual direction. Auroras also occur poleward of the auroral zone as either diffuse patches or arcs, which can be subvisual.

Auroras are occasionally seen in latitudes below the auroral zone, when a geomagnetic storm temporarily enlarges the auroral oval. Large geomagnetic storms are most common during the peak of the 11-year sunspot cycle or during the three years after the peak. An aurora may appear overhead as a "corona" of rays, radiating from a distant and apparent central location, which results from perspective. An electron spirals (gyrates) about a field line at an angle that is determined by its velocity vectors, parallel and perpendicular, respectively, to the local geomagnetic field vector B. This angle is known as the "pitch angle" of the particle.

The distance, or radius, of the electron from the field line at any time is known as its Larmor radius. The pitch angle increases as the electron travels to a region of greater field strength nearer to the atmosphere. Thus, it is possible for some particles to return, or mirror, if the angle becomes 90° before entering the atmosphere to collide with the denser molecules there. Other particles that do not mirror enter the atmosphere and contribute to the auroral display over a range of altitudes.

Other types of auroras have been observed from space, e.g. "poleward arcs" stretching sunward across the polar cap, the related "theta aurora", and "dayside arcs" near noon. These are relatively infrequent and poorly understood. Other interesting effects occur such as flickering aurora, "black aurora" and subvisual red arcs. In addition to all these, a weak glow (often deep red) observed around the two polar cusps, the field lines separating the ones that close through the Earth from those that are swept into the tail and close remotely.

Causes
A full understanding of the physical processes which lead to different types of auroras is still incomplete, but the basic cause involves the interaction of the solar wind with the Earth's magnetosphere. The varying intensity of the solar wind produces effects of different magnitudes, but includes one or more of the following physical scenarios.

1. A quiescent solar wind flowing past the Earth's magnetosphere steadily interacts with it and can both inject solar wind particles directly onto the geomagnetic field lines that are 'open', as opposed to being 'closed' in the opposite hemisphere, and provide diffusion through the bow shock. It can also cause particles already trapped in the radiation belts to precipitate into the atmosphere. Once particles are lost to the atmosphere from the radiation belts, under quiet conditions, new ones replace them only slowly, and the loss-cone becomes depleted. In the magnetotail, however, particle trajectories seem constantly to reshuffle, probably when the particles cross the very weak magnetic field near the equator. As a result, the flow of electrons in that region is nearly the same in all directions ("isotropic"), and assures a steady supply of leaking electrons. The leakage of electrons does not leave the tail positively charged, because each leaked electron lost to the atmosphere is replaced by a low energy electron drawn upward from the ionosphere. Such replacement of "hot" electrons by "cold" ones is in complete accord with the 2nd law of thermodynamics. The complete process, which also generates an electric ring current around the Earth, is uncertain.

2. Geomagnetic disturbance from an enhanced solar wind causes distortions of the magnetotail ("magnetic substorms"). These 'substorms' tend to occur after prolonged spells(hours) during which the interplanetary magnetic field has had an appreciable southward component. This leads to a higher rate of interconnection between its field lines and those of Earth. As a result, the solar wind moves magnetic flux (tubes of magnetic field lines, 'locked' together with their resident plasma) from the day side of Earth to the magnetotail, widening the obstacle it presents to the solar wind flow and constricting the tail on the night-side. Ultimately some tail plasma can separate ("magnetic reconnection"); some blobs ("plasmoids") are squeezed downstream and are carried away with the solar wind; others are squeezed toward Earth where their motion feeds strong outbursts of auroras, mainly around midnight ("unloading process"). A geomagnetic storm resulting from greater interaction adds many more particles to the plasma trapped around Earth, also producing enhancement of the "ring current". Occasionally the resulting modification of the Earth's magnetic field can be so strong that it produces auroras visible at middle latitudes, on field lines much closer to the equator than those of the auroral zone.

3. Acceleration of auroral charged particles invariably accompanies a magnetospheric disturbance that causes an aurora. This mechanism, which is believed to predominantly arise from strong electric fields along the magnetic field or wave-particle interactions, raises the velocity of a particle in the direction of the guiding magnetic field. The pitch angle is thereby decreased, and increases the chance of it being precipitated into the atmosphere. Both electromagnetic and electrostatic waves, produced at the time of greater geomagnetic disturbances, make a significant contribution to the energising processes that sustain an aurora.

Particle acceleration provides a complex intermediate process for transferring energy from the solar wind indirectly into the atmosphere. The details of these phenomena are not fully understood. However it is clear that the prime source of auroral particles is the solar wind feeding the magnetosphere, the reservoir containing the radiation zones and temporarily magnetically-trapped particles confined by the geomagnetic field, coupled with particle acceleration processes.

Causes
Auroras result from emissions of photons in the Earth's upper atmosphere, above 80 km (50 mi), from ionized nitrogen atoms regaining an electron, and oxygen atoms and nitrogen based molecules returning from an excited state to ground state. They are ionized or excited by the collision of particles precipitated into the atmosphere. Both incoming electrons and protons may be involved. Excitation energy is lost within the atmosphere by the emission of a photon, or by collision with another atom or molecule:

Oxygen emissions
green or orange-red, depending on the amount of energy absorbed.

Nitrogen emissions
blue or red; blue if the atom regains an electron after it has been ionized, red if returning to ground state from an excited state.

Oxygen is unusual in terms of its return to ground state: it can take three quarters of a second to emit green light and up to two minutes to emit red. Collisions with other atoms or molecules absorb the excitation energy and prevent emission. Because the highest atmosphere has a higher percentage of oxygen and is sparsely distributed such collisions are rare enough to allow time for oxygen to emit red. Collisions become more frequent progressing down into the atmosphere, so that red emissions do not have time to happen, and eventually even green light emissions are prevented. This is why there is a colour differential with altitude; at high altitudes oxygen red dominates, then oxygen green and nitrogen blue/red, then finally nitrogen blue/red when collisions prevent oxygen from emitting anything. Green is the most common colour. Then comes pink, a mixture of light green and red, followed by pure red, then yellow (a mixture of red and green), and finally, pure blue.

3 Halo

Halo is the name for a family of optical phenomena produced by sunlight interacting with ice crystals suspended in the atmosphere. Halos can have many forms, ranging from coloured or white rings to arcs and spots in the sky. Many of these appear near the Sun or Moon, but others occur elsewhere or even in the opposite part of the sky. Among the best known halo types are the circular halo (properly called the 22° halo), light pillars, and sun dogs, but many others occur; some are fairly common while others are (extremely) rare. The ice crystals responsible for halos are typically suspended in cirrus or cirrostratus clouds in the upper troposphere (5–10 km (3.1–6.2 mi)), but in cold weather they can also float near the ground, in which case they are referred to as diamond dust. The particular shape and orientation of the crystals are responsible for the type of halo observed. Light is reflected and refracted by the ice crystals and may split into colours because of dispersion. The crystals behave like prisms and mirrors, refracting and reflecting light between their faces, sending shafts of light in particular directions. Atmospheric optical phenomena like halos were used as part of weather lore, which was an empirical means of weather forecasting before meteorology was developed. They often do indicate that rain will fall within the next 24 hours, since the cirrostratus clouds that cause them can signify an approaching frontal system. Other common types of optical phenomena involving water droplets rather than ice crystals include the glory and rainbow.

Light Pillar
A light pillar, or sun pillar, appears as a vertical pillar or column of light rising from the sun near sunset or sunrise, though it can appear below the sun, particularly if the observer is at a high elevation or altitude. Hexagonal plate- and column-shaped ice crystals cause the phenomenon. Plate crystals generally cause pillars only when the sun is within 6 degrees of the horizon; column crystals can cause a pillar when the sun is as high as 20 degrees above the horizon. The crystals tend to orient themselves near-horizontally as they fall or float through the air, and the width and visibility of a sun pillar depend on crystal alignment. Light pillars can also form around the moon, and around street lights or other bright lights. Pillars forming from ground-based light sources may appear much taller than those associated with the sun or moon. Since the observer is closer to the light source, crystal orientation matters less in the formation of these pillars.

METEOROLOGY Weather Phenomenon Halo

Circular Halo
Among the best-known halos is the 22° halo, often just called "halo", which appears as a large ring around the Sun or Moon with a radius of about 22° (roughly the width of an outstretched hand at arm's length). The ice crystals that cause the 22° halo are oriented semi-randomly in the atmosphere, in contrast to the horizontal orientation required for some other halos such as sun dogs and light pillars. As a result of the optical properties of the ice crystals involved, no light is reflected towards the inside of the ring, leaving the sky noticeably darker than the sky around it, and giving it the impression of a "hole in the sky". The 22° halo is not to be confused with the corona, which is a different optical phenomenon caused by water droplets rather than ice crystals, and which has the appearance of a multi-coloured disk rather than a ring. Other haloes can form at 46° to the sun, or at the horizon, or around the zenith, and can appear as full haloes or incomplete arcs.

Bottlinger's Ring
A Bottlinger's ring is a rare type of halo that is elliptical instead of circular. It has a small diameter, which makes it very difficult to see in the Sun's glare and more likely to be spotted around the dimmer Subsun, often seen from mountain tops or airplanes. Bottlinger's rings are not well understood yet. It is suggested that they are formed by very flat pyramidal ice crystals with faces at uncommonly low angles, suspended horizontally in the atmosphere. These precise and physically problematic requirements would explain why the halo is very rare.

4 Afterglow

METEOROLOGY Weather Phenomenon Afterglow

An afterglow is a broad arch of whitish or pinkish sunlight in the sky that is scattered by fine particulates like dust suspended in the atmosphere. An afterglow may appear above the highest clouds in the hour of fading twilight, or be reflected off high snowfields in mountain regions long after sunset. The particles produce a scattering effect upon the component parts of white light. True alpenglow, which occurs long after sunset or long before sunrise, is caused by the backscattering of red sunlight by aerosols and fine dust particles low in the atmosphere.

After sunset, alpenglow is an afterglow caused by the illumination of atmospheric particles by sunlight as it gets refracted and scattered through the Earth's atmosphere. The high-energy and high-frequency light is scattered out the most, while the remaining low-energy and -frequency light reaches the observer on the horizon at twilight. The backscattering of this light further turns it pinkish to reddish. This period of time is referred to as blue hour and is widely treasured by photographers and painters, as it offers breathtaking views.

The afterglow persists until the Earth's shadow (terminator line) overtakes the sky above the observer as night falls and the stars appear, with Venus (the second-brightest celestial object after the Moon in the night sky) visible above the horizon opposite of the Belt of Venus around the antisolar point. After the 1883 eruption of the volcano Krakatoa, a remarkable series of red sunsets appeared worldwide. An enormous amount of exceedingly fine dust were blown to a great height by the volcano's explosion, and then globally diffused by the high atmospheric winds. Edvard Munch's painting The Scream possibly depicts an afterglow during this period.

5 Corona

METEOROLOGY Weather Phenomenon Corona

In meteorology, a corona (plural coronae) is an optical phenomenon produced by the diffraction of sunlight or moonlight (or, occasionally, bright starlight or planetlight) by individual small water droplets and sometimes tiny ice crystals of a cloud or on a foggy glass surface. In its full form, a corona consists of several concentric, pastel-coloured rings around the celestial object and a central bright area called aureole. The aureole is often (especially in case of the Moon) the only visible part of the corona and has the appearance of a bluish-white disk which fades to reddish-brown towards the edge. The angular diameter of a corona depends on the sizes of the water droplets involved; smaller droplets produce larger coronae. For the same reason, the corona is the most pronounced when the size of the droplets is most uniform.

Coronae differ from halos in that the latter are formed by refraction (rather than diffraction) from comparatively large rather than small ice crystals. Pollen suspended in the air can also cause diffraction of sunlight that produces coronae. Because pollen grains are not always spherical, the resulting pollen coronae often have characteristic elliptic shape and brighter spots in them. They can be seen during blooming season where there is significant source of pollen like forests. They are more easily seen during sunset or sunrise as there is less sun glare and the light path through pollen laden atmosphere is longer.

6 Circumzenithal Arc

METEOROLOGY Weather Phenomenon Circumzenithal Arc

The circumzenithal arc, also called the circumzenith arc (CZA), upside-down rainbow, and the Bravais arc, is an optical phenomenon similar in appearance to a rainbow, but belonging to the family of halos arising from refraction of sunlight through ice crystals, generally in cirrus or cirrostratus clouds, rather than from raindrops. The arc is located at a considerable distance (approximately 46°) above the sun and at most forms a quarter of a circle centred on the zenith. It has been called "a smile in the sky", its first impression being that of an upside-down rainbow. The CZA is one of the brightest and most colourful members of the halo family. Its colours, ranging from violet on top to red at the bottom, are purer than those of a rainbow because there is much less overlap in their formation. The intensity distribution along the circumzenithal arc requires consideration of several effects: Fresnel's reflection and transmission amplitudes, atmospheric attenuation, chromatic dispersion (i.e. the width of the arc), azimuthal angular dispersion (ray bundling), and geometrical constraints. In effect, the CZA is brightest when the sun is at about 20°. Contrary to public awareness, the CZA is not a rare phenomenon, but it tends to be overlooked since it occurs so far overhead. It is worthwhile to look out for it when sun dogs are visible, since the same type of ice crystals that cause them (plate-shaped hexagonal prisms in horizontal orientation) are responsible for the CZA.

Formation
The light that forms the CZA enters an ice crystal through its flat top face, and exits through a side prism face. The refraction of almost parallel sunlight through what is essentially a 90-degree prism accounts for the wide colour separation and the purity of colour. The CZA can only form when the sun is at an altitude lower than 32.2°. The CZA is brightest when the sun is at 22° above the horizon, which causes sunlight to enter and exit the crystals at the minimum deviation angle; then it is also about 22° in radius, 3° in width. The CZA radius varies between 32.2° and 0° depending on the solar altitude. Towards either of the extremes it is vanishingly faint. When the sun is above 32.2°, light exits the crystals through the bottom face instead, to contribute to the almost colourless parhelic circle. Because the phenomenon also requires that the ice crystals have a common orientation, it occurs only in the absence of turbulence and when there is no significant up- or downdraft.

7 Circumhorizontal Arc

METEOROLOGY Weather Phenomenon Circumhorizontal

A circumhorizontal arc is an optical phenomenon that belongs to the family of ice halos formed by the refraction of sun- or moonlight in plate-shaped ice crystals suspended in the atmosphere, typically in cirrus or cirrostratus clouds. In its full form, the arc has the appearance of a large, brightly spectrum-coloured band (red being the topmost colour) running parallel to the horizon, located far below the Sun or Moon. The distance between the arc and the Sun or Moon is twice as far as the common 22-degree halo. Often, when the halo-forming cloud is small or patchy, only fragments of the arc are seen. As with all halos, it can be caused by the Sun as well as (but much more rarely) the Moon. Other currently accepted names for the circumhorizontal arc are circumhorizon arc or lower symmetric 46° plate arc. The misleading term "fire rainbow" is sometimes used to describe this phenomenon, although it is neither a rainbow, nor related in any way to fire. The term, apparently coined in 2006, may originate in the occasional appearance of the arc as "flames" in the sky, when it occurs in fragmentary cirrus clouds.

Formation
The halo is formed by sunlight entering horizontally-oriented, flat, hexagonal ice crystals through a vertical side face and leaving through the near horizontal bottom face (plate thickness does not affect the formation of the halo). In principle, Parry oriented column crystals may also produce the arc, although this is rare. The 90° inclination between the ray entrance and exit faces produce the well-separated spectral colours. The arc has a considerable angular extent and thus, rarely is complete. When only fragments of a cirrus cloud are in the appropriate sky and sun position, they may appear to shine with spectral colours.

Frequency
How often a circumhorizontal arc is seen, depends on the location and the latitude of the observer. In the United States it is a relatively common halo, seen several times each summer in any one place. In contrast, it is a rare phenomenon in northern Europe for several reasons. Apart from the presence of ice-containing clouds in the right position in the sky, the halo requires that the light source (Sun or Moon) be very high in the sky, at an elevation of 58° or greater. This means that the solar variety of the halo is impossible to see at locations north of 55°N or south of 55°S. A lunar circumhorizon arc might be visible at other latitudes, but is much rarer since it requires a nearly full Moon to produce enough light. At other latitudes the solar circumhorizontal arc is visible, for a greater or lesser time, around the summer solstice. Slots of visibility for different latitudes and locations may be looked up here. For example, in London, England the sun is only high enough for 140 hours between mid-May and late July, whereas Los Angeles has the sun higher than 58 degrees for 670 hours between late March and late September.

Artificial Circumhorizontal Arcs
A water glass experiment (known about since at least 1920) may be modified slightly to create an artificial circumhorizontal arc. Illuminating under a very steep angle from below the side face of a nearly completely water-filled cylindrical glass will refract the light into the water. The glass should be situated at the edge of a table. The second refraction at the top water-air interface will then project a hyperbola at a vertical wall behind it. The overall refraction is then equivalent to the refraction through an upright hexagonal plate crystal when the rotational averaging is taken into account. A colourful artificial circumhorizontal arc will then appear projected on the wall. Using a spherical projection screen instead will result in a closer analogy to the natural halo counterpart. Other artificial halos can be created by similar means.

Similar Optical Phenomena
Circumhorizontal arcs, especially when only fragments can be seen, are sometimes confused with cloud iridescence. This phenomenon also causes clouds to appear multi-coloured, but it originates from diffraction (typically by liquid water droplets or ice crystals) rather than refraction. The two phenomena can be distinguished by several features. Firstly, a circumhorizon arc always has a fixed location in the sky in relation to the Sun or Moon (namely below it at an angle of 46°), while iridescence can occur in different positions (often directly around the Sun or Moon). Secondly, the colour bands in a circumhorizon arc always run horizontally with the red on top, while in iridescence they are much more random in sequence and shape, which roughly follows the contours of the cloud that causes it. Finally, the colours of a circumhorizon arc are pure and spectral (more so than in a rainbow), while the colours in cloud iridescence have a more washed-out, "mother of pearl" appearance. Confusion with other members of the halo family, such as sun dogs or the circumzenithal arc, may also arise, but these are easily dismissed by their entirely different positions in relation to the Sun or Moon. More difficult is the distinction between the circumhorizontal arc and the infralateral arc, both of which almost entirely overlap when the Sun or Moon is at a high elevation. The difference is that the circumhorizontal arc always runs parallel to the horizon (although pictures typically show it as a curved line due to perspective distortion), whereas the infralateral arc curves upward at its ends.

8 Crepuscular Rays

Crepuscular rays (more commonly known as sunbeams, sun rays, splintered light, or god rays), in meteorological optics, are rays of sunlight that appear to radiate from the point in the sky where the Sun is located. Shining through openings in clouds (particularly stratocumulus) or between other objects such as mountains, these columns of sunlit scattering particles are separated by darker shadowed volumes. Despite seeming to converge toward the light source, the rays are essentially parallel shafts of sunlit and shadowed particles. Their apparent convergence is a visual illusion from linear perspective. This illusion is the same as railway lines' or long hallways' appearing to converge at a distant vanishing point. The scattering particles that make crepuscular rays visible can be air molecules or particulates.

Colour
Crepuscular rays usually appear orange because the path through the atmosphere at sunrise and sunset passes through up to 40 times as much air as rays from a high midday sun. Particles in the air scatter short wavelength light (blue and green) through Rayleigh scattering much more strongly than longer wavelength yellow and red light.

9 Anticrepuscular Rays

Anticrepuscular rays, or antisolar rays, are meteorological optical phenomena similar to crepuscular rays, but appear opposite of the Sun in the sky. Anticrepuscular rays are essentially parallel, but appear to converge toward the antisolar point, the vanishing point, due to a visual illusion from linear perspective. Anticrepuscular rays are most frequently visible around sunrise or sunset. This is because the atmospheric light scattering that makes them visible is larger for low angles to the horizon, backscattering, (see Mie theory) than at most other angles. Anticrepuscular rays are dimmer than crepuscular rays because backscattering is less than forward scattering. Anticrepuscular rays can be continuous with crepuscular rays, curving across the whole sky in great circles.

Mountain Shadow
A common example of a single anticrepuscular ray is provided by the shadow of a mountain at sunset, when viewed from the summit. It appears to be triangular, whatever the shape of the mountain, with the apex at the antisolar point.

Wagon-Wheel Spokes
Anticrepuscular rays are sometimes seen enclosed by a rainbow (see picture). In this case they can be called wagon-wheel spokes.

10 Sun Dog

A sun dog (or sundog) or mock sun, formally called a parhelion in meteorology, is an atmospheric optical phenomenon that consists of a bright spot to one or both sides of the Sun. Two sun dogs often flank the Sun within a 22° halo. The sun dog is a member of the family of halos, caused by the refraction of sunlight by ice crystals in the atmosphere. Sun dogs typically appear as a pair of subtly coloured patches of light, around 22° to the left and right of the Sun, and at the same altitude above the horizon as the Sun. They can be seen anywhere in the world during any season, but are not always obvious or bright. Sun dogs are best seen and most conspicuous when the Sun is near the horizon.

Formation
Sun dogs are commonly caused by the refraction and scattering of light from plate-shaped hexagonal ice crystals either suspended in high and cold cirrus or cirrostratus clouds, or drifting in freezing moist air at low levels as diamond dust. The crystals act as prisms, bending the light rays passing through them with a minimum deflection of 22°. As the crystals gently float downwards with their large hexagonal faces almost horizontal, sunlight is refracted horizontally, and sun dogs are seen to the left and right of the Sun. Larger plates wobble more, and thus produce taller sundogs. Sun dogs are red-coloured at the side nearest the Sun; farther out the colours grade through oranges to blue.

The colours overlap considerably and are muted, never pure or saturated. The colours of the sun dog finally merge into the white of the parhelic circle (if the latter is visible). The same plate-shaped ice crystals that cause sun dogs are also responsible for the colourful circumzenithal arc, meaning that these two types of halo tend to co-occur. The latter is often missed by viewers, since it is located more or less directly overhead. Another halo variety often seen together with sun dogs is the 22° halo, which forms a ring at roughly the same angular distance from the sun as the sun dogs, thus appearing to interconnect them.

As the Sun rises higher, the rays passing through the plate crystals are increasingly skewed from the horizontal plane, causing their angle of deviation to increase and the sun dogs to move farther from the 22° halo, while staying at the same elevation. It is possible to predict the forms of sun dogs as would be seen on other planets and moons. Mars might have sun dogs formed by both water-ice and CO2-ice. On the gas giant planets — Jupiter, Saturn, Uranus and Neptune—other crystals form clouds of ammonia, methane, and other substances that can produce halos with four or more sun dogs.

11 Mirage

A mirage is a naturally occurring optical phenomenon in which light rays bend to produce a displaced image of distant objects or the sky. The word comes to English via the French mirage, from the Latin mirari, meaning "to look at, to wonder at". This is the same root as for "mirror" and "to admire". Mirages can be categorized as "inferior" (meaning lower), "superior" (meaning higher) and "Fata Morgana", one kind of superior mirage consisting of a series of unusually elaborate, vertically stacked images, which form one rapidly changing mirage. In contrast to a hallucination, a mirage is a real optical phenomenon that can be captured on camera, since light rays are actually refracted to form the false image at the observer's location. What the image appears to represent, however, is determined by the interpretive faculties of the human mind. For example, inferior images on land are very easily mistaken for the reflections from a small body of watersurface.

Inferior Mirage
For exhausted travellers in the desert, an inferior mirage may appear to be a lake of water in the distance. An inferior mirage is called "inferior" because the mirage is located under the real object. The real object in an inferior mirage is the (blue) sky or any distant (therefore bluish) object in that same direction. The mirage causes the observer to see a bright and bluish patch on the ground in the distance which is also called oasis mirage. Light rays coming from a particular distant object all travel through nearly the same air layers and all are bent over about the same amount. Therefore, rays coming from the top of the object will arrive lower than those from the bottom. The image usually is upside down, enhancing the illusion that the sky image seen in the distance is really a water or oil puddle acting as a mirror. Inferior images are not stable. Hot air rises, and cooler air (being more dense) descends, so the layers will mix, giving rise to turbulence. The image will be distorted accordingly. It may be vibrating; it may be vertically extended (towering) or horizontally extended (stooping). If there are several temperature layers, several mirages may mix, perhaps causing double images. In any case, mirages are usually not larger than about half a degree high (same apparent size as the sun and moon) and from objects only a few kilometres away.

Heat Haze
Heat haze, also called heat shimmer, refers to the inferior mirage experienced when viewing objects through a layer of heated air; for example, viewing objects across hot asphalt or through the exhaust gases produced by jet engines. When appearing on roads due to the hot asphalt, it is often referred to as a highway mirage. Heat haze, also called heat shimmer, refers to the inferior mirage experienced when viewing objects through a layer of heated air; for example, viewing objects across hot asphalt or through the exhaust gases produced by jet engines. When appearing on roads due to the hot asphalt, it is often referred to as a highway mirage. Light from the sky at a shallow angle to the road is refracted by the index gradient, making it appear as if the sky is reflected by the road's surface. The mind interprets this as a pool of water on the road, since water also reflects the sky. The illusion fades as one gets closer. On tarmac roads it may look as if water, or even oil, has been spilled. These kinds of inferior mirages are often called "desert mirages" or "highway mirages". Both sand and tarmac can become very hot when exposed to the sun, easily being more than 10 °C hotter than the air one meter above, enough to create conditions suitable for the formation of the mirage. Heat haze is not related to the atmospheric phenomenon of haze.

Superior Mirage
A superior mirage occurs when the air below the line of sight is colder than the air above it. This unusual arrangement is called a temperature inversion, since warm air above cold air is the opposite of the normal temperature gradient of the atmosphere. Passing through the temperature inversion, the light rays are bent down, and so the image appears above the true object, hence the name superior. Superior mirages are in general less common than inferior mirages, but, when they do occur, they tend to be more stable, as cold air has no tendency to move up and warm air has no tendency to move down. Superior mirages are quite common in polar regions, especially over large sheets of ice that have a uniform low temperature. Superior mirages also occur at more moderate latitudes, although in those cases they are weaker and tend to be less smooth and stable. For example, a distant shoreline may appear to tower and look higher (and, thus, perhaps closer) than it really is. Because of the turbulence, there appear to be dancing spikes and towers. This type of mirage is also called the Fata Morgana or hafgerdingar in the Icelandic language. A superior mirage can be right-side up or upside down, depending on the distance of the true object and the temperature gradient. Often the image appears as a distorted mixture of up and down parts. Superior mirages can have a striking effect due to the Earth's curvature. Were the Earth flat, light rays that bend down would soon hit the ground and only nearby objects would be affected.

Since Earth is round, if their downward bending curve is about the same as the curvature of the Earth, light rays can travel large distances, perhaps from beyond the horizon. This was observed and documented for the first time in 1596, when a ship under the command of Willem Barentsz in search of the Northeast passage became stuck in the ice at Novaya Zemlya. The crew was forced to endure the polar winter there. They saw their midwinter night come to an end with the rise of a distorted Sun about two weeks earlier than expected. It was not until the 20th century that science could explain the reason: the real Sun had still been below the horizon, but its light rays followed the curvature of the Earth. This effect is often called a Novaya Zemlya mirage. For every 111.12 kilometres (69.05 mi) the light rays can travel parallel to the Earth's surface, the Sun will appear 1° higher on the horizon. The inversion layer must have just the right temperature gradient over the whole distance to make this possible. In the same way, ships that are in reality so far away that they should not be visible above the geometric horizon may appear on the horizon or even above the horizon as superior mirages. This may explain some stories about flying ships or coastal cities in the sky, as described by some polar explorers. These are examples of so-called Arctic mirages, or hillingar in Icelandic. If the vertical temperature gradient is +12.9 °C per 100 meters (where the positive sign means temperature gets hotter as one goes higher) then horizontal light rays will just follow the curvature of the Earth, and the horizon will appear flat. If the gradient is less (as it almost always is) the rays are not bent enough and get lost in space, which is the normal situation of a spherical, convex "horizon".

Fata Morgana
A Fata Morgana, the name of which comes from the Italian translation of Morgan le Fay, the fairy shapeshifting half-sister of King Arthur, is a very complex superior mirage. It appears with alternations of compressed and stretched areas, erect images, and inverted images. A Fata Morgana is also a fast-changing mirage. Fata Morgana mirages are most common in polar regions, especially over large sheets of ice with a uniform low temperature, but they can be observed almost anywhere. In polar regions, a Fata Morgana may be observed on cold days; in desert areas and over oceans and lakes, a Fata Morgana may be observed on hot days.

For a Fata Morgana, temperature inversion has to be strong enough that light rays' curvatures within the inversion are stronger than the curvature of the Earth. The rays will bend and create arcs. An observer needs to be within an atmospheric duct to be able to see a Fata Morgana. Fata Morgana mirages may be observed from any altitude within the Earth's atmosphere, including from mountaintops or airplanes. A Fata Morgana can go from superior to inferior mirage and back within a few seconds, depending on the constantly changing conditions of the atmosphere.

Sixteen frames of the mirage of the Farallon Islands, which cannot be seen from sea level at all under normal conditions because they are located below the horizon, were photographed on the same day. The first fourteen frames have elements of a Fata Morgana display—alternations of compressed and stretched zones. The last two frames were photographed a few hours later around sunset. The air was cooler while the ocean was probably a little bit warmer, which made temperature inversion lower. The mirage was still present, but it was not as complex as it had been a few hours before sunset, and it corresponded no longer to a Fata Morgana but rather to a superior mirage display.

Distortions of image and bending of light can produce spectacular effects. In his book Pursuit: The Chase and Sinking of the "Bismarck", the author Ludovic Kennedy describes an incident that allegedly took place below the Denmark Strait during 1941, following the sinking of the Hood. The Bismarck, while pursued by the British cruisers Norfolk and Suffolk, passed out of sight into a sea mist. Within a matter of seconds, the ship re-appeared steaming toward the British ships at high speed. In alarm the cruisers separated, anticipating an imminent attack, and observers from both ships watched in astonishment as the German battleship fluttered, grew indistinct and faded away. Radar watch during these events indicated that the Bismarck had in fact made no changes of course.

Night-Time Mirages
The conditions for producing a mirage can take place at night. Under most conditions, these are not observed. However, under some circumstances lights from moving vehicles, aircraft, ships, buildings, etc. can be observed at night, even though, as with a daytime mirage, they would not be observable. This includes the mirage of astronomical objects.

5 Weather Patterns

Weather generally follows set patterns, use this to your advantage by reading the signs.

El Niño

El Niño is the warm phase of the El Niño–Southern Oscillation (ENSO) and is associated with a band of warm ocean water that develops in the central and east-central equatorial Pacific (between approximately the International Date Line and 120°W), including the area off the Pacific coast of South America. The ENSO is the cycle of warm and cold sea surface temperature (SST) of the tropical central and eastern Pacific Ocean. El Niño is accompanied by high air pressure in the western Pacific and low air pressure in the eastern Pacific. El Niño phases are known to occur close to four years, however, records demonstrate that the cycles have lasted between two and seven years. During the development of El Niño, rainfall develops between September–November. The cool phase of ENSO is La Niña, with SSTs in the eastern Pacific below average, and air pressure high in the eastern Pacific and low in the western Pacific. The ENSO cycle, including both El Niño and La Niña, causes global changes in temperature and rainfall.

Developing countries that depend on their own agriculture and fishing, particularly those bordering the Pacific Ocean, are usually most affected. In American Spanish, the capitalized term El Niño means "the boy". In this phase of the Oscillation, the pool of warm water in the Pacific near South America is often at its warmest about Christmas. The original phase, El Niño de Navidad, arose centuries ago, when Peruvian fishermen named the weather phenomenon after the newborn Christ. La Niña, chosen as the "opposite" of El Niño, is American Spanish for "the girl".

La Niña

La Niña is a coupled ocean-atmosphere phenomenon that is the colder counterpart of El Niño, as part of the broader El Niño–Southern Oscillation climate pattern. The name La Niña originates from Spanish, meaning "the little girl", analogous to El Niño meaning "the little boy". It has also in the past been called anti-El Niño, and El Viejo (meaning "the old man"). During a period of La Niña, the sea surface temperature across the equatorial Eastern Central Pacific Ocean will be lower than normal by 3 to 5°C (5.4 to 9°F). An appearance of La Niña persists for at least five months. It has extensive effects on the weather across the globe, particularly in North America, even affecting the Atlantic and Pacific hurricane seasons, in which more tropical cyclones in the Atlantic basin due to low wind shear and warmer sea surface temperatures, while reducing tropical cyclogenesis in the Pacific Ocean during a La Niña.

La Niña is the positive and cold phase of the El Niño–Southern Oscillation, and is associated with cooler-than-average sea surface temperatures in the central and eastern tropical Pacific Ocean. However, each country and island nation has a different threshold for what constitutes a La Niña event, which is tailored to their specific interests. For example, the Australian Bureau of Meteorology looks at the trade winds, SOI, weather models and sea surface temperatures in the Niño 3 and 3.4 regions before declaring that a La Niña event has started. However, the Japan Meteorological Agency declares that a La Niña event has started when the average five-month sea surface temperature deviation for the NINO.3 region is more than 0.5 °C (0.90 °F) cooler for six consecutive months or longer.

6 Reading Weather

Beaufort Scale

The Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. Its full name is the Beaufort wind force scale. For additional wind speed conversions such as those of a cyclone or hurricane, see the NATURAL DISASTERS > Cyclone / Hurricane section.

Rating	Term	Windspeed	Land Description	Sea Description
0	Calm	<2 km/h <1 mph <1 Knot	Smoke rises vertically.	Sea like a mirror.
1	Light Air	2-5 km/h 1-3 mph 1-3 Knots	Direction shown by smoke drift but not by wind vanes.	Ripples with appearance of scales are formed, without foam crests.
2	Light Breeze	6-11 km/h 4-7 mph 4-6 Knots	Wind felt on face; leaves rustle; wind vane moved by wind.	Small wavelets still short but more pronounced; crests have a glassy appearance but do not break.
3	Gentle Breeze	12-19 km/h 8-12 mph 7-10 Knots	Leaves and small twigs in constant motion; light flags extended.	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses.
4	Moderate Winds	20-29 km/h 13-18 mph 11-16 Knots	Raises dust and loose paper; small branches are moved.	Small waves - becoming longer; fairly frequent white horses.
5	Fresh Winds	30-39 km/h 19-24 mph 17-21 Knots	Small trees in leaf begin to sway; crested wavelets form on inland waters.	Moderate waves, taking a more pronounced long form; many white horses are formed - a chance of some spray.
6	Strong Winds	40-50 km/h 25-31 mph 22-27 Knots	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty.	Large waves begin to form; the white foam crests are more extensive with probably some spray.
7	Near Gale	51-62 km/h 32-38 mph 28-33 Knots	Whole trees in motion; inconvenience felt when walking against wind.	Sea heaps up and white foam from breaking waves begins to be blown in streaks along direction of wind.

8	Gale	63-75 km/h 39-46 mph 34-40 Knots	Twigs break off trees; progress generally impeded.	Moderately high waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked streaks along the direction of the wind.
9	Strong Gale	76-87 km/h 47-54 mph 41-47 Knots	Slight structural damage occurs - roofing dislodged; larger branches break off.	High waves; dense streaks of foam; crests of waves begin to topple, tumble and roll over; spray may affect visibility.
10	Storm, Whole Gale	88-102 km/h 55-63 mph 48-55 Knots	Seldom experienced inland; trees uprooted; considerable structural damage.	Very high waves with long overhanging crests; the resulting foam in great patches is blown in dense white streaks; the surface of the sea takes on a white appearance; the tumbling of the sea becomes heavy with visibility affected.
11	Violent Storm	103-1170 km/h 64-72 mph 56-63 Knots	Very rarely experienced - widespread damage.	Exceptionally high waves; small and medium sized ships occasionally lost from view behind waves; the sea is completely covered with long white patches of foam; the edges of wave crests are blown into froth.
12	Hurricane	118+ km/h 73+ mph >= 64 Knots	Devastation.	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected.

7 Predicting Weather

How to use the signs around us to predict the weather.

Using Nature

Observing the Wind

1	Detect the direction of the wind. Wind is caused when air moves from a high-pressure area to a low-pressure area. Since weather moves in from the west, westerly winds indicate good weather because they suggest the bad weather is already to your east. Easterly winds suggest that the bad weather is coming toward you. ● You can use grass or flower petals to determine the direction of the wind. Throw your grass or flower petals into the wind and watch the way that it blows or falls. ● You can also detect the direction of the wind by wetting your finger and holding it out. The side of your finger that gets cool will tell you from which direction the wind is blowing.
2	Watch smoke from a fire. The air pressure determines what direction the smoke will go. In high pressure, the smoke will go directly up into the air. If the pressure is low, it will spiral back down around the fire. If you see the smoke spiralling back down, bad weather is likely on the way. ● When smoke spirals downwards, it means that bad weather is very close. The low-pressure system is already in place over your area.
3	Watch for calm conditions. Before a storm, the low-pressure system can push out the area's normal wind patterns. This creates a temporary calm before the storm begins. You'll notice a lack of wind, which creates a stillness over the area. If you're near water, it will be calm and still, as well. This calm indicates a coming storm. ● At this point, you should be able to observe other signs of a storm, such as dark clouds.
4	Take a deep breath. Close your eyes and smell the air. Smells become wet right before a storm, making them stronger. Before a storm, you should also notice a compost smell as plants release their waste. If you start to smell a compost scent, it likely means that a storm is coming. ● If you are near a swamp, you will likely smell swamp gases right before a storm. Swamp gas smells like rotten eggs because it comes from decaying vegetation.
5	Check for humidity. High humidity often precedes a storm, so watch for signs of high humidity, such as frizzy hair, curling leaves, and swollen wood. These signs can tell you that a storm is on the way. ● Pine cones can also tell you if it's humid because they will stay closed if the humidity is high but will open if the air is dry. ● If you live in an area that always has high humidity, rely on other observations to predict the weather.
6	Observe ocean swells. If you're near the ocean, look for ocean swells. These swells can be caused by winds that are blowing a storm system from out over the sea. This could mean that rain is on the way.

Observing Clouds

1	Look at the shape of the clouds. The types of clouds in the sky can tell you a lot about the weather. In general, clouds that are white and high indicate good weather, and clouds that are dark and low mean rain or storms are on the way. ● White, wispy clouds usually mean that the weather will be clear. ● Flat clouds mean that the air is stable, while fluffy clouds mean that it is unstable. ● Smaller puffy clouds may look calm, but they often build over the course of the day. If you see these clouds, it could mean a storm is brewing.
2	Observe the position of the clouds. Clouds that look high usually mean that they are farther away but could become a weather threat up to six hours later. Lower clouds mean that bad weather is closer. As the weather threat approaches, you will see the clouds move lower in the sky.
3	Check the colour of the clouds. Clouds can be various shades of white, gray, black, and brown, and each also means something different about the weather. ● Black clouds mean that there is a coming storm that does not have strong winds. ● Brown clouds mean that there is a coming storm that does have strong winds. ● White clouds usually mean good weather, though a storm could be on its way later in the day. ● Gray clouds usually mean a new or a light storm. However, gray skies mean that the storm is affecting a large area and may remain for awhile.
4	Watch the movement of the clouds. The direction that the clouds are travelling can tell you if weather is on the way. Additionally, you should watch if the clouds are coming together or moving apart. ● Lowering, gathering clouds are a sign of bad weather coming. ● Clouds that are rising and spreading out indicate that the weather is clearing.

Observing the Sky

METEOROLOGY Predicting Weather Using Nature Observing the Sky

1	Check for a red sky in the morning. Weather moves from west to east, while the sun rises in the east and sets in the west. If you see a red sky in the morning, then it means that there is clear weather in the east where the sun is rising, but bad weather in the west, making the sky look red. The bad weather from the west will be moving toward you, as that is how weather patterns work. ● The redness can appear as a bold orange to a deep red. ● If you see a red sky in the evening, you can rest easy. This means that there are clear skies in the west coming toward you, while the bad weather is to the east moving away from you. ● You can use the following rhyme: "Red sky at night is a shepherd's delight. Red sky in the morning is a shepherd's warning."
2	Look for a rainbow in the west. A rainbow in the west means that the sun's morning rays are striking moisture to your west, which is the direction from which the weather is moving. This means that a storm is moving your way, indicating bad weather later in the day. ● If you see a rainbow in the east, then it means that the weather has already passed over you, so clear skies are likely ahead. ● Remember the old saying, "Rainbow in the morning gives you fair warning."
3	Stare at the moon. Look to see how visible the moon is. If the moon is easy to see in a clear sky, then it could mean that the weather is cooling. It may also mean that a low-pressure system is moving into the area, which clears away dust. This means rain could be on the way. If the moon is visible, look for a wide halo that spreads out from the moon. A halo happens when the moon shines through cirrus clouds, which suggests coming rain. ● Remember the old saying, "Ring around the moon? Rain real soon." A ring around the moon means a warm front is coming, which usually brings rain. The ring is caused by ice crystals that are passing over the moon. ● A double halo around the moon could signal strong winds in the coming storm. ● Another old saying is, "Clear moon, frost soon." A clear sky means that there are no clouds to hold in the earth's heat. This means that the weather will be cooler that night and the next morning, even if it's not cold enough to frost.
4	Count the stars. If you suspect a storm is coming, look at the stars. More than ten stars means that any coming storms should be light, while fewer than ten visible stars means that the storm will be heavy. ● A lack of stars means that there is excessive cloud coverage from an oncoming weather system. If many stars are visible, then the sky is clear.

Observing Animals

METEOROLOGY Predicting Weather Using Nature Observing Animals

1	Look for high ant mounds. Before a storm, ants will build up their mounds and create steep sides. If you see raised ant beds, especially if they were lower before, then there may be a storm coming.
2	Watch for low-flying or roosting birds. When the air pressure falls before a storm, birds feel discomfort in their ears. This causes them to fly lower toward the ground or to perch on lower tree branches or power lines. You may also observe the birds eating ground insects. This behaviour suggests that a storm is coming. ● If the birds are flying high in the sky, then there will likely be fair weather. ● If you're near the sea, look for seagulls perched on the beach, which could indicate that a storm is coming. ● Watch for large groups of roosting birds. ● Birds also become quiet before a storm. Singing and chirping birds could indicate good weather.
3	Look for bird migrations. Birds can sense air pressure and will time their migrations to good weather. If you see flocks of birds migrating in the sky, then the weather will likely be good that day.
4	Notice if birds eat during a storm. If a storm is going to be short, birds will usually wait for the rain to end before looking for food. If you see birds eating during a storm, then it will likely last for a long time. Birds can sense the pressure patterns, allowing them to predict the weather.
5	Search for bees and butterflies. Bees and butterflies return to their homes before a storm for safety. In the case of bees, they also work to preserve the hive. If you don't see any bees and butterflies when you would expect to - such as in a field of flowers - then there may be a storm coming.
6	Check cow pastures to see if they are lying down together. Cows usually gather together and lie down in their pasture before a rainstorm. This is likely because it cools down before a storm, and cows like to be close to the ground when the weather cools. Cows lying on the ground is an indication that it may rain. ● This only applies to cows, not other livestock.
7	Look for snakes. Snakes will leave their nests before bad weather, even if it's in the middle of wintertime. Seeing snakes in unexpected places or at a time when the snake would normally be in its nest can be a sign of bad weather. ● Snakes can even predict earthquakes. If you see a snake out of its nest behaving erratically, there could be an earthquake coming. ● Snakes usually come out of their nests in sunny weather to warm themselves. They don't like the cold because they are cold-blooded. A snake out of its nest when it's not a warm, sunny day is an indication that bad weather is coming.
8	Watch tortoises if they are nearby. Tortoises will seek higher ground before a storm, so look for movement to higher locations. You may see them in the road one to two days before a rain.

Using Tools

Thermometer

METEOROLOGY Predicting Weather Using Tools Thermometer

The following directions apply to all types of thermometers, from classic mercury thermometers to new-age digital temperature sensors.

● Place the thermometer 1.5m (5ft) above the ground (+/- 1ft.). A thermometer too low will pick up excess heat from the ground and a thermometer too high will likely have too cool of a temperature due to natural cooling aloft.
● The thermometer must be placed in the shade. If you put your thermometer in full sunlight, direct radiation from the sun is going to result in a temperature higher than what it should be.
● Have good air flow for your thermometer. This keeps air circulating around the thermometer, maintaining a balance with the surrounding environment. Therefore, it is important to make sure there are no obstructions blocking your thermometer such as trees or buildings. The more open, the better.
● Place the thermometer over a grassy or dirt surface. Concrete and pavement attract much more heat than grass. That is why cities are often warmer compared to suburbs. It is recommended to keep the thermometer at least 30m (100ft) from any paved or concrete surfaces to prevent an erroneously high temperature measurement.

● Keep the thermometer covered. When precipitation falls, you do not want your thermometer to get wet as that could permanently damage it. A Stevenson screen is a great place to store thermometers and other instruments as they provide cover as well as adequate ventilation. If you can't get one, a simple solar radiation shield is adequate.

Thermometer Limits	**Digital Thermometer Limits** **Min:** -58°C (-72.4°F) **Max:** 572°C (1061°F)	**Mercury Thermometer Limits** **Min:** -38.83°C (-37.894°F) **Max:** 356.7°C (674.06°F)	**Coloured Ethanol Thermometer Limits** **Min:** -144°C (-227°F) **Max:** 78°C (172°F)

Barometer

A barometer is a scientific instrument used in meteorology to measure atmospheric pressure. Pressure tendency can forecast short term changes in the weather. Many measurements of air pressure are used within surface weather analysis to help find surface troughs, high pressure systems and frontal boundaries. Barometers and pressure altimeters (the most basic and common type of altimeter) are essentially the same instrument, but used for different purposes. An altimeter is intended to be transported from place to place matching the atmospheric pressure to the corresponding altitude, while a barometer is kept stationary and measures subtle pressure changes caused by weather. The main exception to this is ships at sea, which can use a barometer because their elevation does not change.

Barometer Reading
Find the difference of pressure over an hour to determine the weather. The bigger the difference the more wild the weather. Set the barometers pointer every hour to easily tell what the last reading was.

High Pressure
A sign of good weather.

Low Pressure
A sign of clouds, rain and storms.

Barometer Weather Prediction

Baro	Fluctuation	Wind Direction	Weather
1016-1022 (30-30.20)	Steady	Westerly	Fair, with slight changes in temp for one to two days
1016-1022 (30-30.20)	Rising Fast	Westerly	Fair, followed within two days by warmer and rain.
1016-1022 (30-30.20)	Falling Fast	South to East	Warmer and rain within 24 hours.
>=1022 (30.20)	Falling Fast	South to East	Warmer and rain within 36 hours.
1022 (30.20)	Falling Fast	West to North	Cold and clear, followed by warmer rain.
>=1022 (30.20)	Steady	Variable	No early change.
<=1016 (30.00)	Falling Slowly	South to East	Rain within 18 hours continuing a day.
<=1016 (30.00)	Falling Fast	SE-NE	Rain with high wind, clearing within 2 days, colder.
<=1016 (30.00)	Rising	South to West	Clearing and colder within 12 hrs.
<=1009 (29.80)	Falling Fast	South to East	Severe storm of wind and rain imminent.
<=1009 (29.80)	Rising Fast	Going West	Clearing and colder.

Skills

Skills one should possess prior to a disaster and how to train them

"Talent you have naturally, Skill is only developed by hours and hours and hours of beating on your craft."
Will Smith

Introduction

This is a list of any skills relevant to prepping and a short description on each as well as a sentence on how you can train it. You can use this section to compare listed skills with your own to shear up any weaknesses you may have. A good goal to set yourself is to go through the list and work on one of the skills a weekend and complete the training section.

Everyone has a different set of skills which is simply a fact of life. Some may excel at programming, others at knitting and sports. As the potential leader of your bug-out group you should have knowledge about the skills each member of your team possesses. The last thing you want to do is give someone a job they are terrible at when they could be doing one they love and have a natural talent for. The rows below contain an incomplete list of skills that you may need in a disaster situation and how to train them beforehand. I recommend filling out the template skills analyser at the bottom of this section for each of your party members so you can understand and make the most of your teams skills.

Purpose	The aim of SKILLS is to have a complete list of the useful abilities which are of use in a survival situation. It also covers how these skills can be trained and honed prior to a disaster so that you're ready when one occurs. It also lays out the foundation for creating a party skills checklist so you can visually see the individual abilities of each member.
Lost?	• For information on a specific skill you wish to learn, find and read the corresponding category in this guide. • For a list of skill terms, see the ADDENDUM > Dictionary section.

Contents

1 Basic Attributes

SKILLS | Basic Attributes

These aren't skills you can typically train but are attributes of people that will make understanding them easier. This information would be useful on a spreadsheet detailing your party members and their strengths, weaknesses and limits.

Subheadings

1 Attributes

Name		The name of the person.	
Nickname		The nickname of the person if they have one.	
Codename		The codename of the person in case they have to be referenced stealthily.	
Age		How old the person is.	
Gender		The gender of the person.	
Nationality		The nationality of this person.	
Ethnicity		The ethnic background of this person.	
Social Class		The social class this person is currently part of.	

2 Location

Home Address		Where this person resides and sleeps at night.	
Work Address		The work address of this person (if any).	
Commonly At		The location this person is usually at outside of work.	
Country & Hometown		The country and town this person grew up in.	

3 Appearance

Build		The build of this person whether skinny, normal or obese.	
Skin Colour		White, Olive, Tan, Black etc.	
Hair Colour		The colour or colours of their hair.	
Eye Colour		The colour or colours of their eyes.	
Accessories		Such as glasses, watch, earrings, necklace etc.	
Face Shape		The spare of their face such as oval, round, slim or chubby.	
Distinguishing Features		Any features that immediately stand out when you meet that person.	
Dress		How this person usually dresses such as conservative or casual.	

4 Physical Attributes

Strength		How much weight the person can carry in their arms.	Training: Train your physical strength by going to the gym regularly.
Back Strength		How much weight the person can carry on their back comfortably.	Training: Walking around with a heavy backpack can accustom you to the weight of a BOB.
Speed		How fast the person can move.	Training: Sprinting short distances from stopped and see how far you get in 1 minute.
Fitness (Cardio)		How far the person can run/jog unencumbered.	Training: Short and long distance running to get your body used to running/jogging.
Agility/Acceleration		How fast the person can change direction, speed up and stop on their feet.	Training: Running through an obstacle course darting around and between objects.
Flexibility		The range of movement a person has.	Training: Stretching and warming up muscles. Limbo-ing, "avoiding laser beams".

5 Measurements

Size		How big or small the person is.	
Weight		How heavy the person is.	
Height		How tall the person is.	

6 Skills

Known Skills		This persons education level.	
Known Talent		The line of work and job this person has.	
Past Experience		How switched-on this person is.	

7 Education & Work

Education		This persons education level.	
Occupation		The line of work and job this person has.	
Intelligence		How switched-on this person is.	

8 Allegiances

Nationality		The country which this person was born.	
Allegiances		Any other allegiances this person has ties to.	
Religion		The religion of this person.	

9 Mannerisms

Mannerisms		Recognisable mannerisms this person does frequently such as blinking or touching their face.	
Habits		Habits this person has such as smoking.	
Speech		The way this person speaks whether it's fast, slow or hard to understand.	
Accent		The accent this person has.	
Style		How this person presents themselves such as elegant or shabby.	

10 Health

Health		The general health and wellbeing of this person.	
Medical Conditions		Medical conditions that affect this person such as asthma or diabetes.	
Medication		Any medication this person takes on a recurring basis.	
Disabilities		Any disabilities the person may have, whether physical or mental.	

11 Character

Confidence		How confident this person is.	

12 Personality

MBTI Personality		The MBTI personality of this person.	
Technology Dependence		How dependent the person is on technology such as a mobile.	
Lifestyle Dependence		How dependent the person is on their current lifestyle and how they will react if SHTF.	

2 Preparedness Skills

Each skill below has the following fields:
- Importance: How important this skill is to know based on a preparedness skillset rated on a number between 1-5
- Skill: The name of the skill
- Skill Description: A short description of the skill
- Training: How you can train this skill

Subheadings

		1. Camping	2. Looting	3. Bartering	4. Scouting		
		5. Fire Building	6. Fire Lighting	7. Water Acquisition	8. Water Purification		
		9. Caches	10. Gear Maintenance	11. Electricity			

1 Camping

Importance	Skill	Skill Description	Training
3	Camping	Camping skills will make accustomization to living outdoors easier such as sleeping with strange noises around and lying on hard ground.	Training: Camping in the great outdoors in various locations, climates and environments.

3	**Tent Pitching**	How fast and accurately you can pitch and tear down your tent.	Training: Training requires timing yourself on how fast you can erect your tent and then again to pack it up.
2	**Leave No Trace**	Leaving a campsite exactly as you found it to help prevent litter and being tracked.	Training: Camping and then ensuring that nobody can tell you've been staying there.
4	**Self Contained Camper**	Living out of a bag while camping so you can flee if required.	Training: Camping and being ready to flee the area at any moment.
5	**Campsite Security**	Keeping an eye and ear out for threats while camping.	Training: Camping and maintaining a lookout and ear-out for threats.

2 Looting

Importance	Skill	Skill Description	Training
	Object Recognition	The ability to quickly see an object and ascertain its value and uses.	Training: Moving through an unknown building and knowing where the valuable items are likely to be.
	Object Uses	The ability to see an object for uses besides its primary use.	Training: Picking any random object and working out how else you could use it.
	Looting Speed	The speed an efficiency you can clear rooms taking what you need.	Training: Moving quickly through unknown rooms looking for items you need and taking them swiftly.
	Siphoning Fuel	Siphoning fuel from other cars.	Training: By siphoning fuel from other cars into your own either using a pump or your mouth.

3 Bartering

Importance	Skill	Skill Description	Training
	Bartering	The ability to barter for items you need with a profit.	Training: Bartering with people for goods and trying to get the best deal.
	Negotiating	Negotiating with hostiles for some form of return such as hostages, stolen items etc.	Training: Can be trained by bartering with money to buy it at a lower price.

4 Scouting

Importance	Skill	Skill Description	Training
	Feature Recognition	Knowing land terrains and features.	Training: Hiking through unknown terrain and saying out loud what type of terrain is around you.
	Perception	Knowing what's going on around you and keeping an eye on the enemy.	Training: Sitting on a bench in a city and taking note of everything around you.

5 Fire Building

Importance	Skill	Skill Description	Training
	Fire Lighting	Knowing how to light a fire in any condition.	Training: By lighting fires in sun, rain, a storm, wind etc.
	Tinder Identification	Identifying tinder in the bush.	Training: Either experiment on potential tinder near you or look for already identified tinders.
	Hidden Fire	Creating a smokeless pit fire to stay stealthy.	Training: By creating a pit fire with minimum smoke and visibility.
	Finding Dry Wood	Finding dry wood in a wet environment.	Training: Search for dry woods in a damp or rainy environment and try to light a fire.
	Split Firewood	Splitting firewood to put on a small fire.	Training: By splitting firewood with an axe, taking note of health and safety.
	Chainsawing	Using a chainsaw to fell trees effectively.	Training: Cutting down trees with a chainsaw.
	Batoning	Using a knife and a log to split wood into manageable pieces.	Training: Splitting wood with a knife and a heavy, flat object.

6 Fire Lighting

Importance	Skill	Skill Description	Training
	Using Flint	Knowing how to use flint and a striker to create a fire.	Training: By starting fires with only a flint and steel.
	Bow Drill	Using a bow drill to start a fire.	Training: Starting a fire with a bow drill from scavenged materials.
	Fire Piston	Using a fire piston to start a fire.	Training: Light fires using a fire piston.
	Chemical Fire	Using chemicals to start a fire.	Training: Light a fire using any chemicals you have handy.
	Electrical Fire	Using electricity to start a fire.	Training: Creating a fire from a variety of batteries such as AA, C, 18650 or a car battery.
	Solar Fire	Using the sun to start a fire.	Training: Try to light a fire with a magnifying glass or parabolic mirror.

7 Water Acquisition

Importance	Skill	Skill Description	Training
	Find Flowing Water	Finding flowing water using geographical features.	Training: Finding rivers or other flowing water by looking at the landscape layout.
	Find Still Water	Finding still water using geographical features.	Training: Finding bodies of water such as oceans, lakes or puddles by looking at the landscape layout.
	Find Vegetation Water	Find water from vegetation.	Training: Look for and collect water which is trapped by or in plants.
	Find Animal Water	Knowing how to use the water in animals to drink.	Training: Obtain water from animals which have been trapped, fished or hunted.
	Atmospheric Collection	Collecting water from the atmosphere.	

Importance	Skill	Skill Description	Training
	Condensation Collection	Collecting condensation for drinking.	Training: Collect dew by wiping dewy grass with a cloth and wringing it into a bucket.
	Water Table Collection	Collecting water from an underground water table	Training: Locating and pumping water from a water table.
	Finding Groundwater	Finding clean groundwater and springs to drink from.	Training: Looking for natural springs and obtain water from them by digging into the earth.
	Evapotranspiration	Acquiring water from small bushes and shrubs.	Training: Place transparent bags over vegetation until water is collected in the bottom of them.

8 Water Purification

Importance	Skill	Skill Description	Training
	Water Filter Construction	Crafting your own water filter from bush materials.	Training: Building a water filter from sand, stones and moss.
	Modern Water Filtration	Filtering water using modern filtration methods.	Training: Filtering water with a purchased filter as per the instructions.
	Additive Purification	Purification using water additives like Calcium Hypochlorite.	Training: Kill bacteria in water by using pot perm or calc hypo (among others) to treat it.
	Boiling	Boiling water to kill pathogens.	Training: Boil water for the correct amount of time depending on altitude.
	Distillation	Distilling water to remove pathogens.	Training: Distil water.
	SODIS	Using solar disinfection to kill parasites.	Training: Fill a clear bottle or bag with water and leave it out in the sun.
	Flora-transpiration	Using flora to generate drinking water.	Training: Put clear bags around fresh vegetation gather water from evaporated and condensed water.
	Desalination	Knowing different ways to remove salt from water.	Training: Remove salt from water using distillation or other methods.
	Solar Still	Using a solar still to generate fresh drinking water.	Training: Build a solar still in sand or dirt and collect water.
	UV Purification	Purification of water using UV light.	Training: Kill bacteria in water by using a UV light for the required amount of time.
	Electrolytic Purification	Purifying water using salt and electrolysis.	Training: Use an electrolytic generator to create a chlorine compound and mix it with the water to be purified.

9 Caches

Importance	Skill	Skill Description	Training
	Storing Caches	Knowing how to store caches properly to avoid being found.	Training: Planting multiple caches without being seen and documenting them well.
	Locating Caches	Locating stored caches you've previously hidden months earlier.	Training: Finding caches you've hidden or locating geocaches.
	Location Marking	Marking locations you've hidden assets and knowing how to read them later.	Training: Return to old cache sites and try to use your markings to find it again.

10 Gear Maintenance

Importance	Skill	Skill Description	Training
	Gear Knowledge	How well the person knows and uses their gear.	Training: Go camping and use every piece of gear, pushing its capability.
	Gear Repairing	Knowing how to repair gear with any available resources if required.	Training: Trained by repairing anything and everything as it breaks with whatever is on hand.
	Gear Maintenance	Knowing how to properly maintain and look after all gear except weapons	Training: Proper maintenance of your gear from gas stoves to water filters.
	Gas Equipment	Lighting and operating gas lanterns or stoves which run on kerosene, petrol etc.	Training: Light gas lanterns, cooktops, kerosene lanterns etc.

11 Electricity

Importance	Skill	Skill Description	Training
	Electrical Systems	Understanding circuits, power, electricity, wiring etc.	Training: Build simple circuits, make simple repairs etc.
	Generator Maintenance	Using and maintaining a generator safely.	Training: Use a generator to power your equipment in an open space.
	Understanding Batteries	Knowing types and sizes of batteries, capacity, how to recharge them etc.	Training: Research different batteries, voltages, amps and safe recharging methods.
	Solar Power	Understanding how solar power works, positioning of panels and power generation.	Training: Set up a solar system to run your electronics and charge batteries.

3 Food Skills

Subheadings

1. Food Craft	**2. Consumption**	**3. Cooking**	**4. Cooking Methods**
5. Fishing	**6. Foraging**	**7. Gardening**	**8. Preservation**

1 Food Craft

Importance	Skill	Skill Description	Training

	Baking	Know how to bake bread and other food.	Training: Bake some bread with locally sourced ingredients.
	Cake	Knowing how to bake a cake.	Training: Bake a simple cake from easily obtainable ingredients.
	Beer Making	How to brew beer for consumption and trading.	Training: Brew some beer ensuring it's safe to drink.
	Butter Churning	Churning milk into butter for consumption.	Training: Buy some milk and churn it into cream and then further into butter.
	Cheese Making	Churning Butter into cheese for consumption.	Training: Buy some milk and churn it into cream then cheese.

2 Consumption

Importance	Skill	Skill Description	Training
	Nutrition	Knowing nutrition values of foods and what's required for daily intake.	Training: Learn about the nutritional values of food and what you need to survive.
	Energy Requirements	Knowing how much energy is in foods and what you need personally.	Training: Understanding energy values and how many calories you need to survive.

3 Cooking

Importance	Skill	Skill Description	Training
	Campfire Cooking	How to cook over a fire accounting for the variable heat.	Training: Cook over the flames of a fire.
	Coal Cooking	Cooking over hot coals	Training: Cook over hot coals instead of the flame.
	Gas Cooking	Cooking food on a gas stove.	Training: Cook food on a gas stove.
	Solar Cooking	Cooking food using the sun's heat.	Training: Cook food using the heat of the sun.
	Chemical Bag Cooking	Cooking food in a chemical bag.	Training: Cook food in a chemical bag.
	Electric Cooking	Cooking food on an electric stove.	Training: Cook food on an electric stove.

4 Cooking Methods

Importance	Skill	Skill Description	Training
	Spit Roasting	Knowing how to roast meats on a spit.	Training: Cook food on a spit.
	Grilling	Knowing how to grill foods.	Training: Grill food.
	Frying	Knowing how to fry foods.	Training: Fry food.
	Rotisserie	Knowing how to cook food on a rotisserie.	Training: Cook food on a rotisserie.
	Baking	Knowing how to bake foods.	Training: Bake some foods such as bread and cakes.
	Deep Frying	Knowing how to deep fry foods.	Training: Deep fry some foods.
	Pressure Cooking	Knowing how to use and cook with a pressure cooker.	Training: Cook food and can food in a pressure cooker.
	Roasting	Knowing how to roast foods.	Training: Roast some food.
	Steaming	Knowing how to steam foods.	Training: Steam some foods such as vegetables.
	Steeping	How to steep tea.	Training: Make some tea and steep some wild edibles like pine needles.

5 Fishing

Importance	Skill	Skill Description	Training
	Hand Fishing	Knowing how to hand fish for food.	Training: Catch fish with only your hands.
	Spear/Harpoon Fishing	Knowing how to spear fish for food.	Training: Catch fish by using a spear.
	Netting	Knowing how to net for food.	Training: Catch fish by using a net.
	Angling	Knowing how to fish with a rod for food.	Training: Catch fish by using a rod, line and bait.
	Bow Fishing	Knowing how to fish with a bow for food.	Training: Catch fish by using a bow.
	Fish Trapping	Knowing how to trap fish for food.	Training: Trap fish using cages etc.
	Boat Fishing		

6 Foraging

Importance	Skill	Skill Description	Training
	Identifying	Identifying what plants are edible.	Training: Try to identify edible plants.
	Harvesting Wild Food	Harvesting wild foods safely without damaging the plant or food.	Training: Harvest wild food properly to maximise the gain from them and to avoid spoilage.
	Taste Unknown Plants	Know how to taste foreign foods for edibility.	Training: Test if foods are edible by using the unknown plant procedure. (Be Careful of Poisons)

SKILLS | Food Skills | Gardening

7 Gardening

Importance	Skill	Skill Description	Training
	Planting	When, where and how to plant food.	Training: Plant vegetables and fruit using different methods.
	Maintenance	Maintaining plants in the garden.	Training: Care for your plants until they produce food.
	Watering	How when and how much to water plants.	Training: Water each plant the correct amount for your chosen gardening method.
	Pruning	Pruning plants to remove dead branches and shoots to keep them healthy.	Training: Prune your plants properly to remove dead branches to keep them healthy.
	Harvesting	Harvesting plants properly to maximise gain.	Training: Harvest any food you have grown.
	Maintaining Soil	Maintaining soil Ph and other features to help plants grow properly.	Training: Understand the composition and maintain the soil of your plants.
	Pest Extermination	How to get rid of pests eating your plants.	Training: Use different methods to try and reduce or remove the amount of pests on your plants.

SKILLS | Food Skills | Preservation

8 Preservation

Importance	Skill	Skill Description	Training
	Cheese Waxing	Waxing cheese to extend the lifespan.	Training: Wax some cheese whether purchased or churned.
	Smoking	Smoking food to extend the lifespan.	Training: Smoke various types of food such as fish.
	Dehydrating	Dehydrating food to extend the lifespan.	Training: Dehydrate foods such as fruit.
	Canning	Canning food to extend the lifespan.	Training: Can different types of food safely such as meat and vegetables.
	Curing	Curing meats to extend the lifespan.	Training: Cure meats by rubbing them with salt, sugar or herbs.
	Mylar Bagging	Sealing food in a mylar bag to extend the lifespan.	Training: Seal food in mylar bags like rice and wheat.

SKILLS | Outdoor

4 Outdoor Skills

SKILLS | Outdoor Skills

Subheadings

1. Hunting	**2. Field Dressing**	**3. Shelter**	**4. Navigation**
5. Plant Identification	**6. Animal Identification**	**7. Insect Identification**	**8. Weather**
9. Geography			

SKILLS | Outdoor Skills | Hunting

1 Hunting

Importance	Skill	Skill Description	Training
	Trapping	The ability to set traps and catch animals.	Training: Set traps to catch small game like rabbits.
	Tracking	Using game tracks and signs of animals to track and find them.	Training: Find and track animals to their den.
	Trail Marking	The marking and reading of signs on trails that you've left to navigate by.	Training: Walk along known hiking trails and identify signs and markings.
	Scent Camouflage	Camouflaging your scent so animals aren't deterred by you.	Training: Disguise your scent around popular animal locations so they don't detect you.

SKILLS | Outdoor Skills | Field Dressing

2 Field Dressing

Importance	Skill	Skill Description	Training
	Filleting	The acquisition of meat from an animal.	Training: Fillet some fish properly.
	Removing Gizzards	The ability to identify and remove the waste products of animals without breaking them open.	Training: Remove the entrails and waste products from hunted animals.
	Small Game Dressing	Preparing small game such as rabbits for cooking.	Training: Cutting open small animals and preparing them for cooking.
	Large Game Dressing	Preparing large game such as deer for cooking.	Training: Cutting or quartering large animals to prepare them for cooking.

SKILLS | Outdoor Skills | Shelter

3 Shelter

Importance	Skill	Skill Description	Training
	Shelter Building	Knowing how to build various types of temporary shelters from local materials.	Training: Build temporary shelters out of twigs, leaves and logs.
	Hammock Hanging	Hanging a hammock up safely and securely.	Training: Set up a hammock.
	Knot Tying	Knowing how to tie knots for shelter construction which will hold securely.	Training: Practise a variety of different knots.

4 Navigation

Importance	Skill	Skill Description	Training

SKILLS | Outdoor Skills | Navigation

	Compass Navigation	The ability to use a compass and map to navigate to a location.	Training: Navigate to different locations with a variety of compasses.
	Sun Navigation	Using the sun to find north and to navigate by.	Training: Navigate to locations using only the sun.
	Star Navigation	Using the stars to find north and to navigate by year round.	Training: Navigate to certain locations using only the stars.
	GPS Navigation	Using a GPS to find your location and navigate to others.	Training: Navigate using a GPS system.
	Watch Navigation	Using your watch to find north in both hemispheres.	Training: Find direction using a watch.
	Feature Navigation	Navigation by use of the surrounding environment.	Training: Navigate in an unknown location to find resources such as rivers, the ocean etc.
	Map Making	Documenting new maps for a location if you don't have any.	Training: Explore a new location and map prominent features to navigate by.
	Pace Counting	Keeping track of your paces so you don't get lost as easily.	Training: While hiking keep track of your paces and in turn your distance travelled.

5 Plant Identification

SKILLS | Outdoor Skills | Plant

Importance	Skill	Skill Description	Training
	Edible Identification	Identifying plants in their natural habitat.	Training: Identify local edible plants.
	Poisonous Identification	Identifying which plants are toxic by ingestion or skin contact.	Training: Identify local poisonous plants
	Natural Remedies	Knowing which plants have medicinal properties that you can use.	Training: Research local plants which have medicinal properties and practise applying them.

6 Animal Identification

SKILLS | Outdoor Skills | Animal

Importance	Skill	Skill Description	Training
	Animal Identification	Identifying animals in their natural habitat.	Training: Learn about your local animals and the types of animals.
	Animal Deterrence	Deterring animals to prevent an attack.	Training: Practise by avoiding animals and researching what to do in animal attacks.

7 Insect Identification

SKILLS | Outdoor Skills | Insect

Importance	Skill	Skill Description	Training
	Edible Insect Identification	Identifying insects.	Training: Research and learn what insects are edible.
	Poisonous Identification	Identifying poisonous insects.	Training: Research local poisonous creatures.
	Insect Deterrence	Knowing how to deter insects to prevent bites and illness.	Training: Research how to avoid insects targeting you.

8 Weather

SKILLS | Outdoor Skills | Weather

Importance	Skill	Skill Description	Training
	Cloud Identification	Identifying different types of clouds.	Training: Lay on the grass and try to identify each cloud as it goes by or look out the window every few hours.
	Weather Prediction	Predicting the weather which is likely to follow certain weather patterns.	Training: Understand barometric pressure and how it influences weather patterns and look for other patters in clouds and timing.
	Preserving Heat		

9 Geography

SKILLS | Outdoor Skills | Geography

Importance	Skill	Skill Description	Training
	Regional Knowledge	How much knowledge about the local area the person has.	Training: Learn about your town, the electoral candidates, the shops, the topography, weather etc.
	Urban/City Survival	Knowing how to survive in an urban or city environment, particularly in a post apocalyptic environment.	Training: Very hard to train and it's not recommended to stay in cities during disasters but research prepping daily.
	Forest Survival	Knowing how to survive in a forest environment.	Training: Travel to and try to survive in a forest climate for a week.
	Desert Survival	Knowing how to survive in a desert or sandy environment.	Training: Travel to and try to survive in a desert for a week.
	Ocean Survival	Knowing how to survive on an ocean in a boat.	Training: Travel to and try to survive in a boat for a week and desalinate your own water.
	Jungle Survival	Knowing how to survive in a jungle.	Training: Travel to and try to survive in a jungle climate for a week.
	Island Survival	Knowing how to survive on an island surrounded by water.	Training: Travel to and try to survive on a large island for a week.
	Arctic Survival	Knowing how to survive in a frozen arctic environment.	Training: Travel to and try to survive in an arctic climate for a week.
	Mountain Survival	Knowing how to survive in a mountainous environment.	Training: Travel to and try to survive in a mountain climate for a week.
	Plains Survival	Knowing how to survive in a flat grassy plains style environment.	Training: Travel to and try to survive on a grassy plain for a week, preferably one with few trees and identifiable features.

5 Communication Skills

SKILLS

Communication Skills

Subheadings

		1. Communication	2. Foreign Language	3. Radio	4. Visual		
		5. Signalling					

1 Communication

Importance	Skill	Skill Description	Training
	Leadership Skills	How well you can lead a group of people and make good decisions for the best of them all.	Training: By leading a group on a hiking trip or something similar.
	Teamwork Skills	How well the person works within a team environment.	Training: By working in a team whether in a work environment or casual environment.
	Effective Communication	The communication skills of the individual and how effectively they get a point across.	Training: Being part of a work environment strengthens this skill substantially.
	Conflict Management	How well the person deals with conflict between others or themselves.	Training: Being a boss or manager where you have the chance to mediate conflicts.
	Listening	How well the person listens to others and understands them.	Training: Practise listening to people when they talk and remembering everything they say while keeping the conversation going.
	Reliable	The reliability of the person, whether they are on time or late.	Training: Trained by trying to keep your word and only saying what you know you can accomplish.
	Respectful	Whether the person has respect for others and follows the hierarchy.	Training: Respecting those tho are higher in the food chain and being kind to those under you. Particularly parents and elders.
	Trustworthy	Whether the person can be trusted to keep their word or if they often betray and backstab others for their own gain.	Training: Keep your word when you commit and be a good steward with what you've been trusted with.
	Constructive / Positive	The optimism of the person, determining whether they look for the best or the worst in situations.	Training: Being an optimistic person in all situations but particularly when things aren't going as planned.
	Organised	How organised the person is with their ideas, content and time.	Training: Organise your day and scheduled events while planning ahead for the future ones.
	Persuasion	How good this person is at persuading others to do something they weren't intending.	Training: Try to persuade or nudge someone in a direction you want them to go in.

2 Foreign Language

Importance	Skill	Skill Description	Training
	English	Speaking fluent English.	Training: Take an English class online or digitally.
	Mandarin	Speaking fluent Mandarin.	Training: Take an Mandarin class online or digitally.
	Spanish	Speaking fluent Spanish.	Training: Take an Spanish class online or digitally.
	Japanese	Speaking fluent Japanese.	Training: Take an Japanese class online or digitally.
	Hindi	Speaking fluent Hindi.	Training: Take an Hindi class online or digitally.
	Arabic	Speaking fluent Arabic.	Training: Take an Arabic class online or digitally.
	Portuguese	Speaking fluent Portuguese.	Training: Take an Portuguese class online or digitally.
	Russian	Speaking fluent Russian.	Training: Take an Russian class online or digitally.
	French	Speaking fluent French.	Training: Take an French class online or digitally.
	Bengali	Speaking fluent Bengali.	Training: Take an Bengali class online or digitally.
	German	Speaking fluent German.	Training: Take an German class online or digitally.

3 Radio

Importance	Skill	Skill Description	Training
	HAM Communication	Having a license and knowing how to operate a HAM radio.	Training: Purchase a HAM radio and licence and communicate with other HAM users.
	2 Way Communication	Knowing how to operate a two way radio.	Training: Practise using your radios in a variety of situations including ones which may block the signal.
	SW Radio	Listening to short-wave radio stations.	Training: Learn how to operate and receive signals with a SW radio.

4 Visual

Importance	Skill	Skill Description	Training
	Flag Semaphore	Knowing the flag codes when an individual on a ship holds them up.	Training: Look at pictures of various flag semaphore and try to identify them.
	Sign Language	Knowing sign language to communicate with the deaf or communicate silently.	Training: Watch videos of sign language and try to read them.
	Flag Codes	Knowing the flag codes used on ship masts.	Training: Look at pictures of various flag codes and try to identify them.
	Body Language	Reading and interpreting body language to ascertain intent.	Training: Interpreting other peoples body language while they are speaking to anyone.

5 Signalling

Importance	Skill	Skill Description	Training
	Mirror Signalling	Signalling for help using a pocket mirror.	Training: Get a friend and position them at a distant location and try to get their attention with a mirror.
	Flare Signalling	Signalling for help using flares, either handheld or fired.	Training: Get a friend, position them at a distant location and try to get their attention with a flare.
	Smoke Signalling	Signalling for help using smoke from fires.	Training: Get a friend, position them at a distant location and try to get their attention with a flare.
	Whistle Signalling	Signalling for help using a whistle.	Training: Get a friend and position them out of line of sight within a certain radius and see if they can locate you with a whistle.

6 Homesteading Skills

Subheadings

		1. Animal Husbandry	**2. Horsemanship**	**3. Housework**	**4. Construction**		
		5. Trades	**6. Hygiene**	**7. Household Crafts**			

1 Animal Husbandry

Importance	Skill	Skill Description	Training
	Beekeeping	The keeping of bees for a means of food.	Training: Get some bees and take care of their needs and retrieve honey.
	Chicken Cooping	The keeping of chickens for a means of food.	Training: Get some chickens and take care of them, harvesting eggs when you can.
	Raising Rabbits	The keeping of rabbits for a means of food.	Training: Get some rabbits and take care of them.
	Raising Dogs	The raising of dogs for companionship or farm assistance.	Training: Get a dog and take care of them. Training them to accomplish tasks where possible.
	Raising Cows	The keeping of cows for a means of food.	Training: Get some cows and take care of their needs.
	Raising Sheep	The keeping of sheep for a means of food and clothing.	Training: Get some sheep and take care of their needs, shearing them where necessary.
	Cow Milking	The ability to milk a cow for a means of food.	Training: Milk your cows or see if you can milk some local cows with permission.
	Raising Pigs	The keeping of pigs for a means of food.	Training: Get some pigs and take care of their needs.

2 Housework

Importance	Skill	Skill Description	Training
	Raising Horses	The raising of horses for transport or labour.	Training: Get a horse and take care of it.
	Riding Horses	The ability to ride horses for a swift and quiet movement.	Training: Take horse-riding lessons and eventually jumping lessons.
	Horseback Shooting	Knowing how to shoot a bow from a horse.	Training: Practise shooting from horseback if you own a horse.
	Horseback Scouting	Scouting new locations on horseback swiftly and silently.	Training: Take a horseback adventure or take your own horse to unknown locations and scout them out.

3 Housework

Importance	Skill	Skill Description	Training
	Ironing	Iron clothes to remove creases.	Training: Practise by ironing your clothes every day even if you won't wear them.
	Washing Dishes	Washing dishes properly to maintain hygiene.	Training: Wash dishes in a bucket or other container as if you were camping.
	Cleaning	Cleaning the campsite or homestead for hygienic purposes.	Training: Keep your rooms and bench tops tidy and germ free.

4 Construction

Importance	Skill	Skill Description	Training
	Earth Oven		
	Shelter Building		
	Masonry Oven		

5 Trades

Importance	Skill	Skill Description	Training
	Plumbing	Knowing how plumbing systems work to repair your home.	

	Skill	Skill Description	Training
	Electrical	Knowing how electrical systems work to repair your home.	
	Carpentry	Building furniture from scratch.	
	Blacksmithing	Knowing how to smith your own weapons, armour and furniture.	
	Tool Making	Crafting your own tools via blacksmithing or whittling.	
	Shoemaking	Crafting and repairing your own shoes.	

6 Hygiene

Importance	Skill	Skill Description	Training
	Clothes Washing	Washing clothes without a washing machine.	
	Camp Hygiene	Maintaining good camp hygiene to stay healthy.	
	Shower Construction	Building your own shower to clean yourself.	
	Waste Disposal	Knowing proper waste disposal.	

7 Household Crafts

Importance	Skill	Skill Description	Training
	Candle Making	Crafting candles for additional lighting methods.	
	Soap Making	Knowing how to make soap for hygienic purposes.	Training: Try to make your own soap.
	Washing Powder	Creating your own washing powder for ease of washing clothes.	

7 Crafting Skills

Subheadings

1. Fire Crafts	**2. Tool Making**	**3. Weapon Making**	**4. Furniture Crafting**
5. Fire Crafting	**6. Needlework**	**7. Woodworking**	

1 Fire Crafts

Importance	Skill	Skill Description	Training
	Crafting a Bow Drill		
	Crafting a Fire Plough		

2 Tool Making

Importance	Skill	Skill Description	Training
	Air Filter Creation		

3 Weapon Making

4 Furniture Crafting

Importance	Skill	Skill Description	Training
	Bed Crafting	Knowing how to craft a bed from resources such as wood.	
	Chair Crafting	Knowing how to craft chairs from resources such as wood.	
	Table Crafting	Knowing how to craft a table from resources such as wood.	
	Shelf Crafting	Knowing how to craft shelves that attach to the frames of houses.	

5 Fire Crafting

Importance	Skill	Skill Description	Training
	Charcoal Making	Create charcoal to clean objects and heal illnesses.	

	Activated Charcoal	Used to heal illnesses and clean objects.	

6 Needlework

Importance	Skill	Skill Description	Training
	Knitting	To create your own clothes and cold weather gear.	
	Crocheting	To create your own clothes and cold weather gear.	
	Sewing	Knowing how to sew to repair clothing.	

7 Woodworking

Importance	Skill	Skill Description	Training
	Whittling	Whittle objects to use in the kitchen or to keep away boredom.	
	Carving	Carve objects to keep occupied or use later.	
	Boat Making	Craft boats for travel to remote locations.	
	Wood Processing	Includes chopping, splitting and whittling wood.	

8 Medical Skills

Subheadings

		1. First Aid	2. Herbal Healing	3. Fitness	4. Medicating		
		5. Bandaging	6. Animal / Insect Attacks	7. Recognise Symptoms			

1 First Aid

Importance	Skill	Skill Description	Training
	Basic First Aid	Knowing the use for first aid items and how to apply them when the time comes.	
	First Aid Trauma	Knowing the use for advanced trauma items and how to apply them.	
	Heimlich Manoeuvre	Knowing how to perform this manoeuvre to save a life.	
	CPR	How to use CPR to save a life.	Training: Attend a CPR class so you know the correct procedure.
	Know ABC	How to use ABC to save a life.	
	Know DCAP-BTLS	Useful to save a life.	
	Know OPQRST	How to use OPQRST to save a life.	
	Know RICE	How to use RICE to save a life.	
	Know SAMPLE History		
	Know SOAP Note		
	Use a Defibrillator	How to use a defibrillator to restart a heart.	

2 Herbal Healing

Importance	Skill	Skill Description	Training
	Identify Medical Herbs	Knowing what wild plants can use used for medical poultices.	
	Make Poultices	Creating poultices from wild herbs to produce a healing effect when applied.	
	Applying Poultices	Knowing where and how to apply wild herb medical poultices.	

3 Fitness

Importance	Skill	Skill Description	Training
	Backpacking	The ability to carry a backpack over long distances.	Training: Fill your pack with gear and head out on a hike.
	Stretching	Know how to stretch before working out.	Training: Research how to stretch different muscle groups and learn them off by heart.
	Jogging	Have the ability to jog long distances.	Training: Jog for 30 minutes around your area.
	Cardio Training	Strengthening your heart to prevent heart related problems.	
	Flexibility	Be flexible and manoeuvrable.	

SKILLS Medical Skills Skills

	Strength		
	Endurance		

4 Medicating

Importance	Skill	Skill Description	Training
	Treat Shock	Know the signs of shock and how to treat it.	
	Treat Anaphylactic Shock	Know the signs of anaphylactic shock and how to treat it.	Training: Pretend your friend is going into anaphylactic shock and administer their epi-pen.
	Treat Seizures	Know the signs of a seizure and what to do in that situation.	
	Tourniquet Use	Using a tourniquet in the right circumstance for the right amount of time.	
	Treating Burns	Categorizing burns and knowing how to treat them.	
	Treat Choking	Understand different types of choking and the types of treatments you can use.	
	Treat Cardiac Arrest	What to do when someone goes into cardiac arrest and how to recognise the signs.	
	Childbirth	How to deliver a baby in a safe manageable way.	
	Hypoglycaemia		
	Treat Dislocations	How to treat dislocations and get the bone back into the socket.	
	Treat Poisoning	What to do in a case of poisoning and how to recognise the signs.	

5 Bandaging

Importance	Skill	Skill Description	Training
	Wound Sanitisation	The cleaning of wounds of dirt and the killing of pathogens and bacteria.	Training: Smear a bit of dirt onto a leg and then pretend to treat it as if it were real.
	Wound Dressing	Dressing wounds with clean bandages.	
	Break Immobilisation	Knowing the different ways to immobilise limbs if they are broken.	Training: Practise immobilizing different limbs on a friend.

6 Animal / Insect Attacks

Importance	Skill	Skill Description	Training
	Treat Snakebites	Knowing what to do when a snake bites someone.	Training: Knowing which snakes are poisonous in your area. Simulate a poisonous snake bite and wrap bandages around the area.
	Treat Spider Bites	Knowing what to do when a spider bites someone.	Training: Know which spiders are poisonous in your area. Simulate a poisonous spider bite and wrap bandages around the area.
	Treat Bee/Wasp Stings	Knowing what to do when a bee/wasp stings someone.	
	Remove Ticks / Leeches	Knowing how to remove ticks and leeches safely.	Training: You could purposely get a leech sucking your blood to train you getting it off.
	Rabies Treatment	Knowing how to treat a bite from a rabid animal.	
	Vertebrate Bites	Knowing what to do when a vertebrate bites someone.	
	Arthropods Bites	Knowing what to do when an arthropod bites someone.	

7 Recognise Symptoms

Importance	Skill	Skill Description	Training
	Dehydration Signs	Knowing the signs of dehydration and how to treat it.	
	Heatstroke Signs	Knowing the signs of heatstroke and how to treat it.	
	Frostbite Signs	Knowing the signs of frostbite and how to treat it.	
	Hypothermia	Identifying hypothermia in a person and how to treat it.	
	Stroke Signs	Identifying a stroke in a person and how to treat it.	Training: Take a class or watch videos of people having strokes and learn the signs.
	Recognise Shock	Identifying shock in a person and how to treat it.	
	Altitude Sickness	Identifying altitude sickness in a person and how to treat it.	
	Asphyxiation	Identifying asphyxiation signs in a person and how to treat it.	
	Heart Attack Signs	Identifying heart attack signs in a person and how to treat it.	
	Hair Tourniquet		

9 Combat Skills

Subheadings

		1. Unarmed	2. Bladed Weapons	3. Thrown/Shot Weapons	4. Ranged		
		5. Guns	6. Explosives	7. Threat Identification			

1 Unarmed

Importance	Skill	Skill Description	Training
	Karate		Training: Start a karate class.
	Jujutsu		Training: Start a jujutsu class.
	Boxing		Training: Take up boxing.
	Judo		Training: Start a judo class.
	Kickboxing		Training: Start a kickboxing class.
	Muay Thai		Training: Start a muay thai class.
	Krav Maga		Training: Start a krav maga class.
	Hapkido		Training: Start a hapkido class.
	Pencak Silat		Training: Start a pencak silat class.
	Wing Chun		Training: Start a wing chun class.
	Opportunistic Weapons	Items which are around you that could be used as weapons such as chairs and books.	Training: Have a mock fight with a friend using only items around you at the time.

2 Bladed Weapons

Importance	Skill	Skill Description	Training
	Knife	Knowing knife combat and how to use it properly.	
	Sword	Knowing sword combat and how to use it properly.	Training: Practising swordsmanship on a dummy or punching bag using a weighted wooden stick.
	Nunchaku		
	Hidden Blade		
	Mace		
	Battleaxe		

3 Thrown/Shot Weapons

Importance	Skill	Skill Description	Training
	Spear	Knowing how to throw spears effectively.	Training: Practise throwing them at a tree on your property.
	Throwing Knives	Knowing how to throw throwing knives effectively.	Training: Practise throwing them at a tree on your property.
	Chakram	Knowing how to throw chakram effectively.	Training: Practise throwing them at a board on your property.
	Ballistic Knife	Knowing how to shoot ballistic knives effectively.	Training: Practise shooting it at a tree on your property.
	Tomahawks	Knowing how to throw tomahawks effectively.	Training: Practise throwing them at a tree on your property.
	Shuriken	Knowing how to throw shuriken effectively.	Training: Practise throwing them at a board on your property.
	Bolas	Knowing how to throw bolas effectively.	Training: Practise throwing them at a target on your property.

4 Ranged

Importance	Skill	Skill Description	Training
	Compound Bow	Knowing how to shoot a compound bow effectively.	Training: Go to an archery range and practise shooting.
	Recurve Bow	Knowing how to shoot a recurve bow effectively.	Training: Go to an archery range and practise shooting.
	Longbow	Knowing how to shoot a longbow effectively.	Training: Go to an archery range and practise shooting.
	Crossbow	Knowing how to shoot a crossbow effectively.	Training: Go to an archery range and practise shooting.
	Fletching Bows	How to create your own bows from local wood.	Training: Head out into the wild and find bowmaking materials and try to build one.

	Fletching Arrows	How to create your own arrows from local wood.	
	Slingshot	Knowing how to shoot a slingshot effectively.	
	Sling	Knowing how to use a sling and rocks effectively.	
	Blowgun	Knowing how to shoot a blowgun effectively.	

5 Guns

Importance	Skill	Skill Description	Training
	Marksmanship	Training to become an accurate shooter.	
	Maintenance	Knowing how to maintain and look after a gun.	
	Reloading	Reloading a weapon swiftly and efficiently.	
	Gun Repairs	Repairing a gun with spare parts or found components.	
	Gun Safety	Knowing how to use a gun safely and effectively.	
	Ballistic Types	Knowing what effects different types of ammo have.	

6 Explosives

Importance	Skill	Skill Description	Training
	Molotov Cocktail	Knowing how to throw a molotov correctly.	
	Grenade	Knowing how to throw a grenade properly.	Training: Buy a training grenade to practise with and research how to throw them properly.
	Pipe Bomb	Knowing how to arm a pipe bomb properly.	
	Landmine	Knowing how to arm and avoid landmines.	

7 Threat Identification

Importance	Skill	Skill Description	Training

10 Transport Skills

Subheadings

1. On Foot	2. Driving	3. Cycling	4. Air
5. Sea			

1 On Foot

Importance	Skill	Skill Description	Training
	Hiking	Walking through unfamiliar terrain swiftly for great distances without tiring.	
	Backpacking	How used you are to using and hiking with a backpack.	
	Mountaineering	The ability to traverse rough terrain and steep slopes swiftly.	
	Climbing	Climbing up and down obstacles if they are blocking your route.	
	Sprinting	The ability to sprint fair distances to escape danger.	

2 Driving

Importance	Skill	Skill Description	Training
	Driving	Knowing how to drive a motor vehicle, whether manual or automatic.	
	Vehicle Maintenance	Maintaining vehicles to an optimum condition and performing regular checks.	Training: Research and maintain your vehicle yourself such as air filter change, light changes, oil changes etc.
	Vehicle Repairs	Repairing vehicles when they become damaged.	
	Evasive Driving	Avoiding obstacles in a rapidly changing environment.	
	Change a Tyre	Knowing how to change a tyre if it becomes punctured.	Training: Practise changing your tyre a few times every few months so you don't forget the skill.

	Repair a Tyre	Repairing a tyre with scavenged materials if needed.	
	Snow Driving	Driving in slippery and cold conditions.	
	Flood Driving	Driving through flood waters and gauging if it's safe to do so.	
	Jump Starting	Starting a cars engine using another car.	

3 Cycling

Importance	Skill	Skill Description	Training
	Cycling	Knowing how to ride a bike and stay balanced.	
	Bike Maintenance	Keeping your bike in optimum condition, oiled and dirt free.	
	Bike Repair	Repairs such as fixing a chain and repairing a puncture.	

4 Air

Importance	Skill	Skill Description	Training
	Piloting	Knowing how to fly an aircraft safely.	
	Aircraft Maintenance	Maintaining aircraft to an optimum condition and performing regular checks.	

5 Sea

Importance	Skill	Skill Description	Training
	Swimming	Knowing how to swim and the hazards in oceans.	
	Driving Boats	Knowing how to drive motor boats.	
	Boat Maintenance	Maintaining boats to an optimum condition and performing regular checks.	
	Sailing	Controlling a boat with masts and sails.	
	Lifesaving	Saving someone's life who is drowning.	

11 Modern Skills

Subheadings

		1. Computing	**2. Life Skills**	**3. Infiltration Skills**	**4. Fuel**		
		5. Metalwork					

1 Computing

Importance	Skill	Skill Description	Training
	Typing	The speed and accuracy of your typing on PCs and mobiles.	Training: Practise by typing to friends and family often. Focus on accuracy rather than speed.
	Hacking	Whether or not you can hack computers, networks etc.	Training: Attempting to hack wireless networks then go on to something more challenging like modern technology or software.

2 Life Skills

Importance	Skill	Skill Description	Training
	Critical Thinking		
	Child Care	How good this person is with children and looking after kids.	Training: Set it on yourself to try and keep kids occupied with games at events or parties.
	Parenting	How good this person is at parenting a child.	Training: The best way is to watch a good parent in action as you shouldn't be parenting someone else's children.
	Reasoning		
	Imagination	How out of the box and vivid your imagination is.	Training: Imagine unique and possibly strange ways of accomplishing your tasks.
	Time Management	How well your time is spent.	Training: Write down how you currently spend your time and work out how you can be more efficient.
	Relationships	How well you maintain your relationships with others.	Training: Being a good friend and lending an ear when they need you. Loving your family and spouse.

3 Infiltration Skills

Importance	Skill	Skill Description	Training

	Lockpicking	Using lockpicks to open locked doors, safes and locks.	Training: Buy a lockpick set and practise picking the locks on your house and car, but starting off with practise clear locks.
	Pickpocketing	Stealing items off a mark without them knowing.	Training: Try to pick your friends pockets without them knowing while they're over - then give it back.
	Hotwiring	Starting a car through the manipulation of electrical cables.	Training: Varies with different cars but learn about hotwiring and then try to hotwire your own car.

4 Fuel

Importance	Skill	Skill Description	Training
	Creating Biodiesel	Knowing how to create biodiesel at home for vehicle fuel.	
	Creating Ethanol	Knowing how to create ethanol at home for vehicle fuel.	

5 Metalwork

Importance	Skill	Skill Description	Training
	Ammo Smithing	Crafting your own ammo at home.	Training: Set up a blacksmithing forge and ammo station so you can melt down metals to create your own ammo.
	Weapon Smithing	Smithing your own weapons at home on a forge.	Training: Practise forging a sword and knives at home with scrap metal.
	Armour Smithing	Smithing your own armour at home on a forge.	Training: Practise forging armour at home.
	Welding	Attaching two pieces of metal together.	Training: Weld some metal together or make something out of metal that required welding.

12 Tactical Skills

Subheadings

		1. Tactics	2. Evasion	3. Camouflage	4. Strategy		
		5. Security					

1 Tactics

Importance	Skill	Skill Description	Training
	Situational Awareness	Knowing what's going on around you at all times.	Training: Sit in a café or other city location and observe everything going on around you. Know where the exits are and try to memorise people who stand out and other important details.
	Conflict Avoidance	Avoiding conflict when wise to do so and knowing how to get out of heated situations.	Training: Start a mock fight with a friend and try to defuse the situation or get out fast.
	Conflict De-Escalation	Talking a person down or stepping down yourself to tone down a disruption.	Training: Have a friend come at you angrily and start a verbal conflict then try to talk them down.
	Sensing Danger	The ability to know when something is wrong before it happens.	Training: You could have a friend try to break into your house on a random day a few times every month to keep you alert at all times and to heighten your senses.
	Breaking Down Doors	Breaking down or opening doors swiftly, quietly and efficiently without injury to yourself.	Training: Hard to practise without expenses but you could always try to scout out an unknown house as quickly and quietly as possible while checking every room.
	Infiltration	Gaining access into an enemy occupied building and achieving specific outcomes.	Training: Infiltrate a friends house and leave with a specific object.
	Silent Movement	Moving between locations without making much noise.	Training: Try to move as silently as possible in different environments such as rain, fallen leaves and through a building.
	Scouting	Scouting new unknown locations.	Training: Go to an unknown location and investigate the area marking landmarks on a map so you can find them again later.
	Looting	Finding items needed to survive on in unknown locations.	Training: Borrow a friends house to loot everything you may need for survival as a practise.

2 Evasion

Importance	Skill	Skill Description	Training
	Losing a Tail	Losing a person who's following you.	Training: Have a friend tail you at a reasonable distance in a city environment and try to evade them.
	Evading Authorities	Keeping one step ahead of the CIA, police etc.	Training: Not really trainable, watch The Bourne Ultimatum maybe?

3 Camouflage

Importance	Skill	Skill Description	Training
	Grey Man	Knowing how to blend in to a crowd and avoid detection.	Training: Practise being unseen in urban environments. Be the person who blends in.

Importance	Skill	Skill Description	Training
	Personal Camouflage	Having the ability to camouflage yourself into the surrounding terrain.	Training: Identify where you want to camouflage yourself and buy some camo gear of the same style and try to blend in. Get a friend to take pictures from every angle.
	Shelter Camouflage	Camouflaging your shelter into the terrain to avoid detection.	Training: Camp out in the wild and try to hide your tent from every angle using natural materials.
	UV Camouflage	Tactics and skills for camouflage from UV detection.	Training: Camp out in the wild and use a UV camera to try and identify your position.
	Thermal Camouflage	Tactics and skills for camouflage from thermal imaging.	Training: Camp out in the wild and use a thermal camera to try and identify your position.
	Hiding in Plain Sight	Involves being the centre of attention, so much so that all suspicion on you is absolved. Also known as "Somebody Else's Problem".	Training: Dress so ridiculously that people try to avoid or ignore you completely, like dressing up as a clown and wandering in a park.

4 Strategy

Importance	Skill	Skill Description	Training
	Bug-Out Plan	Knowing how to make efficient and detailed bug out plans is a skill that takes time to develop.	Training: Create a bug out plan and test it out and then made adjustments to it.
	House Invasion Strategy	Knowing the best ways to defend your house or estate can only be accomplished by practice.	Training: Get some friends to invade your house so you can fix any weaknesses they may find.
	Strategy	Advanced strategies and tactics used in wars or conflicts.	Training: Get two families to have a mock firefight where you command your party where to go and what to do.

5 Security

Importance	Skill	Skill Description	Training
	Woodland Alarms	The ability to create alarms from bush materials to alert you of trouble.	Training: Set up some tripwire can alarms on your property and test them.

13 Mental Skills

Subheadings

		1. Personality	2. Psychological Skills	3. Mental Fitness	4. Ethics		

1 Personality

Importance	Skill	Skill Description	Training
	Stable Personality	A stable personality will assist in clear decision making and make you a strong leader.	Training: When faced with hard or emotional times try to remain at your median personality without being too affected by whatever emotion is being challenged.
	Self Understanding	Understand your body, mind and what you need to survive.	Training: Takes notes of what you eat, what you spend your time on and work out why you do them or eat it and whether or not it benefits you.
	Self Comfort	Be comfortable with yourself and your own thoughts.	Training: Spend a week or two alone, without other human interaction and try to find ways to be comfortable with yourself.
	Discipline	Follow through on commitments and keep your word.	Training: Have a routine and stick to it, but don't become predictable.
	Perfectionism	How perfectly you try to accomplish everything.	Training: Try to complete jobs or tasks before moving onto something else so there's no unfinished projects.

2 Psychological Skills

Importance	Skill	Skill Description	Training
	Perseverance	The ability to keep going no matter what challenges are facing you.	Training: If you're faced with challenges, trials or failures try to keep pushing through until you succeed.
	Creativity	Finding unique ways to accomplish a task that isn't obvious.	Training: Look for new and creative ways of doing your job or other tasks.
	Researching	Researching or experimentation is important for learning theories you didn't know.	Training: Practise by researching things you don't know very much about, soon you should be able to find information much faster.
	Strategic Thinking	Creative thoughts about safety, security and planning enemies moves before them.	Training: Try to look for unique ways to do preparedness related activities specific to you.
	Adaptability	Adapting to any circumstance life or weather may throw at you.	Training: Throw yourself a few curve-balls in life and adapt to the situation like pretending your car won't start.
	Alertness	Staying alert for risks, threats or dangers.	Training: Keep your mind on possible threats and potential exits throughout the day whenever you can and soon it will be second nature.

3 Mental Fitness

Importance	Skill	Skill Description	Training

	Fear Control	Quell or contain any fears that may start to bubble up.	Go into situations that may scare you such as holding a non dangerous spider if you're afraid of them.
	Positive Mental Attitude	Have a strong and focused mindset on what you want to achieve and know you will survive.	Training: Focus on the positives in any situation you may be faced with no matter how trivial.

4 Ethics

Importance	Skill	Skill Description	Training
	Strong Morals	Have strong morals and stick by them in tough times.	Training: When situations arise that challenge your ethics or morals, be sure to stick by them.
	Religious Conviction	Stay with your religion and beliefs in all situations.	Training: Know the ins and outs of your religion and stick to what you believe in hard times.
	Code of Conduct	Have a code of conduct and treat others well.	Training: Set some rules for living by and try to stick to them at all times.
	Good Samaritan Law	Know the good Samaritan law to help others out.	Training: When people are in need around you, be the one to help them and go the extra mile.

14 Skills Analyser

The skills analyser is used for detailing the strengths and weaknesses of individuals, but particularly bug-out party members. Below is a breakdown of skills into smaller units which are easier to recognise.

Knowledge	How much information the individual knows about the subject. **Example:** Someone who's watched a lot of videos on prepping but has never put it into action.
Level 0	No prior knowledge of this skill.
Level 1	A small amount of knowledge on this skill.
Level 2	They know quite a bit of information but are still in the early stages.
Level 3	Someone who knows about half the information on a skill.
Level 4	They know most of what there is to learn about the skill.
Level 5	Someone who knows everything there is to know about a skill.
Experience	How much real life experience the person has had. **Example:** Someone who's been actively prepping for years but hasn't researched how do it more efficiently.
Level 0	Absolutely no experience in this skill.
Level 1	Someone with a small amount of experience in that skill.
Level 2	A person with a moderate amount of skill who has been doing it a while.
Level 3	An apprentice level of skill where they should be able to perform it by themselves quite easily.
Level 4	An extremely skilled person doing it very well every time.
Level 5	A master of that skill, doing it flawlessly every time.
Talent	The natural talent and ability the individual has in this skill. **Example:** Someone who picks up new prepping skills and pushes the boundaries so naturally.
Level 0	No natural talent whatsoever.
Level 1	Only a small amount of natural talent.
Level 2	A person with a slightly less than average amount of talent.
Level 3	They have quite a talent for this skill and can perform it quite easily.
Level 4	A person who has a wonderous talent for this skill who pushes the boundaries.
Level 5	Someone with an absolutely marvellous affinity for this skill, always on the leading edge.

Example

This is an example on how to create a list of the skills of the individuals in your bug out party. Each letter with a number beside them represents the skill above and how that person ranks. The total score is made with an average of the three numbers below. (E.g. 2+2+3 = 7, ÷ 3 = 2.3)

	Person 1	Person 2	Person 3	Person 4	Person 5						
Leadership	**2.3** K2, E2, T3	**1.6** K2, E2, T1	**0** K0, E0, T0	**0.3** K1, E0, T0	**N/A** K0, E0, T0						

Crafting

Projects and crafting ideas for your home or campsite

"The desire to create is one of the deepest yearnings of the human soul."
Elder Uchtdorf

Introduction

This section discusses craft-able objects you can create at home or the campsite such as chairs, ovens or shampoo.

Purpose	The aim of CRAFTING is to provide a list of crafting recipes to allow the creation of furniture, clothing, stoves, household consumables such as soap and candles, kitchen equipment, whittled items, weapons, ammunition and glass objects. This section finishes with a list of tools and their primary purpose.
Lost?	• If you're looking for information on the types of materials used to craft with, see the MATERIALS section. • For information on building a signal fire to be seen or to signal others, see the COMMUNICTION section. • If you want to build and set traps, see the HUNTING section. • For more information about crafting shelters, see the SHELTER section. • If you want to craft a weapon out of resources you have, see the OFFENCE section.

Contents

1 Furniture

Bed

Use	For sleeping on and having a good nights sleep.
Construction	

CRAFTING | Furniture

Chair

Use	For sitting on without getting damp or dirty.
Construction	

Table

Use	For storage of goods while semi-protecting them from animals.
Construction	

Heat

Heat Reflector

Use	Build a heat wall to reflect the warmth back towards the tent.
Construction	

2 Clothing

Hat

Hat

Use	For keeping the sun out of your eyes and reflecting the heat away.
Construction	

Shoes

Use	To prevent splinters, injuries and critters attacking you as easily.
Construction	

3 Sewing & Knitting

Sewing

Knitting

Knitting

Hat	
Beanie	
Sweater	
Gloves	
Socks	
Toys	

Repairs

Repairs

Button Repair	
Hole Stitch	
Tent Repair	

4 Kitchen Items

Stoves & Cooktops

Camp Grill	How to build stoves and cooking ranges.

CRAFTING | Kitchen Items | Stoves & Cooktops

Camp Grill	Food placed on wire grid above or below heat, cooked by thermal radiation.
Rotisserie	A slow cooking process where the food is skewered on a spit and rotated slowly to cook evenly. Peg two sticks with a Y fork at the end into the ground. Place another stick with a bend at the end across the top ensuring that it has been cleaned first prior to adding food.
Earth Oven	An oven pit in the ground used to trap heat and bake, smoke or steam food. Wrap food in banana leaves or similar and place underground with hot coals.
Masonry Oven	An oven consisting of a baking chamber make of brick, concrete, stone or clay. Used for heating, baking, drying or cooking foods. Find sufficient bricks/rocks to create the oven with.
Dehydrating Rack	Removes the moisture from foods using a fan and low heat to preserve them longer.
Sun Stove	

5 Camp Recipes

These are recipes for useful non-edible items such as candles, shampoo or soap.

Herbal Shampoo

Prep: min **Cook:** min **Yield:** 7serv	Pic	**Description:** **Prep Time:** **Cook Time:** **Yield:**
Ingredients	• 2 tbsp. shampoo base or liquid castile soap • 1 cup distilled water • 1/4 cup of fresh herbs or 3 tbsp. of dried herbs (see choices below) • 1 tsp. apricot kernel oil or almond oil • 2 drops essential oil of your choice (if making for children, Roman chamomile is recommended) • Edible Wilds in Recipe: Dandelion, Horsetail, Red Clover • Herbs for normal hair: dandelion, horsetail, red clover. • Herbs for oily hair: lemongrass, white willow bark, strawberry leaves, watercress. • Herbs for dry hair: comfrey root, elder flowers, orange blossoms.	
Instructions	1. Place herbs in a Pyrex bowl. Boil water and then pour over the herbs. Let steep 20 minutes. 2. Strain liquid from the herbs. Into the liquid add the liquid castile soap or shampoo base; then the almond or apricot kernel oil; mix thoroughly. 3. Scent with essential oil and mix again. Pour into refillable plastic container.	

Others

Beeswax Candles	
Soap	
Laundry Soap	

6 Fletching

Fletching is the crafting of bows and arrows.

Bows

Arrows

7 Woodworking

The woodworking category helps you identify wood types, guidance on felling trees and what you can use the resulting wood for.	"Measure twice, cut once, then force it to fit."

Woodcutting Tools

A list of tools which can be used to cut trees, logs and branches.

Identifying Trees
Different trees have a huge variety of purposes, from better firewood to better at whittling to better for constructing houses and bows. You should choose the wood you will be using carefully or it may have catastrophic consequences. For a list of features to determine the type of tree see the PLANTS section. For a list of known tree types and useful features see the MATERIALS section.

Saws

A saw is a tool consisting of a tough blade, wire, or chain with a hard toothed edge. It is used to cut through material, very often wood though sometimes metal or stone. The cut is made by placing the toothed edge against the material and moving it forcefully forth and less forcefully back or continuously forward. This force may be applied by hand, or powered by steam, water, electricity or other power source. An abrasive saw has a powered circular blade designed to cut through metal or ceramic.

Wire Saw	A wire saw is a saw that uses a metal wire or cable for cutting. Industrial wire saws are usually powered. There are also hand-powered survivalist wire saws suitable for cutting branches. Wire saws are classified as continuous (or endless, or loop) or oscillating (or reciprocating). Sometimes the wire itself is referred to as a "blade". Wire saws are similar in principle to band saws or reciprocating saws, but they use abrasion to cut rather than saw teeth. Depending on the application, diamond material may or may not be used as an abrasive. The wire can have one strand or many strands braided together (cable). A single-strand saw can be roughened to be abrasive, abrasive compounds can be bonded to the cable, or diamond-impregnated beads (and spacers) can be threaded on the cable. Wire saws are often cooled and lubricated by water or oil. One major advantage of wire saws is their smaller kerf, as compared to a blade. Another is the precision of the cut. Their main disadvantage is the slower speed. Other disadvantages include a greater chance the wire will break and any surface imperfections can cause errors in the cut.
Hand Saw	In woodworking and carpentry, hand saws, also known as "panel saws", are used to cut pieces of wood into different shapes. This is usually done in order to join the pieces together and carve a wooden object. They usually operate by having a series of sharp points of some substance that is harder than the wood being cut. The hand saw is a bit like a tenon saw, but with one flat, sharp edge. There are two main types of saw teeth: the 'cross cut' saw teeth and the 'rip' saw teeth. These cut into the wood using different mechanisms. Wood is composed of many long cells running length-ways. Thus, crosscut saws have sawteeth that are usually shaped, often with a metal file, in such a way that they form a series of tiny knifelike edges. The wood cells are contacted by the knife-edge of the tooth and cut. Rip saws, on the other hand, are usually shaped so that they form a series of tiny chisel-like edges. The wood cells are contacted by the chisel and 'ripped' apart from the bundle of other cells. It is common that people do not recognize the difference and use saws both ways. However, a rip saw is much faster than a cross-cut saw when cutting with the grain but leaves a very rough cut, often with splinters on the surface, and has more difficulty maintaining a straight cut when cutting across the grain. The cross-cut saw can cut in any direction but is much slower than needs be when cutting with the grain.
Two-Man Saw	A two-man saw (known colloquially as a "misery whip") is a saw designed for use by two sawyers. While some modern chainsaws are so large that they require two persons to control, two-man crosscut saws were primarily important when human power was used. Such a saw would typically be 1 to 4 m (4 to 12 feet) long, and sometimes up to 5 m (16 feet), with a handle at each end. In some cases, such as when felling Giant Sequoias, sawblades could be brazed together end-to-end in order to create longer saws. The technique in using a two-man saw involved a sawyer standing at each end. Together the sawyers would alternate pulling the saw through the wood. If the kerf began closing, causing the saw to bind, wedges would be inserted behind the sawblade in order to keep the kerf open. Cutting from underneath a suspended log, called "underbucking", might also have been used if binding became a big problem. Many variations on the design were used, but they mainly fell into two types. Felling saws were used to fell the trees, and bucking saws were used to cut felled trees into lumber. The two applications require slightly different designs: a felling saw has a narrower blade, allowing wedges to be more easily inserted, while a bucking saw has a wider blade, giving it more strength. Two-man saws were designed to cut in both directions. Careful tooth design was necessary to clear the sawdust during the cut.

Axes

These are different types of axes you may find.

Hatchet	Fine for chopping up kindling or tackling the occasional small tree. A good hatchet should ideally include a hickory handle, have a well-weighted head, and a balanced feel. It's the balanced feel that helps you strike accurately each time, felling a tree much quicker than a cheaper hatchet.
Felling Hatchet	These axes are catered to the felling of trees and chopping larger logs. This time around, the handle is longer, the head is angled more aggressively and usually, the handle is designed to produce a powerful swing.
Splitting Maul	Similar in size to a felling axe, yet this time its job is to split logs into kindling for a fire. The axe head will have a less aggressive, more concave blade to it, allowing you to split the wood across the grain, rather than cut into it.
Tomahawk	These are the axes you see frequently on camping trips. They tend to be used incorrectly for firewood collecting and clearing brush, something a quality machete would be a better fit for.
Tactical Axe	A good tactical axe, is not usually made of hickory, or any type of wood. They're generally made of forged steel, with helpful notches and serrated edges to help with specific tasks. A great example of this are climbing axes, which feature special cut-outs and parts to cut rock or help attach bolts to rock faces.
Viking/Danish Axe	A standard issue Viking axe is huge. They can easily be 6ft in height, with different sizes depending on the user (you can also be fitted for a Viking Axe, just like a suit).
The Double Bit Axe	This axe is a cumbersome beast, yet it's dual head is more useful than you'd think. One side of the double bit axe is always much sharper than the other. It's this side that you use to fell a tree or cut wood.
Battle Axe	Unlike the Viking Axe, the battle axe is much smaller and designed to be held in one hand. They're extremely powerful weapons, with a heavy cut head that's designed to carry as much power through the swing, and ultimately onto your target.

Mechanical Cutting

Ways logs can be cut by mechanical or electrical means.

Chainsaw

A chainsaw is a portable, mechanical saw which cuts with a set of teeth attached to a rotating chain that runs along a guide bar. It is used in activities such as tree felling, limbing, bucking, pruning, cutting firebreaks in wildland fire suppression and harvesting of firewood. Chainsaws with specially designed bar and chain combinations have been developed as tools for use in chainsaw art and chainsaw mills. Specialized chainsaws are used for cutting concrete. Chainsaws are sometimes used for cutting ice, for example for ice sculpture and in Finland for winter swimming. Someone who uses a saw is a sawyer.

Log Splitter

Chipper / Mulcher

Sawmill

Cutting Wood

Felling a Tree

Felling is the process of cutting down individual trees, an element of the task of logging. See the "Fuel" section for the difficulty level of felling various types of trees.

Preparation

Survey	Survey the area around the tree for structures. Take a look at the area around the tree to make sure there aren't structures or other trees in the area where you want it to fall. Things like power lines, fences, and roads should all be considered before you fell a tree. You'll want there to be an area that's cleared out where the tree is free to fall. Cutting down a tree so that it falls into another tree could start a potentially dangerous domino effect. Examine the tree for stability and lean. Make sure that your tree is healthy and free of disease or the cutting down process could be unpredictable. Similarly, you'll want to make sure that the tree isn't leaning significantly in a certain direction because then you won't be able to control the direction it falls in.
Fall Path	Determine the fall path of the tree. The fall path should be free of structures, roads, and other trees. Make sure that there's enough space for the tree to fall on its side without colliding with anything else. Estimate the height of the tree, then use a tape measure to measure the distance from the base of the tree to an area that's free of objects. This will be your fall path. To control the fall path, you'll cut a notch in the side of the tree that you want it to fall on.
Debris	Pick up sticks and debris near the tree. Sticks, logs, and stones could trip you as you try to get away from the falling tree. Remove anything from around the tree that could cause you to trip or fall.
Escape Route	Plan an escape route for after the tree falls. Once you get to know the area around you, you can establish a route to walk in as the tree is falling. You should never stand or walk in front or behind a falling tree. Make sure there is a clear path to walk in and step at least 15 feet (4.6 m) to the side of the tree as it falls.

Saw Felling

Step 1	Make a horizontal cut on the side you want the tree to fall on. Put the teeth of the handsaw 1–2 feet (0.30–0.61 m) above the tree's roots and move it back and forth to create a horizontal cut. Continue cutting through the tree until you've made it 1/3 of the way through.
Step 2	Hatchet a 70-degree front cut above the horizontal cut. Once the horizontal cut has been made, you can start hatchetting above the cut to create the notch. Use both hands and swing a hatchet above your head and down into the side of the tree at an angle. Continue cutting at the tree until you've made a defined notch, but don't go past 1/3 of the tree's width.
Step 3	Saw through the tree on the opposite side of the notch. Go to the other side of the tree and repeat the pattern, but this time saw all the way through the tree to the notch. As you get closer to the notch, get ready to quickly walk away because the tree will fall.
Step 4	Walk out of the way of the tree as it falls. Quickly walk down the path that you cleared out before. If you did everything correctly, the tree will fall in the direction of the notch.

Axe Felling

Step 1	Cut a v-shaped notch (kerf) about waist high into the tree in the direction you want the tree to fall. Cut to a depth of about 1/3 the diameter of the tree.
Step 2	Cut another notch on the opposite side about a foot above the first. The wood between the two cuts creates a "hinge," holding the tree in place as it begins to fall.
Step 3	Expand the width of the first notch in an upward direction until it approaches the height of the second notch. When the tree begins to fall, make your way to safe distance back along the escape route. Be aware of any branches on nearby trees that might become entangled with the falling tree.

Chainsaw Felling

Step 1	Cut on a notch at a 70-degree angle. Decide the direction that you want the tree to fall because this is the side of the tree that you'll cut the notch. Turn on the chainsaw and carefully cut down into the tree at a 70-degree angle. The top of the notch should be the shallowest part of the cut, while the bottom of the notch will be the deepest area of the cut. The chainsaw should not go more than 1/3 through the tree. The bottom of the notch cut should be 1–2 feet (0.30–0.61 m) off the ground. Hold onto the handle tightly with both hands so you have full control over the chainsaw.
Step 2	Make a horizontal cut 1/3 through the tree. Use the chainsaw and make a clean, horizontal cut at the base of the notch that you created. This cut will make the bottom of the notch straight. Do not go further than 1/3 through the tree.
Step 3	Make a bore cut through the other side of the tree. A bore cut is when you insert the tip of the saw blade into the tree instead of cutting the tree from its side. Line up the chainsaw blade 1–2 inches (2.5–5.1 cm) away from the edge of the notch cut, and push it all the way through the tree. Then, continue sawing into the opposite direction of the notch until you make a clean horizontal cut through the other end of the tree. This will weaken the tree but won't cause it to fall over.
Step 4	Hammer wedges into the bore cut. Insert a wood cutting wedge into the bore cut that you created and hammer it 1–2 inches (2.5–5.1 cm) into the bore cut. Go to the opposite side of the tree and hammer another wedge into the opposite side of the tree.
Step 5	Cut through the remaining portion of the bore cut. Position the chainsaw on the opposite end of the notch and cut through the remaining wood connecting the tree together. If you've done everything correctly, the tree should start to slowly fall in the direction of the notch.
Step 6	Stand clear of the tree. You'll hear the tree crack and see it start to fall over towards the notch. As soon as you see this, turn off your chainsaw and walk down the predetermined path that you created earlier. Stand at least 15 feet (4.6 m) away from the tree.

CRAFTING Woodworking Cutting Wood Splitting Whittling Wood Types Types of Cuts

Limbing

Limbing in logging is the process of removing branches from the trunk of a fallen tree.

Hewing

Hewing is the process of converting a log from its rounded natural form into lumber (timber) with more or less flat surfaces using primarily an axe.

Log Bucking

Bucking is the process of cutting a felled and delimbed tree into logs.

Splitting Wood

Wood splitting is the breaking up of logs into smaller pieces generally for firewood.

Chopping Area	

Chainsawing

Whittling

Whittling may refer either to the art of carving shapes out of raw wood using a knife or a time-occupying, non-artistic (contrast wood carving for artistic process) process of repeatedly shaving slivers from a piece of wood. Softwoods are the best for whittling because they cut nice and easy. After you've learned the basics of whittling, feel free to move on to harder woods. No matter which kind of wood you use, look for wood with a straight grain as it is easier to whittle than wood that has the grain going in multiple directions. Avoid wood with lots of knots–those are a booger to whittle. For generations, whittlers have used nothing but their trusty pocket knife to create ruggedly handsome works of art. And some whittling purists will argue that the pocket knife is the only acceptable tool for true whittling. Pocket knives are certainly an excellent choice because they're so portable. Anytime you find a good piece of wood, you can just whip out your pocket knife and start sculpting your wooden masterpiece.

Whittling Tips
- Keep your knife sharp and the blade should glide right through the wood.
- Take extra precaution and cut away from your hands.
- Take it slowly, whittling is as relaxing as it is useful.
- Using gloves early on while understanding the different strokes can save your hands.
- Sometimes it's easy to tell the direction of the grain on a piece of wood simply by looking at it. Cuts made with the grain will peel away smoothly; cuts made against the grain will give resistance and eventually split. Cuts against the grain cause your wood to tear, split and the resistance makes whittling much more difficult.

Wood Types

These are the best types of woods you can use to whittle with.

Basswood	It's a good wood to whittle with because it's soft and doesn't have much grain.
Pine	It's soft, cuts easily, and is readily available. But it has its drawbacks. Some whittlers think pine doesn't hold detail very well. And if you're using a fresh pine twig or branch, you'll have to regularly clean the sticky sap off your knife while you're whittling.
Balsa	Balsa wood is a soft, inexpensive, lightweight wood that's perfect for beginning whittlers.
Twigs / Branches	Twigs and branches from most kinds of trees make for great whittling. There's nothing more enjoyable than sitting around a campfire and whittling away at a twig while you talk to your buddies. Wooden knives are a popular item to whittle from a tree branch.

Types of Cuts

These are the types of cuts you can use to whittle with.

Straightaway Rough Cutting	Use this cut at the very beginning of your project to carve your project's general shape. Hold the wood in your left hand and your knife firmly in your right. Make a long, sweeping cut with the grain and away from your body. Don't cut too deep or you might split the wood. Make several, thin slices to reduce the wood to the desired size and shape.
Pull Stroke (Pare Cut)	If you've ever seen an old-timer whittle, chances are you saw him using the pull stroke. It's the most used cut in whittling. To perform this cut, imagine you're paring an apple. Hold the wood in your left hand, the knife in your right with the blade facing towards you. Brace your right thumb against the wood, and squeeze your right fingers in order to draw the blade to your right thumb. Make your stroke short and controlled. Keep your right thumb out of the path of the blade. For added safety, wear a thumb pad. The pull stroke gives you lots of control over your blade and is best for detailed cuts.
Push Stroke (Thumb Pushing)	Sometimes where you want to cut won't allow you to do the pull stroke. That's when it's time to bust out the push stroke. Hold the wood in your left hand and the knife firmly in your right hand with the blade facing away from you. Place both your right and left thumbs on the back of the knife blade. Push the blade forward with your left thumb while your right thumb and fingers guide the blade through the wood. The push stroke, like the pull stroke, gives you greater control over your knife for detailed cuts.

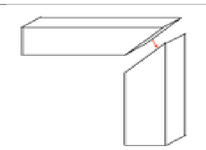
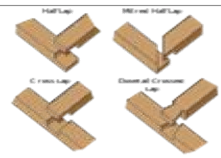
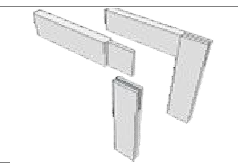
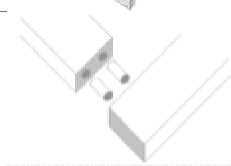
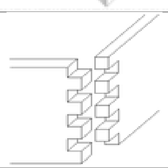
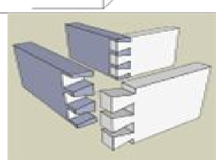
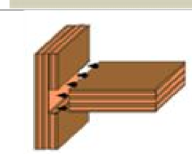
Items to Whittle

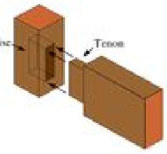
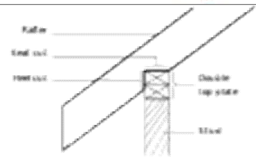
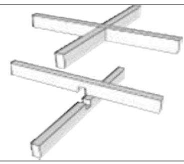
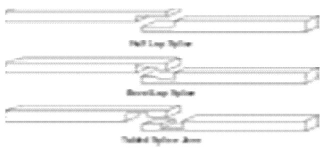
You can whittle any item you want, but here's a few common ones to help you choose.

Kitchen Utensils	Spoon, fork, knife, cup, plate.
Useful Camp Items	Tent Stake, Fishing Spear, Whistle, Arrows.
Entertainment	Chess Board, Chess Pieces, Checker Board, Playing Cards, Pendant.
Gifts	Sentimental value objects like dolphins, stars, ducks, symbols, cross.
Advanced Items	Boat, Mural, Clock, Artwork.

8 Carpentry

Joint Types

Butt Joint		The end of a piece of wood is butted against another piece of wood. This is the simplest and weakest joint. Of those, there is the a) T-butt, b) end-to-end butt, c) T-lap d) Miter butt and e) edge-to-edge butt.
Mitre Joint		Similar to a butt joint, but both pieces have been bevelled (usually at a 45 degree angle).
Lap Joint		The end of a piece of wood is laid over and connected to another piece of wood. This is the next simplest and weakest joint.
Bridle Joint		Also known as open tenon, open mortise and tenon, or tongue and fork joints, this joint is where the through mortise is open on one side and forms a fork shape. The mate has a through tenon or necked joint. Bridle joints are commonly used to join rafter tops, also used in scarf joints and sometimes sill corner joints in timber framing.
Dowel Joint		The end of a piece of wood is butted against another piece of wood. This is reinforced with dowel pins. This joint is quick to make with production line machinery and so is a very common joint in factory-made furniture.
Finger Joint		Also known as a box joint, is a corner joint with interlocking fingers. Receives pressure from two directions.
Dovetail Joint		A form of box joint where the fingers are locked together by diagonal cuts. More secure than a finger joint.
Dado Joint		Also called a housing joint or trench joint, a slot is cut across the grain in one piece for another piece to set into; shelves on a bookshelf having slots cut into the sides of the shelf, for example.
Groove Joint		Like the dado joint, except that the slot is cut with the grain.
Tongue and Groove		Each piece has a groove cut all along one edge, and a thin, deep ridge (the tongue) on the opposite edge. If the tongue is unattached, it is considered a spline joint.

Mortise and Tenon		A stub (the tenon) will fit tightly into a hole cut for it (the mortise). This is a hallmark of Mission Style furniture, and also the traditional method of jointing frame and panel members in doors, windows, and cabinets. This joint is a good strong joint to use.
Birdsmouth Joint		Also called a bird's beak cut, this joint used in roof construction. A V-shaped cut in the rafter connects the rafter to the wall-plate.
Cross Lap		A joint in which the two members are joined by removing material from each at the point of intersection so that they overlap.
Splice Joint		A joint used to attach two members end to end.

9 Blacksmithing

Blacksmithing has been an essential skill for thousands of years, allowing the crafting of swords, armour and metal equipment.

Subheadings

1 Anvil

An Anvil is used to place your heated metal on so you can work it. Typically, working it means pounding it with a hammer but there are other ways to work heated metal. The pointed horn is made so you can hammer curved shapes out of your metal. The holes are so you can insert various types of jigs and moulds so you can do even more varied work. Typically an anvil will have markings on it that will display the company that made it and the weight of the anvil. As far as the weight goes there are several different ways that this is done. American made anvils will often be marked in pounds, European anvils often marked in kilograms and older anvils, particularly from great Britain could have a peculiar marking system called "Hundred Weight". It will be shown as three digits with a dot between each digit.

Something like this: 2 - 2 - 6

The HundredWeight Anvil marking: the first digit is multiplied by 112 pounds, the second digit is multiplied by 28 and the last digit is the remaining pounds. And all three of these results are added together. So an anvil marked with 2-2-6 would actually weigh 286 pounds.

Anvil Features

These are the features of an anvil.

Horn	Used for forming curves in metal
Cutting Table	Used for cutting metal. You don't want to cut metal on the face of the anvil. It could cause damage. The cutting table usually is of a softer metal than the face of the anvil.
Face	Where you do most of your hammering.
Pritchel Hole	A hole used to punch holes through metal.
Hardy Hole	Tools are placed in this so you can work use the tool. A good example would be a hot cut tool. it is placed in the hardy hole and it has a cutting edge on the top. So you place the metal to be cut on top of this tool then strike it.
Base	Hold the feet and adds strength.
Feet	Help stabilize the anvil while hammering.
Heel	The back end of the anvil opposite the horn.
Hardy Attachments	

2 Forge

This is the place where fire heats up steel and iron to a high temperature. The forge needs an air supply , bellows or fan, to blow on the fuel source in order to bring the temperature of the fire up above normal burning temperature. And forges come in a lot of different configurations. The forge is of course where you heat the metal. But you have to get the metal really hot and this takes a few distinct things including some kind of air source that will blow a strong air current on the coals. This raises the temperature significantly. In medieval times they used something called a bellows that had to be hand pumped or hand cranked. Nowadays we use an electrical device like a fan or blower. The Basic Idea - The coal or charcoal is placed in the container and cantered right in the middle where the brake drum is.

The blower blows a stream of air right up into it. The pipe extends down from the fire pot and it has a spring loaded cover on it.This way I can easily open it up and clean it. Coal is a great material for burning because it burns at a much higher temperature than regular wood, and depending on the amount of air that is available it can burn very hot - in excess of 3,500°F. The available air is important because it is a chemical reaction that is happening. And if you blow air through the coal you make more air available for the chemical reaction. Hardwood Lump Charcoal It is hardwood that has been burnt under pressure which concentrates the carbons. This causes it to burn much hotter than regular wood.

Types of Forges
- Mini Whitlox Wood-Fired Forge
- Atlas Knife Company Gas Forge
- Handy Forge
- Atmospheric Forge

Sword Forge
But we very much need something like this so we can harden, temper, anneal, and normalize a sword. To do these things you have to heat up the whole sword so you need a long forge with a long enough fire pit. That's what this forge is all about. A sword forge also solves the problem of heat treating a sword if you made it with the stock removal method. With that method you don't need a forge or an anvil. You can shape the whole thing with hand tools. But... you still have to heat treat the whole blade of the sword. And this is where the sword forge comes into use. Cut a 55 gallon drum in half longitudinally. This is the bulk of the forge. Add legs to it. They can be welded on or bolted on. Be sure to put it at a comfortable height to reach in and work on things. Now you need to put a tuyere in so the airflow can get in there. The feed tuyere is in the centre of the tube so the air can be distributed evenly to both sides. That tube that goes the length of the forge has a whole lot of holes drilled in it. And you can see that it stands up off the bottom of the barrel by about two inches. This is so it will be the right height for the fire bricks that will go in later. I will show you that. This illustration gives you a good look at the paddle system inside the forge. By rotating the rods we can rotate the paddies and control the airflow to sections of the forge. This picture shows the forge now completed. I have placed firebricks in it and a screen.

Forge Construction
The basic set up is an old rusty brake drum with a few pieces of pipe and hair dryer. This is really all you need and you can stand the whole thing up on top of some cinder blocks. In the case of this forge we used the deck from an old broken lawn mower. The deck is the part that protects the spinning lawn mower blade. We simply turned it over and it forms a nice pit for the charcoal. The drum brake is on top and the trap door is on the bottom. This trap door remains closed while the forge is going and you open it up to clean out all the fallen soot and coal. The most difficult thing here is to connect the pipes together and connect the pipe to the drum brake. You can do this all with welding or you can actually use plumbing pipes and thread it all together. Just be sure you don't use any galvanized piping. It can give off a toxic fume (lead). Attaching the Hair Dryer to the Tube: It really doesn't matter how you do this. As long as the hair dryer is a reasonable distance from the actual fire pot of the forge. I used some rubber hosing and clamps. You can just use duct tape. If the hair dryer is very close to the fire pot you might want to consider disconnecting the heating coils inside the hair dryer. The Trap Door: Also doesn't matter too much but you definitely need a trap door. It should have some kind of a way to seal it closed while forging and then easily open it afterwards so you can clean out all the debris and coal.

Coal Selection

There are variables when it comes to coal. Just like there are variables with everything else. Some of the things you might consider are the type of forge you have, the type of forging you want to do, the amount of money you want to spend among other things. But a good rule of thumb is that you can get a bituminous coal that is metallurgical grade. You can't go wrong with it. You get a hot fire and low smoke, low sulphur.

Amount: This of course depends on how much forging you will be doing. If you are doing an afternoon of forging then 20 pounds of hardwood lump charcoal should be plenty and 5 pounds of coal should do.
Temperature: The hardwood lump charcoal burns the coolest but it is more than adequate for most forging. I have used it many times to make knives and swords. Bituminous coal is the next coal, it is a softer coal and it burns hotter than the lump charcoal. Anthracite coal is a hard coal and it burns the hottest.

For amateur blacksmithing it doesn't matter much. Use whatever you can get. It is when you want to do some really good forging that you need to think about the coal. For example: Need to worry about the carbon content of a sword you are making? Or the impurities that it will pick up? Then you might want to consider a coal that is metallurgy grade. Got a lot of forging to do and need to efficiently get through it? Then you might want the hottest fire which is given with anthracite. If you are just tinkering around with blacksmithing it doesn't matter a whole lot what you use and I recommend you pick up a bag of Hardwood Lump Charcoal. I use it all the time and like it a lot. A 20 pound bag will last you a few hours of forging. Depending on how you use it.

Want to start out with a small amount of coal so you can get a sense for it. Depending on your forge and what you are doing you should be able to get a day of forging out of a 16 pound box of it. It is bituminous coal which means it is the softer coal and easy to light. But very hot.

Bituminous Coal	It is metallurgical coal which is superb for blacksmithing. That means high heat, good carbon content, low smoke and low sulphur content for clean burning.
Anthracite Coal	It is harder and the nuggets are more defined.

3 Techniques

The object of blacksmithing is to manipulate metal into a variety of shapes and there are a lot of different ways to do this. You of course heat up the metal in a forge then you manipulate it in a variety of ways on the anvil. Twisting and straightening metal are pretty straightforward and easy to understand but folding takes a little bit of extra know how. When you are folding over metal like I show you in the video you are forming air gaps between the layers. These air gaps have to be removed or it will cause weakness in the metal. You do this two ways: First by heating and hammering. This fuses and forges the metal into one piece but there still could be air gaps and you remove these by liberally sprinkling something called borax on the metal! This use of Borax is called using flux on the metal and it actually serves several purposes. It helps prevent the metal from oxidizing and it lowers the melting point of scale on the metal making it more liquid and helping it to squirt out contaminants.

Metal Techniques

Folding	When you are folding over metal like I show you in the video you are forming air gaps between the layers. These air gaps have to be removed or it will cause weakness in the metal. You do this two ways: First by heating and hammering. This fuses and forges the metal into one piece but there still could be air gaps and you remove these by liberally sprinkling something called borax on the metal.
Twisting	
Straightening	

Drawing Out Metal	It is the act of making a piece of heated metal thinner and longer, or thinner and wider.

Hammering Techniques

Parallel	Hammer flat onto the piece of metal.
Angle	Angle the hammer and the metal.
Half Face Near	Hammer the metal flat on the nearest edge to you.
Half Face Far	Hammer the metal flat on the furthest edge from you.
Edge Hammer Near	Hammer the metal flat on the nearest edge to you.
Edge Hammer Far	Hammer the metal flat on the furthest edge from you.
Back Face	Hammer the metal from the side of the anvil.
Shearing	Hammering the metal downwards over the edge of the anvil.

4 Steel Types

There are quite a few grades of steel that are used by knife makers and some others that I haven't mentioned are W2, W3, 02, 06, D1, L2 and L6.

Galvanized Steel	This is one of the most important aspects of safety when it comes to blacksmithing. Galvanized steel should not be used in any aspect of smithing. It shouldn't be put in a forge and it shouldn't be used as part of a forge. This latter aspect sometimes happens when people buy galvanized pipes to use as part of their forge. Galvanized steel gives off a toxic and even deadly gas when heated. If you are in doubt about your steel being galvanized talk to an experienced blacksmith or avoid the steel totally.
Heat and Burns	We all know that the fire and the coals and the flames are hot and dangerous. So... take precautions against that. But, one thing we often don't consider as a beginner is that steel or other metals in your forge might not be glowing red but still might be dangerously hot! So be careful handling metals in your forge. The end of the steel or iron that is glowing hot is dangerous yes, but the other end that doesn't glow red might also be hot!
Apparel	Long Sleeves Leather and long pants - Sparks fly and you can't predict when or where they will fly. You should always wear long sleeves and long pants when blacksmithing. You should also preferably wear some kind of a heat protecting welding apron.
Repetitive Stress Injuries	If you are blacksmithing a whole lot you should be conscious of the fact that swinging a hammer thousands of times can cause serious repetitive stress injuries. So, be conscious of good hammer technique and watch for unusual aches and pains in your hand, shoulder and elbow. One thing to watch for is to not place your thumb on the handle of the hammer when hammering. Wrap your thumb around the handle.

5 Steel Temperature

Below is a colour temperature guide for determining the heat of a metal.

Colour	Manipulation	°C	°F
White	Forging Temperature	1315°C	2400°F
Bright Yellow	Forging Temperature	1093°C	2000°F
Dark Yellow	Forging Temperature	1037°C	1900°F
Orange Yellow	Forging Temperature	982°C	1800°F
Orange	Forging Temperature	926°C	1700°F
Orange Red	Forging Temperature	871°C	1600°F
Bright Red	Forging Temperature	815°C	1500°F
Red	Forging Temperature	760°C	1400°F
Medium Red		704°C	1300°F
Dull Red		648°C	1200°F
Slight Red		593°C	1100°F
Very Slightly Red		537°C	1000°F
Dark Grey	Tempering Temperature	426°C	800°F
Blue	Tempering Temperature	301°C	575°F
Dark Purple	Tempering Temperature	282°C	540°F
Purple	Tempering Temperature	271°C	520°F
Brown / Purple	Tempering Temperature	260°C	500°F
Brown	Tempering Temperature	248°C	480°F
Dark Straw	Tempering Temperature	240°C	465°F
Light Straw	Tempering Temperature	229°C	445°F
Faint Straw	Tempering Temperature	198°C	390°F

6 Weapons

Steels for Knifemaking

One of the first challenges you face when making a knife is getting the right steel. For the most part you will be using tool steel. This is pretty standard stuff for knifemaking. But there are a lot of different types of tool steel and they all have different characteristics when it comes to how they are treated, how they are worked and how they are as a final knife. Steel is an alloy -that is a melding of two or more different ingredients. And in the case of tool steel it is a combination of Iron and Carbon.

Pure Iron, also known as "Wrought Iron" is no good for knife making because it is very soft and very brittle. When a certain amount of carbon is added to Iron it becomes much stronger and tougher. Steel is a combination of Iron and Carbon and the amount of carbon that is added to the steel makes a big difference.

Just a small amount of carbon is added and the strength of the steel is significantly improved and this continues up to about .65% of added carbon where maximum strength is achieved. Adding more carbon does continue to improve the wearability and durability of the steel all the way up to around 1.5% carbon added.

So this adding of carbon to the steel in this range creates something typically called plain carbon steels and blacksmiths will work within this range of about .4% to 1.5%. There are quite a few different type of tool steel that are used in knifemaking and for the most part they are determined by the amount of carbon added to the Iron and the amount of some other type of ingredient such as Chromium or Nickel. The addition of these other ingredients add some beneficial characteristics.

01 Tool Steel	Contains about 1% carbon and has small amounts of chromium and tungsten added. These make it a great candidate for oil quenching. It is more stable than steels that are water quenched. You harden then temper this steel. Harden by heating to red-orange then quickly dipping and swirling in oil. You temper by heating to a colour controlled temperature. (The colour changes as the tempering changes for example you want to temper the edge to a certain point of hardness and strength but you don't want to temper the whole blade to that same hardness)
D2 Tool Steel	Contains about 1.5% carbon and also has chromium and molybdenum added . The chromium which is about 12% adds significant stain resistance and wear and corrosion resistance.
440C Tool Steel	This grade of steel is popular for pocket knives and smaller knives. It is good for making blades that are smaller and that get lighter use. It is also stain resistant. Typically the carbon content for this type of steel can vary from between .95% and 1.2% and it has 16 -18% chromium added.
154CM Tool Steel	This is a very strong steel that has great corrosion resistance and good edge holding power. This is achieved by replacing some of the Chromium content with molybdenum. It has 1.05% carbon, 14% Chromium and 4% Molybdenum along with small amounts of Manganese and Silicon.

Types of Knifemaking

Stock Removal Method	The Stock Removal Method of knifemaking: This is where you start out with a piece of steel, draw a pattern out on it and then use tools to cut out the profile of the blade. You get the whole knife including tang to the exact shape you want. You can use any number of metal working tools including a hacksaw, jeweller's saw, cut off grinder, bench grinder, belt sander and more. This method is often the method of choice for beginners because it requires less of an investment in time and skill. And you still make a perfectly beautiful knife.
Forging Method	This method is quite a bit different than the stock removal method. You work your billet or piece of steel on the anvil to bring it to the desired knife shape.

Steels for Knifemaking
You can get off to a good knifemaking start with a piece of flat stock tool steel. The size of the stock will of course depend on the size of the knife you make but if you are just generally wanting to make a few knives you can do a nice job with stock that is between 1/16 and 3/16 inch thick and about 2" wide. From there it is a matter of the length you want. Recommended to start with either 01 or D2.

See the MATERIALS > Metal section for more information on different types of steel.

Damascus Steel Knife

Materials
- 1 blank knife billet (of Damascus steel)
- A piece of hardwood for the handle
- Amazing Mould putty to make a mould of the handle
- Amazing Clear Cast to make the clear acrylic handles
- About 6 inches of 1/4" brass rod for the pins
- About 6 inches of 1/8" steel rod to pin the finger guard
- Hacksaw, mill files
- Memory paper
- 4" belt sander (optional)

The first thing you need to do is draw out your knife. Keep it within the size of your blank of steel. How do you want the knife to look? How much blade? How much handle? Put your hand on that drawn handle. Would it be large enough? If you have never done any knifemaking or metal work I recommend you keep it very simple with a minimal of sharp curves and angles. This is because sharp curves are more challenging to cut. And finally I settled on this. I like it. It has a bit of curve to it but it isn't too crazy. Should function well as a knife and be comfortable. Now trace your pattern all the way around the perimeter of it. This is so you have something called the profile of the knife. You can also think of it as the outline. Cut that pattern out. It is now a template for your knife. Apply an adhesive to the template. Coat the whole thing. If you have a spray adhesive you should use it. We want a good and even adhesion.

Now affix that template to your piece of steel. You should carefully look over the piece of steel. How do you want the pattern to show off the best? Flip the bar over, turn it left/right. Decide what section would be best where the blade is and then adhere your template to the steel. Now let's flex our muscles and start doing the actual work. Start our with a hacksaw and cut all the way around the template. Remove as much steel as you can. A hacksaw isn't great for curves but you can get somewhat of a curve out of it. Just do the best you can. Take your time and remove as much of the stock as you can. This is why it is called the stock removal method of knife making. You are simply removing all the stock around the pattern of the blade. You can make multiple cuts. Take out pieces as you can. Try different angles of cuts. Continue removing steel any way you can with the hacksaw.

Now use any other tools you have available to you in order to get it down to the actual template shape. The next step I did was use a 4 inch belt sander with an 80 grit belt. I used a variety of metal working tools to achieve my profile. They include mill files, a one inch belt sander and a dremel for the hard to reach curves. And there you go. Keep at it until your knife is profiled. It looks good. Touch it up with some emory paper. Lets start by making the bevel in the blade. I drew it out with a sharpie. This is what we are looking for on both sides of the blade. We do it with a file. And we use a mill file. The picture here shows a close-up of a Mill File. There is no crosshatching. A quick note about filing your blade - You have to follow good form with your filing. First off always use a Mill file. This is the kind of file that has only one set of angled grooves. This is rather than something called a bastard file that has a crosshatch of grooves.

The bastard file will leave a rough finish. And, when filing you only file in the forward direction. See how in the previous picture I am holding the handle with one hand and pressing down on the front part of the file with the other hand? This is the technique you want to use. Press down as you move forward, then lift the file right off the knife and return to start. File forward, lift and return, file forward, lift and return. Ok, the bevel is off to a good start. We continue this on both sides of the blade. I made and used a file jig to make the filing easier and more accurate. I will be posting a tutorial on how to make one of these. Look for that link here. I recommend you don't file it all the way down to a sharp cutting edge. This makes the steel very thin. And it could cause challenges when hardening and tempering the knife with heat. That thin steel could easily overheat. Next we make the brass finger guard. I start by making one out of foam board so I can tinker with sizes and the feel of it. When it looks good, make it out of brass. To cut the brass finger guard I first drilled a hole at the end of the slot. Then I cut out the slot with a hacksaw. And finished it off with a file.

Next drill the handle holes according to the template. I am drilling quarter inch holes because I will be using quarter inch brass rod stock. I am going to make the handle out of a clear epoxy resin. But first I need a mould so I can cast the resin. And I do this by first making the handle pieces out of wood. The thickness here is about an inch and a half. That gives us a little bit of extra when we carve it down. I first drilled out the holes in the whole block so they are an exact match to each other and to the knife. Then I cut that handle right down the middle, creating the two handle halves. Each is about 3/4 of an inch thick. At this point you could call these two wooden handle halves knife scales. Next assemble the handles to the blade and pin it all together with wooden dowels. I am using wooden dowel because this is just a temporary assembly.

Secure it in a vice and use a rasp to shape the handle to what you want. These handles are nice but we want to make clear resin handles so that we can see the Damascus pattern through them. We are going to use a very easy method to make moulds of the handles. This is something called amazing mould putty. Yup, it is actually called that. You mix equal portions together. Mix it quickly. You only have a few minutes of workable time. Form it around the wooden handles. Once the mould has set, according to the directions of the particular product you use, you can remove the handle pieces. Next we mix up a two part resin. Equal amounts of each.

And then pour it into the moulds. Now we let it set according to the directions. In the case of this product it will take between 24 and 48 hours to fully cure. The purchased blank of Damascus steel is annealed. This means it is soft and workable by tools. Which is a good thing. Otherwise we wouldn't have been able to cut and file it. But this is no good as a functioning knife. It needs to be strengthened by hardening and tempering. This will make the knife durable and strong. It will keep a sharp edge. Yet it will still have some resiliency so it doesn't shatter or crack. Our first step is to heat up the blade of the knife. We don't have to worry much about the handle. We focus on the blade. We are going to heat it up to about 1500 fahrenheit. It will be glowing red hot. And at this temperature the crystalline structure of the steel will have change. But how do we know when it is at the right temperature? We check it with a magnet. The steel is magnetic.

When it gets to the temperature we need it will lose its magnetism. So, as it is getting red hot check it with a magnet. Once a magnet no longer sticks to it, put it back in the fire for another 30 seconds. Then quickly and efficiently plunge it into the quench. It needs to drop by about 500°F in less than a second. This will give us a good hardening. About the quenching liquid. This will depend on the type of steel or steels in your knife. Generally with Damascus water is used. It will help with the quick dropping of temperature. It is also a bit more risky. The quick drop in temperature may crack the knife. I am using used motor oil that I have pre warmed by plunging a hot iron into it. This technique potentially doesn't give us as good a quench but it does decrease the risk of cracking. We may get a knife that is not as hardened as it could be. It is a trade off. The knife is now hardened. You can check it by gently running a file over it. You will hear the difference. It will be like sliding a file over glass. The file won't bite the steel it will glide over it. Next we will temper the knife. In it's current state it is very hard. But it is also brittle. If you were to drop it onto a hard surface it could possibly shatter. That is not a good characteristic of a knife.

What we want is to find a balance where it is strong and tough so it will be durable and hold a good edge. Yet we want it to be soft enough to take use without cracking or shattering. We find this balance of characteristics by now tempering the blade which is heating it to a bit of softness. Start by cleaning off the knife with some emory paper. As we are heating it we will watch the changing colours of the steel. Now we are going to slowly heat the blade to about 500 fahrenheit. Do this slowly. Place the knife a distance from the fire like you see here. And notice how I have the spine of the knife toward the fire. This is a good technique and it helps prevent the thin edge of the blade from heating too quickly. How do we know when we have achieved the right temperature? We can't check it with a magnet this time. That would be about 1500 F. But we can monitor the colour changes as it heats up. We bring it up to wheat colour. This knife is just about there. You can see it starting to turn wheat. A little bit more. Quench it once it gets to wheat colour. The knife has been blackened by the forge. Clean all that off with a fine grit emory paper. And then clean the whole thing very thoroughly with acetone. We want to get it very clean. Any impurities on the blade will impede the etching.

About Etching: There are a lot of different ways to etch a steel blade. The method we use is pretty traditional and it has been done this way successfully for a long time. But it uses toxic chemicals. So... this is something not to be done lightly and only by adults with some skill.

Safety Note: I am using Ferric Chloride for the etching. It is a very commonly used acid for the making of circuit boards. It must be handled carefully and you should take all safety precautions including gloves and a respirator. And, once you are done with it you should neutralize it with baking soda then dispose of it properly by contacting your local municipality and asking them where to bring hazardous waste. Do not pour it down the drain. Research the handling and use of ferric chloride more thoroughly before ordering and using it.

If all of this is a bit intimidating there are alternative etching methods such as using vinegar and salt. I diluted the ferric chloride by mixing it with distilled water. I used three parts water and 1 part ferric chloride. And note that when mixing water and acid you always add the acid to the water. Never ever add the water to the acid. This is important. Things like this are why I recommend researching this whole thing a bit more if you are going to use it for etching. Interesting Tip about etching in acid. You might think that the stronger the acid the better. But this isn't really the case. We don't want a fast etch. This will leave it irregular, pitted and unsightly. We want a nice slow etch. It will be much better. I diluted my acid and then soaked the knife in it for 15 minutes. And I am confident that it would have been even better if I would have brought the soak time up to 30 minutes. Just use the minimum amount needed to cover the knife.

No need to mix up more than is needed. Carefully, using a wire, set the knife into the acid so it is completely covered. You can carefully check on the progress of the etch. And when it is ready you can transfer it to a neutralizing bath. That second tub is water mixed with a large amount of baking soda (Calcium Carbonite). Once it has been neutralized you should then rinse it very thoroughly with plain water before handling it. We have waited more than 24 hours and the handles are cured so we remove them. Now, if needed clean up the handle pieces. I used a light grit emory paper. It is a bit frosted and we will clarify it later by adding a coat of casing resin to it later, after we have completed the knife. Now drill out the holes in those resin handles. Use the knife itself as a guide.

Next we glue those handle pieces to the knife and pin them in place with brass pins. I am using a gorilla glue clear epoxy resin. I want a clear epoxy so we can still see the Damascus through the handle. Mix together equal parts of the epoxy then spread a thin coat on both sides of the knife. Note something in this picture. I have mounted the brass finger guard on the knife before attaching the handle. You can do it either way but be sure you have a nice clean edge between the two. This may take some sanding of the handles or the brass. To attach that brass guard I drilled two holes all the way through. And then pinned with 1/8 steel pins. Apply the handles and pin them in place. And clamp the handle in place. Use any tools you have available to get the shape and the form of it just the way you want it. This includes the finger guard matching the handle well. I used a 1 inch belt sander. And I used a file to bring down the brass pins so they are flush with the handle. I also used the file on the finger guard. And we finish off the knife by cleaning up the resin handles. They are cloudy and the filing and sanding has further clouded them. Mix up a small batch of the same resin you used to cast the handles. Then paint that on. It will clear up the handles. Now we can see the Damascus pattern through the handles. It will improve as the resin dries.

Rebar Knife

Rebar is a readily available building material. There is lots of it around and it is pretty cheap. It is also pretty easy to work with. So, in terms of blacksmithing it is a nice material for beginners to work with. In this tutorial I show you how to make a simple knife with it. And along the way I show you a few different techniques like bending steel and hardening/tempering it. We leave the ribbing on part of the knife creating a nice looking spine. We flatten out the blade. We make the first curve on the handle using a hammer. We make the second curve on the handle using a turning tool in the Hardy Hole. Here is our piece of Rebar. It is fifteen inches long. We start by heating one end and flattening out the blade. We don't flatten it completely to the blade shape. We are just getting it to the rough shape of the blade we want in terms of size, thickness and length. Notice how you can see the ribs on this side of the blade. Let's leave those alone. They will look good on the spine of the knife. This is something to think about when working with materials. Sometimes they have a nice attribute that we want to take advantage of or use. With the basic shape of the blade done we are going to turn it around and work on the handle.

Let's start by hammering in the point at the very end. Once the point is done we want to make the curves in the handle. There are two curves, a small one and a large one. We want to make the small curve first. This is an important thing to note when making curves. Sometimes you have to be conscious of which curves to do first. This is because once you put a curve in you might have difficulty getting at the metal to make subsequent curves. So, before curving you should think about the best way to do it. For this knife it is definitely easier to make the outer curve (the smaller curve) first. This is an easy curve, not very sharp so we can do this with the hammer directly on the anvil like you see in this picture. Now, to get the larger curve in the knife we are going to use something called a hardy tool. It goes in the square hole in the anvil. This particular tool is made for turning steel and making curves.

We put the knife in the tool and then pull on it with a pair of pliers. See how it bends around one of the posts? Easy enough to do. You can make all kinds of curves and curls with this tool. So, I tinker with that curve a bit to get it just the way I want it. Ok, now we return to the blade and finish rough shaping it into an actual blade. I also round out the end of the blade. It is difficult to see here but I am holding the knife on the anvil on its edge not on its flat and I am rounding off the edge. And notice how the spine is still pretty intact with the initial rebar pattern. We like that a lot! And finally we finish it off by tapering the blade. The spine or back part of the blade remains thick, while we hammer the cutting edge so it is thinner. We want this to be a nice sloping bevel from thick to thin. Ok! The forging is done and it looks pretty good. We can take it into the shop and work on it some more. When it comes to the shop work we follow a certain process that is common when working with any kind of tool. We start with the rough work, usually with power tools. Then we move on to the more detailed work, usually with hand tools. Now we take the knife into the shop and we have two tasks - clean it and shape it. You can use power tools for this and you can use hand tools, or any combination of each. The picture shows me using a four inch belt sander. In the background you can also see the one inch belt sander and a grinder. The knife is cleaned and close to final shape. Next we move on to files. To further refine the shape and the finish.

A quick note about filing your blade - You have to follow good form with your filing. First off always use a Mill file. This is the kind of file that has only one set of angled grooves. This is rather than something called a bastard file that has a crosshatch of grooves. The bastard file will leave a rough finish. The picture here shows a close-up of a Mill File. There is no crosshatching. And, when filing you only file in the forward direction. See how in the previous picture I am holding the handle with one hand and pressing down on the front part of the file with the other hand? This is the technique you want to use. Press down as you move forward, then lift the file right off the knife and return to start. File forward, lift and return, file forward, lift and return. Then we move on to a series of emory paper. Just for the polishing of the blade. You do this through a series of grits starting with coarse grit and moving through subsequently finer grits. Typically you start around 100 grit and then movie on to 200, 400 and 600. This gives us a decent polish. Now we need to finish off the blade, so it is back out to the forge to harden and temper the blade so it is useable as a knife. The first thing we want to do is harden the blade. we do this by heating it to red hot. That will be about 1,500°F.

We know we have it at the right temperature by using a magnet on it. When it is red hot heck it with a magnet. When it no longer sticks you have reached the right temperature. This is called Curie temperature. The steel has changed its molecular arrangement and is now very hard. You will get good at finding this temperature just by the colour of the steel. I can see that this is not quite hot enough and it needs to glow more red before it is at the right temperature. Now, to lock those molecules in their hardened configuration you quench the knife in oil. This cools it very quickly not allowing the molecules to go back to their original pattern. But, hardened steel is very brittle! It can easily shatter or crack. So we actually want to soften it up a little bit. This process of softening it is called tempering. We monitor the process of tempering by checking the colour of the steel as we heat it.

We know the steel is at the right temperature when it is wheat in colour. So.. clean off the blade of the knife with emory paper. It is very easy to clean at this point. Now we will be able to see the steel as it changes colour in the forge. We want to heat it slowly and only to about 450-500°F. To do this you put something over the forge like this that will support the knife blade about six inches from the fire. This way it heats slowly. Rotate and turn the knife over regularly. Monitor it closely. This is just about right. A little bit more heat and the wheat colour will darken more. Just be careful not to overheat it. A blue/plum colour will set in. That means it is getting too soft. Once it gets to that wheat colour quench it again. This quench isn't as hot so it won't be as dramatic. Just a little smoke this time. And that's it. The knife is now hardened and tempered. Which means it has strength. It will keep an edge very well. Yet it has a little flexibility to it so it won't snap easily. Now we just need to do the final sanding. Use emory paper, starting around 100 grit and work your way up as high as you want. The higher the grit you go the more mirror-like the finish of the blade. You can go as high as 1500 to give you a mirror like finish. Congratulations! Your Rebar Knife is done!

Railroad Spike Knife

This is an easy blacksmithing tutorial. It is one of the first projects that a person might make when first starting out in the craft. It is pretty much a staple project of the art. We do a down and dirty, quick and easy knife. If you are new to blacksmithing this is a great project to start out with. And you don't need a whole lot of guidance for this project. You can pretty much visualize the shape of the knife and then hammer it into that shape. Variety of hammers - they make a big difference when it comes to blacksmithing. Watch the video if you want to see the various hammers in action. The more blacksmithing you do the more hammers you are going to accumulate. Okay! Inspect the spike. A little bit of rust is quite ok. The forge will burn it off. No need to try to remove it. Heat it nice and evenly. But you don't have to worry much about the butt of the spike. We aren't going to be working that part of it. This looks great. It has a nice even colour and needs just a little bit more heating.

Once it's heated give it some hits with a heavy hammer. I am using a 3 1/2 pound hammer here. Just to start to flatten out the blade end of it. And do this evenly on this side, then flip it over and do it on the other side too. Now, I am not hammering directly flat down on it. We don't want to flatten it exactly even. We are leaning toward one side of it. That is because the spine of the knife is thicker than the blade. See how the Blade is starting to take shape? And see how you can now determine which side is the actual edge to be sharpened is. This is what the leaned hammering does. And just like that, with a little bit of hammering our knife is starting to take shape. So, continue heating and hammering. As you are doing this you will start to get a feel for the malleability of the metal and you will get a sense from that and from the colour as to when it should go back in the forge for more heating.

Now we start to define the difference between the blade and the handle. This is where the blade is flatter and it flares into the handle. How do we do this? We do something called half face near hammering. This is where we put the piece on the edge of the anvil and hit it with the hammer with the centre of the hammer right about at the edge of the anvil. Hitting it right about where the white arrow shows. This area of the knife where the blade tapers into the handle is called the choil of the knife. Keep an eye on the spine of the knife. Working it will distort it a lot which is ok. Just keep looking at it and bringing it back into shape along a centre line. And you can see how you have to hammer one side of the knife and then flip the knife over and hammer the other side. This will keep it along the centre line. (White line is added to show the imaginary centre line.) Ok, it is looking good and the major shape has been formed. Now we can switch to a lighter hammer and do some more work on it. But with the lighter hammer we can get more accurate. Ok, starting to look pretty good. It is pretty straight and starting to thin out nicely. It needs more work because it is still way too thick for a knife. Keep at it. Keep hammering, flattening and straightening.

But with the lighter hammer. I like the shape. It is just the way I want it. Now I switch to an even lighter hammer to do the lighter detail work, further getting it right about to where I want it. Don't try to get it exactly to your final knife shape. We will do that work with sanding. Keep it a little oversized in every dimension. We are just about done with the blacksmithing part of this knife so one more thing to show you. Remember that half face near hammering we did at the choil? Well, we can further work on this with a cross peen hammer and a ball peen hammer. this will allow us to shape it exactly how we want. One final step. Now I want to smooth it out and give it a fairly flat and even surface. I do this with a nice smooth hammer. A planishing hammer would be great for this. I am using the flat end of a ball peen hammer. The Forging is done and this is what we have. Just a little bit of work left to do to finish off this knife. We are going to use whatever power tools we have in order to do two things. We are cleaning it up and doing the final shaping. Cleaning it up isn't polishing. We will do that by hand.

And during this process I actually switched belts. I started out with a heavy grit and moved on to a medium grit in this picture. This is for the same reason we switched hammers at the forge. We do heavy and rough work first and move consecutively down to the medium then finer work. The first belt is around a 50-80 grit. This second belt is around 120-150. And at any time during this process you can also use a file to shape it. If you don't have a belt sander you can do all of this shaping and cleaning work with a file. Note about the file: You use a file called a Mill file. This only has one set of cutting lines. You don't use a bastard file (it has a crosshatch). And with the mill file you only file in the forward direction. You don't go back and forth with the file. Do the filing to get the knife to it's final shape. This picture shows the correct type of file (Mill file) see how there is just a series of cutting lines parallel to each other? There is no crosshatching.

HARDENING AND TEMPERING
Ok, just a little bit more to go. We need to heat treat this knife so it is strong and durable and will hold a nice sharp edge. There are a few different ways to do this and you can use the forge. But in this tutorial I am going to use a plumbers torch. First we harden the knife. We do this by heating up the blade to red hot. This will be about 1,500°F. You know it is at the right temperature when a magnet no longer sticks to it. Once it is at the desired temperature quench it quickly in oil. Any kind of oil will do; vegetable or motor oil, used or new. Doesn't matter. The knife is now hardened. But hardened means it is also brittle and susceptible to shattering when being used so we want to soften it up a bit. This softening is called tempering. And we temper it by heating it up just a little bit. To around 500°F. But how do we know when it is at the right temperature? We know this by the colour of the steel as it heats. Once the knife has cooled clean it up with emory paper. This is very easy to do. The scale comes right off.

Slowly and with the flame further away, heat the blade up until it turns a wheat colour. That is the right temperature. Try to keep it even along the length of the blade. Move the flame! This knife has started the wheat colour but could go a little bit further. It is pretty close though so I am going with it. Quench it again. And that's it. The knife is hardened and tempered. Now we just need to polish it up to give it a nice shine. We do this with a series of emory paper. As before we start with the heavy grits and work our way through the finer grits. I usually start around 80-100, switch to 180, then 220, 400 and 600. If you want it mirror polished you can continue like this all the way up to around 1200 grit which is almost like a sheet of paper fine. And that's it! Your Railroad Spike Knife is done.

Sub Hilt Knife

Push Dagger

Medieval Rondel

Karambit Fighting Knife

Throwing Knife

Dagger

Sword

This is a quick overview of the steps normally taken to make a traditional sword. There are variations on this process but this gives you a nice overview of the whole thing and how to do it. This is the most common way swords are made. It takes six distinct steps:

1	Forging A bar of the desired metal or combination of metals is heated in a forge and then it is hammered into shape. This hammering process can take a long time. This is called drawing out the sword. The sword is worked on in sections (usually around 6 inches in length) and repeatedly hammered and heated until the sword comes into the desired shape. This process is repeated and the sword is often heated then allowed to cool without hammering. This is required by the metal to keep the desired properties of strength and flexibility.
2	Annealing When the final shape is complete the total sword is heated and then allowed to cool very slowly. Often it is wrapped in an insulating material to slow down this cooling. It can take as long as 24 hours and this process is called Annealing and this makes the sword soft and easy to grind.
3	Grinding Now the blacksmith uses a grinder to work out the edge and point of the sword. This would also be when any engraving is added. This is not a completed sword yet. It is still much too soft.
4	Hardening Now the sword is heated to a very high temperature and then placed into a quenching tank. This quenching allows it to cool quickly and evenly which will harden the metal.
5	Tempering Again the blade is heated and quenched. But now the heating is at a much lower temperature than was used at the hardening. This heating/quenching cycle may be repeated several times. This tempering allows the blade to be strong but not brittle. It will have a certain amount of flexibility yet still retain its sharp edge.
6	The sword blade itself is now complete. Now the additional parts will be added such as the pommel the guard and the hilt.

7 Armour

8 Bullets

9 Melting Precious Metals

Melting Silver

Silver is the most common of the precious metals. It's used in jewelry, electronics, medical supplies, and a number of industrial uses. Until the end of the nineteenth century, silver was also a major medium of currency throughout the world. As a result, silver is abundant in our world. As an abundant precious metal, people today like to work with it for a number of reasons. However, while silver is attractive and is a good metal for beginners to start with, melting any metal is a relatively complicated thing to do if you have no experience. Fortunately, with some knowledge, work, and the proper supplies, it's possible for someone with no experience to begin melting and casting silver at home.

Preparation

Secure items to melt. You need to find some items to melt down. Luckily, although silver is considered a rare metal, it is fairly common in our day-to-day activities. Some of the most common uses for silver are jewelry, although we can still find a substantial amount of silver coins, as well as silver in industrial applications.
● Traditional uses for silver include creating coins, jewelry, decorative items and cutlery. These items are most commonly used when melting silver.
● Industrial uses of silver include batteries, ball bearings, soldering or brazing other metal items, as an industrial catalyst to create chemicals, and in electronics such as circuit boards, membrane switches, and television screens. Be careful when melting anything that might contain hazardous materials.
● Emerging technologies which utilize silver include medical, solar energy, and water purification. Silver minimizes bacterial growth by interrupting the ability of the bacteria to form chemical bonds and is used to prevent the spread of bacteria and to promote healing.

Get a foundry crucible. A foundry crucible is a container that is used for metal production. Crucibles are made of clay, aluminum, graphite, and silicon carbide. They are extremely heat resistant and will not melt under the same circumstances as the metal you are trying to melt down.
● Make sure you get a crucible that is an appropriate size for your project and is in good shape. Avoid old crucibles with cracks or excessive wear.
● You will use your crucible to store your silver as it melts and turns into its molten form.
● You will then poor the molten silver out of the crucible into a cast or mold.
● You can purchase a foundry crucible at a local casting supply store or at many online retailers.

Find some good heavy-duty crucible tongs. Crucible tongs will be used to move your crucible if you need to. These are an important element, because your crucible will be way too hot for you to touch it with your hands or even with gloves. Make sure:
● Your tongs are rated to be used with a crucible.
● Your tongs are in good working order.
● Your tongs are large enough to move your crucible.
● Purchase your crucible tongs at local hardware or metal casting stores or online.

Buy a graphite stir rod. You should get yourself a good graphite stir rod. You'll use the stir rod to stir your molten silver and to make sure that it is completely melted before you cast it in a mold.
● Make sure you get one that is rated properly.
● Make sure you buy one that is long enough for whatever level of melting you'll be doing.
● Purchase your graphite stir rod at a local casting supply shop or online.

Secure a furnace or a blow torch. The furnace or torch is what you'll be using to heat your silver to its melting point. As such, the furnace or blow torch are critical items in melting silver. Depending on the amount of melting you'll be doing, you can choose between a furnace or torch. Consider:
● A furnace might be prohibitively expensive if you are only doing small-scale melting like several ounces every couple of weeks. However, if you're doing projects every weekend or more often, you should consider a furnace.
● A blow torch might be inefficient if you are melting substantial amounts of silver.
● If you are starting out, you might want to start with a blow torch and then move up to a furnace once you are committed to melting silver.
● These items may be purchased from a metal casting supplier, specialty hardware stores, or online.

Make or create a mold or cast. Molds and casts will be the way you shape your molten silver to create a final product. As a result, they are critical for your silver melting operation. Consider:
● Molds and casts can be made from wood, certain alloys, ceramic, or clay.
● Molds and casts may be one of the most inexpensive of your supplies.
● You can make your own molds or casts or buy them from specialty casting stores in your community or from online retailers.
● To make your mold: pick a material and like wood or clay. Carve or shape your material to the size and using the detail desire. If you're using ceramic or clay, you'll need to fire them at temps over 1,000 degrees Fahrenheit or 537 degrees Celsius.

Purchase safety equipment to protect yourself. Melting silver, or any other metal for that fact, is potentially very dangerous. You need to get yourself some good safety equipment to protect yourself. Remember to take lots of care when you melt silver, and do not do so unless you are properly protected. Make sure to get:
● Industrial-grade goggles that are rated to protect against molten metal.
● Industrial-grade gloves rated to protect against molten metal.
● Industrial-grade apron rated to protect against molten metal.
● Industrial-grade face shield rated to protect against molten metal.
● You can purchase safety equipment from metal casting supply shops or from online retailers.

Melting

Put on your safety gear and secure the area. Before you even start the process of melting and molding your silver, you need to take out and put on all of your safety gear. Melting any type of metal is a very dangerous activity, so there is no reason to take any chances.
● Put on your goggles, your gloves, your apron, and your face shield.
● Take out your skimming rod and any other materials you'll need during the process.
● Inform family or roommates about what you're doing and lock up any dogs or other pets in an area far from your smelting workshop.

Place the crucible with the silver object on or in your furnace. The first thing you need to do is to put your silver in the crucible and place it on or in your furnace. This will vary depending on the type of furnace you have. You don't want to heat up your furnace and then place your crucible inside, as this will increase the chance of you hurting yourself.

Heat the furnace to a temperature which exceeds the melting point of silver. The first thing you need to do is heat your furnace to the appropriate temperature. Depending on what type of furnace you have, this might take a little or a lot of time. Consider:
● The melting point of silver is 1,763 degrees Fahrenheit or 961.8 degrees Celsius.
● Monitor the temperature inside your furnace as it heats. Most furnaces include a temperature gauge to help you monitor it. If not, have one installed.
● Don't remove the silver until it is completely melted.
● Only use your furnace outside or in an extremely well-ventilated area designed for foundry work.

Apply your blow torch to the silver, if you've chosen to use a blow torch. If you're using a smaller crucible and are melting on a smaller scale, you might have chosen to use a blow torch to melt your silver. If this is the case, take your blow torch and apply it to the silver. Keep your torch on the silver and it will slowly heat the silver up.
● Make sure you know how to use your blow torch before you start to melt your silver.
● Direct the flame directly at the silver item.
● Temperature will be difficult to monitor with a blow torch. However, many blow torches come with a temp. gauge attached. If you don't have one, just wait for the silver to melt completely.
● The amount of time it takes to melt the silver will depend, based on the alloy composition, as well as the size of the object.
Break large silver objects into smaller pieces and melt them in small batches to allow a more even distribution of heat which results in a quicker melting process.

Molding

Remove the crucible once the silver has melted. Once your silver is melted, you're going to need to remove your crucible from the furnace (if that's what you've used), and get ready to cast your molten silver. Be careful doing this, as it is potentially dangerous. Make sure to:
● Put on your gloves.
● Take your heat resistant tongs and grip the crucible.
● Place the crucible next to your cast or mold.
● Make sure you wear shoes and your other safety equipment.
● If you're using a blow torch, take your tongs and move the crucible next to the mold you'll be using.

Skim the slag off of your sliver. Using your graphite stir rod or another tool, skim the slag off the top of your molten silver. Slag is impurities and other materials that have separated from the silver during the melting process. Slag might be a result of non-silver items being melted with silver, or it may be the result of the silver having impurities in it. Regardless of the reason, always skim and remove your slag before you pour and cast your silver.
● Take your rod and gently and evening slide it over the top of the molten silver.
● Then slide the flat side of your rod underneath the slag and lift it out of the silver.
● Place your slag someone safe, as you might want to melt it again to remove excess silver.

Pour the silver into the mold, quickly. Once you've removed the crucible from the furnace, and sat it next to your mold, you should quickly pour the molten silver into the mold. You need to do this quickly while the silver is still liquid. Don't move too quickly, as you don't want to spill the silver or hurt yourself. If the silver does begin to firm up into solid state, just put it back into the furnace to heat it back up.
● Melted silver can be poured directly into molds, or casts, to create a number of items including jewelry, decorative items, cutlery, tableware, and containers.
● Pour very carefully and slowly so that you get all of the silver into the cast or mold and that you get the proper shape and angles that you want.
● Depending on the size of your silver casting project, you may need to utilize centrifugal force to allow the silver to reach all areas of the cast.
● Wait for your silver to cool and harden.

Dump your silver out of the mold. Wait a few minutes for your silver to cool. This could take from 2 minutes to 20 minutes depending on the size and depth of your silver. Ultimately, judging when to dump your silver is an art and depends on a number of factors including the type of mold. In the end, you'll learn by trial and error, but consider:
● Depending on your mold, it might be better to wait longer and having to break your mold instead of recasting the silver.
● Once the silver appears dry, give it another minute for the interior to cool off a little more.
● When dumping your silver, make sure you are wearing hand safety mitts, your apron, and even head gear. This will protect you from splash back if you do empty the mold too early.
● Pick up your mold and bang it on a hard surface. It should come right out.

Quench your silver. After you've dumped your silver out of the mold, you'll need to quench your silver. Quenching is the process in which silver is cooled and hardened by being submerged in water. This is the final stage of smelting silver.
● Take your tongs and pick up the silver bar or item.
● Slowly submerge the silver in clean/distilled water.
● As you submerge it, the water around the silver will boil and will produce steam.
● Leave the silver submerged for several moments -- until the boiling and steam have subsided.
● Remove your silver from the water and enjoy!

10 Jewellery

10 Glass Crafts

Making Glass	
Glassblowing	

11 Tools

Tools arguably are the most valuable asset in any homestead. You can create anything if you have the right tools for the job. Below is a list of tools sorted by category which you are likely to need if you invest into a homestead.

Subheadings

		1. Wood & Metalwork Tools	2. Exterior Tools	3. Interior Tools	4. Medical Tools		
		5. Fitness Tools	6. Specialised Tools				

1 Wood & Metalwork Tools

Woodwork Tools

Manual Woodwork Tools

Hammer	For hitting nails, knocking things into place or breaking items.
Saw	Cuts through wood.
Chisel	Used for shaping wood.
File	For filling down sharp surfaces or making minor adjustments.
Planer	Takes a thin layer off of the material, used by hand in long sweeping motions.
Moisture Meter	Measures moisture content in various materials, such as wood, building materials, or soil.
Screwdriver	For inserting or removing screws of various sizes. It's recommended to have a kit of screwdrivers with different heads.
Clamps	For holding two pieces of material together.
Framing Square	Right angles in construction
Graphometer	For measuring angles.

Electric Woodworking Tools

Electric Drill	Easier to insert or remove screws than with a screwdriver. Requirements: ● Battery Pack or ● Electricity
Electric Circular Saw	Generally cuts in straight lines through thicker materials. Requirements: ● Battery Pack or ● Electricity
Electric Jigsaw	For cutting intricate patterns into materials. Requirements: ● Battery Pack or ● Electricity
Electric Planer	Takes a thin layer off of the material by a rapidly spinning blade. Requirements: ● Battery Pack or ● Electricity
Hammer Drill	A drill that combines rotary drilling with a rapid hammering action, for drilling into hard, brittle materials like concrete or brick. Requirements: ● Battery Pack or ● Electricity
Palm Sander	A compact, handheld power sander typically used for fine finishing and smoothing surfaces in small or confined areas. Requirements: ● Battery Pack or ● Electricity
Orbital Sander	A sander that moves its pad in small, rapid, eccentric circles, producing a smooth, swirl-free finish. Requirements: ● Battery Pack or ● Electricity

Metalwork Tools

Manual Metalwork Tools

Tin Snips	Cutting tools resembling heavy-duty scissors used for manually shearing and shaping thin sheet metal.
Punch Set	A collection of tools used to create precise holes or indentations in metal.

Smithing Tools

These are some basic smithing tool you will likely need to get into the craft.

Anvil	For shaping the metal.
Cross Peen Hammer	For hammering the metal. 2 and 3 pound cross peen. Has a thin horizontal end.
General Tongs	For holding the hot metal.
Furnace	To heat the metal in.
Billows	To increase the furnace temperature further.
Skimmer	Remove dross prior to pouring.
Lift-Out Tongs	Grips the crucible.
Pouring Tongs	For pouring the metal out.
Face Helmet	To protect from heat.
Metal Moulds / Patterns	For pouring the metal into.
Wolf Jaw Tongs	Have ridges and shapes that help grasp different shaped objects.
Leather Apron	A heat resistant piece of clothing used for protection from heat and sparks.
Leather Welding Gloves	A heat resistant piece of clothing used for protection from heat and sparks.
Steel Capped Boots	To prevent foot damage if hot metal or tools are dropped.
Coal Rake	To manipulate the fire.
2 Metal Buckets	For Quenching and Sand.
Large Metal Bucket	To hold ash.
Shovel	For coal and ash.
Borax	Used for welding steel pieces together.
Hardy Cut Off Tool	Attaches to anvil and used to cut hot steel.
Large Bastard Files	Used for rapid removal of significant amounts of material from metal, shaping, and preliminary smoothing before finer finishing.
4 Inch Belt Sander	A power tool used for aggressive material removal, grinding, shaping, and finishing larger metal surfaces with abrasive belts.
Vice	This is a very useful tool for a blacksmith. And often times a smith will have something called a leg vice.

1 Inch Belt Sander	A smaller, more precise sander used for detailed grinding, shaping, and finishing in tighter spaces or for smaller metalwork pieces.
Electric Angle Grinder	A versatile handheld power tool used with various abrasive discs for cutting, grinding, deburring, and polishing metal.
Bench Grinder	A stationary tool featuring two abrasive wheels used for sharpening tools, grinding, shaping, and deburring metal workpieces.
Hardy Benching Tool	An anvil accessory that fits into the hardy hole of an anvil, used for cutting, bending, or punching hot metal.
Blacksmith Coal	A type of coal used as fuel in a blacksmith's forge to heat metal to forging temperatures, making it pliable for shaping.
Quench	This is a bin or some other kind of container that contains a fluid like water or oil.
Pritchel Tool	To pierce a hole in metal. Place the work over the hole then punch through it.
Fullering Tool	The fuller is the groove in the blade of a knife or sword. It is commonly referred to as the blood groove.
Cold Chisel	Used for marking and scoring metal while it is cold.
Wire Brush	As steels and irons are heated they accumulate slag and scale. This needs to be firmly brushed off.

Fixed Machining Tools

Stationary Tools

Drill Press	A tool used for accurately drilling precise and consistent holes into various materials.
Table Saw	A woodworking tool with a circular blade protruding through a table for precise straight cuts in large pieces of wood.
Welding Machine	A power tool used to join pieces of metal by heating them to melting point and fusing them together.
Bench Grinder	A tool featuring two abrasive wheels used for sharpening tools, grinding, shaping, and deburring various materials.
Router	A handheld or table-mounted power tool used to hollow out areas in wood, primarily for decorative edges or grooves.
Band Saw	A power tool with a continuous loop blade running on two wheels, for cutting irregular shapes, curves, and resawing wood.
Radial Arm Saw	A machine where the saw blade is mounted on a sliding arm, primarily used for making accurate crosscuts in wood.
Jointer	Used to create a flat, straight edge on a piece of wood, preparing it for subsequent operations like gluing or planing.

2 Exterior Tools

Gardening Tools

Pick Axe	
Hoe	
Pitchfork	For moving hay bales easily.
Rake	Makes raking leaves and other debris easier.
Shovel	
Trowel	
Dibbler	
Wheelbarrow	Used for transporting relatively small amounts of earth, sand or other substances.

Tree Tools

Axe	Used to cut down large trees.
Pole Pruner	
Pruning Saw	
Shears	For trimming small twigs and shoots.
Hedge Shears	
Bypass	
Lopper	
Bow Pruning Saw	

3 Interior Tools

Manual Kitchen Tools

Measuring Cups	Liquid and dry goods.
Measuring Spoon	A spoon used to measure an amount of an ingredient, either liquid or dry.
Can Opener	Opens Cans.

Small Kitchen Appliances

Kettle	Heats water to the boiling point.
Toaster	Toasts bread.

Fixed Kitchen Appliances

Oven	Used for cooking or baking foods in. Requirements: ● Electricity
Stove	Used for cooking foods in a pan on. Requirements: ● Electricity or Gas

Microwave	Quickly reheats food using radio waves. Requirements: ● Electricity
Sink	Holds water for washing up in.
Dishwasher	Washes dishes automatically. Requirements: ● Electricity

Household Equipment

Vacuum Cleaner	Removes the dust and particles from the floor.
Iron	Removes the crinkles in clothing.

4 Medical Tools

Glucometer	Blood Glucose. (Diabetes)
Spirometer	The lung capacity.
Sphygmomanometer	Blood pressure.
Cardioverter / Defibrillator	To correct arrhythmias of the heart or to start up a heart that is not beating.
Endoscope	To look inside the gastrointestinal tract, used mainly in surgery or by surgical consultants.
Surgical Scissors	Used for dissecting or cutting.
Hypodermic Needle / Syringe	For injections and aspiration of blood or fluid from the body.
Ophthalmoscope	To look at the retina.
Otoscope	To look into the external ear cavity.
Proctoscope	To look inside the anal canal and lower part of the rectum.
Reflex Hammer	To test motor reflexes of the body.
Bedpan	For patients who are unconscious or too weak to sit up or walk to the toilet to defecate.
Cannula	To create a permanent pathway to a vein (or artery) for the purpose of repeated injections or infusion of intravenous fluids.
Catheter	To drain and collect urine directly from the bladder (primary use); also to act as a makeshift oxygen tube, etc.
Dialyser	To remove toxic materials from the blood that are generally removed by the kidneys; used in case of renal failure.
Electrocardiograph Machine	To record the electrical activity of the heart over a period of time.
Enema Equipment	To passively evacuate the rectum of faeces.
Surgical Scissors	Used for dissecting or cutting.
Hypodermic Needle / Syringe	For injections and aspiration of blood or fluid from the body.
Infection Control Equipment	As in gloves, gowns, bonnets, shoe covers, face shields, goggles, and surgical masks for preventing nosocomial or healthcare-associated infection.
Instrument Sterilizer	To sterilize instruments in absence of an autoclave.
Kidney Dish	As a tray for instruments, gauze, tissue, etc.
Stethoscope	To hear sounds from movements within the body like heart beats, intestinal movement, breath sounds, etc.
Thermometer	To record body temperature.
Measuring Tape	For length, height, head circumference and girth measurements.
Medical Halogen Penlight	To see into the eye, natural orifices, etc. and to test for pupillary light reflex, etc.
Nasogastric Tube	For nasogastric suction or the introduction of food or drugs into the body.
Nebulizer	To produce aerosols of drugs to be administered by respiratory route.
Oxygen Mask and Tubes	To deliver gases to the mouth/nostrils to assist in oxygen intake or to administer aerosolized or gaseous drug
Pipette / Dropper	To measure out doses of liquid, specially in children.
Suction Device	To suck up blood or secretions.
Thermometer	To record body temperature.
Transfusion Kit	To transfuse blood and blood products.
Tuning Fork	To test for deafness and to categorize it.
Ventilator	To assist or carry out the mechanical act of inspiration and expiration so the non-respiring patient can do so; a common component of "life support".
Watch / Stopwatch	For recording rates like heart rate, respiratory rate, etc.; for certain hearing tests.
Weighing Scale	To measure weight.
Crocodile Forceps	To remove foreign bodies from ear or nasal cavities.

5 Fitness Tools

Pedometer	Measures steps.
Heart Rate Monitor	
Stopwatch	Measures time and lap times.
Weights	Allows strengthening of certain muscle groups.
Jump Rope	
Exercise Bike	
Treadmill	
Rowers	

6 Specialised Tools

The following tools are used for measuring various phenomenon on earth.

CRAFTING Tools Specialised Tools

Pen and Paper Tools

Protractor	Measures angles, typically only those drawn on paper.
Ruler	For measuring length.
Compass	For finding direction.

Weather

Anemometer	Measures windspeed.
Barometer	Measures air pressure.
Ceilometer	Height of a cloud base
Disdrometer	Size, speed, and velocity of raindrops
Evaporimeter	Rate of evaporation
Hygrometer / Psychrometer	Humidity
Nephoscope	Measures the speed and direction of clouds.
Rain Gauge	Measures the amount of rain fallen.
Seismometer	Measures seismic waves such as during earthquakes.
Thermometer	Measures the temperature.
Wind Vane	Measures wind direction.

Solar

Actinometer	Measures the heating power of sunlight.
Pyranometer	Measures solar radiation.
Pyrheliometer	Measures direct solar insolation.

Light

Colorimeter	Measures Colour
Densitometer	Degree of darkness in photographic or semitransparent material
Light Meter	Light (in photography)
Lux Meter	Intensity of light
Photometer	Illuminance or irradiance
Spectrometer	Properties of light
Spectrophotometer	Intensity of light as a function of wavelength
Tintometer	Colour

Brewing

Alcoholmeter	Alcoholic strength of liquids
Nephelometer	Particles in a liquid.
Refractometer	Sugar concentration of sap and syrup.
Breathalyser	Breath alcohol content
Saccharometer	Amount of sugar in a solution
Zymometer	Fermentation

Unpowered Bench Tools

Saw Horse	A raised platform used for sawing and drilling through wood on.
Work Bench	For tinkering, sawing, drilling etc.
Tool Storage Wall	Storage of all the tools in the shed / garage.
Rip Fence	
Mitre Gauge	

Vehicle Tools

Jack	Used to hold a tyre off the ground allowing you to change it.
Winch	For pulling cars from ditches and mud.
Tool Kit	For simple repairs if required.
Hydrometer	Measures the density of a fluid, aka the charge of a battery.
Accelerometer	Physical, accelerations
Dynamometer	Force, torque or power
Fuel Gauge	Fuel levels
Odometer	Distance travelled
Speedometer	Speed, velocity of a vehicle
Tacheometer	Measures distance.
Tachometer	Revolutions per minute, rate of blood flow, speed of aeroplanes

Electrical Tools

CRAFTING Tools Specialised Tools Electrical Tools

Multimeter	Measures AC and DC voltage, resistance, amperage.
Wattmeter	A device used to measure the electric power (in watts) consumed or produced by an electrical circuit or load.
Voltmeter	Mmeasures the electric potential difference (voltage) between two points in an electrical circuit.
Ammeter	Measures the electric current (in amperes) flowing through a specific point in an electrical circuit.
Electricity Meter	Measures the total amount of electrical energy consumed over a period.
Electrometer	A voltmeter with extremely high input impedance, for measuring very small electric charges without drawing much current.
Frequency Counter	An electronic instrument used to measure the frequency of a repetitive electrical signal, typically in hertz (Hz).
Galvanometer	A sensitive electromechanical instrument used for detecting and measuring small electric currents.
Ohmmeter	A device used to measure the electrical resistance (in ohms) of a component or circuit.
Potentiometer	Voltage (term is also used to refer to a variable resistor)

Plumbing Tools

CRAFTING Tools Specialised Tools Plumbing Tools

pH Meter	Measures pH (chemical acidity/basicity of a solution)
Mass Flow Meter	Mass flow rate of a fluid travelling through a tube
Pressure Measurer	Measure the pressure in a pipe.
Pipe Cutters	To cut metal and plastic piping.
Pipe Cleaning	Cleaning house piping.
Wrenches	For tightening large bolts on things like cars.
Pipe Benders	For bending metal pipes.

Measuring Tools

CRAFTING Tools Specialised Tools Measuring Tools

Tape Measure	Measures distance often in construction.
Bubble Level	Measures the tilt and angle of a surface somewhat in-accurately.
Sliding Bevel	A woodworking tool used to copy, transfer, and mark specific angles for cutting or joining materials.
Layout Square	A measuring and marking tool used for quickly marking accurate 90-degree and 45-degree angles, as well as straight lines.
Calipers	Calipers are measuring instruments used to accurately determine the internal, external, or depth dimensions of an object.
Clock	Tells the time in either analog or digital format.
Dosimeter	Exposure to hazards, especially radiation; radiation of item.
Geiger Counter	Ionizing radiation. (alpha, beta, gamma, etc.)
Inclinometer	Angle of a slope.
Load Cell	Measurement of force.
Osmometer	Osmotic strength of a solution, colloid, or compound matter of an object.
Pycnometer	Measures fluid density.
Radiometer	Radiant flux of electromagnetic radiation
Weighing scale	Weight

Positioning Tools

CRAFTING Tools Specialised Tools Positioning Tools

Altimeter	Measures altitude.
Binoculars	Magnifies distant objects. First # - Magnification, Second # - Objective Size
Wind Sock	Indicates strength and direction of wind.
Anemometer	Measures wind speed up to 200kph, wind direction, wind chill factor and min & max temperature.
Clinometer	Measures angles, elevation or slope.
Compass	Direction of North
Sextant	Location on earth's surface (used in naval navigation)

Knots

Tying knots and using rope skills like rappelling

"It was like looking at a knot, knowing it was a knot,
but not knowing how to untie it. I had to map for this life."
Laurie Halse Anderson

Introduction

Knots are a valuable addition to your skillset allowing you to tie up items, pitch a tent and rappel down a rock face. It contains the various types of knots you are likely to use in a disaster situation.

Purpose	The aim of KNOTS is to inform the reader of the different types of knots available for different uses. It attemps to present the best knot for each situation one might encounter and includes a detailed description on how to tie it. There is also a section on the different types of robe available and the purpose for each type.
Lost?	● To find out what kind of rope you should have in your BOB, see the GEAR section. ● The best use for this section is to compliment the SHELTER category when constructing any kind of shelter. ● For a list of the knot terms, see the ADDENDUM > Dictionary section.

Contents

1 Rope

A rope is an indispensable lifeline for a climber, rescuer, etc. It is one of the few elements in the protection system that is not backed up by other equipment, and one that absolutely must not fail. An understanding of the design and construction of ropes as well as knowledge of their selection, use and care, is crucial to reducing the risks associated with their use. Ropes used for climbing are dynamic - they are designed to stretch when fallen on, absorbing and dissipating the energy generated by the fall. Static ropes, such as those used in rescue work are designed with minimal stretch and should never be used for climbing. Although static and dynamic ropes look the same they are not interchangeable. Static ropes are not climbing ropes - never use a static rope for climbing or any application where dynamic loads may be encountered. Climbing ropes utilize a kernmantle construction consisting of a core (kern) covered by a sheath (mantle). The core is the main load bearing element, and largely determines a rope's major characteristics, such as maximum impact force, and number of test falls held.

The sheath is braided tightly around the core and its primary purpose is to protect the core against abrasion, although the sheath also helps determine a rope's handling characteristics. Maximum breaking strength is the load whereby a single strand of rope (free of knots or sharp bends) breaks. High breaking strengths are desirable, especially in static life support and rescue ropes. Knots, bends, edges and falls all reduce maximum breaking strength. For example, the breaking strength of a given rope over a carabineer with a diameter of 10 millimetres (0.39 in) is approximately 30% less than the maximum breaking strength. Smaller diameter carabineers or rock edges reduce the strength even further. Sharp edges are extremely dangerous and are the main cause of rope failure. Use of double or twin ropes reduces this danger considerably. Static elongation is the stretch of a rope when weighted with a 79.8kg (176 lb) load. A low static elongation is desirable for rappelling and hauling.

Maximum impact force is the maximum load transmitted to the climber during a fall. The UIAA specifies a maximum impact force of 1,152 kg (2,540 pounds) for single ropes and 798 kg (1,760 pounds) for double ropes. A rope with a low maximum impact force absorbs more of the energy generated in a given fall than a rope with a high maximum impact fore, thus transmitting less energy to the protection system and to the falling climber. However, low impact force is often associated with high rope stretch, which may increase the climber's chances of hitting a ledge or the ground. The number of test falls held indicates how many UIAA certified falls a given rope can sustain before breaking. The testing procedure - dropping a 79.8 kg (176 pound) weight attached to an 2.5m (8.25 foot) length of rope a distance of 5m (16.5 feet) - yields a very severe fall which would be difficult to duplicate in any but the worst actual climbing situation. It is important to note that ropes lose elasticity, and their ability to absorb energy, when subjected to repeated falls.

Subheadings

1 Rope Attributes

Several attributes of a rope's design and construction are important to consider.

Flexibility	If a rope is too stiff, knots are difficult to tie and may even untie themselves. The more flexible the rope, the easier it is to tie knots and have them stay tied.
Water	Ropes absorb water, increasing the weight of the rope greatly. In cold weather absorbed water freezes, making the rope stiff and unmanageable (ice crystals also reduce rope strength). Many climbing ropes are treated with a water repellent coating to help prevent moisture absorption. "Dry" ropes will not saturate immediately when subjected to moisture; therefore, they will remain lighter and stronger than untreated ropes. Sheath weave also affects water absorption. Ropes with tightly woven sheaths absorb water slower than ropes with loose woven sheaths, and in some instances untreated ropes with tight sheaths absorb less moisture than dry treated ropes with loose sheaths.
Abrasion Resistance	Abrasion resistance is the rope's ability to resist fraying. Weave patterns, flexibility, and treatments all affect a rope's abrasion resistance.
Kinking	Every rope kinks. Help prevent kinking by properly uncoiling the rope from the manufacturer's coil. Place your arms inside the main coil. Spin your arms, allowing the rope to un-wind. Do not pull the rope; let it unravel as your arms rotate. Further kinking problems are generally due to improper coiling techniques (i.e. loop coils), and rappel devices (i.e. fig. 8's and Munter hitches).
Hand	Hand" describes how a rope feels and handles. Diameter, weave pattern, coatings/treatments, sheath tightness, sheath material, and production quality all help determine a rope's hand.

2 Rope Selection

First, determine whether a dynamic or static rope is best for your intended use. Always use a dynamic rope for lead climbing. Static ropes may be used for rappelling, rescuing, caving, top roping, and hauling where there is no chance of significant impact loading. Typically, climbing ropes sold in the United States carry a CE mark and a tag stating rope diameter, length, manufacturer's statement on number of falls held, maximum impact force, weight per meter, and classification of rope (single, double, etc.).

Single ropes are the most common and are identified by the number "1" inside a circle on the label at either end of the rope. Single ropes vary in diameter from 9.8 to 11 millimetres. Thick ropes last longer and usually hold more falls. Small diameter ropes are lighter and easier to clip into protection, making them the preferred choice for high-end lead climbing and glacier travel.

Double ropes (or half ropes) are used only in pairs. These ropes range from 8.2 to 9 millimetres in diameter and are identified by a number "1/2" within a circle on the label at the end of the rope. Double ropes may be clipped alternately through the protection, reducing rope drag and decreasing the chances of rope failure over an edge. Twin ropes are a third classification offered by some manufacturers and are certified by the UIAA. These are delineated by a "f" symbol on the UIAA label.

Both of the twin ropes are clipped through every protection point. The strands should never be separated. Twin ropes are uncommon in the United States. Double and twin ropes are designed to be used with a matching rope. Use of unmatched ropes will cause undue wear on one of the ropes, usually the one with the lowest working elongation or greatest diameter. Bi-coloured ropes change colours or sheath patterns at the midpoint. This feature allows you to easily find the centre of the rope.

Rope Inspection
Inspect your rope before and after each use. It is the user's responsibility to know the history of the rope and to determine when it should be retired; keep a rope log on how many times it has been used and the number of falls held. When in doubt, retire your rope. Generally, a rope should be discarded after holding a long hard fall, if it has flat or soft spots, becomes stiff, or shows sheath damage. Retire a rope after no more than four years of occasional use, two years of weekend climbing, or one year of active use. Retiring a rope after only six months of hard use isn't uncommon; some climbing gym ropes wear out after only a few weeks of intensive use. Also, multiple short lead falls (common in sport climbing), bounding rappels, and shock-loaded top rope falls can have a cumulative negative effect on the rope's shock-absorbing capacity.

3 Rope Care

KNOTS Rope Rope Care

- Always protect your rope at potential abrasion points.
- Most ropes are retired because they become frayed, not because of the number of falls held.
- Watch for sharp edges like rock crystals, bolt hangers, glass, and even pack grommets, which can cut a rope's sheath.
- Retire your rope if you can see the core at an abraded area or if the rope feels lumpy or flat in spots.
- Keep your rope clean.
- Dirt shortens rope life by causing internal as well as external abrasion.
- Transport and store your rope in a protective bag or pack.
- Wash a dirty rope in cold water using mild, non detergent soap.
- Adding fabric softener while washing improves rope flexibility by lubricating the fibres.
- Do not bleach your rope.
- Air dry your rope away from direct sunlight.
- Do not dry it in a dryer.
- Store your rope away from heat, sunlight and chemicals.
- Protect your rope from all compounds containing acids, alkalis and oxidizing agents.
- Avoid contact with battery acid and bleach.
- Avoid contact with petroleum substances such as gasoline and oil which do not appreciably affect nylon ropes by themselves but may contain additives that can cause damage.
- These substances also attract dirt which causes the rope to wear more quickly.
- Always use proper rappelling techniques.
- Fast rappels, bounding, or swinging can damage your rope.
- Some rappel devices place a sharp bend in the rope which creates excessive heat build up and stresses the rope's fibres, leading to accelerated wear.
- Never use a climbing rope for any purpose other than for what it was intended.
- It is not for towing cars, trimming trees, working on roof, etc.
- Never step on a rope, stepping on a rope grinds dirt into the rope fibres, causing excessive wear.

4 Rope Types

The choice between single, half, twin and static ropes depends on what type of climbing you do.

Single Ropes

These are best for trad climbing, sport climbing, big-wall climbing and top roping. The vast majority of climbers buy single ropes. The name “single” indicates that the rope is designed to be used by itself and not with another rope as some other rope types are. Single ropes come in many different diameters and lengths, making them suitable for a wide range of climbing disciplines, and they're generally easier to handle than two-rope systems. Some single ropes are also rated as half and twin ropes, allowing you to use them with any one of the three climbing techniques. It's important to only use a rope as it was designed and tested to be used. Single ropes are marked with a circled 1 on each end of the rope.

Half Ropes

	Advantages	Disadvantages
These are best for trad climbing on wandering multi-pitch rock routes, mountaineering and ice climbing. When climbing with half ropes, you use two ropes. As you ascend, clip one rope to protection on the left and the other to protection on the right. When done correctly, this allows the ropes to run parallel and straight, thereby reducing rope drag on wandering routes. Half ropes have a couple advantages and disadvantages compared to single ropes:	● Half-rope technique reduces rope drag on wandering routes. ● Tying the two ropes together when rappelling allows you to go twice as far as you can with a single rope. ● Two ropes provide redundancy if one gets damaged during a fall or cut by rockfall.	● Half ropes require more skill and effort to manage compared to a single rope due to the fact that you're climbing and belaying with two ropes. ● The combined weight of two ropes is heavier than a single rope. (However, you can share the load with your climbing partner by each carrying one rope.)

Half ropes are designed and tested only for use as a matching pair; don't mix sizes or brands. Some half ropes are also rated as twin ropes, allowing you to use them with either technique. There are also some triple-rated ropes that can be used as half, twin and single ropes for maximum versatility. It's important to only use a rope the way it was designed and tested to be used. Half ropes have a circled ½ symbol on each end.

Twin Ropes

	Advantages	Disadvantages
These are best for trad climbing on non-wandering multi-pitch rock routes, mountaineering and ice climbing. Similar to half ropes, twin ropes are a two-rope system. However, with twin ropes, you ALWAYS clip both strands through each piece of protection, just like you would with a single rope. This means there will be more rope drag than with half ropes, making twin ropes a good option for non-wandering routes. On the plus side, twin ropes tend to be a bit thinner than half ropes, making for a lighter and less bulky system.	● Tying the two ropes together when rappelling allows you to go twice as far as you can with a single rope. ● Two ropes provide redundancy if one gets damaged during a fall or cut by rockfall.	● Twin ropes require more skill and effort to manage compared to a single rope due to the fact that you're climbing and belaying with two ropes. ● The combined weight of two ropes is heavier than a single rope. (However, you can share the load with your climbing partner by each carrying one rope.)

Just as with half ropes, twin ropes are designed and tested only for use as a matching pair; don't mix sizes or brands. Some twin ropes are also rated as half ropes, allowing you to use them with either technique. There are also some triple-rated ropes that can be used as twin, half and single ropes for maximum versatility. It's important to only use a rope as it was designed and tested to be used. Twin ropes have a circled infinity symbol (∞) on each end.

Static Ropes

These are best for rescue work, caving, climbing fixed lines with ascenders and hauling loads. Static ropes excel in situations where you don't want the rope to stretch, such as when you are lowering an injured climber, ascending a rope, or hauling a load up with the rope. Never use a static rope for top roping or lead climbing as they are not designed, tested or certified for those types of loads.

5 Rope Diameter

Affects the rope's weight and durability and determine its best use. Generally speaking, a skinnier rope is lighter. However, skinnier ropes can be less durable and require more skill to safely belay with. Thicker-diameter ropes can be more abrasion-resistant and often stand up better to frequent use. If you're top roping at the local crag, you'll probably want a thicker rope. If you're hiking long distances for multi-pitch climbs, you'll want a skinnier, lighter rope.

Single Ropes up to 9.4mm	Ropes in this range are very lightweight, making them ideal for long multi-pitch climbs where weight is important. However, skinny single ropes are not rated to hold as many falls as thicker ropes, they are harder to handle and they tend to be less durable. If you plan to do lots of top-roping or take repeated falls while figuring out the moves on a sport climb, choose a thicker rope. Be aware that a skinny rope can move quickly through a belay device, so you need a very experienced and attentive belayer to climb with one.
9.5 – 9.9mm single Ropes	A single rope in this range is good for all-around use, including trad and sport climbing. These ropes are light enough to take into the mountains yet durable enough for top-roping at the local crag. They're generally more durable than very skinny ropes and they are easier to handle.
Single Ropes 10mm and above	Ropes with a diameter of 10mm and above are best for gym climbing, frequent top roping, figuring out the moves on sport routes and big-wall climbing. These styles of climbing can wear out a rope faster so it's wise to go with a thicker, more durable rope.
Half and twin Ropes	Half ropes typically have a diameter of about 8 – 9mm, while twin ropes are usually about 7 - 8mm thick.
Static Ropes	Static ropes have a diameter of 9 – 13mm, and are commonly measured in inches, so you may see the diameter stated as 7/16", for example.

6 Rope Length

Affects the rope's weight and durability and determine its best use. Dynamic ropes for rock climbing range in length from 30m to 80m. A 60m rope is the standard and will meet your needs most of the time. If you're unsure what length rope you need for a particular climbing area, it's best to ask other climbers and consult a guidebook.

Outdoor Climbing Ropes	When deciding what length to buy, remember that your rope needs to be long enough so that half its length is equal to or greater than the route or pitch you'll be climbing. For example, if a climbing route is 30m long, then you need at least a 60m rope to be able to climb up and be lowered back down off of an anchor at the top of the climb. Some modern sport-climbing routes require a 70m rope in order to lower to the ground.
Indoor Climbing Ropes	Shorter-length ropes, about 35m long, are commonly used for gym climbing because indoor routes tend to be shorter than outdoor routes. Again, be sure the length of rope is long enough to lower a climber.
Static Ropes	Static ropes for rescue work, caving, climbing fixed lines with ascenders and hauling loads come in a variety of lengths and are sometimes sold by the foot so you can get the exact length you need.

7 Rope Weight

The overall weight of a climbing rope is largely determined by the diameter and length. Generally, a skinnier rope will be lighter than a thicker rope, but core construction is a factor that can make a skinny rope heavier than a thick rope. It's standard for weight of dynamic climbing ropes to be listed as grams per meter (eg. 58 g/m), making it easy to compare rope weight regardless of the overall length. Use the grams per meter number and the length of a rope to calculate a rope's overall weight. Weight for static ropes is often given as weight per foot.

8 Rope Features

Look for these features when you are comparing climbing ropes. They can make a difference in performance and ease of use.

Dry Treatment	When a rope absorbs water, it gets heavier and is less able to withstand forces generated in a fall (the rope will regain all of its strength when dry). When it's cold enough for absorbed water to freeze, a rope gets stiff and unmanageable. To combat this, some ropes include a dry treatment that reduces water absorption. Dry-treated ropes are more expensive than non-dry-treated ropes so consider whether or not you need dry treatment. If you primarily sport climb, a non-dry rope is probably sufficient since most sport climbers will pull their ropes and go home when it rains. If you will be ice climbing, mountaineering or multi-pitch trad climbing, you will encounter rain, snow or ice at some point, so choose a dry-treated rope. Dry ropes can have a dry core, a dry sheath or both. Ropes with both offer the greatest moisture protection.
Middle Mark	Most ropes include a middle mark, often black dye, to help you identify the middle of the rope. Being able to identify the middle of your rope is essential when rappelling.
Bicolour	Some ropes are bicolour, which means they have a change in weave pattern that clearly differentiates the two halves of the rope and creates a permanent, easy-to-identify middle mark. This is a more effective (if more expensive) way to mark the middle of a rope than black dye because dye can fade and become difficult to see.
End Warning Marks	Some ropes include thread or black dye showing that you are coming to the end of the rope. This is helpful when you're rappelling or lowering a climber.

9 Rope Safety

Looking at these ratings while thinking about what type of climbing you will be doing can help you choose a rope. The Union Internationale des Associations d'Alpinisme (UIAA) is the international mountaineering and climbing federation that creates safety standards to which all climbing ropes must adhere. Independent labs are responsible for carrying out the tests. All dynamic ropes carried by REI pass the UIAA tests. The packaging on dynamic climbing ropes lists the test results for UIAA safety standards, including fall rating, static elongation, dynamic elongation and impact force. Looking at these ratings while thinking about what type of climbing you will be doing can help you choose a rope.

Fall Rating	The UIAA tests ropes to see how many falls they can hold before failing. Lab falls create much greater force than most real-world climbing falls. Therefore, the fall rating is mostly a comparative value. Single ropes are tested by dropping an 80kg weight onto the rope, half ropes are tested by dropping a 55kg weight on a single strand, and twin ropes are tested by dropping an 80kg weight on 2 strands. All single ropes and half ropes must withstand a minimum of 5 UIAA falls. Twin ropes must withstand a minimum of 12 UIAA falls. All ropes that meet the UIAA fall rating standard are safe for climbing. A rope with a higher fall rating may mean that that rope will last longer than a rope with a lower rating. However, always inspect your rope closely after a severe fall and consider retiring it if any damage is detected.
Static Elongation	Static elongation, also called working elongation, is the amount that a dynamic rope stretches with an 80kg weight hanging from it. Elongation on single and twin ropes cannot exceed 10 percent of the total rope length and half ropes cannot exceed 12 percent. Static elongation is important to consider when top-rope climbing, hauling gear and climbing fixed ropes with ascenders. Higher static elongation generally indicates less efficiency because energy is wasted through rope stretch.

Dynamic Elongation	Dynamic elongation is the distance the rope stretches during the first UIAA fall. Higher elongation equals a longer fall, so generally speaking, a lower number is better because less stretch may prevent a falling climber from hitting a ledge or the ground. However, less dynamic elongation means a higher impact force on the climber, belayer and gear. The UIAA allows ropes to stretch no more than 40 percent of the length of the entire rope.
Impact Force	Impact force is the amount of force in kilonewtons that is put on the falling weight during the first UIAA fall. A lower number indicates less force on the falling climber, the belayer and the gear. The higher the dynamic elongation, the lower the impact force. Lower impact forces make for a soft landing on the rope when you fall, but with that usually comes greater stretch, which can be less efficient when top roping.

2 Rope Techniques

While all climbers aspire to reach the top of a pitch, getting back down is every bit as important. Lowering on belay is what most of us do when we start climbing. Rappelling is another essential skill, though, for you to become a well-rounded climber. Lowering requires a belay partner, while in rappelling the climber self lowers. Rappelling comes in handy in a number of scenarios, including:

- Having no approach trail to access the base of your climb (like on a sea cliff).
- The wall has a lot of loose rocks and you want to clean the route before you climb.
- You have an injured climber and a rescue from the top of the climb is warranted.
- You want to minimize wear and tear on an anchor system (like one that has rappel rings) after you've cleaned the anchor and need to get down.
- Any situation when climbing down, lowering and walking off are all not possible or not preferable.

Belay

Climbing Anchors

Lasso

3 Arborist Knots

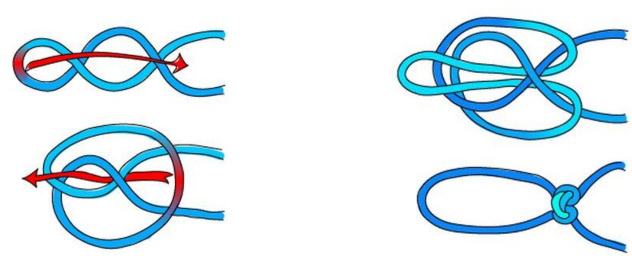
An arborist or tree surgeon is a professional in the practice of arboriculture, which is the cultivation, management, and study of individual trees, shrubs, vines, and other perennial woody plants in dendrology and horticulture. These knots are designed to help keep them attached to the tree.

Other Arborist Knots

- Water Knot
- Zeppelin Bend
- Trucker's Hitch
- Running Bowline
- Bowline on a Bight
- Valdotain Tresse
- Stopper Knot
- Alpine Coil
- Backup Knot
- Blake's Hitch
- Bowline
- Prusik Hitch
- Autoblock Knot
- Slippery Eight Loop
- Distel Hitch
- Double Fisherman
- Figure Eight

Alpine Butterfly Knot

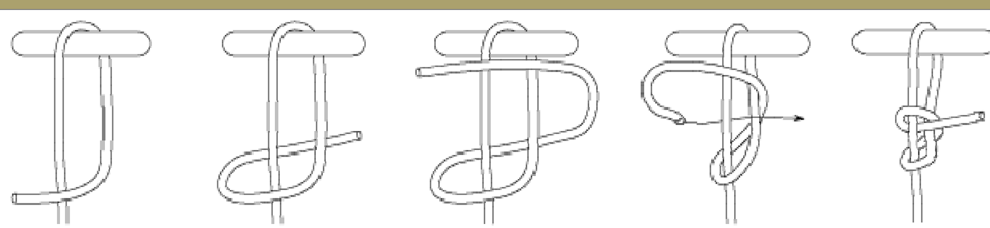
Alpine Butterfly Knot (Butterfly Loop)
Forms a secure loop in the middle of the rope.



1. Make a loop in the rope and twist it one full rotation into an eight shape.
2. Fold the top of the eight down around the bottom of the eight.
3. Now up and out through the lower opening of the eight and pull tight.

Buntline Hitch

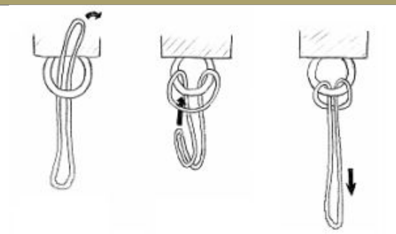
Buntline Hitch
Tie items to the end of a rope.



1. Pass the end of a line through the object being attached to the rope. Bring free end up and cross over, then under the standing line.
2. Bring the free end to the front of the knot and you will now finish by tying a half hitch around the standing line.
3. This is the completed knot prior to tightening.
4. Pull the knot tight and slide down onto the attached object.

Cow Hitch

Cow Hitch
Tie a rope to a post or object.



1. Wrap end of rope around object from behind.
2. Cross behind standing line.
3. Wrap tag end around object in opposite direction as first wrap (half hitch) and feed through opening created by wrap.
4. Pull both ends to tighten the knot.

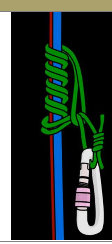
Half Hitch

Half Hitch
Basic overhand knot.

1. Pass the end of a rope around the object and tie an overhand knot.
2. For the Two Half Hitches, repeat with a second overhand knot in the same direction.

Klemheist Knot

Klemheist Knot
Climber Knot



1. Place a loop consisting of cordage no more than 1/2 the diameter of the main line behind the static line.
2. Make a wrap around the static line with the loop on the right.
3. Repeat two more times working from bottom to top.
4. Feed left hand loop through loop on right.
5. Pull left hand loop back over to left side of static line and pull down hard to set the knot.
6. Grasp entire knot and slide up the static line. Load and grip the knot to the static line with weight to the loop.

Munter Hitch

Munter Hitch
Climbing belay knot.

1. Make a loop in the rope and slip the loop into a locking carabineer. Form a second loop with the line crossing opposite the first loop.
2. Slip second loop into the carabineer and lock carabineer.
3. Make sure the strand carrying the load is next to the spine of the carabineer.

Timber Hitch

Timber Hitch
Secure a rope around a post.

1. Pass the working end of a rope around the object and take a turn around the standing part.
2. Tuck the working end back around itself three times with the lay of the rope.
3. Add one or two half hitches near the hauling end for hoisting and to keep load from twisting.

4 Bends

A bend is a knot used to join two lengths of rope.

Other Bend Knots
- Double Overhand Stopper
- Heaving Line Knot
- Monkey Fist
- Double Fisherman

Carrick Bend

Carrick Bend
Join heavy ropes together.

1. Form a basic loop with the larger size rope (white rope in illustration) and lay loop on top of and across working end of second rope.
2. Remember the sequence: over, under, over, under, over and pass working end of second rope around first loop and itself following the sequence.
3. The ends come out of opposite sides of the knot. The knot loses its beautiful symmetry when tightened.
4. The ends should be seized to the standing parts if the ropes are large.

Sheep Shank

Sheep Shank
To shorten a rope.

1. Take up slack in rope and make underhand loops as shown at A and B.
2. Pass bight A1 through loop A, and bight B1 through loop B.
3. Pull free ends of rope in opposite directions. Maintain tension on knot.

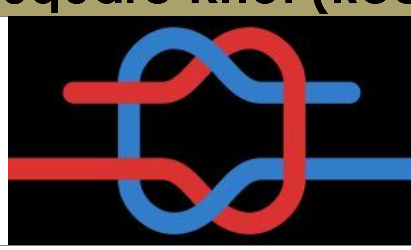
Sheet Bend

Sheet Bend
Join ropes of unequal size.

1. Form a loop in the end of one rope. Pass the free end of the rope to be joined under the opening of the loop, around both parts of the first rope and back under itself.
2. Pull all four ends to tighten.
3. Two wraps around both parts of the first rope make a Doubled Sheet Bend.

Square Knot (Reef Knot)

Square Knot
Secure non critical items.



1. Tie two over hand knots. First, right over left and twist. Then left over right and twist.
2. Make sure both parts of the rope exit the knot together!

Stopper Knot

Stopper Knot
Stopper knot for the end of a rope.

1. Form a small loop at the end of a line by running tag end over standing line.
2. Tie an overhand knot around standing line.
3. Pull overhand knot tight and feed tag end through noose (loop) end.
4. Pull tag end all the way through and slide knot down tight.
5. Pull both ends tight.

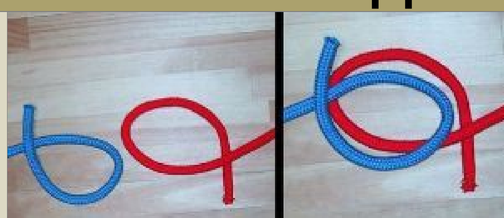
Water Knot

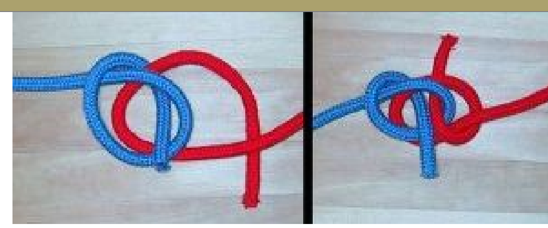
Water Knot
Best knot for webbing.

1. Tie an overhand knot in one end of the webbing leaving the desired length of the loop free.
2. Retrace the knot in the opposite direction with the other end of the webbing and.
3. Pull tight. Make sure the free ends are a couple inches long to visually inspect for slippage during use.

Zeppelin Bend

Zeppelin Bend
Easy to untie knot for joining two ropes.





1. An easy way to start the Zeppelin knot is to form a "6" with one rope with the running line under, and form a "9" with the other rope with the running line over. Then lay the 6 partially over the 9.
2. Take the end of the 6 and pass it through the opening of the 9 and the 6.
3. Repeat with the end of the 9 in the opposite direction - through the opening of the 6 and through the opening of the 9.
4. Pull ends tight.

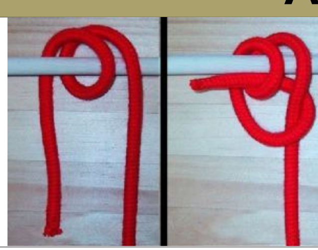
5 Boating Knots

Knots for boats and rigging.

Other Boating Knots
- Zeppelin Bend
- Water Knot
- Alpine Butterfly Knot
- Bowline
- Running Bowline
- Heaving Line Knot
- Double Bowline Knot
- Carrick Bend
- Buntline Hitch
- Spanish Bowline
- Bowline On A Bight
- Common Whipping
- Stevedore Stopper Knot
- Sailor's Coil

Anchor Bend

Anchor Bend
A good knot for tying an anchor to a rope.



1. Make two turns around the shackle, leaving turns open.
2. Pass free end behind the standing line and feed the free end through the first turns and pull tight.
3. Now tie a half hitch around the standing line and pull tight.
4. Seize the free end or tie the knot with a long tag end and tie a backup knot such as one half of a Double Fisherman's (see Backup Knot) with the tag end around the standing part.

Cleat Hitch

Cleat Hitch
To tie a rope to a cleat on a boat or dock.

1. Take a turn around the base of the cleat, and then bring the line over the top of the cleat. Wrap the line back under the arm of the cleat opposite the first turn, then back over the top of the cleat.
2. Wrap under the first arm a 2nd time and then back over the top of the cleat. You have now made a figure eight pattern over and around the cleat.
3. Now form an under hand loop and slip that loop over the arm of the cleat, which pins the free end under the last wrap.
4. Pull the free end tight and you have the neat, tidy and secure Cleat Hitch.

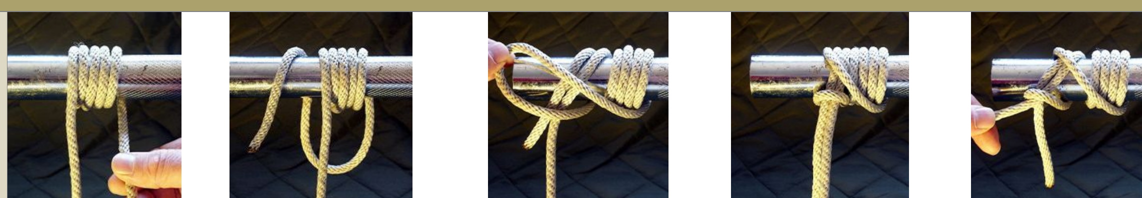
Halyard Hitch

Halyard Hitch
Compact and reliable knot for shackles and rings.

1. Pass the end of a rope through the shackle and make a turn around the standing line.
2. Make a second turn around the standing line below the first turn.
3. Bring the end of the rope back up to the top of the knot and feed the end down through the two loops just created.
4. Pull working end to tighten the knot and then pull the standing line to seat the knot against the shackle.

Icicle Hitch

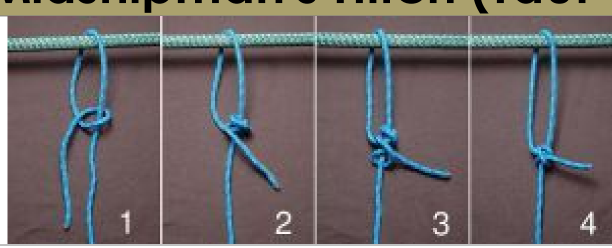
Icicle Hitch
Slide and grip knot useful to hoist a post.



1. Wrap working end of rope around the post four times. Then pass the standing line behind the wraps and pass it over the post leaving a hanging loop behind the wraps.
2. Take the hanging loop by its longest part and pass the loop in front of the working end on the front side of the post and pass the loop over the end of the post.
3. Tighten everything up and pull down on the standing line to further tighten the wraps around the post. Spread the wraps out on the post to hoist the post vertically.

Midshipman's Hitch (Taut-line Hitch)

Midshipman's Hitch
Creates an adjustable loop.



1. Pass the working end of a rope around an object such as a post or cleat. Pass the working end around the standing line creating the first Half Hitch.
2. Pass it around again, working back away from the object toward the standing line. Pull tight. This forms an Awning Hitch that can take load while the next step is tied.
3. Now make a half hitch in the same direction outside of the loop around the standing line. Pull the knot tight. The Midshipman's Hitch can now be slid on the standing line when there is no load and will hold tight when load is applied.

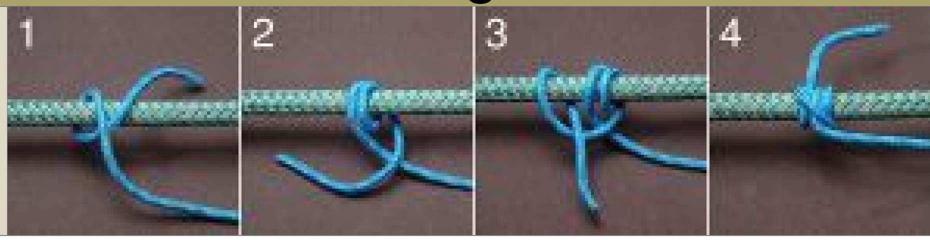
Mooring Hitch

Mooring Hitch
Quick release knot.

1. Make a turn around a post and then form a loop with the free end exiting the loop on the inside (leave longer free end than illustrated).
2. Grasp the standing line and pull a section through your loop.
3. Grasp a section of the free end (but not the very end) and pull part way through the new loop.
4. Tighten the knot by pulling down on the standing line. Release the knot by pulling the free end.

Rolling Hitch

Rolling Hitch
Secure a line to a post.



1. Wrap the end of a line around an object. Repeat, crossing over the standing line a second time.
2. Wrap a third time around the object but wrap above the standing line so as to not cross over it.
3. Pass the free end under the last wrap and pull tight.

Trucker's Hitch

Trucker's Hitch
Load securing knot.

1. Tie one end of rope to fixed object such as car bumper. About mid way on the rope tie a slippery half hitch to form a loop in the middle of the line. Be sure the loop part is formed with the slack part of the rope or it will tighten down on itself under pressure.
2. Make a wrap around another fixed point opposite the tie-in point and feed free end through the loop.
3. Using the loop as a pulley, pull down with the free end as tight as you can and secure the knot with two half hitches around one or both lines.

6 Climbing Knots

For climbing up rocks, trees and slopes.

Other Climbing Knots
- Zeppelin Bend
- Water Knot
- Stopper Knot
- Figure Eight
- Backup Knot
- Klemheist Knot
- Bowline on a Bight
- Alpine Butterfly Knot
- Girth Hitch
- Farmer's Loop
- Munter Hitch
- Distel Hitch
- Double Fisherman

Alpine Coil

Alpine Coil
To carry a coil of rope over your shoulder.

1. Bring both ends to the top of the newly made coil and form a bight in one of the ends.
2. Wrap the working end of the other rope around the strands of the coil and the bight, working forward as shown.
3. Tuck the working end of the rope being wrapped around through the bight first formed.
4. Pull the standing end of the bight to capture the working end tight.

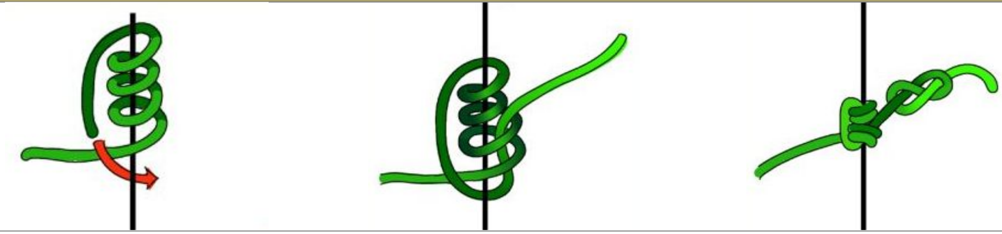
Autoblock Knot

Autoblock Knot
Friction knot for descending/rappelling.

1. Wrap your Autoblock Hitch cord four or five times around the rappel ropes. Use a thin cord such as 5mm or 6mm static cordage. Use up most of the cord on the wraps. The more wraps that you use, the more friction generated.
2. Then clip both ends of the cord into the locking carabineer on your harness leg loop. Lock the carabineer so the cord can't come undone. Finally, arrange all the wraps so they're neat and not crossed.

Blake's Hitch

Blake's Hitch
Arborist ascending/descending knot.



1. Wrap line four times around other rope, working from bottom to top.
2. Leave room in 2nd wrap to accommodate tag end of rope.
3. Run tag end down to and over standing line, behind static rope and out through 2nd wrap.
4. Tighten knot and finish with a stopper knot (Figure Eight) at the end of the line.

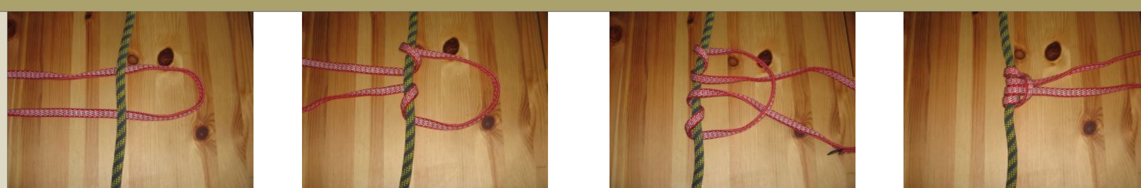
Bowline

Bowline
Forms a secure loop.

1. Lay the rope across your left hand with the free end hanging down. Form a small loop in the line in your hand.
2. Bring the free end up to and pass through the eye from the under side (the rabbit comes out of the hole).
3. Wrap the line around the standing line and back down through the loop (around the tree and back down the hole).
4. Tighten the knot by pulling on free end while holding standing line

Prusik Hitch

Prusik Hitch
Secures a movable loop to another line.



1. Make a sling of cordage (no more than 1/2 the diameter of main rope).
2. Tie a Girth Hitch around the main rope.
3. Pass the loop of the sling back through the centre of the Girth Hitch three or four more times.
4. Load with weight to make sure it

Running Bowline

Running Bowline
A slip knot.

1. Double the end of a rope and wrap tag end over then under standing line and up to side of new loop created.
2. Make a small loop on the topside of the original loop by twisting the line over itself.
3. Feed tag end through the small loop.
4. Wrap tag end once around topside of large loop and back down through small loop.
5. Pull tag end tight creating fixed loop that the main line can slip through.

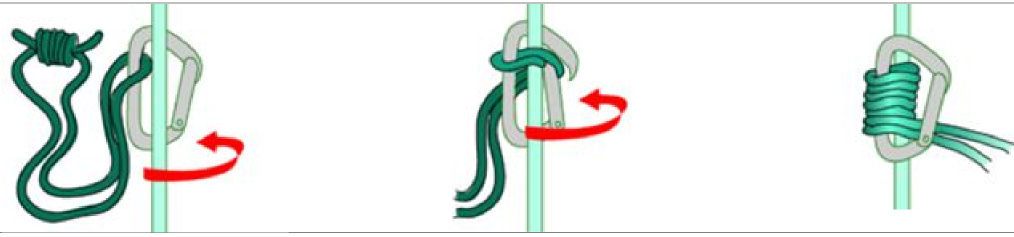
7 Hitch Knots

For tying a rope to an object.

Other Hitch Knots
- Valdotain Tresse
- Trucker's Hitch
- Timber Hitch
- Sledge Knot
- Rolling Hitch
- Prusik Hitch
- Mooring Hitch
- Midshipman's Hitch
- Munter Hitch
- Klemheist Knot
- Icicle Hitch
- Halyard Hitch
- Half Hitch
- Girth Hitch
- Distel Hitch
- Cow Hitch
- Cleat Hitch
- Autoblock Knot
- Blake's Hitch
- Anchor Bend
- Buntline Hitch

Bachmann Knot

Bachmann Knot
Friction hitch for ascending/descending.



1. Construct a strop of rope (not more than 1/2 the diameter of the vertical rope) or use a pre-made strop.
2. Clip the strop into the carabineer.
3. Hold the carabineer against the vertical rope and wrap the strop around the rope and pass through the carabineer.
4. Repeat, wrapping around the vertical rope and through the carabineer again (an additional wrap can be made if there is room in the carabineer).
5. Apply load to the end of the strop to bind the knot in place with friction.

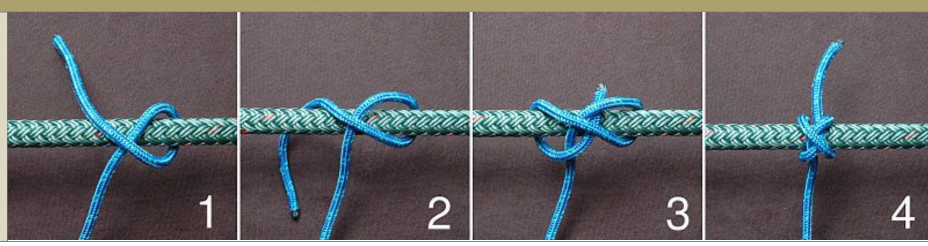
Barrel Hitch

Barrel Hitch
To hoist a barrel or drum.

1. Stand the barrel on the lifting rope.
2. Tie a simple overhand knot across the top.
3. Spread the overhand knot until it opens wide enough to slip over the sides of the barrel.
4. Adjust to embrace the top third of the barrel.
5. Tie a Bowline Knot with the ends of the rope to join together and lift.

Constrictor Knot

Constrictor Knot
Tie up a bundle of items.



1. Starting in front of the objects, make one wrap from right to left around the object(s) to be bound and cross over in the front.
2. Wrap around the object again.
3. Feed the working end back under the two wraps making sure you first cross over the standing line.
4. Pull both ends to tighten up the knot.

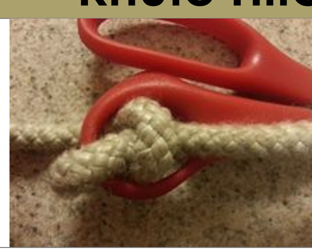
Highwayman's Hitch

Highwayman's Hitch
Quick release knot.

1. Double line to make the first bight in the rope and place bight behind post, rail or spar.
2. Make a second bight in the standing line and pass that bight through the first bight.
3. Give a little pull on the working end to tighten down on the second bight and hold it in place.
4. Take the working (which should be longer than it appears in the accompanying illustration) and make a third bight.
5. Pass the third bight through second and pull on the standing line to tighten the knot.
6. The knot holds with tension on the standing part and can be released with a tug on the working end.

Knute Hitch

Knute Hitch
Attach a lanyard to an object.



1. Tie a figure eight knot or other stopper knot in the end of the lanyard.
2. Form a bight and pass bight through the hole in the tool.
3. Pass the stopper knot through the bight and tighten the bight down by pulling on the standing line.

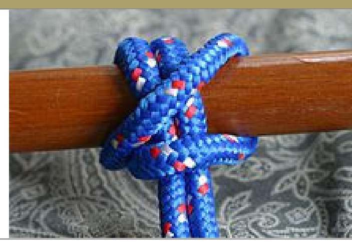
Marl

Marl
Arborist timber hitch alternative.

1. Tie a Running Bowline around the end of the log or branch. When pulled tight, it will cinch down to secure the log.
2. Run the rope a short way down the below the Running Bowline and wrap around the log.
3. Feed end of rope under the wrap just made, effectively tying an overhand knot.
4. Repeat once or twice more.

Pile Hitch

Pile Hitch
Attach a rope to an object.



1. Double end of a line into a loop and wrap around post or object from front to back.
2. Cross over standing lines and slide open end of loop over top of post.
3. Pull tight.

Rolling Bend

Rolling Bend
Secure a line to a post.

1. Wrap working end around object three to four times and then back around standing part.
2. Wrap working end around object again.
3. Finish knot with two half hitches with working end. Pull tight and maintain tension with standing line.

Schwabish Hitch

Schwabish Hitch
Arborist friction hitch.

1. Make four wraps around main static rope with a hand tied or sewn prusik or spliced eye split tail friction cord.
2. After fourth wrap bring wrapping tail down and make an additional wrap at bottom of other wraps in opposite direction while tying a half hitch around other rope. This results in both tails exiting the knot together.
3. Join eyes in front and clip together with a carabineer.

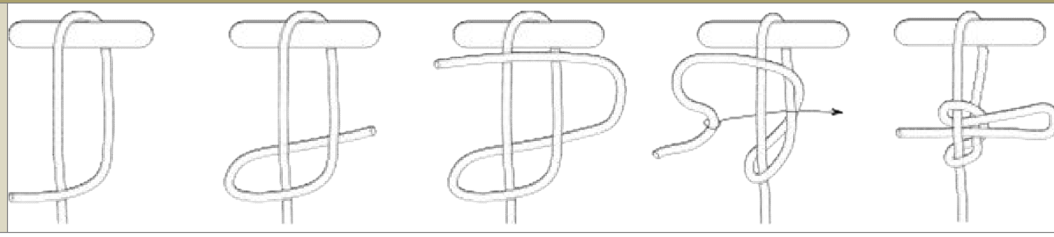
Slip Knot

Slip Knot
A knot for a sliding loop.

1. Make a loop by doubling line back onto itself.
2. Run tag end back toward loop and lay over the doubled lines.
3. Make one or two turns with the tag end around doubled lines and through new loop created.

Slipped Buntline

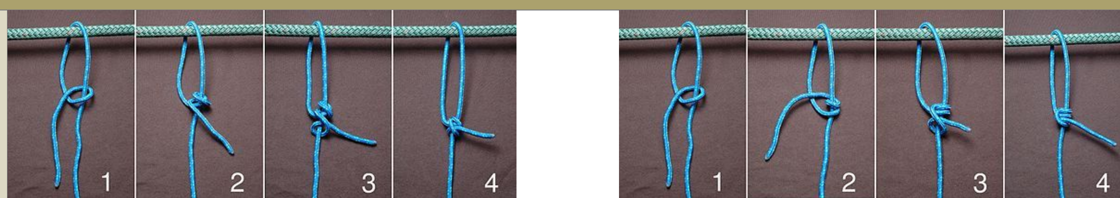
Slipped Buntline
A quick release knot.



1. Wrap working end around object and run end behind loop just created.
2. Bring working end back to front of knot and grasp in middle of working part.
3. Feed bight just formed between front and back lines of original loop.
4. Carefully tighten the knot. To release the knot, pull on tag end.

Tautline Hitch

Tautline Hitch
An adjustable knot.



1. Make a turn around a post or other object several feet from the free end.
2. Coil the free end twice around the standing line working back toward the post.
3. Make one additional coil around the standing line on the outside of the coils just made.
4. Tighten the knot and slide it on the standing line to adjust tension.

Tautline Hitch to Rope

Tautline Hitch to Rope
A movable knot on another line or object.

1. Lay line across rope or object you are attaching it to and make two downward wraps.
2. Move the working end up across the wraps and pass behind rope.
3. Make two more wraps around the rope, passing inside the working end.
4. Tighten down the wraps and grasp entire knot to slide up or down. A load on the standing line grips the knot to the rope or object.
5. A Figure Eight or other stopper knot should be tied in the end of the working end for security.

Adjusting
Once snug and set, the hitch can be adjusted as needed. To tighten the line with respect to a load attached to the standing part, the user can grasp the standing part with one hand inside of the loop and pull toward the anchor object. The hitch may be grasped with the other hand and as slack develops within the loop, the hitch slid away from the anchor object, taking up the slack and enlarging the loop. To loosen, the hitch may be slid toward the anchor object, making the loop smaller and lengthening the standing part.

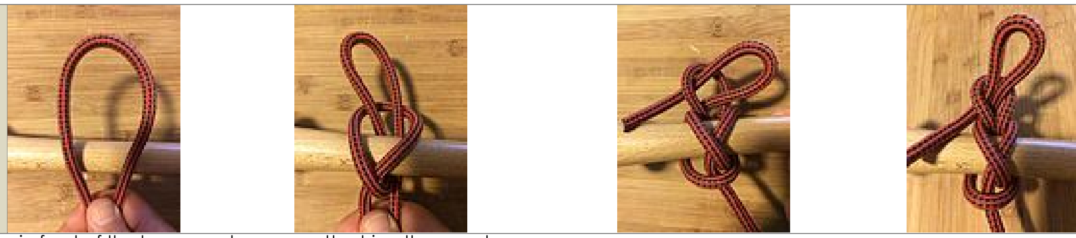
Transom Knot

Transom Knot
A lashing knot that ties two poles together.

1. Pass the working end behind the upright spar and back across the rope.
2. Now pass the working end behind the upright spar below the horizontal spar.
3. Working back toward the top, tuck the working end under both turns.
4. Pull both the working end and the standing part to tighten the knot. Trim ends if desired.

Tumble Hitch

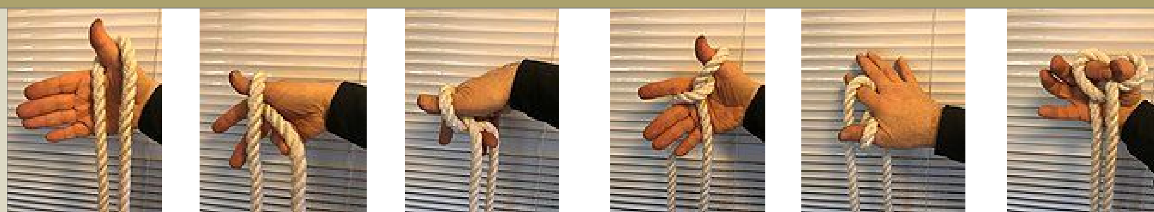
Tumble Hitch
A good quick release knot.



1. Form a bight in the rope in front of the bar or post you are attaching the rope to.
2. Now form a bight in the working end and run that bight behind the bar and pass it through the loop created by the first bight formed. A slight tug on the standing line can help to hold the second loop in place.
3. Pass working end behind standing line.
4. Pass working end in front of standing line.
5. Form another bight in the working end and run behind bar and pass up and through the 2nd loop.
6. Tighten the knot by applying load to the standing line while adjusting the knot down onto the final pass of the working end. Release the knot with a pull to the working end.

Clove Hitch

Clove Hitch
Secures rope to a solid structure quickly.



1. Wrap the free end of a rope around a post.
2. Crossover itself and around the post again.
3. Slip working end under last wrap.
4. Pull tight.

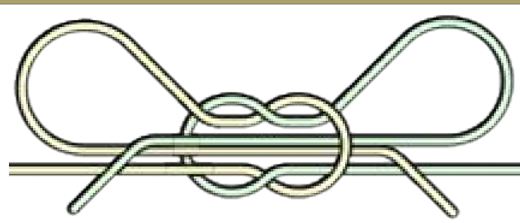
8 Loop Knots

For making loops.

Other Loop Knots
- Running Bowline
- Alpine Butterfly Knot
- Bowline
- Spanish Bowline
- Bowline on a Bight

Better Bow Knot

Better Bow Knot
A more secure shoelace knot.



1. Begin as if tying the standard shoelace knot with an overhand knot.
2. Make a loop on one side.
3. Now wrap two times around the loop. Be sure to wrap both these turns around the end of your thumb or finger.
4. Form a second loop at the end of the line you made the wraps with and push it through the space made by your thumb or finger while making the wraps.
5. Pull both loops in opposite directions.
6. Tighten and adjust loops.

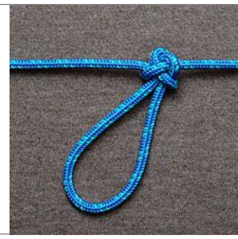
Double Bowline Knot

Double Bowline Knot
A more robust bowline knot.

1. Lay the rope across your left hand with the free end hanging down. Form a small loop in the line in your hand.
2. Repeat to form a second small loop below the first.
3. Bring the free end up to and pass through both small loops from the under side (the rabbit comes out of the hole).
4. Wrap the line around the standing line and back down through the two loops (around the tree and back down the hole).
5. Tighten the knot by pulling on free end while holding standing line.

Farmer's Loop

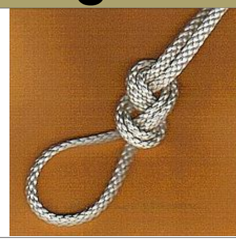
Farmer's Loop
Form a secure loop in the middle of a rope.



1. Start by wrapping the rope around your palm three times, letting the ends hang.
2. Next, lift the middle loop over the right loop (which becomes the middle).
3. In the same manner, pull the new middle loop over the left loop.
4. Again, middle over right.
5. Now middle over left, and pull out a little further to make the final loop of desired size.

Figure Eight

Figure Eight
The strongest knot for a loop at the end of a rope.



1. Tie a single eight in the rope two feet from its end. Pass the free end through any tie-in point if desired.
2. Retrace the original eight with the free end leaving a loop at the bottom of the desired size.
3. Pull all four strands of rope to cinch down the knot.

Honda Knot

Honda Knot
The lasso knot.

1. Tie a loose overhand knot at the end of a rope.
2. Now tie a tight overhand knot at the very end of the rope for a “stopper” and bring the end back through one side of the overhand knot.
3. Tighten down the loose overhand knot and pull the stopper knot up tight. That is the circular Honda Knot.
4. Now feed the main line through the Honda to form a lasso of any size.

Slippery Eight Loop

Slippery Eight Loop
An adjustable loop knot.

1. Begin by tying a Figure Eight at the end of a rope with enough extra line to make a loop of the desired size.
2. Leave the Eight loose and bring the working end back to the top of the knot.
3. Pass behind the standing line and feed the end through the Eight as illustrated.
4. Pull the knot tight. Adjust the size of the loop by alternately pulling the working end or one side of the loop.

Yosemite Bowline

Yosemite Bowline
A very secure loop knot.

1. First, tie a regular Bowline with a little longer working end: Lay the rope across your left hand with the free end hanging down. Form a small overhand loop in the line in your hand.
2. Bring the free end up to and pass through the loop from the under side and wrap line around standing line ("around the tree").
3. Feed line back down through the loop. That completes the regular Bowline.
4. Now wrap tag end around the front of the loop and follow exactly the path of the standing line up through the top eye, finishing on the right side of the standing line as you look at the knot from the front.
5. The tightening of this knot must be done exactly right to set it in the right order! Take the standing part and the bottom of the loop and pull tight. That tightens the original Bowline (which must be done first!).
6. Tug on the working end to tighten the Yosemite Finish. If you were to tighten the knot with the working end first you actually lose the original bowline and the knot isn't a secure knot. (To gain the benefits of the Yosemite Finish, it must be tied carefully and correctly. Many climbers do not trust using this knot with their life.)

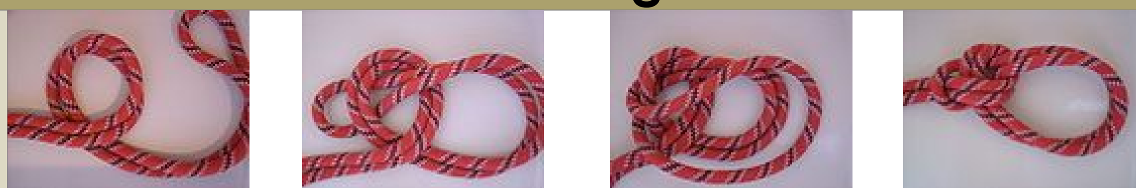
9 Rescue Knots

Useful for search and rescue or survival.

Other Rescue Knots
- Bowline
- Alpine Butterfly Knot
- Figure Eight
- Zeppelin Bend
- Water Knot
- Blake's Hitch
- Backup Knot
- Stopper Knot
- Farmer's Loop
- Munter Hitch
- Running Bowline
- Autoblock Knot

Bowline on a Bight

Bowline on a Bight
Forms a loop in the middle of a line.



1. Double a section of line and form a loop or "eye" in the line.
2. Pass the free end up through the eye forming a double loop below the eye.
3. Spread open the free end and bring it down to the bottom of the double loop.
4. Pass over double loop and continue up to top of eye.
5. Seat the knot by pulling on the double loop while holding the standing line.

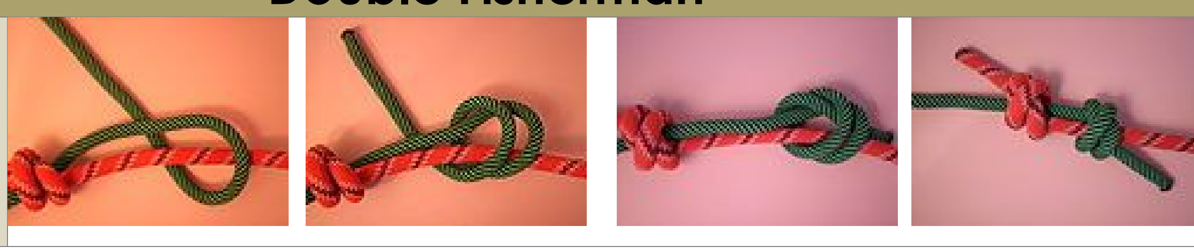
Distel Hitch

Distel Hitch
Arborist friction hitch.

1. Make four wraps around main static rope with a hand tied or sewn prusik or spliced eye split tail friction cord.
2. After fourth wrap bring wrapping tail down and make an additional wrap at bottom of other wraps in same direction while tying a half hitch by tucking tail under itself in the front of the knot.
3. Join eyes in front and clip together with a carabineer.

Double Fisherman

Double Fisherman
Join two ropes.



1. Lay the ends of two lines parallel to each other.
2. Coil the free end of one rope twice around the second rope and pass it back through the inside of the coils.
3. Repeat with second rope in opposite direction.
4. Pull free ends to tighten knots, then standing lines to slide knots together.

Fireman's Coil

Fireman's Coil
Coil a rope with a quick release.

1. Make a coil with your rope by looping it in circles. Use one hand to make the circles and the other to hold them in place.
2. Take the working end of rope (the end after the last coil is made) and make a loop mid rope at the top of the coils.
3. Take hold of the working end just below the loop and bring to back side of coil and run it up through the loop. That essentially makes a loop going through a loop.
4. Tighten down the first loop onto the second loop. This loop can be used for a hanging hook. Pull on the end of the rope to release.

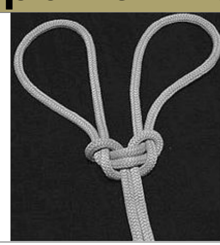
Sledge Knot

Sledge Knot
Bind things together very firmly.

1. Wrap working end of rope around items to be lashed together twice.
2. Pass working end behind standing line.
3. Wrap working end around standing line and itself three times working from bottom of knot up toward top of knot.
4. After passing the working end over the front of both ropes for the third time, wrap behind only the left side rope and feed working end down through the top most loop formed.
5. Next, pass end over the next two parts of lower loop and BEHIND bottom part of lower loop.
6. Tighten the knot by pulling first on the working end to tighten up the loops.
7. Now pull on the standing line to move the knot up to your anchor point, just like any slip knot and continue pulling and working the knot tighter and tighter.

Spanish Bowline

Spanish Bowline
A double loop knot.



1. Make a loop in the end of a rope and tuck the loop under the parallel lines.
2. Make a twist in each of the two sides of the loop, twisting in toward the centre with the outer part of the loops.
3. Now take the left loop and insert it in and through the right loop, moving first under then over the ropes it is crossing.
4. Grasp the new small lower loop by each side and pull those sides through the loops above.
5. Once you have the ropes part way through pull the two vertical ropes to help tighten down the knot.
6. Adjust the loops and pull everything very tight.

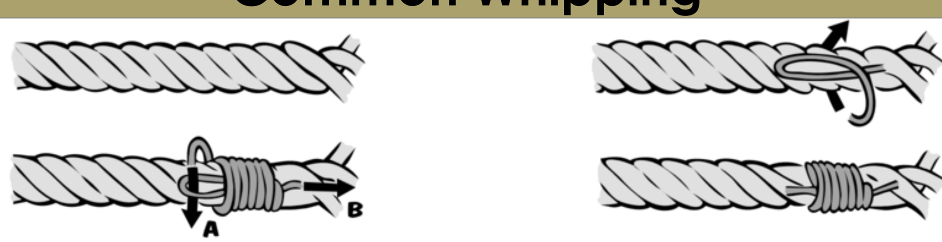
10 Misc Knots

Uncategorised knots for special purposes.

Other Misc Knots
- Alpine Coil
- Backup Knot
- Fireman's Coil
- Sledge Knot
- Stopper Knot

Common Whipping

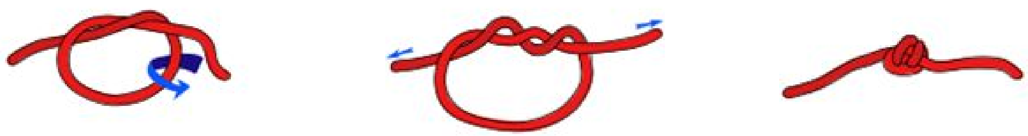
Common Whipping
Whipping knot to keep end of rope from unravelling.



1. Lay the twine along the rope and make a bight back along the rope. Note that the rope should be whipped a short distance (one and a half times the diameter) from its end.
2. Begin wrapping the twine around the rope and bight of twine securely.
3. Wrap until the whipping is one and a half times wider than the rope is thick.
4. Run the working end of the twine through the bight. Carefully pull on the standing end of the twine until the bight and working end are pulled under the whipping (Note: It is normally necessary to maintain tension on the working end to prevent the bight from being dragged completely through otherwise the whipping will fall apart.)
5. Cut the twine flush with the edges of the whipping to give the rope end a finished look.

Double Overhand Knot

Double Overhand Knot
Easy to tie stopper knot at end of rope.



1. Tie an overhand knot at the end of a rope but do not tighten the knot down.
2. Pass the end of the line through the loop created by the first overhand knot.
3. Tighten the knot down while sliding it into place at the end of the line. Be sure to leave some tail sticking out from the end of the knot.

French Whipping

French Whipping
Whipping knot to keep end of rope from unravelling.

1. Near the end of the rope, tie a simple overhand knot leaving a short tag end and a long working end.
2. Lay the tag end on top of the rope and begin making half hitches over the tag end and around the rope end being whipped.
3. Continue this same process of tying half hitches around the rope and burying the tag end in the new wraps.
4. Once you have wrapped past the tag end and approximately one to one and a half times the diameter of the rope being whipped, you will now secure the knot by leaving two half hitches open and inserting the working end through both loops of the half hitches.
5. You can repeat this a second time if desired.
6. Pull the working end very tight and trim close to the wraps.

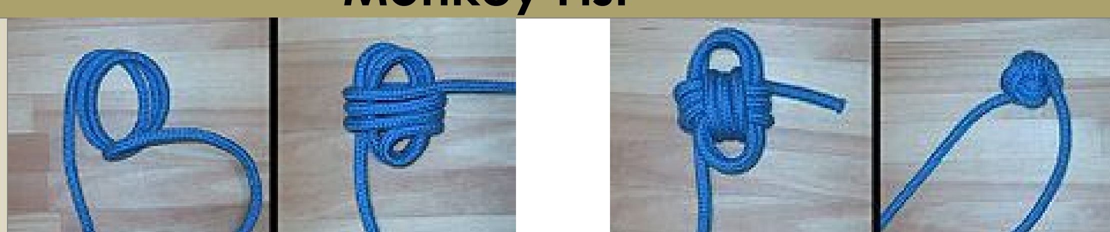
Heaving Line Knot

Heaving Line Knot
Adds weight to the end of a rope.

1. Double end of line.
2. Make 2 - 5 wraps around outside of both parts of doubled line.
3. Tuck tag end through loop.
4. Pull tight.

Monkey Fist

Monkey Fist
Decorative ball shaped knot.



KNOTS Misc Monkey Fist

1. Take your rope and with the long working end make three wraps around the fingers of your hand.
While holding the first set of turns in place, make three more turns passing outside the middle of the first three turns.
Finish this step by passing the working end around one side of the first set of turns. This sets up the working end for the next step which passes the end through the inside of the previous wraps.
2. Now make three turns around the set of wraps made in the previous step, passing through the inside of the knot. Double check that you have made the same number of turns for each step.
3. Finishing the knot: At this point a round object can be inserted in the centre of the wraps or the standing end of the rope can be tucked inside either with or without a stopper knot at the end as well. Working slowly begin tightening by working on each wrap, starting near the buried stopper knot and finishing with the other end of the rope. Do not pull too hard on the first few wraps. You will need to work your way through the knot more than once. The use of a small screwdriver or awl can help on the last tightening session through the knot.

KNOTS Misc Knots Sailor's Coil

Sailor's Coil

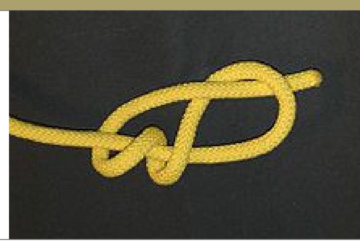
Sailor's Coil
Coil for storing rope at sea.

1. Coil the rope by making consecutive circles of the rope of equal size, gathering them up with one hand while using the other hand to make the circles.
2. Make a single hitch around a section of the coil. Then make a second hitch to the left of the first hitch.
3. Pull end tight.

KNOTS Misc Knots Stevedore Stopper

Stevedore Knot

Stevedore Knot
A bulky stopper knot for the end of a rope.



1. Form a bight in the end of the rope. Pass the working end over the standing line and continue around making one complete turn around the standing line.
2. Repeat 2-3 making a second complete turn around the standing line, working back towards the end of the rope.
3. Pass the end down through the original bight and tighten down the turns. Pull on both ends to tighten down the stopper knot.

Animals

Animal types, tracks, poisonous creatures and edibility

"An animal's eyes have the power to speak a great language."
Martin Buber

Introduction

This section contains animals found on the planet grouped by various means to help you identify them and whether they can help you or injure you.

Purpose	The aim of ANIMALS is to inform the reader on the most dangerous and poisonous creatures on the planet. It also includes information on their geographic region, habitat and information on what to do if you're bitten or stung.
Lost?	• If you've been bitten or stung by one of the animals listed here, go to the INJURY > Animal & Plant section. • For information on raising and caring for tame animals, see the ANIMAL HUSBANDRY section. • For utilizing animals for transport, see the TRANSPORT section. • For animals as pets, see the ENTERTAINMENT section. • If you want to prepare a captured animal for consumption, see the FIELD DRESSING section. • For defence against animals and insects such as mosquitos, see the DEFENCE section. • For information on dangerous animals by region, see the GEOGRAPHY section. • For animal-based disasters such as locust swams, see the NATURAL DISASTERS section.

Contents

1 Animal Tracks

These are any animal tracks you may encounter in the wild to either help determine what wildlife is in the area, what threats may be in the area and what kinds of traps to set.

Identification

Animals are around us in the woods, but we often don't know they are there. They lurk in the thick brush, hide in the trees or are nocturnal and only come out at night. You sometimes see the scat they leave behind, but if conditions are right, you may stumble upon some tracks. Animal tracks in snow, mud, sand or any other soft substrate are easier to spot and you may have to look up and look around you when tracking to find them. Take some time to examine the surrounding environment - you may find other signs of the animal or additional clues to help you ID the print. Use the tips and tricks below to figure out what animal just crossed your path.

Walking Patterns

The first thing you should look for when you find an animal track is the track pattern. There are four unique track patterns which will help you narrow down the group of animals that are responsible for the print.

Zig-Zaggers (Perfect Walkers)	Perfect walkers walk very carefully to conserve energy. Their rear paw/hoof will land in the spot where their front paw previously fell. This gait leaves a zig-zag pattern that is easy to spot. Deer, moose, fox, coyote, bobcat are perfect walkers.
Waddlers	Waddlers appear to move one side of their body and then the other side when they walk. Their rear foot does not land in the print of front foot. Their track is comprised of four prints. Bear, skunk, woodchuck, raccoon, muskrat, beaver, porcupine are waddlers.

Bounders	Bounders place their front feet down, and in one motion they leap forward by lifting up their front feet and putting their rear feet in the exact spot where the front feet previously landed. Their tracks appear as two paws that fall side-by-side. Otters, weasels and other mustelids are bounders.
Hoppers	Hoppers move by placing their rear feet slightly ahead of their front feet and pushing off so their front feet land first and their back feet land in front. This pattern of leapfrogging is found in rabbits and rodents like mice, red squirrels, and chipmunks.

Track Characteristics

Finding the track pattern helps you narrow down the animal you are trying to identify into larger groups, but that is only the first step of identification. You need to get up close and personal with the print, examining the details such as the size of each print, the number of toes, and more.

Width/Length	Width and length help you tell the difference between closely related animals. Within the canines, a fox print will be smaller than a wolf print. Be aware that there is some overlap. A wolf pup may have the same size print as an adult fox. In these cases, you need to look for other clues, such as the tracks of the mother wolf or multiple tracks from a litter of fox kits. There also may be scat nearby as well.
Number of Toes	The number of toes is important to tell the major groups of animals apart! Bear have five toes, while canines and felines have four, for example.
Nails	Nails are a huge find when you can see them! Canines tend to leave a nail print while felines don't since they can retract their nails. There is some grey area -- a feline may bring out its nails because it is on alert or a dog won't sink down enough to imprint its nails. Look for additional prints and other tracks to help fill in these blanks.
Depth	Depth is useful when comparing tracks left in the same substrate at the same time. The heavier the animal, the deeper the print it will leave. Be careful when comparing prints from different locations and times. A deer could make a print that resembles a moose because it is walking on mud softened by a recent rainstorm.
Front/Rear	Front and rear paws may have a slightly different size and shape, depending on the animal. Most guidebooks will have measurements for both prints.
Webbing	Webbing is usually found on animals that frequently swim in the water.
Stride and Straddle	Stride and straddle measure the gate of an animal and can be used to distinguish between two very closely related prints. Stride is measured from the heel of one print to the heel of the other print on the same side. Straddle is the measurement of the width of the track from the outside of the right track to the outside of the left track.

Animal Categories

Canine Tracks

Canine prints are distinctive -- the overall shape is oval with four twos and a heel pad that is concave at the bottom. The four toes point forward and are held closely together with the two front toes often lining up side-by-side. There usually are claws visible in the track and they also point forward. Because of the arrangement of the toes and pad, you can draw an "X" through the canine print. When comparing front and rear tracks, the fore prints of all members of the dog family are significantly larger than the hind print.

Wolf	Wolves are among the largest canines, and their paws are the biggest in the group with a long (4") and wide print.
Coyote	Coyotes are slightly smaller than wolves and have a print that is more narrow (2.5 to 3.5") than the wolf.
Fox	The fox is the smallest canine in the group and have the smallest print (2 to 3"), almost dainty when compared to their bigger cousins. Fox tend to drag their feet and also have more hair in their paws producing a print that is fuzzy around the edges and has a small pad imprint.
Dog	A domestic dog can have a similar sized print to wolf or coyote making it difficult to tell them apart. If you can find a set of prints, you can usually tell the difference by how the two animals walk. Wild animals like wolves and coyotes tend to walk in a straight line to conserve energy, while dogs zig-zag and circle around quite a bit when they are walking. Domestic dogs also tend to splay their toes, producing a track with toes and nails that are pointing outward. Another difference is the nails -- dog nails are thick and blunt while wild canines leave thin and sharp nail prints.

Feline Tracks

Feline prints have four toes and a heel pad with three lobes at the bottom edges that are shaped like a bubble letter "M". Cats actually have five toes up front and four toes in the back, but the extra toe up front does not appear in the tracks. Feline prints are as wide as they are long, making them more round in shape than a canine. Felines also have a leading toe much like a person's middle finger. You can draw a "C" through between the pad and toes of a feline print.

Cougar/ Mountain Lion	Among the felines, cougar tracks are the largest (greater than 3"), about the size of the domestic dog.
Lynx	Though smaller in stature, lynx tracks are the same size as a cougar, but are not as defined due to the fur around their paws.
Bobcat	Bobcats have smaller tracks (2") that are often confused with coyote or fox. Look for a lack of nails and a round-shaped print to identify the bobcat track from its canine counterparts.
House Cat	The prints of a house cat are small (1 to 1.5"). Similar to the domestic dog, the house cat also tends to meander when walking and does not try to conserve energy.

Hoof Tracks (Large)

Ungulates have a split hoof with two toes that leave a distinct imprint. Ungulates can be divided into two main groups based upon the shape of their toes. One group has toes that curve forming a heart-shaped print, while the other have toes that are rounded and leave a round or even square-shaped print.

Moose	Moose are among the largest of the hooved animals and have two toes that curve together into a point forming almost a heart shape print. Moose are heavy and sink down deep into snow allowing the dew claws to sometimes appear in the track. Their tracks measure 5-7" long, about the size of your hand.
Deer	Deer, like moose, have two toes that curve sharply together forming almost a heart shape print. The prints are smaller in size than a moose measuring 2-3.5".

Elk	Elk are similar to moose and deer, but their toes are rounder and not as sharply tapered at the tips. The prints measure 3-5", placing them right in between the deer and moose. Dew claws sometimes appear in deep snow or when the elk is galloping.
Bison	Bison also have two toes in their hooves, but their toes are rounder and they print doesn't taper to a point like the deer, moose and elk. Their print is wide and more round than heart-shaped. It measures 4.5 to 6".
Cow	Cow prints are often confused with bison since they share the same round shape and relative size. The easiest way to tell them apart is to know your surroundings. Is there a farm nearby?

Hoof Tracks (Small)

Mountain goats, bighorn sheep and wild hogs have the same two-toed hooves as their bigger ungulate cousins, but the shapes of their hooves reflect their lifestyle and habitat.

Mountain Goats	To help them climb, mountain goats have toes that spread when they step, creating a distinctive V shape at the top of their print.
Bighorn Sheep	Bighorn sheep have an elongated hooves that are easily confused with those from a deer. In general, the bighorn sheep prints have straighter edges and are less pointed than a deer. They are more blocky and less shaped like a heart.
Wild Hog	The wild boar track is often confused with the deer since they are about the same size. The shape is the discriminating feature. The boar has toes that are wider, rounder and blunter than the deer and don't come to a point like the deer. Hogs also have a dew claw that rests slightly outside the print.

Bird Tracks

Bird tracks can be grouped into categories based upon whether they live mainly in trees or on the ground. Tree dweller tend to hop on the ground and leave a pair of prints behind, while ground birds will leave alternating tracks.

Crow	The crow has the standard bird track with three thin forward-facing toes and one rear-facing toe. They are hoppers and leave a pair of prints approximately 2-2.5" long.
Grouse	Grouse are small ground birds that have a game bird track with only three forward facing toes. They measure about 2" long.
Turkey	Turkey also are ground birds like the grouse and have a similar game bird track. Turkey are much larger than a grouse measuring 4" long.
Duck	The duck has the same toe arrangement as the game birds, but the webbing gives its print a distinctively different shape. Duck also tend to wander and leave a maze of tracks.

Small Animals

These small mammals produce small prints, so you have to look closely at the prints and the track patterns to tell them apart. It's a diverse group with hoppers and waddlers that range from the forest to the river's edge. With the exception of the rabbit and armadillo, most of these small mammals have five toes on their front and rear feet.

Raccoon	If you see a print that looks like the hand of a baby, then it is likely a raccoon. Raccoon have five toes that resemble a human hand. The front print is smaller (1-3") and has a C-shaped heel pad, while the rear print has a longer (1.5-4") heel pad. Raccoon waddle when they walk.
Opossum	With five fingers and a human hand shape, opossum tracks resemble the raccoon, but there is one major difference. Opossum have opposable thumbs on their hind feet that appear in their prints. They are the only North American mammal with opposable thumbs. Opossum also tend to stagger when they walk
Otter	Look for signs of otter on muddy or snowy river banks where you can find prints and trough from belly-sliding into the water. They have five toes on their feet and short claws that give their prints a pointed look. Their toes are partially webbed which sometimes show up in the mud.
Skunk	Skunk have five toes on their hind and front feet. Unlike most mammal that have large hind feet, and small front feet the front and hind feet of the skunk are approximately the same size. They also have claws that show up in many of their prints.
Rabbit	Rabbits are hoppers and move by placing their larger hind feet ahead of their smaller front feet. Unlike squirrels which keep their feet next to each other as they hop, rabbits stagger their feet producing a "Y" shaped track.
Armadillo	Armadillo are only found in the southeast and south central US so you don't have to worry about their tracks in the rest of the US. Armadillo have four long toe prints with a sharp claw at the tip. The front print shows a distinct "V" between the middle toes. They also have a scaly tail they drag behind them that often obscures their tracks.

Reptile / Amphibian

Reptiles and Amphibians have very different life cycles, but they share a similar feature -- they all have long toes that provide extra grip for walking, hopping and climbing.

Alligator	The first thing you notice about an alligator track is not its four toes or its foot shape, but the large through its tail creates as it walks. Look for a central trough with pairs of prints on either side. Another key is the size -- alligators have large feet. The front prints have five toes and are wide in the heel while the rear prints are longer and have four toes with a narrow, pointed heel.
Lizards	Unlike an alligator, lizards are lightweight and don't leave much of a track. Lizards may leave light scuff from their feet and a small tail drag. The tail drag tends to be straighter and more pronounced than other tail-bearing animals like mice.
Frogs	Frogs have four bulbous toes in their front and five in their hind prints. Their front toes point slightly inward producing a "K" shaped print, while their rear toes slope upward and outward. Their belly sometimes appears in the track. They are hoppers with their front feet often landing between their much larger hind feet.

Rodents

Rodents are a very diverse group of mammals, and their tracks reflect their diversity. You have to think about habitat, body shape, and track pattern as much as the individual prints. All rodents leave behind front tracks with four toes and hind tracks with five toes.

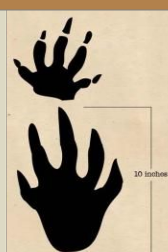
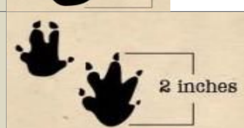
Beaver	You can tell a beaver is nearby by the dams they build and the gnawed trees they leave behind. They have webbed hind feet with 5 toes (4.5-7"), but their tracks often are hard to find. You rarely see the four-toed front prints (2.5-3.5") because the hind print wipes out the front print when they waddle as they walk. And sometimes you don't even see any prints at all as the beaver's large tail can wipe out all their tracks.
Porcupine	Porcupines move slowly and waddle when they walk. They also are climbers and have both big heel pads and long toes with claws. Usually, you will only see their pads in their prints (1-2") along with an occasional trail drag. These pads have a rough surface that aids in climbing and can be seen in soft mud. Each print points inward because they are pigeon-toed. In winter, porcupines are so low to ground that they leave a deep trough in the snow.
Muskrat	Muskrat tracks are hand-like much like the raccoon, but smaller measuring approximately 2-3". Their prints have five long finger-like toes on their hind foot and four long fingers on their front. Muskrat tracks are found near marshes, beaver ponds, and similar slow-moving waterways.
Mouse	Mice, like squirrels, are hoppers. Their larger back feet (0.5-1") land slightly ahead of their smaller front feet (0.25-0.5") producing a cluster of four prints. Mice prints are very small may show a tail drag.
Squirrel	Squirrels are hoppers with their larger back feet (1.5-2") landing slightly ahead of their smaller front feet (1-1.5"). Their feet tend to land side-by-side producing a repeating series of four distinct prints. These tracks often meander from tree to tree.

Bear Tracks

You can't miss a bear track -- its paw is huge with five rounded toes and a wide heel pad. Black and Grizzly Bear tracks can be hard to differentiate. Geographic location can help narrow down the possibilities.

Black Bear	A black bear has short claws and its toes spread out in a curve over its foot pad. Generally going to be smaller than Grizzly Bear paw.
Grizzly Bear	A grizzly has long claws that extend out further from their toes. Its toes also are held closer together, forming almost a straight line above the foot pad.

Tracks

Alligator / Crocodile									
Armadillo									
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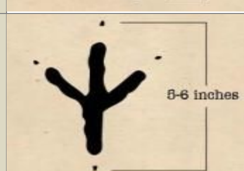
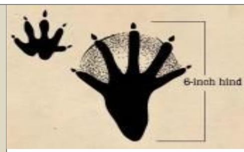
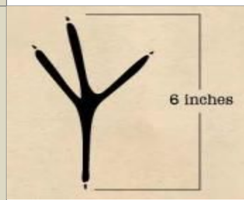
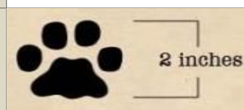
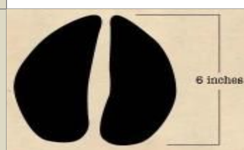
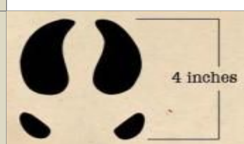
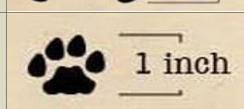
Bald Eagle									
Bear (Black)									
Bear (Grizzly)									

Beaver									
Blue Heron									
Bobcat									
Buffalo									
Caribou									
Cat (Domestic)									
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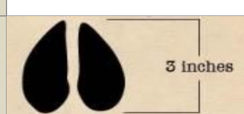
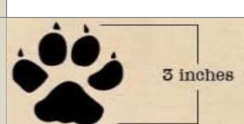
Deer									
Dog (Domestic)									
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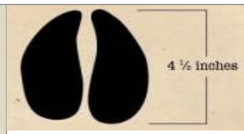
Elk									
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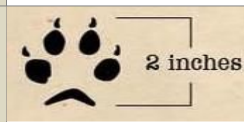
Fox									
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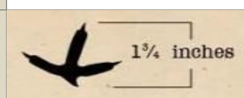
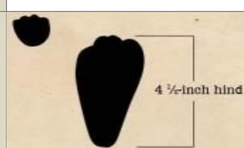
Grouse									
Hare									
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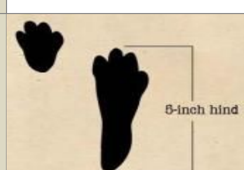
Jackrabbit									
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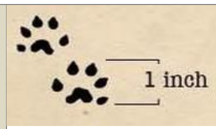
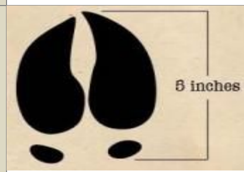
Mink									
Moose									
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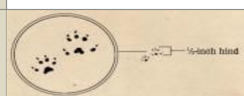
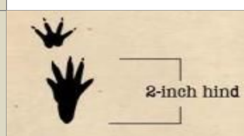
Mouse									
Muskrat									
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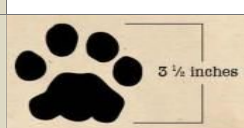
Panther									
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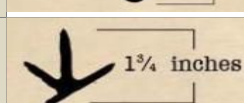
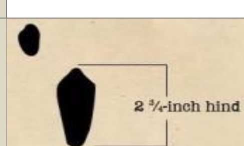
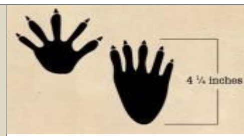
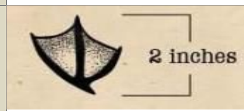
Quail									
Rabbit									

Raccoon	
Seagull	
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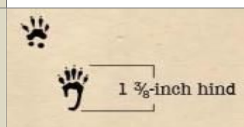
Squirrel	
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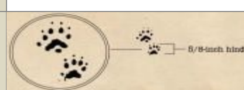
Weasel	
Wolf (Gray)	
Woodchuck	

2 Poisonous Creatures

A section identifying poisonous creatures of the world. This only includes creatures that have poison and exclude creatures that can injure you by other means.

Subheadings

1. Snakes	2. Spiders	3. Scorpions	4. Insects
5. Other Arthropods	6. Toxic Birds	7. Mammals	8. Lizards
9. Amphibians	10. Fish	11. Cephalopods	12. Cnidarians

1 Snakes

Snakes are elongated, legless, carnivorous reptiles of the suborder Serpentes. Like all other squamates, snakes are ectothermic, amniote vertebrates covered in overlapping scales. Many species of snakes have skulls with several more joints than their lizard ancestors, enabling them to swallow prey much larger than their heads with their highly mobile jaws. To accommodate their narrow bodies, snakes' paired organs (such as kidneys) appear one in front of the other instead of side by side, and most have only one functional lung. Some species retain a pelvic girdle with a pair of vestigial claws on either side of the cloaca. Lizards have evolved elongate bodies without limbs or with greatly reduced limbs about twenty-five times independently via convergent evolution, leading to many lineages of legless lizards. Legless lizards resemble snakes, but several common groups of legless lizards have eyelids and external ears, which snakes lack, although this rule is not universal. The snakes below are ordered from most venomous to least venomous, but don't be fooled - they can all kill you under the right circumstances.

Treatment
The application of a compression bandage above the wound and the availability and administration of a polyvalent (broad-spectrum) antivenom in the local hospital can save your life.

Dubois' Sea Snake

Aipysurus duboisii, also known as the Dubois' sea snake or reef shallows sea snake, is a species of venomous sea snake. Adults of A. duboisii grow up to 148 cm (4.86 feet) in total length (including tail) but usually to around 80 cm (2.6 feet). The head is slightly wider than the neck with nostrils on its upper part and nasals contacting each other.

Eyes are separated from supralabial scales by a row of large subocular scales. Dorsal scales are usually smooth, but sometimes have a small keel or small knobs. Individuals vary significantly in colour and its body patterns. The tail is relatively long; the chin and throat have lighter colour than rest of the body.

Habitat
Its geographic range includes Papua New Guinea, New Caledonia and the northern, eastern and western coastal areas of Australia, that is the Coral Sea, Arafura Sea, Timor Sea and Indian Ocean. They live at depths up to 80 meters (262 feet) in coral reef flats, sandy and silty sediments which contain seaweed, invertebrates and corals or sponges that can serve as shelter.

Venom
The fangs are 1.8 mm long, which are relatively short for a snake, and the venom yield is 0.43 mg. Aipysurus duboisii is a crepuscular species, meaning that they are most active at dawn and dusk. It is the most venomous sea snake, and one of the top three most venomous snakes in the world. The most venomous sea snake in the world and one of the top three most venomous snakes in the world

Aggressiveness
They have medium aggressiveness, i.e., will bite if provoked, but not spontaneously.

Inland Taipan

The inland taipan (Oxyuranus microlepidotus), also commonly known as the western taipan, the small-scaled snake, or the fierce snake, is an extremely venomous snake of the taipan (Oxyuranus) genus. The inland taipan is dark tan, ranging from a rich, dark hue to a brownish light-green, depending on season. Its back, sides and tail may be different shades of brown and grey, with many scales having a wide blackish edge. These dark-marked scales occur in diagonal rows so that the marks align to form broken chevrons of variable length that are inclined backward and downward.

The lowermost lateral scales often have an anterior yellow edge. The dorsal scales are smooth and without keels. The round-snouted head and neck are usually noticeably darker than the body (glossy black in winter, dark brown in summer), the darker colour allowing the snake to heat itself while only exposing a smaller portion of the body at the burrow entrance.

The eye is of average size with a blackish brown iris and without a noticeable coloured rim around the pupil. It has 23 rows of dorsal scales at midbody, between 55 and 70 divided subcaudal scales, and one anal scale. The inland taipan averages approximately 1.8 metres (5.9 ft) in total length, although larger specimens can reach total lengths of 2.5 metres (8.2 ft). Its fangs are between 3.5 and 6.2 mm long (shorter than those of the coastal taipan).

Habitat
It's endemic to semi-arid regions of central east Australia. The inland taipan inhabits the black soil plains in the semi-arid regions where Queensland and South Australia borders converge. Because it lives in such remote locations, the inland taipan seldom comes in contact with people; therefore it is not considered the most deadly snake in the world overall, especially in terms of disposition and human deaths per year. The word "fierce" from its alternative name describes its venom, not its temperament.

Venom
The inland taipan is the most venomous snake in the world. Its venom, drop for drop, is by far the most toxic of any snake. Unlike most snakes, the inland taipan is a specialist mammal hunter so its venom is specially adapted to kill warm-blooded species. It is estimated that one bite possesses enough lethality to kill at least 100 fully grown men, and, depending on the nature of the bite, it has the potential to kill someone in as little as 30 to 45 minutes if left untreated.

The average quantity of venom delivered by this species is 44 mg and the maximum dose recorded is 110 mg, compared to the Indian cobra (Naga raja) 169 mg/max 610 mg, and the North American eastern diamondback rattlesnake (Crotalus adamanteus) 410 mg/max 848 mg etc. The median lethal dose (LD50), subcutaneous (the most applicable to actual bites) for mice is 0.025 mg/kg (0.01 mg/kg subcutaneous, in bovine serum albumin).

Compared to the beaked sea snake (Enhydrina schistosa) 0.164 mg/kg, Indian cobra 0.565 mg/kg, North American eastern diamondback rattlesnake 11.4 mg/kg, etc., the inland taipan has a smaller venom yield than its cousin the coastal taipan yet its venom is almost four times as toxic. One bite's worth of venom is enough to kill 100 fully grown men. It is an extremely fast and agile snake that can strike instantly with extreme accuracy, often striking multiple times in the same attack, and it envenoms in almost every case.

Although extremely venomous and a capable striker, in contrast to the rather aggressive coastal taipan, the inland taipan is usually quite a shy and reclusive snake, with a placid disposition, and prefers to escape from trouble. However, it will defend itself and strike if provoked, mishandled, or prevented from escaping.

Clinical Effects
The mortality rate is high in untreated cases:
Dangerousness of bite: Severe envenomation likely, high lethality potential.
Rate of envenoming: >80%
Untreated lethality rate: >80%

Inland taipans adapt to their environment by changing the colour of the skin during seasonal changes. They tend to become lighter during summer and darker during the winter. This seasonal colour change serves the purpose of thermoregulation, allowing the snake to absorb more light in the colder months.

Aggressiveness
Many reptile keepers consider it a placid snake to work with.
Inland taipans are rarely encountered in the wild by the average person because of their remoteness and brief above-ground appearance during the day. So long as a person is not creating much vibration and noise the inland taipan may not feel alarmed or bothered by a human presence. However, caution should be exercised and a safe distance maintained as it can inflict a potentially fatal bite. The inland taipan will defend itself and strike if provoked, mishandled, or prevented from escaping. Firstly, but not always, it makes a threat display by raising its forebody in a tight low S-shaped curve with its head facing the threat. Should the person choose to ignore the warning the inland taipan will strike. It is an extremely fast and agile snake that can strike instantly with extreme accuracy, and it envenoms in almost every case.

Symptoms
The first local and general symptoms of a bite are local pain and variable non-specific effects which may include headache, nausea, vomiting, abdominal pain, diarrhoea, dizziness, collapse or convulsions leading to major organ effects: neurotoxicity, coagulopathy, rhabdomyolysis or renal failure/damage and finally death. Inland taipan snake venom contains potent presynaptic neurotoxins (toxins in venom that cause paralysis or muscle weakness). Also present are postsynaptic neurotoxins, which are less potent but more rapid acting than the presynaptic neurotoxins. Presynaptic neurotoxins disrupt neurotransmitter release from the axon terminal. This takes days to resolve and does not respond to antivenom.

Eastern Brown Snake

The eastern brown snake, often referred to as the common brown snake, is an extremely venomous snake of the family Elapidae, native to eastern and central Australia and southern New Guinea. Considered the world's second-most venomous land snake after the Inland Taipan and based on its LD50 value (subcutaneous) in mice, it is responsible for about 60% of snake-bite deaths in Australia. The eastern brown snake is of slender to average build with no demarcation between its head and neck.

Its snout appears rounded when viewed from above. Most specimens have a total length (including tail) up to 1.5 m (4.9 ft), with some large specimens reaching 2 m (6.6 ft). The maximum recorded size for the species is 2.4 m (7.9 ft). There is evidence that snakes from the northern populations tend to be larger than those from southern populations. The adult eastern brown snake is variable in colour. Its upperparts range from pale to dark brown, or sometimes shades of orange or russet, with the pigment more richly coloured in the posterior part of the dorsal scales. Eastern brown snakes from Merauke have tan to olive upperparts, while those from eastern Papua New Guinea are very dark grey-brown to blackish. It has a dark tongue. The iris is blackish with a paler yellow-brown or orange ring around the pupil.

Habitat
The eastern brown snake is found along the east coast of Australia, from Malanda in far north Queensland, along the coasts and inland ranges of Queensland, New South Wales, Victoria, and to the Yorke Peninsula in South Australia. Disjunct populations occur on the Barkly Tableland and the MacDonnell Ranges in the Northern Territory and the far east of the Kimberley in Western Australia, and discontinuously in parts of New Guinea, specifically northern Milne Bay Province and Central Province in Papua New Guinea, and the Merauke region of Papua Province, in the Indonesian part of New Guinea. It is common in south-eastern Queensland between Ipswich and Beenleigh. The eastern brown snake is found in most habitats except dense forests. It has become more common in farmland and on the outskirts of urban areas, benefitting from agriculture due to the increased numbers of its main prey, the introduced house mouse.

Venom
The eastern brown snake is considered to be the second-most venomous terrestrial snake in the world, behind only the inland taipan of central east Australia. It is the most commonly encountered dangerous snake in Adelaide, and is also found in Melbourne, Canberra, Sydney, and Brisbane. It is classified as a snake of medical importance by the World Health Organization. Clinically, the venom of the eastern brown snake is known to cause diarrhoea, dizziness, collapse or convulsions, renal failure, paralysis, and cardiac arrest. Without medical treatment, bites can be fatal. As this species tends to initiate its defence with nonfatal bites, the untreated mortality rate in most snakebite cases reported is 10–20%, a relatively low figure.
As a genus, brown snakes accounted for 41% of identified snakebite victims in Australia between 2005 and 2015, with 15 deaths recorded.

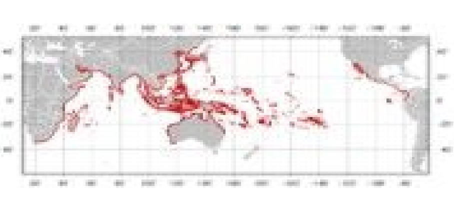
Aggressiveness
The eastern brown snake reacts when confronted with one of two neck displays. During a partial display, the snake raises the front part of its body horizontally just off the ground, flattening its neck and sometimes opening its mouth. In a full display, the snake rises up vertically high off the ground, coiling its neck into an S shape, and opening its mouth. The snake is able to strike more accurately from a full display and more likely to deliver an envenomed bite. Due to the snake's height off the ground in full display, the resulting bites are often on the upper thigh.

Behaviour
The eastern brown snake is active during the day, though it may retire in the heat of hot days to come out again in the late afternoon. It is most active in spring, with males venturing out earlier in the season than females, and is sometimes active on warm winter days. Individuals have been recorded basking on days with temperatures as low as 14 °C (57 °F). Occasional nocturnal activity has been reported. Australian naturalist David Fleay reported it could outpace a person running at full speed. Many people mistake defensive displays for aggression. A field study in farmland around Leeton that monitored 455 encounters between eastern brown snakes and people found that the snake withdrew around half the time and tried to hide for almost all remaining encounters. In only 12 encounters did the snake advance. They noted that snakes were more likely to notice dark clothing and move away early, reducing the chance of a close encounter. Close encounters were more likely if a person was walking slowly, but a snake was less likely to be aggressive in this situation.

Yellow Bellied Sea Snake

Hydrophis platurus, commonly known as the yellow-bellied sea snake, yellowbelly sea snake or pelagic sea snake, is a species of snake from the subfamily Hydrophiinae (the sea snakes) found in tropical oceanic waters around the world except for the Atlantic Ocean. The yellow-bellied sea snake, as the name implies, has a distinctive bicolor pattern with a yellow underbelly and brown back, making it easily distinguishable from other sea snake species.

Yellow-bellied sea snakes, like many other species of sea snake, are fully adapted to living their whole lives at sea: mating, eating and giving birth to live young (ovoviviparous). Adaptations to aquatic life include the reduced ventral scale size, laterally compressed body and paddle-tail for swimming, valved nostrils and palatine seal for excluding seawater, and cutaneous gas exchange for prolonging dive times.



Habitat
The yellow-bellied sea snake is one of the most widely distributed snakes in the world. It is completely pelagic and is often observed on oceanic drift lines, using surface currents and storms to move around the ocean. Their distribution appears to be largely determined by favourable water temperatures, oceanic currents and recent formation of land bridges that have blocked farther dispersal. The yellow-bellied sea snake has an extensive distribution covering the entire tropical Indo-Pacific, as well as extending to Costa Rica, southern California, and northern Peru. It is the only sea snake to have reached the Hawaiian Islands. The sea snake has also been reported in colder waters such as the coasts of southern California, Tasmania, and New Zealand, a country that would otherwise be free of snakes were it not for the infrequent visits of yellow-bellied sea snake and banded sea kraits. These cold water occurrences are believed to be linked with el Niño events or severe storms.

Venom
The venom of this species is highly potent, like that of other sea snakes. The subcutaneous LD50 of the venom is 0.067 mg/kg and the venom yield per bite is 1.0–4.0 mg. Yellow-bellied sea snake venom contains several different neurotoxins and two other isotoxins. Sea snake venom can cause damage to skeletal muscle with consequent myoglobinuria, neuromuscular paralysis or direct renal damage. The venoms of significant species of sea snake are neutralised with Commonwealth Serum Laboratories Ltd (of Melbourne, Australia) sea snake (Enhydrina schistosa) antivenom.

Peron's Sea Snake

Hydrophis peronii, commonly known as the spiny-headed seasnake, Peron's sea snake, or the horned sea snake, endemic to the western tropical Pacific Ocean. It is the only sea snake with spines on the head. Like other members of the family, Hydrophiidae or Elapidae, it is venomous. It is sometimes placed in its own genus Acalyptophis. The spiny-headed seasnake is a medium-size snake, with the diameter of the neck only one third to two fifths the diameter of the thickest part of the body.

The head is small and the tail flattened laterally. The supraoculars are raised, and their free borders are pointed. This species reaches a snout-vent length of up to 1.23 m (4.0 ft). Dorsally, it is grayish, pale olive, or tan, with dark crossbands, which are narrower than the spaces between them and taper to a point on the sides of the belly. Ventrally, it is uniform whitish or with a series of dark crossbars alternating with spots.

Habitat
It is found in the Gulf of Siam, Thailand, Vietnam, the South China Sea, the coast of Guangdong and Strait of Taiwan, the Philippines, Indonesia, New Guinea, New Caledonia, the Coral Sea Islands, Papua New Guinea, and Australia, (North Territory, Queensland, West Australia, & possibly New South Wales). It prefers seas with sandy beds and coral reefs.

Coastal Taipan

The coastal taipan (Oxyuranus scutellatus), or common taipan, is a species of large, extremely venomous snake in the family Elapidae. The species is native to the coastal regions of northern and eastern Australia and the island of New Guinea. According to most toxicological studies, this species is the third-most venomous land snake in the world. The coastal taipan is the longest venomous snake in Australia. Adult specimens of this species typically attain sexual maturity around 1.2 m (3.9 ft) in total length (including tail).

More mature specimens can grow to between 1.5 and 2.0 m (4.9 and 6.6 ft). Other taipans, including the inland taipan, attain broadly similar sizes although they tend to be slightly smaller in average size. A specimen of an average 2 m (6.6 ft) total length weighs around 3 kg (6.6 lb). The head of the coastal taipan is long and narrow like that of the African black mamba, but without the "coffin" shape.

The two species are strongly convergent in several aspects of morphology, ecology and behaviour. O. scutellatus has an angular brow and is lighter-coloured on the face. The body is slender and colouration can vary. It is often uniformly light olive or reddish-brown in colour, but some specimens may be dark gray to black. The colouration is lighter on the sides of the body, and the ventral side (the belly) is usually a creamy-white to a pale light yellow in colour, and is often marked with orange or pink flecks. Individuals undergo a seasonal change in colour, becoming darker in winter and fading in summer.

Habitat
The coastal taipan occurs only in Australia and the island of New Guinea, which comprises two Indonesian provinces on the west side of the island and the nation of Papua New Guinea on the east side of the island. Found in northern and eastern Australia, the coastal taipan, despite its name, can live in habitats hundreds of kilometres away from the nearest beach. Its geographical range extends from north-western Western Australia, the Northern Territory, across Cape York Peninsula and down eastern Queensland into northern New South Wales (as far south as Grafton). However, the coastal taipan is not found in regions where the maximum winter temperature is below 20 °C (68 °F). The second subspecies (Oxyuranus scutellatus canni) is found throughout the island of New Guinea, with higher concentrations of the snake being found in the nation of Papua New Guinea.

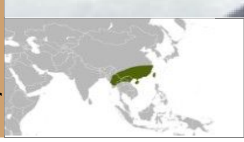
Venom
Oxyuranus scutellatus is the world's third-most venomous snake. Its venom contains primarily taicatoxin, a highly potent neurotoxin affecting the nervous system and the blood's ability to clot. Bite victims may experience headache, nausea/vomiting, collapse, convulsions, paralysis, internal bleeding, myolysis (destruction of muscle tissue), and kidney damage. In cases of severe envenomation, death can occur as early as 30 minutes after being bitten, but the average is around 2.5 hours. The time between a bite and death depends on various factors such as the nature of the bite and the constitution of the victim.

Aggressiveness
It is not a confrontational snake and will seek to escape any threat. When cornered, though, it can become very aggressive and may strike repeatedly.

Many-Banded Krait

The many-banded krait (Bungarus multicinctus), also known as the Taiwanese krait or the Chinese krait, is a highly venomous species of elapid snake found in much of central and southern China and Southeast Asia. The species was first described by the scientist Edward Blyth in 1861. The many-banded krait is a medium to large sized species of snake, averaging 1 to 1.5 m (3.3 to 4.9 ft) in length, with maximum lengths reaching 1.85 m (6.1 ft). Its body is slender and moderately compressed. The scales of this species are smooth and glossy, with a noticeably distinct vertebral ridge.

The colour of the snake is black to dark bluish-black with approximately 21–30 white or creamy white cross bands along the entire length of its upper body. More banding is seen in longer than average sized specimens. The tail is short and pointed, that is also black in colour with alternating white cross bands, of which there are 7–11. The belly of the snake is usually white in colour, but could be an off white or creamy white.



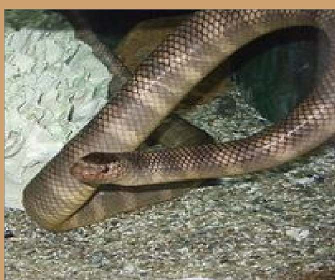
Habitat
This species is found throughout Taiwan (including the Archipelagos of Matsu and Kinmen), in the central and southern regions of mainland China (in the provinces of Hainan, Anhui, Sichuan, Guangdong, Guangxi, Hunan, Hubei, Yunnan, Guizhou, Jiangxi, Zhejiang, and Fujian), Hong Kong, Myanmar (Burma), Laos, and northern Vietnam. It may also be found in Thailand.

Venom
The venom of the many-banded krait consists of both pre- and postsynaptic neurotoxins (known as a-bungarotoxins and β-bungarotoxins, among others). By weight, almost half of the protein content of the venom is composed of β-bungarotoxins.
The average venom yield from specimens kept on snake farms is about 4.6 mg—19.4 mg per bite. Based on several LD50 studies, the many-banded krait is among the most venomous land snakes in the world.

Behaviour
The snake is nocturnal, and may be more defensive at night. It is, however, a timid and placid species of snake. In the daytime, it hides under stones or in holes. The snake appears from April and retreats into hibernation in November. It is considered to be more defensive than the Banded krait (Bungarus fasciatus), thrashing about as it is handled. Unlike other Bungarus species, who are primarily snake-eaters, the many-banded krait usually feeds on fish, but it is also preys on other species of snakes, including members of its own species. This species also feeds on rodents, eels, frogs, and occasionally lizards.

Symptoms
The local symptoms of victims bitten by the many-banded krait are usually neither serious swelling nor pain; the victims merely feel slightly itchy and numb. Systemic symptoms occur, in general, one to six hours after being bitten by this snake. Symptoms may include bilateral ptosis, diplopia, discomfort in the chest, general ache, weak feeling in limbs, ataxia, glossolysis, loss of voice, dysphagia, tunnel vision, and difficulty breathing. In case of serious bite, suppression of breathing may occur, leading to death. Hyponatremia is also seen, but less commonly. Estimated mortality rates associated with untreated bites from this species vary between studies from 25–35% to 70–100%. During the Vietnam War, American soldiers referred to the many-banded krait as the "two-step Charlies," in the mistaken belief that its venom was lethal enough to kill within two steps. The many-banded krait gathered worldwide attention after a juvenile individual bit and killed Dr. Joe Slowinski on September 11, 2001 in Myanmar. He died 29 hours after being bitten.

Black-Banded Sea Krait

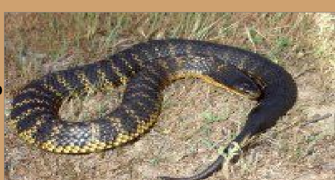


The black-banded sea krait, or Chinese sea snake (Laticauda semifasciata), known in Japan as erabu umi hebi, and Okinawa as the irabu, is a member of the Laticauda genus of sea snakes. It is found in most of the warm wāters of the western Pacific Ocean. This high snake frequents coral reef areas. It has a short head, thick trunk, and no easily discernible neck. The tail is simply extended skin, spread wide like a fin, and unsupported by any projection. Only 1 out of 3 will produce fangs. The stomach is comparatively wide. Massing together near the shore, they breed between narrow cracks in the reef and in caves. It is a nocturnal snake, rarely seen during the day.

It breathes air, so breaks the surface at least once every six hours. It is too slow to catch fish in a straight chase, so it hunts for fish hiding in the coral. Alternately, gathering in the hundreds, black-banded sea kraits form hunting alliances with yellow goatfish and bluefin trevally, flushing potential prey from narrow crannies in a reef the same way some moray eels do. The bite is highly venomous and paralyses the prey. Females lay their eggs on land.

Habitat
Generally, the species is found in Fiji, southern Japan and Singapore. Their venom is ten times stronger than that of a cobra, making them extremely dangerous. This snake does not bite humans unless it feels threatened.

Black Tiger Snake



See Below for the Tiger Snake Information.

Habitat
The black tiger snake is only found on the island of Tasmania. This species of snake inhabits dense woodland, heathy shrub land and dense tussock grassland, often around waterways and swamps.

Western Tiger Snake

Tiger snakes (Notechis scutatus) are a highly venomous snake species found in the southern regions of Australia, including its coastal islands, such as Tasmania. These snakes are highly variable in their colour, often banded like those on a tiger, and forms in their regional occurrences. All populations are in the genus Notechis, and their diverse characters have been described in further subdivisions of this group; they are sometimes described as distinct species and/or subspecies.

Notechis is a genus of large venomous snake in the family Elapidae restricted to subtropical and temperate regions of Australia. Tiger snakes are a large group of distinct populations, which may be isolated or overlapping, with extreme variance in size and colour. Individuals also show seasonal variation in colour.

The total length is typically about 1.2 metres The patterning is darker bands, strongly contrasting or indistinct, which are pale to very dark in colour. Colouration is composed of olive, yellow, orange-brown, or jet-black, and the underside of the snake is light yellow or orange. The tiger snake uses venom to dispatch its prey, and may bite an aggressor; they are potentially fatal to humans. Tolerant of low temperatures, the snake may be active on warmer nights. When threatened, they flatten their bodies and raise their heads above the ground in a classic prestrike stance.

Habitat
Tiger snakes are found in coastal environments, wetlands, and creeks where they often form territories. Areas with an abundance of prey can support large populations. The species' distribution extends from the south of Western Australia through to South Australia, Tasmania, including Savage River National Park up through Victoria, and New South Wales. Its common habitat includes the coastal areas of Australia.

Venom
Tiger snakes accounted for 17% of identified snakebite victims in Australia between 2005 and 2015, with four deaths recorded from 119 confirmed envenomations. Tiger snake venoms possess potent neurotoxins, coagulants, haemolysins, and myotoxins. Symptoms of a bite include localized pain in the foot and neck region, tingling, numbness, and sweating, followed by a fairly rapid onset of breathing difficulties and paralysis. In a study, the mortality rate from untreated bites is reported to be between 40 and 60%.

Treatment
Treatment is the same for all Australian venomous snakes. The pressure immobilization method is used to inhibit the flow of venom through the lymphatic system. Broad, thick bandages are applied over the bite, then down and back along the limb to the armpit or groin. The affected limb is then immobilized with a splint. Identification of the venom is possible if traces are left near the wound. Identifying the snake is not necessary if bitten in Tasmania, because the same antivenom is used to treat all Tasmanian snakes' bites. The availability of antivenom has greatly reduced the incidence of fatal tiger snake bites. Among the number of deaths caused by snakebite in Australia, those from tiger snakes are exceeded only by the brown snake.

Beaked Sea Snake

Enhydrina schistosa, commonly known as the beaked sea snake, hook-nosed sea snake, common sea snake, or the Valakadyn sea snake, is a highly venomous species of sea snake common throughout the tropical Indo-Pacific. This species is implicated in more than 50% of all bites caused by sea snakes, as well as the majority of envenomings and fatalities.

The rostral scale is longer than broad, and is in contact with four shields; frontal more long than broad, shorter than the parietals; nasals in contact with the two anterior labials; sometimes partially divided; one pre- and one or two postoculars; temporals I–3; seven or eight upper labials, fourth or third and fourth entering the eye, the last sometimes divided; anterior chin-shields rather indistinct, separated.

Scales with a tubercle or keel, in 50–70 rows; ventrals 230–314, slightly enlarged. The snake is usually uniformly dark grey above; sides and lower parts whitish. Young specimens olive or grey with black transverse bands, broadest in the middle. Length of head and body 1110 mm; tail 190 mm.

Distribution
It is found in the Arabian Sea and Persian Gulf (off Oman), south of the Seychelles and Madagascar, the seas off South Asia (Pakistan, India and Bangladesh), Southeast Asia (Myanmar (formerly Burma), Thailand, Vietnam). Snakes from Australia (Northern Territory and Queensland) and New Guinea are now provisionally identified as Enhydrina zweifeli, due to DNA tests that have shown they are not related to Enhydrina schistosa.

Habitat
These snakes are generally found in the coast and coastal islands of India. They are amongst the most common of the 20 kinds of sea snakes found in that region. They are active both during the day and at night. They are able to dive up to 100 m and stay underwater for a maximum of five hours before resurfacing. Sea snakes are equipped with glands to eliminate excess salt. They are venomous and notably aggressive, with some herpetologists describing them as "cantankerous and savage". About 1.5 milligrams of its venom is estimated to be lethal.

Venom
The venom of this species is made up of highly potent neurotoxins and myotoxins. This widespread species is responsible for the vast majority of deaths from sea snake bites (up to 90% of all sea snake bites). The LD50 value is 0.1125 mg/kg based on toxicology studies. The average venom yield per bite is approximately 7.9–9.0 mg, while the lethal human dose is estimated to be 1.5 mg.

Black Mamba

The black mamba (Dendroaspis polylepis) is a species of extremely venomous snake native to parts of Sub-Saharan Africa. First formally described by Albert Günther in 1864, it is the second-longest venomous snake after the king cobra; mature specimens generally exceed 2 metres (6.6 feet) and commonly grow to 3 m (10 ft). Specimens of 4.3 to 4.5 m (14.1 to 14.8 ft) have been reported. Its skin colour varies from grey to dark brown. Juvenile black mambas tend to be paler than adults and darken with age.

The species is both terrestrial (ground-living) and arboreal (tree-living); it inhabits savannah, woodland, rocky slopes and in some regions, dense forest. It is diurnal and is known to prey on birds and small mammals. Over suitable surfaces, it can move at speeds up to 16 km/h (10 mph) for short distances. Adult black mambas have few natural predators. The black mamba is a long, slender, cylindrical snake. It has a "coffin-shaped" head with a somewhat pronounced brow ridge and a medium-sized eye.

The adult snake's length typically ranges from 2 to 3 m (6 ft 7 in to 9 ft 10 in) but specimens have grown to lengths of 4.3 to 4.5 m (14.1 to 14.8 ft). It is the second-longest venomous snake species, exceeded in length only by the king cobra. The black mamba is a proteroglyphous (front-fanged) snake, with fangs up to 6.5 mm (0.26 in) in length, located at the front of the maxilla. The tail of the species is long and thin, the caudal vertebrae making up 17–25% of its body length. Black mambas weigh about 1.6 kg (3.5 lb) on average.

Distribution
The black mamba inhabits a wide range in Sub-Saharan Africa; its range includes Burkina Faso, Cameroon Central African Republic, Democratic Republic of the Congo, South Sudan, Ethiopia, Eritrea, Somalia, Kenya, Uganda, Tanzania, Burundi, Rwanda, Mozambique, Swaziland, Malawi, Zambia, Zimbabwe, Botswana, South Africa, Namibia, and Angola. The black mamba's distribution in parts of West Africa has been disputed.

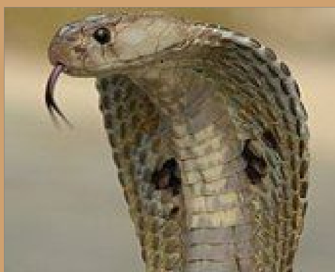
Habitat
The species prefers moderately dry environments such as light woodland and scrub, rocky outcrops and semi-arid savannah. It also inhabits moist savannah and lowland forests. It is not commonly found at altitudes above 1,000 m (3,300 ft), although its distribution does include locations at 1,800 m (5,900 ft) in Kenya and 1,650 m (5,410 ft) in Zambia. It is rated as a species of least concern on the International Union for Conservation of Nature (IUCN)'s Red List of Endangered species, based on its huge range across sub-Saharan Africa and no documented decline.

Behaviour
The black mamba is both terrestrial and arboreal. On the ground, it moves with its head and neck raised, and typically uses termite mounds, abandoned burrows, rock crevices and tree cracks as shelter. Black mambas are diurnal; in South Africa, they are recorded to bask between 7 and 10 am and again from 2 to 4 pm. They may return daily to the same basking site. Skittish and often unpredictable, the black mamba is agile and can move quickly. In the wild, black mambas seldom tolerate humans approaching more closely than about 40 metres (130 ft). When it perceives a threat, it retreats into brush or a hole. When confronted it is likely to engage in a threat display, gaping to expose its black mouth and flicking its tongue. It also is likely to hiss and spread its neck-flap.

Aggressiveness
In a threat display, the black mamba usually opens its inky-black mouth, spreads its narrow neck-flap and sometimes hisses. It is capable of striking at considerable range and may deliver a series of bites in rapid succession. Its venom is primarily composed of neurotoxins that often induce symptoms within ten minutes, and is frequently fatal unless antivenom is administered. Despite its reputation as a formidable and highly aggressive species, the black mamba only attacks humans if it is threatened or cornered.

Venom
The black mamba is the most feared snake in Africa because of its size, aggression, toxicity and speed of onset of symptoms. Unlike many venomous snake species, black mamba venom does not contain protease enzymes. Its bites do not generally cause local swelling or necrosis, and a tingling sensation in the bitten area might be the only initial symptom. The snake tends to bite repeatedly and let go, so there might be multiple puncture wounds. Its bite can deliver about 100–120 mg of venom on average. Bites were often fatal before antivenom was widely available. The venom is predominantly neurotoxic; symptoms often become apparent within ten minutes. Early neurological signs that indicate severe envenoming include metallic taste, drooping eyelids (ptosis) and gradual symptoms of bulbar palsy. Other neurological symptoms include miosis, blurred or diminished vision, paresthesia, dysarthria, dysphagia, dyspnea, difficulty handling oral secretions, an absent gag reflex, fasciculations, ataxia, vertigo, drowsiness and loss of consciousness, and respiratory paralysis. Other more general symptoms include nausea and vomiting, abdominal pain, diarrhoea, sweating, salivation, goosebumps and red eyes. The bite of a black mamba can cause collapse in humans within 45 minutes or less. Without appropriate antivenom treatment, symptoms typically progress to respiratory failure, which leads to cardiovascular collapse and death. This typically occurs in 7 to 15 hours.

Indian Cobra



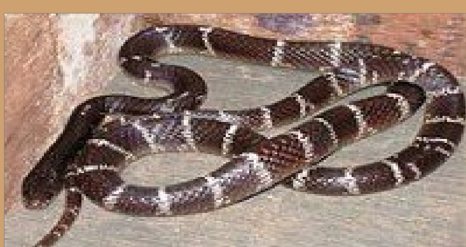
The Indian cobra (Naja naja) also known as the spectacled cobra, Asian cobra, or binocellate cobra is a species of the genus Naja found in India, Pakistan, Bangladesh, Sri Lanka, Nepal, and Bhutan, and a member of the "big four" species that inflict the most snakebites on humans in India. It is distinct from the king cobra which belongs to the monotypic genus Ophiophagus. The Indian cobra varies tremendously in colour and pattern throughout its range.

The ventral scales or the underside colouration of this species can be grey, yellow, tan, brown, reddish or black. Dorsal scales of the Indian cobra may have a hood mark or colour patterns. The most common visible pattern is a posteriorly convex light band at the level of the 20th to 25th ventrals. Salt-and-pepper speckles, especially in adult specimens, are seen on the dorsal scales. Specimens, particularly those found in Sri Lanka may exhibit poorly defined banding on the dorsum.

Habitat
The Indian cobra is native to the Indian subcontinent and can be found throughout India, Pakistan, Sri Lanka, Bangladesh, and southern Nepal. In India, it may or may not occur in the state of Assam, some parts of Kashmir, and it does not occur in high altitudes of over 2,000 metres (6,600 ft) and extreme desert regions. In Pakistan, it is absent in most of Balochistan province, parts of North-West Frontier Province, desert areas elsewhere and Northern Areas. The most westerly record comes from Duki, Balochistan in Pakistan, while the most easterly record is from the Tangail District in Bangladesh. As this species has been observed in Drosh, in the Chitral Valley, it may also occur in the Kabul River Valley in extreme eastern Afghanistan. There's been at least one report of this species occurring in Bhutan.

Venom
The Indian cobra's venom mainly contains a powerful post-synaptic neurotoxin and cardiotoxin. The venom acts on the synaptic gaps of the nerves, thereby paralysing muscles, and in severe bites leading to respiratory failure or cardiac arrest. The venom components include enzymes such as hyaluronidase that cause lysis and increase the spread of the venom. Envenomation symptoms may manifest between 15 minutes and 2 hours following the bite. The Indian cobra is one of the big four snakes of South Asia which are responsible for the majority of human deaths by snakebite in Asia. Polyvalent serum is available for treating snakebites caused by these species. Zedoary, a local spice with a reputation for being effective against snakebite, has shown promise in experiments testing its activity against cobra venom. The venom of young cobras has been used as a substance of abuse in India, with cases of snake charmers being paid for providing bites from their snakes. Though this practice is now seen as out-dated, symptoms of such abuse include loss of consciousness, euphoria, and sedation.

Common Krait



The common krait (Bungarus caeruleus), also known as Indian krait or blue krait) is a species of venomous snake of the genus Bungarus found in the jungles of the Indian subcontinent. It is a member of the "big four" species, inflicting the most snakebites on humans in India. The average length is 0.9 m (3.0 ft), but they can grow to 1.75 m (5 ft 9 in). Males are longer, with proportionately longer tails. The head is flat and the neck hardly evident. The body is cylindrical, tapering towards the tail. The tail is short and rounded.

The eyes are rather small, with rounded pupils, indistinguishable in life. The head shields are normal, with no loreals; four shields occur along the margin of the lower lip; the third and fourth supraoculars touch the eye. The scales are highly polished, in 15-17 rows; the vertebral row is distinctly enlarged and hexagonal. Ventrals number 185-225 and caudals 37-50, entire. Colouration is generally black or bluish black, with about 40 thin, white crossbars which may be indistinct or absent anteriorly.

The pattern, however, is complete and well defined in the young, which are marked with conspicuous crossbars even anteriorly; in old individuals, the narrow white lines may be found as a series of connected spots, with a prominent spot on the vertebral region. A white preocular spot may be present; the upper lips and the belly are white.

Habitat
This species is found in main Peninsular India from Sindh (Pakistan), to the West Bengal plains. It occurs throughout South India and Sri Lanka at elevations up to about 1600 m. It is also recorded from Afghanistan, Bangladesh, and Nepal. Its range comprises a wide variety of habitats. It is found in fields and low scrub jungle, as well as inhabited areas. It is known to take up residence in termite mounds, brick piles, rat holes, even inside houses. It is frequently found in water or in proximity to a water source.

Venom
The common krait's venom consists mostly of powerful neurotoxins, which induce muscle paralysis. Clinically, its venom contains presynaptic and postsynaptic neurotoxins. Kraits are nocturnal, so seldom encounter humans during daylight hours; incidents occur mainly at night. Frequently, little or no pain occurs from a krait bite, and this can provide false reassurance to the victim. Typically, victims complain of severe abdominal cramps, accompanied by progressive paralysis. If death occurs, it takes place about four to eight hours after the krait bite. Cause of death is general respiratory failure, i.e. suffocation. Often during the rainy season, the snakes come out of their hiding places and find refuge inside dry houses. If bitten by a krait while sleeping, a victim may not realize he has been bitten, as the bite feels like that of an ant or mosquito. The victim may die without waking up. Krait bites are significant for eliciting minimal amounts of local inflammation/swelling. This may help in species identification if the snake has not been seen. The few symptoms of the bite include: tightening of the facial muscles in one to two hours of the bite; inability of the bite victim to see or talk, and, if left untreated, the patient may die from respiratory paralysis within four to five hours. A clinical toxicology study gives an untreated mortality rate of 70-80%.

Behaviour
Behavioural differences during day and night time have been reported in B. caeruleus. During the day, it is sluggish and generally docile. It often hides in rodent holes, loose soil, or beneath debris, so is rarely seen. It often rolls its body into a loose, coiled ball, keeping its head well concealed. When in this 'balled' condition, the snake allows considerable handling, but overhandling often instigates bites. However, at night, the snake is very active and escapes by hissing loudly, or keeping still, occasionally biting the source of the annoyance. When agitated, it will coil up with its head concealed and body flattened, and makes jerky movements. It may also lift its tail. It is reluctant to bite, but when it does, it typically holds on for a while, which enables it to inject considerable amounts of venom. It may become aggressive at night if threatened since this is its active time.

Russell's Viper

Russell's viper is a species of venomous snake in the family Viperidae. of venomous Old World vipers. The single member species, D. russelii, is found in Asia throughout the Indian subcontinent, much of Southeast Asia, southern China and Taiwan. D. russelii can grow to a maximum length (body + tail) of 166 cm (5.5 ft) and averages about 120 cm (4 ft) on mainland Asian populations. Island populations may be slightly smaller on average. It is more slender than most vipers.

The head is flattened, triangular, and distinct from the neck. The snout is blunt, rounded, and raised. The nostrils are large, each in the middle of a large, single nasal scale. The lower edge of the nasal scale touches the nasorostral scale. The supranasal scale has a strong crescent shape and separates the nasal from the nasorostral scale anteriorly. The rostral scale is as broad as it is high.

Geography
D. russelii is found in India, Sri Lanka, Bangladesh, Nepal, Myanmar, Thailand, Pakistan, Cambodia, Tibet, China (Guangxi, Guangdong), Taiwan and Indonesia (Endeh, Flores, east Java, Komodo, and Lomblen Islands). The type locality is listed as "India". More specifically, this would be the Coromandel Coast, by inference of Russell (1796).

Habitat
D. russelii is not restricted to any particular habitat, but does tend to avoid dense forests. The snake is mostly found in open, grassy or bushy areas, but may also be found in second growth forests (scrub jungles), on forested plantations and farmland. It is most common in plains, coastal lowlands, and hills of suitable habitat. Generally, it is not found at altitude, but has been reported as far up as 2300–3000 m (7,500-9,800 ft). Humid environments, such as marshes, swamps, and rain forests, are avoided.

Venom
Envenomation symptoms begin with pain at the site of the bite, immediately followed by swelling of the affected extremity. Bleeding is a common symptom, especially from the gums and in the urine, and sputum may show signs of blood within 20 minutes after the bite. The blood pressure drops, and the heart rate falls. Blistering occurs at the site of the bite, developing along the affected limb in severe cases. Necrosis is usually superficial and limited to the muscles near the bite, but may be severe in extreme cases. Vomiting and facial swelling occur in about one-third of all cases. Kidney failure (renal failure) also occurs in approximately 25-30 percent of untreated bites. Severe disseminated intravascular coagulation also can occur in severe envenomations. Early medical treatment and early access to antivenom can prevent and drastically reduce the chance of developing the severe/potentially lethal complications.

Severe pain may last for 2–4 weeks. Locally, it may persist depending on the level of tissue damage. Often, local swelling peaks within 48–72 hours, involving both the affected limb and the trunk. If swelling up to the trunk occurs within 1–2 hours, massive envenomation is likely. Discoloration may occur throughout the swollen area as red blood cells and plasma leak into muscle tissue. Death from septicaemia or kidney, respiratory, or cardiac failure may occur 1 to 14 days after the bite or even later.

Aggressiveness
When threatened, they form a series of S-loops, raise the first third of the body, and produce a hiss that is supposedly louder than that of any other snake. When striking from this position, they can exert so much force that even a large individual can lift most of its body off the ground in the process. These snakes are strong and may react violently to being picked up. The bite may be a snap, or they may hang on for many seconds.

Behaviour
D. russelii is terrestrial and active primarily as a nocturnal forager. However, during cool weather, it alters its behaviour and becomes more active during the day. Adults are reported to be slow and sluggish unless pushed beyond a certain limit, after which they can become very aggressive. Juveniles, though, are generally more nervous. When threatened, they form a series of S-loops, raise the first third of the body, and produce a hiss that is supposedly louder than that of any other snake. When striking from this position, they can exert so much force that even a large individual can lift most of its body off the ground in the process.

Saw-Scaled Viper

Echis is a genus of venomous vipers found in the dry regions of Africa, the Middle East, Pakistan, India, and Sri Lanka. They have a characteristic threat display, rubbing sections of their body together to produce a "sizzling" warning sound. The name Echis is the Latin transliteration of the Greek word for "viper". Their common name is "saw-scaled vipers" and they include some of the species responsible for causing the most snakebite cases and deaths in the world. Twelve species are currently recognized. Saw-scaled vipers are relatively small snakes, the largest species (E. leucogaster, E. pyramidum) usually below 90 cm (35 in) long, and the smallest (E. hughesi, E. jogeri) being around 30 cm (12 in).

Habitat
Species of this genus are found in Pakistan, India (in rocky regions of Maharashtra, Rajasthan, Uttar Pradesh, and Punjab) and Sri Lanka, parts of the Middle East, and Africa north of the equator.

Venom
The venom of Echis species consists mostly of hemotoxins and cytotoxins. The genus is recognized as medically significant in many tropical rural areas. They are widespread and live in areas lacking modern medical facilities. Most victims are bitten after dark when these snakes are active. Most of these species have venom that contains factors that can cause a consumption coagulopathy and defibrination, which may persist for days to weeks. This may result in bleeding anywhere in the body, including the possibility of an intracranial haemorrhage. The latter classically occurs a few days following the bite. The amount of venom produced also varies. Reported yields include 20–35 mg of dried venom from specimens 41–56 cm in length, 6–48 mg (16 mg average) from Iranian specimens and 13–35 mg of dried venom from animals from various other localities. Yield varies seasonally, as well as between the sexes: the most venom is produced during the summer months and males produce more than females.

Behaviour
All members of this genus have a distinctive threat display, which involves forming a series of parallel, C-shaped coils and rubbing them together to produce a sizzling sound, rather like water on a hot plate. The proper term for this is stridulation. As they become more agitated, this stridulating behaviour becomes faster and louder. This display is thought to have evolved as a means of limiting water loss, such as might occur when hissing. However, some authors describe this display as being accompanied by loud hissing. These snakes can be fierce and will strike from the position described above. When doing so, they may overbalance and end up moving towards their aggressor (an unusual behaviour for snakes).

Fer-De-Lance

Bothrops asper is a highly venomous pit viper species ranging from southern Mexico to northern South America and is considered to be one of the most dangerous snakes in the western hemisphere. Sometimes referred to as the "ultimate pit viper", these snakes are found in a wide range of lowland habitats, often near human habitations. Its proximity to human habitations and temperament are likely the reasons why it is considered more dangerous to humans than others. Bothrops species can be distinguished by their broad, flattened heads which are set apart from the rest of their bodies. The head of this snake is light to dark brown or even black. Although usually absent, it may have occipital blotches or streaks that range from indistinct to distinct. The underside is most often pale yellow. This species has different patterns and colours on its dorsal and ventral sides and it exhibits a postorbital stripe. The ventral side is yellow, cream, or a whitish gray, with dark blotches that are more frequent closer to the posterior end.

Distribution
It is found in the Atlantic lowlands of eastern Mexico and Central America, including Guatemala, Belize, Honduras, Nicaragua, Costa Rica and Panama. An isolated population occurs in south-eastern Chiapas (Mexico) and south-western Guatemala. In northern South America, it is found in Colombia, Ecuador, Guyana and Venezuela. The type locality given is "Obispo, on the Isthmus of Darien" (Panama). This is mostly a lowland species that, in Mexico and Central America, occurs from about sea level to 1,200 to 1,300 meters (3,900 to 4,300 ft) altitude. In South America, it apparently ranges to considerably higher elevations: up to 2,500 metres (8,200 ft) in Venezuela and at least 2,640 metres (8,660 ft) in Colombia according to herpetologist Lancini.

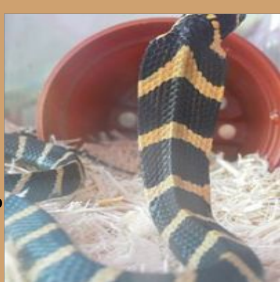
Habitat
This species likes moist environments, and occurs in most life zones located at low or middle elevations (up to 600 metres (2,000 ft)), excluding those with strong seasonal dry periods. They are, however, sometimes found at much higher elevations. This is true in the premontane forest in Costa Rica, the cloud forest of Guatemala and Mexico, or the lower montane wet forest in the Caribbean Region of Colombia and Ecuador. It chiefly inhabits tropical rainforest and evergreen forest, but it also occurs in drier areas of tropical deciduous forest, thorn forest and pine savannah near lakes, rivers and streams.

Venom
Together with Crotalus durissus, it is the leading cause of snakebite in Yucatán, Mexico. It is considered the most dangerous snake in Costa Rica, responsible for 46% of all bites and 30% of all hospitalized cases; before 1947, the fatality rate was 9%, but this has since declined to almost 0%. Bite symptoms include pain, oozing from the puncture wounds, local swelling that may increase for up to 36 hours, bruising that spreads from the bite site, blisters, numbness, mild fever, headache, bleeding from the nose and gums, hemoptysis, gastrointestinal bleeding, hematuria, hypotension, nausea, vomiting, impaired consciousness and tenderness of the spleen.

Aggressiveness
When cornered or threatened, this species can be very defensive and may exhibit an S-coiled defence display. Juveniles are often semiarboreal and even adults are sometimes encountered in bushes and low trees. Juveniles are also known to exhibit caudal luring, a use of their differently coloured tail tips to lure prey. Although both males and females display this behaviour, only males have bright coloured tail tips. Compared to the common lancehead, B. atrox, these snakes have been described as excitable and unpredictable when disturbed. They can, and often will, move very quickly, usually opting to flee from danger, but are capable of suddenly reversing direction to vigorously defend themselves. Adult specimens, when cornered and fully alert, should be considered dangerous. In a review of bites from this species suffered by field biologists, Hardy (1994) referred to it as the "ultimate pit viper".

Behaviour
This species is nocturnal and solitary. It is less active in colder and drier periods. B. asper is often found near rivers and streams, basking under the sun during the day and lying still while well camouflaged in leaf litter or under forest cover waiting to ambush prey (including rats and mice) that comes within range during the night.

King Cobra



The king cobra, also known as the hamadryad, is a venomous snake species in the family Elapidae, endemic to forests from India through Southeast Asia. It is threatened by habitat destruction and has been listed as Vulnerable on the IUCN Red List since 2010. It is the world's longest venomous snake. Adult king cobras are 3.18 to 4 m (10.4 to 13.1 ft) long. It preys chiefly on other snakes and occasionally on some other vertebrates, such as lizards and rodents. It is a dangerous snake that has a fearsome reputation in its range, although it typically avoids confrontation with humans when possible. The king cobra typically weighs about 6 kg (13 lb).

The skin of king cobra is dark olive or brown with black bands and white or yellow crossbands. The head is black with two crossbars near the snout and two behind the eyes. Adult king cobras are 3.18 to 4 m (10.4 to 13.1 ft) long. The longest known individual measured 5.85 m (19.2 ft). Its belly is cream or pale yellow. It has 17 to 19 rows of smooth scales. Ventral scales are uniformly oval shaped. Dorsal scales are placed in an oblique arrangement. Males have 235 to 250 ventral scales, while females have 239 to 265. The subcaudal scales are single or paired in each row, numbering 83 to 96 in males and 77 to 98 in females.

Habitat
The king cobra is distributed across the Indian subcontinent, Southeast Asia, and the southern areas of East Asia (where it is not common), in Bangladesh, Bhutan, Burma, Cambodia, China, India, Indonesia, Laos, Malaysia, Nepal, the Philippines, Singapore, Thailand, Vietnam and southern China. In India it has been recorded from Goa; Western Ghats of Karnataka, Kerala and Tamil Nadu; east coastline of Andhra Pradesh and Odisha; Sundarban mangroves; Himalayan foothills from Uttarakhand, Uttar Pradesh, Bihar, northern parts of West Bengal to most of the north-east region and Andaman Islands.

Venom
The venom of the king cobra consists primarily of neurotoxins, known as the haditoxin, with several other compounds. This species is capable of delivering a fatal bite and the victim may receive a large quantity of venom with a dose of 200 to 500 mg up to 7 ml. The toxins affect the victim's central nervous system, resulting in severe pain, blurred vision, vertigo, drowsiness, and eventually paralysis. If the envenomation is serious, it progresses to cardiovascular collapse, and the victim falls into a coma. Death soon follows due to respiratory failure. Bites from a king cobra may result in a rapid fatality which can be as early as 30 minutes after the envenomation. The king cobra's envenomation was even recorded to be capable of killing elephants within hours.

Aggressiveness
When annoyed, this species quickly attempts to escape and avoid confrontation. However, if continuously provoked, the king cobra can be highly aggressive. Wild king cobras, the snakes appear to be of rather placid disposition, and they usually end up being killed or subdued with hardly any hysterics. A good defence for anyone who accidentally encounters this snake is to slowly remove a shirt or hat and toss it to the ground while backing away.

Behaviour
A king cobra, like other snakes, receives chemical information via its forked tongue, which picks up scent particles and transfers them to a special sensory receptor (Jacobson's organ) located in the roof of its mouth. This is akin to the human sense of smell. When the scent of a meal is detected, the snake flicks its tongue to gauge the prey's location (the twin forks of the tongue acting in stereo); it also uses its keen eyesight; king cobras are able to detect moving prey almost 100 m (330 ft) away. Its intelligence and sensitivity to earth-borne vibration are also used to track its prey. Following envenomation, the king cobra swallows its struggling prey. King cobras, like all snakes, have flexible jaws. The jaw bones are connected by pliable ligaments, enabling the lower jaw bones to move independently. This allows the king cobra to swallow its prey whole, and swallow prey much larger than its head.

Malayan Krait

Bungarus candidus, commonly known as the Malayan krait or blue krait, is a highly venomous species of snake. The blue krait is a member of the elapid family. The Malayan krait may attain a total length of 108 cm (about 3.5 ft), with a tail 16 cm (6.3 in) long.

Dorsally, it has a pattern of 27-34 dark-brown, black, or bluish-black crossbands on the body and tail, which are narrowed and rounded on the sides. The first crossband is continuous with the dark colour of the head. The dark crossbands are separated by broad, yellowish-white interspaces, which may be spotted with black. Ventrally, it is uniformly white. An unbanded black phenotype also occurs in some populations e.g. Bali and reportedly in West and Central Java. The smooth dorsal scales are arranged in 15 rows, with the vertebral row much enlarged. The ventrals number 195-237; the anal plate is entire; and the single (undivided) subcaudals are 37-56 in number.

Habitat
It is found in southeast Asia from Indochina south to Java and Bali in Indonesia.

Common Death Adder

The common death adder (Acanthophis antarcticus) is a species of death adder native to Australia. It is one of the most venomous land snakes in Australia and globally. While it remains widespread (unlike related species), it is facing increased threat from the ongoing Australian cane toad invasion. The common death adder has a broad flattened, triangular head and a thick body with bands of red, brown and black with a grey, cream or pink belly.

It can reach a maximum body length of 70–100 centimetres (2.3–3.3 ft). Death adders possess the longest fangs of any Australian snake. Unlike the common or European adder (Vipera berus), the common death adder is a member of the snake family Elapidae, rather than the family Viperidae, which are not found in Australia.

Habitat
The common death adder occurs over much of eastern and coastal southern Australia – Queensland, New South Wales, Victoria and South Australia. It is more scarce in the Northern Territory, Western Australia and the west parts of South Australia. It is also native to Papua New Guinea. Common death adders are found in forests, woodlands, grasslands and heaths of the eastern coast of Australia. The death adder is a master of camouflage, due to its band stripes, hiding beneath loose leaf litter and debris in woodland, shrubland and grassland.

Venom
The common death adder venom contains highly toxic neurotoxin which can cause paralysis or even kill. It can deliver the fastest strike among all venomous snakes recorded in Australia. Human death can occur within six hours after the bite.

Western Green Mamba

The western green mamba (Dendroaspis viridis), also known as the West African green mamba or Hallowell's green mamba, is a long, thin, and highly venomous snake of the mamba genus, Dendroaspis. The western green mamba is a fairly large and predominantly arboreal species, capable of navigating through trees swiftly and gracefully. It will also descend to ground level to pursue prey such as rodents and other small mammals. The western green mamba is a very alert, nervous, and extremely agile snake that lives mainly in the coastal tropical rainforest, thicket, and woodland regions of western Africa.

Like all the other mambas, the western green mamba is a highly venomous elapid species. Its venom is a highly potent mixture of rapid-acting presynaptic and postsynaptic neurotoxins (dendrotoxins), cardiotoxins and fasciculins. Some consider this species to not be a particularly aggressive snake, but others have suggested that they are extremely nervous and are prone to attack aggressively when cornered.

The western green mamba is a long and very slender bodied snake with a long tapering tail. The average length of an adult snake of this species is between 1.4 metres (4.6 ft) and 2.1 metres (6.9 ft). Some specimens of this species can grow to maximum lengths of 2.4 metres (7.9 ft). The head is narrow and elongate, with a distinct canthus and slightly distinct from the neck. On rare occasions the neck may be flattened when the snake is aroused, but there is no hood. Eyes are medium in size with round pupils and a yellow brown iris.

Habitat
The western green mamba is native to West Africa. Different sources give slightly different ranges but generally agree that it occurs from Gambia and southern Senegal to Benin, including the intervening countries (from west to east) Guinea-Bissau, Guinea, Sierra Leone, Liberia, Cote d'Ivoire (Ivory Coast), Ghana, and Togo. In Togo it has a known northern limit to its distribution in Aledjo, but it might occur in forests of the more northerly Kara region Records from Nigeria might be unreliable, and its presence in the Central African Republic is similarly unclear. Some sources mention it also from the very southern tip of Mali along the border with Côte d'Ivoire, as well as from western Cameroon and Gabon.

Venom
The western green mamba's venom is similar to those of other members of the mamba genus (Dendroaspis), but differs from others in toxicity and the composition of the toxins. Human fatalities as a result of bites from this species are rare due to the fact that this species does not often cross paths with humans, but bites have occurred and the majority of the recorded bites have been fatal. The three species of green mambas, including the western green mamba, have venom toxicities that are similar to and comparable to many species of cobras, but green mamba bites often present with more severe and life-threatening symptoms in a shorter period of time.

Mortality rates are also higher among green mamba bite victims than with cobra bite victims. Although bites by Dendroaspis viridis are not well documented and the rate of bites, envenoming and fatality is not well known, it appears that bites attributed to this species produce more severe envenomation than bites caused by Dendroaspis angusticeps (eastern green mamba), but far less severe than bites caused by Dendroaspis polylepis (black mamba). When bitten, symptoms rapidly begin to manifest, usually within the first 15 minutes or less. The extraordinary speed with which the venom spreads through tissue and produces rapid manifestations of life-threatening symptoms is unique to mambas.

Common symptoms of a bite from a western green mamba include local pain and swelling, although uncommon, local necrosis can be moderate, ataxia, headache, drowsiness, difficulty breathing, vertigo, hypotension (low blood pressure), diarrhoea, dizziness, and paralysis. Left untreated, new and more severe symptoms rapidly progress. All symptoms worsen and the victim eventually dies due to suffocation resulting from paralysis of the respiratory muscles. Bites with envenomation can be rapidly fatal, which can be possible in 30 minutes.

Aggressiveness
Conflict with humans is low compared to some other species found in the region. Bites to people by this species are quite uncommon. Their mortality rate, however, is high; many of the recorded bites have been fatal. Rapid progression of severe, life-threatening symptoms are hallmarks of mamba bites. Bites with envenomation can be rapidly fatal.

Behaviour
This species is mostly diurnal, but may be active at night as well. It is an arboreal snake, but it does commonly go to the ground. In fact, it is equally at home hunting and feeding on prey on the ground or in trees. When it wants to sleep it seeks out tree branches that offer dense cover. It is a very quick, extremely agile, alert, and nervous snake. When confronted it will quickly attempt to escape (usually up a tree if possible) and avoid any sort of confrontation. If cornered, the western green mamba is highly dangerous and will show a fearsome display of aggression, loudly hissing and striking repeatedly.

Eastern Green Mamba

The eastern green mamba (Dendroaspis angusticeps), also known as the common mamba, East African green mamba, green mamba, or white-mouthed mamba, is a large, tree-dwelling, highly venomous snake species of the mamba genus Dendroaspis. This snake mostly inhabits the coastal regions of southern East Africa. Adult females average approximately 2.0 metres (6.6 ft) in length, and males are slightly smaller. Eastern green mambas prey on birds, eggs, bats, and rodents such as mice, rats, and gerbils. They are shy and elusive snakes which are rarely seen, making them somewhat unusual among mambas.

This elusiveness is usually attributed to the species' green colouration which blends with its environment, and its arboreal lifestyle. However, eastern green mambas have also been observed to use "sit-and-wait" or ambush predation like many vipers, unlike the active foraging style typical of other elapids, which may be a factor in the rarity of sightings.

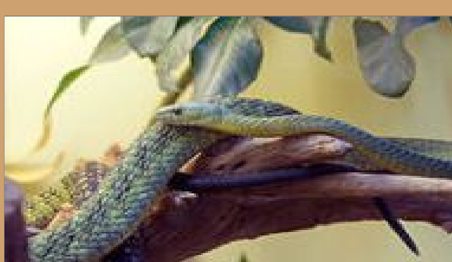
The eastern green mamba is a large, with a slightly compressed, and very slender bodied snake with a medium to moderately long tapering tail. Adult males average around 1.8 metres (5.9 ft) in total length, while females average 2.0 metres (6.6 ft) in total length. The head is narrow, elongate, and coffin-shaped, with a distinct canthus which is slightly distinct from the neck. When threatened or otherwise aroused in some way, this species is capable of flattening its neck area, though no real hood is formed.

Habitat
This species is indigenous to more coastal regions of southern Africa and east Africa. The eastern green mamba's range extends from Kenya south through Tanzania, Mozambique, Malawi, eastern Zimbabwe, eastern Zambia into South Africa as far as southern Natal and northern Pondoland. It can also be found in Zanzibar. The distribution of this species is assumed to be continuous, but reports seem to be scarce in regions within the species' range.

Venom
The eastern green mamba is a highly venomous snake. Like all other mamba species, the toxicity of individual specimens within the same species can vary greatly based on several factors including geographical region, age, seasonal variation, diet, and so on. Local swelling is variable and sometimes absent after mamba bites. However, patients bitten by the eastern green mamba develop swelling of the entire bitten limb and also show mild haemostatic disturbances (Warrell DA; MacKay et al. 1966). The rare cases of local tissue damage usually resulted from bites on the fingers or the use of a tight tourniquet. This species has caused bites to humans and many of the bites attributed to this species have often resulted in fatalities. The mortality rate of untreated bites is unknown but is thought to be quite high. Symptoms of envenomation by this species include swelling of the bite site, dizziness, and nausea, accompanied by difficulty breathing and swallowing, irregular heartbeat, convulsions, rapid progression to respiratory paralysis. Bites that produce severe envenomation can be rapidly fatal. Case reports of rapidly fatal outcomes, in as little as 30 minutes, have been recorded for this species.

Behaviour
The eastern green mamba is a diurnal, arboreal, and secretive species of snake, and it tends to spend most of its time above the ground in relatively dense brush, where it is well camouflaged. This species is not commonly found on land unless motivated by thirst, prey, or the need to bask in the sun (thermoregulation). It is an alert, nervous, excellent climber and extremely agile snake. It sleeps at night in a tree coiled up in leafy clumps rather than seeking a tree hollow (although sometimes found in them). In a study of the movement patterns of two adult specimens of this species over a 27-day period, the researcher found that their activity range areas to be very low, comparable to other predators who ambush prey rather than actively hunt them.

Jameson's Mamba



Jameson's mamba (Dendroaspis jamesoni) is a species of quick, highly arboreal and highly venomous snake of the family Elapidae. The species is endemic to Africa. Jameson's mamba is a large, slender elapid snake with smooth scales and a long tapering tail which typically accounts for 20 to 25% of its total length. The average total length (including tail) of an adult snake is approximately 1.5 meters (4.9 ft) to 2.2 meters (7.2 ft). It may grow as large as 2.64 meters (8 ft 8 in). Adults tend to be dull green across the back, blending to pale green towards the underbelly with scales generally edged with black. The ventral side, neck and throat are typically cream or yellowish in colour.

Jameson's mamba has a narrow and elongated head containing a small eye and round pupil. Like the western green mamba, the neck may be flattened. The subspecies D. jamesoni kaimosae, which is typically found in the eastern part of the species' range, features a black tail, while central and western examples typically have a pale green or yellow tail.

No significant sexual dimorphism has been observed between male and female snakes. Untreated envenomation may cause death within 30 to 120 minutes. However, the average death time for untreated bite victims is usually two to three hours post-envenomation, but it may take up to four to six hours or longer. The mortality rate of untreated bites is not exactly known, but it is said to be very high.

Habitat
Jameson's mamba occurs mostly in Central Africa and West Africa, and in some parts of East Africa. In Central Africa it can be found from Angola northwards to the Democratic Republic of Congo, Republic of Congo, Central African Republic, and as far north as the Imatong Mountains of South Sudan. In West Africa it ranges from Ghana eastwards to Togo, Nigeria, Cameroon, Equatorial Guinea and Gabon. In East Africa it can be found in Uganda, Kenya, Rwanda, Burundi and Tanzania. It is a relatively common and widespread snake, particularly across its western range.

Venom
Like other mambas, the venom of the Jameson's mamba is a highly neurotoxic venom. Its other components include cardiotoxins, and fasciculins. Its venom may also have hemotoxic and myotoxic components to it. The average venom yield per bite for this species is 80 mg, but some specimens may yield as much as 120 mg in a single bite. The SC LD50 for this species according to Brown (1973) is 1.0 mg/kg, while the IV LD50 is 0.8 mg/kg.

Caspian Cobra

The Caspian cobra (Naja oxiana), also called the Central Asian cobra, Oxus cobra, or Russian cobra is a species of venomous snake in the family Elapidae. The species is endemic to Central Asia. N. oxiana is medium in length, a heavy-bodied snake with long cervical ribs capable of expansion to form a hood. Anteriorly, the body is depressed dorsoventrally, and posteriorly it is subcylindrical. This species averages about 1 m (3.3 ft) in total length (including tail) and rarely reaches lengths over 1.5 m (4.9 ft). The head is elliptical, depressed, and slightly distinct from the neck, with a short, rounded snout and large nostrils. The eye is medium in size with a round pupil. The dorsal scales are smooth and strongly oblique, with the outer two or three scale rows larger than the remainder. Juveniles tend to be pale, with a faded appearance. Juveniles have noticeable dark and light cross-bands of approximately equal width around the body. Adults of this species are completely light to chocolate brown or yellowish, with some specimens retaining traces of juvenile banding, especially the first few dark ventral bands. This species has no hood mark and no lateral throat spots.

Habitat
N. oxiana occurs in the Transcaspian region. It is found in Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan, north and east Afghanistan, north-eastern Iran, the northern half of Pakistan, from the Kashmir region east to the state of Himachal Pradesh in India, and in south-western Tajikistan. There is also some anecdotal evidence of it ranging as far north as the Aral Sea on the Uzbekistan/Kazakhstan border.

Venom
The bite of this species may cause severe pain and swelling, along with severe neurotoxicity. Weakness, drowsiness, ataxia, hypotension, and paralysis of throat and limbs may appear in less than one hour after the bite. Without medical treatment, symptoms rapidly worsen and death can occur soon after a bite due to respiratory failure. A woman bitten by this species in north-western Pakistan suffered severe neurotoxicity and died while en route to the closest hospital nearly 50 minutes after envenomation. Between 1979 and 1987, 136 confirmed bites were attributed to this species in the former Soviet Union. Of the 136, 121 received antivenom, and only 8 died. Of the 15 who did not receive antivenom, 11 died - a 73% mortality rate. Antivenom is not as effective for envenomation by this species as it is for other Asiatic cobras within the same region, like the Indian cobra (Naja naja), and massive amounts of antivenom are often required for patients. As a result, a monovalent antivenom serum is being developed by the Razi Serum and Vaccine Research Institute in Iran. The untreated mortality rate for this species is approximately 70-75%, which is among the highest of all cobra species of the genus Naja. In both Central Asia and Iran this species is responsible for high rates of snakebites and resulting mortality.

Behaviour
This terrestrial species is mainly diurnal, but it may be crepuscular and nocturnal in some parts of its range during the hottest months (July and August). It is a good climber and a good swimmer. It is often found in water and seldom found too far away from it. It feeds on small mammals, amphibians, and birds during the evening and early morning. The Caspian cobra will prey mainly on rodents, toads and frogs, occasionally fish, and birds and their eggs. Quick-moving and agile, this species lives in holes in embankments or trees.

Aggressiveness
N. oxiana is generally aggressive and bad-tempered. Although it will avoid humans as much as it can, it will become fiercely aggressive when threatened or cornered. Even juveniles tend to be very aggressive. When cornered and provoked, it will spread its hood, hiss, sway from side to side and strike repeatedly; it is not a spitter.

Forest Cobra

The forest cobra (Naja melanoleuca), also commonly called the black cobra and the black and white-lipped cobra, is a species of venomous snake in the family Elapidae. The species is native to Africa, mostly the central and western parts of the continent. It is the largest true cobra species with a total length (including tail) of up to 3.1 meters (10 feet). Although it prefers lowland forest and moist savannah habitats, this cobra is highly adaptable and can be found in drier climates within its geographical range. It is a very capable swimmer and is often considered to be semi-aquatic. The forest cobra is a generalist in its feeding habits, having a highly varied diet: anything from large insects to small mammals and other reptiles.

This species is alert, nervous and is considered to be a very dangerous snake. When cornered or molested, it will assume the typical cobra warning posture by raising its fore body off the ground, spreading a narrow hood, and hissing loudly. Bites to humans are less common than from other African cobras due to various factors, though a bite from this species is a life-threatening emergency.

The length of an average adult is 1.4 to 2.2 m (4.6 to 7.2 ft), but they may attain lengths of 3.1 metres (10 feet) in rare cases. Males and females grow to be similar in length, as there is no sexual dimorphism within this species. The head of this snake is large, broad, flattened and is slightly distinct from the neck. It is a slightly depressed, tapered and moderately thick bodied snake with a slender tail that is medium in length.

Distribution
The forest cobra occurs mainly in western and central Africa. It is found from Senegal, Guinea-Bissau, Guinea, south-eastern Mali, Sierra Leone, Liberia, Côte d'Ivoire, Burkina Faso, Ghana, Togo, Benin, Nigeria, Equatorial Guinea, Cameroon, and Gabon in western Africa to the Republic of Congo, the Democratic Republic of Congo, Central African Republic, and northern Angola in central Africa to western Kenya, Uganda, Rwanda, and Burundi in eastern Africa, and to fragmented parts of southern Africa, including the Natal.

Habitat
A snake of forest or woodland, it is the only one of Africa's cobras that will live in high forest. The forest cobras are snakes that are well adapted to many environments and the habitat of the forest cobra is strongly dependent on what part of its African range the snake originates from. Forest cobras originating in the southern African regions are typically found in savannah and grassland, but they can also be found in broken rock country. They are mainly found in the tropical and subtropical rainforest regions of west and central Africa. It also inhabits mangroves in western Africa.

Venom
The venom of this cobra is a postsynaptic neurotoxin and bites result in severe neurotoxicity. The forest cobra is one of the least frequent causes of snake bite among the African cobras, largely due its forest-dwelling habits but a bite by this species should be taken very seriously because it ranks as the 4th most venomous Naja (True Cobra) species. The symptomology is thought to be very similar to that of the Egyptian cobra (Naja haje).

Aggressiveness
When agitated, it rears up to a considerable height and spreads a long, narrow hood. It can strike quickly, to quite a long distance, and if molested and cornered, it will rush forward and make a determined effort to bite. It is an alert and agile species of cobra. Some authorities believe it is one of the most dangerous African snakes to be kept as many captive forest cobras are described to be particularly aggressive when handled. This species is not able to "spit" its venom.

Behaviour
The forest cobra is an agile, diurnal species that climbs well and is one of the most aquatic of the true cobras of the genus Naja. It is terrestrial, but it is fast, graceful climber, known to ascend trees to a height of 10 metres (33 feet) or more. It is quick moving and alert. It swims well and readily takes to the water; in some areas its main diet is fish and could be regarded as semi-aquatic. Although it is active mostly during the day (diurnal) in uninhabited areas, it can also be active by night (nocturnal) where it goes into urban areas. When not active, it takes cover in holes, brush piles, hollow logs, among root clusters or in rock crevices, or in abandoned termite mounds at forest fringe or clearings.

Philippine Cobra

The Philippine cobra (Naja philippinensis) also called northern Philippine cobra, is a stocky, highly venomous species of spitting cobra native to the northern regions of the Philippines. The Philippine cobra is called ulupong in Tagalog, carasaen in Ilocano and agawason in Cebuano-Bisaya. The Philippine cobra is a stocky snake of medium length with long cervical ribs capable of expanding, so when threatened, a hood can be formed. The average length of this species is 1.0 metre (3.3 ft).

The species can grow to lengths of 1.6 metres (5.2 ft) However, subpopulations of the species, particularly specimens from Mindoro Island, are said to attain lengths of 2 metres (6.6 ft), but these are unconfirmed claims. If true, however, 2 m would be very rare and would be considered the absolute maximum for this species.

The head is elliptical, depressed, slightly distinct from neck with a short, rounded snout and large nostrils. The eyes are moderate in size with dark brown and round pupils, typical of other cobra species and similar to other elapids in general. It has a fairly stocky build for an elapid, and adult snakes are uniformly light to medium brown, while the juveniles tend to be a darker brown in colour. They have 23-27 scale rows around the neck and 21 just above the middle part of the body; 182-193 ventrals, 36-49 subcaudals, and basal pairs are sometimes undivided.

Habitat
The Philippine cobra occurs mostly in the northern regions of the Philippines. They can be found on the islands of Luzon, Mindoro, Catanduanes, Azria and Masbate. This species likely may occur in other neighbouring islands, but this remains unconfirmed. Records from the Calamianes group and Palawan require confirmation. The Philippine cobra's habitat include low-lying plains and forested regions, along with open fields, grasslands, dense jungle, agricultural fields, and human settlements. This species of cobra is particularly fond of water, so it can be found very close to ponds, rivers, or large puddles of water.

Venom
The venom of the Philippine cobra is a potent postsynaptic neurotoxin which affects respiratory function and can cause neurotoxicity and respiratory paralysis, as the neurotoxins interrupt the transmission of nerve signals by binding to the neuromuscular junctions near the muscles. Research has shown its venom is purely a neurotoxin, with no apparent necrotizing components and no cardiotoxins. These snakes are capable of accurately spitting their venom at a target up to 3 metres (9.8 ft) away. The symptoms of a bite might include headache, nausea, vomiting, abdominal pain, diarrhoea, dizziness, and difficulty breathing. Bites by the Philippine cobra produce prominent neurotoxicity with minimal to no local signs. Complete Respiratory failure developed in 19 patients, and was often rapid in onset; in three cases, apnea occurred within just 30 minutes of the bite. There were two deaths, both in patients who were moribund upon arrival at the hospital. Three patients developed necrosis, and 14 individuals with systemic symptoms had no local swelling at all. Both cardiotoxicity and reliable nonspecific signs of envenoming were absent. Bites by the Philippine cobra produce a distinctive clinical picture characterized by severe neurotoxicity of rapid onset and minimal local tissue damage.

Cape Cobra

The Cape cobra (Naja nivea), also called the yellow cobra, is a moderate-sized, highly venomous species of cobra inhabiting a wide variety of biomes across southern Africa including arid savannah, fynbos, bushveld, desert and semi-desert regions. The species is diurnal and is a feeding generalist, preying on a number of different species and carrion. Predators of this species include birds of prey, honey badgers and various species of mongoose. The Cape cobra is also known as the "geelslang" (yellow snake) and "bruinkapel" (brown cobra) in South Africa.

The Cape cobra is a medium-sized species of cobra. Mature specimens are typically about 1.2 to 1.4 metres (3.9 to 4.6 ft) long, but may grow up to 1.6 metres (5.2 ft) in length. Males are slightly larger than females. Cape cobras vary widely in colouration, from yellow through golden brown to dark brown and even black.

In addition, individuals show a varying degree of black or pale stippling and blotches, and although colour and marking are geographically related, it is also possible to observe virtually all colour varieties at one location. For example, the Kalahari Desert specimens in Botswana and Namibia are usually more consistently yellow than the more southerly populations. However, at De Hoop, and other specific locations in the Western Cape, all colour variations have been recorded.

Habitat
The Cape cobra is endemic to southern Africa. In South Africa, where it most often occurs, the species occurs throughout the Western Cape, Northern Cape, Eastern Cape, Free State, and North West Province. It also is found in the southern half of Namibia, south-western Botswana, and western Lesotho. Although the Cape cobra has a smaller geographical range than any other African cobra, it occurs in a variety of different habitats. The preferred habitat of the species is fynbos, bushveld, karoo scrubland, arid savannah, the Namib desert and the Kalahari desert.

Behaviour
The Cape cobra is a diurnal species and actively forages throughout the day. During very hot weather it may become crepuscular, but is rarely if ever observed during the hours of darkness. It is a terrestrial snake, but will readily climb trees and bushes, and shows considerable agility in for example systematically robbing the nests of the sociable weaver. When not active, it hides in holes or under ground cover, such as brush piles, often remaining in the same retreat for some time. It is a quick moving and alert species, and although a report mentions that this species is generally calm when compared to some other African venomous snakes, it strikes readily if threatened. When disturbed and brought to bay the Cape cobra raises its forebody off the ground, spreads a broad hood and may hiss loudly. While on the defensive, it strikes unhesitatingly. If the threat remains motionless, the snake will quickly attempt to escape, but at any sign of movement will adopt its defensive posture again. The Cape cobra is more aggressive during the mating period.

Venom
The Cape cobra is regarded as one of the most dangerous species of cobra in all of Africa, by virtue of its potent venom and frequent occurrence around houses. The venom of this snake tends to be thick and syrupy in consistency and dries into shiny pale flakes, not unlike yellow sugar. The mortality rate for untreated bites is not exactly known, but is thought to be high. This can be due to various factors including the amount of venom injected, psychological state of the bitten subject, the penetration of one or both fangs, and so on. Mechanical ventilation and symptom management is often enough to save a victim's life, but cases of serious Cape cobra envenomation will require antivenom. When death does occur, it normally takes anywhere from an hour (in severe cases) to ten hours (or more) and it is often as a result of respiratory failure, due to the onset of paralysis. The antivenom used in case of a bite is a polyvalent antivenom produced by the South African Institute of Medical Research (SAIMR).

Jararaca

Bothrops jararaca is a species of pit viper endemic to southern Brazil, Paraguay, and northern Argentina. The specific name, jararaca, is derived from the Tupi words yarará and ca, which mean "large snake". Within its geographic range, it is often abundant and is an important cause of snakebite. No subspecies are currently recognized.

The drugs known as angiotensin converting enzyme (ACE) inhibitors, used for the treatment of hypertension and some types of congestive heart failure, were developed from a peptide found in the venom of this species. This is a slender and terrestrial species that grows to a maximum total length of 160 cm (63 in), although the average total length is much less.

The head scalation includes 5-12 intersupraoculars that are weakly keeled, 7-9 supralabials (usually 8) of which the second is fused with the prelacunal to form a lacunolabial, and 9-13 sublabials (usually 10-12). Midbody, there are 20-27 rows of dorsal scales (usually 23-25). The ventrals number 170-216 (rarely 218) and the 51-71 subcaudals are mostly paired.

Geography
This snake is found in southern Brazil, north-eastern Paraguay and northern Argentina (Misiones). The type locality is listed as "Lagoa d'Arara am Mucurî" (Brazil) by Wied-Neuwied in 1825. Occurs from near sea level to over 1,000 m altitude.

Habitat
The species prefers deciduous tropical forests and savannah country, as well as semitropical upland forests. It is said to favour open areas, such as farmland, with nearby vegetation cover.

Venom
This species is often abundant within its range, where it is an important cause of snakebite. It is the best-known venomous snake in the wealthy and heavily populated areas of south-eastern Brazil, where it was responsible for 52% (3,446 cases) of snakebites between 1902 and 1945, with a 0.7% fatality rate (25 deaths). The average venom yield is 25–26 milligrams (0.39–0.40 gr) with a maximum of 300 milligrams (4.6 gr) of dried venom. The venom is quite toxic. In mice, the median lethal dose (LD50) is 1.2-1.3 mg/kg intravenous, 1.4 mg/kg intraperitoneal and 3.0 mg/kg subcutaneous. For humans, the LD50 is estimated to be 210 milligrams (3.2 gr) subcutaneous. Typical envenomation symptoms include local swelling, petechiae, bruising and blistering of the affected limb, spontaneous systemic bleeding of the gums and into the skin, subconjunctival haemorrhage and incoagulable blood. The systemic symptoms can potentially be fatal and may involve haemostatic disorders, intracranial haemorrhage, shock and renal failure.

South American Bushmaster

Lachesis muta is a venomous pit viper species found in South America (including the island of Trinidad in the Republic of Trinidad and Tobago). Two subspecies are currently recognized, including the nominate subspecies described here. Adults grow to an average of 2 to 2.5 m (6½-8 feet), although 3 m (10 feet) is not too unusual. The largest recorded specimen was almost 3.65 m (12 feet) long, making this the largest of all vipers and the longest venomous snake in the western hemisphere.

Lachesis muta is the third longest venomous snake in the world. Weight in this species is estimated at an average of 3 to 5 kg (6.6 to 11.0 lb), somewhat less than the heaviest rattlesnakes or Bitis vipers, such as gaboon viper, and rhinoceros vipers. The head is broad and distinct from the narrow neck. The snout is broadly rounded. There is no canthus.

A pair of small internasals is present, separated by small scales. The supraoculars are narrow. Other parts of the crown are covered with very small scales. Laterally, the second supralabial forms the anterior border of the loreal pit, while the third is very large. The eye is separated from the supralabials by 4-5 rows of small scales.

Distribution
Found in South America in the equatorial forests east of the Andes: Colombia, eastern Ecuador, Peru, northern Bolivia, eastern and southern Venezuela, the island of Trinidad in the Republic of Trinidad and Tobago, Guyana, Surinam, French Guiana and much of Brazil. The type locality is "Surinami" (Surinam). It occurs in primary and secondary forests; adjacent fields and cleared areas. In Trinidad it tends to prefer hilly and mountainous regions.

Venom
Some reports suggest that this species produces a large amount of venom that is weak compared to some other vipers. Others, however, suggest that such conclusions are not accurate. These animals are badly affected by stress and rarely live long in captivity. This makes it difficult to obtain venom in useful quantities and good condition for study purposes.

Gaboon Viper

The Gaboon viper (Bitis gabonica) is a viper species found in the rainforests and savannahs of sub-Saharan Africa. Like all vipers, it is venomous. It is the largest member of the genus Bitis, and it has the longest fangs – up to 2 inches in length (5 cm) – and the highest venom yield of any snake. No subspecies are currently recognized.

Adults average 125–155 cm (4 to 5 feet) in total length (body + tail) with a maximum total length of 205 cm (81 in) for a specimen collected in Sierra Leone. The sexes may be distinguished by the length of the tail in relation to the total length of the body: approximately 12% for males and 6% for females. Adults, especially females, are very heavy and stout.

Habitat
This species can be found in Guinea, Ghana, Togo, Nigeria, Cameroon, Equatorial Guinea, Gabon, Republic of the Congo, DR Congo, northern Angola, Central African Republic, South Sudan, Uganda, Kenya, eastern Tanzania, Zambia, Malawi, eastern Zimbabwe, Mozambique, and northeast KwaZulu-Natal Province in South Africa. Mallow et al. (2003) also list Sierra Leone and Liberia in West Africa. The type locality is given as "Gabon" (Africa). The Gaboon viper is usually found in rainforests and nearby woodlands, mainly at low altitudes, but sometimes as high as 1500 m. Spawls et al. (2004) mention a maximum altitude of 2100 m. According to Broadley and Cock (1975), it is generally found in environments that are parallel to those occupied by its close relative, B. arietans, which is normally found in more open country.

Aggressiveness
If threatened, they may hiss loudly as a warning, doing so in a deep and steady rhythm, slightly flattening the head at the expiration of each breath. Despite this, they are unlikely to strike unless severely provoked; however, they are one of the fastest-striking snakes in the world, so care should be taken in handling them. There have been numerous descriptions of their generally unaggressive nature. Sweeney (1961) wrote they are so docile that they "can be handled as freely as any non-venomous species", although this is absolutely not recommended. In Lane (1963), Ionides explained he would capture specimens by first touching them lightly on the top of the head with a pair of tongs to test their reactions. Hissing and anger was rarely displayed, so the tongs were usually set aside and the snakes firmly grasped by the neck with one hand and the body supported with the other as he picked them up and carried them to a box for containment. He said the snakes hardly ever struggled.

Behaviour
Primarily nocturnal, Gaboon vipers have a reputation for being slow-moving and placid. They usually hunt by ambush, often spending long periods motionless, waiting for suitable prey to pass by. On the other hand, they have been known to hunt actively, mostly during the first six hours of the night. In Kumasi, Ghana, they were regularly killed around some stables in an open area with the forest some 500 meters away — a sign that they were hunting rats in the grassland. They are usually very tolerant snakes, even when handled, and rarely bite or hiss, unlike most vipers. However, bites by bad-tempered individuals do occur.

Venom
Bites from this species are extremely rare, due to their unaggressive nature and because their range is limited to rainforest areas. Due to their sluggishness and unwillingness to move even when approached, bites most often occur due to persons accidentally stepping on a Gaboon viper, but even then in some cases this does not guarantee a bite. However, when a bite does occur, it should always be considered a serious medical emergency. Even an average bite from an average-sized specimen is potentially fatal. Antivenom should be administered as soon as possible to save the victim's life if not the affected limb. In humans, a bite from a Gaboon viper causes rapid and conspicuous swelling, intense pain, severe shock and local blistering. Other symptoms may include uncoordinated movements, defecation, urination, swelling of the tongue and eyelids, convulsions and unconsciousness. Blistering, bruising and necrosis may be extensive. There may be sudden hypotension, heart damage and dyspnoea. The blood may become incoagulable with internal bleeding that may lead to haematuria and haematemesis. Local tissue damage may require surgical excision and possibly amputation to any affected limb. Healing may be slow and fatalities during the recovery period are not uncommon.

Chinese Cobra

The Chinese cobra (Naja atra), also called Taiwan cobra, is a species of cobra in the family Elapidae, found mostly in southern China and a couple of neighbouring nations and islands. It is one of the most prevalent venomous snakes in China and Taiwan, which has caused many snakebite incidents to humans.

This medium-sized snake is usually 1.2 to 1.5 metres (3.9 to 4.9 ft) long, but they can grow to a maximum length of 2 metres (6.6 ft) though this is rare. The hood mark shape is variable from spectacle, mask to horseshoe or O- shape and is often linked to light throat area on at least one side. The throat area is clearly defined light which is usually with a pair of clearly defined lateral spots.

The Chinese cobra is iridescent black with a number of distant transversal double lines of a yellow colour. The abdominal surface is pearl or slaty coloured. The dorsal colour of the Chinese cobra is usually brown, grey or black, with or without narrow, light transverse lines at irregular intervals which are especially prominent in juveniles. The upper head is usually the same colour as the tail and dorsal part of the body, while the sides of the head are lighter in colour. Specimens with other colours on their dorsal surface, such as white, yellow or brown do occur.

Distribution
This species is found in south-eastern China (including the provinces of Sichuan, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Hubei, Zhejiang, and the Island province of Hainan), Hong Kong, northern Laos, northern Vietnam, and Taiwan, where it is much more common in the south.

Habitat
Its typical habitat is woodlands, shrublands, grasslands, and mangroves. This species is adaptable to a wide range of terrain including grassland plains, jungle, open fields and even heavily populated regions. As an adaptable species, it occurs in a wide variety of habitats across its range. It can be found in rice paddy fields in maritime lowlands to various types of montaine forests, though it avoids dark forest with closed canopy. In primary monsoon season and rain forests, Naja atra inhabits clearings and riverbanks.

Venom
The Chinese cobra is a highly venomous member of the true cobras (genus Naja). Its venom consists mainly of postsynaptic neurotoxins and cardiotoxins. Four cardiotoxin-analogues I, II, III, and IV, account for about 54% of the dry weight of the crude venom and have cytotoxic properties. The distribution of the venom of the Chinese cobra has been studied in mice using a whole-animal radiographic technique. Results indicate that venom accumulates primarily in the kidney (marked localization in the cortex) with little or no activity in the brain of mice sacrificed one to two minutes after intravenous injection of massive dose levels of venom. Although this is not a spitting cobra, some individuals (mostly specimens from Guizhou Province) are capable of ejecting venom towards a threat within a distance of 2 metres (6.6 ft). In Taiwan there were 593 recorded cases of envenomation by the Chinese cobra from 1904–1938, of those 87 cases were fatal which is a 15% mortality rate. This is higher than mortality rates for Naja naja (the Indian cobra). Local symptoms in victims caused by a Chinese cobra bite are wound darkening, localized redness and swelling, pain, insensibility, and invariably blisters and necrosis. Necrosis is a serious problem in cases of cobra bite as it may persist for many years after the general recovery of the victim. The following systemic symptoms may also occur: chest discomfort, fever, sore throat, difficulty in swallowing, loss of voice, weak feeling in limbs, walking haltingly, general ache, lockjaw, and difficulty in breathing. Fatality occasionally occurs. The antivenom is widely available and deaths are much rarer than they used to be.

Behaviour
The Chinese cobra is a very alert, seldom cornered, but if confronted will raise its forebody and spread its hood and strike readily if necessary. Adults can be very aggressive, but the younger tend to be more aggressive as they are more nervous to the things surrounding them. The Chinese cobra usually escapes to avoid confrontation with humans. The snake is terrestrial, diurnal and crepuscular. This species has been observed hunting during all daylight periods and as late as 2–3 hours after sunset from March to October, with ambient temperatures of 20–32 °C (68–90 °F).

Monocled Cobra

The monocled cobra (Naja kaouthia), also called monocellate cobra, is a cobra species widespread across South and Southeast Asia and listed as Least Concern by IUCN. The monocled cobra has an O-shaped, or monocellate hood pattern, unlike that of the Indian cobra, which has the "spectacle" pattern (two circular ocelli connected by a curved line) on the rear of its hood. Coloration in the young is more constant. The dorsal surface may be yellow, brown, gray, or blackish, with or without ragged or clearly defined cross bands.

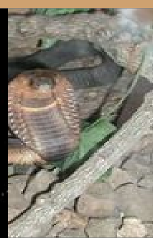
It can be olivaceous or brownish to black above with or without a yellow or orange-coloured, O-shaped mark on the hood. It has a black spot on the lower surface of the hood on either side, and one or two black cross-bars on the belly behind it. The rest of the belly is usually the same colour as the back, but paler. As age advances, the snake becomes paler, wherein the adult is brownish or olivaceous.

Habitat
Monocled cobras are distributed from India in the west through to China, Vietnam and Cambodia. They are also found on the Malay Peninsula and are native to Bangladesh, Bhutan, Myanmar, Laos, Nepal, and Thailand.
These cobras can adapt to a range of habitats, from natural to anthropogenically impacted environments. They prefer habitats associated with water, such as paddy fields, swamps, and mangroves, but can also be found in grasslands, shrublands, and forests. The species also occurs in agricultural land and human settlements including cities. They can be found at elevations of up to 1,000 m (3,300 ft) above sea level.

Venom
The monocled cobra causes the highest fatality due to snake venom poisoning in Thailand. Envenomation usually presents predominantly with extensive local necrosis and systemic manifestations to a lesser degree. Drowsiness, neurological and neuromuscular symptoms will usually manifest earliest; hypotension, flushing of the face, warm skin, and pain around bite site typically manifest within one to four hours following the bite; paralysis, ventilatory failure or death could ensue rapidly, possibly as early as 60 minutes in very severe cases of envenomation. However, the presence of fang marks does not always imply that envenomation actually occurred. In a preliminary study, extract of Mimosa pudica plant has been shown to possibly have neutralizing effects on the toxins present in this venom.

Aggressiveness
Monocled cobras are terrestrial and most active at dusk. In rice-growing areas, they hide in rodent burrows in the dykes between fields and have become semi-aquatic in this type of habitat. Juveniles feed mostly on amphibians whereas adults prey on small mammals, snakes and fish. When disturbed they prefer to take flight. However, when threatened they will raise the anterior portions of their bodies, spread their hood, usually hiss loudly, and strike in an attempt to bite and defend themselves. They are often found in tree holes and areas where rodents are plentiful. Some populations of the monocled cobra have the ability to spit venom.

Egyptian Cobra



The Egyptian cobra is a species of venomous snake in the family Elapidae. Naja haje is one of the largest cobra species native to Africa, second to the forest cobra (Naja melanoleuca). The Egyptian cobra is one of the largest cobras of the African continent. The head is large and depressed and slightly distinct from the neck. The neck of this species has long cervical ribs capable of expanding to form a hood, like all other cobras.

The snout of the Egyptian cobra is moderately broad and rounded. The eye is quite big with a round pupil. The body of the Egyptian cobra is cylindrical and stout with a long tail. The length of the Egyptian cobra is largely dependent on subspecies, geographical locale, and population.

The average total length (including tail) of this species is between 1 and 2 metres (3.3 and 6.6 ft), with a maximum total length of just under 3 metres (9.8 ft). The most recognizable characteristics of this species are its head and hood. The colour is highly variable, but most specimens are some shade of brown, often with lighter or darker mottling, and often a "tear-drop" mark below the eye. Some are more copper-red or grey-brown in colour.

Range
The Egyptian cobra ranges across most of North Africa north of the Sahara, across the savannahs of West Africa to the south of the Sahara, south to the Congo basin and east to Kenya and Tanzania. Older literature records from southern Africa and the Arabian Peninsula refer to other species (see Taxonomy section below).

Habitat
Naja haje occurs in a wide variety of habitats like, steppes, dry to moist savannahs, arid semi-desert regions with some water and vegetation. This species is frequently found near water. The Egyptian cobra is also found in agricultural fields and scrub vegetation. It also occurs in the presence of humans where it often enter houses. It is attracted to villages by rodent pests (rats) and domestic chickens. There are also notes of the Egyptian cobra swimming in the Mediterranean sea, so it seems to like water where it has been found quite often.

Venom
The venom affects the nervous system, stopping the nerve signals from being transmitted to the muscles and at later stages stopping those transmitted to the heart and lungs as well, causing death due to complete respiratory failure. Envenomation causes local pain, severe swelling, bruising, blistering, necrosis and variable non-specific effects which may include headache, nausea, vomiting, abdominal pain, diarrhoea, dizziness, collapse or convulsions along with possible moderate to severe flaccid paralysis. Unlike some other African cobras (for example the red spitting cobra), this species does not spit venom.

Behaviour
The Egyptian cobra is a terrestrial and crepuscular or nocturnal species. It can however, be seen basking in the sun at times in the early morning. This species shows a preference for a permanent home base in abandoned animal burrows, termite mounds or rock outcrops. It is an active forager sometimes entering human habitations, especially when hunting domestic fowl. Like other cobra species, it generally attempts to escape when approached, at least for a few metres, but if threatened it assumes the typical upright posture with the hood expanded, and strikes. This species prefers to eat toads, but it will prey on small mammals, birds, eggs, lizards and other snakes.

Banded Water Cobra

Naja annulata (formerly Boulengerina annulata), commonly known as the banded water cobra or the ringed water cobra, is a species of water cobra native to western and central Africa. The species is one of the two species of water cobras in the world, the other one being the Congo water cobra (Naja christyi).

It has medium-sized dark eyes with round pupils. The body is cylindrical; the tail is long. The scales are smooth and glossy, in 21-23 rows at midbody. Adults grow to an average of 1.4 to 2.2 metres (4.6 to 7.2 ft) in length, but they can grow to a maximum of 2.7 metres (8.9 ft).

Habitat
Scales are smooth, indicating the largely aquatic life of this species. It is capable of spreading a narrow, yet impressive hood. Body colours are mostly glossy brown, grayish-brown, or reddish-brown with black bands all along the body. The belly is pale yellow, while the tail is wholly black.

Habitat
This species is found in parts of central and western Africa, in Burundi, Cameroon, Central African Republic, Democratic Republic of Congo, Republic of Congo, Equatorial Guinea, Gabon, Rwanda, and the province of Cabinda in Angola, as well as along the Burundian, Tanzanian and Zambian shores of Lake Tanganyika. It is largely an aquatic species and rarely is found far away from water.

Venom
The venom of this species is not well studied, but it is believed that the venom is dangerously neurotoxic, like that of most elapids. A study listed the intraperitoneal (IP) LD50 of this species at 0.143 mg/kg.

Aggressiveness
It is a secretive species and is seldom encountered by humans. It is active by day and night, though it is usually more active by day. This largely aquatic snake spends most of its time in the water. It is an excellent swimmer and is capable of remaining under water for up to 10 minutes and diving to depths of 25 metres (82 ft). It is a slow mover on land, and it tends to hide among rocks, in holes or overhanging tree roots at the shoreline. It also makes use of any man-made structures, such as bridges and jetties, to hide. It is generally not aggressive, and if approached in water, it will swim away swiftly and on land will attempt to escape into water. If threatened on land, it will rear up and spread its narrow, yet prominent hood and it may hiss loudly, but it tends not to make any forward movements. It will only bite when provoked.

Congo Water Cobra

Naja christyi (formerly Boulengerina christyi), commonly known as the Congo water cobra or Christy's water cobra, is a species of venomous snakes belonging to the family Elapidae. The species is native to Sub-Saharan Africa. This species was formerly in the genus Boulengerina, but more recent research by Wallach et al. has shown that Boulengerina is actually a subgenus and Boulengerina christyi is a synonym of Naja christyi. This species has no known subspecies.

N. christyi is a medium to moderately long, somewhat compressed, moderately slender-bodied, but heavily built snake, with a medium length tapering tail. The head is short, with an indistinct canthus, and is distinct from the neck. The neck is capable of being spread into a hood.

The eyes are relatively small in size with round pupils. The dorsal scales are smooth and shiny. The average total length (including tail) of an adult specimen is around 1.1 metres (3.6 ft), but it may grow to upwards of 2.3 metres (7.5 ft) The rostral is once and a half as broad as deep, and is just visible from above.

Habitat
N. christyi has a small geographic range. It occurs in western Democratic Republic of Congo, the southern half of the Republic of Congo, a very small portion of south-eastern Gabon, and in the province of Cabinda in far northern Angola. N. christyi is found most commonly in or near water, in lowland bushy or wooded areas along banks of lakes, rivers, and streams. It is limited to the lower Congo River and nearby wet forested areas.

Behaviour
Not much is known about N. christyi. However, it is believed to be active by day and night. It is a semi-aquatic snake which spends much of its time in the water. An excellent swimmer. It tends to hide amongst rocks, in holes or overhanging tree roots at the shore line. It also makes use of any man-made structures such as bridges and jetties to hide. Generally this is not an aggressive snake. If approached in water it will swim away swiftly. If threatened on land it will rear up, spread its narrow hood and hiss. It may strike if it's provoked extensively.

Venom
The venom of N. christyi is not well studied, but it is believed that the venom is dangerously neurotoxic, like that of most elapids. A study listed the intraperitoneal (IP) LD50 of this species at 0.12 mg/kg. At least one human has been reported to have been bitten by this species. The individual had only mild symptoms (headache, local pain), but this species is capable of causing serious envenomation of humans. No specific antivenom currently produced against this species' venom.

Black Desert Cobra

Walterinnesia is a genus of venomous snakes in the family Elapidae. The genus contains two species, known commonly as desert black snakes or black desert cobras, which are endemic to the Middle East. Walterinnesia aegyptia was long considered to be the only species within the genus. However, it was recently found that the eastern populations actually represent a different species, Walterinnesia morgani. W. aegyptia is entirely black in colour, and has highly shiny scales. These snakes are medium in length, with a medium, cylindrical body and a short tail.

Their average length is 0.5 meters (1 ft 8 in), but they can grow to lengths of 1.8 meters (5 ft 11 in). Their head is moderately small, broad, flattened and slightly distinct from the neck. The snout is broad, sharply edged with a distinct canthus rostralis.

The eyes are small in size with round pupils. Dorsal scales are smooth anteriorly and weakly keeled on the posterior part of the body and tail. They are very glossy throughout. Dorsal scale count 27 (24 to 29) - 23 (21 - 25) - 17. Unlike other snakes commonly referred to as "cobras", the black desert cobra rarely rear up or produces a hood before striking in defence.

Geography
They are native to the Middle East. Walterinnesia aegyptia is found in the countries of Egypt, Lebanon, Jordan, Israel, north-western Saudi Arabia, and Kuwait. It may also be found in areas of Syria that border Lebanon, as well as the deserts of Qatar.

Habitat
These species occur in the desert (excluding completely sand deserts such as the ad-Dahna Desert). They can also be found in semi-desert scrublands and rocky terrain, extending into the foothills of vegetated Mediterranean terrain. They are also often found near human habitation in irrigated agricultural settlements.

Venom
W. aegyptia is highly venomous. The subcutaneous LD50 for the venom of W. aegyptia is 0.4 mg/kg. For comparison, the Indian cobra's (Naja naja) subcutaneous LD50 is 0.80 mg/kg, while the Cape cobra's (Naja nivea) subcutaneous LD50 is 0.72 mg/kg. This makes W. aegyptia (the desert black snake) a more venomous snake than both. Like many elapid snakes, the venom is primarily neurotoxic and effects of envenenomation are from systemic circulation of the toxins rather than from local effect on tissue near the site of injection.

Behaviour
The desert black snakes are nocturnal and are strictly terrestrial snakes. They are most active around midnight. They actively pursue and forage for their prey and rather than envenomate their prey with an open mouth, they'll usually bite their prey sideways at short distances and often use constriction and suffocation techniques in addition to their venom to kill their prey. There are reports of these snakes being aggressive when molested, but like most snakes, they will usually try to escape rather than immediately bite or face their threat. Venom is not injected immediately when they bite, but released seconds later with chewing movement.

Samar Cobra

The Samar cobra (Naja samarensis) also called Peters' cobra, southern Philippine cobra or Visayan cobra, is a highly venomous species of spitting cobra native to the Visayas and Mindanao island groups of the Philippines. The Samar cobra is a species of spitting cobra that can grow up to 1.4 meters in length. Their colouring varies from a black and yellow to green.

Habitat
The Samar cobra is endemic to the southern Philippines. Specifically, the Visayas and Mindanao island groups. Habitat can vary widely from mountainous jungle to tropical plains. They can live close to human settlements.

Behaviour
Like the Philippine cobra (Naja philippinensis), the Samar cobra feeds mostly on rodents. They will also prey upon frogs and reptiles. Since their main food source is attracted to rice paddies and human settlements, this species often comes into conflict with people.

Venom
The Samar cobra's venom is a potentially deadly neurotoxin, with cytotoxic properties as well. Envenomations can result in respiratory distress and paralysis, as well as considerable tissue necrosis around the bite site. They are noted for their nervous behaviour, and are quick to strike as well as to spray venom, which they generally aim towards the face and eyes. If venom gets in the eyes, it causes extreme pain and mechanical damage to the eyeball. If not properly flushed out, it can result in permanent blindness due to its tissue destroying properties. Antivenin for the Samar cobra is produced in the Philippines, but is not widely available due to this species' restricted distribution and thus, relatively low numbers of individuals.

Indochinese Spitting Cobra

The Indochinese spitting cobra (Naja siamensis) also called the Thai spitting cobra, Siamese spitting cobra or black-and-white spitting cobra, is a species of spitting cobra found in Southeast Asia. This is a medium-sized cobra with a rather thin body compared to other cobras. The body colour of this species is variable from grey to brown to black, with white spots or stripes. The white patterning can be so prolific that it covers the majority of the snake.

The highly distinctive black and white colour phase is common in central Thailand, specimens from western Thailand are mostly black, whereas individuals from elsewhere are usually brown. The hood mark can be spectacle-shaped, irregular or missing altogether, especially in adults. Adults average 0.9 to 1.2 metres (3.0 to 3.9 ft) long, and can reach a maximum of 1.6 metres (5 ft) though this is very rare.

Habitat
It is found in Southeast Asia, including Thailand, Cambodia, Vietnam, and Laos. May occur in eastern Myanmar but no records are known. It occupies a range of habitats including lowlands, hills, plains, and woodland. It can also be found in jungle habitat and it is sometimes attracted to human settlements because of the abundant populations of rodents in and around these areas.

Venom
Like most other spitting cobras, its venom is primarily a postsynaptic neurotoxin and cytotoxin (necrotizing or tissue-death). The LD50 of its venom is 1.07-1.42 mg/gram of mouse body weight. Bite symptoms include pain, swelling and necrosis around the wound. The bite of this snake is potentially lethal to an adult human. Deaths, which generally happen due to paralysis and consequent asphyxiation, mainly occur in rural areas where the procurement of antivenin is difficult. If the snake spits venom into the eyes of an individual, the individual will experience immediate and severe pain as well as temporary and sometimes even permanent blindness.

Aggressiveness
It is a primarily nocturnal species. It shows variable temperament depending on the time of day it is encountered. When threatened during daylight hours, the snake is generally timid and seeks refuge in the nearest burrow. However, when the snake is threatened at night, it is more aggressive and is more likely to stand its ground, rear up and display its hood and spit out its venom. If spitting venom doesn't work, it will strike and bite as a last resort. When biting, this species tends to hold on and chew savagely. It usually feeds on rodents, toads, and other snakes.

Black-Necked Spitting Cobra

The black-necked spitting cobra (Naja nigricollis) is a species of spitting cobra found mostly in sub-Saharan Africa. They are moderately sized snakes that can grow to a length of 1.2 to 2.2 m (3.9 to 7.2 ft) in length. Their coloration and markings can vary considerably. They prey primarily on small rodents. They possess medically significant venom, although the mortality rate for untreated bites on humans is relatively low (~ 5–10%, in endemic regions under 1%). Like other spitting cobras, they can eject venom from their fangs when threatened (one drop over 7 metres (23 ft) and more in perfect accuracy).

The neurotoxic venom irritates the skin, causing blisters and inflammation, and can cause permanent blindness if the venom makes contact with the eyes and is not washed off. N. nigricollis is a moderately sized, venomous snake with a moderately distinct head; the shape of the head is due primarily to two large venom glands found on each side of the head. Its colour can vary depending on region of origin. Some specimens are black or pale grey with a yellow or reddish ventral side with a broad, black neck band, often with an orange or pinkish bar on the neck. Other specimens can be yellowish-brown or have a yellow copper colour and are missing the bandings around the neck and the reddish colour on the belly.

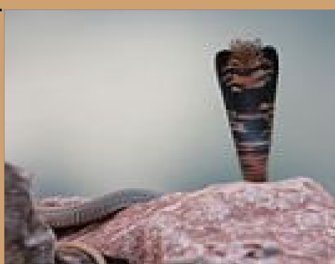
Habitat
The species is very common and is widespread through much of sub-Saharan Africa and is found in western, eastern, central, and parts of southern Africa. It is absent from the rainforests of the Congo Basin. It has been recorded from Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo (except in the centre), Congo, Ethiopia, Gabon, Ghana, Guinea Bissau, Guinea, Ivory Coast, Kenya, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Gambia, Mauritania, Sudan, Tanzania, Somalia, Togo, Uganda, Zambia.

Venom
The venom of Naja nigricollis is somewhat unusual among elapids in that it consists primarily of cytotoxins, but with other components also. It retains the typical elapid neurotoxic properties while combining these with highly potent cytotoxins (necrotic agents) and cardiotoxins. Bite symptoms include severe external hemorrhaging and tissue necrosis around the bite area and difficulty breathing. Although the mortality rate in untreated cases is low (~ 5–10%), when death occurs, it is usually due to asphyxiation by paralysis of the diaphragm.

Behaviour
Unlike other snakes, Naja nigricollis can be either nocturnal or diurnal depending on the time of year, geographic location, and average daytime temperature. This adaptability allows the snake to better regulate its body temperature and to gain access to the most abundant food sources of a particular area. It feeds primarily on small rodents, such as small rats and mice, birds, and fishes, but will also eat lizards, eggs, and other snakes.

Aggressiveness
Like other spitting cobras, this species is known for its ability to project venom at a potential threat. The venom is an irritant to the skin and eyes. If it enters the eyes, symptoms include extreme burning pain, loss of coordination, partial loss of vision, and permanent blindness. N. nigricollis is known for its tendency to liberally spit venom and bite with only the slightest provocation. This species is sometimes found in captivity, and wild-caught individuals are generally nervous and prone to spitting. Captive-bred animals tend to be much more docile and calm when compared to their wild-caught counterparts.

Mozambique Spitting Cobra



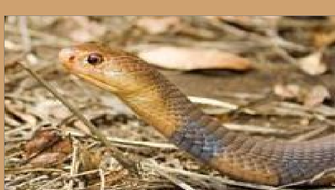
The Mozambique spitting cobra is a highly venomous species of spitting cobra native to Africa. In colour the snake is slate to blue, olive or tawny black above, with some or all scales black-edging. Below, salmon pink to purple yellowish, with black bars across the neck and ventrals speckled or edged with brown or black; young specimens sometimes have pink or yellow bars on the throat. The average length of adults is between 90 cm - 105 cm (3-3½ feet), but largest specimen actually measured was a male 154 cm (5 feet) long. (Durban, Kwa-Zulu Natal, South Africa).

Distribution
This species is the most common cobra of the savannah regions of the tropical and subtropical Africa. The distribution includes Natal, as far south as Durban, Mpumalanga Province Lowveld region, south-eastern Tanzania and Pemba Island and west to southern Angola and northern Namibia. Younger specimens are much more frequently encountered in the open at daytime. Unlike the Egyptian Cobra, this species prefers localities near water, to which it will readily take when disturbed.

Habitat
This snake is nervous and temperamental. When confronted at close quarters, it can rear up as much as two-thirds of its length and spread its long narrow hood, and will readily "spit" in defence, usually from a reared-up position. The venom can be propelled 2–3 metres (6½-10 feet), with great accuracy. The spitting cobra might bite instead of spitting, depending on its circumstances, and like the rinkhals it may feign death to avoid further molestation.

Venom
It is considered one of the most dangerous snakes in Africa. Its venom is about as toxic as the American Mojave rattlesnake, considered the world's most venomous rattlesnake. Like the rinkhals, it can spit its venom. Its bite causes severe local tissue destruction (similar to that of the puff adder). Venom to the eyes can also cause impaired vision or blindness. The venom of this species contains postsynaptic neurotoxin and cytotoxin. There have been only a few fatalities resulting from bites of this species but survivors are mostly disfigured.

Mali Cobra



The Mali cobra, also called the Katian spitting cobra, is a species of spitting cobra found in West Africa.

Range
This species ranges from Senegal to Cameroon, with recorded sightings in Gambia, Guinea-Bissau, far northern Guinea, Southern Mali, Ivory Coast, Burkina Faso, Northern Ghana, Togo, South-western Niger and Nigeria.

Habitat
This species occurs in both tropical and subtropical grasslands, savannahs, and shrublands.

Rinkhals

The rinkhals, also called the ringhals or ring-necked spitting cobra, is a species of venomous elapid found in parts of southern Africa. It is not a true cobra in that it does not belong to the genus Naja, but instead belongs to the monotypic genus Hemachatus. While rinkhals bear a great resemblance to true cobras they also possess some remarkable differences from these, resulting in their placement outside the genus Naja.

Coloration varies throughout its distribution area, but a characteristic of the species is the belly is dark with one or two light-coloured crossbands on the throat. Their average length is 90–110 cm. Some individuals may have a mostly black body, while others are striped. Rinkhals scales are distinct from those of Naja cobras in that they are ridged and keel-like.

Habitat
The rinkhals generally prefers grassland habitats because it allows them to blend in with the surroundings. Rinkhals also may live in swamps around southern Africa.

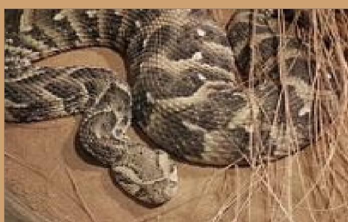
Venom
The venom of the rinkhals is neurotoxic and partially cytotoxic, and is less viscous than that of other African elapids. When confronting a human, it generally aims its venom at the face. If the venom enters the eyes, it causes great pain. A polyvalent antivenom is currently being developed by the Universidad de Costa Rica's Instituto Clodomiro Picado

Aggressiveness
If distressed, the rinkhals spreads its hood, showing its distinctive, striped neck. It is a spitting cobra, and can spray its venom up to 2.5 m. Its spitting mechanism is primitive and it has to rear up and fling its body forward to spray its venom. It is also known to fake death by rolling onto its back with its mouth agape.

Behaviour
The rinkhals has a varied diet. Its main prey is toads, but it also eats small mammals, amphibians, and other reptiles.
Rinkhals are unique amongst African cobras in being ovoviviparous. They give birth to 20–35 live young, but as many as 65 young have been recorded.

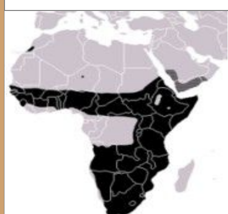
Bite Symptoms
Local symptoms of swelling and bruising is reported in about 25% (a quarter) of cases. General symptoms of drowsiness, nausea, vomiting, violent abdominal pain, cramps and vertigo often occur, as does a mild pyrexial reaction.

Puff Adder



Bitis arietans is a venomous viper species found in savannah and grasslands from Morocco and western Arabia throughout Africa except for the Sahara and rain forest regions. It is responsible for causing the most snakebite fatalities in Africa owing to various factors, such as its wide distribution, frequent occurrence in highly populated regions, and aggressive disposition. Two subspecies are currently recognized, including the nominate subspecies described here. The average size is about 1m (39.3 inches) in total length (body + tail) and very stout.

Large specimens of 190 cm (75 in) total length, weighing over 6.0 kg (13.2 lbs) and with a girth of 40 cm (16 in) have been reported. Specimens from Saudi Arabia are not as large, usually no more than 80 cm (31 in) in total length. Males are usually larger than females and have relatively longer tails. The head has a less than triangular shape with a blunt and rounded snout.



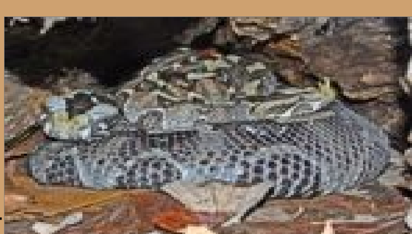
Range
This species is probably the most common and widespread snake in Africa. It is found in most of sub-Saharan Africa south to the Cape of Good Hope, including southern Morocco, Mauritania, Senegal, Mali, southern Algeria, Guinea, Sierra Leone, Côte d'Ivoire, Ghana, Togo, Benin, Niger, Nigeria, Chad, Sudan, Cameroon, Central African Republic, northern, eastern and southern Democratic Republic of the Congo, Uganda, Kenya, Somalia, Rwanda, Burundi, Tanzania, Angola, Zambia, Malawi, Mozambique, Zimbabwe, Botswana, Namibia and South Africa. It also occurs on the Arabian peninsula, where it is found in south-western Saudi Arabia and Yemen.

Habitat
It is found in all habitats except true deserts, rain forests, and (tropical) alpine habitats. It is most often associated with rocky grasslands. It is not found in rainforest areas, such as along the coast of West Africa and in Central Africa (i.e., central DR Congo); it is also absent from the Mediterranean coastal region of North Africa. On the Arabian peninsula, it is found as far north as Ta'if. It has been reported to be found in the Dhofar region of southern Oman.

Venom
This species is responsible for more snakebite fatalities than any other African snake. This is due to a combination of factors, including its wide distribution, common occurrence, large size, potent venom that is produced in large amounts, long fangs, their habit of basking by footpaths and sitting quietly when approached. In humans, bites from this species can produce severe local and systemic symptoms. Based on the degree and type of local effect, bites can be divided into two symptomatic categories: those with little or no surface extravasation, and those with haemorrhages evident as ecchymosis, bleeding and swelling. In both cases there is severe pain and tenderness, but in the latter there is widespread superficial or deep necrosis and compartment syndrome. Serious bites cause limbs to become immovably flexed as a result of significant haemorrhage or coagulation in the affected muscles. Residual induration, however, is rare and usually these areas completely resolve. Other bite symptoms that may occur in humans include edema, which may become extensive, shock, watery blood oozing from the puncture wounds, nausea and vomiting, subcutaneous bruising, blood blisters that may form rapidly, and a painful swelling of the regional lymph nodes.

Behaviour
Normally a sluggish species, it relies on camouflage for protection. Locomotion is primarily rectilinear, using the broad ventral scales in a caterpillar fashion and aided by its own weight for traction. When agitated, it can resort to a typical serpentine movement and move with surprising speed. Although mainly terrestrial, these snakes are good swimmers and can also climb with ease; often they are found basking in low bushes. One specimen was found 4.6 m above the ground in a densely branched tree. If disturbed, they will hiss loudly and continuously, adopting a tightly coiled defensive posture with the fore part of their body held in a taut "S" shape. At the same time, they may attempt to back away from the threat towards cover. They may strike suddenly and fast, to the side as easily as forwards, before returning quickly to the defensive position, ready to strike again. During a strike, the force of the impact is so strong, and the long fangs penetrate so deeply, that prey items are often killed by the physical trauma alone. The fangs apparently can penetrate soft leather. They can strike to a distance of about one third of their body length, but juveniles will launch their entire bodies forwards in the process. These snakes rarely grip their victims, instead releasing quickly to return to the striking position.

Rhinoceros Viper



Bitis nasicornis is a venomous viper species found in the forests of West and Central Africa. A large viper, known for its striking coloration and prominent nasal "horns." No subspecies are currently recognized. Large and stout, it ranges in total length (body + tail) from 72 to 107 cm (about 28 to 42 inches). Spawls et al. (2004) mentioned a maximum total length of 120 cm (47 in), but admitted this is exceptional, quoting an average total length of 60–90 cm (about 24–35 inches).

Females grow larger than males. The head is narrow, flat, triangular and relatively small compared to the rest of the body. The neck is thin. It has a distinctive set of two or three horn-like scales on the end of the nose, the front pair of which may be quite long. The eyes are small and set well forward. The fangs are not large: rarely more than 1.5 cm (0.59 in) long.

Habitat
It is found from Guinea to Ghana in West Africa, and in Central Africa in the Central African Republic, southern Sudan, Cameroon, Gabon, Congo, DR Congo, Angola, Rwanda, Uganda and western Kenya. The type locality is listed only as "interior parts of Africa." This snake occurs in forested areas, rarely venturing into woodlands.

Venom
Bitis nasicornis is considered to be one of the most dangerous snakes in Africa. Small doses of the snake's primarily hemotoxic venom can be deadly. This is unlike the Gaboon viper, the largest of the vipers, which uses a considerably larger amount of venom. Bitis nasicornis has both neurotoxic, as well as hemotoxic venom, as do most other venomous snakes. The hemotoxic venom in rhinoceros vipers is much more dominant. This venom attacks the circulatory system of the snake's victim, destroying tissue and blood vessels. Internal bleeding also occurs. When not in use, the rhino viper's fangs are folded up into the roof of the snake's mouth. The snake has the ability to control the movement of its fangs. Simply because the rhino viper may open its mouth does not mean that the fangs will flip down into place. These fangs penetrate deep into the victim and the small doses of venom flow through the hollow fangs into the wound.

Aggressiveness
They are slow moving, but capable of striking quickly, forwards or sideways, without coiling first or giving a warning. Holding them by the tail is not safe; as it is somewhat prehensile, they can use it to fling themselves upwards and strike. They have been described as generally placid creatures, less so than B. gabonica, but not as bad-tempered as B. arietans. When approached, they often reveal their presence by hissing, said to be the loudest hiss of any African snake—almost a shriek.

Behaviour
Primarily nocturnal, they hide during the day in leaf litter, in holes, around fallen trees or tangled roots of forest trees. Their vivid coloration actually gives them excellent camouflage in the dappled light conditions of the forest floor, making them almost invisible. Although mainly terrestrial, they are also known to climb into trees and thickets, where they have been found up to 3 m (9.8 ft) above the ground. This climbing behaviour is aided by a partially prehensile tail. They are sometimes found in shallow pools and have been described as powerful swimmers. They are slow moving, but capable of striking quickly, forwards or sideways, without coiling first or giving a warning. Holding them by the tail is not safe; as it is somewhat prehensile, they can use it to fling themselves upwards and strike.

King Brown Snake

The mulga snake (Pseudechis australis) is a species of venomous snake found in Australia. It is one of the longest venomous snakes in the world, and is the second-longest in Australia (surpassed only by the coastal taipan). Its alternative common name is king brown snake, although it is a species in the genus Pseudechis (black snakes) and only distantly related to true brown snakes.

Mulga snakes are large, venomous snakes growing up to 2.5 to 3.0 m (8.2 to 9.8 ft) in length in the largest specimens, although 1.5 m (4.9 ft) is a more typical length for an average adult. It is exceeded in length among venomous snakes only by the Asiatic king cobra, some species of African mambas, genus Lachesis (bushmasters) of the American neotropics, and the Australian taipan.

A good-sized adult mulga snake of 2.0 to 2.5 m (6.6 to 8.2 ft) length can weigh 3 to 6 kg (6.6 to 13.2 lb), and mulga snakes are often heavier than the co-occurring taipans. The colour of the snakes differs from area to area within their range; they can be a light brown colour in the desert to a dark, brown-blackish colour in the cooler regions of Queensland, South Australia, and New South Wales. This snake is robust, with a wide head and smooth snout.

Habitat
Mulga snakes occur in most states of Australia except for Tasmania. Its range includes all of the Northern Territory, most parts of Western Australia, Queensland, New South Wales, and South Australia. It may also be found in the western parts of the Australian Capital Territory. Mulga snakes inhabit woodlands, hummock grasslands, chenopod scrublands, and almost bare gibber or sandy deserts, usually sheltering near humans under timber, rubbish piles, burrows, and deep soil cracks. They are not found in rainforests.

Venom
The mulga snake accounted for 4% of identified snakebite victims in Australia between 2005 and 2015, with no deaths recorded. It is classified as a snake of medical importance by the World Health Organization.
The mulga snake venom consists of myotoxins. Black snake antivenin is used to treat bites from this species, after a CSL venom detection kit has returned a conclusive result for mulga snake envenomation, and signs indicate antivenin use is required. Venomous snakes normally only attack humans when disturbed. Mulga snakes have been noted, however, to bite people who were asleep at the time.

Red-Bellied Black Snake

The red-bellied black snake (Pseudechis porphyriacus) is one of eastern Australia's most commonly encountered snakes. Averaging around 1.25 metres (4 ft 1 in) in length, it has glossy black upperparts, bright red or orange flanks and a pink or dull red belly. It is not an aggressive species and generally retreats from encounters with people, but can attack if provoked. Although its venom is capable of causing significant illness, no deaths have been recorded from its bite, which is less venomous than other Australian elapid snakes.

The venom contains neurotoxins, myotoxins, coagulants and has haemolytic properties; victims can also lose their sense of smell. Common in woodlands, forests and swamplands, the red-bellied black snake often ventures into nearby urban areas. It forages in bodies of shallow water, commonly with tangles of water plants and logs, where it hunts its main prey item, frogs, as well as fish, reptiles and small mammals.

The red-bellied black snake has a glossy black top body with a light-grey snout and brown mouth, and a completely black tail. It lacks a well-defined neck, its head merges seamlessly into the body. Its flanks are bright red or orange, fading to pink or dull red on the belly. The red-bellied black snake is on average around 1.25 metres (4 ft 1 in) long, the largest individual recorded at 2.55 m (8 ft 4 in). Males are generally slightly larger than females. The red-bellied black snake can have a strong smell, which some field experts have used to find the snakes in the wild.

Habitat
The red-bellied black snake is native to the east coast of Australia, where it is one of the most commonly encountered snakes. It can be found in the urban forest, woodland, plains and bushland areas of the Blue Mountains, Canberra, Sydney, Brisbane, Melbourne, Cairns and Adelaide. The Macquarie Marshes mark a western border to its distribution in New South Wales, and Gladstone in central Queensland marks the northern limit to the main population. To the south, it occurs across eastern and central Victoria, and extends along the Murray River into South Australia. There are disjunct populations in the southern Mount Lofty Ranges in South Australia, and in North Queensland. The red-bellied black snake is most commonly seen close to dams, streams, billabongs and other bodies of water, although they can venture up to 100 m (350 ft) away, including into nearby backyards. In particular, the red-bellied black snake prefers areas of shallow water with tangles of water plants, logs or debris.

Venom
Bites from red-bellied black snakes can be very painful—needing analgesia—and result in local swelling, prolonged bleeding and even local necrosis, particularly if the bite is on a finger. Severe local reactions may require surgical debridement or even amputation. Symptoms of systemic envenomation—including nausea, vomiting, headache, abdominal pain, diarrhoea or excessive sweating—were thought to be rare, but a 2010 review found they occurred in most bite victims. Most people also go on to develop an anticoagulant coagulopathy in a few hours. This is characterised by a raised aPTT, and subsides over 24 hours. It resolves quickly with antivenom.

Aggressiveness
The red-bellied black snake is generally not an aggressive species, typically withdrawing when approached. If provoked, it will recoil into a striking stance as a threat, holding its head and front part of its body horizontally above the ground and widening and flattening its neck. It may bite as a last resort. It is generally active by day, though night-time activity has occasionally been recorded. When not hunting or basking it may be found beneath timber, rocks and rubbish or down holes and burrows.

Behaviour
Red-bellied black snakes can hide in multiple places in their habitat including logs, old mammal burrows and grass tussocks. They can flee into water and hide there; one was reported as staying submerged for 23 minutes. When swimming they may hold their full head or the nostrils above the water's surface. At times they may float without moving on the water surface looking like a stick. Within their habitat, red-bellied black snakes appear to have ranges or territories that they are familiar with and generally remain within. A 1987 field study in three New South Wales localities found that these areas vary widely, from 0.02 to 40 ha (0.05 to 100 acres) in size. Within their territory, they may have some preferred places to reside. Snakes are active when their body temperatures are between 28 and 31 °C (82 and 88 °F). They also thermoregulate by basking in warm sunny spots in the cool early morning and rest in shade in the middle of hot days, and may reduce their activity in hot dry weather in late summer and autumn. Rather than entering true hibernation, red-bellied black snakes become relatively inactive over winter retreating to cover and at times emerging on warm, sunny days. Their dark colour allows them to absorb heat from sunshine more quickly.

Dugite

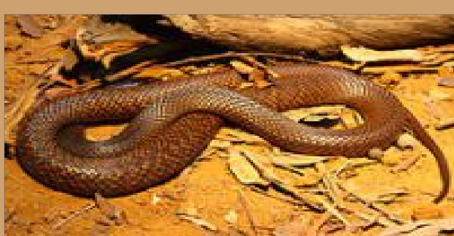
The dugite is a species of venomous, potentially lethal, snake native to Western Australia, a member of the family Elapidae. The dugite is a venomous snake, considered dangerous. It is coloured grey, green, or brown. The colours vary widely between individuals and are an unreliable means of identifying the species. Black scales can be scattered over the body; their scales are relatively large with a semi-glossy appearance. The most distinguishing characteristic is the head that can be rather small and indistinct from the neck. A dugite's body is long and slender in build and can grow up to 2 m (6 ft 7 in) in total length (including tail), but the typical size is roughly 1.5 m.

Habitat
P. affinis is found in southern parts of Western Australia and in remote coastal parts of western South Australia.
The dugite occupies a wide variety of habitats ranging from coastal dunes and heathlands to shrub lands and woodlands. It also appears to thrive in heavily degraded habitats such as golf courses, industrial areas, and open agricultural farmlands. The dugite has increased in population since the opening up of its natural habitats and introduction of the house mouse due to the mouse being a main food source for it. In the Perth metropolitan area, the dugite is one of the most common snakes found next to buildings. In areas of human population, the snake will take temporary shelter under concrete slabs, fibro sheeting, roofing tin, and such, although in more natural habitats, it will shelter under rocks and in abandoned termite mounds. It also burrows during the winter.

Venom
The venom of P. affinis is potentially one of the most lethal in the world, causing coagulopathic and procoagulant effects. Dugites generally avoid biting humans, but risks of encounters rise when they are most active during the mating season through October and November.
The last death attributed to a dugite was in Fremantle (South Beach) on 15 August 2015. A woman was bitten on her heel mid-afternoon while walking alone. She walked home and later collapsed whilst her husband was taking her to her car to transport her to the hospital. The ambulance was called, arriving 5 minutes later, but medics were unable to revive her. In January 2011, a seven-year-old Perth boy was bitten and temporarily paralysed after a dugite entered his bedroom and wrapped itself around his arm while he slept. After receiving immediate medical attention, he made a full recovery.

Behaviour
In the wild, dugites may be sheltering beneath logs or rocks. When disturbed, they are very shy and often slither away, but they will defend themselves if cornered. The species is diurnal. On hot days, activity occurs mainly in the morning, and to lesser extent in the afternoon.

Western Brown Snake



Pseudonaja nuchalis, commonly known as the western brown snake or gwardar, is a species of very fast, highly venomous elapid snake native to Australia. Its colour and pattern are rather variable, depending largely on its location. Some experts assert that the western brown's wide variation in appearance and extensive distribution mean that the western brown species in fact covers multiple related, but separate species with three derivative species now officially recognised, P. nuchalis, P. aspidorhyncha, and P. mengdeni.

The name gwardar is a word meaning "go the long way around" in an Aboriginal language. This may be regarded as advice for people who come across the species in the wild: that is, while P. nuchalis is generally cautious, shy and inclined to retreat rather than attack, it will defend itself if cornered.

The western brown snake grows up to 1.8 m (5.9 ft) in total length (including tail). Its back can feature shades of orange-brown with flecks and bands, or appear plain. Its belly is cream to orange with pink blotches. Some individuals have jet black heads (this can cause it to be confused with the black-headed python), while others feature a black 'V' shape on the back of their neck, below their head.

Habitat
The western brown has a wide distribution and is found across most of the Australian continent, including all of the Northern Territory, as well as most of Queensland, Western Australia, and some of Victoria. The western brown is a ground dwelling snake which prefers drier habitats but is also found in coastal eucalypt forests, woodlands, and grasslands. Although the western brown is not an arboreal species, it is not uncommon for it to climb small shrubs or trees. It also hides in crevices and under rocks, and in urban areas can be found under rubbish or tin piles.

Venom
Although the western brown snake's venom is not the most toxic in the brown snake genus, its average delivery contains a relatively high quantity of venom, and thus the western brown snake has high potential to deliver a deadly bite. Its venom contains neurotoxins, nephrotoxins, and a procoagulant, although humans are not usually affected by the neurotoxins. The bite is usually painless and difficult to see due to their small fangs. Human symptoms of a western brown snake bite are headache, nausea/vomiting, abdominal pain, severe coagulopathy, and sometimes kidney damage. In dogs and cats, paralysis is also likely to occur.

Behaviour
The western brown snake is known to be very aggressive when disturbed or threatened, but like most snakes, will usually prefer to retreat from danger. It may develop nocturnal habits during the warmer months but is otherwise active during the day and enjoys lots of sunlight. The Western Brown snake has also been known to practise cannibalism, although this is not common. Western brown snakes kill their prey with a combination of venom and constriction.

Tiger Rattlesnake

The tiger rattlesnake, Crotalus tigris, is a highly venomous pit viper species found in the south-western United States and north-western Mexico. No subspecies are currently recognized. The specific name tigris, Latin for "tiger", refers to the many narrow dorsal crossbands, which create a pattern of vertical stripes when viewed from the side. The tiger rattlesnake is easily identified by its small, spade-shaped head, which is about 1/25 of its total body length. It has the smallest head of any rattlesnake, and a large rattle.

The colour pattern consists of a gray, lavender, blue-gray, pink, or buff ground colour that usually turns to pink, pale orange, or cream on the sides. Tiger rattlesnakes are the only rattlesnake with crossbands on the anterior portion of their bodies, with a series of 35 to 52 gray, olive, or brown bands across the dorsum consisting mainly of heavy punctations. These crossbands have vague borders and are wider dorsally than laterally.

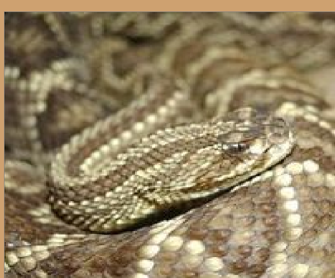
Habitat
The species' range extends from central Arizona south through south-central Arizona in the United States, to southern Sonora, Mexico, including Isla Tiburón in the Gulf of California and was recently discovered in the southern Peloncillo Mountains of Arizona. The type locality is described as "Sierra Verde and Pozo Verde". The latter is a spring located on the Sonora side of the US-Mexico border, near Sasabe. According to Stejneger (1893), this spring is on the western slope of the southern Sierra Verde, which is also known as the Sierra del Pozo Verde. In these areas, the tiger rattlesnake is observed at elevations from sea level to about 1,465 m (4,806 ft) Reported occurrences at higher elevations have not been confirmed. Tiger rattlesnakes habitats include rocky desert canyons, foothills, and bajadas, in vegetation zones ranging from thornscrub, ocotillo-mesquite-creosote bush, saguaro-paloverde, mesquite grassland, and chaparral to tropical deciduous forest (southern Sonora) and the lower edge of oak woodland. In south-eastern Arizona, this snake occurs strictly in rocky areas in winter and spring, but uses edges of arroyos in summer. It is a terrestrial species, but may climb into low vegetation.

Venom
Although it has a comparatively low venom yield, its toxicity is considered to be the second highest of all rattlesnake venoms (next to the mojave), and the second highest of all snakes in the Western Hemisphere. There is very little information available for bite symptoms. Human bites by the tiger rattlesnake are infrequent, and literature available on bites by this snake is scarce. The several recorded human envenomations by tiger rattlesnakes produced little local pain, swelling, or other reaction following the bite, and despite the toxicity of its venom no significant systemic symptoms.

The comparatively low venom yield (6.4–11 mg dried venom) and short 4.0 mm (0.40 cm) to 4.6 mm (0.46 cm) fangs of the tiger rattlesnake possibly prevent severe envenoming in adult humans. However, the clinical picture could be much more serious if the person bitten was a child or a slight build individual. The early therapeutic use of antivenom is important if significant envenomation is suspected. Despite the low venom yield, a bite by this rattlesnake should be considered a life-threatening medical emergency. Untreated mortality rate is unknown but this snake has a very high venom toxicity and its bites are capable of producing major envenomation.

Behaviour
Tiger rattlesnakes are terrestrial snakes and are nocturnal during the hot summer (June–August), but become diurnal and crepuscular during the fall season. They hibernate during the late fall and winter in rock crevices or animal burrows. In spite of being ground-dwelling, their activity is not restricted to the ground. They swim readily and have been found in bushes 60 cm (24 in) above the ground. Little information is available concerning communication and perception among tiger rattlesnakes. However, like other pit vipers, tiger rattlesnakes have heat-sensing pits (located on each side of the face between the eye and nostril) to detect warm-blooded predators and prey.

Cascabel



Crotalus durissus is a venomous pit viper species found in South America. The most widely distributed member of its genus, this species poses a serious medical problem in many parts of its range. Currently, nine subspecies are recognized, including the nominate subspecies described here. This large Neotropical rattlesnake grows to a length of 1.5 m (4.9 ft), and rarely to a maximum length of 1.9 m (6.2 ft). It has two distinct stripes starting at the base of the head. Within the lines, the colour is lighter than the stripes.

Habitat
C. durissus is found in South America except the Andes Mountains. However, its range is discontinuous, with many isolated populations in northern South America, including Colombia, Venezuela, Guyana, Suriname, French Guiana and northern Brazil. It occurs in Colombia and eastern Brazil to south-eastern Peru, Bolivia, Paraguay, Uruguay, and northern Argentina. Also, it occurs on some islands in the Caribbean, including Morro de la Iguana, Tamarindo and Aruba. The type locality given is "America. It prefers savannah and semi-arid zones. It has been reported to occur in littoral xerophilous scrub, psammophilous and halophilous littoral grassland, thorny xerophilous scrub, tropophilous deciduous and semideciduous scrub, as well as tropophilous semideciduous seasonal forest in the northwest of Venezuela. In the Chaco region of Paraguay, it is found in the drier, sandier areas.

Venom
Bite symptoms are very different from those of Nearctic species due to the presence of neurotoxins (crotoxin and crotamine) that cause progressive paralysis. Bites from C. d. terrificus in particular can result in impaired vision or complete blindness, auditory disorders, ptosis, paralysis of the peripheral muscles, especially of the neck, which becomes so limp as to appear broken, and eventually life-threatening respiratory paralysis. The ocular disturbances are sometimes followed by permanent blindness. Phospholipase A2 neurotoxins also cause damage to skeletal muscles and possibly the heart, causing general aches, pain, and tenderness throughout the body. Myoglobin released into the blood results in dark urine. Other serious complications may result from systemic disorders (incoagulable blood and general spontaneous bleeding), hypotension, and shock. Hemorrhagins may be present in the venom, but any corresponding effects are completely overshadowed by the startling and serious neurotoxic symptoms.

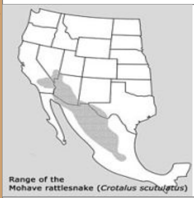
Mojave Rattlesnake

Crotalus scutulatus (common names: Mojave rattlesnake, Mojave green,) is a highly venomous pit viper species found in the deserts of the south-western United States and central Mexico. It is perhaps best known for its potent neurotoxic-hemotoxic venom, which is considered the world's most potent rattlesnake venom.

Two subspecies are recognized, including the nominate subspecies described here. This species grows to an average of less than 100 cm (3.3 ft) in length, with a maximum of 137.3 cm (4.50 ft). The colour varies from shades of brown to pale green depending on the surroundings. The green hue found among Mojave rattlesnakes has led to them being known as "Mojave greens" in some areas.

Like C. atrox (the western diamondback rattlesnake), which it closely resembles, C. scutulatus has a dark diamond pattern along its back. With C. scutulatus, the white bands on the tail tend to be wider than the black, while the band width is usually more equal in C. atrox. Additionally, C. scutulatus has enlarged scales on top of the head between the supraoculars, and the light postocular stripe passes behind the corner of the mouth. In C. atrox, the crown is covered in small scales, and the light postocular stripe intersects the mouth.

Geography
This snake is found in the south-western United States in southern California, southern Nevada, extreme south-western Utah, most of Arizona, southern New Mexico, and some of Texas. It also ranges southward through much of Mexico to southern Puebla. It is found in deserts and other areas with xeric vegetation from near sea level to about 2500 m altitude. No type locality is given. Smith and Taylor (1950) proposed "Wickenburg, Maricopa County, Arizona" (USA), while Schmidt (1953) listed the type locality as "Mojave Desert, California" (USA).


Range of the Mohave rattlesnake (*Crotalus scutulatus*)

Habitat
Primarily a snake of high desert or lower mountain slopes, it is often found near scrub brush such as mesquite and creosote, but may also reside in lowland areas of sparse vegetation, among cacti, Joshua tree forests, or grassy plains. It tends to avoid densely vegetated and rocky areas, preferring open, arid habitats.

Venom
The Mojave rattlesnake is one of the world's most venomous snakes. The most common subspecies of Mojave rattlesnake (type A) has a neurotoxic venom that is considered to be the most debilitating and potentially deadly of all rattlesnakes, and even matching several elapids. However, chances for survival are very good if medical attention is sought as soon as possible after a bite. In people bitten by venom A Mojave rattlesnakes (those outside the relatively small Venom B area in south-central Arizona), the onset of serious signs and symptoms can be delayed, sometimes leading to an initial underestimation of the severity of the bite. Significant envenomations (as with all snakebites, the quantity of venom injected is highly variable and unpredictable) can produce vision abnormalities and difficulty swallowing and speaking. In severe cases, skeletal muscle weakness can lead to difficulty breathing and even respiratory failure. Contrary to popular belief, fatalities are uncommon. This is largely due to the wide availability of antivenom.

Behaviour
C. scutulatus is most active from April to September, and brumates alone or in small groups during the winter. Ambush predators, they eat mostly small rodents and lizards. Females bear live young, from two to 17 (average about eight), from July through September. Although they have a reputation for being aggressive towards people, such behaviour is not described in the scientific literature. Like other rattlesnakes, however, they will defend themselves vigorously when disturbed.

Malayan Pit Viper

Calloselasma is a monotypic genus created for a venomous pit viper species, C. rhodostoma, which is endemic to Southeast Asia from Thailand to northern Malaysia and on the island of Java. No subspecies are currently recognized. Attains an average total length of 76 cm (30 in), with females being slightly longer than males. Occasionally, they may grow as long as 91 cm (36 in). A specimen with a total length of 81 cm (32 in) has a tail 9 cm (3.5 in) long.

Dorsally it is reddish, grayish, or pale brown, with two series of large, dark brown, black-edged triangular blotches, which are alternating or opposite. There is also a thin dark brown vertebral stripe, which may be interrupted or indistinct in some specimens. The upper labials are pink or yellowish, and powdered with brown. There is a broad, dark brown, black-edged diagonal stripe from the eye to the corner of the mouth, with a narrower light-coloured stripe above it. Ventrally it is yellowish, uniform or powdered or spotted with grayish brown.

The smooth dorsal scales are arranged in 21 rows at midbody. Ventrals 138-157; anal plate entire; subcaudals 34-54 pairs. Snout pointed and upturned. Rostral as deep as broad. Two internasals and two prefrontals. Frontal as long as or slightly longer than its distance from tip of snout, as long as or slightly shorter than the parietals. 7-9 upper labials. Loreal pit not in contact with the upper labials. This is the only Asian pit viper with large crown scales and smooth dorsal scales.

Habitat
Found in Nepal, Thailand, Cambodia, Laos, Vietnam, northern West Malaysia and on the Indonesian island of Java. The type locality is listed as "Java". There are unconfirmed, but credible reports from southern Myanmar (Burma), northern Sumatra and northern Borneo. Prefers coastal forests, bamboo thickets, unused and overgrown farmland, orchards, plantations as well as forests around plantations, where it searches for rats and mice.

Venom
This species has a reputation for being bad-tempered and quick to strike. In northern Malaysia it is responsible for some 700 incidents of snakebite annually with a mortality rate of about 2 percent. Remarkably sedentary, it has often been found in the same spot several hours after an incident involving humans. Its venom causes severe pain and local swelling and sometimes tissue necrosis, but deaths are not common. Unfortunately many victims are left with dysfunctional or amputated limbs due to the lack of antivenom and early treatment.

Sharp-Nosed Pit Viper

Deinagkistrodon is a monotypic genus created for the venomous pit viper species, D. acutus, which is endemic to Southeast Asia. There are no subspecies which are recognized as being valid. Deinagkistrodon acutus is light brown or greyish brown dorsally, with a series of dark brown lateral triangles on each side. The two pointed tops of the two opposite triangles meet each other at the mid-line, forming a series of about 20 light brown, squarish blotches on the back. A row of large black spots extends along each side near the belly.

The top and upper sides of the head are uniformly black, with a black streak from the eye to the angle of the mouth. D. acutus is yellowish ventrally, spotted with dark brown. The young are much lighter than the adults with essentially the same pattern. The head is large, triangular, with an upturned snout. The body is very stout. The tail is short, ending in a compressed, pointed slightly curved cornified scale. The top of the head is covered with nine large shields.

The dorsal scales are strongly and tubercularly keeled. The subcaudals are mostly in pairs, some of the anterior ones are single. This stout snake, usually between 0.8 and 1.0 metre (2.6 and 3.3 ft) in total length (including tail), reaches a maximum total length of 1.57 metres (5.2 ft) in males and 1.41 metres (4.6 ft) in females. The largest specimen on record measured approximately 1.549 metres (5.08 ft).

Habitat
D. acutus is found in southern China (Zhejiang, Fujian, Hunan, Hubei, Guangdong), Taiwan, northern Vietnam, and possibly Laos. The type locality was not included in the original description. The species D. acutus inhabits high, forested mountains up to 1,350 metres (4,430 ft), but has also been found in low coastal regions (100 metres (330 ft)). It prefers lower mountain slopes or rocky hills with small valleys.

Behaviour
D. acutus is a nocturnal species. It is generally discovered by day on rocks or among vegetation along banks of streams, or in firewood near houses, or even in houses. When encountered it may appear sluggish at first, but it is capable of striking vigorously when threatened.

Venom
Dangerous animals often have exaggerated reputations and the species D. acutus is no exception. The popular name "hundred pacer" refers to a local belief that, after being bitten, the victim will only be able to walk 100 steps before dying. In some areas, it has even been called the "fifty pacer." Nevertheless, this species is considered dangerous, and fatalities are not unusual. An antivenom is produced in Taiwan. According to the US Armed Forces Pest Management Board, the venom is a potent hemotoxin that is strongly hemorrhagic. Bite symptoms include severe local pain and bleeding that may begin almost immediately. This is followed by considerable swelling, blistering, necrosis, and ulceration. Systemic symptoms, which often include heart palpitations, may occur suddenly and relatively soon after the bite. Because of its body size and large hinged fangs which permit effective delivery of large quantities of venom, victims bitten by this snake should be treated accordingly.

Other Snakes

Common adder (Vipera berus) Venomous	
Death Adder () Venomous	
Common death adder (Acanthophis antarcticus) Venomous	
Desert death adder (Acanthophis pyrrhus) Venomous	
Horned adder (Bitis caudalis) Venomous	
Long-nosed adder (Vipera ammodytes) Venomous	
Many-horned adder (Bitis cornuta) Venomous	
Mountain adder (Bitis atropos) Venomous	
Mud adder (Denisonia devisi) Venomous	
Namaqua dwarf adder (Bitis schneideri) Venomous	
Nightingale adder	
Peringuey's adder (Bitis peringueyi) Venomous	

2 Spiders

Australian Funnel-Web Spider

Atracidae is a family of mygalomorph spiders, commonly known as Australian funnel-web spiders or atracids. It has been included as a subfamily of the Hexathelidae, but is now recognized as a separate family. All members of the family are native to Australia. Atracidae consists of three genera: Atrax, Hadronyche, and Illawarra, comprising 35 species. Some members of the family produce venom, which is dangerous to humans, and bites by spiders of six of the species have caused severe injuries to victims.

The bite of the Sydney funnel-web spider (Atrax robustus) and northern tree funnel-web spider (Hadronyche formidabilis) are potentially deadly, but no fatalities have occurred since the introduction of modern first-aid techniques and antivenom. Spiders in the family Atracidae are medium to large in size, with body lengths ranging from 1 to 5 cm (0.4 to 2.0 in). They have a hairless carapace covering the front part of the body.

Some atracids have relatively long spinnerets; this is especially true of A. robustus. Males have a large mating spur projecting from the middle of their second pair of legs. Like other Mygalomorphae – an infraorder of spiders that includes the tropical tarantulas – these spiders have fangs that point straight down the body and do not point towards each other (cf. Araneomorphae). They have ample venom glands that lie entirely within their chelicerae. Their fangs are large and powerful, capable of penetrating fingernails and soft shoes.

Australian funnel-web spiders make their burrows in moist, cool, sheltered habitats – under rocks, in and under rotting logs, some in rough-barked trees (occasionally metres above ground). They are commonly found in suburban rockeries and shrubberies, rarely in lawns or other open terrain. A burrow characteristically has irregular silk trip-lines radiating from the entrance. Unlike some related trapdoor spiders, they do not build lids to their burrows. The primary range of the Australian funnel-web spiders is the eastern coast of Australia, with specimens found in New South Wales, South Australia, Victoria, and Queensland.

The only Australian states or territories without members of this family are Western Australia and the Northern Territory. Examination of bite records has implicated wandering males in most if not all fatal funnel-web bites to humans. Adult males, recognised by the modified terminal segment of the palp, tend to wander during the warmer months of the year looking for receptive females for mating.

They are attracted to water, hence are often found in swimming pools, into which they often fall while wandering. They are attracted to water, hence are often found in swimming pools, into which they often fall while wandering. The spiders can survive immersion in water for several hours and can deliver a bite when removed from the water. They also show up in garages and yards in suburban Sydney. Contrary to commonly held belief, funnel-web spiders are not able to jump, although they can run quickly. While some very venomous spiders do not always inject venom when they bite, these spiders most often do. The volume of venom delivered to large animals is often small, possibly due to the angle of the fangs, which are not horizontally opposed, and because contact is often brief before the spider is brushed off. About 10 to 25% of bites are claimed to produce significant toxicity, but the likelihood cannot be predicted and all bites should be treated as potentially life-threatening.

Symptoms
Envenomation symptoms observed following bites by these spiders are very similar. The bite is initially very painful, due to the size of the fangs penetrating the skin. Puncture marks and local bleeding are also usually visibles. If substantial envenomation occurs, symptoms generally occur within minutes and progress rapidly. Early symptoms of systemic envenomation include goose bumps, sweating, tingling around the mouth and tongue, twitching (initially facial and intercostal), salivation, watery eyes, elevated heart rate, and elevated blood pressure. As systemic envenomation progresses, symptoms include nausea, vomiting, shortness of breath (caused by airway obstruction), agitation, confusion, writhing, grimacing, muscle spasms, pulmonary oedema (of neurogenic or hypertensive origin), metabolic acidosis, and extreme hypertension. The final stages of severe envenomation include dilation of the pupils (often fixed), uncontrolled generalised muscle twitching, unconsciousness, elevated intracranial pressure, and death. Death generally is a result of progressive hypotension or possibly elevated intracranial pressure consequent on cerebral oedema. The onset of severe envenomation can be rapid. In one prospective study, the median time to onset of envenomation was 28 minutes, with only two cases having onset after 2 hours (both had pressure immobilisation bandages applied). Death may occur within a period ranging from 15 minutes (this occurred when a small child was bitten) to 3 days.

Treatment
Owing to the severity of symptoms, and the speed with which they progress, in areas where these spiders are known to live, all bites from large, black spiders should be treated as though they were caused by Australian funnel-web spiders. First-aid treatment for a suspected funnel-web spider bite consists of immediately applying a pressure immobilization bandage; a technique which consists of wrapping the bitten limb with a crepe bandage, as well as applying a splint to limit movement of the limb. This technique was originally developed for snakebites, but has also been shown to be effective at slowing venom movement and preventing systemic envenomation in case of a funnel-web spider bite.

Some evidence suggests that periods of prolonged localisation may slowly inactivate the venom. Further supportive care may be necessary, but the mainstay of treatment is antivenom. Venom from the male A. robustus is used in producing the antivenom, but it appears to be effective against the venom of all species of atracids. Funnel-web antivenom has also been shown, in vitro, to reverse the effects of eastern mouse spider (Missulena bradleyi) venom.

Prior to the introduction of antivenom, envenomation resulted in significant morbidity and mortality. The purified rabbit IgG antivenom was developed in 1981 through a team effort led by Dr Struan Sutherland, head of immunology at the Australian Commonwealth Serum Laboratories in Melbourne. The antivenom is fast-acting and highly and globally effective. Antivenom therapy has shortened the course of envenomation effects; prior to its availability, the average length of hospital treatment for severe bites was about 14 days. Today, antivenom-treated patients are commonly discharged from hospital within 1 to 3 days. No deaths are known since it became available.

Brazilian Wandering Spiders

Phoneutria fera is a species of spider in the family Ctenidae found in South America (Colombia, Ecuador, Peru, Brazil, Suriname and Guyana). It is commonly known as the Brazilian wandering spider as well as the banana spider, although these names are applied to other species in the genus Phoneutria, particularly Phoneutria nigriventer. P. fera tends to spend a larger amount of time in vegetation during the early period of its life and spends more time on the ground once they become larger. This is more common in females, since they typically tend to be larger in size than males.

Widow Spiders

Latrodectus is a broadly distributed genus of spiders, which is composed of both black widow spiders and brown widow spiders. Species vary widely in size. In most cases, the females are dark-coloured and readily identifiable by reddish markings on the abdomen, which are often hourglass-shaped. These small spiders have an unusually potent venom containing the neurotoxin latrotoxin, which causes the condition latrodectism, both named after the genus. Female widow spiders have unusually large venom glands and their bite can be particularly harmful to large vertebrates, including humans.

Only the bites of the females are dangerous to humans. Despite their notoriety, Latrodectus bites are rarely fatal or even produce serious complications. Female widow spiders are typically dark brown or a shiny black in colour when they are full grown, usually exhibiting a red or orange hourglass on the ventral surface (underside) of the abdomen; some may have a pair of red spots or have no marking at all.

The male widow spiders often exhibit various red or red and white markings on the dorsal surface (upper side) of the abdomen, ranging from a single stripe to bars or spots, and juveniles are often similar to the male pattern. Females of a few species are paler brown and some have no bright markings. The bodies of black widow spiders range from 3–10 mm (0.12–0.39 in) in size; some females can measure 13 mm (0.51 in) in their body length.

Behaviour
The prevalence of sexual cannibalism, a behaviour in which the female eats the male after mating, has inspired the common name "widow spiders". This behaviour may promote the survival odds of the offspring; however, females of some species only rarely show this behaviour, and much of the documented evidence for sexual cannibalism has been observed in laboratory cages where the males could not escape. Male black-widow spiders tend to select their mates by determining if the female has eaten already to avoid being eaten themselves. Like other members of the Theridiidae, widow spiders construct a web of irregular, tangled, sticky silken fibres. Black-widow spiders prefer to nest near the ground in dark and undisturbed areas, usually in small holes produced by animals, or around construction openings or wood piles. Indoor nests are in dark, undisturbed places such as under desks or furniture or in a basement.

The spider frequently hangs upside down near the centre of its web and waits for insects to blunder in and get stuck. Then, before the insect can extricate itself, the spider rushes over to envenomate and wrap it in silk. To feed, the mouth pulses digestive juices over the prey which is liquified and then internalized by capillary action, allowing the slurry to be sucked back up into the mouth. Their prey consists of small insects such as flies, mosquitoes, grasshoppers, beetles, and caterpillars. If the spider perceives a threat, it quickly lets itself down to the ground on a safety line of silk.

As with other web-weavers, these spiders have very poor eyesight and depend on vibrations reaching them through their webs to find trapped prey or warn them of larger threats. When a widow spider is trapped, it is unlikely to bite, preferring to play dead or flick silk at the potential threat; bites occur when they cannot escape. Many injuries to humans are due to defensive bites delivered when a spider gets unintentionally squeezed or pinched.

Distribution
Widow spiders can be found on every continent of the world except Antarctica. In North America, the black widows commonly known as southern (Latrodectus mactans), western (Latrodectus hesperus), and northern (Latrodectus variolus) can be found in the United States, as well as parts of southern Canada – particularly in the Okanagan Valley of British Columbia, as can the "gray" or "brown widow spiders" (Latrodectus geometricus) and the "red widow spiders" (Latrodectus bishopi). The most prevalent species occurring in eastern Asia and Australia is commonly called the redback (Latrodectus hasselti).

Bite
Due to the presence of latrotoxin in their venom, black widow bites are potentially dangerous and may result in systemic effects (latrodectism) including severe muscle pain, abdominal cramps, hyperhidrosis, tachycardia, and muscle spasms. Symptoms usually last for 3–7 days, but may persist for several weeks. In the United States each year, about 2,200 people report being bitten by a black widow, but most do not need medical treatment. Some bites have no venom injected, a "dry" bite. Black widows are not especially aggressive spiders, and they rarely bite humans unless startled or otherwise threatened. Since the venom is not likely to be life-threatening, antivenom has been used as pain relief and not to save lives.

False Black Widows

One common name is cupboard spider, for many species build their webs in dark, sheltered, undisturbed places around the house or garden, in sheds and garages, under garden furniture, compost bins, and the like. Signs of the cupboard spider include small white spots of spider droppings, like small splashes of paint, on the floor underneath the web. Many spiders of the genus Steatoda are often mistaken for widow spiders (Latrodectus), and are known as false black widows.

They are closely related (in the family Theridiidae) but Steatoda are significantly less harmful to humans. Not all Steatoda species resemble black widows – they come in many different colours and sizes, mostly smaller than Latrodectus specimens.

Steatoda paykulliana can grow larger than the black widow, and Steatoda castanea looks more like a brown widow. Like other theridiidae, they often feed on other spiders that get tangled up in their webs, including spiders that are considered hazardous to humans, like wandering male hobo spiders.

Steatoda grossa sometimes preys on black widows. The colour can range from sandy pale brown to reddish plum to satiny black. Like most spiders, its cephalothorax is smaller than its abdomen, which is somewhat egg-shaped, and can have white or beige to orange markings. Although sometimes not or partially visible, these markings usually consists of a frontal crescent, often with a dorsal line or triangular shapes or both. Orange to reddish-marked Steatoda paykulliana can be mistaken for the redback spider). In common with other members of the Theridiidae family, Steatoda spiders construct a tangled web, i.e., an irregular tangle of sticky silken fibres. As with other web-weavers, these spiders have very poor eyesight and depend mostly on vibrations reaching them through their webs to orient themselves to prey or to warn them of larger animals that could injure or kill them.

Recluse Spiders

The recluse spiders or brown spiders, genus Loxosceles, also known as fiddle-backs, violin spiders, or reapers, are a genus of venomous spiders known for their bite, which sometimes produces a characteristic set of symptoms known as loxoscelism. Recluse spiders are now identified as members of the family Sicariidae, having formerly been placed in their own family, the Loxoscelidae. Although recluse spiders have a bad reputation, they are usually not aggressive. Loxosceles is distributed nearly worldwide in warmer areas. All have six eyes arranged in three groups of two (dyads) and some are brownish with a darker brown characteristic violin marking on the cephalothorax.

However, the "violin marking" cannot be used as a reliable way to identify the spider as thousands of species of spider have similar markings. Spiders come with many markings varying greatly within the same species.

Most Loxosceles can live for one and a half to two years. Many species of this genus can live for very long times without food or water. They are about 7–12 mm long. The most common and most famous species in the United States is the brown recluse spider (Loxosceles reclusa). It is found in a large area of the Midwest, west to Colorado and the New Mexico state line and east to northern Georgia.

Sporadic records from other locations only represent incidental introductions, not established populations. The brown recluse feeds on whatever small prey is available, and has been observed to prefer scavenging over actively hunting. Other notable members of this genus include the Chilean recluse spider (L. laeta) and the Mediterranean recluse spider (L. rufescens). Recently, concerns have been raised regarding recluses spreading faster due to warmer air carrying them farther as a result of changing climate. On the contrary, newly hatched recluses do not travel via ballooning and thus the populations are confined to very tight spaces with dense populations.

Venom
Many types of skin wounds are mistaken for or assumed to be the result of a recluse spider bite. Several diseases can mimic the lesions of the bite, including Lyme disease, various fungal and bacterial infections, and the first sore of syphilis. It is important to associate the spider directly with the bite to avoid improper treatment, and to successfully treat common infections or other conditions if no spider was seen. Bites most often occur as a defence when the spider is trapped against the skin, in clothing, for example. Insecticides often fail to kill the spider, instead intoxicating its nervous system and inducing erratic behaviour.

The bite of a recluse spider can generally be categorized into one of the following groups:
● Unremarkable - self-healing minute damage
● Mild reaction - self-healing damage with itchiness, redness, patterns of aggressive behaviour and a mild lesion.
● Dermonecrotic - the uncommon, "classic" recluse bite, producing a necrotic skin lesion. About 66% of necrotic bite lesions heal with no complications. In extreme cases, the lesion may be up to 40 centimetres wide, last for several months, and heal with a permanent scar.
● Systemic or viscerocutaneous - an extremely rare, systemic reaction to envenomation of the bloodstream. It is observed more often in children.
Most bites are unremarkable or mild.

Macrothele spp.

Macrothele is a genus of mygalomorph spiders. It is the only genus in the family Macrothelidae. Most species occur in Asia from India to Japan and Java, with four found in Africa and two in Europe. Spiders of this genus are fairly large, with Chinese species ranging from 1–3 cm (0.4–1.2 in) in female body length. Males are smaller, sometimes only half that length. Macrothelids can be distinguished from other mygalomorph spiders by having larger posterior sigillae on the sternum, and the arrangement of the rows of teeth on the margin of the chelicerae: larger front-facing margin and smaller rear-facing.

These spiders build tube-webs or funnel-webs under rocks or logs, or in crevices in the ground. Macrothele ranges from the western Mediterranean and West Africa to Southeast Asia, mainland China and Taiwan. However, there is some doubt if the western and eastern species should be grouped in the same genus.

Missulena

Missulena is a genus of mygalomorph spiders in the Actinopodidae family, sometimes called mouse spiders. It was first described by Charles Athanase Walckenaer in 1805. M. tussulena is found in Chile, but the rest are indigenous to Australia.

Region
The term "mouse spider" comes from the now disproven belief that they dig deep burrows similar to those of mice. Scotophaeus blackwalli also shares the common name "mouse spider", but is actually quite different. It is in a different family, not a mygalomorph, is much smaller, looks very different, and is not considered dangerous. Mouse spiders are medium-to-large spiders which range in length from 1 cm to 3 cm. Their carapace is glossy, and they have high, broad heads, with eyes spread out across the front of the head. They have short spinnerets, located in the rear of the abdomen. Mouse spiders exhibit sexual dimorphism, with female spiders being all black; and male spiders having species-specific colouration. The male eastern mouse spider (M. bradleyi) has a bluish patch, and the male red-headed mouse spider (M. occatoria) is brownish or blue-black in colour, with bright red-tinged jaws. Mouse spiders prey mainly on insects, though they may consume other small animals as opportunity presents. The primary predators of the mouse spider include wasps, centipedes, and scorpions.

Habitat
The mouse spiders have a Gondwanan distribution, with one species found in Chile and the rest distributed throughout Australia, while the nearest related genera occur in South America. Similar to trapdoor spiders, mouse spiders live in burrows covered with trapdoors, which can extend to nearly 30 cm (1 ft) in depth. Female mouse spiders generally remain in their burrows; the males wander in search of mates.

Symptoms
The bites of several species of mouse spiders in Australia have been found to produce serious symptoms, similar to the Australian funnel-web spider. However, serious envenomations are relatively rare; most mouse spider bites documented in the medical literature did not require use of antivenom or involve serious symptoms. The venom of the eastern mouse spider (M. bradleyi) was found to have toxins similar to the robustoxin found in funnel-web venom; and funnel-web antivenom has been found to be effective in treating severe mouse spider bites. Unlike the funnel-web, however, the mouse spider is far less aggressive towards humans, and may often give "dry" bites. Some evidence suggests that the bite of a mouse spider is potentially as serious as that of an Australasian funnel-web spider; however, recorded bites by this spider are rare, despite the abundance of some species amid human habitation. Funnel-web antivenom has been found to be an effective treatment for serious bites.

Sicarius spp.

Sicarius is a genus of spider in the family Sicariidae. In 2017, the genus Hexophthalma was split off from Sicarius; as currently circumscribed, Sicarius is native to South America with one species found in Central America. Sicarius is one of three genera in the family Sicariidae. The venom of its species appears to be less dangerous than that of species of the other two genera, Hexophthalma and Loxosceles.

Sicarius are desert and dry country spiders that live in the Southern Hemisphere in South America (the single exception is the Central American S. rugosus), known primarily for their self-burying behaviour. All have six eyes arranged in three groups of two (dyads). Sicarius resembles the crab spiders of the family Thomisidae and the members of the family Homalonychidae. However, Sicarius lacks the characteristic violin-shaped marking of the related recluse spiders.

Individual Sicarius can live for as much as 15 years, which makes these among the longest-lived araneomorphae spiders (some tarantulas can live well over 20–30 years), and can live for a very long time without food or water. Sicarius spiders are between one and two inches in length. The females produce egg sacs covered with a mixture of sand and silk.

Venom Components
The spiders of this genus, like those of other species in the family Sicariidae, produce venom containing the necrotic (dermonecrotic) agent, sphingomyelinase D, which is otherwise found only in a few pathogenic bacteria. Species remaining in reduced genus Sicarius appear to have less potent venom than those moved to Hexophthalma. Sicariids are found in barren deserts and are able to bury themselves partially in the sand. Because of this, humans seldom come in contact with them.

Hexophthalma spp.

Hexophthalma is a genus of spiders in the family Sicariidae. Although the genus was originally erected in 1878 (then with the name Hexomma), it was merged into the genus Sicarius in the 1890s, and remained unused until revived in 2017, when it was discovered that the African species then placed in Sicarius were distinct. The English name six-eyed sand spiders is used for members of the genus, particularly Hexophthalma hahni. Species in the genus have necrotic (dermonecrotic) venom, and can potentially cause serious or even life-threatening wounds.

Venom

Species of Hexophthalma produce venom that can have necrotic (dermonecrotic) effects, capable of causing serious or even life-threatening wounds, particularly if the wound becomes infected or the venom spreads in the body. The necrotic effects are caused by a family of proteins related to sphingomyelinase D, present in the venom of all sicariid spiders. In this respect, the genus resembles Loxosceles, the recluse spiders However, most Hexophthalama species have only been studied in vitro, and the detailed effects of their venom in humans and other vertebrates are unknown.

Tarantula

Tarantulas comprise a group of large and often hairy arachnids belonging to the Theraphosidae family of spiders, of which about 900 species have been identified. This article only describes members of the Theraphosidae, although some other members of the same infraorder (Mygalomorphae) are commonly referred to as "tarantulas". Some species have become popular in the exotic pet trade. New World species kept as pets have urticating hairs that can cause irritation to the skin and, in extreme cases, cause damage to eyes.

Like all arthropods, the tarantula is an invertebrate that relies on an exoskeleton for muscular support. Like other Arachnida, a tarantula's body comprises two main parts, the prosoma (or cephalothorax) and the opisthosoma (or abdomen). The prosoma and opisthosoma are connected by the pedicel, or pregenital somite. This waist-like connecting piece is actually part of the prosoma and gives the opisthosoma a wide range of motion relative to the prosoma.

Tarantula sizes range from as small as a fingernail to as large as a dinner plate when the legs are fully extended. Depending on the species, the body length of tarantulas ranges from 2.5 to 10 cm (1 to 4 in), with leg spans of 8–30-centimetre (3–12 in). Leg span is determined by measuring from the tip of the back leg to the tip of the front leg on the opposite side. Some of the largest species of tarantula may weigh over 85 g (3 oz); the largest of all, the goliath birdeater (Theraphosa blondi) from Venezuela and Brazil, has been reported to attain a weight of 170 g (6.0 oz) and a leg-span up to 30 cm (12 in), males being longer and females greater in girth. The fang size of this tarantula reaches a maximum of 3.8 cm (1.5 in).

Theraphosa apophysis (the pinkfoot goliath) was described 187 years after the goliath birdeater, so its characteristics are not as well attested. Theraphosa blondi is generally thought to be the heaviest tarantula, and T. apophysis to have the greatest leg span. Two other species, Lasiodora parahybana (the Brazilian salmon birdeater) and Lasiodora klugi, rival the size of the two goliath spiders. Most species of North American tarantulas are brown.

Elsewhere, species have been found that variously display cobalt blue (Cyriopagopus lividus), black with white stripes (Aphonopelma seemanni), yellow leg markings (Eupalaestrus campestratus), metallic blue legs with vibrant orange abdomen and green prosoma (Chromatopelma cyaneopubescens). Their natural habitats include savannah, grasslands such as the pampas, rainforests, deserts, scrubland, mountains, and cloud forests. They are generally classed among the terrestrial types. They are burrowers that live in the ground.

Distribution

Tarantulas of various species occur throughout the United States, Mexico, in Central America, and throughout South America. Other species occur variously throughout Africa, much of Asia (including Ryukyu Islands in southern Japan), and all of Australia. In Europe, some species occur in Spain, Portugal, Turkey, south Italy, and Cyprus.

Habits

Some genera of tarantulas hunt prey primarily in trees; others hunt on or near the ground. All tarantulas can produce silk – while arboreal species typically reside in a silken "tube tent", terrestrial species line their burrows with silk to stabilize the burrow wall and facilitate climbing up and down. Tarantulas mainly eat large insects and other arthropods such as centipedes, millipedes, and other spiders, using ambush as their primary method of prey capture. Armed with their massive, powerful chelicerae tipped with long chitinous fangs, tarantulas are well-adapted to killing other large arthropods. The biggest tarantulas sometimes kill and consume small vertebrates such as lizards, mice, bats, birds, and small snakes.

Symptoms

All tarantulas are venomous and some bites cause serious discomfort that might persist for several days. In general, the effects of the bites of all kinds of tarantula are not well known. While the bites of many species are known to be no worse than a wasp sting, accounts of bites by some species are reported to be very painful and to produce intense spasms that may recur over a period of several days; the venom of the African tarantula Pelinobius muticus also causes strong hallucinations.

For Poecilotheria species, researchers have described more than 20 bites with the delayed onset of severe and diffuse muscle cramps, lasting for several days, that in most cases resolved completely with the use of benzodiazepines and magnesium. In all cases, seeking medical aid is advised. Because other proteins are included when a toxin is injected, some individuals may suffer severe symptoms due to an allergic reaction rather than to the venom. Such allergic effects can be life-threatening. Additionally, the large fangs of a tarantula can inflict painful puncture wounds which can lead to secondary bacterial infections if not properly treated.

Before biting, tarantulas may signal their intention to attack by rearing up into a "threat posture", which may involve raising their prosoma and lifting their front legs into the air, spreading and extending their fangs, and (in certain species) making a loud hissing by stridulating. Tarantulas often hold this position for longer than the duration of the original threat. Their next step, short of biting, maybe to slap down on the intruder with their raised front legs.

If that response fails to deter the attacker, the tarantulas of the Americas may next turn away and flick urticating bristles toward the pursuing predator. The next response may be to leave the scene entirely, but especially if no line of retreat is available, their final response may also be to whirl suddenly and bite. Some tarantulas are well known to give "dry bites", i.e., they may defensively bite some animal that intrudes on their space and threatens them, but they do not pump venom into the wound. New World tarantulas (those found in North and South America) are equipped with urticating hairs (technically bristles) on their abdomens, and almost always throw these barbed bristles as the first line of defence.

These bristles irritate sensitive areas of the body and especially seem to target curious animals which may sniff these bristles into the mucous membranes of the nose. Some species have more effective urticating bristles than others. The goliath birdeater is known for its particularly irritating urticating bristles. Urticating bristles can penetrate the cornea, so eye protection should be worn when handling such tarantulas. Old World tarantulas (from Europe, Africa, Asia, and Australia) have no urticating bristles and are more likely to attack when disturbed. They often have more potent, medically significant venom, and are faster and much more nervous and defensive than New World species.

Some dangerous spider species are related to tarantulas and are frequently confused with them. A popular urban legend maintains that deadly varieties of tarantula exist somewhere in South America. This claim is often made without identifying a particular spider, although the "banana tarantula" is sometimes named. A likely candidate for the true identity of this spider is the dangerous Brazilian wandering spider Phoneutria fera, of the family Ctenidae, as it is sometimes found hiding in clusters of bananas and is one of several spiders called the "banana spider." It is not technically a tarantula, but it is fairly large (4- to 5-inch legspan), somewhat hairy, and is highly venomous to humans.

Another dangerous type of spider that has been confused with tarantulas is the Australian funnel-web spider. The best known of these is the Sydney funnel-web spider Atrax robustus, a spider that is aggressive, highly venomous, and (prior to the development of antivenom in the 1980s) was responsible for numerous deaths in Australia. These spiders are members of the same suborder as tarantulas, Opisthothelae. Some Australians use the slang term 'triantelope' (a corruption of the incorrect term 'tarantula', which is also used) for large, hairy, and harmless members of the huntsman spider family which are often found on interior household walls and in automobiles.

3 Scorpions

Centruroides spp.

The number of species accepted as valid may vary, depending on the authority. The genus is highly speciose, containing at least 70 species. Centruroides is a genus of scorpions belonging to the family Buthidae. Several North American species are known by the common vernacular name bark scorpion. Numerous species are extensively found throughout the southern United States, Mexico, Central America, the Antilles and northern South America. Some are known for their interesting patterning or large size (among Buthidae); most if not all fluoresce strongly under ultraviolet illumination, except after moulting. They contain several highly venomous species, and fatalities are known to occur. The venom of the Mexican scorpion Centruroides limpidus limpidus contains the neurotoxins CII1 and CII2.

Deathstalker

The deathstalker (Leiurus quinquestriatus) is a species of scorpion, a member of the Buthidae family. It is also known as the Palestinian yellow scorpion, Omdurman scorpion, Naqab desert scorpion and by many other colloquial names, which generally originate from the commercial captive trade of the animal. To eliminate confusion, especially important with potentially dangerous species, the scientific name is normally used to refer to them.

The name Leiurus quinquestriatus roughly translates into English as "five-striped smooth-tail". Other species of the genus Leiurus are also often referred to as "deathstalkers". Leiurus quinquestriatus is yellow, and 30–77 millimetres (1.2–3.0 in) long, with an average of 58 mm (2.3 in).

Distribution
Leiurus quinquestriatus can be found in desert and scrubland habitats ranging from North Africa through to the Middle East. Its range covers a wide sweep of territory in the Sahara, Arabian Desert, Thar Desert, and Central Asia, from Algeria and Mali in the west through to Egypt, Ethiopia, Asia Minor and the Arabian Peninsula, eastwards to Kazakhstan and western India in the northeast and southeast.

Hazards
The deathstalker is one of the most dangerous species of scorpions. Its venom is a powerful mixture of neurotoxins, with a low lethal dose. While a sting from this scorpion is extraordinarily painful, it normally would not kill a healthy adult human. However, young children, the elderly, or infirm (such as those with a heart condition and those who are allergic) are at much greater risk. Any envenomation runs the risk of anaphylaxis, a potentially life-threatening allergic reaction to the venom. A study from Israel shows a high rate of pancreatitis following envenomation. If a sting from Leiurus quinquestriatus does prove deadly, the cause of death is usually pulmonary edema. Antivenom for the treatment of deathstalker envenomations is produced by pharmaceutical companies Twyford (German) and Sanofi Pasteur (French), and by the Antivenom and Vaccine Production Centre in Riyadh. Envenomation by the deathstalker is considered a medical emergency even with antivenom treatment, as its venom is unusually resistant to treatment and typically requires large doses of antivenom.

Uses
A component of the deathstalker's venom, the peptide chlorotoxin, has shown potential for treating human brain tumors. There has also been some evidence to show that other components of the venom may aid in the regulation of insulin and could be used to treat diabetes.

4 Insects

Bees

Wasps

Ants

Lepidopteran Caterpillars

5 Other Arthropods

Centipedes

ANIMALS Other Arthropods Centipedes

Centipedes (from Latin prefix centi-, "hundred", and pes, pedis, "foot") are arthropods belonging to the class Chilopoda of the subphylum Myriapoda, an arthropod group which also includes Millipedes and other multi-legged creatures. Centipedes are elongated metameric creatures with one pair of legs per body segment. Centipedes are highly venomous, and often inject paralysing venom; some species contains neurotoxic venom. Despite the name, centipedes can have a varying number of legs, ranging from 30 to 354. Centipedes always have an odd number of pairs of legs. Therefore, no centipede has exactly 100 legs.

A key trait uniting this group is a pair of venom claws or forcipules formed from a modified first appendage. Centipedes are predominantly carnivorous. Their size can range from a few millimetres in the smaller lithobiomorphs and geophilomorphs to about 30 cm (12 in) in the largest scolopendromorphs.

Centipedes can be found in a wide variety of environments. They normally have a drab coloration combining shades of brown and red. Cavernicolous (cave-dwelling) and subterranean species may lack pigmentation, and many tropical scolopendromorphs have bright aposematic colours. Worldwide, an estimated 8,000 species of centipedes are thought to exist, of which 3,000 have been described. Centipedes have a wide geographical range, where they even reach beyond the Arctic Circle. They are found in an array of terrestrial habitats from tropical rainforests to deserts. Within these habitats, centipedes require a moist microhabitat because they lack the waxy cuticle of insects and arachnids, therefore causing them to rapidly lose water. Accordingly, they are found in soil and leaf litter, under stones and dead wood, and inside logs.

Centipedes are among the largest terrestrial invertebrate predators, and often contribute significantly to the invertebrate predatory biomass in terrestrial ecosystems. Centipedes have a rounded or flattened head, bearing a pair of antennae at the forward margin. They have a pair of elongated mandibles, and two pairs of maxillae. The first pair of maxillae form the lower lip, and bear short palps. The first pair of limbs stretch forward from the body to cover the remainder of the mouth. These limbs, or maxillipeds, end in sharp claws and include venom glands that help the animal to kill or paralyse its prey.

Many species of centipedes lack eyes, but some possess a variable number of ocelli, which are sometimes clustered together to form true compound eyes. However, these eyes are only capable of discerning light and dark, and have no true vision. In some species, the first pair of legs at the head end of the centipede acts as sense organs similar to antennae, but unlike the antennae of most other animals, theirs point backwards. Unusual sense organs found in some groups are the organs of Tömösváry. These are located at the base of the antennae, and consist of a disc-like structure with a central pore surrounded by sensory cells. They are probably used for sensing vibrations, and may even provide a sense of hearing. Forcipules are a unique feature found only in centipedes and in no other arthropods. The forcipules are modifications of the first pair of legs, forming a pincer-like appendage always found just behind the head. Forcipules are not true mouthparts, although they are used in the capture of prey items, injecting venom and holding onto captured prey. Venom glands run through a tube almost to the tip of each forcipule.

Hazards
Some species of centipedes can be hazardous to humans because of their bite. Although a bite to an adult human is usually very painful and may cause severe swelling, chills, fever, and weakness, it is unlikely to be fatal. Bites can be dangerous to small children and those with allergies to bee stings. The venomous bite of larger centipedes can induce anaphylactic shock in such people. Smaller centipedes are generally incapable of piercing human skin. Even nonvenomous centipedes are considered frightening by humans due to their dozens of legs moving at the same time and their tendency to dart swiftly out of the darkness towards one's feet. A 19th-century Tibetan poet warned his fellow Buddhists, "if you enjoy frightening others, you will be reborn as a centipede."

Remipede

Remipedia is a class of blind crustaceans found in coastal aquifers which contain saline groundwater, with populations identified in almost every ocean basin so far explored, including in Australia, the Caribbean Sea, and the Atlantic Ocean. The first described remipede was the fossil Tesnusocaris goldichi (Lower Pennsylvanian), but, since 1979, at least seventeen living species have been identified in subtropical regions around the world. Remipedes are 1–4 centimetres (0.4–1.6 in) long and comprise a head and an elongate trunk of up to thirty-two similar body segments. They lack eyes and pigmentation. The swimming appendages are lateral on each segment, and the animals swim on their backs.

They are generally slow-moving. They are the only known venomous crustaceans, and have fangs connected to secretory glands, which inject a combination of digestive enzymes and venom into their prey. They have a generally primitive body plan in crustacean terms, and have been thought to be a basal, ancestral crustacean group.

However, Fanenbruck et al. showed that at least one species, Godzilliognomus frondosus, has a highly organized and well-differentiated brain, with a particularly large olfactory area which is a common feature for species that live in dark environments.

6 Toxic Birds

Hooded Pitohui

A medium-sized songbird with rich chestnut and black plumage, this species is one of the few known poisonous birds, containing a range of batrachotoxin compounds in its skin, feathers and other tissues. These toxins are thought to be derived from their diet, and may function both to deter predators and protect the bird from parasites. The hooded pitohui (Pitohui dichrous) is a species of bird in the genus Pitohui found in New Guinea. The species was long thought to be a whistler (Pachycephalidae) but is now known to be in the Old World oriole family (Oriolidae). Within the oriole family this species is most closely related to the variable pitohuis in the genus Pitohui, and then the figbirds.

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The close resemblance of this species to other unrelated birds also known as pitohuis which are also poisonous is an example of convergent evolution and Müllerian mimicry. Their appearance is also mimicked by unrelated non-poisonous species, a phenomenon known as Batesian mimicry.

The toxic nature of this species is well known to local hunters, who avoid it. This species is one the most poisonous species of pitohui, but the toxicity of individual birds can vary geographically. The hooded pitohui is found in forests from sea-level up to 2,000 m (6,600 ft), but is most common in hills and low mountains. A social bird, it lives in family groups and frequently joins and even leads mixed-species foraging flocks. The diet is made up of fruits, seeds and invertebrates. This species is apparently a cooperative breeder, with family groups helping to protect the nest and feed the young. The hooded pitohui is common and not at risk of extinction.

Physiology
The hooded pitohui is 22 to 23 cm (8.7–9.1 in) long and weighs 65–76 g (2.3–2.7 oz). The adult has a black upperwing, head, chin, throat and upper breast and a black tail. The rest of the plumage is a rufous chestnut. The bill and legs are black, and the irises are either reddish brown, dark brown or black. Both sexes look alike. Juvenile birds look like adults, except that the rectrices of the tail and remiges of the wing are tinged with brown. The function of the toxins to the hooded pitohui has been the source of debate and research since its discovery. The initial suggestion was that the toxins acted as a chemical deterrent to predators. Some researchers cautioned this suggestion was premature, and others noted that the levels of batrachotoxins were three orders of magnitude lower than in the poison dart frogs that do use it in this way. Another explanation for the purpose of the toxins is to mitigate the effects of parasites. In experimental conditions chewing lice were shown to avoid toxic feathers of hooded pitohui in favour of feathers with lower concentrations of toxin or no toxins at all. Additionally lice that did live in the toxic feathers did not live as long as control lice, suggesting that the toxins could lessen both the incidence of infestation and the severity.

Distribution
The hooded pitohui is endemic to the islands of New Guinea. It is found widely across the main island, and also on the nearby island of Yapen. It inhabits rainforest, forest edge habitats and secondary growth, and sometimes mangrove forests. It is most commonly found in hills and low mountains, between 350–1,700 m (1,150–5,580 ft), but is found locally down to sea-level and up to 2,000 m (6,600 ft). It typically occurs at higher elevations than the lowland variable pitohui and lower than the (unrelated) black pitohui, although there is some overlap.

Little Shrikethrush

The little shrikethrush (Colluricincla megarhyncha) is a species of bird in the family Pachycephalidae.

Habitat
It is found in Australia and New Guinea. Its natural habitats are subtropical or tropical moist lowland forests and subtropical or tropical moist montane forests.

Toxicity
During a study of toxicity in birds, two specimens of this species were tested. One of these specimens contained traces of batrachotoxins (BTXs) similar to those found in the secretions of Central and South American poison dart frogs.

Spur-Winged Goose

The spur-winged goose (Plectropterus gambensis) is a large bird in the family Anatidae, related to the geese and the shelducks, but distinct from both of these in a number of anatomical features, and therefore treated in its own subfamily, the Plectropterinae.

It occurs in wetlands throughout sub-Saharan Africa. Adults are 75–115 cm (30–45 in) long and weigh on average 4–6.8 kg (8.8–15.0 lb), rarely up to 10 kg (22 lb), with males noticeably larger than the females. The wingspan can range from 150 to 200 cm (59 to 79 in). One source claims the average weight of males is around 6 kg (13 lb) and the weight of females is around 4.7 kg (10 lb).

However, 11 geese of this species banded in South Africa were found to average only 3.87 kg (8.5 lb), with a range of 2.4 to 5.4 kg (5.3 to 11.9 lb). Another study in South Africa found that 58 males weighed an average of 5.52 kg (12.2 lb) and measured 98.1 cm (38.6 in) in total length; while 34 females averaged 3.35 kg (7.4 lb) in weight and 84.2 cm (33.1 in) in total length.

Habitat
This species often occurs in open grasslands with lakes, seasonal pools, rivers, swamps and river deltas. Large inland rivers and lakes are perhaps most commonly inhabited, with saline lakes and upland areas generally being avoided, although the species can occur to an elevation of 3,000 m (9,800 ft) in eastern Africa. It is also absent from arid zones.

Common Quail

The common quail (Coturnix coturnix) or European quail is a small ground-nesting game bird in the pheasant family Phasianidae. Coturnix is the Latin for this species. With its characteristic call of "wet my lips", this species of quail is more often heard than seen. It is widespread in Europe and North Africa, and is categorised by the IUCN as "least concern". It should not be confused with the Japanese quail, Coturnix japonica, native to Asia, which, although visually similar, has a very distinct call. Like the Japanese quail, common quails are sometimes kept as poultry. It is a small, round bird, essentially streaked brown with a white eyestripe, and, in the male, a white chin. As befits its migratory nature, it has long wings, unlike the typically short-winged gamebirds. It measures roughly 18.0–21.9 cm (7.1–8.62 in) and weighs 91–131 g (3.2–4.62 oz)

Habits
This is a terrestrial species, feeding on seeds and insects on the ground. It is notoriously difficult to see, keeping hidden in crops, and reluctant to fly, preferring to creep away instead. Even when flushed, it keeps low and soon drops back into cover. Often the only indication of its presence is the distinctive "wet-my-lips" repetitive song of the male. The call is uttered mostly in the mornings, evenings and sometimes at night. It is a strongly migratory bird, unlike most game birds.

Poisoning
If they have eaten certain plants, although which plants is still in debate, the meat from quail can be poisonous, with one in four who consume poisonous flesh becoming ill with coturnism, which is characterized by muscle soreness, and which may lead to kidney failure.

7 Mammals

European Mole

The European mole (Talpa europaea) is a mammal of the order Eulipotyphla. It is also known as the common mole and the northern mole. This mole lives in an underground tunnel system, which it constantly extends. It uses these tunnels to hunt its prey. Under normal conditions the displaced earth is pushed to the surface, resulting in the characteristic molehills. It feeds mainly on earthworms, but also on insects, centipedes and even mice and shrews.

Its saliva contains toxins which paralyse earthworms in particular. The mole has a cylindrical body and is 11 to 16 cm (4.3 to 6.3 in) long, weighing 70 to 130 g (2.5 to 4.6 oz). Females are typically smaller than males. The eyes are small and hidden behind fur, while the ears are just small ridges in the skin.

The fur is usually dark grey, but the actual range of colours is larger, as due to the subterranean habits there is no disadvantage in having off-coloured fur. European moles with white, light grey, tan, taupe, and black fur have all been reported.

Habitat

While moles are typically found in tunnel systems, the European mole is not exclusively an underground dweller. In the spring and early summer when the young moles leave their mothers' burrows they must find new territory. This forces them to leave their burrow and they can either make new tunnel systems or enter existing systems. In the summer time, however, they are likely to burrow much more superficially. The superficial burrowing could be due in part to the soil that is much harder, which makes burrowing a greater challenge. T. europaea have also been found to spend a lot of time at the sides of drainage lines and streams but do not inhabit flooded or dry soils. However, dry areas do become important when their normal habitats become flooded. Factors such as the type of soil, vegetation present, and altitude have no effect on the areas that moles choose to inhabit. The one factor that does greatly influence the mole population in a specific area is the abundance of earthworms. One would expect for the earthworm population to decrease as the moles feed, however no research has shown this to be true.

Platypus

The platypus (Ornithorhynchus anatinus), sometimes referred to as the duck-billed platypus, is a semiaquatic egg-laying mammal endemic to eastern Australia, including Tasmania. Together with the four species of echidna, it is one of the five extant species of monotremes, the only mammals that lay eggs instead of giving birth to live young. The animal is the sole living representative of its family (Ornithorhynchidae) and genus (Ornithorhynchus), though a number of related species appear in the fossil record.

The first scientists to examine a preserved platypus body (in 1799) judged it a fake, made of several animals sewn together. The unusual appearance of this egg-laying, duck-billed, beaver-tailed, otter-footed mammal baffled European naturalists when they first encountered it, with some considering it an elaborate hoax. It is one of the few species of venomous mammals: the male platypus has a spur on the hind foot that delivers a venom capable of causing severe pain to humans.

The unique features of the platypus make it an important subject in the study of evolutionary biology and a recognizable and iconic symbol of Australia; it has appeared as a mascot at national events and features on the reverse of the Australian twenty-cent coin. The platypus is the animal emblem of the state of New South Wales. Until the early 20th century humans hunted the platypus for its fur, but it is now protected throughout its range. Although captive-breeding programs have had only limited success, and the platypus is vulnerable to the effects of pollution, it is not under any immediate threat. The body and the broad, flat tail of the platypus are covered with dense, brown fur that traps a layer of insulating air to keep the animal warm. The fur is waterproof, and the texture is akin to that of a mole.

The platypus uses its tail for storage of fat reserves (an adaptation also found in animals such as the Tasmanian devil). The webbing on the feet is more significant on the front feet and is folded back when walking on land. The elongated snout and lower jaw are covered in soft skin, forming the bill. The nostrils are located on the dorsal surface of the snout, while the eyes and ears are located in a groove set just back from it; this groove is closed when swimming. Platypuses have been heard to emit a low growl when disturbed and a range of other vocalisations have been reported in captive specimens.

Venom

While both male and female platypuses are born with ankle spurs, only the male's spurs deliver venom, composed largely of defensin-like proteins (DLPs), three of which are unique to the platypus. The DLPs are produced by the immune system of the platypus. The function of defensins is to cause lysis in pathogenic bacteria and viruses, but in platypuses they also are formed into venom for defence.

Although powerful enough to kill smaller animals such as dogs, the venom is not lethal to humans, but the pain is so excruciating that the victim may be incapacitated. Oedema rapidly develops around the wound and gradually spreads throughout the affected limb. Information obtained from case histories and anecdotal evidence indicates the pain develops into a long-lasting hyperalgesia (a heightened sensitivity to pain) that persists for days or even months.

Venom is produced in the crural glands of the male, which are kidney-shaped alveolar glands connected by a thin-walled duct to a calcaneus spur on each hind limb. The female platypus, in common with echidnas, has rudimentary spur buds that do not develop (dropping off before the end of their first year) and lack functional crural glands. The venom appears to have a different function from those produced by nonmammalian species; its effects are not life-threatening to humans, but nevertheless powerful enough to seriously impair the victim.

Since only males produce venom and production rises during the breeding season, it may be used as an offensive weapon to assert dominance during this period. Similar spurs are found on many archaic mammal groups, indicating that this is an ancient characteristic for mammals as a whole, and not exclusive to the platypus or other monotremes.

Eurasian Water Shrew

The Eurasian water shrew (Neomys fodiens), known in the United Kingdom as the water shrew, is a relatively large shrew, up to 10 cm (4 in) long, with a tail up to three-quarters as long again. It has short, dark fur, often with a few white tufts, a white belly, and a few stiff hairs around the feet and tail. It lives close to fresh water, hunting aquatic prey in the water and nearby. Its fur traps bubbles of air in the water which greatly aids its buoyancy, but requires it to anchor itself to remain underwater for more than the briefest of dives.

Like many shrews, the water shrew has venomous saliva, making it one of the few venomous mammals, although it is not able to puncture the skin of large animals, nor that of humans. Highly territorial, it lives a solitary life and is found throughout the northern part of Europe and Asia, from Britain to Korea.

The Eurasian water shrew grows to a length of about 10 cm (4 in) long with a tail length of 8 cm (3 in) and weight of 15 to 19 grams (0.53 to 0.67 oz). The dense short fur on the head, back and sides is greyish-black. The underparts are dirty white and are sharply demarcated from the dorsal surface. Sometimes they are tinged with rusty brown or occasionally are entirely dark grey. There is a white spot just behind the eye and often another near the small, rounded ear which is nearly hidden in the fur. The nose is black and the snout long and tapering.

Distribution
The Eurasian water shrew is found throughout Europe with the exception of Iceland, Ireland, certain Mediterranean islands and the Balkans. In Asia, its range extends from western Siberia and Asia Minor to North Korea and the Pacific coast of Siberia. It rarely strays far from water and is found in and around ditches, streams, ponds, watercress beds, fish ponds, damp meadows and rough bushy ground adjoining water.

Mediterranean Water Shrew

The Mediterranean, Southern or Miller's water shrew (Neomys anomalus) is a species of mammal in the family Soricidae.

Distribution
This shrew is found in Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Iran, Italy, Liechtenstein, Lithuania, North Macedonia, Poland, Portugal, Romania, Serbia and Montenegro, Slovakia, Slovenia, Spain, Switzerland, Turkey, and Ukraine.

Feeding Habits
It feeds mainly on amphibians and small fish, but also take insects and worms. Because of its small size and thus higher surface area to volume ratio, it loses body heat more quickly and must eat two or three times its body mass each day.

Northern Short-Tailed Shrew

The northern short-tailed shrew (Blarina brevicauda) is the largest shrew in the genus Blarina, and occurs in the north-eastern region of North America. It is a semifossorial, highly active, and voracious insectivore and is present in a variety of habitats. It is notable in that it is one of the few venomous mammals. The specific epithet, brevicauda, is a combination of the Latin brevis and cauda, meaning "short tail". This shrew has a total length of 108 to 140 mm (4.3 to 5.5 in), of which 18 to 32 mm (0.71 to 1.26 in) is tail; and weighs 15 to 30 g (0.53 to 1.06 oz).

The species exhibits slight sexual dimorphism in size, with the male being slightly larger than the female. The dorsal fur is thick and velvety, and can be black, brownish black, or silvery gray, with the ventral fur being a bit lighter and grayer. The shrew molts from a summer coat which is shorter and paler than the winter pelage in October and November, and back again sometime in February through July.

Range
This shrew is found throughout central and eastern North America, from southern Saskatchewan to Atlantic Canada and south to northern Arkansas and Georgia. It is probably the most common shrew in the Great Lakes region. Population densities usually range from five to 30 shrews per hectare (two to 12 per acre), but rarely exceed 200/ha (80/ac). The typical home range of a shrew is 2.5 ha, and may overlap slightly with the ranges of other shrews.

Habitat
Both disturbed and undisturbed habitats are used by the northern short-tailed shrew, including grasslands, old fields, fencerows, marshy areas, deciduous and coniferous forests, and household gardens, though the preferred habitats are those which are moist with leaf litter or thick plant cover. Burned-over forests are not quickly recolonized by B. brevicauda, and shrews quickly depart clear-cuts.

Toxin
The saliva of the northern short-tailed shrew contains a kallikrein-like protease, used to paralyse and subdue its prey. The toxin is strong enough to kill small animals, up to sizes somewhat larger than the shrew itself, and results in painful bites to humans who attempt to handle the shrew. The venomous saliva is secreted from submaxillary glands, through a duct which opens at the base of the lower incisors, where the saliva flows along the groove formed by the two incisors, and into the prey. The toxin is very similar in structure to the one produced by the Mexican beaded lizard (Heloderma horridum) which independently developed its toxin from the same precursor protein.

Behaviour
Other shrews spend more time above ground than does the northern short-tailed shrew, which prefers to tunnel along below ground, through the leaf litter, or at the snow/ground interface. Bouts of frenzied activity, lasting around five minutes, are followed by longer periods of resting, with the total active time amounting to only 16% of a 24-hour day. This animal is capable of digging at a rate of 2.5 cm/min, in between resting. The shrew constructs a nest up to 20 cm (8 in) in diameter underground or underneath a log, and lines it with leaves or the fur of the meadow vole (Microtus pennsylvanicus). This nest is kept clean, with wastes deposited outside the nest in a latrine area. Other parts of the burrow system are used for food storage.

Southern Short-Tailed Shrew

The southern short-tailed shrew is a gray, short-tailed shrew that inhabits the eastern United States. The southern short-tailed shrew is the smallest shrew in its genus, measuring 7 to 10 cm (2.8 to 3.9 in) in total length, and weighing less than 14 g (0.49 oz). It has a comparatively heavy body, with short limbs and a thick neck, a long, pointed snout and ears that are nearly concealed by its soft, dense fur. As its name indicates, the hairy tail is relatively short, measuring 1.2 to 2.5 cm (0.47 to 0.98 in). The feet are adapted for digging, with five toes ending in sharp, curved claws. The fur is slate gray, being paler on the underparts.

Distribution
The southern short-tailed shrew is found in the south-eastern United States, from southern Virginia to eastern Texas, and in the Mississippi valley as far as southern Illinois. Within this region, it is found primarily in pine forests. However, these range from dry to wet and even swampy habitats, as well as disturbed forests and abandoned agricultural land.

Elliot's Short-Tailed Shrew

Elliot's short-tailed shrew (Blarina hylophaga) is a small, slate grey, short-tailed species of shrew. Its common name comes from Daniel Giraud Elliot, who first described the species in 1899. Elliot's short-tailed shrew is similar in appearance to the closely related southern short-tailed shrew, although slightly larger on average, and was long thought to belong to the same species. It is a heavily built shrew with short legs and tail, and a long, pointed snout with long whiskers. The ears and eyes are both small, the eyelids being permanently closed in some individuals, a feature otherwise unknown among shrews. The fur is velvety in texture, and uniformly coloured greyish to brown. Adults range from 9 to 12 cm (3.5 to 4.7 in) in total length, including the 2-to-3 cm (0.79-to-1.18 in) tail, and weigh 13 to 16 g (0.46 to 0.56 oz).

Distribution
Elliot's short-tailed shrew is found in lowland environments with heavy vegetation from southern Iowa and Nebraska in the north to parts of Texas and northern Louisiana in the south, including much of the states of Missouri, Kansas, Oklahoma, and Arkansas, and the north-eastern corner of Colorado. The species inhabits a diverse range of habitats, including grasslands, agricultural land, and woodland. Although it generally prefers well watered environments with plenty of ground litter, it is also known from relatively dry and sandy terrain in Texas and Colorado, often with minimal ground cover. Elliot's short-tailed shrew is generally a solitary, nocturnal animal, spending the day sleeping in burrows in soft soil or leaf litter. The burrows may contain nests made from grass or leaves, and are surrounded by a network of trackways that the shrew uses while hunting for prey. They have been reported to travel across home ranges of anything from 0.06 to 0.55 hectares (0.15 to 1.36 acres), and to travel mostly around dawn and sunset. Having poor eyesight, they hunt primarily by means of echolocation. They are active throughout the year, and do not hibernate.

Hispaniolan Solenodon

The Hispaniolan solenodon (Solenodon paradoxus), also known as the Haitian solenodon, or agouta, is a solenodon found only on Hispaniola, the island shared by Haiti and the Dominican Republic. It was first described by Brandt in 1833. A similar but smaller species, Marcano's solenodon (S. marcanoi), once lived on the island, but became extinct after European colonization. The Hispaniolan solenodon looks much like an oversized shrew; males and females are similar in size. Adults measure 49 to 72 cm (19 to 28 in) in total length, including a tail 20 to 25 cm (7.9 to 9.8 in), and weigh about 800 g (28 oz) on average. Although they are somewhat variable in colour, they are typically dusky brown over most of the body, with a paler underside and reddish fur on the sides of the head, throat and upper chest. The tail, legs, snout, and eyelids are hairless.

Distribution
Hispaniolan solenodona are found only on the island of Hispaniola, in the Dominican Republic and parts of southern Haiti. Their habitat is usually undisturbed moist forest below 1,000 m (3,300 ft) elevation, although they are sometimes found at higher altitudes or close to developed agricultural land.

Behaviour
Hispaniolan solenodons are nocturnal; during daylight hours, they stay in their burrows, trees, hollowed-out logs or caves, remaining hidden from view. Their burrows may contain multiple chambers and tunnels and are typically inhabited by an adult pair accompanied by up to six younger family members. When they emerge into the open air, they run on the soles of their feet, following an erratic, zigzag course. Hispaniolan solenodons feed mainly on arthropods, but will also eat worms, snails, mice and small reptiles; they may also feed on a small amount of fruit, grains, and leaf litter. They probe the earth with their snouts and dig or rip open rotten logs with their claws. They have been reported to make a number of vocalisations, including a loud defensive "chirp", an aggressive "squeal", a soft "squeak" when encountering familiar conspecifics, and a high-pitched "clic" when encountering strangers. They have also been reported to make echolocation clicks at 9 to 31 kHz.

Slow Loris

Slow lorises are a group of several species of nocturnal strepsirrhine primates that make up the genus Nycticebus. Found in Southeast Asia and bordering areas, they range from Bangladesh and Northeast India in the west to the Sulu Archipelago in the Philippines in the east, and from Yunnan province in China in the north to the island of Java in the south. Slow lorises have a round head, a narrow snout, large eyes, and a variety of distinctive coloration patterns that are species-dependent. Their arms and legs are nearly equal in length, and their trunk is long and flexible, allowing them to twist and extend to nearby branches. The hands and feet of slow lorises have several adaptations that give them a pincer-like grip and enable them to grasp branches for long periods of time.

Slow lorises move slowly and deliberately, making little or no noise, and when threatened, they stop moving and remain motionless. Their only documented predators—apart from humans—include snakes, changeable hawk-eagles and orangutans, although cats, civets and sun bears are suspected. Little is known about their social structure, but they are known to communicate by scent marking. Males are highly territorial. Slow lorises reproduce slowly, and the infants are initially parked on branches or carried by either parent. They are omnivores, eating small animals, fruit, tree gum, and other vegetation.

Distribution
Slow lorises are found in South and Southeast Asia. Their collective range stretches from Northeast India through Indochina, east to the Sulu Archipelago (the small, southern islands of the Philippines), and south to the island of Java (including Borneo, Sumatra, and many small nearby islands). They are found in India (North-eastern states), China (Yunnan province), Laos, Vietnam, Cambodia, Bangladesh, Burma, Thailand, Malaysia, the Philippines, Indonesia, Brunei, and Singapore.

Toxicity
Slow lorises have a toxic bite, a trait rare among mammals and unique to lorisid primates. The toxin is obtained by licking a gland on their arm, and the secretion is activated by mixing with saliva. Their toxic bite is a deterrent to predators, and the toxin is also applied to the fur during grooming as a form of protection for their infants. The secretion from the arm contains a chemical related to cat allergen, but may be augmented by secondary toxins from the diet in wild individuals. The secretion from the brachial gland of captive slow lorises is similar to the allergen in cat dander, hence the secretions may merely elicit an allergic reaction, not toxicosis. Loris bites cause a painful swelling, and the single case of human death reported in the scientific literature was believed to have resulted from anaphylactic shock.

8 Lizards

Gila Monster

The Gila monster is a species of venomous lizard native to the south-western United States and north-western Mexican state of Sonora. A heavy, typically slow-moving lizard, up to 60 cm (2.0 ft) long, the Gila monster is the only venomous lizard native to the United States and one of only two known species of venomous lizards in North America, the other being its close relative, the Mexican beaded lizard (H. horridum). Although the Gila monster is venomous, its sluggish nature means it represents little threat to humans. However, it has acquired a fearsome reputation, and is sometimes killed despite being protected by state law in Arizona.

Distribution
The Gila monster is found in the South-western United States and Mexico, a range including Sonora, Arizona, parts of California, Nevada, Utah, and New Mexico (potentially including Baja California). They inhabit scrubland, succulent desert, and oak woodland, seeking shelter in burrows, thickets, and under rocks in locations with ready access to moisture. In fact, Gila monsters seem to like water and can be observed immersing themselves in puddles of water after a summer rain. They avoid living in open areas such as flats and farmland.

Mexican Beaded Lizard

The Mexican beaded lizard (Heloderma horridum) is a species of lizard in the family Helodermatidae, one of the two species of venomous beaded lizards found principally in Mexico and southern Guatemala. It and its congener (member of the same genus) the Gila monster (Heloderma suspectum) are the only lizards known to have evolved an overt venom delivery system. The Mexican beaded lizard is larger than the Gila monster, with duller coloration, black with yellowish bands.

As it is a specialized predator that feeds primarily upon eggs, the primary use of its venom is still a source of debate among scientists. However, this venom has been found to contain several enzymes useful for manufacturing drugs in the treatment of diabetes, and research on the pharmacological use of its venom is ongoing.

Adult beaded lizards range from 57 to 91 cm (22 to 36 in) in length. They are substantially larger than the Gila monster, which only reaches lengths of 30 to 56 cm (12 to 22 in). The snout-to-vent length of a beaded lizard averages 33 to 48 cm (13 to 19 in). The average body mass of an adult beaded lizard is 800 g (1.8 lb), about 45% heavier than the average mass of a gila monster, with large specimens exceeding 2,000 g (4.4 lb). Maximum weight known is 4,000 g (8.8 lb) Although males are slightly larger than females, the lizards are not sexually dimorphic.

Habitat
Beaded lizards are found in the Pacific drainages from southern Sonora to south-western Guatemala and two Atlantic drainages, from central Chiapas to south-eastern Guatemala. Their habitats are primarily in the desert, tropical deciduous forests and thorn scrub forests, but are found in pine-oak forests, with elevations from sea level to 1500 m. In the wild, the lizards are only active from April to mid-November, spending about an hour per day above the ground.

Venom
The venom glands of the beaded lizard are modified salivary glands located in the reptile's lower jaw. Each gland has a separate duct leading to the base of its grooved teeth. When biting, the beaded lizard hangs on its victim and chews to get its venomous saliva into the wound. Although its jaw grip is strong, its unsocketed teeth are easily broken off at their bases. The beaded lizard's venom is a weak hemotoxin, and although human deaths are rare, it can cause respiratory failure.

It consists of a number of components, including L-amino acid oxidase, hyaluronidase, phospholipase A, serotonin, and highly active kallikreins that release vasoactive kinins. The venom contains no enzymes that significantly affect coagulation. Almost all documented human bites (eight in the past century) have resulted from prodding captive lizards with a finger or bare foot.

While invertebrates are essentially immune to the effects of this venom, effects on vertebrates are more severe and varied. In mammals such as rats, major effects include a rapid reduction in carotid blood flow followed by a marked fall in blood pressure, respiratory irregularities, tachycardia, and other cardiac anomalies, as well as hypothermia, edema, and internal haemorrhage in the gastrointestinal tract, lungs, eyes, liver, and kidneys.

In humans, the effects of bites are associated with excruciating pain that may extend well beyond the area bitten and persist up to 24 hours. Other common effects of bites on humans include local edema (swelling), weakness, sweating, and a rapid fall in blood pressure. Beaded lizards are immune to the effects of their own venom.

Komodo Dragon

The Komodo dragon (Varanus komodoensis), also known as the Komodo monitor, is a species of lizard found in the Indonesian islands of Komodo, Rinca, Flores, and Gili Motang. A member of the monitor lizard family Varanidae, it is the largest living species of lizard, growing to a maximum length of 3 metres (10 ft) in rare cases and weighing up to approximately 70 kilograms (150 lb). Their unusually large size has been attributed to island gigantism, since no other carnivorous animals fill the niche on the islands where they live.

However, recent research suggests the large size of Komodo dragons may be better understood as representative of a relict population of very large varanid lizards that once lived across Indonesia and Australia, most of which, along with other megafauna, died out after the Pleistocene (as a result of human activity). As a result of their size, these lizards dominate the ecosystems in which they live. Komodo dragons hunt and ambush prey including invertebrates, birds, and mammals.

It has been claimed that they have a venomous bite; there are two glands in the lower jaw which secrete several toxic proteins. The biological significance of these proteins is disputed, but the glands have been shown to secrete an anticoagulant. Komodo dragons' group behaviour in hunting is exceptional in the reptile world. The diet of big Komodo dragons mainly consists of Timor deer, though they also eat considerable amounts of carrion. Komodo dragons also occasionally attack humans.

Behaviour
The Komodo dragon prefers hot and dry places, and typically lives in dry, open grassland, savannah, and tropical forest at low elevations. As an ectotherm, it is most active in the day, although it exhibits some nocturnal activity. Komodo dragons are solitary, coming together only to breed and eat. They are capable of running rapidly in brief sprints up to 20 km/h (12 mph), diving up to 4.5 m (15 ft), and climbing trees proficiently when young through use of their strong claws. To catch out-of-reach prey, the Komodo dragon may stand on its hind legs and use its tail as a support. As it matures, its claws are used primarily as weapons, as its great size makes climbing impractical. For shelter, the Komodo dragon digs holes that can measure from 1 to 3 m (3.3 to 9.8 ft) wide with its powerful forelimbs and claws. Because of its large size and habit of sleeping in these burrows, it is able to conserve body heat throughout the night and minimise its basking period the morning after. The Komodo dragon hunts in the afternoon, but stays in the shade during the hottest part of the day.

Saliva
Although previous studies proposed that Komodo dragon saliva contains a variety of highly septic bacteria that would help to bring down prey, research in 2013 suggested that the bacteria in the mouths of Komodo dragons are ordinary and similar to those found in other carnivores. They actually have surprisingly good mouth hygiene. As Bryan Fry put it: "After they are done feeding, they will spend 10 to 15 minutes lip-licking and rubbing their head in the leaves to clean their mouth... Unlike people have been led to believe, they do not have chunks of rotting flesh from their meals on their teeth, cultivating bacteria."

Venom

In late 2005, researchers at the University of Melbourne speculated the perentie (Varanus giganteus), other species of monitors, and agamids may be somewhat venomous. The team believes the immediate effects of bites from these lizards were caused by mild envenomation. Bites on human digits by a lace monitor (V. varius), a Komodo dragon, and a spotted tree monitor (V. scalaris) all produced similar effects: rapid swelling, localised disruption of blood clotting, and shooting pain up to the elbow, with some symptoms lasting for several hours. In 2009, the same researchers published further evidence demonstrating Komodo dragons possess a venomous bite. MRI scans of a preserved skull showed the presence of two glands in the lower jaw. The researchers extracted one of these glands from the head of a terminally ill dragon in the Singapore Zoological Gardens, and found it secreted several different toxic proteins. The known functions of these proteins include inhibition of blood clotting, lowering of blood pressure, muscle paralysis, and the induction of hypothermia, leading to shock and loss of consciousness in envenomated prey. As a result of the discovery, the previous theory that bacteria were responsible for the deaths of Komodo victims was disputed.

Perentie

The perentie (Varanus giganteus) is the largest monitor lizard or goanna native to Australia, and the fourth-largest living lizard on earth, after the Komodo dragon, Asian water monitor, and the crocodile monitor. Found west of the Great Dividing Range in the arid areas of Australia, it is rarely seen because of its shyness and the remoteness of much of its range from human habitation. The lizard can grow up to 2.5 m (8 ft 2 in) long, although the average length is around 1.75 to 2 m (5 ft 9 in to 6 ft 7 in) and weigh up to 15 kg (33 lb) — maximum weight can be over 20 kg (44 lb).

Its rival for the title of the third-largest lizard is the crocodile monitor, which although often longer, exceeding 2.4 m in length, is lighter and less bulky than the perentie. However, perenties are relatively lean lizards and are less bulky than either the Komodo dragon or the Asian water monitor.

Venom

In late 2005, University of Melbourne researchers discovered that all monitors may be somewhat venomous. Previously, bites inflicted by monitors were thought to be prone to infection because of bacteria in their mouths, but the researchers showed that the immediate effects are caused by mild envenomation. Bites on the hand by Komodo dragons, (V. komodensis), perenties (V. giganteus), lace monitors (V. varius) and spotted tree monitors (V. scalaris) have been observed to cause swelling within minutes, localised disruption of blood clotting, and shooting pain up to the elbow, which can often last for several hours.

Distribution

Perenties are found in the arid desert areas of Western Australia, South Australia, the Northern Territory, and Queensland. Their habitats consist of rocky outcroppings and gorges, with hard-packed soil and loose stones.

Behaviour

Uncommon, perenties generally avoid human contact and will retreat before they are seen. Being able diggers, they can excavate a burrow for shelter in only minutes. Their long claws enable them to easily climb trees. They often stand on their back legs and tail to gain a better view of the surrounding terrain. This behaviour, known as "tripoding", is quite common in monitor species. Perenties are fast sprinters, and can run using either all four legs or just their hind legs. Typical of most goannas, the perentie will either freeze (lying flat on the ground, and remaining very still until the danger has passed) or run if detected. If cornered, this powerful carnivore will stand its ground and use its arsenal of claws, teeth, and whip-like tail to defend itself. They inflate their throats and hiss as a defensive or aggressive display, and strike at opponents with their muscular tails. Perenties will also lunge forward with open mouths, either as a bluff or as an attack. The bite of a perentie can do much damage, not only from the teeth, but also because of the oral secretions from their mouths.

Lace Monitor

The lace monitor or lace goanna (Varanus varius) is a member of the monitor lizard family, Australian members of which are commonly known as goannas. It belongs to the subgenus Varanus. Lace monitors are the second-largest monitor in Australia after the perentie. They can be as long as 2.1 m (over 6.8 ft) with a head-and-body length of up to 76.5 cm (2.5 ft). The tail is long and slender and about 1.5 times the length of the head and body. The maximum weight of lace monitor can be 20 kg (44 lb), but most adults are much smaller.

Distribution

These common terrestrial and often arboreal monitors are found in eastern Australia and range from Cape Bedford on Cape York Peninsula to south-eastern South Australia. They frequent both open and closed forests and forage over long distances (up to 3 km a day).

Venom

In late 2005, University of Melbourne researchers discovered that all monitors may be somewhat venomous. Previously, bites inflicted by monitors were thought to be prone to infection because of bacteria in their mouths, but the researchers showed that the immediate effects may be caused by mild envenomation. Bites on the hand by Komodo dragons (V. komodoensis), perenties (V. giganteus), lace monitors (V. varius) and spotted tree monitors (V. scalaris) have been observed to cause swelling within minutes, localised disruption of blood clotting, and shooting pain up to the elbow, which can often last for several hours.

Washington State University biologist Kenneth V. Kardong and toxicologists Scott A. Weinstein and Tamara L. Smith, have stated that this allegation of venom glands "has had the effect of underestimating the variety of complex roles played by oral secretions in the biology of reptiles, produced a very narrow view of oral secretions and resulted in misinterpretation of reptilian evolution". According to these scientists "reptilian oral secretions contribute to many biological roles other than to quickly dispatch prey". They concluded that, "Calling all in this clade venomous implies an overall potential danger that does not exist, misleads in the assessment of medical risks, and confuses the biological assessment of squamate biochemical systems".

9 Amphibians

American Toad

The American toad (Anaxyrus americanus) is a common species of toad found throughout the eastern United States and Canada. It is divided into three subspecies—the eastern American toad (A. a. americanus), the dwarf American toad, and the rare Hudson Bay toad. Recent taxonomic treatments place this species in the genus Anaxyrus instead of Bufo.

Asiatic Toad

The Asiatic toad or Chusan Island toad (Bufo gargarizans) is a species of toad endemic to East Asia. It is common in China (specifically Anhui, Fujian, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangsu, Jiangxi, Jilin, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, and Zhejiang) and portions of the Russian Far East (up north to the Amur River valley and on Sakhalin Island, and east to Transbaikalia in Siberia), but relatively rare on the Korean Peninsula. Asiatic toads are also found on the Miyako Islands of southern Japan, although they have been extirpated from some islands in recent years, possibly including Okinawa.

The Miyako subspecies, Bufo gargarizans miyakonis, is also known as the Miyako toad. The Asiatic toad avoids dense forests, but is found in most other habitats, including grasslands, open forests, meadows, and cultivated areas. It prefers humid areas, and is seldom found at altitudes of more than 800 meters. The Asiatic toad plays an important role in traditional Oriental medicine.

An extract of the toxins secreted by the toad, known as toad venom or chan-su, has long been touted for its medicinal properties. In addition, dried toad skins have been prescribed as remedies for dropsy and other ailments. More recently, Western medical science has also taken an interest in the toad. In 1998, an antimicrobial peptide was extracted from the toad, and patented.

Cane Toad

The cane toad (Rhinella marina), also known as the giant neotropical toad or marine toad, is a large, terrestrial true toad native to South and mainland Central America, but which has been introduced to various islands throughout Oceania and the Caribbean, as well as Northern Australia. It is the world's largest toad. It is a member of the genus Rhinella, but was formerly in the genus Bufo, which includes many different true toad species found throughout Central and South America.

The cane toad is a prolific breeder; females lay single-clump spawns with thousands of eggs. Its reproductive success is partly because of opportunistic feeding: it has a diet, unusual among anurans, of both dead and living matter. Adults average 10–15 cm (3.9–5.9 in) in length; the largest recorded specimen had a snout-vent length of 24 cm (9.4 in). The cane toad is very large; the females are significantly longer than males, reaching a typical length of 10–15 cm (3.9–5.9 in), with a maximum of 24 cm (9.4 in).

Larger toads tend to be found in areas of lower population density. They have a life expectancy of 10 to 15 years in the wild, and can live considerably longer in captivity, with one specimen reportedly surviving for 35 years. The skin of the cane toad is dry and warty. It has distinct ridges above the eyes, which run down the snout. Individual cane toads can be grey, yellowish, red-brown, or olive-brown, with varying patterns. A large parotoid gland lies behind each eye. The ventral surface is cream-coloured and may have blotches in shades of black or brown. The pupils are horizontal and the irises golden. The toes have a fleshy webbing at their base, and the fingers are free of webbing.

Distribution
The cane toad is native to the Americas, and its range stretches from the Rio Grande Valley in South Texas to the central Amazon and south-eastern Peru, and some of the continental islands near Venezuela (such as Trinidad and Tobago). This area encompasses both tropical and semiarid environments. The density of the cane toad is significantly lower within its native distribution than in places where it has been introduced. In South America, the density was recorded to be 20 adults per 100 m (109 yd) of shoreline, 1 to 2% of the density in Australia.

Colorado River Toad

The Colorado River toad (Incilius alvarius), also known as the Sonoran Desert toad, is found in northern Mexico and the south-western United States. Its toxin, as an exudate of glands within the skin, contains 5-MeO-DMT and bufotenin. The Colorado River toad can grow to about 190 millimetres (7.5 in) long and is the largest toad in the United States apart from the non-native cane toad (Rhinella marina). It has a smooth, leathery skin and is olive green or mottled brown in colour. Just behind the large golden eye with horizontal pupil is a bulging kidney-shaped parotoid gland.

Below this is a large circular pale green area which is the tympanum or ear drum. By the corner of the mouth there is a white wart and there are white glands on the legs. All these glands produce toxic secretions. Dogs that have attacked toads have been paralysed or even killed. Raccoons have learned to pull a toad away from a pond by the back leg, turn it on its back and start feeding on its belly, a strategy that keeps the raccoon well away from the poison glands.

Unlike other vertebrates, this amphibian obtains water mostly by osmotic absorption across its abdomen. Toads in the family bufonidae have a region of skin known as "the seat patch", which extends from mid abdomen to the hind legs and is specialized for rapid rehydration. Most of the rehydration is done through absorption of water from small pools or wet objects.

Distribution
The Colorado River toad is found in the lower Colorado River and the Gila River catchment areas, in south-eastern California, New Mexico, Mexico and much of southern Arizona. It lives in both desert and semi-arid areas throughout its range. It is semiaquatic and is often found in streams, near springs, in canals and drainage ditches, and under water troughs. The Colorado River toad is known to breed in artificial water bodies (e.g., flood control impoundments, reservoirs) and as a result, the distributions and breeding habitats of these species may have been recently altered in south central Arizona. It often makes its home in rodent burrows and is nocturnal. Its call is described as, "a weak, low-pitched toot, lasting less than a second."

Common Toad

The common toad, European toad, or in Anglophone parts of Europe, simply the toad (Bufo bufo, from Latin bufo "toad"), is an amphibian found throughout most of Europe (with the exception of Ireland, Iceland, and some Mediterranean islands), in the western part of North Asia, and in a small portion of Northwest Africa. It is one of a group of closely related animals that are descended from a common ancestral line of toads and which form a species complex. The toad is an inconspicuous animal as it usually lies hidden during the day.

It becomes active at dusk and spends the night hunting for the invertebrates on which it feeds. It moves with a slow, ungainly walk or short jumps, and has greyish-brown skin covered with wart-like lumps. Although toads are usually solitary animals, in the breeding season, large numbers of toads converge on certain breeding ponds, where the males compete to mate with the females. Eggs are laid in gelatinous strings in the water and later hatch out into tadpoles.

After several months of growth and development, these sprout limbs and undergo metamorphosis into tiny toads. The juveniles emerge from the water and remain largely terrestrial for the rest of their lives. The common toad can reach about 15 cm (6 in) in length. Females are normally stouter than males and southern specimens tend to be larger than northern ones. The head is broad with a wide mouth below the terminal snout which has two small nostrils.

There are no teeth. The bulbous, protruding eyes have yellow or copper coloured irises and horizontal slit-shaped pupils. Just behind the eyes are two bulging regions, the paratoid glands, which are positioned obliquely. They contain a noxious substance, bufotoxin, which is used to deter potential predators. The head joins the body without a noticeable neck and there is no external vocal sac. The body is broad and squat and positioned close to the ground. The fore limbs are short with the toes of the fore feet turning inwards. At breeding time, the male develops nuptial pads on the first three fingers. He uses these to grasp the female when mating. The hind legs are short relative to other frogs' legs and the hind feet have long, unwebbed toes. There is no tail.

The skin is dry and covered with small wart-like lumps. The colour is a fairly uniform shade of brown, olive-brown or greyish-brown, sometimes partly blotched or banded with a darker shade. The common toad tends to be sexually dimorphic with the females being browner and the males greyer. The underside is a dirty white speckled with grey and black patches.

Distribution
After the common frog (Rana temporaria), the edible frog (Pelophylax esculentus) and the smooth newt (Lissotriton vulgaris), the common toad is the fourth most common amphibian in Europe. It is found throughout the continent with the exception of Iceland, the cold northern parts of Scandinavia, Ireland and a number of Mediterranean islands. These include Malta, Crete, Corsica, Sardinia and the Balearic Islands. Its easterly range extends to Irkutsk in Siberia and its southerly range includes parts of north-western Africa in the northern mountain ranges of Morocco, Algeria and Tunisia.

Corroboree Frog

The corroboree frogs are two species of small, poisonous ground dwelling frogs, native to Southern Tablelands of Australia. The two species are the southern corroboree frog (Pseudophryne corroboree) and the northern corroboree frog (Pseudophryne pengilleyi). They are unique among frogs in that they produce their own poison rather than obtain it from their food source as is the case in every other poisonous frog species.

Distribution
Corroboree frogs have different patterns. The corroboree frog is found only in 400 km2 patches in the sub-alpine regions of the Australian Capital Territory and southern New South Wales.

Toxicity
Corroboree frogs are the first vertebrates discovered that are able to produce their own poisonous alkaloids, as opposed to obtaining it via diet as many other frogs do. The alkaloid is secreted from the skin as a defence against predation, and potentially against skin infections by microbes. It has been described as potentially lethal to mammals if ingested. The unique alkaloid produced has been named pseudo-phrynamine.

Behaviour
Corroborree frogs are quite unusual in their nature. Not only do they not start breeding until four years of age, they also hibernate during winter under whatever shelter they can find. This may be snow gum trees, or bits of bark or fallen leaves. Males stay with the egg nests and may breed with many females over the course of one season.

European Green Toad

The European green toad (Bufo viridis) is a species of toad found in mainland Europe. It lives in many habitats, including steppes, mountainous areas, semi-deserts, and urban areas. The species comprises at least 12 major evolutionary lineages, and there are variations in the colour and pattern of this toad across its range. The spots on the back vary from green to dark brown and sometimes red spots appear, too.

The underside is white or very lightly coloured. The European green toad will change colour in response to heat and light changes. Females are larger than males and can lay 9,000 to 15,000 eggs at a time. It can reach a maximum size (head and body length) of 10 cm (about 4 inches), but growth to this size is rare.

Fowler's Toad

Fowler's toad (Anaxyrus fowleri, formerly Bufo fowleri) is a species of toad in the family Bufonidae. The species is native to North America, where it occurs in much of the eastern United States and parts of adjacent Canada. It was previously considered a subspecies of Woodhouse's toad (Anaxyrus woodhousii, formerly Bufo woodhousii). Fowler's toad is usually brown, grey, olive green and rust red in colour with darkened warty spots. If the toad has a pale stripe on its back it is an adult.

The belly is usually uniformly whitish except for one dark spot. The male may be darker in overall colour than the female. The adult toad is typically 5 to 9.5 cm (2.0 to 3.7 in) in head-body length. The tadpole is oval with a long tail and upper and lower fins, and is 1 to 1.4 cm (0.39 to 0.55 in) long.

Behaviour
Predators of Fowler's toad include snakes, birds, and small mammals. It uses defensive coloration to blend into its surroundings. It also secretes a noxious compound from the warts on its back. The secretion is distasteful to predators and can be lethal to small mammals. The toad is also known to play dead.

Habitat
Fowler's toad lives in open woodlands, sand prairies, meadows, and beaches. It burrows into the ground during hot, dry periods and during the winter.

Mantella

Mantella (also known as golden frogs or Malagasy poison frogs) are a prominent genus of aposematic frogs in the family Mantellidae, endemic to the island of Madagascar. The members of the genus are diurnal and terrestrial in behaviour, exhibiting bright colouration or cryptic markings which are species specific. All the species of the genus are considered small frogs in morphology, typically varying in sizes of 18–31 millimetres (0.71–1.22 in). A common characteristic across most species within the genus is that species are sexually dimorphic in size, with female specimens usually being larger than males.

Mantella are often compared to the neotropical family of Dendrobatidae due to their use of aposematism, a defence mechanism that uses dramatic colourations to deter potential predators. Colourations and markings vary from species to species, with combinations of green, red, orange, yellow, blue, brown, white and black. These colourations are often evidence that the specimen is, to a degree, toxic with pharmacologically active alkaloid secretions.

Distribution
Mantella are endemic to the island of Madagascar and its smaller coastal islands ("Nosy" in Malagasy). They inhabit a wide variety of different habitat types including primary rainforests, secondary rainforests, swamps, bamboo forests, semi-arid streambeds, slow moving forest streams, seasonal streams, montane grassland savannah and in wet canyons.

Panamanian Golden Frog

The Panamanian golden frog (Atelopus zeteki) is a species of toad endemic to Panama. Panamanian golden frogs inhabit the streams along the mountainous slopes of the Cordilleran cloud forests of west-central Panama. While the IUCN lists it as critically endangered, it may in fact have been extinct in the wild since 2007. Individuals have been collected for breeding in captivity in a bid to preserve the species. The alternative common name, Zetek's golden frog, and the epithet zeteki both commemorate the entomologist James Zetek.

Despite its common name, the Panamanian golden frog is a true toad, a member of the family Bufonidae. It was first described as a subspecies of Atelopus varius, but is now classified as a separate species. The Panamanian golden frog is a national symbol and is considered to be one of the most beautiful frogs in Panama.

The skin colour ranges from light yellow-green to bright gold, with some individuals exhibiting black spots on their backs and legs. Females are generally larger than males; females typically range from 45 to 63 mm (1.8 to 2.5 in) in length and 4 to 15 g (0.14 to 0.53 oz) in weight, with males between 35 and 48 millimetres (1.4 and 1.9 in) in length and 3 and 12 grams (0.11 and 0.42 oz) in weight.

Toxicity
The Panamanian golden frog has a variety of toxins, including steroidal bufadienolides and guanidinium alkaloids of the tetrodotoxin class. One of the latter, zetekitoxin AB, has been found to be a blocker of voltage-dependent sodium channels several orders of magnitude more potent than its analog saxitoxin. Their toxin is water-soluble and affects the nerve cells of anyone who comes in contact with it. Panamanian golden frogs use this toxin to protect themselves from most predators. Due to the risk of testing the poison on humans, it has been done with mice. Large doses can be fatal in 20 or 30 minutes. Death is preceded by clonic (grand mal) convulsions until the functions of the circulatory and respiratory systems cease.

Distribution
The Panamanian golden frog is endemic to Panama, living close to mountain streams on the eastern side of the Tabasará mountain range in the Coclé and Panamá provinces. Its geographic range previously extended as far east as the town of El Copé in western Coclé Province before the onset of the fungal disease chytridiomycosis, which caused the El Copé population to rapidly collapse in 2004. Vital habitat is lost each year to small farms, commercialized agriculture, woodlot operations, livestock range, industrial expansion, and real estate development. Individuals are kept in captive-breeding programmes in more than 50 institutions across North America and Panama.

Poison Dart Frog

Poison dart frog (also known as dart-poison frog, poison frog or formerly known as poison arrow frog) is the common name of a group of frogs in the family Dendrobatidae which are native to tropical Central and South America. These species are diurnal and often have brightly coloured bodies. This bright coloration is correlated with the toxicity of the species, making them aposematic. Some species of the family Dendrobatidae exhibit extremely bright coloration along with high toxicity, while others have cryptic coloration with minimal to no amount of observed toxicity. The species that have great toxicity derive this from their diet of ants, mites and termites. Other species however, that exhibit cryptic coloration and low to no amounts of toxicity, eat a much larger variety of prey.

These amphibians are often called "dart frogs" due to the Amerindians' indigenous use of their toxic secretions to poison the tips of blowdarts. However, of over 170 species, only four have been documented as being used for this purpose (curare plants are more commonly used), all of which come from the genus Phyllobates, which is characterized by the relatively large size and high levels of toxicity of its members.

Most species of poison dart frogs are small, sometimes less than 1.5 cm (0.59 in) in adult length, although a few grow up to 6 cm (2.4 in) in length. They weigh 1 oz. on average. Most poison dart frogs are brightly coloured, displaying aposematic patterns to warn potential predators. Their bright coloration is associated with their toxicity and levels of alkaloids.

Habitat
Poison dart frogs are endemic to humid, tropical environments of Central and South America. These frogs are generally found in tropical rainforests, including in Bolivia, Costa Rica, Brazil, Colombia, Ecuador, Venezuela, Suriname, French Guiana, Peru, Panama, Guyana, Nicaragua, and Hawaii (introduced). Natural habitats include subtropical and tropical, moist, lowland forests, subtropical or tropical high-altitude shrubland, subtropical or tropical, moist, montanes and rivers, freshwater marshes, intermittent freshwater marshes, lakes and swamps. Other species can be found in seasonally wet or flooded lowland grassland, arable land, pastureland, rural gardens, plantations, moist savannah and heavily degraded former forest. Premontane forests and rocky areas have also been known to hold frogs. Dendrobatids tend to live on or close to the ground, but also in trees as much as 10 m (33 ft) from the ground.

Toxicity
Many poison dart frogs secrete lipophilic alkaloid toxins such as allopumiliotoxin 267A, batrachotoxin, epibatidine, histrionicotoxin, and pumiliotoxin 251D through their skin. Alkaloids in the skin glands of poison frogs serve as a chemical defence against predation, and they are therefore able to be active alongside potential predators during the day. About 28 structural classes of alkaloids are known in poison frogs. The most toxic of poison dart frog species is Phyllobates terribilis. It is argued that dart frogs do not synthesize their poisons, but sequester the chemicals from arthropod prey items, such as ants, centipedes and mites – the diet-toxicity hypothesis.

Fire Salamander

The fire salamander (Salamandra salamandra) is possibly the best-known salamander species in Europe. It is black with yellow spots or stripes to a varying degree; some specimens can be nearly completely black while on others the yellow is dominant. Shades of red and orange may sometimes appear, either replacing or mixing with the yellow according to subspecies. Fire salamanders can have a very long lifespan; one specimen lived for more than 50 years in Museum Koenig, a German natural history museum.

Habitat
Fire salamanders live in central Europe forests and are more common in hilly areas. They prefer deciduous forests since they like to hide in fallen leaves and around mossy tree trunks. They need small brooks or ponds with clean water in their habitat for the development of the larvae. Whether on land or in water, fire salamanders are inconspicuous. They spend much of their time hidden under wood or other objects. They are active in the evening and the night, but on rainy days they are active in the daytime as well.

Toxicity
The fire salamander's primary alkaloid toxin, samandarin, causes strong muscle convulsions and hypertension combined with hyperventilation in all vertebrates. The poison glands of the fire salamander are concentrated in certain areas of the body, especially around the head and the dorsal skin surface. The coloured portions of the animal's skin usually coincide with these glands. Compounds in the skin secretions may be effective against bacterial and fungal infections of the epidermis; some are potentially dangerous to human life.

Distribution
Fire salamanders are found in most of southern and central Europe. They are most commonly found at altitudes between 250 metres (820 ft) and 1,000 metres (3,300 ft), only rarely below (in Northern Germany sporadically down to 25 metres (82 ft)). However, in the Balkans or Spain they are commonly found in higher altitudes as well.

Iberian Ribbed Newt

The Iberian ribbed newt or Spanish ribbed newt (Pleurodeles waltl) is a newt endemic to the central and southern Iberian Peninsula and Morocco. It is the largest European newt species and it is also known for its sharp ribs which can puncture through its sides, and as such is also called the sharp-ribbed newt. This species should not be confused with the different species with similar common name, the Iberian newt (Lissotriton boscai). The Iberian ribbed newt has tubercles running down each side. Through these, its sharp ribs can puncture. The ribs act as a defence mechanism, causing little harm to the newt.

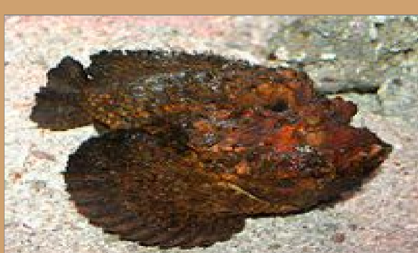
This mechanism could be considered as a primitive and rudimentary system of envenomation, but is completely harmless to humans. At the same time as pushing its ribs out the newt begins to secrete poison from special glands on its body.

The poison coated ribs create a highly effective stinging mechanism, injecting toxins through the thin skin in predator's mouths. The newt's effective immune system and collagen coated ribs mean the pierced skin quickly regrows without infection.

In the wild, this amphibian grows up to 30 cm (12 in), but rarely more than 20 cm (7.9 in) in captivity. Its colour is dark gray dorsally, and lighter gray on its ventral side, with rust-coloured small spots where its ribs can protrude. This newt has a flat, spade-shaped head and a long tail, which is about half its body length. Males are more slender and usually smaller than females. The larvae have bushy external gills and usually paler colour patterns than the adults.

10 Fish

Stonefish



Synanceia is a genus of fish of the family Synanceiidae, the stonefishes, whose members are dangerously venomous and even fatal to humans. It is one of the most venomous fish known. They are found in the coastal regions of the Indo-Pacific.

Habitat
Synanceia are primarily marine, though some species are known to live in rivers. Its species have potent neurotoxins secreted from glands at the base of their needle-like dorsal fin spines which stick up when disturbed or threatened. The vernacular name of the species, the stonefish, derives from its grey and mottled camouflage similar to the colour of a stone. Swimmers may not notice them and inadvertently step on them, triggering a sting. When the stonefish is disturbed, it may inject an amount of venom proportional to the amount of pressure applied to it.
A study published in 2018 reports that stonefish also have the ability to extend a sharp, specialized spine known as a lachrymal saber as an additional defence mechanism.

Treatment
Stonefish stings are extremely painful and potentially lethal. The two most recommended treatments are the application of heat to the affected area, and antivenom. Hot water (at a temperature no higher than 45 °C (113 °F)) applied to the injured area has been found to destroy stonefish venom, and causes minimal discomfort to the victim. Antivenom is used in more extreme cases. Vinegar is found on some Australian beaches as it is said to lessen the pain. The stonefish is one of the most venomous fish in the world and stings can cause death if not treated. Most stonefish stings occur as a result of stepping on the creature which forces venom into the foot, while it is less common for the fish to sting when it is picked up. Stonefish stings can occur on the beach, not just in the water, since stonefish can survive out of the water for up to 24 hours. They are not easily seen as they look similar to rocks or coral. Stonefish antivenom is the second-most administered in Australia.

Lionfishes

Pterois is a genus of venomous marine fish, commonly known as lionfish, native to the Indo-Pacific. Also called zebrafish, firefish, turkeyfish, tastyfish or butterfly-cod, it is characterized by conspicuous warning coloration with red, white, creamy, or black bands, showy pectoral fins, and venomous spiky fin rays. Pterois radiata, Pterois volitans, and Pterois miles are the most commonly studied species in the genus. Pterois species are popular aquarium fish. P. volitans and P. miles are a recent and significant invasive species in the west Atlantic, Caribbean Sea and Mediterranean Sea. Pterois fish in the Atlantic range from 5 to 45 cm (2.0 to 17.7 in) in length, weighing from 0.025 to 1.3 kg (0.055 to 2.866 lb). They are well known for their ornate beauty, venomous spines, and unique tentacles. Juvenile lionfish have a unique tentacle located above their eye sockets that varies in phenotype between species. The evolution of this tentacle is suggested to serve to continually attract new prey; studies also suggest it plays a role in sexual selection.

Interaction
Lionfish are known for their venomous fin rays, an uncommon feature among marine fish in the East Coast coral reefs. The potency of their venom makes them excellent predators and hazardous to fishermen and divers. Pterois venom produced negative inotropic and chronotropic effects when tested in both frog and clam hearts and has a depressing effect on rabbit blood pressure. These results are thought to be due to nitric oxide release. In humans, Pterois venom can cause systemic effects such as extreme pain, nausea, vomiting, fever, breathing difficulties, convulsions, dizziness, redness on the affected area, headache, numbness, paresthesia (pins and needles), heartburn, diarrhoea, and sweating.

Rarely, such stings can cause temporary paralysis of the limbs, heart failure, and even death. Fatalities are common in very young children, the elderly, those with a weak immune system, or those who are allergic to their venom. Their venom is rarely fatal to healthy adults, but some species have enough venom to produce extreme discomfort for a period of several days. However, Pterois venom is a danger to allergic victims as they may experience anaphylaxis, a serious and often life-threatening condition that requires immediate emergency medical treatment. Severe allergic reactions to Pterois venom include chest pain, severe breathing difficulties, a drop in blood pressure, swelling of the tongue, sweating, runny nose, or slurred speech. Such reactions can be fatal if not treated.

Range
The lionfish is a predator native to the Indo-Pacific. It aggressively preys on small fish and invertebrates. They can be found around the seaward edge of reefs and coral, in lagoons, and on rocky surfaces commonly to 50 m deep, although lionfish have on multiple occasions been recorded to 300 m depth. They show a preference for turbid inshore areas and harbours, and have a generally hostile attitude and are territorial towards other reef fish. Many universities in the Indo-Pacific have documented reports of Pterois aggression towards divers and researchers. P. volitans and P. miles are native to subtropical and tropical regions from southern Japan and southern Korea to the east coast of Australia, Indonesia, Micronesia, French Polynesia, and the South Pacific Ocean. P. miles is also found in the Indian Ocean, from Sumatra to Sri Lanka and the Red Sea.

Scorpionfish

Scorpaenidae (also known as the scorpionfish) are a family of mostly marine fish that includes many of the world's most venomous species. As the name suggests, scorpionfish have a type of "sting" in the form of sharp spines coated with venomous mucus. The family is a large one, with hundreds of members. They are widespread in tropical and temperate seas, but mostly found in the Indo-Pacific. They should not be confused with the cabezones, of the genus Scorpaenichthys, which belong to a separate, though related, family, Cottidae. Some types, such as the lionfish, are attractive as well as dangerous, and highly desired for aquaria. In addition to the name scorpionfish, informal names for family members include firefish, turkeyfish, dragonfish, and stingfish, usually with adjectives added. General characteristics of family members include a compressed body, ridges and/or spines on the head, one or two spines on the operculum, and three to five spines on the preopercle. The dorsal fin has 11 to 17 spines, often long and separated from each other, and the pectoral fins are well-developed, with 11 to 25 rays.

The spines of the dorsal, anal, and pelvic fins all have venom glands at their bases. Most species are bottom-dwellers that feed on crustaceans and smaller fish. Many inhabit shallow waters, but a few live as deep as 2,200 m (7,200 ft). Most scorpionfish, such as the stonefish, wait in disguise for prey to pass them by before swallowing, while lionfish often ambush their prey. When not ambushing, lionfish may herd the fish, shrimp, or crab into a corner before swallowing. Like many perciform fishes, scorpionfish are suction feeders that capture prey by rapidly projecting a suction field generated by expansion of the fish's buccal cavity.

Toadfish

Batrachoididae is the only family in the ray-finned fish order Batrachoidiformes. Members of this family are usually called toadfish, or "frogfish": both the English common name and scientific name refer to their toad-like appearance (batrakhos is Greek for frog). Toadfish are benthic ambush predators that favour sandy or muddy substrates where their cryptic coloration helps them avoid detection by their prey. Toadfish are well known for their ability to "sing", males in particular using the swim bladder as a sound-production device used to attract mates. Toadfish are usually scaleless, with eyes set high on large heads.

Their mouths are also large, with both a maxilla and premaxilla, and often decorated with barbels and skin flaps. They are generally drab in colour, although those living on coral reefs may have brighter patterns. They range in size from 7.5 cm (3.0 in) length in Thlassophryne megalops, to 57 cm (22 in) in the Pacuma toadfish.

The gills are small and occur only on the sides of the fish. The pelvic fins are forward of the pectoral fins, usually under the gills, and have one spine with several soft rays. For the two separate dorsal fins, the first is smaller with spines, while the second has from 15 to 25 soft rays. The number of vertebrae range from 25 to 47.

Distribution
Toadfishes are found worldwide. Most toadfish are marine, though some are found in brackish water and one subfamily, the Thalassophryninae, is found exclusively in freshwater habitats in South America. In particular, Daector quadrizonatus and Thalassophryne amazonica are known from the Atrato River in Colombia and the Amazon River, respectively.

Habits
Toadfishes are bottom-dwellers, ranging from near-shore areas to deep waters. They tend to be omnivorous, eating sea worms, crustaceans, mollusks, and other fish. They often hide in rock crevices, among the bottom vegetation, or even dig dens in the bottom sediments, from which they ambush their prey. Toadfish can survive out of water for as long as 24 hours, and some can move across exposed mudflats at low tide using their fins.

Rabbitfishes

Rabbitfishes or spinefoots are perciform fishes in the family Siganidae. The 29 species are in a single genus, Siganus. In some now obsolete classifications, the species having prominent face stripes—colloquially called foxfaces–are in the genus Lo. Other species, such as the masked spinefoot (S. puellus), show a reduced form of the stripe pattern. Rabbitfishes are native to shallow waters in the Indo-Pacific, but S. luridus and S. rivulatus have become established in the eastern Mediterranean via Lessepsian migration.

They are commercially important food fish, and can be used in the preparation of dishes such as bagoong. All rabbitfish have large, dark eyes and small, somewhat rabbit-like mouths, which gives them their name. Most species have either bright colours or a complex pattern. The largest rabbitfish grows to about 53 cm (21 in), but most species only reach between 25 and 35 cm (10 and 14 in).

Another unusual feature among rabbitfishes is their pelvic fins, which are formed from two spines, with three soft rays between them. The dorsal fin bears 13 spines with 10 rays behind, while the anal fin has seven spines and nine rays behind; the fin spines are equipped with well-developed venom glands. The sting is very painful, but it is generally not considered medically significant in healthy adults.

Goblinfish

Glyptauchen panduratus, the goblinfish, is a species of waspfish endemic to the reefs off the southern coast of Australia at depths from 5 to 60 metres (16 to 197 ft). This species grows to a total length of 20 centimetres (7.9 in). This species is the only known member of its genus. The fish has an elongated, compressed body with a distinctive rounded to squarish head, with a 'neck', or notch, between the eyes and dorsal fin.

A large erectile spine occurs on each side below the eyes which are ringed with red, and are the most visible part of the fish. The fins are well developed, the spinous part of dorsal fin is very long and fairly high, and the pectorals are long and wide and may be spread to the sides like fans.

The colouration is cryptic, and is variable from white to grey, reddish-brown, and black. The fish can rapidly adjust its colouration to blend in with the environment. A dark band may be seen across the rear part of the body, with a caudal peduncle and posterior of dorsal and anal fins pale. Whitish patches and small black spots may be scattered on body and fins. The goblinfish has venomous dorsal spines.

Behaviour
The fish is a bottom dweller, generally nocturnal, and does not move around much during the day, so it is not seen very often by divers.

Distribution
It is found in sheltered and moderately exposed coastal reef and rocky areas in estuaries between 3 and 60 m deep near Rottnest Island, Western Australia, to Sydney, New South Wales, and around Tasmania.

Inimicus spp.

Inimicus is a genus of venomous fishes, closely related to the true stonefishes. This genus is a member of the family Synanceiidae (devilfishes, goblinfishes, and stonefishes) of the ray-finned fish order Scorpaeniformes. These benthic fishes are found on sandy or silty substrates of lagoon and seaward reefs, in coastal regions of tropical oceans. The ten described species are collectively known by various common names, including ghoul, goblinfish, sea goblin, spiny devilfish, stinger, and stingfish).

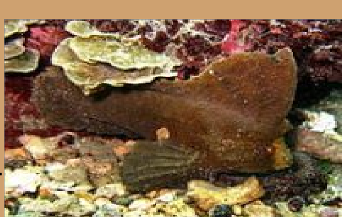
Adults are typically 13-25 centimetres in length, and can weigh up to 480 grams. The body colour can be a dull yellow, gray, brown, or rust in colour with light blotches, and very similar to that of the surrounding sandy or coral seabed in which they are found. This coloration acts as a camouflage which renders them extremely difficult to detect in their natural habitat.

Distribution
Members of the genus Inimicus are distributed mainly in warm tropical waters in the coastal regions of Indo-Pacific oceans. Their range does however extend a little into the subtropical zone. The waters of the Red Sea off the coast of Egypt appear to mark the westernmost limit of their range, while specimens have been reported as far to the east as New Caledonia. The northern coast of New South Wales, Australia marks the southernmost extent of their range, which extends as far to the north as Japan's Aomori, the northernmost prefecture of Japan's main island. Inimicus are benthic fishes, living mainly on the bottom of mangrove swamps and coral reefs, at depths between 5 and 450 meters.

Toxins
Like all known members of the family Synanceiidae, all members of the genus Inimicus possess a complex and extremely potent venom. It is stored in glands at the bases of needle-like spines in their dorsal fins. Upon contact with the dorsal fin, the fish can deliver a very painful, potentially fatal, sting. The venom consists of a mixture of proteolytic enzymes, including stonustoxin (a hemotoxin), trachynilysin (a neurotoxin), and cardioleputin (a cardiotoxin). Envenomation results severe and immediate local pain, sometimes followed by shock, paralysis, tissue necrosis, and even death.

Treatment
Envenomation by Inimicus species is characterized by immediate and severe local pain. Medical aid must be sought at the earliest opportunity after envenomation. Recommended first aid treatment includes immersion of the affected area in hot water. Immersing the injured area in water at a temperature of at least 45 °C (113 °F) can partially denature the proteolytic enzymes in the venom. Some relief can also be obtained by infiltrating the envenomation site with a local anesthetic. For more extreme cases, an intramuscular injection of a specific horse-derived antivenom can be lifesaving. Tetanus toxoid vaccine should also be administered, if indicated. Surviving victims often suffer localized tissue necrosis and nerve damage, leading to atrophy of adjoining muscle tissues.

Cockatoo Waspfish



Ablabys taenianotus, the Cockatoo waspfish, is a small fish species that belongs to the scorpionfishes family Scorpaenidae. This fish can be up to 6 inches (15 cm) in length. The body compressed laterally, endowed with a dorsal fin starting from the top of the head until joining practically the superior base of the caudal fin. When the dorsal fin is spread, it looks like a crest resembling the one on a cockatoo. The thorns of the dorsal fin are venomous. This fish mostly stays on the substratum and moves by means of its pectoral fins. Its colour varies from cream to dark brown, with irregular spots.

Distribution
This species occurs in the tropical West Pacific Ocean, from Malaysia to Japan and from Indonesia to Australia. Ablabys taenianotus lives at depths from 2 to 60 ft (1 to 18 m) on sandy, silty or rubble bottoms, and also in fields of sea grass Zosteraceae.

Behaviour
This species is benthic and nocturnal. It is an opportunistic predator and ambushes passing prey while mimicking a crumpled, dead leaf or a drifting piece of seaweed. It allows itself to drift with the moving water in the way that an inert object would do. It may be found singly or in pairs. The fish feeds on small shrimp and other tiny crustaceans that pass near its mouth.

Striped Blenny

Meiacanthus grammistes the striped blenny, also called the striped fang blenny, grammistes blenny, line-spot harptail blenny or striped poison-fang blenny, is a species of combtooth blenny from the western Pacific Ocean. The fish stays in the open ocean, but travels into shallow saltwater and brackish estuaries. This venomous species occasionally makes its way into the aquarium trade.

Venom
The unusual venom, which targets the body's opioid receptors, is being investigated as a potential new painkiller for human use. The venom consists of a neuropeptide also seen in cone snail venom, a lipase similar to the one used by certain species of scorpions and an opioid peptide. Blennies use it to stun predators. The venom reduces the blood pressure of the predator, relaxing its jaws so the blenny can escape. Administration of the venom was found to not cause pain in mice, which is atypical, as most fish venoms are painful. Administration of the venom also did not result in a drop in heart rate in rats.

Stargazers

The stargazers are a family, Uranoscopidae, of perciform fish that have eyes on top of their heads (hence the name). The family includes about 51 species (one extinct) in eight genera, all marine and found worldwide in shallow and deep saltwaters. In addition to the top-mounted eyes, a stargazer also has a large, upward-facing mouth in a large head. Their usual habit is to bury themselves in sand, and leap upwards to ambush prey (benthic fish and invertebrates) that pass overhead.

Some species have a worm-shaped lure growing out of the floors of their mouths, which they can wiggle to attract prey's attention. Both the dorsal and anal fins are relatively long; some lack dorsal spines. Lengths range from 18 up to 90 cm, for the giant stargazer Kathetostoma giganteum. Stargazers are venomous; they have two large venomous spines situated behind their opercles and above their pectoral fins. The species within the genera Astroscopus and Uranoscopus can also cause electric shocks.

Astroscopus species have a single electric organ consisting of modified eye muscles, while Uranoscopus species have theirs derived from sonic muscles. These two genera within stargazers are out of eight total independent evolutions of bioelectrogenesis. They are also unique among electric fish in not possessing specialized electroreceptors.

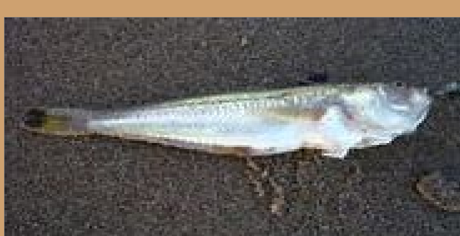
Venom
The unusual venom, which targets the body's opioid receptors, is being investigated as a potential new painkiller for human use. The venom consists of a neuropeptide also seen in cone snail venom, a lipase similar to the one used by certain species of scorpions and an opioid peptide. Blennies use it to stun predators. The venom reduces the blood pressure of the predator, relaxing its jaws so the blenny can escape. Administration of the venom was found to not cause pain in mice, which is atypical, as most fish venoms are painful. Administration of the venom also did not result in a drop in heart rate in rats.

Chimaeras

Chimaeras are cartilaginous fish in the order Chimaeriformes, known informally as ghost sharks, rat fish, spookfish or rabbit fish; the latter three names are not to be confused with rattails, Opisthoproctidae or Siganidae, respectively. At one time a "diverse and abundant" group (based on the fossil record), their closest living relatives are sharks, though their last common ancestor with sharks lived nearly 400 million years ago. Today, they are largely confined to deep water. Chimaeras live in temperate ocean floors down to 2,600 m (8,500 ft) deep, with few occurring at depths shallower than 200 m (660 ft).

Exceptions include the members of the genus Callorhinchus, the rabbit fish and the spotted ratfish, which locally or periodically can be found at relatively shallow depths. Consequently, these are also among the few species from the Chimaera order kept in public aquaria. They have elongated, soft bodies, with a bulky head and a single gill-opening. They grow up to 150 cm (4.9 ft) in length, although this includes the lengthy tail found in some species. In many species, the snout is modified into an elongated sensory organ.

Weevers



Weevers (or weeverfish) are nine extant species of fishes of family Trachinidae, order Trachiniformes, part of the Percomorpha clade. They are long (up to 37 cm), mainly brown in colour, and have venomous spines on their first dorsal fins and gills. During the day, weevers bury themselves in sand, just showing their eyes, and snatch prey as it comes past, which consists of shrimp and small fish.

Weevers are unusual in not having swim bladders, as do most bony fish, and as a result, sink as soon as they stop actively swimming. With the exception of T. cornutus from the southeast Pacific, all species in this family are restricted to the eastern Atlantic (including the Mediterranean). A tenth, extinct species, Callipterus speciosus, is known from the Monte Bolca lagerstätte of the Lutetian epoch.

Distribution
The lesser weever can be found from the southern North Sea to the Mediterranean, and is common around the south coast of the United Kingdom and Ireland, the Atlantic coast of France, Portugal and Spain, and the northern coast of the Mediterranean. The high number of bathers found on popular tourist beaches in these areas means stings are common, although individual chances of being stung are low. The South Wales Evening Post stated (on 8 August 2000) that around 40 weever stings are recorded in the Swansea and Gower area every year, but many victims do not seek medical assistance and go uncounted.

Interaction
Most human stings are inflicted by the lesser weever, which habitually remains buried in sandy areas of shallow water and is thus more likely to come into contact with bathers than other species (such as the greater weever, which prefers deeper water); stings from other species are generally limited to anglers and commercial fishermen. Even very shallow water (sometimes little more than damp sand) may harbour lesser weevers. The vast majority of injuries occur to the foot and are the result of stepping on buried fish; other common sites of injury are the hands and buttocks. Stings are most common in the hours before and after low tide (especially at springs), so one possible precaution is to avoid bathing or paddling at these times. They also increase in frequency during the summer (to a maximum in August), but this is probably the result of the greater number of bathers.

Symptoms
At first, many victims believe they have simply scratched themselves on a sharp stone or shell, although this barely hurts; significant pain begins about 2–3 minutes after being stung. Weever stings cause severe pain; common descriptions from victims are "extremely painful" and "much worse than a wasp (or bee) sting". Common and minor symptoms include severe pain, itching, swelling, heat, redness, numbness, tingling, nausea, vomiting, joint aches, headaches, abdominal cramps, lightheadedness, increased urination, and tremors. Rare and severe symptoms include abnormal heart rhythms, weakness, shortness of breath, seizures, decreased blood pressure, gangrene, tissue degeneration, and unconsciousness.

Treatment
Although extremely unpleasant, weever stings are not generally dangerous and the pain will ease considerably within a few hours even if untreated. Complete recovery may take a week or more; in a few cases, victims have reported swelling and/or stiffness persisting for months after envenomation. First aid treatment consists of immersing the affected area in hot water (as hot as the victim can tolerate without being scalded), which will accelerate denaturation of the protein-based venom. The use of hot water will reduce the pain felt by the victim after a few minutes. Usual experience is that the pain then fades within 10 to 20 minutes, as the water cools. Folklore often suggests the addition of substances to the hot water, including urine, vinegar, and Epsom salts, but this is of limited (if any) value. Heat should be applied for at least 15 minutes, but the longer the delay (before heat is applied), the longer the treatment should be continued. Once the pain has eased, the injury should be checked for the remains of broken spines, and any found need to be removed. Over-the-counter analgesics, such as aspirin or ibuprofen, may be of assistance in management of pain and can also reduce edema.

Dogfish Sharks

The Squalidae, also called dogfish sharks or spiny dogfishes, are a family of sharks in the order Squaliformes. They have two dorsal fins, each with smooth spines, but no anal fin, and their skin is generally rough to the touch. Unlike virtually all other shark species, dogfish sharks possess venom which coats their dorsal spines – this venom is mildly toxic to humans. These sharks are characterized by teeth in upper and lower jaws similar in size; a caudal peduncle with lateral keels; the upper precaudal pit usually is present; and the caudal fin is without a subterminal notch. They are carnivorous, principally preying upon organisms smaller than themselves. The livers and stomachs of the Squalidae contain the compound squalamine, which possesses the property of reduction of small blood vessel growth in humans. Two genera are known: Squalus, which contains numerous species, and Cirrhigaleus, which has three species.

Stingrays

Stingrays are a group of sea rays, which are cartilaginous fish related to sharks. Many species are endangered. They are classified in the suborder Myliobatoidei of the order Myliobatiformes and consist of eight families: Hexatrygonidae (sixgill stingray), Plesiobatidae (deepwater stingray), Urolophidae (stingarees), Urotrygonidae (round rays), Dasyatidae (whiptail stingrays), Potamotrygonidae (river stingrays), Gymnuridae (butterfly rays), and Myliobatidae (eagle rays). Stingrays are common in coastal tropical and subtropical marine waters throughout the world.

Some species, such as Dasyatis thetidis, are found in warmer temperate oceans, and others, such as Plesiobatis daviesi, are found in the deep ocean. The river stingrays, and a number of whiptail stingrays (such as the Niger stingray), are restricted to fresh water. Most myliobatoids are demersal (inhabiting the next-to-lowest zone in the water column), but some, such as the pelagic stingray and the eagle rays, are pelagic.

There are about 220 known stingray species organized into 10 families and 29 genera. Stingray species are progressively becoming threatened or vulnerable to extinction, particularly as the consequence of unregulated fishing. As of 2013, 45 species have been listed as vulnerable or endangered by the IUCN. The status of some other species is poorly known, leading to their being listed as data deficient.

Injuries
Stingrays are not usually aggressive and attack humans only when provoked, as when a ray is accidentally stepped on. Contact with the stinger causes local trauma (from the cut itself), pain, swelling, muscle cramps from the venom, and later may result in infection from bacteria or fungi. The injury is very painful, but seldom life-threatening unless the stinger pierces a vital area. The barb usually breaks off in the wound, and surgery may be required to remove the fragments. Fatal stings are very rare. The death of Steve Irwin in 2006 was only the second recorded in Australian waters since 1945. The stinger penetrated his thoracic wall, causing massive trauma.

Venom
The venom of the stingray has been relatively unstudied due to the mixture of venomous tissue secretions cells and mucous membrane cell products that occurs upon secretion from the spinal blade. Stingrays can have anywhere between one and three blades. The spine is covered with the epidermal skin layer. During secretion, the venom punctures through the epidermis and mixes with the mucus to release the venom on its victim. Typically, other venomous organisms create and store their venom in a gland.

The stingray is notable in that it stores its venom within tissue cells. The toxins that have been confirmed to be within the venom are cystatins, peroxiredoxin, and galectin. Galectin induces cell death in its victims and cystatins inhibit defence enzymes. In humans, these toxins lead to increased blood flow in the superficial capillaries and cell death. Despite the number of cells and toxins that are within the stingray, there is little relative energy required to produce and store the venom. The venom is produced and stored in the secretory cells of the vertebral column at the mid-distal region.

These secretory cells are housed within the ventrolateral grooves of the spine. The cells of both marine and freshwater stingrays are round and contain a great amount of granule-filled cytoplasm. The cells of marine stingrays are located only within these lateral grooves of the stinger. The cells of freshwater stingray branch out beyond the lateral grooves to cover a larger surface area along the entire blade. Due to this large area and an increased number of proteins within the cells, the venom of freshwater stingrays has a greater toxicity than that of marine stingrays.

Estuary Cobbler (Catfish)

Cnidoglanis macrocephalus is a species of catfish (order Siluriformes) of the family Plotosidae, and is the only species of the genus Cnidoglanis. It is commonly known as the cobbler, estuary cobbler, deteira, estuary catfish, South Australian catfish, or Swan River catfish. Like other eeltail catfish, the cobbler resembles a catfish in front, but an eel behind. It can grow up to 91.0 centimetres (35.6 in) SL, 2,500 grams (5.5 lb). They may live up to 13 years. The dorsal and pectoral fins have sharp, venomous spines that can inflict painful wounds.

Distribution
The cobbler is found from Main Beach, Queensland to Jervis Bay, New South Wales, and Kingston SE, South Australia to Houtman Abrolhos Islands, Western Australia and Duck River, Tasmania, in near-shore and reef habitats.

Treatment
Treatment of injuries by submersion of the wound in hot water is suggested though the role of heat in denaturation of toxins is debated. However, despite this study, hot water immersion is still the recommended first aid treatment for envenomation.

Ecology
The estuary cobbler is an inshore marine species which lives in shallow bays and sandy inlets near river mouths. It is found most frequently over sand, rocks and weeds in clear to turbid waters. By day, the estuary cobbler are most often found in holes and on ledges in banks. Estuary cobblers stay in holes and under ledges during the day, then come out at night to feed. They are opportunistic feeders, primarily feed on molluscs, crustaceans (prawns and amphipods), polychaete worms, algae, and organic debris.

Striped Eel Catfish

Plotosus lineatus, common name striped eel catfish, is a species of eeltail catfishes belonging to the family Plotosidae. Plotosus lineatus can reach a maximum length of 32 cm (13 in). The body is brown with cream-colored or white longitudinal bands.

The most striking feature of this species is in the fins, in fact the second dorsal, caudal and anal are fused together as in eels. In the rest of the body is quite similar to a freshwater catfish: the mouth is surrounded by four pairs of barbels, four on the upper jaw and four on the lower jaw. The first dorsal and each of the pectoral fins have a highly venomous spine. They may even be fatal.

Distribution
P. lineatus occurs in the Indian Ocean, in the western Pacific Ocean and sometimes enters freshwaters in East Africa and Madagascar. The species now also occurs in the Mediterranean, having invaded as a Lessepsian migrant through the Suez Canal. P. lineatus is found in coral reefs; it is also found in estuaries, tide pools and open coasts.

11 Cephalopods

Blue-Ringed Octopus

Blue-ringed octopuses, comprising the genus Hapalochlaena, are four highly venomous species of octopus that are found in tide pools and coral reefs in the Pacific and Indian oceans, from Japan to Australia. They can be identified by their yellowish skin and characteristic blue and black rings that change colour dramatically when the animal is threatened. They eat small animals, including crabs, hermit crabs, shrimp, and other crustaceans.

They are recognized as one of the world's most venomous marine animals. Despite their small size—12 to 20 cm (5 to 8 in)—and relatively docile nature, they are dangerous to humans if provoked and handled because of their venom, which contains the powerful neurotoxin tetrodotoxin.

Behaviour
Blue-ringed octopuses spend most of their time hiding in crevices while displaying effective camouflage patterns with their dermal chromatophore cells. Like all octopus, they can change shape easily, which helps them to squeeze into crevices much smaller than themselves. This, along with piling up rocks outside the entrance to its lair, helps safeguard the octopus from predators. If they are provoked, they quickly change colour, becoming bright yellow with each of the 50-60 rings flashing bright iridescent blue within a third of a second as an aposematic warning display. In the greater blue-ringed octopus (Hapalochlaena lunulata), the rings contain multi-layer light reflectors called iridophores. These are arranged to reflect blue–green light in a wide viewing direction. Beneath and around each ring there are dark pigmented chromatophores which can be expanded within 1 second to enhance the contrast of the rings. There are no chromatophores above the ring, which is unusual for cephalopods as they typically use chromatophores to cover or spectrally modify iridescence. The fast flashes of the blue rings are achieved using muscles which are under neural control. Under normal circumstances, each ring is hidden by contraction of muscles above the iridophores. When these relax and muscles outside the ring contract, the iridescence is exposed thereby revealing the blue colour.

Toxicity
The blue-ringed octopus, despite its small size, carries enough venom to kill twenty-six adult humans within minutes. Their bites are tiny and often painless, with many victims not realizing they have been envenomated until respiratory depression and paralysis start to set in. As of 2018 no blue-ringed octopus antivenom is available.

Venom
The octopus produces venom containing tetrodotoxin, histamine, tryptamine, octopamine, taurine, acetylcholine and dopamine. The venom can result in nausea, respiratory arrest, heart failure, severe and sometimes total paralysis, blindness, and can lead to death within minutes if not treated. Death, if it occurs, is usually from suffocation due to paralysis of the diaphragm. The major neurotoxin component of the blue-ringed octopus is a compound that was originally known as maculotoxin but was later found to be identical to tetrodotoxin, a neurotoxin also found in pufferfish, and in some poison dart frogs. Tetrodotoxin is 1,200 times more toxic than cyanide. Tetrodotoxin blocks sodium channels, causing motor paralysis, and respiratory arrest within minutes of exposure. The tetrodotoxin is produced by bacteria in the salivary glands of the octopus. Direct contact is necessary to be envenomated. Faced with danger, the octopus's first instinct is to flee. If the threat persists, the octopus will go into a defensive stance, and show its blue rings. If the octopus is cornered, and touched, the person would be in danger of being bitten and envenomated.

Effects
Tetrodotoxin causes severe and often total body paralysis. Tetrodotoxin envenomation can result in victims being fully aware of their surroundings but unable to move. Because of the paralysis that occurs, they have no way of signalling for help or any way of indicating distress. The victim remains conscious and alert in a manner similar to curare or pancuronium bromide. This effect, however, is temporary and will fade over a period of hours as the tetrodotoxin is metabolized and excreted by the body.

Treatment
First aid treatment is pressure on the wound and artificial respiration once the paralysis has disabled the victim's respiratory muscles, which often occurs within minutes of being bitten. Because the venom primarily kills through paralysis, victims are frequently saved if artificial respiration is started and maintained before marked cyanosis and hypotension develop. Efforts should be continued even if the victim appears not to be responding. Respiratory support until medical assistance arrives will improve the victim's chances of survival. It is essential that rescue breathing be continued without pause until the paralysis subsides and the victim regains the ability to breathe on their own. This is a daunting physical prospect for a single individual, but use of a bag valve mask respirator reduces fatigue to sustainable levels until help can arrive. Definitive hospital treatment involves placing the patient on a medical ventilator until the toxin is removed by the body. Victims who survive the first twenty-four hours usually recover completely.

12 Cnidarians

Jellyfish

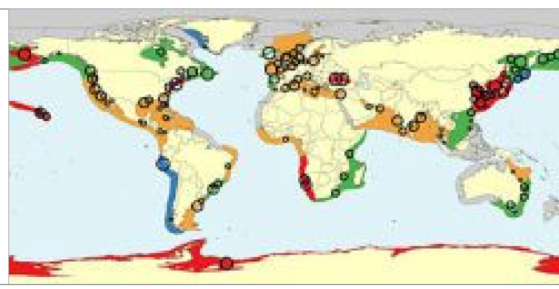
Jellyfish or sea jellies are the informal common names given to the medusa-phase of certain gelatinous members of the subphylum Medusozoa, a major part of the phylum Cnidaria. Jellyfish are mainly free-swimming marine animals with umbrella-shaped bells and trailing tentacles, although a few are not mobile, being anchored to the seabed by stalks. The bell can pulsate to provide propulsion and highly efficient locomotion. The tentacles are armed with stinging cells and may be used to capture prey and defend against predators. Jellyfish have a complex life cycle; the medusa is normally the sexual phase, the planula larva can disperse widely and is followed by a sedentary polyp phase. Jellyfish are found all over the world, from surface waters to the deep sea. Scyphozoans (the "true jellyfish") are exclusively marine, but some hydrozoans with a similar appearance live in freshwater. Large, often colourful, jellyfish are common in coastal zones worldwide. The medusae of most species are fast growing, mature within a few months and die soon after breeding, but the polyp stage, attached to the seabed, may be much more long-lived.

Anatomy
The main feature of a true jellyfish is the umbrella-shaped bell. This is a hollow structure consisting of a mass of transparent jelly-like matter known as mesoglea, which forms the hydrostatic skeleton of the animal. 95% or more of the mesogloea (the tissue that functions as a hydro-static skeleton) consists of water, but it also contains collagen and other fibrous proteins, as well as wandering amoebocytes which can engulf debris and bacteria. The mesogloea is bordered by the epidermis on the outside and the gastrodermis on the inside. The edge of the bell is often divided into rounded lobes known as lappets, which allow the bell to flex. In the gaps or niches between the lappets are dangling rudimentary sense organs known as rhopalia, and the margin of the bell often bears tentacles.

Size
Jellyfish range from about one millimetre in bell height and diameter, to nearly 2 metres (6.6 ft) in bell height and diameter; the tentacles and mouth parts usually extend beyond this bell dimension. The smallest jellyfish are the peculiar creeping jellyfish in the genera Staurocladia and Eleutheria, which have bell disks from 0.5 millimetres (0.02 in) to a few millimetres in diameter, with short tentacles that extend out beyond this, which these jellyfish use to move across the surface of seaweed or the bottoms of rocky pools.

Map of population trends of native and invasive jellyfish. Circles represent data records; larger circles denote higher certainty of findings.

Red - High Certainty
Yellow - Low Certainty
Green - Stable
Blue - Decrease
Grey - No Data



Habitats
Most jellyfish are marine animals, although a few hydromedusae inhabit freshwater. The best known freshwater example is the cosmopolitan hydrozoan jellyfish, Craspedacusta sowerbii. It is less than an inch (2.5 cm) in diameter, colourless and does not sting. Some jellyfish populations have become restricted to coastal saltwater lakes, such as Jellyfish Lake in Palau. Jellyfish Lake is a marine lake where millions of golden jellyfish (Mastigias spp.) migrate horizontally across the lake daily. Although most jellyfish live well off the ocean floor and form part of the plankton, a few species are closely associated with the bottom for much of their lives and can be considered benthic. The upside-down jellyfish in the genus Cassiopea typically lie on the bottom of shallow lagoons where they sometimes pulsate gently with their umbrella top facing down.

Parasites
Jellyfish are hosts to a wide variety of parasitic organisms. They act as intermediate hosts of endoparasitic helminths, with the infection being transferred to the definitive host fish after predation. Some digenean trematodes, especially species in the family Lepocreadiidae, use jellyfish as their second intermediate hosts. Fish become infected by the trematodes when they feed on infected jellyfish.

Stings
Jellyfish are armed with nematocysts. Contact with a jellyfish tentacle can trigger millions of nematocysts to pierce the skin and inject venom, but only some species' venom causes an adverse reaction in humans. The effects of stings range from mild discomfort to extreme pain and death. Most jellyfish stings are not deadly, but stings of some box jellyfish (Irukandji jellyfish), such as the sea wasp, can be deadly. Stings may cause anaphylaxis (a form of shock), which can be fatal. Jellyfish kill 20 to 40 people a year in the Philippines alone. In 2006 the Spanish Red Cross treated 19,000 stung swimmers along the Costa Brava. Vinegar (3–10% aqueous acetic acid) may help with box jellyfish stings, but not the stings of the Portuguese man o' war.

Salt water may help if vinegar is unavailable. Rubbing wounds, or using alcohol, ammonia, fresh water, or urine is not advised as they can encourage the release of more venom. Clearing the area of jelly and tentacles reduces nematocyst firing. Scraping the affected skin, such as with the edge of a credit card, may remove remaining nematocysts. Once the skin has been cleaned of nematocysts, hydrocortisone cream applied locally reduces pain and inflammation. Antihistamines may help to control itching. Immunobased antivenins are used for serious box jellyfish stings.

Hydrozoans

Hydrozoa are a taxonomic class of individually very small, predatory animals, some solitary and some colonial, most living in salt water. The colonies of the colonial species can be large, and in some cases the specialized individual animals cannot survive outside the colony.

A few genera within this class live in fresh water. Hydrozoans are related to jellyfish and corals and belong to the phylum Cnidaria. Some examples of hydrozoans are the freshwater jelly (Craspedacusta sowerbyi), freshwater polyps (Hydra), Obelia, Portuguese man o' war (Physalia physalis), chondrophores (Porpitidae), "air fern" (Sertularia argentea), and pink-hearted hydroids (Tubularia).

Sea Anemones

Sea anemones are a group of marine, predatory animals of the order Actiniaria. As cnidarians, sea anemones are related to corals, jellyfish and Hydra. A typical sea anemone is a single polyp attached to a hard surface by its base, but some species live in soft sediment and a few float near the surface of the water. The polyp has a columnar trunk topped by an oral disc with a ring of tentacles and a central mouth. The tentacles can be retracted inside the body cavity or expanded to catch passing prey. They are armed with cnidocytes (stinging cells).

In many species, additional nourishment comes from a symbiotic relationship with single-celled dinoflagellates, zooxanthellae or with green algae, zoochlorellae, that live within the cells. Some species of sea anemone live in association with hermit crabs, small fish or other animals to their mutual benefit. Sea anemones breed by liberating sperm and eggs through the mouth into the sea.

The resulting fertilized eggs develop into planula larvae which, after being planktonic for a while, settle on the seabed and develop directly into juvenile polyps. Sea anemones also breed asexually, by breaking in half or into smaller pieces which regenerate into polyps. Sea anemones are sometimes kept in reef aquariums; the global trade in marine ornamentals for this purpose is expanding and threatens sea anemone populations in some localities, as the trade depends on collection from the wild.

Habitats
Sea anemones are found in both deep oceans and shallow coastal waters worldwide. The greatest diversity is in the tropics although there are many species adapted to relatively cold waters. The majority of species cling on to rocks, shells or submerged timber, often hiding in cracks or under seaweed, but some burrow into sand and mud, and a few are pelagic.

Coral

Corals are marine invertebrates within the class Anthozoa of the phylum Cnidaria. They typically live in compact colonies of many identical individual polyps. Corals species include the important reef builders that inhabit tropical oceans and secrete calcium carbonate to form a hard skeleton. A coral "group" is a colony of myriad genetically identical polyps. Each polyp is a sac-like animal typically only a few millimetres in diameter and a few centimetres in length. A set of tentacles surround a central mouth opening. An exoskeleton is excreted near the base.

Over many generations, the colony thus creates a large skeleton characteristic of the species. Individual heads grow by asexual reproduction of polyps. Corals also breed sexually by spawning: polyps of the same species release gametes simultaneously over a period of one to several nights around a full moon.

Although some corals are able to catch small fish and plankton using stinging cells on their tentacles, most corals obtain the majority of their energy and nutrients from photosynthetic unicellular dinoflagellates in the genus Symbiodinium that live within their tissues. These are commonly known as zooxanthellae. Such corals require sunlight and grow in clear, shallow water, typically at depths less than 60 metres (200 ft).

Soft Corals
In soft corals, there is no stony skeleton but the tissues are often toughened by the presence of tiny skeletal elements known as sclerites, which are made from calcium carbonate. Soft corals are very variable in form and most are colonial. A few soft corals are stolonate, but the polyps of most are connected by sheets of coenosarc. In some species this is thick and the polyps are deeply embedded. Some soft corals are encrusting or form lobes. Others are tree-like or whip-like and have a central axial skeleton embedded in the tissue matrix. This is composed either of a fibrous protein called gorgonin or of a calcified material. In both stony and soft corals, the polyps can be retracted, with stony corals relying on their hard skeleton and cnidocytes for defence against predators, and soft corals generally relying on chemical defences in the form of toxic substances present in the tissues known as terpenoids.

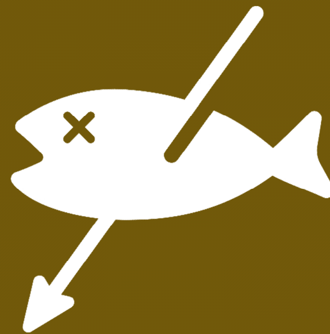
Stony Corals
The polyps of stony corals have six-fold symmetry while those of soft corals have eight. The mouth of each polyp is surrounded by a ring of tentacles. In stony corals these are cylindrical and taper to a point, but in soft corals they are pinnate with side branches known as pinnules. In some tropical species these are reduced to mere stubs and in some they are fused to give a paddle-like appearance. In most corals, the tentacles are retracted by day and spread out at night to catch plankton and other small organisms. Shallow water species of both stony and soft corals can be zooxanthellate, the corals supplementing their plankton diet with the products of photosynthesis produced by these symbionts. The polyps interconnect by a complex and well-developed system of gastrovascular canals, allowing significant sharing of nutrients and symbionts.

3 Dangerous Animals

These are animals which aren't poisonous but can kill you or cause severe damage to you.

Bear

Shark



Hunting

How to track, hunt and trap any type of animal

"The hunter that travels out into the woods is lost to the world, yet finds themself."
Unknown

Introduction

Hunting details the different types of methods you can use to track and capture wild animals.

Purpose	The aim of HUNTING is to expose the reader to a wide range of techniques to catch, collect, trap and kill animals humanely in preparation for field dressing and eventual consumption.
Lost?	• For a list of animal tracks, see the ANIMALS section. • If you want to prepare a captured animal for consumption, head to the FIELD DRESSING section. • For the hunting of fish, see the FISHING section. • If you're injured by a wild animal or insect, head to the INJURY > Animal & Plant section. • For raising tame animals, see the ANIMAL HUSBANDRY section.

Contents

1 Hunting Types

Quickly summarises the different forms of hunting which are discussed in more detail below.

Baiting	The use of decoys, lures, scent or food to attract targeted animals.
Blind or Stand Hunting	Waiting for animals in a concealed or elevated position.

Calling	The use of noises to attract or drive animals.
Camouflage	Concealing oneself visually, or with scent, to blend in with the environment.
Dogs	Used to help flush, herd, drive, track, point at, pursue, or retrieve animals.
Game Drive System	Prehistoric hunting strategy where game were herded into areas where they could be hunted in groups.
Driving	The herding of animals in a particular direction, as over a cliff or to other hunters.
Flushing	The practice of scaring targets from concealed areas.
Spotlighting	The use of artificial light to find or blind targets before capture. Modern lighting also includes IR and other devices.
Scouting	Consists of a variety of tasks and techniques for finding animals to hunt.
Stalking	The practice of walking stealthily, often in pursuit of an identified animal.
Tracking	The practice of interpreting physical evidence to pursue animals.
Trapping	The use of devices (e.g., snares, pits, deadfalls) to capture or kill an animal.

2 Baiting

The use of decoys, lures, scent or food to attract targeted animals. E.g. in a mousetrap.

3 Blind/Stand Hunting

Waiting for animals in a concealed or elevated position.

4 Calling

The use of noises to attract or drive animals.

5 Camouflage

Concealing oneself visually, or with scent, to blend in with the environment.

6 Dogs

Used to help flush, herd, drive, track, point at, pursue, or retrieve animals.

7 Game Drive System

Prehistoric hunting strategy where game were herded into areas where they could be hunted in groups.

8 Driving

The herding of animals in a particular direction, as over a cliff or to other hunters.

9 Flushing

The practice of scaring targets from concealed areas.

10 Spotlighting

The use of artificial light to find or blind targets before capture. Modern lighting also includes IR and other devices.

11 Scouting

Consists of a variety of tasks and techniques for finding animals to hunt.

12 Stalking

The practice of walking stealthily, often in pursuit of an identified animal.

13 Tracking

The practice of interpreting physical evidence to pursue animals.

Animal Tracks

Below are images of different animals tracks in the ground for identification purposes.

	Armadillo	Badger	Black Bear	Beaver	-
Track Identification					

Scat Identification

14 Trapping

The use of devices (e.g., snares, pits, deadfalls) to capture or kill an animal.

Trapping

Leg-hold Traps	
Body Gripping Traps	
Deadfall Traps	
Snares	Use brass wire, fishing wire or string for the best traps.
Trapping Pit	
Cage Traps	
Glue Trap	

Spring Traps

Gin Trap	A Gin Trap is mechanical device designed to catch an animal by the leg using spring operated jaws either with or without a serrated edge or teeth. They come in a variety of shapes and sizes.
Fenn Trap	Fenn Traps are the most popular spring trap used by gamekeepers. Sometimes referred to as Solway Spring Trap, they come in two sizes, MK4 or MK6. It is an offence to set any spring trap in the open.
Body Grip	

Kania Trap 2000	
Scissor Style Mole Trap	

Cage Traps

Fox Cage	

Bird Cage Traps

Larsen Trap	
Multi-Trap	

15 Killing

Techniques for the humane killing of animals while hunting.

Fishing

Fishing tips for any style, weather condition or region

"There is a fine line between fishing and just standing on the shore like an idiot."
Steven Wright

Introduction

This section contains advice on how to fish with different equipment and climates.

Purpose	The aim of FISHING is to provide details into the various ways you can catch sea-life, from rod fishing to spearfishing to netting. It concludes with the various conditions that can affect your ability to catch fish such as the weather or time of day.
Lost?	• If you're injured by a wild fish, head to the INJURY > Animal & Plant section. • For the care of tame fish in an agricultural system, see the GARDENING > Permaculture section. • For the continual harvesting of fish for food at home, see the ANIMAL HUSBANDRY section. • For information on cooking fish, see the COOKING section. • For a list of dangerous sea creatures, see the ANIMALS section. • For information on waves and tides, see the SURVIVAL section.

Contents

1 Fishing Types

These are the different types to catch fish.

Hand-Gathering

It is possible to harvest sea foods with minimal equipment by using the hands. Gathering seafood by hand can be as easy as picking shellfish or kelp up off the beach, or doing some digging for clams or crabs.

Flounder Tramping

Every August, the small Scottish village of Palnackie hosts the world flounder tramping championships where flounder are captured by stepping on them.

Noodling

The noodler places his hand inside a catfish hole. If all goes as planned, the catfish swims forward and latches onto the noodler's hand, and can then be dragged out of the hole.

Pearl Divers

Traditionally harvested oysters by free-diving to depths of thirty metres. Today, free-diving recreational fishers catch lobster and abalone by hand.

Trout Binning

Another method of taking trout. Rocks in a rocky stream are struck with a sledgehammer. The force of the blow stuns the fish.

Trout Tickling

In the British Isles, the practice of catching trout by hand is known as trout tickling.

Spearfishing

Spearfishing is an ancient method of fishing conducted with an ordinary spear or a specialised variant such as a harpoon, trident, arrow or eel spear. Some fishing spears use slings (or rubber loops) to propel the spear.

Bowfishing

Uses a bow and arrow to kill fish in shallow water from above.

Gigging

Uses small trident type spears with long handles for gigging bullfrogs with a bright light at night, or for gigging suckers and other rough fish in shallow water.

Hawaiian Slings

Have a sling separate from the spear, in the manner of an underwater bow and arrow.

Harpoons

Spearfishing with barbed poles was widespread in palaeolithic times.

Pike Pole Fishing

In the past, pike poles were used for ice fishing. Fisherman in large numbers put pike poles into ice holes in places known for big fish to crowd, so that a dense forest is made of pike poles. When drifting fish hits a pole, a fisherman feels this and pulls the catch out.

Polespears

Have a sling attached to the spear.

Modern Spearguns

Traditional spearfishing is restricted to shallow waters, but the development of the speargun has made the method much more efficient. With practice, divers are able to hold their breath for up to four minutes and sometimes longer.

Tridents

Three-pronged spears. They are also called leisters or gigs. They are used for spear fishing and were formerly also a military weapon.

Netting

Fishing nets are meshes usually formed by knotting a relatively thin thread.

Cast Nets

Round nets with small weights distributed around the edge. They are also called throw nets. The net is caste or thrown by hand in such a manner that it spreads out on the water and sinks. Fish are caught as the net is hauled back in.

Drift Nets

Nets which are not anchored. They are usually gillnets, and are commonly used in the coastal waters of many countries.

Gillnets

Catch fish which try to pass through by snagging on the gill covers. Trapped, the fish can neither advance through the net nor retreat.

Hand Nets

Are small nets held open by a hoop. They have been used since antiquity. They are also called scoop nets, and are used for scooping up fish near the surface of the water.

Seine Nets

Are large fishing nets that can be arranged in different ways. In purse seining fishing the net hangs vertically in the water by attaching weights along the bottom edge and floats along the top.

Surrounding Net

A surrounding net is a fishing net which surrounds fish and other aquatic animals on the sides and underneath. It is typically used by commercial fishers, and pulled along the surface of the water. There is typically a purse line at the bottom, which is closed when the net is hauled in.

Tangle Nets

Also known as tooth nets, are similar to gillnets except they have a smaller mesh size designed to catch fish by the teeth or upper jaw bone instead of by the gills.

Trawl Nets

Large nets, conical in shape, designed to be towed in the sea or along the sea bottom. The trawl is pulled through the water by one or more boats, called trawlers. The activity of pulling the trawl through the water is called trawling.

2 Angling

Angling is a method of fishing by means of an "angle" (hook). The hook is usually attached to a line, and is sometimes weighed down by a sinker so it sinks in the water. The hook is usually baited with lures or bait fish.

Angling

Line fishing is fishing with a fishing line. A fishing line is any cord made for fishing. Important parameters of a fishing line are its length, material, and weight (thicker, sturdier lines are more visible to fish).

Droplining

A dropline consists of a long fishing line set vertically down into the water, with a series of baited hooks Droplines have a weight at the bottom and a float at the top. They are not usually as long as longlines and have fewer hooks.

Handlining

Is fishing with a single fishing line, baited with lures or bait fish, which is held in the hands. Handlining can be done from boats or from the shore. It is used mainly to catch groundfish and squid, but smaller pelagic fish can also be caught.

Jiggerpole

A long fishing pole that is used with a short and heavy line, usually a foot (0.3 m) or less of 50 lbf (220 N) test or heavier. Then a large lure or bait is attached and manually worked around the shoreline and cover.

Jigging

Is the practice of fishing with a jig, a type of fishing lure. A jig consists of a lead sinker with a hook moulded into it and usually covered by a soft body to attract fish. Jigs are intended to create a jerky, vertical motion, as opposed to spinnerbaits which move through the water horizontally.

Longlining

FISHING Angling Angling

Is a commercial technique that uses a long heavy fishing line with a series of hundreds or even thousands of baited hooks hanging from the main line by means of branch lines called "snoods". Longlines are usually operated from specialised boats called longliners.

Slabbing

A bass fishing technique, that involves repetitively lifting and dropping a flat lure, usually made of 1 to 2.5 oz of lead painted to look like a baitfish (or heavy slabs of metal), through a school of actively feeding fish that the angler has located on a fishfinder.

Trolling

Is fishing with one or more baited lines which are drawn through the water. This may be done by pulling the line behind a slow moving boat, or by slowly winding the line in when fishing from the land. Trolling is used to catch pelagic fish such as mackerel and kingfish.

Trotlining

A trotline is like a dropline, except that a dropline has a series of hooks suspended vertically in the water, while a trotline has a series of hooks suspended horizontally in the water.

Angling - Rod Fishing

Fishing rods give more control of the fishing line. The rod is usually fitted with a fishing reel which functions as a mechanism for storing, retrieving and paying out the line. Floats may also be used, and can function as bite indicators. The hook can be dressed with lures or bait.

Bank Fishing

Fishing from river banks and similar shorelines. Bank fishing is usually performed with a fishing rod and reel, although nets, traps, and spears can also be used. People who fish from a boat can sometimes access more areas in prime locations with greater ease than bank fishermen.

Casting

The act of throwing the fishing line out over the water using a flexible fishing rod. The usual technique is for the angler to quickly flick the rod from behind toward the water. Casting is also a sport adjunct to fishing, much as shooting is to hunting.

Float Tubes

Small doughnut-shaped boats with an underwater seat in the "hole". Float tubes are used for fly fishing and enable the angler to reach deeper water without splashing and disturbing stillwater fish.

Fly Fishing

The use of artificial flies as lures. These are cast with specially constructed fly rods and fly lines. The fly line (today, almost always coated with plastic) is heavy enough cast in order to send the fly to the target. Artificial flies vary dramatically in size, weight and colour. Fly fishing is a distinct and ancient angling method, most renowned as a method for catching trout and salmon

Tenkara Fishing

Tenkara is a form of fly fishing that originated in Japan over 200 years ago. It was originally done with a bamboo pole between 12' and 20' with the line tied directly on the tip of the rod requiring no reel. Modern tenkara rods are usually made of graphite and are telescopic. Unlike western style fly fishing tenkara uses either a tapered line or a level line and forgoes the PVC coated fly fishing line.

Rock Fishing

Fishing from rocky outcrops into the sea. It is a popular pastime in Australia and New Zealand. It can be a dangerous pastime and claims many lives each year.

Pitch Fishing

A technique designed to deliver the lure quietly and at a distance over the water. The lure will fly high and far out over the water, landing in a loud splash. Pitch fishing involves sending the lure out a lower angle, and thus making a smaller splash which will hopefully not scare the fish.

Surfcasting

Fishing from a shoreline using a rod to cast into the surf. With few exceptions, surf fishing is done in saltwater, often from a beach. The basic idea of most surfcasting is to cast a bait or lure as far out into the water as is necessary to reach the target fish from the shore. This may or may not require long casting distances and muscular techniques.

Angling - Other

Other forms of angling not mentioned above.

Bottom Fishing

Is fishing at the bottom of a body of water. In the United Kingdom it is called "ledgering". A common rig for fishing on the bottom is a weight tied to the end of the line, with a hook about an inch up line from the weight. The method can be used both with hand lines and rods.

Ice Fishing

The practice of catching fish with lines and hooks through an opening in the ice on a frozen body of water. It is practised by hunter-gatherers such as the Inuit and by anglers in other cold or continental climates.

Kayak Fishing

Many of the techniques used are the same as those used on other fishing boats, apart from difference is in the set-up, how each piece of equipment is fitted to the kayak, and how each activity is carried out on such a small craft.

Kite Fishing

Kites can provide the boatless fishermen access to waters that would otherwise be available only to boats. Similarly, for boat owners, kites provide a way to fish in areas where it is not safe to navigate such as shallows or coral reefs where fish may be plentiful. Kites can also be used for trolling a lure through the water.

Kontiki Fishing

Is the practice of using either a Kontiki sailing raft, or a modern motorised torpedo device to pull a longline (up to 25 hooks) from the beach up to two thousand metres offshore. This method of fishing is very popular on the surf beaches of New Zealand. The electric kontikis can also be used to pull surfcasting lines and baits offshore, before releasing them to fish. Modern electric kontikis use electric trolling motors, lithium batteries and GPS controlled autopilots, and electric winches are used to retrieve the line, hooks and kontiki back to shore.

Boat Anglers

Fishing is usually done either from a boat or from a shoreline or river bank. When fishing from a boat, pretty much any fishing technique can be used, from nets to fish traps, but some form of angling is by far the most common.

Remote Control Fishing

Fishing can also be done using a remote controlled boat. This type of fishing is commonly referred to as RC fishing. The boat is usually one to three feet long and runs on a small DC battery. A radio transmitter controls the boat. The fisherman connects the fishing line/bait to the boat; drives it; navigating the water by manipulating the remote controller.

3 Trapping

Traps are culturally almost universal and seem to have been independently invented many times. There are essentially two types of trap, a permanent or semi-permanent structure placed in a river or tidal area and pot-traps that are baited to attract prey and periodically lifted.

Dam Fishing

An artisanal technique called dam fishing is used by the Baka pygmies. This involves the construction of a temporary dam resulting in a drop in the water levels downstream—allowing fish to be easily collected.

Basket Weir Fish Traps

Were widely used in ancient times. They are shown in medieval illustrations and surviving examples have been found. Basket weirs are about 2 m long and comprise two wicker cones, one inside the other—easy to get into and hard to get out.

Fishing Weir

Large fishing weir structures were constructed from wood posts and wattle fences. 'V' shaped structures in rivers could be as long as 60 metres and worked by directing fish towards fish traps or nets. Such fish traps were evidently controversial in medieval England.

Fish Wheels

Operate alongside streams, much as a water-powered mill wheel. A wheel complete with baskets and paddles is attached to a floating dock. The wheel rotates due to the current of the stream. The baskets on the wheel capture fish travelling upstream and transfer them into a holding tank. When the holding tank is full, the fish are removed.

Lobster Traps

Also called lobster pots, are traps used to catch lobsters. They resemble fish traps, yet are usually smaller and consist of several sections. Lobster traps are also used to catch other crustaceans, such as crabs and crayfish. They can be constructed in various shapes, but the design strategy is to make the entry into the trap much easier than exit.

Rod Types

Line Types

4 Conditions

Seasonal Conditions

Summer Conditions

Early Morning (4:30-9am)	Fishing is excellent from before sunup to just before mid-morning. At this time of year there is abundant food and cover for fish, so finding hungry fish can be a challenge.
Late Morning-Early Afternoon (9am-5pm)	Fishing is poor for most of the day. Fish move to deep water to cool off.
Afternoon-Early Evening (5pm-9pm)	Fishing is excellent from early sundown until dark as the waters cool and fish rise up from the depths.

Fall/Autumn Conditions

Early Morning (Daybreak-9am)	Fish aren't biting much from sunup to early morning. The water is cool because the sun is too low to penetrate the water.
Late Morning-Early Afternoon (9am-12pm)	Fish are biting off and on in warmer, shallow water. The water is generally cool due to the season.
Afternoon-Early Evening (12pm-6pm)	Fishing at this point is excellent. Sun is directly overhead for several hours and the water gets more comfortable near the surface. This makes for seasonally good fishing because fish are putting on weight for the winter.

Winter Conditions

Water temperature serves as the most critical element in locating and catching fish. Fish are cold blooded, during colder periods their metabolic rate slows way down and they eat less. On colder days, fish stay in the warmest water they can find, so try to locate deeper dredge holes, canals and pockets adjacent to shallow flats, and slow down your presentation to a crawl. The colder the water, the slower the retrieve. The warmer the water in winter, the more chance you have at catching fish. Deeper water will be the best bet in early mornings and on sunny days the flats can come alive as those temperatures begin to rise. The current which triggers fish feeding can come from the wind and from the tide.

They love to take up a position on the down tide/wind side of a point that has the current sweeping across it. During bouts of cold weather with sunny days, fish the flats late in the afternoon when the water has absorbed maximum radiation. Fish will move to the warmer water to feed. Areas of dark bottom can be especially productive late in the afternoon. Cold water is extremely clear water. Use lighter fishing tackle, less visible in the water. Fish respond to changes in atmospheric pressure. Cold fronts usher in high pressure shut down the fishing action completely.
Don't let cold weather stop you from fishing.

Spring Conditions

Early Morning (6am-9am)	Fish aren't biting. The water is cold and doesn't heat up because the sun is low and the rays bounce off the water. Best to wait until a week or so after thaw, as spring turnover takes time for the water temperature to even out to 39.2°C.
Late Morning-Early Afternoon (9am-1pm)	Fish are biting off and on. The water begins to warm up because rays begin to penetrate the water. Remember to fish the downwind shoreline, as the winds will push the warmer surface water along with surface food into that area.
Afternoon-Early Evening (1pm-5pm)	Fish are eating a lot because their metabolism and digestion are cranked. Water is warm because the sun is directly overhead.

Time Conditions

These are the time conditions which affect when fish are most likely to bite.

Temperature	Too many hot days in the summer can make fish in shallow lakes, ponds and rivers sluggish. The same thing happens in the winter when water temperatures are lower.

FISHING Conditions Time Con

Light	Fish prefer early morning and evening sun to the bright sun of midday. Morning sun warms the shallows, creating more comfortable water temperatures for fish to feed. Late morning is best when the sun has had more of a chance to warm the shallows. This is particularly true during early spring in shallows with dark or mud bottoms because dark areas absorb heat more rapidly than light sandy bottoms. Warm water temperatures make bait fish more active and available to game fish on cool early-spring days. On hot sunny days, fish move to cooler, deeper waters to stay comfortable. High-heat conditions make shallow and top water lures and fishing bait best only in the early morning and late afternoon when cooler temperatures and lower light levels allow fish to cruise the shallows for meals. In midday, hot water surface temperature, decreased surface oxygen and occasional increasing winds cause fish to move deeper. In these conditions, deep fishing baits, rigs and lures are best. Already, you can see how a combination of time of day, light and weather can affect your fishing.

Variables

FISHING Conditions Variables

These are the other variables such as weather which affect when fish are most likely to bite.

Wind	Wind can play a large role in when to fish and your fishing success. Wind pushes water and surface food to the far shore, with bait fish behind it, and with game fish behind the bait fish. So if you're fishing from shore on a windy day, fish where you have to cast into the wind. That way your lure moves with the wind, just like the other food in the lake at the same time. If you're fishing from a boat, cast with the wind on a sheltered shore.
Storms	Storms and changing weather patterns affect fishing success since fish are keenly attuned to changes in barometric conditions. With many fish, feeding increases during the hours immediately before a cold front, but slows during and after a storm or front hits. Fishing after a cold front is poor and continues to be poor for a day or two. Warm fronts cause surface water temperatures to increase, putting fish into a feeding mode. This can be particularly true in the winter, when a warming trend can cause otherwise sluggish fish to start feeding actively. Most of this feeding activity is on or near the warm surface.
Cloudy Days	Cloudy days improve fishing since the clouds prevent light penetration. Overcast skies signal when to fish because they cause fish to cruise for food more than they would during bright days when they tend to hide and stay close to structure. On overcast, cloudy days, fish are less likely to be at specific structure spots or areas and more likely to be scattered throughout a waterway.
Light Rain	A light rain is another good time to fish, especially a warm spring or summer rain. Rain can help you hide from the fish since the rain breaks up the view a fish has through the water surface. This is true for shore, wade or boat fishing. Rain also washes insects and fishing bait into the water, creating a feeding binge for fish.
Hard Rain	Hard rain conditions are a poor time to fish. A hard rain muddies the water, makes it difficult for fish to find bait or lures and causes heavy runoff, which can clog their gills. The increased water flow in rivers from any rain increases current flow and makes it difficult for fish to maintain a comfortable position in the river. High water levels can also create rapids, waves and unsafe fishing conditions.
Tide	The rising or falling time is the best for fishing while water level is not too deep or too low. As a water level decreasing, fish sense the dropping water and will move out with the tide to deeper water. When water level increases, larger fish, such as redfish, flounder, drum and trout will also follow that rising tide. Tides cause bait to move and promote active feeding coastal fish.

FISHING Conditions Variables

Gardening

How to grow any type of food, herbs and flowers

"To plant a garden is to believe in tomorrow."
Audrey Hepburn

Introduction

Gardening is the practice of growing and cultivating plants as part of horticulture. In gardens, ornamental plants are often grown for their flowers, foliage, or overall appearance; useful plants, such as root vegetables, leaf vegetables, fruits, and herbs, are grown for consumption, for use as dyes, or for medicinal or cosmetic use. Gardening is considered by many people to be a relaxing activity. Gardening ranges in scale from fruit orchards, to long boulevard plantings with one or more different types of shrubs, trees, and herbaceous plants, to residential back gardens including lawns and foundation plantings, and to container gardens grown inside or outside.

Gardening may be very specialized, with only one type of plant grown, or involve a large number of different plants in mixed plantings. It involves an active participation in the growing of plants, and tends to be labour-intensive, which differentiates it from farming or forestry. In respect to its food-producing purpose, gardening is distinguished from farming chiefly by scale and intent. Farming occurs on a larger scale, and with the production of salable goods as a major motivation.

Gardens take time so once the crisis is upon you is when you need to begin thinking about a renewable food source. You have to have seeds in the ground while you still have plenty of food on hand. Plants do not develop over night and there are never any guarantees of a good harvest. You should have enough supplies stockpiled so food is not an immediate concern while your garden develops. If the crisis happens in the winter months you need enough food to last until spring and then until your plants begin to bear fruit. You should have at a minimum a 12-month supply of food, to allow for all variables. Some crops can take months before the plants would be ready for harvesting.

In some areas of the country, you may have a shortened growing season so once a plant is ready for harvest you cannot expect to get another crop in and matured before the first frost in the fall. A growing season is typically determined by the number of days between the last frost in the spring and the first frost in the fall. You will never achieve a 100 percent rate in other words a percentage of what you raise will never reach your table. Some of your produce will be eaten by pests or animals and some may even rot prematurely not to mention lack of rain, hailstorms or even excessive rainfall will influence crop yields.

Purpose	The aim of GARDENING is to provide tips and tricks on growing vegetables, fruit, herbs, spices, nuts and other edible plants. There's sections on assisting the growth of plants such as soil quality, pests and diseases. The end of the guide is dedicated to permaculture techniques such as Aeroponics, Aquaponics, Hydroponics and Aquaculture.
Lost?	• For ways to identify wild plants and trees, see the PLANTS section. • For ideas on what to grow for medicinal purposes, see the NATURAL REMEDIES section. • For ideas on what to grow based on dish, see the RECIPE section. • For ideas on what to grow based on nutrition, see the HEALTH section.

Contents

	11	**Permaculture**	Development of sustainable agricultural ecosystems.		

1 Types of Gardening

In-ground gardening poses one of the best ways to get started gardening, however can be one of the most challenging to maintain. First you must pick a spot, rip up the sod, till the soil, and continue to work in compost and soil amendments until the soil is at your desired level of fertility.

Subheadings

		1. In-Ground Gardening	**2. Aquaponics**	**3. Hydroponics**	**4. Raised Beds**		
		5. Back To Eden	**6. Straw Bale Gardening**	**7. Core Gardening**	**8. Container Gardening**		
		9. Square Foot Gardening	**10. Mittleider Method**	**11. Keyhole Gardening**	**12. Window Farms**		

1 In-Ground Gardening

In-ground gardening poses one of the best ways to get started gardening, however can be one of the most challenging to maintain. First you must pick a spot, rip up the sod, till the soil, and continue to work in compost and soil amendments until the soil is at your desired level of fertility.	**Advantages** Cost effective, easy to start, easy to change methods if needed.	**Disadvantages** Good soil is hard to come by, weeds will be your number one enemy, slow to start in the spring since it is often muddy, can be wasteful on water, tilling kills worms and soil life, and open soil is left bare to be exposed to solar radiation.

Preparing The Garden	If you decide to plant in the ground directly, you should first complete a soil test to ensure soil quality.	**Tools** ● Garden spades ● A rotary tiller (locate a rental, or hire someone locally to the job) ● Yard waste bags ● Garden stakes and twine (for edged beds) ● A hose (for circular beds) ● Tarp (optional - this is if you would like to start a separate compost pile for grass) ● Compost	For purchased compost, calculate the amount needed using a soil calculator- simply enter the square footage of your bed, and the # of inches of compost that you would like to till into your soil (4-5 inches is recommended). Your will then be given the cubic yardage of compost needed.
Steps	1. Mow the grass as low as possible before removing all of the sod and grass. 2. For an edged bed, use the garden stakes and twine to create an outline on the grass – for a round bed, use the hose to form a circular shape. 3. Using the garden spades, follow the outside of the twine (or hose) to cut straight down into the soil. 4. Put aside the stakes, twine, or hose. Till the entire plot with the roto-tiller. 5. Form a separate compost pile of the patches of grass and sod (they would overwhelm your bin!). Layer them with their roots side facing up, sprinkle with water, and let them decompose. At the end of the day, cover them with the tarp. 6. As you work, remove any pebbles, stones or other debris. Pull out weeds and roots; dispose in yard waste bags. 7. Add your calculated amount of compost (about 4-5 inches across the total square footage of the bed; if purchasing compost, use a soil calculator to determine the total number of cubic yards needed). Rake and dig into the soil. 8. Return the excess soil to the bed, and smooth out with garden hoes and rakes to form an even top layer. 9. You are now ready to plant your garden!		

2 Aquaponics

Aquaponics is the process of growing plants with the use of fish. The fish waste will be broken down by bacteria, turning the nitrates into nitrites that the plant can use as food. It is an organic form of hydroponics and allows for the ability to grow 2 crops at once (fish and plants).	**Advantages** Conserves water, allows for soil-less growing, organic version of hydroponics, grows 2 crops at once.	**Disadvantages** Can be expensive, lots of space needed to house fish tank and plants, dependent on fish food to feed fish.
See the Permaculture section for more.		

3 Hydroponics

The process of growing food using a nutrient solution. Hydroponics uses water soluble nutrients to feed the plants right at the source. This leads to fast growth and the ability to grow without soil.	**Advantages** Grow without soil, grow indoors or outdoors, fastest growth of any gardening method, all nutrients are 100% plant available.	**Disadvantages** Can be expensive to set up, indoor lights are pricey, dependency on synthetic fertilizers costs money, no organic options.
See the Permaculture section for more.		

4 Raised Beds

Garden beds made from wood, timbers, bricks, or mounds that elevates the soil higher than the original level.	**Advantages** Elevates the soil to dry it out faster, allows for better drainage, reduces strain on the back from reducing how far one must bend to weed, plant or harvest, better soil quality, reduces compaction of the soil because you are not stepping in the bed, weeding is easier due to the uncompacted soil.	**Disadvantages** Wood can be expensive, once the beds are in and built it is a commitment to keep them there.

GARDENING Types of Gardening

5 Back To Eden

Back To Eden	Advantages	Disadvantages
Placing 4-6 inches of wood chips on the soil to cover the soil and act as protection for soil bacteria, as well as retain moisture, and mulch weeds. Most often you can get wood chips for free just by contacting your local municipal tree company. They have to pay to throw out the wood chips, so if you call they will usually drop off more than enough for free.	Retains moisture, amends soil over time, protects the soil from solar radiation and weathering, and suppresses weeds.	Wood chips will take nitrogen from the soil if mixed into the soil leaving plants with nitrogen deficiencies, hardy weeds will still find a way to grow, so weeding is still something that has to be done, moving wood chips can be labour intensive and tiring. Planting seeds is also a challenge since mulch does not delineate between weeds and your vegetable plants.

6 Straw Bale Gardening

Straw Bale Gardening	Advantages	Disadvantages
Bales are great raised beds: straw collects/disburses moisture and is compostable, which means over time your plants will gain nutrients as the straw decomposes. Plus, the bales retain heat to extend your gardening season even further.	Cheap gardening method for those who want raised bed gardens, but do not like the weeds and the building of the beds. Straw bales are relatively lightweight and can be moved around, if you change your mind about a gardening method, they are not permanent.	Dries out fast, takes lots of time to break down the centre of the bales (condition them) so that there is something to grow in, many farmers spray hay with weed killer and this can be harmful to consume and may even inhibit plant growth.

7 Core Gardening

Core Gardening	Advantages	Disadvantages
Use this in combination with raised beds to provide the most amazing growing conditions for the plants. The soil holds on to water like a sponge for weeks at a time (once charged), the grass breaks down quickly feeding the soil, the nitrogen prevents any nitrogen from being taken from the soil during the breaking down of the grass, and the organic material adds good drainage, porosity, and loamyness.	Easy to set up, retains water, amends soil quickly, doesn't mound soil like hügelkultur, breaks down faster than hügelkultur, loosens soil, increases drainage, and allows for microbes and fungi to colonize the straw and interact with plant roots.	Takes some water to charge the core initially.

8 Container Gardening

Container Gardening	Advantages	Disadvantages
Growing in pots is a great way to maximize space, increase productivity, or use a spot that normally would not be able to have plants grown. From balcony gardens to patio gardens, this method is popular and fun! All the benefits of gardening can be had in square inches, rather than square feet. Make sure to have a steady watering schedule with your plants, so they will not dry out on you. Also if you are looking to container garden for a long time, invest on good quality pots. Clay pots tend to crack, so look into other alternatives.	Small footprint, great for people that do not have a ton of space (apartments, condos, patios), mobile.	Constant water upkeep since soil tends to dry faster, pots can be expensive, pot size limits growth.

9 Square Foot Gardening

Square Foot Gardening	Advantages	Disadvantages
The basic concept: Create a small garden bed (4 feet by 4 feet or 4 feet by 8 feet are common sizes) and divide it into a grid of 1-foot squares, which you manage individually. Seeds or seedlings of each kind of vegetable are planted in one or more squares, at a density based on plant size (e.g., you'd plant about 16 radish seeds per square, but only one tomato plant). Since there are no paths, there is no wasted space, and the soil in the bed stays loose because you never step on it.	High yields, fast set-up, minimal regular maintenance, less weeding.	High initial cost, cramped beds, insufficient depth, lots of watering, more frequent maintenance.

The Square Foot Gardening method can be started using only a frame and some dividers. Picture a box divided into smaller squares, each measuring 1-foot by 1-foot. The square foot gardening method focuses on the number of seeds that can be planted within each square box based on the size of the plant. For example, one tomato plant might occupy its own square while oregano can be planted 4 times within a square. Carrot seeds, on the other hand, can be planted 16 to a square.

10 Mittleider Method

Mittleider	Advantages	Disadvantages
The Mittleider Gardening method is an easy-to-use method that allows gardeners to raise an abundance of vegetables and other crops on almost any soil, in practically any season, in almost any climate, and virtually at any elevation.	Cheap soil, grow in any climate.	Difficult to build the garden.

11 Keyhole Gardening

Keyhole gardens provide adequate growing conditions in less-than-adequate environments. Keyhole gardens are named after their shape: they are typically round beds with a pie-slice-shaped aisle for easy access, all built around a circular centre compost. These types of garden beds provide the best of several worlds: raised beds allow for regulated soil conditions, the compost centre permits rich nutrients to re-enter the soil through recycling, and soil stays nourished via water poured into the compost pile, essentially drought-proofing your crops.	**Advantages** o	**Disadvantages** o

12 Window Farms

A vertical cascade of hanging vessels–typically halved soda/water bottles–home to soil-less leafy green plants and herbs. The method is simple enough. Plants grow out of the bottle while an air pump (such as those used in fish tanks) circulate liquid nutrients that gently flow down the structure. Sunlight is necessary, but for windows that don't receive enough light, hanging LED lights will work. This method of gardening is ideal for residents with no patch of grass for their own; the method is also dirtless.	**Advantages** o	**Disadvantages** o

2 Soil

Information on the different types of soil, fertilizers and how to prepare soil for use.

Preparing Soil

Soil Testing
Before you start dumping on the lime and fertilizers, your first step should be taking a soil sample to send off for testing. A good soil test will evaluate the basic texture of your soil - sand, silt, or clay—and determine its acidity—the pH level. The available amounts of nutrients including magnesium, calcium, phosphorus, and potassium will be calculated and recommendations will be made for raising each to the correct levels for optimum plant growth. Armed with this knowledge, you can make the proper improvements. Too much of a good thing can be just as harmful as too little so let your soil test be your guide. Home test kits are available but they are not as accurate or thorough as professional testing. Contact your county extension office for soil testing information and instructions. Most have websites; fees for soil testing, along with the proper forms, can be found there.

- To take a representative sample, scrape away any surface litter, plant residues, leaves, etc.
- Avoid sampling in a spot where ashes have been dumped, manure or compost stored, or brush burned.
- Cut straight into the soil with a shovel or trowel 6 to 8 inches deep making a V-shaped hole.
- Cut a 1 inch wide slice of soil the length of the hole from one side. Take a 1 inch strip from the centre of this slice to use in your sample.
- Repeat sampling randomly around the garden and mix the samples together in a clean glass jar or bucket. Since we use raised beds we take a slice from each bed and mix them all together.
- Measure out a cupful of soil, dry it indoors for a few days, and seal in a plastic bag with your information on it.
- Send it in with the proper forms and fees.

Results
When you get your test results the fertilizer recommendations will be quite specific, and speak to three elements: nitrogen, phosphorus, and potassium. Fertilizer terms can be confusing. What is the NPK ratio? What are nitrogen, phosphorous, and potassium? Let us take the guesswork out of fertilizing. It's all about the soil. Most soil doesn't have all the nutrients needed for optimal growth, which means you won't get the harvest or flower bloom desired. There are six primary nutrients that plants require—carbon, hydrogen, oxygen, nitrogen, phosphorus, and potassium. The latter three nutrients come from the soil.

N P K Fertilizer Labels
Every fertilizer label will give information relating to its "N-P-K" content, expressed as a number ratio. On the label, you'll see numbers like 5-10-10, 10-10-10, and 10-6-4. There is valuable information in the labelled numbers: They indicate the amount of nitrogen, phosphorus, and potassium (standardized in that order) in the particular fertilizer blend.

For example, 100-pound bag of 10-10-10 contains ten pounds of each element. The rest is filler, which gives it bulk and makes it easier to spread.

Nitrogen
N stands for nitrogen which helps plants make leafy growth. For nitrogen they will tell you how much manure to use. If you are using fresh manure, spread it on in the fall so it can break down over the winter and be safe for spring planting. If you prefer, dried blood, alfalfa, soybean, or cottonseed meals can be substituted. Nitrogen is released quickly from them so it is best to wait until spring to add it to your soil. 10 pounds of blood meal supplies the same amount of nitrogen as 10-20 bushels of manure but without the added benefit of all the organic matter that manure contains.

Phosphorus
P stands for phosphorus which is necessary for germination, strong root growth, flowers, and fruit. It helps plants absorb minerals, grow strong stems, and withstand disease. Rock phosphate provides phosphorus, magnesium, and trace minerals. Rock powders are wonderful soil enhancements. They are slow acting but long lasting so they need to be applied only every 3-4 years. Bone meal and bone char are more readily available sources of phosphorus.

Potassium
K stands for potassium or potash. It regulates the flow of water in plant cells and is necessary for flowering, fruiting, and disease resistance. A lack of potassium will cause plants to have weak stems and stunted growth. For added potassium you can use granite dust or greensand which is made from glauconite, an ocean mineral high in potassium and iron. Wood ashes are also high in potash.

Amending pH
Achieve the proper soil pH. A very high or very low soil pH may result in plant nutrient deficiency or toxicity. A pH value of 7 is neutral; microbial activity is greatest and plant roots absorb/access nutrients best when the pH is in the 5.5 to 7 range. Add organic matter to your soil. It improves structure, slowly releases nutrients, and increases beneficial microbial activity. (NOTE: It is virtually impossible to know the nutrient content of aged manure.)

Fertilizers

Natural, Organic, Synthetic Fertilizers
Fertilizer providing the N-P-K nutrients mentioned above can come in both organic and synthetic versions. What's the difference?
Organic fertilizers come from sources such as manure, blood meal, cottonseed meal, feather meal, crab meal, etc. (Bear in mind: Not all products labelled "natural" are organic. Greensand—derived from inorganic mineral-based or "rock" matter—is an example of a natural, although inorganic, material.) Organic fertilizers work in concert with soil microbes that break fertilizers down for plant uptake. Because they don't add excess salts and acid to the soil, organic fertilizers are beneficial in encouraging healthy soil biology rich in microbial activity.

Synthetic fertilizers are lab-made and derived from compounds like ammonium nitrate, ammonium phosphate, superphosphate, and potassium sulphate. They expedite plant growth and can contribute to bloom rate in flowering plants. However, they are high in salts and can be detrimental to populations of beneficial microorganisms and also leach into water sources. Applying too much synthetic fertilizer can "burn" foliage and damage your plants. Synthetic fertilizers are great for a boost, but do little to improve your soil's long-term health, texture, or long-term fertility.

Because synthetic fertilizers are highly water-soluble, they can also leach out into streams and ponds. In general, organic fertilizers need time to enrich the soil, so they're best applied in the fall so the nutrients will be available in the spring. For the spring, some fertilizers combine the best of both worlds with an organically-based fertilizer mix that also contains small amounts of synthetic fertilizers to ensure the immediate availability of nutrients.

Note that the N-P-K ratio of organic fertilizers is typically lower than that of a synthetic fertilizer. By law, the ratio label can only list nutrients that are immediately available.

Granular vs Soluble
You may also notice that there are both granular and soluble formulations.
● Granular fertilizers are solids that must be worked into the soil and given time (and water) before they dissolve and become available to plants.
● Slow-release fertilizers are a subset of granular formulations. A portion of the fertilizer is not immediately available to the plant. Nutrients are metered out over several weeks. Therefore, they are applied less frequently.
● Sometimes called "liquid feed," soluble fertilizers are sold as either ready-to-use solutions or packaged dry-milled materials that need to be dissolved in water. These tend to be quick-release fertilizers high in nitrogen that result in fast green growth. (Miracle-Gro is a good example of a soluble fertilizer.)
To build the long-term health and fertility of your soil, we recommend using granular organic fertilizers. Supplementing with an additional water-soluble fertilizer is a way to ensure that your plants have the nutrients they need when they need a boast (during active growth).

Buying Fertilizer
Shopping for fertilizer can be confusing because plants have individual nutrient requirements.
If you don't have any specific soil needs, a 5-5-5 fertilizer is an all-purpose fertilizer that provide plants with what they need for healthy growth.
Evergreens — holly, rhododendron, yew, and others — not only need high nitrogen to keep them green, but several trace elements as well. Evergreen food may have an analysis of 30-10-10, plus a dose of copper, molybdenum, and iron. Flowering annuals, on the other hand, burst into bloom when nitrogen is held back. The tonic they need is 5-10-10..
Good-quality bonemeal worked into the soil around newly planted bulbs keeps them springing up for several years.

Compost Tea
Before buying bags or bottles of fertilizers, consider how you might add nutrients to the soil by improving its biology. Try compost tea, a liquid produced by extracting beneficial microbes (bacteria, fungi, protozoa, and nematodes) from compost. Applying compost tea to both soil and plant foliage adds those beneficial microorganisms to the growing medium, which boosts plant health and encourages growth. Compost tea is made using a brewing process similar to that used for making beer. Active compost, a brewing kit, and a little information can go a long way toward turning your landscape into a thriving ecosystem. See information on how to make compost tea.

Soil Fixes
If you have clay soil, add coarse sand (not beach sand), compost, and peat moss. If you have sandy soil, add humus or aged manure, peat moss, or sawdust with some extra nitrogen. Heavy, clay-rich soil can also be added to improve the soil. If you have silt soil, add coarse sand (not beach sand) or gravel and compost, or well-rotted horse manure mixed with fresh straw.

Soil Amendments

Let your soil test be your guide when adding fertilizers and amendments to your soil. Too much of a good thing is worse than not enough so don't overdo it. The idea is to feed the soil not the plants. Healthy soil results in healthy growth.

Minerals

The minerals used in soil correction.

Aragonite	A source of calcium found in mollusc shells. Since it is low in magnesium it is good to use if your soil needs calcium but does not need any extra magnesium. Too much magnesium can "tie up" other nutrients, making them unavailable for plants to use. If your pH is low, aragonite has almost as much sweetening power as limestone.
Azomite	A trademarked acronym for A to Z Minerals Including Trace Elements. Mined in Utah, it is ancient volcanic dust that merged with sea water 30 million years ago. It has over 60 minerals that are good for plant growth.
Bone Char	Burned bone meal that provides a readily used source of phosphorus.
Calphos Colloidal Phosphate	A good choice if your soil is low in calcium and phosphorus.
Dolomitic Limestone	Will not only sweeten your soil better than pure limestone it also provides calcium and magnesium.
Granite Meal	A rock powder that provides slow release potassium and trace minerals without changing the pH of your soil.
Greensand	Also called glauconite. It is high in potassium and iron and has small amounts of magnesium and other trace elements. It is good for loosening clay soils and improving sandy soil.
Gypsum	23% calcium and 17% sulphur so it provides calcium without raising pH levels. It helps improve drainage by aerating the soil. It neutralizes plant toxins and removes sodium from the soil. The sulphur reacts with water and forms a weak sulphuric acid that frees up calcium in your soil.
Hi-Cal Lime	Used to raise the pH and add calcium at the same time.
Sulphate of Potash	Contains 51% potassium and 18% sulphur along with trace amounts of calcium and magnesium. It is mined in the Great Salt Lake Desert in Utah.

Sul-Po-Mag	Also called langbeinite, is used if you need magnesium and potassium but not more calcium. It does not raise pH.
Zeolites	Found in volcanic ash and can improve water and mineral retention in sandy soils.

Fertilizers

Alfalfa Meal	A source of readily available nitrogen for plant growth and also feeds soil organisms. It contains vitamins, folic acid, and trace minerals.
Blood Meal	Very high in fast-release nitrogen. It also repels deer.
Fish Meal	An excellent source of nitrogen and potassium. It is a by-product of fish farming.
Kelp Meal	Dried, ground up seaweed. It provides trace minerals, amino acids, and enzymes that stimulate plant and root growth and are beneficial to soil life. By improving soil structure it can help your soil hold moisture and reduce the effects of drought and frost.
Soybean Meal	Contains high amounts of nitrogen and potassium that are released slowly as it breaks down. Look for organic sources since most commercially grown soybeans are genetically modified.

Composting

Compost is organic matter that has been decomposed in a process called composting. This process recycles various organic materials otherwise regarded as waste products and produces a soil conditioner (the compost). Compost is rich in nutrients. It is used, for example, in gardens, landscaping, horticulture, urban agriculture and organic farming. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil. In ecosystems, compost is useful for erosion control, land and stream reclamation, wetland construction, and as landfill cover. At the simplest level, the process of composting requires making a heap of wet organic matter (also called green waste), such as leaves, grass, and food scraps, and waiting for the materials to break down into humus after a period of months.

However, composting also can take place as a multi-step, closely monitored process with measured inputs of water, air, and carbon- and nitrogen-rich materials. The decomposition process is aided by shredding the plant matter, adding water and ensuring proper aeration by regularly turning the mixture when open piles or "windrows" are used. fungi, earthworms and other detritivores further break up the material. Bacteria requiring oxygen to function (aerobic bacteria) and fungi manage the chemical process by converting the inputs into heat, carbon dioxide, and ammonium.

Fundamentals
Composting is an aerobic method (meaning that it requires the presence of air) of decomposing organic solid wastes. It can therefore be used to recycle organic material. The process involves decomposition of organic material into a humus-like material, known as compost, which is a good fertilizer for plants. Composting requires the following three components: human management, aerobic conditions, development of internal biological heat.

Composting organisms require four equally important ingredients to work effectively:
- **Carbon** - for energy; the microbial oxidation of carbon produces the heat, if included at suggested levels. High carbon materials tend to be brown and dry.
- **Nitrogen** - to grow and reproduce more organisms to oxidize the carbon. High nitrogen materials tend to be green (or colourful, such as fruits and vegetables) and wet.
- **Oxygen** - for oxidizing the carbon, the decomposition process.
- **Water** - in the right amounts to maintain activity without causing anaerobic conditions.

Certain ratios of these materials will provide microorganisms to work at a rate that will heat up the pile. Active management of the pile (e.g. turning) is needed to maintain sufficient supply of oxygen and the right moisture level. The air/water balance is critical to maintaining high temperatures 130–160 °F (54–71 °C) until the materials are broken down.

The most efficient composting occurs with an optimal carbon: nitrogen ratio of about 25:1. Hot container composting focuses on retaining the heat to increase decomposition rate and produce compost more quickly. Rapid composting is favoured by having a C/N ratio of ~30 or less. Above 30 the substrate is nitrogen starved, below 15 it is likely to outgas a portion of nitrogen as ammonia.

Nearly all plant and animal materials have both carbon and nitrogen, but amounts vary widely, with characteristics noted above (dry/wet, brown/green). Fresh grass clippings have an average ratio of about 15:1 and dry autumn leaves about 50:1 depending on species. Mixing equal parts by volume approximates the ideal C:N range. Few individual situations will provide the ideal mix of materials at any point. Observation of amounts, and consideration of different materials as a pile is built over time, can quickly achieve a workable technique for the individual situation.

Aerobic Composting

Anaerobic Composting

Vermicomposting

3 Seed Bank

A seed bank stores seeds to preserve genetic diversity; hence it is a type of gene bank. There are many reasons to store seeds. The genes that plant breeders need to increase yield, disease resistance, drought tolerance, nutritional quality, taste, etc. of crops. A seed bank is recommended regardless of whether you currently have the outdoor space or not for a garden because vegetables and certain fruits can be raised indoors, in a garage, basement or any room as long as you have adequate sunlight or artificial lighting. Additionally you may have to evacuate to a safe haven and you must always consider the possibility of never returning. You may have to rebuild your life essentially in another location and this means you would need a renewable and sustainable food source.

Seed Types

Hybrid Seeds
A hybrid seed is seed produced by cross-pollinated plants. The best plants are selected to improve the characteristics of the resulting plants, to increase yields, uniformity of the fruit, improve the colour, and for disease and drought resistance and so on. Many believe that taste does suffer when cross-pollinating however. While, the hybrid seeds you plant will produce the same plant, the seeds from the hybrid plant will not have any consistency nor have the desired characteristics of the plants from which the seeds were developed. In other words, you cannot harvest the seeds from a plant grown from a hybrid seed and expect to get an identical plant or even a plant at all in some cases.

The seeds may not germinate and if they do, the plant may not blossom, nor bear fruit because they generally will not pollinate. This means for you the Prepper you would have to purchase or have enough seeds stockpiled to plant every season. This means that hybrid seeds and the resulting plants would not be a renewable nor sustainable food source. If you only had enough seeds for one season and did not have a way of obtaining more seeds, you would not have a food source. You would have to have enough hybrid seeds stockpiled to last indefinably. There is another option however and that is heirloom seeds.

Heirloom Seeds
An heirloom plant or often called an heirloom variety and even called heritage fruit is considered an old cultivar. It is quite common for a plants' heritage to be well over 100 years old. The heritage is maintained by open-pollination of the plant to produce a seed that carries the plant's heritage forward. The good and bad traits of the plant are carried forward in the seed.

Note: Harvest your seeds from the plants that produce the most fruit and appear to be the strongest/healthiest. Gather seeds from more than just one tomato plant, for example, to ensure you are not always carrying the worst traits of the plants forward. What you need to be concerned about is the fact that an heirloom plant will produce seeds that once planted will replicate the plant exactly and will produce a plant that bears fruit. The seeds inside the fruit can then be harvested for the next growing season.

You can do this year after year. However, the seeds must be harvested and stored in a specific way to ensure the seeds will germinate. You can stockpile hybrid seeds as well as heirloom seeds in your seed bank. Use the hybrid seeds when growing conditions are not ideal because the seeds are developed using the best traits of the plant so they are more likely to produce fruit under less than ideal conditions.

If you know, you will only be in a location for one growing season, do not have the time or resources to properly prepare the garden plot, and do not have time to compost for fertilization then you should consider planting hybrids, because of their hardiness. Always have heirloom plants in the ground when possible as well, so you can be continually harvesting seeds for your seed bank to establish a long-term food source.

Seed List

A recommended collection of seeds to keep on hand for disasters. These foods will cover your nutritional requirements. You should choose foods based on your location and what grows best there.

Vegetable Seeds	Bean	Broccoli	Capsicum (Green Pepper)	Carrot	Corn	Cucumber	Lettuce	Potato	Pea	Pumpkin	Tomato
Fruit Seeds	Apple	Blackberry	Fig	Grapes	Lemon	Mango	Orange	Pear	Pineapple	Strawberry	Watermelon
Herb Seeds	Bay Leaf	Basil	Black Pepper	Chives	Coriander	Garlic	Lavender	Mint	Oregano	Parsley	Rosemary
Nut Seeds	Almond	Cashew	Hazelnuts	Macadamia	Peanut	Pistachio	Pine Nut	Walnut			
Other Seeds	Wheat	Sugar	Oat	Barley	Couscous	Rice	Rye	Olive	Cocoa Bean	Tea	Coffee Bean

4 Vegetables

How to grow a variety of vegetables from either a seed or cutting. Avacados can be found in the fruit section and tomatos are in the vegetable section.

Subheadings

1 Artichoke

The globe artichoke is a variety of a species of thistle cultivated as a food. The edible portion of the plant consists of the flower buds before the flowers come into bloom. The budding artichoke flower-head is a cluster of many budding small flowers (an inflorescence), together with many bracts, on an edible base. Once the buds bloom, the structure changes to a coarse, barely edible form. This vegetable grows to 1.4–2 m (4.6–6.6 ft) tall, with arching, deeply lobed, silvery, glaucous-green leaves 50–82 cm (20–32 in) long. The flowers develop in a large head from an edible bud about 8–15 cm (3–6 in) diameter with numerous triangular scales; the individual florets are purple. The edible portions of the buds consist primarily of the fleshy lower portions of the involucral bracts and the base, known as the "heart"; the mass of immature florets in the centre of the bud is called the "choke" or beard. These are inedible in older, larger flowers.

Sowing Season	**Northern Hemisphere (Cold Climate)** Jan-Apr	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-Nov	**Southern Hemisphere (Temperate Climate)** Aug-Nov	**Southern Hemisphere (Subtropical Climate)** Aug-Nov	**Southern Hemisphere (Tropical Climate)** Feb-Aug			
Sowing Guide	**Sowing Depth** 6mm	**Row Spacing** 150-250cm	**Plant Spacing** 150-250cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** D	**Germination Time** 15-25 Days	**Maturity Time** 290-400 Days				
Introduction											

Planting

Begin by starting seeds indoors, ideally 8-12 weeks before your region's last expected frost date. Use individual pots or modules, approximately 10-15 cm (4-6 inches) deep, filled with a high-quality seed-starting mix. Sow seeds about 1 cm (½ inch) deep, as they need a bit of darkness to germinate.

Maintain consistent moisture in the soil, ensuring it's damp but not waterlogged. Optimal germination occurs with soil temperatures between 21-26°C (70-80°F), usually taking 10-20 days. Once seedlings emerge and develop a few true leaves, they'll need a period of "vernalization" if you're growing them as annuals in cooler climates. This involves exposing them to temperatures between 0-10°C (32-50°F) for 10-14 days, which helps trigger flower bud formation later in the season. After this, or once the danger of frost has passed, harden off the seedlings by gradually exposing them to outdoor conditions over 1-2 weeks before transplanting them into their final garden spot.

Care

- Watering: Keep soil consistently moist, especially during establishment and bud formation. Deep watering is preferred.
- Mulching: Apply a thick layer of organic mulch around plants to retain moisture, suppress weeds, and regulate soil temperature.
- Fertilizing: Artichokes are heavy feeders. Supplement with balanced fertilizer in spring; established plants may benefit from additional feeding during bud development.
- Support: Stake tall plants if necessary to prevent them from falling over in strong winds or due to heavy buds.
- Pest/Disease: Monitor for aphids, slugs, and snails. Ensure good drainage to prevent crown rot.
- First-Year Buds (Perennials): Consider removing any first-year flower stalks to encourage stronger root development for future seasons.
- Overwintering (Cold Climates): After harvest or frost, cut back plants to 15-30 cm (6-12 inches) and mulch heavily over the crown to protect from severe cold.

Pests / Diseases

Common Pests & Mitigation
- Aphids: Small, soft-bodied insects that cluster on new growth and undersides of leaves, causing curling and stunted growth. They also excrete "honeydew," which can lead to sooty mold.
Mitigation/Treatment: Blast with a strong stream of water, especially under leaves. Use insecticidal soap or neem oil for heavier infestations. Encourage natural predators like ladybugs and lacewings.
- Slugs and Snails: Chew holes in leaves and can damage young plants.
Mitigation/Treatment: Hand-pick them, especially at night. Use barriers like copper tape or diatomaceous earth around plants. Employ organic slug/snail baits.
- Artichoke Plume Moth (larvae): Considered a serious pest, larvae tunnel into leaves, stems, and buds, causing significant damage and deformity.
Mitigation/Treatment: Primarily affects perennial artichokes. Monitor with pheromone traps. Remove and destroy infested plant parts. Bacillus thuringiensis (Bt) is an organic spray that targets caterpillars. Proper garden sanitation, including removing old plant debris, helps.

Common Diseases & Mitigation
- Crown Rot (e.g., Bacterial Crown Rot): Caused by fungi or bacteria, leading to wilting, dark discoloration of stems, and softening/rotting of the crown. Often exacerbated by poor drainage.
Mitigation/Treatment: Ensure excellent soil drainage and avoid overwatering. Plant in raised beds if soil is heavy. Use healthy propagation material and sanitize tools between plants. Remove and destroy infected plants promptly.
- Powdery Mildew: White, powdery fungal growth on leaves, typically in warm, humid conditions.
Mitigation/Treatment: Ensure good air circulation by proper plant spacing. Avoid overhead watering, especially late in the day. Remove affected leaves. Horticultural oils or sulfur-based fungicides can treat outbreaks.
- Botrytis (Gray Mold): A fungal disease causing fuzzy gray mold on leaves and buds, especially in cool, moist, and poorly ventilated conditions.
Mitigation/Treatment: Improve air circulation by spacing plants adequately. Avoid overhead watering. Remove infected plant material. Sanitation and good hygiene are crucial.

General Proactive Measures
- Healthy Soil: Vigorous plants are more resistant to pests and diseases. Maintain rich, well-drained soil with plenty of organic matter.
- Proper Watering: Water at the base of the plant to avoid wetting foliage, reducing fungal disease risk.
- Air Circulation: Space plants adequately to promote airflow.
- Sanitation: Remove and dispose of diseased or heavily infested plant material promptly.
- Crop Rotation: If growing artichokes as annuals, rotate their location to prevent soil-borne disease buildup.

Harvest / Storage

Harvesting Artichokes
Harvest artichoke buds when they are fully formed, firm, and tightly closed, typically about 7-10 cm (3-4 inches) in diameter (for main buds). The lower scales should still be tight against the bud. If the scales begin to open or separate, the artichoke is past its prime for eating and will become tough and fibrous, though you can let it flower for ornamental value or seed collection. Use sharp pruning shears or a knife to cut the stem 2-5 cm (1-2 inches) below the base of the bud, leaving a bit of stem attached. This encourages the plant to produce smaller side buds for a continuous harvest.

Storing Artichokes
For short-term storage (up to a week), lightly sprinkle unwashed artichokes with water and place them in a plastic bag (perforated or with a few holes for air circulation). Store in the crisper drawer of your refrigerator. Do not wash them before storing, as excess moisture can encourage mold. For longer storage (several months), artichokes must be cooked or blanched first. Trim and clean them, then boil for about 20 minutes in lemon water. Drain, cool in ice water, pat dry thoroughly, and then freeze in airtight freezer bags or containers.

Variants

- Green Globe (and 'Green Globe Improved'): The most common and widely cultivated variety, large and round with thick, fleshy green leaves.
- Imperial Star: Bred for annual production from seed, often yielding buds in the first year without cold vernalization.
- Violet de Provence (or 'French Artichoke'): Smaller, more compact, with dark purple leaves, often eaten raw or lightly cooked.
- Romanesco (or 'Purple Romanesco'): Italian variety with a distinctive slightly conical or spiral shape and a violet hue, known for a tender, sweet flavor.
- Big Heart: Known for its large, meaty heart and often thornless bracts, making it easier to prepare.
- Purple Sicilian: Features small, deep purple buds, sometimes eaten raw when young.
- Emerald: A hybrid variety known for being earlier to mature than some others, and tolerant of various conditions.
- Opal F1 / Concerto F1 / Tempo F1: Modern F1 hybrid varieties, often chosen for specific traits like color, yield, or disease resistance.

Other Tips

- Choose Wisely: Select varieties suited to your climate (perennial types for mild winters, annual types like 'Imperial Star' for colder areas).
- Deep, Rich Soil: Artichokes are heavy feeders; ensure soil is well-amended with compost and drains excellent.
- Full Sun: They need at least 6-8 hours of direct sunlight daily for optimal growth and bud production.
- Ample Space: Give plants 90-150 cm (3-5 feet) of space; they grow large.
- Consistent Water: Maintain steady moisture, especially when buds are forming, to prevent toughness.
- Mulch Heavily: A thick layer of organic mulch conserves moisture, suppresses weeds, and regulates soil temperature.
- Fertilize: Feed established plants regularly with a balanced fertilizer, particularly in spring.
- Vernalization (for Annuals): If growing from seed in colder climates, a period of cold exposure (vernalization) is crucial for bud production.
- First-Year Sacrifices: Consider removing any buds in the first year of perennial plants to encourage stronger root development.
- Harvest Promptly: Pick buds when firm and tightly closed; waiting too long makes them tough and fibrous.
- Overwintering Prep: In cold regions, cut back foliage and mulch crowns heavily for winter protection.
- Good Drainage is Key: Avoid waterlogging, which can lead to fatal crown rot.

2 Asparagus

Asparagus, or garden asparagus, folk name sparrow grass, scientific name Asparagus officinalis, is a spring vegetable, a flowering perennial plant species in the genus Asparagus. It was once classified in the lily family, like the related Allium species, onions and garlic, but the Liliaceae have been split and the onion-like plants are now in the family Amaryllidaceae and asparagus in the Asparagaceae. Asparagus is a herbaceous, perennial plant growing to 100–150 cm (39–59 in) tall, with stout stems with much-branched, feathery foliage. The "leaves" are in fact needle-like cladodes (modified stems) in the axils of scale leaves; they are 6–32 mm (0.24–1.26 in) long and 1 mm (0.039 in) broad, and clustered four to 15 together, in a rose-like shape. The root system is adventitious and the root type is fasciculated. The flowers are bell-shaped, greenish-white to yellowish, 4.5–6.5 mm (0.18–0.26 in) long, with six tepals partially fused together at the base; they are produced singly or in clusters of two or three in the junctions of the branchlets.

It is usually dioecious, with male and female flowers on separate plants, but sometimes hermaphrodite flowers are found. The fruit is a small red berry 6–10 mm diameter, which is poisonous to humans. Plants native to the western coasts of Europe are treated as Asparagus officinalis subsp. prostratus, distinguished by its low-growing, often prostrate stems growing to only 30–70 cm (12–28 in) high, and shorter cladodes 2–18 mm (0.079–0.709 in) long.

Sowing Season	Northern Hemisphere (Cold Climate) Dec-Jan	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Sep-Nov	Southern Hemisphere (Temperate Climate) Aug-Nov	Southern Hemisphere (Subtropical Climate) Aug-Nov	Southern Hemisphere (Tropical Climate) Mar-Oct			
Sowing Guide	Sowing Depth 10mm	Row Spacing 100cm	Plant Spacing 20-40	Frost Tender / Hardy FT	Direct Sow / Raise Seeds D	Germination Time 20-35 Days	Maturity Time 2-3 Years				
Introduction	Asparagus is one of the first plants that greets us in springtime! It's a perennial, which means that once it gets established, asparagus will return year after year. Here's how to grow asparagus in your garden. Asparagus plants may take 2 to 3 years to truly get started and produce, so patience is needed! But then again, the plant can be productive for up to 25 years, so we think it's worth the wait. Asparagus are dioecious, which means that there are male and female plants. The key to the sex of the plant appears in the fall: Red berries form on female ferns. Inside the berries are tiny seeds—about 19,200 to a pound—and, yes, you can plant them—although it will take at least 3 years before you have a harvestable crop. Because male plants do not need to expend energy in producing berries, they have stronger root systems and can be up to three times more productive than female plants. Regions with cool winters are best for this cool-season crop, which is planted in early spring.										

Planting

Asparagus is planted in early spring as soon as the soil can be worked.
The plant is normally grown from "crowns" (1-year-old plants). Before you do anything, check the pH of your soil. Asparagus likes a pH of 6.0 to 8.0. Asparagus does not like to have its feet "wet," so be sure that your garden bed has good drainage. (For that reason, raised beds can be a good place to plant asparagus. Eliminate all weeds from the bed, digging it over and working in a 2- to 4-inch layer of compost, manure or soil mix.

Plant crowns deeply to protect them from the deep cultivation needed for annual weed control.
Dig a trench of about 12 to 18 inches wide and 6 to 8 inches deep. If digging more than one trench, space the trenches at least 3 feet apart. Within the trench, space asparagus crowns 12 to 18 inches apart (measured from root tip to root tip).

The traditional method of planting asparagus goes as follows:
1. Add a 2-inch-high mound of rich soil to the bottom of the trench and place the asparagus crowns on top of the mound, spreading their roots out evenly.
2. Add about 2 inches of soil over top of the crowns.
3. As the season progresses and spears grow to be 2–3 inches tall, add 2 more inches of soil, being careful not to bury the spears completely.
4. Once the spears again grow through the layer of soil, add an additional 2-inch layer of soil. Repeat this process until the trench has been filled to ground level. Depending on how deep you dug your trench, you may need to add soil one or two more times throughout the season.
5. After you've filled the trench completely, mound the soil slightly to prevent water from pooling around the emerging spears.

Rather than fill in the trench little by little, some gardeners prefer to fill it in all at once. While it's thought that the traditional method results in stronger plants overall, gardeners don't typically have any issues result from the "all-at-once" method, either. As long as the soil is fairly loose, the spears won't have a problem pushing through to the surface.

Care

When the trench is filled, add a 4- to 6-inch layer of mulch and water regularly. Do not harvest the spears in the first year (the plant needs time to grow out its root system), but cut down dead foliage in late fall and side-dress with compost. During the second year, harvest for only 3 to 4 weeks, side-dressing in spring and early fall and cutting down dead foliage in late fall. During the third year, the bed should be in full production, so you can start to harvest asparagus sparingly throughout the season.

Pests / Diseases

- Asparagus Beetles (Common and Spotted): These are the primary pest. Adults (shiny, often metallic blue-black with red/yellow markings or orange with black spots) and their greyish larvae feed on spears, causing scarring and browning, and can defoliate ferns, weakening the plant. Eggs are laid on spears and ferns.
- Asparagus Aphids: Tiny, pale green, powdery insects that suck sap from ferns, leading to stunted or distorted growth.
- Slugs and Snails: They can chew holes in emerging spears and foliage, especially in damp conditions.
- Asparagus Miner: Small maggots that tunnel within the stems, making plants vulnerable to diseases.
- Cutworms: Larvae that can sever young spears at the soil line, or feed on roots.

Harvest / Storage

If you have young plants, the season may last 2 to 3 weeks. However, established plants produce longer—up to 8 weeks. Asparagus can take three growing seasons to harvest, though you may be able to lightly harvest during the second year. Check your plant every other day for harvest-ready spears. Spears grow quickly and may become too woody before you know it! Once an asparagus spear starts to open and have foliage, it's too tough for eating. Harvest spears at 6 to 8 inches tall and at least ½ inch thick, cutting the spears off with a knife or scissors at the soil line. Stop harvesting spears when the diameter of the spears decreases to the size of a pencil. After harvest, allow the ferns to grow; this replenishes the nutrients for next year's spear production. Always leave one or two spears. Cut back asparagus AFTER the foliage has died back and turned brown or yellow. This is usually in the fall after frost. Cut back to the ground.

Asparagus does not keep for very long after it's picked, so be sure to eat it within two or three days from harvest. Brush off any visible dirt or give the spears a light washing with cold water before storing. It's very important to dry washed spears thoroughly; moisture can lead to mould. To store, bundle the spears together, wrap the stem ends of the spears in a moist paper towel, and place the bundle in a plastic bag. Store in the crisper drawer of your refrigerator. If you have enough space in your fridge, you can also store asparagus by placing the spears in a cup of water. Keep about an inch of clean water in the cup.

Variants

For highest yields, plant male hybrids such as 'Jersey Giant', 'Jersey King', and 'Jersey Knight'. Older varieties 'Mary Washington' and 'Martha Washington' may produce female plants, which are not as productive as the males. White asparagus is not a variety, but simply asparagus grown in the absence of sunlight to prevent chlorophyll from developing. White asparagus is slightly sweeter, but has less fibre than green asparagus. Purple asparagus is bred to be purple in colour, but turns green when it is cooked. Purple varieties tend to have thicker spears, but fewer of them.

Other Tips

A pinch of baking soda in the cooking water keeps beans, spinach, and asparagus greener. At only 40 calories per cup, asparagus is amazingly healthy. For more planting tips, see our page on growing asparagus from seed.

3 Bean (Climbing)

A bean is a seed of one of several genera of the flowering plant family Fabaceae, which are used for human or animal food. Seeds called "beans" are often included among the crops called "pulses" (legumes), although a narrower prescribed sense of "pulses" reserves the word for leguminous crops harvested for their dry grain. They are distinguished from the many other varieties of beans in that green beans are harvested and consumed with their enclosing pods, before the bean seeds inside have fully matured. An analogous practice is the harvest and consumption of unripened pea pods, as is done with snow peas or sugar snap peas.

Bean (Climbing)	Plant Type ○	Sun Exposure ○	Soil Type ○	Soil pH ○	Bloom Time ○	Flower Colour ○	Hardiness Zones ○	Special Features ○			
Sowing Season	Northern Hemisphere (Cold Climate) Apr-Jul	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Oct-Dec	Southern Hemisphere (Temperate Climate) Sep-Jan	Southern Hemisphere (Subtropical Climate) Aug-Apr	Southern Hemisphere (Tropical Climate) Feb-Oct			
Sowing Guide	Sowing Depth 20-30mm	Row Spacing 100cm	Plant Spacing 10-25cm	Frost Tender / Hardy FT	Direct Sow / Raise Seeds D	Germination Time 7-15 Days	Maturity Time 70-85 Days				

Introduction

Pole and bush beans (more commonly called green beans) are a tender vegetable and a great addition to any garden!
Green beans are delicious when incorporated into any recipe. The main difference between bush and pole beans is the plants' growing styles: bush beans tend to grow more compactly and do not require support, while pole beans will vine and need to be grown up stakes or trellises. Bush beans generally require less maintenance and are easier to grow, but pole beans typically yield more beans and are very disease resistant. Green beans (also called string beans) are a tender annual that can grow anywhere with 6 to 8 hours of sun. Though most green beans are indeed green, they also come in purple, red, yellow and streaked varieties.

Introduction

The main difference between bush and pole beans is the plants' growing styles.
- Bush beans tend to grow more compactly (about two-feet tall) and do not require support. Pole beans will vine (a good ten feet) and need to be grown up stakes or trellises.
- Bush beans generally require less maintenance and are easier to grow, but pole beans typically yield more beans and are very disease-resistant.
- Bush beans produce before pole beans in about 50 to 55 days; pole beans will take 55 to 65 days.
- Bush beans often come in all at once, so stagger your planting every two weeks. Pole beans need their vines to grow and will produce for a month or two if you keep harvesting.

Planting

Pole beans will grow as a climbing vine that will grow 10 to 15 feet tall. Therefore, pole beans require a trellis or staking. Bush beans will spread up to 2 feet, but do not require support. Do not start seeds indoors; they may not survive transplanting. Normal, moderately-rich soil is fine for beans. Beans don't need supplemental fertilizer as they fix their own nitrogen, but you should still amend the soil with organic matter. Seeds can be sown outdoors anytime after the last spring frost; minimum soil temperature is 48 degrees F. Don't plant too early or the seeds can rot.

Plant all bean seeds 1 to 2 inches deep in normal soil, and a little deeper for sandier soils. Cover soil to warm if necessary. Bush beans: Plant about 4 inches apart. Pole beans: Set up trellises or teepees first for support. Then plant seeds about 6 to 8 seeds per teepee or every 6 inches apart. If you like pole beans, an easy support for them is a "cattle panel"—a portable section of wire fence—16 feet long and 5 feet tall. The beans will climb with ease and you won't have to get into contorted positions to pick them. For a harvest that lasts all summer, sow beans every 2 weeks. If you're going to be away, skip a planting. Beans do not wait for anyone. Rotate crops each year.

Care

Mulch soil to retain moisture; make sure that it is well-drained. Beans have shallow roots so mulch keep them cool. Water regularly, from start of pod to set. If you do not keep beans well watered, they will stop flowering. Water on sunny days so foliage will not remain soaked. Avoid a high-nitrogen fertilizer or you will get lush foliage and few beans. Just add a side dressing of compost or composted mature halfway through their growing season. Weed diligently and use shallow cultivation to prevent disturbing the root systems.

Pests / Diseases

- Mexican Bean Beetles (These beetles eat the flowers, beans and especially leaves of beans.)
- Japanese Beetles
- Aphids
- Slugs (These pests are attracted to damp conditions.)
- Cucumber Beetles
- White Mould (Avoid damp conditions)
- Mosaic Viruses (Try to keep vines dry by not crowding plants and providing ample air circulation)
- Woodchucks
- Cutworms
- Bean blossoms will drop from the plant if the weather is too hot, and too much nitrogen in the soil will prevent pods from setting.

Harvest / Storage

Green beans are picked young and tender before the seeds inside have fully developed. Look for firm, sizable that are firm and can be snapped, generally as thick as a pencil. Snap or cut off the plant, do not tear the plant. Fresh beans should snap easily when broken. Once you see the seeds inside bulging, green beans are past their peak and will taste tough. Pick green beans every day; the more you pick, the more beans grow. Store beans in a moisture-proof, airtight container in the refrigerator. Beans will toughen over time even when stored properly. Beans can be kept fresh for about 4 days, or blanched and frozen immediately after harvesting. Beans can also be canned or pickled.

Variants

- 'Kentucky Wonder' (pole): Will produce a bountiful harvest.
- 'Bountiful' (bush): Early producer. Stringless heirloom.
- 'Bush Blue Lake' (bush): Keeps flavour well after harvest.
- 'Bean Mascotte' (bush): Compact, ideal for container gardens.
- 'Fortex' (pole): French variety, large beans.
- 'Royal Burgundy' (bush): Purple pods that turn green when cooked. Early producing. Not popular with the bean beetle.

Other Tips

Beans are commonly used in everyday expressions to indicate something of little value. Consequently, someone who isn't worth a hill of beans is seen as being worth very little, although one could argue that today a hill of beans actually costs a pretty penny.

4 Beetroot

The beetroot is the taproot portion of the beet plant, usually known in North America as the beet, also table beet, garden beet, red beet, or golden beet. It is one of several of the cultivated varieties of Beta vulgaris grown for their edible taproots and their leaves (called beet greens). Usually the deep purple roots of beetroot are eaten boiled, roasted or raw, and either alone or combined with any salad vegetable. A large proportion of the commercial production is processed into boiled and sterilized beets or into pickles. In Eastern Europe, beet soup, such as borscht, is a popular dish. In Indian cuisine, chopped, cooked, spiced beet is a common side dish. Yellow-coloured beetroots are grown on a very small scale for home consumption.

Sowing Season	**Northern Hemisphere (Cold Climate)** Mar-Aug	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-Apr	**Southern Hemisphere (Temperate Climate)** Jul-Apr	**Southern Hemisphere (Subtropical Climate)** Feb-Oct	**Southern Hemisphere (Tropical Climate)** Mar-Jun			
Sowing Guide	**Sowing Depth** 20-30mm	**Row Spacing** 30-40cm	**Plant Spacing** 5-10cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** D	**Germination Time** 15-25 Days	**Maturity Time** 55-85 Days				
Introduction	Beets are a cool-season vegetable crop. This root veggie grows quickly and has many different varieties, which showcase deep red, yellow, or white bulbs of different shapes. Beets can survive frost and almost freezing temperatures, which makes them a great choice for northern gardeners and an excellent long-season crop.										

Planting

A soil pH between 6.0 and 7.0 is best, but slightly alkaline soils are tolerated in some areas. Till in aged manure before planting. Beets require especially good nutrition and a high phosphorus level to germinate. Go easy on nitrogen however, an excess will cause sprawling greens and tiny bulbs beneath the soil. (Learn more about soil amendments and preparing soil for planting.) Wait until soil reaches 50°F before planting. Plant seeds ½ inch deep and 1-2 inches apart. Make sure soil remains moist for germination. In zones with low moisture and rainfall, soak the seeds for 24 hours before planting. Early crop can be planted in March/April, and late crop anytime from June to September. Successive plantings are also possible as long as the weather doesn't exceed 75°F. Space plantings about 20 days apart. Winter crops are a definite possibility in Zone 9 and above.

Care

Thinning is necessary, as you may get more than one seedling out of each seed. Thin when they reach about 2 inches high by pinching them off. Pulling them out of the ground may disturb the roots of nearby seedlings. Established plants should be thinned to 3–4 inches between plants. Mulch and water well. Beets need to maintain plenty of moisture. Any necessary cultivation should be gentle, beets have shallow roots that are easily disturbed.

Pests / Diseases

● Flea Beetles
● Leaf Hoppers
● Mexican Bean Beetles

Harvest / Storage

Days to maturity tend to be between 50 and 70 for most varieties, although they can be harvested at any time you see fit. If you like larger bulbs, wait longer, but understand they will be tougher and woody. Don't let greens grow above 6 inches before harvesting. Don't forget about the tops! Beet greens have a delicious and distinctive flavour, and hold more nutrition than the roots. Fresh beets can be stored in the refrigerator for 5–7 days. Clipping the tops off beets will keep them fresher for longer. Leave about one inch of stem on each beet, and store the greens separately. For root cellar type storage, make sure you brush off any soil clinging to these crops, then store them in a cool, dry place. An unheated closet might do, or put them in a cooler in your basement. Beets can be frozen, canned, and pickled. Read more about a new way to store beets in the root cellar.

Variants

● 'Detroit Dark Red' - Sturdy, traditional red variety, round.
● 'Formanova' - Long, cylindrical beets that grow in the same fashion as carrots. Excellent for canning.

Other Tips

The humble beet, steamed, boiled, roasted, pickled, borscht'ed—but especially served raw—has emerged as a nutrient-dense food considered especially beneficial for health.

5 Broccoli

Broccoli is an edible green plant in the cabbage family whose large flowering head is eaten as a vegetable.
The word broccoli comes from the Italian plural of broccolo, which means "the flowering crest of a cabbage", and is the diminutive form of brocco, meaning "small nail" or "sprout". Broccoli is often boiled or steamed but may be eaten raw. Broccoli is a cool-weather crop that does poorly in hot summer weather. Broccoli grows best when exposed to an average daily temperature between 18-23°C (64-73°F). When the cluster of flowers, also referred to as a "head" of broccoli, appear in the centre of the plant, the cluster is green. Garden pruners or shears are used to cut the head about an inch from the tip. Broccoli should be harvested before the flowers on the head bloom bright yellow. While the heading broccoli variety performs poorly in hot weather, mainly due to insect infestation, the sprouting variety is more resistant, though attention must be paid to sucking insects (such as aphids), caterpillars and whiteflies

Sowing Season	**Northern Hemisphere (Cold Climate)** May-Aug	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Nov-Mar	**Southern Hemisphere (Temperate Climate)** Sep-Apr	**Southern Hemisphere (Subtropical Climate)** Feb-Jun	**Southern Hemisphere (Tropical Climate)** Mar-Jun			
Sowing Guide	**Sowing Depth** 6mm	**Row Spacing** 40-60cm	**Plant Spacing** 35-45cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R/D	**Germination Time** 15-25 Days	**Maturity Time** 60-120 Days				
Introduction	Broccoli is a cool-season crop that, like spinach, can be grown in the spring or fall. Here's how to grow broccoli in your garden. With broccoli, you may even be able to get a continual harvest throughout the summer and fall if you practice succession gardening and your summers don't get excessively hot. A member of the cabbage family, broccoli is rich in vitamins.										

Planting

As a cool-season crop, broccoli can germinate in soil with temperatures as low as 40°F (5°C), though most gardeners start broccoli indoors if growing it from seed. See our free online Planting Calendar for local seed-starting dates. For outdoor spring plantings, sow seeds or set transplants into the garden 2 to 3 weeks before your last spring frost date. (See local frost dates here.) If you transplant, assume 10 less days for growth or the "days to maturity" given on the seed packet. You may need to make use of a cold frame to protect young plants from frost. For fall plantings, seed 85 to 100 days before your average first fall frost. If you live in a warm climate, a fall planting is best, as broccoli thrives in cool weather.

Plant seeds in mid- to late-summer in most places. Broccoli requires full sun and moist, fertile soil that's slightly acidic. Work in 2 to 4 inches of rich compost or a thin layer of manure before planting. (Learn more about soil amendments and preparing soil for planting.) Plant seeds ½ inch deep, or set transplants slightly deeper than they were grown originally. Within a row, space your plants 12 to 24 inches apart with 36 inches between each row. Space plants 12 to 24 inches apart, depending on the side heads you want to harvest. If you overseed, you will need to thin seedlings to 12 inches apart to give room for the broccoli to grow.

Care

Fertilize broccoli three weeks after transplanting seedlings into the garden. Provide consistent soil moisture with regular watering, especially in drought conditions. Some varieties of broccoli are heat tolerant, but all need adequate moisture. Do not get developing broccoli heads wet when watering. Roots are very shallow, so try not to disturb the plants. Suffocate weeds with mulch. Mulch will also help to keep soil temperatures down.

Pests / Diseases

● Flea Beetles
● Aphids: Curling leaves may mean that the plant's sap is being sucked by insects. Apply soapy water to all sides of leaves whenever you see aphids.
● Downy mildew: Yellow patches on leaves are usually caused by moist weather. Keep leaves as dry as possible with good air circulation. Buy resistant varieties.
● Cabbage loopers: Small holes on the leaves between the veins mean small green caterpillars are present. Look at the undersides of the leaves. Hand pick if the problem is small or control with Bacillus thuringiensis, a natural, bacterial pesticide. Use a floating row cover just after planting through harvest to prevent caterpillars.
● Cabbageworms and other worm pests: Treat same as loopers.
● Cabbage root maggots
● Whiteflies
● Nitrogen deficiency: If the bottom leaves turn yellow and the problem continues toward the top of the plant, the plants need a high nitrogen (but low phosphorus) fertilizer or blood meal. Blood meal is a quick nitrogen fix for yellowing leaves.

● Clubroot: Quickly wilting plants may be due to this fungus in the soil. The entire plant, including all roots and root tendrils, must be gently dug up and removed. If the roots are gnarled and misshapen, then clubroot is the problem. Act quickly to remove the plants so that the fungus doesn't continue to live in the soil. Do not compost the plants. Raise the pH of your soil to above 7.2. You may need to sterilize your soil, too.
● Woodchucks

Harvest / Storage

In terms of timing: Harvest broccoli when the buds of the head are firm and tight, right before the heads flower. If you do see yellow petals, harvest immediately. For best taste, harvest in the morning before the soil heats up. Cut heads from the plant, taking at least 6 inches of stem. Cut the stalk of the main head at an angle, about 5 to 8 inches below the head. Most varieties have side-shoots that will continue to develop after the main head is harvested. You can harvest from one plant for many weeks, in some cases, from spring to fall, if your summer isn't too hot. Learn more tips on harvesting broccoli.

Store broccoli in the refrigerator for up to 5 days. If you wash before storing, make sure to dry it thoroughly. Broccoli can be blanched and frozen for up to one year.

Variants

● 'Green Goliath' is heat-tolerant and sprouts side shoots that will mature for harvesting.
● 'Green Duke' is heat tolerant and an early variety that's especially good for Southern gardeners.
● 'Calabrese' is a prolific Italian heirloom that sprouts side shoots that will mature for harvesting. Great for fall planting, too.
● 'Flash' is a fast-growing, heat-resistant hybrid with good side-shoot production once the central head is cut. Great for fall planting, too.
● 'Paragon' is a popular variety in Canada.

Other Tips

One ounce of broccoli has an equal amount of calcium as one ounce of milk. Learn more about the amazing health benefits of broccoli. Once you've gotten broccoli down pat, why not try growing one of its relatives? See our Growing Guides for cauliflower, cabbage, Brussels sprouts, rutabaga, kale, and turnips!

6 Brussels Sprouts

The Brussels sprout is a member of the Gemmifera Group of cabbages (Brassica oleracea), grown for its edible buds. The leafy green vegetables are typically 2.5–4 cm (0.98–1.6 in) in diameter and look like miniature cabbages. The Brussels sprout has long been popular in Brussels, Belgium, and may have originated and gained its name there. Brussels sprouts grow in temperature ranges of 7–24°C (45–75°F), with highest yields at 15–18°C (59–64°F). Fields are ready for harvest 90 to 180 days after planting. The edible sprouts grow like buds in helical patterns along the side of long, thick stalks of about 60 to 120 cm (24 to 47 in) in height, maturing over several weeks from the lower to the upper part of the stalk.

Sprouts may be picked by hand into baskets, in which case several harvests are made of five to 15 sprouts at a time, or by cutting the entire stalk at once for processing, or by mechanical harvester, depending on variety. Each stalk can produce 1.1 to 1.4 kg (2.4 to 3.1 lb), although the commercial yield is about 900 g (2.0 lb) per stalk. Harvest season in temperate zones of the northern latitudes is September to March, making Brussels sprout a traditional winter stock vegetable. In the home garden, harvest can be delayed as quality does not suffer from freezing. Sprouts are considered to be sweetest after a frost. Brussels sprouts are a cultivar group of the same species as cabbage, collard greens, broccoli, kale, and kohlrabi; they are cruciferous (they belong to the Brassicaceae family; old name Cruciferae). Many cultivars are available, some being purple in colour, such as Ruby Crunch or Red Bull.

Sowing Season	**Northern Hemisphere (Cold Climate)** May-Aug	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Oct-Feb	**Southern Hemisphere (Temperate Climate)** Dec-Apr	**Southern Hemisphere (Subtropical Climate)** Feb-Jun	**Southern Hemisphere (Tropical Climate)** Feb-Apr		
Sowing Guide	**Sowing Depth** 6mm	**Row Spacing** 90cm	**Plant Spacing** 50-75cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R/D	**Germination Time** 6-12 Days	**Maturity Time** 80-140 Days			
Introduction	Brussels sprouts are a member of the cabbage family, and an excellent source of protein and vitamins. Here's how to plant and grow Brussels sprouts in your garden! They have a long growing season (80+ days to harvest), and are generally more successful when grown for a fall harvest, as they only increase in flavour after a light frost or two.									

Planting

Due to Brussels sprouts' need for a long growing season, plant them with a fall or winter harvest in mind. In regions with cold winters, where temperatures are regularly below freezing, start seeds indoors about 2–3 weeks before the last spring frost date for an early fall harvest. In regions with mild winters, where temperatures are occasionally below freezing, start seeds outdoors in early to mid-summer for a mid-fall or early winter harvest. In regions with warm winters, where temperatures are rarely or never below freezing, start seeds outdoors in late summer for a mid- to late winter harvest. Another way to determine planting time is to count backwards from your first fall frost date.

Direct sow seeds into the garden about 4 months before the first fall frost. Raised beds are especially recommended for cold-season vegetables, especially when seasons are changing and temps are not consistent. Work fertilizer into soil a few days before planting or transplanting. Plant transplanted seedlings 12–24 inches apart. If direct sowing seeds, plant ½ inch deep and 2–3 inches apart. Thin plants to 12–24 inches apart when they reach 6 inches tall. Water well at time of planting/transplanting.

Care

Fertilize three weeks after transplanting. Mulch to retain moisture and keep the soil temperature cool. If growing during hot weather, be sure to keep the plants well watered. Do not disturb the soil around the plants; roots are shallow and susceptible to damage.

Pests / Diseases

● Aphids
● Cabbage Root Maggots
● Flea Beetles
● Clubroot
● Downy Mildew
● White mould

Harvest / Storage

Harvest sprouts from the bottom of the stalk when they reach about 1 inch in diameter. Do not wash the sprouts before storing them, only right before use. Keep in plastic for up to 5 days, in the refrigerator. Protect the plant by mulching with straw or providing a cover if you plan to harvest into the winter.

Variants

- 'Jade Cross' is resistant to some diseases and known for its tolerance for hotter weather.
- 'Oliver' and 'Long Island Improved' are early varieties with shorter growing season requirements (80–90 days).
- 'Valiant' produces consistent, uniform sprouts.

Other Tips

7 Cabbage

Cabbage or headed cabbage is a leafy green, red (purple), or white (pale green) biennial plant grown as an annual vegetable crop for its dense-leaved heads. It is closely related to broccoli and cauliflower; Brussels sprouts; and savoy cabbage. Brassica rapa is commonly named Chinese, celery or napa cabbage and has many of the same uses. Cabbage is high in nutritional value. Cabbage heads generally range from 0.5 to 4 kilograms (1 to 9 lb), and can be green, purple or white. Smooth-leafed, firm-headed green cabbages are the most common. Smooth-leafed purple cabbages and crinkle-leafed savoy cabbages of both colours are rarer. It is a multi-layered vegetable. Under conditions of long sunny days, such as those found at high northern latitudes in summer, cabbages can grow quite large. As of 2012, the heaviest cabbage was 62.71 kilograms (138.25 lb). Cabbage seedlings have a thin taproot and cordate (heart-shaped) cotyledon. The first leaves produced are ovate (egg-shaped) with a lobed petiole. Plants are 40–60 cm (16–24 in) tall in their first year at the mature vegetative stage, and 1.5–2.0 m (4.9–6.6 ft) tall when flowering in the second year. Heads average between 0.5 and 4 kg (1 and 8 lb), with fast-growing, earlier-maturing varieties producing smaller heads.

Most cabbages have thick, alternating leaves, with margins that range from wavy or lobed to highly dissected; some varieties have a waxy bloom on the leaves. Plants have root systems that are fibrous and shallow. About 90 percent of the root mass is in the upper 20–30 cm (8–12 in) of soil; some lateral roots can penetrate up to 2 m (6.6 ft) deep. The inflorescence is an unbranched and indeterminate terminal raceme measuring 50–100 cm (20–40 in) tall, with flowers that are yellow or white. Each flower has four petals set in a perpendicular pattern, as well as four sepals, six stamens, and a superior ovary that is two-celled and contains a single stigma and style. Two of the six stamens have shorter filaments. The fruit is a silique that opens at maturity through dehiscence to reveal brown or black seeds that are small and round in shape. Self-pollination is impossible, and plants are cross-pollinated by insects. The initial leaves form a rosette shape comprising 7 to 15 leaves, each measuring 25–35 cm (10–14 in) by 20–30 cm (8–12 in); after this, leaves with shorter petioles develop and heads form through the leaves cupping inward.

Sowing Season	**Northern Hemisphere (Cold Climate)** Feb-Sep	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Aug-Apr	**Southern Hemisphere (Temperate Climate)** Jun-Apr	**Southern Hemisphere (Subtropical Climate)** All Year	**Southern Hemisphere (Tropical Climate)** Feb-Nov			
Sowing Guide	**Sowing Depth** 6mm	**Row Spacing** 50-70cm	**Plant Spacing** 40-50cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R/D	**Germination Time** 6-12 Days	**Maturity Time** 60-120 Days				
Introduction	Cabbage is a hardy, leafy vegetable full of vitamins. It can be difficult to grow; it only likes cool temperatures and it can be a magnet for some types of garden pests. Here are some tips for growing cabbage in your garden! By planning your growing season and providing diligent care, you may have two successful crops in one year, in both spring and fall. Many varieties are available to suit both your growing conditions and taste preferences.										

Planting

To prepare soil, till in aged manure or compost. Start cabbage seeds indoors 6 to 8 weeks before the last spring frost in your area. Consult our Planting Calendar for suggested dates. Before planting the seedlings outdoors, harden off the plants over the course of a week. Transplant outdoors 2 to 3 weeks before the last expected frost date. If possible, plant on a cloudy day so that the seedlings aren't subjected to intense sunlight right away. Plant 12 to 24 inches apart in rows, depending on the size of head desired. The closer you plant, the smaller the cabbages. Because cabbage, broccoli, and cauliflower are closely related, and require similar nutrients, it's best not to plant them together. They are all heavy feeders, depleting the soil faster of required nutrients; plus, they will attract the same pests and diseases. For cabbage, also avoid proximity to strawberries and tomatoes. Cabbages can be grown near beans and cucumbers. Check out our chart of plant companions for an expanded list of friends and foes.

Care

When seedlings reach about 5 inches tall, thin to make sure that they are still the desired length apart. (The plants you remove can be transplanted elsewhere in your garden.) Mulch thickly around the area to retain moisture and regulate soil temperature. Fertilize 3 weeks after transplanting with an all-purpose fertilizer. Practice crop rotation with cabbages to avoid a build-up of soil borne diseases.

Pests / Diseases

- Imported Cabbageworms: Dill protects all members of the cabbage family by attracting beneficial wasps that kill cabbageworms and other pests.
- Aphids
- Cabbage Root Maggots
- Flea Beetles
- Cutworms
- Splitting

Harvest / Storage

Harvest when heads reach desired size and are firm. This will take around 70 days for most green cabbage varieties. Most early varieties will produce 1- to 3-pound heads. Cut each cabbage head at its base with a sharp knife. After harvesting, bring inside or put in shade immediately. To get two crops from early cabbage plants, cut the cabbage head out of the plant, leaving the outer leaves and root in the garden. The plant will send up new heads—pinch them off until only four or so smaller heads remain. When these grow to tennis-ball size, they'll be perfect for salad. After harvesting, remove the entire stem and root system from the soil to prevent disease build-up. Only compost healthy plants; destroy those with maggot infestation. Cabbage can be stored in the refrigerator for no more than two weeks, wrapped lightly in plastic. Make sure it is dry before storing. In proper root cellar conditions, cabbage will keep for up to 3 months.

Variants

● If you are planting for a fall harvest, try red or Chinese cabbage. Good varieties include 'Ruby Perfection' and 'Lei-Choy'.
● For a quick harvest time, try 'Golden Acre', 'Primo', or 'Stonehead'.
● 'Early Jersey Wakefield' resists splitting.
● Disease-resistant varieties include 'Blue Vantage' and 'Cheers'.

Other Tips

Cabbage is a hardy vegetable, is an antioxidant- and nutrient-rich, and a great addition to any garden!

8 Peppers (Capsicum)

Peppers (also known as Capsicum) is a genus of flowering plants in the nightshade family Solanaceae. In addition to use as spices and food vegetables, Capsicum species have also been used as medicines and lachrymatory agents.

Sowing Season	**Northern Hemisphere (Cold Climate)** Apr-Jun	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-Nov	**Southern Hemisphere (Temperate Climate)** Aug-Dec	**Southern Hemisphere (Subtropical Climate)** Aug-Mar	**Southern Hemisphere (Tropical Climate)** All Year			
Sowing Guide	**Sowing Depth** 4mm	**Row Spacing** 80-100cm	**Plant Spacing** 40-60cm	**Frost Tender / Hardy** FT	**Direct Sow / Raise Seeds** R/D	**Germination Time** 10-20 Days	**Maturity Time** 70-110 Days				
Introduction	Peppers are a tender, warm-season crop. Here's how to grow peppers in your garden! Peppers resist most garden pests and offer something for everyone: spicy, sweet, or hot; and a variety of colours, shapes, and sizes. For this page, we will focus on sweet bell peppers.										

Planting

Start seeds indoors 8-10 weeks before last spring frost date. The temperature must be at least 70° F for seed germination, so keep them in a warm area for the best and fastest results. Start pepper seeds three to a pot, and thin out the weakest seedling. Let the remaining two pepper plants spend their entire lives together as one plant. The leaves of two plants help protect peppers against sunscald and the yield is often twice as good as two segregated plants. Begin to harden off plants about 10 days before transplanting. A week before transplanting, introduce fertilizer or aged compost into your garden soil. After the danger of frost has passed, transplant seedlings outdoors, 18 to 24 inches apart (but keep paired plants close to touching.) Soil should be at least 65° F, as peppers will not survive transplanting at temps any colder. Northern gardeners can warm up the soil by covering it with black plastic. Put two or three match sticks in the hole with each plant, along with about a teaspoon of fertilizer. These give the plants a bit of sulphur, which they like.

Care

Soil should be well drained, but be sure to maintain adequate moisture either with mulch or plastic covering. Water one to two inches per week, but remember that peppers are extremely heat sensitive. If you live in a warm or desert climate, watering everyday may be necessary. Fertilize after the first fruit set. Weed carefully around plants. If necessary, support plants with cages or stakes to prevent bending. Try commercially available cone-shaped wire tomato cages. They may not be ideal for tomatoes, but they are just the thing for peppers. Or, build your own garden supports. For larger fruit, spray the plants with a solution of one tablespoon of Epsom salts in a gallon of water, once when it begins to bloom, and once ten days later.

Pests / Diseases

● Aphids
● Flea Beetles
● Cucumber Mosaic Virus
● Blossom-End Rot appears as a soft, sunken area which turns darker in colour.
● Pollination can be reduced in temperatures below 60° F and above 90° F.
● Too much nitrogen will reduce fruit from setting.

Harvest / Storage

Harvest as soon as peppers reach desired size. The longer bell peppers stay on the plant, the more sweet they become and the greater their Vitamin C content. Use a sharp knife or scissors to cut peppers clean off the plant for the least damage. Peppers can be refrigerated in plastic bags for up to 10 days after harvesting. Bell peppers can be dried, and we would recommend a conventional oven for the task. Wash, core, and seed the peppers. Cut into one-half-inch strips. Steam for about ten minutes, then spread on a baking sheet. Dry in the oven at 140° F (or the lowest possible temperature) until brittle, stirring occasionally and switching tray positions. When the peppers are cool, put them in bags or storage containers.

Variants

● Green to Red: 'Lady Bell,' 'Gypsy,' 'Bell Boy,' 'Lipstick'
● Yellow: 'Golden California Wonder'

Other Tips

The popular green and red bell peppers that we see in supermarkets are actually the same thing; the red peppers have just been allowed to mature on the plant longer, changing colour and also gaining a higher content of Vitamin C.

9 Carrot

The carrot (Daucus carota) is a root vegetable, usually orange in colour, though purple, black, red, white, and yellow cultivars exist. Carrots are a domesticated form of the wild carrot, Daucus carota, native to Europe and south-western Asia. The plant probably originated in Persia and was originally cultivated for its leaves and seeds. The most commonly eaten part of the plant is the taproot, although the stems and leaves are eaten as well.

Sowing Season	Northern Hemisphere (Cold Climate) Mar-Aug	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Aug-Mar	Southern Hemisphere (Temperate Climate) Sep-May	Southern Hemisphere (Subtropical Climate) Feb-Nov	Southern Hemisphere (Tropical Climate) Feb-Sep			
Sowing Guide	Sowing Depth 4mm	Row Spacing 25-30cm	Plant Spacing 3-8cm	Frost Tender / Hardy Half Hardy	Direct Sow / Raise Seeds D	Germination Time 10-20 Days	Maturity Time 70-120 Days				
Introduction	Carrots are a popular root vegetable that's easy to grow as long as it's planted in loose, sandy soil. Here's what you need to know about planting, growing, and harvesting carrots in your garden! Most varieties of carrots are resistant to pests and diseases, and they are also a good late-season crop that can tolerate frost. In fact, they prefer to be grown during the cooler ends of the growing season—spring and fall. Carrots' root is rich in sugar, and a great source of vitamins and carotene. Not all carrots are orange; varieties vary in colour from purple to white! If there is a challenge to growing carrots, it's just having soil that's not too heavy—otherwise, you'll end up with stunted, round carrots! Most carrot varieties need deep, loose soil that lets them grow without difficulty. Carrots are grown from seed and take between two and four months to mature, depending on the variety. Depending on the variety and local growing conditions, carrots may take anywhere from 2 to 4 months to mature.										

Planting

Prepare the seedbed for carrots well before sowing seed! See more about preparing the soil below. Wait until the soil has dried out before digging it. Plan to plant seeds outdoors 3 to 5 weeks before the last spring frost date. Find your local frost dates here. Tip: Plant additional seeds every 3 weeks or so for multiple harvests. Plant carrot seeds 3 to 4 inches apart in rows. Rows should be at least a foot apart. Cover the newly sown seeds with sand or fine soil that will not crust over when dry. Keep the soil moist with frequent shallow waterings. The soil can't crust for small carrot seeds to germinate. (If you put your finger in the ground, it should be moist, but not wet, to the middle knuckle.) Carrots are sometimes slow to germinate. They may take 2 to 3 weeks to show any signs of life, so don't panic if your carrots don't appear right away! Carrots are best grown in full sunlight, but can tolerate a moderate amount of shade. Carrots grown in shade won't be as robust as those in full sun, however. Provide shade for seeds planted in mid-summer so that the soil does not heat up. Garden fleece will do this job.

One of the most important things to consider when growing carrots (and other root vegetables) is the condition of your soil. Follow these guidelines to ensure a healthy carrot harvest: Make sure your soil is free of stones. Stones obstruct the path of carrot roots, which can result in a stunted and misshapen crop. Till your soil before planting. Carrots need deeply-tilled, loose soil that they can easily push through. Use the right type of soil. Carrots grow best in sandy or loamy soil (as opposed clayey or silty soil), so add sand if necessary! Avoid using manure or too much fertilizer. Have you ever seen a carrot that has grown "legs" or has forked? Fresh manure, or even recently-applied rotted manure, can cause carrots to fork and send out little side roots. Don't use it before you plant your carrot seeds.

Care

After planting, gently mulch to retain moisture, speed germination, and block the sun from hitting the roots directly. Once plants are an inch tall, thin so that they stand 3 inches apart. Snip them with scissors instead of pulling them out to prevent damage to the fragile roots of the remaining plants. Water at least one inch per week. Weed diligently, but be careful not to disturb the carrots' roots while doing so. Fertilize with a balanced fertilizer 5-6 weeks after sowing.

Pests / Diseases

● Wireworms
● Flea Beetles
● Aster Yellow Disease will cause shortened and discoloured carrot tops and hairy roots. This disease is spread by pests as they feed from plant to plant. Keep weeds down and invest in a control plan for pests such as leafhoppers. This disease has the ability to overwinter.

Harvest / Storage

Carrots should be mature and ready for harvest in about 2–4 months, or when they reach at least ½ inch in diameter. You may harvest whenever desired maturity is reached. If you're growing carrots in the spring and early summer, harvest before daily temperatures get too hot, as the heat can cause carrot roots to grow fibrous. Carrots taste much better after a couple of frosts. (A frost encourages the plant to start storing energy—sugars—in its root for later use.) Following the first hard frost in the fall, cover carrot rows with an 18-inch layer of shredded leaves to preserve them for harvesting later.

To store freshly-harvested carrots, twist off the green tops, scrub off the dirt under cold running water, let dry and seal in airtight plastic bags, and refrigerate. If you simply put fresh carrots in the refrigerator, they'll go limp in a few hours. You may leave mature carrots in the soil for temporary storage if the ground will not freeze and pests aren't a problem. Carrots can be stored in tubs of moist sand for winter use.

Variants

Nantes varieties are 6 to 7 inches long, cylindrical (not tapered), and entirely edible. They are medium-sized, sweet and mild, and have a crisp texture. Danvers carrots are a classic heirloom carrot, 6 to 8 inches long, that tapers at the end and has a rich, dark orange colour. This variety can handle heavy soil better than most varieties.
● 'Little Finger' is a small Nantes type of carrot only 4 inches long and one inch thick. Great for containers.
● 'Bolero': resists most leaf pests.
● 'Thumberline': round carrot, good for clumpy or clay soil.

Other Tips

Don't expect the perfect shape of grocery store carrots. Your carrots will still taste better, whatever their shape! Carrots' root is rich in sugar, and a great source of vitamins and carotene. Not all carrots are orange; varieties vary in colour from purple to white. Carrots are biennial plants. If you leave them in the ground, the tops will flower and produce seeds the second year. Carrots have a long list of health benefits, not just those from Vitamin A.

Do your carrots look round, short, fat, and/or more like a potato?	Carrots need loose, light, airy soil. Most of us need to add sand. We use 100% sand mixed with ⅓ peat moss.
Do your carrots look round, short, fat, and/or more like a potato?	Till deeper! Carrots usually give up if they grow down a foot and hit any soil clumps. While we're not normally big fans of tilling, you must prepare a carrot bed. Till down 18 inches and make sure there are no rocks, weeds, or even soil clumps to impede your carrots' growth.
Do you carrots look as if they have legs or do they split?	Do not amend the soil. You have too much heavy compost or manure and too many nutrients. Not enough sand. Do not baby carrots.
Do you carrots look as if they have legs or do they split?	Seed directly in the ground. Don't transplant. Try to distribute seed in an even fashion so seeds don't grow together or use a seed-sower or thin vigorously to the right space.

Do you carrots look as if they have legs or do they split?	Main soil moisture with frequent shallow waterings during germination. The soil can't crust over.

10 Cauliflower

Cauliflower is one of several vegetables in the species Brassica oleracea in the genus Brassica, which is in the family Brassicaceae. It is an annual plant that reproduces by seed. Typically, only the head is eaten – the edible white flesh sometimes called "curd" (with a similar appearance to cheese curd).

Sowing Season	Northern Hemisphere (Cold Climate) May-Jul	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Nov-Apr	Southern Hemisphere (Temperate Climate) Dec-Apr	Southern Hemisphere (Subtropical Climate) Jan-May	Southern Hemisphere (Tropical Climate) Jan-Apr			
Sowing Guide	Sowing Depth 6mm	Row Spacing 75-90cm	Plant Spacing 45-70cm	Frost Tender / Hardy H	Direct Sow / Raise Seeds R/D	Germination Time 6-12 Days	Maturity Time 100-160 Days				
Introduction	Cauliflower is a cool-season crop and a descendant of the common cabbage. It is more difficult to grow than its relatives because it does not tolerate the heat or cold as well. If you plant to attempt growing cauliflower in the home garden, it requires consistently cool temperatures with temperatures in the 60s. Otherwise, it may prematurely "button"—form small, button-size heads—rather than forming a single, large, white head. Given that cauliflower enjoys cool temperature, it's a good autumn crop in many regions. Because of its temperature requirements, however, cauliflower is usually grown commercially and not the best crop for the beginner gardener. Are you up for the challenge?										

Planting

Select a site with at least 6 hours of full sun. Soil needs to be very rich in organic matter; add composted mature to the soil before planting. Fertile soil holds in moisture to prevent heads from "buttoning." Test your soil! (Get a comprehensive soil test through your local cooperative extension office.) The soil pH should be between 6.5 and 6.8. It is best to start cauliflower from transplants rather than seeds. Transplant 2 to 4 weeks before the average frost date in the spring, no sooner and not much later. Space the transplants 18 to 24 inches apart with 30 inches between rows. Use starter fertilizer when transplanting. Plant fall cauliflower about the same time as fall cabbage. This is usually 6 to 8 weeks before the first fall frost, but after the daytime temperature is below 75 degrees F. If you really want to try starting cauliflower from seeds, start the seeds 4 to 5 weeks before the plants are needed. Plant the seeds in rows 3 to 6 inches apart and up to half an inch deep. Do not forget to water the seeds during their germination and growth. Once they become seedlings, transplant them to their permanent place in the garden. In early spring, be ready to cover your plants with old milk jugs for protection if needed. For fall crops, shade them if they need protection from the heat. Add mulch to conserve moisture.

Care

Make sure that the plants have uninterrupted growth. Any interruption can cause the plants to develop a head prematurely or ruin the edible part completely. Cauliflower requires consistent soil moisture. They need 2 inches of water each week; with normal rainfall, this usually requires supplemental watering. For best growth, side-dress the plants with a nitrogen fertilizer. Note that the cauliflower will start out as a loose head and that it takes time for the head to fully form. Many varieties take at least 75 to 85 days from transplant. Be patient! When the curd (the white head) is about 2 to 3 inches in diameter, tie the outer leaves together over the head with a rubber band, tape, or twine. This is called blanching, and it protects the head from the sun and helps you get that pretty white colour. The plants are usually ready for harvest 7 to 12 days after blanching.

Pests / Diseases

- Cabbageworm: Nectar from dwarf zinnias lures in ladybugs and other predators that help to protect cauliflower from cabbageworms.
- Cabbage root maggots
- Aphids
- Harlequin bugs
- Clubroot
- Black Rot

Harvest / Storage

When the heads are compact, white, and firm, then it is time to harvest them. Ideally, the heads will grow to 6 to 8 inches in diameter. Cut the heads off the plant with a large knife. Be sure to leave some of the leaves around the head to keep it protected. If the heads are too small, but have already started to open up, they will not improve and should be harvested. If the cauliflower has a coarse appearance, it is too mature and should be tossed. If you want to store cauliflower, you can put the head in a plastic bag and store it in the refrigerator. It should last for about a week. For long-term storage, you can also freeze or pickle the heads.

Variants

- 'Snowball', which produces medium heads and a good yield throughout the growing season.
- 'Orange', which has a similar taste to the white cauliflower, but has more vitamin A.

Other Tips

11 Celery

Celery (Apium graveolens) is a marshland plant in the family Apiaceae that has been cultivated as a vegetable since antiquity. Celery has a long fibrous stalk tapering into leaves. Depending on location and cultivar, either its stalks, leaves, or hypocotyl are eaten and used in cooking. Celery seed is also used as a spice and its extracts have been used in herbal medicine.

Sowing Season	**Northern Hemisphere (Cold Climate)** Mar-Jun	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-Dec	**Southern Hemisphere (Temperate Climate)** Sep-Feb	**Southern Hemisphere (Subtropical Climate)** Mar-Oct	**Southern Hemisphere (Tropical Climate)** Apr-Sep			
Sowing Guide	**Sowing Depth** 4mm	**Row Spacing** 30-55cm	**Plant Spacing** 15-30cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R	**Germination Time** 15-25cm	**Maturity Time** 120-140 Days				

Introduction

Celery is a long-season vegetable grown in the spring or fall. It has the reputation of being fussy; however, it's really quite easy if you understand its specific needs. Here are tips from the pros on sowing, growing, and harvesting celery. We enjoy growing celery because it's not only crunchy, but also more flavourful than what you typically find in grocery stores. Plus, commercial celery is one of the most pesticide-laden crops so why not grow your own! Celery has three critical needs:
1. A long growing season (130 to 140 days of mostly cool weather). Celery will not tolerate high heat.
2. A constant, unfailing water supply. The soil must stay watered at all times. If celery has a spell without water, it will be problematic (stringy, tough, and/or hollow stalks).
3. Rich, fertile soil with plenty of organic matter mixed in. The crop is a big feeder and also needs to be fertilized during its growth period, too. Because celery roots are shallow (just a few inches deep), make sure nutrients are in the top of the soil.

Celery is often grown as a winter crop in the South, a summer crop in the far North, and a fall crop in most other areas Transplants are hard to find, so be prepared to start plants from seed.

Planting

Because the season is so long, celery seeds should always be started indoors for the best success rate. For a spring crop, sow seeds indoors 10 to 12 weeks before the average last frost date for your area. For a fall crop, sow in summer, timing so that you can set out transplants 10 to 12 weeks before the first autumn frost. Soak seeds in warm water overnight prior to planting to reduce germination time. To get good germination, don't cover the seeds with soil. Simply press the seeds into potting soil that's formulated for seed-starting and cover the trays or pots with plastic covers to hold the moisture. Germination should take place in about a week. When the plants are two inches tall, transplant them to individual peat pots or to another, deeper, flat with new potting soil. If you use flats, put the plants at least two inches apart.

Plant celery outdoors when the soil temperature reaches 50 degrees F. or more, and when the nights don't dip down below 40 degrees F. Work organic compost into the soil prior to planting. (Learn more about soil amendments and preparing soil for planting.) Or mix in fertilizer (about one pound of 5-10-10 per 30 square feet). Harden off seedlings before transplanting by reducing water slightly, and keeping them outdoors for a couple hours a day. Transplant seedlings 8 to 10 inches apart. Direct sow seeds ¼ inch deep. These will need to be thinned to 12 inches apart when they reach about six inches high. Mulch the plants after they are 6 inches tall to keep the soil moist and the roots cool. Water directly after planting.

Care

Celery requires lots of water. Make sure to provide plenty of water during the entire growing season, especially during hot, dry weather. If celery does not get enough water, the stalks will be dry and small. Add plenty of compost and mulch around the plants to retain moisture. Sidedress with a 5-10-10 fertilizer in the second and third month of growth (one tablespoon per plant and sprinkle it in a shallow furrow three to four inches from the plant and cover it with soil). Keep celery weeded but be careful when weeding as celery has shallow roots and could easily get disturbed. Tie growing celery stalks together to keep them from sprawling.

Pests / Diseases

- Flea beetles
- Slugs and Snails
- Earwigs

To control pests, cover the plants with garden fabric (row covers) during the first four to six weeks of the growing season.

Harvest / Storage

The parts of celery that are harvested are mainly the stalks, which will be above ground. Pick the stalks whenever you want. Young celery is as good as the mature product. Harvest stalks from the outside in. You may begin harvesting when stalks are about 8 inches tall. Celery can be kept in the garden for up to a month if soil is built up around it to maintain an ideal temperature. Celery will tolerate a light frost, but not consecutive frosts. Tip: The darker the stalks become, the more nutrients they will contain. Texture changes with colour; dark green stalks will be tougher. Keep celery in a plastic bag in the refrigerator. Celery stores really well; you can keep it for many weeks with no trouble.

Variants

- 'Utah 52-70R Improved' is good for gardeners with limited space. Will only reach 18 inches tall.
- 'Alfina' has slender stalks and is a dark green, quick-growing variety (60 days to maturity).
- 'Conquistador' is tolerant of higher temps and watering shortage.

Other Tips

Keep in mind the grocery store celery is lighter in colour and bigger than home-grown celery because the commercial varieties are grown in greenhouses and/or protected from the sun; they often carries a lot of pesticides, too. Celery stalks can be frozen. Cut the stalks into half-inch pieces and store in freezer-grade bags. The ancient Romans believed that celery had healing powers, especially when it came to headaches.

12 Chilli

The chilli pepper (also chile pepper, chilli pepper, or simply chilli) is the fruit of plants from the genus Capsicum, members of the nightshade family, Solanaceae. Chilli peppers are widely used in many cuisines to add spiciness to dishes.

Sowing Season	**Northern Hemisphere (Cold Climate)** o	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-Nov	**Southern Hemisphere (Temperate Climate)** Aug-Dec	**Southern Hemisphere (Subtropical Climate)** Jul-Mar	**Southern Hemisphere (Tropical Climate)** All Year			

GARDENING Vegetables Chilli

Sowing Guide	Sowing Depth	Row Spacing	Plant Spacing	Frost Tender / Hardy	Direct Sow / Raise Seeds	Germination Time	Maturity Time				
	4mm	80-100cm	40-60cm	FT	R/D	10-20 Days	60-110 Days				
Introduction											

Planting

To plant chili pepper seeds, begin by starting them indoors about 8-12 weeks before your region's last expected frost date. This gives the plants a crucial head start, as they require a long, warm growing season. Use small seed-starting trays or individual pots filled with a high-quality, well-draining seed-starting mix. Sow the seeds shallowly, about 0.5 cm (¼ inch) deep, and lightly cover them with soil.

Chili pepper seeds need warmth to germinate, ideally a consistent soil temperature between 26-32°C (80-90°F), with hotter varieties often preferring the higher end of this range. You can achieve this by placing trays on a heat mat, on top of a refrigerator, or in a warm, sunny spot. Keep the soil consistently moist but not waterlogged, as excessive wetness can lead to rot. Germination times vary widely by variety, from about 7-10 days for common types to several weeks for super-hots. Once seedlings emerge and have their first true leaves, provide them with plenty of light and prepare to harden them off before transplanting outdoors after all danger of frost has passed.

Care

Once established, chili pepper plants thrive with consistent care focused on warmth, moisture, and nutrition. Ensure they receive at least 6-8 hours of direct sunlight daily; they are sun-loving plants. Maintain consistently moist soil, especially as flowers and fruits begin to develop, but avoid overwatering, which can lead to root rot. Good drainage is paramount, so consider planting in raised beds or containers if your native soil is heavy. Regularly check the soil moisture and water deeply when the top inch or two feels dry.

Chili peppers are heavy feeders and benefit from a regular fertilization schedule. Begin with a balanced fertilizer during their initial growth phase to encourage strong foliage. Once flowering starts and fruits begin to set, switch to a fertilizer higher in phosphorus and potassium to promote blooming and fruiting rather than just leafy growth. Providing adequate air circulation by spacing plants appropriately helps prevent fungal diseases. For taller varieties or those with heavy fruit loads, staking or caging the plants will offer essential support, preventing stems from breaking and keeping the peppers off the ground. Regularly inspect plants for pests like aphids or spider mites and treat promptly with organic solutions like insecticidal soap if necessary.

Pests / Diseases

● Aphids: Small, soft-bodied insects clustering on new growth, causing stunted, curled leaves.
Mitigation: Blast with water, use insecticidal soap, neem oil, or introduce natural predators (ladybugs).
● Spider Mites: Tiny, often reddish mites causing stippling (tiny dots) on leaves and fine webbing, especially in dry conditions.
Mitigation: Increase humidity, spray with insecticidal soap or neem oil, introduce predatory mites.
● Whiteflies: Small, white, winged insects found on leaf undersides, causing yellowing and stunted growth.
Mitigation: Use sticky traps, insecticidal soap, or neem oil.
● Thrips: Tiny, slender insects causing silvery streaks on leaves and distorted growth.
Mitigation: Blue sticky traps, neem oil, or insecticidal soap.
● Fungus Gnats: Small, dark flies usually indicating overwatering; their larvae can feed on roots.
Mitigation: Allow soil to dry out between waterings, use sticky traps, or beneficial nematodes.
● Cutworms: Larvae that sever young seedlings at the soil line.
Mitigation: Use cardboard collars around seedling stems, remove garden debris, or apply Bt (Bacillus thuringiensis).

● Powdery Mildew: White, powdery fungal growth on leaves.
Mitigation: Ensure good air circulation, avoid overhead watering, apply neem oil or horticultural oils.
● Bacterial Leaf Spot: Dark, water-soaked spots on leaves that turn brown/black, causing defoliation.
Mitigation: Use disease-free seeds/starts, avoid overhead watering, ensure good air circulation, remove affected leaves.
● Anthracnose: Fungal disease causing sunken, circular lesions on ripe fruit, sometimes with pinkish spores.
Mitigation: Use disease-free seeds, rotate crops, improve air circulation, harvest promptly, remove infected fruit/debris. Use fungicides in severe cases.
● Phytophthora Blight/Root Rot: Causes wilting, stem lesions, and root rot, especially in waterlogged conditions.
Mitigation: Ensure excellent drainage, avoid overwatering, plant in raised beds if soil is heavy. Remove infected plants.
● Mosaic Viruses (e.g., Tobacco Mosaic Virus): Causes mottled, yellowing, or distorted leaves and stunted growth.
Mitigation: Plant resistant varieties, sanitize tools, control insect vectors (aphids), avoid tobacco use near plants, remove and destroy infected plants.
● Blossom End Rot: Not a disease, but a calcium deficiency causing black, sunken spots on the blossom end of fruits.
Mitigation: Ensure consistent watering (avoiding dry/wet cycles), maintain proper soil pH (6.0-7.0), and ensure adequate soil calcium (amend with gypsum or

Harvest / Storage

Chili peppers are ready for harvest when they have reached their mature size and their desired color, which can vary from green to vibrant reds, yellows, oranges, or even purples, depending on the variety. For most common uses, like fresh consumption or cooking, pick them when they are fully colored. If you're aiming for maximum heat, especially with super-hot varieties, allow the peppers to remain on the plant a bit longer after they've colored up, as this can increase their capsaicin content. Always use sharp scissors or pruning shears to cut the stem about 2-5 cm (1-2 inches) above the cap of the pepper to avoid damaging the plant, and pick regularly to encourage further production. For hotter varieties, wearing gloves is highly recommended to prevent skin irritation.

For short-term storage, fresh chili peppers can be kept unwashed in the crisper drawer of your refrigerator for two to three weeks. It's best to store them loosely or in a perforated plastic bag to allow for some air circulation, as excess moisture can lead to mold. Do not wash them before refrigerating.

For longer-term preservation, freezing is an excellent option. Wash and thoroughly dry the peppers before freezing. You can freeze them whole by spreading them in a single layer on a baking sheet until solid, then transferring them to airtight freezer bags. Alternatively, you can chop them (removing stems and seeds if desired) before freezing in freezer bags or containers. Drying is another effective method, particularly for thinner-walled varieties; peppers can be air-dried in ristras or using a dehydrator, then stored whole or ground into powder or flakes. Pickling in a vinegar-based brine is also a popular way to preserve chili peppers for extended periods.

Variants

• Bell Pepper (Capsicum annuum): No heat (0 SHU), commonly green, red, yellow, orange, or purple.
• Jalapeño (Capsicum annuum): Mild to medium heat (2,500-8,000 SHU), typically green, turning red when mature. Often pickled or used in salsas.
• Serrano (Capsicum annuum): Hotter than jalapeños (10,000-23,000 SHU), small, slender, and bright green.
• Poblano (Capsicum annuum): Mild heat (1,000-2,000 SHU), dark green, broad, and often used for stuffing. When dried, it's called an Ancho.
• Cayenne (Capsicum annuum): Medium to hot heat (30,000-50,000 SHU), long, thin, and red. Often dried and ground into powder.
• Habanero (Capsicum chinense): Very hot (100,000-350,000 SHU), fruity flavor, typically orange or red, but can be other colors.
• Scotch Bonnet (Capsicum chinense): Similar heat and fruity flavor to habaneros (80,000-400,000 SHU), but with a distinctive squat, "bonnet" shape.
• Bird's Eye Chili (Thai Chili) (Capsicum annuum or Capsicum frutescens): Hot (50,000-100,000 SHU), small, pointed, and widely used in Asian cuisine.
• Tabasco (Capsicum frutescens): Medium-hot (30,000-50,000 SHU), primarily known for making Tabasco sauce.
• Anaheim (Capsicum annuum): Mild (500-2,500 SHU), long, often used for roasting or stuffing.
• Banana Pepper (Hungarian Wax) (Capsicum annuum): Mild to medium heat (0-15,000 SHU), yellow, long, and often pickled.
• Ghost Pepper (Bhut Jolokia) (Capsicum chinense): Extremely hot (800,000-1,041,427 SHU), one of the former world record holders.
• Carolina Reaper (Capsicum chinense): World's hottest (1,400,000-2,200,000+ SHU), extremely pungent with a distinctive pointed tail.

Other Tips

• Sunlight is Key: Chillies need at least 6-8 hours of direct sunlight daily for best growth and fruit production.
• Warmth Lovers: They thrive in warm conditions; protect from frost. Start seeds indoors in cooler climates.
• Well-Drained Soil: Use rich, well-draining soil with a pH between 6.0-7.0. Raised beds or containers are excellent for drainage.
• Consistent Watering: Keep the soil consistently moist but never waterlogged. Overwatering can lead to root rot.
• Fertilize Regularly: Chillies are heavy feeders. Use a balanced fertilizer during vegetative growth, then switch to one higher in phosphorus and potassium once flowering begins.
• Good Air Circulation: Space plants adequately to ensure airflow, reducing fungal disease risk.
• Pinch for Bushiness: Pinch off the top few leaves of young plants to encourage bushier growth and more fruit.
• Support Tall Varieties: Stake or cage taller plants to support heavy fruit loads and prevent breakage.
• Patience for Heat: For hotter varieties, allowing fruit to stay on the plant longer (until fully colored) often increases capsaicin (heat) levels.
• Pest Vigilance: Regularly check for aphids, spider mites, and whiteflies. Treat promptly with insecticidal soap or neem oil.
• Harvesting: Pick chillies as they ripen to encourage more production. Use sharp snips to avoid damaging the plant.

13 Corn / Maize

Maize, also known as corn, is a cereal grain first domesticated by indigenous peoples in southern Mexico about 10,000 years ago. The leafy stalk of the plant produces pollen inflorescences and separate ovuliferous inflorescences called ears that yield kernels or seeds, which are fruits.

Sowing Season	**Northern Hemisphere (Cold Climate)** o	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Oct-Jan	**Southern Hemisphere (Temperate Climate)** Sep-Jan	**Southern Hemisphere (Subtropical Climate)** Aug-Feb	**Southern Hemisphere (Tropical Climate)** All Year			
Sowing Guide	**Sowing Depth** 15-25mm	**Row Spacing** 50-90cm	**Plant Spacing** 20-30cm	**Frost Tender / Hardy** FT	**Direct Sow / Raise Seeds** D	**Germination Time** 6-12 Days	**Maturity Time** 80-120 Days				
Introduction	Sweet corn is an annual with yellow, white, and bi-collared ears. A long, frost-free growing season is necessary. Here's how to plant, grow, and harvest corn in your garden. Sweet corn is wind-pollinated, so it should be planted in blocks, rather than in single rows. Early, mid, and late-season varieties extend the harvest. If you miss the optimal harvest time, the corn's flavour will go downhill fast, as sugars convert to starch.										

Planting

Corn plants are picky about their soil. Work in aged manure or compost the fall before planting and let it overwinter in the soil. Starting corn seeds indoors is not recommended. Plant seeds outdoors two weeks after the last spring frost date. Make sure the soil temperature is above 60°F (16°C) for successful germination. (Up to 65°F/18°C for super sweet varieties.) In colder zones, the ground can be warmed by a black plastic cover if necessary. Plant seeds through holes in the plastic. Plant seeds 1.5 to 2 inches deep and 4 to 6 inches apart. Rows 30 to 36 inches apart. For sufficient pollination, plan your plot right. Don't plant two long rows, rather, plant corn blocks of at least four rows. You may choose to fertilize at planting time; corn is meant to grow rapidly. If you are confident that the soil is adequate, this can be skipped. Water well at planting time.

Care

When your plants are 3 to 4 inches tall, thin them so they are 8 to 12 inches apart. Be careful not to damage the roots when weeding. Soil must be well drained and able to keep consistent moisture. In dry conditions, be sure to keep corn well watered due to its shallow roots. Water at a rate of 5 gallons per sq yard. Mulch helps reduce evaporation.

Pests / Diseases

• Raccoons
• Deer
• Spotted Cucumber Beetles
• Flea Beetles
• Cutworms

Harvest / Storage

Harvest when tassels begin to turn brown and cobs start to swell. Kernels should be full and milky. Pull ears downward and twist to take off stalk. Sweet corn varieties lose their sweetness soon after harvesting. Prepare for eating or preserving immediately after picking. Sweet corn freezes well, especially if removed from ears before freezing. Learn how to properly freeze corn. Corn kernels can also be harvested for other purposes, like corn-filled therapy packs.

Variants

There are three types of sweet corn: Normal, sugar-enhanced, and super sweet. Each one contains a different level of sucrose, changing the flavour and texture of the corn. Sweeter varieties will stay sweeter for longer after harvest.
• 'Iochief': Midseason, normal-sugar variety. Yellow.
• 'Silver Queen': normal sugar-variety. Resistant to some bacterial diseases. White.
• 'Sweet Sunshine': supersweet variety, disease resistant, high yield. Yellow.
• 'Argent': sugar-enhanced variety, good taste. White.

Other Tips

Baby corn is produced from regular corn plants that are harvested early, while the ears are immature. Regular sweet corn, sugar-enhanced sweet corn, and supersweet corn varieties can be used, along with a few varieties that are specific for baby corn. If your corn shucks harder than usual, prepare for a cold winter. Corn is one of the Three Sisters; its growing style pairs perfectly with beans and squash. Corn is great for eating but also has so many other uses including medicinal.

14 Cucumber

The cucumber (Cucumis sativus), or less formally cuke, is a widely cultivated plant in the gourd family, Cucurbitaceae. It is a creeping vine that bears cucumiform fruits that are used as vegetables. There are three main varieties of cucumber: slicing, pickling, and seedless.

Sowing Season	Northern Hemisphere (Cold Climate) Apr-Jun	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Oct-Dec	Southern Hemisphere (Temperate Climate) Sep-Feb	Southern Hemisphere (Subtropical Climate) Jul-Mar	Southern Hemisphere (Tropical Climate) Feb-Sep			
Sowing Guide	Sowing Depth 10mm	Row Spacing 100-120cm	Plant Spacing 40-60cm	Frost Tender / Hardy FT	Direct Sow / Raise Seeds D	Germination Time 10-15 Days	Maturity Time 60-90 Days				
Introduction	An easy-care vegetable that loves sun and water, cucumbers grow quickly as long as they receive consistent watering. Most varieties will grow in any amount of space, thanks to the plant's ability to climb. Of course, these prolific veggies are perfect for pickling! There are two types of cucumber plants: vining cucumbers and bush cucumbers. The most common varieties grow on vigorous vines shaded by large leaves. The growth of these plants is fast, and the crop yield is abundant if you care for them properly. Vining varieties grow up a trellis or fence. They will be cleaner—versus those that grow atop soil—often more prolific, and easier to pick. Bush cucumbers are, however, nicely suited to containers and small gardens. Make successive plantings (every two weeks for continued harvests). In already-warm summer soil, cucumbers will grow quickly and ripen in about six weeks! If you're interested in making pickles, we recommend several prolific varieties below that are bred especially for pickling, such as heirloom 'Boston Pickling'. For crispy pickles, be sure to prepare them within a few hours of harvesting!										

Planting

Cucumber plants are seeded or transplanted outside in the ground no earlier than 2 weeks after last frost date. Cucumbers are extremely susceptible to frost damage; the soil must be at least 70°F for germination. Do not plant outside too soon. Before you plant outside, select a site with full sun. Soil should be neutral or slightly alkaline with a pH of 7.0. Cucumbers require fertile soil. Mix in compost and/or aged manure before planting to a depth of 2 inches and work into the soil 6 to 8 inches deep. Make sure that soil is moist and well-drained, not soggy.

Improve clay soil by adding organic matter. Improve dense, heavy soil by adding peat, compost or rotted manure. (Get a soil test if you are unsure of your soil type; contact your local county cooperative extension.) Light, sandy soils are preferred for northern gardens, as they warm quickly in the spring.

Plant seedlings one inch deep and about 36 to 60 inches apart, depending on variety. For vines trained on a trellis, space plants 1 foot apart. For an early crop, start cucumber seeds indoors about 3 weeks before you transplant them in the ground. They like bottom heat of about 70°F (21°C). If you don't have a heat mat, put the seeds flat on top of the refrigerator or perch a few on top of the water heater. If you live in the cooler climates, you can help warm the soil by covering the hill or row with black plastic.

Once the ground is warm, mulch with pine straw, chopped leaves, or another organic mulch to keep pests at bay, and also keep bush types off the ground to avoid disease. A trellis is a good idea if you want the vine to climb, or if you have limited space. Trellising also protects the fruit from damage from lying on the moist ground.

Care

The main plant care requirement for cucumbers is water—consistent watering! They need one inch of water per week (more if temperatures are sky high). Put your finger in the soil and when it is dry past the first joint of your finger, it is time to water. Inconsistent watering leads to bitter-tasting fruit. Water slowly in the morning or early afternoon, avoiding the leaves so that you don't get leaf diseases which will ruin the plant. If possible, water your cucumbers with a soaker hose or drip irrigation to keep the foliage dry. Mulch to hold in soil moisture. Cover seeds with netting or a berry basket if you have pests; this will keep them from digging out the seeds. When seedlings emerge, begin to water frequently, and increase to a gallon per week after fruit forms. When seedlings reach 4 inches tall, thin plants so that they are 1½ feet apart.

If you've worked organic matter into the soil before planting, you may only need to side-dress your plants with compost or well-rotted manure. If you wish, use a liquid fertilizer from your garden store such as vegetable plant food which is low nitrogen/high potassium and phosphorus formula. Apply at planting, 1 week after bloom, and every 3 weeks, directly to the soil around the plants. Or, you can work a granular fertilizer into the soil. Do not over-fertilize or the fruits will get stunted. If you have limited space or would prefer vertical vines, set up trellises early to avoid damage to seedlings and vines. Spray vines with sugar water to attract bees and set more fruit.

Pests / Diseases

If your cucumber plants do not set fruit, it's not usually a disease. There is probably a pollination issue. The first flowers were all male. Both female and male flowers must be blooming at the same time. This may not happen early in the plant's life, so be patient. (Female flowers are the ones with a small cucumber-shaped swelling at the base that will become the fruit.) Lack of fruit may also be due to poor pollination by bees, especially due to rain or cold temperatures, or insecticides. To rest assured, you could always hand pollinate. (Dip a Q-tip into the male pollen and transfer it to the centre of the female flower.) Remember, gynoecious hybrids require pollinator plants. Squash bugs may attack seedlings. Aphids are always a nuisance for any vegetable plant but easily managed. Powdery mildew can be a problem if the leaves get wet (water at the soil level). Apply fungicides at the first sign of its presence. Cucumber Beetles may attack the vines and can cause disease.

Harvest / Storage

Don't let cucumbers get too large or they will taste bitter. At peak harvesting time, you should be picking cucumbers every couple of days. They'll grow quickly! Harvest regular slicing cucumbers when they about 6 to 8 inches long (slicing varieties). Harvest dills at 4 to 6 inches long and pickles at 2 inches long for pickles. The large burpless cucumbers can be up to 10 inches long and some types are even larger. Cucumbers are best picked before their seeds become hard and are eaten when immature. Do not let them get yellow. A cucumber is of highest quality when it is uniformly green, firm, and crisp.

Any cucumbers left on the vine too long will also get tough skins and lower plant productivity. How to pick? Using a knife or clippers, cut the stem above the fruit. Pulling the fruit may damage the vine. Keep them picked. If you don't, as plants mature, they will stop producing. Cucumbers are over 90 percent water. Store wrapped tightly in plastic wrap to retain moisture. They will keep for a week to 10 days when stored properly in the refrigerator.

Variants

- Burpless Bush Hybrid is a popular bush form of cucumber.
- ‘Boston Pickling’ is our favourite heirloom variety bred especially for pickling.
- We also recommend disease-resistant ‘Sassy’ or ‘Calypso’ for early yields.
- Long, thin ‘Parisian Pickling’ is great for making gherkins or cornichons.
- Lemon cucumber is a smaller cucumber many folks find reliable.

Other Tips

Plant cucumbers while you are wearing your pajamas, on the first day of May, before sunrise, and no bugs will eat them. If you’re pickling, consider growing dill, the favourite pickling herb! Plant every few weeks into midsummer to ensure a constant supply. Don’t forget that cucumbers aren’t just for eating. When puréed in the blender, cucumbers make a great summer facial for toning the skin. With special moulds, you can grow cucumbers in different shapes like hearts and stars!

15 Eggplant

Eggplant (Solanum melongena) is a species in the nightshade family (Solanaceae) grown for its edible fruit. Although eggplant is the common name in many countries, in British English, it is called aubergine, and in South Asia and South Africa, brinjal.

Sowing Season	**Northern Hemisphere (Cold Climate)** Apr-May	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Oct-Dec	**Southern Hemisphere (Temperate Climate)** Sep-Feb	**Southern Hemisphere (Subtropical Climate)** Aug-Mar	**Southern Hemisphere (Tropical Climate)** All Year			
Sowing Guide	**Sowing Depth** 4mm	**Row Spacing** 80-90cm	**Plant Spacing** 50-75cm	**Frost Tender / Hardy** FT	**Direct Sow / Raise Seeds** R/D	**Germination Time** 10-20 Days	**Maturity Time** 90-120 Days				

Introduction

Eggplants—also known as aubergine—are warm-weather vegetables that are harvested in mid- to late summer. See how to plant, grow, harvest, and cook these lovely deep purple crops—one of our favourite grilling vegetables! Eggplants are actually perennials though they are treated by most gardeners as annuals. Given their tropical and subtropical heritage, eggplants do require relatively high temperatures, similar to tomatoes and peppers (which are also in the nightshade family of vegetables). Like tomatoes, eggplants grow hanging from the vines of a plant that grows several feet in height. Because they need warm soil, eggplants are usually purchased as transplants (or, started indoors about two months in advance). Raised beds enriched with composted manure are an ideal growing place for eggplants because the soil warms more quickly. Eggplants are also great for containers and make lovely ornamental borders. Though eggplants are usually a beautiful dark purple colour, their colour can vary, and so can the size and shape—from small- to large-fruited. Explore eggplants!

Planting

Start plants indoors in flats or peat pots 2 months before the soil warms up or buy nursery transplants just before planting. Plant outdoors in a very sunny spot with well-draining, fertile soil (with a pH from 6.3 to 6.8). Mix 1 inch or so of well-rotted manure or a general fertilizer such as 5-10-5 throughout the planting bed about a week before planting. (Apply 2 to 3 pounds per 100 square feet.) Use a covering of black plastic mulch to warm heavy clay soils before setting out transplants. If transplanting, set 3- to 4-inch tall seedlings 24 to 30 inches apart in well-prepared beds. Mix 1 tablespoon of 5-10-5 or a shovelful of rotted manure or good compost with the soil in the bottom of each planting hole and cover with more soil.

If you’re growing eggplant in pots, use a dark-coloured container. Each plant needs five-gallon (or, larger) pots and should be placed in full sun and outdoors so it can be pollinated. Use a premium potting mix to avoid disease. Stake the plants right away (just an inch or two from the plant) to provide support as they climb and to avoid disturbing the soil later. If you live in a cold climate, consider using row covers to keep the eggplants warm and sheltered. Open the ends of the row covers on warm days so that the bees may pollinate. After planting, water well. Add a layer of mulch to retain moisture and suppress weeds.

Care

Eggplant will fall over once loaded with fruit. Be sure to stake plants 24 inches tall or use a cage to keep the plants upright. If growing eggplant in containers, stake the stems before the fruit forms. Water well without letting the soil get soggy. Consistent watering is best, and a soaker hose or drip system at ground level is ideal. Apply a balanced fertilizer every two weeks during the growing season. For bigger fruits, restrict to five or six per plant. Pinch out the terminal growing points for a bushier plant.

Pests / Diseases

Flea beetles are probably the most common pest, but a healthy eggplant should be able to withstand damage from their tiny holes. Verticillium wilt and Powdery Mildew can affect eggplant. Tomato Hornworms are sometimes an issue. Eggplant fruit may not ripen properly due to cold temperatures, pest damage, or infertile soils. Strangely-shaped eggplant are the result of inconsistent watering or low moisture.

Harvest / Storage

Harvest 16 to 24 weeks after sowing when the skin of the fruit is shiny and unwrinkled. Don’t wait too long to harvest! As soon as the skin does not rebound to gentle pressure from your finger, it’s ripe. When harvesting, do not pull the fruit (as it won’t come off). Cut the fruit with a sharp knife or pruning shears close to the stem, leaving about an inch of it attached. Eggplants can be stored for up to two weeks in humid conditions no lower than 50 degrees Fahrenheit. Store in the refrigerator where it will keep for several days. Do not wash or cut in advance to avoid damaging the skin, which will quickly perish if exposed.

Variants

- ‘Black Beauty’ is the traditional eggplant size. One plant produces 4 to 6 large rounded fruit.
- ‘Ichiban’ eggplant is a slim, long hybrid with thin skin. Expect a dozen or more fruit from one plant.
- ‘Little Fingers’ are small, finger-sized eggplant. Small-fruited varieties tend to be especially heavy bearers.
- ‘Easter Egg’ is an ornamental eggplant, usually white in colour. (It’s not edible.)

Other Tips

16 Leek

The leek is a vegetable, a cultivar of Allium ampeloprasum, the broadleaf wild leek. The edible part of the plant is a bundle of leaf sheaths that is sometimes erroneously called a stem or stalk. The genus Allium also contains the onion, garlic, shallot, scallion, chive, and Chinese onion.

Sowing Season	**Northern Hemisphere (Cold Climate)** Apr-Sep	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-Apr	**Southern Hemisphere (Temperate Climate)** Aug-Apr	**Southern Hemisphere (Subtropical Climate)** Jan-May	**Southern Hemisphere (Tropical Climate)** Feb-May			
Sowing Guide	**Sowing Depth** 4mm	**Row Spacing** 30-40cm	**Plant Spacing** 10-20cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R	**Germination Time** 10-20 Days	**Maturity Time** 90-140 Days				
Introduction											

Planting

Care

Pests / Diseases

Harvest / Storage

Variants

Other Tips

17 Lettuce

Lettuce (Lactuca sativa) is an annual plant of the daisy family, Asteraceae. It is most often grown as a leaf vegetable, but sometimes for its stem and seeds. Lettuce is most often used for salads, although it is also seen in other kinds of food, such as soups, sandwiches and wraps; it can also be grilled.

Sowing Season	**Northern Hemisphere (Cold Climate)** Jan-Dec	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-May	**Southern Hemisphere (Temperate Climate)** All Year	**Southern Hemisphere (Subtropical Climate)** All Year	**Southern Hemisphere (Tropical Climate)** Apr-Nov			
Sowing Guide	**Sowing Depth** 5mm	**Row Spacing** 20-30cm	**Plant Spacing** 20-30cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R/D	**Germination Time** 6-12 Days	**Maturity Time** 60-90 Days				
Introduction	Home-grown lettuce is far superior—in both taste and vitamin A content—to the store-bought alternative! Here's how to plant, grow, and harvest lettuce in your garden. Lettuce is cool-season crop that grows well in the spring and fall in most regions. Lettuce seedlings will even tolerate a light frost. Temperatures between 7.2-18.3°C (45-65°F) are ideal. Because lettuce grows quickly, the best approach is to plant a small amount at a time, staggering your plantings.										

Planting

Before you plant your lettuce seeds, make sure the soil is prepared. It should be loose and drain well so it's moist without staying soggy. To keep the soil fertile, feed it with composted organic matter about one week before you seed or transplant. Since the seed is so small, a well-tilled seedbed is essential. Stones and large clods of dirt will inhibit germination. Direct sowing is recommended as soon as the ground can be worked. Plant seeds ½ inch deep. Snow won't hurt them, but a desiccating cold wind will. If you want an earlier crop, however, you may start seeds indoors 4 to 6 weeks before your last spring frost date for an earlier crop. Harden off seedlings for about one week, and transplant outside between 2 weeks before and 2 weeks after last spring frost.

Seed may be sown in single rows or broadcast for wide row planting. When broadcasting, you'll need to "thin" for the proper spacing.
- Leaf lettuce: Plant 4 inches apart.
- Cos and loose-headed types: Plant 8 inches apart.
- Firm-headed types: Plant 16 inches apart.

Your rows of plants should be 12 to 15 inches apart. Cover the seeds with ¼ to ½ inch of soil. Water thoroughly at time of transplanting. Consider planting rows of chives or garlic between your lettuce to control aphids. They act as "barrier plants" for the lettuce. If you'd like to grow your lettuce inside your home, check out these tips for growing lettuce indoors. In some regions, it's possible to plant a second crop of lettuce in the fall or even early winter.

Care

Care

Fertilize 3 weeks after transplanting. Lettuce prefers soil that is high in organic material, with plenty of compost and a steady supply of nitrogen to keep if growing fast. Use organic alfalfa meal or a slow-release fertilizer. Make sure the soil remains moist but is well drained. Lettuce will tell you when it needs water. Just look at it. If the leaves are wilting, sprinkle them anytime—even in the heat of the day—to cool them off and slow down the transpiration rate. An organic mulch will help conserve moisture, suppress weeds, and keep soil temperatures cool throughout the warmer months.

Weed by hand if necessary, but be careful of damaging your lettuce plants' roots; they are shallow. Planning your garden so that lettuce will be in the shade of taller plants, such as tomatoes or sweet corn, may reduce bolting in the heat of the summer. You should be able to sow additional lettuce seeds every two weeks for a continuous harvest throughout the growing season. To plant a fall crop, create cool soil in August by moistening the ground and covering it with a bale of straw. A week later, the soil under the bale will be about 10°F (6°C) cooler than the rest of the garden. Sow a three-foot row of lettuce seeds every couple of weeks—just rotate the straw bale around the garden.

Pests / Diseases

- Aphids
- Earwigs
- Cutworms
- White Mould
- Woodchucks
- Rabbits

Harvest / Storage

Lettuce should be harvested when full size, but just before maturity. The leaves taste best when they're still young and tender. Before maturity, you can harvest leaf lettuce by simply removing outer leaves so that the centre leaves can continue to grow. Butterhead or romaine types can be harvested by removing the outer leaves, digging up the whole plant, or cutting the plant about an inch above the soil surface. A second harvest is often possible when using the first or third methods. Crisphead lettuce is picked when the centre is firm. Mature lettuce gets bitter and woody and will go bad quickly, so check your garden everyday for ready-to-harvest leaves. It's best to harvest lettuce in the morning before leaves have been exposed to sun. As time passes and the plant loses vigour, you may be better off planting a second round of seeds than waiting for new leaves. Keep lettuce in the refrigerator for up to 10 days in a loose plastic bag.

Variants

- Crisphead: 'King Crown', 'Mission'
- Cos (Romaine): 'Wallop', 'Paris White Cos'
- Loose Heads: 'Burpee Bibb'
- Red Leaf: 'Red Sail' (Not recommended for hot weather; the red pigment absorbs more heat.)

Other Tips

Did you know that lettuce and sunflowers are relatives? They both belong to the Asteraceae (or "daisy") family. Your lettuce has wilted? Put the leaves in a bowl of cold water with ice cubes and soak for about 15 minutes. Eating lettuce for dinner can be calming and help to reduce stress.

18 Mushroom

Edible mushrooms are the fleshy and edible fruit bodies of several species of macrofungi (fungi which bear fruiting structures that are large enough to be seen with the naked eye). They can appear either below ground (hypogeous) or above ground (epigeous) where they may be picked by hand.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○		
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○	Maturity Time ○			
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19 Onion

The onion, also known as the bulb onion or common onion, is a vegetable that is the most widely cultivated species of the genus Allium. Its close relatives include the garlic, leek, chive, and Chinese onion.

Sowing Season	**Northern Hemisphere (Cold Climate)** Oct-Feb	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Feb-Sep	**Southern Hemisphere (Temperate Climate)** Feb-Aug	**Southern Hemisphere (Subtropical Climate)** Feb-Jun	**Southern Hemisphere (Tropical Climate)** Feb-May		
Sowing Guide	**Sowing Depth** 5mm	**Row Spacing** 25-40cm	**Plant Spacing** 5-10cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** R/D	**Germination Time** 10-20 Days	**Maturity Time** 160-230 Days			

Introduction

Onions are a cold-season crop, easy to grow because of their hardiness. Here's how to grow an endless supply of onions in your garden! Typically, onions are planted early in the spring and harvested in the fall after their tops begin to die back. In the southern U.S., some onion varieties can be planting in the fall. We recommend using onion sets, which can be planted without worry of frost damage and have a higher success rate than direct seed or transplants. Onion plants grow well on raised beds or raised rows at least 4 inches high. If you'd prefer to start your onions from seeds, check out our tips for growing onions from seed indoors.

Planting

Plant onions as soon as the ground can be worked in the spring, usually late March or April. Make sure outdoor temperatures don't dip below 20°F (-6°C). Select a location with full sun, where your onions won't be shaded by other plants. Soil needs to be well-drained, loose, and rich in nitrogen; compact soil affects bulb development. Add aged manure or compost to the soil in early spring, before planting. Onion plants are heavy feeders and need constant nourishment to produce big bulbs. At planting time, mix in some nitrogen fertilizer. Onion seeds are short-lived. If planting seeds indoors, start with fresh seeds each year. Start seeds indoors about 6 weeks before transplanting to the garden. Think of onions as a leaf crop, not a root crop. When planting onion sets, don't bury them more than 1 inch under the soil. For sets or transplants, space plants 4 to 5 inches apart in rows 12 to 18 inches apart. Practice crop rotation with onions. Add mulch between the rows of onions. This will help retain moisture and stifle weeds.

Care

Fertilize every few weeks with nitrogen to get big bulbs. Cease fertilizing when the onions push the soil away and the bulbing process has started. Do not put the soil back around the onions; the bulb needs to emerge above the soil. Generally, onion plants do not need consistent watering if mulch is used. About one inch of water per week (including rain water) is sufficient. If you want sweeter onions, water more. Onions will look healthy even if they are bone dry, so be sure to water during drought conditions.

Pests / Diseases

● Thrips: To control thrips—tiny insects about as fat as a sewing needle—take a dark piece of paper into the garden and knock the onion tops against it; if thrips are present, you will spot their tan-coloured bodies on the paper. A couple of treatments with insecticidal soap kills them. Follow the package directions. Spray the plants twice, three days apart, and the thrips should disappear.
● Onion Maggots: Cover your emerging onion crop with a fine mesh netting. Seal it by mounding soil around the edges. The onion maggot likes to lay its eggs at the base of plants, so the netting should prevent that. You should also keep mulch away because the insects like decaying organic matter, and make sure you completely harvest your onions as the season progresses. Onion maggots are usually a problem in very rainy periods, so these precautions may be unnecessary if you have a dry season.

Harvest / Storage

Pull any onions that send up flower stalks; this means that the onions have stopped growing. These onions will not store well but can be used in recipes within a few days. When onions start to mature, the tops (foliage) become yellow and begin to fall over. At that point, bend the tops down or even stomp on them to speed the final ripening process. Loosen the soil around the bulbs to encourage drying. When tops are brown, pull the onions. Be sure to harvest in late summer, before cool weather. Mature onions may spoil in fall weather. Clip the roots and cut the tops back to 1 inch (but leave the tops on if you are planning to braid the onions). Let the onions cure on dry ground for a few days, weather permitting. Always handle them very carefully—the slightest bruise will encourage rot to set in.

Allow onions to dry for several weeks before you store them in a root cellar or any other storage area. Spread them out on an open screen off the ground to dry. Store at 40 to 50°F (4 to 10°C) in braids or with the stems removed in a mesh bag or nylon stocking. Mature, dry-skinned bulbs like it cool and dry. Don't store onions with apples or pears, as the ethylene gas produced by the fruits will interrupt the onions' dormancy. Onions may also spoil the flavour of these fruits (as well as potatoes). A pungent onion will store longer than a sweet onion. Eat the sweet varieties first and save the more pungent onions for later.

Variants

Long-day Varieties
● 'Yellow Sweet Spanish': large, round shape; yellow-white.
● 'First Edition': high-yielding, stores well, flavourful, creamy-yellow
● 'Red Wethersfield': flat bulbs that store well, white flesh, red-skinned
Short-day Varieties
● 'Stuttgarter': sold in sets, early maturity with slightly flat shape, yellow
● 'White Bermuda': extremely mild, with thick, flat bulbs; white
● 'Burgundy': good table onion with mild, sweet white flesh, red-skinned

Other Tips

Yes, you can plant a sprouted onion, though you won't get more onions from it. You will get lots of tasty green sprouts, however! Here's how to do it: Fill a pot with potting soil and make a hole in the middle that is about the depth and width of the onion. Place the onion in the hole and cover with soil. Water and put the pot in a sunny spot. Harvest the green sprouts as needed for cooking. If you get a sprout with a flower, wait until the flower goes to seed. Save the seeds for planting in the spring. Practice crop rotation with onions. To make onions taste milder, soak them in milk or pour boiling water over the slices and let stand for 20 minutes. Rinse with cold water.

20 Onions (Spring)

Scallions (also known as green onions, spring onions or salad onions) are vegetables of various Allium onion species. Scallions have a milder taste than most onions. Their close relatives include garlic, shallot, leek, chive, spring onion and Chinese onion.

Sowing Season	Northern Hemisphere (Cold Climate) Apr-Sep	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○		
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○	Maturity Time ○			
Introduction										

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Other Tips

21 Parsnip

The parsnip is a root vegetable closely related to the carrot and parsley. It is a biennial plant usually grown as an annual. Its long, tuberous root has cream-colored skin and flesh; and left in the ground to mature, it becomes sweeter in flavour after winter frosts. In its first growing season, the plant has a rosette of pinnate, mid-green leaves.

Sowing Season	Northern Hemisphere (Cold Climate) Apr-Sep	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Aug-Feb	Southern Hemisphere (Temperate Climate) Jul-Mar	Southern Hemisphere (Subtropical Climate) Feb-Sep	Southern Hemisphere (Tropical Climate) Mar-Aug		
Sowing Guide	Sowing Depth 5mm	Row Spacing 35-50cm	Plant Spacing 5-10cm	Frost Tender / Hardy H	Direct Sow / Raise Seeds D	Germination Time 20-30 Days	Maturity Time 120-140 Days			
Introduction	Parsnips, popular with ancient Greeks and Romans, were brought over to the Americas with the first colonists. Although parsnips are biennials, they are usually grown as an annual vegetable. Here's how to plant and grow parsnips in your garden! Parsnips are a hardy, cool-season crop that is best harvested after a hard frost. Parsnips are not only tasty in soups and stews, but can also be enjoyed by themselves.									

Planting

Always sow fresh seed. Parsnips need a long growing season, so sow as soon as the soil is workable. Loosen the soil to a depth of 12-15 inches and mix in a 2- to 4-inch layer of compost. Sow 2 seeds per inch ½ an inch deep. Seedlings will emerge in 2-3 weeks.

Care

Thin the seedlings to stand 3-6 inches apart. Water during the summer if rainfall is less than 1 inch per week. Always keep the beds free of weeds.

Pests / Diseases

Pests

- Aphids
- Leaf Miners
- Carrot Rust Flies
- Parsnip Canker (all cultivars but 'Tender and True' are resistant to this)

Harvest / Storage

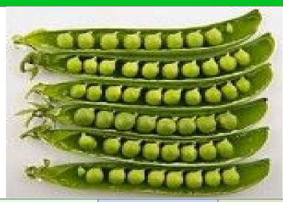
Parsnips mature in about 16 weeks. Leave your parsnips in the ground for a few frosts but harvest before the ground freezes. If you leave them in the ground for the winter, cover them with a thick layer of mulch and harvest immediately after the ground thaws in the spring.

Variants

- 'Avonresister' (short)
- 'Cobham Improved Marrow' (medium)
- 'Gladiator' (long)

Other Tips

22 Pea



The pea is most commonly the small spherical seed or the seed-pod of the pod fruit Pisum sativum. Each pod contains several peas, which can be green or yellow. Pea pods are botanically fruit, since they contain seeds and develop from the ovary of a (pea) flower.

Sowing Season	**Northern Hemisphere (Cold Climate)** Feb-May	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Jan-Oct	**Southern Hemisphere (Temperate Climate)** Feb-Sep	**Southern Hemisphere (Subtropical Climate)** Mar-Jul	**Southern Hemisphere (Tropical Climate)** Mar-Jun			
Sowing Guide	**Sowing Depth** 20-30mm	**Row Spacing** 40-60cm	**Plant Spacing** 5-10cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** D	**Germination Time** 8-16 Days	**Maturity Time** 65-90 Days				
Introduction	Peas are one of the first crops we plant. Plant as soon as the ground can be worked—even if snow falls after you plant them! Here's our guide on how to plant, grow, and harvest peas. There are three varieties of peas that will suit your garden and cooking needs: ● Pisum savitum, which includes both types of garden peas: sweet peas (inedible pods) and snow peas (edible flat pods with small peas inside). ● Pisum macrocarpon, snap peas (edible pods with full-size peas). Pea plants are easy to grow, but have a very limited growing season. Furthermore, peas do not stay fresh long after harvest, so enjoy them while you can!										

Planting

Preparation
To give your plants the best head start, turn over your pea planting beds and add compost or manure to the soil in the fall. Add wood ashes and bonemeal to the soil before planting. Peas need phosphorus and potassium, but excess nitrogen will encourage foliage growth instead of flowers or pods. For tall and vining pea varieties, set up poles or a trellis at the time of planting. Learn how to build supports here.

Planting
Sow seeds outdoors 4 to 6 weeks before your last spring frost date, when soil temperatures reach at least 45°F (7°C). Here are some more tips on when to start planting peas. Plant seeds 1 inch deep (slightly deeper if soil tends to dry out quickly) and about 2 inches apart. Plant in rows spaced 12–24 inches apart. Get peas in the ground while the soil is still cool, but beware of excessive moisture caused by snowmelt or spring rain, as you don't want the seeds to sit in wet soil. It's a delicate balance of proper timing and weather conditions. If your garden tends to stay too wet, consider investing in raised garden beds. Poke in any seeds that get washed out of the soil. (A chopstick is an ideal tool for this.) A blanket of snow won't hurt emerging pea plants, but several days with temperatures in the teens could. Be prepared to plant again if the first peas don't make it. Alternatively, try starting your peas in a cold frame. A second round of peas can be planted in the late summer or early fall, approximately 6–8 weeks before your first fall frost date. Fall plantings are typically not as productive as spring-grown peas, but make for a nice fall snack nonetheless!

Care

Water sparsely unless the plants are wilting. Do not let plants dry out, or no pods will be produced. To avoid disturbing fragile roots, gently remove intrusive weeds by hand. It's best to rotate pea crops every year or two to avoid a build-up of soil-borne diseases. In between pea plantings, plant other vegetables to take advantage of the nitrogen-rich soil. Peas are best grown in temperatures below 70°F (21°C). Once temperatures get above 80°F (27°C), peas tend to stop producing pods or the pods become tough.

Pests / Diseases

- Aphids
- Mexican Bean Beetles
- Woodchucks
- Fusarium Wilt

Harvest / Storage

Keep your peas well picked to encourage more pods to develop. Pick peas in the morning after the dew has dried. They are crispiest then. Always use two hands when you pick peas. Secure the vine with one hand and pull the peas off with your other hand to avoid damaging the plant. Peas can be frozen or kept in the refrigerator for about 5 days. Place in paper bags, then wrap in plastic. If you missed your peas' peak period, you can still pick, dry, and shell them for use in winter soups.

Variants

- 'Snowbird' (snow pea), resistant to fusarium wilt
- 'Sugar Ann' (snap pea), early variety, short vine
- 'Green Arrow' (garden pea), mid-season variety, high yields, resistant to fusarium wilt

Other Tips

23 Potato

The potato is a starchy, tuberous crop from the perennial nightshade Solanum tuberosum. In many contexts, potato refers to the edible tuber, but it can also refer to the plant itself. Common or slang terms include tater and spud.

Sowing Season	Northern Hemisphere (Cold Climate) Feb-Jun	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Aug-Sep	Southern Hemisphere (Temperate Climate) Jan-Feb, Jul-Sep	Southern Hemisphere (Subtropical Climate) Feb-Sep	Southern Hemisphere (Tropical Climate) Feb-Sep			
Sowing Guide	Sowing Depth o	Row Spacing o	Plant Spacing o	Frost Tender / Hardy o	Direct Sow / Raise Seeds o	Germination Time o	Maturity Time o				
Introduction	Wondering how to grow potatoes? We're here to help! The taste and the texture of home-grown potatoes are far superior to those of store-bought spuds, especially the early varieties. Here's how to plant, grow, and harvest potatoes in your garden. Potatoes like cool weather and well-drained, loose soil that is about 45-55°F (7-13°C). In warmer climates, potatoes can be grown as a winter crop.										

Planting

Planting - Time
Potatoes can be started 0 to 2 weeks after last spring frost. You may plant earlier, as soon as soil can be worked, but be aware that some crops may be ruined by a frost or wet soil. However, if have a "late" spring, it's not too late to plant potatoes through April (depending on where you're located). Some folks even plant through June, especially in containers or potato towers.

Planting
With a hoe or round-point shovel, dig a trench about 6 inches wide and 8 inches deep, tapering the bottom to about 3 inches wide. Potatoes are best grown in rows. Space rows about 3 feet apart. Spread and mix in rotted manure or organic compost in the bottom of the trench before planting. (Learn more about soil amendments and preparing soil for planting.) In the trench, place a seed potato piece, cut side down, every 12 to 14 inches and cover with 3 to 4 inches of soil. The best starters are seed potatoes from which eyes (buds) protrude.

(Do not confuse seed potatoes with potato seeds or grocery produce.) Use a clean, sharp paring knife to cut large potatoes into pieces that are roughly the size of a golf ball, making sure that there are at least 2 eyes on each piece. (Potatoes that are smaller than a hen's egg should be planted whole.)

If you are cutting up potato pieces for planting, do so 1 to 2 days ahead of planting. This will give them the chance to "heal" and form a protective layer over the cut surface, improving both moisture retention and rot resistance. 12 to 16 days after planting, when sprouts appear, use a hoe to gently fill in the trench with another 3 to 4 inches of soil, leaving a few inches of the plants exposed. Repeat in several weeks, leaving the soil mounded up 4 to 5 inches above ground level (this is called "hilling"). After the potato plants have emerged, add organic mulch between the rows to conserve moisture, help with weed control, and cool the soil.

Care

Do not allow sunlight to fall on the tubers, which develop under the surface of the soil, or they will turn green. Do the hilling in the morning, when plants are at their tallest. During the heat of the day, plants start drooping. Maintain even moisture, especially from the time when sprouts appear until several weeks after they blossom. The plants need 1 to 2 inches of water per week. If you water too much right after planting and not enough as the potatoes begin to form, the tubers can become misshapen. The last hilling should be done before the potato plants bloom, when the plant is about 6 inches tall. Hoe the dirt up around the base of the plant in order to cover the tubers as well as to support the plant. Hilling keeps the potatoes from getting sunburned, which can cause them to turn green and produce a chemical called solanine. Solanine gives off a bitter taste and is toxic.

Pests / Diseases

- Potato Scab: Most likely caused by a high soil pH. Remember: Potatoes like acidic soil (do not plant in soil with a pH higher than 5.2). Dust seed potatoes with sulphur before planting. Some readers suggest adding pine straw on top of the potatoes when planting for natural anti-bacterial elements.
- Colorado potato beetles need to be hand-picked and predatory birds will often eat them. While they're in the nymph state, they can be controlled with Diatomaceous Earth (food grade) which is a non-toxic way to control pests in the garden. If they continue to be a problem, a few sprays of Spinosad, an organic pesticide, will get rid of the beetles. Always use products at dawn or dusk to avoid harming beneficial insects.
- Aphids
- Flea Beetles
- Early/Late Blight

Harvest / Storage

"New potatoes," which are potatoes that are purposefully harvested early for their smaller size and tender skin, will be ready for harvest 2 to 3 weeks after the plants stop flowering. For mature potatoes, wait 2 to 3 weeks after the foliage has died. New potatoes should not be cured and should be eaten within a few days of harvest, as they will not keep for much longer. Dig potatoes on a dry day. Dig up gently, being careful not to puncture the tubers. Avoid cutting or bruising potato skin. The soil should not be compact, so digging should be easy. If the soil is very wet, let the potatoes air-dry as much as possible before putting them in bags or baskets. For the biggest and best potatoes, harvest only after the plant's foliage has died back. Cut browning foliage to the ground and wait 10 to 14 days before harvesting to allow the potatoes to develop a thick enough skin. Don't wait too long, though, or the potatoes may rot.

Allow freshly dug potatoes to sit in a dry, cool place (45–60°F/7–15°C) for up to two weeks. This allows their skins to cure, which will help them keep for longer. After curing, make sure you brush off any soil clinging to the potatoes, then store them in a cool, somewhat humid, dark place. The ideal temperature for storage is 38 to 40°F (3 to 4°C). Do not store potatoes with apples; the apples' ethylene gas will cause potatoes to spoil. Never store potatoes in the refrigerator. Whether you dig your own potatoes or buy them at a store, don't wash them until right before you use them. Washing potatoes shortens their storage life.

Variants

There are more than 100 varieties of potatoes. Tan-skinned and red-skinned varieties with white flesh are the most common in home gardens.

Early Varieties
- ‘Irish Cobbler’: tan skin, irregular shape
- ‘Norland’: red skin, resistant to potato scab
- ‘Mountain Rose’: red skin and pink flesh, resistant to some viruses

Mid-Season Varieties
- ‘Red Pontiac’: red skin, deep eyes
- ‘Viking’: red skin, very productive
- ‘Chieftan’: red skin, resistant to potato scab, stores well

Late Varieties
- ‘Katahdin’: tan skin, resistant to some viruses
- ‘Kennebec’: tan skin, resistant to some viruses and late blight
- ‘Elba’: tan skin, large round tubers, resistant to blight and potato scab

Other Tips

If your garden soil is very rocky, put the seed potato pieces directly on the ground. Sprinkle with a mix of soil and compost. Cover them with straw or leaves, hilling the material up as the potatoes grow.

24 Pumpkin

A pumpkin is a cultivar of a squash plant, most commonly of Cucurbita pepo, that is round, with smooth, slightly ribbed skin, and deep yellow to orange coloration. The thick shell contains the seeds and pulp.

Sowing Season	**Northern Hemisphere (Cold Climate)** Apr-Jun	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Oct-Dec	**Southern Hemisphere (Temperate Climate)** Sep-Dec	**Southern Hemisphere (Subtropical Climate)** Aug-Mar	**Southern Hemisphere (Tropical Climate)** Feb-Nov			
Sowing Guide	**Sowing Depth** 15-20mm	**Row Spacing** 100-200cm	**Plant Spacing** 100-150cm	**Frost Tender / Hardy** FT	**Direct Sow / Raise Seeds** D	**Germination Time** 8-16 Days	**Maturity Time** 100-140 Days				
Introduction	Note that pumpkins do require a lot of food and a long growing season (generally from 75 to 100 frost-free days) so you need to plant them by late May in northern locations to early July in extremely southern states. Do not plant this tender vegetable until all danger of frost has passed and the soil is warmed, as the seedlings will be injured or rot. Find your local frost dates here. Pumpkins are easy to maintain if you have the space.										

Planting

Site Selection
Pick a site with full sun (to light shade) and lots of space for sprawling vines. Vine varieties need 50 to 100 square feet per hill. However, if your garden space is limited, no worries! Plant pumpkins at the edge of the garden and direct vine growth across the lawn or sidewalk. The vines will only be bothersome for a few weeks. You can also grow pumpkins in big 5 to 10 gallon buckets! Or, try miniature varieties. Pumpkins are big, greedy feeders. They prefer very rich soil that is well-drained and not too soggy. Mix lots of compost and aged mature into the planting site before you sow seeds or transplant.

Planting
Pumpkins do best when the seeds are planted directly in the ground. If your growing season is very short, seed indoors in peat pots about 2 to 4 weeks before last spring frost. Be sure to harden off before transplanting. Wait until the plant soil is 70°F or more before sowing seeds. Optimum soil temperature is 95°F. Pumpkins are very sensitive to the cold. Plant seeds in rows or “pumpkin hills,” which are the size of small pitcher mounds. With hills, the soil will warm more quickly and the seeds will germinate faster. This also helps with drainage and pest control. Prepare the hills in advance with an abundance of old manure dug deep into the ground (12 to 15 inches). If you don’t have manure, loosen the soil and mix in a 2- to 4-inch layer of compost. Plant the seeds 1 inch deep into the hills (4 to 5 seeds per hill). Space hills 4 to 8 feet apart. Your plants should germinate in less than a week with the right soil temperature (70 degrees F) and emerge in 5 to 10 days. When the plants are 2 to 3 inches tall, thin to 2 to 3 plants per hill by snipping off unwanted plants without disturbing the roots of the remaining ones. In rows, sow seeds 6 to 12 inches apart in rows 6 to 10 feet apart. Snip off plants to thin to one plant every 18 to 36 inches.

Care

Use row covers to protect plants early in the season and to prevent insect problems. However, remember to remove covers before flowering to allow pollination by insects! Pumpkins are very thirsty plants and need lots of water. Water one inch per week. Water deeply, especially during fruit set. When watering: Try to keep foliage and fruit dry unless it’s a sunny day. Dampness will make rot and other diseases more likely. Add mulch around your pumpkins to keep in moisture, suppress weeks, and discourage pests. Remember that pumpkins are tender from planting to harvest. Control weeds with mulch. Do not overcultivate, or their very shallow roots may be damaged. Most small vine varieties can be trained up a trellis.

Larger varieties can be trained upward on a trellis, too—though it is an engineering challenge to support the fruit—usually with netting or old stockings. If your first flowers aren’t forming fruits, that’s normal. Both male and female blossoms need to open. Be patient. Bees are essential for pollination, so be mindful when using insecticides to kill pests. If you must use, apply only in the late afternoon or early evening, when blossoms are closed for the day. To attract more bees, try placing a bee house in your garden. Pumpkin vines, though obstinate, are very delicate. Take care not to damage vines, which reduces the quality of fruit.

Pumpkins are HEAVY feeders. Regular treatments of manure or compost mixed with water will sustain good growth. Fertilize on a regular basis. Use a high nitrogen formula in early plant growth. Fertilize when plants are about one foot tall, just before vines begin to run. Switch over to a fertilizer high in phosphorous just before the blooming period. Pinch off the fuzzy ends of each vine after a few pumpkins have formed. This will stop vine growth so that the plant’s energies are focused on the fruit. Pruning the vines may help with space, as well as allow the plant’s energy to be concentrated on the remaining vines and fruit. Gardeners who are looking for a “prize for size” pumpkin might select the two or three prime candidates and remove all other fruit and vines. As the fruit develops, they should be turned (with great care not to hurt the vine or stem) to encourage an even shape. Place a thin board or heavy cardboard under ripening melons and pumpkins to avoid decay and insect damage.

Pests / Diseases

- Squash bugs and cucumber beetles are common, especially later in summer.
- Aphids
- Squash Vine Borer
- Powdery Mildew
- Anthracnose

Poor light, too much fertilizer, poor weather at bloom time, and reduced pollinating insect activity can negatively impact fruit set.

Harvest / Storage

Your best bet is to harvest pumpkins when they are mature. They will keep best this way. Do not pick pumpkins off the vine because they have reached your desired size. If you want small pumpkins, buy a small variety. A pumpkin is ripening when its skin turns a deep, solid colour (orange for most varieties). When you thumb the pumpkin, the rind will feel hard and it will sound hollow. Press your nail into the pumpkin's skin; if it resists puncture, it is ripe. Harvest pumpkins and winter squashes on a dry day after the plants have died back and the skins are hard. To slow decay, leave an inch or two of stem on pumpkins and winter squash when harvesting them. To harvest the pumpkin, cut the fruit off the vine carefully with a sharp knife or pruners; do not tear. Be sure not to cut too close to the pumpkin; a liberal amount of stem (3 to 4 inches) will increase the pumpkin's keeping time.

Handle pumpkins very gently or they may bruise. Pumpkins should be cured in the sun for about a week to toughen the skin and then stored in a cool, dry bedroom, cellar, or root cellar—anywhere around 55°F. If you get a lot of vines and flowers, but no pumpkins, you need more bees in your garden to pollinate the flowers. Grow some colourful flowers next to your pumpkin patch this year and you may get more bees and butterflies! The yellowish pumpkins will soon come handy to give the cows. They help out the fall feed, and if there is anything better for cows in milk we should like to know it. If you're saving seeds, they should last for 6 years.

Variants

- Miniature pumpkins: 'Jack Be Little' miniature pumpkin variety, perfect for a holiday table. Vine variety. Days to maturity: 90 to 100 days. 'We-B-Little' is an All-America Selection winner, and 'Munchkin' is another great miniature pumpkin. Miniature pumpkins are very productive and easy to grow, sometimes producing up to a dozen fruits per plant.
- Pumpkins for carving: 'Autumn Gold' great for carving, decorating. All-America Selection winner. Vine variety. Excellent for Jack-o-Lanterns. Days to maturity are generally 100 to 120 days.
- Giant pumpkins: 'Dill's Atlantic Giant' jumbo variety can grow to 200 pounds. Great for those who want to grow a giant pumpkin. Vine will spread to 25 feet, so space is a must. Days to maturity are 130 to 160 days, so plant early! Thin to the best one or two plants. Feed heavily but keep cultivation shallow. Remove first 2 or 3 female flowers after the plants start to bloom so that the plants grow larger with more leaf surface before setting fruit. Allow a single fruit to develop and pick off all female flowers that develop after this fruit has set on the plant. Take care that the vine doesn't root down near the joints to avoid breakage.

- Perfect pumpkins for pies: 'Sugar Treat' semi-bush hybrid. Ideal for cooking and baking. Days to maturity are generally 100 to 120 days. 'Hijinks' and 'Baby Bear' are both All-America Selection winners and have sweet flesh for pumpkin pie. 'Cinderella's Carriage' is also perfect for pies or soups. 'Peanut Pumpkin' also produces very sweet flesh and can be great in pumpkin pie or pumpkin puree.
- Colourful pumpkins: 'Jarrahdale' has blue-green skin and makes for great decorations. 'Pepitas Pumpkin' is orange and green, and 'Super Moon' is a large white pumpkin.

Other Tips

Pumpkins have been grown in North America for almost 5,000 years.

25 Radish

The radish (Raphanus raphanistrum subsp. sativus) is an edible root vegetable of the Brassicaceae family that was domesticated in Europe in pre-Roman times. Radishes are grown and consumed throughout the world, being mostly eaten raw as a crunchy salad vegetable. They have numerous varieties, varying in size, flavour, colour, and length of time they take to mature.

Sowing Season	Northern Hemisphere (Cold Climate)	Northern Hemisphere (Temperate Climate)	Northern Hemisphere (Subtropical Climate)	Northern Hemisphere (Tropical Climate)	Southern Hemisphere (Cold Climate)	Southern Hemisphere (Temperate Climate)	Southern Hemisphere (Subtropical Climate)	Southern Hemisphere (Tropical Climate)			
	Mar-Oct	o	o	o	Aug-Jun	All Year	All Year	All Year			

Sowing Guide	Sowing Depth	Row Spacing	Plant Spacing	Frost Tender / Hardy	Direct Sow / Raise Seeds	Germination Time	Maturity Time				
	15mm	20-30cm	3-7cm	H	D	5-10 Days	40-60 Days				

Introduction

Radishes are a hardy, easy-to-grow root vegetable that can be planted multiple times in a growing season. Here's how to plant and grow radishes in your garden! Radish seeds can be planted in both the spring and the fall, but growing should be suspended in the height of summer, when temperatures are typically too hot. Hot temperatures may cause radishes to bolt, making them essentially useless. Otherwise, radishes are one of the easiest vegetables to grow.

Planting

Site Selection

Plant in a sunny spot. If radishes are planted in too much shade—or even where neighbouring vegetable plants shade them—they will put all their energy into producing larger leaves. Like carrots, radish plants are primarily grown for their roots. Though the soil needs to be rich in organic matter, it should not be compacted. If your soil is more clay-like, mix in some sand to loosen it and improve drainage. If your soil isn't rich in organic matter, incorporate a few inches of aged compost or all-purpose fertilizer (see packaging for amount) into the planting site as soon as the soil is workable. Till your garden bed to remove any rocks or dirt clods before planting. Practice three-year crop rotation. In other words, only plant radishes in the same spot every third year. This will help prevent diseases from affecting your crop.

Planting

For a spring planting, sow seeds 4–6 weeks before the average date of last frost. It's best to plant radish seeds directly in the garden so as not to disturb their roots. Directly sow seeds outdoors ½ to 1 inch deep and 1 inch apart in rows 12 inches apart. Plant another round of seeds every 10 days or so—while weather is still cool—for a continuous harvest of radishes in the late spring and early summer. Plan on a fall planting. You can plant radishes later than any other root crop in late summer or early fall and still get a harvest. Sow seeds 4–6 weeks before the first fall frost.

Care

Thin radishes to about 2 inches apart when the plants are a week old. Crowded plants do not grow well. Consistent, even moisture is key. Keep soil evenly moist but not waterlogged. A drip irrigation system is a great way to achieve this. Putting a thin layer of mulch around the radishes can help retain moisture in dry conditions.

Pests / Diseases

- Cabbage Root Maggot
- Clubroot
- Weeds: Weeds will quickly crowd out radishes, so keep the bed weed-free.

Harvest / Storage

Radishes will be ready to harvest quite rapidly, as soon as three weeks after planting for some varieties. For most varieties, harvest when roots are approximately 1 inch in diameter at the soil surface. Pull one out and test it before harvesting the rest! Do not leave radishes in the ground long after their mature stage; their condition will deteriorate quickly. Cut the tops and the thin root tail off, wash the radishes, and dry them thoroughly. Store in plastic bags in the refrigerator. Radish greens can be stored separately for up to three days.

Variants

- ‘French Breakfast’: a late-maturing variety that does OK in moderate heat.
- ‘Watermelon’: a mild, sweet radish with white skin and a pinkish centre.
- ‘Burpee White’: spring variety, white skin.
- ‘Daikon’: A white, Japanese, “winter radish” that gets large (up to 16 inches long). Best grown in cooler climates or during the cooler ends of the growing season.
- ‘Rat’s Tail’: These radishes are grown for their seedpods rather than their root. The pods offer a tangy, spicy flavour stronger than your usual radish.
- ‘Dragon’s Tail’: Like ‘Rat’s Tail’, these radishes are grown for their seedpods. The pods of this variety are thinner and turn a lovely purple colour.

Other Tips

Radish seeds have a fairly long shelf life. Don’t be afraid to plant radish seeds that are up to five years old. All may not germinate, but you’ll have plenty that will.

26 Spinach

Spinach (Spinacia oleracea) is an edible flowering plant in the family Amaranthaceae native to central and western Asia. Its leaves are commonly eaten as a vegetable, either fresh, frozen, canned, chipped, or dehydrated.
It is an annual plant (rarely biennial) growing as tall as 30 cm (1 ft). Spinach may overwinter in temperate regions.

Sowing Season	Northern Hemisphere (Cold Climate) Aug-Feb	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Feb-Nov	Southern Hemisphere (Temperate Climate) Feb-Sep	Southern Hemisphere (Subtropical Climate) Mar-Jul	Southern Hemisphere (Tropical Climate) Apr-Jun			
Sowing Guide	Sowing Depth 8mm	Row Spacing 40-50cm	Plant Spacing 25-35cm	Frost Tender / Hardy H	Direct Sow / Raise Seeds D	Germination Time 10-25 Days	Maturity Time 50-70 Days				
Introduction	Spinach, a super–cold-hardy vegetable, is a tender-leafed crop that can be planted in very early spring, as well as in fall and winter. Spinach has similar growing conditions and requirements as lettuce, but it is more versatile in both its nutrition and its ability to be eaten raw or cooked. It is higher in iron, calcium, and vitamins than most cultivated greens, and one of the best sources of vitamins A, B, and C.										

Planting

When to Plant
Spring plantings can be made as soon as the soil can be properly worked. In order to give spinach the required six weeks of cool weather from seeding to harvest, it’s important to seed as soon as you can. For proper germination, soil should not be warmer than 70°F (21°C). Successive plantings should be made every two weeks during early spring. Gardeners in northern climates can harvest early-spring spinach if it’s planted just before the cold weather arrives in fall. Protect the young plants with a cold frame or thick mulch through the winter, then remove the protection when soil temperature in your area reaches 40°F (5°F). Common spinach cannot grow in midsummer. (For a summer harvest, try New Zealand Spinach or Malabar Spinach, two similar leafy greens that are more heat tolerant.) If you live in a place with mild winters, you can also plant in the fall. Wait to plant until soil temps are cool enough.

Planting
Select a planting site with full sun to light shade and well-drained soil. Prepare the garden soil with aged manure about a week before planting, or, you may wish to prepare your spot in the fall so that you can sow the seeds outdoors in early spring as soon as the ground thaws. Although seeds can be started indoors, it is not recommended, as seedlings are difficult to transplant. Sow seeds ½-inch to 1-inch deep, covering lightly with soil. Sow about 12 seeds per foot of row, or sprinkle over a wide row or bed. Water the new plants well in the spring.

Care

Fertilize only if necessary due to slow growth, or use as a supplement if your soil pH is inadequate. When seedlings sprout to about two inches, thin them to 3-4 inches apart. Beyond thinning, no cultivation is necessary. Roots are shallow and easily damaged. Keep soil moist with mulching. Water regularly. Spinach can tolerate the cold; it can survive a frost and temps down to 15°F (-9°C).

Pests / Diseases

- Leaf Miners: Radishes attract leaf miners away from spinach. The damage that the leaf miners do to radish leaves doesn’t prevent the radishes from growing underground.
- Bolting
- Mosaic Virus/Blight
- Downy Mildew

Harvest / Storage

Keep an eye on your plants. Harvest when leaves reach the desired size. Don’t wait too long to harvest or wait for larger leaves; bitterness will set in quickly after maturity. The whole plant can be harvested at once, and cut at the base, or leaves may be picked off plants one layer at a time, giving inner layers more time to develop.

Variants

- ‘Giant Nobel’ is a plain leaf variety.
- ‘Winter Bloomsdale’ is a crinkled-leaf, fall variety, tolerant to mosaic viruses.
- ‘Tyee’ can be planted in spring or fall, and is resistant to downy mildew.
- Malabar Spinach (Basella alba) and New Zealand Spinach (Tetragonia tetragonoides) are two heat-tolerant leafy greens that are similar to common spinach. Grow them in the summer, when common spinach can’t take the heat.

Other Tips

Scatter spinach or lettuce seeds around emerging bulb foliage to make wise use of your garden space, and have a leafy green crop at the ready to cover the bare spots left by deadheaded spring flowers. A pinch of baking soda in the cooking water keeps spinach greener. Spinach boosts your brainpower, but it can hinder iron absorption. For better absorption of iron, eat spinach with orange slices.

27 Squash / Zucchini

Cucurbita (Latin for gourd) is a genus of herbaceous vines in the gourd family, Cucurbitaceae, also known as cucurbits, native to the Andes and Mesoamerica. Five species are grown worldwide for their edible fruit, variously known as squash, pumpkin, or gourd depending on species, variety, and local parlance, and for their seeds.

Sowing Season	Northern Hemisphere (Cold Climate) Mar-Jun	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Sep-Jan	Southern Hemisphere (Subtropical Climate) Aug-Feb	Southern Hemisphere (Tropical Climate) Feb-Nov			
Sowing Guide	Sowing Depth 15-25mm	Row Spacing 90-100cm	Plant Spacing 60-100cm	Frost Tender / Hardy FT	Direct Sow / Raise Seeds D	Germination Time 6-18 Days	Maturity Time 50-90 Days				
Introduction	Squash, especially zucchini, are very prolific producers! Easy to grow, each plant will produce several squash a day during peak season. Make sure you harvest summer squash when tender and still immature! Squash are generally divided into two categories based on when they’re harvested and how they’re used: Summer squash are harvested in the summer before they reach full maturity. Because they’re harvested early, their skin is edible and they have a relatively short shelf life. Summer squash varieties include zucchini, straightneck squash (a.k.a. “yellow summer squash”), and crookneck squash. Winter squash are harvested in autumn after or just before they reach full maturity. This leaves their skin inedible, but gives them a longer shelf life (some varieties are capable of keeping through the winter—hence the name “winter squash”). Winter squash varieties include pumpkins, butternut squash, spaghetti squash, and acorn squash.										

Planting

Planting Timing
We generally recommend direct-seeding for squash because they do not always transplant well. The soil needs to be warm (at least 60°F/16°C at a two-inch depth), so plant summer squash after spring (cool-season) crops, like peas, lettuce, and spinach—from about one week after the last spring frost to midsummer. If you wish to start seeds indoors due to a short gardening season, sow 2 to 4 weeks before your last spring frost in peat pots. If you do transplant, be very gentle with the roots. To get an early start when soil temperatures are not yet ideal, warm the soil with black plastic mulch once the soil has been prepared in early spring. In fact, waiting to plant a few seeds in midsummer will help avoid problems from squash vine borers and other pests and diseases common earlier in the season.

Planting Site
The planting site needs to receive full sun; the soil should be moist and well-drained, but not soggy. Squash plants are heavy feeders. Work compost and plenty of organic matter into the soil before planting for a rich soil base. Most summer squash now come in bush varieties, which take up less space, but winter squash are vining plants that need more space. Bush varieties will need to be thinned in early stages of development to about 8 to 12 inches apart.

Planting
To germinate outside, use a cloche, row cover, or frame protection in cold climates for the first few weeks. Plant seeds about 1-inch deep and 2 to 3 feet apart in a traditional garden bed. Alternatively, plant as a “hill” of 3 or 4 seeds sown close together on a small mound; this is helpful in northern climates, as the soil is warmer off the ground. Allow 5 to 6 feet between hills.

Care

Mulch around plants to protect shallow roots, discourage weeds, and retain moisture. When the first blooms appear, apply a small amount of fertilizer as a side dress application. If your squash blooms flowers but never bears actual fruit, or it bears fruit that stops growing when it’s very small, then it’s a pollination issue. For all types of squash, frequent and consistent watering is important for good fruit development. Water most diligently when fruits form and throughout their growth period. Water deeply once a week, applying at least one inch of water. Do not water shallowly; the soil needs to be moist 4 inches down. After harvest begins, fertilize occasionally for vigorous growth and lots of fruits. If your fruits are misshapen, they might not have received enough water or fertilization.

Pests / Diseases

There are a couple of challenging pests, especially the squash vine borer and the squash bug. The best solution is to get ahead of them before they arrive.
- Cucumber Beetle
- Blossom-End Rot: If the blossom ends of your squash turn black and rot, then your squash have blossom-end rot. This condition is caused by uneven soil moisture levels, often wide fluctuations between wet and dry soil. It can also be caused by calcium levels. To correct the problem, water deeply and apply a thick mulch over the soil surface to keep evaporation at a minimum. Keep the soil evenly moist like a wrung out sponge, not wet and not completely dried out.
- Stink Bug: If your squash looks distorted with a dimpled area, the stink bugs overwintered in your yard. You need to spray or dust with approved insecticides and hand pick in the morning. Clean up nearby weeds and garden debris at the end of the season to avoid this problem.
- Aphids

Harvest / Storage

Harvesting Summer Squash
Harvest summer squash when small and tender for best flavour. You may harvest as "baby squash" or when mature (6 to 8 inches long). Large squash have very little taste. Most varieties average 60 days to maturity, and are ready as soon as a week after flowering. Check plants everyday for new produce. Once squash starts producing, you'll be picking every day! Cut the fruit off the vine rather than breaking them off. Leave at least an inch of stem on the fruit. Use a sharp knife. Should you miss a picking or two, remove the overripe squash as soon as possible to reduce demands on the plants for moisture and nutrients. Summer squash is very susceptible to frost and heat damage, so you do want to pick them all before the first fall frosts arrive. Fresh summer squash can be stored in the refrigerator for up to ten days.

Harvesting Winter Squash
Harvest winter squash when the rind is hard and deep in colour, usually late September through October. Winter squash can be stored in a cool, dark place until needed. Many varieties will last for most of the winter (except for acorn squash, which do not keep for more than a few weeks). If you have a cool bedroom, stashing them under the bed works well. They like a temperature of about 50 to 65°F (10 to 18°C). Pull up the vines and compost them after you've picked everything or after a frost has killed them. Then till the soil to stir up the insects a bit.

Variants

- 'Goldbar' (yellow summer squash)
- 'Cocozelle' (zucchini, summer) dark green, slender
- 'Butterbush' (butternut, winter)
- 'Cream of the Crop' (acorn hybrid, winter)

Other Tips

Squash flowers are edible and make a tasty treat when fried in a light batter. Pumpkins and other squashes are nutritional powerhouses.

28 Tomato

The tomato is the edible, often red, berry of the nightshade Solanum lycopersicum, commonly known as a tomato plant. The tomato is consumed in diverse ways, raw or cooked, as an ingredient in many dishes, sauces, salads, and drinks. While tomatoes are fruits botanically classified as berries, they are considered culinarily as vegetables, to be utilized as an ingredient or side dish for savoury meals.

Sowing Season	Northern Hemisphere (Cold Climate) Mar-May	Northern Hemisphere (Temperate Climate) o	Northern Hemisphere (Subtropical Climate) o	Northern Hemisphere (Tropical Climate) o	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Aug-Dec	Southern Hemisphere (Subtropical Climate) Aug-Mar	Southern Hemisphere (Tropical Climate) Feb-Jul			
Sowing Guide	Sowing Depth 5mm	Row Spacing 50-70cm	Plant Spacing 40-60cm	Frost Tender / Hardy FT	Direct Sow / Raise Seeds R/D	Germination Time 10-20 Days	Maturity Time 80-120 Days				
Introduction	America's favourite vegetable is fairly easy to grow and will produce a bumper crop with proper care. Its uses are numerous, however, tomato plants are susceptible to pests and diseases so proper plant care is important. Though we technically eat the fruit of the tomato plant, the tomato is typically treated as a vegetable in eating and cooking and, thus, commonly categorized as such.										

Planting

If you're starting tomatoes from seed (versus transplants), you'll want to start your seeds indoors 6 to 8 weeks before the average last spring frost date. Transplant seedlings after the last spring frost when the soil has warmed. Select a site with full sun and well-drained soil. For northern regions, it is VERY important that your site receives at least 6 hours of daily sunlight. For southern regions, light afternoon shade will help tomatoes survive and thrive. Two weeks before transplanting tomato plants outdoors, dig soil to about 1 foot deep and mix in aged manure or compost. Some sort of support system is recommended, but sprawling plants can also produce fine crops if you have the space and if the weather cooperates.

Harden off seedlings or transplants for a week before planting in the garden. Set young plants outdoors in the shade for a couple of hours the first day, gradually increasing the amount of time the plants are outside each day to include some direct sunlight. Plant transplants about 2 feet apart. Place tomato stakes or cages in the soil at the time of planting to avoid damaging roots later on. Staking keeps developing tomato fruit off the ground, while caging lets the plant hold itself upright. Pinch off a few of the lower branches on transplants, and plant the root ball deep enough so that the remaining lowest leaves are just above the surface of the soil. If your transplants are leggy, you can remedy this by burying up to ⅔ of the plant, including the lower sets of leaves. Tomato stems have the ability to grow roots from the buried stems. Water well to reduce shock to the roots.

Growing in Containers
Use a large pot or container with drainage holes in the bottom. Use loose, well-draining soil. We recommend a good potting mix with added organic matter. Plant one tomato plant per pot. Choose from bush or dwarf varieties; many cherry tomatoes grow well in pots. Taller varieties may need to be staked. Place the pot in a sunny spot with 6 to 8 hours of full sun a day. Keep soil moist. Containers will dry out more quickly than the garden soil, so check daily and provide extra water during a heat wave.

Care

Water generously the first few days. Water well throughout the growing season, about 2 inches per week during the summer. Water deeply for a strong root system. Water in the early morning. This gives plant the moisture it needs to make it through a hot day. Avoid watering late afternoon or evening. Mulch five weeks after transplanting to retain moisture and to control weeds. Mulch also keeps soil from splashing the lower tomato leaves. To help tomatoes through periods of drought, find some flat rocks and place one next to each plant. The rocks prevent water from evaporating from the soil. Side dress plants with fertilizer or compost every two weeks starting when the tomato fruits are about 1 inch in diameter.

If using stakes, prune plants by pinching off suckers (side stems) so that only a couple of branches are growing from each plant. The suckers grow between the branch and the main stem. Tie growing stems to stakes with twine or soft string. As the plants grow, trim all the lower leaves off the bottom 12 inches of the stem. This helps to keep diseases from spreading from the soil to foliage. Practice crop rotation from year to year to prevent diseases that may have overwintered.

Pests / Diseases

● Aphids
● Flea Beetles
● Tomato Hornworm
● Whiteflies
● Blossom-End Rot
● Late Blight is a fungal disease that can strike during any part of the growing season. It will cause grey, mouldy spots on leaves and fruit which later turn brown. The disease is spread and supported by persistent damp weather. This disease will overwinter, so all infected plants should be destroyed.
● Mosaic Virus creates distorted leaves and causes young growth to be narrow and twisted, and the leaves become mottled with yellow. Unfortunately, infected plants should be destroyed (but don't put them in your compost pile).
● Cracking: When fruit growth is too rapid, the skin will crack. This usually occurs due to uneven watering or uneven moisture from weather conditions (very rainy periods mixed with dry periods). Keep moisture levels constant with consistent watering and mulching.

Harvest / Storage

Leave your tomatoes on the vine as long as possible. If any fall off before they appear ripe, place them in a paper bag with the stem up and store them in a cool, dark place. Never place tomatoes on a sunny windowsill to ripen; they may rot before they are ripe! The perfect tomato for picking will be firm and very red in colour, regardless of size, with perhaps some yellow remaining around the stem. If you grow orange, yellow or any other colour tomato, wait for the tomato to turn the correct colour.

If your tomato plant still has fruit when the first hard frost threatens, pull up the entire plant and hang it upside down in the basement or garage. Pick tomatoes as they ripen. If temperatures start to drop and your tomatoes aren't ripening, watch this video for tips. Never refrigerate fresh tomatoes. Doing so spoils the flavour and texture that make up that garden tomato taste. To freeze, core fresh unblemished tomatoes and place them whole in freezer bags or containers. Seal, label, and freeze. The skins will slip off when they defrost. You can harvest seeds from some tomato varieties.

Variants

Tomatoes grow in all sizes, from tiny "currant" to "cherry" to large "beefsteak." There are thousands of tomato varieties to suit different climates and tastes.
Early Varieties (60 or fewer days to harvest)
● 'Early Cascade': trailing plant, large fruit clusters
● 'Early Girl': one of the earliest tomatoes, produces through the summer
Mid-season Varieties (70 to 80 days to harvest)
● 'Floramerica': firm, deep red flesh, strong plant
● 'Fantastic': meaty rich flavour, heavy yields, crack resistant
Late-season Varieties (80 days or more to harvest)
● 'Amish Paste': Large paste tomatoes, good slicers, heavy yields
● 'Brandywine': A beefsteak with perfect acid-sweet combination, many variants are available

Cherry Tomatoes
● 'Matt's Wild Cherry': bright red tomatoes, foolproof in any climate, bears abundant fruit in high or low temps and in rain or drought
● 'Sun Gold': golden orange tomatoes, very sweet yet tart flavour, huge clusters

Other Tips

29 Turnip

The turnip or white turnip is a root vegetable commonly grown in temperate climates worldwide for its white, bulbous taproot. Small, tender varieties are grown for human consumption, while larger varieties are grown as feed for livestock.

Sowing Season	**Northern Hemisphere (Cold Climate)** Jan-Mar, Jul-Aug	**Northern Hemisphere (Temperate Climate)** o	**Northern Hemisphere (Subtropical Climate)** o	**Northern Hemisphere (Tropical Climate)** o	**Southern Hemisphere (Cold Climate)** Sep-May	**Southern Hemisphere (Temperate Climate)** Sep-May	**Southern Hemisphere (Subtropical Climate)** Aug-May	**Southern Hemisphere (Tropical Climate)** Mar-Jun		
Sowing Guide	**Sowing Depth** 10mm	**Row Spacing** 20-40cm	**Plant Spacing** 7-15cm	**Frost Tender / Hardy** H	**Direct Sow / Raise Seeds** D	**Germination Time** 6-12 Days	**Maturity Time** 50-90 Days			
Introduction	Turnips are cool-weather vegetables that can be grown both in spring and fall, avoiding the hot summer months. They mature very rapidly and you can enjoy both the greens and the roots. Try this ancient root vegetable that's been grown for over 3,000 years. Turnips are hardy biennials usually grown as annuals by the home gardener. We enjoy them most as an autumn crop, seeded in late summer, because they are usually sweeter and more tender than spring crops—and pests are less problematic. What's wonderful about turnips is that they germinate in only a few days. Within a month, you can enjoy their bright greens, and within a second month, you can eat the swollen roots. Try them as a substitute for potatoes.									

Planting

When to Plant
For a late spring harvest, sow turnip seeds directly in the garden as soon as the ground is workable, usually 2 to 3 weeks before the average last frost date. For an autumn harvest, sow turnips in late summer. Sow after summer crops of onions, squash, beans or sweet corn. You can also sow seeds in early autumn for a late autumn harvest.

Planting
Turnips are seeded directly into the garden; they do not transplant well. Select a site that gets full sun. Soil should be well-draining and loosened to a depth of 12 to 15 inches. In advance, mix in a 2- to 4-inch layer of compost or aged manure. Add sand to heavy, clay soil. Scatter turnip seed. Do not cover the seeds with more than ½ an inch of soil. Once seedlings are 4 inches high, thin them to 4 to 6 inches apart. Space wide rows 12 inches apart. Thin turnips grown for greens from 2 to 3 inches apart (or, some of us don't bother thinning for greens at all).

Care

Keep the beds weed free. Mulch heavily. Turnips do not need much care, but consistent soil moisture is important. Keep soil lightly moist, watering at a rate of 1 inch per week to prevent the roots from becoming tough and bitter.

Pests / Diseases

- Root Maggots
- Flea Beetles
- Powdery Mildew
- Downy Mildew
- Aphids

Harvest / Storage

Harvest some turnips very early as turnip greens. The leaves taste best when young and tender. Harvest early types after about 5 weeks; maincrop types after 6 to 10 weeks. Harvest turnips at any size you wish, however, the small, young turnips are nicer and more tender. For fall turnips, consider harvesting just after a light frost (but before a hard freeze) for a sweeter taste. Store for up to 3 or 4 months in a cool outdoor place covered with straw.

Variants

- 'Just Right'
- 'Yellow Globe' have wonderful golden turnip roots, great for roasting.
- 'Purple Top White Globe' are great for an extended production of greens.

Recommended for the Upper Midwest and Canada are cold hardy varieties 'Green Globe' and 'York Globe.' If you are growing turnips primarily for their greens, most any turnip variety will do.

Other Tips

Young turnips are so tender that you can peel and eat them just as you would an apple. Turnips are often confused with rutabagas because they are similar, and people like to plant them together. The two root vegetables grow well under the same conditions, but rutabagas take about four weeks longer to mature. Many turnips are grown not for the root itself but for the turnip greens, which can be cooked or used raw in salads. Younger turnip greens will not be as bitter as mature leaves. If you're wondering how to cook turnips, you're not alone. Both the turnip greens and roots are very nutritious. Turnip roots should generally be peeled and sliced before using them. Both turnip roots and turnip greens are usually cooked, but can also be enjoyed raw.

5 Fruit

How to grow a variety of fruits from either a seed, cutting or young tree.

Subheadings

		1. Apple	**2. Avocado**	**3. Blackberry**	**4. Blueberry**		
		5. Cherry	**6. Fig**	**7. Grapefruit**	**8. Grapes**		
		9. Lemon	**10. Lime**	**11. Mango**	**12. Orange**		
		13. Peach	**14. Pear**	**15. Pineapple**	**16. Plum**		
		17. Raspberry	**18. Strawberry**	**19. Tangerine**	**20. Watermelon**		

1 Apple

An apple is a sweet, edible fruit produced by an apple tree (Malus pumila). Apple trees are cultivated worldwide, and are the most widely grown species in the genus Malus. The tree originated in Central Asia, where its wild ancestor, Malus sieversii, is still found today. The apple is a deciduous tree, generally standing 6 to 15 ft (1.8 to 4.6 m) tall in cultivation and up to 30 ft (9.1 m) in the wild. When cultivated, the size, shape and branch density are determined by rootstock selection and trimming method. The leaves are alternately arranged dark green-collared simple ovals with serrated margins and slightly downy undersides. Blossoms are produced in spring simultaneously with the budding of the leaves, and are produced on spurs and some long shoots. The 3 to 4 cm (1.2 to 1.6 in) flowers are white with a pink tinge that gradually fades, five petaled, with an inflorescence consisting of a cyme with 4–6 flowers.

The central flower of the inflorescence is called the "king bloom"; it opens first, and can develop a larger fruit. The fruit matures in late summer or autumn, and cultivars exist with a wide range of sizes. Commercial growers aim to produce an apple that is 2 3⁄4 to 3 1/4 in (7.0 to 8.3 cm) in diameter, due to market preference. Some consumers, especially those in Japan, prefer a larger apple, while apples below 2 1/4 in (5.7 cm) are generally used for making juice and have little fresh market value. The skin of ripe apples is generally red, yellow, green, pink, or russetted although many bi- or tri-collared cultivars may be found. The skin may also be wholly or partly russeted i.e. rough and brown. The skin is covered in a protective layer of epicuticular wax. The exocarp (flesh) is generally pale yellowish-white, though pink or yellow exocarps also occur.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy	Soil pH Neutral	Bloom Time Summer, Fall	Flower Colour ○	Hardiness Zones ○					
Introduction	How are your apple trees growing? Don't forget to water young trees as they establish their root systems! Here's more advice on planting, growing, and harvesting apples. Apples trees aren't just for people with acres upon acres of land. Even in a small space, you can plant a hedge of dwarf apple trees or an apple espalier and yield a successful crop.										

Planting

Climate Consideration

Not every apple grows everywhere. Each variety has a specific number of days needed for fruit maturity. Tree tags don't always tell you where the variety grows best, but many catalogues do. Also check with your local Cooperative Extension Service for a recommendation specific to your area. As a general rule, if a tree is termed hardy, it grows best in Hardiness Zones 3 to 5. If termed long-season, apple quality will be best in Zones 5 to 8. Check your zone here. Each variety has a number of chill hours needed to set fruit (i.e., the amount of time temperatures are between 32-45°F). The farther north you go, the more chill hours an apple variety needs to avoid late spring freeze problems. Check tree tags for chill hour information or ask the seller.

Site & Soil
Take a soil test prior to planting your apple trees. Your local Cooperative Extension Service can instruct you in collecting the soil sample, help you interpret the results, and provide valuable information about the soil in your county. Results from the soil test will determine the soil amendments necessary to correct nutrient deficiencies and adjust soil pH. The amendments should be worked into the soil to a depth of 12 to 18 inches where the tree will root, not just the planting hole. Apple trees need well-drained soil, nothing too wet. Soil needs to be moderately rich and retain moisture as well as air; mulch with straw, hay, or some other organic material to keep soil moist and provide nutrients as they decompose. Choose a sunny site. For best fruiting, an apple tree needs "full sunlight," which means six or more hours of direct summer sun daily. The best exposure for apples is a north- or east-facing slope. Tree spacing is influenced by the rootstock, soil fertility, and pruning. Seedlings or full-size trees should be planted about 15 to 18 feet apart in a row. A dwarfing rootstock might be 4 to 8 feet apart in a row. Dwarf apple trees are notoriously prone to uprooting under the weight of a heavy crop, so you should provide a support system for your hedge. You can grow your trees against a fence, or you can provide free-standing support in the form of a trellis. Make sure the tree will not be planted in a "frost pocket" where cold air settles in low-lying areas. Choose a higher site with a slip if possible so that cold air will flow away from the trees. Do not plant trees near wooded areas or trees.

Planting
Before planting, remove all weeds and the grass in a 4-foot diameter circle. After you purchase the tree, protect it from injury, drying out, freezing, or overheating. If the roots have dried out, soak them in water about 24 hours before planting. Dig a hole approximately twice the diameter of the root system and 2 feet deep. Place some of the loose soil back into the hole and loosen the soil on the walls of the planting hole so the roots can easily penetrate the soil. Spread the tree roots on the loose soil, making sure they are not twisted or crowded in the hole. Continue to replace soil around the roots. As you begin to cover the roots, firm the soil to be sure it surrounds the roots and to remove air pockets. Do not add fertilizer at planting time, as the roots can be "burned". Fill the remainder of the hole with the loose soil, and press the soil down well. Most apple trees are grafted. The graft union must be at least 2 inches above the soil line so that roots do not emerge from the scion. The graft union (where the scion is attached to the rootstock) can be recognized by the swelling at the junction.

Care

Water young trees regularly, especially those on semidwarfing or dwarfing rootstocks, to ensure that the root system becomes well established. Renew mulch periodically, but pull it away from the tree in the fall so mice don't nest over the winter and eat the bark.

Training Young Trees
When trees are young, it's important to nurture a strong frame of branches so the trees can carry heavy apple crops. Dwarf apple trees are trained to a central leader system. Standard (and sem-dwarf) trees should also be trained to a modified leader.

Minimize Pruning of Trees
Pruning slows a young tree's overall growth and can delay fruiting, so don't be in a hurry to prune, other than removing misplaced, broken, or dead branches. There are several techniques to direct growth without heavy pruning. For example:

Minimize Pruning of Trees
- Rub off misplaced buds before they grow into misplaced branches.
- Bend a stem down almost horizontally for a few weeks to slow growth and promote branches and fruiting. Tie down with strings to stakes in the ground or to lower branches.

Pruning
Prune your mature tree when it is dormant. Completely cut away overly vigorous, upright stems (most common high up in the tree). Remove weak twigs (which often hang from the undersides of limbs. Shorten stems that become too droopy, especially those low in the tree. After about ten years, fruiting spurs (stubby branches that elongate only about a half-inch per year) become overcrowded and decrepit. Cut away some of them and shorten others. When a whole limb of fruiting spurs declines with age, cut it back to make room for a younger replacement.

Thinning Apples
Apples are often grown without any thinning other than what nature provides in the annual spring drop. However, to avoid potential disease and insect problems, it's helpful to thin after the natural fruit drop (about 4 to 6 weeks after bloom) to one fruit per cluster, or about 6 to 8 inches between fruit. This seems hard but this practice evens out production, prevents a heavy crop from breaking limbs, and ensures better-tasting, larger fruit crop. Soon after fruit-set, remove the smallest fruits or damaged ones, leaving about four inches between those that remain.

Pests / Diseases

Apples are prone to insect and diseases—including apple maggots, plum curculios, green fruit worms, and codling moths. Many gardeners who swear off pesticides find they need to find, at minimum, an acceptual annual spray treatment for a decent crop. One idea to avoid pesticides is to select disease-resistant varieties such as 'Prima', 'Priscilla', 'Liberty', and 'Freedom'. They do not require spraying for apple scab, cedar-apple rust, and other common diseases, while most other varieties require periodic spraying every spring and summer after planting. Check with your extension service to find approved pest prevention programs for your area. You can also try an anti-insect oil, found at garden stores.

Spray it in the spring when your apple trees are in the tight cluster stage: after the leaves have unfolded from the fruiting cluster, but before the buds begin to show pink. Other pests such as scales, mites, and aphids should be controlled by natural parasite and predator populations if you haven't used a lot of sprays. The apple maggot can be trapped simply enough by hanging one or two round, softball-size balls—painted red and coated with sticky "Tangle-Trap"—from a branch in June through the summer.

Reapply the sticky goo a time or two, as necessary. Keep deer at bay with repellents, fencing, or deer-resistant plants; deter mice and rabbits with wire-mesh cylinders around the base of the tree. To keep insects away from apple trees, make a solution of 1 cup of vinegar, 1 cup of sugar, and 1 quart of water. Pour this mixture into a wide mouthed plastic jug. Hang the jug, uncovered, in your apple tree. Fend off diseases by raking apple leaves, burying them beneath mulch, or grinding them with a lawnmower at season's end.

Harvest / Storage

Harvest patiently. After all this pruning and caring, be sure to harvest your apples at their peak of perfection. Pluck your apples when their background colour is no longer green. The stem should part readily from the branch when the fruit is cupped in the palm of your hand and given a slight twist around, then up (do not yank on the apple). Different apple varieties mature at different times, so the harvest season can stretch from August to October. If the apple is overripe and soft, use for cooking.

Storing Apples
Only store mid or late season apples. Early season varieties don't keep and are best eaten soon after picking. Mid season varieties should keep for a few weeks, while late season varieties will stay in good condition for anywhere up to five months in a root cellar. Apples destined for storage must be perfect, with no bruises or blemishes that could provide entry points for rot. Store apples by wrapping up individual fruits in newspaper or tissue paper. Place the wrapped apples onto trays that allow air to circulate. You can also store them unwrapped, but the fruits should not touch. Different varieties store for different lengths of time, so keep them separate and eat those that won't store as long first. The ideal store is somewhere cool, dark, and well-ventilated. Most garages and sheds are ideal, while attics and basements should be avoided due to either excessive heat, lack of ventilation or low humidity. Check stored apples regularly and remove any that are going soft, brown or rotting.

Variants

Look for disease-resistant trees, such as 'Liberty', 'Jonafree', 'Macfree', and 'Williams Pride', which will give you the ability to grow organic fruit or to use fewer chemicals. Maintenance is easier, too. You need to choose a rootstock. All apple trees sold have 2 parts: a "rootstock" or foundation and a "scion" or top portion which determines the fruit variety. A rootstock can be "seeding" (which produces a full-size tree) or it can be "dwarfing" or "size-controlling" (which produces a smaller tree for easier care and harvest). For dwarf trees, make sure that the rootstock is specified. A Bud 9 is a common, hardy tree that's easy to train for USDA Climate Zones 3 to 5. The M9 is probably the most widely planted rootstock, though it could die in frigid winters. Buy dormant, bare-root, 1-year-old nursery trees with good root systems. Dwarfs and semi-dwarfs will bear in 3 to 4 years, yielding 1 to 2 bushels per year. Standard-size trees will bear in 5 to 8 years, yielding 4 to 5 bushels of apples per year.

The variety of apple selected should be based on fruit characteristics, bloom time, and pollen compatibility. Consult a local nursery to see which trees are potential cross-pollinators in your area. For best results, include a 'Grimes Golden', 'Golden Delicious', 'Red Delicious', or 'Winter Banana' in your planting. These varieties are known pollinators. Crab-apple trees can also be used as pollinators if they bloom at the same time as the desired variety. Nursery catalogues will provide pollination charts. Most apple varieties do not pollinate themselves or any flowers of the same apple variety; this requires planting at least two different apple tree varieties close to one another so that the bees can pollinate. (There are actually some self-pollinating apple tree varieties if you are really short on space. However, even these apple trees will bear more fruit if cross-pollinated.) Also consider how you will use your apples: Do you love to bake apple pies? Or, perhaps you just want apples that taste far better than what you could buy in a grocery store. See Best Apples for Baking for more information.

A young dwarf tree produces about 1 ½ bushels of fruit—and even less when the tree is part of an apple hedge. So, if you're interested in baking lots of 'Cox's Orange Pippin' apple pies, you'll need to plant several trees of that variety to get enough fruit. If you have no particular culinary goal, try planting one each of different varieties that ripen over the entire harvest season. Then you can enjoy regular apple tastings and still have enough fruit on hand for a "mess" of cooked apples. Seek out the advice of local orchardists about the varieties that will do well in your area. Do the bulk of your planning from an easy chair, with a half-dozen nursery catalogues in your lap!

Other Tips

Most apples are grown from grafted trees and will not come true from seed. The seeds might germinate, and they could develop into productive trees, but the fruit might not be similar to the fruit you purchased. Fruit breeders plant thousands of apple seeds every year from controlled crosses they make. Of these seedlings, no more than one or two are expected to make it into commercial production. If you want an apple tree that develops tasty fruit, you should buy a known variety from a nursery or mail-order source. You can find almost any variety of tree available, and trees you purchase will fruit in a much shorter time. A seed-started tree could take 8-10 years to fruit. Also, apple trees started from seed will have no dwarfing characteristics. Unless you have a large yard, they may be too big for your site.

2 Avocado

The avocado (Persea americana) is a tree, long thought to have originated in South Central Mexico, classified as a member of the flowering plant family Lauraceae. The fruit of the plant, also called an avocado (or avocado pear or alligator pear), is botanically a large berry containing a single large seed known as a "pit" or a "stone". The tree grows to 20 m (66 ft), with alternately arranged leaves 12–25 cm (4.7–9.8 in) long. The flowers are inconspicuous, greenish-yellow, 5–10 mm (0.2–0.4 in) wide. The pear-shaped fruit is 7–20 cm (2.8–7.9 in) long, weighs between 100 and 1,000 g (3.5 and 35.3 oz), and has a large central seed, 5–6.4 cm (2.0–2.5 in) long. Botanically, the avocado fruit is a single-seeded berry, due to the imperceptible endocarp covering the seed, rather than a drupe. The subtropical species needs a climate without frost and with little wind. High winds reduce the humidity, dehydrate the flowers, and affect pollination. When even a mild frost occurs, premature fruit drop may occur, although the 'Hass' cultivar can tolerate temperatures down to −1°C (30.2°F). The trees also need well-aerated soils, ideally more than 1 m deep. Yield is reduced when the irrigation water is highly saline.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Spring	Flower Colour Green-Yellow	Hardiness Zones 9-11					

Sprouting

Step 1
You'll need to start by removing the pit from the avocado carefully (without cutting it), and then washing it clean of all the avocado fruit (often it helps to soak the pit in some water for a few minutes and then scrub all the remaining fruit off). Be careful not to remove the brown skin on the pit – that is the seed cover.

Step 2
Some avocado pits are slightly oblong, whereas others are shaped almost like perfect spheres – but all avocado pits have a 'bottom' (from where the roots will grow), and a 'top' (from which the sprout will grow). The slightly pointier end is the top, and the flat end is the bottom. In order to get your pit to sprout, you will need to place the bottom root end in water, so it's very important to figure out which end is the 'top' and which is the 'bottom' before you go piercing it with toothpicks.

Step 3
Take four toothpicks and stick them at a slight downward angle into the avocado seed, spaced evenly around the circumference of the avocado. These toothpicks are your avocado scaffolding, which will allow you to rest the bottom half of the avocado in water, so therefore the toothpicks need to be wedged in there firmly. I recommend sticking them in at a slight angle (pointing down), so that more of your avocado base rests in the water when you set this over a glass.

Step 4
And set on a quiet windowsill with sunlight. It's helpful to use a clear glass so you can easily see when roots start to grow, and also when the water needs to be changed. Many guides recommend to change the water every day, but I found, through trial and error, that it is better to change the water every five days to a week or so. You do want to make sure you change the water regularly, to prevent mould, bacteria and fungus growth, which can doom your little avocado sprout.

Step 5
Many online guides I have read say that sprouting can take anywhere from 2-4 weeks, but in my experience, it usually takes at least 8 weeks to get a sprout, so be patient. Here is the process you will witness:
1. The top of the avocado pit will dry out and form a crack, and the outer brown seed skin will slough off.
2. The crack will extend all the way to the bottom of the avocado pit, and through the crack at the bottom, a tiny taproot will begin to emerge.
3. The taproot will grow longer and longer (and may branch), and eventually a small sprout will peek through the top of the avocado pit.
4. Do not allow your taproot to dry out unsubmerged EVER – doing so will be the death of your plant.

Step 6
When the stem is 6-7 inches long, cut it back to about 3 inches, this will encourage new growth. When it hits 6-7 inches again, pot it up in a rich humus soil in an 8-10" diameter pot, leaving the top half of the seed exposed. Place on a sunny windowsill. Avocados love sun – the more sun the better.

Step 7
Give it frequent waterings with an occasional deep soak. The soil should always be moist, but not saturated. Yellowing leaves are a sign of over-watering; let the plant dry out for a few days.

Step 8
When the stem reaches 12 inches tall, pinch out the top two sets of leaves. This will encourage the plant to grow side shoots and more leaves, making it bushy. Each time the plant grows another 6 inches pinch out the 2 newest sets of leaves on top.

Step 9
My avocado trees seem to collect aphids – the nasty critters can't get enough of the delicious avocado leaves. If you get them, here's how to get rid of them: Wash all of the aphids off the plant by spraying your plant down with a hose outside or in the sink/shower. Once the little pests are off, spray your plant with a mixture of water with a small squirt of dishwashing liquid and a teaspoon of neem oil. This will keep aphids from returning. Check your plant every 4-5 days and re-clean and spray when necessary.

Step 10
Baby avocado trees can kick it outdoors in summer, but if you live anywhere where it gets cooler than 7°C (45°F), you'll need to bring them back indoors in the fall/winter, before the temperatures fall.

Planting

You can start with an avocado seed. Wash it. Use three toothpicks to suspend it broad end down over a water-filled glass to cover about an inch of the seed. Put the glass in a warm place out of direct sunlight and replenish water as needed. You should see the roots and stem start to sprout in about two to six weeks. (If you've followed this process so far and have not seen roots or a stem sprout in more than six to eight weeks, try another seed.) When the stem is 6 to 7 inches long, cut it back to about 3 inches. When the roots are thick and the stem has leaves again, plant it in a rich humus soil in a 10½-inch-diameter pot, leaving the seed half exposed. Water it frequently, with an occasional deep soak. The soil should be moist but not saturated. And don't forget: the more sunlight, the better. If the plant turns yellow, you may be over-watering; let it dry out for a few days. If the leaves turn brown and fry at the tips, too much salt has accumulated in the soil. Let water run freely into the pot, and drain it for several minutes. When the stem is 12 inches high, cut it back to 6 inches to encourage the growth of new shoots.

Planting: Young Tree
Remember that avocado trees do best at moderately warm temperatures (60 F to 85 F) with moderate humidity. They can tolerate temperatures, once established, of around 28 F to 32 F with minimal damage. Avoid freezing temperatures. Plant your tree in March through June. If you plant during the summer, there is always the risk of sun damage, because avocado trees don't absorb water very well when they're young. Plant it in a non-lawn area and away from sidewalks and, if you can, plant it in a spot protected from wind and frost. Remember, full sun is best. Dig a hole as deep as the current root ball and just as wide as the width plus a little extra so you can get your hands into the hole to plant it. The avocado is a shallow-rooted tree with most of its feeder roots in the top 6 inches of soil, so give it good aeration. Its root system is very sensitive, and great care should be taken not to disturb it when transplanting. If the tree is root-bound, however, loosen up the soil around the edges and clip the roots that are going in circles.

Soil
Avocado trees like the soil's pH around 6 to 6.5. If you have a heavy clay soil, elevate the tree in a mound for better drainage. Make the mound 1 to 2 feet high and 3 to 5 feet around. Don't put gravel or anything else like planting media in the hole. The sooner the roots get into the bulk soil, the better the tree will do.

Care

Watering
Trees typically need to be watered two to three times a week. As the roots reach out into the bulk soil, more water can be applied and the frequency of watering can diminish to about once a week after a year. When watering the tree, soak the soil well, and then allow it to dry out somewhat before watering again. As with most plants, you don't want the tree to get too dry. The rule of thumb for mature trees is about 20 gallons of water a day during the irrigation season. Seedlings will require quite a bit less water, of course. Check the soil before watering each time to make sure it has dried somewhat. If the soil from around the roots can hold the impression of a hand when squeezed, it has enough water.

Mulching and Fertilizing
Mulch with coarse yard mulch. Redwood bark or cocoa bean husks and shredded tree bark will work. Choose something that is woody and about 2 inches in diameter. Coarse yard mulch is available at some garden-supply centres and through tree-trimming operations. Tree-trimming operations sometimes have material that has been pruned from the tops of trees and doesn't contain any diseased roots. Use online search engines to find a local tree service. Put 20 pounds of gypsum spread around the tree base, and mulch the area with 6 inches of mulch, keeping the material about 6 to 8 inches away from the tree trunk. Fertilize your young avocado trees with ½ to 1 pound of actual nitrogen per tree per year. You can spread it out over several applications as long as it totals ½ to 1 pound of nitrogen. The other important nutrient for avocado trees is zinc. Ordinary home fertilizer for houseplants will normally work.

Other Growing Tips
Be patient about seeing fruit. If you have purchased and planted a tree, you can probably expect to see your first fruit three to four years after planting. If you are growing from a seed, it can take anywhere from five to 13 years before the tree is mature enough to set fruit. When the tree does flower, expect a lot of flowers to fall without setting fruit. This is natural.

Should I plant a "B" type avocado with an "A" type avocado to help with good pollination?	Avocado flowering patterns fall into two groups: "A" type and "B" type flowers. A-type flowers open female in the morning and male in the afternoon, B-type are male in the morning and female in the afternoon. It is widely accepted that fruit production can be helped with the presence of another avocado variety, but it isn't always required.
How does temperature influence pollination and fruit set?	Optimum fruit set occurs at temperatures between about 65 - 75 F. Cooler or warmer temperatures are less ideal. Under some conditions, you may get a fruit from a flower that did not pollinate properly. These small, elongated fruit will often fall from the tree on their own, but if they "hang on" you can pick them and eat them. These fruit are called "cukes" but are sometimes marketed in stores as "Cocktail" or "Finger" avocados.
What can I do about my avocado tree dropping fruit?	This is called fruit drop. An avocado tree typically produces about one million flowers, but only 100-200 pieces of fruit per tree. In other words, 1 fruit in 10,000 will set and mature. Sometimes the tree will set fruit but drop them when they are pea to walnut size. This is typical. To minimize fruit drop of good "fertilized" fruit, avoid stressing the tree. Don't under or overwater it. Research suggests that fruit retention is also better when there are other avocado varieties present to provide cross-pollination, and that these crossed fruit have a higher tendency to stay on the tree. There is also some indication that over-fertilizing with Nitrogen during the early fruit stages can also somewhat influence fruit drop.
How can I tell when my avocados are ripe and ready to pick?	Avocados do not "ripen" on the tree, that is, they do not get soft while on the tree. They mature on the tree. Once you pick an avocado, it can take from 7-21 days for it to soften when left at room temperature. You can speed the process up slightly by placing the avocado in a bag with some other ripe fruit (like an apple or banana) or slow the process down by keeping the fruit in the refrigerator. More on how to ripen avocados.
So, when should I pick my avocados?	Pick a couple of avocados and try to ripen them. If they shrivel up or seem rubbery instead of soft, they are not mature yet. Keep picking fruit every few weeks. Note on the calendar when they soften instead of turning rubbery. Also, note the taste of the fruit. The oil content of the fruit usually increases through the season, and there will be a certain point when it tastes "just right." That date will usually vary somewhat due to climate conditions, and some years will be better than others. Some varieties can also reach a point where they have too much oil and some will turn rancid (although many types fall from the tree before reaching that point).
How many fruit will a mature tree produce in one year?	It is possible for an avocado tree to produce 200 to 300 fruit per tree once it is about 5-7 years of age. The avocado tree, however, alternates bearing. This means that the tree may produce a large crop one year, and then produce a small crop the following year. There are lots of variables that influence this.
How many years will a normal avocado tree produce fruit?	Typically, an avocado tree will continue to grow and produce fruit until something kills the tree.

When is the best time to prune avocado trees?	Avocados can be pruned any time of the year, but there tends to be less vigorous regrowth if it is done after cold weather in the winter, sometime around February.
How large will my avocado tree get?	Growth is reflected in rootstock, variety, soil depth and texture, windiness, irrigation and pruning. Reed, Bacon and Hass trees can ultimately grow to 35 feet in 30 years. Pruning can keep the trees to a manageable size, under 15 feet, but it must be done on a regular basis.
What's the creamy-white foamy looking stuff that grows out of the bark where there are cuts, or small branches have died and dropped off?	It is just sap coming from a wound. It dries into that sugary white, fluffy stuff.

3 Blackberry

The blackberry is an edible fruit produced by many species in the genus Rubus in the family Rosaceae, hybrids among these species within the subgenus Rubus, and hybrids between the subgenera Rubus and Idaeobatus. The taxonomy of the blackberries has historically been confused because of hybridization and apomixis, so that species have often been grouped together and called species aggregates. What distinguishes the blackberry from its raspberry relatives is whether or not the torus (receptacle or stem) "picks with" (i.e., stays with) the fruit. When one picks a blackberry fruit, the torus does stay with the fruit. With a raspberry, the torus remains on the plant, leaving a hollow core in the raspberry fruit.

The term bramble, a word meaning any impenetrable thicket, has traditionally been applied specifically to the blackberry or its products, though in the United States it applies to all members of the genus Rubus. In the western US, the term caneberry is used to refer to blackberries and raspberries as a group rather than the term bramble. The usually black fruit is not a berry in the botanical sense of the word. Botanically it is termed an aggregate fruit, composed of small drupelets. It is a widespread and well-known group of over 375 species, many of which are closely related apomictic microspecies native throughout Europe, north-western Africa, temperate western and central Asia and North and South America.

In its first year, a new stem, the primocane, grows vigorously to its full length of 3–6 m (in some cases, up to 9 m), arching or trailing along the ground and bearing large palmately compound leaves with five or seven leaflets; it does not produce any flowers. In its second year, the cane becomes a floricane and the stem does not grow longer, but the lateral buds break to produce flowering laterals (which have smaller leaves with three or five leaflets). First- and second-year shoots usually have numerous short-curved, very sharp prickles that are often erroneously called thorns. The flowers are produced in late spring and early summer on short racemes on the tips of the flowering laterals. Each flower is about 2–3 cm in diameter with five white or pale pink petals.

Sowing Season	**Northern Hemisphere (Cold Climate)** ○	**Northern Hemisphere (Temperate Climate)** ○	**Northern Hemisphere (Subtropical Climate)** ○	**Northern Hemisphere (Tropical Climate)** ○	**Southern Hemisphere (Cold Climate)** ○	**Southern Hemisphere (Temperate Climate)** ○	**Southern Hemisphere (Subtropical Climate)** ○	**Southern Hemisphere (Tropical Climate)** ○			
Growing	**Sun Exposure** Full Sun	**Soil Type** Loamy, Well-drained	**Soil pH** 5.5-6.5	**Bloom Time** Spring-Summer	**Flower Colour** White-Pink	**Hardiness Zones** 4-9					
Introduction	Blackberries, like raspberries, are a very easy fruit to grow. Once this native berry is ripe, get ready for an abundant harvest, picking every couple of days! Here's how to grow and harvest blackberries in your backyard. Basically, there are three types of blackberries: 1. erect thorny blackberries, 2. erect thornless blackberries, 3. trailing thornless blackberries. The erect blackberries are bushes that support themselves. The trailing blackberries have long canes that must be trellised for support. All blackberries are perennials; the roots come back year after year. However, the top of the plant above the soil is what we call biennial. This means that the canes grow vegetatively for a year, bear fruit the next year, and then die. However, every year the plant sends up new canes to replace those that died! For a great fruit harvest and to avoid a messy plant, pruning is important.										

Planting

Blackberries and hybrids are all self-fertile, so multiple plants are not needed for fruit production. Select a site that receives full sun for the best berry yields. Soil needs to be fertile with good drainage. Add organic content to enrichen your soil. Make sure you plant your blackberries far away from wild blackberries that may carry viruses. For semi-erect cultivars, space plants 5 to 6 feet apart. Space erect cultivars 3 feet apart. Space trailing varieties 5 to 8 feet apart. Space rows about 8 feet apart. Plant shallowly: about one inch deeper than they were grown in the nursery. Planting may be done in late fall, however, it should be delayed until early spring in very cold areas as low temperatures could kill some hybrids.

Care

Mulching is important throughout the season to conserve moisture and suffocate weeds. Keep a thick layer of mulch surrounding plants at all times. Blackberries require plenty of moisture, especially when growing and ripening. Ensure plants receive one inch of water per week and more in hot temperatures. Blackberries benefit from fertilizing in early spring with an all-purpose fertilizer such as 10-10-10, or a 16-16-8. Trellis Trailing Blackberries: Trailing blackberries need a trellis or support. Explore a two-wire system, running a top wire at five to six feet with a second line 18 inches below the top wire. After the first year, there will be fruiting floricanes along the wires. Train the new primocanes into a narrow row below the fruiting canes. Directing all canes in one direction may make it simpler.

Pruning
The main idea is to simply remove the old canes that already bore fruit and let new ones take their place. Trailing blackberries: After the fruit harvest period, the old fruiting (floricanes) are removed to the ground. However, unless there is a lot of disease, it's best to delay removing the old fruiting canes until they have died back considerably. This allows the dying canes to move nutrients back into the crown and roots. After old fruiting canes are removed, train the primocanes up on the wires. Work with one or two canes at a time in a spiral around the trellis wires. Canes from adjacent plants may overlap a little. No pruning of primocanes is necessary. In areas with low winter temperatures, leave the primocanes on the ground for the winter where they could be mulched for winter protection. In the spring, after danger of extreme cold has passed, train the old primocanes (now considered floricanes) up on the wires. Avoid working with the canes in cold weather, as they are more prone to breaking. Erect blackberries produce stiff, shorter canes that come from the crown and from root suckering (often forming a hedgerow).

Erect blackberries benefit from summer pruning. Remove the top one to two inches of new primocanes when they are four feet tall. This causes the canes to branch, increasing next year's yields. Plants will require several pruning sessions to tip each cane as it reaches the four foot height. Primocanes (suckers) that grow outside the hedgerow should be regularly removed. In the winter, remove the dead floricanes (old fruiting canes) from the hedgerow. Also shorten the lateral branches to about 1½ to 2½ feet. If you have primocane-fruiting erect blackberries, cut all canes off just above the ground in the late winter for the best fruit. In the summer, when the primocanes are 3½ feet tall, removed the top 6 inches. The primocanes will branch, thereby producing larger yields in the fall. If you have semi-erect blackberries, they are easier to manage on a Double T Trellis.

Install four-foot cross arms at the top of a six-foot post. Install a three-foot cross arm about two feet below the top line. String high-tensile wire down the rows, connecting to the cross arms. Semi-erect berries need to be pruned in the summer. When the primocanes are five feet tall, remove the top two inches to encourage branching. Several pruning sessions will be required as canes reach the appropriate height. In the winter, remove the dead floricanes (old fruiting canes). Spread the primocanes (new floricanes) out along the trellis. Canes do not need to be shortened. However, they can be if they are difficult to train.

Pests / Diseases

- Raspberry Borers
- Fruit Worms
- Gray Mould
- Viruses

If your plant is suffering from the blackberry disease known as Raspberry Bushy Dwarf virus, the leaves will be have some bright yellow on them, and the leaves of the fruiting vines may have a bleached look in the summer. The disease known as Blackberry Calico will cause faint yellow blotches on the leaves of the plant.

Harvest / Storage

Pick only berries that are fully black. Mature berries are plump yet firm, a deep black colour, and pull freely from the plant without a yank. Berries do no ripen after being picked. Once blackberries start to ripen, they must be picked often—every couple of days. When picking, keep the central plug within the fruit (unlike raspberries). Harvest during the cooler parts of the day. Once picked, place berries in the shade and refrigerate as soon as possible. Blackberries are highly perishable and will only last a few days once harvested, even with refrigeration. Although fresh fruit is always best, blackberries can be stored by canning, preserving, or freezing. Techniques used for freezing blueberries can also be used on blackberries.

Variants

- Erect Thornless: 'Navaho,' 'Arapaho'
- Erect Thorny: 'Cherokee,' 'Brazos,' 'Shawnee,' and 'Cheyenne'
- Semi-erect Thornless: 'Black Satin'
- Trailing: Olallie

Other Tips

Blackberries, raspberries, and strawberries are very high in ellagic acid, which is an antioxidant that acts as a scavenger, helping to make potential cancer-causing chemicals inactive. Ellagic acid reduces the genetic damage caused by carcinogens like tobacco smoke and air pollution. Blackberries also contain other antioxidants that can help lower cholesterol and ward off cardiovascular disease.

4 Blueberry

Blueberries are perennial flowering plants with blue– or purple–collared berries. They are classified in the section Cyanococcus within the genus Vaccinium. Vaccinium also includes cranberries, bilberries, and huckleberries. Commercial "blueberries" – including both wild ('lowbush') and cultivated ('highbush') blueberries – are native to North America. The highbush blueberry varieties were introduced into Europe during the 1930s. Blueberries are usually prostrate shrubs that can vary in size from 10 centimetres (3.9 in) to 4 meters (13 ft) in height. In commercial production of blueberries, the species with small, pea–size berries growing on low–level bushes are known as "lowbush blueberries" (synonymous with "wild"), while the species with larger berries growing on taller cultivated bushes are known as "highbush blueberries".

The leaves can be either deciduous or evergreen, ovate to lanceolate, and 1–8 cm (0.39–3.15 in) long and 0.5–3.5 cm (0.20–1.38 in) broad. The flowers are bell-shaped, white, pale pink or red, sometimes tinged greenish. The fruit is a berry 5–16 millimetres (0.20–0.63 in) in diameter with a flared crown at the end; they are pale greenish at first, then reddish-purple, and finally dark purple when ripe. They are covered in a protective coating of powdery epicuticular wax, colloquially known as the "bloom". They have a sweet taste when mature, with variable acidity. Blueberry bushes typically bear fruit in the middle of the growing season: fruiting times are affected by local conditions such as altitude and latitude, so the peak of the crop, in the northern hemisphere, can vary from May to August.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Acidic	Soil pH 4.5-5.5	Bloom Time Spring	Flower Colour White-Pink	Hardiness Zones 3-9					
Introduction	The modern blueberry is a 20th-century invention. Before the 1900s, the only way to enjoy these North American natives was to find them in the wild. Then, scientists started to unlock the secrets of cultivating blueberries, and we're glad they did! Plump, juicy berries are now easy to grow in your backyard on bushes that are resistant to most pests and diseases, and can produce for up to 20 years. A relative of rhododendron and azalea, blueberry bushes aren't just a great edible plant but also an attractive addition to your overall landscape, offering scarlet fall foliage and creamy-white, bell-shaped spring flowers. Learn more about why you should grow blueberries in your home garden. Note: Blueberries are a favourite snack of hungry birds, so it's recommended that you protect blueberry bushes ahead of time with netting or other methods. There are four types of blueberries: highbush, lowbush, hybrid half-high and rabbiteye. The most commonly planted blueberry is the highbush. Most blueberry breeding has focused on this species, so there are many varieties that range widely in cold hardiness and fruit season, size, and flavour. Read more about blueberry varieties below.										

Planting

Fruit Blueberry Planting

Select a sunny, sheltered spot. While blueberries are tolerant of shade, better crops are obtained in the sun. Blueberries thrive in soil that is acidic. The soil pH should ideally be between 4 and 5. Soil can be acidified by mixing a small amount of granulated sulphur into the soil several months before planting. Peat moss, as well as pine bark or needles, are also good additions that will help acidify your soil. The blueberry is a shallow-rooted plant. Therefore, it requires a soil that holds moisture, but also drains well and doesn't stay wet. Mix organic matter into the soil before you set your blueberry bushes. Bushes should be planted as early in the spring as possible. If available, 1- to 3-year-old plants are a good choice. Be sure to go to a reputable nursery.

Dig holes about 20 inches deep and 18 inches wide (about twice as wide and twice as deep as the roots of the plant). Space bushes about 5 feet apart in a row, with at least 8 feet between rows. Prepare a planting mixture of 2 parts loam and one part oak leaf mould, peat moss, aged sawdust, or compost, and place a layer of this mixture in the bottom of the hole. Set the bush in the hole with its roots spread out. Don't plant the bush any deeper than it grew in the pot. Pack the hole tightly with soil. Apply fertilizer one month after planting, not at the time of planting. Apply ½ ounce of a 10-10-10 fertilizer in a band around the plant 6 to 12 inches from the crown.

GARDENING Fruit Blueberry Planting

Growing in a Container Blueberries grown in containers are easier to protect from birds and other critters, more disease resistant, easy to harvest, and easy to move if needed.	● Use a large container with drainage holes. ● Use a potting mix designed for acid-loving plants such as azaleas or rhododendrons, or mix sandy soil with peat moss and compost. ● Plant the bush in the container and water well. ● Add mulch on top of the soil. ● Place the pot in a sunny spot. ● Keep soil moist. ● In northern regions, overwinter the blueberry container in a protected area or cover the container with straw or wrap it in burlap.

Care

GARDENING Blueberry Care

Mulch to keep shallow blueberry root systems moist, which is essential. Apply a 2- to 4-inch layer of woodchips, saw dust, or pine needles around the bush after planting. Blueberries need 1 to 2 inches of water per week. Drape netting over ripening blueberries, so that the birds won't make away with the entire crop. One year after planting, apply 1 ounce of 10-10-10 fertilizer per bush in the spring at blooming time, and increase the rate by 1 ounce each year thereafter to a maximum of 8 ounces for mature bushes. Do not allow the bush to produce fruit for the first year or two after planting. Pinch back any blossoms developing on newly set plants to allow the energy to go to growth.

Pruning
For the first 4 years after planting, there is no need to prune blueberry bushes. From then on, pruning is needed to stimulate growth of the new shoots that will bear fruit the following season. Prune plants in late winter or early spring before new growth begins. Cut out dead, broken, short, weak, and spindly shoots. On highbush varieties, begin with large cuts, removing wood that is more than 6 years old, drooping to the ground, or crowding the centre of the bush. Also remove low-growing branches whose fruit will touch the ground, as well as spindly twigs. Prune lowbush blueberries by cutting all stems to ground level. Pruned plants will not bear the season following pruning, so prune a different half of a blueberry patch every two years (or a different third of a patch every three years).

Pests / Diseases

Fruit Blueberry

- Birds
- Blueberry Maggot
- Powdery Mildew

Harvest / Storage

GARDENING

Blueberries will be ready for picking in late July to mid August. Don't rush to pick the berries as soon as they turn blue. Wait a couple days. When they are ready, they should fall off right into your hand. If you plant 2-year-old blueberry bushes, they should start to bear within a year or two. (Pick off any flowers that form the first year or two after planting, to allow the bush to become established.) Be aware that full production is reached after about 6 years. Blueberries are one of the easiest fruits to freeze. Learn how to properly freeze blueberries so you can have them all winter long.

Variants

Blueberry Fruit Variants GARDENING Blueberry

Highbush
Blueberries are partially self-fertile, so you will harvest more and larger berries by planting two or more varieties. Planting more than one variety can also extend the harvest season. Highbush (Vaccinium corymbosum): A six-foot shrub hardy from Zone 4 to Zone 7. For withstanding cold winters, choose 'Bluecrop', 'Blueray', 'Herbert', 'Jersey', or 'Meader'. For big berries, choose 'Berkeley', 'Bluecrop', 'Blueray', 'Coville', 'Darrow', or 'Herbert'. For flavour, usually the main reason for growing your own fruit, choose 'Blueray', 'Darrow', 'Herbert', 'Ivanhoe', 'Pioneer', 'Stanley', or 'Wareham'. For something different, try 'Pink Lemonade', which produces bright pink blueberries!

Lowbush
Lowbush (Vaccinium angustifolium): For the coldest climates, lowbush varieties are your best bet, hardy from Zone 3 to Zone 7. These are the blueberries you find in cans on supermarket shelves. When fresh, the fruits are sweet and covered with a waxy bloom so thick that the berries appear sky blue or gray. The creeping plants, a foot or so high, are spread by underground stems, or rhizomes. They blanket the rocky upland soils of the Northeast and adjacent portions of Canada. Lowbush blueberries make a nice ornamental fruiting ground cover. Plants sold by nurseries are usually seedlings or unnamed wild plants, rather than named varieties.

Half-High
● Half-High: Breeders have combined qualities of highbush and lowbush blueberries into hybrids known as half-high blueberries. University of Minnesota introductions include 'Northcountry', a variety that grows 18 to 24 inches high and has excellent, mild-flavoured, slightly aromatic sky-blue fruits; and 'Northblue', which grows 20 to 30 inches high and produces an abundance of dark-blue, nickel-size, somewhat tart fruits-just right for pies. 'Northland' is a half-high that grows 3 to 4 feet tall. From Michigan, it has relatively bland, average-quality fruit.

Variants Fruit GARDENING Blueberry

Rabbiteye
Rabbiteye (Vaccinium ashei): Grown in the south-eastern United States, Rabbiteye varieties are extremely adaptable, productive, and pest-tolerant. They do, however, have a high degree of self-incompatibility and require two or more varieties be planted together to ensure pollination.

Container Varieties
- 'Top Hat': Bred by the University of Michigan for small spaces and containers.
- 'Pink Lemonade': Pink blueberries contain genetics from rabbiteye blueberries (a standard in the hot South). These pink berries can be planted in nearly every climate.
- 'Pink Champagne': Another pink variety full of antioxidants and sweeter than blue blueberries.

Other Tips

Blueberries are one of the few truly blue foods on earth. Dried berries were crushed into a powder and rubbed into meat for flavour. Blueberry juice was also used as a purple dye for cloth and baskets. A tea made from the leaves of the blueberry plant was believed to be good for the blood.

5 Cherry

A cherry is the fruit of many plants of the genus Prunus, and is a fleshy drupe (stone fruit). The cherry fruits of commerce usually are obtained from cultivars of a limited number of species such as the sweet cherry (Prunus avium) and the sour cherry (Prunus cerasus). The name 'cherry' also refers to the cherry tree and its wood, and is sometimes applied to almonds and visually similar flowering trees in the genus Prunus, as in "ornamental cherry" or "cherry blossom". Like most temperate-latitude trees, cherry seeds require exposure to cold to germinate (an adaptation which prevents germination during the autumn, which would then result in the seedling being killed by winter temperatures). The pits are planted in the autumn (after first being chilled) and seedlings emerge in the spring. A cherry tree will take three to four years in the field to produce its first crop of fruit, and seven years to attain full maturity. Because of the cold-weather requirement, no members of the genus Prunus can grow in tropical climates.

Cherries have a short growing season and can grow in most temperate latitudes. Cherries blossom in April (in the Northern Hemisphere) and the peak season for the cherry harvest is in the summer. In southern Europe in June, in North America in June, in England in mid-July, and in southern British Columbia (Canada) in June to mid-August. In many parts of North America, they are among the first tree fruits to flower and ripen in mid-Spring. In the Southern Hemisphere, cherries are usually at their peak in late December and are widely associated with Christmas. 'Burlat' is an early variety which ripens during the beginning of December, 'Lapins' ripens near the end of December, and 'Sweetheart' finish slightly later.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Early Spring	Flower Colour White	Hardiness Zones 4-8					
Introduction	Cherry trees are a sight to behold in the spring, when they're covered in white or pink blossoms. After that, they produce the delicious cherries most people know and love. Here's how to grow cherry trees in your own garden! Sweet cherries are the variety most often found in markets. They have a thick, rich, and almost plumb-like texture. Sweet cherries grow in hardiness zones 5 to 7; they are self-sterile and best for an orchard or a large garden. You'll need at least two or three trees, as they'll need to pollinate each other. However, a recent and exciting development in sweet cherries is the dwarf, self-pollinating cultivar, 'Stella'. Sour cherries are not usually eaten raw, but are widely used for preserves and other cooking uses. Sour cherries are much smaller than sweet cherries and all varieties are self-fertile. They grow in zones 4 to 6. Cherry trees generally start bearing fruit in their fourth year; dwarf trees bear fruit a year earlier. One mature, standard-size tart or sweet cherry tree will produce 30 to 50 quarts of cherries each year; a dwarf tree, about 10 to 15 quarts.										

Planting

Plant cherries in the late fall or early spring (when the ground is soft and has a higher moisture content). For sweet cherries, make sure the different varieties will pollinate each other. Plant in a sunny site with good air circulation; avoid planting near trees or buildings that shade. Cherry trees need deep, well-drained soil. Space sweet cherries 35 to 40 feet apart; dwarfs, 5 to 10 feet apart. Space tart cherries 20 to 25 feet apart; dwarfs, 8 to 10 feet apart. Set trees on standard rootstocks with the graft union a few inches below the soil level. Set trees on dwarf rootstock with the graft union several inches above the soil level.

When planting fan-trained trees, construct the necessary supports before planting. Plant fans only 12 to 15 feet apart. For bareroot trees, place the rootstock on a small mound of soil in the centre of the planting hole, and spread the roots down and away, trying not to bend the roots. Backfiill with soil. For container-grown trees, first remove the rootball and on its side; cut through the roots with shears. Don't cover the top of the root-ball.

Care

There is no difference in care between sour and sweet cherries. Apply mulch to retain moisture. Drape netting over trees to protect the fruit from birds. Water routinely in dry areas. Thinning the fruit is not necessary for cherry trees, as they typically thin naturally in early summer. Prune trees every year in late winter to encourage the growth of new fruiting wood. Don't prune in the fall. Fertilize each spring until trees start to bear, then fertilize only after harvest each season.

Pests / Diseases

- Aphids
- Japanese Beetles
- Caterpillars
- Brown Rot
- Black Knot
- Bacterial Canker: Cut out any branches with signs of black knot or bacterial canker as soon as possible
- Birds

Harvest / Storage

Pick fruits only when FULLY ripe (dark red, black, yellow); the sugar content rises the few days before fully ripened. Be ready to harvest within a week's time. Eat or cook immediately. Pick fruits when firm if they are to be frozen. Be sure top pick with the cherry stem so you do not tear into the fruit, however, take care to lead the fruit spur to produce fruit next year. Hand-picking may injure the shoots and cause infection; Cut the stalks with scissors. Remember that cherry trees do not bear fruit until their fourth year. Thereafter, they should produce about 30 to 50 quarts of cherries each year.

Variants

- Sweet Cherry - Early - 'Black Tartarian'
- Sweet Cherry - Midseason - 'Bing'
- Sweet Cherry - Late - 'Stella'
- Sour Cherry- Early - 'Early Richmond'
- Sour Cherry- Midseason - 'Montmorency'
- Sour Cherry- Late - 'Meteor'

Other Tips

6 Fig

Ficus carica is an Asian species of flowering plant in the mulberry family, known as the common fig. It is the source of the fruit also called the fig and as such is an important crop in those areas where it is grown commercially. Native to the Middle East and western Asia, it has been sought out and cultivated since ancient times and is now widely grown throughout the world, both for its fruit and as an ornamental plant. Ficus carica is a gynodioecious (functionally dioecious), deciduous tree or large shrub, growing to a height of 7–10 metres (23–33 ft), with smooth white bark. Its fragrant leaves are 12–25 centimetres (4.7–9.8 in) long and 10–18 centimetres (3.9–7.1 in) across, and deeply lobed with three or five lobes. The complex inflorescence consists of a hollow fleshy structure called the syconium, which is lined with numerous unisexual flowers.

The flowers themselves are not visible from outside the syconium, as they bloom inside the infructescence. Although commonly referred to as a fruit, the fig is actually the infructescence or scion of the tree, known as a false fruit or multiple fruit, in which the flowers and seeds are borne. It is a hollow-ended stem containing many flowers. The small orifice (ostiole) visible on the middle of the fruit is a narrow passage, which allows the specialized fig wasp Blastophaga psenes to enter the fruit and pollinate the flower, where after the fruit grows seeds.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-6.5	Bloom Time Spring-Summer	Flower Colour Inconspicuous	Hardiness Zones 8-10					

Introduction

Figs are a delicious treat that thrive in warm climates, but can also be grown in more temperate regions with a bit of extra care. Here's how to grow a fig tree in your garden! Figs thrive in areas with long and hot summers (Zones 8 and warmer), though they can also be grown in colder zones if grown in containers and properly insulated from freezing temperatures or brought indoors. The common fig tree (Ficus carica) is the most popular species of fig for home gardeners because its flowers do not require pollination to yield figs. Many varieties of the common fig tree exist, including hardy cultivars that can be grown outdoors in slightly cooler climates (Zones 6 and 7). Other species of figs either do not produce edible fruit or have very specific pollination requirements (such as needing to be pollinated by a certain type of wasp), making them too much trouble for home gardeners to grow. Figs can be eaten fresh from the tree, preserved, or used in cooking.

Planting

Figs can be planted outdoors in Zone 8 and warmer. In zones where winter temperatures get colder than -12°C (10°F) for periods of time, figs are best grown in containers and kept inside for the winter. Plant fig trees outdoors in the early spring or late fall, when the tree is dormant. For container fig trees, grow them in a soil-based potting mix and add fine bark chips to improve drainage. Keep the tree in full sun in the summer. Be sure to add a high-nitrogen fertilizer every 4 weeks in the spring and summer and water the tree moderately. In the winter, move the tree indoors and keep the soil moist. For outdoor fig trees, plant the tree in the spring or early fall in full sun. Fig trees can grow in most types of soil as long as the soil is well-drained and contains plenty of organic material. Space fig trees at least 20 feet away from any buildings or other trees. Fig trees put down deep roots if given the chance, so bear that in mind when choosing a planting spot.

To plant container-grown trees in the ground:
1. Remove the plant from its pot and remove any circling roots by laying the root ball on its side and using shears to cut through the roots.
2. Dig a hole that is a few inches deeper and wider than the spread of the roots. Set the tree on top of a small mound of soil in the middle of the hole. Be sure to spread the roots away from the trunk without excessively bending them.
3. Plant the tree 2 to 4 inches deeper than it was originally in the pot (check the colour of the trunk to see the original soil line).

Care

Water young fig trees regularly to help them become established. In areas with dry climates, water fig trees deeply at least once a week. Unless grown in containers, most fig trees do not require regular fertilization. However, if your fig tree is not growing much (less than 12 inches in one growing season), you can add ½ to 1 pound of nitrogen supplement. Divide up the nitrogen into 3 to 4 feedings. Start applying the nitrogen in late winter and end in midsummer. You can also apply a layer of mulch around the tree to help prevent weeds and keep in moisture for the roots. Fig trees require little pruning.

During the dormant season, be sure to remove all dead, diseased, or weak branches to encourage growth. If you have an abundant growth of figs, you can thin the fruit to encourage larger figs. In colder regions, bring container-grown fig trees indoors for the winter. Keep the soil moist. If your area experiences a particularly cold winter, fig trees planted outdoors may die back to the ground. If the tree is of a hardy variety, the below-ground part of the tree will likely be unaffected. Remove all dead wood while the tree is still dormant and watch for new growth in the spring.

Pests / Diseases

- Root-Knot Nematodes
- Leaf Spots
- Rust
- Thrips
- Twig Dieback

Harvest / Storage

You should harvest figs only when they are fully ripe, as they will not continue to ripen off the tree. The figs should be fully collared and slightly soft to the touch. You may need to invest in bird netting to protect your crop; figs are a favourite of birds and squirrels. When picking figs, wear gloves or long sleeves because the sap from the fig tree can irritate your skin. Figs are very perishable. Store figs in the refrigerator; they will keep for 2 to 3 days. For long-term storage, you can freeze figs whole for later use. Another storage method is to dry the figs. You can also can your own figs.

Variants

- 'Brown Turkey', which produces abundant medium to large figs. This type works best in warm climates, but is fairly tolerant of cooler temperatures, too.
- 'Celeste' produces small, sweet, purplish figs. It is one of the more winter-hardy varieties.
- 'Hardy Chicago' is a winter-hardy variety that produces purple, medium-size figs.
- 'King' is well adapted for the cooler conditions found in the northwest. It produces medium figs that are sweet and rich in flavour.
- 'Kadota', which vigorously produces small to medium fruit. Its figs are rich and sweet, and it is the most commonly canned fig.

Other Tips

Figs are an excellent source of potassium, dietary fibre, and calcium.

7 Grapefruit

The grapefruit (Citrus × paradisi) is a subtropical citrus tree known for its sour to semi-sweet, somewhat bitter fruit. Grapefruit is a hybrid originating in Barbados as an accidental cross between two introduced species, sweet orange and pomelo or shaddock. The evergreen grapefruit trees usually grow to around 5–6 meters (16–20 ft) tall, although they may reach 13–15 m (43–49 ft). The leaves are glossy, dark green, long (up to 15 centimetres (5.9 in)), and thin. It produces 5 cm (2 in) white four-petaled flowers. The fruit is yellow-orange skinned and generally, an oblate spheroid in shape; it ranges in diameter from 10–15 cm (3.9–5.9 in). The flesh is segmented and acidic, varying in colour depending on the cultivars, which include white, pink, and red pulps of varying sweetness (generally, the redder varieties are the sweetest).

Sowing Season	**Northern Hemisphere (Cold Climate)** ○	**Northern Hemisphere (Temperate Climate)** ○	**Northern Hemisphere (Subtropical Climate)** ○	**Northern Hemisphere (Tropical Climate)** ○	**Southern Hemisphere (Cold Climate)** ○	**Southern Hemisphere (Temperate Climate)** ○	**Southern Hemisphere (Subtropical Climate)** ○	**Southern Hemisphere (Tropical Climate)** ○			
Growing	**Sun Exposure** Full Sun	**Soil Type** Loamy, Well-drained	**Soil pH** 6.0-7.0	**Bloom Time** Spring	**Flower Colour** White	**Hardiness Zones** 9-11					
Introduction	Although Citrus is a subtropical genus, northern gardeners can grow lemons, oranges, and other citrus trees in containers to enjoy fresh citrus fruit. Standard-size grapefruit and orange trees can grow 18 to 22 feet tall, whereas dwarf varieties only grow 8 to 12 feet tall. Most citrus varieties are self-fertile, so only one tree is needed for fruit production. On average, fruit bearing begins when the trees are between 3 and 6 years old; however, exact timing will depend on the type of citrus (lemons, oranges, grapefruit, etc.), the cultivar, your climate, the health of the plant and its care, and other factors. Flowering is not seasonal, but occurs during warm weather and regular rainfall. Flowers and fruits may coincide.										

Planting

Citrus trees should be planted in a sunny and wind-protected area. In the citrus belt (a loosely defined area stretching from southern California to Florida), trees can be planted at any time, however, spring is the best time for container-grown plants. Standard-size citrus trees should be spaced 12 to 25 feet apart and dwarf citrus trees should be set 6 to 10 feet apart. The exact distance depends on the variety. The bigger the fruit, the farther the distance. If the soil is not well-drained, plant the trees on a slight mound to prevent waterlogging. To plant citrus trees inside from seeds, remove the seeds from the desired fruit. Soak the seeds overnight in water and plant them ½ inch deep in moist potting soil. Cover the pot with a plastic bag or wrap and let it sit in a warm and sunny spot for a few weeks until the seeds start to grow. Then, remove the plastic but keep the pot near a warm and sunny window.

Care

A few weeks after planting, and for the first few years (before bearing age), feed the tree a balanced (such as 6-6-6) fertilizer. Learn more about soil amendments and preparing soil for planting. For newly bearing trees, provide nutrients to continue branch and leaf growth, but also to replace nutrients lost by fruit forming. A citrus blend is ideal. Check manufacturer's directions, ask a garden nursery, or consult your local cooperative extension as to how often and how much fertilizer to apply during each year of a tree's growth. Mulches are not recommended for citrus trees, but if trees are located in a cultivated plant bed where mulch is used, keep at least 12 inches of bare ground between the tree trunk and the mulch. Pre-emergent herbicides may be used to prevent weed seeds from germinating. Fruit thinning is unnecessary for citrus trees, as they typically experience something called the "June drop." In late spring or early summer (May or June for most of the country), citrus trees naturally drop a number of their immature fruit.

Pests / Diseases

- Aphids
- Spider Mites
- Root and Crown Rots
- Fungal Leaf Spots
- Fruit Flies
- Tristeza Virus spread by Aphids

Harvest / Storage

Depending on the climate, citrus fruits may take 6 to 8 months to ripen. Citrus fruits will not ripen off the tree, so refrain from picking them too early. The best indicator of ripeness is taste. Harvest the fruit by cutting them off with pruning shears or by pulling the fruit stalk from the tree. Undamaged citrus fruits can be stored for several weeks at cool temperatures.

Variants

- 'Red Blush' (pink flesh)
- 'Marsh Seedless' (white flesh)
- 'Star Ruby' (red flesh)

Other Tips

8 Grapes

A grape is a fruit, botanically a berry, of the deciduous woody vines of the flowering plant genus Vitis.
Grapes can be eaten fresh as table grapes or they can be used for making wine, jam, juice, jelly, grape seed extract, raisins, vinegar, and grape seed oil. Grapes are a non-climacteric type of fruit, generally occurring in clusters. Grapes are a type of fruit that grow in clusters of 15 to 300, and can be crimson, black, dark blue, yellow, green, orange, and pink. "White" grapes are actually green in colour, and are evolutionarily derived from the purple grape. Mutations in two regulatory genes of white grapes turn off production of anthocyanins, which are responsible for the colour of purple grapes. Anthocyanins and other pigment chemicals of the larger family of polyphenols in purple grapes are responsible for the varying shades of purple in red wines. Grapes are typically an ellipsoid shape resembling a prolate spheroid.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Late Spring	Flower Colour Green-White	Hardiness Zones 4-10					
Introduction	Grapes are often ignored in home gardens, and yet are one of the most widely produced fruit in the world—as well as beautifully ornamental plants. We have plenty of tips for growing grapes in your own backyard. Grape vines not only produce sweet and versatile fruits, they add an element of drama to a garden or landscape. They are vigorous growers, and with the proper pruning, they will produce fruit with ease and can last longer than 30 years. There are three different types of grapes: American (V. labrusca), European (V. viniferia), and North American native Muscadine (V. rotundifolia). American grapes are the most cold-hardy, while European grapes, usually more for wine than the table, do well in warm, dry, Mediterranean type zones. Hybrids are available. Thick skinned Muscadines thrive in the South. Make sure you purchase grape vines from a reputable nursery. Vigorous, 1-year-old plants are best. Smaller, sometimes weaker, 1-year-old plants are often held over by the nursery to grow another year and are then sold as 2-year-old stock. Obtain certified virus-free stock when possible.										

Planting

Plant dormant, bare-root grape vines in the early spring. Construct a trellis or arbor before planting. Grape vines will need to be trained to some sort of support to grow upward. This will also cut the risk of disease. Most grape varieties are self-fertile. To be sure, ask when you are buying vines if you will need more than one plant for pollination. Before planting grapevines, soak their roots in water for two or three hours. Select a site with full sun. If you don't have a spot with full sun, make sure it at least gets morning sun. A small amount of afternoon shade won't hurt. Your soil needs to be deep, well-drained, and loose. You also need good air circulation. Space vines 6 to 10 feet apart (16 feet for muscadines). For each vine, dig a planting hole 12 inches deep and 12 inches wide. Fill with 4 inches of topsoil. Trim off broken roots and set the vine into the hole slightly deeper than it grew in the nursery. Cover the roots with 6 inches of soil and tamp down. Fill with the remaining soil, but don't tamp this down. Prune the top back to two or three buds at planting time. Water at time of planting.

Care

In the first couple of years, the vine should not be allowed to produce fruit. It needs to strengthen its root system before it can support the extra weight of fruit. Pruning is important. Not only would vines run rampant without control, but canes will only produce fruit once. Prune annually when vines are dormant, in March or April. This is before the buds start to swell, but when winter damage is apparent. Don't be afraid to remove at least 90 percent of the previous season's growth. This will ensure a higher quality product. Remember, the more you prune, the more grapes you will have. In the first year, cut back all buds except for 2 or 3. Then, select a couple of strong canes and cut back the rest. Make sure the remaining canes are fastened to the support. In the second year, prune back all canes. Leave a couple of buds on each of the arms. Remove flower clusters as they form. Do not fertilize in the first year unless you have problem soil. Fertilize lightly in the second year of growth. Use mulch to keep an even amount of moisture around the vines. A mesh net is useful in keeping birds away from budding fruit.

Pests / Diseases

- Aphids
- Japanese Beetles
- Powdery Mildew
- Black Rot

Harvest / Storage

If grapes aren't ripening, pinch back some of the foliage to let in more sunlight. Grapes will not continue ripening once picked from the vine. Test a few to see if they are to your liking before harvesting, usually in late summer or early fall. Grapes are ripe and ready to harvest when they are rich in colour, juicy, full-flavoured, easily crushed but not shriveled, and plump. They should be tightly attached to the stems. Sample different grapes from different clusters, and the taste should be between sweet and tart. Check our ripeness guide for more tips on colour. Grapes can be stored for up to six weeks in the cellar, but grapes can absorb the odours of other fruits and vegetables, so keep them separate. Use cardboard boxes or crates lined with clean, dry straw. Separate bunches with straw or sawdust. Check often for spoilage.

Variants

- 'Edelweiss': Hardy in zones 4–7 -28.9°C (–20°F), early white variety. Table and wine.
- 'Reliance': Hardy in zones 4–8, seedless, pink table grape.
- 'Seibel': Hybrid, wine grape. Cold hardy.
- 'Swenson Red': Hardy in zones 4–8, red table grape.
- 'Magnolia': White Muscadine wine grape. Sweet. Best in zones 7–9.
- 'Valiant': Eating grape hardy to Zone 2.

Other Tips

Grapefruit (Citrus paradisi) resemble grapes only in that they grow in clusters, but that was sufficient reason for early European explorers in Barbados to bestow this name on them.

9 Lemon

The lemon, Citrus limon (L.) Osbeck, is a species of small evergreen tree in the flowering plant family Rutaceae, native to South Asia, primarily North eastern India. The tree's ellipsoidal yellow fruit is used for culinary and non-culinary purposes throughout the world, primarily for its juice, which has both culinary and cleaning uses. The pulp and rind (zest) are also used in cooking and baking. The juice of the lemon is about 5% to 6% citric acid, with a pH of around 2.2, giving it a sour taste. The distinctive sour taste of lemon juice makes it a key ingredient in drinks and foods such as lemonade and lemon meringue pie.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 5.5-6.5	Bloom Time Year-round	Flower Colour White	Hardiness Zones 9-11					

Introduction

Although Citrus is a subtropical genus, northern gardeners can grow lemons, oranges, and other citrus trees in containers to enjoy fresh citrus fruit. Standard-size grapefruit and orange trees can grow 18 to 22 feet tall, whereas dwarf varieties only grow 8 to 12 feet tall. Most citrus varieties are self-fertile, so only one tree is needed for fruit production. On average, fruit bearing begins when the trees are between 3 and 6 years old; however, exact timing will depend on the type of citrus (lemons, oranges, grapefruit, etc.), the cultivar, your climate, the health of the plant and its care, and other factors. Flowering is not seasonal, but occurs during warm weather and regular rainfall. Flowers and fruits may coincide.

Planting

Citrus trees should be planted in a sunny and wind-protected area. In the citrus belt (a loosely defined area stretching from southern California to Florida), trees can be planted at any time, however, spring is the best time for container-grown plants. Standard-size citrus trees should be spaced 12 to 25 feet apart and dwarf citrus trees should be set 6 to 10 feet apart. The exact distance depends on the variety. The bigger the fruit, the farther the distance. If the soil is not well-drained, plant the trees on a slight mound to prevent waterlogging. To plant citrus trees inside from seeds, remove the seeds from the desired fruit. Soak the seeds overnight in water and plant them ½ inch deep in moist potting soil. Cover the pot with a plastic bag or wrap and let it sit in a warm and sunny spot for a few weeks until the seeds start to grow. Then, remove the plastic but keep the pot near a warm and sunny window.

Care

A few weeks after planting, and for the first few years (before bearing age), feed the tree a balanced (such as 6-6-6) fertilizer. Learn more about soil amendments and preparing soil for planting. For newly bearing trees, provide nutrients to continue branch and leaf growth, but also to replace nutrients lost by fruit forming. A citrus blend is ideal. Check manufacturer's directions, ask a garden nursery, or consult your local cooperative extension as to how often and how much fertilizer to apply during each year of a tree's growth. Mulches are not recommended for citrus trees, but if trees are located in a cultivated plant bed where mulch is used, keep at least 12 inches of bare ground between the tree trunk and the mulch. Pre-emergent herbicides may be used to prevent weed seeds from germinating. Fruit thinning is unnecessary for citrus trees, as they typically experience something called the "June drop." In late spring or early summer (May or June for most of the country), citrus trees naturally drop a number of their immature fruit.

Pests / Diseases

- Aphids
- Spider Mites
- Root and Crown Rots
- Fungal Leaf Spots
- Fruit Flies
- Tristeza Virus spread by Aphids

Harvest / Storage

Depending on the climate, citrus fruits may take 6 to 8 months to ripen. Citrus fruits will not ripen off the tree, so refrain from picking them too early. The best indicator of ripeness is taste. Harvest the fruit by cutting them off with pruning shears or by pulling the fruit stalk from the tree. Undamaged citrus fruits can be stored for several weeks at cool temperatures.

Variants

- 'Eureka'
- 'Sun Gold'

Other Tips

10 Lime

A lime (from French lime, "lemon") is a hybrid citrus fruit, which is typically round, green in colour, 3–6 centimetres (1.2–2.4 in) in diameter, and contains acidic juice vesicles. There are several species of citrus trees whose fruits are called limes, including the Key lime, Persian lime, kaffir lime, and desert lime. Limes are a rich source of vitamin C, sour and are often used to accent the flavours of foods and beverages. They are grown year-round. Plants with fruit called "limes" have diverse genetic origins; limes do not form a monophyletic group.

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Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Year-round	Flower Colour White	Hardiness Zones 9-11					

Introduction

Although Citrus is a subtropical genus, northern gardeners can grow lemons, oranges, and other citrus trees in containers to enjoy fresh citrus fruit. Standard-size grapefruit and orange trees can grow 18 to 22 feet tall, whereas dwarf varieties only grow 8 to 12 feet tall. Most citrus varieties are self-fertile, so only one tree is needed for fruit production. On average, fruit bearing begins when the trees are between 3 and 6 years old; however, exact timing will depend on the type of citrus (lemons, oranges, grapefruit, etc.), the cultivar, your climate, the health of the plant and its care, and other factors. Flowering is not seasonal, but occurs during warm weather and regular rainfall. Flowers and fruits may coincide.

Planting

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Care

A few weeks after planting, and for the first few years (before bearing age), feed the tree a balanced (such as 6-6-6) fertilizer. Learn more about soil amendments and preparing soil for planting. For newly bearing trees, provide nutrients to continue branch and leaf growth, but also to replace nutrients lost by fruit forming. A citrus blend is ideal. Check manufacturer's directions, ask a garden nursery, or consult your local cooperative extension as to how often and how much fertilizer to apply during each year of a tree's growth. Mulches are not recommended for citrus trees, but if trees are located in a cultivated plant bed where mulch is used, keep at least 12 inches of bare ground between the tree trunk and the mulch. Pre-emergent herbicides may be used to prevent weed seeds from germinating. Fruit thinning is unnecessary for citrus trees, as they typically experience something called the "June drop." In late spring or early summer (May or June for most of the country), citrus trees naturally drop a number of their immature fruit.

Pests / Diseases

- Aphids
- Spider Mites
- Root and Crown Rots
- Fungal Leaf Spots
- Fruit Flies
- Tristeza Virus spread by Aphids

Harvest / Storage

Depending on the climate, citrus fruits may take 6 to 8 months to ripen. Citrus fruits will not ripen off the tree, so refrain from picking them too early. The best indicator of ripeness is taste. Harvest the fruit by cutting them off with pruning shears or by pulling the fruit stalk from the tree. Undamaged citrus fruits can be stored for several weeks at cool temperatures.

Variants

- 'Bearss'
- 'Rangpur'

Other Tips

11 Mango

Mangoes are juicy stone fruit (drupe) from numerous species of tropical trees belonging to the flowering plant genus Mangifera, cultivated mostly for their edible fruit. Mango trees grow to 35–40 m (115–131 ft) tall, with a crown radius of 10 m (33 ft). The trees are long-lived, as some specimens still fruit after 300 years. In deep soil, the taproot descends to a depth of 6 m (20 ft), with profuse, wide-spreading feeder roots and anchor roots penetrating deeply into the soil. 'The leaves are evergreen, alternate, simple, 15–35 cm (5.9–13.8 in) long, and 6–16 cm (2.4–6.3 in) broad; when the leaves are young they are orange-pink, rapidly changing to a dark, glossy red, then dark green as they mature. The flowers are produced in terminal panicles 10–40 cm (3.9–15.7 in) long; each flower is small and white with five petals 5–10 mm (0.20–0.39 in) long, with a mild, sweet fragrance. Over 500 varieties of mangoes are known, many of which ripen in summer, while some give a double crop. The fruit takes four to five months from flowering to ripen. The ripe fruit varies in size, shape, colour, sweetness, and eating quality.

Cultivars are variously yellow, orange, red, or green, and carry a single flat, oblong pit that can be fibrous or hairy on the surface, and which does not separate easily from the pulp. The fruits may be somewhat round, oval, or kidney-shaped, ranging from 5–25 centimetres (2–10 in) in length and from 140 grams (5 oz) to 2 kilograms (5 lb) in weight per individual fruit. The skin is leather-like, waxy, smooth, and fragrant, with colour ranging from green to yellow, yellow-orange, yellow-red, or blushed with various shades of red, purple, pink or yellow when fully ripe. Ripe intact mangoes give off a distinctive resinous, sweet smell. Inside the pit 1–2 mm (0.039–0.079 in) thick is a thin lining covering a single seed, 4–7 cm (1.6–2.8 in) long. Mangoes have recalcitrant seeds which do not survive freezing and drying. Mango trees grow readily from seeds, with germination success highest when seeds are obtained from mature fruits.

Sowing Season	**Northern Hemisphere (Cold Climate)** ○	**Northern Hemisphere (Temperate Climate)** ○	**Northern Hemisphere (Subtropical Climate)** ○	**Northern Hemisphere (Tropical Climate)** ○	**Southern Hemisphere (Cold Climate)** ○	**Southern Hemisphere (Temperate Climate)** ○	**Southern Hemisphere (Subtropical Climate)** ○	**Southern Hemisphere (Tropical Climate)** ○			
Growing	**Sun Exposure** Full Sun	**Soil Type** Loamy, Well-drained	**Soil pH** 6.0-7.0	**Bloom Time** Winter-Spring	**Flower Colour** White-Pink	**Hardiness Zones** 10-11					

Planting

Care

Pests / Diseases

Harvest / Storage

Variants

Other Tips

12 Orange

The orange is the fruit of the citrus species Citrus × sinensis in the family Rutaceae. It is also called sweet orange, to distinguish it from the related Citrus × aurantium, referred to as bitter orange. The sweet orange reproduces asexually (apomixis through nucellar embryony); varieties of sweet orange arise through mutations. The orange tree is an evergreen, flowering tree, with an average height of 9 to 10 m (30 to 33 ft), although some very old specimens can reach 15 m (49 ft). Its oval leaves, alternately arranged, are 4 to 10 cm (1.6 to 3.9 in) long and have crenulate margins.

Sweet oranges grow in a range of different sizes, and shapes varying from spherical to oblong. Inside and attached to the rind is a porous white tissue, the white, bitter mesocarp or albedo (pith). The orange contains a number of distinct carpels (segments) inside, typically about ten, each delimited by a membrane, and containing many juice-filled vesicles and usually a few seeds (pips). When unripe, the fruit is green.

The grainy irregular rind of the ripe fruit can range from bright orange to yellow-orange, but frequently retains green patches or, under warm climate conditions, remains entirely green. Like all other citrus fruits, the sweet orange is non-climacteric. The Citrus sinensis group is subdivided into four classes with distinct characteristics: common oranges, blood or pigmented oranges, navel oranges, and acidless oranges.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Spring	Flower Colour White	Hardiness Zones 9-11					
Introduction	Although Citrus is a subtropical genus, northern gardeners can grow lemons, oranges, and other citrus trees in containers to enjoy fresh citrus fruit. Standard-size grapefruit and orange trees can grow 18 to 22 feet tall, whereas dwarf varieties only grow 8 to 12 feet tall. Most citrus varieties are self-fertile, so only one tree is needed for fruit production. On average, fruit bearing begins when the trees are between 3 and 6 years old; however, exact timing will depend on the type of citrus (lemons, oranges, grapefruit, etc.), the cultivar, your climate, the health of the plant and its care, and other factors. Flowering is not seasonal, but occurs during warm weather and regular rainfall. Flowers and fruits may coincide.										

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Care

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Pests / Diseases

- Aphids
- Spider Mites
- Root and Crown Rots
- Fungal Leaf Spots
- Fruit Flies
- Tristeza Virus spread by Aphids

Harvest / Storage

Depending on the climate, citrus fruits may take 6 to 8 months to ripen. Citrus fruits will not ripen off the tree, so refrain from picking them too early. The best indicator of ripeness is taste. Harvest the fruit by cutting them off with pruning shears or by pulling the fruit stalk from the tree. Undamaged citrus fruits can be stored for several weeks at cool temperatures.

Variants

- Sour Oranges - 'Bouquet de Fleurs'
- Sour Oranges - 'Seville'
- Sweet Oranges - 'Valencia' (Valencia)
- Sweet Oranges - 'Ruby' (Blood)
- Sweet Oranges - 'Washington' (Navel)

Other Tips

13 Peach

The peach (Prunus persica) is a deciduous tree native to the region of Northwest China where it was first domesticated and cultivated. It bears an edible juicy fruit called a peach or a nectarine. Prunus persica grows to 4–10 m (13–33 ft) tall and 6 in. in diameter. The leaves are lanceolate, 7–16 cm (2.8–6.3 in) long, 2–3 cm (0.79–1.18 in) broad, pinnately veined. The flowers are produced in early spring before the leaves; they are solitary or paired, 2.5–3 cm diameter, pink, with five petals. The fruit has yellow or whitish flesh, a delicate aroma, and a skin that is either velvety (peaches) or smooth (nectarines) in different cultivars. he flesh is very delicate and easily bruised in some cultivars, but is fairly firm in some commercial varieties, especially when green. The single, large seed is red-brown, oval shaped, approximately 1.3–2 cm long, and is surrounded by a wood-like husk. Peaches, along with cherries, plums and apricots, are stone fruits (drupes). There are various heirloom varieties, including the Indian Peach, or Indian Blood Peach, which arrives in the latter part of the summer, and can have colour ranging from red and white, to purple.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Early Spring	Flower Colour Pink	Hardiness Zones 4-9					

Introduction

Peaches picked at their peak are perfection. Here's how to plant, grow, and harvest peaches at the right time! Plus, we have some delicious peach recipes to try with your bounty! To grow peaches, the trick to choose a type that will fit with your specific climate. Peach trees can grow in USDA Zones 5 to 8, but do especially well in Zones 6 and 7. If you live in one of these zones, you can focus on choosing a variety based on its flavour and harvest-time. If you live in colder regions, there are some varieties that are more cold tolerant that you can choose.

Planting

Before planting peaches, choose a site with well-drained, moderately fertile soil in full sun. Be sure to avoid low areas because frost can more easily settle there and destroy your peaches. Plant the trees in spring. It is best to plant the trees the day you get them (if possible). Pick a tree that is about 1 year old. For container-grown trees, remove the plant from its pot and remove any circling roots by laying the root ball on its side and using shears to cut through the roots. For grafted trees, position the inside of the curve of the graft union away from the sun when planting. Dig a hole that is a few inches deeper and wider than the spread of the roots. Set the tree on top of a small mound of soil in the middle of the hole. Be sure to spread the roots away from the trunk without excessively bending them. If you are planting standard-size trees, space them 15 to 20 feet apart. Space dwarf trees 10 to 12 feet apart. However, most types of peach trees are self-fertile, so planting one tree at a time is fine.

Alternative Planting

If your circumstances are suitable, you might want to try a technique practiced in England. It involves planting a peach tree—ideally a dwarf variety—on the south side of the home or other building, under the eaves of the it. Over time, the gardener prunes and trains the peach tree to espalier in a fan-shape against or very near to the wall of the house. Plastic sheeting is attached to the eaves and draped to cover but not touch the tree, similar to a lean-to. This keeps the tree dry in winter, and the tree enjoys the warms of the sun, directly and as reflected off the house, year round. The plastic should be opened or lifted during bloom time to welcome pollinating insects and on hot, sunny days to ventilate the tree and prevent foliage burn.

Care

Thin the fruits so that they are 6 to 8 inches apart on the branch after the tree blooms (about 4 to 6 weeks). This ensures that the fruits will be larger. Prune and fertilize to accomplish 10 to 18 inches of new growth each season.

Fertilizer

About 6 weeks after planting, fertilize the young trees with 1 pound of a nitrogen fertilizer. During the second year, add ¾ pound of nitrogen fertilizer once in the spring and once in the early summer. After the third year, add about 1 pound of actual nitrogen per year to the mature trees in the spring. To help make the tree hardier, do not fertilize it within 2 months of the first fall frost date or when the fruits are maturing.

Pruning

Each pruning should NOT be avoided. If left unpruned, peach trees weaken, get diseased, and bear less fruit every year. Peaches bloom and bear fruit on second-year wood; therefore, the trees need to make good growth each spring and summer to insure a crop for the next year. Each winter, a large number of red 18- to 24-inch shoots need to be present as fruiting wood. If the trees are not pruned annually, the fruiting shoots move higher and higher, becoming out of reach. Alternate-year pruning results in excessive growth the year following heavy pruning, so annual, moderate pruning is essential for the long-term control of tree vigour and fruiting wood. Be sure to prune the tree to an open centre shape. In the summer of the first year, cut the vigorous shoots that form on the top of the tree by two or three buds. After about a month, check the tree. As soon as you have three wide-angled branches, spaced equally apart, cut back any other branches so that these three are the main branches. In the early summer of the second year, cut back the branches in the middle of the tree to short stubs and prune any shoots developing below the three main branches. After the third year, remove any shoots in the centre of the tree to keep its shape. Be sure to prune the tree annually to encourage production. Pruning is usually done mid to late April. Pinching the trees in the summer is also helpful.

Pests / Diseases

- Borers
- Aphids
- Japanese Beetles
- Leaf Hoppers
- Brown Rot
- Powdery Mildew
- Leaf Curl
- Mosaic Viruses

Harvest / Storage

Peaches are harvested when they are fully ripe from late June through July and August. With peaches, it's especially important to harvest at the RIGHT time. Though this timing depends on what type of peach variety, you can generally go by the colour of the fruit. When peaches are fully ripe, the ground colour of the fruit changes from green to completely yellow. No green should be left on the fruit. They should come off the tree with only a slight twist. The fruits found on the top and outside of the tree usually ripen first. Be careful when picking your peaches because some varieties bruise very easily.

Storage

You can store peaches in the refrigerator in a plastic bag. They should keep for about 5 days. You can also store peaches by making jam or by making pickled peaches. Peaches can also be canned or kept frozen for storage.

Variants

● 'Redhaven', which is the standard and most popular choice. These peaches are medium-size, but can be small if the tree is not properly thinned. Its skin is tough and firm and red in colour.
● 'Reliance', which is a hardy variety. It produces small and soft fruits.
● 'Harmony' ('Canadian Harmony'), which is winter hardy and moderately resistant to bacterial leaf spot. It produces medium to large fruit and freezes well.
● Hale
● Madison
● Saturn
● Contender
● Frost
● Topaz
● Florida Beauty

Other Tips

Although peaches are native to the Chinese countryside, the peach was brought to the western world from Iran. Peaches ripen faster in a closed paper bag at room temperature. Test buds of peaches and other sensitive fruits for freeze damage. Bring in a few twigs cut from the trees and place them in a vase of water. If the twigs bloom in a week or two, expect blossoms in the spring and a crop the following fall.

14 Pear

The pear is any of several tree and shrub species of genus Pyrus, in the family Rosaceae.
It is also the name of the pomaceous fruit of the various trees. Several species of pear are valued for their edible fruit and juices, while others are cultivated as trees.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Early Spring	Flower Colour White	Hardiness Zones 3-9					
Introduction	Biting into a juicy pear is one of the joys of the season. See how to plant, grow, and harvest pears in your own backyard. They are easy to fit into small yard spaces, and attractive, and require very little care once established. Growing pears is generally easier than growing apples, as they have less pest and disease issues. Two cultivars are generally needed for successful pollination and fruit set. Most pear trees are not self-pollinating. There are many different types of pears; some are best eaten raw and some are best for cooking. You can also grow pears in containers—and plant at any time of the year. Make sure you purchase pears specifically bred for containers. Be aware that pears can take from 3 to 10 years to begin flowering and bear fruit. Once they start producing, pear trees are prolific and long-lasting!										

Planting

● Plant pear trees in late winter or early spring.
● You'll need full sun for best fruit set and fertile, well-drained soil as well as good air circulation.
● If you live outside of the dry western regions, you should choose fire blight–resistant types and rootstocks.
● Plan to plant at least two varieties of pear trees, as they will need to be cross-pollinated to produce fruit. Make sure the varieties are compatible with each other.
● Space standard-size trees 20 to 25 feet apart. Space dwarf trees 12 to 15 feet apart.
● For container-grown trees, remove the plant from its pot and remove any circling roots by laying the root ball on its side and using shears to cut through the roots.
● For grafted trees, position the inside of the curve of the graft union away from the sun when planting.
● Dig a hole that is a few inches deeper and wider than the spread of the roots. Set the tree on top of a small mound of soil in the middle of the hole. Be sure to spread the roots away from the trunk without excessively bending them. Do not add fertilizer or topsoil to the hole.

Care

● Water the young trees well during dry spells to help establish the roots.
● Apply a small amount of fertilizer early in the year. Add ⅛ pound of ammonium nitrate per tree multiplied by the number of years the tree has been set in moderately fertile soil. If you have highly fertile soil, use less fertilizer.
● If the leaves are pale green or yellowish during the summer, use a little more fertilizer the next year.
● If the tree grows more than 12 inches in one season, use less fertilizer the next year.
● Be very careful when applying fertilizer! If you give your trees too much nitrogen, they will become more susceptible to fire blight and also may focus too much energy on producing foliage instead of flowers and fruit.

Pruning
● Prune annually to keep the tree healthy. Generally, prune lightly to keep the trees looking their best and productive.
● For dwarf trees, prune them to a central leader system.
● Standard-size trees can be pruned to either a central leader system or a modified leader system, which is easier to maintain.
● The central leader system features a central trunk with branches that spiral out every 5 to 8 inches, making sure that no branch is directly above another. The training for such a system begins in the early summer of the first year, during which time you should remove any shoots that form within 18 inches of the ground. The end result should resemble a Christmas tree.
● Use spreaders to help shape the branches of the trees. These help the branches to spread outward rather than upward. When the branches are small, you can use clothespins to push the branches away from the main trunk. For bigger branches, use wooden slats with a "V" shape notched into each end.
● Remember to thin the fruit as well, leaving about 6 inches between each cluster of fruit per branch.
● After your trees are established, water them regularly.

Pests / Diseases

● Fire Blight
● Pear Psylla
● Aphids
● Mites
● Powdery Mildew

Harvest / Storage

Harvest / Storage

- Harvest pears when they are mature but still hard. Ripen the pears at room temperature for the best quality fruits.
- Mature pear trees produce a lot of fruit in a short window of time. Be prepared!
- To store pears, pick them when they are fully grown but still very hard. You can keep them in the refrigerator; they should last for about 1 week. You can also keep them in containers in a cool 4.4°C (40°F), dark place; they should keep for 1 to 2 months.
- You can also can the pears for longer storage.

Variants

- ‘Bartlett’, which is the standard choice for pear trees. This tree type is average-size and produces medium to large fruits. These pears ripen to a yellow colour. However, this variety is very vulnerable to fire blight.
- ‘Kieffer’, which is resistant to fire blight. This type produces medium fruit and can be used in canning.
- ‘Anjou’, which produces light-green fruit with a sweet flavour. This type is a good choice for late-blooming pears. Good for canning and fresh use. This type can store for up to 6 months with little loss in quality.

Other Tips

Pick pears when the fruit has a faint yellow blush but is still green. Drop peeled pears in cold, lightly salted water, and they won’t turn brown.

15 Pineapple

The pineapple (Ananas comosus) is a tropical plant with an edible multiple fruit consisting of coalesced berries, also called pineapples, and the most economically significant plant in the family Bromeliaceae.
Pineapples may be cultivated from the offset produced at the top of the fruit, possibly flowering in five to ten months and fruiting in the following six months. The pineapple is a herbaceous perennial, which grows to 1.0 to 1.5 m (3.3 to 4.9 ft) tall, although sometimes it can be taller. In appearance, the plant has a short, stocky stem with tough, waxy leaves. When creating its fruit, it usually produces up to 200 flowers, although some large-fruited cultivars can exceed this. Once it flowers, the individual fruits of the flowers join together to create what is commonly referred to as a pineapple. After the first fruit is produced, side shoots (called 'suckers' by commercial growers) are produced in the leaf axils of the main stem. These may be removed for propagation, or left to produce additional fruits on the original plant.

Commercially, suckers that appear around the base are cultivated. It has 30 or more long, narrow, fleshy, trough-shaped leaves with sharp spines along the margins that are 30 to 100 cm (1.0 to 3.3 ft) long, surrounding a thick stem. In the first year of growth, the axis lengthens and thickens, bearing numerous leaves in close spirals. After 12 to 20 months, the stem grows into a spike-like inflorescence up to 15 cm (6 in) long with over 100 spirally arranged, trimerous flowers, each subtended by a bract. The ovaries develop into berries, which coalesce into a large, compact, multiple fruit. The fruit of a pineapple is arranged in two interlocking helices, eight in one direction, 13 in the other, each being a Fibonacci number.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 5.0-6.0	Bloom Time Year-round	Flower Colour Blue-Purple	Hardiness Zones 10-11					

Planting

Care

Pests / Diseases

Harvest / Storage

Variants

Other Tips

16 Plum

A plum is a fruit of the subgenus Prunus of the genus Prunus. The subgenus is distinguished from other subgenera (peaches, cherries, bird cherries, etc.) in the shoots having terminal bud and solitary side buds (not clustered), the flowers in groups of one to five together on short stems, and the fruit having a groove running down one side and a smooth stone (or pit). Mature plum fruit may have a dusty-white waxy coating that gives them a glaucous appearance. This is an epicuticular wax coating and is known as "wax bloom".

Dried plum fruits are called "dried plums" or prunes, although, in many countries, prunes are a distinct type of dried plum having a wrinkled appearance. Plums are a diverse group of species. The commercially important plum trees are medium-sized, usually pruned to 5–6 metres height. The tree is of medium hardiness. Without pruning, the trees can reach 12 metres in height and spread across 10 metres.

They blossom in different months in different parts of the world; for example, in about January in Taiwan and early April in the United Kingdom. Fruits are usually of medium size, between 2 and 7 centimetres in diameter, globose to oval. The flesh is firm and juicy. The fruit's peel is smooth, with a natural waxy surface that adheres to the flesh. The plum is a drupe, meaning its fleshy fruit surrounds a single hard seed.

GARDENING Fruit Plum

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Early Spring	Flower Colour White	Hardiness Zones 4-9					
Introduction	Plums! They're ready to pick from late August to early September in most regions. Ever thought about growing plums? Less demanding than most fruit trees, plums are a great choice for beginner gardeners. They're compact and prolific producers and add beauty to your backyard. Plus, plums are delicious cooked in jams and cakes or eaten right out of hand! Plums are a type of stone fruit, which also includes peaches, nectarines, apricots, and cherries.										

Choosing a Variety
● It's important to choose a type of plum that will work with your location. There are three major categories of plum trees: European, Japanese, and American hybrids. The hardy European types work in most regions across the U.S., whereas the Japanese types flourish where peach trees thrive (warmer regions, generally). American hybrids are typically the hardiest of the plums, with some varieties being able to survive as far north as Zone 3.
● European plums are generally self-fertile, but Japanese and American hybrid plums typically need to cross-pollinate with a second variety for cross-pollination. So, if you have space for only one tree, go with a European plum.
● Order bare-root, rather than potted trees, if possible. A well-established tree will yield up to 2 bushels of plums.

Planting

● Plant plum trees in loamy, well-drained soil. Plums do not do well when planted in clay-heavy soils or in locations where their roots will be constantly wet.
● Choose a planting location that receives full sun—at least 6 to 8 hours of direct sunlight.
● Avoid planting in pockets where frost may settle, as the frost may damage your trees.
● If possible, find a sheltered location, such as a south- or west-facing spot out of the wind. This will help the plum tree set fruit.

Planting the Tree
● Space standard-size trees 20 to 25 feet apart and dwarf trees 10 to 15 feet apart.
● Set bare-root trees atop a small mound of soil in the centre of the planting hole, and spread the roots down and away without unduly bending them. Keep the graft union an inch above the soil line.
● For container-grown tree for planting, remove the tree from its pot and get rid of any tightly circling roots by laying the root ball on its side and using shears to trim off these roots. Do your best to untangle roots without damaging roots, but if the root ball is particularly pot-bound, you can loosen it by scraping up and down the sides with a knife or hand fork.
● When planting grafted trees, it's important to keep the graft union 1 to 2 inches above the soil line. This is especially true for dwarf varieties, as roots may start to grow from above the graft if the tree is planted too deep, bypassing the rootstock that keeps the tree dwarf-size.
● Dig a hole that's a few inches deeper and wider than the spread of the roots. For bare-root trees, set the tree on top of a small mound of soil in the middle of the hole and spread the roots away from the trunk without excessively bending them.
For container-grown trees, simply place the root ball in the middle of the hole.

Fill in the hole, stopping periodically to make sure that the roots are thoroughly covered and no air pockets remain around the tree.
● Water the tree thoroughly; this helps the soil to settle around the roots. Keep the tree well watered for the first few weeks after planting.
● For bare-root trees, it's often recommended to stake the tree for at least one year, until the tree is stable enough to stand on its own.

Care

Thinning plum trees is important to prevent branches from breaking under the weight of the fruit. If branches do break, prune them back to undamaged wood, ideally cutting back to a natural fork to avoid leaving stubs. Be sure to water the young trees heavily every week during the first growing season to help promote growth. Then, water regularly. It's best to water the plant deeply at the soil line, then let the soil dry out (though not completely) and water again. Water your tree well into mid-October to give it plenty of moisture through the winter months.

Do not fertilize young fruit trees until they have set a crop. Once established, fruit production requires regular fertilizing all year long. If there's good fruit set, fertilize with one pound calcium nitrate per tree or 1½ lb. 10-10-10. Cut back the nitrogen in fall and winter to avoid encouraging new growth in those seasons. In the fall, rake away all debris and fallen trees.

Prune in early spring or mid-summer to avoid infection. The best time for pruning is usually spring for young trees and mid-summer for established ones. Do NOT prune in the fall or winter injury and infection may occur. To prevent winter injury: Consider a tree wrap or guard around the lower trunk, especially for a young plum tree. To help control pests and diseases, remember to prune your trees to keep them open. You can also mulch around the trees in the spring to help control weeds, but be sure to remove the mulch in the late fall so that no pests use it over the winter.

You can also lightly cultivate the soil around your trees in late spring to eliminate any pests in the soil. Keep an eye on the lower bark and branches for mouse or rabbit damage; if this could be a problem, you may need to install tree guards or fence in young trees with chicken wire for the winter.

Pruning Japanese Plum Trees
If you have a Japanese variety, the best pruning method is to create an "open centre" shape, where the central trunk is cut short and several large branches radiate outwards from it's tip. In the summer of the first year, cut the vigorous shoots that form on the top of the tree by two or three buds. After about a month, check the tree. As soon as you have three wide-angled branches, spaced equally apart, cut back any other branches so that these three are the main branches. In the early summer of the second year, cut back the branches in the middle of the tree to short stubs and prune any shoots developing below the three main branches. After the third year, remove any shoots in the centre of the tree to keep its shape. Japanese types require heavy pruning to help keep them in shape and to produce better fruit. It is also good to thin out the fruit on these types of trees. You should space the plums about 3 to 4 inches apart on each branch.

Pruning European Plum Trees
If you have a European variety, the best pruning method is to create a central leader. This shape features a central trunk with branches that spiral out every 5 to 8 inches, making sure that no branch is directly above another. The training for such a system begins in the early summer of the first year, during which time you should remove any shoots that form within 18 inches of the ground. The end result should resemble a Christmas tree. European types do not require fruit thinning because they do not produce as much fruit as Japanese types. However, the fruit on these types should be spaced about 2 inches apart on each branch.

Pests / Diseases

- Silver Leaf Disease
- Honey Fungus
- Bacterial Canker
- Pocket Plum
- Japanese Beetles
- Plum Aphids
- Plum Moth

Harvest / Storage

European plums have the best flavour when left to ripen on the tree. You can tell when plums are ripe by applying gentle pressure with your fingers. If the skin of the fruit feels soft, then it is ready to be picked. Plums should come off the tree easily with just a slight twist of the fruit. Japanese plums are picked slightly early and allow them to ripen in a cool place. Unfortunately, the fruit does not store for long, so must be eaten or preserved. Alternatively, you can pick the fruits when they are still slightly firm and store them in a cool place to fully ripen. The best place to store plums is in the refrigerator. The best temperature for storing plums is about -0.5-0°C (31-32°F) with relative humidity around 90–95%; if kept at this temperature, plums may last for 2 to 4 weeks.

Variants

For a European type, try the ‘Stanley’. This semi-freestone type is works great for the eastern, midwestern, and some of the northwest regions of the U.S. It is self-fertile, meaning no cross-pollination is necessary. It’s harvested in late August, producing medium to large plums with dark blue skin and greenish-yellow flesh and is great for cooking, canning, or eating fresh. For a Japanese type, try the ‘Satsuma’, which produces large, dark-red plums. This kind is good for eating fresh and canning because of its sweet taste. American hybrid trees, such as ‘Alderman’, ‘Superior’, and ‘Underwood’, are all popular choices. These trees combine the taste of the Japanese variety with the hardiness of the European variety. These types work well for regional extremes.

Other Tips

17 Raspberry

The raspberry is the edible fruit of a multitude of plant species in the genus Rubus of the rose family, most of which are in the subgenus Idaeobatus; the name also applies to these plants themselves. Raspberries are perennial with woody stems. Various kinds of raspberries can be cultivated from hardiness zones 3 to 9. Raspberries are traditionally planted in the winter as dormant canes, although planting of tender, plug plants produced by tissue culture has become much more common. Plants are typically planted 2-6 per m in fertile, well drained soil; raspberries are usually planted in raised beds/ridges, if there is any question about root rot problems. All cultivars of raspberries have perennial roots but, many do not have perennial shoots. In fact, most raspberries have shoots that are biennial (meaning shoots grow in the first growing season and fruits grow off of those shoots during the second growing season). The flowers can be a major nectar source for honeybees and other pollinators.

Raspberries are vigorous and can be locally invasive. They propagate using basal shoots (also known as suckers), extended underground shoots that develop roots and individual plants. They can sucker new canes some distance from the main plant. For this reason, raspberries spread well, and can take over gardens if left unchecked. Raspberries are often propagated using cuttings, and will root readily in moist soil conditions. The fruit is harvested when it comes off the receptacle easily and has turned a deep colour (red, black, purple, or golden yellow, depending on the species and cultivar). This is when the fruits are ripest and sweetest. Excess fruit can be made into raspberry jam or frozen. High tunnel bramble production offers the opportunity to bridge gaps in availability during late fall and late spring. Furthermore, high tunnels allow less hardy floricane-fruiting raspberries to overwinter in climates where they wouldn't otherwise survive. In the tunnel plants are established at close spacing usually prior to tunnel construction.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 5.5-6.5	Bloom Time Spring-Summer	Flower Colour White-Pink	Hardiness Zones 3-9					

Introduction

Raspberries are relatively easy to grow and can bear fruit indefinitely with proper care. Here’s how to grow raspberries in your garden—from planting to harvest! There are two types of raspberries, both with their own specific requirements for growing:
- Summer-fruiting raspberries bear one crop per season, in summertime (often June or July).
- Ever-bearing raspberries (also called fall-bearing or primocane-fruiting) bear a fall crop and can also produce fruit the following summer.

Most raspberries are summer-bearing varieties and all are self-fertile, meaning you’ll get fruit with only one variety. They’re best pollinated by bees, and will start producing fruit a year after planting. Though raspberry bushes are naturally inclined to grow in cooler climates, the plants now come in many varieties suited to a range of planting zones. All raspberries will need pruning annually! Raspberries are perennials, however it’s important to realize that their branches (or canes) which bear the fruit live for only two summers. During the first year, the new green cane (primocane) grows vegetatively. The cane develops a brown bark, is dormant in winter, and during the second growing season is called a floricane. The floricane produces fruit in early to mid summer and then dies. New primocanes are produced each year, so fruit production continues year after year. It’s your job to prune out those dead canes each year.

Planting

When to Plant
Raspberry plants can be purchased as dormant, bare-root plants or as potted plants. Plant bare-root transplants in the early spring as soon as the soil can be worked. Plant potted transplants in the spring after threat of frost has passed.

How to Plant
Pick a site with full sun to produce the most fruit. The plant will grow in part shade, but harvests will be meager. Your site needs rich and well-drained soil, great air circulation, and shelter from wind. Avoid a wet area, as well as a windy spot, as raspberries do not like to stand in water nor dry out. Prepare soil with a couple inches of compost or aged manure a couple weeks before planting. (A good rate is about 3 ½ cubic feet of compost per 100 square feet.) Till the soil well before planting. Plant far from wild growing berries, otherwise risk the spread of pests and diseases to your garden. Before planting, soak the roots for an hour or two. Dig a hole that is roomy enough for the roots to spread. Whether you’re planting bare-root or potted plants, keep the crown of the plant 1 or 2 inches above the ground. Space red and yellow raspberry plants from 2 to 3 feet apart, in rows 8 feet apart. Space black and purple types 4 feet apart. Depending on the variety you plant, you may need to fashion a support. A trellis or a fence are good options. If you chose to use one of these, establish them at or before time of planting so the plants are not disturbed when maturing.

Care

Mulching is important throughout the season to conserve moisture and suffocate weeds. Keep a thick layer of mulch surrounding plants at all times. Water one inch per week from spring until after harvest. Regular watering is better than infrequent deep soaking. The roots send up an abundant amount of shoots, called canes. Keep order by pruning away the majority of them, so that the survivors can produce lots of berries.

Pruning
Summer-Bearers produce berries on two year old canes while one year old canes grow right beside them. You shouldn't have trouble telling which is which: the older canes have brown stems, and the young ones are still green. Prune only the older ones, the ones that have finished their fruitful year.

Red Raspberries: Prune any time after the last harvest and before growth begins in the spring. Cut all canes that produced fruit to the ground. Thin to 6 sturdy canes per hill (per foot of row). In areas where winter injury is common, you may delay thinning the primocanes (new growth) until the following spring, when you will be able to tell which canes have survived. Before growth starts in spring, cut the canes to about 12 inches above the support. Don't cut back more than 25% of each cane, to avoid reducing yield.
Black and Purple Raspberries: When primocanes are between 24 to 30 inches in height, pinch out the tip of each shoot to induce branching. This will make the fruit easier to pick and increase production. After harvest, cut down all canes that bore fruit to ground level. Before growth begins the following spring, cut back all side branches so they are 12 to 18 inches long. Select 6 canes per hill, and prune out the rest. Tie these canes to the support system.
Ever-bearing or fall-bearing raspberries: This is easy. Just cut all canes to the ground any time after harvest and before growth begins in the spring. They give fruit on canes which are in their first year of growth, after which there is no reason to keep them. Mow them to the ground or use pruning shears for a small patch.
Ever-bearing or fall-bearing raspberries: Clean up all debris—diseases and pests overwinter. Pruning is not required during the growing season unless you want to keep a uniform order.

Note: This assumes you are harvesting a fall crop. To get both fall and following summer crop, do not remove the primocanes that produced the fall crop. Prune them back in spring to about 12 inches above the support, or to the last visible node that had fruit, cutting off the dead tips.

Pests / Diseases

Raspberries are one of the few fruits that are hardly bothered by pests and diseases. (Black raspberries are more susceptible to this type of damage than red or purple.)

- Keep an eye out for spider mites and Japanese beetles from June through August.
- Rabbits love to eat the canes in winter. A chicken wire fence will help prevent rabbit damage.
- Powdery Mildew
- Cane Borers

Harvest / Storage

All varieties will begin to produce fruit in their second season. In some cases, ever-bearers may bear small berries in their first autumn. In early summer, berries will ripen over a time of about 2 weeks. You will need to pick berries every couple of days. Try to harvest berries on a sunny day, when they are dry. Don't tug too hard on your raspberries when picking. A ripe raspberry will leave the vine willingly. Raspberries can be kept refrigerated for about 5 days. If possible, don't wash the berries after picking, unless you're going to eat them straight away. They will grow mouldy and mushy if not kept dry in storage. If you do need to wash them, let them air dry completely before storing. If the fruit is to be made into preserves, it should be done straight off the plant. Raspberries can be frozen. As with freezing blueberries, make a single layer of berries on a cookie sheet. When frozen, place into airtight bags.

Variants

There are many, many raspberry varieties available today—and each one is unique! Here are a few to get you started. Ask your local garden centre or cooperative extension service which raspberry varieties are best-suited for your area.

- 'Canby': red berries; summer-bearing; nearly thornless; recommended for New England, Upper Great Lakes, and Northwest
- 'Heritage': red berries; ever-bearing; recommended for the Mid-Atlantic and Ohio Valley
- 'Plainsman': red berries; ever-bearing; does well in higher altitudes (the Rockies and High Plains)
- 'Fallgold': yellow berries; ever-bearing; recommended for the Upper Midwest and Canada
- 'Double Gold': yellow berries tinged with peach; ever-bearing; better for warmer areas, as the fall crop can be quite late
- 'Royalty': purple berries; summer-bearing; better for warmer areas
- 'Jewel': black berries; summer-bearing; disease-resistant and great for warmer areas
- 'Black Hawk': black berries; summer-bearing; heat and drought tolerant

Other Tips

Raspberries are a great source of dietary fibre and Vitamin C and they may help to protect against disease.

18 Strawberry

The garden strawberry (or simply strawberry; Fragaria × ananassa) is a widely grown hybrid species of the genus Fragaria, collectively known as the strawberries. It is cultivated worldwide for its fruit. The fruit is widely appreciated for its characteristic aroma, bright red colour, juicy texture, and sweetness. Strawberry cultivars vary widely in size, colour, flavour, shape, degree of fertility, season of ripening, liability to disease and constitution of plant. On average, a strawberry has about 200 seeds on its external membrane.

Some vary in foliage, and some vary materially in the relative development of their sexual organs. Strawberries may also be propagated by seed, though this is primarily a hobby activity, and is not widely practiced commercially. A few seed-propagated cultivars have been developed for home use, and research into growing from seed commercially is ongoing.

Seeds (achenes) are acquired either via commercial seed suppliers, or by collecting and saving them from the fruit. Strawberries can also be grown indoors in strawberry pots. Although the plant may not naturally grow indoors in the winter, use of LED lighting in combination of blue and red light can allow the plant to grow during the winter. Additionally, in certain areas like the state of Florida, winter is the natural growing season where harvesting starts in mid-November.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 5.5-6.5	Bloom Time Spring	Flower Colour **White**	Hardiness Zones 3-10					

GARDENING | Fruit | Strawberry

Introduction	Sweet, juicy strawberries are treats when right off the plant. Supermarket berries tend to be tart with grainy texture; this is because the natural sugar in the berries begins converting to starch as soon as it is plucked from the plant. It's definitely worth your while to try growing strawberries, and the good news is that they are relatively easy to grow if you have full sun. Strawberry plants come in three types. For the home garden, we recommend Junebearers. Although you will have to wait a year for fruit harvesting, it will be well worth it.
Day-Neutral	Insensitive to day length, these varieties produce buds, fruits and runners continuously if temperature remains between 35 and 85. Production is less than that of Junebearers.
Everbearer	These varieties form buds during the long days of summer and the short days of autumn. The summer-formed buds flower and fruit in autumn, and the autumn-formed buds fruit the following spring.
Junebearer	Length-of-day sensitive, these varieties produce buds in the autumn, flowers and fruits the following spring, and runners during the long days of summer.

Planting

- Buy disease-resistant plants from a reputable nursery, of a variety recommended in your area.
- Plan to plant as soon as the ground can be worked in the Spring. See your local frost dates.
- Establish new plants each year to keep berry quality high each season.
- Strawberries are sprawling plants. Seedlings will send out runners, or 'daughter' plants, which in turn will send out their own runners.
- Make planting holes deep and wide enough to accommodate the entire root system without bending it. However, don't plant too deep: The roots should be covered, but the crown should be right at the soil surface.
- Provide adequate space for sprawling. Set plants out 20 inches apart, and leave 4 feet between rows.
- Roots shouldn't be longer than 8 inches when plants are set out. Trim them if necessary.
- It is also possible to grow strawberries from last year's runners.
- pH should be between 5.5 and 7. If necessary, amend your soil in advance.
- Strawberry plants require 6-10 hours a day of direct sunlight, so choose your planting site accordingly.
- Tolerant of different soil types, although prefer loam. Begin working in aged manure or compost a couple months before planting.
- Planting site must be well-drained. Raised beds are a particularly good option for strawberry plants.
- Practice crop rotation for the most success. Do not plant in a site that recently had strawberries, tomatoes, peppers, or eggplant.

Care

- In the first year, pick off blossoms to discourage strawberry plants from fruiting. If not allowed to bear fruit, they will spend their food reserves on developing healthy roots. The yields will be much greater in the second year.
- Eliminate daughter plants as needed. First and second generations produce higher yields. Try to space each plant about 10 inches apart.
- Moisture is incredibly important due to shallow roots. Water adequately, about one inch per week. Strawberry plants need a lot of water when the runners and flowers are developing and again in the fall when the plants are mature.
- Keep the beds mulched to reduce water needs and weed invasion.
- Be diligent about weeding. Weed by hand, especially in the first months after planting.
- When the growing season is over, mow or cut foliage down to one inch and mulch plants about 4 inches deep with straw, pine needles or other organic material. This can be done after the first couple of frosts, or when air temps reach -6°C (20°F).
- Remove mulch in early spring, after danger of frost has passed.
- Row covers are a good option for protecting blossoms and fruit from birds.

Pests / Diseases

- Gray Mould
- Powdery Mildew
- Japanese Beetles
- Spider Mites
- Slugs

Keeping beds weed-free and using a gritty mulch can deter slugs and bugs. Spread sand over the strawberry bed to deter slugs. (This also works well for lettuce.) Pine needles also foil slug and pill-bug damage. For bigger bugs such as Japanese beetles, spray your plants with puréed garlic and neem seed oil. When birds threaten your strawberries, position balloons with scare-eyes above the beds and use reflective Mylar bird tape to deter them.

Harvest / Storage

- Fruit is ready for harvesting 4–6 weeks after blossoming.
- Harvest only fully red (ripe) berries, and pick every three days.
- Cut by the stem; do not pull the berry.
- Harvest will last up to 3 weeks. You should have an abundance of berries, depending on the variety.
- Store unwashed berries in the refrigerator for 3–5 days.
- Strawberries can be frozen whole for about 2 months.

Variants

Try planting more than one variety. Each will respond differently to conditions, and you will have a range of different fruits to enjoy.

- 'Northeaster' is best suited for the north-eastern US and south-eastern Canada. Fruit has strong flavour and aroma.
- 'Sable' is hardy to zone 3, early season, great flavour.
- 'Primetime' is a mild-flavoured, disease-resistant variety, best adapted to the Mid-Atlantic.
- 'Cardinal' is a good variety to try in the South.
- 'Camarosa' is a good variety to try on the West Coast.
- 'Tristar' is a day-neutral variety that's very well-suited for hanging baskets.

Other Tips

19 Tangerine

The tangerine (Citrus tangerina) is a group of orange-coloured citrus fruit consisting of hybrids of mandarin orange (Citrus reticulata). Tangerines are smaller and less rounded than common oranges. The taste is considered less sour, as well as sweeter and stronger, than that of an orange. Tangerines contain 85% water, 13% carbohydrates, and negligible amounts of fat and protein (table). Among micronutrients, only vitamin C is in significant content (32% of the Daily Value) in a 100 gram reference serving, with all other nutrients in low amounts. A ripe tangerine is firm to slightly soft, heavy for its size, and pebbly-skinned with no deep grooves, as well as orange in colour. The peel is very thin, with very little bitter white mesocarp, which makes them usually easier to peel and to split into segments. All of these traits are shared by mandarins generally.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Loamy, Well-drained	Soil pH 6.0-7.0	Bloom Time Spring	Flower Colour White	Hardiness Zones 9-11					

Introduction

Although Citrus is a subtropical genus, northern gardeners can grow lemons, oranges, and other citrus trees in containers to enjoy fresh citrus fruit. Standard-size grapefruit and orange trees can grow 18 to 22 feet tall, whereas dwarf varieties only grow 8 to 12 feet tall. Most citrus varieties are self-fertile, so only one tree is needed for fruit production. On average, fruit bearing begins when the trees are between 3 and 6 years old; however, exact timing will depend on the type of citrus (lemons, oranges, grapefruit, etc.), the cultivar, your climate, the health of the plant and its care, and other factors. Flowering is not seasonal, but occurs during warm weather and regular rainfall. Flowers and fruits may coincide.

Planting

Citrus trees should be planted in a sunny and wind-protected area. In the citrus belt (a loosely defined area stretching from southern California to Florida), trees can be planted at any time, however, spring is the best time for container-grown plants. Standard-size citrus trees should be spaced 12 to 25 feet apart and dwarf citrus trees should be set 6 to 10 feet apart. The exact distance depends on the variety. The bigger the fruit, the farther the distance. If the soil is not well-drained, plant the trees on a slight mound to prevent waterlogging. To plant citrus trees inside from seeds, remove the seeds from the desired fruit. Soak the seeds overnight in water and plant them ½ inch deep in moist potting soil. Cover the pot with a plastic bag or wrap and let it sit in a warm and sunny spot for a few weeks until the seeds start to grow. Then, remove the plastic but keep the pot near a warm and sunny window.

Care

A few weeks after planting, and for the first few years (before bearing age), feed the tree a balanced (such as 6-6-6) fertilizer. Learn more about soil amendments and preparing soil for planting. For newly bearing trees, provide nutrients to continue branch and leaf growth, but also to replace nutrients lost by fruit forming. A citrus blend is ideal. Check manufacturer's directions, ask a garden nursery, or consult your local cooperative extension as to how often and how much fertilizer to apply during each year of a tree's growth. Mulches are not recommended for citrus trees, but if trees are located in a cultivated plant bed where mulch is used, keep at least 12 inches of bare ground between the tree trunk and the mulch. Pre-emergent herbicides may be used to prevent weed seeds from germinating. Fruit thinning is unnecessary for citrus trees, as they typically experience something called the "June drop." In late spring or early summer (May or June for most of the country), citrus trees naturally drop a number of their immature fruit.

Pests / Diseases

- Aphids
- Spider Mites
- Root and Crown Rots
- Fungal Leaf Spots
- Fruit Flies
- Tristeza Virus spread by Aphids

Harvest / Storage

Depending on the climate, citrus fruits may take 6 to 8 months to ripen. Citrus fruits will not ripen off the tree, so refrain from picking them too early. The best indicator of ripeness is taste. Harvest the fruit by cutting them off with pruning shears or by pulling the fruit stalk from the tree. Undamaged citrus fruits can be stored for several weeks at cool temperatures.

Variants

Other Tips

20 Watermelon

Citrullus lanatus is a plant species in the family Cucurbitaceae, a vine-like (scrambler and trailer) flowering plant originally from Africa. It is cultivated for its fruit. The subdivision of this species into two varieties, watermelons and citron melons. The watermelon is an annual that has a prostrate or climbing habit. Stems are up to 3 m long and new growth has yellow or brown hairs. Leaves are 60 to 200 mm long and 40 to 150 mm wide. These usually have three lobes which are themselves lobed or doubly lobed. Plants have both male and female flowers on 40-mm-long hairy stalks. These are yellow, and greenish on the back. The watermelon is a large annual plant with long, weak, trailing or climbing stems which are five-angled (five-sided) and up to 3 m (10 ft) long. Young growth is densely woolly with yellowish-brown hairs which disappear as the plant ages. The leaves are large, coarse, hairy pinnately-lobed and alternate; they get stiff and rough when old. The plant has branching tendrils.

The white to yellow flowers grow singly in the leaf axils and the corolla is white or yellow inside and greenish-yellow on the outside. The flowers are unisexual, with male and female flowers occurring on the same plant (monoecious). The male flowers predominate at the beginning of the season; the female flowers, which develop later, have inferior ovaries. The styles are united into a single column. The large fruit is a kind of modified berry called a pepo with a thick rind (exocarp) and fleshy centre (mesocarp and endocarp). Wild plants have fruits up to 20 cm (8 in) in diameter, while cultivated varieties may exceed 60 cm (24 in). The rind of the fruit is mid- to dark green and usually mottled or striped, and the flesh, containing numerous pips spread throughout the inside, can be red or pink (most commonly), orange, yellow, green or white.

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Growing	Sun Exposure Full Sun	Soil Type Sandy Loam	Soil pH 6.0-7.0	Bloom Time Summer	Flower Colour Yellow	Hardiness Zones 4-11					

Planting

If you live in warmer climes, you can sow seeds directly outdoors, but wait until the soil temperature warms to at least 21.1°C (70°F) to avoid poor germination. Watermelon vines are very tender and should not be transplanted until all danger of frost has passed. (To be safe, wait at least two weeks past your last frost date.) If you are in a cooler zone, start seeds indoors about a month before transplanting. Amend soil with aged manure, seaweed, and/or compost before planting. Watermelons are heavy feeders. Learn more about soil amendments and preparing soil for planting. Watermelons prefer a soil pH between 6 and 6.8. Growing the vines in raised rows, known as hills, ensures good drainage and will hold the sun's heat longer. Space the plants about 2 feet apart in a 5-foot-wide hill. If you're growing in rows, space 6 feet by 6 feet apart. Watermelons like loamy, well-drained soil. Handle them gently when you transplant. After you transplant, cover the plants with row covers to keep pests at bay. You'll remove the row covers when you see both male and female flowers on the vine.

Care

Mulching with black plastic will serve multiple purposes: it will warm the soil, hinder weed growth, and keep developing fruits clean. Watering is very important—from planting until fruit begins to form. While melon plants are growing, blooming, and setting fruit, they need 1 to 2 inches of water per week. Keep soil moist, but not waterlogged. Water at the vine's base in the morning, and try to avoid wetting the leaves and avoid overhead watering. Reduce watering once fruit are growing. Dry weather produces the sweetest melon. If you choose to fertilize (and many do), make sure it delivers more nitrogen than phosphorus and potassium. However, after flowering begins, use a fertilizer with less nitrogen. We like to use liquid seaweed. Pruning isn't necessary, but vine productivity may be improved if you do not allow lateral (side) vines to grow and stick to the main vine.

When the plant is young, just cut off the end buds as they form (before the side shoots become vines). You can also pinch off some blossoms to focus the energy on fewer melons (though it's a challenge to kill off a potential fruit). Vines produce male and female flowers separately on the same plant. They often begin producing male flowers several weeks before the females appear. Do not be concerned if the male flowers fall off. The female flowers (which have a swollen bulb at the base) will stay on the vine and bear fruit. Blossoms require pollination to set fruit, so be kind to the bees! As fruit is ripening, prevent rotting by gently lifting it and putting cardboard or straw between the fruit and the soil.

Pests / Diseases

- Aphids
- Cucumber Beetles
- Squash Vine Borer Moths
- Fusarium Wilt

Harvest / Storage

Watermelons don't sweeten after they are picked, so harvest time is important. They generally ripen over two weeks so keep your eye on them.

Tell if it's Ripe
How to tell if watermelons are ripe: Thump it. If the watermelon sounds hollow, it's ripe. Look at the colour on the top. The watermelon is ripe when there is little contrast between the stripes. Look at the colour on the bottom. A green watermelon will have a white bottom; a ripe melon will have a cream- or yellow-coloured bottom. Press on it. If the watermelon sounds like it gives a little, it's ripe. (Rhodes doesn't like this method because it can ruin the quality of the fruit.) Check the tendril. If it's green, wait. If it's half-dead, the watermelon is nearly ripe or ripe. If the tendril is fully dead, it's ripe or overripe; it's not going to get any riper, so you might as well pick! Stems should be cut with a sharp knife close to the fruit. Watermelons can be stored uncut for about 10 days. If cut, they can last in the refrigerator for about 4 days. Wrap tightly in plastic.

Variants

- 'Sugar Baby': 80 days to maturity. Produces 10-pound melons with bright red flesh. This variety of smaller fruit can be planted just 4 feet apart.
- 'Sweet Beauty': 80 days to maturity. A 2004 All-America Selection. Bears 6-pound, oblong melons with red flesh.
- 'Golden Midget': 70 days to maturity. Bears petite, yellow-skinned 3-pound melons with pink flesh. Good for Northern gardeners.

Other Tips

Watermelon is 90% water.

6 Herbs & Spices

How to grow most herbs and spices.

Subheadings

1 Bay Leaf

GARDENING
Herbs & Spices
Bay Leaf

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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2 Basil

GARDENING
Herbs & Spices
Basil

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Feb	Southern Hemisphere (Temperate Climate) Sep-Dec	Southern Hemisphere (Subtropical Climate) Aug-Feb	Southern Hemisphere (Tropical Climate) All Year			
Sowing Guide	Sowing Depth 3mm	Row Spacing ○	Plant Spacing 25-40cm	Frost Tender / Hardy FT	Direct Sow / Raise Seeds R/D	Germination Time 7-14 Days					

Introduction

Basil is a warm-weather, fragrant herb that tastes great in Italian dishes—and let's not forget homemade pesto! Plant seeds or transplants after all danger of frost has passed and soil is warm, and it will yield an abundant harvest within weeks. Keep harvesting the leaves to keep the plant going strong. The most common type of basil is sweet basil; other types include purple basil (less sweet than common basil), lemon basil (lemon flavour), and Thai basil (liquorice flavour). Basil is easy to grow but it only grows outdoors in the summer—and only once the soil has warmed up nicely—so plan accordingly. If you're planning on making pesto, grow several plants. Otherwise one or two basil plants yields plenty.

Planting

- To get a head start, start the seeds indoors 6 weeks before the last spring frost. (See local frost dates.)
- To plant outside, wait until the soil is at least 50°F, preferably around 70°F for best growth. Don't rush basil. Without heat, the plant won't grow.
- Basil needs to be in a location that gets 6 to 8 hours of full Sun daily; soil should be moist and well-drained.
- Plant seeds/seedlings about ¼-inch deep and 10 to 12 inches apart. They should grow to about 12 to 24 inches in height. For smaller plants, plant farther apart (about 16 to 24 inches).
- During the dry periods in summer, water the plants freely.
- Remember to pinch out the flower heads as soon as they appear to make sure that the leaves will continue growing.
- If you're planning on cooking with these plants, plant in clean soil (don't use fertilizers that leave harmful residues) and grow them away from driveways and busy streets so that exhaust won't settle on the plants.
- Tomatoes make great neighbours for basil plants in the garden.

Care

Make sure that the soil is moist. Basil plants like moisture. If you live in a hot area, use mulch around the basil plants (the mulch will help keep the soil moist). After the seedlings have their first six leaves, prune to above the second set. Every time a branch has six to eight leaves, repeat pruning the branches back to their first set of leaves. After 6 weeks, pinch off the centre shoot to prevent early flowering. If flowers do grow, just cut them off. If the weather is going to be cold, be sure to harvest your basil beforehand, as the cold weather will destroy your plants.

Pests / Diseases

- Aphids
- Variety of bacterial and fungal leaf, stem, and root diseases

Harvest / Storage

Start picking the leaves of basil as soon as they are 6 to 8 inches tall. Once temperatures hit 80°F, basil will really start leafing out. Make sure to pick the leaves regularly to encourage growth throughout the summer. Even if you don't need to leaves, pick them to keep the plant going. Freeze the leaves. If you pick regularly, twelve basil plants will produce 4 to 6 cups of leaves per week. The best method for storing basil is freezing. Freezing will prevent the plant from losing any of its flavour. To quick-freeze basil, dry whole sprigs of basil and package them in airtight, resealable plastic bags, then place in the freezer. Another storage method is drying the basil (although some of the flavour will be lost). Pinch off the leaves at the stem and place them in a well-ventilated and shady area. After 3 to 4 days, if the plants are not completely dry, place them in the oven on the lowest heat setting with the door slightly open. Remember to turn the leaves (for equal drying) and check them frequently.

Variants

Cinnamon basil, to add a hint of cinnamon to a dish. Purple basil, to add some nice colour to your garden (when steeped in white vinegar, it creates a beautiful colour) Thai basil, to add a sweet liquorice flavour to a dish.

Other Tips

Basil has a lovely fragrance. Pick from the stems and put in water for a few days as you would cut flowers!

3 Bergamot

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Oct-Mar	Southern Hemisphere (Temperate Climate) Sep-Apr	Southern Hemisphere (Subtropical Climate) Apr-Sep	Southern Hemisphere (Tropical Climate) Apr-Sep
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○		
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4 Black Pepper

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○		
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5 Cayenne Pepper

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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6 Chamomile

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Jul-Nov	Southern Hemisphere (Subtropical Climate) Mar-Oct	Southern Hemisphere (Tropical Climate) Aug-Sep			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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7 Chives

Sowing Season	**Northern Hemisphere (Cold Climate)** ○	**Northern Hemisphere (Temperate Climate)** ○	**Northern Hemisphere (Subtropical Climate)** ○	**Northern Hemisphere (Tropical Climate)** ○	**Southern Hemisphere (Cold Climate)** Oct-Mar	**Southern Hemisphere (Temperate Climate)** Sep-Mar	**Southern Hemisphere (Subtropical Climate)** All Year	**Southern Hemisphere (Tropical Climate)** All Year			
Sowing Guide	**Sowing Depth** ○	**Row Spacing** ○	**Plant Spacing** ○	**Frost Tender / Hardy** ○	**Direct Sow / Raise Seeds** ○	**Germination Time** ○					

Introduction Chives are a perennial member of the onion family that sport beautiful purple flowers. Here's how to grow chives in your garden! Chives are cool-season, cold-tolerant perennials that are planted in early spring. Be mindful when planting this herb, as it will take over your garden if the flowers are left to ripen (the flowers scatter the seeds). However, this plant is easy to dig up and moved if it overwhelms your garden.

Planting

Chives prefer full sun. Soil needs to be moist, fertile, rich, and well-draining. Before planting, incorporate 4 to 6 inches of well-composted organic matter. Apply 2 to 3 tablespoons of all-purpose fertilizer (16-16-8) per square foot of planting area. Work compost and fertilizer into the soil to a depth of 6 to 8 inches. For a head start, start the seeds indoors 8 to 10 weeks before the last spring frost. (See local frost dates.) Transplants need good growth before being set in the garden. If you are growing from seed, sow as soon as the soil is workable in the spring. For the best growth, the soil should be around 60° to 70°F. Plant seeds ¼ inch deep and final plant spacing should be 4 to 6 inches apart in all directions.

Care

It is important to give chives consistent watering throughout the growing season for high yields. Moisten the soil thoroughly when watering. Use mulch to conserve moisture and keep the weeds down. For good production, sidedress with fertilizer in May and July with 1 teaspoon of 21-0-0 per square foot. Minimal care is needed for fully grown plants. After the flowers bloom, be sure to remove them so that the seeds aren't spread throughout your garden. Plants grow to be 12 to 24 inches tall and may spread a foot across. Remember to divide the plants every 3 to 4 years in the spring. Chives are much more productive if divided regularly. Allow divided plants to grow for several weeks before harvesting.

Pests / Diseases

- Bulb rots (caused by soilborne fungi)
- White Rot
- Mildew
- Rust
- Smut
- Various fungal leaf spots (such as purple blotch and gray mould)
- Onion Fly
- Thrips

Harvest / Storage

Harvest chives 30 days after you transplant or 60 days after seeding. Be sure to cut the leaves down to the base when harvesting (within 1 to 2 inches of the soil). Harvest 3 to 4 times during the first year. In subsequent years, cut plants back monthly. The chive plant will flower in May or June. (The flowers are edible.) Use chives when they're fresh or frozen (freeze the leaves in an airtight bag). Dried chives lose their flavour. Store chives in a cool place in a resealable container.

Variants

Other Tips

- In the garden, plant chives next to carrots.
- Bunches of chives hung in the home were used to drive away diseases and evil.
- Garlic chives, to add a mild garlic flavour to any dish

8 Chocolate Mint

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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9 Cinnamon

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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10 Coriander

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Mar-Apr, Aug-Nov	Southern Hemisphere (Subtropical Climate) Mar-Oct	Southern Hemisphere (Tropical Climate) Mar-Oct			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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11 Cumin

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Nov	Southern Hemisphere (Temperate Climate) Sep-Nov	Southern Hemisphere (Subtropical Climate) Sep-Nov	Southern Hemisphere (Tropical Climate) Sep-Nov			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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12 Dill

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Jan	Southern Hemisphere (Temperate Climate) Aug-Apr	Southern Hemisphere (Subtropical Climate) Mar-Oct	Southern Hemisphere (Tropical Climate) Apr-Sep			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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13 Fennel Seed

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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14 Garlic

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
Introduction	In July and August, we harvest the garlic we planted last fall. Garlic produces numerous bulbs after a long growing season. In October, we'll plant garlic anew! See our tips on both planting and harvesting garlic. It's so easy to grow—and frost-tolerant, too! Beyond its intense flavour and culinary uses, "the stinking rose" is also good in the garden as an insect repellent and has been used for centuries as a home remedy.										

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15 Ginger

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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16 Lavender

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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17 Lemon Basil

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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18 Lime Thyme

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Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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19 Mint

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Aug-Dec	Southern Hemisphere (Subtropical Climate) Aug-Nov	Southern Hemisphere (Tropical Climate) Apr-Jul			
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20 Mustard

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Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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21 Nutmeg

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Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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22 Oregano

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Aug-Dec, Mar-Apr	Southern Hemisphere (Subtropical Climate) Mar-Oct	Southern Hemisphere (Tropical Climate) Apr-Sep			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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23 Paprika

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
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24 Parsley

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Mar	Southern Hemisphere (Temperate Climate) Aug-Mar	Southern Hemisphere (Subtropical Climate) Mar-Sep	Southern Hemisphere (Tropical Climate) May-Jul			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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25 Rosemary

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Mar-May, Sep-Nov	Southern Hemisphere (Temperate Climate) Mar-May, Sep-Nov	Southern Hemisphere (Subtropical Climate) Mar-May, Sep-Nov	Southern Hemisphere (Tropical Climate) Mar-May, Sep-Nov			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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26 Saffron

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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27 Sage

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Nov	Southern Hemisphere (Temperate Climate) Sep-Jan	Southern Hemisphere (Subtropical Climate) All Year	Southern Hemisphere (Tropical Climate) All Year			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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28 Spearmint

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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29 Thai Basil

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
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30 Thyme

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) Sep-Dec	Southern Hemisphere (Temperate Climate) Mar-Apr, Sep-Dec	Southern Hemisphere (Subtropical Climate) Mar-Oct	Southern Hemisphere (Tropical Climate) Mar-Sep			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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31 Turmeric

Sowing Season	Northern Hemisphere (Cold Climate) ○	Northern Hemisphere (Temperate Climate) ○	Northern Hemisphere (Subtropical Climate) ○	Northern Hemisphere (Tropical Climate) ○	Southern Hemisphere (Cold Climate) ○	Southern Hemisphere (Temperate Climate) ○	Southern Hemisphere (Subtropical Climate) ○	Southern Hemisphere (Tropical Climate) ○			
Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					

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32 Vanilla

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Sowing Guide	Sowing Depth ○	Row Spacing ○	Plant Spacing ○	Frost Tender / Hardy ○	Direct Sow / Raise Seeds ○	Germination Time ○					
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7 Nuts

How to grow different types of nuts.

Subheadings

		1. Almonds	2. Brazil Nuts	3. Cashews	4. Hazelnuts		
		5. Macadamias	6. Peanuts	7. Pecans	8. Pistachios		
		9. Pine Nuts	10. Walnuts				

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1 Almonds

Almonds

2

Brazil Nuts

3

Cashews

4

Hazelnuts

5

Macadamias

6

Peanuts

7

8

9

10

8 Other Edibles

Any other edible plants.

Subheadings

1. Wheat	2. Sugar	3. Amaranth	4. Oats
5. Barley	6. Couscous	7. Rice	8. Rye
9. Olives	10. Cocoa Beans	11. Tea	12. Coffee Beans
13. Aloe Vera			

1 Wheat

2 Sugar

GARDENING Other Edibles Sugar

3 Amaranth

GARDENING Other Edibles Amaranth

4 Oats

GARDENING Other Edibles Oats

5 Barley

GARDENING Other Edibles Barley

6 Couscous

GARDENING Other Edibles Couscous

7 Rice

GARDENING Other Edibles Rice

8 Rye

9 Olives

10 Cocoa Beans

11 Tea

12 Coffee Beans

13 Aloe Vera

The aloe vera plant is an easy, attractive succulent that makes for a great indoor companion. Aloe vera plants are useful, too, as the juice from their leaves can be used to relieve pain from scrapes and burns when applied topically. Aloe vera plants have thick, variegated leaves that fan out from the plant's central stem. Keep the aloe vera plant in a pot near a kitchen window for everyday use. Please note: Aloe vera leaves should not be ingested by humans or pets. They can cause unpleasant symptoms and may be toxic in larger quantities.

Planting

Before Planting
Select a container that's about as wide as it is deep. If your aloe plant has a stem, choose a container that is deep enough for you to plant the entire stem under the soil. A pot made from terra-cotta or a similarly porous material is recommended, as it will allow the soil to dry thoroughly between waterings and will also be heavy enough to keep the plant from tipping over. A plastic or glazed pot may also be used, though these will hold more moisture. When choosing a container, be sure to pick one that has at least one drainage hole in the bottom. This is key, as the hole will allow excess water to drain out. Use a well-draining potting mix, such as those made for cacti and succulents. A good mix should contain perlite, lava rock, coarse sand, or all three. Aloe vera plants are hardy, but a lack of proper drainage can cause rot and wilting, which is easily the most common cause of death for this plant. A layer of gravel, clay balls, or any other "drainage" material in the bottom of the pot is not necessary. This only takes up space that the roots could otherwise be using. A drainage hole is drainage enough! (Optional) To encourage your aloe to put out new roots after planting, dust the stem of the plant with a rooting hormone powder. Rooting hormone can be found at a local garden or hardware store, or online.

Planting
If your aloe plant has grown leggy, has gotten too large, or simply needs an upgrade, it's time to re-pot it. Here's how:

1	Prepare your pot. After giving the new pot a quick rinse (or a good scrub, if it's a pot you've used before) and letting it dry thoroughly, place a small piece of screen over the drainage hole; this will keep the soil from falling out the bottom and will allow water to drain properly. A doubled-up piece of paper towel or newspaper can also work in a pinch, though these will break down over time.
2	Prepare your plant. Remove the aloe vera plant from its current pot and brush away any excess dirt from the roots, being careful not to damage the roots. If your plant has any pups, remove them now. (See the "Care" section of this page for instructions on removing and potting pups.) If your plant has a very long, spindly stem that won't fit in the pot, it is possible to trim the stem off partially. Note that this is risky and could kill the plant. To trim the stem: Cut off part of the stem, leaving as much as possible on the plant. Next, take the bare plant and place it in a warm area that gets indirect light. After several days, a callous will form over the wound. At this point, continue with the repotting instructions below.
3	Plant your plant. Fill the pot about a third of the way with a well-draining potting mix, then place your plant in the soil. Continue filling in soil around the plant, bearing in mind that you should leave at least ¾ of an inch of space between the top of the soil and the rim of the pot. The bottom leaves of the aloe plant should rest just above the soil, too. Do not water after planting.
4	Ignore your plant (temporarily). After you've placed your aloe in its new pot, don't water it for at least a week. This will decrease the chance of inducing rot and give the plant time to put out new roots. Until the plant seems to be rooted and happy, keep it in a warm place that receives bright but indirect light.

Replanting
Mature aloe vera plants often produce offsets—also known as plantlets, pups, or "babies"—that can be removed to produce an entirely new plant (a clone of the mother plant, technically).
1. Find where the offsets are attached to the mother plant and separate them using pruning shears, scissors, or a sharp knife. Leave at least an inch of stem on the offset.
2. Allow the offsets to sit out of soil for several days; this lets the offset form a callous over the cut, which helps to protect it from rot. Keep the offsets in a warm location with indirect light during this time.
3. Once the offsets have formed callouses, pot them in a standard succulent potting mix. The soil should be well-draining.
4. Put the newly-potted pups in a sunny location. Wait at least a week to water and keep the soil on the dry side.

Care

Place in bright, indirect sunlight or artificial light. A western or southern window is ideal. Aloe vera does best in temperatures between 13-27°C (55-80°F). Water aloe vera plants deeply, but infrequently. To discourage rot, allow the soil to dry at least 1 to 2 inches deep between waterings. Don't let your plant sit in water. Water about every 3 weeks and even more sparingly during the winter. Use your finger to test dryness before watering. If the potting mix stays wet, the plants' roots can begin to rot. Fertilize sparingly (no more than once a month), and only in the spring and summer with a balanced houseplant formula mixed at ½ strength. Re-pot when root bound, following the instructions given in "Planting," above.

Pests / Diseases

Aloe vera plants are susceptible to common garden pests, such as mealybugs and scale. Avoid overwatering to keep these conditions from developing.

Common Diseases
● Root rot
● Soft rot
● Fungal stem rot
● Leaf rot

Harvest / Storage

To make use of the aloe vera plant's soothing properties, remove a mature leaf from the plant and cut it lengthwise. Squeeze the gel out of the leaf and apply it to your burn, or simply lay the opened leaf gel-side–down on top of the affected area.

Variants

● Tiger or Partridge-Breasted Aloe (Aloe variegata) – A compact aloe characterized by short, spiky leaves with white stripes.
● Lace Aloe (Aloe aristata) – A small plant with white-spotted, finely sawtoothed leaves.
● Blue Aloe (Aloe glauca) – A larger aloe species with silver-blue leaves.

Other Tips

Aloe vera will decorate a kitchen shelf with quiet grace while doing double duty as a self-regenerating first-aid kit. Read more about the natural health benefits of aloe vera. One of aloe's most famous uses is to soothe sunburnt skin, and it can be also used for cold sores.

9 Non Edibles

This section is for growing non edible plants, plants with other uses or just visually appealing plants.

Subheadings

1 Dahlias

GARDENING Non Edibles Dahlias

2 Geranium

GARDENING Non Edibles Geranium

3 Jade Plant

GARDENING Non Edibles Jade Plant

4 Lilies

GARDENING Non Edibles Lilies

5 Marijuana

GARDENING Non Edibles Marijuana

6 Nasturtium

GARDENING Non Edibles Nasturtium

7 Peace Lily

8 Rose

9 Snake Plant

10 Sunflower

11 Tulips

10 Plant Pests & Diseases

Pests

Staying on Top of Pests

Keep your eyes open when you are weeding and you may be surprised by the kinds of pests you find. Look for tell-tale signs like holes in leaves, egg masses, and webs. Leaf miners tunnel between leaf layers in chard, spinach, lamb's quarters, and beet greens leaving a light green meandering trail behind. Often you don't notice them until you cook up the greens and find a lot of tiny worms.

Cutworms are one of the many critters that do their dastardly deeds at night. In the morning you'll find plants chewed off at the soil line leaving only stubs behind. Sometimes if you dig around the base of the plants you'll find a fat cutworm sleeping it off and you can remove him from the premises in any way you choose.

Another night time visitor is the slug. If large ragged holes are appearing in your hostas and petunia leaves, the slugs have been dining there. The only tip they leave are the silvery trails of dried mucus they slid out on. We've all seen green aphids on plants in the springtime, but every summer we get a crop of red aphids on our heliopsis plants. They are easy to dislodge with a strong spray of water and usually don't come back.

Flea beetles are tiny black hoppers that eat small holes in the leaves making them look like they have been hit with mini-buckshot. Their larvae, white grubs with brown heads, are 3/4 inch long - much larger than the adults. They live in the soil and eat plant roots.

Make sure to check for asparagus beetles during the summer. There are two kinds. One is black and white and appears very early in the spring. The other one is bright orange and it is active right now (mid-summer), laying eggs on the fronds which hatch into fat slimy worms that hungrily defoliate the plants. Like many beetles they tend to drop when disturbed so stick a small container of soapy water under them and shake the frond a bit and they will fall right into it. The larvae cling on tighter and have to be squished.

Female Mexican bean beetles can lay over 500 eggs. If your bean leaves are being skeletonized check the underside for clusters of yellow eggs and crush them. Handpick the beetles or knock them into a bucket of soapy water and squish or drown the spiny yellow larvae.

Colorado potato beetles will not only eat potatoes but other nightshades as well including tomatoes, eggplants, peppers, and petunias. Like the bean beetles they lay masses of yellow eggs on the undersides of the leaves. When the brick red larvae hatch they eat large amounts of foliage. By now you know the drill—handpick the adults and squish or drown them and their offspring.

Deer-Resistant Plants

Do you have problems with deer eat your garden plants? See our list of deer-resistant plants, flowers, and shrubs to keep the hungry herds away from your garden! Deer love narrow-leafed evergreens, especially arborvitae and fir, and show a particular preference for hostas, daylilies, and English ivy, according to researchers from the University of Rhode Island, who have studied white-tailed deer damage to nurseries in the Northeast. They report that the heaviest browsing occurs from October through February, when food is naturally scarce. Deer seem to prefer plants that have been fertilized to those that haven't.

Dislikes

- Not surprisingly, deer tend to stay away from poisonous plants. Daffodils, foxgloves, and poppies are common flowers that have a toxicity that deer avoid.
- Deer also turn their noses up at fragrant plants with strong scents. Herbs such as sages, ornamental salvias, and lavender, as well as flowers like peonies and bearded irises, are just "stinky" to deer.
- Would you want to eat something prickly? Neither do deer (unless they're desperate). Plants such as lamb's ear are not on their preferred menu.
- One our favourite deer-resistant perennials are bleeding hearts (Dicentra spectabilis). They are popular with us, but not deer!

Keeping in mind that the first rule in deer-proofing is that there are really no completely deer-proof plants, here is a chart with some plants that deer rarely or seldom severely damage:

● Yarrow ● Zinnia ● Monkshood ● Ageratum ● Onion ● Pine ● Snapdragon ● Horseradish ● Tarragon ● Silver Mound ● Jack-in-the-pulpit ● Wild Ginger ● Asparagus ● Aster ● Astilbe	● Common Boxwood ● Anise ● Cactus ● Pot Marigold ● Blue Mist Shrub ● Dusty Miller ● Bachelor's Buttons ● Spider Flower ● Autumn Crocus ● Larkspur ● Lily of the Valley ● Lamb's Ear ● Threadleaf Coreopsis ● Corydalis ● Broom	● Wood Fern ● Purple Coneflower ● Small Globe Thistle ● Bluebell ● Winer Aconite ● Buttercup ● Spurge ● Blue Fescue ● Crown Imperial, Fritilia ● Common Lilac ● Common Tansy ● Baby's Breath ● Strawflower ● Heliotrope ● Hyssop	● Juniper ● Lantana ● Lavender ● Statice ● Sweet Alyssum ● Snowdrops ● Horehound ● Lemon Balm ● Mint ● Bee Balm ● Forget-Me-Not ● Bayberry ● Daffodil ● Catmint ● Basil	● Poppy ● Russian Sage ● Dwarf Alberta Spruce ● Lenten / Christmas Rose ● Allegheny Serviceberry ● Snow-on-the-Mountain ● Cinquefoil ● Fragrant Sumac ● Rosemary ● Black-Eyed Susan ● Rue ● Willows ● Garden Sage ● Peony ● Germander	● Barberry ● Borage ● Butterfly Bush ● Thyme ● Daphne ● Bleeding Heart ● Common Foxglove ● Yucca ● American Holly ● Winterberry Holly ● Iris ● Arrowwood Viburnum ● Fern ● Pachysandra

Fungus Gnats

Often considered only a minor houseplant pest, fungus gnats can quickly become a major issue if an infestation gets out of hand. Here's how to identify, get rid of, and prevent fungus gnat infestations in your plants. Fungus gnats are a fruit fly–sized insect pest that primarily affects indoor houseplants. Attracted to the moisture of potting soil, adult gnats lay their eggs (up to about 200) on organic matter near the soil surface.

After about three days, the eggs hatch into larvae, which burrow into the soil to feed on fungi and decaying plant material. Two weeks after that, adult gnats emerge from the soil to repeat the process. Adults live for about one week. Fungus gnats are completely harmless to humans, since they can't bite and don't spread diseases. They can be a problem for houseplants, however, when their population explodes and their larvae starts to feed on plants' roots.

Plants Affected
- Spider Plants
- African Violets
- Peace Lilies
- Geraniums
- Wandering Jew

Fungus gnats may also spread Pythium, a group of plant pathogens that causes "damping off" in seedlings. Once you have a fungus gnat infestation, using consistent management and prevention techniques is key to ending it. Further down on this page, we've listed a few of the best ways to both get rid of adult gnats and prevent new gnats from emerging. Once you have a fungus gnat infestation, using consistent management and prevention techniques is key to ending it. Further down on this page, we've listed a few of the best ways to both get rid of adult gnats and prevent new gnats from emerging.

Size	Adult fungus gnats are tiny. Their size ranges from about 1/16 to ⅛ of an inch in length (1.5 to 3mm), which is about the same size as a fruit fly. Fungus gnat larvae may be up to ⅛ of an inch in length.
Appearance	Adult fungus gnats are a greyish-black colour and have gray or see-through wings. Their long legs and long antennae give them a mosquito-like appearance, though they are much, much smaller in size. Compared to a fruit fly, fungus gnats have a thinner body with longer legs and antennae. Larvae have a small, black head and a thin, white or see-through body.
Activity	Fungus gnats tend to spend most of their time on the soil surface of potted plants, but they may be seen flying around the outer edge of the pot or near drainage holes as well. They are not strong fliers, so they have a tendency to walk along the soil and fly only in short bursts. Their flight is erratic and they are much slower than fruit flies, acting more like mosquitoes while flying. Annoyingly, fungus gnats have a tendency to fly into people's faces and drinks, though they are completely harmless and a few well-placed swats will show them what's what.
Damage	In small numbers, fungus gnats are more of an annoyance than anything. In fact, the adult gnats don't actively harm plants nor people. If their population gets out of hand, however, the larvae may start feeding on plant roots, causing notable damage. This is especially bad for young plants, such as seedlings, which have only a few delicate roots. Fungus gnats are also capable of spreading the plant pathogen that causes damping off and the eventual death of seedlings. Fungus gnat damage will appear similar to that of any other root-related issue, such as root rot. Lower leaves may turn yellow and drop, and the plant's growth may slow down or stop completely. In particularly bad cases, wilting of the entire plant could occur, followed by the death of the plant if roots are extremely damaged.
Removal	Getting rid of fungus gnats is all about consistency. Catching the adults is fairly easy, but because the adult population comes in cycles, you need to make sure that your traps are refreshed regularly. For the best results, use a combination of the traps listed here as well as the additional preventative methods listed in the subsequent section.

Sticky Cards	These traps consist of a yellow note card covered in a sticky adhesive. They are most effective when cut into small squares and placed directly on top of the soil or attached to skewers just above the soil. Adult gnats will fly or crawl onto the card and become trapped. Fungus gnats are attracted to the colour yellow, so use the yellow sticky cards rather than the blue ones. Both can be bought at most hardware or garden stores, as well as online.
Cider-Vinegar Traps	Simple and effective, cider-vinegar traps consist of a shallow container with a small amount of apple cider vinegar, water, and liquid dish soap. Make a cider-vinegar trap: Find a shallow container—a tuna can is perfect—and fill it with equal parts water and apple cider vinegar. (The liquid should be at least ¼-inch deep.) Put a few drops of liquid dish soap into the mixture and stir gently. Place the trap near the base of the affected plant or, ideally, inside the pot on top of the soil. Check it every few days to refresh with new vinegar and water.
Diatomaceous Earth	Diatomaceous earth (DE) is an organic, abrasive powder that works well on fungus gnats. The powder sticks to the gnats, dehydrating and immobilizing them. Use "food-grade" DE, which is available at most garden and hardware stores. To use DE: Dust the soil surface with DE, especially around the inside edges of the pot and the base of the plant. DE should only be applied when the soil is dry—otherwise, it will soak up moisture and won't stick to the gnats. In our experience, using DE on top of a layer of sand and watering from the bottom of the pot has been most effective.
Flypaper	Flypaper ribbons, such as those hung in horse barns to catch outdoor flies, can also be used to catch fungus gnats. However, these traps are usually overkill for gnats and can easily get stuck to things you don't want them to stick to, such as furniture, hair, plants, and so on.
Keep Soil Dry	Fungus gnats seek out moist soil, so allowing your houseplants to dry out a bit between waterings can slow down or stop an infestation. Let the top inch or two of soil dry out before watering again, and try to go as long as possible between waterings. Gnats may be deterred from laying their eggs if the soil is dry on the surface.
Mosquito Dunks	Mosquito dunks are used to keep mosquito larvae from populating fountains, animal troughs, fish ponds, and other small bodies of water. The product consists of a dry pellet containing a type of bacteria called Bacillus thuringiensis subspecies isrealensis. This beneficial bacteria infects and kills the larvae of flying insects, including mosquitoes, fruit flies, and fungus gnats. To use mosquito dunks: Fill up a gallon jug (or watering can) with clean water and toss in a mosquito dunk. It's a good idea to break up the dunk a bit before placing it in the water, or you can wait for it to soften before breaking it apart. Let the dunk soak in the water for as long as possible (at least overnight), then remove it from the water (the dunk can be reused) and use this water for fungus gnat–infested plants. The bacteria will have leeched into the water and will now infect and kill any larvae that come into contact with it in the soil. Repeat this process every time you water your plants for at least a few months.
Sand Layer	Put a half-inch layer of coarse sand on top of your houseplant's soil to stop adult gnats from laying eggs and new gnats from emerging from the soil. Consistent coverage is key. Be sure to water from the bottom of the pot, too; otherwise the sand will just wash away.
Cover Drainage Holes	Though gnats typically remain near the tops of pots, they may find their way to the drainage holes on the underside of a pot and start laying eggs there, too. If this happens, cover the drainage holes with a piece of synthetic fabric to prevent the gnats from getting in or out of the hole, but to also let water pass through freely. Attach with tape or rubber bands.

Slugs

Slugs are very damaging garden pests that can be found throughout the country, most likely in moist and humid climates. Your garden is likely to have more slugs during a particularly rainy season. Slugs are not insects, rather, they are soft-bodied molluscs. Slugs never change, because they are members of the phylum Mollusca, along with the giant squid, the periwinkle, and the steamer clam. Unlike seagoing molluscs, the slug is equipped with a single lung. Its shell is lacking or represented only by a small plate, but it does not seem to mind.

Slugs are hermaphroditic, with each individual having both male and female reproductive organs. As you would expect, their love life is complex. The common gray garden slug dances an elaborate, hour-long nuptial waltz before mating, while other species perform acrobatic movements while hanging suspended from threads of slime.

- Most garden slugs are gray to dark brown and about one-inch long. They will hide in dark, damp places during the day.
- Many people are prompted to ask, "Where do slugs come from?" This is because they are hard to spot in the soil due to their dark colour, but also because they only feed at night and hide throughout the day. If you realize you have slug damage but can't find the slugs, you're not alone.
- Slugs will leave a slimy secretion where they have been, so even if you can't spot them, you'll know they are there. Look for slime both on plants and surrounding soil. It is easiest to see the trails of slime first thing in the morning.
- You can monitor slug activity in your garden by digging holes that are four inches wide and six inches deep. Cover these holes with a board, and then check for slugs after three days. If you see many of them, these might be the sneaky pests that are eating your plants!
- Slugs lay their eggs in moist soil or compost. Their populations can grow rapidly in cool and moist conditions.

What do slugs eat? They will feed on almost anything in the garden—look for holes and ragged edges on leaves and stems. The holes should have irregular shapes due to their file-like mouthparts. Small seedlings can be consumed entirely.

Slugs can digest tissues from most plants, but you might find them especially liking your beans, lettuce, cabbage, and tomatoes.

Removal

- You can create the perfect slug trap by laying boards or pieces of cardboard on the bare soil around your plantings. Each morning, turn the boards over and scrape the hiding garden slugs into large plastic containers. Cover and place in freezer for three hours. When frozen stiff, dump them on your compost pile.
- Place shallow dishes of beer around the garden to lure the slugs to a drunken death. Or mix water with molasses, cornmeal, flour, and baking yeast to replace the beer. These are both great slug baits that can help control your garden slug population.
- Some slugs are a bit beer-resistant and might crawl out of the dish. If you find this happening, try creating a beer trap that they can't escape from: Cut the spout end off a plastic beverage bottle just where it reaches the fattest diameter. Now, turn the pour-spout around so that it's pointing inside the bottle and fasten it with staples or duct tape. Pour a little beer into the bottle (add extra yeast, if desired) and lay it on its side in the garden.
- If necessary, get out and handpick the little rascals—a task best undertaken in the evening twilight or in the early light of dawn, before they have sought shelter from the heat of the day.

- If you need a slug repellent to keep slugs away from tender plants, circle them with wood ashes (which are also a good source of potassium for your plants), diatomaceous earth, copper sheeting, coffee grounds, pine needles, coarse sand, or crushed eggshells. These rough mulches rip up a slug's tender underside.
- Alcohol kills these pests by acting as a surfactant, or wetting agent, that can penetrate an insect's waxy coat of armour and kill on contact with the body. Isopropanol (rubbing alcohol) works fine and is easy to find, but be sure it doesn't have additives. Ethanol (grain alcohol) seems to work best. Alcohol usually comes in 70 percent strength in stores (or 95 percent strength purchased commercially). To make an insecticidal spray, mix equal parts 70 percent alcohol and water (or, if using 95 percent alcohol, mix 1 part alcohol to 1 ½ parts water).
- A spray of cold coffee can control small slugs, but it must completely drench them to be effective.
- Some plants have been shown to do well despite being around slugs. If you tend to have slugs and are having trouble getting rid of them, try planting astilbe, phlox, or mint to reduce damage.

Prevention
● It is helpful to rake your garden in early spring in order to clean up some of the moist debris that slugs love, as well as to rake away any slug eggs. Large wood chips also provide hiding areas for slugs, so try not to use them.
● Only water your garden when necessary so as to minimize the damp places in which slugs congregate.
● Slugs have many natural predators. If you have chickens or ducks, they will help by eating slugs and their eggs. Also, be sure to encourage the populations of snakes, turtles, frogs, toads, and ground beetles in your garden. The same goes for songbirds, so check out our tips on creating a bird-friendly habitat.
● Slugs experience a small shock when exposed to copper, which will make them turn back. Try making a perimeter around your plants with copper tape.

Voles

Voles drive gardeners and home owners crazy! You'll know voles by the snakelike tunnels all over your lawn. Here's advice on how to identify, prevent, and control your vole population. First off, voles are not moles! People confuse the two animals because they both tunnel through your yard. You might not have seen either critter since they're usually underground, but they look very different. Voles (Myodes) are small, stocky rodents similar to field mice. In fact, a vole might look like a mouse at first glance. In contrast, moles are NOT rodents. Moles are all nose and mouth. And they have big feet used in digging!

Voles have small rounded ears that are often hidden by their fur, small eyes, and short tails. Their fur is generally thick and light brown to gray. Two common species of voles in North America are the prairie vole and the meadow vole. Meadow voles are more widely distributed, but prairie voles are more common in prairie areas. They are very similar, and methods for controlling them are mostly the same.

Voles, similar to other rodents, have a mainly vegetarian diet. Voles mainly eat stems and blades of lawn grass—so it's usually vole tunnels that you'll see near the surface of the yard. Moles have a mainly carnivorous diet. (Moles are beneficial in many ways. They help plow the soil and eat grubs and insects!)

It's helpful to know this difference not only because it will help you identify the damage but also because a vole bait would use peanut butter whereas moles would be more interested in an insect or earthworm. If it helps, remember that their frenzied activity does subside. Vole populations cycle, and about every 3 to 5 years there will be a population boom. Mild winters with good snowfall can help to increase vole populations.

Identification	You'll know voles by the shallow snake-like tunnels that you'll see all over your lawn. The tunnels are about two inches wide and very near the surface so they can eat their favourite food, grass stems and blades. Voles are especially manic in the early springtime. Moles, on the other hand, have deeper feeding tunnels that they use as a network. They do have secondary runways that appear on your lawn's surface, however, they look more like raised ridges and have little volcano-shaped mounds. Voles leave no mounds behind.

You'll also be able to identify voles by the type of damage. Remember: It's the voles who are plant eaters.
● If you have partially eaten carrots, potatoes, or other root vegetables, you probably have a vole problem. According to one reader, "They dig under my carrots, pulling them down, and eating them. There's just a row of holes where the carrots were. Kind of amusing, like a bugs bunny cartoon. They're a real pest this year."
● Voles also eat flower bulbs from below the ground as they're near the surface.
● If you see chewed-up bark near the base of trees and shrubs, look closely. A vole's front teeth will leave ¼ inch side-by-side grooves in the wood as it gnaws away on the bark.

Prevention	Make your yard inhospitable to voles! Prevention is very important to keep vole numbers down. ● Voles like dense, heavy vegetative cover, weeds, and meadows because it provides them with protection from predators and provides nesting material. Cut back brush, mow, weed, and create a clean space. ● Remove woodpiles and hiding places for voles from near your garden, shrubs, and trees. ● Keep your lawn mowed and bushes trimmed up from the ground. ● Avoid putting dense mulch too close to trees and shrubs. ● Keep snow cleared from the base of trees and shrubs. Protect young trees by wrapping the lower trunk with a guard.

Removing Voles
● In small areas, trapping may be an effective way of reducing vole populations. Try Havahart live vole traps situated perpendicular to the widest vole runways or near the nesting sites at the base of trees and shrubs. Bait traps with peanut butter. Set baits midday to early evening when voles get more active. Reset the traps as often as necessary until you eliminate the population. Relocate voles if it's legal where you live. The key to trapping is persistence. You may want to cover the traps so that pets and children do not accidentally find them.
● Large vole populations have been effectively reduced with toxic baits. There are some pesticides available for home use. Be sure to read the label before you buy any pesticide and again before use. Vole baits should be placed inside bait stations to reduce the risk of non-target species ingesting the bait. Most pesticides recommended for voles are restricted and can only be used by Certified Pesticide Applicators.
● Some readers have suggested a variety of irritants sprinkled into vole tunnels (from natural to chemical): cayenne powder, garlic, onion, castor oil, a little nitrogen fertilizer, moth balls, and ammonia. In many cases, these ingredients can be mixed with water or soapy water and put in a spray bottle. However, you need to reapply ever time it rains.
● Repellents have mixed results and need to be reapplied after it rains. Garden stores sell fox or coyote (predator) urine which usually turns off voles. (You can also pee in your own yard!)
● Bulb control? You can discourage voles from nibbling on bulbs by adding gravel to the planting hole (surrounding the bulbs). When you plant bulbs, drench or powder them with a fungicide to keep voles at bay. Plus, check our list of rodent-proof bulbs.
● Voles in the veggie garden? These little critters aren't very good climbers. Protect plants by fencing the area with a half-inch of mesh (hardware cloth), at least 12 inches above the ground and buried 6 to 10 inches deep.

Tomato Hornworms

Big, fat, and green! Here are tips on how to identify, control, and get rid of tomato hornworms in your garden. If you've ever grown garden tomatoes, chances are you have dealt with these green caterpillar pests. They can be found in most any region of the US and can ruin your tomato crop in record time; they also feed on eggplants, peppers, and potatoes. They can blend in quite easily with the green foliage and feed non-stop, creating spotty and chewed leaves and fruit.

Tomato hornworms live according to the following life cycle:
● In late spring, large adult moths lay eggs on the undersides of foliage, which will hatch within a week.
● Caterpillar larvae will feed from 4–6 weeks before creating a cocoon for overwintering in the soil. If the weather is warm enough, larvae may only burrow for as little as 2–3 weeks.
● Moths will emerge in the spring, and will then lay eggs once again. More than one generation a year may be possible in warmer climates.

Identification

Tomato hornworms can be up to 5 inches long—which can be quite a shock when you first come across one! They do the most damage in the caterpillar, or larval, stage. They are pale green with white and black markings, plus a horn-like protrusion stemming from their rear. (Don't worry, they aren't able to sting!) The caterpillar also has eight V-shaped stripes on its green body. Tomato hornworms come from a mottled brown-gray moth.

The larvae blend in really well with the plant greenery. Just get used to a daily patrol, looking for hornworm eggs and small caterpillars. Here are some cues of infestations:
● Look closely at the TOP of your tomato leaves for dark green droppings left by the larvae feeding on the leaves. Then look at the underside of leaves and you'll find a hornworm.
● Look for stems missing some leaves and wilted leaves hanging down. You may find white cocoons and their hornworm hosts nearby.

There are a few species of hornworms that inhabit North American gardens, including tomato hornworms (Manduca quinquemaculata) and tobacco hornworms (Manduca sexta). Both species feed on common garden plants like tomatoes, potatoes, peppers, and eggplants. Here's how to tell which caterpillar is which:
● Tobacco hornworms have parallel white stripes; tomato hornworms have white V–shaped markings.
● Tobacco hornworms have black spots lining each of their stripes; tomato hornworms do not.
● Tobacco hornworms have a red "horn" on their tail end; tomato hornworms have a black horn.

If you see leaves with large holes and severe defoliation, devoured flowers, and/or scarring on fruit surfaces, you have tomato hornworms. The fruit also might be damaged by sunscald because of the reduced foliage.

Prevention

Handpicking is an excellent tactic for control if you have the time and patience, or a small garden. The caterpillars are not dangerous and cannot sting. If you are squeamish about crushing these large insects, drop them into soapy water instead (or feed them to your chickens, if you've got a flock).

If the hornworm population or the area of your garden is too large, insecticides can be a useful control. You can use the organic pesticide Bt (Bacillus thuringiensis), which is a bacterium that acts as a stomach poison on some insects (but doesn't harm other plants or animals). Please check with your local Cooperative Extension for a list of approved insecticides in your area.

● Till soil at the beginning and end of each gardening season to destroy overwintering larvae. Tillage has shown to cause up to 90% mortality.
● To keep hornworms away from your tomato plants next year, try interplanting dill or basil; marigolds are also an excellent companion plant and keep many pests away.
● Keep wasps around; they're beneficial insects which feed on hornworms and act as a biological control. You may see hormworms with parasitic wasp larvae attached, which look like grains of rice. These attacked hornworms will continue to feed for a little while, but will soon succumb to their hitchhikers, so it's wise to leave them alone and let the wasps carry out their life cycle. Alternatively, remove infected hornworms and place them far away from your garden. This way, the wasps will still do their job, but the hornworm won't continue to damage your crops.

Japanese Beetles

Japanese beetles are small bugs that carry a big threat. They do not discriminate on what types of plants they feed on. In fact, they are classified as a pest to hundreds of different species. They are one of the major insect pests in the Eastern and Midwestern United States, causing monumental damage to crops each year.

Identification

Japanese Beetles are ½ inch in length with metallic blue-green heads, copper backs, tan wings, and small white hairs lining each side of the abdomen. Japanese beetles usually feed in small groups. They lay eggs in the soil during June, which develop into tiny white grubs with brown heads and six legs that are up to ¾ inch in length. These grubs will remain under wraps for about 10 months, overwintering and growing in the soil.

They emerge from the soil as adult beetles and begin feeding in June. They usually attack plants in groups, which is why damage is so severe. Although the lifecycle of the adult Japanese beetle is barely 40 days, it can cover a lot of ground. Even if you succeed in controlling your Japanese beetle population, your neighbour's Japanese beetles might come on over.

Japanese beetles eat a wide variety of flowers and crops (the adult beetles attack more than 300 different kinds of plants), but they are especially common on roses, as well as beans, grapes, and raspberries.
They can devour most of the foliage on favoured plants like roses. Look for leaves that are "skeletonised" (only have veins remaining). This is a tell-tale sign of Japanese Beetles. Mexican Bean Beetles can also leave foliage skeletonised, though, so be sure to identify them by their appearance as well.

Prevention

● Row Covers: Protect your plants from Japanese beetles with row covers during the 6- to 8-week feeding period.
● Hand Pick: Unfortunately, the most effective way of getting rid of Japanese beetles is to hand pick them. It's time consuming, but it works, especially if you are diligent. When you pick them off, put them in a solution of 1 tablespoon of liquid dishwashing detergent and water, which will cause them to drown.
● Neem Oil: Neem oil and sprays containing potassium bicarbonate are somewhat effective, especially on roses. The adults ingest a chemical in the neem oil and pass it on in their eggs, and the resulting larvae die before they become adults. Neem can be harmful to fish and should be reapplied after rainstorms.
● Use a Dropcloth: Put down a dropcloth and, in the early morning when they're most active, shake them off and dump them into a bucket of soapy water.
● Insecticides: If you wish to spray or dust with insecticides, speak to your local cooperative extension or garden centre about approved insecticides in your area.

Or, try this safe homemade solution: Mix 1 teaspoon of liquid dishwashing detergent with 1 cup of vegetable oil and shake well; then add it to 1 quart of water. Add 1 cup of rubbing alcohol and shake vigorously to emulsify. Pour this mixture into a spray bottle and use it at ten-day intervals on pests. Homemade sprays can run more of a risk of damaging plant leaves, so be careful. Apply sprays in the morning, never in full sun or at temperatures above 90ºF. If your plants start to wilt, rinse the leaves immediately with clean water.

● Traps: Japanese beetle traps can be helpful in controlling large numbers of beetles, but they also might attract beetles from beyond your yard. Eugenol and geraniol, aromatic chemicals extracted from plants, are attractive to adult Japanese beetles as well as to other insects. Unfortunately, the traps do not effectively suppress adults and might even result in a higher localized population. If you want to try them, be sure to place traps far away from plants so that the beetles do not land on your favoured plants on their way to the traps.
● Fruit Cocktail: You can buy Japanese beetle traps of all sorts, but most are no more effective than a can of fruit cocktail. Open the can and let it sit in the sun for a week to ferment. Then place it on top of bricks or wood blocks in a light-coloured pail, and fill the pail with water to just below the top of the can. Place the pail about 25 feet from the plants you want to protect. The beetles will head for the sweet bait, fall into the water, and drown. If rain dilutes the bait, start over.
● Geraniums: Japanese beetles are attracted to geraniums. They eat the blossoms, promptly get dizzy, fall down, and permit you to dispose of them conveniently with a dustpan and brush. Plant geraniums close to more valuable plants which you wish to save from the ravages of Japanese beetles.

Squirrels

GARDENING Plant Pests & Diseases Pests Squirrels

With a fondness for fresh fruits, vegetables, and flowers, the common squirrel has long spelled trouble for home gardeners. From Maine to Montana, these wily critters yank geraniums from window boxes, pluck cherry tomatoes from their vines, and strip apple trees like professional pickers. Though their foraging forays can happen at any time of year, a squirrel's raid in autumn can drive a gardener nuts.

Squirrels are especially active in autumn as they stock up for winter. They do not hibernate (although they may "lie low" during cold spells), so their underground pantries are vitally important winter warehouses. They have a major instinct for hoarding food, which helps them to survive. Gray squirrels stash food by burying it in a scattered fashion around their territory.

The average squirrel gathers acorns, pinecones, nuts, bark, fruit, berries, fungi, and insects, but is not above stealing bird eggs and bulbs. Sometimes they will even ruin your flowers just for the fun of it! Keep an eye out for these pesky visitors and try some of our tips below.

Identification	Weighing an average of 16 to 24 ounces, the type of squirrel that is probably causing damage in your garden is the common gray squirrel. Its color varies from gray, tan, or light brown to dark brown and black. Its belly is light, from white to gray. Its body is 8 to 11 inches in length, and its tail measures 8 to 10 inches. Its vocal call is a rapid CRRK CRRK or QUACK QUACK, similar to a duck. The famous feature of the gray squirrel is its bushy tail, a luxurious puff of fur used for warmth, communication, and balance. Squirrels have a very keen sense of smell, which most gardeners blame for their bulb pilfering. The nose of these expert foragers is a tiny but powerful tool in the search for hidden nuts and berries. Gardeners aren't sure whether the squirrels do actively seek out the spring bulbs or not, but the problem of bulb snatching is real and widespread. ● Spring bulbs snacked on? You're probably dealing with squirrels or chipmunks. Squirrels love to dig up spring bulbs during their autumn foraging—both to eat the bulbs and to use the ready-made holes to store their nuts. ● Squirrels will not only attack your gardens, but your bird feeders as well. If you notice your bird food disappearing rather quickly, you may have a squirrel problem.
Prevention	Is your yard covered in nuts, berries, and acorns from trees? If so, your place is squirrel heaven! Be sure to rake and remove their food so you're not party central. Also, make sure you have tight-fitting trash cans and never leave food sitting out. Consider protecting your garden with a wire fence and make sure it is buried about a foot into the ground, so the squirrels can't dig under it.

● There are many natural repellents on the market. Some are made with the urine of squirrels' predators. These are meant to be sprayed around gardens to keep squirrels away.
● Try sprinkling cayenne pepper, pepper flakes, and/or garlic pepper on and around your plants when they are ready to bloom. Squirrels won't eat anything with cayenne—which you can often buy in bulk. Birds don't mind the taste.
● One reader claims blood meal sprinkled around the garden soil works.
● For edibles, you may wish to invest in some netting and put that over your plants—just as you would invest in bird netting for berry bushes.
● A dog or cat is a great squirrel chaser if that's an option.
● Pots are easy to protect with a layer of netting across the top of the pot.
● Or, here's an expensive pantry solution: Lay aluminum foil across the top of vegetable pots; poke holes for water. The squirrels do not like the shiny reflection.

● Scatter dog or human hair around your garden. One readers shares, "I used to have a problem with squirrels digging up my bulbs. Now, once in the spring and once in the fall, I ask my hairdresser to save a big bag of hair for me. I lightly dig this into the soil. Squirrels can not stand the smell of humans, so they leave the gardens alone."
● Plant nasturtiums, marigolds, and mustard as a border around your vegetable garden; these plants have an unpleasant aroma.
● Don't trap and relocate squirrels. This is a losing battle, since the population of squirrels is extremely high. Also, if the animal is a female, there is a high likelihood that you will remove her from babies that depend on her for survival.
● Some readers will feed the squirrels in a different part of the yard so that they don't eat their garden vegetables or plants. We've never tried this approach!
● If you're really going crazy, explore the idea of a raptor perch and owl nest box for natural predators who will eat them in no time.

Protecting Bulbs from Squirrels
● To protect spring bulbs, cover the surface of the bed with black plastic netting, which is invisible and inexpensive.
● Or, you can line the planting hole itself with wire mesh "hardware cloth." Some gardeners have found that planting the bulbs in a handful of sharp, crushed gravel discourages the squirrels. This might help provide better drainage as well.
● If squirrels are especially challenging, try chicken wire. Plant beds with one inch chicken wire and place more wire on top of the bulbs. The plants can grow through the wires, but the squirrels can't get to the bulbs. Also, consider planting bulbs that squirrels don't like such as daffodils, ornamental onions (Allium), snowdrops (Galanthus), and grape hyacinths (Muscari). Plus, check out our list of rodent-proof bulbs.
● Don't advertise your newly dug bulbs by leaving papery bits of bulb debris in or on the soil. Clean up your act, or better still, try not to lay your bulbs on the ground while you dig the holes to plant them—squirrels will smell their favorite and scamper over.
● If all else fails, just grow tulips in pots as squirrels aren't attracted to tulips.

Suggestions
● Try motion-activated sprinklers, primarily designed to keep cats and rabbits out of gardens, may help scare away squirrels, especially in small yards or at corners of front yards where damage is most likely to occur. However, the presence of numerous squirrels, stray animals, or children may result in overwatering and high water bills if they continually trigger this device.
● Get some mousetraps. Anchor them solidly to the ground in the area where the squirrels have been digging. Cover them with newspaper, and sprinkle a little dirt on top. When a squirrel comes to dig, it will set off the traps. As the mechanism snaps, it will scare and throw dirt at the squirrel. Once it's scared enough times, it will find another digging area. Be sure to anchor the traps just in case the wind blows the newspaper off of them. If the trap is anchored, the squirrel will not get hurt.

Rabbits

GARDENING Plant Pests & Diseases Pests Rabbits

Anyone who tills the soil regards the rabbit as more than a cute threat to the carrot patch. This long-eared animal possesses a voracious appetite for all kinds of fresh vegetation—woody plants, perennials, annuals, vegetables, and berries. In fact, a menu of rabbit favorites is so ridiculously long that it's easier to list the few plants they don't enjoy.

Rabbits also have an extremely high reproductive potential, which is why keeping them around might quickly cause a total garden infestation. They reach up to three litters of six babies each per year in the north, and up to six litters of three babies each per year in the south. The first litter appears in March in the north, year-round elsewhere. The gestation period is 29 days.

Your backyard bunny's primary concern is to eat without being eaten, a difficult task given that rabbits are relished by more than two dozen species of predators. Nibbling your petunias is therefore not a carefree picnic but a danger-fraught mission. However, if your neighborhood bunny can squeeze through a hole in your garden fence, it will be able to munch in safety.

Identification

Of the nine species of North American cottontail rabbits, it's the eastern cottontail (Sylvilagus floridanus) that is our most abundant and annoying. Ranging from Boston to Boulder and south into Mexico, this bunny-about-town is rarely found in forests; preferring instead brushy fence rows, field edges, brush piles, and—you guessed it—landscaped backyards. Its fondness for flowers, vegetables, bark, and bulbs often results in pruned peppers and clipped cosmos.

Even though its nicknames are adorable (among them bunny, bunny rabbit, and cottontail), and you'll probably want to befriend it once you see its cute ears, the eastern cottontail can be a bothersome pest. It is gray or brownish, with a short tail and big ears. It can weigh 2 to 4 pounds, be 15 to 19 inches in length, and live for 12 to 15 months. Its vocal call is almost silent, but it will emit a scream when threatened. Its famous features include a short white tail resembling a cotton ball and long, tapered ears.

For an eastern cottontail, security is a pile of brush, leaves, or another animal's abandoned burrow. Unlike their European cousins, these rabbits do not dig intricate burrows or warrens but make due with what they find. Rabbits rarely leave their shelters in broad daylight, preferring instead early morning or evening. Like most animals, they are sensitive to the change in day length as spring approaches. For rabbits, the longer days signal the start of two things: breeding season and spring dining.

Damage

Rabbits are voracious eaters and leave clean-cut damage. Check the leaves and stems of your plants for cleanly cut damage; insects and other pests usually leave jagged edges on damaged plants. This clean-cut damage often happens at ground level, as rabbits tend to eat the yummy green shoots of tulips and other plants.

These low mowers graze close to the ground and sniff out the first tender young shoots and crop them short. They love to munch on flowers, clover, peas, lettuce, beans, and more. Many of these plants are also the favorites of woodchucks or groundhogs, so check for burrows before deciding you have rabbit damage. Once your plants have passed the seedling stage, they are usually safe from rabbit damage.

Although bunny nibbling occurs in every season, it's especially discouraging in the early spring when rabbits mercilessly munch the tender green shoots of plants. As a Connecticut gardener remembers, "My tulips were just poking through the snow when suddenly it looked like they'd been weed-whacked. Cut clean off! I blame the bunnies—their little paw prints were everywhere."

Prevention

● As their twitching noses indicate, rabbits sniff a lot. Try sprinkling dried sulfur around or on your plants. Rabbits also dislike the smell of onions, so try planting these around your garden to further deter the furry creatures.
● To discourage pesky rabbits, try dusting your plants with plain talcum powder.
● Since rabbits are great sniffers, powdered red pepper sprinkled around the garden or on targeted plants may keep them out.
● Irish Spring soap shavings placed in little drawstring bags around the garden will also help to keep rabbits away.
● Make a bad-tasting rabbit cocktail by grinding together three hot peppers, three large onions, and one whole bunch of garlic. Add water to cover, and place into a covered container overnight. Strain, and then add enough additional water to make a gallon of the mixture. Spray onto plants, repeating after rainfall. Commercial products using pungent garlic oil are also worth a try.
● Spray your plants with a mixture of 1 teaspoon Lysol and 1 gallon of water.
● Some people protect plants with individual "collars" of tin cans or screening so that the plants may reach a less vulnerable size. Put the collar around each stem for protection.

● Use cylinders of ¼-inch mesh hardware cloth to keep rabbits from nibbling on young fruit and landscape trees. The cylinders should extend higher than a rabbit's reach while the rabbit is standing on the expected depth of snow, and they should stand one to two inches out from the tree trunk.
● Some of the deer techniques related to odor are also said to work against rabbits. Deter rabbits with commercially-available deer repellents that contain a mixture of dried bovine blood, sulfured eggs, and garlic.
● Legend has it that rabbits are terrified of their own reflection, so try an old-time rabbit remedy and place large, clear glass jars of water throughout the garden. Garden centers sell ready-made reflectors, as well as other devices—crouching cats, fake snakes, menacing owls—designed to frighten bunnies away from your plants.
● Sometimes, humane traps are the best solution. If you don't want to buy a trap, consider building one. Place the trap where you've seen the rabbits feeding or resting, and cover it with a piece of canvas. Apples, carrots, cabbage, and other fresh green veggies make excellent bait. Check it often, and release bunnies in rural areas several miles away.

● It's best to keep rabbits from crossing into the garden to begin with, and many old-time remedies rely on spreading various products around the perimeter of the garden such as dried blood or dried blood meal or human hair. Sprinkle dried blood on the surface around all your plants as early in the season as you can, and repeat after a heavy rain. Note: If you have dogs, don't try this method because they might be attracted to the scent and start digging up your garden.
● Do not rely on repellents alone. The most effective way of keeping out rabbits is chicken wire fencing. Install a fence that is 4 feet high and bury it 6 inches deep. Bend the top foot of the fence away from the garden like a security fence, so that they can't climb or jump over it. For new bulbs, try a dome or cage of chicken wire secured over the bed.
● Rabbits don't like to leave their shelters, so try to reduce the possible rabbit homes around your yard. Brush away piles of brush and leaves, and fill in abandoned burrows. If a rabbit doesn't have a place to live, hopefully it won't stay and munch. Rabbits will also breed much more if they have a good habitat available—all the more reason to have no vacancy!

Disliked Plants

According to bunny experts, rabbits have plant preferences based on taste, nutritive value, the presence of poison or prickles, and ease of availability. Their tastes in food can also vary by region and season, so not all plants work for all rabbits. Be tricky and tend plants that rabbits don't find very appetizing.

Rabbits tend to avoid some of the same plants as deer and Japanese beetles. If you'd like to control all these pests, check our list of deer-resistant plants and best and worst plants for Japanese beetles to know which plants might do best. Choose plants such as forsythia, lilac bush, marigolds, zinnias, daffodils, lavender, and snapdragons for rabbits. This might help to reduce your rabbit population. This is not a guaranteed solution, as hungry rabbits will eat almost anything, but filling your garden with these plants might make your garden less appetizing than another one. Here are more plants that rabbits dislike:

Woody Plants
● Azalea (Rhododendron sp.)
● Boxwood (Buxus sp.)
● Bush cinquefoil (Potentilla fruticosa)
● Butterfly bush (Buddleia davidii)
● Cotoneaster (Cotoneaster sp.)
● Japanese maple (Acer palmatum)
● Mountain laurel (Kalmia latifolia)
● Rhododendron (Rhododendron sp.)
● Tatarian dogwood (Cornus alba)
● Tulip tree (Liriodendron tulipifera)

Perennials
● Adam's needle (Yucca filamentosa)
● Creeping phlox (Phlox stolonifera)
● Foam flower (Tiarella cordifolia)
● Lamb's ear (Stachys byzantina)
● Meadow rue (Thalictrum rochebrunianum)
● Peony (Paeonia hybrids)
● Perennial salvia 'East Friesland' (Salvia x superba)
● Primrose (Primula x polyantha)
● Russian sage (Perovskia atriplicifolia)
● Sedum 'Autumn Joy' (Sedum)
● Speedwell (Veronica sp.)
● Spring cinquefoil (Potentilla verna)
● Stokes' aster (Stokesia laevis)

Annuals
● Four o'clock flower (Mirabilis jalapa)
● Geranium, zonal and bedding (Pelargonium x hortorum)
● Mexican ageratum (Ageratum houstonianum)
● Pot marigold (Calendula officinalis)
● Spiderflower (Cleome hasslerana)
● Vinca (Catharanthus roseus)
● Wax begonia (Begonia x semperflorens-cultorum)

GARDENING	Plant Pests & Diseases	Pests	Rabbits			
				Bulbs ● Daffodil (Narcissus sp.) ● Hyacinth (Hyacinth orientalis) ● Persian onion (Allium giganteum) **Vegetables** ● Asparagus ● Leeks ● Onions ● Potatoes ● Rhubarb ● Summer squash ● Tomatoes	**Herbs** ● Basil ● Marjoram ● Mint ● Oregano ● Parsley ● Savory ● Tarragon		

GARDENING Plant Pests & Diseases Pests Skunks

Skunks

Skunks are nocturnal animals that are naturally mild-mannered and non-aggressive; they prefer small animals and insects for dinner instead of your garden. They occasionally visit gardens and if they do, it may be because corn or other plants are close to the ground.

The skunk claims homesteading rights from coast to coast. Distributed across the country are 4 species of skunks, including the striped skunk (Mephitis mephitis) and the spotted skunk (Spilogale putorius). The common striped skunk lives mostly in sparse forests and fields.

Skunks can be very nice to have around because they dig up and feed on the larvae of cutworms, Japanese beetles, hornworms, and other crop-destroying insect life. However, skunks are not only partial to insects; they will eat leaves, buds, grasses, grains, garbage, any fruit or berries within reach, and even small game. They also may disturb your plants while digging for these grubs. This is what can make them a bit of a nuisance to gardeners.

Damage	If your lawn or flower bed has lots of holes in it, you may have a skunk problem. Skunks dig up the turf looking for grubs. They move around at night and dig in grassy areas, making distinct 3- to 4-inch deep holes. Skunk activity increases in the spring and then lessens naturally, so any problems may stop all on their own. Skunks sometimes feed on corn, but they tend to only eat the lower ears that they can reach. If a corn stalk has been toppled over, the culprit is more likely a raccoon. Planting taller varieties of corn can minimize this damage.
Prevention	● Spray a mixture of castor oil and dish-washing detergent diluted in water. Skunks find the smell offensive. Spray the area at night when the skunk is away foraging. ● Probably the best skunk repellent is a light. Skunks are nocturnal and their eyes are very light sensitive. A bright light or a motion sensor flood light will scare skunks away. ● Most animals, including skunks, dislike the smell of citrus fruits. Place orange or lemon peels around the yard as a natural skunk repellent. ● Predator urine (dogs, coyotes) can be used to repel a skunk. These are commercially sold in garden centers. ● Many readers have found success placing ammonia-soaked rags around the yard, however, these need to be replaced often. ● If the skunks are in a smaller garden patch, put bars of strong–smelling soap or a room deodorizer near your garden. Ironically, skunks hate strong scents.

● If nothing works, there are humane ways for professionals to trap raccoons and skunks and transport them elsewhere. Often, skunk removal by trapping is the only answer, and there just isn't a lot you can do if it is a skunk. However, be aware that many species of wildlife do not survive when placed in a new territory, and it may not even be legal to trap and relocate wild animals in your area.
● As skunks love to find lots of grubs in your garden, one of the best preventative methods is to treat your lawn so that you get rid of their favorite snacks. Spray your lawn with milky spore disease or beneficial nematodes. This will also help to control Japanese beetle larvae, so it's a win-win! Contact your local Cooperative Extension Service for suggestions.
● Fencing may also be a good idea for small areas, such as a garden patch.
● If you don't want skunks living under your deck or shed, seal these areas with chicken wire. Leave at least one foot of additional wire on the ground extending from the structure to prevent skunks from digging under to enter.

GARDENING Plant Pests & Diseases Pests Crows

Crows

Crows are often unwanted neighbors, but they're also fascinating birds. Here are some common questions and answers about these raucous pests. Crows and ravens are in the same genus (Corvus), and they have many similarities, but they are in fact different birds. Ravens are bigger and have shaggy throat feathers, while crows are smaller. Ravens also have wedge-shaped tails, while crows do not. Ravens soar more often than crows and sometimes do somersaults in the air. One of the main differences between ravens and crows is the sounds that they make. The call of a crow is a harsh, strong caw. The sound of a raven is a deeper, more throaty croak. Crows will eat almost anything, but they tend to feed on the ground. They eat any insects like earthworms, but they will also eat other small animals, seeds, and fruit. Crows are known for fishing through garbage, eating carrion, and robbing chicks from their nests. Crows will live in any open place where they can perch in a tree and have a good supply of food. During the winter, crows live in communal roosts with hundreds or thousands of neighbors.

Damage	If your seedlings, such as corn, are being pulled up, chances are you have crows. Also, be aware of any chicks that go missing from bird nests in your yard or of any visitors to your garbage cans.
Prevention	● Fruit crops can be protected with flexible bird netting. You can find some at a local garden center or hardware store. Four-inch mesh is recommended as it will keep the big crows out, but still allow smaller birds to slip through. ● Place netting securely at the base of a shrub or the trunk of a tree. This keep crows out from the bottom of your trees. Nets can also be used for growing crops. ● Use visual scare tactics. Shiny pie tins or CDs hung from trees, Mylar scare tape, Mylar balloons, scarecrows, and flags can all be used to startle crows. An old-fashioned scarecrow may also work. ● Protect seedlings with covers. Corn can be protected by placing a cup or bag over each ear after the silk has turned brown. ● Fishing line or cord can be placed in grid like patterns high above the garden to prevent crows from swooping in from above. ● Crows are smart and will eventually learn that even Mylar balloons are no threat. Try changing the position of these items often enough to confuse the crows and keep them away. ● Old folklore says that to make a scarecrow more effective, you should make its arms from hickory wood. If you build a scarecrow, be sure to move it around and change certain elements.

● Crows will kill the young of other birds. Prevent this in the first steps of nest box building: make sure there is more than six inches between the entry hole and the bottom of the box. Removing the perch or ledge under the hole will also prevent crows from having a stand where they can wait for young to peep their heads out.
● Try using feeders that are too small for crows but big enough for small birds.

GARDENING Plant Pests & Diseases Pests

Groundhogs

GARDENING Plant Pests & Diseases Pests Groundhogs

If every day is Groundhog Day in your garden, you'll probably agree with those who call that gluttonous rodent their least favorite backyard creature. Even skunks get more respect. Speaking of Groundhog Day, find out the origins of that funny holiday and some folklore surrounding groundhogs and weather. The problem is that groundhogs—also known as woodchucks or whistle-pigs—are binge eaters who can wipe out your vegetable garden in a matter of minutes. They climb, they burrow, they swim, and they eat—an adult consumes about a pound to a pound-and-a-half of vegetation daily. Between spring and fall, they double their body weight.

Soon after they emerge from a winter's hibernation, they mate, giving birth in mid-spring—at a time when the picking are at their slimmest. Neat rows of seedlings must look like manna from heaven to hungry groundhogs, who sometimes perch on garden fence posts as if they are looking over the salad bar. When hibernating, groundhogs—who are never speedy—really slow down, drawing a breath only about once every five minutes. Hibernation is curious behavior: Barely breathing, these mammals cool off to just a few degrees above the ambient temperature, sometimes as low as 39º to 40ºF. Their metabolic rate drops, and they sleep profoundly in their winter dens, neither eating nor drinking for four-and-a-half to five-and-a-half months, drawing all their nourishment from the body fat they accumulated during the summer.

Identification	Members of the squirrel family, groundhogs are squarish, stocky animals that typically weigh between 4 and 14 pounds. The have short, strong legs; coarse, grizzled, gray-brown fur; small ears; a short, bushy tail; and curved claws. Groundhogs look a bit like runaway fur coats as they waddle back to their burrows. This critter can grow to be about 3 feet long. They have large, competent, chisel-like teeth that make them efficient, but not quite endearing. Wondering where groundhogs live? See any deep tunnels in your yard, under your deck, or near your foundation? You may have a groundhog; they dig burrows to live in and the entrances are usually 10 to 12 inches wide with the excavated soil spread around the entrances. There are usually 2 or 3 entrances.
Damage	What do groundhogs eat? Everything from flowers to vegetables. Favorite foods include alfalfa, clover, peas, beans, lettuce, broccoli, plantain, and soybeans. Groundhogs will often devour your seedlings before they even have time to grow. Rabbits and deer eat some of the same plants, so make sure to check for burrows before concluding that you have groundhogs. If you don't have vegetables around, groundhogs will settle for twigs, bark, bugs, and blossoms. Groundhogs eat mostly during the early morning and afternoon, so try to see when your garden is receiving the most damage. These creatures will also gnaw and claw at fruit trees, so check your trees for any such marks.
Prevention	● Sprinkle blood meal, ground black pepper, dried blood, or talcum powder around the perimeter of your garden. You can try using hair clippings as well. ● Puree and strain hot peppers and garlic, mix them with water and enough liquid soap to make it stick, and spray it liberally around the garden. ● Put some harmless but strong-smelling substance just inside the burrow (such as urine-saturated clumps of kitty litter). Loosely seal the entrance, so the smell stays inside the burrow. ● Would you eat lettuce tossed with bobcat urine? Neither would a woodchuck! Fox, coyote, wolf, and bobcat urines are among the forbidding predator scents now sold as groundhog repellents. ● Eliminate woodpiles and other places where groundhogs nest. ● Keep undergrowth and grass cover low to deter groundhogs.

● Groundhogs are always looking for vacant burrows. Close down their tunnel systems. Bury a three-foot-square panel of welded wire, centered over the entrance hole before an abandoned burrow is rediscovered.
● Traps and relocation may be the only solution. Place traps in front of burrow entrances or in the garden. Bait them with broccoli, apple slices, fresh lettuce, carrots, or sweet corn, and work the bottom of the trap into the earth. Check the trap often after setting it to minimize stress and injury to trapped creatures.

The best woodchuck deterrent is a fence. Excluding woodchucks from the garden will also keep out deer, rabbits, raccoons, and stray pets. Since groundhogs climb and also burrow, you'll need to build a secure enclosure using six-foot-wide woven-wire fencing. Above ground, the fence should be about four feet high, with the top 12 inches unattached to fence posts (i.e., floppy and facing away from the garden, so that when a groundhog tries to go over the top, its weight will flip it back). The two feet of fencing buried underground should form an L-shape, with 12 inches going straight down and the bottom 12 inches bent at a right angle away from the garden.

An apron of weighed-down black plastic around the garden discourages some diggers, as does an electric fence strung four to six inches off the ground about four to six inches outside the woven-wire fence. Pay special attention to areas facing fields where woodchucks live or places where they have been digging; sometimes extra fortification in just these spots is called for. Be sure the gate is protected, too. Fencing is not inexpensive, but it's an investment in serious gardening.

Raccoons

Raccoons (Procyon lotor) have masks over their eyes because they could rob even a bank vault. These resourceful animals are second in persistence and imagination to no other animal (unless it's a squirrel at a bird feeder).

Raccoons are great climbers, swimmers, jumpers, and runners. Their five-toed paws make them very dexterous, and their agility can allow them to outsmart every human concoction used to deter them. If they aren't breaking into your garden, they might try to climb into your chimney to use it as a den.

Raccoons do not hibernate during the winter, but they will live in dens for periods of severe weather, causing them to lose a lot of their body fat in northern areas. They often live in hollow trees during the warm part of the year. Populations of raccoons often include many youngsters, and families will stay together for about a year.

Identification	Raccoons are small mammals 2 to 3 feet in length and weighing about 10 to 30 pounds. Raccoons have distinct black "masks" on their faces, which often characterizes them as bandits. They have fluffy, ringed tails and their bodies are varying shades of gray, with hints of light brown. The forepaws of raccoons resemble tiny human hands with five toes, which makes raccoons very dexterous. Raccoons are nocturnal creatures, meaning that they feed at night. This might make it hard for you to identify them, as you might only see the damage they cause. Looking for raccoon tracks near the damage might also help you to identify them. Learn more about identifying animal tracks.
Damage	If your lawn has a lot of holes in it, or your mulch pile has a lot of holes, you probably have a nightly visitor. Raccoons will dig up lawns and mulch piles looking for insects to eat. They will also empty bird feeders, so keep an eye on your feeders to see if you have a raccoon problem. Additionally, raccoons are known to raid chicken coops, stealing eggs and even killing chickens. Of course, if you have corn, there's nothing more infuriating than finding stalks toppled and ears ripped open and half eaten. (Even more frustrating is the idea, offered by animal researchers, that raccoons are wasteful because they don't really like sweet corn all that much; in fact, they seem to prefer sunflower seeds, dog food, and sardines.)

Prevention

The persistence and proliferation of raccoons has inspired many solutions; one of them is bound to work for you. Here are tips from all our readers and staff! See what works for you.
● If your raccoon problem is persistent, you can set live raccoon traps in your garden and release the animal at least three miles away (check local and state laws first). Raccoons will eat virtually anything; try fish-flavored dry cat food, chicken necks, ears of corn, or whole peanuts for bait.
● To keep raccoons at a distance, try scattering blood meal around corn plants. Also try sprinkling wood ashes around your plants.
● Grind up garlic, mix it with an equal portion of chili powder, and spread it around the garden. Frequent applications are needed.
● One reader says, "Hang shoes and clothes that smell of human perspiration around your garden or corn patch." Similarly, "You can try to repel raccoons by putting dog hair or human hair around the garden."

● Tune a radio to a rock station and set it in the middle of your garden and/or corn patch. Leave it on all night. The noise will scare away the raccoons.
● Put lights in the garden. A bright lantern will sometimes keep Sun-shy raccoons away.
● Plant enough corn for man and beast alike.
● Add some pinwheels and streamers to your garden to scare the creatures.
● Folk wisdom suggests that you spread newspapers around the perimeter of the garden.
● Build a good fence around your garden. Beware though, raccoons are agile and intelligent; make sure your fence will keep them out. You may need to install an electric fence. This is a good measure. A two-wire fence, with one wire four to six inches above the ground and the other at 12 inches, should be effective.
● If your home is near your garden, remove any possible food sources from the area, including pet food and bird seed. Buy garbage cans with locking lids and keep garbage inside if possible. Keep pet doors sealed shut between dusk and dawn. Cap your chimneys. Seal any holes or gaps in attics and roofs.

● Grow tall varieties of corn such as 'Silver Queen', 'Kandy Korn', and 'Lancelot'. Taller plants bear their ears higher, causing raccoons trouble getting leverage to topple stalks and ravage them. They prefer shorter plants.
● You can also plant squash around your corn or other plants to deter raccoons; they don't like walking on the prickly squash vines.

Thrips

Thrips are tiny insects about as fat as a sewing needle that dine on many plants worldwide. Also known as thysanoptera or thunderflies, thrips are sucking insects that can cause some damage to plants. However, their damage can be much worse when they transmit viruses to plants.

Thrips Life Cycle: The life cycle depends on the species of thrips as well as the location, host plant, and other factors. Adult thrips overwinter in plant debris, bark, or other materials. They become active in early spring and lay eggs in plant tissue. These eggs hatch after 3–5 days, and the nymphs then feed for 1–3 weeks before resting to molt in 1–2 weeks. Thrips can have up to 15 generations per year outdoors. Adult thrips live short lives of about one month.

Identification

Adult thrips are slender and tiny, at 1 / 50- to 1 / 25-inches long. Their colors can be anywhere from yellow to brown or black, and if you try to get close to them, they will probably leap or fly away. They have narrow, fringed wings. The nymphs look like even smaller adults, though they tend to be light green or yellow rather than darker colors. Their wings are also not fully developed, and they sometimes have red eyes.

Thrips appear to be tiny dark slivers on your plants. It is hard to see their bodies well without a magnifying glass, but up close, they look a bit like lobsters. Shake them onto a white background in order to see them well.

Damage

Thrips damage includes streaks, silvery speckling, and small white patches. This happens because the thrips suck plant cells from many garden plants, flowers, fruits, and shade trees. If you have a major infestation of thrips, your plants might be stunted with damaged flowers and fruit. The damage that you notice might instead come from the virus that the thrips spread (usually tomato spotted wilt virus).

Prevention

● To keep thrips populations under control, try using yellow or blue sticky traps.
● Shaking branches to remove the thrips and catching them on a cloth underneath is one easy way to quickly remove them.
● For onion thrips: Take a dark piece of paper into the garden and knock the onion tops against it; if thrips are present, you will spot their tan-colored bodies on the paper. A couple of treatments with insecticidal soap kills them. Follow the package directions. Spray the plants twice, three days apart, and the thrips should disappear.
● For fruit trees: Spray dormant oil on the trees.
● As a last resort, dust the undersides of leaves with diatomaceous earth.
● For flower thrips on gladiolus: Mix 1 tablespoon Lysol household cleaner with 1 gallon water. Soak gladiolus corms in the liquid and plant while still wet to prevent thrips.
● You can plant various flowers to attract beneficial insects that are natural predators to thrips. Some good predators include pirate bugs, lacewings, and lady bugs. Learn more about attracting those predators.
● For onion and western flower thrips, try releasing minute pirate bugs or the predatory mite Amblyseius cucumeris.

● Reflective mulches can help to hide your plants from thrips.
● If there is a very big thrips problem in your area, some plants have resistant varieties.
● Try not to overfertilize plants, as this can lead to more thrips damage.

Cabbage Worms

Cabbage worms are the same pest as "imported cabbageworms." The adult butterflies are sometimes called cabbage whites or small whites. The Latin name is Pieris rapae, or Artogeia rapae.

This is a common pest for cabbage, kale, cauliflower, broccoli, and other members of the cabbage vegetable family. Do not be overly concerned if you see a hole in a leaf; plants can withstand much leaf loss without consequence. It is during seedling establishment or early head formation that plants will incur true damage to their growth and yield.

Identification

Cabbage worms are velvety green larvae. They have a few faint yellow stripes. They are not to be confused with cabbage loopers, which are yellow-green caterpillars. Unlike cabbageworms, cabbage loopers raise and lower their bodies as they move because they have no middle legs. Cabbage worms become cabbage white butterflies, which are mostly white with a few black markings. Cabbage white butterflies might seem like a pretty addition to the garden, but they are probably laying eggs on the undersides of leaves.

Where you find cabbage worms and cabbage loopers, you also might find the eggs and larvae of the diamondback moth and the zebra caterpillar. The camouflage of these creatures is excellent, so you will often see the frass, or fecal matter, that they leave behind before you see them.

Damage

Cabbage worms can happily eat away at the bases of cabbage, cauliflower, or the heads of broccoli without being noticed. They feed on foliage, and eventually they can leave plants only with stems and large veins. If left to their own devices, cabbage worms can devour your crops. Their fecal matter can also stain and contaminate the produce.

GARDENING Plant Pests & Diseases Pests Cabbage Worms

Prevention	● Manually remove (handpick) the eggs if possible. ● Yellow sticky traps will catch the adult butterflies, but may also catch beneficial insects. ● Spraying with Bt (Bacillus thuringiensis var. kurstaki) every 1 to 2 weeks will also help control cabbage family pests. Sevin also is effective. And, the few pests that remain on the vegetables can be washed out after harvest using water and a small amount of detergent or other surfactant. ● It is said that if you dampen cabbage leaves and sprinkle them with cornmeal, the caterpillars will eat the meal, swell, and die. ● Check with your local Cooperative Extension for your area's regulations on chemical control. ● Years ago, people sprinkled rye flour over cabbage plants in the early morning. The flour dehydrated the cabbage worms. ● Cover your plants with row covers to deter the adult butterflies from laying eggs on the cabbages.

● Trichogramma wasps (very tiny; they do not sting humans) parasitize the eggs of the imported cabbage worm; these beneficial insects are available by mailorder, although you'll need to time their release appropriately—the mailorder company would be able to help you. Read more about beneficial insects.
● Companion planting is a useful deterrent for many pests. Cabbage worms are repelled by thyme, so it would be a good idea to plant thyme near your susceptible plants. Cabbage worms are attracted to mustard plants, so planting mustard near more valuable plants can be a good trap for cabbage worms. Once they take over the mustard, you can destroy the plant.
● Try planting red leafed varieties of cabbage. The cabbage worms won't be able to camouflage, so they are less likely to choose these plants.

Cucumber Beetles

If you find that the stems of your seedlings are being eaten off, leaves are yellowing and wilting, and holes are appearing, you may have a striped or spotted cucumber beetle problem. Striped cucumber beetles are specialists on cucurbits (such as cucumbers, squash, pumpkin, watermelons) while spotted cucumber beetles feed on other plants in addition to cucurbits.

Often, the beetles leave their hibernating sites early in the season (mid-April to early June), and feed on seedlings right as they are emerging, usually killing them. Then their larvae feed on the roots of the host plants. As they grow into adults (mid-July to September), the beetles will once again feed on the leaves, vines, and fruit of plants that survive, leaving deep marks in the rind.

Cucumber beetles hold another threat too: They can spread bacterial diseases and viruses from plant to plant, such as bacterial wilt or mosaic virus.

Identification	Adult striped cucumber beetles are about ¼ inch long and have a yellow-and-black–striped abdomen and a dark-colored head and antennae. Spotted cucumber beetles are the same length but have 12 black spots on a yellow abdomen. The larvae are worm-like, white, dark-headed, and have three pairs of legs on the thorax.
Damage	While cucumber beetle larvae feed on cucurbit roots, adult feeding is more damaging to the crop. Adults feed on leaves and can stunt plant growth. Look for holes and yellowing and wilting leaves. Feeding on flowers can reduce fruit production, and direct feeding on fruits causes unattractive scars and pock marks on the fruit, too. Often, the cucumber beetles alone will not kill the plants or cause major damage, but the spread of disease will. Feeding by adult cucumber beetles can spread bacterial wilt disease among cucurbit plants, even when population density of the insect is low. Adult cucumber beetles overwinter in weeds, garden debris, and woody areas. The diseases they carry can also overwinter internally.
Prevention	● Inspect newly planted cucurbit plants for the presence of this beetle; be watchful when plants are seedlings. ● Use yellow sticky traps to catch cucumber beetles and other pests. ● Knock beetles to the ground and catch them with a piece of cardboard placed under the plant. Or, use a handheld vacuum to suck up the beetles. They are very hard to hand pick, but it is easier to hand pick them with yellow gloves coated in petroleum jelly. ● Cover seedlings with row covers, though you must remove during blossoming time several hours each day to allow for pollination. ● Few insecticides can be used on cucurbit plants because they are very sensitive. They would need to be used when plants are just beginning to emerge through the soil. Please contact your local cooperative extension for a list of approved insecticides for your area. ● Nasturtiums and wood ashes are effective against cucumber beetles.

● If you till your garden in the late fall, you will expose cucumber beetles hiding there to harsh winter conditions and reduce their populations next year. Remove all debris after fall harvest to reduce overwintering habitat.
● Rotate crops so cucurbit crops are not planted directly into soils containing overwintering populations.
● Transplanting young plants rather than direct seeding can protect vulnerable seedlings from damage.
● Planting trap crops (cucurbit varieties highly attractive to cucumber beetles) at the perimeter of the harvested crop can keep cucumber beetles from migrating into the harvested crop.
● Where cucumber beetles are a problem, let the beetles come out of hiding and plant late. They have a knack for finding vulnerable seedlings. When yours are up and growing, the cucumber beetles will be gone, fooled into thinking you don't have any cucumbers in your garden.
● Natural predators include beneficial insects like braconid wasps, some nematodes, and soldier beetles.
● Companion planting your vegetables with flowers can help to keep pests away from the plants you don't want the beetles to attack.
● Once bacterial disease has entered the plant, there's very little that you can do. If it's bacterial wilt, you'll see the leaves dry up and the plant will quickly wilt and die. Take prevention for next year, as described above.

Flea Beetles

Flea beetles are small, shiny-coated beetles with large rear legs, which allow them to jump like fleas when threatened (the source of their name!).

There are many species of flea beetles. Some species attack a wide range of plants, while others target only certain plant families. In the garden, a number of vegetable crops are susceptible to these pests, particularly those in the Brassica family, like broccoli, cabbage, kale, radishes, and turnips, as well as Nightshades such as tomatoes, peppers, and eggplants.

Identification	Given that there are so many species of flea beetles, they vary in appearance quite a bit. Colors range from black to tan, with other, brighter colors mixed in, and the beetles may have a solid, striped, or spotted pattern depending on the species. To identify flea beetles, it's easier to look for signs of their damage (described below) than for the beetles themselves. At only 1/16 of an inch in length, flea beetles are very tiny and will quickly spring away—like fleas—if they see you approach! Adult flea beetles overwinter in brush and wooded areas. Adults pose the biggest threat early in the planting season as they are emerging, typically when outdoor temperatures reach 50°F (10°C). At this time, seedlings are being planted, too, and they are most susceptible to beetle damage. Eggs are laid at the base of plant stems in early summer after the spring feeding period, and larvae feed at the roots.

GARDENING Plant Pests & Diseases Pests Flea Beetles

Damage	Adult beetles feed on foliage, producing "shotholes" in the leaves. Look out for these holes especially on young seedlings, where damage is most rapid and will cause the most harm. The holes they make will be round and can quickly damage leafy greens. New leaves are usually damaged first, and they will have a lacy appearance. Flea beetles usually don't cause fatal damage to established plants because the leaves are already large enough to survive with a few holes. The real danger is that the beetles can spread bacterial diseases, such as wilt and blight, from plant to plant. Therefore, they are still important to consider a pest.
Prevention	● Try this homemade spray to control flea beetles: 2 cups rubbing alcohol, 5 cups water, and 1 tablespoon liquid soap. Test out the mixture on a leaf of the plant, let it sit overnight, then spray the rest of the plant if you don't notice any adverse effects. Spray the mixture on the foliage of garden plants that are susceptible to these pests. ● Dusting your plants with plain talcum powder repels flea beetles on tomatoes, potatoes, peppers, and other plants. ● Use white sticky traps to capture flea beetles as they jump. ● Insecticides may be used early in the season, but are generally unnecessary in the control of flea beetles on adult plants. Be extra diligent if your soil has history of bacterial diseases. Please contact your local nursery or cooperative extension for further advice. ● In the spring, emerging flea beetles will be waiting to feast on your garden. Cut off their food supply by delaying transplanting or planting by a couple weeks if possible. ● In the fall, till the garden to unearth any hiding flea beetles. This will also make soil easier to work the next spring.

● Row covers may be successful at keeping these pests out, as long as they are completely sealed. They should be used immediately after transplanting, so the pests do not have time to find the plant.
● Flea beetles are repelled by catnip and basil. They are attracted by nasturtium and radishes. You can plant these as traps for the flea beetles so that they do not attack other more valuable plants.

Cutworms

"Cutworm" is the name used for the larvae of a number of species of adult moths. Eggs that hatch in the fall can produce larvae capable of overwintering in the soil or a woodpile. They do the most damage early in the gardening season, when they emerge from hibernation. Cutworms are caterpillars, but they are often mistaken for the grubs of beetles such as Japanese beetles (which are damaging in their own right).

Identification	Cutworms are common on a wide variety of vegetables and any fresh seedlings. To identify them, try patrolling your garden in dusk and evening hours, when cutworms will begin to feed. They are also partial to cloudy days. Different species range in color from grey to pink, green and black and can be as long as two inches. They can be solid, spotted, or striped. They tend be curled up when they are not on the move. Cutworms are stealthy, and tend to feed only at night, while hiding in daylight hours. Black cutworms, also known as Agrotis ipsilon, are some of the most common cutworms. They have small dark spots on their bodies and mature into the dark sword-grass moth. Variegated cutworms, another common species, are mottled brown and have a faint white stripe down their backs. Adult cutworms are moths of dark wing colors. They are usually brown or gray, and they are about 1 ½ inches long with a 1 ½-inch wing length. You should keep an eye out for them, because the females will lay eggs in dry soil after they mate.
Damage	Cutworms chew through plant stems at the base. They primarily feed on roots and foliage of young plants, and will even cut off the plant from underneath the soil. In most cases, entire plants will be destroyed; they do a lot of damage in no time at all. Even if only the bottom of the plant is destroyed, the top will often shrivel and die. In the summer, cutworms sometimes crawl to the tops of plants and do damage there. Be careful not to mistake this damage for slug damage.
Prevention	● Make plant collars. Put a 4-inch piece of cardboard around each plant stem to help stop cutworms from reaching tender stems, especially right at transplanting. This time-consuming task works, though it is only efficient for a smaller garden. ● Save toilet paper tubes, cut them in half, fill with potting soil, and stand up in a tray. Use for planting seeds. When young plants are ready, plant them, tube and all. ● Hand pick. Go out at night with a flashlight and gloves. Pick off the cutworms and drop into soapy water; repeating this every few nights. ● Sprinkle used coffee grounds or egg shells around your plants. ● Circle stems with diatomaceous earth, a natural powder made from ground up fossils which kills insects when they walk over it. ● Apply an insecticide late in the afternoon for best control. Some readers use Bacillus thuringiensis, a natural way to kill cutworms. However, note that this bacterium may harm butterflies, an important pollinator. ● A mulch of oak leaves is useful against cutworms.

● Tansy planted near cabbages keeps them free of cutworms.
● A hog turned into a garden in early spring will root up cutworms.
● In the spring, emerging cutworms will be waiting to feast on your garden. Cut off their food supply by delaying transplanting or planting by a couple weeks if possible.
● Keep up with cultivation. The moths prefer to lay eggs in high grass and weeds. At the end of the season, plow or till the garden and mow surrounding areas to expose cutworms and destroy their winter habitat.
● Fireflies are a fun insect to have around the garden, plus they are a natural predator to cutworms. Check out these tips to attract fireflies to your garden.
● Birds are another natural predator to cutworms. Learn how to make your garden bird-friendly.

Aphids

Aphids seem to find their way into every garden. They are small, soft-bodied insects that feed by sucking the nutrient-rich liquids out of plants. In large numbers, they can weaken plants significantly, harming flowers and fruit. Aphids multiply quickly, so it's important to get them under control before reproduction starts. Many generations can occur in one season. The good news is that they tend to move rather slowly and aphid control is relatively easy.

Identification	Aphids are tiny (adults are under ¼-inch), and often nearly invisible to the naked eye. Various species can appear white, black, brown, gray, yellow, light green, or even pink! Some may have a waxy or woolly coating. They have pear-shaped bodies with long antennae; the nymphs look similar to adults. Most species have two short tubes (called cornicles) projecting from their hind end. Adults are usually wingless, but most species can develop a winged form when populations become crowded, so that when food quality suffers, the insects can travel to other plants, reproduce, and start a new colony. Aphids usually feed in large groups, although you might occasionally see them singly or in small numbers. While aphids in general feed on a wide variety of plants, different species of aphids can be specific to certain plants. For example, some species include bean aphids, cabbage aphids, potato aphids, green peach aphids, melon aphids, and woolly apple aphids.

Damage

Nymphs and adults feed on plant juices, attacking leaves, stems, buds, flowers, fruit, and/or roots, depending on the species. Most aphids especially like succulent new growth. Some, such as the green peach aphid, feed on a variety of plants, while others, such as the rosy apple aphid, focus on one or just a few plant hosts.

- Look for misshapen, curling, stunted, or yellowing leaves. Be sure to check the undersides of leaves; aphids love to hide there.
- If the leaves or stems are covered with a sticky substance, that is a sign that aphids may have been sipping sap. This "honeydew," a sugary liquid produced by the insects as waste, can attract other insects, such as ants, which gather the substance for food. When aphids feed on trees, their honeydew can drop onto cars, outdoor furniture, driveways, and so on.
- The honeydew can sometimes encourage a fungal growth called sooty mold, causing branches and leaves to appear black.
- Flowers or fruit can become distorted or deformed due to feeding aphids.
- Some aphid species cause galls to form on roots or leaves.
- Aphids may transmit viruses between plants, and also attract other insects that prey on them, such as ladybugs.

Prevention

- Try spraying cold water on the leaves; sometimes all aphids need is a cool blast to dislodge them. Typically they are unable to find their way back to the same plant.
- If you have a large aphid invasion, dust plants with flour. It constipates the pests.
- Neem oil, insecticidal soaps, and horticultural oils are effective against aphids. Be sure to follow the application instructions provided on the packaging.
- You can often get rid of aphids by wiping or spraying the leaves of the plant with a mild solution of water and a few drops of dish soap. Soapy water should be reapplied every 2-3 days for 2 weeks.
- One variation of this soap-water mix includes cayenne pepper: Stir together 1 quart water, 1 tsp liquid dish soap, and a pinch of cayenne pepper. Do not dilute before spraying on plants.
- Diatomaceous earth (DE) is a non-toxic, organic material that will kill aphids. Do not apply DE when plants are in bloom; it is harmful to pollinators, too.
- For fruit or shade trees, spray dormant horticultural oil to kill overwintering aphid eggs.

- Beneficial insects, such as ladybugs, lacewings, and parasitic wasps, will feed on aphids. Supplemental populations of these insects can be ordered online and should help keep the aphid populations controlled from the start.
- Aphids are repelled by catnip.
- Aphids are especially attracted to mustard and nasturtium. Plant these near more valuable plants as traps for the aphids. (Check your trap plants regularly to keep aphid populations from jumping to your valued plants.)
- Nasturtiums spoil the taste of fruit tree sap for aphids and will help keep aphids off of broccoli.
- Garlic and chives repel aphids when planted near lettuce, peas, and rose bushes.

Earwigs

Earwigs can be found in almost any growing zone, although they are more likely to inhabit warm, humid climates. You might have trouble spotting one—not only are they quick movers, they are also nocturnal, and tend to hide out during the day when you are tending the garden. They like decaying wood and plant material, and dark, damp spaces. Oftentimes, they can be found in basements and woodpiles.

Earwigs are the sole members of the insect order Dermaptera, ancient bugs that began crawling around Earth about 208 million years ago. Today, nearly 2,000 species are scattered everywhere but in Earth's polar regions. The name "earwig" comes from the Old English ear-wicga, which means "ear wiggler"—so named because the insect was once thought to seek out human ears to reside in. In France, they're called "ear piercers," and in Germany, "ear worms."

Earwigs enjoy a lively social scene. They congregate during the day because they tend to find the same hiding places. Their nests can number in the thousands, and they aren't territorial, so they often live together.

Pincher bugs are omnivores, meaning they'll eat pretty much anything that's made available to them. In the garden, they primarily feed on dead or decaying plant and animal matter. However, they will also readily prey on aphids, insect eggs, maggots, grubs, and army worms. When their population gets out of control, they may turn to feasting on living plant matter, especially the seedlings or young foliage of vegetables and flowers. This creates a conundrum for gardeners… Should earwigs be allowed to remain in your garden to eat up aphids and other pests? Or should they be removed before they turn their attention on your plants? Generally, earwigs do not cause enough damage to be worth fighting. However, if you do see large numbers of them around your plants, you can consider taking action.

The pincers at the end of an earwigs abdomen look rather formidable. They are capable of pinching (and sometimes biting) humans, but the pinch is not particularly powerful. Earwigs usually use their pincers to ward off enemies like toads and birds, or—in some species—to catch prey. The pincers, or "cerci," are also important for romance. They are indicators of gender, like tusks on an elephant. A male earwig's pincers are long and curved, while a female's are shorter and straighter.

Identification

- Earwigs get to be about ¾-inch long. They're reddish-brown insects with appendages on their tail-ends that look like forceps. Few other insects have a set of scary-looking pincers like the earwig has. This is why some folks call them "pincher bugs" or "pinching bugs." Attached at the insect's abdomen, these appendages are called cerci.
- Earwigs run very quickly and can also fly, though they rarely do so. They actually have two sets of wings, and their pincers aid in unfolding the wings.
- What do earwigs eat? Nocturnal by nature, an earwig's main meal is decaying plant material and wood, but it will attack living plants, including vegetables, fruit trees, and ornamentals, if given the opportunity. Earwigs are especially fond of flowers, lettuce, celery, and fruits.
- Female earwigs lay 40 to 50 shiny eggs in underground tunnels. The eggs are protected from predators and hatch in about a week, making it very difficult to control earwig populations before they hatch.
- Nymphs simply appear to be miniature versions of adult earwigs. They shed several skins, and ten weeks later, they reach adulthood.
- Earwigs often hide underneath pots during the day and then eat the flowers in the pots at night.

Damage

- Leaves will appear jagged and full of holes. Plants will become ragged overnight, and some leaves will only be partially eaten. There will also probably be a scattering of earwig excrement, which will be small, black pellets.
- Damage will often occur after rainy weather, which forces earwigs to seek dry shelter and climb up into plants and leaves.
- You might find the earwigs under pots that contain damaged plants.
- Earwig damage looks similar to that of slugs and snails. To tell the difference, look for the tell-tale sign of slugs and snails: a trail of slime residue on foliage.

Prevention

Generally, earwigs are not as much of a threat to your garden as other pests, like Japanese beetles and aphids, though they can be as big of an annoyance! They can also produce a foul odor when disturbed, so keep that mind. Try these remedies:

- Lay one-foot sections of bamboo or garden hose in the beds between your plants. Check these "traps" each morning, and dump the earwigs into a bucket of soapy water.
- Spread petroleum jelly around the stems of your plants. Earwigs won't crawl over it.
- If they are infesting your woodpile, try sprinkling borax around it, but keep pets and children away from this area after doing so.
- Oil pit traps are a great remedy for earwigs. Combine equal parts soy sauce and olive or vegetable oil, put it in a small plastic container, and secure the lid. Punch holes in the top of the container, near the lid. Make the holes large enough for the earwigs to get in. Bury the container in the soil just up to the holes. The soy sauce will attract the earwigs, and the oil will prevent them from escaping. Change the mixture as needed.

- Alcohol controls these pests by acting as a surfactant, or wetting agent, that can penetrate an insect's waxy coat of armor and kill on contact with the body. Isopropanol (rubbing alcohol) works fine and is easy to find, but be sure it doesn't have additives. Ethanol (grain alcohol) seems to work best. Alcohol usually comes in 70 percent strength in stores (or 95 percent strength purchased commercially). To make an insecticidal spray, mix equal parts 70 percent alcohol and water (or, if using 95 percent alcohol, mix 1 part alcohol to 1 ½ parts water).
- WARNING: Before using an insecticidal spray on your plants, test it on a single leaf. Wait 24 hours and observe to see if the plant has an adverse reaction. If it does, dilute your alcohol solution more and test again.
- Earwigs are also susceptible to diatomaceous earth (DE), so consider placing a ring of DE around the bases of plant if the soil is dry enough. In wet weather, DE is not effective.
- Expect more earwigs during rainy years, and prepare accordingly.
- Avoid growing susceptible plants near walls covered in ivy or hedges, as many earwigs might live in these areas.
- Birds and toads are both natural predators of earwigs. Check out our tips for creating a bird-friendly garden.

- Occasionally, earwigs will move from mulch and other moist material outside into your house. They aren't harmful, but can be an annoyance nonetheless. To prevent this, check for bugs on everything you bring inside, especially laundry, lawn furniture, flowers, vegetables, houseplants, and firewood. Also, move mulch away from your house's foundation and establish a zone of bare soil that will dry out. If earwigs do happen to get into your home, vacuum them up.

Squash Bugs

Squash bugs can be the bane of a gardener's existence! They are very difficult to manage and can cause a lot of havoc. Squash bugs are most commonly found on squash plants (hence the name) such as zucchini, winter squash, and pumpkins, but they may also affect other crops in the cucurbit family (like cucumbers, cantaloupe, and watermelon). Other pests that are commonly found on squash include squash vine borers.

Squash bugs are often mistaken for stink bugs, as they are similar in appearance and both have a foul odor when squashed. However, stink bugs are wider and rounder than squash bugs.

Identification	The squash bug is fairly large (over ½-inch long) with a brownish or gray body and flat back. The edges and undersides of the abdomen have orange stripes. They are able to fly, but they often simply walk around on plants. Young squash bugs, or squash bug nymphs, are gray and have black legs. They move quickly and often in groups on the undersides of leaves. Squash bugs overwinter in your dead leaves, vines, under boards, and even in buildings. They fly to garden plants to mate as soon as vines start forming, and they lay egg masses on the undersides of the leaves. You'll find adults beneath damaged leaves and near the plant crown.
Damage	These bugs inject a toxin into the plant and suck the sap right out of it with their sharp, sucking mouthparts. This causes yellow spots that eventually turn brown. The leaves will wilt because the damage prevents the flow of nutrients to the leaves, and then they will dry up and turn black, crisp, and brittle. The leaves also sometimes have ragged holes. Smaller plants will die, and squash bug feeding can decimate young fruit. The wilting can resemble bacterial wilt, which is a disease spread by cucumber beetles (yet another squash pest), so be sure to find the bugs or eggs and identify them correctly.
Prevention	● Early detection is critical! You want to catch squash bugs before they grow into adults or they are very difficult to get rid of completely. ● Pick egg masses off the plants in the morning and later in the day. One reader fills a vase with water and liquid dish soap and flicks the squash bugs into the water. Once the bugs are dead, it's fine to dump the water anywhere. You can also simply scrape the eggs off the leaves with a butter knife and let them fall onto the ground, where beetles will eat them. Eggs hatch in about ten days, so be sure to check for them on at least a weekly basis. ● Place a board or shingle in the garden at night. During the night, both adults and nymphs will congregate underneath the board. Squash between two hard surfaces in the morning and dispose. ● Insecticides (such as carbaryl/Sevin) are most effective if applied when eggs are hatching. See your local garden center or cooperative extension service for controls that are locally approved. ● Keep checking your plants, at least daily. If there are no more than a few vines infected, keep collecting and destroying the bugs and crushing the egg clusters that you find on the undersides of leaves.

- Prevention is key: In the fall, be sure to burn or compost old squash vines to rid your garden of any possible shelters for breeding and over-wintering.
- Avoid deep, cool mulches like straw or hay that provide an environment that these bugs seem to love.
- Practice crop rotation.
- Consider keeping vines covered until blossoming begins. Remove the cover for pollination needs. There is only one generation of squash bugs per year, and you can avoid them by covering your plants for the first month of spring. You can also delay planting your squash until the early months of summer.
- Companion planting can be useful in repelling squash bugs. Try planting nasturtium and tansy around your plants that are commonly affected by squash bugs.
- Select varieties of squash that are resistant to the squash bug if you have a big problem. 'Butternut', 'Royal Acorn', and 'Sweet Cheese' varieties are all more resistant to squash bugs.

Whiteflies

Whiteflies are soft-bodied, winged insects closely related to aphids and mealybugs. Despite their name, whiteflies are not a type of fly, though they do have wings and are capable of flying. Whiteflies can be as small as 1/12 of an inch, are somewhat triangular in shape, and are often found in clusters on the undersides of leaves. They are active during the day and will scatter when disturbed, so they can be easier to spot than some nocturnal insect pests. There are hundreds of species of whiteflies, but most affect only a small number of host plants. However, there are a few whitefly species that affect a wider range of plants, which make them the most problematic in horticulture. These whitefly species include the greenhouse whitefly, bandedwinged whitefly, giant whitefly, and silverleaf whitefly, among others. Silverleaf whiteflies, which are slightly smaller and more yellow than other whiteflies, are especially common in the southern United States.

In USDA Zone 7 and colder, whiteflies are not able to survive winter outdoors, so their presence tends to be limited to indoor plants or greenhouse environments. However, if outdoors plants are bought from an infested greenhouse, whiteflies may become a seasonal outdoor garden pest. (Always inspect plants before bringing them home!) In warmer regions, whiteflies are capable of overwintering and reproducing outdoors throughout the year, so they can be a problem for both indoor and outdoor plants. You'll often start to see whiteflies in mid- to late-summer when it gets warm and humid.

Whiteflies can be found on a wide variety of plants, from ornamental flowers to warm-weather vegetables, including tomatoes, eggplant, peppers, and okra. Some species may attack sweet potatoes, plants from the cabbage family, and citrus trees. Indoors, they will feed on most common houseplants, especially those with soft, smooth leaves.

Identification	Like aphids, whiteflies use their piercing mouthparts to suck up plant juices and, in turn, produce a sticky substance known as honeydew. Honeydew left on its own can cause fungal diseases such as sooty mold to form on leaves. With heavy whitefly feeding, plants will quickly become extremely weak and may be unable to carry out photosynthesis. Leaves will wilt, turn pale or yellow, growth will be stunted, and eventually leaves may shrivel and drop off the plant. Honeydew is a sign that the whiteflies have been feeding for several days. You might also see ants, which are attracted to the sweet honeydew. Whiteflies tend to prefer to feed on new growth, so check around any newly unfurled leaves first. Check the undersides of leaves—especially around the veins—for white insects, even if they aren't immediately visible, and feel leaf surfaces for sticky honeydew. If the whiteflies are feeding, they'll suddenly all fly off the leaves in a swarm, so it's very obvious. You may also find eggs laid on the undersides of leaves.
This is the beginning of a new generation! When the eggs hatch, the larvae will look like teeny white ovals without legs; they don't move but they immediately start sucking the plant juice. This is why gardeners often miss whiteflies until it's too late. Adult females can produce up to 400 eggs, which hatch in about one week to a month after laying. They are usually laid in a circular pattern. Eggs are pale yellow when newly laid and brown when about to hatch.	
Damage	
Prevention	To control whiteflies, there are various solutions and traps that you can use. The biggest tip is: start early! In the mornings and evenings, as you wander the garden or tend to your houseplants, check the back of the leaves for eggs or notice when little bugs "fly away" as you approach your plants. ● Always start with blasting whiteflies (as with aphids and many other insect pests) with your watering hose or a spray bottle. This will cause them to scatter and will dislodge nymphs and eggs to some extent. ● Consider spraying your plants' leaves with an insecticidal soap, following the directions on the packaging. Be sure to spray the undersides of leaves, too. Follow up 2 or 3 times, as necessary. ● According to the National Gardening Association, the following simple homemade mixture should be helpful to control and deter whiteflies: Use a mix of dish soap and water. A good squirt of soap to a gallon of water should work. As mentioned above, only spray in cooler temperatures; late in the day is best. The NGA mixture is a pretty benign combination, and whiteflies are nearly impossible to get rid of, so it's best to try more preventative tactics first, as mentioned below.
● Tip: Spray plants in the evening when temperatures are cooler, as mid-day heat may cause an adverse reaction in your plant. Plus, spraying in the evening allows you to avoid accidentally spraying any pollinators or beneficial insects. ● If all else fails and your whitefly population is persistent, you can use a handheld vacuum every few days to remove them from your plants. This gets rid of both nymphs and adults. Just be sure NOT to empty your vacuum into a trash can inside your home afterward! ● Your first line of defense should be inspecting all plants for pests before you bring them home, as well as keeping any new additions away from the rest of your plants for a period of time. This will allow you to identify and curtail any pest or disease issues that appear. ● Keeping natural predators around will prevent whiteflies from ever exploding in population. For this reason, avoid using insecticides. Ladybugs, spiders, green lacewing larvae, and dragonflies are a few of many beneficial insects that can control a whitefly population. Hummingbirds are another natural predator. Try creating a habitat that will attract dragonflies and damselflies (which also helpfully eat mosquitoes) or beautiful hummingbirds. ● When it comes to whiteflies, avoid chemical insecticides; they're usually resistant and all you end up doing is killing the beneficial insects—their natural predators—and the insects that pollinate the garden for a better harvest! ● Mulch early in the season with aluminum reflective mulch, especially around tomatoes and peppers. The reflective mulch makes it challenging for whiteflies to find their preferred host plants. ● Set out yellow index cards coated with petroleum jelly to monitor whiteflies, especially when it comes to tomatoes, peppers, sweet potatoes, or cabbage crops. A half-and-half mixture of petroleum jelly and dish soap, spread over small boards painted bright yellow, is sticky enough to catch little whiteflies, too. To whiteflies, the color yellow looks like a mass of new foliage. The bugs are attracted to the cards, get stuck in the jelly, and die.	

Diseases

Rust Plant Disease

What is rust plant disease? This fungal disease affects a wide range of woody and herbaceous plants. Even though it rarely kills plants, it reduces a plant's health, vigour, and flower production.

Causes	Rust disease is caused by a fungal parasite that needs living plants to survive. Rust diseases occur most often in mild, moist conditions. Rust is spread by spores that are transferred from infected plants to healthy plants. These spores can be transferred either by the wind or by water, which is why rust disease often spreads after watering. Wet surfaces are also needed to cause infections.
Identification	Rust diseases come in different varieties and can affect a wide range of plants. People often struggle with rust on their roses. It is easy to remember the defining characteristics of this fungus, as they match its name. Rust plant disease will look similar to the rust that appears on that old bicycle in the shed. ● Look for yellow or white spots forming on the upper leaves of a plant. ● Look for reddish to orange blister-like swellings called pustules on the undersides of leaves. ● Orange or yellow spots or streaks appear on the undersides of the leaves. ● Within these spots that form are spores. ● Usually leaf distortion and defoliation occur.
Control / Prevention	● Remove all infected parts and destroy them. For bramble fruits, remove and destroy all the infected plants and replant the area with resistant varieties. ● Clean away all debris in between plants to prevent rust from spreading. ● Avoid splashing water onto the leaves, as this can help spread rust. ● Dust your plants with sulphur early in the season to prevent infection or to keep mild infections from spreading. ● Space your plants properly to encourage good air circulation. ● Avoid wetting the leaves when watering plants. ● There are many effective rust fungicides you can try. Ask your local nursery for which products you should use.

Powdery Mildew

GARDENING | Plant Pests & Diseases | Diseases | Powdery Mildew

Wondering about that white fungus on your plants? The fungal disease powdery mildew affects a wide variety of plants and takes away a plant's nutrients. This causes the plant to bloom less and become weaker. There are many different species of the fungal disease powdery mildew, and each species attacks a range of different plants. Unlike many other fungal diseases, powdery mildew thrives in warm, dry climates, though it does require fairly high relative humidity (i.e., humidity around the plant) to spread. In cooler, rainy areas, it does not spread as well.

That being said, it is capable of infecting your plants under a wide variety of conditions. When the fungus begins to take over one of your plants, the mildew that forms is made up of many spores. These spores carry the infection to other plants through the wind. Powdery mildew can slow down the growth of your plant. In some cases, if the infection is severe enough, powdery mildew can kill your plants.

Identification	● Plants infected with powdery mildew look as if they have been dusted with flour. ● Powdery mildew usually starts off as circular, powdery white spots, which can appear on leaves, stems, and sometimes fruit. ● Powdery mildew usually covers the upper part of the leaves, but may grow on the undersides as well. ● Young foliage is most susceptible to damage. Leaves turn yellow and dry out. ● The fungus might cause some leaves to twist, break, or become disfigured. ● The white spots of powdery mildew will spread to cover most of the leaves or affected areas. ● The leaves, buds, and growing tips will become disfigured as well. These symptoms usually appear late in the growing season.
Control / Prevention	● Remove all the infected plant parts and destroy them. Remember, do not compost any infected plant, as the disease can still be spread by the wind and persist in the composted materials. ● Spray infected plants with fungicides. Effective organic fungicides for treating powdery mildew include sulphur, lime-sulphur, neem oil, and potassium bicarbonate. ● Choose plants that are resistant or tolerant to powdery mildew. Many mildew-resistant varieties of cucurbits (melons, cucumbers, squash, etc.) have been developed and can be bought from major seed suppliers. ● Avoid watering plants from overhead in order to reduce relative humidity. ● Selectively prune overcrowded areas to increase air circulation; this also helps to reduce humidity around your plants. ● Spray your plants with the fungicides mentioned above according to the directions included with the products. ● If you don't want to use fungicides, try spraying your plants with a bicarbonate solution: Mix 1 teaspoon baking soda in 1 quart of water. Spray plants thoroughly, as the solution will only kill fungus that it comes into contact with.

Tomato Diseases and Disorders

Resisting Pests

Diatomaceous Earth

Diatomaceous earth (DE) is the fossilized skeletons of microscopic single-celled aquatic organisms called diatoms. Their skeletons are made of a natural substance called silica—which makes up 26% of the Earth's crust by weight. Deep deposits of diatomaceous earth are mined in the western United States in places where lakes once covered the area millions of years ago. Snugs and snails do not like to crawl over DE because the silica skeletons are very sharp—like tiny pieces of broken glass. (Slugs and snails don't like eggshells either!) If their soft bodies do get cut, they eventually dehydrate and die.

This process works on other soft bodied insects, too, including caterpillars and aphids, as well as on those with hard shells, such as beetles, fleas, cockroaches, and even bed bugs. The tiny particles of DE get into the insects' joints, causing irritation and dehydration. The downside to DE is that it does not discriminate between pests and beneficial insects. Ladybugs, green lacewings, butterflies, bees, and other "good guys" will also be affected by DE.

● When shopping for DE, look for the "food grade" quality. The DE used in pool filters is not effective against garden pests.
● Sprinkle bands of DE around the plants you are trying to protect. It's important that the ring of DE does not have any gaps for pests to sneak through.
● If pests are eating the leaves of your plants, you can dust the leaves with DE, which should discourage further damage. However, you should avoid applying DE near the plants' flowers, where pollinators might inadvertently come into contact with it.
● When using DE, it's recommended to wear eye protection and a dust mask, as the small particles can be irritating.
● DE works best in dry conditions. It clumps together when wet, so reapply after it rains.

Even though the industry states that this product does not cause lung damage, I would still refrain from breathing it in. Remember, it might feel soft to the touch, like talcum powder, but it still is an abrasive and can cause irritation to your eyes, nose, lungs, and throat. Wear a dust mask and eye protection when handling it just to be on the safe side. Surprisingly, DE is not toxic if eaten! In fact, we probably have been eating it for years unknowingly, since it is often mixed with grain in storage to kill insects. It can also be found in toothpastes and skin care products. Some people take it a step farther and use it for treating internal parasites! DE does not harm the soil since it is made from silica, the same as sand and many rocks.

It does not break down when exposed to sun. Rain can wash it into local water sources but it is non-toxic to fish and other aquatic life. It is not harmful to birds or other wildlife. It has been added to livestock feed for years. If pests are enough of a problem that you would be tempted to resort to a chemical pesticide, give DE a try first. It is considered organic by the Organic Materials Review Institute (OMRI) and the National Organic Program considers it a non-synthetic and permits it use in crop production.

11 Permaculture

A section on developing thriving ecosystems in your backyard from aquaponics to hydroponics.

Types

Agroforestry

Hügelkultur

GARDENING Permaculture Types

Natural Building

Natural Types

Rainwater Harvesting

GARDENING Permaculture Types

Sheet Mulching

Sheet Types

Intensive Rotational Grazing

GARDENING Permaculture Types

Keyline Design

Keyline Types

Fruit Tree Management

Fruit

GARDENING Permaculture

Aeroponics

Aeroponics

Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium (known as geoponics).

Aquaponics

Aquaponics refers to any system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment.

GARDENING Permaculture

Hydroponics

Hydroponics is a subset of hydroculture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent.

Aquaculture

Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants.

Plants

Identification tips for plants to determine its uses and edibility

"If a plant is sad, do other plants photosympathise with it..."
Unknown

Introduction

This section will guide you on how to identify wild plants with a high accuracy, however you will need the separate TPE Plant Identification section, a plant database or book to search in. The additional plant section is not included due to the size and containing over 5,000 rows. The section at the end will detail ways you can obtain a plant database.

Purpose	The aim of PLANTS is to provide a list of identification factors which can be used to help identify shrubs, plants and trees. It then discusses how to properly forage food and includes an edibility test for unknown plants.
Lost?	● For information on edible plants and growing your own food, see the GARDENING section. ● For a list of plants that grow in certain climates, see the SURVIVAL section. ● For information on the use of medicinal plants, see the NATURAL REMEDIES section. ● For a list of recipes for commonly foraged plants, see the RECIPES section. ● For information on the legality of drug plants by region, see the GEOGRAPHY section.

Contents

1 Plant Type

Plant Type

Cactus/Succulent	
Fern	
Grass/Grass-Like	
Herb/Forb	

Shrub	
Tree	
Vine	
Woody Plants	
Aquatic plants	
Grass-like Plants	
Orchids and Related Plants	
Ferns	
All other flowering non-woody plants	

Location

Habitat	Tree ○	Shrub ○	Vine or ground cover ○		

2 Stem Identification

Stem Type

Thorns, prickles, or spines	
Pendulous	
Twisted or Curved	

Leaf Branching

Alternate Branching	
Opposite Branching	

3 Leaf Identification

Leaf Features

Leaf Type

Simple Leaf (One Part)	
Compound Leaf (Multiple Parts)	

Leaf Apex (Leaf Tip)

Leaf Length

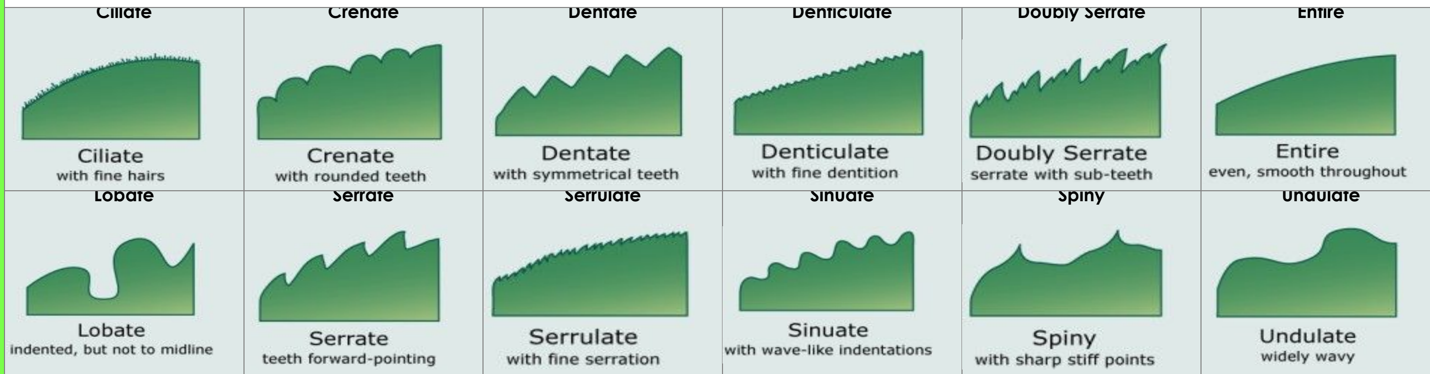
<3cm	
3-8cm	
8-15cm	
15-25cm	
25cm+	

Leaflet Count

Two Leaflets	
Three Leaflets	
Four Leaflets	

Leaf Margin

The leaf margin is the edges of a leaf.

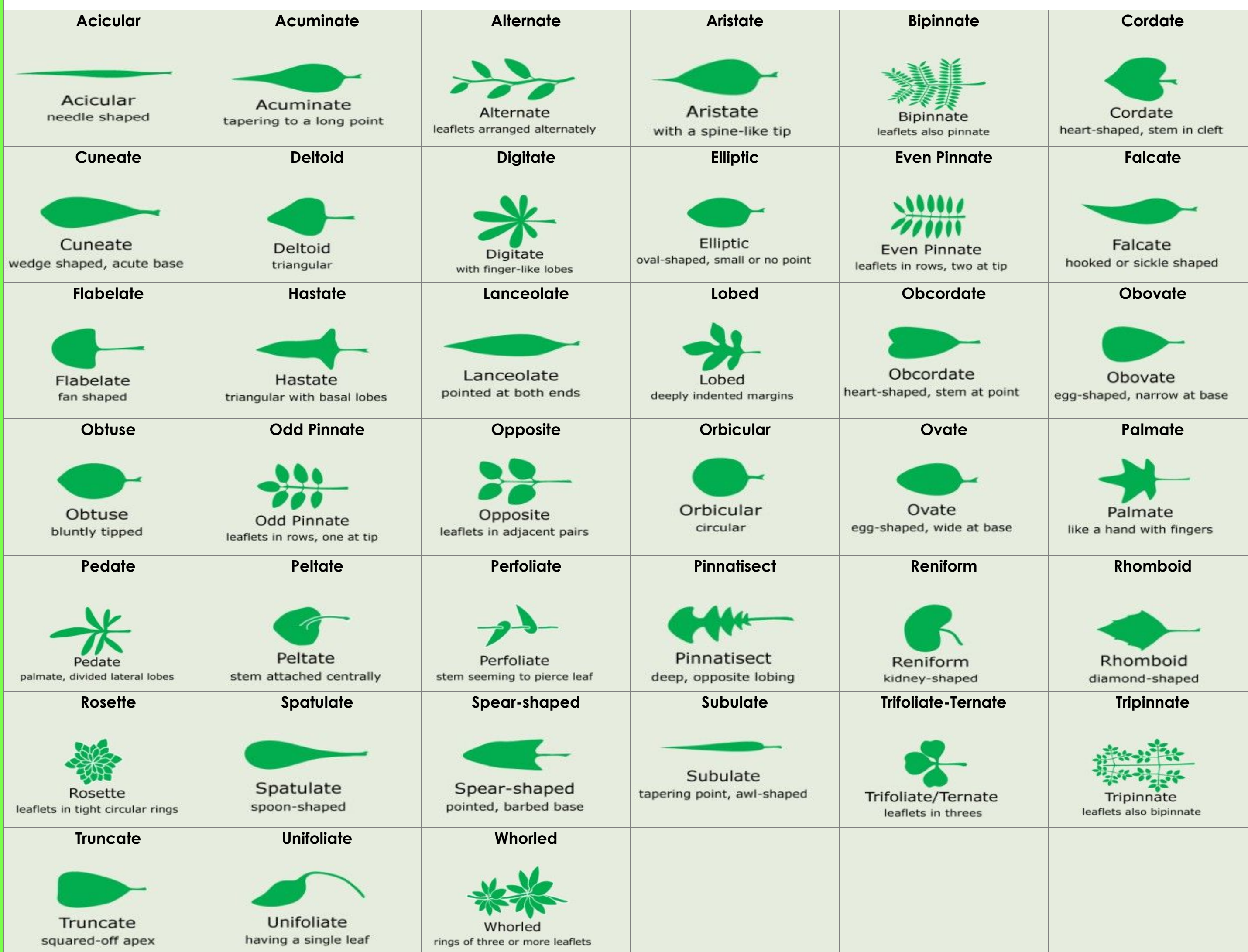


Leaf Base (Start of the Leaf)

Leaf Orientation

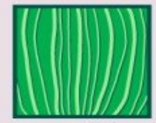
Leaf Shape

The leaf shape is the overall shape and look of a leaf.



Leaf Venation

Leaf venation is the pattern of the veins on the leaves.

Arcuate	Cross-Venulate	Dicotomous	Longitudinal	Palmate	Parallel
 Arcuate secondary veins bending toward apex	 Cross-Venulate small veins connecting secondary veins	 Dichotomous veins branching symmetrically in pairs	 Longitudinal veigns aligned mostly along long axis of leaf	 Palmate several primary veins diverging from a point	 Parallel veins arranged axially, not intersecting
Pinnate	**Reticulate**	**Rotate**			
 Pinnate secondary veins paired oppositely	 Reticulate smaller veins forming a network	 Rotate in peltate leaves, veins radiating			

Leaf Stipules

Stipules in general are appendages emerging in most cases at the base of the petiole (leaf stalk). They can appear in a range of different forms; as a pair of rolled up sheaves (encasing the developing leaf and being discarded as the leaf unfurls), as tendrils (without being discarded), as small leaves and also as spines. They can be easily noticeable to minute in size. The presence or absence of stipules, their different appearances and scaring of young branches (after detaching) can greatly assist in identification of tree species.

4 Flower Identification

Size

Not Showy	Tiny or of little ornamental value
Showy	Obvious, colourful or abundant, etc.

Position of Flower

Only on Top	
Raceme - Spike	
Umbel-cyme-panicle	
Individually on Several Stems	
Whorled Group	

Predominant Colour

White/Gray	Red	Violet	Green	Yellow	Blue
Orange	Pink	Purple	Brown		

Petal Count

No Petals	
2-3 Petals	
4 Petals	
5 Petals	
6 Petals	
7+ Petals	
Numerous	The petals are so numerous that they are hard to count.

Shape of Corolla

Radiate	
Slightly Mirror-Symmetrical	
Mirror-Symmetrical	
Bell-Shaped	
Capitular Flower	
Other	

Breadth of Corolla

<1cm	
1-3cm	
>3cm	

5 Fruit Identification

Shape

Oblong	A pod or rod-like fruit shape, e.g. pea pod, banana, redbud, magnolia.
Spherical or ovoid	e.g. rose hips, black walnut, pecan
Winged	e.g. ash, maple, elm, etc.
Catkin or cone-like	e.g. birch, alder
Acorn	e.g. oak
Other	Lobed, hemispherical, cone, etc.

Colour

White/Gray	Red	Violet	Violet/Lilac	Yellow	Orange
Green	Brown	Black	Pink	Blue	

Smell

6 Tree Identification

Tree Type

Evergreen	Doesn't lose its leaves during the course of the winter.
Deciduous	Lose their leaves at the end of the growing season and grows them back again typically in the spring.

Bark Identification

Bark Types

Scaly	
Furrowed	

Papery	
Smooth	

Bark Scent

7 Foraging

How to find and forage wild food, what to avoid and the health benefits of them.

Foraging Weeds

Dandelion

Benefits	
Identification	
Edible Parts	
Preparation	
Avoid	
Hints	

Pine Needles

Benefits	
Identification	Long needle-like green leaves which have 2-3 needles per pod.
Edible Parts	
Preparation	Strip the brown ends off, chop up into 2cm lengths and add to hot tea.
Avoid	
Hints	Pick fresh young leaves which give milder, juicier leaves.

Chickweed

Benefits	
Identification	Long needle-like green leaves which have 2-3 needles per pod.
Edible Parts	
Preparation	Strip the brown ends off, chop up into 2cm lengths and add to hot tea.
Avoid	
Hints	Pick fresh young leaves which give milder, juicier leaves.

Weed Nutrience

Vitamin Weeds

Vitamin C	• Pine Needles • Lamb's-quarters • Chickweed • Purslane	• Sheep Sorrel • Stinging Nettle • Amaranth • Wood Sorrel			
Vitamin A	• Dandelion • Lamb's-quarters • Chickweed • Purslane	• Stinging Nettle • Amaranth			
Vitamin K	• Dandelion • Lamb's-quarters				
Vitamin D	• Chickweed • Stinging Nettle				
Vitamin E	• Purslane • Sheep Sorrel				
Vitamin B2	• Stinging Nettle				

Mineral Weeds

Calcium	• Dandelion • Lamb's-quarters • Chickweed • Purslane	• Stinging Nettle • Amaranth			
Iron	• Dandelion • Chickweed • Purslane • Stinging Nettle	• Amaranth			
Manganese	• Stinging Nettle • Amaranth				
Potassium	• Chickweed • Purslane • Stinging Nettle • Amaranth				
Omega 3	• Purslane				
Magnesium	• Lamb's-quarters • Purslane				
Phosphorus	• Chickweed				
Zinc	• Dandelion • Amaranth				
Iodine	• Stinging Nettle				
Folate	• Amaranth				
Copper	• Amaranth				
Thiamine	• Amaranth				
Niacin	• Amaranth				

8 Edibility Test

How to test unidentified food to ensure it's safe to eat.

1	Find a plant that is plentiful. You don't want to go through the rigorous process of testing a plant if there's not a lot of it to eat.
2	Abstain from eating or drinking anything but purified water for 8 hours before the test. (If you have to use this method, this step will probably be unavoidable.)
3	Separate the plant into parts. Some plants have edible parts and poisonous parts. In order to test if a plant is edible, you must separate it into the leaf, stem, and root and test each part separately for edibility. After you have separated the plant into parts, inspect each part you are preparing for parasites. If you encounter worms or small insects inside the plant, discontinue the test with that sample and consider seeking a different sample of the same plant. Evidence of worms, parasites or insects indicates that the plant is rotten, especially if the organism has vacated the plant. Many parts of plants are only edible during certain seasons (for example, acorns collected after the fall are usually rotten). If you find grubs inside the plant, the plant is rotting, but the grubs are edible and contain high amounts of protein (although they taste sour and are gritty).
4	Find out if the plant is contact-poisonous. A contact-poisonous plant is one that causes a reaction merely by touching your skin. Rub the selected plant part on the inside of your elbow or wrist. Crush it so that the sap touches your skin, and hold it there for 15 minutes. If the plant causes a reaction in the next 8 hours, do not continue testing that part of that plant. Do this with each part of the plant until you find a part that isn't contact-poisonous.
5	Cook a small portion of the plant part. Some plants are poisonous only when raw, so it's a good idea to cook the plant part you are testing if possible. If you can't cook the plant or if you don't anticipate that you will be able to cook it in the future, just test it raw.
6	This portion of the test is where things get dangerous, so proceed very slowly and carefully. Take the following steps to test the plant in your mouth: Hold a small portion of the prepared plant part against your lip for 3 minutes. Do not put the plant in your mouth. If you notice any burning, tingling, or other reaction, discontinue testing.
7	Place another small portion of the plant part on your tongue. Hold the plant on your tongue without chewing for 15 minutes. Discontinue testing if you notice any reaction.
8	Chew the plant and hold it in your mouth for 15 minutes. Chew the plant well, and do not swallow. Discontinue testing if you notice any reaction.
9	Swallow the small portion of the plant.
10	Wait 8 hours. Do not eat or drink anything during this period except purified water. If you feel sick, immediately induce vomiting and drink plenty of water. If activated charcoal is available, take that with the water. Discontinue testing if you experience any adverse reaction.
11	Eat 1/4 cup of the same kind of plant part prepared the same way. It is critical that you use exactly the same part of exactly the same kind of plant, and that you prepare it in exactly the same way as you did the initial sample.
12	Wait an additional 8 hours. Abstain from any other food except purified water. Induce vomiting immediately as above if you should feel ill. If no reaction has occurred, you may assume only that particular part of the plant is safe to eat, and only as prepared during the test.

PLANTS E

13	Begin a new test if the plant part you have chosen fails any of the tests. If the first plant part you choose appears contact-poisonous, you may immediately test a new plant on your other arm or behind your knee. If the plant causes a reaction before you have swallowed it, wait until the symptoms have disappeared before testing a new plant. If you have an adverse reaction after you've swallowed the plant, wait until symptoms have disappeared and start a new test. Although there may be edible parts of the plant you initially chose, it is preferable to move on to a different plant for subsequent tests.

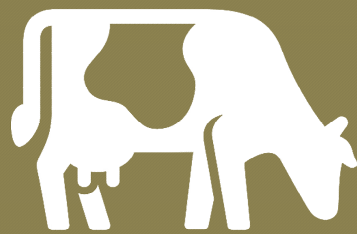
9 Plant Databases

PLANTS Plant Databases

Below you can find a list of plant databases available for purchase and download. Unfortunately I couldn't include an entire plant database of 7,000+ plants on TPE although I definitely tried. Therefore this section will recommend ways you can obtain your own database so you can use the information listed above to identify the plants.

Databases

Plants For A Future	If you are interested in the PFAF database of plants see the link below. You could also download the entire website using a mirror program like HTTRACK.	https://pfaf.org/user/shop.aspx
Plantfile	They have a database of 2,900 commonly cultivated plants. Not perfect for identifying weeds but still helpful.	http://www.plantfile.com/plantfile-standard-version



Animal Husbandry

Raising and sustaining animals for food or companionship

"Until one has loved an animal a part of one's soul remains unawakened."
Anatole France

Introduction

Animal husbandry is the raising of animals for something in return, whether it's meat, wool or company.

Purpose	The aim of ANIMAL HUSBANDRY is to help the reader raise any kind of animal to full maturity, and to help harvest the resources it provides, whether it's wool, milk or leather.
Lost?	• If you've been bitten or stung by an animal, go to the INJURY > Animal & Plant section. • For information on dangerous and poisonous animals, see the ANIMALS section. • If you want to prepare an animal for consumption, see the FIELD DRESSING section. • For information on setting up a homestead with animals, see the HOMESTEADING section. • For utilizing animals for transport, see the TRANSPORT section. • For defence against animals and insects such as mosquitos, see the DEFENCE section. • For animal-based disasters such as locust swams, see the NATURAL DISASTERS section.

Contents

1 Insects

Subheadings

1. Bees	**2. Crickets**	**3. Snails**	**4. Mealworms**
5. Earthworms			

1 Bees

Summary

Benefits	**Drawbacks**	**Breeds**	**Requirements**	**Labour**
• Honey • Wax • Honeycomb • "Silent"	• May Sting • Protection Suit • Bee Smoker • Can't be Tamed	•	• Hive • Flowers • Water Nearby • Queen Bee	• Harvest honey and wax twice a year • Split if population is too high

ANIMAL HUSBANDRY | Insects | Bees

	Food ● Constant supply of flowers nearby	**Disease Concerns** ● N/A	**Life Span** ● Wild: 122-152 Days ● Queen: 5-7 Years ● Production End: Never	**Other** ●	

Introduction
○

Benefits

Drawbacks

Breeds

Requirements

Raising

Labour

Labour	
Daily Maintenance	
Weekly Maintenance	
Monthly Maintenance	
Yearly Maintenance	

Diet

Disease

Life Span

Cost

Tips

2 Crickets

ANIMAL HUSBANDRY | Insects | Crickets

Summary

	Benefits ●	**Drawbacks** ●	**Breeds** ●	**Requirements** ●	**Labour** ●
	Food ●	**Disease Concerns** ●	**Life Span** ●	**Other** ●	

Introduction
○

3 Snails

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction
○

4 Mealworms

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction
○

5 Earthworms

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction
○

2 Small Animals

Animals, creatures or insects which either can't/shouldn't be picked up or ones that fit in your hand.

Subheadings

1. Bees	**2. Catfish**	**3. Tilapia**	**4. Quail**
5. Snails	**6. Crickets**	**7. Mealworms**	**8. Compost Worms**
9. Yabbies/Crayfish	**10. Mice/Rats**		

1 Bees

Summary

	Benefits • Honey • Wax • Honeycomb • "Silent"	**Drawbacks** • May Sting • Protection Suit • Bee Smoker • Can't be Tamed	**Breeds** •	**Requirements** • Hive • Flowers • Water Nearby • Queen Bee	**Labour** • Harvest honey and wax twice a year • Split if population is too high
	Food • Constant supply of flowers nearby	**Disease Concerns** • N/A	**Life Span** • Wild: 122-152 Days • Queen: 5-7 Years • Production End: Never	**Other** •	

Introduction
○

Benefits

Drawbacks

Breeds

Requirements

Raising

Labour

Daily Maintenance	
Weekly Maintenance	
Monthly Maintenance	
Yearly Maintenance	

Diet

Disease

Life Span

Cost

Tips

2 Catfish

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** • N/A	**Life Span** • Domestic: 60 Years	**Other** •	

Introduction
- o

3 Tilapia

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** • N/A	**Life Span** • Domestic: 9 Years • Slaughter Age: 240 Days	**Other** •	

Introduction
- o

4 Quail

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction

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5 Snails

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction

○

6 Crickets

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction

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7 Mealworms

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction

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8 Compost Worms

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction

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9 Yabbies/Crayfish

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction
○

10 Mice/Rats

Summary

	Benefits ●	**Drawbacks** ●	**Breeds** ●	**Requirements** ●	**Labour** ●
	Food ●	**Disease Concerns** ●	**Life Span** ●	**Other** ●	

Introduction
○

3 Medium Animals

Animals and creatures which can be held in your arms.

Subheadings

		1. Chickens	**2. Rabbits**	**3. Ducks**	**4. Dogs**		
		5. Cats	**6. Turkeys**				

1 Chickens

Summary

	Benefits ● Eggs ● Chicken ● Cleans Up Gardens ● Generally Friendly	**Drawbacks** ● Early Rooster Crows ● Can Fly Away	**Breeds** ● (Eggs) Australorp ● (Meat) Cornish Cross ● (Pets) Brahmas ● (Show) Polish	**Requirements** ● Coop ● Place to Roost ● Weather Protection ● Predator Protection	**Labour** ● Collect Eggs ● Close Coop at Night ● Clean Shelter
	Food ● Chicken Feed ● Free Range	**Disease Concerns** ● Worms ● Lice ● Mites	**Life Span** ● Wild: 8-10 Years ● Domestic: 12-15 Years ● Production End: Less over time ● Slaughter Age: 6-8 Weeks	**Other** ●	

Introduction
There's a lot to like about raising chickens in your backyard. The eggs are a real temptation - tastier and fresher than any store bought eggs and better for baking, too. The shells, along with the chicken poop, can be tossed right into the compost pile. Much of the day, the birds entertain themselves, picking at grass, worms, beetles, and all of the good things that go into making those yummy farm eggs. Plus, with their keen eye for insect pests, chickens make for great gardening companions!

Benefits

Eggs	These eggs are fresh, taste great, and are full of nutrition because you control what goes into egg production with the food you give your chickens. You can also try your hand at selling fresh eggs to make some extra money, which is a great idea for kids. Expect one egg per day from each hen you have. Some breeds do not lay eggs daily, but will lay 3 to 4 eggs weekly.
Meat	If raising your chickens for meat, home-grown chickens taste better and are healthier than factory farmed poultry. You'll enjoy more flavour, less fat and calories.
Fertilizer	Chicken manure contains a good deal of nitrogen, phosphorus and potassium – the primary ingredients in lawn and garden fertilizers. Chicken manure can be composted and added to the soil of your garden, flowers, trees, shrubs, and lawns. The all-natural homemade fertilizer will save you money and help produce great results. Speak to the experts at your local Grange Co-op to learn more about composting.
Company	Chickens have their own individual personalities and are affectionate toward humans. Each is its own bird, as they say, with some being sweet, shy, grouchy, or playful. You will find yourself having a lot of fun with your unique flock of backyard chickens.
Pest Control	Without the use of chemicals and insecticides, you can control over-population of crickets, grasshoppers, snails, slugs and other pests in your garden as chickens eat them up.
Little Maintenance	A low-maintenance animal, chickens basically need to be fed, watered, and given a coop to nest in. You may find this less work in comparison to other livestock.
Health Care	Just like other pets or farm animals, chickens can get sick or injured, which may require professional pet care. The most common chicken illnesses include poultry bumblefoot, a prolapsed vent, mites, and respiratory problems.

Drawbacks

Noisy	Chickens can be noisy with the familiar barnyard sounds. But they can also provide quieter sounds of cooing and clucking that many find relaxing and even enjoyable. Also, some chickens are definitely noisier than others so research before you buy.
Poop	Chickens will poop a lot. However chicken poop is a wonderful fertilizer, but it will require some work to clean up and utilize.

Holes	They will dig a lot in the yard. Chickens scratch when they dig for bugs and can really tear up their space.
Salmonella	Chickens have the potential of carrying Salmonella germs in their droppings and on their feathers, feet, and beaks. It's important to wash your hands after handling chickens or touching places where they live to avoid the risk of illness.
Legality	If you're raising chickens in town, check your local ordinances and zoning code regulations to make sure you can keep chickens legally. For example, in Medford, Oregon, residents can raise chickens and roosters within city limits but "the environment they are kept in must be kept odour and debris free; and the chickens cannot cause a noise disturbance to neighbouring properties."
Chicken Rivalry	Unfortunately, you will have to deal with some chickens bullying each other. They will peck at each other and even draw blood, which can make them peck more until one dies.
Predators	If your yard is accessible to predators such as foxes, raccoons, skunks, possums, coyotes, or other animals who pose a threat to the safety of your chickens, you may consider making it a mandatory part of your routine by bringing them in each night for their safety.
Requires Shelter	Chickens require a shelter known as a chicken coop. Chickens don't need a lot of space, but they need room to stretch their legs.
Social Animals	Chickens are social animals and need other chickens for companionship. One chicken by itself can die of loneliness so we always encourage a small flock for the happiest, healthiest backyard chickens.

Breeds

Breeds for Eggs

These breeds are used for the best eggs.

Australorp	The Australian Orpington. An excellent egg layer that currently holds the world record for egg output in one year – 364! The Australorp is a dual purpose hen too. They dress out at a respectable 5-6lb and the meat is said to be good.
Delaware	These birds were all set to become the broiler bird of the US, and then the Cornish cross was introduced. The Delaware fell into near obscurity but has been making a comeback with the 'backyard crowd' of chicken keepers. The Delaware is a respectable layer of 4 brown eggs per week. The hen is also a good dual purpose bird dressing out at 5lb.
New Hampshire	This is a good dual purpose hen. The New Hampshire will lay around 200 eggs per year and as a dual purpose hen will dress out to an average of 5-6lb.
Buckeye	A dual purpose hen that thrives in the cold! The Buckeye has the distinction of being the only breed to have been created by a woman. Buckeyes will give you around 200 eggs each year. They can be butchered as young as 16 weeks and can dress out to a respectable 7-9lb bird.
Plymouth Rock	One of our favourites, the Plymouth Rock is a great all-rounder. She will give you about 280 eggs per year. As a dual purpose bird, they will dress out to 5lb or more.
Sussex	The Sussex has been well thought of in its' homeland of the UK for centuries now. A good dependable layer in the region of 250-300 eggs per year. The speckled Sussex was the table fare of England until the newer, faster maturing breeds came along.
Brown Leghorn	The Brown Leghorn is a useful dual purpose bird. It will lay an average of 280 eggs per year. They can be butchered at 16 weeks and weigh a good 5-6lb. They are also good foragers, so the feed ratio is good. Although Leghorns are not usually known for their meat qualities, the meat is said to be decent on the brown variety. If you're interested in reading more about egg laying breeds, make sure to read 10 Breeds of Chicken That Will Lay Lots of Eggs for You.

Meat Breeds

These breeds are used for the best meat.

Cornish Cross	They are the quintessential meat chicken. They grow fast, too fast for their bodies to keep up; hence they must be butchered to save them from suffering. They are ready to cull at 4-6 weeks and by this age will weigh around 8lb. The downside to this bird is their feed consumption which is high, making them not so great in the feed ratio.
Bresse	The original Bresse line of chickens is still alive and well, living in France. The French Bresse hen is a breed apart. They are cared for and fed a special diet, all of which is monitored by the French Agriculture Department. All this attention makes for a costly chicken dinner. There are now American Bresse chickens. They are essentially much the same bird but raised differently. The meat is said to be superb tasting. They are culled at 16-20 weeks and will dress out at 5-7 lb. They are slower growers so feed conversion is average.
Jersey Giants	Jerseys are one of the largest chickens you will ever see; the Jersey Giant is huge! Although the size of the current bird is smaller than its ancestors, this chicken will dress out at 10-13lb. They are slow growers and can start to be culled around 16 weeks.

Friendliness Breeds

These breeds are just really friendly and make great pets.

Brahmas	They are large cuddly hens. They can be shy, but are usually friendly and enjoy human company.
Cochin	The fluffy hen that loves to be cuddled and can easily become a lap chicken. This bird would be suitable as a therapy bird.
Faverolles	These hens will make you smile. They are talkative, curious, friendly and a bit scatter brained!
Orpingtons	A very calm and friendly bird. Never in a hurry to go anywhere, curious and will be your friend for life if you give her treats.
Polish	This bird will light up your day with their antics and crazy hairdo. They are a very friendly bird, making great house pets and therapy birds.
Sultan	The hen is a very poor layer and was really created centuries ago as a bird of leisure and pleasure. They make good house hens and would likely make a good therapy bird choice.

Appearance Breeds

These breeds are chosen for appearance and showmanship.

Polish	The Polish hen is unmistakable with the pom-pom on the head. The pom-pom can get in the way of their vision at times, so may need light trimming.

Silkie	The chicken that looks like a cuddly toy! Silkies have feathers that do not latch together, so they look like they are wearing fur not feathers. They are friendly and cuddly too.
Phoenix	A German breed created from the Japanese Onagadori. It has a long tail that can reach up to several feet in length.
Onagadori	The original long tailed chicken. Tails have been recorded with lengths up to 27ft! This is possible because the male Onagadori has a non-molting gene and can take up to 3 years to completely shed some of its feathers.
Houdan	The Houdan reminds you a bit of the Polish chicken with its' elaborate head feathers. It is described as a sweet bird, a fair to moderate layer and doesn't like the cold.
Turken	The Transylvanian Naked Neck chicken (aka Turken) has an unusual appearance. The neck area is completely devoid of feathers, giving it a turkey like appearance. It is a very hardy bird usually kept for meat; egg laying is moderate. Due to the genetic issue with the feathers it really doesn't do well in extreme heat or cold.

Requirements

Land	How much land and what type of land chickens should have.
Shelter	The type of shelter and protection the chicken needs.
Environment	To wrap it up, what your hens need are laying hen pellets, fresh water, greens, fresh air and exercise. Indulge them by giving them an interesting environment, compost to shred, and your delighted attention. Once in a while, toss them something really special. Your treat will be having healthy, active, laying, hens.
Separation	Separation from other animals or chickens.

Raising

How to raise a chicken from an egg.

Insemination
To lay a clutch of fertilized eggs, a hen must have first mated with a rooster. The hen will then form an egg- a process which takes all of approximately 25 hours. This process will begin with the formation of the egg yolk, it is produced by the hens ovary during the ovulation process- the yolk is referred to as the oocyte at this stage. As it travels down the oviduct, it will be fertilized internally by the sperm of the rooster. As it continues to travel down the oviduct it becomes covered with a white membrane called 'vitelline membrane', as well as some layers of the egg white or 'albumen'. Still travelling further down the oviduct, a casing for the egg white and yolk will begin to form. Eventually, the shell will be completely developed, and thus the egg is completely formed. The hen will then lay this new life form in a comfortable and quiet spot. A hen will generally lay a clutch of approximately 12 eggs, with each egg being laid a day apart.

Egg Stage
The hen will then lay this new life form in a comfortable and quiet spot. A hen will generally lay a clutch of approximately 12 eggs, with each egg being laid a day apart. If hatching naturally, the mother hen will sit on the eggs to maintain the optimum temperature so they can develop until it is almost hatching time. Sometimes hens won't take to sitting on their eggs, and so you may need to purchase an incubator and do this step yourself. (See the row below)

Incubation

1

Set Up an Incubator
Depending on how many eggs they accommodate and how automated they are, Incubators run from around $50 for the homesteader favourite 'Hova-Bator' into the thousands of dollars for commercial scale incubators. With top-of-the-line incubators, you put in an egg, close the door and out pops the chick three weeks later. You can also go the DIY route, which saves money, but is almost as much work as sitting on the eggs yourself. No matter how fancy or jerry-rigged, all incubators must accomplish a few basic things:

Temperature	The eggs need to be kept at 99.5 degrees at all times; just one degree higher or lower for a few hours can terminate the embryo.
Humidity	40 to 50 percent humidity must be maintained for the first 18 days; 65 to 75 percent humidity is needed for the final days before hatching.
Ventilation	Egg shells are porous, allowing oxygen to enter and carbon dioxide to exit; incubators need to have holes or vents that allow fresh air to circulate so the fetuses can breathe.

Homemade versions usually involve some sort of insulated box – a cheap Styrofoam cooler will do. An adjustable heating pad or a light bulb on a dimmer switch will suffice for the heat source and a pan of water with a sponge in it will make the air humid. Low-end commercial incubators don't amount to much more than this, but the more you pay, the more automated the temperature and humidity controls will be. A high-quality thermometer and hygrometer (a device to measure humidity) are the most important tools of incubation; cheap models are usually not accurate enough. If you're not working with an incubator that has these instruments built in, opt for a combo thermometer/hygrometer with an external display.

These have a sensor that goes inside the incubator with an LED screen on the outside that shows the temperature and humidity readings without having to open the incubator and ruin your carefully calibrated environment. One time-saving feature is a device to rotate the eggs automatically. Much of the fussing that a hen does over her eggs comes from an evolutionary instinct to constantly move them about. The finely tuned ecosystem inside a chicken egg is kept in balance by constantly changing the position of the egg.

High-end incubators have a built-in egg turning device, but there are also standalone egg turners that can be placed inside a homemade incubator to do the job. Or, you can rotate manually according to the instructions below. The incubator should be placed in a location with the least possible fluctuation in temperature and humidity throughout the day – a basement is ideal, a sunny window is not.

2

Find Fertile Eggs
If you already have a flock of chickens that includes a rooster, the majority of the eggs they lay will be fertile. Collect them as soon as possible after laying and transfer to the incubator. If you don't already have chickens, find a friend or a nearby farmer who does and ask if you can buy some fertile eggs. Websites like Craigslist and BackyardChickens.com are a good way to link with people that may have eggs to spare. Some feed stores sell fertile eggs in the spring and there are many suppliers that sell eggs online.

The closer to home, the better the egg source. The jostling about and fluctuations in temperature and humidity that occur during transport are hard on the developing fetus. Hatching rates on eggs straight from the coop are often in the 75 to 90 percent range; with mail-order eggs, there is no guarantee that any will hatch. When picking eggs to incubate, use those that are clean, well-formed and full-size. Above all, do not clean the eggs – there is a naturally occurring coating that is vital to the success of the embryo. Wash your hands before handling and be as gentle as possible, as the embryos are extremely susceptible to damage from sudden movements.

ANIMAL HUSBANDRY Medium Animals Chickens Raising

Ideally, the eggs are transferred directly to the incubator, but it's possible to store them in egg cartons if needed. Kept at temperatures between 50 and 60 degrees and 75 percent humidity, the development of the eggs can be delayed for up to ten days without sacrificing the viability of the embryos. However, they must be stored with the fat side of the egg pointed up to keep the embryo alive.

3	**Incubate** It takes 21 days on average for an egg to hatch once incubation begins. Before placing the eggs inside, turn on the heat source and measure the temperature and humidity over a 24-hour period, making adjustments as necessary to create the optimal environment. If the humidity is too high or low, use a sponge with more or less surface area to adjust it. Raise and lower the temperature of the heat source in tiny increments until the thermometer reads 99.5. Once the incubator is functioning properly, it's just a matter of maintaining the environment until the chicks hatch. Place the eggs on their side in the incubator, close the door and check the levels religiously to make sure nothing goes askew. Water may have to be added to the pan occasionally to keep the humidity up. At day 18, add more water to boost the humidity level.

If you're going to turn the eggs yourself, there is a standard method to mimic the efforts of a hen:

- Draw an 'X' on one side of the egg and an 'O' on the other to keep track of which eggs have been turned.
- At least three times a day, gently turn the eggs over; more frequent turning is even better, but the number of turns per day should be odd (3,5,7 etc.) so that the eggs are never resting on the same side for two consecutive nights. Experts also recommend alternating the direction of turning each time – the goal is to vary the position of the embryo as much as possible.
- Continue turning until day 18, but then leave the eggs alone for the last few days.

4	**Hatching** In the final days before hatching. the eggs may be observed shifting about on their own as the fetus becomes active. The chick will eventually peck a small hole in the large end of the egg and take its first breath. It is normal at this point for the chick to rest for six to 12 hours while its lungs adjust before continuing to hatch. Resist the urge to help with the hatching process – it's easy to cause injury. Once the chick is free from the egg, let it dry off in the warmth of the incubator before moving it a brooder, where it will spend the first weeks of its life.

Chick Stage

The chick inside the egg will generally grow for 21 days, using the egg yolk as a means of nutrition as it grows. Along with sitting on the eggs, the hen will also use her beak to turn them to aid their development. On about day 19 of the incubation period, the chicks will begin the pipping process. This involves the baby chick using their 'egg tooth' to peck a hole in the eggshell around the air sac to access oxygen, before pipping an area large enough for it to be free of its shell. This process can take up to 24 hours and should not be rushed. The chicken will emerge with wet 'down' feathers, however they dry quickly, and will be extra fluffy and adorable in no time.

Most chickens are able to stand and walk about straight after birth, however some may be a bit wobbly at first. After birth, a baby chicken will need to be placed in a brooder- an indoor space that is heated up by the heat of an infrared lamp. The chickens will remain in the brooder for the first few weeks of their life- they will be fed in the brooder and sleep in the brooder, so it's important it is cleaned regularly, so the chickens can remain at the height of their health. A chick will start developing it's first true feathers at around 5 days old, and at approximately 12 days the chick will begin to show defining breed bone development, as will it's wing feathers.

By day 18, the chicken should have significant feathering, and by day 30, it will have developed the characteristics that identify it with its breed. Unfortunately many young roosters are discarded as soon as they can be sexed- especially if they were being bred for egg production. Some may be kept and raised for meat, or to produce the next generation of chickens, but for most this is not the case. A chicken will continue to grow and develop- learning common chicken behaviours such as roosting and foraging under the guidance of their mothers. Within six months the bird will have developed all of it's adult features, and is now considered a mature chicken.

Pullets (Young Chicken)

Younger hens are known as pullets and may be ready to lay as young as 18 weeks, however this will vary between breeds. All birds tend to come into lay earlier during periods of increasing sunlight, or later if they reach maturity in early winter. A healthy and productive female hen will lay eggs until they are about 72 weeks old, however this will also depend on the period of their first moult.

Adults

Birds have an annual moult in which they lose their old feathers, a grow lovely new ones in their place. This generally occurs in late summer or early Autumn, and the result is a tatty and quite alarming looking bird. During moult, chickens will generally cease egg production, although they may lay one here and there, as all their energy and nutrients are going into producing a delightful new covering of feathers. While many birds will start laying again in no time at all, older birds may be expended from their egg laying days, and their egg production will dwindle significantly. As hens get older, they will start showing signs of their age. A wrinkled and dull face, heavy eyes, increasing rear size, and lack of energy are all possible indications that a chicken is approaching old age. Despite this, they will still remain the delightful creatures they once were through to their very last days.

Labour

Daily Maintenance	**Feeding:** Ensuring the chickens have enough food and water. **Egg Check:** Check for laid eggs and collecting them if needed. **Check-Up:** Monitoring the chickens to ensure they are behaving and are safe from predators. **Coop Opening/Closing:** Opening and closing the coop if you've let them out during the day.
Weekly Maintenance	
Monthly Maintenance	**Bedding Change** ● Change the bedding and remove the droppings to use in the garden.
Yearly Maintenance	**Coop Cleaning** ● A thorough clean and disinfection of the coop.

Diet

Water

The one most essential thing to provide your flock is fresh water. Even though it does seem as if chickens prefer muddy pools always have clean water for them. Put the water font up off the ground so that it stays clean. Scrub the water font weekly. In the winter, if you are located in an area with freezing temperatures, either use an electric heating stand under the waterer (these are designed for chicken waterers) or be prepared to swap frozen waterers for fresh several times a day. A chicken without water will die within a day. In the summer I put an extra waterer out in the pen near the shady area where the hens like to hang out. Chickens overheat easily and water will go a long way to keeping them healthy and alive.

Food

When your chickens start to lay eggs they will needs to be fed 'layers pellets' or 'layers mash'. This is usually 15-17% protein and will help them to regularly lay eggs.

How Much Food

Your chickens should have a constant supply of food throughout the day. Chickens will eat when they need it and should go to bed with a full crop as they need lots of food to produce eggs. A fully grown chicken will typically eat about 120 grams of layers pellets a day. You should check the feeders every day to ensure they are topped up. It can be a good idea to have two feeders, one inside of their coop run and one outside of their run (if they are free ranging). This will stop any dominant chickens stopping less dominant chickens from getting their share of food.

Grit	Chickens need to eat small stones in order to help digest their food. Chickens don't have teeth so swallow whatever they choose to eat whole. Any grit they eat is used to grind up food in their Gizzard. When keeping chickens it is important to give them a supply of grit as they may not be able to naturally find enough grit. Grit with oyster shells is even better as the oyster shells provide calcium which your chickens need to lay eggs with strong shells. You can choose to add a handful of grit to their food, or just provide grit from a separate feeder such as the Grit Station Feeder.
Corn	Chickens absolutely love corn, and will come running at the sound of you getting their corn. Corn is a great way to tame your chickens. However mixed corn is high in fat so should only be given as a treat, as an overweight chicken won't lay as many tasty eggs. A handful of corn per hen scattered on the ground is plenty.
Kitchen Scraps & Greens	Chickens will eat most things that you give them (within reason). They will enjoy pasta, green veggies, cereals, raisins, banana….the list goes on. Its nice to give them a treat, but do make sure you aren't giving them too many treats as they will fill up on those and not eat their layers pellets.

Food (Chicks)

For the first two days of life the chick makes use of the yolk that is still inside of it. After that, the chick needs food and water. Chicks should be given free-choice finely ground feed that is 18% protein. They shouldn't eat laying hen pellets because it is too high in calcium and too low in protein. The easiest way to feed chicks is to purchase chick starter. Do not purchase chick finisher or special "grow" feeds, as those are for meat birds that are slaughtered before maturity. Chicks remain on the chick feed for the first 14 to 18 weeks, which is about when they are mature enough to lay. Some people use medicated feed to protect the chicks against a protozoan disease called coccidia. I don't believe in using medicated feeds unless the chicks show symptoms of illness. Most chicks are kept in brooders, which are essentially heated boxes bedded with pine shavings. These are safe places for the chicks to grow but not ideal. I think it is essential to give the chicks a clod of dirt with some greens attached the first week.

The clump of earth is beneficial to the chicks in many ways. It exposes them to small amounts of local microbes so that they develop natural immunity. It gives them something to do, as even chicks get bored! It gets a bit of grit into their gizzards. Most importantly, it teaches the chicks to peck the ground and not each other. Providing that clod of dirt will greatly reduce aggression and pecking issues later. Do make sure, though, that there isn't fine grass clinging to it. The greens should be sturdy so that the chicks peck little bits off. Dandelions are perfect for this. You don't want them getting impacted crop from fine blades of grass. It is tempting to give the chicks other treats as well, everything from sunflower seeds to strawberries. But, remember that if the chicks were outside with a mamma, that they'd be moving and eating tiny bits of things and not standing still and gorging. You can give them treats, but in very small amounts, and make sure that they fill up on chick feed first. As soon as it is warm enough the chicks can go outside and peck and eat whatever they want. Just make sure that the bulk of their diet is a balanced chick feed that they get free choice.

Disease

Diseases that can affect chickens and other poultry.

External Parasites (Ticks / Fleas / Lice)	Poultry can carry a large variety of parasites on their bodies. These range in size from large, blood sucking ticks up to 1cm in size, down to the microscopic scaly face (and leg) mite that is less than 0.5mm in size. Other external parasites that are commonly encountered are the stickfast flea (small, black fleas on the comb that do not move), and lice (small, white insects that move rapidly through the feathers). External parasites generally cause mild clinical signs such as feather damage, anaemia and irritation, but they may also carry severe, life threatening diseases such as tick fever. Backyard poultry should be examined regularly, and treated for external parasites every two to three months. Products to treat these diseases can be recommended by your veterinarian.
Internal Parasites (Roundworms)	Backyard poultry also carry a wide range of internal parasites. These range from large roundworms (Ascarids) that are visible with the naked eye; to small, single celled organisms only visible under a microscope (Coccidia, Trichomonas, and Giardia). Internal parasites attack the lining of the intestine, and absorb nutrients from the gut that the bird should be using for maintenance of its own body and production of eggs. Worms (and other internal parasites) are spread from bird to bird by the ingestion of eggs from the faeces of infected birds. Regular removal and cleaning of faeces from the bird's enclosure will result in less worm eggs in the environment, and less chance of worms spreading from bird to bird. Signs of internal parasitism may include weight loss, pale combs or diarrhoea. Your local veterinarian will be able to look at faeces under the microscope, and advise you which type of worms and protozoan parasites are present by the type and number of eggs they observe in the faecal sample. Some types of worms, such as Capillaria, are more difficult to treat than others.

Your veterinarian will be able to advise you of a suitable treatment that is specific for the parasites they observe. It is important that withholding periods for treatments are observed. This requires that eggs and meat from birds treated with certain drugs be discarded for a period of time after the drug has been used. This prevents humans ingesting the drugs the chickens were treated with via the eggs or meat. Make sure you check the exact withholding period with your veterinarian, or on the label of the product.

Marek's Disease	Marek's disease is a viral infection that only affects poultry. The virus is spread from bird to bird in feather dander and dust. It lives in the environment for long periods, and can spread between properties on people's clothes and on shared equipment. Birds are usually infected at a young age, but may not show signs of disease until some months later. The virus that causes Marek's disease attacks the white blood cells of the bird, and results in cancer. These cancers most commonly affect the nerves and cause paralysis. Usually, the legs are affected, but the tumours may also affect the nerves in the wings and neck. Birds may also develop tumours in the body. As they grow, these tumours may cause a number of signs including weight loss, diarrhoea, ill thrift, and difficulty breathing. A vaccine should be given to birds at one day of age. It is recommended that all birds be vaccinated, even though the vaccine is not as effective as it used to be. This is due to the virus that causes the disease mutating slightly over time. Most large hatcheries vaccinate their chicks, so birds purchased from them should be protected, and vaccine is available at a reasonable cost for birds hatched privately.
Leucosis	Avian leucosis is also a viral disease affecting chickens which causes tumours or cancers. These tumours occur in older birds than those affected by Marek's disease, usually more than 6 months old. It causes listlessness and loss of weight and the bird eventually dies. The viruses affect the white cells and tumours usually appear in the liver and spleen but also in other sites. Sometimes the tumour appears as white lumps, at other times the liver and spleen appear larger than normal. The viruses are transmitted through the egg and commercial producers attempt to eliminate it from their strains of birds. There is very little that a poultry owner can do except keep the bird comfortable and destroy it when life becomes unpleasant for it.

Respiratory Disease	There are many causes of respiratory disease in poultry. Respiratory signs such as coughing, sneezing and discharge from the eyes and nostrils can be caused by parasites (such as the gapeworm, Syngamus trachea), dust, high ammonia levels, or a variety of bacteria or viruses. In all cases, a veterinarian with experience in poultry disease must diagnose the exact cause, particularly if mortalities occur. Some of the respiratory viruses such as Infectious laryngotracheitis virus (ILT), Newcastle disease and Avian influenza are notifiable or exotic diseases, and must be reported to a Government Veterinarian or Animal Health Officer if they are suspected. Treatment will depend on the cause of the respiratory signs. For some viral causes such as ILT, vaccination is recommended.
Fowl Pox	Another viral infection of birds is fowl pox. This disease is spread by biting insects and sometimes by fighting. The virus enters the body through a scratch or scrape, and raised scabs form on the scratch and surrounding areas particularly noticeable on the combs and wattles. Scabs can also form in the mouth and throat. Most cases improve without treatment, although some birds become ill from secondary infection. Birds that recover are immune for life. Symptoms are characterized by distinctive bumps that look like warts and are visible on the wattle and comb. In addition, young birds experienced stunted growth and egg production decreases. Prevention is again the best idea, and vaccination is available, although this may need to be done every few years to give complete protection.
Nutritional Deficiencies	Many small flocks of birds are fed only table scraps. This diet is not sufficient to meet the nutritional demands of growing birds or layers. Common deficiencies include calcium (resulting in poor bone growth and rickets), energy (poor growth, weight loss, poor egg production), and vitamin A (poor skin and feathering). Formulated diets are available for all stages of a hen's life, (starter, grower and layer) and these should be fed in conjunction with table scraps, fruit and vegetables to form a balanced diet.
Reproductive Problems	Commercial birds are bred to lay for only one or two laying seasons. If they are then sold to backyard producers for extended laying, they are prone to reproductive problems. This includes egg binding (where the egg is unable to be passed out of the bird), metritis (inflammation of the oviduct and shell gland), and yolk peritonitis (free yolk in the abdominal cavity, leading to infection). Affected birds stop laying eggs, are depressed, stop eating and eventually die. They often develop a swollen abdomen, and may have respiratory difficulties. Surgery by a veterinarian is possible to resolve these conditions, however, the surgery results in the bird being unable to lay eggs. Hence, it is reserved only for pet birds.
Fowl Cholera	Fowl Cholera is a chronic disease caused by Pasteurella Multocida that can affect the joints, wattles, infraohits, sinuses and other tissues. Common symptoms include loss of appetite, diarrhoea with a greenish tinge, ruffled feathers, swollen purple wattle, swollen comb, swollen joints, lameness, oral, nasal and ocular discharge and sudden death. Most commonly found in older chickens, Fowl Cholera affects more cocks than it does hens.
Coccidiosis	Coccidiosis is a parasitic disease caused by Coccidian protozoa that lives in and damages a specific region of the gut in chickens. The trouble starts when chickens consume a sporulated oocyst which is broken down by chemicals in the gut, releasing an infective sporocyst. This begins the life cycle that causes the destruction of intestinal epithelial cells. Together with damage to the gut walls, it causes loss of appetite, diarrhoea, ruffled feathers, weight loss and inability to absorb nutrients.
Newcastle Disease	Newcastle disease is an acute respiratory disease that can spread rapidly. Symptoms of the disease depends on whether the infecting virus has a predilection for respiratory, digestive, or nervous systems. While it can affect both wild and domesticated fowl, domestic poultry is much more susceptible to contract severe symptoms.
Salmonellosis	Salmonellosis is a bacterial disease that can cause septicemia and enteritis in young chickens. With a low mortality rate, infections are contracted orally and can be spread by rodents. Symptoms of salmonellosis include diarrhoea, closed eyes, loss of appetite, thirst, ruffled feathers and dejection.

Life Span

The lifespan of a backyard chicken can be anything from 3-10+ years but 7-9 on average. In rare circumstances they can live up to 15 years long.

Cost

Baby chicks cost $1-$5 each, depending on a variety of factors including the sex (females are more expensive than males) and how rare the breed. Started pullets (young hens that have just started laying eggs) should cost $15-$25 each.

Start-up Costs
Chicken Coop: From $100 up but can be constructed yourself.
Food: About $25 a month. This can be substituted with kitchen scraps.
Bedding: Around $30 a month.
De-wormers: $20 a year.

Tips

You shouldn't have just one chicken as they are social creatures and will not do well alone. A minimum of two is best. Roosters are VERY noisy, and contrary to popular belief, they don't just crow in the morning. They crow all day long. Hens are much quieter - you basically won't hear them until they've just laid an egg, or if they're threatened. Standard chickens weigh 4-7 pounds depending on the breed and the sex (roosters weigh more than hens). "Bantam" chickens - which are the same as standard chickens, only smaller -- weigh 1-2 pounds. Chickens will come back to the same place to sleep every night -- so you can let your chickens roam your yard during the day and when it gets dark they will return to their coop to catch up on their beauty rest. (A "roost" is a pole they perch on, which they much prefer to sleeping on the ground.)

Chickens can sort of fly. Smaller (lighter) breeds, and "bantams" -- which are the same as "standard" breeds but about 1/4 the size -- can fly 25-50 feet and will roost in trees if allowed to. Heavier breeds have much more limited flight. The chickens in your backyard will lay eggs unlike any you've tried before. A good rule of thumb: the more orange the egg yolk, the more healthy and better-tasting the egg is.

Plus, research shows that if you allow your chickens to roam your yard freely (which we highly recommend you do) your eggs will be higher in Omega-3 fatty acids and lower in cholesterol, among other health benefits. The colour of the egg has no effect on how healthy it is. However, how chickens are kept DOES have an effect on how healthy the eggs are! See the next question for more on this topic.

2 Rabbits

Summary

	Benefits ● Meat ● Cheap ● Quiet ● Can Handle Easily ● Fast Repopulation	**Drawbacks** ● Banned in Some Areas	**Breeds** ●	**Requirements** ● Dry ● Draft-Free ● Keep out of heat and cold ● Predator Protection	**Labour** ●
	Food ● Hay ● Grasses ● Vegetables	**Disease Concerns** ● N/A	**Life Span** ● Wild: 3 Years ● Domestic: 8-12 Years ● Slaughter Age: 10-12 Wks	**Other** ●	

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Benefits

Drawbacks

Breeds

Requirements

Raising

Labour

Labour	
Daily Maintenance	
Weekly Maintenance	
Monthly Maintenance	
Yearly Maintenance	

Diet

Disease

Life Span

Cost

Tips

3 Ducks

Summary

	Benefits ● Large Eggs ● Meat ● Down ● Feathers	**Drawbacks** ● Noisy Females	**Breeds** ●	**Requirements** ● Pond or pool ● Duck House	**Labour** ●

Food •	**Disease Concerns** • N/A	**Life Span** • Wild: 5-10 Years • Domestic: 6-8 Years • Slaughter Age: 7-8 Weeks	**Other** •	

Introduction
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4 Dogs

Summary

Benefits • Companionship • Rounding Up • House-pet • Protection • Alarm	**Drawbacks** • May Chew House Objects • May try to Eat Animals • Training Time • Leaves Fur Everywhere	**Breeds** •	**Requirements** •	**Labour** •
Food •	**Disease Concerns** • N/A	**Life Span** • Domestic: 10-13 Years	**Other** •	

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5 Cats

Summary

Benefits • Companionship	**Drawbacks** • May Damage House • Leaves Fur Everywhere	**Breeds** •	**Requirements** •	**Labour** •
Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction
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6 Turkeys

Summary

Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

Introduction
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4 Large Animals

Animals which generally can't be picked up due to their size and weight. This section covers most commonly kept cattle such as cows and sheep.

Subheadings

1. Dairy Cows	**2. Beef Cows**	**3. Sheep**	**4. Horses**
5. Pigs	**6. Goats**	**7. Alpacas/Llamas**	**8. Donkeys**
9. Water Buffalo	**10. Camels**	**11. Ostriches**	

1 Dairy Cows

Summary

Benefits • Milk • Cream • Cheese • Meat	**Drawbacks** • Storage of all the meat • Large and tough to handle • Requires lots of space • Large food requirement	**Breeds** •	**Requirements** • Shelter in cold months.	**Labour** •

	Food	Disease Concerns	Life Span	Other	
	Food ● Good Grass ● Feed/Hay	**Disease Concerns** ● N/A	**Life Span** ● Wild: 18-25 Years ● Domestic: 18-22 Years ● Production End: 4-5 Years ● Slaughter Age: 36 Months	**Other** ●	

Introduction
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Benefits

Drawbacks

Breeds

Requirements

Raising

Labour

Daily Maintenance	
Weekly Maintenance	
Monthly Maintenance	
Yearly Maintenance	

Diet

Disease

Life Span

Cost

Tips

2 Beef Cows

Summary

	Benefits	Drawbacks	Breeds	Requirements	Labour
	Benefits ● Milk ● Cream ● Cheese ● Meat	**Drawbacks** ● Storage of all the meat ● Large and tough to handle ● Requires lots of space ● Large food requirement	**Breeds** ●	**Requirements** ● Shelter in cold months.	**Labour** ●

ANIMAL HUSBANDRY | Large Animals | Beef Cows

	Food ● Good Grass ● Feed/Hay	**Disease Concerns** ● N/A	**Life Span** ● Wild: 18-25 Years ● Domestic: 18-22 Years ● Production End: 4-5 Years ● Slaughter Age: 36 Months	**Other** ●	

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Benefits

Drawbacks

Breeds

Requirements

Raising

Labour

Labour	
Daily Maintenance	
Weekly Maintenance	
Monthly Maintenance	
Yearly Maintenance	

Diet

Disease

Life Span

Cost

Tips

3 Sheep

Summary

	Benefits ● Wool ● Milk ● Lamb/Mutton	**Drawbacks** ● Escape Artists ● Disease Ridden ● Requires Lots of Attention ● Loud ● Stubborn / Stupid	**Breeds** ●	**Requirements** ● Shepherding ● Fencing	**Labour** ● Trimming Wool

	Food •	**Disease Concerns** • N/A	**Life Span** • Wild: 10-12 Years • Domestic: 10-12 Years • Slaughter Age: 6-8 Weeks	**Other** • Synergises well with dog	

Introduction
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4 Horses

Summary

	Benefits • Companionship • Transport	**Drawbacks** • Large food requirement • Requires lots of space	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** • N/A	**Life Span** • Wild: 30-40 Years • Domestic: 15-20 Years	**Other** •	

Introduction
o

5 Pigs

Summary

	Benefits • Bacon	**Drawbacks** • Heavy • Requires lots of food	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** • N/A	**Life Span** • Wild: 4-8 Years • Domestic: 15-20 Years • Slaughter Age: 6 Months	**Other** •	

Shelter / Pen	
Food	
Predators	
Environment Req.	
Care	

Introduction
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6 Goats

Summary

	Benefits • Milk • Cream • Cheese • Yogurt • Eats Anything • Well Adaptable	**Drawbacks** • Destroys things • Escape Artists	**Breeds** •	**Requirements** •	**Labour** • Milk twice a day
	Food •	**Disease Concerns** • Mineral Deficiencies • Parasites	**Life Span** • Wild: 15-18 Years • Domestic: 15-18 Years • Slaughter Age: 3-5 Years	**Other** • Can be violent and unruly	

Introduction
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7 Alpacas/Llamas

Summary

	Benefits •	**Drawbacks** •	**Breeds** •	**Requirements** •	**Labour** •
	Food •	**Disease Concerns** •	**Life Span** •	**Other** •	

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8 Donkeys

Summary

	Benefits •	Drawbacks •	Breeds •	Requirements •	Labour •
	Food •	Disease Concerns •	Life Span •	Other •	

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9 Water Buffalo

Summary

	Benefits •	Drawbacks •	Breeds •	Requirements •	Labour •
	Food •	Disease Concerns •	Life Span •	Other •	

Introduction
○

10 Camels

Summary

	Benefits •	Drawbacks •	Breeds •	Requirements •	Labour •
	Food •	Disease Concerns •	Life Span •	Other •	

Introduction
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11 Ostriches

Summary

	Benefits •	Drawbacks •	Breeds •	Requirements •	Labour •
	Food •	Disease Concerns •	Life Span •	Other •	

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HOMESTEADING

Homesteading

Creating a sustainable lifestyle in a self-sufficient off-grid home

"The ordinary acts we practice every day at home are of more importance to the soul than their simplicity might suggest."
Thomas Moore

Introduction

Information on developing a sustainable lifestyle from a homestead and how to build it up. Generally a homestead contains everything you need to live self sufficiently from food to water, shelter and tools. Some homesteads may be advanced and contain looms, blacksmiths, electronics bay, advanced power tools etc.

Purpose	The aim of HOMESTEADING is to provide a framework for a self-sufficient, off-grid lifestyle with an emphasis on security. Specifically it contains information on the best way to set-up and organise your home far from the amenities of a modern lifestyle.
Lost?	• For information on building your own shelter and viewing shelter protection levels, see the SHELTER section. • For a list of household items you can craft, see the CRAFTING section. • If you're looking for information on raising animals on your homestead, see the ANIMAL HUSBANDRY section. • For more information on security on your homestead, see the SAFETY & SECURITY and DEFENCE sections. • For additional information on budgets and money, see the ECONOMY section. • For off-grid electricity systems, see the ELECTRICITY section.

Contents

1 Location

Location

Ensure some form of water is on the property whether a spring or flowing river. Know your land boundaries and put up a fence if possible. Build a basement for storage of foods and for shelter during attacks. A cooler location would be better to build as it's easier to heat a home. Know how far it is to resources like the hospital, police station, water treatment plant and other high priority locations in SHTF.

Risks

Ensure the house isn't in a flood-prone area. Know the population density and how far to the nearest major city. Research how often cyclones, hurricanes, earthquakes and fires occur in the region. Know what the ground consists of and whether it's safe to build on. Is the site in a violent or crime laden area, or is there a prison or mental facility nearby.

Terrain

Know every inch of your bug out location and exactly what you own. Know the ground composition and local flora and fauna. Know the history of the land and if any major events transpired on it.

Weather

Know the seasons and what weather is considered normal in the region. Research the chance of every disaster affecting the location.

Rights

Ensure you have the rights to use any water on your land either to drink or for energy generation. Ensure you have the correct build rights and are allowed livestock on your land. Ensure you can install a septic system for sewage. Make sure the land isn't protected or has endangered native animals living on it.

Positioning

Positioning where you are in the landscape is important to develop a successful defensive plan. When buying land look for defensible positions and how your enemies may use it against you. Land on a hill with your house on a slightly higher part of the hill is ideal for observing every direction.

Ensure the bedrooms are on the west side of the house. A square shape house with a central gardening section would be the strongest design for defence and allows harvesting food in safety. Positioning a house in the centre of your land will allow you to plan more with regards to security and give more time to detect intruders.

Resources

Determine what resources are nearby and which ones you can harvest.

Resources List
- River Water
- Water Table
- Trees
- Sunlight
- Wind
- Rapid Water

2 Common Rooms

Common rooms are areas of homes which almost everyone has.

Common Rooms
- Bedroom
- Lounge
- Kitchen
- Dining Room
- Bathroom

Bedroom

Ensure the bedrooms are on the west side of the house. Have an ensuite for luxury.

Lounge

Heating: Has a smaller fireplace than the basement for heating during events.

Kitchen

Water: Should have its own water tank connection with a filter between it for washing dishes.
Pantry: Use a walk-in pantry for storage of non-perishable foods which don't need to be kept cool.
Fridge / Freezer: Run a small fridge off the battery bank to store perishable items.
Appliances: Have a large area for machinery required to create food such as a mill/grindstone for making bread.
Water Filter: Have a free standing gravity ceramic water filter from the water tank.

Dining Room

Bathroom

Toilet: Connect to a water tank for flushing and to the garden for waste disposal.
Shower / Bath: Connects directly to the water tank and a gas heating system.

3 Uncommon Rooms

Uncommon rooms are areas of homes which some people may have in their home or that aren't frequented often.

Uncommon Rooms
- Basement
- Garage
- Attic
- Lookout
- Roof

Basement

Food Storage	One of the rooms dedicated for food storage to keep it at a level temperature. Keep it as far from the fireplace as possible.
Water Storage	Backup internal water storage to protect against the elements, animals and thieves.
Fireplace	Includes a fireplace to generate heat and distribute it throughout the house, comes with a vent to let the hazardous smoke outside.
Security Monitoring	Contains the computer attached to the security cameras for monitoring the property. A desk containing a monitor displaying the status and screens of the security cameras at all times. Ideally the desk should be manned most of the time, but all times in periods of strife or at night when you suspect thieves.
Generator	Produces power in emergencies when the other methods fail, includes vents joined with the fireplace to release toxins.
Structure	Reinforced walls to protect occupants with a blast floor leading down to the basement. Protects against disasters such as earthquakes and cyclones with it's structural integrity. Contains pillars for extra strength.
Battery Bank	Contains the battery bank array to store the collected power. Includes regulators and controllers to prevent overcharge.
Toilet	Contains a second toilet for complete self-sufficiency within the basement.
Wood Storage	Have a stockpile of wood to get through the winter.
Water Treatment	Treats water for particles, bacteria and viruses before being pumped back up.
Water Pump	Have a pump on hand for water leaks in the house. Connect it to the river for pumping water from the river when supplies get low.
Guns / Explosives	Store guns on a rack or in a gun cabinet and as much ammo as needed.

Panic Room

A panic room is an extremely secure room, often underground which should be able to withstand natural disasters, strong gunfire and basic bombs and missiles. Ideally it should be attached to the basement and slightly deeper underground with two points of access, one for entry and one for exit. The panic room is not designed for extended stays, but rather the ride out the primary disaster with a maximum of about 3 days for a family.

Foundations	The walls should be thick concrete with lots of reinforced steel beams on every wall as well as pillars for even more roof strength. Most surfaces should be rock, stone or concrete to prevent fire spread.	
Resistance	The following items are resistances that the panic room should comply with to be fully effective.	**Resistances** • Highest Category Winds • Hand Shot Missiles • Grenades • Earthquakes • Volcanos • Floods • Fireproof • Bulletproof

Entry Door	The entry should come from an already secure location such as the basement and would help if the room is already completely or partially underground. Ideally the entry door from the house should be disguised or hidden behind a bookcase, a rug or other inconspicuous object.
Exit Door	The exit should lead back to the surface via a manhole which can only be accessed from the inside. The manhole should be completely watertight but remain easy to open from the inside. The exit location should be hidden from plain sight and on raised ground to avoid water entering when opened. Labelling the exit location as a "Sewer Access Point" should be enough to deter people from attempting to enter it, but even if attempted, there would be no way of opening it from the outside.
Resources	The following items is a list of resources that should be included in the panic room. There should be enough for 3 days without having to leave. **Stocked Resources** • Water • Food • Hygiene Products • Entertainment
Air	There should be two air intake vents that weaves through the house to the roof to allows fresh air to be brought into the room. Two because one may become blocked or sabotaged by the enemy or naturally become clogged. Automatic and manual ways to pump the air in should also be included along with various filters to remove particulate and radiation if required. A backup canister of oxygen with slow release valve if the outside air is contaminated.
Electricity	A small battery bank should be included to charge small devices and power an internal light for up to 3 days.

Garage

Room	Allow room for two cars and extra space for tools, storage and workbenches.
Workbenches	Have some workbenches for home improvement projects and store the larger fixed power tools here.
Storage	Have room for tool storage on the walls and shelves for bigger power tools.
Sound	Soundproof the room to allow the ability to use power tools and the silent entry/departure of cars.
Garage Door	Have a fast yet silent door opening/closing system for fast getaways if you have a bug-out vehicle already stocked. Use individual doors for each side.
Refuelling Pump	A pumping station for biodiesel, electricity and other home made fuels.

Attic

Insulation	Keep the house cool in summer and warm in winter.
Storage	Use for backup storage of various goods.
Access	Allow easy access to the solar panels on the roof for cleaning and repairs.

Lookout Tower

View	Ensure you can view every side of the land and your view isn't obstructed.
Staircase	Have a staircase for access to the attic and lookout tower. use the space for storage of household cleaning items.
Access	Allow easy access to the solar panels on the roof for cleaning and repairs.
Weapons	If required, have vertical sliding windows to allow guns to be fired from it. Add sound dampening walls to prevent noise.
Windows	These should be bullet proof to protect the lookout from gunfire or snipers.
Communications	Have a HAM radio in this room for communication and for observation of the local environment.
Satellite Dish	Add a dish to the roof for maximum signal transmission.

Roof

Solar Panels	Used for electricity generation.
Satellite Dish	Used for communications and receiving internet and radio waves.
Guttering	Used for directing water to the water tanks, include wire mesh to prevent leaves entering.
Snow Mechanisms	Stops the snow building up on the roof and causing a collapse.
Wind Turbine	Used for electricity generation.
Skylight	Used for natural light.
Solar Heating	Have a solar heating system to prevent the use of gas as often.

Communications Dish	For receiving Tv, radio and internet signals as well as allowing transmission over short distances.

4 Exterior

External locations which consists of any areas on or outside the house that may have their own structure.

House Exterior	
Garden	
Solar Farm	
Windmill / Turbine	
Dam / Lake	
Workshop	Useful if you produce any of your own items such as furniture.

House Exterior

Water Tank	Split the water tanks up to lessen the loss if one becomes contaminated.
Cameras	Face cameras in all four directions to cover all the land. Ensure there's no blind spots intruders could hide in.
Floodlights	Have flood lights facing out in all directions with the ability to switch different ones on if the need arises.
Hot Water Tank	Have an electronic hot water tank to heat water if the solar one fails.
Window Protection	Have electronic metal rolling blinds to prevent intruders and to protect the glass during storms. Ensure there's no light leaking out for emergency situations.
Gas Tanks	Tuck gas tanks away in an inset into the house with a wall in front to protect from gunfire.
Walls	Reinforce walls with bullet resistant materials for safety.
Frame	Have a steel frame to greatly strengthen the house in extreme weather or gunfire.

Garden / Greenhouse

Sewage Treatment	Use the waste from the house to produce manure which will grow crops better.
Garden	Grow food in the relative safety near the house or inside the house if possible.
Fence / Boundary	Have a fence to mark your land and use as a first line of defence.
Farm	Have visibility of the animals from the house and keep under surveillance.
Trees	Make sure trees are sturdy and won't fall on the house in a disaster. Make sure they don't reduce the line of sight.
Well	Have a well and a electricity free pumping system to retrieve the water if water is nearby.
Windmill	Use a windmill to procure water from a well or to generate electricity.
Solar Farm	Have an external solar farm where the panels turn to face the sun if your electricity requirements are high.
River	Use a hydroelectric generator to produce electricity and return it to the basement for use or storage.
Shipping Container	Have a shipping container to store various other gardening items such as ride on mowers and other tools.
Garden Defence	Your garden will be a highly sought after looting location especially if food is scarce. Building 3m (10ft) concrete walls around the garden will deter thieves. Additionally if you put barbed wire on the top it will make it much more difficult to get over the fence in one piece. Combining this with a detection method such as adding bells to the barbed wire you will be able to hear anyone attempting to climb over. The thick concrete walls will also provide a very secure perimeter against bullets and prevent enemies (snipers) seeing into your home. Ensure it isn't too easy to get under the wall either as people may attempt this instead of going over.
Garden Defence	

Workshop

Animal Quarters

Solar Farm

Windmill / Turbine

Dam / Lake

Well

5 Distant External

Distant external items are any items outside your primary living residence which may take more than a minute to get to. It includes items still on your own private land or on an allies land and generally applies to large properties. If you look at your house like a medieval castle with everything inside those walls being your home, all the villages nearby are your property but not your primary residence. The purpose of distant fixtures is the ability to see attacks coming long before they are visible from the main residence. Your allies in the area can also provide vital information.

Distant External Areas
- Lookout Towers
- Security Cameras
- Mines / Traps
- Kill Zones
- Allies

Lookout Towers

Towers built in the corners of your land allowing you to view the area within and the land outside. They can be tall towers to provide a greater area of view or a pillbox style which is bullet resistant and stealthier.

Security Cameras

Multiple disguised cameras pointed around the exterior of your land will provide you with additional notice of anything going on. They can be hidden in trees with small solar panels up high beyond the leaf level to hide the fact they are there. They should transmit wirelessly back to the control centre in the house and be monitored frequently.

Mines / Traps

Having some traps on your land would be an ideal setup to deter any intruders.

Deadfall	
Pitfall	
Mines	
Manual Explosives	

Kill Zone

The kill zone is a designated area which manipulates adversaries accordingly that they are easier to kill. A kill zone can be a funnel which forces people to go through that area, where you have explosives or a line of sight from a powerful gun. It's worth thinking about how the enemy could approach your land and fix up the weak points.

Allies

Allies are vital in a SHTF scenario, as long as you can trust them. The aim is to establish a mutual neighbourhood watch pact where you inform each other about the approach of hostiles.

Be sure not to reveal too much about your setup, and don't reveal that you're a prepper if they aren't.

6 Utilities

Utilities are the internal systems to your house that are virtually essential to modern living.
Utilities include: Heating, Cooling, Water, Gas, Electricity and Sewage.

Heating

Have a fireplace in the basement with heating pipes transmitting the warmth to the bedroom and Lounge Room upstairs. Have a backup gas heater to prevent going out for wood in winter.

Heating Systems
- Water Heating
- Air Heating
- Fireplace
- Gas Heating

Cooling

Cooling Systems
- Air Conditioning
- Air Heating
- Windows
- Fans

Water

Have at least 1,200L per person in your water tanks. This amount should be enough for one person for an entire year. Use the roof for water catchment and store it in the water tanks. Triple your water requirements for redundancy and have them located at different points around the house. Store one of the tanks in a basement for protection against the elements and from contamination from radiation or pests. Put a water tank up higher than the house to eliminate the need for electricity to pump it.

Gas

Electricity

Solar Panels	Calculate how much sunlight you will receive based on the daylight hours and any obstacles between the sun.
Hydroelectric	Make sure you can create a small dam to harvest the water or utilize a waterfall.
Steam Power	Combine the fireplace with a generator to heat the home and generate electricity. Add thermoelectric panels on the external wall to produce even more.
Fuel Generator	Have a backup fuel generator in the basement in case the other electricity methods fail and you need it fast.
Wind Power	Have a couple of wind turbines on the roof for additional power - especially useful in windy areas or during storms.

Know how much electricity everything in the house uses and how much you need to generate different times of the year to run them.

Sewage

Removes any sewage from your house and brings in flushing water.

7 Security

Have security cameras positioned around the land to cover every blind spot from the lookout tower.

Security	Put a high fence around your land to deter intruders. Try to remove objects that can be used for advancing intruders to hide behind, unless there's a plan behind having it.
Deterrence	The first level of security is deterring potential criminals. This can be achieved by menacing signs such as "Trespassers will be shot". If your house looks like a fortress with barbed wire and high fences it will also deter most common people. However the more secure your house looks - the more people will think there's goodies inside.
Physical Blockages	Internal walls, wooden stakes and barbed wire will slow down people enough to give you time to detect them.
Warning Shots	If you have a vantage point in your home to shoot from, you can wait and give some warning shots to those attempting to enter.
Explosives	Mines and other manually controlled explosives are the last line of defence to protect yourself. A sign mentioning a minefield alone will prevent most people entering an area. Manual explosives such as those used in "I Am Legend" can be used to obliterate an oncoming wave of people and severely scare any others.
Security	

8 Storage

General Storage

A section detailing storage solutions for household items.

Wooden Box	For packing of heavy goods, fragile items and has resistance to handlings.
Plastic Storage Box	Often comes in large sizes and has wheels for ease of transport.
Wooden Pallet	Allows transportation via forklift and keeps materials off the ground and in airflow.
Shelving	Storage of multiple items such as food cans, water and medical equipment. Comes in wood or metal varieties.
Shipping Container	Provides extreme protection. Check for dents, rust and holes. Can be layered with wood on the bottom. Weight from 2T-4T.
Plastic Barrel	For water or food storage if it's food grade and BPA free.
Metal Grid Reinforced Water Container	Heavy duty water container for large water requirements, transport requirements or protection from the elements.

Storing Gear

Water Storage

Small Containers (Easily Portable) (1-25L)

Plastic Container **1-25L** Any fixed size portable water container.	**Collapsible Container** **1-20L** Any flexible container that grows with the volume of water.	**Metal Container** **1-25L** o			

Small Container Tips
Ensure the plastic is capable of holding water without leeching chemicals. See the water section for a list of plastics safe for storing water. Stacking containers will make it easy to store water and maximise the use of the storage space. Barrels with large circular lids can be easily cleaned on the inside. For ease of use, ensure the container has a tap on it.

Medium Containers (Portable with Transport) (50-1000L)

IBC Tote (Caged Water Tank) (Rectangular) 1000L	**Metal Drum** (Cylindrical) 200L	**Plastic Drum** (Cylindrical) Air Tight Lid Store off cement floors			

Plastic Rainwater Tanks (Fixed Containers) (340-5,000L)

Round Poly Water Tank (Cylindrical) 340-34,000L	**Slimline Poly Water Tank** (Double Figure 8 Vertical) 450-5,000L	**Underground Water Tank** (Double Figure 8 Flat) 3,000-5,000L	**Underdeck Water Tank** (Rounded Rectangle) 1,000-5,000L		

Metal Rainwater Tanks (Fixed Containers) (1,000-378,000L)

Round Steel Tank (Round) 1,000-27,000L Corrugated Design	**Slimline Steel Water Tank** (Thin Rounded Rectangle) 1,000-8,000L Corrugated Design	**Modline Steel Water Tank** (Thick Rounded Rectangle) 1,000-7,000L Corrugated Design	**Square Steel Water Tank** (Thick Rounded Rectangle) 1,000-7,000L Corrugated Design	**Large Steel Panel Tank** (Thick Rounded Rectangle) 24,000-378,000L Corrugated Design Needs Assembly	

Other Rainwater Tanks (1-1000L)

Cement Tank (Above or underground) (Round or Square) 1-378,000L	**Water BOB** 378L Used for filling a bathtub with water in emergencies.				

Storing Water Long Term (Using Household Water)
To store household water long term first get a suitable container. Some plastics are unsuitable for water storage as the chemicals leak out. See the Water section for more information. Never use a container which has previously had food or foreign liquids inside it such as juice or milk. Make sure the container is washed out thoroughly and that there's no particles, bugs, leaves or droppings inside it. Fill the container with water, the less oxygen there is - the less chance that bacteria can spread. Put on the lid and shake the bubbles to the top and then fill the gap. Drop in some chlorine tablets equivalent to the volume of water to be stored.

Typically 1L = 1 Tablet (Or use as directed) Put the cap on tightly and ensure no water escapes when you tip it upside-down. Store the water in a cool, dry location until used. It's better to rotate the water out every 6 months to keep it's freshest, but it's not necessary. When you need to use the water always check for any growth inside the container, if there's any bacteria you should add more purification tablets and filter the water prior to drinking to be safe. You may need to re-oxygenate water that has been sitting for a while as it would have become 'flat'. To do this just tip some out into a bottle and give it a shake for a few seconds, then shake the rest of the container as there's now air inside it.

Food Storage

Fuel Storage

Here you'll find the recommended storage methods for all types of fuels.

Wood Storage

Woods should be stored in a dry, sheltered area to protect it from rain and allow it to dry out more. Wood should be dried for half a year for optimum performance as a firewood. The location need not be internal

Gas Fuel Storage

For petrol fuels, most stove manufactures will recommend that you use metal containers for storage. Although metal is ideal for safety reasons, many plastics can be used to store petroleum based liquids. In fact, some companies even sell camp fuels packaged in plastic containers. If you decide to pack petroleum fuels in a plastic bottle, you should test store it in a bottle prior to packing it in your pack. This should be of course done is a safe place where leakage or fire will not be a concern. You may also need to use a good gasket on your cap to prevent leakage.

Alcohol Fuel Storage

Alcohol can simply be stored in an empty light weight disposable water/juice bottle. And unlike the image shown below, you should remove the water or drink label and mark your bottle so that it says "DANGER FUEL DO NOT DRINK" on it. I like to also add several skull and crossbones on it for the non English readers that may be rummaging through my pack. Then when you use your fuel bottle, try not to spill any fuel on your writing if it isn't protected. It is illegal to use a food container for storage of fuel or other poisons in Australia. Remove any labels that would suggest that the contents are drinkable and mark all bottles with "FUEL". Many fuel stabilizer and lead substitute bottles may be ideal, as they are light weight, can be easy to find and has a measuring chamber on top that allows you to measure generally in 1/4oz increments. They also come in many sizes, (4oz, 8oz, 16oz, 32oz, etc). Metal fuel canisters used for other fuels are heavy and entirely unnecessary for alcohol storage.

Utensils	**Syringe** Syringes and disposable pipettes found at a drug store (a short length of flexible tubing is also nice to have) may aid in precision fuel measurement and help in avoiding over priming a stove.	**Funnel** A funnel aids in getting most the of the fuel you pour out of your original fuel can into your trail fuel bottle.			

Shipping Containers

Sizes

10ft Container (3m)	• Length: 3m • Width: 2.4m	• Corten Steel • 2.8cm Thick • 2.8cm Ply Flooring	Excellent for burying to store weapons, food or water.
20ft Container (6.1m)	• Length: 6m • Width: 2.4m • Weight: 2,267kg • Ground Support: 12ton • Roof Support: 200kg	• Corten Steel • 2.8cm Thick • 2.8cm Ply Flooring	Excellent for burying to store weapons, food, water or as a shelter.
40ft Container (12m)	• Length: 12m • Width: 2.4m • Weight: 3,900kg • Ground Support: 33ton • Roof Support: 200kg	• Corten Steel • 2.8cm Thick • 2.8cm Ply Flooring	Excellent for burying to store weapons, food, water or as a shelter.

Styles

Flat Rack Container	Perfect storage for vehicles.
High Cube Container	Extra 305mm high. Less claustrophobic with the extra headroom and storage space.
Insulated Container	Protection from temperature swings for sensitive goods or small living quarters.
Open Top Container	Useful for transporting tall cargo with a smaller footprint. Great as a container for storing dirt easily accessible by dump trucks.
Refrigerated Container	Refrigerated containers for storage of food, medicine and water. Requires access to air if buried underground. **Refrigeration:** Single phase chillers 0-10°C (32-50°F), Three phase freezers -20-20°C (-4°F-68°F)
Side Opening Container	Useful to store larger objects that won't fit in the main entry. Useful storage for two quads to drive them straight out.

Location

Shipping Storage Above Ground
Shipping containers above ground are essentially giant ovens which will heat up significantly over summer greatly increasing the chance to spoil food over this period. Therefore it's recommended that non food, water, combustible or medical related items should be stored in this location. It will be ideal for a workshop with benches, power tools and other equipment which is semi-used. The doors can be opened to allow airflow when the container is in use such as if it's set up as a workshop. The ability to stack containers above ground will let you store additional equipment at no footprint cost due to the strengthened corners of the container. Although a way to the second container needs to be considered.

Shipping Storage Below Ground
Below ground shipping containers can be used for storage of food, water, explosives and medical equipment as they will last much longer. They are ideal for storing waxed cheeses, wines, spirits, beer and other forms of drinks which will age well in the cooler environment. Another benefit of underground storage is the camouflage factor where an entrance can be easily disguised in the form of a backyard shed. The shipping container may need extra reinforcement on the walls due to the pressure of the dirt from the sides and top which over time could crush the container.

Cache

A cache or survival cache is a hidden collection of items typically underground which is usually dug up at a later date when required. Containers are typically plastic or metal, waterproof and airtight that are resistant to the elements and rustproof. They are typically buried underground at a minimum of 15cm deep and up to 1m. The shallower - the easier they are to be found by others but they can be retrieved faster. Document the location well using a GPS if possible and the alignment of three visible landmarks. Beware of shifting grounds or erosion which could reveal the container over time.

HOMESTEADING Storage Cache Building a Cache

Building a Cache

Creating a PVC Pipe Cache
Use PVC Pipe to create small caches as a weatherproof means to store any supplies you will require later. PVC fits together snugly and can be sealed with a primer and glue rendering it waterproof and won't degrade underground over time.

1	Select the width of the pipe you require to store equipment in, ensuring it will fit everything you need. Pressure pipe is slightly thicker and will provide better resistance to the elements if required.
2	Ensure the pipe size you selected has stoppers and screw ends to allow easy recovery of the contents.
3	Cut the pipe to the required sizes and sand down the ends until they are flat and free of burrs.
4	Glue the ends on using a primer first and then let it sit for 24 hours.

Positioning

The Three Minute Rule
Try to position the cache so you can get to it quickly and it won't take too long to align the landmarks if the scenery has changed. It should take a maximum of 3 minutes total to retrieve a cache during a bug out situation starting from the car and stopping when you return to the car. This gives you about one minute to walk to the location from the nearest road, one minute to dig it up, retrieve the cache and to cover the hole again and another minute to return to your transport. You can modify this any way such as having 30 seconds travel time each way and 2m to dig it up and cover it again.

This rule generally only applies to transport bugging out to allow a swift bug-out and prevent vehicle theft but can also apply to on-foot bugging out to speed up the process. During a disaster less emphasis can be placed on covering up the location afterwards as you're not likely to ever be returning to that point again which can save some valuable time.

Position the cache in a rarely travelled location away from possible future land development sites. A national park is ideal as they are very unlikely to be turned into developments. Be aware of water courses as they may erode the soil above the cache over time - revealing it. Therefore put it near the low point of a hill, or on flat terrain. If the location is a dried riverbed, take note that when you attempt to retrieve the cache, that the water level could be higher than anticipated. Always try to place the cache in a location next to an unmovable landmark such as a large tree or a rock which can be easily identified for future recovery. Scout the surroundings prior to planting a cache to check for people who might see you or for threats such as wild animals. Once planted, make sure the ground looks just like the surrounding area with no obvious marks. Try not to leave any scent or smell of food at the location as animals could dig it up.

Positioning Locations

Your Land	The most secure choice is burying it on your own land at your BOL where it's extremely unlikely to be found.
Friends Land	The second best location, although there is a risk in telling them, because when a disaster happens they could remember and go dig it up themselves.
National Park	A secure location which is very unlikely to be found in the thick scrub and undergrowth and the necessity to keep the area untouched.
Beside Roads	Probably the most convenient location in a bug-out situation due to not having to travel far from the car to retrieve it. However it may be found in more suburban areas due to hole digging for poles and posts and other construction.
Near Streams	In and on the banks of streams could be other secluded locations, however beware of erosion. Between the roots of trees would be secure if packed tightly and attached to the roots by a rope if the roots dip into the water. Be careful of the water level.
Parks	Generally parks don't change much over the years which could make them useful to hide caches in the bushes.

Documenting

Don't trust your memory if you plant a cache. Not only could you forget the location but it could dramatically change by the time you want to recover the contents, with new bushes, trees and undergrowth. Write down the coordinates of the location to get within a few metres of the cache easily. However don't rely on GPS's working when SHTF. Use a trifecta of solid landmarks to accurately pinpoint the location of the cache and jot down which side of the landmark it's on. (N, E, SW etc.) I recommend also pinpointing the location of the cache on an offline mapping program such as a Garmin GPS or the Alpine Quest app.

Example Cache Notes **Location Name** Richard Lawson Park Fuel Cache **GPS Location** 27° 20' 45.2" S 152° 53' 21.4" E **Visible Landmarks** Large Oak Tree - NW Lake - NNE Road - SSE	**Positioning** On the east side of the lone pine tree in the field, one step away. **Planted** - 2 May 2018 **Depth** - 30cm **Container Type** - PVC **Soil Hardness** - Soft **Waterproof** - Yes	**Contents** 2L Petrol, 40 Matches, Various Medications, 2L Water, 3 MREs, 1 Water Filter. **Expirable Items** Medications (2021) MREs (2040) Petrol (Feb 2020)	You could encrypt the coordinates if required by adding a simple number modifier to the location in case somebody comes across your notes. An example is adding 1 to each coordinate grouping. **From:** 27° 20' 45.2" S **To:** 28° 21' 46.2" S

Retrieval

When retrieving a cache either to refresh the contents or during bugging out - be sure you aren't being followed or observed when digging up the location. Practice occasionally on a variety of test locations where possible to get used to finding them again. Returning to the same place yearly and modifying a cache would be ideal as the area would likely have changed slightly. Going geocaching will sharpen your navigation skills and may give you some great ideas of hiding your own caches. Otherwise get friends to hide a cache, marking it and getting you to find it.

Cache Supplies

Caches Locations	Keeping a note of additional caches in the area is possible but be sure to encrypt the coordinates in case one is found.
Fuel	One of the most common items to stash in caches en route especially long ones as liquid is heavy and volatile to transport. Although it must be refreshed every year or so if the fuel has a stabiliser added.

Water / Water Filters	Another heavy item, however water does not go off if stored properly. This is more useful if the surrounding water is contaminated or you're hiking through the area.
Food	Long life foods such as canned food, freeze dried food and MREs are ideal as a restock along the way. Food can last from 5 years to indefinitely and will store well as it's cooler underground.
Tools	Tools will be essential for backups in case your primaries fail. This type of cache would only need to be visited if your tools are broken. Ensure the cache is weather proof to prevent rust.
Shelter	Backup shelter for element protection such as snow or heavy rain - especially if on foot.
Medical	It's always important to have additional medical gear in case your supplies dwindle or you need more specialised gear for emergencies like splints.
Misc	Items such as paracord, region maps, compass, whistle, notepad, money, barter-items, clothing, traps, firearms, ammo, gas masks, duct tape, playing cards, hygiene items, tubing, snare wire, condoms, garbage bags and batteries.

Theft Protection

Safes	
Vaults	
Lock Types	

Mobile Protection

These are the different types of mobile locks and protection you can enable on most phones.

Swipe	No security, just swipe left or right to unlock.
Pattern	Low security level, uses a directional pattern to unlock.
PIN	High level of security, uses 4-8 digits as a pin.
Password	Very high level of security, 8 characters or more.
Biometrics Finger	High level of security, uses your finger's pattern to unlock the phone.
Biometrics Face	Medium level of security, uses your face to unlock the phone. May also work with a photo.
Biometrics Iris	High level of security, uses your iris pattern to unlock the phone. However there's a small chance it could be fooled by a photo - if someone happens to have a photo of your eye.

Information Storage

Different ways you can store digital information so that it's secure and weather resistant.

Types of Storage	• USB Flash Drive • Phone Internal Storage • Hard Drive • Portable SSD Drive				
Element Storage	**Water Protection** ○	**Fire Protection** ○	**EMP Protection** ○		
Encryption					

Limited Storage

You may live in very small quarters or have a very limited area for storing supplies such as an apartment in a city. This section will help you make the most of limited, tight or strangely shaped storage options.

For more information about living in and making the most of small quarters see the Minimalism section below.

9 Conservation

How to conserve any type of resources you have such as water, electricity, gas and heat.

Conserving Water

Different ways you can conserve water.

Conserving Electricity

To start conserving electricity your house should be based on a 12v circuit especially if you're off grid or aiming to go off grid. Avoid using inverters as you lose between 5-30% of the energy during conversion. Turn off appliances when they aren't needed.

Conserving Gas

Different ways you can conserve gas.

Conserving Heat

Ways you can conserve heat.

Conserving Oxygen

How you can conserve oxygen if you have a limited amount.

10 Reusing

We throw away a lot of items in the trash that we could reuse around the house throughout our lives. Reusing not only saves the environment but saves the cost of recycling the materials in the first place. The MATERIALS section has useful tips on alternative survival uses for items around the house.

Finding Alternative Uses

11 Recycling

This section is dedicated to recycling at home either in the recycling bin or doing it yourself.

Recyclables

Newspaper	
Paper / Cardboard	
Plastics	Depending on the type of plastic it may be able to be recycled. See the MATERIALS section for recyclable materials.
Glass	
Metal	
Food Scraps	
Electronic Waste	
Hazardous Waste	

Recycling Water

How you can recycle used water, whether it's bore, grey water or black water.

Non-Recyclables

Items which aren't recyclable.

- Cellophane
- Ceramics
- Clothes
- Drinking Glasses
- Food Waste
- Garden Waste
- Heat-Proof Dishes
- Nappies
- Photographs
- Needles
- Plastic Bags
- Polystyrene Foam
- Soft Plastics
- Tissues
- Toilet Paper
- Wax Coated Paper

Recycling at Home

This section details how you can recycle items at home which you can then reuse. For tips on reusing materials in different ways, scroll down to the "Reusing" section.

Recycling Paper

Recycling Plastic

Recycling Metal

12 Alternatives

The aim of this section is to find any alternatives for technology which draws its power from the grid. It can be also useful if you're looking for compact entertainment or other items to fit into your BOB. These recommendations are best used when you want to live an easy and simple life off the grid relying off solar.

General

Electricity (Small Power)	• **Power Bank:** Perfect to charge phones and other electronic devices. • **Batteries:** The ideal solution to keep your torches on, just swap and go.
Electricity (Big Power)	• **Petrol/Diesel Generator:** Good to power the heavy-draw devices around the house such as fridges and air-conditioners. • **Electric Power Station:** A viable solution for silent portable power equal to generators. They can also be recharged with solar.
Electricity (Renewable)	See the ELECTRICITY section.

Kitchen

Toaster	• **Gas Stove:** A gas stove with a hot plate can toast bread. • **Open Fire:** Using a fire and something to hold the bread you can toast it nicely.
Kettle	• **Gas Stove:** A gas stove can boil water quickly.
Coffee Machine	• **Instant Coffee:** Simply put it into a cup and add water. This is freeze-dried and lasts many years. • **Camping Percolator:** A manual percolator which is pumped by hand and uses either pods or ground coffee.
Blender / Mixer	• **Hand Mixing:** Mixing the ingredients by hand to combine them.
Non Electric Fridge	• **Yakhchāl:** An early form of fridge used for storing items that require a cool environment. • **Icebox:** o • **Evaporative Cooler:** o • **Zeer Pot:** o • **Radiant Fridge:** o • **Root Cellar:** o • **Gas Fridge (Absorption Fridge):** o • **Kerosene Fridge (Absorption Fridge):** o
Portable Electric Fridge	• **Vaccine Fridge (Compression):** o
Freezer	• **Outdoors:** If you live in a location where it snows, you could store food outside in a special freezer box.
Microwave	• **Gas Stove:** A gas stove can reheat food - albeit slower.
Grill	• **Gas Heater:** Using a gas heater very close to the food you can grill it slowly.
Oven	• **Solar Oven:** These are quite large and bulky and take all day to cook, as well a requiring a bright sunny day to cook food. • **Hot Coals:** A fire or the hot coals remaining from a fire can be used to cook food if you want to go to the effort.
Garbage Disposal Unit	• **Compost Bin:** A great way to recycle scraps and it can be used in the garden.
Dishwasher	• **Handwashing:** The only alternative generally. • **Disposable Plates:** You could go for this option however it generates a lot of waste.

Lounge

Lights	• **Natural Light:** Use natural light to light up your home. • **String Lights:** Use string lights to provide enough light to allow navigation and reading at night.
Tv	• **Laptop:** Laptops can do almost everything a Tv can do but doubles as a computer to save space. • **Tablet:** Again, basically a mini Tv, but can provide some computing and gaming functions. • **Mobile Phone:** The smallest package with the most power and very compact and easily transported.

Speakers	• **Headphones / Earphones:** The most compact listening method for one person. Can be used anywhere and fits into a pocket or backpack. • **Phone Speakers:** Wired or wireless speakers to let others listen as well.
Computer	• **Laptop:** Can be used for business work as well as gaming and fits into a much smaller space than a pc. • **Tablet:** Tablets have their uses for watching movies, listening to music and playing some casual games. • **Mobile Phone:** Similar to tablets but even more compact allowing games, music and Tv to be watched as well as some work completed.
Game Console	• **Handheld Console:** Similar to a console but doesn't require wall power. Some older consoles can even be modded into handheld types. • **Card Games:** A classic way to keep entertained although not as entertaining as consoles to modern kids. • **Board Games:** Not as compact as card games but still viable for keeping you entertained. • **Reading:** Get a good book or a series of good books and spend the time in another universe.
Air Conditioner	• **Open Window:** Having an open window can let natural airflow through the house. • **Evaporative Cooler:** Can be used to cool the air by natural evaporation. May be used with ice if that's possible to generate. • **Fan:** A ceiling or pedestal fan can take the edge off when it's an extremely hot day out. • **Reducing Clothing:** Taking off some layers can relieve you of a bit of heat.
Fan	• **Open Windows:** Having an open window can let natural airflow through the house. • **Reducing Clothing:** Taking off some layers can relieve you of a bit of heat.
Heater	• **Fireplace:** The natural heating method for centuries but ensure it's safely operated inside. • **Gas Heater:** Uses gas canisters to heat the space although watch out for carbon monoxide build up.
Sewing Machine	• **Hand Sewing:** If you have the skills you can hand sew whatever you are making instead.

Bathroom

Hair Dryer	• **Sun:** Getting out into the sun can dry your hair naturally and give you some vitamin B as well. • **Air Dry:** Your hair will dry naturally over time but lie down and spread it out so it dries faster. • **Gas Heater:** A gas heater can be used to dry hair if it's dark or cold outside.
Hair Trimmer	• **Razor:** A battery operated trimmer uses little power and can easily be recharged via solar power. • **Scissors:** A simple pair or scissors can be used to trim any type of hair, but it's best if you have another person to help with some training.
Hair Straightener	• **None:** Not many viable options for off grid hair straightening.
Ceiling Heat Lamp	• **Gas Heater:** A gas heater could warm you up and help dry you after a shower.

Laundry

Washing Machine	• **Hand Washing:** For a non powered washing machine alternative you can use a hand washing method or use a bucket/barrel. • **Camping Washer:** You can purchase small barrels which you put your clothes into and spin around repeatedly to clean them.
Dryer	• **Mangle / Wringer:** Wind the wringer to press all the water from the clothes to dry it faster. • **Clothesline:** Pegging out the clothes in the sun will dry them within a few hours.
Iron	• **Fire Iron:** An iron which has a metal base and is placed into a fire to heat up. • **Pegging Out:** Hanging clothes in the warm sun can remove some wrinkles. • **Steaming:** Steaming clothes removes wrinkles quickly if you have the ability to do so.
Vacuum Cleaner	• **Broom:** Sweep up and collect the dirt manually. • **Manual Vacuum Cleaner:** o

Garage

Automatic Door	• **Manual Door:** A door which you lift and lower yourself.
Power Tools	• **Wireless Tools:** Battery operated tools with a solar recharger. • **Hand Tools:** Tools from the olden days where effort and force is required.
Lawn Mower	• **Manual Lawn Mower:** A lawn mower that you push around which cuts the grass with the blades. • **Machete:** Sure, you can cut the grass with a machete or other bladed items such as scissors. • **Animals:** Animals such as sheep, cows and horses can stop your grass growing too long.

External

Water Heater	• **Solar Heating:** Rooftop solar heating can generate hot water from the sun. • **Gas Heating:** Gas heating generates instant heat for on demand applications such as showers.
Water Pump	• **Solar Pump:** A pump which uses the sun to work. • **Hand Pump:** A pump that requires someone to manually pump it when required.
Security System	• **Dogs:** Dogs can hear and smell people from much further away than humans and work as a great deterrent. • **Fences:** If they can't climb it they aren't likely to keep trying to get onto your land.

13 Minimalism

Minimalism isn't just about having few possessions, but about the relaxed and carefree lifestyle that comes with thinking, being and working efficiently and away from distractions. It also covers getting away from the bustle of the cities and suburbs in search of an off-grid or country lifestyle where the pleasures and company are easier.

Physical Minimalism

Physical minimalism or simple living is the art of only using and doing what is essential to stay alive. There are a number of minimalism styles from possession minimalism to digital minimalism. People try to limit their possessions down to a suitcase, backpack or limit it by an item count such as 100.

The art of reducing physical possessions down to only the essentials you need for continued survival.

Prepping and Physical Minimalism	Prepping and minimalism seem like two opposite ends of the spectrum but you can in fact be a minimalist prepper with some skill. The trick is to count your prepper backpack as one item and have a minimal number of everything else you own so that you're ready for disaster and lightweight. It also makes leaving home permanently easier when you have so few possessions and you might even be able to bring them all.
Removing Items	A simple way to get rid of everything you don't need is to put everything into boxes and only take out what you need at the time. After a month or so, just sell or give away the remaining items as if you haven't used them by now, you're not likely to. This is much harder than it sounds as you become more attached to items just before you go to get rid of them.

Possessions

Tips to downsizing your possessions to live clutter-free.

Start with the Big	Remove the larger possessions first, you will be invigorated by how much new space you have and want to continue.
Eliminate Unnecessary	Our houses are often filled with junk we buy, use once and then forget about. Try to remove anything you haven't used in months.
Simplify Your Wardrobe	Reduce that over cluttered wardrobe in your bedroom with multiple pairs of pants and that shirt that only goes with one pair of pants.
Simplify Pc Files	Digital clutter can be as stressful as real clutter. Keep your files orderly and off the desktop, it will appear much cleaner.
Limit Purchases	Ask yourself "Do I really need this to live?"
Clean Desk Policy	Always aim to keep your desk clear of clutter. Put it into the drawer when finished.
Live Frugally	Have simple inexpensive meals that still taste appealing.
Smaller Car	If you can't remove the car altogether, try to drive a smaller, more economical car.
Recycle	Recycle old bottles, cartons and boxes, even if you don't use the resultant product, it's better for the environment.

Possession Quiz

Start at the first question and work towards down if you are directed to the next question. Otherwise take the recommended action.

Can it and should it be digitalised?	Documents, photos, cods, DVDs, books and some games can be converted to a digital format which eliminates the space they require.	**Yes: Digitalize it** **No: Next Question**
Can you substitute, downsize or reduce the duplicates you have?	Items such as cutlery, dishes, containers and stationary.	**Yes: Keep it** **No: Next Question**
Do you use it Regularly?	Items such as TVs, toothbrush, phone, watch, kettle.	**Yes: Keep it** **No: Next Question**
Does it have Sentimental Value?	Items such as photos, gifts or memorabilia?	**Yes: Keep it** **No: Next Question**
Are you 100% likely to use it within a month or year?	Items you are guaranteed to use within a month like food, tools, vacuum, car cleaners but may not use week to week.	**Yes: Keep it** **No: Next Question**
Is it a tool or used in conjunction with another object?	These items are generally useful and required for daily life such as cutlery, power tools, screwdrivers and cables.	**Yes: Keep it** **No: Next Question**
Is it worth money?	If the item is worth money and you've passed the other questions, you should sell it.	**Yes: Sell the item** **No: Discard or donate it**

Digital Minimalism

Digital or online minimalism is your overall exposure to digital media formats. It involves reducing spam or catalogue emails, having few files and no desktop clutter and only the essential apps and programs. It does not include the amount of time spent on digital devices, this falls under time minimalism.

Digital Exposure

Ads & Spam

Desktop Clutter

Files

Time Minimalism

How you spend your time and prioritization of the most important things. It's good to start with a blank schedule and begin to fill in what you have to do. Write down all the tasks and group them by how essential they are to do.		**Task Groupings** ● Essential ● Preparation ● Social ● Leisure
Essential Tasks	First start with the essential tasks that you must complete for staying alive.	**Essential Tasks** ● Sleep (7-9 Hours) ● Work (Varies) ● Eating (1 Hour)
Preparation Tasks	This grouping of task is used in preparation for the essential tasks such as travel to and from work.	**Preparation Tasks** ● Bed Time Routine ● Work Travel ● Cooking
Social Time	Time spent with family or friends including parties, movies and drinks.	
Leisure Time	Any remaining time is considered leisure time and during this window you can do whatever you want or use it to finish an earlier uncompleted task.	
Wasted Time	Time which is spent when you're actually supposed to be doing something else such as Facebook, twitter, instagram. These aren't considered wasted time if it's part of leisure time or you use it for your business as a means to interact with customers.	**Wasted Time** ● Facebook ● Twitter ● Instagram

Budget Minimalism

This type of minimalism is the spending of money wisely and setting up a budget. A study has shown that the average person is subjected to over 500 adverts per day, every one at them either aimed at us buying a product or altering our thoughts on a subject. With this much exposure to ads it makes it significantly harder to hold on to your cash, especially when most of these ads are targeted specifically to you.		
Bugdeting	Budgeting is the first, and most powerful step to saving money. Not only are all funds allocated based on needs but you will have a surprising amount of leeway if a surprise expense comes up. Try not to exceed your budget when buying food, appliances and entertainment as this will hurt you in the future. You'll be amazed by the amount of money you can save by budgeting properly and avoiding excess purchases - which often end up in landfill anyway.	**Bugdet** ●
Subscription Services	There are endless ways companies part us from our money these days and they are more and more turning into subscription based services. These services are paid for automatically behind the scenes which is intended to help us forget the cost over time and make us dependant on them. Unnecessary subscription services such as YouTube, Spotify, Cloud Storage, Adobe Software, Netflix etc can easily drain our income as soon as it's in our bank. Consider which services are essential to your requirements, what you would do without them and then cut off the rest of the services you don't need while transitioning to alternative methods to accomplish it without the service.	**Subscription Services** ● Mobile Internet ● Home Internet ● Music Streaming ● Video Streaming ● Website Hosting ● Cloud Storage ● Productivity Suites
Extras	When shopping we're often presented with aisles of great deals marked down from crazy prices and we're often coerced into making these purchases because we perceive the mto be great deals. This comes in the form of cheap chocolates, drinks and lollies at the checkouts which we don't need but feel we deserve. Saying no to anything outside your budget is a skill to learn, particularly if you're prone to making additional purchases.	**Example Extras** ● Chocolates ● Sweets ● Sugary Drinks
Lower Quality & Less Features	We don't always need the best of everything when making purchases as the marketing seems to suggest. Sometimes the cheaper version can get the job done just as well and you don't waste your hard earnt cash on additional features you'll never use. Keep in mind that it's better to have a good quality device (such as a phone) over multiple cheap devices because this saves space and will often last longer with daily use.	**Examples** ● Smaller packs of food ● Basic Appliances

Minimalism Tips

Evaluation

Evaluate Time	Work out what you spend your time on every day and eliminate the unnecessary.
Evaluate Commitments	Repeating commitments suck a lot of time, evaluate and ditch the ones you find you don't need.
Simplify Jobs	Simplify the routine jobs you do or split them up into multiple smaller tasks.

HOMESTEADING	Minimalism	Minimalism Tips	Evaluation		
HOMESTEADING	Minimalism	Minimalism Tips	Evaluation	Say No	Free up your spare time by saying no to outings, trips and events.
HOMESTEADING	Minimalism	Minimalism Tips	Evaluation	Limit Communication	Today's life is full of continuous contact even when you're far away, try to reduce this contact to weekly.
HOMESTEADING	Minimalism	Minimalism Tips	Evaluation	Limit Media	Slow your mind and prevent the inflow of the useless by switching off from all media forms where possible.
HOMESTEADING	Minimalism	Minimalism Tips	Evaluation	Develop a Budget	A budget can help assist you get your spending under control and save easier as well as reduce clutter.
HOMESTEADING	Minimalism	Minimalism Tips	Evaluation	Debt	The biggest stress of all is debt, try to pay it off as quickly as possible to gain financial freedom. Or don't get in debt at all.

Daily Tasks

HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks		
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Eat Slowly	In our busy lives we often forget to enjoy the simple pleasures, slow your eating and enjoy the experience.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Drive/Walk Slowly	Not only is it safer, but travelling slower can let you experience the world around us we don't often get the time to.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Notice the Small Things	There's so much complexity in the world today but we miss it rushing by. Literally stop to smell the roses.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Eat Healthily	Healthy eating can simplify your lifestyle and help that weight to stay off.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	A Place for Everything	You should store every item you own in it's own place, know where it goes and store it there when not in use.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Live without a Car	Nothing feels as freeing then ditching your car in favour of living without a money guzzling pollutant.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Single Tasks	Set a single task for the day and then relax once it's done. Don't overcomplicate your schedule.
HOMESTEADING	Minimalism	Minimalism Tips	Daily Tasks	Doing Nothing	Everyone needs some time alone, especially time alone to just do nothing and relax, feel how calm you are without stresses.

Simplify

HOMESTEADING	Minimalism	Minimalism Tips	Simplify		
HOMESTEADING	Minimalism	Minimalism Tips	Simplify	Quality not Quantity	Own fewer better quality possessions and you will save space and value them more.
HOMESTEADING	Minimalism	Minimalism Tips	Simplify	Small Pleasures	Enjoy the small pleasures in your daily life and celebrate the minor achievements you complete.
HOMESTEADING	Minimalism	Minimalism Tips	Simplify	Pack Light	You probably don't use 2/3rds of what you pack on a daily basis, leave it at home and favour only the essentials you need.
HOMESTEADING	Minimalism	Minimalism Tips	Simplify	Smaller Home	There's nothing like freedom by downsizing your home and possessions in favour of simple living and having no debt.
HOMESTEADING	Minimalism	Minimalism Tips	Simplify	Live Closer to Work	This will make ditching your car so much easier and give you one more inch of freedom.
HOMESTEADING	Minimalism	Minimalism Tips	Simplify	Re-Use and Repair	Most items today are discarded and deserted rather than repaired. Try to pick up the old tradition of repairing clothes and re-using old objects.

Time

HOMESTEADING	Minimalism	Minimalism Tips	Time		
HOMESTEADING	Minimalism	Minimalism Tips	Time	Free Up Time	See what activities you don't need to do and set that time aside. When you have free time, don't fill it straight away.
HOMESTEADING	Minimalism	Minimalism Tips	Time	Do what you Love	In your free time, do what you love over anything.
HOMESTEADING	Minimalism	Minimalism Tips	Time	Spend Time with Your Love	The time your spend with people you love is always the best spent time and memories are kept forever.
HOMESTEADING	Minimalism	Minimalism Tips	Time	Alone Time	We need our alone time to self reflect and ponder our life decisions and the big questions in life.
HOMESTEADING	Minimalism	Minimalism Tips	Time	Live in the Present	Don't worry too much about the future or remember the problems of the past.
HOMESTEADING	Minimalism	Minimalism Tips	Time	Planning	Planning activities and what you aim to achieve will increase your productivity and efficiency.
HOMESTEADING	Minimalism	Minimalism Tips	Time	Establish Routines	Routines will keep your life simple and have regularity so you won't have any surprises.

Population

Details on prepper circles, gangs and surviving with others

"In order to stabilize world population, we must eliminate 350,000 people per day."
Jacques-Yves Cousteau

Introduction

Information regarding population, country strength, types of people, gangs etc.

Purpose	The aim of POPULATION is to look into each nation, social class and individual that comprises the population of the world, including information on how they currently interact and how they could interact in a disaster.
Lost?	● For information on hiding from others, see the STEALTH & TACTICS section. ● For a description of the countries of the world, their population and their laws, see the GEOGRAPHY section. ● For communication between people of other languages, see the LANGUAGE section. ● For leading your party during a disaster, see the LEADERSHIP section. ● For tips and rehearsals on bugging-out when others are nearby, see the PREPAREDNESS section. ● For information on communicating with others, see the COMMUNICATION section. ● For information on how people will react in times of turmoil, see the DISASTER TRIGGERS section. ● For information on the religions of the world and what people believe, see RELIGION. ● For preparedness skills you can learn, see the SKILLS section.

Contents

1 Population Facts

Population Facts

Current Population[n] 7,866,588,747 (Dec 2020)	During the 20th century alone, the population in the world has grown from 1.65 billion to 6 billion. Population in the world is currently growing at a rate of around 1.09% per year. (2018[n]) 106 billion people have been born since the dawn of the human species until now. 6% are currently alive.	• 131.4 million births per year. • 250 births each minute. • 55.3 million people die each year. • 105 people die each minute. • Average life expectancy is 67 years.

Country Population

A list of the most populated countries on earth, sorted by population as at 2018.[n]

Country Population Density (P/km^2) Land Area (Km^2)	**China** 1,415,045,928 151 9,388,211	**India** 1,354,051,854 455 2,973,190	**U.S.A.** 326,766,748 36 9,147,420	**Indonesia** 266,794,980 147 1,811,570	**Brazil** 210,867,954 25 8,358,140	**Pakistan** 200,813,818 260 770,880	**Nigeria** 195,875,237 215 910,770	**Bangladesh** 166,368,149 1,278 130,170	**Russia** 143,964,709 9 16,376,870	**Mexico** 130,759,074 67 1,943,950	**Japan** 127,185,332 349 364,555
Country Population Density (P/km^2) Land Area (Km^2)	**Ethiopia** 107,534,882 108 1,000,000	**Philippines** 106,512,074 357 298,170	**Egypt** 99,375,741 100 995,450	**Vietnam** 96,491,146 311 310,070	**DR Congo** 84,004,989 37 2,267,050	**Germany** 82,293,457 236 348,560	**Iran** 82,011,735 50 1,628,550	**Turkey** 81,916,871 106 769,630	**Thailand** 69,183,173 135 510,890	**U.K.** 66,573,504 275 241,930	**France** 65,233,271 119 547,557
Country Population Density (P/km^2) Land Area (Km^2)	**Italy** 59,290,969 202 294,140	**Tanzania** 59,091,392 67 885,800	**South Africa** 57,398,421 47 1,213,090	**Myanmar** 53,855,735 82 653,290	**South Korea** 51,164,435 526 97,230	**Kenya** 50,950,879 90 569,140	**Colombia** 49,464,683 45 1,109,500	**Spain** 46,397,452 93 498,800	**Argentina** 44,688,864 16 2,736,690	**Uganda** 44,270,563 222 199,810	**Ukraine** 44,009,214 76 579,320
Country Population Density (P/km^2) Land Area (Km^2)	**Algeria** 42,008,054 18 2,381,740	**Sudan** 41,511,526 24 1,765,048	**Iraq** 39,339,753 91 434,320	**Poland** 38,104,832 124 306,230	**Canada** 36,953,765 4 9,093,510	**Afghanistan** 36,373,176 56 652,860	**Morocco** 36,191,805 81 446,300	**Saudi Arabia** 33,554,343 16 2,149,690	**Peru** 32,551,815 25 1,280,000	**Venezuela** 32,381,221 37 882,050	**Uzbekistan** 32,364,996 76 425,400
Country Population Density (P/km^2) Land Area (Km^2)	**Malaysia** 32,042,458 98 328,550	**Angola** 30,774,205 25 1,246,700	**Mozambique** 30,528,673 39 786,380	**Nepal** 29,624,035 207 143,350	**Ghana** 29,463,643 129 227,540	**Yemen** 28,915,284 55 527,970	**Madagascar** 26,262,810 45 581,795	**North Korea** 25,610,672 213 120,410	**Côte d'Ivoire** 24,905,843 78 318,000	**Australia** 24,772,247 3 7,682,300	**Cameroon** 24,678,234 52 472,710
Country Population Density (P/km^2) Land Area (Km^2)	**Taiwan** 23,694,089 669 35,410	**Niger** 22,311,375 18 1,266,700	**Sri Lanka** 20,950,041 334 62,710	**Burkina Faso** 19,751,651 72 273,600	**Romania** 19,580,634 85 230,170	**Malawi** 19,164,728 203 94,280	**Mali** 19,107,706 16 1,220,190	**Kazakhstan** 18,403,860 7 2,699,700	**Syria** 18,284,407 100 183,630	**Chile** 18,197,209 24 743,532	**Zambia** 17,609,178 24 743,390
Country Population Density (P/km^2) Land Area (Km^2)	**Guatemala** 17,245,346 161 107,160	**Netherlands** 17,084,459 507 33,720	**Zimbabwe** 16,913,261 44 386,850	**Ecuador** 16,863,425 68 248,360	**Senegal** 16,294,270 85 192,530	**Cambodia** 16,245,729 92 176,520	**Chad** 15,353,184 12 1,259,200	**Somalia** 15,181,925 24 627,340	**Guinea** 13,052,608 53 245,720	**South Sudan** 12,919,053 21 610,952	**Rwanda** 12,501,156 507 24,670

Global Population

Population Over Time[n]	**1955** - 2,772,242,535 **1960** - 3,033,212,527 **1965** - 3,339,592,688 **1970** - 3,700,577,650 **1975** - 4,079,087,198		**1980** - 4,458,411,534 **1985** - 4,873,781,796 **1990** - 5,330,943,460 **1995** - 5,751,474,416 **2000** - 6,145,006,989		**2005** - 6,542,159,383 **2010** - 6,958,169,159 **2015** - 7,383,008,820 **2016** - 7,466,964,280 **2017** - 7,550,262,101		**2018** - 7,632,819,325 **2019** - 7,713,468,100 **2020** - 7,794,798,739				
Billion Milestones[n]	The year the earths population hit a new billion milestone.		**1 Billion** 1804	**2 Billion** 1930	**3 Billion** 1960	**4 Billion** 1974	**5 Billion** 1987	**6 Billion** 1999	**7 Billion** 2011	**8 Billion (Projected)** 2023	**10 Billion (Projected)** 2055
Religious Population[n]	**Christian** **31%** 2.173 Bil	**Muslims** **23%** 1.598 Bil	**No Religion** **16%** 1.126 Bil	**Hindus** **15%** 1.033 Bil	**Buddhists** **7%** 487 Mil	**Folk Religion** **6%** 405 Mil	**Other Religions** **1%** 58 Mil	**Jews** **0.2%** 13.8 Mil			

2 Psychology

Hierarchy of Needs

Maslow's hierarchy of needs is a theory in psychology proposed by Abraham Maslow in his 1943 paper "A Theory of Human Motivation" in Psychological Review. Maslow subsequently extended the idea to include his observations of humans' innate curiosity. His theories parallel many other theories of human developmental psychology, some of which focus on describing the stages of growth in humans. The goal of Maslow's Theory is to attain the fifth level or stage: self-actualization needs.

Maslow's hierarchy of needs is often portrayed in the shape of a pyramid with the largest, most fundamental needs at the bottom and the need for self-actualization and self-transcendence at the top. The most fundamental and basic four layers of the pyramid contain what Maslow called "deficiency needs" or "d-needs": esteem, friendship and love, security, and physical needs. If these "deficiency needs" are not met – with the exception of the most fundamental (physiological) need – there may not be a physical indication, but the individual will feel anxious and tense.

Maslow's theory suggests that the most basic level of needs must be met before the individual will strongly desire (or focus motivation upon) the secondary or higher level needs. Maslow also coined the term "metamotivation" to describe the motivation of people who go beyond the scope of the basic needs and strive for constant betterment.

The human brain is a complex system and has parallel processes running at the same time, thus many different motivations from various levels of Maslow's hierarchy can occur at the same time. Maslow spoke clearly about these levels and their satisfaction in terms such as "relative", "general", and "primarily". Instead of stating that the individual focuses on a certain need at any given time, Maslow stated that a certain need "dominates" the human organism.

Physiological Needs • Breathing • Water • Food • Sleep	Physiological needs are the physical requirements for human survival. If these requirements are not met, the human body cannot function properly and will ultimately fail. Physiological needs are thought to be the most important; they should be met first. This is the first and basic need on the hierarchy of needs. Without them, the other needs cannot follow up.
Safety Needs • Personal Security • Emotional Security • Financial Security • Health • Safety	Once a person's physiological needs are relatively satisfied, their safety needs take precedence and dominate behaviour. In the absence of physical safety – due to war, natural disaster, family violence, childhood abuse, etc. – people may (re-) experience post-traumatic stress disorder or transgenerational trauma.

POPULATION Psychology Heirachy of Needs

Love / Belonging ● Friends ● Intimacy ● Family	After physiological and safety needs are fulfilled, the third level of human needs is interpersonal and involves feelings of belongingness. This need is especially strong in childhood and it can override the need for safety as witnessed in children who cling to abusive parents.
Esteem ● Prestige ● Accomplishment	Esteem needs are ego needs or status needs develop a concern with getting recognition, status, importance, and respect from others. All humans have a need to feel respected; this includes the need to have self-esteem and self-respect. Esteem presents the typical human desire to be accepted and valued by others. People often engage in a profession or hobby to gain recognition. These activities give the person a sense of contribution or value.
Self-Actualization ● Achieving Full Potential ● Creative Activities	"What a man can be, he must be." This quotation forms the basis of the perceived need for self-actualization. This level of need refers to what a person's full potential is and the realization of that potential. Maslow describes this level as the desire to accomplish everything that one can, to become the most that one can be. Individuals may perceive or focus on this need very specifically. For example, one individual may have the strong desire to become an ideal parent.
Self-Transcendence ● Spirituality ● Greater Good	Later, Maslow explored a further dimension of needs, while criticizing his own vision on self-actualization. By this later theory, the self only finds its actualization in giving itself to some higher outside goal, in altruism and spirituality. He equated this with the desire to reach the infinite.

POPULATION Psychology

Bunker Survival

POPULATION Psychology Bunker Survival

Large scale bunkers have shared facilities, and some people may not get along well. Humans are meant to be free, not confined in a box without sunlight and air. Agreed upon schedules, rules and regulations essential, however this could break down over time. Requires strong leadership and governance for multiple people. People may attempt to escape, become diseased, become oppositional or become mentally ill. Conditions will deteriorate over time as people become irritable, anxious and desperate for fresh air. Each person requires their own space away from people if required. Shifts may need to be taken to watch for threats and intruders. Each inhabitant needs to watch out for the mental health of other's inside the bunker.

Attitude of inhabitants needs to be kept optimistic to keep their drive for survival. Mental health needs to be kept in check such as ADHD, Schizophrenia and OCD. People struggling with substance addiction will be struggling with withdrawal and will seek an outlet for their vices. Medicine dependence can cause negative psychological effects. Simulated night/day sleep cycle. Lack of sunlight causes disorders. Entertainment essential, lack of stimulation causes irritability. Depression, suicide and self harm can manifest over time living underground. Lack of intel from the outside. Group goals, what are we working towards.

Lack of Sunlight

POPULATION Psychology Lack of Sunlight

These are some of the effects from a lack of sunlight.

Depression	Cooler temperatures can bring on gloomy moods. Whether you call it the winter blues, cabin fever, or seasonal affective disorder (SAD), doctors often chalk up cold-weather mood dips to lack of sunshine. In fact, a study published in the American Journal of Geriatric Psychiatry found that people with lower levels of vitamin D are 10 times more likely to be depressed than those who have a healthy dose of the so-called “sunshine vitamin.” “Basically, it comes down to levels of the hormone serotonin in your brain,” explains Wesley Delbridge, RN, spokesperson for the Academy for Nutrition and Dietetics. “With exposure to bright light, like sunlight, serotonin will increase.”
Weight Gain	Along with prompting skin to manufacture vitamin D, sunshine supplies the important nutrient nitric oxide, which keeps your metabolism running smoothly and discourages binge eating. A study published in the journal Diabetes found that exposure to UV rays can slow weight gain and ward off diabetes.
Risk of Heart Disease	There’s still the risk of skin cancer to worry about. But if you’re limiting your sun exposure—some researchers say we spend 90 percent of our lives indoors!—you could be more likely to develop breast and prostate cancer, as well as cardiovascular disease. Last year, the Harvard School of Public Health found that men with vitamin D deficiencies caused by lack of sunlight were twice as likely to develop a heart condition. Some doctors recommend spending about 15 minutes a day in the sun without sunscreen to give your body a chance to create its daily dose of vitamin D.
Bones Ache	What might be mistaken as arthritis or fibromyalgia (chronic muscle pain and fatigue) in adults could actually be a vitamin D deficiency due to a lack of sunlight, according to Delbridge. Adults who don’t get enough sunshine, especially in the winter when it’s too cold to spend time outside, often feel aches and pains in their muscles and bones, or they might feel a bit stiffer in the morning. Nutrients like calcium and collagen work together to build bones, but without a proper dose of vitamin D, the process is interrupted, and “your bones can actually ache and throb,” says Delbridge.
Sick More Often	Avoiding daylight could be making you sicker. A healthy dose of vitamin D gives your immune system a boost, which decreases your chance of developing infections and the flu. To knock out a pesky cold, try to spend about 10 to 15 minutes outside, recommends Michael Holick, MD, professor of medicine, physiology, and biophysics at Boston University Medical Centre and author of The UV Advantage, on everydayhealth.com. Try these other ways to get vitamin D—even if it’s not summer.
Not Sleeping Well	A lack of sunlight could wreak havoc on your body long after the sun goes down. Research shows that spending an extended amount of time in artificial lighting or staring at electronic screens causes serious sleep problems. In fact, if you skimp on the sun’s rays by staying indoors, you can throw off your circadian rhythm (your body’s internal clock), which could mean you’re not sleeping deeply enough, and may easily trigger insomnia.
Excessive Sweating	Excessive sweating on your forehead, especially if you’re not exercising or overheated, is one of the classic signs that you’re not getting enough vitamin D. If your forehead has a little extra shine (even if your body temperature and activity level is normal), it might be time to ask your doctor about getting your blood checked for a vitamin D deficiency. Even moderately low levels of vitamin D may be linked to a surprising number of health conditions, including diabetes, osteoarthritis, and cancer.

POPULATION ology

Others

Isolation

We are social creatures and we need interaction to survive. Need people to share our lives with in good times or hardship.

Fear

Fear

Energy of the nervous system to flee or engage the situation.
- Fear, stress and anxiety is needed for optimal performance.
- Control your emotions, body and thoughts and you can control the fear.
- Fear can cause compromising moves to be made running headstrong towards or away from the source of fear.
- Become tense and have other visual signs of fear/stress.

Hysterical Strength
A display of extreme strength by humans, beyond what is believed to be normal, usually occurring when people are in life-and-death situations.

Fear Outcomes
- Fight
- Fight
- Freeze
- Faint

Cannibalism

Survival Psychology

Let go of the familiar and embrace the change as everything will be different when SHTF. Preppers attempt to carry over their previous lives into the new world. Adapt to the changing circumstances. See the alternative possibilities in all situations, other uses for all objects. Addiction is the inability to adapt to changing circumstances.

3 Personalities

Personalities Overview

ISTJ - The Inspector	At first glance, ISTJs are intimidating. They appear serious, formal, and proper. They also love traditions and old-school values that uphold patience, hard work, honour, and social and cultural responsibility. They are reserved, calm, quiet, and upright. These traits result from the combination of I, S, T, and J, a personality type that is often misunderstood.
ISFJ - The Nurturer	ISFJs are philanthropists and they are always ready to give back and return generosity with even more generosity. The people and things they believe in will be upheld and supported with enthusiasm and unselfishness. ISFJs are warm and kind-hearted. They value harmony and cooperation, and are likely to be very sensitive to other people's feelings. People value the ISFJ for their consideration and awareness, and their ability to bring out the best in others.
INFJ - The Counsellor	INFJs are visionaries and idealists who ooze creative imagination and brilliant ideas. They have a different, and usually more profound, way of looking at the world. They have a substance and depth in the way they think, never taking anything at surface level or accepting things the way they are. Others may sometimes perceive them as weird or amusing because of their different outlook on life.
INTJ - The Mastermind	INTJs, as introverts, are quiet, reserved, and comfortable being alone. They are usually self-sufficient and would rather work alone than in a group. Socializing drains an introvert's energy, causing them to need to recharge. INTJs are interested in ideas and theories. When observing the world they are always questioning why things happen the way they do. They excel at developing plans and strategies, and don't like uncertainty.
ISTP - The Craftsman	ISTPs are mysterious people who are usually very rational and logical, but also quite spontaneous and enthusiastic. Their personality traits are less easily recognizable than those of other types, and even people who know them well can't always anticipate their reactions. Deep down, ISTPs are spontaneous, unpredictable individuals, but they hide those traits from the outside world, often very successfully.
ISFP - The Composer	ISFPs are introverts that do not seem like introverts. It is because even if they have difficulties connecting to other people at first, they become warm, approachable, and friendly eventually. They are fun to be with and very spontaneous, which makes them the perfect friend to tag along in whatever activity, regardless if planned or unplanned. ISFPs want to live their life to the fullest and embrace the present, so they make sure they are always out to explore new things and discover new experiences. It is in experience that they find wisdom, so they do see more value in meeting new people than other introverts.
INFP - The Idealist	INFPs, like most introverts, are quiet and reserved. They prefer not to talk about themselves, especially in the first encounter with a new person. They like spending time alone in quiet places where they can make sense of what is happening around them. They love analysing signs and symbols, and consider them to be metaphors that have deeper meanings related to life. They are lost in their imagination and daydreams, always drowned in the depth of their thoughts, fantasies, and ideas.
INTP - The Thinker	INTPs are well known for their brilliant theories and unrelenting logic, which makes sense since they are arguably the most logical minded of all the personality types. They love patterns, have a keen eye for picking up on discrepancies, and a good ability to read people, making it a bad idea to lie to an INTP. People of this personality type aren't interested in practical, day-to-day activities and maintenance, but when they find an environment where their creative genius and potential can be expressed, there is no limit to the time and energy INTPs will expend in developing an insightful and unbiased solution.
ESTP - The Doer	ESTPs have an Extraverted, Sensing, Thinking, and Perceptive personality. ESTPs are governed by the need for social interaction, feelings and emotions, logical processes and reasoning, along with a need for freedom. Theory and abstracts don't keep ESTP's interested for long. ESTPs leap before they look, fixing their mistakes as they go, rather than sitting idle or preparing contingency plans.
ESFP - The Performer	ESFPs have an Extraverted, Observant, Feeling and Perceiving personality, and are commonly seen as Entertainers. Born to be in front of others and to capture the stage, ESFPs love the spotlight. ESFPs are thoughtful explorers who love learning and sharing what they learn with others. ESFPs are "people people" with strong interpersonal skills. They are lively and fun, and enjoy being the centre of attention. They are warm, generous, and friendly, sympathetic and concerned for other people's well-being.
ENFP - The Champion	ENFPs have an Extraverted, Intuitive, Feeling and Perceiving personality. This personality type is highly individualistic and Champions strive toward creating their own methods, looks, actions, habits, and ideas — they do not like cookie cutter people and hate when they are forced to live inside a box. They like to be around other people and have a strong intuitive nature when it comes to themselves and others. They operate from their feelings most of the time, and they are highly perceptive and thoughtful.

ENTP - The Visionary	Those with the ENTP personality are some of the rarest in the world, which is completely understandable. Although they are extroverts, they don't enjoy small talk and may not thrive in many social situations, especially those that involve people who are too different from the ENTP. ENTPs are intelligent and knowledgeable need to be constantly mentally stimulated. They have the ability to discuss theories and facts in extensive detail. They are logical, rational, and objective in their approach to information and arguments.
ESTJ - The Supervisor	ESTJs are organized, honest, dedicated, dignified, traditional, and are great believers of doing what they believe is right and socially acceptable. Though the paths towards "good" and "right" are difficult, they are glad to take their place as the leaders of the pack. They are the epitome of good citizenry. People look to ESTJs for guidance and counsel, and ESTJs are always happy that they are approached for help.
ESFJ - The Provider	ESFJs are the stereotypical extroverts. They are social butterflies, and their need to interact with others and make people happy usually ends up making them popular. The ESFJ usually tends to be the cheerleader or sports hero in high school and college. Later on in life, they continue to revel in the spotlight, and are primarily focused on organizing social events for their families, friends and communities. ESFJ is a common personality type and one that is liked by many people.
ENFJ - The Giver	ENFJs are people-focused individuals. They are extroverted, idealistic, charismatic, outspoken, highly principled and ethical, and usually know how to connect with others no matter their background or personality. Mainly relying on intuition and feelings, they tend to live in their imagination rather than in the real world. Instead of focusing on living in the "now" and what is currently happening, ENFJs tend to concentrate on the abstract and what could possibly happen in the future.
ENTJ - The Commander	An ENTJ's primary mode of living focuses on external aspects and all things are dealt with rationally and logically. Their secondary mode of operation is internal, where intuition and reasoning take effect. ENTJs are natural born leaders among the 16 personality types and like being in charge. They live in a world of possibilities and they often see challenges and obstacles as great opportunities to push themselves. They seem to have a natural gift for leadership, making decisions, and considering options and ideas quickly yet carefully. They are "take charge" people who do not like to sit still.

Detailed Personalities

ISTJ - The Inspector

The ISTJ personality type is thought to be the most abundant, making up around 13% of the population. Their defining characteristics of integrity, practical logic and tireless dedication to duty make ISTJs a vital core to many families, as well as organizations that uphold traditions, rules and standards, such as law offices, regulatory bodies and military. People with the ISTJ personality type enjoy taking responsibility for their actions, and take pride in the work they do – when working towards a goal, ISTJs hold back none of their time and energy completing each relevant task with accuracy and patience.

ISTJs don't make many assumptions, preferring instead to analyse their surroundings, check their facts and arrive at practical courses of action. ISTJ personalities are no-nonsense, and when they've made a decision, they will relay the facts necessary to achieve their goal, expecting others to grasp the situation immediately and take action. ISTJs have little tolerance for indecisiveness, but lose patience even more quickly if their chosen course is challenged with impractical theories, especially if they ignore key details – if challenges becomes time-consuming debates, ISTJs can become noticeably angry as deadlines tick nearer.

When ISTJs say they are going to get something done, they do it, meeting their obligations no matter the personal cost, and they are baffled by people who don't hold their own word in the same respect. Combining laziness and dishonesty is the quickest way to get on ISTJs' bad side. Consequently, people with the ISTJ personality type often prefer to work alone, or at least have their authority clearly established by hierarchy, where they can set and achieve their goals without debate or worry over other's reliability. ISTJs have sharp, fact-based minds, and prefer autonomy and self-sufficiency to reliance on someone or something. Dependency on others is often seen by ISTJs as a weakness, and their passion for duty, dependability and impeccable personal integrity forbid falling into such a trap.

This sense of personal integrity is core to ISTJs, and goes beyond their own minds – ISTJ personalities adhere to established rules and guidelines regardless of cost, reporting their own mistakes and telling the truth even when the consequences for doing so could be disastrous. To ISTJs, honesty is far more important than emotional considerations, and their blunt approach leaves others with the false impression that ISTJs are cold, or even robotic.

People with this type may struggle to express emotion or affection outwardly, but the suggestion that they don't feel, or worse have no personality at all, is deeply hurtful. ISTJs' dedication is an excellent quality, allowing them to accomplish much, but it is also a core weakness that less scrupulous individuals take advantage of. ISTJs seek stability and security, considering it their duty to maintain a smooth operation, and they may find that their co-workers and significant others shift their responsibilities onto them, knowing that they will always take up the slack.

ISTJs tend to keep their opinions to themselves and let the facts do the talking, but it can be a long time before observable evidence tells the whole story. ISTJs need to remember to take care of themselves – their stubborn dedication to stability and efficiency can compromise those goals in the long term as others lean ever-harder on them, creating an emotional strain that can go unexpressed for years, only finally coming out after it's too late to fix. If they can find co-workers and spouses who genuinely appreciate and complement their qualities, who enjoy the brightness, clarity and dependability that they offer, ISTJs will find that their stabilizing role is a tremendously satisfying one, knowing that they are part of a system that works.

ISFJ - The Nurturer

The ISFJ personality type is quite unique, as many of their qualities defy the definition of their individual traits. Though possessing the Feeling (F) trait, ISFJs have excellent analytical abilities; though Introverted (I), they have well-developed people skills and robust social relationships; and though they are a Judging (J) type, ISFJs are often receptive to change and new ideas. As with so many things, people with the ISFJ personality type are more than the sum of their parts, and it is the way they use these strengths that defines who they are. ISFJs are true altruists, meeting kindness with kindness-in-excess and engaging the work and people they believe in with enthusiasm and generosity. There's hardly a better type to make up such a large proportion of the population, nearly 13%. Combining the best of tradition and the desire to do good, ISFJs are found in lines of work with a sense of history behind them, such as medicine, academics and charitable social work. ISFJ personalities (especially Turbulent ones) are often meticulous to the point of perfectionism, and though they procrastinate, they can always be relied on to get the job done on time. ISFJs take their responsibilities personally, consistently going above and beyond, doing everything they can to exceed expectations and delight others, at work and at home.

The challenge for ISFJs is ensuring that what they do is noticed. They have a tendency to underplay their accomplishments, and while their kindness is often respected, more cynical and selfish people are likely to take advantage of ISFJs' dedication and humbleness by pushing work onto them and then taking the credit. ISFJs need to know when to say no and stand up for themselves if they are to maintain their confidence and enthusiasm. Naturally social, an odd quality for Introverts, ISFJs utilize excellent memories not to retain data and trivia, but to remember people, and details about their lives. When it comes to gift-giving, ISFJs have no equal, using their imagination and natural sensitivity to express their generosity in ways that touch the hearts of their recipients. While this is certainly true of their co-workers, whom people with the ISFJ personality type often consider their personal friends, it is in family that their expressions of affection fully bloom. ISFJ personalities are a wonderful group, rarely sitting idle while a worthy cause remains unfinished. ISFJs' ability to connect with others on an intimate level is unrivalled among Introverts, and the joy they experience in using those connections to maintain a supportive, happy family is a gift for everyone involved. They may never be truly comfortable in the spotlight, and may feel guilty taking due credit for team efforts, but if they can ensure that their efforts are recognized, ISFJs are likely to feel a level of satisfaction in what they do that many other personality types can only dream of.

INFJ - The Counsellor

INFJ - The Counsellor

The INFJ personality type is very rare, making up less than one percent of the population, but they nonetheless leave their mark on the world. As Diplomats, they have an inborn sense of idealism and morality, but what sets them apart is the accompanying Judging (J) trait – INFJs are not idle dreamers, but people capable of taking concrete steps to realize their goals and make a lasting positive impact. INFJs tend to see helping others as their purpose in life, but while people with this personality type can be found engaging rescue efforts and doing charity work, their real passion is to get to the heart of the issue so that people need not be rescued at all. INFJs indeed share a unique combination of traits: though soft-spoken, they have very strong opinions and will fight tirelessly for an idea they believe in. They are decisive and strong-willed, but will rarely use that energy for personal gain – INFJs will act with creativity, imagination, conviction and sensitivity not to create advantage, but to create balance. Egalitarianism and karma are very attractive ideas to INFJs, and they tend to believe that nothing would help the world so much as using love and compassion to soften the hearts of tyrants.

INFJs find it easy to make connections with others, and have a talent for warm, sensitive language, speaking in human terms, rather than with pure logic and fact. It makes sense that their friends and colleagues will come to think of them as quiet Extraverted types, but they would all do well to remember that INFJs need time alone to decompress and recharge, and to not become too alarmed when they suddenly withdraw. INFJs take great care of other's feelings, and they expect the favour to be returned – sometimes that means giving them the space they need for a few days. Really though, it is most important for INFJs to remember to take care of themselves. The passion of their convictions is perfectly capable of carrying them past their breaking point and if their zeal gets out of hand, they can find themselves exhausted, unhealthy and stressed. This becomes especially apparent when INFJs find themselves up against conflict and criticism – their sensitivity forces them to do everything they can to evade these seemingly personal attacks, but when the circumstances are unavoidable, they can fight back in highly irrational, unhelpful ways. To INFJs, the world is a place full of inequity – but it doesn't have to be. No other personality type is better suited to create a movement to right a wrong, no matter how big or small. INFJs just need to remember that while they're busy taking care of the world, they need to take care of themselves, too.

INTJ - The Mastermind

It's lonely at the top, and being one of the rarest and most strategically capable personality types, INTJs know this all too well. INTJs form just two percent of the population, and women of this personality type are especially rare, forming just 0.8% of the population – it is often a challenge for them to find like-minded individuals who are able to keep up with their relentless intellectualism and chess-like manoeuvring. People with the INTJ personality type are imaginative yet decisive, ambitious yet private, amazingly curious, but they do not squander their energy. With a natural thirst for knowledge that shows itself early in life, INTJs are often given the title of "bookworm" as children. While this may be intended as an insult by their peers, they more than likely identify with it and are even proud of it, greatly enjoying their broad and deep body of knowledge. INTJs enjoy sharing what they know as well, confident in their mastery of their chosen subjects, but owing to their Intuitive (N) and Judging (J) traits, they prefer to design and execute a brilliant plan within their field rather than share opinions on "uninteresting" distractions like gossip. A paradox to most observers, INTJs are able to live by glaring contradictions that nonetheless make perfect sense – at least from a purely rational perspective. For example, INTJs are simultaneously the most starry-eyed idealists and the bitterest of cynics, a seemingly impossible conflict. But this is because INTJ types tend to believe that with effort, intelligence and consideration, nothing is impossible, while at the same time they believe that people are too lazy, short-sighted or self-serving to actually achieve those fantastic results.

Yet that cynical view of reality is unlikely to stop an interested INTJ from achieving a result they believe to be relevant. INTJs radiate self-confidence and an aura of mystery, and their insightful observations, original ideas and formidable logic enable them to push change through with sheer willpower and force of personality. At times it will seem that INTJs are bent on deconstructing and rebuilding every idea and system they come into contact with, employing a sense of perfectionism and even morality to this work. Anyone who doesn't have the talent to keep up with INTJs' processes, or worse yet, doesn't see the point of them, is likely to immediately and permanently lose their respect. Rules, limitations and traditions are anathema to the INTJ personality type – everything should be open to questioning and revaluation, and if they see a way, INTJs will often act unilaterally to enact their technically superior, sometimes insensitive, and almost always unorthodox methods and ideas. This isn't to be misunderstood as impulsiveness – INTJs will strive to remain rational no matter how attractive the end goal may be, and every idea, whether generated internally or soaked in from the outside world, must pass the ruthless and ever-present "Is this going to work?" filter.

This mechanism is applied at all times, to all things and all people, and this is often where INTJ personality types run into trouble. INTJs are brilliant and confident in bodies of knowledge they have taken the time to understand, but unfortunately the social contract is unlikely to be one of those subjects. White lies and small talk are hard enough as it is for a type that craves truth and depth, but INTJs may go so far as to see many social conventions as downright stupid. Ironically, it is often best for them to remain where they are comfortable – out of the spotlight – where the natural confidence prevalent in INTJs as they work with the familiar can serve as its own beacon, attracting people, romantically or otherwise, of similar temperament and interests. INTJs are defined by their tendency to move through life as though it were a giant chess board, pieces constantly shifting with consideration and intelligence, always assessing new tactics, strategies and contingency plans, constantly outmanoeuvring their peers in order to maintain control of a situation while maximizing their freedom to move about. This isn't meant to suggest that INTJs act without conscience, but to many Feeling (F) types, INTJs' distaste for acting on emotion can make it seem that way, and it explains why many fictional villains (and misunderstood heroes) are modelled on this personality type.

ISTP - The Craftsman

ISTPs love to explore with their hands and their eyes, touching and examining the world around them with cool rationalism and spirited curiosity. People with this personality type are natural Makers, moving from project to project, building the useful and the superfluous for the fun of it, and learning from their environment as they go. Often mechanics and engineers, ISTPs find no greater joy than in getting their hands dirty pulling things apart and putting them back together, just a little bit better than they were before. ISTPs explore ideas through creating, troubleshooting, trial and error and first-hand experience. They enjoy having other people take an interest in their projects and sometimes don't even mind them getting into their space.

Of course, that's on the condition that those people don't interfere with ISTPs' principles and freedom, and they'll need to be open to ISTPs returning the interest in kind. ISTPs enjoy lending a hand and sharing their experience, especially with the people they care about, and it's a shame they're so uncommon, making up only about five percent of the population. ISTP women are especially rare, and the typical gender roles that society tends to expect can be a poor fit – they'll often be seen as tomboys from a young age. While their mechanical tendencies can make them appear simple at a glance, ISTPs are actually quite enigmatic.

Friendly but very private, calm but suddenly spontaneous, extremely curious but unable to stay focused on formal studies, ISTP personalities can be a challenge to predict, even by their friends and loved ones. ISTPs can seem very loyal and steady for a while, but they tend to build up a store of impulsive energy that explodes without warning, taking their interests in bold new directions. Rather than some sort of vision quest though, ISTPs are merely exploring the viability of a new interest when they make these seismic shifts.

ISTPs' decisions stem from a sense of practical realism, and at their heart is a strong sense of direct fairness, a "do unto others" attitude, which really helps to explain many of ISTPs' puzzling traits. Instead of being overly cautious though, avoiding stepping on toes in order to avoid having their toes stepped on, ISTPs are likely to go too far, accepting likewise retaliation, good or bad, as fair play. The biggest issue ISTPs are likely to face is that they often act too soon, taking for granted their permissive nature and assuming that others are the same.

They'll be the first to tell an insensitive joke, get overly involved in someone else's project, roughhouse and play around, or suddenly change their plans because something more interesting came up. ISTPs will come to learn that many other personality types have much more firmly drawn lines on rules and acceptable behaviour than they do – they don't want to hear an insensitive joke, and certainly wouldn't tell one back, and they wouldn't want to engage in horseplay, even with a willing party. If a situation is already emotionally charged, violating these boundaries can backfire tremendously.

ISTPs have a particular difficulty in predicting emotions, but this is just a natural extension of their fairness, given how difficult it is to gauge ISTPs' emotions and motivations. However, their tendency to explore their relationships through their actions rather than through empathy can lead to some very frustrating situations. People with the ISTP personality type struggle with boundaries and guidelines, preferring the freedom to move about and colour outside the lines if they need to. Finding an environment where they can work with good friends who understand their style and unpredictability, combining their creativity, sense of humour and hands-on approach to build practical solutions and things, will give ISTPs many happy years of building useful boxes – and admiring them from the outside.

ISFP - The Composer

ISFP personality types are true artists, but not necessarily in the typical sense where they're out painting happy little trees. Often enough though, they are perfectly capable of this. Rather, it's that they use aesthetics, design and even their choices and actions to push the limits of social convention. ISFPs enjoy upsetting traditional expectations with experiments in beauty and behaviour – chances are, they've expressed more than once the phrase "Don't box me in!" ISFPs live in a colourful, sensual world, inspired by connections with people and ideas. ISFP personalities take joy in reinterpreting these connections, reinventing and experimenting with both themselves and new perspectives.

No other type explores and experiments in this way more. This creates a sense of spontaneity, making ISFPs seem unpredictable, even to their close friends and loved ones. Despite all this, ISFPs are definitely Introverts (I), surprising their friends further when they step out of the spotlight to be by themselves to recharge. Just because they are alone though, doesn't mean people with the ISFP personality type sit idle – they take this time for introspection, assessing their principles. Rather than dwelling on the past or the future, ISFPs think about who they are.

They return from their cloister, transformed. ISFPs live to find ways to push their passions. Riskier behaviours like gambling and extreme sports are more common with this personality type than with others. Fortunately their attunement to the moment and their environment allows them to do better than most. ISFPs also enjoy connecting with others, and have a certain irresistible charm. ISFPs always know just the compliment to soften a heart that's getting ready to call their risks irresponsible or reckless.

'However, if a criticism does get through, it can end poorly. Some ISFPs can handle kindly phrased commentary, valuing it as another perspective to help push their passions in new directions. But if the comments are more biting and less mature, ISFP personalities can lose their tempers in spectacular fashion. ISFPs are sensitive to others' feelings and value harmony. When faced with criticism, it can be a challenge for people with this type to step away from the moment long enough to not get caught up in the heat of the moment.

But living in the moment goes both ways, and once the heightened emotions of an argument cool, ISFPs can usually call the past the past and move on as though it never occurred. The biggest challenge facing ISFPs is planning for the future. Finding constructive ideals to base their goals on and working out goals that create positive principles is no small task. Unlike Sentinel types, ISFPs don't plan their futures in terms of assets and retirement. Rather, they plan actions and behaviours as contributions to a sense of identity, building a portfolio of experiences, not stocks.

If these goals and principles are noble, ISFPs can act with amazing charity and selflessness – but it can also happen that people with the ISFP personality type establish a more self-centred identity, acting with selfishness, manipulation and egoism. It's important for ISFPs to remember to actively become the person they want to be. Developing and maintaining a new habit may not come naturally, but taking the time each day to understand their motivations allows ISFPs to use their strengths to pursue whatever they've come to love.

INFP - The Idealist

INFP personalities are true idealists, always looking for the hint of good in even the worst of people and events, searching for ways to make things better. While they may be perceived as calm, reserved, or even shy, INFPs have an inner flame and passion that can truly shine. Comprising just 4% of the population, the risk of feeling misunderstood is unfortunately high for the INFP personality type – but when they find like-minded people to spend their time with, the harmony they feel will be a fountain of joy and inspiration.

Being a part of the Diplomat personality group, INFPs are guided by their principles, rather than by logic (Analysts), excitement (Explorers), or practicality (Sentinels). When deciding how to move forward, they will look to honour, beauty, morality and virtue – INFPs are led by the purity of their intent, not rewards and punishments. People who share the INFP personality type are proud of this quality, and rightly so, but not everyone understands the drive behind these feelings, and it can lead to isolation. At their best, these qualities enable INFPs to communicate deeply with others, easily speaking in metaphors and parables, and understanding and creating symbols to share their ideas.

The strength of this intuitive communication style lends itself well to creative works, and it comes as no surprise that many famous INFPs are poets, writers and actors. Understanding themselves and their place in the world is important to INFPs, and they explore these ideas by projecting themselves into their work. INFPs have a talent for self-expression, revealing their beauty and their secrets through metaphors and fictional characters.

INFPs' ability with language doesn't stop with their native tongue, either – as with most people who share the Diplomat personality types, they are considered gifted when it comes to learning a second (or third!) language. Their gift for communication also lends itself well to INFPs' desire for harmony, a recurring theme with Diplomats, and helps them to move forward as they find their calling.

Unlike their Extraverted cousins though, INFPs will focus their attention on just a few people, a single worthy cause – spread too thinly, they'll run out of energy, and even become dejected and overwhelmed by all the bad in the world that they can't fix. This is a sad sight for INFPs' friends, who will come to depend on their rosy outlook. If they are not careful, INFPs can lose themselves in their quest for good and neglect the day-to-day upkeep that life demands. INFPs often drift into deep thought, enjoying contemplating the hypothetical and the philosophical more than any other personality type.

Left unchecked, INFPs may start to lose touch, withdrawing into "hermit mode", and it can take a great deal of energy from their friends or partner to bring them back to the real world. Luckily, like the flowers in spring, INFP's affection, creativity, altruism and idealism will always come back, rewarding them and those they love perhaps not with logic and utility, but with a world view that inspires compassion, kindness and beauty wherever they go.

INTP - The Thinker

The INTP personality type is fairly rare, making up only three percent of the population, which is definitely a good thing for them, as there's nothing they'd be more unhappy about than being "common". INTPs pride themselves on their inventiveness and creativity, their unique perspective and vigorous intellect. Usually known as the philosopher, the architect, or the dreamy professor, INTPs have been responsible for many scientific discoveries throughout history. INTPs are known for their brilliant theories and unrelenting logic – in fact, they are considered the most logically precise of all the personality types. They love patterns, and spotting discrepancies between statements could almost be described as a hobby, making it a bad idea to lie to an INTP. This makes it ironic that INTPs' word should always be taken with a grain of salt – it's not that they are dishonest, but people with the INTP personality type tend to share thoughts that are not fully developed, using others as a sounding board for ideas and theories in a debate against themselves rather than as actual conversation partners. This may make them appear unreliable, but in reality no one is more enthusiastic and capable of spotting a problem, drilling through the endless factors and details that encompass the issue and developing a unique and viable solution than INTPs – just don't expect punctual progress reports. People who share the INTP personality type aren't interested in practical, day-to-day activities and maintenance, but when they find an environment where their creative genius and potential can be expressed, there is no limit to the time and energy INTPs will expend in developing an insightful and unbiased solution.

They may appear to drift about in an unending daydream, but INTPs' thought process is unceasing, and their minds buzz with ideas from the moment they wake up. This constant thinking can have the effect of making them look pensive and detached, as they are often conducting full-fledged debates in their own heads, but really INTPs are quite relaxed and friendly when they are with people they know, or who share their interests. However, this can be replaced by overwhelming shyness when INTP personalities are among unfamiliar faces, and friendly banter can quickly become combative if they believe their logical conclusions or theories are being criticized. When INTPs are particularly excited, the conversation can border on incoherence as they try to explain the daisy-chain of logical conclusions that led to the formation of their latest idea. Oftentimes, INTPs will opt to simply move on from a topic before it's ever understood what they were trying to say, rather than try to lay things out in plain terms. The reverse can also be true when people explain their thought processes to INTPs in terms of subjectivity and feeling. Imagine an immensely complicated clockwork, taking in every fact and idea possible, processing them with a heavy dose of creative reasoning and returning the most logically sound results available – this is how the INTP mind works, and this type has little tolerance for an emotional monkey-wrench jamming their machines.

Further, with Thinking (T) as one of their governing traits, INTPs are unlikely to understand emotional complaints at all, and their friends won't find a bedrock of emotional support in them. People with the INTP personality type would much rather make a series of logical suggestions for how to resolve the underlying issue, a perspective that is not always welcomed by their Feeling (F) companions. This will likely extend to most social conventions and goals as well, like planning dinners and getting married, as INTPs are far more concerned with originality and efficient results. The one thing that really holds INTPs back is their restless and pervasive fear of failure. INTP personalities are so prone to reassessing their own thoughts and theories, worrying that they've missed some critical piece of the puzzle, that they can stagnate, lost in an intangible world where their thoughts are never truly applied. Overcoming this self-doubt stands as the greatest challenge INTPs are likely to face, but the intellectual gifts – big and small – bestowed on the world when they do makes it worth the fight.

ESTP - The Doer

ESTP personality types always have an impact on their immediate surroundings – the best way to spot them at a party is to look for the whirling eddy of people flitting about them as they move from group to group. Laughing and entertaining with a blunt and earthy humour, ESTP personalities love to be the centre of attention. If an audience member is asked to come on stage, ESTPs volunteer – or volunteer a shy friend. Theory, abstract concepts and plodding discussions about global issues and their implications don't keep ESTPs interested for long. ESTPs keep their conversation energetic, with a good dose of intelligence, but they like to talk about what is – or better yet, to just go out and do it. ESTPs leap before they look, fixing their mistakes as they go, rather than sitting idle, preparing contingencies and escape clauses. ESTPs are the likeliest personality type to make a lifestyle of risky behaviour. They live in the moment and dive into the action – they are the eye of the storm. People with the ESTP personality type enjoy drama, passion, and pleasure, not for emotional thrills, but because it's so stimulating to their logical minds. They are forced to make critical decisions based on factual, immediate reality in a process of rapid-fire rational stimulus response. This makes school and other highly organized environments a challenge for ESTPs. It certainly isn't because they aren't smart, and they can do well, but the regimented, lecturing approach of formal education is just so far from the hands-on learning that ESTPs enjoy.

It takes a great deal of maturity to see this process as a necessary means to an end, something that creates more exciting opportunities. Also challenging is that to ESTPs, it makes more sense to use their own moral compass than someone else's. Rules were made to be broken. This is a sentiment few high school instructors or corporate supervisors are likely to share, and can earn ESTP personalities a certain reputation. But if they minimize the trouble-making, harness their energy, and focus through the boring stuff, ESTPs are a force to be reckoned with. With perhaps the most perceptive, unfiltered view of any type, ESTPs have a unique skill in noticing small changes. Whether a shift in facial expression, a new clothing style, or a broken habit, people with this personality type pick up on hidden thoughts and motives where most types would be lucky to pick up anything specific at all. ESTPs use these observations immediately, calling out the change and asking questions, often with little regard for sensitivity. ESTPs should remember that not everyone wants their secrets and decisions broadcast. Sometimes ESTPs' instantaneous observation and action is just what's required, as in some corporate environments, and especially in emergencies.

If ESTPs aren't careful though, they may get too caught in the moment, take things too far, and run roughshod over more sensitive people, or forget to take care of their own health and safety. Making up only four percent of the population, there are just enough ESTPs out there to keep things spicy and competitive, and not so many as to cause a systemic risk. ESTPs are full of passion and energy, complemented by a rational, if sometimes distracted, mind. Inspiring, convincing and colourful, they are natural group leaders, pulling everyone along the path less travelled, bringing life and excitement everywhere they go. Putting these qualities to a constructive and rewarding end is ESTPs' true challenge.

ESFP - The Performer

If anyone is to be found spontaneously breaking into song and dance, it is the ESFP personality type. ESFPs get caught up in the excitement of the moment, and want everyone else to feel that way, too. No other personality type is as generous with their time and energy as ESFPs when it comes to encouraging others, and no other personality type does it with such irresistible style. Born entertainers, ESFPs love the spotlight, but all the world's a stage. Many famous people with the ESFP personality type are indeed actors, but they love putting on a show for their friends too, chatting with a unique and earthy wit, soaking up attention and making every outing feel a bit like a party. Utterly social, ESFPs enjoy the simplest things, and there's no greater joy for them than just having fun with a good group of friends. It's not just talk either – ESFPs have the strongest aesthetic sense of any personality type. From grooming and outfits to a well-appointed home, ESFP personalities have an eye for fashion. Knowing what's attractive the moment they see it, ESFPs aren't afraid to change their surroundings to reflect their personal style. ESFPs are naturally curious, exploring new designs and styles with ease. Though it may not always seem like it, ESFPs know that it's not all about them – they are observant, and very sensitive to others' emotions. People with this personality type are often the first to help someone talk out a challenging problem, happily providing emotional support and practical advice. However, if the problem is about them, ESFPs are more likely to avoid a conflict altogether than to address it head-on. ESFPs usually love a little drama and passion, but not so much when they are the focus of the criticisms it can bring.

The biggest challenge ESFPs face is that they are often so focused on immediate pleasures that they neglect the duties and responsibilities that make those luxuries possible. Complex analysis, repetitive tasks, and matching statistics to real consequences are not easy activities for ESFPs. They'd rather rely on luck or opportunity, or simply ask for help from their extensive circle of friends. It is important for ESFPs to challenge themselves to keep track of long-term things like their retirement plans or sugar intake – there won't always be someone else around who can help to keep an eye on these things. ESFPs recognize value and quality, which on its own is a fine trait. In combination with their tendency to be poor planners though, this can cause them to live beyond their means, and credit cards are especially dangerous. More focused on leaping at opportunities than in planning out long-term goals, ESFPs may find that their inattentiveness has made some activities unaffordable. There's nothing that makes ESFPs feel quite as unhappy as realizing that they are boxed in by circumstance, unable to join their friends. ESFPs are welcome wherever there's a need for laughter, playfulness, and a volunteer to try something new and fun – and there's no greater joy for ESFP personalities than to bring everyone else along for the ride. ESFPs can chat for hours, sometimes about anything but the topic they meant to talk about, and share their loved ones' emotions through good times and bad. If they can just remember to keep their ducks in a row, they'll always be ready to dive into all the new and exciting things the world has to offer, friends in tow.

ENFP - The Champion

The ENFP personality is a true free spirit. They are often the life of the party, but unlike Explorers, they are less interested in the sheer excitement and pleasure of the moment than they are in enjoying the social and emotional connections they make with others. Charming, independent, energetic and compassionate, the 7% of the population that they comprise can certainly be felt in any crowd. More than just sociable people-pleasers though, ENFPs, like all their Diplomat cousins, are shaped by their Intuitive (N) quality, allowing them to read between the lines with curiosity and energy. They tend to see life as a big, complex puzzle where everything is connected – but unlike Analysts, who tend to see that puzzle as a series of systemic machinations, ENFPs see it through a prism of emotion, compassion and mysticism, and are always looking for a deeper meaning. ENFPs are fiercely independent, and much more than stability and security, they crave creativity and freedom. Many other types are likely to find these qualities irresistible, and if they've found a cause that sparks their imagination, ENFPs will bring an energy that oftentimes thrusts them into the spotlight, held up by their peers as a leader and a guru – but this isn't always where independence-loving ENFPs want to be. Worse still if they find themselves beset by the administrative tasks and routine maintenance that can accompany a leadership position. ENFPs' self-esteem is dependent on their ability to come up with original solutions, and they need to know that they have the freedom to be innovative – they can quickly lose patience or become dejected if they get trapped in a boring role.

Luckily, ENFPs know how to relax, and they are perfectly capable of switching from a passionate, driven idealist in the workplace to that imaginative and enthusiastic free spirit on the dance floor, often with a suddenness that can surprise even their closest friends. Being in the mix also gives them a chance to connect emotionally with others, giving them cherished insight into what motivates their friends and colleagues. They believe that everyone should take the time to recognize and express their feelings, and their empathy and sociability make that a natural conversation topic. The ENFP personality type needs to be careful, however – if they rely too much on their intuition, assume or anticipate too much about a friend's motivations, they can misread the signals and frustrate plans that a more straightforward approach would have made simple. This kind of social stress is the bugbear that keeps harmony-focused Diplomats awake at night. ENFPs are very emotional and sensitive, and when they step on someone's toes, they both feel it. ENFPs will spend a lot of time exploring social relationships, feelings and ideas before they find something that really rings true. But when they finally do find their place in the world, their imagination, empathy and courage are likely to produce incredible results.

ENTP - The Visionary

The ENTP personality type is the ultimate devil's advocate, thriving on the process of shredding arguments and beliefs and letting the ribbons drift in the wind for all to see. Unlike their more determined Judging (J) counterparts, ENTPs don't do this because they are trying to achieve some deeper purpose or strategic goal, but for the simple reason that it's fun. No one loves the process of mental sparring more than ENTPs, as it gives them a chance to exercise their effortlessly quick wit, broad accumulated knowledge base, and capacity for connecting disparate ideas to prove their points. An odd juxtaposition arises with ENTPs, as they are uncompromisingly honest, but will argue tirelessly for something they don't actually believe in, stepping into another's shoes to argue a truth from another perspective. Playing the devil's advocate helps people with the ENTP personality type to not only develop a better sense of others' reasoning, but a better understanding of opposing ideas – since ENTPs are the ones arguing them. This tactic shouldn't be confused with the sort of mutual understanding Diplomats seek – ENTPs, like all Analyst personality types, are on a constant quest for knowledge, and what better way to gain it than to attack and defend an idea, from every angle, from every side? Taking a certain pleasure in being the underdog, ENTPs enjoy the mental exercise found in questioning the prevailing mode of thought, making them irreplaceable in reworking existing systems or shaking things up and pushing them in clever new directions. However, they'll be miserable managing the day-to-day mechanics of actually implementing their suggestions.

ENTP personalities love to brainstorm and think big, but they will avoid getting caught doing the "grunt work" at all costs. ENTPs only make up about three percent of the population, which is just right, as it lets them create original ideas, then step back to let more numerous and fastidious personalities handle the logistics of implementation and maintenance. ENTPs' capacity for debate can be a vexing one – while often appreciated when it's called for, it can fall painfully flat when they step on others' toes by say, openly questioning their boss in a meeting, or picking apart everything their significant other says. This is further complicated by ENTPs' unyielding honesty, as this type doesn't mince words and cares little about being seen as sensitive or compassionate. Likeminded types get along well enough with people with the ENTP personality type, but more sensitive types, and society in general, are often conflict-averse, preferring feelings, comfort, and even white lies over unpleasant truths and hard rationality. This frustrates ENTPs, and they find that their quarrelsome fun burns many bridges, oftentimes inadvertently, as they plough through others' thresholds for having their beliefs questioned and their feelings brushed aside. Treating others as they'd be treated, ENTPs have little tolerance for being coddled, and dislike when people beat around the bush, especially when asking a favour.

ENTP personalities find themselves respected for their vision, confidence, knowledge, and keen sense of humour, but often struggle to utilize these qualities as the basis for deeper friendships and romantic relationships. ENTPs have a longer road than most in harnessing their natural abilities – their intellectual independence and free-form vision are tremendously valuable when they're in charge, or at least have the ear of someone who is, but getting there can take a level of follow-through that ENTPs struggle with. Once they've secured such a position, ENTPs need to remember that for their ideas to come to fruition, they will always depend on others to assemble the pieces – if they've spent more time "winning" arguments than they have building consensus, many ENTPs will find they simply don't have the support necessary to be successful. Playing devil's advocate so well, people with this personality type may find that the most complex and rewarding intellectual challenge is to understand a more sentimental perspective, and to argue consideration and compromise alongside logic and progress.

ESTJ - The Supervisor

ESTJs are representatives of tradition and order, utilizing their understanding of what is right, wrong and socially acceptable to bring families and communities together. Embracing the values of honesty, dedication and dignity, people with the ESTJ personality type are valued for their clear advice and guidance, and they happily lead the way on difficult paths. Taking pride in bringing people together, ESTJs often take on roles as community organizers, working hard to bring everyone together in celebration of cherished local events, or in defence of the traditional values that hold families and communities together. Demand for such leadership is high in democratic societies, and forming no less than 11% of the population, it's no wonder that many of America's presidents have been ESTJs. Strong believers in the rule of law and authority that must be earned, ESTJ personalities lead by example, demonstrating dedication and purposeful honesty, and an utter rejection of laziness and cheating, especially in work. If anyone declares hard, manual work to be an excellent way to build character, it is ESTJs. ESTJs are aware of their surroundings and live in a world of clear, verifiable facts – the surety of their knowledge means that even against heavy resistance, they stick to their principles and push an unclouded vision of what is and is not acceptable. Their opinions aren't just empty talk either, as ESTJs are more than willing to dive into the most challenging projects, improving action plans and sorting details along the way, making even the most complicated tasks seem easy and approachable.

However, ESTJs don't work alone, and they expect their reliability and work ethic to be reciprocated – people with this personality type meet their promises, and if partners or subordinates jeopardize them through incompetence or laziness, or worse still, dishonesty, they do not hesitate to show their wrath. This can earn them a reputation for inflexibility, a trait shared by all Sentinels, but it's not because ESTJs are arbitrarily stubborn, but because they truly believe that these values are what make society work. ESTJs are classic images of the model citizen: they help their neighbours, uphold the law, and try to make sure that everyone participates in the communities and organizations they hold so dear. The main challenge for ESTJs is to recognize that not everyone follows the same path or contributes in the same way. A true leader recognizes the strength of the individual, as well as that of the group, and helps bring those individuals' ideas to the table. That way, ESTJs really do have all the facts, and are able to lead the charge in directions that work for everyone.

ESFJ - The Provider

People who share the ESFJ personality type are, for lack of a better word, popular – which makes sense, given that it is also a very common personality type, making up twelve percent of the population. In high school, ESFJs are the cheerleaders and the quarterbacks, setting the tone, taking the spotlight and leading their teams forward to victory and fame. Later in life, ESFJs continue to enjoy supporting their friends and loved ones, organizing social gatherings and doing their best to make sure everyone is happy.

At their hearts, ESFJ personalities are social creatures, and thrive on staying up to date with what their friends are doing. Discussing scientific theories or debating European politics isn't likely to capture ESFJs' interest for too long. ESFJs are more concerned with fashion and their appearance, their social status and the standings of other people. Practical matters and gossip are their bread and butter, but ESFJs do their best to use their powers for good. ESFJs are altruists, and they take seriously their responsibility to help and to do the right thing.

Unlike their Diplomat relatives however, people with the ESFJ personality type will base their moral compass on established traditions and laws, upholding authority and rules, rather than drawing their morality from philosophy or mysticism. It's important for ESFJs to remember though, that people come from many backgrounds and perspectives, and what may seem right to them isn't always an absolute truth.

ESFJs love to be of service, enjoying any role that allows them to participate in a meaningful way, so long as they know that they are valued and appreciated. This is especially apparent at home, and ESFJs make loyal and devoted partners and parents. ESFJ personalities respect hierarchy, and do their best to position themselves with some authority, at home and at work, which allows them to keep things clear, stable and organized for everyone. Supportive and outgoing, ESFJs can always be spotted at a party – they're the ones finding time to chat and laugh with everyone!

But their devotion goes further than just breezing through because they have to. ESFJs truly enjoy hearing about their friends' relationships and activities, remembering little details and always standing ready to talk things out with warmth and sensitivity. If things aren't going right, or there's tension in the room, ESFJs pick up on it and to try to restore harmony and stability to the group. Being pretty conflict-averse, ESFJs spend a lot of their energy establishing social order, and prefer plans and organized events to open-ended activities or spontaneous get-togethers. People with this personality type put a lot of effort into the activities they've arranged, and it's easy for ESFJs' feelings to be hurt if their ideas are rejected, or if people just aren't interested.

Again, it's important for ESFJs to remember that everyone is coming from a different place, and that disinterest isn't a comment about them or the activity they've organized – it's just not their thing. Coming to terms with their sensitivity is ESFJs' biggest challenge – people are going to disagree and they're going to criticize, and while it hurts, it's just a part of life. The best thing for ESFJs to do is to do what they do best: be a role model, take care of what they have the power to take care of, and enjoy that so many people do appreciate the efforts they make.

ENFJ - The Giver

ENFJs are natural-born leaders, full of passion and charisma. Forming around two percent of the population, they are oftentimes our politicians, our coaches and our teachers, reaching out and inspiring others to achieve and to do good in the world. With a natural confidence that begets influence, ENFJs take a great deal of pride and joy in guiding others to work together to improve themselves and their community. People are drawn to strong personalities, and ENFJs radiate authenticity, concern and altruism, unafraid to stand up and speak when they feel something needs to be said. They find it natural and easy to communicate with others, especially in person, and their Intuitive (N) trait helps people with the ENFJ personality type to reach every mind, be it through facts and logic or raw emotion.

ENFJs easily see people's motivations and seemingly disconnected events, and are able to bring these ideas together and communicate them as a common goal with an eloquence that is nothing short of mesmerizing. The interest ENFJs have in others is genuine, almost to a fault – when they believe in someone, they can become too involved in the other person's problems, place too much trust in them. Luckily, this trust tends to be a self-fulfilling prophecy, as ENFJs' altruism and authenticity inspire those they care about to become better themselves. But if they aren't careful, they can overextend their optimism, sometimes pushing others further than they're ready or willing to go.

ENFJs are vulnerable to another snare as well: they have a tremendous capacity for reflecting on and analysing their own feelings, but if they get too caught up in another person's plight, they can develop a sort of emotional hypochondria, seeing other people's problems in themselves, trying to fix something in themselves that isn't wrong. If they get to a point where they are held back by limitations someone else is experiencing, it can hinder ENFJs' ability to see past the dilemma and be of any help at all. When this happens, it's important for ENFJs to pull back and use that self-reflection to distinguish between what they really feel, and what is a separate issue that needs to be looked at from another perspective.

ENFJs are genuine, caring people who talk the talk and walk the walk, and nothing makes them happier than leading the charge, uniting and motivating their team with infectious enthusiasm. People with the ENFJ personality type are passionate altruists, sometimes even to a fault, and they are unlikely to be afraid to take the slings and arrows while standing up for the people and ideas they believe in. It is no wonder that many famous ENFJs are US Presidents – this personality type wants to lead the way to a brighter future, whether it's by leading a nation to prosperity, or leading their little league softball team to a hard-fought victory.

ENTJ - The Commander

ENTJs are natural-born leaders. People with this personality type embody the gifts of charisma and confidence, and project authority in a way that draws crowds together behind a common goal. But unlike their Feeling (F) counterpart, ENTJs are characterized by an often ruthless level of rationality, using their drive, determination and sharp minds to achieve whatever end they've set for themselves. Perhaps it is best that they make up only three percent of the population, lest they overwhelm the more timid and sensitive personality types that make up much of the rest of the world – but we have ENTJs to thank for many of the businesses and institutions we take for granted every day. If there's anything ENTJs love, it's a good challenge, big or small, and they firmly believe that given enough time and resources, they can achieve any goal.

This quality makes people with the ENTJ personality type brilliant entrepreneurs, and their ability to think strategically and hold a long-term focus while executing each step of their plans with determination and precision makes them powerful business leaders. This determination is often a self-fulfilling prophecy, as ENTJs push their goals through with sheer willpower where others might give up and move on, and their Extraverted (E) nature means they are likely to push everyone else right along with them, achieving spectacular results in the process.

At the negotiating table, be it in a corporate environment or buying a car, ENTJs are dominant, relentless, and unforgiving. This isn't because they are cold-hearted or vicious per se – it's more that ENTJ personalities genuinely enjoy the challenge, the battle of wits, the repartee that comes from this environment, and if the other side can't keep up, that's no reason for ENTJs to fold on their own core tenet of ultimate victory. The underlying thought running through the ENTJ mind might be something like "I don't care if you call me an insensitive b*****d, as long as I remain an efficient b*****d".

If there's anyone ENTJs respect, it's someone who is able to stand up to them intellectually, who is able to act with a precision and quality equal to their own. ENTJ personalities have a particular skill in recognizing the talents of others, and this helps in both their team-building efforts (since no one, no matter how brilliant, can do everything alone), and to keep ENTJs from displaying too much arrogance and condescension. However, they also have a particular skill in calling out others' failures with a chilling degree of insensitivity, and this is where ENTJs really start to run into trouble.

Emotional expression isn't the strong suit of any Analyst type, but because of their Extraverted (E) nature, ENTJs' distance from their emotions is especially public, and felt directly by a much broader swath of people. Especially in a professional environment, ENTJs will simply crush the sensitivities of those they view as inefficient, incompetent or lazy. To people with the ENTJ personality type, emotional displays are displays of weakness, and it's easy to make enemies with this approach – ENTJs will do well to remember that they absolutely depend on having a functioning team, not just to achieve their goals, but for their validation and feedback as well, something ENTJs are, curiously, very sensitive to.

ENTJs are true powerhouses, and they cultivate an image of being larger than life – and often enough they are. They need to remember though, that their stature comes not just from their own actions, but from the actions of the team that props them up, and that it's important to recognize the contributions, talents and needs, especially from an emotional perspective, of their support network. Even if they have to adopt a "fake it 'til you make it" mentality, if ENTJs are able to combine an emotionally healthy focus alongside their many strengths, they will be rewarded with deep, satisfying relationships and all the challenging victories they can handle.

Discussing Feelings

Because children have fears, which can be more intense than those of an adult, they are discussed by the instructor during the Child Survival lecture. The following words are addressed to the students, and elaborated. Talking about FEELINGS, and knowing how to deal with them, is very important. Nobody likes being scared or frightened. Help yourself keep calm by singing, whistling or even telling yourself jokes or stories. Do anything it takes to make yourself feel better. Try using your imagination to pretend you are somewhere else that you really enjoy. You usually do not have to worry about wild animals. They do not like to be near people. If they hear or smell you, they will usually run away. A good rule is 'Answer a Noise with a Noise'. If you hear a noise in the woods, make a noise back. If it is an animal it will run away, if it is a searcher then you will be found. The fear of dark can be easily overcome by memorizing your surroundings during daylight so that you can see with your memory when it gets dark. Nothing changes just because it gets dark. Try practicing in your bedroom. There is no punishment for being lost and yet children have been known to hide or run away from searchers in fear of punishment. Children should not have any fear of returning home. Mum and Dad, or whoever is looking after you are going to be very happy to see you again. There will be NO punishment. There are Friendly strangers who will help you when needed. Some of these are police officers, fire fighters, ambulance personnel and Search and Rescue teams. Generally, these Friendly strangers always work in groups.

Child Survival Kit

During the presentation of this Child Survival lecture, the instructor would show the students each item and how it is made. For instance the reflector is tin foil pasted to cardboard (no sharp edges), and, the right and safe way to tear a face hole in the bright orange garbage bag is demonstrated.

Make an Emergency Survival Kit (and practice using it):
- A Zip Lock sandwich bag for the container (also used as a cup for drinking water)
- A snack of high energy trail mix (contained in its own zip lock bag)
- A whistle used for calling for help (three short blasts)
- A signal flag that can be cut from orange plastic garbage bag
- A reflector for sending signals (use soft, flexible material)
- A large, bright colour garbage bag used as poncho (pre-tear slit for face opening - Do not "cut" hole)

The 9 Rules for Survival

Prepare yourself and your Child	Child survival needs adult assistance. You can help children learn what to do if they get lost in the woods, by discussing and practicing the "Rules for Survival". Nobody ever expects to get lost, but it happens. Hopefully, this information will ensure a safe return of your child should this misfortune ever occur.
Stay Together, do not Separate - if with a friend or pet.	The reason for this rule is body heat. Cuddling up to a large dog or friend will help keep you warm. If with a dog, do not let it run loose, it can help you more by staying close and providing heat and companionship.
Stay in one place or area, do not wander	This is the MOST important rule of them all. If you wander - We Can not Find You. One reason is that people looking for you move very slowly while searching for clues. If you are out front running along, we won't be able to catch up. Another reason for not wandering is the possibility of falling and hurting yourself while travelling. Being lost and hurt could be tragic.
Keep Warm	This rule means to keep warm with the clothes you are wearing. NEVER take any clothes off. Cover up all the exposed skin you can. If you are wearing a sweater or jacket, do it up. Watch out for your shoe laces. Branches have a tricky way of undoing them. The most important part of your clothing is a hat or something that covers your head. Over 70% of all your body heat escapes through your head.
Find a Cosy Waiting Place, Not a Hiding Place.	A cosy waiting place means, a warm place out of the wind and rain but not a place where searchers can not see you. Under a large tree is a good place.
Put Out Something Bright	Put out something bright or make something to tell people searching for you where you are. Make a flag using what you have, but do not take off any clothes to do so. Some suggestions are white paper, money, hair ribbons, a strip from an orange garbage bag, etc. Spell the word "HELP" or "SOS" on the ground using rocks and sticks or make a large arrow with them, pointing to where you are. Do anything to attract attention!
Look Bigger For Searchers	If possible, your waiting place should be near an open space. When you hear someone coming or a helicopter overhead, move to the middle of the clearing and call. Do Not Run in the direction of the noise. If it is an aircraft you heard, lie down so the pilot has a bigger target to look at. Then wave with both your arms and legs, like making an angel in the snow. Stand up immediately after the aircraft has passed, as the ground can be very cold.
Do Not Lie on the Bare Ground	The only exception to this rule is the one above. Laying on the cold ground for a very short period of time, attracting attention, is OK. Being in direct contact with the ground for any length of time is dangerous. The cold ground can rob precious body heat from you. Build a mattress using available materials such as branches, moss, leaves, etc. This mattress should be as thick as the mattress you sleep on at home! After the mattress is completed, gather the same amount or more, of the same material and use it for the blankets. This is called a survival bed.
Do Not Eat Anything you are not sure of	Do Not eat any berries, mushrooms or anything else unless you are 100% sure what they are. Being hungry is not too bad of a feeling compared with being violently sick. And remember, there won't be anyone there to look after you. You can go without food for a long time, but you cannot go without water.
Stay Away from Large Rivers and Lakes	You must have drinking water to survive, but be careful where you get it from. Do Not go near any large bodies of water. Instead, drink from a water supply that is smaller than you are, so you can not fall in. Another source of water can be found on leaves in the form of dew.

5 Global Firepower

This is an estimation of a countries military power and other details about the military. The statistics may be out dated numerically however the general order of superpowers will typically remain the same. This section is aimed at giving you an estimate at each countries military power if a war does break out. If certain countries join forces you can combine the military power and do basic checks to estimate who will win the conflict. This will only be correct however if a country doesn't have a game-changing weapon like the nuclear bomb was in 1945. The information of each country has been compressed to fit into 11 rows total. Countries are listed by power index - The strongest to the weakest.

Last Update
16 May 2018[n]

Rankings

	Power Index 0.0000 is Perfect.	Total Population The total population of the country.	Fit-for-Service Those who are fit to fight, elderly, disabled and youth removed.	Total Military Personnel The number of current serving members.	Airforce Strength The combined strength of Airforce.	Army Strength The combined strength of the Army.	Navy Strength The total number of Navy assets.	Labour Force The size of the labour force.	Defence Budget How much the country has to spend on defence. (USD)	External Debt The external debt of the country. (USD)	Square Land Area The amount of land in the country. (Km)
United States	0.0818	326,625,791	120,025,000	2,083,100	13,362	47,648	415	160,400,000	647 Billion	17.9 Trillion	9,826,675
Russia	0.0841	142,257,519	47,000,000	3,586,128	3,914	61,952	352	76,530,000	47 Billion	451.5 Billion	17,098,242
China	0.0852	1,379,302,771	619,000,000	2,693,000	3,035	27,014	714	806,700,000	151 Billion	1.6 Trillion	9,596,961
India	0.1417	1,281,935,911	489,600,000	4,207,250	2,185	12,187	295	521,900,000	47 Billion	483.4 Billion	3,287,263
France	0.1869	67,106,161	23,750,000	388,635	1,262	6,870	118	30,680,000	40 Billion	5.3 Trillion	643,801
United Kingdom	0.1917	64,769,452	24,040,000	279,230	832	5,848	76	33,500,000	50 Billion	8.1 Trillion	243,610
South Korea	0.2001	51,181,299	21,035,000	5,827,250	1,560	12,092	166	27,470,000	40 Billion	376.9 Billion	99,720
Japan	0.2107	126,451,398	44,000,000	310,457	1,508	4,658	131	67,770,000	44 Billion	3.2 Trillion	377,915
Turkey	0.2216	80,845,215	35,010,000	710,565	1,056	13,875	194	31,300,000	10.2 Billion	429.6 Billion	783,562
Germany	0.2461	80,594,017	29,540,000	208,641	714	5,213	81	45,900,000	45.2 Billion	5.3 Trillion	357,022
Italy	0.2565	62,137,802	22,600,000	267,500	828	11,163	143	25,940,000	37.7 Billion	2.4 Trillion	301,340
Egypt	0.2751	97,041,072	35,306,000	1,329,250	1,132	25,185	319	29,950,000	4.4 Billion	76.3 Billion	1,001,450
Iran	0.3131	82,021,564	39,570,000	934,000	505	8,026	398	30,500,000	6.3 Billion	10.5 Billion	1,648,195
Brazil	0.3198	207,353,391	84,000,000	1,987,000	723	3,031	110	111,600,000	29.3 Billion	554.5 Billion	8,514,877
Indonesia	0.3266	260,580,739	107,540,000	975,750	478	2,163	221	126,100,000	6.9 Billion	322.6 Billion	1,904,569
Israel	0.3444	8,299,706	3,000,000	615,000	596	14,433	65	4,021,000	20 Billion	93 Billion	20,770
Pakistan	0.3689	204,924,861	75,325,000	919,000	1,281	6,477	197	63,890,000	7 Billion	75.6 Billion	796,095
North Korea	0.3876	25,248,140	10,100,000	6,445,000	944	26,728	967	14,000,000	7.5 Billion	5 Billion	120,538
Spain	0.4079	48,958,159	18,725,000	174,700	524	3,059	46	22,750,000	11.6 Billion	2 Trillion	505,370
Vietnam	0.4098	96,160,163	41,505,000	5,488,500	283	8,519	65	56,460,000	3.3 Billion	91.9 Billion	331,210
Australia	0.4203	23,232,413	8,800,000	79,700	469	2,174	47	12,910,000	26.3 Billion	1.6 Trillion	7,741,220
Poland	0.4276	38,476,269	15,585,000	184,650	466	4,428	83	17,600,000	9.3 Billion	362 Billion	312,684
Algeria	0.4296	40,969,443	17,250,000	792,350	528	9,825	85	11,820,000	10.5 Billion	8.1 Billion	2,381,741
Taiwan	0.4331	23,508,428	10,030,000	1,932,500	843	8,069	87	11,780,000	10.7 Billion	204.7 Billion	35,980
Canada	0.4356	35,623,680	13,025,000	88,000	413	3,245	63	19,520,000	16.4 Billion	1.6 Trillion	9,984,670
Saudi Arabia	0.4636	28,571,770	14,000,000	256,000	844	7,892	55	12,340,000	56.7 Billion	212.9 Billion	2,149,690
Thailand	0.4735	68,414,135	27,500,000	627,425	565	4085	81	38,370,000	5.3 Billion	135.5 Billion	513,120
Greece	0.5255	10,768,477	4,050,000	413,750	567	6,716	115	4,769,000	6.5 Billion	506.6 Billion	131,957
Ukraine	0.5383	44,033,874	15,700,000	1,182,000	240	17,678	25	17,990,000	4.8 Billion	125.3 Billion	603,550
Czech Republic	0.5969	10,674,723	4,062,000	29,050	103	820	0	5,427,000	2.6 Billion	145.8 Billion	78,867
Term Descriptions	Power Index	Total Population	Fit-for-Service	Total Military Personnel	Airforce Strength	Army Strength	Navy Strength	Labour Force	Defence Budget (USD)	External Debt (USD)	Square Land Area (Km)

6 Prepper Circle

A prepper circle is a small band of people (typically 1-7) whom you prep and practice with, share tips, resources and bug-out with if the time comes. They are trusted completely. Try to limit your prepper circle to 2-8 people or it may become overwhelming to deal with and control them. The smaller the less rebellion there could be during SHTF.

You (1 Person)	The only person you can absolutely trust and share your darkest secrets with.	Can trust this person
Spouse (1 person)	The second most important person in your life, you can typically put your life in their hands. It's best to share prepping with this person if you're married.	Can trust this person
Immediate Family (1-6 people)	The family that raised you from birth including parents and siblings. You can share prepping with them if you believe they will be of benefit to you.	Can usually trust these people
Closest Friends (1-4 people)	These people could be much more like-minded than family members and support your prepping completely.	Can usually trust these people
Extended Family	Grandparents, Aunts, Uncles and Cousins. It's strongly advised against telling these people you are prepared unless they also prep. A few could be included in your circle if needed.	Can sometimes be trusted
Skilled Individuals (1-5 people)	People who aren't your friends yet but live nearby and have useful skills such as welding, farming, hunting, law enforcement and more.	Rarely to be trusted
Neighbours (2-8 people)	These people are outsiders who you may or may not have met which could be beneficial during SHTF to help protect your street from looters if bugging in.	Not to be trusted
Citizens	Everybody else not covered. These people can't be trusted at all and you must be wary around them, they may try to loot or kill you - never have them in your circle.	Not to be trusted

Other People

Blue Collar Workers	A working class person who performs manual labour. Blue-collar work may involve skilled or unskilled manufacturing, mining, sanitation, custodial work, textile manufacturing, commercial fishing, food processing, oil field work, waste disposal, and recycling, construction, mechanic, maintenance, warehousing, technical installation, and many other types of physical work. Blue-collar work often involves something being physically built or maintained.
White Collar Workers	A white-collar worker is a person who performs professional, managerial, or administrative work. White-collar work may be performed in an office or other administrative setting.
Pink Collar Workers	In the United States and (at least some) other English-speaking countries, a pink-collar worker refers to someone working in the care-oriented career field or in jobs historically considered to be "women's work." This may include jobs in nursing, teaching, secretarial work, waitressing, or child care.
Green Collar Workers	A green-collar worker is a worker who is employed in the environmental sectors of the economy. Environmental green-collar workers (or green jobs) satisfy the demand for green development. Generally, they implement environmentally conscious design, policy, and technology to improve conservation and sustainability.
Grey Collar Workers	Grey-collar refers to the balance of employed people not classified as white- or blue collar. It is used to refer to occupations that incorporate some of the elements of both blue- and white-collar, and generally are in between the two categories in terms of income-earning capability. Grey-collar workers often have licenses, associate degrees or diplomas from a trade or technical school in a particular field. They are unlike blue-collar workers in that blue-collar workers can often be trained on the job within several weeks whereas grey-collar workers already have a specific skill set and require more specialized knowledge than their blue-collar counterparts.

Law Enforcement	
Hobos	
Mobs/Gangs	

7 Gangs

These are the types of gangs that operate around the world and their goals.

Drug Cartel	A drug cartel is any criminal organization with the intention of supplying drug trafficking operations. They range from loosely managed agreements among various drug traffickers to formalized commercial enterprises.
Organized Crime	Organized crime is a category of transnational, national, or local groupings of highly centralized enterprises run by criminals who intend to engage in illegal activity, most commonly for money and profit.
Outlaw Motorcycle Club	An outlaw motorcycle club is a motorcycle subculture that has its roots in the immediate post-World War II era of American society. It is generally cantered on the use of cruiser motorcycles, particularly Harley-Davidsons and choppers, and a set of ideals that celebrate freedom, nonconformity to mainstream culture, and loyalty to the biker group.
Prison Gang	A prison gang is an inmate organization that operates within a prison system. It has a corporate entity and exists into perpetuity. Its membership is restrictive, mutually exclusive, and often requires a lifetime commitment. Prison officials and others in law enforcement use the euphemism "security threat group" (or "STG").
American Mafia	The American Mafia (commonly referred to as the Mafia or the Mob) or Italian-American Mafia, is the highly organized Italian-American criminal society. The organization is often referred to by members as Cosa Nostra and by the government as La Cosa Nostra (LCN).
Mexican Mafia	The Mexican Mafia (Spanish: Mafia Mexicana), also known as La Eme (Spanish for "the M"), is a highly organized Mexican American criminal organization in the United States. Despite its name, the Mexican Mafia did not originate in Mexico, and is entirely a U.S. criminal prison organization. Sureño gangs use the number 13 to show allegiance to the Mexican Mafia, as M is the 13th letter of the alphabet.
Russian Mafia	Russian organized crime or Russian mafia, sometimes referred to as Bratva (Russian: братва: "brotherhood"), is a collective of various organized crime elements originating in the former Soviet Union. The acronym OPG is Organized Criminal Group, used to refer to any of the Russian mafia groups, sometimes modified with a specific name, e.g. Orekhovskaya OPG. Sometimes the acronym is translated and OCG is used.
Sicilian Mafia	The Sicilian Mafia, also known as simply the Mafia and frequently referred to by members as Cosa Nostra, is a Mafia-terrorist-type organized crime syndicate based in Sicily, Italy. It is a loose association of criminal groups that share a common organisational structure and code of conduct. The basic group is known as a "family", "clan", or "cosca". Each family claims sovereignty over a territory, usually a town or village or a neighbourhood (borgata) of a larger city, in which it operates its rackets.

Gangs Per Country

This is a list of gangs operating in each country.

America	• 14K Triad • 38th Street gang • Abergil crime family • Albanian mafia • Almighty Black P. Stone Nation • Almighty Vice Lord Nation • Armenian Power • Bandidos Motorcycle Club • Barker–Karpis gang • Black Disciples • Black Dragons • Bloods • The Breed Motorcycle Club • Chaldean Mafia • Chicago Gaylords	• Crips • Diablos Motorcycle Club • Dominicans Don't Play • Dotbusters • El Forastero Motorcycle Club • Four Corner Hustlers • Free Souls Motorcycle Club • Freight Train Riders of America • Friends Stand United • Galloping Goose Motorcycle Club • Fullerton Boys • Grim Reapers Motorcycle Club (USA) • Gypsy Joker Motorcycle Club • Hammerskins • Hells Angels	• Hidden Valley Kings • Highwaymen Motorcycle Club • Iron Horsemen • La Raza Nation • Latin Eagles • Latin Kings • Los Solidos • Mickey Cobras • Ñetas • Nine Trey Gangsters • Norteños • Outlaws Motorcycle Club • OVS • Pagan's Motorcycle Club • Playboys (gang)	• Sex Money Murda • Silver Dollar Group • Simon City Royals • Sons of Silence • Spanish Gangster Disciples • The Stopwatch Gang • Sureños • TAP Boyz • The Dillinger Gang • Tiny Rascal Gang • Vagos Motorcycle Club • Vatos Locos • Wah Ching
Albania	• Albanian Mafia • Gang of Çole • Gang of Gaxhai • Gang of Pusi i Mezinit			
Argentina	• Ashkenazum • Pincheira Brothers • Puccio Family • Zwi Migdal			
Australia	• Bandidos • Coffin Cheaters • Comanchero • DLASTHR	• Finks • Black Bandits • Gypsy Joker • Hells Angels	• Nomads • Notorious • Rebels	
Belgium	• Albanian Mafia • Bandidos Motorcycle Club • Blue Angels Motorcycle Club	• Brabant Killers • Hells Angels • Outlaws Motorcycle Club	• Scarface gang • Sun Yee On • Turkish mafia	
Brazil	• Amigos dos Amigos • Cangaço • Comando Vermelho	• Hells Angels • Pacifying Police Unit • Primeiro Comando da Capital	• Sun Yee On • Terceiro Comando • Terceiro Comando Puro	

Canada	• 14K Triad • 18th Street gang • 856 gang • Aboriginal-based organized crime (Canada) • Albanian mafia • Almighty Vice Lord Nation • Bandidos Motorcycle Club • Crips	• Dixon Bloods • Flying Dragons (gang) • Grim Reapers Motorcycle • Club (Canada) • Hammerskins • Hells Angels • Indo-Canadian organized crime • Latin Kings (gang)	• Lynx gang • Manitoba Warriors - 1323 • Mara (gang) • Markham Gang • Mickey Cobras • Mongols Motorcycle Club • MS-13 • Outlaws Motorcycle Club	
Chile	• Lanzas Chilenos			
China	• Big Circle Gang • Four Seas Gang			
Columbia	• Bacrims • The Black Eagles • Los Rastrojos • Clan del Golfo • FARC dissidents • Oficina de Envigado			
Denmark	• AK81 • Albanian Mafia • Bandidos Motorcycle Club	• Black Cobra (gang) • Hells Angels • Serb mafia in Scandinavia		
France	• Corsican Mafia • The Affair of the Gang of Barbarians • Albanian mafia • Apaches (subculture) • Bandidos Motorcycle Club • Bonnot Gang • Cape Verdean organized crime	• Corsican mafia • Gang de la Brise de Mer • Gang des postiches • Gang des Tractions Avant • Hammerskins • Hells Angels • Hornec gang	• 2015 Marseille shooting • Outlaws Motorcycle Club • Scarface gang • Sun Yee On • Turkish mafia • Unione Corse	
India	• Chaddi Baniyan gang • D-Company • Kala Kaccha gang • Thuggee			
Italy	• Banda della Magliana • Mongols Motorcycle Club • Albanian mafia	• Bandidos Motorcycle Club • Hammerskins • Hells Angels	• Mongols Motorcycle Club • Outlaws Motorcycle Club • Rebels Motorcycle Club	
Kenya	• Mungiki • Sabaot Land Defence Force			
Mexico	• Juárez Cartel • Mongols Motorcycle Club • Sinaloa Cartel	• Tijuana Cartel • Beltrán-Leyva Cartel • Gulf Cartel	• Los Ántrax • Los Negros • Sonora Cartel	
Netherlands	• Ah Kong • Bandidos Motorcycle Club • Black Jackets • Cape Verdean organized crime • Hammerskins	• Hells Angels • Hopi Boys • Lanzas Chilenos • No Limit Soldiers (organized crime group) • Penose	• Rebels Motorcycle Club • Satudarah • Scarface Gang • Sun Yee On	
New Zealand	• 14K Triad • Black Power (New Zealand gang) • Fourth Reich (New Zealand gang) • Gang Patch • Hammerskins • Head Hunters MC	• Hells Angels • Highway 61 Motorcycle Club • Killer Beez (gang) • King Cobras (gang) • Lone Legion Brotherhood • Lost Breed	• Mongrel Mob • New Zealand Nomads • Rebels Motorcycle Club • Road Knights • Tongan Crip Gang • Tribesmen Motorcycle Club	
Nigeria	• Area Boys • Bakassi Boys • One Million Boys			
Norway	• Bandidos Motorcycle Club • Gypsy Joker Motorcycle Club • Hells Angels • Original Gangsters (gang) • Outlaws Motorcycle Club			
Pakistan	• Chotu gang • D-Company			
Russia	• A.U.E. • GTA gang • Kazan Phenomenon • Russian Mafia • Sun Yee On • Thief in law			
South Africa	• Foster gang • Hard Livings • Khumalo gang • The Numbers Gang • Sun Yee On • The Americans			
Spain	• Albanian Mafia • Blue Angels Motorcycle Club • Galician Mafia • Garduña • Hammerskins • Hells Angels • Latin Kings (gang) • Rebels Motorcycle Club			
Sri Lanka	• Aava Gang			

Sweden	• Albanian Mafia • Bandidos Motorcycle Club • Black Cobra (gang) • Brödraskapet • Fu**ed For Life • Hammerskins	• Hells Angels • Naserligan • Original Gangsters (gang) • Outlaws Motorcycle Club Sala gang • Serb Mafia in Scandinavia		
United Kingdom	• Bandidos Motorcycle Club • Blue Angels Motorcycle Club • British Firms (organised crime) • Hells Angels • Outlaws Motorcycle Club			

Gang Details

Bloods

Originally from Los Angeles, the Bloods are one of the largest associations of street gangs in the United States. These extremely violent and aggressive street gangs, referred to as sets, have adopted a common gang philosophy. Members use violence to protect and expand their drug distribution. The sets share a comprehensive philosophy, expressed in an oath, a prayer, a song, a motto, a concept of war, and 31 common rules including an Initiation, where a new member must withstand 31 seconds of beating or sexual relations.

Identifiers
- Colours red, black, brown and pink
- B's up, C's Down
- MOB = Member of Bloods
- Dog paws made up of three dots
- CK Crip Killa
- 031 / 021
- Red, black, brown or pink bandanas and wave caps

Phrases
- Blatt Blatt
- Greetings: "What dat red be like?"
- Referred to each other as dogs
- DAMU = Brother/Blood
- DAMUETTE = Sister Bloodettes Ruby Red
- Blood Love
- What's popping?

Crips

Originally from Los Angeles, the Crips are an organization of aggressive and brutal gang members who are heavily involved in the drug trade. Throughout the 1980's and 1990's the Crips developed intricate networks and a respected reputation with other gangs across America. Crip gangs are well established across the United States.

Identifiers
- Colours blue, gray, orange and purple
- 6 Pointed Star of David
- C's up, B's down
- Blue, gray, orange or purple bandanas or wave caps
- Crip Walks
- B's crossed out

Phrases
- BK Blood Killa
- Loc (Love only crips)
- C-Ya
- Slobs (Derogatory Bloods)
- C's Up Cuzz
- What's Crackalacking?
- Refer each other as cousins

Latin Kings

Originally from Chicago, the Latin Kings are extremely violent and a well organized gang. The gang is active in New York, New Jersey and Pennsylvania. Its main source of income is from the distribution of drugs and robbery.

Identifiers
- Colours black and gold
- 3 or 5 pointed crowns
- Eyebrows cut to form five points
- Pittsburgh sports team apparel
- Yellow and black bandanas, beads or wave caps

Phrases
- Kingism
- Pee Wee King (for those under18)
- ADR Amor de rey (Love of the king)
- 360° whole, complete and unbreakable

Ñeta

Ñeta originated in the prisons of Puerto Rico and is an extremely violent gang. The group was formed to address prisoners' rights issues in the Puerto Rican prison system. In the United States, Ñeta chapters exist inside and outside of prison.

Identifiers
- The colours black, red, white and blue
- The term 150%
- Tattoo with the numbers 1.50
- Depicting shackles and handcuffs
- Beads
- Bandanas

Phrases
- DeCorazon
- Primos
- Insectos

Ms 13

Originating in Los Angeles, MS 13 is one of the most violent street gangs in the United States. Members smuggle and distribute illicit drugs and are extremely violent.

Identifiers
- Heavily tattooed
- Typical Latin gang tattoos
- "Heavy Metal" tattoos
- Blue and black bandanas

Phrases
- "La Mara" stands for Gangs
- "Salva" stands for Salvadorian
- "Trucha" stands for "look out"
- EME ESE stands for MS
- Locotes
- Cliques

POPULATION | SHTF Population

A section which will outline the types of people that could be found during an extended disaster. They are categorised into Good, Neutral and Evil types although some may be some classified in between groups.

People Categories
- Individuals
- Families
- Groups
- Village/Town

Good

Good people typically spend their time helping those around them. They refrain from stealing, killing and may give items away to those in need.

Virtuous Individual	Individuals who go around helping the needy and lending a hand to those who need it.
Virtuous Families	
Religious Groups	Those of religious faith will stick to their convictions and try to help those in need giving selflessly. They base their goodness in the knowledge that it is rewarded in heaven later. Churches will attempt to do what they can to help people in need including purifying water and giving away food.
Democratic Town	A village of like minded people who work together to farm the land and let people take refuge within their walls.

Neutral

Neutral people typically keep to themselves and don't give or take items. They follow the majority of the population and try to keep on living.

General Population	
Desperate People	These people are at a junction where they are at the point they could do anything to get what they need, but they aren't bad people. Even normal people will be so desperate for food and water that they can become criminals.

Evil

Evil people take what they want for themselves from anyone and everyone. They focus inwardly and only care to fill their current desires for themselves or for their group.

Gangs	Gangs and organized crime will be prevalent due to the desperation of common folk seeking food, water and safety.
Solo Criminals	Solo criminals work alone and do what they want to acquire what they need. Being solo they are likely to travel and steal in the cover of night.
Criminals	Criminals are classified as people who are currently acting out a criminal life. Acts may include stealing, murder, rape, destruction and terrorism. Their personality will be quick to anger, itchy trigger fingers and come across as abrasive and hateful.

9 SHTF Individual

10 SHTF Families

11 SHTF Groups

12 SHTF Towns

Here you will find information about the different types of towns in a SHTF world. Democratic towns, dictatorship towns, slave towns etc. It also contains information about setting up your own town and

Democratic Towns

Towns that use democracy and a system of voting to elect a leader.

Dictator Towns

Towns that have one primary leader who is typically the founder and cannot be changed. The word dictator typically has negative connotations as an evil ruler, but they could also be a fair and just ruler.

Slave Towns

Slave towns run on the backs of slaves who are forced to work.

Leadership

How to lead your family, small group or town post-disaster

"Leadership is your ability to hide your panic from others."
Lao Tzu

Introduction

This section focuses on how to lead different types of groups and the considerations that must be made. It dives into how you can establish a functioning town with individual jobs, roles and responsibilities.

Purpose	The aim of LEADERSHIP is to help people become strong, decisive, accountable and honest leaders who can make the tough decisions while leading their family, group or an entire town through times of disaster.
Lost?	● For information on communicating with others efficiently, see the COMMUNICATION section. ● For information on hiding from others if you're solo, see the SECURITY section. ● For a description of the different laws around the world, see the GEOGRAPHY section. ● For communication between people of other languages, see the LANGUAGE section. ● For tips and information on bugging-out when you're leading a group, see the PREPAREDNESS section. ● For preparedness skills you can learn, see the SKILLS section.

Contents

1 Self Leadership

Being comfortable with yourself and being able to set goals and work towards them is the first step in becoming a great leader. The more you can trust your skills, equipment and others, the more you can flourish in a SHTF environment.

2 Family Leadership

Family leadership is a tough form of leadership because they are still likely to see you the same way they have their whole lives. This may be a position of superiority to you, for example if you are the youngest child and they still only see you as that even if you're 40.

3 Group Leadership

4 Town Leadership

Leading an entire town may seem like a daunting task but when broken into smaller tasks it's much more achievable. The section below does just that, breaking everything down into easy to follow steps. A functioning town is much stronger than a collection of the same number of people each trying to survive on their own.

Subheadings

1. Starting Resources	2. Bounds	3. Law	4. Discipline
5. Roles & Responsibilities	6. Leading	7. Trade	

1 Starting Resources

First check if you have the resources to plant a town.

Minimum Population	Around 25+ people should be a sufficient number to start a town. You will need enough people to do all the word that is required to maintain it.
Minimum Buildings	Between 3-5 buildings should be enough to start off your town. They should be located adjacent to each other and have a road down the middle or around the outside.
Minimum Resources	Before starting a town you should have a few basic resources to ensure you can complete the journey to a successful town. 1. Enough able-bodied people to construct barriers and set up defences. 2. Skills, Knowledge and eBooks about farming, raising animals, security, etc. Or this spreadsheet. 3. Enough people to cover all the required fields and establish a 24/7 defence watch. 4. Enough food for the town's population for at least a month. 5. Enough clean water or a water source that is easily obtained to sustain people for a month. This includes washing and bathing water. 6. Guns, ammo and defensive equipment. 7. A form of contact between houses.

Goals

Setting goals for the town is essential in getting everything set up and running correctly and gives you objectives to work towards. Take a note whether they are short, mid or long term goals.

Recurring Goals
You can have goals that reoccur every so often

Importance	**Low Importance** Can be done when nothing else needs doing.	**Medium Importance** Should be completed when possible.	**High Importance** Should be done reasonably quickly.	**Critical Importance** Complete ASAP.	
Timeframe	**Short Term Goal** Should be completable within 1-3 weeks.	**Mid Term Goal** Should be completable within 1-6 months.	**Long Term Goal** Should be completable within a year or more.		
Examples	**Example Goal** Train everyone in first aid. **(High Importance)** **(Mid Term Goal)**	**Example Goal** Set up a tall barricade system around the town. **(Critical Importance)** **(Mid Term Goal)**	**Example Goal** Add security methods around the perimeter such as jingling bells and dogs in every house. **(Critical Importance)** **(Short Term Goal)**	**Example Goal** Have a population of 500. **(Low Importance)** **(Long Term)**	

Winning People
You may have to win a lot of people over to your cause before they want to join willingly. This may involve having to sacrifice resources to do so. Ultimately you want and need people to join your cause to form a stronger town, but once you're established you can be more selective.

2 Bounds

The first thing to work out is the boundary of the town and what land you consider to be yours. Be sure to research and not settle on land which is already owned to avoid conflict.

Boundary Marking	Have a way to mark the established boundaries of your land so others know not to trespass.
Fortification	Fortification of the town to allow control of who enters and leaves would be recommended to vet everyone residing within your town and those passing through. Outer boundaries could also be fortified with a fence or make use of natural barriers such as the coast, fallen trees and cliffs.

3 Law

Laws keep society held together in a package which everyone can understand. If someone isn't following the laws they either need to be disciplined or kicked out from the town. Below are some example laws which you can base your town's laws on.

LEADERSHIP | Town Leadership | Law

Citizenship	Some people may want to join your town over time and become citizens. Generally this is fine except you have to make sure they fit the prerequisites first. In fact when looking at it closely it's more of a trade. You give them safety, security, food and water in exchange for work, knowledge and sometimes resources to help sustain the village. Potential citizens should meet a few minimum number of requirements first and be on a probationary period to see how they fit into the environment. (See the prerequisites in the row below then return here) Once they have passed your minimum checks they should select their occupation based on current openings. Show them their residence and where they can store their possessions. Assign someone to give them a tour and to keep track of them and how they are faring in this new environment. After your assigned probation period is up, you should review their case and either grant full citizenship or kick them out.
Citizenship Prerequisites	**Inspection:** They should be checked for weapons, listening devices and other items that risk the safety of those inside. **Reason:** Listen to their reason for wanting to join. **Observe:** Take note of the condition they are in and how desperate they might be. **Skills:** Take a note of what skills they possess and their job before SHTF. **Interaction:** How they interact with the town and get along with the population is important to decide whether they will be a good fit. **Deception:** Appearances can be deceiving so be careful you're not letting a spy in.
Citizens	Citizens should be granted additional rights over those on probation to instil loyalty. Have a scale of trust for people living in your town, where they can earn more over time and have additional responsibility, currency or power.
Identification	People of your town should have some form of identification so you and guards etc can tell who's not supposed to be here. It will also assist in those returning from scavenging missions to gain entry easier.
Weapons	The following are potential rules for weapons you could set. Are weapons allowed to be visibly carried in the town by all citizens?
Curfew	A mandatory curfew can help protect your town at night. If everyone's safe in their homes the town guards can be more certain anyone they see is an intruder.
Leaving Permanently	Some people may way to leave permanently for different reasons, you shouldn't try to stop them however you should at least know why.

4 Discipline

LEADERSHIP | Town Leadership | Discipline

People in your town are bound to break the rules set up by yourself and the other leaders so you need a form of punishment to help deter this behaviour in the future.

Aims of Discipline
People are punished for a purpose. Often the aims of a punishment overlap, eg the death penalty aims to protect the public from the individual who has committed a specific crime whilst deterring others from committing similar acts. There are six recognised aims of punishment:
● Deterrence - punishment should put people off committing crime
● Protection - punishment should protect society from the criminal and the criminal from themselves
● Reformation - punishment should reform the criminal
● Retribution - punishment should make the criminal pay for what they have done wrong
● Reparation - punishment should compensate the victim(s) of a crime
● Vindication - the punishment makes sure that the law is respected

Crimes

LEADERSHIP | Town Leadership | Discipline | Crimes

This is a list of common crimes which currently occur today. Some of them won't apply in a SHTF situation but are included anyway in case society hasn't collapsed and you want to look them up.

Aggravated Assault	Aggravated assault is an assault which criminal laws punish more severely due to its seriousness. Factors which raise an assault to the aggravated level typically include the use of a weapon, the status of the victim, the intent of the perpetrator, and the degree of injury caused. Assaults that happen in the victim's home can also qualify as an aggravated assault. States classify certain assaults as aggravated under their criminal codes. They may also use more specific names such as assault with a deadly weapon. Often, aggravated assaults qualify as felonies, while simple assaults can be misdemeanors. Many states have multiple degrees of criminal charges for aggravated assault.
Aiding and Abetting / Accessory	A criminal charge of "aiding and abetting" or accessory can usually be brought against anyone who helps in the commission of a crime, though legal distinctions vary by state. A person charged with these accomplice crimes is usually not present when the crime itself is committed, but he or she has knowledge of the crime before or after the fact, and may assist in its commission through advice, actions, or financial support. Andy draws a floor plan of a bank, knowing of Dan's intention to rob it. After Dan commits the robbery, Alice agrees to let him store the stolen money at her house. Both Andy and Alice can be charged with aiding and abetting, or acting as accessories to the robbery.
Arson	Arson is defined as the wilful and malicious burning or charring of property. There are many types of arson crimes, including setting fire to one's property with fraudulent intent--like when someone burns their house to collect insurance money. While the majority of arson crimes involve damage to buildings, arson can also be committed by a person who sets fire to forest land or a boat. Arson statutes typically classify arson as a felony due to the potential to cause injuries or death. In its most basic sense a person commits arson when they knowingly, by means of a fire or explosive: ● Damage any real or personal property of another without their consent; or ● Damage any real or personal property with intent to defraud an insurer.
Assault / Battery	In most states, an assault/battery is committed when one person: 1) tries to or does physically strike another, or 2) acts in a threatening manner to put another in fear of immediate harm. In short, an assault is an attempt or threat to injure another person, while battery is the act of making contact with another person in a harmful or offensive manner. Below is a more in-depth look at both offenses and their elements, which helps explain how these two offenses are so closely tied together.

LEADERSHIP	Town Leadership	Discipline	Crimes	**Attempt**	The definitions for criminal attempt -- in which the defendant ultimately fails to pull off the crime -- vary from state to state. But generally, attempted offenses occur when an individual has an actual intent to commit a crime (in legal terms, specific intent), and takes direct action toward completion of the crime. Once a crime is completed, then those charges would apply and the attempt would not be charged. Not all crimes can be "attempted," legally speaking, only those with specific intent. Specific intent refers to the state of mind in which an individual plans to commit a certain crime, knowing what the outcome may be. For instance, attempted battery is not a criminal charge because the crime of battery doesn't require a premeditated intent to cause harm. But someone who threatens bodily harm may be charged with assault.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Bribery**	Bribery is the offer or acceptance of anything of value in exchange for influence on a government/public official or employee. In general, bribes can take the form of gifts or payments of money in exchange for favourable treatment, such as awards of government contracts. Other forms of bribes may include property, various goods, privileges, services and favours. Bribes are always intended to influence or alter the action of various individuals and go hand in hand with both political and public corruption. No written agreement is necessary to prove this crime, but a prosecutor generally must show corrupt intent. In most situations, both the person offering the bribe and the person accepting can be charged.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Burglary**	Burglary is typically defined as the unlawful entry into almost any structure (not just a home or business) with the intent to commit any crime inside (not just theft/larceny). No physical breaking and entering is required; the offender may simply trespass through an open door. Unlike robbery, which involves use of force or fear to obtain another person's property, there is usually no victim present during a burglary. For example, Dan enters Victor's boathouse through an open window, intending to steal Victor's boat. Finding the boat is gone, Dan returns home. Though he took nothing, Dan has committed burglary.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Child Abandonment**	Child abandonment occurs when a parent, guardian, or person in charge of a child either deserts a child without any regard for the child's physical health, safety or welfare and with the intention of wholly abandoning the child, or in some instances, fails to provide necessary care for a child living under their roof. While abandoning a child typically involves physical abandonment -- such as leaving a child at a stranger's doorstep when no one is home -- it may also include extreme cases of emotional abandonment -- such as when a "work-a-holic" parent offers little or no physical contact or emotional support over long periods of time.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Child Abuse**	Child abuse is broadly defined as any type of cruelty inflicted upon a child, including physical or emotional harm, endangerment, abandonment, neglect or sexual abuse. Severe punishments exist for offenders. Child services agencies also investigate reports of maltreatment and can remove children from unsafe or unhealthy environments. This combination of criminal prohibitions and protective services forms the basis of child abuse laws, which vary somewhat from state to state. One major hurdle to stopping child abuse is the difficulty of uncovering it. That's why states have also enacted mandatory reporting requirements for certain professions. These laws apply primarily to people who have regular contact with children or who are most likely to discover abuse or neglect -- such as teachers, doctors, nurses and social workers.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Child Pornography**	Federal and state laws make it a crime to produce, distribute, or even just possess pornographic materials that portray a minor (someone under the age of 18). Increasingly, child pornography laws are being relied on to punish individuals who use the internet to share or obtain pornographic images and videos involving children. A violation of federal child pornography laws is a serious crime and the penalties are harsh. First-time offenders found guilty of producing child pornography are sentenced to between 15 and 30 years in prison. Individuals caught with child pornography on their personal computers receive prison time. Offenders may be prosecuted under federal or state law (or both).
LEADERSHIP	Town Leadership	Discipline	Crimes	**Computer Crime**	Computer crime describes a very broad category of offenses. Some of them are the same as non-computer offenses, such as larceny or fraud, except that a computer or the Internet is used in the commission of the crime. Others, like hacking, are uniquely related to computers. Read on to find out what kinds of activities are considered computer crimes and how to protect yourself from them. Computer crime laws in many states prohibit a person from performing certain acts without authorization, including: ● Improperly accessing a computer, system, or network; ● Modifying, damaging, using, disclosing, copying, or taking programs or data; ● Introducing a virus or other contaminant into a computer system; ● Using a computer in a scheme to defraud; ● Interfering with someone else's computer access or use; ● Using encryption in aid of a crime; ● Falsifying email source information; and ● Stealing an information service from a provider.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Conspiracy**	A criminal conspiracy exists when two or more people agree to commit almost any unlawful act, then take some action toward its completion. The action taken need not itself be a crime, but it must indicate that those involved in the conspiracy knew of the plan and intended to break the law. A person may be convicted of conspiracy even if the actual crime was never committed. For example, Jason, Alice and Hank plan a bank robbery. They 1) visit the bank first to assess its security, and 2) pool their money and buy a gun. All three can be charged with conspiracy to commit robbery, regardless of whether the robbery itself is ever attempted or completed.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Credit / Debit Card Fraud**	Credit and debit card fraud is a form of identity theft that involves an unauthorized taking of another's credit card information for the purpose of charging purchases to the account or removing funds from it. This theft can occur physically when the actual credit and debit card is taken, or the theft can occur when just the numbers are stolen from an unprotected website or a card reader at a gas station. Debit/credit card fraud can be committed in a variety of ways, such as when a person: 1. Fraudulently obtains, takes, signs, uses, sells, buys, or forges someone else's credit or debit card or card information; 2. Uses his or her own card with the knowledge that it is revoked or expired or that the account lacks enough money to pay for the items charged; or 3. Sells goods or services to someone else with knowledge that the credit or debit card being used was illegally obtained or is being used without authorization.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Criminal Contempt of Court**	Contempt of court generally refers to conduct that defies, disrespects, or insults the authority or dignity of a court. Often, contempt takes the form of actions that are seen as detrimental to the court's ability to administer justice. Judges typically have much discretion in deciding whom to hold in contempt and the type of contempt. Those held in contempt can include parties to a proceeding, attorneys, witnesses, jurors, people in or around a proceeding, and officers or staff of the court itself. There are two types of contempt of court: criminal contempt of court and civil contempt.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Cyberbullying**	The term "cyberbullying" refers to the use of Internet and/or mobile technology to harass, intimidate, or cause harm to another. Although bullying is hardly a new problem, it has moved from the schoolyard to social networking sites such as Facebook, emails, and mobile text messages. Nearly all states have bullying laws in place, many with cyberbullying or electronic harassment provisions. Despite the absence of physical contact or audible insults, cyberbullying can be even more traumatizing than traditional forms of bullying. Through social media and mobile communications, bullying can now potentially be viewed by all of a child's friends, family, and acquaintances. As a result, the embarrassment, shame, and other more severe consequences of bullying can become even more severe.

LEADERSHIP | Town Leadership | Discipline | Crimes

Disorderly Conduct	Almost every state has a disorderly conduct law making it a crime to be drunk in public, "disturb the peace," or loiter in certain areas. Since the statutes are often used as "catch-all" crimes, many types of obnoxious or unruly conduct may fit the definition. Generally speaking, police often use a disorderly conduct charge to keep the peace when a person is behaving in a disruptive manner, but presents no serious public danger. The definition of disorderly conduct can vary from state to state. In New York, for instance, disorderly conduct requires the intent to cause public inconvenience, annoyance or alarm, or to recklessly create such a risk. Examples of such conduct include making unreasonable noise, obstructing traffic, and using obscene or abusive language in public.
Disturbing the Peace	Disturbing the peace, also known as breach of the peace, is a criminal offense that occurs when a person engages in some form of unruly public behaviour, such as fighting or causing excessively loud noise. When a person's words or conduct jeopardizes another person's right to peace and tranquillity, he or she may be charged with disturbing the peace. Laws exist that make it a crime to create a public disruption or commotion. These laws vary from state to state, but they typically prohibit: ● Fighting or challenging someone to fight in a public place; ● Using offensive words in a public place likely to incite violence; ● Shouting in a public place intending to incite violence or unlawful activity; ● Bullying a student on or near school grounds; ● Knocking loudly on hotel doors of sleeping guests with the purpose of annoying them; ● Holding an unlawful public assembly;
Domestic Violence	Domestic violence refers to violent acts committed by a family or household member against another, such as child abuse or the mistreatment of one's spouse. Domestic violence can refer to physical harm inflicted on a member of a household or family, by another member of the same household or family. The catch-all term domestic violence can generally apply to any partners -- married or unmarried, straight or gay, living together or simply dating. Domestic violence (sometimes called "spousal abuse") usually involves repetitive physical and psychological abuse, and a "cycle of violence". Specific crimes charged vary based on 1) severity of the victim's injuries, 2) whether a minor was present, and 3) whether a protective or restraining order was violated.
Drug Manufacturing and Cultivation	Cultivating or manufacturing illegal drugs, such as methamphetamine or marijuana, is illegal under federal and state laws (with limited exceptions for marijuana in certain states). Drug "manufacturing," in a criminal law setting, occurs when an individual is involved in any step of the illicit drug production process. Those who sell certain precursor chemicals, specialized equipment, or simply offer to help produce drugs also may be charged with the crime. The production of drugs typically is charged as a felony, with sentences including prison time, steep fines, and probation. Prison sentences and fines may be doubled for those convicted of manufacturing illegal drugs near schools and playgrounds.
Drug Possession	Federal and state drug possession laws make it a crime to wilfully possess illegal controlled substances such as marijuana, methamphetamine, cocaine, LSD, "club drugs," and heroin. These laws also criminalize the possession of "precursor" chemicals used in drug cultivation and manufacturing, as well as certain accessories related to drug use. However, what constitutes drug possession can vary according to the type of drug, the amount, and the geographic area where the offense took place. Possession of certain illicit drugs can violate both federal and state laws. While drug possession laws vary widely from state to state, the elements of the offense are generally the same, as prosecutors must be able to prove, beyond a reasonable doubt, that the defendant: ● Knew the drug in question was a controlled substance; and ● That he or she knowingly had possession of, or control over, the drug.
Drug Trafficking / Distribution	Drug distribution or trafficking laws penalize the selling, transportation, and illegal import of unlawful controlled substances, such as marijuana, cocaine, heroin, methamphetamines, and other illegal drugs. The punishment for drug trafficking can vary widely depending on several factors including the type and quantity of drugs involved, the type of drugs, geographic area of distribution, and whether children were targeted. Sentences for drug distribution and trafficking can generally range from 3-5 years to life in prison, but can be substantially higher when larger quantities are involved. Drug trafficking/distribution is a felony, and is a more serious crime than drug possession. If you're found in possession of drugs, you could be charged with trafficking if police believe you intended to sell them. If you're found with a large quantity of drugs or cash at the time of your arrest, it is likely you'll be facing drug distribution charges.
DUI / DWI	Most state laws define crimes of drunk driving as driving a motor vehicle on a road or highway while under the influence of alcohol. This can mean that you have driven poorly, even if your blood-alcohol concentration (BAC) is low. Newer statutes also provide for what is called a "per se offense," which a person commits when driving a motor vehicle on a road or highway with a blood-alcohol concentration of .08 percent. This means that even if you have driven perfectly, you can still be charged with driving under the influence. Several state statutes require a person to be driving a vehicle in order to be convicted of a drunk driving offense. Other states use the terms "operating a vehicle" or "being in actual physical control of the vehicle." These terms are not normally synonymous, so it is important to determine how an individual state defines the term in its laws.
Embezzlement	The crime of embezzlement was created to fill a loophole in the theft/larceny statutes of English law. In old English law theft/larceny required a trespass, but there is no trespass with embezzlement. The person who embezzles is in lawful possession of the money or property, they just don't give it back to the owner or use it for unauthorized purposes. The crime of embezzlement is where a person: ● Has lawful possession of the property of another; ● Converts or takes that property for their own use; and ● Has no intention of giving it back.
Extortion	A large, intimidating man walks into a profitable liquor store in the heart of the city, not to buy anything but to offer "protection" to the shopkeeper (for a weekly fee, of course). She declines, but he insists. The man casually lists the names of her four children and states he wouldn't want anything "bad" to happen to them. The shopkeeper relents, agreeing to pay him a set amount each week. Per the above illustration, extortion is the crime of obtaining money or property by threat to a victim's property or loved ones, intimidation, or false claim of a right. The following is an overview of the crime.
Forgery	It was Oscar Wilde that said "Imitation is the sincerest form of flattery . . .", but when an artist attempts to pass on that imitation as the real thing, it's called forgery. We tend to think of forgery in connection with the art world. However, the crime of forgery generally refers to the making of a fake document, the modification of an existing document, or the unauthorized signing of a signature without authorization. Forgery involves a false document, signature, or other imitation of an object of value used with the intent to deceive another. Those who commit forgery are often charged with the crime of fraud. Documents that can be the object of forgery include contracts, identification cards, and legal certificates. Most states require that forgery be done with the intent to commit fraud or larceny.
Fraud	Fraud is a broad term that refers to acts intended to swindle someone. In essence, it's the use of intentional deception for monetary or personal gain. Thousands of people each year fall victim to it. Fraud always includes a false statement, misrepresentation or deceitful conduct. The purpose is to gain something of value, usually money, by misleading or deceiving someone into believing something that the perpetrator knows to be false. Fraud is covered by both criminal and civil laws. The most obvious difference has to do with who files the legal case. Only government prosecutors can bring criminal charges, but a victim of fraud can file a civil lawsuit. Sometimes a person who commits fraud is both criminally prosecuted and sued in a civil action.

Harassment	"Harassment" refers to a broad number of behaviours that are subject to both criminal punishment and civil liability. On the criminal side, states have a wide variety of criminal laws forbidding harassment in many forms, including general harassment crimes as well as specific forms of harassment, such as stalking and cyberstalking. Criminal harassment should not be confused with how "harassment" is often used in contexts such as workplace discrimination lawsuits. Federal and state laws ban discrimination against certain types of people in certain situations, such as at work or in housing decisions. In these non-criminal contexts, the victim can sue the harasser in a private civil lawsuit, alleging that the harassment constitutes discrimination.
Hate Crimes	Hate crime is the violence of intolerance and bigotry, intended to hurt and intimidate someone because of their race, ethnicity, national origin, religion, sexual orientation, or disability. A hate crime (also known as a bias crime) is a criminal offense where the purveyors of hate can use explosives, arson, weapons, vandalism, physical violence, and verbal threats of violence to instil fear in their victims, leaving them vulnerable to more attacks and feeling alienated, helpless, suspicious, and fearful. Others may become frustrated and angry if they believe the local government and other groups in the community will not protect them; this is a reason that hate crimes are often unreported. When perpetrators of hate are not prosecuted as criminals and their acts not publicly condemned, their crimes can weaken even those communities with the healthiest race relations.
Homicide	Not all homicides are crimes. However, all killings of humans are included in the homicide definition. Many homicides, such as murder and manslaughter, violate criminal laws. Others, such as a killing committed in justified self-defence, are not criminal. Illegal killings range from manslaughter to murder, with multiple degrees of each representing the gravity of the crime. **Homicide Types** ● Murder ● Manslaughter ● Legal Homicides
Identity Theft	Identity theft and identity fraud are terms used to refer to all types of crime in which someone wrongfully obtains and uses another person's personal data in some way that involves fraud or deception, typically for economic gain. For example, someone rummages through your garbage and steals an envelope with some old tax records, finding your Social Security number, birth date, and other sensitive information. They use this information to open a credit card in your name. Identity theft laws in most states make it a crime to misuse another person's identifying information -- whether personal or financial. Such data (including Social Security numbers, credit history, and PIN numbers) is often acquired through: 1. The offender's unlawful access to information from government and financial entities or 2. Lost or stolen mail, wallets and purses, identification, and credit or debit cards.
Indecent Exposure	Indecent exposure laws in most states make it a crime to purposefully display one's genitals in public, causing others to be alarmed or offended. While the motive will vary from person to person, indecent exposure is often committed for the sexual gratification of the offender or to entice a sexual response. Exposing one's genitals means just that -- to show your bare genitals. However, flashing one's underwear, no matter how revealing or skimpy, is usually not considered indecent exposure for purposes of most states' laws. While showing a bare female breast could result in a criminal charge, most states carve out an exception for women breastfeeding their babies.
Insurance Fraud	Insurance fraud occurs most often when an insured individual or entity makes a false or exaggerated insurance claim, seeking compensation for injuries or losses that weren't actually suffered. This type of crime also can be committed upon customers through the sale of unlicensed or bogus insurance coverage to unsuspecting clients, or an insurance broker or agent's diversion or theft of insurance premiums paid by clients. Fraud in the context of insurance refers to any duplicitous act performed with the intent to obtain an improper payment from an insurer. This crime is committed by individuals from all walks of life. Law enforcement officials have prosecuted doctors, lawyers, chiropractors, car salesmen, insurance agents, and people in positions of trust. Anyone who seeks to benefit from insurance through making inflated or false claims of loss or injury can be prosecuted.
Kidnapping	Under federal and state law, kidnapping is commonly defined as the taking of a person from one place to another against their will, or the confinement of a person to a controlled space. Some kidnapping laws require that the taking or confinement be for an unlawful purpose, such as extortion or the facilitation of another crime. Additionally, a parent without legal custody rights may be charged with kidnapping for taking their own child in certain circumstances. Most kidnapping cases are prosecuted on the state level. However, federal authorities will typically get involved and file federal charges if the kidnapping crosses state lines. Federal criminal code (18 U.S.C. Section 1201) makes kidnapping a serious felony offense, with prison sentences of 20 or more years, depending on prior convictions and the circumstances of the case. Federal law prosecutes international parental kidnapping under a different code (18 U.S.C. Section 1204), allowing for three-year prison sentences upon conviction.
Manslaughter: Involuntary	Consider the following scenario: Dan comes home to find his wife in bed with Victor. Distraught, Dan heads to a local bar to drown his sorrows. After having five drinks, Dan jumps into his car and drives down the street at twice the posted speed limit. If Dan had killed Victor in a "heat of passion" at the time he discovered the affair, then he could be charged with voluntary manslaughter. However, Dan instead accidentally hit and killed a pedestrian while driving recklessly and intoxicated -- and is now being charged with involuntary manslaughter. Involuntary manslaughter usually refers to an unintentional killing that results from criminal negligence or recklessness, or from committing an offense such as a DUI. It differs from voluntary manslaughter in that the victim's death is unintended. The following is an overview of involuntary manslaughter and how it differs from voluntary manslaughter.
Manslaughter: Voluntary	Voluntary manslaughter is commonly defined as an intentional killing in which the offender had no prior intent to kill, such as a killing that occurs in the "heat of passion." The circumstances leading to the killing must be the kind that would cause a reasonable person to become emotionally or mentally disturbed; otherwise, the killing may be charged as a first-degree or second-degree murder. For example, Dan comes home to find his wife in bed with Victor. In the heat of the moment, Dan picks up a golf club from next to the bed and strikes Victor in the head, killing him instantly. On the spectrum of homicides, this offense lies somewhere in between the killing of another with malice aforethought (aka, murder) and the excusable, justified, or privileged taking of life that does not constitute a crime, such as some instances of self-defence. There is a range of potential sentences and penalties for voluntary manslaughter and it is often left up to the judge to decide the sentence.
Medical Marijuana	The term "medical marijuana" refers to the use, possession, and/or cultivation of marijuana for medical purposes. People who are terminally ill, or suffer from painful or long-term symptoms associated with certain diseases, such as epilepsy, AIDS, glaucoma, and cancer, often request medical marijuana as a form of treatment and/or pain relief. As a general principle, medical marijuana is no different than standard marijuana (or cannabis). A growing number of states have legalized medical cannabis within their borders. Under the federal Controlled Substances Act, however, marijuana is classified as a "Schedule I drug," meaning it: 1. Has the potential for abuse, 2. Has no currently accepted medical use in treatment in the U.S., and 3. Has a lack of accepted safety for use of the drug under medical supervision.
MIP: A Minor in Possession	Many states have laws concerning alcohol and drugs found in the possession of minors, regardless of whether they were using the substances. These are often referred to as "minor in possession" or "MIP" laws. Some states strictly enforce MIP laws and prosecute minors to the fullest extent of the law. In other states, however, a minor in an MIP case may be able to receive probation by entering a court-ordered diversionary program (similar to those offered to DUI offenders), getting medical help, and staying out of trouble.

LEADERSHIP	Town Leadership	Discipline	Crimes	**Money Laundering**	Bob has a cash-only diner downtown that does a so-so amount of business, even though Bob drives a Rolls Royce around town. Turns out, he also operates one of the city's biggest methamphetamine operations. Authorities suspect his real source of income is something much shadier than selling omelettes and pie at the diner, but they can't yet prove it. Turns out, Bob uses the diner to "launder" money from the illicit drug trade in an attempt to hide its true source. Money laundering statutes make it a crime to transfer money derived from almost any criminal activity (including organized crime, white-collar offenses, terrorist activities, and drug transactions) into seemingly legitimate channels, in an attempt to disguise the origin of the funds.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Murder: First-Degree**	In most states, first-degree murder is defined as an unlawful killing that is both wilful and premeditated, meaning that it was committed after planning or "lying in wait" for the victim. For example, Dan comes home to find his wife in bed with Victor. Three days later, Dan waits behind a tree near Victor's front door. When Victor comes out of his house, Dan shoots and kills him. Most states also adhere to a legal concept known as the "felony murder rule," under which a person commits first-degree murder if any death (even an accidental one) results from the commission of certain violent felonies, such as: ● Arson ● Burglary ● Kidnapping ● Rape ● Robbery
LEADERSHIP	Town Leadership	Discipline	Crimes	**Murder: Second-Degree**	Second-degree murder is best viewed as the middle ground between first-degree murder and voluntary manslaughter. While some states don't use the term "second-degree murder," they probably still divide the crime of murder into two different degrees and impose lower sentences for the lesser crime. While the exact definition of murder in the second degree varies by jurisdiction, the crime generally covers killings that: ● Are intentional but lack premeditation. ● Result from acts intended to only cause serious bodily harm. ● Result from acts that demonstrate extreme indifference to human life.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Open Container (of alcohol)**	Can you carry an alcoholic drink in a plastic beer mug while walking down your city's main street? The answer depends on the open container laws in your state and local community. Open containers laws serve a number of goals. Most notably, open container laws seek to: ● Maintain the quality-of-life for community residents and business by preventing people from being drunk in public, preventing rowdy behaviour; ● Prevent car, bus, and other motor vehicle accidents outlawing the use of alcohol by drivers and passengers; and ● Maintain federal highway construction fund subsidies for states (under federal law, states that lack open container laws lose federal transportation subsidies).
LEADERSHIP	Town Leadership	Discipline	Crimes	**Perjury**	Juries and judges often base their verdicts, sentences, or other important decisions on sworn testimony and signed documents. Statements given under oath and certain legal documents are presumed to be truthful, or at least made in good faith. But how do we know for sure that witnesses and other parties involved in a legal matter are telling the truth? We can't always be certain, but those who are caught knowingly misleading a court face serious criminal charges of perjury. To "perjure" yourself is to knowingly make misleading or false statements under oath or to sign a legal document you know to be false or misleading. This crime is taken very seriously because the foundation of the legal system depends on trust and credibility. After all, just one sworn statement has the power to tip the scales of justice and dramatically alter someone's life. Perjury is considered a crime against justice, since lying under oath compromises the authority of courts, grand juries, governing bodies, and public officials.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Probation Violation**	Probation violation is an offense that occurs when you break the terms or conditions of your probation. The punishment for probation violation usually depends on a variety of factors, such as the nature and seriousness of the violation, whether you have any prior violations, and whether there are other circumstances that may lessen (or worsen) the severity of the situation. A probation violation may result in significant penalties, such as heavy fines, extended probation, jail time, or more. Probation violation laws vary among the states and are governed by federal and state law. Generally, a probation violation occurs when you ignore, avoid, refuse, or otherwise break the terms or conditions of your probation at any time during the probation period. Probation typically runs from one to three years, but may also last for several years depending on the original offense.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Prostitution**	Sometimes called "the oldest profession," prostitution is known by many names, from streetwalkers and brothels, to sophisticated call-girl or escort services. However, whatever name it goes by, prostitution is illegal in almost all fifty-states. At its most basic definition, prostitution is the exchange of a sexual act for money. State laws have expanded the definition to make it a crime to offer, agree to, or engage in a sexual act for compensation of any kind.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Public Intoxication**	Public intoxication, often called being "drunk and disorderly," is a legal charge alleging that a person is visibly drunk or under the influence of drugs in public. It's usually a misdemeanor crime under state and local law. These laws exist to prevent people from disturbing others in public and to remove people who appear to be unable to stop themselves from hurting themselves or others. By definition, a public intoxication charge usually has three basic elements, all of which must be met in order to obtain a conviction. Specifically, it must be shown that a defendant: ● Was under the influence of alcohol/drugs/controlled substances; ● Caused a disturbance or harm to another person; and ● Was present in a public place.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Pyramid Schemes**	People are always thinking up new ways to swindle others out of their hard-earned cash. Some of these schemes can take new and creative forms. But the pyramid scheme, which is still prevalent today, hasn't changed much in over 200 years. Although there's arguably a fine line between what we call "multi-level marketing" businesses (such as AmWay) and illegal pyramid schemes, it's an important distinction of which consumers should be aware. These types of scams follow a predictable formula. Usually, one person, known as the "recruiter," will create a fraudulent business which requires others to pay a fee to join. The people he recruits to the business then recruit others to join as well, and pocket the fees (often with fees paid to the recruiter as well). This cycle of recruitment is supposed to continue indefinitely, so that everyone who joins the "business" will continue to receive the recruitment fees of the newest recruits.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Racketeering / RICO**	Racketeering is when organized groups run illegal businesses, known as "rackets," or when an organized crime ring uses legitimate organizations to embezzle funds. Such activities can have devastating consequences for both public and private institutions. Consequently, the federal government and numerous state governments have created systems of laws designed to prosecute these criminals who otherwise may evade police. Most older forms of rackets dealt in industries that were clearly illegal, such as prostitution, sex trafficking, drug trafficking, illegal weapons trafficking, and counterfeiting. These "businesses" organized large groups of people to help keep the racket profitable and covert, allowing them to make illegal products available to the public quickly and in such large amounts that authorities couldn't make all the necessary arrests and prosecutions.

LEADERSHIP	Town Leadership	Discipline	Crimes	**Rape**	The crime of rape generally refers to non-consensual sexual intercourse that is committed by physical force, threat of injury, or other duress. Common law defined rape as unlawful intercourse by a man against a woman who is not his wife by force or threat and against her will. However, most states have refined and broadened the statutory definition of rape so that marriage, gender, and force are not relevant. The victim's lack of consent is the crucial element. A lack of consent can include the victim's inability, due to the effects of drugs or alcohol, to say "no."
LEADERSHIP	Town Leadership	Discipline	Crimes	**Robbery**	Essentially, robbery is theft accomplished by violence or the threat of it. Unlike theft or burglary, the crime of robbery almost always requires the presence of a victim who is threatened with bodily harm. If a weapon such as a gun is used or the victim suffers injury, the robbery may be charged as "armed" or "aggravated." For example, Chris sneaks up on John, demanding John's money while pressing a plastic object into his back, and John gives up his wallet. This would be charged as a robbery. If Chris used an actual gun or John was injured, the crime likely would be elevated to armed or aggravated robbery.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Securities Fraud**	Generally, securities fraud occurs when someone makes a false statement about a company or the value of its stock, and others makes financial decisions based on the false information. In cases of insider trading, insiders (i.e. executives, board members, etc.) buy or sell stocks based on information that isn't available to the public. Although the crime itself isn't complicated, securities fraud can be particularly difficult to grasp if you lack an understanding of securities regulation. The first type of securities fraud occurs when an officer or director of a corporation doesn't accurately report the company's financial information to its shareholders. This can artificially raise the worth of the company's stock and encourage investors to buy shares of an unhealthy company. If the company subsequently goes bankrupt, the people who bought shares based on false information lose their investment completely.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Sexual Assault**	Sexual assaults affect millions of Americans annually. The term encompasses various actions that involve behaviour or contact toward another person without their consent. The actions are defined by state law and can therefore differ by jurisdiction. However, some common examples of sexual assault include: ● Fondling, kissing, or making unwanted bodily contact; ● Forcing another person to perform or receive oral sex; ● Forcing a tongue, mouth, finger, penis, or an object on another person's anus, penis, or vagina; and ● Forced masturbation.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Shoplifting**	"Shoplifting" generally refers to the theft of merchandise from a store or place of business. Shoplifting is a type of larceny, which simply means taking the property of someone else without their permission, and with the intent to permanently deprive the owner of the property taken. Though states may punish shoplifting under their general larceny or theft statutes, many states have enacted statutes to specifically address shoplifting. States may refer to the crime by different names, including "retail theft" and "concealment of merchandise."
LEADERSHIP	Town Leadership	Discipline	Crimes	**Solicitation**	The character Fagin in Charles Dickens' Oliver Twist took young boys under his wing and taught them to be pickpockets. He would then send the boys out into the streets of London to steal for him. Fagin didn't need to personally steal anything, but under modern statutes, Fagin could still be charged with inducing the boys to commit theft under what is known as solicitation. The crime of solicitation is requesting, encouraging or demanding someone to engage in criminal conduct, with the intent to facilitate or contribute to the commission of that crime. Commonly, solicitation often is linked to prostitution with the crime being the request of someone to engage in sex for money.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Stalking**	The crime of stalking can be simply described as the unwanted pursuit of another person. Examples of this type of behaviour includes following a person, appearing at a person's home or place of business, making harassing phone calls, leaving written messages or objects, or vandalizing a person's property. By its nature, stalking is not a one-time event, but rather a pattern of behaviour meant to cause harm or distress. The individual's actions must be considered in connection with other actions to determine if someone is being stalked. It includes repeated harassing or threatening behaviour toward another person, whether that person is a total stranger, slight acquaintance, current or former intimate partner, or anyone else.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Statutory Rape**	Statutory rape refers to sexual relations involving someone below the "age of consent." People who are underage cannot legally consent to having sex, so any form of sexual activity with them violates the law. This is true even in situations where they signal their agreement. While the crime is popularly called statutory rape, many states don't use that term officially but instead classify it as sexual assault, corruption of a minor, or carnal knowledge of a child. Most laws on this subject are state rather than federal ones.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Tax Evasion / Fraud**	As the saying goes, the only sure things in life are death and taxes. If you intentionally fail to pay taxes or underreport your taxable income, you could be charged with tax evasion. While it's certainly a crime in and of itself, it's also commonly charged against those suspected of certain organized crimes where the source of their income is in doubt. For instance, famous Prohibition-era gangster Al Capone was convicted not for murder or racketeering, but for evading taxes. Tax forms are long, the Internal Revenue Code is complicated, and unless you're an accountant or other tax professional, you're bound to make some mistakes that may result in underpaying taxes. Although you should always try to fill out your tax forms correctly, there's no need to worry about being convicted for tax evasion over a simple error.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Telemarketing Fraud**	Many scams take place over the phone, often with the lure of a possible "grand prize" or some other way of keeping you on the line. Scammers often try to extract sensitive information from their victims, such as Social Security numbers, or may try to sell you something with no intention of actually delivering and every intention of taking your money. But if you know how to protect yourself, you can avoid being defrauded. At its core, telemarketing fraud is a pretty simple crime: someone calls the victim, makes a false statement, and the misrepresentation causes the victim to give money or sensitive information to the caller. This definition can cover a large variety of scams. Sometimes, victims are told that they won a prize in a foreign lottery and their personal information is required to receive the prize.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Theft**	The term theft is used widely to refer to crimes involving the taking of a person's property without their permission. But theft has a very broad legal meaning which may encompass more than one category, and multiple degrees, of crimes. This article provides a theft overview, including definitions and specific examples. Theft is often defined as the unauthorized taking of property from another with the intent to permanently deprive them of it. Within this definition lie two key elements: 1. A taking of someone else's property; and 2. The requisite intent to deprive the victim of the property permanently.
LEADERSHIP	Town Leadership	Discipline	Crimes	**Vandalism**	Vandalism laws are designed to prohibit conduct that has the potential to cost states millions of dollars each year in clean-up efforts, and may cause psychological or emotional damage to property owners as well. When a person defaces, alters, or otherwise destroys someone's property, they may be required to clean-up, repair, or replace the damaged property or, more substantially, face criminal penalties in the form of jail time, fines, or both. Vandalism is a broad category crime that's used to describe a variety of behaviours. Generally, it includes any wilful behaviour aimed at destroying, altering, or defacing property belonging to another, which can include: ● Spray painting another's property with the purpose of defacing; ● "Egging" someone's car or house; ● Keying (or scratching) paint off of someone's car; ● Breaking someone's windows; ● Defacing public property with graffiti and other forms of "art"; ● Slashing someone's tires; ● Defacing park benches; ● Altering or knocking down street signs; and ● Kicking and damaging someone's property with your hands or feet.

White Collar Crimes	"White collar crime" can describe a wide variety of crimes, but they all typically involve crime committed through deceit and motivated by financial gain. The most common white collar crimes are various types of fraud, embezzlement, tax evasion and money laundering. Many types of scams and frauds fall into the bucket of white collar crime, including Ponzi schemes and securities fraud such as insider trading. More common crimes, like insurance fraud and tax evasion, also constitute white collar crimes. Securities fraud comes in many flavours, but one common type is "insider trading," in which someone with inside information about a company or investment trades on that information in violation of a duty or obligation. For example, an executive knows confidential information about an upcoming company earnings report decides to sell of a chunk of his stock in the company. That would be considered securities fraud; specifically, insider trading.
Wire Fraud	The crime of fraud can take many forms. Scams that take place over interstate wires, such as telemarketing fraud, phishing, or spam-related schemes, are all called wire fraud. Federal wire fraud is a federal offense and is typically investigated by the Federal Bureau of Investigation, but state laws and charges can also apply. The definition of wire fraud is rather broad and includes any writings, signs, signals, pictures or sounds transmitted by wire, radio or television in interstate or foreign commerce. Federal prosecutors often charge persons with wire fraud in order to bring federal charges against them, typically when the crimes committed would only be subject to state laws.

Punishment Tiers

You should have varying punishments proportionate to the type of crime committed.

5 Roles & Responsibilities

These are the jobs that are available in the town. Vacancies can be filled and people can swap between roles if they desire. The population percentage shows how many of that type of person are in the field. The orange tinted population percentages aren't included in the total percent as they are part time jobs.

Leader

The leader of the town. There should only be one per town.

Population Percentage 1 Person	The leader decides the fate of the town and helps it to grow and expand while keeping peace and order. There may be a chance of assassination depending on rival towns/gangs and if your village hates you or not.	**Roles** •	There's a moderate chance of injury in this job.

Leader Group (Admin)

Assistants to the leader who help on decision making and informing the community.

Population Percentage 5%	These are the gatekeepers who decide who to let in and to keep track of population, and those outside the walls.	**Roles** • Population Tracking • Food Consumption • Food Stocks • Farming Output • Job Availability • Equipment Stores • Ammo Stocks/Usage • Town Escape Plans • Defensive Plans	There isn't a high chance of getting injured in this job.

Farmers

People who grow food to support the rest of the village.

Population Percentage 25%	Farmers are in the sun long hours looking after crops and help sustain the village. More food than necessary should be grown to support any additional people that may come along and to safeguard against crop failure.	**Roles** •	There isn't a high chance of getting injured in this job.

Cooks

The people who turn the produced food into edible food ready for consumption.

Population Percentage 10%		**Roles** •	There isn't a high chance of getting injured in this job.

Cleaners (Part Time)

Cleaners keep the residences and the town in a respectable condition.

Population Percentage 10%		**Roles** •	There isn't a high chance of getting injured in this job.

Doctors (Part Time)

Medical professionals who diagnose and heal the sick. They also look after the medical gear and medicines.

Population Percentage 10%	Doctors should keep the medical equipment locked up when not in use. This excludes the basics such as bandaids. The doctor should be on call 24/7 for any emergency that may occur to members of the town.	**Roles** •	There isn't a high chance of getting injured in this job.

Pastor / Priest

Pastor

A pastor who spends time in communion with God and preaching to the town, giving thanks for meals and teaching the Bible.

Population Percentage 5%	It's one thing to die an earthly death but you don't want to die a second spiritual death, and that's where the pastor comes in.	**Roles** •	There isn't a high chance of getting injured in this job.

Scavengers

The people who leave the town in search of useful equipment, items and food to bring back.

Population Percentage 10%	Setting a priority item for the scavengers to look for can be beneficial if you need certain items quickly. Scavengers should be masters of stealth and be split up into groups of 3 who don't stray far from each other.	**Scavenging Priorities** • Food • Water Filtration • Solar Panels • Weapons / Ammo • Valuables	**Roles** •	They have a high chance of getting injured while outside the town due to wild animals or other people.

Defenders / Law Enforcers

These people patrol the city bringing order to it and watch the boundaries for threats.

Population Percentage 15%	Defenders guard the town 24/7 and have an alert system in place for approaching threats. The defenders train the town how to defend themselves with a gun, sword, bow or knife.	**Roles** •	There's a moderate chance of injury in this job.

Utility Workers

These individuals look after construction, electrical, water, gas and sewage routes, fixing them when they break.

Population Percentage 15%		**Roles** •	There isn't a high chance of getting injured in this job.

Craftsmen

These people are blacksmiths, knitters, toymakers etc who build things from scraps and skill.

Population Percentage 5%		**Roles** •	There isn't a high chance of getting injured in this job.

Tradesmen (Part Time)

Traders who venture out from the town to trade needed items and valuables with others.

Population Percentage 2-3 People		**Roles** •	There's a moderate chance of injury in this job.

Non Workers

There should be little to no people who don't work in the town. Only small children, mothers with babies, the disabled and the elderly shouldn't be working.

Population Percentage 10%		**Roles** •	There isn't a high chance of getting injured in this job.

Universal Knowledge

These are jobs that everyone in the town should have knowledge of or the ability to do.
- Everyone who has mastered their trade will be a teacher of it to continue the generations.
- Everyone should know how to defend themselves with some form of weapon in case the town is under attack.
- The doctor should train everyone in basic first aid.
- Everyone should know about basic security and be on the look out for suspicious acts.

Job Flexibility

As with anything you should adapt the above to your personal situations. If you need more people defending the town then assign people to it instead of another, less essential job. If you are finding that you need more people bringing in food you can set more people to farming or give a food priority to the scavengers.

LEADERSHIP

Town Leadership

Leadin

Once the town is set up you have to lead the people and make wise decisions that will appease most citizens. You will never be able to please everyone so having a democratic village will help solve some problems. You need to be a strong yet merciful leader where necessary but not so much you look like a pushover. Listen to all people, young or old, strong or weak for every idea is worth considering and you may uncover true talent. Have strong unshakable ideals and don't stray from them. Such as a fixed policy on punishment.

7 Trade

Trade

Some form of currency or trade is required if you wish to have a barter economy within your village.

Makeshift Currencies
- Legacy Money
- Bottle Caps
- Valuables

Economy

Storing valuables, precious metals and maintaining a portfolio

"I used to be a banker, but then I lost interest."
Unknown

Introduction

This section discusses money, the economy, your portfolio, storage of cash and the peaks of major economic pillars such as oil.

Purpose	The aim of ECONOMY is to provide an overview of money and how the money system works, as well as information to what happens when this system breaks down. It also has detailed information on identifying genuine precious gems and metals as well as correct storage procedures to help prevent theft. There is also a large section on bartering items if the need arises in a post-disaster world.
Lost?	• For a list of personal money problems such as bankruptcy, see the PERSONAL DISASTERS section. • For man-made disasters such as hyperinflation and recessions, see the MAN-MADE DISASTERS section.

Contents

1 Money

Forms of Money

Assets	Any assets you own that can be used in a SHTF situation to survive which are generally worthless and can't usually be traded. Before the days of banks, people used to trade their crafts at local markets for other items they needed. An example being 1 chicken and a hand knitted jumper for a piglet. In the end the assets you have will help you to survive as you can't eat any form of money, and due to the fact very few people will be without food, it will be the most needed item besides water. Therefore before you begin investing into cash or bullion you should have a stockpile of food and water purification devices.
Tradables	Any physical items you own that could be needed or traded in SHTF. Items like alcohol, condoms, toilet paper, guns, food, water and medical equipment can be traded quite easily if you need another item.
Land	Any pieces of land you may own, with or without a property on it. Land could be a valuable asset in a disaster, especially if you have stored good on site. However it will be tough convincing people you own the land if you discover someone has claimed it for themselves when there's no law.

Housing	Any houses you own irrelevant of who owns the land. Houses provide comfort and protection from people, weather and unrest. Although you will have to abandon it if you bug out you can always return in the hopes it's still standing. A bug out house which is reinforced and assault-proof will prove vital in a situation where your primary property is abandoned.
Metal Bullion	Bullion is any form of precious metal that can be used to trade. This does not include any bullion that's stored in another physical location that you technically own. If you can't touch it then it's not yours when SHTF comes. Commonly stored in smaller values and used as Gold, Silver and Copper in order of value respectively, so have a selection of each type.
Cash	Any coins of paper money used for purchasing items. Cash is generally ignored today in favour of card payments to prevent needing to carry the often heavy coins. Cash may have a value in SHTF situations but primarily depends on if people will deem it worth anything in SHTF. Generally it will be accepted for a short period into a disaster before people run out of it and resort to unsavoury means of getting what they need. For short term, local or national disasters generally people will continue to use cash as a means of payment unless the disaster goes on too long or the disaster is economy based where the currency declines.
Bank Account	Any money in your bank account. Money in the bank will become useless if the internet goes down or the economy breaks down. Therefore it's wise to store some in physical forms for bartering. Many banks close without warning and you could instantly lose all your money stored within without the chance to withdraw it. It may not even be SHTF for this to occur.
Bonds	A bond is a debt obligation from a company that requires money. As soon as things start going downhill companies will lose money and you will lose your investment. You can't just get out of a bond depending on the contract, so choose carefully and watch the state of the world closely.
Stocks	Any company or stocks you've invested in. Good for investment when the grid is up, but as soon as that goes down you've lost all your money. Chances are that businesses will be finding it tougher and tougher as the disaster approaches if it's economy related and therefore you will lose money anyway.
Cryptocurrency	Probably the most volatile and risky form on investment today. Not only does the price fluctuate wildly but it's entirely online and there's no guarantee it will even be used in the future for transactions. Crypto is good for making a little money while the grid is up but for no reason do you want money in it when a disaster is coming, and the whole reason for being prepared is you're not sure when a disaster will occur.

NIIP

The difference between a country's external financial assets and liabilities is its net international investment position (NIIP). If your country is in debt watch out in particular for economical instability, financial problems and job cuts.

Table Layout
- Country Name
- NIIP Balance
- External Debt
- NIIP % in GDP (Optional)

Info
- Alphabetical Order
- Green is Profit
- Red is Debt
- Values are in USD

Last Update
17 May 2018[n]

Argentina +55.380 bil 363 Billion	**Australia** -866.700 bil 1.487 Trillion -56.8%	**Austria** +18.135 bil 638 Billion	**Belgium** +208.701 bil 1.278 Trillion	**Brazil** -776.537 bil 556 Billion -31.2%	**Bulgaria** -47.542 bil 40 Billion	**Canada** +101.31 bil 1.931 Trillion	**Chile** -43.601 bil 173 Billion	**Croatia** -244.493 bil 46 Billion	**Cyprus** -22.453 bil 119 Billion -139.8%	**Czech Republic** -1,175.539 bil 137 Billion	**Denmark** +1,156.818 bil 491 Billion
Estonia -7.797 bil 20 Billion	**Finland** +15.305 bil 483 Billion	**France** -351.142 bil 5.689 Trillion	**Germany** +1,705.043 bil 5.398 Trillion	**Greece** -240.107 bil 476 Billion -126.4%	**Hong Kong** +1,114.87 bil 108 Billion	**Hungary** -20,662.860 bil 148 Billion	**Iceland** -7,936.987 bil 24 Billion	**India** -364.700 bil 513 Billion -18.0%	**Indonesia** -419.770 bil 335 Billion -47.5%	**Ireland** -492.505 bil 2.384 Trillion	**Israel** +135.124 bil 89 Billion
Italy -249.638 bil 2.510 Trillion	**Japan** +339,263.000 bil 3.586 Trillion	**Kazakhstan** -35.201 bil 165 Billion	**Latvia** -14.554 bil 41 Billion	**Lithuania** -16.726 bil 36 Billion	**Luxembourg** +12.585 bil 4.113 Trillion	**Malta** +4.693 bil 96 Billion	**Mexico** -426.553 bil 437 Billion	**Netherlands** +529.253 bil 4.510 Trillion	**New Zealand** -154.592 bil 186 Billion	**Nigeria** -60.459 bil 15 Billion	**Norway** +592.04 bil 623 Billion
People's Republic of China +1,800.537 bil 1.710 Trillion	**Philippines** -40.700 bil 72 Billion -10%	**Poland** -1,146.824 bil 363 Billion	**Portugal** -194.358 bil 447 Billion -113.3%	**Romania** -376.268 bil 108 Billion	**Russia** +226.954 bil 537 Billion	**Singapore** +276.09 bil 1.320 Trillion	**Slovakia** -47.063 bil 86 Billion	**Slovenia** -13.736 bil 49 Billion	**South Korea** +278.500 bil 407 Billion	**Spain** -938.434 bil 2.259 Trillion -90.5%	**Sweden** -730.190 bil 938 Billion
Switzerland +777.75 bil 1.820 Trillion	**Taiwan** +659.915 bil 170 Billion	**Turkey** -437.029 bil 453 Billion	**United Kingdom** -21.278. bil 8.475 Trillion -24.1%	**United States** -8,109.7 bil 21.171 Trillion -44.8%	**Venezuela** +155.667 bil 110 Billion						

2 Valuables Storage

Keeping your valuables safe and sound is essential to protect it against thieving hands. This section covers ways to conceal your treasures to make it much more difficult to find and steal.

Valuable Storage Triangle
There is a constant pull between these three factors. You can have a high level of security but the accessibility and diversity drops. Prioritise the most important for your requirements.

Valuable Storage Triangle
- Security Depth
- Accessibility
- Diversity

Security Depth
This represents how well items are hidden and how many layers they are hidden with. This makes them hard to access and diversity is harder due to the cost of this depth.

Accessibility
The easier to access your valuables are, the more likely they will be found, but it provides a very fast way to retrieve your assets in an emergency.

Diversity
Spreading out your assets may protect them if one is found, but you can't often have very deep security for all of them and it will be a pain to access them all.

Location

On You

You can store a surprising amount of valuables on your person if done correctly. Being always on you there's little risk of being stolen or burnt.

Advantages	• You always know where your valuables are	• No risk of being burnt up	• No worrying about thieves		
Disadvantages	• Could be stolen if you're mugged	• May weigh you down depending on size	• Limited storage space	• Can't store more than a few oz of precious metals	
Wallet	An obvious place to store some valuables, but at least you know where it is at all times. You might be able to get a few gold or silver coins in as well.				

Shoe/Boot	Under the flap of your boot is a great place to store a coin or some paper money. It may become an inconvenience if you try to stash too much especially if you have to run.
Around Neck	You can store precious metals around your neck in the form of gold/silver chains, jewellery or on the end of a pendant. These can be pretty obvious to others that you are carrying it however so it may be a risk.
Phone Case	Store a few hundred dollars inside your phone case for emergencies. You could even fit another bank card if the case is big enough.
Money Pouch	A pouch that is worn around the belly for valuables such as passport, cash and credit cards. Generally this is thin enough to not be seen, but ensure your clothes aren't see-through.
Under Your Skin	At the extreme end you can always store valuables under the skin. This has to be carefully considered as the blood is likely to try to expel the foreign object.
In Your Body	You can even store valuables inside your mouth, nose, butt or vagina if you're attempting to sneak it past someone.

Inside

Interior storage of valuables is a common practice today due to the ease of access. Although it can be just as easily accessed and found by someone looking for it.

Advantages	• Easy to access without much effort	• Don't have to get dirty and go into the rain/snow to retrieve it	• Lots of nooks and crannies to hide valuables in	• Ability to use disguised cans/books etc to hide things in	
Disadvantages	• House fire Risk	• The first place thieves will look	• Limited to a number of common places to hide valuables		
Obvious Hiding Places	Don't use the following storage locations as they are easily found by thieves.				• Inside a Safe • Under a Mattress • Under a Drawer • In a Cupboard • In a Wardrobe
Excellent Hiding Places	These are the best locations to store valuables and are only found by the most explorative person.			• Inside your sneaker/boot • Inside a fake can • In the Fridge • In the wall	• In Hollow Doors • Inside a Mattress • Under any Fake Floor • Inside a Piano
Tips	Make sure the item can't just be picked up and taken away whole such as safes not attached to the ground. It's safer to put items inside larger items that also can't be taken away such as a piano. Be sure to tell your significant other where you hide valuables so they don't throw them away by accident.				

Outside

Hiding your valuables outside is the optimum location if you aren't planning on needing them for many months or years. You can feel relatively safe that your items won't be found if you own the land it's buried on and it's buried deep enough.

Advantages	• Much harder to find valuables hidden outside and especially underground.	• Can bury items in a relatively large amount safely.			
Disadvantages	• Takes time to find dig up	• May be difficult to find the exact location if it becomes overgrown	• Erosion may reveal the cache over time		
Positioning	See the Cache section below for tips on positioning and burying valuables.				
Tips	**Midnight Gardening** Burying a safe at night. Ensure airtight, waterproof, rustproof container. Should be a challenge to find and not obvious if people know.				

Defence in Depth

Store items multiple layers deep such as in a floor safe, under floor boards with a rug over the top. 3 is a great number to aim for when layering security measures. Try to make it less obvious each layer down that there's valuables close by.

Accessibility

Preppers need quick access to their money in the case of an emergency when they have a few minutes to grab their BOB and leave. You absolutely don't want to run around the house pulling money out of every cranny if it will take hours to find it all.

Risk / Reward
o

Diversity

Almost the opposite of accessibility is diversity, the art of spreading out your assets so if one is compromised, the rest will be fine. Diversity makes it hard to retrieve your valuables in the event of an emergency when you have 5 minutes to grab gear, particularly when it's spread among other locations or hard-to-reach-quick locations.

Weight / Space

The more valuables you have the more space it will take up, making it more costly to store and hide particularly precious metals. As the collection of valuables grows the weight could also become an issue if stores in places such as an attic or shelves which could bend or break under the load. Diversity can help to not only protect your valuables by spreading them out to help prevent theft of everything but to distribute the weight around.

Metals
Large amounts of precious metals can become very heavy quickly so it's vital to choose a location strong enough. Silver takes about 128 times more space than gold for the same value, however silver has more uses and is better for low value barter.

Camouflage

The art of hiding valuables in seemingly common invaluable items as a way to reduce the risk of theft.

Decoys

Decoys are the opposite of camouflage - being items which look like they possess valuables but only contain junk or semi-valuable items. Putting semi-valuables inside decoys may make the thief feel like they have the best items even though you have the real cache somewhere else.

Putting a safe in a wardrobe is a sure way to get a thief interested in what's inside it, especially if it has a certain heft to it.

Area Security

Home Security
Cameras for video recording and monitoring.

Comfort Storage Level

Comfort Storage Level
How many people know?
Work in the public eye?
House alarm system?
Fireproof / Waterproof?

Professional Storage

Professional Storage
1. Outside the banks
2. Allocated in your name
3. Fully Insured
4. Easy online access

3 Portfolio

Money Portfolio

A Non-Volatile method of investing money to ensure it survives drops but it's also dependant on the grid being up. You should have an annual or Semi-Annual reallocation of stocks. To be prepared for a grid down SHTF situation most of your money should be safe in non volatile physical cash and metals for trading. It is always better to have items in your possession that provide a function rather than any form of money including bullion and cash. For example you should have a water filter rather than the money needed to buy one.

Grid Up Asset Classes
- Stocks - 20%
- Bonds - 20%
- Cryptocurrency - 0%
- Cash (Physical) - 20%
- Cash (Digital) - 20%
- Metal Bullion - 20%

Preparedness Asset Classes
- Stocks - 4%
- Bonds - 0%
- Cryptocurrency - 1%
- Cash (Physical) - 25%
- Cash (Digital) - 10%
- Metal Bullion - 60%

Protecting Money
Use multiple banks to store digital money like savings in case one of them shuts down without warning and you lose it all. Try to keep 6-12 months of living expenses of cash on hand. This includes everything from food and water to bills.

SHTF Portfolio

When SHTF occurs a lot of people's money will be inaccessible. You should ensure your money is protected from "the system" by being offline and accessible. The following is a list of ways money is commonly stored, the risks they involve and systems they rely on from the highest risk to the smallest risk.

Monetary Type	Description	Risks	Requirements	SHTF Outcome
Cryptocurrency	Any money stored in crypto.	• Online • Intangible • Unstable • Digital Theft	• Internet • Grid Up	You lose it all instantly if SHTF.

Stocks	Any stocks you've invested in.	• Online • Intangible	• Internet • Grid Up	You lose it all instantly if SHTF.
Bonds	Any bonds you may own.	• Online • Intangible	• Grid Up	You lose it all instantly if SHTF.
Cash - Digital	Any money stored in a bank account.	• Online • Intangible • Digital Theft • Bank Closure	• Internet • Grid Up	You lose it all instantly if SHTF.
Precious Metals - Digital	Precious metals you own that are stored in a bank or area not controlled by you in a another location.	• Online • Intangible	• Internet • Grid Up	You lose it all instantly if SHTF.
Cash - Credit Card	Money you don't own therefore no big loss if SHTF.	• Online • Intangible	• Internet • Grid Up	You lose it all instantly if SHTF.
Cash - Physical	Any money you have stored in a physical location.	• Theft • Fire • Undervalued • Unvalued	• Security • Storage Space	Cash may or may not still have value.
Precious Metals - Physical	Precious metals you own physically.	• Theft • Possible Fire Damage • Rust/Tarnish	• Security • Storage Space	Precious metals should always have a value even if you have to wait a few years.
Tradables	Valuable items that you can barter in SHTF excluding precious metals.	• Theft • Expiry • Fire	• Security • Storage Space	Tradable and valuable items will always be useful.
Assets	Any material goods not considered valuable but still useful. E.g. Scissors, linen, metal poles.	• Expiry • Fire	• Storage Space	Items that could be repurposed in a survival situation.

4 Bartering

Everything from clothes, wine, gold, silver and gems has been bartered throughout history as a means of trading something you don't need for another item that you do. The ability to barter goods and services in any disaster will be almost essential due to the lack of survival skills today and the complexity of our current lifestyle. This section will inform you on why to barter, how to barter, how to negotiate and what sorts of items are best to barter.

Subheadings

1. Trade Value	**2. Valuables**	**3. Vices**	**4. Essentials**
5. Others	**6. Negotiating**	**7. Trading**	

1 Trade Value

Trade value is an intrinsic method for calculating the value of products. If you have the value of one item you can extrapolate the value of everything else.

Don't look at the typical dollar value of the trade unit when bartering as prices are subject to multiple conditions in a disaster affected world.	**1oz Copper** = 2 Trade Value **1oz Silver** = 50 Trade Value **1oz Gold** = 4000 Trade Value	**AOCS** American Open Currency Standard

2 Valuables

Precious metals are unsurprisingly, precious to a lot of people as the value isn't inflated like paper money today. Below are a selection of precious metals, their uses and values.

Precious Metals
- Copper
- Silver
- Gold
- Platinum
- Palladium

Precious Metals

Based on intrinsic value, hard to verify quality. Good to trade for in hard times to make a profit afterwards. Buy Silver over Gold pre-SHTF for small transactions during a SHTF scenario. Have fewer Gold coins.

Gold	Used for purchasing expensive items.
Silver	Used for purchasing common items and daily exchanges. Silver can also be used for making colloidal silver and silver can sterilize wounds.
Platinum	Used for purchasing uncommon items and daily exchanges.
Palladium	Used for purchasing uncommon items and daily exchanges.
Copper	Used for cheap purchases and daily use.

Verifying Silver

Verifying any precious metals is vital in ensuring you are getting exactly what you are bartering for. There may be people who try to scam you with fake gems, metals and money. Metals can look and weigh the same as the real thing but may only be plated on the exterior.

Visual Test

Silver has a distinctive look and feel to the coin not too shiny and not too cloudy. Grab an old magnifier, the one's that jeweller's use, and take a good look at the coin. It's always best to have an authentic coin or bar next to the one you are examining. Mismatched surfaces, text spacing, crevices, or edges will stand out if it is a fake. Your tool of choice for this test is a handy magnifying glass or a jeweller's loupe. A loupe if a special magnifying glass without the handle with higher magnification due to its special lens. These are essential to the world of coin collecting & numismatics, making it easier to grade the quality as well as identify counterfeit coins such as fake silver dollars. A dead giveaway is the edges of the coin or reeding. If there are no grooves or reeds, there is a 99.9% chance it is a fake since minted coins non-reeded (errors) are extremely rare. Examine where the coin meets the rim and between the reeds, sometimes silver-plated coins will not fill these in and with a proper magnifying glass they will be detected.

Weight

The best way to take advantage of this is by using a good digital electronic scale. You will want to get a scale that measures at least to 2 decimal points in grams. Silver Eagles have a minted weight of 1 Troy oz. ~ 31.103 grams.

Sound (Ping Test)

The great thing about silver is that it has a certain high-pitched ring to it when struck with another metal, many people refer to this as the ping test and it works fairly well. To do this, simply place one silver coin on your fingertip and take another between your thumb and forefinger and gently tap your coin. It should produce a nice high-pitched bell ring. The neat thing about this test is that silver rings at a certain frequency of about 6145 Hz.

Resistivity

Measuring the resistance of the surface and through the metal then comparing them can determine if it's plated or true metal.

Magnetic

While many fakes can easily pass this test, silver as well as gold bullion for that matter are both non-magnetic. If a bullion coin or bar sticks to a magnet you can easily throw this one out. Fakes that are produced with any iron or steel content in them will give off some magnetic attraction and identify itself as a fake. Metals that have a core of zinc, copper, lead or other non-magnetic metal will not be detected by this test.

Diamagnetism

Continuing on with magnets, another test you can to spot counterfeit silver is using a magnetic slide. Simple and easy to build, this is a fun way to instantly spot fakes without any complicated testing. Even though silver is non-magnetic it has a property known as diamagnetism. This causes silver to repel when in contact with a magnetic field. So real silver moving down a magnetic slide will move slower than fake silver. A fake will move down the slide with no resistance.

Ice Test

Cheap and easy to do, getting some ice from the freezer is a simple way to test both silver coins and bars for authenticity. All you need to do is place the ice on the silver and watch. The ice should begin to melt immediately, this is because silver is the best conductor of heat for all the metals. Below is a chart on thermal conductivity amongst popular metals. You will see that silver tops them all even including copper which is the most popular metal to use. This makes it extremely useful in electronics and as an industrial metal, check out 101 uses of silver, and you will see how useful this metal really is!

Thermal Conductivity
- Silver - 406
- Copper - 385
- Gold - 315
- Aluminium - 205
- Rhodium - 151
- Iron - 79.5
- Palladium - 71.2
- Platinum - 69.1

Bleach Test

Another cheap and simple way to test for real silver vs. fake is to use some household bleach. Silver will tarnish very fast when exposed to any sort of oxidizing chemical like bleach. All you will need is just 1 drop, place it on the silver and if it begins to turn black then you can check it is silver. If your coin has numismatic value of any sort, this test may reduce its premium and you may want to perform another test. (Silver-plated items will also pass this test)

Specific Gravity Test (Highly Accurate)

The specific gravity test of silver is basically a ratio of densities and due to its chemical & composition makeup should equal ~ 10.49, given by the formula:
Specific Gravity of Silver = Weight of Silver / Weight of Silver Submerged

This test will weed out those silver-plated or clad coins if they have a composition of some other base metal. You cannot change the density of metal and pure silver will always give a reading close to 10.49. To calculate this perform the steps below:
- Obtain dry weight of the silver coin or bar with an accurate scale to .01g
- Use a cup of water enough to fully submerge the silver into and measure its weight or reset the scale with it on.
- Tie some string around the coin and setup an apparatus to hold the coin
- Submerge the silver into the water and record the submerged weight minus the weight of the water & cup.
- Divide the dry weight by the submerged weight to obtain the specific gravity of silver

Be warned: Sophisticated counterfeiters also have ways of combining certain metals together to get a similar specific gravity readout. Using this test together with the ring test & visual test should be able to detect these types of fakes.

The Acid Test

Another test with high accuracy, this test uses acid solution usually of nitric acid and muriatic acid. You will have to purchase this from a dealer or on Amazon. Just search for silver acid testing kit or puritest. You will also want to get a testing stone to use with the solution. While this test can immediately verify pure silver, it will damage the coin. So it is best to use this is you bought a lot of coins or bars and want to test 1-2 for purity. If you suspect the outside is silver-plated, you may need to file through an edge to get to the centre metal in order to test. Once the acid is placed, pure silver will stay a certain colour, while fake silver will turn a different colour depending on the metal used to counterfeit. This test is also really useful for testing sterling silver if you're not sure that platter you bought at the goodwill is 925.

XRF Analysers

If you're serious about silver or maybe ultra paranoid, you may consider investing in a portable or handheld XRF Analyser. XRF is short for X-ray fluorescence, and is used not only in detecting precious metals but all sorts of metal alloys, mining samples, environmental assessments etc. These handheld device are just like scanners, point and shoot, and the device will give an accurate readout of the metal composition. If you're interested in getting one of these cool little toys, 2 companies that make them are Niton and Bruker. Be warned these are extremely pricey can run over $10,000 and are usually carried only by gold/silver bullion or jeweller shops.

Ultrasonic Thickness Test

If XRF analysers are out of your price range, but you still want a scientific tool to determine real vs. counterfeit silver, an ultrasonic thickness gauge may be for you. What this test does is measure how long it takes for sound to travel through a metal object, in our case silver. If your bar is pure silver, it will give an accurate reading, if it is a mix of metals, the reading will be off. For different metals, you will get different readouts of thickness. This is also a great way to test for fake gold coins and bars. The speed of sound for silver is 3650 meters/second at room temperature.
You can check the speed of sound of other metals here. Gold is 3240 m/s.

- Set the device to a velocity of 3,650
- Measure the silver bar with a proper caliper
- Place a dab of glycerine on the bar where you will measure the thickness
- Measure the thickness with the sensor
- Readout thickness should match the actual thickness of the bar (in mm)

This works really well for large silver bars or ingots. If the bar is plated in silver/gold it will give an inaccurate thickness tipping you off that the silver is counterfeited with some other metal. From here you could perform a few other tests to confirm your suspicion. If you are a regular buyer of silver bars this maybe the tester for you as you can buy an entry-level gauge for several hundred dollars unlike the expensive XRF analysers. Here is one for less than $200 on Amazon.

Sigma Metalytics Precious Metals Verifier

A step up from an ultrasonic gauge but still less expensive than an XRF analyser is the Sigma Metalytics Precious Metals Verifier. This ingenious product sends electromagnetic waves though the metal & confirms it with stored patterns. This is ideal for any coin shop, bullion dealer, or avid coin collector. Besides silver, also a foolproof way to spot fake gold coins & bars.
- Can verify any metal including gold & silver
- Determines metal from bulk not the coating or plating
- Very fast reading times, only seconds
- No dangerous or wet chemicals
- Can read through packaging, good especially for numismatic coins
- Comes with 3 wands to read 1/10 oz. up to 100 oz. bars

Verifying Gold

Gold Properties
- Resistant to oxidation - it doesn't tarnish or rust.
- Gold is non-magnetic.
- High thermal and electrical conductive – also corrosion resistant. Thus it makes gold indispensable in electronics.
- Gets dissolved only by nitro-hydrochloric acid – a mix of 75% nitric acid and 25% hydrochloric acid which has a yellow-orange colour.
- Malleable – presses into very thin sheets, 10x thinner as a paper sheet. The sheets are then used for infrared reflectivity (by evaporating the sheets onto glass), as fillings for teeth, etc.
- Ductile – can be drawn into thin wires that deposit onto circuits, like transistors, useful as a brazing alloy, industrial solder, orthodontic appliances, jet engine fabrication, etc.
- Sectile – it's a relatively soft metal. To combat its weakness, it must alloy with other metals like silver, nickel, copper or platinum.

Karat Equivalency Table

Gold Content	Karat System	Millesimal Fineness System	Gold / Not Gold		
33.30%	8K	333	Not Gold		
37.50%	9K	375	Not Gold		
41.70%	10K	417	Gold Alloy		
58.30%	14K	583 (585)	Gold Alloy		
62.50%	15K	625	Gold Alloy		
75%	18K	750	Gold Alloy		
83.30%	20K	833	Gold Alloy		
87.50%	21K	875	Gold Alloy		
91.60%	22K	916	Gold Alloy		
95.80%	23K	958	Gold Alloy		
99.90%	24K	999	Pure Gold		

Magnifying Glass Test

The Magnifying Glass Test is the first home test for gold you can take if you want to determine the authenticity of your gold product. This test is straightforward since it requires only your gold bullion or jewellery and a magnifying glass.

Look For
- Discoloration
- Colour
- Shininess
- Purity Hallmark

Discoloration
Gold is chemically inert. This means that gold doesn't react to any environmental factors. So if you spot some discoloration marks on your item, it indicates fake gold or gold-plated. This is especially true if you detect other metal under the discoloured areas.

Colour and Shininess
Genuine gold has a beautiful soft yellow colour and is not very shiny. If your gold piece is too shiny, too yellow or has another colour tone(reddish), then it's not pure gold.

The Purity Hallmark
The purity hallmark can be either in millesimal fineness or Karat system as mentioned above. For example, if you own the purest gold, you should see hallmark "999" or "24K" engravings somewhere on the item. However, keep in mind that this engraving could also be fake. Therefore, you should conduct further tests to authenticate your item. The purity hallmark is a good clue if showing a value less than 10K. It instantly certifies that your item is not genuine gold according to US standards.

Hallmark Test

How to examine gold jewellery at first glance? Start with the Hallmark Test. The terms gold hallmarks or gold markings refer to a set of compulsory marks which are engravings on the gold item. Jewellery producers usually mark their pieces with stamps which are called Gold Jewellery Markings Symbols. On necklaces and bracelets, these jewellery hallmarks can be found on, or near, the clasp. However, on rings they are somewhere on the inside surface. These markings must include the purity of the piece (in Karats or millesimal fineness).

Also, the gold markings on jewellery should include the manufacturer's stamp. This will help you authenticate the producer of your gold item. Some countries have certain hallmark standards. India is an example. Five hallmarks help purchasers identify Indian gold. These include Gold Assay Marks. (BIS Standard Mark, Assayer or Hallmarking Centre's mar), which are third-party assayers). Additionally, you can identify by the Purity Grade expressed in millesimal fineness and year of marking. The year of marking is an alphabet letter approved by BIS and the jeweller's mark.

Gold Plated Stamps
- “HGP” - Heavy (Hard) Gold Plate
- “GF” - Gold Filled
- "GP" - Gold Plated
- "H.G.E." - Hydrostatic gold electroplating
- "G.E.P." - Gold electroplating
- ".925" - Sterling Silver
- "1/20" - 1/20 gold which is just gold-filled

They all mean that the item is gold plated. Also, beware of 800, 925 and 950 marks because these are all silver hallmarks. This means the item is undoubtedly fake. The Hallmark Test isn't 100% accurate because it doesn’t give any reliable evidence that you have real gold coins, bars or jewellery. However, it may help you a little bit by giving you initial clues when the gold is not genuine.

Skin Test

One of the easiest methods of testing gold purity is the Skin Discoloration Test. Real gold won’t leave any stains or spots on your skin. However, if you are wearing fake gold jewellery or handle fake gold bullion - your skin will discolour. Just hold your gold item in your hand for a couple of minutes. If it’s fake gold, the sweat on your skin will create a chemical reaction with the metal. Your skin will discolour to a black or green colour. This is because it will react with the other alloy metals. If it’s genuine gold – it won’t react with your skin. Important: If you test your gold item on a skin area with previously applied liquid foundation or powder, the real gold will leave a black streak on your skin. This may compromise your testing. For this reason, we recommend you ensure that your skin is clean and without makeup. Thus, if your clean skin experiences black or green discoloration – then it’s fake gold. Otherwise, you can perform the next tests to ensure you have pure gold.

Makeup Test

If you'd like to take the skin test one step further, you can also learn how to test gold at home with makeup. Let's explore how to tell if gold is real with makeup. You'll need liquid foundation makeup and powder. First, coat the top of your hand, or your forehead with a thin layer of foundation and powder. Wait until the foundation thoroughly dries. Once the foundation dries, press the gold into your skin. Then, lightly rub the gold against the foundation. If your gold leaves a line or black streak, it is very likely to be authentic gold. If you do not see a line or black streak, the object is likely to be another metal or gold-plated.

Float Test

One of the simplest ways to test gold at home is the Float Test. All you need is a cup (or bowl) of water and your gold item. Place your gold piece into the water. If it’s genuine gold, then it will immediately sink to the bottom of the cup. Pure gold is heavy due to its high density – 19.32 g/ ml. If your gold item floats or hovers above the cup’s bottom – it’s fake or plated gold. Its density is lower: 14K – 12.9 to 14.6 g/ml, 18K – 15.2 to 15.9 g/ml, and 22K – 17.7 to 17.8 g/ml. However, the Float Test is not a 100% accurate test because the fake item can have other heavy metals which sink as well. This is why it must be a preliminary method only. Also, keep in mind that real gold doesn’t rust or discolour if you place in water. Any signs indicating this reaction is a confirmation of a fake gold or gold plated item.

Porcelain Tile Test (Scratch Test)

Another easy to carry out, yet good preliminary gold purity check is the Porcelain Tile Test. This is also known as the Gold Scratch Test. To perform it, you need a piece of unglazed porcelain tile or ceramic plate. You can buy these at any hardware or home maintenance shop. For testing gold jewellery or bullion, you have to rub (or scratch) it across the porcelain tile/ceramic plate. Then you analyse the colour of the produced streak. If the gold is real, then it should show a golden, yellow colour. If you see a black streak instead, then you have pyrite or fake gold. However, keep in mind that by scratching gold, you can cause irreplaceable damage to it. This will alter its value. Thus, you may think of using other harmless testing methods to authenticate pure gold.

Magnet Test

The Gold Magnet Test is one of the most convenient home gold tests. It’s also very quick and easy to use. A magnet is a cheap and portable solution. You can carry this test out anytime you need to check gold authenticity when buying gold bullion or jewellery. To perform this test, you need a high-strength magnet, which you can buy at any local hardware store. Place the magnet near the gold item. Fake gold or gold alloys will be instantly attracted to the magnet. This reveals the true nature of the underlying metal. It is not made of gold or has a meagre percentage of it. Gold is a non-ferrous metal, which means it won't attract the magnet.

So, even if the item is slightly magnetic (but doesn’t stick to the magnet) – it’s gold-plated. This is common for some counterfeit coins that appear like gold. Yet these coins are only gold on the surface. So, if your magnet was attracting your gold piece, you can certainly skip the next tests. You know for sure whether your gold is pure or not. If your gold item doesn’t get attracted at all – it’s likely pure gold. However, remember that the Magnet Test for Gold is not a foolproof test to find out if the item is made of genuine gold.

This is because some counterfeit pieces have other metals which are also not magnetic (like silver). So make sure to perform additional testing to be sure you own a piece of real gold. Also, note that jewellery items may have strength pieces that are not real gold. These include things like clasps and bracelet wire which can be magnetic. So it may look like the jewellery is attracted to the magnet. But it’s the metal inside that specific piece that is doing the attracting, not the gold. Be sure to test the chain and charms to be utterly sure of its purity.

Acid Test

The Gold Acid Test is the most popular and accurate home gold test. This is because it may harm or damage only fake materials. However, make sure to perform the acid test only if your item was identified as non-magnetic during the previous test. This helps to avoid any unnecessary expenses and actions. Additionally, take into consideration to carry out the acid test only on pieces of gold that you won’t mind scratching/damaging. Or, that you won’t sell for aesthetic value.

- Gold Testing Acid Kit – which may include either hydrochloric and nitric acids along with a dropper, or particular samples for each type of gold Karat acids (10K acid, 18K acid, 22K acid, etc.).
- Black Gold Testing Stone – you must thoroughly rub it with a 320 grit sandpaper, wash and rinse it before making each test.
- Acid Test Gold Needles – they have different Karat gold tips to use for comparison with your test pieces.
- Two glass beakers – one with water mixed with baking soda, for washing the stone and other with water to rinse the stone in it.
- Rubber gloves, protective eyewear, a piece of glass and a plain white paper towel – as additional safety measures that you can find in a hardware store.

Once you have all of the above items, make sure to find a well-ventilated area to perform the testing gold with acid. Put on your gloves and eyeglasses. Then, prepare your testing space and proceed to test your gold piece. There are two known ways how to test gold by using the acid kit. However, before beginning them, you should differentiate the peculiarities of your specific acid test kit. The gold testing acid kit, which includes nitric and hydrochloric acids, is good for determining if it’s real or fake gold. You should know that nitric acid (also called aqua fortis) will dissolve any metal that is not gold. Therefore, checking for a reaction with nitric acid will let you see if your gold is fake or is an alloy.

A mix of 3:1 of nitric and hydrochloric acids (also known as the aqua regia) is the only acid mixture that can dissolve gold, even the purest one. You can use this solution only if your gold successfully passed all the nitric acid tests. If you have a gold karat acid test kit, then you should know that each bottle is a different mixture of nitric acid and other components. Therefore, a reaction with a specific Karat bottle shows that your gold piece has a lower fineness. Additionally, a slight response indicates that you’ve matched the Karat. Lastly, an absence of reaction is a sign of higher purity. Now you know the differences between the two gold acid test kits.

Place the gold testing acid directly on your item.
First of all, you should put the piece of glass on your table and cover it with the plain white paper towel to avoid any damage to your working surface. Place your gold item on a towel. Then, use a small sharp graver to make a small notch preferably in a hidden spot. Make sure to penetrate and expose the metal beneath the surface. Then place a drop of nitric acid directly on the notch. Observe the chemical reaction. If you immediately notice a green effervescent, bubbly, and smoky fizz it's fake gold. (contains copper). In some cases, it will burn off plating or discolour the object. At this point, no further testing is required. However, if the notch looks cream-milky, then you have gold-over-sterling-silver.

If the spot turned darker in colour or looks like rusty gold, then you most likely have a low Karat gold. If you have a special gold karat acid test kit, you should repeat the acid test starting with the highest Karat acid. Then watch the results until the acid stays clear like water. No reaction, or a slight one, means that you've matched the right Karat of gold with the correct acid. An important thing to keep in mind is that when testing different Karat acids, you need to wash the acid off the item in the water and baking soda mix beaker. Then, rinse it in the water beaker.

Genuine gold will stand the test by not reacting with the nitric acid. It will leave a clear drop of liquid over the unaffected notch, with no changes in colour. If you want to double test for real gold, you can use the aqua regia mix. However, we do not recommend placing it directly on your item because it will damage your piece. Use a testing stone instead. You should make a small scratch with your gold piece and put a drop of aqua regia. If it's dissolved – you have real gold.

Scratch test gold on the Black Gold Testing Stone
Begin with placing the glass piece on your testing surface. Then take your gold item and scratch it on the Black Gold Testing Stone until it leaves a slight line. Make sure you scratch through any potential plating. Now take the Gold Testing Needles and mark your line with a symbol ("X" or "?") by using any of the needles. Then, for each needle repeat the gold line parallel to yours and write the Karat symbol above the line. Take the first acid to test gold (usually 10K) and apply its content across your gold samples. Or you can make small drops on each sample. After 30 seconds, wash the testing stone in the water/baking soda mixture. Rinse it in water and pat it with the plain white paper towel. If the acid dissolves your testing sample, then you have a lower Karat piece. Yet, if your sample has a slight reaction, you've matched the Karat. If it hasn't changed under the acid's action, then you have a higher Karat gold. In this case, you should repeat the test steps with the following Karat acids until the result matches your sample. If you have a 23K or 24K piece, and the last acid bottle from the kit is the 22K, then you should either proceed to test using gold testing machines. Or, if you have pure nitric and hydrochloric acid, perform the aqua regia acid test for gold on your scratch sample. If it gets dissolved, it's genuine gold.

Vinegar Test

The vinegar is a quick and easy test. You only need a dropper or glass container. You'll also need some white vinegar. To use the dropper follow these steps. First, secure your dropper and fill with white vinegar. Next, hold your gold in your hand or set on a flat surface. Third, place a few drops of vinegar onto your gold. Finally, if the vinegar drops change the gold colour, it is not pure gold. If the colour does not vary, it is pure gold. If you're using a glass bowl or cup, fill it with white vinegar. Let the gold sit in the vinegar for about 15 minutes. Remove the gold piece and rinse it. If the gold is real, it will shine. If the gold is fake, it will change colour. This reaction is to the acetic acid.

Weight / Size Test

This test is ideal if you own bullion coins and want to check the size and weight of your gold. Gold bullion coins are a specific weight and size, made to specification. This will give you a starting point to ensure the authenticity of your gold coin. Since gold is very dense (one of the densest materials in the world)--it is very hard to replicate. Real gold will be less compact. Fake gold materials are different-counterfeiters will need more of the material to replicate the weight of gold. You should know what your gold coin is supposed to weigh, as well as it's diameter and thickness. Now weigh and measure your piece. This will help you to more easily spot real vs fake.

Black Jeweller's Stone Test

For this test, you'll need to purchase a black jeweller's stone. It is critical to ensure you buy the right stone for this test. You can purchase through a local jeweller. Additionally, you can buy one online at a jewellery supply store. Note: Be extremely careful with this test. You risk damaging your gold if done improperly. Position your black jeweller's stone on a flat surface, such as a table. Hold your gold in your hand. Carefully wipe it along the stone. Do this firmly enough to leave a mark, but without damaging your gold piece. If the mark is solid and gold in colour, congrats! Your piece is pure gold. If there is a faint line or no line, your piece is not real gold. Or, it is gold-plated.

Ceramic Plate Test

For the ceramic plate test, you'll need an unglazed ceramic plate. Set your plate on a flat surface such as a countertop or table. Hold your gold steadily in your hand. Carefully scrape item along the plate. Now watch to see if you spot a line, or streak, appear. A black line means it is not gold or it is gold-plated.

Take a Bite Test

Many people have seen movies where a wild west cowboy, or city businessman, will bite into gold to see if it's real. The saying goes that if your teeth leave bite marks on the gold piece, it's real. However, this test isn't recommended for two reasons. The first is that even gold-plated pieces will show bite marks. The second is that biting into gold, or gold-plated pieces, can severely damage your teeth.

Sigma Metalytics Machine

Testing is performed by matching gold's electrical characteristics on each Karat with the results of the gold piece. The gold sample is assessed in less than a second, and it doesn't affect the bar or coin in any way due. This is due to the absence of any physical damage or use of chemicals. The Precious Metal Verifier uses electromagnetic waves that allow you to measure the underlying metal beneath plating or other surface features. It penetrates deeply into the bar or coin. Therefore, it ignores the surface and assesses the main body of your gold piece.

Besides, you don't have to remove your coins or bars from their protective holders because the Verifier can work through these plastic cases. The Sigma Metalytics electronic gold tester comes with different sized sensors for different sized gold samples. The main housing comes with the biggest sensor for large precious metal samples, such as 1 oz. bars and coins. For measuring smaller gold items, you should connect to the main unit, via the cable, one of three external wands:

Advantages
- Fast and Easy
- Universal solution
- Highly Accurate
- Convenient
- Portable and Durable

- Bullion Wand - penetrates the surface of bullion to a depth of .08in (2 mm).
- Small Wand - for small precious metal samples, such as 1 gram bars, CombiBars, and 1/10 oz coins, etc.
- Large Wand - for coins and bars with weights between 1/4 and 1 oz. After placing your gold piece on the right sensor, you must select the gold sample you expect it to be. The Verifier will show the result of your item's resistivity on its display. If the black cursor is displayed between the brackets, your item matches the fineness of your gold sample. If an arrow shows up on the display, it indicates that your item is not consistent with gold. Small changes in alloy will also make a huge difference in the Verifier's results.

XRF Thermo Scientific

ECONOMY Bartering Valuables Verifying Gold

The most accurate gold testing machines use X-ray fluorescence (XRF) spectrometers. These can cost thousands of dollars. The devices send X-rays through the gold piece. It makes its atoms momentarily excited-- moving them into a higher energy state. When returning to their ground state, the atoms release radiation. Then, the XRF precious metal tester detects and reads. It figures out exactly what the piece is made of. The best gold tester is the XRF Thermo Scientific™ analyser. It will give you a fast, accurate, and non-destructive appraisal of your gold item or any precious metal piece. This gold tester comes with the unique AuDIT™ gold-plating detection technology (Au (Gold) Detection & Identification Technology).

It alerts you if your item is plated or not. Also, it provides you with the exact karat weight and percentage of gold and other elements within your item. Thus, you can easily identify advanced counterfeit gold or items with lower karat than expected. The main advantages of using this gold tester are that you will get the precise concentration of gold and other metals. This is without having to manually change any settings or calibration. Besides, since there are no chemicals or physical damage involved, this method is the most accurate and inoffensive test to authenticate your gold items.

Verifying Gemstones

There are nearly an infinite number of combinations of rocks in the earth but if it's attractive to you then you should sell/buy it. Based on intrinsic value, hard to verify quality. Good to trade for in hard times to make a profit afterwards. The more common gems such as diamonds and sapphires are more likely to be fakes.

	Precious Gemstones	Semi-Precious Gemstones	Semi-Precious Gemstones
These are any type of rock that is dug up from the earth and is generally considered valuable.	● Diamond ● Ruby ● Sapphire ● Emerald	● Amethyst ● Garnet ● Lapis Lazuli ● Malachite	● Onyx ● Pearl ● Quartz ● Topaz

Use a gemstone identification chart to help with the identification.

1	Feel the stone's surface. A stone with a rough or sandy texture should not be identified as a gemstone.
2	Check its malleability. A stone that is readily malleable—i.e. easy to shape by hammering, crushing, or bending it—the stone is more likely a metallic ore than an actual gemstone. ● True gemstones have a crystalline structure. This structure can be shaped through cutting, fracturing, and abrasion, but it has fixed planes that cannot be altered by pressure alone. ● Don't hit a stone with a hammer if you don't want to shatter it. Real gemstones don't get bend or reshaped, but they do break.
3	Know which materials are not classified as gemstones. In particular, pearls and fossilized wood can be mistakenly classified as gemstones but do not fit the qualifications in the strictest sense of the term.
4	Watch out for synthetics. Synthetic stones share the same structure, chemical composition, and physical properties of their natural counterparts, but they are created in a lab rather than made naturally. You can usually spot a synthetic by observing several characteristics. ● Synthetic stones often have curved growth patterns inside the stone rather than angular growth patterns. ● Gas bubbles are that are round and come in large strings are often an indication, but be careful, since a gas bubble in an inclusion can occur within natural stones. ● Platinum or gold platelets can stick to synthetic stones. ● Fingerprint-patterned inclusions are common in synthetics, as are nail-shaped inclusions, chevron (v-shaped) growth patterns, wispy veil-like inclusions, and interior columnar structures.
5	Watch out for imitations. An imitation stone is a material that looks like a real gemstone upon first glance in spite of the fact that it is made of a completely different material. These stones can be natural or artificial, but there are a few good techniques used to spot them either way. Pay a special attention while checking Turquoise, Lapis, Sapphire, Ruby and Emerald because there are many treatments available in market which make the stones the same as the natural version. ● The surface of an imitation may look pitted and uneven, like an orange peel. ● Some imitations have swirl marks known as "flow lines." ● Large, round gas bubbles are common within imitations. ● Imitations tend to feel lighter than their natural counterparts.
6	Determine whether or not the gemstone is an assembled stone. Assembled stones are made of two or more materials. These stones may consist entirely of natural gems, but oftentimes, synthetic materials are mixed in. ● Use a penlight to illuminate the stone when checking for signs of assembly. ● Look for differences in lustre or for coloured and colourless cement. ● Also look for the "red ring effect." Turn the stone face down and look for a red ring along the outer part of the stone. If you spot the red ring, you probably have an assembled stone.
7	Look at the colour. The colour of the gemstone is often your first clue. This component can be further divided into three parts: hue, tone, and saturation. ● Do not shine a light into the stone to examine its colour unless you have a dark stone and need to determine whether it is black, dark blue, or another deep colour. ● "Hue" refers to the stone's overall body colour. Be as specific as possible. For instance, if a stone is a yellowish green, identify it as such instead of merely saying "red." The GIA separates stone hue into 31 different colours. ● "Tone" refers to whether a colour is dark, medium, light, or somewhere in between. ● "Saturation" refers to the intensity of colour. Determine whether the hue is warm (yellow, orange, red) or cool (purple, blue, green). With warm colours, check the stone for brown tints. For cool colours, check the stone for gray tints. The more brown or gray you see, the less saturated the stone colour is.
8	Observe the transparency. Transparency describes how light filters through the gemstone. A stone can be transparent, translucent, or opaque. ● Transparent stones are completely see-through (example: diamonds). ● Translucent stones can be seen through, but some colour or haze alters the image (example: amethyst or aquamarine). ● Opaque stones cannot be seen through (example: opal).
9	Check its heft or estimated specific gravity. You can determine heft—how heavy the gemstone is—by simply bouncing it in your hand. This is a quick and easy way to estimate a stone's weight without performing complex specific gravity tests and equations. ● To judge heft, bounce the stone in the palm of your hand and ask yourself if it feels as heavy as you would expect for its size or if it feels heavier or unusually light. ● Specific gravity readings are fairly out-dated as a practice among gemologists, and heft measurements are used as a relatively accurate estimation. ● For example, aquamarine has low heft while blue topaz, which is similar in appearance, has a high or heavy heft. Similarly, diamond has a lower heft than synthetic cubic zirconia.
10	Note the cut. While not a foolproof method of identification, some gemstones are more likely to be cut in certain ways. Oftentimes, ideal cuts are determined by the way light bounces off the crystalline structure of the stone. ● The most common cut styles you will run across include faceted, cabochon, cameo, bead, and tumbled. Within each of these basic cut styles, you will usually see sub-styles, as well.

11	Ask yourself if damage tests are appropriate. There are a few identification tests that you may wish to avoid if you need to preserve the gemstone in its current state. This includes hardness, streak, and cleavage tests. ● Some stones are physically harder than others, and hardness is usually measured by the Mohs' Scale. Use the various substances provided in a hardness kit to scratch the surface of the gemstone. If the stone can be scratched, it is softer than the substance you scratched it with. If the stone cannot be scratched, it is harder than the substance. ● To test streak, drag the stone across a ceramic plate. Compare the streak left behind to the streaks illustrated on a streak chart. ● "Cleavage" refers to the way a crystal breaks. If there are chips along to surface, examine the area inside the chips. If not, you will need to strike the gemstone hard enough to break it. Ask yourself if the area is rounded like rings on a seashell (conchoidal), straight like steps, granular, splintery, or uneven.
12	Check optical phenomena. Optical phenomenon only occurs inside certain stones. Depending on the stone, you might observe colour change, asterism, bands of moving light, or more. ● Check for optical phenomena by passing a pen light across the stone's surface. ● Colour change is one of the most important optical phenomena to look for, and every stone should be checked for colour change. Look for changes in colour between natural light, incandescent light, and fluorescent light.
13	Look at the lustre. Lustre refers to the quality and intensity with which a surface reflects light. When testing for lustre, reflect light off the portion of the gemstone with the best polish. ● To check for lustre, turn the stone, allowing light to reflect off its surface. View the stone with the naked eye and with a 10x loupe. ● Determine if the stone looks dull, waxy, metallic, shiny (adamantine), glass-like (vitreous), greasy, or silky.
14	Observe the gemstone's dispersion. The manner in which a stone separates white light into its spectral colours is called dispersion, and the visible display of dispersion is called fire. Examine the amount and strength of this "fire" to help identify the stone. ● Shine a penlight through the stone and examine the fire inside the stone. Ask yourself if the fire is weak, moderate, strong, or extreme.
15	Determine the refractive index. You can test refractive index (RI) using a refractometer. Using this device, you'll be able to measure the degree at which the course of light is altered within the stone. Each gemstone has its own RI, so discovering a sample's RI can help you figure out what sort of stone it actually is. ● Place a small bead of RI fluid on the metal surface of the refractometer near the back of the crystal hemicylinder (the window on which the stone will sit). ● Place the stone facet face down on the fluid dot and slide it toward the middle of the hemicylinder crystal using your fingers. ● Look through the viewer lens without magnification. Continue looking until you see the outline of a bubble, then look at the bottom of this bubble. Take the reading from there, rounding the decimal to the nearest hundredth. ● Use the magnifying lens to take a more specific reading and round it to the nearest thousandth.
16	Consider testing the birefringence, as well. Birefringence is related to RI. While doing birefringence test, you will turn the gemstone on the refractometer six times throughout the observation period and note the changes. ● Perform a standard RI test. Instead of keeping the stone still, gradually turn it 180 degrees, making each separate turn about 30 degrees. At each 30 degree mark, take a new RI reading. ● Subtract the lowest reading from the highest to find the stone's birefringence. Round it to the nearest thousandth.
17	Check for single or double refraction. Use this test on translucent and transparent stones. You can determine whether the stone is only singly refractive (SR) or doubly refractive (DR) to help identify it. Some stones can also be classified as aggregate (AGG). ● Turn on the light of a polariscope and place the stone face down on the lower glass lens (polarizer). Look through the top lens (analyser), turning the top lens until the area around the stone looks darkest. This is your starting point. ● Turn the analyser 360 degrees and watch how the light around the stone changes. ● If the stone appeared dark and stays dark, it is likely an SR. If the stone starts light and stays light, it is likely AGG. If the lightness or darkness of the stone changes, it is likely DR.

3 Vices

Feeds people's addictions which they will need after a disaster.

Alcohol

Alcohol will be a sought after product as people will want to drown their sorrows. It also has a multitude of other uses too.
Fermentation (Degradation) of the alcohol stops past 20%

Alcohol Uses
- Drinking
- Antiseptic / Sterilization
- Pain Reliever
- Fire Lighting
- Defence / Molotov
- Car Fuel Source
- Stove Fuel Source
- Lighting

Strongest Alcohols
- Stroh Rum $75 - 80%
- King's 190 Proof $129 - 95%
- Spirytus - 95%
- Everclear - 95%

Alcohol Content
- Beer - 3-10%
- Wine 9-18%
- Liquors - 15-45%
- Spirits - 20-55%
- Moonshine / Everclear 70-90%

Spirits (Whisky, Vodka) are the most versatile to trade, ensure it's over 40% ABV. Nips (airplane bottles) would be better to trade in the smaller bottles to transport and trade for less.

Cigarettes

This will still be a black-market item in the apocalypse and people will want to get their fix.

Caffeine / Tea / Coffee

Some people are so addicted to their tea and coffee they will get a throbbing headache if their daily dose isn't met.

Sugar & Lollies

Sugar is another addiction people will want to quench and they could get just as bad reactions if they don't get their fill.

Sugar / Lollies
- Sugars
- Hardboiled Lollies
- Soft / Gummy Lollies
- Chocolates

Drugs

This will still be a black-market item in the apocalypse and people will want to get their fix.

Sex

People are likely to have a lot of sex during disasters and people won't want to raise a child in a world with violence everywhere. Condoms, lubricants and sex toys could become sought after. Some people who have never considered it may even barter sex itself to stay alive.

4 Essentials

These are the essentials everyone needs to survive.

Water

Everyone will need food and water and these essentials will be the main form of trade.

Access to Water	
Milk / Juice	
Soft Drinks	

Food

Everyone will need food and water and these essentials will be the main form of trade.

Fresh Foods	Freshly grown foods are an ideal way to make a profit and to sustain yourself.
Long Life Foods	Long life foods such as certain breads, chips and biscuits will be fairly rare.
Canned Foods	Canned foods will be a common barter item as their infinite life will make them easily available at first.
Lollies / Sweets	These won't be traded often but with their long life they will at least provide some nutrition.

5 Others

Animals

Animals, especially ones that give food will be highly sought after in a SHTF world. You will need to be extremely careful with them however due to the high risk of them being stolen.

Medicine

Medicine will be extremely rare in a long term disaster due to the generally close expiry dates, the need to keep them refrigerated and the amount you need to take to heal a condition.

Non Prescription
- Panadol
- Nurofen
- Imodium
- Hayfever
- Melatonin

Prescription
- Amoxicillin
- Ciprofloxacin
- Cephalexin

Wound Care
- Band-Aids
- Israeli Bandages
- Cleaning Pads

Dental
- Mouth Mirrors
- Toothpaste
- Tooth Filler

Electricity

Electricity can be sold in the form of recharging rechargeable batteries for someone or having a direct line from your solar panels to another location to run a customers device. Although it's a tricky one to sell it can be done with relative ease if say, the customers bring their rechargeable batteries to you and you give them back the next.

Electricity Sources
- Solar
- Generator
- Dynamo/Pedal
- Wind
- Water

Digital Files

Digital files can be traded to those in need of information as long as technology still works. The best part about digital files is that you can barter them out infinitely without needing a physical item while retaining your own copy. Be sure you tell each person you barter with about the value in the digital files and why they shouldn't be given out freely to other people they don't know.

Digital Maps

Maps are a vital source in a world without the internet and many people won't be ready for a world without navigation. Downloaded offline maps can be extremely useful for other people to navigate properly and find their family and other locations they seek.

Map Formats
- .jpg
- .png
- .aqm (Alpine Quest)

Digital Entertainment

People will still want entertainment when the grid goes down and if you have a collection of movies and Tv shows you'll be able to trade them for something you need.

Entertainment
- Movies
- Tv Series
- Games
- Music

Knowledge

Transferring knowledge often takes time to sit down with someone and teach them something unless there's blueprints, plans or books you can give them instead. The easiest way to make a profit would be for selling books on techniques for keeping you alive. Another form that could be marketed is teaching someone how to filter water, ensure food is safe and farming.

Hunter/Gathering	Knowledge on hunting animals and foraging for food.
Water Purification	How to build and maintain a water purification device.
Fire Lighting	How to light fires from items around the house.
Construction	How to build shelters from wood or rebuild a partially destroyed house.
Medical Advice	Many won't have access to doctors and you could charge per client.
Farming	Setting up a farm and how to maintain it.
Home Defence	House reinforcements and defence training.

Skills

Much like today there will be a lot of jobs requiring contractor skillsets which you can make a profit from.	**Skills** ● Doctor ● Plumber ● Bodyguard ● Thousands More	See the "Skills" section for more ideas on skills you can barter.

Payment
Payment of the hired individual should occur at multiple stages throughout the hiring term. An example is if you've hired someone for 12 hours, they should be paid in 2 hour instalments to prevent them ripping you off or vice versa. At minimum the payments should be split into 2, one before they start work and one when they finish.

Other Items

Other barter items.

Guns & Bullets	Never trade these, they could be used against you.
Fuel	Degrades quickly if not stabilised and worthless if the disaster is an EMP.
Condoms	A great item with multiple uses such as sex or water storage.
Toilet Paper	People won't be able to give up their toilet paper easily and this will sell well in the early days of a disaster.
Water Filters & Tablets	Everyone requires water to live and these will be a vital commodity.
Crafted Items	You can create your own items to sell from sun catchers to water filters to homemade meals.

6 Negotiating

This section details how to set up a trade, ensure it's protected and negotiating skills. There may be hubs of trade in a SHTF scenario after the initial panic and the stores are bare and this is what the following section is based around. This guide assumes you have family or friends who can act as bodyguards and protection for your merchandise. It also assumes that you have a few barterable items on you or in a portable trailer if you're selling and a selection of valuables if buying.

Being a SHTF scenario with no form of solid trade in place, prices will always be open for offers and bartering. Haggling has an emotional component. The seller often employs negotiating tactics to elicit an emotional response, hoping you'll feel compelled to pay more than you want to. At the same time your goal is to soften their resolve so they will give you a lower price. The word "bartering" is often used in place of haggling, and while they both require similar skills of negotiation, bartering is an exchange of services or products, whereas haggling is a negotiation for a lower price, most often paid with money. Try to negotiate everything when possible as you could save some "money" which you may need later.

Preparation

Choose the Location	Choose a location far from your prepper stockpile and house to ensure their security. The location should ideally be a public place with lots of bypassers. The location shouldn't be enclosed by trees, houses or other places an ambush could happen. Check that you aren't being followed to or from the location.
The Trader	The trader is the person who has a high charisma and people skills. They are generally unarmed if they have trained bodyguards as a weapon could deter a trade if they are armed. Keeping calm in any situation is vital, you can't let people know you're desperate for an item. The trader keeps a small amount of money on them in a hidden location for change if needed.
Protection	Bring 1 or more trusted people or bodyguards to observe the transaction. Ensure the guards are visibly armed and they have a view of the merchandise and the transaction. The guards should be positioned behind the salesperson near the storage point of the rest of the merchandise with a full view of both. Only have a few items out on display at a time and never bring more then you can carry on your person. Do business with people which have a good reputation. Watch out for thieves if your merchandise is touchable and never let yourself be distracted. If a theft does happen and the bodyguards see it, ensure at least one armed person stays with the rest of the gear while the other chases them down.
Positioning	Polish your gold and silverware to ensure it looks its best when on display. Put the valuables centrally to you and your guards.

Negotiating as the Buyer

ECONOMY Bartering Negotiating

- Don't flash the amount of money you have as it weakens your bargaining position.
- Know the value of the item you're buying and how long it will last. Be sure it's not a counterfeit.
- Know your ceiling and never pass it.
- Don't let your reactions betray you, if you need an item desperately don't show it or the price may go up.
- Never follow a customer back to their house who claims to have an item of value to trade, make them bring it to you.
- Never do a trade at, or near your home.
- Do not go to trade with your best shots all together, it makes you look desperate.
- Do not ever give a reason for someone to attack you because of what you have on you.

Negotiating as the Seller

- Never go below your minimum.
- Look for signs in the customer if they need an item desperately or not. If they do, don't simply mark up the price to make a quick buck particularly if nobody else needs that item.
- Don't fall for "sad" tales such as a family member is terribly ill and needs it.
- Customers are often in worse positions than the seller due, so don't be cold-hearted.

Tips

Watch the customers body language, if something looks wrong stop the trade. Keep your own body language open and cheerful rather than closed and disinterested.

Never give away the location of your home / storage location. Avoid giving hints that you have large stockpiles of resources at home. Never make threats even if the customer is being difficult.

7 Trading

When an agreed price has been reached the trade must then take place.

Selling	Generally the seller gets the money first and then they will give the bartered item. Although at the same time is also recommended if possible. If the customer doesn't get their item after paying for it they have the right to complain and make a fuss that the seller is a bad dealer and tell others to stay away.
Refunds / Replacements	Try to keep customers happy throughout the sale and have a form of guarantee if for some reason something goes wrong. If you sell them a rusted can of beans where a tiny hole is hidden by the label, that's highly dangerous to their health and they deserve a refund or replacement. If the customer accidentally breaks something themselves after payment in view of you then that's generally on them unless you have a kind heart. Some people may try to return an item after replacing it with a cheaper counterfeit so be wary after the item has left your sight. You could also say that all sales are final and no refunds for wrong choice, broken merchandise or incorrect fit apply.

Never Accept

This is a list of items you should never accept in a trade unless you deem the risk safe.

IOU's	"I Owe You's" can never be verified simply by a verbal promise of an item in the future and you are likely to never see them again.
Deflated or Deflating Currency	Forms of modern money aren't worth the paper they're printed on if the entire world has fallen.
Credit Card	Seems obvious, but if for some reason the internet is still functioning, you shouldn't accept this form of payment if you can't withdraw physical money.
Worthless Items	Sure, their collection of ultra rare baseball cards was worth $15,000 before the collapse but if you can't eat them they aren't worth anything now.
Black-Market Items	Any item with a questionable background shouldn't be accepted. This includes drugs and any black market items such as drugs and porn.
Deflating Items	Items which the value can only go down over time such as perishable foods, unless you're planning on eating it yourself.

5 Cash

Cash Stockpile

	Cash Notes Distribution (Percent of total cash)	Australian Coin Weights	American Coin Weights
Store at least $10,000 physical cash on hand for emergencies in a safe location with protection from fire, flood and theft. Only use it after SHTF has occurred as you should have all you need prepared already. If you use a safety deposit box be sure to know when you can access it and if you can withdraw it all if you fear that SHTF will occur. Have a range of notes to give change if necessary and to barter more effectively.	$1 - 10% $5 - 20% $10 - 20% $20 - 20% $50 - 10% $100 - 20% (Same for Australia except use dollar coins instead)	5c - 2.8g 10c - 5.6g 20c - 11.2g 50c - 15.5g $1 - 8.9g $2 - 6.5g	Cent - 2.5g Nickel - 5g Dime - 2.268g Quarter Dollar - 5.67g Half Dollar - 11.340g Dollar - 8.1g

6 Metal

Precious Metal Stockpile

Recommended Metal Ownage Percentage	Recommended Stockpile Distribution	Pure .999 Metal Weight Conversion (Rounded)	Pure .999 Metal Weight Conversion (Rounded)
Copper - 20% Silver - 60% Gold - 20%	1oz - 50% 5oz - 30% 10oz - 15% 1kg (32.1oz) - 4% 100oz - 1%	1g - 0.0321507 toz 5g - 0.160754 toz 10g - 0.321507 toz 1 Tr oz - 31.1035 toz 2 Tr oz - 62.207 toz 5 Tr oz - 155.517 toz	10 Tr oz - 311.035 g 25 Tr oz - 777.587 g 50 Tr oz - 1555.17 g 100 Tr oz - 3110.35 g 1/2 Kg - 16.0754 toz 1 Kg - 32.1507 toz

Actual Silver Weight

1	Determine the coin's weight in grams by consulting a coin collecting book or online guide or by weighing the coin yourself with a precision scale. Ex: 2.50g
2	Determine the coin's fineness, which is given as a percentage of silver in the coin, by consulting a coin collecting book or Internet guide. Ex: 0.900 (90%)
3	Multiply the coin's total weight times the fineness (expressed as a decimal). This product is the amount of pure silver in the coin expressed in metric units (grams). Ex: 2.5g × 0.900 = 2.25g
4	Multiply that number times 0.0321507 oz t (3.21 one-hundredths of a troy ounce), which is the weight of one gram expressed in troy ounces, i.e., 1.00 g = 0.0321507 oz t. This product is the amount of pure silver in the coin expressed in troy units. Ex: 0.0321507 × 2.25 = 0.072339075 oz t (2.249996740996 g)

7 Oil

Peak Oil

8 Gas

Peak Gas

9 Banking

Fractional-Reserve Banking

Fractional-reserve banking is the common practice by commercial banks of accepting deposits, and making loans or investments, while holding reserves at least equal to a fraction of the bank's deposit liabilities. Reserves are held as currency in the bank, or as balances in the bank's accounts at the central bank. Fractional-reserve banking is the current form of banking practiced in most countries worldwide. Fractional-reserve banking allows banks to act as financial intermediaries between borrowers and savers, and to provide longer-term loans to borrowers while providing immediate liquidity to depositors (providing the function of maturity transformation).

However, a bank can experience a bank run if depositors wish to withdraw more funds than the reserves that are held by the bank. To mitigate the risks of bank runs and systemic crises (when problems are extreme and widespread), governments of most countries regulate and oversee commercial banks, provide deposit insurance and act as lender of last resort to commercial banks.

Because banks hold reserves in amounts that are less than the amounts of their deposit liabilities, and because the deposit liabilities are considered money in their own right, fractional-reserve banking permits the money supply to grow beyond the amount of the underlying base money originally created by the central bank. In most countries, the central bank (or other monetary authority) regulates bank credit creation, imposing reserve requirements and capital adequacy ratios.

This can limit the process of money creation that occurs in the commercial banking system, and helps to ensure that banks are solvent and have enough funds to meet demand for withdrawals. However, rather than directly controlling the money supply, central banks usually pursue an interest rate target to adjust the rate of inflation and bank issuance of credit.

Regulatory Framework
In most legal systems, a bank deposit is not a bailment. In other words, the funds deposited are no longer the property of the customer. The funds become the property of the bank, and the customer in turn receives an asset called a deposit account (a checking or savings account). That deposit account is a liability on the balance sheet of the bank.

Each bank is legally authorized to issue credit up to a specified multiple of its reserves, so reserves available to satisfy payment of deposit liabilities are less than the total amount which the bank is obligated to pay in satisfaction of demand deposits. Fractional-reserve banking ordinarily functions smoothly. Relatively few depositors demand payment at any given time, and banks maintain a buffer of reserves to cover depositors' cash withdrawals and other demands for funds.

ECONOMY Banking Fractional-Reserve Banking

However, during a bank run or a generalized financial crisis, demands for withdrawal can exceed the bank's funding buffer, and the bank will be forced to raise additional reserves to avoid defaulting on its obligations. A bank can raise funds from additional borrowings (e.g., by borrowing in the interbank lending market or from the central bank), by selling assets, or by calling in short-term loans. If creditors are afraid that the bank is running out of reserves or is insolvent, they have an incentive to redeem their deposits as soon as possible before other depositors access the remaining reserves. Thus the fear of a bank run can actually precipitate the crisis. Many of the practices of contemporary bank regulation and central banking, including centralized clearing of payments, central bank lending to member banks, regulatory auditing, and government-administered deposit insurance, are designed to prevent the occurrence of such bank runs.

Types of Money
There are two types of money in a fractional-reserve banking system operating with a central bank:
1. Central bank money: money created or adopted by the central bank regardless of its form – precious metals, commodity certificates, banknotes, coins, electronic money loaned to commercial banks, or anything else the central bank chooses as its form of money.
2. Commercial bank money: demand deposits in the commercial banking system; also referred to as "chequebook money", "sight deposits" or simply "credit".

When a deposit of central bank money is made at a commercial bank, the central bank money is removed from circulation and added to the commercial banks' reserves (it is no longer counted as part of M1 money supply). Simultaneously, an equal amount of new commercial bank money is created in the form of bank deposits.

Central Banks
Government controls and bank regulations related to fractional-reserve banking have generally been used to impose restrictive requirements on note issue and deposit taking on the one hand, and to provide relief from bankruptcy and creditor claims, and/or protect creditors with government funds, when banks defaulted on the other hand. Such measures have included:
1. Minimum required reserve ratios (RRRs)
2. Minimum capital ratios
3. Government bond deposit requirements for note issue
4. 100% Marginal Reserve requirements for note issue, such as the Bank Charter Act 1844 (UK)
5. Sanction on bank defaults and protection from creditors for many months or even years, and
6. Central bank support for distressed banks, and government guarantee funds for notes and deposits, both to counteract bank runs and to protect bank creditors.

Reserve Requirements
The currently prevailing view of reserve requirements is that they are intended to prevent banks from:
1. Generating too much money by making too many loans against the narrow money deposit base;
2. Having a shortage of cash when large deposits are withdrawn (although the reserve is thought to be a legal minimum, it is understood that in a crisis or bank run, reserves may be made available on a temporary basis).

In some jurisdictions, (such as the United States and the European Union), the central bank does not require reserves to be held during the day. Reserve requirements are intended to ensure that the banks have sufficient supplies of highly liquid assets, so that the system operates in an orderly fashion and maintains public confidence. In addition to reserve requirements, there are other required financial ratios that affect the amount of loans that a bank can fund. The capital requirement ratio is perhaps the most important of these other required ratios. When there are no mandatory reserve requirements, which are considered by some economists to restrict lending, the capital requirement ratio acts to prevent an infinite amount of bank lending.

Full-Reserve Banking

ECONOMY Banking Full-Reserve

Full-reserve banking (also known as 100% reserve banking) is a proposed alternative to fractional-reserve banking in which banks would be required to keep the full amount of each depositor's funds in cash, ready for immediate withdrawal on demand. Funds deposited by customers in demand deposit accounts (such as checking accounts) would not be loaned out by the bank because it would be legally required to retain the full deposit to satisfy potential demand for payments. Proposals for such systems generally do not place such restrictions on deposits that are not payable on demand, for example time deposits.

Monetary reforms that included full-reserve banking have been proposed in the past, notably in 1935 by a group of economists, including Irving Fisher, as a response to the Great Depression. More recently, there has been renewed interest following the Great Recession. Currently, no country in the world requires full-reserve banking. Banks operating under a full-reserve ratio generally do so by choice or by contract, although the governments in some countries such as Iceland and the US have considered implementing full reserve banking to avoid future financial crises.

Negative Interest Rates

ECONOMY Banking Negative Interest Rates

Negative interest rates refer to a scenario in which cash deposits incur a charge for storage at a bank, rather than receiving interest income. Instead of receiving money on deposits in the form of interest, depositors must pay regularly to keep their money with the bank. This environment is intended to incentivize banks to lend money more freely. While real interest rates can be effectively negative if inflation exceeds the nominal interest rate, the nominal interest rate had been theoretically bounded by zero. Negative interest rates are often the result of a desperate and critical effort to boost economic growth through financial means. Negative interest rates may occur during deflationary periods when people and businesses hold too much money instead of spending. This can result in a sharp decline in demand, and send prices even lower. Often, a loose monetary policy is used to deal with this type of situation. However, with strong signs of deflation still a factor, simply cutting the central bank's interest rate to zero may not be sufficient enough to stimulate growth in credit and lending.

Understanding a Negative Interest Rate Environment
A negative interest rate environment is in effect when the nominal interest rate drops below zero percent for a specific economic zone, meaning banks and other financial firms would have to pay to keep their excess reserves stored at the central bank rather than receive positive interest income. A negative interest rate policy (NIRP) is an unusual monetary policy tool in which nominal target interest rates are set with a negative value, below the theoretical lower bound of zero percent.

Real World Example of a Negative Interest Rate
In recent years, central banks in Europe, Scandinavia, and Japan have implemented a negative interest rate policy (NIRP) on excess bank reserves in the financial system. This unorthodox monetary policy tool is designed to spur economic growth through spending and investment as depositors would be incentivized to spend cash rather than store it at the bank and incur a guaranteed loss. It's still not clear if this policy worked in these countries in the way it was intended, and whether negative rates successfully spread beyond excess cash reserves in the banking system to other parts of the economy.

Offence

Using weapons, crafting your own and hand to hand combat

"Attack the evil that is within yourself, rather than attacking the evil that is in others."
Confucius

Introduction

Sometimes offence is the best defence and there will be times that offence will be needed to defuse a situation. The Offence section is based around an intent to kill or harm another person. It's also wise to understand the forms of weapons and explosives used during wars to be prepared if they are used on your city. Offence should be used as a last measure if the other forms of de-escalation have failed, and should only be used enough to incapacitate your opponent.

There's a fine line between killing for self-interests and killing for self-defence or protecting one's country.
As a great man once said: ►

"True courage is about knowing not when to take a life, but when to spare one."
J.R.R. Tolkien

Every life is precious no matter what people's past, and careless murder of others who are simply trying to survive is not only despicable but you will carry that burden for the rest of your life. This aim of offence is to disarm or disable your opponent so they can no longer injure you.

Conscience
o

Moral Injury
A term coined by Dr. Jonathan Shay, it refers to the outcome of having done something that so contravenes one's sense of right and wrong that it can be devastating to one's sense of self as a decent human being. Killing, which one West Point instructor called "the biggest moral taboo" one can break, certainly applies, and it's clear that the military spends much more time preparing recruits to kill than it does preparing them to deal with the aftermath.

PTSD
Post-traumatic stress disorder (PTSD) is a particular set of reactions that can develop in people who have been through a traumatic event which threatened their life or safety, or that of others around them. This could be a car or other serious accident, physical or sexual assault, war or torture, or disasters such as bushfires or floods. As a result, the person experiences feelings of intense fear, helplessness or horror. Many people experience some of the symptoms of PTSD in the first couple of weeks after a traumatic event, but most recover on their own or with the help of family and friends. For this reason, treatment does not usually start until about two weeks after a traumatic experience. Even though formal treatment may not commence, it is important during those first few days and weeks to get whatever help is needed.

Purpose

The aim of OFFENCE is to help prepare and equip you for a hostile world in which anyone could be armed, dangerous and could kill you in a moments notice. It lists the major categories of modern weapons used today and how to use them safely and effectively. It also covers how to craft some weapons yourself, such as a bow and slingshot. It also covers sections such as improvised weapons, verbal offence, and spiritual offence.

Lost?

- If you're looking for modern guns, see the WEAPONS section.
- For defensive weapons such as tasers and defence against animals and insects, see the DEFENCE category.
- For smithing your own weapons and ammo, see the CRAFTING > Blacksmithing section.
- To help avoid combat with others, have a look at the SECURITY section.
- For information on shooting animals humanely, see the FIELD DRESSING section.
- For large scale warfare and weapons, see the WARFARE section.
- For effects of violence and riots, see the DISASTER TRIGGERS section.
- For information on man-made disasters such as wars and civil-wars, see the MAN-MADE DISASTERS section.
- For the wide scale effects of modern weapons and natural disasters, see the MASS DESTRUCTION section.
- For offence against animals, see the HUNTING or FISHING sections.
- For spiritual offence, and the sword of the spirit see the RELIGION section.

Contents

1 Unarmed

Knowing a form of combat training is vital to defending yourself when needed.

Natural Weapons

A list of naturally strong point on your body from which to inflict damage.

Hand Edge	
Fingers Folded Knuckle	
Second Finger Knuckle	
Heel of Hand	
Foot	
Elbows	
Knees	
Teeth	

Vulnerable Points

A list of vulnerable points on the body which to aim for when you are unarmed.

Eyes	Use your fingers in a V-shape and attack in gouging motion.
Nose	(Extremely vulnerable) Strike with the knife edge of the hand along the bridge, which will cause breakage, sharp pain, temporary blindness, and if the blow is hard enough, death. Also, deliver a blow with the heel of your hand in an upward motion, this will shove the bone up into the brain causing death.
Adam's Apple	This spot is usually pretty well protected, but if you get the chance, strike hard with the knife edge of your hand. This should sever the wind-pipe, and then it's all over in a matter of minutes.
Temple	There is a large artery up here, and if you hit it hard enough, it will cause death. If you manage to knock your enemy down, kick him in the temple, and he'll never get up again.
Back of Neck	A rabbit punch, or blow delivered to the base of the neck can easily break it, but to be safe, it is better to use the butt of a gun or some other heavy blunt object.
Upper Lip	A large network of nerves are located. These nerves are extremely close to the skin. A sharp upward blow will cause extreme pain, and unconsciousness.
Ears	Coming up from behind an enemy and cupping the hands in a clapping motion over the victims ears can kill him immediately. The vibrations caused from the clapping motion will burst his eardrums, and cause internal bleeding in the brain.
Groin	A VERY vulnerable spot. If left open, get it with knee hard, and he'll buckle over very fast.
Kidneys	A large nerve that branches off to the spinal cord comes very close to the skin at the kidneys. A direct blow with the knife edge of your hand can cause death.

2 Hand & Fist Weapons

Hand / Fist	Single-handed weapons not resembling a straight dagger blade, usually wielded without wrist action; often protects the forearm.

Tiger Claws	
Knuckle Dusters	
Cestus	
Deer Horn Knives	
Gauntlet	
Katar	
Pata	
Push Dagger	
Japanese Fan	
Wind and Fire Wheels	
Emeici	

3 Edged & Bladed

Thrusting and slicing weapons for close quarters melee.

Multitool

Swords

Long swords were classified by Gordon as longer than 28 inches/71 cm.

Curved 1-Handed

Straight 1-Handed

Curved 2-Handed

Greatsword 2-Handed

Shortswords

Delineated as 20-28 inches/51–71 cm total length.

Straight Shortsword

Curved Shortsword

Axe-Like Swords

Other Swords

Fighting Knives

Sickles

Generally short, concave blades used for heavy cutting.

Pickaxes

Axes

4 Blunt

Wielded with one or two hands at close quarters with swinging motions.

5 Pole Weapons

Wielded mainly with two hands. Primarily for melee with sweeping, thrusting, and/or hooking motions.

Blunt Staves

Spears (Non Thrown)

Polearms - Axelike

Polearms - Spike

6 Thrown

OFFENCE Thrown OFFENCE Thrown OFFENCE Thrown OFFENCE Ranged Longbows OFFENCE Ranged OFFENCE Ranged Crossbows OFFENCE Ranged Crossbows

All could be used as polearm spears, but were designed and primarily used for throwing.

Spears / Javelins

Throwing Sticks

Throwing Blades

Throwing Axes

Could also be used as axe weapons, but were specifically designed for throwing.

Throwing Balls

Bolas

7 Ranged

The bow and arrow is a ranged weapon system consisting of an elastic launching device (bow) and long-shafted projectiles (arrows).

Longbows

A longbow is a type of bow that is tall – roughly equal to the height of the user – allowing the archer a fairly long draw. A longbow is not significantly recurved.

Decurve Bow

Deflex Bow

Recurve Bows

Choose a bow that compliments your dominant eye as shooting will be more natural. Never release the string without an arrow or it may snap the bow.

Short / Reflex Bows

Crossbows

Crossbows are stock-mounted bows that shoot bolts and primarily used for hunting and target shooting. If you are interested in either field, the first thing you should do is to determine the most suitable type of crossbow for your needs and abilities.

Recurve Crossbow

These have longer draw length compared to ordinary cross bows, which provide reduced hand shock and better acceleration. Using recurved crossbows, however, also produce greater strain on the bow structure itself. Recurve crossbows are often used by advanced archers, shooters, and hunters. They are also noisy to use and thus require the accompanying use of a bowstring silencer.

Compound Crossbow

There are several variants to a compound crossbow, but all of them basically work the same way. The string of a compound crossbow is attached to a number of pulleys, and which one or several of it are connected by cables to the opposite limb. Upon preparing to take a shot, the string will naturally draw back, which makes the pulleys turn and the cables to move accordingly. The limbs will then bend, thus storing energy for the shot. These crossbows are characterized by limbs that are stiffer than usual and require greater pressure from the users because of the design. Their structure, however, allows compound crossbows to become more energy efficient than other types of crossbows.

OFFENCE Ranged Crossbows Rifle

Pistol Crossbow

Pistol crossbows are named so because of their relatively compact size. There are 80lb and 150lb pistol crossbows and other variants.

Rifle Crossbow

These are crossbows primarily designed to provide better aim, just like how rifles perform compared to other guns. Rifle crossbows are one of the most advanced models you can use. A 150lb rifle crossbow, for instance, can come with adjustable sights, foot pull, and heavy-duty fibre construction. It can hit your target as far as 250 feet away. Of course, such power also requires you to possess equivalent strength to launch your shot and cock your bow effectively.

Bullet Crossbow

This type of crossbow is also aptly named because it shoots bullet-looking projectiles made of stone, lead, or clay. Some bullet crossbows come with a string slot and barrel while others have a double string design.

Repeating Crossbow

With this type, you only have to make a single movement and everything, from bow stringing, projectile launching, and shooting, will be completed. This way, you'll be able to shoot at a faster rate than usual.

Arrows / Bolts

8 Slings

Sling

A sling is a projectile weapon typically used to throw a blunt projectile such as a stone, clay, or lead "sling-bullet". It is also known as the shepherd's sling.

Slingshot

A slingshot is normally a small hand-powered projectile weapon. The classic form consists of a Y-shaped frame held in the off hand (non-dominant hand), with two natural-rubber strips attached to the uprights. The other ends of the strips lead back to a pocket that holds the projectile. The dominant hand grasps the pocket and draws it back to the desired extent to provide power for the projectile—up to a full span of the arm with sufficiently long bands.

9 Blowgun

A blowgun (also called a blowpipe or blow tube) is a simple ranged weapon consisting of a long narrow tube for shooting light projectiles such as darts. It operates by having the projectile placed inside the pipe and using the force created by one's forced exhalation ("blow") to pneumatically propel the projectile. The propulsive power is limited by the user's strength of respiratory muscles and the vital capacity of the lungs.

10 Fire

Flamethrower

A flamethrower is a mechanical incendiary device designed to project a long, controllable stream of fire. Most military flamethrowers use flammable liquid thickened into a substance similar to napalm, but commercial flamethrowers tend to use high-pressure propane and gasoline, which is considered safer as they both die out faster and are easier to put out.

Homemade Flamethrower

You can make a homemade flamethrower by using an ignition source with a stream of flammable fluid compressed in a can. Simply light the ignition source so that it's constantly on and spray your fluid through the flame to ignite it. The higher the compression in the can, the further it will shoot. It's highly dangerous to try, so ensure you don't get any flammable fluid on your hands.	**Ignition Sources** ● Lighter ● Camping Stove	**Flammable Fluids** ● WD40 ● Hair Spray

Napalm

11 Flexible Weapons

Whips

A whip is a tool which was traditionally designed to strike animals or people to aid guidance or exert control over animals or other people, through pain compliance or fear of pain, although in some activities, whips can be used without use of pain, such as an additional pressure aid or visual directional cue in equestrianism. Whips are generally of two types, either a firm stick designed for direct contact, or a flexible whip that requires a specialized swing to be effective, but has a longer reach and greater force, but may have less precision. There are also whips which combine both a firm stick (the stock or handle) and a flexible line (the lash or thong), such as hunting whips.

Sectional / Composite

Chains / Ropes

A chain weapon is a weapon made of one or more heavy objects attached to a chain, sometimes with a handle. The flail was one of the more common types of chain weapons associated with medieval Europe, although some flails used hinges instead of chains.

12 Explosives

Harmless Explosives

Molotov's

A Molotov cocktail, also known as a petrol bomb, bottle bomb, poor man's grenade or just Molotov, sometimes shortened as Molly, is a generic name used for a variety of bottle-based improvised incendiary weapons. Due to the relative ease of production, Molotov cocktails have been used by street criminals, protesters, rioters, gangsters, urban guerrillas, terrorists, irregular soldiers, or even regular soldiers short on equivalent military-issue weapons. They are primarily intended to ignite rather than obliterate targets.

Plastic Explosives

Dynamite

Bombs

A bomb is an explosive weapon that uses the exothermic reaction of an explosive material to provide an extremely sudden and violent release of energy. Detonations inflict damage principally through ground- and atmosphere-transmitted mechanical stress, the impact and penetration of pressure-driven projectiles, pressure damage, and explosion-generated effects. Bombs have been in use since the 11th century in Song Dynasty China.

Fuses

Grenades

A grenade is a small explosive weapon typically thrown by hand. Generally, a grenade consists of an explosive charge, a detonating mechanism, and firing pin to trigger the detonating mechanism. Once the soldier throws the grenade, the safety lever releases, the striker throws the safety lever away from the grenade body as it rotates to detonate the primer. The primer explodes and ignites the fuse (sometimes called the delay element). The fuse burns down to the detonator, which explodes the main charge. There are several types of grenades such as fragmentation grenades and stick grenades. Fragmentation grenades are probably the most common in armies. They are weapons that are designed to disperse lethal fragments on detonation.

Land Mines

A land mine is an explosive device concealed under or on the ground and designed to destroy or disable enemy targets, ranging from combatants to vehicles and tanks, as they pass over or near it. Such a device is typically detonated automatically by way of pressure when a target steps on it or drives over it, although other detonation mechanisms are also sometimes used. A land mine may cause damage by direct blast effect, by fragments that are thrown by the blast, or by both.

Naval Mines

A naval mine is a self-contained explosive device placed in water to damage or destroy surface ships or submarines. Unlike depth charges, mines are deposited and left to wait until they are triggered by the approach of, or contact with, any vessel. Naval mines can be used offensively, to hamper enemy shipping movements or lock vessels into a harbour; or defensively, to protect friendly vessels and create "safe" zones.

Car Bombs

A car bomb, lorry bomb, or truck bomb, also known as a vehicle-borne improvised explosive device (VBIED), is an improvised explosive device placed inside a car or other vehicle and detonated. Car bombs can be roughly divided into two main categories; those used primarily to kill the occupants of the vehicle (often as an assassination); and those used as a means to kill, injure or damage people and buildings outside the vehicle. The latter type may be either parked (the vehicle disguising the bomb and allowing the bomber to get away), or the vehicle might be used to deliver the bomb (often as part of a suicide bombing).

Rockets

A rocket is a missile, spacecraft, aircraft or other vehicle that obtains thrust from a rocket engine. Rocket engine exhaust is formed entirely from propellant carried within the rocket before use. Rocket engines work by action and reaction and push rockets forward simply by expelling their exhaust in the opposite direction at high speed, and can therefore work in the vacuum of space.

Missiles

In modern language, a missile, also known as a guided missile, is a guided self-propelled system, as opposed to an unguided self-propelled munition, referred to as a rocket (although these too can also be guided). Missiles have four system components: targeting or missile guidance, flight system, engine, and warhead. All known existing missiles are designed to be propelled during powered flight by chemical reactions inside a rocket engine, jet engine, or other type of engine.

Missile types
- Surface-to-surface
- Air-to-surface missiles (ballistic, cruise, anti-ship, anti-tank, etc.)
- Surface-to-air missiles (and anti-ballistic)
- Air-to-air missiles
- Anti-satellite weapons.

Nuclear

A nuclear weapon is an explosive device that derives its destructive force from nuclear reactions, either fission (fission bomb) or from a combination of fission and fusion reactions (thermonuclear bomb). Both bomb types release large quantities of energy from relatively small amounts of matter. The first test of a fission ("atomic") bomb released an amount of energy approximately equal to 20,000 tons of TNT (84 TJ). The first thermonuclear ("hydrogen") bomb test released energy approximately equal to 10 million tons of TNT (42 PJ). A thermonuclear weapon weighing little more than 2,400 pounds (1,100 kg) can release energy equal to more than 1.2 million tons of TNT (5.0 PJ). A nuclear device no larger than traditional bombs can devastate an entire city by blast, fire, and radiation. Since they are weapons of mass destruction, the proliferation of nuclear weapons is a focus of international relations policy.

See "Mass Destruction" for more information.

13 Improvised Weapons

These are weapons that can easily be picked up from your surroundings and used either offensively or defensively.

Stones	Stoning used to be a popular way for executions in ancient history and stones are still as dangerous today depending on how you throw them.

Frying Pan	A frying pan would make an excellent weapon if there's notihng else nearby.
Lollipop	A lollipop - if held in the palm with the stick between your knuckes makes a powerful weapon if used correctly.
Furniture	Any kind of furniture (that can be picked up) can be used as a weapon. Folding chairs are commonly used in wrestling.
Improvised Explosives	Most compressed gasses can be the source of improvised explosions such as deodorant, LPG and butane gas.

14 Verbal Offence

15 Spiritual Offence

Defence

Self defence from attackers, animals and pests

"The best defence is a good offense."
Jack Dempsey

Introduction

The Defence section (spelt Defense in America) is about defending yourself and de-escalating any form of conflict until you can escape or the threat is neutralised. It also covers all types of armour. Defence is vital in a SHTF situation as people will be desperate to acquire what you have at any cost.

Purpose	The aim of DEFENCE is to give you the skills to be able to defend yourself from any attack whether it's a knife-wielding madman, a horde of thirsty mosquitos or a brutal snowstorm.
Lost?	● For smithing your own armour, see the CRAFTING > Blacksmithing section. ● If you're looking for modern guns, see the WEAPONS section. ● For offensive weapons, look at the OFFENCE section. ● To help avoid combat with others, have a look at the SECURITY section. ● For information on national security and defence, see the SAFETY & SECURITY section. ● For spiritual defence, and the armour of God, see the RELIGION section. ● Some categories have their own safety section such as FIRE and WEAPONS, check to see if it has its own safety section first. ● For household defence see the HOMESTEADING section. ● For shelter defence and what natural disasters they can withstand, see the SHELTER section.

Contents

1 Non Lethal

These are any non-lethal weapons which can help you defend yourself.

Subheadings

1. Pepper Spray	**2. Ammunition**	**3. Explosives**	**4. Directed Energy Weapons**

		5. Other Non Lethal Weapons					

DEFENCE | Non Lethal | Pepper Spray

Pepper Spray

Pepper spray is a lachrymatory agent (a chemical compound that irritates the eyes to cause tears, pain, and temporary blindness) used in policing, riot control, crowd control, and self-defence, including defence against dogs and bears. Its inflammatory effects cause the eyes to close, taking away vision. This temporary blindness allows officers to more easily restrain subjects and permits people in danger to use pepper spray in self-defence for an opportunity to escape. Although considered a less-than-lethal agent, it has been deadly in rare cases, and concerns have been raised about a number of deaths where being pepper sprayed may have been a contributing factor.

Types

Stream	This is a common type that releases a concentrated, ballistic stream of liquid. **Advantages:** Offers greater accuracy, reduced risk of blowback (spraying yourself or bystanders) compared to mist, and a longer effective range (often up to 15-20 feet). **Disadvantages:** Requires more precise aim.
Fogger/Cone/Mist	These sprays release a wide, mist-like pattern. **Advantages:** Covers a broader area, making it easier to hit a target and suitable for multiple attackers or crowd control. Less precise aim is needed. **Disadvantages:** Highly susceptible to wind, which can cause blowback or disperse the spray before it reaches the target. Can make indoor areas temporarily uninhabitable.
Gel	This formulation dispenses a sticky gel rather than a liquid or mist. **Advantages:** Adheres firmly to the attacker, ensuring effective incapacitation and making it harder to remove. Offers greater accuracy and significantly reduces the risk of blowback and cross-contamination, making it safer for indoor use. Can have a longer range than stream sprays. **Disadvantages:** Requires more precise targeting.
Foam	This type dispenses a thick, sticky foam that expands on contact. **Advantages:** Coats the attacker's face, incapacitating them. Suitable for both indoor and outdoor use. **Disadvantages:** Typically has a shorter range (around 6-8 feet).

Creation

DEFENCE | Non Lethal | Ammunition

Ammunition

Non-lethal rounds, or less-lethal projectiles are firearm rounds which are designed to incapacitate, but not kill, a target. The rounds rely on the transfer of kinetic energy and blunt force trauma to accomplish this incapacitation. Rubber bullets, rubber buckshot, soft polymer rounds, wax bullets, plastic bullets, beanbag rounds, sponge grenades, ring airfoil projectiles and rubber bullets with electroshock effect are less lethal than conventional metal bullets, and are also propelled at lower speed by using less propellant.

Rubber Bullets/ Baton Rounds	**Description:** These are among the oldest types of less-lethal projectiles. Despite the name, modern "rubber bullets" often have a metal core with a rubber coating, or are made of a composite material with rubber being a minority component. They can be solid cylindrical or spherical projectiles. **Mechanism:** They deliver a blunt force impact designed to cause pain and incapacitation. **Usage:** Primarily used in riot control and to disperse protests. **Risks:** Historically, rubber bullets have caused significant injuries, including blindness, broken bones, internal organ damage, and even fatalities, especially when fired from close range or at the head/upper body. Their tendency to bounce unpredictably also increases the risk of unintended injuries.
Plastic Bullets	**Description:** Similar to rubber bullets but made from solid plastic (e.g., PVC). They are typically cylindrical. **Mechanism:** Also rely on blunt force impact. **Usage:** Used for similar purposes as rubber bullets, particularly in riot control. **Risks:** Like rubber bullets, plastic bullets can cause severe injuries and fatalities.
Bean Bag Rounds (Flexible Baton Rounds)	**Description:** These are typically fabric bags (like small pillows or socks) filled with fine lead shot or plastic pellets. They are fired from shotguns. **Mechanism:** Upon firing, the bag spreads out in flight to distribute its impact over a larger surface area, aiming to deliver a blow that causes pain and muscle spasm without penetrating the skin. **Usage:** Common in law enforcement for subduing individuals, riot control, and situations where a direct, painful impact is needed. **Risks:** While designed for a wider impact, bean bag rounds can still cause serious injury (e.g., broken bones, internal bleeding) or death if they hit vulnerable areas or are fired from too close a range.
Sponge Rounds/ Foam-Tipped Rounds (Sponge Grenades)	**Description:** These projectiles have a plastic body with a soft, deformable sponge or foam nose. They are typically fired from 40mm grenade launchers. **Mechanism:** The sponge/foam nose is designed to deform on impact, spreading the force over a wider area and reducing the risk of penetration while still delivering a significant blunt trauma. **Usage:** Used by law enforcement for crowd control and tactical situations, often for point-of-aim, point-of-impact application. **Risks:** Can still cause significant injuries, especially if they hit the head or face, or are fired from too close.
Pepper Rounds/Kinetic Impact Projectiles with Irritant Payload	**Description:** These are projectiles (often .68 caliber, similar to paintball rounds) that contain a chemical irritant (like PAVA or synthetic capsaicin) inside a frangible (breakable) shell. **Mechanism:** They combine a kinetic impact with the dispersal of an irritating powder upon striking the target or a hard surface. The powder causes pain, coughing, and irritation to the eyes, nose, and throat. **Usage:** Increasingly popular for civilian self-defense (where legal) and for law enforcement as a less-lethal option. **Risks:** Can cause pain and temporary incapacitation. Direct impact can still be painful and cause bruising. The irritant can exacerbate respiratory conditions.

DEFENCE Non Lethal Ammunition

Nylon Balls/Hard Kinetic Rounds	**Description:** These are solid, hard plastic or nylon balls. Some variations may include powdered metal for added weight. **Mechanism:** They rely purely on kinetic impact to create pain and discomfort. **Usage:** Used in some less-lethal firearms, particularly in regions where other less-lethal options (like pepper rounds) are restricted. **Risks:** Due to their hardness, these can cause significant blunt force trauma, potentially leading to serious injury or even death, especially if impacting sensitive areas or used at close range.

Explosives

DEFENCE Non Lethal Explosives

Stun Grenades (Flashbangs)	**Effect:** Produce a blinding flash of light (often 2.5 to 7 million candela) and an extremely loud bang (over 170 decibels). **Mechanism:** They use a pyrotechnic mix (e.g., magnesium or aluminum with an oxidizer) that detonates without fragmentation. The casing is designed to remain intact. **Purpose:** To temporarily disorient, confuse, and stun individuals through sensory overload, making them unable to respond effectively. **Usage:** Commonly used in close-quarters combat, door breaching, and riot control by police tactical units and special forces. **Risks:** While designed to be non-lethal, close proximity to detonation can cause temporary or permanent hearing loss, burns, or concussive injuries. They can also ignite flammable materials.
Sting Grenades	**Effect:** Combine a loud bang and bright light with the projection of multiple small rubber balls or pellets at a non-lethal velocity. They may also release a chemical irritant. **Mechanism:** These grenades contain a main charge that, upon detonation, expels rubber spheres. Some variations also incorporate a chemical irritant like tear gas or pepper spray. **Purpose:** To inflict blunt trauma pain and psychological deterrent through impact, sound, and sometimes chemical irritation, causing individuals to disperse or comply. **Usage:** Primarily used in crowd management and riot control to push back or disperse aggressive crowds. **Risks:** While generally less harmful than traditional force, direct impact from the rubber pellets can cause bruising or other injuries. Their indiscriminate use in crowds is controversial.
Tear Gas Grenades	**Effect:** Release a chemical irritant that causes severe irritation to the eyes (tearing, pain, temporary blindness), nose, mouth, and lungs (coughing, difficulty breathing). **Mechanism:** These grenades contain lachrymatory agents (like CS, CN, or CR gas) in a solid or liquid aerosolized form. When activated, the chemical is dispersed into the air. **Purpose:** To force compliance, disperse crowds, or flush out individuals from enclosed spaces due to the intense discomfort they cause. **Usage:** Widely used by law enforcement for riot control and by military forces for training and certain operational contexts. **Risks:** While temporary, exposure can lead to severe allergic reactions, chemical burns, or respiratory issues, especially in high concentrations or enclosed spaces. Direct impact from the canister itself can cause serious injury or death.
Smoke Grenades	**Effect:** Produce dense clouds of colored or white smoke. **Mechanism:** These are canister-type grenades containing a pyrotechnic composition that, when ignited by a fuse, produces a large amount of smoke. **Purpose:** Primarily used for signaling (e.g., marking targets, landing zones), obscuring movement (creating smoke screens for concealment or retreat), or for tactical diversions. **Usage:** Employed by military, police, and even in civilian applications like paintball. **Risks:** Generally non-toxic, but can be a fire hazard if used carelessly, especially with dry vegetation. Some specialized military smoke grenades (e.g., white phosphorus) are incendiary and are not considered non-lethal.

Directed Energy Weapons

DEFENCE Non Lethal Directed Energy Weapons

Directed energy weapons are weapons that emit energy in an aimed direction without the means of a projectile. They are non-lethal and can immobilize people as well as machines (e.g. vehicles). Directed energy weapons include electromagnetic weapons, (including laser weapons) and microwave weapons, particle beam weapons, sonic weapons and plasma weapons.

High-Energy Lasers (HELs)

High-Energy Lasers (HELs)

HELs produce a highly concentrated and coherent beam of light, typically in the infrared to visible regions of the electromagnetic spectrum. This beam delivers thermal energy to a target, causing it to heat up, melt, burn, or even vaporize. The effect depends on the laser's power, the material of the target, and the duration of exposure.

Applications:
● Counter-UAS (Unmanned Aerial Systems) / Counter-drone: This is one of the most prominent applications, as lasers can effectively engage and destroy small, fast-moving drones with high precision and low cost per shot.
● Missile defense: Intercepting incoming missiles (ballistic, cruise, hypersonic) by damaging their guidance systems, control surfaces, or warheads.
Area denial/protection: Creating "no-go" zones by making areas hazardous for personnel or equipment.
● Dazzling/Blinding: Temporarily or permanently impairing optical sensors or human vision (though permanent blinding is often prohibited by international conventions).
● Precision strike: Engaging specific components of a target with high accuracy.

Advantages: Speed-of-light engagement, high precision, "deep magazine" (limited only by power), low cost per shot compared to kinetic interceptors.
Challenges: Atmospheric conditions (rain, fog, dust, turbulence) can degrade beam quality and effectiveness, requiring significant power and complex beam-steering and adaptive optics systems. Cooling requirements are also substantial.

Example: The Dazzler

DEFENCE Non Lethal Directed Energy Weapons High-Energy Lasers (HELs)

Dazzlers typically use lasers or intense light sources to overwhelm the retina or the sensor of a camera. The intense light causes temporary flash blindness, making it difficult to see or track targets. The effect is similar to being suddenly exposed to a bright camera flash.

Types of Dazzlers
● Laser Dazzlers: These use lasers, often in the visible or near-infrared spectrum, to create a temporary blinding effect. The power levels are carefully controlled to avoid causing permanent eye damage.
● Light-Based Dazzlers: These use intense lamps or LEDs to generate a bright, disorienting light.

The Light Emitting Diode (LED) Incapacitator is a weapon designed like a flashlight. It emits an extremely bright, rapid, and well-focused series of 'differently-coloured random pulses.' Before the human eyes can focus in on one frequency, another frequency comes on, causing intracranial pressure, which results in headaches, nausea, vomiting, disorientation, irritability, and visual impairment to the target (opponent). The non-lethal weapon is intended as a means of protection by law enforcement officials such as police and border patrols.

DEFENCE Non Lethal Directed Energy Weapons High-Energy Lasers (HELs)

The light emitted is capable of rendering opponents temporarily blind so that they can be subdued more easily. Some test subjects have been completely unaffected by the light, and although the manufacturer makes claims about the product's effectiveness, the CEO of Intelligent Optics, the producer of the device, has commented "I don't think we've had anyone actually be sick." There is debate over how well the devices work and what their effects are.

Applications
● Optical Sensor Disruption: To temporarily blind or degrade the performance of enemy optical sensors (e.g., cameras on drones, binoculars, missile seekers).
● Personnel Incapacitation: To create temporary flash blindness, making it difficult for individuals to aim weapons or coordinate movements.

● Escalation of Force: As a step before resorting to lethal force.
● Maritime Security: To warn or deter approaching vessels.
● Anti-Piracy: To disrupt the vision of pirates.
● Counter-UAS (Unmanned Aerial System): To disrupt the vision of drone operators.

Important Considerations
● Non-Lethal Intent: Dazzlers are designed to be non-lethal, causing temporary visual impairment rather than permanent damage.
● Distinction from Blinding Weapons: International law, specifically the Protocol on Blinding Laser Weapons, prohibits the use of laser weapons specifically designed to cause permanent blindness. Dazzlers operate within the bounds of this protocol by using lower power levels and carefully controlled wavelengths to avoid causing irreversible eye injury. The key distinction is the intent and the effect - dazzlers aim for temporary disruption, while blinding weapons aim for permanent vision loss.
● Power Levels and Safety: Dazzlers are designed with safety in mind, using power levels that cause temporary effects without causing permanent harm when used as intended. However, misuse or excessive exposure can still pose a risk.

DEFENCE Non Lethal Directed Energy Weapons High-Power Microwaves (HPMs) Weapons

High-Power Microwaves (HPMs) Weapons

Also known as High-Power Radio Frequency (HPRF) Weapons, these weapons emit powerful bursts of electromagnetic energy in the microwave or radio frequency spectrum. This energy can couple with and overload electronic systems, causing temporary disruption, degradation, or permanent damage. They can also cause physiological effects on personnel.

Applications:
● Disabling electronics: Neutralizing drones, vehicles, communication systems, and critical infrastructure by disrupting or frying their electronic components.
● Area denial/crowd control (non-lethal): The Active Denial System (ADS) is a well-known example of a millimeter-wave weapon that heats the water molecules in a person's skin, creating an intense burning sensation that forces them to move away without causing lasting injury.
● Anti-missile defense: Disrupting missile guidance systems.

Advantages: Can affect multiple targets simultaneously due to a wider beam, less susceptible to atmospheric conditions than lasers, can penetrate certain materials to affect internal electronics, can be used for both lethal (disrupting electronics) and non-lethal (ADS) effects.
Challenges: Can affect friendly electronics if not carefully directed, attribution can be difficult, shorter range compared to lasers for destructive effects.

Example: The "Heat Ray"

The Active Denial System works by emitting a highly focused beam of millimeter-wave electromagnetic energy (specifically, 95 GHz). When this invisible beam strikes a person, it rapidly heats the outer layer of their skin (to a depth of about 0.4mm, or the thickness of three sheets of paper). This sensation is described as an intense, unbearable burning feeling, similar to touching a very hot oven or frying pan. The pain is immediate and compels the person to instinctively move away from the beam, hence the "active denial" effect. The sensation ceases as soon as the person moves out of the beam or the system is deactivated, and it's designed not to cause lasting injury.

Key Characteristics and Applications
● **Non-Lethal:** The primary design goal is to create a strong deterrent without causing permanent harm or tissue damage. The shallow penetration of the millimeter waves is key to this.
● **Long Range:** ADS can engage targets at distances well beyond the range of small arms (up to several hundred meters, or even a kilometer in some configurations). This provides a significant standoff capability.

● **Speed-of-Light Engagement:** As a directed energy weapon, the effect is virtually instantaneous.
● **Area Denial/Perimeter Security:** Ideal for creating a "keep out" zone around military installations, checkpoints, or secure perimeters.
● **Crowd Control:** Can be used to disperse or deter hostile crowds without resorting to more injurious methods.
● **Personnel Deterrence:** Stopping individuals or groups from approaching a sensitive area or engaging in threatening behavior.
● **Maritime Security:** Demonstrated for repelling boarders from small boats approaching larger vessels.

Main Configurations/Generations
● **Vehicle-Mounted Systems (e.g., on Humvees or trucks)**
The initial and most publicized configurations of ADS were large, vehicle-mounted systems designed for battlefield or base protection. These require significant power sources and a robust platform. Raytheon has been a primary developer and manufacturer of these systems. Examples include the original ADS prototype and later versions like the "Sheriff" system.

● **Containerized Systems**
Some ADS iterations have been designed as armored, containerized units that can be transported by tactical vehicles, offering flexibility for deployment in various scenarios.
● **More Compact and Mobile Systems (Solid-State Technology)**
Ongoing research and development (e.g., by the U.S. Army and others) focuses on reducing the size, weight, and power requirements (SWAP-C) of ADS. This involves leveraging advancements in solid-state technology, such as Gallium Nitride (GaN) Monolithic Microwave Integrated Circuits (MMICs). The goal is to enable integration into smaller, more diverse mobile platforms, potentially even man-portable or airborne versions in the future.

DEFENCE Non Lethal Directed Energy Weapons Particle Beam

Particle Beam Weapons

These weapons accelerate a stream of charged (e.g., electrons, protons) or neutral particles to very high velocities. When these particles impact a target, they transfer immense kinetic energy, causing physical damage or even inducing radiation effects.

Applications (theoretical/research phase):
● Ballistic missile defense: Intercepting missiles in space or the upper atmosphere.
● Anti-satellite warfare: Disabling or destroying satellites.

Advantages: Potentially very high destructive power, can penetrate deeper than lasers into some materials.
Challenges: Highly complex technology, maintaining a focused beam in the atmosphere is difficult (due to thermal blooming for both charged and neutral beams, and electrical blooming for charged beams), requiring massive power sources and large accelerators. Mostly in the research and development phase.

DEFENCE Non Lethal Directed Energy Weapons Pulsed Energy

Pulsed Energy Projectiles (PEPs)

PEP systems fire an invisible infrared laser pulse that, upon striking a target (person or material), creates a rapidly expanding plasma. This plasma generates a pressure wave (acoustic blast), an electromagnetic pulse, and a shockwave.

Applications (non-lethal):
● Pain and temporary paralysis: The combined effect of the sound, shock, and electromagnetic waves can cause significant pain and temporary muscle incapacitation, suitable for crowd control or subduing individuals.
● Material effects: Can also be used to ablate (vaporize) thin layers of material.

Advantages: Non-lethal capabilities, can affect targets without direct physical contact.
Challenges: Limited range, still in developmental stages, potential for unforeseen long-term effects.

DEFENCE Non Lethal Directed Energy Weapons Acoustic Weapons (Sonic Weapons)

Acoustic Weapons (Sonic Weapons)

These systems use highly focused sound waves, often at very high frequencies or infrasound frequencies, to cause discomfort, disorientation, nausea, or even physical pain. The Long Range Acoustic Device (LRAD) is a common example, which can emit highly directional, painfully loud sounds or communicate over long distances.

Applications (non-lethal):
● Crowd control: Dispersing crowds.
● Area denial: Deterring entry into a specific zone. (Active Denial Systems)
● Communication: Broadcasting messages over long distances in noisy environments.

Advantages: Non-lethal, can cover a wider area than some other DEWs for non-lethal effects.
Challenges: Can be affected by environmental factors, potential for hearing damage at close range, ethical concerns regarding their use.

Portable/Handheld LRADs

These are smaller, more compact units designed for immediate deployment and portability.

LRAD 100X: This is a popular and relatively compact model, often described as a "loud hailer on steroids." It significantly outperforms traditional bullhorns and vehicle-based PA systems.
Uses: Cell extractions in correctional facilities, de-escalating confrontations without physical entry, communication in noisy environments, smaller crowd control situations, and tactical communication. It's often used by law enforcement, security personnel, and even for wildlife control (e.g., deterring birds from airport runways).

Mid-Range LRADs

These models offer increased range and volume compared to handheld units, suitable for mounting on vehicles or fixed installations.

LRAD 450XL: A versatile model designed for mounting on tripods, vessels, or vehicles. It provides clear communication over longer distances.
Uses: Mobile operations, maritime security (warning approaching vessels), communication in large open areas, and mid-sized crowd management.

LRAD 500X-RE / 500X-MMT: These are often designed for mobile or permanent tower installations, covering wider areas. The "MMT" version is specifically designed for helicopter mounting for air-to-ground communication.
Uses: Riot control, emergency notifications, long-range communication from vehicles or fixed checkpoints, and air-to-ground communication for public safety or military.

Longer-Range / Fixed-Installation LRADs

These are the most powerful systems, designed for extended communication ranges and large-scale applications.

LRAD 1000Xi: Known as a long-distance communication system, often used for critical infrastructure protection and border security. It's also been used by navies for communication with vessels at sea.
Uses: Border patrol, large vessel communication, perimeter security for critical infrastructure (power plants, military bases), and mass notification during emergencies.
LRAD 950NXT: A highly advanced acoustic hailing device that integrates with radar and motion sensors for automated security alerts, combining communication with surveillance.
Uses: Advanced perimeter security, maritime defense, and integrated surveillance and communication platforms.
LRAD 1950XL: Often cited as the "loudest, longest range single head AHD." It's designed to broadcast voice messages and alert tones effectively over several kilometers.
Uses: Extreme long-range communication, large-scale emergency warnings, and significant standoff distances for security or military operations.

DEFENCE Non Lethal Other Non Lethal

Other Non Lethal Weapons

Any other non-lethal weapons not listed above.

DEFENCE Non Lethal Other Non Lethal Weapons Stun Devices

Stun Devices

Stun devices deliver an electric shock upon direct contact to incapacitate a person. This is distinct from a "Taser," which is a specific brand (Axon) of conducted energy weapon that fires probes connected by wires, allowing for a standoff distance.

Compact/Handheld Stun Guns (Tasers)

These are the most common type of stun gun. They are small, often about the size of a smartphone, remote control, or even disguised as everyday items like lipstick tubes, pens, or flashlights. They typically have two metal prongs or electrodes at one end.
How they work: When activated and pressed against an attacker's body, they deliver a high-voltage, low-amperage electrical shock. This disrupts the attacker's muscle function and nervous system, causing pain, muscle spasms, disorientation, and temporary incapacitation. They do NOT cause "neuromuscular incapacitation" (NMI) like Tasers do, as they lack the spread of probes needed to override the central nervous system.
Purpose: Primarily for self-defense at very close range.
Examples: Many generic brands offer these in various designs.

Stun Batons / Stun Sticks / Stun Flashlights

These are longer devices, resembling a baton or a large flashlight, with electrodes at one end.
How they work: Similar to compact stun guns, they deliver an electric shock upon direct contact. The extended length provides a bit more reach and standoff distance than a compact handheld unit, allowing the user to keep the attacker further away. Many models also include a powerful LED flashlight, which can serve as a deterrent or disorient the attacker. Some may have an electrified shaft to prevent the baton from being grabbed.

Purpose: Self-defense, tactical use (for security personnel or law enforcement), and sometimes for animal control.
Examples: Various brands offer stun batons and flashlight stun guns in different lengths and power outputs.

Disguised Stun Guns

These are stun guns designed to look like ordinary objects to provide an element of surprise or for discreet carry.
Examples: Lipstick stun guns, cell phone stun guns, pen stun guns, ring stun guns, cane stun guns, umbrella stun guns.
How they work: Function identically to compact stun guns, requiring direct contact.
Purpose: Concealed self-defense.

Stun Shields

These are riot shields (often transparent) with embedded electrodes on the front face.
How they work: Designed for crowd control, they can deliver an electric shock upon contact with a crowd member, providing a physical barrier combined with a non-lethal incapacitating effect.
Purpose: Riot control, law enforcement tactical operations.
Status: Less common than other types, often used by specialized units.

Tear Gas

"Tear gas" is a colloquial term for a class of chemical compounds known as riot control agents (RCAs) or lachrymators. Despite the name, they are not true gases but are typically solid or liquid compounds that are dispersed as aerosols (fine particles or droplets) when deployed from grenades, canisters, sprays, or other devices. Their primary effect is to irritate mucous membranes (eyes, nose, throat, lungs) and skin, causing temporary incapacitation.

CS Gas (o-Chlorobenzylidenemalononitrile)

This is by far the most commonly used and recognized form of tear gas globally. It's a white crystalline powder.
Effects: Causes immediate and intense burning sensations in the eyes, excessive tearing (lacrimation), involuntary eye closure (blepharospasm), difficulty breathing, coughing, a burning sensation in the nose and throat, and skin irritation (stinging, redness, sometimes blistering).
Onset/Duration: Effects typically appear within 20-60 seconds of exposure and usually resolve within 10-30 minutes of leaving the contaminated area and getting fresh air.
Deployment: Often deployed as a fine powder mixed with a pyrotechnic charge in grenades or canisters, or dissolved in solvents for aerosol sprays.
History: Developed in 1928, it became widely adopted by the British army in 1958 and the U.S. Army in 1959, replacing older agents due to its perceived higher potency and lower toxicity than CN.

CN Gas (Chloroacetophenone)

An older type of tear gas, also a solid chemical. It's the primary component of the older aerosol agent "Mace" (the original brand name).
Effects: Primarily affects the eyes, causing intense tearing, pain, and irritation. It's considered more toxic and potentially more damaging to the skin and eyes than CS at higher concentrations.
Onset/Duration: Effects are rapid.
History: Developed during World War I. While less common now for widespread crowd control compared to CS, it was widely used before the advent of CS.
Note: Some sources suggest CN is more likely to cause severe injury to the skin compared to CS.

CR Gas (Dibenzoxazepine)

This is considered the most potent of the three main tear gas agents (CS, CN, CR). It's a white crystalline solid.
Effects: Produces very intense irritation of the eyes, skin, and respiratory tract, often described as more severe than CS. It's a powerful TRPA1 agonist, meaning it strongly activates pain receptors.
Onset/Duration: Effects are rapid and may last longer than CS, and it is more difficult to remove from the skin.
Deployment: Less commonly used than CS, but known for its higher potency.
History: Developed in 1962.

OC Gas (Oleoresin Capsicum) / Pepper Spray

While often lumped in with "tear gas" colloquially, OC is chemically different. It's a natural extract from chili peppers, with capsaicin as its active ingredient. It's an oily resin.
Effects: Causes intense burning pain on skin and mucous membranes, profuse tearing, involuntary eye closure, coughing, shortness of breath, and a feeling of suffocation. It works by activating TRPV1 pain receptors.
Deployment: Typically used in handheld aerosol sprays for personal defense or by law enforcement in "pepper ball" rounds or larger canisters. Unlike CS/CN/CR which are synthesized chemicals, OC is derived from natural sources.
History: Developed as an animal repellent in the 1960s and adopted by law enforcement in the 1980s.
Note: While also an irritant, its mechanism and chemical structure are distinct from the synthetic lachrymators like CS, CN, and CR.

Tranquilizer Guns

Tranquilizer guns are specialized devices used to remotely deliver sedatives, tranquilizers, or other medications to animals. They are often called dart guns or chemical immobilization projectors. They are not used on humans in this context, and their use is highly regulated, primarily by veterinarians, wildlife management professionals, and zookeepers.

Tranquilizer Dart Components
Regardless of the projector type, the darts themselves are specialized ballistic syringes. They typically consist of:
- **Needle:** Designed to penetrate the animal's hide. Some have barbs or collars to help retain the dart, ensuring the full dose is administered.
- **Syringe Barrel:** Holds the liquid tranquilizer.
- **Plunger:** Pushed forward to inject the drug.
- **Tailpiece:** Often with fletching (like a dart or arrow) for flight stability.
- **Injection Mechanism:** Upon impact, a mechanism (e.g., compressed air/gas, a spring, or a small chemical reaction/explosive charge within the dart's tailpiece) triggers the plunger to deliver the drug into the animal.

Blowpipes (Blowguns)

These are long, hollow tubes through which a lightweight dart, filled with a sedative, is propelled by the operator's breath.
● **Mechanism:** Manual pneumatic propulsion using lung power.
● **Range:** Short range (typically 1-10 meters).
● **Advantages:** Very quiet, inexpensive, lightweight, and offer a gentle impact. Ideal for small to medium-sized animals, in confined spaces, or when stealth is necessary (e.g., dense vegetation, stables, urban areas where firearms are not suitable).
● **Disadvantages:** Limited range and dart capacity, requires considerable operator skill and practice, not suitable for large or thick-skinned animals that require higher doses or deeper penetration.

CO2-Powered Projectors (Pistols & Rifles)

These devices use compressed CO2 cartridges to propel the dart. They come in both pistol and rifle configurations.
● **Mechanism:** Compressed CO2 gas provides the propulsion. Pressure can often be adjusted to control dart velocity and impact force.
● **Range:** Medium range (pistols typically 3-20 meters; rifles generally 3-80 meters, depending on dart size and pressure settings).
● **Advantages:** More precise control over dart velocity than powder-charged systems, quieter than powder-charged systems, reliable, and versatile for various animal sizes and distances. Good for both short and medium ranges with adjustable pressure.
● **Disadvantages:** Can be affected by very cold temperatures (CO2 pressure drops), limited number of shots per CO2 cartridge (though some have larger tanks).
● **Examples of Brands:** DANiNJECT, Pneu-Dart, TeleDart, Cap-Chur.

Powder-Charged Projectors (Rifles & Shotguns)

These tranquilizer guns use a small blank cartridge (similar to a firearm blank) to generate the gas pressure needed to propel the dart. They are typically in rifle or modified shotgun forms.
● **Mechanism:** A small explosive charge (blank cartridge) generates high-pressure gas to propel the dart. Different strength blank cartridges are used for different ranges.
● **Range:** Longest range (typically 40-100+ meters, some up to 120 meters).
● **Advantages:** Longest effective range, powerful penetration for large or thick-skinned animals, not as affected by ambient temperature as CO2.
● **Disadvantages:** Louder operation (can startle animals), higher risk of impact injury to the animal due to greater force if not precisely controlled, generally less fine-tuned pressure control than CO2 systems, requires careful selection of blank charge.
● **Examples of Brands:** DANiNJECT, Pneu-Dart, TeleDart, Cap-Chur.

Jabsticks (Pole Syringes)

While not a "gun" in the traditional sense, a jabstick is a long pole with a syringe and needle attached to one end. Modern jabsticks often have a mechanism that automatically injects the drug upon full impact.
● **Mechanism:** Manual, direct contact.
● **Range:** Very short range (0-2 meters).
● **Advantages:** Very quiet, no projectile involved, allows for direct and precise drug administration. Ideal for animals in confined spaces, already restrained animals, or when a very gentle approach is needed.
● **Disadvantages:** Requires close proximity to the animal, which can be dangerous with large or aggressive animals in unprotected spaces. Not suitable for open areas or unapproachable animals.

Net Guns

Non-lethal net guns are devices designed to capture or immobilize a target by entangling it in a net, without causing significant injury. They are widely used in various fields, from wildlife management to law enforcement and even counter-drone operations. The primary ways to categorize different types of non-lethal net guns are by their propulsion mechanism and their intended target/design.

Animal Capture Net Guns

Design: Vary widely in size, from small handheld devices for birds or small mammals (e.g., stray dogs, cats) to larger rifle-like systems for bigger animals (e.g., deer, kangaroos). The nets themselves come in different mesh sizes and strengths to suit the target animal.
Purpose: Humane capture, rescue, relocation, and wildlife management.
Nets: Typically made of durable nylon or high-tensile polymers like Dyneema, often with weighted corners to ensure proper deployment and entanglement.

Human/Tactical Net Guns (Law Enforcement/Security)

Design: These are specifically designed to entangle human targets. They often use larger, stronger nets and may have features for rapid reloading.
Purpose: Non-lethal immobilization of suspects, crowd control, or neutralizing threats without using lethal force.
Legality: The use of net guns on humans is highly regulated and controversial, and their deployment by law enforcement is limited to specific circumstances and agencies.

Drone Capture Net Guns

Design: Can be handheld, shoulder-fired, or mounted on another drone. They are specifically designed to entangle drone propellers and rotors.
Purpose: Neutralizing unauthorized or hostile drones in sensitive airspace (e.g., airports, government buildings, military bases).
Nets: Often designed with specific mesh sizes and materials that are effective at fouling drone rotors.

CO2-Powered Net Guns

These are the most common type. They use compressed CO2 cartridges (similar to those used in paintball guns) to generate the burst of air needed to launch the net.
Mechanism: The CO2 cartridge is punctured, releasing gas into a chamber, which then rapidly propels the net and its weights (often small metal or rubber weights at the corners of the net) forward.
Advantages: Relatively quiet, portable, reusable, and offer adjustable power settings for different ranges or targets. They are generally considered reliable and easy to reload.
Applications: Widely used for animal control (stray dogs, cats, raccoons, birds), wildlife research and rescue, and increasingly for drone capture.
Examples: Many commercial "net gun" or "net launcher" products sold for animal control and drone defense operate on CO2.

Powder-Charged (Blank Cartridge) Net Guns

These systems use a small blank firearm cartridge (like a .22 or .308 blank) to generate the gas pressure to launch the net. These often resemble modified rifles or shotguns.
Mechanism: The blank cartridge is fired, and the expanding gases propel the net and its weights.
Advantages: Offer the longest ranges and greatest power, suitable for larger animals or drones at greater distances, and less affected by very cold temperatures compared to CO2.
Disadvantages: Much louder operation (can startle animals), require proper firearm safety protocols (even though they don't fire live ammunition), and the force of impact can be higher, requiring careful calibration.
Applications: Primarily used for larger wildlife capture (deer, elk, kangaroos in some contexts), or for military/law enforcement applications where greater range is needed.
Examples: Some professional wildlife capture companies offer these, sometimes using modified rifle platforms (e.g., Remington Model 700 adapted to fire nets).

Pneumatic/Air-Powered Net Guns (Manual Pump or External Tank)

These systems use compressed air, either from a manual pump (like a bicycle pump) or an external air tank (like SCUBA tanks or paintball HPA tanks).
Mechanism: Air is compressed into a reservoir and then released to propel the net.
Advantages: Can offer consistent power and are rechargeable without needing disposable cartridges (if using a refillable tank). Quieter than powder-charged systems.
Disadvantages: Requires an external air source or manual pumping, which can be less convenient for rapid deployment.
Applications: Less common for commercial net guns than CO2, but might be found in custom or DIY builds, or specialized industrial applications.

Drone-Launched Net Systems

This is a newer and specialized type where a net is launched from another drone, often designed to intercept rogue drones.
Mechanism: The attacking drone carries a compact net launcher (which might be CO2-powered or spring-loaded) and fires the net at the target drone in mid-air. Some designs even involve nets that are dragged by the attacking drone, aiming to entangle the target's rotors.
Advantages: Offers aerial pursuit and interception capabilities, reducing the risk to human operators. Can capture the drone for forensic analysis.
Applications: Counter-drone technology for security, military, and critical infrastructure protection.
Examples: Systems like SkyWall (a ground-based bazooka-like launcher), or drone-on-drone capture systems (e.g., those developed by Tokyo police, or various defense contractors).

Water Cannons

A crowd water cannon is a specialized vehicle, typically a large truck, equipped with a high-pressure pumping system and one or more powerful nozzles designed to project strong jets of water. Its primary purpose is crowd control and dispersal by law enforcement and security forces.

While often described as "non-lethal," water cannons can cause significant injuries, especially at close range, high pressure, or in cold weather. International human rights organizations often raise concerns about their indiscriminate nature and potential for misuse.
How They Work
● Water Source: The vehicle carries a large water tank (ranging from a few thousand liters up to 14,000 liters or more). Some systems can also connect directly to fire hydrants for a continuous supply.
● High-Pressure Pump: A powerful pump creates immense pressure, forcing the water through a specialized nozzle.
● Nozzle/Monitor: The nozzles, often called "monitors," are typically computer-controlled and can be remotely aimed and operated from within the armored cabin. They can rotate 360 degrees and adjust elevation.

● Jet Versatility: Modern water cannons can deliver different types of water jets:
  ● High-pressure streams: Designed to physically push back or knock over individuals. This is the most dangerous mode.
  ● Low-pressure streams / "Rain Shower" mode: Intended to soak individuals, causing discomfort and potentially hypothermia in cold weather, but with less kinetic impact.
  ● Pulsed jets ("slugs" or "bullets"): Delivering short, sharp bursts of water for more targeted impact.

Standard Armored Riot Control Vehicles

These are the most common type, built on heavy-duty truck chassis (often 4x4 or 6x6) with significant armor protection for the cabin, engine, and fuel tank. They are designed to withstand projectiles and attacks from rioters.
Water Capacity: Varying tank sizes, usually from 5,000 to 10,000+ liters.
Nozzles: Typically one or two main water cannons mounted on the roof.

Additional Features:
● Self-protection spray systems: Water or foam nozzles around the vehicle to protect against Molotov cocktails or other incendiary devices.
● Public address (PA) systems: For issuing warnings and commands.
● Surveillance cameras: For monitoring the crowd and aiming.
● Integrated lighting: Searchlights, strobe lights.
● Tear gas/Dye/Malodorant Additives: Many modern water cannons have separate tanks and injection systems to mix chemicals into the water jet.
● Colored Dyes: Used to mark individuals for later identification and arrest. These dyes can be difficult to remove.
● Chemical Irritants (e.g., CS gas, OC spray): Powders or liquids of tear gas agents or pepper spray are mixed with the water to enhance the dispersal effect through irritation and pain. This is highly controversial due to the indiscriminate nature of exposure.
● Malodorants: Foul-smelling chemicals that adhere to people and property, causing extreme discomfort and humiliation.
● Firefighting capability: Many are also equipped to act as basic firefighting vehicles.

Smaller/Lighter Water Cannon Vehicles

Some forces utilize smaller, more maneuverable vehicles (sometimes based on commercial vans or smaller trucks) equipped with water cannons. These may have less armor or smaller water tanks.
Purpose: For use in narrower streets, urban environments, or where a full-sized armored vehicle might be overkill.

Static/Fixed Water Cannons

Less common for crowd control, but in some high-security areas (like prisons or sensitive government buildings), fixed water cannon systems might be installed to deter or disperse intruders.
Mechanism: Connected to a permanent water supply and controlled remotely.

Makeshift/Improvised Water Cannons

In some situations, authorities have adapted standard fire hoses or even agricultural spraying equipment to act as rudimentary water cannons.
Purpose: To disperse crowds when purpose-built equipment isn't available.
Concerns: These are particularly dangerous as they lack the safety features, pressure control, and specialized training associated with purpose-built crowd control vehicles, significantly increasing the risk of severe injury.

Scent Weapons

Scent weapons, or malodorants, are a niche but intriguing category of non-lethal weapons that utilize extremely foul or noxious odors to incapacitate, deter, or identify individuals. The primary goal is to induce intense nausea, discomfort, or psychological distress without causing physical harm.

DEFENCE Non Lethal Other Non Lethal Weapons Scent Weapons

General Characteristics and Challenges of Scent Weapons

- Non-Lethal Intent: Designed to cause extreme discomfort and deter, without causing permanent physical harm.
- Pervasiveness: They are notoriously difficult to contain and can contaminate wide areas, affecting non-targets.
- Persistence: Many malodorants are designed to linger for hours or even days, making decontamination difficult.
- Psychological Impact: While some people might be severely affected, others might build a tolerance or simply endure the smell, limiting its effectiveness. The psychological effect is highly subjective.
- Ethical Concerns: Their use raises significant ethical questions regarding humane treatment, the indiscriminate nature of their effect, and the potential for long-term psychological distress or social stigma from the persistent smell.
- Development Challenges: Developing an effective malodorant that is truly non-toxic, easily dispersible, persistent, and universally repulsive, while also being controllable, is a significant technical hurdle.

"Stink Bombs" / Vomit Inducing Agents (e.g., US Military's "Skunk Bomb")

Description: These are perhaps the most well-known type, designed to produce incredibly repulsive and persistent odors that can induce nausea, vomiting, or overwhelming disgust.
Chemicals Used: Often compounds based on thiols (also known as mercaptans), which are organic sulfur compounds known for their extremely potent and offensive smells (e.g., rotten eggs, skunk spray, decaying flesh).

- "Skunk": Developed by the Israeli Defense Forces (IDF) for crowd control, "Skunk" is one of the most prominent examples. It's a non-toxic liquid composed of food-grade ingredients (but designed to smell like a combination of rotting corpses, raw sewage, and unwashed socks). It's sprayed from water cannons or handheld devices. The smell is incredibly pervasive and difficult to wash off.

- "Whoopee Fluid" / US Military's "Stink Bomb": The U.S. military also explored various malodorants, including "Whoopee Fluid" (based on sulfurous compounds) and a "Malodorant Weapon" designed to mimic the smell of feces and vomit. These efforts aimed to develop non-lethal incapacitants.

Mechanism: Overwhelm the olfactory (smell) sense, triggering strong physiological and psychological reactions like nausea, gagging, difficulty breathing (psychosomatic), panic, and a strong desire to flee the area.

Applications:
- Crowd Dispersal: To make an area so unpleasant that people choose to leave.
- Area Denial: To prevent access to a specific location.
- Psychological Warfare: To demoralize or disrupt an enemy.
- Prisoner Control: To induce compliance.

Limitations: The indiscriminate nature of the smell can affect friendly forces or bystanders, and it's difficult to contain. The psychological effect can vary between individuals.

Tracking/Identification Malodorants (Less about incapacitation, more about detection)

These malodorants are designed to cling to individuals, clothing, and objects for an extended period, allowing for later identification or tracking. The smell might not be overtly nauseating but distinct and persistent.
Chemicals Used: Could be variations of thiols or other highly persistent and identifiable compounds.
Mechanism: The chemical adheres to surfaces and slowly evaporates, releasing a unique, recognizable odor.

Applications
- Marking Rioters: To later identify individuals who participated in illegal activities within a crowd.
- Tracking Suspects: To assist K9 units or human trackers in following a trail.
- Property Protection: To mark stolen goods, making them easier to identify.

Limitations: Ethical concerns about long-term exposure and the persistent nature of the smell on individuals.

Non-Lethal Insect Repellents (Indirect Scent Weapon)

While not directly targeting humans with foul odors, some systems use highly concentrated insect repellents to create an uninhabitable zone due to swarms of insects being driven away. This is more about creating an environmental barrier than directly incapacitating via human smell.
Mechanism: Large-scale dispersal of strong insect repellents.
Applications: Area denial, particularly in environments prone to insect-borne diseases or highly irritating insect populations.
Limitations: Effectiveness depends on the insect population, environmental conditions, and the concentration of the repellent.

Psychochemicals

Psychochemicals, also known as incapacitating agents or "drug weapons," are a class of chemical warfare agents designed to temporarily impair an adversary's mental or physical functions without causing permanent injury or death. Unlike lethal chemical weapons (like nerve agents or blister agents), their goal is to disorient, confuse, or induce hallucinations, making the target unable to fight effectively.

Research into psychochemicals was actively pursued during the Cold War by countries like the US and UK, but they were largely deemed impractical for widespread battlefield use due to unpredictable effects and difficulties in dispersion and dosage. Many of these programs were later terminated or scaled back. However, the concept of using chemicals to alter cognition or behavior for military or control purposes remains a topic of concern in discussions about non-lethal weapons and emerging chemical threats.

Anticholinergics

These compounds block the action of acetylcholine, a neurotransmitter crucial for both the central and peripheral nervous systems.
Effects: They induce a state resembling delirium, characterized by:
Cognitive Dysfunction: Confusion, disorientation, impaired memory, difficulty concentrating.
Hallucinations: Visual and auditory hallucinations, often vivid and disorienting.
Physiological Effects: Dry mouth, dilated pupils (leading to blurred vision), rapid heartbeat, elevated body temperature, and decreased sweating.
Behavioral Effects: Erratic behavior, agitation, ataxia (lack of muscle coordination), lethargy, and sometimes stupor or coma.
Key Example: BZ (3-quinuclidinyl benzilate) is the most well-known anticholinergic psychochemical. The United States extensively researched and even weaponized BZ (e.g., in the M43 BZ cluster bomb), though these stocks were later destroyed. It's an odorless, stable white crystalline powder.

Mechanism: Competitive inhibition of muscarinic acetylcholine receptors.
Limitations: Highly unpredictable effects, varying widely based on dose, individual physiology, and environmental factors. Recovery can take hours to days.

Psychedelics/Hallucinogens

These agents induce profound alterations in perception, mood, and thought.
Effects: Visual and auditory hallucinations, altered sense of reality, euphoria or dysphoria, paranoia, confusion, and impaired judgment.
Key Example: LSD (lysergic acid diethylamide) was extensively investigated by the CIA (e.g., Project MKUltra) and the US Army (Edgewood Arsenal experiments) as a potential psychochemical weapon. Mescaline and psilocybin were also studied.

Mechanism: Primarily by affecting serotonin receptor systems in the brain.
Limitations: Extremely unpredictable effects, even within a controlled environment, making them unreliable for battlefield use. A soldier under the influence might become completely incapacitated, or conversely, agitated and aggressive. Dosage control for a widespread effect is also a major challenge. The "trip" can vary wildly and unpredictably.

Opioids/Analgesics (with incapacitating potential)

While primarily pain relievers, extremely potent opioids can cause profound sedation, respiratory depression, and unconsciousness, leading to incapacitation.
Effects: Extreme drowsiness, sedation, confusion, respiratory depression, nausea, and potentially loss of consciousness.
Key Examples: Fentanyl and its analogues (e.g., carfentanil, remifentanil) have gained notoriety in the context of psychochemicals, particularly after the 2002 Moscow theater siege, where Russian forces used an aerosolized fentanyl derivative to incapacitate Chechen hostage-takers. While effective at incapacitating, the extremely narrow therapeutic window (the difference between an incapacitating dose and a lethal dose) makes them exceptionally dangerous and prone to causing fatalities, as tragically demonstrated in Moscow.

Mechanism: Agonism of opioid receptors in the central nervous system.
Limitations: High risk of death due to respiratory depression. Difficult to disperse evenly and safely. The indiscriminate nature makes them dangerous to non-combatants and even friendly forces.

Dissociatives

Agents that produce a sense of detachment from one's body and surroundings.
Effects: Dissociation, numbness, memory loss (amnesia), confusion, hallucinations, and impaired motor function.
Key Example: PCP (phencyclidine), known as "angel dust," has been studied for its potential to induce psychopathological symptoms. Ketamine (a medical anesthetic and dissociative) also falls into this category.
Mechanism: Primarily by acting as NMDA receptor antagonists.
Limitations: Can lead to unpredictable and sometimes aggressive behavior, high risk of overdose, and difficulties in control.

Sleeping Gas

The term often refers to incapacitating agents or psychochemicals, which are designed to temporarily alter mental or physical functions to the point of incapacitation, including inducing unconsciousness or deep sedation.

These agents are highly dangerous and their use as weapons is generally prohibited under the Chemical Weapons Convention (CWC) due to the high risk of severe harm or death, and their unpredictable effects.

Opioids (e.g., Fentanyl and its Derivatives)

These are synthetic opioids, significantly more potent than morphine, often used medically for pain management and anesthesia. Examples include fentanyl, sufentanil, carfentanil, and remifentanil.
Mechanism: They act on opioid receptors in the brain and central nervous system, leading to profound analgesia (pain relief), sedation, and crucially, dose-dependent respiratory depression (slowing or stopping breathing).

The most infamous real-world incident involving an opioid as an incapacitating agent was the 2002 Moscow theater hostage crisis. Russian special forces used an aerosolized fentanyl derivative (likely carfentanil or remifentanil) to incapacitate Chechen terrorists. While the terrorists were incapacitated, over 120 hostages also died, primarily from respiratory depression, highlighting the extreme dangers of using such agents indiscriminately.

Medical Use: Anesthesia (often intravenous), pain management (transdermal patches, IV, oral), especially for severe acute or chronic pain.

General Anesthetics (Inhalational Anesthetics)

These are volatile liquids or gases administered via inhalation to induce and maintain general anesthesia during surgery.
Mechanism: They depress overall central nervous system activity, leading to unconsciousness, amnesia, and muscle relaxation.
Types:
● Volatile Anesthetics: Liquids at room temperature that are vaporized for inhalation. Examples include Halothane (Fluothane) (older, less common now), Isoflurane, Sevoflurane, and Desflurane.
● Gaseous Anesthetics: Gases at room temperature. The primary example is Nitrous Oxide (N_2O), commonly known as "laughing gas." It's a weaker anesthetic often used in combination with others or for sedation (e.g., dental procedures, childbirth).
Some research into "non-lethal" incapacitating agents has historically considered these. For instance, halothane was mentioned in some discussions about the Moscow theater incident as a potential component, though fentanyl derivatives were confirmed.
Medical Use: Inducing and maintaining surgical anesthesia, sedation for minor procedures (nitrous oxide).

Anticholinergics (e.g., BZ - 3-Quinuclidinyl Benzilate)

These are psychochemicals designed to induce delirium, confusion, and temporary mental incapacitation. While they can lead to stupor or a sleep-like state, their primary effect is profound disorientation.

Mechanism: They block the action of acetylcholine, a neurotransmitter involved in memory, learning, and various bodily functions.
BZ was extensively researched and even weaponized by the U.S. during the Cold War. While not directly a "sleeping gas," severe intoxication can lead to a comatose state.
Medical Use: Some anticholinergics are used medically for conditions like motion sickness, Parkinson's disease, or to dry secretions, but not for inducing general sleep or unconsciousness for non-medical purposes.

Sticky Foam

"Sticky foam," often referred to as "riot foam" or "mobility denial foam," is a type of less-lethal weapon that was developed primarily by the U.S. military and some research institutions for crowd control and to incapacitate individuals. It's not a widely adopted or commonly seen tool in civilian policing, but it has been explored and deployed in specific military contexts.

It consists of highly adhesive and rapidly expanding polymers (a mix of rubbers, resins, oils, fire retardants, and other chemicals) stored in a compressed form with a propellant. When fired from a dispenser, it rapidly expands (often to 30 times its original volume or more) and becomes extremely tacky and tenacious upon contact.

The primary mechanism of action is immobilization and entanglement. When the foam hits a person, it:

1. Adheres immediately: It sticks to skin, hair, and clothing with incredible tenacity.
2. Expands and hardens/becomes viscous: As it expands, it can quickly envelop limbs, making movement difficult or impossible. It doesn't necessarily "harden" into a solid block but becomes a very thick, gooey, and strong viscous material that resists movement.
3. Physically restrains: The stickiness and bulk of the foam can pin a person to the ground, glue their limbs together, or simply make it too cumbersome to move effectively.

Chemical Formulation
Different formulations have been developed over time, aiming for better adhesion, faster expansion, easier cleanup, and improved safety.

Delivery Systems
● Backpack-mounted dispensers: This was the primary mode in early prototypes (e.g., developed by Sandia National Laboratories). A large tank is worn like a backpack, with a hose leading to a "gun" or nozzle. This allows for a continuous stream or multiple shots.
● "Gun"/Launcher Systems: Devices resembling large guns or bazookas designed to fire discrete "shots" of sticky foam.
● Vehicle Arresting Systems: Larger-scale versions developed to immobilize vehicles by deploying large quantities of foam.
● "Sponge Bombs": A more recent concept (reportedly used by the IDF in tunnels) that uses two liquid reagents that mix upon activation, rapidly expanding and solidifying to create a physical barrier. While this shares some chemical principles, its primary goal is sealing, not direct crowd immobilization in the open.

Despite its seemingly "cartoonish" non-lethal concept, sticky foam faces several serious practical and ethical challenges that have limited its widespread adoption:

● Suffocation Risk: This is the most significant concern. If the foam covers a person's nose and mouth, it poses a serious risk of suffocation. This makes it difficult to use indiscriminately in a crowd and raises severe safety and ethical issues.
● Indiscriminate: Like other area-denial weapons, it's hard to control exactly who or what the foam sticks to, potentially affecting friendly forces, bystanders, or even gluing multiple people together.
● Cleanup Difficulty: The foam is extremely adhesive and can take a long time (hours) and specific solvents (like mineral oil or baby oil) to remove from skin, hair, and clothing. This creates logistical problems for apprehension, medical treatment, and decontamination.
● Limited Range and Bulkiness: Early dispensers were often large and bulky, and the effective range was relatively short, making them impractical for controlling large, dispersed crowds.

● Clogging: The dispensing mechanisms could be prone to clogging.
● Public Perception: The visual of someone covered in sticky foam, while perhaps appearing "non-lethal," could still be visually disturbing and lead to significant negative publicity and human rights concerns.

Due to these practical and safety drawbacks, sticky foam has largely remained an experimental or niche technology rather than a frontline tool for crowd control. Other less-lethal options like tear gas, water cannons, and impact munitions are far more common, despite their own controversies.

2 Unarmed

Unarmed combat, often referred to as hand-to-hand combat, self-defense, or martial arts, encompasses a vast array of fighting systems and disciplines that rely solely on the human body as a weapon.

These can be broadly categorized based on their primary focus and techniques.
● Striking Arts: These martial arts emphasize using fists, kicks, elbows, knees, and other parts of the body to deliver blows.
● Grappling Arts: These martial arts focus on grappling techniques, including throws, takedowns, chokes, and joint locks.
● Self-Defence Arts: These systems prioritize practical techniques for self-defense in real-world scenarios.
● Other: Styles of unarmed combat which either combine multiple of the above or use a completely new style.

The ten martial arts below have been chosen as a mix of the above categories and are listed in DEFENCE rather than OFFENCE because their primary focus is to defend oneself from an attacker, rather than to instigate the attack.

Subheadings

Krav Maga

Krav Maga, as a self-defense system rather than a traditional martial art, is structured in a practical and progressive way to train individuals for real-world violent encounters. It doesn't adhere to rigid forms or rituals found in many traditional martial arts, but rather focuses on efficiency, instinct, and adaptability.

Brazilian Jiu-Jitsu

Brazilian Jiu-Jitsu (BJJ) is a martial art, combat sport, and self-defense system that originated in Brazil, but with deep roots in Japanese martial arts. It's renowned for its emphasis on grappling and ground fighting, particularly focusing on the concept that a smaller, weaker person can successfully defend themselves against a larger, stronger assailant by using leverage, proper technique, and taking the fight to the ground.

Muay Thai

Muay Thai, often referred to as "The Art of Eight Limbs," is a dynamic and devastating combat sport and martial art originating from Thailand. It differentiates itself by utilizing a fighter's entire body as a weapon, allowing strikes with fists, elbows, knees, and shins (the "eight limbs"), complemented by powerful clinching techniques for close-range grappling and knee/elbow attacks. This full-contact discipline emphasizes rigorous physical conditioning, mental fortitude, and devastating power, making it highly effective for both competitive fighting and realistic self-defense scenarios.

Boxing (Western Boxing)

Western Boxing, often called "the sweet science," is a combat sport and martial art focused exclusively on punching techniques and highly refined defensive movements. Fighters utilize jabs, crosses, hooks, and uppercuts, combined with intricate footwork, head movement, and body rotation, to deliver powerful blows while simultaneously evading and blocking incoming attacks. It's a discipline that hones precision, speed, endurance, and strategic thinking, making it a highly effective and foundational striking art for self-defense and competitive sport.

Wrestling

Wrestling, as a martial art, is a comprehensive grappling system centered on controlling an opponent through takedowns, throws, and ground control, without the use of strikes. It emphasizes leverage, balance, and strategic positioning to subdue an adversary, aiming to either pin them to the ground or maintain dominance. Rooted in ancient practices, wrestling develops immense strength, endurance, and practical skills for managing close-quarters confrontations, teaching practitioners to effectively neutralize an opponent by dictating the fight's terms and preventing them from standing or gaining an advantageous position.

Judo

Judo, meaning "the gentle way," is a Japanese martial art and Olympic sport founded by Jigoro Kano. It focuses on using an opponent's momentum and balance against them through throws (Nage-Waza), takedowns, and pins (Osaekomi-Waza), as well as joint locks and chokeholds (Shime-Waza and Kansetsu-Waza) on the ground. Judo emphasizes efficient use of energy, respect, and discipline, teaching practitioners to effectively control and submit an opponent without striking, making it a highly effective self-defense system.

Mixed Martial Arts (MMA)

Mixed Martial Arts (MMA) is a full-contact combat sport that integrates techniques from various martial arts and combat disciplines, including striking arts like boxing, Muay Thai, and karate, alongside grappling arts such as Brazilian Jiu-Jitsu, wrestling, and Judo. Competitors engage in stand-up striking, clinching, takedowns, and ground fighting, aiming to defeat their opponent through knockout, submission, or judges' decision. MMA is celebrated for its dynamic blend of skills, demanding comprehensive physical conditioning and strategic versatility from its athletes to compete effectively across all ranges of combat.

Sambo (Russian Sambo)

Sambo, a Russian acronym meaning "self-defense without weapons," is a comprehensive martial art and combat sport developed in the Soviet Union during the early 20th century. It synthesizes elements from Judo, various forms of wrestling, and indigenous martial arts from across the Soviet regions. Sambo is primarily characterized by its dynamic throws, effective ground fighting techniques, and a wide array of leg locks, with two main disciplines: Sport Sambo, which is a jacket wrestling style similar to Judo but with distinct rules regarding gripping and submissions, and Combat Sambo, a more aggressive discipline that incorporates striking (punches, kicks, elbows, knees) alongside grappling, making it a versatile system for both self-defense and military applications.

Wing Chun

Wing Chun is a unique Chinese martial art known for its efficiency, directness, and emphasis on close-quarters combat. Developed with the principle of simultaneous defense and attack, it utilizes economic movements, a strong central line theory, and short-range power generation. Practitioners focus on rapid, continuous striking, trapping, and redirecting an opponent's force, making it highly effective for self-defense in confined spaces and against aggressive, direct attacks.

Kyokushin Karate

Kyokushin Karate is a full-contact Japanese martial art founded by Masutatsu Oyama, emphasizing extreme discipline, rigorous physical conditioning, and powerful, knockdown techniques. Unlike many traditional karate styles, Kyokushin practices full-contact sparring with minimal protective gear, fostering immense resilience, striking power, and a strong fighting spirit. Its training focuses on developing devastating kicks, punches, and knee strikes, along with conditioning the body to both deliver and withstand significant impact, making it a highly effective and physically demanding system for combat and self-defense.

3 Armour

This section describes the types of armour and padding to protect against foreign attacks, both melee or ranged.

DEFENCE Armour Head Armour

Head Armour

Head armour is any piece of defensive apparel designed to protect the wearers head.

Standard Ballistic Helmets (e.g., ACH/MICH)

These helmets are the most common issue for general infantry and special operations forces. Made primarily from advanced aramid fibers (like Kevlar) or Ultra-High-Molecular-Weight Polyethylene (UHMWPE), they offer significant protection against handgun rounds and fragmentation. Their design, often referred to as "mid-cut," balances coverage with compatibility for communication headsets and hearing protection.

Enhanced Ballistic Helmets (e.g., ECH)

Representing an upgrade to the standard ballistic helmets, these typically utilize advanced UHMWPE materials to achieve higher levels of ballistic protection, often against certain rifle threats or higher-velocity fragmentation, while striving to maintain or reduce weight. They generally maintain a similar mid-cut profile for broad applicability.

High-Cut

High-Cut Ballistic Helmets (e.g., FAST Helmets)

Distinguished by a higher cut above the ears, these helmets prioritize compatibility with large communication headsets, active hearing protection, and other mounted accessories like night vision devices (NVDs) and tactical lights. While offering less lateral coverage, their design is favored by special operations units for enhanced situational awareness, reduced weight, and modularity.

Integrated Head Protection Systems (IHPS)

This represents the newest generation of combat head protection, designed as a modular suite. The IHPS aims to provide improved ballistic and blunt force protection, often with lighter weight, and is built for seamless integration with communication systems, hearing protection, night vision goggles, and optional facial and mandibular protection (visors, jaw guards) for comprehensive head and face protection.

Neck Armour

Neck Armour

Neck armour is any piece of defensive apparel designed to protect the wearers neck.

Integrated

Integrated Collar/Throat Protectors (Soft Armor)

These are the most common form of neck protection, designed as detachable or integrated components of modern ballistic body armor vests (like the US Interceptor Body Armor - IBA or UK Osprey systems). They consist of soft ballistic panels (made from Kevlar, Dyneema, or other aramid/UHMWPE fabrics) that extend upwards from the vest to cover the front (throat) and sometimes the sides and back of the neck. They are designed to provide Level IIIA ballistic protection against handgun rounds and fragmentation. While effective, their bulk can sometimes restrict head movement or interfere with weapon shouldering, leading some soldiers to remove them in certain situations.

Mandible Guards (Integrated Helmet Accessories)

These are rigid or semi-rigid pieces of ballistic material that attach to the front of a combat helmet (especially high-cut models like FAST helmets). While primarily protecting the lower jaw and face, they also provide some extended protection to the upper neck and throat area directly below the chin. They are designed to protect against ballistic threats, blunt force, and blast fragments.

Nape Protectors (Integrated Helmet Accessories)

These are ballistic panels that attach to the rear lower rim of the helmet, extending downwards to cover the nape (back) of the neck.
They are specifically designed to provide protection against fragmentation and ballistic threats from the rear.

Ballistic

Ballistic Scarves/Gaiters

Some specialized units or specific manufacturers offer ballistic scarves or neck gaiters made from cut-resistant and/or ballistic fabrics (like Dyneema or aramid blends). These are worn like a regular neck gaiter but provide a layer of protection against slashing, fragments, and potentially some low-velocity ballistic threats. They prioritize flexibility and comfort.

Modular Armor Supplement Systems

Companies like FirstSpear offer "Modular Armor Supplement Systems" (M.A.S.S.) which include standalone throat guards and collars that can be easily added or removed from plate carriers or tactical vests. These provide augmentation to existing armor with varying ballistic protection levels.

Body

Body Armour

DEFENCE Armour Body Armour

Body armour is any piece of defensive apparel designed to protect the wearers chest.

Soft Armour (Soft Ballistic Panels)

Soft Armour

Primarily designed to protect against handgun rounds (up to .44 Magnum), fragmentation (shrapnel from grenades, IEDs), and sometimes stab threats.
Materials: Made from multiple layers of flexible, high-strength synthetic fibers such as Kevlar (aramid), Dyneema, or Spectra (both UHMWPE). These fibers absorb and disperse the energy of a projectile, deforming it and preventing penetration.
Form Factor: Flexible and relatively lightweight, soft armour is often used in concealed vests (worn under clothing), as liners in military vests, or as "backers" behind hard plates to absorb residual energy and blunt force trauma.
Protection Levels: Typically rated from NIJ Level IIA to IIIA, based on the National Institute of Justice (NIJ) standards.

Hard Armour Plates (Ballistic Plates)

DEFENCE Armour Body Armour Hard Armour Plates (Ballistic

Designed to provide superior protection against high-velocity rifle rounds, armor-piercing ammunition, and more severe fragmentation.
Materials:
- Ceramic Plates: Most common in military applications, made from materials like boron carbide, silicon carbide, or alumina. They work by shattering or deforming the projectile upon impact, with a composite fiber backing (often UHMWPE or aramid) catching any fragments and absorbing residual energy. While offering excellent protection and relatively lighter weight, they can be prone to cracking from multiple impacts in the same spot or rough handling.
- Polyethylene (UHMWPE) Plates: Made from compressed, multi-layered sheets of ultra-high-molecular-weight polyethylene. These are exceptionally lightweight and can offer excellent multi-hit capability against certain rifle threats without significant weight penalty. However, they can be thicker than ceramic plates and may have lower heat resistance.
- Steel Plates (with anti-spall coating): Less common in frontline military combat due to their weight and the risk of "spalling" (fragments of the bullet or plate ricocheting off the surface), but some modern steel plates feature advanced anti-spall coatings (e.g., polyurea or rubber compounds) to mitigate this. They are known for their durability and multi-hit capability in the same impact area.

Form Factor: Rigid plates inserted into dedicated pockets in vests or plate carriers.
Protection Levels: Typically rated NIJ Level III or Level IV, with Level IV offering the highest protection against armor-piercing rifle rounds.

Plate Carriers and Vests

DEFENCE Armour Body Armour Plate Carriers

Plate Carriers: These are lightweight, modular vests designed specifically to hold hard armour plates (front, back, and often sides). They feature webbing systems (like MOLLE/PALS) for attaching pouches, magazines, and other tactical gear, allowing soldiers to customize their loadout. Plate carriers prioritize mobility and adaptability.

Tactical Vests (e.g., IOTV - Improved Outer Tactical Vest): These are more comprehensive body armour systems that typically integrate soft armour panels throughout the torso, along with pockets for inserting hard armour plates. They offer broader coverage (including groin, collar, and shoulder protection) than minimalist plate carriers but are generally heavier and bulkier.

Modular and Integrated Systems

DEFENCE Armour Body Armour

Modern trends, such as the US Army's Soldier Protection System (SPS) which includes the Modular Scalable Vest (MSV), focus on highly modular and scalable designs. These systems allow soldiers to add or remove various soft and hard armor components (like deltoid protectors, groin protectors, side plates, and collar inserts) based on the specific threat level and mission requirements, balancing protection with agility.

Shoulder Armour

DEFENCE Armour Shoulder Armour

Shoulder armour is any piece of defensive apparel designed to protect the wearers shoulders.

Integrated Deltoid Protectors (Soft Armour)

Integrated

These are the most common form of modern combat shoulder protection. They are typically detachable or integrated components of comprehensive ballistic vests (like the U.S. Army's Improved Outer Tactical Vest - IOTV, or the Modular Scalable Vest - MSV).
Material: Made from multiple layers of soft ballistic fabrics (such as Kevlar or UHMWPE - e.g., Dyneema, Spectra). These flexible panels are designed to stop handgun rounds and fragmentation.
Attachment: They attach to the main vest via hook-and-loop fasteners (Velcro), straps, or other modular systems, allowing soldiers to add or remove them based on mission requirements and the desired level of protection versus mobility.
Purpose: To provide extended coverage to the upper arm and shoulder area, complementing the torso protection of the main vest.

Hard Plate Shoulder Inserts (Less Common/Specialized)

DEFENCE Armour Shoulder Armour Hard Plate

While most shoulder protection is soft armour, some specialized or heavier body armour systems might incorporate very small, purpose-built hard armour inserts into the deltoid protectors. These are rarer than soft inserts due to the mobility constraints they would impose.
Material: If present, these would typically be made from ceramics or thicker UHMWPE to offer protection against higher-velocity rifle rounds, but their size would be very limited to maintain joint articulation.
Purpose: To offer enhanced ballistic protection to a very specific, critical area of the shoulder, often for specialized roles or high-threat environments where mobility compromise is accepted.

Modular & Scalable Systems

DEFENCE Armour

Modern body armour philosophy emphasizes modularity. Shoulder protection falls under this, allowing commanders or individual soldiers to "scale" their armour based on the threat level, climate, and physical demands of the mission. For instance, a soldier might wear shoulder protection during a dismounted patrol where fragmentation is a high risk, but remove it for mounted operations where agility inside a vehicle is paramount.

Hand Armour

DEFENCE Armour Hand Armour

Hand armour is any piece of defensive apparel designed to protect the wearers hands.

Hard Knuckle Tactical Gloves

These are the most common type of protective glove in military and law enforcement. They feature reinforced knuckles, typically made from molded carbon fiber, hard plastic (like Thermoplastic Rubber - TPR), or Kevlar, to protect against blunt force impacts, abrasion, and minor strikes.
Purpose: To prevent injuries to the knuckles from impacts during close-quarters combat, handling equipment, or operating in confined spaces.
Other Features: Often include durable palm materials (leather, synthetic leather) for enhanced grip, touchscreen compatibility, and sometimes D3O or other shock-absorbing padding in the palm to reduce vibration and impact.

Cut-Resistant Gloves

Designed to protect hands from lacerations and slashes, these gloves are constructed with inner linings or integrated materials made from high-performance fibers such as Kevlar, Dyneema (UHMWPE), or other proprietary cut-resistant blends.
Purpose: To prevent injuries from sharp objects like knives, broken glass, jagged metal, or other debris often encountered in urban combat or hazardous environments.
Levels: Cut resistance is often rated by standards like EN 388 (e.g., Level 5 or higher), indicating the degree of protection against cutting forces.

Impact-Resistant Gloves (General)

While often overlapping with hard knuckle gloves, some tactical gloves offer broader impact protection across the fingers, palm, and back of the hand using various padding materials (e.g., TPR, foam, D3O) and reinforced stitching.
Purpose: To mitigate the effects of blunt force impacts, pinches, and abrasions across the entire hand, crucial for tasks involving heavy equipment, breaching, or operating in rugged terrain.

Flame-Resistant (FR) Gloves

Made from materials that resist ignition and melting when exposed to high heat or flames, such as Nomex, Kevlar, or fire-resistant leather.
Purpose: To protect hands from burns during explosions, vehicle fires, or when handling hot equipment. These are standard issue for aircrews and personnel operating in environments with fire risks.

Specialized/Ballistic Hand Protection (Limited Use)

Full ballistic protection for the hands in a glove form is extremely rare in modern combat due to the severe dexterity limitations it imposes. However, some very specialized units or bomb disposal experts might use gloves with limited ballistic inserts (e.g., small, flexible soft armor panels) for specific high-risk tasks.
Purpose: To offer a minimal level of ballistic or blast fragmentation protection where absolute protection outweighs dexterity. This is not common for general combat roles.

Leg Armour

Leg armour is any piece of defensive apparel designed to protect the wearers legs or groin.

Groin Protectors

These are soft ballistic panels that attach to the front lower edge of the main body armour vest, extending downwards to cover the groin and often part of the inner thighs.
Material: Made from multiple layers of flexible ballistic fabrics like Kevlar or UHMWPE (e.g., Dyneema).
Purpose: To protect the highly vulnerable groin and femoral artery/vein area from ballistic threats, fragmentation, and shrapnel. While crucial, their bulk can sometimes be an issue for mobility.

Thigh Protectors / Upper Leg Armor

These are soft armour panels designed to cover the outer and sometimes inner thigh areas. They are often worn as separate modules that attach to the main body armour system (e.g., plate carrier or vest) or a specialized tactical belt, sometimes wrapping around the thigh.
Material: Constructed from flexible ballistic materials such as aramid fibers or UHMWPE, offering protection against handgun rounds and fragmentation.
Purpose: To protect the large muscle groups and major arteries/veins in the thigh from ballistic threats, fragmentation, and blunt force injuries. Some designs include MOLLE webbing for attaching additional pouches.

Ballistic Lower Leg/Shin Guards

While less common for general infantry due to mobility concerns, specialized units (e.g., those involved in breaching, EOD, or urban operations) may utilize lower leg or shin protection. These are often rigid or semi-rigid pads with ballistic inserts.
Material: Can incorporate soft ballistic panels, hard plastic, or even small ceramic/UHMWPE plates for enhanced protection.
Purpose: To protect the shins and calves from direct impacts, fragmentation, and potentially low-velocity ballistic threats, often in environments where debris or close-range threats are prevalent.

Integrated Knee Pads

While not ballistic armor, modern combat trousers often feature integrated knee pad pockets designed to hold removable protective inserts. These inserts are made of hard plastic and/or dense foam.
Material: Typically plastic (for the hard cap) and high-density foam or gel (for impact absorption).
Purpose: To protect the knees from impacts, abrasions, and blunt force trauma when kneeling, crawling, or moving over rough terrain, enhancing comfort and preventing injury. They are an essential part of modern combat uniform systems.

Foot Armour

Foot armour is any piece of defensive apparel designed to protect the wearers feet.

Standard Combat Boots

These are the most common type, designed for general use across various terrains. They are built for durability, support, and protection.
Protective Features:
- Ankle Support: High-cut designs provide stability and help prevent sprains on uneven terrain.
- Durable Materials: Made from robust leather, nylon, or composite materials that resist abrasion, tearing, and punctures from debris.
- Reinforced Toes and Heels: Often have hardened toe caps (though rarely steel-toed due to thermal conductivity and impact risks in combat) and reinforced heels for impact protection.
- Aggressive Outsoles: Provide superior grip and traction on varied surfaces, preventing slips and falls.
- Puncture Resistance: Soles are often designed to resist punctures from sharp objects on the ground.

Hot Weather / Desert Boots:

Lighter and more breathable versions of combat boots, specifically designed for arid and hot environments.
Protective Features:
- Breathability: Incorporate breathable fabrics (e.g., CORDURA nylon) and drainage vents to allow air circulation and water expulsion, preventing heat accumulation and moisture-related foot issues.
- Sand/Dust Protection: Designed to minimize sand and dust entry while still allowing airflow.
- Reduced Weight: Lighter materials reduce fatigue in hot conditions.

Jungle / Wet Weather Boots

Built to withstand constant moisture, rapidly drain water, and provide grip in slippery, muddy conditions.
Protective Features:
- Drainage Vents: Prominent drainage holes in the instep allow water to quickly escape.
- Quick-Drying Materials: Utilize materials that resist water absorption and dry quickly.
- Enhanced Traction: Outsoles are often designed with deep lugs and specialized patterns for grip in mud and on slick surfaces.
- Puncture Resistance: Soles are typically robust to prevent punctures from sharp vegetation or hidden dangers.

Cold Weather / Mountain Boots

Heavily insulated and waterproof boots designed for extreme cold, snow, and ice.
Protective Features:
- Insulation: Multiple layers of insulation (e.g., Thinsulate, Gore-Tex liners) to retain warmth and prevent frostbite.
- Waterproofing: Fully waterproof membranes to keep feet dry in wet, snowy conditions.
- Stiff Soles: Often feature stiffer soles for use with snowshoes or crampons, and enhanced grip on icy surfaces.
- Blunt Force Protection: Bulkier design offers increased protection against blunt impacts.

Specialized Tactical Footwear

Boots designed for specific roles requiring additional protection.
Protective Features:
- Reinforced Toes/Shanks: May include steel, composite, or even more robust protection in the toe or sole for specific tasks like breaching or EOD (Explosive Ordnance Disposal) work where foot protection from debris or blast fragments is critical.
- Anti-Slip/Oil-Resistant Soles: For environments with fluid spills.
- Electrical Hazard Protection: Some models offer insulation against electrical shock.

Shields

Shields are any piece of defensive apparel held to protect the wearers from any weapon, projectile or shrapnel.

Handheld Ballistic Shields

These are the most common type, carried by an individual operator. They vary significantly in size, from smaller models designed for rapid deployment and maneuverability in confined spaces (e.g., doorways, hallways) to larger versions offering more comprehensive body coverage.
Purpose: Provide mobile protection during dynamic entry operations (e.g., SWAT raids), active shooter scenarios, clearing buildings, or establishing a defensive perimeter. They allow the operator to advance while maintaining a ballistic barrier.
Materials: Typically constructed from advanced lightweight composite materials like Ultra-High-Molecular-Weight Polyethylene (UHMWPE, e.g., Dyneema, Spectra), aramid fibers (e.g., Kevlar) sometimes combined with ceramic plates for higher threat levels.
Features: Often include ballistic viewports (bulletproof glass or transparent composites) for situational awareness, ergonomic handle systems (single or ambidextrous), adjustable forearm straps, and sometimes integrated LED lighting systems for illumination or disorientation.

Tactical Ballistic Shields

These are generally larger and heavier handheld shields specifically designed to withstand rifle rounds (NIJ Level III or higher, up to Level IV for armor-piercing threats). They provide a higher level of protection than those rated only for handgun rounds.
Purpose: Used in situations where rifle threats are anticipated, such as military operations, high-risk engagements, or against heavily armed suspects. They offer enhanced protection but may be more cumbersome due to their weight and thickness.
Materials: Often incorporate ceramic strike faces bonded to a composite backing (UHMWPE or aramid) or thicker, denser UHMWPE.
Features: May include weapon rests or cutouts to facilitate firing a weapon from behind the shield, and often larger viewports.

Rolling Ballistic Shields / Mobile Personnel Shields

These are very large, heavy ballistic shields mounted on wheels or a trolley system. They can be full-body height or even include overhead protection.
Purpose: Designed to provide maximum protection for multiple officers or a team, often used in prolonged standoffs, checkpoints, hostage rescue situations, or when advancing in open areas without natural cover. Their wheeled design reduces fatigue and allows for easier repositioning of a heavy protective barrier.
Materials: Can be made from very thick composites, steel with anti-spall coatings, or a combination, offering high levels of ballistic protection (often Level III or IV).
Features: May include deployable "kick-stands," interlocking features to create a continuous wall, and integrated lighting.

Transparent Ballistic Shields

While most ballistic shields are opaque, some are designed with a transparent ballistic material, usually advanced polycarbonate or acrylic composites.
Purpose: Used in situations where maintaining an uninterrupted line of sight is critical, such as VIP protection, certain crowd control scenarios, or where officers need maximum peripheral vision.
Limitations: While offering good visibility, they typically provide lower levels of ballistic protection compared to opaque shields of similar weight, often limited to handgun or fragmentation threats (Level IIIA or lower), and can be susceptible to scratches.

4 Insect Protection

This section describes how you can protect yourself against insects which may not may not be carrying diseases. In this section, insects are categorised as small, nuisance critters which are no bigger than a fist. The advice is generic for each type of insect and doesn't go into detail on the different varients such as the Tsetse Fly or Horse Fly.

Mosquitoes

Human Detection
First, if she smells carbon dioxide, she accelerates upwind, zigzagging across the path of the gas. Between 5 and 15 meters away, she spots you with her eyes. Then she makes her final approach, using heat, humidity, and the scents on your skin to decide whether (and where) to land. Simply following the trail of CO2 would lead the insect straight into your mouth, where neither of you wants her to be. Looking only for heat would limit the mosquito to targets that are already close by. But by deploying a string of sensory tools, the mosquito can find all her juicy options.

Sensing Area
- **Carbon Dioxide Detection:** 10-50 Metres
- **Mosquito Vision:** 5-10 Meters
- **Thermal / Moisture Detection:** Around 20cm

Active Times
The common house mosquito (Culex pipiens) is most likely to bite during the evening or the first few hours of the night. The Asian tiger mosquito tends to bite during the day, the morning and late afternoon. All types of mosquitoes are least likely to bite during the middle part of the day, when the sun and heat are at their peak. Once a mosquito gains entry into a home or building, they are protected from dehydration and more likely to fly around for many more hours than they normally would. They stay active longer because of the temperature and light controls in your home. They avoid daylight at all costs because sun exposure can dehydrate and kill them. During the day, this species of mosquito seeks out cool, shaded and wet areas until dusk returns. Species of mosquitoes most active at night are likely to bite early in the evening when they first stir from their hiding places. After a night of activity, they will seek out places to rest before dawn. With that activity cycle, most mosquito bites occur early in the evening, but they can also occur throughout the night. That's why it's important to keep mosquitoes out of your home. If one gets inside, it will likely bite repeatedly throughout the night simply because there aren't other targets.

Active Locations
Some areas are more likely to attract large numbers of mosquitoes such as damp areas or areas near farming operations, bogs, salt marshes, standing water or dredge spoil are more likely to have larger mosquito populations than drier areas. The female mosquito lays her eggs in stagnant water, and larvae need only 1cm (1/2 inch) of water to survive. Is it true that you should let mosquitoes finish sucking your blood to prevent itching later? No. The greater the time the mosquito is allowed to feed, the more saliva she'll inject into the skin. Allowing her to feed longer will increase your reaction to the saliva and enhance the risk of infection from mosquito-borne pathogens.

Rain
Mosquitos have a high affinity for warm, standing water. Any stagnant pond or even waterlogged junk you forgot to clean up is ripe for mosquito infestation. On the other hand, where standing water already existed prior, rainfall can disrupt the eggs that have been laid and therefore inhibit later mosquito activity. But once it passes this same rainfall will increase mosquito infestations if the water tends to pool nearby. Young mosquitoes will spend about ten days in the water only, so if a pool forms you may have some time before the problem becomes serious. The bottom line is to prevent pockets of extra, stagnant moisture whenever possible, as soon as possible. In general, heavy rains increase the numbers of mosquitoes in the area.

Weather
It's known that mosquitoes enjoy wet and warm climates. The southern US is favoured mosquito territory, but they exist almost everywhere. Certain weather conditions can bring them out in force, wherever you live. They are most active in temperatures above 26°C (80°F). As temperatures climb higher, mosquito activity can decline. Mosquitoes will bite less when it becomes excessively hot. However, higher temperatures also make any diseases they carry more active and hence more transmissible. So when mosquitoes are around, a cool spell following very hot temperatures could be ripe for mosquito borne diseases, as highly infectious mosquitoes increase their biting activity. Just as important, relatively high night-time lows increase mosquito activity. So if nights are warm for an extended period, beware mosquitoes at all other times as well. When temperatures fall below 10°C (50°F), mosquitoes go dormant. Cold winter temperatures do not, however, actually kill the mosquitoes. As long as the temperature is within a typical range for your region, mosquitoes have documented adaptations that allow them to hibernate during cold and some have reproductive strategies that let their eggs survive to hatch the following season when it warms up.

DEFENCE Insect Protection Mosquitoes

Hiding
● Wear Low Contrast Clothing: The best option is probably to convince someone to wear high-contrast clothing, such as something with black-and-white stripes or spots, while you wear light, muted colours that blend in with the surroundings.
● Avoid Sweating, Salty Food and High Potassium Food: Mosquitoes and other insects are attracted to the smell of lactic acid, so your scent will be even more appealing to them.
● Avoid Sweating and Exertion
● Avoid Floral or Fruity Fragrances: Wearing floral or fruity smelling perfume, body lotions and sunscreen or using scented shampoos and body washes can increase the likelihood of a bug bite. If you smell like flowers or fruit, an insect is likely to confuse you with vegetation and will be attracted to your scent. Even subtle fragrances that come from products like dryer sheets and fabric softeners can attract insects. Washing your clothing in fragrant detergents might also entice bugs.

Flies

Houseflies

Sandflies

Tsetse Flies

Black Flies

Horse Flies and Deer Flies

Stable Flies

Biting Midges / No-see-ums

Biting midges, are tiny, insidious flies belonging to the insect family Ceratopogonidae. They are globally distributed, though often go by local names like "no-see-ums" (in North America) or "sandflies" (in parts of Australia, though distinct from the larger sandflies that transmit leishmaniasis).

These minuscule insects typically range from 1 to 3 millimeters (less than 1/8 inch) in length, making them very difficult to spot. Only the female midges bite, as they require blood meals to produce their eggs. Their bites are disproportionately painful and itchy for their size, often resulting in small, red welts that can persist for days or even weeks. Unlike mosquitoes, biting midges are not significant vectors of human diseases in most regions, though they can transmit diseases to livestock. They are weak fliers and are most active during calm periods around dawn and dusk, or on overcast days, typically thriving in humid environments near water sources like swamps, marshes, riverbanks, and coastal areas.

Personal Protection
Insect Repellents: The most crucial defense. Look for products containing:
● DEET: Highly effective against biting insects, including midges. Use concentrations appropriate for the duration of exposure (higher percentages offer longer protection).
● Picaridin: Another highly effective option, often preferred for its pleasant feel and lack of plastic-damaging properties.
● Oil of Lemon Eucalyptus (OLE) / PMD: A plant-based alternative that is also effective.
● Other Essential Oils: Some individuals find relief with repellents containing rosemary, cedarwood, citronella, or lavender, though their effectiveness and duration can vary. Cream formulations that create a physical barrier can also be effective.
Cover Up: Wear long-sleeved shirts, long pants, socks, and closed-toe shoes, especially during peak midge activity. Loose-fitting, light-colored clothing is often recommended as midges may be drawn to dark colors.
Avoid Peak Activity Times: Limit outdoor exposure around dawn and dusk, when midges are most active.
Fans: Midges are weak fliers, so using ceiling fans or portable fans (indoors or on patios/decks) can create enough air movement to deter them.

Environmental and Home Protection

Fine Mesh Screening: Standard window and door screens often have mesh too large for midges. Install "midge mesh" or "no-see-um mesh" (typically 0.6mm x 0.6mm or finer) on all windows, doors, and vents.
Seal Gaps: Ensure all entry points into homes or tents are properly sealed.
Reduce Breeding Sites: While challenging due to their diverse natural habitats, try to minimize damp areas, standing water, and decaying organic matter around your immediate living space. Keep lawns mowed and vegetation sparse around your home to reduce resting areas for adult midges.
Insecticides/Barrier Sprays: For severe infestations, professional pest control can apply residual insecticides to outdoor surfaces where midges rest (e.g., walls, screens, vegetation). This can provide temporary relief but must be used carefully due to potential impacts on non-target insects. Insecticide vaporizers or coils can offer some localized protection outdoors.
Lighting: Some evidence suggests midges are attracted to bright white lights. Consider using yellow or red "bug lights" outdoors.

DE | Insect Protection | Midg

Treating Bites

Clean the Area: Wash bites with soap and water to prevent secondary infection.
Relieve Itching: Apply cold compresses, over-the-counter anti-itch creams (e.g., hydrocortisone, antihistamines), calamine lotion, or natural remedies like aloe vera.
Avoid Scratching: Scratching can break the skin, leading to infection and prolonged discomfort.

DEFENCE | Insect Protection | Ticks

Ticks

Ticks are small arachnids, related to spiders and mites, that are external parasites. They feed on the blood of animals, including humans, birds, reptiles, and amphibians. Ticks are found worldwide in various habitats, including wooded areas, tall grasses, brush, leaf litter, and even around residential yards. They do not fly or jump; instead, they "quest" by perching on vegetation with their front legs extended, waiting to grab onto a passing host. Once on a host, they crawl to a suitable spot, bite into the skin, and begin to feed, often remaining attached for several days.

The primary concern with tick bites is their ability to transmit a wide variety of pathogens, including bacteria, viruses, and protozoa, which can cause serious illnesses in humans and animals. Some common tick-borne diseases include Lyme disease, Rocky Mountain spotted fever, Anaplasmosis, Babesiosis, and Tick-Borne Encephalitis, among many others. In some regions, ticks can also cause tick paralysis due to toxins in their saliva.

DEFENCE | Insect Protection | Ticks

Before Going Outdoors
Know Tick Habitats: Be aware that ticks live in grassy, brushy, or wooded areas, and even in leaf litter. Stay in the center of trails and avoid walking through tall grass and dense vegetation.

Use Repellents
Apply EPA-registered insect repellents containing DEET, Picaridin, IR3535, Oil of Lemon Eucalyptus (OLE), or 2-Undecanone to exposed skin. Always follow product instructions carefully.
Treat clothing and gear (boots, pants, socks, tents) with products containing 0.5% Permethrin. Permethrin kills ticks on contact and remains effective through several washes. Do NOT apply permethrin directly to skin. You can also buy pre-treated clothing.

Dress Appropriately: Wear long-sleeved shirts, long pants, and tuck your pant legs into your socks or boots to create a barrier. Light-colored clothing can make it easier to spot ticks.

DEFENCE | Insect Protection | Ticks

While Outdoors

Regular Checks: Periodically check yourself, children, and pets for ticks while outdoors, especially after moving through dense vegetation.
Stay on Trails: Stick to cleared paths and avoid venturing into tall grass or dense brush.

DEFENCE | Insect Protection | Ticks

After Coming Indoors

Full Body Check: Conduct a thorough full-body check upon returning indoors. Ticks often hide in warm, moist areas:
● Under the arms, ● In and around the ears, ● Inside the belly button, ● Back of the knees, ● In and around hair, ● Between the legs, ● Around the waist
Shower Promptly: Showering within two hours of coming indoors can help wash off unattached ticks and provides a good opportunity for a tick check.
Check Gear and Pets: Ticks can hitch a ride on clothing, backpacks, and pets. Examine them carefully before bringing them inside.
Clothing Care: Tumble dry clothes on high heat for at least 10 minutes (or longer if damp) to kill any remaining ticks. Washing alone in cold or medium water may not kill ticks.

DEFENCE | Insect Protection | Ticks

Tick Removal

Use Fine-Tipped Tweezers: If you find an attached tick, grasp it as close to the skin's surface as possible with fine-tipped tweezers.
Pull Straight Up: Pull upward with a steady, even pressure. Do not twist or jerk the tick, as this can cause the mouthparts to break off and remain in the skin.
Avoid Folk Remedies: Do not use heat (matches), petroleum jelly, nail polish, or other substances to try to make the tick detach, as these methods can irritate the tick and cause it to regurgitate infectious fluids into the bite wound.
Clean the Area: After removing the tick, clean the bite area and your hands with rubbing alcohol or soap and water.
Monitor: Watch for symptoms like fever, rash, joint pain, or fatigue in the days and weeks following a tick bite. Seek medical attention if you develop any concerning symptoms.

DEFENCE | Insect Protection | Bees

Bees/Wasps/Hornets

DEFENCE | Insect Protection | Ants

Ants

Identify Ant Activity: Before sitting down or setting up camp, visually inspect the area for ant trails, individual ants, and especially ant nests or mounds. Different ants build different types of nests (e.g., dome-shaped mounds for fire ants, smaller holes for others, or nests under rocks/logs).
Avoid Nests: The most aggressive ant attacks occur when their nests are disturbed. If you see a mound or a cluster of ants, give it a wide berth. Teach children to do the same.
Check for Food/Water: Ants are attracted to food and water. Be extra cautious in picnic areas, near food spills, or around pet food bowls.

Protection | Ants

Wear Protective Clothing
● Long Pants and Sleeves: Wear long pants and long-sleeved shirts, especially when walking through grassy or wooded areas.
● Tuck In: Tuck your pant legs into your socks or boots to prevent ants from crawling up your legs.
● Closed-Toe Shoes: Always wear closed-toe shoes outdoors, especially in areas where ants might be present. Avoid sandals or bare feet.
● Gloves: If you're gardening or moving items that might harbor ants (like logs, rocks, or debris), wear sturdy gloves.
● Permethrin-Treated Clothing: Clothing pre-treated with permethrin (an insecticide that repels and kills insects on contact) can offer an additional layer of protection against ants, as well as ticks and mosquitoes. This is different from skin repellents and should not be applied directly to skin.

DEFENCE Insect Protection Ants

Use Repellents
● Insect Repellents on Skin: While not all insect repellents are highly effective against ants, some can offer a deterrent effect. Repellents containing DEET or Picaridin are generally the most reliable for broad-spectrum insect protection. Apply to exposed skin according to product instructions.
● Essential Oil-Based Repellents: Some natural repellents containing essential oils like peppermint oil, tea tree oil, lemon, eucalyptus, or cinnamon are believed to deter ants. These can be sprayed on clothing or applied to skin (test a small area first). Brands like "OzKleen Ants Gone" (available in Australia) specifically market peppermint-based sprays for surfaces and outdoor areas.

Manage Your Outdoor Space (if applicable)
● Clear Debris: Keep your yard clear of leaf litter, fallen logs, and other debris that can provide shelter for ant nests.
● Seal Entry Points: If ants are entering your home from outdoors, seal cracks and crevices in foundations, walls, and around windows and doors.
Reduce Food Sources: Clean up food spills promptly, keep garbage cans tightly sealed, and ensure pet food bowls are not left out for long periods.

If You Encounter Ants
● Move Quickly: If you find yourself on an ant mound or swarmed by biting ants (like fire ants, which often emerge in large numbers), move away quickly.
● Brush Them Off: Aggressively brush ants off your skin before they can bite or sting.

First Aid for Bites/Stings
For most ant bites, wash the area with soap and water. Apply a cold compress to reduce swelling and pain. Over-the-counter anti-itch creams (hydrocortisone, calamine lotion) or oral antihistamines can help with itching and discomfort.
● For Fire Ant Stings: Fire ant stings typically form itchy, painful pustules (blisters). Do NOT break these blisters. Clean the area with soap and water, and apply a cold compress. Seek medical attention if you experience a severe allergic reaction (anaphylaxis: difficulty breathing, swelling of the face/throat, dizziness) or if symptoms worsen.

Spiders

Scorpions

Fleas

Leeches

Snails & Slugs

Assassin Bugs

Repellents

Repellents only repel insects from the source and only for a short duration of a few hours. They work well when you have to be amongst bugs and insects, particularly at night. Deet is the most effective on insects followed by picaridin, permethrin, deltamethrin and citronella.

Synthetic repellents tend to be more effective and/or longer lasting than "natural" repellents. For protection against mosquito bites, the U.S. Centres for Disease Control (CDC) recommends DEET, picaridin, oil of lemon eucalyptus, ethyl butylacetylaminopropionate and 2-undecanone with the caveat that higher percentages of the active ingredient provide longer protection. Researchers tested 10 commercially available products for their effectiveness at repelling mosquitoes. On the mosquito Aedes aegypti, only one repellent that did not contain DEET had a strong effect for the duration of the 240 minutes test: a lemon eucalyptus oil repellent. All DEET-containing mosquito repellents were active. In one comparative study from 2004, ethyl butylacetylaminopropionate was as effective or better than DEET in protection against Aedes aegypti and Culex quinquefasciatus mosquitoes. Essential oil repellents can be short-lived in their effectiveness, since essential oils can evaporate completely. A test of various insect repellents by an independent consumer organization found that repellents containing DEET or picaridin are more effective than repellents with "natural" active ingredients.

All the synthetics gave almost 100% repellency for the first 2 hours, where the natural repellent products were most effective for the first 30 to 60 minutes, and required reapplication to be effective over several hours. Permethrin is recommended as protection against mosquitoes for clothing, gear, or bed nets. In an earlier report, the CDC found oil of lemon eucalyptus to be more effective than other plant-based treatments, with a similar effectiveness to low concentrations of DEET. However, a 2006 published study found in both cage and field studies that a product containing 40% oil of lemon eucalyptus was just as effective as products containing high concentrations of DEET. Research has also found that neem oil is mosquito repellent for up to 12 hours. Citronella oil's mosquito repellency has also been verified by research, including effectiveness in repelling Aedes aegypti, but requires reapplication after 30 to 60 minutes.

Repelling Properties

Achillea Alpina • Mosquitoes	**Breadfruit** • Insect Repelling	**Camphor** • Moths	**Castor Oil** • Mosquitoes	**Catnip Oil** • Mosquitoes	**Cedar Oil** • Mosquitoes	**Citronella Oil** • Mosquitoes	**Oil of Cloves** • Mosquitoes	**Eucalyptus Oil** • Mosquitoes • Flies • Dust Mites	**Fennel Oil** • Mosquitoes	**Garlic** • Mosquitoes • Rice Weevil • Wheat Flour Beetle	**Lemon Eucalyptus** • Mosquitoes
Lemongrass Oil • Mosquitoes	**Marjoram** • Spider Mites	**Neem Oil** • Mosquitoes	**Oleic Acid** • Bees • Ants	**Pennyroyal** • Mosquitoes • Fleas	**Peppermint** • Mosquitoes	**Rosemary** • Mosquitoes	**Thyme** • Mosquitoes				

Smoke

Smoke can repel unwanted insects, and this has been a common practice by humans for thousands of years. The effectiveness varies depending on the type of smoke, the insect species, and the concentration of the smoke.

How Smoke Repels Insects
● Irritation and Disorientation: The compounds in smoke (such as phenols, cresols, and other volatile organic compounds) are often irritants to insects' respiratory systems and sensory organs. This irritation makes the environment unpleasant for them, causing them to move away.
● Masking Scents: Smoke can mask the chemical cues (like carbon dioxide, lactic acid, and other bodily odors) that humans and animals emit, which insects like mosquitoes and biting flies use to locate their blood meal sources. By obscuring these attractants, smoke makes it harder for insects to find you.
● Physical Barrier: A dense cloud of smoke can act as a physical barrier, making it difficult for small insects to fly through or see their targets.
● Neurotoxic Effects (in some cases): Some compounds in smoke, particularly from certain plants or burning materials, can have mild neurotoxic effects on insects, further deterring them.

Types of Smoke and Their Effectiveness

● Wood Smoke (e.g., Campfires, Bonfires):
Common Use: This is the most traditional form of insect repellent.
Effectiveness: Generally effective for keeping away mosquitoes, midges/no-see-ums, and some flies in the immediate vicinity of the smoke. The specific wood used can influence effectiveness; woods with aromatic compounds tend to be more potent.
Limitations: The smoke needs to be consistently present, and its effectiveness diminishes rapidly as you move away from the source. It can also be irritating to human eyes and lungs, especially in enclosed spaces.

● Mosquito Coils/Sticks:

Common Use: Specifically designed products that burn slowly to release insecticidal smoke.
Effectiveness: Highly effective. They typically contain pyrethroids (synthetic versions of natural pyrethrins from chrysanthemum flowers) or other insecticides, which are neurotoxic to insects.
Limitations: Designed for outdoor or well-ventilated use due to potential respiratory irritation and exposure to insecticides.

● Incense Sticks/Cones (especially citronella or specific repellent blends):

Common Use: Some incense is formulated with insect-repelling essential oils.
Effectiveness: Can offer some localized, temporary relief, but generally less potent than mosquito coils or strong chemical repellents.
Limitations: Limited range, can be irritating to some people.

● "Smudge Sticks" (e.g., dried herbs like sage, rosemary, or cedar):
Common Use: Historically and culturally used for various purposes, including insect deterrence.
Effectiveness: The smoke from certain aromatic herbs can deter insects due to the volatile compounds released.
Limitations: Requires active burning, limited range.

DEET (Diethyltoluamide)

DEET or Diethyltoluamide is the most common active ingredient in insect repellents. It is a slightly yellow oil intended to be applied to the skin or to clothing and provides protection against many biting insects. A powerful insect repellent which is often sprayed on exposed skin to create a repellent barrier which lasts for up to 8 hours. The higher percentage of deet, the less you will need to use for the same effectiveness. They are generally sold between 25%-100% deet. Deet in combination with permethrin provides an extremely strong barrier against insects. As permethrin only works on clothing it will close the gaps where insects can bite you.

Effective For
● Mosquitoes
● Ticks
● Fleas
● Chiggers
● Leeches
● Other Biting Insects

Effectiveness
DEET serves as a true repellent in that mosquitoes intensely dislike the smell of the chemical. A type of olfactory receptor neuron in special antennal sensilla of mosquitoes that is activated by DEET, as well as other known insect repellents such as eucalyptol, linalool, and thujone, has been identified. Moreover, in a behavioural test, DEET had a strong repellent activity in the absence of body odour attractants such as 1-octen-3-ol, lactic acid, or carbon dioxide. Both female and male mosquitoes showed the same response.

Concentrations
Insect repellents containing DEET are the most effective. The concentration of DEET in products may range from less than 10 percent to over 30 percent. The benefits of DEET reach a peak at a concentration of 30 percent, the maximum concentration currently recommended for infants and children. DEET should not be used on children under 2 months of age. DEET is often sold and used in spray or lotion in concentrations up to 100%. Consumer Reports found a direct correlation between DEET concentration and hours of protection against insect bites. 100% DEET was found to offer up to 12 hours of protection while several lower concentration DEET formulations (20–34%) offered 3–6 hours of protection. Other research has corroborated the effectiveness of DEET. The Centres for Disease Control and Prevention recommends 30–50% DEET to prevent the spread of pathogens carried by insects.

Effects
DEET is an effective solvent, and may dissolve some watch crystals, plastics, rayon, spandex, other synthetic fabrics, and painted or varnished surfaces including nail polish. It also may act as a plasticizer by remaining inside some formerly hard plastics, leaving them softened and more flexible. Though DEET is not expected to bioaccumulate, it has been found to have a slight toxicity for fresh-water fish such as rainbow trout and tilapia, and it also has been shown to be toxic for some species of freshwater zooplankton.

Picaridin (Icaridin, KBR 3023)

DEFENCE Insect Protection Repellents Picaridin

Icaridin, also known as picaridin, is an insect repellent. It has broad efficacy against various insects and ticks and is almost colourless and odourless. Icaridin has been reported to be as effective as DEET without the irritation associated with DEET. According to the WHO, icaridin "demonstrates excellent repellent properties comparable to, and often superior to, those of the standard DEET." Icaridin does not dissolve plastics. Icaridin-based products, first used in Europe in 2001, have been evaluated by Consumer Reports in 2016 as among the most effective insect repellents when used at a 20% concentration. Icaridin was earlier reported to be effective by Consumer Reports (7% solution) and the Australian Army (20% solution). Consumer Reports retests in 2006 gave as result that a 7% solution of icaridin offered little or no protection against Aedes mosquitoes (vector of dengue fever) and a protection time of about 2.5 hours against Culex (vector of West Nile virus), while a 15% solution was good for about one hour against Aedes and 4.8 hours against Culex.

DEFENCE Insect Protection Repellents Citronella Oil

Citronella Oil

Citronella oil is an essential oil obtained from the leaves and stems of different species of Cymbopogon (lemongrass). Citronella oil is popular as a natural insect repellent. Its mosquito repellent qualities have been verified by research, including effectiveness in repelling Aedes aegypti (dengue fever mosquito). To be continually effective, most citronella repellent formulas need to be reapplied to the skin every 30–60 minutes.

Research also indicates that citronella oil is an effective repellent for body lice, head lice, and stable flies. A study conducted by ARPA in 1963 determined that hydroxycitronellal was an effective repellent against both aquatic and terrestrial leeches.

The US Environmental Protection Agency states that citronella oil has little or no toxicity when used as a topical insect repellent, with no reports of adverse effects of concern over a 60-year period. Some products are applied to human skin, so EPA requires proper precautionary labelling to help assure safe use.

If used according to label instructions in the US, citronella is not expected to pose health risks to people, including children and other sensitive populations. The US Food & Drug Administration considers citronella oil as generally recognized as safe (GRAS). Canadian regulatory concerns with citronella as an insect repellent are primarily based on data-gaps in toxicology, not on incidents.

DEFENCE Insect Protection Repellents

Beautyberry Leaves (Callicarpa Leaves)

Birch Tree Bark

Traditionally made into tar. Combined with another oil (e.g., fish oil) at 1/2 dilution, it is then applied to the skin for repelling mosquitoes.

DEFENCE Insect Protection Repellents

Bog Myrtle (Myrica Gale)

Catnip Oil

Where the active compound is Nepetalactone.

DEFENCE Insect Protection Repellents

Lemon Eucalyptus Oil (Corymbia Citriodora)

Neem Oil

DEFENCE Insect Protection Repellents

Lemongrass

DEFENCE Insect Protection Repellents Tea Tree Oil

Tea Tree Oil

Tea Tree Oil (TTO) (also known as melaleuca oil), can be used as an insect repellent, and research supports its repellent and even insecticidal properties against various pests.

How it works
Tea Tree Oil, derived from the Australian native plant Melaleuca alternifolia, contains a complex mixture of compounds, notably terpinen-4-ol and cineole. These compounds are believed to:
● Mask Human Scents: The strong, distinct smell of tea tree oil can help mask the natural odors (like carbon dioxide and lactic acid) that attract insects.
● Disrupt Sensory Perception: Some compounds in TTO can interfere with insects' neurological pathways, making it difficult for them to locate and process information from their senses.
● Irritation/Toxicity: At higher concentrations, components of tea tree oil can be irritating or even toxic to insects, causing them to avoid treated areas or, in some cases, leading to their demise.

DEFENCE | Insect Protection | Repellents | Tea Tree Oil

Effectiveness and Limitations
● Mosquitoes and Midges: Studies have shown that tea tree oil can be effective in repelling mosquitoes and biting midges. Some research indicates that certain formulations of TTO can provide protection comparable to some synthetic repellents, though often for a shorter duration.
● Other Insects: Anecdotal evidence and some studies suggest it may also help repel flies (including bush flies), ticks, ants, and even some mites.
● Duration: A common limitation of many essential oil-based repellents, including TTO, is their relatively short duration of effectiveness compared to synthetic repellents like DEET or Picaridin. You may need to reapply it more frequently.
● Formulation and Concentration: The effectiveness of tea tree oil as a repellent largely depends on its concentration in the product and how it's formulated (e.g., in a carrier oil, cream, or spray). Higher concentrations (e.g., 5-10%) tend to be more effective, but must be used with caution.
Species Specificity: What repels one insect species might not be as effective against another, even closely related ones.

How to Use Tea Tree Oil as a Repellent
● Dilution is Key: Tea tree oil is potent and should always be diluted before applying to the skin to avoid irritation or allergic reactions. A common dilution ratio is 5-10 drops of tea tree oil per ounce (30ml) of a carrier oil (like coconut oil, jojoba oil, or almond oil) or water (mixed with a small amount of an emulsifier like witch hazel).

● Topical Application: Apply the diluted mixture to exposed skin.
● Diffusers/Oil Burners: For outdoor areas (like a patio), you can use an essential oil diffuser or an oil burner to release the scent into the air, creating a repellent zone.
● DIY Sprays: Create a spray by mixing diluted TTO with water in a spray bottle.
● Blends: Tea tree oil is often more effective when combined with other insect-repelling essential oils like lemon eucalyptus, citronella, lavender, or rosemary.

Tobacco

Nicotine, a fast acting nerve toxin in insects and mammals.

Dimethyl Carbate

Dimethyl carbate is an insect repellent. It can be prepared by the Diels–Alder reaction of dimethyl maleate and cyclopentadiene.

Ethyl Butylacetylaminopropionate

Ethyl butylacetylaminopropionate (trade name IR3535) is an insect repellent. As ethyl butylacetylaminopropionate is solely a repellent, it has no killing action and does not give rise to selection pressure or development of resistance. It is a colourless and almost odourless oil and is intended to be applied to the skin of humans and animals. It has a broad efficacy against various insects like mosquitoes, ticks, lice, and other bugs. Ethyl butylacetylaminopropionate is safe for use on infants, pregnant and breastfeeding women. It is biodegradable and completely degraded in the environment within a very short time.

Metofluthrin

Metofluthrin is a pyrethroid used as an insect repellent. The vapours of metofluthrin are highly effective and capable of repelling up to 97% of mosquitoes in field tests. Metofluthrin is used in a variety of consumer products, called emanators, for indoor and outdoor use. These products produce a vapour that protects an individual or area. Effectiveness is reduced by air movement. Metofluthrin is neurotoxic, and is not meant to be applied directly to human skin. Although metofluthrin has insectidal properties against other insects, it may not be an effective repellent for insects other than mosquitoes.

SS220

SS220 is an insect repellent with a broad range of efficacy. In the field, it has been shown to provide significantly better protection than DEET. It was developed in 2002 at the Chemicals Affecting Insect Behaviour Laboratory of the United States Department of Agriculture and has been found to "exert repellent and deterrent effects upon the behaviour of mosquitoes and sand flies". SS220 has a slightly fruity odour, tends not to provoke allergic skin reactions, lasts longer on the skin than other repellents, does not have an oily consistency, and does not tend to plasticize. Its principal disadvantage is that only one stereoisomer of the molecule is active, meaning it will be much more costly to produce than icaridin. As of 2007 the chemical had not been registered, and the costs involved in registration are prohibitively enormous.

Insecticides

Insecticides are designed to inhibit a vital function of insects so they eventually die after exposure.

Permethrin

Permethrin, sold under the brand name Nix among others, is a medication and insecticide. As a medication, it is used to treat scabies and lice. It is applied to the skin as a cream or lotion. As an insecticide, it can be sprayed on clothing or mosquito nets to kill the insects that touch them. Side effects include rash and irritation at the area of use. Use during pregnancy appears to be safe. It is approved for use on and around people over the age of two months. Permethrin is in the pyrethroid family of medications. It works by disrupting the function of the neurons of lice and scabies mites. Often in combination with piperonyl butoxide to enhance its effectiveness.

Medical Use
Permethrin is available for topical use as a cream or lotion. It is indicated for the treatment and prevention in exposed individuals of head lice and treatment of scabies. For treatment of scabies: Adults and children older than 2 months are instructed to apply the cream to the entire body from head to the soles of the feet. Wash off the cream after 8–14 hours. In general, one treatment is curative. For treatment of head lice: Apply to hair, scalp, and neck after shampooing. Leave in for 10 minutes and rinse. Avoid contact with eyes.

Pest Control
Kills insects within about 5 minutes of contact. Generally too long to kill them before they bite you but good to know they won't bite you again. Permethrin kills ticks and mosquitoes on contact with treated clothing. A method of reducing deer tick populations by treating rodent vectors involves stuffing biodegradable cardboard tubes with permethrin-treated cotton. Mice collect the cotton for lining their nests. Permethrin on the cotton instantly kills any immature ticks feeding on the mice. Permethrin is used in tropical areas to prevent mosquito-borne disease such as dengue fever and malaria. Mosquito nets used to cover beds may be treated with a solution of permethrin. This increases the effectiveness of the bed net by killing parasitic insects before they are able to find gaps or holes in the net. Military personnel training in malaria-endemic areas may be instructed to treat their uniforms with permethrin, as well. Permethrin is the most commonly used insecticide worldwide for the protection of wool from keratinophagous insects such as Tineola bisselliella.

Side Effects
Permethrin application can cause mild skin irritation and burning. Permethrin has little systemic absorption, and is considered safe for topical use in adults and children over the age of 2 months. According to the Connecticut Department of Public Health, permethrin "has low mammalian toxicity, is poorly absorbed through the skin, and is rapidly inactivated by the body. Skin reactions have been uncommon." Excessive exposure to permethrin can cause nausea, headache, muscle weakness, excessive salivation, shortness of breath, and seizures. Worker exposure to the chemical can be monitored by measurement of the urinary metabolites, while severe overdose may be confirmed by measurement of permethrin in serum or blood plasma. Permethrin does not present any notable genotoxicity or immunotoxicity in humans and farm animals, but is classified by the EPA as a likely human carcinogen, based on reproducible studies in which mice fed permethrin developed liver and lung tumours. It is known to be highly toxic to fish and aquatic species.

Other Animals
Permethrin is listed as a "restricted use" substance by the US Environmental Protection Agency (EPA) due to its high toxicity to aquatic organisms, so permethrin and permethrin-contaminated water should be properly disposed. Permethrin is quite stable, having a half life of 51–71 days in an aqueous environment exposed to light. It is also highly persistent in soil. Permethrin has little effect on dogs; however, it is toxic to cats. Pesticide-grade permethrin is toxic to cats. Many cats die after being given flea treatments intended for dogs, or by contact with dogs having recently been treated with permethrin. In cats it may induce hyperexcitability, tremors, seizures, and death. Toxic exposure of permethrin can cause several symptoms, including convulsion, hyperaesthesia, hyperthermia, hypersalivation, and loss of balance and coordination. Exposure to pyrethroid-derived drugs such as permethrin requires treatment by a veterinarian, otherwise the poisoning is often fatal. This intolerance is due to a defect in glucuronosyltransferase, a common detoxification enzyme in other mammals, that also makes the cat intolerant to paracetamol. The use of any external parasiticides based on permethrin is contraindicated for cats.

Deltamethrin

Deltamethrin products are among the most popular and widely used insecticides in the world and have become very popular with pest control operators and individuals in the United States. This material is a member of one of the pesticides called synthetic pyrethroids. This pesticide is highly toxic to aquatic life, particularly fish, and therefore must be used with extreme caution around water. Although generally considered safe to use around humans, it is still neurotoxic to humans. Deltamethrin is able to pass from a woman's skin through her blood and into her breast milk. It is an allergen and causes asthma in some people. There are many uses for deltamethrin, ranging from agricultural uses to home pest control. Deltamethrin has been instrumental in preventing the spread of diseases carried by tick-infested prairie dogs, rodents and other burrowing animals. It is helpful in eliminating and preventing a wide variety of household pests, especially spiders, fleas, ticks, carpenter ants, carpenter bees, cockroaches and bed bugs. Deltamethrin is also one of the primary ingredients in ant chalk.

Malaria Control
Deltamethrin plays a key role in controlling malaria vectors, and is used in the manufacture of long-lasting insecticidal mosquito nets. It is used as one of a battery of pyrethroid insecticides in control of malarial vectors, particularly Anopheles gambiae, and whilst being the most employed pyrethroid insecticide, can be used in conjunction with, or as an alternative to, permethrin, cypermethrin and organophosphate-based insecticides, such as malathion and fenthion. Resistance to deltamethrin (and its counterparts) is now extremely widespread and threatens the success of worldwide vector control programmes.

Resistance
Resistance has been characterised in several insects, including important vectors of malaria like the mosquito Anopheles gambiae as well as non-disease carrying pests like bed bugs. Methods of resistance include thickening of the cuticle of the insect to limit permeation of the insecticide, metabolic resistance and the knockdown resistance (kdr) sodium channel mutations which render the action of insecticides ineffectual, even when co-administered with piperonyl butoxide.

Poisoning
Since deltamethrin is a neurotoxin, it temporarily attacks the nervous system of any animal with which it comes into contact. Skin contact can lead to tingling or reddening of the skin local to the application. If taken in through the eyes or mouth, a common symptom is facial paraesthesia, which can feel like many different abnormal sensations, including burning, partial numbness, "pins and needles", skin crawling, etc. There are no reports indicating that chronic intoxication from pyrethroid insecticides causes motor neuron damage or motor neuron disease. There are no antidotes, and treatment must be symptomatic, as approved by a physician. Over time, deltamethrin is metabolized, with a rapid loss of toxicity, and passed from the body. A poison control centre should be contacted in the event of an accidental poisoning. Cases of toxicity have been observed in cattle following use of agricultural deltamethrin preparation in external application for tick control.

Allethrin

The allethrins are a group of related synthetic compounds used in insecticides. They are synthetic pyrethroids, a synthetic form of a chemical found naturally in the chrysanthemum flower. They are commonly used in ultra-low volume sprays for outdoor mosquito control including many household insecticides such as RAID as well as mosquito coils. The compounds have low toxicity for humans and birds. It is highly toxic to fish and aquatic invertebrates. At normal application rates, allethrin is slightly toxic to bees. Insects subject to exposure become paralysed (nervous system effect) before dying. Allethrins are toxic to cats because they either do not produce, or produce less of certain isoforms of glucuronosyltransferase, which serve in hepatic detoxifying metabolism pathways.

Bifenthrin

Bifenthrin is a pyrethroid insecticide used primarily against the red imported fire ant by influencing its nervous system. It has a high toxicity to aquatic organisms. Although it is listed as a restricted use chemical in the United States, it is allowed to be sold for daily use, provided the product sold has a low concentration of bifenthrin. Bifenthrin is poorly soluble in water and often remains in soil. Its residual half-life in soil is between 7 days and 8 months, depending on the soil type, with a low mobility in most soil types. Bifenthrin has the longest known residual time in soil of insecticides currently on the market. It is a white, waxy solid with a faint sweet smell. It is chemically synthesized in various forms, including powder, granules and pellets. However, it is not naturally occurring.

On a large scale, bifenthrin is often used against red imported fire ants. It is also effective against aphids, worms, other ants, gnats, moths, beetles, earwigs, grasshoppers, mites, midges, spiders, ticks, yellow jackets, maggots, thrips, caterpillars, flies, fleas, and termites. It is mostly used in orchards, nurseries, and homes. In the agricultural sector, it is used in great amounts on certain crops, such as corn. About 70% of all hops and raspberries cultured in the United States are treated with bifenthrin.

Bifenthrin is used by the textile industry to protect woollen products from insect attack. It was introduced as an alternative to permethrin-based agents, due to greater efficacy against keratinophagous insects, better wash-fastness, and lower aquatic toxicity. Bifenthrin is not at all toxic to plants. Though it does not have a large toxicological risk towards mammals or birds, bifenthrin is able to accumulate in food, so it might be dangerous to mammals or birds in some scenarios.

Toxicology

Mosquitoes
Bifenthrin is an effective pesticide to use against malaria and filaria vector mosquitoes. It is still effective when a resistance to other pyrethroids is found. Mosquito nets and indoor walls can be treated with bifenthrin to keep more mosquitoes away. Bifenthrin is an effectively used insecticide, but the risk is high of it working only for a short time. Mosquitoes can develop a resistance to it, as well.

Aquatic Life
Bifenthrin is hardly soluble in water, so nearly all bifenthrin will stay in the sediment, but it is very harmful for the aquatic life. Even in small concentrations, fish and other aquatic animals are affected by bifenthrin. One of the reasons for the high sensitivity of fish is fish have a slow metabolism. Bifenthrin will stay longer in the system of the fish. Another reason for the high sensitivity of fish is the effect of bifenthrin as ATPase-inhibitor. The gills need ATP to control the osmotic balance of oxygen. If the fish is no longer capable of taking up oxygen because ATP can no longer be used, the fish will die. In cold water, bifenthrin is even more dangerous. pH and calcium concentration are also factors that influence the toxicity. Vertebrates are less sensitive to the effects of bifenthrin as ATPase-inhibitor.

Bees
In bees, the lethal concentration (LC50) of bifenthrin is about 17 mg/l. At sublethal concentrations, bifenthrin reduces the fecundity of bees, decreases the rate at which bee larvae develop into adults, and increases their immature periods. Bifenthrin and other synthetic pyrethroids are being used in agriculture in increasing amounts because of the high efficiency of these substances in killing insects, the low toxicity for mammals, and good biodegradability. However, because of its success, they are being used more often (also indoors) and high exposure of bifenthrin to humans can occur.

Human Neurotoxicity
Exposure to bifenthrin can be achieved either by skin contact or ingestion. Skin contact is not toxic, apart from a slight tingling sensation on the specific location of contact. Ingestion is toxic, although only slightly. Commercially available bifenthrin (Ortho Home Defence Max, for example), however, can induce toxic effects in those concentrations, because the added chemicals which improve the sustainability either potentiate bifenthrin or are toxic on their own. Symptoms of excessive exposure are nausea, headaches, hypersensitivity for touch and sound, and irritation of the skin and the eyes.

Bioallethrin

Bioallethrin refers to a mixture of two of the allethrin isomers (1R,trans;1R and 1R,trans;1S) in an approximate ratio of 1:1, where both isomers are active ingredients. A mixture of the two same stereoisomers, but in an approximate ratio of R:S in 1:3, is called esbiothrin. A mixture containing only S-forms of allethrin is referred to as esbioallethrin or S-bioallethrin. Bioallethrin is a synthetic pyrethroid used as a pesticide against household pest insects such as mosquitoes, houseflies and cockroaches. It is claimed to have low mammalian toxicity.

Cyhalothrin (Lambda-Cyhalothrin)

Cyhalothrin is an organic compound that is used as a pesticide. It is a pyrethroid, a class of synthetic insecticides that mimic the structure and insecticidal properties of the naturally occurring insecticide pyrethrin which comes from the flowers of chrysanthemums. Pyrethroids such as cyhalothrin are often preferred as an active ingredient in insecticides because they remain effective for longer periods of time than pyrethrin. It is a colourless solid, although samples can appear beige, with a mild odour. It has a low water solubility and is non-volatile. It is used to control insects in cotton crops. Pyrethroids, including lambda-cyhalothrin, disrupt the functioning of the nervous system in an organism. By disrupting the nervous system of insects, lambda-cyhalothrin may cause paralysis or death. Temperature influences its effectiveness. It is highly toxic to many fish and aquatic invertebrate species.

Cypermethrin

Cypermethrin is a synthetic pyrethroid used as an insecticide in large-scale commercial agricultural applications as well as in consumer products for domestic purposes. It behaves as a fast-acting neurotoxin in insects. It is easily degraded on soil and plants but can be effective for weeks when applied to indoor inert surfaces. Exposure to sunlight, water and oxygen will accelerate its decomposition. Cypermethrin is highly toxic to fish, bees and aquatic insects, according to the National Pesticides Telecommunications Network (NPTN). It is found in many household ant and cockroach killers, including Raid, Ortho, Combat, and ant chalk. Cypermethrin is used in agriculture to control ectoparasites which infest cattle, sheep, and poultry. In veterinary medicine, it is effective at controlling ticks on dogs.

Human Exposure
Cypermethrin is moderately toxic through skin contact or ingestion. It may cause irritation to the skin and eyes. Symptoms of dermal exposure include numbness, tingling, itching, burning sensation, loss of bladder control, incoordination, seizures and possible death. Pyrethroids may adversely affect the central nervous system. Human volunteers given dermal doses of 130 µg/cm2 on the earlobe experienced local tingling and burning sensations. One man died after eating a meal cooked in a 10% cypermethrin concentrate that was mistakenly used for cooking oil. Shortly after the meal, the victim experienced nausea, prolonged vomiting, stomach pains, and diarrhoea which progressed to convulsions, unconsciousness and coma. Other family members exhibited milder symptoms and survived after hospital treatment. Cypermethrin is not a skin or eye irritant, but it may cause allergic skin reactions. Excessive exposure can cause nausea, headache, muscle weakness, salivation, shortness of breath and seizures. In humans, cypermethrin is deactivated by enzymatic hydrolysis to several carboxylic acid metabolites, which are eliminated in the urine. Worker exposure to the chemical can be monitored by measurement of the urinary metabolites, while severe over dosage may be confirmed by quantitation of cypermethrin in blood or plasma.

Animal Exposure
Cypermethrin is very toxic to cats which cannot tolerate the therapeutic doses for dogs. This is associated with glucuronidase deficiency in cats, the enzyme responsible for metabolizing cypermethrin. As a consequence, cypermethrin remains much longer in the cat's organs than in dogs or other mammals and can be fatal in large doses. One study showed that cypermethrin inhibits "gap junctional intercellular communication", which plays an important role in cell growth and is inhibited by carcinogenic agents. Studies have shown that residue from cypermethrin can last for 84 days in the air, on walls, the floor and on furniture.

Environmental Effects
Cypermethrin is a broad-spectrum insecticide, which means it kills beneficial insects as well as the targeted insects. Fish are particularly susceptible to cypermethrin, but when used according directions, application around residential sites poses little risk to aquatic life. Resistance to cypermethrin has developed quickly in insects exposed frequently and can render it ineffective.

Cyfluthrin

Cyfluthrin is a pyrethroid insecticide and common household pesticide. It is a complex organic compound and the commercial product is sold as a mixture of isomers. Like most pyrethroids, it is highly toxic to fish and invertebrates, but it is far less toxic to humans. It is generally supplied as a 10–25% liquid concentrate for commercial use and is diluted prior to spraying onto agricultural crops and outbuildings. Excessive exposure can cause nausea, headache, muscle weakness, salivation, shortness of breath and seizures. Cyfluthrin is used in insecticidal sprays such as Temprid, an odourless insecticide mix (Bayer) which uses a combination of (beta-) cyfluthrin and imidacloprid, a residual control agent.

Etofenprox

DEFENCE | Insect Protection | Insecticides | Etofenprox

Etofenprox is a pyrethroid derivative which is used as an insecticide. Mitsui Chemicals Agro Inc. is the main manufacturer of the Chemical. It is also used as an ingredient in flea medication for cats. Etofenprox is an insecticide which disturbs insect nervous systems following direct contact or ingestion, and which is active against a broad spectrum of pests. It is used in agriculture, horticulture, viticulture, forestry, animal health and public health against many insect pests, for instance Lepidoptera, Hemiptera, Coleoptera, Diptera, Thysanoptera, and Hymenoptera. In agriculture, etofenprox is used on a broad range of crops such as rice, fruits, vegetables, corn, soybeans, and tea.

It is poorly absorbed by roots and little translocation occurs within plants. In the public health sector, etofenprox is used for vector control either by direct application in infested areas or indirectly by impregnating fabrics, such as mosquito nets. Etofenprox is used at low volumes to control adult mosquitoes, non-biting midges, and biting and non-biting flies. Etofenprox is used undiluted for ultra low volume aerosol applications or diluted with a diluent such as mineral oil for direct applications, for the control of pest species in or near residential, industrial, commercial, urban, recreational areas, woodlands, golf courses, and other areas where these pests are a problem.

Etofenprox is harmful if swallowed and causes moderate eye irritation. Contact with eyes, skin or clothing should be avoided. Repeated exposure to etofenprox can cause skin irritation. This pesticide is toxic to aquatic organisms, including fish and aquatic invertebrates. Runoff from treated areas or deposition into bodies of water may be hazardous to fish and other aquatic organisms. Etofenprox is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Time applications to provide the maximum possible interval between treatment and the next period of bee activity. Etofenprox is decomposed in soil by anaerobic and aerobic microorganisms. In sterilized soil, little degradation took place in a 56-day test. Photochemical oxidative degradation is rapid, in air the half life is estimated at 2.07 hours.

Etofenprox is combustible and should not be used or stored near heat or open flame.

Fenvalerate

DEFENCE | Insect Protection | Insecticides | Fenvalerate

Fenvalerate is a synthetic pyrethroid insecticide. It is a mixture of four optical isomers which have different insecticidal activities. The 2-S alpha (or SS) configuration, known as esfenvalerate, is the most insecticidally active isomer. Fenvalerate consists of about 23% of this isomer. Fenvalerate is an insecticide of moderate mammalian toxicity. In laboratory animals, central nervous system toxicity is observed following acute or short-term exposure. Fenvalerate has applications against a wide range of pests including some of the more destructive such as the Helicoverpa Assulta. Residue levels are minimized by low application rates. Fenvalerate is most toxic to bees and fish. It is found in some emulsifiable concentrates, ULV, wettable powders, slow release formulations, insecticidal fogs, and granules. It is most commonly used to control insects in food, feed, and cotton products, and for the control of flies and ticks in barns and stables. Fenvalerate does not affect plants, but is active for an extended period of time. Fenvalerate may irritate the skin and eyes on contact, and is also harmful if swallowed.

Phenothrin

DEFENCE | Insect Protection | Insecticides | Phenothrin

Phenothrin, also called sumithrin and d-phenothrin, is a synthetic pyrethroid that kills adult fleas and ticks. It has also been used to kill head lice in humans. d-Phenothrin is used as a component of aerosol insecticides for domestic use. Phenothrin is often used with methoprene, an insect growth regulator that interrupts the insect's biological life cycle by killing the eggs. Phenothrin is the active agent in the branded product Raid Fly & Wasp Killer. Phenothrin is primarily used to kill fleas and ticks. It is also used to kill head lice in humans, but studies conducted in Paris, France and the United Kingdom have shown widespread resistance to phenothrin. It is extremely toxic to bees. A U.S. Environmental Protection Agency (EPA) study found that 0.07 micrograms was enough to kill honey bees. It is also extremely toxic to aquatic life with a study showing concentrations of 0.03 ppb killing mysid shrimp. It has increased risk of liver cancer in rats and mice in long term exposure. It is capable of killing mosquitoes, although remains poisonous to cats and dogs, with seizures and deaths being reported due to poisoning. Specific data on concentrations or exposure is lacking. Phenothrin has been found to possess antiandrogen properties, and was responsible for a small epidemic of gynecomastia via isolated environmental exposure. In 2005, the U.S. EPA cancelled permission to use phenothrin in several flea and tick products, at the request of the manufacturer, Hartz Mountain Industries. The products were linked to a range of adverse reactions, including hair loss, salivation, tremors, and numerous deaths in cats and kittens. In the short term, the agreement called for new warning labels on the products.

Prallethrin

DEFENCE | Insect Protection | Insecticides

Prallethrin is a pyrethroid insecticide. Prallethrin 1.6% w/w liquid vaporizer is a repellent insecticide which is generally used for the control of mosquitoes in the household. It is marketed as a mosquito repellent by Godrej as "GoodKnight Silver Power" and SC Johnson as "All Out" in India. It is also the primary insecticide in certain products for killing wasps and hornets, including their nests. It is the main ingredient in the consumer product "Hot Shot Ant & Roach Plus Germ Killer" spray. The World Health Organization published in 2004 that "Prallethrin is of low mammalian toxicity, with no evidence of carcinogenicity" and "is very toxic to bees and fish but of low toxicity to birds.

Resmethrin

Resmethrin is a pyrethroid insecticide with many uses, including control of the adult mosquito population. Commercial trade names for products that contain resmethrin are Chrysron, Crossfire, Pynosect, Raid Flying Insect Killer, Scourge, Sun-Bugger #4, SPB-1382, Synthrin, Syntox, Vectrin and Whitmire PT-110.

Tetramethrin

DEFENCE | Insect Protection | Insecticides

Tetramethrin is a potent synthetic insecticide in the pyrethroid family. It is a white crystalline solid with a melting point of 65-80 °C. The commercial product is a mixture of stereoisomers. It is commonly used as an insecticide, and affects the insect's nervous system. It is found in many household insecticide products.

Tralomethrin

DEFENCE | Insect Protection | Insecticides | Tralomethrin

Tralomethrin is a pyrethroid insecticide. Tralomethrin has potent insecticidal properties; it kills by modifying the gating kinetics of the sodium channels in neurons, increasing the length of time the channel remains open after a stimulus, thereby depolarizing the neuron for a longer period of time. This leads to uncontrolled spasming, paralysis, and eventual death. Insects with certain mutations in their sodium channel gene may be resistant to tralomethrin and other similar insecticides. Tralomethrin is also effective against most members of class Arachnida as well as insects, in addition studies by the EPA on the ecotoxicity of tralomethrin shows results as follows:

Aquatic plants
Accumulation

Insects
Mortality, Population

Crustaceans
Intoxication, Population

Molluscs
Intoxication

Fish
Accumulation, Mortality, Population

Zooplankton
Intoxication, Mortality, Population

Tralomethrin is a pyrethroid insecticide. The symptoms of poisoning with pyrethroid compounds are all alike:
- Irritation of skin and eyes.
- Irritability to sound or touch, abnormal facial sensation, sensation of prickling, tingling or creeping on skin, numbness.
- Headache, dizziness, nausea, vomiting, diarrhoea, excessive salivation, fatigue.
- In severe cases: fluid in the lungs and muscle twitching may develop. Seizures may occur and are more common with more toxic cyano-pyrethroids.

Transfluthrin

DEFENCE | Insect Protection | Insecticides

Transfluthrin is a fast-acting pyrethroid insecticide with low persistency. Transfluthrin can be used in the indoor environment against flies, mosquitoes, moths and cockroaches. It is a relatively volatile substance and acts as a contact and inhalation agent. Transfluthrin, if used contrary to product instructions, may cause symptoms of poisoning including nervousness, anxiety, tremor, convulsions, skin allergies, sneezing, running nose and irritation. No specific antidotes are known, but symptomatic treatment with antihistamines may help to control any allergies.

Trapping / Killing

A section detailing different types of ways to trap insects.

Bug Zapper	A device that attracts and kills flying insects that are attracted by light. A light source attracts insects to an electrical grid, where they are electrocuted by touching two wires with a high voltage between them. Bug zappers are usually housed in a protective cage of plastic or grounded metal bars to prevent people or animals from touching the high voltage grid. A light source is fitted inside, often a fluorescent lamp designed to emit both visible and ultraviolet light, which is visible to insects and attracts them. The light is surrounded by a pair of interleaved bare wire grids or spirals. The distance between adjacent wires is typically about 2 mm (0.079 in). A high-voltage power supply powered by mains electricity, which may be a simple transformerless voltage multiplier circuit made with diodes and capacitors, generates a voltage of 2,000 volts or more, high enough to conduct through the body of an insect which bridges the two grids, but not high enough to spark across the air gap. Enough electric current flows through the small body of the insect to heat it to a high temperature. The impedance of the power supply and the arrangement of the grid is such that it cannot drive a dangerous current through the body of a human. Many bug zappers are fitted with trays that collect the electrocuted insects; other models are designed to allow the debris to fall to the ground below. Some use a fan to help to trap the insect.
Light Traps	Insects are attracted to 365nm UV-A light. Light sources may include fluorescent lamps, mercury-vapour lamps, black lights, or light-emitting diodes. Designs differ according to the behaviour of the insects being studied. Light traps are widely used to survey nocturnal moths. Total species richness and abundance of trapped moths may be influenced by several factors such as night temperature, humidity and lamp type.
Carbon Dioxide Traps	Mosquitoes are attracted to carbon dioxide and some traps use this ot their advantage. Mosquito Magnet® Patriot Plus Mosquito Trap: This is one of the traps that emit carbon dioxide, heat & moisture to attract mosquitoes
Adhesive Traps	Sticky traps may be simple flat panels or enclosed structures, often baited, that ensnare insects with an adhesive substance. Baitless ones are nicknamed "blunder" traps, as pests might blunder into them while wandering or exploring. Sticky traps are widely used in agricultural and indoor pest monitoring. Shelter traps, or artificial cover traps, take advantage of an insect's tendencies to seek shelter in loose bark, crevices, or other sheltered places. Baited shelter traps such "Roach Motels" and similar enclosures often have adhesive material inside to trap insects.
Flying Insect Traps	These traps are designed to catch flying or wind-blown insects. Flight interception traps or are net-like or transparent structures that impede flying insects and funnel them into collecting. Barrier traps consist of a simple vertical sheet or wall that channels insects down into collection containers. The Malaise trap, a more complex type, is a mesh tent-like trap that captures insects that tend to fly up rather than down when impeded. Pan traps (also called water pan traps) are simple shallow dishes filled with a soapy water or a preservative and killing agent such as antifreeze. Pan traps are used to monitor aphids and some other small insects. Bucket traps and bottle traps, often supplemented with a funnel, are inexpensive versions that use a bait or attractant to lure insects into a bucket or bottle filled with soapy water or antifreeze. Many types of moth traps are bucket-type traps. Bottle traps are widely used, often used to sample wasp or pest beetle populations.
Terrestrial Arthropod Traps	Pitfall traps are used for ground-foraging and flightless arthropods such as Carabid beetles and spiders. Pitfall traps consist of a bucket or container buried in soil or other substrate so that its lip is flush with the substrate. A grain probe is a type of trap used to monitor pests of stored grain, consisting of a long cylindrical tube with multiple holes along its length that can be inserted at various depths within grain. Soil emergence traps, consisting of an inverted cone or funnel with collecting jar on top, are employed to capture insects with a subterranean pupal stage. Emergence traps have been used to monitor important disease-vectors such as Phlebotomine sandflies.
Aquatic Arthropod Traps	Aquatic interception traps typically involve mesh funnels that or conical structures that guide insects into a jar or bottle for collecting. Aquatic emergence traps are cage-like or tent-like structures used to capture aquatic insects such as chironomids, caddisflies, mosquitoes, and odonates upon their transition from aquatic nymphs to terrestrial adults. Aquatic emergence traps may be free floating on the water's surface, submerged, or attached to a post near shore.

5 Animal Defence

The section is focused on defending yourself against different kinds of animal attacks due to direct attack. They are sorted from most common to least common.

Subheadings

1. Dogs	**2. Wild Dogs**	**3. Cats**	**4. Birds**
5. Horses	**6. Cows / Bulls**	**7. Snakes**	**8. Rats & Mice**
9. Wild Boar & Hogs	**10. Crocodiles**	**11. Alligators**	**12. Deer**
13. Hippopotamuses	**14. Elephants**	**15. Lions**	**16. Sharks**
17. Bears	**18. Coyotes/Foxes**	**19. Jellyfish**	**20. Stingrays**
21. Leopards & Tigers	**22. Rhinoceroses**	**23. Komodo Dragons**	

Dogs

Wild Dogs

Cats

Birds

Horses

Cows / Bulls

Snakes

Rats & Mice

Wild Boar & Hogs

Crocodiles

Alligators

Deer

Hippopotamuses

Elephants

Lions

Sharks

Bears

Coyotes/Foxes

Jellyfish

Stingrays

Leopards & Tigers

Rhinoceroses

Komodo Dragons

6 Displaced Defence

Tips on how to defend yourself or your group who have no shelter - from various threats such as nature and people.

From Nature

If you're in the open and facing a weather anomaly.

From Man Made Threats

If you're in the open and facing a man-made threat such as an enemy plane or a pandemic infected area.

From People

If you're in the open and in a conflict situation with other people.

7 Home Defence

How to defend your home from various threats such as nature, people and animals.

From Nature

If your shelter is about to face a barrage of natural elements.

- Ensure the building is structurally sound, if not it's recommended you find another building to shelter in.

From Man Made Threats

If your shelter is in a danger zone for a man made threat such as a war or virus. Below are tips you can do to help protect yourself if you can't leave or bug-out.

From Animals

If your temporary shelter such as a tent or log cabin is being attacked by animals or insects. Modern buildings aren't included here due to them being generally impenetrable to most animals.

Insects & Critters

If small creatures such as ticks, leeches, centipedes, ants and mosquitoes are finding their way into your tent or cabin the best way to prevent their entry is to seal up as many of the small holes as possible. Use fine mesh cloth or tent repair kits to fix holes in your tent as soon as you can. You could also utilize a DEET based spray to help discourage their entry.

Small Animals

Small animals include snakes, possums, moles and rabbits, all of which can scurry about your shelter looking for food. Possums in particular can tear holes in your tent or hammock with their large claws when trying to get to food. As always, food should be kept outside any makeshift or portable shelter while you sleep because the last thing you want is some animal making its way into your shelter.

Large Animals

Large animals include bears, rhinoceros, lions, crocodiles, wolves and bulls. These animals will cause a lot of damage to portable shelters such as tents and hammocks if the try to get to any food inside them. It's essential to use a bear bag if you're in bear country - or even for just good practise. A can of bear deterrent may also come in handy for bears among other animals. An air horn can also be of use to deter animals.

From People

If your shelter is about to be attacked by a gang or mob.

Caltrops	(Perimeter Defence)
Tripwires / Claymores	

8 Bullet Defence

The following section shows what kind of materials and thicknesses stop various types of bullets. This is AI generated, so do your own research to confirm the accuracy.

Material	Shotgun Slug (cm/in)	9mm Pistol (cm/in)	.30 Cal Rifle (cm/in)	AK-47 (7.62x39mm) (cm/in)	.50 Cal Sniper (cm/in)
Hardwood Tree (30cm/12in)	15cm / 5.9in	25cm / 9.8in	Penetration	Penetration	Penetration
Hardwood Tree (40cm/16in)	20cm / 7.9in	30cm / 11.8in	Penetration	Penetration	Penetration
Hardwood Tree (60cm/24in)	30cm / 11.8in	40cm / 15.7in	50cm / 19.7in	Penetration	Penetration
Softwood Tree (30cm/12in)	25cm / 9.8in	Penetration	Penetration	Penetration	Penetration
Softwood Tree (40cm/16in)	30cm / 11.8in	Penetration	Penetration	Penetration	Penetration
Softwood Tree (60cm/24in)	40cm / 15.7in	Penetration	Penetration	Penetration	Penetration
Hardwood Plank (5cm/2in)	3cm / 1.2in	5cm / 2in	8cm / 3.1in	10cm / 3.9in	Penetration
Softwood Plank (5cm/2in)	4cm / 1.6in	7cm / 2.8in	12cm / 4.7in	15cm / 5.9in	Penetration
Particleboard (2cm/0.8in)	1cm / 0.4in	3cm / 1.2in	5cm / 2in	6cm / 2.4in	Penetration
Household Door (Hollow, 3cm/1.2in)	2cm / 0.8in	4cm / 1.6in	8cm / 3.1in	10cm / 3.9in	Penetration

Water (60cm/24in)	30cm / 11.8in	60cm / 23.6in	Penetration	Penetration	90cm Penetration
Sheet Metal (0.5cm/0.2in)	0.3cm / 0.1in	0.5cm / 0.2in	1cm / 0.4in	1.5cm / 0.6in	Penetration
Sandstone Brick (10cm/4in)	5cm / 2in	8cm / 3.1in	15cm / 5.9in	20cm / 7.9in	Penetration
Double Brick Wall (20cm/8in)	10cm / 3.9in	15cm / 5.9in	25cm / 9.8in	30cm / 11.8in	Penetration
Car Engine Block (Steel, 5cm/2in)	2cm / 0.8in	4cm / 1.6in	8cm / 3.1in	12cm / 4.7in	20cm / 7.9in
Drywall (1.5cm/0.6in)	1cm / 0.4in	2cm / 0.8in	3cm / 1.2in	4cm / 1.6in	Penetration
Cinder Block (15cm/6in)	8cm / 3.1in	12cm / 4.7in	20cm / 7.9in	25cm / 9.8in	Penetration
Packed Dirt (50cm/20in)	25cm / 9.8in	40cm / 15.7in	Penetration	Penetration	Penetration
Glass Window (1cm/0.4in)	0.5cm / 0.2in	1cm / 0.4in	2cm / 0.8in	3cm / 1.2in	Penetration
Concrete (15cm/6in)	10cm / 3.9in	12cm / 4.7in	20cm / 7.9in	25cm / 9.8in	Penetration
Concrete (30cm/12in)	15cm / 5.9in	20cm / 7.9in	30cm / 11.8in	40cm / 15.7in	50cm / 19.7in
Concrete (50cm/20in)	25cm / 9.8in	30cm / 11.8in	45cm / 17.7in	Penetration	Penetration
Fabric (Denim, 5 layers)	2cm / 0.8in	3cm / 1.2in	5cm / 2in	6cm / 2.4in	Penetration
Metal Supports (I-Beam, 1cm/0.4in)	0.5cm / 0.2in	1cm / 0.4in	2cm / 0.8in	3cm / 1.2in	5cm / 2in
Metal Sheeting (1cm/0.4in)	0.5cm / 0.2in	1cm / 0.4in	2cm / 0.8in	3cm / 1.2in	6cm / 2.4in
Stacked Books (30cm/12in)					
Vehicle Door (Modern, Composite, 5cm/2in)	3cm / 1.2in	5cm / 2in	10cm / 3.9in	15cm / 5.9in	Penetration
Wooden Dresser (2.5cm Hardwood, 40cm/16in Total)	15cm / 5.9in	25cm / 9.8in	Penetration	Penetration	Penetration
Mattress (Spring + Padding, 30cm/12in)	20cm / 7.9in	Penetration	Penetration	Penetration	Penetration

Choosing Shelter

This section will assist you in choosing what objects to hide behind during a gun fight.

The primary way to prevent being shot is to not be seen, therefore objects that break the line of sight are your best bet.

9 Military Defence

Military defence is an existing defence structure that provides a form of tactical advantage and security on the battlefield.

Field Defences
Field defences form an integral part of any soldier's security measures when at the halt or in any defensive post or locality. These include the construction of shell scrapes or sangars and, for longer duration defence, weapon pits containing a fighting bay and sleeping bay, or other forms of hardened defensive structure. It also includes sandbagging, wiring, culverts, Hesco-Bastion bags (mesh baskets containing rubble etc.), and enhancing existing structures, either as part of these structures or for other protective measures. Overhead cover is any light thin covering that is placed over a trench or pit. It should not be confused with overhead protection (OHP), which is a much thicker and heavier covering designed to offer protection from blast. Overhead cover is principally used to provide thermal shielding against the heat and flash effects of nuclear weapons. It also provides a measure of concealment and protection against fallout and the weather. The material used should be opaque and fire-resistant and placed in such a way that soldiers' bodies or clothing do not touch it. The degree of protection provided can be improved by a sprinkling of earth or sand on the cover. Where time permits and the effective use of weapons will not be reduced, overhead cover should be converted to OHP as soon as possible to achieve blast protection as well.

In constructing overhead cover at least one of the following conditions must be met:
a. It must be possible to remove the cover quickly, either completely or sufficiently to enable weapons to be fired.
b. There must be adequate headroom and loopholes beneath the cover so that weapons may be fired without removing the overhead cover.
c. It must be possible to aim and fire through the cover while it is in position.

For gun pits and similar large excavations, the material must also be supported from underneath. Limited thermal shielding for personnel digging can be provided by propping the cover up or by stretching it between two vehicles. It should be noted that if camouflage nets are used to conceal a position, they will at the same time provide a limited measure of overhead cover. In field defences, the normal manner of providing OHP (Overhead Protection) is by placing material excavated from the trench on a roof. Protection will be improved if a layer of stone or broken brick is included in the earth covering. As a general rule the covering should be at least 0.5 m thick. When supported on a flat roof above ground level the earth covering should extend at least 0.5 m beyond the roof wherever possible. To minimise the effect of blast, earth coverings that project above ground level must be gently sloped in all directions and merged into any adjoining parapets. This will also assist in camouflage.

Weapon Pits

DEFENCE Military Defence Weapons Pits

Weapon pits are used to protect soldiers when it is possible to dig into the ground. When the ground is rocky, or in many urban situations, some form of above-ground structure will be required. Since the location of pits, particularly those for crew-served weapons, must fit in to an overall defensive plan, the digging of weapon pits starts only after the commander has visited each section and is satisfied with the pit locations and orientations. Once the location of the weapon pit is confirmed, each soldier begins to construct a shell scrape. This forms the basis for the continuing development of the position. The final structure of the weapon pit includes:

1. Fighting bay, made up of:
- **a.** elbow rests;
- **b.** weapon stakes;
- **c.** revetment/sandbags; and
- **d.** sump; and

2. Sleeping bays, including OHP.

Shell Scrapes
Shell scrapes are a quick means of providing some protection for troops until either moving off or developing the position further. Shell scrapes are dug to a limited depth, and provide only very limited protection from the effects of indirect and direct fire weapons. Shell scrapes are regarded as the first stage of a weapon pit and as such must be tactically sited and correctly aligned. However, when occupying a deliberate defence position, Stage 1 is the digging of a fighting bay, Stage 2 sleeping bays and Stage 3 is OHP on sleeping bays.

Fighting Bay
The fighting bay is developed if the unit is occupying a deliberate defensive position. The dimensions are 2 x 1 x 0.5m. If the unit has occupied a temporary position and has subsequently been told to develop the position, then the fighting bay is to be adjacent to shell scrapes as sited by the commander. The dimensions of the fighting bay must permit efficient operation of personal and crew-served weapons and allow observation of the battlespace while providing reasonable protection against direct and indirect fire. At the front edge of the pit, it is often necessary to provide an elbow rest for firers, which allows them to fire with the maximum amount of support and protection from frontal fire. Revetting or sandbagging is used to reinforce the structure. Weapon stakes are driven into the forward edge of the pit to limit the traverse or elevation of weapons to allow firers to engage targets as dictated by the commander even during periods of obscuration. Revetment is used to support the walls of the pit to prevent their collapse. Corrugated galvanised iron (CGI) can be used as revetment.

Sleeping Bays
Sleeping bays are developed by deepening the shell scrapes and connecting the excavation to the fighting bay. Their floor should be higher than the floor of the fighting bay and they should be covered with at least 0.5 m of OHP. OHP consists of a layer of bearers (logs or star pickets) which support a layer of CGI on which is placed a double layer of filled sandbags. The remaining spoil is then placed on top and the area camouflaged. Once completed, the top of the OHP must not obscure the line of sight from the fighting bay to the engagement area.

Weapons Pit Development

DEFENCE Military Defence Weapons Pit Development

The sequence of development for the most common form of weapon pit. This design may require modification to suit the type of weapon system it is protecting as well as the particular ground and terrain. The sequence followed in fully developing a defensive weapon pit is as follows:

1. Once the pit location is confirmed by the commander, dig two shell scrapes in the locations that will become the sleeping bays.
2. Construct a fighting bay 2 m long, 0.5 m wide and 1.25 m deep to the rear of the shell scrapes.
3. Dig the sleeping bays.
4. Revet the fire trench.
5. Add OHP to the sleeping bays.
6. Local camouflage is applied throughout the construction period and maintained for as long as the pit is occupied.
7. When developing a weapon pit, spoil can be placed in sandbags to develop a temporary sandbag wall constructed in front of the pit to provide immediate protection. Once the pit is completed the sandbag wall is removed and the spoil used for OHP or hidden in dead ground.

Construction Sequence
When constructing roofs at or below ground level the following construction sequence is recommended:
1. revet the trench or pit or slope the walls;
2. on either side of the trench at 0.5 m intervals, dig small trenches the size of the bearers to be used;
3. set the roof bearers into the small trenches;
4. put roofing material across the roof bearers with the corrugations of the CGI or length of other materials at right angles to the bearers;
5. lay two rows of filled sandbags across the whole roof;
6. back-fill earth onto the roof to a depth of 0.5 m; and
7. camouflage.

Construction Notes
- Timber roof bearers are usually the easiest to obtain and they can be quickly cut to the length required. Steel pickets may be used as roof bearers for trenches not more than 0.75 m wide but they must be laid not more than 0.25 m apart.
- When using round timbers that taper, set each bearer the opposite way to its neighbour.
- Roof bearers must be a least 0.5 m longer than the width of the trench or pit and should not be supported on sandbag walls except as a very temporary measure.
- The sheeting must be laid at right angles to the bearers.
- If possible cover the roof with a waterproof material before covering with earth.
- Make sure that the roof is level in both directions before putting earth on it. Stop up any small cracks with sandbags.
- When back-filling the earth on the roof, tread it well down to compact it. Slope it gently wherever possible and blend it into adjoining parapets.

Sangars

DEFENCE Military Defence Sangars

Sangars are improvised defensive walls constructed of locally-gained material such as rocks, rubble and logs. The materials must be hard enough to provide protection from small arms fire and shrapnel. Caution should be taken not to select materials that may become secondary projectiles. Any form of material that can be obtained may be used in the construction of field defences. This may include prefabricated concrete blocks or pipes which may be used for the basic structure of the sangar.

Sandbags

DEFENCE
Military Defence
Sandbags

Sandbags provide a simple and flexible building material for use in the field. The bag can be filled with any material (such as spoil from digging weapon pits or a mixture of sand and cement) but soft sand provides the best opportunity for moulding the shape of the sandbag. Sandbags can be used for revetment but are most often used in above-ground construction to increase the thickness of walls or as free-standing walls to provide blast protection. When using sandbags for field defences, the finished wall should be as shown in Figure 3–5. The following factors should be considered:

1. Sandbags, once laid, should be moulded into a standard shape about 500 x 250 x 125 mm.
2. Free-standing walls must be at least four sandbags wide at the base.
3. Sandbags are laid using headers and stretchers.
4. Tops should be finished with headers.
5. Joins should be staggered.
6. Sandbags should be laid so that the necks and seams are not showing out.
7. Star pickets and wire may be used within the sandbag wall for reinforcement.

Barbed Wire

Barbed wire obstacles are sited to channel and break up enemy assaults. They must be sited so that they are covered by observation and fire from the defensive position. Antipersonnel weapons (Claymores), other obstacles and trip flares can be sited in conjunction with the wire obstacles. Wire obstacles are constructed by wiring parties from the defending troops. Advice is given from the Assault Pioneers or Engineers. The pickets are driven in with the top of the 'Y' facing towards the enemy. The basic types of wire obstacles include:

1. Catwire Type 1 Fence. Double concertina barbed wire is used in an '8' configuration,
2. Catwire Type 2 Fence. Two rows of double concertina barbed wire are used in an '88' configuration.
3. Catwire Type 3 Fence. A single row of concertina wire is used between two rows of double concertina barbed wire in an '808' configuration.
4. Low Wire Entanglement (Bastard Wire). Single strands of barbed wire are woven between trees or pickets at ankle height.

Concertina wire may be used simply by bouncing it out to provide a quick deterrent, such as when setting up a snap vehicle checkpoint or food distribution point, to deny access and to channel. Windlassing is a method of securing wire used in wire obstacles and tightening revetting. It involves using a bar or strong stick to twist the wire.

10 Verbal Defence

Sometimes you have the ability to defuse a fight before it even starts by how you use your words.

Conflict De-escalation

11 Hazard Protection

Subheadings

		1. Respiratory Protection	2. Body Protection	3. Eye Protection	4. Hearing Protection		
		5. Head Protection	6. Hand Protection	7. Foot Protection	8. Other Limb Protection		
		9. Skin Protection	10. Height Protection	11. Elemental Protection			

1 Respiratory Protection

Types of Respiratory Protection

Respiratory Protection	**Description** Protection of the airway and access to sufficient oxygen.	**Deficiency Protection** Protects against a deficit of oxygen by supplying some to a face mask.	**Particulate Protection** Reduces the number of particles breathed in.	**Gas/Vapour Contaminants** Protects against gases in the air such as mustard gas.	
Deficiency Protection	**Oxygen Deficiency** An oxygen tank can allow breathing in situations where it wouldn't be normal.				
Particulate Protection	**Surgical Mask** Protect against large droplets, splashes and keeps your own sicknesses inside the mask.	**N-95 Respirator** Protects against dusts, fumes, mists, microorganisms.	**Half-Mask Respirator** Purifies air: protects against variety of particulates, vapours, dust, mists, fumes; depends on filter cartridge used.	**Full-Face Respirator** Same as half-mask, with greater protection factor; eye, mucus membranes and face protection; depends on filter cartridge used.	
Gas/Vapour Contaminants					

Gas Masks

You will only survive about three minutes without air in a chemical attack, so get your gas mask on quickly.

Gas Mask Tips
- Surplus gas masks usually aren't a good deal.
- Gas masks were not created equally. Get an NBC gas mask.
- You'll need spare filters.
- Your gas mask must be secured before the attack or exposure.
- Facial hair will not work with gas masks (and most do not fit children).
- Remove the plastic filter plug and know how to operate your gas mask.
- Your location matters, as attacks will likely happen over large cities.
- You can't live in a gas mask, though you may very well drink from one!

NBC Masks NBC masks cover Nuclear, Biological, and Chemical exposures. These are the top three threats that a soldier would face, which is why military personnel has access to them in targeted zones.	**Nuclear** Nuclear fission or fusion from accident or attack. Protection from particles of radioactive fallout.	**Chemical** Toxic chemicals such as mustard gas, Sarin gas, tear gas (riot control), blister gas, blood gas, or choking gas (nerve agent), etc.	**Biological** Viruses, bacteria, fungi or other micro organisms, such as anthrax (bacterial agent); Ebola; Avian flu and other pandemics; also volcanic ash. Unfortunately, there is no way to give advance notice of a biological attack.

Quality Masks
An NBC gas mask is usually an assurance of a quality gas mask; however, there are many variables. Most people think the highest calibre of gas mask you can buy is an NBC gas mask. Certainly an NBC gas mask protects against Nuclear, Biological and Chemical attacks, and the U.S. Military uses them as do preppers, but if you want to go one step higher, and it is available, get a CBRN gas mask if you can afford one. They are the most expensive and designed for first responders in a terror attack. A CBRN gas mask protects against Chemical, Biological, Radiological and Nuclear threats, though sometimes people confuse the "R" to mean riot protection for civil unrest. The difference between radiological and nuclear in a gas mask is that a radiological mask (CBRN gas mask) provides protection from radioactive material generated from the by-products and waste of industrial or medical therapies, or those occurring naturally in the environment. First responders use them for CBRN incidents. They are often associated with riot control because they have the highest level of protection. Riot control requires the ability to speak through the gas mask. They usually also have a wider field of view as well.

In short, the CBRN gas mask was designed for the military. A CBRN gas mask covers the following increased specifications over an NBC gas mask: ● Increased visor ballistics protection; ● Reduced weight and bulk (greater comfort); ● Improved field of view; ● Lowered breathing resistance; and ● Ability to change out cartridges on a contaminated field. Additionally, a CBRN gas mask may be fire resistant.	**NATO Rating** NATO gas mask filter specifications are those from the North Atlantic Treaty Organization (NATO), and they include a standard for a 40 mm thread. The standard thread ensures you can interchange the replacement cartridges.	**NIOSH Rating** Just because it's NIOSH approved, doesn't mean it's a gas mask! Although some are gas masks, NIOSH approved is simply a rating given by the National Institute for Occupational Safety and Health (NIOSH). Generally, these kinds of masks are "air purifying" and approved for work use. Manufacturers must apply for NIOSH respirator approval and there are categories. The highest category they approve is aCBRN gas mask. It's important to note that a NIOSH respirator will help protect you against airborne contaminants, such as solvents, pesticides, and paint, not necessarily gas. For example, a NIOSH-approved welding respirator is not a gas mask. Another important distinction is that NIOSH doesn't approve surgical masks or medical respirators.

Surplus Masks Owning a surplus gas mask is better than no gas mask at all. Having said this, surplus gas masks usually aren't a good deal for many reasons:	● Surplus usually means it has been sitting on the shelf too long for a reason: the expiration date may be nearing. Expiration dates are the main reason not to buy a surplus gas mask; unless you are on an extreme budget. Many preppers aren't aware that gas masks expire. ● Guarantees for surplus are next to nil. In all fairness, there's no regulation for testing of gas masks in the United States. No agency in the U.S. certifies their respirators for public use, but you have no recourse with an inferior gas mask made overseas. ● Sometimes you can't read the instructions. Sometimes you'll find an Israeli surplus gas mask intended for civilians, or one from China or Russia, but it has instructions in the respective foreign language. Unfortunately, people have died by using gas masks incorrectly. ● You could be breathing asbestos. A Russian GP filter circulating is laden with asbestos, so it may help you live through the Sarin gas exposure, but die of lung cancer years later. ● Surplus gas masks usually aren't a good deal, though you may be able to find some inexpensive Israeli gas masks, your best bet as a prepper is to get an NBC gas mask.

Pandemic NBC Mask
Absolutely an NBC gas mask can protect you in a pandemic crisis. The "B" in NBC stands for biological threats and this includes pandemics. Your family deserves the protection of an NBC mask for nuclear, biological, and chemical threats. NBC gas masks not only serve to protect you from toxic gases and fumes, but they have the benefit in a pandemic situation of sealing over the nose and mouth to create a superior barrier over traditional surgical masks, as well as providing ample coverage for shielding your face from tiny droplets. The only problem being that an NBC gas mask used for combating and preventing Ebola will need to be properly decontaminated and disposed after a one-time-use. It's not very economical, but it's lifesaving!

Respirator vs Gas Mask
A respirator is a general term for a protective device worn over the mouth and nose (or covering the entire face) to prevent inhalation of dust, smoke, or noxious substances. While the CDC refers to gas mask as respirators, and surprisingly doesn't recommend them*, could be as simple as a dust mask or surgical mask. A gas mask on the other hand is a more substantial protective shield and breathing apparatus with the specific purpose of covering a person's face as a defence against poisonous gas.

N95 / N100 Gas Masks
These are not gas masks. The classification of N95 or N100 is for respirators cleared by FDA for use by healthcare workers and are used for minimizing risk of disease transmission both from the patient and from the health professional. Think of them as surgical masks! They are disposable, one time use only and do not protect the entire face. An N-95 or N-100 is not a gas mask. It has been tested to remove 95% of the airborne particles you see N95 on the packaging. It has been tested to remove 100% of threats if you see N100 on the packaging. You'll find N95 and N100 respirators excellent for protection against bird flu, swine flu and the like; however, for a pandemic, like Ebola, you'll want a full-face respirator.

Other Notes The most important thing to know about gas masks is that they can fail from improper use. Problems may also arise from the circumstance of use. If you use a gas mask correctly you can reduce the exposure you might otherwise receive. Consider the problems so you can remedy them:	**Additions** ● Chemical suit (with booties and gloves); ● Canteen and hydration straw; ● Kevlar tactical helmet ● Gas mask pouch (for spare filters in the field) ● Spare filters (check as they expire)		

Wearing Gas Mask

Realistically, you can only wear a gas mask for a few hours for many reasons:

Overheating	A gas mask will become very hot.

Headaches	Severe headaches from pressure were a common complaint during the Gulf war.
Exhaustion	There's a lot of work needed to draw air through a carbon filter in a gas mask.
Eating / Drinking	While there is gear available to drink through your gas mask (be sure you have a hydration plug), eventually you'll need to eat (and you can't do that through a gas mask)!

Gas Mask Problems

Claustrophobia	Kids will become restless and will have the most difficulty in wearing gas masks for extended periods; however, anyone who suffers from claustrophobia is at risk for taking a gas mask off too early.
Training	Improper use of a gas mask could result in injury or death! If you strap a gas mask on too tightly, it can snap your jaw: too loosely and you'll die of the nuclear, biological or chemical exposure. During the gulf war people died simply for not unscrewing the cap from the filter. They suffocated.
Fake Masks	The respirator, right, is a Survivair Opti-Fit Full Face APR Respirator (NIOSH) and provides audio transmission, has anti-fog, a wide viewing area, but it's unclear as to what it's true purpose is. If it doesn't say it's an NBC gas mask, don't buy it.
Fogging	Fogging is a problem, and some gas mask have anti-fog capabilities. It's a particular problem with kids who are you're prone to cry particularly during times of stress! This was true of the gulf war, when kids were crying fogged up their gas masks impeding visibility and effectiveness. Some gas masks have a nose cup to prevent fogging.
Proper Fitting	It's important to ensure you have a good fit with your gas mask. This is especially true if you have children. Typically they are too big. It's also a problem in men who have beards. A man's whiskers can make it difficult to get a secure fit. The respirator, right, works better than a half face respirator for moustaches and goatees NIOSH approved (P100 class); however, it's not an NBC gas mask.
Improper Use	During the Gulf War parents accidentally suffocated their children by forcing them to wear gas mask in which they forgot to properly remove the plastic filter on the carbon filter!
Gas Affects Skin	A gas mask won't protect you against the skin blistering power of mustard gas (though it provides a level of protection from inhalation of mustard gas)! You'll need other protective gear for your skin, including chemical suit, boots, and gloves in addition to your gas mask.
Delayed Use	Chemical detection kits are available to warn you of chemical agents, but such detection kits are difficult to source (without one, you may not know when to put on a gas mask and it may be too late).
Mask Expiry	Gas masks have an expiration date! Many preppers don't realize that gas masks have a shelf life, but they do! Gas masks are not only limited by the, but they are also limited in the absorbent capacity of the filter itself. Sealing caps help protect the filter from air intake prior to use.

Respirator

A respirator is part of an emergency preparedness plan. For nuclear, biological or chemical substances, you should also have a shelter-in-place plan. The goal of a shelter-in-place is to help filter the large amounts of debris which may infiltrate the air and which may be contaminated.

Respirator	**Correct Respirator** Be careful not to buy a costume gas mask. Look for an NBC gas mask that protects against Nuclear, Biological and Chemical attack.	**Fits Properly** Pay close attention to children, people with small faces or facial hair. A respirator will help reduce exposure to certain airborne contaminants; however, misuse may result in sickness or death.	**Know How to Use** Respirators require proper training.	**Availability** By the time you realize you need your gas mask, it might be too late, such is the case with nerve agents, which are the most toxic and fast-acting.	**Already Contaminated** Even the most sophisticated gas mask might be for one use only and should be disposed. Contagion or chemical exposure could render a gas mask useless on the second go around. How many respirators can you stock for Ebola?
Respirator Types	**Respirator** Generic term to mean surgical mask, escape hood or gas mask	**Dust Mask** (N-95, N100) sawing, bagging or processing minerals, coal, iron ore, flour, metal, wood, pollen, and certain other substances.	**Surgical Mask** Surgical masks are disposable coverings for mouth and nose to protect against infection during surgical procedures.	**Anti Viral Face Mask** An antiviral face mask inactivates some harmful pathogens, including imminent strains of influenza, such as H1N1, avian flu and swine flu. (It contains citric acid, zinc and copper to inactivate flu viruses.)	**Escape Hoods** Smoke escape mask has a filter designed to remove dangerous smoke particles from the air. The price of these kinds of respirators varies greatly! Immediate right is a powered escape mask that provides 30-minute protection for fire, smoke chemical spills, sarin or mustard gas, nuclear contamination or other terrorist threats, so it's an NBC gas mask. The other escape hood is good only for escaping fire
Respirator Types	**NIOSH Gas Mask (N95 and N100)** NIOSH-approved respirators are for use in environments containing certain oil and non-oil based particles. It's an air-purifying respirator that filters particles from the air the user is breathing.	**NBC Gas Mask** This full-face respirator protects against Nuclear, Biological and Chemical substances.			

HEPA & MERV Air Filters

This is a table showing what the different type of HEPA and MERV filters trap.

MERV Rating	Traps Particles Sized 0.3 to 1.0 Microns	Traps Particles Sized 1.0 to 3.0 Microns	Traps Particles Sized 3.0 to 10 Microns	Filter Type and Particles Removed
MERV 1	<20%	<20%	<20%	**Fiberglass and Aluminium Mesh** Pollen, Dust Mites, Spray Paint, Carpet Fibres, Pet Dander
MERV 2	<20%	<20%	<20%	
MERV 3	<20%	<20%	<20%	

MERV 4	<20%	<20%	<20%	Dander
MERV 5	<20%	<20%	20%-34%	**Disposable Filters** Mold Spores, Kitchen Aerosols, Hair Spray, Furniture Polish, Cleaning Sprays
MERV 6	<20%	<20%	35%-49%	
MERV 7	<20%	<20%	50%-69%	
MERV 8	<20%	<20%	70%-85%	
MERV 9	<20%	>50%	85% or better	**Home Box Filters** Lead Dust, Flour, Auto Fumes, Welding Fumes
MERV 10	<20%	50%-64%	85% or better	
MERV 11	<20%	65%-79%	85% or better	
MERV 12	<20%	80%-90%	90% or better	**Commercial Filters** Bacteria, Wildfire Smoke, Respiratory Droplets
MERV 13	>75%	90% or better	90% or better	
MERV 14	75% - 84%	90% or better	90% or better	
MERV 15	85% - 94%	95% or better	90% or better	
MERV 16	95% or better	95% or better	90% or better	
MERV 17	99.97%	99% or better	99% or better	**HEPA & ULPA** Filters Viruses, Carbon Dust
MERV 18	99.997%	99% or better	99% or better	
MERV 19	99.9997%	99% or better	99% or better	
MERV 20	99.99997%	99% or better	99% or better	

2 Body Protection

Protection of the body as an entirety such as body armour, hazmat suits etc.

Traditional Protection	General use; chemical, biological, radiation and physical hazards.
Flame Resistant	Working with water or air reactive chemicals, large volumes of organic solvents, and potentially explosive chemicals.
Barrier	Working with infectious materials.

3 Eye Protection

Protection of the eyes from various elements via any covering medium.

General Safety Glasses	Protects the eyes from dust and small flying particles.
Laser Safety Glasses	Protects the eyes from the lasers power.
Chemical Splash Goggles	Protects against chemicals or infectious substances.
Impact Goggles	Offers protection from flying debris and has ventilation holes in the sides.
Face Shields	Protects from chemical splashes and can be worn with chemical splash goggles.

4 Hearing Protection

Protects the ears from loud noises and sustained noise to prevent ear damage and hearing loss.

Disposable Ear Buds	In-ear buds that reduce the decibel level to protect the ears from damage. Disposed after use.
Reusable Ear Buds	In-ear buds that reduce the decibel level to protect the ears from damage.
Hearing Band	An in-ear band that can be worn around the neck which reduces the decibel level to protect the ears from damage.
Ear Muffs	Over-ear muffs that reduce the decibel level to protect the ears from damage.
Hearing Aid	Not hearing is as dangerous as hearing too loudly but it's often overlooked.

5 Head Protection

Any form of protection of the head excluding respiratory protection such as gas masks.

Hats	A simple piece of clothing to keep sun off the head.				
Helmets	**Bicycle Helmet** Protection from objects falling on the head.	**Construction Helmet** A helmet suspended above the head slightly to cushion the impact of falling beams and other debris.	**Combat Helmet** A metal helmet designed to deflect or stop bullets.		

6 Hand Protection

Protects the hands from injury and often provides specific resistance to various elements.

Disposable Latex For working with biological hazards like blood and bodily fluids.	**Disposable Nitrile** Working with biological hazards and chemical splash hazards.	**Disposable Vinyl** Working with biological hazards.	**Natural Rubber Latex** Working with small volumes of corrosive liquids, organic solvents, flammable compounds	**Nitrile** Using apparatus under pressure, air or water reactive chemicals.	**Butyl** Working with large volumes of organic solvents; small to large volumes of dangerous solvents, acutely toxic or hazardous materials.
Silver Shield Same as butyl and Viton II gloves, added mechanical protection, hazardous material spills.	**Terrycloth Autoclave** Working with hot liquids and equipment, open flames, water bath, oil bath.	**Cryogen** Handling cryogenic liquids.	**Wire Mesh** Working with live animals and exposed to potential cuts.	**Viton II** Same as butyl gloves, plus hazardous material spills.	

7 Foot Protection

Protects the feet from dirt, sticks, rocks, insects and animals.

Boots

Keeps the feet protected from falling objects. They are often steel capped for extra protection.

8 Other Limb Protection

Knee/Elbow Pads Protects the knees from scrapes and falls.	**Gaiters** Protects the legs from thorns and sharp flora additionally offering protection from small animals.	**Riot Shield** For protection from thrown projectiles, debris and bullets.		

9 Skin Protection

Solar Radiation Protection from the UV component of sunlight.	**Insect Repellent** Protection from biting or stinging insects.			

Solar Radiation

- Attempt to schedule work in full sun to take place outside the hours of 10am to 3pm.
- Use shade wherever possible.
- Wear dark, loose and closely woven clothing (long sleeved, button up, collared shirt).
- Wear a 10 cm wide brimmed hat or hat with a neck flap.
- Wear Gloves.
- Put on broad spectrum water resistant SPF30+ sunscreen at least 10-15 minutes before going out in the sun. Re-apply every two hours.
- Drink plenty of water.
- Check your skin regularly for changes.

Insect Repellent

10 Height Protection

Height protection includes protection from falls from any height.

11 Elemental Protection

Air Protection

Includes protection from air pathogens, gases, lack of oxygen, high speed wind etc.

Water Protection

Protection from water and liquids such as chemicals and high pressure water.

Fire Protection

Protection from fire and flames.

Earth Protection

Protection from earth, dirt, earth bacteria etc.

Heat Protection

Protection from heat from sunlight, mechanical equipment, fires etc.

Cold Protection

Protection from cold temperatures, liquid nitrogen etc.

12 Safety

Camping Safety

Sleeping Never sleep in contact with the ground - you will absorb the cold.	**Fire Extinguisher/Blanket** Offers a defence against different types of fires.	**Medical Kit** A medical kit to treat minor injuries sustained. May include some more advanced components.			

Bear Bag

Traditionally a bear bag was simply something to hold your food out of reach of bears. This usually meant finding a way to suspend it from a high branch, and in this instance it's usually sufficient for the bag to be waterproof. There are two options. One is to get a bear canister to keep all of your food in and, in some localities where bears are common, this might even be required by law. The other option is to hang a bear bag. Since I don't have room in my pack for a large bear canister, I always choose the bear bag method. Bears aren't the only wild animals which will be attracted by the smell and come to eat all of your food. There are also animals like raccoons, foxes and rabbits to consider. For this reason, it's best to hang a bear bag even if there isn't a real risk of bears. The bear bag should be hung at least 60m (200ft) downwind from your campsite and the same distance from your kitchen area.

Bear Canister

Bear-resistant food storage containers, also called bear canisters or bear cans, are usually hard-sided containers used by backpackers to protect their food from theft by bears. Bear canisters are seeing increased popularity in areas where bears have become habituated to human presence, and are required in some regions such as Yosemite National Park in the United States. A bear canister typically weighs between 2-4 lb (1-2 kg), and has a storage capacity of 400 - 900 in3 (6 - 15 litres). Hard-sided bear cans employ such materials as polycarbonate, ABS plastic, carbon fibre, and aluminium in their construction. An effective canister must resist both the tremendous strength and high intelligence of an attacking animal. Most containers are too large for a bear to simply pick up and carry away.

The lid of a canister is usually recessed in order to prevent it being pried off, and tool use, or at least an advanced degree of motor skills, is required to remove it. Some bear canisters contain gaskets that block the scent from escaping the container. At least one model of soft-sided "bear bag" is made from Spectra (UHMWPE) fabric.

While a soft-sided container may prevent a bear from eating its contents, the food inside is likely to be reduced to purée in the attempt. A newer model comes with an aluminium stiffener that protects the contents more effectively than the bag alone. An alternative is bear bagging, wherein items attractive to a bear such as food or other perishables are placed in a bag and then raised into the air using a rope — out of reach of a bear. The rationale is that bears, being unable to reach the food, are less drawn to campsites and pose less of a threat to campers and their equipment.

Type of Bag

Your bag needs to be sturdy enough to hold all of your food, and ideally you should be able to seal it fairly well so bugs and birds don't get to the food inside. The best bear bag is a waterproof drawstring bag with a strap on the bottom. You actually hang the bag by the strap so it is upside down. This way no water can drip into it if it rains. If you don't have one of these bags, don't fret. So long as the bag is sturdy and waterproof, you are fine. A heavy-duty shopping bag will work in a pinch. I have a waterproof cover for my backpack, and I use this as my bear bag too.

Hanging

Equipment ● Bear Bag ● 12m (40ft) Rope ● Throw/Rope Bag ● Mini Carabineer ● Small Twig	**Positioning** When properly hung the bag should be about 2m (~6ft) away from the trunk, 2m below the branch, and about 4m (12ft) above the ground.

1. Fill the bear bag with all food items, trash and scented items including chewing gum and flavoured lip gloss.
2. Add rocks to the throw bag and attach carabineer (with rope attached) to the bag's draw string to secure. Find a branch about 6 meters (20 feet) above the ground and toss the throw bag over.
3. Unclip throw bag from the carabineer and clip the carabineer onto the bear bag. Feed the loose ends of the rope through the carabineer and pull loose end to raise the bear bag to the top of the tree branch.
4. Use a carabineer to attach the line to your food bag, then clip the other side of the line into the carabineer. Hoist the bag until it touches the branch.
5. Reach as high as you can and tie a clove hitch around the twig on the loose end of the rope, creating a toggle.
6. Release the loose end of the rope. The bear bag will stop at the toggle.

Food Safety

Cooking Safety

Fire Safety

Heating Safety

Carbon Monoxide
Never use fuel-burning equipment such as gas stoves, heaters, lanterns, and charcoal grills inside a tent, camper, or other enclosed shelter.

Electrical Safety

Navigation Safety

Survival Safety

Baby Safety

Safety relating to babies and children.

Home Safety Checklist

This is a home safety checklist to go through if you have a baby who is about to start crawling. Every home is different. Some items in the following checklist may not apply in your home, or there might be some risks that only apply to your house.

General

☐ Is an emergency evacuation plan (including an agreed meeting spot) in place and is practised regularly?	☐ Has a list of emergency contact numbers been created and placed near each phone?

Throughout the Home

☐Are the floor coverings sound and free of trip hazards?	☐ Are safety barriers installed at the top and bottom of stairs to prevent falls?	☐ Are the railings designed to prevent children climbing?	☐ Has an electrical safety switch been installed and is it operational?
☐ Have safety covers been fitted in unused power outlets?	☐ Have the smoke alarms have been tested within the last month, are operational, and batteries changed once per year?	☐ Are button/lithium batteries and products containing button/lithium batteries out of reach of children, stored securely and always disposed of safely?	☐ Are heaters, open fires and candles screened with a secured guard or inaccessible? Children should be supervised at all times when these are in use.
☐ Are electrical appliances in good working order?	☐ Are all electrical appliances switched off and unplugged when not in use and cords stored out of reach?	☐ Are blind and curtains cords out of children's reach to avoid strangulation?	☐ Are matches, cigarettes and lighters stored out of reach of children?
☐ Are smoke alarms installed as per regulations on each floor and near the kitchen?	☐ Are power boards used instead of adaptors?	☐ Are the power boards overloaded?	☐

Kitchen and Dining

☐ Are knives and other sharp objects stored in a lockable cupboard or out of reach of children?	☐ Is the highchair stable and fitted with a five point safety harness? A five point safety harness should be fastened whenever highchair is in use.	☐ Are cleaning and hazardous products such as medications, chemicals, plastic bags, matches and lighters, batteries, etc. stored in a lockable cupboard or are inaccessible to children?	☐ Do you use rear burners on the stove whenever possible and ensure pot handles are always turned away from the front of the stove?
☐ Is the stove bolted to the wall to prevent tipping forward?	☐ Is the dishwasher kept closed at all times?	☐ Is the microwave positioned out of reach of children?	☐ Are curtains kept away from stove or other appliances?
☐ Is access to the kitchen when cooking restricted by use of a secure safety barrier?	☐ Are safety catches installed on drawers and cupboards containing dangerous items?	☐ Are kettles, toasters and appliance cords kept out of reach of children?	☐ Are non-slip placemats are used instead of table cloths?
☐ Are hot drinks and alcohol placed out of reach of children?	☐ Is a fire blanket/fire extinguisher located in the kitchen?	☐ Is alcohol stored in a child resistant cupboard?	☐

Laundry

☐ Are hazardous substances such as cleaning products stored in a lockable cupboard or inaccessible to children?	☐ Are poisonous substances stored in their original container?	☐ Is the soaking bucket inaccessible to children and have a firm fitting lid?	☐ Is the iron out of reach of children?

☐ Is the lint filter in dryer cleaned regularly?	☐	☐	☐
Living Room			
☐ Is furniture arranged to allow access and to avoid trip hazards and collisions?	☐ Is the furniture positioned away from windows?	☐ Are large items of furniture, such as televisions, bookcases and entertainment units, secured to prevent them falling on children?	☐ Are protective covers placed on sharp corners/ edges of furniture?
☐ Are heaters located at least one (1) metre away from any curtains or other flammable materials?	☐ Is safety glass or safety film installed to low level glass doors and windows?	☐ Are stickers or frosting applied to glass sliding doors to prevent collisions?	☐ Is a separate play space provided for children?
☐ Are toys checked regularly for damage or loose parts?	☐	☐	☐
Bathroom			
☐ Is a hot water temperature device installed so tap water is no hotter than 50°C?	☐ Is the bath water temperature always tested before putting the child in? Starting with cold, then hot, then finishing with cold water?	☐ Are hazardous products such as shampoos, razors and medications stored in a lockable cupboard or inaccessible to children?	☐ Are electrical appliances removed from the bathroom?
☐ Is a non-slip bath mat or floor surface provided?	☐ Are non-slip stickers or a non-slip suction mat used in the base of the bath or shower?	☐ Are children supervised at all times in the bathroom?	☐ Is the room heater out of reach of children (avoid radiating heaters)?
☐ Are bath taps inaccessible to children?	☐	☐	☐
Bedroom			
☐ Is the cot free of soft toys, pillows, bumpers etc.?	☐ Is furniture arranged to avoid trip hazards and collisions?	☐ Does the cot comply with your countries standards for cot rails?	☐ Is the cot mattress firm and does it fit snuggly? 50mm apart?
☐ Is furniture (including cots and beds) positioned away from windows, blind cords, electrical outlets and ceiling fans?	☐ Is the child's bed of safe design? The top section of a bunk bed is NOT recommended for a child of under twelve (12) years of age).	☐ Does the bunk bed comply with your countries standard and not in a room with a ceiling fan?	☐ Are toys stored where children can reach them without climbing?
☐ Are toys in good condition and suitable for the child's age?	☐ Is the change table stable?	☐ Is the change table mat secure?	☐ Are items needed for changing baby located at an arm's reach of the change table?
☐ Is a five point safety harness used when changing baby on the change table?	☐ Is 'low fire danger' nightwear worn?	☐ Are electric blankets checked prior to fitting them to an older child's bed?	☐
Garage and Shed			
☐ Is the garage and shed lockable?	☐ Are poisonous and hazardous substances, such as paint, pesticides and flammable liquids, stored in a lockable cupboard or are inaccessible to children?	☐ Are power tools and hardware etc. inaccessible to children?	☐ Do children have restricted access to the garage and shed?
Outdoors			
☐ Are the wading pools and other water containers emptied immediately after use?	☐ Are play areas fenced securely, checked and maintained regularly and not located near a driveway?	☐ Are fence and gates in good condition and in working order?	☐ Is sunscreen and hat worn when outside?
☐ Is play equipment checked regularly and in good condition?	☐ Are trampoline, swings and climbing items positioned on a soft surface, eg. well maintained grass or mulch?	☐ Is garden free from poisonous or hazardous plants?	☐ Are wrist, knee and elbow guards worn when riding a scooter, inline skates or skateboard etc.?
☐ Are children supervised in the backyard at all times?	☐ Are children restricted from accessing the driveway?	☐ Are helmets worn when riding a tricycle, bike, scooter, inline skates or skateboard etc.?	☐ Are branches and twigs removed from children's eye level?
☐ Are children supervised around pets, especially dogs?	☐ Does pram or stroller comply with your countries standards?	☐ Is five point safety harness on the pram or stroller secured when in use?	☐ Are garden statues and birdbaths cemented in to prevent a crushing hazard?
☐ Is the pool or spa isolated on all 4 sides with a fence and a self-closing gate?	☐	☐	☐

Weapons

Information, tips and handling of modern weapons

"Due to the rising cost of ammunition I'm no longer able to provide a warning shot. Thanks for your understanding."
Unknown

Introduction

This section is based around modern handheld weapons such as pistols, rifles, shotguns, energy weapons, etc and how to handle them.

Purpose	The aim of WEAPONS is to provide detailed information on the most common types of modern guns and ammunition. It focuses on proper handling techniques, safety practises, weapon attachments and weapon maintenance.
Lost?	• For tips on avoiding using your guns, see the SECURITY section. • For a recommendation on guns and ammo counts for your kits, see the GEAR section. • For information on shooting animals humanely, see the FIELD DRESSING section. • If you want information on gunshot wounds, see the INJURY > Foreign Bodies section. • For using weapons defensively, and how far bullets can penetrate different materials, look at the DEFENCE section. • For smithing your own guns and ammo, see the CRAFTING > Blacksmithing section. • For large-scale, or vehicle mounted weapons, see the WARFARE section. • For wars and other gun violence, see the MAN-MADE DISASTERS section.

Contents

1 Gun Safety

Gun safety rules and practice recommendations are intended to avoid accidental discharge or negligent discharge, or the consequences of firearm malfunctions. Their purpose is to eliminate or minimize the risks of unintentional death, injury or property damage caused by improper possession, storage or handling of firearms. There were 47,000 unintentional firearm deaths worldwide in 2013.

WEAPONS Gun Safety Rules and Mindset

Rules and Mindset

Gun safety training seeks to instill a certain mindset and appropriate habits by following specific rules. The mindset is that firearms are inherently dangerous and must always be stored carefully and handled with care. Handlers are taught to treat firearms with respect for their destructive capabilities, and strongly discouraged from playing or toying with firearms, a common cause of accidents. The rules of gun safety follow from this mindset.

Various version of the "Ten Commandments of Gun Safety" have been published. This one is from the Sporting Shooters Association of Australia:

1. Treat every gun with the respect due a loaded gun.
2. Carry only empty guns, taken down or with the action open, into your car, camp and home.
3. Always be sure that the barrel and action are clear of obstructions.
4. Always carry your gun so that you can control the direction of the muzzle.
5. Be sure of your target before you pull the trigger.
6. Never point a gun at anything you do not want to shoot.
7. Never leave your gun unattended unless you unload it first.
8. Never climb a tree or a fence with a loaded gun.
9. Never shoot at a flat, hard surface or the surface of water.
10. Do not mix gunpowder and alcohol.

The National Rifle Association provides a similar set of rules:
1. ALWAYS keep the gun pointed in a safe direction.
2. ALWAYS keep your finger off the trigger until ready to shoot.
3. ALWAYS keep the gun unloaded until ready to use.

The United States Marine Corps uses the following four weapons safety rules:
1. Treat every weapon as if it were loaded
2. Never point the weapon at anything you do not intend to shoot
3. Keep your finger straight and off the trigger until you're ready to fire
4. Keep the weapon on safe until you intend to fire

Blank ammunition, which is a primed casing filled with gunpowder, either crimped or covered with a wad, is dangerous up to 15 feet. In the past, people have injured or killed themselves believing that blanks were not dangerous. Therefore, gun safety rules apply even to guns loaded with blanks.

Treat Firearms As Loaded

This rule is a matter of keeping a vigilant mindset. The purpose is to create safe handling habits, and to discourage presumptive reasoning along the lines of, "I know my gun is unloaded so certain unsafe practices are OK". The proposition "the gun is always loaded" means that, even though it may be known that this is not true of a particular firearm, that knowledge is never trusted or relied upon until definitively proven. Thus even if the firearm turned out to be loaded when the handler thought it was not, treating it as loaded would avoid an "unintentional discharge", and if one should occur anyway, avoiding damage, injury or death.

Many firearm accidents result from the handler mistakenly believing a firearm is emptied, safetied, or otherwise disarmed when in fact it is ready to be discharged. Such misunderstandings can arise from a number of sources.

● Faulty handling of the firearm. A handler may execute the steps of procedures such as loading, firing and emptying in the wrong order or omit steps of the procedures.
● Misunderstandings about a firearm's status. For instance, a handler may think the safety is on when it is not. A round of ammunition may be left in the chamber or in the magazine while the handler thinks it is emptied. The firearm may have been handled by another individual without the handler's knowledge. A handler may receive a firearm and assume it is in a certain state without checking whether that assumption is true. For example, as handlers interact and pass the firearm between them, each avoids over-relying on the "show clear" of the other. Person 1 may misjudge the status; person 2 cannot assume that "it's OK because person 1 already checked it".
● Mechanical failures. Wear, faulty assembly, damage or faulty design of the firearm can cause it not to function as intended. For instance, a safety may have been worn down to a point where it is no longer functioning. Broken or worn parts in the trigger, sear or hammer/striker may have given the firearm a "hair trigger" (a very sensitive trigger). A dented or bent body of the firearm may cause jams or premature discharge of ammunition. Sensitivity to impact may cause a firearm to discharge if dropped or struck against another object. A broken extractor may result in a round remaining in the chamber even when the otherwise proper steps have been taken to unload the weapon.

If a handler always treats firearms as capable of being discharged at any time, the handler is more likely to take precautions to prevent an unintentional discharge and to avoid damage or injury if one does occur.

Point the Muzzle Away

Also known as muzzle discipline, this rule is intended to minimize the potential damage caused by an unintended discharge. While the first rule teaches that a firearm must be assumed to be ready to fire, this second rule goes beyond that and says, "Since the firearm might fire, assume that it will and make sure no harm occurs when it does." A consequence of this rule is that any kind of playing or "toying" with firearms is prohibited. Playfully pointing firearms at people or other non-targets violates this rule and is possibly an extreme endangerment to life and/or property. To discourage this kind of behavior, the rule is sometimes alternately stated, "Never point a firearm at anything unless you intend to destroy it."

Two natural "safe" directions to point the muzzle are up (at the sky) and down (at the ground). Both have their advantages and disadvantages. Firing at the ground may result in a ricochet or cause hazardous fragments to be flung at people or objects. Aiming upward eliminates this risk but replaces it with the risk that the bullet may cause damage when it comes down to the ground again. A bullet fired straight up only returns at the terminal velocity of the bullet. However, a bullet fired at an angle not perfectly vertical will retain its spin and ballistic stability on the way down and can attain much more lethal speeds.

Several accidents have reportedly been caused by discharging firearms into the air; although the evidence in a few such cases has been disputed, a study by the Centers for Disease Control and Prevention found 43 likely cases of injury from falling bullets during 2004 New Year celebrations in Puerto Rico. It is also possible that the muzzle will inadvertently be pointed at a non-target such as someone's head or an aircraft.

In cases where the firearm is being handled indoors, up and down may not be safe directions. For example, a bullet fired upward or downward may travel through the ceiling, floor and plenum between adjacent floors of a multi-story building. In indoor areas where firearms will be handled often, a suitably safe direction should be designated. Firing ranges often designate a direction in which it is safe to point a firearm; almost universally this is downrange into a backstop which is designed to contain bullets and eliminate potential ricochets. In armories or other areas where weapons must be handled, a container filled with sand known as a "clearing barrel" or "clearing can" is often used for this purpose; bullets unintentionally discharged into the barrel will be safely stopped and contained by the sand.

Keep Fingers off the Trigger

Also known as trigger discipline, this rule is intended to prevent an undesired discharge. Normally a firearm is discharged by depressing its trigger. A handler's finger may involuntarily move for any of several reasons: the handler is startled, a lack of full attention on body movements, physiological reasons beyond conscious control such as a spasm, stumbling or falling, or the finger being pushed by something (as when trying to holster a handgun with one's finger on the trigger). Handlers are therefore taught to minimize the harmful effects of such a motion by keeping their finger off and far away from the trigger until the muzzle is pointing at the target and the handler wishes to discharge the firearm.

The trigger guard and the receiver area above the trigger of a firearm presents a natural point for a handler to keep their finger out straight alongside the weapon, so as not to violate this rule. Another recommendation is to keep the trigger finger above the trigger guard, so that there is less chance of the finger involuntarily slipping into the guard when startled. A properly indexed trigger finger also helps remind the person holding the firearm of the direction of the muzzle.

In popular culture, such as movies and TV shows, this rule is often violated, even by characters such as military personnel or law enforcement officers who should be trained in gun safety and thus would logically know better.

Be sure of the Target, and Beyond

This rule is intended to eliminate or minimize collateral damage to non-targets when a firearm is intentionally discharged. Unintended damage may occur if a non-target is misidentified as a target, if the target is missed, or if the bullet hits something or someone other than the intended target.

Handlers are taught that they must positively identify and verify their target. Additionally, they learn that even when firing at a valid target, unintended targets may still be hit, for three reasons:

- The bullet may miss the intended target and hit a non-target around or beyond the target.
- A non-target may pass in front of the target and be hit with a bullet aimed at the target.
- The bullet may pass through the intended target and hit a non-target beyond it, so-called "overpenetration".

Therefore, this rule requires a handler to "always be sure of your target; not just the target itself, but above, below, to the left, to the right, in front of, and behind the target".

This may create situations that present dilemmas for a handler. Such situations are for instance a police officer in a riot with bystanders, a civilian facing a possible intruder at night, or a soldier in a confrontation where civilians are near the enemy. Indecision or misjudgment of the handler's abilities in such a situation may cause undesired outcomes, such as injury to the handler due to hesitation, or the handler violating rules of engagement and causing unintended damage. Hunters are commonly prohibited from shooting across roads and trails, or after dusk and before dawn, due to the risk of inadvertently hitting an unintended target. All discharge of firearms is prohibited in some cities, in part due to the possibility of hitting unseen targets.

Training is used to minimize the risk of such outcomes. Target practice increases the precision with which the handler can discharge the firearm and thus increase the chances that the intended target is hit. Education about terminal ballistics gives the handler knowledge about the characteristics of a bullet after a target is hit. This knowledge coupled with insight into the handler's own capabilities makes it easier for the handler to make appropriate decisions about whether to discharge or not, even if given little time and/or put under severe stress. Ammunition can be chosen to reduce the risk of overpenetration.

Range Safety Rules

Ranges and organized shoots may impose additional safety rules on participants. For example, at its marksmanship clinics, Project Appleseed requires that a range safety officer (RSO) uses a weed trimmer line to check each rifle's bore for obstructions prior to its first use for the day. Six steps are then always followed when a round of shooting is complete and the line is ready to go "cold" to allow posting or checking targets, or when a rifle is ready to be removed from the line:

1) Magazine out;
2) Bolt back;
3) Safety on;
4) Chamber flag in;
5) Ground the rifle;
6) Step back; no one touching the rifle.

Open bolt indicators, or chamber flags, such as the yellow safety flag distributed by the Civilian Marksmanship Program or the green chamber flag distributed by Project Appleseed, may be required to be inserted in the chamber to show the chamber is empty.

Ranges may limit the type of ammunition used, such as prohibiting the use of incendiary, tracer, or armor-piercing rounds, or more powerful rounds than a range is equipped to handle. They may require the use of ear and eye protection. Alcohol is commonly forbidden. Some ranges impose a waiting period for shooters who wish to rent a firearm, or require them to bring a friend, in order to reduce the incidence of suicides. Ranges are advised to designate a range safety officer to enforce these rules.

Ranges must be designed with safety in mind, including the use of proper backstops for the intended type of shooting.

Malfunctions

Firearm malfunctions may be caused by the primer and/or powder, by mechanical failures, or by mishandling.

Failure to Fire Malfunctions

Malfunctions associated with the firing pin of a firearm, or with the primer and/or powder within a cartridge include failures to discharge (misfires, "duds"), delayed discharge (hang fires), and incomplete or insufficient discharge (squibs). A misfire is when the cartridge does not fire after it is struck by the firing pin. A hangfire is when the firing pin strikes the cartridge, but there is a delay of some seconds before the cartridge finally fires. A squib is when an underpowered round is fired, perhaps with an insufficient amount of powder in the case, and the bullet lodges in the bore. If the firearm is fired again, the barrel can peel back, severely damaging the weapon and injuring the shooter.

In each case, the shooter should wait for a period of time, commonly recommended between 25 seconds, up to two minutes, with the firearm pointed in a safe direction, then carefully remove the magazine, extract any mis-fed or misfired cartridge(s), and, with the breech opened carefully, check to ensure there is not a bullet or other obstruction lodged in the bore of the barrel. If there is an obstruction, and a subsequent round is fired, the firearm can fail explosively resulting in serious injury. Misfired rounds should be disposed of properly, usually in a special container for live ammo that failed to fire after ejecting round; such rounds should not be simply disposed of in the trash.

Mechanical Malfunctions

Mechanical malfunctions of firearms include slamfires, out-of-battery discharges, jams, accidental release of the firing pin, and failure of the breech or barrel to contain the propellant.

A slam fire is when a cartridge fires immediately upon being chambered, before a trigger squeeze, and is most often caused by a floating firing pin that becomes obstructed by debris, or by an improperly raised primer that is installed on a cartridge case. A slamfire can also be caused by a softer primer being used than normally recommended, commonly in military firearms, which usually use cartridges with relatively hard primers.

Out-of-battery discharges occur when a cartridge is not correctly secured by the bolt but can be fired by the firearm's firing pin. Out-of-battery discharges can be initiated by either the operator deliberately releasing the firing pin or as a slamfire. Out-of-battery discharges often cause extreme damage to the firearm, particularly on the bolt, firing pin, magazine, and receiver as well as injure the operator and nearby observers. Eye damage and blinding are common injuries caused by out-of-battery firings. Eye protection, such as shooting glasses, are highly recommended for avoiding eye injuries. Out-of-battery discharges can be avoided by careful understanding of the firearm's operating mechanism.

Types of jams include failures to feed, extract, or eject a cartridge; failure to fully cycle after firing; and failure of a recoil- or gas-operated firearm to lock back when empty (largely a procedural hazard, as a "slide lock" is a visual cue that the firearm's ammunition supply is empty). When a jam occurs, the handler should exercise extreme caution as a cartridge whose primer has been struck and which has been deformed in a jam can discharge unexpectedly (in a "hang-fire"). One method of quickly clearing a jammed semi-automatic weapon is tap rack bang.

Firearms may also fire unintentionally for several reasons, including dropping the weapon or when a firearm receives any hard mechanical shocks. Similarly, unintentional firing may occur due to faulty triggers, or excessive heat buildup in the chamber which leads to the propellant cooking off. To prevent accidental firing when firearms are dropped or jarred, experts often suggest using modern firearm designs that have safety features such as a transfer bar or a firing pin block which prevent the firing pin from striking the primer unless the trigger is squeezed. For older firearms without these features, experts suggest that they should be carried without a round in the chamber, or with the firing pin resting on an empty chamber in the case of revolvers.

Firearms may undergo catastrophic failure (a "kaBoom" or "kB") due to various causes, some caused by mishandling and others by poor design, weakened parts or the use of ammunition for which the firearm was not designed, but which will chamber and fire nonetheless. Barrels may become blocked by foreign material, such as dirt, snow, or even water. For that reason, the muzzle should never be allowed to rest on the ground or allowed to accumulate precipitation. Another form of mishandling is the use of a cartridge that generates more pressure than the firearm was designed for. This can occur through faulty handloading, or the use of overpressure ammunition (+P or +P+) or magnum loads in firearms not rated for them.

Storage

Proper storage prevents unauthorized use or theft of firearms and ammunition, or damage to them.

Gun Safes

A 'gun safe' or 'gun cabinet' is commonly used to physically prevent access to a firearm. Local laws may require particular standards for the lock, for the strength and burglar resistance of the cabinet, and may even require guns and ammunition to be stored separately.

Disassembly

Access to a functioning firearm can be prevented by keeping the firearm disassembled and the parts stored at separate locations. Sometimes, this rule is codified in law. For example, Swedish law requires owners of firearms either to store the entire firearm in a safe or lockable gun rack, or to lock the "vital piece" (bolt, etc.) away in a safe place.

Locks

There are several types of locks that serve to make it difficult to discharge a firearm. Locks are considered less effective than keeping firearms stored in a lockable safe since locks are more easily defeated than approved safes. An unauthorized handler can bypass the locked firearm at their leisure. Some manufacturers, such as Taurus, build locks into the firearm itself.

California effected regulations in 2000 that forced gun locks to be approved by a firearm safety device laboratory via California Penal Code Section 12088. All gun locks under this code must receive extensive tests including saw, pick, pull, and many other tests in order to be approved for the state of California. If a lock passes the requirements then it is said to be California Department of Justice (CADOJ) approved.

Trigger Locks

Trigger locks prevent trigger manipulation, however they do not guarantee that the firearm absolutely cannot be discharged. Some trigger locks are integrated into the design of the weapon, requiring no external parts besides the key. Generally, two pieces come together from either side behind the trigger and are locked in place, which can be unlocked with a key or combination. This physically prevents the trigger from being depressed to discharge the weapon. Other more commercially common types of trigger locks do not go behind the trigger, but encompass the full area within the trigger guard to making the trigger inaccessible to users. Identilock is a gun attachment that completely covers and prevents access to the trigger, which makes it different from other trigger locks.

There is controversy surrounding manufacturing standards, usage, and legislation of trigger locks. While supporters of trigger locks argue that they will save children from dying in gun accidents, critics point to demonstrations that some models can be removed by children with very little force and common household tools.

Many firearms can go off if the gun is dropped. It is important to make sure to look for firearms that fully disengage the hammer when the safety is put on. A former senior product manager at Master Lock, a trigger lock manufacturer, was quoted as saying "If you put a trigger lock on any loaded gun, you are making the gun more dangerous." Critics also point out that a trigger lock will increase the time it takes a gun owner to respond to a self-defense emergency. In 2008, the U.S. Supreme Court overturned a Washington, D.C. law that required handguns to be locked or otherwise kept inoperative within the home, saying that this "makes it impossible for citizens to use them for the core lawful purpose of self-defense." Although there are no universal standards for the design or testing of trigger locks, some jurisdictions, such as the state of California, maintain a list of approved trigger lock devices. In Canada, a trigger lock is one of the methods prescribed by law to secure a firearm during transport or storage.

Chamber Locks

Chamber locks aim to block ammunition from being chambered, since most firearms typically cannot be discharged unless the ammunition is in the correct position. They are used to prevent live ammunition from being loaded into a firearm by blocking the chamber with a dummy cartridge or a chamber plug, which is sometimes wedged into place with the use of a tool, in essence jamming the gun. Another type is one in which a steel rod locked into the safety cartridge with a key. As long as the rod and safety cartridge are engaged, the dummy round cannot eject nor can live ammunition be loaded into the firearm. Chamber locks work with most firearm types including revolvers, pistols, rifles and shotguns. They are available in any caliber and length, and may include such features as unique keying, rapid removal, and rigorous testing and certification by major state departments such as the California Department of Justice. Some shooting ranges require the handler to insert a temporary chamber plug which often has a brightly colored external tag, to signal the chamber being devoid of ammunition and blocked, whenever the gun is being unused. These are called empty chamber indicators, or simply chamber flags.

Cable Locks

Cable locks are a popular type of lock that usually threads into the receiver through the ejection port of repeating firearms. These locks physically obstruct the movements of the bolt, thereby preventing the cycling of the action, and deny the return to "battery" and the closure of the breech. In many designs of pistol and rifle, they also thread through the magazine well of the gun to prevent the proper insertion of a magazine.

Smart Guns

Personalized guns, or smart guns, are intended to prevent unauthorized use with built-in locks that are released by RFID chips or other proximity devices, fingerprint recognition, magnetic rings, or a microchip implant.

Secondary Dangers

While a firearm's primary danger lies in the discharge of ammunition, there are other ways a firearm may be detrimental to the health of the handler and bystanders.

Noise

When a firearm is discharged it emits a very loud noise, typically close to the handler's ears. This can cause temporary or permanent hearing damage such as tinnitus. Hearing protection such as earplugs, or earmuffs, or both, can reduce the risk of hearing damage. Some earmuffs or headphones made for shooting and similar loud situations use active noise control. Firearms may also have silencers which reduce the sound intensity from the barrel.

Hot Gases and Debris

A firearm emits hot gases, powder, and other debris when discharged. Some weapons, such as semi-automatic and fully automatic firearms, typically eject spent cartridge casings at high speed. Casings are also dangerously hot when ejected. Revolvers store spent casings in the chamber, but may emit a stream of hot gases and possible fine particulate debris laterally from the interface between the revolving chamber and the gun barrel. Any of these may hurt the handler or bystanders through burning or impact damage. Because eyes are particularly vulnerable to this type of damage, eye protection should be worn to reduce the risk of injury. Prescription lenses and various tints to suit different light conditions are available. Some eye protection products are rated to withstand impact from birdshot loads, which offers protection against irresponsible firearms use by other game bird shooters.

Toxins and Pollutants

In recent years the toxic effects of ammunition and firearm cleaning agents have been highlighted.

- Lead ammunition left in nature may become mobilized by acid rain.
- Older ammunition may have mercury-based primers.
- Lead accumulates in shooting range backstops.

Indoor ranges require good ventilation to remove pollutants such as powder, smoke, and lead dust from the air around the shooters. Indoor and outdoor ranges typically require extensive decontamination when they are decommissioned to remove all traces of lead, copper, and powder residues from the area.

Lead, copper and other metals will also be released when a firearm is cleaned. Highly aggressive solvents and other agents used to remove lead and powder fouling may also present a hazard to health. Installing good ventilation, washing hands after handling firearms, and cleaning the space where the firearm was handled lessens the risk of unnecessary exposure.

Unsafe Users

Impaired Users

Firearms should never be handled by persons who are under the influence of alcohol or any drugs which may affect their judgment. Gun safety teachers advocate zero tolerance of their use. In the United States, this recommendation is codified in many states' penal codes as a crime of "carrying under the influence", with penalties similar to DWI/DUI. Other sources of temporary impairment include exhaustion, dehydration, and emotional stress. These can affect reaction time, cognitive processing, sensory perception, and judgment.

Many jurisdictions prohibit the possession of firearms by people deemed generally incapable of using them safely, such as the mentally ill or convicted felons.

Children

Children who are generally considered too young to be allowed to handle firearms at all can be taught a different set of rules:

- Stop.
- Don't touch.
- Leave the area.
- Tell an adult.

The purpose of these rules is to prevent children from inadvertently handling firearms. These rules are part of the Eddie Eagle program developed by the National Rifle Association for preschoolers through 6th graders.

Whether programs like Eddie Eagle are effective has not been conclusively determined. Some studies published in peer-reviewed journals have shown that it is very difficult for young children to control their curiosity even when they have been taught not to touch firearms. Gun access is also a major risk factor for youth suicide. The American Academy of Pediatrics (AAP) advises that keeping a gun in the home, especially a handgun increases the risk of injury and death for children and youth in the home. If families do keep a gun in the home, the AAP advises keeping it unloaded and locked up, with the ammunition locked in a separate location, and the keys to the locked boxes hidden.

Polling shows that over half of parents who do not own a gun have never talked with their children age 5–17 about gun safety. The ASK Campaign (Asking Saves Kids) is based on the fact that many families with children have a gun, and almost half these guns are left unlocked or loaded. The ASK Campaign urges parents to ask their friends, neighbors and family members if they have an unlocked gun in the home before sending their children over to play.

2 Handguns

A handgun is a firearm designed to be usable with only one hand. It is distinguished from a long barreled gun (i.e., carbine, rifle, shotgun, submachine gun, or machine gun) which typically is intended to be held by both hands and braced against the shoulder. Handguns have shorter effective ranges compared to long guns, and are much harder to shoot accurately. While most early handguns are single-shot pistols, the two most common types of handguns used in modern times are revolvers and semi-automatic pistols.

Handgun Types

Handgun	The smallest of all firearms is the handgun. There are two common types of handguns: revolvers and semi-automatic pistols.
Single Shot	Single-shot firearms are firearms that hold only a single round of ammunition, and must be reloaded after each shot.
Revolver	Revolvers have a number of firing chambers or "charge holes" in a revolving cylinder; each chamber in the cylinder is loaded with a single cartridge or charge.
Semi Automatic	Semi-automatic pistols have a single fixed firing chamber machined into the rear of the barrel, and a magazine so they can be used to fire more than one round. Each press of the trigger fires a cartridge, using the energy of the cartridge to activate the mechanism so that the next cartridge may be fired immediately.
Bolt Action	Bolt action is a type of repeater firearm action where the handling of cartridges into and out of the weapon's barrel chamber are operated by manually manipulating the bolt handle, which is most commonly placed on the right-hand side of the weapon (as most users are right-handed).
Fully Automatic	Gun specialists point out that the word automatic is sometimes misunderstood to mean fully automatic fire when used to refer to a self-loading, semi-automatic firearm not capable of fully automatic fire. In this case, automatic refers to the loading mechanism, not the firing capability.
Pocket Pistol	A pocket pistol is any small, pocket-sized semi-automatic pistol, (or less commonly derringer, or small revolver), suitable for concealed carry in either a front or rear pocket of a pair of trousers, or in an exterior coat pocket.
Machine Pistol	A machine pistol is typically a handgun-style machine gun, capable of fully automatic or burst fire, and chambered for pistol cartridges.

Notable Handguns

Smith & Wesson M&P Series	The Smith & Wesson M&P (Military and Police) is a polymer-framed, short recoil operated, locked breech semi-automatic pistol introduced in the summer of 2005 by the American company Smith & Wesson. It uses a Browning-type locking system. While targeted at law enforcement agencies, the M&P is also widely available on the commercial market.
Smith & Wesson Shield	Smith & Wesson's latest addition to the M&P SHIELD lineup is intended to reduce the barriers to shooting a semiautomatic handgun. The M&P 9 SHIELD EZ is touted as easy to use from all perspectives.
Glock G29	The Glock 29 is a 10mm Auto equivalent of the subcompact Glock 26 introduced in 1997 along with the Glock 30 (.45 ACP). The pistol features a 96 mm (3.8 in) barrel and a standard magazine capacity of 10 rounds. Like other subcompact Glock pistols, the Glock 29 functions with the factory magazines from its related full-size model, giving an optional capacity of 15 rounds.
CZ-USA 85 Combat	The CZ 85 Combat is a large frame semi-automatic pistol chambered in 9mm. The 85 Combat is produced by CZ-USA, a Kansas City based subsidiary of the Czech arms manufacturer Česká Zbrojovka Uherský Brod. The 85 Combat is similar to the 85 B, but offers several additional features. The 85 Combat differs from other models in its inclusion of a fully adjustable rear sight, an extended magazine release, an ambidextrous slide stop, and a drop free magazine. Drop free magazines fall free of the gun when the magazine release is pressed, disengaging from the firearm completely.
Dan Wesson Specialist	A full-size 1911, the Specialist is chambered in .45 or 9mm and loaded with features to satisfy a public servant?s special requirements. The forged stainless steel slide wears our popular Clark-style serrated rib with a single amber tritium dot in the rear sight and a green lamp with white target ring in front.
Ruger MK III	The Ruger Mark III is a .22 Long Rifle semi-automatic pistol manufactured by Sturm, Ruger & Company. It replaced the MK II in 2004. The Mark III was succeeded by the MK IV, with production of the Mark III ending on December 8, 2016.
Magnum Research Micro Desert Eagle	Magnum Research made their name with the iconic Desert Eagle, a large, heavy, powerful semi-automatic that shoots cartridges primarily used in revolvers like .357 Magnum, .44 Magnum and .50 AE. And the name is now so iconic and so well known, I guess the company figured, why not slap it on to other products? Like the Micro Desert Eagle in .380 ACP. Even though this gun is very small, fairly light, has a tiny barrel and shoots a marginal cartridge.
Glock G19	The Glock 19 is effectively a reduced-size Glock 17, called the "Compact" by the manufacturer. It was first produced in 1988, primarily for military and law enforcement. The Glock 19's barrel and pistol grip are shorter by about 12 mm (0.5 in) than the Glock 17, and it uses a magazine with a standard capacity of 15 rounds. The pistol is compatible with factory magazines from the Glock 17 and Glock 18, giving the Glock 19 available capacities of: 17 rounds (standard magazine with +2 extension), 10, 17, and 19 (standard Glock 17 magazine with +2), 24 and 26 (standard magazine with +2 extension) and the 31 (standard Glock 18 magazine with +2 removed) and 33 rounds of the Glock 18. To preserve the operational reliability of the short recoil system, the mass of the slide remains the same as in the Glock 17 from which it is derived. With the exception of the slide, frame, barrel, locking block, recoil spring, guide rod, and slide lock spring, all of the other components are interchangeable between the models 17 and 19.
Colt Defender	The Colt Defender™ offers power and performance every time. Now available in 9mm and the classic .45 ACP, this package is an excellent choice for concealed carry. With Novak sights and a Colt Upswept Beavertail Grip Safety, this pistol will provide an exceptional hold and quick target acquisition. The Colt Defender is an accurate and reliable workhorse able to withstand the rigors of everyday carry and numerous trips to the range.
Browning Buckmark	Browning's flagship handgun, the Buck Mark, is the prototype for what a bargain pistol should be. However, just because the price is low, doesn't mean the quality is too. Each of these Rimfire pistols is crafted with some of the finest materials as well as with the latest gunsmithing technology. Many of the Buck Marks are quite heavy, but that's fine considering that it's not intended to be a CCW. Most of the weight is thanks to the aircraft-grade aluminum alloy components. But some models are heavier than others; for instance one of the models has a hefty 5.5" slab bull stainless steel barrel. The most impressive feature of the Buck Marks has to be the variety and quality of their grips. There are several options out there and they are all exceptional –you just have to find the one that fits best to your hands.

Handgun Anatomy

Loading Handguns

Hunting with handguns has grown in popularity in recent years. Many of the fundamentals of rifle firing also apply to shooting handguns.
● Single-action revolvers typically load through a gate on the right side of the frame. To rotate the cylinder, pull the hammer back to half-cock. For a safer carry in the holster or hand, leave an empty chamber in front of the hammer.
● Double-action revolvers have cylinders that fall downward, exposing all chambers for loading.
● Semi-automatics usually fire rounds stored in a magazine that is inserted in the grip or handle.

Firing Handguns

Body position and grip are vital to hitting the target. The hand position on the grip of a pistol is especially critical. Although the grip configuration of the revolver and semi-automatic are different, the gripping procedure is the same.
● Hold the handgun high on the grip so that the recoil is directed back to the hand and arm in a straight line. This allows better repeat shots and more accurate shooting.
● Use a two-handed hold whenever possible, applying pressure from front to rear.

Handgun Modifications

3 Rifles

A rifle is a long-barrelled firearm designed for accurate shooting, with a barrel that has a helical pattern of grooves ("rifling") cut into the bore wall. In keeping with their focus on accuracy, rifles are typically designed to be held with both hands and braced firmly against the shooter's shoulder via a buttstock for stability during shooting. Rifles are used extensively in warfare, law enforcement, hunting and shooting sports.

Rifle Types

A rifle is so named for the spiral fluting (rifling) machined into the inner surface of its barrel, which imparts a self-stabilizing spin to the single bullets it fires.

Lever-action Rifle	Lever action is a type of firearm action which uses a lever located around the trigger guard area (often including the trigger guard itself) to load fresh cartridges into the chamber of the barrel when the lever is worked. This contrasts to bolt-action, pump-action, semi-automatic, or selective-fire weapons. Most lever-action firearms are rifles, but some lever-action shotguns and a few pistols have also been made. The Winchester Model 1873 rifle is one of the most famous lever-action firearms, but many manufacturers—notably Henry and Marlin—also produce lever-action rifles. Even Colt's Mfg. Co. produced the 6403 lever-action Colt-Burgess rifles from 1883 until 1885. Mossberg produces the 464 in centerfire .30-30 and rimfire .22. While the term lever action generally implies a repeating firearm, it is also sometimes—and incorrectly—applied to a variety of single shot or falling block actions that use a lever for cycling, such as the Martini–Henry or the Ruger No. 1.
Bolt-action Rifle	Bolt action is a type of firearm action where the handling of cartridges into and out of the weapon's barrel chamber is operated by manually manipulating the bolt directly via a bolt handle, which is most commonly placed on the right-hand side of the weapon (as most users are right-handed). When the handle is operated, the bolt is unlocked from the receiver and pulled rearward to open the breech allowing the spent cartridge case to be extracted and ejected, the firing pin within the bolt is cocked (either on opening or closing of the bolt depending on the gun design) and engages the sear, then upon the bolt being pushed back, a new cartridge (if available) is loaded into the chamber, and finally the breech is closed tight by the bolt re-locking against the receiver.
Pump-action Rifle	A pump-action or slide-action firearm is one in which a forend can be moved forward and backward in order to eject a spent round of ammunition and to chamber a fresh one. It is much faster than a bolt-action and somewhat faster than a lever-action, as it does not require the trigger hand to be removed from the trigger while reloading. Once fired, the forend is slid rearward by hand and the expended cartridge ejected. It is then reloaded by manually moving the forend to the front.
Assault Rifle	An assault rifle is a selective-fire rifle that uses an intermediate cartridge and a detachable magazine. Assault rifles were first put into mass production and accepted into widespread service during World War II. Though Western nations were slow to accept the assault rifle concept, by the end of the 20th century they had become the standard weapon in most of the world's armies, replacing full-powered rifles and sub-machine guns in most roles. Examples include the StG 44, AK-47 and the M16 rifle.
Battle Rifle	A battle rifle is a military service rifle that is capable of semi or fully automatic fire, and fires a full-powered rifle cartridge. The term "battle rifle" was created largely out of a need to better differentiate the intermediate-power assault rifles (e.g. StG-44, AK-47, M16, AUG) from full-powered automatic rifles (e.g. FG-42, FN FAL, M14, H&K G3) as both classes of firearms have a similar appearance and share many of the same features such as detachable magazines, pistol grips, etc.
Carbine	A carbine is a long gun firearm but instead with a shorter barrel rather than a standard rifle or musket. Most carbines are shortened versions of full-length rifles, shooting the same type of ammunition, while others fire generally lower-powered ammunition, including types designed for pistols. The smaller size and lighter weight of carbines make them easier to handle. They are typically issued to high-mobility troops such as special-operations soldiers and paratroopers, as well as to mounted, artillery, logistics, or other non-infantry personnel whose roles do not require full-sized rifles, although there is a growing tendency for carbines to be issued to front-line soldiers to offset the increasing weight of other issued equipment. An example of this is the US Army's M4 carbine, which is standard issue.
Service Rifle	A service rifle or service weapon (also known as a standard-issue rifle) is a weapon which an armed force issues as standard to its service members. In modern forces, this is typically a versatile and rugged battle rifle, assault rifle, or carbine suitable for use in nearly all environments. Most armies also have service pistols or side arms.
Sniper Rifle	A sniper rifle is a high-precision, long range rifle. Requirements include accuracy, reliability, mobility, concealment and optics for anti-personnel, anti-materiel and surveillance uses of the military sniper. The modern sniper rifle is a portable shoulder-fired weapon system with a choice between bolt-action or semi-automatic action, fitted with a telescopic sight for extreme accuracy and chambered for a high-ballistic performance centerfire cartridge.

Notable Rifles

WEAP Rifles Rifle

Rifle Anatomy

Loading Rifles

WEAPONS Rifles

Firing Rifles

WEAPONS Rifles Rifle

Rifle Modifications

4 Shotguns

A shotgun (also known as a scattergun, peppergun, or historically as a fowling piece) is a long-barreled firearm designed to shoot a straight-walled cartridge known as a shotshell, which discharges numerous small spherical projectiles called shot, or a single solid projectile called a slug. Shotguns are most commonly used as smoothbore firearms, meaning that their gun barrels have no rifling on the inner wall, but rifled barrels for shooting sabot slugs (slug barrels) are also available.

WEAPONS Shotguns Shotgun Types

Shotgun Types

Shotguns are predominantly smoothbore firearms designed to fire a number of shot; pellet sizes commonly ranging between 2 mm #9 birdshot and 8.4 mm #00 (double-aught) buckshot.

Combat Shotgun	
Semi-Automatic Shotgun	
Automatic Shotgun	

WEAPONS Shotguns

Notable Shotguns

Shotgun Anatomy

WEAPONS Shotguns

Loading Shotguns

WEAPONS Shotguns Firing Shotguns Aiming

Firing Shotguns

Shouldering the Shotgun

- When you bring the shotgun to your shoulder, the stock should be brought to your cheek first and then back to your shoulder.
- A common error is lowering the head and cheek to the stock, instead of bringing the stock all the way up to the cheek. When done properly, with your head naturally erect, the gun butt always should come to the same spot on your shoulder.

Aiming the Shotgun

- Because targets usually appear suddenly and move quickly, there's no time to "aim" a shotgun. It's designed to be pointed, with the eye sighting along the top of the barrel or rib.
- The sight is usually a bead on the front of the gun. Your eye must be in line with the barrel, so it's important to position your head properly on the stock.
- When you bring the gun to your face, the stock should fit snugly against your cheek with your eye on that side above the centerline of the gun. If you can't assume that position comfortably, you may need to adjust the "gun fit."

Firing

- Unlike rifle firing, quick trigger action is important when hunting with a shotgun. To fire, quickly slap the trigger with a firm motion, keeping a firm grip on the shotgun while pulling the stock rearward.
- Because the trigger is pulled quickly and the body and gun are typically in motion, breath control isn't necessary.
- Continue the shotgun's swing as you pull the trigger. Stopping the swing as you shoot will cause you to hit behind a moving target.

Unlike rifle firing, quick reflexes and flexibility are essential for effective shotgun shooting. Proper shotgun techniques will help you develop the rapid, fluid response you need to hit your target. A shotgun is almost always shot at a moving target from a standing position. You must be able to swing freely over a wide arc and maintain control. That requires a relaxed, balanced stance.

- Stand with your feet spread about shoulder-width apart and your knees bent slightly so that you are balanced perfectly. Bring your left foot slightly forward (if you're a right-handed shooter), and lean your body in the same direction. The position of the feet is important. The toes of your forward foot should point at about 45 degrees toward the target. Take the time to place your feet properly, even for a quick shot.
- Keeping your knees slightly bent makes it easier to swing with a moving target. The bent leg to the rear supports the movements of your hips, allowing you to swing smoothly.

Shotgun Modifications

5 Carbines

A carbine is a long gun that has a barrel shortened from its original length. Most modern carbines are rifles that are compact versions of a longer rifle or are rifles chambered for less powerful cartridges.

Carbine Types

A carbine is a firearm similar to a rifle in form and intended usage, but generally shorter or smaller than the typical "full-size" hunting or battle rifle of similar time period, and sometimes using a smaller or less-powerful cartridge.

Notable Carbines

Carbine Anatomy

Loading Carbines

Firing Carbines

Carbine Modifications

6 Machine Guns

A machine gun (MG) is a fully automatic and rifled firearm designed for sustained direct fire with rifle cartridges. Other automatic firearms such as automatic shotguns and automatic rifles (including assault rifles and battle rifles) are typically designed more for firing short bursts rather than continuous fire and are not considered true machine guns.

Machine Gun Types

These are the different types of machine guns available.

General-purpose Machine Gun	

Light Machine Gun	
Heavy Machine Gun	
Minigun	

Notable Machine Guns

Machine Gun Anatomy

Loading Machine Guns

Firing Machine Guns

Machine Gun Modifications

7 Submachine Guns

A submachine gun (SMG) is a magazine-fed automatic carbine designed to fire handgun cartridges. The term "submachine gun" was coined by John T. Thompson, the inventor of the Thompson submachine gun, to describe its design concept as an automatic firearm with notably less firepower than a machine gun (hence the prefix "sub-"). As a machine gun must fire rifle cartridges to be classified as such, submachine guns are not considered machine guns.

Submachine Gun Types

Notable Submachine Guns

Submachine Gun Anatomy

Loading Submachine Guns

Firing Submachine Guns

Submachine Gun Modifications

8 Automatic Rifles

An automatic rifle is a type of autoloading rifle that is capable of fully automatic fire. Automatic rifles are generally select-fire weapons capable of firing in semi-automatic and automatic firing modes (some automatic rifles are capable of burst-fire as well). Automatic rifles are distinguished from semi-automatic rifles in their ability to fire more than one shot in succession once the trigger is pulled. Most automatic rifles are further subcategorized as battle rifles or assault rifles.

Automatic Rifle Types

Notable Automatic Rifles

Automatic Rifle Anatomy

Loading Automatic Rifles

Firing Automatic Rifles

Automatic Rifle Modifications

9 Assault Rifles

An assault rifle is a select fire rifle that uses an intermediate-rifle cartridge and a detachable magazine. Assault rifles were first put into mass production and accepted into widespread service during World War II.

Assault Rifle Types

Notable Assault Rifles

Assault Rifle Anatomy

Loading Assault Rifles

WEAPONS Assault Rifles

Firing Assault Rifles

Assault Rifle Modifications

WEAPONS Energy

10 Energy Weapons

A directed-energy weapon (DEW) is a ranged weapon that damages its target with highly focused energy, including laser, microwaves and particle beams. Potential applications of this technology include weapons that target personnel, missiles, vehicles, and optical devices.

WEAPONS Energy Weapons Rifle Types

Energy Weapon Types

Electrolaser	An electrolaser is a type of electroshock weapon that is also a directed-energy weapon. It uses lasers to form an electrically conductive laser-induced plasma channel (LIPC). A fraction of a second later, a powerful electric current is sent down this plasma channel and delivered to the target, thus functioning overall as a large-scale, high energy, long-distance version of the Taser electroshock gun.
Pulsed Energy Projectile	It involves the emission of an invisible laser pulse which, upon contact with the target, ablates the surface and creates a small amount of exploding plasma. This produces a pressure wave that stuns the target and knocks him off his feet, and electromagnetic radiation that affects nerve cells causing a painful sensation. The technology can also be used as a lethal weapon, and indeed an early name was pulsed impulsive kill laser.

WEAPONS Energy Weapons Active Denial System

Active Denial System

Active Denial System (Millimetre Wave Crowd Control Gun)
The Active Denial System (ADS) is a non-lethal, directed-energy weapon developed by the U.S. military, designed for area denial, perimeter security and crowd control. Informally, the weapon is also called the heat ray since it works by heating the surface of targets, such as the skin of targeted human subjects. Raytheon is currently marketing a reduced-range version of this technology. The ADS was deployed in 2010 with the United States military in the Afghanistan War, but was withdrawn without seeing combat. As of 2014, the ADS was only a vehicle-mounted weapon, though U.S. Marines and police were both working on portable versions. ADS was developed under the sponsorship of the DoD Non-Lethal Weapons Program with the Air Force Research Laboratory as the lead agency. There are reports that Russia and China are developing their own versions of the Active Denial System. The device can be used for targets up to 250 metres (820 ft) away.

Effects
The ADS works by firing a high-powered beam of 95 GHz waves at a target, which corresponds to a wavelength of 3.2 mm. The ADS millimetre wave energy works on a similar principle as a microwave oven, exciting the water and fat molecules in the skin, and instantly heating them via dielectric heating. One significant difference is that a microwave oven uses the much lower frequency (and longer wavelength) of 2.45 GHz. The short millimetre waves used in ADS only penetrate the top layers of skin, with most of the energy being absorbed within 0.4 mm (1⁄64 inch), whereas microwaves will penetrate into human tissue about 17 mm (0.67 inch).

The ADS's effect of repelling humans occurs at slightly higher than 44°C (111°F), though first-degree burns occur at about 51°C (124°F), and second-degree burns occur at about 58°C (136°F). In testing, pea-sized blisters have been observed in less than 0.1% of ADS exposures, indicating that second degree surface burns have been caused by the device. The radiation burns caused are similar to microwave burns, but only on the skin surface due to the decreased penetration of shorter millimetre waves. The surface temperature of a target will continue to rise so long as the beam is applied, at a rate dictated by the target's material and distance from the transmitter, along with the beam's frequency and power level set by the operator.
Most human test subjects reached their pain threshold within 3 seconds, and none could endure more than 5 seconds. Like all focused energy, the beam will irradiate all matter in the targeted area, including everything beyond/behind it that is not shielded, with no possible discrimination between individuals, objects or materials. Anyone incapable of leaving the target area (e.g., physically handicapped, infants, incapacitated, trapped, etc.) would continue to receive radiation until the operator turned off the beam. Reflective materials such as aluminium cooking foil should reflect this radiation and could be used to make clothing that would be protective against this radiation.

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Following approximately ten thousand test exposures of volunteers to ADS beams, a Penn State Human Effects Advisory Panel (HEAP) concluded that ADS is a non-lethal weapon that has a high probability of effectiveness with a low probability of injury:
- No significant effects for wearers of contact lenses or other eyewear (including night vision goggles)
- Normal skin applications, such as cosmetics, have little effect on ADS's interaction with skin
- No age-related differences in response to ADS exposures
- No effect on the male reproduction system
- Damage was the occurrence of pea-sized blisters in less than 0.1% of the exposures (6 of 10,000 exposures).

Long Term Effects
Many possible long-term effects have been studied, with the conclusion that no long-term effects are likely at the exposure levels studied. However, overexposures of either operators or targets may cause thermal injury. According to an official military assessment, "In the event of an overexposure to a power density sufficient to produce thermal injury, there is an extremely low probability that scars derived from such injury might later become cancerous. Proper wound management further decreases this probability, as well as the probability of hypertrophic scarring or keloid formation. ADS operators would be exposed to more than the standard maximum permissible exposure (MPE) limits for RF energy, and military use requires an exception to these exposure limits.

Possible Long-Term Effects
● Cancer: A mouse cancer study was performed at two energy levels and exposures with a 94 GHz transmitter: a single 10 second, 1 W/cm2 exposure; and repeated 10 second exposures over 2 week period at 333 mW/cm2. At both energy levels, no increase in skin cancers were observed. No studies of higher energy levels, or longer exposure times have been performed on millimetre-wave systems.
● Cornea damage: Tests on non-human primate eyes have observed no short-term or long-term damage as the blink reflex protects the eye from damage within 0.25 seconds.
● Birth defects: Millimetre waves only penetrate 0.4 mm (1⁄64 inch) into the skin, making direct damage to the testes or ovaries impossible.
● Blisters and scarring: Pea-sized blistering due to second degree burns occurred in a very small minority (less than 0.1%) of tested exposures, which have a remote potential for scarring.

5G Network Risk
Today's cellular and Wi-Fi networks rely on microwaves – a type of electromagnetic radiation utilizing frequencies up to 6 gigahertz (GHz) in order to wirelessly transmit voice and data. This era of wireless frequency is almost over making room for new 5G applications will require using new spectrum bands in much higher frequency ranges above 6 GHz to 100 GHz and beyond, utilizing sub-millimeter and millimetre waves. Millimetre waves are utilized by the U.S. Army in crowd dispersal guns called Active Denial Systems. Dr. Paul Ben-Ishai pointed to research that was commissioned by the U.S. Army to find out why people ran away when the beam touched them.

"If you are unlucky enough to be standing there when it hits you, you will feel like your body is on fire." The U.S. Department of Defence explains how: "The sensation dissipates when the target moves out of the beam. The sensation is intense enough to cause a nearly instantaneous reflex action of the target to flee the beam." It uses radio frequency millimetre waves in the 96GHz range to penetrate the top 1/64 of an inch layer of skin on the targeted individual, instantly producing an intolerable heating sensation that causes them to flee. A lot of respected people have posted warnings about the mass deployment of commercial millimetre-wave technology.

5G networks have divided network services into three categories: enhanced Mobile Broadband (eMBB) or handsets; Ultra-Reliable Low-Latency Communications (URLLC), which includes industrial applications and autonomous vehicles; and Massive Machine Type Communications (MMTC) or sensors. Initial 5G deployments will focus on eMBB and fixed wireless, which makes use of many of the same capabilities as eMBB. 5G will use spectrum in the existing LTE frequency range (600 MHz to 6 GHz) and also in millimetre wave bands (24–86 GHz). 5G technologies have to satisfy ITU IMT-2020 requirements and/or 3GPP Release 15; while IMT-2020 specifies data rates of 20 Gbit/s, 5G speed in sub-6 GHz bands is similar to 4G.

Dazzler
A dazzler is a non-lethal weapon which uses intense directed radiation to temporarily disable its target with flash blindness. Targets can include sensors or human vision.

Particle-Beam Weapon
A particle-beam weapon uses a high-energy beam of atomic or subatomic particles to damage the target by disrupting its atomic and/or molecular structure.

Sonic Weapon
Sonic and ultrasonic weapons (USW) are weapons of various types that use sound to injure, incapacitate, or kill an opponent.

11 Homemade Weapons

12 Ammo

Ammunition (informally ammo) is the material fired, scattered, dropped or detonated from any weapon. Ammunition is both expendable weapons (e.g., bombs, missiles, grenades, land mines) and the component parts of other weapons that create the effect on a target (e.g., bullets and warheads). Nearly all mechanical weapons require some form of ammunition to operate.

The purpose of ammunition is to project a force against a selected target to have an effect (usually, but not always, lethal). The most iconic example of ammunition is the firearm cartridge, which includes all components required to deliver the weapon effect in a single package.

Ammunition comes in a great range of sizes and types and is often designed to work only in specific weapons systems. However, there are internationally recognized standards for certain ammunition types (e.g., 5.56×45mm NATO) that enable their use across different weapons and by different users. There are also specific types of ammunition that are designed to have a specialized effect on a target, such as armor-piercing shells and tracer ammunition, used only in certain circumstances. Ammunition is commonly colored in a specific manner to assist in the identification and to prevent the wrong ammunition types from being used accidentally.

Design
Ammunition design has evolved throughout history as different weapons have been developed and different effects required. Historically, ammunition was of relatively simple design and build (e.g., sling-shot, stones hurled by catapults), but as weapon designs developed (e.g., rifling) and became more refined, the requirement for more specialized ammunition increased. Modern ammunition can vary significantly in quality but is usually manufactured to very high standards.

For example, ammunition for hunting can be designed to expand inside the target, maximizing the damage inflicted by a single round. Anti-personnel shells are designed to fragment into many pieces and can affect a large area. Armor-piercing rounds are specially hardened to penetrate armor, while smoke ammunition covers an area with a fog that screens people from view. More generic ammunition (e.g., 5.56×45mm NATO) can often be altered slightly to give it a more specific effect (e.g., tracer, incendiary), whilst larger explosive rounds can be altered by using different fuzes.

Naming

The measurements in metric are almost always a "diameter to length" ratio. **5.56x45 Means** 5.56mm Wide 45mm Long	Shotshells are measured in "gauge", with a lower number being a larger diameter.			

Terms

These are the terms used for the different types of ammunitions.

Round	A round is a single cartridge containing a projectile, propellant, primer and casing.
Shell	A shell is a form of ammunition that is fired by a large caliber cannon or artillery piece. Before the mid-19th century, these shells were usually made of solid materials and relied on kinetic energy to have an effect. However, since that time, they are more often filled with high-explosives (see artillery).
Shot	A shot refers to a single release of a weapons system. This may involve firing just one round or piece of ammunition (e.g., from a semi-automatic firearm), but can also refer to ammunition types that release a large number of projectiles at the same time (e.g., cluster munitions or shotgun shells).
Dud	A dud refers to loaded ammunition that fails to function as intended, typically failing to detonate on landing. However, it can also refer to ammunition that fails to fire inside the weapon, known as a misfire, or when the ammunition only partially functions, known as a hang fire. Dud ammunition, which is classified as an unexploded ordnance (UXO), is regarded as highly dangerous. In former conflict zones, it is not uncommon for dud ammunition to remain buried in the ground for many years. Large quantities of ammunition from World War I continue to be regularly found in fields throughout France and Belgium and occasionally still claim lives. Although classified as an unexploded ordnance, landmines that have been left behind after conflict are not considered duds as they have not failed to work and may still be fully functioning and simply forgotten.
Bomb	A bomb, or more specifically a guided or unguided bomb (also called an aircraft bomb or aerial bomb), is typically an airdropped, unpowered explosive weapon. Mines and the warheads used in guided missiles and rockets are also referred to as bomb-type ammunition.

Components

The components of ammunition intended for rifles and munitions may be divided into these categories:

Fuze / Primer	The term "fuze" refers to the detonator of an explosive round or shell. The spelling is different in British English and American English (fuse/fuze respectively) and they are unrelated from a fuse (electrical). A fuse was earlier used to ignite the propellant (e.g., such as on a firework) until the advent of more reliable systems such as the primer or igniter that is used in most modern ammunitions. The fuze of a weapon can be used to alter how the ammunition works. For example, a common artillery shell fuze can be set to 'point detonation' (detonation when it hits the target), delay (detonate after it has hit and penetrated the target), time-delay (explode a specified time after firing or impact) and proximity (explode above or next to a target without hitting it, such as for airburst effects or anti-aircraft shells). These allow a single ammunition type to be altered to suit the situation it is required for. There are many designs of a fuze, ranging from simple mechanical to complex radar and barometric systems. Fuzes are usually armed by the acceleration force of firing the projectile, and usually arm several meters after clearing the bore of the weapon. This helps to ensure the ammunition is safer to handle when loading into the weapon and reduces the chance of the detonator firing before the ammunition has cleared the weapon.
Explosive Materials / Propellants	The propellant is the component of ammunition that is activated inside the weapon and provides the kinetic energy required to move the projectile from the weapon to the target. Before the use of gunpowder, this energy would have been produced mechanically by the weapons system (e.g., a catapult or crossbow); in modern times, it is usually a form of chemical energy that rapidly burns to create kinetic force, and an appropriate amount of chemical propellant is packaged with each round of ammunition. In recent years, compressed gas, magnetic energy and electrical energy have been used as propellants.
Projectile	The projectile is the part of the ammunition that leaves the weapon and has the effect on the target. This effect is usually either kinetic (e.g., as with a standard bullet) or through the delivery of explosives.
Cartridge Casing	The cartridge is the container that holds the projectile and propellant. Not all ammunition types have a cartridge case. In its place, a wide range of materials can be used to contain the explosives and parts. With some large weapons, the ammunition components are stored separately until loaded into the weapon system for firing. With small arms, caseless ammunition can reduce the weight and cost of ammunition, and simplify the firing process for increased firing rate, but the maturing technology has functionality issues. Generally brass, nickel, or steel.

Ammo Types

These are the different types of bullets and their purposes.

Handgun Bullets

Jacketed Hollow Point (JHP)	Jacketed Hollow Point (JHP) bullets have full-length jacket with a hollow point. This construction provides deep penetration with controlled expansion, and also enables reliable feeding into the chamber and good function in autoloading pistols. These very accurate bullets are suitable for revolvers, too.
Semi Jacketed Hollow Point (SJHP)	Semi Jacketed Hollow Point (SJ HP) bullets provide optimum expansion with controlled penetration. Due to the partly exposed lead in the nose they are less suitable for pistols and they are mainly used in revolver ammunition.
Semi Jacket Flat Point (SJFP)	Semi Jacketed Flat Point (SJ FP) bullets with flat exposed lead tips are suitable for short range shooting with revolvers. They provide deeper penetration with less expansion than SJ HP bullets, which provide deep penetration with controlled expansion and good functioning in auto loading pistols.
Full Metal Jacket (FMJ)	Full Metal Jacket (FMJ) bullets are general purpose bullets suitable for auto loading pistols. They provide excellent cartridge feeding into the weapon chamber and good penetration. These bullets are good choice for practice shooting.
Flat Point Jacket (FPJ)	Flat Point Jacket (FPJ) bullets are actually FMJ bullets with a flat nose. These bullets are designed to improve the stopping power of the FMJ bullets. They are suitable primarily for revolver ammunition but are also used in pistol ammunition.
Full Metal Spitz (FMS)	Full Metal Spitz (FMS) is our bullet with conical nose used in 357 Magnum and 38 Special cartridges. Main characteristic of this bullet is excellent penetration capability.
Lead Round Nose (LRN)	Lead Round Nose (LRN) bullets are versatile, economical bullets for general purpose, used mainly in revolvers. They are very accurate and especially suitable for practice.
Semi Wad Cutter (SWC)	Semi Wad Cutter (SWC) have higher velocity and power and provide accurate shooting at somewhat longer distances than it is possible with WC bullets.
Wad Cutter (WC)	Wad Cutter (WC) bullets are specially designed lead bullets with excellent accuracy intended for shooting competitions. These cylindrical bullets cut clean holes in target for easy reading of results. Because of low recoil they are suitable for training.

Semi Wad Cutter Hollow Point (SWCHP)	Semi Wad Cutter Hollow Point (SWC HP) with a nose deliver immediate expansion and efficient transfer of energy. They leave clean holes in paper targets.
Total Metal Jacket (TMJ)	Total Metal Jacket (TMJ) bullets are FMJ bullets of special design in which the lead is not exposed. The enclosed base eliminates lead vaporization during firing. These bullets are suitable for indoor shooting.

Rifle Bullets

Soft Point (SP)	The tip of the bullet is left uncoated. (Exposed Lead)
Pointed Soft Point (PSP)	Pointed Soft Point (PSP) bullets have sharp lead nose, which cause the bullets expansion when hitting and aerodynamically shaped ogival part which provide better ballistic coefficient and maximum striking energy at longer ranges.
Soft Point Boat Tail (SPBT) and Pointed Soft Point Boat Tail (PSPBT)	Soft Point Boat Tail (SPBT) and Pointed Soft Point Boat Tail (PSP BT) bullets have specially shaped back part of a reduced diameter, which lowers the air drag. The better ballistic coefficient of these bullets, primary PSP BT bullet, provides successful firing at longer distances, at which the bullet keeps higher striking energy with reduced drift and flatter trajectory.
Soft Point Round Nose (SPRN)	Soft Point Round Nose (SP RN) bullets have a blunt rounded nose and are suitable for short range shooting, especially in bushes (or in woods). The large lead weight exposed in the nose assures high energy impact and bullet mushrooming that is reliable even at smaller velocitiest. These bullets have larger bullet weight for a certain length.
Flat Soft Point (FSP)	Flat Soft Point (FSP) bullets have a flat lead nose of increased diameter. These bullets are suitable for use in the carbines with tubular magazines as they reduce the possibility of primer ignition in the cartridge placed in front due to recoil when firing. They expand reliably and penetrate deeply on light to medium game.
Hollow Soft Point (HSP)	Hollow Soft Point (HSP) bullets have a cavity in the nose which causes expansion and helps mushroooming during penetration.
Hollow Point (HP)	Hollow Point (HP) bullets are designed primary for shooting competition. Due to cavity in the nose, center of gravity is placed back, improving flight stability and accuracy. Hollow point initiates rapid expansion on impact.
Hollow Point Boat Tail (HPBT)	Hollow Point Boat Tail (HPBT) bullets have higher ballistic coefficient because of small meplat, long ogival and boat tail design. These features enable very accurate long range shooting, with flat trajectory and reduced wind drift.
Full Metal Jacket (FMJ)	Full Metal Jacket (FMJ) bullets are nonexpanding bullets with a full-length jacket opened at the base only. Due to their sharp nose, these bullets provide good penetration. They are suitable for target shooting, but also for varmint hunting as they cause minimal tissue damage and leave a small exit hole.
Full Metal Jacket Round Nose (FMJRN)	Full Metal Jacket Round Nose (FMJ RN) with rounded nose is suitable for short range shooting. They provide maximum penetration when hunting dangerous game.
Full Metal Jacket Boat Tail (FMJ BT)	Full Metal Jacket Boat Tail (FMJ BT) bullets are specially shaped bullets to reduce air resistance. The rear cone in combination with aerodynamically shaped ogival part provides high ballistic coefficient, slight velocity drop on trajectory, greater down-range energy and less wind drift as well.

Other Bullets

Semi Jacketed (SJ)	
Armour Piercing (AP)	Has an alloy core, instead of lead.
Boat Tail (BT)	The rear end of the cartridge is tapered to stabilize the projectile in flight.
Tracer Bullet	Tracer ammunition (tracers) are bullets or cannon-caliber projectiles that are built with a small pyrotechnic charge in their base. When fired, the pyrotechnic composition is ignited by the burning powder and burns very brightly, making the projectile trajectory visible to the naked eye during daylight, and very bright during nighttime firing. This allows the shooter to visually trace the flight path of the projectile and thus make necessary ballistic corrections, without having to confirm projectile impacts and without even using the sights of the weapon. Tracer fire can also be used as a marking tool to signal other shooters to concentrate their fire on a particular target during battle.

Ammo Performance

13 Gun Modifications

Firearm modification is commonly done in order to enhance various aspects of the performance of a firearm. Reasons for these modifications can range from cosmetic to functional, and can be simple operations that the owner can perform, or complex operations requiring the services of a gunsmith.

Accessories

Grips

Gun Holders

Gun Sights

A sight is an aiming device used to assist in visually aligning ranged weapons, surveying instruments or optical illumination equipments with the intended target. Sights can be a simple set or system of markers that have to be aligned together with the target (such as iron sights on firearms), or optical devices that allow the user to see a sometimes optically enhanced (e.g. magnified) image of the target aligned in the same focus with an aiming point (e.g. telescopic sights, reflector sights and holographic sights). There are also sights that project an aiming point (or a "hot spot") onto the target itself, such as laser sights and infrared illuminators on some night vision devices.

There are many types of sighting devices. They can be fixed, mechanical, optical, computational, or a mixture of all of these attributes.

Iron Sights	Iron sights operate simply. Most manufacturers install them as "standard"on commercially available rifles and pistols. A rear and front sight make up a set of iron sights. The front sight should be the shooter's focus when aiming; The rear sight is often adjustable to let the shooter account for windage and elevation. While more accurate sights are available, we don't see iron sights falling out of favor any time soon. They are generally low profile, simple to use and maintain, and don't require a power source. Open sights like you would see on a revolver are the more common of the iron sights. There are a ton of open sights out there. You may see any combination of differently shaped rear and front sights.
Telescopic Sight	Also called a scope, a telescopic sight is true to its name — think of it as a little telescope that is put on top of a rifle, or less frequently a pistol. The lens magnifies the distant target for the shooter, and a reticle in the sight's center indicates the point of aim. Naturally, self-defense seldom calls for a scope that can let you hit your target from several hundred feet away. This is why you'll find telescopic sights on the rifles of hunters, snipers, and target shooters. For instance, the optic on the AR-10 featured above can help take down game like deer from longer distances with .308 ammo than a red dot or iron sights would likely allow. A telescopic sight requires more finesse than iron sights when used properly. You have to take time to "sight-in" or zero-in telescopic sights before you use them. This helps ensure the sight reflects an accurate picture of where your shots will land with your specific firearm and ammunition. The primary disadvantage of telescopic sights is that they limit their user's field of vision. However, because telescopic sights require less visual acuity from the shooter than iron sights, they're often easier to use for those of us on the wrong side of 30.
Reflex Sight	A reflex sight is a handy device for quickly lining up a shot on a target at short to medium range. It utilizes reflective glass, may be magnified or non-magnified, and superimposes a reticle over the point of aim. The red dot sight is a commonly used type of reflex sight. It fittingly indicates the point of aim with a single red LED. The accuracy and speed provided by a red dot sight make it a good choice for a novice shooter who would like to quickly become proficient with their firearm. It allows aiming with both eyes open and without shifting focus. A larger diameter reticle makes acquiring a target even easier, but at the expense of obscuring it and making accurate long distance shooting more difficult. The downside to red dot sights is that they need a power source (albeit not a strong one). They also generally require closer positioning to the shooter's face, and good ones aren't cheap.
Laser Sight	You must zero in laser sights like telescopic sights, but once zeroed they permit far faster aiming than iron sights. Laser sights also facilitate with accurate rapid fire. Red lasers are most common because they are economical and require relatively little electricity, but their light is harder to see in bright sunlight. A green laser is preferable when the sun is shining, but it will be costlier. A laser's greatest drawbacks are that it makes its shooter a far more obvious target, is straight and therefore less capable of accommodating dropoff, and needs a significant energy supply. When laser guns become real, perhaps a very weak laser could also come out of the barrel for aiming purposes. We came up with that idea first — Lockheed Martin, please take note.
Red Dot Sights	Red Dot sights use lower magnification and can be incorporated into lower magnification telescopic sights. This type of optic comes either battery-powered or utilizes other sources of light such as fiber optics or luminescent materials. Despite its construction, all red dots provide the same sighting presentation — an illuminated, adjustable dot delivering precise aiming capabilities. Though it uses the "red" moniker, the dot doesn't have to be that color. Some may appear green or adopt other colors. These sights are popular options for short-range shooting due to the dot's ability to been seen in both peripheral vision direct focus. Non-magnifying red dot sights typically appear on pistols, carbines and shorter-range rifles. There are several kinds of red dots to include holographic sights, reflex sights and prism sights.
Holographic Sight	Holographic sights are precise non-magnifying optical sights that use a laser to project a fine reticle in a glass viewer. Battery-powered, they usually come with adjustable brightness settings. Holographic sights offer shooters faster acquisition than standard red dots because it allows the eye to focus on the target and the reticle simultaneously. Additionally, many holographic sights offer a larger view window which helps when shooting. Due to their patented technology and market demand, these optics, like the EOTech XPS2, are typically more expensive.
Prism Sights	Another optic that falls under the red dot catch-all is the prism sight. This type of optic is a compact device that uses a prism to magnify the image. Much like the telescopic sight, it can be adjusted to correct elevation and windage. Due to the compact prism used internally, prism sights are much smaller than telescopic sights. Prism sights usually offer a fixed magnification, typically towards the lower end of the power spectrum. The prism magnification also gives shorter eye relief than telescopic sights, requiring shooters to mount the optic much closer to be used properly.

Lighting

This includes any forms of lighting that can be attached to a gun such as a torch or a laser.

Mounted Torches

Mounted Lasers

Stock

A gunstock or often simply stock, the back portion of which is also known as a shoulder stock, a buttstock or simply a butt, is a part of a long gun that provides structural support, to which the barrel, action, and firing mechanism are attached. The stock also provides a means for the shooter to firmly brace the gun and easily aim with stability by being held against the user's shoulder when shooting the gun, and helps to counter muzzle rise by transmitting recoil straight into the shooter's body.

Stock Accessories

These are any accessories that can be mounted to the stock.

Magazines

A magazine is an ammunition storage and feeding device within or attached to a repeating firearm. Magazines can be removable (detachable) or integral (internal/fixed) to the firearm. The magazine functions by moving the cartridges stored within it into a position where they may be loaded into the barrel chamber by the action of the firearm. The detachable magazine is often colloquially referred to as a clip, although this is technically inaccurate.

Choke

In firearms, a choke is a tapered constriction of a gun barrel at the muzzle end. Chokes are most commonly seen on shotguns, but are also used on some rifles, pistols, or even airguns. Notably, some .22 LR match rifles have a constricted bore diameter near the muzzle.

Monopods & Bipods

A bipod is an attachment, usually to a weapon, that helps support and steady it. The bipod provides significant stability along two axes of motion (side-to-side, and up-and-down).

Recoil Pads

A recoil pad is a piece of rubber, foam, leather, or other soft material usually attached to the buttstock of a rifle or shotgun. Recoil pads may also be worn around the shoulder with straps, placing the soft material between the buttstock and the shoulder of the person firing the gun. The purpose of this device is to provide additional padding between the typically hard buttstock surface and the user's shoulder, to reduce the amount of felt recoil of the firearm, and to prevent slippage on the shooter's clothing while aiming.

Swivels

A swivel is a connection that allows the connected object, such as a gun, chair or swivel caster to rotate horizontally or vertically.

Suppressors

A silencer, also known as a sound suppressor, suppressor or sound moderator, is a muzzle device that reduces the acoustic intensity of the muzzle report (sound of gunfire) and eliminates muzzle flash when a gun (firearm or air gun) is discharged, by modulating the speed and pressure of the gas ejection from the muzzle and hence suppressing the muzzle blast. Like a muzzle brake, a silencer can be a detachable accessory mounted separately onto the muzzle, or an integral part of the barrel.

Silencers

Suppressor Sleeve

Flash Hider

Modifications

Common modifications include:
- Cosmetic and ergonomic modifications
  - Replacement or alteration of grips or stocks
  - Changing of sights, such as the adjustable iron sights or a telescopic sight
  - Adding or removing weight to ease carrying, alter balance, or help moderate recoil
  - Metal engraving or custom woodwork
  - Checkering or stippling wood or metal
  - Altering the metal finish, using techniques such as bluing, electroplating, or parkerizing
  - Use of a shorter barrel to reduce size and weight, or a longer barrel to increase velocity
- Caliber conversions
  - Rechambering or rebarreling for a new caliber, such as conversions made to chamber a wildcat cartridge
  - Use of a caliber conversion sleeve or other readily removable insert to fire a smaller, less expensive cartridge

- Operating mechanism conversions
  - Muzzleloading or paper cartridge to metallic cartridge conversions, such as the Allin conversion or Lund conversion
  - Conversion from fully automatic or select fire to semiautomatic only or manual operation, or vice versa
  - Short recoil to blowback conversions, used in various .22 Long Rifle conversions, such as the Colt Ace and J. A. Ceiner conversion kits.
  - Conversion from handgun to carbine or rifle
  - Addition of a rifled barrel to a shotgun to allow it to better fire shotgun slugs
- Accurizing
- Sporterizing

Legal Issues
Care must be taken when modifying firearms, as some operations may convert a legal firearm into an illegal one. An example of this is the restrictions in the US National Firearms Act, which define restricted classes of firearms. Examples of illegal firearms under this act are:

- Rifles with overall lengths under 26 inches, or barrels under 16 inches in length
- Shotguns with overall lengths under 26 inches, or barrels under 18 inches in length
- Machine guns
- A conversion to a fixed cartridge of over .50 caliber

These restrictions vary from location to location; some areas may restrict magazine capacity or require special safety devices such as loaded chamber indicators, integral locking mechanisms, magazine disconnects. Also commonly required are identifying marks such as serial numbers or firearm microstamping components, removal of which may be illegal Furthermore - conversion of semi-automatic weapons into select-fire weapons has been illegal for non-SOT holding gunsmiths since the passage of the Hughes Amendment in 1986.

Such weapons may be held only by law enforcement and military only except for "dealer samples" left in the hands of SOT holders. Fully automatic weapons converted to semi-automatic only operation are machine guns per the NFA. The BATFE's policy is "Once a machine gun, always a machine gun."

14 Weapon Handling

How to hold, shoot and reload various types of weapons.

Firing Stance

These are different techniques and stances in which you can shoot a weapon.

Standing	With neither arm supported, this is the most difficult position for firing an accurate shot. Rather than trying to hold the barrel steady, which is impossible, try to keep movement of the barrel to as small an area as possible. Smooth, natural motion will produce the best shot.
Sitting	Both arms are supported by your legs. Next to the prone position, this is the steadiest position.
Kneeling	With only one arm braced, the kneeling position is less steady than the prone and sitting positions.
Prone	The prone position is the steadiest of the four positions. Because it's the easiest to hold, it's the best position for mastering the fundamentals of firing—aiming, breath control, trigger squeeze, and follow through.

Firing Styles

These are the different ways you can fire a weapon.

Sighted Fire	
Hip Fire	Shooting a gun without using the sights at all. This is most commonly a video game term, but could apply to real weapons too.
Leading the Target: Swing-Through Method	The two most common methods of leading targets at long distances are swing-through and sustained lead. ● Swing-through is the best technique for the beginning student. ● Point your shotgun at a moving target and swing with it. Increase the speed of the gun so that the muzzle passes the target, and then fire. In other words, literally "swing through" the target and fire at a blank space in front of the target.
Leading the Target: Sustained Lead	The two most common methods of leading targets at long distances are swing-through and sustained lead. ● The sustained lead method is a little more challenging because it requires more experience. ● You estimate the length of the lead necessary to hit the target, and maintain that lead as you swing with the target, fire, and continue the swing.
Snap-Shooting	Snap-shooting is a technique to use if you must make a quick shot and the target is straight ahead at close range. You simply raise the shotgun, and point where you think the target will be when the shot arrives.

Firing Preparation

A list of recommended procedures to complete before firing.

Choosing a Choke

As with firing a rifle, good shotgun marksmanship begins with proper preparation, which includes adjusting your gun and ammunition for maximum performance and mastering shotgun techniques. You also must choose the proper choke.

A choke allows you to fine-tune your shotgun for the type of game you're hunting. Built-in or attached to the muzzle end of the barrel, the choke is a constriction that controls the shot string, thus affecting pellet density at various distances.
The tighter the constriction, the greater the distance that the cluster of pellets stays together. The looser the constriction, the faster the shot pattern spreads.

Here are the four most common chokes, ranging from most open to tightest.
- Cylinder (unchoked)
- Improved Cylinder
- Modified
- Full

Aiming

How to aim a gun properly and safely.

Determine Your Dominant Eye

Just as you have a dominant hand, you also have a dominant eye. You need to aim with the dominant—or master—eye for the most accurate shooting. Usually your dominant eye is the same as your dominant hand, but not always. You should determine which is your dominant eye before you sight-in your rifle or handgun.

To determine your dominant eye:
1. Form a triangular opening with your thumbs and forefingers.
2. Stretch your arms out in front of you.
3. Focus on a distant object while looking through the triangular opening and keeping both eyes open.
4. Bring your hands slowly to your face, keeping sight of the object through the opening; the opening will come to your dominant eye naturally.
5. If you're not sure, close one eye at a time. The weak eye will see the back of your hand; the strong one will be focused on the object in the triangle.

Sighting In

Sight alignment is the process of lining up rear and front sights. The sight picture is the image you see when the sights are aligned correctly with the target. To ensure that the bullet will travel to the target in your sight, it's necessary to sight-in your rifle or handgun.
- With an open sight, you line up the target with the blade or bead of the front sight within the notch of the rear sight.
- With an aperture sight, you line up the target so that the front sight is within the rear peephole.
- With a telescopic sight with a crosshair reticle, you line up the target with the crosshairs of the sight.
- With a telescopic sight with a dot reticle, you line up the target with the dot of the sight. The dot must be centered.

Rifle bullets don't travel in a straight line. They travel in an arc, formed by the pull of gravity. "Sighting-in" is a process of adjusting the sights to hit a target at a specific range. Deer hunters, for example, often sight-in their rifles to hit the bull's-eye at 100 yards. All rifles should be sighted-in before every hunt using the ammunition you plan to use, especially rifles with peep or telescopic sights. Guns you sighted-in prior to your last outing could have been knocked out of alignment by a single jolt. That misalignment could mean the difference between a successful hunt and a disappointing experience.

Other than ensuring accurate shots, sighting-in a rifle has other advantages:
- Forces you to practice
- Makes accurate shooting possible
- Helps identify problems with your firing technique
- Helps determine the farthest range at which you can hit your target
- Improves safety by helping you know where your rifle will fire
- Builds confidence in your shooting ability

Sighting-In Procedure
Fire your rifle from a solid bench rest with the forestock resting on a pad or a sandbag. Don't rest the gun on its barrel—it will shoot higher than normal. Ideally, use an adjustable shooting tripod with sandbags. A spotting scope is also useful.

Sight-in instructions are printed on some targets available from retail outlets or manufacturers. The sighting-in process for most centerfire rifles begins at 25 yards and then should be repeated at 100 yards. The basic steps involve firing at least three shots carefully and consistently at a target. If the bullets form a relatively small group of holes on the target, but not where you were aiming, the sights will have to be adjusted.

Adjusting Your Sight
When adjusting peep or telescopic sights, the rear sights or dials are adjusted by a certain number of minutes-of-angle, or "clicks," in a certain direction. Read the sight's instruction manual to see how much each click changes the sight at 100 yards. The rear sight is moved in the same direction you want your shot to move on the target. Moving shots from side to side is "adjusting for windage." Moving shots up or down is "adjusting for elevation."

Specific instructions about trajectory and what fractions or inches you should be above the bull's-eye at 25, 50, or 100 yards are usually included on sight-in targets. You also might consult a ballistics chart or get help from an experienced shooter.

Firing

Using correct firing techniques will help you steady the rifle for the most accurate shooting. Bear in mind that these are only the basics. Further study will help you understand other factors that can affect your accuracy, such as wind, heat, and parallax.

Firing Principles

Shooting From a Rest
When shooting in the field, the safest and most accurate shots are taken from a rest—a log, large rock, or other stable object. Don't rest the barrel directly on a hard surface, or the rifle will fire higher than normal—put some padding, such as a hat or a jacket, under the rifle.

Breathing
Your breathing can move the rifle just enough to throw off your shot.
- When you're ready to fire, draw a deep breath, and exhale about half of it.
- Then hold your breath as you squeeze the trigger.
- Bear in mind that if you hold your breath too long, your heart beats faster, which increases your pulse and causes the rifle to move. If you notice this happening, take another breath and start over.
- At times the excitement of spotting game will make it more difficult to control your breathing. Try to relax and follow the correct procedure.

Trigger Squeeze
Jerking the trigger or abruptly clenching the trigger hand can move the gun enough to cause a miss.
To squeeze the trigger without jarring the gun, simply apply slow, steady pressure until the gun fires.
Practice makes breath control and proper trigger squeeze habitual.

Follow Through
After the bullet fires, it's important to continue the squeeze or follow through. That prevents you from jerking the gun before the bullet has left the barrel.

Four Fundamentals for Accurate Shooting
1. Aim carefully, aligning your sights.
2. Take a deep breath, and then release about half of it.
3. Squeeze the trigger slowly.
4. Follow through.

Reloading

This section shows you how to reload the most common types of guns.

15 Maintenance

Maintenance

Firearm maintenance (or gun care for short) is a series of periodic preventive maintenance procedures aiming to ensure the proper function of a firearm, often with the use of a variety of specialized tools and chemical solutions. Typically such maintenance is performed by the owner of the firearm using either simple methods such as cleaning the firearm with oil or other cleaning solutions, or more sophisticated practices such as lubricating moving parts with oil/grease and recoating exposed surfaces with protective finishes such as varnishing or bluing.

When a firearm presents with physical damage related to the ordinary use of the firearm, or when a firearm malfunctions in a life-threatening manner, a professional gunsmith should perform advanced maintenance to determine if the firearm is repairable and/or safe to shoot anymore.

An inadequately maintained firearm will often accumulate excessive fouling and dirt within the barrel and receiver, which not only can clog up the rifling and decrease the firearm's accuracy and precision, but can also interfere with the proper operation of the action and lead to potentially dangerous malfunctions. Furthermore, some of the foulings and dirts are either corrosive themselves, or capable of making the firearm vulnerable to rusting and wears, and thus can lead to irreversible damages to the firearm over time.

The consequences of neglecting proper maintenance can be serious. For instance, during the Vietnam War, the newly issued M16A1 assault rifle was distributed to US troops with marketing literature from Colt Firearms claiming that the weapon was self-cleaning, which implied to many to mean that it did not have to be routinely maintained. However, this misapprehension compounded the rifle's design flaws and made the weapon notorious for repeated failures in combat, which led to needless casualties among US forces. Once the problem was acknowledged by the US military, the weapon was not only subject to upgrades, but US troops were also trained in proper maintenance of the weapon and supplied with cleaning kits and an illustrated booklet on the subject by Will Eisner.

The ordinary firing action releases fine particles of gunpowder, metals (mostly lead and copper from the bullet moving over the riflings) and other contaminates into the inner spaces of a firearm, which may cause malfunctions or in rarer cases of extreme buildup may raise the barrel pressure too high causing the firearm to explode (catastrophic failure) upon being fired. It has been widely reported that firearms without a spring to control the inertia of the firing pin require constant cleaning of the bolt assembly, as extremely dangerous phenomena such as slamfire may occur. Slamfire is a malfunction in which a firearm which is normally semi-automatic may temporarily and involuntarily become fully automatic, firing repeatedly — without another pull of the trigger — until the firearm is out of ammunition or jams.

Every major firearms manufacturer provides detailed information on the proper methods used to disassemble, clean and then reassemble a firearm they produced. This information is usually packaged with the firearm. In the event that this information is not present with the firearm at the point of purchase, it is advisable to ask the manufacturer where this information may be obtained. For safety reasons the manufacturer's directions for cleaning, maintenance and care should always be followed.

There are many different types of weapon and firearm cleaning kits available on for sale. These kits will give you the necessary tools and materials to properly clean your firearm safely and effectively. These kits help keep your firearm stay maintained and properly lubricated, making the firearm last longer without failure.

Firearms produce massive momentary forces upon firing a bullet. A typical 9mm projectile produces a maximum of 34,084 psi (2,350.0 bar) of pressure in the instant of firing. The amount of pressure a firearm may endure for the first few milliseconds after the cartridge fires can be over 2,300 times more than the normal atmospheric pressure. Therefore, it is important for the safety of the shooter, and the longevity of a firearm that it is properly lubricated as per the manufacturer's specifications.

When in an extreme and life-threatening situation such as preparing for combat, the manufacturer's recommended lubricants may not be available to soldiers, or others who may enter these scenarios.

If there is time to perform firearm maintenance before a life-threatening emergency (such as daily cleaning of a rifle in a combat zone) it may become necessary to use other sources of lubrication, as a firearm will function better with some lubricant than it will with none. One United States Marine Corps sergeant recounts that synthetic motor oil performed better than standard military issued lubricant in extreme conditions. However it is advisable to immediately return to the standard recommendation of the firearm manufacturer when conditions allow.

It is critically important that a firearm is free of ammunition before beginning maintenance. The National Rifle Association teaches gun owners that "before cleaning your gun, make absolutely sure that it is unloaded. The gun's action should be open during the cleaning process. Also, be sure that no ammunition is present in the cleaning area". When reassembling a firearm after it has been cleaned, it is very important to know how to put the weapon back together properly. Failure to reassemble your firearm properly could lead to malfunction when firing and could lead to injury.

Maintenance Tips

Clean your gun after every use. A good-quality firearm is a significant investment, whether you're using it for sport, hunting, or home defense. Make sure you give it the attention it deserves whenever you get back from a round of firing it. The whole cleaning process, start to finish, only takes 20 or 30 minutes. It's worth it to do it regularly. You might even consider getting out old guns from the back of the closet and doing them all at once while you've got the materials out.

Consider investing in a barrel snake and/or ultrasonic cleaners. Like everything else, gun cleaning technology is cutting edge. For rifles and shotguns, barrel snakes are long multi-purpose cleaners that make the job much quicker and easier, some featuring lights on the end that allow you to see the interior of the barrel much more easily. It cuts down on time and makes the job more efficient.

Store your guns unloaded in a cool and dry environment. To ensure the longest life for your gun, don't store them anywhere they'll be significantly affected by the elements. Keep them indoors, in temperature-controlled environments. Consider investing in trigger locks to keep your gun safe and tamper proof. Soft or hard cases are available for guns, anywhere as cheap as $15 or $20. If you have a higher budget, there are also lockable gun cabinets and safes made for the purpose of storing guns in a controlled and locked environment.

Cleaning

Properly inspecting and regularly cleaning your guns will keep them functioning effectively and firing safely. Because of the tiny explosion in the chamber every time you pull the trigger, residue and sediment are left on the inside of the barrel, making it essential that you take the time to clean it regularly to avoid dangerous malfunctions. You should clean a gun after every time you fire it, and particularly after target practice when you are firing lots of rounds.

Get a cleaning kit. Whether you purchase a pre-assmebled cleaning kit from a sporting goods store or you assemble the necessary components individually, you'll need a few basic things to have in your arsenal of cleaning supplies. A basic set includes:
- Cleaning solvent
- Lubricant, or gun oil
- A bore brush
- A patch holder and patches
- Cleaning rod
- A nylon cleaning brush
- Flashlight
- Cotton swabs
- Microfiber cloths for polishing

Unload your gun. Always take the time to properly unload your gun and double-check to make sure that it's unloaded every time you pick it up to clean it. Remember that your gun may still have a round ready to fire after you remove the magazine, so check and remove this round. After opening the chamber, look through the barrel from back to front. Confirm that no round remains inside, either in the chamber or stuck in the barrel. No gun can be considered unloaded until you have looked through the barrel.

Disassemble your gun only as much as the manufacturer recommends. Check the owner's manual for disassembly instructions to prepare the gun for cleaning. This will allow you to access all parts that become dirty from firing.
- Semi-automatic pistols and rifles will generally be stripped into their major components: barrel, slide, guide rod, frame and magazine. Revolvers, shotguns, and most other sorts of guns will not need to be stripped to clean them.
- Field stripping is not necessary to clean the gun thoroughly. Don't take apart your gun more than you have to unless it requires repair. Likewise, some guns can't be stripped at all and it won't be necessary to do anything but open the chamber to clean it.

Always clean your gun in a well-ventilated area. Find a a place with good air circulation to clean your guns. Solvent fumes are noxious and can make you sick. Likewise, the solvent and lubricant used just flat-out smell foul if you try to clean your guns indoors, so keep your family happy and don't stink up the joint. Cover your work surface with plastic bags, newspaper, or old towels you've saved for the purpose. Head out to the garage and put the door up, or clean your guns on a bright and dry day to get them cleaned properly.

Clean out the barrel with cleaning rod and patches. Soak the bore, or inside of the barrel, using a cleaning rod, patch holder and the right size cotton patches for your gun. Work from the back of the bore if you can. If not, use a muzzle guard. The muzzle guard keeps the cleaning rod from banging against the muzzle, which can cause your gun to malfunction. To thoroughly clean the barrel out, push a solvent-soaked patch through the bore until it exits the other end. Remove the patch, don't pull it back through. Pulling it back through will just redeposit all the gunk you clean off.

Alternate the bore brush and patches to thoroughly scrub the barrel. Remove the patch holder and attach the bore brush. Run the bore brush back and forth along the full length of the bore 3 or 4 times to loosen any debris. Next, reattach the patch holder and run solvent-soaked cotton patches through the bore. Remove them when they exit the front. Repeat this process until a patch comes out clean. Run one more dry patch through to dry it out and inspect it closely for any build-up you may have missed.

Lubricate the barrel. Attach the cotton mop to the cleaning rod. Apply a few drops of gun conditioner or lubricant to the cotton mop and run it through the bore to leave a light coating of gun oil on the inside. Clean and lubricate the action with solvent. Apply solvent to the gun brush and brush all parts of the action. Wipe them dry with a clean cloth. Next, lubricate the moving parts of the action lightly. A light coating helps prevent rust. A heavy coating gets gummy and attracts debris, so only use a small amount.

Wipe down the rest of your gun with a luster cloth. This is a flannel cloth that comes pre-treated with a silicon lubricant. It will remove any remaining debris, including acid from fingerprints, and add shine. If you don't have a particular cloth designated for cleaning guns, old t-shirts and pairs of socks work really well for the purpose. Use something you've got lying around and won't need to reuse.

Warfare

The components and aim of large scale warfare

"The object of war is not to die for your country
but to make the other bastard die for theirs."
George S. Patton

Introduction

This section covers the types of equipment, traps, units, vehicles, aircraft and ships you may see during a war. Knowing what each looks like and does can help you hide from them and give you foreknowledge what's likely to come.

Purpose	The aim of WARFARE is to give the reader a grasp of modern weapons and vehicles in the 21st century, where military units are perpetually alert and ready to strike. It starts off by covering land, sea, air and space materiel such as tanks, submarines, bombers and hypersonic missiles. Warfare also covers intelligence agencies, espionage and the different kinds of covert operations run across the world. Finally it covers electronic warfare such as drones, UAVs and robots and then moves to the traps and explosives currently in-use around the world so the reader can identify them if the need arises. By the end you should be able to easily identify the different assets of war and be able to understand each one's purpose and capability for the use of escaping the destruction it's designed to inflict.
Lost?	● For information on global wars, hacking and terrorism, see the MAN-MADE DISASTERS section. ● For the effects of nuclear warfare on our planet, see the MASS DESTRUCTION section. ● For tips on hiding from thermal and infrared technology, see the SECURITY section. ● For information on national security, see the SAFETY & SECURITY section. ● For buildings and shelters that can withstand modern missiles and nuclear weapons, see the SHELTER section. ● For personal defence against modern weapons, see the DEFENCE section. ● For the lootability of military bases and military vehicles, see the LOCATIONS section. ● For a description of the terms used in this section, see the ADDENDUM > Dictionary section.

Contents

1 Personnel

Any types of people employed by the army or special agencies to perform certain tasks.

Army Personnel

The Army calls its jobs military occupational specialties, or MOS. Each of the MOS requires advanced individual training and specialization. Army jobs can be divided into two basic categories: those that participate in combat missions and those that support the soldiers who are in combat roles. The Army has around 190 MOSs available for enlisted soldiers. Similar specialties are divided into "branches" or "fields." Below are the Army enlisted job fields.

Native Language Speaker	These soldiers are recruited for their native language abilities, and perform translation and interpreter duties in many foreign languages and cultures.	
Infantry	Infantry is the oldest and largest branch in the US Army combat arms, with its soldiers trained to use small arms, anti-armour or indirect fire weapons such as mortars during combat missions.	• Infantryman (Rifleman) • Indirect Fire Infantryman (Mortarman)
Corps of Engineers		
Field Artillery		
Air Defence Artillery		
Aviation		
Cyber Operations Specialist (COS)		
Special Forces		
Armour		
Signal Corps		
Judge Advocate General's Corps		
Electronic Warfare		
Military Police		
Military Intelligence		
Financial Management		
Psychological Operations		
Civil Affairs		
Adjutant General's Corps		
Public Affairs		
Acquisition Corps		
Chaplain		
Medical CMF		
Recruiting and Retention		
Transportation		
Ammunition		
Mechanical Maintenance		
Quartermaster Corps		
Electronic/Missile Maintenance		

Navy Personnel

Air Force Personnel

Aircrew Operations	
Cyberspace Career Field	
Command & Control Systems Operations	
Intelligence	
Aircrew Flight Equipment	

Safety	
Aircrew Protection	
Unmanned Aerospace Systems (UAS)	
Weather	
Aerospace Maintenance	
Comm-Elec / WireSystems Maintenance	
Fuels	
Logistics Plans	
Missile & Space Systems Maintenance	
Precision Measurement	
Maintenance Management Systems	
Material Management	
Transportation & Vehicle Maintenance	
Munitions & Weapons	
Information Management	
Communication-Computer Systems	
Cyberspace Support	
Civil Engineering	
Services	
Public Affairs	
Security Forces (Military Police)	
Mission Support	
Medical	
Dental	
Paralegal	
Chaplain Assistant	
Contracting	
Financial	
Special Investigations (OSI)	
Special Duty Identifiers	
Special Reporting Identifiers	

Special Forces (Green Berets)

Intelligence Officers

Secret Agents

Intelligence Agent

Provides access to sensitive information through the use of special privileges. If used in corporate intelligence gathering, this may include gathering information of a corporate business venture or stock portfolio. In economic intelligence, "Economic Analysts may use their specialized skills to analyse and interpret economic trends and developments, assess and track foreign financial activities, and develop new econometric and modelling methodologies." This may also include information of trade or tariff.

Access Agent

Provides access to other potential agents by providing profiling information that can help lead to recruitment into an intelligence service.

Agent of Influence

Provides political influence in an area of interest, possibly including publications needed to further an intelligence service agenda. The use of the media to print a story to mislead a foreign service into action, exposing their operations while under surveillance.

Agent Provocateur

An agent provocateur (French for "inciting agent") is a person who commits or who acts to entice another person to commit an illegal or rash act or falsely implicate them in partaking in an illegal act, so as to ruin the reputation or entice legal action against the target or a group they belong to. An agent provocateur may be a member of a law enforcement agency acting out of their own sense of duty or under orders, or other entity. They may target any group, such as a peaceful protest or demonstration, a union, a political party or a company. Prevention of infiltration by agents provocateurs, is part of the duty of demonstration marshals, also called stewards, deployed by organizers of large or controversial assemblies. An agent provocateur may be a police officer or a secret agent of police who encourages suspects to carry out a crime under conditions where evidence can be obtained; or who suggests the commission of a crime to another, in hopes they will go along with the suggestion and be convicted of the crime. A political organization or government may use agents provocateurs against political opponents. The provocateurs try to incite the opponent to do counter-productive or ineffective acts to foster public disdain or provide a pretext for aggression against the opponent. Historically, labour spies, hired to infiltrate, monitor, disrupt, or subvert union activities, have used agent provocateur tactics. Agent provocateur activities raise ethical and legal issues. In common law jurisdictions, the legal concept of entrapment may apply if the main impetus for the crime was the provocateur.

Facilities Agent

Provides access to buildings, such as garages or offices used for staging operations, resupply, etc.

Principal Agent

Functions as a handler for an established network of agents, usually considered "blue chip."

Confusion Agent

In espionage, a confusion agent is an individual who is dispatched for the primary purpose of confounding the intelligence or counterintelligence apparatus of another country, rather than for the purpose of collecting and transmitting information. Such an individual may provide misleading information, among other confusion tactics.

Sleeper Agent

A sleeper agent is a spy who is placed in a target country or organization not to undertake an immediate mission but to act as a potential asset if activated. Even if unactivated, the "sleeper agent" is still an asset and is still playing an active role in sedition, treason or espionage by virtue of agreeing to act if activated. Sleeper agents are popular plot devices in fiction, particularly in espionage fiction and science fiction. This common use in fiction is directly related to and results from repeated instances of real-life "sleeper agents" participating in spying, espionage, sedition, treason, and assassinations.

There are sleeper agents, most being portrayed unrealistically in movies and books. In espionage, a sleeper agent is one who has infiltrated into the target country and has "gone to sleep", sometimes for many years. The agent does nothing to communicate with the sponsor or any existing agents or to obtain information beyond what is in public sources. The agent can also be referred to as a 'deep cover' agent. The agent acquires jobs and identities, ideally ones that will prove useful in the future, and attempts to blend into everyday life as a normal citizen. Counter-espionage agencies in the target country cannot, in practice, closely watch all those who might possibly have been recruited some time before. In a sense, the best sleeper agents are those who do not need to be paid by the sponsor, as they are able to earn enough money to finance themselves. That avoids any possibly traceable payments from abroad. In such cases, it is possible that the sleeper agent might be successful enough to become what is sometimes termed an "agent of influence". Sleeper agents who have been discovered have often been natives of the target country who moved elsewhere in early life and were co-opted (perhaps for ideological or ethnic reasons) before returning to the target country. That is valuable to the sponsor as the sleeper's language and other skills can be those of a 'native' and thus less likely to trigger suspicion. Choosing and inserting sleeper agents has often posed difficulties, as it is uncertain that the target will be appropriate some years in the future. If the sponsor government and its policies change after the sleeper has been inserted, the sleeper might be found to have been planted in the wrong target.

Illegal Agent

Double Agent

WARFARE Personnel Secret Agent

In the field of counterintelligence, a double agent (also double secret agent) is an employee of a secret intelligence service for one country, whose primary purpose is to spy on a target organization of another country, but who, in fact, has been discovered by the target organization and is now spying on their own country's organization for the target organization. Double agentry may be practiced by spies of the target organization who infiltrate the controlling organization or may result from the turning (switching sides) of previously loyal agents of the controlling organization by the target. The threat of execution is the most common method of turning a captured agent (working for an intelligence service) into a double agent (working for a foreign intelligence service) or a double agent into a re-doubled agent. It is unlike a defector, who is not considered an agent as agents are in place to function for an intelligence service and defectors are not, but some consider that defectors in place are agents until they have defected. Double agents are often used to transmit disinformation or to identify other agents as part of counter-espionage operations. They are often very trusted by the controlling organization since the target organization will give them true, but useless or even counterproductive, information to pass along.

WARFARE Personnel Secret Agents

Redoubled Agent

A re-doubled agent is an agent who gets caught as a double agent and is forced to mislead the foreign intelligence service. F.M. Begoum describes the redoubled agent as "one whose duplicity in doubling for another service has been detected by his original sponsor and who has been persuaded to reverse his affections again".

WARFARE Personnel Secret Agents

Unwitting Double Agent

Offers or is forced to recruit as a double or redoubled agent and in the process is recruited by either a third-party intelligence service or his own government without the knowledge of the intended target intelligence service or the agent. This can be useful in capturing important information from an agent that is attempting to seek allegiance with another country. The double agent usually has knowledge of both intelligence services and can identify operational techniques of both, thus making third-party recruitment difficult or impossible. The knowledge of operational techniques can also affect the relationship between the operations officer (or case officer) and the agent if the case is transferred by an operational targeting officer to a new operations officer, leaving the new officer vulnerable to attack. This type of transfer may occur when an officer has completed his term of service or when his cover is blown.

Triple Agent

A triple agent is a spy who pretends to be a double agent for one side, while he or she is truthfully a double agent for the other side. Unlike a re-doubled agent, who changes allegiance due to being compromised, a triple agent is usually considered to have always been loyal to their original side. It may also refer to a spy who works for three opposing sides, such that each side thinks the spy works for them alone.

WARFARE Hierarchy

2 Hierarchy

Military organization or military organisation is the structuring of the armed forces of a state so as to offer such military capability as a national defence policy may require. In some countries paramilitary forces are included in a nation's armed forces, though not considered military. Armed forces that are not a part of military or paramilitary organizations, such as insurgent forces, often mimic military organizations, or use ad hoc structures, while formal military organization tends to use hierarchical forms.

WARFARE Hierarchy Army Hierarchy

Army Hierarchy

The following table gives an overview of some of the terms used to describe army hierarchy in armed forces across the world. Whilst it is recognized that there are differences between armies of different nations, many are modelled on the British or American models, or both. However, many military units and formations go back in history for a long time, and were devised by various military thinkers throughout European history. For example, the modern Corps was first introduced in France about 1805 by Napoleon as a more flexible tactical grouping of two or more divisions during the Napoleonic Wars. They have become part of the organization of most armies around the world.

Symbol	Name	Nature	Strength	Constituent Units	Commander or Leader
XXXXXX	region, theatre	Command	1,000,000–10,000,000	4+ army groups	general, army general, five-star general or field marshal
XXXXX	army group, front	Command	400,000–1,000,000	2+ armies	general, army general, five-star general or field marshal
XXXX	army	Command	100,000–200,000	2–4 corps	general, army general, four-star general or colonel general
XXX	corps	Formation	20,000–50,000	2+ divisions	lieutenant general, corps general or three-star general
XX	division, legion	Formation	6,000–20,000	2–4 brigades or regiments	major general, divisional general or two-star general
X	brigade	Formation	3,000–5,000	2+ regiments, 3–6 battalions or Commonwealth regiments	brigadier, brigadier general, brigade general, or one-star general (sometimes colonel)
III	regiment or group	Unit	1,000–3,000	2+ battalions or U.S. Cavalry squadrons	colonel
II	battalion, U.S. Cavalry squadron, Commonwealth armoured regiment or Argentine Army regiment/artillery group/battalion, German Abteilung, artillery or cavalry division in some languages, cohort	Unit	300–1,000	2–6 companies, batteries, U.S. Cavalry troops, or Commonwealth squadrons, Argentine squadrons/companies	lieutenant colonel
I	infantry company, artillery battery, U.S. Cavalry troop, Commonwealth armour or combat engineering squadron or Argentine cavalry squadron or engineering company	Subunit	80–250	2–8 platoons or Commonwealth troops	chief warrant officer, captain or major
•••	platoon or Commonwealth troop	Sub-subunit	26–55	2+ Section, or vehicles	warrant officer, first or second lieutenant
••	section or patrol	-	12–24	1–2+ squads or 3–6 fireteams	sergeant or staff sergeant

•	squad or crew	-	8–12	2–3 fireteams or 1+ cell	corporal or sergeant
Ø	fireteam or cell	-	4-Mar	n/a	lance corporal to sergeant
Ø	fire and manoeuvre team	-	3-Feb	n/a	any/private first class

Rungs may be skipped in this ladder: for example, typically NATO forces skip from battalion to brigade. Likewise, only large military powers may have organizations at the top levels and different armies and countries may also use traditional names, creating considerable confusion: For example, a British or Canadian armoured regiment (battalion) is divided into squadrons (companies) and troops (platoons), whereas an American cavalry squadron (battalion) is divided into troops (companies) and platoons. Army, army group, region, and theatre are all large formations that vary significantly between armed forces in size and hierarchy position. While divisions were the traditional level at which support elements (field artillery, hospital, logistics and maintenance, etc.) were added to the unit structure, since World War II, many brigades now have such support units, and since the 1980s, regiments also have been receiving support elements.

A regiment with such support elements is called a regimental combat team in US military parlance, or a battle group in the UK and other forces. During World War II the Red Army used the same basic organizational structure. However, in the beginning many units were greatly underpowered and their size was actually one level below on the ladder that is usually used elsewhere; for example, a division in the early-WWII Red Army would have been about the size of most nations' regiments or brigades. At the top of the ladder, what other nations would call an army group, the Red Army called a front. By contrast, during the same period the German Wehrmacht Army Groups, particularly on the Eastern Front, such as Army Group Centre significantly exceeded the above numbers, and were more cognate with the Soviet Strategic Directions.

Naval Hierarchy

Naval organization at the flotilla level and higher is less commonly abided by, as ships operate in smaller or larger groups in various situations that may change at a moment's notice. However, there is some common terminology used throughout navies to communicate the general concept of how many vessels might be in a unit. Navies are generally organized into groups for a specific purpose, usually strategic, and these organizational groupings appear and disappear frequently based on the conditions and demands placed upon a navy. This contrasts with army organization where units remain static, with the same men and equipment, over long periods of time.

Unit Name	Vessel Types	No. of Vessels	Officer in Command
Navy or Admiralty	All vessels in a navy	2+ Fleets	Fleet Admiral, Admiral of the Fleet, Grand Admiral or Admiral
Fleet	All vessels in an ocean or general region	2+ Battle Fleets or Task Forces	Admiral or Vice Admiral
Battle Fleet or Task Force	A large number of vessels of all types	2+ Task Groups	Vice Admiral
Task Group	A collection of complementary vessels	2+ Task Units or Squadrons	Rear Admiral (upper half) or Rear Admiral
Squadron or Task Unit	Usually capital ships	A small number of vessels	Rear Admiral (lower half), Commodore, or Flotilla Admiral
Flotilla or Task Unit	Usually not capital ships	A small number of vessels, usually of the same or similar types	Rear Admiral (lower half), Commodore, or Flotilla Admiral
Task Element	A single vessel	One	Captain or Commander

The five-star ranks of Admiral of the Fleet and Fleet Admiral have largely been out of regular use since the 1990s, with the exception of ceremonial or honorary appointments. Currently, all major navies are commanded by an admiral (four-star rank) or vice-admiral (three-star rank) depending on relative size. Smaller naval forces, such as the RNZN, or those navies that are effectively coastguards, are commanded by a rear-admiral (two-star rank), commodore (one-star rank) or even a captain. Aircraft carriers are typically commanded by a captain. Submarines and destroyers are typically commanded by a captain or commander. Corvettes, the smallest class of warship, are commanded by officers with the rank of commander or lieutenant-commander.

Auxiliary ships, including gunboats, minesweepers, patrol boats, military riverine craft, tenders and torpedo boats are usually commanded by lieutenants, sub-lieutenants or warrant officers. Usually, the smaller the vessel, the lower the rank of the ship's commander. For example, patrol boats are often commanded by ensigns, while frigates are rarely commanded by an officer below the rank of commander. Historical navies were far more rigid in structure. Ships were collected in divisions, which in turn were collected in numbered squadrons, which comprised a numbered fleet. Permission for a vessel to leave one unit and join another would have to be approved on paper. The modern U.S. Navy is primarily based on a number of standard groupings of vessels, including the carrier strike group and the Expeditionary Strike Group. Additionally, Naval organization continues aboard a single ship. The complement forms three or four departments (such as tactical and engineering), each of which has a number of divisions, followed by work centres.

Air Force Hierarchy

The organizational structures of air forces vary between nations: some air forces (such as the United States Air Force and the Royal Air Force) are divided into commands, groups and squadrons; others (such as the Soviet Air Force) have an Army-style organizational structure. The modern Royal Canadian Air Force uses Air Division as the formation between wings and the entire air command. Like the RAF, Canadian wings consist of squadrons.

Symbol	Unit Name (USAF/RAF/Other Air Forces)	No. of Personnel	No. of Aircraft	No. of Subordinate Units (USAF/RAF)	Officer in Command (USAF/RAF)
XXXXXX +	Air Force	Entire air force	Entire air force	All Major Commands / Commands	GAF / MRAF or Air Chf Mshl
XXXXX	Major Command/Command or Tactical Air Force / Russian Air army	Varies	Varies	By Region or Duty (subordinate units varies)	Gen/Air Chf Mshl or Air Mshl
XX	Numbered Air Force/No RAF equivalent/Aviation Division /Air Division/Air Brigade	By Region (subordinate units varies)	Varies	2+ Wings/Groups	Maj-Gen or Lt-Gen / N/A
X	Wing/Group (inc. EAGs)/Russian aviation brigade	1,000–5,000	48–100	2+ Groups/Wings	Brig-Gen/AVM or Air Cdre
III	Group/Wing (inc. EAWs) or Station/Russian aviation regiment	300–1,000	17–48	3–4 Squadrons/3–10 Flights	Col/Gp Capt or Wg Cdr
II	Squadron	100–300	7–16	3–4 Flights	Lt Col or Maj/Wg Cdr or Sqn Ldr
•••	Flight	20–100	4–6	2 Sections plus maintenance and support crew	Capt/Sqn Ldr or Flt Lt
••	Element or Section	5–20	n/a–2	n/a	Junior Officer or Senior NCO

•	Detail	2–4	n/a	n/a	Junior NCO

Task Force

A task force is a unit or formation created as a temporary grouping for a specific operational purpose. Aside from administrative hierarchical forms of organization that have evolved since the early 17th century in Europe, fighting forces have been grouped for specific operational purposes into mission-related organizations such as the German Kampfgruppe or the U.S. Combat Team (Army) and Task Force (Navy) during the Second World War, or the Soviet Operational manoeuvre group during the Cold War. In the British and Commonwealth armies the battlegroup became the usual grouping of companies during the Second World War and the Cold War. Within NATO, a Joint Task Force (JTF) would be such a temporary grouping that includes elements from more than one armed service, a Combined Task Force (CTF) would be such a temporary grouping that includes elements from more than one nation, and a Combined Joint Task Force (CJTF) would be such a temporary grouping that includes elements of more than one armed service and more than one nation.

3 Land Materiel

Materiel, refers to supplies, equipment, and weapons in military supply chain management, and typically supplies and equipment only in a commercial supply chain context.

Armoured Fighting Vehicles

An armoured fighting vehicle (AFV) is an armed combat vehicle protected by armour, generally combining operational mobility with offensive and defensive capabilities. AFVs can be wheeled or tracked. Main battle tanks, armoured cars, armoured self-propelled guns, and armoured personnel carriers are all examples of AFVs. Armoured fighting vehicles are classified according to their intended role on the battlefield and characteristics. The classifications are not absolute; two countries may classify the same vehicle differently, and the criteria change over time. For example, relatively lightly armed armoured personnel carriers were largely superseded by infantry fighting vehicles with much heavier armament in a similar role. Successful designs are often adapted to a wide variety of applications. For example, the MOWAG Piranha, originally designed as an APC, has been adapted to fill numerous roles such as a mortar carrier, infantry fighting vehicle, and assault gun.

Tank

Tank Classifications
Over time, tanks tended to be designed with heavier armour and weapons, increasing the weight of all tanks, so these classifications are relative to the average for the nation's tanks for any given period. An older tank design might be reclassified over time, such as a tank being first deployed as a medium tank, but in later years relegated to light tank roles. Tanks were also classified by roles that were independent of size, such as cavalry tank, cruiser tank, fast tank, infantry tank, tank destroyer, "assault" tank, or "breakthrough" tank. Military theorists initially tended to assign tanks to traditional military infantry, cavalry, and artillery roles, but later developed more specialized roles unique to tanks. In modern use, the heavy tank has fallen out of favour, being supplanted by more heavily armed and armoured descendant of the medium tanks – the universal main battle tank. The light tank has, in many armies, lost favour to cheaper, faster, lighter armoured cars; however, light tanks (or similar vehicles with other names) are still in service with a number of forces as reconnaissance vehicles, most notably the Russian Marines with the PT-76, the British Army with the Scimitar, and the Chinese Army with the Type 63.

Light Tanks	Smaller tanks with thinner armour and lower-powered guns, allowing for better tactical mobility and ease of strategic transport. These are intended for armoured reconnaissance, skirmishing, artillery observation, expeditionary warfare and supplementing airborne or naval landings. Light tanks are typically cheaper to build and maintain, but fare poorly against heavier tanks. They may be held in reserve for exploiting any breakthroughs in enemy lines, with the goal of disrupting communications and supply lines.
Medium Tanks	Mid-sized tanks with adequate armour and guns, and fair mobility, allowing for a balance of fighting abilities, mobility, cost, and transportability.
Heavy Tanks	Larger tanks with thick armour and more powerful guns, but less mobile and more difficult to transport. They were intended to be more than a match for typical enemy medium tanks, easily penetrating their armour while being much less susceptible to their attacks. Heavy tanks cost more to both build and maintain.

Main Battle Tank
Modern main battle tanks or "universal tanks" incorporate recent advances in automotive, artillery, armour, and electronic technology to combine the best characteristics of the historic medium and heavy tanks into a single, all around type. They are also the most expensive to mass-produce. A main battle tank is distinguished by its high level of firepower, mobility and armour protection relative to other vehicles of its era. It can cross comparatively rough terrain at high speeds, but its heavy-dependency on fuel, maintenance, and ammunition makes it logistically demanding. It has the heaviest armour of any AFVs on the battlefield, and carries a powerful precision-guided munition weapon systems that may be able to engage a wide variety of both ground targets and air targets. Despite significant advances in anti-tank warfare, it still remains the most versatile and fearsome land-based weapon-systems of the 21st-century, valued for its shock action and high survivability.

Tankette
A tankette is a tracked armed and armoured vehicle resembling a small "ultra-light tank" or "super-light tank" roughly the size of a car, mainly intended for light infantry support or scouting. They were one or two-man vehicles armed with a machine gun. Colloquially it may also simply mean a "small tank". Tankettes were designed and built by several nations between the 1920s and 1940s. They were very popular with smaller countries. Some saw some combat (with limited success) in World War II. However, the vulnerability of their light armour eventually caused the concept to be abandoned.

Super-Heavy Tank
The term "super-heavy tank" has been used to describe armoured fighting vehicles of extreme size, generally over 75 tonnes. Programs have been initiated on several occasions with the aim of creating an invincible siegeworks/breakthrough vehicle for penetrating enemy formations and fortifications without fear of being destroyed in combat. Examples were designed in World War I and World War II (such as the Panzer VIII Maus), along with a few in the Cold War. However, few working prototypes were built and there are no clear evidence any of these vehicles saw combat, as their immense size would have made most designs impractical.

Flame Tank
A flame tank is an otherwise-standard tank equipped with a flamethrower, most commonly used to supplement combined arms attacks against fortifications, confined spaces, or other obstacles. The type only reached significant use in the Second World War, during which the United States, Soviet Union, Germany, Italy, Japan and the United Kingdom (including members of the British Commonwealth) all produced flamethrower-equipped tanks. Usually, the flame projector replaced one of the tank's machineguns, however, some flame projectors replaced the tank's main gun. Fuel for the flame weapon was generally carried inside the tank, although a few designs mounted the fuel externally, such as the armoured trailer used on the Churchill Crocodile. Flame tanks have been superseded by thermobaric weapons such as the Russian TOS-1.

WARFARE

Automated Fighting Vehicles

Tank

Infantry Tank
The idea for this tank was developed during World War I by British and French. The infantry tank was designed to work in concert with infantry in the assault, moving mostly at a walking pace, and carrying heavy armour to survive defensive fire. Its main purpose was to suppress enemy fire, crush obstacles such as barbed-wire entanglements, and protect the infantry on their advance into and through enemy lines by giving mobile overwatch and cover. The French Renault FT was the first iteration of this concept. The British and French retained the concept between the wars and into the Second World War era. Because infantry tanks did not need to be fast, they could carry heavy armour. One of the best-known infantry tanks was the Matilda II of World War II. Other examples include the French R-35, the British Valentine, and the British Churchill.

Cruiser Tank
A cruiser tank, or cavalry tank, was designed to move fast and exploit penetrations of the enemy front. The idea originated in "Plan 1919", a British plan to break the trench deadlock of World War I in part via the use of high-speed tanks. The first cruiser tank was the British Whippet. Between the wars, this concept was implemented in the "fast tanks" pioneered by J. Walter Christie. These led to the Soviet BT tank series and the British cruiser tank series. During World War II, British cruiser tanks were designed to complement infantry tanks, exploiting gains made by the latter to attack and disrupt the enemy rear areas. In order to give them the required speed, cruiser designs sacrificed armour and armament compared to the infantry tanks. Pure British cruisers were generally replaced by more capable medium tanks such as the US Sherman and, to a lesser extent, the Cromwell by 1943. The Soviet fast tank (bistrokhodniy tank, or BT tank) classification also came out of the infantry/cavalry concept of armoured warfare and formed the basis for the British cruisers after 1936. The T-34 was a development of this line of tanks as well, though their armament, armour, and all-round capability places them firmly in the medium tank category.

Armoured Car

The armoured car is a wheeled, often lightly armoured, vehicle adapted as a fighting machine. Its earliest form consisted of a motorised ironside chassis fitted with firing ports. By World War I, this had evolved into a mobile fortress equipped with command equipment, searchlights, and machine guns for self-defence. It was soon proposed that the requirements for the armament and layout of armoured cars be somewhat similar to those on naval craft, resulting in turreted vehicles. The first example carried a single revolving cupola with a Vickers gun; modern armoured cars may boast heavier armament – ranging from twin machine guns to large calibre cannon. Some multi-axled wheeled fighting vehicles can be quite heavy, and superior to older or smaller tanks in terms of armour and armament. Others are often used in military marches and processions, or for the escorting of important figures. Under peacetime conditions, they form an essential part of most standing armies. Armoured car units can move without the assistance of transporters and cover great distances with fewer logistical problems than tracked vehicles. During World War II, armoured cars were used for reconnaissance alongside scout cars. Their guns were suitable for some defence if they encountered enemy armoured vehicles, but they were not intended to engage enemy tanks. Armoured cars have since been used in the offensive role against tanks with varying degrees of success, most notably during the South African Border War, Toyota War, the Invasion of Kuwait, and other lower-intensity conflicts.

Aerosani
An aerosani is a type of propeller-driven snowmobile, running on skis, used for communications, mail deliveries, medical aid, emergency recovery and border patrolling in northern Russia, as well as for recreation. Aerosanis were used by the Soviet Red Army during the Winter War and World War II. The first aerosanis may have been built by young Igor Sikorsky in 1909–10, before he built multi-engine airplanes and helicopters. They were very light plywood vehicles on skis, propelled by old airplane engines and propellers.

Scout Car
A scout car is a military armoured reconnaissance vehicle, capable of off-road mobility and often carrying mounted weapons such as machine guns for offensive capabilities and crew protection. They often only carry an operational crew aboard, which differentiates them from wheeled armoured personnel carriers (APCs) and Infantry Mobility Vehicles (IMVs), but early scout cars, such as the open-topped US M3 Scout Car could carry a crew of seven. The term is often used synonymously with the more general term armoured car, which also includes armoured civilian vehicles. They are also differentiated by being designed and built for purpose, as opposed to improvised "technicals" which might serve in the same role.

Reconnaissance Vehicle
A reconnaissance vehicle, also known as a scout vehicle, is a military vehicle used for forward reconnaissance. Both tracked and wheeled reconnaissance vehicles are in service. In some nations, light tanks such as the M551 Sheridan and AMX-13 are also used by scout platoons. Reconnaissance vehicles are usually designed with a low profile or small size and are lightly armoured, relying on speed and cover to escape detection. Their armament ranges from a medium machine gun to a large cannon. Modern examples are often fitted with ATGMs and a wide range of sensors. Some armoured personnel carriers and infantry mobility vehicle, such as the M113, TPz Fuchs, and Cadillac Gage Commando double in the reconnaissance role.

Internal Security Vehicle
An internal security vehicle (ISV), also known as an armoured security vehicle (ASV), is a combat vehicle used for suppressing civilian unrest. Security vehicles are typically armed with a turreted heavy machine gun and auxiliary medium machine gun. The vehicle is designed to minimize firepower dead space and the vehicles weapons can be depressed to a maximum of 12°. Non-lethal water cannons and tear gas cannons can provide suppressive fire in lieu of unnecessary deadly fire. The vehicle must be protected against weapons typical of riots. Protection from incendiary devices is achieved though coverage of the air intake and exhaust ports as well as a strong locking mechanism on the fuel opening. Turret and door locks prevent access to the interior of the vehicle by rioters. Vision blocks, ballistic glass and window shutters and outside surveillance cameras allow protected observation from within the vehicle. Wheeled 4x4 and 6x6 configurations are typical of security vehicles. Tracked security vehicles are often cumbersome and leave negative political connotations for being perceived as an imperial invading force.

Improvised Fighting Vehicle
An improvised fighting vehicle is a combat vehicle resulting from modifications to a civilian or military non-combat vehicle in order to give it a fighting capability. Such modifications usually consist of the grafting of armour plating and weapon systems. Various militaries have procured such vehicles, ever since the introduction of the first automobiles into military service. During the early days, the absence of a doctrine for the military use of automobiles or of an industry dedicated to producing them, lead to much improvisation in the creation of early armoured cars, and other such vehicles. Later, despite the advent of arms industries in many countries, several armies still resorted to using ad hoc contraptions, often in response to unexpected military situations, or as a result of the development of new tactics for which no available vehicle was suitable. The construction of improvised fighting vehicles may also reflect a lack of means for the force that uses them. This is especially true in developing countries, where various armies and guerrilla forces have used them, as they are more affordable than military-grade combat vehicles. Modern examples include military gun truck used by units of regular armies or other official government armed forces, based on a conventional cargo truck, that is able to carry a large weight of weapons and armour. They have mainly been used by regular armies to escort military convoys in regions subject to ambush by guerrilla forces. "Narco tanks", used by Mexican drug cartels in the Mexican Drug War, are built from such trucks, which combines operational mobility, tactical offensive, and defensive capabilities.

Troop Carriers (APC)

Troop-carrying AFVs are divided into three main types – armoured personnel carriers (APCs), infantry fighting vehicles (IFVs) and infantry mobility vehicles (IMV). The main difference between the three is their intended role – the APC is designed purely to transport troops and is armed for self-defence only – whereas the IFV is designed to provide close-quarters and anti-armour fire support to the infantry it carries. IMV is a wheeled armoured personnel carrier serving as a military patrol, reconnaissance or security vehicle.

Armoured Personnel Carrier
Armoured personnel carriers (APCs) are intended to carry infantry quickly and relatively safely to the point where they are deployed. In the Battle of Amiens, 8 August 1918, the British Mk V* (Mark Five Star) tank carried a small number of machine gunners as an experiment, but the men were debilitated by the conditions inside the vehicle. Later that year the first purpose-built APC, the British Mk IX (Mark Nine), appeared. In 1944, the Canadian general Guy Simonds ordered the conversion of redundant armoured vehicles to carry troops (generically named "Kangaroos"). This proved highly successful, even without training, and the concept was widely used in the 21st Army Group. Post-war, specialised designs were built, such as the Soviet BTR-60 and US M113.

WARFARE Automated Fighting Vehicles Troop Carriers (APC)

Infantry Fighting Vehicle
An infantry fighting vehicle (IFV), also known as a mechanized infantry combat vehicle (MICV), is a type of armoured fighting vehicle used to carry infantry into battle and provide direct fire support. The first example of an IFV was the West German Schützenpanzer Lang HS.30 which served in the Bundeswehr from 1958 until the early 1980s. IFVs are similar to armoured personnel carriers (APCs) and infantry carrier vehicles (ICVs), designed to transport a section or squad of infantry (generally between five and ten men) and their equipment. They are differentiated from APCs— which are purely "troop-transport" vehicles armed only for self-defence— because they are designed to give direct fire support to the dismounted infantry and so usually have significantly enhanced armament. IFVs also often have improved armour and some have firing ports (allowing the infantry to fire personal weapons while mounted). They are typically armed with an autocannon of 20 to 40 mm calibre, 7.62mm machine guns, anti-tank missiles (ATGMs) and/or surface-to-air missiles (SAMs). IFVs are usually tracked, but some wheeled vehicles fall into this category. IFVs are generally less heavily armed and armoured than main battle tanks. They sometimes carry anti-tank missiles to protect and support infantry against armoured threats, such as the NATO TOW missile and Soviet Bastion, which offer a significant threat to tanks. Specially equipped IFVs have taken on some of the roles of light tanks; they are used by reconnaissance organizations, and light IFVs are used by airborne units which must be able to fight without the heavy firepower of tanks.

Infantry Mobility Vehicle
An infantry mobility vehicle (IMV) or protected patrol vehicle (PPV) is a wheeled armoured personnel carrier (APC) serving as a military patrol, reconnaissance or security vehicle. Examples include the ATF Dingo, AMZ Dzik, AMZ Tur, Mungo ESK, and Bushmaster IMV. This term also applies to the vehicles currently being fielded as part of the MRAP program. IMVs were developed in response to the threats of modern counter insurgency warfare, with an emphasis on Ambush Protection and Mine-Resistance. Similar vehicles existed long before the term IMV was coined, such as the French VAB and South African Buffel. The term is coming more into use to differentiate light 4x4 wheeled APCs from the traditional 8x8 wheeled APCs. It is a neologism for what might have been classified in the past as an armoured scout car, such as the BRDM, but the IMV is distinguished by having a requirement to carry dismountable infantry. The up-armoured M1114 Humvee variant can be seen as an adaptation of the unarmoured Humvee to serve in the IMV role.

WARFARE Automated Fighting Vehicles Amphibious Vehicles

Amphibious Vehicles

Many modern military vehicles, ranging from light wheeled command and reconnaissance, through armoured personnel carriers and tanks, are manufactured with amphibious capabilities. Contemporary wheeled armoured amphibians include the French Véhicule de l'Avant Blindé and Véhicule Blindé Léger. The latter is a small, lightly armoured 4x4 all-terrain vehicle that is fully amphibious and can swim at 5.4 km/h. The VAB (Véhicule de l'Avant Blindé - "Armoured Vanguard Vehicle") is a fully amphibious armoured personnel carrier powered in the water by two water jets, that entered service in 1976 and produced in numerous configurations, ranging from basic personnel carrier, anti-tank missile platform. During the Cold War the Soviet bloc states developed a number of amphibious APCs, fighting vehicles and tanks, both wheeled and tracked. Most of the vehicles the Soviets designed were amphibious, or could ford deep water. Wheeled examples are the BRDM-1 and BRDM-2 4x4 armoured scout cars, as well as the BTR-60, BTR-70, BTR-80 and BTR-94 8x8 armoured personnel carriers and the BTR-90 infantry fighting vehicle.

The US Marine Corps currently uses the AAV7-A1 Assault Amphibious Vehicle, which was to be succeeded by the Expeditionary Fighting Vehicle, which was capable of planing on water and can achieve water speeds of 37–46 km/h. The EFV project has been cancelled. A significant amount of tracked armoured vehicles that are primarily intended for land-use, have some amphibious cability, tactically useful inland, reducing dependence on bridges. They use their tracks, sometimes with added propeller or water jets for propulsion. As long as the banks have a shallow enough slopes to enter or leave the water they can cross rivers and water obstacles. Some heavy tanks can operate amphibiously with a fabric skirt to add buoyancy. The Sherman DD tank used in the Normandy landings had this setup. When in water the waterproof float screen was raised and propellers deployed. Some modern vehicles use a similar skirt.

WARFARE Automated Fighting Vehicles Armoured Engineering Vehicle

Armoured Engineering Vehicle

Modern engineering AFV's utilize chassis based on main battle tank platforms: these vehicles are as well armoured and protected as tanks, designed to keep up tanks, conduct obstacle breaching operations to help tanks get to wherever it needs to be, perform utility functions necessary to expedite mission objectives of tanks, and to conduct other earth-moving and engineering work on the battlefield. These vehicles go by different names depending upon the country of use or manufacture. In the United States the term "combat engineer vehicle (CEV)" is used, in the United Kingdom the term "Armoured Vehicle Royal Engineers (AVRE)" is used, while in Canada and other commonwealth nations the term "armoured engineer vehicle (AEV)" is used. There is no set template for what such a vehicle will look like, yet likely features include a large dozer blade or mine ploughs, a large calibre demolition cannon, augers, winches, excavator arms and cranes, or lifting booms. Although the term "armoured engineer vehicle" is used specifically to describe these multi-purpose tank-based engineering vehicles, that term is also used more generically in British and Commonwealth militaries to describe all heavy tank-based engineering vehicles used in the support of mechanized forces. Thus, "armoured engineer vehicle" used generically would refer to AEV, AVLB, Assault Breachers, and so on. Good examples of this type of vehicle include the UK Trojan AVRE, the Russian IMR, and the US M728 Combat Engineer Vehicle.

Breaching Vehicle
A breaching vehicle is especially designed to clear pathways for troops and other vehicles through minefields and along roadside bombs and Improvised Explosive Devices. These vehicles are equipped with mechanical or other means for the breaching of man made obstacles. Common types of breaching vehicles include mechanical flails, mine plough vehicles, and mine roller vehicles.

Armoured Bulldozer
The armoured bulldozer is a basic tool of combat engineering. These combat engineering vehicles combine the earth moving capabilities of the bulldozer with armour which protects the vehicle and its operator in or near combat. Most are civilian bulldozers modified by addition of vehicle armour/military equipment, but some are tanks stripped of armament and fitted with a dozer blade. Some tanks have bulldozer blades while retaining their armament, but this does not make them armoured bulldozers as such, because combat remains the primary role – earth moving is a secondary task.

Armoured Recovery Vehicle
An armoured recovery vehicle (ARV) is a type of vehicle recovery armoured fighting vehicle used to repair battle- or mine-damaged as well as broken-down armoured vehicles during combat, or to tow them out of the danger zone for more extensive repairs. To this end the term "Armoured Repair and Recovery Vehicle" (ARRV) is also used. ARVs are normally built on the chassis of a main battle tank (MBT), but some are also constructed on the basis of other armoured fighting vehicles, mostly armoured personnel carriers (APCs). ARVs are usually built on the basis of a vehicle in the same class as they are supposed to recover; a tank-based ARV is used to recover tanks, while an APC-based one recovers APCs, but does not have the power to tow a much heavier tank.

Armoured Vehicle-Launched Bridge
An armoured vehicle-launched bridge (AVLB) is a combat support vehicle, sometimes regarded as a subtype of combat engineering vehicle, designed to assist militaries in rapidly deploying tanks and other armoured fighting vehicles across rivers. The AVLB is usually a tracked vehicle converted from a tank chassis to carry a folding metal bridge instead of weapons. The AVLB's job is to allow armoured or infantry units to cross water, when a river too deep for vehicles to wade through is reached, and no bridge is conveniently located (or sufficiently sturdy, a substantial concern when moving 60-ton tanks). The bridge layer unfolds and launches its cargo, providing a ready-made bridge across the obstacle in only minutes. Once the span has been put in place, the AVLB vehicle detaches from the bridge, and moves aside to allow traffic to pass. Once all of the vehicles have crossed, it crosses the bridge itself and reattaches to the bridge on the other side. It then retracts the span ready to move off again. A similar procedure can be employed to allow crossings of small chasms or similar obstructions. AVLBs can carry bridges of 60 feet (18 metres) or greater in length. By using a tank chassis, the bridge layer is able to cover the same terrain as main battle tanks, and the provision of armour allows them to operate even in the face of enemy fire. However, this is not a universal attribute: some exceptionally sturdy 6x6 or 8x8 truck chassis have lent themselves to bridge-layer applications.

Combat Engineer Section Carriers
The combat engineer section carriers are used to transport sappers (combat engineers) and can be fitted with a bulldozer's blade and other mine-breaching devices. They are often used as APCs because of their carrying ability and heavy protection. They are usually armed with machine guns and grenade launchers and usually tracked to provide enough tractive force to push blades and rakes. Some examples are the U.S. M113 APC, IDF Puma, Nagmachon, Husky, and U.S. M1132 ESV (a Stryker variant).

Air Defence Vehicles

An anti-aircraft vehicle, also known as a self-propelled anti-aircraft weapon (SPAA) or self-propelled air defence system (SPAD), is a mobile vehicle with a dedicated anti-aircraft capability. The Russian equivalent of SPAAG is ZSU (from zenitnaya samokhodnaya ustanovka – "anti-aircraft self-propelled mount"). Specific weapon systems used include machine guns, autocannons, larger guns, or missiles, and some mount both guns and longer-ranged missiles. Platforms used include both trucks and heavier combat vehicles, such as APCs and tanks, which add protection from aircraft, artillery, and small arms fire for front line deployment. Anti-aircraft guns are usually mounted in a quickly traversing turret with a high rate of elevation, for tracking fast-moving aircraft. They are often in dual or quadruple mounts, allowing a high rate of fire. Today, missiles (generally mounted on similar turrets) have largely supplanted anti-aircraft guns.

Self-Propelled Artillery

Self-propelled artillery vehicles give mobility to artillery. Within the term are covered self-propelled guns (or howitzers) and rocket artillery. They are highly mobile, usually based on tracked chassis carrying either a large howitzer or other field gun or alternatively a mortar or some form of rocket or missile launcher. They are usually used for long-range indirect bombardment support on the battlefield. In the past, self-propelled artillery has included direct-fire "Gun Motor Carriage" vehicles, such as assault guns and tank destroyers (also known as self-propelled anti-tank guns).

These have been heavily armoured vehicles, the former providing danger-close fire-support for infantry and the latter acting as specialized anti-tank vehicles. Modern self-propelled artillery vehicles may superficially resemble tanks, but they are generally lightly armoured, too lightly to survive in direct-fire combat. However, they protect their crews against shrapnel and small arms and are therefore usually included as armoured fighting vehicles. Many are equipped with machine guns for defence against enemy infantry. The key advantage of self-propelled over towed artillery is that it can be brought into action much faster. Before towed artillery can be used, it has to stop, unlimber and the guns set up.

To move position, the guns must be limbered up again and brought — usually towed — to the new location. By comparison, self-propelled artillery in combination with modern communications, can stop at a chosen location and begin firing almost immediately, then quickly move on to a new position. This ability is very useful in a mobile conflict and particularly on the advance. Conversely, towed artillery was and remains cheaper to build and maintain. It is also lighter and can be taken to places that self-propelled guns cannot reach, so despite the advantages of the self-propelled artillery, towed guns remain in the arsenals of many modern armies.

Assault Gun
An assault gun is a gun or howitzer mounted on a motor vehicle or armoured chassis, designed for use in the direct fire role in support of infantry when attacking other infantry or fortified positions. Historically, the custom-built fully armoured assault guns usually mounted the gun or howitzer in a fully enclosed casemate on a tank chassis. The use of a casemate instead of a gun turret limited these weapons' field of fire, but allowed a larger gun to be fitted relative to the chassis, more armour to be fitted for the same weight, and provided a cheaper construction. In most cases, these turretless vehicles also presented a lower profile as a target for the enemy.

Mortar Carrier
A mortar carrier is a self-propelled artillery vehicle carrying a mortar as its primary weapon. Mortar carriers cannot be fired while on the move and some must be dismounted to fire. In U.S. Army doctrine, mortar carriers provide close and immediate indirect fire support for manoeuvre units while allowing for rapid displacement and quick reaction to the tactical situation. The ability to relocate not only allows fire support to be provided where it is needed faster, but also allows these units to avoid counter-battery fire. Mortar carriers have traditionally avoided direct contact with the enemy. Many units report never using secondary weapons in combat. Prior to the Iraq War, American 120 mm mortar platoons reorganized from six M1064 mortar carriers and two M577 fire direction centres (FDC) to four M1064 and one FDC. The urban environment of Iraq made it difficult to utilize mortars. New technologies such as mortar ballistic computers and communication equipment and are being integrated. Modern era combat is becoming more reliant on direct fire support from mortar carrier machine guns.

Multiple Rocket Launcher
A multiple rocket launcher is a type of unguided rocket artillery system. Like other rocket artillery, multiple rocket launchers are less accurate and have a much lower (sustained) rate of fire than batteries of traditional artillery guns. However, they have the capability of simultaneously dropping many hundreds of kilograms of explosive, with devastating effect. The Korean Hwacha is an example of an early weapon system with a resemblance to the modern-day multiple rocket launcher. The first modern multiple rocket launcher was the German Nebelwerfer of the 1930s, a small towed artillery piece. Only later in World War II did the Allies deploy similar weapons in the form of the Land Mattress. The first self-propelled multiple rocket launchers – and arguably the most famous – were the Soviet BM-13 Katyushas, first used during World War II and exported to Soviet allies afterwards. They were simple systems in which a rack of launch rails was mounted on the back of a truck. This set the template for modern multiple rocket launchers. The Americans mounted tubular launchers atop M4 Sherman tanks to create the T34 Calliope rocket launching tank, only used in small numbers, as their closest equivalent to the Katyusha.

Tank Destroyer
Tank destroyers and tank hunters are armed with an anti-tank gun or missile launcher, and are designed specifically to engage enemy armoured vehicles. Many have been based on a tracked tank chassis, while others are wheeled. Since World War II, main battle tanks have largely replaced gun-armed tank destroyers; although lightly armoured anti tank guided missile (ATGM) carriers are commonly used for supplementary long-range anti-tank engagements.

In post-Cold War conflict, the resurgence of expeditionary warfare has seen the emergence of gun-armed wheeled vehicles, sometimes called "protected gun systems", which may bear a superficial resemblance to tank destroyers, but are employed as direct fire support units typically providing support in low intensity operations such as Iraq and Afghanistan. These have the advantage of easier deployment, as only the largest air transports can carry a main battle tank, and their smaller size makes them more effective in urban combat. Many forces' IFVs carry anti-tank missiles in every infantry platoon, and attack helicopters have also added anti-tank capability to the modern battlefield.

But there are still dedicated anti-tank vehicles with very heavy long-range missiles, or intended for airborne use. There have also been dedicated anti-tank vehicles built on ordinary armoured personnel carrier or armoured car chassis. Examples include the U.S. M901 ITV (Improved TOW Vehicle) and the Norwegian NM142, both on an M113 chassis, several Soviet ATGM launchers based on the BRDM reconnaissance car, the British FV438 Swingfire and FV102 Striker and the German Raketenjagdpanzer series built on the chassis of the HS 30 and Marder IFV.

Armoured Train

An armoured train is a railway train protected with armour. Armoured trains usually include railroad cars armed with artillery and machine guns. They were mostly used during the late 19th and early 20th century, when they offered an innovative way to quickly move large amounts of firepower. Most countries discontinued their use – road vehicles became much more powerful and offered more flexibility, and train tracks proved too vulnerable to sabotage as well as to attacks from the air. However, the Russian Federation used improvised armoured trains in the Second Chechen War of 1999–2009.

Carriage Roles

Artillery	Fielding a mixture of guns, machine guns and rocket launchers. See also railway guns.

Infantry	Designed to carry infantry units, may also mount machine guns.
Machine Gun	Dedicated to machine guns.
Anti-Aircraft	Equipped with anti-aircraft weapons.
Command	Similar to infantry wagons, but designed to be a train command centre.
Anti-Tank	Equipped with anti-tank guns, usually in a tank gun turret.
Platform	Unarmoured, used for any purpose from the transport of ammunition or vehicles, through track repair or derailing protection to railroad ploughs for track destruction.
Troop Sleepers	A railroad passenger car which had been constructed to serve as something of a mobile barracks (essentially, a sleeping car) for transporting troops over distances sufficient to require overnight accommodations.
Tank Transport	A light tank on a flatbed car which could be quickly offloaded by means of a ramp and used away from the range of the main railway line to chase down enemy partisans.
Missile Transport	The USSR had railway-based RT-23 Molodets ICBMs by the late 1980s (to reduce the chances of a first strike succeeding in destroying the launchers for a retaliatory strike). The US at one time proposed having a railway-based system for the MX Missile program but this never got past the planning stage.

Design
Different types of armour were used to protect from attack by tanks. In addition to various metal plates, concrete and sandbags were used in some cases for improvised armoured trains. Armoured trains were sometimes escorted by a kind of rail-tank called a draisine. One such example was the 'Littorina' armoured trolley which had a cab in the front and rear, each with a control set so it could be driven down the tracks in either direction. Littorina mounted two dual 7.92mm MG13 machine gun turrets from Panzer I light tanks.

Reconnaissance Vehicles

A reconnaissance vehicle, also known as a scout vehicle, is a military vehicle used for forward reconnaissance. Both tracked and wheeled reconnaissance vehicles are in service. In some nations, light tanks such as the M551 Sheridan and AMX-13 have also been used by scout platoons. Reconnaissance vehicles are usually designed with a low profile or small size and are lightly armoured, relying on speed and cover to escape detection. Their armament ranges from a medium machine gun to a large cannon. Modern examples are often fitted with ATGMs and a wide range of sensors.

Role
Reconnaissance of enemy positions can involve firing upon the enemy in hopes of receiving return fire that gives away the enemy's position. This can make the reconnaissance vehicle vulnerable to return fire that may destroy the vehicle before the enemy's position can be relayed. Dismounted operations by armed scouts include observation post manning, reconnaissance of areas not traversable by vehicle, and marking enemy mine fields. CBRN reconnaissance vehicles can also detect weapons of mass destruction. They accompany regular reconnaissance vehicles and are fully protected against airborne threats.

Military Engineering Vehicles

A military engineering vehicle is a vehicle built for the construction work or for the transportation of combat engineers on the battlefield. These vehicles may be modified civilian equipment or purpose-built military vehicles.

Civilian and Militarized Heavy Equipment

Military engineering can employ a wide variety of heavy equipment in the same or similar ways to how this equipment is used outside the military. Bulldozers, cranes, graders, excavators, dump trucks, loaders, and backhoes all see extensive use by military engineers. Military engineers may also use civilian heavy equipment which was modified for military applications. Typically, this involves adding armour for protection from battlefield hazards such as artillery, unexploded ordnance, mines, and small arms fire. Often this protection is provided by armour plates and steel jackets. Some examples of armoured civilian heavy equipment are the IDF Caterpillar D9, American D7 TPK, Canadian D6 armoured bulldozer, cranes, graders, excavators, and M35 2-1/2 ton cargo truck. Militarized heavy equipment may also take on the form of traditional civilian equipment designed and built to unique military specifications. These vehicles typically sacrifice some depth of capability from civilian models in order to gain greater speed and independence from prime movers. Examples of this type of vehicle include high speed backhoes such as the Australian Army's High Mobility Engineering Vehicle (HMEV) from Thales or the Canadian Army's Multi-Purpose Engineer Vehicle (MPEV) from Arva.

Armoured Engineering Vehicle

Typically based on the platform of a main battle tank, these vehicles go by different names depending upon the country of use or manufacture. In the US the term "combat engineer vehicle (CEV)" is used, in the UK the term "Armoured Vehicle Royal Engineers (AVRE)" is used, while in Canada and other commonwealth nations the term "armoured engineer vehicle (AEV)" is used. There is no set template for what such a vehicle will look like, yet likely features include a large dozer blade or mine ploughs, a large calibre demolition cannon, augers, winches, excavator arms and cranes or lifting booms. These vehicles are designed to directly conduct obstacle breaching operations and to conduct other earth-moving and engineering work on the battlefield. Good examples of this type of vehicle include the UK Trojan AVRE, the Russian IMR, and the US M728 Combat Engineer Vehicle. Although the term "armoured engineer vehicle" is used specifically to describe these multi-purpose tank based engineering vehicles, that term is also used more generically in British and Commonwealth militaries to describe all heavy tank based engineering vehicles used in the support of mechanized forces. Thus, "armoured engineer vehicle" used generically would refer to AEV, AVLB, Assault Breachers, and so on.

Armoured Earth Mover

Lighter and less multi-functional than the CEVs or AEVs described above, these vehicles are designed to conduct earth-moving work on the battlefield. These vehicles have greater high speed mobility than traditional heavy equipment and are protected against the effects of blast and fragmentation. Good examples are the American M9 ACE and the UK FV180 Combat Engineer Tractor.

Breaching Vehicle

These vehicles are equipped with mechanical or other means for the breaching of man made obstacles. Common types of breaching vehicles include mechanical flails, mine plough vehicles, and mine roller vehicles. In some cases, these vehicles will also mount Mine-clearing line charges. Breaching vehicles may be either converted armoured fighting vehicles or purpose built vehicles. In larger militaries, converted AFV are likely to be used as assault breachers while the breached obstacle is still covered by enemy observation and fire, and then purpose built breaching vehicles will create additional lanes for following forces. Good examples of breaching vehicles include the USMC M1 Assault Breacher Vehicle, the UK Aardvark JSFU, and the Singaporean Trailblazer.

WARFARE

Military Engineering Vehicles

Bridging Vehicles

Several types of military bridging vehicles have been developed. An armoured vehicle-launched bridge (AVLB) is typically a modified tank hull converted to carry a bridge into battle in order to support crossing ditches, small waterways, or other gap obstacles. Another type of bridging vehicle is the truck launched bridge. The Soviet TMM bridging truck could carry and launch a 10-meter bridge that could be daisy-chained with other TMM bridges to cross larger obstacles. More recent developments have seen the conversion of AVLB and truck launched bridge with launching systems that can be mounted on either tank or truck for bridges that are capable of supporting heavy main battle tanks. Earlier examples of bridging vehicles include a type in which a converted tank hull is the bridge. On these vehicles, the hull deck comprises the main portion of the tread way while ramps extend from the front and rear of the vehicle to allow other vehicles to climb over the bridging vehicle and cross obstacles. An example of this type of armoured bridging vehicle was the Churchill Ark used in the Second World War.

Combat Engineer Section Carriers

Another type of CEVs are armoured fighting vehicles which are used to transport sappers (combat engineers) and can be fitted with a bulldozer's blade and other mine-breaching devices. They are often used as APCs because of their carrying ability and heavy protection. They are usually armed with machine guns and grenade launchers and usually tracked to provide enough tractive force to push blades and rakes. Some examples are the U.S. M113 APC, IDF Puma, Nagmachon, Husky, and U.S. M1132 ESV (a Stryker variant).

Military Ferries and Amphibious Crossing Vehicles

One of the major tasks of military engineering is crossing major rivers. Several military engineering vehicles have been developed in various nations to achieve this task. One of the more common types is the amphibious ferry such as the M3 Amphibious Rig. These vehicles are self-propelled on land, they can transform into raft type ferries when in the water, and often multiple vehicles can connect to form larger rafts or floating bridges. Other types of military ferries, such as the Soviet Plavayushij Transportyor - Srednyj, are able to load while still on land and transport other vehicles cross country and over water. In addition to amphibious crossing vehicles, military engineers may also employ several types of boats. Military assault boats are small boats propelled by oars or an outboard motor and used to ferry dismounted infantry across water.

Anti-Aircraft

Anti-aircraft warfare or counter-air defence is defined by NATO as "all measures designed to nullify or reduce the effectiveness of hostile air action". They include surface based, subsurface (submarine launched), and air-based weapon systems, associated sensor systems, command and control arrangements and passive measures (e.g. barrage balloons). It may be used to protect naval, ground, and air forces in any location. However, for most countries the main effort has tended to be 'homeland defence'. NATO refers to airborne air defence as counter-air and naval air defence as anti-aircraft warfare. Missile defence is an extension of air defence as are initiatives to adapt air defence to the task of intercepting any projectile in flight. In some countries, such as Britain and Germany during the Second World War, the Soviet Union, NATO, and the United States, ground-based air defence and air defence aircraft have been under integrated command and control. However, while overall air defence may be for homeland defence including military facilities, forces in the field, wherever they are, invariably deploy their own air defence capability if there is an air threat. A surface-based air defence capability can also be deployed offensively to deny the use of airspace to an opponent. Until the 1950s, guns firing ballistic munitions ranging from 7.62 mm to 152.4 mm were the standard weapons; guided missiles then became dominant, except at the very shortest ranges (as with close-in weapon systems, which typically use rotary autocannons or, in very modern systems, surface-to-air adaptations of short range air-to-air missiles).

Artillery

Artillery is a class of heavy military weapons built to fire munitions far beyond the range and power of infantry's small arms. Early artillery development focused on the ability to breach defensive walls, and fortifications, and led to heavy, fairly immobile siege engines. As technology improved, lighter, more mobile field artillery developed for battlefield use. This development continues today; modern self-propelled artillery vehicles are highly mobile weapons of great versatility providing the largest share of an army's total firepower. In its earliest sense, the word artillery referred to any group of soldiers primarily armed with some form of manufactured weapon or armour. Since the introduction of gunpowder and cannon, the word "artillery" has largely meant cannon, and in contemporary usage, it usually refers to shell-firing guns, howitzers, mortars, rockets and guided missiles. In common speech, the word artillery is often used to refer to individual devices, along with their accessories and fittings, although these assemblages are more properly called "equipments". However, there is no generally recognised generic term for a gun, howitzer, mortar, and so forth: the United States uses "artillery piece", but most English-speaking armies use "gun" and "mortar". The projectiles fired are typically either "shot" (if solid) or "shell" (if not). "Shell" is a widely used generic term for a projectile, which is a component of munitions. By association, artillery may also refer to the arm of service that customarily operates such engines. In some armies one arm has operated field, coastal, anti-aircraft artillery and anti-tank artillery, in others these have been separate arms and in some nations coastal has been a naval or marine responsibility.

Artillery

In the 20th century technology based target acquisition devices, such as radar, and systems, such as sound ranging and flash spotting, emerged to acquire targets, primarily for artillery. These are usually operated by one or more of the artillery arms. The widespread adoption of indirect fire in the early 20th century introduced the need for specialist data for field artillery, notably survey and meteorological, in some armies provision of these are the responsibility of the artillery arm. Artillery originated for use against ground targets—against infantry, cavalry and other artillery. An early specialist development was coastal artillery for use against enemy ships. The early 20th century saw the development of a new class of artillery for use against aircraft: anti-aircraft guns. Artillery is arguably the most lethal form of land-based armament currently employed, and has been since at least the early Industrial Revolution. The majority of combat deaths in the Napoleonic Wars, World War I, and World War II were caused by artillery. In 1944, Joseph Stalin said in a speech that artillery was "the God of War".

Artillery Piece
Although not called as such, machines performing the role recognizable as artillery have been employed in warfare since antiquity. Historical references show artillery was first employed by the Roman legions at Syracuse in 399 BC. Until the introduction of gunpowder into western warfare, artillery was dependent upon mechanical energy which not only severely limited the kinetic energy of the projectiles, it also required the construction of very large engines to store sufficient energy. A 1st-century BC Roman catapult launching 6.55 kg (14.4 lb) stones achieved a kinetic energy of 16,000 joules, compared to a mid-19th-century 12-pounder gun, which fired a 4.1 kg (9.0 lb) round, with a kinetic energy of 240,000 joules, or a late 20th century US battleship that fired a 1,225 kg (2,701 lb) projectile from its main battery with an energy level surpassing 350,000,000 joules.

Precision-Guided Artillery
Modern artillery is most obviously distinguished by its long range, firing an explosive shell or rocket and a mobile carriage for firing and transport. However, its most important characteristic is the use of indirect fire, whereby the firing equipment is aimed without seeing the target through its sights. Indirect fire emerged at the beginning of the 20th century and was greatly enhanced by the development of predicted fire methods in World War I. However, indirect fire was area fire; it was and is not suitable for destroying point targets; its primary purpose is area suppression. Nevertheless, by the late 1970s precision-guided munitions started to appear, notably the US 155 mm Copperhead and its Soviet 152 mm Krasnopol equivalent that had success in Indian service. These relied on laser designation to 'illuminate' the target that the shell homed onto.

WARFARE Artillery Ammunition

However, in the early 21st Century, the Global Positioning System (GPS) enabled relatively cheap and accurate guidance for shells and missiles, notably the US 155 mm Excalibur and the 227 mm GMLRS rocket. The introduction of these led to a new issue, the need for very accurate three dimensional target coordinates—the mensuration process. Weapons covered by the term 'modern artillery' include "cannon" artillery (such as howitzer, mortar, and field gun) and rocket artillery. Certain smaller-calibre mortars are more properly designated small arms rather than artillery, albeit indirect-fire small arms. This term also came to include coastal artillery which traditionally defended coastal areas against seaborne attack and controlled the passage of ships.

With the advent of powered flight at the start of the 20th century, artillery also included ground-based anti-aircraft batteries. The term "artillery" has traditionally not been used for projectiles with internal guidance systems, preferring the term "missilery", though some modern artillery units employ surface-to-surface missiles. Advances in terminal guidance systems for small munitions has allowed large-calibre guided projectiles to be developed, blurring this distinction.

Ammunition

One of the most important roles of logistics is the supply of munitions as a primary type of artillery consumable, their storage (ammunition dump, arsenal, magazine) and the provision of fuses, detonators and warheads at the point where artillery troops will assemble the charge, projectile, bomb or shell.

A round of artillery ammunition comprises four components:
- Fuze
- Projectile
- Propellant
- Primer

Fuzes

Fuzes are the devices that initiate an artillery projectile, either to detonate its high explosive (HE) filling or eject its cargo (illuminating flare or smoke canisters being examples). The official military spelling is "fuze". Broadly there are four main types:
- Impact (including graze and delay)
- Mechanical time including airburst
- Proximity sensor including airburst
- Electronic time including airburst

Most artillery fuzes are nose fuzes. However, base fuzes have been used with armour piercing shells and for squash head (HESH or HEP) anti-tank shells. At least one nuclear shell and its non-nuclear spotting version also used a multi-deck mechanical time fuze fitted into its base. Impact fuzes were, and in some armies remain, the standard fuze for HE projectiles. Their default action is normally 'superquick', some have had a 'graze' action which allows them to penetrate light cover and others have 'delay'.

Delay fuzes allow the shell to penetrate the ground before exploding. Armour- or concrete-piercing fuzes are specially hardened. During World War I and later, ricochet fire with delay or graze fuzed HE shells, fired with a flat angle of descent, was used to achieve airburst. HE shells can be fitted with other fuzes. Airburst fuzes usually have a combined airburst and impact function. However, until the introduction of proximity fuzes, the airburst function was mostly used with cargo munitions—for example, shrapnel, illumination, and smoke. The larger calibers of anti-aircraft artillery are almost always used airburst. Airburst fuzes have to have the fuze length (running time) set on them.

This is done just before firing using either a wrench or a fuze setter pre-set to the required fuze length. Early airburst fuzes used igniferous timers which lasted into the second half of the 20th century. Mechanical time fuzes appeared in the early part of the century. These required a means of powering them. The Thiel mechanism used a spring and escapement (i.e. 'clockwork'), Junghans used centrifugal force and gears, and Dixi used centrifugal force and balls. From about 1980, electronic time fuzes started replacing mechanical ones for use with cargo munitions.

Proximity fuzes have been of two types: photo-electric or radar. The former was not very successful and seems only to have been used with British anti-aircraft artillery 'unrotated projectiles' (rockets) in World War II. Radar proximity fuzes were a big improvement over the mechanical (time) fuzes which they replaced. Mechanical time fuzes required an accurate calculation of their running time, which was affected by non-standard conditions. With HE (requiring a burst 20 to 30 feet (9.1 m) above the ground), if this was very slightly wrong the rounds would either hit the ground or burst too high. Accurate running time was less important with cargo munitions that burst much higher. The first radar proximity fuzes (codenamed 'VT') were invented by the British and developed by the US and initially used against aircraft in World War II.

Their ground use was delayed for fear of the enemy recovering 'blinds' (artillery shells which failed to detonate) and copying the fuze. The first proximity fuzes were designed to detonate about 30 feet (9.1 m) above the ground. These air-bursts are much more lethal against personnel than ground bursts because they deliver a greater proportion of useful fragments and deliver them into terrain where a prone soldier would be protected from ground bursts. However, proximity fuzes can suffer premature detonation because of the moisture in heavy rain clouds. This led to 'controlled variable time' (CVT) after World War II.

These fuzes have a mechanical timer that switched on the radar about 5 seconds before expected impact, they also detonated on impact. The proximity fuze emerged on the battlefields of Europe in late December 1944. They have become known as the U.S. Artillery's "Christmas present", and were much appreciated when they arrived during the Battle of the Bulge. They were also used to great effect in anti-aircraft projectiles in the Pacific against kamikaze as well as in Britain against V-1 flying bombs.

Electronic multi-function fuzes started to appear around 1980. Using solid-state electronics they were relatively cheap and reliable, and became the standard fitted fuze in operational ammunition stocks in some western armies. The early versions were often limited to proximity airburst, albeit with height of burst options, and impact. Some offered a go/no-go functional test through the fuze setter. Later versions introduced induction fuze setting and testing instead of physically placing a fuze setter on the fuze. The latest, such as Junghan's DM84U provide options giving, superquick, delay, a choice of proximity heights of burst, time and a choice of foliage penetration depths. A new type of artillery fuze will appear soon. In addition to other functions these offer some course correction capability, not full precision but sufficient to significantly reduce the dispersion of the shells on the ground.

Projectile

The projectile is the munition or "bullet" fired downrange. This may or may not be an explosive device. Traditionally, projectiles have been classified as "shot" or "shell", the former being solid and the latter having some form of "payload". Shells can also be divided into three configurations: bursting, base ejection or nose ejection. The latter is sometimes called the shrapnel configuration. The most modern is base ejection, which was introduced in World War I. Both base and nose ejection are almost always used with airburst fuzes. Bursting shells use various types of fuze depending on the nature of the payload and the tactical need at the time.

Payloads have included:
Bursting: High-explosive, white phosphorus ("Willie Pete" or "Wilson Picket"), coloured marker, chemical, nuclear devices; high explosive anti-tank (HEAT) and canister may be considered special types of bursting shell.
Nose Ejection: Shrapnel, star, incendiary and flechette (a more modern version of shrapnel).
Base Ejection: Dual purpose improved conventional munitions (DPICM)-bomblets, which arm themselves and function after a set number of rotations after having been ejected from the projectile (this produces unexploded sub-munitions, or "duds", which remain dangerous), scatterable mines, illuminating, coloured flare, smoke, incendiary, propaganda, chaff (foil to jam radars) and modern exotics such as electronic payloads and sensor-fuzed munitions.

Stabilization

Rifled	Traditionally, artillery projectiles have been spin-stabilised, meaning that they spin in flight so that gyroscopic forces prevent them from tumbling. Spin is induced by gun barrels having rifling which engages a soft metal band around the projectile, called a "driving band" (UK) or "rotating band" (U.S.). The driving band is usually made of copper, but synthetic materials have also been used.
Smoothbore/Fin-Stabilized	In modern artillery, smoothbore tubes have been used mostly by mortars. These projectiles use fins in the airflow at their rear to maintain correct orientation. The primary benefits over rifled barrels is reduced barrel wear, longer ranges that can be achieved (due to the reduced loss of energy to friction and gas escaping around the projectile via the rifling) and larger explosive cores for a given calibre artillery due to less metal needing to be used to form the case of the projectile because of less force applied to the shell from the non-rifled sides of the barrel of smooth bore guns.
Rifled/Fin-Stabilized	A combination of the above can be used, where the barrel is rifled, but the projectile also has deployable fins for stabilization, guidance or gliding.

Propellant

Most forms of artillery require a propellant to propel the projectile at the target. Propellant is always a low explosive, this means it deflagrates instead of detonating, as with high explosives. The shell is accelerated to a high velocity in a very short time by the rapid generation of gas from the burning propellant. This high pressure is achieved by burning the propellant in a contained area, either the chamber of a gun barrel or the combustion chamber of a rocket motor. Until the late 19th century, the only available propellant was black powder. Black powder had many disadvantages as a propellant; it has relatively low power, requiring large amounts of powder to fire projectiles, and created thick clouds of white smoke that would obscure the targets, betray the positions of guns, and make aiming impossible.

In 1846, nitrocellulose (also known as guncotton) was discovered, and the high explosive nitroglycerin was discovered at much the same time. Nitrocellulose was significantly more powerful than black powder, and was smokeless. Early guncotton was unstable, however, and burned very fast and hot, leading to greatly increased barrel wear. Widespread introduction of smokeless powder would wait until the advent of the double-base powders, which combine nitrocellulose and nitroglycerin to produce powerful, smokeless, stable propellant.

Many other formulations were developed in the following decades, generally trying to find the optimum characteristics of a good artillery propellant; low temperature, high energy, non-corrosive, highly stable, cheap, and easy to manufacture in large quantities. Broadly, modern gun propellants are divided into three classes: single-base propellants which are mainly or entirely nitrocellulose based, double-base propellants composed of a combination of nitrocellulose and nitroglycerin, and triple base composed of a combination of nitrocellulose and nitroglycerin and Nitroguanidine.

Artillery shells fired from a barrel can be assisted to greater range in three ways:
- Rocket-assisted projectiles (RAP) enhance and sustain the projectile's velocity by providing additional 'push' from a small rocket motor that is part of the projectile's base.
- Base bleed uses a small pyrotechnic charge at the base of the projectile to introduce sufficient combustion products into the low-pressure region behind the base of the projectile responsible for a large proportion of the drag.
- Ramjet-assisted, similar to rocket-assisted, but using a ramjet instead of a rocket motor; it is anticipated that a ramjet-assisted 120-mm mortar shell could reach a range of 22 mi (35 km).

Propelling charges for tube artillery can be provided in one of two ways: either as cartridge bags or in metal cartridge cases. Generally, anti-aircraft artillery and smaller-calibre (up to 3" or 76.2 mm) guns use metal cartridge cases that include the round and propellant, similar to a modern rifle cartridge. This simplifies loading and is necessary for very high rates of fire. Bagged propellant allows the amount of powder to be raised or lowered, depending on the range to the target. It also makes handling of larger shells easier. Each requires a totally different type of breech to the other. A metal case holds an integral primer to initiate the propellant and provides the gas seal to prevent the gases leaking out of the breech; this is called obturation. With bagged charges, the breech itself provides obturation and holds the primer. In either case, the primer is usually percussion, but electrical is also used, and laser ignition is emerging. Modern 155 mm guns have a primer magazine fitted to their breech.

Artillery ammunition has four classifications according to use:

Service	Ammunition used in live fire training or for wartime use in a combat zone. Also known as "warshot" ammunition.
Practice	Ammunition with a non- or minimally-explosive projectile that mimics the characteristics (range, accuracy) of live rounds for use under training conditions. Practice artillery ammunition often utilizes a coloured-smoke-generating bursting charge for marking purposes in place of the normal high-explosive charge.
Dummy	Ammunition with an inert warhead, inert primer, and no propellant; used for training or display.
Blank	Ammunition with live primer, greatly reduced propellant charge (typically black powder), and no projectile; used for training, demonstration or ceremonial use.

Field Artillery System

Because field artillery mostly uses indirect fire the guns have to be part of a system that enables them to attack targets invisible to them in accordance with the combined arms plan. The main functions in the field artillery system are:
- Communications
- Command: authority to allocate resources;
- Target acquisition: detect, identify and deduce the location of targets;
- Control: authority to decide which targets to attack and allot fire units to the attack;
- Computation of firing data – to deliver fire from a fire unit onto its target;
- Fire units: guns, launchers or mortars grouped together;
- Specialist services: produce data to support the production of accurate firing data;
- Logistic services: to provide combat supplies, particularly ammunition, and equipment support.

All these calculations to produce a quadrant elevation (or range) and azimuth were done manually using instruments, tablulated, data of the moment, and approximations until battlefield computers started appearing in the 1960s and 1970s. While some early calculators copied the manual method (typically substituting polynomials for tabulated data), computers use a different approach. They simulate a shell's trajectory by 'flying' it in short steps and applying data about the conditions affecting the trajectory at each step. This simulation is repeated until it produces a quadrant elevation and azimuth that lands the shell within the required 'closing' distance of the target coordinates. NATO has a standard ballistic model for computer calculations and has expanded the scope of this into the NATO Armaments Ballistic Kernel (NABK) within the SG2 Shareable (Fire Control) Software Suite (S4).

Classifications

Artillery types can be categorised in several ways, for example by type or size of weapon or ordnance, by role or by organizational arrangements.

Heavy Artillery	Capable of firing a long distance to bombard its target.
Field Artillery	Mobile weapons used to support armies in the field. Subcategories include:

Infantry Support Guns	Directly support infantry units.
Mountain Guns	Lightweight weapons that can be moved through difficult terrain.
Field Guns	Capable of long range fire.
Howitzers	Capable of high angle fire, they are most often employed for indirect-fire.
Gun Howitzers	Capable of high or low angle fire with a long barrel.
Mortars	Typically short-barreled, high-trajectory weapons designed primarily for an indirect-fire role.
Anti-Tank Artillery	Weapons, usually mobile, designed for attacking tanks.
Anti-Aircraft Artillery	Weapons, usually mobile, designed for attacking aircraft from the ground. Some guns were suitable for dual-role anti-aircraft and field (anti-tank) use. The World War II German 88 mm gun was a famous example.
Rocket Artillery	Rocket-launched instead of shot or shell.
Railway Gun	Large-calibre weapons that are mounted on, transported by and fired from specially-designed railway wagons.
Naval Artillery	Guns mounted on warships and used either against other ships or in support of ground forces. The crowning achievement of naval artillery was the battleship, but the advent of airpower and missiles have rendered this type of artillery largely obsolete. They are typically longer-barreled, low-trajectory, high-velocity weapons designed primarily for a direct-fire role.
Coastal Artillery	Fixed-position weapons dedicated to defence of a particular location, usually a coast (for example, the Atlantic Wall in World War II) or harbour. Not needing to be mobile, coastal artillery used to be much larger than equivalent field artillery pieces, giving them longer range and more destructive power. Modern coastal artillery (for example, Russia's "Bereg" system) is often self-propelled, (allowing it to avoid counter-battery fire) and fully integrated, meaning that each battery has all of the support systems that it requires (maintenance, targeting radar, etc.) organic to its unit.
Other Categories	Modern field artillery can also be split into two other subcategories: towed and self-propelled. As the name suggests, towed artillery has a prime mover, usually an artillery tractor or truck, to move the piece, crew, and ammunition around. Towed artillery is in some cases equipped with an APU for small displacements. Self-propelled artillery is permanently mounted on a carriage or vehicle with room for the crew and ammunition and is thus capable of moving quickly from one firing position to another, both to support the fluid nature of modern combat and to avoid counter-battery fire. It includes mortar carrier vehicles, many of which allow the mortar to be removed from the vehicle and used dismounted, potentially in terrain in which the vehicle cannot navigate, or in order to avoid detection.

Equipment Types

The three main types of artillery "gun" are guns, howitzers, and mortars. During the 20th century, guns and howitzers have steadily merged in artillery use, making a distinction between the terms somewhat meaningless. By the end of the 20th century, true guns with calibers larger than about 60 mm had become very rare in artillery use, the main users being tanks, ships, and a few residual anti-aircraft and coastal guns. The term "cannon" is a United States generic term that includes guns, howitzers, and mortars; it is not used in other English speaking armies. The traditional definitions differentiated between guns and howitzers in terms of maximum elevation (well less than 45° as opposed to close to or greater than 45°), number of charges (one or more than one charge), and having higher or lower muzzle velocity, sometimes indicated by barrel length. These three criteria give eight possible combinations, of which guns and howitzers are but two. However, modern "howitzers" have higher velocities and longer barrels than the equivalent "guns" of the first half of the 20th century. True guns are characterized by long range, having a maximum elevation significantly less than 45°, a high muzzle velocity and hence a relatively long barrel, smooth bore (no rifling) and a single charge.

The latter often led to fixed ammunition where the projectile is locked to the cartridge case. There is no generally accepted minimum muzzle velocity or barrel length associated with a gun. Howitzers can fire at maximum elevations at least close to 45°; elevations up to about 70° are normal for modern howitzers. Howitzers also have a choice of charges, meaning that the same elevation angle of fire will achieve a different range depending on the charge used. They have rifled bores, lower muzzle velocities and shorter barrels than equivalent guns. All this means they can deliver fire with a steep angle of descent. Because of their multi-charge capability, their ammunition is mostly separate loading (the projectile and propellant are loaded separately). That leaves six combinations of the three criteria, some of which have been termed gun howitzers. A term first used in the 1930s when howitzers with a relatively high maximum muzzle velocities were introduced, it never became widely accepted, most armies electing to widen the definition of "gun" or "howitzer". By the 1960s, most equipments had maximum elevations up to about 70°, were multi-charge, had quite high maximum muzzle velocities and relatively long barrels.

Equipment types

Mortars are simpler. The modern mortar originated in World War I and there were several patterns. After that war, most mortars settled on the Stokes pattern, characterized by a short barrel, smooth bore, low muzzle velocity, elevation angle of firing generally greater than 45°, and a very simple and light mounting using a "baseplate" on the ground. The projectile with its integral propelling charge was dropped down the barrel from the muzzle to hit a fixed firing pin. Since that time, a few mortars have become rifled and adopted breech loading. There are other recognized typifying characteristics for artillery. One such characteristic is the type of obturation used to seal the chamber and prevent gases escaping through the breech. This may use a metal cartridge case that also holds the propelling charge, a configuration called "QF" or "quickfiring" by some nations. The alternative does not use a metal cartridge case, the propellant being merely bagged or in combustible cases with the breech itself providing all the sealing. This is called "BL" or "breech loading" by some nations.

A second characteristic is the form of propulsion. Modern equipment can either be towed or self-propelled (SP). A towed gun fires from the ground and any inherent protection is limited to a gun shield. Towing by horse teams lasted throughout World War II in some armies, but others were fully mechanized with wheeled or tracked gun towing vehicles by the outbreak of that war. The size of a towing vehicle depends on the weight of the equipment and the amount of ammunition it has to carry. A variation of towed is portee, where the vehicle carries the gun which is dismounted for firing. Mortars are often carried this way. A mortar is sometimes carried in an armoured vehicle and can either fire from it or be dismounted to fire from the ground. Since the early 1960s it has been possible to carry lighter towed guns and most mortars by helicopter.

Even before that, they were parachuted or landed by glider from the time of the first airborne trials in the USSR in the 1930s. In an SP equipment, the gun is an integral part of the vehicle that carries it. SPs first appeared during World War I, but did not really develop until World War II. They are mostly tracked vehicles, but wheeled SPs started to appear in the 1970s. Some SPs have no armour and carry little or no ammunition. Armoured SPs usually carry a useful ammunition load. Early armoured SPs were mostly a "casemate" configuration, in essence an open top armoured box offering only limited traverse. However, most modern armoured SPs have a full enclosed armoured turret, usually giving full traverse for the gun. Many SPs cannot fire without deploying stabilizers or spades, sometimes hydraulic. A few SPs are designed so that the recoil forces of the gun are transferred directly onto the ground through a baseplate.

A few towed guns have been given limited self-propulsion by means of an auxiliary engine. Two other forms of tactical propulsion were used in the first half of the 20th century: Railways or transporting the equipment by road, as two or three separate loads, with disassembly and re-assembly at the beginning and end of the journey. Railway artillery took two forms, railway mountings for heavy and super-heavy guns and howitzers and armoured trains as "fighting vehicles" armed with light artillery in a direct fire role. Disassembled transport was also used with heavy and super heavy weapons and lasted into the 1950s.

Application of Fire

There are several dimensions to this subject. The first is the notion that fire may be against an opportunity target or may be prearranged. If it is the latter it may be either on-call or scheduled. Prearranged targets may be part of a fire plan. Fire may be either observed or unobserved, if the former it may be adjusted, if the latter then it has to be predicted. Observation of adjusted fire may be directly by a forward observer or indirectly via some other target acquisition system. NATO also recognises several different types of fire support for tactical purposes:

Application of Fire

Counterbattery Fire	Delivered for the purpose of destroying or neutralizing the enemy's fire support system.
Counterpreparation Fire	Intensive prearranged fire delivered when the imminence of the enemy attack is discovered.
Covering Fire	Used to protect troops when they are within range of enemy small arms.
Defensive Fire	Delivered by supporting units to assist and protect a unit engaged in a defensive action.
Final Protective Fire	An immediately available prearranged barrier of fire designed to impede enemy movement across defensive lines or areas.
Harassing Fire	A random number of shells are fired at random intervals, without any pattern to it that the enemy can predict. This process is designed to hinder enemy forces' movement, and, by the constantly imposed stress, threat of losses and inability of enemy forces to relax or sleep, lowers their morale.
Interdiction Fire	Placed on an area or point to prevent the enemy from using the area or point.
Preparation Fire	Delivered before an attack to weaken the enemy position.

These purposes have existed for most of the 20th century, although their definitions have evolved and will continue to do so, lack of suppression in counterbattery is an omission. Broadly they can be defined as either:

Deep Supporting Fire	Directed at objectives not in the immediate vicinity of own force, for neutralizing or destroying enemy reserves and weapons, and interfering with enemy command, supply, communications and observation; or
Close Supporting Fire	Placed on enemy troops, weapons or positions which, because of their proximity present the most immediate and serious threat to the supported unit.

Two other NATO terms also need definition:

Neutralization Fire	Delivered to render a target temporarily ineffective or unusable; and
Suppression Fire	That degrades the performance of a target below the level needed to fulfil its mission. Suppression is usually only effective for the duration of the fire.

The tactical purposes also include various "mission verbs", a rapidly expanding subject with the modern concept of "effects based operations". Targeting is the process of selecting target and matching the appropriate response to them taking account of operational requirements and capabilities. It requires consideration of the type of fire support required and the extent of coordination with the supported arm. It involves decisions about:

- What effects are required, for example, neutralization or suppression;
- The proximity of and risks to own troops or non-combatants;
- What types of munitions, including their fuzing, are to be used and in what quantities;
- When the targets should be attacked and possibly for how long;
- What methods should be used, for example, converged or distributed, whether adjustment is permissible or surprise essential, the need for special procedures such as precision or danger close
- How many fire units are needed and which ones they should be from those that are available (in range, with the required munitions type and quantity, not allotted to another target, have the most suitable line of fire if there is a risk to own troops or non-combatants);

The targeting process is the key aspect of tactical fire control. Depending on the circumstances and national procedures it may all be undertaken in one place or may be distributed. In armies practicing control from the front, most of the process may be undertaken by a forward observer or other target acquirer. This is particularly the case for a smaller target requiring only a few fire units. The extent to which the process is formal or informal and makes use of computer based systems, documented norms or experience and judgement also varies widely armies and other circumstances.

Surprise may be essential or irrelevant. It depends on what effects are required and whether or not the target is likely to move or quickly improve its protective posture. During World War II UK researchers concluded that for impact fuzed munitions the relative risk were as follows:

- Men standing – 1
- Men lying – 1/3
- Men firing from trenches – 1/15–1/50
- Men crouching in trenches – 1/25–1/100

Airburst munitions significantly increase the relative risk for lying men, etc. Historically most casualties occur in the first 10–15 seconds of fire, i.e. the time needed to react and improve protective posture, however, this is less relevant if airburst is used.

There are several ways of making best use of this brief window of maximum vulnerability:

- Ordering the guns to fire together, either by executive order or by a "fire at" time. The disadvantage is that if the fire is concentrated from many dispersed fire units then there will be different times of flight and the first rounds will be spread in time. To some extent a large concentration offsets the problem because it may mean that only one round is required from each gun and most of these could arrive in the 15 second window.
- Burst fire, a rate of fire to deliver three rounds from each gun within 10 or 15 seconds, this reduces the number of guns and hence fire units needed, which means they may be less dispersed and have less variation in their times of flight. Smaller calibre guns, such as 105 mm, have always been able to deliver three rounds in 15 seconds, larger calibers firing fixed rounds could also do it but it wasn't until the 1970s that a multi-charge 155 mm howitzer, FH-70 first gained the capability.
- Multiple round simultaneous impact (MRSI), where a single weapon or multiple individual weapons fire multiple rounds at differing trajectories so that all rounds arrive on target at the same time.
- Time on target, fire units fire at the time less their time of flight, this works well with prearranged scheduled fire but is less satisfactory for opportunity targets because it means delaying the delivery of fire by selecting a 'safe' time that all or most fire units can achieve. It can be used with both the previous two methods.

Counter-Battery Fire

Modern counter-battery fire developed in World War I, with the objective of defeating the enemy's artillery. Typically such fire was used to suppress enemy batteries when they were or were about to interfere with the activities of friendly forces (such as to prevent enemy defensive artillery fire against an impending attack) or to systematically destroy enemy guns. In World War I the latter required air observation. The first indirect counter-battery fire was in May 1900 by an observer in a balloon. Enemy artillery can be detected in two ways, either by direct observation of the guns from the air or by ground observers (including specialist reconnaissance), or from their firing signatures. This includes radars tracking the shells in flight to determine their place of origin, sound ranging detecting guns firing and resecting their position from pairs of microphones or cross-observation of gun flashes using observation by human observers or opto-electronic devices, although the widespread adoption of 'flashless' propellant limited the effectiveness of the latter.

Once hostile batteries have been detected they may be engaged immediately by friendly artillery or later at an optimum time, depending on the tactical situation and the counter-battery policy. Air strike is another option. In some situations the task is to locate all active enemy batteries for attack using a counter-battery fire at the appropriate moment in accordance with a plan developed by artillery intelligence staff. In other situations counter-battery fire may occur whenever a battery is located with sufficient accuracy. Modern counter-battery target acquisition uses unmanned aircraft, counter-battery radar, ground reconnaissance and sound-ranging. Counter-battery fire may be adjusted by some of the systems, for example the operator of an unmanned aircraft can 'follow' a battery if it moves. Defensive measures by batteries include frequently changing position or constructing defensive earthworks, the tunnels used by North Korea being an extreme example. Counter-measures include air defence against aircraft and attacking counter-battery radars physically and electronically.

Field Artillery Team

Field Artillery Team' is a US term and the following description and terminology applies to the US, other armies are broadly similar but differ in significant details. Modern field artillery (post–World War I) has three distinct parts: the forward observer (or FO), the fire direction centre (FDC) and the actual guns themselves. The forward observer observes the target using tools such as binoculars, laser rangefinders, designators and call back fire missions on his radio, or relays the data through a portable computer via an encrypted digital radio connection protected from jamming by computerized frequency hopping. A lesser known part of the team is the FAS or Field Artillery Survey team which setups up the "Gun Line" for the cannons. Today most artillery battalions use a(n) "Aiming Circle" which allows for faster setup and more mobility. FAS teams are still used for checks and balances purposes and if a gun battery has issues with the "Aiming Circle" a FAS team will do it for them.

The FO can communicate directly with the battery FDC, of which there is one per each battery of 4–8 guns. Otherwise the several FOs communicate with a higher FDC such as at a Battalion level, and the higher FDC prioritizes the targets and allocates fires to individual batteries as needed to engage the targets that are spotted by the FOs or to perform preplanned fires. The Battery FDC computes firing data—ammunition to be used, powder charge, fuse settings, the direction to the target, and the quadrant elevation to be fired at to reach the target, what gun will fire any rounds needed for adjusting on the target, and the number of rounds to be fired on the target by each gun once the target has been accurately located—to the guns. Traditionally this data is relayed via radio or wire communications as a warning order to the guns, followed by orders specifying the type of ammunition and fuse setting, direction, and the elevation needed to reach the target, and the method of adjustment or orders for fire for effect (FFE). However, in more advanced artillery units, this data is relayed through a digital radio link. Other parts of the field artillery team include meteorological analysis to determine the temperature, humidity and pressure of the air and wind direction and speed at different altitudes. Also radar is used both for determining the location of enemy artillery and mortar batteries and to determine the precise actual strike points of rounds fired by battery and comparing that location with what was expected to compute a registration allowing future rounds to be fired with much greater accuracy.

Time on Target
A technique called Time on Target was developed by the British Army in North Africa at the end of 1941 and early 1942 particularly for counter-battery fire and other concentrations, it proved very popular. It relied on BBC time signals to enable officers to synchronize their watches to the second because this avoided the need to use military radio networks and the possibility of losing surprise, and the need for field telephone networks in the desert. With this technique the time of flight from each fire unit (battery or troop) to the target is taken from the range or firing tables, or the computer and each engaging fire unit subtracts its time of flight from the TOT to determine the time to fire. An executive order to fire is given to all guns in the fire unit at the correct moment to fire. When each fire unit fires their rounds at their individual firing time all the opening rounds will reach the target area almost simultaneously. This is especially effective when combined with techniques that allow fires for effect to be made without preliminary adjusting fires.

MRSI (Multiple Rounds Simultaneous Impact)
A modern version of the earlier "time on target" is a concept in which fire from different weapons was timed to arrive on target at the same time. It is possible for artillery to fire several shells per gun at a target and have all of them arrive simultaneously, which is called MRSI (Multiple Rounds Simultaneous Impact). This is because there is more than one trajectory for the rounds to fly to any given target: typically one is below 45 degrees from horizontal and the other is above it, and by using different size propelling charges with each shell, it is possible to create multiple trajectories. Because the higher trajectories cause the shells to arc higher into the air, they take longer to reach the target and so if the shells are fired on these trajectories for the first volleys (starting with the shell with the most propellant and working down) and then after the correct pause more volleys are fired on the lower trajectories, the shells will all arrive at the same time. This is useful because many more shells can land on the target with no warning. With traditional volleys along the same trajectory, anybody at the target area may have time (however long it takes to reload and re-fire the guns) to take cover between volleys. However, guns capable of burst fire can deliver several rounds in 10 seconds if they use the same firing data for each, and if guns in more than one location are firing on one target they can use Time on Target procedures so that all their shells arrive at the same time and target.
To engage targets using MRSI requires two things, firstly guns with the requisite rate of fire and sufficiently different size propelling charges, secondly a fire control computer that has been designed to compute such missions and the data handling capability that allows all the firing data to be produced, sent to each gun and then presented to the gun commander in the correct order. The number of rounds that can be delivered in MRSI depends primarily on the range to the target and the rate of fire, for maximum rounds the range is limited to that of lowest propelling charge that will reach the target. Examples of guns with a rate of fire that makes them suitable for MRSI includes UK's AS-90, South Africa's Denel G6-52 (which can land six rounds simultaneously at targets at least 25 km (16 mi) away), Germany's Panzerhaubitze 2000 (which can land five rounds simultaneously at targets at least 17 km (11 mi) away), and Slovakia's 155 mm SpGH ZUZANA model 2000.

The Archer project (developed by BAE-Systems in Sweden) is a 155 mm howitzer on a wheeled chassis which is claimed to be able to deliver up to six shells on target simultaneously from the same gun. The 120 mm twin barrel AMOS mortar system, joint developed by Hägglunds (Sweden) and Patria (Finland), is capable of 7 + 7 shells MRSI. The United States Crusader program (now cancelled) was slated to have MRSI capability. It is unclear how many fire control computers have the necessary capabilities. Two-round MRSI firings were a popular artillery demonstration in the 1960s, where well trained detachments could show off their skills for spectators.

Air Burst
The destructiveness of artillery bombardments can be enhanced when some or all of the shells are set for airburst, meaning that they explode in the air above the target instead of upon impact. This can be accomplished either through time fuzes or proximity fuzes. Time fuses use a precise timer to detonate the shell after a preset delay. This technique is tricky and slight variations in the functioning of the fuse can cause it to explode too high and be ineffective, or to strike the ground instead of exploding above it. Since December 1944 (Battle of the Bulge), proximity fuzed artillery shells have been available that take the guesswork out of this process. These embody a miniature, low powered radar transmitter in the fuse to detect the ground and explode them at a predetermined height above it. The return of the weak radar signal completes an electrical circuit in the fuze which explodes the shell. The proximity fuse itself was developed by the British to increase the effectiveness of anti-aircraft warfare. This is a very effective tactic against infantry and light vehicles, because it scatters the fragmentation of the shell over a larger area and prevents it from being blocked by terrain or entrenchments that do not include some form of robust overhead cover. Combined with TOT or MRSI tactics that give no warning of the incoming rounds, these rounds are especially devastating because many enemy soldiers are likely to be caught in the open. This is even more so if the attack is launched against an assembly area or troops moving in the open rather than a unit in an entrenched tactical position.

4 Sea Materiel

Aircraft Carrier

An aircraft carrier is a warship that serves as a seagoing airbase, equipped with a full-length flight deck and facilities for carrying, arming, deploying, and recovering aircraft. Typically, it is the capital ship of a fleet, as it allows a naval force to project air power worldwide without depending on local bases for staging aircraft operations. Carriers have evolved since their inception in the early twentieth century from wooden vessels used to deploy balloons to nuclear-powered warships that carry numerous fighters, strike aircraft, helicopters, and other types of aircraft. While heavier aircraft such as fixed-wing gunships and bombers have been launched from aircraft carriers, it is currently not possible to land them. By its diplomatic and tactical power, its mobility, its autonomy and the variety of its means, the aircraft carrier is often the centrepiece of modern combat fleets. Tactically or even strategically, it replaced the battleship in the role of flagship of a fleet. One of its great advantages is that, by sailing in international waters, it does not interfere with any territorial sovereignty and thus obviates the need for overflight authorizations from third party countries, reduce the times and transit distances of aircraft and therefore significantly increase the time of availability on the combat zone. There is no single definition of an "aircraft carrier", and modern navies use several variants of the type. These variants are sometimes categorized as sub-types of aircraft carriers, and sometimes as distinct types of naval aviation-capable ships. Aircraft carriers may be classified according to the type of aircraft they carry and their operational assignments.

Admiral Sir Mark Stanhope, RN, former First Sea Lord (head) of the Royal Navy, has said, "To put it simply, countries that aspire to strategic international influence have aircraft carriers." Henry Kissinger, while United States Secretary of State, also said: "An aircraft carrier is 100,000 tons of diplomacy". As of April 2019, there are 41 active aircraft carriers in the world operated by thirteen navies. The United States Navy has 11 large nuclear-powered fleet carriers—carrying around 80 fighter jets each—the largest carriers in the world; the total combined deckspace is over twice that of all other nations combined. As well as the aircraft carrier fleet, the U.S. Navy has nine amphibious assault ships used primarily for helicopters, although these also carry up to 20 vertical or short take-off and landing (V/STOL) fighter jets and are similar in size to medium-sized fleet carriers. China, France, India, Russia, and the UK each operate a single large/medium-size carrier, with capacity from 30 to 60 fighter jets. Italy operates two light fleet carriers and Spain operates one. Helicopter carriers are operated by Japan (4), France (3), Australia (2), Egypt (2), Brazil (1), South Korea (1), and Thailand (1). Future aircraft carriers are under construction or in planning by Brazil, China, India, Russia, the United Kingdom, and the United States.

Types of Carriers

Amphibious Assault Ship	An amphibious assault ship is a type of amphibious warfare ship employed to land and support ground forces on enemy territory by an amphibious assault. The design evolved from aircraft carriers converted for use as helicopter carriers (and as a result, are often mistaken for conventional fixed-wing aircraft carriers). Modern ships support amphibious landing craft, with most designs including a well deck. Coming full circle, some amphibious assault ships also support V/STOL fixed-wing aircraft, now having a secondary role as aircraft carriers.
Anti-Submarine Warfare Carrier	An anti-submarine warfare carrier (ASW carrier) (US hull classification symbol CVS) is a type of small aircraft carrier whose primary role is as the nucleus of an anti-submarine warfare hunter-killer group. This type of ship came into existence during the Cold War as a development of the escort carriers used in the ASW role in the North Atlantic during World War II.
Balloon Carrier / Balloon Tenders	A balloon carrier or balloon tender was a ship equipped with a balloon, usually tied to the ship by a rope or cable, and usually used for observation. During the second half of the 19th century and the early 20th century, these ships were built to have the furthest possible view of the surrounding waters. After several experiments, the type became formalized in the early 1900s, but was soon to be superseded by the development of seaplane carriers and regular aircraft carriers at the beginning of World War I.
Escort Carrier	The escort carrier or escort aircraft carrier (US hull classification symbol CVE), also called a "jeep carrier" or "baby flattop" in the United States Navy (USN) or "Woolworth Carrier" by the Royal Navy, was a small and slow type of aircraft carrier used by the Royal Navy, the United States Navy, the Imperial Japanese Navy and Imperial Japanese Army Air Force in World War II. They were typically half the length and a third the displacement of larger fleet carriers. While they were slower, carried fewer planes and were less well armed and armoured, escort carriers were cheaper and could be built quickly, which was their principal advantage.
Fleet Carrier	A fleet carrier is an aircraft carrier designed to operate with the main fleet of a nation's navy. The term was developed during World War II, to distinguish it from the escort carrier and other lesser types. In addition to many medium-sized carriers, supercarriers, as well as some light carriers, are also classed as fleet carriers.
Flight Deck Cruiser	The flight-deck cruiser was a proposed type of aircraft cruiser, warships combining features of aircraft carriers and light cruisers designed by the United States Navy during the period between World War I and World War II. Several designs were proposed for the type, but none was approved for construction. The final design was developed just before World War II, and the entry of the United States into the war saw the project come to an end.
Helicopter Carrier	A helicopter carrier is a type of aircraft carrier whose primary purpose is to operate helicopters. A helicopter carrier has a large flight deck that occupies a large part of the ship, which can extend the full length of the ship like HMS Ocean of the Royal Navy (RN), or only partway, usually aft, as in the Soviet Navy's Moskva class, the Chinese Navy's Type 0891A or the RN's RFA Argus. It often also has a hangar deck for the storage of aircraft.
Light Aircraft Carrier	A light aircraft carrier, or light fleet carrier, is an aircraft carrier that is smaller than the standard carriers of a navy. The precise definition of the type varies by country; light carriers typically have a complement of aircraft only one-half to two-thirds the size of a full-sized fleet carrier. A light carrier was similar in concept to an escort carrier in most respects, however light carriers were intended for higher speeds to be deployed alongside fleet carriers, while escort carriers usually defended convoys and provided air support during amphibious operations.
Sea Control Ship	The Sea Control Ship (SCS) was a small aircraft carrier developed and conceptualized by the United States Navy under Chief of Naval Operations Elmo Zumwalt during the 1970s. Currently the term refers to naval vessels that can perform similar duties. The SCS was intended as an escort vessel, providing air support for convoys. It was cancelled after budgetary cuts to the US Navy. The SCS was to be equipped with a mix of Rockwell XFV-12 fighter aircraft and anti-submarine warfare helicopters. It was tasked with carrying out anti-submarine warfare operations.
Seaplane Tender and Seaplane Carriers	A seaplane tender is a boat or ship that supports the operation of seaplanes. Some of these vessels, the seaplane carriers, could not only carry seaplanes but also provided all the facilities needed for their operation; these ships are regarded by some as the first aircraft carriers and appeared just before the First World War.
Aircraft Cruiser	The aircraft cruiser (also known as aviation cruiser or cruiser-carrier) is a warship that combines the features of the aircraft carrier and a surface warship such as a cruiser or battleship. A more modern derivative of the aircraft cruiser is the helicopter cruiser which could typically operate at least 4 or more helicopters including medium and heavy lift varieties. This is in contrast to surface warships such as cruisers, destroyers, and frigates which have basic aviation facilities, including a hanger and landing pad, that are sufficient only for 1–2 light/medium helicopters.

Hull Classification

CV - Generic aircraft carrier CVA - Attack carrier CVB - Large aircraft carrier (retired) CVAN - Nuclear-powered attack carrier CVE - Escort carrier	CVG - Flight deck cruiser (proposed) CVHA - Aircraft carrier, Helicopter Assault (retired) CVHE - Aircraft carrier, Helicopter, Escort (retired) CVV - Aircraft Carrier (Medium) (proposed) CVL - Light aircraft carrier CVN - Nuclear-powered aircraft carrier	CVS - Anti-submarine warfare carrier LHA - Landing Helicopter Assault, a type of amphibious assault ship LHD - Landing Helicopter Dock, a type of amphibious assault ship 'LPH - Landing Platform Helicopter, a type of amphibious assault ship

Structure

Carriers are large and long ships, although there is a high degree of variation depending on their intended role and aircraft complement. The size of the carrier has varied over history and among navies, to cater to the various roles that global climates have demanded from naval aviation. Regardless of size, the ship itself must house their complement of aircraft, with space for launching, storing, and maintaining them. Space is also required for the large crew, supplies (food, munitions, fuel, engineering parts), and propulsion. US aircraft carriers are notable for having nuclear reactors powering their systems and propulsion. This makes the carrier reasonably tall.

The top of the carrier is the flight deck, where aircraft are launched and recovered. On the starboard side of this is the island, where air-traffic control and the bridge are located. The constraints of constructing a flight deck affect the role of a given carrier strongly, as they influence the weight, type, and configuration of the aircraft that may be launched. For example, assisted launch mechanisms are used primarily for heavy aircraft, especially those loaded with air-to-ground weapons. CATOBAR is most commonly used on USN fleet carriers as it allows the deployment of heavy jets with full loadouts, especially on ground-attack missions.

STOVL is used by other navies because it is cheaper to operate and still provides good deployment capability for fighter aircraft. Due to the busy nature of the flight deck, only 20 or so aircraft may be on it at any one time. A hangar storage several decks below the flight deck is where most aircraft are kept, and aircraft are taken from the lower storage decks to the flight deck through the use of an elevator. The hangar is usually quite large and can take up several decks of vertical space. Munitions are commonly stored on the lower decks because they are highly explosive. Usually this is below the water line so that the area can be flooded in case of emergency.

Flight Deck

As "runways at sea", aircraft carriers have a flat-top flight deck, which launches and recovers aircraft. Aircraft launch forward, into the wind, and are recovered from astern. The flight deck is where the most notable differences between a carrier and a land runway are found. Creating such a surface at sea poses constraints on the carrier. For example, the fact that it is a ship means that a full-length runway would be costly to construct and maintain. This affects take-off procedure, as a shorter runway length of the deck requires that aircraft accelerate more quickly to gain lift. This either requires a thrust boost, a vertical component to its velocity, or a reduced take-off load (to lower mass). The differing types of deck configuration, as above, influence the structure of the flight deck. The form of launch assistance a carrier provides is strongly related to the types of aircraft embarked and the design of the carrier itself.

There are two main philosophies in order to keep the deck short: add thrust to the aircraft, such as using a Catapult Assisted Take-Off (CATO-); and changing the direction of the airplanes' thrust, as in Vertical and/or Short Take-Off (V/STO-). Each method has advantages and disadvantages of its own:

● Catapult assisted take-off but arrested recovery (CATOBAR): A steam- or electric-powered catapult is connected to the aircraft, and is used to accelerate conventional aircraft to a safe flying speed. By the end of the catapult stroke, the aircraft is airborne and further propulsion is provided by its own engines. This is the most expensive method as it requires complex machinery to be installed under the flight deck, but allows for even heavily loaded aircraft to take off.
● Short take-off but arrested recovery (STOBAR) depends on increasing the net lift on the aircraft. Aircraft do not require catapult assistance for take off; instead on nearly all ships of this type an upwards vector is provided by a ski-jump at the forward end of the flight deck, often combined with thrust vectoring by the aircraft. Alternatively, by reducing the fuel and weapon load, an aircraft is able to reach faster speeds and generate more upwards lift and launch without a ski-jump or catapult.

● Short take-off vertical-landing (STOVL): On aircraft carriers, non-catapult-assisted, fixed-wing short takeoffs are accomplished with the use of thrust vectoring, which may also be used in conjunction with a runway "ski-jump". Use of STOVL tends to allow aircraft to carry a larger payload as compared to during VTOL use, while still only requiring a short runway. The most famous examples are the Hawker Siddeley Harrier and the Sea Harrier. Although technically VTOL aircraft, they are operationally STOVL aircraft due to the extra weight carried at take-off for fuel and armaments. The same is true of the F-35B Lightning II, which demonstrated VTOL capability in test flights but is operationally STOVL.
● Vertical take-off and landing (VTOL): Aircraft are specifically designed for the purpose of using very high degrees of thrust vectoring (e.g. if the thrust to weight-force ratio is greater than 1, it can take off vertically), but are usually slower than conventionally propelled aircraft.

On the recovery side of the flight deck, the adaptation to the aircraft loadout is mirrored. Non-VTOL or conventional aircraft cannot decelerate on their own, and almost all carriers using them must have arrested-recovery systems to recover their aircraft. Aircraft that are landing extend a tailhook that catches on arrestor wires stretched across the deck to bring themselves to a stop in a short distance.

Operations

Carriers steam at speed, up to 35 knots (65 km/h; 40 mph) into the wind during flight deck operations to increase wind speed over the deck to a safe minimum. This increase in effective wind speed provides a higher launch airspeed for aircraft at the end of the catapult stroke or ski-jump, as well as making recovery safer by reducing the difference between the relative speeds of the aircraft and ship. Since the early 1950s on conventional carriers it has been the practice to recover aircraft at an angle to port of the axial line of the ship. The primary function of this angled deck is to allow aircraft that miss the arresting wires, referred to as a bolter, to become airborne again without the risk of hitting aircraft parked forward. The angled deck allows the installation of one or two "waist" catapults in addition to the two bow cats. An angled deck also improves launch and recovery cycle flexibility with the option of simultaneous launching and recovery of aircraft.

Deck Structures

The superstructure of a carrier (such as the bridge, flight control tower) are concentrated in a relatively small area called an island, a feature pioneered on HMS Hermes in 1923. While the island is usually built on the starboard side of the flight deck, the Japanese aircraft carriers Akagi and Hiryū had their islands built on the port side. Very few carriers have been designed or built without an island. The flush deck configuration proved to have significant drawbacks, primary of which was management of the exhaust from the power plant. Fumes coming across the deck were a major issue in USS Langley. In addition, lack of an island meant difficulties managing the flight deck, performing air traffic control, a lack of radar housing placements and problems with navigating and controlling the ship itself. Another deck structure that can be seen is a ski-jump ramp at the forward end of the flight deck. This was first developed to help launch STOVL aircraft take off at far higher weights than is possible with a vertical or rolling take-off on flat decks. Originally developed by the Royal Navy, it since has been adopted by many navies for smaller carriers. A ski-jump ramp works by converting some of the forward rolling movement of the aircraft into vertical velocity and is sometimes combined with the aiming of jet thrust partly downwards. This allows heavily loaded and fuelled aircraft a few more precious seconds to attain sufficient air velocity and lift to sustain normal flight.

National Fleets (Longest Carriers)

The U.S. Navy has the largest carriers in the world, and currently has eleven in service. The UK operates one 65,000 tonne STOVL carrier. The navies of China, France, India, and Russia each operate a single medium-sized fleet carrier. The US has nine similarly sized Amphibious Warfare Ships. There are three small light carriers in use capable of operating both fixed-wing aircraft and helicopters, Italy operates two, and Spain one.

United States	China	Russia	England	India	France
USS Gerald R. Ford	**Liaoning**	**Admiral Kuznetsov**	**HMS Queen Elizabeth**	**INS Vikramaditya**	**Charles de Gaulle**
Weight: 100,000 Tonnes	59,000 Tonnes	59,000 Tonnes	65,000 Tonnes	45,000 Tonnes	42,000 Tonnes
Length: 1,092ft	985ft	985ft	932ft		858ft
80 Aircraft	50 Aircraft	50 Aircraft	40 Aircraft	30 Aircraft	40 Aircraft

Brazil	United States	Italy	Spain		
Sao Paulo	USS America	Cavour	Juan Carlos I		
32,800 Tonnes	45,000 Tonnes	26,000 Tonnes	27,000 Tonnes		
869ft	844ft	800ft	757ft		
39 Aircraft	30 Aircraft	20 Aircraft	30 Aircraft		

Anti-Submarine Warfare Carrier

An anti-submarine warfare carrier (ASW carrier) (US hull classification symbol CVS) is a type of small aircraft carrier whose primary role is as the nucleus of an anti-submarine warfare hunter-killer group. This type of ship came into existence during the Cold War as a development of the escort carriers used in the ASW role in the North Atlantic during World War II. After World War II, the main naval threat to most Western nations was confrontation with the Soviet Union. The Soviets ended the war with a small navy and took the route of asymmetric confrontation against Western surface ship superiority by investing heavily in submarines both for attack and later fielding submarine-launched missiles. Several nations who purchased British and US surplus light carriers were most easily able to accommodate slow-moving, less expensive, and easy-to-land anti-submarine aircraft from the 1960s forward, such as the S-2 Tracker, which flew from the decks of US, Canadian, Australian, Dutch, Argentine, and Brazilian carriers, or Alizé, which flew from French and Indian ships, allowing these ships to still remain useful especially in the framework of NATO even as newer fighter and strike aircraft were becoming too heavy for the equipment designed for World War II aircraft.

Improvement in long-range shore-based patrol and conventional ship-based ASW helicopter capability combined with the increasing difficulty maintaining surplus WWII carriers led to most of these ships being retired or docked by smaller nations from the 1970s to the mid-1980s. This trend in ASW force draw-down only accelerated with the massive reduction in the operational Soviet/Russian submarine fleet, which rarely went to sea in large numbers in the 1990s. Ships that could be called dedicated ASW carriers are now only found within the Japan MSDF, which operates helicopters and no fixed-wing carrier-based aircraft of any kind. Even the United States Navy, the last nation to regularly operate a dedicated fixed-wing carrier-based ASW aircraft, the S-3 Viking, on its mixed-role super carriers had already removed most ASW equipment in the 1990s from this aircraft and has now removed this type from service as of January 2009 without replacement. The Argentine Navy, currently without much hope of a replacement CATOBAR carrier of its own, trained several times a year landings and takeoffs of their S-2 Turbo Trackers aboard the Brazilian aircraft carrier São Paulo until this carrier was also retired. Much easier to operate from small decks than fixed-wing aircraft were ASW helicopters, which flew from the decks of nearly all allied conventional carriers to this day and most LPH or STOVL carriers operated by the Soviet, Spanish, Italian, Japanese, British, and Thai navies.

Air-Cushioned Landing Craft

An air-cushioned landing craft, also called an LCAC (landing craft, air cushioned) is a modern variation on the amphibious landing boat. The majority of these craft are small- to mid-sized multi-purpose hovercraft, also known as "over the beach" ("OTB") craft. This allows troops and material to access more than 70 percent of the world's coastline, while only approximately 15 percent of that coastline is available to conventional boat-type landing craft. Typical barriers to conventional landing craft are soft sandy beaches, marshes, swampland, and loose surfaces. Air cushion technology has vastly increased the landing capability of the craft, providing greater speed and flexibility over traditional landing craft. Like the mechanized landing craft, they are usually equipped with mounted machine guns; they also support grenade launchers and heavy weapons.

Amphibious Assault Ship

An amphibious assault ship (also commando carrier or an amphibious assault carrier) is a type of amphibious warfare ship employed to land and support ground forces on enemy territory by an amphibious assault. The design evolved from aircraft carriers converted for use as helicopter carriers (and as a result, are often mistaken for conventional fixed-wing aircraft carriers). Modern ships support amphibious landing craft, with most designs including a well deck. Coming full circle, some amphibious assault ships also support V/STOL fixed-wing aircraft, now having a secondary role as aircraft carriers. The role of the amphibious assault ship is fundamentally different from that of a standard aircraft carrier: its aviation facilities have the primary role of hosting helicopters to support forces ashore rather than to support strike aircraft. However, some are capable of serving in the sea-control role, embarking aircraft like Harrier fighters for combat air patrol and helicopters for anti-submarine warfare or operating as a safe base for large numbers of STOVL fighters conducting air support for an expeditionary unit ashore. Most of these ships can also carry or support landing craft, such as air-cushioned landing craft (hovercraft) or LCUs. The largest fleet of these types is operated by the United States Navy, including the Wasp class dating back to 1989 and the very similar America-class ships that debuted in 2014. Amphibious assault ships are also operated by the French Navy, the Italian Navy, the Republic of Korea Navy, the Royal Australian Navy, the Brazilian Navy, and the Spanish Navy. The term amphibious assault ship is often used interchangeably with other ship classifications. It applies to all large-deck amphibious ships such as the Landing Platform Helicopter (LPH), Landing Helicopter Assault (LHA), and Landing Helicopter Dock (LHD).

Battlecruiser

The battlecruiser, or battle cruiser, was a type of capital ship of the first half of the 20th century. They were similar in displacement, armament and cost to battleships, but differed slightly in form and balance of attributes. Battlecruisers typically carried slightly thinner armour and a lighter main gun battery than contemporary battleships, installed on a longer hull with much higher engine power in order to attain faster speeds. The first battlecruisers were designed in the United Kingdom in the first decade of the century, as a development of the armoured cruiser, at the same time as the dreadnought succeeded the pre-dreadnought battleship.

The goal of the design was to outrun any ship with similar armament, and chase down any ship with lesser armament; they were intended to hunt down slower, older armoured cruisers and destroy them with heavy gunfire while avoiding combat with the more powerful but slower battleships. However, as more and more battlecruisers were built, they were increasingly used alongside the better-protected battleships.

Battlecruisers served in the navies of the UK, Germany, the Ottoman Empire, Australia and Japan during World War I, most notably at the Battle of the Falkland Islands and in the several raids and skirmishes in the North Sea which culminated in a pitched fleet battle, the Battle of Jutland. British battlecruisers in particular suffered heavy losses at Jutland, where their crews' poor fire safety & ammunition handling practices left them vulnerable to catastrophic magazine explosions following hits to their main turrets from large-calibre shells. This dismal showing led to a persistent general belief that battlecruisers were too thinly armoured to function successfully.

By the end of the war, capital ship design had developed with battleships becoming faster and battlecruisers becoming more heavily armoured, blurring the distinction between a battlecruiser and a fast battleship. The Washington Naval Treaty, which limited capital ship construction from 1922 onwards, treated battleships and battlecruisers identically, and the new generation of battlecruisers planned was scrapped under the terms of the treaty.

Improvements in armour design and propulsion created the 1930s "fast battleship" with the speed of a battlecruiser and armour of a battleship, making the battlecruiser in the traditional sense effectively an obsolete concept. Thus from the 1930s on, only the Royal Navy continued to use "battlecruiser" as a classification for the World War I–era capital ships that remained in the fleet; while Japan's battlecruisers remained in service, they had been significantly reconstructed and were re-rated as full-fledged fast battleships.

Battlecruisers were put into action again during World War II, and only one survived to the end. There was also renewed interest in large "cruiser-killer" type warships, but few were ever begun, as construction of battleships and battlecruisers was curtailed in favour of more-needed convoy escorts, aircraft carriers, and cargo ships. In the post–Cold War era, the Soviet Kirov class of large guided missile cruisers have also been termed "battlecruisers".

Battleship

WARFARE Sea Materiel Battleship

A battleship is a large armoured warship with a main battery consisting of large calibre guns. During the late 19th and early 20th centuries the battleship was the most powerful type of warship, and a fleet of battleships was considered vital for any nation that desired to maintain command of the sea. The term battleship came into formal use in the late 1880s to describe a type of ironclad warship, now referred to by historians as pre-dreadnought battleships. In 1906, the commissioning of HMS Dreadnought into the United Kingdom's Royal Navy heralded a revolution in battleship design. Subsequent battleship designs, influenced by HMS Dreadnought, were referred to as "dreadnoughts", though the term eventually became obsolete as they became the only type of battleship in common use. Battleships were a symbol of naval dominance and national might, and for decades the battleship was a major factor in both diplomacy and military strategy. A global arms race in battleship construction began in Europe in the 1890s and culminated at the decisive Battle of Tsushima in 1905, the outcome of which significantly influenced the design of HMS Dreadnought. The launch of Dreadnought in 1906 commenced a new naval arms race.

Three major fleet actions between steel battleships took place: the long range gunnery duel at the Battle of the Yellow Sea in 1904, the decisive Battle of Tsushima in 1905, both, during the Russo-Japanese War, and the inconclusive Battle of Jutland (1916) during the First World War. Jutland was the largest naval battle and the only full-scale clash of dreadnaughts of the war, it was the last major battle fought primarily by battleships in naval history. The Naval Treaties of the 1920s and 1930s limited the number of battleships, though technical innovation in battleship design continued. Both the Allied and Axis powers built battleships during World War II, though the increasing importance of the aircraft carrier meant that the battleship played a less important role than had been expected. The value of the battleship has been questioned, even during their heyday. There were few of the decisive fleet battles that battleship proponents expected, and used to justify the vast resources spent on building battlefleets. Even in spite of their huge firepower and protection, battleships were increasingly vulnerable to much smaller and relatively inexpensive weapons: initially the torpedo and the naval mine, and later aircraft and the guided missile.

WARFARE Sea Materiel CAM Ship

CAM Ship

CAM ships were World War II-era British merchant ships used in convoys as an emergency stop-gap until sufficient escort carriers became available. CAM ship is an acronym for catapult aircraft merchant ship. They were equipped with a rocket-propelled catapult launching a single Hawker Hurricane, dubbed a "Hurricat" or "Catafighter" to destroy or drive away an attacking bomber. Normally the Hurricane fighter would be lost when the pilot then bailed out or ditched in the ocean near the convoy. CAM ships continued to carry their normal cargoes after conversion. The concept was developed and tested by the five fighter catapult ships, commissioned as warships and commanded and crewed by the Royal Navy - but the CAM ships were merchant vessels, commanded and crewed by the Merchant Navy.

WARFARE Sea Materiel Corvette

Corvette

A corvette is a small warship. It is traditionally the smallest class of vessel considered to be a proper (or "rated") warship. The warship class above the corvette is that of the frigate, while the class below was historically that of the sloop-of-war. The modern types of ship below a corvette are coastal patrol craft and fast attack craft. In modern terms, a corvette is typically between 500 tons and 2,000 tons although recent designs may approach 3,000 tons, which might instead be considered a small frigate.

The word "corvette" is first found in Middle French, a diminutive of the Dutch word corf, meaning a small ship, from the Latin corbis, meaning "basket". The rank "corvette captain", equivalent in many navies to "lieutenant commander", derives from the name of this type of ship. The rank is the most junior of three "captain" ranks in several European (e.g., France, Spain, Italy, Croatia) and South American (e.g., Argentina, Chile) navies, because a corvette, as the smallest class of rated warship, was traditionally the smallest class of vessel entitled to a commander of a "captain" rank.

WARFARE Sea Materiel Cruiser

Cruiser

A cruiser is a type of warship. Modern cruisers are generally the largest ships in a fleet after aircraft carriers and amphibious assault ships, and can usually perform several roles. The term has been in use for several hundred years, and has had different meanings throughout this period. During the Age of Sail, the term cruising referred to certain kinds of missions – independent scouting, commerce protection, or raiding – fulfilled by a frigate or sloop-of-war, which were the cruising warships of a fleet. In the later 20th century, the obsolescence of the battleship left the cruiser as the largest and most powerful surface combatant after the aircraft carrier.

The role of the cruiser varied according to ship and navy, often including air defence and shore bombardment. During the Cold War, the Soviet Navy's cruisers had heavy anti-ship missile armament designed to sink NATO carrier task forces via saturation attack. The U.S. Navy built guided-missile cruisers upon destroyer-style hulls (some called "destroyer leaders" or "frigates" prior to the 1975 reclassification) primarily designed to provide air defence while often adding anti-submarine capabilities, being larger and having longer-range surface-to-air missiles (SAMs) than early Charles F. Adams guided-missile destroyers tasked with the short-range air defence role.

WARFARE Sea Materiel Cruiser

By the end of the Cold War, the line between cruisers and destroyers had blurred, with the Ticonderoga-class cruiser using the hull of the Spruance-class destroyer but receiving the cruiser designation due to their enhanced mission and combat systems. Indeed, the newest U.S. and Chinese destroyers are more heavily armed than some of the cruisers that they succeeded. Currently only two nations operate cruisers: the United States and Russia, and in both cases the vessels are primarily armed with guided missiles. BAP Almirante Grau was the last gun cruiser in service, serving with the Peruvian Navy until 2017.

WARFARE Sea Materiel Cruiser Armoured Cruiser

Armoured Cruiser

The armoured cruiser was a type of warship of the late 19th and early 20th centuries. It was designed like other types of cruisers to operate as a long-range, independent warship, capable of defeating any ship apart from a battleship and fast enough to outrun any battleship it encountered. Varying in size, it was distinguished from other types of cruiser by its belt armour—thick iron (or later steel) plating on much of the hull to protect the ship from shellfire much like that on battleships. The first armoured cruiser, the Imperial Russian Navy's General-Admiral, was launched in 1873 and combined sail and steam propulsion. By the 1890s cruisers had abandoned sail and took on a modern appearance. For many decades naval technology had not advanced far enough for designers to produce a cruiser which combined an armoured belt with the long range and high speed required to fulfil its mission; for this reason, many navies preferred to build protected cruisers in the 1880s and early 1890s. It was often possible to build cruisers which were faster and better all-round using this type of ship, which relied on a lighter armoured deck to protect the vital parts of the ship; however, by the late 1880s the development of rapid-fire cannon and high-explosive shells made the reintroduction of side armour a necessity. The invention of face-hardened armour in the mid-1890s offered effective protection with less weight than previously. Schematic of armoured cruiser. Red lines: armoured upper and middle decks and side belt. Grey areas: lateral protective coal bunkers. The machinery was arranged in the protected internal void above the double-bottom.

Light Cruiser

WARFARE Sea Materiel Cruiser Light Cruiser

A light cruiser is a type of small- or medium-sized warship. The term is a shortening of the phrase "light armoured cruiser", describing a small ship that carried armour in the same way as an armoured cruiser: a protective belt and deck. Prior to this smaller cruisers had been of the protected cruiser model, possessing armoured decks only. While lighter and smaller than other contemporary ships they were still true cruisers, retaining the extended radius of action and self-sufficiency to act independently across the world. Through their history they served in a variety of roles, primarily as convoy escorts and destroyer command ships, but also as scouts and fleet support vessels for battle fleets. BAP Almirante Grau of the Peruvian Navy was the last light cruiser in service, being retired in 2017. Another four are preserved as museum ships: HMS Belfast in London, HMS Caroline in Belfast, USS Little Rock in Buffalo, New York, and Mikhail Kutuzov at Novorossiysk. Similar ships include the protected cruisers Aurora (St. Petersburg) and USS Olympia (Philadelphia, Pennsylvania), and the bow of the Puglia (Italy). In the United States Navy, light cruisers have the hull classification symbol CL. Both heavy cruisers and light cruisers were classified under a common CL/CA sequence after 1931, hence there are some missing hull numbers, see List of United States Navy cruisers. After the development of seaborne guided missiles in the 1950s, all remaining cruisers armed solely with guns, regardless of calibre were redesignated as "Gun Cruisers" (hull classification symbol CA), with guided missile cruisers (which generally carry some gun armament) gaining the new hull classification symbol CG. By the 1975 fleet realignment, all gun cruisers were out of the fleet.

Destroyer

WARFARE Sea Materiel Destroyer

In naval terminology, a destroyer is a fast, manoeuvrable long-endurance warship intended to escort larger vessels in a fleet, convoy or battle group and defend them against smaller powerful short-range attackers. They were originally developed in the late 19th century by Fernando Villaamil for the Spanish Navy as a defence against torpedo boats, and by the time of the Russo-Japanese War in 1904, these "torpedo boat destroyers" (TBDs) were "large, swift, and powerfully armed torpedo boats designed to destroy other torpedo boats". Although the term "destroyer" had been used interchangeably with "TBD" and "torpedo boat destroyer" by navies since 1892, the term "torpedo boat destroyer" had been generally shortened to simply "destroyer" by nearly all navies by the First World War.

Before World War II destroyers were light vessels with little endurance for unattended ocean operations; typically a number of destroyers and a single destroyer tender operated together. After the war, the advent of the guided missile allowed destroyers to take on the surface combatant roles previously filled by battleships and cruisers. This resulted in larger and more powerful guided missile destroyers more capable of independent operation.

At the start of the 21st century, destroyers are the global standard for surface combatant ships, with only two nations (United States and Russia) operating the heavier class cruisers, with no battleships or true battlecruisers remaining. Modern guided missile destroyers are equivalent in tonnage but vastly superior in firepower to cruisers of the World War II era, and are capable of carrying nuclear tipped cruise missiles. At 510 feet (160 m) long, a displacement of 9,200 tons, and with armament of more than 90 missiles, guided missile destroyers such as the Arleigh Burke-class are actually larger and more heavily armed than most previous ships classified as guided missile cruisers.

Dreadnought

WARFARE Sea Materiel Dreadnought

The dreadnought was the predominant type of battleship in the early 20th century. The first of its kind, the Royal Navy's HMS Dreadnought, made such a strong impression on people's minds when launched in 1906 that similar battleships built subsequently were referred to generically as "dreadnoughts", and earlier battleships became known as "pre-dreadnoughts". Dreadnought's design had two revolutionary features: an "all-big-gun" armament scheme, with more heavy-calibre guns than previous ships, and steam turbine propulsion. As dreadnoughts became a symbol of national power, the arrival of these new warships was a crucial catalyst in the intensifying naval arms race between the United Kingdom and Germany.

With the launch of a single ship, Dreadnought, the scales of naval power were reset overnight. As a result, dreadnought races sprang up around the world, including in South America, during the lead up to World War I. Successive designs increased rapidly in size and made use of improvements in armament, armour, and propulsion throughout the dreadnought era. Within five years, new battleships had outclassed Dreadnought. These more powerful vessels were known as "super-dreadnoughts". Most of the original dreadnoughts were scrapped after the end of World War I under the terms of the Washington Naval Treaty, but many of the newer super-dreadnoughts continued to be used throughout World War II.

The only surviving dreadnought is USS Texas, located near the San Jacinto Battleground State Historic Site. Dreadnought-building consumed vast resources in the early 20th century, but there was only one battle between large dreadnought fleets. In the 1916 Battle of Jutland, the British and German navies clashed with no decisive result. The term "dreadnought" gradually dropped from use after World War I, especially after the Washington Naval Treaty, as virtually all remaining battleships shared dreadnought characteristics; the term can also be used to describe battlecruisers, the other type of ship resulting from the dreadnought revolution.

Escort Aircraft Carrier

WARFARE Sea Materiel Escort Aircraft Carrier

The escort carrier or escort aircraft carrier (US hull classification symbol CVE), also called a "jeep carrier" or "baby flattop" in the United States Navy (USN) or "Woolworth Carrier" by the Royal Navy, was a small and slow type of aircraft carrier used by the Royal Navy, the United States Navy, the Imperial Japanese Navy and Imperial Japanese Army Air Force in World War II. They were typically half the length and a third the displacement of larger fleet carriers. While they were slower, carried fewer planes and were less well armed and armoured, escort carriers were cheaper and could be built quickly, which was their principal advantage. Escort carriers could be completed in greater numbers as a stop-gap when fleet carriers were scarce.

However, the lack of protection made escort carriers particularly vulnerable and several were sunk with great loss of life. The light carrier (hull classification symbol CVL) was a similar concept to escort carriers in most respects, but were capable of higher speeds to allow operation alongside fleet carriers. Most often built on a commercial ship hull, escort carriers were too slow to keep up with the main forces consisting of fleet carriers, battleships, and cruisers. Instead, they were used to escort convoys, defending them from enemy threats such as submarines and planes.

In the invasions of mainland Europe and Pacific islands, escort carriers provided air support to ground forces during amphibious operations. Escort carriers also served as backup aircraft transports for fleet carriers and ferried aircraft of all military services to points of delivery. In the Battle of the Atlantic, escort carriers were used to protect convoys against U-boats. Initially escort carriers accompanied the merchant ships and helped to fend off attacks from aircraft and submarines. As numbers increased later in the war, escort carriers also formed part of hunter-killer groups that sought out submarines instead of being attached to a particular convoy.

In the Pacific theatre, CVEs provided air support of ground troops in the Battle of Leyte Gulf. They lacked the speed and weapons to counter enemy fleets, relying on the protection of a Fast Carrier Task Force. However, at the Battle off Samar, one U.S. task force of escort carriers managed to successfully defend itself against a much larger Japanese force of battleships and cruisers. The Japanese met a furious defence of carrier aircraft, screening destroyers, and destroyer escorts, proving that CVEs could appear to have the same striking power as full CVs.

Frigate

A frigate is a type of warship, having various sizes and roles over the last few centuries. In the 17th century, a frigate was any warship built for speed and manoeuvrability, the description often used being "frigate-built". These could be warships carrying their principal batteries of carriage-mounted guns on a single deck or on two decks (with further smaller carriage-mounted guns usually carried on the forecastle and quarterdeck of the vessel). The term was generally used for ships too small to stand in the line of battle, although early line-of-battle ships were frequently referred to as frigates when they were built for speed.

In the 18th century, frigates were usually as long as a ship of the line and were square-rigged on all three masts (full-rigged), but were faster and with lighter armament, used for patrolling and escort. In the definition adopted by the British Admiralty, they were rated ships of at least 28 guns, carrying their principal armaments upon a single continuous deck – the upper deck – while ships of the line possessed two or more continuous decks bearing batteries of guns. In the late 19th century (beginning about 1858 with the construction of prototypes by the British and French navies), the armoured frigate was a type of ironclad warship that for a time was the most powerful type of vessel afloat.

The term "frigate" was used because such ships still mounted their principal armaments on a single continuous upper deck. In modern navies, frigates are used to protect other warships and merchant-marine ships, especially as anti-submarine warfare (ASW) combatants for amphibious expeditionary forces, underway replenishment groups, and merchant convoys. Ship classes dubbed "frigates" have also more closely resembled corvettes, destroyers, cruisers and even battleships. Some European navies such as the French, German or Spanish ones use the term "frigate" for both their destroyers and frigates. The rank "frigate captain" derives from the name of this type of ship.

Fast Attack Craft

A fast attack craft (FAC) is a small, fast, agile and offensive warship armed with anti-ship missiles, gun or torpedoes. FACs are usually operated in close proximity to land as they lack both the sea keeping and all-round defensive capabilities to survive in blue water. The size of the vessel also limits the fuel, stores and water supplies. In size they are usually between 50–800 tonnes and can reach speeds of 25–50 knots. A fast attack craft's main advantage over other warship types is its affordability.

Many FACs can be deployed at a relatively low cost, allowing a navy which is at a disadvantage to effectively defend itself against a larger adversary. A small boat, when equipped with the same weapons as its larger counterpart, can pose a serious threat to even the largest of capital ships. Their major disadvantages are poor seagoing qualities, cramped quarters and poor ability to defend themselves against aerial threat.

Gunboat

A gunboat is a naval watercraft designed for the express purpose of carrying one or more guns to bombard coastal targets, as opposed to those military craft designed for naval warfare, or for ferrying troops or supplies. In the later 19th century and early 20th century, "gunboat" was the common name for smaller armed vessels. These could be classified, from the smallest to the largest, into river gunboats, river monitors, coastal-defence gunboats (such as SMS Panther), and full-fledged monitors for coastal bombardments. In the 1870s and 1880s Britain took to building so called "flat-iron" (or Rendel) gunboats for coastal defence. When there would be few opportunities to re-coal, vessels carrying a full sailing rig continued in use as gunboats; HMS Gannet, a sloop preserved at Chatham Historic Dockyard in the United Kingdom, exemplifies this type of gunboat.

Hospital Ship

A hospital ship is a ship designated for primary function as a floating medical treatment facility or hospital. Most are operated by the military forces (mostly navies) of various countries, as they are intended to be used in or near war zones. Although attacking a hospital ship is a war crime, belligerent navies have the right to board such ships for inspections. In the nineteenth century redundant warships were used as moored hospitals for seamen.

Hospital ships were covered under the Hague Convention X of 1907. Article four of the Hague Convention X outlined the restrictions for a hospital ship:
● Ship must be clearly marked and lighted as a hospital ship
● The ship should give medical assistance to wounded personnel of all nationalities
● The ship must not be used for any military purpose
The ship must not interfere with or hamper enemy combatant vessels
● Belligerents, as designated by the Hague Convention, can search any hospital ship to investigate violations of the above restrictions
● Belligerents will establish the location of a hospital ship

According to the San Remo Manual on International Law Applicable to Armed Conflicts at Sea, a hospital ship violating legal restrictions must be duly warned and given a reasonable time limit to comply. If a hospital ship persists in violating restrictions, a belligerent is legally entitled to capture it or take other means to enforce compliance. A non-complying hospital ship may only be fired on under the following conditions:
● Diversion or capture is not feasible
● No other method to exercise control is available
● The violations are grave enough to allow the ship to be classified as a military objective
● The damage and casualties will not be disproportionate to the military advantage.

In all other circumstances, attacking a hospital ship is a war crime.

Ironclad

An ironclad is a steam-propelled warship protected by iron or steel armour plates used in the early part of the second half of the 19th century. The ironclad was developed as a result of the vulnerability of wooden warships to explosive or incendiary shells. The first ironclad battleship, Gloire, was launched by the French Navy in November 1859. The British Admiralty had been considering armoured warships since 1856 and prepared a draft design for an armoured corvette in 1857; in early 1859 the Royal Navy started building two iron-hulled armoured frigates, and by 1861 had made the decision to move to an all-armoured battle fleet. After the first clashes of ironclads (both with wooden ships and with one another) took place in 1862 during the American Civil War, it became clear that the ironclad had replaced the unarmoured ship of the line as the most powerful warship afloat. This type of ship would come to be very successful in the American Civil War.

Ironclads were designed for several roles, including as high seas battleships, coastal defence ships, and long-range cruisers. The rapid development of warship design in the late 19th century transformed the ironclad from a wooden-hulled vessel that carried sails to supplement its steam engines into the steel-built, turreted battleships and cruisers familiar in the 20th century. This change was pushed forward by the development of heavier naval guns (the ironclads of the 1880s carried some of the heaviest guns ever mounted at sea at the time), more sophisticated steam engines, and advances in metallurgy which made steel shipbuilding possible. The quick pace of change meant that many ships were obsolete as soon as they were finished, and that naval tactics were in a state of flux. Many ironclads were built to make use of the ram or the torpedo, which a number of naval designers considered the important weapons of naval combat. There is no clear end to the ironclad period, but towards the end of the 1890s the term ironclad dropped out of use. New ships were increasingly constructed to a standard pattern and designated battleships or armoured cruisers.

Landing Craft

WARFARE Sea Materiel Landing Craft

Landing craft are small and medium seagoing watercraft such as boats, and barges, used to convey a landing force (infantry and vehicles) from the sea to the shore during an amphibious assault. The term excludes landing ships, which are larger. Production of landing craft peaked during World War II, with a significant number of different designs produced in large quantities by the United Kingdom and United States. Because of the need to run up onto a suitable beach, World War II landing craft were flat-bottomed, and many designs had a flat front, often with a lowerable ramp, rather than a normal bow. This made them difficult to control and very uncomfortable in rough seas. The control point (too rudimentary to call a bridge on LCA and similar craft) was normally at the extreme rear of the vessel, as were the engines. In all cases, they were known by an abbreviation derived from the official name rather than by the full title.

Littoral Combat Ship

WARFARE Sea Materiel Littoral Combat Ship

The Littoral combat ship (LCS) is a set of two classes of relatively small surface vessels designed for operations near shore by the United States Navy. It was "envisioned to be a networked, agile, stealthy surface combatant capable of defeating anti-access and asymmetric threats in the littorals." Littoral combat ships are the American equivalent of corvettes. The Freedom class and the Independence class are the first two LCS variants. Each is slightly smaller than the U.S. Navy's Oliver Hazard Perry-class frigate but larger than Cyclone-class patrol ships. They have the capabilities of a small assault transport, including a flight deck and hangar for housing two SH-60 or MH-60 Seahawk helicopters, a stern ramp for operating small boats, and the cargo volume and payload to deliver a small assault force with fighting vehicles to a roll-on/roll-off port facility.

Standard armaments include Mk 110 57 mm guns and RIM-116 Rolling Airframe Missiles. They are also equipped with autonomous air, surface, and underwater vehicles. Possessing lower air defence and surface warfare capabilities than destroyers, the LCS concept emphasizes speed, flexible mission modules and a shallow draft. The first littoral combat ship, USS Freedom, was commissioned on 8 November 2008 in Veteran's Park, Milwaukee, Wisconsin. The second ship, and first of the trimaran-based USS Independence, was commissioned on 16 January 2010, in Mobile, Alabama.

The concept behind the littoral combat ship, as described by former Secretary of the Navy Gordon R. England, is to "create a small, fast, manoeuvrable and relatively inexpensive member of the DD(X) family of ships." The ship is easy to reconfigure for different roles, including anti-submarine warfare, mine countermeasures, anti-surface warfare, intelligence, surveillance and reconnaissance, homeland defence, maritime intercept, special operations, and logistics. Due to its modular design, the LCS will be able to replace slower, more specialized ships such as minesweepers and larger amphibious-type assault ships. Most of the mission modules' functions are performed by carried vehicles such as helicopters or unmanned vehicles such as the Spartan Scout, AN/WLD-1 RMS Remote Minehunting System and MQ-8B Fire Scout as part of the Navy's goal to "unman the front lines".

Performing functions such as sonar sweeps for mines or submarines as well as launching torpedoes against hostile submarines at a distance from the ship is less risky. Placing sensors on remote vehicles allows the LCS to exploit concepts such as bistatic sonar. DARPA's Tactically Exploited Reconnaissance Node (TERN) program aims to build a Medium-altitude long-endurance unmanned aerial vehicle (MALE UAV) that can operate from LCS-2 and can carry a payload of 600 pounds (270 kg) out to an operational radius of 600–900 nautical miles (1,100–1,700 km).

Mine Planter

WARFARE Sea Materiel Mine Planter

Mine planter and the earlier "torpedo planter" was a term used for mine warfare ships into the early days of World War I. In later terminology, particularly in the United States, a mine planter was a ship specifically designed to install controlled mines or contact mines in coastal fortifications. This type of ship diverged in both function and design from a ship operating as a naval minelayer. Though the vessel may be seagoing it is not designed to lay large numbers of mines in open sea. A mine planter was designed to place controlled minefields in exact locations so that they might be fired individually or as a group from shore when observers noted a target to be at or near a designated mine's position. The terms and types of specialized ship existed from the 1860s where "torpedoes" were made famous in the American Civil War until the demise of large, fixed coastal fortifications brought on by the changes of World War II. The earliest mines were the "torpedoes" associated with harbour defences. Thus the vessels required to place the torpedoes were termed torpedo planters with the equipment evolving with the mines.

Minesweeper

WARFARE Sea Materiel Minesweeper

A minesweeper is a small naval warship designed to engage in minesweeping. Using various mechanisms intended to counter the threat posed by naval mines, waterways are kept clear for safe shipping. Minesweepers are equipped with mechanical or electrical devices, known as "sweeps", for disabling mines. The modern minesweeper is designed to reduce the chances of it detonating mines itself; it is soundproofed to reduce its acoustic signature and often constructed using wood, fiberglass or non-ferrous metal, or is degaussed to reduce its magnetic signature. Mechanical sweeps are devices designed to cut the anchoring cables of moored mines, and preferably attach a tag to help the subsequent localization and neutralization. They are towed behind the minesweeper, and use a towed body (e.g. oropesa, paravane) to maintain the sweep at the desired depth and position. Influence sweeps are equipment, often towed, that emulate a particular ship signature, thereby causing a mine to detonate. The most common such sweeps are magnetic and acoustic generators.

There are two modes of operating an influence sweep: MSM (mine setting mode) and TSM (target simulation mode or target setting mode). MSM sweeping is founded on intelligence on a given type of mine, and produces the output required for detonation of this mine. If such intelligence is unavailable, the TSM sweeping instead reproduces the influence of the friendly ship that is about to transit the area. TSM sweeping thus clears mines directed at this ship without knowledge of the mines. However, mines directed at other ships might remain. The minesweeper differs from a minehunter; the minehunter actively detects and neutralises individual mines. Minesweepers are in many cases complementary to minehunters, depending on the operation and the environment; a minesweeper is, in particular, better suited to clearing open-water areas with large numbers of mines. Both kinds of ships are collectively called mine countermeasure vessels (MCMV), a term also applied to a vessel that combines both roles. The first such ship was HMS Wilton, also the first warship to be constructed from fiberglass.

Missile Boat

WARFARE Sea Materiel Missile Boat

A missile boat or missile cutter is a small fast warship armed with anti-ship missiles. Being smaller than other warships such as destroyers and frigates, missile boats are popular with nations interested in forming a navy at lower cost. They are similar in concept to the torpedo boats of World War II; in fact, the first missile boats were modified torpedo boats with the torpedo tubes replaced by missile tubes. The doctrine behind the use of missile boats is based on the principle of mobility over defence and firepower. The advent of proper guided missile and electronic countermeasure technologies gave birth to the idea that warships could now be designed to outmanoeuvre their enemies and conceal themselves while carrying powerful weapons. Previously, increasing the potency of naval artillery required larger projectiles, which required larger and heavier guns, which in turn called for larger ships to carry these guns and their ammunition and absorb their recoil. This trend culminated in the giant battleships of World War II. The ability to deploy anti-ship guided self-propelled warheads from small, manoeuvrable platforms partially negated the advantages provided by the earlier and larger warships.

Missile boats, when equipped with sophisticated anti-ship missiles, and especially when used in a swarm, can pose a significant threat to even the largest of capital ships, and do so at much greater ranges than is possible with torpedoes. Iran and North Korea have some of the largest numbers of missile boats in operation today. North Korea alone operates more than 300, while Iran has been developing "swarm boats" to be used as harassing vessels in the heavily contested littoral waters of the Persian Gulf. To counter the threat, the US Navy has been developing an ASUW Littoral Defensive Anti-Surface Warfare doctrine, along with vessels such as the littoral combat ship. The People's Liberation Army Navy of China also has a large fleet of missile craft, which include Type 22 missile boats, Type 037IG Houxin-class missile boats and Type 037II Houjian-class missile boats, with a total of 109 units.

Monitor (Warship)

WARFARE Sea Materiel Monitor

A monitor was a relatively small warship which was neither fast nor strongly armoured but carried disproportionately large guns. They were used by some navies from the 1860s, during the First World War and with limited use in the Second World War. During the Vietnam War they were used by the United States Navy. The Brazilian Navy's Parnaíba is the last monitor in service. The original monitor was designed in 1861 by John Ericsson, who named it USS Monitor. They were designed for shallow waters and served as coastal ships. The term "monitor" also encompassed more flexible breastwork monitors, and was sometimes used as a generic term for any turreted ship. The term "monitor" also encompasses the strongest of riverine warcraft, known as river monitors. In the early 20th century, the term "monitor" was revived for shallow-draught armoured shore bombardment vessels, particularly those of the Royal Navy: the Lord Clive-class monitors carried guns firing heavier shells than any other warship ever has, seeing action (albeit briefly) against German targets during World War I. The Lord Clive vessels were scrapped in the 1920s.

Patrol Boat

WARFARE Sea Materiel Patrol Boat

A patrol boat (also referred to as a patrol craft, patrol ship or patrol vessel) is a relatively small naval vessel generally designed for coastal defence duties. There have been many designs for patrol boats. They may be operated by a nation's navy, coast guard, police force or customs and may be intended for marine (blue water) or estuarine or river ("brown water") environments. They are commonly found engaged in various border protection roles, including anti-smuggling, anti-piracy, fisheries patrols, and immigration law enforcement. They are also often called upon to participate in rescue operations. Vessels of this type include the original yacht (from Dutch/Low German jacht meaning hunting or hunt), a light, fast-sailing vessel used by the Dutch navy to pursue pirates and other transgressors around and into shallow waters. They may be broadly classified as inshore patrol vessels (IPVs) and offshore patrol vessels (OPVs). They are warships typically smaller in size than a corvette and can include fast attack craft, torpedo boats and missile boats, although some are as large as a frigate. The offshore patrol vessels are usually the smallest ship in a navy's fleet that is large and seaworthy enough to patrol off-shore in the open ocean. In larger militaries, such as in the United States military, offshore patrol vessels usually serve in the coast guard, but many smaller nations navies operate these type of ships.

Torpedo Boat

WARFARE Sea Materiel Torpedo Boat

A torpedo boat is a relatively small and fast naval ship designed to carry torpedoes into battle. The first designs rammed enemy ships with explosive spar torpedoes, and later designs launched self-propelled Whitehead torpedoes. They were created to counter battleships and other slow and heavily armed ships by using speed, agility, and the power of their torpedo weapons. A number of inexpensive torpedo boats attacking en masse could overwhelm a larger ship's ability to fight them off using its large but cumbersome guns. An inexpensive fleet of torpedo boats could pose a threat to much larger and more expensive fleets of capital ships, albeit only in the coastal areas to which their small size and limited fuel load restricted them. The introduction of fast torpedo boats in the late 19th century was a serious concern to the era's naval strategists. In response, navies operating large ships introduced smaller ships to counter torpedo boats, mounting light quick-firing guns. These ships, which came to be called "torpedo boat destroyers" and later simply "destroyers", became larger and took on more roles, making torpedo attacks as well as defending against them, and eventually defending against submarines and aircraft. The destroyer eventually became the predominant type of surface warship in the guided missile age. In the modern era, the old concept of a very small, fast, and cheap surface combatant with powerful offensive weapons is taken up by the "fast attack craft".

Patrol Torpedo (PT) Boat

WARFARE Sea Materiel Patrol Torpedo (PT) Boat

A PT boat (short for patrol torpedo boat) was a torpedo-armed fast attack vessel (MTB) used by the United States Navy in World War II. It was small, fast, and inexpensive to build, valued for its manoeuvrability and speed but hampered at the beginning of the war by ineffective torpedoes, limited armament, and comparatively fragile construction that limited some of the variants to coastal waters. The PT boat was very different from the first generation of torpedo boat, which had been developed at the end of the 19th century and featured a displacement hull form. These first generation torpedo boats rode low in the water, displaced up to 300 tons, and had a top speed of 25 to 27 kn (29 to 31 mph; 46 to 50 km/h). During World War I Italy, the US and UK developed the first high-performance motor torpedo boats (often with top speeds over 40 kn (46 mph; 74 km/h)) and corresponding torpedo tactics, but these projects were all quickly disbanded with the Armistice. World War II PT boats continued to exploit some of the advances in planing hull design borrowed from offshore powerboat racing and were able to grow in size due to advancements in engine technology.

During World War II, PT boats engaged enemy warships, transports, tankers, barges, and sampans. As gunboats they could be effective against enemy small craft, especially armoured barges used by the Japanese for inter-island transport. Several saw service with the Philippine Navy, where they were named "Q-boats", most probably after President Manuel L. Quezon. Primary anti-ship armament was four 2,600 pound (1,179 kg) Mark 8 torpedoes. Launched by 21-inch Mark 18 (530 mm) torpedo tubes, each bore a 466-pound (211 kg) TNT warhead and had a range of 16,000 yards (14,630 m) at 36 knots (66 km/h). Two twin M2 .50 cal (12.7 mm) machine guns were mounted for anti-aircraft defence and general fire support. Some boats shipped a 20 mm Oerlikon cannon. Propulsion was via a trio of Packard 4M-2500 and later 5M-2500 supercharged gasoline-fuelled, liquid-cooled marine engines. Nicknamed "the mosquito fleet" – and "devil boats" by the Japanese – the PT boat squadrons were hailed for their daring and earned a durable place in the public imagination that remains strong into the 21st century.

Q-Ship

WARFARE Sea Materiel Q-

Q-ships, also known as Q-boats, decoy vessels, special service ships, or mystery ships, were heavily armed merchant ships with concealed weaponry, designed to lure submarines into making surface attacks. This gave Q-ships the chance to open fire and sink them. They were used by the British Royal Navy (RN) and the German Kaiserliche Marine during the First World War and by the RN, the Kriegsmarine and the United States Navy during the Second World War (1939–45).

Seaplane Tender

WARFARE Sea Materiel Seaplane Tender

A seaplane tender is a boat or ship that supports the operation of seaplanes. Some of these vessels, the seaplane carriers, could not only carry seaplanes but also provided all the facilities needed for their operation; these ships are regarded by some as the first aircraft carriers and appeared just before the First World War. In maritime parlance a tender is a vessel that is used to support the operation of other vessels. In British usage, the term tender was used for small craft, with the term depot ship being used for large sea going vessels. Flying boats and float planes even when based at home in ports and harbour had a need for small support vessels to operate. British tenders were small craft of launch to pinnace size. These were used to ferry crews, stores and supplies between shore and the aircraft, to maintain the buoys used to mark out "taxiways" and "runways" and to keep these clear of debris to prevent foreign object damage, and in the case of emergency to act as rescue craft and airport crash tenders. All those functions that on land would require wheeled ground support equipment had a need for a watercraft equivalent. When deploying flying boat squadrons, bases could rapidly be established in areas lacking infrastructure by sending in addition to small craft tenders, flying boat depot ships, these ships could carry out the function of barracks, workshops and control towers, i.e. those functions which in a land based airfield would be fulfilled by buildings.

Submarine

RFARE Sea Materiel arine

WARFARE Sea Materiel Submarine

A submarine (or simply sub) is a watercraft capable of independent operation underwater. It differs from a submersible, which has more limited underwater capability. It is also sometimes used historically or colloquially to refer to remotely operated vehicles and robots, as well as medium-sized or smaller vessels, such as the midget submarine and the wet sub. Although experimental submarines had been built before, submarine design took off during the 19th century, and they were adopted by several navies. Submarines were first widely used during World War I (1914–1918), and are now used in many navies large and small. Military uses include attacking enemy surface ships (merchant and military), attacking other submarines, aircraft carrier protection, blockade running, ballistic missile submarines as part of a nuclear strike force, reconnaissance, conventional land attack (for example using a cruise missile), and covert insertion of special forces. Civilian uses for submarines include marine science, salvage, exploration and facility inspection and maintenance. Submarines can also be modified to perform more specialized functions such as search-and-rescue missions or undersea cable repair. Submarines are also used in tourism, and for undersea archaeology. Most large submarines consist of a cylindrical body with hemispherical (or conical) ends and a vertical structure, usually located amidships, which houses communications and sensing devices as well as periscopes. In modern submarines, this structure is the "sail" in American usage and "fin" in European usage.

A "conning tower" was a feature of earlier designs: a separate pressure hull above the main body of the boat that allowed the use of shorter periscopes. There is a propeller (or pump jet) at the rear, and various hydrodynamic control fins. Smaller, deep-diving and specialty submarines may deviate significantly from this traditional layout. Submarines use diving planes and also change the amount of water and air in ballast tanks to change buoyancy for submerging and surfacing. Submarines have one of the widest ranges of types and capabilities of any vessel. They range from small autonomous examples and one- or two-person vessels that operate for a few hours, to vessels that can remain submerged for six months—such as the Russian Typhoon class, the biggest submarines ever built. Submarines can work at greater depths than are survivable or practical for human divers. Modern deep-diving submarines derive from the bathyscaphe, which in turn evolved from the diving bell.

WARFARE Sea Materiel Submarine

All surface ships, as well as surfaced submarines, are in a positively buoyant condition, weighing less than the volume of water they would displace if fully submerged. To submerge hydrostatically, a ship must have negative buoyancy, either by increasing its own weight or decreasing its displacement of water. To control their displacement, submarines have ballast tanks, which can hold varying amounts of water and air. For general submersion or surfacing, submarines use the forward and aft tanks, called Main Ballast Tanks (MBT), which are filled with water to submerge or with air to surface. Submerged, MBTs generally remain flooded, which simplifies their design, and on many submarines these tanks are a section of interhull space. For more precise and quick control of depth, submarines use smaller Depth Control Tanks (DCT) – also called hard tanks (due to their ability to withstand higher pressure), or trim tanks. The amount of water in depth control tanks can be controlled to change depth or to maintain a constant depth as outside conditions (chiefly water density) change. Depth control tanks may be located either near the submarine's centre of gravity, or separated along the submarine body to prevent affecting trim. When submerged, the water pressure on a submarine's hull can reach 4 MPa (580 psi) for steel submarines and up to 10 MPa (1,500 psi) for titanium submarines like K-278 Komsomolets, while interior pressure remains relatively unchanged. This difference results in hull compression, which decreases displacement. Water density also marginally increases with depth, as the salinity and pressure are higher. This change in density incompletely compensates for hull compression, so buoyancy decreases as depth increases.

WARFARE Sea Materiel Submarine

A submerged submarine is in an unstable equilibrium, having a tendency to either sink or float to the surface. Keeping a constant depth requires continual operation of either the depth control tanks or control surfaces. Submarines in a neutral buoyancy condition are not intrinsically trim-stable. To maintain desired trim, submarines use forward and aft trim tanks. Pumps can move water between the tanks, changing weight distribution and pointing the sub up or down. A similar system is sometimes used to maintain stability. The hydrostatic effect of variable ballast tanks is not the only way to control the submarine underwater. Hydrodynamic manoeuvring is done by several surfaces, which can be moved to create hydrodynamic forces when a submarine moves at sufficient speed. The stern planes, located near the propeller and normally horizontal, serve the same purpose as the trim tanks, controlling the trim, and are commonly used, while other control surfaces may not be present on all submarines. The fairwater planes on the sail and/or bow planes on the main body, both also horizontal, are closer to the centre of gravity, and are used to control depth with less effect on the trim. When a submarine performs an emergency surfacing, all depth and trim methods are used simultaneously, together with propelling the boat upwards. Such surfacing is very quick, so the sub may even partially jump out of the water, potentially damaging submarine systems.

WARFARE Sea Materiel Submarine

Hull

Modern submarines are cigar-shaped. This design, visible in early submarines, is sometimes called a "teardrop hull". It reduces the hydrodynamic drag when submerged, but decreases the sea-keeping capabilities and increases drag while surfaced. Since the limitations of the propulsion systems of early submarines forced them to operate surfaced most of the time, their hull designs were a compromise. Because of the slow submerged speeds of those subs, usually well below 10 kt (18 km/h), the increased drag for underwater travel was acceptable. Late in World War II, when technology allowed faster and longer submerged operation and increased aircraft surveillance forced submarines to stay submerged, hull designs became teardrop shaped again to reduce drag and noise. USS Albacore (AGSS-569) was a unique research submarine that pioneered the American version of the teardrop hull form (sometimes referred to as an "Albacore hull") of modern submarines. On modern military submarines the outer hull is covered with a layer of sound-absorbing rubber, or anechoic plating, to reduce detection. The occupied pressure hulls of deep diving submarines such as DSV Alvin are spherical instead of cylindrical. This allows a more even distribution of stress at the great depth. A titanium frame is usually affixed to the pressure hull, providing attachment for ballast and trim systems, scientific instrumentation, battery packs, syntactic flotation foam, and lighting.

WARFARE Sea Materiel Submarine

A raised tower on top of a submarine accommodates the periscope and electronics masts, which can include radio, radar, electronic warfare, and other systems including the snorkel mast. In many early classes of submarines (see history), the control room, or "conn", was located inside this tower, which was known as the "conning tower". Since then, the conn has been located within the hull of the submarine, and the tower is now called the "sail". The conn is distinct from the "bridge", a small open platform in the top of the sail, used for observation during surface operation. Modern submarines and submersibles, as well as the oldest ones, usually have a single hull. Large submarines generally have an additional hull or hull sections outside. This external hull, which actually forms the shape of submarine, is called the outer hull (casing in the Royal Navy) or light hull, as it does not have to withstand a pressure difference. Inside the outer hull there is a strong hull, or pressure hull, which withstands sea pressure and has normal atmospheric pressure inside. As early as World War I, it was realized that the optimal shape for withstanding pressure conflicted with the optimal shape for sea keeping and minimal drag, and construction difficulties further complicated the problem. This was solved either by a compromise shape, or by using two hulls; internal for holding pressure, and external for optimal shape.

WARFARE Sea Materiel Submarine

Until the end of World War II, most submarines had an additional partial cover on the top, bow and stern, built of thinner metal, which was flooded when submerged. Germany went further with the Type XXI, a general predecessor of modern submarines, in which the pressure hull was fully enclosed inside the light hull, but optimized for submerged navigation, unlike earlier designs that were optimized for surface operation. The pressure hull is generally constructed of thick high-strength steel with a complex structure and high strength reserve, and is separated with watertight bulkheads into several compartments. There are also examples of more than two hulls in a submarine, like the Typhoon class, which has two main pressure hulls and three smaller ones for control room, torpedoes and steering gear, with the missile launch system between the main hulls. The dive depth cannot be increased easily. Simply making the hull thicker increases the weight and requires reduction of on-board equipment weight, ultimately resulting in a bathyscaphe. This is acceptable for civilian research submersibles, but not military submarines.

WARFARE Sea Materiel Submarine

Propulsion

The first submarines were propelled by humans. The first mechanically driven submarine was the 1863 French Plongeur, which used compressed air for propulsion. Anaerobic propulsion was first employed by the Spanish Ictineo II in 1864, which used a solution of zinc, manganese dioxide, and potassium chlorate to generate sufficient heat to power a steam engine, while also providing oxygen for the crew. A similar system was not employed again until 1940 when the German Navy tested a hydrogen peroxide-based system, the Walter turbine, on the experimental V-80 submarine and later on the naval U-791 and type XVII submarines. Until the advent of nuclear marine propulsion, most 20th-century submarines used batteries for running underwater and gasoline (petrol) or diesel engines on the surface, and for battery recharging. Early submarines used gasoline, but this quickly gave way to kerosene (paraffin), then diesel, because of reduced flammability. Diesel-electric became the standard means of propulsion. The diesel or gasoline engine and the electric motor, separated by clutches, were initially on the same shaft driving the propeller. This allowed the engine to drive the electric motor as a generator to recharge the batteries and also propel the submarine. The clutch between the motor and the engine would be disengaged when the submarine dived, so that the motor could drive the propeller. The motor could have multiple armatures on the shaft, which could be electrically coupled in series for slow speed and in parallel for high speed (these connections were called "group down" and "group up", respectively).

Nuclear Power
Steam power was resurrected in the 1950s with a nuclear-powered steam turbine driving a generator. By eliminating the need for atmospheric oxygen, the time that a submarine could remain submerged was limited only by its food stores, as breathing air was recycled and fresh water distilled from seawater. More importantly, a nuclear submarine has unlimited range at top speed. This allows it to travel from its operating base to the combat zone in a much shorter time and makes it a far more difficult target for most anti-submarine weapons. Nuclear-powered submarines have a relatively small battery and diesel engine/generator power plant for emergency use if the reactors must be shut down. Nuclear power is now used in all large submarines, but due to the high cost and large size of nuclear reactors, smaller submarines still use diesel-electric propulsion. The ratio of larger to smaller submarines depends on strategic needs. The US Navy, French Navy, and the British Royal Navy operate only nuclear submarines, which is explained by the need for distant operations. Other major operators rely on a mix of nuclear submarines for strategic purposes and diesel-electric submarines for defence. Most fleets have no nuclear submarines, due to the limited availability of nuclear power and submarine technology.

Armament
The success of the submarine is inextricably linked to the development of the torpedo, invented by Robert Whitehead in 1866. His invention is essentially the same now as it was 140 years ago. Only with self-propelled torpedoes could the submarine make the leap from novelty to a weapon of war. Until the perfection of the guided torpedo, multiple "straight-running" torpedoes were required to attack a target. With at most 20 to 25 torpedoes stored on board, the number of attacks was limited. To increase combat endurance most World War I submarines functioned as submersible gunboats, using their deck guns against unarmed targets, and diving to escape and engage enemy warships. The importance of guns encouraged the development of the unsuccessful Submarine Cruiser such as the French Surcouf and the Royal Navy's X1 and M-class submarines. With the arrival of Anti-submarine warfare (ASW) aircraft, guns became more for defence than attack. A more practical method of increasing combat endurance was the external torpedo tube, loaded only in port. The ability of submarines to approach enemy harbours covertly led to their use as minelayers. Minelaying submarines of World War I and World War II were specially built for that purpose. Modern submarine-laid mines, such as the British Mark 5 Stonefish and Mark 6 Sea Urchin, can be deployed from a submarine's torpedo tubes.

Sensors
A submarine can have a variety of sensors, depending on its missions. Modern military submarines rely almost entirely on a suite of passive and active sonars to locate targets. Active sonar relies on an audible "ping" to generate echoes to reveal objects around the submarine. Active systems are rarely used, as doing so reveals the sub's presence. Passive sonar is a set of sensitive hydrophones set into the hull or trailed in a towed array, normally trailing several hundred feet behind the sub. The towed array is the mainstay of NATO submarine detection systems, as it reduces the flow noise heard by operators. Hull mounted sonar is employed in addition to the towed array, as the towed array can't work in shallow depth and during manoeuvring. In addition, sonar has a blind spot "through" the submarine, so a system on both the front and back works to eliminate that problem. As the towed array trails behind and below the submarine, it also allows the submarine to have a system both above and below the thermocline at the proper depth; sound passing through the thermocline is distorted resulting in a lower detection range. Submarines also carry radar equipment to detect surface ships and aircraft. Submarine captains are more likely to use radar detection gear than active radar to detect targets, as radar can be detected far beyond its own return range, revealing the submarine. Periscopes are rarely used, except for position fixes and to verify a contact's identity. Civilian submarines, such as the DSV Alvin or the Russian Mir submersibles, rely on small active sonar sets and viewing ports to navigate. The human eye cannot detect sunlight below about 300 feet (91 m) underwater, so high intensity lights are used to illuminate the viewing area.

Navigation
Early submarines had few navigation aids, but modern subs have a variety of navigation systems. Modern military submarines use an inertial guidance system for navigation while submerged, but drift error unavoidably builds over time. To counter this, the crew occasionally uses the Global Positioning System to obtain an accurate position. The periscope—a retractable tube with a prism system that provides a view of the surface—is only used occasionally in modern submarines, since the visibility range is short. The Virginia-class and Astute-class submarines use photonics masts rather than hull-penetrating optical periscopes. These masts must still be deployed above the surface, and use electronic sensors for visible light, infrared, laser range-finding, and electromagnetic surveillance. One benefit to hoisting the mast above the surface is that while the mast is above the water the entire sub is still below the water and is much harder to detect visually or by radar.

Communication
Military submarines use several systems to communicate with distant command centres or other ships. One is VLF (very low frequency) radio, which can reach a submarine either on the surface or submerged to a fairly shallow depth, usually less than 250 feet (76 m). ELF (extremely low frequency) can reach a submarine at greater depths, but has a very low bandwidth and is generally used to call a submerged sub to a shallower depth where VLF signals can reach. A submarine also has the option of floating a long, buoyant wire antenna to a shallower depth, allowing VLF transmissions by a deeply submerged boat. By extending a radio mast, a submarine can also use a "burst transmission" technique. A burst transmission takes only a fraction of a second, minimizing a submarine's risk of detection. To communicate with other submarines, a system known as Gertrude is used. Gertrude is basically a sonar telephone. Voice communication from one submarine is transmitted by low power speakers into the water, where it is detected by passive sonars on the receiving submarine. The range of this system is probably very short, and using it radiates sound into the water, which can be heard by the enemy.

Life Support Systems
With nuclear power or air-independent propulsion, submarines can remain submerged for months at a time. Conventional diesel submarines must periodically resurface or run on snorkel to recharge their batteries. Most modern military submarines generate breathing oxygen by electrolysis of water (using a device called an "Elektrolytic Oxygen Generator"). Atmosphere control equipment includes a CO2 scrubber, which uses an amine absorbent to remove the gas from air and diffuse it into waste pumped overboard. A machine that uses a catalyst to convert carbon monoxide into carbon dioxide (removed by the CO2 scrubber) and bonds hydrogen produced from the ship's storage battery with oxygen in the atmosphere to produce water, is also used. An atmosphere monitoring system samples the air from different areas of the ship for nitrogen, oxygen, hydrogen, R-12 and R-114 refrigerants, carbon dioxide, carbon monoxide, and other gases. Poisonous gases are removed, and oxygen is replenished by use of an oxygen bank located in a main ballast tank. Some heavier submarines have two oxygen bleed stations (forward and aft). The oxygen in the air is sometimes kept a few percent less than atmospheric concentration to reduce fire danger. Fresh water is produced by either an evaporator or a reverse osmosis unit. The primary use for fresh water is to provide feedwater for the reactor and steam propulsion plants. It is also available for showers, sinks, cooking and cleaning once propulsion plant needs have been met.

Seawater is used to flush toilets, and the resulting "black water" is stored in a sanitary tank until it is blown overboard using pressurized air or pumped overboard by using a special sanitary pump. The blackwater–discharge system is difficult to operate, and the German Type VIIC boat U-1206 was lost with casualties because of human error while using this system. Water from showers and sinks is stored separately in "grey water" tanks and discharged overboard using drain pumps. Trash on modern large submarines is usually disposed of using a tube called a Trash Disposal Unit (TDU), where it is compacted into a galvanized steel can. At the bottom of the TDU is a large ball valve. An ice plug is set on top of the ball valve to protect it, the cans atop the ice plug. The top breech door is shut, and the TDU is flooded and equalized with sea pressure, the ball valve is opened and the cans fall out assisted by scrap iron weights in the cans. The TDU is also flushed with seawater to ensure it is completely empty and the ball valve is clear before closing the valve.

Submarine Aircraft Carrier

A submarine aircraft carrier is a submarine equipped with aircraft for observation or attack missions. These submarines saw their most extensive use during World War II, although their operational significance remained rather small. The most famous of them were the Japanese I-400-class submarines and the French submarine Surcouf, although small numbers of similar craft were built for other nations' navies as well. Most operational submarine aircraft carriers, with the exception of the I-400 and AM classes, used their aircraft for reconnaissance and observation. This is in contrast to the typical surface aircraft carrier, whose main function is serving as a base for offensive aircraft. No submarine aircraft carriers remain in use, but the concept reappears periodically. The ability to make a stealth attack has an allure, but sustained air operations largely negate the advantage of being submersible, and the size limitations preclude sizable sustained aerial operations. Furthermore, any submarine large enough to be useful would be vulnerable to detection and counterattack. Combined with the cost for such a specialized vessel, it is unlikely that any navy would consider their construction worthwhile. In addition, submarine launchable cruise missiles increasingly incorporate limited surveillance capabilities, allowing them to serve as both strike weapons and disposable reconnaissance drones; this further reduces the value of operating aircraft from submarines.

U-Boat

U-boat is an anglicised version of the German word U-Boot, a shortening of Unterseeboot, literally "underseaboat." While the German term refers to any submarine, the English one (in common with several other languages) refers specifically to military submarines operated by Germany, particularly in the First and Second World Wars. Although at times they were efficient fleet weapons against enemy naval warships, they were most effectively used in an economic warfare role (commerce raiding) and enforcing a naval blockade against enemy shipping. The primary targets of the U-boat campaigns in both wars were the merchant convoys bringing supplies from Canada and other parts of the British Empire, and from the United States to the United Kingdom and (during the Second World War) to the Soviet Union and the Allied territories in the Mediterranean. German submarines also destroyed Brazilian merchant ships during World War II, causing Brazil to declare war on the Axis powers in 1944.

Submarine Chaser

A submarine chaser is a small and fast naval vessel that is specifically intended for anti-submarine warfare. Many of the American submarine chasers used in World War I found their way to Allied nations by way of Lend-Lease in World War II. U.S. Navy submarine chasers were designed specifically to destroy German submarines in World War I, and Japanese and German submarines in World War II. The small 110-foot (34 m) SC-1-class submarine chasers of the design used in World War I carried the hull designator SC (for Submarine Chaser). Their main weapon was the depth charge. They also carried machine guns and anti-aircraft guns. The similar-sized SC-497-class was built for World War II. Also in World War II, larger 173-foot (53 m) PC-461-class submarine chasers used the PC hull classification symbol (for Patrol, Coastal).

Survey Ship

A survey vessel is any type of ship or boat that is used for mapping. It is a type of research vessel.

The task of survey vessels is to map the bottom, benthic zone, full water column, and surface for the purpose of:
- Hydrography
- General oceanography
- Marine habitats
- Salvage
- Dredging
- Marine archaeology

Typically, modern survey vessels are equipped with one or more of the following equipment:
- GPS positioning and logging
- Single beam sonar
- Multibeam sonar
- Side-scan sonar
- Towed magnetometer
- Subsurface profiler
- Grab sampler
- Bottom coring device
- DCHP
- CTD
- Inertial Measurement Unit

Troopship

A troopship (also troop ship or troop transport or trooper) is a ship used to carry soldiers, either in peacetime or wartime. Operationally, standard troopships – often drafted from commercial shipping fleets – cannot land troops directly on shore, typically loading and unloading at a seaport or onto smaller vessels, either tenders or barges. Attack transports, a variant of ocean-going troopship adapted to transporting invasion forces ashore, carry their own fleet of landing craft. Landing ships beach themselves and bring their troops directly ashore.

5 Air Materiel

A military aircraft is any fixed-wing or rotary-wing aircraft that is operated by a legal or insurrectionary armed service of any type. Military aircraft can be either combat or non-combat:

- Combat aircraft are designed to destroy enemy equipment using their own aircraft ordnance. Combat aircraft are typically developed and procured only by military forces.
- Non-combat aircraft are not designed for combat as their primary function, but may carry weapons for self-defence. These mainly operate in support roles, and may be developed by either military forces or civilian organizations.

Combat aircraft, or "Warplanes", are divided broadly into multi-role, fighters, bombers, attackers, and electronic warfare support. Variations exist between them, including fighter-bombers, such as the MiG-23 ground-attack aircraft and the Soviet Ilyushin Il-2 Shturmovik. Also included among combat aircraft are long-range maritime patrol aircraft, such as the Hawker Siddeley Nimrod and the S-3 Viking that are often equipped to attack with anti-ship missiles and anti-submarine weapons.

Fighter Aircraft

The primary role of fighters is destroying enemy aircraft in air-to-air combat, as part of both offensive and defensive counter air operations. Many fighters also possess a degree of ground attack capability, allowing them to perform surface attack and close air support missions. In addition to their counter air duties they are tasked to perform escort mission for bombers or other aircraft. Fighters are capable of carrying a variety of weapons, including machine guns, cannons, rockets, guided missiles, and bombs. Many modern fighters can attack enemy fighters from a great distance, before the enemy even sees or detects them. Examples of fighters include the F-22 Raptor, F-15 Eagle, and Su-27.

Fighter Aircraft

A fighter aircraft is a military aircraft designed primarily for air-to-air combat against other aircraft, as opposed to bombers and attack aircraft, whose main mission is to attack ground targets. The hallmarks of a fighter are its speed, manoeuvrability, and small size relative to other combat aircraft. Many fighters have secondary ground-attack capabilities, and some are designed as dual-purpose fighter-bombers; often aircraft that do not fulfil the standard definition are called fighters. This may be for political or national security reasons, for advertising purposes, or other reasons. A fighter's main purpose is to establish air superiority over a battlefield. Since World War I, achieving and maintaining air superiority has been considered essential for victory in conventional warfare. The success or failure of a belligerent's efforts to gain air superiority hinges on several factors including the skill of its pilots, the tactical soundness of its doctrine for deploying its fighters, and the numbers and performance of those fighters. Because of the importance of air superiority, since the early days of aerial combat armed forces have constantly competed to develop technologically superior fighters and to deploy these fighters in greater numbers, and fielding a viable fighter fleet consumes a substantial proportion of the defence budgets of modern armed forces.

Fifth Generation Jet Fighters (2005 to the present)
Currently the cutting edge of fighter design, fifth-generation fighters are characterized by being designed from the start to operate in a network-centric combat environment, and to feature extremely low, all-aspect, multi-spectral signatures employing advanced materials and shaping techniques. They have multifunction AESA radars with high-bandwidth, low-probability of intercept (LPI) data transmission capabilities. The Infra-red search and track sensors incorporated for air-to-air combat as well as for air-to-ground weapons delivery in the 4.5th generation fighters are now fused in with other sensors for Situational Awareness IRST or SAIRST, which constantly tracks all targets of interest around the aircraft so the pilot need not guess when he glances. These sensors, along with advanced avionics, glass cockpits, helmet-mounted sights (not currently on F-22), and improved secure, jamming-resistant LPI datalinks are highly integrated to provide multi-platform, multi-sensor data fusion for vastly improved situational awareness while easing the pilot's workload. Avionics suites rely on extensive use of very high-speed integrated circuit (VHSIC) technology, common modules, and high-speed data buses. Overall, the integration of all these elements is claimed to provide fifth-generation fighters with a "first-look, first-shot, first-kill capability".

A key attribute of fifth-generation fighters is a small radar cross-section. Great care has been taken in designing its layout and internal structure to minimize RCS over a broad bandwidth of detection and tracking radar frequencies; furthermore, to maintain its VLO signature during combat operations, primary weapons are carried in internal weapon bays that are only briefly opened to permit weapon launch. Furthermore, stealth technology has advanced to the point where it can be employed without a trade-off with aerodynamics performance, in contrast to previous stealth efforts. Some attention has also been paid to reducing IR signatures, especially on the F-22. Detailed information on these signature-reduction techniques is classified, but in general includes special shaping approaches, thermoset and thermoplastic materials, extensive structural use of advanced composites, conformal sensors, heat-resistant coatings, low-observable wire meshes to cover intake and cooling vents, heat ablating tiles on the exhaust troughs (seen on the Northrop YF-23), and coating internal and external metal areas with radar-absorbent materials and paint (RAM/RAP). The AESA radar offers unique capabilities for fighters (and it is also quickly becoming essential for Generation 4.5 aircraft designs, as well as being retrofitted onto some fourth-generation aircraft).

In addition to its high resistance to ECM and LPI features, it enables the fighter to function as a sort of "mini-AWACS," providing high-gain electronic support measures (ESM) and electronic warfare (EW) jamming functions. Other technologies common to this latest generation of fighters includes integrated electronic warfare system (INEWS) technology, integrated communications, navigation, and identification (CNI) avionics technology, centralized "vehicle health monitoring" systems for ease of maintenance, fibre optics data transmission, stealth technology and even hovering capabilities. Manoeuvre performance remains important and is enhanced by thrust-vectoring, which also helps reduce take-off and landing distances.

Supercruise may or may not be featured; it permits flight at supersonic speeds without the use of the afterburner – a device that significantly increases IR signature when used in full military power. Such aircraft are sophisticated and expensive. The fifth generation was ushered in by the Lockheed Martin/Boeing F-22 Raptor in late 2005. The U.S. Air Force originally planned to acquire 650 F-22s, but now only 187 will be built. As a result, its unit flyaway cost (FAC) is around US$150 million. To spread the development costs – and production base – more broadly, the Joint Strike Fighter (JSF) program enrols eight other countries as cost- and risk-sharing partners.

Altogether, the nine partner nations anticipate procuring over 3,000 Lockheed Martin F-35 Lightning II fighters at an anticipated average FAC of $80–85 million. The F-35, however, is designed to be a family of three aircraft, a conventional take-off and landing (CTOL) fighter, a short take-off and vertical landing (STOVL) fighter, and a Catapult Assisted Take Off But Arrested Recovery (CATOBAR) fighter, each of which has a different unit price and slightly varying specifications in terms of fuel capacity (and therefore range), size and payload. Other countries have initiated fifth-generation fighter development projects, with Russia's Sukhoi Su-57 and Mikoyan LMFS. In December 2010, it was discovered that China is developing the 5th generation fighter Chengdu J-20. The J-20 took its maiden flight in January 2011.

The Shenyang J-31 took its maiden flight on 31 October 2012. Japan is exploring its technical feasibility to produce fifth-generation fighters. India is developing the Advanced Medium Combat Aircraft (AMCA), a medium weight stealth fighter jet designated to enter into serial production by late 2030s. India also had initiated a joint fifth generation heavy fighter with Russia called the FGFA. As of 2018 May, the project is suspected to have not yielded desired progress or results for India and has been put on hold or dropped altogether. Other countries considering fielding an indigenous or semi-indigenous advanced fifth generation aircraft include Korea, Sweden and Turkey.

Sixth Generation Jet Fighters

As of November 2018, France, Germany, Japan, Russia, the United Kingdom and the United States have announced the development of a sixth-generation aircraft program. France and Germany will develop a joint sixth-generation fighter to replace their current fleet of Dassault Rafales, Eurofighter Typhoons, and Panavia Tornados by 2035. The overall development will be led by a collaboration of Dassault and Airbus, while the engines will reportedly be jointly developed by Safran and MTU Aero Engines. Thales and MBDA are also seeking a stake in the project. Spain is reportedly planning to join the programme in the later stages and is expected to sign a letter of intent in early 2019. Currently at the concept stage, the first sixth-generation jet fighter is expected to enter service in the United States Air Force and United States Navy in 2025–30 period. The USAF seeks a new fighter for the 2030–50 period named the "Next Generation Tactical Aircraft" ("Next Gen TACAIR"). The US Navy looks to replace its F/A-18E/F Super Hornets beginning in 2025 with the Next Generation Air Dominance air superiority fighter. The United Kingdom's proposed stealth fighter is being developed by a European consortium called Team Tempest, consisting of BAE Systems, Rolls-Royce, Leonardo S.p.A. and MBDA. The aircraft is intended to enter service in 2035.

Fighter Weapons

Throughout the history of air combat, fighters which, by surprise or manoeuvre, attain a good firing position have achieved the kill about one third to one half the time, no matter what weapons were carried. The only major historic exception to this has been the low effectiveness shown by guided missiles in the first one to two decades of their existence. From WWI to the present fighter aircraft have featured machine guns and automatic cannons as weapons, and they are still considered as essential back-up weapons today. The power of air-to-air guns has increased greatly over time, and has kept them relevant in the guided missile era. In WWI two rifle calibre machine guns was the typical armament producing a weight of fire of about 0.4 kg (0.88 lb) per second. The standard WWII American fighter armament of six 0.50-cal (12.7mm) machine guns fired a bullet weight of approximately 3.7 kg/sec (8.1 lbs/sec), at a muzzle velocity of 856 m/s (2,810 ft/s). British and German aircraft tended to use a mix of machine guns and autocannon, the latter firing explosive projectiles. The modern M61 Vulcan 20 mm rotating barrel Gatling gun that is standard on current American fighters fires a projectile weight of about 10 kg/s (22 lb/s), nearly three times that of six 0.50-cal machine guns, with higher velocity of 1,052 m/s (3450 ft/s) supporting a flatter trajectory, and with exploding projectiles.

Modern fighter gun systems also feature ranging radar and lead computing electronic gun sights to ease the problem of aim point to compensate for projectile drop and time of flight (target lead) in the complex three dimensional manoeuvring of air-to-air combat. However, getting in position to use the guns is the challenge. The range of guns is longer than in the past but still quite limited compared to missiles, with modern gun systems having a maximum effective range of approximately 1,000 meters. High probability of kill also requires firing to usually occur from the rear hemisphere of the target. Despite these limits, when pilots are well trained in air-to-air gunnery and these conditions are satisfied, gun systems are tactically effective and highly cost efficient. The cost of a gun firing pass is far less than firing a missile, and the projectiles are not subject to the thermal and electronic countermeasures than can sometimes defeat missiles. When the enemy can be approached to within gun range, the lethality of guns is approximately a 25% to 50% chance of "kill per firing pass". The range limitations of guns, and the desire to overcome large variations in fighter pilot skill and thus achieve higher force effectiveness, led to the development of the guided air-to-air missile. There are two main variations, heat-seeking (infrared homing), and radar guided.

Radar missiles are typically several times heavier and more expensive than heat-seekers, but with longer range, greater destructive power, and ability to track through clouds. The highly successful AIM-9 Sidewinder heat-seeking (infrared homing) short-range missile was developed by the United States Navy in the 1950s. These small missiles are easily carried by lighter fighters, and provide effective ranges of approximately 10 to 35 km (~6 to 22 miles). Beginning with the AIM-9L in 1977, subsequent versions of Sidewinder have added all-aspect capability, the ability to use the lower heat of air to skin friction on the target aircraft to track from the front and sides.

The latest (2003 service entry) AIM-9X also features "off-boresight" and "lock on after launch" capabilities, which allow the pilot to make a quick launch of a missile to track a target anywhere within the pilot's vision. The AIM-9X development cost was U.S. $3 billion in mid to late 1990s dollars, and 2015 per unit procurement cost is $0.6 million each. The missile weighs 85.3 kg (188 lbs), and has a maximum range of 35 km (22 miles) at higher altitudes. Like most air-to-air missiles, lower altitude range can be as limited as only about one third of maximum due to higher drag and less ability to coast downward.

The effectiveness of heat-seeking missiles was only 7% early in the Vietnam War, but improved to approximately 15%–40% over the course of the war. The AIM-4 Falcon used by the USAF had kill rates of approximately 7% and was considered a failure. The AIM-9B Sidewinder introduced later achieved 15% kill rates, and the further improved AIM-9D and J models reached 19%. The AIM-9G used in the last year of the Vietnam air war achieved 40%. Israel used almost totally guns in the 1967 Six-Day War, achieving 60 kills and 10 losses. However, Israel made much more use of steadily improving heat-seeking missiles in the 1973 Yom Kippur War.

In this extensive conflict Israel scored 171 of out of 261 total kills with heat-seeking missiles (65.5%), 5 kills with radar guided missiles (1.9%), and 85 kills with guns (32.6%). The AIM-9L Sidewinder scored 19 kills out of 26 fired missiles (73%) in the 1982 Falklands War. But, in a conflict against opponents using thermal countermeasures, the United States only scored 11 kills out of 48 fired (Pk = 23%) with the follow-on AIM-9M in the 1991 Gulf War. Radar guided missiles fall into two main missile guidance types. In the historically more common semi-active radar homing case the missile homes in on radar signals transmitted from launching aircraft and reflected from the target.

This has the disadvantage that the firing aircraft must maintain radar lock on the target and is thus less free to manoeuvre and more vulnerable to attack. A widely deployed missile of this type was the AIM-7 Sparrow, which entered service in 1954 and was produced in improving versions until 1997. In more advanced active radar homing the missile is guided to the vicinity of the target by internal data on its projected position, and then "goes active" with an internally carried small radar system to conduct terminal guidance to the target. This eliminates the requirement for the firing aircraft to maintain radar lock, and thus greatly reduces risk. A prominent example is the AIM-120 AMRAAM, which was first fielded in 1991 as the AIM-7 replacement, and which has no firm retirement date as of 2016. The current AIM-120D version has a maximum high altitude range of greater than 160 km (>99 miles), and cost approximately $2.4 million each (2016). As is typical with most other missiles, range at lower altitude may be as little as one third that of high altitude. In the Vietnam air war radar missile kill reliability was approximately 10% at shorter ranges, and even worse at longer ranges due to reduced radar return and greater time for the target aircraft to detect the incoming missile and take evasive action. At one point in the Vietnam war, the U.S. Navy fired 50 AIM-7 Sparrow radar guided missiles in a row without a hit. Between 1958 and 1982 in five wars there were 2,014 combined heat-seeking and radar guided missile firings by fighter pilots engaged in air-to-air combat, achieving 528 kills, of which 76 were radar missile kills, for a combined effectiveness of 26%.

However, only four of the 76 radar missile kills were in the beyond-visual-range mode intended to be the strength of radar guided missiles. The United States invested over $10 billion in air-to-air radar missile technology from the 1950s to the early 1970s. Amortized over actual kills achieved by the U.S. and its allies, each radar guided missile kill thus cost over $130 million. The defeated enemy aircraft were for the most part older MiG-17s, −19s, and −21s, with new cost of $0.3 million to $3 million each. Thus, the radar missile investment over that period far exceeded the value of enemy aircraft destroyed, and furthermore had very little of the intended BVR effectiveness.

However, continuing heavy development investment and rapidly advancing electronic technology led to significant improvement in radar missile reliabilities from the late 1970s onward. Radar guided missiles achieved 75% Pk (9 kills out of 12 shots) in operations in the Gulf War in 1991. The percentage of kills achieved by radar guided missiles also surpassed 50% of total kills for the first time by 1991. Since 1991, 20 of 61 kills worldwide have been beyond-visual-range using radar missiles. Discounting an accidental friendly fire kill, in operational use the AIM-120D (the current main American radar guided missile) has achieved 9 kills out of 16 shots for a 56% Pk. Six of these kills were BVR, out of 13 shots, for a 46% BVR Pk. Though all these kills were against less capable opponents who were not equipped with operating radar, electronic countermeasures, or a comparable weapon themselves, the BVR Pk was a significant improvement from earlier eras.

However, a current concern is electronic countermeasures to radar missiles, which are thought to be reducing the effectiveness of the AIM-120D. Some experts believe that as of 2016 the European Meteor missile, the Russian K-37M, and the Chinese PL-15 are more resistant to countermeasures and more effective than the AIM-120D. Now that higher reliabilities have been achieved, both types of missiles allow the fighter pilot to often avoid the risk of the short-range dogfight, where only the more experienced and skilled fighter pilots tend to prevail, and where even the finest fighter pilot can simply get unlucky.

Taking maximum advantage of complicated missile parameters in both attack and defence against competent opponents does take considerable experience and skill, but against surprised opponents lacking comparable capability and countermeasures, air-to-air missile warfare is relatively simple. By partially automating air-to-air combat and reducing reliance on gun kills mostly achieved by only a small expert fraction of fighter pilots, air-to-air missiles now serve as highly effective force multipliers.

Air Superiority Fighter

An air superiority fighter, is a type of fighter aircraft designed for entering and seizing control of enemy airspace as a means of establishing complete dominance over the enemy's air force (air supremacy). Air superiority fighters are designed primarily to effectively engage enemy fighters, more than other types of aircraft, although some may have a secondary role for air-to-ground strikes. During World War II and through the Korean War, fighters were classified by their role: heavy fighter, interceptor, escort fighter, night fighter, and so forth. With the development of guided missiles in the 1950s, design diverged between fighters optimized to fight in the beyond visual range (BVR) regime (interceptors), and fighters optimized to fight in the within visual range (WVR) regime (air superiority fighters). In the United States, the influential proponents of BVR developed fighters with no forward-firing gun, such as the original F-4 Phantom II, as it was thought that they would never need to resort to WVR combat. These aircraft would sacrifice high manoeuvrability, and instead focus on other performance characteristics, as they presumably would never engage in a dogfight with enemy fighters.

After lessons learned from combat experiences involving modern military air capacity, the U.S. Navy's VFAX/VFX and U.S. Air Force's F-X (Fighter Experimental) reassessed their tactical direction which resulted in the U.S. Navy's F-14 Tomcat and US Air Force's F-15 Eagle. The two designs were built to achieve air superiority and significant consideration was given during the development of both aircraft to allow them to excel at the shorter ranges of fighter combat. Both aircraft also serve as interceptors due to their high maximum speed. By contrast, the Soviets (and the succeeding Russian Federation) developed and continue to operate separate types of air superiority (MiG-29, Su-27) and interceptor (MiG-25, MiG-31) fighters. For the US Navy, the F-14 Tomcat was initially deployed solely as an air superiority fighter (plus fleet defence interceptor and tactical aerial reconnaissance). By contrast, the multirole F/A-18 Hornet was designed as strike fighter while having only enough of an edge to defend itself against enemy fighters if needed.

While the F-14 had an undeveloped secondary ground attack capability, the Navy did not want to risk it in the air-to-ground role at the time, due to its lack of proper defensive electronic countermeasures (DECM) and radar homing and warning (RHAW) for overland operations, as well as the fighter's high cost. In the 1990s, the US Navy added LANTIRN pods to its F-14s and deployed them on precision ground-attack missions. The F-15 Eagle was envisioned originally as an air superiority fighter and interceptor under the mantra "not a pound for air-to-ground". However, the F-15C can carry "dumb" and GPS guided bombs, such capabilities which were first used by Israeli Air Force. In fact, the basic airframe proved versatile enough to produce a very capable strike fighter, the F-15E Strike Eagle. While designed for ground attack, it retains the air-to-air lethality of the original F-15. Similarly, the F-16 Fighting Falcon was also originally designed as an air superiority fighter but has since evolved into a successful all-weather multirole aircraft. Since the 1990s, with air superiority fighters such as the F-14 and F-15 pressed into the strike role and/or having a strike derivative, the lines between air superiority fighters and multirole fighters has blurred somewhat. With the retirement of the F-14 Tomcat, the US Navy has pressed its F/A-18 Hornet and its upsized derivative, the F/A-18E/F Super Hornet, into the air superiority role, despite the Hornets being originally designed as multirole strike fighters.

Interceptor Aircraft

An interceptor aircraft, or simply interceptor, is a type of fighter aircraft designed specifically to attack enemy aircraft, particularly bombers and reconnaissance aircraft, as they approach. There are two general classes of interceptor: relatively lightweight aircraft built for high performance, and heavier aircraft designed to fly at night or in adverse weather and operate over longer ranges. For daytime operations, conventional fighters normally fill the interceptor role, as well as many other missions. Daytime interceptors have been used in a defensive role since the World War I era, but are perhaps best known from several major actions during World War II, notably the Battle of Britain where the Supermarine Spitfire and Hawker Hurricane developed a good reputation. Few aircraft can be considered dedicated daytime interceptors. Exceptions include the Messerschmitt Me 163B—the only rocket-powered, manned military aircraft ever to see combat—and to a lesser degree designs like the Mikoyan-Gurevich MiG-15, which had heavy armament specifically intended for anti-bomber missions.

Night fighters and bomber destroyers are, by definition, interceptors of the heavy type, although initially they were rarely referred to as such. In the early Cold War era the combination of jet-powered bombers and nuclear weapons created air forces' demand for highly capable interceptors; it is during this period that the term is perhaps most recognized and used. Examples of classic interceptors of this era include the F-106 Delta Dart, Sukhoi Su-15, and English Electric Lightning. Through the 1960s and 1970s, the rapid improvements in design led to most air-superiority and multirole fighters, such as the Grumman F-14 Tomcat and McDonnell Douglas F-15 Eagle, having the performance to take on the interceptor role, and the strategic threat moved from bombers to intercontinental ballistic missiles (ICBMs). Dedicated interceptor designs became rare, with the only widely used examples designed after the 1960s being the Tornado F3, Mikoyan MiG-25 "Foxbat", Mikoyan MiG-31 "Foxhound", and the Shenyang J-8 "Finback".

WARFARE Air Materiel Fighter Aircraft Interceptor Aircraft

Point Defence Interceptors
In the spectrum of various interceptors, one design approach especially shows sacrifices necessary to achieve decisive benefit in a chosen aspect of performance. A "Point defence interceptor" is of a lightweight design, intended to spend most of its time on the ground located at the defended target, and able to launch on demand, climb to altitude, manoeuvre and then attack the bomber in a very short time, before the bomber can deploy its weapons. At the end of Second World War, the Luftwaffe's most critical requirement was for interceptors as the Commonwealth and American air forces pounded German targets night and day.

As the bombing effort grew, notably in early 1944, the Luftwaffe introduced a rocket-powered design, the Messerschmitt Me 163 Komet, in the very-short-range interceptor role. The engine allowed about 7 minutes of powered flight, but offered such tremendous performance that they could fly right by the defending fighters. The Me 163 required an airbase, however, which were soon under constant attack. Following the Emergency Fighter Program, the Germans developed even odder designs, such as the Bachem Ba 349 Natter, which launched vertically and thus eliminated the need for an airbase.

In general all these initial German designs proved difficult to operate, often becoming death traps for their pilots, and had little effect on the bombing raids. Rocket-boosted variants of both of Germany's jet fighters; the Me 262 in its "C" subtype series, all nicknamed "home protector" (Heimatschützer, in four differing formats) and the planned He 162E subtype, using one of the same BMW 003R turbojet/rocket "mixed-power" engine as the Me 262C-2b Heimatschützer II used a pair of, had airworthy prototypes built, but were never produced in quantity.

In the initial stage of Cold War, bombers were expected to attack flying higher and faster, even at transonic speeds. Initial transonic and supersonic fighters had modest internal fuel tanks in their slim fuselages, but a very high fuel consumption. This led fighter prototypes emphasizing acceleration and operational ceiling, with a sacrifice on the loiter time, essentially limiting them to point defence role. Such were the mixed jet/rocket power Republic XF-91 or Saunders Roe SR.53.

The Soviet and Western trials with zero-length launch were also related. None of these found practical use. Designs that depended solely on jet engines achieved more success with the F-104 Starfighter (initial A version) and the English Electric Lightning. The role of manned point defence designs was reassigned to unmanned interceptors—surface-to-air missiles (SAMs)—which first reached an adequate level in 1954–1957. SAM advancements ended the concept of massed high-altitude bomber operations, in favour of penetrators (and later cruise missiles) flying a combination of techniques colloquially known as "flying below the radar". By flying terrain masking low-altitude nap-of-the-earth flight profiles the effective range, and therefore reaction time, of ground-based radar was limited to at best the radar horizon. In the case of ground radar systems this can be countered by placing radar systems on mountain tops to extend the radar horizon, or through placing high performance radars in interceptors or in AWACs aircraft used to direct point defence interceptors.

Area Defence
As capabilities continued to improve – especially through the widespread introduction of the jet engine and the adoption of high speed, low level flight profiles, the time available between detection and interception dropped. Most advanced point defence interceptors combined with long-range radars were struggling to keep the reaction time down enough to be effective. Fixed times, like the time needed for the pilot to climb into the cockpit, became an increasing portion of the overall mission time, there were few ways to reduce this. During the Cold War in times of heightened tensions, quick reaction alert (QRA) aircraft were kept piloted, fully fuelled and armed, with the engines running at idle on the runway ready to take off. The aircraft being kept topped up with fuel via hoses from underground fuel tanks. If a possible intruder was identified, the aircraft would be ready to take off as soon as the external fuel lines were detached. However, keeping QRA aircraft at this state of readiness was physically and mentally draining to the pilots and was expensive in terms of fuel. As an alternative, longer-range designs with extended loiter times were considered. These area defence interceptors or area defence fighters were in general larger designs intended to stay on lengthy patrol and protect a much larger area from attack, depending on greater detection capabilities, both in the aircraft themselves and operating with AWACS, rather than high speed to reach targets.

The exemplar of this concept was the Tupolev Tu-28. The later Panavia Tornado ADV was able to achieve long range in a smaller airframe through the use of more efficient engines. Rather than focusing on acceleration and climb rate, the design emphasis is on range and missile carrying capacity, which together translate into combat endurance, look-down/shoot-down radars good enough to detect and track fast moving interdictors against ground clutter, and the capability to provide guidance to air-to-air missiles (AAM) against these targets. High speed and acceleration was put into long-range and medium-range AAMs, and agility into short range dog fighting AAMs, rather than into the aircraft themselves. They were first to introduce all-weather avionics, assuring successful operations during night, rain, snow, or fog. Countries that were strategically dependent on surface fleet, most notably US and UK, maintained also fleet defence fighters, such as the F-14 Tomcat.

Fighter-Bomber

A fighter-bomber is a fighter aircraft that has been modified, or used primarily, as a light bomber or attack aircraft. It differs from bomber and attack aircraft primarily in its origins, as a fighter that has been adapted into other roles, whereas bombers and attack aircraft are developed specifically for bombing and attack roles. Although still used, the term fighter-bomber has less significance since the introduction of rockets and guided missiles into aerial warfare. Modern aircraft with similar duties are now typically called multirole combat aircraft or strike fighters.

Development
Prior to World War II, general limitations in available engine and aeronautical technology required that each proposed military aircraft have its design tailored to a specific prescribed role. Engine power grew dramatically during the early period of the war, roughly doubling between 1939 and 1943. The Bristol Blenheim, a typical light bomber of the opening stages of the war, was originally designed in 1934 as a fast civil transport to meet a challenge by Lord Rothermere, owner of the Daily Mail. It had two Bristol Mercury XV radial engines of 920 hp each, a crew of three, and its payload was just 1,200 lbs of bombs. The Blenheim suffered disastrous losses over France in 1939 when it encountered Messerschmitt Bf 109s, and light bombers were quickly withdrawn. In contrast, the Vought F4U Corsair fighter—which entered service in December 1942—had in common with its eventual U.S. Navy stablemate, the Grumman F6F Hellcat and the massive, seven-ton USAAF Republic P-47 Thunderbolt—a single Pratt & Whitney R-2800 Double Wasp radial engine of 2,000 hp in a much smaller, simpler and less expensive single-seat aircraft, and was the first aircraft design to ever fly with the Double Wasp engine in May 1940.

With less airframe and crew to lift, the Corsair's ordnance load was either four High Velocity Aircraft Rockets or 2,000 lbs of bombs; a later version could carry eight rockets or 4,000 lbs of bombs. The massive, powerful 18-cylinder Double Wasp engine weighed almost a ton—half as much again as the V12 Rolls-Royce Merlin and twice as much as the 9-cylinder Bristol Mercury that powered some heavy fighters. Increased engine power meant that many existing fighter designs could carry useful bomb loads, and adapt to the fighter-bomber role. Notable examples include the Focke-Wulf Fw 190, Hawker Typhoon and Republic P-47 Thunderbolt. Various bombing tactics and techniques could also be used: some designs were intended for high-level bombing, others for low-level semi-horizontal bombing, or even for low-level steep dive bombing as exemplified by the Blackburn Skua and North American A-36 Apache. Larger twin-engined aircraft were also used in the fighter-bomber role, especially where longer ranges were needed for naval strikes. Examples include the Lockheed P-38 Lightning, the Bristol Beaufighter (developed from a torpedo bomber), and de Havilland Mosquito (developed from an unarmed fast bomber). The Beaufighter MkV had a Boulton-Paul turret with four 0.303 in (7.7 mm) machine guns mounted aft of the cockpit but only two were built. Bristol's Blenheim was even pushed into service as a fighter during the Battle of Britain but it was not fast enough. Equipped with an early Airborne Interception (AI) radar set, however, it proved to be an effective night fighter.

Strike Fighter

In current military parlance, a strike fighter is a multirole combat aircraft designed to operate primarily as an attack aircraft, while also incorporating certain performance characteristics of a fighter for air-to-air combat. As a category, it is distinct from fighter-bombers. It is closely related to the concept of interdictor aircraft, but it puts more emphasis on air-to-air combat capabilities as a multirole combat aircraft. Examples of contemporary American strike fighters are the McDonnell Douglas F-15E Strike Eagle, Boeing F/A-18E/F Super Hornet, and Lockheed Martin F-35 Lightning II. Beginning in the 1940s, the term "strike fighter" was occasionally used in navies to refer to fighter aircraft capable of performing air-to-surface strikes, such as the Westland Wyvern, Blackburn Firebrand and Blackburn Firecrest.

The term entered normal use in the United States Navy by the end of the 1970s, becoming the official description of the new McDonnell Douglas F/A-18 Hornet. In 1983, the U.S. Navy even renamed each existing Fighter Attack Squadron to Strike Fighter Squadron to emphasize the air-to-surface mission (as the "Fighter Attack" designation was confused with the "Fighter" designation, which flew pure air-to-air missions). This name quickly spread to non-maritime use. When the F-15E Strike Eagle came into service, it was originally called a "dual role fighter", but it instead quickly became known as a "strike fighter". In 1995, the U.S. military's Joint Advanced Strike Technology program changed its name to the Joint Strike Fighter program. The project consequently resulted in the development of the F-35 Lightning II family of fifth generation multirole fighters to perform ground attack, reconnaissance, and air defence missions with stealth capability.

Bomber Aircraft

Bombers are normally larger, heavier, and less manoeuvrable than fighter aircraft. They are capable of carrying large payloads of bombs, torpedoes or cruise missiles. Bombers are used almost exclusively for ground attacks and not fast or agile enough to take on enemy fighters head-to-head. A few have a single engine and require one pilot to operate and others have two or more engines and require crews of two or more. A limited number of bombers, such as the B-2 Spirit, have stealth capabilities that keep them from being detected by enemy radar. An example of a conventional modern bomber would be the B-52 Stratofortress. An example of a World War II bomber would be a B-17 Flying Fortress. Bombers include light bombers, medium bombers, heavy bombers, dive bombers, and torpedo bombers.

Bomber

A bomber is a combat aircraft designed to attack ground and naval targets by dropping air-to-ground weaponry (such as bombs), firing torpedoes and bullets, or deploying air-launched cruise missiles.

Classification	
Strategic	Strategic bombing is done by heavy bombers primarily designed for long-range bombing missions against strategic targets such as supply bases, bridges, factories, shipyards, and cities themselves, to diminish the enemy's ability to wage war by limiting access to resources through crippling infrastructure or reducing industrial output. Current examples include the strategic nuclear-armed bombers: B-2 Spirit, B-52 Stratofortress, Tupolev Tu-95 'Bear', and Tupolev Tu-22M 'Backfire'; historically notable examples are the: Gotha G.IV, Avro Lancaster, Heinkel He 111, Junkers Ju 88, Boeing B-17 Flying Fortress, Consolidated B-24 Liberator, Boeing B-29 Superfortress, and Tupolev Tu-16 'Badger'.
Tactical	Tactical bombing, aimed at countering enemy military activity and in supporting offensive operations, is typically assigned to smaller aircraft operating at shorter ranges, typically near the troops on the ground or against enemy shipping. This role is filled by tactical bomber class, which crosses and blurs with various other aircraft categories: light bombers, medium bombers, dive bombers, interdictors, fighter-bombers, attack aircraft, multirole combat aircraft, and others.

Modern Era
At present, the U.S. and Russia are involved in developing replacements for their legacy bomber fleets, the USAF with the Northrop Grumman B-21 and the Russian Air Force with the PAK DA. A 1999 USAF report calls for the US bomber fleet to remain in service until the late 2030s-early 2040s, and the B-21 is scheduled to reach deployment in the 2020s. The U.S. is also considering another bomber in 2037. The B-21, however, required to provide an answer to the fifth generation defence systems (such as SA-21 Growlers, bistatic radar and active electronically scanned array radar). Also, it has been chosen to be able to stand against rising superpowers and other countries with semi-advanced military capability. Finally, a third reason is the role of long-term air support for areas with a low threat level (Iraq, Afghanistan), the latter referred to as close air support for the global war on terror (CAS for GWOT). The B-21 would thus be able to stay for extended periods on a same location (called persistence).

Strategic Bomber

A strategic bomber is a medium to long range penetration bomber aircraft designed to drop large amounts of air-to-ground weaponry onto a distant target for the purposes of debilitating the enemy's capacity to wage war. Unlike tactical bombers, penetrators, fighter-bombers, and attack aircraft, which are used in air interdiction operations to attack enemy combatants and military equipment, strategic bombers are designed to fly into enemy territory to destroy strategic targets (e.g., infrastructure, logistics, military installations, factories, cities, and civilians). In addition to strategic bombing, strategic bombers can be used for tactical missions. There are currently three countries that operate strategic bombers: the United States, Russia, and China. The modern strategic bomber role appeared after strategic bombing was widely employed, and atomic bombs were first used in combat during World War II. Nuclear strike missions (i.e., delivering nuclear-armed missiles or bombs) can potentially be carried out by most modern fighter-bombers and strike fighters, even at intercontinental range, with the use of aerial refuelling, so any nation possessing this combination of equipment and techniques theoretically has such capability. Primary delivery aircraft for a modern strategic bombing mission need not always necessarily be a heavy bomber type, and any modern aircraft capable of nuclear strikes at long range is equally able to carry out tactical missions with conventional weapons. An example is France's Mirage IV, a small strategic bomber replaced in service by the ASMP-equipped Mirage 2000N fighter-bomber and Rafale multirole fighter.

Post Cold War
Today the French Republic has limited its strategic armaments to a squadron of four nuclear-powered ballistic missile submarines, with 16 SLBM tubes apiece. France also maintains an active force of supersonic fighter-bombers carrying stand-off nuclear missiles such as the ASMP, with Mach 3 speed and a range of 500 kilometres. These missiles can be delivered by the Dassault Mirage 2000N and Rafale fighter-bombers; the Rafale is also capable of refuelling others in flight using a buddy refuelling pod. Newer strategic bombers such as the Rockwell International B-1B Lancer, the Tupolev Tu-160, and the Northrop Grumman B-2 Spirit designs incorporate various levels of stealth technology in an effort to avoid detection, especially by radar networks.

Despite these advances earlier strategic bombers, for example the B-52 (last produced in 1962) or the Tupolev Tu-95 remain in service and can also deploy the latest air-launched cruise missiles and other "stand-off" or precision guided weapons such as the JASSM and the JDAM. The Russian Air Force's new Tu-160 strategic bombers are expected to be delivered on a regular basis over the course of 10 to 20 years. In addition, the current Tu-95 and Tu-160 bombers will be periodically updated, as was done during the 1990s with the Tu-22M bombers.

Strategic bombers of the Cold War were primarily armed with nuclear weapons. During the post-1940s Indochina Wars, and also since the end of the Cold War, modern bombers originally intended for strategic use have been exclusively employed using non-nuclear, high explosive weapons. During the Vietnam War, Operation Menu, Operation Freedom Deal, Gulf War, military action in Afghanistan, and the 2003 invasion of Iraq, American B-52s and B-1s were mostly employed in tactical roles. During the Soviet-Afghan war in 1979–88, Soviet Air Forces Tu-22Ms carried out several mass air raids in various regions of Afghanistan.

Nomenclature
Bombers listed below were used in the main or represented a shift in long-range bomber design (Maximum bomb load). In practice, bomb loads carried are dependent on factors such as the distance to target and the individual type, size or weight of bombs used. Nomenclature for size classification of aircraft types used in strategic bombing varies, particularly since the time of World War II due to sequential technological advancements and changes in aerial warfare strategy and tactics. The B-29, for example was a benchmark aircraft of the heavy bomber type at end of World War II due to its size, range and load carrying ability; as the Cold War began, it became an intercontinental range strategic bomber with the development of new techniques, such as aerial refuelling (which also greatly extended the range of other medium- to long-range bombers, fighter-bombers and attack aircraft). During the 1950s the U.S. Strategic Air Command also briefly brought back the out-dated term "medium bomber" to distinguish its Boeing B-47 Stratojets from somewhat larger contemporary Boeing B-52 Stratofortress "heavy bombers" in bombardment wings; older B-29 and B-50 heavy bombers were also redesignated as "medium" during this period.

SAC's nomenclature here was purely semantic and bureaucratic, however as both the B-47 and B-52 strategic bombers were much larger and had far greater performance and load-carrying ability than any of the World War II-era heavy or medium bombers. Other aircraft such as the twin-jet U.S. FB-111, Douglas A-3 Skywarrior and France's Dassault Mirage IV had nominal warloads of less than 20,000 lb (9,100 kg), and were significantly smaller in size and gross weight compared with their strategic bomber contemporaries, based on which they might be classified as medium bombers. In the nuclear strike role, France would replace its Mirage IVs beginning in the late 1980s with the even smaller, single-engine Mirage 2000N fighter-bomber, a further example of advancing technologies and changing tactics in military aviation and aircraft design. France's newer twin-engine Dassault Rafale multirole fighter also has nuclear strike capability.

Carpet Bombing
Carpet bombing, also known as saturation bombing, is a large aerial bombing done in a progressive manner to inflict damage in every part of a selected area of land. The phrase evokes the image of explosions completely covering an area, in the same way that a carpet covers a floor. Carpet bombing is usually achieved by dropping many unguided bombs. The term obliteration bombing is sometimes used to describe especially intensified bombing with the intention of destroying a city or a large part of the city. The term area bombing refers to indiscriminate bombing of an area and also encompasses cases of carpet bombing, including obliteration bombing. It was used in that sense especially during World War II. Carpet bombing of cities, towns, villages, or other areas containing a concentration of civilians is considered a war crime as of the 1977 Protocol I of the Geneva Conventions.

High Level Bombing
High level bombing (also called high-altitude bombing) is a tactic of dropping bombs from bomber aircraft in level flight at high altitude. The term is used in contrast to both World War II-era dive bombing and medium or low level bombing. Prior to the modern age of precision-guided munitions (PGMs), high level bombing was primarily used for strategic bombing—inflicting mass damage on the enemy's economy and population—not for attacks on specific military targets. High level bombing missions have been flown by many different types of aircraft, including medium bombers, heavy bombers, strategic bombers and fighter-bombers.

The choice to use high level bombing as an offensive tactic of aerial warfare is dependent not only upon the inherent accuracy and effectiveness of the bombing aircraft and their delivered ordnance on the target, but also upon a target's air defence capabilities. From the 1940s onward, radar in particular became a powerful new defensive early warning tool, and a serious threat to attacking aircraft when they flew at higher altitudes towards their target.

Bombing from medium to high altitudes, especially in the post-World War II era with sophisticated surface-to-air missiles, interceptor aircraft and radars exposes attacking bomber aircraft to greater risks of detection, interception and destruction. During World War II, various methods were employed to protect high level bombers from flak, fighter aircraft and radar detection, including defensive armament, escort fighters, chaff and electronic jamming. Modern stealth aircraft technologies, for example, can alleviate some risks inherent to high level bombing missions, but are not a guarantee of success or permanent solution for the attackers.

Strategic Bombing
Strategic bombing is a military strategy used in total war with the goal of defeating the enemy by destroying its morale or its economic ability to produce and transport materiel to the theatres of military operations, or both. It is a systematically organized and executed attack from the air which can utilize strategic bombers, long- or medium-range missiles, or nuclear-armed fighter-bomber aircraft to attack targets deemed vital to the enemy's war-making capability. One of the strategies of war is to demoralize the enemy, so that peace or surrender becomes preferable to continuing the conflict. Strategic bombing has been used to this end. The phrase "terror bombing" entered the English lexicon towards the end of World War II and many strategic bombing campaigns and individual raids have been described as terror bombing by commentators and historians. Because the term has pejorative connotations, some, including the Allies of World War II, have preferred to use euphemisms such as "will to resist" and "morale bombings". The theoretical distinction between tactical and strategic air warfare was developed between the two world wars. Some leading theorists of strategic air warfare during this period were the Italian Giulio Douhet, the Trenchard school in the United Kingdom, and General Billy Mitchell in the United States. These theorists were highly influential, both on the military justification for an independent air force (such as the Royal Air Force) and in influencing political thoughts on a future war as exemplified by Stanley Baldwin's 1932 comment that the bomber will always get through.

Defensive measures against air raids include:
- Attempting to shoot down attackers using fighter aircraft and anti-aircraft guns or surface-to-air missiles
- The use of air raid shelters to protect the population
- Air raid sirens
- Employment of Air Raid Wardens
- Setting up organizations like the British ARP (Air Raid Precautions)
- Blackouts - extinguishing all lights at night to make bombing less accurate

Tactical Bombing
Tactical bombing is aerial bombing aimed at targets of immediate military value, such as combatants, military installations, or military equipment. This is in contrast to strategic bombing, or attacking enemy cities and factories to cripple future military production and enemy civilians' will to support the war effort, in order to debilitate the enemy's long-term capacity to wage war. A tactical bomber is a bomber aircraft with an intended primary role of tactical bombing. Tactical bombing is employed for two primary assignments.

Aircraft providing close air support attack targets in nearby proximity to friendly ground forces, acting in direct support of the ground operations (as a "flying artillery"). Air interdiction, by contrast, attacks tactical targets that are distant from or otherwise not in contact with friendly units. Tactical bombing was the first type of aerial bombing mission. It began in World War I when pilots dropped small bombs over the side of their open cockpits onto enemy troops below. One of the earliest examples of tactical bombing was at the Battle of Neuve Chapelle in 1915 when the Royal Flying Corps dropped bombs on German rail communications.

By the time of World War II a number of specialized aircraft were developed to fulfil this role, including various fighter-bombers. During the Korean War tactical bombing missions were sometimes carried out by older piston-powered fighters such as the Vought F4U Corsair. In the Vietnam War, missions were frequently directed by forward air controllers (FACs) flying small propeller-driven planes. The FAC would mark targets with smoke, often in coordination with infantry on the ground. Bombers orbiting overhead would then fly in to hit the target. In the modern era, precision-guided munitions ("smart bombs") can be directed with extreme accuracy.

Heavy Bomber

Heavy bombers are bomber aircraft capable of delivering the largest payload of air-to-ground weaponry (usually bombs) and longest range of their era. Archetypal heavy bombers have therefore usually been among the largest and most powerful military aircraft at any point in time. In the second half of the 20th century, heavy bombers were largely superseded by strategic bombers, which were often smaller in size, but were capable of delivering nuclear weapons. Because of advances in aircraft design and engineering — especially in powerplants and aerodynamics — the size of payloads carried by heavy bombers have increased at rates greater than increases in the size of their airframes. The largest bombers of World War I, the four engine aircraft built by the Zeppelin-Staaken company in Germany, could carry a payload of up to 4,400 pounds (2,000 kg) of bombs. By the middle of World War II even a single-engine fighter-bomber could carry a 2,000-pound (910 kg) bomb load, and such aircraft were taking over from light and medium bombers in the tactical bombing role.

Advancements in four-engine aircraft design enabled heavy bombers to carry even larger payloads to targets thousands of kilometres away. For instance, the Avro Lancaster (introduced in 1942) routinely delivered payloads of 14,000 pounds (6,400 kg) (and sometimes up to 22,000 lb/10,000 kg) and had a range of 2,530 miles (4,070 km). The B-29 (1944) delivered payloads in excess of 20,000 pounds (9,100 kg) and had a range of 3,250 miles (5,230 km). By the early 1960s, the jet-powered Boeing B-52 Stratofortress, travelling at speeds of up to 650 miles per hour (1,050 km/h) (i.e., more than double that of a Lancaster), could deliver a payload of 70,000 pounds (32,000 kg), over a combat radius of 4,480 miles (7,210 km). During World War II, mass production techniques made available large, long-range heavy bombers in such quantities as to allow strategic bombing campaigns to be developed and employed.

This culminated in August 1945, when B-29s of the United States Army Air Forces dropped atomic bombs over Hiroshima and Nagasaki in Japan, contributing significantly to the end of hostilities. The arrival of nuclear weapons and guided missiles permanently changed the nature of military aviation and strategy. After the 1950s intercontinental ballistic missiles and ballistic missile submarines began to supersede heavy bombers in the strategic nuclear role. Along with the emergence of more accurate precision-guided munitions ("smart bombs") and nuclear-armed missiles, which could be carried and delivered by smaller aircraft, these technological advancements eclipsed the heavy bomber's once-central role in strategic warfare by the late 20th century. Heavy bombers have, nevertheless, been used to deliver conventional weapons in several regional conflicts since World War II (e.g., B-52s in the Vietnam War). Heavy bombers are now operated only by the air forces of the United States, Russia and China. They serve in both strategic and tactical bombing roles.

After World War II, the name strategic bomber came into use, for aircraft that could carry aircraft ordnances over long distances behind enemy lines. They were supplemented by smaller fighter-bombers with less range and lighter bomb load, for tactical strikes. Later these were called strike fighters, attack aircraft and multirole combat aircraft. When North Korea attacked South Korea in 1950 the USAF responded with daylight bomber raids on supply lines through North Korea. B-29 Superfortresses flew from Japan on behalf of the United Nations. But the supply to North Korea's army from the Soviet Union was physically and politically out of reach. There were no worthwhile strategic targets in North Korea. The Soviet mentored Northern forces easily routed the South Korean army. The distance to North Korea was too great for fighter escorts based in Japan. So the B-29s flew alone. In November, Mikoyan-Gurevich MiG-15s flown by Soviet pilots started to intercept the US bombers, over North Korea.

The MiG-15 was specifically designed to master US heavy bombers, with nuclear weapons. It could out-perform any fighter deployed by United Nations air forces until the capable F-86 Sabre was produced in greater numbers and brought to Korea. After 28 B-29s were lost, the bombers were restricted to night interdiction and concentrated on destroying supply routes, including the bridges over the Yalu river into China. By the 1960s, manned heavy bombers could not match the intercontinental ballistic missile in the strategic nuclear role. More accurate precision-guided munitions ("smart bombs"), nuclear-armed missiles or bombs were able to be carried by smaller aircraft such as fighter-bombers and multirole fighters. Despite these technological innovations and new capabilities of other contemporary military aircraft, large strategic bombers such as the B-1, B-52 and B-2 have been retained for the role of carpet bombing in several conflicts. The most prolific example (in terms of total bomb tonnage) is the U.S. Air Force B-52 Stratofortress during the 1960s–early 1970s Vietnam War era, in Operation Menu, Operation Freedom Deal, and Operation Linebacker II.

In 1987 the Soviet Tu-160 — the heaviest supersonic bomber/aircraft ever built — entered service; it can carry twelve long-range cruise missiles. The 2010 New START agreement between the United States of America and the Russian Federation defined a "heavy bomber" by two characteristics:
● Range greater than 8,000 kilometres (5,000 mi)
● Equipped for long-range nuclear "air-launched cruise missiles" (ALCMs), defined as an air-to-surface cruise missile of a type flight-tested from an aircraft or deployed on a bomber after 1986.

Medium Bomber

A medium bomber is a military bomber aircraft designed to operate with medium-sized bombloads over medium range distances; the name serves to distinguish this type from larger heavy bombers and smaller light bombers. Mediums generally carried about two tons of bombs, compared to light bombers that carried one ton, and heavies that carried four or more. The term was used prior to and during World War II, based on available parameters of engine and aeronautical technology for bomber aircraft designs at that time. After the war, medium bombers were replaced in world air forces by more advanced and capable aircraft.

History
Subsequent to World War II, only the U.S. Strategic Air Command ever used the term "medium bomber" in the 1950s to distinguish its Boeing B-47 Stratojets from somewhat larger contemporary Boeing B-52 Stratofortress "heavy bombers" in bombardment wings (older B-29 and B-50 heavy bombers were also redesignated as "medium" during this period). This nomenclature was purely semantic and bureaucratic, however as both the B-47 and B-52 strategic bombers were much larger and had far greater performance and load-carrying ability than any of the World War II-era heavy or medium bombers. Similarly, the Royal Air Force referred at times to its V bomber force as medium bombers, but this was in terms of range rather than load-carrying capacity. Although the term is no longer used, development of aircraft that fulfil a 'medium bomber' mission in all but name continued and these have been employed in various post-World War II conflicts; examples include dedicated tactical bombers such as the Su-24 and F-111 which have greater payload and range capability than fighter-bombers, but less than heavier strategic bombers.

Interdictor

An interdictor is a type of attack aircraft that operates far behind enemy lines, with the express intent of interdicting the enemy's military targets, most notably those involved in logistics. The interdiction prevents or delays enemy forces and supplies from reaching the battlefront; the term has generally fallen from use. The strike fighter is a closely related concept, but puts more emphasis on air-to-air combat capabilities as a multirole combat aircraft. Larger versions of the interdictor concept are generally referred to as penetrators.

In the post-war era, the RAF introduced interdictor variants of their English Electric Canberra jet bomber, the aircraft being available as the strategic bombing role had been taken over by the new V bombers. An early interdictor was the F-111, an aircraft able to operate at long distances from its base. The Panavia Tornado was built for a similar purpose, although operating over shorter ranges in the European theatre. The Soviet Sukhoi Su-24/Sukhoi Su-34, Chinese Xian JH-7 and the aborted British BAC TSR-2 are similar interdictor designs.

Attack Aircraft

Attack aircraft can be used to provide support for friendly ground troops. Some are able to carry conventional or nuclear weapons far behind enemy lines to strike priority ground targets. Attack helicopters attack enemy armour and provide close air support for ground troops. An example historical ground-attack aircraft is the Soviet Ilyushin Il-2 Shturmovik. Several types of transport airplanes have been armed with sideways firing weapons as gunships for ground attack. These include the AC-47 and AC-130 aircraft.

Attack Aircraft

An attack aircraft, strike aircraft, or attack bomber, is a tactical military aircraft that has a primary role of carrying out airstrikes with greater precision than bombers, and is prepared to encounter strong low-level air defences while pressing the attack. This class of aircraft is designed mostly for close air support and naval air-to-surface missions, overlapping the tactical bomber mission. Designs dedicated to non-naval roles are often known as ground-attack aircraft. Fighter aircraft often carry out the attack role, although they would not be considered attack aircraft per se, although fighter-bomber conversions of those same aircraft would be considered part of the class. Strike fighters, which have effectively replaced the fighter-bomber and light bomber concepts, also differ little from the broad concept of an attack aircraft. The dedicated attack aircraft as a separate class existed primarily during and after World War II. The precise implementation varied from country to country, and was handled by a wide variety of designs.

In the United States and Britain attack aircraft were generally light bombers or medium bombers, sometimes carrying heavier forward-firing weapons like the North American B-25G Mitchell and de Havilland Mosquito Tsetse. In Germany and the USSR, where they were known as Schlachtflugzeug ("battle aircraft") or sturmovik ("storm trooper") respectively, this role was carried out by purpose-designed and heavily armoured aircraft such as the Henschel Hs 129 and Ilyushin Il-2. The Germans and Soviets also used light bombers in this role: cannon-armed versions of the Junkers Ju 87 Stuka greatly outnumbered the Hs 129, while the Petlyakov Pe-2 was used for this role in spite of not being specifically designed for it. In the latter part of World War II the fighter-bomber began to take over many attack roles, a transition that continued in the post-war era. Jet-powered examples were relatively rare but not unknown, such as the Blackburn Buccaneer. The U.S. Navy continued to introduce new aircraft in their A-series, but these were mostly similar to light and medium bombers. The need for a separate attack aircraft category was greatly diminished by the introduction of precision-guided munitions which allowed almost any aircraft to carry out this role while remaining safe at high altitude.

Attack helicopters also have overtaken many remaining roles that could only be carried out at lower altitudes. Since the 1960s, only two dedicated attack aircraft designs have been widely introduced, the American Fairchild Republic A-10 Thunderbolt II and Soviet Sukhoi Su-25 Frogfoot. One anomaly belonging to this class is the Lockheed AC-130, which features as its primary armament high-calibre artillery guns adapted for aircraft use including the 105 mm M102 howitzer. A variety of light attack aircraft have also been introduced in the post-World War II era, usually based on adapted trainers or other light fixed-wing aircraft. These have been used in counter-insurgency operations.

Recent History
On 17 January 1991, Task Force Normandy began its attack on two Iraqi anti-aircraft missile sites. TF Normandy, under the command of LTC Richard A. "Dick" Cody, consisted of nine AH-64 Apaches, one UH-60 Black Hawk and four Air Force MH-53J Pave Low helicopters. The purpose of this mission was to create a safe corridor through the Iraqi air defence system. The attack was a huge success and cleared the way for the beginning of the Allied bombing campaign. One concern involving the Apache arose when a unit of these helicopters was very slow to deploy during U.S. military involvement in Kosovo. According to the Army Times, the Army is shifting its doctrine to favour ground-attack aircraft over attack helicopters for deep strike attack missions because ground-attack helicopters have proved to be highly vulnerable to small-arms fire; the U.S. Marine Corps has noted similar problems. In the late 1960s the United States Air Force requested a dedicated close air support (CAS) plane that became the Fairchild Republic A-10 Thunderbolt II.

The A-10 was originally conceived as an anti-armour weapon (the A-X program requirements specifically called for an aircraft mounting a large rotary cannon to destroy massed Warsaw Pact armoured forces) with limited secondary capability in the interdiction and tactical bombing roles. Today it remains the only dedicated fixed-wing ground-attack aircraft in any U.S. military service. Overall U.S. experience in the Gulf War, Kosovo War, Afghanistan and Iraq War has resulted in renewed interest in such aircraft. The U.S. Air Force is currently researching a replacement for the A-10 and started the OA-X program to procure a light attack aircraft. The Soviets' similar Sukhoi Su-25 (Frogfoot) found success in the "flying artillery" role with many air forces. The UK has completely retired the BAE Harrier II in 2011, expecting to obtain the F-35 in the near future; it retains its fleet of Panavia Tornado dedicated attack-reconnaissance aircraft and Eurofighter Typhoon multirole fighters.

Gunship

A gunship is a military aircraft armed with heavy guns, primarily intended for attacking ground targets. In modern usage the term "gunship" refers to fixed-wing aircraft aircraft having laterally-mounted heavy armaments (i.e. firing to the side) to attack ground or sea targets. These gunships were configured to circle the target instead of performing strafing runs. Such aircraft have their armament on one side harmonized to fire at the apex of an imaginary cone formed by the aircraft and the ground when performing a pylon turn (banking turn). The term "helicopter gunship" is commonly used to describe armed helicopters.

Fixed-Wing Aircraft
In the more modern, post-World War II fixed-wing aircraft category, a gunship is an aircraft having laterally-mounted heavy armaments (i.e. firing to the side) to attack ground or sea targets. These gunships were configured to circle the target instead of performing strafing runs. Such aircraft have their armament on one side harmonized to fire at the apex of an imaginary cone formed by the aircraft and the ground when performing a pylon turn (banking turn). The Douglas AC-47 Spooky was the first notable modern gunship. In 1964, during the Vietnam War, the popular Douglas C-47 Skytrain transport was successfully modified into a gunship by the United States Air Force with three side-firing Miniguns for circling attacks. At the time the aircraft was known as a "Dragonship", "Puff, the Magic Dragon" or "Spooky" (officially designated FC-47, later corrected to AC-47). Its three 7.62 mm miniguns could selectively fire either 50 or 100 rounds per second. Cruising in an overhead left-hand orbit at 120 knots air speed at an altitude of 3,000 feet (910 m), the gunship could put a bullet or glowing red tracer (every fifth round) into every square yard of a football field-sized target in potentially less than 10 seconds.

And, as long as its 45-flare and 24,000-round basic load of ammunition held out, it could do this intermittently while loitering over the target for hours. The less known Fairchild AC-119G Shadow were twin-engine piston-powered gunships developed by the United States during the Vietnam War. Armed with four 7.62 mm GAU-2/A Miniguns and two 20 mm (0.787 in) M61 Vulcan six-barrel rotary cannons, they replaced the Douglas AC-47 Spooky and operated alongside the early versions of the AC-130 Spectre gunship. It was the later and larger Lockheed AC-130 Gunship II that became the modern, post–World War II origin of the term gunship in military aviation. These heavily armed aircraft used a variety of weapon systems, including 7.62 mm GAU-2/A Miniguns, 20 mm (0.787 in) M61 Vulcan six-barrel rotary cannons, 25 mm (0.984 in) GAU-12/U Equalizer five-barreled rotary cannons, 30 mm Mk44 Bushmaster II chain guns, 40 mm (1.58 in) L/60 Bofors autocannons, and 105 mm (4.13 in) M102 howitzers.

The Douglas AC-47 Spooky, the Fairchild AC-119, and the AC-130 Spectre/Spooky, were vulnerable, and meant to operate only after achieving air superiority. Smaller gunship designs such as the Fairchild AU-23 Peacemaker and the Helio AU-24 Stallion were also designed by the United States during the Vietnam War. These aircraft were meant to be cheap and easy to fly and maintain, and were to be given to friendly governments in Southeast Asia to assist with counter-insurgency operations, eventually seeing service with the Khmer National Air Force, Royal Thai Air Force, and Republic of Vietnam Air Force as well as limited use by the United States Air Force. Renewed interest in the concept of gunships has resulted in the development of a gunship variant of the Alenia C-27J Spartan. Although the United States Air Force decided not to procure the AC-27J, other nations including Italy have chosen the aircraft for introduction. Additionally, in 2013 the US Air Force Special Operations Command reportedly tested a gunship version of the C-145A Skytruck armed with a GAU-18 twin-mount .50-calibre machine gun system.

Helicopter Gunships
Early helicopter gunships also operated in the side-firing configuration, an early example being the Aérospatiale Alouette III. During the Overseas wars in Africa in the 1960s, the Portuguese Air Force experimented to install M3 Browning .50 calibre machine guns in a side-firing twin-mounting configuration in some of its Alouette III helicopters. Later, the .50 calibre machine guns were replaced by a MG 151 20mm cannon in a single mounting. These helicopters were known in Portuguese service as "helicanhões" (heli-cannons) and were used in the escort of unarmed transport helicopters in air assault operations and in the fire support to the troops in the ground. The South African and Rhodesian air forces later used armed Alouette III in similar configurations as the Portuguese, respectively in the South African Border and Rhodesian Bush wars. During the Algerian War, the French operated Sikorsky H-34 "Pirate" armed with a German 20mm MG151 cannon and two .50 machine guns.

During the early days of the Vietnam War, USMC H-34s were among the first helicopter gunships in theatre, fitted with the Temporary Kit-1 (TK-1), comprising two M60C machine guns and two 19-shot 2.75 inch rocket pods. The operations were met with mixed enthusiasm, and the armed H-34s, known as "Stingers" were quickly phased out. The TK-1 kit would form the basis of the TK-2 kit used later on the UH-1E helicopters of the USMC. The U.S. Army also experimented with H-34 gunships armed M2 .50 calibre machine-guns and 2.75-inch rockets. In September 1971, a CH-34 was armed with two M2 .50 calibre machine guns, four M1919 .30 calibre machine guns, forty 2.75-inch rockets, two 5-inch high velocity aerial rockets (HV AR), plus two additional .30 calibre machine guns in the left side aft windows and one .50 calibre machine gun in the right side cargo door. The result was the world's most heavily armed helicopter at the time.

Also, during the Vietnam War, the ubiquitous Bell UH-1 Iroquois helicopters were modified into gunships by mounting the U.S. Helicopter Armament Subsystems—these were forward-firing weapons, such as machine guns, rockets, and autocannons, that began to appear in 1962–1963. Rotary-wing aircraft (helicopters) can use a variety of combat manoeuvres to approach a target. In their case, the term gunship is synonymous with heavily armed helicopter. Specifically, dedicated attack helicopters such as the Bell AH-1 Cobra also fit this meaning. In any case, the gunship armaments include machine guns, rockets, autocannons, missiles, etc. The Soviet Mil Mi-24 (NATO code name: Hind) is a large, heavily armed and armoured helicopter gunship and troop transport. It was introduced in the 1970s and operated by the pre-1991 Soviet Air Force and its successors post-1991, and more than 30 other nations. Its armaments include machine guns, rockets, cannons, missiles, etc. Its fuselage is heavily armoured and is designed to withstand .50 calibre (12.7 mm) machine gun fire. Its armoured cockpits and titanium rotor head are able to withstand 20 mm cannon hits.

Electronic Warfare Aircraft

An electronic-warfare aircraft is a military aircraft equipped for electronic warfare (EW), that is, degrading the effectiveness of enemy radar and radio systems by using radar jamming and deception methods. A recent example would be the Boeing EA-18G Growler, which is a modified version of the Boeing F/A-18F Super Hornet. In 1943, British Avro Lancaster aircraft were equipped with chaff in order to blind enemy air defence radars. They were supplemented by specially-equipped aircraft flown by No. 100 Group RAF, which operated modified Halifaxes, Liberators and Fortresses carrying various jammers such as Carpet, Airborne Cigar, Mandrel, Jostle, and Piperack.

Maritime Patrol Aircraft

A maritime patrol aircraft (MPA), also known as a patrol aircraft, maritime reconnaissance aircraft, or by the older American term patrol bomber, is a fixed-wing aircraft designed to operate for long durations over water in maritime patrol roles — in particular anti-submarine warfare (ASW), anti-ship warfare (AShW), and search and rescue (SAR). Some patrol aircraft were designed for this purpose, like the Kawasaki P-1. Many others are modified designs of pre-existing aircraft, such as the Boeing P-8 Poseidon, which is based on the Boeing 737-800 airliner.

Armament and Countermeasures
The earliest patrol aircraft carried bombs and machine guns. Between the wars the British experimented with equipping their patrol aircraft with the COW 37 mm gun. During World War II, depth charges that could be set to detonate at specific depths, and later when in proximity with large metal objects replaced "anti-submarine" bombs that detonated on contact. Patrol aircraft also carried defensive armament which was necessary when patrolling areas close to enemy territory such as Allied operations in the Bay of Biscay targeting U-boats starting out from their base. As a result of Allied successes with patrol aircraft against U-boats, the Germans introduced U-flak (submarines equipped with more antiaircraft weaponry) to escort U-boats out of base and encouraged commanders to remain on the surface and fire back at attacking craft rather than trying to escape by diving. The advantage was short lived as the submarine was defenceless if it tried to dive for long enough for the aircraft to make its attack, effectively preventing it from diving until a surface ship could arrive to destroy it. Equipping submarines with radar-warning devices and the snorkel made them harder to find. To counter the German long-range patrol aircraft that targeted merchant convoys, the Royal Navy introduced the "CAM ship", which was a merchant vessel equipped with a lone fighter plane which could be launched once to engage the enemy planes. Then the small escort carriers of WW II became available to cover the deep oceans, and the land air bases in the Azores became available in mid-1943 from Portugal.

Sensors
Maritime patrol aircraft are typically fitted with a wide range of sensors:
● Radar to detect surface shipping movements. Radar can also detect a submarine snorkel or periscope, and the wake it creates.
● Magnetic anomaly detector (MAD) to detect the iron in a submarine's hull. The MAD sensor is typically mounted on an extension from the tail or is trailed behind the aircraft on a cable to minimize interference from the metal in the rest of the aircraft;
● Sonobuoys - self-contained sonar transmitter/receivers dropped into the water to transmit data back to the aircraft for analysis;
● ELINT sensors to monitor communications and radar emissions;
● Infrared cameras (sometimes referred to as FLIR for forward looking infrared) for detecting exhaust streams and other sources of heat and are useful in monitoring shipping movements and fishing activity.
● Visual inspection using the aircrew's eyes, in some cases aided by searchlights or flares.

A modern military maritime patrol aircraft typically carries a dozen or so crew members, including relief flight crews, to effectively operate the equipment for 12 hours or more at a time.

Multirole Combat Aircraft

Many combat aircraft today have a multirole ability. Normally only applying to fixed-wing aircraft, this term signifies that the plane in question can be a fighter or a bomber, depending on what the mission calls for. An example of a multirole design is the F-15E Strike Eagle, F/A-18 Hornet, F-35 Lightning II. A World War II example would be the P-38 Lightning.

Multirole Combat Aircraft

A multirole combat aircraft (MRCA) is a combat aircraft intended to perform different roles in combat. A multirole fighter is a multirole combat aircraft which is, at the same time, also a fighter aircraft; in other words, an aircraft whose various roles include, among others, the role of air-to-air combat. The term "Multirole" had originally been reserved for aircraft designed with the aim of using a common airframe for multiple tasks where the same basic airframe is adapted to a number of differing roles.

The main motivation for developing multirole aircraft is cost reduction in using a common airframe. More roles can be added, such as aerial reconnaissance, forward air control, and electronic-warfare aircraft. Attack missions include the subtypes air interdiction, suppression of enemy air defence (SEAD), and close air support (CAS). Multirole has also been applied to one aircraft with both major roles, a primary air-to-air combat role, and a secondary role like air-to-surface attack.

However, those designed with an emphasis on aerial combat are usually regarded as air superiority fighters and usually deployed solely in that role, even though they are theoretically capable of ground attack. A good example is the F-14 Tomcat versus the F/A-18 Hornet; the F-14 was envisioned originally for air superiority and fleet interception defence with some variants later receiving secondary ground attack capability, while the F/A-18 was designed from the onset for air-to-surface strikes with a limited capacity to defend itself from other aircraft. In another instance, the Eurofighter Typhoon and Dassault Rafale are classified as multirole fighters; however the Typhoon is frequently considered an air superiority fighter due to its higher dogfighting prowess while its built-in strike capability has a lighter bomb load compared to contemporaries, compared to the more balanced Rafale which sacrifices air-to-air ability for a heavier payload.

Swing-Role
Some aircraft, like the Saab JAS 39 Gripen, are called swing-role, to emphasize the ability of a quick role change, either at short notice, or even within the same mission. According to the Military Dictionary: "the ability to employ a multi-role aircraft for multiple purposes during the same mission." According to BAE Systems, "an aircraft that can accomplish both air-to-air and air-to-surface roles on the same mission and swing between these roles instantly offers true flexibility. This reduces cost, increases effectiveness and enhances interoperability with allied air forces". "(Swing-role) capability also offers considerable cost-of-ownership benefits to operational commanders." Although the term "multirole aircraft" may be relatively novel, certain airframes in history have proven versatile to multiple roles. In particular, the Junkers Ju 88 was renowned in Germany for being a "jack-of-all-trades", capable of performing as a bomber, dive bomber, night fighter, and so on, much as the British de Havilland Mosquito did as a fast bomber/strike aircraft, reconnaissance, and night fighter. The US joint forces F-4 Phantom II built by McDonnell-Douglas also fits the definition of a multi-role aircraft in its various configurations of the basic airframe design. The various F-4 Phantom II configurations were used in air-to air, fighter bomber, reconnaissance, and suppression of enemy air defences (SEAD) mission roles to name a few.

The first use of the term was by the multinational European project named Multi-Role Combat Aircraft, which was formed in 1968 to produce an aircraft capable of tactical strike, aerial reconnaissance, air defence, and maritime roles. The design was aimed to replace a multitude of different types in the cooperating air forces. The project produced the Panavia Tornado, which used the same basic design to undertake a variety of roles, the Tornado IDS (Interdictor/Strike) variant and later the Panavia Tornado ADV (Air Defence Variant). By contrast, the F-15 Eagle which was another fighter aircraft of that era was designed for air superiority and interception, with the mantra "not a pound for ground" (although the F-15C did have a rarely-used secondary ground attack capability), but that program eventually evolved into the F-15E Strike Eagle interdictor/strike derivative which retained the air-to-air combat lethality of earlier F-15s. The newest fighter jet that fits the definition of 'multi-role' is the Lockheed Martin F-35 Lightning II/Joint Strike Fighter, designed to perform stealth-based ground/naval strike, fighter, reconnaissance and electronic warfare roles. Like a modern-day F-4, 3 variants of this aircraft fulfil the various strike and air defence roles among its joint service requirements: the standard variant is intended to eventually replace the F-16 and A-10 in the USAF and other Western air forces, a STOVL version intended to replace the Harrier in US Marine Corps, British Royal Air Force and Royal Navy service, and a carrier variant intended to eventually replace the older F/A-18C/D for the US Navy and other F-18 operators. The F-35's design goal can be compared to its larger and more air superiority-focused cousin, the F-22 Raptor.

Fighter-Bomber

A fighter-bomber is a fighter aircraft that has been modified, or used primarily, as a light bomber or attack aircraft. It differs from bomber and attack aircraft primarily in its origins, as a fighter that has been adapted into other roles, whereas bombers and attack aircraft are developed specifically for bombing and attack roles. Although still used, the term fighter-bomber has less significance since the introduction of rockets and guided missiles into aerial warfare. Modern aircraft with similar duties are now typically called multirole combat aircraft or strike fighters.

Second World War

When war broke out in Europe, Western Allied Air Forces employed light twin-engined bombers in the tactical role for low level attack. These were found to be extremely vulnerable both to ground fire and to single engine fighters. The German and Japanese Air Forces had chosen dive bombers which were similarly vulnerable. The Ilyushin Il-2 is a heavily armoured two seat single-engine ground attack aircraft. It first flew a month later although few had reached the Soviet Air Force in time for Operation Barbarossa. Naval forces chose both torpedo and dive bombers. None of these could be considered as fighter bombers as they could not combat fighters. The Bristol Blenheim and Douglas A-20 Havoc (which the RAF called Boston) were used as night fighters during the Blitz, as they could carry the heavy early airborne radars. In 1934, the British Air Ministry called for a carrier aircraft which could combine the roles of dive bomber and fighter, to save limited space on small carriers.

The Blackburn Skua was not expected to encounter land-based fighters but was to intercept long-range bombers attacking the fleet and also to sink ships. As a two-seater it could not fight the Messerschmitt Bf 109 on equal terms. But the second seat carried a radio operator with a homing device that could find the carrier even when it had moved, in foul North Sea weather. It achieved one of the first kills of the war, when three from HMS Ark Royal downed a German Dornier Do 18 flying boat over the North Sea. During the Battle of Britain, the Luftwaffe conducted fighter-bomber attacks on the United Kingdom from September to December 1940. A larger fighter-bomber campaign was conducted against the UK from March 1942 until June 1943. These operations were successful in tying down Allied resources at a relatively low cost to the Luftwaffe, but the British Government regarded the campaign as a nuisance given the small scale of the individual raids.

Post-War

Fighter-bombers became increasingly important in the 1950s and 1960s, as new jet engines dramatically improved the power of even the smallest fighter designs. Many aircraft initially designed as fighters or interceptors found themselves in the fighter-bomber role at some point in their career. Notable among these is the Lockheed F-104 Starfighter, first designed as a high-performance day fighter and then adapted to the nuclear strike role for European use. Another such aircraft was the Indian HAL HF-24 Marut. It was used during the Indo-Pak war of 1971, and only three aircraft were lost to ground fire. One aerial kill recorded by Marut flown by Squadron Leader K.K. Bakshi of 220 Squadron shot down a PAF F-86 Sabre on 7 Dec 71 (Flag Officer Hamid Khwaja of 15 Squadron PAF). Other U.S. examples include the North American F-100 Super Sabre and (perhaps most famously) the McDonnell Douglas F-4 Phantom II, each of which were widely used during the Vietnam War.

Strike Fighter

In current military parlance, a strike fighter is a multirole combat aircraft designed to operate primarily as an attack aircraft, while also incorporating certain performance characteristics of a fighter for air-to-air combat. As a category, it is distinct from fighter-bombers. It is closely related to the concept of interdictor aircraft, but it puts more emphasis on air-to-air combat capabilities as a multirole combat aircraft. Examples of contemporary American strike fighters are the McDonnell Douglas F-15E Strike Eagle, Boeing F/A-18E/F Super Hornet, and Lockheed Martin F-35 Lightning II.

Military Transport Aircraft

Military transport aircraft or military cargo aircraft are typically fixed wing and rotary wing cargo aircraft which are used to airlift troops, weapons and other military equipment by a variety of methods to any area of military operations around the surface of the planet, usually outside the commercial flight routes in uncontrolled airspace. Originally derived from bombers, military transport aircraft were used for delivering airborne forces during World War II and towing military gliders. Some military transport aircraft are tasked to perform multi-role duties such as aerial refuelling and rescue missions, tactical, operational and strategic airlifts onto unprepared runways, or those constructed by engineers.

Fixed-Wing

Fixed-wing transport aircraft are defined in terms of their range capability as strategic airlift or tactical airlift to reflect the needs of the land forces which they most often support. These roughly correspond to the commercial flight length distinctions: Eurocontrol defines short-haul routes as shorter than 1,500 km (810 nmi), long-haul routes as longer than 4,000 km (2,200 nmi) and medium-haul between. A more specialised role of a cargo aircraft is that of transporting fuel in support of other aircraft with more limited flight endurance such as fighters or helicopters. Smaller cargo aircraft, known as "utility", are often used to transport military communications equipment as temporary or permanent platforms, and in the command role by providing airborne command post or as an air ambulance.

Rotary Wing

Military transport helicopters are used in places where the use of conventional aircraft is impossible. For example, the military transport helicopter is the primary transport asset of US Marines deploying from LHDs and LHA. The landing possibilities of helicopters are almost unlimited, and where landing is impossible, for example densely packed jungle, the ability of the helicopter to hover allows troops to deploy by abseiling and roping. Transport helicopters are operated in assault, medium and heavy classes. Air assault helicopters are usually the smallest of the transport types, and designed to move an infantry squad or section and their equipment. Helicopters in the assault role are generally armed for self-protection both in transit and for suppression of the landing zone. This armament may be in the form of door gunners, or the modification of the helicopter with stub wings and pylons to carry missiles and rocket pods. For example, the Sikorsky S-70, fitted with the ESSM (External Stores Support System), and the Hip E variant of the Mil Mi-8 can carry as much disposable armament as some dedicated attack helicopters.

The assault helicopter can be thought of as the modern successor to the military glider. Finally, there is the generic term utility helicopter, which generally refers to medium-lift designs. Not all militaries are able to operate a full range of transport helicopters, so the medium transport type is probably the most useful compromise and probably the most common specialist transport type. Medium transport helicopters are generally capable of moving up to a platoon of infantry and are capable of being able to transport towed artillery or light vehicles either internally or as underslung roles. Unlike the assault helicopter they are usually not expected to land directly in a contested landing zone, but are used to reinforce and resupply landing zones taken by the initial assault wave. Examples include the unarmed versions of the Mil Mi-8, Super Puma, and CH-46 Sea Knight. Heavy lift helicopters are the largest and most capable of the transport types, currently limited in service to the CH-53 Sea Stallion and related CH-53E Super Stallion, CH-47 Chinook, Mil Mi-26, and Aérospatiale Super Frelon.

Capable of lifting up to 80 troops and moving small Armoured fighting vehicles (usually as slung loads but also internally), these helicopters operate in the tactical transport role in much the same way as small fixed wing turboprop air-lifters. The lower speed, range and increased fuel consumption of helicopters are more than compensated by their ability to operate virtually anywhere.

Airborne Early Warning and Control

An airborne early warning and control (AEW&C) system is an airborne radar picket system designed to detect aircraft, ships and vehicles at long ranges and perform command and control of the battlespace in an air engagement by directing fighter and attack aircraft strikes. AEW&C units are also used to carry out surveillance, including over ground targets and frequently perform C2BM (command and control, battle management) functions similar to an Air Traffic Controller given military command over other forces. When used at altitude, the radar on the aircraft allows the operators to detect and track targets and distinguish between friendly and hostile aircraft much farther away than a similar ground-based radar. Like a ground-based radar, it can be detected by opposing forces, but because of its mobility, it is much less vulnerable to counter-attack. AEW&C aircraft are used for both defensive and offensive air operations, and are to the NATO and US forces trained or integrated Air Forces what the combat information centre is to a US Navy warship, plus a highly mobile and powerful radar platform. The system is used offensively to direct fighters to their target locations, and defensively, directing counterattacks on enemy forces, both air and ground. So useful is the advantage of command and control from a high altitude, the United States Navy operates Northrop Grumman E-2 Hawkeye AEW&C aircraft off its Supercarriers to augment and protect its carrier Command Information Centres (CICs).

The designation airborne early warning (AEW) was used for earlier similar aircraft, such as the Fairey Gannet AEW.3 and Lockheed EC-121 Warning Star, and continues to be used by the RAF for its Sentry AEW1, while AEW&C (airborne early warning and control) emphasizes the command and control capabilities that may not be present on smaller or simpler radar picket aircraft. AWACS (Airborne Warning and Control System) is the name of the specific system installed in the E-3 and Japanese Boeing E-767 AEW&C airframes, but is often used as a general synonym for AEW&C. Modern AEW&C systems can detect aircraft from up to 400 km (220 nmi) away, well out of range of most surface-to-air missiles. One AEW&C aircraft flying at 9,000 m (30,000 ft) can cover an area of 312,000 km2 (120,000 sq mi). Three such aircraft in overlapping orbits can cover the whole of Central Europe. AEW&C systems communicate with friendly aircraft, vectoring fighters towards bogeys, providing data on threats and targets, help extend their sensor range and make offensive aircraft more difficult to track, since they no longer need to keep their own radar active to detect threats.

Current Systems

Many countries have developed their own AEW&C systems, although the Boeing E-3 Sentry and Northrop Grumman E-2 Hawkeye are the most common systems worldwide. The E-3 Sentry was built by the Boeing Defence and Space Group (now Boeing Defence, Space & Security) and was based on the Boeing 707-320 aircraft. Sixty-five E-3s were built and it is operated by the United States, NATO, the United Kingdom, France, and Saudi Arabia. The specially designed Grumman E-2 Hawkeye entered service in 1965 and has been operated by eight different nations. Over 168 have been produced so far and new versions continue to be developed, making it the most widely used AEW system. For the Japan Air Self-Defence Force, the E-3 technology has been fitted into the Boeing E-767. After World War 2, the United Kingdom deployed a substantial AEW capability with American Douglas AD-4W Skyraiders, designated Skyraider AEW.1, which in turn were replaced by the Fairey Gannet AEW.3, using the same AN/APS-20 radar.

With the retirement of the conventional aircraft carriers, the Gannet was withdrawn and the Royal Air Force (RAF) installed the radars from the Gannets on Avro Shackleton MR.2 airframes, redesignated Shackleton AEW.2. To replace the Shackleton AEW.2, an AEW variant of the Hawker Siddeley Nimrod, known as the Nimrod AEW3, was ordered in 1974. However, after a protracted and problematic development, this was cancelled in 1986, and seven E-3Ds, designated Sentry AEW.1 in RAF service, were purchased instead. The Russian Air Force is currently using around 15–20 Beriev A-50 and A-50U "Shmel" in the AEW role. The "Mainstay" is based on the Ilyushin Il-76 airframe, with a large non-rotating disk radome on the rear fuselage. These replaced the 12 Tupolev Tu-126 that filled the role previously. The A-50 and A-50U will eventually be replaced by the Beriev A-100, which features an AESA array in the radome and is based on the updated Il-476.

In May 1997, Russia and Israel agreed to jointly fulfil an order from China to develop and deliver an early warning system. China reportedly ordered one Phalcon for $250 million, which entailed retrofitting a Russian-made Ilyushin-76 cargo plane with advanced Elta electronic, computer, radar and communications systems. Beijing was expected to acquire several Phalcon AEW systems, and reportedly could buy at least three more (and possibly up to eight) of these systems, the prototype of which was planned for testing beginning in 2000. Finally, in July 2000 the United States pressured Israel to back out of the $1 billion agreement to sell China four Phalcon phased-array radar systems. Following the cancelled A-50I/Phalcon deal, China turned to indigenous solutions. The Phalcon radar and other electronic systems were taken off from the unfinished Il-76, and the airframe was handed to China via Russia in 2002. The Chinese AWACS has a unique phased array radar (PAR) carried in a round radome. Unlike the US AWACS aircraft, which rotate their rotodomes to give a 360 degree coverage, the radar antenna of the Chinese AWACS does not rotate.

Instead, three PAR antenna modules are placed in a triangular configuration inside the round radome to provide a 360 degree coverage. The installation of equipment at the Il-76 began in late 2002 aircraft by Xian aircraft industries (Xian Aircraft Industry Co.). The first flight of an airplane KJ-2000 made in November 2003. All four machines will be equipped with this type. The last to be introduced into service the Chinese Air Force until the end of 2007. In 2003, the Indian Air Force (IAF) and Defence Research and Development Organisation (DRDO) began a study of requirements for developing an Airborne Early Warning and Control (AWAC) system. In 2015, DRDO delivered 3 AWACs, called Netra, to the air force with indigenous radar systems built on the Brazilian Embraer EMB-145 air frame. Netra gives a 240-degree coverage of airspace. The Emb-145 also has air-to-air refuelling capability for longer surveillance time. The Indian Air Force also operates three Israeli EL/W-2090 systems (Il-76/Phalcon system deal cancelled for China), the first of which first arrived on May 25, 2009. India subsequently signed with Israel to pick up the A-50I instead of China, therefore, A50I adopted the 3-radar arrangement designed by Chinese team. The DRDO is now developing a more advanced AWACS with a longer range and with a 360-degree coverage akin to the Phalcon system, based on the Airbus A-330 airframe.

Helicopter AEW Systems

The British Sea King ASaC7 naval helicopter was operated from Invincible-class aircraft carriers. The creation of Sea King ASaC7, and earlier AEW.2 and AEW.5 was the consequence of lessons learnt by the Royal Navy during the 1982 Falklands War when the lack of AEW coverage for the task force was a major tactical handicap, and left them vulnerable to low level attack. The Spanish Navy fields the SH-3 Sea King in the same role, operated from the LPH Juan Carlos I. The AgustaWestland EH-101A AEW of the Italian Navy is operated from the aircraft carriers Cavour and Garibaldi. In 2018 the British will replace their Sea Kings with a modular "Crowsnest" system that can be fitted to any of their Merlin HM2 fleet. The Russian-built Kamov Ka-31 is deployed by the Indian Navy on the aircraft carrier INS Vikramaditya and Talwar-class frigates and will be deployed on the Vikrant-class aircraft carriers. The Russian Navy has two Ka-31R variants, at least one of which was deployed on their aircraft carrier Kuznetsov in 2016. It is fitted with E-801M Oko (Eye) airborne electronic warfare radar that can track 20 targets simultaneously, detecting aircraft up to 150 km (90 mi) away, and surface warships up to 200 km (120 mi) distant.

Airborne Warning and Control System (AWACS)

Boeing produces a specific system with a rotating radar dome 'rotodome' radome designed and built by Boeing (Defence & Space Group) using Westinghouse (now Northrop Grumman) radar. It is mounted on either the E-3 Sentry aircraft (Boeing 707) or more recently the Boeing E-767 (Boeing 767), the latter only being used by the Japan Air Self-Defence Force. When AWACS first entered service it represented a major advance in capability, being the first AEW to use a pulse-Doppler radar, which allowed it to track targets normally lost in ground clutter. Previously, low-flying aircraft could only be readily tracked over water.

Reconnaissance Aircraft

A reconnaissance aircraft is a military surveillance aircraft designed or adapted to perform aerial reconnaissance. Their roles include collection of imagery intelligence (such as photography), signals intelligence, and measurement and signature intelligence. In addition to general intelligence gathering, modern technology has also enabled some aircraft and UAVs to carry out real-time surveillance. In years prior to the development and common use of sophisticated electronic sensors (such as radar) and image recording devices, reconnaissance aircraft were also relied upon by military forces for distant visual observation and scouting of enemy movement. An example is the PBY Catalina maritime patrol flying boat used by the Allies in World War II: a flight of U.S. Navy Catalinas spotted part of the Japanese fleet approaching Midway Island, beginning the Battle of Midway. Since the Cold War much of the strategic reconnaissance aircraft role has passed over to satellites, and the tactical role to unmanned aerial vehicles (UAVs). This has been proven in successful uses by Israel, and by the United States in Desert Storm operations.

Surveillance Aircraft

A surveillance aircraft is an aircraft used for surveillance—collecting information over time. They are operated by military forces and other government agencies in roles such as intelligence gathering, battlefield surveillance, airspace surveillance, observation (e.g. artillery spotting), border patrol and fishery protection. This article concentrates on aircraft used in those roles, rather than for traffic monitoring, law enforcement and similar activities. Surveillance aircraft usually carry no armament, or only limited defensive armament. A surveillance aircraft does not necessarily require high-performance capability or stealth characteristics. It may be a modified civilian aircraft. Surveillance aircraft have also included moored balloons (e.g. TARS) and unmanned aerial vehicles (UAVs). Reconnaissance aircraft are a type of surveillance aircraft. The terms “surveillance” and “reconnaissance” have sometimes been used interchangeably, but, in the military context, a distinction can be drawn between surveillance, which monitors a changing situation in real time, and reconnaissance, which captures a static picture for analysis. Surveillance is sometimes grouped with Intelligence, Target acquisition and Reconnaissance under the title ISTAR. Observation was the term used for surveillance when the main sensor was the human eye.

Roles	
Maritime Patrol	Maritime patrol aircraft are typically large, slow machines capable of flying continuously for many hours, with a wide range of sensors. Such aircraft include the Hawker-Siddeley Nimrod, the Breguet Atlantique, the Tupolev Tu-95, the Lockheed P-2 Neptune and the Lockheed P-3 Orion/CP-140 Aurora.
Law Enforcement	Predator UAVs have been used by the US for border patrol.
Battlefield and Airspace Surveillance	

Current Use
Unmanned (UAV) surveillance aircraft have been deployed or are under development in many countries, including Israel, the UK, the United States, Canada, China, India, South Africa and Pakistan. Unmanned surveillance UAVs include both airships—such as Sky Sentinel and HiSentinel 80—and airplanes. Most air forces around the world lack dedicated surveillance planes. Several countries adapt aircraft for electronic intelligence (ELINT) gathering. The Beech RC-12 Super King Air and Boeing RC-135 Rivet Joint are examples of this activity.

UAVs

An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without a human pilot aboard. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously by on-board computers. Compared to manned aircraft, UAVs were originally used for missions too "dull, dirty or dangerous" for humans. While they originated mostly in military applications, their use is rapidly expanding to commercial, scientific, recreational, agricultural, and other applications, such as policing, peacekeeping, and surveillance, product deliveries, aerial photography, agriculture, smuggling, and drone racing. Civilian UAVs now vastly outnumber military UAVs, with estimates of over a million sold by 2015.

Experimental Aircraft

An experimental aircraft is an aircraft that has not yet been fully proven in flight. Often, this implies that new aerospace technologies are being tested on the aircraft, though the label is more broad. The term "experimental aircraft" is usually used to refer to aircraft flown with an experimental certificate. In the United States, this includes most homebuilt aircraft; many of which are based on conventional designs and hence are experimental only in name. The term "research aircraft", by contrast, generally denotes aircraft modified to perform scientific studies, such as weather research or geophysical surveying, similar to a research vessel.

ICBM

An intercontinental ballistic missile (ICBM) is a guided ballistic missile with a minimum range of 5,500 kilometres (3,400 mi) primarily designed for nuclear weapons delivery (delivering one or more thermonuclear warheads). Similarly, conventional, chemical, and biological weapons can also be delivered with varying effectiveness, but have never been deployed on ICBMs. Most modern designs support multiple independently targetable re-entry vehicles (MIRVs), allowing a single missile to carry several warheads, each of which can strike a different target. Early ICBMs had limited precision, which made them suitable for use only against the largest targets, such as cities. They were seen as a "safe" basing option, one that would keep the deterrent force close to home where it would be difficult to attack. Attacks against military targets (especially hardened ones) still demanded the use of a more precise, manned bomber. Second- and third-generation designs (such as the LGM-118 Peacekeeper) dramatically improved accuracy to the point where even the smallest point targets can be successfully attacked. ICBMs are differentiated by having greater range and speed than other ballistic missiles: intermediate-range ballistic missiles (IRBMs), medium-range ballistic missiles (MRBMs), short-range ballistic missiles (SRBMs) and tactical ballistic missiles (TBMs). Short and medium-range ballistic missiles are known collectively as theatre ballistic missiles.

Modern ICBMs typically carry multiple independently targetable re-entry vehicles (MIRVs), each of which carries a separate nuclear warhead, allowing a single missile to hit multiple targets. MIRV was an outgrowth of the rapidly shrinking size and weight of modern warheads and the Strategic Arms Limitation Treaties which imposed limitations on the number of launch vehicles (SALT I and SALT II). It has also proved to be an "easy answer" to proposed deployments of Anti-ballistic missile (ABM) systems—it is far less expensive to add more warheads to an existing missile system than to build an ABM system capable of shooting down the additional warheads; hence, most ABM system proposals have been judged to be impractical. The first operational ABM systems were deployed in the U.S. during the 1970s. Safeguard ABM facility was located in North Dakota and was operational from 1975 to 1976. The USSR deployed its ABM-1 Galosh system around Moscow in the 1970s, which remains in service. Israel deployed a national ABM system based on the Arrow missile in 1998, but it is mainly designed to intercept shorter-ranged theatre ballistic missiles, not ICBMs. The Alaska-based United States national missile defence system attained initial operational capability in 2004.

Flight Phases
The following flight phases can be distinguished:
- Boost phase: 3 to 5 minutes; it is shorter for a solid-fuel rocket than for a liquid-propellant rocket; depending on the trajectory chosen, typical burnout speed is 4 km/s (2.5 mi/s), up to 7.8 km/s (4.8 mi/s); altitude at the end of this phase is typically 150 to 400 km (93 to 249 mi).
- Midcourse phase: approx. 25 minutes—sub-orbital spaceflight with a flight path being a part of an ellipse with a vertical major axis; the apogee (halfway through the midcourse phase) is at an altitude of approximately 1,200 km (750 mi); the semi-major axis is between 3,186 and 6,372 km (1,980 and 3,959 mi); the projection of the flight path on the Earth's surface is close to a great circle, slightly displaced due to earth rotation during the time of flight; the missile may release several independent warheads and penetration aids, such as metallic-coated balloons, aluminium chaff, and full-scale warhead decoys.
- Re-entry/terminal phase (starting at an altitude of 100 km, 62 mi): 2 minutes – impact is at a speed of up to 7 km/s (4.3 mi/s) (for early ICBMs less than 1 km/s (0.62 mi/s)); see also manoeuvrable re-entry vehicle

ICBMs usually use the trajectory which optimizes range for a given amount of payload (the minimum-energy trajectory); an alternative is a depressed trajectory, which allows less payload, shorter flight time, and has a much lower apogee.

Deployability
- In missile silos, which offer some protection from military attack (including, the designers hope, some protection from a nuclear first strike)
- On submarines: submarine-launched ballistic missiles (SLBMs); most or all SLBMs have the long range of ICBMs (as opposed to IRBMs)
- On heavy trucks; this applies to one version of the Topol which may be deployed from a self-propelled mobile launcher, capable of moving through roadless terrain, and launching a missile from any point along its route
- Mobile launchers on rails

The last three kinds are mobile and therefore hard to find. During storage, one of the most important features of the missile is its serviceability. One of the key features of the first computer-controlled ICBM, the Minuteman missile, was that it could quickly and easily use its computer to test itself. After launch, a booster pushes the missile and then falls away. Most modern boosters are solid-fuelled rocket motors, which can be stored easily for long periods of time. Early missiles used liquid-fuelled rocket motors. Many liquid-fuelled ICBMs could not be kept fuelled all the time as the cryogenic fuel liquid oxygen boiled off and caused ice formation, and therefore fuelling the rocket was necessary before launch. This procedure was a source of significant operational delay, and might allow the missiles to be destroyed by enemy counterparts before they could be used. To resolve this problem the United Kingdom invented the missile silo that protected the missile from a first strike and also hid fuelling operations underground.

Once the booster falls away, the remaining "bus" releases several warheads, each of which continues on its own unpowered ballistic trajectory, much like an artillery shell or cannonball. The warhead is encased in a cone-shaped re-entry vehicle and is difficult to detect in this phase of flight as there is no rocket exhaust or other emissions to mark its position to defenders. The high speeds of the warheads make them difficult to intercept and allow for little warning, striking targets many thousands of kilometres away from the launch site (and due to the possible locations of the submarines: anywhere in the world) within approximately 30 minutes. As the nuclear warhead re-enters the Earth's atmosphere its high speed causes compression of the air, leading to a dramatic rise in temperature which would destroy it if it were not shielded in some way.

Deployability

As a result, warhead components are contained within an aluminium honeycomb substructure, sheathed in a pyrolytic carbon-epoxy synthetic resin composite material heat shield. Warheads are also often radiation-hardened (to protect against nuclear-tipped ABMs or the nearby detonation of friendly warheads), one neutron-resistant material developed for this purpose in the UK is three-dimensional quartz phenolic. Circular error probable is crucial, because halving the circular error probable decreases the needed warhead energy by a factor of four. Accuracy is limited by the accuracy of the navigation system and the available geodetic information.

Land-Based ICBMs

Russia, the United States, China, North Korea and India are the only countries currently known to possess land-based ICBMs, Israel has also tested ICBMs but is not open about actual deployment. The United States currently operates 405 ICBMs in three USAF bases. The only model deployed is LGM-30G Minuteman-III. All previous USAF Minuteman II missiles were destroyed in accordance with START II, and their launch silos have been sealed or sold to the public. The powerful MIRV-capable Peacekeeper missiles were phased out in 2005. China has developed several long range ICBMs, like the DF-31. The Dongfeng 5 or DF-5 is a 3-stage liquid fuel ICBM and has an estimated range of 13,000 kilometres. The DF-5 had its first flight in 1971 and was in operational service 10 years later. One of the downsides of the missile was that it took between 30 and 60 minutes to fuel. The Dong Feng 31 (a.k.a. CSS-10) is a medium-range, three-stage, solid-propellant intercontinental ballistic missile, and is a land-based variant of the submarine-launched JL-2. Israel is believed to have deployed a road mobile nuclear ICBM, the Jericho III, which entered service in 2008. It is possible for the missile to be equipped with a single 750 kg (1,650 lb) nuclear warhead or up to three MIRV warheads. It is believed to be based on the Shavit space launch vehicle and is estimated to have a range of 4,800 to 11,500 km (3,000 to 7,100 mi). In November 2011 Israel tested an ICBM believed to be an upgraded version of the Jericho III.

Submarine-Launched

A submarine-launched ballistic missile (SLBM) is a ballistic missile capable of being launched from submarines. Modern variants usually deliver multiple independently targetable re-entry vehicles (MIRVs) each of which carries a nuclear warhead and allows a single launched missile to strike several targets. Submarine-launched ballistic missiles operate in a different way from submarine-launched cruise missiles. Modern submarine-launched ballistic missiles are closely related to intercontinental ballistic missiles (with ranges of over 5,500 kilometres (3,000 nmi), and in many cases SLBMs and ICBMs may be part of the same family of weapons.

Anti-Ballistic Missile

An anti-ballistic missile (ABM) is a surface-to-air missile designed to counter ballistic missiles (see missile defence). Ballistic missiles are used to deliver nuclear, chemical, biological, or conventional warheads in a ballistic flight trajectory. The term "anti-ballistic missile" is a generic term conveying a system designed to intercept and destroy any type of ballistic threat, however it is commonly used for systems specifically designed to counter intercontinental ballistic missiles (ICBMs). There are only three systems in the world that can intercept ICBMs. Besides them, some smaller systems exist (tactical ABMs), that generally cannot intercept intercontinental strategic missiles, even if within range—an incoming ICBM simply moves too fast for these systems.

● The Russian A-135 anti-ballistic missile system is used for the defence of Moscow. It became operational in 1995 and was preceded by the A-35 anti-ballistic missile system. The system uses Gorgon and Gazelle missiles with nuclear warheads to intercept incoming ICBMs.
● The U.S. Ground-Based Midcourse Defence System (GMD), formerly known as National Missile Defence (NMD), was first tested in 1997 and had its first successful intercept test in 1999. Instead of using an explosive charge, it launches a hit-to-kill kinetic projectile to intercept an ICBM. The current GMD system is intended to shield the United States mainland against a limited nuclear attack by a rogue state such as North Korea. GMD does not have the ability to protect against an all-out nuclear attack from Russia, as there are currently 44 ground-based interceptors deployed against crossing projectiles headed toward the homeland. (This does not include the THAAD, or Aegis, or Patriot defences against directly incoming projectiles.)
● The Israeli Arrow 3 system entered operational service in 2017. It is designed for exo-atmosphere interception of ballistic missiles during the spaceflight portion of their trajectory, including those of ICBMs. It may also act as an anti-satellite weapon.

United States

In several tests, the U.S. military have demonstrated the feasibility of destroying long and short range ballistic missiles. Combat effectiveness of newer systems against 1950s tactical ballistic missiles seems very high, as the MIM-104 Patriot (PAC-1 and PAC-2) had a 100% success rate in Operation Iraqi Freedom. The U.S. Navy Aegis combat system uses RIM-161 Standard Missile 3, which hit a target going faster than ICBM warheads. These systems, as opposed to U.S. GMD system, are not capable of a mid-course intercept of an ICBM. The U.S. Terminal High Altitude Area Defence (THAAD) system began production in 2008. Its stated range as a short to intermediate ballistic missile interceptor means that it is not designed to hit midcourse ICBMs, which can reach terminal phase speeds of mach 8 or greater.

But for terminal phase, a THAAD interceptor's speed can reach mach 8, and THAAD has repeatedly proven it can intercept descending exoatmospheric missiles in a ballistic trajectory. The United States Army released information as early as 2004 about their plans to develop a command system that was intended to replace Raytheon's Patriot missile (SAM) engagement control station along with seven other forms of defence command systems.

The system, the Integrated Air and Missile Battle Command System (IBCS), is an anti-ballistic missile defence system designed to shoot down short, medium, and intermediate range ballistic missiles in their terminal phase by intercepting with a hit-to-kill approach. A prime contractor was announced in 2010; by May 2015, a first flight test integrated a networked IBCS 280 engagement operations centre with radar sensor and interceptor launchers. This test demonstrated a missile kill with the first interceptor. By Army doctrine, two interceptors were launched against that missile. By November 2016, IBCS tests demonstrated sensor fusion from disparate data streams,:minute 2:28 identification and tracking of targets, selection of appropriate kill vehicles, and interception of the targets.

Israel

Arrow 2	The Arrow project was begun after the U.S. and Israel agreed to co-fund it on 6 May 1986. The Arrow ABM system was designed and constructed in Israel with financial support by the United States by a multibillion-dollar development program called "Minhelet Homa" (Wall Administration) with the participation of companies like Israel Military Industries, Tadiran and Israel Aerospace Industries.
Arrow 3	The Arrow 3 system is capable of exo-atmosphere interception of ballistic missiles, including of ICBMs. It also acts as an anti-satellite weapon. Lieutenant General Patrick J. O'Reilly, Director of the US Missile Defence Agency, said: "The design of Arrow 3 promises to be an extremely capable system, more advanced than what we have ever attempted in the U.S. with our programs."

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David's Sling	David's Sling, is an Israel Defence Forces military system being jointly developed by the Israeli defence contractor Rafael Advanced Defence Systems and the American defence contractor Raytheon, designed to intercept tactical ballistic missiles, as well as medium- to long-range rockets and slower-flying cruise missiles, such as those possessed by Hezbollah, fired at ranges from 40 km to 300 km. It is designed with the aim of intercepting the newest generation of tactical ballistic missiles, such as Iskander.

6 Space Warfare

Space warfare is combat that takes place in outer space. The scope of space warfare therefore includes ground-to-space warfare, such as attacking satellites from the Earth; space-to-space warfare, such as satellites attacking satellites; and space-to-ground warfare, such as satellites attacking Earth-based targets.

As of 2020 no actual warfare has ever taken place in space, though a number of tests and demonstrations have been performed. International treaties are in place that regulate conflicts in space and limit the installation of space weapon systems, especially nuclear weapons.

History

1960s

Early efforts to conduct space warfare were directed at space-to-space warfare, as ground-to-space systems were considered to be too slow and too isolated by Earth's atmosphere and gravity to be effective at the time. The history of active space warfare development goes back to the 1960s when the Soviet Union began the Almaz project, a project designed to give them the ability to do on-orbit inspections of satellites and destroy them if needed. Similar planning in the United States took the form of the Blue Gemini project, which consisted of modified Gemini capsules that would be able to deploy weapons and perform surveillance.

One early test of electronic space warfare, the so-called Starfish Prime test, took place in 1962, when the United States exploded a ground-launched nuclear weapon in space to test the effects of an electromagnetic pulse. The result was a deactivation of many then-orbiting satellites, both American and Soviet. The deleterious and unfocused effects of the EMP test led to the banning of nuclear weapons in space in the Outer Space Treaty of 1967.

In the early 1960s the U.S. military produced a film called Space and National Security which depicted space warfare.

1970s–1990s

Through the 1970s, the Soviet Union continued their project and test-fired a cannon to test space station defense. This was considered too dangerous to do with a crew on board, however, so the test was conducted after the crew had returned to Earth.

A USAF F-15 Eagle launching an ASM-135 ASAT (anti-satellite) missile in 1985.
A 1976 Soviet report suggested that the design of the space shuttle had been guided by a requirement to deliver a payload- such as a bomb- over Russia and return to land after a single orbit. This may have been a confusion based on requirements 3A and 3B for the shuttle's design, which required the craft to be able to deploy or retrieve an object from a polar orbit in a single pass.

Both the Soviets and the United States developed anti-satellite weaponry designed to shoot down satellites. While early efforts paralleled other space-to-space warfare concepts, the United States was able in the 1980s to develop ground-to-space laser anti-satellite weapons. None of these systems are known to be active today; however, a less powerful civilian version of the ground-to-space laser system is commonly used in the astronomical technique of adaptive optics.

Since 2000

The U.S. developed an interceptor missile, the SM-3, testing it by hitting ballistic test targets while they were in space. On February 21, 2008, the U.S. used a SM-3 missile to destroy a spy satellite, USA-193, while it was 247 kilometers (133 nautical miles) above the Pacific Ocean. Japan fields the U.S.-made SM-3 missile, and there have been plans to base the land-based version in Romania and Vietnam.

In March 2019, India shot down a satellite orbiting in a Low Earth orbit using an ASAT missile during an operation code named Mission Shakti, thus making its way to the list of space warfare nations, establishing the Defense Space Agency the following month, followed by its first-ever simulated space warfare exercise on 25 July which would inform a joint military space doctrine.

In July 2019 Emmanuel Macron "called for a space high command to protect" France's satellites. This was followed by a plan released by military officials. French Defense Minister, Florence Parly, announced a space weapons program that would move the country's space surveillance strategy towards active protection of its assets in space, e.g. satellites. The projects outlined include: patrolling nano-satellites swarms, ground-based laser systems to blind spying satellites, and machine guns mounted on satellites.

Theoretical Space Weaponry

Ballistic Warfare

In the late 1970s and through the 1980s the Soviet Union and the United States theorized, designed and in some cases tested a variety of weaponry designed for warfare in outer space. Space warfare was seen primarily as an extension of nuclear warfare, and so many theoretical systems were based around the destruction or defense of ground and sea-based missiles.

Space-based missiles were not attempted due to the Outer Space Treaty, which banned the use, testing or storage of nuclear weapons outside the Earth's atmosphere. When the U.S. gained "interest in utilizing space-based lasers for ballistic missile defense", two facts emerged. One being that the ballistic missiles are fragile and two, chemical lasers project missile killing energy (3,000 kilometers). This meant that lasers could be put into space to intercept a Ballistic missile.

Systems proposed ranged from measures as simple as ground and space-based anti-missiles to railguns, space based lasers, orbital mines and similar weaponry. Deployment of these systems was seriously considered in the mid-1980s under the banner of the Strategic Defense Initiative announced by Ronald Reagan in 1983, using the term "evil empire" to describe the Soviets (hence the popular nickname "Star Wars").

If the Cold War had continued, many of these systems could potentially have seen deployment: the United States developed working railguns, and a laser that could destroy missiles at range, though the power requirements, range, and firing cycles of both were impractical. Weapons like the space-based laser was rejected, not just by the government, but by Universities, moral thinkers, and religious people because it would have increased the waging of the arms race and questioned the United States' role in the Cold War.

Electronic Warfare

With the end of the Cold War and continued development of satellite and electronics technology, attention was focused on space as a supporting theatre for conventional warfare. Currently, military operations in space primarily concern either the vast tactical advantages of satellite-based surveillance, communications, and positioning systems or mechanisms used to deprive an opponent of said tactical advantages.

Accordingly, most space-borne proposals which would traditionally be considered "weapons" (a communications or reconnaissance satellite may be useful in warfare but isn't generally classified as a weapon) are designed to jam, sabotage, and outright destroy enemy satellites, and conversely to protect friendly satellites against such attacks. To this end, the US (and presumably other countries) is researching groups of small, highly mobile satellites called "microsats" (about the size of a refrigerator) and "picosats" (approximately 1 cubic foot (≈27 litres) in volume) nimble enough to maneuver around and interact with other orbiting objects to repair, sabotage, hijack, or simply collide with them.

Kinetic Bombardment

Another theorized use involves the extension of conventional weaponry into orbit for deployment against ground targets. Though international treaties ban the deployment of nuclear missiles outside the atmosphere, other categories of weapons are largely unregulated. Traditional ground-based weapons are generally not useful in orbital environments, and few if any would survive re-entry even if they were, but as early as the 1950s, the United States has toyed with kinetic bombardment, i.e. orbiting magazines of non-explosive projectiles to be dropped onto hardened targets from low Earth orbit.

Kinetic weapons have always been widespread in conventional warfare—bullets, arrows, swords, clubs, etc.—but the energy a projectile would gain while falling from orbit would make such a weapon rival all but the most powerful explosives. A direct hit would presumably destroy all but the most hardened targets without the need for nuclear weapons.

Such a system would involve a 'spotter' satellite, which would identify targets from orbit with high-power sensors, and a nearby 'magazine' satellite to de-orbit a long, needle-like tungsten dart onto it with a small rocket motor or just dropping a very big rock from orbit (such as an asteroid). This would be more useful against a larger but less hardened target (such as a city). Though a common device in science fiction, there is no publicly available evidence that any such systems have actually been deployed by any nation.

Directed-Energy Weapons

Weapon systems that fall under this category include lasers, linear particle accelerators or particle-beam based weaponry, microwaves and plasma-based weaponry. Particle beams involve the acceleration of charged or neutral particles in a stream towards a target at extremely high velocities, the impact of which creates a reaction causing immense damage. Most of these weapons are theoretical or impractical to implement currently, aside from lasers which are starting to be used in terrestrial warfare. That said, directed-energy weapons are more practical and more effective in a vacuum (i.e. space) than in the Earth's atmosphere, as in the atmosphere the particles of air interfere with and disperse the directed energy. Nazi Germany had a project for such a weapon, considered a wunderwaffe, the sun gun, which would have been an orbital concave mirror able to concentrate the sun's energy on a ground target.

Space-Based Lasers

Light Amplification by the Stimulated Emission of Radiation (acronym LASER) excite molecules within a chamber, creating an electronic state that releases energy in the form of photons. The photons pass by other molecules, spreading energy, making more photons. To make an actual laser, a beam has to pass through mass quantities of laser medium by bouncing back and forth between mirrors placed at opposing ends. Then the light beam exits through one of the mirrors which is more transparent than the other. Making a functional laser requires the electrons to not only reach their excited state, but is reliant on the time it takes for them to get excited, and also the time for the energy created to reach new electrons. The efficiency of the laser relies on the amount of heat that exits. In terms of lasers, the power of the laser far outweighs the chemical efficiency. Of course the trajectory of the laser matters as well as its ability to hit the target it is aimed at, but when lasers are placed in space, Diffraction can cause interference.

Lethality of Space Lasers
Lasers require mirrors in the system to direct their beams to achieve impact, but if not done correctly, major damage can affect the skin. However, if the laser or lasers does make impact,

"a 10 meter mirror with a HF laser beam would yield a 0.32 micro-radian divergence angle and create a laser spot 1.3 meter in diameter at a range of 4,000 meters. The distribution of the 20MW over the laser spot would create an energy flux of 1.5 kilowatts per square centimeter (kW/cm^2). The laser spot would need to dwell on the target for 6.6 seconds to create the nominal lethal fluence of 10 kilojoules per square centimeter (kJ/cm^2)"

meaning that the laser would essentially blow holes into missiles they are aimed at, as long as the laser mirrors are aimed correctly and the heated molecules exit the beam quickly. Other factors of impact would be the type of laser itself, the amount of exposure, what the laser is attempting to hit (the target), environmental factors, and the ability of the target to either absorb or reflect the laser beam itself. So what happens when a target is hit? Since this is a topic of space-based lasers it's safe to assume that the target is in the atmosphere so,

"a beam with an intensity of around 10 million watts per square centimeter would cause the air immediately in front of the target to ionize, which would create a layer of plasma as the beam hits the surface. The plasma would absorb the energy of the laser beam and grow extremely hot (around 6,000 degrees Celsius). The plasma would distribute this energy in two ways, by emitting ultraviolet radiation and by expanding explosively. These mechanisms could increase the extent of the beam energy attached to the target to approximately 30 percent and reduce the amount of energy the laser would have to produce."

When a laser is placed on the ground there are many more chances for obscurity in terms of a laser beam having to travel through the atmosphere as well as a much farther length of travel for the beam to hit the target. Other issues that can cause the laser beam to not be efficient is a state called Thermal blooming when the laser heats up the air around it which can cause diffusion because of the heat, sparking, and simply decreasing the beam size by increasing the mirror size could fight against thermal blooming. The atmosphere can also cause absorption, scattering, turbulence, and sparking to the beam, even simply bending the beam so the target isn't accurate.

Practical Considerations

Space warfare is likely to be conducted at far greater distances and speeds than terrestrial combat. The vast distances involved pose difficult challenges for targeting and tracking, as even light requires a few seconds to traverse ranges measured in hundreds of thousands of kilometers. For example, if attempting to fire upon a target at the distance of the Moon from the Earth, the image one sees reflects the position of the target slightly more than a second earlier. Thus even a laser would need approximately 1.28 seconds, meaning a laser-based weapon system would need to lead a target's apparent position by $1.28\times2 = 2.56$ seconds. A projectile from a railgun recently tested by the US Navy would take over eighteen hours to cross that distance, assuming that it would travel in a straight line at a constant velocity of 5.8 km/s along its entire trajectory.

Three factors conspire to make engaging targets in space very difficult. First, the vast distances involved mean that an error of even a fraction of a degree in the firing solution could result in a miss by thousands of kilometers. Second, space travel involves tremendous speeds by terrestrial standards—a geostationary satellite moves at a speed of 3.07 km/s whereas objects in low earth orbit can move at up to 8 km/s. Third, though distances are large, targets remain relatively small. The International Space Station, currently the largest artificial object in Earth orbit, measures slightly over 100m at its largest span. Other satellites can be orders of magnitude smaller, e.g. Quickbird measures a mere 3.04m.

External ballistics for stationary terrestrial targets is enormously complicated—some of the earliest analog computers were used to calculate firing solutions for naval artillery, as the problems were already beyond manual solutions in any reasonable time—and the issues in targeting objects in space make a difficult problem even harder. Additionally, though not a problem for orbital kinetic weapons, any directed energy weapon would require large amounts of electricity. So far the most practical batteries are lithium batteries, and the most practical method of generating electricity in space is through photovoltaic modules, which are currently only up to 30% efficient, and fuel cells, which have limited fuel. Current technology might not be practical for powering effective lasers, particle beams, and railguns in space. In the context of the Strategic Defense Initiative, the Lawrence Livermore National Laboratory in the United States worked on a project for expandable space-based x-ray lasers powered by a nuclear explosion, Project Excalibur, a project canceled in 1992 for lack of results.

General William L. Shelton has said that in order to protect against attacks, Space Situational Awareness is much more important than additional hardening or armoring of satellites. The Air Force Space Command has indicated that their defensive focus will be on "Disaggregated Space Architectures".

Space Debris
Anti-satellite attacks, especially ones involving kinetic kill vehicles, can contribute to the formation of space debris which can remain in orbit for many years and could interfere with future space activity or in a worst case trigger a Kessler Syndrome. In January 2007 China demonstrated a satellite knock out whose detonation alone caused more than 40,000 new chunks of debris with a diameter larger than one centimeter and a sudden increase in the total amount of debris in orbit. The PRC is reported to be developing "soft-kill" techniques such as jamming and vision kills that do not generate much debris.

Possible Warfare Over Space
Most of the world's communications systems rely heavily on the presence of satellites in orbit around Earth. Protecting these assets might seriously motivate nations dependent upon them to consider deploying more space-based weaponry, especially in conflicts involving advanced countries with access to space.

Since 2017, the United States Air Force has run an annual military exercise called "Space Flag" at Peterson Air Force Base, which involves a red team simulating attacks on U.S. satellites.

7 Electronic Warfare

Drones

UAVs

Robots (Animaloid)

Robots (Humanoid)

8 Traps & Explosives

IEDs

An improvised explosive device (IED) is a bomb constructed and deployed in ways other than in conventional military action. It may be constructed of conventional military explosives, such as an artillery shell, attached to a detonating mechanism. IEDs are commonly used as roadside bombs. IEDs are generally seen in heavy terrorist actions or in asymmetric unconventional warfare by insurgent guerrillas or commando forces in a theatre of operations. In the second Iraq War, IEDs were used extensively against US-led invasion forces and by the end of 2007 they had become responsible for approximately 63% of coalition deaths in Iraq. They are also used in Afghanistan by insurgent groups, and have caused over 66% of coalition casualties in the 2001–present Afghanistan War. IEDs were also used extensively by cadres of the rebel Tamil Tiger (LTTE) organisation against military targets in Sri Lanka.

Background

An IED is a bomb fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic, or incendiary chemicals and designed to destroy or incapacitate personnel or vehicles. In some cases, IEDs are used to distract, disrupt, or delay an opposing force, facilitating another type of attack. IEDs may incorporate military or commercially sourced explosives, and often combine both types, or they may otherwise be made with homemade explosives (HME). An HME lab refers to a Homemade Explosive Lab, or the physical location where the devices are crafted. An IED has five components: a switch (activator), an initiator (fuse), container (body), charge (explosive), and a power source (battery). An IED designed for use against armoured targets such as personnel carriers or tanks will be designed for armour penetration, by using a shaped charge that creates an explosively formed penetrator. IEDs are extremely diverse in design and may contain many types of initiators, detonators, penetrators, and explosive loads.

Antipersonnel IEDs typically also contain fragmentation-generating objects such as nails, ball bearings or even small rocks to cause wounds at greater distances than blast pressure alone could. In the conflicts of the 21st century, anti-personnel improvised explosive devices (IED) have partially replaced conventional or military landmines as the source of injury to dismounted (pedestrian) soldiers and civilians. These injuries were recently reported in BMJ Open to be far worse with IEDs than with landmines resulting in multiple limb amputations and lower body mutilation. This combination of injuries has been given the name "Dismounted Complex Blast Injury" and is thought to be the worst survivable injury ever seen in war. IEDs are triggered by various methods, including remote control, infrared or magnetic triggers, pressure-sensitive bars or trip wires (victim-operated). In some cases, multiple IEDs are wired together in a daisy chain to attack a convoy of vehicles spread out along a roadway. IEDs made by inexperienced designers or with substandard materials may fail to detonate, and in some cases, they actually detonate on either the maker or the placer of the device. Some groups, however, have been known to produce sophisticated devices constructed with components scavenged from conventional munitions and standard consumer electronics components, such as mobile phones, consumer-grade two-way radios, washing machine timers, pagers, or garage door openers.

The sophistication of an IED depends on the training of the designer and the tools and materials available. IEDs may use artillery shells or conventional high-explosive charges as their explosive load as well as homemade explosives. However, the threat exists that toxic chemical, biological, or radioactive (dirty bomb) material may be added to a device, thereby creating other life-threatening effects beyond the shrapnel, concussive blasts and fire normally associated with bombs. Chlorine liquid has been added to IEDs in Iraq, producing clouds of chlorine gas. A vehicle-borne IED, or VBIED, is a military term for a car bomb or truck bomb but can be any type of transportation such as a bicycle, motorcycle, donkey (DBIED), etc. They are typically employed by insurgents in particular ISIS, and can carry a relatively large payload. They can also be detonated from a remote location. VBIEDs can create additional shrapnel through the destruction of the vehicle itself and use vehicle fuel as an incendiary weapon. The act of a person's being in this vehicle and detonating it is known as an SVBIED suicide. Of increasing popularity among insurgent forces in Iraq is the house-borne IED, or HBIED from the common military practice of clearing houses; insurgents rig an entire house to detonate and collapse shortly after a clearing squad has entered.

An IED is rarely, if ever, produced by traditional manufacturing processes with a rigid mode of employment. The key to them is their 'improvised' nature – one that will utilize available materials in order to attack an opponent. An explosive charge might be constructed from commonly available chemicals, but can also include conventional munitions (such as artillery shells adapted as roadside bombs). IEDs are certainly not a new phenomenon, with records of IED use over the last 500 years. But they continue to evolve both in their design, which is defined by available materials and by the use to which they are put. Typically, IEDs have four key components: a main charge of explosives, an explosive initiator (a small amount of energetic explosives), a switching mechanism and a container of some sort. Most developments in IED design and construction involve one or more of these.

Recent developments in the design of IEDs have focused on a number of areas, namely:
1. Explosive component design (for instance to provide better target effects and become more lethal). Here, the main charge and the container in which it is contained are changed or developed.
2. Explosive component precursors (for instance the use of commonly available precursors to make explosives). Here the main charge is developed. In some cases alternate explosive initiators have been developed.
3. Design of projected IEDs such as improvised mortars and rockets, to extend range and effect. Here a range of aspects including the container and other components have been developed.
4. Device concealment to better hide the presence of an IED. Here the container is developed to conceal the device better.
5. Command initiation developments, typically to utilise modern radio technology. Here the switching mechanism is developed.
6. Sensor initiation developments, typically to utilise modern sensors to initiate victim operated devices. Again this is a switching mechanism development. Some developments in IEDs however have seen a regressive use of technology – old, well known technology (such as the use of two saw blades set in parallel which form a circuit when they touch due to the pressure of a foot continually recycle over the ages).

Explosive Component Design
Perpetrators of IED attacks are faced with a range of targets and naturally those targets may take measures to improve their protection in the event of an attack. This naturally leads to the perpetrator considering ways in which to amplify the effect of the explosive component in order to overcome those defensive measures. At the simplest level this might simply be the use of larger quantities of explosives. In the 1970s, a car bomb or Vehicle IED (VBIED) might typically contain explosives within a container such as a barrel or a suitcase loaded into the trunk of the vehicle, because targets of VBIEDs were not protected. Today, with a greater awareness and presence of the VBIED threat, defences include protected facilities or greater 'stand-off' achieved by security measures. Over the last few years we have seen larger and larger VBIEDs in a variety of countries around the world as security protocols, using things such as road blocks, keep VBIEDs further from their targets. A second development is the use of a more sophisticated explosive component design. When faced with armoured targets some terrorist groups have used the physics of explosive component design to develop the design of the warhead to create a more penetrative effect, using – for instance – shaped charges. Shaped charges come in a variety of configurations, from high angle cones to dishes, all of which are deformed by the complex transition of the explosive blast wave into a range of penetrative effects. These effects can be further developed by the use of a range of different metals, which deform in different ways.

Explosive Component Precursors
Perpetrators of IED attacks do not necessarily have access to military explosives. In these circumstances, those constructing IEDs must develop their own explosives. Typically, this has been by utilizing a mix of an 'oxidiser' and a 'fuel' in appropriate portions, which one might consider as precursor chemicals. The chemistry of an oxidising reaction is such that in the right proportions and with the right level of mixing, the reaction becomes explosive when properly initiated. Over the past few decades one of the most common explosive mixes has been Fuel Oil (fuel) and Ammonium Nitrate (oxidiser), commonly called ANFO. However, a very wide range of different fuels are possible and they do not need to be carbon based – some recent developments have seen the use of a range of differing fuels and oxidisers, usually driven by the availability of material (e.g. if Ammonium Nitrate is made difficult to obtain by security legislation). Sometimes, albeit rarely, the explosive mix might be chosen to provide a slightly different effect, such as Ammonium Nitrate and Aluminium powder (the fuel in this case), which has a shorter peak pressure than ANFO – more likely to 'crack' concrete than perhaps 'lift and throw' it. But there may be other reasons for this development.

ANFO mixes separate out over time as the liquid fuel oil moves to the bottom of the container, causing less than perfect mixing – but an Aluminium powder and Ammonium Nitrate mix separates much less over time. The range of possible fuels and oxidizers is quite significant, and some developments have seen the use of innovative precursor materials. In other circumstances, rather than create a mix of fuels and oxidisers some IED constructors have developed explosive compounds – a single chemical material that is explosive when it decomposes. Such explosives were effectively first discovered in the 19th century, with the work of Nobel to develop Nitroglycerine and subsequently others to develop TNT. While theoretically today's IED user could produce such material, very often they use easier-to-obtain precursors such as Hydrogen peroxide and acetone to produce TATP, a particularly sensitive explosive. TATP has been used in devices as a main charge, but is also energetic and sensitive enough to be used as an initiator.

Device Concealment
In recent years there have been some significant developments to conceal IEDs so that they can pass a variety of forms of security screenings. Devices have been built in to the body of a vehicle, into shoes so to hide them during pre-flight aviation security, and in one incident built into a complex piece of equipment (a printer) to allow it to be loaded on an aircraft. In truth, concealing devices is not new but IED users are continuing to show innovative developments in this regard.

Sensor Initiation Developments
Makers of IEDs have always used radio initiation systems to remove themselves from the site of a bomb location. Ever since "jammers" were deployed by those defending against such attacks, terrorists have explored ways of getting around such defences, either by moving the frequency of the command system to an area of spectrum outside the jammer's capability or using a combination of switches. Such as a radio control signal to turn on a sensor before a vehicles jammer affects the radio signal, allowing the sensor to trigger the device. Fundamentally, the radio control system is no more than a switch, but a switch that many nations have now spent billions of dollars to defeat. IED designers will use a variety of ingenious mechanisms for victim operated switching. Sometimes these will use the latest technology, such as IR heat sensors, but less sophisticated mechanical booby trap pull-switches or pressure-plates are constantly being used and updates. The ways in which IEDs are employed are as diverse as the methods of construction. While IEDs are certainly used as a tactical weapon to defeat personnel and vehicles, they also play an important role at the strategic level of warfare. As Michael D. Barbero, Lieutenant General, U.S. Army Director JIEDDO, has succinctly said: 'The IED is a weapon used strategically to cause casualties, create the perception of insecurity, and influence national will.' A current example of the use of IEDs as weapons of both tactical and strategic use is their use – both suicide-initiated and otherwise, by the so-called Islamic State (IS).

Offensive Operations
At the tactical level, Iraqi Ba'atthist doctrines of superior firepower at the outset of attacks have been adopted by IS in its more conventional (ground holding) military operations. However, as sufficient resources of armour and artillery are in short supply, they have adapted to using Suicide Vehicle Borne IEDs (SVBIEDs) in place of conventional military equipment to achieve the same aim. In their attack on Ramadi in May 2015, for example, IS used up to 30 car bombs to overwhelm static military defences in advance of an infantry attack. In the same offensive campaign, IS also used roadside IEDs to block roads to cut off the city from reinforcements – again showing their ability to use improvised weapons for conventional fighting. Another important example of the use of IEDs as a tactic in offensive operations was the Abu Ghraib prison break on 21 July 2013, where the use of SVBIEDs led the way for an infantry assault which resulted in the escape of over 500 prisoners, bolstering the numbers of al- Qaeda in Iraq.

Defensive Operations
IEDs also play an important role in the defence of IS held territory at the tactical level. For example, during the YPG's assault on Hassaka neighbourhood of al-Zuhur, IS fighters placed IEDs to slow the Kurdish advance, showing their adaptability in using improvised weapons as a tactic of a conventional fighting force. At a strategic level, while they may be struggling to hold ground in recent months, the extensive placement of IEDs can prevent or delay post-conflict stabilisation of areas IS formerly held, which disguises their numerical inferiority. This 'economy of force' strategy is, according to Michael Knights and Alexandre Mello of the Washington Institute for Near East Policy, an under-acknowledged capability of the Islamic State, and this 'slow burn' strategy is 'where its real strength lies'. This underlines the importance of the use of IEDs to IS's broader strategy.

Types

IED - By Warhead

Explosive	A device placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic, or incendiary chemicals and designed to destroy, incapacitate, harass, or distract. It may incorporate military stores, but is normally devised from non-military components.
Explosively formed penetrator/projectiles (EFPs)	IEDs have been deployed in the form of explosively formed projectiles (EFP), a special type of shaped charge that is effective at long standoffs from the target (50 meters or more), however they are not accurate at long distances. This is because of how they are produced. The large "slug" projected from the explosion has no stabilization because it has no tail fins and it does not spin like a bullet from a rifle. Without this stabilization the trajectory can not be accurately determined beyond 50 meters. An EFP is essentially a cylindrical shaped charge with a machined concave metal disc (often copper) in front, pointed inward. The force of the shaped charge turns the disc into a high velocity slug, capable of penetrating the armour of most vehicles in Iraq.
Directionally Focused Charges	Directionally focused charges (also known as directionally focused fragmentary charges depending on the construction) are very similar to EFPs, with the main difference being that the top plate is usually flat and not concave. It also is not made with machined copper but much cheaper cast or cut metal. When made for fragmentation, the contents of the charge is usually nuts, bolts, ball bearings and other similar shrapnel products and explosive. If it only consists of the flat metal plate, it is known as a platter charge, serving a similar role as an EFP with reduced effect but easier construction.
Chemical	A device incorporating the toxic attributes of chemical materials designed to result in the dispersal of these toxic chemical materials for the purpose of creating a primary patho-physiological toxic effect (morbidity and mortality), or secondary psychological effect (causing fear and behaviour modification) on a larger population. Such devices may be fabricated in a completely improvised manner or may be an improvised modification to an existing weapon.
Biological	A device incorporating biological materials designed to result in the dispersal of vector borne biological material for the purpose of creating a primary patho-physiological toxic effect (morbidity and mortality), or secondary psychological effect (causing fear and behaviour modification) on a larger population. Such devices are fabricated in a completely improvised manner.
Incendiary	A device making use of exothermic chemical reactions designed to result in the rapid spread of fire for the purpose of creating a primary patho-physiological effect (morbidity and mortality), or secondary psychological effect (causing fear and behaviour modification) on a larger population or it may be used with the intent of gaining a tactical advantage. Such devices may be fabricated in a completely improvised manner or may be an improvised modification to an existing weapon. A common type of this is the Molotov cocktail.
Radiological	A speculative device incorporating radioactive materials designed to result in the dispersal of radioactive material for the purpose of area denial and economic damage, and/or for the purpose of creating a primary patho-physiological toxic effect (morbidity and mortality), or secondary psychological effect (causing fear and behaviour modification) on a larger population. Such devices may be fabricated in a completely improvised manner or may be an improvised modification to an existing nuclear weapon. Also called a Radiological Dispersion Device (RDD) or "dirty bomb".
Nuclear	Improvised nuclear device of most likely gun-type or implosion-type. Nanotechnology can theoretically be used to develop miniaturised laser-triggered pure fusion weapon that will be easier to produce than conventional nuclear weapons and could be used in terrorist attacks.

IED - By Delivery Mechanism

Car	A vehicle may be laden with explosives, set to explode by remote control or by a passenger/driver, commonly known as a car bomb or vehicle-borne IED (VBIED, pronounced vee-bid). On occasion the driver of the car bomb may have been coerced into delivery of the vehicle under duress, a situation known as a proxy bomb. Distinguishing features are low-riding vehicles with excessive weight, vehicles with only one passenger, and ones where the interior of the vehicles look as if they have been stripped down and built back up. Car bombs can carry thousands of pounds of explosives and may be augmented with shrapnel to increase fragmentation. The U.S. State Department has published a guide on car bomb awareness. ISIS has used truck bombs with devastating effects.
Boat	Boats laden with explosives can be used against ships and areas connected to water. An early example of this type was the Japanese Shinyo suicide boats during World War II. The boats were laden with explosives and attempted to ram Allied ships, sometimes successfully, having sunk or severely damaged several American ships by war's end. Suicide bombers used a boat-borne IED to attack the USS Cole, US and UK troops have also been killed by boat-borne IEDs in Iraq.

Animal	Monkeys and war pigs were used as incendiaries around 1000 AD. More famously the "anti-tank dog" and "bat bomb" were developed during World War II. In recent times, a two-year-old child and seven other people were killed by explosives strapped to a horse in the town of Chita in Colombia The carcasses of certain animals were also used to conceal explosive devices by the Iraqi insurgency.
Collar	IEDs strapped to the necks of farmers have been used on at least three occasions by guerrillas in Colombia, as a way of extortion. American pizza delivery man Brian Douglas Wells was killed in 2003 by an explosive fastened to his neck, purportedly under duress from the maker of the bomb. In 2011 a schoolgirl in Sydney, Australia had a suspected collar bomb attached to her by an attacker in her home. The device was removed by police after a ten-hour operation and proved to be a hoax.
Suicide	Suicide bombing usually refers to an individual wearing explosives and detonating them in order to kill others including themselves, a technique pioneered by LTTE (Tamil Tigers). The bomber will conceal explosives on and around their person, commonly using a vest (or possibly a prosthetic) and will use a timer or some other trigger to detonate the explosives. The logic behind such attacks is the belief that an IED delivered by a human has a greater chance of achieving success than any other method of attack. In addition, there is the psychological impact of fighters prepared to deliberately sacrifice themselves for their cause.
Surgically Implanted	In May 2012 American counter-terrorism officials leaked their acquisition of documents describing the preparation and use of surgically implanted improvised explosive devices. The devices were designed to evade detection. The devices were described as containing no metal, so they could not be detected by X-rays. Security officials referred to bombs being surgically implanted into suicide bombers' "love handles". According to the Daily Mirror UK security officials at MI-6 asserted that female bombers could travel undetected carrying the explosive chemicals in otherwise standard breast implants. The bomber would blow up the implanted explosives by injecting a chemical trigger.
Robot	Robots can be used to carry explosives. First such documented case was during the aftermath of 2016 shooting of Dallas police officers when a bomb disposal robot was used to deliver explosives to kill Micah Xavier Johnson, who was hiding in a place unaccesible to police snipers.
Tunnel	ISIS and Al-Nusra have used bombs detonated in tunnels dug under targets.
Improvised Rocket	In 2008, rocket-propelled IEDs, dubbed Improvised Rocket Assisted Munitions, Improvised Rocket Assisted Mortars and (IRAM) by the military, came to be employed in numbers against U.S. forces in Iraq. They have been described as propane tanks packed with explosives and powered by 107 mm rockets. They are similar to some Provisional IRA barrack buster mortars. New types of IRAMs including Volcano IRAM and Elephant Rockets, are used during Syrian Civil War.
Improvised Mortar	Improvised mortar has been used by many insurgent groups including during civil war in Syria and Boko Haram insurgency. IRA used improvised mortars called barrack busters.
Improvised Artillery	Improvised artillery including hell cannons are used by rebel forces during Syrian Civil War.
IED - By Trigger Mechanism	
Wire	Command-wire improvised, explosive devices (CWIED) use an electrical firing cable that affords the user complete control over the device right up until the moment of initiation.
Radio	The trigger for a radio-controlled improvised explosive device (RCIED) is controlled by radio link. The device is constructed so that the receiver is connected to an electrical firing circuit and the transmitter operated by the perpetrator at a distance. A signal from the transmitter causes the receiver to trigger a firing pulse that operates the switch. Usually the switch fires an initiator; however, the output may also be used to remotely arm an explosive circuit. Often the transmitter and receiver operate on a matched coding system that prevents the RCIED from being initiated by spurious radio frequency signals or jamming. An RCIED can be triggered from any number of different mechanisms including car alarms, wireless door bells, cell phones, pagers and encrypted GMRS radios.
Mobile Phone	A radio-controlled IED (RCIED) incorporating a mobile phone that is modified and connected to an electrical firing circuit. Mobile phones operate in the UHF band in line of sight with base transceiver station (BTS) antennae sites. In the common scenario, receipt of a paging signal by phone is sufficient to initiate the IED firing circuit.
Victim-Operated	Victim-operated improvised explosive devices (VOIED), also known as booby traps, are designed to function upon contact with a victim. VOIED switches are often well hidden from the victim or disguised as innocuous everyday objects. They are operated by means of movement. Switching methods include tripwire, pressure mats, spring-loaded release, push, pull or tilt. Common forms of VOIED include the under-vehicle IED (UVIED), improvised landmines, and mail bombs.
Infrared	The British accused Iran and Hezbollah of teaching Iraqi fighters to use infrared light beams to trigger IEDs. As the occupation forces became more sophisticated in interrupting radio signals around their convoys, the insurgents adapted their triggering methods. In some cases, when a more advanced method was disrupted, the insurgents regressed to using uninterruptible means, such as hard wires from the IED to detonator; however, this method is much harder to effectively conceal. It later emerged however, that these "advanced" IEDs were actually old IRA technology. The infrared beam method was perfected by the IRA in the early '90s after it acquired the technology from a botched undercover British Army operation. Many of the IEDs being used against the invading coalition forces in Iraq were originally developed by the British Army who unintentionally passed the information on to the IRA. The IRA taught their techniques to the Palestine Liberation Organisation and the knowledge spread to Iraq.
Timed	The IED is initiated by a timing mechanism, set by the perpetrator, so they can remove themselves from the scene. The timing mechanisms might be a burning fuse, a mechanical timer or an electronic timer.

Counterefforts

Counter-IED efforts are done primarily by military and law enforcement (led by intelligence efforts) with the assistance of the diplomatic and financial communities. It involves a comprehensive approach of countering the threat networks that employ improvised explosive devices (IEDs), defeating the devices themselves, and training others. Counter-IED, or C-IED, is usually part of a broader counter-terrorism, counter-insurgency, or law enforcement effort. Because IEDs are a subset of a number of forms of asymmetric warfare used by insurgents and terrorists, C-IED activities are principally against adversaries and not only against IEDs. C-IED treats the IED as a systemic problem and aims to defeat the IED System. This IED System requires multiple actions and resources in order to stage an IED Event. The IED System may be either hierarchical or non-hierarchical but it will contain nodes such as personnel, resources and other actions that are linked.

The importance of these nodes and the linkages between them will vary and identifying the critical vulnerabilities within the IED System is an important C-IED activity. Some IED Systems may be part of large, international terrorist organizations and some may be state sponsored. Some may work completely independently, while others may extend from theatre down to village level. This span of possibilities increases the complexity of military and law enforcement operations and requires a comprehensive approach to C-IED potentially involving close cooperation and coordination between the diplomatic, military, economic, and informational levers of power. The complexity of the IED System is increased since mobile phones and the internet provide a low-cost and easily accessible medium for information sharing and the swift promulgation of tactical ideas and practices, thereby facilitating the efficient operation of these diverse systems. IED network members also have the ability to operate part-time and can blend back into the civilian population when their actions are completed. Such systems can be extremely resilient, invariably hard to target and are, therefore, survivable.

Also, adversary targets can range from the specific such as host nation security force bases and recruiting events to the indiscriminate such as concentrations of people in public places. However, IEDs are not only found within the land environment; other targets may include maritime choke points and ships alongside, as well as aircraft in flight or on the ground. The first organization to tackle IED's on a large scale was the Joint IED Defeat Organization or JIEDDO of the U.S. Department of Defence on 14 February 2006. NATO later adopted JIEDDO's tactics, techniques and procedures. The C-IED approach used by NATO involves 3 mutually supporting and complementary pillars of activity which are: attack the network, defeat the device, and prepare the force. These are all underpinned by understanding and intelligence. (Counter-IED efforts can also be broken up into 6 key operational activities: predict, prevent, detect, neutralize, mitigate, and exploit.)

Countering Threat Networks (CTN)
A growing danger to the international community consists of highly complex adversary networks with international span that employ criminal financing as well as terror attacks and other destructive capabilities. Effectively countering these dynamic and violent illicit networks requires the creation of an international and multi-functional framework to share information on these networks as well as collaborative multinational countermeasures. Attack the network (AtN) is the principal pillar requiring this joint, inter-agency and multinational approach. Attack the network operations are defined as actions, kinetic or non-kinetic, used to disrupt, destroy, or reduce an enemy's capacity to mount terror operations, specifically groups that use IEDs. It consists of largely offensive and proactive activities, driven by intelligence that may go beyond the theatre of operations, designed to disrupt the networks of the adversary's IED System. Counter-network operations usually focus on leadership targeting of an organization, which follows the logic that by catching the right hornet, the whole colony dies. What is often overlooked in this approach, however, is that if just a worker bee is killed, the nest is aggravated and a much bigger problem is created.

While this concept provides a convenient metaphor to discuss possible targeting methodology, it seldom resembles the facts, because human networks are not directly analogous to a hornet's nest. In other words, not every situation can be resolved by a single kill or capture of the "queen". Activity is focused on the critical vulnerabilities of the IED System, for example, by denying the supply of components, finance, leaders, specialists and recruits and adversary exploitation and isolating the adversary from the local population. AtN/CTN seeks to 1) shape and influence IED networks, 2) disrupt their operations, and 3) undermine their financiers and supply chains. Exploitation is a vital component of the attack the networks activity. Information gained provides a picture of adversary capabilities and intentions, perpetrator relationships and the technical construction of the device. This enables the prediction of forthcoming IED activity, informs the targeting process, and enables follow up activities to further disrupt the IED System. Intelligence gained from exploitation also feeds into the other C-IED pillars.

9 War Targets

This section covers the likely targets that may be attacked during a war to help you avoid them. You may already be living close to one of the following, so consider the risk of staying or moving your house or BOL elsewhere.

Common War Targets

Military Troops	Any large gatherings of troops make good targets for adversaries.
Military Bases	All military bases regardless whether they are for the army, navy or air force are often the highest priority targets.
Power Plants	
Nuclear Plants	
Dams	Dams have been targeted in previous wars to help 'starve out' the opposition.
Airports	Civilian airports can sometimes be targeted, especially when they are being used to transport military troops.
Weapons Depot	Weapons depots are targeted to destroy the enemies weapons before they have a chance to use them.
Communications & Radars	All large scale communications towers and long range radars are often high priority targets.
Rail Networks	Railways are targeted because of their efficiency in transporting military equipment around a country.
Gas Pipelines	
Major Roads	Major roads used to transport supplies such as ammo, food, water and weapons could be targeted by enemies.

Restricted War Targets

These locations are generally not targeted or are outside the scope of 'humane' warfare. There are however those countries or armies who are considered scum and will still attack them out of hatred and spite disregarding the rules of fair warfare.

Hospitals	
Hospital Ships	Sometimes hospital ships have been known to be attacked in wars, particularly by Germany during world war 1.

Article four of the Hague Convention X outlined the restrictions for a hospital ship:
- Ship must be clearly marked and lighted as a hospital ship
- The ship should give medical assistance to wounded personnel of all nationalities
- The ship must not be used for any military purpose
- The ship must not interfere with or hamper enemy combatant vessels
- Belligerents, as designated by the Hague Convention, can search any hospital ship to investigate violations of the above restrictions
- Belligerents will establish the location of a hospital ship

Schools	Both Primary and Secondary.
Places of Worship	Churches and Mosques.

Civilian Dwellings	Suburbs.

Security

Camouflage, infiltration and awareness tips

"I changed my password to 'incorrect' so whenever I forget what it is, the computer will say 'Your password is incorrect'."
Unknown

Introduction

Tactics and Stealth are vital factors when bugging out or even when bugging in as the need to avoid people has never been higher. Today almost everything we do is tracked and monitored which can be extremely dangerous when the government is seeking to kill preppers.

Purpose	The aim of SECURITY is to conceal you from the eye of bystanders, from technology such as thermal and infrared, from animals, and from government agencies. It also has information on 'antisocial' behaviours such as building infiltration, lockpicking, siphoning fuel, hacking and spying. Finally it includes tips on military tactics to help you understand how armies are likely to proceed so you can avoid them, and information on observing and evading authorities such as governments and police using situational awareness.
Lost?	● For life security and staying alive against nature, see the PREPAREDNESS section. ● For information about the military vehicles with infrared and thermal, see the WARFARE section. ● For information on global wars, national hacking operations and terrorism, see the MAN-MADE DISASTERS section. ● For information on national security, see the SAFETY & SECURITY section. ● For the effects of nuclear warfare on our planet, see the MASS DESTRUCTION section. ● For buildings and shelters that can withstand modern missiles and nuclear weapons, see the SHELTER section. ● For personal defence against modern weapons, see the DEFENCE section. ● For the lootability of military bases and military vehicles, see the LOCATIONS section. ● If you wish to communicate stealthily and securely, see the COMMUNICATION > Codes section. ● For the terms used in this section, see the ADDENDUM > Dictionary section.

Contents

1 Personal Security

Safeguarding an individual's well-being, safety, and privacy. Essentially, the art of being your own bodyguard with the mindset of Jason Bourne.

Awareness

Awareness is primarily about being highly attuned to your surroundings, your own state, and how these factors interact to influence your vulnerability to threats. It's the cognitive foundation upon which all other personal security measures are built.

Situational Awareness

Situational awareness (SA) is a critical cognitive skill, particularly in dynamic and high-stakes environments. It's not just about "being aware" but involves a structured process of perceiving, understanding, and projecting. The most widely accepted model of situational awareness, proposed by Dr. Mica Endsley, breaks it down into three hierarchical levels:

Perception of Elements in the Environment

This is the foundational level, involving actively gathering information about the relevant elements in your surroundings. It's about being vigilant and observing cues through your senses. Key aspects include:

Observation: Consciously scanning your environment, noticing people, objects, events, and their current states (locations, conditions, actions). This includes both expected and unexpected elements.
Data Gathering: Collecting sensory input (sight, sound, smell, touch) and also internal information (e.g., equipment readings, system status).
Cue Detection: Identifying critical pieces of information that might signal a change or a potential issue.
Monitoring: Continuously tracking the status and dynamics of these elements over time.

Comprehension of the Current Situation

This level goes beyond simply perceiving individual elements. It's about understanding what those perceived elements mean when integrated together, in relation to your goals and objectives. It involves:

Integration: Connecting disparate pieces of information to form a coherent mental picture of the situation.
Interpretation: Assigning meaning to the perceived information, drawing on your knowledge, experience, and mental models. This helps answer the "so what?" question.
Pattern Recognition: Identifying familiar patterns or anomalies that indicate a particular state or development.
Assessment: Evaluating the significance of the situation in terms of its impact on your goals or potential threats.

Projection of Future Status

This is the highest level of situational awareness and is crucial for effective decision-making and proactive action. It involves anticipating how the current situation will evolve in the near future. Key elements include:

Prediction: Forecasting future events or states based on your comprehension of the current situation and your knowledge of how things typically progress.
Anticipation: Thinking ahead about potential developments, opportunities, or threats.
Mental Simulation: Running "what-if" scenarios in your mind to evaluate possible outcomes.
Goal-Directed Action Planning: Using your projections to determine the most favorable course of action to achieve your objectives or mitigate risks.

Cooper Readiness Code

To help people prepare the mind for danger, Cooper taught what is now known as the Cooper Colour Code. The most important means of surviving a lethal confrontation, according to Cooper, is neither the weapon nor the martial skills. The primary tool is the ‘combat mindset’. As taught by Cooper, it relates to the degree of peril you are willing to do something about — which allows you to move from one level of mindset to another to enable you to properly handle a given situation. The Black code has been added by members of the community to split the decision to fight and the decision to end a threat's life since you want to try every alternative prior to having to shoot.

White Unaware and Unprepared	This is a condition you should try to avoid. You will probably lose a fight here. One of the only times in condition white is when you’re asleep. And even then you wouldn’t consider yourself unprepared; you’re just unaware. If attacked in Condition White, the only thing that may save you is the “inadequacy or ineptitude” of your attacker. When suddenly confronted while in this condition your immediate reaction will probably be “OMG! This can’t be happening to me…”
Yellow Relaxed Alert	Yellow means you are aware of what is happening around you, but you do not perceive a potential threat. Your mindset should be prepared to defend yourself if the need arises. Everywhere you go, you should be in Condition Yellow. You should keep a pretty good watch on the people around you, and continuously rate each person’s danger level in your mind. There is no specific threat situation. Your mindset is that “today could be the day I may have to defend myself”. You are simply aware that the world is a potentially unfriendly place and that you are prepared to defend yourself, if necessary. You use your eyes and ears. You don’t have to be armed in this state, but if you are armed you should be in Condition Yellow. You use your eyes and ears. You don’t have to be armed in this state, but if you are armed you should be in Condition Yellow. You should always be in Yellow whenever you are in unfamiliar surroundings or among people you don’t know. You can remain in Yellow for long periods, as long as you are able to “Watch your six.” (In aviation 12 o’clock refers to the direction in front of the aircraft’s nose. Six o’clock is the blind spot behind the pilot.) In Yellow, you are “taking in” surrounding information in a relaxed but alert manner, like a continuous 360 degree radar sweep. As Cooper put it, “I might have to shoot.”
Orange Specific Alert	It means that there is a potential threat that's gained your attention. This can be almost anything and usually results in nothing, at which time you go back to yellow. An example of Condition Orange could be when you spot a firearm under that bulky coat… Instantly, you determine what you’re going to do if he reaches for that gun. Something is not quite right and has your attention. Your radar has picked up a specific alert. You shift your primary focus to determine if there is a threat (but you do not drop your six). Your mindset shifts to “I may have to shoot that person today”, focusing on the specific target which has caused the escalation in alert status. In Condition Orange, you set a mental trigger: “If that person does “X”, I will need to stop them”. Your pistol usually remains holstered in this state. Staying in Orange can be a bit of a mental strain, but you can stay in it for as long as you need to. If the threat proves to be nothing, you shift back to Condition Yellow.

Red Primed	It means that you are in a lethal mode of mindset and will fight if the circumstances are warranted. In the make-believe scenario, Bulky Coat draws a gun from under his coat and begins yelling at the people around them. At this point, you implement your action plan that was determined during Condition Orange. This doesn't always mean fight. If there are too many innocents around or you don't have the means, your best plan might be to wait and see what happens or even retreat and call the police. Your mental trigger (established back in Condition Orange) has been tripped. "If 'X' happens I will move to Black and shoot that person". In short, the Colour Code helps you "think" in a fight. As the level of danger increases, your willingness to take certain actions increases. If you ever do go to Condition Red, the decision to use lethal force has already been made (your "mental trigger" has been tripped).
Black Fight	This state means that you've made the decision to fight and have committed to eliminate the theat. You have determined that the only way out of this conflict is to subdue the attacker physically. In the scenario, Bulky Coat guy begins firing at people. Your mindset shifts to "I am going to shoot that person in order to save myself and those around me", focusing on the specific target which has caused the escalation in alert status. Remember that shooting does not mean killing. You can shoot to disarm someone, or otherwise render them incapacitated.

Self-Awareness

While often overlooked in security discussions, understanding yourself is crucial. This includes:

Your Habits and Routines: Recognizing if you have predictable patterns that could make you a target (e.g., always leaving home at the same time, taking the same route, posting your location on social media).
Your Physical State: Are you tired, distracted, under the influence of alcohol, or otherwise impaired? These states reduce your ability to perceive and respond to threats.
Your Emotional State: Are you stressed, preoccupied, or overly confident? Emotions can impact your judgment and alertness.
Your Appearance and Demeanour: How do you present yourself? Do you appear confident and aware, or distracted and vulnerable? Attackers often look for easy targets.
Your Instincts: Trusting your gut feeling. If a situation makes you feel uneasy, even if you can't logically explain why, it's a critical piece of personal awareness that should prompt you to take action.

Threat Awareness

This involves recognizing the types of dangers that exist (e.g., crime, natural disasters, cyberattacks, scams, accidents).

Assessing Your Vulnerabilities

Identifying your personal weak points or habits that could make you a target (e.g., predictable routines, displaying valuables, poor home security, sharing too much online).

Recognizing Suspicious Behavior

Learning to identify behaviors that might indicate a potential threat, such as loitering, unusual interest in your routine, or attempts to gain unauthorized access.

Deterrence

Making Yourself Less Appealing as a Target: This involves adopting behaviors and implementing measures that discourage potential attackers.
Physical Deterrents: Good lighting, visible security cameras, strong locks, alarm systems, well-maintained fencing, and a clear distinction between public and private space around your home.
Behavioral Deterrents: Walking confidently, making eye contact, avoiding distractions (like excessive phone use), and not displaying expensive items.
Establishing Boundaries: Clearly communicating "no" or "stop" to unwanted advances.

Prevention

Home Security

Physical Barriers: Deadbolts, window locks, reinforced doors, security screens.
Alarm Systems: Monitored alarms are generally more effective.
Lighting: Exterior and interior lighting (including timers).
Key Management: Keeping keys secure, not labeling them, changing locks if keys are lost.
Neighborhood Watch: Engaging with your community to collectively deter crime.

Personal Safety Out & About

Route Planning: Choosing well-lit, familiar routes.
Travel Companions: Traveling with friends or informing someone of your whereabouts.
Car Safety: Locking doors, parking in well-lit areas, having keys ready before approaching your vehicle, checking the backseat, knowing what to do if followed.
Public Transport: Being aware of your surroundings, avoiding isolated stops.
Valuables: Keeping them out of sight, carrying bags securely.

Digital Security

Strong Passwords & Two-Factor Authentication (2FA): Unique, complex passwords and using 2FA for all accounts.
Software Updates: Keeping operating systems, browsers, and apps updated to patch vulnerabilities.
Wi-Fi Security: Securing your home network, avoiding public Wi-Fi or using a VPN.
Phishing/Scam Awareness: Recognizing and avoiding suspicious links, emails, and texts.
Privacy Management: Being cautious about what personal information you share online.

Response & Self-Defense

Emergency Planning: Having a plan for various emergencies (e.g., fire, medical crisis, assault), including emergency contacts and evacuation routes.
Self-Defense Training: Learning basic self-defense techniques can increase confidence and provide options if a physical confrontation is unavoidable.
Personal Safety Devices: Carrying items like pepper spray (where legal), personal alarms, or whistles.
Reporting Incidents: Reporting all crimes or suspicious activities to the authorities helps build data and can prevent future incidents.
Trusting Instincts: If a situation feels wrong, remove yourself immediately.

Continuous Improvement

Regular Review: Periodically assessing your security measures and habits to ensure they are still effective.
Learning from Experience: Both your own and others' experiences can provide valuable lessons.
Staying Informed: Keeping up-to-date on new threats and security best practices.

2 Physical Security

Physical security normally refers to the security systems used on a property used as a dwelling (commonly including doors, locks, alarm systems, lighting, fencing); and personal security practices (such as ensuring doors are locked, alarms activated, windows closed etc.)

Perimeter Security

This is the first line of defense, establishing a boundary around the protected area.

Physical Barriers
Fences and Walls: Create a clear boundary and deter casual trespassers. Can be enhanced with barbed wire, razor wire, or electric fencing.
Gates and Turnstiles: Control entry and exit points for vehicles and pedestrians.
Bollards and Planters: Prevent unauthorized vehicle access to sensitive areas.
Reinforced Structures: Walls, doors, windows designed to resist forced entry.

Environmental Design
Lighting: Proper illumination deters intruders and enhances visibility for surveillance.
Landscaping: Clear sightlines, avoid dense bushes that can provide hiding spots, use thorny plants as barriers.
Signage: Clearly indicate boundaries, restricted areas, and security measures.

Access Control

These measures restrict who can enter a secured area and when.

Mechanical Locks and Keys: Traditional locks provide basic security but can be compromised by lost or duplicated keys.
Electronic Locks:
- Keypad Entry: Requires a PIN code.
- Card Readers (Keycards, Fobs): Require an authorized credential to open a locked door.
- Biometric Scanners: Use unique physical traits (fingerprints, iris scans, facial recognition) for authentication, offering high security.
- Mobile Access Control: Uses smartphones as credentials.

Security Personnel/Guards: Control entry points, verify identities, and provide a visible deterrent.
Visitor Management Systems: Track visitors, issue temporary credentials, and ensure they are escorted or limited to specific areas.

Surveillance and Monitoring

These systems observe and record activities to detect threats and provide evidence.

Closed-Circuit Television (CCTV) / IP Cameras: Strategically placed cameras provide real-time monitoring and recorded video feeds.
- Video Analytics: Advanced software that can detect unusual activity, motion, loitering, facial recognition, or unauthorized access attempts.

Monitoring Stations: Centralized locations where security personnel watch live feeds and respond to alerts.
Intrusion Detection Systems (IDS):
- Motion Sensors: Detect movement (PIR, microwave, ultrasonic).
- Glass Break Detectors: Sense the sound or vibration of breaking glass.
- Door/Window Sensors: Detect when a door or window is opened.
- Vibration Sensors: Detect attempts to breach walls or ceilings.
- Perimeter Sensors: Infrared beams, seismic sensors, buried cables to detect intrusions across a boundary.

Alarm Systems: Audible and/or visual alarms that trigger upon detection of a breach, alerting personnel or authorities.

Response Measures

These are the procedures and personnel in place to react to a security incident.

Security Personnel: Trained guards who can physically respond to incidents, apprehend intruders, or manage emergencies.
Law Enforcement/Emergency Services Integration: Direct lines of communication and established protocols for involving police, fire, or medical services.
Communication Systems: Radios, intercoms, and other systems to coordinate response efforts.
Emergency Procedures: Lockdowns, evacuation plans, and crisis management protocols.

Specialized Physical Security

Asset Protection: Safes, vaults, secure cabinets for high-value items, documents, or data.
Environmental Controls: Measures to protect against natural disasters (fire suppression systems, flood barriers, reinforced structures for earthquakes or storms) or utility disruptions (backup power, uninterruptible power supplies - UPS).
Cyber-Physical Security Integration: The growing convergence of IT security and physical security, where physical access systems, cameras, and alarms are connected to a network and managed through software, introducing cybersecurity considerations.

3 Cybersecurity

Electronic security, also known as cyber security or IT security, refers to the security of computing devices such as computers and smartphones, as well as computer networks such as private and public networks, and the Internet.

Encryption	
Offline Files	Any files offline are completely secure against being hacked, therefore all your preparedness plans should be in a device with no access to the internet. To be considered completely disconnected from the internet - any transmitting card and antennas should be removed, especially in mobiles.

4 National Security

National security refers to the security of a nation state, including its people, economy, and institutions.

5 Other Security Types

These are other smaller categories of security which don't require as much space or are referred to in other parts of this document.

Food Security

Food security refers to the ready supply of, and access to, safe and nutritious food.

Financial Security

Environmental Security

Environmental security, also known as environmental security, refers to the integrity of ecosystems and the biosphere, particularly in relation to their capacity to sustain a diversity of life-forms (including human life).

6 Surveillance

Surveillance is the monitoring of behaviour, activities, or other changing information for the purpose of influencing, managing, directing, or protecting people. To hide from surveillance methods first you need to understand how they work and the programming behind them.

Computer Surveillance

The vast majority of computer surveillance involves the monitoring of data and traffic on the Internet but can also include local monitoring such as recording keystrokes. In the United States for example, under the Communications Assistance For Law Enforcement Act, all phone calls and broadband Internet traffic (emails, web traffic, instant messaging, etc.) are required to be available for unimpeded real-time monitoring by federal law enforcement agencies. There is far too much data on the Internet for human investigators to manually search through all of it. Therefore, automated Internet surveillance computers sift through the vast amount of intercepted Internet traffic to identify and report to human investigators the traffic that is considered interesting or suspicious. This process is regulated by targeting certain "trigger" words or phrases, visiting certain types of web sites, or communicating via email or online chat with suspicious individuals or groups.

Telephone Surveillance

The official and unofficial tapping of telephone lines is widespread. In the United States for instance, the Communications Assistance For Law Enforcement Act (CALEA) requires that all telephone and VoIP communications be available for real-time wiretapping by Federal law enforcement and intelligence agencies. Two major telecommunications companies in the U.S.—AT&T Inc. and Verizon—have contracts with the FBI, requiring them to keep their phone call records easily searchable and accessible for Federal agencies, in return for $1.8 million per year. Between 2003 and 2005, the FBI sent out more than 140,000 "National Security Letters" ordering phone companies to hand over information about their customers' calling and Internet histories. About half of these letters requested information on U.S. citizens. Human agents are not required to monitor most calls. Speech-to-text software creates machine-readable text from intercepted audio, which is then processed by automated call-analysis programs, such as those developed by agencies such as the Information Awareness Office, or companies such as Verint, and Narus, which search for certain words or phrases, to decide whether to dedicate a human agent to the call.

Law enforcement and intelligence services in the United Kingdom and the United States possess technology to activate the microphones in cell phones remotely, by accessing phones' diagnostic or maintenance features in order to listen to conversations that take place near the person who holds the phone. The StingRay tracker is an example of one of these tools used to monitor cell phone usage in the United States and the United Kingdom. Originally developed for counterterrorism purposes by the military, they work by broadcasting powerful signals that cause nearby cell phones to transmit their IMSI number, just as they would to normal cell phone towers. Once the phone is connected to the device, there is no way for the user to know that they are being tracked. The operator of the stingray is able to extract information such as location, phone calls, and text messages, but it is widely believed that the capabilities of the StingRay extend much further. Mobile phones are also commonly used to collect location data. The geographical location of a mobile phone (and thus the person carrying it) can be determined easily even when the phone is not being used, using a technique known as multilateration to calculate the differences in time for a signal to travel from the cell phone to each of several cell towers near the owner of the phone. The legality of such techniques has been questioned in the United States, in particular whether a court warrant is required. Records for one carrier alone (Sprint), showed that in a given year federal law enforcement agencies requested customer location data 8 million times.

Camera Surveillance

Surveillance cameras are video cameras used for the purpose of observing an area. They are often connected to a recording device or IP network, and may be watched by a security guard or law enforcement officer. Cameras and recording equipment used to be relatively expensive and required human personnel to monitor camera footage, but analysis of footage has been made easier by automated software that organizes digital video footage into a searchable database, and by video analysis software (such as VIRAT and HumanID). The amount of footage is also drastically reduced by motion sensors which only record when motion is detected.

With cheaper production techniques, surveillance cameras are simple and inexpensive enough to be used in home security systems, and for everyday surveillance. There are about 350 million surveillance cameras worldwide as of 2016. About 65% of these cameras are installed in Asia. The growth of CCTV has been slowing in recent years. In 2018, China was reported to have a huge surveillance network of over 170 million CCTV cameras with 400 million new cameras expected to be installed in the next three years, many of which use facial recognition technology.

Box Camera	A Box Style camera is a standalone camera. The name is derived from the shape of the camera.	**Features** ● Functions like any other camera ● Can be used in Outdoor Environmental Housings or for Indoor mountings if aesthetics are not a concern	**Benefits** ● Allows for customization of the lens, camera and housing to fit the needs of the installation ● Offers many lens options, including vari-focal and fixed
Dome Camera	A dome camera is a combination of camera, lens, and ceiling mount packaged in a discreet dome shape.	**Features** ● Functions like any other camera but comes in a dome-shaped housing ● Is well-suited for environments that tend to get dirty, like kitchens and warehouses ● Typically available in indoor or outdoor housings	**Benefits** ● Aesthetically pleasing / compact in appearance ● Available in vandal-resistant housings
PTZ Security Camera	A PTZ camera contains mechanical controls that allow the operator to remotely pan, tilt, and zoom the camera.	**Features** ● Pan, Tilt and Zoom features ● Control movement via joystick or software ● Can automatically run patterns or turn to a preset position	**Benefits** ● Focuses on areas of interest ● Auto Track movement ● Survey a wide area of interest and zoom in to detail
Bullet Security Camera	A bullet camera is a combination of camera, lens, and housing packaged in a bullet-style body.	**Features** ● Commonly includes IR illuminators ● Sealed enclosure decreases need for servicing ● Small footprint	**Benefits** ● Requires no separate housing or lens ● Good for low-light situations
IP Security Camera	An IP camera transmits a digital signal using Internet Protocol over a network.	**Features** ● Increased resolution and scalability ● Many have built-in video analytic software	**Benefits** ● Better system management than analog cameras ● Resolutions from VGA to 29 Megapixel
Day/Night Security Camera	A day/night camera is a camera used indoor and outdoor for environments with low light conditions.	**Features** ● IR filter that is lifted as lighting levels decrease	**Benefits** ● Handles both day and night-time lighting situations

SECURITY Surveillance Camera Surveillance

Thermal Security Camera	A thermal camera uses thermal imaging to produce surveillance footage in dark or harsh environments. It uses heat to differentiate objects.	**Features** ● Uses heat sensing to distinguish objects and people	**Benefits** ● Detect people and objects in smoke, haze, dust, light fog ● Works in complete darkness
Wide Dynamic Security Camera	Wide Dynamic Cameras have the ability to balance light-levels on a pixel-by-pixel basis.	**Features** ● Capable of handling a wide range of lighting levels in the same scene	**Benefits** ● Capture clear face shots when a people are entering with bright light behind them and with dark shadows on their faces ● Used in areas with too much sunshine or where headlights are used, such as parking lots
Wireless IP Camera	Wireless IP security cameras offers ease of installation and eliminates the cost of network cabling when adding this camera to your video surveillance system.	**Features** ● Wi-Fi enabled for easy installation and setup ● Tilting and swivel options to maximize viewing	**Benefits** ● Motion detection for instant alerts of intruders ● Crystal clear images, even in low light conditions

Social Network Analysis

One common form of surveillance is to create maps of social networks based on data from social networking sites such as Facebook, MySpace, Twitter as well as from traffic analysis information from phone call records such as those in the NSA call database, and others. These social network "maps" are then data mined to extract useful information such as personal interests, friendships & affiliations, wants, beliefs, thoughts, and activities. Many U.S. government agencies such as the Defence Advanced Research Projects Agency (DARPA), the National Security Agency (NSA), and the Department of Homeland Security (DHS) are investing heavily in research involving social network analysis. The intelligence community believes that the biggest threat to U.S. power comes from decentralized, leaderless, geographically dispersed groups of terrorists, subversives, extremists, and dissidents. These types of threats are most easily countered by finding important nodes in the network, and removing them. To do this requires a detailed map of the network. AT&T developed a programming language called "Hancock", which is able to sift through enormous databases of phone call and Internet traffic records, such as the NSA call database, and extract "communities of interest"—groups of people who call each other regularly, or groups that regularly visit certain sites on the Internet. AT&T originally built the system to develop "marketing leads", but the FBI has regularly requested such information from phone companies such as AT&T without a warrant, and, after using the data, stores all information received in its own databases, regardless of whether or not the information was ever useful in an investigation.

Biometric

Biometric surveillance is a technology that measures and analyses human physical and/or behavioural characteristics for authentication, identification, or screening purposes. Examples of physical characteristics include fingerprints, DNA, and facial patterns. Examples of mostly behavioural characteristics include gait (a person's manner of walking) or voice. Facial recognition is the use of the unique configuration of a person's facial features to accurately identify them, usually from surveillance video. Both the Department of Homeland Security and DARPA are heavily funding research into facial recognition systems. The Information Processing Technology Office ran a program known as Human Identification at a Distance which developed technologies that are capable of identifying a person at up to 500 ft (150 m) by their facial features.

Another form of behavioural biometrics, based on affective computing, involves computers recognizing a person's emotional state based on an analysis of their facial expressions, how fast they are talking, the tone and pitch of their voice, their posture, and other behavioural traits. This might be used for instance to see if a person's behaviour is suspect (looking around furtively, "tense" or "angry" facial expressions, waving arms, etc.). A more recent development is DNA profiling, which looks at some of the major markers in the body's DNA to produce a match. The FBI is spending $1 billion to build a new biometric database, which will store DNA, facial recognition data, iris/retina (eye) data, fingerprints, palm prints, and other biometric data of people living in the United States. The computers running the database are contained in an underground facility about the size of two American football fields. The Los Angeles Police Department is installing automated facial recognition and license plate recognition devices in its squad cars, and providing handheld face scanners, which officers will use to identify people while on patrol.

Aerial Surveillance

Aerial surveillance is the gathering of surveillance, usually visual imagery or video, from an airborne vehicle—such as an unmanned aerial vehicle, helicopter, or spy plane. Military surveillance aircraft use a range of sensors (e.g. radar) to monitor the battlefield. Digital imaging technology, miniaturized computers, and numerous other technological advances over the past decade have contributed to rapid advances in aerial surveillance hardware such as micro-aerial vehicles, forward-looking infrared, and high-resolution imagery capable of identifying objects at extremely long distances. For instance, the MQ-9 Reaper, a U.S. drone plane used for domestic operations by the Department of Homeland Security, carries cameras that are capable of identifying an object the size of a milk carton from altitudes of 60,000 feet, and has forward-looking infrared devices that can detect the heat from a human body at distances of up to 60 kilometres.

The United States Department of Homeland Security is in the process of testing UAVs to patrol the skies over the United States for the purposes of critical infrastructure protection, border patrol, "transit monitoring", and general surveillance of the U.S. population. Miami-Dade police department ran tests with a vertical take-off and landing UAV from Honeywell, which is planned to be used in SWAT operations. Houston's police department has been testing fixed-wing UAVs for use in "traffic control".

The United Kingdom, as well, is working on plans to build up a fleet of surveillance UAVs ranging from micro-aerial vehicles to full-size drones, to be used by police forces throughout the U.K. In addition to their surveillance capabilities, MAVs are capable of carrying tasers for "crowd control", or weapons for killing enemy combatants.

Data Mining / Profiling

Data mining is the application of statistical techniques and programmatic algorithms to discover previously unnoticed relationships within the data. Data profiling in this context is the process of assembling information about a particular individual or group in order to generate a profile — that is, a picture of their patterns and behaviour. Data profiling can be an extremely powerful tool for psychological and social network analysis. A skilled analyst can discover facts about a person that they might not even be consciously aware of themselves. Economic (such as credit card purchases) and social (such as telephone calls and emails) transactions in modern society create large amounts of stored data and records. In the past, this data was documented in paper records, leaving a "paper trail", or was simply not documented at all.

Correlation of paper-based records was a laborious process—it required human intelligence operators to manually dig through documents, which was time-consuming and incomplete, at best. But today many of these records are electronic, resulting in an "electronic trail". Every use of a bank machine, payment by credit card, use of a phone card, call from home, checked out library book, rented video, or otherwise complete recorded transaction generates an electronic record. Public records—such as birth, court, tax and other records—are increasingly being digitized and made available online. In addition, due to laws like CALEA, web traffic and online purchases are also available for profiling.

Electronic record-keeping makes data easily collectable, storable, and accessible—so that high-volume, efficient aggregation and analysis is possible at significantly lower costs. Information relating to many of these individual transactions is often easily available because it is generally not guarded in isolation, since the information, such as the title of a movie a person has rented, might not seem sensitive. However, when many such transactions are aggregated they can be used to assemble a detailed profile revealing the actions, habits, beliefs, locations frequented, social connections, and preferences of the individual. This profile is then used, by programs such as ADVISE and TALON, to determine whether the person is a military, criminal, or political threat. In addition to its own aggregation and profiling tools, the government is able to access information from third parties — for example, banks, credit companies or employers, etc. — by requesting access informally, by compelling access through the use of subpoenas or other procedures, or by purchasing data from commercial data aggregators or data brokers. The United States has spent $370 million on its 43 planned fusion centres, which are national network of surveillance centres that are located in over 30 states. The centres will collect and analyse vast amounts of data on U.S. citizens. It will get this data by consolidating personal information from sources such as state driver's licensing agencies, hospital records, criminal records, school records, credit bureaus, banks, etc. – and placing this information in a centralized database that can be accessed from all of the centres, as well as other federal law enforcement and intelligence agencies.

Human Operatives

Organizations that have enemies who wish to gather information about the groups' members or activities face the issue of infiltration. In addition to operatives' infiltrating an organization, the surveilling party may exert pressure on certain members of the target organization to act as informants (i.e., to disclose the information they hold on the organization and its members). Fielding operatives is very expensive, and for governments with wide-reaching electronic surveillance tools at their disposal the information recovered from operatives can often be obtained from less problematic forms of surveillance such as those mentioned above. Nevertheless, human infiltrators are still common today. For instance, in 2007 documents surfaced showing that the FBI was planning to field a total of 15,000 undercover agents and informants in response to an anti-terrorism directive sent out by George W. Bush in 2004 that ordered intelligence and law enforcement agencies to increase their HUMINT capabilities.

Identification

One of the simplest forms of identification is the carrying of credentials. Some nations have an identity card system to aid identification, whilst others are considering it but face public opposition. Other documents, such as passports, driver's licenses, library cards, banking or credit cards are also used to verify identity. If the form of the identity card is "machine-readable", usually using an encoded magnetic stripe or identification number (such as a Social Security number), it corroborates the subject's identifying data. In this case it may create an electronic trail when it is checked and scanned, which can be used in profiling, as mentioned above.

RFID & Geolocation

Radio Frequency Identification (RFID) tagging is the use of very small electronic devices (called "RFID tags") which are applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. The tags can be read from several meters away. They are extremely inexpensive, costing a few cents per piece, so they can be inserted into many types of everyday products without significantly increasing the price, and can be used to track and identify these objects for a variety of purposes. Some companies appear to be "tagging" their workers by incorporating RFID tags in employee ID badges. Workers in U.K. considered strike action in protest of having themselves tagged; they felt that it was dehumanizing to have all of their movements tracked with RFID chips.

GPS Tracking	In the U.S., police have planted hidden GPS tracking devices in people's vehicles to monitor their movements, without a warrant. In early 2009, they were arguing in court that they have the right to do this. Several cities are running pilot projects to require parolees to wear GPS devices to track their movements when they get out of prison.
Mobile Phones	Mobile phones are also commonly used to collect geolocation data. The geographical location of a mobile phone (and thus the person carrying it) can be determined easily (whether it is being used or not), using a technique known multilateration to calculate the differences in time for a signal to travel from the cell phone to each of several cell towers near the owner of the phone. Dr. Victor Kappeler of Eastern Kentucky University indicates that police surveillance is a strong concern, stating the following statistics from 2013: Of the 321,545 law enforcement requests made to Verizon, 54,200 of these requests were for "content" or "location" information—not just cell phone numbers or IP addresses. Content information included the actual text of messages, emails and the wiretapping of voice or messaging content in real-time. A comparatively new off-the-shelf surveillance device is an IMSI-catcher, a telephone eavesdropping device used to intercept mobile phone traffic and track the movement of mobile phone users. Essentially a "fake" mobile tower acting between the target mobile phone and the service provider's real towers, it is considered a man-in-the-middle (MITM) attack. IMSI-catchers are used in some countries by law enforcement and intelligence agencies, but their use has raised significant civil liberty and privacy concerns and is strictly regulated in some countries.

Microchips

A human microchip implant is an identifying integrated circuit device or RFID transponder encased in silicate glass and implanted in the body of a human being. A subdermal implant typically contains a unique ID number that can be linked to information contained in an external database, such as personal identification, medical history, medications, allergies, and contact information. Several types of microchips have been developed in order to control and monitor certain types of people, such as criminals, political figures and spies, a "killer" tracking chip patent was filed at the German Patent and Trademark Office (DPMA) around May 2009. Verichip is an RFID device produced by a company called Applied Digital Solutions (ADS).

Verichip is slightly larger than a grain of rice, and is injected under the skin. The injection reportedly feels similar to receiving a shot. The chip is encased in glass, and stores a "VeriChip Subscriber Number" which the scanner uses to access their personal information, via the Internet, from Verichip Inc.'s database, the "Global VeriChip Subscriber Registry". Thousands of people have already had them inserted. In Mexico, for example, 160 workers at the Attorney General's office were required to have the chip injected for identity verification and access control purposes.

Devices (Bugs)

Covert listening devices and video devices, or "bugs", are hidden electronic devices which are used to capture, record, and/or transmit data to a receiving party such as a law enforcement agency. The U.S. has run numerous domestic intelligence operations, such as COINTELPRO, which have bugged the homes, offices, and vehicles of thousands of U.S. citizens, usually political activists, subversives, and criminals. Law enforcement and intelligence services in the U.K. and the United States possess technology to remotely activate the microphones in cell phones, by accessing the phone's diagnostic/maintenance features, in order to listen to conversations that take place nearby the person who holds the phone.

Stakeout

A stakeout is the coordinated surveillance of a location or person. Stakeouts are generally performed covertly and for the purpose of gathering evidence related to criminal activity. The term derives from the practice by land surveyors of using survey stakes to measure out an area before the main building project is commenced.

Counter Surveillance

How to stay under the radar and avoid being detected.

7 Counter Surveillance

How to hide from modern technology such as thermal imaging, mobile tracking and night vision technology.

Thermal Concealment

How to conceal yourself from thermal imaging devices.

Thermal Concealment	A warm body can be detected by thermal imaging equipment from its IR (Infrared) heat signature. It's a difficult challenge to avoid detection, be it animal or human. Warm blooded. You may be camouflaged in the best concealment there is, but highly visible to IR thermal imaging on the ground or maybe a drone flying overhead. The same thing applies for any warm or hot equipment that you may wish to conceal.
What is Infrared	It's light that's not visible to the human eye. It's electromagnetic radiation with longer wavelengths than visible light. Infrared extends from the red edge of the visible spectrum at 700 nanometres (frequency 430 THz), to 1 millimetre (300 GHz). Most of the thermal radiation emitted by objects near room temperature is infrared. Humans actually emit (instead of just reflecting) at IR wavelengths. Our normal body temperature radiates chiefly within the thermal infrared region of (8 – 15 μm) or (0.008 – 0.015 millimetres) – a frequency range of 20–37 THz. That's right in the infrared spectrum and is detectable by sophisticated modern instrumentation. Thermal imaging devices can 'see' you. They create images based on differences in surface temperature by detecting infrared radiation (heat) that emanates from objects (e.g. your body or that of an animal) and their surrounding environment.

Concealment

Space Blanket	A simple method to block IR (with caveats) is an ordinary 'space blanket', 'emergency blanket' or 'thermal blanket'. They are made of mylar foil and will block any Infrared (IR) heat signature behind it. However, if you wrap yourself in it, there's a problem. Heat will build up and will eventually heat the mylar itself up to make you visible again. This heat will then be visible to IR thermal imaging devices. Concealment for the most part will be temporary without more elaborate techniques to disperse the heat. So instead of wrapping yourself, spread the blanket out a metre (3ft) or so above you and tie it up. The breeze between you and the UAVs or cameras will then keep the blanket cool and shield you from the thermal cameras.
Glass	One of the most effective methods to block IR is to conceal behind glass. Glass is entirely opaque to thermal imaging. It's not a practical solution though, due to the obvious impracticality of movement or 'on-the-go'. But it's good to know.
Netting Materials	Thick Netting will help. Especially visible detection. The holes throughout the netting / webbing will help disperse heat signature – though not completely. A significant deterrent though from thermal IR heat detection. It will help to disperse the heat or hot spots that may be underneath as the airflow will be somewhat broken up by the webbing. The heat signature will not be as intense, but spread out more. An example may be to cover a vehicle that has been running with netting. Best to leave some air gap between the material and hot surface (prop it up).
Heavy Blanket	For a quick temporary method of IR concealment, throw a blanket over yourself. A thick woollen blanket will help defeat thermal imaging. It works surprisingly well. Covering with a layer of insulation, the heat is blocked (or partially blocked) so that it doesn't radiate. This is only temporary concealment as the heat builds beneath the blanket. It may work long enough to conceal during a quick TI scan or Drone flyover.
Other Heat Sources	Concealment by blending in next to other warm objects, like warm stones or thick walls that may still be holding the heat from the day. The vents in buildings may be out-flowing warm air; a source of heat that can help obscure your own thermal outline. You get the idea… wherever there is existing natural or man-made heat, you can blend in with that to help conceal your presence to an IR or thermal imager.
Ghillie Suit	A Ghillie suit will certainly help disperse your heat signature. It won't block it, but it will help diffuse a heat signature.
Insulated Jacket	Insulated pants and a hat. It won't be 100% but it will help lessen the heat signature. Again, the heat will build and escape through the neck openings and face. You could cover your face with cool mud, which will work temporarily. It's all pretty much common sense; reduce, disperse, or cover the sources of heat.
Objects Between the Sensor	Put trees and/or brush between you and the suspected IR imager. Trees overhead will help break up the infrared signature, especially under a heavy canopy of leaves.
Stationary	A moving heat signature at night is quicker to identify than a stationary one (up to a point). Avoid detection by moving slowly.
Tips	When you are hiding your heat signature (with a Mylar emergency blanket or other means), under some conditions your signature may look 'too cold' to an IR scan of the area (an extra dark outline, or a 'black hole'), which may make you detectable. The problem with most IR cloaking methods, IR clothing or netting designed to block IR, is that it will also block the background IR – creating a black hole of varying degrees. Ideally you would want something that 'cloaks' or blends your IR signature such that the background scatter at your location is what the observer sees. Avoid open spaces and skylines by day or night. Thermal Imaging does not perform well in falling rain.

Hiding from Thermal/Infrared

- Use ground, hills and heavy undergrowth to stop your infrared radiation. Block your body heat. Keep it as close to the background temperature as possible.

SECURITY Technology Stealth Thermal Concealment Hiding from Thermal/Infrared

- Thermal images are composed of heat emissions and the coefficient of emissivity for objects. To hide from thermal you need to reduce your heat output and camouflage the emissivity output.
- Staying near water in warm weather, as the evaporating moisture will hold heat and distort the image.
- Hide in an area with a multi-temperature background.
- In an emergency, setting things on fire will help camouflage you.
- White phosphorous or rubber-impregnated smoke shells to block thermal pictures, because they fill the air with burning particles and create a wall of heat that's opaque to the imager.
- Thermal Crossover: Just after Sunrise and Sunset thermal imagers don't work as effectively and reduce the contrast of the viewer. On a bright sunny day it can be a few seconds but if the weather's overcast it can last several minutes. High humidity will extend the length of crossover, and so will wind.
- Use decoys such as heat packs to confuse the observer.
- During day, white clothes can reflect more heat, keeping you closer to ambient temperature.
- Insulating your heat from the imager, such as a wool blanket. The more effective the insulation, the more time you have bought yourself.
- Spreading your heat over a larger surface area. Your body has a finite surface area, if you can transfer your body heat to a larger object, that object will be cooler. Think of a heat sink.
- You can vent heat to the atmosphere. The thermal imager cannot see the heat travelling through the air, at least not at the temperatures we are talking about. It would have to be directly to the atmosphere because if the heat were to heat up your cover, that would be noticeable.
- You can mechanically trap heat.
- Use infrared LEDs in high numbers to blind the camera or distract them from you.
- Mylar foil appears opaque on infrared imaging - so use for windows to prevent seeing in.
- Companies have begun producing anti-IR garments; metalized fabrics similar to space blankets woven into overcoats, ponchos, hoodie -- even panties.
- Dazzle Camouflage: Designed to break up an object's silhouette against the background.
- Detergents that contain brighteners cause them to light up like a white light under infrared.

Thermal	The most obvious issue in evading thermal imaging is dealing with the heat that a human produces. It is impossible to stop the body from producing heat and it is also impossible to inexpensively contain all of the heat the body produces. Expensive thermal cameras, such as the ones in drones and helicopters, sense the actual photons emitted from an object. Less expensive handhelds use a material that measures the differences in temperature. Either one first needs the heat from your body to reach the sensor. If your heat cannot reach the sensor, you cannot be seen. A physical object between you in the camera, such as the roof of your house, a boulder, or a tree will stop the infrared energy from reaching the sensor.
Emissivity	After the sun sets different objects cool at different rates. If you were successful enough to create a cloak that can achieve near ambient air temperature you may now appear colder than your surroundings. Your best bet is to know what objects offer the closest temperature/emissivity match, tall grasses may cool faster than rocks, pine needles and leaves may be good options.
Shape	Paints and dyes are really effective in visible light, but are almost useless in thermal. Ideally, the layer facing the imager would be constructed of different materials with mis-matched emissivities, sort of like covering yourself with leaves, branches, grasses, etc. This is probably not commercially viable, but if you were to do so by hand it would probably benefit the overall effectiveness of your camouflage. If you've masked your thermal signature but can't quite match the emissivity your best bet is to look like something nearby, a rock, bush, a patch of bare dirt. Unless you can create something with very complex emissivity patterns you have to do the next best thing, not look human.
Stealth	Thermal imagers have a finite resolution. It is pretty easy to understand, standard definition TV (the old stuff) had a digital resolution of 720×480 pixels. High Definition TV has a resolution of 1280×720 (720P) or 1920×1080 (1080P or Blu-Ray). Most of you know from experience that your eyes couldn't resolve a persons face in a crowd at a sporting event on old TV, but you can now. Again, the same is true with thermal. High end military imagers are about the equivalent of 720P television.
Distance	Military imagers can detect a person at a distance of many miles, but to achieve this distance the lensing only affords a very narrow field of view, like looking through a straw. In airborne systems, the thermal imagers will generally have two selectable options, a wide field of view for surveillance, and a narrow field of view for target acquisition. Unless they've already seen you, they will be searching using the wider field of view. If you've reduced your signature by 90%, the imager needs to be 90% closer to detect you.

Night Vision Concealment

SECURITY Technology Stealth Night Vision Concealment

Image Intensification	Image intensification technology maximizes the amount of light received from different natural sources (like starlight or moonlight). This technology doesn't work in complete darkness because there is no light to absorb and magnify. Night vision devices with image intensification technology are best recognized by the green image they create. **Hiding:** To hide from this type of technology scientist have developed various models of military camouflage that's covered with carefully crafted patterns which reflect infrared lights and blend the person wearing it with the environment. Researchers at UC Irvine have created a new camouflage coating inspired by the pencil squid that is invisible to infrared cameras. A film that can easily be applied to all sorts of materials and surfaces which need to be hidden.
Active Illumination	Combines image intensification technology with an active illumination source of the near or shortwave infrared band. These types of cameras provide high-quality imaging at night or low-light conditions. They are widely used in commercial, residential and government security. **Hiding:** Hiding from this types of camera is difficult, but a German company Blucher Systems GmbH developed thermal/IR (Infrared) camouflage fabric technology that makes the person wearing it nearly invisible to infrared cameras. Fabric for this camouflage uses metalized fibres to achieve infrared and thermal signature reduction.

Mobile Concealment

SECURITY Technology Stealth Mobile

Mobile companies can track your phone usage and triangulate your position, sometimes even when your phone is turned off. This section will assist in how you can protect yourself from being tracked via your phone.

Air Concealment

Technology Stealth Air

Concealment from any type of scouting aircraft such as drones, UAVs and scout helicopters.

8 Infiltration

This section is for accessing areas which are normally inaccessible such as locked houses and cars.

Subheadings

1 Combination Locks & PIN Numbers

This section helps give you the best chance to open a combination lock (or guess a PIN) in the fewest number of tries using math and bias. Combination locks are those that have any number of rotatable digit/letter rows which opens when the code is correct and you pull on the lock. You may need to use a bike which has been abandoned but is chained to a pole, there might be a combination lock preventing you from entering a section of a building you're hunkering down in which may have supplies or you might want to access a bank account you forgot the PIN to.

The Odds
1 Tumbler Lock - (10 Digits) - (10 Combinations)
2 Tumbler Locks - (10 Digits) - (100 Combinations)
3 Tumbler Locks - (10 Digits) - (1,000 Combinations)
4 Tumbler Locks - (10 Digits) - (10,000 Combinations)
5 Tumbler Locks - (10 Digits) - (100,000 Combinations)
6 Tumbler Locks - (10 Digits) - (1,000,000 Combinations)
7 Tumbler Locks - (10 Digits) - (10,000,000 Combinations)
8 Tumbler Locks - (10 Digits) - (100,000,000 Combinations)

This is how long it would take to brute force the each lock with 2 seconds for each attempt:
1 Tumbler - (10 Digits) = 20s (0.2m) **(No lock would only have 1 tumbler)**
2 Tumblers - (10 Digits) = 200s (3.3m) **(No lock would only have 2 tumblers)**
3 Tumblers - (10 Digits) = 2,000s (33.3m) **(Very easy to crack even if you have to brute-force it)**
4 Tumblers - (10 Digits) = 20,000s (333.3m / 5.5h) **(Anything bigger than this is not worth trying to crack after the most common numbers)**
5 Tumblers - (10 Digits) = 200,000s (3,333.3m / 55.5h / 2.2d) **(Only try the most common 50 numbers from here on)**
6 Tumblers - (10 Digits) = 2,000,000s (33,333m / 555.5h / 23.1d)
7 Tumblers - (10 Digits) = 20,000,000s (333,333m / 5,555.5h / 231d) **(It would be easier to find lock cutters than crack this)**
8 Tumblers - (10 Digits) = 200,000,000s (3,333,333m / 55,555.5h / 2,314d / 6.5y) **(It would be easier to forge your own lock cutters than crack this)**

Cracking the Code

To greatly reduce the time it would take to brute force the lock there are a number of sequences that people commonly use which will give you a much higher chance to break the code quicker. The below shows you how.

1	Start by attempting the most common numbers: 0000, 1111, 2222, 3333, 4444, 5555, 6666, 7777, 8888, 9999 1234, 1212, 1004, 2000, 6969, 1122, 1313, 4321, 2001, 1010, 0007, 0070, 2580, 2468, 1357, (The current year)
2	Try years from 1960-1999 and then years 2000 to about 10 years in the future from the current year: 1960, 1961, 1962… 1998, 1999… 2000, 2001, 2002… 2020, 2021, 2022, 2023, 2024, 2025… 2033, 2034, 2035.
3	Start on dates or birthdays which people commonly use for combinations. Use the date format most used in your country - so MMDD for the U.S. and DDMM for Australia etc. An example is 0301 (Jan 3rd in Australia) or 0103 (Jan 3rd in the U.S.). (MMDD) 0101, 0102, 0103… 0131, 0201…
4	Then a few of the least likely numbers because people who have read articles online are likely to use them: 8068, 8093, 9629, 6835, 7637, 0738, 8398, 6793, 9480, 8957, 0859, 7394, 6827, 6093, 7063, 8196, 9539, 0439, 8438, 9047, 8557 **(If you're creating your own pin or combination code you should try something similar to those on this list, but not one of them)**
5	If you still haven't cracked the code yet you should start from 0000 and head up to 9999 while skipping the patterns you've already tried.

Tips

- People generally prefer even numbers over odd.
- People often choose important years as codes such as the 19xx range and 20xx range.
- People may often choose the current year, the past few years or upcoming years.
- Dates in the DDMM or MMDD formats are very popular. (01-31 / 31-01)
- Numbers close to each other (67, 32, 98) occur much more frequently than numbers widely spaced (29, 17, 18)
- 1 is by far the most likely first digit in the code, followed by 0 then 2 through 9 in that order.
- Numerical runs are very high choices for codes, such as: 1234, 7890, 5678.
- Repeated pair couplets (XYXY) make up 17.8% of all pins. (3434)

Notes

- Make sure you pull the lock strongly each time you try a code or you may accidentally skip the correct combination.

2 Breaking Glass

You may be in an emergency situation where you have to break glass quickly to escape such as in a sinking car. This section shows the best ways to break different types of glass.

Before you can talk about how to break a window, you need to know what kind of glass you are dealing with. This will help you to safely plan your emergency entry. There are three main types of glass you will encounter: tempered glass, non-tempered glass, and laminated glass. This list is not exhaustive as there are many variations on each type.

Tempered Glass	Tempered glass is heat-treated and is much stronger than non-tempered glass. Tempered glass is used where there is a likelihood of human contact and as such is made to shatter into small ¼" pieces when broken. The small pieces are not very sharp and safer to deal with than non-tempered glass.
Non-Tempered Glass	When broken, non-tempered glass makes large, irregular, jagged pieces that are razor sharp. It is much more dangerous than tempered glass.
Laminated Glass	Laminated glass has plastic layers sandwiched between glass layers. Because of the plastic sheeting, it tends not to break, but be punctured under force. High impact is needed to defeat laminated glass, and fragmentation and spalling can occur which send small flakes and powdered glass inward.

Tools

These are the recommended items for breaking glass.

Purpose-Built Window Punch	Best used for cars windows but they will smash any type of glass quickly and efficiently.
Baton	A baton can be used to break windows and remove the resulting glass shards from the frame.
Spark Plug (Or Broken Ceramic)	Get a spark plug and break the porcelain casing around the spark plug with a hammer. Then take a sharp piece of the ceramic and throw it at the window you want broken. When throwing the ceramic piece aim for the edges as this is where the glass is weakest. This works best against tempered glass.

Window Glass

Buildings can have either tempered or non-tempered glass. Many commercial applications, storefront windows and modern sliding glass doors are made of tempered glass. In fact, there are often building codes or laws that require tempered glass to be installed in residential and commercial windows that are within 48" of doors.

You can sometimes identify tempered glass as it normally has a manufacturer's watermarks at all four corners. However, this is not foolproof as it can be ordered without the watermarks. Non-tempered glass is most often encountered in ordinary residential windows, whether jalousie, casement, Miami-style, single or double-hung. Older sliding glass doors and older storefront windows were also made from non-tempered glass.

Large windows made of non-tempered glass can cause severe lacerations and even kill you when shattered. These break into large, heavy, sharp shards. When these come crashing down a single piece can slice your arm, face or leg open. In the wrong place, you could bleed out before paramedics got to you.

This is another reason why you should carry a tourniquet on your person. Skylights and some commercial storefront doors and windows are constructed with laminated glass. As with car windshields, these are tough to defeat also. Another type of laminated glass is wire glass. This is made for security purposes and is very hard to defeat, as the wire mesh is anchored to the window or door's frame.

Breaking Window Glass
The safest place to strike large glass is near an upper corner, while you are standing as far to the side of the window as you can. Once the glass is broken, use a longer item, like your baton or a long-handled tool, to clear the glass from the opening. Pay particular attention to clearing out the glass above you. Breaking tempered glass in a residence is the same as with a car window. You can use a punch and attack a lower corner. Just make sure you are certain it is tempered glass. If you have to break out a large window in an older structure, don't break it at the bottom. If it is non-tempered glass, it will rain down heavy fragments that will injure you badly.

Breaking Glass Silently

Firstly duct tape the window around the edges with a big X through the centre and another + across the whole window if you want to reduce noise further. Then get a piece of broken ceramic such as one from a spark plug and throw it at one of the corners of the glass without tape. Repeat this multiple times until you can easily pull the tape off and most of the glass shards come with it.

Car Glass

Glass types are selected based on where and for what they will be used. The two primary locations where police officers will need to break glass are automobile windows and building windows. Auto glass is purposefully strong and resists breaking. If non-tempered glass was used in cars, there would be far more injuries and deaths from auto accidents. Car side and rear windows are frequently made of tempered glass. However, there is a push to use laminated glass for all car windows. Right now, tempered glass is the norm. Car windshields are constructed with laminated glass, which is the safest but toughest of the glass types discussed here. The problem is that you have to punch out the entire plastic sheet to clear the window and it can take some time.

Breaking Car Glass
Car windows are made from tempered glass and are designed to resist blunt force. As such, pounding on a window with a blunt object may have no effect. Window punches used for car side glass are usually effective at a lower corner. In general, there is less danger from the tempered safety glass than with non-tempered glass when it comes down. Target around the edges, not the center, as this is where the glass breaks more easily. Also, do not try and break the front windshield or back windows of a car as these are manufactured to break differently than passenger windows and will be nearly impossible to break through.

Climbing Through

This is how you can climb through a shattered window safely.

1	Once you've smashed the glass the first thing you want to do before climbing through is to remove the jagged pieces from the frame. Run a long blunt object such as a mallet or baton along the frame of the window to break off these smaller pieces so there's less of a chance they will catch you on the way through. There shouldn't be any pieces of glass around the frame larger than 1cm, and next to none visible on the bottom.
2	If you have boots on, slide the glass on the floor to either side just in case you fall back through.
3	Find a thick piece of cloth or clothing to wrap around your hands multiple times to help prevent shards impaling you as you hold the frame. The cloth should be 2.5cm (1 in) thick at a minimum on all sides of your hand.

4	Put a few more thick pieces of piece of cloth (such as towels) onto the lower part of the frame to provide a safe area to sit on if you don't think you can jump out the window. Let them drape down both sides of the window a decent amount so they won't easily fall out.
5	If possible, make it easier to climb through the window by pushing a large secure object under the window to stand on.
6	Place your hands on the lower frame of the window to support yourself as you swing your leg onto the frame. From there lift your other leg onto the frame so you're in a squatting position. Alternatively you can sit down at this point if you feel like you covered the bottom frame well enough. From here just jump out of the window if you're squatting (being sure not to contact the top of the window with your head), or swing your legs to the other side of the window and slide out if you're sitting.

3 Lockpicking

How to pick the locks of houses and cars.

Lockpicks

Pick Shapes

Picks come in several shapes and sizes. Figure A.1 shows the most common shapes. The handle and tang of a pick are the same for all picks. The handle must be comfortable and the tang must be thin enough to avoid bumping pins unnecessarily. If the tang is too thin, then it will act like a spring and you will loose the feel of the tip interacting with the pins. The shape of the tip determines how easily the pick passes over the pins and what kind of feedback you get from each pin. The design of a tip is a compromise between ease of insertion, ease of withdrawal and feel of the interaction.

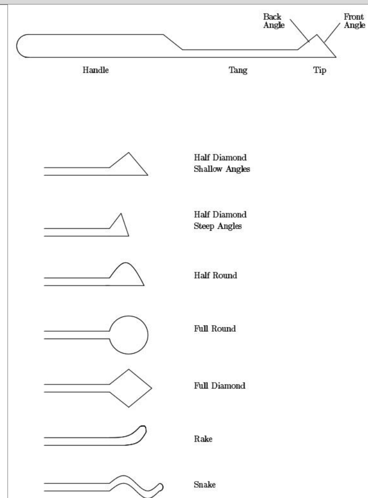


Figure A.1: Selection of pick shapes

The half diamond tip with shallow angles is easy to insert and remove, so you can apply pressure when the pick is moving in either direction. It can quickly pick a lock that has little variation in the lengths of the key pins.

If the lock requires a key that has a deep cut between two shallow cuts, the pick may not be able to push the middle pin down far enough. The half diamond pick with steep angles could deal with such a lock, and in general steep angles give you better feedback about the pins. Unfortunately, the steep angles make it harder to move the pick in the lock. A tip that has a shallow front angle and a steep back angle works well for Yale locks.

The half round tip works well in disk tumbler locks. See section 9.13. The full diamond and full round tips are useful for locks that have pins at the top and bottom of the keyway. The rake tip is designed for picking pins one by one. It can also be used to rake over the pins, but the pressure can only be applied as the pick is withdrawn. The rake tip allows you to carefully feel each pin and apply varying amounts of pressure.

Some rake tips are flat or dented on the top to makes it easier to align the pick on the pin. The primary benefit of picking pins one at a time is that you avoid scratching the pins. Scrubbing scratches the tips of the pins and the keyway, and it spreads metal dust throughout the lock. If you want to avoid leaving traces, you must avoid scrubbing. The snake tip can be used for scrubbing or picking. When scrubbing, the multiple bumps generate more action than a regular pick.

The snake tip is particularly good at opening five pin household locks. When a snake tip is used for picking, it can set two or three pins at once. Basically, the snake pick acts like a segment of a key which can be adjusted by lifting and lowering the tip, by tilting it back and forth, and by using either to top or bottom of the tip. You should use moderate to heavy torque with a snake pick to allow several pins to bind at the same time. This style of picking is faster than using a rake and it leaves as little evidence.

Making Lockpicks

The spring steel bristles used on street cleaners make excellent tools for lock picking. The bristles have the right thickness and width, and they are easy to grind into the desired shape. The resulting tools are springy and strong. The section below describes how to make tools that are less springy out of bicycle spokes. The first step in making tools is to sand off any rust on the bristles. Course grit sand paper works fine as does a steel wool cleaning pad (not copper wool). If the edges or tip of the bristle are worn down, use a file to make them square.

A torque wrench has a head and a handle as shown in figure A.2. The head is usually 1/2 to 3/4 of an inch long and the handle varies from 2 to 4 inches long. The head and the handle are separated by a bend that is about 80 degrees. The head must be long enough to reach over any protrusions (such as a grip-proof collar) and firmly engage the plug. A long handle allows delicate control over the torque, but if it is too long, it will bump against the doorframe. The handle, head and bend angle can be made quite small if you want to make tools that are easy to conceal (e.g., in a pen, flashlight, or belt buckle). Some torque wrenches have a 90 degree twist in the handle.

The twist makes it easy to control the torque by controlling how far the handle has been deflected from its rest position. The handle acts as a spring which sets the torque. The disadvantage of this method of setting the torque is that you get less feedback about the rotation of the plug. To pick difficult locks you will need to learn how to apply a steady torque via a stiff handled torque wrench. The width of the head of a torque wrench determines how well it will fit the keyway. Locks with narrow keyways (e.g., desk locks) need torque wrenches with narrow heads. Before bending the bristle, file the head to the desired width. A general purpose wrench can be made by narrowing the tip (about 1/4 inch) of the head. The tip fits small keyways while the rest of the head is wide enough to grab a normal keyway. The hard part of making a torque wrench is bending the bristle without cracking it. To make the 90 degree handle twist, clamp the head of the bristle (about one inch) in a vise and use pliers to grasp the bristle about 3/8 of an inch above the vise.

You can use another pair of pliers instead of a vise. Apply a 45 degree twist. Try to keep the axis of the twist lined up with the axis of the bristle. Now move the pliers back another 3/8 inch and apply the remaining 45 degrees. You will need to twist the bristle more than 90 degrees in order to set a permanent 90 degree twist.

To make the 80 degree head bend, lift the bristle out of the vise by about 1/4 inch (so 3/4 inch is still in the vise). Place the shank of a screw driver against the bristle and bend the spring steel around it about 90 degrees. This should set a permanent 80 degree bend in the metal. Try to keep the axis of the bend perpendicular to the handle. The screwdriver shank ensures that the radius of curvature will not be too small. Any rounded object will work (e.g., drill bit, needle nose pliers, or a pen cap). If you have trouble with this method, try grasping the bristle with two pliers separated by about 1/2 inch and bend. This method produces a gentle curve that won't break the bristle.

A grinding wheel will greatly speed the job of making a pick. It takes a bit of practice to learn how make smooth cuts with a grinding wheel, but it takes less time to practice and make two or three picks than it does to hand file a single pick. The first step is to cut the front angle of the pick. Use the front of the wheel to do this. Hold the bristle at 45 degrees to the wheel and move the bristle side to side as you grind away the metal. Grind slowly to avoid overheating the metal, which makes it brittle.

If the metal changes color (to dark blue), you have overheated it, and you should grind away the colored portion. Next, cut the back angle of the tip using the corner of the wheel. Usually one corner is sharper than the other, and you should use that one. Hold the pick at the desired angle and slowly push it into the corner of the wheel. The side of the stone should cut the back angle. Be sure that the tip of the pick is supported. If the grinding wheel stage is not close enough to the wheel to support the tip, use needle nose pliers to hold the tip.

The cut should should pass though about 2/3 of the width of the bristle. If the tip came out well, continue. Otherwise break it off and try again. You can break the bristle by clamping it into a vise and bending it sharply. The corner of the wheel is also used to grind the tang of the pick. Put a scratch mark to indicate how far back the tang should go. The tang should be long enough to allow the tip to pass over the back pin of a seven pin lock. Cut the tang by making several smooth passes over the corner. Each pass starts at the tip and moves to the scratch mark. Try to remove less than a 1/16th of an inch of metal with each pass. I use two fingers to hold the bristle on the stage at the proper angle while my other hand pushes the handle of the pick to move the tang along the corner.

Use whatever technique works best for you. Use a hand file to finish the pick. It should feel smooth if you run a finger nail over it. Any roughness will add noise to the feedback you want to get from the lock. The outer sheath of phone cable can be used as a handle for the pick. Remove three or four of the wires from a length of cable and push it over the pick. If the sheath won't stay in place, you can put some epoxy on the handle before pushing the sheath over it.

An alternative to making tools out of street cleaner bristles is to make them out of nails and bicycle spokes. These materials are easily accessible and when they are heat treated, they will be stronger than tools made from bristles. A strong torque wrench can be constructed from an 8-penny nail (about .1 inch diameter). First heat up the point with a propane torch until it glows red, slowly remove it from the flame, and let it air cool; this softens it. The burner of a gas stove can be used instead of a torch.

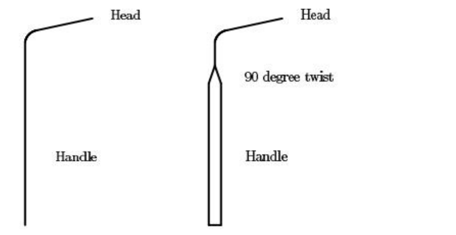


Figure A.2: Torque wrenches

Grind it down into the shape of a skinny screwdriver blade and bend it to about 80 degrees. The bend should be less than a right angle because some lock faces are recessed behind a plate (called an escutcheon) and you want the head of the wrench to be able to reach about half an inch into the plug. Temper (harden) the torque wrench by heating to bright orange and dunking it into ice water. You will wind up with a virtually indestructible bent screwdriver that will last for years under brutal use.

Bicycle spokes make excellent picks. Bend one to the shape you want and file the sides of the business end flat such that it's strong in the vertical and flexy in the horizontal direction. Try a right-angle hunk about an inch long for a handle. For smaller picks, which you need for those really tiny keyways, find any large-diameter spring and unbend it. If you're careful you don't have to play any metallurgical games.

Lockpicking Basics

The following lockpicking guide below was produced by "Ted the Tool" on September 1, 1991.

How a Key Opens a Lock (Chapter 2)

This chapter presents the basic workings of pin tumbler locks, and the vocabulary used in the rest of this booklet. The terms used to describe locks and lock parts vary from manufacture to manufacture and from city to city, so even if you already understand the basic workings of locks, you should look at figure 2.1 for the vocabulary. Knowing how a lock works when it is opened by a key is only part of what you need to know. You also need to know how a lock responds to picking. Chapters 3 and 5 present models which will help you understand a lock's response to picking. Figure 2.1 introduces the vocabulary of real locks.

The key is inserted into the keyway of the plug. The protrusions on the side of the keyway are called wards. Wards restrict the set of keys that can be inserted into the plug. The plug is a cylinder which can rotate when the proper key is fully inserted. The non-rotating part of the lock is called the hull.

The first pin touched by the key is called pin one. The remaining pins are numbered increasingly toward the rear of the lock. The proper key lifts each pin pair until the gap between the key pin and the driver pin reaches the sheer line.

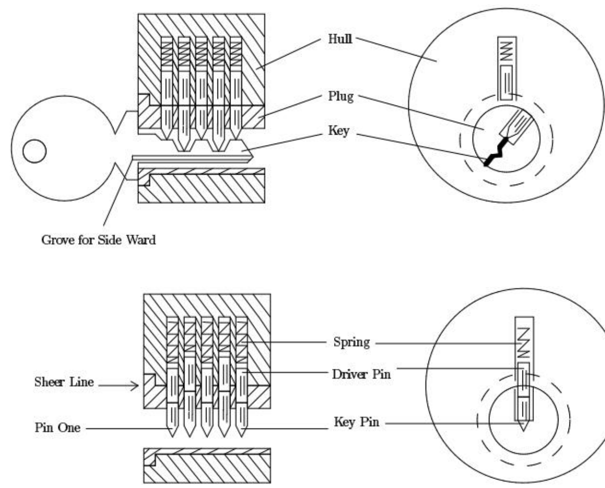


Figure 2.1: Workings of pin tumbler locks

When all the pins are in this position, the plug can rotate and the lock can be opened. An incorrect key will leave some of the pins protruding between the hull and the plug, and these pins will prevent the plug from rotating.

The Flatland Model (Chapter 3)

In order to become good at picking locks, you will need a detailed understanding of how locks works and what happens as it is picked. This document uses two models to help you understand the behavior of locks. This chapter presents a model that highlights interactions between pin positions. Chapter 4 uses this model to explain how picking works.

Chapter 9 (not included in this excerpt) will use this model to explain complicated mechanical defects. The "flatland" model of a lock is shown in Figure 3.1. This is not a cross section of a real lock.

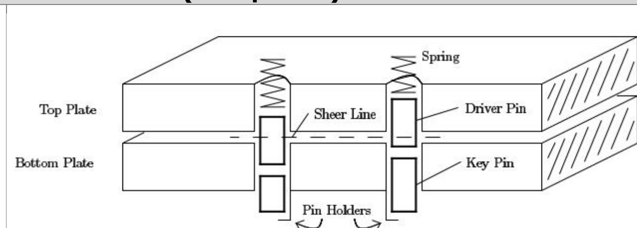


Figure 3.1: Flatland model of a lock

It is a cross section of a very simple kind of lock. The purpose of this lock is to keep two plates of metal from sliding over each other unless the proper key is present. The lock is constructed by placing the two plates over each other and drilling holes which pass through both plates.

The figure shows a two hole lock. Two pins are placed in each hole such that the gap between the pins does not line up with the gap between the plates. The bottom pin is called the key pin because it touches the key. The top pin is called the driver pin. Often the driver and key pins are just called the driver and the pin.

A protrusion on the underside of the bottom plate keeps the pins from falling out, and a spring above the top plate pushes down on the driver pin. If the key is absent, the plates cannot slide over each other because the driver pins pass through both plates.

The correct key lifts the pin pairs to align the gap between the pins with the gap between the plates. See Figure 3.3. That is, the key lifts the key pin until its top reaches the lock's sheer line. In this configuration, the plates can slide past each other.

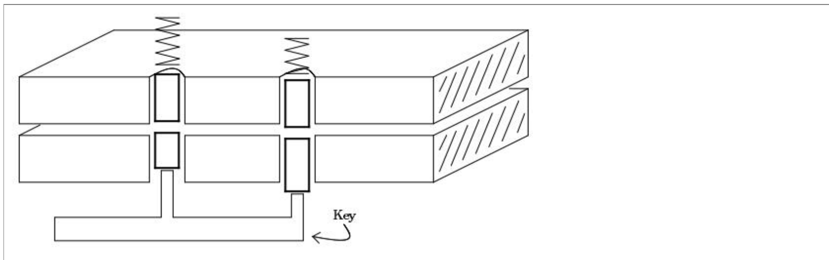


Figure 3.2: (a) Flatland key raises pins

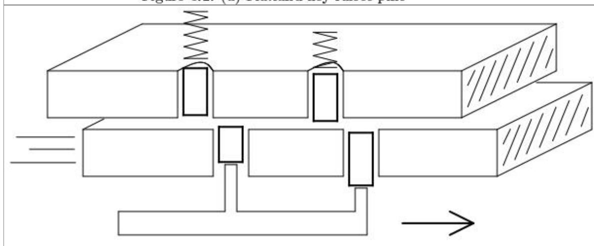


Figure 3.3: (b) Proper key allows plates to slide

Figure 3.3 also illustrates one of the important features of real locks. There is always a sliding allowance. That is, any parts which slide past each other must be separated by a gap. The gap between the top and bottom plates allows a range of keys to open the lock. Notice that the right key pin in Figure 3.3 is not raised as high as the left pin, yet the lock will still open.

Basic Picking & The Binding Defect (Chapter 4)

The flatland model highlights the basic defect that enables lock picking to work. This defect makes it possible to open a lock by lifting the pins one at a time, and thus you don't need a key to lift all the pins at the same time. Figure 4.3 shows how the pins of a lock can be set one at a time. The first step of the procedure is to apply a sheer force to the lock by pushing on the bottom plate.

This force causes one or more of the pins to be scissored between the top and bottom plate. The most common defect in a lock is that only one pin will bind. Figure 4.3a shows the left pin binding.

Even though a pin is binding, it can be pushed up with a picking tool, see Figure 4.3b. When the top of the key pin reaches the sheer line, the bottom plate will slide slightly. If the pick is removed, the driver pin will be held up by the overlapping bottom plate, and the key pin will drop down to its initial position, see Figure 4.3c. The slight movement of the bottom plate causes a new pin to bind. The same procedure can be used to set the new pin.

Thus, the procedure for one pin at a time picking a lock is to apply a sheer force, find the pin which is binding the most, and push it up.

When the top of the key pin reaches the sheer line, the moving portion of the lock will give slightly, and driver pin will be trapped above the sheer line. This is called setting a pin.
Chapter 9 (not included in this excerpt) discusses the different defects that cause pins to bind one at a time.

1. Apply a sheer force.
2. Find the pin that is binding the most.
3. Push that pin up until you feel it set at the sheer line.
4. Go to step 2.

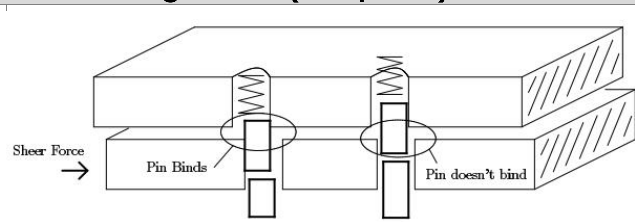


Figure 4.1: (a) Sheer force causes driver to bind

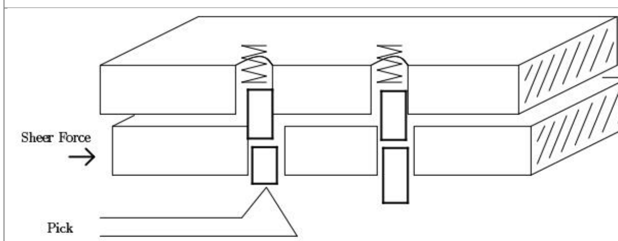


Figure 4.2: (b) Pick lifts the binding pin

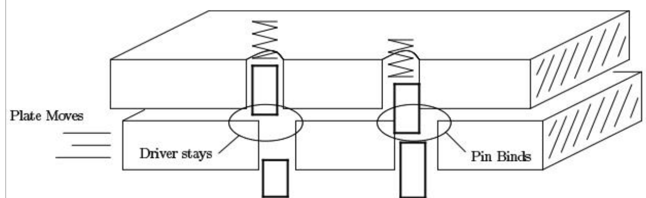


Figure 4.3: (c) Left driver sets and right driver binds

The Pin Column Model (Chapter 5)

The flatland model of locks can explain effects that involve more than one pin, but a different model is needed to explain the detailed behavior of a single pin.

See Figure 5.1.

The pin-column model highlights the relationship between the torque applied and the amount of force needed to lift each pin. It is essential that you understand this relationship. In order to understand the "feel" of lock picking you need to know how the movement of a pin is affected by the torque applied by your torque wrench (tensioner) and the pressure applied by your pick.

A good way to represent this understanding is a graph that shows the minimum pressure needed to move a pin as a function of how far the pin has been displaced from its initial position.

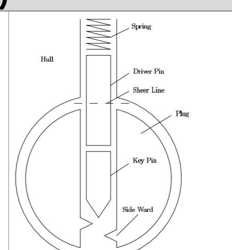


Figure 5.1: The pin-column model

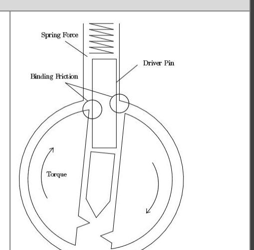


Figure 5.2: Binding in the pin-column model

The remainder of this chapter will derive that force graph from the pin-column model. Figure 5.2 shows a single pin position after torque has been applied to the plug. The forces acting of the driver pin are the friction from the sides, the spring contact force from above, and the contact force from the key pin below. The amount of pressure you apply to the pick determines the contact force from below.

The spring force increases as the pins are pushed into the hull, but the increase is slight, so we will assume that the spring force is constant over the range of displacements we are interested in. The pins will not move unless you apply enough pressure to overcome the spring force. The binding friction is proportional to how hard the driver pin is being scissored between the plug and the hull, which in this case is proportional to the torque.

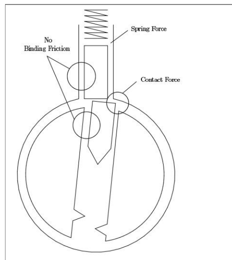


Figure 5.3: Pins at the sheer line

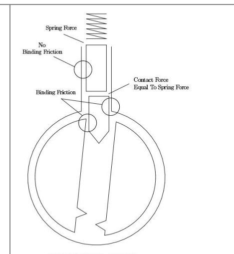


Figure 5.4: Key pin enters hull

The more torque you apply to the plug, the harder it will be to move the pins. To make a pin move, you need to apply a pressure that is greater than the sum of the spring and friction forces. When the bottom of the driver pin reaches the sheer line, the situation suddenly changes. See Figure 5.3. The friction binding force drops to zero and the plug rotates slightly (until some other pin binds). Now the only resistance to motion is the spring force. After the top of the key pin crosses the gap between the plug and the hull, a new contact force arises from the key pin striking the hull. This force can be quite large, and it causes a peak in the amount of pressure needed to move a pin. If the pins are pushed further into the hull, the key pin acquires a binding fiction like the driver pin had in the initial situation.

See Figure 5.4.

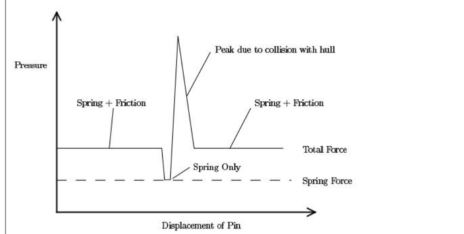


Figure 5.5: Pressure required to move pins

Thus, the amount of pressure needed to move the pins before and after the sheer line is about the same. Increasing the torque increases the required pressure. At the sheer line, the pressure increases dramatically due to the key pin hitting the hull. This analysis is summarized graphically in figure 5.5.

Basic Scrubbing (Chapter 6)

At home you can take your time picking a lock, but in the field, speed is always essential. This chapter presents a lock picking technique called scrubbing that can quickly open most locks. The slow step in basic picking (chapter 4) is locating the pin which is binding the most.

The force diagram (Figure 5.5) developed in chapter 5 suggests a fast way to select the correct pin to lift. Assume that all the pins could be characterized by the same force diagram. That is, assume that they all bind at once and that they all encounter the same friction.

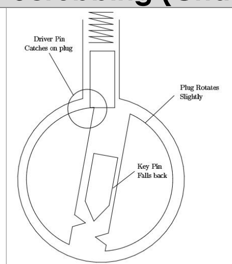


Figure 6.1: Driver pin catches on plug

Now consider the affect of running the pick over all the pins with a pressure that is great enough to overcome the spring and friction forces but not great enough to overcome the collision force of the key pin hitting the hull. Any pressure that is above the at portion of the force graph and below the top of the peak will work.

As the pick passes over a pin, the pin will rise until it hits the hull, but it will not enter the hull. See Figure 5.3. The collision force at the sheer line resists the pressure of the pick, so the pick rides over the pin without pressing it into the hull. If the proper torque is being applied, the plug will rotate slightly. As the pick leaves the pin, the key pin will fall back to its initial position, but the driver pin will catch on the edge of the plug and stay above the sheer line. See figure 6.1. In theory one stroke of the pick over the pins will cause the lock to open.

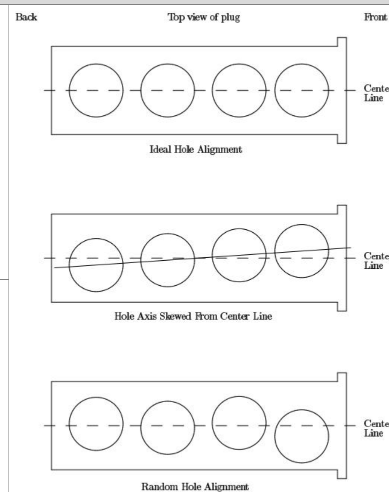


Figure 6.2: Alignment of plug holes

In practice, at most one or two pins will set during a single stroke of the pick, so several strokes are necessary. Basically, you use the pick to scrub back and forth over the pins while you adjust the amount of torque on the plug. The exercises in chapter 8 will teach you how to choose the correct torque and pressure. You will find that the pins of a lock tend to set in a particular order. Many factors affect this order, but the primary cause is a misalignment between the center axis of the plug and the axis on which the holes were drilled. See figure 6.2.

If the axis of the pin holes is skewed from the center line of the plug, then the pins will set from back to front if the plug is turned one way, and from front to back if the plug is turned the other way.

Many locks have this defect. Scrubbing is fast because you don't need to pay attention to individual pins. You only need to find the correct torque and pressure. Figure 6.1 summarizes the steps of picking a lock by scrubbing. The exercises will teach you how to recognize when a pin is set and how to apply the correct forces. If a lock doesn't open quickly, then it probably has one of the characteristics described in chapter 9 and you will have to concentrate on individual pins.

Advanced Lock Picking (Chapter 7)

Simple lock picking is a trade that anyone can learn. However, advanced lock picking is a craft that requires mechanical sensitivity, physical dexterity, visual concentration and analytic thinking. If you strive to excel at lock picking, you will grow in many ways.

Mechanical Skills
Learning how to pull the pick over the pins is surprisingly difficult. The problem is that the mechanical skills you learned early in life involved maintaining a fixed position or fixed path for your hands independent of the amount of force required. In lock picking, you must learn how to apply a fixed force independent of the position of your hand. As you pull the pick out of the lock you want to apply a fixed pressure on the pins. The pick should bounce up and down in the keyway according to the resistance offered by each pin. To pick a lock you need feedback about the effects of your manipulations. To get the feedback, you must train yourself to be sensitive to the sound and feel of the pick passing over the pins. This is a mechanical skill that can only be learned with practice. The exercises will help you recognize the important information coming from your fingers.

Zen and the Art of Lock Picking
In order to excel at lock picking, you must train yourself to have a visually reconstructive imagination. The idea is to use information from all your senses to build a picture of what is happening inside the lock as you pick it. Basically, you want to project your senses into the lock to receive a full picture of how it is responding to your manipulations. Once you have learned how to build this picture, it is easy to choose manipulations that will open the lock. All your senses provide information about the lock. Touch and sound provide the most information, but the other senses can reveal critical information. For example, your nose can tell you whether a lock has been lubricated recently.

As a beginner, you will need to use your eyes for hand-eye coordination, but as you improve you will find it unnecessary to look at the lock. In fact, it is better to ignore your eyes and use your sight to build an image of the lock based on the information you receive from your fingers and ears. The goal of this mental skill is to acquire a relaxed concentration on the lock. Don't force the concentration. Try to ignore the sensations and thoughts that are not related to the lock. Don't try to focus on the lock.

Analytic Thinking
Each lock has its own special characteristics which make picking harder or easier. If you learn to recognize and exploit the "personality traits" of locks, picking will go much faster. Basically, you want to analyze the feedback you get from a lock to diagnose its personality traits and then use your experience to decide on an approach to open the lock. Chapter 9 (not included in this excerpt) discusses a large number of common traits and ways to exploit or overcome them. People underestimate the analytic skills involved in lock picking. They think that the picking tool opens the lock. To them the torque wrench is a passive tool that just puts the lock under the desired stress. Let me propose another way to view the situation.

The pick is just running over the pins to get information about the lock. Based on an analysis that information the torque is adjusted to make the pins set at the sheer line. It's the torque wrench that opens the lock. Varying the torque as the pick moves in and out of the keyway is a general trick that can be used to get around several picking problems. For example, if the middle pins are set, but the end pins are not, you can increase the torque as the pick moves over the middle pins.

This will reduce the chances of disturbing the correctly set pins. If some pin doesn't seem to lift up far enough as the pick passes over it, then try reducing the torque on the next pass. The skill of adjusting the torque while the pick is moving requires careful coordination between your hands, but as you become better at visualizing the process of picking a lock, you will become better at this important skill.

Lock Picking Exercises (Chapter 8)

This chapter presents a series of exercises that will help you learn the basic skill of lock picking. Some exercises teach a single skill, while others stress the coordination of skills. When you do these exercises, focus on the skills, not on opening the lock. If you focus on opening the lock, you will get frustrated and your mind will stop learning.

The goal of each exercise is to learn something about the particular lock you are holding and something about yourself. If a lock happens to open, focus on the memory of what you were doing and what you felt just before it opened. These exercises should be practiced in short sessions. After about thirty minutes you will find that your fingers become sore and your mind looses its ability to achieve relaxed concentration.

Exercise 1: Bouncing the pick
This exercise helps you learn the skill of applying a fixed pressure with the pick independent of how the pick moves up and down in the lock. Basically you want to learn how to let the pick bounce up and down according to the resistance o ered by each pin. How you hold the pick makes a difference on how easy it is to apply a fixed pressure. You want to hold it in such a way that the pressure comes from your fingers or your wrist. Your elbow and shoulder do not have the dexterity required to pick locks. While you are scrubbing a lock notice which of your joints are fixed, and which are allowed to move. The moving joints are providing the pressure. One way to hold a pick is to use two fingers to provide a pivot point while another finger levers the pick to provide the pressure. Which fingers you use is a matter of personal choice.

Another way to hold the pick is like holding a pencil. With this method, your wrist provides the pressure. If your wrist is providing the pressure, your shoulder and elbow should provide the force to move the pick in and out of the lock. Do not use your wrist to both move the pick and apply pressure. A good way to get used to the feel of the pick bouncing up and down in the keyway is to try scrubbing over the pins of an open lock. The pins cannot be pushed down, so the pick must adjust to the heights of the pins.

Try to feel the pins rattle as the pick moves over them. If you move the pick quickly, you can hear the rattle. This same rattling feel will help you recognize when a pin is set correctly. If a pin appears to be set but it doesn't rattle, then it is false set. False set pins can be fixed by pushing them down farther, or by releasing torque and letting them pop back to their initial position. One last word of advice. Focus on the tip of the pick. Don't think about how you are moving the handle; think about how you are moving the tip of the pick.

Exercise 2: Picking pressure
This exercise will teach you the range of pressures you will need to apply with a pick. When you are starting, just apply pressure when you are drawing the pick out of the lock. Once you have mastered that, try applying pressure when the pick is moving inward. With the flat side of your pick, push down on the first pin of a lock. Don't apply any torque to the lock. The amount of pressure you are applying should be just enough to overcome the spring force. This force gives you an idea of minimum pressure you will apply with a pick.

The spring force increases as you push the pin down. See if you can feel this increase. Now see how it feels to push down the other pins as you pull the pick out of the lock. Start out with both the pick and torque wrench in the lock, but don't apply any torque. As you draw the pick out of the lock, apply enough pressure to push each pin all the way down.

The pins should spring back as the pick goes past them. Notice the sound that the pins make as they spring back. Notice the popping feel as a pick goes past each pin. Notice the springy feel as the pick pushes down on each new pin. To help you focus on these sensations, try counting the number of pins in the lock. Door locks at MIT have seven pins, padlocks usually have four. To get an idea of the maximum pressure, use the flat side of your pick to push down all the pins in the lock. Sometimes you will need to apply this much pressure to a single pin. If you encounter a new kind of lock, perform this exercise to determine the stiffness of its springs.

Exercise 3: Picking Torque
This exercise will teach you the range of torque you will need to apply to a lock. It demonstrates the interaction between torque and pressure which was describe in chapter 5. The minimum torque you will use is just enough to overcome the friction of rotating the plug in the hull. Use your torque wrench to rotate the plug until it stops. Notice how much torque is needed to move the plug before the pins bind. This force can be quite high for locks that have been left out in the rain. The minimum torque for padlocks includes the force of a spring that is attached between the plug and the shackle bolt. To get a feel for the maximum value of torque, use the flat side of the pick to push all the pins down, and try applying enough torque to make the pins stay down after the pick is removed. If your torque wrench has a twist in it, you may not be able to hold down more than a few pins.

If you use too much torque and too much pressure you can get into a situation like the one you just created. The key pins are pushed too far into the hull and the torque is sufficient to hold them there. The range of picking torque can be found by gradually increasing the torque while scrubbing the pins with the pick.

Some of the pins will become harder to push down. Gradually increase the torque until some of the pins set. These pins will loose their springiness. Keeping the torque fixed, use the pick to scrub the pins a few times to see if other pins will set. The most common mistake of beginners is to use too much torque. Use this exercise to find the minimum torque required to pick the lock.

Exercise 4: Identifying Set Pins
While you are picking a lock, try to identify which pins are set. You can tell a pin is set because it will have a slight give. That is, the pin can be pushed down a short distance with a light pressure, but it becomes hard to move after that distance (see chapter 6 for an explanation). When you remove the light pressure, the pin springs back up slightly. Set pins also rattle if you flick them with the pick. Try listening for that sound. Run the pick over the pins and try to decide whether the set pins are in the front or back of the lock (or both).

Try identifying exactly which pins are set. Remember that pin one is the frontmost pin (i.e., the pin that a key touches first). The most important skill of lock picking is the ability to recognize correctly set pins. This exercise will teach you that skill. Try repeating this exercise with the plug turning in the other direction. If the front pins set when the plug is turned one way, the back pins will set when the plug is turned the other way. See Figure 6.2 for an explanation.

One way to verify how many pins are set is to release the torque, and count the clicks as the pins snap back to their initial position. Try this. Try to notice the difference in sound between the snap of a single pin and the snap of two pins at once. A pin that has been false set will also make a snapping sound. Try this exercise with different amounts of torque and pressure. You should notice that a larger torque requires a larger pressure to make pins set correctly. If the pressure is too high, the pins will be jammed into the hull and stay there.

Exercise 5: Projection
As you are doing the exercises try building a picture in your mind of what is going on. The picture does not have to be visual, it could be a rough understanding of which pins are set and how much resistance you are encountering from each pin. One way to foster this picture building is to try to remember your sensations and beliefs about a lock just before it opened.

When a lock opens, don't think "that's over", think "what happened". This exercise requires a lock that you find easy to pick. It will help you refine the visual skills you need to master lock picking. Pick the lock, and try to remember how the process felt. Rehearse in your mind how everything feels when the lock is picked properly.

Basically, you want to create a movie that records the process of picking the lock. Visualize the motion of your muscles as they apply the correct pressure and torque, and feel the resistance encountered by the pick. Now pick the lock again trying to match your actions to the movie. By repeating this exercise, you are learning how to formulate detailed commands for your muscles and how to interpret feedback from your senses. The mental rehearsal teaches you how to build a visual understanding of the lock and how to recognize the major steps of picking it.

This concludes the guide on lockpicking. There is more discussed in the full guide by 'Ted the Tool' which you can find online.

Lockpicking Houses

Lockpicking Cars

Lockpicking Padlocks

Padlocks are those rectangular locks with a thick metal "U" bending up and around into the lock. These use relatively small keys to open and are often found on sheds or bike locks.

4 Hotwiring

5 Hacking

Hacking is the gaining of entry into a computer system to read, change, remove or add files. It is often done remotely but can also be done in person.

Hacking Mobile Devices

Hacking Computers

Hacking WiFi

9 Stealth

This section on using stealth and camouflage effectively as well as being a "Grey Man" in suburbia.

Grey Man

The term "Grey Man" (or "Gray Man") in a security context refers to an individual who intentionally cultivates an inconspicuous appearance and demeanor to blend seamlessly into their environment and avoid drawing any unwanted attention. The goal is to become unremarkable, forgettable, and therefore, less of a target. It's a strategy rooted in the principle of avoidance and is highly valued in personal security, intelligence, and survival/prepper communities.

Core Principles
- Inconspicuousness: The primary objective is to not stand out from the crowd. This means avoiding anything that would make you memorable or cause someone to take a second look.
- Blending In: Adapting your appearance, behavior, and even possessions to match the "baseline" of your surroundings. What's normal in one environment (e.g., hiking gear in a national park) would make you stand out in another (e.g., the same gear in a city center).
- Reduced Target Profile: By being unremarkable, you reduce your chances of being singled out by criminals, hostile actors, or even just people seeking assistance (especially in a crisis situation).
- Concealment of Capabilities: A true Grey Man is often well-prepared and capable, but they do not outwardly display these capabilities (e.g., no overt tactical gear, no bragging about survival skills).

Becoming a Grey Man

Here's the steps of becoming a Grey Man.

Appearance

● Neutral Clothing: Wear colors that are common and blend with the environment (greys, blues, browns, blacks, creams). Avoid bright, flashy, or highly patterned clothing.
● No Logos or Branding: Avoid prominent brand names, sports team logos, political statements, or anything that could identify you or attract attention.
● Unremarkable Accessories: Keep jewelry to a minimum or none at all. Use plain, common bags or backpacks rather than tactical ones.
● Appropriate for the Environment: Dress according to the local fashion norms, weather, and activity. Don't wear a suit to a beach or camouflage in a city unless it's genuinely part of the local norm.
● No "Tactical" Look: Avoid clothing or gear that screams "prepper," "military," or "security." This includes cargo pants, tactical vests, obvious knife clips, or tactical boots unless they genuinely blend in.

Behavior & Demeanor

● Neutral Body Language: Walk with purpose but without arrogance or extreme urgency. Avoid fidgeting or looking lost. Maintain a neutral expression.
● Avoid Eye Contact (mostly): While situational awareness requires scanning, prolonged or aggressive eye contact can be perceived as a challenge or invitation to interaction. Learn to observe with your peripheral vision.
● Quiet and Calm: Avoid being loud, boisterous, or drawing attention through your voice or gestures.
● Don't Engage Unnecessarily: Avoid lengthy conversations with strangers or expressing strong opinions. Be polite but brief.
● Mimic the Crowd: Observe how others around you are behaving (their pace, their level of engagement, their typical actions) and subtly adjust your own to match. If people are hurrying, hurry. If they're leisurely, be leisurely.
● Don't Show Off: Don't display wealth (e.g., expensive watches, cash), gadgets, or any signs of preparedness.

Possessions

● Concealed Gear: Any necessary self-defense items, first-aid kits, or survival tools should be carried discreetly and not be visible or obvious.
● Plain Bags: Use common, everyday backpacks or bags that don't look tactical or specialized.
● Digital Discretion: Be mindful of what you share online, especially regarding your location, possessions, or routines, as this can undermine the Grey Man approach.

Camouflage

Hiding yourself within nature.

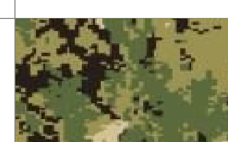
Identifiers

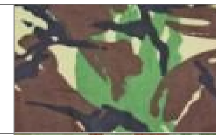
To detect objects the human visual system looks for object signatures which differentiates it from the background. The term visual saliency is used in cognitive science to describe the features that make objects detectable.

Movement	Shapes moving in a static environment or not moving in a dynamic environment will draw attention.
Shine & Glint	Metal, glass, plastic, sweaty skin, etc.
Shape	Humanoid shapes draw attention. i.e. Faces in rock formation, man shaped trees stumps.
Silhouette	A contrasting blob against the background.
Colour & Texture	Blue in a green jungle doesn't work, neither does low texture in a high texture environment.
Shadow	The mind can calculate probable shapes from the shadows cast, especially human shapes.
Spacing & Patterns	Regular spaced objects form a pattern that will draw attention.
Smell	Animals can pick up your scent from a great distance, especially dogs.
Sound	Unusual sounds can cause you to stand out, or the absence of sound if birds know you are nearby. Know what sounds animals make when they know someone is nearby.

Camouflage Families

These are the different camouflage families which have been utilized by military's worldwide over the years.

Camouflage Name	Description	Camouflage Types	Pattern
Woodland	It is a four colour, high contrast disruptive pattern with irregular markings in sand, brown, green and black. **Use:** Woods	● Australian Multicam (2014) ● A-TACS (2010) ● Desert Camouflage Pattern (1991) ● Disruptive Pattern Camouflage (2017) ● HyperStealth Afghan Forest (2009) ● Multicam (2002) ● Operational Camouflage Pattern (2015) ● U.S. Woodland (1981)	
Digital	Multi-scale camouflage is a type of military camouflage combining patterns at two or more scales, often (though not necessarily) with a digital camouflage pattern created with computer assistance. **Use:** American Armed Forces	● AOR-1 (NWU Type II) (2010) ● AOR-2 (NWU Type III) (2010) ● Canadian Disruptive Pattern (2002) ● M05 (2007) ● Marine Pattern (MARPAT) (2002) ● NWU Type I (2018) ● Type 07 (China) (2007) ● Universal Camouflage Pattern (2018)	
Flecktarn	Flecktarn "mottled camouflage" is a family of 3-, 4-, 5- or 6-color disruptive camouflage patterns, the most common consisting of dark green, light green, black, red brown and green brown or tan depending on the manufacturer. **Use:** European Temperate Woodland Terrain.	● Bundeswehr Tropentarn (1993) ● Flächentarnmuster (1967) ● Flecktarn (1990) ● M84 (1984) ● Multitarn (2016) ● Platanenmuster (1937)	

DPM (Disruptive Pattern Material)	The main variants of DPM are a four-colour woodland pattern, and desert patterns in two, three or four colours. **Use:** British Armed Forces	● Disruptive Pattern Material (1968) ● Multi-Terrain Pattern (2010)	
Frog Skin	Frog Skin is a battledress camouflage pattern with mottle and disruptive coloration to blend into the environment similar to a frog's crypsis skin.	● Frog Skin/Spot (1942)	
Lizard	The lizard pattern is a family of many related designs of military camouflage pattern, first used by the French Army on uniforms from 1947 to the late 1980s.	● Lizard (1947)	
Splinter	Splinter pattern camouflage is a military camouflage pattern consisting of polygons.	● M90 (1989)	

Somebody Else's Problem (SEP)

Somebody Else's Problem (SEP) is a psychological effect where people choose to dissociate themselves from an issue that may be in critical need of recognition. An SEP is something we can't see, or don't see, or our brain doesn't let us see, because we think that it's somebody else's problem. The brain just edits it out, it's like a blind spot. The Somebody Else's Problem field... relies on people's natural predisposition not to see anything they don't want to, weren't expecting, or can't explain. An example would be a bunch of people dressed up as clowns going about their days work. People will look for a while, while trying to grasp their purpose but then leave it for someone else to fix.

Urban Camouflage

The gray man is an individual who moves around the periphery of our awareness without creating any stimulus. This makes that person invisible for all practical purposes.

Size	Height is an element of being a gray man that we have little control over. The best gray man is ordinary in every respect. He's of average height and weight. He has no obvious physical features that draw attention, ie, big nose, bald head, facial hair, etc.
Dress	Dress is an element within our control. For the most part, natural and neutral colours work best; Browns and greys. Nothing to create a memory like a T-shirt with a saying or photos. Style of clothing tends to be very conservative. Nothing showing skin, nothing too fashionable, nothing to out of fashion. Ordinary is the key word here.
Mannerisms	Since the gray man attracts no attention, his mannerisms must be small and discreet. No sweeping gestures. Energetically, the gray man is withdrawn. He does not project confidence. He does not look around much, he avoids eye contact.
Movement	One of the key elements of camouflage is learning to match your movement to the baseline. If you spend any time in a city, you will notice that every neighbourhood has a unique flavour. We call that the baseline. It refers to the sound, motion, activity level of the neighbourhood in a normal situation. The speed at which people move, the way they gesture, the volume and speed with which they speak. All these elements and many more make up the baseline. You can learn the baseline for a given neighbourhood by sitting somewhere and watching.
Route	A key element in avoiding trouble is not to go where trouble tends to be. This means you must know the terrain like a native. You must know what neighbourhoods are safe (relatively) and which ones to avoid. You must know roads and routes, locations of police stations, gas stations, convenience stores and emergency clinics. You should know what areas have street lights at night and which are dark. Know where the choke points are and where LE is likely to set up blockades. Being a gray man means avoiding trouble by not going where trouble is, unless necessary.
Observation	Sit back and watch the crowd. Notice the stimulus that drew your eye. The purpose is to pound into your consciousness the stimulus – what you notice about each person. "That guy has a huge nose." Then after a few minutes, someone will walk by and you will not find anything. Pay attention to that person. Observe them carefully. See how they move, what kind of energy they project. See how they interact with others, what they pay attention to (or not). If possible follow them for a bit. Observe them move.

House Camouflage

During times of crisis your house should be camouflaged to fit in with those around you. This can be done by looking at the state of nearby houses and matching what they look like. If they appear to be trashed with junk all over the lawn, overgrown and with broken windows, you should blend it in by doing the same and lessening the chance someone will target you. If all the other houses in the street don't have power, don't go lighting up every room and showing that you have power. Instead tape up any windows that you will have light in and ensure there's no gaps. This also applies to sound, food scent and even smoke coming from your chimney.

Stealth Camping

Stealth camping is camping overnight (generally illegally) and leaving without being detected. By setting up camp at dusk and packing up at dawn, the camper spends the least number of hours with the shelter set up to avoid detection. The following section details tips on being as stealthy as possible.

SECURITY Stealth Stealth Camping

- Don't wear a full set of camo in public areas or people may ask questions. Instead, switch into camo clothes when you are at your campsite.
- Choose hiking, backpacking, and camping gear and clothing that are natural earth tone colours like green, brown, tan, or black.
- Shelters should ideally be below 80cm (31.5in) high to remain hidden easier. Under 60cm (23.6in) is preferred. Their width and length doesn't matter too much.
- Bring a camo net to camouflage your shelter with the background and ensure it's a suitable colour for the environment.
- Pad metallic items in your bag so they don't make noise when hiking and never put pots and pans outside your pack.
- Ensure you don't have any reflective/glowing or luminous surfaces on your gear which could give away your position.
- Try not to carry too much gear in an oversized backpack or people may start to ask questions. Have answers ready if someone does ask you such as you're training for the army.
- Ensure your tent has no reflective markers on it which could bounce torchlight back.
- Use a brown or green toned or camo tent with a low maximum height.
- Mobiles keep your location data on hand so be sure to disable any connections before setting out. They can even store data while offline and upload it after you reconnect.
- Ensure mobiles are set to silent as a ringtone or even a vibration is a sure way of being found.

Giveaways

Try to reduce the amount of gear which can give away your position in various ways, such as:

Reflective Surfaces	Any items with reflective surfaces such as watches, glasses or mirrors.
Clanging/Bumping	Any items in your pack that bump together and produce sound.
Bright Colours	Any items that have colours contrasting to the natural surroundings.
Tall Objects	Objects such as tents which stand up taller than 80cms.
Electronic Sound	Any items that can produce sound electronically such as mobiles and watches.
Artificial Sound	Any items that can produce artificial sounds such as gas stoves, tent zippers and velcro.
Luminous Objects	Items that glow in the dark or are designed to reflect light.
Scent	The smell of cooking food or body odour can easily give away your position.

Moving

- Avoid situations where your moving silhouette is visible, especially at dusk and dawn.
- Cover your tracks if your footprints are visible and you believe it will help your situation. Use a stick of leaves to scrub the tracks clean as you walk.
- Only let people see you when you want to be seen such as before you've set up your camp and when you're returning from camp.

Hiking

- Stay on the trail if it is muddy or wet. Hike through it. If you walk around the mud the trail will widen and become even muddier in the future. Mud is part of the backcountry challenge. Wear waterproof boots and gaiters to protect your feet from mud and water. Stay on the trail!
- Stay on designated trails while hiking or backpacking. Walk single file in the centre of the path. Leave only the lightest of footprints.
- Use existing trails. Don't shortcut switchbacks.
- To minimize trail damage, wear as light a boot as possible for the conditions. Heavy boots with deep treads compact the soil more and tend to tear up the trail. Wear camp shoes (sandals, sneakers, moccasins, etc.) to minimize impact while in camp.
- If travelling cross-country hike on durable surfaces (rock, sand, gravel, snow, pine needles, or dry grasses) to prevent vegetation damage and erosion. Have your group spread out while hiking off-trail so that new trails aren't created.
- Camp and travel in small groups. They are quieter and do less damage.
- Cover up any footprints or vehicle tracks you make which could lead people to you.
- Stay on tracks that are already defined such as an established hiking trail. Walk through muddy sections of track to conceal your tracks more as most people will go around.
- Move slowly as it's harder to detect.
- To be stealthy when walking through mud, slide your boots into the water without breaking the surface and then take them off the bottom just enough to take another step without taking them out of the water.
- Walk on the most durable ground you can find to reduce your impact on that location and conceal your footprints. Rocks instead of dirt and dead leaves instead of live flora.
- If you always pretend that people are following you and you want to lose them, you will quickly learn how to evade detection.

Regulations

- Know the regulations and concerns for the area you'll be hiking, backpacking, or camping in. Restrictions are based on any past abuse and the special conditions of an area.
- Some areas don't allow fires or only allow fires in designated areas. Know the regulations for the area you will be visiting.
- The laws change wildly from country to country and knowing what your rights are can help persuade people who find you that you're in the right, or didn't know the law.

Car Parking

- Leaving a note on your car saying it's broken down and detailing a fictional friend "Dave" who will come and pick it up could deter carjackers and thieves. Just make sure it looks like that problem has occurred.
- Blend your car in by leaving typical gear in it that people nearby use such a fishing rod and bucket.
- Take an essential part of your car with you rending it inoperable until you return and replace it such as a spark plug.
- Remove or hide any items that are in the car to deter thieves from breaking into it.

Scouting

- Google Earth locations prior to setting out so you have a few options to check out and pick the best from.
- You could set up a game camera in an area you wish to camp in prior to heading there to see what sort of activity there is from humans and animals.
- Read over maps of the destination prior to going so you understand the terrain and have a few ideal spots in mind.
- Know what the weather will be for your trip as this will have a large impact on your campsite location.

Location Tips

SECURITY Stealth Stealth Camping Location Tips

- Try to position your camp so that you have thick vegetation on most sides.
- If you're on a hiking trip never camp in the same place multiple times in a row, find a new one every night to make it harder to be detected.
- Don't let anyone see you entering or leaving a campsite, if you're spotted make it look like you're just hiking through.
- If it's not a SHTF situation, ensure that someone knows where you are in case an emergency arises.
- Use shadows to your advantage. Hide in dark spaces near fallen trees where you won't be spotted.
- People tend to look down more then up and some won't bother climbing hills so try to camp high.
- Good campsites are found, not made so try not to alter the terrain to suit.
- Be sure to camp on durable surfaces. Avoid fragile areas that will impact easily and take a long time to heal after you leave. Try to concentrate use into campsites that are already established. Give places just beginning to show impact a chance to heal themselves.
- Look for large natural fallen logs to set up near as they will provide a wind break, additional camouflage and protection from falling branches and sticks.
- Know the location, your way out and keep track of where you've been.

- Nobody will know where you are so you are your only source of help unless you have an emergency beacon or let someone know exactly where you will be.
- Beware of floor based dangers such as traps, pitfalls, landmines or quicksand.
- Have an escape plan in mind in case you have to get out of the area swiftly without being detected, such as nearby humans who haven't seen you yet.
- Getting more practice can help the experience become easier as you know what to look for in a campsite and what to avoid.
- The harder it is to get to your campsite, the less likely you will be found.
- Pitching amongst bushes or long grass will help cut your silhouette out and completely hide you however there may be unwanted critters in there you wake up to such as snakes or ticks.

Hazards

- Check your potential camping area for hazards like dead branches, tall trees, game trails, deadly creatures, sharp objects etc.
- Ensure your chosen camp isn't a safety hazard such as prone to floods, wildfires or dangerous animals.

Avoid

Popular Areas	Avoid popular areas during heavy use times such as parks, fishing hotspots and patrolled areas.
Cut Grass	Watch out for cut grass, it could be a sign this area is a commonly occupied space such as a park or grazing area.
Private Property	Don't camp in areas where there are Private Property or No Trespassing signs, you don't have an excuse of not knowing and it generally means they keep an eye for campers or it's happened in the past.
Camp Away From Water	Don't camp near water. Camp at least 61m (200ft) away from water sources. Animals come to water to drink and may be scared off. Areas near water are also more fragile and camping too close can lead to erosion.
Avoid Cattle	Avoid areas with large amounts of cattle, this is easy to detect as the landscape will be spotted with faeces and animals can detect you easier then humans.
Purple Paint	Purple paint on fences or trees denote they are privately owned.
Geocachers	Avoid areas frequented by geocachers, they are likely to find you if you are near a cache. Create a geocacher account just to look up where caches are so you can avoid those areas.

Setup

- Pile sticks and other natural elements around your tent so it blends in more and breaks up any sharp lines.
- Pitch the tent at dusk and pack it up at dawn. You need to use the night as cover.
- Stay away from frequently travelled paths or where domestic pets can pick up your scent.
- Keep your fire profile low and below ground level to avoid the bright flames being seen - if you need a fire at all.
- If you are discovered before setting up your camp while hiking around, ensure to move at least 1km away and out of that person's land.
- Avoid pitching your tent in the dark, find a suitable location for camping prior to setting up and go for a local hike to scout the location out and return when it's almost dark.
- Set up hammocks low to the ground or barely touching it to maintain a low profile.
- Try to keep tents as taut as possible to avoid them flapping about in wind.
- Don't let people see you setting up your camp or leaving the trail as this will arouse suspicion.

Speed

- Know how to set up and dismantle your camp easily, keep as much done as possible so you can pack up within 2 minutes if you need to get out fast.
- Time yourself at home and try to get the tent set up and dismantled within 2 minutes.
- Learn to dismantle your entire camp with no trace within a few minutes.
- If your shelter takes over 5 minutes to set up it's recommended to either practice until you can set it up under 2 minutes or buy another, simpler one.
- Setup Speed (Fastest to Slowest) - Bivy, Bedroll, Swag, Hammock, Tent

Cover

- Place a few natural materials on and around your shelter to blend it in more naturally than camo nets because its colours may be slightly off.
- When placing sticks and branches around your site be careful they don't puncture your shelter.
- Handfuls of leaves on top of a camo net shelter is a perfect final step for blending it in to the environment.

Overnight

- Keep as quiet as possible and avoid using light sources over 10 lumens for long. Or just use the sun as your light and sleep at night.
- Know what's in your pack and where you keep it for easy access if you're in a hurry.
- Keep the items you aren't using in your pack so you can make a quick getaway if you need to.

Inside the Shelter

- While inside the shelter keep unnatural sounds to a minimum such as bag zips, inflatable mattress sounds, clanging and velcro tearing.
- Minimise bodily noises like sneezing, coughing and yes, farting.
- If you snore, try to sleep in a position that minimises your noise or purchase a device that prevents snoring as you're at your most vulnerable when asleep.

Entering & Exiting

SECURITY Stealth Stealth Camping

- Avoid getting in and out of your shelter as much as possible as the sound of zippers and velcro can easily give you away. If you must, unzip it slowly.
- Before moving out of your shelter, take a few moments to look and listen around you for people, animals or other threats.
- Keep lighting to a minimum when moving around your campsite and only use red or green lights.

Awareness

- Know what's going on around you and always pay attention to the sounds outside your shelter.
- Try to identify any foreign sounds if you're uncomfortable with them.
- Try not to shut out the world when you're in your shelter by listening to music, try to keep at least one earbud off to listen out.

Fire

- Keep your fire small. Use small (wrist size or smaller) dead wood that was already on the ground. Break wood into smaller pieces as needed. Using small wood will ensure that it burns more completely.
- Building a pit fire is the best option to hide the flames at night which can be visible from many miles away.
- Using gas or liquid fuels like butane and denatured alcohol instead of wood is stealthier and are less visible if you wish to cook.
- Smoke from a fire gives away your position easily, not only by sight by from small also so try to make them at night when it's harder to see and there's less people around.
- Keep in mind that cooked food can be smelt from ages away and will draw predators and possibly humans to the source.

Animals

- If a bear beats your bear bag system and steals your food bag during the night, try and find the remains and properly dispose of them before you leave. The bear will be done eating in the morning and most likely had his feast a little ways from your campsite. You are responsible for everything you bring into the backcountry.
- Do not feed the animals! You will create a nuisance because the animal will develop a taste for human food, associate humans with food, and then raid our campsites to steal our food. Cook and eat away from your campsite so you don't attract bears.
- Learn how to properly store your food to protect it from bears and other animals.
- Treat the animals you encounter with respect. Remember that you are a visitor and are travelling and camping in their backyard.
- Observe wildlife from a distance so you don't interfere with their natural decisions.
- If you are on a horse you are responsible for its waste also. Would you do to the toilet in the middle of a hiking trail? Move your horse's waste off the trail. Do not let your horse do it's thing by any water sources or campsites.
- Learn how to properly store your food to protect it from bears and other animals.

Hygiene

- Wash yourself and dishes 200 feet from any water sources and away from campsites.
- Food scraps will attract insects and animals. Filter your dishwater and carry out your food scraps with the rest of your trash.
- Don't use soap or shampoo. Keep chemicals out of the backcountry! So-called biodegradable soap still has an impact on the environment. If you absolutely must use soap use it 200 feet from any water sources and only use a little bit.
- Bury human waste in cat holes about 6-8" deep 200 feet from any water sources, campsites, or trails. It is good to carry out used toilet paper since animals often dig it up and spread it all over. Carry out all plastic or cotton feminine hygiene products. Do not bury them.

Getting Caught

- Public/Private Land (No Trespassing Sign) Generally they ask you to leave.
- Public/Private Land (With Trespassing Signs) 50/50 chance of prosecution in America.
- Real Estate Land - Prosecution, Fine and Jail.
- If you get caught you may be searched, harassed and questioned.
- It's best to be truthful in these situations and they might go easier on you.
- Don't Have: Firearms, Drugs, Illegal Knives.
- If you're found, act lost, like you didn't know the rules, say you'll leave or that it's completely fine to camp there if they aren't a ranger or the land owner.
- If you're found, even by someone who appears not to care, move your campsite.
- During dry periods it can be dangerous or against regulations to build a fire. Make sure your fire is completely out before leaving an area.

Speed

- Know Your Tent - Know how to dismantle your camp quickly and keep as much done as possible so you can pack up within 2 minutes if you need to get out fast.
- Time Challenge - Time yourself at home and try to get the tent set up and dismantled within 2 minutes.
- Dismantle Speed - Learn to dismantle your entire camp with no trace within a few minutes.

Leave No Trace

Leave No Trace	Make it look like you were never there when you leave.
Trash Bag	Make sure you have a way to properly dispose of your trash. (Use your Ziploc bags or bring an extra garbage bag)
Environmental Impact	Get back to the basics. Select your gear and plan your trip by thinking about how it will impact the environment and also how it may affect others as well.
Camp Lighting	Use a candle lantern for light instead of building a fire. If you use regular candles don't leave your wax drippings all over the place. It is not "natural".
Unburnable Waste	Contrary to popular belief tin foil and plastic bottles do not completely burn.
Negative Trace	Practice "Negative Trace". Pick up trash that others may have missed or that were dropped by accident. Pick up trash you find along the trail.
Never Bury Trash	Do not bury your trash. Animals will dig it up or it will become exposed later on for someone else to find.
Remove Evidence	Make your site or travel route look like nobody was ever there. Leave no signs of human influence. Remove all evidence of your stay. Inspect your campsite for trash or misplaced gear before you leave.
Carry Out Trash	If it wasn't there when you came then don't leave it there when you leave! You are responsible for anything you bring into the backcountry. Carry out all your trash.
Rules	Take only pictures, leave only the lightest of footprints, and bring home only memories.
Don't Steal Nature	Resist the temptation to take home souvenirs. Leave stones, feathers, artefacts, shells, petrified wood, etc. so that others may enjoy them.
Keep Nature Pristine	Leave the place you're visiting in a natural condition. Do not alter a site in any way. Good campsites are found, not made. Don't pound nails into trees or damage live vegetation or trees.

Reduce Trash	Reduce the amount of trash you bring into the woods by eliminating all unnecessary packaging like cardboard boxes, etc.
Unburned Trash	Remove all unburned trash from your fire ring. Contrary to popular belief aluminium foil and plastic bottles do not completely burn in fires. Scatter your leftover cold ashes over a large area away from campsites.
Use Dead Wood	Don't break or saw off branches from dead trees, live trees, or fallen trees. Use only wood that's on the ground. Don't burn green wood. Don't peel the bark off trees for use as fuel. It takes many years to heal and remains an eyesore in the meantime.
Reusable Containers	Repackage your food into re-usable containers like Ziploc bags. Avoid tin or aluminium cans and glass.
Use Tree Straps	If using a hammock use tree straps to reduce the impact and damage to the trees.
Footprints	Leaving nothing but your footprints.
Blackened Rocks	Don't make a fire ring with rocks. Blackened rocks are very unsightly and stay that way for many years.

Stealth Vehicle Camping

Grid Up

This section is about sleeping in a vehicle stealthily overnight without being detected. It is assumed that the grid is up and society is functional.

Vehicle Tips

Choose a van with no obvious features, typically white without decals, paint jobs etc. A sprinter van can be fitted out to look like a small apartment.	**Possible Vehicles** ● Mercedes-Benz Sprinter ● Nissan NV2500 ● Ford Transit ● Dodge RAM ProMaster

Parking Tips

● The most obvious place to park is the best, it looks natural outside homes but try to find a spot between houses so it looks to each one like you're visiting the other's house.
● Don't stay in the same place more than 2-3 nights in a row to avoid suspicion.
● Try to avoid revealing the interior of the van and showing there's a bed inside, so be quick when entering and leaving the vehicle.
● Look for a shaded area if it becomes hot during the day.

Examples

Sprinter Van	A wonderfully compact and modern looking sprinter van to house conversion. URL: stealthsprinter.com/
Van Build	URL: sean.cm/i/van-build/

Grid Down

This section is about sleeping in a vehicle stealthily overnight without being detected. It is assumed that the grid is down and a SHTF situation is ensuing.

Vehicle Tips

● If you're using a brightly coloured car change the colour to a white, black or gray colour if possible.
● Use a camo net to cover the car if you're parking in the bush.
● Keep out of sight from any roads and preferably behind thick foliage.
● Cars have a lot of shiny reflective surfaces which can be seen from miles away so try to reduce these surfaces as much as possible.

Weapon Concealment

How to conceal weapons effectively on your body and in your home.

Body Concealment

Home Concealment

10 Tactics

Military Routine

While away from the secure base it is normal to develop a routine linked to the change from day to night, as this is the time when the effect of the environment changes. A defensive posture is adopted, and a set of routine actions are conducted around daybreak and another around sunset. These are called morning and evening routines and are described as follows:

Morning Routine

Reveille	Everybody is woken, shelters are struck if applicable, all equipment is packed and weapons are manned at all times.
Stand-to	The duration of any stand-to varies according to the season and the country but is always for a specific time (not necessarily first and last light). Each member puts on their fighting equipment, occupies fire positions and remains alert. Clearing patrols may be sent out in this period and stand-down ordered only when all tasks are completed and sentries posted.

SECURITY
Tactics
Military Routine
Morning Routine

Communications	All forms of communications are checked and tested.
Security	All sensor devices are checked, tested and repositioned as required. Observation posts (OP) are also checked and repositioned for day routines as ordered.
Weapons and Ammunition	Avoid cleaning all weapons simultaneously. Individuals in pits should remain alert while the buddy checks and cleans theirs. The cleaning and inspection of light support weapons must be coordinated, so that not all are out of action together. Soldiers are responsible for reporting any defects or requirements for deeper maintenance.
Administration	Troops conduct ablutions, an free from infestation/infection inspection is undertaken and water bottles are filled and sterilised. Breakfast may be cooked or eaten in pairs under section arrangements. Any anti-malarial or other drugs are taken. The section area is cleaned, equipment laid out for specific use and camouflage refurbished. Clothing and equipment is checked and repaired as required.
Briefings	The section or team is briefed on the day's activities, patrol requirements, duties, rest requirements and any special tasks.
Tasks	Operational tasks are prepared and undertaken, such as reconnaissance, area improvements, camouflage and wiring.

Evening Routine

SECURITY
Tactics
Military Routine
Evening Routine

Weapons / Ammo / Equip	Re-clean and check all weapons, ammunition natures and equipment.
Personal Hygiene	Re-check personal hygiene, reapplying medications as required for foot and crotch care and conduct a further free from infestation/infection inspection.
Prepare and Conduct Night Routine	The evening meal is eaten and orders for the night are issued. These include preparations for the evening such as sentry rosters, OP/listening posts, checking night vision equipment, clearing patrols and preparations for night activities. Personal equipment is prepared and laid out for the evening as required. Rest is taken and security is maintained throughout the evening hours.
Tasks	The force is then prepared for night patrols and so on.

Rest Periods

SECURITY
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Military Routine
Rest

Rest Periods	Rest periods are a requirement and, if not placed in the soldier's routine, can lead to sleep loss, fatigue and stress.
Rest Programs	Commanders must take every opportunity to program rest periods which include a periodic release from duty, sleep periods for those on 24-hour duties.
Sleep	As a rule, every soldier should attempt to get 4 to 5 hours of unbroken sleep daily.

Military Food Acquisition

SECURITY
Tactics
Military Routine
Military Food Acquisition

Fresh Rations	These are fresh foodstuffs made available through the catering and supply system for consumption in established kitchens, or field kitchens, in a camp or secure defended area. They are prepared by catering personnel allotted to the unit.
Individual Meal Combat Ration	The individual meal combat ration provides sufficient rations for one soldier for one meal and is prepared by the soldier.
Combat Rations One Man	The combat rations one man is designed to last 24 hours and offers five different menus. It is designed to ensure that a soldier receives the energy and vitamins required each day for demanding operations. The combat rations one man is prepared by the soldier and it is recommended that all the food in the pack be consumed.
Patrol Ration One Man	The patrol ration one man consists of two dehydrated main meals and a number of sundry items. This ration is designed to ensure that a soldier receives sufficient energy and vitamins for 24 hours.
Combat Ration Five Man	The combat ration five man consists of three main meals and a number of sundry items, capable of feeding five soldiers for one day. Most items consist of portion-controlled packs for individual meals and are prepared collectively by the soldiers.
Emergency Rations	Emergency rations consist of high energy chocolate bars designed to provide sufficient energy for a short period, until other food is available.
Locally Acquired Food Sources	On some types of operations, there may be a requirement to purchase food stuffs from local sources. Caution should be exercised in relation to hygiene standards. Unit SOP may dictate the extent of local acquisition or ban it entirely.

General Combat Tactics

SECURITY
Tactics
General Combat Tactics

Exploiting Prevailing Weather	The tactical use of weather as a force multiplier has influenced many important battles throughout history, such as the Battle of Waterloo.
Fire Attacks	Reconnaissance by fire is used by apprehensive soldiers when they suspect the enemy is nearby.
Force Concentration	The practice of concentrating a military force against a portion of an enemy force.
Night Combat	Combat that takes place at night. It often requires more preparation than combat during daylight and can provide significant tactical advantages and disadvantages to both the attacker and defender.
Reconnaissance	A mission to obtain information by visual observation or other detection methods, about the activities and resources of the enemy or potential enemy, or about the meteorologic, hydrographic, or geographic characteristics of a particular area.
Smoke Screening	The practice of creating clouds of smoke positioned to provide concealment, allowing military forces to advance or retreat across open terrain without coming under direct fire from the enemy.

SECURITY
Tactics
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Small Unit Tactics

Individual Movement Techniques
Individual movement techniques or IMTs (also known as infantry minor tactics in Australia) are the most basic tactics that are employed at the fire team, squad, section or platoon level. They are similar in most modern armies. In most situations except static defence, IMTs are based on the principle of fire and movement. That is, firing and moving as fire teams, with one team suppressing (supporting) the enemy whilst the other moves either toward the enemy or to a more favourable position. The movement is often only 5–10 metres per move. When closing on the enemy position, the team breaks down into pairs for better angles of suppression, and this technique is referred to as "pepper-potting" (British/Commonwealth).

The United States Army focuses on the three individual movement techniques of high crawl, low crawl, and 3-5 second rush. Individual movement techniques are typically taught to all arms and services both in basic training and often also whilst undergoing non-infantry specialty training. In some military forces, such as the Australian Army, the entire British Armed Forces and the United States Military, all units in the field force regardless of corps, regiment, trade or specialty are supposed to undergo annual refresher training in IMTs, on the basis that all soldiers can be expected to at least provide local security for their unit.

Most IMTs are taught in the form of a battle drill, a series of choreographed steps that occur automatically in reaction to certain stimuli, such as sighting an enemy to the front, or being fired upon by an enemy from the flank. The initial stages of the drill are always the same and therefore action does not require full appraisal of the situation. Such stimulus-response training allows coordinated responses without the need for direct orders. In combat, this allows the first few moments of the engagement to occur almost automatically and gives the soldiers a way to respond appropriately and predictably while the unit commander evaluates the situation prior to issuing orders.

Fire and Movement	Working in 'fire teams', one team attempts to suppress the enemy while the other moves either toward the enemy or to a more favourable position.
Basic Drill	A standard drill that all individual soldiers are supposed to perform if they come under fire.
Contact Drill	
Immediate Ambush Drill	
Counter Ambush Drill	

Hull-Down											
Shoot-and-Scoot											
Infiltration Tactics											
Marching Fire	**Four Fs** find, fix, flank, finish	**Overwatch** ● Bounding overwatch	**Centre Peel** ○								
Patrolling	**Reconnaissance Patrol** ○	**Fighting Patrol** ○	**Standing Patrol (OP/LP)** ○								
Ambush	**Linear Ambush** ○	**L Ambush** ○	**Area Ambush** ○								
Guerrilla											

Offensive Tactics

Charge	Highland Charge ○										
Ambush											
Skirmish											
Trench Raiding											
Peaceful Penetration											
Rapid Dominance	**Blitzkrieg** A method of warfare whereby an attacking force is spearheaded by a dense concentration of armoured and motorized or mechanized infantry formations, and heavily backed up by close air support	**Carpet Bombing** Also known as saturation bombing, is a large aerial bombing done in a progressive manner to inflict damage in every part of a selected area of land.	**Human Wave Attack** ○	**Shock Tactics** ○	**Swarming** ○						
Planned Attack	**Supporting Fire** ○	**Ambush** ○	**Indirect Fire Support** ○	**Base of Fire** ○	**Flying Wedge** ○	**Armoured Spearhead** ○	**Encirclement** ○	**Hammer and Anvil** ○	**Inverted Wedge** ○	**Frontal Assault** ○	**Holding Attack** ○
Planned Attack	**Penetration / Infiltration** ○	**Pincer Movement** ○	**Bull Horn Formation** ○	**Flanking Manoeuvre** ○							
Interdiction	Severing or disrupting lines of communication and supply	**Air Interdiction** ○									
Control MSR											
Envelopment Tactics	**Circumvallation** ○	**Finnish Motti Tactics** ○	**Siege** ○	**Vertical Envelopment** ● Airborne Forces ● Air Mobile Forces							
Rapid Deployment	**Capturing Key Points** ○	**Airborne Operations** ○	**Air Mobile Operations** ○	**Amphibious Operations** ○	**Motorized Operations** ○	**Tank Desant** ○	**Mechanized Operations** ○	**Armoured Operations** ○	**Raiding** A small team is inserted deep behind enemy lines to capture a high-value individual or destroy a vital enemy installation then extracted before the enemy can respond		
Decapitation Strike											
Pre-emptive War											
Disrupting Communications	**Electronic Countermeasures** ○	**Radar Jamming** ○	**Radio Jamming** ○								

Defensive Tactics

Basic Principles

Defence in Depth	

Basic Principles

Mutual Support	
Echelon Formation	
Phalanx Formation	
All Round Defence	
Force Dispersal	
Fire Trap	

Fighting Withdrawal

Reserved Demolitions	
Scorched Earth	
Booby Traps	• Minefields
Trench Warfare	

Counter Attack

Breakout	
Counter Battery Fire	
Rapid Reaction Force	

Fortification

Over Head Protection	
Revetting	
Sangars	
Shell Scrapes	
Foxholes	
Manholes	
Spider Holes	
Strong Points	

Terrain Use / Improvement

High Ground o	
Protection o	
Natural Barriers e.g., rivers	
Reverse Slope Defence o	
Obstacles / Barriers (Man Made)	• Barbed wire • Anti-vehicle ditches • Anti-vehicle berms (knife edges)

Other

Delaying Defence	Break Contact o										
Hedgehog Defence	Military Bottleneck o										
Pakfront											
Multiple Axis of Movement											

Topography Restrictions

Topography refers to the shape of the land surface. It includes the degree of slope and the surface material such as bare rock, fertile soil or loose sand. The surface can be covered or saturated with water, or dry. Each of these has a particular effect on military manoeuvre. The following are some effects of topography on military actions:

Topography

● Steeper slopes limit or deny access to vehicles and so access may be limited to dismounted soldiers or air insertion. For the dismounted soldier, movement is strenuous and the need to man-pack loads adds to the level of exertion required.
● At high elevations, the oxygen content of the air is less, making breathing difficult.
● On mountains, observation of close areas can be restricted, although elevated positions offer good observation of large parts of the surrounding area.
● Manoeuvre is restricted in mountain areas. Access is often only possible through naturally formed or artificially made tracks, passes and roads of various standards.
● Mountains can be lightly wooded on the lower slopes, becoming bare as the gradient increases. The bare areas provide little cover or concealment by vegetation but may contain caves and crevices that can be used as fire positions.
● Flat and undulating land offers good going for both foot and mounted forces, allowing large areas to be dominated but at the same time allowing rapid changes in the tactical situation as forces manoeuvre.
● Low land, particularly plains near rivers, is subject to flooding or at least water logging during heavy rain and with a reduction in accessibility.

● Soil conditions in desert areas vary from bare rock to gibber to loose sand. Equipment and tactics need to be modified and adapted to account for dusty and rugged landscapes that can damage suspensions or bog vehicles.
● All equipment is subject to abrasion from sand, and specific lubricants are used to avoid build-up of sand on weapons and so on. With the arrival of sandstorms, the levels of visibility can drop from 50 km to a few metres.
● The soil type affects the way in which soldiers 'dig in' in defensive positions, with special requirements for revetting in sandy soils to prevent collapse and a change to above-ground 'sangars' in rocky ground that cannot be excavated.
● In most parts of the world, the areas with better quality soil are cleared for cultivation. Cultivated areas include open farmland for crops and grazing, rice paddies, market gardens and plantations, or anywhere food or cash crops are grown.
● Some cultivated areas may not contain any crops but have been prepared for planting. Some of these areas have a water supply and are subject to inundation. Cultivated areas, whether cropped or recently ploughed, should be regarded as obstacles, as they provide little concealment, and signs of passage often remain obvious.

● For humanitarian reasons, these areas should be avoided (unless the mission requires their clearance), as local populations depend on these areas for their only source of food and sustainment. There may also be high levels of organic matter such as animal and human faeces leading to increased skin and generalised infection risk.
● Grazing areas generally have most of the larger vegetation removed to encourage the growth of natural grasses and cultivated improved pastures. Herds of domestic animals, like crops, should be avoided for humanitarian reasons and soldiers need to be aware of their position being given away by animal actions such as freezing and looking or stampeding.
● Beach landings across sandy beaches can present 'desert' conditions, at least for the first few metres, while in other areas the foreshore may be swampy and covered with mangroves and create the same challenges as a forest environment, or the terrain may be rugged.
● Operations on islands present particular challenges to the soldier. It is necessary to travel between islands in exposed boats and to disembark onto the shore. This is often difficult to do without detection and the transition from one form of transport to another is an ideal time for engagement. Sound landing drills and discipline are required to achieve success for the landing force.

● Wetlands are created by the rise of the water table beneath the soil, or by water from creeks and rivers flowing into a low-lying area. They also exist along the coast between the high and low tide levels. Wetlands include swamps and bogs, usually covered by specialised flora. In many cases there is little or no canopy or overhead cover but mangrove swamps are an exception to this. Wetlands provide very difficult going for both mounted and dismounted forces, and restrict manoeuvre.
● Forces will need to move from one terrain type to another during operations. For example, close country may be interspersed with cultivated areas, steep slopes, rivers and waterways, and patches of close country may occur in generally open country. The perimeters of urban terrain will interface with other terrain types. The change from one type of terrain to another necessitates changes in formation, mounting or dismounting and thus the threat level is heightened.

Vegetation

The types of plants existing in the natural environment are closely tied to the climate of the region. The following considerations apply to vegetation:

● The vegetation provides much of the concealment that soldiers need to maintain security, and its density and type varies. Camouflage must take account of the background.
● Close country is an area with dense vegetation, as found in temperate and tropical forests, and in jungle. Often the ground is relatively clear of undergrowth in forests but there is usually good overhead cover or canopy.
● Jungle refers to those areas in tropical rainforests adjacent to clearings or streams where the sunlight penetrates, causing the growth of a mass of vines and undergrowth. Indigenous populations in forest areas clear patches of forest for cultivation and this area reverts to jungle when abandoned.
● In both forest and jungle, there is limited observation and restricted fields of fire for most weapon systems. Close country inhibits mounted movement and requires separation of mounted and dismounted FE. Close country affords opportunities for deliberate or immediate ambush by either combatant.
● Open country is characterised by terrain that can be devoid of vegetation, through to savannah and grassland, with copses of lightly forested areas. A key feature of open country for the soldier is the lack of any significant overhead cover or canopy. Open country generally offers good observation in most directions and wide fields of fire for any weapon system.
● Some plants can be dangerous. Examples include gympie bush, a rainforest plant that has stinging barbs on its leaves and the branches of some eucalypts which can fall without warning, causing impact injuries.
● Some particular plants inhibit movement. Examples include 'wait-a-while' vines whose barbs catch on skin and clothing, the above-ground root systems of mangroves and moss that can make rocky surfaces very slippery.
● Water and food can be safely obtained from some plants such as palms and bamboo. This can be useful in survival situations if the soldier is well-trained in what is safe.

Animals

Generally, most animals will have little effect on military operations with the following being some significant exceptions:

● Animals startled by soldiers' actions can alert the enemy to their presence. Good knowledge of the behaviours of local animal populations can turn this to an advantage for either side.
● Poisonous animals exist on land and in the water. Bites from these can have effects ranging from discomfort to death. Also, the bites of many non-venomous animals can create infected wounds.
● Animals such as crocodiles, tigers and sharks can attack and kill humans.
● Some diseases are carried by animals and transmitted to humans through close contact or bites. Some examples of animals transmitting disease include paralysis tick, mosquito, dogs with rabies, rodents and any bird populations that are infected with avian influenza.
● Some diseases such as amoebic dysentery are caused directly by organisms (amoeba) ingested in impure drinking water.
● Diseases such as cholera and influenza are caused by bacteria and viruses respectively. These diseases can be contracted from airborne particles or direct contact with infected animals or persons.
● In a survival situation, many animals provide a source of food but care must be taken to cook the meat as un-domesticated animals are likely to contain parasites which can affect the consumer.

Deception

Sun Tzu said that all war is based on deception back in the 4th century BC; a wise commander takes measures to let his opponent only react to the wrong circumstances. Diversionary attacks, feints, decoys; there are thousands of tricks that have been successfully used, and still have a role in the future.

Perfidy	Combatants tend to have assumptions and ideas of rules and fair practices in combat, but the ones who raise surrender flags to lure their attackers in the open, or who act as stretcher bearers to deceive their targets, tend to be especially disliked.
False Flag	An ancient ruse de guerre – in the days of sail, it was permissible for a warship to fly the flag of an enemy power, so long as it properly hoisted its true colours before attacking. Wearing enemy uniforms and using enemy equipment to infiltrate or achieve surprise is also permissible though they can be punished as spies if caught behind enemy lines.
Demoralization	A process in psychological warfare that can encourage them to retreat, surrender, or defect rather than defeating them in combat.

Disinformation

Military Camouflage

Stealth Technology

Feint & Diversionary Attacks

Electronic Warfare

Electronic Countermeasures

Electronic Counter-Countermeasures	
Radio Silence	While travelling, a fleet will refrain from communicating by radio to avoid detection by enemy forces.

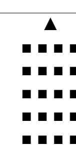
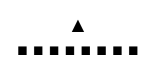
Force Multiplication

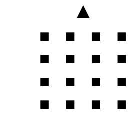
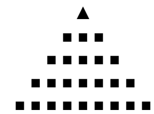
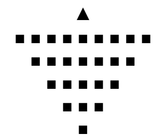
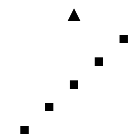
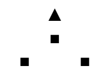
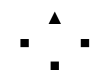
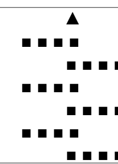
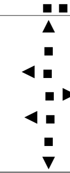
Use of Surprise

Parthian Shot	
Hit-and-Run Tactics	
Irregular Warfare	

Tactical Formation

The following are infantry tactical formations. The arrows indicate which the direction of travel is, or which way the individual faces if more than one arrow.

Column		
Line		

Square		
Wedge		
Inverted Wedge		
Echelon		
Wedge		
Vee		
Staggered Column		
Herringbone		

Military Movement

Route Selection
When patrolling, soldiers should be prepared for enemy contact by selecting a route that allows them to rapidly adopt a fire position that provides cover. When in contact prior to leaving a place of cover, the next position and the best route to it must be selected. The next position must be one from which the soldier can observe and engage the enemy while being covered from enemy fire (fire position). The route should, as much as possible, be clear of obstructions and be short enough to allow the soldier to complete it in less time than the enemy can be expected to take to acquire a sight picture. It must conform to the axis of advance. The method of movement (run, walk, crawl etc.) must be determined to match the tactical situation and the amount of cover available. To provide the section with all-round observation and protection, each soldier has an arc of responsibility. This arc is observed and covered with the weapon, while moving and when in a fire position. When not being engaged, the soldier will not actually adopt a fire position, but must be selecting positions so as to be prepared to do so if the enemy engages. Each soldier must choose the best route according to the threat and environment, using speed, deception and cover to continue advancing from fire position to fire position, planning each movement in advance.

Once engaged, the soldier applies the following basic drill: 1. run, 2. down, 3. crawl, 4. observe, 5. aim, 6. fire, and 7. move again.	Identification of Potential Enemy Positions. Identifying potential enemy positions assists in finding and planning the safest route and the locations that should be checked include: (1) positions of elevation such as dominating buildings and rooftops, high ground, towers, trees; (2) windows or other openings facing down the street; and (3) foliage, rubble, vehicles and industrial material that provide cover or concealment.
Blind Spaces	Each soldier must be aware that there are areas of the battlespace that are not visible to that soldier. However, with a dispersed fire team, other members of the team may be able to observe some or all of these areas. Figure 3–16 shows blind spaces associated with a single building. In urban terrain, there will be far more extensive areas of blind space. In thick vegetation, much of the area will be blind space.

Movement Methods

Movement Methods	Each soldier should know how to combine techniques of concealment and cover with movement in all environments. Different methods of movement are required for different heights of cover. The following are important considerations for any soldier planning to change position: ● a. Movement of foliage or stirred up dust can attract the enemy's attention. ● b. The reaction of local populations, animals or birds can attract attention. ● c. All movement should be covered by observation and the ability to apply fire from within the section. ● d. Movement during any distraction, such as loud noises or low flying aircraft can assist in covering movement. ● e. Fog, smoke, or haze can assist in concealment.
Patrolling	On a dismounted patrol, the method of movement is the walk. This is not just a stroll but involves deliberate movement between potential fire positions while maintaining observation and weapon orientation. It is important that the body is kept balanced in preparation for rapid deployment.
The Monkey Run	The monkey run is useful when moving behind low cover or through dead ground. The monkey run involves the following: ● a. holding the weapon in the master hand; ● b. using the non-master hand and feet (or knees) as a balanced three-point support to 'run' while keeping a low profile; and ● c. ensuring that observation is maintained.
The Leopard Crawl	The leopard crawl involves crawling on the elbows and the inside of the knees. It is useful when moving behind very low cover, when moving to a fire position and during the break-in and fight-through of an assault. It involves the following: ● a. holding the weapon with the master hand on the pistol grip with the butt over the forearm and the weapon balanced in the crook of the elbow of the non-master arm; and ● b. moving alternate elbows and knees, the weight of the body is carried on the forearm and the inner calves. The body is rolled slightly as each knee is bent. With the leopard crawl, the weapon is not immediately ready for use but the body is as low as possible. If it is necessary to have the weapon more readily available it can be held horizontal in front of your face. This will have the effect of raising the body somewhat and is more physically demanding. In either method, observation must be maintained.
The Stomach Crawl	The stomach crawl is a very quiet means of closing with the enemy used mainly at night. It is slow and tiring. Lie on the stomach and search the ground ahead for twigs, dry leaves and trip wires with the non-master hand. Lift the body on the forearms and toes, press the body forward, and lower it to the ground. The weapon should be moved with the master hand. As a result, this method should only be used when extreme caution is required or when crossing open ground with sparse cover. When using this method the head is pressed as close to the ground as is possible, and as a result frequent stops must be made in order to observe and listen.
The Roll	The roll is a very quick method of moving away from a position when already in the prone position. The arms and the weapon remain close to the body so that the body will roll quickly.
Rushing	The rush is the fastest means of moving from one position to another and is usually used when crossing ground that provides no cover while under enemy fire. It involves bursting quickly from cover as soon as covering fire is effective and moving as fast as possible by the shortest route to the new position, then applying the basic drill. When facing frontal fire, the soldier should zigzag to make it more difficult for the enemy to effectively aim their weapons. If enfilade fire is expected, a direct route will minimise the time of exposure.

Movement at Night

When using NFE, the vision through the NVG is tunnelled and thus the ground immediately in the soldier's path is not seen without moving the head. The monocular does not provide depth perception. Additional care must be taken to identify and avoid any hazards.

11 Strategy

Offensive

Air Superiority	Essential to a successful air campaign. It is achieved by 1) mastery of the air, 2) attacking the means of production, 3) maintain battle ourselves, 4) prevent the enemy from battle
Attrition Warfare	A strategy of wearing down the enemy to the point of collapse through continuous loss of personnel and material. Used to defeat enemies with low resources and high morale.
Bait and Bleed	To induce rival states to engage in a protracted war of attrition against each other "so that they bleed each other white", similar to the concept of divide and conquer.
Battle of Annihilation	The goal of destroying the enemy military in a single planned pivotal battle.
Bellum se ipsum alet	A strategy of feeding and supporting an army with the potentials of occupied territories.
Blitzkrieg	An attack that uses concentrated force and rapid speed to break through enemy lines, named after the German World War II strategy meaning Lightning War.
Blockade / Siege	An attempt to cut off food, supplies, war material or communications from a particular area by force, usually taking place by sea.
Clear and Hold	A counter-insurgency strategy.
Coercion	Compelling the enemy to involuntarily behave in a certain way by targeting the leadership, national communications, or political-economic centres.
Command of the Sea	The naval equivalent of air superiority.
Counter-Offensive	A strategic offensive taking place after the enemy's front line troops and reserves have been exhausted, and before the enemy has had the opportunity to assume new defensive positions. Tactic is usually implemented through surging at the enemy after their attack..

SECURITY	Strategy	Offensive		**Counterforce**	A strategy used in nuclear warfare of targeting military infrastructure (as opposed to civilian targets)
				Countervalue	The opposite of counterforce; targeting of enemy cities and civilian populations. Used to distract the enemy.
				Decapitation	Achieving strategic paralysis by targeting political leadership, command and control, strategic weapons, and critical economic nodes.
				Divide and Conquer	Bringing a large portion of one's own force to bear on small enemy units in sequence, rather than engaging the bulk of the enemy force all at once.
				Deception	A strategy that seeks to deceive, trick, or fool the enemy and create a false perception in a way that can be leveraged for a military advantage.
				Denial	A strategy that seeks to destroy the enemy's ability to wage war.
				Distraction	An attack by some of the force on one or two flanks, drawing up to a strong frontal attack by the rest of the force.
				Encirclement	Both a strategy and tactic designed to isolate and surround enemy forces.
				Ends, Ways, Means, Risk	Strategy is much like a three legged stool of ends, ways, means balanced on a plane of varying degree of risk
				Exhaustion	A strategy that seeks to erode the will or resources of a country.
				Feint	To draw attention to another point of the battle where little or nothing is going on.
				Flanking Manoeuvre	Involves attacking the opponent from the side, or rear.
				Guerrilla Tactics	Involves ambushes on enemy troops. Usually used by insurgency.
				Heavy Force	A counterinsurgency strategy that seeks to destroy an insurgency with overwhelming force while it is still in a manageable state.
				Human Wave Attack	An unprotected frontal attack where the attacker tries to move as many combatants as possible into engaging close range combat with the defender.
				Incentive	A strategy that uses incentives to gain cooperation.
				Indirect Approach	Dislocation is the aim of strategy. Direct attacks almost never work, one must first upset the enemy's equilibrium, fix weakness and attack strength, Eight rules of strategy: 1) adjust your ends to your means, 2) keep your object always in mind, 3) choose the line of the least expectation, 4) exploit the line of least resistance, 5) take the line of operations which offers the most alternatives, 6) ensure both plans and dispositions are flexible, 7) do not throw your weight into an opponent while he is on guard, 8) do not renew an attack along the same lines if an attack has failed.
				Interior Lines	Placing one's forces in between the enemy forces and attacking each in turn in order to allow one's forces to have better communications and allows one to mass all of one's forces against a part of the enemies.
				Limited War	A war in which the survival of a nation is not at stake.
				Penetration	A direct attack through enemy lines, then an attack on the rear once through.
				Periclean Strategy	The two basic principles of the "Periclean Grand Strategy" were the rejection of appeasement (in accordance with which he urged the Athenians not to revoke the Megarian Decree) and the avoidance of overextension.
				Persisting Strategy	A strategy that seeks to destroy the means by which the enemy sustains itself.
				Pincer Ambush	A "U"-shaped attack with the sides concealed and the middle held back until the enemy advances, at which point the concealed sides ambush them.
				Pincer Manoeuvre	Allowing the enemy to attack the centre, sometimes in a charge, then attacking the flanks of the charge.
				Punishment	A strategy that seeks to push a society beyond its economic and physiological breaking point.
				Rapid Decisive Operations	Compelling the adversary to undertake certain actions or denying the adversary the ability to coerce or attack others..
				Raiding	Attacking with the purpose of removing the enemy's supply or provisions.
				Refusing the Flank	lding back one side of the battle line to keep the enemy from engaging with that flank. The refused flank is held by smallest force necessary to hold out against the enemy's attack while concentrating the main battle force against the enemy's centre or other flank.
				Separation of Insurgents	A counterinsurgency strategy should first seek to separate the enemy from the population, then deny the enemy re-entry, and finally execute long enough to deny the insurgent access.
				Scorpion Attack	A pincer attack that is supplemented by an air strike.
				Shape, Clear, Hold, Build	The counterinsurgency theory that states the process of winning an insurgency is shape, clear, hold, build.
				Siege	Continuous attack by bombardment on a fortified position, usually by artillery.
				Shock and Awe	A military doctrine using overwhelming power to try to achieve rapid dominance over the enemy.
				Swarming	Military swarming involves the use of a decentralized force against an opponent, in a manner that emphasizes mobility, communication, unit autonomy and coordination/synchronization.
				Theatre Strategy	Concepts and courses of action directed toward securing the objectives of national and multinational policies and strategies through the synchronized and integrated employment of military forces and other instruments of national power.
				Total War	War in which a nation's survival is at stake.
				Troop Surge	Deploying a large number of troops into theatre in order to overcome resistance.
				Turning Manoeuvre	An attack that penetrates the enemy's flank, then curls into its rear to cut it off from home.

SECURITY Strategy Defensive

Win Without Fighting	Sun Tzu argued that a brilliant general was one that could win without killing anybody.

Defensive

Boxing Manoeuvre	Boxing manoeuvre – A strategy used to "box in" and force an attack on all sides at once.
Choke Point	A use of strategic geography, usually in a narrow area, intended to concentrate the enemy into a confined area where the defender can maximize his forces.
Defence in Depth	A strategy to delay rather than prevent the advance of the attackers by buying time and causing additional casualties by yielding space so that the momentum of the attack is lost and the attacking force can be attacked on its flanks.
Elastic Defence	A strategy to flexibly absorb then repel the advance of attackers through carefully planned integrated fighting positions, perfected by the German Army in WWI.
Fortification	A semi-permanent or permanent defensive structure that gives physical protection to a military unit.
Fabian Strategy	Wearing down the enemy by using attrition warfare and indirection, while avoiding pitched battles or frontal assaults. Named after Quintus Fabius Maximus Verrucosus in his defence against Carthage. See Pyrrhic warfare.
Military District	An area controlled by a military force, for administrative purposes rather than combat. Also known as Wehrkreis in German.
Scorched Earth	Destroying anything that might be of use to the enemy while retreating, or advancing.
Turtling	Continuous reinforcement of the military front until it has reached its full strength, then an attack with the now-superior force.
Withdrawal	A retreat of forces while maintaining contact with the enemy.

Concepts

Centre of Gravity	The hub of all power and movement on which everything depends, the point at which all energies should be directed.
Decisive Point	A geographic place, specific key event, critical system, or function that allows commanders to gain a marked advantage over an enemy and greatly influence the outcome of an attack.
DIME(FIL)	The elements of national power diplomacy, information, military, and economics, often included are financial, intelligence, and law enforcement see MIDLIFE.
Expediency	War is a matter of expedients – von Moltke.
Fog, Friction, Chance	War is characterized by fog, friction, and chance.
Golden Bridge	To leave an opponent an opportunity to withdraw in order to not force them to act out of desperation – Sun Tzu.
Iron Calculus of War	Resistance = Means x Will – Clausewitz.
MIDLIFE	The elements of national power diplomacy, information, military, and economics, often included are financial, intelligence, and law enforcement, see DIME(FIL).
Moral Ascendancy	Moral force is the trump card for any military event because as events change the human elements of war remain unchanged – Du Piq.
OODA Loop	Decision-making occurs in a recurring cycle of observe-orient-decide-act. An entity (whether an individual or an organization) that can process this cycle quickly, observing and reacting to unfolding events more rapidly than an opponent, can thereby "get inside" the opponent's decision cycle and gain the advantage – Boyd.
Paradoxical Nature	The nature of strategy is a paradoxical and does not follow a linear pattern – Luttwak.
Positive Ends	The possibility of taking advantage of a new security environment to create conditions for long-term peace – Wass de Czege
Primary Trinity	(1) primordial violence, hatred, and enmity; (2) the play of chance and probability; and (3) war's element of subordination to rational policy – Clausewitz.
Secondary Trinity	People, Army, and Government – Clausewitz.
Systems Approach	Nation-states operate like biological organisms composed of discrete systems. These systems included: leadership, organic essentials, infrastructure, population, and the military – Warden
Tipping Point	The point at which "the momentum for change becomes unstoppable." – Gladwell.
VUCA	Volatility, uncertainty, complexity and ambiguity characterize the strategic environment – U.S. Army War College.

Principles of War

Objective	Direct every military operation towards a clearly defined, decisive, and attainable objective.
Offensive	Seize, retain, and exploit the initiative.
Mass	Concentrate combat power at the decisive place and time.
Economy of Force	Allocate minimum essential combat power to secondary efforts.
Manoeuvre	Place the enemy in a disadvantageous position through the flexible application of combat power.
Unity of Command	For every Objective, ensure Unity of effort under one responsible commander.
Security	Never permit the enemy to acquire an unexpected advantage.

Surprise	Strike the enemy at a time, at a place, or in a manner for which he is unprepared.
Simplicity	Prepare clear, uncomplicated plans and clear, concise orders to ensure thorough understanding

Weinberger-Powell Doctrine

A list of questions have to be answered affirmatively before military action is taken by the United States.

- Is a vital national security interest threatened?
- Do we have a clear attainable objective?
- Have the risks and costs been fully and frankly analysed?
- Have all other non-violent policy means been fully exhausted?
- Is there a plausible exit strategy to avoid endless entanglement?
- Have the consequences of our action been fully considered?
- Is the action supported by the people?
- Do we have genuine broad international support?

Economic Concepts

- Always pay your troops on time.
- Ensure the cost of enemy losses (or objectives) is at least an order of magnitude higher than the costs of attacking.
- Ensure there is sufficient funds and revenue streams to finish the war.

12 Evasion

How to escape and keep evading people, search dogs, gangs or even the government.

Escaping

How to escape from a location if you're being held against your will, such as a prison or concentration camp.

Evading

How to evade authorities, governments or search parties who are actively looking for you.

Changing Identity

How to change your identity to help prevent detection and keep you ahead of any pursuers.

Removing Your Digital Presence

The first step in changing your identity is to eliminate all personal electronic devices which can give away your future identity. Governments can easily track the location of your phone - even when it's off, they can take pictures with your phone and can listen in to calls and can listen in even if you're not on a call. If you're dedicated to changing your identity you may have to give up on a phone and comunication technology altogether. If you know you're being tracked you may want to leave your phone with a friend to make it look like you're just going about your daily life as normal to give you more time to complete the identity change.

Items that can track you today:
- Mobile Phone - Can track you via GPS, WiFi, Bluetooth, Cameras and the Microphone.
- Smart Watches and Health Devices - Can link to mobile phones and track you in all the same ways and more, including heart rate.
- Bank Cards - Once a transaction is made they can positively identify you are in that area.
- Cars - Some cars have tracking software, but particularly hired cars.
- Computers - Computers and laptops can be used to identify your position via IP addresses and WiFi as well as any attached cameras.
- Swipe Cards - Such as those used for entering buildings such as Gyms and office buildings will give away your position.

Changing Your Appearance

Changing your appearance is the next step in changing your identity. Robin Williams was lucky enough to have his own make-up artists and mask builders in 'Mrs Doubtfire', but you probably won't have any contacts like that who will keep your new identity a secret. Therefore you will likely have to make all these changes yourself. The main goal of this step is to make you look 'generic' and boring with no easily identifiable features.

Here's a list of recommended changes you can make to help you look like a new person:
- Full Face Mask - If you want to go all the way you could use a full-face mask like the ones used in Mission Impossible or Mrs Doubtfire.
- Hair Length - It's easier to go shorter than longer, however wigs are an option.
- Hair Colour - Change the colour of your hair, or wear a coloured wig as mentioned above.
- Haircut Style - Change the style of your haircut to something radically different.
- Glasses - If you wear glasses, try to move to contacts, or if you don't try wearing glasses that just look prescription, sunglasses are another good option.
- Eye Colour - This can be done with contact lenses.
- Makeup - Wear some makeup and eyeliner if you don't usually and go without if you normally do.
- Facial Hair - Try growing it out or shortening it if you're able.
- Bling - Change around the items you wear on your body like necklaces, watches, rings and bangles.
- Piercings - If you have some piercings remove them, and if you don't try adding clip-on ones.
- Tattoos - Removing tattoos is difficult but can be done to some extent. If you don't have any, you could buy some temporary tattoos.
- Body Mass - You could add some stuffing for a little extra body mass if you're a thin or average build.
- Clothing - Change your clothing style entirely, something generic and plain with no words, brands, symbols or band names etc.

There are quite a few additional things you can change about yourself to make you harder to detect such as:
- Always wear sunglasses in public - This will greatly reduce your chance of getting a visual match on your face, particularly if they are large aviators.
- Always wear a hat in public - This can eliminate the chance that cameras high up will match your face.
- Wearing a particle mask such as most of the population in China could reduce your chances of a camera identifying you.

Changing Your Locality

There's no point in changing your identity if you hang out in all the old places you usually do. The next step is to 'secretly' move house without letting others know. This is the point where being a minimalist would come in extremely handy, when you can pack everything you own into a single car or backpack. You may have to pre-arrange to live with a (distant) friend or family member both in terms of your relationship with them and their distance away from your current place. The most ideal location would be somewhere in the bush in a small town where there's little digital surveillance.

Changing Your Accent

Changing an accent is quite difficult to do, but can be done with enough practise and repetition. Try watching YouTube videos on the desired accent you want to achieve, however as per the first step above, it's recommended you download these videos before starting your identity change or they may be able to trace you. Better yet, if you can speak a second language, you could only speak that and pretend you don't speak your original one. Alternatively you could learn a new language from scratch and exclusively speak that.

Changing Your Personality

Changing your personality is another difficult one to accomplish since it's hardwired into you from birth. Over time though you can slowly forge a new personality. There is a list of personalities in the POPULATION > Personalities section which you can go through to choose one you feel you can emulate.

Changing Your Mannerisms

There are cameras in China that can identify you by the way you walk. To fully hide from this kind of technology within a city you will need to change every aspect about the way your move, including your unconscious mannerisms. This is probably the hardest part of the journey as you often don't realize you do them such as writing left or right handed.

Speech Mannerisms	● Uses a falling inflection ● Ends sentences with question marks ● Speaks in a whisper ● Always talks over others ● Tendency to mumble ● Slurs words, even when sober ● Has a sing-song speech pattern	● Shortness of breath from talking too fast ● Unnecessary or exaggerated throat clearing ● Deep breaths between every sentence ● Constantly swallowing when nervous ● Heavy reliance on buffer words: “Like,” “Um,” “Uh,” “Totally,” “Basically,” “You know”	
Noise Mannerisms	● Whistling ● Humming ● Sighing ● Stuttering ● Coughing ● Scoffing	● Laughter to fill in uncomfortable silences ● Muttering to oneself ● Noisy breathing ● “Sorry” ● “Tsk” ● “God”	
Head Mannerisms	● Tilting head in thought ● Hair tossing ● Hair playing or twirling when flirting ● Head bobbing while listening to music ● Grinding teeth ● Scratching the head ● Flaring nostrils	● Rubbing the neck when embarrassed ● Raised eyebrows ● Head on the chin in resting position ● Jaw clenching in moments of tension ● Sweating excessively ● Jutted chin ● Nose twitching or wrinkling	
Mouth Mannerisms	● Smacking lips in satisfaction ● Mouthing the lyrics of a song ● Licking the lips when nervous ● Sticking out the tongue while thinking ● Counting teeth with the tongue when distracted	● Biting the bottom lip ● Pulling at the bottom lip ● Biting the inside of the cheek ● Movement of the mouth: quivering, curling, pursed, twitching, tensed	
Eye Mannerisms	● Sideways glance ● Likes to wink ● Fluttering eyelids ● Tendency to look down one’s nose ● Eyes that dart everywhere ● Tendency to avoid eye contact ● Always breaking eye contact ● Prolonged eye contact in conversation	● Looking down at feet while walking ● Rapid blinking when lying ● Frequently gazes off into space ● Has a thousand-yard stare ● Movement of the eyes: rolling, squinting, twitching ● Description of the eyes: wide, glassy, crossed, dilated, narrowed	
Hand Mannerisms	● Movement of the index finger: pointing, jabbing downwards, stabbing the air ● Arms crossed over chest ● Pinching the bridge of the nose ● Rubbing the temple ● Stroking chin in thought ● Tracing scars without thinking ● Standing with hands clasped behind back ● Doodling absently ● Wiping clammy hands ● Tightly clenched hands ● Running a hand through the hair	● Standing with hands in pocket ● Picking or pinching at the flesh ● Covering mouth with a hand when smiling ● Rubbing the tips of fingers together ● Hooking a thumb in pockets while standing ● Braiding hair automatically ● Covering mouth while chewing or laughing ● Passing a hand over the face when tired ● Flexing fingers and cracking knuckles ● Drumming fingers on a surface or twiddling thumbs ● Swinging arms back and forth when walking	● Steepled hands ● Snapping fingers ● Rubbing the eyes ● Touching the nose ● Tugging at ear ● Wild gesturing while talking ● Biting fingernails
Upper Body Mannerisms	● Shrugging shoulders ● Dropping shoulders ● Swaying while standing	● Slouching, slumping posture ● Tight, drawn-in shoulders when sitting ● Broad stance when standing	

Leg Mannerisms	● Crossing legs when sitting ● Foot drags while walking ● Foot stamping ● Foot tapping ● Legs will uncontrollably shake ● Strides quickly when walking ● Stands too close to others when talking	● Knees knocking against each other ● Rocking back and forth on heels ● Shifting weight from one foot to the other ● Pacing back and forth in a room ● Sitting, legs apart ● Bouncing leg up and down in a chair	
Interactive Mannerisms	● Adjusting or pushing up glasses ● Putting earpiece of glasses in mouth ● Has a cigarette always dangling out of mouth ● Always buttoning and unbuttoning coat ● Always sitting on the very edge of chair ● Hands habitually on coat lapels ● Chewing the tip of a pen or pencil ● Jingling money in pockets ● Playing with the marker ● Tugging at pants before sitting ● Tearing at a napkin at the table ● Checking watch repeatedly	● Using a toothpick at all times ● Touching up makeup constantly ● Repeatedly checking cell phone ● Twirling a pencil at a desk ● Clicking a ballpoint pen open and close ● Playing with a Rubix Cube when bored ● Shredding paper without thinking ● Peeling labels from bottles ● Bending paperclips in half ● Twisting the rings on fingers ● Leaning against the wall while talking ● Tugging at collar of shirt when nervous	● Peering over glasses ● Tipping chair back ● Cleaning their glasses ● Fiddling with earrings ● Smacking gum

Changing Your Identification

If you still use your old documentation such as a birth certificate and drivers licence you will need to secure new (faked) forms of identification. This would be amazingly simple if you have an identical twin, but unfortunately most people don't.

Changing Your DNA

Unfortunately changing your DNA isn't possible. The alternative is to try to make as little contact as possible with the surfaces you interact with. In the 1997 movie Gattaca, DNA and any evidence of Vincent's existence was methodically cleaned, vacuumed and wiped after doing anything. It may be extreme, but if you need to do this, it's certainly an option.

Shadowing

Shadowing is covertly following a person without being detected in one instance or over multiple instances usually to obtain information or to find an opportunity to confront them. It's generally used to gather intelligence on the 'mark'.

Being Stalked

Being stalked is a pattern of unwanted behaviour where an individual (who often knows the person) is tracking someone's movements over a period. The perpetrator's intent is to harass, intimidate, control, threaten, or cause fear or distress to the victim.

Behaviors (can include, but are not limited to):
● Repeatedly following or loitering near someone (at home, work, places they frequent).
● Unwanted contact through any means: repeated calls, texts, emails, social media messages, letters, unwanted gifts.
● Surveillance: Watching, monitoring, or tracking a person's movements, activities, or communications (including using technology like GPS trackers, spyware, or constantly checking social media).
● Interfering with property: Vandalism, leaving unwanted items.
● Making threats: Direct or indirect threats of harm to the person, their loved ones, or pets.
● Spreading rumors or publishing private information.
● Using third parties to contact or gather information about the victim.

If you suspect you are being stalked, it's crucial to document all incidents (dates, times, locations, descriptions of behavior, screenshots of messages) and seek assistance from law enforcement or support organizations.

Being Followed

Being followed is generally worse than being stalked and implies that the follower doesn't want to be noticed and that they want to do something to cause harm in the opportune moment. They almost always have a line of sight or multiple people to tag in and out with. They may be watching you over the period of a few minutes or keeping tabs on you for over a year. The intent may be innocent, such as wanting to return an item you dropped, or they recognised you from years ago, but oftentimes they want to physically harm the individual - or see them as a target.

Threats can follow you many different ways, these are some of the different combinations.
● You're on foot - the suspect is on foot
● You're on foot - the suspect is in a car
● You're in a car - the suspect is on foot
● You're in a car - the suspect is in a car
● You're stationery (at home) - the suspect is watching from a car
● You're stationery (at home) - the suspect is watching from a nearby building

Terms

Some of the terms used when being followed.

Rough Shadowed	A private investigations industry term that means following someone at close range with the intent of being noticed.
Piggybacking	Two people or cars take turns following you to avoid suspicion.
Caltrops (In a Vehicle)	Always have one side facing up which will puncture tires if driven over. Keep a box in your car for emergencies.

Followed Confirmation

SECURITY Evasion Being Followed

Followed Confirmation

How to tell if you're being followed.

Spotting Someone Multiple Times	If you notice someone three times during your outing, chances are that it might be more than just coincidence. It may that someone is following you and time to change your situational awareness level from condition Yellow to condition Orange.
Someone Matches Your Speed	If someone behind you is continually matching your pace, the alarm bells should ring. The situation will become more revealing if you change your pace several times and the follower continues to match. Chances are that someone is following you.
Excessive Eye Contact	You can't help but make eye contact with others while out in public. There's a normality about making eye contact with a stranger. But when eye contact is "too long" and especially when there are multiple occurrences, you know you're being focused upon. Exception: Some of you gals may simply appear "hot", and I'm sure you're used to being stared at occasionally. You might look at it as a blessing rather than a curse. However don't dismiss it quickly, raise your alert to condition Orange as well.

Action Plan

Immediately upon recognizing that you're being followed, change your posture to one of confidence. Some people tend to slouch and appear weak. If that's you, walk tall. Shoulders back and head up. Criminals look for weak prey, not strong prey.

● Move to a location with more people around, this will help unsettle the pursuer with more witnesses if something happens.
● Slow down, stop, and turn around or sideways. Appear as though you are looking for someone else. Then look right at the person who you suspect is following you. This sudden turn of events may likely thwart the follower who will move on.
● You might turn and confront the follower using your choice of WTF verbiage. Again, most non-professional criminals are looking for an easy target. When you confront them, you are no longer an easy target.
● If you're walking alone and see people nearby walk up them if they look friendly and start chatting to one of them making it seem like you know them.
● Stay in well lit areas, or at night head towards a populated or well secured building such as a bars, banks, police stations, casinos or hospitals which often have security guards nearby.
● Check reflective surfaces instead of looking behind you to gauge if you're being followed.
● Caution: Some people are just plain crazy and arguably shouldn't be out in public. Often it's easy to tell if someone fits in this category. Best not to confront them. Use your best judgement. Not everyone can present a firm, confident, or even threatening posture under the circumstances of confrontation.

Losing a Tail

Use mass transit to your advantage by slipping amongst the people and abruptly changing directions every so often until you lose them. Cause distractions to put the pursuer off their game and become the centre of attention. Change the pursuers mental image of you by removing your jacket or putting on a hat when they've lost sight of you for a second.

Being Tracked

Being tracked is slightly different to being followed. Tracked means that your pursuer has no line of sight to you or which direction you may have gone in. Tracking can even occur days after you've been through that area. Trackers commonly use sniffer dogs to find a scent and follow it.

Search Dogs	While search and rescue dogs are capable, in principle, of being trained as both air scent and trailing dogs, most dog handlers train their dogs to perform only one of these disciplines. Therefore, the most valuable dog team, in terms of obtaining a high probability of detection, is one with a dog that can switch back and forth between air scenting and trailing as conditions dictate. All humans, alive or dead, constantly emit microscopic particles bearing human scent. Millions of these are airborne and are carried by the wind for considerable distances.
Air Scent Dogs	The air scent dog is the type most frequently encountered. This dog finds lost people by picking up traces of human scent that are drifting in the air, and looks for the "cone" of scent where it is most concentrated. This dog will not normally discriminate scents, so there is the possibility of a "false alarm" if other people (searchers, citizens) are nearby. Airscent dogs work best in situations such as large parks or private lands that are closed at the time, since the dog will home in on any human scent. The success of an air scent dog will be affected by a number of factors, including wind conditions, air temperature, time of day, terrain, and presence or absence of contamination (auto exhaust, smoke, etc.). The best conditions for air scent dogs to work are early mornings or late afternoons on cool, cloudy days when there is a light wind.
Trailing Dogs	The trailing dog is often referred to as a "tracking" dog, although "tracking" and "trailing" are not the same to the purist. The trailing dog is directed to find a specific person by following minute particles of human tissue or skin cells cast off by the person as he or she travels. These heavier-than-air particles, which contain this person's scent, will normally be close to the ground or on nearby foliage, so the trailing dog will frequently have its "nose the ground," unlike the air scent dog. A Bloodhound is typically trained for scent discrimination. Each dog is usually worked in a harness, on a leash, and given an uncontaminated scent article (such as a piece of clothing) belonging to the missing person. The dog follows that scent and no other. At times, the dog may track, following the person's footsteps, or air scent, and home in on the subject's scent. Field contamination (scent of others) should not affect his work. He should be able to trail scents on pavements, streets, grass, water, etc. If there is a good scent article and a point where the person was last seen, a trailing dog can be the fastest way to find the victim. Without the scent article and a point where the person was last seen, these dogs cannot work effectively. While those are the two standard types of search and rescue dogs, there are also other dogs trained to find lost people.
Tracker Dog	A tracking dog is trained to follow the path of a certain person. It physically tracks the path of the person, without relying on air scenting. This dog is usually worked in a harness and on leash. This type of dog is effective when pursuing an escaped criminal if no scent article is available. These dogs are also used successfully in search and rescue operations.
Disaster Dog	A disaster dog is trained to find human scent in very unnatural environments, including collapsed structures and areas effected by tornadoes, earthquakes and other disasters. This dog is trained to work on unstable surfaces, in small, confined spaces and other settings not usually found in the wilderness.
Cadaver Dog	A cadaver dog reacts to the scent of a dead human. The dog can be trained for above ground and buried cadaver searches. Although many dogs have the potential to detect human scent, whether dead or alive, the cadaver dog is trained to locate only human remains. The training process includes detection of very minute pieces of cadaver or even blood drops in a specified area.
Water Search Dog	A water search dog is trained to detect human scent that is in or under the water, focusing on the scent of the bodily gases that rise up. As a team, the handler and dog usually work in a boat or along the shoreline. Because of currents and general changes in the water, it can be hard to pinpoint the location of a body. To enhance the chance of location, a diver should be ready to search as soon as the dog indicates. Additional teams, unaware of the previous teams' findings, work independently to indicate a location. This allows team members to determine the most likely location of the body.
Avalanche Dog	An avalanche search dog is trained to detect human scent that is in or under snow, subsequent to an avalanche. These dogs are trained to detect the scent under many feet of snow, sometimes, 15 feet or more!

Materials

Uses and types of materials such as wood, metal and plastic

"Make the workmanship surpass the materials."
Ovid

Introduction

There are virtually an infinite number of materials in the world which can be used, reused and recycled for different purposes. The below items are highly useful for survival situations and have multiple uses. These items could be seen as a list of items to look out for when looting a building depending on your current needs.

Purpose	The aim of MATERIALS is to provide you with a foundational knowledge of the basic elements and materials on earth and the composite materials created from them. It also goes into depth about alternative preparedness uses for items you may have at home which may save your life in a survival situation.
Lost?	● If you wish to craft items from materials, see the CRAFTING section. ● For a list of modern manufactured items and their uses, see the GEAR section. ● For the recommended gear and materials you should grab when scavenging, see the LOCATIONS section. ● For information on materials found in the whild which can be used for crafting, see the SURVIVAL section. ● For information on foraging plants and materials, see the PLANTS > Foraging section. ● For a list of electrical componentry and their uses, see the ELECTRICITY section. ● For more information on wood, see the FUEL and CRAFTING > Woodworking sections.

Contents

1 Chemical Elements

Elements

Element	Atomic Number	Symbol	Group	Period	Atomic Weight	Density	Melt (K)	Boil (K)	Heat Capacity	Electronegativity	Abundance
Hydrogen	1	H	1	1	1.008	0.00008988	14.01	20.28	14.304	2.2	1400
Helium	2	He	18	1	4.002602	0.0001785	—	4.22	5.193	–	0.008
Lithium	3	Li	1	2	6.94	0.534	453.69	1560	3.582	0.98	20
Beryllium	4	Be	2	2	9.0121831	1.85	1560	2742	1.825	1.57	2.8

Boron	5	B	13	2	10.81	2.34	2349	4200	1.026	2.04	10
Carbon	6	C	14	2	12.011	2.267	3800	4300	0.709	2.55	200
Nitrogen	7	N	15	2	14.007	0.0012506	63.15	77.36	1.04	3.04	19
Oxygen	8	O	16	2	15.999	0.001429	54.36	90.2	0.918	3.44	461000
Fluorine	9	F	17	2	18.998403163	0.001696	53.53	85.03	0.824	3.98	585
Neon	10	Ne	18	2	20.1797	0.0008999	24.56	27.07	1.03	–	0.005
Sodium	11	Na	1	3	22.98976928	0.971	370.87	1156	1.228	0.93	23600
Magnesium	12	Mg	2	3	24.305	1.738	923	1363	1.023	1.31	23300
Aluminium	13	Al	13	3	26.9815385	2.698	933.47	2792	0.897	1.61	82300
Silicon	14	Si	14	3	28.085	2.3296	1687	3538	0.705	1.9	282000
Phosphorus	15	P	15	3	30.973761998	1.82	317.3	550	0.769	2.19	1050
Sulphur	16	S	16	3	32.06	2.067	388.36	717.87	0.71	2.58	350
Chlorine	17	Cl	17	3	35.45	0.003214	171.6	239.11	0.479	3.16	145
Argon	18	Ar	18	3	39.948	0.0017837	83.8	87.3	0.52	–	3.5
Potassium	19	K	1	4	39.0983	0.862	336.53	1032	0.757	0.82	20900
Calcium	20	Ca	2	4	40.078	1.54	1115	1757	0.647	1	41500
Scandium	21	Sc	3	4	44.955908	2.989	1814	3109	0.568	1.36	22
Titanium	22	Ti	4	4	47.867	4.54	1941	3560	0.523	1.54	5650
Vanadium	23	V	5	4	50.9415	6.11	2183	3680	0.489	1.63	120
Chromium	24	Cr	6	4	51.9961	7.15	2180	2944	0.449	1.66	102
Manganese	25	Mn	7	4	54.938044	7.44	1519	2334	0.479	1.55	950
Iron	26	Fe	8	4	55.845	7.874	1811	3134	0.449	1.83	56300
Cobalt	27	Co	9	4	58.933194	8.86	1768	3200	0.421	1.88	25
Nickel	28	Ni	10	4	58.6934	8.912	1728	3186	0.444	1.91	84
Copper	29	Cu	11	4	63.546	8.96	1357.77	2835	0.385	1.9	60
Zinc	30	Zn	12	4	65.38	7.134	692.88	1180	0.388	1.65	70
Gallium	31	Ga	13	4	69.723	5.907	302.9146	2673	0.371	1.81	19
Germanium	32	Ge	14	4	72.630	5.323	1211.4	3106	0.32	2.01	1.5
Arsenic	33	As	15	4	74.921595	5.776	1090	887	0.329	2.18	1.8
Selenium	34	Se	16	4	78.971	4.809	453	958	0.321	2.55	0.05
Bromine	35	Br	17	4	79.904	3.122	265.8	332	0.474	2.96	2.4
Krypton	36	Kr	18	4	83.798	0.003733	115.79	119.93	0.248	3	1×10−4
Rubidium	37	Rb	1	5	85.4678	1.532	312.46	961	0.363	0.82	90
Strontium	38	Sr	2	5	87.62	2.64	1050	1655	0.301	0.95	370
Yttrium	39	Y	3	5	88.90584	4.469	1799	3609	0.298	1.22	33
Zirconium	40	Zr	4	5	91.224	6.506	2128	4682	0.278	1.33	165
Niobium	41	Nb	5	5	92.90637	8.57	2750	5017	0.265	1.6	20
Molybdenum	42	Mo	6	5	95.95	10.22	2896	4912	0.251	2.16	1.2
Technetium	43	Tc	7	5	98	11.5	2430	4538	–	1.9	~ 3×10−9
Ruthenium	44	Ru	8	5	101.07	12.37	2607	4423	0.238	2.2	0.001
Rhodium	45	Rh	9	5	102.90550	12.41	2237	3968	0.243	2.28	0.001
Palladium	46	Pd	10	5	106.42	12.02	1828.05	3236	0.244	2.2	0.015
Silver	47	Ag	11	5	107.8682	10.501	1234.93	2435	0.235	1.93	0.075
Cadmium	48	Cd	12	5	112.414	8.69	594.22	1040	0.232	1.69	0.159
Indium	49	In	13	5	114.818	7.31	429.75	2345	0.233	1.78	0.25
Tin	50	Sn	14	5	118.710	7.287	505.08	2875	0.228	1.96	2.3
Antimony	51	Sb	15	5	121.760	6.685	903.78	1860	0.207	2.05	0.2
Tellurium	52	Te	16	5	127.60	6.232	722.66	1261	0.202	2.1	0.001
Iodine	53	I	17	5	126.90447	4.93	386.85	457.4	0.214	2.66	0.45
Xenon	54	Xe	18	5	131.293	0.005887	161.4	165.03	0.158	2.6	3×10−5
Caesium	55	Cs	1	6	132.90545196	1.873	301.59	944	0.242	0.79	3
Barium	56	Ba	2	6	137.327	3.594	1000	2170	0.204	0.89	425
Lanthanum	57	La	3	6	138.90547	6.145	1193	3737	0.195	1.1	39
Cerium	58	Ce		6	140.116	6.77	1068	3716	0.192	1.12	66.5
Praseodymium	59	Pr		6	140.90766	6.773	1208	3793	0.193	1.13	9.2
Neodymium	60	Nd		6	144.242	7.007	1297	3347	0.19	1.14	41.5
Promethium	61	Pm		6	145	7.26	1315	3273	–	1.13	2×10−19
Samarium	62	Sm		6	150.36	7.52	1345	2067	0.197	1.17	7.05
Europium	63	Eu		6	151.964	5.243	1099	1802	0.182	1.2	2
Gadolinium	64	Gd		6	157.25	7.895	1585	3546	0.236	1.2	6.2
Terbium	65	Tb		6	158.92535	8.229	1629	3503	0.182	1.2	1.2
Dysprosium	66	Dy		6	162.500	8.55	1680	2840	0.17	1.22	5.2
Holmium	67	Ho		6	164.93033	8.795	1734	2993	0.165	1.23	1.3
Erbium	68	Er		6	167.259	9.066	1802	3141	0.168	1.24	3.5
Thulium	69	Tm		6	168.93422	9.321	1818	2223	0.16	1.25	0.52
Ytterbium	70	Yb		6	173.045	6.965	1097	1469	0.155	1.1	3.2
Lutetium	71	Lu		6	174.9668	9.84	1925	3675	0.154	1.27	0.8
Hafnium	72	Hf	4	6	178.49	13.31	2506	4876	0.144	1.3	3
Tantalum	73	Ta	5	6	180.94788	16.654	3290	5731	0.14	1.5	2
Tungsten	74	W	6	6	183.84	19.25	3695	5828	0.132	2.36	1.3
Rhenium	75	Re	7	6	186.207	21.02	3459	5869	0.137	1.9	7×10−4
Osmium	76	Os	8	6	190.23	22.61	3306	5285	0.13	2.2	0.002
Iridium	77	Ir	9	6	192.217	22.56	2719	4701	0.131	2.2	0.001
Platinum	78	Pt	10	6	195.084	21.46	2041.4	4098	0.133	2.28	0.005
Gold	79	Au	11	6	196.966569	19.282	1337.33	3129	0.129	2.54	0.004
Mercury	80	Hg	12	6	200.592	13.5336	234.43	629.88	0.14	2	0.085
Thallium	81	Tl	13	6	204.38	11.85	577	1746	0.129	1.62	0.85
Lead	82	Pb	14	6	207.2	11.342	600.61	2022	0.129	1.87	14
Bismuth	83	Bi	15	6	208.98040	9.807	544.7	1837	0.122	2.02	0.009
Polonium	84	Po	16	6	209	9.32	527	1235	–	2	2×10−10
Astatine	85	At	17	6	210	7	575	610	–	2.2	3×10−20
Radon	86	Rn	18	6	222	0.00973	202	211.3	0.094	2.2	4×10−13
Francium	87	Fr	1	7	223	1.87	300	950	–	0.7	~ 1×10−18
Radium	88	Ra	2	7	226	5.5	973	2010	0.094	0.9	9×10−7
Actinium	89	Ac	3	7	227	10.07	1323	3471	0.12	1.1	5.5×10−10
Thorium	90	Th		7	232.0377	11.72	2115	5061	0.113	1.3	9.6
Protactinium	91	Pa		7	231.03588	15.37	1841	4300	–	1.5	1.4×10−6
Uranium	92	U		7	238.02891	18.95	1405.3	4404	0.116	1.38	2.7
Neptunium	93	Np		7	237	20.45	917	4273	–	1.36	≤ 3×10−12
Plutonium	94	Pu		7	244	19.84	912.5	3501	–	1.28	≤ 3×10−11
Americium	95	Am		7	243	13.69	1449	2880	–	1.13	0
Curium	96	Cm		7	247	13.51	1613	3383	–	1.28	0
Berkelium	97	Bk		7	247	14.79	1259	2900	–	1.3	0
Californium	98	Cf		7	251	15.1	1173	(1743)	–	1.3	0
Einsteinium	99	Es		7	252	8.84	1133	(1269)	–	1.3	0
Fermium	100	Fm		7	257	(9.7)	(1125)	–	–	1.3	0
Mendelevium	101	Md		7	258	(10.3)	(1100)	–	–	1.3	0
Nobelium	102	No		7	259	(9.9)	(1100)	–	–	1.3	0
Lawrencium	103	Lr		7	266	(15.6)	(1900)	–	–	1.3	0
Rutherfordium	104	Rf	4	7	267	(23.2)	(2400)	(5800)	–	–	0
Dubnium	105	Db	5	7	268	(29.3)	–	–	–	–	0
Seaborgium	106	Sg	6	7	269	(35.0)	–	–	–	–	0
Bohrium	107	Bh	7	7	270	(37.1)	–	–	–	–	0
Hassium	108	Hs	8	7	277	(40.7)	–	–	–	–	0
Meitnerium	109	Mt	9	7	278	(37.4)	–	–	–	–	0
Darmstadtium	110	Ds	10	7	281	(34.8)	–	–	–	–	0
Roentgenium	111	Rg	11	7	282	(28.7)	–	–	–	–	0
Copernicium	112	Cn	12	7	285	(23.7)	–	~357	–	–	0
Nihonium	113	Nh	13	7	286	(16)	(700)	(1400)	–	–	0

Flerovium	114	Fl	14	7	289	(14)	–	~210	–	–	0
Moscovium	115	Mc	15	7	290	(13.5)	(700)	(1400)	–	–	0
Livermorium	116	Lv	16	7	293	(12.9)	(709)	(1085)	–	–	0
Tennessine	117	Ts	17	7	294	(7.2)	(723)	(883)	–	–	0
Oganesson	118	Og	18	7	294	(5.0)	–	(350)	–	–	0

2 Chemistry

How to create chemical compounds.

Chemical Equivalency

A list of alternative chemicals that are required in some nefarious projects such as creating explosives. Some of the chemicals can be found around the house and are easily accessible.

Acacia Gum Arabic	**Acetic Acid** Vinegar	**Aluminium Oxide** Alumina	**Aluminium Potassium Sulphate** Alum	**Aluminium Sulphate** Alum	**Ammonium Carbonate** Hartshorn	**Ammonium Hydroxide** Ammonia	**Ammonium Nitrate** Salt Peter	**Ammonium Oleate** Ammonia Soap	**Amylacetate** Banana Oil	**Barium Sulphide** Black Ash	**Carbon Carbinate** Chalk
Carbontetrachloride Cleaning Fluid	**Calcium Hypochloride** Bleaching Powder	**Calcium Oxide** Lime	**Calcium Sulphate** Plaster of Paris	**Carbonic Acid** Seltzer	**Cetyltrimethylammoniumbromide** Ammonium Salt	**Ethylinedichloride** Dutch Fluid	**Ferric Oxide** Iron Rust	**Furfuraldehyde** Bran Oil	**Glucose** Corn Syrup	**Graphite** Pencil Lead	**Hydrochloric Acid** Muriatic Acid
Hydrogen Peroxide Peroxide	**Lead Acetate** Sugar of Lead	**Lead Tero-Oxide** Red Lead	**Magnesium Silicate** Talc	**Magnesium Sulphate** Epsom Salt	**Methylsalicylate** Winter Green Oil	**Naphthalene** Mothballs	**Phenol** Carbolic Acid	**Potassium Bicarbonate** Cream of Tarter	**Potassium Chromium Sulphate** Chromealum	**Potassium Nitrate** Salt Peter	**Sodium Oxide** Sand
Sodium Bicarbonate Baking Soda	**Sodium Borate** Borax	**Sodium Carbonate** Washing Soda	**Sodium Chloride** Salt	**Sodium Hydroxide** Lye	**Sodium Silicate** Glass	**Sodium Sulphate** Glauber's Salt	**Sodium Thiosulfate** Photographer's Hypo	**Sulphuric Acid** Battery Acid	**Sucrose** Cane Sugar	**Zinc Chloride** Tinner's Fluid	**Zinc Sulphate** White Vitriol

3 Alternative Uses

This is a list of alternative survival or prepping uses for common items.

Ingredients

Salt

Detaching Leeches	Leeches literally fall from your body within seconds when salt is poured onto them.
Supplemental Use	
Water Purification	Salt can be used with water and electricity to generate chlorine. See the Water Section.
Preserving Food	Salt is a natural preserver and salting meats will help them last longer.
Boiling Water	
Cleaning	• Antibacterial Agent
Medicinal Uses	• Soothes Sore Throats • Topical Treatment • Diuretic
Melting Ice / Snow	
Killing Bacteria	
Removing Rust	
Preventing Cheese Mould	
Prevent Iodine Problems	
Test Egg Freshness	
Cleaning Metals	
Scaling Fish	
Cooking With	

Sugar

Fermentation	Allows the brewing of beers and other alcoholic drinks.
Energy	Sugar gives you short bursts of energy.
Medicinal Uses	• Helps Hydration • Skin Healing • Helps Diabetics
Fuel	Sugar can be fermented into alcohol to create fuels.

Honey

Energy	Honey gives you short bursts of energy.
Medicinal Use	• Wound Healing • Wound Protection • Soothes Throat • Burn Care
Maintaining Blood Sugar	
Healing Properties	

Vinegar

Lemons

Alcohol

Drinking	Drowns your sorrows.
Killing Germs	Kills basically all germs on contact within 10 seconds.
Firelighting	Can be lit with a flame, spark or an electric arc.
Self Defence	Can be turned into a molotov cocktail, lit and thrown at an enemy.

Cooking Oil

Corn Starch

Baking Soda

Cayenne Pepper

Stops Bleeding	
Helps Digestion	One of the major cayenne pepper benefits is the positive effect it has on the digestive system.
Migraine Relief	Researchers suggest that cayenne pepper, due to its spice, is able to stimulate a pain response in a different part of the body.
Prevents Blood Clots	Blood clots are blockages in your arteries and blood vessels that limit blood flow through your circulatory system.
Prevents Allergies	Because cayenne is an anti-inflammatory agent, it has the power to prevent allergies and the symptoms related to allergies.

Kitchen Materials

Hydrogen Peroxide

Water Purification	It can be used to purify water by killing pathogens.
Cleaning Wounds	It can be used to clean wounds and kill most pathogens.

Iodine

Water Purification	Iodine can be used to purify water by killing pathogens.

Tinfoil

Light Reflector / Signaller	The reflective properties of tinfoil can be used as a signalling device.
Water Container	It can be used to hold water temporarily.
SODIS Reflector	Place behind a clear bottle to reflect the suns rays back through the bottle to improve SODIS effectiveness.
Heat Reflector	Can be used to reflect heat towards or away from something.
Pot Lid	Used as a lid to keep the heat in thus boiling water faster.

Garbage Bag

Rain Poncho	Can be used for rain protection if nothing else is available.
Water Collector	Can be used to collect rainwater.
Water Container	Store water in the bag for later.
Roof Material	Useful to prevent rain entering your shelter.
Solar Still	Used to obtain water from the ground via a solar still.

Chopsticks

Eating	Used for eating with instead of other utensils.
Tent Pegs	Makeshift tent pegs which will secure your tent better than nothing.
Snares	Can be used to make snares and traps.
Hunting	
Medicinal Uses	• Splint • Tongue Depressor
Kindling	Can be used for kindling in an emergency. (Unless metal)

Aspirin

Pain Treatment	Reduces the amount of pain of an injury or headache.

Tin Cans

Water Storage	Water can be stored and boiled in cans then saved for later use.

Ziplock Bags

Water Storage	These can hold water and can also be used for SODIS.
Kit Bags	They are great at holding smaller loose items and weigh nothing.

Plastic Bottles

Storing Water	Perfect for storing water.
SODIS	Plastic bottles (if clear) can be used for purifying water via SODIS.

Coffee Filters

Filtering Water	You can filter water through a coffee filter to remover larger particulate.

Filtering Coffee	Its default purpose.
Particle Mask	If taped to your face it can be used to remove larger particulate from the air such as dust and dirt.

Drinking Straws

Drinking Hot Water	If recently boiled water isn't cool yet, you might be able to drink it early if sipped through a straw.
Fire Bellows	Can be used to stoke a fire by blowing through the straw at the base of a fire.

Wax

Candle Making	As always it can be used for making candles.
Soap Making	

Bathroom Materials

Safety Pins

Fish Hooks	Can be used for catching fish if bent into shape.
Medicinal Uses	• A Needle • Closing Wounds
Securing	Securing clothes together or other items.
Repairing Clothes	Pins can be used to temporarily repair clothes or to prevent them tearing more.
Starting a Fire w/Battery	When placed between the contacts of a battery it will heat up greatly and can be used to start a fire.
Toothpick	You can use it to remove food from your teeth.

Bobby Pins

Unlubricated Condoms

Water Bag	They can hold about 1L of water when extended, but ensure they are unlubricated.
Sex	They can be used for their original purpose, as people will still be doing it.

Tampons

Wound Control	Tampons can be placed in gunshot wounds to prevent excessive bleeding.
Water Filter	You can use a tampon as a water filter if the water flows through it. It won't remove viruses or most bacteria however.
Tinder	Once fluffed up it makes great tinder.
Candle Wick	Use the string from the tampon in animal fat to create a candle.
Female Requirements	

Zote Soap

Dental Floss

String	Could be used to tie things together.
Flossing	As always it can be used to clean your teeth.
Fishing	Can be used as a replacement fishing line.

Mouthwash

Killing Germs	

Isopropyl Alcohol

Killing Germs	Alcohol as always will kill bacteria on any surfaces it comes in contact with.
Cleaning Surfaces	Cleans marks off most surfaces.
Firelighting	Lights extremely easily with any spark.
Sterilization	It can be used to sterilize medical equipment.

Epsom Salt (Magnesium Sulphate)

Foot Soak	
Medicinal Uses	• A Laxative • Topical Agent • Remove Splinters
Gardening	• Fertilizer

Zote Soap

Activated Charcoal

Poison Extractor	Consume with water to absorb toxins in the body.
Water Purifier	Removes bad odour and taste from water.

Hand Sanitiser

Killing Bacteria	
Firelighting	

Dental Floss

Laundry Materials

Borax

Petroleum Jelly (Vaseline)

Firestarter	When combined with a fibrous material it's great for light with a spark.
Lip Balm	Can be used on chapped lips to prevent further damage.
Rash Treatment	
Seam Sealant	Useful to seal small tears and rips to prevent the ingress of water.

Silica Gel

Bleach

Cleaning	Great for cleaning surfaces and sterilizing items.
Killing Bacteria	Kills pathogens on any surface it touches within 10 seconds.
Purifying Water	Adding 1 drop of unscented bleach per litre can kill pathogens.

Bandana

Water Filter	You can fold it over multiple times and use it to filter particulate out of water.
Air Filter	Filters the air of larger particles such as dust or dirt.

Bucket

Transporting	Buckets are great at transporting water, gear, sand, rocks or anything you need to move.
Storage Container	It can be used to store items for a later date, including water if it's sealed properly.

Chalk

Quick Lime

Garage Materials

Duct Tape

Sealing Holes	Great for sealing holes in tents, tarps etc.
Water Container	Can be used to make water containers or collection bowls.
Medical Tape	You can tape up wounds and broken bones to prevent them from moving if you don't have anything else.
Repairing Objects	Can repair objects like shoes when you can't find more suitable materials.
Securing	It can secure items to other items.
Signalling	You can form words on a beach if you need rescuing.

Paracord

Attaching	Attach items together to hold them.
Shelter Building	Use paracord to lash together some sticks for a shelter.
Tinder	Split the strands to create a flammable tinder.

Steel Wool

Cleaning	Steel wool can make a great scrubbing utensil.
Firelighting	Generates heat and flames when a battery connects strands of fine steel wool.

Superglue

Closing Wounds	You can glue open wounds together.
Bonding Items	Glues items together.

WD-40

Lubricating	Lubricate mechanical items so they function properly.
Self Defence	Spraying a stream into fire will create a flamethrower.
Firelighting	Spraying some onto wood will make it easy to light.

Zip Ties

Securing	Used to secure items to other items.
Handcuffs	Can be used to restrain people provided they are long enough.

Nails / Screws

Hanging Items	Can be used to hang items from walls or trees.
Securing Items	Secures items to something else such as planks against a door.

PVC Pipe

Plumbing	Used as its primary purpose to direct liquids.
Creating Caches	When cut and capped it can be used to store gear watertight underground.

Tarpaulin

Shelter Building	Used as a shelter building material in the wild.
Shelter Roofing	Used to keep the rain off you or to repair a hole in the roof.
Water Collection	It can be placed on the ground to collect or divert water.
Solar Still	When placed over groundwater in the sun, it can heat it up and allow collection of it.

Plastic Sheeting

Water Collection	
Blackout Sheeting	
Solar Still	
Virus Barrier	

Latex Tubing

Slingshot	When combined with a Y stick it can make a slingshot.
Straw	A long rubbery straw, but still a straw.
Binding Items	It can be used to firmly attach two items together.
Belt	Can be used to hold your pants up if required.
Tourniquet	If tightened enough it could stop blood flow.

Pry Bar

Breaking Things	Perfect for smashing and breaking down objects.
Prying	You can separate two objects if they don't want to come apart or haven't been opened in a long time.
Weapon	Make a formidable weapon.

Kerosene

Fuel	Works well with a wick to produce light.

External Materials

Hose

Liquid Transfer	Great for transferring liquids between locations.

Wooden Fence

Firewood	Wooden fences can be used as firewood if you're desperate.
Door Braces	You can hammer the planks to your door to prevent people gaining entry.

Natural Materials

Bamboo

Structural Beam	Bamboo is great for construction beams.
Spear	It can be sharpened to a spear for a formidable weapon.
Water Container	It can be used to store water in its sections if cleaned out.
Piping	It can direct the flow of liquids if split in half and overlapped.

4 Types of Materials

Knowledge of materials allows for comparison of everyday materials, e.g. different kinds of wood, rock, metal, paper, plastic, on the basis of their properties, including hardness, strength, flexibility and magnetic behaviour, and to relate these properties to everyday uses of the materials. The following sections will detail the types of materials and any subcategories.

Wood	Wood is a composite material made from lignin and cellulose. Wood makes use of a lignin matrix and cellulose fibres to form a polymer composite. The lignin holds the cellulose compressively in place so that the cellulose fibres can carry tensile loads. Wood has excellent structural properties, in light of its low weight and high strength.
Metal	Metals are comparatively malleable, optically reflective, and electrically conductive. Most metals and alloys are easily shaped by forming. Their disassociate electron bonding makes them excellent conductors of electricity and heat. Almost all metals have an orderly arrangement of atoms, resulting in a crystalline structure that may have multiple crystal phases bordering each other.
Polymer & Plastic	Plastics/polymers are made up of millions of repeated links to make long molecules or networks that are tangled or cross linked together. Almost all polymers use carbon atoms in very long chains. The carbon atoms may be attached to other carbon, oxygen, nitrogen, and hydrogen atoms. Polymers may or may not have an orderly arrangement of atoms.
Ceramic	A ceramic is a non-metallic material composed of inorganic molecules, normally prepared by heating a powder or slurry. Many common ceramics are made up of oxides or nitride compounds and are highly crystalline with long-range molecular order. Some ceramics are partially or fully amorphous, with no long-range molecular order; these are typically classified as glassy materials.
Glass	Glassy materials are hard, brittle, and noncrystalline. The lack of crystalline grains often results in optical transparency. The glass we are used to is a ceramic usually consisting of a mixture of silicates or sometimes borates or phosphates formed by fusion of silica or of oxides of boron or phosphorus with a flux and a stabilizer into a mass that cools to a rigid condition without crystallization.
Concrete	Concrete is a ceramic composite made up of water, sand, gravel, crushed stone, and cement. The ingredients are mixed together thoroughly, and are poured into a form. After the concrete is completely dry, it has excellent compressive strength.

Composites	Composites are mixtures of two or more bonded materials. Composites are the mixture of multiple materials, which in combination offer superior properties to the materials alone. Structural composites usually refer to the use of fibres which are embedded in a plastic. These composites offer high strength with very little weight.
Biomaterials	A biomaterial is any substance that has been engineered to interact with biological systems for a medical purpose - either a therapeutic (treat, augment, repair or replace a tissue function of the body) or a diagnostic one. The study of biomaterials is called biomaterials science or biomaterials engineering. Biomaterials science encompasses elements of medicine, biology, chemistry, tissue engineering and materials science.
Electronic & Optical	Electronic/optical materials are tailored to conduct electricity or light. These materials may be metals, ceramics or polymers. These materials are carefully formulated to control the intensity, scattering, and bending of electrons or photons which pass through them.
Metamaterials	A metamaterial is an engineered material specifically designed to exhibit a behaviour that can only occur at specific organizations and sizes of materials. Metamaterials often seem to break the rules of physical behaviour. Though many metamaterials phenomenon have not yet been usefully produced at scale, they include materials with negative Poisson's ratios (they expand when stretched instead of getting thinner), unusual interactions with light and other forms of electromagnetic radiation (cloaking and other phenomena), and nanomaterial effects like iridescence and molecular filtering of light and sound.
NanoMaterials	Nanomaterial is a "material with any external dimension in the nanoscale or having internal structure or surface structure in the nanoscale", with nanoscale defined as the "length range approximately from 1 nm to 100 nm". This includes both nano-objects, which are discrete pieces of material, and nanostructured materials, which have internal or surface structure on the nanoscale; a nanomaterial may be a member of both these categories.

5 Wood

Softwoods (Coniferous)

Araucaria	Hoop Pine	Monkey Puzzle Tree	Paraná Pine								
Cedar											
Celery-Top Pine											
Cypress	Arizona Cypress	Bald Cypress	Alerce	Hinoki Cypress	Lawson's Cypress	Mediterranean Cypress					
Douglas-Fir	Coast Douglas-Fir	Rocky Mountain Douglas-Fir									
European Yew											
Fir	Balsam Fir	Silver Fir	Noble Fir	Pacific Silver Fir							
Hemlock	Eastern Hemlock	Mountain Hemlock	Western Hemlock								
Huon Pine / Macquarie Pine											
Kauri											
Queensland Kauri											
Japanese Nutmeg-Yew, Kaya											
Larch	European Larch	Japanese Larch	Tamarack	Western Larch							
Pine	European Black Pine	Jack Pine	Lodgepole Pine	Monterey Pine	Ponderosa Pine	Red Pine	Scots Pine / Red Pine	**White Pine** • Eastern White Pine • Western White Pine • Sugar Pine	**Southern Yellow Pine** • Loblolly Pine • Longleaf Pine • Pitch Pine • Shortleaf Pine		
Red Cedar	Eastern Red Cedar	Western Red Cedar									
Coast Redwood											
Rimu											
Spruce	Norway Spruce	Black Spruce	Red Spruce	Sitka Spruce	White Spruce						
Sugi											
White Cedar	Northern White Cedar	Atlantic White Cedar									
Nootka Cypress											

Hardwoods

Hardwoods (Angiosperms)											
Abachi											
Acacia											
African Padauk											
Afzelia / Doussi											
Agba / Tola											
Alder	Black Alder	Red Alder									
American Chestnut											
Ash	Black Ash	Blue Ash	Common Ash	Green Ash	Oregon Ash	Pumpkin Ash	White Ash				
Aspen	Bigtooth Aspen	European Aspen	Quaking Aspen								
Australian Red Cedar											
Balsa											
Basswood / Linden	American Basswood	White Basswood	American Beech								
Birch	**American Birches** • Gray Birch • Black Birch • Paper Birch • Sweet Birch • Yellow Birch	**European Birches** • Silver Birch • Downy Birch									
Blackbean											
Black Tupelo											
Blackwood	Australian Blackwood	African Blackwood / Mpingo									
Bloodwood											
Boxelder											
Boxwood / Common box											
Brazilian Walnut											
Brazilwood											
Gumbo Limbo											
Buckeye	Horse-Chestnut	Ohio Buckeye	Yellow Buckeye								
Butternut											
California Bay Laurel											
Camphor Tree											
Cape Chestnut											
Catalpa / Catawba											
Ceylon Satinwood											
Cherry	Black Cherry	Red Cherry	Wild Cherry								
Coachwood											
Cocobolo											
Corkwood											
Cottonwood	Balsam Poplar	Eastern Cottonwood	Swamp Cottonwood								
Cucumbertree											
Dogwood	Flowering Dogwood	Pacific Dogwood									
Ebony	Andaman Marblewood	African Ebony	Ceylon Ebony								
Elm	American Elm	English Elm	Rock Elm	Slippery Elm / Red Elm	Wych Elm						
Eucalyptus	Lyptus: Flooded Gum	White Mahogany	Brown Mallet	Banglay / Southern Mahogany	River Red Gum	Karri	Blue Gum	Flooded Gum / Rose Gum	York Gum	Jarrah	Tallowwood
Eucalyptus	Grey Ironbark	Blackbutt	Mountain Ash	Australian Oak	Alpine Ash	Red Mahogany	Swamp Mahogany, Swamp Messmate	Sydney Blue Gum	Mugga / Red Ironbark	Redwood	Wandoo
European Crabapple											
European Pear											
Gonçalo Alves											
Greenheart											
Grenadilla / Mpingo											
Guanandi											
Gum											
Hackberry											
Hickory	Pecan	Pignut Hickory	Shagbark Hickory	Shellbark Hickory							
Hornbeam											
American Hophornbeam											
Iroko / African Teak											
Ironwood	Balau	American Hornbeam	Sheoak / Polynesian Ironwood	Giant Ironwood	Diesel Tree	Borneo Ironwood	**Lignum Vitae** • Guaiacwood • Holywood	Takian	Ipê	Black Ironwood	Lebombo Ironwood
Ironwood	Catalina Ironwood	Ceylon Ironwood	Olive	Desert Ironwood	Persian Ironwood	Brazilian Ironwood / Pau Ferro	Yellow lapacho				

Jacarandá-Boca-De-Sapo											
Jacarandá De Brasil											
Jatobá											
Kingwood											
Lacewood	Northern Silky Oak	American Sycamore	London Plane								
Limba											
Locust	Black Locust	Honey Locust									
Mahogany	**Genuine Mahogany** ● West Indies Mahogany ● Bigleaf Mahogany ● Pacific Coast Mahogany										
Other Mahogany	African Mahogany	Chinese Mahogany	Australian Red Cedar / Indian Mahogany	Philippine Mahogany / Calantis / Kalantis	Indonesian Mahogany / Suren	Sapele	Mountain Mahogany / Bottle Tree	Indian Mahogany / Chickrassy / Chittagong wood	Spanish Cedar / Cedro / Brazilian Mahogany	Light Bosse / Pink Mahogany	Dark Bosse / Pink Mahogany
Other Mahogany	American Muskwood	Carapa / Royal Mahogany / Demerara Mahogany / Bastard Mahogany / Andiroba / Crabwood	Bead-Tree / White Cedar / Persian Lilac								
Maple	**Hard Maple** ● Sugar Maple ● Black Maple	**Soft Maple** ● Boxelder ● Red Maple ● Silver Maple	**European Maple** ● Sycamore Maple								
Marri / Red Gum											
Meranti											
Merbau / Ipil											
Oak	**White Oak** ● White Oak ● Bur Oak ● Post Oak ● Swamp White Oak ● Southern Live Oak ● Swamp Chestnut Oak ● Chestnut Oak ● Chinkapin Oak ● Canyon Live Oak	English Oak	**Red Oak** ● Northern Red Oak ● Eastern Black Oak ● Laurel Oak ● Southern Red Oak ● Water Oak ● Willow Oak ● Nuttall's Oak								
Okoumé											
Olive											
Pink Ivory											
Poplar	Balsam Poplar	Black Poplar	Hybrid Black Poplar	Tulip Tree							
Purpleheart											
Queensland Maple											
Ramin											
Śāl											
Sweetgum											
Sandalwood	Indian Sandalwood										
Sassafras	Southern Sassafras										
Silky Oak											
Silver Wattle											
Sourwood											
Spanish-Cedar											
Spanish Elm											
Tamboti											
Teak											
Thailand Rosewood											
Tupelo											
Turpentine											
Walnut	Eastern Black Walnut	Common Walnut									
Wenge	Panga-Panga										
Willow	Black Willow	Cricket-Bat Willow	White Willow	Weeping Willow							
Zingana / African Zebrawood											
Hardwoods (Monocotyledons)											
Bamboo											
Palm Tree	Coconut Timber	Toddy Palm Timber									

Manufactured Woods

Engineered wood, also called composite wood, man-made wood, or manufactured board, includes a range of derivative wood products which are manufactured by binding or fixing the strands, particles, fibres, or veneers or boards of wood, together with adhesives, or other methods of fixation to form composite materials. These products are engineered to precise design specifications which are tested to meet national or international standards. Engineered wood products are used in a variety of applications, from home construction to commercial buildings to industrial products. The products can be used for joists and beams that replace steel in many building projects.

Typically, engineered wood products are made from the same hardwoods and softwoods used to manufacture lumber. Sawmill scraps and other wood waste can be used for engineered wood composed of wood particles or fibres, but whole logs are usually used for veneers, such as plywood, MDF or particle board. Some engineered wood products, like oriented strand board (OSB), can use trees from the poplar family, a common but non-structural species. Alternatively, it is also possible to manufacture similar engineered bamboo from bamboo; and similar engineered cellulosic products from other lignin-containing materials such as rye straw, wheat straw, rice straw, hemp stalks, kenaf stalks, or sugar cane residue, in which case they contain no actual wood but rather vegetable fibres.

Advantages

● Because engineered wood is man-made, it can be designed to meet application-specific performance requirements. Required shapes and dimension do not drive source tree requirements (length or width of the tree)
● Engineered wood products are versatile and available in a wide variety of thicknesses, sizes, grades, and exposure durability classifications, making the products ideal for use in unlimited construction, industrial and home project application.
● Engineered wood products are designed and manufactured to maximize the natural strength and stiffness characteristics of wood. The products are very stable and some offer greater structural strength than typical wood building materials.
● Glued laminated timber (glulam) has greater strength and stiffness than comparable dimensional lumber and is stronger than steel.
● Some engineered wood products offer more design options without sacrificing structural requirements.
● Engineered wood panels are easy to work with using ordinary tools and basic skills. They can be cut, drilled, routed, jointed, glued, and fastened. Plywood can be bent to form curved surfaces without loss of strength. Large panel size speeds construction.

● Engineered wood products make more efficient use of wood. They can be made from small pieces of wood or wood with defects.
● Wood trusses are competitive in many housing applications, and their high strength-to-weight ratios permit long spans.
● Engineered wood is felt to offer structural advantages for home construction.
● Sustainable design advocates recommend using engineered wood, which can be produced from relatively small trees, rather than large pieces of solid dimensional lumber, which requires cutting a large tree.

Disadvantages

● They require more primary energy for their manufacture than solid lumber.
● The adhesives used in some products may be toxic. A concern with some resins is the release of formaldehyde in the finished product, often seen with urea-formaldehyde bonded products.
● Cutting and otherwise working with some products can expose workers to toxic compounds.
● Some engineered wood products, such as those specified for interior use, may be weaker and more prone to humidity-induced warping than equivalent solid woods. Most particle and fibre-based boards are not appropriate for outdoor use because they readily soak up water.

Plywood

Plywood, a wood structural panel, is sometimes called the original engineered wood product. Plywood is manufactured from sheets of cross-laminated veneer and bonded under heat and pressure with durable, moisture-resistant adhesives. By alternating the grain direction of the veneers from layer to layer, or "cross-orienting", panel strength and stiffness in both directions are maximized. Other structural wood panels include oriented strand board and structural composite panels. It is popular in the furniture and flooring industries due to its inherent strength and resistance to warping due to the bonded cross-ply construction.

Densified Wood	Densified wood is made by using a mechanical hot press to compress wood fibres and increase the density by a factor of three. This increase in density is expected to enhance the strength and stiffness of the wood by a proportional amount. Early studies confirmed this result with a reported increase in mechanical strength by a factor of three.
MDF (Medium Density Fibreboard)	Medium-density fibreboard, is made by breaking down hardwood or softwood residuals into wood fibres, combining it with wax and a resin binder, and forming panels by applying high temperature and pressure. MDF is very strong and is considerably more popular than people think. In-fact many will be surprised as to how much MDF furniture is around them. With its strong/dense structure, your furniture is likely to last a lot longer than you expect, however it's no solid wood, but it's a fraction of the price of solid wood. MDF is extremely popular with IKEA, another leading furniture retailer. In the majority of cases, furniture built with MDF will have a wooden veneer bonded to it to give it an expensive looking finishing touch.
Particle Board (Chipboard)	Particle board is manufactured from wood chips, sawmill shavings, or even sawdust, and a synthetic resin or other suitable binder, which is pressed and extruded. Oriented strand board, also known as flakeboard, waferboard, or chipboard, is similar but uses machined wood flakes offering more strength. Particle board is cheaper, denser and more uniform than conventional wood and plywood and is substituted for them when cost is more important than strength and appearance. A major disadvantage of particleboard is that it is very prone to expansion and discoloration due to moisture, particularly when it is not covered with paint or another sealer. Chipboard is extremely popular when making furniture, especially IKEA furniture. It is a dense wood and is commonly used with a veneered surface which is used for flat-packed furniture and work surfaces.
Oriented Strand Board	Oriented strand board (OSB) is a wood structural panel manufactured from rectangular-shaped strands of wood that are oriented lengthwise and then arranged in layers, laid up into mats, and bonded together with moisture-resistant, heat-cured adhesives. The individual layers can be cross-oriented to provide strength and stiffness to the panel. However, most OSB boards are delivered with more strength in one direction. The wood strands in the outmost layer on each side of the board are normally aligned into the strongest direction of the board. Arrows on the product will often identify the strongest direction of the board (When bought in most cases the height (The longest dimension) of the board). Produced in huge, continuous mats, OSB is a solid panel product of consistent quality with no laps, gaps or voids. OSB is delivered in various dimensions, strengths and levels of water resistance.
Laminated Timber	Glued laminated timber (glulam) is composed of several layers of dimensional timber glued together with moisture-resistant adhesives, creating a large, strong, structural member that can be used as vertical columns or horizontal beams. Glulam can also be produced in curved shapes, offering extensive design flexibility.
Laminated Veneer	Laminated veneer lumber (LVL) is produced by bonding thin wood veneers together in a large billet. The grain of all veneers in the LVL billet is parallel to the long direction. The resulting product features enhanced mechanical properties and dimensional stability that offer a broader range in product width, depth and length than conventional lumber. LVL is a member of the structural composite lumber (SCL) family of engineered wood products that are commonly used in the same structural applications as conventional sawn lumber and timber, including rafters, headers, beams, joists, rim boards, studs and columns. A veneer refers to a thin layer of wood which is cut from the circumference of a tree. It is then bonded onto a dense piece of wood, which is typically MDF, chipboard or plywood. Veneers are available in many sizes, ranging from 3 to 6mm thick. Many people mistakenly assume that veneered furniture is cheaper than solid wood; however, veneers quite often are used in high end furniture pieces and it can be more costly than solid wood. The way to find out if your piece of furniture is veneered is by looking at the edges, and checking if the grain lines run off the top and over the edges of the wood. As a veneer is real wood, it will accept stains and finishes much like solid wood.
Cross Laminated	Cross-Laminated Timber (CLT) is a versatile multi-layered panel made of lumber. Each layer of boards is placed cross-wise to adjacent layers for increased rigidity and strength. CLT can be used for long spans and all assemblies, e.g. floors, walls or roofs. CLT has the advantage of faster construction times as the panels are manufactured and finished off site and supplied ready to fit and screw together as a flat pack assembly project.
Parallel Strand	Parallel strand lumber (PSL) consists of long veneer strands laid in parallel formation and bonded together with an adhesive to form the finished structural section. A strong, consistent material, it has a high load carrying ability and is resistant to seasoning stresses so it is well suited for use as beams and columns for post and beam construction, and for beams, headers, and lintels for light framing construction. PSL is a member of the structural composite lumber (SCL) family of engineered wood products.
Laminated Strand	Laminated strand lumber (LSL) and oriented strand lumber (OSL) are manufactured from flaked wood strands that have a high length-to-thickness ratio. Combined with an adhesive, the strands are oriented and formed into a large mat or billet and pressed. LSL and OSL offer good fastener-holding strength and mechanical connector performance and are commonly used in a variety of applications, such as beams, headers, studs, rim boards, and millwork components. These products are members of the structural composite lumber (SCL) family of engineered wood products. LSL is manufactured from relatively short strands—typically about 1 foot long—compared to the 2 foot to 8 foot long strands used in PSL.
Finger Joint	The finger joint is made up of short pieces of wood combined to form longer lengths and is used in doorjambs, mouldings and studs. It is also produced in long lengths and wide dimensions for floors.

6 Metal

A metal is a material that, when freshly prepared, polished, or fractured, shows a lustrous appearance, and conducts electricity and heat relatively well. Metals are typically malleable (they can be hammered into thin sheets) or ductile (can be drawn into wires). A metal may be a chemical element such as iron; an alloy such as stainless steel; or a molecular compound such as polymeric sulfur nitride.

In physics, a metal is generally regarded as any substance capable of conducting electricity at a temperature of absolute zero. Many elements and compounds that are not normally classified as metals become metallic under high pressures. For example, the nonmetal iodine gradually becomes a metal at a pressure of between 40 and 170 thousand times atmospheric pressure. Equally, some materials regarded as metals can become nonmetals. Sodium, for example, becomes a nonmetal at pressure of just under two million times atmospheric pressure.

Rust Triangle
Require all three sides of the triangle to cause rust on a ferrous metal.

- Iron
- Oxygen
- Moisture

Metal Properties

Metals[n]	**Weight** The weight of the metal per cubic centimetre.	**Strength** The tensile strength of the metal in megapascals.	**Rusts** If this metal rusts or not.	**Corrodes** Whether the metal corrodes or not.	**Melting Point** The temperature the metal begins to melt at and deform at.	**Conductivity** How conductive the metal is in Siemens per Metre.	**Thermal Conductivity** How well the metal conducts heat. Higher is better for cooking on	**Magnetic** Whether this metal is attracted to a magnet.	**Water Sterilization** Whether this metal slowly purifies water by killing bacteria and viruses	**Price[n]** How costly the metal is per kilogram in AUD. As at August 2018	**Other Information**
Steel	7.85g/cm³	1725 Mpa	Yes	Yes	1425°C (2597°F)	1.32	15	Yes	No	$4.45/kg	
Stainless Steel	8.03g/cm³	1725 Mpa	No	No	1510°C (2750°F)	1.32	15	Composition Based	No	$4.45/kg	
Copper	8.94g/cm³	220 Mpa	No	No	1084°C (1983°F)	58.5	401	No	Yes	$5.55/kg	Cooking on copper forms toxins
Titanium	4.54g/cm³	275-690 Mpa	No	No	1668°C (3034°F)	2.4	21	No	No	$12.38/kg	
Aluminium	2.643g/cm³	2.643g/cm³	No	No	660°C (1220°F)	36.9	237	No	No	$0.7/kg	Melts in Wood Fires
Iron	7.87g/cm³	7.87g/cm³	Yes	Yes	1149°C (2100°F)	10.1	80	Yes	No	$0.83/kg	

Cast Iron	7.207g/cm³	7.207g/cm³	Yes	Yes	1127°C (2060°F)	10.1	80	Yes	No	$0.83/kg	
Wrought Iron	7.658g/cm³	7.658g/cm³	Yes	Yes	1482°C (2699°F)	10.1	80	Yes	No	$0.83/kg	
Carbon Steel	1.8g/cm³	1.8g/cm³	Yes	Yes	2500°C (4532°F)	5.9	129	Yes	No	$0.55/kg	
Silver	10.49g/cm³	10.49g/cm³	No	No	961°C (1761°F)	62.1	420	No	Yes	$734/kg	
Sterling Silver (92.5% Silver)			No	Yes	893°C (1640°F)		361	No	Yes - Slowly	$687.2/kg	
Gold	19.32g/cm³	19.32g/cm³	No	No	1063°C (1945°F)	44.2	317	No	Yes	$54,217/kg	
Platinum	21.44g/cm³	145 Mpa	No	No	1772°C (3221°F)	17.5	71.6	No	No	$36,212/kg	
Palladium	12.02g/cm³	325 Mpa	No	No	1554°C (2829°F)	9.26	71.8	Yes - Weakly	No	$40,154/kg	
Lead	11.341g/cm³	18 Mpa	No	No	327°C (620°F)	4.7	35	No	No	$2.48/kg	Melts in Wood Fires
Brass	8.553g/cm³	400 Mpa	No	Yes	930°C (1706°F)	15.9	150	No	Yes	$3.37/kg	
Zinc	7.144g/cm³	27.57 Mpa	No	No	419°C (786°F)	16.6	116	No	No	$2.22/kg	Melts in Wood Fires

Steel

Steel is an alloy of iron and carbon, and sometimes other elements like chromium. Because of its high tensile strength and low cost, it is a major component used in buildings, infrastructure, tools, ships, trains, automobiles, machines, appliances, and weapons.

Iron is the base metal of steel. Iron is able to take on two crystalline forms (allotropic forms), body centred cubic and face-centred cubic, depending on its temperature. In the body-centred cubic arrangement, there is an iron atom in the centre and eight atoms at the vertices of each cubic unit cell; in the face-centred cubic, there is one atom at the centre of each of the six faces of the cubic unit cell and eight atoms at its vertices. It is the interaction of the allotropes of iron with the alloying elements, primarily carbon, that gives steel and cast iron their range of unique properties.

Components of Steel

These are different ingredients of steel which can affect its overall strength and durability. This can be used as a guide if blacksmithing.

Carbon	This ingredient is essential to steel's creation; all steel will have some amount of carbon. It is the most important hardening element, but as it is added it can reduce the toughness of the material. Carbon reduces the amount that the knife will wear over time. So, the amount of carbon in the blade tells you a lot about the quality of the steel. Low carbon means there is (.3% or less), medium has between (.4-.7%), and high is (.8% and above).
Chromium	Combats corrosion. Stainless steel knives will have chromium as a major ingredient, typically at a minimum of 12%. Chromium will also increase the strength of a knife, but adding chromium in large amounts decreases toughness.
Cobalt	Strengthens the blade.
Copper	Combats corrosion.
Manganese	Hardens the blade. If added in high quantities it can increase brittleness.
Molybdenum	Maintains the steel's strength at high temperatures.
Nickel	Adds toughness.
Nitrogen	This element is sometimes used as a replacement for carbon in steel.
Phosphorus	Improves strength.
Silicon	Increases strength. Also, removes oxygen from the metal while it is being formed.
Sulphur	Increases machinability but decreases toughness.
Tungsten	Increases wear resistance.
Vandium	Increases wear resistance and makes the blade harder.

Groups of Steel

The SAE steel grades system is a standard alloy numbering system (SAE J1086 - Numbering Metals and Alloys) for steel grades maintained by SAE International.

In the 1930s and 1940s, the American Iron and Steel Institute (AISI) and SAE were both involved in efforts to standardize such a numbering system for steels. These efforts were similar and overlapped significantly. For several decades the systems were united into a joint system designated the AISI/SAE steel grades. In 1995 the AISI turned over future maintenance of the system to SAE because the AISI never wrote any of the specifications.

Today steel quotes and certifications commonly make reference to both SAE and AISI, not always with precise differentiation. For example, in the alloy/grade field, a cert might say "4140", "AISI 4140", or "SAE 4140", and in most light-industrial applications any of the above is accepted as adequate, and considered equivalent, for the job at hand, as long as the specific specification called out by the designer (for example, "4140 bar per ASTM-A108" or "4140 bar per AMS 6349") is certified to on the certificate. The alloy number is simply a general classifier, whereas it is the specification itself that narrows down the steel to a very specific standard.

Major Classifications of Steel

Carbon steels and alloy steels are designated a four digit number, whereby the first digit indicates the main alloying element(s), the second digit indicates tg (top grade) element(s), and the last two digits indicate the amount of carbon, in hundredths of a percent (basis points) by weight. For example, a 1060 steel is a plain-carbon steel containing 0.60 wt% C.

An "H" suffix can be added to any designation to denote hardenability is a major requirement. The chemical requirements are loosened but hardness values defined for various distances on a Jominy test.

Major Classifications of Steel
1xxx - Carbon Steels
2xxx - Nickel Steels
3xxx - Nickel-chromium steels
4xxx - Molybdenum steels
5xxx - Chromium steels
6xxx - Chromium-vanadium steels
7xxx - Tungsten steels
8xxx - Nickel-chromium-molybdenum steels
9xxx - Silicon-manganese steels

1xxx Carbon Steels	**Carbon Steels** 10xx - Plain carbon (Mn 1.00% max.) 11xx - Resulfurized 12xx - Resulfurized and rephosphorized 15xx - Plain Carbon (Mn 1.00–1.65% max.)	**Manganese Steels** 13xx - Mn 1.75%	

2xxx Nickel Steels	**Nickel Steels** 23xx - Ni 3.50% 25xx - Ni 5.00%		
3xxx Nickel-chromium steels	**Nickel-chromium Steels** 31xx - Ni 1.25%; Cr 0.65%, or 0.80% 32xx - Ni 1.75%; Cr 1.07% 33xx - Ni 3.50%; Cr 1.50%, or 1.57% 34xx - Ni 3.00%; Cr 0.77%	The Klean Kanteen 18/8 stainless steel is from the 3xxx range featuring 18% chromium and 8% nickel. It corrodes faster in the presence of salt.	
4xxx Molybdenum steels	**Molybdenum Steels** 40xx - Mo 0.20%, 0.25%, or Mo 0.25% and S 0.042% 44xx - Mo 0.40%, or 0.52% **Chromium-molybdenum (chromoly) Steels** 41xx - Cr 0.50%, 0.80%, or 0.95%; Mo 0.12%, 0.20%, 0.25%, or 0.30%	**Nickel-molybdenum Steels** 46xx - Ni 0.85%, or 1.82%; Mo 0.20%, or 0.25% 48xx - Ni 3.50%; Mo 0.25%	**Nickel-chromium-molybdenum Steels** 43xx - Ni 1.82%; Cr 0.50–0.80%; Mo 0.25% 43BVxx - Ni 1.82%; Cr 0.50%; Mo 0.12%, or 0.35%; V 0.03% min 47xx - Ni 1.05%; Cr 0.45%; Mo 0.20%, or 0.35%
5xxx Chromium steels	**Chromium Steels** 50xx - Cr 0.27%, 0.40%, 0.50%, or 0.65% 50xxx - Cr 0.50%; C 1.00% min 50Bxx - Cr 0.28%, or 0.50%; and added boron 51xx - Cr 0.80%, 0.87%, 0.92%, 1.00%, or 1.05% 51xxx - Cr 1.02%; C 1.00% min. 51Bxx - Cr 0.80%; and added boron 52xxx - Cr 1.45%; C 1.00% min.		
6xxx Chromium-vanadium steels	**Chromium-vanadium Steels** 61xx - Cr 0.60%, 0.80%, 0.95%; V 0.10%, or 0.15% min.		
7xxx Tungsten steels	**Tungsten-chromium Steels** 72xx - W 1.75%; Cr 0.75%		
8xxx Nickel-chromium-molybdenum steels	**Nickel-chromium-molybdenum Steels** 81xx - Ni 0.30%; Cr 0.40%; Mo 0.12% 81Bxx - Ni 0.30%; Cr 0.45%; Mo 0.12%; and added boron 86xx - Ni 0.55%; Cr 0.50%; Mo 0.20% 87xx - Ni 0.55%; Cr 0.50%; Mo 0.25% 88xx - Ni 0.55%; Cr 0.50%; Mo 0.35%		
9xxx Silicon-manganese steels	**Silicon-manganese Steels** 92xx - Si 1.40%, or 2.00%; Mn 0.65%, 0.82%, or 0.85%; Cr 0.00%, or 0.65%	**High-strength low-alloy Steels** 9xx - Various SAE grades xxBxx - Boron steels xxLxx - Leaded steels	**Nickel-chromium-molybdenum Steels** 93xx - Ni 3.25%; Cr 1.20%; Mo 0.12% 94xx - Ni 0.45%; Cr 0.40%; Mo 0.12% 97xx - Ni 0.55%; Cr 0.20%; Mo 0.20% 98xx - Ni 1.00%; Cr 0.80%; Mo 0.25%

Stainless Steel

100 Series
Type 102—austenitic general purpose stainless steel

200 Series—austenitic chromium-nickel-manganese alloys
Type 201—austenitic that is hardenable through cold working
Type 202—austenitic general purpose stainless steel

300 Series—austenitic chromium-nickel alloys
Type 301—highly ductile, for formed products. Also hardens rapidly during mechanical working. Good weldability. Better wear resistance and fatigue strength than 304.
Type 302—same corrosion resistance as 304, with slightly higher strength due to additional carbon.
Type 303—free machining version of 304 via addition of sulfur and phosphorus. Also referred to as "A1" in accordance with ISO 3506.
Type 304—the most common grade; the classic 18/8 (18% chromium, 8% nickel) stainless steel. Outside of the US it is commonly known as "A2 stainless steel", in accordance with ISO 3506 (not to be confused with A2 tool steel). The Japanese equivalent grade of this material is SUS304.
Type 304L—same as the 304 grade but lower carbon content to increase weldability. Is slightly weaker than 304.
Type 304LN—same as 304L, but also nitrogen is added to obtain a much higher yield and tensile strength than 304L.
Type 305—same as 304, but with more nickel to decrease work hardening.
Type 308—used as the filler metal when welding 304.
Type 309—better temperature resistance than 304, also sometimes used as filler metal when welding dissimilar steels, along with inconel.

Type 310 310S— is a highly alloyed austenitic stainless steel used for high temperature application. The high chromium and nickel content give the steel excellent oxidation resistance as well as high strength at high temperature. This grade is also very ductile, and has good weldability enabling its widespread usage in many applications.
Type 316—the second most common grade (after 304); for food and surgical stainless steel uses; alloy addition of molybdenum prevents specific forms of corrosion. It is also known as marine grade stainless steel due to its increased resistance to chloride corrosion compared to type 304. 316 is often used for building nuclear reprocessing plants.
Type 316L—is an extra low carbon grade of 316, generally used in stainless steel watches and marine applications, as well exclusively in the fabrication of reactor pressure vessels for boiling water reactors, due to its high resistance to corrosion. Also referred to as "A4" in accordance with ISO 3506.
Type 316Ti—variant of type 316 that includes titanium for heat resistance. It is used in flexible chimney liners.
Type 321—similar to 304 but lower risk of weld decay due to addition of titanium. See also 347 with addition of niobium for desensitization during welding.

400 Series—ferritic and martensitic chromium alloys
Type 405—ferritic for welding applications
Type 408—heat-resistant; poor corrosion resistance; 11% chromium, 8% nickel.
Type 409—cheapest type; used for automobile exhausts; ferritic (iron/chromium only).
Type 410—martensitic (high-strength iron/chromium). Wear-resistant, but less corrosion-resistant.
Type 416—easy to machine due to additional sulfur
Type 420—Cutlery Grade martensitic; similar to the Brearley's original rustless steel. Excellent polishability.
Type 430—decorative, e.g., for automotive trim; ferritic. Good formability, but with reduced temperature and corrosion resistance.
Type 439—ferritic grade, a higher grade version of 409 used for catalytic converter exhaust sections. Increased chromium for improved high temperature corrosion/oxidation resistance.

Type 440—a higher grade of cutlery steel, with more carbon, allowing for much better edge retention when properly heat-treated. It can be hardened to approximately Rockwell 58 hardness, making it one of the hardest stainless steels. Due to its toughness and relatively low cost, most display-only and replica swords or knives are made of 440 stainless. Available in four grades:
Type 440A—has the least amount of carbon making this the most stain-resistant.
Type 440B—slightly more carbon than 440A.
Type 440C—has the greatest amount of carbon of the Type 440 variants. Strongest and considered more desirable in knifemaking than the Type 440A variant, except for diving or other salt-water applications. This variant is also more readily available than other variants of Type 440.
Type 440F—a free-machining variant. Contains the same high carbon content as Type 440C.
Type 446—For elevated temperature service

500 Series—heat-resisting chromium alloys
The 500 series was rumored to be the first choice for the Starship rocket, currently under development by Elon Musk's SpaceX.

600 Series—originally created for proprietary alloys (which are no longer given SAE grade numbers)
601 through 604: Martensitic low-alloy steels.
610 through 613: Martensitic secondary hardening steels.
614 through 619: Martensitic chromium steels.
630 through 635: Semiaustenitic and martensitic precipitation hardening stainless steels.
Type 630 is most common PH stainless, better known as 17-4; 17% chromium, 4% nickel.
650 through 653: Austenitic steels strengthened by hot/cold work.
660 through 665: Austenitic superalloys; all grades except alloy 661 are strengthened by second-phase precipitation.

900 series—austentic chromium-molybdenum alloys
Type 904—similar to 316 but with higher chromium and molybdenum content for more corrosion resistance

Plain Carbon Steels

Plain carbon steels are steels that contain iron, carbon, and a small amount of manganese. In contrast, alloy steels have a specified composition and contain certain percentages of vanadium or molybdenum, and they also typically have a larger amount of manganese. Tool steel contains tungsten, molybdenum, and other alloying elements.

The 10XX Steels
1095 is the most common 10XX steel used for knife blades. Steel in the range 1045-1095 are used for knife blades, although 1050 is more commonly seen in swords. 1045 steel has less carbon (.45%), where 1095 has more (.95%), inversely 1095 has less manganese and 1045 has more. So in essence, 1095 steel would have more wear resistance, but would also be less tough.

1045	Carbon: 0.43-0.50 Manganese: 0.60-0.90 1045 holds an okay edge in comparison to the great edge of 1095.
1050	Carbon: 0.47-0.55 Manganese: 0.60-0.90
1055	Carbon: 0.52-0.60 Manganese: 0.60-0.90
1060	Carbon: 0.55-0.65 Manganese: 0.60-0.90
1065	Carbon: 0.60-0.70 Manganese: 0.60-0.90
1070	Carbon: 0.65-0.75 Manganese: 0.60-0.90
1075	Carbon: 0.70-0.80 Manganese: 0.40-0.70
1080	Carbon: 0.75-0.88 Manganese: 0.60-0.90
1085	Carbon: 0.80-0.93 Manganese: 0.70-1.00
1095	Carbon: 0.90-1.03 Manganese: 0.30-0.50 1095 steel holds an edge great, and is easy to sharpen. The major drawback to this type of steel is that it rusts easily. Because of this issue, you will often see 1095 blades with some type of coating to combat rust. If you buy a knife with this type of blade, be sure to store it well and you should have no problem.

Alloy Steels

This is plain carbon steel (1060) that has been mixed with a little bit of chromium. There is not enough chromium to make it a stainless steel, but the chromium has been added to strengthen the material. This type of steel is known for its outstanding toughness. This type of steel typically has .56-.64% carbon.

8637	Alloy Steel 8637 is medium carbon steel that includes chromium, manganese, and molybdenum. Thanks to its strength and wear resistance, Alloy Steel 8637 is popular in the aerospace, defence, oil and gas, and automotive industries.
41L49	Also sold under the brand name DYNA-LOY 41L49, this cold-drawn alloy steel offers users excellent machinability. Known for its good surface, Alloy Steel 41L49 alloy offers users outstanding finish, tensile strength, elasticity, and a hardness range of Rockwell C43 to C56.
9260	Alloy Steel 9260, also sold AISI 9260, is a high-silicon, spring alloy steel. It offers users outstanding corrosion resistance, hardness, toughness, and strength. Alloy Steel 9260 is machinable in the annealed condition, and is weldable by most common methods except oxyacetylene welding. You will find Alloy Steel 9260 in a wide variety of applications, most of which demand resistance to bending and failures.
8750	Alloy Steel 8750 is a low carbon steel with a medium manganese content. Known for its good hardening properties, Alloy Steel 8750 also offers users fair machinability as well as excellent cold bending and forming operations. It has a decent level of weldability and is perfect for shafting and for applications that do not require the high levels of strength found in higher carbon and alloy steels.
8640	Alloy Steel 8640 is a special-alloy steel that includes chromium, manganese, and molybdenum. Due to its lower carbon levels, Alloy Steel 8640 takes mechanical and heat treatments better than most alloys. Alloy Steel 8640 is popular in the aerospace, defence, oil and gas, and automotive industries.

4150	Alloy Steel 4150, also sold under the name AISI/SAE 4150, is a high-carbon alloy that includes chromium, manganese, and molybdenum. This tough steel alloy offers uniform strength, wear resistance, and great hardness. It is important to note that Alloy Steel 4150 must be heat-treated to be suitable for machining. The weldability of Alloy Steel 4150 is high and can be achieved through most commercial methods.
8630	Alloy Steel 8630, also known as AISI 8630, is a low alloy that is unique due to its levels of chromium, molybdenum, and chromium. Alloy Steel 8630 offers users good mechanical properties, as well as weldability by most common methods. This popular alloy works well with hot forging and rolling, in addition to annealing.
4120	Alloy Steel 4120, also sold as SAE/AISI 4120, is a chromium-molybdenum structural alloy steel. This case-hardened alloy offers users good strength, toughness, and wear-resistance. Leaders in a wide variety of industries, including aerospace, oil and gas, automotive, agricultural and defence.
8620	Alloy Steel 8620, also sold as AISI 8620, is a hardenable, carburizing, low alloy steel. This alloy offers users outstanding flexibility, wear resistance, as well as ease of weldability through conventional methods.
4140	Alloy Steel 4140, also sold under the name AISI/SAE 4140, is a low alloy steel that contains chromium, molybdenum, and manganese. Known for its impact and abrasion resistance, Alloy Steel 4140 also offers users outstanding fatigue and torsional strength. Welding is possible through most popular techniques, and it has a high level of ductility. Machinability is possible in the annealed condition, while Alloy Steel 4140 takes cold working, heating, and quenching well.
5160 Steel	This is plain carbon steel (1060) that has been mixed with a little bit of chromium. There is not enough chromium to make it a stainless steel, but the chromium has been added to strengthen the material. This type of steel is known for its outstanding toughness. This type of steel typically has .56-.64% carbon.
Tool Steels	
This is high carbon tool steel. It typically has .98-1.10% carbon. This steel is harder than many others, and consequently it holds an edge well. This is one of the best steels to use if you are worried about it holding an edge. This material is used often for hunting knives. The major drawback to this steel is that it has less chromium than other steel and consequently can rust.	
52100 Steel	This is high carbon tool steel. It typically has .98-1.10% carbon. This steel is harder than many others, and consequently it holds an edge well. This is one of the best steels to use if you are worried about it holding an edge. This material is used often for hunting knives. The major drawback to this steel is that it has less chromium than other steel and consequently can rust.
A2 Steel	This is very tough steel. However, it has less wear resistance than other tool steels. This steel is often used for custom made combat knives because of its toughness. It has a carbon content range of 0.95-1.05%. This steel does not contain lots of chromium (typically around 5%) and needs to be maintained carefully to avoid rust. It will often be coated on a knife blade to avoid this issue.
CPM 10V Steel	CPM stands for Crucible Particle Metallurgy, which is a brand name. This is one of the most wear resistant tool steels. It also has decent toughness for a tool steel. This is a great choice if you are looking for something with lots of wear resistance, but is not a really tough material.
CPM 3V Steel	This steel was designed to be tough while also being a high wear resistance steel.
CPM M4 Steel	This steel has excellent wear resistance and toughness. Has about 1.42% carbon.
D2 Steel	This steel has high chromium content, just less than what might classify it as stainless steel. Because of this it has good rust resistance. It is much tougher than most stainless steels, but not as tough as most of the other tool steel. This steel does have excellent wear resistance. It has great edge retention but can be very difficult to sharpen. This is also a tough material to mirror polish, so it you will almost never see it that way. Its carbon content is 1.50-1.60%.
L6 Steel	This steel is tough and holds an edge well. However, like other non-stainless steel it rusts easily. Some consider this to be one of the best steels available for cutlery. It is also used frequently in saw blades, but any knife made from this material needs consistent maintenance.
M2 Steel	This steel is extremely heat resistant. It has about .85% carbon. It holds an edge really, really well, but it can be brittle on large knives.
O1 Steel	This material has good edge retention, because it is hard material. Its major problem is that it rusts rather quickly if it isn't maintained. It has a carbon content range of .85-1.00%.
O6 Steel	This is a much tougher metal than 0-1. This is one of the absolute best edge retention steels.
W2 Steel	This steel is basically plain carbon steel with extra carbon. It is very hard and holds an edge well.
Stainless Steels	
Stainless steel knives will have chromium as a main ingredient, typically at a minimum of 12%. Has about .38% carbon. The low carbon content means that this steel is very soft, and doesn't hold an edge well. It is low quality, low cost material. Many cheap knives tend to be made of this material because of its cost. Blades made from this material need to be sharpened frequently, and often chip. Stainless steel knives will have chromium as a main ingredient, typically at a minimum of 12%.	
420 Steel	Has about .38% carbon. The low carbon content means that this steel is very soft, and doesn't hold an edge well. It is low quality, low cost material. Many cheap knives tend to be made of this material because of its cost. Blades made from this material need to be sharpened frequently, and often chip. On the bright side, all 420 stainless steel is extremely rust resistant. This means that one of the best uses for this material is to make diving knives because of their constant contact with saltwater. Sometimes, you will also see 420J. 420J is the lowest quality 420 steel, but is also the most rust resistant.
440 Steel	There are three different types of 440 steel, the hardest part of telling them apart is that often steel makers mark 440 on the tang of the blade and not the letter grade. This is especially true when it is one of the lower grades. This has led certain knife manufacturers to rename 440C as other things in order to differentiate the quality of the product.
440A Steel	Has a carbon content range of .65-.75%. This is a low cost stainless steel. It is the most rust resistant of 440 steel, and 440C is the least rust resistant of the three. However, the 400 series are some of the most rust resistant knives out there.
440B Steel	Very similar to 440A but has a higher carbon content range (.75-.95%).
440C Steel	This has a carbon content range between .95-1.20%. This is considered a higher end stainless steel. This alloy is one of the most common in knives. It is wear resistant, and it is a hard steel.
425M Steel	This is a material similar to the 400 series that has .5% carbon and is used by Buck knives.
154 CM Steel	This is high quality steel. It has a carbon content of 1.05%. It holds an edge well and is hard steel. It actually has pretty good toughness for how hard the steel is as well. It is tougher than 440 C. Some go as far as to call this super steel. This steel often gets compared to ATS 34 because the two are so similar. Some people prefer this steel to ATS 34 because this one is made by Crucible, an American company.

MATERIALS Metal Steel Groups of Steel

8Cr14MoV Steel	This steel is very similar to AUS-8. It is manufactured in China and has about .75% carbon content.
9Cr13CoMoV Steel	This is 440 steel with extra cobalt mixed in to strengthen the blade. Has about .85% carbon.
AEBL Steel	This steel is similar to 440 B.
ATS 34 Steel	This steel is very similar to 154 CM. It has 1.05% carbon. It is also one of those classified in the super category. There are lots of high-end custom knives that use this steel.
ATS 55 Steel	This steel does not have the vanadium that is present in both ATS-34 and 154-CM. This means that it does hold an edge as well, and has also been reported to be less rust resistant than ATS-34. It has a carbon content of 1.00%.
AUS-6 Steel	Has .65% carbon. This is a low quality steel, comparable to 420.
AUS-8 Steel	Has .75% carbon. Cold Steel has made popular use of this steel. This is tough steel, and holds an edge well.
AUS-10 Steel	Has 1.1% carbon. This steel is comparable to 440C. It has more vanadium and less chromium than 440C so it is slightly tougher, but also a little less rust resistant.
BG 42 Steel	This is a relatively new stainless steel that has excellent rust resistance. It is gaining popularity as custom knife makers begin using this steel.
Bohler M390 Steel	Has 1.9% carbon. This material is very stain resistant and has excellent wear resistance. It has vanadium as an additive, consequently it is a popular hard steel. This is also the type of steel used most often for surgical applications.
Bohler N680 Steel	Has .54% carbon. This is another very hard steel that is highly stain resistant, and so is good for salt water applications.
N690 Steel	Has 1.07% carbon. This steel is made in Austria and is very similar to 440C.
Gingami 1 Steel (GIN 1)	This is a wonderful stainless steel. It has .80-.90% carbon. It has good edge retention.

The series below is becoming quite popular because of its strength, ability to resist rust, and how well it holds an edge. These are difficult steels to sharpen though, if you do need to give them an edge. All of these knives are very wear resistant. This type of steel is also very difficult to mirror polish, so you will almost never see it. The 30, 60, and 90 in this series stand for 3%, 6%, and 9% vanadium in the alloy respectively.

S30V Steel	This steel was designed to be used for knives. This steel is very tough, and yet still has great wear resistance. For how tough the steel is, it actually has very good hardness also, which is why many consider it to be one of the best choices for knife making. It has a carbon content of 1.45%.
S60V(CPM T440V) Steel	This stainless steel has high wear resistance. It has lots of vanadium, and also has a carbon content of 2.15%. It is just a step above S30V. Currently, this steel is not commonly used.
S90V(CPM T420V) Steel	This steel has superior edge retention. However, it can be almost impossible to sharpen. Right now custom makers are the only ones using this type of steel. Its carbon content is around 2.30%.
VG 10 Steel	This is another type of steel that gets referred to as super steel. It is a very high end stainless steel. It has vanadium which gives it extra toughness. This steel holds an edge really well. It is also very rust resistant. It has a carbon content of 0.95-1.05%.
X15 Steel	Has .40% carbon. This is a French steel that was developed for the airplane industry. It was developed to resist corrosion in the worst possible conditions. It is the most stain resistant steel on the market, and is a hard material. It is not very tough, but is especially good material for diving knives.
Z60CDV14 Steel	This steel is similar to 440A. It is supposed to hold an edge slightly better than the 440 steels. It has about .40% carbon.

Damascus Steel

Today, pattern welded steel is made to reproduce the look of ancient Damascus steel. This type of steel is made by taking two (or more) layers of different types of steel and folding them together over and over again. After the two different steels are folded together, the steel is acid etched. The colour contrast and patterns on the blade comes from the fact that the two types of steel etch differently. Damascus steel is considered a precious metal, because it is difficult to make, and can result in very beautiful knife blades. This means that knife blades made with Damascus tend to be expensive and only used for custom blades.

Ceramic Blades

Ceramic blades do not rust, so they are popular for use in scuba knives. This material is really, really hard so it almost never needs to be sharpened. It can be almost impossible to sharpen them, but as a trade off ceramic blades are often very brittle.

Titanium Blades

Titanium is popular because it is lightweight and very tough. It does not hold an edge very well so it doesn't usually make a really good blade, but it has been used in diving knives and some custom knives.

Stellite 6-K

Stellite is a special material that has no iron in it. This is a very tough material.

7 Polymers (Plastics)

A polymer is a large molecule, or macromolecule, composed of many repeated subunits. Due to their broad range of properties, both synthetic and natural polymers play essential and ubiquitous roles in everyday life. Polymers range from familiar synthetic plastics such as polystyrene to natural biopolymers such as DNA and proteins that are fundamental to biological structure and function. Polymers, both natural and synthetic, are created via polymerization of many small molecules, known as monomers. Their consequently large molecular mass relative to small molecule compounds produces unique physical properties, including toughness, viscoelasticity, and a tendency to form glasses and semicrystalline structures rather than crystals.

Polymers are of two types: naturally occurring and synthetic or man made. Natural polymeric materials such as shellac, amber, wool, silk and natural rubber have been used for centuries. A variety of other natural polymers exist, such as cellulose, which is the main constituent of wood and paper. The list of synthetic polymers, roughly in order of worldwide demand, includes polyethylene, polypropylene, polystyrene, polyvinyl chloride, synthetic rubber, phenol formaldehyde resin (or Bakelite), neoprene, nylon, polyacrylonitrile, PVB, silicone, and many more. More than 330 million tons of these polymers are made every year (2015). The eight most common types of synthetic organic polymers, commonly found in households are below.

Types

Low-Density Polyethylene (LDPE)

Low-density polyethylene (LDPE) is a thermoplastic made from the monomer ethylene. It was the first grade of polyethylene, produced in 1933 by Imperial Chemical Industries (ICI) using a high pressure process via free radical polymerization. Its manufacture employs the same method today. The EPA estimates 5.7% of LDPE (recycling number 4) is recycled. Despite competition from more modern polymers, LDPE continues to be an important plastic grade. In 2013 the worldwide LDPE market reached a volume of about US$33 billion. LDPE is defined by a density range of 0.917–0.930 g/cm3.

It is not reactive at room temperatures, except by strong oxidizing agents, and some solvents cause swelling. It can withstand temperatures of 80 °C continuously and 90 °C (194 °F) for a short time. Made in translucent or opaque variations, it is quite flexible and tough. LDPE has more branching (on about 2% of the carbon atoms) than HDPE, so its intermolecular forces (instantaneous-dipole induced-dipole attraction) are weaker, its tensile strength is lower, and its resilience is higher. Also, because its molecules are less tightly packed and less crystalline due to the side branches, its density is lower.

Chemical Resistance
- Excellent resistance (no attack / no chemical reaction) to dilute and concentrated acids, alcohols, bases and esters
- Good resistance (minor attack / very low chemical reactivity) to aldehydes, ketones and vegetable oils
- Limited resistance (moderate attack / significant chemical reaction, suitable for short-term use only) to aliphatic and aromatic hydrocarbons, mineral oils and oxidizing agents
- Poor resistance, and not recommended for use with halogenated hydrocarbons.

High-Density Polyethylene (HDPE)

High-density polyethylene (HDPE) or polyethylene high-density (PEHD) is a polyethylene thermoplastic made from petroleum. It is sometimes called "alkathene" or "polythene" when used for pipes. With a high strength-to-density ratio, HDPE is used in the production of plastic bottles, corrosion-resistant piping, geomembranes, and plastic lumber. HDPE is commonly recycled, and has the number "2" as its resin identification code. HDPE is known for its large strength to density ratio. The density of HDPE can range from 930 to 970 kg/m3.

Although the density of HDPE is only marginally higher than that of low-density polyethylene, HDPE has little branching, giving it stronger intermolecular forces and tensile strength than LDPE. The difference in strength exceeds the difference in density, giving HDPE a higher specific strength. It is also harder and more opaque and can withstand somewhat higher temperatures (120 °C/ 248 °F for short periods).

High-density polyethylene, unlike polypropylene, cannot withstand normally required autoclaving conditions. The lack of branching is ensured by an appropriate choice of catalyst (e.g., Ziegler-Natta catalysts) and reaction conditions. HDPE is also used for cell liners in subtitle D sanitary landfills, wherein large sheets of HDPE are either extrusion welded or wedge welded to form a homogeneous chemical-resistant barrier, with the intention of preventing the pollution of soil and groundwater by the liquid constituents of solid waste.

HDPE is preferred by the pyrotechnics trade for mortars over steel or PVC tubes, being more durable and safer. HDPE tends to rip or tear in a malfunction instead of shattering and becoming shrapnel like the other materials. Milk bottles, jugs, and other hollow goods manufactured through blow moulding are the most important application area for HDPE, accounting for one-third of worldwide production, or more than 8 million tonnes.

Applications	• Swimming pool installation • 3-D printer filament • Arena Board (puck board) • Backpacking frames • Ballistic plates • Banners • Bottle caps • Boats • Chemical-resistant piping	• Food storage containers • Fuel tanks for vehicles • Corrosion protection for steel pipelines • Electrical and plumbing boxes • Far-IR lenses • Folding chairs and tables • Storage sheds • Coax cable inner insulator	• Geothermal heat transfer piping systems • Heat-resistant firework mortars • Microwave telescope windows • Natural gas distribution pipe systems • Potable Water Mains • Sewage Mains • Plastic bags • Fireworks	• Plastic lumber • Plastic surgery (skeletal and facial reconstruction) • Root barrier • Snowboard rails and boxes • Stone paper • Telecom ducts • Housewrap (Tyvek) • Wood plastic composites	• Geomembrane for hydraulic applications (such as canals and bank reinforcements) and chemical containment • Water pipes for domestic water supply and agricultural processes • Plastic bottles suitable both for recycling (such as milk jugs) or re-use

Polypropylene (PP)

Polypropylene (PP), also known as polypropene, is a thermoplastic polymer used in a wide variety of applications. It is produced via chain-growth polymerization from the monomer propylene. Polypropylene belongs to the group of polyolefins and is partially crystalline and non-polar. Its properties are similar to polyethylene, but it is slightly harder and more heat resistant. It is a white, mechanically rugged material and has a high chemical resistance. Polypropylene is the second-most widely produced commodity plastic (after polyethylene) and it is often used in packaging and labelling. In 2013, the global market for polypropylene was about 55 million tonnes. Polypropylene is in many aspects similar to polyethylene, especially in solution behaviour and electrical properties.

The methyl group improves mechanical properties and thermal resistance, although the chemical resistance decreases. The density of (PP) is between 0.895 and 0.92 g/cm³. Therefore, PP is the commodity plastic with the lowest density. With lower density, mouldings parts with lower weight and more parts of a certain mass of plastic can be produced. Unlike polyethylene, crystalline and amorphous regions differ only slightly in their density. Polypropylene is normally tough and flexible, especially when copolymerized with ethylene. This allows polypropylene to be used as an engineering plastic, competing with materials such as acrylonitrile butadiene styrene (ABS). Polypropylene is reasonably economical.

The melting point of polypropylene occurs in a range, so the melting point is determined by finding the highest temperature of a differential scanning calorimetry chart. Perfectly isotactic PP has a melting point of 171 °C (340 °F). Commercial isotactic PP has a melting point that ranges from 160 to 166 °C (320 to 331 °F), depending on atactic material and crystallinity. Syndiotactic PP with a crystallinity of 30% has a melting point of 130 °C (266 °F). Below 0 °C, PP becomes brittle. The thermal expansion of polypropylene is very large, but somewhat less than that of polyethylene. Polypropylene at room temperature is resistant to fats and almost all organic solvents, apart from strong oxidants. Non-oxidizing acids and bases can be stored in containers made of PP. At elevated temperature, PP can be dissolved in nonpolar solvents such as xylene, tetralin and decalin.

Due to the tertiary carbon atom PP is chemically less resistant than PE. Most commercial polypropylene is isotactic and has an intermediate level of crystallinity between that of low-density polyethylene (LDPE) and high-density polyethylene (HDPE). Isotactic & atactic polypropylene is soluble in P-xylene at 140 °C. Isotactic precipitates when the solution is cooled to 25 °C and atactic portion remains soluble in P-xylene. Polypropylene is liable to chain degradation from exposure to temperatures above 100 °C. Oxidation usually occurs at the tertiary carbon centres leading to chain breaking via reaction with oxygen. In external applications, degradation is evidenced by cracks and crazing.

Polyvinyl Chloride (PVC)

MATERIALS | Polymers (Plastics) | Types | Polyvinyl Chloride (PVC)

Polyvinyl chloride is the world's third-most widely produced synthetic plastic polymer, after polyethylene and polypropylene. About 40 million tonnes are produced per year. PVC comes in two basic forms: rigid (sometimes abbreviated as RPVC) and flexible. The rigid form of PVC is used in construction for pipe and in profile applications such as doors and windows. It is also used in making bottles, non-food packaging, and cards (such as bank or membership cards). It can be made softer and more flexible by the addition of plasticizers, the most widely used being phthalates. In this form, it is also used in plumbing, electrical cable insulation, imitation leather, flooring, signage, phonograph records, inflatable products, and many applications where it replaces rubber.

With cotton or linen, it is used to make canvas. Pure polyvinyl chloride is a white, brittle solid. It is insoluble in alcohol but slightly soluble in tetrahydrofuran. PVC has high hardness and mechanical properties. The mechanical properties enhance with the molecular weight increasing but decrease with the temperature increasing. The mechanical properties of rigid PVC (uPVC) are very good; the elastic modulus can reach 1500-3,000 MPa. The soft PVC (flexible PVC) elastic limit is 1.5–15 MPa. The heat stability of raw PVC is very poor, so the addition of a heat stabilizer during the process is necessary in order to ensure the product's properties. Traditional product PVC has a maximum operating temperature around 140°F (60°C) when heat distortion begins to occur.

Melting temperatures range from 212°F to 500°F (100°C to 260°C) depending upon manufacture additives to the PVC. The linear expansion coefficient of rigid PVC is small and has good flame retardancy, the limiting oxygen index (LOI) being up to 45 or more. PVC is chemically resistant to acids, salts, bases, fats, and alcohols, making it resistant to the corrosive effects of sewage, which is why it is so extensively utilized in sewer piping systems. It is also resistant to some solvents, this, however, is reserved mainly for uPVC (unplasticized PVC). PVC is commonly used as the insulation on electrical cables such as teck; PVC used for this purpose needs to be plasticized. Flexible PVC coated wire and cable for electrical use has traditionally been stabilised with lead, but these are being replaced with calcium-based systems.

In a fire, PVC-coated wires can form hydrogen chloride fumes; the chlorine serves to scavenge free radicals and is the source of the material's fire retardance. While hydrogen chloride fumes can also pose a health hazard in their own right, it dissolves in moisture and breaks down onto surfaces, particularly in areas where the air is cool enough to breathe, and is not available for inhalation. PVC is a common, strong but lightweight plastic used in construction. It is made softer and more flexible by the addition of plasticizers. If no plasticizers are added, it is known as uPVC (unplasticized polyvinyl chloride) or rigid PVC.

Polystyrene (PS)

MATERIALS | Polymers (Plastics) | Types | Polystyrene (PS)

Polystyrene (PS) is a synthetic aromatic hydrocarbon polymer made from the monomer styrene. Polystyrene can be solid or foamed. General-purpose polystyrene is clear, hard, and rather brittle. It is an inexpensive resin per unit weight. It is a rather poor barrier to oxygen and water vapour and has a relatively low melting point. Polystyrene is one of the most widely used plastics, the scale of its production being several million tonnes per year. Polystyrene can be naturally transparent, but can be coloured with colourants. Uses include protective packaging (such as packing peanuts and CD and DVD cases), containers (such as "clamshells"), lids, bottles, trays, tumblers, disposable cutlery and in the making of models. As a thermoplastic polymer, polystyrene is in a solid (glassy) state at room temperature but flows if heated above about 100 °C, its glass transition temperature.

It becomes rigid again when cooled. This temperature behaviour is exploited for extrusion (as in Styrofoam) and also for moulding and vacuum forming, since it can be cast into moulds with fine detail. Polystyrene is slow to biodegrade and is therefore a focus of controversy among environmentalists. It is increasingly abundant as a form of litter in the outdoor environment, particularly along shores and waterways, especially in its foam form, and also in increasing quantities in the Pacific Ocean. Polystyrene is flammable, and releases lots of black smoke upon burning. Like all organic compounds, polystyrene burns to give carbon dioxide and water vapour.

MATERIALS | Polymers (Plastics) | Types | Polystyrene (PS)

Polystyrene is chemically very inert, being resistant to acids and bases but is easily dissolved by many chlorinated solvents, and many aromatic hydrocarbon solvents. Because of its resilience and inertness, it is used for fabricating many objects of commerce. It is attacked by many organic solvents, which dissolve the polymer. Foamed polystyrene is used for packaging chemicals. Polystyrene is commonly injection moulded, vacuum formed, or extruded, while expanded polystyrene is either extruded or moulded in a special process.

Polystyrene copolymers are also produced; these contain one or more other monomers in addition to styrene. In recent years the expanded polystyrene composites with cellulose and starch have also been produced. Polystyrene (PS) is used for producing disposable plastic cutlery and dinnerware, CD "jewel" cases, smoke detector housings, license plate frames, plastic model assembly kits, and many other objects where a rigid, economical plastic is desired. Polystyrene foams are 95-98% air.

Polystyrene foams are good thermal insulators and are therefore often used as building insulation materials, such as in insulating concrete forms and structural insulated panel building systems. Grey polystyrene foam, incorporating graphite has superior insulation properties. PS foams also exhibit good damping properties, therefore it is used widely in packaging. Discarded polystyrene does not biodegrade for hundreds of years and is resistant to photo-oxidation. Animals do not recognize polystyrene foam as an artificial material and may even mistake it for food. Polystyrene foam blows in the wind and floats on water, due to its low specific gravity. It can have serious effects on the health of birds or marine animals that swallow significant quantities.

Nylon

MATERIALS | Polymers (Plastics) | Types | Nylon

Nylon is a generic designation for a family of synthetic polymers, based on aliphatic or semi-aromatic polyamides. Nylon is a thermoplastic silky material that can be melt-processed into fibres, films or shapes. Nylon was the first commercially successful synthetic thermoplastic polymer. Nylon was first used commercially in a nylon-bristled toothbrush in 1938, followed more famously in women's stockings or "nylons" which were shown at the 1939 New York World's Fair and first sold commercially in 1940. During World War II, almost all nylon production was diverted to the military for use in parachutes and parachute cord. Wartime uses of nylon and other plastics greatly increased the market for the new materials. Nylon clothing tends to be less flammable than cotton and rayon, but nylon fibres may melt and stick to skin. Above their melting temperatures, Tm, thermoplastics like nylon are amorphous solids or viscous fluids in which the chains approximate random coils. Below Tm, amorphous regions alternate with regions which are lamellar crystals. The amorphous regions contribute elasticity and the crystalline regions contribute strength and rigidity.

MATERIALS | Polymers (Plastics) | Types | Nylon

Nylon 6,6 Characteristics	● Pleats and creases can be heat-set at higher temperatures ● More compact molecular structure ● Better weathering properties; better sunlight resistance ● Softer "Hand" ● High melting point (256 °C/492.8 °F) ● Superior colourfastness ● Excellent abrasion resistance
Nylon 6 Characteristics	● Variation of lustre: nylon has the ability to be very lustrous, semilustrous or dull. ● Durability: its high tenacity fibres are used for seatbelts, ballistic cloth etc. ● High elongation ● Excellent abrasion resistance ● Highly resilient (nylon fabrics are heat-set) ● High resistance to insects, fungi, animals, as well as moulds, mildew, rot and many chemicals ● Used in carpets and nylon stockings ● Melts instead of burning ● Good specific strength ● Transparent to infrared light (−12 dB)
Food Packaging	Nylon resins are used as a component of food packaging films where an oxygen barrier is needed. Some of the terpolymers based upon nylon are used every day in packaging. Nylon has been used for meat wrappings and sausage sheaths. The high temperature resistance of nylon makes it useful for oven bags.
Filaments	Nylon filaments are primarily used in brushes especially toothbrushes and string trimmers. They are also used as monofilaments in fishing line. Nylon 610 and 612 are the most used polymers for filaments. Its various properties also make it very useful as a material in additive manufacturing; specifically as a filament in consumer and professional grade fused deposition modelling 3D printers.

Teflon (Polytetrafluoroethylene)

Polytetrafluoroethylene (PTFE) is a synthetic fluoropolymer of tetrafluoroethylene that has numerous applications. The best known brand name of PTFE-based formulas is Teflon by Chemours. PTFE is a fluorocarbon solid, as it is a high-molecular-weight compound consisting wholly of carbon and fluorine. PTFE is hydrophobic: neither water nor water-containing substances wet PTFE, as fluorocarbons demonstrate mitigated London dispersion forces due to the high electronegativity of fluorine. PTFE has one of the lowest coefficients of friction of any solid. PTFE is used as a non-stick coating for pans and other cookware. It is nonreactive, partly because of the strength of carbon–fluorine bonds, and so it is often used in containers and pipework for reactive and corrosive chemicals. Where used as a lubricant, PTFE reduces friction, wear, and energy consumption of machinery. It is commonly used as a graft material in surgical interventions.

Also, it is frequently employed as coating on catheters; this interferes with the ability of bacteria and other infectious agents to adhere to catheters and cause hospital-acquired infections. PTFE is a thermoplastic polymer, which is a white solid at room temperature, with a density of about 2200 kg/m3. According to Chemours, its melting point is 600 K (327 °C; 620 °F).

It maintains high strength, toughness and self-lubrication at low temperatures down to 5 K (−268.15 °C; −450.67 °F), and good flexibility at temperatures above 194 K (−79 °C; −110 °F). PTFE gains its properties from the aggregate effect of carbon-fluorine bonds, as do all fluorocarbons. The only chemicals known to affect these carbon-fluorine bonds are highly reactive metals like the alkali metals, and at higher temperatures also such metals as aluminium and magnesium, and fluorinating agents such as xenon difluoride and cobalt(III) fluoride.

The coefficient of friction of plastics is usually measured against polished steel. PTFE's coefficient of friction is 0.05 to 0.10, which is the third-lowest of any known solid material (BAM being the first, with a coefficient of friction of 0.02; diamond-like carbon being second-lowest at 0.05). PTFE's resistance to van der Waals forces means that it is the only known surface to which a gecko cannot stick. In fact, PTFE can be used to prevent insects climbing up surfaces painted with the material.

PTFE is so slippery that insects cannot get a grip and tend to fall off. For example, PTFE is used to prevent ants climbing out of formicaria. Processing PTFE can be difficult and expensive, because the high melting temperature, 327 °C (621 °F), is above the initial decomposition temperature, 200 °C (392 °F). Even when melted, PTFE does not flow, but instead behaves as a gel due to the absence of crystalline phase and high melt viscosity. The major application of PTFE, consuming about 50% of production, is for wiring in aerospace and computer applications (e.g. hookup wire, coaxial cables).

This application exploits the fact that PTFE has excellent dielectric properties, especially at high radio frequencies, making it suitable for use as an excellent insulator in connector assemblies and cables, and in printed circuit boards used at microwave frequencies. Gore-Tex is a brand of expanded PTFE (ePTFE), a material incorporating a fluoropolymer membrane with micropores. The roof of the Hubert H. Humphrey Metrodome in Minneapolis, US, was one of the largest applications of PTFE coatings.

Thermoplastic Polyurethanes (TPU)

Thermoplastic polyurethane (TPU) is any of a class of polyurethane plastics with many properties, including elasticity, transparency, and resistance to oil, grease and abrasion. Technically, they are thermoplastic elastomers consisting of linear segmented block copolymers composed of hard and soft segments. TPU has many applications including automotive instrument panels, caster wheels, power tools, sporting goods, medical devices, drive belts, footwear, inflatable rafts, and a variety of extruded film, sheet and profile applications. TPU is also a popular material found in outer cases of mobile electronic devices, such as mobile phones. It is also used to make keyboard protectors for laptops. TPU is well known for its applications in performance films, wire and cable jacketing, hose and tube, in adhesive and textile coating applications and as an impact modifier of other polymers. TPU pellets are used as Adidas' most recent cushioning technology, known as Boost. Several thousands of TPU pellets are bound together to create a comfortable sole for the shoe.

Properties
- High abrasion resistance
- Low-temperature performance
- High shear strength
- High elasticity
- Transparency
- Oil and grease resistance

TPUs can be divided mainly in two groups:
- Polyester-based TPUs (mainly derived from adipic acid esters)
- Polyether-based TPUs (mainly based on tetrahydrofuran (THF) ethers).

Trade Names
Epamould, Epaline, Epacol, Pakoflex, Elastollan, Pearlthane, Desmopan, Estane, Pellethane, Irogran, Exelast EC, Laripur, Avalon, Isothane, Zythane, TPU 95A.

8 Ceramics

A ceramic is any of the various hard, brittle, heat-resistant and corrosion-resistant materials made by shaping and then firing a nonmetallic mineral, such as clay, at a high temperature. Common examples are earthenware, porcelain, and brick.

Clay Products

Kaolinite	Kaolinite is a clay mineral, part of the group of industrial minerals, with the chemical composition $Al_2Si_2O_5(OH)_4$. It is a layered silicate mineral, with one tetrahedral sheet of silica (SiO_4) linked through oxygen atoms to one octahedral sheet of alumina (AlO_6) octahedra. Rocks that are rich in kaolinite are known as kaolin or china clay. In many parts of the world it is coloured pink-orange-red by iron oxide, giving it a distinct rust hue. Lighter concentrations yield white, yellow, or light orange colours. Alternating layers are sometimes found, as at Providence Canyon State Park in Georgia, United States. Commercial grades of kaolin are supplied and transported as dry powder, semi-dry noodle or as liquid slurry.
Montmorillonite-Smectite	Montmorillonite is a very soft phyllosilicate group of minerals that form when they precipitate from water solution as microscopic crystals, known as clay. It is named after Montmorillon in France. Montmorillonite, a member of the smectite group, is a 2:1 clay, meaning that it has two tetrahedral sheets of silica sandwiching a central octahedral sheet of alumina. The particles are plate-shaped with an average diameter around 1 μm and a thickness of 0.96 nm; magnification of about 25,000 times, using an electron microscope, is required to "see" individual clay particles. Members of this group include saponite.
Illite	Illite is a group of closely related non-expanding clay minerals. Illite is a secondary mineral precipitate, and an example of a phyllosilicate, or layered alumino-silicate. Its structure is a 2:1 sandwich of silica tetrahedron (T) – alumina octahedron (O) – silica tetrahedron (T) layers. The space between this T-O-T sequence of layers is occupied by poorly hydrated potassium cations which are responsible for the absence of swelling. Structurally, illite is quite similar to muscovite with slightly more silicon, magnesium, iron, and water and slightly less tetrahedral aluminium and interlayer potassium.
Chlorite	The chlorites are a group of phyllosilicate minerals. Chlorites can be described by the following four endmembers based on their chemistry via substitution of the following four elements in the silicate lattice; Mg, Fe, Ni, and Mn. In addition, zinc, lithium, and calcium species are known. The great range in composition results in considerable variation in physical, optical, and X-ray properties. Similarly, the range of chemical composition allows chlorite group minerals to exist over a wide range of temperature and pressure conditions. For this reason chlorite minerals are ubiquitous minerals within low and medium temperature metamorphic rocks, some igneous rocks, hydrothermal rocks and deeply buried sediments.

MATERIALS Ceramics

Traditional Ceramics

Whitewares	Whitewares are not necessarily white. They consist typically of clays, feldspar, potter's flint, and whiting. The modern oxide ceramics would also be in this group. For technical use, these whitewares are usually vitrified (nonporous) or very nearly so. Most commonly the pieces are glazed. To produce white-bodied ceramics, the raw materials must be of superior quality and selection. The range of materials available is comparatively limited. Although clays are widely distributed over the Earth, large, uniform deposits of white burning clays are not common. Most whiteware clays are basically kaolins and chemically are hydrous aluminium silicates. Ball clays are less pure than kaolins and contain free silica and small amounts of other contaminants. Kaolins are generally not highly plastic, whereas ball clays are very plastic. The plasticity derives from the physical form of the minute particles, which are colloidal in size. Ball clays are not as white-burning as kaolins and impart colour to the fired body. Porcelains, china, and stoneware are composed of clays, silica, and feldspar. Steatites are composed of talc (magnesium silicate) and clay. Minor variations are made to enhance special properties.	**Includes** ● Porcelain ● China ● Pottery ● Earthenware ● Stoneware ● Steatites ● Vitreous Tile
Structural Clay Products	Structural clay products, ceramic products intended for use in building construction. Typical structural clay products are building brick, paving brick, terra-cotta facing tile, roofing tile, and drainage pipe. These objects are made from commonly occurring natural materials, which are mixed with water, formed into the desired shape, and fired in a kiln in order to give the clay mixture a permanent bond. Finished structural clay products display such essential properties as load-bearing strength, resistance to wear, resistance to chemical attack, attractive appearance, and an ability to take a decorative finish. Structural clay products are made from 35 to 55 percent clays or argillaceous (clayey) shales, 25 to 45 percent quartz, and 25 to 55 percent feldspar. As with all traditional ceramic products, the clay portion acts as a former, providing shaping ability; the quartz (silica) serves as a filler, providing strength to the formed object; and the feldspar serves as a fluxing agent, lowering the melting temperatures of the clay and quartz during firing. The proportions cited above are often found directly in shale deposits, so that blending is often not necessary. In addition, little or no beneficiation, or crushing and grinding of the mined material, is employed. Local clays or shales of highly variable composition are used in order to keep transportation costs as low as possible. The colour of the finished product derives from impurities, most notably iron oxides, present in the raw materials.	
Bricks	A brick is building material used to make walls, pavements and other elements in masonry construction. Traditionally, the term brick referred to a unit composed of clay, but it is now used to denote any rectangular units laid in mortar. A brick can be composed of clay-bearing soil, sand, and lime, or concrete materials. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Two basic categories of bricks are fired and non-fired bricks. Block is a similar term referring to a rectangular building unit composed of similar materials, but is usually larger than a brick. Lightweight bricks (also called lightweight blocks) are made from expanded clay aggregate. Fired bricks are one of the longest-lasting and strongest building materials, sometimes referred to as artificial stone, and have been used since circa 4000 BC. Air-dried bricks, also known as mudbricks, have a history older than fired bricks, and have an additional ingredient of a mechanical binder such as straw. Bricks are laid in courses and numerous patterns known as bonds, collectively known as brickwork, and may be laid in various kinds of mortar to hold the bricks together to make a durable structure.	
Tiles	A tile is a thin object usually square or rectangular in shape. Tile is a manufactured piece of hard-wearing material such as ceramic, stone, metal, baked clay, or even glass, generally used for covering roofs, floors, walls, or other objects such as tabletops. Alternatively, tile can sometimes refer to similar units made from lightweight materials such as perlite, wood, and mineral wool, typically used for wall and ceiling applications. In another sense, a tile is a construction tile or similar object, such as rectangular counters used in playing games (see tile-based game). The word is derived from the French word tuile, which is, in turn, from the Latin word tegula, meaning a roof tile composed of fired clay. Tiles are often used to form wall and floor coverings, and can range from simple square tiles to complex or mosaics. Tiles are most often made of ceramic, typically glazed for internal uses and unglazed for roofing, but other materials are also commonly used, such as glass, cork, concrete and other composite materials, and stone. Tiling stone is typically marble, onyx, granite or slate. Thinner tiles can be used on walls than on floors, which require more durable surfaces that will resist impacts.	
Abrasives	Abrasive ceramics are used to grind or cut away other softer material. Primarily, when considering the design of a abrasive material it is hardness and wear resistance that are of the most importance. Toughness is also considered as a necessary requirement so that the abrasive material does not shatter during grinding. Abrasives can be either natural or synthetic. Common examples include diamond, silicon carbide SiC, tungsten carbide WC, or normal silica sand. Abrasives may generally be either bonded to grinding wheels, coated on paper, or exist as loose grains.	
Refractories	Because of their high heat resistance, ceramic materials are used as refractories. Refractory ceramics are insulating materials and are designed to withstand high stresses and temperatures and must also resist the effects of molten metals, abrasive particles and hot gases. Ceramics made of pure oxides are quite often the best refractories, however, these are expensive and therefore mixtures of ceramic compounds are often used.	

Electroceramics

Electronic Substrate Package Ceramics	Electronic substrate and package ceramics, advanced industrial materials that, owing to their insulating qualities, are useful in the production of electronic components. Modern electronics are based on the integrated circuit, an assembly of millions of interconnected components such as transistors and resistors that are built up on a tiny chip of silicon. In order to maintain their reliability, these circuits depend on insulating materials that can serve as substrates (that is, the bases on which the microscopic electronic components and their connections are built) and packages (that is, the structures that seal a circuit from the environment and make it a single, compact unit). The insulating properties of ceramics are well known, and these properties have found application in advanced ceramic materials for substrates and packages. The materials and products are described in this article.
Capacitor Dielectric, Piezoelectric Ceramics	Capacitor dielectric and piezoelectric ceramics, advanced industrial materials that, by virtue of their poor electrical conductivity, are useful in the production of electrical storage or generating devices. Capacitors are devices that store electric energy in the form of an electric field generated in the space between two separated, oppositely charged electrodes. Their capacity to store energy makes them essential components in many electric circuits, and that capacity can be greatly increased by inserting a solid dielectric material into the space separating the electrodes. Dielectrics are materials that are poor conductors of electricity. The nonconducting properties of ceramics are well known, and some ceramics are made into extremely effective dielectrics. Indeed, more than 90 percent of all capacitors are produced with ceramic materials serving as the dielectric. Piezoelectrics are materials that generate a voltage when they are subjected to mechanical pressure; conversely, when subjected to an electromagnetic field, they exhibit a change in dimension. Many piezoelectric devices are made of the same ceramic materials as capacitor dielectrics.
Magnetic Ceramics	Magnetic ceramics, oxide materials that exhibit a certain type of permanent magnetization called ferrimagnetism. Commercially prepared magnetic ceramics are used in a variety of permanent magnet, transformer, telecommunications, and information recording applications.

Optical Ceramics	Optical ceramics, advanced industrial materials developed for use in optical applications. Optical materials derive their utility from their response to infrared, optical, and ultraviolet light. The most obvious optical materials are glasses, which are described in the article industrial glass, but ceramics also have been developed for a number of optical applications. This article surveys several of these applications, both passive (e.g., windows, radomes, lamp envelopes, pigments) and active (e.g., phosphors, lasers, electro-optical components).
Conductive Ceramics	Conductive ceramics, advanced industrial materials that, owing to modifications in their structure, serve as electrical conductors. In addition to the well-known physical properties of ceramic materials—hardness, compressive strength, brittleness—there is the property of electric resistivity. Most ceramics resist the flow of electric current, and for this reason ceramic materials such as porcelain have traditionally been made into electric insulators. Some ceramics, however, are excellent conductors of electricity. Most of these conductors are advanced ceramics, modern materials whose properties are modified through precise control over their fabrication from powders into products.

Advanced Structural Ceramics

Nuclear Ceramics
Nuclear ceramics, ceramic materials employed in the generation of nuclear power and in the disposal of radioactive nuclear wastes. In their nuclear-related functions, ceramics are of major importance. Since the beginning of nuclear power generation, oxide ceramics, based on the fissionable metals uranium and plutonium, have been made into highly reliable fuel pellets for both water-cooled and liquid-metal-cooled reactors. Ceramics also can be employed to immobilize and store nuclear wastes. Although vitrification (glass formation) is a favoured approach for waste disposal, wastes can be processed with other ceramics into a synthetic rock, or synroc, or they can be mixed with cement powder to make hardened cements. All these nuclear applications are extremely demanding. In addition to severe thermal and chemical driving forces, nuclear ceramics are continuously subjected to high radiation doses.

Bioceramics
Bioceramics and bioglasses are ceramic materials that are biocompatible. Bioceramics are an important subset of biomaterials. Bioceramics range in biocompatibility from the ceramic oxides, which are inert in the body, to the other extreme of resorbable materials, which are eventually replaced by the body after they have assisted repair. Bioceramics are used in many types of medical procedures. Bioceramics are typically used as rigid materials in surgical implants, though some bioceramics are flexible. The ceramic materials used are not the same as porcelain type ceramic materials. Rather, bioceramics are closely related to either the body's own materials or are extremely durable metal oxides.

Tribological Ceramics
Tribological ceramics, also called wear-resistant ceramics, ceramic materials that are resistant to friction and wear. They are employed in a variety of industrial and domestic applications, including mineral processing and metallurgy. There are two basic mechanisms of tribological wear—impingement wear and rubbing wear. In impingement wear, particles impact and erode the surface. This is the major wear mechanism encountered in mineral handling, for example. Rubbing wear, on the other hand, occurs when two materials under load slide against each other. This wear occurs in such devices as rotating shafts, valve seats, and metal extrusion and drawing dies. Ceramics are well suited to resisting these mechanisms because, owing to the strong chemical bonds that hold them together, they tend to be extremely hard and strong. These properties are essential to tribological applications, but tribological ceramics display other important properties as well—most notably, elasticity, toughness, thermal expansion, and thermal conductivity.

Automotive Ceramics
Automotive ceramics, advanced ceramic materials that are made into components for automobiles. Examples include spark plug insulators, catalysts and catalyst supports for emission control devices, and sensors of various kinds. Catalytic converters are used to reduce the amounts of nitrogen oxides, carbon monoxide, and unreacted hydrocarbons in automotive emissions. Catalytic conversion requires a precisely balanced air-to-fuel ratio, hence the need for oxygen sensors such as those described in conductive ceramics: Oxygen sensors to aid in feedback control of fuel injection. In dual-bed converter systems the exhaust gases are first reduced in order to eliminate the oxides of nitrogen; then they are oxidized with added air in order to eliminate carbon monoxide and unburned hydrocarbons. In more advanced three-way converters individual catalysts accomplish reduction of each species simultaneously. Catalysts are either platinum-group metals or base metals such as chromium, nickel, and copper. In base-metal catalysts the active surfaces are actually ceramic oxides of the metals. Because platinum metals are extremely expensive, they are deposited on ceramic catalyst supports as salts and then reduced to finely divided metal particles. For efficiency of conversion, extremely large surface areas are required.

9 Glass

Glass is a non-crystalline amorphous solid that is often transparent and has widespread practical, technological, and decorative usage in, for example, window panes, tableware, and optoelectronics. The most familiar, and historically the oldest, types of glass are "silicate glasses" based on the chemical compound silica (silicon dioxide, or quartz), the primary constituent of sand. The term glass, in popular usage, is often used to refer only to this type of material, which is familiar from use as window glass and in glass bottles.

Of the many silica-based glasses that exist, ordinary glazing and container glass is formed from a specific type called soda-lime glass, composed of approximately 75% silicon dioxide (SiO_2), sodium oxide (Na_2O) from sodium carbonate (Na_2CO_3), calcium oxide (CaO), also called lime, and several minor additives. Many applications of silicate glasses derive from their optical transparency, giving rise to their primary use as window panes. Glass will transmit, reflect and refract light; these qualities can be enhanced by cutting and polishing to make optical lenses, prisms, fine glassware, and optical fibres for high speed data transmission by light.

Glass can be coloured by adding metallic salts, and can also be painted and printed with vitreous enamels. These qualities have led to the extensive use of glass in the manufacture of art objects and in particular, stained glass windows. Although brittle, silicate glass is extremely durable, and many examples of glass fragments exist from early glass-making cultures. Because glass can be formed or moulded into any shape, it has been traditionally used for vessels: bowls, vases, bottles, jars and drinking glasses.

In its most solid forms it has also been used for paperweights, marbles, and beads. When extruded as glass fibre and matted as glass wool in a way to trap air, it becomes a thermal insulating material, and when these glass fibres are embedded into an organic polymer plastic, they are a key structural reinforcement part of the composite material fibreglass.

Optical Properties	Glass is in widespread use largely due to the production of glass compositions that are transparent to visible light. In contrast, polycrystalline materials do not generally transmit visible light. The individual crystallites may be transparent, but their facets (grain boundaries) reflect or scatter light resulting in diffuse reflection. Glass does not contain the internal subdivisions associated with grain boundaries in polycrystals and hence does not scatter light in the same manner as a polycrystalline material. The surface of a glass is often smooth since during glass formation the molecules of the supercooled liquid are not forced to dispose in rigid crystal geometries and can follow surface tension, which imposes a microscopically smooth surface. These properties, which give glass its clearness, can be retained even if glass is partially light-absorbing—i.e., coloured. Glass has the ability to refract, reflect, and transmit light following geometrical optics, without scattering it (due to the absence of grain boundaries). It is used in the manufacture of lenses and windows.

Common glass has a refraction index around 1.5. This may be modified by adding low-density materials such as boron, which lowers the index of refraction or increased (to as much as 1.8) with high-density materials such as lead oxide, or in modern uses, less toxic oxides of zirconium, titanium, or barium. These high-index glasses (inaccurately known as "crystal" when used in glass vessels) cause more chromatic dispersion of light, and are prized for their diamond-like optical properties. According to Fresnel equations, the reflectivity of a sheet of glass is about 4% per surface (at normal incidence in air), and the transmissivity of one element (two surfaces) is about 90%. Glass with high germanium oxide content also finds application in optoelectronics—e.g., for light-transmitting optical fibres.

Other Properties	In the process of manufacture, silicate glass can be poured, formed, extruded and moulded into forms ranging from flat sheets to highly intricate shapes. The finished product is brittle and will fracture, unless laminated or specially treated, but is extremely durable under most conditions. It erodes very slowly and can mostly withstand the action of water. It is mostly resistant to chemical attack, does not react with foods, and is an ideal material for the manufacture of containers for foodstuffs and most chemicals. Glass is also a fairly inert substance.
Corrosion	Although glass is generally corrosion-resistant and more corrosion resistant than other materials, it still can be corroded. The materials that make up a particular glass composition have an effect on how quickly the glass corrodes. A glass containing a high proportion of alkalis or alkali earths is less corrosion-resistant than other kinds of glasses. Glass flakes have applications as anti-corrosive coating.
Strength	Glass typically has a tensile strength of 7 megapascals (1,000 psi), however theoretically it can have a strength of 17 gigapascals (2,500,000 psi) due to glass's strong chemical bonds. Several factors such as imperfections like scratches and bubbles and the glass's chemical composition impact the tensile strength of glass. Several processes such as toughening can increase the strength of glass.
Colour	Colour in glass may be obtained by addition of electrically charged ions (or colour centres) that are homogeneously distributed, and by precipitation of finely dispersed particles (such as in photochromic glasses). Ordinary soda-lime glass appears colourless to the naked eye when it is thin, although iron(II) oxide (FeO) impurities of up to 0.1 wt% produce a green tint, which can be viewed in thick pieces or with the aid of scientific instruments. Further FeO and chromium(III) oxide (Cr_2O_3) additions may be used for the production of green bottles. Sulphur, together with carbon and iron salts, is used to form iron polysulfides and produce amber glass ranging from yellowish to almost black. A glass melt can also acquire an amber colour from a reducing combustion atmosphere. Manganese dioxide can be added in small amounts to remove the green tint given by iron(II) oxide. Art glass and studio glass pieces are coloured using closely guarded recipes that involve specific combinations of metal oxides, melting temperatures and "cook" times. Most coloured glass used in the art market is manufactured in volume by vendors who serve this market, although there are some glassmakers with the ability to make their own colour from raw materials.

Silicate Glass

Silica (SiO_2) is a common fundamental constituent of glass. In nature, vitrification of quartz occurs when lightning strikes sand, forming hollow, branching root-like structures called fulgurites. Fused quartz is a glass made from chemically-pure silica. It has excellent resistance to thermal shock, being able to survive immersion in water while red hot. However, its high melting temperature (1723 °C) and viscosity make it difficult to work with. Normally, other substances are added to simplify processing.

One is sodium carbonate (Na_2CO_3, "soda"), which lowers the glass-transition temperature. The soda makes the glass water-soluble, which is usually undesirable, so lime (CaO, calcium oxide, generally obtained from limestone), some magnesium oxide (MgO) and aluminium oxide (Al_2O_3) are added to provide for a better chemical durability. The resulting glass contains about 70 to 74% silica by weight and is called a soda-lime glass.

Soda-lime glasses account for about 90% of manufactured glass. Most common glass contains other ingredients to change its properties. Lead glass or flint glass is more "brilliant" because the increased refractive index causes noticeably more specular reflection and increased optical dispersion. Adding barium also increases the refractive index. Thorium oxide gives glass a high refractive index and low dispersion and was formerly used in producing high-quality lenses, but due to its radioactivity has been replaced by lanthanum oxide in modern eyeglasses.

Iron can be incorporated into glass to absorb infrared radiation, for example in heat-absorbing filters for movie projectors, while cerium(IV) oxide can be used for glass that absorbs ultraviolet wavelengths. The following is a list of the more common types of silicate glasses and their ingredients, properties, and applications:

Fused quartz / Fused-Silica Glass / Vitreous-Silica Glass	Silica (SiO_2) in vitreous, or glass, form (i.e., its molecules are disordered and random, without crystalline structure). It has very low thermal expansion, is very hard, and resists high temperatures (1000–1500 °C). It is also the most resistant against weathering (caused in other glasses by alkali ions leaching out of the glass, while staining it). Fused quartz is used for high-temperature applications such as furnace tubes, lighting tubes, melting crucibles, etc.
Soda-Lime-Silica glass / Window Glass	Silica + sodium oxide (Na_2O) + lime (CaO) + magnesia (MgO) + alumina (Al_2O_3). Is transparent, easily formed and most suitable for window glass (see flat glass). It has a high thermal expansion and poor resistance to heat (500–600 °C). It is used for windows, some low-temperature incandescent light bulbs, and tableware. Container glass is a soda-lime glass that is a slight variation on flat glass, which uses more alumina and calcium, and less sodium and magnesium, which are more water-soluble. This makes it less susceptible to water erosion.
Sodium Borosilicate Glass / Pyrex	Silica + boron trioxide (B_2O_3) + soda (Na_2O) + alumina (Al_2O_3). Stands heat expansion much better than window glass. Used for chemical glassware, cooking glass, car head lamps, etc. Borosilicate glasses (e.g. Pyrex, Duran) have as main constituents silica and boron trioxide. They have fairly low coefficients of thermal expansion (7740 Pyrex CTE is 3.25×10^{-6}/°C as compared to about 9×10^{-6}/°C for a typical soda-lime glass), making them more dimensionally stable. The lower coefficient of thermal expansion (CTE) also makes them less subject to stress caused by thermal expansion, thus less vulnerable to cracking from thermal shock. They are commonly used for reagent bottles, optical components and household cookware.
Lead-Oxide Glass / Crystal Glass / Lead Glass	Silica + lead oxide (PbO) + potassium oxide (K_2O) + soda (Na_2O) + zinc oxide (ZnO) + alumina. Because of its high density (resulting in a high electron density), it has a high refractive index, making the look of glassware more brilliant (called "crystal", though of course it is a glass and not a crystal). It also has a high elasticity, making glassware "ring". It is also more workable in the factory, but cannot stand heating very well. This kind of glass is also more fragile than other glasses and is easier to cut.
Aluminosilicate Glass	Silica + alumina + lime + magnesia + barium oxide (BaO) + boric oxide (B_2O_3). Extensively used for fibreglass, used for making glass-reinforced plastics (boats, fishing rods, etc.) and for halogen bulb glass. Aluminosilicate glasses are also resistant to weathering and water erosion.
Germanium-Oxide Glass	Alumina + germanium dioxide (GeO_2). Extremely clear glass, used for fibre-optic waveguides in communication networks. Light loses only 5% of its intensity through 1 km of glass fibre.
Crushed Alkali Glass	Another common glass ingredient is crushed alkali glass or 'cullet' ready for recycled glass. The recycled glass saves on raw materials and energy. Impurities in the cullet can lead to product and equipment failure. Fining agents such as sodium sulphate, sodium chloride, or antimony oxide may be added to reduce the number of air bubbles in the glass mixture. Glass batch calculation is the method by which the correct raw material mixture is determined to achieve the desired glass composition.

Fibreglass

MATERIALS Glass Fiberglass

Fibreglass (also called glass-reinforced-plastic) is a composite material made up of glass fibres (also called fibreglass or glass friller) embedded in a plastic resin. It is made by melting glass and stretching the glass into fibres. These fibres are woven together into a cloth and left to set in a plastic resin. Fibreglass filaments are made through a pultrusion process in which the raw materials (sand, limestone, kaolin clay, fluorspar, colemanite, dolomite and other minerals) are melted in a large furnace into a liquid which is extruded through very small orifices (5–25 micrometres in diameter if the glass is E-glass and 9 micrometers if the glass is S-glass). Fibreglass has the properties of being lightweight and corrosion resistant. Fibreglass is also a good insulator, allowing it to be used to insulate buildings. Most fibreglasses are not alkali resistant. Fibreglass also has the property of becoming stronger as the glass ages.

Electrolytes

Electrolytes or molten salts are mixtures of different ions. In a mixture of three or more ionic species of dissimilar size and shape, crystallization can be so difficult that the liquid can easily be supercooled into a glass. The best-studied example is Ca0.4K0.6(NO3). Glass electrolytes in the form of Ba-doped Li-glass and Ba-doped Na-glass have been proposed as solutions to problems identified with organic liquid electrolytes used in modern lithium-ion battery cells.

Glass Properties

Glass is a unique and extremely versatile material that can be engineered to exhibit specific optical, thermal, chemical, and mechanical properties. As a result of its exceptional engineering properties – transparency, strength, workability, transmittance and u value, glass has been heavily used in the construction industry. We will briefly feature some of the most common commercial glass types and typical applications.

Annealed Glass (Float Glass)	Annealed glass is the basic flat glass product that is the first result of the float process. It is the common glass that tends to break into large, jagged shards. It is used in some end products -- often in double-glazed windows, for example. It is also the starting material that is turned into more advanced products through further processing such as laminating, toughening, coating, etc. The float glass process is renowned for flatness and optical clarity. It is available in clear, toned, high performance toned, ultra clear low iron glass and Low E pyrolitic coated.
Insulated Glass (Double Glazing)	Two or more panels of glass are bonded to a perimeter spacer, either a metal or thermoplastic spacer, (TPS). Either air or argon gas fills the space between the glass panes. Their primary benefit is insulation and solar control. Most types of glass can be incorporated into an insulating glass unit.
Toughened Glass	Toughened glass is treated to be far more resistant to breakage than simple annealed glass, and to break in a more predictable way when it does break, thus providing a major safety advantage in almost all of its applications. Toughened glass is made from annealed glass treated with a thermal tempering process. A sheet of annealed glass is heated to above its "annealing point" of 600 °C; its surfaces are then rapidly cooled while the inner portion of the glass remains hotter. The different cooling rates between the surface and the inside of the glass produces different physical properties, resulting in compressive stresses in the surface balanced by tensile stresses in the body of the glass. These counteracting stresses give toughened glass its increased mechanical resistance to breakage, and are also, when it does break, what cause it to produce regular, small, typically square fragments rather than long, dangerous shards that are far more likely to lead to injuries. Toughened glass also has an increased resistance to breakage as a result of stresses caused by different temperatures within a pane. Toughened glass has extremely broad application. Glass portions of building façades, glass sliding doors and partitions in houses and offices, and many other products typically use toughened glass. Products made from toughened glass often also incorporate other technologies.
Heat Strengthen Glass	With heat-strengthened glass, the cooling process is slower, which results in lower compression strength. Heat-strengthened glass is approximately twice as strong as annealed, or untreated, glass.
Fully Tempered Glass	Before the glass can be used as a building material it is often heat-treated for durability and safety. There are two different types of heat-treated glasses, heat-strengthened and tempered. While the production process is similar, heating the glass to approximately 1,200°F and then force-cooling, the cooling process in tempered glass is accelerated to create a higher surface and/or edge compression in the glass. This process makes the glass four to five times stronger and safer than annealed or untreated glass. Fully-tempered safety glass is often used for other applications where safety is desirable, because of its break pattern or when significant additional strength is needed to resist wind pressure, thermal stress or both.
Laminated Glass	Laminated glass is made of two or more layers of glass with one or more "interlayers" of polymeric material bonded between the glass layers. Laminated glass offers many advantages. Safety and security are the best-known of these -- rather than shattering on impact, laminated glass is held together by the interlayer, reducing the safety hazard associated with shattered glass fragments, as well as, to some degree, the security risks associated with easy penetration. But the interlayer also provides a way to apply several other technologies and benefits, such as colouring, sound dampening, resistance to fire, ultraviolet filtering, and other technologies that can be embedded in or with the interlayer. Laminated glass is used extensively in building and housing products and in the automotive and transport industries. Most building façades and most car windscreens, for example, are made with laminated glass, usually with other technologies also incorporated.

Laminated glass is produced using one of two methods:
● Poly Vinyl Butyral (PVB) laminated glass is produced using heat and pressure to sandwich a thin layer of PVB between layers of glass. On occasion, other polymers such as Ethyl Vinyl Acetate (EVA) or Polyurethane (PU) are used. This is the most common method.
● For special applications, Cast in Place (CIP) laminated glass is made by pouring a resin into the space between two sheets of glass that are held parallel and very close to each other.

Coated	Surface coatings can be applied to glass to modify its appearance and give it many of the advanced characteristics and functions available in today's flat glass products, such as low maintenance, special reflection/transmission/absorption properties, scratch resistance, corrosion resistance, etc. Coatings are usually applied by controlled exposure of the glass surface to vapours, which bind to the glass forming a permanent coating. The coating process can be applied while the glass is still in the float line with the glass still warm, producing what is known as "hard-coated" glass. Alternatively, in the "off-line" or "vacuum" coating process, the vapour is applied to the cold glass surface in a vacuum vessel. Coated glasses can be toughened, laminated or incorporated into an insulating glass unit.
Security Glass	Glass that is designed to resist physical attack, ballistic and bomb blasts. These products are specialist laminates that use multiple layers of glass and rigid interlayers depending on the resistance required.

Poly Vinyl Butyral (PVB)	Poly Vinyl Butyral or PVB laminated glass is produced using heat and pressure to sandwich a thin layer of PVB between layers of glass. SGP stands for SentryGuard Plus Interlayer manufactured by Dupont. Thanks to its high-security performance, the SGP can withstand severe weather conditions such as storms, hurricane, and cyclones. The SGP also demonstrates higher post breakage strength, as the interlayer offers five times the tear strength and 100 times the rigidity of the more conventional PVB interlayer. Another common polymer known as Ethyl Vinyl Acetate (EVA) is frequently combined with other materials to achieve striking decorative effects. An alternative laminating technique to standard interlayer lamination using PVB or Sentry interlayers is Resin Lamination or Cast in Place (CIP). Resin lamination involves mechanically holding two panels of glass together and pouring liquid resin into the small gap in-between. Once the small cavity between the glass panels has been filled, the resin is then cured, either using a chemical process or under the effect of ultraviolet radiation on UV beds.

Resin lamination is especially suited to glass panels with an uneven surface such as kiln formed or cast glass. Laminated glass is used extensively in building and housing products and in the automotive and transport industries vastly on account of its advanced safety features. Laminated glass displays high-performance impact and bullet resistance capabilities as well as fragment retention performance. So, instead of shattering on impact, it is held together by the interlayer which reduces the safety hazard from the shattered glass fragments. But the interlayer also provides a way to apply several other technologies and benefits, such as colouring, sound dampening, resistance to fire, ultraviolet filtering and other technologies that can be embedded in or with the interlayer.

Screen Printed Glass	Uses ceramic paint that is screen printed and permanently fused to the toughened glass surface.
Mirrored Glass	To produce mirrored glass, a metal coating is applied to one side of the glass. The coating is generally made of silver, aluminium, gold or chrome. For simple mirrored glass, a fully reflective metal coating is applied and then sealed with a protective layer. It can also include a vinyl backing for safety. To produce "one-way" mirrors, a much thinner metal coating is used, with no additional sealing or otherwise opaque layer. Mirrored glass is gaining a more prominent place in architecture, for important functional reasons as well as for the aesthetic effect.
Patterned Glass	Patterned glass is flat glass whose surfaces display a regular pattern. The most common method for producing patterned glass is to pass heated glass (usually just after it exits the furnace where it is made) between rollers whose surfaces contain the negative relief of the desired pattern(s). Patterned glass is mostly used in internal decoration and internal architecture. Today, it is typically used for functional reasons, where light but not transparency is desired, and the patterns are accordingly subtle. However, it has also at times been fashionable as a design feature in itself, in such cases often displaying more prominent patterns.
Self Cleaning Glass	Used for exteriors. The glass incorporates a pyrolitic coating that dissolves dirt (photo activ) and sheds water (hydrophilic) using natural UV light and rain.
Low-Iron/ Extra Clear Glass	Extra clear glass is created by reducing the amount of iron within its content which removes the green tint inherent in standard glass. Extra clear glass's almost completely transparent appearance means it has limited sun reflection properties. It is particularly useful in solar energy applications where it is important that the glass cover lets light through to reach the thermal tubes or photovoltaic cells. Anti-reflective properties can be further increased by applying a special coating on the low-iron glass. It's widely used in windows or facades as it offers brilliant clarity, which allows occupants to appreciate true colours and to enjoy true-to-life views.
Decorative Glass	Today, there are various decorative glass types offer a variety of design options for residential or commercial solutions. Acid etched is called the glass that has been chemically treated with an acidic material, such as hydrofluoric acid, to produce a surface finish that will diffuse transmitted light, reduce glare and has a "frosted" appearance. The treatment on the glass is used to diffuse light, reduce glare and obtain a translucent appearance. The treatment on a mirror is used to obtain a soft matted reflection. The treatment can be applied to provide different levels of translucence, either uniformly over the entire surface or in selected areas creating decorative patterns. While a Ceramic Frit or Silk Screen is a pigmented glass enamel fired onto the glass at temperatures in excess of 1,200°F and permanently fused to the glass surface. Ceramic frit can be applied using a full coverage coating process, a silk screen process or a pre-printed ceramic decal. This type of decorative glass is available in many colours, patterns, and translucencies and is used for both exterior and interior applications.

10 Composites

The below composite materials are common in the camping and ultralight hiking circles. They are harder to get substances and often pricier but offer great statistics for what they do.

Tritan

Tritan is the plastic-like compound which Nalgene uses to produce their unbreakable bottles. It's a very hard wearing and heavy duty substance and they claim to be unbreakable.

Cuben Fibre (Dyneema)

Dyneema Composite Fabrics are high-performance, non-woven, rip-stop, composite laminates. Dyneema fibre is laid out in opposing grid orientations, sandwiched between thin outer layers of polyester film, and melded together in a high-pressure autoclave. Dyneema Composite Fabrics are highly durable but light enough to float on water. The material's unique properties allow for continual flex at stress points without compromising strength or structural integrity. Lighter than Silnylon but stronger than Kevlar, Dyneema Composite Fabrics are 100% waterproof prior to stitching with high chemical and UV resistance. Originally designed for use in high tech sails for America's Cup racing boats, and marketed as Cuben Fibre, Dyneema Composite Fabrics are regarded as the premium material of choice for modern ultralight tents, backpacking tarps, and stuff sacks.

DCF8 **0.8 oz/yd2 // 26 g/m2**	Used in: Ultamid 2, Ultamid 4, Echo II Shelter System, Flat Tarps, Drawstring Stuff Sacks, + Stuff Sack Pillows.
DCF11 **1.3 oz/yd2 // 43 g/m2**	Used in: Pods, Drawstring Stuff Sacks, Roll-Top Stuff Sacks, Stuff Pack, and all Shelter Inserts.
DCF-WPB **1.2 oz/yd2 // 40 g/m2**	Used in: The Shell (Jacket)
DCH50 **3.5 oz/yd2 // 120 g/m2**	50-Denier White: 2400 + 3400 Pack Bodies, Metro + Summit Pack
DCH150 **5.0 oz/yd2 // 170 g/m2**	150-Denier Black: 2400 + 3400 Pack Bodies, Daybreak, Metro + Summit Pack 150-Denier White: 4400 Packs.
DCHW **5.0 oz/yd2 // 170 g/m2**	375-Denier White: The Dyneema Series

Cuben fibre is not as durable as some other materials used in the construction of backpacking gear. In backpacking lighter often means less durable which is generally true for cuben fibre as well. Cuben fibre resists puncture and tearing relatively well. Not so much with abrasion and folding. Cuben fibre is less durable than sil-nylon. It also depends on the application (tent, stuff sack, pack, etc). Once damaged, it is easy to apply duct tape to it for field repair. You can also use cuben fibre patches. Cuben Fibre is often used as a tear resistant groundsheet for camping.

Thickness

The thickness of cuben fibre is measured in oz/sq inch. The following cells describe common thicknesses and how they feel.

0.5 oz/sq inch	Extremely thin and feels like plastic.
0.75 oz/sq inch	
1 oz/sq inch	
2 oz/sq inch	
3 oz/sq inch	
5 oz/sq inch	

Silnylon

Tyvek

Tyvek (House Wrap) is a brand of flashspun high-density polyethylene fibres, a synthetic material. Tyvek is often used as housewrap, a synthetic material used to protect buildings during construction. It can be used as a strong tear resistant groundsheet for camping. Sound very similar to a chip packet as described by many, so this material may not be the best for stealth camping. The material is difficult to tear but can easily be cut with scissors or a knife. Water vapour can pass through Tyvek, but liquid water cannot.

Properties
- Light weight
- Class 1 flammability rating
- Chemical resistant
- Dimensional stabilized
- Opaque
- Neutral pH
- Tear resistant

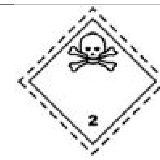
11 Dangerous Goods

There are 9 dangerous goods classes. Substances, and articles are assigned to one of the following 9 classes according to the most predominant hazards they pose in transport. Some of the classes can be further divided down.

Class 1

Class 1 - Explosives	**Class 1 dangerous goods are explosive substances and articles.**	Commonly transported Class 1 Dangerous Goods include ammunitions, fireworks, air bag inflactors and fuse, etc.			
Divisions	**Division 1.1:** Mass explosion hazard **Division 1.2:** Projection hazard but not a mass explosion hazard **Division 1.3:** Fire hazard and a minor blast hazard, a minor projection hazard or both	**Division 1.4** Present no significant hazard; only a small hazard in the event of ignition or initiation	**Division 1.5** Very insensitive substances which have a mass explosion hazard	**Division 1.6** Extremely insensitive articles which do not have a mass explosion hazard	
Symbols	 **Class 1** Division 1.1, 1.2, 1.3	 **Class 1** Division Type 1.4	 **Class 1** Division Type 1.5	 **Class 1** Division Type 1.6	
Examples	• Ammunition/cartridges • Fireworks/pyrotechnics • Flares • Blasting caps / detonators • Fuse	• Primers • Explosive charges (blasting, demolition etc) • Detonating cord • Air bag inflators	• Igniters • Rockets • TNT / TNT compositions • RDX / RDX compositions • PETN / PETN compositions		

Class 2

Class 2 - Gases	**Class 2 dangerous goods are gases. It covers compressed gases, liquefied gases, dissolved gases, refrigerated liquefied gases, mixtures of gases and aerosol dispensers/articles containing gas.**	Commonly transported class 2 dangerous goods include oxygen, natural gas, carbon dioxide, lighters, and aerosols.				
Divisions	**Division 2.1** Flammable gases		**Division 2.2** Non-flammable, non-toxic gases		**Division 2.3** Toxic gases	
Symbols	 **Class 2** **Division 2.1** Flammable Gases	 **Class 2** **Division 2.1** Flammable Gases	 **Division Type 2.2** Non-flammable, non-toxic Gases	 **Division Type 2.2** Non-flammable, non-toxic Gases	 **Class 2** **Division Type 2.3** Toxic Gases	
Examples	• Aerosols • Compressed air • Hydrocarbon gas-powered devices • Fire extinguishers • Gas cartridges • Natural gas • Oil gas • Petroleum gases	• Ethylene • Fertilizer ammoniating solution • Insecticide gases • Refrigerant gases • Lighters • Acetylene / Oxyacetylene • Butane • Propane • Ethane	• Methane • Carbon dioxide • Helium / helium compounds • Hydrogen / hydrogen compounds • Oxygen / oxygen compounds • Nitrogen / nitrogen compounds • Methane • Dimethyl ether • Propene / propylene			

Class 3

Class 3 - Flammable Liquids	**Class 3 dangerous goods are flammable liquids with flash points no more than 60°C.**	It covers liquid substances, molten solid substances with a flash point above 60°C and liquid desensitized explosives. Commonly transported class 3 dangerous goods include acetone, adhesives, paints, gasoline, perfume, ethanol, methanol and some pesticides with flammable solvents.				
Symbols	 **Class 3**	 **Class 3**				
Examples	• Acetone / acetone oils • Adhesives • Paints / lacquers / varnishes • Alcohols • Perfumery products • Kerosene • Resins • Tars • Turpentine • Carbamate insecticides • Organochlorine pesticides • Ethers	• Gasoline / Petrol • Diesel fuel • Aviation fuel • Liquid bio-fuels • Coal tar / coal tar distillates • Ethanol • Benzene • Butanols • Dichloropropenes • Diethyl ether • Organophosphorus pesticides	• Petroleum crude oil • Petroleum distillates • Gas oil • Shale oil • Heating oil • Isobutanols • Isopropyls • Methanol • Octanes • Copper based pesticides • Esters			

Class 4

Class 4 - Flammable Solids	**Class 4 dangerous goods include flammable solids, substances liable to spontaneous combustion and substances which, in contact with water, emit flammable gases.**	Commonly transported class 4 dangerous goods include sulphur, matches, activated carbon, alkali metals and some metal powders.				
Divisions	**Division 4.1** Flammable solids	**Division 4.2** Substances liable to spontaneous combustion	**Division 4.3** Substances which, in contact with water, emit flammable gases			
Symbols	 **Class 4** **Division 4.1** Flammable Solids	 **Class 4** **Division 4.2** Possible Spontaneous Combustion	 **Class 4** **Division 4.3** Emits flammable gas on water contact	 **Class 4** **Division 4.3** Emits flammable gas on water contact		

Examples	• Alkali metals • Metal powders • Aluminium phosphide • Sodium batteries • Sodium cells • Firelighters • Matches • Calcium carbide • Camphor • Carbon	• Activated carbon • Celluloid • Cerium • Copra • Seed cake • Oily cotton waste • Desensitized explosives • Oily fabrics • Oily fibres • Ferrocerium	• Iron oxide (spent • Iron sponge/direct-reduced iron (spent) • Metaldehyde • Naphthalene • Nitrocellulose • Phosphorus • Sulphur	

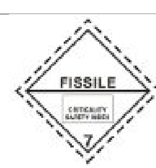
Class 5

Class 5 - Oxidizing Substances	**Class 5 dangerous goods are oxidizing substances and organic peroxides.**	Commonly transported class 5 dangerous goods include hydrogen peroxide, potassium permanganate, sodium nitrite, ammonium nitrate fertilizers and oxygen generators.				
Divisions	**Division 5.1** Oxidizing substances	**Division 5.2** Organic peroxides				
Symbols	 **Class 5** **Division 5.1** Oxidizing Substances	 **Class 5** **Division 5.2** Organic Peroxides	 **Class 5** **Division 5.2** Organic Peroxides			
Examples	• Chemical oxygen generators • Ammonium nitrate fertilizers • Chlorates • Nitrates • Nitrites • Perchlorates • Permanganates • Persulphates • Aluminium nitrate	• Ammonium dichromate • Hydrogen peroxide • Magnesium peroxide • Lead nitrate • Lithium hypochlorite • Potassium chlorate • Ammonium nitrate • Ammonium persulphate • Calcium hypochlorite	• Calcium nitrate • Calcium peroxide • Potassium nitrate • Potassium chlorate • Potassium perchlorate • Potassium permanganate • Sodium nitrate • Sodium persulphate			

Class 6

Class 6 - Toxic and Infectious Substances	**Class 6 dangerous goods are toxic substances and infectious substances.**	Usually chemicals which are classified as acute toxicity category 1, 2 and 3 under GHS belong to class 6.1 dangerous goods. Commonly transported class 6 dangerous goods include cyanides, lead compounds, phenol, cresols, some pesticides, biological samples and clinical wastes.				
Divisions	**Division 6.1** Toxic substances	**Division 6.2** Infectious substances				
Symbols	 **Class 6** **Division 6.1** Toxic Substances	 **Class 6** **Division 6.2** Infectious Substances				
Examples	• Medical/Biomedical waste • Clinical waste • Biological cultures / samples / specimens • Medical cultures / samples / specimens • Tear gas substances • Motor fuel anti-knock mixture • Dyes • Carbamate pesticides • Alkaloids	• Acids • Arsenates • Arsenites • Cyanides • Thiols/mercaptans • Cresols • Barium compounds • Arsenics / arsenic compounds • Beryllium/ beryllium compounds • Lead compounds • Resorcinol	• Mercury compounds • Nicotine / nicotine compounds • Selenium compounds • Antimony • Ammonium metavanadate • Adiponitrile • Chloroform • Dichloromethane • Hexachlorophene • Phenol • Allyls			

Class 7

Class 7 - Radioactive Materials	**Class 7 dangerous goods are radioactive materials. There is no sub-division.**	However, there are different labels for radioactive materials which depend on the content and activity of such materials. Commonly transported class 7 dangerous goods include enriched uranium, radioactive ores, isotopes and some medical equipments or parts.				
Symbols	 **Class 7** **Division 7A** Radioactive	 **Class 7** **Division 7B** Radioactive	 **Class 7** **Division 7C** Radioactive	 **Class 7** **Division 7E** Fissile Material		

MATERIALS | Dangerous Goods | Class

Examples	• Radioactive ores • Medical isotopes • Yellowcake • Density gauges • Mixed fission products • Enriched Uranium	• Surface contaminated objects • Caesium radionuclides / isotopes • Iridium radionuclides / isotopes • Americium radionuclides / isotopes • Plutonium radionuclides / isotopes • Radium radionuclides / isotopes	• Thorium radionuclides / isotopes • Uranium radionuclides / isotopes • Depleted uranium / depleted uranium products • Uranium hexafluoride	

MATERIALS | Dangerous Goods | Class 8 -

Class 8

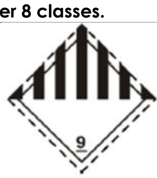
MATERIALS | Dangerous Goods | Class 8 - Corrosive Substances

Class 8 - Corrosive Substances	**Class 8 dangerous goods are corrosive substances. There is no sub-division.**	Corrosive substances may cause severe damage when in contact with living tissue such as skin or damage or destroy surrounding materials in case of leakage. Commonly transported class 8 dangerous goods include acids such as sulphuric acid, strong bases such as sodium hydroxide, batteries and its fluids.				
Divisions	Skin irritation/corrosion category 1 (1A/1B/1C) - GHS. Class 8 corrosive substances, Packing group I, II, III - TDG					
Symbols	 Class 8					
Examples	• Acids/acid solutions • Batteries • Battery fluid • Fuel cell cartridges • Dyes • Fire extinguisher charges • Formaldehyde • Flux • Paints	• Alkylphenols • Amines • Polyamines • Sulphides • Polysulphides • Chlorides • Chlorosilanes • Bromine • Cyclohexylamine	• Phenol / carbolic acid • Hydrofluoric acid • Hydrochloric acid • Sulphuric acid • Nitric acid • Sludge acid • Hydrogen fluoride • Iodine • Morpholine			

MATERIALS | Dangerous Goods

Class 9

MATERIALS | Dangerous Goods | Class 9 - Miscellaneous Substances

Class 9 - Miscellaneous Dangerous Substances	**Class 9 Miscellaneous Dangerous Goods are substances and articles which during transport present a danger or hazard not covered by other 8 classes.**	This class encompasses, but is not limited to, environmentally hazardous substances, substances that are transported at elevated temperatures, miscellaneous articles and substances, genetically modified organisms and micro-organisms and magnetized materials and aviation regulated substances. Commonly transported class 9 dangerous goods include marine pollutants such as zinc oxide, lithium ion batteries, genetically modified organisms, air bag modules and motor engines.				
Symbols	 Class 9					
Examples	• Dry ice / cardice / solid carbon dioxide • Expandable polymeric beads / polystyrene beads • Ammonium nitrate fertilizers • Blue asbestos / crocidolite • Lithium ion batteries • Lithium metal batteries • Battery powered equipment • Battery powered vehicles	• Internal combustion engines • Vehicles • Magnetized material • Dangerous goods in apparatus • Dangerous goods in machinery • Genetically modified organisms • Genetically modified micro-organisms • Chemical kits • First aid kits	• Life saving appliances • Air bag modules • Seatbelt pretensioners • Plastics moulding compound • Castor bean plant products • Polychlorinated biphenyls • Polychlorinated terphenyls • Dibromodifluoromethane • Benzaldehyde • Fuel cell engines			

Communication

Any form of contact from radio to smoke signals and chalk markings

"The single biggest problem in communication
is the illusion that it has taken place."
George Bernard Shaw

Introduction

There are a huge array of communication forms from visual, digital, verbal and physical. Knowing which to use and how to communicate a message is vital.

The main steps inherent to all communication are:
1. The formation of communicative motivation or reason.
2. Message composition (further internal or technical elaboration on what exactly to express).
3. Message encoding (for example, into digital data, written text, speech, pictures, gestures and so on).
4. Transmission of the encoded message as a sequence of signals using a specific channel or medium.
5. Noise sources such as natural forces and in some cases human activity (both intentional and accidental) begin influencing the quality of signals propagating from the sender to one or more receivers.
6. Reception of signals and reassembling of the encoded message from a sequence of received signals.
7. Decoding of the reassembled encoded message.
8. Interpretation and making sense of the presumed original message.

Purpose	The aim of COMMUNICATION is to educate the reader on a multitude of different ways they can communicate a message to another person. It includes information on speaking, gestures, digital communication, radio communication, codes, ciphers, markings and more.
Lost?	● If you want to communicate with someone who speaks another language, see the LANGUAGE section. ● If you are looking for effective communication techniques for a leader, see the LEADERSHIP section. ● If you want to work out how far a broadcast will travel, see the GEOGRAPHY > World Map section. ● For information on setting up a communications hub in your home, see the HOMESTEADING section. ● If you want to communicate for leisure, see the ENTERTAINMENT section. ● If you want to understand the meaning of unknown words, see the ADDENDUM > Dictionary section.

Contents

1 Unpowered Communication

This section covers any unpowered forms of communication and how to use them.

Subheadings

1. Signalling for Help	**2. Body Gestures**	**3. Flag Semaphore**	**4. Audible Communication**

1 Signalling for Help

This section helps you to be found by bystanders if you're lost or trapped.

SOS is the International Morse code distress signal. It is used as a start-of-message mark for transmissions requesting help when loss of life or catastrophic loss of property is imminent. In popular usage, SOS became associated with such phrases as "Save our Souls" and "Save our Ship". The radio frequency of 500 kilohertz (500 kHz) has been an international calling and distress frequency for Morse code maritime communication since early in the 20th century. The radio frequency 2182 kHz is one of the international calling and distress frequencies for maritime radio communication in a frequency band allocated to the mobile service on primary basis, exclusively for distress and calling operations.	SOS • • • — — — • • •

Mirror Signalling

Light the signal fire to produce thick black smoke. Use a mirror or reflective surface to bounce it off the plane. Have an SOS or HELP sign to convey you need assistance.

Fire Signalling

Light the signal fire in a large open area so the light is visible from a great distance.

Flare Gun

Use a flare or flare gun to attract attention.

Light Sources

Use any lighting sources such as mobiles to wave around to attract attention.

Smoke Signals

Smoke

Smoke signals are a form of visual communication used over long distances. In general smoke signals are used to transmit news, signal danger, or gather people to a common area. To kick up your smokiness, gather a bundle of green sticks and grass. Dump them on your fire. Douse your bedroll with water – and toss it over your fire until no more smoke is rising from the flames. Once the smoke has stopped rising, quickly pull the blanket off the fire. A white cloud of smoke should rise from the flames, just in time for you to throw the blanket back over the fire. The cloud will rise as a single puff, your first signal. Once you can send smoke signals, encoding your long-distance messages isn't hard. Although there is no universal smoke-signal language, American campers have a pretty clear system of signalling. A single puff simply lets observers know where you are. A series of two signals is generally accepted as a code that all's well, while three puffs in quick succession alert viewers to an emergency.

2 Body Gestures

One Handed Gestures

These are common one handed gestures which are used to communiate a particular message.

A-ok or Okay	Made by connecting the thumb and forefinger in a circle and holding the other fingers straight, may signal the word okay.
Beckoning sign	In North America or Northern Europe a beckoning sign is made with the index finger sticking out of the clenched fist, palm facing the gesturer. The finger moves repeatedly towards the gesturer (in a hook) as to draw something nearer. It has the general meaning of "come here"
Hand of benediction and blessing	The benediction gesture (or benediction Latina gesture) is a raised right hand with the ring finger and little finger touching the palm, while the middle and index fingers remain raised.
Blah-blah	Blah-blah. The fingers are kept straight and together, held horizontal or upwards, while the thumb points downwards. The fingers and thumb then snap together repeatedly to suggest a mouth talking. The gesture can be used to indicate that someone talks too much, gossips, is saying nothing of any consequence, or is boring.
Check, please	This gesture, used to mean that a dinner patron wishes to pay the bill and depart, is executed by touching the index finger and thumb together and "writing" a checkmark, circle, or wavy line (as if signing one's name) in the air.
Clenched Fist	Used as a gesture of defiance or solidarity. Facing the signer, it threatens physical violence (i.e., "a thumping").
Crossed Fingers	Used to superstitiously wish for good luck or to nullify a promise.
Cuckoo Sign	Touched or screw loose. In North America, making a circling motion of the index finger at the ear or temple signifies that the person "has a screw loose", i.e. is speaking nonsense or is crazy.
Cuckold's Horns	Traditionally placed behind an unwitting man (the cuckold) to insult him and represent that his wife is unfaithful. The "symbolism has been forgotten but the insult remains" in modern culture as bunny ears.
Fig Sign	A gesture made with the hand and fingers curled and the thumb thrust between the middle and index fingers, or, rarely, the middle and ring fingers, forming the fist so that the thumb partly pokes out. In some areas of the world, the gesture is considered a good luck charm; in others (including Indonesia, Japan, Korea, Russia, Serbia and Turkey among others), it is considered an obscene gesture.
The Finger	An extended middle finger with the back of the hand towards the recipient, is an obscene hand gesture used in much of Western culture.
Finger Gun	A hand gesture in which the subject uses their hand to mimic a handgun. If pointed to oneself (with or without the "hammer falling" of the thumb indicating firing), it may indicate boredom or awkwardness in the sense of wanting to commit (social) suicide; when pointed to another, it is interpreted as a threat of violence, either genuine or in jest.

Fist Bump	Is similar to a handshake or high five which may be used as a symbol of respect.
Fist Pump	A celebratory gesture in which a closed fist is raised before the torso and subsequently drawn down in a vigorous, swift motion.
Hand Plateau	The extending of an open hand with an upturned palm to indicate an item or person. When swept horizontally it can signify an entire area. It is considered more polite than a pointed finger.
Handshake	A greeting ritual in which two people grasp each other's hands and may move their grasped hands up and down.
High Five	A celebratory ritual in which two people simultaneously raise one hand and then slap these hands together.
Hitchhiking Gesture	Sticking one thumb upward, especially in North America, or pointing an index finger toward the road elsewhere to request a ride in an automobile.
Horn Sign	A hand gesture made by extending the index and little finger straight upward. It has a vulgar meaning in some Mediterranean Basin countries like Italy and is used in rock and roll, especially in heavy metal music.
ILY sign	Extend the thumb, index finger, and little finger while the middle and ring finger touch the palm. It is an informal expression of love.
Knocking on Wood	a superstitious gesture used to ensure that a good thing will continue to occur after it has been acknowledged. However, it is sometimes used after speaking of a plausible unfortunate event, so that it does not actually occur.
Loser	Made by extending the thumb and forefinger to resemble the shape of an L on the forehead is an insulting gesture.
Money Sign	The thumb rubs repeatedly over the tip of the index finger and middle finger. This gesture resembles the act of rubbing coins or bills together and is generally used when speaking about money.
Nazi Salute	Was used in Germany and Italy during World War II to indicate loyalty to Adolf Hitler or Benito Mussolini and their respective parties. The right arm is raised in a straight diagonal position forward with the palm open facing downward.
Outstretched hand	(with palm up) is a near-universal gesture for begging or requesting, extending beyond human cultures and into other primate species. This gesture can also be done with both hands to form a bowl.
Pointing	With index finger may be used to indicate an item or person.
Raised Fist	A salute and logo most often used by leftist activists.
Respect	A gesture made by extending the index, middle, and ring fingers of one hand at another person with the middle finger raised slightly higher than the index and ring fingers. It is used in restricted circle as a sign of respect and approval.
Scout Handshake	A left-handed handshake used as a greeting among members of various Scouting organizations.
Shocker	A hand gesture with a sexual connotation. The ring finger and thumb are curled or bent down while the other fingers are extended. It suggests simultaneous vaginal and (unexpected) anal penetration.
So-so Gesture	Expresses neutral ("so-so") sentiment or mild dissatisfaction ("meh"), or can describe an uncertain situation ("maybe"). The hand is held parallel to the ground (face down) and rocked slightly.
Talk to the Hand	An English language slang expression of contempt popular during the 1990s. The associated hand gesture consists of extending a palm toward the person insulted.
Telephone	Thumb and little outstretched, other fingers tight against palm. Thumb to ear and little finger to mouth as though they were a telephone receiver. Used to say, "I'll call you", or may be used to request a future telephone conversation or to tell someone of a call.
Thumbs Up / Thumbs Down	Common gestures of approval or disapproval made by extending the thumb upward or downward.
V Sign / Victory	Made by raising the index and middle fingers and separating them to form a V, usually with the palm facing outwards. This sign began to be used during World War II to indicate "V for Victory".
Vulcan salute	Used in the television program Star Trek. It consists of all fingers raised and parted between the ring and middle fingers with the thumb sticking out to the side. It was devised and popularized by Leonard Nimoy, who portrayed the half-Vulcan character Mr. Spock.
Wanker	Made by curling the fingers into a loose fist and moving the hand up and down as though masturbating. The gesture has the same meaning as the British slang insult, "wanker", or might indicate a failure or waste in other countries.
Wave	A gesture in which the hand is raised and moved left and right, as a greeting or sign of departure.

Two Handed Gestures

These are common two handed gestures which are used to communiate a particular message.

Air Quotes	Made by raising both hands to eye level and flexing the index and middle fingers of both hands while speaking. Their meaning is similar to that of scare quotes in writing.
Añjali Mudrā (namaste)	A sign of respect in India and among yoga practitioners. It is made by pressing the palms together.
Applause	An expression of approval made by clapping the hands together to create repetitive staccato noise. Applause is most appropriate within a group setting, to collectively show approval by the volume, duration, and clamor of the noise.
Awkward Turtle	A two handed gesture used to mark a moment as awkward. One hand is placed flat atop the other with both palms facing down, fingers extended outward from the hand and thumbs stuck out to the sides. The thumbs are rotated to symbolize flippers
Batsu	In Japanese culture, the batsu (literally: ×-mark) is a gesture made by crossing one's arms in the shape of an "X" in front of them in order to indicate that something is "wrong" or "no good".
Bras d'honneur	An obscene gesture made by flexing one elbow while gripping the inside of the bent arm with the opposite hand

Golf Clap	Unlike applause, is a timid and practically silent clapping of the palms together, to silently approve of something. It may be performed when loud applause is inappropriate; however, it may instead be done in mockery or to display faux approval.
Hand-rubbing	Rubbing both hands palms together along the fingers' direction may mean that one is expecting or anticipating something or that one feels cold.
Hands Up	A gesture expressing military surrender by lifting both hands. This may have originated with that you would show that you had no weapons, making you not a threat.
Hand Heart	A recent pop culture symbol meaning love. The hands form the shape of a heart.
Jazz Hands	Used in dance or other performances by displaying the palms of both hands with fingers splayed.
Mani Giunte	An Italian gesture used when expressing exasperation or disbelief by putting both palms together in prayer and moving them down and back up towards your chest repeatedly.
Mano a Borsa	An Italian gesture, used when something is unclear. It is created by extending all the digits on the hand bringing them together with palms facing up and moving the hand up and down by the action of the wrist and/or elbow. It implies a question, such as "what do you want?", "what are you saying?" or "what is your point?", and it generally requires a response. This gesture can be done with either hand or both hands.
Maru	In Japanese culture is a gesture made by holding both arms curved over the head with the hands joined, thus forming a circular shape, to express that something is "correct" or "good". This is the counterpart of "batsu", above, though its daily use is not quite as widespread.
Merkel-Raute	Described as "probably one of the most recognizable hand gestures in the world", the signature gesture of Angela Merkel has become a political symbol used by both her supporters and opponents. a hand gesture made by resting one's hands in front of the stomach so that the fingertips meet, with the thumbs and index fingers forming a rough quadrangular shape.
Open Palms	A gesture seen in humans and other animals as a psychological and subconscious behaviour in body language to convey trust, openness and compliance.
Praying Hands	A reverent clasping of the hands together, is an expression used in most major religions during prayer. The palms of the hands are held together with the fingers extended and touching or the fingers folded upon the opposite hand. This gesture is often made with the two hands held at chest or head level, the elbows against the side, and the head bowed towards the hands.
Suck It	Used to express superiority over another by forming an X with hands over the groin area.
Victory Clasp	Used to exclaim victory by clasping one's own hands together and shaking them to one's side to another at, or above, one's head.
Whatever	Made with the thumb and forefinger of both hands to form the letter "W", the gesture is used to signal that something is not worth the time and energy.

Other Body Gestures

These are common body gestures which are used to communiate a particular message.

Air Kiss	Conveys meanings similar to kissing, but is performed without making bodily contact
Blowing a Raspberry	AKA Bronx cheer, signifies derision by sticking out the tongue and blowing (Lingualabial trill) to create a sound similar to flatulence.
Bowing	Lowering the torso or head; a show of respect in many cultures.
Cheek Kissing	Pressing one's lips to another person's cheek, may show friendship or greeting.
Curtsey	A greeting typically made by women, performed by bending the knees while bowing the head.
Dabbing or Dab	Is a simple dance move in which a person drops the head into the bent crook of their slanted arms.
Davai vyp'yem (Russian drinking sign)	The index finger is flicked against the side of the neck, just below the jaw.
Duck Face	A popular gesture among teenagers which involves puckering lips. The gesture is often used as a "funny face" when taking pictures.
Eskimo Kissing	A gesture in Western cultures loosely based on an Inuit greeting, performed by two people touching noses.
Eyebrow Raising	Briefly raising the eyebrows is used to acknowledge the presence of another person or to signal assent.
Eye-rolling	Performed by rotating the eyes upward and back down; can indicate incredulity, contempt, boredom, frustration, or exasperation; can be performed unconsciously or consciously; occurs in many countries of the world, and is especially common among adolescents.
Facepalm	An expression of frustration or embarrassment made by raising the palm of the hand to the face.
Genuflection	A show of respect by bending at least one knee to the ground.
Hand-kissing	A greeting made by kissing the hand of a person worthy of respect.
Hat Tip	A salutation or show of respect made by two people removing their hats.
Head Shake	Indicates a negative reaction to a query or a rejection in English-speaking cultures; also used occasionally in disbelief.
Headbanging	A deep and abrupt shaking of the head, sometimes to whip long hair back and forth. Done in time with music, headbanging is used as a sign of excitement and appreciation of a performance.
Hongi	A traditional Māori greeting in New Zealand, performed by pressing one's nose and forehead (at the same time) to another person.

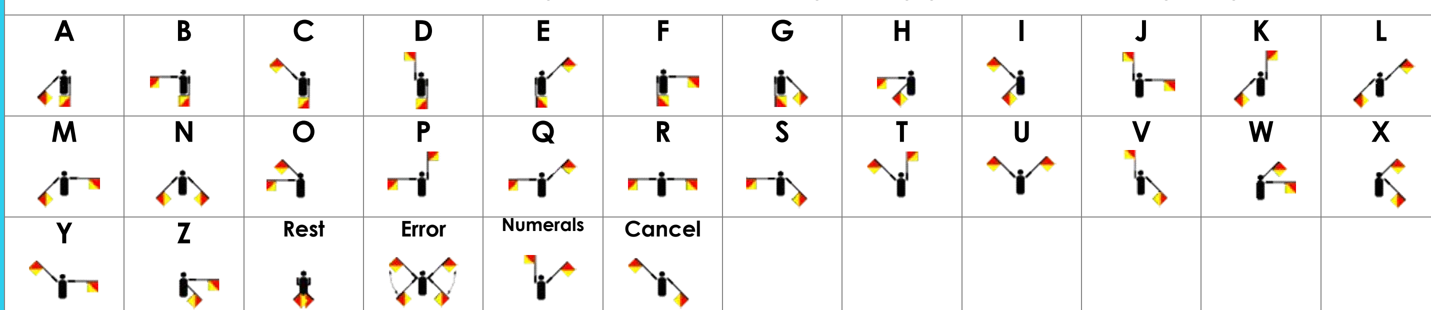
Kowtow	Shows respect by bowing deeply and touching one's head to the ground.
Mooning	A show of disrespect by displaying one's bare buttocks.
Namaste	Is a praying hands gesture usually coupled with a greeting and a head bow.
Nod	Tilting the head up and down that usually indicates assent. When shaken once firmly, it is an expression of strong agreement such as "Indeed" or "Yes sir." When shaken quickly the person is indicating a desire to move along with the topic.
Puppy Face	Tilting the head down with eyes looking up, like a puppy; has a number of uses.
Shrug	Lifting both shoulders indicates lack of knowledge or concern. Sometimes the gesture is a palms upwards from bent elbows motion with possible raised eyebrows.
Shush	the index finger of one hand is extended and placed vertically in front of the lips, with the remaining fingers curled toward the palm with the thumb forming a fist; used to demand or request silence from those to whom it is directed. Can be silent or accompanied by an audible "Sssh!" sound which alone has the same meaning.
Sign of the Cross	Used in many Christianity rituals, consists of drawing the shape of a cross over one's body or in the air.
Throat slash	Made by moving one's index finger, thumb or entire hand, held straight and with palm down, horizontally across one's throat; the gesture imitates cutting a person's throat with a blade, indicating strong disapproval, extreme anger, or displeasure with others or with oneself; alternatively, it can be a signal to stop broadcasting.
Thumbing the Nose	A sign of derision in Britain made by putting the thumb on the nose, holding the palm open and perpendicular to the face, and wiggling the remaining fingers, often combined with sticking out the tongue.
Touching Heads	Is a gesture to express positive emotions between friends, relatives, lovers etc.
Twisting the Cheek	Thumb and forefinger are placed against the cheek, and a screwing motion, as if making a dimple, is made by twisting the wrist; in Italian culture, this can mean that something is delicious; in Germany, the gesture can be used to suggest that someone is crazy.
Woe is Me	A melodramatic gesture of distress made by lifting the arm and placing the back of the hand on the forehead.
Exaggerated Yawning	Generally with one hand held to the mouth, is used to express boredom.

Unintentional Body Language

Sign Language

3 Flag Semaphore

Flag semaphore is the telegraphy system conveying information at a distance by means of visual signals with hand-held flags, rods, disks, paddles, or occasionally bare or gloved hands. Information is encoded by the position of the flags; it is read when the flag is in a fixed position. Semaphores were adopted and widely used (with hand-held flags replacing the mechanical arms of shutter semaphores) in the maritime world in the 19th century. It is still used during underway replenishment at sea and is acceptable for emergency communication in daylight or using lighted wands instead of flags, at night.



4 Audible Communication

Communication is the act of conveying meanings from one entity or group to another through the use of mutually understood signs, symbols, and semiotic rules.

Talking

Speech is human vocal communication using language. Each language uses phonetic combinations of vowel and consonant sounds that form the sound of its words (that is, all English words sound different from all French words, even if they are the same word, e.g., "role" or "hotel"), and using those words in their semantic character as words in the lexicon of a language according to the syntactic constraints that govern lexical words' function in a sentence. In speaking, speakers perform many different intentional speech acts, e.g., informing, declaring, asking, persuading, directing, and can use enunciation, intonation, degrees of loudness, tempo, and other non-representational or paralinguistic aspects of vocalization to convey meaning. In their speech speakers also unintentionally communicate many aspects of their social position such as sex, age, place of origin (through accent), physical states (alertness and sleepiness, vigor or weakness, health or illness), psychic states (emotions or moods), physico-psychic states (sobriety or drunkenness, normal consciousness and trance states), education or experience, and the like.

Although people ordinarily use speech in dealing with other persons (or animals), when people swear they do not always mean to communicate anything to anyone, and sometimes in expressing urgent emotions or desires they use speech as a quasi-magical cause, as when they encourage a player in a game to do or warn them not to do something. There are also many situations in which people engage in solitary speech. People talk to themselves sometimes in acts that are a development of what some psychologists (e.g., Lev Vygotsky) have maintained is the use in thinking of silent speech in an interior monologue to vivify and organize cognition, sometimes in the momentary adoption of a dual persona as self addressing self as though addressing another person. Solo speech can be used to memorize or to test one's memorization of things, and in prayer or in meditation (e.g., the use of a mantra).

NATO Phonetic Alphabet

The NATO phonetic alphabet is the most widely used radiotelephone spelling alphabet. It is officially the International Radiotelephony Spelling Alphabet, and also commonly known as the ICAO phonetic alphabet.

The International Civil Aviation Organization (ICAO) assigned codewords acrophonically to the letters of the English alphabet, so that critical combinations of letters and numbers are most likely to be pronounced and understood by those who exchange voice messages by radio or telephone, regardless of language differences or the quality of the communication channel. Such spelling alphabets are often called "phonetic alphabets", but they are unrelated to phonetic transcription systems such as the International Phonetic Alphabet.

A = Alfa	J = Juliett	S = Sierra
B = Bravo	K = Kilo	T = Tango
C = Charlie	L = Lima	U = Uniform
D = Delta	M = Mike	V = Victor
E = Echo	N = November	W = Whiskey
F = Foxtrot	O = Oscar	X = X-ray
G = Golf	P = Papa	Y = Yankee
H = Hotel	Q = Quebec	Z = Zulu
I = India	R = Romeo	

Whistling

Whistling can be either a sound produced by your mouth or a physical whistle.

Mouth Whistling

How to whistle using your lips and mouth.

1	Wet your lips and pucker them.
2	Blow air through your lips, softly at first. You should hear a tone.
3	Blow harder, keeping your tongue relaxed.
4	Adjust your lips, jaw, and tongue to create different tones.

Finger Whistling

Knowing how to whistle with your fingers can come in handy when you need to hail a cab or get someone's attention. Whistling with your fingers can be tricky, but with a little practice, you'll be whistling loudly in no time!

1	Press the end of your index finger and thumb together. It doesn't matter which hand you use, but you should only be using one hand. It may be easier to use your dominant hand. Your index finger and thumb should be making a ring shape.
2	Open your mouth and stretch your lips over your teeth. You want your teeth to be completely covered. Your lips should be curled into your mouth.
3	Move your tongue back in your mouth. Curl your tongue up so the end is pointing toward the roof of your mouth. Then, move it back in your mouth so the space in the front of your mouth is open. There should be about .5 inches (1.3 cm) between your tongue and your front teeth.
4	Put your index finger and thumb in your mouth. Push your fingers into your mouth until they touch your tongue. The ring shape between your fingers should be horizontal now.
5	Take a deep breath and close your mouth around your fingers. Keep your lips stretched over your teeth. The only gap between your lips should be the space between your fingers. That's where the air will come out when you whistle.
6	Blow air through your fingers and out of your mouth. Blow out forcefully, but not so much that it hurts. Don't worry if you don't make a whistling sound at first. It may take some practice before you're able to whistle with your fingers. If you don't make a whistling sound, take in another deep breath and try again. Eventually you'll get it!

Physical Whistle

A whistle can come in handy in circumstances you want to find someone or be found without expending much energy.

1	Simply blow into the end of the whistle. The power of your breath usually dictates the volume and pitch of the sound.

5 Ground Signals

The following symbols can be used to assist others in finding your location. Be sure to create them in a location they will be seen and won't be blown away or trampled over.

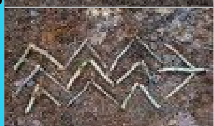
Grass Signals

Long grass such as a tuft can be visual cues to assist direction to others.	**Tied Tuft - Vertical:** Means straight ahead **Tied Tuft - Leaning Left:** Turn Left **Tied Tuft - Leaning Right:** Turn Right

Stick Signals

Signals left in the form of sticks to convey a message.

	**Direction**	A basic directional arrow – it can be made from sticks, stones or even twisted grass.

	**Not This Way**	Use this symbol when you do not want those following to take a particular route.
	**Turn Left or Right**	A variation on the basic directional arrow.
	**Over Obstacle**	Use this symbol when a trail crosses over an obstacle like a fence or a stream.
	**Water in this Direction**	This sign shows followers the direction of a water source.
	**Message this Way**	This symbol indicates that a message or note has been left nearby – usually somewhere high up and visible such as the branches of a tree or on a rock.
	**Party Split Up**	This symbol shows that the main party has split up and is now following two separate paths.
	**Gone Home**	This symbol means it is the end of the trail and everybody has gone home or back to base.

Pebble Signals

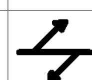
Many small pebbles can be used as a direction guide. A arrow signifies which direction should be taken.	**Horizontal Row:** Don't go this way

Rock Signals

Fewer larger rocks can also be direction guides.	**Two Rocks Stacked:** Straight Ahead **Two Rocks Stacked with one Right:** Turn Right **Two Rocks Stacked with one Left:** Turn Left **Row of Rocks:** Don't go this way

6 Ground to Air Signals

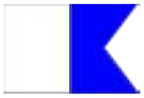
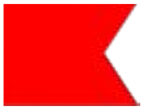
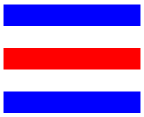
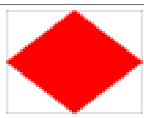
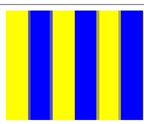
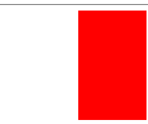
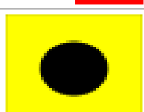
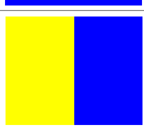
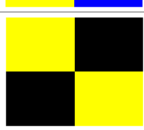
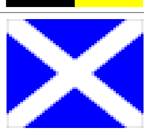
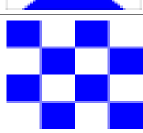
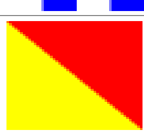
These are ground to air signals that can be created on the ground with sticks, rocks or anything else handy. Lay signals in the open, easily viewed from all angles on an open field with little else nearby. Each symbol should be around 3m (9.8ft) high based on available space. Trampled snow stands out if done deep enough.

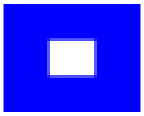
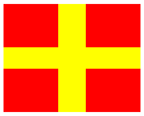
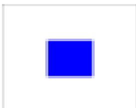
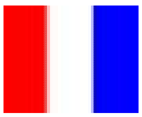
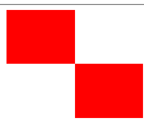
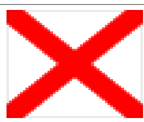
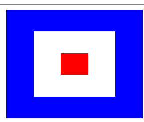
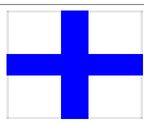
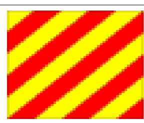
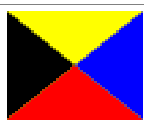
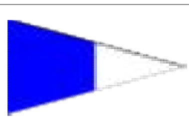
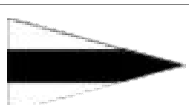
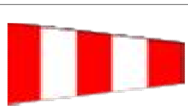
I	II	F	N	Y	LL	X	↑	K	JL	□	△
Require Doctor / Medical Evacuation	Need Medical Supplies	Need Food and Water	Negative (No)	Affirmative (Yes)	All is Well	Unable to Move On	Am Moving on this Way	Indicate Direction to Proceed	Do Not Understand	Need Compass and Map	Think Safe to Land Here
¦	L7		L	V	NN	<u>LL</u>		++	XX		
Need Radio / Signal Lamp / Battery	Aircraft Badly Damaged	Require Fuel and Oil	Require Fuel and Oil	Require Assistance	Nothing Found, Will Continue to Search	Found All Missing Persons	Have divided into two groups, proceeding in directions shown	We Have Found Only Some Missing Personnel	We are not able to continue. Returning to base.		

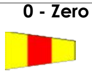
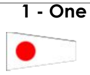
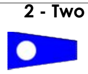
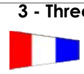
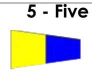
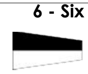
Aircraft Acknowledgements
Message Understood: An aircraft will indicate that ground signals have been understood by rocking from side to side or by making green flashes with a signal lamp.
Message Not Understood: An aircraft will indicate that ground signals are not understood by making a complete right-hand circuit or by making red flashes with a signal lamp.
Yes / Affirmative: An aircraft will indicate yes or affirmative by tilting the nose up and down.
No / Negative: An aircraft will indicate no or negative by shaking the nose left and right.

7 International Code of Signals (ICS)

The International Code of Signals (ICS) is an international system of signals and codes for use by vessels to communicate important messages regarding safety of navigation and related matters. Signals can be sent by flaghoist, signal lamp ("blinker"), flag semaphore, radiotelegraphy, and radiotelephony. The International Code is the most recent evolution of a wide variety of maritime flag signalling systems.

	**A - Alfa**	"I have a diver down; keep well clear at slow speed."
	**B - Bravo**	"I am taking in or discharging or carrying dangerous goods."
	**C - Charlie**	"Affirmative."
	**D - Delta**	"Keep clear of me; I am manoeuvring with difficulty."
	**E - Echo**	"I am altering my course to starboard."
	**F - Foxtrot**	"I am disabled; communicate with me."
	**G - Golf**	"I require a pilot."
	**H - Hotel**	"I have a pilot on board."
	**I - India**	"I am altering my course to port."
	**J - Juliet**	"I am on fire and have dangerous cargo on board: keep well clear of me." or "I am leaking dangerous cargo."
	**K - Kilo**	"I wish to communicate with you."
	**L - Lima**	In harbour: "The ship is quarantined." At sea: "You should stop your vessel instantly."
	**M - Mike**	"My vessel is stopped and making no way through the water."
	**N - November**	"Negative."
	**O - Oscar**	"Man overboard." (Often attached to the man overboard pole on boats).

	**P - Papa**	In harbour: All persons should report on board as the vessel is about to proceed to sea. At sea: It may be used by fishing vessels to mean: "My nets have come fast upon an obstruction."
	Q - Quebec	"My vessel is 'healthy' and I request free pratique."
	**R - Romeo**	(No ICS meaning as a single flag)
	**S - Sierra**	"I am operating astern propulsion."
	**T - Tango**	"Keep clear of me; I am engaged in pair trawling."
	**U - Uniform**	"You are running into danger."
	**V - Victor**	"I require assistance."
	**W - Whiskee**	"I require medical assistance."
	**X - Xray**	"Stop carrying out your intentions and watch for my signals."
	**Y - Yankee**	"I am dragging my anchor."
	**Z - Zulu**	"I require a tug." By fishing vessels near fishing grounds: "I am shooting nets."
The substitutes below allow any four letter or number combination to be sent using only one set of flags.		
	**1st Substitute**	Used to repeat the first flag of a hoist later within the same hoist.
	**2nd Substitute**	Used to repeat the second flag of a hoist later within the same hoist.
	**3rd Substitute**	Used to repeat the third flag of a hoist later within the same hoist.
	**Code/Answer Pennant**	At the dip (about half-way up the halyard): Ready to receive message **Close up:** Message has been received and understood (the flag is then hauled back at the dip to receive the next hoist) **Hauled down:** Signals end of message. **With numerals:** Decimal point **By a warship:** When flown over a hoist, indicates the message is to be read according to the ICS.

International Code of Signals (ICS)	**0 - Zero**	**1 - One**	**2 - Two**	**3 - Three**	**4 - Four**	**5 - Five**	**6 - Six**	**7 - Seven**	**8 - Eight**	**9 - Nine**
										

International Code of Signals (ICS) Multi-Flag Signal Examples	**Code - 'AC':** I am abandoning my vessel. **Code - 'AD':** I am abandoning my vessel which has suffered a nuclear accident and is a possible source of radiation danger. **Code - 'AN':** I need a doctor. **Code - 'AN1':** I need a doctor; I have severe burns. **Code - 'AN2':** I need a doctor; I have radiation casualties. **Code - 'EL':** Repeat the distress position. **Code - 'EL1':** What is the position of vessel in distress? **Code - 'GM':** I cannot save my vessel. **Code - 'GN':** You should take off persons. **Code - 'GN1':** I wish some persons taken off. Skeleton crew will remain on board. **Code - 'GN2':** I will take off persons.
International Code of Signals (ICS) Multi-Flag Signal Examples	**Code - 'GN3':** Can you take off persons? **Code - 'IT':** I am on fire. **Code - MAA':** I request urgent medical advice. **Code - MAB':** I request you to make rendezvous in position indicated. **Code - MAC':** I request you to arrange hospital admission. **Code - MAD':** I am . . . (indicate number) hours from the nearest port. **Code - MS1':** My vessel is a dangerous source of radiation; you may approach from my starboard side. **Code - VG':** The coverage of low clouds is… (number of octants or eighths of sky covered). **Code - US4':** Nothing can be done until weather moderates. **Code - NC':** I am in distress and require immediate assistance (Distress signal).

2 Radio

Radio is the technology of signaling and communicating using radio waves. Radio waves are electromagnetic waves of frequency between 30 hertz (Hz) and 300 gigahertz (GHz). They are generated by an electronic device called a transmitter connected to an antenna which radiates the waves, and received by a radio receiver connected to another antenna. Radio is very widely used in modern technology, in radio communication, radar, radio navigation, remote control, remote sensing and other applications. Radio waves travel much further at night.

ITU Radio Bands

A radio band is a small contiguous section of the radio spectrum frequencies, in which channels are usually used or set aside for the same purpose. To prevent interference and allow for efficient use of the radio spectrum, similar services are allocated in bands. For example, broadcasting, mobile radio, or navigation devices, will be allocated in non-overlapping ranges of frequencies. Each of these bands has a basic bandplan which dictates how it is to be used and shared, to avoid interference and to set protocol for the compatibility of transmitters and receivers.

As a matter of convention, the ITU divides the radio spectrum into 12 bands, each beginning at a wavelength which is a power of ten (10n) metres, with corresponding frequency of 3×108−n hertz, and each covering a decade of frequency or wavelength. Each of these bands has a traditional name. For example, the term high frequency (HF) designates the wavelength range from 100 to 10 metres, corresponding to a frequency range of 3 MHz to 30 MHz. This is just a naming convention and is not related to allocation; the ITU further divides each band into subbands allocated to different uses.

Above 300 GHz, the absorption of electromagnetic radiation by Earth's atmosphere is so great that the atmosphere is effectively opaque, until it becomes transparent again in the near-infrared and optical window frequency ranges. These ITU radio bands are defined in the ITU Radio Regulations. Article 2, provision No. 2.1 states that "the radio spectrum shall be subdivided into nine frequency bands, which shall be designated by progressive whole numbers in accordance with the following table".

The idea to give each band a number, in which the number is the logarithm of the approximate geometric mean of the upper and lower band limits in Hz, originated with B.C. Fleming-Williams, who suggested it in a letter to the editor of Wireless Engineer in 1942. (For example, the approximate geometric mean of Band 7 is 10 MHz, or 107 Hz.)

Band Name	Abbreviation	ITU band number	Frequency and Wavelength	Example Uses	Band Name	Abbreviation	ITU band number	Frequency and Wavelength	Example Uses
Extremely Low Frequency	ELF	1	3–30 Hz 100,000–10,000 km	Communication with submarines	**High Frequency**	HF	7	3–30 MHz 100–10 m	Shortwave broadcasts, citizens band radio, amateur radio and over-the-horizon aviation communications, RFID, over-the-horizon radar, automatic link establishment (ALE) / near-vertical incidence skywave (NVIS) radio communications, marine and mobile radio telephony
Super Low Frequency	SLF	2	30–300 Hz 10,000–1,000 km	Communication with submarines	**Very High Frequency**	VHF	8	30–300 MHz 10–1 m	FM, television broadcasts, line-of-sight ground-to-aircraft and aircraft-to-aircraft communications, land mobile and maritime mobile communications, amateur radio, weather radio
Ultra Low Frequency	ULF	3	300–3,000 Hz 1,000–100 km	Submarine communication, communication within mines	**Ultra High Frequency**	UHF	9	300–3,000 MHz 1–0.1 m	Television broadcasts, microwave oven, microwave devices/communications, radio astronomy, mobile phones, wireless LAN, Bluetooth, ZigBee, GPS and two-way radios such as land mobile, FRS and GMRS radios, amateur radio, satellite radio, Remote control Systems, ADSB
Very Low Frequency	VLF	4	3–30 kHz 100–10 km	Navigation, time signals, submarine communication, wireless heart rate monitors, geophysics	**Super High Frequency**	SHF	10	3–30 GHz 100–10 mm	Radio astronomy, microwave devices/communications, wireless LAN, DSRC, most modern radars, communications satellites, cable and satellite television broadcasting, DBS, amateur radio, satellite radio
Low Frequency	LF	5	30–300 kHz 10–1 km	Navigation, time signals, AM longwave broadcasting (Europe and parts of Asia), RFID, amateur radio	**Extremely High Frequency**	EHF	11	30–300 GHz 10–1 mm	Radio astronomy, high-frequency microwave radio relay, microwave remote sensing, amateur radio, directed-energy weapon, millimetre wave scanner, wireless LAN (802.11ad)
Medium Frequency	MF	6	300–3,000 kHz 1,000–100 m	AM (medium-wave) broadcasts, amateur radio, avalanche beacons	**Tremendously High Frequency (Terahertz)**	THF / THz	12	300–3,000 GHz 1–0.1 mm	Experimental medical imaging to replace X-rays, ultrafast molecular dynamics, condensed-matter physics, terahertz time-domain spectroscopy, terahertz computing/communications, remote sensing, amateur radio

IEEE Radar Bands

Frequency bands in the microwave range are designated by letters. This convention began around World War 2 with military designations for frequencies used in radar, which was the first application of microwaves. Unfortunately there are several incompatible naming systems for microwave bands, and even within a given system the exact frequency range designated by a letter varies somewhat between different application areas. One widely used standard is the IEEE radar bands established by the US Institute of Electrical and Electronic Engineers.

Band Designation	Frequency Range	Explanation of Meaning
HF	0.003 to 0.03 GHz	High Frequency
VHF	0.03 to 0.3 GHz	Very High Frequency
UHF	0.3 to 1 GHz	Ultra High Frequency
L	1 to 2 GHz	Long wave
S	2 to 4 GHz	Short wave
C	4 to 8 GHz	Compromise between S and X
X	8 to 12 GHz	Used in WW II for fire control, X for cross (as in crosshair). Exotic.
Ku	12 to 18 GHz	Kurz-under
Ku	18 to 27 GHz	Kurz (German for "short")
Ka	27 to 40 GHz	Kurz-above
V	40 to 75 GHz	
W	75 to 110 GHz	W follows V in the alphabet
mm or G	110 to 300 GHz	Millimetre

EU, NATO, US ECM Frequency Designations

The radio spectrum is the part of the electromagnetic spectrum with frequencies from 30 Hz to 300 GHz. Electromagnetic waves in this frequency range, called radio waves, are widely used in modern technology, particularly in telecommunication. To prevent interference between different users, the generation and transmission of radio waves is strictly regulated by national laws, coordinated by an international body, the International Telecommunication Union (ITU).

Different parts of the radio spectrum are allocated by the ITU for different radio transmission technologies and applications; some 40 radiocommunication services are defined in the ITU's Radio Regulations (RR). In some cases, parts of the radio spectrum are sold or licensed to operators of private radio transmission services (for example, cellular telephone operators or broadcast television stations). Ranges of allocated frequencies are often referred to by their provisioned use (for example, cellular spectrum or television spectrum). Because it is a fixed resource which is in demand by an increasing number of users, the radio spectrum has become increasingly congested in recent decades, and the need to utilize it more effectively is driving modern telecommunications innovations such as trunked radio systems, spread spectrum, ultra-wideband, frequency reuse, dynamic spectrum management, frequency pooling, and cognitive radio.

NATO Letter Band Designation

New Nomenclature		Old Nomenclature		Broadcasting Band Designation
Band	**Frequency (MHz)**	**Band**	**Frequency (MHz)**	
A	0 – 250	I	100 – 150	**Band I:** 47 – 68 MHz (TV) **Band II:** 87.5 – 108 MHz (FM)
		G	150 – 225	**Band III:** 174 – 230 MHz (TV)
B	250 – 500	P	225 – 390	
C	500 – 1 000	L	390 – 1 550	**Band IV:** 470 – 582 MHz (TV) **Band V:** 582 – 862 MHz (TV)
D	1 000 – 2 000	S	1 550 – 3 900	
E	2 000 – 3 000			
F	3 000 – 4 000			
G	4 000 – 6 000	C	3 900 – 6 200	
H	6 000 – 8 000	X	6 200 – 10 900	
I	8 000 – 10 000			
J	10 000 – 20 000	Ku	10 900 – 20 000	
K	20 000 – 40 000	Ku	Ka 20 000 – 36 000	
L	40 000 – 60 000	Q	36 000 – 46 000	
		V	46 000 – 56 000	
M	60 000 – 100 000	W	56 000 – 100 000	
US-Military / Saclant		**US-Military / Saclant**		
N	100 000 – 200 000	No Change		
O	100 000 – 200 000	No Change		

Comparison of Frequency Bands

Frequency	3 Hz +	30 Hz +	300 Hz +	3 kHz +	30 kHz +	300 kHz +	3 MHz +	30 MHz +	250 MHz +	300 MHz +	500 MHz +
IEEE							HF	VHF	VHF	UHF	UHF
EU, NATO, US ECM	A	A	A	A	A	A	A	A	B	B	C
ITU	ELF	SLF	ULF	VLF	LF	MF	HF	VHF	VHF	UHF	UHF

Frequency	1 GHz +	2 GHz +	3 GHz +	4 GHz +	6 GHz +	8 GHz +	10 GHz +	12 GHz +	18 GHz +	20 GHz +	27 GHz +
IEEE	L	S	S	C	C	X	X	Ku	K	K	Ka
EU, NATO, US ECM	D	E	F	G	H	I	J	J	J	K	K
ITU	UHF	UHF	SHF	SHF	SHF	SHF	SHF	SHF	SHF	SHF	SHF

Frequency	30 GHz +	40 GHz +	60 GHz +	75 GHz +	100 GHz +	110 GHz +	300 GHz +	3 THz +			
IEEE	Ka	V	V	W	W	mm					
EU, NATO, US ECM	K	L	M	M							
ITU	EHF	EHF	EHF	EHF	EHF	EHF	THF				

Radio Propagation

	Band	Frequency	Wavelength	Propagation Via
ELF	Extremely Low Frequency	3–30 Hz	100,000–10,000 km	Guided between the Earth and the D layer of the ionosphere.
SLF	Super Low Frequency	30–300 Hz	10,000–1,000 km	Guided between the Earth and the ionosphere.
ULF	Ultra Low Frequency	0.3–3 kHz (300–3,000 Hz)	1,000–100 km	Guided between the Earth and the ionosphere.
VLF	Very Low Frequency	3–30 kHz (3,000–30,000 Hz)	100–10 km	Guided between the Earth and the ionosphere.
LF	Low Frequency	30–300 kHz (30,000–300,000 Hz)	10–1 km	Guided between the Earth and the ionosphere. Ground waves.
MF	Medium Frequency	300–3000 kHz (300,000–3,000,000 Hz)	1000–100 m	Ground waves. E, F layer ionospheric refraction at night, when D layer absorption weakens.
HF	High Frequency (Short Wave)	3–30 MHz (3,000,000–30,000,000 Hz)	100–10 m	E layer ionospheric refraction. F1, F2 layer ionospheric refraction.
VHF	Very High Frequency	30–300 MHz (30,000,000–300,000,000 Hz)	10–1 m	Line-of-sight propagation. Infrequent E ionospheric (Es) refraction. Uncommonly F2 layer ionospheric refraction during high sunspot activity up to 50 MHz and rarely to 80 MHz. Sometimes tropospheric ducting or meteor scatter
UHF	Ultra High Frequency	300–3000 MHz (300,000,000–3,000,000,000 Hz)	100–10 cm	Line-of-sight propagation. Sometimes tropospheric ducting.
SHF	Super High Frequency	3–30 GHz (3,000,000,000–30,000,000,000 Hz)	10–1 cm	Line-of-sight propagation. Sometimes rain scatter.
EHF	Extremely High Frequency	30–300 GHz (30,000,000,000–300,000,000,000 Hz)	10–1 mm	Line-of-sight propagation, limited by atmospheric absorption to a few kilometres
THF	Tremendously High Frequency	0.3–3 THz (300,000,000,000–3,000,000,000,000 Hz)	1–0.1 mm	Line-of-sight propagation.

Modes

Direct Modes (Line-of-Sight)
Line-of-sight refers to radio waves which travel directly in a line from the transmitting antenna to the receiving antenna. It does not necessarily require a cleared sight path; at lower frequencies radio waves can pass through buildings, foliage and other obstructions. This is the most common propagation mode at VHF and above, and the only possible mode at microwave frequencies and above. On the surface of the Earth, line of sight propagation is limited by the visual horizon to about 40 miles (64 km). This is the method used by cell phones, cordless phones, walkie-talkies, wireless networks, point-to-point microwave radio relay links, FM and television broadcasting and radar. Satellite communication uses longer line-of-sight paths; for example home satellite dishes receive signals from communication satellites 22,000 miles (35,000 km) above the Earth, and ground stations can communicate with spacecraft billions of miles from Earth. Ground plane reflection effects are an important factor in VHF line of sight propagation. The interference between the direct beam line-of-sight and the ground reflected beam often leads to an effective inverse-fourth-power (1/distance4) law for ground-plane limited radiation.

Surface Modes (Groundwave)
Lower frequency (between 30 and 3,000 kHz) vertically polarized radio waves can travel as surface waves following the contour of the Earth; this is called groundwave propagation. In this mode the radio wave propagates by interacting with the conductive surface of the Earth. The wave "clings" to the surface and thus follows the curvature of the Earth, so groundwaves can travel over mountains and beyond the horizon. Ground waves propagate in vertical polarization so vertical antennas (monopoles) are required. Since the ground is not a perfect electrical conductor, ground waves are attenuated as they follow the Earth's surface.

Attenuation is proportional to frequency, so ground waves are the main mode of propagation at lower frequencies, in the MF, LF and VLF bands. Ground waves are used by radio broadcasting stations in the MF and LF bands, and for time signals and radio navigation systems. At even lower frequencies, in the VLF to ELF bands, an Earth-ionosphere waveguide mechanism allows even longer range transmission. These frequencies are used for secure military communications. They can also penetrate to a significant depth into seawater, and so are used for one-way military communication to submerged submarines.

Early long distance radio communication (wireless telegraphy) before the mid-1920s used low frequencies in the longwave bands and relied exclusively on ground-wave propagation. Frequencies above 3 MHz were regarded as useless and were given to hobbyists (radio amateurs). The discovery around 1920 of the ionospheric reflection or skywave mechanism made the medium wave and short wave frequencies useful for long distance communication and they were allocated to commercial and military users.

Ionospheric Modes (Skywave)
Skywave propagation, also referred to as skip, is any of the modes that rely on reflection (actually refraction) of radio waves from the ionosphere. The ionosphere is a region of the atmosphere from about 60 to 500 km (37 to 311 mi) that contains layers of charged particles (ions) which can refract a radio wave back toward the Earth. A radio wave directed at an angle into the sky can be reflected back to Earth beyond the horizon by these layers, allowing long distance radio transmission. The F2 layer is the most important ionospheric layer for long-distance, multiple-hop HF propagation, though F1, E, and D-layers also play significant roles. The D-layer, when present during sunlight periods, causes significant amount of signal loss, as does the E-layer whose maximum usable frequency can rise to 4 MHz and above and thus block higher frequency signals from reaching the F2-layer.

The layers, or more appropriately "regions", are directly affected by the sun on a daily diurnal cycle, a seasonal cycle and the 11-year sunspot cycle and determine the utility of these modes. During solar maxima, or sunspot highs and peaks, the whole HF range up to 30 MHz can be used usually around the clock and F2 propagation up to 50 MHz is observed frequently depending upon daily solar flux 10.7cm radiation values.

During solar minima, or minimum sunspot counts down to zero, propagation of frequencies above 15 MHz is generally unavailable. Although the claim is commonly made that two-way HF propagation along a given path is reciprocal, that is, if the signal from location A reaches location B at a good strength, the signal from location B will be similar at station A because the same path is traversed in both directions. However, the ionosphere is far too complex and constantly changing to support the reciprocity theorem. The path is never exactly the same in both directions.

Ionospheric Modes (Meteor Scattering)
Meteor scattering relies on reflecting radio waves off the intensely ionized columns of air generated by meteors. While this mode is very short duration, often only from a fraction of second to couple of seconds per event, digital Meteor burst communications allows remote stations to communicate to a station that may be hundreds of miles up to over 1,000 miles (1,600 km) away, without the expense required for a satellite link. This mode is most generally useful on VHF frequencies between 30 and 250 MHz.

COMMUNICATION Radio Radio Propagation Modes

Ionospheric Modes (Auroral Backscatter)
Intense columns of Auroral ionization at 100 km altitudes within the auroral oval backscatter radio waves, including those on HF and VHF. Backscatter is angle-sensitive—incident ray vs. magnetic field line of the column must be very close to right-angle. Random motions of electrons spiralling around the field lines create a Doppler-spread that broadens the spectra of the emission to more or less noise-like—depending on how high radio frequency is used. The radio-auroras are observed mostly at high latitudes and rarely extend down to middle latitudes. The occurrence of radio-auroras depends on solar activity (flares, coronal holes, CMEs) and annually the events are more numerous during solar cycle maxima. Radio aurora includes the so-called afternoon radio aurora which produces stronger but more distorted signals and after the Harang-minima, the late-night radio aurora (sub-storming phase) returns with variable signal strength and lesser doppler spread. The propagation range for this predominantly back-scatter mode extends up to about 2000 km in east-west plane, but strongest signals are observed most frequently from the north at nearby sites on same latitudes. Rarely, a strong radio-aurora is followed by Auroral-E, which resembles both propagation types in some ways.

Ionospheric Modes (Sporadic-E Propagation)
Sporadic E (Es) propagation can be observed on HF and VHF bands. It must not be confused with ordinary HF E-layer propagation. Sporadic-E at mid-latitudes occurs mostly during summer season, from May to August in the northern hemisphere and from November to February in the southern hemisphere. There is no single cause for this mysterious propagation mode. The reflection takes place in a thin sheet of ionisation around 90 km height. The ionisation patches drift westwards at speeds of few hundred km per hour. There is a weak periodicity noted during the season and typically Es is observed on 1 to 3 successive days and remains absent for a few days to reoccur again. Es do not occur during small hours; the events usually begin at dawn, and there is a peak in the afternoon and a second peak in the evening. Es propagation is usually gone by local midnight. Observation of radio propagation beacons operating around 28.2 MHz, 50 MHz and 70 MHz, indicates that maximum observed frequency (MOF) for Es is found to be lurking around 30 MHz on most days during the summer season, but sometimes MOF may shoot up to 100 MHz or even more in ten minutes to decline slowly during the next few hours. The peak-phase includes oscillation of MOF with periodicity of approximately 5...10 minutes. The propagation range for Es single-hop is typically 1000 to 2000 km, but with multi-hop, double range is observed. The signals are very strong but also with slow deep fading.

Tropospheric Modes
Radio waves in the VHF and UHF bands can travel somewhat beyond the visual horizon due to refraction in the troposphere, the bottom layer of the atmosphere below 20 km. This is due to changes in the refractive index of air with temperature and pressure. Tropospheric delay is a source of error in radio ranging techniques, such as the Global Positioning System (GPS). In addition, unusual conditions can sometimes allow propagation at greater distances.

Tropospheric Modes (Tropospheric Ducting)
Sudden changes in the atmosphere's vertical moisture content and temperature profiles can on random occasions make UHF, VHF and microwave signals propagate hundreds of kilometres up to about 2,000 kilometres (1,200 miles)—and for ducting mode even farther—beyond the normal radio-horizon. The inversion layer is mostly observed over high pressure regions, but there are several tropospheric weather conditions which create these randomly occurring propagation modes. Inversion layer's altitude for non-ducting is typically found between 100 and 1,000 meters (330 and 3,280 feet) and for ducting about 500 to 3,000 meters (1,600 to 9,800 feet), and the duration of the events are typically from several hours up to several days. Higher frequencies experience the most dramatic increase of signal strengths, while on low-VHF and HF the effect is negligible. Propagation path attenuation may be below free-space loss. Some of the lesser inversion types related to warm ground and cooler air moisture content occur regularly at certain times of the year and time of day. A typical example could be the late summer, early morning tropospheric enhancements that bring in signals from distances up to few hundred kilometres for a couple of hours, until undone by the Sun's warming effect.

Tropospheric Modes (Tropospheric Scattering (Troposcatter))
At VHF and higher frequencies, small variations (turbulence) in the density of the atmosphere at a height of around 6 miles (9.7 km) can scatter some of the normally line-of-sight beam of radio frequency energy back toward the ground. In tropospheric scatter (troposcatter) communication systems a powerful beam of microwaves is aimed above the horizon, and a high gain antenna over the horizon aimed at the section of the troposphere though which the beam passes receives the tiny scattered signal. Troposcatter systems can achieve over-the-horizon communication between stations 500 miles (800 km) apart, and the military developed networks such as the White Alice Communications System covering all of Alaska before the 1960s, when communication satellites largely replaced them.

Tropospheric Modes (Rain Scattering)
Rain scattering is purely a microwave propagation mode and is best observed around 10 GHz, but extends down to a few gigahertz—the limit being the size of the scattering particle size vs. wavelength. This mode scatters signals mostly forwards and backwards when using horizontal polarization and side-scattering with vertical polarization. Forward-scattering typically yields propagation ranges of 800 km. Scattering from snowflakes and ice pellets also occurs, but scattering from ice without watery surface is less effective. The most common application for this phenomenon is microwave rain radar, but rain scatter propagation can be a nuisance causing unwanted signals to intermittently propagate where they are not anticipated or desired. Similar reflections may also occur from insects though at lower altitudes and shorter range. Rain also causes attenuation of point-to-point and satellite microwave links. Attenuation values up to 30 dB have been observed on 30 GHz during heavy tropical rain.

Tropospheric Modes (Airplane Scattering)
Airplane scattering (or most often reflection) is observed on VHF through microwaves and, besides back-scattering, yields momentary propagation up to 500 km even in mountainous terrain. The most common back-scatter applications are air-traffic radar, bistatic forward-scatter guided-missile and airplane-detecting trip-wire radar, and the US space radar.

Tropospheric Modes (Lightning Scattering)
Lightning scattering has sometimes been observed on VHF and UHF over distances of about 500 km. The hot lightning channel scatters radio-waves for a fraction of a second. The RF noise burst from the lightning makes the initial part of the open channel unusable and the ionization disappears quickly because of recombination at low altitude and high atmospheric pressure. Although the hot lightning channel is briefly observable with microwave radar, no practical use for this mode has been found in communications.

Other Effects (Diffraction)
Knife-edge diffraction is the propagation mode where radio waves are bent around sharp edges. For example, this mode is used to send radio signals over a mountain range when a line-of-sight path is not available. However, the angle cannot be too sharp or the signal will not diffract. The diffraction mode requires increased signal strength, so higher power or better antennas will be needed than for an equivalent line-of-sight path. Diffraction depends on the relationship between the wavelength and the size of the obstacle. In other words, the size of the obstacle in wavelengths. Lower frequencies diffract around large smooth obstacles such as hills more easily. For example, in many cases where VHF (or higher frequency) communication is not possible due to shadowing by a hill, it is still possible to communicate using the upper part of the HF band where the surface wave is of little use. Diffraction phenomena by small obstacles are also important at high frequencies. Signals for urban cellular telephony tend to be dominated by ground-plane effects as they travel over the rooftops of the urban environment. They then diffract over roof edges into the street, where multipath propagation, absorption and diffraction phenomena dominate.

Other Effects (Absorption)
Low-frequency radio waves travel easily through brick and stone and VLF even penetrates sea-water. As the frequency rises, absorption effects become more important. At microwave or higher frequencies, absorption by molecular resonances in the atmosphere (mostly from water, H_2O and oxygen, O_2) is a major factor in radio propagation. For example, in the 58–60 GHz band, there is a major absorption peak which makes this band useless for long-distance use. This phenomenon was first discovered during radar research in World War II. Above about 400 GHz, the Earth's atmosphere blocks most of the spectrum while still passing some - up to UV light, which is blocked by ozone - but visible light and some of the near-infrared is transmitted. Heavy rain and falling snow also affect microwave absorption.

Practical Effects

The average person can notice the effects of changes in radio propagation in several ways. In AM broadcasting, the dramatic ionospheric changes that occur overnight in the mediumwave band drive a unique broadcast license scheme, with entirely different transmitter power output levels and directional antenna patterns to cope with skywave propagation at night. Very few stations are allowed to run without modifications during dark hours, typically only those on clear channels in North America. Many stations have no authorization to run at all outside of daylight hours. Otherwise, there would be nothing but interference on the entire broadcast band from dusk until dawn without these modifications.

For FM broadcasting (and the few remaining low-band TV stations), weather is the primary cause for changes in VHF propagation, along with some diurnal changes when the sky is mostly without cloud cover. These changes are most obvious during temperature inversions, such as in the late-night and early-morning hours when it is clear, allowing the ground and the air near it to cool more rapidly. This not only causes dew, frost, or fog, but also causes a slight "drag" on the bottom of the radio waves, bending the signals down such that they can follow the Earth's curvature over the normal radio horizon.

The result is typically several stations being heard from another media market — usually a neighbouring one, but sometimes ones from a few hundred kilometres away. Ice storms are also the result of inversions, but these normally cause more scattered omnidirection propagation, resulting mainly in interference, often among weather radio stations. In late spring and early summer, a combination of other atmospheric factors can occasionally cause skips that duct high-power signals to places well over 1000 km away.

Non-broadcast signals are also affected. Mobile phone signals are in the UHF band, ranging from 700 to over 2600 Megahertz, a range which makes them even more prone to weather-induced propagation changes. In urban (and to some extent suburban) areas with a high population density, this is partly offset by the use of smaller cells, which use lower effective radiated power and beam tilt to reduce interference, and therefore increase frequency reuse and user capacity. However, since this would not be very cost-effective in more rural areas, these cells are larger and so more likely to cause interference over longer distances when propagation conditions allow.

While this is generally transparent to the user thanks to the way that cellular networks handle cell-to-cell handoffs, when cross-border signals are involved, unexpected charges for international roaming may occur despite not having left the country at all.

This often occurs between southern San Diego and northern Tijuana at the western end of the U.S./Mexico border, and between eastern Detroit and western Windsor along the U.S./Canada border. Since signals can travel unobstructed over a body of water far larger than the Detroit River, and cool water temperatures also cause inversions in surface air, this "fringe roaming" sometimes occurs across the Great Lakes, and between islands in the Caribbean. Signals can skip from the Dominican Republic to a mountainside in Puerto Rico and vice versa, or between the U.S. and British Virgin Islands, among others. While unintended cross-border roaming is often automatically removed by mobile phone company billing systems, inter-island roaming is typically not.

Modulation Types

AM	Amplitude modulation is the simplest type and the most commonly used for shortwave broadcasting. The instantaneous amplitude of the carrier is controlled by the amplitude of the signal (speech, or music, for example). At the receiver, a simple detector recovers the desired modulation signal from the carrier.
SSB	Single sideband transmission is a form of amplitude modulation but in effect filters the result of modulation. An amplitude-modulated signal has frequency components both above and below the carrier frequency. If one set of these components is eliminated as well as the residual carrier, only the remaining set is transmitted. This reduces power in the transmission, as roughly 2⁄3 of the energy sent by an AM signal is in the “carrier”, which is not needed to recover the information contained in the signal. It also reduces signal bandwidth, enabling less than one-half the AM signal bandwidth to be used. The drawback is the receiver is more complicated, since it must re-create the carrier to recover the signal. Small errors in the detection process greatly affect the pitch of the received signal. As a result, single sideband is not used for music or general broadcast. Single sideband is used for long-range voice communications by ships and aircraft, Citizen's Band, and amateur radio operators. Lower sideband (LSB) is customarily used below 9 MHz and USB (upper sideband) above 9 MHz.
VSB	Vestigal sideband transmits the carrier and one complete sideband, but filters out the other sideband. It is a compromise between AM and SSB, enabling simple receivers to be used, but requires almost as much transmitter power as AM. One advantage is only half the bandwidth of an AM signal is used. It can be heard in the transmission of certain radio time signal stations. Vestigial sideband is used for over the air Television Broadcasts both analog and digital.
NFM	Narrow-band frequency modulation (NBFM or NFM) is used typically above 20 MHz. Because of the larger bandwidth required, NBFM is commonly used for VHF communication. Regulations limit the bandwidth of a signal transmitted in the HF bands, and the advantages of frequency modulation are greatest if the FM signal has a wide bandwidth. NBFM is limited to short-range transmissions due to the multiphasic distortions created by the ionosphere.
DRM	Digital Radio Mondiale (DRM) is a digital modulation for use on bands below 30 MHz. It is a digital signal, like the data modes, below, but is for transmitting audio, like the analog modes above.

Station Types

International Broadcasting	International broadcasting primarily by government-sponsored propaganda, international news (for example, the BBC World Service) or cultural stations to foreign audiences: the most common use of all.
Domestic Broadcasting	Domestic broadcasting: to widely dispersed populations with few longwave, mediumwave and FM stations serving them; or for specialty political, religious and alternative media networks; or of individual commercial and non-commercial paid broadcasts.
Oceanic Air Traffic Control	Oceanic air traffic control uses the HF/shortwave band for long distance communication to aircraft over the oceans and poles, which are far beyond the range of traditional VHF frequencies. Modern systems also include satellite communications, such as ADS-C/CPDLC.
"Utility" Stations	"Utility" stations transmitting messages not intended for the general public, such as merchant shipping, marine weather, and ship-to-shore stations; for aviation weather and air-to-ground communications; for military communications; for long-distance governmental purposes, and for other non-broadcast communications.
Amateur Radio	Amateur radio operators at the 80/75, 60, 40, 30, 20, 17, 15, 12, and 10-meter bands. Licenses are granted by authorized government agencies.
Time Signal and Radio Clock Stations	Time signal and radio clock stations: In North America, WWV radio and WWVH radio transmit at these frequencies: 2.5 MHz, 5 MHz, 10 MHz, and 15 MHz; and WWV also transmits on 20 MHz. The CHU radio station in Canada transmits on the following frequencies: 3.33 MHz, 7.85 MHz, and 14.67 MHz. Other similar radio clock stations transmit on various shortwave and longwave frequencies around the world. The shortwave transmissions are primarily intended for human reception, while the longwave stations are generally used for automatic synchronization of watches and clocks.
Clandestine Stations	These are stations that broadcast on behalf of various political movements such as rebel or insurrectionist forces. They may advocate civil war, insurrection, rebellion against the government-in-charge of the country to which they are directed. Clandestine broadcasts may emanate from transmitters located in rebel-controlled territory or from outside the country entirely, using another country's transmission facilities.

Numbers Stations	These stations regularly appear and disappear all over the shortwave radio band but are unlicensed and untraceable. It is believed that Numbers Stations are operated by government agencies and are used to communicate with clandestine operatives working within foreign countries. However, no definitive proof of such use has emerged. Because the vast majority of these broadcasts contain nothing but the recitation of blocks of numbers, in various languages, with occasional bursts of music, they have become known colloquially as "Number Stations". Perhaps the most noted Number Station is the "Lincolnshire Poacher", named after the 18th century English folk song, which is transmitted just before the sequences of numbers.
Unlicensed Two Way Radio	Unlicensed two way radio activity by individuals such as taxi drivers, bus drivers and fishermen in various countries can be heard on various shortwave frequencies. Such unlicensed transmissions by "pirate" or "bootleg" two way radio operators can often cause signal interference to licensed stations.
Pirate Radio	Pirate radio broadcasters who feature programming such as music, talk and other entertainment, can be heard sporadically and in various modes on the shortwave bands.
Over-The-Horizon Radar	Over-the-horizon radar: From 1976 to 1989, the Soviet Union's Russian Woodpecker over-the-horizon radar system blotted out numerous shortwave broadcasts daily.
Ionospheric Heaters	Ionospheric heaters used for scientific experimentation such as the High Frequency Active Auroral Research Program in Alaska, and the Sura ionospheric heating facility in Russia.

Broadcasting Frequencies

Shortwave AM Radio	**Mediumwave AM Radio**	**Longwave AM Radio**			
1.7 MHz – 30 MHz (HF)	525 kHz – 1710 kHz (MF)	148.5 kHz – 283.5 kHz (LF)			

Shortwave Radio

Shortwave radio is radio transmission using shortwave radio frequencies. There is no official definition of the band, but the range always includes all of the high frequency band (HF), and generally extends from 1.7–30 MHz (176.3–10.0 m); from the high end of the medium frequency band (MF) just above the mediumwave AM broadcast band, to the end of the HF band. Radio waves in the shortwave band can be reflected or refracted from a layer of electrically charged atoms in the atmosphere called the ionosphere.

Therefore, short waves directed at an angle into the sky can be reflected back to Earth at great distances, beyond the horizon. This is called skywave or "skip" propagation. Thus shortwave radio can be used for very long distance communication, in contrast to radio waves of higher frequency which travel in straight lines (line-of-sight propagation) and are limited by the visual horizon, about 40 miles (64 km).

Shortwave radio is used for broadcasting of voice and music to shortwave listeners over very large areas; sometimes entire continents or beyond. It is also used for military over-the-horizon radar, diplomatic communication, and two-way international communication by amateur radio enthusiasts for hobby, educational and emergency purposes, as well as for long distance aviation and marine communications. Shortwave radio frequency energy is capable of reaching any location on the Earth as it is influenced by ionospheric reflection back to the earth by the ionosphere, (a phenomenon known as "skywave propagation").

A typical phenomenon of shortwave propagation is the occurrence of a skip zone where reception fails. With a fixed working frequency, large changes in ionospheric conditions may create skip zones at night. As a result of the multi-layer structure of the ionosphere, propagation often simultaneously occurs on different paths, scattered by the E or F region and with different numbers of hops, a phenomenon that may be disturbed for certain techniques.

Particularly for lower frequencies of the shortwave band, absorption of radio frequency energy in the lowest ionospheric layer, the D layer, may impose a serious limit. This is due to collisions of electrons with neutral molecules, absorbing some of a radio frequency's energy and converting it to heat. Predictions of skywave propagation depend on:

- The distance from the transmitter to the target receiver.
- Time of day. During the day, frequencies higher than approximately 12 MHz can travel longer distances than lower ones. At night, this property is reversed.
- With lower frequencies the dependence on the time of the day is mainly due to the lowest ionospheric layer, the D Layer, forming only during the day when photons from the sun break up atoms into ions and free electrons.
- Season. During the winter months of the Northern or Southern hemispheres, the AM/MW broadcast band tends to be more favourable because of longer hours of darkness.
- Solar flares produce a large increase in D region ionization so high, sometimes for periods of several minutes, all skywave propagation is non-existent.

Air Band

Band 118 to 137 MHz	Airband refers to VHF frequencies 118 to 137 MHz, used for navigation and voice communication with aircraft. Trans-oceanic aircraft also carry HF radio and satellite transceivers.

Marine Band

The greatest incentive for development of radio was the need to communicate with ships out of visual range of shore. From the very early days of radio, large oceangoing vessels carried powerful long-wave and medium-wave transmitters. High-frequency allocations are still designated for ships, although satellite systems have taken over some of the safety applications previously served by 500 kHz and other frequencies. 2182 kHz is a medium-wave frequency still used for marine emergency communication. Marine VHF radio is used in coastal waters and relatively short-range communication between vessels and to shore stations. Radios are channelized, with different channels used for different purposes; marine Channel 16 is used for calling and emergencies.

HAM Radio

Get your HAM radio licence and know how to operate the radio. Pal up with other radio enthusiasts prior to SHTF and keep in contact even if nothing happens. Understand the procedures and broadcasting restrictions as well as the frequencies you can use. Amateur radio frequency allocations vary around the world. Several bands are common for amateurs worldwide, usually in the HF part of the spectrum. Other bands are national or regional allocations only due to differing allocations for other services, especially in the VHF and UHF parts of the radio spectrum.

Citizen Band

Citizens' band radio is allocated in many countries, using channelized radios in the upper HF part of the spectrum (around 27 MHz). It is used for personal, small business and hobby purposes. Other frequency allocations are used for similar services in different jurisdictions, for example UHF CB is allocated in Australia. A wide range of personal radio services exist around the world, usually emphasizing short-range communication between individuals or for small businesses, simplified or no license requirements, and usually FM transceivers using around 1 watt or less.

Land Mobile Band

Bands of frequencies, especially in the VHF and UHF parts of the spectrum, are allocated for communication between fixed base stations and land mobile vehicle-mounted or portable transceivers. In the United States these services are informally known as business band radio. Police radio and other public safety services such as fire departments and ambulances are generally found in the VHF and UHF parts of the spectrum. Trunking systems are often used to make most efficient use of the limited number of frequencies available.

Radio Control

Reliable radio control uses bands dedicated to the purpose. Radio-controlled toys may use portions of unlicensed spectrum in the 27 MHz or 49 MHz bands, but more costly aircraft, boat, or land vehicle models use dedicated radio control frequencies near 72 MHz to avoid interference by unlicensed uses. The 21st century has seen a move to 2.4 gigahertz spread spectrum RC control systems. Licensed amateur radio operators use portions of the 6-meter band in North America. Industrial remote control of cranes or railway locomotives use assigned frequencies that vary by area.

Radar

Radar applications use relatively high power pulse transmitters and sensitive receivers, so radar is operated on bands not used for other purposes. Most radar bands are in the microwave part of the spectrum, although certain important applications for meteorology make use of powerful transmitters in the UHF band. Radio waves are a type of electromagnetic radiation with wavelengths in the electromagnetic spectrum longer than infrared light. Radio waves have frequencies as high as 300 GHz to as low as 3 kHz, though some definitions describe waves above 1 or 3 GHz as microwaves, or include waves of any lower frequency.

At 300 GHz, the corresponding wavelength is 1 mm (0.039 in), and at 3 kHz is 100 km (62 mi). Like all other electromagnetic waves, they travel at the speed of light. Naturally occurring radio waves are generated by lightning, or by astronomical objects. Artificially generated radio waves are used for fixed and mobile radio communication, broadcasting, radar and other navigation systems, communications satellites, computer networks and innumerable other applications. Radio waves are generated by radio transmitters and received by radio receivers.

Different frequencies of radio waves have different propagation characteristics in the Earth's atmosphere; long waves can diffract around obstacles like mountains and follow the contour of the earth (ground waves), shorter waves can reflect off the ionosphere and return to earth beyond the horizon (skywaves), while much shorter wavelengths bend or diffract very little and travel on a line of sight, so their propagation distances are limited to the visual horizon.

To prevent interference between different users, the artificial generation and use of radio waves is strictly regulated by law, coordinated by an international body called the International Telecommunications Union (ITU), which defines radio waves as "electromagnetic waves of frequencies arbitrarily lower than 3 000 GHz, propagated in space without artificial guide". The radio spectrum is divided into a number of radio bands on the basis of frequency, allocated to different uses.

Signal Jammer

Blocks GPS, GLONASS, Compass, Galileo, QZSS, SBAS, GSM, 3G, radio, Tv, bluetooth and wifi signals. Banned in a lot of countries so getting one will be the hardest problem. Extremely useful device, can prevent calls in and out, drops drones from the sky, blocks radio and Tv frequencies. GSM bands might be used in technologies like Cell ID to triangulate the location of cell phone user between three closest cell phone towers. Such technologies are used by corporations to find out where you are. In addition GSM signals might be intercepted and used for eavesdropping of your conversations in real time.

Listening

This section contains a list of the English Short Wave radio stations around the world, ordered by country. **LSB** = lower sideband, **USB** = upper sideband, **v** = frequency varies or is not exact. Many of these stations are easily heard; some are difficult and rarely audible.

Shortwave Listening Tips
- USA: Listen to Asia and Australia in the morning and listen to Europe at night.
- No SW frequency operates 24 hours. You may not hear anything unless you are listening at the right time, or you may hear another language, or you may hear some other country sharing the frequency.
- Many countries are better heard in non-English broadcasts.
- Some stations only air a few minutes of English; or only in ID announcements (Mexico); or only language lessons (Ecuador).
- Country of origin is shown. Many of the frequencies are relayed from elsewhere. In the case of China, all of them shown below are relays. Don't assume any particular frequency is actually coming directly from the originating country.
- Some major countries no longer broadcast to North America intentionally, such as Australia, Germany, South Africa or the UK. Longer frequency lists for these give you more chances to hear something directed elsewhere.
- More than one station may be involved under some countries, or even outside broadcasts to that country (Liberia, Nigeria, Sudan).
- Many of the strongest signals from strictly religious broadcasters in the US and elsewhere are not shown.

Full sized rows under a country are additional stations you may want to listen to. The table headings are as follows:
Country - Station - UTC Time - Notes - Frequencies

ALASKA	6150, 6950, 7355, 9920

Alaska	KNLS	0800-0900 As	7370
Alaska	KNLS	1000-1100 As	7370
Alaska	KNLS	1200-1300 As	7355, 7370
Alaska	KNLS	1400-1500 As	7355

ALBANIA	6115, 7425, 7450, 7465
ARGENTINA	9690, 11710, 15345
AUSTRALIA	2310, 2325, 2485, 4835, 4910, 5025, 5995, 6020, 6080, 7240, 9475, 9560, 9580, 9590, 9660, 9710, 11650, 11880, 12080, 13630, 13670, 15160, 15230, 15240, 15515, 17715, 17750, 17775, 17785, 17795, 21725

Australia	Reach Beyond Aust	0000-0015 eAs, W,F	15400
Australia	Reach Beyond Aust	1115-1130 As,M-W,F	15575
Australia	Reach Beyond Aust	1145-1200 sAs,Sa-Su	11915
Australia	Reach Beyond Aust	1200-1215 seAs, F	11865
Australia	Reach Beyond Aust	1215-1230 seAs, F	11865
Australia	Reach Beyond Aust	1230-1245 seAs, F	11865
Australia	Reach Beyond Aust	1245-1300 sAs	11865
Australia	Reach Beyond Aust	1300-1330 sAs, Su	9610
Australia	Reach Beyond Aust	1315-1330 sAs, M,W,F	11865
Australia	Reach Beyond Aust	2230-2245 eAs, M-F	15400

ACT Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Canberra ACT: 2CN - 666, 2RN - 846, 1RPH - 1125, 2CC - 1206, 1EA - 1440

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NSW Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Albury NSW: 2AY - 1494
Armidale NSW: 2RN - 720, 2AD - 1134
Bega NSW: 2EC - 765, 2BA - 810
Bourke NSW: 2WEB - 585
Broken Hill NSW: 2BH - 567, 2NB - 999
Byrock NSW: 2BY - 657
Cobar NSW: 2DU - 972
Coffs Harbour NSW: 2HC - 639
Cooma NSW: 2XL - 918, 2CP - 1602
Corowa NSW: 2CO - 675
Cumnock NSW: 2CR - 549
Deniliquin NSW: 2QN - 1521
Dubbo NSW: 2DU - 1251

Glen Innes NSW: 2GL - 819
Goulburn NSW: 2RN - 1098, 2GN 1368
Grafton NSW: 2NR - 738, 2GF - 1206
Griffith NSW: 2RG - 963
Gunnedah NSW: 2MO - 1080
Inverell NSW: 2NZ - 1188
Kempsey NSW: 2PM - 531, 2KP - 684
Lismore NSW: 2LM - 900
Lithgow NSW: 2LT - 900, 2LG - 1395
Moree NSW: 2VM - 1530
Mudgee NSW: 2MG - 1449
Murwillumbah NSW: 2ML - 720, 2MW - 972
Muswellbrook NSW: 2ML - 981, 2UL - 1044
Narooma NSW: 2EC - 1584

Newcastle NSW: 2HD - 1143, 2NC - 1233, 2EA - 1413, 2PB - 1458, 2RN - 1512
Nowra NSW: 2RN - 603, 2ST - 999
Orange NSW: 2EL - 1089
Parkes NSW: 2PK - 1404
Sydney NSW: 2RN - 576, 2PB - 630, 2BL - 702, 2GB - 873, 2UE - 954, 2KY - 1017, 2EA - 1107, 2CH - 1170, 2RPH - 1224, 2SB - 1269
Tamworth NSW: 2NU - 648, 2TM - 1287
Taree NSW: 2TR - 756, 2RE - 1557
Wagga Wagga NSW: 2WG - 1152
Wilcannia NSW: 2RN - 1485, 2WA - 1584
Wollongong NSW: 2EA - 1035, 2RN - 1431, 2EA - 1485
Young NSW: 2LF - 1350

NT Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Alice Springs NT: 8AL - 783, 8HA - 900
Darwin NT: 8RN - 657
Jabiru NT: 8JB - 747
Katherine NT: 8RN - 639, 8HOT - 765
Nhulunbuy NT: 8GO - 990
Tennant Creek NT: 8RN - 684

QLD Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Atherton QLD: 4AM - 558, 4AT - 720
Biloela QLD: 4CC - 666
Brisbane QLD: 4QR - 612, 4KQ - 693, 4RN - 792, 4BH - 882, 4PB - 936, 4TAB - 1008, 4BC - 1116, 4YB - 1197, 4RPH - 1296
Bundaberg QLD: 4BU - 1332
Cairns QLD: 4QY - 801, 4EL - 846
Charleville QLD: 4CH - 603, 4VL - 918
Charters Towers QLD: 4GC - 828
Cloncurry QLD: 4LM - 693
Cunamulla QLD: 4VL - 1584
Dysart QLD: 4HI - 945
Eidsvold QLD: 4QC - 855
Emerald QLD: 4HI - 1143, 4QD - 1548
Gladstone QLD: 4CC - 927

Gordonvale QLD: 4EL - 954
Gympie QLD: 4GY - 558, 4GM - 1566
Hughenden QLD: 4GC - 765, 4HU 1485
Innisfail QLD: 4KZ - 531
Julia Creek QLD: 4JK - 567
Kingaroy QLD: 4SB - 1071
Mossman QLD: 4MS - 639
Mt Isa QLD: 4LM - 666
Oakey QLD: 4AK - 1242
Pialba QLD: 4BQ - 855
Pt Douglas QLD: 4AM - 1422
Longreach QLD: 4QL - 540, 4LG - 1098
Mackay QLD: 4AA - 1026
Maryborough QLD: 4FC - 1161

Moranbah QLD: 4HI - 1215
Rockhampton QLD: 4RK - 837, 4RO - 990, 4CC - 1584
Roma QLD: 4ZR - 1476
St George QLD: 4QW - 711
Toowoomba QLD: 4QS - 747, 4GR - 864
Torres Strait QLD: 4TI - 1062, 4MW - 1260
Townsville QLD: 4QN - 630
Tully QLD: 4KZ - 693
Warwick QLD: 4WK - 963
Weipa QLD: 4WP - 1044

SA Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Adelaide SA: 5RN - 729, 5AN - 891, 5PB - 972, 5RPH - 1197, 5DN - 1323, 5AA - 1395
Leigh Creek SA: 5LC - 1602
Mt Gambier SA: 5SE - 963, 5MG - 1476
Murray Bridge SA: 5MU - 1125
Naracoorte SA: 5PA - 1161
Pt Augusta SA: 5AU - 1242
Pt Lincoln SA: 5CC - 765, 5LN - 1485
Pt Pirie SA: 5CK - 639, 5AU - 1044
Renmark SA: 5RM - 801, 5MV - 1062, 5RN - 1305
Streaky Bay SA: 5SY - 693
Woomera SA: 5WM - 1584

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TAS Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Burnie TAS: 7BU - 558
Devonport TAS: 7AD - 900
Fingal TAS: 7FG - 1161
Hobart TAS: 7RN - 585, 7PB - 747, 7RPH - 864, 7ZR - 936
Queenstown TAS: 7RN - 630
Scottsdale TAS: 7SD - 540
St Helens TAS: 7SH - 1584

VIC Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Albury/Wodonga VIC: 3RN - 990
Ballarat VIC: 3BT - 1314
Colac VIC: 3CS - 1134
Hamilton VIC: 3HA - 981
Horsham VIC: 3WV - 594, 3WM - 1089
Maryborough VIC: 3EL - 1071
Melbourne VIC: 3RN - 621, 3AW - 693, 3LO - 774, 3CR - 855, 3UZ - 927, 3PB - 1026, 3AK - 1116, 3RPH - 1179, 3EA - 1224, 3EE - 1278, 3MP - 1377, 3KND - 1503
Mildura VIC: 3MI - 1467
Omeo VIC: 3MT - 720
Sale VIC: 3GI - 828, 3GV - 1242
Shepparton VIC: 3SR - 1260
Swan Hill VIC: 3SH - 1332
Wangaratta VIC: 3RN - 756, 3NE - 1566

Warragul VIC: 3GG - 531
Warrnambool VIC: 3RPH - 882, 3WL - 1602

WA Medium Wave Stations (AM) By Location (Callsign - Frequency (kHz))
Albany WA: 6AL - 630, 6VA - 783
Bridgetown WA: 6BY - 900, 6BR - 1044
Broome WA: 6BE - 675
Bunbury WA: 6EL - 621, 6TZ - 963
Busselton WA: 6BS - 684, 6PB - 1152, 6RN - 1269
Carnarvon WA: 6LN - 666, 6CA - 846
Collie WA: 6TZ - 1134
Dalwallinu WA: 6DL - 531, 6RN - 612
Derby WA: 6DB - 873
Esperance WA: 6SE - 747, 6ED - 837
Exmouth WA: 6XM - 1188
Fitzroy Crossing WA: 6FX - 936
Geraldton WA: 6GN - 828

Kalgoorlie WA: 6GF - 648, 6KG - 981
Karratha WA: 6KP - 702
Katanning WA: 6WB - 1071
Kununurra WA: 6WR - 693, 6KW - 819
Manjimup WA: 6MJ - 738
Margaret River WA: 6TZ - 756
Merredin WA: 6MD - 1098
Morawa WA: 6BAY - 1512
Narrogin WA: 6NA - 918
Newman WA: 6MW - 567
Northam WA: 6AM - 864, 6NM - 1215
Pannawonica WA: 6PN - 567
Paraburdoo WA: 6PU - 567
Perth WA: 6PB - 585, 6WF - 720, 6RN - 810, 6PR - 822, 6IX - 1080

Pt Hedland WA: 6PH - 603
Tom Price WA: 6TP - 567
Wagin WA: 6WA - 558, 6RN - 1296
Wyndham WA: 6WH - 1017

AUSTRIA	5945, 6155, 7325, 9870, 13675, 13730
BAHRAIN	6010
BANGLADESH	7185
BELARUS	7360, 7390, 7420
BULGARIA	7400, 9400, 9500, 9700, 11700, 11900, 15700
CANADA RCI	9610, 9755, 9770, 13650, 15365, 17740
CANADA CBC	6160, 9625

Canada	CFRX	0000-2400 NA	6070
Canada	CFVP	0000-2400 NA	6030
Canada	CKZU	0000-2400 NA	6160

CHINA	5960, 5990, 6005, 6020, 6040, 6080, 6115, 6190, 7285, 9570, 9580, 9690, 9730, 9785, 9790, 9870, 11885, 11900, 11970, 13675, 13740, 15230, 15240

China	China R. Int'l	0000-0100 Eu	7350
China	China R. Int'l	0000-0100 As	6075, 6180, 7425, 9425, 11790, 11885, 15125
China	China R. Int'l	0000-0200 NA	6020al, 9570al
China	China R. Int'l	0100-0200 NA	9580cu
China	China R. Int'l	0100-0200 As	6075, 6180, 7370, 11885, 15125
China	China R. Int'l	0100-0200 Eu	7350, 9675
China	China R. Int'l	0200-0300 As	9610, 11770
China	China R. Int'l	0300-0400 NA	9790cu
China	China R. Int'l	0300-0400 As	11770, 13570, 13590, 13800, 15120
China	China R. Int'l	0400-0500 As	13570, 13590, 15120
China	China R. Int'l	0400-0500 eEu	17730, 17855
China	China R. Int'l	0500-0600 As	11895, 15350, 15430,15465, 17540
China	China R. Int'l	0500-0600 ME	7220al
China	China R. Int'l	0500-0600 Af, ME	17510
China	China R. Int'l	0500-0600 eEu	17730, 17855

China China R. Int'l 0600-0700 As 11895, 13645, 15350, 15430, 15465, 17710
China China R. Int'l 0600-0700 ME 11750al, 11870, 15145
China China R. Int'l 0600-0700 Af, ME 17510
China China R. Int'l 0700-0800 As 11895, 13660, 15185,15350, 15465, 17710
China China R. Int'l 0700-0900 Af, ME 17670
China China R. Int'l 0700-0900 Eu 11785al, 17490
China China R. Int'l 0800-0900 As 9415, 11710, 11895, 15185, 15350, 15465
China China R. Int'l 0900-1000 Oc 15210, 17690
China China R. Int'l 0900-1000 Eu 17490, 17570, 17650
China China R. Int'l 0900-1000 As 9415, 15185, 15350
China China R. Int'l 1000-1100 As 5955, 13590, 13720, 15190, 15350
China China R. Int'l 1000-1100 Eu 17490
China China R. Int'l 1000-1100 Oc 15210, 17690
China China R. Int'l 1000-1100 eEu 7215, 11635
China China R. Int'l 1100-1200 As 5955, 7250, 11650, 11795, 12015, 13590, 13720
China China R. Int'l 1100-1300 Eu 13665al, 17490
China China R. Int'l 1200-1300 As 5955, 7250, 9460, 9600,9645, 9730, 11650, 11980,12015
China China R. Int'l 1200-1300 Oc 9760, 11760
China China R. Int'l 1200-1300 eEu 11690
China China R. Int'l 1200-1300 Eu 17490
China China R. Int'l 1300-1400 NA 9570cu
China China R. Int'l 1300-1400 Eu 13670, 13790
China China R. Int'l 1300-1400 As 5955, 7300, 9655, 9730, 9870, 11910, 11980
China China R. Int'l 1300-1400 Oc 11760, 11900
China China R. Int'l 1300-1400 eEu 9765
China China R. Int'l 1400-1500 Eu 9795, 11880
China China R. Int'l 1400-1500 Af 13685ml, 17630ml
China China R. Int'l 1400-1500 As 5955, 7300, 9460, 9870
China China R. Int'l 1400-1500 NA 15700cu
China China R. Int'l 1400-1500 eEu 9765
China China R. Int'l 1400-1500 ME 6100
China China R. Int'l 1500-1600 Eu 9435, 9525
China China R. Int'l 1500-1600 As 5955, 7325, 7395, 9785, 9870, 9880
China China R. Int'l 1500-1600 Af, ME 6095, 9720
China China R. Int'l 1500-1600 NA 15700cu
China China R. Int'l 1500-1600 Af 13685ml, 17630ml
China China R. Int'l 1600-1700 As 6060, 6175, 7235, 9880
China China R. Int'l 1600-1700 Eu 7255, 9875
China China R. Int'l 1600-1700 Af 7435, 9570
China China R. Int'l 1600-1700 Af, ME 7420
China China R. Int'l 1700-1800 As 6090, 6140, 6175, 7235, 7410, 7420, 9880
China China R. Int'l 1700-1800 ME 6165
China China R. Int'l 1700-1800 Af 7435, 9570
China China R. Int'l 1700-1800 Eu 6100, 7255
China China R. Int'l 1800-1900 Eu 6100, 7405
China China R. Int'l 1900-2000 Af, ME 7295, 9440
China China R. Int'l 2000-2100 Af 5985, 11640ml, 13630ml
China China R. Int'l 2000-2100 Eu 5960al, 7285al, 7415, 9600
China China R. Int'l 2000-2100 Af, ME 7295, 9440
China China R. Int'l 2100-2130 Af 11640ml, 13630ml
China China R. Int'l 2100-2200 Af 7205, 7325
China China R. Int'l 2100-2200 Eu 5960al, 7285al, 7415, 9600
China China R. Int'l 2200-2300 As 5915
China China R. Int'l 2300-2400 Am 5990cu
China China R. Int'l 2300-2400 As 5915, 6145, 7410, 9535, 11790
China China R. Int'l 2300-2400 Eu 7350
China PBS Zizang Lhaza 0700-0800 As 4905, 4920, 6025, 6110, 6130, 6200, 9490, 9580
China PBS Zizang Lhaza 1600-1700 As 4905, 4920, 6025, 6110, 6130, 6200, 7255, 7385

CROATIA	7285, 9470, 11690
CUBA	6000, 6060, 6180, 6300, 9505, 9550, 11760
CZECH REP	5930, 6200, 7345, 7385, 9400, 9430, 9435, 9890, 9955, 11600, 13580, 15710
ECUADOR	6050, 7385, 9745, 11700
EGYPT	4680, 7270, 9990, 11885, 15375, 17835
ETHIOPIA	7165, 9560v
FRANCE	5920, 7315, 9720, 9765, 9805, 9865, 11615, 11725, 13680, 11995, 15160, 15275, 15605, 21620

France Oromo Voice R. 1615-1630 Af, M 17850
France R. France Int'l 0100-0200 LA, F-Sa 11580wr
France R. France Int'l 0200-0300 LA, W-Su 11580wr
France R. France Int'l 0600-0700 Af 9735
France R. France Int'l 2100-2200 LA, M-Tu 15770wr
France R. France Int'l 2115-2200 LA, W 15770wr
France R. France Int'l 2130-2200 LA, Th 15770wr
France Radio Biafra 1800-2100 Af 11700bu

GERMANY	5905, 6140, 6180, 7225, 7240, 7280, 7285, 9565, 9735, 9755, 11690, 12045, 15275

Germany Eur Shortwave R 1000-1200 wEu, M-Sa 6160
Germany Eur Shortwave R 1200-1400 wEu, M-Sa 3975
Germany Eur Shortwave R 1400-1600 wEu, M-Sa 6160
Germany Eur Shortwave R 1600-1800 wEu, M-Sa 3975
Germany Eur Shortwave R 1800-2000 wEu, M-Sa 6160
Germany Eur Shortwave R 2000-2200 wEu, M-Sa 3975
Germany R. der Dokumenta 0600-0800 cEu 15560
Germany R. der Dokumenta 1500-1800 cEu 15560

GHANA	4915
GREECE	7475, 9420, 9935, 12105, 15630, 17525
GUYANA	3291, 5950
HUNGARY	5980, 6025, 6035, 9525
INDIA	7410, 9425, 9445, 9690, 9705, 9910, 9950, 11620, 11645, 11715, 11935, 13605, 13710, 15020, 15075, 15155, 15235, 17510, 17670, 17800, 17895

India All India R. 1000-1100 As 7270, 13605, 15410, 17510
India All India R. 1000-1100 Oc 13695, 15770, 17895
India All India R. 1330-1500 As 9690, 13695
India All India R. 1530-1545 As 6155, 11560
India All India R. 1745-1945 Af 9445, 11935, 13695, 17670
India All India R. 1745-1945 Eu 7550, 9950
India All India R. 2045-2230 Eu 7550, 9445, 9950
India All India R. 2045-2230 Oc 9910, 11620, 11740
India All India R. 2245-2400 As 6045, 7550, 9445, 9705, 11645

INDONESIA	9525v, 11785, 15150v
IRAN	6010, 6120, 6250, 7160, 7320, 7330, 9855, 11695, 15460, 17660
ISRAEL	6280, 6985, 7545, 9345, 15640, 15760, 17535, 17600
ITALY	5965, 6010, 6035, 6090, 6120, 7170, 9760, 11800

Italy IRRS 0800-0900 Eu, Sa 9510bu
Italy IRRS 0930-1200 Eu, Su 9510bu
Italy IRRS 1500-1600 eEu, Su 9400bu
Italy IRRS 1800-1900 Eu, F-Su 7290bu

JAPAN	5975, 6110, 6120, 6145, 7230, 9505, 9535, 9875, 11690, 11695, 11715, 11730, 11740, 11935, 11970, 13650, 15195, 15355, 17685, 17810, 17825, 17845, 17870, 21610, 21670

Japan R. Japan 0500-0530 Eu 6155au
Japan R. Japan 0500-0530 sAf 9770fr
Japan R. Japan 0710-0725 seAs, Sa-Su9730
Japan R. Japan 1100-1130 As 11825si
Japan R. Japan 1100-1130 Eu, F 9760uk drm
Japan R. Japan 1400-1430 As 9560uz, 11925pa
Japan R. Japan 1540-1600 seAs, Th,F 5985my
Japan R. Japan 1800-1830 Af 11800za
Japan R. Japan 1930-2000 wAf 9485va
Japan R. Japan 1930-2000 Oc 9625
Japan Shiokaze 1300-1400 As, Th 6085
Japan Shiokaze 1600-1700 As, Th 7285

JORDAN	11690
KOREA, N	3560, 4405, 6185, 6285, 7570, 9325, 9335, 9345, 9730, 9850, 9975, 9990, 11535, 11545, 11710, 11735, 12015, 13650, 13760, 15100, 15180

North Korea V. of Korea 0430-0527 LA 11735, 13760, 15180
North Korea V. of Korea 0430-0527 neAs 7220, 9445, 9730
North Korea V. of Korea 0530-0627 seAs 13650, 15105
North Korea V. of Korea 0630-0727 neAs 7220, 9445, 9730
North Korea V. of Korea 1030-1127 LA 6170, 9435
North Korea V. of Korea 1030-1127 seAs 6185, 9850
North Korea V. of Korea 1330-1427 NA 9435, 11710
North Korea V. of Korea 1330-1427 wEu 7570, 12015
North Korea V. of Korea 1530-1627 NA 9435, 11710
North Korea V. of Korea 1530-1627 wEu 7570, 12015
North Korea V. of Korea 1630-1727 ME 9890, 11645
North Korea V. of Korea 1830-1927 wEu 7570, 12015
North Korea V. of Korea 1930-2027 ME 9875, 11635
North Korea V. of Korea 1930-2027 sAf 7210, 11910
North Korea V. of Korea 2130-2227 wEu 7570, 12015

KOREA, S	7275, 9560, 9570, 9640, 9650, 9770, 15575

South Korea KBS World R. 0200-0300 LA 9580
South Korea KBS World R. 0800-1030 seAs 9770
South Korea KBS World R. 1100-1130 Eu, Sa 9760uk drm
South Korea KBS World R. 1300-1400 seAs 9570
South Korea KBS World R. 1300-1400 NA 15575
South Korea KBS World R. 1400-1500 sAs 9630
South Korea KBS World R. 1500-1700 Eu 9515
South Korea KBS World R. 1500-1700 As 9630
South Korea KBS World R. 1600-1700 seAs 9640
South Korea KBS World R. 2200-2300 wEu 11810
South Korea KBS World R. 2200-2300 As 13705

LAOS	7145
LIBERIA	4760, 5470, 9525
LIBYA	7320, 17725, 21695
LITHUANIA	7325, 9710, 9875
MALAYSIA	7295, 9750, 15295
MEXICO	6185
MOLDOVA	6235
MONGOLIA	12085
MYANMAR	5986
NEPAL	5005
NETHERLANDS	6020, 6040, 6165, 7120, 9345, 9795, 9895, 11655, 11675, 12065, 12080, 15315, 15525, 15595, 17725, 17810
NEW ZEALAND	3935, 5950, 9765, 9870, 11725, 13840, 15720, 17675

New Zealand RNZI 0000-0458 Oc 15720
New Zealand RNZI 0459-0758 Oc 13730
New Zealand RNZI 0759-1058 Oc 9765
New Zealand RNZI 1059-1258 Oc 11610
New Zealand RNZI 1259-1650 Oc 7390
New Zealand RNZI 1651-1750 Oc, Su-F 7285 drm
New Zealand RNZI 1651-1758 Oc, Sa 7390
New Zealand RNZI 1751-1850 Su-F 9780 drm
New Zealand RNZI 1759-1958 Oc, Sa 11725
New Zealand RNZI 1851-1950 Oc, Su-F 11690 drm
New Zealand RNZI 1951-2050 Oc, Su-F 13840 drm
New Zealand RNZI 1959-2058 Oc, Sa 13840
New Zealand RNZI 2051-2400 Oc 15720

NIGERIA	7255, 7275, 7380, 15120
OMAN	15140
PAKISTAN	6215, 7530, 11570, 15100, 17835
PAPUA NEW GUINEA	3385, 4960, 7120
PHILIPPINES	11720, 11885, 15190, 15270, 17665, 17720
POLAND	7130, 9525
ROMANIA	6055, 6115, 6150, 7105, 7145, 7180, 9515, 9610, 9640, 9690, 9755, 11895, 15105, 15135, 17745
RUSSIA	6240, 7150, 7250, 7350, 9840, 12010, 12030, 13665, 15425
SENEGAL	12000
SERBIA	6100
SINGAPORE	6080, 6150

SLOVAKIA	7230, 9440
SOLOMON IS.	5020v, 9545
SOUTH AFRICA	3345, 7240, 7390, 9685, 15235, 15255, 17770

South Africa Channel Africa 0300-0400 Af, M-F 3345, 6155
South Africa Channel Africa 0400-0500 Af, M-F 3345
South Africa Channel Africa 0500-0900 Af, M-F 7230
South Africa Channel Africa 0600-0700 Af, M-F 15255
South Africa Channel Africa 0900-1600 Af, M-F 9625
South Africa Channel Africa 1500-1600 Af, M-F 9625
South Africa Channel Africa 1700-1755 Af, M-F 15235
South Africa S.Afr. Radio Leag.0800-0900 Af, Su 7205, 17660
South Africa S.Afr. Radio Leag.1630-1730 Af, M 4895

SPAIN	6055, 6125, 9680, 11625, 11680
SRI LANKA	6005, 9770, 11905, 15745v
SUDAN	4750, 7280, 9525, 9660, 9840, 13720
SURINAME	4990
SWEDEN	6010, 7420, 11550, 15240
SYRIA	9330, 12085, 13610
TAIWAN	5950, 7130, 7445, 9355, 9680, 9785, 11550, 11850, 1995, 15215, 15465
TAJIKISTAN	7245
THAILAND	5890, 9535, 9680, 9725, 9805, 9810, 13770
TIBET	4820, 4905, 5935, 6050, 7170, 7240, 9490
TURKEY	5960, 6020, 6055, 7240, 9525, 11735, 12035
TURKMENISTAN	4930, 5015
UGANDA	4976, 5026
UKRAINE	5820, 5830, 9925
UNITED KINGDOM	5875, 5975, 6005, 6040, 6130, 6195, 7130, 7160, 7320, 9410, 9480, 9660, 9740, 9750, 11675, 11750, 11765, 11920, 12095, 15105, 15285, 15360, 15400, 15575, 17640, 17830, 17885, 21470

United Kingdom BBC 0000-0200 As 5970om
United Kingdom BBC 0200-0300 As 6155om
United Kingdom BBC 0300-0400 ME 6195om, 9410om
United Kingdom BBC 0400-0500 Af 9915as, 12095ae
United Kingdom BBC 0400-0500 ME 9410om, 12035om
United Kingdom BBC 0500-0600 Af 3255za, 5875as, 5925as, 6005as, 6190za, 12095za, 15420ma
United Kingdom BBC 0600-0700 Af 6005as, 6190za, 7325, 7345as, 7445za
United Kingdom BBC 0600-0700 Eu 3955 drm
United Kingdom BBC 0600-0700 Af 12095za, 15420ma, 17640ae
United Kingdom BBC 0700-0800 Af 6190za, 7445za, 9915as, 11770as, 12095as, 15400za, 15420ma, 17830za
United Kingdom BBC 0800-0900 As 17790si drm
United Kingdom BBC 1000-1100 As 6195si, 9740si, 11895si, 15285si
United Kingdom BBC 1100-1200 As 6195si, 9740si, 15285si
United Kingdom BBC 1200-1300 As 6195si, 9740si, 11895si
United Kingdom BBC 1300-1400 As 9410om
United Kingdom BBC 1400-1500 As 9410om
United Kingdom BBC 1500-1600 Af 12095ma, 15420za
United Kingdom BBC 1500-1600 ME 7405om
United Kingdom BBC 1500-1630 As 9540si, 9940ch
United Kingdom BBC 1600-1700 Af 3255za, 6190za, 7445ma, 12095za, 17640as, 17830as
United Kingdom BBC 1600-1700 ME 7405om
United Kingdom BBC 1700-1800 Af 3255za, 6190za, 7445ma, 9410za, 15400as, 17780as, 17830as
United Kingdom BBC 1700-1900 ME 6195om
United Kingdom BBC 1800-1900 Af 3255za, 6190za, 7445ma, 9410ae, 9915
United Kingdom BBC 1800-1900 Af 11810as, 15400as
United Kingdom BBC 1900-2000 Af 3255za, 6190za, 7445ma, 9410ae
United Kingdom BBC 1900-2000 Af 11810as, 15400as
United Kingdom BBC 2000-2100 Af 11810as, 12095as
United Kingdom BBC 2100-2200 Af, M-F 9915as, 11810as, 12095as
United Kingdom BBC 2200-2300 As 3915si, 5905om, 5960om, 6195si, 7205om, 7300om, 9890om
United Kingdom BBC 2300-2400 As 3915si, 6195si
United Kingdom Bible Voice 0445-0515 ME, Su 7325ge
United Kingdom Bible Voice 0800-0830 wEu, Su 7220ge
United Kingdom Bible Voice 1200-1230 As, Sa 21480ma
United Kingdom Bible Voice 1230-1245 As, Sa 21480ma
United Kingdom Bible Voice 1400-1415 sAs, Sa 6260uz
United Kingdom Bible Voice 1400-1430 sAs, Sa 17510fr
United Kingdom Bible Voice 1430-1500 sAs, Sa 17510fr
United Kingdom Bible Voice 1730-1800 eAf, M 11790ge
United Kingdom Bible Voice 1800-1815 ME, F 9715au
United Kingdom Bible Voice 1800-1830 ME, Sa 9715au
United Kingdom Bible Voice 1800-2000 ME, Su 9715au
United Kingdom Bible Voice 1815-2000 ME, Sa 9715au
United Kingdom Bible Voice 1830-1930 eEu, Su 6030ge
United Kingdom Bible Voice 1930-2015 ME, Su 7425ge

United Kingdom Bible Voice 1930-2015 ME Su 7425ge
United Kingdom End Times Coming 1900-1930 wEu 11590bu
United Kingdom FEBA 1415-1430 As, M 9775sl

UNITED NATIONS	9565, 17810
USA AFRTS	4319-USB, 5446.5-USB, 5765-USB, 6350-USB, 7811.5-USB, 10320-USB, 12133.5-USB, 12759-USB, 13362-USB
USA VOA	4930, 4960, 5960, 6080, 6105, 6110, 7125, 7175, 7205, 7405, 9645, 9760, 9785, 9885, 11655, 11885, 11890, 11975, 12015, 12150, 13600, 13640, 13710, 13735, 13755, 15150, 15185, 15205, 15290, 15445, 15580, 17640, 17715, 17730, 17895
USA KAIJ	5755, 9480
USA WBCQ	5110-LSB, 7415, 9330-LSB, 18910-LSB
USA WEWN	5810, 5850, 7560, 7570, 9450, 9955, 9975, 15785, 17595
USA WRMI	7385, 9955
USA WWCR	3215, 5070, 7465, 9985, 12160, 15825

U. S. A.	AWR 1530-1600 As, Sa-W 11985sl
U. S. A.	AWR 1600-1630 As 11955sl, 17730ma
U. S. A.	AWR 1830-1900 Af 15155ma
U. S. A.	AWR 2100-2130 Af 11980au
U. S. A.	AWR 2200-2230 As,M,W,Sa 9720sl
U. S. A.	AWR 2230-2300 LA 5950wr
U. S. A.	Eternal Good News 0200-0215 NA, M 7385wh
U. S. A.	Eternal Good News 0445-0500 Eu,Sa 11635wh
U. S. A.	Eternal Good News 1230-1245 As, Su 21480ma
U. S. A.	Eternal Good News 1230-1245 As,Su 9930pa
U. S. A.	Eternal Good News 1400-1415 As, Sa 17650fr
U. S. A.	Eternal Good News 1730-1745 Af, Sa 21600wh
U. S. A.	Eternal Good News 1815-1830 As, Su 7365ge
U. S. A.	Eternal Good News 1930-1945 Eu, Sa 6030ge
U. S. A.	Eternal Good News 2100-2115 Eu, Su 11705wh
U. S. A.	Eternal Good News 2345-2400 LA,Su 7315wh
U. S. A.	Follow the Bible M1900-1930 Af 12005as, 12030ae
U. S. A.	From Isle of Music0000-0100 NA,Eu, Tu 7490wq
U. S. A.	From Isle of Music1200-1300 Eu, Sa 6070ge
U. S. A.	From Isle of Music1500-1600 eEu,Su 9400bu
U. S. A.	From Isle of Music1900-2000 Eu, Tu 6070ge
U. S. A.	KVOH 1900-2000 LA, F 17775
U. S. A.	Overcomer Ministry0000-0100 NA,Eu, M 5920wh
U. S. A.	Overcomer Ministry0000-0100 NA 9370wb, 7570wr, 7780wr
U. S. A.	Overcomer Ministry0100-0200 LA 7780wr
U. S. A.	Overcomer Ministry0100-0200 eNA 9370wb
U. S. A.	Overcomer Ministry0100-0200 wNA 5850wr
U. S. A.	Overcomer Ministry0100-0200 eNA, M 7490wq
U. S. A.	Overcomer Ministry0100-0200 wNA 7570wr, 7730wr
U. S. A.	Overcomer Ministry0200-0300 eNA, F-Su 7490wq
U. S. A.	Overcomer Ministry0200-0300 eNA 3185wb, 5130wq
U. S. A.	Overcomer Ministry0200-0300 LA 7780wr
U. S. A.	Overcomer Ministry0200-0300 wNA 5850wr, 7570wr, 7730wr
U. S. A.	Overcomer Ministry0200-0300 eNA, Tu,W 7490wq
U. S. A.	Overcomer Ministry0300-0400 wNA 5850wr, 7570wr, 7730wr
U. S. A.	Overcomer Ministry0300-0400 LA 7780wr
U. S. A.	Overcomer Ministry0300-0400 wEu 11580wr
U. S. A.	Overcomer Ministry0300-0400 eNA 3185wb, 5130wq, 7490wq
U. S. A.	Overcomer Ministry0400-0500 wNA 5850wr,7570wr, 7730wr
U. S. A.	Overcomer Ministry0400-0500 wEu 11580wr
U. S. A.	Overcomer Ministry0400-0500 eNA 3185wb
U. S. A.	Overcomer Ministry0400-0500 LA 5890wc, 7780wr
U. S. A.	Overcomer Ministry0500-0600 wEu 11580wr
U. S. A.	Overcomer Ministry0500-0600 wNA 5850wr, 7570wr, 7730wr
U. S. A.	Overcomer Ministry0500-0600 eNA 3185wb
U. S. A.	Overcomer Ministry0500-0600 LA 5890wc, 7780wr
U. S. A.	Overcomer Ministry0500-0600 eNA, M-F 3215wc
U. S. A.	Overcomer Ministry0600-0700 eNA, M-Sa 3215wc
U. S. A.	Overcomer Ministry0600-0700 eNA, Su 4840wc
U. S. A.	Overcomer Ministry0600-0700 wNA 5850wr, 7570wr
U. S. A.	Overcomer Ministry0600-0700 eNA 3185wb
U. S. A.	Overcomer Ministry0600-0700 wEu 7315wh, 11580wr
U. S. A.	Overcomer Ministry0600-0700 NA, Su 4840wc
U. S. A.	Overcomer Ministry0600-0700 LA 5890wc, 7780wr, 9955wr
U. S. A.	Overcomer Ministry0700-0800 wNA 7570wr
U. S. A.	Overcomer Ministry0700-0800 eNA, M-Sa 3215wc
U. S. A.	Overcomer Ministry0700-0800 eNA, Sa 4840wc
U. S. A.	Overcomer Ministry0700-0800 wEu 7355wh, 11580wr
U. S. A.	Overcomer Ministry0700-0800 LA 5890wc, 7780wr, 9955wr
U. S. A.	Overcomer Ministry0800-0900 LA 5890wc, 7730wr, 7780wr, 9955wr
U. S. A.	Pan American B/C 1400-1430 As, Su 15205ge
U. S. A.	Pan American B/C 1430-1445 As, Su 15205bu
U. S. A.	Pan American B/C 1930-2000 Af, Su 5930ge
U. S. A.	V. of America 0300-0400 Af 4930bt, 6080sa, 15580ku
U. S. A.	V. of America 0400-0500 Af 4930bt, 4960sa, 6080sa, 15580ku
U. S. A.	V. of America 0500-0600 Af 4930bt, 6080sa, 15580bt
U. S. A.	V. of America 0600-0700 Af 6080sa, 9550sa, 15580bt
U. S. A.	V. of America 1400-1500 Af 4930bt, 15580bt, 17885bt
U. S. A.	V. of America 1500-1600 Af 4930bt, 7455bt, 15580bt, 17895sa
U. S. A.	V. of America 1600-1630 Af 4930bt, 6080sa,15580bt, 17895va
U. S. A.	V. of America 1630-1700 Af 4930bt, 6080bt Sa-Su, 15580bt Sa-Su
U. S. A.	V. of America 1630-1700 Af, M-F 11850za, 13865uk, 15180va
U. S. A.	V. of America 1700-1730 Af 6080sa, 13590ku, 17895va
U. S. A.	V. of America 1730-1800 Af 6080sa, 13590ku/sa, 15580bt, 17895va
U. S. A.	V. of America 1800-1900 Af 4930bt (Sa-Su), 13590th, 15580bt
U. S. A.	V. of America 1900-2000 Af 4930bt, 13590sa, 15580bt
U. S. A.	V. of America 2000-2100 Af 4930bt, 6195bt, 15580bt
U. S. A.	V. of America 2030-2100 Af, Sa-Su 4960sa
U. S. A.	V. of America 2100-2200 Af 6195bt, 15580gr
U. S. A.	WBCQ 0000-0100 Am, Sa 5130
U. S. A.	WBCQ 0100-0200 Am, Tu-Sa 7490
U. S. A.	WBCQ 0100-0200 Am 9330
U. S. A.	WBCQ 0100-0500 Am, Su-M 5130
U. S. A.	WBCQ 0300-0500 Am, M 7490
U. S. A.	WBCQ 0400-0500 Am, M-Sa 7490
U. S. A.	WBCQ 2000-2100 Am, Tu 7490
U. S. A.	WBCQ 2100-2200 Am, M-F 7490
U. S. A.	WBCQ 2200-2300 Am, Su 7490
U. S. A.	WBCQ 2200-2400 Am, Sa-Su 7490
U. S. A.	WEWN 0000-0900 Af 11520
U. S. A.	WEWN 1200-1500 As 12065
U. S. A.	WEWN 1500-1900 ME 15610
U. S. A.	WEWN 1900-2400 Af 15610
U. S. A.	WHRI 0000-0100 NA, Tu-Su 5920
U. S. A.	WHRI 0000-0100 NA 7385
U. S. A.	WHRI 0100-0200 NA, Su-M 7385
U. S. A.	WHRI 0100-0200 NA, Tu-Sa 5920
U. S. A.	WHRI 0200-0300 NA 7385
U. S. A.	WHRI 0200-0300 LA 7315
U. S. A.	WHRI 0200-0300 NA 5920
U. S. A.	WHRI 0300-0400 NA 5920
U. S. A.	WHRI 0300-0400 NA 7385
U. S. A.	WHRI 0300-0400 Eu, Su 7520
U. S. A.	WHRI 0300-0400 LA, M-Sa 7315
U. S. A.	WHRI 0400-0430 NA 7385

U. S. A. WINB 0000-0230 LA, Tu-Sa 9265
U. S. A. WINB 0000-0300 LA, M 9265
U. S. A. WINB 1100-1300 LA, Su 9265
U. S. A. WINB 1300-1930 LA, Sa-Su 9265
U. S. A. WINB 1930-2400 LA 9265
U. S. A. WJHR 1400-2200 NA 15555 USB
U. S. A. Wld Univ Network 0000-0100 NA 13845wc
U. S. A. Wld Univ Network 0000-1200 Af 5935wc
U. S. A. Wld Univ Network 1200-2400 NA, Sa-Su 13845wc
U. S. A. Wld Univ Network 1500-2400 NA, M-F 13845wc
U. S. A. WMLK 1700-2200 Eu 9275
U. S. A. World Voice 0200-0300 As 9600ma
U. S. A. World Voice 0300-0400 As 15560ma
U. S. A. World Voice 0400-0500 Af 11825ma
U. S. A. World Voice 1800-1900 Af 17640ma
U. S. A. World Voice 2000-2100 Af 17640ma
U. S. A. WRMI 0000-0100 LA 9955
U. S. A. WRMI 0100-0300 Eu 11580
U. S. A. WRMI 0100-0600 LA 9955
U. S. A. WRMI 0700-1000 LA 5850
U. S. A. WRMI 1000-1030 NA 5850
U. S. A. WRMI 1100-1500 LA 9955
U. S. A. WRMI 2100-2200 Eu 15770
U. S. A. WRMI 2100-2400 LA 9955
U. S. A. WRMI 2100-2400 LA, W-Su 9955
U. S. A. WRMI 2300-2400 Eu 5850, 11580
U. S. A. WRMI 2300-2400 LA 9955
U. S. A. WRNO 0200-0500 Am 7506.4
U. S. A. WTWW 0000-0100 NA 12105
U. S. A. WTWW 0000-0100 LA 9930
U. S. A. WWCR2 0000-1200 Af 5935
U. S. A. WWCR2 1200-1500 Af 7490
U. S. A. WWCR2 1500-2000 Af 12160
U. S. A. WWCR2 2000-2200 Af 9350
U. S. A. WWCR2 2200-2400 Af 5890
U. S. A. WWCR3 0000-1200 eNA, wEu 4840
U. S. A. WWCR3 1200-1500 NA, M-F 13845
U. S. A. WWCR3 1500-1700 NA, Sa 13845
U. S. A. WWCR4 0000-0200 Af, Tu-Sa 7520
U. S. A. WWCR4 0200-0300 Af, Tu-Sa 5890
U. S. A. WWCR4 1900-2200 Af, Sa-Su 9980
U. S. A. WWCR4 2300-2400 Af, M-F 7520
U. S. A. WWRB 0000-0200 NA 3215
U. S. A. WWRB 0200-0500 NA 3195
U. S. A. WWRB 2200-2400 NA 3215

VANUATU	3945v, 7260v
VATICAN	4005, 5885, 6185, 7250, 7305, 7360, 7365, 9310, 9610, 9635, 9645, 9660, 9755, 11625, 11740, 11850, 13765, 15595

Vatican City Vatican R. 0730-0745 ME 11935
Vatican City Vatican R. 1130-1200 ME, F 15595, 17590
Vatican City Vatican R. 1530-1600 As, Sa 9510ph, 11700ph
Vatican City Vatican R. 1630-1700 Af 11625ma
Vatican City Vatican R. 1715-1730 ME 9700
Vatican City Vatican R. 2000-2027 Af 7365, 9660

VIETNAM	6175, 7285, 9840, 12020
YEMEN	9780v
ZAMBIA	4910, 5915, 6165
ZANZIBAR	11735

Australia

Transmitting

This section identifies any transmitting requirements or laws per country.

Australia

Licences

Class Licences
A class licence lets you use common radio equipment on shared frequencies. There are 15 class licences. Each licence has rules about the type of equipment you can use, and how you can use it. These rules aim to prevent interference to you and other users. You do not need to apply for a class licence and there are no licence fees.

Spectrum Licences
A spectrum licence lets you use a range of radio devices in a specific: Geographic area or Frequency band.
Spectrum licences may be valid for up to 15 years. We usually auction spectrum licences. Organisations consider them assets. If you hold a spectrum licence, you can also trade it (or parts of it) with others.

There are 15 class licences (shown below). You must follow the rules of the class licence to use the equipment.

- **27 MHz handphone stations** - Use a 27 MHz handphone station.
- **Aircraft and aeronautical mobile stations** - Use mobile radio equipment on or near an aircraft.
- **Body scanners** - For trained people who use body scanners at Australian airports.
- **Cellular mobile telecom devices** - Use devices that communicate with a licensed PTS base station.
- **Citizen band radio stations** - Use CB radio to communicate over short distances.
- **Communication with a space object** - Operate earth stations that communicate with a licensed space station.
- **Cordless communications devices** - Use certain cordless devices.
- **Emergency locating devices** - To help search and rescue groups find survivors.
- **Intelligent transport systems** - Wireless technology for vehicles and traffic systems.
- **Low interference potential devices (LIPD)** - Use a range of low power radiocommunications devices.
- **Maritime ship station – 27 MHz and VHF** - Lets qualified people use marine radio equipment on certain frequencies.
- **Overseas amateur visiting Australia** - Lets visitors to Australia use the amateur frequencies for a short time.
- **Public safety and emergency response** - Only for public safety agencies.
- **Radio-controlled models** - Use a device that controls a model plane, train, car or boat.
- **Radio navigation satellite service** - Use GPS (Global Positioning System) receivers.

Citizen Band Radio Stations Class Licence
This class licence lets you use citizen band (CB) radios to communicate over short distances.
● You can use CB radio to communicate over short distances via the Citizen Band Radio Service (CBRS).

You can use the CBRS for any voice communications, telemetry and telecommand. All users operate on shared frequencies. You don't need to apply for a class licence or pay any fees. Your equipment cannot exceed the maximum power stated in the class licence. We do not allow packet radio and other types of data operation on CB bands.

You can only use CB radios on designated channels in these frequencies:
● HF – 26.965 MHz to 27.405 MHz (inclusive)
● UHF – 476.4125 to 477.4125 MHz (inclusive)

Call signs are a unique series of letters and numbers. They make it easy to identify a station. You do note need to use a call sign for class licences. But we recommend that you identify yourself when you communicate by CB radio.

There are 2 channels you can use to contact other CB users for the first time. These are:
● Channel 11 (AM) (27.085 MHz) and Channel 16 (SSB) (27.155 MHz) in the HF band
● Channel 11 (476.675 MHz) in the UHF band
After you've made contact you should move to another channel. This leaves the channel available for other users to contact each other.

We set aside 2 channels that are only for emergency messages:
● Channel 9 (27.065 MHz) in the HF band
● Channels 5/35 (476.525/477.275 MHz) in the UHF band

Australian Channels	**Australian Citizen Band Frequencies** HF 26.965-27.405 MHz UHF 476.4125-477.4125 MHz	**Australian Citizen Band Frequencies** 148-174 MHz 403-420 MHz 450-520 MHz	**Contacting Travellers** Channel 11 AM 27.085 MHz Channel 16 SSB 27.155 MHz Channel 11 UHF 476.675 MHz	**Data Transmitting** UHF 22 476.950 UHF 23 476.975	**Emergency Channels** Channel 9 27.065 MHz Channel 5 476.525 Channel 35 UHF 477.275 MHz

Canada

China

France

Germany

United Kingdom

United States

Radio Triangulation

These are the various ways you can find the position of a radio broadcaster. This is part of the Search & Rescue manual in the SURVIVAL section.

Maximum Radio Signal Range Calculations
By using the following formula:
Maximum Range (in Nautical Miles) = 1.2 x √h (Square Root x height)
(Where: h = height/altitude of the receiving antenna in feet)

The theoretical maximum range of the transmitter may be calculated, or for search purposes, the theoretical maximum distance at which a beacon signal may be received given the receiving antenna's height above ground level. Note: The transmitting antenna is assumed to be at ground level. The area in which the transmitter is located may be determined by plotting a circle, with radius equal to the calculated range, from the position at which the beacon was heard. The intersection of circles plotted from two or more hearing positions will result in a fix of the probable position of the transmitter.

Locating a Signal from the Ground

Ground parties may be able to locate the source of a signal using a portable Aviation Band Multichannel AM VHF Radio. If the radio is tuned to 121.55 or 121.45 MHz and a signal is heard, it is likely that the source of the signal is within 100 metres. Progressive detuning whilst retaining the signal will locate the source of the signal. If a beacon signal can only be heard on 121.5 MHz, the beacon is some distance away.

Using a building or obstruction as a shield, if the signal is lost the building or obstruction is between the receiver and the beacon. It is also possible to use the body as a shield by holding the receiver to the chest. The signal should be weakest with the back to the signal. To check individual craft as the source of a signal, a domestic FM or AM radio is likely to receive the signal if placed within a few metres of the source. Also the aerial may be removed from an Aviation VHF radio if the signal is still received the source is very close.

Detecting a beacon by hand can be done with one or more hand-held 121.5MHz DF sets. A single device is used in a gentle sweeping action from side to side, attempting to maintain the strongest signal in the centre of the arc of swing. Slowly walking towards the strongest signal while continually sweeping from side to side will eventually arrive at the beacon.

With two or more DF sets each can be set some distance apart and the apparent direction of the strongest signal plotted onto a map, the 'cocked hat' where the bearings intersect should be the most probable location of the beacon. The DF sets may have to be moved several times to take into account obstructions caused by the environment.

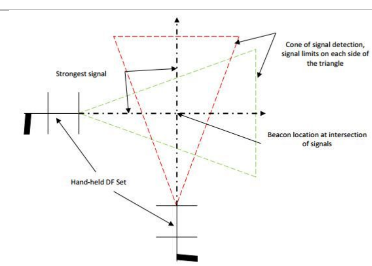


Figure 4-17 Hand-held DF Set usage

3 Antennas

In radio, an antenna is the interface between radio waves propagating through space and electric currents moving in metal conductors, used with a transmitter or receiver. In transmission, a radio transmitter supplies an electric current to the antenna's terminals, and the antenna radiates the energy from the current as electromagnetic waves (radio waves). In reception, an antenna intercepts some of the power of a radio wave in order to produce an electric current at its terminals, that is applied to a receiver to be amplified.

Antennas are essential components of all radio equipment, and are used in radio broadcasting, broadcast television, two-way radio, communications receivers, radar, cell phones, satellite communications and other devices. An antenna is an array of conductors (elements), electrically connected to the receiver or transmitter. During transmission, the oscillating current applied to the antenna by a transmitter creates an oscillating electric field and magnetic field around the antenna elements. These time-varying fields radiate energy away from the antenna into space as a moving transverse electromagnetic field wave, a radio wave.

Conversely, during reception, the oscillating electric and magnetic fields of an incoming radio wave exert force on the electrons in the antenna elements, causing them to move back and forth, creating oscillating currents in the antenna. Antennas can be designed to transmit and receive radio waves in all horizontal directions equally (omnidirectional antennas), or preferentially in a particular direction (directional or high gain antennas). An antenna may include parasitic elements, parabolic reflectors or horns, which serve to direct the radio waves into a beam or other desired radiation pattern.

Antennas are required by any radio receiver or transmitter to couple its electrical connection to the electromagnetic field. Radio waves are electromagnetic waves which carry signals through the air (or through space) at the speed of light with almost no transmission loss. Radio transmitters and receivers are used to convey signals in broadcast (audio) radio, television, mobile telephones, Wi-Fi (WLAN) data networks, and remote control devices among many others.

Radio waves are also used directly for measurements in radar, GPS, and radio astronomy. Transmitters and receivers require antennas, although these are sometimes hidden (such as the antenna inside an AM radio or inside a laptop computer equipped with Wi-Fi). Antennas can be classified as omnidirectional, radiating energy approximately equally in all directions, or Directional, where energy radiates more along one direction than others.

A completely uniform omnidirectional antenna is not physically possible. Many important antenna types have a uniform radiation pattern in the horizontal plane, but send little energy upward or downward. A "directional" antenna usually is intended to maximize its coupling to the electromagnetic field in the direction of the other station. One example of omnidirectional antennas is the very common vertical antenna or whip antenna consisting of a metal rod. A dipole antenna is similar but consists of two such conductors extending in opposite directions. Dipoles are typically oriented horizontally in which case they are weakly directional: signals are reasonably well radiated toward or received from all directions with the exception of the direction along the conductor itself; this region is called the antenna blind cone or null. Both the vertical and dipole antennas are simple in construction and relatively inexpensive. The dipole antenna, which is the basis for most antenna designs, is a balanced component, with equal but opposite voltages and currents applied at its two terminals through a balanced transmission line.

Isotropic Antenna
An isotropic antenna (isotropic radiator) is a hypothetical antenna that radiates equal signal power in all directions. It is a mathematical model that is used as the base of comparison to calculate the gain of real antennas. No real antenna can have an isotropic radiation pattern. However approximately isotropic antennas, constructed with multiple elements, are used in antenna testing.

For more information on Antennas, see the ELECTRICITY > Componentry > Passive Components > Antennas section.

Dipole

The dipole is the prototypical antenna on which a large class of antennas are based. A basic dipole antenna consists of two conductors (usually metal rods or wires) arranged symmetrically, with one side of the balanced feedline from the transmitter or receiver attached to each. The most common type, the half-wave dipole, consists of two resonant elements just under a quarter wavelength long. This antenna radiates maximally in directions perpendicular to the antenna's axis, giving it a small directive gain of 2.15 dBi. Although half-wave dipoles are used alone as omnidirectional antennas, they are also a building block of many other more complicated directional antennas.

Yagi-Uda	One of the most common directional antennas at HF, VHF, and UHF frequencies. Consists of multiple half wave dipole elements in a line, with a single driven element and multiple parasitic elements which serve to create a uni-directional or beam antenna. These typically have gains between 10–20 dBi depending on the number of elements used, and are very narrowband (with a usable bandwidth of only a few percent) though there are derivative designs which relax this limitation. Used for rooftop television antennas, point-to-point communication links, and long distance shortwave communication using skywave ("skip") reflection from the ionosphere.
Log-Periodic Dipole Array	Often confused with the Yagi-Uda, this consists of many dipole elements along a boom with gradually increasing lengths, all connected to the transmission line with alternating polarity. It is a directional antenna with a wide bandwidth. This makes it ideal for use as a rooftop television antenna, although its gain is much less than a Yagi of comparable size.
Turnstile	Two dipole antennas mounted at right angles, fed with a phase difference of 90°. This antenna is unusual in that it radiates in all directions (no nulls in the radiation pattern), with horizontal polarization in directions coplanar with the elements, circular polarization normal to that plane, and elliptical polarization in other directions. Used for receiving signals from satellites, as circular polarization is transmitted by many satellites.
Corner Reflector	A directive antenna with moderate gain of about 8 dBi often used at UHF frequencies. Consists of a dipole mounted in front of two reflective metal screens joined at an angle, usually 90°. Used as a rooftop UHF television antenna and for point-to-point data links.
Patch (Microstrip)	A type of antenna with elements consisting of metal sheets mounted over a ground plane. Similar to dipole with gain of 6–9 dBi. Integrated into surfaces such as aircraft bodies. Their easy fabrication using PCB techniques have made them popular in modern wireless devices. Often combined into arrays.

Monopole

A monopole antenna consists of a single conductor such as a metal rod, usually mounted over the ground or an artificial conducting surface (a so-called ground plane). One side of the feedline from the receiver or transmitter is connected to the conductor, and the other side to ground or the artificial ground plane. The radio waves reflected from the ground plane seem to come from an image antenna below the ground, with the monopole and its image forming a dipole, so the monopole antenna has a radiation pattern identical to the top half of the pattern of a similar dipole antenna.

Since all of the equivalent dipole's radiation is concentrated in a half-space, the antenna has twice (3 dB increase of) the gain of a similar dipole, not considering losses in the ground plane. The most common form is the quarter-wave monopole which is one-quarter of a wavelength long and has a gain of 5.12 dBi when mounted over a ground plane. Monopoles have an omnidirectional radiation pattern, so they are used for broad coverage of an area, and have vertical polarization. The ground waves used for broadcasting at low frequencies must be vertically polarized, so large vertical monopole antennas are used for broadcasting in the MF, LF, and VLF bands. Small monopoles are used as nondirectional antennas on portable radios in the HF, VHF, and UHF bands.

COMMUNICATION Antennas Monopole

Whip	Type of antenna used on mobile and portable radios in the VHF and UHF bands such as boom boxes, consists of a flexible rod, often made of telescoping segments.
Rubber Ducky	Most common antenna used on portable two way radios and cordless phones due to its compactness, consists of an electrically short wire helix. The helix adds inductance to cancel the capacitive reactance of the short radiator, making it resonant. Very low gain.
Ground Plane	A whip antenna with several rods extending horizontally from base of whip attached to the ground side of the feedline. Since whips are mounted above ground, the horizontal rods form an artificial ground plane under the antenna to increase its gain. Used as base station antennas for land mobile radio systems such as police, ambulance and taxi dispatchers.
Mast Radiator	A radio tower in which the tower structure itself serves as the antenna. Common form of transmitting antenna for AM radio stations and other MF and LF transmitters. At its base the tower is usually, but not necessarily, mounted on a ceramic insulator to isolate it from the ground.
T / Inverted L	Consist of a long horizontal wire suspended between two towers with insulators, with a vertical wire hanging down from it, attached to a feedline to the receiver or transmitter. Used on LF and VLF bands. The vertical wire serves as the radiator. Since at these frequencies the vertical wire is electrically short, much shorter than a quarter wavelength, the horizontal wire(s) serve as a capacitive "hat" to increase the current in the vertical radiator, increasing the gain. Very narrow bandwidth, requires loading coil to tune out any remaining capacitive reactance. Requires low resistance ground (electricity).
Inverted F	Combines the advantages of the compactness of inverted-L antenna, and the good matching of the F-type antenna. The antenna is grounded at the base and fed at some intermediate point. The position of the feed point determines the antenna impedance. Thus, matching can be achieved without the need for an extraneous matching network.
Umbrella	Very large wire transmitting antennas used on VLF bands. Consists of a central mast radiator tower attached at the top to multiple wires extending out radially from the mast to ground, like a tent or umbrella, insulated at the ends. Extremely narrow bandwidth, requires large loading coil and low resistance counterpoise ground. Used for long range military communications.

Array

COMMUNICATION Antennas Array

Array antennas consist of multiple antennas working as a single antenna. Typically they consist of arrays of identical driven elements, usually dipoles fed in phase, giving increased gain over that of a single dipole.

Collinear	Consist of a number of dipoles in a vertical line. It is a high gain omnidirectional antenna, meaning more of the power is radiated in horizontal directions and less into the sky or ground and wasted. Gain of 8 to 10 dBi. Used as base station antennas for land mobile radio systems such as police, fire, ambulance, and taxi dispatchers, and sector antennas for cellular base stations.
Reflective Array	multiple dipoles in a two-dimensional array mounted in front of a flat reflecting screen. Used for radar and UHF television transmitting and receiving antennas.
Phased Array	A high gain antenna used at UHF and microwave frequencies which is electronically steerable. It consists of multiple dipoles in a two-dimensional array, each fed through an electronic phase shifter, with the phase shifters controlled by a computer control system. The beam can be instantly pointed in any direction over a wide angle in front of the antenna. Used for military radar and jamming systems.
Curtain Array	Large directional wire transmitting antenna used at HF by shortwave broadcasting stations. It consists of a vertical rectangular array of wire dipoles suspended in front of a flat reflector screen consisting of a vertical "curtain" of parallel wires, all supported between two metal towers. It radiates a horizontal beam of radio waves into the sky above the horizon, which is reflected by the ionosphere to Earth beyond the horizon.
Batwing / Superturnstile	A specialized antenna used in television broadcasting consisting of perpendicular pairs of dipoles with radiators resembling bat wings. Multiple batwing antennas are stacked vertically on a mast to make VHF television broadcast antennas. Omnidirectional radiation pattern with high gain in horizontal directions. The batwing shape gives them wide bandwidth.
Microstrip	An array of patch antennas on a substrate fed by microstrip feedlines. Microwave antenna that can achieve large gains in compact space. Ease of fabrication by PCB techniques have made them popular in modern wireless devices. Beamwidth and polarization can be actively reconfigurable.

Loop

COMMUNICATION Antennas Loop

Loop antennas consist of a loop (or coil) of wire. There are essentially two broad categories of loop antennas: big loops and small loops. Loops with circumference of a wavelength are naturally resonant and act somewhat similarly to the half-wave dipole, and when it is necessary to distinguish them from small loops, they are called “full-wave” loops. (The popular “quad” antenna design is necessarily a full-wave loop, so no other distinction is needed.) If the loop is small in comparison to the wavelength it must be modified in some way to make it resonant if that is necessary. Small loops are called “magnetic loops” or “tuned loops”. They function quite differently from full-wave loops. This antenna interacts directly with the magnetic field of the radio wave, making it relatively insensitive to nearby electrical noise. However it has a very small radiation resistance, typically much smaller than the loss resistance, making it inefficient and thus undesirable for transmitting. They are used as receiving antennas at low frequencies, and also as direction finding antennas.

Ferrite (Loopstick)	These are used as the receiving antenna in most consumer AM radios operating in the medium wave broadcast band (and lower frequencies), a notable exception being car radios. Wire is coiled around a ferrite core which greatly increases the coil's inductance. Radiation pattern is maximum at directions perpendicular to the ferrite rod. The null direction of ferrite core antennas are bi-directional and sharper than the maximal directionality. This often makes the null direction more useful than the maximal directionality because the null direction can be used to reject unwanted signals from an interfering station or noise source.
Quad	Quad antennas are made of multiple full-wave loops, lined up in a row along their axes; they resemble the frame of a box kite. One loop in the quad is connected to the feedline and functions as the driver for the antenna and the signal radiator. The other loops are “helpers”; they are not connected to the feed, but are spaced and tuned so that they intercept and reflect the rearward signal from the driven loop back forward, and focus the forward-travelling signal into a narrower beam – like mirrors and lenses in a flashlight. They are called “reflectors” or “directors”, depending on function, or in general parasitic elements since they borrow energy from the field created by the driven element. Quad antennas are the exact analogue, for loops, to a Yagi-Uda antenna made out of dipoles; in fact, a “Yagi” can be built using a mixture of loops and dipoles. Similar to Yagis, quads are used as a directional antennas on the HF bands for shortwave communication, and are sometimes preferred for longer wavelengths because (if square) they are half as wide as a Yagi.

Aperture

ICATION Antennas

Aperture antennas are the main type of directional antennas used at microwave frequencies and above. They consist of a small dipole or loop feed antenna inside a three-dimensional guiding structure large compared to a wavelength, with an aperture to emit the radio waves. Since the antenna structure itself is nonresonant they can be used over a wide frequency range by replacing or tuning the feed antenna.

Parabolic	The most widely used high gain antenna at microwave frequencies and above. Consists of a dish-shaped metal parabolic reflector with a feed antenna at the focus. It can have some of the highest gains of any antenna type, up to 60 dBi, but the dish must be large compared to a wavelength. Used for radar antennas, point-to-point data links, satellite communication, and radio telescopes.
Horn	Simple antenna with moderate gains of 15 to 25 dBi consists of a flaring metal horn attached to a waveguide. Used for applications such as radar guns, radiometers and as feed antennas for parabolic dishes.
Slot	Consist of a waveguide with one or more slots cut in it to emit the microwaves. Linear slot antennas emit narrow fan-shaped beams. Used as UHF broadcast antennas and marine radar antennas.
Dielectric Resonator	Consists of small ball or puck-shaped piece of dielectric material excited by aperture in waveguide Used at millimetre wave frequencies.

Travelling Wave

Unlike the above antennas, travelling wave antennas are nonresonant so they have inherently broad bandwidth. They are typically wire antennas multiple wavelengths long, through which the voltage and current waves travel in one direction, instead of bouncing back and forth to form standing waves as in resonant antennas. They have linear polarization (except for the helical antenna). Unidirectional travelling wave antennas are terminated by a resistor at one end equal to the antenna's characteristic resistance, to absorb the waves from one direction. This makes them inefficient as transmitting antennas.

Random Wire	This describes the typical antenna used to receive shortwave radio, consisting of a random length of wire either strung outdoors between supports or indoors in a zigzag pattern along walls, connected to the receiver at one end. Can have complex radiation patterns with several lobes at angles to the wire.
Beverage	Simplest unidirectional travelling wave antenna. Consists of a straight wire one to several wavelengths long, suspended near the ground, connected to the receiver at one end and terminated by a resistor equal to its characteristic impedance, 400 to 800Ω at the other end. Its radiation pattern has a main lobe at a shallow angle in the sky off the terminated end. It is used for reception of skywaves reflected off the ionosphere in long distance "skip" shortwave.
Rhombic	Consists of four equal wire sections shaped like a rhombus. It is fed by a balanced feedline at one of the acute corners, and the two sides are connected to a resistor equal to the characteristic resistance of the antenna at the other. It has a main lobe in a horizontal direction off the terminated end of the rhombus. Used for skywave communication on shortwave bands.
Helical (Axial Mode)	Consists of a wire in the shape of a helix mounted above a reflecting screen. It radiates circularly polarized waves in a beam off the end, with a typical gain of 15 dBi. It is used at VHF and UHF frequencies. Often used for satellite communication, which uses circular polarization because it is insensitive to the relative rotation on the beam axis.
Leaky Wave	Microwave antennas consisting of a waveguide or coaxial cable with a slot or apertures cut in it so it radiates continuously along its length.

4 Observation

The devices below can be used for viewing distant communication or observing threats.

Binoculars & Monoculars

Binoculars or field glasses are two telescopes mounted side-by-side and aligned to point in the same direction, allowing the viewer to use both eyes (binocular vision) when viewing distant objects. Most are sized to be held using both hands, although sizes vary widely from opera glasses to large pedestal mounted military models. Unlike a (monocular) telescope, binoculars give users a three-dimensional (3D) image: for nearer objects the two views, presented to each of the viewer's eyes from slightly different viewpoints, produce a merged view with an impression of depth.

These are excellent for pinpointing locations, looking at objectives or approaching threats. You will generally only need a monocular, and you'll save about 50% of the space in a backpack or allow you to get a larger version to allow more light in.

Size	Full Size - 8x42, 10x50 Heavy, large, best night vision. Mid Size - 7x35, 10x32 Possible for backpacking. Compact - 8x25, 10x25 Ideal for backpacking.
Magnification	7x35 binoculars have a magnification power of 7. The object will appear 7x closer to you.
Lens Diameter	7x35 binoculars have a lens diameter of 35mm and calculates how much light it gathers.
Exit Pupil	Brightness of an object in low-light conditions. Calculated by lens diameter divided by Magnification. 7x35 - 35 / 7 = 5mm
Exit Pupil Brightness	0-2mm = Bright Light 2-4mm = Daylight (Cloudy) 4-6mm = Dawn/Dusk 6mm+ = Night time

Telescope: Best used for looking at the constellations but can also be used to look at great distances from an elevated position.

Night Vision Goggles

A night-vision device (NVD), also known as night optical/observation device (NOD) and night-vision goggles (NVG), is an optoelectronic device that allows images to be produced in levels of light approaching total darkness. The image may be a conversion to visible light of both visible light and near-infrared, while by convention detection of thermal infrared is denoted thermal imaging. The image produced is typically monochrome, e.g. shades of green. NVDs are most often used by the military and law enforcement agencies, but are available to civilian users. The term usually refers to a complete unit, including an image intensifier tube, a protective and generally water-resistant housing, and some type of mounting system. Many NVDs include a protective sacrificial lens, or optical components such as telescopic lenses or mirrors. An NVD may have an IR illuminator, making it an active as opposed to passive night-vision device.

Generations

Generation 1	1st generation is currently the most popular type of night vision in the world. Utilizing the basic principles described earlier, a 1st generation unit will amplify the existing light several thousand times letting you clearly see in the dark. These units provide a bright and sharp image at a low cost, which is perfect, whether you are boating, observing wildlife, or providing security for your home. You may notice the following when you are looking through a 1st Gen. unit.	**Features** ● A slight high-pitched whine when the unit is on. ● The image you see may be slightly blurry around the edges. This is known as Geometric Distortion. ● When you turn a 1st Gen. unit off it may glow green for some time. ● These are inherent characteristics of a 1st Gen. unit and are normal.
Generation 2	2nd generation is primarily used by law enforcement or for professional applications. This is because the cost of a 2nd Gen. unit is approximately $500.00 to $1000.00 more then a 1st Gen. The main difference between a 1st and a 2nd generation unit is the addition of a micro-channel plate, commonly referred to as a MCP. The MCP works as an electron amplifier and is placed directly behind the photocathode. The MCP consists of millions of short parallel glass tubes. When the electrons pass through these short tubes, thousands more electrons are released. This extra process allows 2nd generation units to amplify the light many more times then 1st generation giving you a brighter and sharper image.	
Generation 3	3rd generation By adding a sensitive chemical, gallium arsenide to the photocathode a brighter and sharper image has been achieved over 2nd generation units. An ion barrier film was also added to increase tube life. 3rd Gen provides the user with good to excellent low light performance.	
Generation 4	4th generation Gated/Filmless technology represents the biggest technological breakthrough in image intensification of the past 10 years. By removing the ion barrier film and "Gating" the system Gen 4 demonstrates substantial increases in target detection range and resolution, particularly at extremely low light levels. The use of film less technology and auto-gated power supply in 4th generation image intensifiers result in:	● Up to 100% improvement in photo response. ● Superb performance in extremely low light level (better S/N and EBI). ● At least triple high light level resolution (a minimum of 36 lp/mm compared to 12 lp/mm).

5 Technology

This section covers all the types of communication technology from GPS devices, Satellites, Mobile Phones and Radios.

GPS	The Global Positioning System (GPS), originally Navstar GPS, is a satellite-based radionavigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Obstacles such as mountains and buildings block the relatively weak GPS signals.
Mobile Phone	A mobile phone, known as a cell phone in North America, is a portable telephone that can make and receive calls over a radio frequency link while the user is moving within a telephone service area. The radio frequency link establishes a connection to the switching systems of a mobile phone operator, which provides access to the public switched telephone network (PSTN).
Airband Portable Transceiver	Handheld transceiver for air traffic, useful for air drops or monitoring air traffic.
Night Vision Goggles	A night vision device (NVD), also known as night optical/observation device (NOD) and night vision goggles (NVG), is an optoelectronic device that allows images to be produced in levels of light approaching total darkness. The image may be a conversion to visible light of both visible light and near-infrared, while by convention detection of thermal infrared is denoted thermal imaging. The image produced is typically monochrome, e.g. shades of green. NVDs are most often used by the military and law enforcement agencies, but are available to civilian users.
VHF Radio	Radio is the technology of using radio waves to carry information, such as sound, by systematically modulating properties of electromagnetic energy waves transmitted through space, such as their amplitude, frequency, phase, or pulse width. When radio waves strike an electrical conductor, the oscillating fields induce an alternating current in the conductor. The information in the waves can be extracted and transformed back into its original form.
Satellite Phone / Iridium	A satellite telephone, satellite phone, or satphone is a type of mobile phone that connects to orbiting satellites instead of terrestrial cell sites. They provide similar functionality to terrestrial mobile telephones; voice, SMS and low-bandwidth Internet access are supported through most systems.
VHF / UHF Car Comms	

Handheld GPS

For location tracking, finding north, getting elevation, saving waypoints and looking at terrain. A highly useful piece of kit if the GPS satellites are still functioning - otherwise it will just be a topographic map viewer. Know how to use it extremely well prior to needing it. Try out all the features. Know how to read the topographic maps and the individual markings on the terrain.

Getting a Signal	

Mobile Phone

Probably the most versatile piece of technology you will possess. Use it to store encrypted personal files, terrain maps, use it as a GPS and more. Download useful apps such as knot tying and the SAS manual. The cell towers most likely won't be available during SHTF so also have a couple of two way radios. You can also transfer files via bluetooth and wifi if the grid is down and use them for short range text or voice communication.

Increasing the Signal

If you want a mobile signal but can't get any reception, try some of the following.	**Exit the Building** Get out of, or get to the roof of the building if possible.	**Move Towards a Tower** Try to get closer to a mobile tower if you know where the nearest one is. They are generally found on tall buildings or hills.	**Get to Higher Ground** Head to the top of a hill or mountain.	**Get to Open Ground** If you're surrounded by buildings or trees, try to find a flat open area.	**Attach an Antenna** If you have access inside the phone, solder a piece of metal or wire to the antenna port to increase it's receiving capability.

Decreasing the Signal

If you don't want to be tracked or receive calls, do the following.	**Removing the Battery** Generally removing the battery works, but some phones can still be located without power.	**Faraday Cage** Put the phone in a completely sealed metal container or faraday bag.	**Abandon It** If you feel you're being tracked, abandon the phone on something that moves - a bus, a car or even a wild animal.	**Smash It** As an absolute last resort, smash the phone, however abandoning it is usually a much better plan as it will throw off pursuers.	

Best Prepper Device

Have you thought about the prospects of using your mobile phone as a tool in a survival situation and how it would work? This section looks at whether your current device is up to the task of serving your off-grid needs, completely devoid of an internet connection ever again. Most people haven't thought about what exactly on their mobile would break in the event the internet was switched off. You may be surprised to find out that as time ticks by without it, more and more features of the phone would cease to operate. I have cataloged multiple options below for choosing the most optimal offline device(s) for the collapse, assuming there's no EMP.

You would typically want more than one device with the exact same data in case one of them fails as well and perhaps another of a different variety to make watching content or reading eBooks easier. This is written with the assumption that you want a smart phone rather than a old-school Nokia brick or something similar, since you would likely want apps which can support your prepping rather than just a 'phone'.

Device Types

To choose the best device that suits your needs first you need to decide on a type of device:

Phone	These are jack of all trade devices which provide a good medium between functionality, entertainment and portability. They are generally pretty frustrating to read e-books on and aren't the best at watching video content either, but the small package means it's lightweight and easy to transport. Today, a phone is pretty much an essential part of your Every Day Carry (EDC) kit since we all probably carry one everywhere we go anyway.
Note Devices (Phablet)	Larger smartphone devices which often come with a pen for note-taking. They are generally 6-8 inches in size which also accommodates space to insert the pen into the device.
Tablet	A larger device which is usually focused more on entertainment rather than functionality – such as phone calls. This device would be great to watch and store prepper related videos on as well as reading e-books and yes, watching movies on as well. Tablets can be pretty light and therefore one could make it into your Bug Out Bag or INCH Bag without too much weight gain – although I would recommend the next device for that instead…
E-Ink Reader	These are similar to tablets but use a screen which can hold an image on it without using any battery which makes them amazing for reading e-books and PDFs during a Bug-Out situation. This is what you want if you are going to be reading documents and other informative e-books often as it will use the battery at a MUCH slower rate to a tablet. The Linux based e-Readers retain batter for longer periods over their Android counterparts. They are generally lighter than tablets and are more durable too. They can also be used for drawing and sketching which may come in handy, but is no substitute for a pen an paper, because at some point you will run out of power.
Laptop	This is probably a bit too large and heavy to use as a prepping device, but someone may find a use for a powerful device and large screen such as this. This is a tool better stored in a Bug-Out location in an EMP proof cage than being carried on you.

My choices: Personally, I have a few Samsung S10+ phones (my primary preparedness devices) with one in an EMP proof bag, a Samsung S5e tablet for watching videos, playing games and reading ebooks and I'm looking at buying an E-Ink device for the long term reading of educational eBooks if electricity is scarce. I also have a laptop as my 'prepper hub' to sync the files between all the devices and to be able to much more easily type blogs such as this. It's alsos also used to flash firmware to the portable devices as the other devices aren't capable of this.

Remember that your usage patterns of the device will vastly change during an emergency. You probably currently spend some time on social medias and chatting to friends on various platforms. However when SHTF, you will pretty much only be looking at maps, reading preparedness manuals and books and watching saved prepper content, with the occasional game if you are stressed. Due to this, don't choose a device with the best online capabilities or 50 fancy cameras, but instead focus on the aspects you really will need in your personal situation.

Hardware

Before we start looking at actual devices, we need to consider what features it should possess. Have a look at my list below on what I wanted in my prepper phone, and then start your own list rating them on how important they are to you.

Screen	Generally the device type you choose above will dictate the screen size you have, although you still have a bit of leeway up or down. Pick a size that suits what you will be doing the most of. Remember that higher density is not always better as it will drain the battery faster – even if you set it to display at a lower resolution. e-Readers should have as high a screen resolution as possible since they update the screen infrequently it won't make much of a difference to the battery life, but you will also be able to read text much more clearly. My choice: About a 6.4 inch screen at 1080p or 1440p.
Repairable	How easily can the device be opened and repaired or maintained if a component in it breaks? Also how readily available are parts for it? Have a look on iFixit.com to see scores on how easily a specific device is to repair. If it's complex, you may want to practice and open it before a disaster hits so you know you can do it without damaging any components – such as the fragile screen. My choice: The iFixit score doesn't matter to me much as I'm quite adept at repairing technology.

Battery	You are going to want a decent battery in any modern device so it can last as long as possible. This is also one of the primary components you will want backups of when the original fails. Ideally you want a removable battery, but most phones today don't give you that option. My choice: My S10+ has a 4000mah battery and I have 2 spares. I also have an ifixit kit to open the phone to do the battery replacement.
Phone Status	Locked/Unlocked My choice: This won't matter in a grid-down situation, but for now I prefer to have it carrier unlocked so I can use any network SIMs in it. When the grid does go down, I will be removing the SIM anyway.
Camera	Wide, Telephoto, Ultrawide etc. My choice: I don't mind what camera a phone has, as long as it has a single one on the back. If it has a front camera, I don't want it using up screen real estate. (One of my main annoyances with my S10+)
Storage	You want to look for the biggest storage space possible to keep all the files you'll end up saving to the device. Generally people regret not going up in size, rarely do they say they wish they bought the smaller model, plus when you start loading up the storage with prepper videos, maps, books and entertainment you will find it runs out pretty quickly. My choice: For my S10+, I look for a 512Gb or 1TB phone.
Micro SD Slot	In my opinion, this is an essential feature for any preparedness phone I'm looking for, since I can plug in a 1TB MicroSD card and instantly have a huge volume of space to do whatever I need. My choice: Absolutely need this. I also have an array of MicroSD cards full of different prepper content which I can plug in and transition between at ease.
Port Type	Do you want a USB-C, Micro USB, Mini USB or another type of charging jack? My choice: Type-C port since I can also plug in my 1TB T1 Samsung portable SSDs into my phone to access a huge array of prepper videos if required. With all the above storage plugged into my phone, this essentially brings the total storage space up to 2.5Tb (512Gb Phone, 1TB MicroSD, 1TB USB-C SSD) – more than enough…. for now.
3.5mm Audio Jack	Used to plug old-school headphones or earbuds into. My choice: I like to have this if possible to avoid wireless devices when in the field which could give away my position. The audio jack is often used as an antenna by wired earphones for the on-board radio in some devices – so if it doesn't have the audio jack, it most likely doesn't have radio capabilities.
Loudspeaker	This may be useful if you want to play wildlife calls to attract animals, otherwise you are likely never going to need a loudspeaker and it may be wise to physically disconnect it from the motherboard to avoid accidentally playing music and giving away your location.
Network Type	3G / 4G / 5G My choice: I avoid 5G phones, so I stick with older models of Samsung phones before 2020. The older phones also have better compatibility with custom roms due to being tried and tested over the years.
Sensors	Fingerprint, accelerometer, gyro, proximity, compass, barometer, heart rate, SpO2 etc. My choice: I just look for the compass and barometer primarily, the rest generally just come with every device today.
Positioning	GPS, GLONASS, BDS, GALILEO, QZSS etc. My choice: I try to get all of the above to make it easier to find my position in offline apps. Most devices today come with at least one type of positioning, however be sure to check the specs on as older tablets may not have any.
Charging	Cable, Wireless (Qi), Reverse Wireless, Fast Charging My choice: Grid-up, my choice is to use wireless charging to save the USB-C port (since each time you plug in the cable, it gets ever so slightly damaged until the port eventually fails and you have to hold the cable at a particular angle to get it to charge). Grid-down I will use cable charging as wireless charging is inefficient due to some power being lost during transmission.
Flip Devices	As a prepping device, you want to avoid anything that can cause your device to break prematurely, and a big cause of failure is any device that can fold. This technology is still relatively new and over time the folding mechanisms have been known to fail, either partially or catastrophically. Even though your screen is more protected when flipped shut, you don't want water somehow seeping into the seam and causing the entire device to stop working. The less points of failure you have – the better. My choice: Avoid flip & folding devices.
Waterproofing	Ideally you will want your device to be usable in heavy rain and also be submersible in water up to a meter or two (in case you drop it into a river). Look for an IP67 or IP68 rating when choosing a phone. My choice: Look for an IP68 device.
Toughness	Finally consider the toughness of the phone. Will it easily break if dropped? Are you the kind of person who drops their phone often? I'm EXTREMELY protective of my phone and always ensure I put it fully on a flat surface, double check it's in my pocket before exiting the car (since I hopped out of the car with it on my lap once – RIP S7 Edge) and I don't carry anything else in my pocket when the phone is in there to prevent it getting scratched by keys etc. Even then, I have cracked 2 phones, so either choose a tough device that can handle the stress of a SHTF world, or carry backups and spare parts. My choice: Being highly 'precious' with my phone, I opted for a device with a large screen and curved edges, but also have backups of the same phone as well.

Have a think about any additional features you would like your prepper phone to have and add to the list above. Consider whether they should be essential, useful or nice-to-have features.

Device Manufacturer

Next you want to look at the which manufacturer you would like to go with which has all the features you listed above. At the same time, you also want to have in mind the next step, which is the operating system you want to use.

Samsung Devices	Cutting edge devices that generally have it all. A couple of things to gripe about such as the recent removal of the MicroSD card slots and the 3.5mm ports from their newest generation phones (from 2010 onwards). Some models have ugly camera cutouts as well, such as the S10+. Samsung phones are not easy to repair yourself and generally don't have user replaceable batteries. (LOS – Lineage OS & EOS – eFoundation Compatible)

Google Devices	The hardware of the Google devices is highly secure, but we want to avoid big tech companies operating systems running on top of that. If you choose a Google device, make sure you flash a new OS onto it such as Graphene – if not, try to avoid Google devices. Also google have dropped a lot of the best prepper related hardware such as the MicroSD slot and the 3.5mm audio jack. (LOS, EOS, Graphene Compatible)
Apple Devices	Avoid! You can't install custom ROMs on iPhones so you're stuck with the apple iOS which is terrible for a number of reasons listed in the section below.
Sony Devices	Generally pretty nice devices. (LOS & EOS Compatible)
LG Devices	A little lackluster in the 'wow' department like Samsung phones, but LG's phones are generally pretty rugged and have the features I need such as a MicroSD card slot. (LOS & EOS Compatible)
ASUS Devices	Another decent phone manufacturer which has some pretty cutting edge features on their devices such as pop-up cameras. (LOS & EOS Compatible)
Fairphone Devices	A very privacy focused company. Some of their phones are a bit plain but they work. (EOS & LOS Compatible)
Motorola Devices	(LOS & EOS Compatible)
Xiaomi Devices	(LOS & EOS Compatible)

My choice: I went with a Samsung device as I'm already familiar with their operating systems and there is such a huge range of phones to choose from I could get nearly exactly what I was looking for in a phone. Also due to their ubiquitous nature modding flagship phones is fairly straightforward. If you need help choosing a company to go with, first decide what operating system you prefer and look up their website to see what phones their OS currently supports.

Operating System

Choose your device's operating system.

Android	This is probably the most ubiquitous operating system out there, but there are so many variants of it that you have to look deeply into what features it provides and what 'bloatware' the manufacturer has installed. Different manufacturers also have varying policies on tracking their users, such as Google and Samsung which you may want to look into.
iOS (Apple)	I would avoid apple products AT ALL COSTS due to their closed source, non-privacy friendly behaviour. There's so much more, so I'll summarize it quickly: They have a culture of cloud storage and synced devices. Devices have limited storage space – compared with other devices with expandable storage. Very difficult/impossible to sideload content. They gather and store information on their users. You can get 'locked' into the iOS environment. Their devices are essentially 'glued' to the internet. You can't customize or expand the storage space. There are no audio ports anymore. The software is locked down. It's difficult and also fairly pointless to jailbreak.
Lineage OS (LOS)	A deGoogled operating system for a variety of phones and tablets. It's a powerful and privacy focuses OS and can be greatly customized and also features a very large user base. The code is open source so there's less likely to be shifty things going on under the hood.
eFoundation (EOS)	Another deGoogled operating system for a larger selection of phones and tablets than the above. EOS is a little more user friendly than Lineage OS for those starting out. It's also open source with their mantra being "Your data is YOUR Data".
Others (Graphene, Ubuntu, Ubuntu Touch, CalyxOS, POP! OS)	Feel free to look into using any other operating systems which take your fancy. Ubuntu and POP! OS are operating systems for laptops if you're going down that route.

My choice: I went with EOS for its privacy friendly and open source nature. I also have files to be able to flash Lineage OS onto my phone at any point in the future without needing the internet. Both of them are pretty much the same, but EOS is slightly more user friendly and Lineage is slightly more secure.

Superuser

There is a degree of skill required to build a prepping phone from scratch due to the need to flash a new operating system (OS) onto the device and the requirement to root it – which if you do either of them wrong can 'brick' the device and cause it to be unusable. Don't worry though, I've made some mistakes flashing my device and there always seems to be a way to recover from it.

If you don't want to go down this route, or don't feel that you have the skills to do this you can always stick with the original OS and not modify anything – just be sure that you will be more vulnerable if there was ever a cyber hack or the 'powers that be' decide they want to track your phone. Below are the four different levels of manipulations which you can modify your phone. Rooting a phone makes it a little more susceptible to being infiltrated.

Stock OS – No Root	This is the default operating system that comes with the phone without root privileges. Most people have this setup by default. There is nothing you need to do to achieve this as phones just come 'stock standard'.
Rooted Stock OS	The default OS with root privileges. This gives you superuser access and allows you to modify pretty much whatever you want. At the very least I recommend rooting your stock operating system to gain the ability to perform superuser functions like backing up and restoring apps.
Custom OS – No Root	The existing operating system has been replaced with a new one, but the phone is not rooted. This is a pretty rate occurrence as rooting can easily occur during the installation of a custom OS.
Rooted Custom OS	In my opinion this is the best setup for privacy and the ability to modify your phone to suit your needs. It requires some skill to do and the process is different for each device, but generally there are complete guides to follow online for most of them – at least for the most popular phone models. There's really only a few more steps to this over the step above, so you might as well go the full way if you're modifying your phone.

Apps

For a list of recommended prepper apps, see the ADDENDUM > Media section.

Recommendations

COMMUNICATION | Technology | Mobile Phone | Best Prepper Device

To make device selection easier, I have included a list of recommended prepper phones that have been suggested by notable figures on the web.

Modern Smartphone Pick: Samsung Galaxy S10/S10+	This phone is a modern all-rounder, featuring the latest technologies (for its time) such as a nice screen, microSD card slot, 3.5mm audio jack, wireless charging, a radio (in USA/Canada), no 5G and more. Although I use the S10+ model, really any Samsung phones around the 2019 era have a great array of useful features needed for prepping. Have a look at the S8+, S9+ as well, as they are all similar with slightly different designs, features and batter sizes, so you will probably find one that suits your needs. The S8/S8+ is smaller and much lighter phone to the S10 if that interests you. Even though I have (and use) the S10+ model, I find it frustrating having a large cutout on the screen taking up screen real estate. The only difference between the S10 and S10+ is the size of the screen, the battery size and the RAM – out of which I only really care about the battery. The negatives of my S10+ is the screen cutout – I wish there was just a small circle, or nothing at all. Also the non-user replaceable battery is frustrating as there's quite a lot of steps opening the phone before you get to the actual battery. Finally, I would have liked an FM radio in mine. (U.S. Version Only) Note: Only the Exynos model of the S10 can have the operating system modified.
Cheap Smartphone Pick LG G4 (Canadian Prepper Recommended)	This 5.5 inch phone features a user replaceable battery, a microSDXC slot, a decent 1440×2560 screen, a 3.5mm audio jack and an FM Radio which is rare on phones. Downsides are that there's only 32Gb internal memory, only 3000mah battery, it has a microUSB port and the phone is now discontinued so it may be hard obtaining one. This is a fairly old recommendation so there are likely to be better models now which have more modern hardware.
Ultra-Privacy Centered Pick: Librem 5	This unique phone has 3 kill switches on the side to physically disconnect the 1. WiFi/Bluetooth, 2. Cellular Networks, and 3. Microphone and Camera for maximum privacy. Each switch will also disable the GPS when flicked as well, which may not be ideal if you are trying to navigate while 'stealthed'. It also has a user replaceable battery and a microSD card slot. It has a low resolution screen coming in at 720×1440, it doesn't have an FM radio and it costs $999+ USD.
Best Privacy & Security Pick: Google Pixel 5/6/7/8	A Google Pixel phone running GrapheneOS is arguably the best private and secure smartphone. Even though Google as a company is highly dubious regarding user privacy, the security hardware on the Pixel phones is unmatched. Additionally, Google makes it easy to install your own operating systems onto their phones which removes a layer of stress which usually comes with flashing a phone like the Samsung S10+ with its many layers of security to try to deter you. Unfortunately Pixels don't come with a MicroSD card slot or a 3.5mm audio jack.
FOSS Pick (Free Open Source Software): Pinephone and Pinephone Pro	These neat little 6" 1440×720 phones are a blend of open source software and privacy focused hardware. They have physical buttons which allow you to disable the cameras, microphone, WiFi, Bluetooth, and the mobile connection at will. It's fully repairable and therefore allows easy access to the hardware modules including the battery. They have MicroSD card slots supporting up to 2TB – which will help you store all those prepper videos, maps and eBooks you'll need.
Ultra Tough Pick: Unihertz Tank	This ultra-rugged phone will withstand even the harshest elements. It has a 22,000mah battery inside which is about 5.5x larger than the average smartphone battery. It has a 3.5mm audio jack and an FM radio which is nice to see. As for negatives, it weights a hefty 560g, the battery isn't removable and there's no MicroSD card.
Tactical Pick: Ulefone Power Armor 19T	A phone with built-in FLIR thermal imaging, a hefty 9,600mah battery, microSD card slot, IP68 & IP69K waterproofing, a 120hz screen and "180MP" camera.

COMMUNICATION | Technology | VHF

VHF Radio

COMMUNICATION | Technology

Airband Portable Transceiver

COMMUNICATION | Technology

Satellite Phone

Useful in SHTF if the satellites are still functioning and you know the numbers of people with other satellite phones.

COMMUNICATION | Technology | International Calling Codes

International Calling Codes

Country calling codes or country dial in codes are telephone dialling prefixes for the member countries or regions of the International Telecommunication Union (ITU). They are defined by the ITU-T in standards E.123 and E.164. The prefixes enable international direct dialling (IDD), and are also referred to as international subscriber dialling (ISD) codes. Country codes are a component of the international telephone numbering plan, and are necessary only when dialling a telephone number to establish a call to another country. Country codes are dialled before the national telephone number. By convention, international telephone numbers are represented by prefixing the country code with a plus sign (+), which also indicates to the subscriber that the local international call prefix must first be dialled.

Calling	**Calls From the US/Canada** For calls to most countries dial the following: 011 + country code + phone number	**Dialling Code** Dial: your country's exit code + destination country code + phone number		

Country Codes

Country calling codes or country dial in codes are telephone dialling prefixes for the member countries or regions of the International Telecommunication Union (ITU). The prefixes enable international direct dialling (IDD), and are also referred to as international subscriber dialling (ISD) codes. Country codes are a component of the international telephone numbering plan, and are necessary only when dialling a telephone number to establish a call to another country. Country codes are dialled before the national telephone number. By convention, international telephone numbers are represented by prefixing the country code with a plus sign (+), which also indicates to the subscriber that the local international call prefix must first be dialled. For example, the international call prefix in all countries belonging to the North American Numbering Plan is 011, while it is 00 in most European, Asian and African countries. On GSM (cellular) networks, the prefix may automatically be inserted when the user prefixes a dialled number with the plus sign.

Format
- Country/Territory
- Country Calling Code
- Time Zone
- DST (If Applicable)

Country Codes A	**Abkhazia** +7 840, +7 940 UTC+03:00	**Afghanistan** +93 UTC+04:30	**Åland Islands** +358 18 UTC+02:00 UTC+03:00	**Albania** +355 UTC+01:00 UTC+02:00	**Algeria** +213 UTC+01:00	**American Samoa** +1 684 UTC-11:00	**Andorra** +376 UTC+01:00 UTC+02:00	**Angola** +244 UTC+01:00	**Anguilla** +1 264 UTC-04:00	**Antigua and Barbuda** +1 268 UTC-04:00	**Argentina +54** UTC-03:00
Country Codes A/B	**Armenia** +374 UTC+04:00	**Aruba** +297 UTC-04:00	**Ascension** +247 UTC+00:00	**Australia** +61 UTC+08:00 to +10:30 UTC+08:00 to +11:00	**Australian Antarctic Territory** +672 1	**Australian External Territories** +672	**Austria** +43 UTC+01:00 UTC+02:00	**Azerbaijan** +994 UTC+04:00 UTC+05:00	**Bahamas** +1 242 UTC-05:00 UTC-04:00	**Bahrain** +973 UTC+03:00	**Bangladesh** +880 UTC+06:00
Country Codes B	**Barbados** +1 246 UTC-04:00	**Barbuda** +1 268 UTC-04:00	**Belarus** +375 UTC+03:00	**Belgium** +32 UTC+01:00 UTC+02:00	**Belize** +501 UTC-06:00	**Benin** +229 UTC+01:00	**Bermuda** +1 441 UTC-04:00 UTC-03:00	**Bhutan** +975 UTC+06:00	**Bolivia** +591 UTC-04:00	**Bonaire** +599 7 UTC-04:00	**Bosnia and Herzegovina** +387 UTC+01:00 UTC+02:00
Country Codes B/C	**Botswana** +267 UTC+02:00	**Brazil** +55 UTC-05:00 to -02:00 UTC-05:00 to -02:00	**British Indian Ocean Territory** +246 UTC+06:00	**British Virgin Islands** +1 284 UTC-04:00	**Brunei Darussalam** +673 UTC+08:00	**Bulgaria** +359 UTC+02:00 UTC+03:00	**Burkina Faso** +226 UTC+00:00	**Burundi** +257 UTC+02:00	**Cambodia** +855 UTC+07:00	**Cameroon** +237 UTC+01:00	**Canada** +1 UTC-08:00 to -03:30 UTC-07:00 to -02:30
Country Codes C	**Cape Verde** +238 UTC-01:00	**Caribbean Netherlands** +599 3, +599 4, +599 7 UTC-04:00	**Cayman Islands** +1 345 UTC-05:00	**Central African Republic** +236 UTC+01:00	**Chad** +235 UTC+01:00	**Chatham Island, New Zealand** +64 UTC+12:00 UTC+13:00	**Chile** +56 UTC-06:00 to -04:00 UTC-05:00 to -03:00	**China** +86 UTC+08:00	**Christmas Island** +61 89164 UTC+07:00	**Cocos (Keeling) Islands** +61 89162 UTC+06:30	**Colombia** +57 UTC-05:00
Country Codes C	**Comoros** +269 UTC+03:00	**Congo** +242 UTC+01:00	**Congo, the Democratic Republic of the (Zaire)** +243 UTC+01:00 to +02:00	**Cook Islands** +682 UTC-10:00	**Costa Rica** +506 UTC-06:00	**Ivory Coast** +225 UTC+00:00	**Croatia** +385 UTC+01:00 UTC+02:00	**Cuba** +53 UTC-05:00 UTC-04:00	**Guantanamo Bay, Cuba** +53 99	**Curaçao** +599 9 UTC-04:00	**Cyprus** +357 UTC+02:00 UTC+03:00
Country Codes C/D	**Czech Republic** +420 UTC+01:00 UTC+02:00	**Denmark** +45 UTC+01:00 UTC+02:00	**Diego Garcia** +246 UTC+06:00	**Djibouti** +253 UTC+02:00	**Dominica** +1 767 UTC-04:00	**Dominican Republic** +1 809, +1 829, +1 849 UTC-04:00	**East Timor** +670 UTC+09:00	**Easter Island** +56 UTC-06:00 UTC-05:00	**Ecuador** +593 UTC-06:00 to -05:00	**Egypt** +20 UTC+02:00	**El Salvador** +503 UTC-06:00
Country Codes E/F	**Ellipso (Mobile Satellite service)** +881 2, +881 3	**EMSAT (Mobile Satellite service)** +882 13	**Equatorial Guinea** +240 UTC+01:00	**Eritrea** +291 UTC+03:00	**Estonia** +372 UTC+02:00 UTC+03:00	**Ethiopia** +251 UTC+03:00	**Falkland Islands** +500 UTC-03:00	**Faroe Islands** +298 UTC+00:00 UTC+01:00	**Fiji** +679 UTC+12:00 UTC+13:00	**Finland** +358 UTC+02:00 UTC+03:00	**France** +33 UTC+01:00 UTC+02:00
Country Codes F/G	**French Antilles** +596	**French Guiana** +594 UTC-03:00	**French Polynesia** +689 UTC-10:00 to -09:00	**Gabon** +241 UTC+01:00	**Gambia** +220 UTC+00:00	**Georgia** +995 UTC+04:00	**Germany** +49 UTC+01:00 UTC+02:00	**Ghana** +233 UTC+00:00	**Gibraltar** +350 UTC+01:00 UTC+02:00	**Global Mobile Satellite System (GMSS)** +881	**Globalstar (Mobile Satellite Service)** +881 8, +881 9
Country Codes G/H	**Greece** +30 UTC+02:00 UTC+03:00	**Greenland** +299 UTC-04:00 to +00:00	**Grenada** +1 473 UTC-04:00	**Guadeloupe** +590 UTC-04:00	**Guam** +1 671 UTC+10:00	**Guatemala** +502 UTC-06:00	**Guernsey** +44 1481, +44 7781, +44 7839, +44 7911 UTC+01:00	**Guinea** +224 UTC+00:00	**Guinea-Bissau** +245 UTC+00:00	**Guyana** +592 UTC-04:00	**Haiti** +509 UTC-05:00 UTC-04:00
Country Codes H/I	**Honduras** +504 UTC-06:00	**Hong Kong** +852 UTC+08:00	**Hungary** +36 UTC+01:00 UTC+02:00	**Iceland** +354 UTC+00:00	**ICO Global (Mobile Satellite Service)** +881 0, +881 1	**India** +91 UTC+05:30	**Indonesia** +62 UTC+07:00 to +09:00	**Inmarsat SNAC** +870	**International Freephone Service (UIFN)** +800	**International Networks** +882, +883	**International Premium Rate Service** +979
Country Codes I/J	**International Shared Cost Service (ISCS)** +808	**Iran** +98 UTC+03:30 UTC+04:30	**Iraq** +964 UTC+03:00	**Ireland** +353 UTC+00:00 UTC+01:00	**Iridium (Mobile Satellite service)** +881 6, +881 7	**Isle of Man** +44 1624, +44 7524, +44 7624, +44 7924 UTC+00:00 UTC+01:00	**Israel** +972 UTC+02:00 UTC+03:00	**Italy** +39 UTC+01:00 UTC+02:00	**Jamaica** +1 876 UTC-05:00	**Jan Mayen** +47 79	**Japan** +81 UTC+09:00
Country Codes J/K/L	**Jersey** +44 1534 UTC+00:00 UTC+01:00	**Jordan** +962 UTC+02:00	**Kazakhstan** +7 6, +7 7 UTC+05:00 to +06:00	**Kenya** +254 UTC+03:00	**Kiribati** +686 UTC+12:00 to +14:00	**Korea, North** +850 UTC+08:30	**Korea, South** +82 UTC+09:00	**Kosovo** +383, +377 44, +377 45, +386 43, +386 49, +381 28, +381 29, +381 38, +381 39 UTC+01:00 UTC+02:00	**Kuwait** +965 UTC+03:00	**Kyrgyzstan** +996 UTC+05:00 to +06:00	**Laos** +856 UTC+07:00
Country Codes L/M	**Latvia** +371 UTC+02:00 UTC+03:00	**Lebanon** +961 UTC+02:00 UTC+03:00	**Lesotho** +266 UTC+02:00	**Liberia** +231 UTC+00:00	**Libya** +218 UTC+01:00 UTC+02:00	**Liechtenstein** +423 UTC+01:00 UTC+02:00	**Lithuania** +370 UTC+02:00 UTC+03:00	**Luxembourg** +352 UTC+01:00 UTC+02:00	**Macau** +853 UTC+08:00	**Macedonia** +389 UTC+01:00 UTC+02:00	**Madagascar** +261 UTC+03:00
Country Codes M	**Malawi** +265 UTC+02:00	**Malaysia** +60 UTC+08:00	**Maldives** +960 UTC+05:00	**Mali** +223 UTC+00:00	**Malta** +356 UTC+01:00 UTC+02:00	**Marshall Islands** +692 UTC+12:00	**Martinique** +596 UTC-04:00	**Mauritania** +222 UTC+00:00	**Mauritius** +230 UTC+04:00	**Mayotte** +262 269, +262 639 UTC+03:00	**Mexico** +52 UTC-08:00 to -06:00 UTC-07:00 to -05:00
Country Codes M/N	**Micronesia, Federated States of** +691 UTC+10:00 to +11:00	**Midway Island, USA** +1 808 UTC-11:00	**Moldova** +373 UTC+02:00 UTC+03:00	**Monaco** +377 UTC+01:00 UTC+02:00	**Mongolia** +976 UTC+07:00 to +08:00 UTC+08:00 to +09:00	**Montenegro** +382 UTC+01:00 UTC+02:00	**Montserrat** +1 664 UTC-04:00	**Morocco** +212 UTC+00:00 UTC+01:00	**Mozambique** +258 UTC+02:00	**Myanmar** +95 UTC+06:30	**Nagorno-Karabakh** +374 47, +374 97 UTC+04:00
Country Codes N	**Namibia** +264 UTC+01:00 UTC+02:00	**Nauru** +674 UTC+12:00	**Nepal** +977 UTC+05:45	**Netherlands** +31 CET (UTC+01:00) AST (UTC-04:00) CET (UTC+02:00) AST (UTC-04:00)	**Nevis** +1 869 UTC-04:00	**New Caledonia** +687 UTC+11:00	**New Zealand** +64 UTC+12:00 UTC+13:00	**Nicaragua** +505 UTC-06:00	**Niger** +227 UTC+01:00	**Nigeria** +234 UTC+01:00	**Niue** +683 UTC-11:00
Country Codes N/O/P	**Norfolk Island** +672 3 UTC+11:00	**Northern Cyprus** +90 392 UTC+02:00 UTC+03:00	**Northern Ireland** +44 28 UTC+00:00 UTC+01:00	**Northern Mariana Islands** +1 670 UTC+10:00	**Norway** +47 UTC+01:00 UTC+02:00	**Oman** +968 UTC+04:00	**Pakistan** +92 UTC+05:00 UTC+06:00	**Palau** +680 UTC+09:00	**Palestine, State of** +970 UTC+02:00 UTC+03:00	**Panama** +507 UTC-05:00	**Papua New Guinea** +675 UTC+10:00
Country Codes P/Q/R	**Paraguay** +595 UTC-04:00 UTC-03:00	**Peru** +51 UTC-05:00	**Philippines** +63 UTC+08:00	**Pitcairn Islands** +64 UTC-08:00	**Poland** +48 UTC+01:00 UTC+02:00	**Portugal** +351 UTC+00:00 UTC+01:00	**Puerto Rico** +1 787, +1 939 UTC-04:00	**Qatar** +974 UTC+03:00	**Réunion** +262 UTC+04:00	**Romania** +40 UTC+02:00 UTC+03:00	**Russia** +7 UTC+02:00 to +12:00
Country Codes R/S	**Rwanda** +250 UTC+02:00	**Saba** +599 4 UTC-04:00	**Saint Barthélemy** +590 UTC-04:00	**Saint Helena** +290 UTC+00:00	**Saint Kitts and Nevis** +1 869 UTC-04:00	**Saint Lucia** +1 758 UTC-04:00	**Saint Martin (France)** +590 UTC-04:00	**Saint Pierre and Miquelon** +508 UTC-03:00 UTC-02:00	**Saint Vincent and the Grenadines** +1 784 UTC-04:00	**Samoa** +685 UTC+13:00 UTC+14:00	**San Marino** +378 UTC+01:00 UTC+02:00
Country Codes S	**São Tomé and Príncipe** +239 UTC+00:00	**Saudi Arabia** +966 UTC+03:00	**Senegal** +221 UTC+00:00	**Serbia** +381 UTC+01:00 UTC+02:00	**Seychelles** +248 UTC+04:00	**Sierra Leone** +232 UTC+00:00	**Singapore** +65 UTC+08:00	**Sint Eustatius** +599 3 UTC-04:00	**Sint Maarten (Netherlands)** +1 721 UTC-04:00	**Slovakia** +421 UTC+01:00 UTC+02:00	**Slovenia** +386 UTC+01:00 UTC+02:00
Country Codes S	**Solomon Islands** +677 UTC+11:00	**Somalia** +252 UTC+03:00	**South Africa** +27 UTC+02:00	**South Georgia and the South Sandwich Islands** +500 UTC-02:00	**South Ossetia** +995 34 UTC+03:00	**South Sudan** +211 UTC+03:00	**Spain** +34 UTC+01:00 UTC+02:00	**Sri Lanka** +94 UTC+05:30	**Sudan** +249 UTC+03:00	**Suriname** +597 UTC-03:00	**Svalbard** +47 79 UTC+01:00 UTC+02:00
Country Codes S/T	**Swaziland** +268 UTC+02:00	**Sweden** +46 UTC+01:00 UTC+02:00	**Switzerland** +41 UTC+01:00 UTC+02:00	**Syria** +963 UTC+02:00 UTC+03:00	**Taiwan** +886 UTC+08:00	**Tajikistan** +992 UTC+05:00	**Tanzania** +255 UTC+03:00	**Telecommunications for Disaster Relief by OCHA** +888	**Thailand** +66 UTC+07:00	**Thuraya (Mobile Satellite service)** +882 16	**Togo** +228 UTC+00:00
Country Codes T/U	**Tokelau** +690 UTC+13:00	**Tonga** +676 UTC+13:00	**Transnistria** +373 2, +373 5 UTC+02:00 UTC+03:00	**Trinidad and Tobago** +1 868 UTC-04:00	**Tristan da Cunha** +290 8 UTC+00:00	**Tunisia** +216 UTC+01:00	**Turkey** +90 UTC+03:00	**Turkmenistan** +993 UTC+05:00	**Turks and Caicos Islands** +1 649 UTC-05:00 UTC-04:00	**Tuvalu** +688 UTC+12:00	**Uganda** +256 UTC+03:00
Country Codes U/V	**Ukraine** +380 UTC+02:00 UTC+03:00	**United Arab Emirates** +971 UTC+04:00	**United Kingdom** +44 UTC+00:00 UTC+01:00	**United States** +1 UTC-10:00 to -05:00 UTC-10:00 to -04:00	**Universal Personal** Telecommunications (UPT) +878	**Uruguay** +598 UTC-03:00 No DST (June 2015)	**US Virgin Islands** +1 340 UTC-04:00	**Uzbekistan** +998 UTC+05:00	**Vanuatu** +678 UTC+11:00	**Venezuela** +58 UTC-04:00	**Vatican City State (Holy See)** +39 06 698, assigned +379 UTC+01:00 UTC+02:00
Country Codes V/W/X/Y/Z	**Vietnam** +84 UTC+07:00	**Wake Island, USA** +1 808 UTC+12:00	**Wallis and Futuna** +681 UTC+12:00	**Yemen** +967 UTC+03:00	**Zambia** +260 UTC+02:00	**Zanzibar** +255 24 UTC+03:00	**Zimbabwe** +263 UTC+02:00				

6 Codes

Subheadings

		1. Phone Keypad	2. Braille	3. Morse Code	4. Atbash		
		5. Caesar Cipher	6. ASCII	7. Binary			

1 Phone Keypad

1 No Letters	2 A, B, C	3 D, E, F
4 G, H, I	5 J, K, L	6 M, N, O
7 P, Q, R, S	8 T, U, V	9 W, X, Y, Z
*	0 +	#

A telephone keypad is the keypad installed on a push-button telephone or similar telecommunication device for dialling a telephone number. The development of the modern telephone keypad is attributed to research in the 1950s by Richard Deininger under the directorship of John Karlin at the Human Factors Engineering Department of Bell Labs. The contemporary keypad is laid out in a rectangular array of twelve push buttons arranged as four rows and three columns of keys. For military applications, a fourth, right-most column of keys was added for priority signalling in the Autovon system in the 1960s. The letters have also been used, mainly in the United States, as a technique for remembering telephone numbers easily. For example, an interior decorator might license the telephone number 1-800-724-6837, but advertise it as the more memorable phoneword 1-800-PAINTER. In mobile phones the letters on the keys are used for text entry tasks such as text messaging, entering names in the phone book, and browsing the web. To compensate for the smaller number of keys, phones used multi-tap and later predictive text processing to speed up the process. Touch-screen phones have made this method obsolete, as they can simulate as many buttons as necessary for full text entry.

Letter Mapping
In the course of telephone history, the positions of telephone dials, as well as keypads have been associated with various patterns of mapping letters and characters to numbers (keyboard layout). The use of alphanumeric codes for exchanges was abandoned in Europe when international direct dialling was introduced in the 1960s, because, for example, dialling VIC 8900 on a Danish telephone would result in a different number to dialling it on a British telephone. At the same time letters were no longer placed on the dials of new telephones. Letters did not re-appear on phones in Europe until the introduction of mobile phones, and the layout followed the new international standard. The ITU established an international standard in the mid-1990s, and that should be the layout used for any new devices. Since many newer smartphones, such as the Palm Treo and BlackBerry, have full alphanumeric keyboards instead of the traditional telephone keypads, the user must execute additional steps to dial a number containing convenience letters. On certain BlackBerry devices, a user can press the Alt key, followed by the desired letter, and the device will generate the appropriate DTMF tone.

2 Braille

Braille is a tactile writing system used by people who are visually impaired. It is traditionally written with embossed paper. Braille users can read computer screens and other electronic supports using refreshable braille displays. They can write braille with the original slate and stylus or type it on a braille writer, such as a portable braille notetaker or computer that prints with a braille embosser.

Letters

A ● ○ ○ ○ ○ ○	B ● ○ ● ○ ○ ○	C ● ● ○ ○ ○ ○	D ● ● ○ ● ○ ○	E ● ○ ○ ● ○ ○	F ● ● ● ○ ○ ○	G ● ● ● ● ○ ○	H ● ○ ● ● ○ ○	I ○ ● ● ○ ○ ○	J ○ ● ● ● ○ ○	K ● ○ ○ ○ ● ○	L ● ○ ● ○ ● ○
M ● ● ○ ○ ● ○	N ● ● ○ ● ● ○	O ● ○ ○ ● ● ○	P ● ● ● ○ ● ○	Q ● ● ● ● ● ○	R ● ○ ● ● ● ○	S ○ ● ● ○ ● ○	T ○ ● ● ● ● ○	U ● ○ ○ ○ ● ●	V ● ○ ● ○ ● ●	W ○ ● ● ● ○ ●	X ● ● ○ ○ ● ●
Y ● ● ○ ● ● ●	Z ● ○ ○ ● ● ●	Letter ○ ○ ○ ● ○ ●									

Numbers

0 ○ ● ● ● ○ ○	1 ● ○ ○ ○ ○ ○	2 ● ○ ● ○ ○ ○	3 ● ● ○ ○ ○ ○	4 ● ● ○ ● ○ ○	5 ● ○ ○ ● ○ ○	6 ● ● ● ○ ○ ○	7 ● ● ● ● ○ ○	8 ● ○ ● ● ○ ○	9 ○ ● ● ○ ○ ○	Number ○ ● ○ ● ● ●	

Special Characters

. ○ ○ ● ● ○ ●	, ○ ○ ● ○ ○ ○	; ○ ○ ● ○ ● ○	: ○ ○ ● ● ○ ○	/ ○ ● ○ ○ ● ○	? ○ ○ ● ○ ● ●	! ○ ○ ● ● ● ○	@ ○ ● ○ ● ● ○	# ○ ● ○ ● ● ●	+ ○ ○ ● ● ● ○	– ○ ○ ● ● ○ ○	* ○ ○ ○ ● ● ○

“	”	'	<	>	(	)	_	Capital	and		
○ ○ ● ○ ● ●	○ ○ ○ ● ● ●	○ ○ ○ ○ ● ○	● ○ ● ○ ○ ●	○ ● ○ ● ● ○	○ ○ ● ● ● ●	○ ○ ● ● ● ●	○ ○ ○ ○ ● ●	○ ○ ○ ○ ○ ●	● ● ● ○ ● ●		

Foreign Characters

Punctuation, abbreviated characters and accented characters vary from country to country.

German

ä	ö	ü	ß								
○ ● ○ ● ● ○	○ ● ● ○ ○ ●	● ○ ● ● ○ ●	○ ● ● ○ ● ●								

French

à	â	ç	é	è	ê	ë	î	ï	ô	œ	û
● ○ ● ● ● ●	● ○ ○ ○ ○ ●	● ● ● ○ ● ●	● ● ● ● ● ●	○ ● ● ○ ● ●	● ○ ● ○ ○ ●	● ● ● ○ ○ ●	● ● ○ ○ ○ ●	● ● ● ● ○ ●	● ● ○ ● ○ ●	○ ● ● ○ ○ ●	● ○ ○ ● ○ ●
ü											
● ○ ● ● ○ ●											

Spanish

á	œ	é	ë	í	ñ	ó	ú	ü			
● ○ ● ● ● ●	○ ○ ○ ● ● ○	○ ● ● ○ ● ●	○ ○ ○ ● ● ○	○ ● ○ ○ ● ○	● ● ● ● ○ ●	○ ● ○ ○ ● ●	○ ● ● ● ● ●	● ○ ● ● ○ ●			

Italian

à	â	ç	é	è	ê	ë	ì	î	ï	ò	ô
● ○ ● ● ● ●	● ○ ○ ○ ○ ●	● ● ● ○ ● ●	● ● ● ● ● ●	○ ● ● ○ ● ●	● ○ ● ○ ○ ●	● ● ● ○ ○ ●	○ ● ○ ○ ● ○	● ● ○ ○ ○ ●	● ● ● ● ○ ●	○ ● ○ ○ ● ●	● ● ○ ● ○ ●
ö	ù	û	ü								
○ ● ● ○ ○ ●	○ ● ● ● ● ●	● ○ ○ ● ○ ●	● ○ ● ● ○ ●								

Dutch

à	ä	ç	é	è	ê	ë	ï	ô	ö	û	y
● ○ ● ● ● ●	○ ● ○ ● ● ○	● ● ● ○ ● ●	● ● ● ● ● ●	○ ● ● ○ ● ●	● ○ ● ○ ○ ●	● ● ● ○ ○ ●	● ● ● ● ○ ●	● ● ○ ● ○ ●	○ ● ● ○ ○ ●	● ○ ○ ● ○ ●	● ● ○ ● ● ●

3 Morse Code

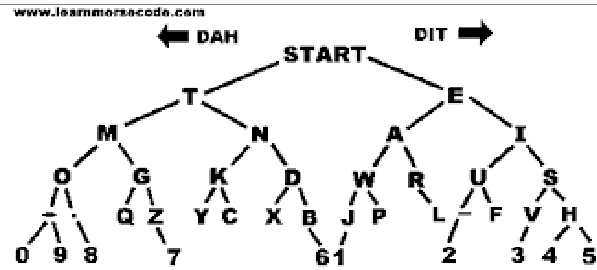
Morse code is a character encoding scheme used in telecommunication that encodes text characters as standardized sequences of two different signal durations called dots and dashes or dits and dahs. Morse code is named for Samuel F. B. Morse, an inventor of the telegraph.

The International Morse Code encodes the 26 English letters A through Z, some non-English letters, the Arabic numerals and a small set of punctuation and procedural signals (prosigns). There is no distinction between upper and lower case letters. Each Morse code symbol is formed by a sequence of dots and dashes. The dot duration is the basic unit of time measurement in Morse code transmission. The duration of a dash is three times the duration of a dot. Each dot or dash within a character is followed by period of signal absence, called a space, equal to the dot duration. The letters of a word are separated by a space of duration equal to three dots, and the words are separated by a space equal to seven dots. To increase the efficiency of encoding, Morse code was designed so that the length of each symbol is approximately inverse to the frequency of occurrence in text of the English language character that it represents. Thus the most common letter in English, the letter "E", has the shortest code: a single dot. Because the Morse code elements are specified by proportion rather than specific time durations, the code is usually transmitted at the highest rate that the receiver is capable of decoding. The Morse code transmission rate (speed) is specified in groups per minute, commonly referred to as words per minute.

One dash (—) equals about three dots worth of time. (●●●)
The space (timed gap) between parts of the same letter is one dot (●).
The space between letters is three dots (●●●).
The space between words is seven dots (●●●●●●●).

This diagram should help simplify the decoding of messages. The left side is dashes (—) and the right side is dots (•). If you hear a dot you will go to the right and if you hear a dash you go to the left. If there's a break of three dots then that's the letter you select.

For example if you hear a dot first, you head to 'E', then if you hear a dash next you will be at 'A' then another dash and you'll be on 'W'. You can continue like this until you hear the three dots silence.



Letters

Letters contain from 1 to 4 characters in their sequence. The most common letters have fewer characters.

A	•—	B	—•••	C	—•—•
D	—••	E	•	F	••—•
G	——•	H	••••	I	••
J	•———	K	—•—	L	•—••
M	——	N	—•	O	———
P	•——•	Q	——•—	R	•—•
S	•••	T	—	U	••—
V	•••—	W	•——	X	—••—
Y	—•——	Z	——••		

Numbers

Numbers always have 5 characters in their sequence so they are easy to tell apart from letters. 1-5 start with dots while 6-9 and 0 start with dashes.

1	•————	2	••———	3	•••——
4	••••—	5	•••••	6	—••••
7	——•••	8	———••	9	————•
0	—————				

Symbols

The sequences for symbols vary between different languages so these are the English versions.

.	•—•—•—	,	——••——	?	••——••
@	•——•—•	_	••——•—	"	•—••—•
!	—•—•——	;	—•—•—•	:	———•••

4 Atbash

Atbash is simply the alphabet in reverse.

A = Z	B = Y	C = X	D = W	E = V	F = U	G = T	H = S	I = R	J = Q	K = P	L = O
M = N	N = M	O = L	P = K	Q = J	R = I	S = H	T = G	U = F	V = E	W = D	X = C
Y = B	Z = A										

5 Caesar Cipher

The Caesar cipher is a code Julius Caesar invented when he mailed letters. He invented it so if his messenger was robbed of that letter and the robber wouldn't be able to read it. It is probably one of the most simple codes ever. It is 3 letters back so A would be X. The Rot Cipher is almost the same as the Caesar Cipher.

A = X	B = Y	C = Z	D = A	E = B	F = C	G = D	H = E	I = F	J = G	K = H	L = I
M = J	N = K	O = L	P = M	Q = N	R = O	S = P	T = Q	U = R	V = S	W = T	X = U
Y = V	Z = W										

Scytale

A message is wrapped around a cylindrical object which when re-wrapped decodes the message automatically. Wrap a thin piece of paper around a cylindrical object making sure there's no gaps and then write your message on multiple rows. Make sure you note the diameter of the cylinder or it will be difficult to decipher. The more lines you write and the smaller the font you use the harder the cipher is to break.

6 ASCII

ASCII, stands for American Standard Code for Information Interchange. It's a 7-bit character code where every single bit represents a unique character. On this webpage you will find 8 bits, 256 characters, ASCII table according to Windows-1252 (code page 1252) which is a superset of ISO 8859-1 in terms of printable characters. In the range 128 to 159 (hex 80 to 9F), ISO/IEC 8859-1 has invisible control characters, while Windows-1252 has writable characters. Windows-1252 is probably the most-used 8-bit character encoding in the world.

ASCII Control Characters

The first 32 characters in the ASCII-table are unprintable control codes and are used to control peripherals such as printers.

Decimal	Octal	Hexadecimal	Binary	Symbol	HTML Number	Description
0	000	00	00000000	NUL	&#000;	Null char
1	001	01	00000001	SOH	&#001;	Start of Heading
2	002	02	00000010	STX	&#002;	Start of Text
3	003	03	00000011	ETX	&#003;	End of Text
4	004	04	00000100	EOT	&#004;	End of Transmission
5	005	05	00000101	ENQ	&#005;	Enquiry
6	006	06	00000110	ACK	&#006;	Acknowledgment
7	007	07	00000111	BEL	&#007;	Bell
8	010	08	00001000	BS	&#008;	Back Space
9	011	09	00001001	HT		Horizontal Tab
10	012	0A	00001010	LF
Line Feed
11	013	0B	00001011	VT	&#011;	Vertical Tab
12	014	0C	00001100	FF		Form Feed
13	015	0D	00001101	CR
Carriage Return
14	016	0E	00001110	SO	&#014;	Shift Out / X-On
15	017	0F	00001111	SI	&#015;	Shift In / X-Off
16	020	10	00010000	DLE	&#016;	Data Line Escape
17	021	11	00010001	DC1	&#017;	Device Control 1 (oft. XON)
18	022	12	00010010	DC2	&#018;	Device Control 2
19	023	13	00010011	DC3	&#019;	Device Control 3 (oft. XOFF)
20	024	14	00010100	DC4	&#020;	Device Control 4
21	025	15	00010101	NAK	&#021;	Negative Acknowledgement
22	026	16	00010110	SYN	&#022;	Synchronous Idle
23	027	17	00010111	ETB	&#023;	End of Transmit Block
24	030	18	00011000	CAN	&#024;	Cancel
25	031	19	00011001	EM	&#025;	End of Medium
26	032	1A	00011010	SUB	&#026;	Substitute
27	033	1B	00011011	ESC	&#027;	Escape
28	034	1C	00011100	FS	&#028;	File Separator
29	035	1D	00011101	GS	&#029;	Group Separator
30	036	1E	00011110	RS	&#030;	Record Separator
31	037	1F	00011111	US	&#031;	Unit Separator

ASCII Printable Characters

Codes 32-127 are common for all the different variations of the ASCII table, they are called printable characters, represent letters, digits, punctuation marks, and a few miscellaneous symbols. You will find almost every character on your keyboard. Character 127 represents the command DEL.

Decimal	Octal	Hexadecimal	Binary	Symbol	HTML Number	Description
32	040	20	00100000			Space
33	041	21	00100001	!	!	Exclamation mark
34	042	22	00100010	"	"	Double quotes (or speech marks)
35	043	23	00100011	#	#	Number
36	044	24	00100100	$	$	Dollar
37	045	25	00100101	%	%	Per cent sign
38	046	26	00100110	&	&	Ampersand
39	047	27	00100111	'	'	Single quote
40	050	28	00101000	(	(	Open parenthesis (or open bracket)
41	051	29	00101001	)	)	Close parenthesis (or close bracket)
42	052	2A	00101010	*	*	Asterisk
43	053	2B	00101011	+	+	Plus
44	054	2C	00101100	,	,	Comma
45	055	2D	00101101	-	-	Hyphen
46	056	2E	00101110	.	.	Period, dot or full stop
47	057	2F	00101111	/	/	Slash or divide
48	060	30	00110000	0	0	Zero
49	061	31	00110001	1	1	One
50	062	32	00110010	2	2	Two
51	063	33	00110011	3	3	Three
52	064	34	00110100	4	4	Four
53	065	35	00110101	5	5	Five
54	066	36	00110110	6	6	Six
55	067	37	00110111	7	7	Seven
56	070	38	00111000	8	8	Eight
57	071	39	00111001	9	9	Nine
58	072	3A	00111010	:	:	Colon
59	073	3B	00111011	;	;	Semicolon
60	074	3C	00111100	<	<	Less than (or open angled bracket)
61	075	3D	00111101	=	=	Equals
62	076	3E	00111110	>	>	Greater than (or close angled bracket)
63	077	3F	00111111	?	?	Question mark
64	100	40	01000000	@	@	At symbol
65	101	41	01000001	A	A	Uppercase A

66	102	42	01000010	B	B	Uppercase B
67	103	43	01000011	C	C	Uppercase C
68	104	44	01000100	D	D	Uppercase D
69	105	45	01000101	E	E	Uppercase E
70	106	46	01000110	F	F	Uppercase F
71	107	47	01000111	G	G	Uppercase G
72	110	48	01001000	H	H	Uppercase H
73	111	49	01001001	I	I	Uppercase I
74	112	4A	01001010	J	J	Uppercase J
75	113	4B	01001011	K	K	Uppercase K
76	114	4C	01001100	L	L	Uppercase L
77	115	4D	01001101	M	M	Uppercase M
78	116	4E	01001110	N	N	Uppercase N
79	117	4F	01001111	O	O	Uppercase O
80	120	50	01010000	P	P	Uppercase P
81	121	51	01010001	Q	Q	Uppercase Q
82	122	52	01010010	R	R	Uppercase R
83	123	53	01010011	S	S	Uppercase S
84	124	54	01010100	T	T	Uppercase T
85	125	55	01010101	U	U	Uppercase U
86	126	56	01010110	V	V	Uppercase V
87	127	57	01010111	W	W	Uppercase W
88	130	58	01011000	X	X	Uppercase X
89	131	59	01011001	Y	Y	Uppercase Y
90	132	5A	01011010	Z	Z	Uppercase Z
91	133	5B	01011011	[	[	Opening bracket
92	134	5C	01011100	\	\	Backslash
93	135	5D	01011101	]	]	Closing bracket
94	136	5E	01011110	^	^	Caret - circumflex
95	137	5F	01011111	_	_	Underscore
96	140	60	01100000	`	`	Grave accent
97	141	61	01100001	a	a	Lowercase a
98	142	62	01100010	b	b	Lowercase b
99	143	63	01100011	c	c	Lowercase c
100	144	64	01100100	d	d	Lowercase d
101	145	65	01100101	e	e	Lowercase e
102	146	66	01100110	f	f	Lowercase f
103	147	67	01100111	g	g	Lowercase g
104	150	68	01101000	h	h	Lowercase h
105	151	69	01101001	i	i	Lowercase i
106	152	6A	01101010	j	j	Lowercase j
107	153	6B	01101011	k	k	Lowercase k
108	154	6C	01101100	l	l	Lowercase l
109	155	6D	01101101	m	m	Lowercase m
110	156	6E	01101110	n	n	Lowercase n
111	157	6F	01101111	o	o	Lowercase o
112	160	70	01110000	p	p	Lowercase p
113	161	71	01110001	q	q	Lowercase q
114	162	72	01110010	r	r	Lowercase r
115	163	73	01110011	s	s	Lowercase s
116	164	74	01110100	t	t	Lowercase t
117	165	75	01110101	u	u	Lowercase u
118	166	76	01110110	v	v	Lowercase v
119	167	77	01110111	w	w	Lowercase w
120	170	78	01111000	x	x	Lowercase x
121	171	79	01111001	y	y	Lowercase y
122	172	7A	01111010	z	z	Lowercase z
123	173	7B	01111011	{	{	Opening brace
124	174	7C	01111100	|			Vertical bar
125	175	7D	01111101	}	}	Closing brace
126	176	7E	01111110	~	~	Equivalency sign - tilde
127	177	7F	01111111		&#127;	Delete

ASCII Extended Codes

There are several different variations of the 8-bit ASCII table. The table below is according to Windows-1252 (CP-1252) which is a superset of ISO 8859-1, also called ISO Latin-1, in terms of printable characters, but differs from the IANA's ISO-8859-1 by using displayable characters rather than control characters in the 128 to 159 range. Characters that differ from ISO-8859-1 is marked by light blue colour.

Decimal	Octal	Hexadecimal	Binary	Symbol	HTML Number	Description
128	200	80	10000000	€	€	Euro sign
129	201	81	10000001			
130	202	82	10000010	‚	‚	Single low-9 quotation mark
131	203	83	10000011	ƒ	ƒ	Latin small letter f with hook
132	204	84	10000100	„	„	Double low-9 quotation mark

133	205	85	10000101	…	…	Horizontal ellipsis
134	206	86	10000110	†	†	Dagger
135	207	87	10000111	‡	‡	Double dagger
136	210	88	10001000	ˆ	ˆ	Modifier letter circumflex accent
137	211	89	10001001	‰	‰	Per mille sign
138	212	8A	10001010	Š	Š	Latin capital letter S with caron
139	213	8B	10001011	‹	‹	Single left-pointing angle quotation
140	214	8C	10001100	Œ	Œ	Latin capital ligature OE
141	215	8D	10001101			
142	216	8E	10001110	Ž	Ž	Latin capital letter Z with caron
143	217	8F	10001111			
144	220	90	10010000			
145	221	91	10010001	‘	‘	Left single quotation mark
146	222	92	10010010	’	’	Right single quotation mark
147	223	93	10010011	“	“	Left double quotation mark
148	224	94	10010100	”	”	Right double quotation mark
149	225	95	10010101	•	•	Bullet
150	226	96	10010110	–	–	En dash
151	227	97	10010111	—	—	Em dash
152	230	98	10011000	˜	˜	Small tilde
153	231	99	10011001	™	™	Trade mark sign
154	232	9A	10011010	š	š	Latin small letter S with caron
155	233	9B	10011011	›	›	Single right-pointing angle quotation mark
156	234	9C	10011100	œ	œ	Latin small ligature oe
157	235	9D	10011101			
158	236	9E	10011110	ž	ž	Latin small letter z with caron
159	237	9F	10011111	Ÿ	Ÿ	Latin capital letter Y with diaeresis
160	240	A0	10100000			Non-breaking space
161	241	A1	10100001	¡	¡	Inverted exclamation mark
162	242	A2	10100010	¢	¢	Cent sign
163	243	A3	10100011	£	£	Pound sign
164	244	A4	10100100	¤	¤	Currency sign
165	245	A5	10100101	¥	¥	Yen sign
166	246	A6	10100110	¦	¦	Pipe, Broken vertical bar
167	247	A7	10100111	§	§	Section sign
168	250	A8	10101000	¨	¨	Spacing diaeresis - umlaut
169	251	A9	10101001	©	©	Copyright sign
170	252	AA	10101010	ª	ª	Feminine ordinal indicator
171	253	AB	10101011	«	«	Left double angle quotes
172	254	AC	10101100	¬	¬	Not sign
173	255	AD	10101101			Soft hyphen
174	256	AE	10101110	®	®	Registered trade mark sign
175	257	AF	10101111	¯	¯	Spacing macron - overline
176	260	B0	10110000	°	°	Degree sign
177	261	B1	10110001	±	±	Plus-or-minus sign
178	262	B2	10110010	²	²	Superscript two - squared
179	263	B3	10110011	³	³	Superscript three - cubed
180	264	B4	10110100	´	´	Acute accent - spacing acute
181	265	B5	10110101	µ	µ	Micro sign
182	266	B6	10110110	¶	¶	Pilcrow sign - paragraph sign
183	267	B7	10110111	·	·	Middle dot - Georgian comma
184	270	B8	10111000	¸	¸	Spacing cedilla
185	271	B9	10111001	¹	¹	Superscript one
186	272	BA	10111010	º	º	Masculine ordinal indicator
187	273	BB	10111011	»	»	Right double angle quotes
188	274	BC	10111100	¼	¼	Fraction one quarter
189	275	BD	10111101	½	½	Fraction one half
190	276	BE	10111110	¾	¾	Fraction three quarters
191	277	BF	10111111	¿	¿	Inverted question mark
192	300	C0	11000000	À	À	Latin capital letter A with grave
193	301	C1	11000001	Á	Á	Latin capital letter A with acute
194	302	C2	11000010	Â	Â	Latin capital letter A with circumflex
195	303	C3	11000011	Ã	Ã	Latin capital letter A with tilde
196	304	C4	11000100	Ä	Ä	Latin capital letter A with diaeresis
197	305	C5	11000101	Å	Å	Latin capital letter A with ring above
198	306	C6	11000110	Æ	Æ	Latin capital letter AE
199	307	C7	11000111	Ç	Ç	Latin capital letter C with cedilla
200	310	C8	11001000	È	È	Latin capital letter E with grave
201	311	C9	11001001	É	É	Latin capital letter E with acute
202	312	CA	11001010	Ê	Ê	Latin capital letter E with circumflex
203	313	CB	11001011	Ë	Ë	Latin capital letter E with diaeresis
204	314	CC	11001100	Ì	Ì	Latin capital letter I with grave

205	315	CD	11001101	Í	Í	Latin capital letter I with acute
206	316	CE	11001110	Î	Î	Latin capital letter I with circumflex
207	317	CF	11001111	Ï	Ï	Latin capital letter I with diaeresis
208	320	D0	11010000	Ð	Ð	Latin capital letter ETH
209	321	D1	11010001	Ñ	Ñ	Latin capital letter N with tilde
210	322	D2	11010010	Ò	Ò	Latin capital letter O with grave
211	323	D3	11010011	Ó	Ó	Latin capital letter O with acute
212	324	D4	11010100	Ô	Ô	Latin capital letter O with circumflex
213	325	D5	11010101	Õ	Õ	Latin capital letter O with tilde
214	326	D6	11010110	Ö	Ö	Latin capital letter O with diaeresis
215	327	D7	11010111	×	×	Multiplication sign
216	330	D8	11011000	Ø	Ø	Latin capital letter O with slash
217	331	D9	11011001	Ù	Ù	Latin capital letter U with grave
218	332	DA	11011010	Ú	Ú	Latin capital letter U with acute
219	333	DB	11011011	Û	Û	Latin capital letter U with circumflex
220	334	DC	11011100	Ü	Ü	Latin capital letter U with diaeresis
221	335	DD	11011101	Ý	Ý	Latin capital letter Y with acute
222	336	DE	11011110	Þ	Þ	Latin capital letter THORN
223	337	DF	11011111	ß	ß	Latin small letter sharp s - ess-zed
224	340	E0	11100000	à	à	Latin small letter a with grave
225	341	E1	11100001	á	á	Latin small letter a with acute
226	342	E2	11100010	â	â	Latin small letter a with circumflex
227	343	E3	11100011	ã	ã	Latin small letter a with tilde
228	344	E4	11100100	ä	ä	Latin small letter a with diaeresis
229	345	E5	11100101	å	å	Latin small letter a with ring above
230	346	E6	11100110	æ	æ	Latin small letter ae
231	347	E7	11100111	ç	ç	Latin small letter c with cedilla
232	350	E8	11101000	è	è	Latin small letter e with grave
233	351	E9	11101001	é	é	Latin small letter e with acute
234	352	EA	11101010	ê	ê	Latin small letter e with circumflex
235	353	EB	11101011	ë	ë	Latin small letter e with diaeresis
236	354	EC	11101100	ì	ì	Latin small letter i with grave
237	355	ED	11101101	í	í	Latin small letter i with acute
238	356	EE	11101110	î	î	Latin small letter i with circumflex
239	357	EF	11101111	ï	ï	Latin small letter i with diaeresis
240	360	F0	11110000	ð	ð	Latin small letter eth
241	361	F1	11110001	ñ	ñ	Latin small letter n with tilde
242	362	F2	11110010	ò	ò	Latin small letter o with grave
243	363	F3	11110011	ó	ó	Latin small letter o with acute
244	364	F4	11110100	ô	ô	Latin small letter o with circumflex
245	365	F5	11110101	õ	õ	Latin small letter o with tilde
246	366	F6	11110110	ö	ö	Latin small letter o with diaeresis
247	367	F7	11110111	÷	÷	Division sign
248	370	F8	11111000	ø	ø	Latin small letter o with slash
249	371	F9	11111001	ù	ù	Latin small letter u with grave
250	372	FA	11111010	ú	ú	Latin small letter u with acute
251	373	FB	11111011	û	û	Latin small letter u with circumflex
252	374	FC	11111100	ü	ü	Latin small letter u with diaeresis
253	375	FD	11111101	ý	ý	Latin small letter y with acute
254	376	FE	11111110	þ	þ	Latin small letter thorn
255	377	FF	11111111	ÿ	ÿ	Latin small letter y with diaeresis

7 Binary

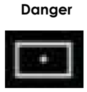
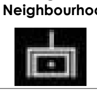
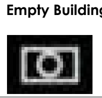
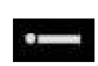
This is an alternative way to count using binary, different to the cardinal numbers of binary above in the ASCII section.

0 = 0	**1 = 1**	**2 = 10**	**3 = 11**	**4 = 100**	**5 = 101**	**6 = 110**	**7 = 111**	**8 = 1000**	**9 = 1001**	**10 = 1010**	
	11 = 1011	**12 = 1100**	**13 = 1101**	**14 = 1110**	**15 = 1111**	**16 = 10000**	**17 = 10001**	**18 = 10010**	**19 = 10011**	**20 = 10100**	

7 Markings

Homeless City Guide

These chalk markings are commonly used by homeless people to communicate with each other. They may be useful in a survival situation.

An Attack Happened Here 	**Danger** 	**Dangerous Neighbourhood** 	**Empty Building** 	**Friendly Place** 	**Good Food Thrown Away** 	**Good Place to Drink & Smoke** 	**Guard Dogs** 	**Message Board X Mins That Way** 	**Safe For Sleeping** 	**Security Guard** 	**Soup Run wRating** 
Squat 	**Strong Police Presence** 	**Unfriendly Place** 	**Work Potential** 	**You'll Get Moved On Here** 							

Nomad Codes

The pictographic Hobo Code is a fascinating system of symbols understood among the hobo community. Because hobos weren't typically welcomed (and were often illiterate), messages left for others in the community had to be easy for hobos to read but look like little more than random markings to everyone else to maintain an element of secrecy. The code features certain elements that appear in more than one symbol, such as the circles and arrows that made up the directional symbols. Hash marks or crossed lines usually meant danger in some form.

Afraid	At Crossroad Go This Way	Bad Water	Be Quiet	Be Ready to Defend Yourself	Beware Dogs	Camp Here	Can Sleep In Loft	Catch Out Here	Chain Gang	You'll Get Cursed Out Here	Cops Active
Cops Inactive	Courthouse or Police Station	Cowards - Will Give to Make You Leave	Danger	Dangerous Neighbourhood	Doctor No Charge	Don't Give Up	Don't Go This Way	Get Out Fast (Hobos Not Welcome)	Worth Robbing	Go	Good Road to Follow
Fresh Water & Campsite	Hobos Arrested On Sight	Hold Your Tongue	Jail	Keep Away	No Alcohol Town	Railroad	Safe Camp	Unsafe Area	Stop	Straight Ahead	Town Allows Alcohol
Tramps Here	Trolley	Turn Left Here	Turn Right Here								

Modern Hoboglyphs

Kind Lady	Kind Gentleman	Judge Lives Here	Good Place for Hand Outs	Owner is Out/Away	Agitated Homeless	Buffet of Sample Foods	Camera Perverts	Check Cashing	Companies test market here	Discover Card Accepted	Dishonest ticket scalpers here
Dog Poop	Dumpster Treasure	GPS will screw you here	High-fee ATM	Instant Parking tickets	It	Kinkos	No Oversight of public transit ticket system	No-fee ATM	Olive Trees	Open Wireless Network	Overpriced Drinks
Plan B Contraception available	Prostitution Sting	Purell Available	25 Minute Wait from Here	Thin Ice	Those aren't women	Unexpected Lawn Sprinklers	Used Frying Oil Available for Biodiesel	Vegans Beware	Well-stocked bathroom		

Other Markings

Shadowmarks (Skyrim) Shadowmarks are a fictional communications system used by the thieves guild in Skyrim, however these marks could have useful have real world applications if learnt.	**Guild** Denotes the location nearby is part of the Guild.	**Safe** Denoting the area is safe for the Guild.	**Danger** Denoting hostile person or trap nearby.	**Escape** Denoting that following this mark leads to escape.	**Protected** Denoting the area or people are under Guild protection.	**Fence** Denoting there is a buyer of stolen goods inside.	**Cache** Denoting a Cache of supplies.	**Loot** Denoting valuables or riches lie inside or nearby.	**Empty** Denoting there is nothing of value inside.
Hunting Markings Markings that hunters use.									
Societal Markings									

Language

Foreign alphabets and translations of words and phrases

"Drawing on my fine command of the English language, I said nothing."
Robert Benchley

Introduction

Being able to speak other languages can be vital in a situation where you're plunged into another country or are being invaded. Not only can it be used to communicate with other people in their native language, but also as a means of communicating in an English speaking country covertly. English isn't included below because you're likely to already excel at it. Included is a selection of the most common words and phrases in each language to be able to get by if required. Languages are sorted alphabetically and have been chosen via a combination of usefulness and number of native speakers. Ideally there's enough information in each language that you can read signs and survive in a foreign country.

Purpose	The aim of LANGUAGE is to help the reader translate signs, words and sentences in an attempt to communicate with those who don't speak their language.
Lost?	• For information about the different regions of the world, see the GEOGRAPHY section. • To understand the drive of different groups of people, see the POPULATION section. • To improve your communication with others, see the COMMUNICATION section.

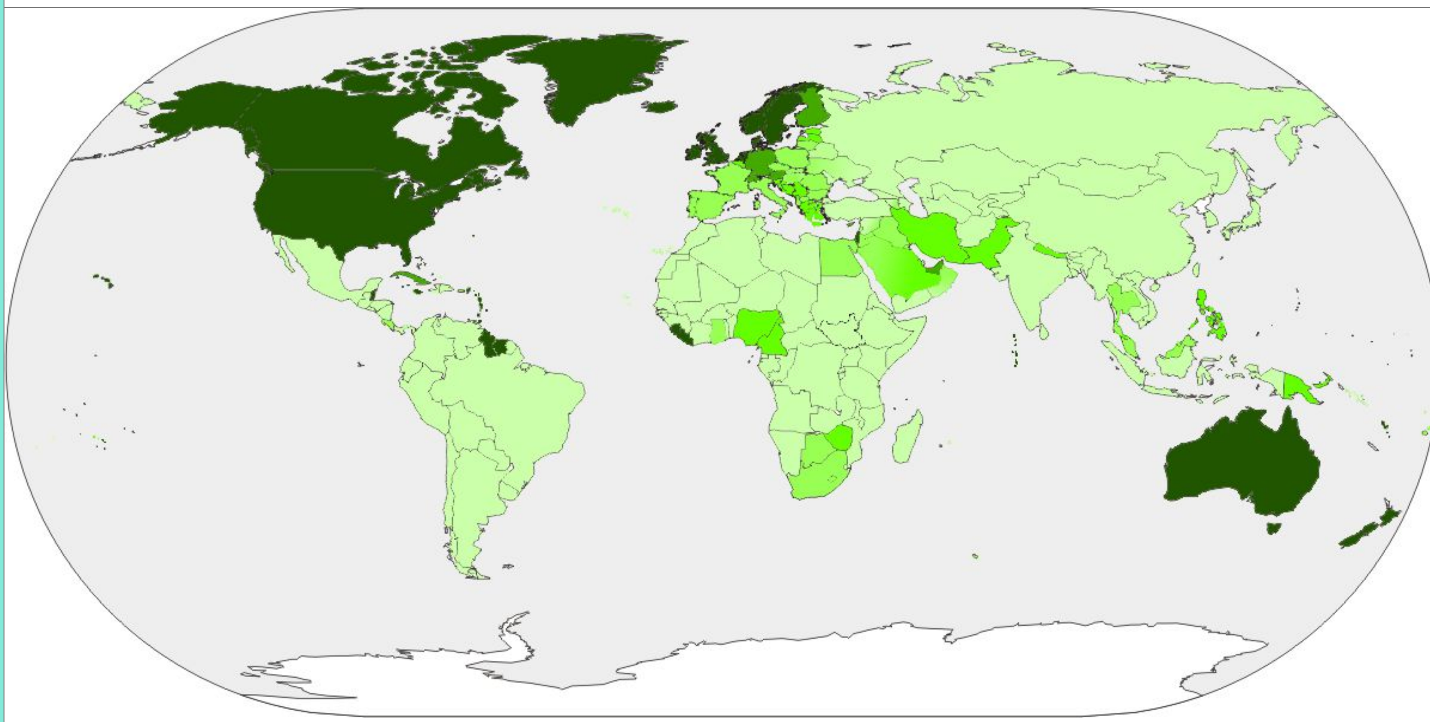
Contents

1 Language

This part contains some important language information and facts.

Most Spoken Languages	**Chinese (Mandarin)** 935m	**Spanish** 390m	**English** 365m	**Hindi** 295m	**Arabic** 280m	**Portuguese** 205m	**Bengali (Bangla)** 200m	**Russian** 160m	**Japanese** 125m	**Punjabi** 95m	**German** 92m
Most Commonly Learned Languages	**English** ○	**French** ○	**Spanish** ○	**Italian** ○	**Chinese** ○	**Japanese** ○	**German** ○	**Arabic** ○	**Latin** ○	**Russian** ○	**Portuguese** ○

The diagram below shows the percentage of English speakers by country.



80-100%	60-80%	40-60%	20-40%	0.1-20%	Not Available

2 Arabic

Arabic is a Semitic language that first emerged in the 1st to 4th centuries CE. It is now the lingua franca of the Arab world. It is named after the Arabs, a term initially used to describe peoples living in the area bounded by Mesopotamia in the east and the Anti-Lebanon mountains in the west, in north-western Arabia, and in the Sinai Peninsula. Arabic is classified as a macrolanguage comprising 30 modern varieties, including its standard form, Modern Standard Arabic, which is derived from Classical Arabic. As the modern written language, Modern Standard Arabic is widely taught in schools and universities, and is used to varying degrees in workplaces, government, and the media.

The two formal varieties are grouped together as Literary Arabic (fuṣḥā), which is the official language of 26 states, and the liturgical language of the religion of Islam, since the Quran and Hadith were written in Arabic. Modern Standard Arabic largely follows the grammatical standards of Classical Arabic, and uses much of the same vocabulary. However, it has discarded some grammatical constructions and vocabulary that no longer have any counterpart in the spoken varieties, and has adopted certain new constructions and vocabulary from the spoken varieties.
Much of the new vocabulary is used to denote concepts that have arisen in the post-classical era, especially in modern times. Due to its grounding in Classical Arabic, Modern Standard Arabic is removed over a millennium from everyday speech, which is construed as a multitude of dialects of this language. These dialects and Modern Standard Arabic are described by some scholars as not mutually comprehensible. The former are usually acquired in families, while the latter is taught in formal education settings. However, there have been studies reporting some degree of comprehension of stories told in the standard variety among preschool-aged children. The relation between Modern Standard Arabic and these dialects is sometimes compared to that of Latin and vernaculars (or today's Italian, French or Spanish) in medieval and early modern Europe.

This view though does not take into account the widespread use of Modern Standard Arabic as a medium of audio-visual communication in today's mass media—a function Latin has never performed. Classical Arabic is the liturgical language of 1.8 billion Muslims, and Modern Standard Arabic is one of six official languages of the United Nations. All varieties of Arabic combined are spoken by perhaps as many as 422 million speakers (native and non-native) in the Arab world, making it the fifth most spoken language in the world. Arabic is written with the Arabic alphabet, which is an abjad script and is written from right to left, although the spoken varieties are sometimes written in ASCII Latin from left to right with no standardized orthography.

Alphabet

The Arabic alphabet or Arabic abjad is the Arabic script as it is codified for writing Arabic. It is written from right to left in a cursive style and includes 28 letters. The following alphabet characters are written from right to left.

ل l	ك k	ي y	ط ṭ	ح ḥ	ز z	و w	ه h	د d	ج j	ب b	أ ʼ
خ kh	ث th	ت t	ش sh	ر r	ق q	ص ṣ	ف f	ع ʻ	س s	ن n	م m

								غ gh	ظ ẓ	ض ḍ	ذ dh

3 Chinese

Chinese is a group of related, but in many cases not mutually intelligible, language varieties, forming the Sinitic branch of the Sino-Tibetan language family. Chinese is spoken by the ethnic Chinese majority and many minority ethnic groups in China. About 1.2 billion people (around 16% of the world's population) speak some form of Chinese as their first language. The varieties of Chinese are usually described by native speakers as dialects of a single Chinese language, but linguists note that they are as diverse as a language family. The internal diversity of Chinese has been likened to that of the Romance languages, but may be even more varied. There are between 7 and 13 main regional groups of Chinese (depending on classification scheme), of which the most spoken by far is Mandarin (about 960 million, e.g. South-western Mandarin), followed by Wu (80 million, e.g. Shanghainese), Min (70 million, e.g. Southern Min), Yue (60 million, e.g. Cantonese), etc.

Most of these groups are mutually unintelligible, and even dialect groups within Min Chinese may not be mutually intelligible. Some, however, like Xiang and certain Southwest Mandarin dialects, may share common terms and a certain degree of intelligibility. All varieties of Chinese are tonal and analytic. Standard Chinese is a standardized form of spoken Chinese based on the Beijing dialect of Mandarin. It is the official language of China and Taiwan, as well as one of the four official languages of Singapore.

Writing Systems

Pinyin	Hanyu Pinyin, often abbreviated to pinyin, is the official romanization system for Standard Chinese in mainland China and to some extent in Taiwan. It is often used to teach Standard Mandarin Chinese, which is normally written using Chinese characters. The system includes four diacritics denoting tones. Pinyin without tone marks is used to spell Chinese names and words in languages written with the Latin alphabet, and also in certain computer input methods to enter Chinese characters.
Traditional	Traditional Chinese characters are Chinese characters in any character set that does not contain newly created characters or character substitutions performed after 1946. They are most commonly the characters in the standardized character sets of Taiwan, of Hong Kong and Macau, and in the Kangxi Dictionary.
Simplified	Simplified Chinese characters are standardized Chinese characters prescribed in the Table of General Standard Chinese Characters for use in mainland China. Along with traditional Chinese characters, they are one of the two standard character sets of the contemporary Chinese written language. The government of the People's Republic of China in mainland China has promoted them for use in printing since the 1950s and 1960s to encourage literacy.
Hanzi	

Alphabet - Pinyin

Initials

A syllable in Chinese is composed of an initial, which is a consonant that begins the syllable, and a final, which covers the rest of the syllable.

	b d g j z zh	p t k q c ch	m n h x s sh	f l r
	m, f, n, l, h and sh are pronounced as in English.	d like "d" in "bed" (unaspirated) j like "g" in "genius" (unaspirated) z like "ds" in "beds" zh like "j" in "job" b like "p" in "spin" (unaspirated) g a soft unaspirated "k" sound x like "sh" in "sheep" but with the corners of the lips drawn back r somewhat like "r" in "rain"	Particular attention should be paid to the pronunciation of the so-called "aspirated" consonants. It is necessary to breath heavily after the consonant is pronounced. p like "p" in "pope" t like "t" in "tap" k like "k" in "kangaroo" q harder than "ch" in "cheap" c like "ts" in "cats"	Distinction between certain initials: b / p d / t g / k j / q z / c zh / ch

Finals

In modern Chinese, there are 38 finals besides the above-represented 21 initials.

	a o e er ai ei ao ou an en ang eng	i ia ie iao iou (iu) ian in iang ieng	ua uo uai uei (ui) uan uen (un) uang ueng	üe üan üen	
	ie like "ye" in "yes" e like "e" in "her"	er like "er" in "sister" (american pronunciation) ai like "y" in "by" (light)	ei like "ay" in "bay" ou like "o" in "go"	an like "an" in "can" (without stressing the "n") -ng (final) a nasalized soung like the "ng" in "bang" without pronouncing the "a"	uei, uen and iou when preceded by an initial, are written as ui, un and iu respectively.

Tones

Mandarin Chinese has four pitched tones and a "toneless" tone.

Tone	Mark	Description
1st	dā	High and level
2nd	dá	Starts medium in tone, then rises to the top
3rd	dǎ	Starts low, dips to the bottom, then rises toward the top
4th	dà	Starts at the top, then falls sharp and strong to the bottom
Neutral	da	Flat, with no emphasis

Tone Changes
A 3rd tone, when immediately followed by another 3rd tone, should pe pronounced in the 2nd tone.
Nǐ hǎo = Ní hǎo

Character List

An incomplete list of simplified Chinese characters and their meanings.

1 Stroke

一 one	乙 second										

2 Strokes

二 two	十 ten	丁 fourth	厂 factory	七 seven	卜 foretell, radish	人 person	入 enter	八 eight	九 nine	几 small table, almost, how many	儿 son
了 finish; understand	力 power	乃 then	刀 knife	又 again							

3 Strokes

乡 rural	三 three	于 to, at, toward, in, on, at	干 shield, invade, dry, do	亏 fail	士 scholar	工 work	土 earth	才 talent, only	寸 inch	下 down, descend	大 large
马 horse	丈 ten feet	与 and, with, participate	万 ten thousand	上 up, ascend	小 small	口 mouth	巾 towel	山 mountain	千 thousand, swing (playground)	乞 beg	川 river
叉 fork	亿 hundred million	个 generic measure word	勺 spoon	久 long time	凡 all, any, every	及 reach	夕 evening	丸 pill	么 interrogative particle	广 wide	亡 death
习 practice, study	门 door	义 righteousness	之 possessive particle	尸 corpse	弓 bow	己 self	已 already	子 child	卫 guard	也 too, also	女 female
刃 blade	飞 fly										

4 Strokes

幻 illusion, fantasy, mirage	丰 lush, beautiful, abundant	王 king	井 well, pit	开 open	夫 male, husband	天 sky, heaven	无 negative, lack	元 first, head	专 monopolize	云 say, cloud	扎 tie, bind, pierce, pull up
书 book, letter, document	艺 art, talent	木 tree, wood	五 five	支 pay, support	厅 hall, central room	不 no, not	太 very, too, extreme	犬 dog	区 a surname, area, region	历 calendar, history	尤 especially, particularly
双 couple, both	友 friend	匹 measure word for horses	车 cart, vehicle	巨 large	牙 tooth	屯 village	比 compare	互 mutually, reciprocally	切 cut, slice, bite	瓦 tile	止 stop
劝 recommend, advise	少 few, less, young	日 sun, day	中 middle, centre, hit on target	冈 ridge	贝 seashell	内 inside	水 water	见 see, observe	午 noon	牛 cattle	手 hand
予 give	毛 hair, fur	气 steam, vapour, air	升 litre, rise	长 long, length, leader, grow	仁 humanity, kindness	什 what, file of ten soldiers	片 slice, splinter, strip	仆 fall forward, servant	化 change, convert, reform	仇 hatred, vengeance	币 currency
允 allow, consent	仍 yet, still, continuing	仅 only	斤 ax, shrewd	爪 claw, talon	反 reverse, opposite, anti	介 lie between, wear armour	父 father	从 from, since, through	今 now, today, modern	凶 culprit, murder, fear	分 divide, place, position
以 therefore	乏 lack, poor	公 fair, public, duke	仓 granary	月 moon, month	氏 clan, family	勿 negative imperative	欠 yawn, lack, owe	风 wind	丹 cinnabar, vermilion	匀 equal	乌 crow, raven
办 manage, handle	凤 male phoenix	勾 hook, join, connect	文 literature, writing	六 six	方 square, rectangle	火 fire, flame	为 do, act, be, for	斗 liquid measure, fight	忆 remember, memory	订 arrange	计 plan, plot, scheme
队 team, group	户 door, family	认 recognize, know, understand	心 heart, mind, soul	尺 foot (measurement)	引 pull, attract, stretch	丑 clown, ugly	巴 greatly desire	孔 opening, hole, orifice			

5 Strokes

玉 jade	刊 publish	示 show	末 last	未 not yet	击 hit	打 beat	巧 smart, deft	正 first, upright	扑 hit, rush at	扒 peel, dig	矛 spear

功 contribution, effect	扔 toss	去 go	甘 sweet	世 generation, era, world	古 old	节 joint, season, festival	本 root, base	术 skill, sorghum	可 able	丙 third	纠 tangle
左 left	厉 severe	右 right	石 stone	布 cloth, promulgate, spread, proclaim	龙 dragon	平 flat	灭 extinguish	轧 crush	东 east	卡 checkpoint, strangle	母 mother
北 north	占 foretell, occupy	业 profession	旧 old, used	帅 commander	归 return	且 moreover	旦 dawn	目 eye	叶 leaf	甲 armour, first	幼 infant
申 explain	叮 bite (insect)	电 lightning, electricity	号 cry loudly, title, order, number	田 field	由 by	史 history	只 measure word for land animals, only	央 centre	兄 older brother	叼 hold by biting	丝 silk
叫 call out	另 other	叨 overly talkative, overly	叹 sigh, praise	四 four	生 grow, live, raw, unfamiliar	失 lose	禾 cereal	丘 mound	付 give, pay	仗 weapon, battle	台 platform, tabletop, typhoon
代 period, generation, replace	仙 immortal being	们 plural marker	仪 rule, rite, decorum	白 white	仔 young, careful	他 he, He (God)	斥 scold	瓜 melon	乎 archaic discourse particle	丛 bushes	对 reply, toward, pair, correct
令 command	用 use	甩 fling	印 seal, mark	乐 joyful, music	句 sentence	匆 hurried	册 booklet	犯 encroach, break (a law)	外 outside	处 stay, place	圣 holy
冬 winter, onomatopoeia, e.g. sound of drums	鸟 bird	务 task, duty	包 bag, wrap	饥 hunger, year of poor harvest	主 master, host, control	市 market, city	立 stand	闪 twinkle	兰 orchid	半 half	孕 pregnant
汁 juice	汇 confluence	头 head	汉 Han Chinese	宁 tranquil	穴 hole	它 it (animate), it (inanimate)	讨 ask for	写 write	让 let	礼 rite, courtesy	发 launch, start, distribute, hair (human and on the head)
训 lecture, train	必 must	议 discuss	讯 information	记 remember	永 eternal	司 manage, agency	尼 nun	民 people	出 go out, piece of drama	辽 distant, expansive	边 side, border
奶 milk	奴 slave	加 add	召 call for	皮 skin, hide							

6 Strokes

式 ceremony, type	刑 judicial punishment	动 move	扛 carry on one's shoulders	寺 temple	吉 auspicious	扣 latch, reduce	考 examination	托 hold up	老 old	执 hold, control	红 red
巩 reinforce	圾 garbage	扩 expand	扫 sweep	地 ground	扬 raise, show	场 plaza, place	耳 ear	共 together	芒 awn, ray	亚 secondary	纤 towline, delicate
芝 lingzhi	朽 rotten	朴 real, natural	机 alder, occasion, machine	权 power, right	过 pass, mistake, experiential aspect	臣 official	再 again	协 cooperate	西 west	压 press	级 level
厌 dislike	在 at, in	有 have, own	百 hundred	存 exist, store	而 and, also	页 page	匠 craftsman	夸 boast, arrogance, exaggerate, praise	夺 rob, take away from	灰 ash, gray	约 constrain, promise, approximately
达 arrive	列 rank, file	死 die	成 succeed, complete	夹 squeeze, clip, lined (clothing)	轨 gauge, track	邪 sinister	划 paddle, slice, scratch, draw, plan	迈 stride	毕 end	至 arrive	纪 rule, eon
此 this	贞 virginity	师 teacher, army	尘 dust	尖 acute	劣 weak, inferior	光 light, glory, bare, finish	当 take a role, facing, apt, pawn, trickery	早 morning, early	吐 spit, eject, vomit	吓 intimidate, fear, cause fear	驰 run fast (horses, vehicles)
虫 bug, insect	曲 bend, bent, melody, song	团 ball, group	同 same	吊 hang, pay respects to the dead	吃 eat	因 reason, because	吸 inhale	吗 Interrogative particle	屿 small island	帆 sail	巡 make a touring inspection
岁 year, age	回 return, times, turn, return	岂 how could	刚 just now	则 rule, then	肉 flesh, meat	网 net	年 year	朱 deep red	先 earlier	丢 lose	戏 play (games); play (drama)
舌 tongue	竹 bamboo	迁 relocate	乔 pretend	伟 great	传 transfer, transmit, records, biography	乒 ping(pong)	乓 (ping)pong	休 rest	伍 military, five	伏 lie on one's stomach, give in	羽 feather

优 excellent	伐 chop (trees)	延 extend	件 component	任 duty, delegate	伤 injure	价 price	份 portion	华 flourish, China	仰 raise head	仿 imitate	观 to watch, Taoist temple
伙 group of people	伪 false, illegitimate	自 self	血 blood	向 toward, direction, toward, guide	似 similar	后 queen, empress, after	行 row, rank, business, walk, move	舟 boat	全 whole, all	会 calculate, a while, meet, group, meeting, able	欢 joy
杀 kill	合 close, gather	兆 omen, trillion	企 tiptoe, look forward to	众 crowd	爷 grandfather, lord	伞 oumbrella	创 wound, create	肌 flesh, muscle	朵 flower, measure word for flowers	杂 mixed, complex	买 buy
危 danger	旬 ten days, ten years	旨 will, decree	负 bear, betray, lose	各 each	名 name, fame	多 many	争 dispute	色 colour, expression, sexual desire, dice	壮 robust, gallant	冲 flush, surge, deep, charge, surge, thoroughfare	妈 mom, mum
冰 ice	庄 solemn, village, villa	庆 celebrate	亦 also	刘 Liu (a surname)	齐 aligned, neat, together	交 cross, give, meet	次 ...time, iteration	衣 clothing	产 produce, property	决 dredge, burst, decide	她 she
充 fill	妄 absurdly, randomly	闭 close, end	问 ask	闯 rush forcefully	羊 sheep, goat	并 Shanxi province, merge, equally, on a level with	关 close, turn off, mountain pass	米 rice grain	灯 lamp	州 state, prefecture	好 good, to like
汗 khan, sweat	污 dirty, sewage	江 great river	池 pond	汤 soup	忙 busy	兴 create, prosper, interest, happy	宇 house, universe	守 guard	宅 residence	字 to give birth to, to deliver a baby, to be pregnant, to be carrying a baby	妇 married woman
安 peaceful	讲 speak	军 military	许 promise, very	论 discuss, describe	农 agriculture, farmer	讽 satire	设 establish	访 visit	寻 seek	那 that, that one	如 as if, if
迅 rapid	尽 as much as possible, end, use up	导 guide, conduct	异 different	孙 grandson	阵 a while, formation	阳 bright, positive, Yang	收 receive, obtain	阶 steps	阴 dark, negative, Yin	防 defend	奸 sinister, traitor, rape, adultery

7 Strokes

寿 longevity	弄 fiddle	麦 wheat, barley	形 shape	进 advance	戒 warn	吞 swallow	远 far	违 break a rule	运 transport	扶 hold onto	纽 button
抚 touch softly	坛 altar	技 skill	坏 bad	扰 disturb	拒 refuse	找 seek	批 comment	扯 pull	址 location	走 run, walk	驴 donkey
抄 copy	坝 dam	贡 tribute	攻 attack	赤 red	折 bend, lose, bend, fold	抓 grab	扮 makeup	抢 rob	孝 filial piety	均 equalized	纺 spin fabric
抛 throw	投 throw	坟 grave	抗 resist	坑 trough	坊 street, shop	抖 shake	护 protect	壳 shell	志 ambition, records	扭 twist	纹 fabric patterns
块 chunk	声 sound	把 hold, direct object marker	报 report	却 but	劫 rob	芽 plant shoot	花 flower	芹 celery	芬 fragrance	苍 deep blue, deep green, gray	纸 paper
芳 fragrance	严 severe	芦 reed	劳 labour	克 defeat, exploit, limit	苏 perilla, wake, revive	杆 rod	杠 flagpole, thick rod	杜 obstruct	材 material	村 village	纷 dispute
杏 apricot	极 extreme	李 plum	杨 poplar	求 ask for	更 change, more	束 bind	豆 bean	两 two	丽 beautiful	医 doctor	纵 let loose
辰 star	励 encourage	否 is not	还 still, yet, give back	歼 annihilate	来 come	连 connect	步 step	坚 hard	旱 drought	盯 stare	纯 pure
呈 to present	时 time	吴 Wu (region)	助 help	县 county	里 community, inside	呆 slow-witted	园 garden	旷 spacious	围 surround	呀 discourse particle	驳 rebut
吨 ton	足 foot, sufficient	邮 mail	男 male	困 trapped, sleepy	吵 make noise, quarrel	串 string of objects	员 member, personnel	听 listen	吩 instruct	吹 blow	纲 outline
呜 onomatopoeia (for crying, etc.)	吧 bar (establishment)	吼 roar	别 other, bend	岗 sentry	帐 canopy	财 money	针 needle	钉 nail, peg	告 tell	我 I	纳 accept
乱 messy	利 benefit	秃 bald	秀 pretty	私 private	每 every	兵 soldier	估 estimate	体 body	何 what	但 but	纱 silk

伸 extend	作 make	伯 father's elder brother	伶 nimble	佣 commission, servant	低 low	你 you (male), you (female)	住 inhabit	位 position	伴 accompany	身 body	努 exert
皂 soap	佛 Buddha	近 near	彻 complete	役 military service	返 return	余 I (archaic), leftover	希 hope	坐 sit	谷 valley, grains, cereals	妥 appropriate	忍 endure
含 contain	邻 neighbour	岔 fork (in a ridge, road, etc.)	肝 liver	肚 abdomen	肠 intestines	龟 tortoise	免 exempt	狂 crazy	犹 as if	角 horn, angle, role	劲 effort, powerful
删 delete	条 strip, twig	卵 egg	岛 island	迎 welcome	饭 meal	饮 drink	系 link, succession, bind	言 speech	冻 freeze	状 form	鸡 chicken
亩 acre	况 situation	床 bed	库 store	疗 treatment	应 should, ought, answer	冷 cold	这 this, this one	序 rank	辛 hardship	弃 abandon	驱 drive (an animal)
冶 metalworking	忘 forget	闲 idle	间 between, space, space, spy	闷 smother, unhappy	判 judge	灶 hearth	灿 dazzling	弟 younger brother	汪 expanse	沙 sand	妨 harm
汽 steam	沃 fertile	泛 float, general	沟 ditch	没 without, submerge	沈 Shen (a surname), Shenyang (a city)	沉 osink	怀 bosom, yearn	忧 worry	快 fast, glad	完 finish	妖 monster
宋 Song (a surname), Song Dynasty	宏 grand	牢 jail	究 investigate	穷 poor	灾 disaster	良 good	证 proof	启 begin	评 comment	补 patch	妙 ingenious
初 initial	社 organization	识 know	诉 tell	诊 diagnose	词 word	译 translate	君 sovereign	灵 spirit	即 namely, suddenly, approaching	层 level	附 adhere
尿 urine	尾 tail	迟 late	局 agency	改 rectify	张 open	忌 hate, fear	际 edge	陆 dry land, six	阿 familiar prefix for kinship terms, pander	陈 antiquated	阻 obstruct

8 Strokes

奉 offer	玩 play	环 ring	武 martial	青 green, blue	责 chastise	现 appear	表 surface, watch (time-keeping)	规 rule	抹 wipe, smear, daub	拢 draw together	贯 string together
拔 pull outward	拣 select	担 carry on a shoulder pole, shoulder pole	坦 flat	押 signature	抽 pull out from between	拐 abduct	拖 drag	拍 clap	者 agent noun suffix	顶 summit	经 warp (in weaving)
拆 demolish	拥 own	抵 withstand	拘 custody	势 power	抱 hug	垃 garbage	拉 pull	拦 block	拌 mix	幸 lucky	绍 continue
招 beckon	坡 slope	披 drape	拨 stir	择 choose	抬 raise	其 that	取 take	苦 bitter	若 if	茂 verdant	驼 camel
苹 apple	苗 seedling	英 outstanding	范 Fan (a surname), model	直 straight	茄 eggplant	茎 stem	茅 thatch	林 forest	枝 branch	杯 cup, trophy	驻 stop
柜 closet	析 break down	板 board, boss	松 pine, loose	枪 gun	构 structure	杰 outstanding	述 describe	枕 pillow	丧 matters regarding the dead, lose	或 or	终 end
画 draw	卧 lie down	事 matter	刺 prick	枣 jujube	雨 rain	卖 sell	矿 mineral	码 tally	厕 toilet	奔 run	织 weave
奇 odd (not even), strange	奋 exert	态 situation	欧 Europe	垄 ridge	妻 wife	轰 loud noise	顷 moment	转 turn change, revolve, stroll	斩 chop	轮 wheel	驶 speedy
软 soft	到 arrive	非 is not	叔 father's younger brother	肯 willing	齿 tooth	些 some	虎 tiger	虏 capture	肾 kidney	贤 sage	细 thin (not thick)
尚 yet	旺 prosper	具 tool	果 fruit	味 taste	昆 older brother	国 country	昌 bright	畅 g unimpeded	明 bright	易 easy	组 group
昂 hold high	典 ceremony	固 firm	忠 loyal	咐 instruct	呼 exhale	鸣 make sound	咏 sing	呢 discourse particle	岸 shore	岩 rock, cliff	练 practice
帖 obedient, document, copy	罗 net	帜 flag	岭 mountain range	凯 triumphal	败 defeat	贩 vend	购 purchase	图 picture	钓 to fish	制 law, manufacture	线 line

知 know	垂 drop	牧 to herd	物 thing	乖 well-behaved	刮 shave, gust (wind)	秆 plant stalk	和 harmony, and, follow, mix, blend	季 season	委 delegate	佳 good	艰 difficult
侍 servant	供 supply, offer	使 cause	例 example	版 slab	侄 brother's child	侦 spy on	侧 side	凭 lean	侨 expatriate	佩 wear on one's clothing, belt etc.	参 participate, ginseng
货 goods	依 lean	的 possessive and nominalization particle, indeed, aim	迫 compel	质 hostage, material	欣 joy	征 expedition, amass	往 towards	爬 crawl	彼 that	径 path	驾 to drive (cars, carts, etc.)
所 place	舍 dwelling, relinquish	金 gold	命 life	斧 ax	爸 dad	采 colour, pick, pluck	受 receive	乳 milk	贪 greedy	念 miss (remember), read	始 start
贫 impoverished	肤 skin	肺 lung	肢 limb	肿 swell (on the body)	胀 expand	朋 friend	股 thigh	肥 fat	服 clothing	胁 threat	姓 surname
周 surround, Zhou Dynasty, week, surround	昏 dim	鱼 fish	兔 rabbit	狐 fox	忽 overlook	狗 dog	备 prepare	饰 decorate	饱 full (after eating)	饲 to rear	姐 older sister
变 change	京 capital city	享 enjoy	店 shop	夜 night	庙 temple	府 government office	底 bottom	剂 odose	郊 suburb	废 waste	姑 father's sister
净 clean	盲 blind	放 release	刻 carve	育 cultivate	闸 floodgate	闹 make noise	郑 Zheng (a surname); Zhengzhou	券 coupon	卷 roller, scroll, roll	单 single	妹 younger sister
炒 stirfry	炊 cook on a fire	炕 heated brick bed	炎 heat	炉 stove	沫 foam	浅 shallow	法 way (to do something), law, technique	泄 leak	河 river	沾 abundant, soak, moisten	限 limit
泪 tear (from the eyes)	油 oil	泊 to berth (a boat), to park (a car)	沿 along	泡 measure word for excreta, bubble	注 pour, annotate	泻 gush	泳 swim	泥 mud	沸 boil	波 wave	降 descend, surrender
泼 splash	泽 swamp	治 govern	怖 fearsome	性 characteristic	怕 afraid	怜 pity	怪 strange	学 learn	宝 treasure	宗 ancestor	陕 Shaanxi province
定 fix	宜 suitable	审 try (at a trial)	宙 universe	官 government official	空 empty	帘 screen	实 filled	试 attempt	郎 young man	诗 poem	孤 orphan
肩 shoulder	房 house	诚 honest	衬 to line (e.g. clothing)	衫 clothing	视 see	话 speech	诞 birth	询 inquire	该 should, ought	详 detailed	孟 eldest
建 establish	肃 solemn	录 record	隶 subordinate	居 inhabit	届 measure word for events	刷 brush	屈 bend	弦 string (of bows, musical instruments)	承 receive		

9 Strokes

奏 play (a musical instrument)	春 spring (season)	帮 help	珍 precious	玻 glass	毒 poison	型 model	挂 hang	封 to seal	持 hold	项 neck	统 unify
垮 collapse	挎 carry under one's arm	城 city	挠 obstruct	政 politics	赴 go toward	赵 Zhao (a surname)	挡 to block	挺 prop up	括 include	拴 bind	绞 wring
拾 pick up	挑 choose, raise	指 finger	垫 cushion	挣 struggle, earn	挤 cram	拼 combine	挖 dig	按 press	挥 to wave	挪 shift	绝 end
某 some, certain	甚 quite	革 leather	荐 recommend	巷 alley	带 belt	草 grass	茧 cocoon	茶 tea	荒 barren	茫 expansive	骆 camel
荡 swing	荣 glory	故 past	胡 anyhow	南 south	药 medicine	标 signage	枯 wilt	柄 handle	栋 building	相 reciprocal, minister	络 network
查 investigate	柏 cypress	柳 willow	柱 pillar	柿 persimmon	栏 railing	树 tree	要 demand, want	咸 all, salty	威 awe	歪 crooked	给 give
研 research	砖 brick	厘 unit of measurement	厚 thick	砌 lay bricks	砍 chop	面 face, noodles	耐 tolerate	耍 play around	牵 pull	残 injured	绘 to draw

殃 harm	轻 light (not heavy)	鸦 crow	皆 all	背 back (of the body), carry on one's back	战 battle	点 dot	临 to face	览 view	竖 vertical	省 omit, wake	骄 arrogant
削 peel	尝 to taste	是 be	盼 anticipate	眨 blink	哄 make noise, coax	显 show	哑 mute	冒 emanate	映 reflect	星 star	绕 coil
昨 yesterday	畏 fear	趴 line prone	胃 stomach	贵 precious	界 boundary	虹 rainbow	虾 shrimp	蚁 ant	思 think	蚂 (combining syllable for insects)	结 knot
虽 although	品 product	咽 swallow	骂 scold	哗 onomatopoeia, make noise	咱 we (inclusive)	响 loud	哈 exhale	咬 bite	咳 cough	哪 which	绒 down (material)
炭 charcoal	峡 gorge	罚 punish	贱 worthless	贴 to stick	骨 bone	钞 money	钟 vessel, clock	钢 steel	钥 key	钩 hook	绑 to tie
卸 unload	缸 vat	拜 worship	看 watch over, look	矩 regulation	怎 how	牲 livestock	选 choose	适 suitable	秒 second (unit)	香 fragrance	垒 pile
种 seed, to plant	秋 autumn, swing (playground)	科 subject	重 double, heavy	复 again, complex	竿 bamboo pole	段 segment	便 convenient, cheap	俩 two	贷 loan	顺 smooth	柔 soft
修 repair	保 protect	促 facilitate	侮 humiliate	俭 thrift	俗 tradition	俘 captive	信 trust	皇 emperor	泉 spring (water source)	鬼 ghost	怠 idle
侵 invade	追 chase	俊 handsome	盾 shield	待 wait	律 rule	很 very	须 must, beard	叙 account	剑 sword	逃 flee	勇 brave
食 eat	盆 basin	胆 gall bladder	胜 win	胞 compatriot	胖 fat	脉 artery	勉 encourage	狭 narrow	狮 lion	独 separate	盈 full
狡 sly	狱 prison	狠 ruthless	贸 trade	怨 grudge	急 hurry	饶 spare (e.g. a life)	蚀 eclipse	饺 dumpling	饼 biscuit	弯 curve	贺 congratulate
将 use, general (military)	奖 prize	哀 sad	亭 pavilion	亮 bright	度 degree	迹 trace	庭 yard	疮 ulcer	疯 crazy	疫 disease	架 shelf
疤 scar	姿 posture	亲 familial	音 sound	帝 emperor	施 carry out	闻 hear	阀 warlord	阁 pagoda	差 difference, bad, messenger	养 to rear	怒 anger
美 beauty	姜 a surname, ginger	叛 rebel	送 send	类 type	迷 to entrance	前 front	首 head	逆 reverse	总 overall	炼 smelt	娇 squeamish
炸 fry, explode	炮 cannon	烂 rot	剃 shave	洁 clean	洪 flood	洒 sprinkle	浇 to water	浊 muddy	洞 hole	测 measure	姻 marriage
洗 wash	活 alive	派 dispatch	洽 harmony	染 dye	济 assist	洋 ocean	洲 continent	浑 turbid	浓 dense	津 ford	姨 aunt (mother's sister)
恒 eternal	恢 restore	恰 exact	恼 anger	恨 hatred	举 raise	觉 sleep, aware	宣 announce	室 room	宫 palace	宪 constitution	姥 grandmother (maternal)
突 protrude	穿 wear	窃 steal	客 guest	冠 crown, to crown	语 language	扁 flat	袄 coat	祖 ancestor	神 god	祝 congratulate	娃 child
误 err	诱 tempt	说 say	诵 recite	垦 cultivate	退 retreat	既 since	屋 house	昼 daytime	费 spend	陡 steep	院 courtyard
眉 eyebrow	孩 child	除 remove	险 danger								

10 Strokes

耕 cultivate	耗 expend	艳 colourful	泰 grand	珠 pearl	班 class	素 plain	蚕 silkworm	顽 tenacious	盏 cup	匪 bandit	继 continue
捞 dredge	栽 to plant	捕 catch	振 shake	载 year, carry	赶 hurry	起 rise	盐 salt	捎 pass	捏 squeeze	埋 bury	绣 embroider
捉 catch	捆 bind	捐 donate	损 damage	都 all, capital	哲 philosophy	逝 pass away	捡 pick up	换 exchange	挽 pull	热 hot	验 experience

恐 fear	壶 kettle	挨 to bear	耻 shame	耽 delay	恭 deference	莲 lotus	莫 not	荷 lotus	获 quarry, harvest	晋 advance	绢 silk
恶 evil, dislike	真 real	框 frame	桂 cinnamon	档 obstruct	桐 candlenut	株 stump	桥 bridge	桃 peach	格 pane	校 proofread, school	桑 mulberry
核 core	样 likeness	根 root	索 rope	哥 elder brother	速 speed	逗 halt	栗 chestnut	配 match up	翅 wing	辱 insult	预 beforehand
唇 lip	夏 summer	础 fundamental	破 break	原 plains	套 sheath	逐 chase	烈 harsh	殊 sever	顾 look behind	轿 sedan	难 difficult, disaster
较 compare	顿 kowtow	毙 die	致 cause	柴 firewood	桌 table	虑 consider	监 guard	紧 tight	党 political party	晒 to sun	能 able
眠 sleep	晓 dawn	鸭 duck	晃 shimmer, shake	晌 noon	晕 dizzy	蚊 mosquito	哨 sentry	哭 cry	恩 favour	唤 call	通 open
啊 ah	唉 sigh	罢 give up	峰 peak	圆 circle	贼 thief	贿 bribe	钱 money	钳 clamp	钻 drill, diamond	铁 iron	娘 woman
铃 bell	铅 lead	缺 lack	氧 oxygen	特 special	牺 sacrifice	造 create	乘 ride, vehicle	敌 enemy	秤 steelyard	租 rent	娱 entertain
积 accumulate	秧 seedling	秩 order	称 to address, weigh	秘 secret	透 thorough	笔 writing brush	笑 laugh	笋 bamboo shoot	债 debt	借 borrow	陪 accompany
值 worth	倚 lean (on)	倾 lean	倒 fall over, pour	倘 if	俱 all	倡 promote	候 wait	俯 bend	倍 fold (2-, 3- etc.)	倦 tired	陷 sink
健 healthy	臭 odour	射 shoot	躬 to bow	息 breath	徒 walk	徐 gradual	舰 ship	舱 cabin	般 manner	航 voyage	陶 pottery
途 route	拿 take	爹 dad	爱 love	颂 ode	翁 old man	脆 crispy	脂 fat	胸 chest	胳 armpit	脏 dirty, organ	陵 mound
胶 glue	脑 brain	狸 leopard cat	狼 wolf	逢 meet	留 remain	皱 wrinkle	饿 hungry	恋 romance	桨 oar	浆 liquid	弱 weak
衰 decline	高 high	席 seat	准 allow, accurate	座 seat	脊 spine	症 symptom	病 illness	疾 illness	疼 pain	疲 fatigue	屑 scraps
效 result	离 depart	唐 Tang dynasty	资 fund	凉 chill	站 stand	剖 cut open	竞 complete	部 part	旁 beside	旅 journey	剧 drama
畜 livestock	阅 read	羞 shy	瓶 bottle	拳 fist	粉 powder	料 material	益 benefit	兼 annex	烤 roast	烘 to dry by heat	展 expand
烦 annoy	烧 burn	烛 candle	烟 smoke	递 deliver	涛 wave	浙 Zhejiang	涝 flood	酒 alcohol	涉 wade	消 disappear	恳 sincere
浩 vast	海 sea	涂 mud	浴 bath	浮 float	流 flow	润 moist	浪 wave	浸 soak	涨 rise	烫 scald	剥 peel
涌 surge	悟 realise	悄 quiet	悔 regret	悦 glad	害 harm	宽 wid	家 home, fellow	宵 night	宴 banquet	宾 guest	谊 friendship
窄 narrow	容 accommodate	宰 butcher	案 desk	请 invite	朗 bright	诸 every	读 read	扇 fan, to fan	袜 sock	袖 sleeve	谈 discuss
袍 robe	被 quilt	祥 auspicious	课 lesson	谁 who	调 transfer, adjust	冤 injustice	谅 forgive				

11 Strokes

球 ball, sphere	理 reason, logic, science	捧 hold in two hands	堵 stop	描 depict, trace	域 land, area	掩 cover, ambush	捷 win, victory	排 line up	掉 drop, fall	堆 pile, crowd	婶 wife of father's younger brother
推 push	掀 lift	授 teach, give	教 teach, teaching	掏 take out	掠 plunder	培 cultivate	接 extend, connect, receive	控 accuse	探 search	据 occupy	颈 neck, throat

11 Strokes

掘 dig	职 office, duty	基 foundation, base	著 obvious, author, tenacious	勒 constrain, strangle	黄 yellow	萌 sprout	萝 turnip	菌 mushroom, microbe	菜 vegetable	萄 grape	绩 spin
菊 chrysanthemum	萍 duckweed	菠 spinach	营 army	械 weapon, tool	梦 dream	梢 tip of branch	梅 plum, prune	检 check, examine	梳 comb, brush	梯 ladder, stair	绪 clue
桶 pail, bucket, tub	救 save, rescue, help	副 assist	票 ticket	戚 relative	爽 cheerful, straightforward	聋 deaf	袭 raid, inherit	盛 abundant	雪 snow	辅 assist	续 continue, success
辆 measure word for vehicles	虚 empty, false	雀 sparrow	堂 government office	常 common, frequent	匙 spoon	晨 dawn	睁 open eyes	眯 squint	眼 eye	悬 hang	骑 ride
野 field, wilderness	啦 assertive particle	晚 evening, night, late	啄 peck	距 distance	跃 jump	略 plan, outline, summary	蛇 snake	累 accumulate, tired	唱 sing, song	患 suffer	绳 rope
唯 only	崖 precipice	崭 steep peak	崇 honour	圈 circle	铜 copper, brass	铲 shovel	银 silver	甜 sweet	梨 pear	犁 plow	维 maintain
移 move, change	笨 stupid, clumsy	笼 cage	笛 flute	符 symbol	第 number	敏 fast, clever	做 do, make	袋 pocket, bag	悠 long time, far	偿 repay	绵 cotton
偶 accidentally, idol	偷 steal, thief	您 you (honorific)	售 sell	停 stop	偏 slant	假 false, holiday	得 obtain, Post-verb particle, must	衔 hold in mouth	盘 plate	船 boat	绸 silk
斜 slant	盒 box	鸽 pigeon, dove	悉 know	欲 desire, want, physical desire, any desire in general	彩 colour	领 neck	脚 foot	脖 neck	脸 face	脱 take off	绿 green
象 elephant	够 enough	猜 guess	猪 pig	猎 hunt	猫 cat	猛 violent, cruel	馅 filling, stuffing	馆 public building	凑 assemble	减 decrease	婚 marriage
毫 hair	麻 hemp	痒 itch	痕 scar	廊 porch	康 peaceful	庸 usual	鹿 deer	盗 steal, thief	章 chapter, section	竟 finally	隐 hide
商 commerce	族 clan, tribe, ethnicity	旋 revolve, revolving	望 hope	率 rate, command	着 move (board games), tactic, catch fire, feel, touch, wear, attach	盖 cover	粘 viscous	粗 rough, thick, rude	粒 grain	断 interrupt	隆 abundant
剪 scissors	兽 beast	清 clear	添 increase	淋 soak	淹 drown	渠 ditch, canal, gutter	渐 gradually	混 mix	渔 fisherman	淘 cleanse, eliminate	蛋 egg
液 liquid	淡 tasteless	深 deep	婆 grandmother	梁 beam of roof, bridge	渗 seep	情 feeling	惜 pity, regret	惭 shame	悼 grieve	惧 fear	随 follow
惕 cautious	惊 frighten	惨 cruel	惯 habit, custom	寇 bandit, enemy	寄 send	宿 stay overnight, Chinese constellation	窑 kiln	密 dense	谋 plan	谎 lie	弹 pellet, bullet, bounce
祸 disaster	谜 riddle	逮 seize	敢 brave	屠 butcher							

12 Strokes

琴 zither	斑 mottled	替 replace	款 funds	堪 to bear	搭 to set up	塔 tower	越 exceed	趁 to take an opportunity	趋 tend toward	超 super-, surpass	缎 shiny fabric
提 carry	堤 dike	博 knowledgeable	揭 uncover	喜 joy	插 insert	揪 to grab from	搜 search	煮 boil	援 aid	裁 to cut fabric	缓 slow
搁 to place	搂 embrace	搅 stir	握 to hold	揉 to rub	斯 this	期 time period	欺 cheat	联 union	散 disperse	惹 annoy	编 to braid
葬 to inter	葛 Kudzu vine	董 direct	葡 grape	敬 respect	葱 scallion	落 to fall	朝 to face, dawn	辜 guilt	葵 sunflower	棒 club (tool)	骗 swindle
棋 chess	植 to plant	森 verdant	椅 chair	椒 chilli	棵 counter for trees	棍 stick (tool)	棉 cotton	棚 shack	棕 brown	惠 favour	缘 edge
惑 confusion	逼 coerce	厨 kitchen	厦 tall building	硬 hard	确 sure	雁 wild goose	殖 colonise	裂 split	雄 imposing, heroic	暂 temporary	嫂 elder sister-in-law

雅 graceful	辈 generation	悲 sad	紫 purple	辉 glorious	敞 open	赏 to appreciate	掌 palm (hand)	晴 sunny	暑 hot weather	最 most	登 climb
量 to measure, amount	喷 spurt	晶 crystal	喇 (combining syllable)	遇 encounter	喊 shout	景 scenery	践 trample	跌 to fall down	跑 run	遗 abandon	絮 loose cotton
蛙 frog	蛛 spider	蜓 dragonfly	喝 shout, drink	喂 feed	喘 to pant	喉 throat	幅 width	帽 hat	赌 gamble	赔 reimburse	隙 space in between
黑 black	铸 to cast	铺 to lay	链 chain	销 smelt	锁 lock	锄 hoe	锅 wok	锈 rust	锋 knife edge	锐 sharp	隔 separate
短 short	智 wise	毯 rug	鹅 goose	剩 remain	稍 slight	程 extent	稀 rare	税 tax	筐 basket	等 wait	疏 uncrowded
筑 build	策 tactic	筛 dift	筒 cylinder	答 reply	筋 tendon	筝 kite	傲 arrogant	傅 mentor	牌 plaque	堡 fortress	粥 congee
集 gather	焦 charred	傍 next to	储 store	奥 deep	街 street	惩 punish	御 control, defend	循 circulate	艇 vessel	舒 comfort	强 stubborn, strong
番 times (once, twice, etc)	释 explain	禽 fowl	腊 twelfth month of the Chinese calendar	脾 spleen	腔 body cavity	鲁 rude	猾 sly	猴 monkey	然 thus	馋 greedy	屡 often
装 to pack into	蛮 barbarian	就 thus	痛 pain	童 child	阔 wide	善 good (vs evil)	羡 envy	普 universal	粪 faeces	尊 respect	属 belong to
道 path	曾 at sometime in the past	焰 flame	港 harbour	湖 lake	渣 crumbs	湿 wet	温 warm	渴 thirst	滑 slippery	湾 bay	谦 humble
渡 to cross	游 swim, travel	滋 grow	溉 irrigate	愤 anger	慌 panic	惰 lazy	愧 shame	愉 glad	慨 emotional	割 cut	谣 rumour
寒 cold	富 wealth	窜 scamper	窝 nest	窗 window	遍 everywhere	裕 prosperous	裤 trousers	裙 skirt	谢 thank		

13 Strokes

瑞 jade implement	魂 spirit	肆 anyhow	摄 absorb, take a photograph	摸 touch	填 fill up	搏 wrestle	塌 collapse	鼓 drum	摆 lay out	携 bring along	谨 cautious
搬 move	摇 sway	搞 fiddle with	塘 banks (water)	摊 lay out	蒜 garlic	勤 industrious	鹊 magpie	蓝 blue	墓 tomb	幕 curtain	福 auspicious
蓬 unkempt	蓄 store	蒙 cover, obscure, Mongolia, cheat, deceive, blind	蒸 steam	献 give	禁 forbid	楚 clear, stark	想 think	槐 pagoda tree	榆 elm	楼 floor (of multi-story building)	群 crowd
概 summary	赖 rely	酬 reward	感 feel	碍 obstruct	碑 monument	碎 shatter	碰 bump	碗 bowl	碌 busy	雷 thunder	殿 palace
零 zero	雾 fog	雹 hailstone	输 transport	督 oversee	龄 age	鉴 scrutiny, mirror	睛 eyeball	睡 sleep	睬 take notice of	鄙 look down on	辟 open up
愚 ignorant	暖 warm	盟 league	歇 rest	暗 dark	照 shine	跨 step over	跳 jump	跪 kneel	路 road	跟 follow	障 obstacle
遣 send	蛾 moth	蜂 bee, wasp	嗓 throat	置 to place	罪 sin	罩 cover	错 error	锡 tin	锣 cymbals	锤 hammer	嫌 dislike
锦 brocade	键 key (keyboard)	锯 saw (tool)	矮 short	辞 farewell	稠 dense	愁 worry	筹 calculate	签 signature, short stick, lots	简 simple	毁 destroy	嫁 marry
舅 mother's brother	鼠 mouse	催 to harry	傻 silly	像 resemble	躲 hide	微 tiny	愈 more and more	遥 far	腰 waist	腥 odour of raw meat	叠 fold
腹 abdomen	腾 leap	腿 leg	触 touch	解 untie	酱 sauce	痰 phlegm	廉 uncorrupt	新 new	韵 rhyme	意 meaning	缝 sew, gap
粮 grains	数 count, number	煎 fry	塑 sculpt	慈 kind	煤 coal	煌 glorious	满 filled	漠 desert	源 source	滤 filter	缠 wind around

滥 flood	滔 gushing	溪 stream	溜 slip away	滚 roll	滨 river banks	粱 sorghum	滩 beach	慎 prudent	誉 reputation	塞 cork, frontier chokepoint	

14 Strokes

静 quiet	碧 blue	璃 glass	墙 wall	撇 cast away	嘉 commend	摧 destroy	截 segment	誓 pledge	境 realm	摘 pluck	寨 encampment
摔 to fall	聚 gather	蔽 conceal	慕 admire	暮 dusk	蔑 look down on, libel	模 imitate, mould	榴 pomegranate	榜 announcement board	榨 extract	歌 song	赛 compete
遭 meet with (misfortune)	酷 hot	酿 ferment	酸 sour	磁 magnet	愿 wish	需 need	弊 disadvantage	裳 clothing	颗 counter for round things	嗽 cough	察 inspect
蜻 dragonfly	蜡 wax	蝇 fly (insect)	蜘 spider	赚 earn money	锹 spade	锻 forge	舞 dance	稳 stable	算 calculate	箩 basket	蜜 honey
管 pipe	僚 colleague	鼻 nose	魄 soul	貌 appearance	膜 membrane	膊 arm	膀 bladder	鲜 fresh	疑 doubt	馒 mantou	谱 music score
裹 wrap	敲 to hit	豪 talented person	膏 paste (substance)	遮 conceal	腐 rot	瘦 thin	辣 spicy	竭 exert	端 endpoint	旗 flag	嫩 tender
精 refine	歉 apology	熄 put out (fire)	熔 melt	漆 paint	漂 float around, bleach, pretty	漫 all over the place	滴 drip	演 to act	漏 leak	慢 slow	翠 green
熊 bear (animal)	凳 stool	骡 mule	缩 shrink								

15 Strokes

慧 wisdom	撕 tear apart	撒 scatter	趣 interest	趟 counter for trips	撑 hold up	播 broadcast	撞 to ram	撤 retreat	增 increase	聪 intelligent	鞋 shoe
蕉 banana	蔬 vegetable	横 horizontal	槽 trough	樱 cherry	橡 rubber	飘 flutter	醋 vinegar	醉 drunk	震 tremor	慰 console	劈 split apart
霉 mould, bad luck	瞒 to cover up (e.g. truth)	题 topic	暴 violent	瞎 blind	影 shadow	踢 kick	踏 trample	踩 step on	踪 tracks	蝶 butterfly	潮 tide
蝴 butterfly	嘱 advise	墨 ink	镇 town	靠 rely on	稻 paddy	黎 multitude	稿 draft (e.g. essay)	稼 to plant	箱 box	箭 arrow	懂 understand
篇 piece of writing	僵 rigid	躺 lie down	僻 out-of-the-way	德 virtue	艘 counter for ships	膝 knee	膛 chest	熟 cooked	摩 rub	颜 face	额 forehead
毅 perseverance	糊 glue	遵 obey	潜 dive								

16 Strokes

操 grasp	燕 northern Hebei province, swallow (bird)	薯 yam, potato	薪 firewood	薄 thin, meager	颠 upside down	橘 orange (fruit)	整 neaten	融 melt	醒 wake up	餐 meal	嘴 mouth
蹄 hoof	器 machine	赠 give	默 silent	镜 mirror	赞 praise	篮 basket	邀 invite	衡 balance	膨 swell	雕 carve, condor	磨 grind
凝 condense	辨 distinguish	辩 debate	糖 sugar	糕 sticky cake	燃 burn	澡 bathe	激 agitate	懒 lazy	壁 wall	避 evade	缴 hand over

17 Strokes

戴 wear (a hat)	擦 wipe	鞠 to bow	藏 to hide, treasure	霜 frost	霞 dawn / dusk glow	瞧 look	蹈 dance	螺 whorl	穗 tassel	繁 complicated	辫 braided hair
赢 win	糟 rotten, poor	糠 husks	燥 hot	臂 arm	翼 wing	骤 sudden					

18 Strokes

鞭 whip	覆 overturn	蹦 jump	镰 sickle	翻 turn over	鹰 eagle						

LANGUAGE Chinese Character List

19 Strokes

警 alert	攀 climb	蹲 squat	颤 shake	瓣 petal	爆 explode	疆 frontier					

20 Strokes

壤 soil	耀 shine	躁 rash	嚼 chew	嚷 shout	籍 record	魔 demon; magic	灌 irrigate				

21 Strokes

蠢 stupid	霸 hegemon	露 dew, expose									

22 Strokes

囊 bag											

23 Strokes

罐 jar											

Common Words

Numbers

一 One	二 Two	三 Three	四 Four	五 Five	六 Six	七 Seven	八 Eight	九 Nine	十 Ten	十一 Eleven	十二 Twelve
二十 20	二十一 21	二十八 28	八十二 82	九十九 99							

Common Phrases

4 French

French is a Romance language of the Indo-European family. It descended from the Vulgar Latin of the Roman Empire, as did all Romance languages. French evolved from Gallo-Romance, the spoken Latin in Gaul, and more specifically in Northern Gaul. Its closest relatives are the other langues d'oïl—languages historically spoken in northern France and in southern Belgium, which French (Francien) has largely supplanted. French was also influenced by native Celtic languages of Northern Roman Gaul like Gallia Belgica and by the (Germanic) Frankish language of the post-Roman Frankish invaders. Today, owing to France's past overseas expansion, there are numerous French-based creole languages, most notably Haitian Creole. A French-speaking person or nation may be referred to as Francophone in both English and French. It is spoken as a first language (in descending order of the number of speakers) in France, Canadian provinces of Quebec, Ontario and New Brunswick as well as other Francophone regions, Belgium (Wallonia and the Brussels-Capital Region), western Switzerland (cantons of Bern, Fribourg, Geneva, Jura, Neuchâtel, Vaud, Valais), Monaco, parts of the United States (Louisiana, Maine, New Hampshire, and Vermont), partly in Luxembourg and in northern Italy (region of Aosta Valley), and by various communities elsewhere.

French is estimated to have about 76 million native speakers and about 235 million daily, fluent speakers and another 77 to 110 million secondary speakers who speak it as a second language to varying degrees of proficiency, mainly in Africa. According to the Organisation internationale de la Francophonie (OIF), approximately 300 million people worldwide are "able to speak the language", without specifying the criteria for this estimation or whom it encompasses. According to a demographic projection led by the Université Laval and the Réseau Démographie de l'Agence universitaire de la francophonie, the total number of French speakers will reach approximately 500 million in 2025 and 650 million by 2050. OIF estimates 700 million by 2050, 80% of whom will be in Africa.

Alphabet

A [a] as in arm	B [be] as in bed	C [se] as in celebrate	D [de] as in delicious	E [eo] as in supple	F [ef] as in elephant	G [ge] as in genesis	H [ash] as in ashtray	I [e] as in eel	J [ji] as in Jim	K [ka] as in carrot	L [el] as in eliminate
M [em] as in hemisphere	N [en] as in enter	O [o] as in orange	P [pe] as in pet	Q [ku] as in cure	R [err] as in eradicate	S [es] as in esthetic	T [te] as in television	U [u] as in cute	V [ve] as in vehicule	W [woa] 4 as in what [va] as in valley	X [ix] as in fix
Y [e grehk] as in eel, graph & trek	Z [zed] as in zebra and dance										

Common Words

Zéro 0	**Un** 1	**Deux** 2	**Trois** 3	**Quatre** 4	**Quatre** 5	**Six** 6	**Sept** 7	**Huit** 8	**Neuf** 9	**Dix** 10	**Onze** 11
Douze 12	**Treize** 13	**Quatorze** 14	**Quinze** 15	**Seize** 16	**Dix-sept** 17	**Dix-huit** 18	**Dix-neuf** 19	**Vingt** 20	**Vingt et un** 21		

Common Phrases

5 German

German is a West Germanic language that is mainly spoken in Central Europe. It is the most widely spoken and official or co-official language in Germany, Austria, Switzerland, South Tyrol in Italy, the German-speaking Community of Belgium, and Liechtenstein. It is also one of the three official languages of Luxembourg and a co-official language in the Opole Voivodeship in Poland. The languages which are most similar to German are the other members of the West Germanic language branch: Afrikaans, Dutch, English, the Frisian languages, Low German/Low Saxon, Luxembourgish, and Yiddish. One of the major languages of the world, German is a native language to almost 100 million people worldwide and the most widely spoken native language in the European Union. German is the third most commonly spoken foreign language in the EU after English and French, making it the second biggest language in the EU in terms of overall speakers.

German is an inflected language with four cases for nouns, pronouns and adjectives (nominative, accusative, genitive, dative), three genders (masculine, feminine, neuter), two numbers (singular, plural), and strong and weak verbs. German derives the majority of its vocabulary from the ancient Germanic branch of the Indo-European language family. A portion of German words are derived from Latin and Greek, and fewer are borrowed from French and Modern English. With slightly different standardized variants (German, Austrian and Swiss Standard German), German is a pluricentric language. It is also notable for its broad spectrum of dialects, with many unique varieties existing in Europe and also other parts of the world. Due to the limited intelligibility between certain varieties and Standard German, as well as the lack of an undisputed, scientific difference between a "dialect" and a "language", some German varieties or dialect groups (e.g. Low German or Plautdietsch) are alternatively referred to as "languages" or "dialects".

Alphabet

A Ah Arm	B Beh Baby	C Tseh Celsius	D Deh Debatte	E Eh Eskimo	F Eff Familie	G Geh Gold	H Hah Haus	I Ih Idee	J Yott Januar	K Kah Kaffee	L Ell Lampe
M Emm Mutter	N Enn Nase	O Oh Ozean	P Peh Pause	Q Kuh Quiz	R Err Regen	S Ess Salami	T The Telefon	U Uh Uhr	V Fau Vater	W Veh Wilkommen	X Iks X-Beine
Y Ypsilon Yoga	Z Tzett Zombie										

6 Hindi

Hindi, or Modern Standard Hindi is a standardised and Sanskritised register of the Hindustani language. Hindi, written in the Devanagari script, is one of the official languages of India, along with the English language. It is one of the 22 scheduled languages of the Republic of India. However, it is not the national language of India because no language was given such a status in the Indian constitution. Hindi is the lingua franca of the Hindi belt, and to a lesser extent other parts of India (usually in a simplified or pidginized variety such as Bazaar Hindustani or Haflong Hindi). Outside India, several other languages are recognized officially as "Hindi" but do not refer to the Standard Hindi language described here and instead descend from other dialects of Hindustani, such as Awadhi and Bhojpuri. As a linguistic variety, Hindi is the fourth most-spoken first language in the world, after Mandarin, Spanish and English. Alongside Urdu as Hindustani, it is the third most-spoken language in the world, after Mandarin and English.

Alphabet (Devanagari)

Alphabet - Vowels

अ a	आ ā	इ i	ई ī	उ u	ऊ ū	ऋ ṛ	ए e	ऐ ai	ओ o	औ au	अं aṅ
अः aḥ	अँ ãṃ										
प pa	पा pā	ि प pi (Appears Incorrect)	पी pī	प ु pu (Appears Incorrect)	पू pū	पृ pṛ	प े pe (Appears Incorrect)	प ै pai (Appears Incorrect)	पो po	पौ pau	पं paṅ
पः paḥ	पाँ pāṃ										

Alphabet - Consonants

क ka	ख kha	ग ga	घ gha	ङ ṅa	च ca	छ cha	ज ja	झ jha	ञ ña	ट ṭa	ठ ṭha
ड ḍa	ढ ḍha	ण ṇa	त ta	थ tha	द da	ध dha	न na	प pa	फ pha	ब ba	भ bha

म ma	य ya	र ra	ल la	व va							
श śa	ष ṣa	स sa	ह ha	क़ qa	ख़ ḫa	ग़ ġa	ज़ za	• zha (Appears Incorrect)	फ़ fa	ड़ ṛa	ढ़ rha
• ksa (Appears Incorrect)	• jña (Appears Incorrect)	• dva (Appears Incorrect)	• dya (Appears Incorrect)	• dda (Appears Incorrect)	• tta (Appears Incorrect)	• dma (Appears Incorrect)	• hma (Appears Incorrect)	• hya (Appears Incorrect)	• śra (Appears Incorrect)	• tra (Appears Incorrect)	प• rpa (Appears Incorrect)
• pra (Appears Incorrect)	• tra (Appears Incorrect)										

Alphabet - Numerals

० 0	१ 1	२ 2	३ 3	४ 4	५ 5	६ 6	७ 7	८ 8	९ 9		

7 Italian

Italianis a Romance language of the Indo-European language family. Italian, together with Sardinian, is by most measures the closest language to Vulgar Latin of the Romance languages. Italian is an official language in Italy, Switzerland (where it is the first language in Canton Ticino and in the districts of Moesa and Bernina in Canton Graubünden), San Marino and Vatican City. Italian is a major European language, being one of the official languages of the Organization for Security and Co-operation in Europe and one of the working languages of the Council of Europe. It is the fourth most widely spoken first language in the European Union with 69 million native speakers (13% of the EU population) and it is spoken as a second language by 16 million EU citizens (3%). Including Italian speakers in non-EU European countries (such as Switzerland and Albania) and on other continents, the total number of speakers is around 90 million.

Alphabet

Aa a	Bb bi	Cc ci	Dd di	Ee e	Ff effe	Gg gi	Hh acca	Ii i	Ll elle	Mm emme	Nn enne
Oo o	Pp pi	Qq cu	Rr erre	Ss esse	Tt ti	Uu u	Vv vi	Zz zeta			

8 Japanese

Japanese is an East Asian language spoken by about 128 million people, primarily in Japan, where it is the national language. It is a member of the Japonic (or Japanese-Ryukyuan) language family, and its relation to other languages, such as Korean, is debated. Japanese is an agglutinative, mora-timed language with simple phonotactics, a pure vowel system, phonemic vowel and consonant length, and a lexically significant pitch-accent.

Word order is normally subject–object–verb with particles marking the grammatical function of words, and sentence structure is topic–comment. Sentence-final particles are used to add emotional or emphatic impact, or make questions. Nouns have no grammatical number or gender, and there are no articles. Verbs are conjugated, primarily for tense and voice, but not person. Japanese equivalents of adjectives are also conjugated. Japanese has a complex system of honorifics with verb forms and vocabulary to indicate the relative status of the speaker, the listener, and persons mentioned.

Japanese Characters
Hiragana and katakana (collectively referred to as kana) are syllabic writing, that is, each character represents a syllable such as "ta" or "o". They're purely phonetic so they don't have direct connotations like kanji do, and both have the same set of syllables.

Hiragana	Hiragana is generally used for Japanese words when they're not written in kanji, and for all the grammatical "glue" such as conjugations and particles.
Katakana	Katakana is usually used for loanwords and onomatopoeia. There's no strict rule though, so you will see katakana used for other purposes as well, such as emphasis.
Kanji	Kanji is ideographic writing, that is, each character represents a concept or an idea. For example, 水 means "water" while 朝 means "morning". Each character also has one or more readings, and the correct one depends on which word the kanji is part of. Many kanji (such as my two examples) can also act as stand-alone words.
Rōmaji	The romanization of Japanese is the use of Latin script to write the Japanese language. This method of writing is sometimes referred to in Japanese as rōmaji (ローマ字, literally, "Roman letters"). There are several different romanization systems. The three main ones are Hepburn romanization, Kunrei-shiki romanization (ISO 3602), and Nihon-shiki romanization (ISO 3602 Strict). Variants of the Hepburn system are the most widely used.

	Dakuten Symbol	Handakuten Symbol
Character Symbols Marks placed after certain katakana that modify the way the consonant is pronounced. These marks indicate that the consonant of the syllable should be voiced.	゛	゜

Font
The font type plays an important role in how the characters are displayed like serifs in English. An alternative font is put beside the character in Times New Roman as different fonts can change the way they are displayed.

Practice If society is still functioning you can use the following websites to learn Hiragana and Katakana via a drag-and-drop interface. If there's no access to the website you could still draw the symbols and words on different post-it notes and try to match them up.	**Hiragana Practice** www.csus.edu/indiv/s/sheaa/projects/genki/hiragana-timer.html	**Katakana Practice** www.csus.edu/indiv/s/sheaa/projects/genki/katakana-timer.html

Hiragana

To learn hiragana is to create a foundation for the rest of your Japanese. By learning hiragana, you will learn the basics of Japanese pronunciation. It will also open doors in terms of the Japanese resources you can use. There are no (good) Japanese textbooks or learning resources that don't require you to know hiragana. In essence, it's the first step to learn Japanese. Many classes and individuals spend months learning hiragana. This is too long. You should be able to learn everything in a couple days.

Hiragana		K-	S-	T-	N-	H-	M-	Y-	R-	W-	N
-A	あ あ A "a" in ah	か か KA "ka" in karate	さ さ SA "sa" in sarcasm	た た TA	な な NA	は は HA	ま ま MA "ma" in mama	や や YA	ら ら RA	わ わ WA	ん ん N
-I	い い I "ee" in eel	き き KI "key" in key	し し SHI "shi" in ship	ち ち CHI	に に NI	ひ ひ HI	み み MI "mi" in middle		り り RI		
-U	う う U "ou" in you	く く KU "ku" in kudo	す す SU	つ つ TSU	ぬ ぬ NU	ふ ふ FU / HU	む む MU "moo"	ゆ ゆ YU "you"	る る RU		
-E	え え E "e" in egg	け け KE "ke" in kelp	せ せ SE "se" in set	て て TE	ね ね NE	へ へ HE	め め ME "me" in meh		れ れ RE		
-O	お お O "o" in original	こ こ KO "co" in cot	そ そ SO "so" in soh	と と TO "to" in toe	の の NO	ほ ほ HO	も も MO	よ よ YO	ろ ろ RO	を を WO	

Hiragana Dakuten

Dakuten takes hiragana and adds an additional symbol to it to change its pronunciation. This symbol either looks like a quotation mark or a small circle.

Hiragana Dakuten	-A	-I	-U	-E	-O	
G-	か → が KA > GA	き → ぎ KI > GI	く → ぐ KU > GU	け → げ KE > GE	こ → ご KO > GO	
Z-	さ → ざ SA > ZA	し → じ SHI > JI	す → ず SU > ZU	せ → ぜ SE > ZE	そ → ぞ SO > ZO	
D-	た → だ TA > DA	ち → ぢ CHI > DZI	つ → づ TSU > DZU	て → で TE > DE	と → ど TO > DO	
B-	は → ば HA > BA	ひ → び HI > BI	ふ → ぶ HU/FU > BU	へ → べ HE > BE	ほ → ぼ HO > BO	
P-	は → ぱ HA > PA	ひ → ぴ HI > PI	ふ → ぷ HU/FU > PU	へ → ぺ HE > PE	ほ → ぽ HO > PO	

Combination Hiragana

Combines different types of kana together to make new sounds. Mainly, we're going to focus on what small ゃ, ゅ, and ょ can do to kana from the い row (that includes き, し, じ, に, etc). To use these, you'll need to combine them with something from the い column. When you do this, you're essentially combining the first (English) letter of the い-kana with the small ゃ, ゅ, ょ sound.

Size Difference	やゃ	ゆゅ	よょ	つっ							
Combination	き + ゃ KIYA → KYA		じ + ょ JIYO → JYO		The "i" gets dropped and it just becomes one syllable of sound.						
Combinations - A	きゃ KYA	ぎゃ GYA	しゃ SHA	じゃ JYA / JA	ちゃ CHA	ぢゃ DZYA	にゃ NYA	ひゃ HYA	びゃ BYA	ぴゃ PYA	みゃ MYA
Combinations - U	きゅ KYU	ぎゅ GYU	しゅ SHU	じゅ JYU / JU	ちゅ CHU	ぢゅ DYZU	にゅ NYU	ひゅ HYU	びゅ BYU	ぴゅ PYU	みゅ MYU
Combinations - O	きょ KYO	ぎょ GYO	しょ SHO	じょ JYO / JO	ちょ CHO	ぢょ DYZO	にょ NYO	ひょ HYO	びょ BYO	ぴょ PYO	みょ MYO
Combinations - A	りゃ RYA										
Combinations - U	りゅ RYU										

Combinations - O	りょ RYO										

As you may have noticed, there's no いゃ sound and there's no combination kana for the Y-column. The first kana has to be a sound with a strong consonant in it, and both "i" and "yi" don't fit the bill. Also, "yi" doesn't exist in modern Japanese.

Small TSU
The small tsu is a weird little thing but we'll make sense of it. The easiest way to think of it, I think, is to call it a "double consonant." Basically, by adding a small っ to something, you are making the (English) letter that follows it double into two consonants. Luckily, you won't see a small tsu before any of the あいうえお kana, so that never becomes an issue. Let's take a look at how the following hiragana converts to romaji.

したい shitai	しったい shit_tai	かこ kako	かっこ kak_ko	いた ita	いった it_ta						

See how that worked? したい is just plain "shitai" without the small っ. But when you add it in, it becomes shittai. The small っ that comes before the "ta" causes the consonant to double, making it "shit_tai." Make sure you understand how that works with kako/kakko too. In terms of pronunciation, this is different as well. It's almost as if you add a small stop where the small っ exists, with one of the double consonants on either side.

Katakana

Katakana is used for transcribing foreign (non-japanese) words. The sounds available in the Japanese languages are not as flexible as many other languages. Therefore, words that are transcribed to katakana often don't sound like the original.

Katakana Uses
- Scientific Words
- Animal Names
- Many Foods
- Company Names
- Emphasized Text

Katakana		K-	S-	T-	N-	H-	M-	Y-	R-	W-	N
-A	ア ア A	カ カ KA	サ サ SA	タ タ TA	ナ ナ NA	ハ ハ HA	マ マ MA	ヤ ヤ YA	ラ ラ RA	ワ ワ WA	ン ン N
-I	イ イ I	キ キ KI	シ シ SHI	チ チ CHI	ニ ニ NI	ヒ ヒ HI	ミ ミ MI		リ リ RI		
-U	ウ ウ U	ク ク KU	ス ス SU	ツ ツ TSU	ヌ ヌ NU	フ フ FU	ム ム MU	ユ ユ YU	ル ル RU		
-E	エ エ E	ケ ケ KE	セ セ SE	テ テ TE	ネ ネ NE	ヘ ヘ HE	メ メ ME		レ レ RE		
-O	オ オ O	コ コ KO	ソ ソ SO	ト ト TO	ノ ノ NO	ホ ホ HO	モ モ MO	ヨ ヨ YO	ロ ロ RO	ヲ ヲ WO	

Katakana Dakuten

Dakuten takes katakana and adds an additional symbol to it to change its pronunciation. This symbol either looks like a quotation mark or a small circle.

Katakana Dakuten	-A	-I	-U	-E	-O	
G-	カ → ガ KA > GA	キ → ギ KI > GI	ク → グ KU > GU	ケ → ゲ KE > GE	コ → ゴ KO > GO	
Z-	サ → ザ SA > ZA	シ → ジ SHI > JI	ス → ズ SU > ZU	セ → ゼ SE > ZE	ソ → ゾ SO > ZO	
D-	タ → ダ TA > DA	チ → ヂ CHI > DZI (or JI)	ツ → ヅ TSU > DZU (or ZU)	テ → デ TE > DE	ト → ド TO > DO	
B-	ハ → バ HA > BA	ヒ → ビ HI > BI	フ → ブ FU > BU	ヘ → ベ HE > BE	ホ → ボ HO > BO	
P-	ハ → パ HA > PA	ヒ → ピ HI > PI	フ → プ FU > PU	ヘ → ペ HE > PE	ホ → ポ HO > PO	

Combination Katakana

Combinations - A	キャ KYA	ギャ GYA	シャ SHA	ジャ JYA (JA)	チャ CHA	ヂャ DYZA	ニャ NYA	ヒャ HYA	ビャ BYA	ピャ PYA	ミャ MYA
Combinations - U	キュ KYU	ギュ GYU	シュ SHU	ジュ JYU (JU)	チュ CHU	ヂュ DYZU	ニュ NYU	ヒュ HYU	ビュ BYU	ピュ PYU	ミュ MYU

Combinations - O	キョ KYO	ギョ GYO	ショ SHO	ジョ JYO (JO)	チョ CHO	ヂョ DYZO	ニョ NYO	ヒョ HYO	ビョ BYO	ピョ PYO	ミョ MYO
Combinations - A	リャ RYA										
Combinations - U	リュ RYU										
Combinations - O	リョ RYO										
Combinations - V	ヴァ BWA VA	ヴィ BWI VI	ヴ BU VU	ヴェ BWE VE	ヴォ BWO VO						
Combinations - W	ウィ WI UI	ウェ WE UE	ウォ WO UO								
Combinations - F	ファ FA	フィ FI	フェ FE	フォ FO							
Other Combinations	シェ SHE	ジェ JE	チェ CHE	トゥ TO Like "two"	ティ TY Like par"ty"	ドゥ DU Like "dew"	ディ DY Like fre"die"	ツァ TSA	ツィ TSI	ツェ TSE	ツォ TSO

Combinations

Small A	Small combining form of hiragana あ (a) used to explicitly specify the vowel part of the previous hiragana character, or to show a speaker's pronunciation or extension of that vowel.	あ ア	ふぁ - the sound [ɸa] rather than [ɸɯ] (ふ) or [ha] (は) ふぁん - transliteration of English fan.
Small I	Small combining form of hiragana い (i) used to explicitly specify the vowel part of the previous hiragana character, or to show a speaker's pronunciation or extension of that vowel.	い イ	ふぃ - the sound [ɸi] rather than [ɸɯ] (ふ) or [çi] (ひ) ふぃぎゅあ - transliteration of English figure.
Small U	Small combining form of hiragana う (u) used to explicitly specify the vowel part of the previous hiragana character, or to show a speaker's pronunciation or extension of that vowel.	う ウ	でぅ - the sound [du] rather than [de] (で) or [zu] (づ) ですぅ - specifies that the final u in です (desu) should not be silent ですぅぅぅ - specifies that the final u in です (desu) should be very long.
Small E	Small combining form of katakana エ (e) used to explicitly specify the vowel part of the previous katakana character, or to show a speaker's pronunciation or extension of that vowel.	え エ	ちぇ - the sound [tɕe] rather than [tɕi] (ち) or [te] (て) ちぇんじ - transliteration of English change.
Small O	Small combining form of hiragana お (o) used to explicitly specify the vowel part of the previous hiragana character, or to show a speaker's pronunciation or extension of that vowel.	お オ	ふぉ - the sound [ɸo] rather than [ɸɯ] (ふ) or [ho] (ほ) しふぉん - transliteration of French chiffon.
Small Ka	Small combining form of hiragana か.	か カ	
Small Tsu	A symbol consisting of a small Tsu (compare with normal Tsu: ツッ). It is used to insert a slight pause. In no case is it pronounced like the full-size つ (tsu).	つ ツ	● Preceeding Consonant: If preceding a consonant, results in the following consonant being geminate; an English example is cattail. ● Word Ending: If ending a word, results in the word ending in a glottal stop. A glottal stop or "choked sound". あっ！(Ah!) ● Combination: The sokuon: a small form of つ (tsu). In romanization, this is represented by doubling the following consonant. The equivalent in katakana is ッ. (いっぱい — ippai) (もっと — motto) (すっぱい — suppai) (おっぱい — oppai)
Small Yo	Small combining form of hiragana よ (yo) used in 拗音 (yōon) morae that end in o, such as しょ (sho), ちょ (cho), and きょ (kyo). Historically not distinguished from full-size version.	よ ヨ	
Small Ya	Combining form of や, used in yōon mora (拗音) that end in the a sound.	や ヤ	This letter appears in the hiragana きゃ (kya), しゃ (sha), ちゃ (cha), にゃ (nya), ひゃ (hya), みゃ (mya), and りゃ (rya); in the dakuten (濁点) ぎゃ (gya), じゃ (ja), and びゃ (bya); and in the handakuten (半濁点) ぴゃ (pya).
Small Yu	Small combining form of hiragana ゆ (yu) used in 拗音 (yōon) morae that end in u, such as しゅ (shu), ちゅ (chu), and きゅ (kyu). Historically not distinguished from full-size version.	ゆ ユ	
Long Vowels (Chōonpu)	Unlike hiragana, which deals with long vowels by adding more vowels to things, katakana has a special vowel extender character. Luckily it's very simple: a dash.	ー	When you see this, you'll just need to extend the vowel that it comes after. ベコン → becon ベーコン → beecon

Hiragana / Katakana

A side by side comparision of the same characters in hiragana and katakana. Both symbols share the same lettering but are used differently.

Hiragana / Katakana		K-	S-	T-	N-	H-	M-	Y-	R-	W-	N
-A	あ ア A	か カ KA	さ サ SA	た タ TA	な ナ NA	は ハ HA	ま マ MA	や ヤ YA	ら ラ RA	わ ワ WA	ん ン N
-I	い イ I	き キ KI	し シ SHI	ち チ CHI	に ニ NI	ひ ヒ HI	み ミ MI		り リ RI		
-U	う ウ U	く ク KU	す ス SU	つ ツ TSU	ぬ ヌ NU	ふ フ FU / HU	む ム MU	ゆ ユ YU	る ル RU		
-E	え エ E	け ケ KE	せ セ SE	て テ TE	ね ネ NE	へ ヘ HE	め メ ME		れ レ RE		
-O	お オ O	こ コ KO	そ ソ SO	と ト TO	の ノ NO	ほ ホ HO	も モ MO	よ ヨ YO	ろ ロ RO	を ヲ WO	

Dakuten Combinations

A side by side comparision of the same dakuten characters in hiragana and katakana.

Dakuten Combinations	-A	-I	-U	-E	-O
G-	が ガ GA	ぎ ギ GI	ぐ グ GU	げ ゲ GE	ご ゴ GO
Z-	ざ ザ ZA	じ ジ JI	ず ズ ZU	ぜ ゼ ZE	ぞ ゾ ZO
D-	だ ダ DA	ぢ ヂ DZI (or JI)	づ ヅ DZU (or ZU)	で デ DE	ど ド DO
B-	ば バ BA	び ビ BI	ぶ ブ BU	べ ベ BE	ぼ ボ BO
P-	ぱ パ PA	ぴ ピ PI	ぷ プ PU	ぺ ペ PE	ぽ ポ PO

Kanji

Kanji are adopted logographic Chinese characters that are used in the Japanese writing system. They are used alongside the Japanese syllabic scripts hiragana and katakana. The Japanese term kanji for the Chinese characters literally means "Han characters". It is written with the same characters in the Chinese language to refer to the character writing system, hànzì (漢字). There are 1,945 characters below sorted by grade.

Jōyō Kanji	The jōyō kanji is the guide to kanji characters announced officially by the Japanese Ministry of Education. Current jōyō kanji are those on a list of 1,945 characters issued on October 10, 1981. (This is the format below)
JLPT Kanji	The Japanese Language Proficiency Test, or JLPT, is a standardized criterion-referenced test to evaluate and certify the Japanese language proficiency of non-native speakers. It is held twice a year in East Asia and once a year in other regions. The JLPT has five levels, with Level N5 being the most basic and Level N1 the most difficult.
Frequent Kanji	2,500 kanji ordered in a list that expresses the relative frequency of occurence of a character in the modern Japanese. The survey is based on newspaper articles.
Jinmeiyō Kanji	The Jinmeiyō Kanji (Chinese characters for use in personal names) are a set of 983 Chinese characters known as the "name kanji" in English. They are a supplementary set of characters which can be legally used in registered personal names in Japan, despite not being in that country's set of "commonly used characters".

Grade 1

一 one	六 six	力 power; strong; strain; bear up; exert	林 grove; forest	立 stand up	夕 evening	木 tree; wood	目 eye; class; look; insight; experience; care; favor	名 name; noted; distinguished; reputation	本 book; present; main; true; real; counter for long cylindrical things	文 sentence; literature; style; art; decoration; figures; plan;	八 eight
花 flower	百 hundred	白 white	二 two	日 day; sun; Japan; counter for days	入 enter; insert	年 year; counter for years	土 soil; earth; ground; Turkey	町 town; village; block; street	天 heavens; sky; imperial	田 rice field; rice paddy	虫 insect; bug; temper
火 fire	男 male	竹 bamboo	中 in; inside; middle; mean; center	大 large; big	早 early; fast	草 grass; weeds; herbs; pasture; write; draft	足 leg; foot; be sufficient; counter for pairs of footwear	村 village; town	石 stone	赤 red	先 before; ahead; previous; future; precedence

下 below; down; descend; give; low; inferior	千 thousand	川 stream; river	正 correct; justice; righteous	生 life; genuine; birth	青 blue; green	水 water	森 forest; woods	人 person	女 woman; female	小 little; small	上 above; up
音 sound; noise	出 exit; leave	十 ten	手 hand	車 car	耳 ear	七 seven	字 character; letter; word; section of village	糸 thread	四 four	子 child; sign of the rat; 11PM-1AM; first sign of Chinese zodiac	三 three
王 king; rule; magnate	山 mountain	左 left	校 exam; school; printing; proof; correction	口 mouth	五 five	月 month; moon	犬 dog	見 see; hopes; chances; idea; opinion; look at; visible	金 gold	九 nine	空 empty; sky; void; vacant; vacuum
円 circle; yen; round	玉 jewel; ball	気 spirit; mind; air; atmosphere; mood	休 rest; day off; retire; sleep	貝 shellfish	学 study; learning; science	右 right	雨 rain				

Grade 2

科 department; course; section	話 tale; talk	来 come; due; next; cause; become	理 logic; arrangement; reason; justice; truth	里 ri; village; parent's home; league	曜 weekday	用 utilize; business; service; use; employ	友 friend	門 gate; counter for cannons	夜 night; evening	野 plains; field; rustic; civilian life	矢 dart; arrow
歌 song; sing	毛 fur; hair; feather; down	明 bright; light	鳴 chirp; cry; bark; sound; ring; echo; honk	毎 every	万 ten thousand	歩 walk; counter for steps	母 mama; mother	方 direction; person; alternative	北 north	妹 younger sister	聞 hear; ask; listen
画 brush-stroke; picture	米 rice; USA; metre	風 wind; air; style; manner	分 part; minute of time; segment; share; degree;	父 father	麦 barley; wheat	半 half; middle; odd number;	番 turn; number in a series	買 buy	売 sell	南 south	肉 meat
会 times; round; game; revolve; counter for occurrences	馬 horse	頭 head; counter for large animals	同 same; agree; equal	道 road-way; street; district; journey; course; moral; teachings	読 read	内 inside; within; between; among; house; home	冬 winter	刀 sword; saber; knife	東 east	当 hit; right; appropriate; himself	答 solution; answer
引 pull; tug; jerk; admit; install; quote; refer to	朝 morning; dynasty; regime; epoch; period; (North) Korea	長 long; leader	鳥 bird; chicken	直 straightaway; honesty; frankness; fix; repair	通 traffic; pass through; avenue; commute; counter for letters, notes, documents, etc.	弟 younger brother; faithful service to elders	店 store; shop	点 spot; point; mark; speck; decimal point	電 electricity	知 know; wisdom	地 ground; earth
何 what	池 pond; cistern; pool; reservoir	茶 tea	昼 daytime; noon	谷 valley	台 pedestal; a stand; counter for machines and vehicles	体 body; substance; object; reality; counter for images	走 run	多 many; frequent; much	太 plump; thick; big around	組 association; braid; plait; construct; assemble; unite; cooperate; grapple	切 cut; cutoff; be sharp
夏 summer	雪 snow	線 line; track	船 ship; boat	前 in front; before	星 star; spot; dot; mark	晴 clear up	声 voice	西 west; Spain	図 map; drawing; plan; unexpected; accidentally	数 number; strength; fate; law; figures	色 color
家 house; home	食 eat; food	心 heart; mind; spirit	新 new	親 parent; intimacy; relative; familiarity	場 location; place	書 write	少 few; little	春 springtime; spring (season)	週 week	首 neck; counter for songs and poems	秋 autumn
黄 yellow	弱 weak; frail	社 company; firm; office; association; shrine	自 oneself	室 room; apartment; chamber; greenhouse; cellar	寺 Buddhist temple	時 time; hour	思 think	止 stop; halt	紙 paper	姉 elder sister	市 market; city; town
遠 distant; far	算 calculate; divining; number; abacus; probability	細 dainty; get thin; taper; slender; narrow	作 make; production; prepare; build	才 genius; years old; cubic shaku	行 going; journey	高 tall; high; expensive	合 fit; suit; join	国 country	黒 black	今 now	考 consider; think over
園 park; garden; yard; farm	工 craft; construction;	広 wide; broad; spacious	後 behind; back; later	語 word; speech; language	交 mingle; mixing; association; coming & going	光 ray; light	公 public; prince; official; governmental	午 noon; sign of the horse; 11AM-1PM; seventh sign of Chinese zodiac	言 say	古 old	戸 door; counter for houses

LANGUAGE — Japanese — Kanji — Grade 2

雲 cloud	計 plot; plan; scheme; measure	元 beginning; former time; origin	原 meadow; original; primitive; field; plain; prairie; tundra; wilderness	形 shape; form; style	近 near; early; akin; tantamount	兄 elder brother; big brother	教 teach; faith; doctrine	強 strong	魚 fish	京 capital	牛 cow
羽 feathers; counter for birds, rabbits	汽 vapor; steam	記 scribe; account; narrative	弓 bow; bow (archery, violin)	帰 homecoming; arrive at; lead to; result in	丸 round; full; month; perfection; -ship; pills; make round; roll up; curl up; seduce; explain away	岩 boulder; rock; cliff	顔 face; expression	間 interval; space	海 sea; ocean	絵 picture; drawing; painting; sketch	外 outside
活 lively; resuscitation; being helped; living	角 angle; corner; square; horn; antlers	楽 music; comfort; ease									

Grade 3

LANGUAGE — Japanese — Kanji — Grade 3

院 Inst.; institution; temple; mansion; school	列 file; row; rank; tier; column	練 practice; gloss; train; drill; polish; refine	路 path; route; road; distance	和 harmony; Japanese style; peace; soften; Japan	緑 green	礼 salute; bow; ceremony; thanks; remuneration	陽 sunshine; yang principle; positive; male; heaven; daytime	落 fall; drop; come down	流 current; a sink; flow; forfeit	旅 trip; travel	両 both; old Japanese coin; counter for carriages (e.g., in a train); two
飲 drink; smoke; take	羊 sheep	葉 leaf; plane; lobe; needle; blade; spear; counter for flat things; fragment; piece	様 Esq.; way; manner; situation; polite suffix	洋 ocean; western style	遊 play	予 beforehand; previous; myself; I	有 possess; have; exist; happen; occur; approx	由 wherefore; a reason	油 oil; fat	薬 medicine; chemical; enamel; gunpowder; benefit	問 question; ask; problem
員 employee; member; number; the one in charge	役 duty; war; campaign; drafted labor; office; service; role	命 fate; command; decree; destiny; life; appoint	面 mask; face; features; surface	味 flavor; taste	放 set free; release; fire; shoot; emit; banish; liberate	勉 exertion	返 return; answer; fade; repay	平 even; flat; peace	部 section; bureau; dept; class; copy; part; portion; counter for copies of a newspaper or magazine	服 clothing; admit; obey; discharge	福 blessing; fortune; luck; wealth
育 bring up; grow up; raise; rear	物 thing; object; matter	負 defeat; negative; -; minus; bear; owe; assume a responsibility	箱 box; chest; case; bin; railway car	畑 farm; field; garden; one's specialty; (kokuji)	発 discharge; departure; publish; emit; start from; disclose; counter for gunshots	反 anti-	板 plank; board; plate; stage	悲 jail cell; grieve; sad; deplore; regret	皮 pelt; skin; hide; leather	美 beauty; beautiful	鼻 nose; snout
医 doctor; medicine	筆 writing brush; writing; painting brush; handwriting	氷 icicle; ice; hail; freeze; congeal	表 surface; table; chart; diagram	病 ill; sick	秒 second (1/60 minute)	品 goods; refinement; dignity; article; counter for meal courses	農 agriculture; farmers	波 waves; billows; Poland	配 distribute; spouse; exile; rationing	倍 double; twice; times; fold	動 move; motion; change; confusion; shift; shake
意 idea; mind; heart; taste; thought; desire; care; liking	童 juvenile; child	豆 beans; pea; midget	島 island	投 throw; discard; abandon; launch into; join; invest in; hurl; give up; sell at a loss	湯 hot water; bath; hot spring	等 etc.; and so forth; class (first); quality; equal; similar	登 ascend; climb up	都 metropolis; capital	度 degrees; occurrence; time; counter for occurrences	帳 notebook; account book; album	調 tune; tone; meter; key (music); writing style; prepare; exorcise; investigate
委 committee; entrust to; leave to; devote; discard	追 chase; drive away; follow; pursue; meanwhile	定 determine; fix; establish; decide	庭 courtyard; garden; yard	笛 flute; clarinet; pipe; whistle; bagpipe; piccolo	鉄 iron	転 revolve; turn around; change	丁 street; ward; town; counter for guns, tools, leaves or cakes of something; even number	注 pour; irrigate; shed (tears); flow into; concentrate on; notes; comment; annotate	柱 pillar; post; cylinder; support	談 discuss; talk	着 don; arrive; wear; counter for suits of clothing
暗 darkness; disappear; shade; informal; grow dark; be blinded	炭 charcoal; coal	短 short; brevity; fault; defect; weak point	代 substitute; change; convert; replace; period; age; counter for decades of ages, eras, etc.; generation; charge; rate; fee	第 No.; residence	題 topic; subject	待 wait; depend on	対 vis-a-vis; opposite; even; equal; versus; anti-; compare	想 concept; think; idea; thought	相 inter-; mutual; together; each other; minister of state; councillor; aspect; phase; physiognomy	送 escort; send	息 breath; respiration; son; interest (on money)
安 relax; cheap; low; quiet; rested; contented; peaceful	速 quick; fast	族 tribe; family	他 other; another; the others	打 strike; hit; knock; pound; dozen	昔 once upon a time; antiquity; old times	全 whole; entire; all; complete; fulfill	整 organize; arranging; tune; tone; meter; key (music)	世 generation; world; society; public	植 plant	深 deep; heighten; intensify; strengthen	申 have the honor to; sign of the monkey; 3-5PM; ninth sign of Chinese zodiac

悪 bad; vice; rascal; false; evil; wrong	真 true; reality; Buddhist sect	神 gods; mind; soul	身 somebody; person; one's station in life	進 advance; proceed; progress; promote	所 place	暑 sultry; hot; summer heat	助 help; rescue; assist	勝 victory; win; prevail; excel	商 make a deal; selling; dealing in; merchant	昭 shining; bright	消 extinguish; blow out; turn off; neutralize; cancel
荷 baggage; shoulder-pole load; bear (a burden); shoulder (a gun); load; cargo; freight	章 badge; chapter; composition; poem; design	乗 ride; power; multiplication; record; counter for vehicles; board; mount; join	集 gather; meet; congregate; swarm; flock	住 dwell; reside; live; inhabit	重 heavy; heap up; pile up; nest of boxes; -fold	宿 inn; lodging; relay station; dwell; lodge; be pregnant; home; dwelling	酒 sake; alcohol	受 accept; undergo; answer (phone); take; get; catch; receive	州 state; province	拾 pick up; gather; find; go on foot; ten	終 end; finish
化 change; take the form of; influence; enchant; delude; -ization	習 learn	取 take; fetch; take up	守 guard; protect; defend; obey	主 lord; chief; master; main thing; principal	者 someone; person	写 copy; be photographed; describe	式 style; ceremony; rite; function; method; system; form; expression	実 reality; truth	詩 poem; poetry	歯 tooth; cog	事 matter; thing; fact; business; reason; possibly
温 warm	持 hold; have	次 next; order; sequence	指 finger; point to; indicate; put into; play (chess); measure (ruler)	死 death; die	始 commence; begin	皿 dish; a helping; plate	仕 attend; doing; official; serve	使 use	坂 slope; incline; hill	祭 ritual; offer prayers; celebrate; deify; enshrine; worship	号 nickname; number; item; title; pseudonym; name; call
屋 roof; house; shop; dealer; seller	根 root; radical; head (pimple)	港 harbor	向 yonder; facing; beyond; confront; defy; tend toward; approach	幸 happiness; blessing; fortune	湖 lake	庫 warehouse; storehouse	軽 lightly; trifling; unimportant	決 decide; fix; agree upon; appoint	血 blood	研 polish; study of; sharpen	県 prefecture
横 sideways; side; horizontal; width; woof	銀 silver	区 ward; district	苦 suffering; trial; worry; hardship; feel bitter; scowl	具 tool; utensil; means; possess; ingredients; counter for armor, suits, sets of furniture	君 old boy; name-suffix	係 person in charge; connection; duty; concern oneself	橋 bridge	業 business; vocation; arts; performance	局 bureau; board; office; affair; conclusion; court lady; lady-in-waiting; her apartment	曲 bend; music; melody; composition; pleasure; injustice; fault; curve; crooked; perverse; lean	去 gone; past; quit; leave; elapse; eliminate; divorce
央 center; middle	起 rouse; wake up; get up	客 guest; visitor; customer; client	宮 Shinto shrine; constellations; palace; princess	急 hurry; emergency; sudden; steep	球 ball; sphere	究 research; study	級 class; rank; grade	期 period; time; date; term	館 building; mansion; large building; palace	岸 beach	寒 cold
駅 station	感 emotion; feeling; sensation	漢 Sino-; China	界 world	開 open; unfold; unseal	階 storey; stair; counter for storeys of a building	運 carry; luck; destiny; fate; lot; transport; progress; advance	泳 swim				

Grade 4

案 plan; suggestion; draft; ponder; fear; proposition; idea; expectation; bill; worry	歴 curriculum; continuation; passage of time	連 take along; lead; join; connect; party; gang; clique	労 labor; thank for; reward for; toil; trouble	老 old man; old age; grow old	録 record	良 good; pleasing; skilled	量 quantity; measure; weight; amount; consider; estimate; surmise	輪 wheel; ring; circle; link; loop; counter for wheels and flowers	類 sort; kind; variety; class; genus	令 orders; ancient laws; command; decree	例 example; custom; usage; precedent
以 by means of; because; in view of; compared with	冷 cool; cold (beer, person); chill	要 need; main point; essence; pivot; key to	養 foster; bring up; rear; develop; nurture	浴 bathe; be favored with; bask in	利 profit; advantage; benefit	陸 land; six	料 fee; materials	勇 courage; cheer up; be in high spirits; bravery; heroism	約 promise; approximately; shrink	満 full; fullness; enough; satisfy	未 un-; not yet; hitherto; still; even now; sign of the ram; 1-3PM; eighth sign of Chinese zodiac
位 rank; grade; throne; crown; about; some	脈 vein; pulse; hope	民 people; nation; subjects	無 nothingness; none; ain't; nothing; nil; not	末 end; close; tip; powder; posterity	包 wrap; pack up; cover; conceal	法 method; law; rule; principle; model; system	望 ambition; full moon; hope; desire; aspire to; expect	牧 breed; care for; shepherd; feed; pasture	便 convenience	兵 soldier; private; troops; army; warfare; strategy; tactics	別 separate; branch off; diverge; fork; another; extra; specially
囲 surround; besiege; store; paling; enclosure; encircle; preserve; keep	変 unusual; change; strange	辺 environs; boundary; border; vicinity	副 vice-; duplicate; copy	粉 flour; powder; dust	不 negative; non-; bad; ugly; clumsy	付 adhere; attach; refer to; append	夫 husband; man	府 borough; urban prefecture; govt office; representative body; storehouse	飯 meal; boiled rice	費 expense; cost; spend; consume; waste	飛 fly; skip (pages); scatter
胃 stomach; paunch; crop; craw	必 invariably; certain; inevitable	標 signpost; seal; mark; stamp; imprint; symbol; emblem; trademark; evidence; souvenir; target	票 ballot; label; ticket; sign	博 Dr.; command; esteem; win acclaim; Ph.D.; exposition; fair	熱 heat; temperature; fever; mania; passion	念 wish; sense; idea; thought; feeling; desire; attention	敗 failure; defeat; reversal	梅 plum	働 work; (kokuji)	堂 public chamber; hall	得 gain; get; find; earn; acquire; can; may; able to; profit; advantage; benefit

LANGUAGE · Japanese · Kanji · Grade 4

衣 garment; clothes; dressing	特 special	毒 poison; virus; venom; germ; harm; injury; spite	灯 lamp; a light; light; counter for lights	努 junior; emptiness; vanity; futility; uselessness; ephemeral thing; gang; set; party; people	兆 portent; 10**12; trillion; sign; omen; symptoms	腸 intestines; guts; bowels; viscera	低 lower; short; humble	停 halt; stopping	底 bottom; sole; depth; bottom price; base; kind; sort	的 bull's eye; mark; target; object; adjective ending	典 code; ceremony; law; rule
印 stamp; seal; mark; imprint; symbol; emblem; trademark; evidence; souvenir; India	伝 transmit; go along; walk along; follow; report; communicate; legend; tradition	貯 savings; store; lay in; keep; wear mustache	置 placement; put; set; deposit; leave behind; keep; employ; pawn	仲 go-between; relationship	達 accomplished; reach; arrive; attain	単 simple; one; single; merely	隊 regiment; party; company; squad	帯 sash; belt; obi; zone; region	巣 nest; rookery; hive; cobweb; den	争 contend; dispute; argue	側 side; lean; oppose; regret
愛 love; affection; favourite	束 bundle; sheaf; ream; tie in bundles; govern; manage; control	続 continue; series; sequel	卒 graduate; soldier; private; die	孫 grandchild; descendants	倉 godown; warehouse; storehouse; cellar; treasury	席 seat; mat; occasion; place	積 volume; product (x*y); acreage; contents; pile up; stack; load; amass	折 fold; break; fracture; bend; yield; submit	節 node; season; period; occasion; verse; clause; stanza; honor; joint; knuckle; knob; knot; tune; melody	説 rumor; opinion; theory	戦 war; battle; match
芽 bud; sprout; spear; germ	浅 shallow; superficial; frivolous; wretched; shameful	選 elect; select; choose; prefer	然 sort of thing; so; if so; in that case; well	清 pure; purify; cleanse; exorcise; Manchu dynasty	静 quiet	成 turn into; become; get; grow; elapse; reach	信 faith; truth; fidelity; trust	臣 retainer; subject	順 obey; order; turn; right; docility; occasion	初 first time; beginning	唱 chant; recite; call upon; yell
貨 freight; goods; property	松 pine tree	焼 bake; burning	照 illuminate; shine; compare; bashful	省 focus; government ministry; conserve	笑 laugh	象 elephant; pattern after; imitate; image; shape; sign (of the times)	賞 prize; reward; praise	祝 celebrate; congratulate	周 circumference; circuit; lap	種 species; kind; class; variety; seed	借 borrow; rent
課 chapter; lesson; section; department; division; counter for chapters (of a book)	辞 resign; word; term; expression	失 lose; error; fault; disadvantage; loss	試 test; try; attempt; experiment; ordeal	児 newborn babe; child; young of animals	治 reign; be at peace; calm down; subdue; quell; govt; cure; heal; rule; conserve	氏 family name; surname; clan	史 history; chronicle	士 gentleman; samurai	参 nonplussed; three; going; coming; visiting; visit; be defeated; die; be madly in love	散 scatter; disperse; spend; squander	産 products; bear; give birth; yield; childbirth; native; property
果 fruit; reward; carry out; achieve; complete; end; finish; succeed	残 remainder; leftover; balance	司 director; official; govt office; rule; administer	察 guess; presume; surmise; judge; understand	札 tag; paper money; counter for bonds; placard; bid	殺 kill; murder; butcher; slice off; split; diminish; reduce; spoil	刷 printing; print	菜 vegetable; side dish; greens	材 lumber; log; timber; wood; talent	昨 yesterday; previous	差 distinction; difference; variation; discrepancy; margin; balance	最 utmost; most; extreme
加 add; addition; increase; join; include; Canada	告 revelation; tell; inform; announce	航 navigate; sail; cruise; fly	功 achievement; merits; success; honor; credit	好 fond; pleasing; like something	康 ease; peace	候 climate; season; weather	固 harden; set; clot; curdle	芸 technique; art; craft; performance; acting; trick; stunt	欠 lack; gap; fail	結 tie; bind; contract; join; organize; do up hair; fasten	健 healthy; health; strength; persistence
億 hundred million	建 build	験 verification; effect; testing	径 diameter; path; method	景 scenery; view	訓 instruction; Japanese character reading; explanation; read	軍 army; force; troops; war; battle	郡 county; district	型 mould; type; model	鏡 mirror; speculum; barrel-head; round rice-cake offering	極 poles; settlement; conclusion; end; highest rank; electric poles; very; extremely; most; highly;	挙 raise; plan; project; behavior; actions
塩 salt	漁 fishing; fishery	競 emulate; compete with; bid; sell at auction; bout; contest; race	共 together; both; neither; all; and; alike; with	協 co-; cooperation	季 seasons	紀 chronicle; account; narrative; history; annals; geologic period	議 deliberation; consultation; debate; consideration	救 salvation; save; help; rescue; reclaim	求 request; want; wish for; require; demand	泣 cry; weep; moan	給 salary; wage; gift; allow; grant; bestow on
英 England; English	希 hope; beg; request; pray; beseech; Greece; dilute (acid); rare; few; phenomenal	旗 national flag; banner; standard	機 mechanism; opportunity; occasion; machine; airplane	器 utensil; vessel; receptacle; implement; instrument; ability; container; tool; set	関 connection; barrier; gateway; involve; concerning	願 petition; request; vow; wish; hope	喜 rejoice; take pleasure in	管 pipe; tube; wind instrument; drunken talk	観 outlook; look; appearance; condition; view	完 perfect; completion; end	官 bureaucrat; the government
栄 flourish; prosperity; honor; glory; splendor	改 reformation; change; modify; mend; renew; examine; inspect; search	械 contraption; fetter; machine; instrument	害 harm; injury	街 boulevard; street; town	各 each; every; either	覚 memorize; learn; remember; awake; sober up					

Grade 5

領 jurisdiction; dominion; territory; fief; reign	河 river	過 overdo; exceed; go beyond; error	賀 congratulations; joy	解 unravel; notes; key; explanation; understanding; untie; undo; solve; answer; cancel; absolve; explain; minute	圧 pressure; push; overwhelm; oppress; dominate	易 easy; ready to; simple; fortune-telling; divination	移 shift; move; change; drift; catch (cold, fire); pass into	因 cause; factor; be associated with; depend on; be limited to	仮 sham; temporary; interim; assumed (name); informal	価 value; price	可 can; passable; mustn't; should not; do not
率 ratio; rate; proportion; %; coefficient; factor	夢 dream; vision; illusion	墓 grave; tomb	報 report; news; reward; retribution	豊 bountiful; excellent; rich	暴 outburst; rave; fret; force; violence; cruelty; outrage	貿 trade; exchange	防 ward off; defend; protect; resist	弁 valve; petal; braid; speech; dialect; discrimination; dispose of; distinguish	保 protect; guarantee; keep; preserve; sustain; support	編 compilation; knit; plait; braid; twist; editing; completed poem; part of a book	武 warrior; military; chivalry; arms
略 abbreviation; omission; outline; shorten; capture; plunder	復 restore; return to; revert; resume	複 duplicate; double; compound; multiple	仏 Buddha; the dead; France	貧 poverty; poor	婦 lady; woman; wife; bride	富 wealth; enrich; abundant	布 linen; cloth	判 judgement; signature; stamp; seal	版 printing block; printing plate; edition; impression; label	犯 crime; sin; offense	比 compare; race; ratio; Philipines
留 detain; fasten; halt; stop	肥 fertilizer; get fat; fertile; manure; pamper	非 un-; mistake; negative; injustice; non-	備 equip; provision; preparation	俵 bag; bale; sack; counter for bags	評 evaluate; criticism; comment	任 responsibility; duty; term; entrust to; appoint	燃 burn; blaze; glow	能 ability; talent; skill; capacity	破 rend; rip; tear; break; destroy; defeat; frustrate	導 guidance; leading; conduct; usher	銅 copper
預 deposit; custody; leave with; entrust to	徳 benevolence; virtue; goodness; commanding respect	独 single; alone; spontaneously; Germany	統 overall; relationship; ruling; governing	張 lengthen; counter for bows & stringed instruments; stretch; spread; put up (tent)	提 propose; take along; carry in hand	程 extent; degree; law; formula; distance; limits; amount	敵 enemy; foe; opponent	適 suitable; occasional; rare; qualified; capable	築 fabricate; build; construct	断 severance; decline; refuse; apologize; warn; dismiss; prohibit; decision; judgement; cutting	団 group; association
容 contain; form; looks	退 retreat; withdraw; retire; resign; repel; expel; reject	貸 lend	態 attitude; condition; figure; appearance; voice (of verbs)	総 general; whole; all; full; total	像 statue; picture; image; figure; portrait	増 increase; add; augment; gain; promote	造 create; make; structure; physique	則 rule; follow; based on; model after	測 fathom; plan; scheme; measure	属 belong; genus; subordinate official; affiliated	損 damage; loss; disadvantage; hurt; injure
余 too much; myself; surplus; other; remainder	素 elementary; principle; naked; uncovered	績 exploits; unreeling cocoons	責 blame; condemn; censure	接 touch; contact; adjoin; piece together	設 establishment; provision; prepare	絶 discontinue; beyond; sever; cut off; abstain; interrupt; suppress	舌 tongue; reed; clapper	銭 coin; .01 yen; money	祖 ancestor; pioneer; founder	税 tax; duty	政 politics; government
輸 transport; send; be inferior	精 refined; ghost; fairy; energy; vitality; semen; excellence; purity; skill	製 made in...; manufacture	制 system; law; rule	勢 forces; energy; military strength	性 sex; gender; nature	常 usual; ordinary; normal; regular	情 feelings; emotion; passion; sympathy; circumstances; facts	条 article; clause; item; stripe; streak	状 status quo; conditions; circumstances; form; appearance	織 weave; fabric	職 post; employment; work
迷 astray; be perplexed; in doubt; lost; err; illusion	序 preface; beginning; order; precedence; occasion; chance; incidentally	承 acquiesce; hear; listen to; be informed; receive	招 beckon; invite; summon; engage	証 evidence; proof; certificate	準 semi-; correspond to; proportionate to; conform; imitate	術 art; technique; skill; means; trick; resources; magic	述 mention; state; speak; relate	授 impart; instruct; grant; confer	修 discipline; conduct oneself well; study; master	謝 apologize; thank; refuse	舎 cottage; inn; hut; house; mansion
綿 cotton	識 discriminating; know; write	質 substance; quality; matter; temperament	資 assets; resources; capital; funds; data; be conducive to; contribute to	飼 domesticate; raise; keep; feed	似 becoming; resemble; counterfeit; imitate; suitable	示 show; indicate; point out; express; display	支 branch; support; sustain; branch radical (no. 65)	枝 bough; branch; twig; limb; counter for branches	師 expert; teacher; master; model; exemplar; army (incl. counter); war	志 intention; plan; resolve; aspire; motive; hopes; shilling	賛 approve; praise; title or inscription on picture; assist; agree with
務 task; duties	酸 acid; bitterness; sour; tart	雑 miscellaneous	桜 occasion; side; edge; verge; dangerous; adventurous; indecent; time; when	在 exist; outskirts; suburbs; located in	罪 guilt; sin; crime; fault; blame; offense	財 property; money; wealth; assets	査 investigate	再 again; twice; second time	妻 wife; spouse	採 pick; take; fetch; take up	災 disaster; calamity; woe; curse; evil
恩 grace; kindness; goodness; favor; mercy; blessing; benefit	講 lecture; club; association	鉱 mineral; ore	混 mix; blend; confuse	構 posture; build; pretend	耕 till; plow; cultivate	効 merit; efficacy; efficiency; benefit	厚 thick; heavy; rich; kind; cordial; brazen; shameless	護 safeguard; protect	限 limit; restrict; to best of ability	個 individual; counter for articles	故 happenstance; especially; intentionally; reason; cause; circumstances; the late; therefore; consequently

応 apply; answer; yes; OK; reply; accept	経 sutra; longitude; pass thru; expire; warp	潔 undefiled; pure; clean; righteous; gallant	件 affair; case; matter; item	券 ticket	検 examination; investigate	険 precipitous; inaccessible place; impregnable position; steep place; sharp eyes	減 dwindle; decrease; reduce; decline; curtail; get hungry	現 present; existing; actual	句 phrase; clause; sentence; passage; paragraph; counter for haiku	群 flock; group; crowd; herd; swarm; cluster	興 entertain; revive; retrieve; interest; pleasure
往 journey; chase away; let go; going; travel	均 level; average	禁 prohibition; ban; forbid	境 boundary; border; region	許 permit; approve	居 reside; to be; exist; live with	旧 old times; old things; old friend; former; ex-	規 standard; measure	技 skill; art; craft; ability; feat; performance; vocation; arts	義 righteousness; justice; morality; honor; loyalty; meaning	逆 inverted; reverse; opposite; wicked	久 long time; old story
演 performance; act; play; render; stage	寄 draw near; stop in; bring near; gather; collect; send; forward	基 fundamentals; radical (chem); counter for machines; foundation	眼 eyeball	刊 publish; carve; engrave	幹 tree trunk	慣 accustomed; get used to; become experienced	格 status; rank; capacity; character; case (law, grammar)	確 assurance; firm; tight; hard; solid; confirm; clear; evident	額 forehead; tablet; plaque; framed picture; sum; amount; volume	快 cheerful; pleasant; agreeable; comfortable	営 occupation; camp; perform; build; conduct (business)
益 benefit; gain; profit; advantage	永 eternity; long; lengthy	衛 defense; protection	液 fluid; liquid; juice; sap; secretio								

Grade 6

朗 melodious; clear; bright; serene; cheerful	巻 scroll; volume; book; part; roll up; wind up; tie; coil; counter for texts (or book scrolls)	干 dry; parch	看 watch over; see	灰 ashes; puckery juice; cremate	拡 broaden; extend; expand; enlarge	閣 tower; tall building; palace	革 leather; become serious; skin; hide; pelt	割 proportion; comparatively; divide; cut; separate; split	宇 eaves; roof; house; heaven	映 reflect; reflection; projection	延 prolong; stretching
論 argument; discourse	郵 mail; stagecoach stop	優 tenderness; excel; surpass; actor; superiority; gentleness	訳 translate; reason; circumstance; case	盟 alliance; oath	模 imitation; copy; mock	密 secrecy; density (pop); minuteness; carefulness	枚 sheet of...; counter for flat thin objects or sheets	幕 curtain; bunting; act of play	補 supplement; supply; make good; offset; compensate; assistant; learner	暮 livelihood; make a living; spend time	宝 treasure; wealth; valuables
臨 look to; face; meet; confront; attend; call on	訪 call on; visit; look up; offer sympathy	亡 deceased; the late; dying; perish	忘 forget	棒 rod; stick; cane; pole; club; line	並 row; and; besides; as well as; line up; rank with; rival; equal	閉 closed; shut	陛 highness; steps (of throne)	片 one-sided; leaf; sheet; right-side kata radical (no. 91)	腹 abdomen; belly; stomach	奮 stirred up; be invigorated; flourish	班 squad; corps; unit; group
欲 longing; covetousness; greed; passion; desire; craving	晩 nightfall; night	否 negate; no; noes; refuse; decline; deny	批 criticism; strike	秘 secret; conceal	難 difficult; impossible; trouble; accident; defect	乳 milk; breasts	認 acknowledge; witness; discern; recognize; appreciate; believe	納 settlement; obtain; reap; pay; supply; store	脳 brain; memory	派 faction; group; party; clique; sect; school	俳 haiku; actor
翌 the following; next	拝 worship; adore; pray to	背 stature; height; back; behind; disobey; defy; go back on; rebel	肺 lungs	届 deliver; reach; arrive; report; notify; forward	党 party; faction; clique	糖 sugar	討 chastise; attack; defeat; destroy; conquer	庁 government office	潮 tide; salt water; opportunity	頂 place on the head; receive; top of head; top; summit; peak	賃 fare; fee; hire; rent; wages; charge
乱 riot; war; disorder; disturb	痛 pain; hurt; damage; bruise	展 unfold; expand	著 renowned; publish; write; remarkable; phenomenal; put on; don; wear; arrival; finish (race); counter for suits of clothing; literary work	段 grade; steps; stairs	値 price; cost; value	宙 mid-air; air; space; sky; memorization; interval of time	忠 loyalty; fidelity; faithfulness	暖 warmth	宅 home; house; residence; our house; my husband	担 shouldering; carry; raise; bear	探 grope; search; look for
卵 egg; ovum; spawn; roe	誕 nativity; be born; declension; lie; be arbitrary	層 stratum; social class; layer; story; floor	操 maneuver; manipulate; operate; steer; chastity; virginity; fidelity	窓 window; pane	装 attire; dress; pretend; disguise; profess	臓 entrails; viscera; bowels	蔵 storehouse; hide; own; have; possess	存 suppose; be aware of; believe; feel	尊 revered; valuable; precious; noble; exalted	創 genesis; wound; injury; hurt; start; originate	奏 play music; speak to a ruler; complete
覧 perusal; see	宣 proclaim; say; announce	専 specialty; exclusive; mainly; solely	泉 spring; fountain	洗 wash; inquire into; probe	染 dye; color; paint; stain; print	善 virtuous; good; goodness	盛 boom; prosper; copulate	聖 holy; saint; sage; master; priest	誠 sincerity; admonish; warn; prohibit; truth; fidelity	寸 measurement; foot/10	垂 droop; suspend; hang; slouch
裏 back; amidst; in; reverse; inside; palm; sole; rear; lining; wrong side	推 conjecture; infer; guess; suppose; support	蒸 steam; heat; sultry; foment; get musty	針 needle; pin; staple; stinger	仁 humanity; virtue; benevolence; charity; man; kernel	城 castle	純 genuine; purity; innocence; net (profit)	処 dispose; manage; deal with; sentence; condemn; act; behave; place	署 signature; govt office; police station	諸 various; many; several; together	除 exclude; division (x/3); remove; abolish; cancel; except	傷 wound; hurt; injure; impair; pain; injury; cut; gash; scar; weak point

LANGUAGE — Japanese — Kanji

Grade 6

律 rhythm; law; regulation; gauge; control	将 leader; commander; general; admiral; or; and again; soon; from now on; just about	障 hinder; hurt; harm	縮 shrink; contract; shrivel; wrinkle; reduce	熟 mellow; ripen; mature; acquire skill	衆 masses; great numbers; multitude; populace	従 accompany; obey; submit to; comply; follow; secondary; incidental; subordinate	縦 vertical; length; height; self-indulgent; wayward	樹 timber trees; wood	収 income; obtain; reap; pay; supply; store	宗 religion; sect; denomination; main point; origin; essence	就 concerning; settle; take position; depart; study; per
幼 infancy; childhood	射 shoot; shine into; onto; archery	捨 discard; throw away; abandon; resign; reject; sacrifice	尺 shaku; Japanese foot; measure; scale; rule	若 young; if; perhaps; possibly; low number; immature	視 inspection; regard as; see; look at	詞 part of speech; words; poetry	誌 document; records	磁 magnet; porcelain	私 private; I; me	至 climax; arrive; proceed; reach; attain; result in	姿 figure; form; shape
域 range; region; limits; stage; level	蚕 silkworm	冊 tome; counter for books; volume	裁 tailor; judge; decision; cut out (pattern)	策 scheme; plan; policy; step; means	砂 sand	座 squat; seat; cushion; gathering; sit	済 finish; come to an end; excusable; need not	鋼 steel	降 descend; precipitate; fall; surrender	刻 engrave; cut fine; chop; hash; mince; time; carving	穀 cereals; grain
遺 bequeath; leave behind; reserve	骨 skeleton; bone; remains; frame	困 quandary; become distressed; annoyed	皇 emperor	紅 crimson; deep red	后 empress; queen; after; behind; back; later	孝 filial piety; child's respect	誤 mistake; err; do wrong; mislead	呼 call; call out to; invite	己 self; snake; serpent	系 lineage; system	警 admonish; commandment
異 uncommon; queerness; strangeness; wonderful; curious; unusual	劇 drama; play	激 violent; get excited; enraged; chafe; incite	穴 hole; aperture; slit; cave; den	憲 constitution; law	権 authority; power; rights	絹 silk	厳 stern; strictness; severity; rigidity	源 source; origin	敬 awe; respect; honor; revere	筋 muscle; sinew; tendon; fiber; plot; plan; descent	胸 bosom; breast; chest; heart; feelings
我 ego; I; selfish; our; oneself	郷 home town; village; native place; district	勤 diligence; become employed; serve	供 submit; offer; present; serve (meal); accompany	貴 precious; value; prize; esteem; honor	疑 doubt; distrust; be suspicious; question	吸 suck; imbibe; inhale; sip	揮 brandish; wave; wag; swing; shake	机 desk; table	危 dangerous; fear; uneasy	簡 simplicity; brevity	株 stocks; stump; shares; stock; counter for small plants
沿 run alongside; follow along; run along; lie along											

Secondary School

霊 spirits; soul	露 dew; tears; expose; Russia	廊 corridor; hall; tower	楼 watchtower; lookout; high building	浪 wandering; waves; billows	漏 leak; escape; time	郎 son; counter for sons	賄 bribe; board; supply; finance	惑 beguile; delusion; perplexity	枠 frame; framework; spindle; spool; bounding-box; (kokuji)	湾 gulf; bay; inlet	腕 arm; ability; talent
麗 lovely; beautiful; graceful; resplendent	糧 provisions; food; bread	陵 mausoleum; imperial tomb	倫 ethics; companion	厘 rin; 1/10sen; 1/10bu	隣 neighboring	塁 bases; fort; rampart; walls; base(ball)	涙 tears; sympathy	累 accumulate; involvement; trouble; tie up; continually	励 encourage; be diligent; inspire	鈴 small bell; buzzer	隷 slave; servant; prisoner; criminal; follower
齢 age	零 zero; spill; overflow; nothing; cipher	謡 noh chanting	踊 jump; dance; leap; skip	抑 repress; well; now; in the first place; push; shove; press; seal; do in spite of	翼 wing; plane; flank	羅 gauze; thin silk; Rome	裸 naked; nude; uncovered; partially clothed	頼 trust; request	雷 thunder; lightning bolt	絡 entwine; coil around; get caught in	酪 dairy products; whey; broth; fruit juice
暦 calendar; almanac	欄 column; handrail; blank; space	濫 excessive; overflow; spread out	吏 officer; an official	履 footgear; shoes; boots; put on (the feet	痢 diarrhea	離 detach; separation; disjoin; digress	硫 sulphur	粒 grains; drop; counter for tiny particles	隆 hump; high; noble; prosperity	竜 dragon; imperial	慮 prudence; thought; concern; consider; deliberate; fear
劣 inferiority; be inferior to; be worse	虜 captive; barbarian; low epithet for the enemy	了 complete; finish	僚 colleague; official; companion	寮 dormitory; hostel; villa; tea pavillion	涼 refreshing; nice and cool	猟 game-hunting; shooting; game; bag	療 heal; cure	窯 kiln; oven; furnace	誉 reputation; praise; honor; glory	庸 commonplace; ordinary; employment	揚 hoist; fry in deep fat
烈 ardent; violent; vehement; furious; severe; extreme	揺 swing; shake; sway; rock; tremble; vibrate	擁 hug; embrace; possess; protect; lead	溶 melt; dissolve; thaw	与 bestow; participate in; give; award; impart; provide; cause; gift; godsend	雄 masculine; male; hero; leader; superiority; excellence	融 dissolve; melt	裕 abundant; rich; fertile	誘 entice; lead; tempt; invite; ask; call for; seduce; allure	悠 permanence; distant; long time; leisure	憂 melancholy; grieve; lament; be anxious; sad; unhappy	猶 furthermore; still; yet
裂 split; rend; tear	諭 rebuke; admonish; charge; warn; persuade	唯 solely; only; merely; simply	幽 seclude; confine to a room; deep; profound; secluded; faint; dark; tranquil; calm	柳 willow	愉 pleasure; happy; rejoice	癒 healing; cure; quench (thirst); wreak	躍 leap; dance; skip	黙 silence; become silent; stop speaking; leave as is	戻 re-; return; revert; resume; restore; go backwards	紋 family crest; figures	匁 monme; 3.75 grams; (kokuji)

LANGUAGE — Japanese — Kanji — Secondary School

恋 romance; in love; yearn for; miss; darling	厄 unlucky; misfortune; bad luck; disaster	猛 fierce; rave; rush; become furious; wildness; strength	盲 blind; blind man; ignoramus	網 netting; network	耗 decrease	銘 inscription; signature (of artisan)	滅 destroy; ruin; overthrow; perish	免 excuse; dismissal	茂 overgrown; grow thick; be luxuriant	妄 delusion; unnecessarily; without authority; reckless	漫 cartoon; involuntarily; in spite of oneself; corrupt
錬 tempering; refine; drill; train; polish	魅 fascination; charm; bewitch	岬 headland; cape; spit; promontory	妙 exquisite; strange; queer; mystery; miracle; excellent; delicate; charming	眠 sleep; die; sleepy	矛 halberd; arms; festival float	霧 fog; mist	婿 bridegroom; son-in-law	娘 daughter; girl	膜 membrane	又 or again; furthermore; on the other hand	抹 rub; paint; erase
炉 hearth; furnace; kiln; reactor	繭 cocoon	慢 ridicule; laziness	穂 ear; ear (grain); head; crest (wave)	募 recruit; campaign; gather (contributions); enlist; grow violent	慕 pining; yearn for; love dearly; adore	簿 register; record book	倣 emulate; imitate	俸 stipend; salary	奉 observance; offer; present; dedicate	峰 summit; peak	崩 crumble; die; demolish; level
敏 cleverness; agile; alert	抱 embrace; hug; hold in arms	泡 bubbles; foam; suds; froth	砲 cannon; gun	縫 sew; stitch; embroider	胞 placenta; sac; sheath	芳 perfume; balmy; flavorable; fragrant	褒 praise; extol	邦 home country; country; Japan	飽 sated; tired of; bored; satiate	乏 destitution; scarce; limited	傍 bystander; side; besides; while; nearby; 3rd person
瓶 flower pot; bottle; vial; jar; jug; vat; urn	剖 divide	坊 boy; priest's residence; priest	妨 disturb; prevent; hamper; obstruct	帽 cap; headgear	忙 busy; occupied; restless	房 tassel; tuft; fringe; bunch; lock (hair); segment (orange); house; room	某 so-and-so; one; a certain; that person	冒 risk; face; defy; dare; damage; assume (a name)	紡 spinning	肪 obese; fat	膨 swell; get fat; thick
廉 bargain; reason; charge; suspicion; point; account; purity; honest; low price; cheap; rested; contented; peaceful	謀 conspire; cheat; impose on; plan; devise; scheme; have in mind; deceive	僕 me; I (male)	墨 black ink; India ink; ink stick; Mexico	撲 slap; strike; hit; beat; tell; speak	朴 crude; simple; plain; docile	没 drown; sink; hide; fall into; disappear; die	堀 ditch; moat; canal	奔 run; bustle	翻 flip; turn over; wave; flutter; change (mind)	凡 mediocre	盆 basin; lantern festival; tray
浜 seacoast; beach; seashore	摩 chafe; rub; polish; grind; scrape	磨 grind; polish; scour; improve; brush (teeth)	魔 witch; demon; evil spirit	麻 hemp; flax	埋 bury; be filled up; embedded	遍 everywhere; times; widely; generally	舗 shop; store	捕 catch; capture	雰 atmosphere; fog	丙 third class; 3rd; 3rd calendar sign	併 join; get together; unite; collective
頻 repeatedly; recur	塀 fence; wall; (kokuji)	幣 cash; bad habit; humble prefix; gift; Shinto offerings of cloth; rope; cut paper	弊 abuse; evil; vice; breakage	柄 design; pattern; build; nature; handle; crank; grip; knob; shaft	壁 wall; lining (stomach); fence	癖 mannerism; habit; vice; trait; fault; kink	偏 partial; side; left-side radical; inclining; biased	賦 levy; ode; prose; poem; tribute; installment	赴 proceed; get; become; tend	附 affixed; attach; refer to; append	侮 scorn; despise; make light of; contempt
賓 V.I.P.; guest	舞 dance; flit; circle; wheel	封 seal; closing	伏 prostrated; bend down; bow; cover; lay (pipes)	幅 hanging scroll; width	覆 capsize; cover; shade; mantle; be ruined	払 pay; clear out; prune; banish; dispose of	沸 seethe; boil; ferment; uproar; breed	噴 erupt; spout; emit; flush out	墳 tomb; mound	憤 aroused; resent; be indignant; anger	紛 distract; be mistaken for; go astray; divert
怖 dreadful; be frightened; fearful	腐 rot; decay; sour	膚 skin; body; grain; texture; disposition	譜 musical score; music; note; staff; table; genealogy	縛 truss; arrest; bind; tie; restrain	肌 texture; skin; body; grain	鉢 bowl; rice tub; pot; crown	髪 hair of the head	伐 fell; strike; attack; punish	罰 penalty; punishment	抜 slip out; extract; pull out; pilfer; quote; remove; omit	閥 clique; lineage; pedigree; faction; clan
扶 aid; help; assist	伴 consort; accompany; bring with; companion	帆 sail	搬 conveyor; carry; transport	畔 paddy ridge; levee	繁 luxuriant; thick; overgrown; frequency; complexity; trouble	般 carrier; carry; all	藩 clan; enclosure	販 marketing; sell; trade	範 pattern; example; model	煩 anxiety; trouble; worry; pain; ill; annoy; nuisance; irksome	頒 distribute; disseminate; partition; understand
敷 spread; pave; sit; promulgate	盤 tray; shallow bowl; platter; tub; board; phonograph record	蛮 barbarian	卑 lowly; base; vile; vulgar	妃 queen; princess	彼 he; that; the	扉 front door; title page; front page	披 expose; open	泌 ooze; flow; soak in; penetrate; secrete	疲 exhausted; tire; weary	碑 tombstone; monument	罷 quit; stop; leave; withdraw; go
普 universal; wide(ly); generally; Prussia	被 incur; cover; veil; brood over; shelter; wear; put on; be exposed (film); receiving	避 evade; avoid; avert; ward off; shirk; shun	尾 tail; end; counter for fish; lower slope of mountain	微 delicate; minuteness; insignificance	匹 equal; head; counter for small animals; roll of cloth	姫 princess	漂 drift; float (on liquid)	描 sketch; compose; write; draw; paint	苗 seedling; sapling; shoot	拍 clap; beat (music)	泊 overnight; put up at; ride at anchor; 3-day stay
浮 floating; float; rise to surface	舶 liner; ship	薄 dilute; thin; weak (tea)	迫 urge; force; imminent; spur on	漠 vague; obscure; desert; wide	爆 bomb; burst open; pop; split	賠 compensation; indemnify	陪 obeisance; follow; accompany; attend on	伯 chief; count; earl; uncle; Brazil	軟 soft	尼 nun	弐 II; two; second

符 token; sign; mark; tally; charm	如 likeness; like; such as; as if; better; best; equal	尿 urine	妊 pregnancy	忍 endure; bear; put up with; conceal; secrete; spy; sneak	寧 rather; preferably	猫 cat	粘 sticky; glutinous; greasy; persevere	悩 trouble; worry; in pain; distress; illness	濃 concentrated; thick; dark; undiluted	把 grasp; faggot; bunch; counter for bundles	覇 hegemony; supremacy; leadership; champion
陳 exhibit; state; relate; explain	婆 old woman; grandma; wet nurse	廃 abolish; obsolete; cessation; discarding; abandon	排 repudiate; exclude; expel; reject	杯 counter for cupfuls; wine glass; glass; toast	輩 comrade; fellow; people; companions	培 cultivate; foster	媒 mediator; go-between	透 transparent; permeate; filter; penetrate	陶 pottery; porcelain	騰 inflation; advancing; going	闘 fight; war
鎮 tranquilize; ancient peace-preservation centers	洞 den; cave; excavation	胴 trunk; torso; hull (ship); hub of wheel	峠 mountain peak; mountain pass; climax; crest; (kokuji)	匿 hide; shelter; shield	督 coach; command; urge; lead; supervise	篤 fervent; kind; cordial; serious; deliberate	凸 convex; beetle brow; uneven	突 stab; protruding; thrusting; thrust; pierce; prick	屯 barracks; police station; camp	豚 pork; pig	曇 cloudy weather; cloud up
珍 rare; curious; strange	鈍 dull; slow; foolish; blunt	縄 straw rope; cord	謄 mimeograph; copy	踏 step; trample; carry through; appraise; evade payment	逃 escape; flee; shirk; evade; set free	奴 guy; slave; manservant; fellow	怒 angry; be offended	倒 overthrow; fall; collapse; drop; break down	凍 frozen; congeal; refrigerate	唐 T'ang; China	塔 pagoda; tower; steeple
沈 sink; be submerged; subside; be depressed; aloes	悼 lament; grieve over	搭 board; load (a vehicle); ride	桃 peach tree	棟 ridgepole; ridge	盗 steal; rob; pilfer	痘 pox; smallpox	筒 cylinder; pipe; tube; gun barrel; sleeve	到 arrival; proceed; reach; attain; result in	斗 Big Dipper; 10 sho (vol)	渡 transit; ford; ferry; cross; import; deliver; diameter; migrate	途 route; way; road
朕 majestic plural; imperial we	弔 condolences; mourning; funeral	彫 carve; engrave; chisel	徴 indications; sign; omen; symptom; collect; seek; refer to; question	懲 penal; chastise; punish; discipline	挑 challenge; contend for; make love to	眺 stare; watch; look at; see; scrutinize	聴 listen; headstrong; naughty; careful inquiry	脹 dilate; distend; bulge; fill out; swell	超 transcend; super-; ultra-	跳 hop; leap up; spring; jerk; prance; buck; splash; sputter; snap	勅 imperial order
津 haven; port; harbor; ferry	亭 pavilion; restaurant; mansion; arbor; cottage; vaudeville; music hall; stage name	偵 spy	貞 upright; chastity; constancy; righteousness	呈 display; offer; present; send; exhibit	堤 dike; bank; embankment	帝 sovereign; the emperor; god; creator	廷 courts; imperial court; government office	抵 resist; reach; touch	締 tighten; tie; shut; lock; fasten	艇 rowboat; small boat	訂 revise; correct; decide
墜 crash; fall (down)	逓 relay; in turn; sending	邸 residence; mansion	泥 mud; mire; adhere to; be attached to	摘 pinch; pick; pluck; trim; clip; summarize	滴 drip; drop	哲 philosophy; clear	徹 penetrate; clear; pierce; strike home; sit up (all night)	撤 remove; withdraw; disarm; dismantle; reject; exclude	迭 transfer; alternation	添 annexed; accompany; marry; suit; meet; satisfy; attach; append; garnish; imitate	殿 Mr.; hall; mansion; palace; temple; lord
塚 hillock; mound	吐 spit; vomit; belch; confess; tell (lies)	塗 paint; plaster; daub; smear; coating	衷 inmost; heart; mind; inside	鋳 casting; mint	駐 stop-over; reside in; resident	恥 shame; dishonor	痴 stupid; foolish	稚 immature; young	致 doth; do; send; forward; cause; exert; incur; engage	遅 slow; late; back; later	畜 livestock; domestic fowl and animals
漬 pickling; soak; moisten; steep	蓄 amass; keeping a concubine; phonograph	逐 pursue; drive away; chase; accomplish; attain; commit	秩 regularity; salary; order	窒 plug up; obstruct	嫡 legitimate wife; direct descent (non-bastard)	抽 pluck; pull; extract; excel	択 choose; select; elect; prefer	拓 clear (the land); open; break up (land)	沢 swamp	濯 laundry; wash; pour on; rinse	託 consign; requesting; entrusting with; pretend; hint
坪 two-mat area; 36 sq ft	濁 voiced; uncleanness; wrong; nigori; impurity	諾 consent; assent; agreement	但 however; but	奪 rob; take by force; snatch away; dispossess; plunder; usurp	脱 undress; removing; escape from; get rid of; be left out; take off	棚 shelf; ledge; rack; mount; mantle; trellis	丹 rust-colored; red; red lead; pills	嘆 sigh; lament; moan; grieve	淡 thin; faint; pale; fleeting	端 edge; origin; end; point; border; verge; cape	胆 gall bladder; courage; pluck; nerve
釣 angling; fish; catch; allure; ensnare	鍛 forge; discipline; train	壇 podium; stage; rostrum; terrace	弾 bullet; twang; flip; snap	逮 apprehend; chase	滝 waterfall; rapids; cascade	卓 eminent; table; desk; high	怠 neglect; laziness	替 exchange; spare; substitute; per-	泰 peaceful; calm; peace; easy; Thailand	滞 stagnate; be delayed; overdue; arrears	胎 womb; uterus
隻 vessels; counter for ships; fish; birds; arrows; one of a pair	袋 sack; bag; pouch	耐 -proof; enduring	駄 burdensome; pack horse; horse load; send by horse	捜 search; look for; locate	掃 sweep; brush	挿 insert; put in; graft; wear (sword)	曹 cadet; friend	槽 vat; tub; tank	燥 parch; dry up	荘 villa; inn; cottage; feudal manor	葬 interment; bury; shelve
粗 coarse; rough; rugged	藻 seaweed; duckweed	遭 encounter; meet; party; association; interview; join	霜 frost	騒 boisterous; make noise; clamor; disturb; excite	憎 hate; detest	贈 presents; send; give to; award to; confer on; presenting something	促 stimulate; urge; press; demand; incite	即 instant; namely; as is; conform; agree; adapt	俗 vulgar; customs; manners; worldliness; mundane things	賊 burglar; rebel; traitor; robber	堕 degenerate; descend to; lapse into
租 tariff; crop tax; borrowing	妥 gentle; peace; depravity	惰 lazy; laziness	訴 accusation; sue; complain of pain; appeal to	阻 thwart; separate from; prevent; obstruct; deter; impede	僧 Buddhist priest; monk	双 pair; set; comparison; counter for pairs	喪 miss; mourning	壮 robust; manhood; prosperity	惜 pity; be sparing of; frugal; stingy; regret	斥 reject; retreat; recede; withdraw; repel; repulse	析 chop; divide; tear; analyze

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礎 cornerstone; foundation stone	籍 enroll; domiciliary register; membership	跡 tracks; mark; print; impression	拙 bungling; clumsy; unskillful	摂 vicarious; surrogate; act in addition to	窃 stealth; steal; secret; private; hushed	仙 hermit; wizard; cent	占 fortune-telling; divining; forecasting; occupy; hold; have; get; take	扇 fan; folding fan	栓 plug; bolt; cork; bung; stopper	潜 submerge; conceal; hide; lower (voice); hush	旋 rotation; go around
疎 alienate; rough; neglect; shun; sparse	繊 slender; fine; thin kimono	薦 recommend; mat; advise; encourage; offer	践 tread; step on; trample; practice; carry through	遷 transition; move; change	銑 pig iron	鮮 fresh; vivid; clear; brilliant; Korea	漸 steadily; gradually advancing; finally; barely	禅 Zen; silent meditation	繕 darning; repair; mend; trim; tidy up; adjust	塑 model; molding	措 set aside; give up; suspend; discontinue; lay aside; except
斉 adjusted; alike; equal; similar variety of	据 set; lay a foundation; install; equip; squat down; sit down	杉 cedar; cryptomeria	澄 lucidity; be clear; clear; clarify; settle; strain; look grave	瀬 rapids; current; torrent; shallows; shoal	畝 furrow; 30 tsubo; ridge; rib	是 just so; this; right; justice	姓 surname	征 subjugate; attack the rebellious; collect taxes	酢 vinegar; sour; acid; tart	吹 blow; breathe; puff; emit; smoke	帥 commander; leading troops; governor
牲 animal sacrifice; offering	炊 cook; boil	睡 drowsy; sleep; die	粋 chic; style; purity; essence; pith; cream; elite; choice	衰 decline; wane; weaken	遂 consummate; accomplish; attain; commit (suicide)	酔 drunk; feel sick; poisoned; elated; spellbound	錘 weight; plumb bob; sinker	随 follow; though; notwithstanding; while; during; both; all; obey; submit to; comply; at the mercy of (the waves)	髄 marrow; pith	崇 adore; respect; revere; worship	浄 clean; purify; cleanse; exorcise; Manchu Dynasty
誓 vow; swear; pledge	畳 tatami mat; counter for tatami mats; fold; shut up; do away with	譲 defer; turnover; transfer; convey	醸 brew; cause	錠 lock; fetters; shackles	嘱 entrust; request; send a message	飾 decorate; ornament; adorn; embellish	殖 augment; increase; multiply; raise	触 contact; touch; feel; hit; proclaim; announce; conflict	辱 embarrass; humiliate; shame	伸 expand; stretch; extend; lengthen; increase	侵 encroach; invade; raid; trespass; violate
請 solicit; invite; ask	唇 lips	娠 with child; pregnancy	寝 lie down; sleep; rest; bed; remain unsold	審 hearing; judge; trial	慎 humility; be careful; discrete; prudent	振 shake; wave; wag; swing	浸 immersed; soak; dip; steep; moisten; wet; dunk	紳 sire; good belt; gentleman	薪 fuel; firewood; kindling	診 checkup; seeing; diagnose; examine	辛 spicy; bitter; hot; acrid
逝 departed; die	震 quake; shake; tremble; quiver; shiver	刃 blade; sword; edge	尋 inquire; fathom; look for	甚 tremendously; very; great; exceedingly	尽 exhaust; use up; run out of; deplete; befriend; serve	迅 swift; fast	陣 camp; battle array; ranks; position	剰 surplus; besides	壌 lot; earth; soil	嬢 lass; girl; Miss; daughter	巡 patrol; go around; circumference
枢 hinge; pivot; door	遵 abide by; follow; obey; learn	庶 commoner; all; bastard	緒 thong; beginning; inception; end; cord; strap	叙 confer; relate; narrate; describe	徐 gradually; slowly; deliberately; gently	償 reparation; make up for; recompense; redeem	匠 artisan; workman; carpenter	升 measuring box; 1.8 liter	召 seduce; call; send for; wear; put on; ride in; buy; eat; drink; catch (cold)	奨 exhort; urge; encourage	宵 wee hours; evening; early night
軸 axis; pivot; stem; stalk; counter for book scrolls	尚 esteem; furthermore; still; yet	床 bed; counter for beds; floor; padding; tatami	彰 patent; clear	抄 extract; selection; summary; copy; spread thin	掌 manipulate; rule; administer; conduct; palm of hand	昇 rise up	晶 sparkle; clear; crystal	沼 marsh; lake; bog; swamp; pond	渉 ford; ferry; port	焦 char; hurry; impatient; irritate; burn; scorch; singe	症 symptoms; illness
芝 turf; lawn	硝 nitrate; saltpeter	礁 reef; sunken rock	祥 auspicious; happiness; blessedness; good omen; good fortune	称 appellation; praise; admire; name; title; fame	粧 cosmetics; adorn (one's person)	紹 introduce; inherit; help	肖 resemblance	衝 collide; brunt; highway; opposition (astronomy); thrust; pierce; stab; prick	訟 sue; accuse	詔 imperial edict	詳 detailed; full; minute; accurate; well-informed
酌 bar-tending; serving sake; the host; draw (water); ladle; scoop; pump	鐘 bell; gong; chimes	丈 length; 10feet; measure; Mr.; Ms.; height; stature; all (one has); only; that's all; merely	冗 superfluous; uselessness	盾 shield; escutcheon; pretext	准 quasi-; semi-; associate	循 sequential; fellow	旬 decameron; 10day period; season (for specific products)	殉 martyrdom; follow by resigning	潤 wet; be watered; profit by; receive benefits; favor; charm; steep	淑 graceful; gentle; pure	粛 solemn; quietly; softly
釈 explanation	塾 cram school; private school	俊 sagacious; genius; excellence	瞬 wink; blink; twinkle	臭 stinking; ill-smelling; suspicious looking; odor; savor; fragrance; be fragrant; stink; glow; be bright	舟 boat; ship	襲 attack; advance on; succeed to; pile; heap	酬 repay; reward; retribution	醜 ugly; unclean; shame; bad looking	充 allot; fill	柔 tender; weakness; gentleness; softness	汁 soup; juice; broth; sap; gravy; pus
爵 baron; peerage; court rank	渋 astringent; hesitate; reluctant; have diarrhea	獣 animal; beast	銃 gun; arms	叔 uncle; youth	儒 Confucian	寿 longevity; congratulations; one's natural life	需 demand; request; need	囚 captured; criminal; arrest; catch	愁 distress; grieve; lament; be anxious	秀 excel; excellence; beauty; surpass	朱 vermilion; cinnabar; scarlet; red; bloody
勺 ladle; one tenth of a go; dip	殊 particularly; especially; exceptionally	狩 hunt; raid; gather	珠 pearl; gem; jewel	趣 gist; proceed to; tend; become	寂 loneliness; quietly; mellow; mature; death of a priest	赦 pardon; forgiveness	斜 diagonal; slanting; oblique	煮 boil; cook	遮 intercept; interrupt; obstruct	蛇 snake; serpent; hard drinker	邪 wicked; injustice; wrong

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執 tenacious; take hold; grasp; take to heart	賜 grant; gift; boon; results	雌 feminine; female	侍 waiter; samurai; wait upon; serve	慈 mercy	滋 nourishing; more & more; be luxuriant; planting; turbidity	璽 emperor's seal	施 alms; apply bandages; administer first-aid	旨 delicious; relish; show a liking for; purport; will; clever; expert	祉 welfare; happiness	紫 purple; violet	肢 limb; arms & legs
湿 damp; wet; moist	脂 fat; grease; tallow; lard; rosin; gum; tar	嗣 heir; succeed	傘 umbrella	惨 wretched; disaster; cruelty; harsh	暫 temporarily; a while; moment; long time	伺 pay respects; visit; ask; inquire; question; implore	刺 thorn; pierce; stab; prick; sting; calling card	撮 snapshot; take pictures	擦 grate; rub; scratch; scrape; chafe; scour	索 cord; rope	錯 confused; mix; be in disorder
漆 lacquer; varnish; seven	載 ride; board; get on; place; spread	剤 dose; medicine; drug	咲 blossom; bloom	崎 promontory; cape; spit	削 plane; sharpen; whittle; pare	搾 squeeze	詐 lie; falsehood; deceive; pretend	鎖 chain; irons; connection	債 bond; loan; debt	催 sponsor; hold (a meeting); give (a dinner)	宰 superintend; manager; rule
疾 rapidly	彩 coloring; paint; makeup	栽 plantation; planting	歳 year-end; age; occasion; opportunity	砕 smash; break; crush; familiar; popular	斎 purification; Buddhist food; room; worship; avoid; alike	衡 equilibrium; measuring rod; scale	貢 tribute; support; finance	購 subscription; buy	郊 outskirts; suburbs; rural area	酵 fermentation	項 paragraph; nape of neck; clause; item; term (expression)
諮 consult with	香 incense; smell; perfume	剛 sturdy; strength	拷 torture; beat	豪 overpowering; great; powerful; excelling; Australia	克 overcome; kindly; skillfully	酷 cruel; severe; atrocious; unjust	獄 prison; jail	腰 loins; hips; waist; low wainscoting	込 crowded; mixture; in bulk; included; (kokuji)	墾 ground-breaking; open up farmland	婚 marriage
掲 put up (a notice); put up; hoist; display; hang out; publish; describe	恨 regret; bear a grudge; resentment; malice; hatred	懇 sociable; kind; courteous; hospitable; cordial	昆 descendants; elder brother; insect	紺 dark blue; navy	魂 soul; spirit	佐 assistant; help	唆 tempt; seduce; instigate; promote	更 grow late; night watch; sit up late; of course	江 creek; inlet; bay	洪 deluge; flood; vast	溝 gutter; ditch; sewer; drain; 10**32
憩 recess; rest; relax; repose	甲 armor; high (voice); A grade; first class; former; instep; carapace	硬 stiff; hard	稿 draft; copy; manuscript; straw	絞 strangle; constrict; wring	綱 hawser; class (genus); rope; cord; cable	肯 agreement; consent; comply with	荒 laid waste; rough; rude; wild	坑 pit; hole	孔 cavity; hole; slit; very; great; exceedingly	巧 adroit; skilled; ingenuity	恒 constancy; always
慶 jubilation; congratulate; rejoice; be happy	慌 disconcerted; be confused; lose one's head	抗 confront; resist; defy; oppose	拘 arrest; seize; concerned; adhere to; despite	控 withdraw; draw in; hold back; refrain from; be moderate	攻 aggression; attack	娯 recreation; pleasure	御 honorable; manipulate; govern	悟 enlightenment; perceive; discern; realize; understand	碁 Go	侯 marquis; lord; daimyo	誇 boast; be proud; pride; triumphantly
恵 favor; blessing; grace; kindness	雇 employ; hire	顧 look back; review; examine oneself; turn around	鼓 drum; beat; rouse; muster	互 mutually; reciprocally; together	呉 give; do something for	孤 orphan; alone	弧 arc; arch; bow	枯 wither; die; dry up; be seasoned	渓 mountain stream; valley	継 inherit; succeed; patch; graft (tree)	茎 stalk; stem
契 pledge; promise; vow	蛍 lightning-bug; firefly	鶏 chicken	迎 welcome; meet; greet	鯨 whale	撃 beat; attack; defeat; conquer	傑 greatness; excellence	倹 frugal; economy; thrifty	兼 concurrently; and	剣 sabre; sword; blade; clock hand	圏 sphere; circle; radius; range	堅 strict; hard; solid; tough; tight; reliable
玄 mysterious; occultness	嫌 dislike; detest; hate	懸 suspend; hang; 10%; install; depend; consult	献 offering; counter for drinks; present; offer	肩 shoulder	謙 self-effacing; humble oneself; condescend; be modest	賢 intelligent; wise; wisdom; cleverness	軒 flats; counter for houses; eaves	遣 dispatch; despatch; send; give; donate; do; undertake	顕 appear; existing	幻 phantasm; vision; dream; illusion; apparition	弦 bowstring; chord; hypotenuse
携 portable; carry (in hand); armed with; bring along	吟 versify; singing; recital	駆 drive; run; gallop; advance; inspire; impel	愚 foolish; folly; absurdity; stupid	虞 expectation; consideration; uneasiness; fear; anxiety; concern	偶 accidentally; even number; couple; man & wife; same kind	遇 interview; treat; entertain; receive; deal with	隅 corner; nook	屈 yield; bend; flinch; submit	掘 dig; delve; excavate	靴 shoes	繰 winding; reel; spin; turn (pages); look up; refer to
緊 tense; solid; hard; reliable; tight	桑 mulberry	勲 meritorious deed; merit	薫 send forth fragrance; fragrant; be scented; smoke (tobacco)	傾 lean; incline; tilt; trend; wane; sink; ruin; bias	刑 punish; penalty; sentence; punishment	啓 disclose; open; say	況 condition; situation	狂 lunatic; insane; crazy; confuse	狭 cramped; narrow; contract; tight	矯 rectify; straighten; correct; reform; cure; control; pretend; falsify	脅 threaten; coerce
菌 germ; fungus; bacteria	響 echo; also N5116; sound; resound; ring; vibrate	驚 wonder; be surprised; frightened; amazed	仰 face-up; look up; depend; seek; respect; rever; drink; take	凝 congeal; freeze; stiff; be absorbed in	暁 daybreak; dawn; in the event	斤 axe; 1.32 lb; catty; counter for loaves of bread; axe radical (no. 69)	琴 harp; koto	挟 pinch; between	恭 respect; reverent	恐 fear; dread; awe	峡 gorge; ravine
襟 collar; neck; lapel	拒 repel; refuse; reject; decline	拠 foothold; based on; follow; therefore	虚 void; emptiness; unpreparedness; crack; fissure; untruth	距 long-distance; spur; fetlock	享 receive; undergo; answer (phone); take; get; catch	凶 villain; evil; bad luck; disaster	叫 shout; exclaim; yell	巨 gigantic; big; large; great	祈 pray; wish	軌 rut; wheel; track; model; way of doing	輝 radiance; shine; sparkle; gleam; twinkle

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謹 discreet; reverently; humbly	飢 hungry; starve	騎 equestrian; riding on horses; counter for equestrians	鬼 ghost; devil	偽 falsehood; lie; deceive; pretend; counterfeit; forgery	儀 ceremony; rule; affair; case; a matter	宜 best regards; good	戯 frolic; play; sport	擬 mimic; aim (a gun) at; nominate; imitate	欺 deceit; cheat; delude	犠 sacrifice	菊 chrysanthemum
岳 point; peak; mountain	吉 good luck; joy; congratulations	喫 consume; eat; drink; smoke; receive (a blow)	詰 packed; close; pressed; reprove; rebuke; blame	却 instead; on the contrary; rather	脚 skids; leg; undercarriage	虐 tyrannize; oppress	丘 hill; knoll	及 reach out; exert; exercise; cause	朽 decay; rot; remain in seclusion	窮 hard up; destitute; suffer; perplexed; cornered	糾 hard up; destitute; suffer; perplexed; cornered
隔 isolate; alternate; distance; separate; gulf	糾 twist; ask; investigate; verify	奇 strange; strangeness; curiosity	岐 branch off; fork in road; scene; arena; theater	幾 how many; how much; how far; how long	忌 mourning; abhor; detestable; death anniversary	既 previously; already; long ago	棋 chess piece; Japanese chess; shogi	棄 abandon; throw away; discard; resign; reject; sacrifice	閑 leisure	陥 collapse; fall into; cave in; fall (castle); slide into	含 include; bear in mind; understand; cherish
郭 enclosure; quarters; fortification; red-light district	頑 stubborn; foolish; firmly	企 undertake; scheme; design; attempt; plan	鑑 specimen; take warning from; learn from	緩 slacken; loosen; relax; lessen; be moderate; ease	缶 tin can; container	肝 liver; pluck; nerve; chutzpah	艦 warship	貫 pierce; 8 1/3lbs; penetrate; brace	還 send back; return	滑 slippery; slide; slip; flunk	褐 brown; woollen kimono
較 contrast; compare	轄 control; wedge	且 moreover; also; furthermore	刈 reap; cut; clip; trim; prune	乾 drought; dry; dessicate; drink up; heaven; emperor	冠 crown; best; peerless	勘 intuition; perception	勧 persuade; recommend; advise; encourage; offer	喚 yell; cry; scream	堪 withstand; endure; support; resist	寛 tolerant; leniency; generosity; relax; feel at home; be at ease; broadminded	患 afflicted; disease; suffer from; be ill
穫 harvest; reap	憾 remorse; regret; be sorry	換 interchange; period; change; change?	敢 daring; sad; tragic; pitiful; frail; feeble	棺 coffin; casket	款 goodwill; article; section; friendship; collusion	歓 delight; joy	汗 sweat; perspire	環 ring; circle; link; wheel	甘 sweet; coax; pamper; be content; sugary	監 oversee; official; govt office; rule; administer	戒 commandment
獲 seize; get; find; earn; acquire; can; may; able to	拐 kidnap; falsify	皆 all; everything	劾 censure; criminal investigation	慨 rue; be sad; sigh; lament	概 outline; condition; approximation; generally	涯 horizon; shore	該 above-stated; the said; that specific	垣 hedge; fence; wall	嚇 menacing; dignity; majesty; threaten	核 nucleus; core; kernel	殻 husk; nut shell
掛 hang; suspend; depend; arrive at; tax; pour	怪 suspicious; mystery; apparition	悔 repent; regret	懐 pocket; feelings; heart; yearn; miss someone; become attached to; bosom; breast	壊 demolition; break; destroy	塊 clod; lump; chink; clot; mass	韻 rhyme; elegance; tone	渦 whirlpool; eddy; vortex	浦 bay; creek; inlet; gulf; beach; seacoast	影 shadow; silhouette; phantom	詠 recitation; poem; song; composing	鋭 pointed; sharpness; edge; weapon; sharp; violent
潟 lagoon	疫 epidemic	悦 ecstasy; joy; rapture	謁 audience; audience (with king)	越 surpass; cross over; move to; exceed; Vietnam	閲 review; inspection; revision	宴 banquet; feast; party	援 abet; help; save	炎 inflammation; flame; blaze	煙 smoke	猿 monkey	縁 affinity; relation; connection; edge; border; verge; brink
喝 hoarse; scold	鉛 lead	汚 dirty; pollute; disgrace; rape; defile	凹 concave; hollow; sunken	奥 heart; interior	押 push; stop; check; subdue; attach; seize; weight; shove; press; seal; do in spite of	欧 Europe	殴 assault; hit; beat; thrash	翁 venerable old man	沖 open sea; offing; rise high into sky	憶 recollection; think; remember	乙 the latter; duplicate; strange; witty; fishhook radical (no. 5)
括 fasten; tie up; arrest; constrict	卸 wholesale	穏 calm; quiet; moderation	佳 excellent; beautiful; good; pleasing; skilled	嫁 marry into; bride	寡 widow; minority; few	暇 spare time; rest; leisure; time; leave of absence	架 erect; frame; mount; support; shelf; construct	禍 calamity; misfortune; evil; curse	稼 earnings; work; earn money	箇 counters for things	華 splendor; flower; petal; shine; luster; ostentatious; showy; gay; gorgeous
渇 thirst; dry up; parch	菓 candy; cakes; fruit	蚊 mosquito	雅 gracious; elegant; graceful; refined	餓 starve; hungry; thirst	介 jammed in; shellfish; mediate; concern oneself with	亜 Asia; rank next; come after; -ous	哀 pathetic; grief; sorrow; pathos; pity; sympathize	握 grip; hold; mould sushi; bribe	扱 handle; entertain; thresh; strip	依 reliant; depend on; consequently; therefore; due to	偉 admirable; greatness; remarkable; conceited; famous; excellent
隠 conceal; hide; cover	威 intimidate; dignity; majesty; menace; threaten	尉 military officer; jailer; old man; rank	慰 consolation; amusement; seduce; cheer; make sport of; comfort; console	為 do; change; make; benefit; welfare; be of use; reach to; try; practice; cost; serve as; good; advantage; as a result of	維 fiber; tie; rope	緯 horizontal; woof; left & right; latitude	違 difference; differ	井 well; well crib; town; community	壱 I; one	逸 deviate; idleness; leisure; miss the mark; evade; elude; parry; diverge	稲 rice plant
陰 shade; yin; negative; sex organs; secret; shadow	芋 potato	姻 matrimony; marry									

Common Words

Numbers

一 ichi One	二 ni Two	三 san Three	四 shi/yon Four	五 go Five	六 roku Six	七 nana / shichi Seven	八 hachi Eight	九 ku/kyuu Nine	十 juu Ten	百 hyaku 100	千 sen 1,000
万 man 10,000	円 en Yen										

Emergency

トイレ toire	Toilet
手洗い tearai	Bathroom
助けて! tasukete!	Help!
わかりません wakarimasen	I don't understand
やめて! yamete!	Stop it!
英語 eigo	English
服 fuku	Clothes
警察 keisatsu	Police
危ない abunai	Dangerous
危険 kiken	Peril, Hazard

Asking

どうした? doushita?	What Happened?
どうして? doushite?	Why?
時間 jikan	Time
質問 shitsumon	Question
だれ? dare?	Who?
いつ? itsu?	When?

People

先生 sensei	Teacher
学生 gakusei	Student
会社員 kaishain	Employee
人 hito	Person
私 watashi	I
あなた anata	You

Locations

ホテル hoteru	Hotel
どこ? doko?	Where?

空港 kuukou	Airport
駅 eki	Station
日本 nihon/nippon	Japan
大学 daigaku	College
本屋 hon'ya	Bookstore
タクシー takushi	Taxi
家 ie/uchi	Home

Food

おなかすいた onaka suita	I am Hungry
はらへった hara hetta	Hungry
食べます tabemasu	To Eat
食べません tabemasen	To Not Eat
飲みます nomimasu	To Drink
飲みません nomimasen	To Not Drink
水 mizu	Water
飲み物 nomimono	Drink
食べ物 tabemono	Food
美味しい Oishii	Good Tasting, Tasty
不味い Mazui	Bad Tasting
レストラン resutoran	Restaurant
コンビニ kombini	Convenience Store
スーパー suupaa	Supermarket

Politeness

ありがとうございます arigatougozaimasu	Thank You
すみません sumimasen	Excuse Me
ごめんなさい gomennasai	Sorry
いただきます itadakimasu	Bon Apetite
ごちそうさまでした gochisousama deshita	Thanks for the food

Greetings

おはようございます ohayougozaimasu	Good Morning
こんにちは konnichiwa	Good Afternoon
こんばんは konbanwa	Good Evening

ではまた dewamata	See You Later
また明日 mata ashita	See You Tomorrow
さようなら sayounara	Goodbye
おやすみなさい oyasuminasai	Good Night

Basic Verbs

行きます ikimasu	To Go
帰ります kaerimasu	To Return (home)
食べます tabemasu	To Eat
します shimasu	To Do
見ます mimasu	To See
買います kaimasu	To Buy
待ちます machimasu	To Wait
書きます kakimasu	To Write
止まります tomarimasu	To Stop
教えます oshiemasu	To Teach
話します hanashimasu	To Speak

Basic Adjectives

新しい atarashii	New
嬉しい ureshii	Happy
大丈夫 daijoubu	Okay
すごい sugoi	Amazing
高い takai	Expensive, Tall
大きい ookii	Big, Large
小さい chiisai	Small
近い chikai	Near
遠い tooi	Far
悪い warui	Bad
いい ii	Good
面白い omoshiroi	Interesting, Funny
楽しい tanoshii	Fun
熱い atsui	Hotel

寒い samui	Cold
上手 jouzu	Good At
下手 heta	Bad At
馬鹿 baka	Stupid

Common Phrases

9 Korean

The Korean language is an East Asian language spoken by about 77 million people. It is a member of the Koreanic language family and is the official and national language of both Koreas: North Korea and South Korea, with different standardized official forms used in each country. It is also one of the two official languages in the Yanbian Korean Autonomous Prefecture and Changbai Korean Autonomous County of Jilin province, China. It is also spoken in parts of Sakhalin, Ukraine and Central Asia. Historical and modern linguists classify Korean as a language isolate; however, it does have a few extinct relatives, which together with Korean itself and the Jeju language (spoken in the Jeju Province and considered somewhat distinct) form the Koreanic language family. The linguistic homeland of Korean is suggested to be somewhere in Manchuria.

Alphabet (Hangul)

Alphabet - Vowels

ㅏ a	ㅑ ya	ㅓ eo	ㅕ yeo	ㅗ o	ㅛ yo	ㅜ oo or u	ㅠ yoo or yu	ㅡ eu	ㅣ ee		

Alphabet - Consonants

ㄱ g or k	ㄴ n	ㄷ d or t	ㄹ r or l	ㅁ m	ㅂ b or p	ㅅ s	ㅇ -	ㅈ ch	ㅊ chh	ㅋ g or k	ㅌ dd
ㅍ pp	ㅎ h										

10 Portuguese

Portuguese (português or, in full, língua portuguesa) is a Western Romance language originating in the Iberian Peninsula. It is the sole official language of Portugal, Brazil, Cape Verde, Guinea-Bissau, Mozambique, Angola, and São Tomé and Príncipe. It also has co-official language status in East Timor, Equatorial Guinea and Macau in China. As the result of expansion during colonial times, a cultural presence of Portuguese and Portuguese creole speakers are also found in Goa, Daman and Diu in India; in Batticaloa on the east coast of Sri Lanka; in the Indonesian island of Flores; in the Malacca state of Malaysia; and the ABC islands in the Caribbean where Papiamento is spoken, while Cape Verdean Creole is the most widely spoken Portuguese-based Creole. Reintegrationists maintain that Galician is not a separate language, but a dialect of Portuguese.

Portuguese is part of the Ibero-Romance group that evolved from several dialects of Vulgar Latin in the medieval Kingdom of Galicia and the County of Portugal, and has kept some Celtic phonology and lexicon. With approximately 215 to 220 million native speakers and 250 million total speakers, Portuguese is usually listed as the sixth most natively spoken language in the world, the third-most spoken European language in the world in terms of native speakers, and the most spoken language in the Southern Hemisphere. It is also the most spoken language in South America and the second-most spoken in Latin America after Spanish, one of the 10 most spoken languages in Africa and is an official language of the European Union, Mercosur, OAS, ECOWAS and the African Union. The Community of Portuguese Language Countries is an international organization made up of all of the world's officially Lusophone nations.

Alphabet

Aa á ah	Bb bê beh	Cc cê she	Dd dê deh	Ee é ay	Ff efe ehf	Gg gê or guê geh	Hh agá a-gah	Ii i ee	Jj jota jota	Kk capa (Rarely Used)	Ll ele éhl
Mm eme éhme	Nn ene éhne	Oo ó óhr	Pp pê peh	Qq quê qay	Rr erre or rê éh-rre	Ss esse éh-sse	Tt tê têh	Uu u oo	Vv vê vay	Ww dâblio or duplo vê (Rarely Used)	Xx xis shish
Yy ípsilon or i grego (Rarely Used)	Zz zê zay										

11 Russian

Russian is an East Slavic language, which is official in the Russian Federation, Belarus, Kazakhstan and Kyrgyzstan, as well as being widely used throughout Eastern Europe, the Baltic states, the Caucasus and Central Asia. It was the de facto language of the Soviet Union until its dissolution on 25 December 1991. Although nearly three decades have passed since the breakup of the Soviet Union, Russian is used in official capacity or in public life in all the post-Soviet nation-states, as well as in Israel and Mongolia. Russian belongs to the family of Indo-European languages, one of the four living members of the East Slavic languages, and part of the larger Balto-Slavic branch. Written examples of Old East Slavonic are attested from the 10th century onward. Russian is the largest native language in Europe and the most geographically widespread language in Eurasia. It is the most widely spoken of the Slavic languages, with 144 million speakers in Russia, Ukraine and Belarus.

Russian is the eighth most spoken language in the world by number of native speakers and the seventh by total number of speakers. The language is one of the six official languages of the United Nations. Russian is also the second most widespread language on the Internet after English. Russian distinguishes between consonant phonemes with palatal secondary articulation and those without, the so-called soft and hard sounds. Almost every consonant has a hard or a soft counterpart, and the distinction is a prominent feature of the language. Another important aspect is the reduction of unstressed vowels. Stress, which is unpredictable, is not normally indicated orthographically though an optional acute accent may be used to mark stress, such as to distinguish between homographic words, for example замо́к (zamók, meaning a lock) and за́мок (zámok, meaning a castle), or to indicate the proper pronunciation of uncommon words or names.

Alphabet

А а a like ar in far	Б б be like b in box	В в ve like v in voice	Г г ge like g in go	Д д de like d in day	Е е ye like ye in yet or e in exit	Ё ё yo like yo in your	Ж ж zhe like s in pleasure	З з ze like z in zoo	И и ee like ee in meet	Й й ee kratkoye (short i) like y in boy	К к ka like k in key or c in cat
Л л el like l in lamp	М м em like m in man	Н н en like n in note	О о o like o in not	П п pe like p in pet	Р р er like r in rock (but rolled)	С с es like s in sun	Т т te like t in table	У у oo like oo in moon	Ф ф ef like f in food	Х х kha like ch in Scottish loch	Ц ц tse like ts in boots
Ч ч che like ch in chat	Ш ш sha like sh in short	Щ щ shcha like sh_ch in fresh_cheese	ъ tviordiy znak (hard sign) has no sound	ы ih* like i in ill	ь myagkiy znak (soft sign) has no sound	Э э e like e in end	Ю ю yoo like u in use	Я я ya like ya in yard			

12 Spanish

Spanish is a Romance language that originated in the Castile region of Spain and today has hundreds of millions of native speakers in the Americas and Spain. It is a global language and the world's second-most spoken native language, after Mandarin Chinese. Spanish is a part of the Ibero-Romance group of languages, which evolved from several dialects of Vulgar Latin in Iberia after the collapse of the Western Roman Empire in the 5th century. The oldest Latin texts with traces of Spanish come from mid-northern Iberia in the 9th century, and the first systematic written use of the language happened in Toledo, then capital of the Kingdom of Castile, in the 13th century.

Around 75% of modern Spanish vocabulary is derived from Latin and, through Latin, Ancient Greek. Spanish vocabulary has been in contact with Arabic from an early date, having developed during the Al-Andalus era in the Iberian Peninsula. With around 8% of its vocabulary being Arabic in origin, this language is the second most important influence after Latin. It has also been influenced by Basque, Iberian, Celtiberian, Visigothic, and by neighboring Ibero-Romance languages. Spanish is one of the six official languages of the United Nations. It is also used as an official language by the European Union, the Organization of American States, the Union of South American Nations, the Community of Latin American and Caribbean States, the African Union and many other international organizations. Despite its large number of speakers, the Spanish language does not feature prominently in scientific writing, with the exception of the humanities.

Alphabet (abecedario)

Aa a amigo	Bb be bonita	Cc ce cereal	Dd de dedo	Ee e español	Ff efe feo	Gg ge gato	Hh hache hormiga	Ii I iglesia	Jj jota José	Kk ka kilo	Ll ele lobo
Mm eme mamá	Nn ene no	Ññ eñe ñoño	Oo o ojo	Pp pe pelo	Qq cu quemar	Rr erre ratón	Ss ese soso	Tt te tocar	Uu u uva	Vv uve vamos	Ww uve doble whisky
Xx equis xilófono	Yy I griega yate	Zz zeta zorro									

13 Phrase Translations

This table allows for rapid translations between multiple languages with common phrases and words. It can also be used to convert non english languages to each other if you can understand one. It focuses on the verbal english rather than the written. Some words have their pronounciation underneath them, and some characters have their spelling under them.

Conversation Basics

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Hello	مرحبا	你好	Bonjour	Hallo	नमस्ते	Ciao	こんにちは	여보세요	Olá	Здравствуйте	Hola

LANGUAGE

Language Translations

Conversation Basics

Good Morning	صباح الخير	早上好	Bonjour	Guten Morgen	शुभ प्रभात	Buongiorno	おはようございます	좋은 아침	Bom Dia	Доброе утро	Buenos días
Good Afternoon	طاب مسائك	下午好	Bonne après-midi	Guten Nachmittag	नमस्कार	Buon pomeriggio	こんにちは	안녕하세요	Boa tarde	Добрый день	Buenas tardes
Good Evening	مساء الخير	晚上好	Bonsoir	Guten Abend	सुसंध्या	buona serata	こんばんは	안녕하세요	Boa noite	Добрый вечер	Buenas tardes
What is your name?	ما اسمك؟	你叫什么名字？	Comment vous appelez-vous?	Wie heißen Sie?	तुम्हारा नाम क्या हे?	Come ti chiami?	お名前は何ですか？	당신의 이름은 무엇입니까?	Qual é o seu nome?	Как вас зовут?	¿Cuál es su nombre?
My name is	اسمي هو	我的名字是	Mon nom est	Mein Name ist	मेरा नाम है	Il mio nome è	私の名前は	내 이름은	Meu nome é	Меня зовут	Me llamo
I am	انا	我是	je suis	ich bin	मैं हूँ	sono	わたし	나는	eu sou	я	yo soy
How are you?	كيف حالك؟	你好吗？	Comment allez-vous?	Wie geht es dir?	क्या हाल है?	Come stai?	お元気ですか？	잘 지냈어요?	Como você está?	Как дела?	¿Cómo estás?
I am well	انا بخير	我很好	Je vais bien	Mir geht es gut	मैं ठीक हूँ	Sto bene	私は元気です	나는 잘한다.	Eu estou bem	У меня все в порядке	estoy bien
Can I have	هل أستطيع الحصول على	我能有……吗	Puis-je avoir	Kann ich haben	क्या मैं ले सकता हूँ	Posso avere	私は持っていますか？	를 가질 수 있어요	Posso ter	Можно мне	Puedo tener
Nice to meet you	تشرفت بمقابلتك	很高兴见到你	Ravi de vous rencontrer	Schön dich zu treffen	आपसे मिलकर अच्छा लगा	piacere di conoscerti	はじめまして	만나서 반갑습니다	Prazer em conhecê-lo	Приятно познакомиться	Encantada de conocerte
I am from	أنا من	我来自	Je viens de	ich komme aus	मैं यहां से आया हूं	io vengo da	私は___出身です	나는 출신이다.	eu sou de	я из	soy de
I would like	أود	我想要	J'aimerais	Ich möchte	मैं पसंद करूँगा	mi piacerebbe	をお願いします。	나는 원한다.	eu gostaria	я бы хотел	Me gustaría
Do you speak English?	هل تتحدث الانجليزية؟	你会说英语吗？	Parlez vous anglais?	Sprichst du Englisch?	क्या आप अंग्रेज़ी बोलते हैं?	Parli inglese?	英語を話せますか？	당신은 영어를하십니까?	Você fala inglês?	Ты говоришь по-английски?	¿Habla usted Inglés?
I don't know	انا لا اعرف	我不知道	Je ne sais pas	Ich weiß es nicht	मुझे नहीं पता	Non lo so	知らない	나는 모른다.	Eu não sei	Я не знаю	No lo sé
I love you	أحبك	我爱你	je t'aime	ich liebe dich	मैं तुमसे प्यार करता हूँ	ti amo	わたしは、あなたを愛しています	사랑해	eu te amo	я люблю тебя	te amo
Let's go	لنذهب	我们走吧	Allons-y	Lass uns gehen	चलिए चलते हैं	Andiamo	行こう	가자	Vamos	Поехали	Vamonos
How much does it cost?	كم يكلف؟	它的价格是多少？	Combien ça coûte ?	Wie viel kostet es?	उसकी क़ीमत क्या है?	Quanto costa?	これはいくらでしょうか。	그거 얼마에요?	Quanto custa?	Сколько это стоит?	¿Cuánto cuesta?
How many are there?	كم يوجد هناك؟	有多少人？	Combien sont-ils ?	Wie viele gibt es?	कितने हैं?	Quante ce ne sono?	どのように多くはありますか。	얼마나 많은 있습니까?	Quantos existem?	Сколько есть?	¿Son cuántos hay?
What time is it?	أي ساعة؟	现在 几点钟？	Quelle heure est-il ?	Wie spät ist es?	समय क्या हुआ है?	Che ora è?	何時ですか。	몇 시예요?	Que horas são?	Сколько времени?	¿Qué horas son?
Where is the Toilet?	أين هو المرحاض؟	厕所在哪里？	Où se trouve les toilettes ?	Wo ist die Toilette?	शौचालय कहां है?	Dov'è il bagno?	トイレはどこですか？ Toire wa dokodesu ka?	화장실은 어디에?	Onde é o banheiro?	Где находится Туалет?	¿Dónde está el baño?
Yes	نعم	是的	Oui	Ja	हाँ	Sì	うん	예	Sim	Да	Sí
No	لا	不	non	Nein	नहीं	No	違います	아니요	Não	Нет	No
I'm Not Sure	أنا لست متأكدًا	我不确定	Je ne suis pas sûr	Ich bin nicht sicher	मुझे यकीन नहीं है	Non sono sicuro	確信がもてません	확실하지 않아요	Não tenho certeza	Я не уверен	No estoy seguro
What did you say?	ماذا قلت؟	你说什么？	Qu'est-ce que vous avez dit?	Was hast du gesagt?	आपने क्या कहा?	Cosa hai detto?	何って言ったの？	뭐라 했니?	O que você disse?	Что ты сказал?	¿Qué dijiste?
Please speak slowly	من فضلك تحدث ببطء	请慢慢讲	S'il te plaît, parle doucement	Bitte sprechen Sie langsam	कृपया धीमें बोलें	Per favore parla lentamente	ゆっくり話してください	천천히 말하십시오.	Por favor fale lentamente	Пожалуйста, говорите медленно	Por favor habla despacio
I Don't Understand	أنا لا أفهم	我不明白	Je ne comprends pas	Ich verstehe nicht	मुझे समझ में नहीं आता	Non capisco	わかりません	나는 이해하지 못한다.	Eu não entendo	Я не понимаю	No entiendo
See you later	أراك لاحقاً	回头见	À plus tard	Bis später	बाद में मिलते हैं	Arrivederci	じゃあまたね	나중에 봐요.	Até logo	Увидимся	Nos vemos más tarde
Goodbye	وداعا	再见	Au revoir	Auf Wiedersehen	अलविदा	addio	さようなら	안녕	Adeus	Прощай	Adiós

Politeness

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Excuse Me	عفوا	打扰一下	Excusez-moi	Entschuldigen Sie mich	मुझे माफ करें	Scusami	すみません	실례합니다	Com licença	Извините	Disculpe
Please	عفوا	请	S'il vous plaît	Bitte	कृप्या	per favore	どうぞ	부디	Por favor	пожалуйста	Por favor
Thank You	شكرا لكم	谢谢	Je vous remercie	Danke	धन्यवाद	Grazie	ありがとう	고맙습니다	Obrigado	Спасибо	Gracias
I'm Sorry	أنا أسف	对不起	Je suis désolé	Es tut mir Leid	मुझे माफ कर दो	Mi dispiace	ごめんなさい	죄송 해요	Eu sinto Muito	Прости	Lo siento

Seasonal Events

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Happy Birthday	عيد مولد سعيد	生日快乐	Bon anniversaire	Alles Gute zum Geburtstag	जन्मदिन की शुभकामनाएं	Buon compleanno	お誕生日おめでとうございます	생일 축하	feliz Aniversário	С днем рождения	Feliz cumpleaños
Happy Anniversary	عيد سعيد	周年快乐	Joyeux anniversaire	Frohes Jubiläum	शादी की सालगिरह मुबारक	Felice anniversario	記念日おめでとう	축하의 기념일	Feliz aniversário	С годовщиной	Feliz aniversario
Congratulations	تهانينا	祝贺	Toutes nos félicitations	Herzliche Glückwünsche	बधाई हो	Congratulazioni	おめでとう	축하해.	Parabéns	Поздравляю	Felicidades
Well Done	أحسنت	做得好	Bien joué	Gut gemacht	बहुत बढ़िया	Molto bene	よくやった	잘 했어	Bem feito	Отлично сработано	Bien hecho
Happy New Year	سنة جديدة سعيدة	新年快乐	Bonne année	Frohes neues Jahr	नया साल मुबारक हो	Felice anno nuovo	明けましておめでとうございます	새해 복 많이 받으세요	Feliz Ano Novo	С новым годом	Feliz año nuevo
Fireworks	العاب ناريه	烟花	Feux d'artifice	Feuerwerk	पटाखे	Fuochi d'artificio	花火	불꽃	Fogos de artifício	Фейерверк	Fuegos artificiales
Merry Christmas	عيد ميلاد سعيد	圣诞节快乐	joyeux Noël	Fröhliche Weihnachten	क्रिसमस की बधाई	buon Natale	メリークリスマス	메리 크리스마스	feliz Natal	счастливого Рождества	Feliz Navidad
Christmas Tree	شجرة عيد الميلاد	圣诞树	Sapin de Noël	Weihnachtsbaum	क्रिसमस वृक्ष	Albero di Natale	クリスマスツリー	크리스마스 트리	Árvore de Natal	Рождественская елка	Árbol de Navidad
Happy Easter	عيد فصح سعيد	复活节快乐	Joyeuses Pâques	Frohe Ostern	हैप्पी ईस्टर	Buona Pasqua	イースター、おめでとう	행복한 부활절	Feliz Páscoa	Счастливой Пасхи	Felices Pascuas
He Is Risen	هو قام	他复活了	Il est ressuscité	Er ist auferstanden	वह बढ़ी है	È risorto	彼は生きている	그는 살아났다.	Ele está ressuscitado	Он воскрес	Él ha resucitado
Hallelujah	الحمد لله	哈利路亚	Alléluia	Halleluja	हलिलुय	Hallelujah	ハレルヤ	할렐루야	Aleluia	Аллилуйя	Aleluya
Easter Egg	بيضة عيد الفصح	复活节彩蛋	œuf de Pâques	Osterei	ईस्टर अंडा	Uovo di Pasqua	イースターエッグ	부활절 달걀	ovos de pascoa	пасхальное яйцо	Huevo de Pascua
Happy Halloween	عيد رعب سعيد	万圣节快乐	Joyeux Halloween	Fröhliches Halloween	हेलोवीन की शुभकामना	Felice Halloween	ハッピーハロウィン	해피 할로윈	Feliz Dia das Bruxas	Счастливого Хэллоуина	Feliz Halloween
Happy Valentines Day	عيد حب سعيد	情人节快乐	Joyeuse saint Valentin	Fröhlichen Valentinstag	वैलेंटाइन्स दिवस मुबारक हो	Buon San Valentino	ハッピーバレンタインデー	행복한 발렌타인 데이	Feliz Dia dos namorados	С днем Святого Валентина	Feliz día de San Valentín
I Like You	انا معجب بك	我喜欢你	Je vous aime bien	Ich mag dich	मैं तुम्हें पसंद करता हूं	Mi piaci	君の事が好きです	나는 너를 좋아해	Eu gosto de você	Ты мне нравишься	Me gustas
I Love You	أحبك	我爱你	Je t'aime	Ich liebe dich	मैं तुमसे प्यार करता हूँ	Ti amo	わたしは、あなたを愛しています	사랑해	Eu te amo	Я люблю тебя	Te amo

People

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Human	بشري	人的	Humain	Mensch	मानव	Umano	にんげん ningen	인간	Humano	Человек	Humano
Humanity	إنسانية	人性	Humanité	Menschheit	मानवता	Umanità	じんるい jinrui	인류	Humanidade	человечество	Humanidad
Person	شخص	人	La personne	Person	व्यक्ति	Persona	ひと hito	사람	Pessoa	Человек	Persona
People	اشخاص	人	Gens	Menschen	लोग	Persone	人	사람들	Pessoas	люди	Gente
Male	الذكر	男	Mâle	Männlich	नर	Maschio	おとこ otoko	남성	Masculino	мужчина	Masculino
Boy	صبي	男孩	Garçon	Junge	लड़का	Ragazzo	おとのこ 少年 otokonoko	소년	Garoto	мальчик	Chico
Man	رجل	人	Homme	Mann	आदमी	Uomo	おとこのひと １つ otokonohito	남자	Homem	мужчина	Hombre
He	هو	他	Il	Er	वह	lui	彼	그	Ele	Он	Él
Female	إناثا	女	Femelle	Weiblich	महिला	Femmina	おんな 女性 onna	여자	Fêmea	женский	Hembra
Girl	فتاة	女孩	Fille	Mädchen	लड़की	Ragazza	しょうじょ shoujo	소녀	Menina	девушка	Niña
Woman	النساء	女人	Femme	Frau	महिला	Donna	おんなのひと 女性 onnanohito	여자	Mulher	Женщина	Mujer

People

She	هي	她	Elle	Sie	वह	Lei	彼女が	여자	Ela	она	Ella
Baby	طفل	宝宝	Bébé	Baby	बच्चा	Bambino	あかちゃん akachan	아가	bebê	малыш	Bebé
Child	طفل	儿童	Enfant	Kind	बच्चा	Bambino	子	어린이	Criança	ребенок	Niño
Children	الأطفال	孩子	Les enfants	Kinder	बच्चे	Bambini	子供	어린이	Crianças	Дети	Niños
Teenager	مراهق	青少年	Adolescent	Teenager	किशोर	Adolescente	わかもの wakamono	십대	Adolescente	подросток	Adolescente
I	أنا	一世	je	ich	मैं	io	わたし watashi	나는	Eu	я	yo
You	أنت	您	Toi	Sie	आप	tu	あなたが	당신	Você	Вы	Tú
They	هم	他们	Ils	Sie	वे	Essi	彼らが	그들	Eles	Они	Ellos

Occupations

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Doctor	طبيب	医生	Docteur	Arzt	चिकित्सक	Medico	いしゃ isha	의사	Médico	Врач	Doctor
Nurse	ممرضة	护士	Infirmière	Krankenschwester	नर्स	Infermiera	かんごし kangoshi	간호사	Enfermeira	Медсестра	enfermera
Politician	سياسي	政治家	Politicien	Politiker	राजनीतिज्ञ	Politico	せいじか seijika	정치가	Político	политик	Político
Lawyer	المحامية	律师	Avocat	Anwalt	वकील	Avvocato	べんごし bengoshi	변호사	Advogado	Адвокат	Abogado
Firefighter	رجال الاطفاء	消防队员	Sapeur pompier	Feuerwehrmann	फायर फाइटर	Pompiere	しょうぼうし shouboushi	소방관	Bombeiro	Пожарный	Bombero
Police Officer	ضابط شرطة	警官	Officier de police	Polizist	पुलिस अधिकारी	Poliziotto	けいさつかん keisatsukan	경찰관	Policial	Офицер полиции	Oficial de policia
Soldier	جندي	士兵	Soldat	Soldat	फोजी	Soldato	へいし heishi	병사	Soldado	солдат	Soldado
Architect	مهندس معماري	建筑师	Architecte	Architekt	वास्तुकार	Architetto	けんちくか kenchikuka	건축가	Arquiteto	Архитектор	Arquitecto
Teacher	مدرس	老师	Prof	Lehrer	अध्यापक	Insegnante	せんせい sensei	선생	Professor	учитель	Profesor
Translator	مترجم	翻译者	Traducteur	Übersetzer	अनुवादक	Traduttore	翻訳者 Hon'yaku-sha	역자	Tradutor	Переводчик	Traductor
Waiter / Waitress	نادل نادلة	服务员女服务员	Serveur serveuse	Kellner Kellnerin	वेटर वेट्रेस	Cameriere cameriera	ウェイター / ウェイトレス U~eitā / U~eitoresu	웨이터 / 웨이트리스	Garçom garçonete	Официант Официантка	Camarero camarera
Cashier	أمين الصندوق	出纳员	La caissière	Kassierer	केशियर	Cassiere	レジ Reji	출납원	Caixa	Касса	Cajero
Office Clerk	موظف مكتب	办公室文员	Commis de bureau	Büroangestellter	कार्यालय लिपिक	Impiegato	事務員 Jimu-in	사무원	Funcionário de escritório	Офисный клерк	Empleado de oficina
Chef / Cook	الشيف / كوك	厨师厨师	Chef cuisinier	Chefkoch	मुख्य बावर्ची	Chef / Cuoco	シェフ/ クック Shefu / Kukku	요리사 / 요리사	Chefe de cozinha	Шеф-повар	Cocinero
Manager	مدير	经理	Directeur	Manager	मैनेजर	Manager	マネージャー manējā	매니저	Gerente	Менеджер	Gerente
Driver	سائق	司机	Chauffeur	Treiber	चालक	autista	ドライバ doraiba	운전사	Motorista	Водитель	Conductor
Singer	مطرب	歌手	Chanteur	Sänger	गायक	Cantante	かしゅ 歌手 kashu	가수	Cantor	певец	Cantante
Engineer	مهندس	工程师	Ingénieur	Ingenieur	इंजीनियर	Ingegnere	エンジニア enjinia	기사	Engenheiro	инженер	Ingeniero

Countries

Continents

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
North America	أمريكا الشمالية	北美	Amérique du Nord	Nordamerika	उत्तरी अमेरिका	Nord America	北米	북아메리카	América do Norte	Северная Америка	Norteamérica
South America	أمريكا الجنوبية	南美洲	Amérique du sud	Südamerika	दक्षिण अमेरिका	Sud America	南アメリカ	남아메리카	América do Sul	Южная Америка	Sudamerica
Europe	أوروبا	欧洲	L'Europe	Europa	यूरोप	Europa	ヨーロッパ	유럽	Europa	Европа	Europa
Africa	أفريقيا	非洲	Afrique	Afrika	अफ्रीका	Africa	アフリカ	아프리카	África	Африка	África
Asia	آسيا	亚洲	Asie	Asien	एशिया	Asia	アジア	아시아	Ásia	Азия	Asia
Australia	أستراليا	澳大利亚	Australie	Australien	ऑस्ट्रेलिया	Australia	オーストラリア	호주	Austrália	Австралия	Australia
Antarctica	القارة القطبية الجنوبية	南极洲	Antarctique	Antarktis	अंटार्कटिका	Antartide	南極大陸 Nankyokutairiku	남극 대륙	Antártica	Антарктида	Antártida

Countries

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
United States	الولايات المتحدة الامريكانية	美国	États Unis	Vereinigte Staaten	संयुक्त राज्य अमेरिका	stati Uniti	アメリカ	미국	Estados Unidos	Соединенные Штаты	Estados Unidos
United Kingdom	المملكة المتحدة	英国	Royaume-Uni	Großbritannien	यूनाइटेड किंगडम	Regno Unito	イギリス	영국	Reino Unido	Великобритания	Reino Unido
Australia	أستراليا	澳大利亚	Australie	Australien	ऑस्ट्रेलिया	Australia	オーストラリア	호주	Austrália	Австралия	Australia
Canada	كندا	加拿大	Canada	Kanada	कनाडा	Canada	カナダ	캐나다	Canadá	Канада	Canadá
New Zealand	نيوزيلاندا	新西兰	Nouvelle-Zélande	Neuseeland	न्यूज़ीलैंड	Nuova Zelanda	ニュージーランド	뉴질랜드	Nova Zelândia	Новая Зеландия	Nueva Zelanda
France	فرنسا	法国	France	Frankreich	फ्रांस	Francia	フランス	프랑스	França	Франция	Francia
Spain	إسبانيا	西班牙	Espagne	Spanien	स्पेन	Spagna	スペイン	스페인	Espanha	Испания	España
China	الصين	中国	Chine	China	चीन	Cina	中国	중국	China	Китай	China
Japan	اليابان	日本	Japon	Japan	जापान	Giappone	日本	일본	Japão	Япония	Japón
Italy	إيطاليا	意大利	Italie	Italien	इटली	Italia	イタリア	이탈리아	Itália	Италия	Italia
Turkey	ديك رومي	火鸡	dinde	Truthahn	तुर्की	tacchino	七面鳥	터키	Peru	Турция	Turquía
Germany	ألمانيا	德国	Allemagne	Deutschland	जर्मनी	Germania	ドイツ	독일	Alemanha	Германия	Alemania
Russia	روسيا	俄国	Russie	Russland	रूस	Russia	ロシア	러시아 제국	Rússia	Россия	Rusia
Mexico	المكسيك	墨西哥	Mexique	Mexiko	मेक्सिको	Messico	メキシコ	멕시코	México	Мексика	Méjico
Malaysia	ماليزيا	马来西亚	Malaisie	Malaysia	मलेशिया	Malaysia	マレーシア	말레이시아	Malásia	Малайзия	Malasia
Austria	النمسا	奥地利	L'Autriche	Österreich	ऑस्ट्रिया	Austria	オーストリア	오스트리아	Áustria	Австрия	Austria
Thailand	تايلاند	泰国	Thaïlande	Thailand	थाईलैंड	Tailandia	タイ	태국	Tailândia	Таиланд	Tailandia
Greece	اليونان	希腊	Grèce	Griechenland	यूनान	Grecia	ギリシャ	그리스	Grécia	Греция	Grecia
Poland	بولندا	波兰	Pologne	Polen	पोलैंड	Polonia	ポーランド	폴란드	Polônia	Польша	Polonia
South Korea	كوريا الجنوبية	韩国	Corée du Sud	Südkorea	दक्षिण कोरिया	Corea del Sud	韓国	대한민국	Coreia do Sul	Южная Корея	Corea del Sur
North Korea	كوريا الشمالية	北朝鲜	Corée du Nord	Nord Korea	उत्तर कोरिया	Corea del nord	北朝鮮	북한	Coreia do Norte	Северная Корея	Corea del Norte
Netherlands	هولندا	荷兰	Pays-Bas	Niederlande	नीदरलैंड	Olanda	オランダ	네덜란드	Países Baixos	Нидерланды	Países Bajos
Ukraine	أوكرانيا	乌克兰	Ukraine	Ukraine	यूक्रेन	Ucraina	ウクライナ	우크라이나	Ucrânia	Украина	Ucrania
Hungary	اليونان	匈牙利	Hongrie	Ungarn	हंगरी	Ungheria	ハンガリー	헝가리	Hungria	Венгрия	Hungría
India	الهند	印度	Inde	Indien	इंडिया	India	インド	인도	Índia	Индия	India
Greece	اليونان	希腊	Grèce	Griechenland	यूनान	Grecia	ギリシャ	그리스	Grécia	Греция	Grecia
Croatia	كرواتيا	克罗地亚	Croatie	Kroatien	क्रोएशिया	Croazia	クロアチア	크로아티아	Croácia	Хорватия	Croacia

LANGUAGE

Language Translations

Countries

Singapore	سنغافورة	新加坡	Singapour	Singapur	सिंगापुर	Singapore	シンガポール	싱가포르	Cingapura	Сингапур	Singapur
Sweden	السويد	瑞典	Suède	Schweden	स्वीडन	Svezia	スウェーデン	스웨덴	Suécia	Швеция	Suecia
Netherlands	هولندا	荷兰	Pays-Bas	Niederlande	नीदरलैंड	Olanda	オランダ	네덜란드	Países Baixos	Нидерланды	Países Bajos
Switzerland	سويسرا	瑞士	Suisse	Schweiz	स्विट्जरलैंड	Svizzera	スイス	스위스	Suíça	Швейцария	Suiza
South Africa	جنوب أفريقيا	南非	Afrique du Sud	Südafrika	दक्षिण अफ्रीका	Sud Africa	南アフリカ	남아프리카	África do Sul	Южная Африка	Sudáfrica
Hungary	اليونان	匈牙利	Hongrie	Ungarn	हंगरी	Ungheria	ハンガリー	헝가리	Hungria	Венгрия	Hungría
Morocco	المغرب	摩洛哥	Maroc	Marokko	मोरक्को	Marocco	モロッコ	모로코	Marrocos	Марокко	Marruecos
Czech Republic	جمهورية التشيك	捷克共和国	République Tchèque	Tschechien	चेक गणतंत्र	Repubblica Ceca	チェコ共和国	체코 공화국	República Checa	Чешская Республика	Republica checa

Body

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Foot	قدم	脚丫子	Pied	Fuß	पैर	Piede	あし 足 ashi	발	Pé	Фут	Pie
Leg	رجل	腿	Jambe	Bein	टांग	Gamba	脚	다리	Perna	ножка	Pierna
Heel	كعب	脚跟	Talon	Hacke	एड़ी	Tacco	かかと ヒール kakato	힐	Salto	пятка	Tacón
Shin	قصبة	胫	Tibia	Schienbein	पिंडली	stinco	すね 脛 sune	정강이	canela	голень	espinilla
Knee	ركبة	膝盖	Le genou	Knie	घुटना	Ginocchio	ひざ 膝 hiza	무릎	Joelho	коленный	Rodilla
Thigh	فخذ	大腿	Cuisse	Schenkel	जांघ	Coscia	もも 大腿 momo	대퇴골	Coxa	бедренная кость	Muslo
Head	رئيس	头	Tête	Kopf	सिर	Capo	あたま 頭 atama	머리	Cabeça	Глава	Cabeza
Face	وجه	面对	Visage	Gesicht	चेहरा	Viso	かお 面 kao	얼굴	Cara	Лицо	Cara
Mouth	فم	口	Bouche	Mund	मुंह	Bocca	くち 口 kuchi	입	Boca	Рот	Boca
Lips	شفاه	嘴唇	Lèvres	Lippen	होंठ	Labbra	くちびる 唇 kuchibiru	입술	Lábios	губы	Labios
Tooth	سن	齿	Dent	Zahn	दांत	Dente	は 歯 ha	이	Dente	Зуб	Diente
Nose	أنف	鼻子	Nez	Nase	नाक	Naso	はな 鼻 hana	코	Nariz	Нос	Nariz
Eye	عين	眼	Œil	Auge	आंख	Occhio	め 眼 me	눈	Olho	глаз	Ojo
Beard	لحية	胡子	Barbe	Bart	दाढ़ी	Barba	ひげ hige	수염	Barba	борода	Barba
Hair	شعر	头发	Cheveux	Haar	केश	Capelli	かみ 髪 kami	머리	Cabelo	Волосы	Cabello
Ear	إذن	耳	Oreille	Ohr	कान	Orecchio	みみ 耳 mimi	귀	Orelha	колос	Oreja
Stomach	معدة	胃	Estomac	Bauch	पेट	Stomaco	い 胃 i	위	Estômago	желудок	Estómago
Arm	ذراع	臂	Bras	Arm	बांह	Braccio	うで 腕 ude	팔	Braço	Рука	Brazo
Elbow	كوع	肘头	Coude	Ellbogen	कोहनी	Gomito	ひじ 肘 hiji	팔꿈치	Cotovelo	угольник	Codo
Shoulder	كتف	肩	Épaule	Schulter	कंधा	Spalla	かた 肩 kata	어깨	ombro	плечо	Hombro
Nail	ظفر	钉	Clou	Nagel	नाखून	Chiodo	つめ 爪 tsume	네일	Unha	Гвоздь	Uña
Hand	يد	手	Main	Hand	हाथ	Mano	て 手 te	손	Mão	Рука	Mano
Wrist	معصم	腕	Poignet	Handgelenk	कलाई	Polso	てくび 手首 tekubi	손목	Pulso	Запястье	Muñeca
Palm	كف	棕榈	Paume	Palme	हथेली	Palma	てのひら パーム te-no-hira	손바닥 안에 감추다	Palma	Пальма	Palma
Finger	اصبع اليد	手指	Doigt	Finger	उंगली	Dito	ゆび 指 yubi	손가락	Dedo	Палец	Dedo
Buttocks	ردفان	臀部	Fesses	Gesäß	नितंबों	Natiche	しり 臀部 shiri	엉덩이	Nádegas	Ягодицы	Nalgas
Abdomen	بطن	腹部	Abdomen	Abdomen	पेट	Addome	おなか 腹部 o-naka	복부	Abdômen	Брюшная полость	Abdomen
Liver	كبد	肝	Foie	Leber	जिगर	Fegato	かんぞう 肝 kanzō	간	Fígado	печень	Hígado
Muscle	عضلة	肌肉	Muscle	Muskel	मांसपेशी	Muscolo	きんにく 筋 kin'niku	근육	Músculo	мускул	Músculo
Neck	رقبة	颈部	Cou	Hals	गरदन	Collo	くび ネック kubi	목	Pescoço	шейка	Cuello
Heart	قلب	心	Cœur	Herz	दिल	Cuore	こころ ハート kokoro	심장	Coração	Сердце	Corazón
Waist	وسط	腰部	Taille	Taille	कमर	Vita	こし ウエスト koshi	허리	Cintura	Талия	Cintura
Back	الى الخلف	背部	Arrière	Zurück	वापस	Indietro	せなか バック senaka	뒤로	Costas	назад	Espalda
Blood	دم	血液	Du sang	Blut	रक्त	Sangue	ち 血液 chi	피	Sangue	Кровь	Sangre
Skin	بشرة	皮肤	Peau	Haut	त्वचा	Pelle	はだ 肌 hada	피부	Pele	кожа	Piel
Bone	عظم	骨	OS	Knochen	हड्डी	osso	ほね 骨 hone	뼈	Osso	кость	Hueso
Chest	صدر	胸部	Poitrine	Brust	छाती	Il petto	むね 胸 mune	가슴	Peito	грудь	Pecho
Diarrhea	إسهال	腹泻	La diarrhée	Durchfall	दस्त	Diarrea	げり 下痢 geri	설사	Diarréia	понос	Diarrea
Illness	مرض	疾病	Maladie	Krankheit	रोग	Malattia	びょうき 病気 byōki	병고	Doença	болезнь	Enfermedad

Family

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Family	أسرة	家庭	Famille	Familie	परिवार	Famiglia	かぞく 家族 kazoku	가족	Família	семья	Familia
Parents	الأباء	父母	Parents	Eltern	माता-पिता	genitori	りょうしん ryoushin	부모님	Pais	Родители	Los padres
Child	طفل	儿童	Enfant	Kind	बच्चा	Bambino	こども kodomo	어린이	Criança	ребенок	Niño

Body

Father	الأب	父亲	Père	Vater	पिता	Padre	ちち chichi	아버지	Pai	Отец	Padre
Mother	أم	母亲	Mère	Mutter	मां	Madre	はは haha	어머니	Mãe	Мама	Madre
Wife	زوجة	妻子	femme	Ehefrau	पत्नी	Moglie	つま tsuma	아내	Esposa	Жена	Esposa
Husband	الزوج	丈夫	Mari	Mann	पति	Marito	おっと otto	남편	Marido	Муж	Marido
Older Brother	الأخ الأكبر	哥哥	Grand frère	Älterer Bruder	बड़ा भाई	Fratello maggiore	あに ani	옛 형제	Irmão mais velho	Старший брат	Hermano mayor
Older Sister	الأخت الكبرى	姐姐	Sœur aînée	Ältere Schwester	बड़ी बहन	Sorella maggiore	あね ane	누나	Irmã mais velha	Старшая сестра	Hermana mayor
Younger Brother	الأخ الأصغر	弟弟	Frère cadet	Jüngerer Bruder	छोटा भाई	Fratello minore	おとうと otōto	남동생	Irmão mais novo	Младший брат	Hermano más joven
Younger Sister	اختي الصغيرة	妹妹	Sœur cadette	Jüngere Schwester	छोटी बहन	Sorella minore	いもうと imōto	여동생	Irmã mais nova	Младшая сестра	Hermana menor
Siblings	القممشترك في نفس	兄弟姐妹	Frères et sœurs	Geschwister	एक माँ की संताने	fratelli	きょうだい kyōdai	동기	Irmãos	Братья и сестры	Hermanos
Grandfather	جد	祖父	Grand-père	Großvater	दादा	Nonno	そふ sofu	할아버지	Avô	Дед	Abuelo
Grandmother	جدة	祖母	Grand-mère	Oma	दादी मा	Nonna	そぼ sobo	할머니	Avó	Бабушка	Abuela
Grandchild	حفيد	孙	Petit enfant	Enkel	पोता	Nipote	まご mago	손자	Neto	внук	Nieto
Uncle	اخو الام	叔叔	Oncle	Onkel	चाचा	Zio	おじ oji	삼촌	Tio	Дядя	Tío
Aunt	عمة	姑妈	Tante	Tante	चाची	Zia	おば oba	이모	Tia	тетка	Tía
Cousin	ولد عم	表姐	Cousin	Cousin	चचेरा भाई	Cugino	いとこ itoko	사촌	Primo	Двоюродная сестра	Prima
Niece	ابنة الاخ	侄女	Nièce	Nichte	भांजी	Nipote	めい mei	조카딸	Sobrinha	Племянница	Sobrina
Nephew	ابن أخ	外甥	Neveu	Neffe	भतीजा	Nipote	おい oi	조카	Sobrinho	Племянник	Sobrino

Animals

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Animal	حيوان	动物	Animal	Tier	जानवर	Animale	どうぶつ 動物 dōbutsu	동물	Animal	животное	Animal
Dog	الكلب	狗	Chien	Hund	कुत्ता	Cane	いぬ 犬 inu	개	Cachorro	Собака	Perro
Cat	قط	猫	Chat	Katze	बिल्ली	Gatto	ねこ 猫 neko	고양이	Gato	Кот	Gato
Cow	بقرة	牛	Vache	Kuh	गाय	Mucca	うし 牛 ushi	소	Vaca	корова	Vaca
Pig	خنزير	猪	Porc	Schwein	सुअर	Maiale	ぶた 豚 buta	돼지	Porco	свинья	Cerdo
Horse	حصان	马	Cheval	Pferd	घोड़ा	Cavallo	うま 馬 uma	말	Cavalo	лошадь	Caballo
Sheep	خروف	羊	Mouton	Schaf	भेड़	pecora	ひつじ 羊 hitsuji	양	Ovelhas	Овца	Oveja
Monkey	قرد	猴	Singe	Affe	बंदर	Scimmia	さる 猿 saru	원숭이	Macaco	Обезьяна	Mono
Mouse	الفأر	老鼠	Souris	Maus	माउस	Topo	ねずみ マウス nezumi	쥐	Rato	мышь	Ratón
Wolf	الذئب	狼	Loup	Wolf	भेड़िया	Lupo	オオカミ ōkami	늑대	Lobo	волк	Lobo
Rabbit	أرنب	兔子	lapin	Hase	खरगोश	coniglio	うさぎ usagi	토끼	Coelho	Кролик	Conejo
Dragon	تنين	龙	Dragon	Drachen	अजगर	Drago	りゅう ドラゴン ryū	용	Dragão	Дракон	Continuar
Deer	الغزال	鹿	Cerf	Hirsch	हिरन	Cervo	しか shika	사슴	Deer	олень	Ciervo
Lion	أسد	狮子	Lion	Löwe	शेर	Leone	しし shishi	사자	Leão	лев	León
Giraffe	زرافة	长颈鹿	Girafe	Giraffe	जिराफ़	Giraffa	キリン kirin	기린	Girafa	Жирафа	Jirafa
Elephant	فيل	象	l'éléphant	Elefant	हाथी	Elefante	ぞう zō	코끼리	Elefante	слон	Elefante
Bird	طائر	鸟	Oiseau	Vogel	चिड़िया	Uccello	とり 鳥 tori	새	Pássaro	птица	Pájaro
Chicken	دجاج	鸡	poulet	Hähnchen	मुर्गी	pollo	にわとり niwatori	치킨	Frango	Курица	Pollo
Sparrow	عصفور	麻雀	Moineau	Spatz	गौरैया	Passero	すずめ suzume	참새	Pardal	Воробей	Gorrión
Eagle	نسر	鹰	Aigle	Adler	ईगल	Aquila	わし washi	독수리	Águia	орел	Águila
Hawk	صقر	鹰	faucon	Falke	बाज़	Falco	たか taka	매	Falcão	ястреб	Halcón
Fish	سمك	鱼	Poisson	Fisch	मछली	Pesce	さかな 魚 sakana	물고기	Peixe	Рыба	Pescado
Tuna	تونة	金枪鱼	Thon	Thunfisch	टूना	tonno	まぐろ maguro	참치	Atum	тунец	Atún
Squid	حبار	乌贼	Calamar	Tintenfisch	स्क्वीड	Calamaro	イカ ika	오징어	Lula	Кальмар	Calamar
Octopus	أخطبوط	章鱼	Poulpe	Tintenfisch	ऑक्टोपस	Polpo	タコ tako	문어	Polvo	Осьминог	Pulpo
Insect	حشرة	昆虫	Insecte	Insekt	कीट	Insetto	むし 昆虫 mushi	곤충	Inseto	Насекомое	Insecto
Butterfly	فراشة	蝴蝶	Papillon	Schmetterling	तितली	Farfalla	ちょう 蝶 chō	나비	Borboleta	бабочка	Mariposa
Moth	حشرة العتة	蛾	Papillon de nuit	Motte	कीट	Falena	ガ ga	나방	Traça	мотылек	Polilla
Dragonfly	اليعسوب	蜻蜓	Libellule	Libelle	Dragonfly	Libellula	トンボ tonbo	잠자리	Libélula	Стрекоза	Libélula
Spider	عنكبوت	蜘蛛	Araign? e	Spinne	मकड़ी	Ragno	クモ kumo	거미	Aranha	паук	Araña
Firefly	يراعة	萤火虫	Luciole	Leuchtkäfer	जुगनू	Lucciola	ホタル hotaru	반딧불	Vaga-lume	Светляк	Luciérnaga
Housefly	الذبابة	苍蝇	Mouche domestique	Stubenfliege	housefly	mosca domestica	ハエ hae	집파리	Mosca doméstica	комнатная муха	Mosca doméstica
Mosquito	بعوض	蚊子	Moustique	Moskito	मच्छर	Zanzara	カ ka	모기	Mosquito	комар	Mosquito
Cockroach	صرصور	蟑螂	Cafard	Kakerlake	तिलचट्टा	Scarafaggio	ゴキブリ gokiburi	바퀴벌레	Barata	таракан	Cucaracha
Lizard	سحلية	蜥蜴	Lézard	Eidechse	छिपकली	Lucertola	トカゲ tokage	도마뱀	Lagarto	ящерица	Lagartija
Snake	ثعبان	蛇	Serpent	Schlange	साँप	Serpente	へび hebi	뱀	Serpente	змея	Serpiente

Plants

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Plant	مصنع	植物	Plante	Anlage	संयंत्र	Pianta	工場 しょくぶつ shokubutsu	공장	Planta	Завод	Planta
Grass	العشب	草	Grass	Grass	घास	Erba	草 くさ kusa	잔디	Grama	Трава	Hierba
Vine	كرمه	藤	Vigne	Rebe	बेल	Vite	つる	포도 나무	Videira	Вайн	Vid
Flower	زهرة	花	Fleur	Blume	फूल	Fiore	花 はな hana	꽃	Flor	Цветок	Flor
Fruit	فاكهة	水果	Fruits	Obst	फल	Frutta	み mi	과일	Frutas	Фрукты	Fruta

Edible	الصالحة للأكل	食用	Comestibles	Essbare	खाद्य	Commestibili	食用	식용	Comestíveis	Съедобный	Comestibles
Tree	شجرة	树	Arbre	Baum	पेड़	Albero	き ki	트리	Árvore	Дерево	Árbol
Leaf	نبات	叶	Feuille	Blatt	पत्ता	Foglia	は or はっぱ ha or happa	잎	Folha	Лист	Hoja
Root	الجذر	根	Racine	wurzel	जड़	Radice	ね or ねっこ ne or nekko	루트	Raiz	Корень	Raíz
Stem	الجذعية	茎	Tige	Stamm	तना	Stelo	幹 くき kuki	줄기	Haste	Стебель	Tallo

Food

Food

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Food	طعام	餐饮	Aliments	Essen	भोजन	Cibo	たべもの tabemono	식품	Comida	питание	Comida
Meal	وجبة	膳食	Repas	Mahlzeit	भोजन	Pasto	ごはん gohan	식사	Refeição	еда	Comida
Cooking	طبخ	烹饪	Cuisine	Kochen	खाना बनाना	cucinando	りょうり ryōri	조리	Cozinhando	приготовление еды	Cocina
Hungry	جوعان	饥饿	Faim	Hungrig	भूखे पेट	Affamato	空腹	배고픈	com fome	голодным	Hambriento
Thirsty	متعطش	渴	Assoiffé	Durstig	प्यासे	assetato	のどが渇いて	물기 없는	Com sede	Жаждущий	Sediento
I am Hungry	أنا جائع	我饿了	J'ai faim	Ich habe Hunger	मैं भूखा हूँ	Ho fame	お腹が空きました	나 배고파	Eu estou com fome	Я голоден	Estoy hambriento
I am Thirsty	أنا أشعر بالعطش	我渴了	J'ai soif	Ich bin durstig	मैं प्यासा हूँ	Sono assetato	のどが渇きました	나는 목 말라.	Estou morrendo de sede	Я хочу пить	Estoy sediento
Breakfast	وجبة افطار	早餐	Petit déjeuner	Frühstück	सुबह का नाश्ता	Prima colazione	ちょうしょく chōshoku	아침 식사	Café da manhã	Завтрак	Desayuno
Lunch	غداء	午餐	Le déjeuner	Mittagessen	दोपहर का भोजन	Pranzo	ひるごはん hirugohan	점심	Almoço	Обед	Almuerzo
Supper	عشاء	晚餐	Souper	Abendessen	रात का खाना	Cena	ばんごはん bangohan	저녁 식사	Ceia	Ужин	Cena
Dinner	وجبة عشاء	晚餐	Dîner	Abendessen	रात का खाना	Cena	ディナー	공식 만찬	Jantar	Обед	Cena
Snack	وجبة خفيفة	小吃	Collation	Snack	नाश्ता	Spuntino	おやつ oyatsu	간식	Snack	Легкая закуска	Bocadillo

Fast Food

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Pizza	بيتزا	比萨	Pizza	Pizza	पिज़्ज़ा	Pizza	ピザ	피자	pizza	Пицца	Pizza
Sushi	سوشي	寿司	Sushi	Sushi	सुशी	Sushi	寿司	회	Sushi	Суши	Sushi
Burger	برغر	汉堡包	Burger	Burger	बर्गर	Burger	バーガー	버거	Burger	бутерброд	Hamburguesa
Hamburger	هامبورجر	汉堡包	Hamburger	Hamburger	हैमबर्गर	Hamburger	ハンバーガー	햄버거	Hamburger	Гамбургер	Hamburguesa
Cheeseburger	تشيز برجر	乳酪汉堡	Cheeseburger	Cheeseburger	चीज़बर्गर	hamburger al formaggio	チーズバーガー	치즈 버거	X-Burger	Чизбургер	Hamburguesa con queso
Falafel	فلافل	沙拉三明治	Falafel	Falafel	फलाफिल	Falafel	ファラフェル	팔라 펠	Falafel	Фалафель	Falafel
Fast Food	الوجبات السريعة	快餐	Fast food	Fast Food	फास्ट फूड	Fast food	ファストフード	패스트 푸드	Comida rápida	Быстрое питание	Comida rápida
Fries	البطاطس	薯条	frites	Fritten	आलू	Patatine fritte	フライドポテト	튀김	Fritas	Fries	Papas fritas
French Fries	البطاطس المقلية	炸薯条	Frites	Pommes frittes	फ्रेंच फ्राइज	Patatine fritte	フライドポテト	감자 튀김	Batatas fritas	Жареный картофель	Papas fritas
Chips	رقائق	芯片	chips	Chips	चिप्स	Patatine fritte	チップス	작은 조각	Salgadinhos	чипсы	Papas fritas
Onion Rings	حلقات البصل	洋葱圈	Rondelles d'oignon	Zwiebelringe	प्याज के छल्ले	Anelli di cipolla	オニオンリング	양파 링	Anéis de cebola	Кольца лука	Aros de cebolla
Spaghetti Bolognese	فرن السباغيتي	肉酱意粉	Spaghetti bolognaise	Spaghetti Bolognese	स्पेगेटी Bolognese	Spaghetti alla bolognese	スパゲティボロネーゼ	봉골레 스파게티	Esparguete à bolonhesa	Спагетти болоньезе	Spaghetti a la boloñesa
Burrito	بوريتو	卷饼	Burrito	Burrito	बरिटो	Burrito	ブリトー	부리 토	Burrito	буррито	Burrito
Hot Dog	نقانق	热狗	Hot-dog	Hotdog	हॉट - डॉग	Hot dog	ホットドッグ	핫도그	Cachorro quente	Хот-дог	Pancho
Taco	تاكو	塔克	Taco	Taco	टैको	Taco	タコス	타코	Taco	Taco	El taco
Kebab	كباب	羊肉串	Kebab	Kebab	कबाब	Kebab	ケバブ	케밥	Churrasquinho	Кебаб	Brocheta
Croissant	كرواسون	新月形面包	Croissant	Croissant	क्रोइसैन	Croissant	クロワッサン	크로와상	Croissant	круассан	Cuerno
Fried Chicken	دجاج مقلي	炸鸡	Poulet frit	Gebratenes Huhn	फ्राइड चिकन	Pollo fritto	唐揚げ	닭 튀김	Frango frito	Жареная курочка	Pollo frito
Baguette	الرغيف الفرنسي	法国面包	Baguette	Stangenbrot	बैगेट	Baguette	バゲット	바게뜨	Baguette	Багет	Junquillo
Noodles	المعكرونة	面条	Nouilles	Nudeln	नूडल्स	Tagliatelle	麺	국수	Macarrão	лапша	Tallarines
Soup	حساء	汤	Soupe	Suppe	सूप	La minestra	スープ	수프	Sopa	Суп	Sopa
Sandwich	ساندويتش	三明治	Sandwich	Sandwich	सैंडविच	Sandwich	サンドイッチ sandoitchi	샌드위치	Sanduíche	сандвич	Sandwich
Salad	سلطة	沙拉	salade	Salat	सलाद	insalata	サラダ sarada	샐러드	Salada	Салат	ensalada
Popcorn	الفشار	爆米花	Pop corn	Popcorn	पॉपकॉर्न	Popcorn	ポップコーン	팝콘	Pipoca	Попкорн	Palomitas de maiz
Lolly	اسكيمو	罗尼	Fric	Lolly	लॉली	lecca-lecca	キャンディー	롤리	Lolly	Лолли	Lolly
Candy	حلويات	糖果	Bonbons	Süßigkeiten	कैंडी	caramella	キャンディー	사탕	Doces	Конфеты	Caramelo
Vending Machine	آلة للبيع	售货机	Distributeur automatique	Verkaufsautomat	व्यापारिक मशीन	Distributore automatico	自動販売機	자판기	Maquina de vendas	Торговый автомат	Máquina expendedora

Fruit

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Fruit	فاكهة	水果	Fruit	Obst	फल	Frutta	くだもの kudamono	과일	Fruta	Фрукты	Fruta
Apple	تفاحة	苹果	Pomme	Apfel	सेब	Mela	リンゴ ringo	사과	maçã	яблоко	manzana
Orange	البرتقالي	橙子	Orange	Orange	नारंगी	arancia	オレンジ	주황색	laranja	оранжевый	naranja
Banana	موز	香蕉	banane	Banane	केला	Banana	かんしょう kanshō	바나나	Banana	Банан	Plátano
Pear	كمثرى	梨	Poire	Birne	नाशपाती	Pera	梨 ナシ nashi	배	Pera	Груша	Pera
Peach	خوخ	桃子	Pêche	Pfirsich	आड़ू	pesca	桃 モモ momo	복숭아	pêssego	персик	melocotón
Plum	وظيفة محترمة	李子	prune	Pflaume	बेर	prugna	梅	자두	ameixa	слива	ciruela
Lemon	ليمون	柠檬	citron	Zitrone	नींबू	Limone	レモン	레몬	Limão	Лимон	Limón
Lime	جير	酸橙	Citron vert	Limette	चूना	Lime	ライム	라임	Lima	Лайм	Lima
Apricot	مشمش	杏	Abricot	Aprikose	खुबानी	Albicocca	アプリコット	살구	Damasco	Абрикос	Albaricoque
Mango	مانجو	芒果	Mangue	Mango	आम	Mango	マンゴー	망고	Manga	манго	Mango
Passionfruit	فاكهة العاطفة	百香果	Fruit de la passion	Passionsfrucht	जूनून का फल	Frutto della passione	パッションフルーツ	열정 과일	Maracujá	маракуйя	Maracuyá
Watermelon	البطيخ	西瓜	Pastèque	Wassermelone	तरबूज	Anguria	スイカ suika	수박	Melancia	Арбуз	Sandía
Blueberry	توت بري	蓝莓	Myrtille	Blaubeere	ब्लूबेरी	Mirtillo	ブルーベリー	블루 베리	Mirtilo	черника	Arándano
Raspberry	توت العليق	覆盆子	Framboise	Himbeere	रसभरी	Lampone	ラズベリー	산딸기	Framboesa	Малина	Frambuesa
Blackberry	بلاك بيري	黑莓	la mûre	Brombeere	ब्लैकबेरी	Mora	ブラックベリー	블랙 베리	Amora	ежевика	Mora

Mulberry	توت	桑	Mûre	Maulbeere	शहतूत	Gelso	桑	짙은 적자색	Amoreira	шелковица	Mora
Tomato	طماطم	番茄	Tomate	Tomate	टमाटर	Pomodoro	トマト	토마토	Tomate	Помидор	Tomate
Avocado	أفوكادو	鳄梨	Avocat	Avocado	एवोकाडो	Avocado	アボカド	아보카도	Abacate	Авокадо	Aguacate

Vegetables

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Vegetable	الخضروات	蔬菜	Légume	Gemüse	सब्जी	Verdura	野菜 やさい yasai	야채	Vegetal	овощной	Vegetal
Potato	البطاطس	土豆	Patate	Kartoffel	आलू	Patata	いも imo	감자	Batata	Картофель	Patata
Sweet Potato	بطاطا حلوة	甘薯	Patate douce	Süßkartoffel	शकरकंद	Patata dolce	スイートポテト	고구마	Batata doce	Сладкий картофель	Batata
Carrot	جزرة	胡萝卜	Carotte	Karotte	गाजर	Carota	にんじん ninjin	당근	Cenoura	Морковь	Zanahoria
Beans	فاصوليا	豆子	Des haricots	Bohnen	फलियां	fagioli	豆 まめ mame	콩	Feijões	Фасоль	Frijoles
Tomato	طماطم	番茄	Tomate	Tomate	टमाटर	Pomodoro	ばんか banka	토마토	Tomate	Помидор	Tomate
Onion	بصلة	洋葱	Oignon	Zwiebel	प्याज	Cipolla	玉ねぎ	양파	Cebola	Лук	Cebolla
Green Peppers	الفلفل الأخضر	青椒	Poivrons verts	Grüne Paprika	हरी मिर्च	Peperoni verdi	ピーマン	피망	Pimentão verde	Зеленые перцы	Pimientos verdes
Capsicum	الفليفلة	辣椒	latin	Capsicum	शिमला मिर्च	Capsico	トウガラシ属	고추	pimento	стручковый перец	Pimiento
Lettuce	الخس	生菜	Salade	Grüner Salat	सलाद	Lattuga	レタス	상추	Alface	Салат	Lechuga
Spinach	سبانخ	菠菜	épinard	Spinat	पालक	Spinaci	ほうれん草	시금치	Espinafre	Шпинат	Espinacas
Olive	زيتون	橄榄	olive	Olive	जैतून	Oliva	オリーブ	올리브	Oliva	оливковый	Aceituna
Mushroom	فطر	蘑菇	Champignon	Pilz	मशरूम	Fungo	キノコ	버섯	Cogumelo	Гриб	Seta
Jalapeno	هالبينو	辣椒	Jalapeno	Jalapeno	Jalapeno	Jalapeno	ハラペニョ	잘 라페 노	Pimenta jalapeno	Jalapeno	Jalapeño
Cucumber	خيار	黄瓜	Concombre	Gurke	खीरा	Cetriolo	きゅうり	오이	Pepino	Огурец	Pepino
Garlic	ثوم	大蒜	Ail	Knoblauch	लहसुन	aglio	ニンニク	마늘	Alho	Чеснок	Ajo
Celery	كرفس	芹菜	Céleri	Sellerie	अजवायन	Sedano	セロリ	셀러리	Aipo	Сельдерей	Apio
Asparagus	نبات الهليون	芦笋	Asperges	Spargel	एस्परैगस	Asparago	アスパラガス	아스파라거스	Espargos	Спаржа	Espárragos
Zucchini	كوسة	夏南瓜	Zucchini	Zucchini	तुरई	Zucchine	ズッキーニ	서양 호박	Abobrinha	Цуккини	Calabacín
Pumpkin	يقطين	南瓜	Citrouille	Kürbis	कद्दू	Zucca	かぼちゃ	호박	Abóbora	тыква	Calabaza
Broccoli	بروكلي	西兰花	brocoli	Brokkoli	ब्रोकोली	broccoli	ブロッコリ	브로콜리	Brócolis	Брокколи	Brócoli
Brussels Sprouts	كرة قدم	布鲁塞尔豆芽	Choux de Bruxelles	Rosenkohl	ब्रसल स्प्राउट	Cavoletti di Bruxelles	芽キャベツ	브뤼셀 콩나물	Couve de Bruxelas	Брюссельская капуста	Coles de Bruselas
Cauliflower	قرنبيط	菜花	choufleur	Blumenkohl	गोभी	Cavolfiore	カリフラワー	콜리 플라워	Couve-flor	Цветная капуста	Coliflor
Cabbage	الكرنب	卷心菜	Chou	Kohl	गोभी	Cavolo	キャベツ	양배추	Repolho	Капуста	Repollo

Dessert

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Dessert	الحلوى	甜点	Dessert	Dessert	मिठाई	Dolce	デザート dezāto	디저트	Sobremesa	Десерт	Postre
Ice Cream	بوظة	冰淇淋	Crème glacée	Eis	आइसक्रीम	Gelato	アイスクリーム aisukurīmu	아이스크림	Sorvete	мороженое	Helado
Cream	كريم	奶油	Crème	Sahne	मलाई	Crema	クリーム	크림	Creme	Крем	Crema
Pancakes	الفطائر	薄煎饼	Crêpes	Pfannkuchen	पेनकेक्स	Pancakes	パンケーキ	팬케이크	Panquecas	Блины	Panqueques
Tiramisu	تيراميسو	提拉米苏	tiramisu	Tiramisu	ट्रिअमिसु	Tiramisù	ティラミス	티라미수	Tiramisu	Тирамису	Tiramisu
Sundae	مثلجات	圣代	Sundae	Eisbecher	संडे	coppa di gelato guarnita	サンデー	선다	Sundae	Пломбир	Helado con frutas y nueces
Donut	تبرع	甜甜圈	Donut	Krapfen	डोनट	Ciambella	ドーナツ	도넛	Rosquinha	Пончик	Rosquilla
Muffin	فطيرة مسطحة ومدورة	松饼	Muffin	Muffin	टिकिया	Focaccina	マフィン	머핀	Muffin	оладья	Mollete
Cupcake	كاب كيك	杯形饼	Petit gâteau	Cupcake	Cupcake	Cupcake	カップケーキ	컵케익	Bolinho	Кекс	Magdalena
Cookie	بسكويت	曲奇饼	Biscuit	Plätzchen	कुकी	biscotto	クッキー	쿠키	Biscoito	печенье	Galleta
Brownie	جنية سمراء صغيرة	布朗尼	Lutin	Brownie	ब्राउनी	folletto buono	ブラウニー	브라우니	Brownie	домовой	Duende
Cake	كيكة	蛋糕	gâteau	Kuchen	केक	torta	ケーキ	케이크	Bolo	Кекс	pastel
Cheesecake	تشيز كيك	芝士蛋糕	cheesecake	Käsekuchen	चीज़केक	torta di formaggio	チーズケーキ	치즈 케잌	bolo de queijo	чизкейк	Tarta de queso
Chocolate Cake	كعكة الشوكولاتة	巧克力蛋糕	Gateau au chocolat	Schokoladenkuchen	चॉकलेट केक	Torta al cioccolato	チョコケーキ	초콜릿 케이크	Bolo de chocolate	Шоколадный торт	Pastel de chocolate
Trifle	تافه	琐事	Bagatelle	Kleinigkeit	trifle	tartufo	小銃	하찮은 것	Bagatela	Мелочь	nimiedad
Tart	لاذع	酸	Tarte	Torte	तीखा	crostata	タルト	타르트	azedo	терпкий	Tarta
Parfait	بارفيه	芭菲	Parfait	Parfait	parfait	parfait	パフェ	파르페	Parfait	Парфе	Parfait
Chocolate	شوكولاتة	巧克力	Chocolat	Schokolade	चॉकलेट	Cioccolato	チョコレート	초콜릿	Chocolate	Шоколад	Chocolate

Drinks

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Water	ماء	水	Eau	Wasser	पानी	acqua	水	물	agua	вода	Agua
Tap Water	الاستفادة من المياه	自来水	L'eau du robinet	Leitungswasser	नल का पानी	Acqua di rubinetto	水道水	수돗물	Água da torneira	Водопроводная вода	Agua del grifo
Sparkling Water	مياه فوارة	苏打水	Eau pétillante	Sprudel	चमकता पानी	Acqua frizzante	炭酸水	탄산수	Água com gás	Газированная вода	Agua con gas
Milk	حليب	牛奶	Lait	Milch	दूध	latte	牛乳	우유	Leite	Молоко	Leche
Tea	شاي	茶	thé	Tee	चाय	Tè	お茶	차	Chá	Чай	Té
Green Tea	شاي أخضر	绿茶	Thé vert	Grüner Tee	हरी चाय	Tè verde	緑茶	녹차	Chá verde	Зеленый чай	Té verde
Black Tea	شاي أسود	红茶	Thé noir	Schwarzer Tee	काली चाय	Tè nero	紅茶	홍차	Chá preto	Черный чай	Te negro
Herbal Tea	شاي اعشاب	凉茶	Thé aux herbes	Kräutertee	औषधिक चाय	Tè alle erbe	ハーブティー	초본 차	Chá de ervas	Травяной чай	Té de hierbas
Oolong	الصيني الاسود	乌龙茶	Oolong	Oolong	ऊलोंग	Oolong	ウーロン	우롱 차	Oolong	Улун	Oolong
Bubble Tea	الشاي فقاعة	珍珠奶茶	Bubble Tea	Bubble Tea	बुलबुला चाय	Bubble Tea	バブルティー	버블티	Chá de bolhas	Bubble Tea	Té de burbujas
Coffee	قهوة	咖啡	café	Kaffee	कॉफ़ी	caffè	コーヒー	커피	Café	Кофе	café
Cappuccino	كابتشينو	热奶咖啡	Cappuccino	Cappuccino	कैपुचिनो	Cappuccino	カプチーノ	카푸치노	Cappuccino	Капучино	Capuchino
Espresso	إسبرسو	浓咖啡	Expresso	Espresso	एस्प्रेसो	Caffè espresso	エスプレッソ	에스프레소	Expresso	Эспрессо	Café exprés
Macchiato	ماكياتو	玛奇朵	Macchiato	Macchiato	Macchiato	Macchiato	マッキアート	마키아토	Macchiato	макиато	Macchiato
Mocha	المخاوي	摩卡	Moka	Mokka	कहवा	moca	モカ	모카	Mocha	кофе мокко	Moca
Latte	لاتيه	拿铁	Latté	Latté	लाटे	Latte macchiato	ラテ	라떼	Café com leite	Латте	Latté
Hot Chocolate	شكولاته ساخنة	热可可	Chocolat chaud	Heiße Schokolade	गर्म चॉकलेट	Cioccolata calda	ホットチョコレート	뜨거운 초콜릿	Chocolate quente	Горячий шоколад	Chocolate caliente
Milkshake	اللبن المخفوق	奶昔	Milk-shake	Milchshake	मिल्कशेक	Frappè	ミルクシェーク	밀크 셰이크	Milkshake	Молочный коктейль	Batido

Smoothie	ملس	冰沙	Smoothie	Smoothie	ठग	Smoothie	スムージー	점잖은 사람	Batido	льстец	Zalamero
Soft Drink	مشروب غازي	汽水	boisson non-alcoolisée	Alkoholfreies Getränk	शीतल पेय	Bibita analcolica	ソフトドリンク	소프트 드링크	Drinque suave	Безалкогольный напиток	Refresco
Coke	فحم الكوك	可乐	du Coca	Koks	कोक	Coca Cola	コークス	콜라	Coca	коксовый	Coca
Cola	الكولا	可乐	Cola	Cola	कोला	Coca Cola	コーラ	콜라	Cola	кола	Reajuste salarial
Fanta	فانتا	芬达	Fanta	Fanta	फैंटा	Fanta	ファンタ	판타	Fanta	Fanta	Fanta
Sprite	شبح	雪碧	Lutin	Sprite	प्रेत	folletto	スプライト	요정	Sprite	эльф	Duende
Lemon Lime and Bitters	الليمون الجير والبيرة	柠檬石灰和苦味	Citron Vert et Bitters	Zitronen-Kalk und Bitter	नींबू चूना और बिटर्स	Limone e amaro	レモンライムとビターズ	레몬 라임과 쓴 맛	Limão e amargo	Лимонная известь и биттер	Limón Limón Y Bitters
Creaming Soda	الصراخ الصراع	奶油苏打水	Soda Crémeux	Aufrahmen von Soda	मलाई सोडा	Soda cremosa	クリームソーダ	크림 소다	Soda Cremosa	Кремовая сода	Crema De Soda
Ginger Beer	جعة زنجبيل	姜汁啤酒	Bière de gingembre	Ingwer Bier	अदरक की बियर	Birra allo zenzero	ジンジャービール	생강 맥주	Cerveja de gengibre	Имбирное пиво	Cerveza de jengibre
Mountain Dew	ندى الجبل	山露	Mountain Dew	Mountain Dew	माउंटेन ड्यू	rugiada di montagna	山のしずく	산 이슬	orvalho da montanha	горная роса	Rocío de la montaña
Juice	عصير	果汁	jus	Saft	रस	Succo	ジュース	주스	Suco	Сок	Jugo
Orange Juice	عصير البرتقال	橙汁	Du jus d'orange	Orangensaft	संतरे का रस	Succo d'arancia	オレンジジュース	오렌지 주스	Suco de laranja	Апельсиновый сок	Zumo de naranja
Energy Drink	مشروب الطاقة	能量饮料	Boisson énergisante	Energiegetränk	ऊर्जा पेय	Bevanda energetica	栄養ドリンク	에너지 드링크	Bebida energética	Энергетический напиток	Bebida energética
Mocktail	موكتيل	无酒精鸡尾酒	Cocktail sans alcool	Mocktail	Mocktail	mocktail	モックテイル	칵테일	Mocktail	Mocktail	Mocktail
Beer	بيرة	啤酒	Bière	Bier	बीयर	birra	ビール	맥주	Cerveja	Пиво	Cerveza
Wine	نبيذ	葡萄酒	Du vin	Wein	वाइन	Vino	ワイン	포도주	Vinho	Вино	Vino
Vodka	فودكا	伏特加	Vodka	Wodka	वोडका	Vodka	ウォッカ	보드카	Vodka	Водка	Vodka
Martini	مارتيني	马蒂尼鸡尾酒	Martini	Martini	मार्टीनी	Martini	マティーニ	마티니	martini	мартини	martini
Whiskey	ويسكي	威士忌酒	Whisky	Whiskey	व्हिस्की	Whisky	ウィスキー	위스키	Uísque	Виски	Whisky
Tequila	تكيلا	龙舌兰酒	Tequila	Tequila	टकीला	Tequila	テキーラ	테킬라	Tequila	текила	Tequila
Rum	رم شراب مسكر	朗姆酒	Rhum	Rum	रम	Rum	ラム	럼 주	Rum	Ром	Ron
Cider	عصير التفاح	苹果酒	Cidre	Apfelwein	साइडर	Cedro	サイダー	사과주	Cidra	Сидр	Sidra
Cocktails	الكوكتيلات	鸡尾酒	Des cocktails	Cocktails	कॉकटेल	cocktail	カクテル	칵테일	Cocktails	Коктейли	Cócteles
Spirits	معنويات	酒	Esprits	Spirituosen	आत्माओं	Spirits	スピリッツ	주정	Espíritos	настроение	Espíritu

Ingredients

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Cheese	جبن	起司	Fromage	Käse	पनीर	Formaggio	チーズ	치즈	Queijo	Сыр	Queso
Cream	كريم	奶油	Crème	Sahne	मलाई	Crema	クリーム	크림	Creme	Крем	Crema
Pasta	معكرونة	意大利面条	Pâtes	Pasta	पास्ता	Pasta	パスタ	파스타	Massa	Макаронные изделия	Pastas
Rice	أرز	白饭	Riz	Reis	चावल	Riso	ご飯 いね ine	쌀	Arroz	Рис	Arroz
Wheat	قمح	小麦	Blé	Weizen	गेहूँ	Grano	小麦 むぎ mugi	밀	Trigo	пшеница	Trigo
Bread	خبز	面包	Pain	Brot	रोटी	Pane	パン pan	빵	Pão	Хлеб	Un pan
Toast	النخب	烤面包	Pain grillé	Toast	टोस्ट	Crostini	トースト	토스트	Torrada	Тост	tostada
Egg	بيضة	蛋	Oeuf	Ei	अंडा	Uovo	卵	계란	Ovo	Яйцо	Huevo
Bacon	لحم خنزير مقدد	培根	Bacon	Speck	सूअर का मांस	Bacon	ベーコン	베이컨	Bacon	Бекон	Tocino
Sausage	سجق	香肠	Saucisse	Wurst	सॉस	Salsiccia	ソーセージ	소시지	Linguiça	Колбаса	Chorizo

Condiments

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Salt	ملح	盐	Sel	Salz	नमक	sale	塩 しお shio	소금	Sal	Поваренная соль	sal
Pepper	فلفل	胡椒	Poivre	Pfeffer	मिर्च	Pepe	コショウ	후추	Pimenta	Перец	Pimienta
Sugar	السكر	糖	Sucre	Zucker	चीनी	zucchero	さとう satō	설탕	Açúcar	сахар	Azúcar
Honey	عسل	蜜糖	Mon chéri	Honig	शहद	Miele	はちみつ	꿀	Querida	Мед	Miel
Soy Sauce	صلصة الصويا	酱油	Sauce soja	Sojasauce	सोया सॉस	Salsa di soia	醤油 しょうゆ shōyu	간장	Molho de soja	Соевый соус	Salsa de soja
Tomato Sauce	صلصة الطماطم	番茄酱	Sauce tomate	Tomatensauce	टमाटर की चटनी	Salsa di pomodoro	トマトソース	토마토 소스	Molho de tomate	Томатный соус	Salsa de tomate
Ketchup	كاتشب	番茄酱	Ketchup	Ketchup	चटनी	Ketchup	ケチャップ	케첩	Ketchup	Кетчуп	Salsa de tomate
Barbecue Sauce	صلصة الشواء	烧烤酱	Sauce barbecue	Barbecue Soße	बारबीक्यू चटनी	Salsa barbecue	バーベキューソース	바베큐 소스	Molho de churrasco	Соус барбекю	Salsa de barbacoa
Aioli	أيولي	蛋黄酱	Aïoli	Aioli	Aioli	Aioli	アイオリ	아이올리	Aioli	Aioli	alioli
Chili Sauce	صلصة الفلفل الحار	辣椒酱	Sauce chili	Chilisoße	चिली सॉस	Salsa chili	チリソース	칠리 소스	Molho De Pimenta	Соус чили	Salsa de chile
Hollandaise Sauce	صلصة هولندي	荷兰酱	sauce hollandaise	Sauce Hollandaise	होल्लान्दैसे सॉस	salsa olandese	オランデーズソース	Hollandaise Sauce	Molho holandês	Голландский соус	Salsa holandesa
Marinara	مارينارا	林纳拉	Marinara	Marinara	marinara	Marinara	マリナラ	마리 나라	Marinara	Marinara	Marinara
Maple Syrup	شراب القيقب	枫糖浆	Sirop d'érable	Ahornsirup	मेपल सिरप	Sciroppo d'acero	メープルシロップ	메이플 시럽	Xarope de bordo	Кленовый сироп	Miel de maple
Mayonnaise	مايونيز	蛋黄酱	Mayonnaise	Mayonnaise	मेयोनेज़	Maionese	マヨネーズ	마요네즈	Maionese	Майонез	Mayonesa
Mustard	خردل	芥末	Moutarde	Senf	सरसों	Mostarda	マスタード	머스타드	Mostarda	горчичный	Mostaza
Nutella	نوتيلا	花生酱	Nutella	Nutella	nutella	Nutella	ヌテッラ	누텔라	Nutella	Nutella	Nutella
Peanut Butter	زبدة الفول السوداني	花生酱	Beurre d'arachide	Erdnussbutter	मूंगफली का मक्खन	Burro di arachidi	ピーナッツバター	땅콩 버터	Manteiga de amendoim	Арахисовое масло	Mantequilla de maní
Relish	استمتع	滋味	Goût	Genießen	स्वाद	assaporare	レリッシュ	맛	Relish	смаковать	Condimento
Salad Dressing	سلطة خلع الملابس	沙拉酱	Vinaigrette	Salatsoße	चटनी	Condimento per l'insalata	サラダドレッシング	샐러드 용 소스	Molho de salada	Заправка для салата	Aderezo para ensaladas
Salsa	نوع من السلطة	莎莎	salsa	Salsa	साल्सा	salsa	サルサ	살사	salsa	Сальса	La salsa
Sour Cream	الكريمة الحامضة	酸奶油	Crème fraîche	Sauerrahm	खट्टी मलाई	Panna acida	サワークリーム	크림	Nata	Сметана	Crema agria
Sweet Chili Sauce	صوص الفلفل الحلو	甜辣椒酱	Sauce chili douce	Süße Chili-Sauce	मीठी मिर्च सॉस	Salsa di peperoncino dolce	甘いチリソース	달콤한 칠리 소스	Molho De Pimentão Doce	Сладкий соус чили	Salsa de chile dulce
Tartar Sauce	صلصة التارتار	鞑靼酱	Sauce tartare	Tartar Sauce	टार्टर चटनी	Salsa tartara	タルタルソース	타르타르 소스	Molho tártaro	Соус тартар	Salsa tártara
Teriyaki Sauce	تريكي صلصة	红烧酱	sauce teriyaki	Teriyaki Soße	तेरियाकी सॉस	Salsa Teriyaki	テリヤキソース	데리야끼 소스	Molho Teriyaki	Соус терияки	Salsa teriyaki
Vinegar	خل	尖酸刻薄	Le vinaigre	Essig	सिरका	Aceto	酢	식초	Vinagre	Уксус	Vinagre

Beverages

Water

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish

Water	ماء	水	Eau	Wasser	पानी	acqua	水	물	agua	вода	Agua
Tap Water	الاستفادة من المياه	自来水	L'eau du robinet	Leitungswasser	नल का पानी	Acqua di rubinetto	水道水	수돗물	Água da torneira	Водопроводная вода	Agua del grifo
Sparkling Water	مياه فوارة	苏打水	Eau pétillante	Sprudel	चमकता पानी	Acqua frizzante	炭酸水	탄산수	Água com gás	Газированная вода	Agua con gas
Potable Water	مياه صالحة للشرب	饮用水	Eau potable	Trinkwasser	पेय जल	Acqua potabile	飲料水	식수	Água potável	Питьевая вода	Agua potable
Cordial	ودي	亲切	Cordial	Herzlich	हार्दिक	Cordiale	コーディアル	강장제	Cordial	радушный	Cordial
Juice	عصير	果汁	jus	Saft	रस	Succo	ジュース	주스	Suco	Сок	Jugo

Tea

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Tea	شاي	茶	thé	Tee	चाय	Tè	お茶	차	Chá	Чай	Té
Green Tea	شاي أخضر	绿茶	Thé vert	Grüner Tee	हरी चाय	Tè verde	緑茶	녹차	Chá verde	Зеленый чай	Té verde
Black Tea	شاي أسود	红茶	Thé noir	Schwarzer Tee	काली चाय	Tè nero	紅茶	홍차	Chá preto	Черный чай	Te negro
Herbal Tea	شاي اعشاب	凉茶	Thé aux herbes	Kräutertee	औषधिक चाय	Tè alle erbe	ハーブティー	초본 차	Chá de ervas	Травяной чай	Té de hierbas
Oolong	الصيني الاسود	乌龙茶	Oolong	Oolong	ऊलोंग	Oolong	ウーロン	우롱 차	Oolong	Улун	Oolong
Bubble Tea	الشاي فقاعة	珍珠奶茶	Bubble Tea	Bubble Tea	बुलबुला चाय	Bubble Tea	バブルティー	버블티	Chá de bolhas	Bubble Tea	Té de burbujas

Coffee

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Coffee	قهوة	咖啡	café	Kaffee	कॉफ़ी	caffè	コーヒー	커피	Café	Кофе	café
Cappuccino	كابتشينو	热奶咖啡	Cappuccino	Cappuccino	कैपुचिनो	Cappuccino	カプチーノ	카푸치노	Cappuccino	Капучино	Capuchino
Espresso	إسبرسو	浓咖啡	Expresso	Espresso	एस्प्रेसो	Caffè espresso	エスプレッソ	에스프레소	Expresso	Эспрессо	Café exprés
Macchiato	ماكياتو	玛奇朵	Macchiato	Macchiato	Macchiato	Macchiato	マッキアート	마키아토	Macchiato	макиато	Macchiato
Mocha	المخاوي	摩卡	Moka	Mokka	कहवा	moca	モカ	모카	Mocha	кофе мокко	Moca
Latte	لاتيه	拿铁	Latté	Latté	लाटे	Latte macchiato	ラテ	라떼	Café com leite	Латте	Latté

Milk

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Milk	حليب	牛奶	Lait	Milch	दूध	latte	牛乳	우유	Leite	Молоко	Leche
Hot Chocolate	شكولاته ساخنة	热可可	Chocolat chaud	Heiße Schokolade	गर्म चॉकलेट	Cioccolata calda	ホットチョコレート	뜨거운 초콜릿	Chocolate quente	Горячий шоколад	Chocolate caliente
Milkshake	اللبن المخفوق	奶昔	Milk-shake	Milchshake	मिल्कशेक	Frappè	ミルクシェーク	밀크 셰이크	Milkshake	Молочный коктейль	Batido
Smoothie	ملس	冰沙	Smoothie	Smoothie	ठग	Smoothie	スムージー	점잖은 사람	Batido	льстец	Zalamero

Carbonated

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Carbonated Drink	شرب الغازية	碳酸饮料	Boisson gazeuse	Kohlensäurehaltiges Getränk	सोडापेय	Bevanda gassata	炭酸飲料	탄산 음료	Refrigerante	Газированный напиток	Bebida carbonatada
Soft Drink	مشروب غازي	汽水	boisson non-alcoolisée	Alkoholfreies Getränk	शीतल पेय	Bibita analcolica	ソフトドリンク	소프트 드링크	Drinque suave	Безалкогольный напиток	Refresco
Coke	فحم الكوك	可乐	du Coca	Koks	कोक	Coca Cola	コークス	콜라	Coca	коксовый	Coca
Cola	الكولا	可乐	Cola	Cola	कोला	Coca Cola	コーラ	콜라	Cola	кола	Reajuste salarial
Fanta	فانتا	芬达	Fanta	Fanta	फेंटा	Fanta	ファンタ	판타	Fanta	Fanta	Fanta
Sprite	شبح	雪碧	Lutin	Sprite	प्रेत	folletto	スプライト	요정	Sprite	эльф	Duende
Lemon Lime and Bitters	الليمون الجير والبيرة	柠檬石灰和苦味	Citron Vert et Bitters	Zitronen-Kalk und Bitter	नींबू चूना और बिटर्स	Limone e amaro	レモンライムとビターズ	레몬 라임과 쓴 맛	Limão e amargo	Лимонный лайм и биттер	Limón Limón Y Bitters
Creaming Soda	الصراخ الصراخ	奶油苏打水	Soda Crémeux	Aufrahmen von Soda	मलाई सोडा	Soda cremosa	クリームソーダ	크림 소다	Soda Cremosa	Кремовая сода	Crema De Soda
Ginger Beer	جعة زنجبيل	姜汁啤酒	Bière de gingembre	Ingwer Bier	अदरक की बियर	Birra allo zenzero	ジンジャービール	생강 맥주	Cerveja de gengibre	Имбирное пиво	Cerveza de jengibre
Mountain Dew	ندى الجبل	山露	Mountain Dew	Mountain Dew	माउंटेन ड्यू	rugiada di montagna	山のしずく	산 이슬	orvalho da montanha	горная роса	Rocío de la montaña
Orange Juice	عصير البرتقال	橙汁	Du jus d'orange	Orangensaft	संतरे का रस	Succo d'arancia	オレンジジュース	오렌지 주스	Suco de laranja	Апельсиновый сок	Zumo de naranja
Energy Drink	مشروب الطاقة	能量饮料	Boisson énergisante	Energiegetränk	ऊर्जा पेय	Bevanda energetica	栄養ドリンク	에너지 드링크	Bebida energética	Энергетический напиток	Bebida energética
Mocktail	موكتيل	无酒精鸡尾酒	Cocktail sans alcool	Mocktail	Mocktail	mocktail	モックテイル	칵테일	Mocktail	Mocktail	Mocktail

Alcoholic

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Alcohol	كحول	醇	De l'alcool	Alkohol	शराब	alcool	アルコール	알코올	Álcool	Алкоголь	Alcohol
Beer	بيرة	啤酒	Bière	Bier	बीयर	birra	ビール	맥주	Cerveja	Пиво	Cerveza
Wine	نبيذ	葡萄酒	Du vin	Wein	वाइन	Vino	ワイン	포도주	Vinho	Вино	Vino
Vodka	فودكا	伏特加	Vodka	Wodka	वोडका	Vodka	ウォッカ	보드카	Vodka	Водка	Vodka
Martini	مارتيني	马蒂尼鸡尾酒	Martini	Martini	मार्टीनी	Martini	マティーニ	마티니	martini	мартини	martini
Whiskey	ويسكي	威士忌酒	Whisky	Whiskey	व्हिस्की	Whisky	ウィスキー	위스키	Uísque	Виски	Whisky
Tequila	تكيلا	龙舌兰酒	Tequila	Tequila	टकीला	Tequila	テキーラ	테킬라	Tequila	текила	Tequila
Rum	رم شراب مسكر	朗姆酒	Rhum	Rum	रम	Rum	ラム	럼 주	Rum	Ром	Ron
Cider	عصير التفاح	苹果酒	Cidre	Apfelwein	साइडर	Cedro	サイダー	사과주	Cidra	Сидр	Sidra
Cocktails	الكوكتيلات	鸡尾酒	Des cocktails	Cocktails	कॉकटेल	cocktail	カクテル	칵테일	Cocktails	Коктейли	Cócteles
Spirits	معنويات	酒	Esprits	Spirituosen	आत्माओं	Spirits	スピリッツ	주정	Espíritos	настроение	Espíritu

Time

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Time	زمن	时间	Temps	Zeit	पहर	Tempo	じかん jikan	시각	Tempo	Время	Hora
Calendar	التقويم	日历	Calendrier	Kalender	कैलेंडर	Calendario	こよみ koyomi	달력	Calendário	Календарь	Calendario
Hours	ساعات	小时	Heures	Std	घंटे	Ore	とき or じ toki or ji)	시간	Horas	часов	Horas
Minute	اللحظة	分钟	Minute	Minute	मिनट	minuto	ふん fun	분	Minuto	минут	Minuto
Second	ثانيا	第二	Seconde	Zweite	दूसरा	Secondo	びょう byō	둘째	Segundo	второй	Segundo
Day	يوم	天	journée	Tag	दिन	Giorno	ひ or にち hi or nichi	일	Dia	День	Día
Week	أسبوع	周	La semaine	Woche	सप्ताह	Settimana	週間 Shūkan	주	Semana	Неделю	Semana
Month	شهر	月	Mois	Monat	महीना	Mese	つき or がつ tsuki or gatsu	달	Mês	Месяц	Mes

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Year	عام	年	An	Jahr	साल	Anno	とし or ねん toshi or nen	년	Ano	Год	Año
Yesterday	في الامس	昨天	Hier	Gestern	बिता कल	Ieri	きのう or さくじつ kinō or sakujitsu	어제	Ontem	Вчера	Ayer
Today	اليوم	今天	Aujourd'hui	Heute	आज	Oggi	きょう kyō	오늘	Hoje	Сегодня	Hoy
Tomorrow	غدا	明天	Demain	Morgen	आने वाला कल	Domani	あした or あす ashita or asu	내일	Amanhã	Завтра	mañana
Morning	صباح	早上	Matin	Morgen	सुबह	Mattina	あさ asa	아침	Manhã	утро	Mañana
Afternoon	بعد الظهر	下午	Après midi	Nachmittag	दोपहर	Pomeriggio	ひる hiru	대낮	Tarde	После полудня	Tarde
Evening	مساء	晚间	Soir	Abend	शाम	Sera	ゆうがた yūgata	저녁	Tarde	Вечер	Noche
Night	ليل	晚	Nuit	Nacht	रात	Notte	よる yoru	밤	Noite	Ночь	Noche

Weekdays

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Week											
Weekend											
Weekday											
Sunday	الأحد	星期日	dimanche	Sonntag	रविवार	Domenica	にちようび nichi-yōbi	일요일	domingo	Воскресенье	domingo
Monday	الإثنين	星期一	Lundi	Montag	सोमवार	Lunedi	げつようび getsu-yōbi	월요일	Segunda-feira	понедельник	lunes
Tuesday	الثلاثاء	星期二	Mardi	Dienstag	मंगलवार	martedì	かようび ka-yōbi	화요일	terça	вторник	martes
Wednesday	الأربعاء	星期三	Mercredi	Mittwoch	बुधवार	mercoledì	すいようび sui-yōbi	수요일	Quarta-feira	среда	miércoles
Thursday	الخميس	星期四	Jeudi	Donnerstag	गुरूवार	giovedi	もくようび moku-yōbi	목요일	Quinta-feira	Четверг	jueves
Friday	يوم الجمعة	星期五	Vendredi	Freitag	शुक्रवार	Venerdì	きんようび kin-yōbi	금요일	Sexta-feira	пятница	viernes
Saturday	يوم السبت	星期六	samedi	Samstag	शनिवार	Sabato	どようび do-yōbi	토요일	sábado	суббота	sábado

Months

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Month	شهر	月	Mois	Monat	महीना	Mese	月	달	Mês	Месяц	Mes
January	كانون الثاني	一月	janvier	Januar	जनवरी	gennaio	1月	일월	janeiro	январь	enero
February	شهر فبراير	二月	février	Februar	फरवरी	febbraio	2月	이월	fevereiro	февраль	febrero
March	مارس	三月	Mars	März	मार्च	marzo	三月	행진	marcha	Март	marzo
April	أبريل	四月	avril	April	अप्रैल	aprile	4月	4 월	abril	апрель	abril
May	قد	五月	Mai	Kann	मई	potrebbe	5月	할 수있다	Pode	май	Mayo
June	يونيو	六月	juin	Juni	जून	giugno	六月	유월	Junho	июнь	junio
July	يوليو	七月	juillet	Juli	जुलाई	luglio	7月	칠월	Julho	июль	julio
August	أغسطس	八月	août	August	अगस्त	agosto	8月	팔월	agosto	августейший	agosto
September	سبتمبر	九月	septembre	September	सितंबर	settembre	9月	구월	setembro	сентябрь	septiembre
October	شهر اكتوبر	十月	octobre	Oktober	अक्टूबर	ottobre	10月	십월	Outubro	октября	octubre
November	شهر نوفمبر	十一月	novembre	November	नवंबर	novembre	11月	십일월	novembro	ноябрь	noviembre
December	ديسمبر	十二月	décembre	Dezember	दिसंबर	dicembre	12月	12 월	dezembro	Декабрь	diciembre

Weather

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Weather	طقس	天气	Météo	Wetter	मौसम	Tempo metereologico	天気 てんき tenki	날씨	Clima	Погода	Clima
Day	يوم	天	journée	Tag	दिन	Giorno	日	일	Dia	День	Día
Night	ليل	晚	Nuit	Nacht	रात	Notte	夜	밤	Noite	Ночь	Noche
Sunrise	شروق الشمس	日出	lever du soleil	Sonnenaufgang	सूर्योदय	Alba	日の出	해돋이	Nascer do sol	Восход	amanecer
Sunset	غروب الشمس	日落	Le coucher du soleil	Sonnenuntergang	सूर्य का अस्त होना	Tramonto	日没	일몰	Pôr do sol	Заход солнца	Puesta de sol
Bright	مشرق	亮	Brillant	Hell	उज्ज्वल	Luminosa	明るい	선명한	Brilhante	яркий	Brillante
Dark	داكن	暗	Foncé	Dunkel	अंधेरा	Buio	ダーク	어두운	Sombrio	Темно	Oscuro
Sun	شمس	太阳	Soleil	Sonne	रवि	Sole	太陽 たいよう taiyō	태양	Dom	солнце	Dom
Sunny	مشمس	晴朗	Ensoleillé	Sonnig	धूप	soleggiato	晴れ	햇볕이 잘 드는	Ensolarado	Солнечно	Soleado
Moon	القمر	月亮	Lune	Mond	चांद	Luna	月 つき tsuki	달	Lua	Луна	Luna
Star	نجمة	星	Étoile	Star	तारा	Stella	星 ほし hoshi	별	Estrela	звезда	Estrella
Clear Weather	طقس صحو	天气晴朗	Temps clair	Klares Wetter	साफ मौसम	Tempo sereno	晴天 はれ hare	맑은 날씨	Tempo limpo	Ясная погода	Tiempo despejado
Rain	تمطر	雨	Pluie	Regen	बारिश	Pioggia	雨 あめ ame	비	Chuva	дождь	Lluvia
Cloudy	غائم	多云的	Nuageux	Wolkig	धुंधला	Nuvoloso	曇り くもり kumori	흐린	Nublado	облачный	Nublado
Snow	ثلج	雪	Neige	Schnee	हिमपात	La neve	雪 ゆき yuki	눈	Neve	Снег	Nieve
Wind	ينفخ	风	Vent	Wind	हवा	Vento	風 かぜ kaze	바람	Vento	ветер	Viento
Storm	عاصفة	风暴	Orage	Sturm	आंधी	Tempesta	嵐 あらし arashi	폭풍	Tempestade	Гроза	Tormenta
Cyclone	الإعصار	气旋	Cyclone	Zyklon	चक्रवात	Ciclone	サイクロン	집진 장치	Ciclone	циклон	Ciclón
Hurricane	اعصار	飓风	ouragan	Hurrikan	तूफान	uragano	ハリケーン	허리케인	Furacão	ураганный	Huracán
Typhoon	الاعصار	台风	Typhon	Taifun	आंधी	Tifone	台風	태풍	Tufão	тайфун	Tifón
Sky	سماء	天空	Ciel	Himmel	आकाश	Cielo	空 そら sora	하늘	Céu	Небо	Cielo
Drought	جفاف	干旱	Sécheresse	Dürre	सूखा	Siccità	干ばつ	가뭄	Seca	засуха	Sequía
Monsoon	ريح موسمية	雨季	Mousson	Monsun	मानसून	Monsone	モンスーン	우기	Monção	муссон	Monzón
Season	الموسم	季节	Saison	Jahreszeit	ऋतु	Stagione	シーズン	시즌	Temporada	Время года	Temporada
Summer	الصيف	夏季	Été	Sommer	गर्मी	Estate	夏	여름	verão	Летом	Verano
Autumn	الخريف	秋季	L'automne	Herbst	पतझड़	Autunno	秋	가을	Outono	осень	Otoño

Winter	شتاء	冬季	Hiver	Winter	सर्दी	Inverno	冬	겨울	Inverno	зима	Invierno
Spring	ربيع	弹簧	Printemps	Frühling	वसंत	Primavera	春	봄	Primavera	весна	Primavera

Disasters

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Disaster	كارثة	灾害	Catastrophe	Katastrophe	आपदा	Disastro	災害	재앙	Desastre	Катастрофа	Desastre
Tornado	إعصار	龙卷风	Tornade	Tornado	बवंडर	Tornado	竜巻	폭풍	Tornado	Торнадо	Tornado
Hurricane	اعصار	飓风	ouragan	Hurrikan	तूफान	uragano	ハリケーン	허리케인	Furacão	ураганный	Huracán
Cyclone	الإعصار	气旋	Cyclone	Zyklon	चक्रवात	Ciclone	サイクロン	집진 장치	Ciclone	циклон	Ciclón
Typhoon	الاعصار	台风	Typhon	Taifun	आंधी	Tifone	台風	태풍	Tufão	тайфун	Tifón
Twister	إعصار	倍捻机	Tornade	Twister	भांजनेवाला	tornado	ツイスター	꼬는 사람	Twister	смерч	Tornado
Earthquake	زلزال	地震	Tremblement de terre	Erdbeben	भूकंप	Terremoto	地震	지진	Tremor de terra	землетрясение	Terremoto
Avalanche	انهيار ثلجي	雪崩	avalanche	Lawine	हिमस्खलन	Valanga	雪崩	눈사태	Avalanche	лавина	avalancha
Landslide	انهيار أرضي	滑坡	Glissement de terrain	Erdrutsch	भूस्खलन	Frana	地すべり	산사태	Deslizamento de terras	оползень	Deslizamiento de tierra
Tsunami	تسونامي	海啸	Tsunami	Tsunami	सुनामी	Tsunami	津波	쓰나미	Tsunami	Цунами	Tsunami
Sinkhole	المجرى	天坑	Évier	Doline	sinkhole	Dolina	シンクホール	싱크 홀	Buraco	выгребная яма	Sumidero
Volcano	بركان	火山	Volcan	Vulkan	ज्वर भाता	Vulcano	火山	화산	Vulcão	Вулкан	Volcán
Flood	فيضان	洪水	Inonder	Flut	बाढ़	Alluvione	洪水	홍수	Inundar	потоп	Inundar
Blizzard	عاصفة ثلجية	暴风雪	Blizzard	Schneesturm	बर्फ़ानी तूफ़ान	bufera di neve	猛吹雪	눈보라	Nevasca	Метель	Tormenta de nieve
Hailstorm	عاصفة البرد	雹暴	Averse de grêle	Hagel	मूसलधार बारिश	Grandinata	ヘイルストーム	우박	Chuva de granizo	ливень	Granizada
Heat Wave	موجة الحرارة	热浪	La canicule	Hitzewelle	हीट वेव	Ondata di caldo	ヒートウェーブ	열파	Onda de calor	Волна тепла	Ola de calor
Cold Wave	موجة باردة	寒潮	Vague froide	Kalte Welle	शीत लहार	Cold Wave	寒波	한파	Onda Fria	Холодная волна	Ola de frio
Drought	جفاف	干旱	Sécheresse	Dürre	सूखा	Siccità	干ばつ	가뭄	Seca	засуха	Sequía
Tornado	إعصار	龙卷风	Tornade	Tornado	बवंडर	Tornado	竜巻	폭풍	Tornado	Торнадо	Tornado
Wildfire	حريق هائل	磷火	Incendies	Lauffeuer	जंगल की आग	Wildfire	山火事	들불	Incêndios	Wildfire	Fuego fatuo
Solar Flare	التوهج الشمسي	耀斑	Éruption solaire	Sonneneruption	सूरज की चमक	Solar Flare	太陽フレア	태양 플레어	Explosão solar	Солнечная вспышка	Erupción solar
Attack	هجوم	攻击	Attaque	Attacke	आक्रमण	attacco	攻撃	공격	Ataque	Атака	Ataque
Murder	قتل	谋杀	Meurtre	Mord	हत्या	Omicidio	殺人	살인	Assassinato	убийство	Asesinato
Riot	شغب	暴动	Émeute	Randalieren	दंगा	rivolta	暴動	폭동	Tumulto	буйство	Alboroto
War	حرب	战争	Guerre	Krieg	युद्ध	Guerra	戦争	전쟁	Guerra	война	Guerra
Missile	صاروخ	导弹	Missile	Rakete	मिसाइल	Missile	ミサイル	미사일	Míssil	ракета	Misil
Nuclear Bomb	قنبلة نووية	核弹	Bombe nucléaire	Atombombe	परमाणु बम	Bomba nucleare	核爆弾	핵폭탄	Bomba nuclear	Ядерная бомба	Bomba nuclear
Pandemic	جائحة	流感大流行	Pandémie	Pandemie	महामारी	Pandemia	パンデミック	세계적 유행병	Pandemia	пандемия	Pandemia

Signs

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Warning	تحذير	警告	Attention	Warnung	चेतावनी	avvertimento	警告	경고	Atenção	Предупреждение	Advertencia
Caution	الحذر	警告	Mise en garde	Vorsicht	सावधान	Attenzione	あぶない	주의	Cuidado	предосторожность	Precaución
Danger	خطر	危险	Danger	Achtung	खतरा	Pericolo	危険	위험	perigo	Опасность	Peligro
Hazard	خطر	冒险	Danger	Gefahr	जोखिम	Rischio	危険	위험	Perigo	опасность	Peligro
Emergency	حالة طوارئ	急 Jí	Urgence	Notfall	आपातकालीन aapaatakaaleen	Emergenza	緊急 Kinkyū	비상 사태	Emergência	Чрезвычайная ситуация	Emergencia
Beware	احترس	谨防	Il faut se méfier	In acht nehmen	खबरदार	diffidare	注意してください	주의	Cuidado	берегись	Tener cuidado
Threat	التهديد	威胁	Menace	Drohung	धमकी	Minaccia	脅威	위협	Ameaça	угроза	Amenaza
Catastrophe	كارثة	灾难	Catastrophe	Katastrophe	तबाही	Catastrofe	大災害	대단원	Catástrofe	катастрофа	Catástrofe
Explosive	مادة متفجرة	爆炸物	Explosif	Sprengstoff	विस्फोटक	Esplosivo	爆発性	폭발물	Explosivo	Взрывчатое вещество	Explosivo
Explosion	انفجار	爆炸	Explosion	Explosion	विस्फोट	Esplosione	爆発	폭발	Explosão	взрыв	Explosión
Flammable	ملتهب	易燃的	Inflammable	Brennbar	ज्वलनशील	Infiammabile	引火性	인화성	Inflamável	легковоспламеняющийся	Inflamable
No Flames	لا اللهب	没有火焰	Pas de flammes	Keine Flammen	कोई फ्लेम नहीं	No fiamme	炎なし	불길 없음	Sem chamas	Нет пламени	No llamas
Asbestos	الحرير الصخري	石棉	Amiante	Asbest	अदह	Amianto	アスベスト	석면	Amianto	асбест	Amianto
Hot Surface	سطح ساخن	热表面	Surface chaude	Heiße Oberfläche	गर्म सतह	Superficie calda	熱い表面	뜨거운 표면	Superfície quente	Горячая поверхность	Superficie caliente
Radiation	إشعاع	辐射	Radiation	Strahlung	विकिरण	Radiazione	放射線	방사	Radiação	излучения	Radiación
Radioactive	إشعاعي النشاط	放射性的	Radioactif	Radioaktiv	रेडियोधर्मी	radioattivo	放射性	방사성	Radioativo	радиоактивное	Radioactivo
Toxic	سام	有毒的	Toxique	Giftig	विषैला	Tossico	毒性	독성	Tóxico	токсичный	Tóxico
Biohazard	واقية	生化危机	Biohazard	Biohazard	Biohazard	Biohazard	バイオハザード	생물 학적 위험	Risco biológico	Биологическая опасность	Riesgo biológico
Chemicals	مواد كيميائية	化学制品	Produits chimiques	Chemikalien	रसायन	Sostanze chimiche	化学薬品	화학	produtos quimicos	химикалии	Productos quimicos
Slippery	زلق	滑	Glissant	Rutschig	फिसलाऊ	Scivoloso	滑りやすい	미끄러운	Escorregadio	скользкий	Resbaladizo
Wet Floor	أرضية مبللة	地面湿滑	Sol humide	Nasser Boden	गीला फर्श	Pavimento bagnato	ぬれた床	젖은 바닥	Chão Molhado	Мокрый пол	Piso mojado
Electricity	كهرباء	电力	Électricité	Elektrizität	बिजली	elettricità	電気	전기	Eletricidade	Электричество	Electricidad
Volts	فولت	伏特	Volts	Volt	वोल्ट	volt	ボルト	볼트	Volts	Volts	Voltios
Do Not Touch	لا تلمس	不要碰	Ne pas toucher	Nicht berühren	छुओ मत	Non toccare	手を触れないでください	만지지 마세요	Não toque	Не трогай	No tocar
Wear Protection	ارتداء حماية	磨损保护	Vêtement de protection	Verschleißschutz	सुरक्षा पहनें	Protezione da indossare	着用保護	마모 보호	Proteção contra desgaste	Защита от износа	Utiliza protección
Stop	توقف	停止	Arrêtez	Halt	रुकें	Stop	やめる	중지	Pare	Стоп	Detener
Give Way	افسح الطريق	让步;让路	Laisser Passer	Vorfahrt beachten	रास्ता दें	far passare	譲れ	방법을 제공	Desista	Уступи дорогу	Ceder el paso
One Way	اتجاه واحد	单程	Sens Unique	Einweg	एक रास्ता	Senso Unico	一方通行	일방 통행	Mão Única	Одностороннее движение	Un camino
Keep Out	ابق بعيدا	避开	Rester dehors	Kein Zutritt	दूर रहो	Tenere fuori	キープアウト	밖으로 나가라.	Não entre	Хранить	Excluir
No Trespassing	لاالتعدي على ممتلكات الغير	没有擅自进入	aucune infraction	Kein Hausfriedensbruch	प्रवेश निषेध	Vietato oltrepassare	立入禁止	침입하지	Não ultrapasse	Нет нарушений	Prohibido el paso
No Entry	ممنوع الدخول	禁止入内	Entrée interdite	Kein Einlass	प्रवेश निषेध	Divieto di ingresso	立入り禁止	출입 불가	Entrada proibida	Нет входа	No hay entrada
No Loitering	لا للتسكع	没有游荡	Pas flânage	Kein Herumlungern	घूमना नहीं	No bighellonare	迷子なし	배회 금지	Nenhuma demora	Нет Loitering	Sin merodear
Restricted Area	منطقة محظورة	管制区	Zone réglementée	Sperrgebiet	प्रतिबंधित क्षेत्र	Area riservata	立入禁止区域	제한 구역	Área restrita	Запретная зона	Área restringida
No Animals	لا حيوانات	没有动物	Pas d'animaux	Keine Tiere	कोई पशु नहीं	Nessun animale	いいえ動物	동물 없음	Nenhum animal	Нет животных	No animales

Directions

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
North	شمال	北	Nord	Norden	उत्तर	Nord	きた kita	북쪽	Norte	север	norte
South	جنوب	南	Sud	Süd	दक्षिण	Sud	みなみ minami	남쪽	Sul	юг	Sur
East	الشرق	东	est	Osten	पूर्व	est	ひがし higashi	동쪽	Leste	восток	Este
West	غرب	西方	Ouest	Westen	पश्चिम	ovest	にし nishi	웨스트	Oeste	запад	Oeste
Here	هنا	这里	Ici	Hier	यहाँ	Qui	ここ koko	여기	Aqui	Вот	aquí
There	هناك	那里	Là	Dort	क्या आप वहां मौजूद हैं	Là	そこ soko	그곳에	Lá	Там	Ahí
Over There	هناك	在那边	Là bas	Da drüben	वहाँ पर	Laggiù	あそこ asoko	오버 저	Lá	Там	Por ahí
Right	حق	对	Droite	Recht	सही	Destra	みぎ migi	권리	Certo	Правильно	Derecha
Left	اليسار	剩下	La gauche	Links	बाएं	Sinistra	ひだり hidari	왼쪽	Esquerda	Оставил	Izquierda
Straight	مباشرة	直行	Tout droit	Gerade	सीधे	Dritto	まっすぐ massugu	직진	Direto	Прямо	Derecho
Above	في الاعلى	以上	Au dessus	Über	ऊपर	Sopra	うえ ue	위	Acima	Выше	Encima
Below	أدناه	下面	Au dessous de	Unten	नीचे	Sotto	した shita	이하	Abaixo	Ниже	Abajo
Front	أمامي	面前	De face	Vorderseite	सामने	Davanti	まえ mae	앞	Frente	Фронт	Frente
Behind	خلف	背后	Derrière	Hinter	पीछे	Dietro a	うしろ ushiro	뒤에	Atrás	За	Detrás
Opposite Side	الجانب المعاكس	对面	Le côté opposé	Gegenüberliegende Seite	विपरीत दिशा	Lato opposto	むこう mukō	반대편	Lado oposto	Противоположная сторона	Lado opuesto
Diagonal	قطري	对角线	Diagonale	Diagonale	विकर्ण	Diagonale	ななめ naname	대각선	Diagonal	Диагональ	Diagonal
Nearer	أقرب	更近	Plus près	Näher	नजदीक	Più vicino	てまえ temae	더 가까이	Mais perto	ближе	Más cerca
Far	بعيدا	远	Loin	Weit	दूर	Lontano	とおい tooi	멀리	Longe	далеко	Lejos
Near	قريب	近	Près	In der Nähe von	पास में	Vicino	ちかい chikai	가까운	Perto	Возле	Cerca

Locations

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
House	منزل	屋	Maison	Haus	मकान	Casa	家	집	casa	дом	Casa
Home	الصفحة الرئيسية	家	Accueil	Zuhause	होम	Casa	ホーム	집	Casa	Главная	Casa
School	مدرسة	学校	École	Schule	स्कूल	Scuola	学校	학교	Escola	Школа	Colegio
University	جامعة	大学	Université	Universität	विश्वविद्यालय	Università	大学	대학	Universidade	Университет	Universidad
Bank	بنك	银行	Banque	Bank	बैंक	Banca	バンク	은행	Banco	Банка	Banco
Hospital	مستشفى	醫院	Hôpital	Krankenhaus	अस्पताल	Ospedale	病院	병원	Hospital	больница	Hospital
Office	مكتب. مقر. مركز	办公室	Bureau	Büro	कार्यालय	Ufficio	オフィス	사무실	Escritório	офис	Oficina
Barbecue Sauce	صلصة الشواء	烧烤酱	Sauce barbecue	Barbecue Soße	बारबीक्यू चटनी	Salsa barbecue	バーベキューソース	바베큐 소스	Molho de churrasco	Соус барбекю	Salsa de barbacoa
Skyscraper	ناطحة سحاب	摩天大楼	Gratte-ciel	Wolkenkratzer	गगनचुंबी इमारत	Grattacielo	超高層ビル	마천루	Arranha-céu	Небоскреб	Rascacielos
Shed	تسلط	棚	Cabanon	Schuppen	बहाना	Capannone	シェッド	흘리다	Galpão	пролить	Cobertizo
Windmill	طاحونة هوائية	风车	Moulin à vent	Windmühle	विंडमिल	Mulino a vento	風車	풍차 비슷한 것	Moinho de vento	ветряная мельница	Molino
Bakery	مخبز	面包店	Boulangerie	Bäckerei	बेकरी	Forno	ベーカリー	빵집	Padaria	пекарня	Panadería
Supermarket	سوبر ماركت	超级市场	Supermarché	Supermarkt	सुपरमार्केट	Supermercato	スーパーマーケット	슈퍼마켓	Supermercado	Супермаркет	Supermercado
Bookshop	مكتبة	书店	Librairie	Buchgeschäft	किताबों का दुकान	Libreria	書店	서점	Livraria	книжный магазин	Librería
Car Wash	غسيل سيارة	洗车	Lave-Auto	Autowäsche	कार धुलाई	Autolavaggio	洗車	세차	Lava-jato	Автомойка	Lavado de autos
Hairdressers	مصففي الشعر	理发师	Salon de coiffure	Friseure	हेयरड्रेसर	Parrucchieri	美容師	미용사	Cabeleireiro	Парикмахеры	Peluquería
Market	سوق	市场	Marché	Markt	बाजार	Mercato	市場	시장	Mercado	рынок	Mercado
Pharmacy	مقابل	药店	Pharmacie	Apotheke	फार्मेसी	Farmacia	薬局	조제	Farmacia	Аптека	Farmacia
Gas Station	محطة غاز	加油站	Station-essence	Tankstelle	पेट्रोल पंप	Stazione di servizio	ガソリンスタンド	주유소	Posto de gasolina	Бензоколонка	Gasolinera
Food Court	محكمة الغذاء	美食广场	Aire de restauration	Fressmeile	फूड कोर्ट	Food Court	フードコート	시식 코너	Praça de alimentação	Ресторанный дворик	Zona de comidas
Hotel	الفندق	旅馆	Un hôtel	Hotel	होटल	Hotel	ホテル	호텔	Hotel	Гостиница	Hotel
Apartment	شقة	公寓	Appartement	Wohnung	अपार्टमेंट	Appartamento	アパート	아파트	Apartamento	квартира	Apartamento
Unit	وحدة	单元	Unité	Einheit	इकाई	Unità	単位	단위	Unidade	Ед. изм	Unidad
Tower	برج	塔	La tour	Turm	मीनार	Torre	タワー	탑	Torre	башня	Torre
Dentist	دكتورالاسنان	牙医	Dentiste	Zahnarzt	दंत चिकित्सक	Dentista	歯科医	치과 의사	Dentista	Дантист	Dentista
Cemetary	مقبرة	公墓	Cimetière	Friedhof	कब्रिस्तान	Cemetary	墓地	묘지	Cemitério	Cemetary	Cementerio
Swimming Pool	حمام السباحة	游泳池	Piscine	Schwimmbad	स्विमिंग पूल	Piscina	スイミングプール	수영장	Piscina	Бассейн	Piscina
Cinema	سينما	电影	Cinéma	Kino	सिनेमा	Cinema	シネマ	영화	Cinema	Кино	Cine
Library	مكتبة	图书馆	Bibliothèque	Bibliothek	पुस्तकालय	Biblioteca	としょうかん	도서관	Biblioteca	Библиотека	Biblioteca
Museum	متحف	博物馆	Musée	Museum	संग्रहालय	Museo	博物館	박물관	Museu	музей	Museo
Church	كنيسة	教会	Église	Kirche	चर्च	Chiesa	教会	교회에	Igreja	церковь	Iglesia
Temple	صدغ	寺庙	Temple	Tempel	मंदिर	Tempio	寺院	신전	Templo	Храм	templo
Embassy	السفارة	大使馆	Ambassade	Botschaft	दूतावास	Ambasciata	大使館	대사관	Embaixada	Посольство	Embajada
Police Station	قسم الامن	警察局	Poste de police	Polizeistation	पुलिस स्टेशन	Stazione di polizia	警察署	경찰서	Delegacia de polícia	Полицейский участок	Estación de policía
Fire Station	محطة الاطفاء	消防局	Caserne de pompiers	Feuerwehr	दमकल केंद्र	Caserma dei pompieri	消防署	소방서	Corpo de Bombeiros	Пожарная станция	Estación de bomberos
Post Office	مكتب البريد	邮政局	Bureau de poste	Post	डाक घर	Ufficio postale	郵便局	우체국	Agência dos Correios	Почта	Oficina postal
Prison	السجن	监狱	Prison	Gefängnis	जेल व	Prigione	刑務所	감옥	Prisão	Тюрьма	Prisión
Nightclub	ملهى ليلي	夜店	Boîte de nuit	Nachtclub	नाइट क्लब	Discoteca	ナイトクラブ	나이트 클럽	Boate	Ночной клуб	Club nocturno
Factory	مصنع	厂	Usine	Fabrik	फ़ैक्टरी	Fabbrica	工場	공장	Fábrica	завод	Fábrica
Airport	مطار	飞机场	Aéroport	Flughafen	हवाई अड्डा	Aeroporto	空港	공항	Aeroporto	аэропорт	Aeropuerto
Parking Lot	ساحة لانتظار السيارات	停车场	Terrain de stationnement	Parkplatz	पार्किंग	Parcheggio	駐車場	주차장	Estacionamento	Автостоянка	Estacionamiento
Park	منتزه	公园	parc	Park	पार्क	Parco	パーク	공원	Parque	Парк	Parque
Bus Station	محطة الباص	公交站	Station de bus	Bushaltestelle	बस स्टेशन	Stazione degli autobus	バス停	버스 정류장	Estação de onibus	Автобусная остановка	Estación de autobuses
Train Station	محطة القطار	火车站	Gare	Bahnhof	रेलवे स्टेशन	Stazione ferroviaria	鉄道駅	기차역	Estação de trem	Железнодорожная станция	Estación de tren
Bridge	جسر	桥	Pont	Brücke	पुल	ponte	ブリッジ	다리	Ponte	Мост	Puente
Gym	نادي رياضي	健身房	Gym	Fitnessstudio	जिम	Palestra	ジム	체육관	Academia	Гимнастический зал	Gimnasio

Materials

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Water	ماء	水	Eau	Wasser	पानी	acqua	水 みず mizu	물	agua	вода	Agua
Hot Water	الماء الساخن	热水	Eau chaude	Heißes Wasser	गर्म पानी	Acqua calda	お湯 ゆ yu	뜨거운 물	Água quente	Горячая вода	Agua caliente
Ice	جليد	冰	La glace	Eis	बर्फ	Ghiaccio	氷 こおり kōri	얼음	Gelo	лед	Hielo
Steam	بخار	蒸汽	Vapeur	Dampf	भाप	Vapore	蒸気 ゆげ yuge	증기	Vapor	Пар	Vapor
Smoke	دخان	抽烟	Fumée	Rauch	धुआं	Fumo	煙	연기	Fumaça	дым	Fumar
Fire	نار	火	Feu	Feuer	आग	Fuoco	火 ひ hi	불	Fogo	Пожар	Fuego
Gas	غاز	加油站	Gaz	Gas	गैस	Gas	ガス gasu	가스	Gás	газ	Gas
Air	هواء	空气	Air	Luft	वायु	Aria	空気 くうき kūki	공기	Ar	Воздух	Aire
Earth	أرض	地球	Terre	Erde	पृथ्वी	Terra	地球 つち tsuchi	지구	Terra	земной шар	Tierra
Dirt	التراب	污垢	Saleté	Schmutz	गंदगी	Sporco	泥	더러운	Sujeira	грязь	Suciedad
Metal	فلز	金属	Métal	Metall	धातु	Metallo	金属 きんぞく kinzoku	금속	Metal	металл	Metal
Mud	طين	泥	Boue	Schlamm	कीचड़	Fango	泥 どろ doro	진흙	Lama	грязевой	Barro
Smoke	دخان	抽烟	Fumée	Rauch	धुआं	Fumo	煙 けむり kemuri	연기	Fumaça	дым	Fumar
Dust	غبار	灰尘	poussière	Staub	धूल	Polvere	ほこり	먼지	Poeira	Пыль	Polvo
Iron	حديد	铁	Le fer	Eisen	लोहा	Ferro	鉄 てつ tetsu	철	Ferro	Железо	Planchar
Copper	نحاس	铜	Cuivre	Kupfer	तांबा	Rame	銅 どう dō	구리	Cobre	медь	Cobre
Gold	ذهب	金	Or	Gold	सोना	Oro	金 きん kin	금	Ouro	Золото	Oro
Silver	فضة	银	argent	Silber	चांदी	Argento	銀 ぎん gin	은	Prata	Серебряный	Plata
Lead	قيادة	铅	Conduire	Führen	लीड	Condurre	鉛 なまり shio	리드	Conduzir	вести	Dirigir
Titanium	التيتانيوم	钛	Titane	Titan	टाइटेनियम	Titanio	チタン	티탄	Titânio	титан	Titanio
Steel	صلب	钢	Acier	Stehlen	इस्पात	Acciaio	鋼	강철	Aço	Сталь	Acero
Stainless Steel	الفولاذ المقاوم للصدأ	不锈钢	Acier inoxydable	Rostfreier Stahl	स्टेनलेस स्टील	Acciaio inossidabile	ステンレス鋼	스테인레스 스틸	Aço inoxidável	Нержавеющая сталь	Acero inoxidable
Aluminium	الألومنيوم	铝	Aluminium	Aluminium	अल्युमीनियम	Alluminio	アルミニウム	알류미늄	Alumínio	алюминий	Aluminio

Measurements

Distance

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Distance	مسافه: بعد	距离	Distance	Entfernung	दूरी	Distanza	距離	거리	Distância	Расстояние	Distancia
Millimetre	ملليمتر	毫米	Millimètre	Millimeter	मिलीमीटर	Millimetro	ミリメートル	밀리미터	Milímetro	миллиметр	Milímetro
Centimetre	سنتيمتر	厘米	Centimètre	Zentimeter	सेंटीमीटर	Centimetro	センチメートル	센티미터	Centímetro	сантиметр	Centímetro
Metre	متر	仪表	Mètre	Meter	मीटर	metro	メートル mētoru	미터	Metro	метр	Metro
Kilometre	كيلومتر	公里	Kilomètre	Kilometer	किलोमीटर	Chilometro	キロメートル	킬로미터	Quilômetro	километр	Kilómetro
Inch	بوصة	英寸	Pouce	Zoll	इंच	pollice	インチ inchi	인치	Polegada	дюйм	Pulgada
Foot	قدم	脚丫子	Pied	Fuß	पैर	Piede	足	발	Pé	Ступня	Pie
Yard	حديقة منزل	码	Cour	Hof	यार्ड	Cortile	ヤード	마당	Jarda	Двор	Yarda
Mile	ميل	英里	Mile	Meile	मील	miglio	マイル	마일	Milha	мили	Milla

Liquid

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Teaspoon	ملعقة صغيرة	茶匙	Cuillère à café	Teelöffel	छोटी चम्मच	Cucchiaino	ティースプーン	작은 스푼	Colher de chá	чайная ложка	Cucharilla
Tablespoon	ملعقة طعام	汤匙	Cuillerée à soupe	Esslöffel	बड़ा चमचा	Cucchiaio	大さじ	큰 스푼	Colher de sopa	столовая ложка	Cucharada
Millilitre	ملليلتر	毫升	Millilitre	Milliliter	मिलीलीटर	Millilitro	ミリリットル	밀리리터	Mililitro	миллилитр	Mililitro
Litre	لتر	升	Litre	Liter	लीटर	Litro	リットル	리터	Litro	Литровый	Litro
Cup	كوب	杯子	tasse	Tasse	कप	Tazza	カップ	컵	copo	кружка	vaso
Pint	نصف لتر	品脱	Pinte	Pint	पिंट	Pinta	パイント	파인트	Cerveja	пинта	Medio litro
Quart	رابعا	夸脱	Litre	Quart	चौथाई गेलन	quarto di gallone	クォート	쿼트	Quart	кварта	Cuarto de galón
Fluid Ounce	أوقية السوائل	液盎司	Once liquide	Flüssigunzen	इतना औंस द्रव	Oncia liquida	液体オンス	액량 온스	Onça fluida	Жидкая унция	Onza fluida
Gallon	غالون	加仑	Gallon	Gallone	गैलन	Gallone	ガロン	갤런	Galão	Галлон	Galón

Weight

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Weight	وزن	重量	Poids	Gewicht	वजन	Peso	重量	무게	Peso	Вес	Peso
Gram	غرام	公克	Gramme	Gramm	ग्राम	Grammo	グラム	그램	Grama	грамм	Gramo
Kilogram	كيلوغرام	公斤	Kilogramme	Kilogramm	किलोग्राम	Chilogrammo	キログラム	킬로그램	Quilograma	Килограмм	Kilogramo
Ton	طن	吨	Tonne	Tonne	टन	tonnellata	トン	톤	Tonelada	тонна	Tonelada
Stone	حجر	石	Pierre	Stein	पत्थर	Pietra	石	돌	Pedra	Камень	Piedra
Ounce	أوقية	盎司	Once	Unze	औंस	Oncia	オンス	온스	Onça	унция	Onza
Pound	جنيه	磅	Livre	Pfund	पौंड	Libbra	ポンド	파운드	Libra	фунт	Libra

Society

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish

Society	المجتمع	社会	Société	Gesellschaft	समाज	Società	しゃかい shakai	사회	Sociedade	общество	Sociedad
Economy	اقتصاد	经济	Économie	Wirtschaft	अर्थव्यवस्था	Economia	けいざい keizai	경제	Economia	экономика	Economía
Company	شركة	公司	Entreprise	Unternehmen	कंपनी	Azienda	かいしゃ kaisha	회사	Empresa	Компания	Empresa
Meeting	لقاء	会议	Réunion	Treffen	मुलाकात	Incontro	かいぎ kaigi	모임	encontro	Встреча	Reunión
School	مدرسة	学校	École	Schule	स्कूल	Scuola	がっこう gakkō	학교	Escola	Школа	Colegio
Store	متجر	商店	le magasin	Geschäft	दुकान	Memorizzare	みせ mise	저장	Loja	хранить	Almacenar
Hotel	الفندق	旅馆	Un hôtel	Hotel	होटल	Hotel	ホテル hoteru	호텔	Hotel	Гостиница	Hotel
Factory	مصنع	厂	Usine	Fabrik	फ़ैक्टरी	Fabbrica	こうじょう kōjō	공장	Fábrica	завод	Fábrica
Money	مال	钱	Argent	Geld	पैसे	I soldi	かね kane	돈	Dinheiro	Деньги	Dinero
Bill	مشروع قانون	法案	Facture	Rechnung	बिल	Conto	さつ satsu	계산서	Conta	Билл	Cuenta
Small Change	تغير بسيط	小变化	Petite monnaie	Kleine Veränderung	छोटा सा बदलाव	Piccolo cambiamento	こぜに kozeni	작은 변화	Pequena mudança	Небольшой изменение	Pequeño cambio
Change	يتغيرون	更改	Changement	Veränderung	परिवर्तन	Modificare	つりせん tsurisen	변화	mudança	Изменить	Cambio
Vending Machine	آلة للبيع	售货机	Distributeur automatique	Verkaufsautomat	व्यापारिक मशीन	Distributore automatico	じどうはんばいき jidōhanbaiki	자판기	Maquina de vendas	Торговый автомат	Máquina expendedora
Stamp	ختم	邮票	Timbre	Briefmarke	डाक टिकट	Francobollo	きって kitte	우표	Carimbo	Печать	Sello

Objects

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Desk	مكتب	台	Bureau	Schreibtisch	डेस्क	Scrivania	机 つくえ tsukue	책상	Mesa	стол письменный	Escritorio
Chair	كرسي	椅子	chaise	Stuhl	कुरसी	Sedia	椅子 いす isu	의자	Cadeira	кресло	Silla
Door	باب	门	Porte	Tür	द्वार	Porta	ドア doa	문	Porta	Дверь	Puerta
Window	نافذة او شباك	窗口	La fenêtre	Fenster	खिड़की	Finestra	窓 まど mado	창문	Janela	Окно	Ventana
House	منزل	屋	Maison	Haus	मकान	Casa	家 いえ ie	집	casa	жилой дом	Casa
Elevator	مصعد	电梯	Ascenseur	Aufzug	लिफ़्ट	Ascensore	エレベーター erebētā	엘리베이터	Elevador	Лифт	Ascensor
Rope	حبل	绳	Corde	Seil	रस्सी	Corda	なわ nawa	로프	Corda	канатный	Cuerda
Bag	كيس	袋	Sac	Tasche	बैग	Borsa	ふくろ fukuro	가방	Bolsa	Мешок	Bolso
Umbrella	مظلة	雨伞	Parapluie	Regenschirm	छाता	Ombrello	傘 かさ kasa	우산	Guarda-chuva	Зонтик	Paraguas
Pen	قلم جاف	钢笔	Stylo	Stift	कलम	Penna	ペン pen	펜	Caneta	Ручка	Bolígrafo
Pencil	قلم	铅笔	Crayon	Bleistift	पेंसिल	Matita	鉛筆 えんぴつ enpitsu	연필	Lápis	Карандаш	Lápiz
Paper	ورقة	纸	Papier	Papier	कागज़	Carta	紙	종이	Papel	Бумага	Papel
Ruler	مسطرة	统治者	Règle	Lineal	शासक	Righello	定規 じょうぎ jōgi	지배자	governante	Правитель	gobernante
Notebook	دفتر	笔记本	Carnet	Notizbuch	स्मरण पुस्तक	Taccuino	ノート nōto	수첩	Caderno	Ноутбук	Cuaderno
Envelope	ظرف	信封	Enveloppe	Briefumschlag	लिफ़ाफ़ा	Busta	ふうとう fūtō	봉투	Envelope	Конверт	Sobre
Computer	الحاسوب	电脑	Ordinateur	Computer	कंप्यूटर	Computer	コンピューター konpyūtā	컴퓨터	Computador	компьютер	Computadora
Laptop	حاسوب محمول	笔记本电脑	Portable	Laptop	लैपटॉप	Il computer portatile	パソコン pasokon	휴대용 퍼스널 컴퓨터	Computador portátil	портативный компьютер	Ordenador portátil
Scissors	مقص	剪刀	Les ciseaux	Schere	कैंची	Forbici	はさみ hasami	가위	Tesouras	Ножницы	tijeras
Stapler	دباسة	订书机	Agrafeuse	Hefter	ऊन बेचनेवाला	Cucitrice	ホッチキス hotchikisu	호치키스	Agrafador	стэплер	Engrapadora
Clothes	ملابس	衣服	vêtements	Kleider	वस्त्र	Abiti	服 ふく fuku	천	Roupas	одежда	Ropa
Belt	حزام	带	Ceinture	Gürtel	बेल्ट	Cintura	ベルト beruto	벨트	Cinto	ремень	Cinturón
Shoe	حذاء	鞋	Chaussure	Schuh	जूता	Scarpa	靴 くつ kutsu	구두	Sapato	башмак	Zapato
Sock	جورب	袜子	Chaussette	Socke	मौज़ा	Calzino	靴下 くつした kutsushita	양말	Meia	Носок	Calcetín
Glasses	نظارات	眼镜	Des lunettes	Brille	चश्मा	Bicchieri	眼鏡 めがね megane	안경	Óculos	Очки	Lentes

Transportation

Transport

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Transport	المواصلات	运输	Transport	Transport	ट्रांसपोर्ट	Trasporto	輸送 Yusō	수송	Transporte	Транспорт	Transporte
Journey	رحلة	旅程	Périple	Reise	यात्रा	Viaggio	旅 Tabi	여행	Viagem	Поездка	Viaje
Transit	عبور	过境	Transit	Transit	पारवहन	Transito	乗り継ぎ Noritsugi	운송	Transito	транзит	Tránsito
Travel	السفر	旅行	Voyage	Reise	यात्रा	Viaggio	旅行 Ryokō	여행	Viagem	Путешествовать	Viajar
Trip	رحلة قصيرة	旅	Voyage	Ausflug	यात्रा	Viaggio	トリップ Torippu	여행	Viagem	Поездка	Viaje
Passenger	راكب	乘客	Passager	Passagier	यात्री	Passeggeri	旅客 Ryokaku	승객	Passageiro	пассажир	Pasajero
Passport	جواز سفر	护照	Passeport	Reisepass	पासपोर्ट	Passaporto	パスポート Pasupōto	여권	Passaporte	Паспорт	Pasaporte
Station	محطة	站	Station	Bahnhof	स्टेशन	Stazione	駅 えき eki	역	Estação	станция	Estación
Ticket	تذكرة	票	Billet	Fahrkarte	टिकट	Biglietto	きっぷ kippu	티켓	Bilhete	Билет	Boleto
Return	إرجاع	返回	Revenir	Rückkehr	वापसी	Ritorno	戻る Modoru	반환	Retorna	Вернуть	Regreso
Travel Card	بطاقة سفر	旅行卡	Carte de voyage	Reisekarte	यात्रा कार्ड	Carta da viaggio	乗車カード Jōsha kādo	여행 카드	Cartão de viagem	Проездной	Tarjeta de viaje
Airplane	مطار	飞机	Avion	Flugzeug	विमान	Aereo	飛行機 ひこうき hikōki	비행기	Avião	самолет	Avión
Flight	طيران	飞行	Vol	Flug	उड़ान	Volo	フライト Furaito	비행	Voar	Рейс	Vuelo
Airport	مطار	飞机场	Aéroport	Flughafen	हवाई अड्डा	Aeroporto	空港 くうこう kūkō	공항	Aeroporto	аэропорт	Aeropuerto
Gate	بوابة	门	Porte	Tor	द्वार	cancello	ゲート Gēto	문	Portão	Ворота	portón
Boarding Pass	بطاقة الصعود	登机牌	Carte d'embarquement	Bordkarte	बोर्डिंग पास	Carta d'imbarco	搭乗券 Tōjō-ken	탑승권	Cartão de embarque	Посадочный талон	Tarjeta de embarque
Boarding	الصعود	登机	Embarquement	Einsteigen	बोर्डिंग	Imbarco	搭乗 Tōjō	탑승	Embarque	абордаж	Embarque
Aisle	ممر	走道	Rayon	Gang	गलियारा	Corridoio	通路 Tsūro	통로	Corredor	придел	Pasillo
Arrival	وصول	到达	Arrivée	Ankunft	पहुचना	Arrivo	到着 Tōchaku	도착	Chegada	прибытие	Llegada
Departure	مقال	出发	Départ	Abfahrt	प्रस्थान	Partenza	出発 Shuppatsu	출발	Saída	Вылет из	Salida

Departing	المغادرين	出发	Départ	Abflug	प्रस्थान	partenza	出発 Shuppatsu	출발	Partindo	Отправляясь	Partiendo
Boarding	الصعود	登机	Embarquement	Einsteigen	बोर्डिंग	Imbarco	搭乗 Tōjō	탑승	Embarque	абордаж	Embarque
Baggage	أمتعة	行李	bagages	Gepäck	सामान	Bagaglio	荷物 Nimotsu	수하물	Bagagem	Багаж	equipaje
Shuttle	خدمة النقل	穿梭	La navette	Shuttle	शटल	Navetta	シャトル Shatoru	우주선	Transporte	челнок	Lanzadera
Street	شارع	街	rue	Straße	सड़क	strada	通り みち michi	거리	Rua	улица	Calle
Road	الطريق	路	Route	Straße	सड़क	Strada	道路 どうろ dōro	도로	Estrada	Дорога	La carretera
Bus	حافلة	总线	Autobus	Bus	बस	Autobus	バス Basu	버스	Ônibus	автобус	Autobús
Route	طريق	路线	Route	Route	मार्ग	Itinerario	ルート Rūto	노선	Rota	маршрут	Ruta
Truck	شاحنة نقل	卡车	un camion	LKW	ट्रक	Camion	トラック Torakku	트럭	Caminhão	Грузовая машина	Camión
Traffic	حركة المرور	交通	Trafic	Der Verkehr	यातायात	Traffico	トラフィック Torafikku	교통	Tráfego	Движение	Tráfico
Coach	مدرب حافلة ركاب	教练	Entraîneur	Trainer	कोच	Allenatore		코치	Treinador	Тренер	Entrenador
Bus Stop	موقف باص	巴士车站	Arrêt de bus	Bushaltestelle	बस स्टॉप	Fermata dell'autobus	バスてい basutei	버스 정류장	Ponto de ônibus	Автобусная остановка	Parada de autobús
Motorbike	دراجات نارية	摩托车	Moto	Motorrad	मोटरबाइक	motocicletta	バイク Baiku	오토바이	Moto	мопед	Moto
Walk	سير	步行	Marche	Gehen	टहल लो	Camminare	歩く Aruku	산책	Caminhar	Ходить	Caminar
Car	سيارة	汽车	Voiture	Auto	गाड़ी	Auto	車 くるま kuruma	차	Carro	Автомобиль	Coche
Taxi	سيارة اجره	出租车	Taxi	Taxi	टैक्सी	Taxi	タクシー Takushī	택시	Táxi	Такси	Taxi
Cab	سيارة أجرة	出租车	Taxi	Taxi	टैक्सी	Taxi	タクシー Takushī	택시	Táxi	Такси	Taxi
Ferry	العبارة	渡船	Traversier	Fähre	नौका	Traghetto	フェリー Ferī	나룻배	Balsa	Паром	Transportar
Boat	قارب	船	Bateau	Boot	नाव	Barca	ボート Bōto	보트	Barco	Лодка	Bote
Ship	سفينة	船	Navire	Schiff	समुंद्री जहाज	Nave	船 Fune	배	Navio	Корабль	Enviar
Bicycle	دراجة	自行车	Vélo	Fahrrad	साइकिल	Bicicletta	自転車 Jitensha	자전거	Bicicleta	велосипед	Bicicleta
Scooter	سكوتر	摩托车	Scooter	Roller	स्कूटर	Scooter	スクーター Sukūtā	스쿠터	Lambreta	Самокат	Scooter
Railway	سكة حديدية	铁路	Chemin de fer	Eisenbahn	रेलवे	Ferrovia	鉄道 Tetsudō	철도	Estrada de ferro	Железнодорожный	Ferrocarril
Train	قطار	培养	Train	Zug	रेल गाडी	Treno	列車 でんしゃ densha	기차	Trem	Поезд	Entrenar
Subway	مترو الانفاق	地铁	Métro	U-Bahn	भूमिगत मार्ग	Metropolitana	地下鉄 Chikatetsu	지하철	Metrô	Подземка	Subterraneo
Bullet Train	قطار سريع	子弹头列车	Train à grande vitesse	Schnellzug	बुलेट ट्रेन	Treno ad alta velocità	新幹線 Shinkansen	초고속 열차	Trem-bala	Скоростной поезд	Tren bala
Steam Train	قطار بخاري	蒸汽火车	Train à vapeur	Dampflokomotive	भाप की रेल	Treno a vapore	蒸気機関車 Jōki kikan-sha	증기 기관차	Comboio a vapor	Паровоз	Tren a vapor
Tram	نوع من القطارات	电车	Tram	Straßenbahn	ट्राम	Tram	路面電車 Romen densha	시가 전차	Eléctrico	трамвай	Tranvía

Directions

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Directions	الاتجاهات	路线	instructions	Richtungen	दिशा-निर्देश	Indicazioni	行き方 Ikikata	지도	instruções	Направления	Direcciones
Drive	قيادة	驾驶	Conduire	Fahrt	चलाना	Guidare	ドライブ Doraibu	드라이브	Dirigir	Привод	Conducir
Go	اذهب	走	Aller	Gehen	चले जाओ	Partire	行く Iku	가기	Vai	Идти	Ir
Turn	منعطف أو دور	转	Tour	Wende	मोड़	turno	順番 Junban	회전	Virar	Очередь	Giro
Left	اليسار	剩下	La gauche	Links	बाएं	Sinistra	左 Hidari	왼쪽	Esquerda	Оставил	Izquierda
Right	حق	对	Droite	Recht	सही	Destra	右 Migi	권리	Certo	Правильно	Derecha
Straight	مباشرة	直行	Tout droit	Gerade	सीधे	Dritto	まっすぐ Massugu	직진	Em linha reta	Прямо	Derecho
Stop	توقف	停止	Arrêtez	Halt	रुकें	Fermare	やめる Yameru	중지	Pare	Стоп	Detener
Faster	بسرعة	快点	plus rapide	Schneller	और तेज	Più veloce	もっと早く Motto hayaku	빨리	Mais rápido	Быстрее	Más rápido
Slower	أبطأ	慢点	Ralentissez	Langsamer	और धीमा	Più lentamente	もっとゆっくり Motto yukkuri	천천히	Mais devagar	Помедленнее	Más lento
Turn Around	التف حوله	回转	Tourner autour	Dreh dich um	मुड़ो	Girarsi	振り向く Furimuku	돌아서 다	Inversão de marcha	Повернись	Giro de vuelta

Language

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Letter	رسالة	信	Lettre	Brief	पत्र	Lettera	じ ji	편지	Carta	Письмо	Carta
Numbers	أعداد	数字	Nombres	Zahlen	नंबर	Numeri	すうじ sūji	번호	Números	чисел	Números
Alphabet	الأبجدية	字母	Alphabet	Alphabet	वर्णमाला	Alfabeto	アルファベット arufabetto	알파벳	Alfabeto	Алфавит	Alfabeto
Foreign Language	لغة اجنبية	外语	Une langue étrangère	Fremdsprache	विदेशी भाषा	Lingua straniera	がいこくご gaikokugo	외국어	Lingua estrangeira	Иностранный язык	Idioma extranjero
English	الإنجليزية	英语	Anglais	Englisch	अंग्रेज़ी	Inglese	えいご eigo	영어	Inglês	английский	Inglés
Arabic	عربي	阿拉伯	arabe	Arabisch	अरबी	Arabo	アラビア語 Arabia-go	아라비아 말	árabe	арабский	Arábica
Chinese	صيني	中文	chinois	Chinesisch	चीनी	Cinese	ちゅうごくご chūgokugo	중국말	chinês	Китайский	chino
French	الفرنسية	法国	français	Französisch	फ्रेंच	francese	ふらんすご furansugo	프랑스 국민	francês	Французский	francés
German	ألمانية	德语	allemand	Deutsche	जर्मन	Tedesco	どいつご doitsugo	독일 사람	alemão	Немецкий	alemán
Hindi	الهندية	印地语	hindi	Hindi	हिंदी	hindi	イタリア語 Hindī-go	힌디 어	hindi	хинди	hindi
Italian	الإيطالي	意大利	italien	Italienisch	इतालवी	italiano	イタリアの Itaria no	이탈리아 사람	italiano	итальянский	italiano
Japanese	اليابانية	日本	Japonais	japanisch	जापानी	giapponese	にほんご nihongo	일본어	japonês	Японский	japonés
Korean	الكورية	朝鲜的	coréen	Koreanisch	कोरियाई	coreano	ちょうせんご chōsengo	한국어	coreano	Корейский	coreano
Portuguese	البرتغالية	葡萄牙语	Portugais	Portugiesisch	पुर्तगाली	portoghese	ポルトガル語 Porutogaru-go	포르투갈 인	Português	португальский	portugués
Russian	الروسية	俄语	russe	Russisch	रूसी	russo	ロシア Roshia	러시아인	russo	русский	ruso
Spanish	الأسبانية	西班牙语	Espanol	Spanisch	स्पेनिश	spagnolo	すぺいんご supeingo	스페인 사람	espanhol	испанский	Español

Numbers

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Zero	صفر	零	Zéro	Null	शून्य	Zero	零 れい or ゼロ rei or zero	제로	Zero	Нуль	Cero
One	واحد	一	Un	Ein	एक	Uno	一 いち ichi	하나	1	Один	Uno
Two	اثنان	二	Deux	Zwei	दो	Due	二 に ni	두	Dois	Два	Dos
Three	ثلاثة	三	Trois	Drei	तीन	Tre	三 さん san	세	Três	Три	Tres

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Four	أربعة	四	Quatre	Vier	चार	quattro	四 よん yon	네	Quatro	четыре	Cuatro
Five	خمسة	五	Cinq	Fünf	पंज	Cinque	五 ご go	다섯	Cinco	5	Cinco
Six	ستة	六	Six	Sechs	छह	Sei	六 ろく roku	육	Seis	Шесть	Seis
Seven	سبعة	七	Sept	Sieben	सात	Sette	七 なな or しち nana or shichi	일곱	Sete	Семь	Siete
Eight	ثمانية	八	Huit	Acht	आठ	Otto	八 はち hachi	여덟	Oito	8	Ocho
Nine	تسعة	九	Neuf	Neun	नौ	Nove	九 きゅう or く kyū or ku	아홉	Nove	9	Nueve
Ten	عشرة	十	Dix	Zehn	दस	Dieci	十 じゅう jū	십	Dez	10	Diez
Eleven	أحد عشر	十一	Onze	Elf	ग्यारह	Undici	十一 jū ichi)	열한	Onze	11	Once
Twelve	اثني عشر	十二	Douze	Zwölf	बारह	Dodici	十二 jū ni	열두	Doze	Двенадцать	Doce
Thirteen	ثلاثة عشر	十三	Treize	Dreizehn	तेरह	Tredici	十三 jū san	열셋	Treze	13	Trece
Fourteen	أربعة عشرة	十四	Quatorze	Vierzehn	चौदह	Quattordici	十四 jū yon	십사	Quatorze	14	Catorce
Fifteen	خمسة عشر	十五	Quinze	Fünfzehn	पंद्रह	Quindici	十五 jū go	열 다섯	Quinze	15	Quince
Sixteen	السادس عشر	十六	Seize	Sechszehn	सोलह	Sedici	十六 jū roku	열 여섯	Dezesseis	Шестнадцать	Dieciséis
Seventeen	سبعة عشر	十七	Dix-sept	Siebzehn	सत्रह	Diciassette	十七 jū nana	십칠	Dezessete	Семнадцать	De diecisiete
Eighteen	الثامنة عشر	十八	Dix-huit	Achtzehn	अठारह	Diciotto	十八 jū hachi	십팔	Dezoito	18	Dieciocho
Nineteen	تسعة عشر	十九	Dix-neuf	Neunzehn	उन्नीस	Diciannove	十九 jū kyū	십구	Dezenove	19	Diecinueve
Twenty	عشرون	二十	Vingt	Zwanzig	बीस	Venti	二十 廿 hatachi	스물	Vinte	20	Veinte
Twenty Five	خمسة وعشرون	二十五	Vingt cinq	Fünfundzwanzig	पच्चीस	Venticinque	二五 ni go	이십오	Vinte e cinco	Двадцать пять	Veinticinco
Thirty	ثلاثون	三十	30	Dreißig	तीस	Trenta	三十 san-jū	서른	Trinta	30	Treinta
Forty	أربعين	四十	Quarante	Vierzig	चालीस	Quaranta	四十 yon-jū	사십	Quarenta	Сорок	Cuarenta
Fifty	خمسون	五十	Cinquante	Fünfzig	पचास	Cinquanta	五十 go-jū	오십	Cinquenta	50	Cincuenta
One Hundred	مائة	一百	Cent	Einhundert	एक सौ	Cento	百 ひゃく hyaku	백개	Cem	Сто	Cien
One Thousand	ألف	一千	Mille	Eintausend	एक हज़ार	Mille	一千 せん sen	1 천만	Mil	Одна тысяча	Mil
Ten Thousand	عشرة آلاف	万	Dix mille	Zehntausend	दस हज़ार	Dieci mila	万 まん man	만	Dez mil	Десять тысяч	Diez mil
One Million	مليون واحد	一百万	Un million	Eine Million	दस लाख	Un milione	百万 hyakuman	1 백만	Um milhão	Один миллион	Un millón
One Hundred Million	مئة مليون	一亿	Cent millions	Ein hundert Millionen	दस करोड़	Cento milioni	一億 ichioku おく oku	일억	Cem milhões	Сто миллионов	Cien millones
One Billion	مليار واحد	十亿	Un milliard	Eine Milliarde	एक अरब	Un miliardo	十億 juu oku	10 억	Um bilhão	Один миллиард	Mil millones
One Trillion	ترليون واحد	一万亿	Un billion de dollars	Eine Billion	दस खरब	Mille miliardi	一兆 itchō	1 조	Um trilhão	Один триллион	Un billón

Colors

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
	اللون	颜色	Couleur	Farbe	रंग	Colore	色 いろ iro	색깔	Cor	цвет	Color
Maroon	كستنائي	栗色	Bordeaux	Kastanienbraun	लाल रंग	Marrone	あずき色 azuki-iro	적갈색	Marrom	каштановый	Granate
Red	أحمر	红色	rouge	rot	लाल	Rosso	赤 あか aka	빨간	Vermelho	красный	rojo
Orange	البرتقالي	橙子	Orange	Orange	नारंगी	arancia	オレンジ orenji	주황색	laranja	оранжевый	naranja
Yellow	الأصفر	黄色	Jaune	Gelb	पीला	Giallo	黄 きいろ kiiro	노랑	Amarelo	желтый	Amarillo
Lime	جير	酸橙	Citron vert	Limette	चूना	Lime	ライム raimu	라임	Lima	Лайм	Lima
Green	أخضر	绿色	vert	Grün	हरा	verde	緑 みどり midori	녹색	Verde	зеленый	Verde
Cyan	ازرق سماوي	青色	Cyan	Cyan	सियान	Ciano	シアン shian	시안	Ciano	Cyan	Cian
Blue	أزرق	蓝色	Bleu	Blau	नीला	Blu	青 あお ao	푸른	Azul	синий	Azul
Purple	أرجواني	紫色	Violet	Lila	बैंगनी	Viola	紫の むらさき murasaki	자	Roxa	Пурпурный	Púrpura
Pink	زهري	粉	Rose	Rosa	गुलाबी	Rosa	ピンク pinku	담홍색	Rosa	розовый	Rosado
White	أبيض	白色	blanc	Weiß	सफेद	bianca	白 しろ shiro	화이트	Branco	белый	Blanco
Black	أسود	黑色	Noir	Schwarz	काली	Nero	くろ kuro	검은	Preto	черный	Negro
Brown	بنى	棕色	marron	Braun	भूरा	Marrone	褐色 ちゃいろ chairo	갈색	Castanho	коричневый	marrón
Grey	اللون الرمادي	灰色	Gris	Grau	धूसर	Grigio	はいいろ haiiro	회색	Cinzento	Серый	Gris
Rainbow	قوس المطر	彩虹	arc en ciel	Regenbogen	इंद्रधनुष	Arcobaleno	虹 niji	무지개	arco Iris	радуга	Arco iris

Abstract Nouns

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
This	هذه	这个	Ce	Diese	इस	Questo	この	이	este	это	Esta
That	أن	那	Cette	Das	उस	Quello	それ	그	que	Тот	Ese
Which	التي	哪一个	Lequel	Welche	कौन कौन से	Quale	どっち	어느	Qual	Который	Cual
Now	الآن	现在	À présent	Jetzt	अभी व	Adesso	今	지금	Agora	Сейчас	Ahora
Then	ثم	然后	ensuite	Dann	फिर	Poi	それから	그때	Então	затем	Entonces
Past	الماضي	过去	Passé	Vergangenheit	अतीत	Passato	過去	과거	Passado	прошлое	Pasado
Future	مستقبل	未来	Futur	Zukunft	भविष्य	Futuro	未来	미래	Futuro	Будущее	Futuro
Yesterday	في الامس	昨天	Hier	Gestern	बिता कल	Ieri	昨日	어제	Ontem	Вчера	Ayer
Today	اليوم	今天	Aujourd'hui	Heute	आज	Oggi	今日	오늘	Hoje	сегодня	Hoy
Tomorrow	غدا	明天	Demain	Morgen	आने वाला कल	Domani	明日	내일	Amanhã	Завтра	mañana
Next	التالى	下一个	Suivant	Nächster	आगामी	Il prossimo	次	다음 것	Próximo	следующий	Siguiente
Before	قبل	之前	Avant	Vor	से पहले	Prima	前	전에	Antes	До	antes de
After	بعد	后	Après	Nach dem	बाद	Dopo	後に	후	Depois de	После	Después

Adjectives

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Good	جيد	好	Bien	Gut	अच्छा	Buono	いい or よい ii or yoi	좋은	Boa	Хорошо	Bueno
Amazing	رائعة حقا	惊人	Incroyable	Tolle	गजब का	Stupefacente	すごい sugoi	놀랄 만한	Surpreendente	Удивительно	Increíble
Wonderful	رائع	精彩	Merveilleux	Wunderbar	आश्चर्यजनक	meraviglioso	すばらしい subarashii	훌륭한	Maravilhoso	Замечательно	Maravilloso
Bad	سيئة	坏	Mal	Schlecht	खराब	Male	わるい warui	나쁜	Mau	Плохой	Malo
Expensive	مكلفة	昂贵	Coûteux	Teuer	महंगा	Costoso	たかい takai	비싼	Caro	Дорого	Costoso
Low	منخفض	低	Faible	Niedrig	कम	Basso	ひくい hikui	낮은	Baixo	Низкий	Bajo
Cheap	رخيص	廉价	Pas cher	Billig	सस्ता	A buon mercato	やすい yasui	싼	Barato	дешево	Barato
Big	كبير	大	Gros	Groß	बड़े	Grande	おおきい ōkii	큰	grande	большой	Grande
Small	صغير	小	Petit	Klein	छोटा	Piccolo	ちいさい chiisai	작은	Pequeno	Маленький	Pequeña
Thin	نحيف ضعيف	瘦	Mince	Dünn	पतला	Magro	ほそい hosoi	얇은	Fino	тонкий	Delgado
Thick	سميك	厚	Épais	Dick	मोटा	Di spessore	ふとい futoi	두꺼운	Grosso	толстый	Grueso
Old	قديم	旧	Vieux	Alt	पुराना	Vecchio	ふるい furui	늙은	Velho	старый	Antiguo
New	الجديد	新	Nouveau	Neu	नया	Nuovo	あたらしい atarashii	새로운	Novo	новый	Nuevo
Young	شاب	年轻	Jeune	Jung	युवा	Giovane	わかい wakai	젊은	Jovem	молодой	Joven
Light	ضوء	光	Lumière	Licht	रोशनी	Luce	かるい karui	빛	Leve	Свет	Ligero
Heavy	ثقيل	重	Lourd	Schwer	भारी	pesante	おもい omoi	무거운	Pesado	тяжелый	Pesado
Easy	سهل	简单	Facile	Einfach	आसान	Facile	やさしい yasashii	쉬운	Fácil	Легко	Fácil
Difficult	صعبة	难	Difficile	Schwer	कठिन	Difficile	むずかしい muzukashii	어려운	Difícil	Сложно	Difícil
Soft	ناعم	柔软的	Doux	Weich	मुलायम	morbido	やわらかい yawarakai	부드러운	Suave	Мягкий	Suave
Hard	الصعب	硬	Difficile	Schwer	कठिन	Difficile	かたい katai	단단한	Difícil	Жесткий	Difícil
Hot	الحار	热	Chaud	Heiß	गरम	Caldo	あつい atsui	뜨거운	Quente	Горячей	Caliente
Cold	البرد	冷	Du froid	Kalt	सर्दी	Freddo	つめたい tsumetai	감기	Frio	Холодно	Frío
Delicious	لذيذ	美味的	Délicieux	Köstlich	स्वादिष्ट	Delizioso	おいしい oishii	맛있는	Delicioso	Вкусные	Delicioso
Awful	سيى	可怕	Terrible	Schrecklich	भयंकर	Terribile	まずい mazui	무서운	Horrível	ужасный	Horrible
Sweet	حلو	甜	Sucré	Süss	मिठाई	Dolce	あまい amai	단	Doce	Милая	Dulce
Spicy Hot	حار جدا	麻辣烫	Épicé	Sehr scharf	मसालेदार गर्म	Piccante	からい karai	매운 뜨거운	Apimentado	Пряный Горячий	Picante
Salty	مالح	咸	Salé	Salzig	नमकीन	Salato	しょっぱい shoppai	소금기 있는	Salgado	соленый	Salado
Bitter	مرارة - مر	苦	Amer	Bitter	कड़वा	Amaro	にがい nigai	쓴	Amargo	ожесточенный	Amargo
Beautiful	جميلة	美丽	Belle	Wunderschönen	सुंदर	Bellissimo	うつくしい utsukushii	아름다운	Lindo	красивая	Hermoso

Feelings

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Happy	السعيدة	快乐	Heureux	glücklich	खुश	Contento	うれしい ureshii	행복	Feliz	Счастливый	Feliz
Fun	مرح	开玩笑	Amusement	Spaß	मज़ा	divertimento	たのしい tanoshii	장난	Diversão	Веселье	Divertido
Sad	حزين	伤心	Triste	Traurig	उदास	Triste	かなしい kanashii	슬퍼	Triste	Печальный	Triste
Lonely	وحيد	孤独	solitaire	Einsam	अकेला	Solitario	さびしい sabishii	고독한	Solitário	Одинокий, уединенный	Solitario
Scared	خائف، خواف، مذعور	害怕	Effrayé	erschrocken	डरा हुआ	Impaurito	こわい kowai	깜짝 놀란	Assustado	Напугана	Asustado
Painful	مؤلم	痛苦	Douloureux	Schmerzlich	दर्दनाक	Doloroso	いたい itai	아픈	Doloroso	мучительный	Doloroso
Itchy	حكة	发痒的	Qui démange	Juckende	खुजलाहट	pruriginoso	かゆい kayui	옴에 걸린	Sarnento	зудящий	Picante
Heartbroken	مكسور القلب	肠断	Navré	Herz gebrochen	टूटा हुआ दिल	affranto	つらい tsurai	상심 한	De coração partido	с разбитым сердцем	Con el corazón roto
Excited	فرح	兴奋	Excité	Aufgeregt	उत्साहित	Eccitato	興奮して	흥분한	Animado	В восторге	Emocionado
Disappointed	خائب الامل	失望	Désappointé	Enttäuscht	निराश	Deluso	がっかり	실망한	Desapontado	Разочарованный	Decepcionado
Sad	ليكون حزينا	伤心	Triste	Traurig	उदास	Triste	悲しい	슬퍼	Triste	Печальный	Triste
Cry	يبكي	哭	Cri	Weinen	रोना	Piangere	泣く	울음 소리	Choro	Плач	Llorar
Laugh	لتضحك	笑	Rire	Lachen	हसना	Ridere	笑い	웃음	Rir	Смех	Risa
Angry	لتكون غاضب	愤怒	Fâché	Wütend	गुस्सा	Arrabbiato	怒っている	성난	Bravo	Сердитый	Enojado
Encourage	لتشجيع	鼓励	Encourager	Ermutigen	प्रोत्साहित करना	Incoraggiare	奨励します	북돋우다	Encoraje	поощрять	Animar
Scold	لتأنيب	骂	Gronder	Schelten	डांटना	sgridare	叱る	꾸짖다	Scold	Ругать	Regaño
Celebrate	من اجل الاحتفال	庆祝	Célébrer	Feiern	जश्न	Celebrare	祝う	세상에 알리다	Comemoro	праздновать	Celebrar
Joy	فرح	喜悦	Joie	Freude	हर्ष	Gioia	喜び	즐거움	Alegria	Радость	Alegría
Bored	أن تكون بالملل	无聊	Ennuyé	Gelangweilt	ऊबा	Annoiato	退屈	지루한	Entediado	скучающий	aburrido
Astonished	لتكون مندهش	专案组	Étonné	Erstaunt	आश्चर्यचकित	stupito	びっくりした	놀란	Atônito	пораженный	Asombrado

Movement

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Go	اذهب	走	Aller	Gehen	चले जाओ	Partire	いく iku	가기	Vai	Идти	Ir
Come	تأتي	来	Viens	Kommen Sie	आइए	Venire	くる kuru	왔다	Venha	Прийти	Ven
Return	إرجاع	返回	Revenir	Rückkehr	वापसी	Ritorno	かえる kaeru	반환	Retorna	Вернуть	Regreso
Walk	سير	步行	Marche	Gehen	टहल लो	Camminare	あるく aruku	산책	Caminhar	Ходить	Caminar
Jump	الانتقال السريع ل	跳	Saut	Springen	कूद	Saltare	とぶ tobu	도약	Saltar	Прыгать	Saltar
Swim	سباحة	游泳	Nager	Schwimmen	तैरना	Nuotare	およぐ oyogu	수영	Nadar	Плавать	Nadar
Move	نقل	移动	Bouge toi	Bewegung	चाल	Mossa	うごく ugoku	움직임	Mover	Переехать	Movimiento
Dance	رقص	舞蹈	Danse	Tanzen	नृत्य	Danza	おどる odoru	댄스	Dança	танец	Danza
Sleep	ينام	睡觉	Dormir	Schlafen	नींद	Dormire	ねる neru	자다	Dormir	Спать	Dormir
Sing	يغنى	唱	Chanter	Singen	गाओ	Cantare	うたう utau	노래	Cantar	Sing	Canta
Bite	عضة	咬	Mordre	Beißen	काटना	Mordere	かむ kamu	물다	Mordida	укусить	Mordedura
Eat	تأكل	吃	Manger	Essen	खाना खा लो	Mangiare	たべる taberu	먹다	Comer	Есть	Comer

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Drink	يشرب	喝	Boisson	Getränk	पेय	Bere	のむ nomu	음주	Bebida	Напиток	Beber
Touch	لمس. اتصال. صلة	触摸	Toucher	Berühren	स्पर्श	Toccare	さわる sawaru	접촉	Tocar	потрогать	Toque
Throw	يرمي	扔	Jeter	Werfen	फेंकना	Gettare	なげる nageru	던지다	Lançar	бросать	Lanzar
Hold	معلق	保持	Tenir	Halt	पकड़	tenere	もつ motsu	보류	Aguarde	Держать	Sostener
Sit	تجلس	坐	Asseoir	Sitzen	बैठिये	Sedersi	すわる suwaru	앉다	Sentar	Сидеть	Sentar
Stand	يفهم	支架	Supporter	Stand	खड़ा	stare in piedi	たつ tatsu	대	Ficar de pé	стенд	Estar
Run	يركض	跑	Courir	Lauf	रन	Correre	はしる hashiru	운영	Corre	Бежать	correr

State Changes

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Unoccupied	غير مشغول	没人住	Inoccupé	Unbesetzt	खुला हुआ	Disoccupato	あく aku	비어있는	Desocupado	незанятый	Desocupado
Crowded	مزدحما	挤	Bondé	Überfüllt	भीड़	affollato	こむ komu	가득 차서	Lotado	переполненный	Concurrido
Need	بحاجة إلى	需要	Avoir besoin	Brauchen	जरुरत	Bisogno	いる iru	필요한 것	Precisar	Необходимость	Necesitar
Become Dry	تصبح جافة	变得干燥	Devenir sec	Trocken werden	शुष्क हो जाना	Diventa asciutto	かわく kawaku	어른이 되라.	Torne-se seco	Стань Сухим	Volverse seco
Disturb	إزعاج	干扰	Déranger	Stören	परेशान	Disturbare	みだす midasu	방해	Perturbar	Беспокоить	Molestar
Serve	تخدم	服务	Servir	Dienen	सेवा कर	Servire	つかえる tsukaeru	서브	Servir	обслуживать	Servir
Excel	تفوق	高强	Exceller	Excel	एक्सेल	Eccellere	すぐれる sugureru	뛰어나다	Excel	превосходить	Sobresalir
Wake	استيقظ	唤醒	Réveiller	Aufwachen	जागो	Wake	さめる sameru	일어나 다	Despertar	Услуга	Despertar
Cool Down	ترطيب	冷却	Refroidir	Abkühlen	शांत हो जाओ	Calmati	さめる sameru	진정	Esfriar	Остыть	Enfriarse
Face Toward	وجه نحو	面向	Face à	Gesicht in Richtung	चेहरे की ओर	Verso Verso	むく muku	얼굴을 향해	Cara para a frente	Лицо к	Cara hacia
Fall	خريف	秋季	Tomber	Fallen	गिरना	Autunno	たおれる taoreru	가을	Outono	Осень	Otoño
Harden	قسى	硬化	Durcir	Härten	कठोर बनाना	indurire	かたまる katamaru	강하게 하다	Endurecer	затвердеть	Endurecer
Increase	زيادة	增加	Augmenter	Erhöhen, ansteigen	बढ़ना	Aumentare	ます masu	증가하다	Aumentar	Увеличение	Incrementar
Decrease	تخفيض	减少	Diminution	Verringern	कमी	Diminuire	へる heru	감소	Diminuir	Уменьшить	Disminución
Deviate	انحرف	偏离	Dévier	Abweichen	हटना	Deviare	はずれる hazureru	빗나가게 하다	Desviar	отклоняться	Desviarse
Grow	تنمو	增长	Croître	Wachsen	आगे बढ़ें	Crescere	成長する	성장하다	Crescer	расти	Crecer
Begin	ابدأ	开始	Commencer	Start	शुरू	Inizio	はじまる hajimaru	시작하다	Início	Начать	Empezar
Finish	إنهاء	完	terminer	Fertig	समाप्त	finire	おわる owaru	끝	Terminar	Конец	Terminar
Decide	قرر	决定	Décider	Entscheiden	तय	Decidere	きめる kimeru	결정하다	Decidir	Принимать решение	Decidir

Senses

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Do	فعل	做	Faire	Tun	करना	Fare	行う	해야 할 것	Faz	Делать	Hacer
See	نرى	看到	Voir	Sehen	देख	Vedere	みる miru	만나다	Vejo	Увидеть	Ver
Hear	سمع	听	Entendre	Hören	सुनो	sentire	きく kiku	듣다	Ouvir	Услышьте	Oír
Touch	لمس. اتصال. صلة	触摸	Toucher	Berühren	स्पर्श	Toccare	さわる sawaru	접촉	Tocar	потрогать	Toque
Smell	رائحة	闻	Odeur	Geruch	गंध	Odore	かぐ kagu	냄새	Cheiro	Запах	Oler
Say	قل	说	Dire	Sagen	कहना	Dire	いう iu	말하다	Dizer	Сказать	Decir
Speak	تحدث	说话	Parler	Sprechen	बोले	Parlare	はなす hanasu	말하다	Falar	Говорить	Hablar
Tell	يخبار	告诉	Dire	Sagen	कहना	Raccontare	かたる kataru	텔	Contar	Расскажи	Contar
Write	كتابة	写	Écrire	Schreiben	लिखो	Scrivi	かく kaku	쓰다	Escrever	Написать	Escribir
Read	اقرأ	读	Lis	Lesen	पढ़ना	Leggere	よむ yomu	독서	Ler	Читать	Leer
Use	استعمال	使用	Utilisation	Benutzen	उपयोग	Uso	つかう tsukau	용도	Usar	использование	Utilizar
Make	يصنع	使	Faire	Machen	बनाना	Rendere	つくる tsukuru	하다	Faço	Делать	Hacer
Fix	حل	固定	Réparer	Fix	ठीक कर	fissare	なおす naosu	고치다	Consertar	исправлять	Fijar
Discard	تجاهل	丢弃	Jeter	Verwerfen	छोड़ना	Scartare	すてる suteru	포기	Descartar	отбрасывать	Descarte
Take	يأخذ	采取	Prendre	Nehmen	लेना	Prendere	とる toru	갖다	Leva	принимать	Tomar
Put	ضع	放	Mettre	Stellen	डाल	Mettere	おく oku	놓다	Colocar	Положил	Poner

Activities

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Meet	يجتمع	遇见	Rencontrer	Treffen	मिलना	Incontrare	あう au	만나다	Conheçer	Встретить	Reunirse
Open	افتح	打开	Ouvrir	Öffnen	खुला	Aperto	あける akeru	열다	Abrir	открыто	Abierto
Play	لعب	玩	Jouer	abspielen	प्ले	Giocare	あそぶ asobu	놀이	Toque	Играть	Jugar
Gather	جمع	收集	Recueillir	Versammeln	इकट्ठा	Raccogliere	あつまる atsumaru	모으다	Reunir	собирать	Reunir
Sell	يبيع	卖	Vendre	Verkaufen	बेचना	Vendere	うる uru	팔다	Vender	продавать	Vender
Obtain	الحصول على	获得	Obtenir	Erhalten	प्राप्त	Ottenere	える eru	얻다	Obtivermos	получать	Obtener
Break	استراحة	打破	Pause	Brechen	टूटना	Rompere	おる oru	단절	Pausa	Перерыв	Descanso
Buy	يشترى	购买	Acheter	Kaufen	खरीदें	Acquistare	かう kau	사다	Comprar	купить	Comprar
Cut	يقطع	切	Couper	Schnitt	कट गया	Taglio	きる kiru	절단	Cortar	Резать	Cortar
Wear	البس، ارتداء	穿	Porter	Tragen	पहन लेना	Indossare	きる kiru	입고 있다	Vestem	носить	Vestir
Change	يتغيرون	更改	Changement	Veränderung	परिवर्तन	Modificare	かえる kaeru	변화	mudança	#NAME?	Cambio
Exchange	تبادل	交换	Échange	Austausch	अदला बदली	Scambio	かえる kaeru	교환	Troca	обмен	Intercambiar
Close	قريب	关	Fermer	Schließen	बंद करे	Vicino	しめる shimeru	닫기	Perto	близко	Cerrar
Tie	ربطة عنق	领带	Attacher	Krawatte	टाई	Cravatta	しめる shimeru	넥타이	Gravata	Галстук	Corbata
Comprise	تضم	包括	Comprendre	Umfassen	समावेश करना	Comprendere	しめる shimeru	이루다	Compreendem	Включать	Comprender
Know	أعرف	知道	Savoir	Kennt	जानना	Conoscere	しる shiru	알고있다	Conhecer	знать	Saber
Get Tired	تعبت	感到疲倦	Se fatiguer	Müde werden	थक जाना	Stancarsi	つかれる tsukareru	피곤하다	Ficar cansado	Уставать	Cansarse
Go Out	اذهب للخارج	出去	Sortir	Hinausgehen	बाहर जाओ	Esci	でかける dekakeru	나가	Saia	Выйди вон	Fuera
Work	عمل	工作	Travail	Arbeit	काम	Lavoro	はたらく hataraku	작업	Trabalhos	Работа	Trabajo

Let Go	اتركه	松手	Allons y	Loslassen	जाने दो	Lascia andare	はなす hanasu	가자	Solte	Отпустить	Déjalo ir
Rest	راحة	休息	Du repos	Sich ausruhen	आराम	riposo	やすむ yasumu	휴식	Descansar	Остальное	Descanso

Other Interjections

	Arabic	Chinese (Simplified)	French	German	Hindi	Italian	Japanese	Korean	Portuguese	Russian	Spanish
Already	سابقا	已经	Déjà	Bereits	पहले से	Già	もう mō	이미	Já	Уже	Ya
Still	ما يزال	仍然	Encore	Immer noch	फिर भी	Ancora	まだ mada	아직도	Ainda	Еще	Todavía
Always	دائما	总是	Toujours	Immer	हमेशा	Sempre	ずっと zutto	항상	Sempre	Всегда	Siempre
Very	للغاية	非常	Très	Sehr	बहुत	Molto	とても totemo	대단히	Muito	Очень	Muy
Like This	مثله	像这样	Comme ça	So was	इस तरह	Come questo	こう kō	이처럼	Como isso	Как это	Me gusta esto
Like That	مثل هذا	像那样	Comme ça	So wie das	उसके जैसा	Come quello	そう sō	그처럼	Curtiu isso	Как это	Como eso
How	ماذا	怎么样	Comment	Wie	किस तरह	Come	どう dō	방법	Como	Как	Cómo
Often	غالبا	经常	Souvent	Häufig	अक्सर	Spesso	しばしば shibashiba	자주	Frequentemente	Часто	A menudo
This	هذه	这个	Ce	Diese	इस	Questo	この kono	이	este	это	Esta
That	أن	那	Cette	Das	उस	Quello	その sono	그	que	Тот	Ese
Which	التي	哪一个	Lequel	Welche	कौन कौन से	Quale	どの dono	어느	Qual	Который	Cual
But	لكن	但	Mais	Aber	परंतु	Ma	でも demo	그러나	Mas	Но	Pero
Besides	بالإضافة إلى	除了	outre	Außerdem	के अतिरिक्त	inoltre	それに soreni	게다가	Além disso	Кроме того	Además
However	ومع ذلك	然而	toutefois	jedoch	हालाँकि	però	だって datte	하나	Contudo	тем не мение	sin embargo
At	في	在	À	Beim	पर	A	で de	에서	No	В	A
And	و	和	Et	Und	तथा	E	と or や to or ya	과	E	А также	Y
And Then	وثم	然后	Et alors	Und dann	और फिर	E poi	そして soshite	그리고	E depois	А потом	Y entonces
To	إلى	至	À	Zu	सेवा मेरे	A	まで made	에	Para	к	A
So	وبالتالي	所以	Alors	So	इसलिए	Così	ので node	그래서	assim	Так	Asi que
From	من عند	从	De	Von	से	A partire dal	から kara	에서	De	От	Desde
Than	من	比	Que	Als	से	Di	より yori	보다	Do que	чем	Que
Whether	سواء	是否	Qu'il s'agisse	Ob	या	Se	か ka	인지 어떤지	Se	Будь то	Ya sea
While	في حين	而	Tandis que	Während	जबकि	Mentre	ながら nagara	동안	Enquanto	В то время как	Mientras
When	متى	什么时候	Quand	Wann	कब	quando	いつ	언제	Quando	когда	Cuando
If	إذا	如果	Si	Ob	अगर	Se	なら nara	만약	E se	Если	Si
Even	حتى في	甚至	Même	Sogar	यहाँ तक की	Anche	さえ sae	조차	Até	Четное	Incluso
Only	فقط	只要	Seulement	Nur	केवल	Solo	しか shika	만	Somente	Только	Solamente
Approximately	تقريبا	大约	Environ	CA	लगभग	Circa	くらい kurai	대략	Aproximadamente	Примерно	Aproximadamente
Also	أيضا	也	Également	Ebenfalls	भी	Anche	でも demo	또한	Além disso	Также	también
For Example	فمثلا	例如	Par exemple	Zum Beispiel	उदाहरण के लिए	Per esempio	など nado	예를 들어	Por exemplo	Например	Por ejemplo
Until	حتى	直到	Jusqu'à ce que	Bis um	जब तक	Fino a	まで made	까지	Até	До тех пор	Hasta
Too	جدا	太	Aussi	Auch	बहुत	Pure	も mo	너무	Também	Тоже	También

Religion

Details on religions, quotes and ethics

"When I do good, I feel good. When I do bad, I feel bad. That's my religion."
Abraham Lincoln

Introduction

During hardship people may seek solace in religions and ask the bigger questions in life. This category also includes a section on ethics throughout history which may be of interest or help at some point.

Purpose	The aim of RELIGION is to provide a quick summary of the big religions of the world, what they stand for and the denominational splits over time. The end of this category features preparedness related quotes from well known individuals and the different ethical standards which have been used throughout history.
Lost?	● For information on the rapture, see the MASS DESTRUCTION section. ● For the ethics of killing other humans, see the OFFENCE section. ● For mental problems such as depression, see the EMOTIONAL section.

Contents

1 Religious Differences

There's approximately 4,200 current religions on planet earth. Due to this reason they all couldn't have their own section below so just a few have been selected for this category, namely; Christianity, Judaism, Islam, Hinduism, Sikhism, Atheism and Buddhism.

Religion By Percentage	Christianity	Islam	Unaffiliated	Hinduism	Buddhism	Folk Religion	Other
	33%	24.1%	16%	16%	7%	5.9%	0.8%

Faith Comparison

	Christianity	Judaism	Islam	Hinduism	Buddhism

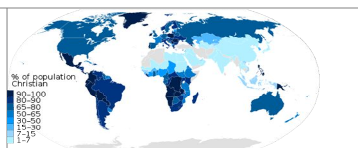
Origin of the Name	From the Greek: christos, 'Anointed' - referring to Jesus Christ.	From the Hebrew: Yehudim, 'Judah'.	Derived from an Arabic word for 'submission'. Also related to the Arabic word salaam, 'peace'.	The word Hindu is derived from the Indo-Aryan and Sanskrit word Sindhu, which means "a large body of water", covering "river, ocean".	Siddhartha Gautama was called the "Buddha". Buddha is one who has attained Bodhi - an ideal state of intellectual and ethical perfection.	**Origin of the Name**
Founder	Jesus Christ, who was crucified around A.D. 30 in Jerusalem.	The Hebrew leader Abraham founded Judaism around 2000 B.C. Moses gave the Jews the Torah around 1250 B.C.	Muhammad, who was born in A.D. 570 at Mecca, in Saudi Arabia.	Hinduism has no founder. An old religion it dates back to around 2300-1500 B.C.	Siddhartha Gautama, called the Buddha, in the 4th or 5th century B.C. in India.	**Founder**
Beliefs	Jesus taught love of God and neighbour and a concern for justice.	Jews believe in the laws of God and the words of the prophets. In Judaism, however, actions are more important than beliefs.	The Five Pillars, or main duties, are: profession of faith; prayer; charitable giving; fasting during the month of Ramadan; and pilgrimage to Mecca at least once.	Reincarnation states that all living things are caught in a cycle of death and rebirth. Life is ruled by the laws of karma, in which rebirth depends on moral behaviour.	The Four Noble Truths: (1) all beings suffer; (2) desire for possessions, power, and so on causes suffering; (3) desire can be overcome; and (4) the path that leads away from desire is the Eightfold Path (the Middle Way).	**Beliefs**
Types	Three main groups: Orthodox, Protestant and Roman Catholic	The three main types are Orthodox, Conservative, and Reform. Conservative Jews follow most traditional practices, but less strictly than the Orthodox. Reform Jews are the least traditional.	Almost 90% of Muslims are Sunnis. Shiites are the second-largest group.	No single belief system unites Hindus. A Hindu can believe in only one god, in many, or in none.	Theravada (Way of the Elders) and Mahayana (Greater Vehicle) are the two main types.	**Types**
Adherents	2.2 billion	14 million	1.6 billion	1 billion	500 million	**Adherents**
Gods	1	1	1	Many (All gods are considered different forms of one Supreme Being.)	None, but there are enlightened beings (Buddhas)	**Gods**
Nature of God	One God, who exists in three distinct persons (The Trinity): Father, Son and Holy Spirit (Matthew 28:19).	One God (known in English as 'Yahweh' or 'Jehovah') - "...Hear Israel, the Lord is our God, the Lord is one." (Deuteronomy 6:4).	One God (Arabic: Allah), who is not a trinity. The Islamic view of God is called strict Monotheism (Quran 112:1).	Many gods, but realize that they all come from Atman.	There is no belief in a personal god. Buddhists believe that nothing is fixed or permanent and that change is always possible.	**Nature of God**
Jesus Christ	The second person of the Trinity and born of the Virgin Mary.	An ordinary Jew, not the Messiah nor a divine person.	Isa (Jesus) was a prophet, sent by Allah and born of the Virgin Mary, but not divine (Quran 5:17).	Jesus' proclamation "The Father and I are one" confirmed the Hindu idea that everyone can realize his own universal "god-consciousness."	The Dalai Lama stated that "Jesus Christ also lived previous lives", and added that "So, you see, he reached a high state, either as a Bodhisattva, or an enlightened person, through Buddhist practice or something like that."	**Jesus Christ**
The Mission of Jesus Christ	To reconcile Man to God, through his death as a sacrifice for the sins of all mankind.	As Judaism rejects the idea of Jesus as Messiah, his mission is of no relevance.	To proclaim the Injil, or gospel. This gospel has been corrupted over time by human additions and alterations.	Jesus travelled across Southeast Asia, learning yogic traditions and returned home to be a guru to the Jews.	To achieve enlightenment.	**The Mission of Jesus Christ**
The Death of Jesus Christ	For our sake He was crucified, He suffered death and was buried. On the third day He rose again, then ascended into heaven.	Jesus was crucified for his claim to be divine.	Jesus was not crucified (Quran 4:157), but was raised to Heaven by Allah (4:158).	Upon his death Jesus became enlightened and merged with the Godhead, which is the Hindu idea of the force from which all creation springs.	The crucifixion of Jesus for the atonement of sins is a direct contrast to Buddhist teachings.	**The Death of Jesus Christ**
	Christianity	**Judaism**	**Islam**	**Hinduism**	**Buddhism**	
Holy Spirit	The third person of the Trinity, truly divine. With the Father and the Son he is worshipped and glorified.	Not a distinct person, but a divine power which for example, was given to the Prophets.	Identical with the Angel Gabriel, who appeared to the Prophet Mohammed giving him the Quranic text.	Many gods, but realize that they all come from Atman.	Buddhism does not believe in One God: Father, Son, and Holy Spirit.	**Holy Spirit**
Holy Writings	The Bible is the sacred text of Christianity.	The most important are the Torah, or the first five books of Moses. Others include Judaism's oral tradition, the written form of which is known as the Talmud.	The Koran is the sacred book of Islam.	The most ancient are the four Vedas.	The most important are the Tripitaka, the Mahayana Sutras, Tantra, and Zen texts.	**Holy Writings**
Sin	We inherit a sinful nature through our common ancestor Adam, who rebelled against God. Jesus Christ atoned for our sins through his death on the Cross (Romans 5:12-17).	Judaism rejects the doctrine of original sin. Atonement for sins committed is made through seeking forgiveness from God in prayer and repentance. In addition, the day of atonement (Yom Kippur) is set aside specially for this purpose.	There is no concept of original sin, nor vicarious atonement. All Humans are born sinless, but human weakness leads to sin.	Repentance for unintentional sins are prescribed, but intentional sins have to be repaid through karmic consequences.	Ordinary human beings possess greed, anger, delusion, ignorance, cravings, etc. and they were compared by the Buddha as 'the fools' and 'the blind'.	**Sin**
Salvation	By grace through faith in Jesus Christ (Ephesians 2:8-9).	Through good works, prayers and the grace of God. There is no parallel to the Christian view of substitutionary atonement.	Achieved through good works, thus personal righteousness must outweigh personal sin (Quran 23:101-103).	Reaching enlightenment by the Path of Knowledge, the Path of devotion, or the Path of Good Deeds.	Buddhism has nothing to do with "salvation". The only goal in Buddhism is to attain Nirvana. To do this, we should let go of our desires, cravings and attachments, and try to dispel our ignorance.	**Salvation**

	Christianity	Judaism	Islam	Hinduism	Buddhism	
Hell	A place of everlasting punishment for the unrighteous (Matthew 25:46). There is no crossover between Heaven and Hell.	Traditionally, there is the concept of Gehinnom or Gehenna - those who die in sin may suffer temporary punishment, but certain sins merit eternal punishment. However, Judaism's ideas of the afterlife have varied widely among different groups and in different time periods. For the most part, Judaism does not emphasize the afterlife.	A place of torment and fire (Quran 25:65, 104:6-7). In Islam, Hell is known as Jahannam. Jahannam has several levels and a person may not necessarily spend eternity there.	A constant cycle of reincarnation until enlightenment is reached.	Until one has attained Nirvana, he or she will be reborn into any of the 31 planes of existence over and over again, due to his/her karma.	**Hell**
Where	Through its missionary activity Christianity has spread to most parts of the globe.	There are large Jewish populations in Israel and the U.S.	Islam is the main religion of the Middle East, Asia, and the north of Africa.	Hinduism is practiced by more than 80% of India's population.	Buddhism is the main religion in many Asian countries.	**Where**
Meaning of Life	All have sinned and are thereby separated from God. Salvation is through faith in Christ.	Obey God's commandments, live ethically. Focus is more on this life than the next.	Submit (Islam) to the will of God to gain paradise after death.	Humans are in bondage to ignorance and illusion, but are able to escape. Purpose is to gain release from rebirth, or at least a better rebirth.	Escape the cycle of rebirth and attain nirvana (Theravada Buddhism). Become a boddhisatva then help others attain enlightenment (Mahayana Buddhism).	**Meaning of Life**
Afterlife	A new body and new soul to dwell in heaven with God forever.	Not emphasized; views vary: no afterlife, shadowy existence, World to Come (similar to heaven), Gehenna (similar to hell), reincarnation	Eternal Paradise or eternal Hell	Reincarnation until gain enlightenment.	Rebirth or nirvana. Nirvana is seen simply as the cessation of suffering by some and as a heavenly paradise by others.	**Afterlife**
Practices	Prayer, Bible study, baptism, Communion, church on Sundays, numerous holidays.	Circumcision at birth, bar/bat mitzvah at adulthood, observing Sabbath, wearing tallit and tefilin, prayer services.	Five Pillars: Faith, Prayer, Alms, Pilgrimage, Fasting. Mosque services on Fridays. Ablutions before prayer. No alcohol or pork. Holidays related to the pilgrimage and fast of Ramadan.	Yoga, meditation, worship (puja), devotion to a god or goddess, pilgrimage to holy cities, live according to one's dharma (purpose/ role).	Meditation, mantras, devotion to deities (in some sects), mandalas (Tibetan)	**Practices**
	Christianity	**Judaism**	**Islam**	**Hinduism**	**Buddhism**	

2 Christianity †

Christianity is the following of Jesus Christ's teachings and having a relationship with our father in heaven because we are all sinners and have strayed from the path set to us by going our own lustful ways. He sent his only Son to die on the cross for every one of these sins and he longs to have a relationship with each of us, and wants to see us prosper and live for him. He alone is the way, the truth and the life.

Geographic Positioning
Countries with the greatest proportion of Christians by country (as of 2010[n])



"For God so loved the world that He gave His only begotten Son, that whoever believes in Him should not perish but have everlasting life."
John 3:16

Largest Christian Populations[n]	**United States** 229,157,250	**Brazil** 169,213,130	**Russia** 114,198,444	**Mexico** 106,204,560	**Nigeria** 80,510,000	**Philippines** 78,790,000	**China** 67,070,000	**Democratic Congo** 63,150,000	**France** 55,948,600	**Italy** 55,832,000	**Ethiopia** 51,477,950

Subheadings

1. Introduction	**2. Denominations**	**3. The Commandments**	**4. Evidence for God**
5. Accepting Jesus	**6. After Death**	**7. The Bible**	**8. Common Questions**
9. Further Reading			

1 Introduction

Many people place the beginning of Christianity some two thousand years ago with the life of Jesus. In actuality, Christianity began as a reform movement within Judaism, which had been established nearly two thousand years earlier. To understand Christianity, we must go back to the roots of Judaism. We find aspects of the history of the Israelites recorded in the Bible, which is ultimately a collection of writings conveying the story of God's relationship with humanity. "In the beginning," the Scriptures state, "God created the heavens and the earth."

However, sometime after creating humanity, things began to go awry. People chose to defy God's command, and sin entered the world. As a direct result of this disobedience, humans have since been struggling with broken relationships with God, themselves, others, and creation. Even worse, through that act, death was introduced to the world. In order to restore everlasting relationship with his creation, God chose one righteous person - Abraham, and initiated a plan of redemption.

"Christianity, if false, is of no importance, and if true, of infinite importance. The only thing it cannot be is moderately important."
C.S. Lewis

Through Abraham's family, a people became a nation that was destined to be a light, a blessing, and a model to the entire world: Israel. Though there were moments when they forgot who they were and neglected God's commands, in time the Israelites succeeded in being God's faithful people—despite threats and attacks levelled against them from surrounding nations. In the Christian understanding, the Israelites' presence in the world and their message of the one true God prepared the peoples of the earth for the next phase of God's plan. Through his prophets, God foretold a final resolution to the broken relationship between God and humans: God himself would enter the world in the form of a human being.

He would experience what we experience. He would suffer the pain that we suffer, endure the temptations we endure, feel the emotions we feel. But more than that, he would be beaten, broken, and crushed. In his death he would take on all the sins of man, until "by his wounds we (would be) healed" and set free from the bondage of sin. And in the end, he would restore his scattered and dispirited people, ushering in an era of unending peace.

Then came Jesus. A Jewish carpenter who lived two thousand years ago, Jesus is called the Son of God. Christians believe Jesus to be fully man and fully God, equally human and divine. Early in his life, Jesus distinguished himself as an unusually precocious child, demonstrating tremendous spiritual wisdom and maturity. When Jesus knew the moment was right, he left behind his home and embarked on a new path. He began to preach, teach, perform miracles, and gather around him a band of disciples. Eventually, they recognized him as the messiah.

What his followers did not realize was that God's plan was going to take an unusual turn. He was going to restore the nation of Israel, as they hoped, but he would do it in a most unexpected way—not through shows of power and the oppression of enemies but through selfless love and compassion.

> *"Christ did not come to make bad men good, but to give dead men life!"*
> ***Chuck Missler***

Jesus, the Son of God, was crucified, died, and rose from the dead. He conquered sin and death in order to restore humanity's broken relationship with God, the Father. Jesus did what we cannot: he lived a perfect, sinless life and paid the price for our transgressions. Christians believe that Jesus' sacrifice for humanity saved us from the permanent consequence of our sins—eternal separation and isolation from God. Through Jesus, we can attain eternal life in relationship with God. Indeed, Jesus said, "I am the way and the truth and the life, and that whoever believes in Him will have everlasting life."

One day, Jesus promised, he will return to reign over his faithful followers in a peaceful kingdom where "there will be no more death or mourning or crying or pain." In the interim, he has sent the Holy Spirit to live and dwell with his followers, leading them in the way of truth. Today, Christianity is practiced in three primary forms: Roman Catholic, Eastern Orthodox, and Protestant. Within each of these three branches, there are numerous subsets and denominations. However, each group concurs on the general story and purposes described above; they divide mainly in the details of how principles should be applied practically.

Over the years, Christianity has seen its fair share of glorious, proud moments and all too many humiliating, shameful ones. But this is less an indictment on God, Jesus, or Christianity than it is on his followers. Mahatma Gandhi allegedly once said, "I like your Christ; I do not like your Christians. Your Christians are so unlike your Christ." He voiced the inconsistency found between the Son of God and those who claim to follow in his footsteps. And yet, should that surprise anyone? The Bible tells story after story of those who failed to live as God called them to live. This is not true just for Christians but for all people. This is why we need a messiah, a redeemer, a saviour. And yet, should that surprise anyone? The Bible tells story after story of those who failed to live as God called them to live.

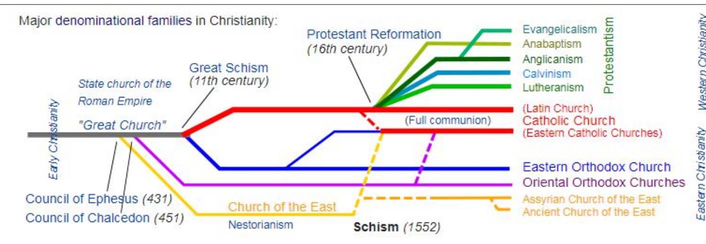
This is not true just for Christians but for all people. This is why we need a messiah, a redeemer, a saviour. Chuck Colson once said, "Christianity is an explanation of all of reality." Simply put, we all know the world is broken. The whole world, including me and you, needs fixing. And no matter how many different fix-it methods we try—whether self-help or sex, missionary work or money—none of them can fill the void that all of us feel. Christianity, from creation up through God's restoring work in Jesus, is both the explanation of and solution to that emptiness. Ultimately, Christianity is the story of God's powerful, redemptive love for his people.

2 Denominations

These are the different denominations of Christianity in the world today. In a world of rampant deception, only the Christian denominations which hold fast to the <u>whole</u> and <u>unaltered</u> word of God (the Bible) can be trusted to lead us to Him. Unfortunately many, if not most have strayed from the truth even partially.

Great Schism (1054 A.D.)
The East–West Schism is the break of communion since the 11th century between the Catholic Church and Eastern Orthodox Churches.

The schism was the culmination of theological and political differences which had developed during the preceding centuries between Eastern and Western Christianity.



(Not shown are non-Nicene, nontrinitarian, and some restorationist denominations.)

Protestant Reformation
The Reformation was a major movement within Western Christianity in 16th-century Europe that posed a religious and political challenge to the Catholic Church and in particular to papal authority, arising from what was perceived to be errors, abuses, and discrepancies by the Catholic Church. The Reformation was the start of Protestantism and the split of Protestantism from the Roman Catholic Church.

Catholicism

Catholic theology is based on the Nicene Creed. The Catholic Church teaches that it is the One, Holy, Catholic and Apostolic church founded by Jesus Christ, that its bishops are the successors of Christ's apostles, and that the Pope is the successor to Saint Peter to whom primacy was conferred by Jesus Christ. Unfortunately today it's rife with Biblical inaccuracies and doctrines of demons. You don't need a priest or interpreter for the Bible, read it for yourself!

Latin Church
It employs the Latin liturgical rites. It is headed by the Bishop of Rome - the pope - and has its headquarters in the Vatican City. The Latin Church traces its history to the earliest days of Christianity.

Protestantism

Originated with the 16th century Reformation, a movement against what its followers perceived to be errors in the Roman Catholic Church.

Ever since, Protestants reject the Roman Catholic doctrine of papal supremacy and sacraments, but disagree among themselves regarding the real presence of Christ in the Eucharist.

They emphasize the priesthood of all believers, justification by faith alone rather than by good works, and the highest authority of the Bible alone in faith and morals.

Historical Protestantism
- Baptist Churches
- Lutheranism
- Methodism
- Calvinism
- Presbyterianism
- Congregationalism
- Anabaptism

Modern Protestantism
- Pentecostalism
- Non-denominational Christianity
- Seventh-day Adventists (SDA)
- New Apostolic Church
- Restoration Movement
- Plymouth Brethren

Anglicanism
Anglicanism is a Western Christian tradition that evolved out of the practices, liturgy and identity of the Church of England following the Protestant Reformation.

Eastern Christianity

Eastern Orthodox Church
The most common estimate of the number of Eastern Orthodox Christians worldwide is 225–300 million, forming a single communion, making it the second largest, single Christian denomination behind the Catholic Church.

Oriental Orthodoxy
Oriental Orthodox churches are the churches descended from those that rejected the Council of Chalcedon in 451. Despite the similar name, they are therefore a different branch of Christianity from the Eastern Orthodox.

Restorationism / Nontrinitarianism
Restorationism, also described as Christian primitivism, is the belief that Christianity has been or should be restored along the lines of what is known about the apostolic early church, which restorationists see as the search for a more pure and more ancient form of the religion.

Latter Day Saint Movement (Mormonism)
- The Church of Jesus Christ of Latter-day Saints
- Community of Christ

Jehovah's Witnesses (JW's)
They believe that the destruction of the present world system at Armageddon is imminent, and that the establishment of God's kingdom over the earth is the only solution for all problems faced by humanity.

Other Minor Branches

Other minor branches of Christianity that have a large number of adherents.

Messianic Judaism	Messianic Judaism is a modern syncretic religious movement that combines Christianity—most importantly, the belief that Jesus is the Messiah—with elements of Judaism and Jewish tradition.

Denomination Comparison

Christianity is based on the word of God (The Bible) and in extension - the teachings of Jesus, the Son of God. Therefore any Christian denomination which strays from the truth of the Bible (both old and new testament) has been developed by the human mind and therefore not by God. Those denominations are apostate (strayed from the truth) and are highly cautioned against.

Below are a few of the main christian denominations. Those with red backgrounds differ from the original word of God. Many churches today have diverted from the truth and have fallen into apostasy, do not be deceived by the ways of the world but seek first the kingdom of heaven. For the safest bet, go with a Baptist Church, although you should always verify what any Bible teacher says yourself.

	Catholic	Presbyterian	Baptist	Anglican	Lutheran	
Founder & Date	Gregory the Great* 590-604 A.D. (*Gradual Development)	John Calvin 1536 A.D.	Jesus Christ 30-33 A.D.	Henry VIII 1534 A.D.	Martin Luther 1520 A.D.	**Founder & Date**
Adherents	1.285 billion	40-50m	75-105m	85m	70-90m	**Adherents**
Creeds	Many, yet focus on the Apostles' Creed and Nicene Creed	Apostles' Creed, Nicene Creed, Westminster Confession	Avoids creeds or confessions that might compromise commitment to Scripture as sole rule of faith	Apostles' Creed and the Nicene Creed	Apostles' Creed, Nicene Creed, Athanasian Creed, Augsburg Confession, Formula of Concord	**Creeds**
Sacraments	Baptism, Eucharist (Lord's Supper), Penance, Confirmation, Marriage, Holy Orders, Anointing of the Sick	Baptism, Lord's Supper	Baptism, Lord's Supper	Baptism, Lord's Supper (Regard the other five that Catholics observe as "minor sacraments")	Baptism, Lord's Supper	**Sacraments**
Salvation	Received at baptism; may be lost by mortal sin; regained by penance	God's grace by faith alone	God's grace by faith alone	God's grace by faith alone	God's grace by faith alone	**Salvation**
Baptism	Sprinkling (As a baby)	Sprinkling	Immersion Only	Sprinkling / Immersion Allowed	Sprinkling (Style isn't important)	**Baptism**
Scripture Inerrancy	God is the author of sacred Scripture. "The divinely revealed realities, which are contained and presented in the text of Sacred Scripture, have been written down under the inspiration of the Holy Spirit	For some the Bible is inerrant; for others it is not necessarily factual, but it breathes with the life of God	Inspired and inerrant	Anglican/Episcopal: Inspired, according to the. Book of Common Prayers, the Catechism	The Lutheran Church Missouri Syndod (LCMS) considers scripture to be inspired and inerrant. The Evangelical Lutheran Church of America (ELCA) does not believe scripture is inspired and inerrant.	**Scripture Inerrancy**
Doctrine Basis	The Bible, church fathers, popes, bishops	The Bible and the Confession of Faith	The Bible only	The Scriptures and the Gospels, church fathers	The Bible only	**Doctrine Basis**
Worship	Traditional style through liturgy; contemporary liturgy is possible	Traditional style through liturgy	Non-liturgical (free) worship; sometimes contemporary	Traditional style through liturgy; contemporary liturgy is possible	Traditional style through liturgy; contemporary worship is possible	**Worship**

	Catholic	Presbyterian	Baptist	Anglican	Lutheran	
The Trinity	The Father is God, the Son is God, and the Holy Spirit is God, and yet there are not three Gods but one God.' In this Trinity of Persons the Son is begotten of the Father by an eternal generation, and the Holy The Persons are co-eternal and co-equal: all alike are uncreated and omnipotent.	God is one in essence or nature. The same immense, one and indivisible God is in person inseparably distinguished as Father, Son and Holy Spirit.	The Lord our God is the one and only living and true God; Whose subsistence is in and of Himself...In this divine and infinite Being there are three subsistences, the Father, the Word or Son, and the Holy Spirit. All are one in substance, power, and eternity; each having the whole divine essence, yet this essence being undivided.	There is only one living and true God, everlasting, without body, parts, or suffering; of infinite power, wisdom, and goodness; the Maker, and Preserver of all things both visible and invisible. And in unity of this Godhead there are three Persons, of one substance, power, and eternity; the Father, the Son, and the Holy Spirit.	We worship one God in Trinity, and Trinity in Unity; Neither confounding the Persons, nor dividing the Substance. For there is one Person of the Father, another of the Son, and another of the Holy Ghost. But the Godhead of the Father, of the Son, and of the Holy Ghost is all one: the glory equal, the majesty coeternal.	**The Trinity**
Governance	Papal/Episcopal (Clergy in local churches presided over by bishop; the pope (the Bishop of Rome) is the ultimate Church leader.)	Presbyterian (A graded organizational system by presbyters or elders.)	Congregational (Local churches are self-governing.)	Episcopal (Clergy in local churches presided over by bishop.)	Mixed (Congregational, Presbyterian, and Episcopal structures exist.)	**Governance**
Mary	From conception, Mary was without original sin, she is the Immaculate Conception. Mary is the "Mother of God." Mary was a virgin when she conceived Jesus and when she gave birth. She remained a virgin throughout her life. She delivers souls from death and continues to bring us the gifts of eternal salvation.	Jesus was conceived and born of the Virgin Mary by the power of the Holy Spirit. Mary is honoured as "God-bearer" and a model for Christians.	Mary was a virgin both when she conceived Jesus and when she gave birth. (Luke 1:34–38). Though "highly favoured" by God (Luke 1:28), Mary was still human and therefore sinned.	Anglicans believe Jesus was conceived and born of the Virgin Mary by the power of the Holy Spirit. Mary was a virgin both when she conceived Jesus and when she gave birth. "They...have difficulties with Catholic belief in her immaculate conception, that Mary was free from the stain of original sin from the moment of her own conception.	Jesus was conceived and born of the Virgin Mary by the power of the Holy Spirit. Mary was a virgin both when she conceived Jesus and when she gave birth.	**Mary**
Purgatory	All who die in God's grace and friendship, but still imperfectly purified. after death they undergo purification, so as to achieve the holiness necessary to enter the joy of heaven.	Rejected	Rejected	The Romish Doctrine concerning Purgatory... is a fond thing vainly invented, and grounded upon no warranty of Scripture, but rather repugnant to the Word of God.	Rejected	**Purgatory**
	Catholic	**Presbyterian**	**Baptist**	**Anglican**	**Lutheran**	

3 The Commandments

1 You shall have no other Gods before me	The Creator of the universe declares He is our God and our deliverer and asks us to demonstrate our love for Him by having no other Gods. The First Commandment is the first of a series of four that define our relationship with our Heavenly Father. Establishing, developing and maintaining that personal relationship with the true and living God is the most important commitment we can ever make. That is the primary focus of the first of the Ten Commandments. We should love, honour and respect Him so much that He alone is the supreme authority and model in our lives. He alone is God. We should allow nothing to prevent us from serving and obeying Him.
2 You shall not make idols	The Second Commandment deals with several crucial questions. How do we perceive God? How do we explain Him to ourselves and to others? Above all, what is the proper way to worship the only true God? The Second Commandment is a constant reminder that only we, of all created things, are made in the image of God. Only we can be transformed into the spiritual image of Christ, who of course came in the flesh as the perfect spiritual image of our heavenly Father. This Commandment protects our special relationship with our Creator, who made us in His likeness and is still moulding us into His spiritual image.
3 You shall not take the name of the LORD your God in vain	The Third Commandment focuses on showing respect to God and His law as we are His ambassadors in the world. It addresses the way we communicate Him to those around us. Ambassadors are diplomats which are meant to uphold the ideals and values of the one they advocate accurately and sincerely. Therefore if we act or behave in ways which disrespect them, the reputation of the one they are emulating will be damaged. All Christians are ambassadors to Him, therefore we should always uphold His values and show others the way He calls us to live. It also depends on the way we express respect for Him in the presence of others. We are expected always to honour and love Him.
4 Remember the Sabbath day, to keep it holy	God starts off the fourth Commandment with the word "Remember". This is because He knew we would forget it. God asks that we keep it set apart for Holy purposes so we can draw nearer to Him. The Fourth Commandment to remember the Sabbath concludes the section of the Ten Commandments that specifically helps define a proper relationship with God, how we are to love, worship and relate to Him. It explains why and when we need to take special time to draw closer to our Creator. It is also a special sign between us and God forever, that it is Him that sanctifies us Him alone we belong to and worship. The Sabbath, the seventh day of the week was set apart by God as a time of rest and spiritual rejuvenation.
5 Honour your father and your mother	The fifth through to the 10th serve as the standards of conduct in areas of human behaviour that generate the most far reaching consequences on individuals, families, groups and society. Families are the building blocks of societies that build strong nations. When families are fractured and flawed, the sad results are tragic and reflected in newspaper headlines daily. The Fifth Commandment shows us from whom and how the fundamentals of respect and honour are most effectively learned. It guides us to know how to yield to others, how to properly submit to authority and how to accept the influence of mentors.

6 You shall not murder	God asks us to demonstrate love and not hate towards others by not murdering. We must learn to control our tempers. Taking another person's life is not our right to decide. That judgment is reserved for God alone. This includes unborn babies and those that wish to die. That is the thrust of this Commandment. God does not allow us to choose to wilfully or deliberately take another person's life. The Sixth Commandment reminds us that God is the giver of life and He alone has the authority to take it or to grant permission to take it. God wants us to go far beyond avoiding murder. He requires that we not maliciously harm another human being in word or deed. God desires that we treat even those who choose to hate us respectfully and do all within our power to live in peace and harmony with them.
7 You shall not commit adultery	God asks us to express and demonstrate our love for our partner by not committing adultery. Adultery is the violation of the marriage covenant by wilful participation in sexual activity with someone other than one's spouse. Since God's law sanctions sexual relationships only within a legitimate marriage, the command not to commit adultery covers in principle, all varieties of sexual immorality. No sexual relationship of any sort should occur outside of marriage. That is the basis of this Commandment. Most of us need the support and companionship of a loving spouse. We need someone special who can share our ups and downs, triumphs and failures. No one can fill this role like a mate who shares with us a deep love and commitment.
8 You shall not steal	God instructs us to show our love and respect for others by not stealing what belongs to them. The Eighth Commandment safeguards everyone's right to legitimately acquire and own property. God wants that right honoured and protected. His approach to material wealth is balanced. He wants us to prosper and enjoy physical blessings. He also expects us to show wisdom in how we use what He provides us and He does not want possessions to be our primary pursuit in life. To Him it is important that generosity rather than greed motivate the choices we make. Because they are qualities of His own character, He asks that we, from the heart, put giving and serving ahead of lavishing possessions on ourselves.
9 You shall not bear false witness against your neighbour	God says if we love others we should not deceive or lie to them. How important is truth? To fully appreciate the Ninth Commandment with its prohibition of lying, we must realize how important truth is to God. Jesus Christ said of God the Father, “Your word is truth” John 17:17. As the source of truth, God requires that His servants always speak truthfully. Under God's inspiration, King David wrote, “…LORD, who may dwell in your sanctuary? Who may live on your holy hill? He whose walk is blameless and who does what is righteous, who speaks the truth from his heart and has no slander on his tongue, who does his neighbour no wrong and casts no slur on his fellow-man, who despises a vile man but honours those who fear the LORD, who keeps his oath even when it hurts” Psalms 15:1-3, NIV.
10 You shall not covet	God instructs us not to covet because He knows it can entrap us into even greater sin. To covet means to crave or desire, especially in excessive or improper ways. The Tenth Commandment does not tell us that all of our desires are immoral. It tells us that some desires are wrong. Coveting is an immoral longing for something that is not rightfully ours. That is usually because the object of our desire already belongs to someone else. But coveting can also include our wanting far more than we would legitimately deserve or that would be our rightful share. Our desire should be to contribute to the well being of others, to make our presence in their lives a blessing to them. In prohibiting coveting, it defines not so much what we must do but how we should think. It asks us to look deep within ourselves to see what we are on the inside.

4 Evidence for God

This section is the evidence for God in the world around us and through the Bible. This is perhaps the most important section if you're an unbeliever. Science doesn't oppose Christianity as many believe, but instead science validates the Bible's integrity.

"The only barrier to truth is the presumption that you already have it."
Chuck Missler

The Universe

The Universe (By Marilyn Adamson)
Scientists are convinced that our universe began with one enormous explosion of energy and light, which we now call the Big Bang. This was the singular start to everything that exists: the beginning of the universe, the start of space, and even the initial start of time itself. Astrophysicist Robert Jastrow, a self-described agnostic, stated, "The seed of everything that has happened in the Universe was planted in that first instant; every star, every planet and every living creature in the Universe came into being as a result of events that were set in motion in the moment of the cosmic explosion...The Universe flashed into being, and we cannot find out what caused that to happen." The universe has not always existed. It had a start...what caused that? Scientists have no explanation for the sudden explosion of light and matter.

In a book entitled "Science Speaks" by Peter Stoner, he proceeds to present scientific evidence in behalf of special creation. For example, he points out that science had previously taught that special creation was impossible because matter could not be destroyed or created. He then points out that atomic physics had now proved that energy can be turned into matter and matter into energy. He then considers the order of creation as presented in Genesis 1:1-13. He presents argument after argument from a scientific viewpoint to sustain the order which Genesis chronicles.

He then asks, “What chance did Moses have when writing the first chapter (of Genesis) of getting thirteen items all accurate and in satisfactory order?” His calculations conclude it would be one chance in 31,135,104,000,000,000,000,000 (1 in 31 x 1021). He concludes, “Perhaps God wrote such an account in Genesis so that in these latter days, when science has greatly developed, we would be able to verify His account and know for a certainty that God created this planet and the life on it.”

The Universe (By Chuck Missler)

The Nature of Light
Not only have recent scientific articles highlighted the discoveries that the speed of light has changed over the centuries (something that Barry Setterfield has been declaring for decades) the very nature of light has ripped open the entire world of quantum physics that has shattered our concepts of reality itself.

The changes in the velocity of light not only impacts our understanding of the astronomical distances and properties, it affects the atomic behaviour involved in the red shift of spectra, the reliability of radiological dating, etc. It is the peculiar properties of photons themselves that continue to astonish the quantum physicists wrestling with the very nature of our physical existence. It is now recognized that subatomic particles lack a property known as "locality." All subatomic particles are now understood to be immediately connected. There is a simultaneity - a "non-locality" - among all photons that has been confirmed in the laboratory. It now appears that our entire universe may actually be a gigantic hologram of some kind.

The Fabric of Space
Most of us assume that space is simply an empty vacuum with nothing "in it." However, it is increasingly evident that even empty space has astonishing properties that have yet to be fully understood. We now know that this "firmament," (raqia) which the Scripture presents, possesses electromagnetic properties including dielectric permittivity, magnetic permeability, an intrinsic impedance, and has an astonishing "zero-point" energy sufficient to keep all the electrons in the entire universe in their orbits. The term "stretching the heavens" appears at least 17 times in the Scriptures.

According to the Scriptures, the heavens can be "torn," "worn out" like a garment, "shaken," "burnt up," "split apart" like a scroll, rolled up" like a mantle or a scroll. The concept of being "rolled up" carries some additional insights. There must be some dimension in which space is "thin." If space can be "bent," there must be a direction it can be bent toward. Thus, this tells us that there must be additional dimensions beyond those of space itself.

It is now understood that we live in even more than four dimensions: ten dimensions is the current estimate (which is precisely what Nachmonides concluded in his commentary on Genesis back in the 13th century!) The more we understand from the current perspectives of modern physics, the more comfortable we are with the chronicle in Genesis One.

The Architecture of the Solar System
The more we study our solar system, the more questions get raised. Here, too, the prevailing assumptions that are broadly taught are totally specious. The "Nebular Hypothesis," that the planets were somehow thrown off by the sun, is mathematically untenable. There is no plausible explanation that would support a solar origin of the planets.

The sun contains 99.86% of all the mass of the solar system, and yet contains only 1.9% of the angular momentum. The nine planets contain 98.1%. Furthermore, the outer planets are far larger than the inner ones. (Jupiter is 5,750 times as massive as mercury, 2,958 times as massive as Mars, etc.)

There are many other provocative enigmas concerning our planetary history:
● There are three pairs of rapid-spin rates among our planets: Mars and Earth, Jupiter and Saturn, and Neptune and Uranus, are each within 3% of each other. Why?
● Earth and Mars have virtually identical spin axis tilts (about 23.5). Why? (From angular momentum and orbital calculations, it would seem that the three pairs of these planets may have been brought here from elsewhere.)
● Why does Mars have 93% of its craters in one hemisphere and only 7% in the other? It would appear that over 80% occurred within a single half-hour!

It's almost as if God designed it to challenge any naturalistic hypotheses!

The Bible

This section is split into many subsections because the Bible IS the primary way that God proves Himself to us. To prove the content in the Bible is from God first we have to authenticate that the Bible is the same today as when it was written as discussed below by Chuck Missler.

If you want to watch a 15 minute video instead of reading the sections below, I recommend "Why Should I Trust the Bible?" by Impact Video Ministries on YouTube. You can find it here: **www.youtube.com/watch?v=XtNcbu5oHQU** and here: **www.fluidicice.com/salvation** as a backup if YouTube has taken it down.

"And you shall know the truth, and the truth shall set you free"
John 8:32

The Christian Scriptures are historically outstanding, deserving serious consideration. One could even say that the history of the Bible is so compelling that to doubt the Bible is to doubt history itself since the Bible is the most historically verifiable book of all antiquity. The only book more historically verifiable than the Old Testament (the Hebrew Bible) is the New Testament. Consider the following:

● More manuscripts exist for the New Testament than for any other of antiquity—it has 5,000 ancient Greek manuscripts, 24,000 in all including other languages. The multiplicity of manuscripts allows for a tremendous research base by which we can test the texts against each other and identify what the originals said.

● The manuscripts of the New Testament are closer in age to the originals than are any other document of antiquity. All of the originals were written within the time of the contemporaries (eyewitnesses), in the first century A.D., and we currently have parts of manuscript dating back to A.D. 125. Whole book copies surface by A.D. 200, and the complete New Testament can be found dating back to A.D. 250. Having all the books of the New Testament initially written within the times of eyewitnesses means that the books did not have time to devolve into myth and folklore. Plus, their truth claims were held accountable by members of the Church who, as personal witnesses to the events, could check the facts.

● The New Testament documents are more accurate than any other of antiquity. John R. Robinson in Honest to God reports that the New Testament documents are 99.9 percent accurate (most accurate of any complete antique book). Bruce Metzger, an expert in the Greek New Testament, suggests a more modest 99.5 percent.

How We Got Our Bible (By Chuck Missler) - www.khouse.org/articles/2016/1260/
The Bible is the single most important book of all time, selling an estimated 5 billion copies. It has been translated into 349 languages, and 2,123 languages have at least one book of the Bible. At the same time, the Bible is scrutinized and attacked more than any other book in the world. It has been outlawed, confiscated and burned at different times and places in history. It has been smuggled into jail cells and across borders.

John Huss was burned at the stake for teaching from the Bible as the final authority for the Church over any earthly church rulers. William Tyndale was strangled and burned for translating the Bible into English. Every week, millions of Christians gather to discuss its words, even as “higher” critics attempt to explain it through the lens of metaphysical naturalism. What we believe about the Bible can be the most important, central issue in our lives, threading its way into the very fabric of who we are and how we live each day.

Where did the Bible come from? Why do we believe its origin is supernatural? Who defined the canon of Scripture? Most importantly, is the Bible the Word of God? You and I are gambling our eternity on the answer to that last question. Why do we believe God is the author of the Bible, and can each one of us defend that belief? Dark times are on the horizon, and it is increasingly important that we learn to live by faith. Where we place our faith fully depends on how we view the Scriptures.

Two World Views
Ultimately, there are two basic world views we can hold. One view regards everything we experience as the result of some cosmic accident. “In the Beginning there was nothing, and then it exploded.” The other view is that everything we experience is the deliberate result of a Creator. Of course, there are numerous variations on each of these views, but each of us must decide where we will place our trust. Each of these world views holds possible solutions to the biggest puzzles of life:

Who am I?, Where did I come from?, Where am I going?, To whom am I accountable?, It is ultimately important that we find the true answers to these questions.

"Now the serpent was more cunning than any beast of the field which the Lord God had made. And he said to the woman, “Has God indeed said, ‘You shall not eat of every tree of the garden’?”"
Genesis 3:1

You and I live in a time of rebellion and self-worship. Parental and marital authority are challenged in the homes and courts. Political, academic and ecclesiastical authority are challenged across the land.

Here, near the very beginning, we are introduced to Satan, the serpent, our adversary, and the first thing we see him do is question God’s Word. “Yea, hath God said?”

His next step is to slander God’s character with straight denial. “Ye shall not surely die,” (Gen 3:4). Thus, Satan encouraged the rejection of God’s authority at the very beginning, while humanity was yet in its infancy. Eve failed to trust God, Adam followed her in directly disobeying what God had told him, and humankind lost everything as a result.

We find the same pattern today. A number of social indicators deteriorate rapidly after 1963 in the United States. There were fewer than 10 births per 1000 unmarried teen women (ages 15–19) prior to 1947, and between 1955 and 1964, the number remained steadily between 15 and 16. After 1964, however, the numbers of teenagers giving birth out of wedlock climbed steadily during the next 30 years to more than 46 births per 1000 teen women in 1994.

Divorce rates escalated, families broke up, crime rates rose, and the acceptance of homosexuality became commonplace. As of 2015, more than 58 million unborn children have been murdered in the United States because they were considered inconvenient. Fifty-eight million. That is nearly ten times the number of Jewish victims in the Holocaust.

It’s noteworthy that in 1963, as a result of the combined court cases Abington School District v. Schempp and Murray v. Curlett, the U.S. Supreme Court banned school-led reading of the Bible and recital of the Lord’s Prayer. These court cases alleged to uphold the principles of freedom and human dignity, yet the end result of turning our backs on God has been destruction and misery. As we choose our own way over God’s way, we’re losing everything.

There is little dignity in divorce or high crime rates. It is ironic that the elements we most desire in life are rarely attained through our own weak wisdom and fleshly desires. After trying our own methods, over and over again we have had to learn that we experience human dignity and true freedom only through moral obedience and accountability to the Creator who fashioned human beings for a high spiritual destiny.

Facing the Skeptics
Skeptics have brutally attacked the Bible throughout history, and during the past century it has become popular among intellectuals to regard the Bible as merely a conglomeration of Jewish writings. It’s considered respectable to dispute the authorship of the books of the Bible and to disregard fulfilled prophecy as events reported after-the-fact.

In 1898, Hermann Schultz, professor of Theology at the University of Gottingen, declared:
"Of the legendary character of the pre-Mosaic narrators, the time of which they treat is a sufficient proof. It was a time prior to all knowledge of writing, a time separated by an interval of more than four hundred years, of which there is absolutely no history."

Yet, the patriarchal accounts in the Bible have been corroborated by archeological evidence. The information we have of Abraham, Isaac and Jacob matches the culture we know of that time in history. Job, the contemporary of Abraham, had the ability to write. Sumerian cuneiform writing certainly predates Moses by much more than 400 years; Ira Spar at the Metropolitan Museum of Art notes that, “By the middle of the third millennium B.C., cuneiform primarily written on clay tablets was used for a vast array of economic, religious, political, literary, and scholarly documents.” The old criticism that no written language existed in Moses’ day has been proven to be false.

The theories that the Gospels and the Epistles were written in the second century, over a hundred years after the fact, have been shredded and refuted by archeological discoveries, documentary discoveries and competent analysis. The common skeptical assertions thrown about in “academic” circles can be shown to be short-sighted.

As we read the Bible, we find there are a number of highly significant verses found at the address “3:16.”
John 3:16 *"For God so loved the world that He gave His only begotten Son, that whoever believes in Him should not perish but have everlasting life."*
1 John 3:16 *"By this we know love, because He laid down His life for us. And we also ought to lay down our lives for the brethren."*
1 Corinthians 3:16 *"Do you not know that you are the temple of God and that the Spirit of God dwells in you?"*
2 Timothy 3:16 *"All Scripture is given by inspiration of God, and is profitable for doctrine, for reproof, for correction, for instruction in righteousness"*

2 Timothy 3:16 is one of these significant “3:16” verses — a little fact that makes it easy to remember its address. This particular verse gives us a foundational message, and we should read it carefully and take it to heart:

“All scripture is given by inspiration of God…” Note this verse says, “All Scripture” — not just certain passages that we might select because we like them best. If we accept only those parts of the Bible that suit us and reject the others, then we are believing in ourselves and our own (unreliable) judgment rather than in the Scripture.

The word “inspiration” in the Greek, θεόπνευστος — theopneustos — means “God-breathed.” That is, the Scriptures were not just influenced by good ideas about God; they were actually infused into human beings by the Spirit of God, who breathed into the hearts and minds of the Bible’s authors.

All Scripture “is profitable for doctrine, for reproof, for correction.” Doctrine is about teaching correct understanding while reproof is involved in addressing wrong conduct and correction deals with wrong understanding. As we study the epistles of Paul, for example, we discover that while Romans is a doctrinal statement of Soteriology (the study of salvation), 1 Corinthians was sent to reprove wrong conduct and Galatians to correct wrong doctrine.

Again, Ephesians presents the doctrine of Ecclesiology (the study of this mystical thing we call the “Church”), while Philippians then presents the reproof and Colossians presents the correction for the Church. 1 and 2 Thessalonians present the doctrine of Eschatology (the study of the last things), and 1 and 2 Peter and Revelation continue that theme.

The more we study the Bible, the more we discover that it’s very well organized specifically for its purposes.

This article was from Dr. Chuck Missler’s book How We Got Our Bible, available in print and eBook. Also available in Kindle format from Amazon. May God bless each one of us as we absorb this material and press onward to live it out every day.

The original Bible was written on manuscripts, these manuscripts were later compiled into the Bible as we know it today and the more manuscripts that validate the authenticity of the Bible - the better. Caesar's life was recorded on a total of 10 manuscripts.

What we know about Plato came from 7 manuscripts and everything about Tacitus was recorded on 20 manuscripts. The number of new testament manuscripts is a whopping 24,633 manuscripts and counting. The next highest number of manuscripts is The Iliad coming in at about 643 manuscripts.

Complexity

Complexity (By Marilyn Adamson)
The complexity of our planet points to a deliberate Designer who not only created our universe, but sustains it today. The Earth...its size is perfect. The Earth's size and corresponding gravity holds a thin layer of mostly nitrogen and oxygen gases, only extending about 50 miles above the Earth's surface.

If Earth were smaller, an atmosphere would be impossible, like the planet Mercury. If Earth were larger, its atmosphere would contain free hydrogen, like Jupiter. Earth is the only known planet equipped with an atmosphere of the right mixture of gases to sustain plant, animal and human life. The Earth is located the right distance from the sun.

Consider the temperature swings we encounter, roughly -30°C (86°F) to +120°C (248°F). If the Earth were any further away from the sun, we would all freeze. Any closer and we would burn up. Even a fractional variance in the Earth's position to the sun would make life on Earth impossible.

The Earth remains this perfect distance from the sun while it rotates around the sun at a speed of nearly 67,000 mph. It is also rotating on its axis, allowing the entire surface of the Earth to be properly warmed and cooled every day. And our moon is the perfect size and distance from the Earth for its gravitational pull. The moon creates important ocean tides and movement so ocean waters do not stagnate, and yet our massive oceans are restrained from spilling over across the continents.

Water...colourless, odourless and without taste, and yet no living thing can survive without it. Plants, animals and human beings consist mostly of water (about two-thirds of the human body is water). You'll see why the characteristics of water are uniquely suited to life:

It has wide margin between its boiling point and freezing point. Water allows us to live in an environment of fluctuating temperature changes, while keeping our bodies a steady 37°C (98.6°F). Water is a universal solvent. This property of water means that various chemicals, minerals and nutrients can be carried throughout our bodies and into the smallest blood vessels.

Water is also chemically neutral. Without affecting the makeup of the substances it carries, water enables food, medicines and minerals to be absorbed and used by the body. Water has a unique surface tension. Water in plants can therefore flow upward against gravity, bringing life-giving water and nutrients to the top of even the tallest trees.

Water freezes from the top down and floats, so fish can live in the winter. Ninety-seven percent of the Earth's water is in the oceans. But on our Earth, there is a system designed which removes salt from the water and then distributes that water throughout the globe.

Evaporation takes the ocean waters, leaving the salt, and forms clouds which are easily moved by the wind to disperse water over the land, for vegetation, animals and people. It is a system of purification and supply that sustains life on this planet, a system of recycled and reused water.

The human brain...simultaneously processes an amazing amount of information. Your brain takes in all the colours and objects you see, the temperature around you, the pressure of your feet against the floor, the sounds around you, the dryness of your mouth, even the texture of your keyboard.

Your brain holds and processes all your emotions, thoughts and memories. At the same time your brain keeps track of the ongoing functions of your body like your breathing pattern, eyelid movement, hunger and movement of the muscles in your hands. The human brain processes more than a million messages a second. Your brain weighs the importance of all this data, filtering out the relatively unimportant.

This screening function is what allows you to focus and operate effectively in your world. The brain functions differently than other organs. There is an intelligence to it, the ability to reason, to produce feelings, to dream and plan, to take action, and relate to other people. The eye...can distinguish among seven million colours.

It has automatic focusing and handles an astounding 1.5 million messages -- simultaneously. Evolution focuses on mutations and changes from and within existing organisms. Yet evolution alone does not fully explain the initial source of the eye or the brain -- the start of living organisms from nonliving matter.

God Pursues Us

God Pursues Us (By Marilyn Adamson)
"I was an atheist at one time. And like many atheists, the issue of people believing in God bothered me greatly. What is it about atheists that we would spend so much time, attention, and energy refuting something that we don't believe even exists?! What causes us to do that? When I was an atheist, I attributed my intentions as caring for those poor, delusional people...to help them realize their hope was completely ill-founded.

To be honest, I also had another motive. As I challenged those who believed in God, I was deeply curious to see if they could convince me otherwise. Part of my quest was to become free from the question of God. If I could conclusively prove to believers that they were wrong, then the issue is off the table, and I would be free to go about my life. I didn't realize that the reason the topic of God weighed so heavily on my mind, was because God was pressing the issue."

"I have come to find out that God wants to be known. He created us with the intention that we would know him. He has surrounded us with evidence of himself and he keeps the question of his existence squarely before us. It was as if I couldn't escape thinking about the possibility of God.

In fact, the day I chose to acknowledge God's existence, my prayer began with, "Ok, you win..." It might be that the underlying reason atheists are bothered by people believing in God is because God is actively pursuing them. I am not the only one who has experienced this. Malcolm Muggeridge, socialist and philosophical author, wrote, "I had a notion that somehow, besides questing, I was being pursued."

C.S. Lewis said he remembered, "...night after night, feeling whenever my mind lifted even for a second from my work, the steady, unrelenting approach of Him whom I so earnestly desired not to meet. I gave in, and admitted that God was God, and knelt and prayed: perhaps, that night, the most dejected and reluctant convert in all of England."

Lewis went on to write a book titled, "Surprised by Joy" as a result of knowing God. I too had no expectations other than rightfully admitting God's existence. Yet over the following several months, I became amazed by his love for me.""

Jesus Christ

Jesus Christ (By Marilyn Adamson)
Why Jesus? Look throughout the major world religions and you'll find that Buddha, Muhammad, Confucius and Moses all identified themselves as teachers or prophets. None of them ever claimed to be equal to God. Surprisingly, Jesus did. That is what sets Jesus apart from all the others.

He said God exists and you're looking at him. Though he talked about his Father in heaven, it was not from the position of separation, but of very close union, unique to all humankind. Jesus said that anyone who had seen Him had seen the Father, anyone who believed in him, believed in the Father. He said, "I am the light of the world, he who follows me will not walk in darkness, but will have the light of life."

He claimed attributes belonging only to God: to be able to forgive people of their sin, free them from habits of sin, give people a more abundant life and give them eternal life in heaven. Unlike other teachers who focused people on their words, Jesus pointed people to himself. He did not say, "follow my words and you will find truth." He said, "I am the way, the truth, and the life, no one comes to the Father but through me."

What proof did Jesus give for claiming to be divine? He did what people can't do. Jesus performed miracles. He healed people...blind, crippled, deaf, even raised a couple of people from the dead. He had power over objects...created food out of thin air, enough to feed crowds of several thousand people.

He performed miracles over nature...walked on top of a lake, commanding a raging storm to stop for some friends. People everywhere followed Jesus, because he constantly met their needs, doing the miraculous. He said if you do not want to believe what I'm telling you, you should at least believe in me based on the miracles you're seeing.

Jesus Christ showed God to be gentle, loving, aware of our self-centeredness and shortcomings, yet deeply wanting a relationship with us. Jesus revealed that although he views us as sinners, worthy of his punishment, his love for us ruled and he came up with a different plan. God himself took on the form of man and accepted the punishment for our sin on our behalf. Sounds ludicrous?

Perhaps, but many loving fathers would gladly trade places with their child in a cancer ward if they could. The Bible says that the reason we would love God is because he first loved us. Jesus died in our place so we could be forgiven. Of all the religions known to humanity, only through Jesus will you see God reaching toward humanity, providing a way for us to have a relationship with him. Jesus proves a divine heart of love, meeting our needs, drawing us to himself.

Because of Jesus' death and resurrection, he offers us a new life today. We can be forgiven, fully accepted by God and genuinely loved by God. He says, "I have loved you with an everlasting love, therefore I have continued my faithfulness to you."17 This is God, in action. Does God exist?

If you want to know, investigate Jesus Christ. We're told that "God so loved the world that he gave his only Son, that whoever believes in him should not perish but have eternal life." God does not force us to believe in him, though he could. Instead, he has provided sufficient proof of his existence for us to willingly respond to him.

The earth's perfect distance from the sun, the unique chemical properties of water, the human brain, DNA, the number of people who attest to knowing God, the gnawing in our hearts and minds to determine if God is there, the willingness for God to be known through Jesus Christ. If you need to know more about Jesus and reasons to believe in him, please see: Beyond Blind Faith.

Israel Restored to the Land

Isaiah 11:11-12
11 *It shall come to pass in that day that the Lord shall set His hand again the second time*
To recover the remnant of His people who are left,
From Assyria and Egypt, From Pathros and Cush, From Elam and Shinar, From Hamath and the islands of the sea.
12 *He will set up a banner for the nations, And will assemble the outcasts of Israel,*
And gather together the dispersed of Judah from the four corners of the earth.

Isaiah 43:5-6
5 *Fear not, for I am with you; I will bring your descendants from the east, And gather you from the west;*
6 *I will say to the north, 'Give them up!' And to the south, 'Do not keep them back!'*
Bring My sons from afar, And My daughters from the ends of the earth—

Isaiah 43:6 when it speaks of the north it means Russia and the phrase "Give Up" was a declaration from God because they would not let them go until their country started to crumble. The same applies to the south referring to Ethiopia who refused to let the Jews return to their country which started to crumble in 1991 after saying no. "Operation Solomon" was the name of the campaign to return the Jews.

The most astonishing fulfilled prophecy within the last 100 years is the return of Israel as a state. Around 722 B.C., the Assyrians invaded and destroyed the northern kingdom of Israel. In 134 A.D, the Roman Empire also invaded forcing the Israelites to flee. However recently on the 14th of May 1948 it was resurrected again as a country. Anyone can look at a map today (If you aren't in an Islamic country) and see Israel. No country in the history of the world has ever come back again from nothingness, particularly after nearly 2,000 years. Not to mention how thinly they have been spread and the fact that multiple leaders have tried to wipe the Jews out from existence multiple times.

Jeremiah 31:8
8 *Behold, I will bring them from the north country, And gather them from the ends of the earth,*
Among them the blind and the lame, The woman with child
And the one who labors with child, together; A great throng shall return there.

One of the flights from Ethiopia to Israel even landed with more passengers than it took off with, showing the intricate detail in the Bible regarding Jeremiah and the fact that there were pregnant mothers on the flight.

Isaiah 35:1-2
1 *The wilderness and the wasteland shall be glad for them, And the desert shall rejoice and blossom as the rose;*
2 *It shall blossom abundantly and rejoice, Even with joy and singing.*
The glory of Lebanon shall be given to it, The excellence of Carmel and Sharon.
They shall see the glory of the Lord, The excellency of our God.

Prior to Israel entering and nurturing the land on 14 May 1948, it was a barren desert and wasteland in which little could have survived.

Alfon Lamartine From - Recollections from the East	*"Outside the walls of Jerusalem we saw no living being, heard no living voice. We encountered that desolation and that deadly silence which we would have expected to find at the ruined gates of Pompey. A total eternal dread spell envelopes the city, the highways and the villages." "A solitude to make one dreary, unpeopled deserts, rusty mounds of barrenness."*

Mark Twain From - The Innocents Abroad	*"A blistering, naked treeless land. The further we went the hotter the sun got and the more rocky, bare, repulsive and dreary the landscape had become." He spoke of the villages as "Ugly cramped, squalid, uncomfortable and fifthy." "There was hardly a tree or shrub anywhere. Even the olive and the cactus, those were fast friends of a worthless soil, had almost deserted the country." "It truly is monotonous and uninviting. It is a hopeless, dreary, heart-broken land."*

Joel 2:21-24
21 *Fear not, O land; Be glad and rejoice, For the Lord has done marvellous things!*
22 *Do not be afraid, you beasts of the field; For the open pastures are springing up,*
And the tree bears its fruit; The fig tree and the vine yield their strength.
23 *Be glad then, you children of Zion, And rejoice in the Lord your God;*
For He has given you the former rain faithfully, And He will cause the rain to come down for you—
The former rain, And the latter rain in the first month.
24 *The threshing floors shall be full of wheat, And the vats shall overflow with new wine and oil.*

Ezekiel 36:33-36
33 *'Thus says the Lord God: "On the day that I cleanse you from all your iniquities, I will also enable you to dwell in the cities, and the ruins shall be rebuilt.*
34 *The desolate land shall be tilled instead of lying desolate in the sight of all who pass by.*
35 *So they will say, 'This land that was desolate has become like the garden of Eden; and the wasted, desolate, and ruined cities are now fortified and inhabited.'*
36 *Then the nations which are left all around you shall know that I, the Lord, have rebuilt the ruined places and planted what was desolate. I, the Lord, have spoken it, and I will do it."*

Today, not only has the land been restored but the nation of Israel is a mini super power. Israel is leading the world in water technology, military technology, digital security, agriculture and many more.[n]

Agriculture: 19/113
Economy: 5/95
Happiness: 11/156
Military: Rank 15/133
Space: 5/50

Future Prophecies

The Bible still contains hundreds of future prophecies which still need to be fulfilled, most of them are found in revelation and are based on the seals, trumpets and bowls. Below are a few prophecies which will soon come to pass, keep an eye out as this is the ultimate proof that there is a God, that He is outside of space and time and that He loves you.

For a complete list of these prophecies and a guide on surviving earth after the rapture, see the "MASS DESTRUCTION > The Rapture" section found in "The Preparedness Encyclopedia" by Fluidic Ice. If this section has been separated from its parent document you can head to **www.fluidicice.com/TPE** to download the complete guide for free.

The Destruction of Damascus (Isaiah 17)	Damascus will be destroyed and never inhabited again. This prophecy seems to imply that nuclear weapons were either hit and destroyed in Damascus or one was launched against the city from another location.
The Russian Invasion of Israel (Ezekiel 38)	Russia, Iran, Turkey, Libya and Syria will launch a massive combined attack against Israel but will fail due to God's intervention and destruction of the armies.
The Rapture (1 Corinthians 15:52)	Jesus calls the believing Christians home, before His wrath is poured out on the earth and Israel.
One World Government (Revelation 13:1-2 & Daniel 7:16-24)	In his apocalyptic vision in the Book of Revelation, the Apostle John sees the "beast," also called the Antichrist, rising out of the sea having seven heads and ten horns (Revelation 13:1). Combining this vision with Daniel's similar one (Daniel 7:16-24), we can conclude that some sort of world system will be inaugurated by the beast, the most powerful "horn," who will defeat the other nine and will begin to wage war against Christians. The ten-nation confederacy is also seen in Daniel's image of the statue in Daniel 2:41-42, where he pictures the final world government consisting of ten entities represented by the ten toes of the statue. Whoever the ten are and however they come to power, Scripture is clear that the beast will either destroy them or reduce their power to nothing more than figureheads. In the end, they will do his bidding. John goes on to describe the ruler of this vast empire as having power and great authority, given to him by Satan himself (Revelation 13:2), being followed by and receiving worship from "all the world" (13:3-4), and having authority over "every tribe, people, language and nation" (13:7). From this description, it is logical to assume that this person is the leader of a one-world government which is recognized as sovereign over all other governments.
One World Religion (Revelation 17:1–18)	The one-world religion described in Revelation 17:1–18 as "the great harlot" will be part of the end-times scenario. The term harlot is used throughout the Old Testament as a metaphor for false religion. The actual identity and makeup of the religion has been debated for centuries and has resulted in a number of different views among Bible commentators and theologians. There are convincing arguments for the one world religion being Catholicism.
The Worldwide 'Mark' (Revelation 13:16-17)	The antichrist will push that everyone on the planet receives his mark on either their right hand or their forehead. "**16** He causes all, both small and great, rich and poor, free and slave, to receive a mark on their right hand or on their foreheads, **17** and that no one may buy or sell except one who has the mark or the name of the beast, or the number of his name."

5 Accepting Jesus

What is Salvation?	Salvation is the deliverance from sin. To save means to deliver or protect. Jesus equated being saved with entering the kingdom of God (Matthew 19:24-25). What are we saved from? We are saved from God's wrath, that is, His judgment of our sin when we meet Him face to face (Romans 5:9; 1 Thessalonians 5:9). Our sin has separated us from God, and the consequence of this violation of God's law is death (Romans 6:23). Biblical salvation refers to our deliverance from the consequences of sin and therefore involves the removal of sin which is already paid for by Jesus on the cross.	www.fluidicice.com/salvation

Who does the saving? Only God can remove sin and deliver us from sin's penalty (2 Timothy 1:9; Titus 3:5). How does God save? God has rescued us through Jesus's death on the cross and subsequent resurrection which achieved our salvation (Romans 5:10; Ephesians 1:7). Scripture is clear that salvation is the gracious, undeserved gift of God (Ephesians 2:5, 8) which is ours for the taking through faith in Jesus Christ (Acts 4:12). How do we receive salvation? We are saved by faith. First, we must hear the gospel—the good news of Jesus' death and resurrection (Ephesians 1:13).

Then, we must believe—fully trust the Lord Jesus (Romans 1:16). This involves repentance, a changing of mind about sin and Christ (Acts 3:19), and calling on the name of the Lord (Romans 10:9-10, 13). A definition of salvation would be "The deliverance, by the grace of God, from eternal punishment for sin which is granted to those who accept by faith God's conditions of repentance and faith in the Lord Jesus." Salvation is available in Jesus alone (John 14:6; Acts 4:12) and is dependent on God alone for provision, assurance, and security.

This is absolutely the most important section in the entire guide, outlining the path to eternal salvation as described in the Bible. Your acceptance or denial of Jesus will affect where you spend eternity, and every soul lives forever, it's just a matter of location. A prerequisite for becoming saved is knowing that God exists and that He created you, the universe and heavens.

God wrote the Bible through man to *further* prove His existence to us alongside the wondrous and spectacular world around us. There are countless incredible facts about the Bible that prove it had to be designed outside of space and time. For a few of these amazing insights read the 'Evidence for God' section in 'Christianity'.

Salvation

A	**Admit that you are a sinner.** Any gap between God's perfect law and our imperfect obedience is called sin, which everyone has committed. ● "For all have sinned, and come short of the glory of God;" (Romans 3:23) ● "There is none righteous, no, not one;" (Romans 3:10) ● "If we say that we have not sinned, we make him a liar, and his word is not in us." (1 John 1:10) ● "For the wages of sin is death, but the gift of God is eternal life in Christ Jesus our Lord." (Romans 6:23)
B	**Believe in your heart that Jesus Christ died for your sins, was buried, and that God raised Jesus from the dead on the third day, taking the punishment you deserved.** Jesus said: "I am the way, the truth, and the life: no man comes unto the Father but by me." (John 14:6) Your own good works cannot save you, no matter how good a person you are, and wouldn't the creator of heaven set the bar for entry? ● "For God so loved the world, that he gave his only begotten Son, that whosoever believes in him should not perish, but have everlasting life." (John 3:16) ● "But God commends his love toward us, in that, while we were yet sinners. Christ died for us." (Romans 5:8)
C	**Call upon the name of the Lord and confess that Jesus Christ is Lord.** Through prayer, invite Jesus into your heart to become your personal Lord and Saviour. There is an example prayer below. ● "If you shall confess with your mouth the Lord Jesus, and shall believe in your heart that God raised him from the dead, you will be saved." (Romans 10:9)

The Sinner's Prayer
"Lord Jesus, I am a sinner and am in need your forgiveness. I believe you are the Son of God who died on the cross for my sins and rose from the dead on the third day. Thank you for bearing my sins and giving me the gift of eternal life. I am ready and willing to trust you as my Lord and Saviour and to turn from my sin. I now invite you into my heart as my personal Saviour. Amen."

> ***"Whoever calls on the name of the Lord shall be saved."***
> *Joel 2:32 / Acts 2:21 / Romans 10:13*

Once you've prayed this prayer, believing it with all your heart, you're saved by the power of the blood of Jesus! He paid that ultimate price of our sin, sacrificing Himself so that we may live. However it's easy to say something with your mouth, what takes real effort is living out a life in pursuit of Jesus, walking according to His will for you and leaving your old sinful ways behind.

Below are some more verses related to salvation and justification, as well as some next steps you should take as a new Christian to help cement your faith. If there's one thing that Satan despises, it's new Christians. So be prepared to battle against the spiritual forces of wickedness by praying and reading your Bible daily as well as putting on your spiritual armour.

- ***Ephesians 2:8-9*** *"For by grace you have been saved through faith, and that not of yourselves; it is the gift of God, not of works, lest anyone should boast."*
- ***2 Corinthians 5:17*** *"Therefore, if anyone is in Christ, he is a new creation; old things have passed away; behold, all things have become new."*
- ***Luke 13:5*** *"I tell you, no; but unless you repent you will all likewise perish."*
- ***Galatians 2:16*** *"Knowing that a man is not justified by the works of the law but by faith in Jesus Christ, even we have believed in Christ Jesus, that we might be justified by faith in Christ and not by the works of the law; for by the works of the law no flesh shall be justified."*
- ***1 Corinthians 15:3-4*** *"How that Christ died for our sins according to the scriptures; And that he was buried, and that he rose again the third day according to the scriptures"*

Next Steps
You should research what the Bible has to say on prophecy and the end times. Have a look at my Christianity posts on my website and watch some of the videos using the QR code to the right to get there. If you don't have a reader you can head to: **www.christianity.fluidicice.com**.

6 After Death

This is an explanation of what happens after death according to the Bible. So what is death? We have 3 parts to our current being, these are: Body, Soul and Spirit. Physical death is the separation between body and soul, or the 'first death' as it's known in the Bible. Spiritual death is the separation of the soul from the spirit, or the 'second death' - which was paid for on the cross by Jesus for those who accepted Him. Every person's spirit lives forever, the question is where will you spend it when you are judged? For a great study by Chuck Missler on what happens after death, watch: **www.youtube.com/watch?v=eJygHgJk6rk**

Chuck Missler
What Happens When You Die?

Statistics

The Afterlife
This is what people believe about an afterlife:
- 81% of people believe in an afterlife of some sort,
- 9% aren't sure on what happens,
- 10% say there's no afterlife.

Heaven
This is what people believe about heaven:
- 46% think it's a state of eternal existence in God's presence,
- 30% think it's a place of rest and reward,
- 14% believe heaven is just symbolic,
- 5% don't believe in heaven and 5% aren't sure.

Hell
This is what people believe about hell:
- 39% believe it's a state of eternal separation from God's presence,
- 32% think it's an actual place of torment and suffering,
- 13% think it's just a symbol of a bad outcome,
- 16% aren't sure or don't believe in hell.

Their Destination
This is where people believe they will end up when they die:
- 65% think they will go to heaven,
- 24% have no idea where they will go,
- 5% think you just cease to exist,
- 5% believe they will come back as another life form,
- 0.5% think they are going to hell.

Heaven Bound
This is why people thought they would get into heaven:
- 43% believe that because they have confessed their sins and accepted Jesus as their saviour,
- 15% because they have tried to obey the ten commandments,
- 15% because they are basically a good person,
- 6% because God loves all people and He won't let them perish.

Contrary Findings
Among Born-again Christians:
- 10% believe that people are reincarnated after death,
- 29% claim it is possible to communicate with the dead,
- 50% contend that a person can earn salvation based on good works,
- Many believe there are multiple options for gaining entry into heaven.

7 The Bible

This section explains the different books of the Bible, how long they are and what the general overview of them is. Further below I've included a selection of the most pertinent books and chapters of the Bible to read. To save space I had to make the font size smaller so you'll have to zoom in to read them or use a magnifying glass if you've printed this sheet.

If you wish to read the other books which aren't included, find a KJV, NKJV, ESV, ISV or NIV Bible as most of the others are either hard to find or aren't biblically accurate. You can also find a variety of different language Bibles below including English. I pray that God will guide you to a Bible if you are truly seeking his word.

"All Scripture is given by inspiration of God, and is profitable for doctrine, for reproof, for correction, for instruction in righteousness" *(2 Timothy 3:16)*

"Inasmuch as many have taken in hand to set in order a narrative of those things which have been fulfilled among us, just as those who from the beginning were eyewitnesses and ministers of the word delivered them to us, it seemed good to me also, having had perfect understanding of all things from the very first, to write to you an orderly account, most excellent Theophilus, that you may know the certainty of those things in which you were instructed." ***Luke 1:1-4***

Other Languages

Here you can download Bibles for free in your native language(s). The links below are mirrors of the site: **www.wordproject.org/bibles/** except for the few .zip files I converted to PDF for easier reading on the go. All downloads below are in the in the KJV or equivalent in the specified language to stay as close to the original text as possible. The zip file contains 66 folders representing each book of the Bible in HTML format, split by chapter. Alternatively you can view this list on my website at: **www.christianity.fluidicice.com/bibles** or via the QR code to the right.

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Preparedness Bible Verses

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The prudent see danger and take refuge, but the simple keep going and pay the penalty. ***Proverbs 22:3***	*A prudent person foresees the danger ahead and takes precautions. The simpleton goes blindly on and suffers the consequences.* ***Proverbs 27:12***	*Therefore, my dear brothers and sisters, stand firm. Let nothing move you. Always give yourselves fully to the work of the Lord, because you know that your labour in the Lord is not in vain.* ***1 Corinthians 15:58***	*For the wages of sin is death, but the gift of God is eternal life in Christ Jesus our Lord.* ***Romans 6:23.***	*Consider it pure joy, my brothers and sisters, whenever you face trials of many kinds, because you know that the testing of your faith produces perseverance. Let perseverance finish its work so that you may be mature and complete, not lacking anything.* ***James 1:2-4***
Be on your guard; stand firm in the faith; be courageous; be strong. ***1 Corinthians 16:13***	*Give generously to them and do so without a grudging heart; then because of this the LORD your God will bless you in all your work and in everything you put your hand to.* ***Deuteronomy 15:10***	*May the God of hope fill you with all joy and peace as you trust in him, so that you may overflow with hope by the power of the Holy Spirit.* ***Romans 15:13***	*The wise store up choice food and olive oil, but fools gulp theirs down.* ***Proverbs 21:20***	*"This, then, is how you should pray: 'Our Father in heaven, hallowed be your name, your kingdom come, your will be done, on earth as it is in heaven. Give us today our daily bread. And forgive us our debts, as we also have forgiven our debtors. And lead us not into temptation, but deliver us from the evil one.'* ***Matthew 6:9-13***
Those who work their land will have abundant food but those who chase fantasies will have their fill of poverty. ***Proverbs 28:19***	*I can do all this through him who gives me strength.* ***Philippians 4:13***	*For God so loved the world that He gave His only begotten Son, that whoever believes in Him should not perish but have everlasting life.* ***John 3:16***	*Be strong and of good courage, do not fear nor be afraid of them; for the Lord your God, He is the One who goes with you. He will not leave you nor forsake you.* ***Deuteronomy 31:6***	*Do you not know? Have you not heard? The LORD is the everlasting God, the Creator of the ends of the earth. He will not grow tired or weary, and his understanding no one can fathom. He gives strength to the weary and increases the power of the weak. Even youths grow tired and weary, and young men stumble and fall; but those who hope in the LORD will renew their strength. They will soar on wings like eagles; they will run and not grow weary, they will walk and not be faint.* ***Isaiah 40:28-31***

The Parable of the Rich Fool
"And He told them this parable: "The ground of a certain rich man yielded an abundant harvest. He thought to himself, 'What shall I do? I have no place to store my crops.' Then he said, 'This is what I'll do. I will tear down my barns and build bigger ones, and there I will store my surplus grain.
And I'll say to myself, "You have plenty of grain laid up for many years. Take life easy; eat, drink and be merry."
But God said to him, 'You fool! This very night your life will be demanded from you. Then who will get what you have prepared for yourself?'
This is how it will be with whoever stores up things for themselves but is not rich toward God."
Luke 12:13-21

8 Common Questions

RELIGION | Christianity | Common Questions

The following are some answers to the most commonly asked questions about Christianity and the Bible. This is a reduced list from the original 'The Rapture Survival Guide (TRSG)' which can be found on my website.

Are natural disasters literally "acts of God"? Does he cause them? (Mark 13:8)
When a volcano erupts, a hurricane devastates a city or lightning ignites a vast forest fire, it is natural for us to ponder God's relationship to the events. How should we regard such tragic occurrences? Are they really "acts of God," as insurance companies still label them? Jesus asked his disciples a similar question. In Luke 13:4, Jesus asked, Those eighteen who died when the tower in Siloam fell on them—do you think they were more guilty than all the others living in Jerusalem?

Jesus was apparently referring to a well-known disaster of his time that had killed 18 people. His point was simple: events and tragedies beyond our control are part of life. There is not necessarily a direct cause and effect between the people who suffer and the tragedies themselves. The Bible offers two reasons for natural disasters.

First, the world itself is beautiful but broken. All of creation suffers as a consequence of the entry of sin, death and decay into the world (Ro 5:12; 8:19–22). Second, all of human history takes place within the context of the cosmic battle between the forces of God and the forces of Satan. Job did not know that the Lord was using his life as an example of faithfulness when Satan afflicted him with sores and sadness. Thankfully, Jesus left his disciples (and us) with this encouragement: In this world you will have trouble. But take heart! I have overcome the world (Jn 16:33).

How do we know the Bible is true? (Hebrews 4:12)
According to the Bible, all Scripture is God-breathed (2Ti 3:16). Peter confirmed this when he said that those who wrote the Bible were not speaking on their own but spoke from God as they were carried along by the Holy Spirit (2Pe 1:21). Many parts of Scripture are directly attributed to God through use of phrases like This is what the LORD says (e.g., Ex 4:22). Finally, Jesus often quoted from the Old Testament and affirmed it as being God's Word. Prophecies that were later fulfilled are corroboration of the accuracy of the Bible's claim to be God's Word.

For example, the vision recorded in Daniel 7 correctly predicted the rise of the Medo-Persian Empire, the Greek Empire under Alexander the Great, and the Roman Empire. Archaeological discoveries are also important evidence of the Bible's accuracy. For example, for many years King David was believed by some to be a fictional character. But recently a composition from a king of Syria referring to the "house of David" was discovered at Tel Dan. This writing provides tangible evidence that ancient rulers indeed recognized the dynasty of David in Judah. Another reason for confidence in the Bible's authenticity is its internal consistency.

The Bible is actually a compilation of 66 books written over a period of 2,000 years by more than 40 different authors, and yet there is a unified message and a striking theological coherence—something that clearly speaks of God's guidance throughout the process of writing, transmitting and assembling the Biblical texts. It is important to remember that the original Biblical documents no longer exist. We are dependent on copies, and copyists can make mistakes.

However, scholars have carefully tracked the accuracy of ancient manuscripts from different centuries, and their consistency gives us good reason to be confident in the Bibles we read today. Furthermore, rigorous standards were applied to determine the canon—both by the Jews, who determined the collection of books that make up the Old Testament Scriptures, and by the early church, which decided the books to be included in the New Testament.

RELIGION Christianity Common Questions

Who is God, what does he value, and how can we approach him? (Exodus 3:13–14)
The Bible doesn't explain who God is or try to prove his divine existence. It assumes God is eternally present (Ge 1:1) and depicts creation as a result of his divine thought and action (Ge 1:1–2:25). God has, however, offered us a glimpse of who he is through creation (Ps 19:1–6), his Word (Ps 18:30–31), and especially through the incarnation of his Son, Jesus Christ, who is the radiance of God's glory and the exact representation of his being (Heb 1:3). Jesus demonstrated God's compassion, grace and glory in his life, death and resurrection. From this and from the empowering presence of the Holy Spirit at Pentecost (Ac 2:1–13), our awareness of God as Trinity (one God in three persons) was formed.

While God's being is beyond comprehension or perception (Ex 33:20; Jn 1:18), both the physical world and the human conscience clearly attest to his values and purposes. In addition, God revealed what he values through the Sinai covenant (Ex 20:1–24:18). The Ten Commandments (Ex 20:2–17; Dt 5:6–21) were affirmed by Jesus as a faithful summary of God's moral values (Mt 5:17–47), and they continue to shape social values and legal systems today. God also revealed what he values through the dietary regulations (Lev 11:1–47) and worship regulations (Lev 1:1–9:24; 16:1–34; 21:1–25:55) that were given to the ancient Israelites. Those regulations emphasized God's holiness and his desire for his people to be holy (Lev 11:44).

When Jesus came to earth, he taught that while actions are important, God is more concerned with the heart (Mt 5:17–47; 15:18–20). God desires that we love him, trust him, obey him and imitate his character in our interactions with others by being compassionate, loving and forgiving. So how can we approach such a holy God? Access to God is only through faith in Jesus Christ (Jn 14:6; Ro 5:1–2; Eph 2:13–18; 3:12). Christ suffered once for sins, the righteous for the unrighteous, to bring (us) to God (1Pe 3:18). Let us then approach God's throne of grace with confidence, so that we may receive mercy and find grace to help us in our time of need (Heb 4:16).

RELIGION Christianity Common Questions

How much influence does Satan have in the world today? (1 Peter 5:8)
Enormous influence! Jesus called him the prince of this world (Jn 12:31), and Paul called him the god of this age (2Co 4:4). Satan controls a vast hierarchical network of fallen angels (Eph 6:12), also called demons. Revelation 12:9 says that Satan … leads the whole world astray. He manipulates nations, rulers, economies and cultures. He remains disguised behind all the idolatries and false religions of the world. In the end, according to Revelation, Satan will orchestrate a vast, worldwide rebellion against Christ and the church, but he will be defeated and suffer eternal punishment (Rev 20:7–10). At the root of all Satan's efforts on earth is his desire to usurp God's glory.

Satan is insanely jealous of God. Created as a mighty and good angel, he fell due to his arrogant desire to take the place of God (Isa 14:12–15; Eze 28:11–19). Satan works in this world primarily through deceit (Jn 8:44). He is skilful beyond our imagination at tempting people to sin. He is also ruthless and willing to spare no one in his pursuit of glory. However, Satan is no match for Jesus Christ, who is Lord of all. Christians will certainly face Satan's attacks as he tempts, tests and accuses them (Job 1:8–12; Rev 12:10). But Christians may always take refuge in Jesus, for by the power of his name (Lk 10:17–20) they are successfully able to resist Satan (1Pe 5:8–10).

RELIGION Christianity Common Questions

Why does God allow bad things to happen? (Deuteronomy 31:16–21)
No one knows the mind of God, except for God himself. He is infinite; we are finite. We are not entirely clueless about his character, however, because God speaks to us through his Word. According to the Bible, one reason bad things happen is because the whole world is under the control of the evil one (1Jn 5:19). That's why Jesus taught us to ask God to deliver us from the evil one when we pray (Mt 6:13). Even in the Garden of Eden—in paradise, before Adam and Eve partook of the forbidden fruit—Satan was already there, waiting to tempt them to disobey God (Ge 3:1–6). Another reason bad things happen is because people sin.

The reason why God allows people to sin and be tempted to sin is not for us to know—at least for now (Dt 29:29). What we do know is that when bad things happen, we should not rage against God. To revolt against God is to fall prey to the devil. The devil is a liar (Jn 8:44) and wants us to believe that God is blameworthy. But the Bible says that God is light; in him there is no darkness at all (1Jn 1:5). God is not the enemy; Satan is the enemy. Through his Spirit God empowers us to war against the enemy by following Jesus Christ, our Lord and Saviour—during good times and bad times.

RELIGION Christianity Common Questions

Are people just pawns in God's chess game? (Job 1:13–19)
It sometimes seems that people are caught in events beyond their control, events manipulated by God or Satan. They may feel forced into situations they would not choose if they were given a choice. While this seems unfair, there is another way —a higher way—to interpret the circumstances of life. We can see them as Godgiven opportunities to cooperate with God's purposes and plans that allow us to participate in something far more significant than our own schemes. We are more than pawns in a chess game.

We can honour Almighty God by the way we live and die. Still, many unanswered questions remain. Only God knows why dozens of bystanders had to die in this unfolding drama between Satan and God. We struggle with the fact that some who are righteous have short, tragic lives, while others who are wicked enjoy wealth and long life. There is one thing we can affirm, however: what seems unfair in this life will be made right in eternity. Our problems will be resolved and many of our questions answered. God has permitted Satan certain freedoms. Satan is called the prince of this world (Jn 14:30) and the ruler of the kingdom of the air (Eph 2:2), for he sometimes uses sicknesses, plagues, wicked people and the forces of nature.

Though God dealt a fatal blow to Satan through Jesus' death and resurrection, Satan continues to struggle against God and will do so until the end (Ro 16:20). There are two sides to the suffering of the righteous: the earthly and the heavenly. The apostle Paul understood the tension of living in a corrupt world. He placed his trust in God and things eternal—God's justice, mercy and love—not in the temporary things of this world—success, wealth and fame. Paul recognized that our struggle is not against flesh and blood (Eph 6:12) and took courage in knowing that our citizenship is in heaven (Php 3:20).

RELIGION Christianity Common Questions

If we are treated unfairly, is God still good? (Job 34:19)
Because of the intrusion of sin and evil into our world, it seems to us that life is often not fair or just (Ps 73:3–12). Events occur that we do not cause or desire, and all our best efforts are not able to produce perfect results. Yet the Bible consistently declares that God is good, fair and just (Ps 9:7–12; 101:1; 145:1–21; 1Th 1:5–7; Rev 19:1–2, 11). Sometimes we find this truth difficult to grasp because of the complexity of this world and its evils. We have limited ability to clearly interpret it. But once we have spiritual insight about the truth, we can conform our behaviours more fully to reflect God's fairness, goodness and righteousness (Php 4:8–9).

Even when things happen that contradict our expressed efforts and knowledge of God's ultimate designs, we can have confidence that God's purposes will prevail (2Co 3:7–5:10); he will restore the fortunes of earth and humankind to his original desires (2Pe 3:13). Both Peter (1Pe 1:6–7; 2:19–25) and Paul (Ro 8:18–39) insisted that when we experience unfairness in life, we are gaining insights into what Jesus went through. We are also learning how to hope for the fullness of God's goodness to renew our world.

RELIGION Christianity Common Questions

Why does it sometimes seem like God is far away? (Psalm 10:1)
God promised his people, The LORD will deliver them to you, and you must do to them all that I have commanded you (Dt 31:5). Yet sometimes God seems distant. During such times, the ever-present God hasn't gone anywhere. Instead, specific obstacles we create or experience can make God seem far away. One obstacle is busyness. Our overloaded schedules can crowd out time with God and make it difficult to sense his presence in our lives.

When Jesus arrived for dinner at the home of friends, Martha chose to busy herself with kitchen duties while her sister sat at the feet of Jesus and was commended for doing what was better (Lk 10:38–42). Busyness isn't next to godliness. In fact, our crammed calendars can cause us to miss connecting with God daily. A second obstacle is "stuff," or possessions. In Matthew 19:16–22, Jesus urged a man to sell all he had and to follow him, but the man went away sad, because he had great wealth (Mt 19:22).

Unfortunately, possessions and wealth can prevent people from pursuing Jesus. He warned, Where your treasure is, there your heart will be also (Mt 6:21). So, if our hearts wander after more and more stuff, we will have little room for God. A third obstacle is sin. Christians can be secure in their relationship with God because their sins have been forgiven through Jesus' death on the cross. But lingering sin in our lives can still stand in the way of present fellowship with God. Fortunately, when we confess our sin, repent and obey God, we will feel the Father's love and personal presence once again (Jn 14:23, 25–27).

Does God send troubles? (Psalm 71:20)
We have trouble in the world and in our lives because of humanity's sinful nature. But the book of Job shows that troubles do not necessarily come in direct proportion to our sin. Troubles may come not because we have committed a particular sin but because of someone else's sin against us.
In this psalm the writer looked back on his life and admitted that God had allowed him to experience some bitter troubles. God is not the blameworthy cause or originator of evil in the world, and he is neither capricious nor a mere passive observer. Sometimes God permits trouble in people's lives; other times he seems to deliberately bring people to a place where they will experience difficulties.

The Bible says that God has many reasons for allowing the godly to experience suffering. Suffering may (1) lead someone away from sin and closer to God (Heb 12:4–11), (2) build up a person's character (Jas 1:2–6) or (3) provide a means to glorify God (Jn 9:1–3). Then again, there is the lesson of Job: explanations cannot always be found. At times we may not understand why God allows us to experience troubles, but even without answers it is good to say with the psalmist, You will restore my life again … you will again bring me up.

Is there any secular evidence to support the Bible's claims? (Psalm 119:160)
Although the Bible is not an ancient history textbook, it does report events that have been confirmed by other historical works. Consider the following examples:
● Archeological digs and ancient Assyrian records confirm the Bible's portrayal of King Sennacherib's invasion of Judah (2Ki 18:13– 19:37).
● Until recent excavations at Tell Mardikh uncovered tablets mentioning Sodom and Gomorrah (Ge 19:1–29), scholars dismissed the existence of both cities as a Biblical legend.
● The Hittites were also considered a Biblical legend until their capital and records were discovered in modern-day Turkey.
● The palace of King Sargon, an Assyrian ruler mentioned in Isaiah, was uncovered in Iraq. The events recorded in Isaiah 20 were even recorded on the palace walls.
● In 1947, the discovery of the Dead Sea Scrolls (which are copies of the Old Testament) confirmed how accurately the Bible was copied from 200 BC to AD 1200.

● Greek and Jewish writers (e.g., Pliny, Tacitus and Josephus) supported the Bible's claims that Jesus really lived, that he was executed between AD 26 and AD 36 and that he was worshiped as God.
● Many of the details of the New Testament including facts about Pontius Pilate, the census recorded in Luke 2, the death of Agrippa I, the execution of Ananias the high priest and the crucifixion of Jesus —are also mentioned in other historical works.

What is hell like? (Matthew 5:21–30)
The Bible offers a variety of disturbing pictures of hell. Hell is described as a place of unquenchable fire (Mk 9:43); condemnation (Mt 23:33); darkness, weeping and gnashing of teeth (Mt 8:11–13); chains and judgment (2Pe 2:4). While some of these images create an apparent conflict (e.g., fire and darkness), together they are a picture of misery. The clearest picture we have of hell comes from Jesus' parable of the rich man and Lazarus in Luke 16:19–31. In this parable, Jesus warned that the boundaries between heaven and hell are permanently fixed.

While Lazarus entered a place of comfort (Lk 16:25), the rich man existed in torment, longing for even a drop of cool water (Lk 16:24). Jesus' description of hell also leads to several observations. People are recognizable there, and it is a place of agony and torment (Lk 16:23). The chasm between heaven and hell prevents escape or movement from hell to heaven (Lk 16:26). And it is not possible for anyone in hell to warn loved ones alive on earth about the reality of hell (Lk 16:31).

Is there value in other religions like Islam, Buddhism and Hinduism? (Galatians 1:9)
Yes, there is value, especially ethical value, in other religions. But the more significant question is, Is there eternal value in other religions? No. Islam, Buddhism and Hinduism all provide very different answers to questions concerning the nature of God, sin, who Jesus Christ is, what the purpose of life is, the afterlife and the eternal significance of being a good person. We should acknowledge the diversity of religions and the diversity of their answers to such basic questions. The writer of Hebrews tells us that God rewards those who earnestly seek him (Heb 11:6).

God wants to be found, and traces of him can be found throughout the world's religions. But much about God's revelation of himself through nature and the world's religions has also been distorted through sin, ignorance, falsehood and superstition (Ro 1:18–32). This is why we all need a more definitive form of revelation. In the Christian faith, the most rudimentary issues concern who Jesus Christ is and whether he actually has the authority to speak on God's behalf. The Gospels record Jesus' teachings and the rest of the New Testament corroborates, clarifies and applies his teachings.
While world religions help to express the human soul's longing to know its Creator, all religions must wrestle with the question of truth about Jesus Christ. Was he a charismatic leader, a prophet, a martyr or the way and the truth and the life (Jn 14:6)? The Bible teaches that believing in Jesus and following his way is the only path to finding a personal relationship with God and receiving eternal life. Jesus said, No one comes to the Father except through me (Jn 14:6). And the apostle Peter said, when speaking about Jesus, Salvation is found in no one else, for there is no other name under heaven given to mankind by which we must be saved (Ac 4:12).

It is logically impossible for the various religions of the world to all be correct. Everyone can't be right. The common practice of picking and choosing from each of the religions creates a self-made spirituality governed by a god made with our own hands and in our own image. All roads do not lead to God. But all roads can be a way to get started on the quest to find him.

9 Further Reading

Further Reading
If you're reading this Christianity section on TPE and you're interested in reading the full guide, head to **www.fluidicice.com/TRSG** for "The Rapture Survival Guide" which is my much more comprehensive guide on the end times. If you're reading TRSG and want a comprehensive end times survival guide, see **www.fluidicice.com/TPE**.

christianity.fluidicice.com

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3 Islam

Islam Introduction

Islam flows out of the life, words, example and revelations of Muhammad, the Islamic prophet, messenger, or apostle, sent from Allah. The revelations he got from his deity were mainly recited on the mosque pulpit in Medina. Some of the earlier ones were cited in various places in Mecca, like the Kabah shrine where the black stone is housed, or in the marketplace. Then he moved to Medina in A.D. 622, because the Meccans persecuted him. The revelations did not stop. He recited them in various places like the marketplace, on his travels, and in the mosque itself. They were written down in the Quran. Since they came directly from Allah, the Quran is sacred and inspired. It is binding on all Muslims, if they interpret it correctly.

Quran
The book of Islamic revelation; scripture. The term means "recitation." The Quran is believed to be the word of God transmitted through the Prophet Muhammad. The Quran proclaims God's existence and will and is the ultimate source of religious knowledge for Muslims. The Quran serves as both record and guide for the Muslim community, transcending time and space. Muslims have dedicated their best minds and talents to the exegesis and recitation of the Quran because the Quran is the criterion by which everything else is to be judged; all movements, whether of radical reform or of moderate change, whether originating at the centre or at the periphery of the Islamic world, have grounded their programs in the Quran and use it as support.

Geographic Positioning
Countries with the greatest proportion of Muslims from Islam by country (as of 2010[n])

Largest Islamic Populations[n]	Indonesia	Pakistan	India	Bangladesh	Nigeria	Iran	Egypt	Turkey	Algeria	Morocco	Afghanistan
	245,000,000	203,000,000	182,000,000	142,937,800	90,000,000	73,238,340	70,056,000	70,036,838	36,092,810	31,351,800	30,112,680

What is Islam?

Islam is a religious system begun in the seventh century by Muhammad. Muslims follow the teachings of the Qur'an and strive to keep the Five Pillars.

The History of Islam
In the seventh century, Muhammad claimed the angel Gabriel visited him. During these angelic visitations, which continued for about 23 years until Muhammad's death, the angel purportedly revealed to Muhammad the words of Allah (the Arabic word for "God" used by Muslims). These dictated revelations compose the Qur'an, Islam's holy book. Islam means "submission," deriving from a root word that means "peace." The word Muslim means "one who submits to Allah."

The Doctrine of Islam
Muslims summarize their doctrine in six articles of faith:
1. Belief in one Allah: Muslims believe Allah is one, eternal, creator, and sovereign.
2. Belief in the angels
3. Belief in the prophets: The prophets include the biblical prophets but end with Muhammad as Allah's final prophet.
4. Belief in the revelations of Allah: Muslims accept certain portions of the Bible, such as the Torah and the Gospels. They believe the Qur'an is the preexistent, perfect word of Allah.
5. Belief in the last day of judgment and the hereafter: Everyone will be resurrected for judgment into either paradise or hell.
6. Belief in predestination: Muslims believe Allah has decreed everything that will happen. Muslims testify to Allah's sovereignty with their frequent phrase, inshallah, meaning, "if God wills."

The Five Pillars of Islam
These five tenets compose the framework of obedience for Muslims:
1. The testimony of faith (shahada): "la ilaha illa allah. Muhammad rasul Allah." This means, "There is no deity but Allah. Muhammad is the messenger of Allah." A person can convert to Islam by stating this creed. The shahada shows that a Muslim believes in Allah alone as deity and believes that Muhammad reveals Allah.
2. Prayer (salat): Five ritual prayers must be performed every day.
3. Giving (zakat): This almsgiving is a certain percentage given once a year.
4. Fasting (sawm): Muslims fast during Ramadan in the ninth month of the Islamic calendar. They must not eat or drink from dawn until sunset.
5. Pilgrimage (hajj): If physically and financially possible, a Muslim must make the pilgrimage to Mecca in Saudi Arabia at least once. The hajj is performed in the twelfth month of the Islamic calendar.

A Muslim's entrance into paradise hinges on obedience to these Five Pillars. Still, Allah may reject them. Even Muhammad was not sure whether Allah would admit him to paradise (Surah 46:9; Hadith 5.266).

An Evaluation of Islam
Compared to Christianity, Islam has some similarities but significant differences. Like Christianity, Islam is monotheistic. However, Muslims reject the Trinity—that God has revealed Himself as one in three Persons: the Father, Son, and Holy Spirit.

Muslims claim that Jesus was one of the most important prophets—not God's Son. Islam asserts that Jesus, though born of a virgin, was created like Adam. Muslims do not believe Jesus died on the cross. They do not understand why Allah would allow His prophet Isa (the Islamic word for "Jesus") to die a torturous death. Yet the Bible shows how the death of the perfect Son of God was essential to pay for the sins of the world (Isaiah 53:5-6; John 3:16; 14:6; 1 Peter 2:24).

Islam teaches that the Qur'an is the final authority and the last revelation of Allah. The Bible, however, was completed in the first century with the Book of Revelation. The Bible warns against anyone adding to or subtracting from God's Word (Deuteronomy 4:2; Proverbs 30:6; Galatians 1:6-12; Revelation 22:18). The Qur'an, as a claimed addition to God's Word, directly disobeys God's command.

Muslims believe that paradise can be earned through keeping the Five Pillars. The Bible, in contrast, reveals that sinful man can never measure up to the holy God (Romans 3:23; 6:23). Only by God's grace may sinners be saved through repentant faith in Jesus (Acts 20:21; Ephesians 2:8-9).

Because of these essential differences and contradictions, Islam and Christianity cannot both be true. The Bible and Qur'an cannot both be God's Word. The truth has eternal consequences.

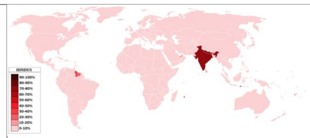
"Beloved, do not believe every spirit, but test the spirits to see whether they are from God, because many false prophets have gone out into the world. By this you know the Spirit of God: every spirit that confesses that Jesus Christ has come in the flesh is from God; and every spirit that does not confess Jesus is not from God; this is the spirit of the antichrist, of which you have heard that it is coming, and now it is already in the world" (1 John 4:1-4; see also John 3:35-36).

4 Hinduism ॐ

Hinduism is not an organized religion and has no single, systematic approach to teaching its value system. Nor do Hindus have a simple set of rules to follow like the Ten Commandments. Local, regional, caste, and community-driven practices influence the interpretation and practice of beliefs throughout the Hindu world. Yet a common thread among all these variations is belief in a Supreme Being and adherence to certain concepts such as Truth, dharma, and karma. And belief in the authority of the Vedas (sacred scriptures) serves, to a large extent, as the very definition of a Hindu, even though how the Vedas are interpreted may vary greatly. Hindus acknowledge that, at the most fundamental level, God is the One without a second — the absolute, formless, and only Reality known as Brahman, the Supreme, Universal Soul.

Brahman is the universe and everything in it. Brahman has no form and no limits; it is Reality and Truth. Thus Hinduism is a pantheistic religion: It equates God with the universe. Yet Hindu religion is also polytheistic: populated with myriad gods and goddesses who personify aspects of the one true God, allowing individuals an infinite number of ways to worship based on family tradition, community and regional practices, and other considerations.

Geographic Positioning
Countries with the greatest proportion of Hindus from Hinduism by country (as of 2010[n])



Largest Hindu Populations[n]	**India** 957,636,314	**Nepal** 21,354,570	**Bangladesh** 14,274,430	**Indonesia** 4,012,470	**Pakistan** 2,603,895	**Sri Lanka** 2,554,606	**Malaysia** 1,700,100	**United States** 1,543,730	**United Arab Emirates** 1,239,610	**South Africa** 749,870	**Mauritius** 665,820

Beliefs

Truth is Eternal	Hindus pursue knowledge and understanding of the Truth: the very essence of the universe and the only Reality. According to the Vedas, Truth is One, but the wise express it in a variety of ways.
Brahman is Truth and Reality	Hindus believe in Brahman as the one true God who is formless, limitless, all-inclusive, and eternal. Brahman is not an abstract concept; it is a real entity that encompasses everything (seen and unseen) in the universe.
The Vedas are the ultimate authority	The Vedas are Hindu scriptures that contain revelations received by ancient saints and sages. Hindus believe that the Vedas are without beginning and without end; when everything else in the universe is destroyed (at the end of a cycle of time), the Vedas remain.
Everyone should strive to achieve dharma	Understanding the concept of dharma helps you understand the Hindu faith. Unfortunately, no single English word adequately covers its meaning. Dharma can be described as right conduct, righteousness, moral law, and duty. Anyone who makes dharma central to one's life strives to do the right thing, according to one's duty and abilities, at all times.
Individual souls are immortal	A Hindu believes that the individual soul (atman) is neither created nor destroyed; it has been, it is, and it will be. Actions of the soul while residing in a body require that it reap the consequences of those actions in the next life — the same soul in a different body. The process of movement of the atman from one body to another is known as transmigration. The kind of body the soul inhabits next is determined by karma (actions accumulated in previous lives).
The goal of the individual soul is moksha	Moksha is liberation: the soul's release from the cycle of death and rebirth. It occurs when the soul unites with Brahman by realizing its true nature. Several paths can lead to this realization and unity: the path of duty, the path of knowledge, and the path of devotion (unconditional surrender to God).

What is Hinduism?

Hinduism is one of the oldest known organized religions—its sacred writings date as far back as 1400 to 1500 B.C. It is also one of the most diverse and complex, having millions of gods. Hindus have a wide variety of core beliefs and exist in many different sects. Although it is the third largest religion in the world, Hinduism exists primarily in India and Nepal. The main texts of Hinduism are the Vedas (considered most important), Upanishadas, the Mahabharata, and the Ramayana. These writings contain hymns, incantations, philosophies, rituals, poems, and stories from which Hindus base their beliefs. Other texts used in Hinduism include the Brahmanas, the Sutras, and the Aranyakas.

Though Hinduism is often understood as being polytheistic, supposedly recognizing as many as 330 million gods, it also has one "god" that is supreme—Brahma. Brahma is an entity believed to inhabit every portion of reality and existence throughout the entire universe. Brahma is both impersonal and unknowable and is often believed to exist in three separate forms: Brahma—Creator; Vishnu—Preserver; and Shiva—Destroyer. These "facets" of Brahma are also known through the many other incarnations of each. It is difficult to summarize Hindu theology since the various Hindu schools contain elements of almost every theological system.

Hinduism can be:
1) Monistic—Only one thing exists; Sankara's school
2) Pantheistic—Only one divine thing exists so that God is identical to the world; Brahmanism
3) Panentheistic—The world is part of God; Ramanuja's School
4) Theistic—Only one God, distinct from Creation; Bhakti Hinduism.

Observing other schools, Hinduism can also be atheistic, deistic, or even nihilistic. With such diversity included under the title "Hindu," one may wonder what makes them "Hindu" in the first place? About the only real issue is whether or not a belief system recognizes the Vedas as sacred. If it does, then it is Hindu. If not, then it is not Hindu. The Vedas are more than theology books. They contain a rich and colorful "theo-mythology," that is, a religious mythology which deliberately interweaves myth, theology, and history to achieve a story-form religious root. This "theo-mythology" is so deeply rooted in India's history and culture that to reject the Vedas is viewed as opposing India.

Therefore, a belief system is rejected by Hinduism if it does not embrace Indian culture to some extent. If the system accepts Indian culture and its theo-mythical history, then it can be embraced as "Hindu" even if its theology is theistic, nihilistic, or atheistic. This openness to contradiction can be a headache for Westerners who seek logical consistency and rational defensibility in their religious views. But, to be fair, Christians are no more logical when they claim belief in Yahweh yet live life as practical atheists, denying Christ with their lives. For the Hindu the conflict is genuine logical contradiction. For the Christian, the conflict is more likely simple hypocrisy.

Hinduism views mankind as divine. Because Brahma is everything, Hinduism asserts that everyone is divine. Atman, or self, is one with Brahman. All of reality outside of Brahman is considered mere illusion. The spiritual goal of a Hindu is to become one with Brahma, thus ceasing to exist in its illusory form of "individual self." This freedom is referred to as "moksha." Until moksha is achieved, a Hindu believes that he/she will be repeatedly reincarnated in order that he/she may work towards self-realization of the truth (the truth being that only Brahman exists, nothing else). How a person is reincarnated is determined by karma, which is a principle of cause and effect governed by nature's balance. What one did in the past affects and corresponds with what happens in the future, past and future lives included.

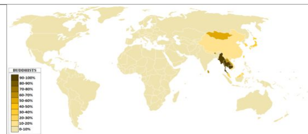
Although this is just a brief synopsis, it is readily seen that Hinduism is in opposition to biblical Christianity on almost every count of its belief system. Christianity has one God who is both personal and knowable (Deuteronomy 6:5; 1 Corinthians 8:6); has one set of Scriptures; teaches that God created the earth and all who live upon it (Genesis 1:1; Hebrews 11:3); believes that man is created in God's image and lives only once (Genesis 1:27; Hebrews 9:27-28); and teaches that salvation is through Jesus Christ alone (John 3:16; 6:44; 14:6; Acts 4:12). Hinduism as a religious system fails because it fails to recognize Jesus as the uniquely incarnated God-Man and Savior, the one solely sufficient source of salvation for humanity.

5 Buddhism

Buddhism is a path of practice and spiritual development leading to Insight into the true nature of reality. Buddhist practices like meditation are means of changing yourself in order to develop the qualities of awareness, kindness, and wisdom. The experience developed within the Buddhist tradition over thousands of years has created an incomparable resource for all those who wish to follow a path — a path which ultimately culminates in Enlightenment or Buddhahood. An enlightened being sees the nature of reality absolutely clearly, just as it is, and lives fully and naturally in accordance with that vision. This is the goal of the Buddhist spiritual life, representing the end of suffering for anyone who attains it.

Because Buddhism does not include the idea of worshipping a creator god, some people do not see it as a religion in the normal, Western sense. The basic tenets of Buddhist teaching are straightforward and practical: nothing is fixed or permanent; actions have consequences; change is possible. So Buddhism addresses itself to all people irrespective of race, nationality, caste, sexuality, or gender. It teaches practical methods which enable people to realise and use its teachings in order to transform their experience, to be fully responsible for their lives.

Geographic Positioning
Countries with the greatest proportion of Buddhists from Buddhism by country (as of 2010[n])



Largest Buddhist Populations[n]	China	Thailand	Japan	Burma	South Korea	India	Malaysia	Sri Lanka	Vietnam	Cambodia	Indonesia
	244,130,000	64,420,000	45,820,000	38,410,000	10,500,000	9,250,000	5,010,000	4,450,000	4,380,000	3,690,000	1,710,000

The Buddha
Buddhism started with the Buddha. The word 'Buddha' is a title, which means 'one who is awake' — in the sense of having 'woken up to reality'. The Buddha was born as Siddhartha Gautama in Nepal around 2,500 years ago. He did not claim to be a god or a prophet. He was a human being who became Enlightened, understanding life in the deepest way possible. Siddhartha was born into the royal family of a small kingdom on the Indian-Nepalese border. According to the traditional story he had a privileged upbringing, but was jolted out of his sheltered life on realising that life includes the harsh facts of old age, sickness, and death. This prompted him to puzzle over the meaning of life. Eventually he felt impelled to leave his palace and follow the traditional Indian path of the wandering holy man, a seeker after Truth. He became very adept at meditation under various teachers, and then took up ascetic practices. This was based on the belief that one could free the spirit by denying the flesh. He practised austerities so determinedly that he almost starved to death.

Teachings

Soon after his Enlightenment the Buddha had a vision in which he saw the human race as a bed of lotus flowers. Some of the lotuses were still enmired in the mud, others were just emerging from it, and others again were on the point of blooming. In other words, all people had the ability to unfold their potential and some needed just a little help to do so. So the Buddha decided to teach, and all of the teachings of Buddhism may be seen as attempts to fulfil this vision — to help people grow towards Enlightenment. Buddhism sees life as a process of constant change, and its practices aim to take advantage of this fact. It means that one can change for the better.

The decisive factor in changing oneself is the mind, and Buddhism has developed many methods for working on the mind. Most importantly, Buddhists practise meditation, which is a way of developing more positive states of mind that are characterised by calm, concentration, awareness, and emotions such as friendliness. Using the awareness developed in meditation it is possible to have a fuller understanding of oneself, other people, and of life itself. Buddhists do not seek to 'evangelise' or coerce other people to adopt their religion, but they do seek to make its teachings available to whoever is interested, and people are free to take.

Three Jewels
The ideals at the heart of Buddhism are collectively known as the 'Three Jewels', or the 'Three Treasures'. These are the Buddha (the yellow jewel), the Dharma (the blue jewel), and the Sangha (the red jewel). It is by making these the central principles of your life that you become a Buddhist.

The Buddha
The Buddha refers both to the historical Buddha and to the ideal of Buddhahood itself. The whole Buddhist tradition derives from the historical Buddha and all schools regard him as their root founder, guide and inspiration. Going for Refuge to the Buddha means seeing him as your ultimate teacher and spiritual example. It also means committing yourself to achieving Buddhahood – Enlightenment for the sake of all beings – which means that you aim to become someone who sees the nature of reality absolutely clearly, just as it is, and lives fully and naturally in accordance with that vision. This is the goal of the Buddhist spiritual life, representing the end of suffering for anyone who attains it.

The Dharma
The Dharma primarily means the teachings of the Buddha, or the truth he understood. The word 'Dharma' has many meanings but most importantly it means the unmediated Truth (as experienced by the Enlightened mind). As a term it also encompasses Buddhist teachings as that same Truth mediated by language and concepts. In this second sense, Dharma is the teaching that was born when the Buddha first put his realisation into words and communicated it to others at Sarnath in Northern India. The occasion is traditionally referred to as 'the first turning of the wheel of the Dharma', and the eight-spoked Dharma wheel is a common emblem of Buddhism.

The Sangha
All of us need other people to learn from. If we are to practise the Dharma we need the example and teaching of others who have done so before us, especially those who have gained insight into the nature of reality themselves. So the third of the Three Jewels is the Sangha or the spiritual community. More broadly 'sangha' also refers to the people with whom we share our spiritual lives. We need the guidance of personal teachers who are further along the path than we are, and the support and friendship of other practitioners. This is very important because Buddhism is not an abstract philosophy or creed; it is a way of approaching life and therefore it only has any meaning when it is embodied in people. More broadly 'sangha' also refers to the people with whom we share our spiritual lives. We need the guidance of personal teachers who are further along the path than we are, and the support and friendship of other practitioners. This is very important because Buddhism is not an abstract philosophy or creed; it is a way of approaching life and therefore it only has any meaning when it is embodied in people.

Our Sangha
The Buddha once said that kalyana mitrata – spiritual friendship or 'friendship with what is beautiful' – is the whole of the spiritual life. Our community takes these words to heart. Kalyana mitrata, one might say, is the whole of the Triratna Buddhist Community. Triratna centres are not simply places for teaching the techniques of meditation, or imparting information about Buddhism. When a person first attends a Triratna centre, they are considered a Friend. They may take part in all the public activities of the centre, including meditation classes, the study and practice of Buddhism, arts events and so on. There is no obligation or pressure to take their involvement further, and some people remain as Friends for many years. For those who want it, however, there is the opportunity to get to know other practitioners and strengthen those connections. The community's structures can all be seen as a framework for kalyana mitrata and friendship.

Threefold Way
Another formulation of the path is the Threefold Way of ethics, meditation, and wisdom. This is a progressive path, as ethics and a clear conscience provides an indispensable basis for meditation, and meditation is the ground on which wisdom can develop.

Ethics
To live is to act, and our actions can have either harmful or beneficial consequences for ourselves and others. Buddhist ethics is concerned with the principles and practices that help one to act in ways that help rather than harm. The core ethical code is known as the Five Precepts. These are not rules or commandments, but 'principles of training', which are undertaken freely and put into practice with intelligence and sensitivity. The Buddhist tradition acknowledges that life is complex and throws up many difficulties, and it does not suggest that there is a single course of action that will be right in all circumstances. Indeed, rather than speaking of actions being right or wrong, Buddhism speaks of them being skilful (kusala) or unskilful (akusala). Many Buddhists around the world recite the five precepts every day, and try to put them into practice in their lives.

Meditation
Meditation is the second stage of the threefold way.

Wisdom
The aim of all Buddhist practices, including meditation, is prajna, or wisdom. The Buddha taught that the fundamental cause of human difficulties is our existential ignorance – our failure to understand the true nature of reality and wisdom is the opposite of this. To start with, we simply need to hear the teachings that indicate the Buddhist vision of life. Then we need to reflect on them and make sense of them in relation to our own experience. But prajna proper means developing our own direct understanding of the truth. It is not enough to know the Buddha's philosophy, or even to have a good understanding of it. The ultimate aim is to realise the truth for oneself and to be transformed by that realisation. The Buddha taught that life - everything we experience - has three characteristics. He called these the three marks of conditioned existence. Firstly he said that all life is dukkha, or unsatisfactory. He also said that it is impermanent. Everything in the universe, including ourselves and the thoughts that make up our minds, is in a constant process of change. And yet we act as if the world around us is predictable and stable, and we live our lives as if death were not a certainty. Buddhists reflect on the fact of impermanence, and try to live with this understanding. Thirdly, wherever we may look in life for something solid and unchanging, we only find flux. So he said that all existence is anatta or insubstantial. There is no fixed, abiding essence to things, and no eternal soul within human beings.

Four Noble Truths
The Four Aryan (or Noble) Truths are perhaps the most basic formulation of the Buddha's teaching. They are expressed as follows:

1	All existence is dukkha. The word dukkha has been variously translated as 'suffering', 'anguish', 'pain', or 'unsatisfactoriness'. The Buddha's insight was that our lives are a struggle, and we do not find ultimate happiness or satisfaction in anything we experience. This is the problem of existence.
2	The cause of dukkha is craving. The natural human tendency is to blame our difficulties on things outside ourselves. But the Buddha says that their actual root is to be found in the mind itself. In particular our tendency to grasp at things (or alternatively to push them away) places us fundamentally at odds with the way life really is.
3	The cessation of dukkha comes with the cessation of craving. As we are the ultimate cause of our difficulties, we are also the solution. We cannot change the things that happen to us, but we can change our responses.
4	There is a path that leads from dukkha. Although the Buddha throws responsibility back on to the individual he also taught methods through which we can change ourselves, for example the Noble Eightfold Path.

Noble Eightfold Path
The Buddha's 'Noble Eightfold Path' is a further 'unpacking' of the 'Threefold Way' and is perhaps the most widely known of the Buddha's teachings. It is ancient, extending back to the Buddha's first discourse and is highly valued as a treasury of wisdom and practical guidance on how to live our lives. Traditionally the teaching is seen as highlighting eight areas or 'limbs' of 'right' practice (Sangharakshita prefers 'perfect' to 'right'), which sit in mutual relationship to one other and are each essential elements in an integrated approach to the Dharma:

1. Right Understanding or Perfect Vision
2. Right Resolve or Perfect Emotion
3. Right Speech or Perfect Speech
4. Right Action or Perfect Action
5. Right Livelihood or Perfect Livelihood
6. Right Effort or Perfect Effort
7. Right Mindfulness or Perfect Awareness
8. Right Meditation or Perfect Samadhi

What is Buddhism?

Buddhism is one of the leading world religions in terms of adherents, geographical distribution, and socio-cultural influence. While largely an "Eastern" religion, it is becoming increasingly popular and influential in the Western world. It is a unique world religion in its own right, though it has much in common with Hinduism in that both teach Karma (cause-and-effect ethics), Maya (the illusory nature of the world), and Samsara (the cycle of reincarnation). Buddhists believe that the ultimate goal in life is to achieve "enlightenment" as they perceive it.

Buddhism's founder, Siddhartha Guatama, was born into royalty in Nepal around 600 B.C. As the story goes, he lived luxuriously, with little exposure to the outside world. His parents intended for him to be spared from the influence of religion and protected from pain and suffering. However, it was not long before his shelter was penetrated, and he had visions of an aged man, a sick man, and a corpse. His fourth vision was of a peaceful ascetic monk (one who denies luxury and comfort). Seeing the monk's peacefulness, he decided to become an ascetic himself. He abandoned his life of wealth and affluence to pursue enlightenment through austerity.

He was skilled at this sort of self-mortification and intense meditation. He was a leader among his peers. Eventually, his efforts culminated in one final gesture. He "indulged" himself with one bowl of rice and then sat beneath a fig tree (also called the Bodhi tree) to meditate till he either reached "enlightenment" or died trying. Despite his travails and temptations, by the next morning, he had achieved enlightenment. Thus, he became known as the 'enlightened one' or the 'Buddha.' He took his new realization and began to teach his fellow monks, with whom he had already gained great influence. Five of his peers became the first of his disciples.

What had Gautama discovered? Enlightenment lay in the "middle way," not in luxurious indulgence or self-mortification. Moreover, he discovered what would become known as the 'Four Noble Truths'—1) to live is to suffer (Dukha), 2) suffering is caused by desire (Tanha, or "attachment"), 3) one can eliminate suffering by eliminating all attachments, and 4) this is achieved by following the noble eightfold path. The "eightfold path" consists of having a right 1) view, 2) intention, 3) speech, 4) action, 5) livelihood (being a monk), 6) effort (properly direct energies), 7) mindfulness (meditation), and 8) concentration (focus).

The Buddha's teachings were collected into the Tripitaka or "three baskets." Behind these distinguishing teachings are teachings common to Hinduism, namely reincarnation, karma, Maya, and a tendency to understand reality as being pantheistic in its orientation. Buddhism also offers an elaborate theology of deities and exalted beings. However, like Hinduism, Buddhism can be hard to pin down as to its view of God. Some streams of Buddhism could legitimately be called atheistic, while others could be called pantheistic, and still others theistic, such as Pure Land Buddhism. Classical Buddhism, however, tends to be silent on the reality of an ultimate being and is therefore considered atheistic.

Buddhism today is quite diverse. It is roughly divisible into the two broad categories of Theravada (small vessel) and Mahayana (large vessel). Theravada is the monastic form which reserves ultimate enlightenment and nirvana for monks, while Mahayana Buddhism extends this goal of enlightenment to the laity as well, that is, to non-monks. Within these categories can be found numerous branches including Tendai, Vajrayana, Nichiren, Shingon, Pure Land, Zen, and Ryobu, among others. Therefore it is important for outsiders seeking to understand Buddhism not to presume to know all the details of a particular school of Buddhism when all they have studied is classical, historic Buddhism.

The Buddha never considered himself to be a god or any type of divine being. Rather, he considered himself to be a 'way-shower' for others. Only after his death was he exalted to god status by some of his followers, though not all of his followers viewed him that way. With Christianity however, it is stated quite clearly in the Bible that Jesus was the Son of God (Matthew 3:17: "And a voice from heaven said, 'This is my Son, whom I love; with him I am well pleased'") and that He and God are one (John 10:30). One cannot rightfully consider himself or herself a Christian without professing faith in Jesus as God.

Jesus taught that He is the way and not simply one who showed the way as John 14:6 confirms: "I am the way, the truth, and the life. No one comes to the Father except by me." By the time Guatama died, Buddhism had become a major influence in India; three hundred years later, Buddhism had encompassed most of Asia. The scriptures and sayings attributed to the Buddha were written about four hundred years after his death. In Buddhism, sin is largely understood to be ignorance. And, while sin is understood as "moral error," the context in which "evil" and "good" are understood is amoral. Karma is understood as nature's balance and is not personally enforced. Nature is not moral; therefore, karma is not a moral code, and sin is not ultimately immoral.

Thus, we can say, by Buddhist thought, that our error is not a moral issue since it is ultimately an impersonal mistake, not an interpersonal violation. The consequence of this understanding is devastating. For the Buddhist, sin is more akin to a misstep than a transgression against the nature of holy God. This understanding of sin does not accord with the innate moral consciousness that men stand condemned because of their sin before a holy God (Romans 1-2). Since it holds that sin is an impersonal and fixable error, Buddhism does not agree with the doctrine of depravity, a basic doctrine of Christianity.

The Bible tells us man's sin is a problem of eternal and infinite consequence. In Buddhism, there is no need for a Savior to rescue people from their damning sins. For the Christian, Jesus is the only means of rescue from eternal damnation. For the Buddhist there is only ethical living and meditative appeals to exalted beings for the hope of perhaps achieving enlightenment and ultimate Nirvana. More than likely, one will have to go through a number of reincarnations to pay off his or her vast accumulation of karmic debt. For the true followers of Buddhism, the religion is a philosophy of morality and ethics, encapsulated within a life of renunciation of the ego-self. In Buddhism, reality is impersonal and non-relational; therefore, it is not loving.

Not only is God seen as illusory, but, in dissolving sin into non-moral error and by rejecting all material reality as maya ("illusion"), even we ourselves lose our "selves." Personality itself becomes an illusion. When asked how the world started, who/what created the universe, the Buddha is said to have kept silent because in Buddhism there is no beginning and no end. Instead, there is an endless circle of birth and death. One would have to ask what kind of Being created us to live, endure so much pain and suffering, and then die over and over again? It may cause one to contemplate, what is the point, why bother? Christians know that God sent His Son to die for us, one time, so that we do not have to suffer for an eternity. He sent His Son to give us the knowledge that we are not alone and that we are loved.

Christians know there is more to life than suffering, and dying, "… but it has now been revealed through the appearing of our Savior, Christ Jesus, who has destroyed death and has brought life and immortality to light through the gospel" (2 Timothy 1:10). Buddhism teaches that Nirvana is the highest state of being, a state of pure being, and it is achieved by means relative to the individual. Nirvana defies rational explanation and logical ordering and therefore cannot be taught, only realized. Jesus' teaching on heaven, in contrast, was quite specific.

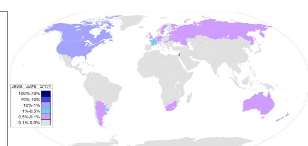
He taught us that our physical bodies die but our souls ascend to be with Him in heaven (Mark 12:25). The Buddha taught that people do not have individual souls, for the individual self or ego is an illusion. For Buddhists there is no merciful Father in heaven who sent His Son to die for our souls, for our salvation, to provide the way for us to reach His glory. Ultimately, that is why Buddhism is to be rejected.

6 Judaism

Judaism is the religion of the Jewish people. It is an ancient, monotheistic, Abrahamic religion with the Torah as its foundational text. It encompasses the religion, philosophy, and culture of the Jewish people. Judaism is considered by religious Jews to be the expression of the covenant that God established with the Children of Israel. Judaism is characterized by a belief in one transcendent God who revealed himself to Abraham, Moses, and the Hebrew prophets and by a religious life in accordance with Scriptures and rabbinic traditions. Judaism is the complex phenomenon of a total way of life for the Jewish people, comprising theology, law, and innumerable cultural traditions. The various teachings of Judaism have often been regarded as specifications of the central idea of monotheism. One God, the creator of the world, has freely elected the Jewish people for a unique covenantal relationship with himself.

This one and only God has been affirmed by virtually all professing Jews in a variety of ways throughout the ages. Jewish monotheism has had both universalistic and particularistic features. Along universal lines, it has affirmed a God who created and rules the entire world and who at the end of history will redeem all Israel (the classical name for the Jewish people), all humankind, and indeed the whole world. The ultimate goal of all nature and history is an unending reign of cosmic intimacy with God, entailing universal justice and peace. Between creation and redemption lies the particularistic designation of the Jewish people as the locus of God's activity in the world, as the people chosen by God to be "a kingdom of priests and a holy nation" (Exodus 19:6). This arrangement is designated a covenant and is structured by an elaborate and intricate law. Thus, the Jewish people are both entitled to special privileges and burdened with special responsibilities from God.

Geographic Positioning
Countries with the greatest proportion of Jews (as of 2016[n])



Largest Jewish Populations[n]	Israel	United States	France	Canada	United Kingdom	Argentina	Russia	Germany	Australia	Brazil	South Africa
	6,336,400	5,700,000	460,000	388,000	290,000	180,700	179,500	117,000	113,000	94,200	69,500

History
Israelite tradition identified YHWH (by scholarly convention pronounced Yahweh), the God of Israel, with the creator of the world, who had been known and worshipped from the beginning of time. Abraham did not discover this God but entered into a new covenantal relationship with him, in which Abraham was promised the land of Canaan and numerous progeny. God fulfilled that promise, it is believed, through the actions of the Hebrew leader Moses (14th–13th century BCE): he liberated the people of Israel from Egypt, imposed covenantal obligations on them at Mt. Sinai, and brought them to the Promised Land.

What is Judaism?

What is Judaism, and who or what is a Jew? Is Judaism simply a religion? Is it a cultural identity or just an ethnic group? Are Jews a clan of people or are they a nation? What do Jews believe, and do they all believe the same things?

Dictionary definitions of a "Jew" include "a member of the tribe of Judah," "an Israelite," "a member of a nation existing in the land of Israel from the 6th century B.C. to the 1st century A.D.," "a person belonging to a continuation through descent or conversion of the ancient Jewish people," and "one whose religion is Judaism."

According to rabbinical Judaism, a Jew is one who has a Jewish mother or one who has formally converted to Judaism. Leviticus 24:10 is often cited to give this belief credibility, although the Torah makes no specific claim in support of this tradition. Some rabbis say that it has nothing to do with what the individual actually believes. These rabbis tell us that a Jew does not need to be a follower of Jewish laws and customs to be considered Jewish.

In fact, a Jew can have no belief in God at all and still be Jewish based on the above rabbinical interpretation. Other rabbis make it clear that unless the person follows the precepts of the Torah and accepts the "Thirteen Principles of Faith" of Maimonides (Rabbi Moshe ben Maimon, one of the greatest medieval Jewish scholars), he cannot be a Jew. Although this person may be a "biological" Jew, he has no real connection to Judaism.

In the Torah—the first five books of the Bible—Genesis 14:13 teaches that Abram, commonly recognized as the first Jew, was described as a "Hebrew." The name "Jew" comes from the name of Judah, one of the twelve sons of Jacob and one of the twelve tribes of Israel. Apparently the name "Jew" originally referred only to those who were members of the tribe of Judah, but when the kingdom was divided after the reign of Solomon (1 Kings 12), the term referred to anyone in the kingdom of Judah, which included the tribes of Judah, Benjamin, and Levi. Today, many believe that a Jew is anyone who is a physical descendant of Abraham, Isaac, and Jacob, regardless of which of the original twelve tribes he descends from.

So, what is it that Jews believe, and what are the basic precepts of Judaism? There are five main forms or sects of Judaism in the world today. They are Orthodox, Conservative, Reformed, Reconstructionist, and Humanistic. The beliefs and requirements in each group differ dramatically; however, a short list of the traditional beliefs of Judaism would include the following:
- God is the creator of all that exists; He is one, incorporeal (without a body), and He alone is to be worshiped as absolute ruler of the universe.
- The first five books of the Hebrew Bible were revealed to Moses by God. They will not be changed or augmented in the future.
- God has communicated to the Jewish people through prophets.
- God monitors the activities of humans; He rewards individuals for good deeds and punishes evil.

Although Christians base much of their faith on the same Hebrew Scriptures as Jews do, there are major differences in belief: Jews generally consider actions and behavior to be of primary importance; beliefs come out of actions. This conflicts with conservative Christians for whom belief is of primary importance and actions are a result of that belief.

- Jewish belief does not accept the Christian concept of original sin (the belief that all people have inherited Adam and Eve's sin when they disobeyed God's instructions in the Garden of Eden).
- Judaism affirms the inherent goodness of the world and its people as creations of God.
- Jewish believers seek to sanctify their lives and draw closer to God by fulfilling mitzvoth (divine commandments).
- Judaism says that no savior is needed or is available as an intermediary.
- The 613 commandments found in Leviticus and other books regulate all aspects of Jewish life. The Ten Commandments, as delineated in Exodus 20:1-17 and Deuteronomy 5:6-21, form a brief synopsis of the Law.

According to Judaism, the Messiah "anointed one of God" will arrive in the future and gather Jews once more into the land of Israel. There will be a general resurrection of the dead at that time. The Jerusalem temple, destroyed in AD 70 by the Romans, will be rebuilt. Beliefs about Jesus vary considerably. Some view Him as a great moral teacher. Others see Him as a false prophet or as an idol of Christianity. Some sects of Judaism will not even say His name due to the prohibition against saying an idol's name.

The Jews are often referred to as God's chosen people. This does not mean that they are in any way to be considered superior to other groups. Bible verses such as Exodus 19:5 simply state that God has selected Israel to receive and study the Torah, to worship God only, to rest on the Sabbath, and to celebrate the festivals. Jews were not chosen to be better than others; they were simply selected to be a light to the Gentiles and to be a blessing to all the nations.

7 Atheism

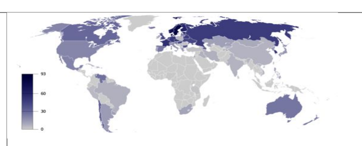
Atheism is the absence of belief in any Gods or spiritual beings. The word Atheism comes from a, meaning without, and theism meaning belief in god or gods. Atheists don't use God to explain the existence of the universe. Atheists say that human beings can devise suitable moral codes to live by without the aid of Gods or scriptures. What are the implications for a religious atheist? Without God, he arrives at the necessary philosophies of moral relativism and naturalism. But does his view line up with objective reality? And is there any evidence for a God?

Atheist Reasoning
- They find insufficient evidence to support any religion.
- They think that religion is nonsensical.
- They once had a religion and have lost faith in it.
- They live in a non-religious culture.
- Religion doesn't interest them.
- Religion doesn't seem relevant to their lives.
- Religions seem to have done a lot of harm in the world.
- The world is such a bad place that there can't be a God.

Strong Atheism
The strong atheist, also known as an explicit atheist or a positive atheist, denies the existence of God or any other deities. This person's views are based solely on what can be found to be true using the scientific method. Since the existence of God cannot be proven using science, the strong atheist concludes that God doesn't exist.

Weak Atheism
The second type of atheist is the weak atheist, also known as an implicit atheist or a negative atheist. This person does not deny the existence of God outright, but rather claims a religious relativism. That is, she would claim that anyone's belief can be true for that person, but she doesn't believe in God herself.

Geographic Positioning
Countries with the greatest proportion of people without religion (including agnostics and atheists) from Irreligion by country. (as of 2007[n])



Atheist Criticisms of Religion
Not all atheists are hostile to religion, but many do think that religion is errant. Here are some of their reasons:
- Religion gets people to believe something untrue.
- Religion makes people base the way they run their lives on a falsehood.
- Religion stops people thinking in a rational and objective way.
- Religion forces people to rely on outside authority, rather than becoming self-reliant.
- Religion imposes irrational rules of good and bad behaviour.
- Religion divides people, and is a cause of conflict and war.
- The hierarchical structure of most religions is anti-democratic, and thus offends basic human rights.
- Religion doesn't give equal treatment to women and gay people, and thus offends basic human rights.
- Religion obstructs scientific research.
- Religion wastes time and money.

Most atheists willingly concede there are some good things about religion, such as:	● Religious art and music ● Religious charities and good works ● Much religious wisdom and scripture ● Human fellowship and togetherness

What is Atheism?

Atheism is the view that God does not exist. Atheism is not a new development. Psalm 14:1, written by David around 1000 B.C., mentions atheism: “The fool says in his heart, ‘There is no God.’” Recent statistics show an increasing number of people claiming to be atheists, up to 10 percent of people worldwide. So why are more and more people becoming atheists? Is atheism truly the logical position atheists claim it to be?

Why does atheism even exist? Why doesn’t God simply reveal Himself to people, proving that He exists? Surely if God would just appear, the thinking goes, everyone would believe in Him! The problem here is that it is not God’s desire to just convince people that He exists. It is God’s desire for people to believe in Him by faith (2 Peter 3:9) and accept by faith His gift of salvation (John 3:16). God clearly demonstrated His existence many times in the Old Testament (Genesis 6-9; Exodus 14:21-22; 1 Kings 18:19-31). Did the people believe that God exists? Yes. Did they turn from their evil ways and obey God? No. If a person is not willing to accept God’s existence by faith, then he/she is definitely not ready to accept Jesus Christ as Savior by faith (Ephesians 2:8-9). God’s desire is for people to become Christians, not just theists (those who believe God exists).

The Bible tells us that God’s existence must be accepted by faith. Hebrews 11:6 declares, “And without faith it is impossible to please God, because anyone who comes to Him must believe that He exists and that He rewards those who earnestly seek Him.” The Bible reminds us that we are blessed when we believe and trust in God by faith: “Then Jesus told him, ‘Because you have seen me, you have believed; blessed are those who have not seen and yet have believed’” (John 20:29).

The existence of God must be accepted by faith, but this does not mean belief in God is illogical. There are many good arguments for the existence of God. The Bible teaches that God’s existence is clearly seen in the universe (Psalm 19:1-4), in nature (Romans 1:18-22), and in our own hearts (Ecclesiastes 3:11). With all that said, the existence of God cannot be proven; it must be accepted by faith. At the same time, it takes just as much faith to believe in atheism. To make the absolute statement “God does not exist” is to make a claim of knowing absolutely everything there is to know about everything and of having been everywhere in the universe and having witnessed everything there is to be seen.

Of course, no atheist would make these claims. However, that is essentially what they are claiming when they state that God absolutely does not exist. Atheists cannot prove that God does not, for example, live in the center of the sun, a higher dimension or beneath the clouds of Jupiter, or even in some distant nebula. Since those places are beyond our capacity to observe, it cannot be proven that God does not exist. It takes just as much faith to be an atheist as it does to be a theist.

Atheism cannot be proven, and God’s existence must be accepted by faith. Obviously, Christians believe strongly that God exists, and admit that God’s existence is a matter of faith. At the same time, we reject the idea that belief in God is illogical. We believe that God’s existence can be clearly seen, keenly sensed, and proven to be philosophically and scientifically necessary. “The heavens declare the glory of God; the skies proclaim the work of his hands. Day after day they pour forth speech; night after night they display knowledge. There is no speech or language where their voice is not heard. Their voice goes out into all the earth, their words to the ends of the world” (Psalm 19:1-4).

Atheist Reasons

These are the most common reasons why people are atheists.

Intellectual	Most atheists would offer some of the following arguments as their reason for deciding that God doesn't exist.
Non-Intellectual	Many people are atheists because of the way they were brought up or educated, or because they have simply adopted the beliefs of the culture in which they grew up. So someone raised in Communist China is likely to have no belief in God because the education system and culture make being an atheist the natural thing to do. Other people are atheists because they just feel that atheism is right.

"*It is wrong always, everywhere, and for anyone to believe anything upon insufficient evidence.*"
W. K. Clifford (1879)

Many are atheists because they think there is no evidence for God's existence - or at least no reliable evidence. They argue that a person should only believe in things for which they have good evidence. These people just haven't done their homework on Christianity yet, and other religions have no actual evidence of their god being outside of space and time.

Fortunately the Bible is overflowing with evidence, you just need to take the time to find it. Head to the Christianity > Evidence for God section for starters. In the same way an author of a book signs their name, God too shows His authenticity of His word throughout the pages. He doesn't expect us to 'blindly' believe in His existance which is why throughout the Bible it says that: "The heavens declare the glory of God; And the firmament shows His handiwork." Psalm 19:1.

Scientific Explanation	Atheists argue that because everything in the universe can be explained in a satisfactory way without using God as part of the explanation, then there is no point in saying that God exists.
Occam's Razor	The argument is based on a philosophical idea called Occam's Razor, popularised by William of Occam in the 14th century. In Latin it goes Pluralitas non est ponenda sine necessitate or in English... "Entities should not be multiplied unnecessarily".

This is usually summarised to say that the simplest answer is usually the best answer. Therefore atheists might argue that since the entire universe, and all of creation can be 'explained' by evolution and scientific cosmology, we don't need the existence of another entity called God. Unfortunately this is not one of those times where Occam's Razor applies because God is an eternal, complex being. He cannot be explained by us with our limited minds.

In summary, if Atheists are right and there is no God or afterlife, Christians lose Nothing. But if Christians are right and there is a God and an afterlife, Atheists lose Everything. You want to be absoutely sure in your conviction before following either.

8 Quotes

These are quotes to help you through tough times or to take your mind of your present situation.

Sayings & Quotes

"In a mad world, only the mad are sane." **Akiro Kurosawa**	"Hunger, love, pain, fear are some of those inner forces which rule the individual's instinct for self preservation." **Albert Einstein**	"You don't know if you're going to be rescued in a day or a month; gotta prepare for the long haul; gotta make the place your home." **Matt Graham**	"The man who goes afoot, prepared to camp anywhere and in any weather, is the most independent fellow on earth." **Horace Kephart**	"And while the law of competition may be sometimes hard for the individual, it is best for the race, because it ensures the survival of the fittest in every department." **Andrew Carnegie**	"Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe to assure the survival and the success of liberty." **John F. Kennedy**
"All I'm trying to do is not join my ancestral spirits just yet." **Joshua Nkomo**	"Through humour, you can soften some of the worst blows that life delivers. And once you find laughter, no matter how painful your situation might be, you can survive it." **Bill Cosby**	"Perhaps catastrophe is the natural human environment, and even though we spend a good deal of energy trying to get away from it, we are programmed for survival amid catastrophe." **Germaine Greer**	"It is not the strongest of the species that survives, nor the most intelligent, but rather the one most adaptable to change." **Charles Darwin**	"If you don't have a vision for the future, then your future is threatened to be a repeat of the past." **A. R. Bernard**	"People who are too weak to follow their own dreams, will always find a way to discourage yours." **Unknown**
"The rules of survival never change, whether you're in a desert or in an arena." **Bear Grylls**	"By failing to prepare, you are preparing to fail." **Benjamin Franklin**	"Extinction is the rule. Survival is the exception." **Carl Sagan**			

Prepper Quotes

"Preparedness is the ultimate confidence builder." **Vince Lombardi**	"Peace is our goal but preparedness is the price we must pay." **Omar N Bradley**	"Chance favours the prepared mind." **Louis Pasteur**	"An ounce of prevention is worth a pound of cure." **Benjamin Franklin**	"Government is the great fiction, through which everybody endeavours to live at the expense of everybody else." **Frederie Bastiat**	"Two is one and one is none." **Navy Seals**
"There's no harm in hoping for the best as long as you're prepared for the worst." **Stephen King**	"Despair is most often the offspring of ill-preparedness." **Don Williams Jr**	"For tomorrow belongs to the people who prepare for it today." **African Proverb**	"When disaster strikes, the time to prepare has passed." **Steve Cyros**	"I'd rather prep 10 years too early than 10 minutes too late." **Prepperzine**	

9 Ethics

This section contains the different values of various groups throughout history such as America, cowboys and pirates.

Subheadings

		1. War Crimes	2. The Constitution	3. Hobo Ethical Code	4. The Code of the West
		5. Knight's Code	6. Pirates Code	7. Thieves Code	

1 War Crimes

War crimes are serious violations of the rules of customary and treaty law concerning international humanitarian law that have become accepted as criminal offenses for which there is individual responsibility. Colloquial definitions of war crime include violations of established protections of the laws of war, but also include failures to adhere to norms of procedure and rules of battle, such as attacking those displaying a peaceful flag of truce, or using that same flag as a ruse to mount an attack on enemy troops. The use of chemical and biological weapons in warfare are also prohibited by numerous chemical arms control agreements and the Biological Weapons Convention. Wearing enemy uniforms or civilian clothes to infiltrate enemy lines for espionage or sabotage missions is a legitimate ruse of war, though fighting in combat or assassinating individuals behind enemy lines while so disguised is not, as it constitutes unlawful perfidy. Attacking enemy troops while they are being deployed by way of a parachute is not a war crime. However, Protocol I, Article 42 of the Geneva Conventions explicitly forbids attacking parachutists who eject from disabled aircraft and surrendering parachutists once landed. These can be used to find places of shelter which are less likely to be attacked such as medical ships.

1 Grave breaches of the Geneva Conventions, such as:

1. Willful killing, or causing great suffering or serious injury to body or health
2. Torture or inhumane treatment
3. Unlawful wanton destruction or appropriation of property
4. Forcing a prisoner of war to serve in the forces of a hostile power
5. Depriving a prisoner of war of a fair trial
6. Unlawful deportation, confinement or transfer
7. Taking hostages
8. Directing attacks against civilians
9. Directing attacks against humanitarian workers or UN peacekeepers
10. Killing a surrendered combatant
11. Misusing a flag of truce
12. Settlement of occupied territory
13. Deportation of inhabitants of occupied territory
14. Using poison weapons
15. Using civilians as shields
16. Using child soldiers
17. Firing upon a Combat Medic with clear insignia.

2	The following acts as part of a non-international conflict:
	1. Murder, cruel or degrading treatment and torture 2. Directing attacks against civilians, humanitarian workers or UN peacekeepers
3	The following acts as part of an international conflict:
	1. Taking hostages 2. Summary execution 3. Pillage 4. Rape, sexual slavery, forced prostitution or forced pregnancy

2 The American Constitution

Articles of Confederation

1	Establishes the name of the confederation with these words: "The stile of this confederacy shall be 'The United States of America.'"
2	Asserts the sovereignty of each state, except for the specific powers delegated to the confederation government: "Each state retains its sovereignty, freedom, and independence, and every power, jurisdiction, and right, which is not by this Confederation expressly delegated."
3	Declares the purpose of the confederation: "The said States hereby severally enter into a firm league of friendship with each other, for their common defence, the security of their liberties, and their mutual and general welfare, binding themselves to assist each other, against all force offered to, or attacks made upon them, or any of them, on account of religion, sovereignty, trade, or any other pretense whatever."
4	Elaborates upon the intent "to secure and perpetuate mutual friendship and intercourse among the people of the different States in this union," and to establish equal treatment and freedom of movement for the free inhabitants of each state to pass unhindered between the states, excluding "paupers, vagabonds, and fugitives from justice." All these people are entitled to equal rights established by the state into which they travel. If a crime is committed in one state and the perpetrator flees to another state, he will be extradited to and tried in the state in which the crime was committed.
5	Allocates one vote in the Congress of the Confederation (the "United States in Congress Assembled") to each state, which is entitled to a delegation of between two and seven members. Members of Congress are to be appointed by state legislatures. No congressman may serve more than three out of any six years.
6	Only the central government may declare war, or conduct foreign political or commercial relations. No state or official may accept foreign gifts or titles, and granting any title of nobility is forbidden to all. No states may form any sub-national groups. No state may tax or interfere with treaty stipulations already proposed. No state may wage war without permission of Congress, unless invaded or under imminent attack on the frontier; no state may maintain a peacetime standing army or navy, unless infested by pirates, but every State is required to keep ready, a well-trained, disciplined, and equipped militia.
7	Whenever an army is raised for common defence, the state legislatures shall assign military ranks of colonel and below.
8	Expenditures by the United States of America will be paid with funds raised by state legislatures, and apportioned to the states in proportion to the real property values of each.
9	Powers and functions of the United States in Congress Assembled: ● Grants to the United States in Congress assembled the sole and exclusive right and power to determine peace and war; to exchange ambassadors; to enter into treaties and alliances, with some provisos; to establish rules for deciding all cases of captures or prizes on land or water; to grant letters of marque and reprisal (documents authorizing privateers) in times of peace; to appoint courts for the trial of pirates and crimes committed on the high seas; to establish courts for appeals in all cases of captures, but no member of Congress may be appointed a judge; to set weights and measures (including coins), and for Congress to serve as a final court for disputes between states. ● The court will be composed of jointly appointed commissioners or Congress shall appoint them. Each commissioner is bound by oath to be impartial. The court's decision is final. ● Congress shall regulate the post offices; appoint officers in the military; and regulate the armed forces. The United States in Congress assembled may appoint a president who shall not serve longer than one year per three-year term of the Congress.
	● Congress may request requisitions (demands for payments) from the states in proportion with their population, or take credit. ● Congress may not declare war, enter into treaties and alliances, appropriate money, or appoint a commander in chief without nine states assented. Congress shall keep a journal of proceedings and adjourn for periods not to exceed six months.
10	When Congress is in recess, any of the powers of Congress may be executed by "The committee of the states, or any nine of them", except for those powers of Congress which require nine states in Congress to execute.
11	If Canada (referring to the British Province of Quebec) accedes to this confederation, it will be admitted. No other colony could be admitted without the consent of nine states.
12	Reaffirms that the Confederation accepts war debt incurred by Congress before the existence of the Articles.
13	Declares that the Articles shall be perpetual, and may be altered only with the approval of Congress and the ratification of all the state legislatures.

Constitution Amendments

1st	Prohibits Congress from making any law respecting an establishment of religion, impeding the free exercise of religion, abridging the freedom of speech, infringing on the freedom of the press, interfering with the right to peaceably assemble or prohibiting the right to petition the government.
2nd	Protects the right to keep and bear arms.
3rd	Places restrictions on the quartering of soldiers in private homes.
4th	Prohibits unreasonable searches and seizures and sets out requirements for search warrants based on probable cause.
5th	Sets out rules for indictment by grand jury and eminent domain, protects the right to due process, and prohibits self-incrimination and double jeopardy.
6th	Protects the right to a fair and speedy public trial by jury, including the rights to be notified of the accusations, to confront the accuser, to obtain witnesses and to retain counsel.
7th	Provides for the right to trial by jury in certain civil cases, according to common law.

8th	Prohibits excessive fines and excessive bail, as well as cruel and unusual punishment.
9th	Protects rights not enumerated in the Constitution.
10th	Reinforces the principle of federalism by stating that the federal government possesses only those powers delegated to it by the states or the people through the Constitution.
11th	Makes states immune from suits from out-of-state citizens and foreigners not living within the state borders; lays the foundation for state sovereign immunity.
12th	Revises presidential election procedures by having the president and vice president elected together as opposed to the vice president being the runner up in the presidential election.
13th	Abolishes slavery, and involuntary servitude, except as punishment for a crime.
14th	Defines citizenship, contains the Privileges or Immunities Clause, the Due Process Clause, the Equal Protection Clause, and deals with post–Civil War issues.
15th	Prohibits the denial of the right to vote based on race, colour or previous condition of servitude.
16th	Permits Congress to levy an income tax without apportioning it among the various states or basing it on the United States Census.
17th	Establishes the direct election of United States senators by popular vote.
18th	Prohibited the manufacturing or sale of alcohol within the United States. (Repealed December 5, 1933, via the 21st Amendment)
19th	Prohibits the denial of the right to vote based on sex.
20th	Changes the date on which the terms of the president and vice president and of members of Congress end and begin (to January 20 and January 3 respectively). States that if the president-elect becomes vacant, the vice president-elect is inaugurated as president in their place.
21st	Repeals the 18th Amendment and makes it a federal offense to transport or import intoxicating liquors into U.S. states and territories where such transport or importation is prohibited by the laws of those states and territories.
22nd	Limits the number of times that a person can be elected president: a person cannot be elected president more than twice, and a person who has served more than two years of a term to which someone else was elected cannot be elected more than once.
23rd	Grants the District of Columbia electors in the Electoral College, their number being not more than those of the least populous state.
24th	Prohibits the revocation of voting rights due to the non-payment of a poll tax or any other tax.
25th	Addresses succession to the presidency and establishes procedures both for filling a vacancy in the office of the vice president, as well as responding to presidential disabilities.
26th	Prohibits the denial of the right of US citizens, eighteen years of age or older, to vote on account of age.
27th	Delays laws affecting Congressional salary from taking effect until after the next election of representatives.

3 Hobo Ethical Code

This is the now outdated hobo code which was used in the 1800's-1900's.

1	Decide your own life, don't let another person run or rule you.
2	When in town, always respect the local law and officials, and try to be a gentleman at all times.
3	Don't take advantage of someone who is in a vulnerable situation, locals or other hobos.
4	Always try to find work, even if temporary, and always seek out jobs nobody wants. By doing so you not only help a business along, but ensure employment should you return to that town again.
5	When no employment is available, make your own work by using your added talents at crafts.
6	Do not allow yourself to become a stupid drunk and set a bad example for locals' treatment of other hobos.
7	When jungling in town, respect handouts, do not wear them out, another hobo will be coming along who will need them as badly, if not worse than you.
8	Always respect nature, do not leave garbage where you are jungling.
9	If in a community jungle, always pitch in and help.
10	Try to stay clean, and boil up wherever possible.
11	When travelling, ride your train respectfully, take no personal chances, cause no problems with the operating crew or host railroad, act like an extra crew member.
12	Do not cause problems in a train yard, another hobo will be coming along who will need passage through that yard.
13	Do not allow other hobos to molest children, expose all molesters to authorities, they are the worst garbage to infest any society.
14	Help all runaway children, and try to induce them to return home.
15	Help your fellow hobos whenever and wherever needed, you may need their help someday.
16	If present at a hobo court and you have testimony, give it. Whether for or against the accused, your voice counts!

4 The Code of the West

This is the code of the wild west which cowboys used to adhere to.

1	Don't inquire into a person's past. Take the measure of a man for what he is today.
2	Never steal another man's horse. A horse thief pays with his life.
3	Defend yourself whenever necessary.
4	Look out for your own.
5	Remove your guns before sitting at the dining table.
6	Never order anything weaker than whiskey.
7	Don't make a threat without expecting dire consequences.
8	Never pass anyone on the trail without saying "Howdy".
9	When approaching someone from behind, give a loud greeting before you get within shooting range.
10	Don't wave at a man on a horse, as it might spook the horse. A nod is the proper greeting.
11	After you pass someone on the trail, don't look back at him. It implies you don't trust him.
12	Riding another man's horse without his permission is nearly as bad as making love to his wife. Never even bother another man's horse.
13	Always fill your whiskey glass to the brim.
14	A cowboy doesn't talk much; he saves his breath for breathing.
15	No matter how weary and hungry you are after a long day in the saddle, always tend to your horse's needs before your own, and get your horse some feed before you eat.
16	Cuss all you want, but only around men, horses and cows.
17	Complain about the cooking and you become the cook.
18	Always drink your whiskey with your gun hand, to show your friendly intentions.
19	Do not practice ingratitude.
20	A cowboy is pleasant even when out of sorts. Complaining is what quitters do, and cowboys hate quitters.
21	Always be courageous. Cowards aren't tolerated in any outfit worth its salt.
22	A cowboy always helps someone in need, even a stranger or an enemy.
23	Never try on another man's hat.
24	Be hospitable to strangers. Anyone who wanders in, including an enemy, is welcome at the dinner table. The same was true for riders who joined cowboys on the range.
25	Give your enemy a fighting chance.
26	Never wake another man by shaking or touching him, as he might wake suddenly and shoot you.
27	Real cowboys are modest. A braggert who is "all gurgle and no guts" is not tolerated. Be there for a friend when he needs you.
28	Drinking on duty is grounds for instant dismissal and blacklisting.
29	A cowboy is loyal to his "brand," to his friends, and those he rides with.
30	Never shoot an unarmed or unwarned enemy. This was also known as "the rattlesnake code": always warn before you strike. However, if a man was being stalked, this could be ignored.
31	Never shoot a woman no matter what.
32	Consideration for others is central to the code, such as: Don't stir up dust around the chuck wagon, don't wake up the wrong man for herd duty, etc.
33	Respect the land and the environment by not smoking in hazardous fire areas, disfiguring rocks, trees, or other natural areas.
34	Honesty is absolute – your word is your bond, a handshake is more binding than a contract.
35	Live by the Golden Rule.

5 Knight's Code

The knights code of chivalry.

1	Thou shalt believe all that the Church teaches and thou shalt observe all its directions.
2	Thou shalt defend the Church.
3	Thou shalt respect all weaknesses, and shalt constitute thyself the defender of them.
4	Thou shalt love the country in which thou wast born.
5	Thou shalt not recoil before thine enemy.
6	Thou shalt make war against the infidel without cessation and without mercy.

7	Thou shalt perform scrupulously thy feudal duties, if they be not contrary to the laws of God.
8	Thou shalt never lie, and shalt remain faithful to thy pledged word.
9	Thou shalt be generous, and give largesse to everyone.
10	Thou shalt be everywhere and always the champion of the Right and the Good against Injustice and Evil.

6 Pirates Code

This is the old pirates code which they used to live by.

I	The Captain is to have two full Shares; the Quartermaster is to have one Share and one Half; The Doctor, Mate, Gunner and Boatswain, one Share and one Quarter.
II	He that shall be found guilty of taking up any Unlawful Weapon on Board the Privateer or any other prize by us taken, so as to Strike or Abuse one another in any regard, shall suffer what Punishment the Captain and the Majority of the Company shall see fit.
III	He that shall be found Guilty of Cowardice in the time of engagements, shall suffer what Punishment the Captain and the Majority of the Company shall think fit.
IV	If any Gold, Jewels, Silver, &c. be found on Board of any Prize or Prizes to the value of a Piece of Eight, & the finder do not deliver it to the Quarter Master in the space of 24 hours he shall suffer what Punishment the Captain and the Majority of the Company shall think fit.
V	He that is found Guilty of Gaming, or Defrauding one another to the value of a Royal of Plate, shall suffer what Punishment the Captain and the Majority of the Company shall think fit.
VI	He that shall have the Misfortune to lose a Limb in time of Engagement, shall have the Sum of Six hundred pieces of Eight, and remain aboard as long as he shall think fit.
VII	Good Quarters to be given when Craved.
VIII	He that sees a Sail first, shall have the best Pistol or Small Arm aboard of her.
IX	He that shall be guilty of Drunkenness in time of Engagement shall suffer what Punishment the Captain and Majority of the Company shall think fit.
X	No snapping of Guns in the Hold.

7 Thieves Code

The thieves code which may come in handy at some point.

1	Forsake his relatives--mother, father, brothers, sisters…
2	Not have a family of his own -- no wife, no children; this does not however, preclude him from having a lover.
3	Never, under any circumstances work, no matter how much difficulty this brings-, live only on means gleaned from thievery.
4	Help other thieves -- both by moral and material support, utilizing the commune of thieves.
5	Keep secret information about the whereabouts of accomplices (i.e. dens, districts, hideouts, safe apartments, etc.).
6	In unavoidable situations (if a thief is under investigation) to take the blame for someone else's crime; this buys the other person time of freedom.
7	Demand a convocation of inquiry for the purpose of resolving disputes in the event of a conflict between oneself and other thieves, or between thieves.
8	If necessary, participate in such inquiries.
9	Carry out the punishment of the offending thief as decided by the convocation.
10	Not resist carrying out the decision of punishing the offending thief who is found guilty, with punishment determined by the convocation.
11	Have good command of the thieves jargon ("Fehnay").
12	Not gamble without being abie to cover losses.
13	Teach the trade to young beginners.
14	Have, if possible, informants from the rank and file of thieves.
15	Not lose your reasoning ability when using alcohol.
16	Have nothing to do with the authorities (particularly with the ITU (Correctional Labour Authority)), not participate in public activities, nor join any community organizations.
17	Not take weapons from the hands of authorities; not serve in the military.
18	Make good on promises given to other thieves.

Entertainment

An endless source of enjoyment during disasters

"No entertainment is so cheap as reading, nor any pleasure so lasting."
Mary Wortley Montagu

Introduction

Keeping yourself entertained is vital to keeping your sanity when faced with tough situations, especially if you're alone. This collection of games, puzzles and facts should help pass the time if you need a distraction from everything going on around. Answers can be found beneath each section with a dark gray background. As this spreadsheet will most likely be viewed on mobile devices in SHTF you may need to write out the questions/riddles with chalk or on paper. To complete all of the activities below you may need a few extra items in your BOB. (See Below)

Equipment that would be handy to have for this section is:
● A Pen & Paper or Chalk (Or sticks and rocks in a pinch)
● Pack of playing cards and boards for other games.

Some games become distorted below a zoom level of 100% and others below 85% zoom. (Excel version only) Play the games zoomed into the cell or you may accidentally see the answers for the puzzle over the separator. The numbers in column "Q" are to maintain the integrity of the row for the puzzles and shouldn't be altered. In addition to this section, the rest of the sheet can be considered entertainment as you read and learn from it. Blank puzzles in the answer sections just help me create additional puzzles faster - so just ignore them.

Purpose	The aim of ENTERTAINMENT is to keep your mind alert and occupied in times of boredom with the included games and puzzles, as well as the other forms of entertainment you can set up yourself such as live plays and sport.
Lost?	● For arts and crafts, see the CRAFTING section. ● If you want to learn a language, see the LANGUAGE section. ● For a crash course in medicine, see the MEDICAL section. ● For information on the planets and space, see the METEOROLOGY section. ● If you're struggling with a chaotic world and can't see the good in it, read the RELIGION section.

Contents

1 Creative

These are activities that create something out of other materials.

Camp Skills

Creative skills you can do while in your camp.

Whittling	A very useful form of entertainment as you end up with a working item by the end, whether it's a spoon, figurine or a boat.
Building	Another useful skill to learn and improve on if you're in the woods.
Weaving	Create various items of clothing such as hats and footwear as well as shelter from the sun.

Constructive

This form of entertainment is constructive in nature and has a useful survival aspect to them.

Construction	If you have the space and resources you could build a shelter for yourself such as a log cabin.
Repairs	You could repair odd items around the house that you haven't had time to up until this point.
Securing	If your house is fairly open to attack or severe weather you could shore up its defences by building pallet-shields that can easily be fitted to cover your windows in an emergency.
Signal Fire Building	You can build a signal fire in the event you see or hear a plane nearby and want to be rescued.
Stone Stacking	You can stack and balance stones to reduce stress. Or you can stack stones in cairns as markers.

Destructive

A form of entertainment that involves destruction in one form or another.

Chopping Trees	Take the stress out on the wood and accomplish a task while doing it. Watching trees fall is also exciting.
Burning	Lighting fires can be fun, but watching them burn can be even better, just don't let it get out of control.
Fireworks	Designed to be visually spectacular through the controlled destruction of chemical compounds.
Demolition	The controlled destruction of a building which is no longer required.
Hunting	Hunting animals is as much sport as it is therapeutic and often required for survival, just don't let the animal go to waste if you do.

2 Paper Games

The simplest form of entertainment, all you need is a writing utensil and a medium to write on. Sudoku games are in the monospaced 'Courier' font to prevent character messups and have been typed out to save size.

Subheadings

1. Random Generators	**2. Sudoku**	**3. Crossword**	**4. Nonograms**
5. Bridges	**6. Nine Letter Word**	**7. Boggle**	**8. Yahtzee**

1 Random Generators

These are randomly generated numbers and letters for you to use if you don't have a die or boggle letters. All the player has to do is pick a number for both the column and row of the 'dice' they wish to use and find the corresponding value. Some tables have been formatted with extra 0's to keep them looking neat. Each table includes every number in the range at least once.

Eg: If you look at the 6 sided die table you will see it has 10x6 below it, you need to pick a number between 1-10 and 1-6 inclusive. If we pick 3 and 2, we would look for the second value on the third row which is a 5. To randomise the values even more you could swap to the next table in the sequence, alternatively you can rotate the direction you read the table from every turn.

- If you're using the letters for boggle, I recommend adding the letter "U" after "Q" to make "Qu" words easier to spell.
- If you want a dice that's not listed below such as a 50 sided die, use an existing dice (100 sided die) and multiply or divide the answer. So if you're after a 50 sided die, divide the roll of the 100 sided die by 2. You can also roll until you get a number in the range you want using a higher sided die than you require. A third option is combining the result of multiple die, so if you wanted a 7 sided die, roll the 3-sided die and the 4-sided die and combine the results.

Coin Flips

Coin Flip (0,1) 4x4 16 Values (Equal Distribution)	**Coin Flip #1**	**Coin Flip #2**	**Coin Flip #3**	**Coin Flip #4**	**Coin Flip #5**
	0 0 1 1 1 0 1 0 0 1 1 0 0 1 0 1	1 0 1 0 1 0 1 0 1 0 0 1 0 1 1 0	1 0 1 0 1 1 0 0 1 0 1 0 1 0 0 1	0 0 1 1 1 0 1 0 0 1 0 1 1 1 0 0	1 0 1 0 1 0 1 0 1 0 0 1 0 0 1 1

Dice Rolls

Die	Dice #1	Dice #2	Dice #3	Dice #4	Dice #5
3 Sided Die (1-3) 3x3 9 Values (Equal Distribution)	**3 Sided Dice #1** 2 3 1 3 2 1 1 2 3	**3 Sided Dice #2** 1 3 2 1 3 2 3 1 2	**3 Sided Dice #3** 3 2 1 1 3 2 2 3 1	**3 Sided Dice #4** 1 2 3 2 1 3 1 3 2	**3 Sided Dice #5** 3 2 1 1 2 3 1 3 2
4 Sided Die (1-4) 4x4 16 Values (Equal Distribution)	**4 Sided Dice #1** 1 4 2 3 3 4 2 1 2 3 1 4 3 1 2 4	**4 Sided Dice #2** 3 4 2 1 1 2 4 3 2 4 1 3 1 3 4 2	**4 Sided Dice #3** 3 1 4 2 3 4 2 1 2 1 3 4 1 2 4 3	**4 Sided Dice #4** 4 1 3 2 3 4 2 1 4 1 3 2 2 1 3 4	**4 Sided Dice #5** 2 1 3 4 1 2 4 3 1 4 3 2 4 2 1 3
5 Sided Die (1-5) 5x5 25 Values (Equal Distribution)	**5 Sided Dice #1** 3 5 2 1 4 2 1 3 4 5 2 4 5 3 1 2 5 3 1 4 5 3 4 1 2	**5 Sided Dice #2** 1 3 4 2 5 4 1 3 5 2 2 5 4 1 3 3 2 5 1 4 3 1 2 5 4	**5 Sided Dice #3** 2 5 4 3 1 3 5 1 2 4 4 3 1 5 2 2 1 4 5 3 5 4 2 1 3	**5 Sided Dice #4** 1 2 3 4 5 2 4 1 5 3 5 2 4 1 3 4 1 5 2 3 1 5 4 3 2	**5 Sided Dice #5** 4 2 3 5 1 2 5 1 4 3 1 3 2 4 5 3 2 1 4 5 2 1 5 3 4
6 Sided Die (1-6) 6x6 60 Values (Equal Distribution)	**6 Sided Dice #1** 4 1 2 3 6 5 6 1 2 4 3 5 6 5 1 2 4 3 4 5 3 1 6 2 1 4 6 2 3 5 4 6 5 1 2 3	**6 Sided Dice #2** 4 5 3 6 1 2 3 5 6 1 4 2 3 5 4 1 6 2 5 6 3 4 2 1 6 3 5 1 4 2 6 4 3 5 2 1	**6 Sided Dice #3** 5 2 3 4 6 1 1 2 6 5 4 3 2 4 5 3 6 1 2 1 4 3 5 6 6 5 3 4 2 1 3 4 6 5 1 2	**6 Sided Dice #4** 4 6 2 1 5 3 1 6 4 3 2 5 5 1 3 6 4 2 6 5 1 3 4 2 2 5 6 4 3 1 2 5 1 6 4 3	**6 Sided Dice #5** 6 5 3 4 1 2 4 5 2 1 3 6 1 2 5 3 6 4 5 3 1 6 4 2 2 3 5 1 4 6 2 4 1 3 5 6
8 Sided Die (1-8) 8x8 64 Values (Equal Distribution)	**8 Sided Dice #1** 8 1 3 6 7 2 4 5 7 5 4 6 8 2 3 1 3 4 5 8 7 2 6 1 3 6 1 7 2 8 5 4 3 8 4 2 6 5 1 7 8 4 6 7 1 5 2 3 6 2 8 4 7 1 5 3 6 3 5 1 7 8 2 4	**8 Sided Dice #2** 3 2 5 8 4 7 6 1 4 8 5 2 3 1 6 7 4 1 7 2 6 8 5 3 6 7 2 5 1 8 4 3 6 2 1 8 4 3 5 7 5 8 3 4 7 1 2 6 3 2 4 1 8 6 7 5 6 5 3 7 4 2 8 1	**8 Sided Dice #3** 4 2 7 5 1 3 6 8 5 7 1 6 3 8 2 4 2 4 8 6 1 5 3 7 1 6 5 2 8 3 4 7 4 2 7 8 5 6 1 3 1 2 5 6 7 4 8 3 3 5 1 7 2 8 4 6 6 1 5 4 8 3 2 7	**8 Sided Dice #4** 1 6 5 3 8 2 7 4 2 1 6 5 3 8 7 4 5 3 4 8 6 7 1 2 4 5 8 3 1 7 6 2 1 4 6 2 7 3 8 5 3 7 4 5 1 6 8 2 4 6 1 7 3 2 8 5 7 3 1 4 2 8 5 6	**8 Sided Dice #5** 8 3 1 2 4 7 5 6 3 7 1 5 6 4 2 8 8 1 2 5 6 7 4 3 4 8 3 7 6 2 5 1 8 6 3 7 2 4 1 5 6 2 4 3 8 7 5 1 1 8 3 2 4 5 6 7 2 3 8 1 6 5 7 4

Die	Dice #1	Dice #2	Dice #3
10 Sided Die (0-9) 10x10 100 Values (Equal Distribution) 0 = 10	**10 Sided Dice #1** 5 0 8 4 6 2 3 9 7 1 8 6 2 3 9 7 4 5 0 1 0 1 9 7 8 2 6 3 4 5 4 7 1 5 0 2 8 9 3 6 2 5 7 6 4 9 3 1 0 8 2 5 3 1 0 8 6 7 9 4 9 7 6 1 4 0 8 5 2 3 1 2 4 3 0 6 7 8 9 5 1 0 7 3 6 2 5 4 8 9 4 7 1 9 3 2 6 8 0 5	**10 Sided Dice #2** 8 6 1 4 2 5 3 0 7 9 4 8 0 5 1 9 7 6 2 3 4 7 8 0 5 3 2 1 9 6 0 9 1 4 5 7 6 2 8 3 9 6 1 5 8 3 7 2 0 4 8 6 3 2 5 4 9 0 1 7 4 2 9 7 5 0 3 1 8 6 7 1 9 8 0 5 6 3 4 2 7 5 3 4 9 2 8 0 6 1 0 5 8 4 6 1 3 9 7 2	**10 Sided Dice #3** 6 2 8 7 1 9 4 0 3 5 4 1 7 0 2 9 6 3 8 5 8 9 1 6 2 5 7 4 3 0 2 9 5 6 0 8 1 7 3 4 9 5 0 6 4 2 3 1 7 8 9 0 2 3 8 4 7 1 5 6 4 8 3 2 5 0 7 1 9 6 3 7 4 8 5 1 9 2 6 0 0 9 3 6 1 5 7 4 8 2 1 2 9 3 4 5 7 0 6 8

Die	Dice #1	Dice #2	Dice #3	Dice #4	Dice #5
12 Sided Die (1-12) 6x6 36 Values (Equal Distribution)	**12 Sided Dice #1** 02 08 11 07 04 05 09 03 01 12 06 10 02 06 01 07 10 05 03 09 04 08 12 11 09 12 11 10 06 01 02 05 07 04 03 08	**12 Sided Dice #2** 12 01 03 09 10 07 05 04 11 08 06 02 03 05 06 11 02 10 07 04 12 08 01 09 04 11 06 09 05 07 01 08 12 03 10 02	**12 Sided Dice #3** 04 08 02 05 03 07 06 11 09 01 12 10 06 03 01 08 02 07 09 05 11 10 12 04 07 04 02 09 11 10 03 05 01 08 06 12	**12 Sided Dice #4** 07 04 11 12 08 05 02 06 03 09 01 10 12 01 05 09 08 11 03 04 10 06 02 07 05 04 09 11 01 06 03 07 08 10 02 12	**12 Sided Dice #5** 08 09 11 03 07 02 01 12 04 06 05 10 03 08 10 07 09 04 02 05 12 06 01 11 03 12 09 06 11 02 07 05 01 08 10 04

Die	Dice #1	Dice #2	Dice #3
20 Sided Die (1-20) 10x10 100 Values (Equal Distribution)	**20 Sided Dice #1** 10 04 01 03 14 09 12 11 06 17 20 13 18 19 07 15 16 05 08 02 19 14 16 11 12 17 05 07 06 02 13 18 03 08 09 04 20 10 15 01 20 13 08 09 17 07 05 02 19 14 04 06 01 10 15 03 11 12 16 18 17 15 19 07 12 10 16 04 13 05 18 06 09 02 20 01 03 11 08 14 01 11 18 17 02 10 15 04 19 09 03 06 12 20 08 13 14 16 07 05	**20 Sided Dice #2** 01 12 18 04 06 09 05 19 07 13 03 14 08 15 17 20 10 02 11 16 15 17 14 12 19 13 16 01 07 02 20 08 10 05 09 18 06 04 03 11 18 14 20 05 04 17 03 10 13 16 11 02 06 09 15 12 19 01 08 07 16 14 06 18 02 08 15 05 04 11 01 12 17 19 07 10 20 03 13 09 11 07 17 06 15 09 19 12 18 10 13 20 08 01 04 14 16 03 02 05	**20 Sided Dice #3** 17 01 16 12 80 11 19 06 18 05 14 03 10 02 15 09 07 20 04 13 18 01 08 17 19 13 20 11 06 09 05 07 02 14 16 04 15 10 12 03 09 14 17 10 20 08 15 18 04 06 02 11 13 16 12 03 19 05 01 07 12 06 17 11 03 04 19 01 05 18 20 02 09 13 08 14 15 10 07 16 11 05 03 08 15 16 14 20 12 02 07 17 06 19 01 10 04 09 18 13
100 Sided Die (0-99) 10x10 100 Values (Equal Distribution) 00 = 100	**100 Sided Dice #1** 27 10 69 86 46 50 85 88 95 77 38 58 30 76 81 03 12 56 47 92 70 33 78 28 84 87 91 49 40 80 35 55 39 72 71 68 26 60 04 13 31 75 06 63 07 45 17 25 00 43 19 36 99 16 73 90 42 62 29 14 79 11 32 01 93 66 34 41 97 59 37 51 89 20 94 61 54 98 15 23 82 67 22 09 83 74 08 02 05 18 48 53 64 44 96 57 52 21 24 65	**100 Sided Dice #2** 38 49 94 05 23 12 20 16 79 73 07 40 48 76 62 75 11 34 85 08 47 53 92 69 90 83 87 15 61 74 35 57 97 25 24 36 67 13 81 41 55 80 65 63 18 17 52 33 58 14 46 29 21 84 51 95 72 91 78 44 54 32 42 50 66 37 82 60 22 64 98 71 09 56 19 89 02 31 86 01 39 93 04 26 43 00 45 77 59 28 88 03 10 27 96 06 70 68 99 30	**100 Sided Dice #3** 59 61 96 15 16 49 77 08 21 35 13 46 02 94 79 67 44 92 43 37 65 73 28 76 81 24 32 63 62 72 55 14 74 99 01 19 41 22 93 03 54 88 06 20 82 09 66 83 29 51 85 98 30 39 33 27 87 60 10 12 48 00 47 70 80 45 26 36 53 52 05 31 86 38 50 64 25 95 78 89 91 57 56 84 40 42 71 04 90 69 97 18 68 17 58 34 75 07 11 23

Letter Generators

ENTERTAINMENT / Paper Games / Random Generators / Letter Generators

Letter Generator (A-Z)
13x13
169 Values
(Unequal Distribution)

Letter Generator #1
```
U A Z E F Y E T U U P Z E
I U O E K X L N G F L A G
G H B M Z E C J E Y E L U
M Z C Z S L L E Y J B C P
R V S W Q H N L R G K G W
I H Z W M L T S Q W S Y Q
L R X T K S U E U Z D T J
J X F E H E V H S T K M J
G L S W J C I Q W D P P L
L J B E P O X K H R V F Q
H M T G R F V I A I X Z V
C X R G Q V L U V K K T A
Q H B K T A M T J R F R H
```

Letter Generator #2
```
Z M O V X V L S E W R N C
J G T Y U Q D F C A V O T
C M G J J I N R E H J I F
V G J L D J Z E G Z K X K
W R R Q E Y R I U A T W S
C A I K U K U J U M Y B Q
E W A Z F X C O J V B T T
L N I F O W O U B A E Q Z
N X X N D J K C A M J G Y
I Z V W Y V H C D Y I U P
D V X O U L A W P M J V T
P G A Q Q F L P R E H Y C
H T G P H O I H G L X N R
```

Letter Generator #3
```
I O D T Z C I Z V B R D V
V D O L Q H A C K A K X O
S S D G P A K B Z Q Z Z S
Z Y M S X D T V A R G T M
T N Z V E U C C Z T Z J O
K Y L D K X Z O E D R Z O
R C L L N C N N O P D I Y
U W Q C P Q M P L N D Z T
Q N Z M H U N X Y I V M A
L C B A Y Q B H J D O K N
E L F X X J J N Y J N A K
Z S L K Q F Z H J K Q C P
V R G F C L Q C E O Q P N
```

Vowel Generator
5x5
25 Values
(Equal Distribution)

Vowel Generator #1
```
A I O O I
U E U A O
E A I I A
I U U O E
E O U A E
```

Vowel Generator #2
```
I E U I A
A E O U I
I U A O U
A U O E E
I O O E A
```

Vowel Generator #3
```
O U A A O
I E A O U
U O E I A
I E U A I
O E U I E
```

Vowel Generator #4
```
I I E I U
A E A E U
U I O U A
O A O U E
E O O I A
```

Vowel Generator #5
```
I O E A E
I A A U O
U I E I U
O A I U E
A O E O U
```

Consonant Generator
8x8
64 Values
(Unequal Distribution)

Consonant Generator #1
```
W R F K Y K B B
X F R R C L L M
K H X L T F X S
N W F Z W N C S
F B T Z D N Z T
S W J P K Q Q G
P F X B J X W V
X N R D W M Y S
```

Consonant Generator #2
```
T Y V T H J J S
P L L W C L D K
M G B R B Q N Q
X L R T M B F C
W L R T Q Q G D
R C Y N C J B Z
M Y N J G K J J
Q R N V F F S J
```

Consonant Generator #3
```
N F Q C S G J P
L T F W D H D S
T V W S L M Q Z
Q C M B F J X Z
G B F M V T V W
T L Q W R B H V
S M J P M N W D
T K V V S Q P S
```

2 Sudoku

Sudoku / Paper Games

How to Play
Every Sudoku has a unique solution that can be reached logically. Enter numbers into the blank spaces so that each row, column and 3x3 box contains the numbers 1 to 9. The 1's are highlighted red and underlined in the example to the right showing that there is only one 1 per line both vertically and horizontally.

Example
```
5 8 6  4 1 2  3 7 9
1 9 2  6 3 7  5 4 8
3 7 4  9 5 8  6 2 1

9 3 8  7 6 1  2 5 4
6 5 1  2 8 4  7 9 3
2 4 7  5 9 3  8 1 7

4 6 5  3 2 9  1 8 7
8 2 9  1 7 6  4 3 5
7 1 3  8 4 5  9 6 2
```

Sudoku Puzzles (Easy)

Easy Puzzle 1
```
8 - 5  - 2 -  - 7 1
3 - 6  - 7 1  5 9 -
7 1 -  - - -  - 6 -

- - 9  - 3 -  - 5 -
- - -  - 8 -  - - -
- 6 -  - 1 -  2 - -

- 3 -  - - -  - 8 4
- 8 1  3 9 -  7 - 5
2 5 -  - 6 -  3 - 9
```

Easy Puzzle 2
```
- 8 -  - 5 2  - 9 7
5 1 3  - - 9  - - -
2 - -  - - 3  - 5 -

- - 9  5 - -  - 8 4
- - -  4 6 8  - - -
3 4 -  - - 7  6 - -

- 5 -  3 - -  - - 1
- - -  9 - -  5 7 6
7 6 -  8 1 -  - 3 -
```

Easy Puzzle 3
```
9 6 -  - - -  7 4 3
8 2 -  - 7 3  - - 6
- - -  4 - 9  - - -

- 7 -  - - 4  2 - -
- 9 -  2 5 1  - 7 -
- - 2  7 - -  - 3 -

- - -  5 - 6  - - -
5 - -  9 8 -  - 6 2
6 4 7  - - -  - 8 9
```

Easy Puzzle 4
```
- - -  - - -  - 3 8
1 - -  4 - -  9 5 -
8 5 3  9 6 1  7 - -

- - -  8 7 -  - - -
- 4 6  1 - 9  5 8 -
- - -  - 3 6  - - -

- - 5  2 1 7  8 6 9
- 7 8  - - 5  - - 2
2 6 -  - - -  - - -
```

Easy Puzzle 5
```
- - -  - - 1  - - 3
4 - 2  - 7 3  6 - -
1 - 3  - - 4  2 - -

- - -  4 - -  5 - -
3 5 6  1 - 2  4 7 9
- - 1  - - 9  - - -

- - 8  9 - -  7 - 5
- - 4  7 1 -  9 - 8
5 - -  3 - -  - - -
```

Easy Puzzle 6
```
- 6 1  8 3 -  - 2 -
- - -  - - 4  - 3 -
- 5 4  - - -  1 8 -

1 - -  - 9 2  8 - 5
- - 6  - 7 -  3 - -
7 - 5  3 4 -  - - 2

- 1 7  - - -  6 5 -
- 3 -  4 - -  - - -
- 2 -  - 5 3  4 1 -
```

Easy Puzzle 7
```
- 2 4  6 3 -  - 8 -
- - 6  4 9 -  2 - -
- 8 -  - - -  - - 3

4 - -  - - -  1 - 2
- 3 -  7 1 9  - 6 -
6 - 1  - - -  - - 8

7 - -  - - -  - 2 -
- - 9  - 2 7  5 - -
- 4 -  - 6 1  3 7 -
```

Easy Puzzle 8
```
4 5 1  7 - -  6 - -
- 6 9  - 5 -  8 - -
- - -  9 - -  1 - 4

9 4 -  - 7 -  - 6 5
5 - -  - - -  - - 9
1 7 -  - 3 -  - 8 2

2 - 8  - - 5  - - -
- - 4  - 1 -  5 3 -
- - 5  - - 6  2 4 1
```

Easy Puzzle 9
```
- 8 -  - 7 -  6 4 3
2 - 7  - - 4  - 8 -
- 6 3  9 8 -  - - 5

- 2 8  - - -  5 - -
6 - -  - - -  - - 2
- - 5  - - -  3 1 -

5 - -  - 4 9  8 3 -
- 9 -  7 - -  2 - 4
3 7 4  - 2 -  - 9 -
```

Easy Puzzle 10
```
6 4 -  - 2 -  - - 5
2 - 5  - 4 -  - - -
- - -  9 - 1  - - -

9 3 2  - - 5  7 - -
- 6 4  2 - 7  9 5 -
- - 7  8 - -  2 3 6

- - -  4 - 9  - - -
- - -  - 8 -  5 - 9
3 - -  - 1 -  - 2 4
```

Easy Puzzle 11
```
- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -
```

Easy Puzzle 12
```
- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -
```

Sudoku Puzzles (Medium)

Medium Puzzle 1
```
- 2 -  - - 6  - - 7
- 3 7  - - -  5 1 -
9 8 -  - - -  3 4 -

- - -  9 1 -  2 - -
7 - -  - - -  - - 5
- - 4  - 3 2  - - -

- 7 9  - - -  - 2 1
- 5 3  - - -  4 6 -
2 - -  8 - -  - 5 -
```

Medium Puzzle 2
```
- 4 -  - - -  - - -
6 1 -  2 3 -  - 9 -
- - 2  - - 5  1 - 3

- - 7  - 2 8  6 4 5
- - -  - - -  - - -
1 5 6  4 9 -  7 - -

3 - 1  7 - -  2 - -
- 8 -  - 5 9  - 1 7
- - -  - - -  - 8 -
```

Medium Puzzle 3
```
- - -  - - 4  - - -
7 9 -  - - 1  8 2 4
- - -  8 6 -  - - 1

8 6 -  - - 3  - - 9
9 - 2  - - -  4 - 3
3 - -  9 - -  - 5 8

1 - -  - 7 9  - - -
2 8 9  3 - -  - 1 7
- - -  1 - -  - - -
```

Medium Puzzle 4
```
- - -  - - -  6 - 4
- - -  - 8 3  1 - -
5 - 8  - 4 7  - 9 3

- - -  - - -  - - 6
7 1 -  - 6 -  - 4 5
4 - -  - - -  - - -

8 5 -  3 9 -  4 - 2
- - 3  5 1 -  - - -
6 - 4  - - -  - - -
```

Medium Puzzle 5
```
9 6 -  4 - -  2 - -
- - -  3 - 5  - 8 -
- - 3  - - -  5 - -

- 5 -  9 - -  - 2 7
- - 2  - - -  1 - -
7 1 -  - - 3  - 4 -

- - 7  - - -  9 - -
- 3 -  7 - 6  - - -
- - 8  - - 9  - 5 2
```

Medium Puzzle 6
```
7 - -  - 1 3  6 - -
3 - 8  7 - 6  - - -
- - 2  9 - -  - - -

- 2 -  - 3 -  7 - -
1 - -  6 9 5  - - 8
- - 6  - 2 -  - 3 -

- - -  - - 9  2 - -
- - -  1 - 2  8 - 5
- - 1  5 6 -  - - 4
```

Medium Puzzle 7
```
- - -  - - -  4 - 3
- 4 -  - - -  9 - -
- 7 1  - 4 -  - 2 8

- 5 -  - 1 3  - - -
3 - -  5 8 4  - - 7
- - -  9 7 -  - 3 -

8 3 -  - 2 -  1 6 -
- - 2  - - -  - 4 -
5 - 6  - - -  - - -
```

Medium Puzzle 8
```
- - -  2 - -  - - 1
9 2 6  - - -  - 5 7
- 5 -  9 - 7  - - -

- 8 -  4 - 2  - - 3
5 - 2  - - -  8 - 9
3 - -  6 - 5  - 1 -

- - -  7 - 6  - 3 -
2 3 -  - - -  1 8 6
6 - -  - - 1  - - -
```

Medium Puzzle 9
```
- - 1  7 - 3  - 9 -
- - -  - 9 -  7 5 -
- 7 4  - - -  3 - -

- - -  - - 4  2 8 -
- 4 -  3 - 8  - 7 -
- 3 2  5 - -  - - -

- - 5  - - -  8 1 -
- 9 3  - 1 -  - - -
- 1 -  2 - 6  9 - -
```

Medium Puzzle 10
```
8 - -  - 7 -  - 3 -
9 4 -  - - -  - - -
1 3 -  - 6 -  - 8 4

3 5 -  - - 1  - - -
- 8 -  4 - 5  - 9 -
- - -  8 - -  - 2 5

2 1 -  - 8 -  - 7 6
- - -  - - -  - 5 2
- 6 -  - 4 -  - - 8
```

Easy Puzzle 11
```
- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -
```

Easy Puzzle 12
```
- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -
```

Sudoku Puzzles (Hard)

Hard Puzzle 1
```
- 9 -   - - 4   2 6 -
- - 4   - - -   - - -
- - -   7 - 6   - 1 -

- 4 -   - - 1   5 - -
6 - -   9 4 2   - - 7
- - 2   8 - -   - 4 -

- 1 -   4 - 5   - - -
- - -   - - -   1 - -
- 2 3   6 - -   - 5 -
```

Hard Puzzle 2
```
- - -   - 8 -   6 - -
9 2 8   3 - 6   7 - -
- - -   - - -   - - 5

- 9 -   7 - -   1 - -
6 - -   - 9 -   - - 3
- - 4   - - 3   - 9 -

8 - -   - - -   - - -
- - 5   1 - 2   9 4 8
- - 7   - 3 -   - - -
```

Hard Puzzle 3
```
- 3 -   - - -   - 1 -
9 - 8   - 6 -   - - -
- - -   2 - -   5 - 4

- - 6   - - 9   3 - -
4 - -   7 1 6   - - 9
- - 1   8 - -   7 - -

7 - 9   - - 4   - - -
- - -   - 5 -   9 - 3
- 1 -   - - -   - 8 -
```

Hard Puzzle 4
```
5 7 -   3 - -   2 - 6
- - -   - - -   3 - -
- - -   9 - 6   - 8 4

- - 5   4 - -   - 6 -
4 - -   - - -   - - 7
- 9 -   - - 5   1 - -

2 8 -   6 - 3   - - -
- - 6   - - -   - - -
3 - 4   - - 1   - 7 8
```

Hard Puzzle 5
```
- - 9   1 - -   5 - 3
4 - -   - - -   - 2 9
2 - -   5 - 9   - - -

- 2 -   - - 6   - 7 -
9 - -   - - -   - - 1
- 3 -   8 - -   - 9 -

- - -   6 - 7   - - 5
7 1 -   - - -   - - 6
6 - 5   - - 8   9 - -
```

Hard Puzzle 6
```
- - 5   - - 6   - 2 -
- - -   8 - 5   - 4 7
4 - 7   - 2 -   - 6 -

- 2 -   - - 4   - - -
- - 9   - - -   5 - -
- - -   1 - -   - 3 -

- 1 -   - 8 -   4 - 3
6 7 -   4 - 2   - - -
- 8 -   5 - -   6 - -
```

Hard Puzzle 7
```
1 - 7   - 9 5   - - -
- 3 -   - 7 -   - 5 -
- 2 5   6 - -   - - -

- - -   - - -   - - 5
9 5 6   - - -   7 4 2
7 - -   - - -   - - -

- - -   - - 2   1 6 -
- 7 -   - 3 -   - 9 -
- - -   9 1 -   8 - 3
```

Hard Puzzle 8
```
- - -   4 - -   - 9 7
- - 4   - - -   - - 2
- 5 -   - 8 3   6 - -

8 - -   - - 2   - - 6
3 - -   - 7 -   - - 5
9 - -   3 - -   - - 8

- - 8   7 5 -   - 2 -
1 - -   - - -   5 - -
5 3 -   - - 4   - - -
```

Hard Puzzle 9
```
- 4 -   - 1 -   - - -
2 - -   6 - -   - - -
3 6 -   - - 8   9 5 1

6 - 2   - - -   - - 3
- - -   - 3 -   - - -
9 - -   - - -   5 - 8

4 5 1   3 - -   - 7 2
- - -   - - 4   - - 9
- - -   - 2 -   - 8 -
```

Hard Puzzle 10
```
- 6 -   - - 1   - - 8
- 3 5   - - 7   - - -
- 1 9   - 2 -   7 5 -

- - -   - - -   3 - 2
- - -   - 9 -   - - -
9 - 1   - - -   - - -

- 4 7   - 3 -   5 2 -
- - -   4 - -   9 8 -
2 - -   1 - -   - 4 -
```

Easy Puzzle 11
```
- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -
```

Easy Puzzle 12
```
- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -
```

Sudoku Puzzles (Expert)

Expert Puzzle 1
```
3 1 8   - - 5   - - -
- 2 -   - 4 -   - - -
- 5 -   1 - -   - - -

7 - -   9 - -   - - 8
6 - -   - 8 -   - - 7
1 - -   - - 6   - - 3

- - -   - - 4   - 9 -
- - -   - 3 -   - 7 -
- - -   2 - -   3 4 1
```

Expert Puzzle 2
```
- 4 2   - 1 -   - - -
- 8 -   - 6 -   - 3 -
3 - 9   - - 7   1 - -

- - -   6 - -   3 - -
- 9 -   - - -   - 5 -
- - 8   - - 5   - - -

- - 3   1 - -   6 - 7
- 6 -   - 2 -   - 4 -
- - -   - 4 -   5 2 -
```

Expert Puzzle 3
```
- 6 -   8 - -   - 7 9
- - 9   - 4 -   5 - -
- - -   - 6 -   2 1 -

- 9 -   - 4 -   - - -
- - 3   - - -   7 - -
- - -   3 - -   - 5 -

- 3 1   - 2 -   - - -
- - 2   - 1 -   4 - -
8 4 -   - - 6   - 9 -
```

Expert Puzzle 4
```
7 - -   - - -   - 6 -
- - -   - - 9   - 1 5
- - 4   6 - 5   - - -

8 - -   - 2 -   3 - -
- - 9   1 - 3   7 - -
- - 7   - 4 -   - - 6

- - -   5 - 1   2 - -
9 2 -   8 - -   - - -
- 1 -   - - -   - - 9
```

Expert Puzzle 5
```
- 2 8   - - 9   - - 7
9 - 5   8 - -   1 - -
- - -   - - 6   - - -

- - -   6 1 5   7 - -
- - -   - - -   - - -
- - 2   7 9 3   - - -

- - -   5 - -   - - -
- - 6   - - 7   3 - 4
5 - -   9 - -   8 6 -
```

Expert Puzzle 6
```
- - -   - - 7   - - -
2 9 -   - - 8   - - -
5 - 3   - - -   - 1 7

6 7 -   - 3 -   - - -
- - 2   9 - 1   3 - -
- - -   - 4 -   - 5 8

9 6 -   - - -   1 - 3
- - -   1 - -   - 6 5
- - -   4 - -   - - -
```

Expert Puzzle 7
```
7 - -   3 - 4   - 9 1
- 2 -   - - -   - - -
- - 8   - 5 -   - 7 -

- 9 4   - - -   - - 6
- - -   1 - 6   - - -
3 - -   - - -   7 5 -

- 3 -   - 4 -   6 - -
- - -   - - -   - 2 -
6 8 -   7 - 2   - - 4
```

Expert Puzzle 8
```
- - -   - - 5   9 - -
- 2 -   - 9 8   5 - -
- - -   - - -   6 7 -

- 9 -   - 5 -   1 8 -
7 - -   - - -   - - 9
- 8 5   - 6 -   - 2 -

- 6 3   - - -   - - -
- - 4   1 8 -   - 6 -
- - 9   2 - -   - - -
```

Expert Puzzle 9
```
9 - -   2 - 4   8 - -
- - -   - - 7   1 2 3
- - -   - 6 -   - - -

- - -   - - -   - 9 5
2 - -   7 - 8   - - 4
4 7 -   - - -   - - -

- - -   - 2 -   - - -
7 2 8   5 - -   - - -
- - 6   4 - 9   - - 8
```

Expert Puzzle 10
```
- 7 3   4 - -   - 1 -
- 8 -   2 1 -   - - -
- - -   - - 6   - - -

- 5 8   - - -   - - 2
6 - 1   - - -   7 - 9
4 - -   - - -   5 3 -

- - -   7 - -   - - -
- - -   - 5 1   - 2 -
- 1 -   - - 2   3 8 -
```

Easy Puzzle 11
```
- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -
```

World's Hardest
```
8 - -   - - -   - - -
- - 3   6 - -   - - -
- 7 -   - 9 -   2 - -

- 5 -   - - 7   - - -
- - -   - 4 5   7 - -
- - -   1 - -   - 3 -

- - 1   - - -   - 6 8
- - 8   5 - -   - 1 -
- 9 -   - - -   4 - -
```

Hexadoku Puzzles

Hexadoku is the same as sudoku but larger and using the characters 0-9 and A-F.

Puzzle 1 (Easy)
```
- - - -   - - - C   - 2 - 9   B 5 - 6
- 1 - -   - F - -   - - - -   E - D -
- 5 - A   - - 3 -   - - - -   8 9 - -
9 2 - 4   - - - E   A - B -   3 - C -

C 9 - -   4 3 E D   - 8 - F   - 1 - 2
- - - -   0 - 2 1   7 9 - -   D C - -
E - 4 -   - 7 6 -   - 5 - -   - - A B
- F - -   - - C -   - B 6 -   - 4 - -

3 B F -   - - - 4   E - - -   1 - - -
- - - -   - 6 - -   - D 2 5   - - 9 -
- - - D   - - B -   - 6 1 -   C - - 7
- - - -   - - - -   - - F -   4 D - E

A - - 9   F - - B   5 E - -   - 6 - -
8 - 5 -   - - - 2   - 7 - -   F E - -
B - - -   - 5 0 -   - F D 8   A 7 - C
- - 3 7   - 4 D -   - - - 6   - - B 8
```

Puzzle 2 (Easy)
```
- B - D   2 F - E   A - 0 -   - - - -
- - C A   - 5 - -   - - 4 -   E - - -
7 - - 6   - C 0 -   - - 5 -   D - - -
- 4 - -   - - A 1   - B 8 -   - 5 - 9

- - - -   - - - -   E - - -   - 4 7 -
- 6 8 0   - - - -   - - 9 F   - - 2 -
- 3 7 F   6 - 5 C   B - - 2   - - 8 -
9 - A E   D - B 8   C 4 - -   5 - - F

0 - - 1   - D - -   8 C - -   - - 6 4
- - 4 -   E - - -   9 - - -   - - - C
- D - -   B - - -   5 - E -   2 3 0 -
- 5 - 3   - - 1 -   - F D 7   - - - A

E - - -   - A 9 -   - - 6 -   7 C - -
- A 9 -   8 6 - F   - - - -   4 - D 5
6 - - -   7 - - D   - - - -   F - E -
- 8 - -   - E C -   - - - A   - 9 B 6
```

Puzzle 3 (Medium)
```
- - B 9   E 5 - -   A - - -   - - - -
- - 3 -   - C 9 -   - - 6 -   A - - -
6 - - A   - - 0 -   - - - -   8 - D 4
- - - -   - D - -   7 - - -   - - C 0

7 9 - 4   - - 5 -   1 8 E D   - - - -
- B 1 D   2 - 6 -   - - 4 -   - - - -
2 - - 3   - - - C   5 - - -   B - 1 -
C - - -   - 9 8 -   - - - -   3 - E -

- - C -   - 0 - -   - E - -   4 D - B
4 - - -   A B - -   - - - -   - - 8 E
0 3 - E   - - - 1   C - F -   - - 2 5
- 5 A 2   D 4 - -   - - 7 -   - - - C

- 6 - -   - F - -   - - 0 5   9 - - -
3 D 9 5   - - - -   - - A 8   - - - -
- - - -   0 3 1 5   E - - C   - 7 F -
1 - 0 -   - - - -   6 7 - -   D - B -
```

Puzzle 4 (Medium)
```
A 8 - 6   - 1 E -   - - - -   - - C -
7 - 2 -   - - - -   - - 6 -   4 - - 5
4 - - E   - 8 - -   1 F - -   3 - - -
1 - - -   5 3 D -   - - - -   A 6 7 -

6 - - -   D - - F   - - - -   - - - -
- - 3 -   1 - 2 E   - A 5 -   - 0 - -
- - - 0   - - - -   - - - 8   B 4 - 3
- - 4 8   - - - 0   - B - D   - 1 - -

- - - -   7 - - -   - - - -   - B - 2
- - 7 5   - D 9 -   - - - F   1 8 - -
- 9 1 -   C - 6 2   - - 7 -   - - 5 -
- - D B   - - - 5   - - C 4   - F 3 -

- C 5 -   4 - - -   B - D -   7 - A -
F - - 3   - E 5 -   - - - -   2 - 8 -
- - - -   - - - -   - 4 E A   0 - - -
- 2 - 1   A - 0 D   6 - - -   - 5 - -
```

Puzzle 5 (Hard)
```
- - - 8   5 6 7 B   9 A - 3   - - - E
- 3 - 9   - - - -   - 1 E -   F B - -
- - - -   8 D - -   - - - -   - - 1 -
- 6 - C   9 - A -   4 - D F   0 - - -

0 - - -   - - - 8   - - A -   - F 4 C
9 C - -   - E - D   - 3 - -   6 - - 1
- 4 6 -   - - - -   - 5 - D   - - - -
- - - 2   3 - 4 -   6 - 1 -   - D 9 -

- - - 7   - A - 6   - - - -   8 - - F
A - C -   - B - -   - - - -   - - D -
2 - - 4   1 - 5 -   D - - -   - 9 B -
- - - -   - - - 3   - - C -   2 - - -

- 5 F -   E - - -   3 - 6 -   - 1 - -
- - B -   7 - - -   - C 5 1   - 0 - -
D - 9 3   C - 8 4   7 - - -   - E - -
- - E -   - 1 B 9   - - F 8   - - 2 5
```

Blank Puzzle
```
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -

- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -

- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -

- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
- - - -   - - - -   - - - -   - - - -
```

Sudoku Answers

Sudoku Answers (Easy)

Puzzle 1 Solution
```
8 9 5   6 2 3   4 7 1
3 4 6   8 7 1   5 9 2
7 1 2   9 4 5   8 6 3

4 7 9   2 3 6   1 5 8
1 2 3   5 8 7   9 4 6
5 6 8   4 1 9   2 3 7

9 3 7   1 5 2   6 8 4
6 8 1   3 9 4   7 2 5
2 5 4   7 6 8   3 1 9
```

Puzzle 2 Solution
```
4 8 6   1 5 2   3 9 7
5 1 3   7 8 9   4 6 2
2 9 7   6 4 3   1 5 8

6 2 9   5 3 1   7 8 4
1 7 5   4 6 8   9 2 3
3 4 8   2 9 7   6 1 5

9 5 2   3 7 6   8 4 1
8 3 1   9 2 4   5 7 6
7 6 4   8 1 5   2 3 9
```

Puzzle 3 Solution
```
9 6 1   8 2 5   7 4 3
8 2 4   1 7 3   9 5 6
7 3 5   4 6 9   1 2 8

1 7 8   6 3 4   2 9 5
3 9 6   2 5 1   8 7 4
4 5 2   7 9 8   6 3 1

2 8 9   5 4 6   3 1 7
5 1 3   9 8 7   4 6 2
6 4 7   3 1 2   5 8 9
```

Puzzle 4 Solution
```
6 9 4   7 5 2   1 3 8
1 2 7   4 8 3   9 5 6
8 5 3   9 6 1   7 2 4

5 1 2   8 7 4   6 9 3
3 4 6   1 2 9   5 8 7
7 8 9   5 3 6   2 4 1

4 3 5   2 1 7   8 6 9
9 7 8   6 4 5   3 1 2
2 6 1   3 9 8   4 7 5
```

Puzzle 5 Solution
```
9 7 5   2 6 1   8 4 3
4 8 2   5 7 3   6 9 1
1 6 3   8 9 4   2 5 7

8 2 9   4 3 7   5 1 6
3 5 6   1 8 2   4 7 9
7 4 1   6 5 9   3 8 2

2 1 8   9 4 6   7 3 5
6 3 4   7 1 5   9 2 8
5 9 7   3 2 8   1 6 4
```

Puzzle 6 Solution
```
9 6 1   8 3 5   7 2 4
8 7 2   1 6 4   5 3 9
3 5 4   9 2 7   1 8 6

1 4 3   6 9 2   8 7 5
2 9 6   5 7 8   3 4 1
7 8 5   3 4 1   9 6 2

4 1 7   2 8 9   6 5 3
5 3 8   4 1 6   2 9 7
6 2 9   7 5 3   4 1 8
```

Puzzle 7 Solution
```
1 2 4   6 3 5   9 8 7
3 7 6   4 9 8   2 5 1
9 8 5   1 7 2   6 4 3

4 9 7   5 8 6   1 3 2
2 3 8   7 1 9   4 6 5
6 5 1   2 4 3   7 9 8

7 1 3   9 5 4   8 2 6
8 6 9   3 2 7   5 1 4
5 4 2   8 6 1   3 7 9
```

Puzzle 8 Solution
```
4 5 1   7 8 2   6 9 3
3 6 9   4 5 1   8 2 7
8 2 7   9 6 3   1 5 4

9 4 2   1 7 8   3 6 5
5 8 3   6 2 4   7 1 9
1 7 6   5 3 9   4 8 2

2 1 8   3 4 5   9 7 6
6 9 4   2 1 7   5 3 8
7 3 5   8 9 6   2 4 1
```

Puzzle 9 Solution
```
9 8 1   5 7 2   6 4 3
2 5 7   3 6 4   9 8 1
4 6 3   9 8 1   7 2 5

1 2 8   4 3 7   5 6 9
6 3 9   1 5 8   4 7 2
7 4 5   2 9 6   3 1 8

5 1 2   6 4 9   8 3 7
8 9 6   7 1 3   2 5 4
3 7 4   8 2 5   1 9 6
```

Puzzle 10 Solution
```
6 4 1   7 2 8   3 9 5
2 9 5   6 4 3   1 8 7
7 8 3   9 5 1   4 6 2

9 3 2   1 6 5   7 4 8
8 6 4   2 3 7   9 5 1
1 5 7   8 9 4   2 3 6

5 2 8   4 7 9   6 1 3
4 1 6   3 8 2   5 7 9
3 7 9   5 1 6   8 2 4
```

Bonus
```
- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -

- - -   - - -   - - -
- - -   - - -   - - -
- - -   - - -   - - -
```

Sudoku Answers (Medium)

Puzzle 1 Solution
```
1 2 5  3 4 6  9 8 7
4 3 7  2 9 8  5 1 6
9 8 6  5 7 1  3 4 2

3 6 8  9 1 5  2 7 4
7 9 2  6 8 4  1 3 5
5 1 4  7 3 2  6 9 8

6 7 9  4 5 3  8 2 1
8 5 3  1 2 7  4 6 9
2 4 1  8 6 9  7 5 3
```

Puzzle 2 Solution
```
8 4 3  9 6 1  5 7 2
6 1 5  2 3 7  8 9 4
7 9 2  8 4 5  1 6 3

9 3 7  1 2 8  6 4 5
4 2 8  5 7 6  9 3 1
1 5 6  4 9 3  7 2 8

3 6 1  7 8 4  2 5 9
2 8 4  6 5 9  3 1 7
5 7 9  3 1 2  4 8 6
```

Puzzle 3 Solution
```
5 1 8  2 9 4  7 3 6
7 9 6  5 3 1  8 2 4
4 2 3  8 6 7  5 9 1

8 6 1  4 5 3  2 7 9
9 5 2  7 1 8  4 6 3
3 7 4  9 2 6  1 5 8

1 4 5  6 7 9  3 8 2
2 8 9  3 4 5  6 1 7
6 3 7  1 8 2  9 4 5
```

Puzzle 4 Solution
```
1 3 7  2 5 9  6 8 4
9 4 2  6 8 3  1 5 7
5 6 8  1 4 7  2 9 3

3 8 5  4 7 1  9 2 6
7 1 9  8 6 2  3 4 5
4 2 6  9 3 5  7 1 8

8 5 1  3 9 6  4 7 2
2 7 3  5 1 4  8 6 9
6 9 4  7 2 8  5 3 1
```

Puzzle 5 Solution
```
9 6 5  4 1 8  2 7 3
2 7 1  3 9 5  6 8 4
4 8 3  6 7 2  5 9 1

8 5 4  9 6 1  3 2 7
3 9 2  8 4 7  1 6 5
7 1 6  2 5 3  8 4 9

1 2 7  5 8 4  9 3 6
5 3 9  7 2 6  4 1 8
6 4 8  1 3 9  7 5 2
```

Puzzle 6 Solution
```
7 5 4  2 1 3  6 8 9
3 9 8  7 5 6  1 4 2
6 1 2  9 8 4  5 7 3

4 2 9  8 3 1  7 5 6
1 3 7  6 9 5  4 2 8
5 8 6  4 2 7  9 3 1

8 6 5  3 4 9  2 1 7
9 4 3  1 7 2  8 6 5
2 7 1  5 6 8  3 9 4
```

Puzzle 7 Solution
```
6 8 5  1 9 2  4 7 3
2 4 3  8 6 7  9 5 1
9 7 1  3 4 5  6 2 8

4 5 7  2 1 3  8 9 6
3 6 9  5 8 4  2 1 7
1 2 8  9 7 6  5 3 4

8 3 4  7 2 9  1 6 5
7 1 2  6 5 8  3 4 9
5 9 6  4 3 1  7 8 2
```

Puzzle 8 Solution
```
8 7 3  2 5 4  6 9 1
9 2 6  3 1 8  4 5 7
1 5 4  9 6 7  3 2 8

7 8 1  4 9 2  5 6 3
5 6 2  1 7 3  8 4 9
3 4 9  6 8 5  7 1 2

4 1 8  7 2 6  9 3 5
2 3 7  5 4 9  1 8 6
6 9 5  8 3 1  2 7 4
```

Puzzle 9 Solution
```
5 2 1  7 4 3  6 9 8
3 8 6  1 9 2  7 5 4
9 7 4  6 8 5  3 2 1

1 5 7  9 6 4  2 8 3
6 4 9  3 2 8  1 7 5
8 3 2  5 7 1  4 6 9

7 6 5  4 3 9  8 1 2
2 9 3  8 1 7  5 4 6
4 1 8  2 5 6  9 3 7
```

Puzzle 10 Solution
```
8 2 6  1 7 4  5 3 9
9 4 7  3 5 8  2 6 1
1 3 5  2 6 9  7 8 4

3 5 2  6 9 1  8 4 7
7 8 1  4 2 5  6 9 3
6 9 4  8 3 7  1 2 5

2 1 9  5 8 3  4 7 6
4 7 8  9 1 6  3 5 2
5 6 3  7 4 2  9 1 8
```

Bonus
```
- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -
```

Sudoku Answers (Hard)

Puzzle 1 Solution
```
3 9 7  1 8 4  2 6 5
1 6 4  5 2 3  9 7 5
2 8 5  7 9 6  4 1 3

7 4 8  3 6 1  5 9 2
6 5 1  9 4 2  8 3 7
9 3 2  8 5 7  6 4 1

8 1 9  4 7 5  3 2 6
5 7 6  2 3 9  1 8 4
4 2 3  6 1 8  7 5 9
```

Puzzle 2 Solution
```
4 5 1  2 8 7  6 3 9
9 2 8  3 5 6  7 1 4
7 3 6  4 1 9  8 2 5

5 9 3  7 2 4  1 8 6
6 7 2  8 9 1  4 5 3
1 8 4  5 6 3  2 9 7

8 1 9  6 4 5  3 7 2
3 6 5  1 7 2  9 4 8
2 4 7  9 3 8  5 6 1
```

Puzzle 3 Solution
```
2 3 4  9 7 5  6 1 8
9 5 8  4 6 1  2 3 7
1 6 7  2 8 3  5 9 4

8 7 6  5 4 9  3 2 1
4 2 3  7 1 6  8 5 9
5 9 1  8 3 2  7 4 6

7 8 9  3 2 4  1 6 5
6 4 2  1 5 8  9 7 3
3 1 5  6 9 7  4 8 2
```

Puzzle 4 Solution
```
5 7 9  3 8 4  2 1 6
6 4 8  1 2 7  3 9 5
1 2 3  9 5 6  7 8 4

7 3 5  4 1 2  8 6 9
4 6 1  8 3 9  5 2 7
8 9 2  7 6 5  1 4 3

2 8 7  6 4 3  9 5 1
9 1 6  5 7 8  4 3 2
3 5 4  2 9 1  6 7 8
```

Puzzle 5 Solution
```
8 7 9  1 2 4  5 6 3
4 5 1  7 6 3  8 2 9
2 6 3  5 8 9  7 1 4

1 2 4  9 5 6  3 7 8
9 8 7  4 3 2  6 5 1
5 3 6  8 7 1  4 9 2

3 9 2  6 4 7  1 8 5
7 1 8  3 9 5  2 4 6
6 4 5  2 1 8  9 3 7
```

Puzzle 6 Solution
```
8 9 5  7 4 6  3 2 1
2 6 1  8 3 5  9 4 7
4 3 7  9 2 1  8 6 5

1 2 6  3 5 4  7 8 9
3 4 9  2 7 8  5 1 6
7 5 8  1 6 9  2 3 4

5 1 2  6 8 7  4 9 3
6 7 3  4 9 2  1 5 8
9 8 4  5 1 3  6 7 2
```

Puzzle 7 Solution
```
1 4 7  3 9 5  2 8 6
6 3 9  2 7 8  4 5 1
8 2 5  6 4 1  3 7 9

4 8 3  7 2 9  6 1 5
9 5 6  1 8 3  7 4 2
7 1 2  5 6 4  9 3 8

3 9 8  4 5 2  1 6 7
2 7 1  8 3 6  5 9 4
5 6 4  9 1 7  8 2 3
```

Puzzle 8 Solution
```
2 1 3  4 6 5  8 9 7
6 8 4  9 1 7  3 5 2
7 5 9  2 8 3  6 4 1

8 7 1  5 9 2  4 3 6
3 4 2  6 7 8  9 1 5
9 6 5  3 4 1  2 7 8

4 9 8  7 5 6  1 2 3
1 2 7  8 3 9  5 6 4
5 3 6  1 2 4  7 8 9
```

Puzzle 9 Solution
```
5 4 8  9 1 3  2 6 7
2 1 9  6 5 7  8 3 4
3 6 7  2 4 8  9 5 1

6 7 2  8 9 5  1 4 3
1 8 5  4 3 2  7 9 6
9 3 4  7 6 1  5 2 8

4 5 1  3 8 9  6 7 2
8 2 6  5 7 4  3 1 9
7 9 3  1 2 6  4 8 5
```

Puzzle 10 Solution
```
7 6 2  9 5 1  4 3 8
4 3 5  6 8 7  2 1 9
8 1 9  3 2 4  7 5 6

5 8 4  7 1 6  3 9 2
3 2 6  5 9 8  1 7 4
9 7 1  2 4 3  8 6 5

6 4 7  8 3 9  5 2 1
1 5 3  4 6 2  9 8 7
2 9 8  1 7 5  6 4 3
```

Bonus
```
- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -

- - -  - - -  - - -
- - -  - - -  - - -
- - -  - - -  - - -
```

Sudoku Answers (Expert)

Puzzle 1 Solution
```
3 1 8  6 9 5  7 2 4
9 2 6  8 4 7  1 3 5
4 5 7  1 2 3  6 8 9

7 3 4  9 5 1  2 6 8
6 9 5  3 8 2  4 1 7
1 8 2  4 7 6  9 5 3

8 6 3  7 1 4  5 9 2
2 4 1  5 3 9  8 7 6
5 7 9  2 6 8  3 4 1
```

Puzzle 2 Solution
```
6 4 2  3 1 9  7 8 5
1 8 7  5 6 4  2 3 9
3 5 9  2 8 7  1 6 4

5 1 4  6 9 2  3 7 8
7 9 6  8 3 1  4 5 2
2 3 8  4 7 5  9 1 6

4 2 3  1 5 8  6 9 7
9 6 5  7 2 3  8 4 1
8 7 1  9 4 6  5 2 3
```

Puzzle 3 Solution
```
2 6 4  8 5 1  3 7 9
7 1 9  2 4 3  5 8 6
3 8 5  7 6 9  2 1 4

5 9 8  1 7 4  6 2 3
1 2 3  6 9 5  7 4 8
4 7 6  3 8 2  9 5 1

9 3 1  4 2 7  8 6 5
6 5 2  9 1 8  4 3 7
8 4 7  5 3 6  1 9 2
```

Puzzle 4 Solution
```
7 5 1  4 8 2  9 6 3
6 8 2  3 7 9  4 1 5
3 9 4  6 1 5  8 7 2

8 4 5  7 2 6  3 9 1
2 6 9  1 5 3  7 8 4
1 3 7  9 4 8  5 2 6

4 7 6  5 9 1  2 3 8
9 2 3  8 6 4  1 5 7
5 1 8  2 3 7  6 4 9
```

Puzzle 5 Solution
```
6 2 8  1 4 9  5 3 7
9 3 5  8 7 2  1 4 6
4 1 7  3 5 6  2 8 9

3 4 9  6 1 5  7 2 8
7 5 1  4 2 8  6 9 3
8 6 2  7 9 3  4 1 5

2 8 3  5 6 4  9 7 1
1 9 6  2 8 7  3 5 4
5 7 4  9 3 1  8 6 2
```

Puzzle 6 Solution
```
4 1 6  3 9 7  5 8 2
2 9 7  5 1 8  6 3 4
5 8 3  6 2 4  9 1 7

6 7 5  8 3 2  4 9 1
8 4 2  9 5 1  3 7 6
1 3 9  7 4 6  2 5 8

9 6 8  2 7 5  1 4 3
3 2 4  1 8 9  7 6 5
7 5 1  4 6 3  8 2 9
```

Puzzle 7 Solution
```
7 6 5  3 2 4  8 9 1
1 2 3  9 8 7  4 6 5
9 4 8  6 5 1  2 7 3

8 9 4  2 7 5  3 1 6
5 7 2  1 3 6  9 4 8
3 1 6  4 9 8  7 5 2

2 3 1  5 4 9  6 8 7
4 5 7  8 6 3  1 2 9
6 8 9  7 1 2  5 3 4
```

Puzzle 8 Solution
```
4 3 7  6 2 5  9 1 8
6 2 1  7 9 8  5 3 4
9 5 8  3 4 1  6 7 2

3 9 2  4 5 7  1 8 6
7 4 6  8 1 2  3 5 9
1 8 5  9 6 3  4 2 7

2 6 3  5 7 4  8 9 1
5 7 4  1 8 9  2 6 3
8 1 9  2 3 6  7 4 5
```

Puzzle 9 Solution
```
9 1 7  2 3 4  8 5 6
5 6 4  9 8 7  1 2 3
8 3 2  1 6 5  9 4 7

6 8 1  3 4 2  7 9 5
2 9 3  7 5 8  6 1 4
4 7 5  6 9 1  3 8 2

3 4 9  8 2 6  5 7 1
7 2 8  5 1 3  4 6 9
1 5 6  4 7 9  2 3 8
```

Puzzle 10 Solution
```
2 7 3  4 9 5  8 1 6
9 8 6  2 1 3  4 7 5
1 4 5  8 7 6  2 9 3

7 5 8  9 3 4  1 6 2
6 3 1  5 2 8  7 4 9
4 9 2  1 6 7  5 3 8

3 2 4  7 8 9  6 5 1
8 6 7  3 5 1  9 2 4
5 1 9  6 4 2  3 8 7
```

World's Hardest
```
8 1 2  7 5 3  6 4 9
9 4 3  6 8 2  1 7 5
6 7 5  4 9 1  2 8 3

1 5 4  2 3 7  8 9 6
3 6 9  8 4 5  7 2 1
2 8 7  1 6 9  5 3 6

5 2 1  9 7 4  3 6 8
4 3 8  5 2 6  9 1 7
7 9 6  3 1 8  4 5 2
```

Sudoku Answers (Hexadoku)

Puzzle 1 Solution (Easy)
```
D 3 E F  7 A 4 C  1 2 8 9  B 5 0 6
7 1 C 0  B F 8 9  6 4 5 3  E 2 D A
6 5 B A  2 1 3 0  F C E D  8 9 7 4
9 2 8 4  6 D 5 E  A 0 B 7  3 F C 1

C 9 7 B  4 3 E D  0 8 A F  6 1 5 2
5 A 6 3  0 B 2 1  7 9 4 E  D C 8 F
E 0 4 1  8 7 6 F  D 5 C 2  9 3 A B
2 F D 8  A 9 C 5  3 B 6 1  7 4 E 0

3 B F C  D 2 9 4  E A 7 0  1 8 6 5
4 7 A E  1 6 F 8  C D 2 5  0 B 9 3
0 8 2 D  5 E B 3  9 6 1 4  C A F 7
1 6 9 5  C 0 A 7  8 3 F B  4 D 2 E

A 4 0 9  F 8 7 B  5 E 3 C  2 6 1 D
8 D 5 6  3 C 1 2  B 7 0 A  F E 4 9
B E 1 2  9 5 0 6  4 F D 8  A 7 3 C
F C 3 7  E 4 D A  2 1 9 6  5 0 B 8
```

Puzzle 2 Solution (Easy)
```
3 B 5 D  2 F 8 E  A 9 0 C  6 7 4 1
8 0 C A  9 5 D 6  3 7 4 1  E B F 2
7 9 1 6  4 C 0 B  F 2 5 E  D 8 A 3
F 4 E 2  3 7 A 1  6 B 8 D  0 5 C 9

5 1 B C  F 9 2 0  E 6 3 8  A 4 7 D
4 6 8 0  A 3 E 7  D 5 9 F  C 1 2 B
D 3 7 F  6 4 5 C  B A 1 2  9 0 8 E
9 2 A E  D 1 B 8  C 4 7 0  5 6 3 F

0 E 2 1  5 D 7 9  8 C A 3  B F 6 4
A 7 4 8  E 2 F 3  9 0 B 6  1 D 5 C
C D F 9  B 8 6 A  5 1 E 4  2 3 0 7
B 5 6 3  C 0 1 4  2 F D 7  8 E 9 A

E F D B  0 A 9 2  4 3 6 5  7 C 1 8
1 A 9 7  8 6 3 F  0 E C B  4 2 D 5
6 C 3 5  7 B 4 D  1 8 2 9  F A E 0
2 8 0 4  1 E C 5  7 D F A  3 9 B 6
```

Puzzle 3 Solution (Medium)
```
F C B 9  E 5 2 4  A D 8 9  7 1 6 3
D E 3 0  7 C 9 8  4 B 6 1  A 2 5 F
6 2 7 A  3 1 0 F  9 5 C E  8 B D 4
5 1 4 8  6 D A B  7 3 2 F  E 9 C 0

7 9 F 4  B A 5 3  1 8 E D  C 6 0 2
8 B 1 D  2 E 6 0  3 C 4 7  5 F A 9
2 0 E 3  F 7 4 C  5 A 9 6  B 8 1 D
C A 5 6  1 9 8 D  0 F B 2  3 4 E 7

9 8 C F  5 0 3 6  2 E 1 A  4 D 7 B
4 7 6 1  A B C 2  D 0 5 9  F 3 8 E
0 3 D E  9 8 7 1  C 4 F B  6 A 2 5
B 5 A 2  D 4 F E  8 6 7 3  1 0 9 C

E 6 2 7  4 F D A  B 1 0 5  9 C 3 8
3 D 9 5  C 6 B 7  F 2 A 8  0 E 4 1
A 4 8 B  0 3 1 5  E 9 D C  2 7 F 6
1 F 0 C  8 2 E 9  6 7 3 4  D 5 B A
```

Puzzle 4 Solution (Medium)
```
A 8 9 6  0 1 E 7  4 D 3 5  F 2 C B
7 3 2 D  F 9 B A  8 0 6 C  4 E 1 5
4 5 B E  2 8 C 6  1 F A 7  3 9 0 D
1 F 0 C  5 3 D 4  2 9 B E  A 6 7 8

6 1 C 2  D B 8 F  0 3 4 9  5 7 E A
B 7 3 F  1 4 2 E  C A 5 6  8 0 D 9
5 D E 0  6 C A 9  F 7 1 8  B 4 2 3
9 A 4 8  3 5 7 0  E B 2 D  C 1 6 F

C E F A  7 0 4 3  D 5 8 1  6 B 9 2
3 6 7 5  E D 9 B  A 2 0 F  1 8 4 C
8 9 1 4  C F 6 2  3 E 7 B  D A 5 0
2 0 D B  8 A 1 5  9 6 C 4  E F 3 7

0 C 5 9  4 6 F 1  B 8 D 2  7 3 A E
F 4 A 3  B E 5 C  7 1 9 0  2 D 8 6
D B 6 7  9 2 3 8  5 4 E A  0 C F 1
E 2 8 1  A 7 0 D  6 C F 3  9 5 B 4
```

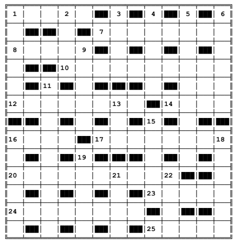
Puzzle 5 Solution (Hard)
```
1 F 0 8  5 6 7 B  9 A 2 3  D 4 C E
7 3 D 9  0 4 C 2  8 1 E 5  F B 6 A
5 A 4 B  8 D F E  C 0 7 6  3 2 1 9
E 6 2 C  9 3 A 1  4 B D F  0 7 5 8

0 D 3 1  B 9 6 8  2 E A 7  5 F 4 C
9 C 7 5  F E 2 D  B 3 8 4  6 A 0 1
F 4 6 E  A 7 1 C  0 5 9 D  B 8 3 2
B 8 A 2  3 0 4 5  6 F 1 C  E D 9 7

3 B 5 7  D A 0 6  1 9 4 2  8 C E F
A 0 C F  2 B 9 7  5 8 3 E  1 6 D 4
2 E 8 4  1 C 5 F  D 6 0 A  7 9 B 3
6 9 1 D  4 8 E 3  F 7 C B  2 5 A 0

8 5 F A  E 2 D 0  3 4 6 9  C 1 7 B
4 2 B 6  7 F 3 A  E C 5 1  9 0 8 D
D 1 9 3  C 5 8 4  7 2 B 0  A E F 6
C 7 E 0  6 1 B 9  A D F 8  4 3 2 5
```

3 Crossword

Fill in the blanks with words which are described either side of the puzzle.
Black Cells: The symbols ███ signify black cells because there's no way to make it entirely black.

Puzzle 1

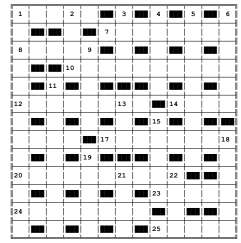
Across
1. Perfect
7. Implied Suggestion
8. White animal, ... bear
10. Feelings
12. Sifts Through
14. Walk with heavy steps
16. Irish Dances
17. Acquired
20. Lighter than air
23. Golfer's two under par
24. Confection on a stick
25. Sedate (character)



Down
1. Urges into motion
2. Unfortunately
3. Taverns
4. Rifle Ends
5. Straightening (rope)
6. Accommodated
9. Try to vomit
11. Lethargically
13. Depressed, at a low ...
15. Stop briefly
16. Sapphires & diamonds
18. Protect
19. Belonging to them
21. Take a peek
22. Common seasoning

Puzzle 2

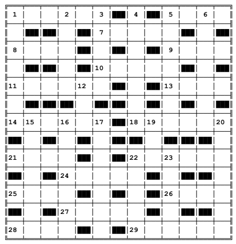
Across
1. Salivate
7. Pedantically stubborn
8. Short-circuited
10. Faster than sound
12. Cooking pot
14. Season's produce
16. Entangle
17. Highly charged
20. Alpine landslides
23. Volley of bullets
24. Personal reminiscence
25. Without company



Down
1. Draws off water from
2. Individuals
3. Cast Ballot
4. Break into pieces
5. Travel schedule
6. Polar covering
9. Deceives
11. Mechanically makes
13. The lot
15. Broad expanse
16. Australian marsupials
18. Prairie wolf
19. Robust
21. Beds
22. Yacht canvas

Puzzle 3

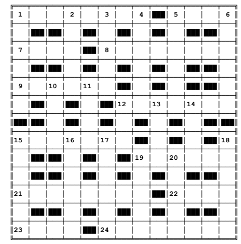
Across
1. Residential district
5. Brave deed
7. Resist authority
8. Border upon
9. Historical periods
10. Delete
11. Representing, on ... of
13. Wheedle
14. Waltzed
18. Calm
21. Drama
22. Underground stems
24. Call up (feelings)
25. Cheeky smile
26. Roman garment
27. Narrow lank links
28. Ancient harp
29. Appear



Down
1. Mopped
2. Extremist
3. Fleeting
4. Grazes
5. Swindled
6. Emphatic
12. Tell untruths
15. Sensitivity to substances
16. Red pepper spice
17. Marriage dissolution
19. Tall bird

Puzzle 4

Across
1. Teacher's charges
5. Shapeless mass
7. Pecans or almonds
8. Noblewoman
9. Sidesteps
12. Mature in years
15. Bath
19. Peacock's mate
21. Six-sided figures
22. Power group
23. Govern
24. Changes hair-do



Down
1. Transmitter
2. Gave medicine to
3. Head supporters
4. Turn informer
5. Conflict
6. Industriously
10. Gorillas or chimpanzees
11. Radiate
12. Fluctuation, ... and flow
13. Rounded roof
14. Skin irritation
15. Shrivel
16. Compassionate
17. Commotion
18. Light meals
19. Fence poles
20. Monastery church

Crossword Answers

Puzzle 1 Across
1. IDEAL
7. INNUENDO
8. POLAR
10. SENSATIONS
12. SEARCHES
14. PLOD
16. JIGS
17. OBTAINED
20. WEIGHTLESS
23. EAGLE
24. LOLLIPOP
25. STAID

Puzzle 1 Down
1. IMPELS
2. ALAS
3. INNS
4. BUTTS
5. UNCOILING
6. HOUSED
9. RETCH
11. LANGUIDLY
13. EBB
15. PAUSE
16. JEWELS
18. DEFEND
19. THEIR
21. LOOK
22. SALT

Puzzle 2 Across
1. DROOL
7. DOGMATIC
8. ARCED
10. SUPERSONIC
12. SAUCEPAN
14. CROP
16. KNOT
17. ELECTRIC
20. AVALANCHES
23. SALVO
24. ANECDOTE
25. ALONE

Puzzle 2 Down
1. DRAINS
2. ONES
3. VOTE
4. SMASH
5. ITINERARY
6. ICECAP
9. DUPES
11. AUTOMATES
13. ALL
15. ACRES
16. KOALAS
18. COYOTE
19. HARDY
21. COTS
22. SAIL

Puzzle 3 Across
1. SUBURB
5. FEAT
7. REBEL
8. ABUT
9. ERAS
10. ERASE
11. BEHALF
13. COAX
14. DANCED
18. SEDATE
21. PLAY
22. TUBERS
24. EVOKE
25. GRIN
26. TOGA
27. NECKS
28. LYRE
29. EMERGE

Puzzle 3 Down
1. SWABBED
2. ULTRA
3. BRIEF
4. ABRADES
5. FLEECED
6. ADAMANT
12. LIE
15. ALLERGY
16. CAYENNE
17. DIVORCE
19. EMU

Puzzle 4 Across
1. STUDENTS
5. BLOB
7. NUTS
8. COUNTESS
9. EVADES
12. ELDERLY
15. WASHTUB
19. PEAHEN
21. HEXAGONS
22. BLOC
23. RULE
24. RESTYLES

Puzzle 4 Down
1. SENDER
2. DOSED
3. NECKS
4. SQUEAL
5. BATTLE
6. BUSILY
10. APES
11. EMIT
12. EBB
13. DOME
14. RASH
15. WITHER
16. HUMANE
17. UPROAR
18. SNACKS
19. POSTS
20. ABBEY

4 Nonograms

You have a grid of squares, which must be blank or filled in. The aim is to fill in the boxes so that it matches the numbers on every side. Numbers are in order regarding to the placement of squares and gaps can be any number of spaces. For example a row with a "2 3" in it could look like: ■■··■■■ or ■■·■■■· or ·■■·■■■

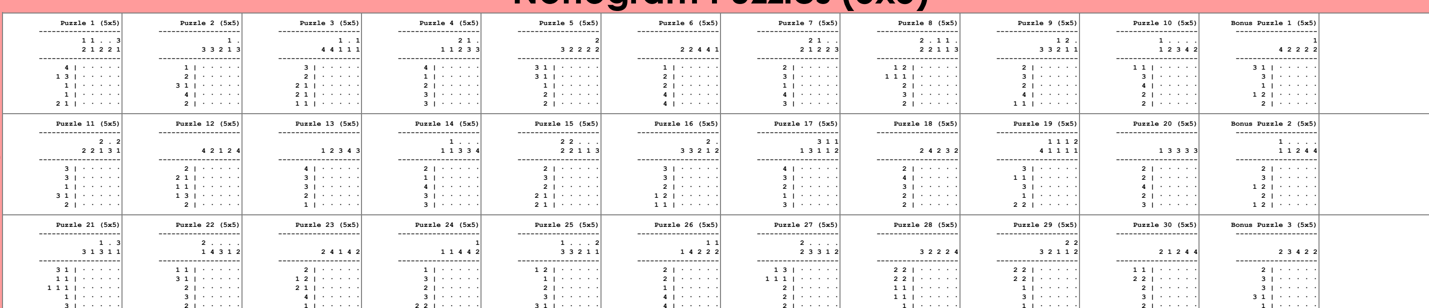
There may be any number of blanks before, after or between the blocks depending on the other rows. In the 15x15 puzzles the underlined double digit numbers are one number but may overlap the space of another row. It was done to keep the table formatted correctly. So 312 means the first columns has 3 and the one beside it has 12.

```
          Example
---------------------
                    2
            4 1 3 1 2
---------------------
      1 3 | ■ · ■ ■ ■
    1 1 1 | ■ · ■ · ■
        3 | ■ ■ ■ · ·
      1 1 | ■ · · · ■
        1 | · · · · ■
```

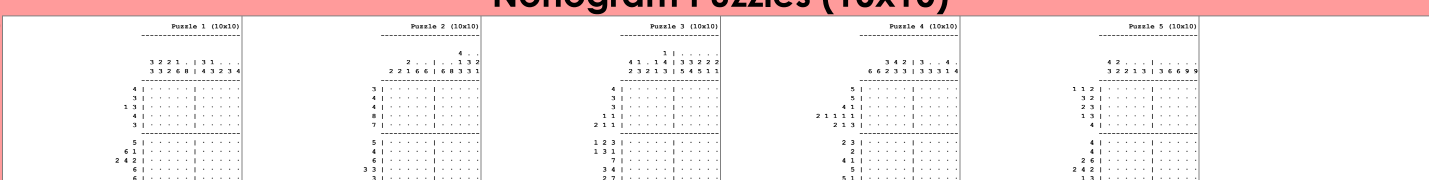
```
Example (Half Completed)
-------------------
              1 . .
            1 1 . .
          2 3 1 2 2
-------------------
        4 | · ■ ■ ■ ·
      1 2 | · · x · ·
        3 | · · ■ · ·
        1 | · · x · ·
        2 | x · ■ · x
```

Cells are aligned right to keep the formatting of the puzzle displaying correctly. The example to the far right shows the first few steps of a new puzzle being solved. Start by filling in the biggest numbers by working out which cells MUST have blocks - such as the three middle blocks of the "4" row. It's useful to put x's in cells which can't have a block.

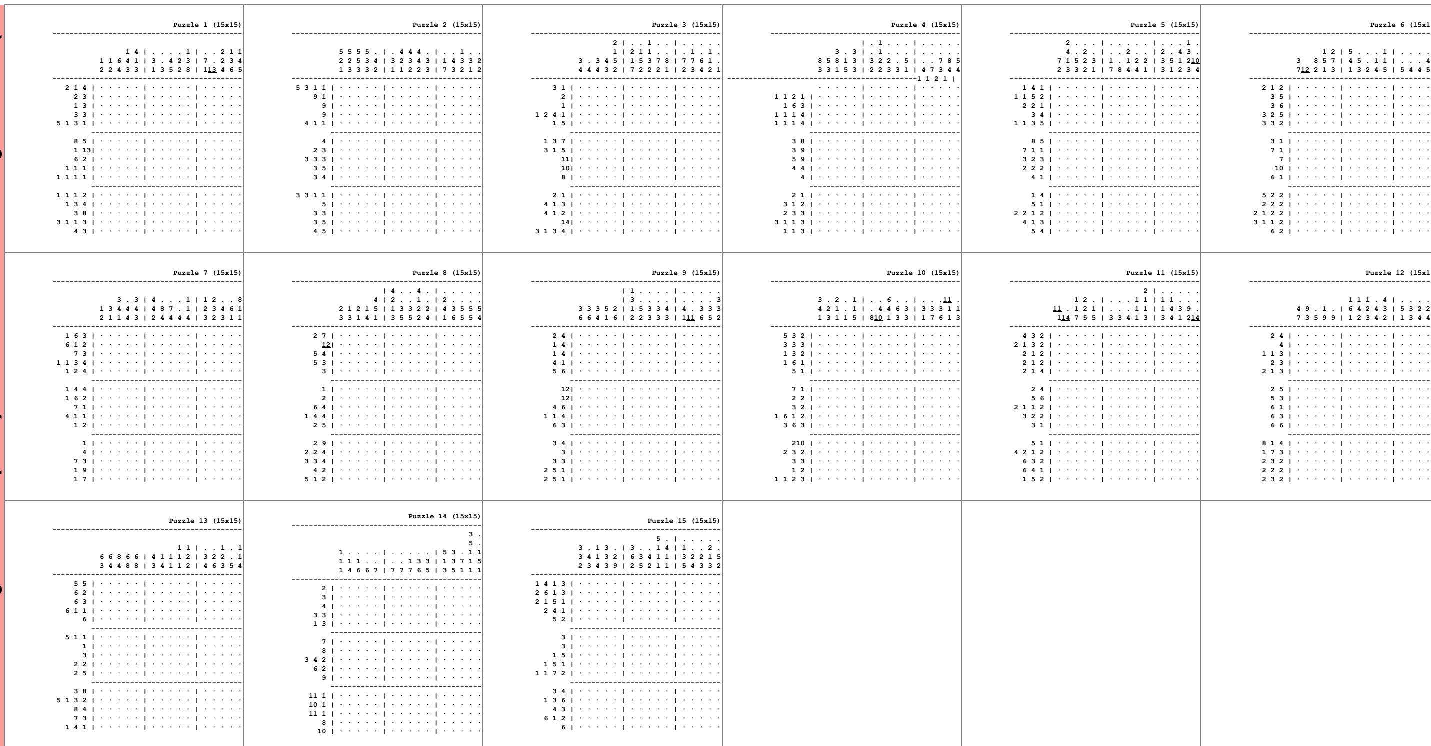
Nonogram Puzzles (5x5)



Nonogram Puzzles (10x10)

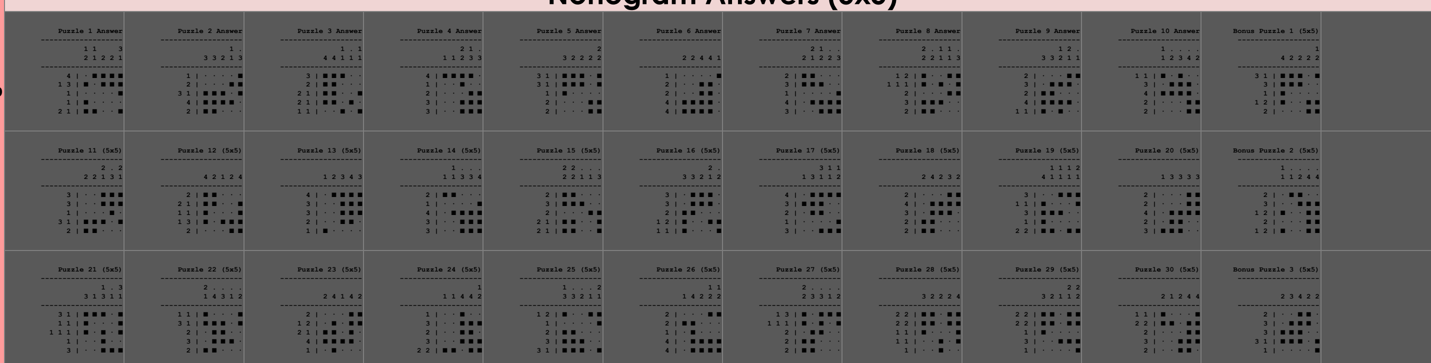


Nonogram Puzzles (15x15)

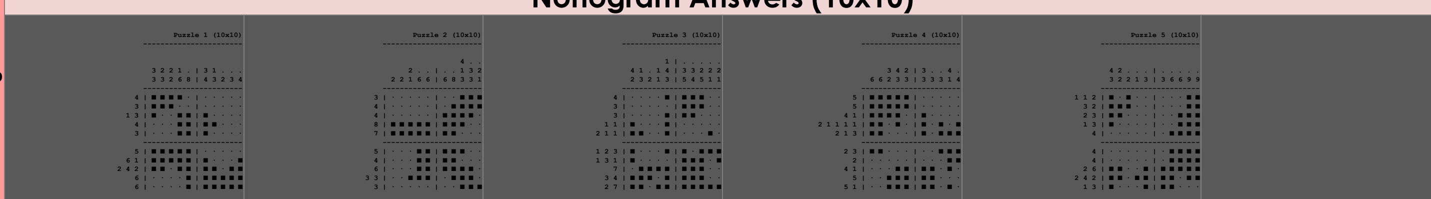


Nonogram Answers

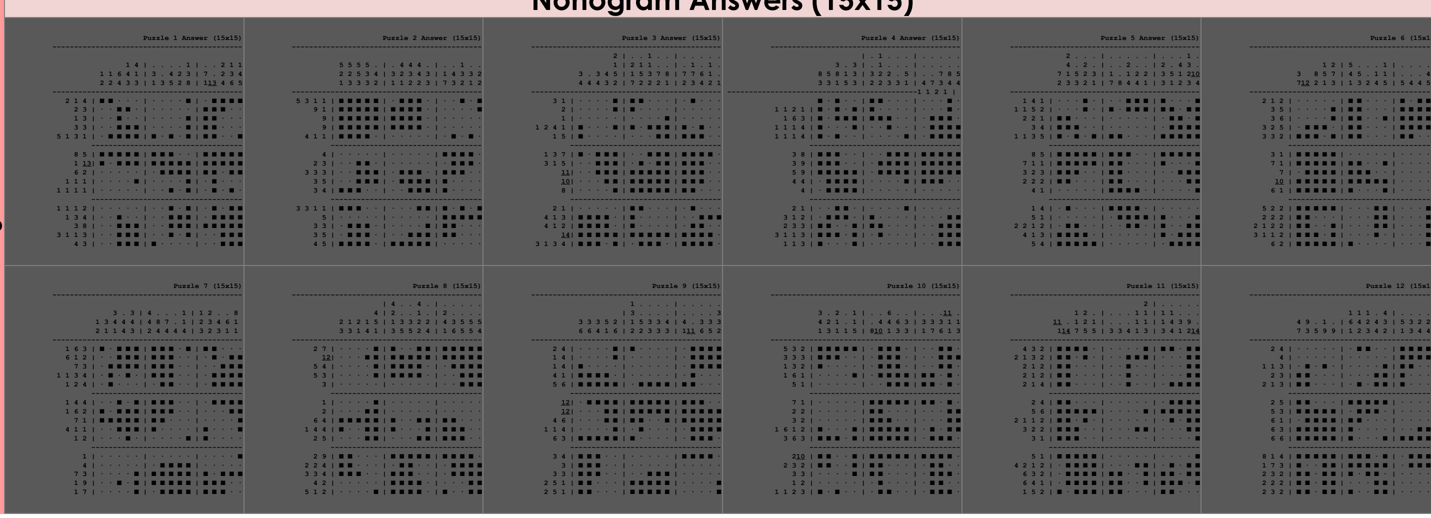
Nonogram Answers (5x5)



Nonogram Answers (10x10)



Nonogram Answers (15x15)



ENTERTAINMENT
Paper Games
Nonograms
Nonogram Answers

Puzzle 13 (15x15)
Puzzle 14 (15x15)
Puzzle 15 (15x15)

5 Bridges

Bridges

Bridge, Hashi or Hashiwokakero is played on a rectangular grid with no standard size. Some cells start out with numbers from 1 to 8 inclusive; these are the islands. The rest of the cells are empty. The goal is to connect all of the islands into a single connected group by drawing a series of bridges between the islands.

The bridges must follow certain criteria: They must begin and end at distinct islands, travelling a straight line in between; They must not cross any other bridges or islands; They may only run orthogonally; At most two bridges connect a pair of islands; and The number of bridges connected to each island must match the number on that island.

Example

```
2---------------2 ·
| · · · · · · · | 2
| 2=============3 ‖
4=================5
| · · · · 1---2 · |
| · 1---3---1 | · |
| · · · | 2===5 · |
| · · · | · · ‖ · |
2-------3---1 ‖ · |
· · · · · 1---5===3
```

Key

```
· holds the grid
(1-8) is an island
- is a single path
| is a single path
= is a double path
‖ is a double path
```

Bridges 10x10 (Easy)

Puzzle 1 · Puzzle 2 · Puzzle 3 · Puzzle 4 · Puzzle 5 · Puzzle 6 · Puzzle 7 · Puzzle 8 · Puzzle 9 · Puzzle 10 · Bonus

Bridges 10x10 (Normal)

Puzzle 1 · Puzzle 2 · Puzzle 3 · Puzzle 4 · Puzzle 5 · Puzzle 6 · Puzzle 7 · Puzzle 8 · Puzzle 9 · Puzzle 10 · Bonus

Bridges 10x10 (Hard)

Puzzle 1 · Puzzle 2 · Puzzle 3 · Puzzle 4 · Puzzle 5 · Puzzle 6 · Puzzle 7 · Puzzle 8 · Puzzle 9 · Puzzle 10 · Bonus

Bridges 15x15

Puzzle 1 (Easy) · Puzzle 2 (Normal) · Puzzle 3 (Normal) · Puzzle 4 (Normal) · Puzzle 5 (Hard)

Bridges Answers

Bridges 10x10 Answers (Easy)

Puzzle 1 Answer · Puzzle 2 Answer · Puzzle 3 Answer · Puzzle 4 Answer · Puzzle 5 Answer · Puzzle 6 Answer · Puzzle 7 Answer · Puzzle 8 Answer · Puzzle 9 Answer · Puzzle 10 Answer · Bonus

Bridges 10x10 Answers (Normal)

Puzzle 1 Answer · Puzzle 2 Answer · Puzzle 3 Answer · Puzzle 4 Answer · Puzzle 5 Answer · Puzzle 6 Answer · Puzzle 7 Answer · Puzzle 8 Answer · Puzzle 9 Answer · Puzzle 10 Answer · Bonus

Bridges 10x10 Answers (Hard)

Puzzle 1 Answer · Puzzle 2 Answer · Puzzle 3 Answer · Puzzle 4 Answer · Puzzle 5 Answer · Puzzle 6 Answer · Puzzle 7 Answer · Puzzle 8 Answer · Puzzle 9 Answer · Puzzle 10 Answer · Bonus

Bridges 15x15 Answers

6 Nine Letter Word

Make four letter words or more using the listed letters only using each letter once. Every problem has at least one 9 letter word associated with it. The letters do not need to be touching.

Puzzle 1

I	A	H
S	N	U
G	S	E

Target: 78 words

Puzzle 2

R	F	C
E	N	N
I	E	A

Target: 57 words

Puzzle 3

E	P	T
E	T	R
U	R	S

Target: 83 words

Puzzle 4

F	D	T
R	A	E
R	W	A

Target: 87 words

Puzzle 5

D	D	T
I	S	L
E	A	E

Target: 142 words

Puzzle 6

R	D	T
W	S	E
E	L	E

Target: 81 words

Puzzle 7

I	R	L
E	S	V
D	O	S

Target: 157 words

Puzzle 8

E	M	C
A	H	C
S	T	I

Target: 91 words

Puzzle 9

S	N	D
E	T	I
E	E	R

Target: 132 words

Puzzle 10

R	L	A
E	E	H
R	A	S

Target: 92 words

Puzzle 11

L	N	A
I	D	F
E	T	Y

Target: 104 words

Nine Letter Word Answers

These are the answers to the nine letter word puzzles. The cells are grey and the font is small to help prevent accidentally reading them.

Puzzle 1 Answers

anguishes, anguish, gnashes, guineas, hessian, anuses, ashing, assign, easing, genius, gneiss, guinea, hinges, neighs, sanies, sansei, shines, singes, anise, ashen, gains, geans, genus, gnash, guans, hangs, hinge, negus, neigh, nisus, sangs, sasin, shine, shins, shuns, signs, sines, singe, sings, sinus, snags, snugs, suing, using, anis, anus, gain, gean, gens, genu, gins, gnus, guan, guns, hang, hens, hins, hung, nags, ness, nigh, sain, sane, sang, sans, sens, shin, shun, sign, sine, sing, sinh, sins, snag, snug, sung, suns, unis

Puzzle 2 Answers

refinance, narceine, cannier, faience, fancier, fiancee, finance, canine, canner, careen, carnie, enface, fainer, fencer, fennec, ferine, fiance, inaner, infare, refine, cairn, caner, crane, crine, fence, finer, franc, inane, infer, infra, inner, nacre, nance, nicer, niece, rance, ranee, renin, acne, cain, cane, cine, earn, erne, fain, fane, fern, fine, firn, naif, narc, near, nice, nine, rain, rani, rein

Puzzle 3 Answers

putterers, sputterer, putterer, pertest, pretest, puttees, putters, reputes, sputter, trustee, truster, turrets, ureters, utterer, erupts, perter, pester, peters, petter, preset, purest, puttee, putter, repute, rester, retest, retuse, septet, setter, street, suttee, terret, terser, tester, truest, turret, ureter, utters, erupt, ester, peter, putts, reest, reset, setup, spurt, steep, steer, stree, strep, strut, stupe, terse, trees, truer, trues, trust, turps, upset, utter, erst, pert, pest, pets, puts, putt, rest, rete, rets, rust, ruts, sept, sett, step, stet, suet, tees, test, tree, tres, tret, true,tuts

Puzzle 4 Answers

afterward, drafter, redraft, warfare, afeard, dafter, darter, drawer, errata, farted, frater, rafted, rafter, redraw, retard, retrad, reward, tarred, trader, wafted, warder, warred, after, award, aware, darer, dater, draft, drear, dwarf, fader, farad, fared, farer, fated, fatwa, radar, rared, rated, rater, rawer, reata, tared, terra, trade, tread, wader, wafer, water, afar, area, awed, daft, dare, dart, data, date, deaf, dear, drat, draw, fade, fard, fare, fart, fate, fear, feat, feta, frae, frat, raft, rare, rata, rate, read, rear, taed, tare, tear, trad, wade, waft, ward, ware, wart, wear

Puzzle 5 Answers

deadliest, desalted, steadied, deadest, details, dilates, ideates, laddies, sedated, teddies, addles, deltas, desalt, diesel, distal, eddies, elates, eldest, elides, elites, ideals, idlest, ladies, lasted, leased, listed, listee, saddle, sailed, salted, sealed, seated, sedate, sidled, silted, slated, staled, stelae, teased, teasel, tildes, adits, aedes, aides, aisle, aside, dales, dates, deals, deeds, deist, delis, dials, didst, diets, eased, easel, edits, ideas, idles, islet, istle, lades, leads, lease, least, litas, sated, setae, sided, sidle, sited, slate, sleet, slide, staid, stale, stead, steal, steed, steel, stela, stile, taels, tails, tales, teals, tease, tesla, tides, tiles, adds, aids, ails, ales, dads, dais, dies, dits, ease, east, eats, eels, else, etas, ides, isle, lads, lase, last, lats, leas, lees, leis, lest, lets, lids, lies, list, said, sail, sale, salt, sate, sati, seal, seat, seed, seel, side, sild, silt, site, slat, sled, slid, slit, tads, teas, teds, tees, ties

Puzzle 6 Answers

sweltered, wrestled, deletes, lewdest, resewed, sleeted, steeled, steered, strewed, sweeter, swelter, weeders, welders, welters, wrested, wrestle, desert, deters, elders, eldest, reseed, rested, reweds, seeder, seeled, slewed, stewed, tweeds, wester, deers, ester, ewers, leers, reeds, reels, reest, reset, resew, sewed, sewer, sleet, steed, steel, steer, stree, strew, swede, sweet, terse, trees, trews, weeds, weest, welds, welts, wrest, dews, eels, else, erst, ewes, lees, lest, lets, reds, rest, rets, seed, seel, seer, sere, sled, slew, stew, teds, tees, tres, weds, wees, west, wets

Puzzle 7 Answers

dissolver, dissolve, soldiers, devisor, devoirs, dossier, drivels, lorises, rissole, silvers, sliders, slivers, solders, soldier, solider, solvers, visored, devils, divers, dories, dosser, drives, droves, idlers, lessor, livers, lories, losers, lovers, oilers, oldies, olives, oriels, osiers, resold, servos, sidles, silver, slider, slides, sliver, soiled, solder, solids, solved, solver, solves, versos, videos, vireos, visors, delis, dives, doers, doles, doses, doves, dress, dries, dross, eidos, evils, idles, idols, isles, levis, lidos, lives, lodes, loess, lords, loris, loser, loses, loves, osier, overs, rides, riels, riles, rises, rives, roils, roles, roses, roves, servo, sides, sidle, silds, silos, sired, sires, sleds, slide, sloes, soils, soled, soles, solid, solve, sores, veils, velds, verso, viols, vised, vises, visor, voids, voles, dies, diss, does, dols, dose, doss, ides, isle, leis, less, lids, lies, lose, loss, odes, oils, oles, ores, oses, reds, reis, revs, rids, rise, rods, roes, rose, side, sild, silo, sire, sirs, sled,slid, sloe, sods, soil, sold, sole, soli, sols, sore, sori, vies, vise, voes

Puzzle 8 Answers

catechism, schematic, misteach, achiest, aitches, atheism, cachets, catches, chasmic, chemist, chicest, matches, caches, cachet, chaise, chaste, cheats, chimes, ethics, haemic, hectic, itches, mashie, sachem, sachet, scathe, schema, taches, theism, aches, aitch, cache, catch, chase, chasm, chats, cheat, chest, chime, chits, ethic, hames, haste, hates, heats, heist, match, meths, saith, shame, smith, stich, tache, teach, techs, theca, ache, ahem, cash, cham, chat, chic, chis, chit, csch, each, echt, etch, hame, hams, hast, hate, hats, heat, hems, hest, hies, hims, hits, itch, mash, math, mesh, sech, sham, shat, shim, shit, tach, them, this

Puzzle 9 Answers

eternised, tenderise, teredines, eternise, inserted, neediest, nerdiest, reediest, resented, resident, sintered, teensier, trendies, destine, dieters, eeriest, entered, entrees, entries, reedits, steered, teenier, tenders, desert, deters, dieter, direst, driest, enters, entire, entree, eterne, insert, inters, nested, reedit, rented, resent, rested, retene, retied, reties, rident, sinter, stride, tender, tensed, tenser, tiered, tinder, trends, trines, deist, dents, deter, diets, dints, edits, enter, ester, inert, inset, inter, nites, nitre, reest, rents, reset, resit, retie, rites, sente, sited, steed, steer, stein, stern, stree, teens, tends, tense, terns, terse, tides, tiers, tined, tines, tired, tires, treed, treen, trees, trend, tried, tries, trine, dent, diet, dint, dirt, dits, edit, erst, nest, nets, nite, nits, rent, rest, rete, rets, rite, sent, site, snit, stir, teds, teed, teen, tees, tend, tens, tern, tide, tied, tier, ties, tine, tins, tire, tree, tres

Puzzle 10 Answers

rehearsal, healers, hearers, rehears, shearer, eraser, haeres, halers, healer, hearer, hearse, lasher, leaser, rasher, realer, reales, rehear, resale, reseal, sealer, sharer, areal, areas, earls, easel, erase, haler, hales, hares, heals, hears, heels, heres, lares, laser, lease, leash, leers, rales, rares, reals, rears, reels, rheas, saree, selah, serer, shale, share, shear, sheer, alae, alee, ales, area, ares, arse, earl, ears, ease, eels, else, eras, errs, hale, hare, heal, hear, heel, here, herl, hers, lase, leas, leer, lees, lehr, rale, rare, rase, real, rear, reel, resh, rhea, sale, seal, sear, seel, seer, sera, sere

Puzzle 11 Answers

defiantly, inflated, defiant, fainted, faintly, inflate, afield, alined, daftly, dainty, deafly, denial, dental, detail, detain, dilate, entail, failed, fealty, featly, fetial, finale, flayed, litany, nailed, neatly, tailed, ailed, alien, aline, anile, anted, daily, dealt, delay, delta, eland, faint, fated, fatly, final, ideal, inlay, laden, laity, lated, leafy, tidal, tinea, yenta, adit, aide, alit, anil, ante, anti, ayin, daft, dale, date, deaf, deal, dean, dial, elan, etna, fade, fail, fain, fane, fate, feal, feat, feta, fiat, fila, flan, flat, flay, flea, idea, ilea, lade, lady, laid, lain, land, lane, late, lati, lead, leaf, lean, naif, nail, neat, taed, tael, tail, tain, tale, tali, teal, yean

7 Boggle

You have to find as many words as possible on the grid. You can move from one letter (dice) to another if it is a neighbour (in all directions).
You cannot use a letter (dice) more than once in a word. You get points for each word - the more letters the better.

Puzzle 1

C	R	E	A
T	N	R	C
R	A	S	E
E	H	E	R

Target: 203 words

Puzzle 2

E	T	I	V
N	R	R	P
A	E	P	I
R	I	T	S

Target: 183 words

Puzzle 3

M	R	D	N
O	E	A	A
T	N	A	O
O	S	T	S

Target: 252 words

Puzzle 4

H	S	E	L
U	S	H	A
T	S	S	D
D	I	E	P

Target: 171 words

Puzzle 5

O	U	E	P
S	D	R	S
H	L	A	P
O	E	N	R

Target: 301 words

Puzzle 6

P	E	D	D
A	T	H	I
L	A	R	A
W	O	S	I

Target: 228 words

Puzzle 7

M	R	U	S
U	N	M	B
A	T	I	T
F	O	S	C

Target: 155 words

Puzzle 8

C	A	N	O
G	E	T	L
N	O	A	D
D	O	C	I

Target: 179 words

Puzzle 9

M	R	T	E
I	A	R	O
R	S	H	A
E	C	T	R

Target: 301 words

Puzzle 10

T	A	D	R
M	E	E	U
I	A	S	M
E	T	N	E

Target: 295 words

Boggle Answers

These are the answers to the boggle puzzles. The cells are grey and the font is small to help prevent accidentally reading them.

Puzzle 1 Answers

276 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

rehearser, centares, reascent, rehearse, careers, centare, crasher, earners, hearers, rearers, reearns, rehears, shearer, sheerer, tanrecs, trasher, anears, arenas, ascent, career, carers, censer, centas, centra, centre, creesh, earner, eraser, errant, haeres, hearer, hearse, nearer, racers, rasher, rearer, recent, reearn, rehear, reheat, rerent, reseat, scarer, searer, secern, sharer, snarer, tanrec, acres, anear, antre, areca, arena, carat, carer, cares, carns, carse, cense, ceres, crane, crash, earns, erase, escar, hanse, hares, hears, heart, heres, herns, narcs, nares, nears, racer, races, rarer, rares, raser, rears, reran, resat, rheas, saner, saree, scare, scena, scent, scree, serac, serer, share, sharn, shear, sheer, snare, tares, tarns, tarre, trans, trash, aces, acre, arcs, area, ares, arse, care, carn, carr, cars, cees, cent, cere, earn, ears, ease, eras, erne, erns, errs, esne, haes, hant, hare, hart, hear, heat, here, hern, hers, narc, near, race, rant, rare, rase, rash, rear, recs, rees, rent, resh, rhea, sane, scar, sear, seat, seer, sera, sere, shat, shea, tahr, tans, tare, tarn, tars, ace, ahs, ane, ant, arc, are, ars, art, ash, car, cee, ear, eat, ens, era, ere, ern, err, ers, hae, has, hat, her, hes, nae, nah, rah, ran, ras, rat, rec, ree, res, sae, sat, sea, sec, see, ser, sha, she, tae, tan, tar, tas

Puzzle 2 Answers

270 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

retirant, trippets, trippier, iterant, retirer, ripener, spirant, stirrer, terrane, terrets, territs, tippets, tippier, tripper, trippet, arpent, entera, entire, errant, periti, perter, pipets, pipier, pipits, pitier, ranter, renter, rerent, retire, ripper, sipper, sippet, spirea, spirit, sprent, sprite, sterna, tenets, tenter, terret, territ, tipper, tippet, traits, triste, triter, airer, antre, arene, arpen, arris, enter, peart, peris, piper, pipet, pipit, piste, preps, rarer, rente, reran, retia, riant, ripen, riper, siren, sirra, spean, spear, speir, spent, spier, spire, spirt, spite, sprit, stent, stere, stern, stipe, stirp, tenet, terai, terne, terra, tipis, trait, trets, tripe, trips, trite, aits, ante, anti, earn, erne, etna, iris, near, nets, pean, pear, pent, pere, peri, perp, pert, perv, pets, pian, pier, pipe, pips, pirn, pits, prep, rant, rare, rear, rent, repp, reps, rets, ripe, rips, rite, sipe, sire, site, spit, step, stir, tear, tent, tern, tier, tipi, tips, tire, tret, trip, air, ait, ane, ant, are, art, ear, era, ere, ern, err, ire, its, nae, net, pea, pen, per, pet, pia, pie, pip, pis, pit, psi, pst, rai, ran, rei, rep, ret, ria, rip, sip, sir, sit, tea, ten, tie, tip, tis

Puzzle 3 Answers

272 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

monstera, mordants, mordents, torments, andante, daemons, monarda, moneran, monster, mordant, mordent, santera, santero, stormed, toasted, toaster, tomenta, tonearm, torment, anadem, ardent, arenas, armets, daemon, demons, mensas, mentor, normed, omenta, ranted, reason, redans, santos, snared, snored, soared, staned, stents, stoned, stoner, stored, tasted, taster, aeons, andro, anear, ansae, antae, antas, anted, areas, arena, armed, armet, aster, deans, demon, denar, dents, drone, easts, enorm, etnas, means, meant, meats, menad, mensa, menta, monad, monas, monos, monte, morae, naans, nanas, neats, noted, noter, oared, oasts, omens, oread, rants, redan, rents, rotos, saned, saner, santo, snare, snore, sonar, stane, stead, steno, stent, stoae, stoas, stone, store, storm, tanto, taste, teats, tenor, tents, toast, toeas, toned, toner, aeon, aero, anas, ansa, anta, ante, ants, area, dans, dare, dean, dear, demo, dens, dent, derm, east, eats, eons, etna, mead, mean, meat, meno, mono, mons, mora, more, mote, mots, naan, nada, nana, nans, naos, nard, near, neat, nerd, nets, nome, norm, note, oast, oats, omen, omer, onos, onto, orad, rand, rant, read, rent, rets, rote, roto, rots, sane, sans, sned, snot, soar, sone, sots, stem, stoa, tans, taos, tear, teas, teat, tens, tent, term, toad, toea, toed, tome, tone, tons, tora, tore, tost, aas, ana, and, ane, ant, are, arm, dan, den, ear, eat, ens, eon, era, med, men, met, mon, mor, mot, nae, nan, net, nom, nor, nos, not, oar, oat, one, ono, ons, ora, ore, rad, ran, red, rem, ret, roe, rom, rot, sae, sat, son, sot, tae, tan, tao, tas, tea, ted, ten, toe, tom, ton, tor

Puzzle 4 Answers

271 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

speisses, ashless, desists, disuses, easiest, hussies, shushes, situses, tussahs, tussehs, dashes, dassie, deists, desist, dishes, dissed, disses, disuse, easies, halest, hasped, hassel, hushes, lashes, lasses, lassie, leased, leases, sadhes, selahs, shades, shales, sisses, speiss, sussed, susses, tushes, tussah, tussal, tusseh, tusses, tussis, ashes, asses, dales, deist, eased, eases, esses, hades, hales, heads, hests, lades, lased, lases, lassi, leads, lease, leash, pedal, pests, sades, sadhe, sales, selah, shade, shads, shale, sheal, sheas, shush, shuts, sisal, situs, stied, sties, ales, dahl, dahs, dale, dash, dhal, died, dies, dish, diss, dits, ease, edhs, hade, haes, hale, hasp, head, heal, hest, hush, huts, lade, lads, lase, lash, lass, lead, leas, less, lest, peds, pest, psis, psst, sade, sale, seal, seas, seis, shad, shea, shes, shut, sits, sped, suss, tied, ties, tush, used, uses, ads, ahs, ale, ash, asp, ass, dah, dal, die, dis, dit, edh, eds, ess, had, hae, has, hes, hut, ids, its, lad, las, lea, les, ped, pes, psi, sad, sae, sal, sea, sei, sel, sha, she, sis, sit, tie, tis, use, uts

Puzzle 5 Answers

359 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

darnels, elapsed, headers, hearsed, holards, holders, leaders, pedlars, presale, pseudos, sheared, alders, darnel, douras, elapse, elders, header, hearse, holard, holder, laders, lapsed, lapser, leader, leased, leaser, neared, padres, panels, pareus, parsed, pedalo, pedals, pedlar, perdus, prudes, pseudo, pseuds, rasped, rasper, resale, shears, soudan, soured, spader, spared, uredos, alder, apres, asper, dares, dhole, doura, dural, duras, dures, eared, earls, eased, elder, heads, heals, heaps, heard, hears, holds, lader, lades, lapse, lards, lares, lased, laser, leads, leaps, learn, lears, lease, nards, nares, neaps, nears, older, padle, padre, panel, pards, pared, pares, pareu, parle, parse, pedal, perdu, perps, prase, preps, presa, prude, pseud, rared, rares, rased, raser, redan, redos, sadhe, sards, sedan, seral, sheal, shear, sheas, sheol, slaps, sodas, sours, spade, spado, spale, spare, sprue, suers, sural, suras, urase, uredo, urped, ursae, ados, aloe, also, apse, ares, arse, dale, dals, daps, dare, darn, dour, dues, duos, dura, dure, earl, earn, ears, ease, edhs, elan, elds, eras, head, heal, heap, hear, held, helo, hold, hole, hols, lade, lads, lane, laps, lard, lars, lase, lead, lean, leap, lear, leas, naps, nards, nares, neap, near, odas, odes, olds, olea, ouds, ours, pads, pale, pals, pane, pard, pare, pars, pase, peds, perp, prep, rads, rale, raps, rare, rase, rasp, redo, reds, reps, rude, rued, rues, rush, sade, sale, sals, sane, sard, sera, shea, shoe, slap, sloe, soda, sour, spae, span, spar, sped, sued, suer, sues, sura, surd, sure, udos, urds, urps, ursa, ado, ads, ale, als, ane, are, ars, asp, dal, dan, dap, dos, due, duo, ear, edh, eds, eld, els, era, ers, hen, hoe, lad, lap, lar, las, lea, nae, nap, oda, ode, ods, ohs, old, ole, oud, our, pad, pal, pan, par, pas, ped, per, pes, rad, ran, rap, ras, red, rep, res, rue, sad, sae, sal, sap, ser, she, sod, sou, spa, sue, udo, urd, urp

Puzzle 6 Answers

340 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

isolated, petrosal, airthed, isolate, latrias, loathed, solaria, solated, talaria, worthed, airted, alated, altars, althea, aortae, aortal, halted, hartal, lahars, lathed, latria, loathe, orated, palate, patrol, petrol, salted, solate, sorted, talars, tarsia, warted, watape, aahed, airth, alate, altar, aorta, arhat, arias, artal, atlas, atria, dealt, death, depth, hairs, halos, hated, ideal, irate, laari, lahar, laris, lated, lathe, lathi, loath, loris, orate, pated, petal, ratal, rated, rathe, sated, solar, sorta, sowar, tahrs, talar, talas, taped, taros, tarsi, tepal, thraw, throw, trawl, watap, worth, ahed, aide, airs, airt, alae, alar, alas, alow, aped, aria, arid, atap, awol, deal, dhal, dirt, eath, etas, hair, halo, halt, hart, hate, heal, heap, heat, hide, idea, irid, iris, lari, lars, late, lath, oars, oath, oral, osar, pate, path, peal, peat, raid, rais, rate, rath, rhea, rias, ride, said, salt, sari, sate, soar, sola, sora, sori, sort, tahr, tala, taos, tape, taro, tars, teal, tepa, thaw, thir, thro, trow, wars, wart, wort, aah, aal, aas, aha, ahi, aid, air, ais, ala, alt, ape, apt, ars, art, ate, awl, did, eat, edh, eta, eth, hao, has, hat, haw, hep, het, hid, lap, lar, las, lat, law, low, oar, oat, ora, ors, ort, owl, pal, pat, pea, ped, peh, pet, rah, rai, ras, rat, raw, ria, rid, row, sal, sat, saw, sir, sol, sow, sri, tae, tao, tap, tar, tas, taw, tea, ted, the, war, was, wat, wos

Puzzle 7 Answers

272 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

submits, animus, antics, aurums, autist, fanums, nimbus, rumina, subito, submit, tanist, tunics, antic, antis, aunts, aurum, autos, bints, biota, bunts, burnt, fanum, fatso, foist, mints, minus, munis, numbs, runic, runts, rutin, sinus, softa, stint, stoic, tints, titan, toits, tunic, units, anis, anti, ants, anus, aunt, auto, bint, bios, bits, bums, buna, bunt, burn, cist, fats, faun, foin, into, iota, mibs, mics, mina, mint, miso, mist, muni, muts, naoi, naos, nibs, nims, nits, nubs, numb, nuts, oats, otic, rubs, rums, runt, ruts, sibs, sims, smit, sofa, soft, stoa, stum, stun, taos, tics, tint, tits, toit, tost, tuna, turn, unau, unit, unto, urus, aft, ani, ant, bin, bio, bis, bit, bum, bun, bur, bus, cis, fan, fat, its, mib, mic, mis, mun, mus, mut, nib, nim, nit, nub, nus, nut, oaf, oat, oft, rub, rum, run, rut, sib, sic, sim, sin, sit, sot, sub, sum, sun, tan, tao, tau, tic, tin, tis, tit, tun, urn, uta, uts

Puzzle 8 Answers

264 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

genocidal, antacid, congeal, negaton, acetal, canola, cantal, canton, catalo, catena, centai, cental, cogent, dalton, dotage, etalon, gentoo, neocon, aceta, agent, agone, alone, antae, atone, caeca, canto, cento, codon, condo, conga, conge, congo, cotan, dicot, donga, dotal, genoa, laten, natal, notal, oaten, talon, togae, tondo, tonga, acid, aeon, agon, alto, anta, ante, cadi, cage, caid, calo, cane, cant, cate, cent, ciao, coal, coat, cone, coon, coot, cote, data, date, dato, dial, doat, doge, done, dong, dote, enol, etna, gaen, gane, gate, gent, geta, goad, goal, goat, gone, good, goon, icon, laic, laid, late, lone, lota, neat, neon, nota, note, onto, tace, taco, teal, tend, toad, toea, toga, tola, told, tone, tong, toon, ace, age, ago, aid, alt, ane, ant, ate, cad, can, cat, cod, cog, con, coo, cot, dal, doc, doe, dog, don, dot, eat, ego, end, eng, eon, eta, gae, gan, gat, gen, get, goa, god, goo, got, lac, lad, lat, lot, nae, nag, neg, net, nod, nog, noo, not, oat, oca, old, one, ono, oot, tad, tae, tag, tan, tao, tea, teg, ten, tod, toe, tog, ton, too

Puzzle 9 Answers

430 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

recharters, recharter, ceramist, charters, recharts, airshot, chamise, charter, craters, echoers, hoarser, misrate, rechart, restart, seriate, tartare, tartars, trisect, ahorse, airest, aortas, arhats, arista, ashore, cerate, cerias, chairs, chaise, charas, chares, charro, charrs, charts, chaser, crater, crista, echoer, eraser, eschar, haters, hoarse, imaret, irater, marish, maters, misate, raiser, rarest, raters, reshoe, reshot, retrim, ristra, sartor, sirrah, tarsia, tartar, terais, terras, terser, thairm, torahs, amirs, aorta, arhat, arise, arras, arris, ceria, cesta, chair, chais, chare, charm, charr, chars, chart, chase, chats, chore, crash, crate, crest, erase, hairs, hares, harts, hater, hoars, hoers, horas, horse, horst, irate, mahoe, mairs, maist, march, marcs, mares, marse, marsh, maser, mater, mires, miser, oaths, orate, orris, raise, rares, raser, ratch, rater, recta, resat, riser, rotas, scram, scrim, serai, share, shoat, shoer, shore, short, shote, simar, sirra, stare, start, tahrs, tamis, tares, tarot, tarre, tarsi, terai, terra, terse, tharm, throe, torah, toras, torse, torsi, trash, airs, airt, amir, amis, arch, arcs, ares, arse, arts, chai, cham, chao, char, chat, cram, cris, echo, echt, eras, erst, etas, hair, hare, harm, hart, hast, hate, hats, hoar, hoer, hora, ires, mair, mara, marc, mare, mars, mart, mash, mast, mate, mire, mirs, mise, mist, oars, oath, oats, orra, rais, rami, rare, rase, rash, rate, rath, rato, rats, recs, resh, rest, rias, rise, roar, rota, rote, sari, sate, sect, sera, sham, shat, shoe, shot, sima, sire, star, tahr, tare, taro, tars, tart, that, thro, tora, tore, torr, tors, tram, trim, tsar, aha, ahs, aim, air, ais, ami, arc, are, arm, ars, art, ash, ate, era, err, ers, eta, ham, hao, has, hat, hoe, hot, ire, mar, mas, mat, mir, mis, oar, oat, ohs, ora, ore, ors, ort, rah, rai, ram, ras, rat, rec, res, ret, rho, ria, rim, roe, rot, sat, sec, ser, sha, sim, sir, sri, tam, tao, tar, tas, tho, toe, tor

Puzzle 10 Answers

388 Words	3 Letter Words	4 Letter Words	5 Letter Words	6 Letter Words	7 Letter Words	8 Letter Words	9 Letter Words				

measurement, dementias, dreamiest, estimated, meantimes, dementia, easement, estimate, meantime, measured, seatmate, dements, ensured, meanest, measure, meatman, medusae, medusan, redates, reemits, steamed, adeems, atmans, damans, demast, dement, demits, dreamt, edemas, ensued, ensure, madres, meated, medusa, mensae, mensed, merdes, reamed, redate, reemit, remuda, reseat, reseda, resent, resume, reused, rudest, rumens, samite, seaman, seamed, seated, sedate, seitan, senate, tamest, teamed, teased, teaser, testae, urease, adeem, adust, aedes, aimed, ameer, amias, amies, atman, atmas, daman, dames, dates, deans, deems, demes, demit, demur, dream, drees, drest, drums, druse, dures, eased, edema, emeus, emits, enate, ensue, entia, etnas, madre, manes, manse, maser, mated, mates, means, meant, meats, mensa, mense, menta, merde, mesne, miasm, mured, mures, mused, muser, named, names, redes, reest, resat, reset, reuse, rumen, seder, sedum, semen, sente, senti, serum, setae, stane, steam, stied, stime, suede, tamed, tames, tease, teats, teems, testa, timed, times, ureas, aits, amas, amia, amie, anes, ante, anti, ants, asea, ates, atma, dame, date, dean, deem, deer, dees, deet, deme, dree, drum, dues, dure, dust, ease, east, eats, emes, emeu, emit, emus, esne, etas, etna, made, maes, mane, mans, mast, mate, mats, mead, mean, meat, meed, meet, mesa, meta, mite, mure, muse, must, name, nest, read, ream, rede, reed, rees, rems, rest, rude, rued, rues, rums, ruse, rust, same, sane, sate, sati, seam, seat, seed, seem, seer, seme, semi, sent, seta, sued, suer, surd, sure, tame, tans, team, teas, teat, teed, teem, tees, test, tied, ties, time, urea, used, user, aim, ait, ama, ami, ane, ant, ate, dam, dee, due, eat, eme, ems, emu, ens, eta, its, mad, mae, man, mas, mat, med, men, met, mud, mus, nae, nam, red, ree, rem, res, rue, rum, sae, sat, sea, see, sei, sen, ser, set, sue, sum, tad, tae, tam, tan, tas, tea, ted, tee, tie, urd, use

8 Yahtzee

Yahtzee is a dice game made by Milton Bradley (now owned by Hasbro), which was first marketed as Yatzie by the National Association Service of Toledo, Ohio, in the early 1940s. It was marketed under the name of Yahtzee by game entrepreneur Edwin S. Lowe in 1956.

The objective of the game is to score points by rolling five dice to make certain combinations. The dice can be rolled up to three times in a turn to try to make various scoring combinations and dice must remain in the box. A game consists of thirteen rounds. After each round the player chooses which scoring category is to be used for that round. Once a category has been used in the game, it cannot be used again. The scoring categories have varying point values, some of which are fixed values and others for which the score depends on the value of the dice. A Yahtzee is five-of-a-kind and scores 50 points, the highest of any category. The winner is the player who scores the most points.

Yahtzee Score Card

Upper Section

In the upper section there are six boxes. The score in each of these boxes is determined by adding the total number of dice matching that box.

Categories	Descriptions	Scores	Examples

Aces	Any combination	The sum of dice with the number 1 (Scores 3 to the right)	
Twos	Any combination	The sum of dice with the number 2 (Scores 6 to the right)	
Threes	Any combination	The sum of dice with the number 3 (Scores 12 to the right)	
Fours	Any combination	The sum of dice with the number 4 (Scores 8 to the right)	
Fives	Any combination	The sum of dice with the number 5 (Scores 5 to the right)	
Sixes	Any combination	The sum of dice with the number 6 (Scores 18 to the right)	

If a player scores a total of 63 or more points in these six boxes, a bonus of 35 is added to the upper section score. Although 63 points corresponds to scoring exactly three-of-a-kind for each of the six boxes, a common way to get the bonus is by scoring four-of-a-kind for some numbers so that fewer of other numbers are needed. A player can earn the bonus even if they score a "0" in an upper section box.

In order to gauge how well a player is doing in the upper section, they often refer to being "up" or "down" compared to the average of three required for each box. So that if a player scores four "sixes" they will be "6 up"; while if they then score just two "twos" they will then be only "4 up". Similarly, if a player starts with two "twos" they will be "2 down".

Lower Section

The lower section contains a number of poker-themed categories with specific point values:

Categories	Descriptions	Scores	Examples
Three Of A Kind	At least three dice the same	Sum of all dice (Scores 17 to the right)	
Four Of A Kind	At least four dice the same	Sum of all dice (Scores 24 to the right)	
Full House	Three of one number and two of another	25 (Scores 25 to the right)	
Small Straight	Four sequential dice (1-2-3-4, 2-3-4-5, or 3-4-5-6)	30 (Scores 30 to the right)	
Large Straight	Five sequential dice (1-2-3-4-5 or 2-3-4-5-6)	40 (Scores 40 to the right)	
Yahtzee	All five dice the same	50 (Scores 50 to the right)	
Chance	Any combination	Sum of all dice (Scores 13 to the right)	

Some players count a Yahtzee as being a valid Full House. However, the official rule is that a Full House is "three of one number and two of another". Small Straight and Large Straight are sometimes called Low and High, Short and Long Straight, or Little and Big Straights.

If a category is chosen but the dice do not match the requirements of the category the player scores 0 in that category. Some combinations offer the player a choice as to which category to score them under; e.g., a full house could be scored in the Full House, the Three-Of-A-Kind, or the Chance categories. The Chance category is often used for a turn that will not score well in any other category.

3 Brain Teasers

These puzzles are aimed at exercising your mind with riddles, jokes, trivia and facts.

Subheadings

1 Logic Puzzles

These are logic puzzles and riddles you can solve with a bit of thinking.

Logic Puzzles

Q1	A pregnant lady named her children: Dominique, Regis, Michelle, Fawn, Sophie and Lara. What will she name her next child? Jessica, Katie, Abby or Tilly?
Q2	What 8 letter word can have a letter taken away and it still makes a word. Take another letter away and it still makes a word. Keep on doing that until you have one letter left. What is the word?
Q3	If you have me, you want to share me. If you share me, you haven't got me. What am I?
Q4	A man has a 12 litre jug of beer, and wants to split it in half, but only has an 8 litre and a 5 litre jug. How can he do it?
Q5	There are three light bulbs in a room, and three light switches outside the room. You are outside, and want to match up which switch goes with which light bulb. You can only travel into the room once, and cannot come back in again. You can do anything you want upon entering the room. How can you set the situation so that you will know which switch goes with which light bulb?
Q6	While looking at the Pentagon building from the ground, what is the probability that you will see three of its sides?
Q7	There are 9 coins, all except one are the same weight, the odd one is heavier than the rest. You must determine which is the odd one out using an old fashioned balance. You may use the balance twice. Explain how this can be done.

Q8	100 people stand in a circle in order 1 to 100. No. 1 has a sword. He kills the next person (i.e. No. 2) and gives the sword to the next living person (i.e. No. 3). All people do the same until only 1 survives. Which number survives to the end?
Q9	A snail is at the bottom of a 30 foot well. Every hour the snail is able to climb up 3 feet, then immediately slide back down 2 feet. How many hours does it take for the snail to get out of the well?
Q10	A blind man is alone on a deserted island. He has two blue pills and two red pills. He must take exactly one red pill and one blue pill or he will die. How does he do it?
Q11	A farmer is on his way back from the market, with him he has a fox, a chicken and some grain. When he reaches a river crossing he must use a small boat only big enough for him and one other item. Unfortunately if the fox is left alone with the chicken it will eat it, as will the chicken eat the grain. Explain how the farmer can cross the river.
Q12	We are to play a version of Russian Roulette, the revolver is a standard six shooter but I will put two bullets in the gun in consecutive chambers. I spin the chambers, put the gun to my head pull the trigger and survive. I hand you the gun and give you a choice... You may put the gun straight to your head and pull the trigger, or you may re-spin the gun before you do the same. What is your choice and why?
Q13	Alice, Bob, and Cheri, three smart people, arrange a three-way duel. Alice is a poor shot, hitting her target only 1/3 of the time on average. Bob is better, hitting his target 2/3 of the time. Cheri is a sure shot hitting 100% of the time. They take turns shooting, first Alice, then Bob, the Cheri, then back to Alice, and so on until one is left. What is Alice's best course of action? And her chances of survival?
Q14	You reach a fork in the road. A sign explains that in one direction is Heaven and the other is Hell. Each path is blocked by a Guard. The sign goes on to say that one of the guards will always lie and the other will always tell the truth, it does not say which guard is which. We assume that the guards do know which path leads to where. You may ask one question of only one guard in order that you can determine, with certainty, the way to Heaven. What is that question?
Q15	Three ants are sitting at the three corners of an equilateral triangle. Each ant randomly picks a direction and starts to move along the edge of the triangle. What is the probability that none of the ants collide?
Q16	You have 10 stacks of 10 gold coins. All of the coins in one of these stacks are counterfeit, all the other coins are not. A real coin weighs 10 grams. A counterfeit coin weighs 11 grams. You have a modern scale that provides an accurate readout. What is the minimum number of weighings needed to determine which stack is fake?
Q17	You are at a point on the Earth. You travel South 100 miles, East 100 Miles and North 100 Miles. You arrive back where you started. Where are you? You are NOT at the North Pole.
Q18	Using only a 4 minute and 7 minute hourglass or egg timer how would you measure exactly 9 minutes?
Q19	An executioner lines up 100 prisoners single file and puts a red or a blue hat on each prisoner's head. Every prisoner can see the hats of the people in front of him in the line - but not his own hat, nor those of anyone behind him. The executioner starts at the end (back) and asks the last prisoner the colour of his hat. He must answer "red" or "blue." If he answers correctly, he is allowed to live. If he gives the wrong answer, he is killed instantly and silently. (While everyone hears the answer, no one knows whether an answer was right.) On the night before the line-up, the prisoners confer on strategy to help them. What should they do?
Q20	On a deserted road, the probability of observing a car during a thirty-minute period is 95%. What is the chance of observing a car in a ten-minute period?
Q21	A regular clock has an hour and minute hand. At 12 midnight the hands are exactly aligned. When is the next time they will exactly align or overlap? How many times a day will they overlap?
Q22	A man has three daughters. A second, intelligent man, asked him the ages of his daughters. The first man told him that the product of their ages (them all multiplied together) was 36. After thinking the second man was unable to find the answer and asked for another clue. The first man replies the sum of their ages is equal to his house door number. Still the second man was unable to answer and asked for another clue. The first man told him that his youngest daughter had blue eyes, and suddenly second man gave the correct answer. Explain how?
Q23	How many squares are there on a chessboard or checkerboard?? (the answer is not 64) Can you extend your technique to calculate the number of rectangles on a chessboard?
Q24	I have three envelopes, into one of them I put a £20 note. I lay the envelopes out on a table in front of me and allow you to pick one envelope. You hold but do not open this envelope. I then take one of the envelopes from the table, demonstrate to you that it was empty, screw it up and throw it away. The question is would you rather stick with the envelope you have selected or exchange it for the one on the table. Why? What would be the expected value to you of the exchange?
Q25	A man is in a rowing boat floating on a lake, in the boat he has a brick. He throws the brick over the side of the boat so as it lands in the water. The brick sinks quickly. The question is, as a result of this does the water level in the lake go up or down?
Q26	You have a string-like fuse that burns in exactly one minute. The fuse is inhomogeneous, and it may burn slowly at first, then quickly, then slowly, and so on. You have a box of matches, and no watch. How do you measure exactly 30 seconds?
Q27	Inside of a dark closet are five hats: three blue and two red. Knowing this, three smart men go into the closet, and each selects a hat in the dark and places it unseen upon his head. Once outside the closet, no man can see his own hat. The first man looks at the other two, thinks, and says, "I cannot tell what colour my hat is." The second man hears this, looks at the other two, and says, "I cannot tell what colour my hat is either." The third man is blind. The blind man says, "Well, I know what colour my hat is." What colour is his hat?
Q28	How many degrees (if any) are there in the angle between the hour and minute hands of a clock when the time is a quarter past three?
Q29	While changing a tyre, a motorist accidentally dropped all four wheel nuts into the sewer grate. He tried everything to retrieve them, but - to no avail. The man was beginning to suspect that he would have to spend many hours by the roadside, when a passing kid suddenly helped him solve the problem. Acting on the kid's advice, he successfully fitted a new tyre and drove to the nearest service station without accidents. What was the advice that the child had given the motorist?

ENTERTAINMENT	Brain Teasers	Logic Puzzles	Logic Puzzles	Q30	Once upon a time, Prince Charming was searching far and wide for his betrothed. Summer had already ended, when he came upon a shack, inhabited by an old witch. The weary traveler asked if she could grant him refuge for the night. The witch obliged and showed her guest a warm welcome, offering him food, drink and a place to sleep. The next morning, as Prince Charming was preparing to continue on his journey, she gave him a present, saying: 'A time will come, when you'll find your way barred by a wide river with no bridge. The only way to cross it is to swim to the other bank. This enchanted tunic will help you - it won't let you drown!'. Our hero continued on his journey. A hundred days and nights had passed before he came across the river the witch had warned him about. But, in the end - he didn't need to put on the tunic to cross it! Can you guess why?!
				Q31	A farmer keeps rabbits in three large hutches that stand in a row in his back yard. Each of the hutches is painted a different color - red, yellow and green. Until recently, the number of rabbits in the green hutch was twice as large as the number of rabbits in the yellow hutch. Then, one day, the farmer took five rabbits out of the left-side hutch and gave them away to the local school's pet corner. He also took half of the rabbits that remained in the left-side hutch and moved them to the red colored hutch. Now, can you guess what color the left-side hutch is?!
				Q32	Can you name one thing that all the people on Earth do simultaneously?
				Q33	Jack is looking at Anne. Anne is looking at George. Jack is married, George is not, and we don't know if Anne is married. Is a married person looking at an unmarried person?
				Q34	A man has 53 socks in his drawer: 21 identical blue, 15 identical black and 17 identical red. The lights are out and he is completely in the dark. How many socks must he take out to make 100 percent certain he has at least one pair of black socks?
				Q35	The day before two days after the day before tomorrow is Saturday. What day is it today?
				Q36	You have two ropes that each take an hour to burn, but burn at inconsistent rates. How can you measure 45 minutes? (You can light one or both ropes at one or both ends at the same time.)
				Q37	You're at a fork in the road in which one direction leads to the City of Lies (where everyone always lies) and the other to the City of Truth (where everyone always tells the truth). There's a person at the fork who lives in one of the cities, but you're not sure which one. What question could you ask the person to find out which road leads to the City of Truth?
				Q38	A farmer wants to cross a river and take with him a wolf, a goat and a cabbage. He has a boat, but it can only fit himself plus either the wolf, the goat or the cabbage. If the wolf and the goat are alone on one shore, the wolf will eat the goat. If the goat and the cabbage are alone on the shore, the goat will eat the cabbage. How can the farmer bring the wolf, the goat and the cabbage across the river without anything being eaten?
				Q39	A man is playing Russian roulette with a six-shooter revolver. He puts in one bullet, spins the chambers and fires at you, but no bullet comes out. He gives you the choice of whether or not he should spin the chambers again before firing a second time. Should he spin again?
				Q40	Susan and Lisa decided to play tennis against each other. They bet $1 on each game they played. Susan won three bets and Lisa won $5. How many games did they play?
				Q41	If five cats can catch five mice in five minutes, how long will it take one cat to catch one mouse?
				Q42	There is a barrel with no lid and some wine in it. "This barrel of wine is more than half full," says the woman. "No, it's not," says the man. "It's less than half full." Without any measuring implements and without removing any wine from the barrel, how can they easily determine who is correct?
				Q43	There are three bags, each containing two marbles. Bag A contains two white marbles, Bag B contains two black marbles, and Bag C contains one white marble and one black marble. You pick a random bag and take out one marble, which is white. What is the probability that the remaining marble from the same bag is also white?
				Q44	Three men are lined up behind each other. The tallest man is in the back and can see the heads of the two in front of him; the middle man can see the one man in front of him; the man in front can't see anyone. They are blindfolded and hats are placed on their heads, picked from three black hats and two white hats. The extra two hats are hidden and the blindfolds removed. The tallest man is asked if he knows what color hat he's wearing; he doesn't. The middle man is asked if he knows; he doesn't. But the man in front, who can't see anyone, says he knows. How does he know, and what color hat is he wearing?
				Q45	There are three crates, one with apples, one with oranges, and one with both apples and oranges mixed. Each crate is closed and labeled with one of three labels: Apples, Oranges, or Apples and Oranges. The label maker broke and labeled all of the crates incorrectly. How could you pick just one fruit from one crate to figure out what's in each crate?
				Q46	A teacher writes six words on a board: "cat dog has max dim tag." She gives three students, Albert, Bernard and Cheryl each a piece of paper with one letter from one of the words. Then she asks, "Albert, do you know the word?" Albert immediately replies yes. She asks, "Bernard, do you know the word?" He thinks for a moment and replies yes. Then she asks Cheryl the same question. She thinks and then replies yes. What is the word?
				Q47	You have five boxes in a row numbered 1 to 5, in which a cat is hiding. Every night he jumps to an adjacent box, and every morning you have one chance to open a box to find him. How do you win this game of hide and seek?
				Q48	You are given three doors to choose from, one of which contains a car and the other two contain goats. After you've chosen one but haven't opened it, Monty, who knows where everything is, reveals the location of a goat from behind one of the other two doors. Should you stick with your original choice or switch, if you want the car?
				Q49	There are three people (Alex, Ben and Cody), one of whom is a knight, one a knave, and one a spy. The knight always tells the truth, the knave always lies, and the spy can either lie or tell the truth. Alex says: "Cody is a knave." Ben says: "Alex is a knight." Cody says: "I am the spy." Who is the knight, who the knave, and who the spy?
				Q50	You meet three gods on a mountain top. One always tells the truth, one always lies, and one tells the truth or lies randomly. We can call them Truth, False and Random. They understand English but answer in their own language, with ja or da for yes and no—but you don't know which is which. You can ask three questions to any of the gods (and you can ask the same god more than one question), and they will answer with ja or da. What three question do you ask to figure out who's who?
				Q51	A boy was 15 in 1990, and in 1995 he turned 10. How is this possible?
				Q52	You have 12 pills and they all got the same weight, except for one, which hasn't got the same weight. You don't know if it is heavier or easier. You have one scale to weight the pills. You now have to find out, which pill is the right one (the one with a different weight), but you can use the scale only three times. How do you know, which one is the right one?You have 12 pills and they all got the same weight, except for one, which hasn't got the same weight. You don't know if it is heavier or easier. You have one scale to weight the pills. You now have to find out, which pill is the right one (the one with a different weight), but you can use the scale only three times. How do you know which one is the right one?

ENTERTAINMENT | Brain Teasers | Logic Puzzles

Q53	A woman was in court for killing her husband. She said she wasn't guilty and that she dearly missed him. In the closing statement, the woman's lawyer stands up and says, "Her husband was just missing. Everyone look at the doors. He's going to walk through them in about 30 seconds." The entire jury stares at the doors waiting for waiting for this woman's husband to walk through the doors. The lawyer and the woman stare at the jury. The lawyer concludes by saying, "See! If you were so sure she killed her husband, you wouldn't be watching that door!" The jury immediately gave a guilty verdict. Why?
Q54	A guy walks into a store and steals a $100 bill from the register without the owners knowledge. He then buys $70 worth of goods using the $100 bill and the owner gives $30 in change. How much money did the owner lose? $30, $70, $100, $130, $170, or $200?
Q55	True Story: Samuel was born first, but his twin brother Ronan who was born in the same hospital is older. How?

Logic Puzzle Answers

A1	Tilly. She is following the scale Do, Re, Mi, Fa, So, La, Ti.
A2	The word is starting. Starting, staring, string, sting, sing, sin, in, I.
A3	A Secret
A4	STEP 0 1 2 3 4 5 6 7 -- 5-Liter 0 0 5 0 3 3 5 0 8-Liter 0 8 3 3 0 8 6 6 12-Liter 12 4 4 9 9 1 1 6
A5	Turn two of the light switches on. Wait a while, and then turn one of them off, then quickly enter the room. One light will be on, one off, and one off but still hot.
A6	The probability is one half, or 50%. This can be directly calculated, but is included here because of an alternative method. Suppose that you have a reflection of yourself directly opposite the pentagon from where you are, at the same distance away. Then, if you see two/three sides, it will necessarily see three/two. Since there is a one-to-one mapping between you and the double, the probability must be one half.
A7	Put 1,2 & 3 on the left side and 4,5 & 6 on the right side. There are three possible outcomes: scale tilts left - means the heavy coin is in group 1,2 & 3 scale tilts right - means the heavy coin is in group 4,5 & 6 scale balances - means the heavy coin is in group 7,8 & 9 Label the three coins we have narrowed it down to as A, B & C. Putting A on the left side, B on the right and C to one side. A goes down - A is the heavy coin B goes down - B is the heavy coin Neither goes down - C is the heavy coin
A8	Number 73
A9	28 hours
A10	Break each of the pills in half, as you do this pop one half in your mouth and lay the other half aside for tomorrow. When he's done this with all four pills he will have consumed one red pill and one blue pill. And have the same left over.
A11	Take B Return Take A (or C) Return B Take C (or A) Return Take B
A12	If we randomise the gun we have a 2 in 6 or 1 in 3 chance of dying. Shooting again we have 1 in 4 chance of dying. So in the case of 2 consecutive bullets it would not be in your interests to re-spin the chamber.
A13	Alice's best strategy is to miss both Bob and Cheri until one of them has dispatched the other, following this plan she will survive something like 39.7% of the time.
A14	We ask the guy on the left what the guy on the right would say. And then do the opposite. By asking one person what the other would suggest we have eliminated the uncertainty of who is the liar and ensured that there is always a lie present in our response.
A15	1/4
A16	So straight in to the answer we number the piles 1 through 10. We take one coin from pile #1, two coins from pile #2, three coins from pile #3 and so on until we have 10 coins from pile #10. This gives us 55 coins which if they were all pure would give us 550g. However, some of them will be fake. Lets say we place them all on the scale, for our one and only weighing, and it reads 553g. The only possible way this could have happened is if we placed 3 counterfeit coins on the balance, and that means that pile #3 is counterfeit.
A17	We start 100 miles North of a line of latitude whose entire length is 100 miles. We will travel South 100 miles, travel East 100 miles circling the South Pole completely, then travel back North 100 miles to finish where we began.
A18	Start them both together and flip the 4 minute hourglass every time it runs out the difference between the 7 minute hourglass ending and the and the 4 minute hourglass ending for the second time is 1 minute. We just then need to flip it two more times to get 9 minutes. A better solution would be one that didn't require us to wait 7 minutes before we start. We need to add 2 minutes on to the end of the 7 minute hourglass. Since the twice-flipped 4 minute hourglass will stop at 8 minutes we can flip our 7 minute hour glass here for the second time. At this point it will have been running for 1 minute, we will flip 1 minute's worth of sand back to the top and it will run for another 1 minute. This will total 9 minutes.

A19	The person at the back, lets call him person number 1, will agree that if he sees an odd number of red hats he calls out red, if he sees an even number of red hats he calls out blue. (Obviously any similar scheme would work, but we will use this one.) Unfortunately this means he has a 50% chance of survival but it guarantees everyone else's.
A20	The chance of observing a car in a ten-minute period is roughly 63.16%.
A21	Both AM and PM: 01:05:27, 02:10:55, 03:16:22, 04:21:49, 05:27:16, 06:32:44, 07:38:11, 08:43:38, 09:49:05, 10:54:33, 12:00:00
A22	The first step is to work out the ages that have a product of 36. We obviously don't know the man's door number. We can assume that the second man does. At this stage we are only assuming, but the fact that he is able later, to definitively answer the puzzle will mean that this is no longer an assumption. Even with the door number the second man does not know the ages of the daughters, so it must still be ambiguous, there are only two combinations that have the same total. The second man took this to mean that there was a youngest daughter. This is not the case with the ages 2, 2 & 9. The only possible solution is 1, 6 & 6
A23	204
A24	Say there are a 1000 envelopes on the table, 1 with a note inside. You pick 1 envelope, the chance that this has the note in it is clearly 1/1000, where as the chance that it is still on the table is 999/1000. Odds are its on the table. Now the questioner could, assuming he can remember where the note is demonstrate to you that the note is not in 998 of the envelopes on the table. In this case nothing would have happened to change the fact that there is only a 1/1000 chance of you having the note. Simply before the exchange you have 1/3 of £20 and afterwards you will have 2/3 of £20, ie the advantage to you is about £6.66
A25	The Water Level Goes Down. 1 litre of water has a mass of 1Kg:- Say the brick weighs 2 kg and is 1 litre in volume. When the brick is in the boat it is forcing the water to be displaced by 2 kg or as we know 2 litres. When the brick is over the side and sat on the bottom of the lake it is displacing just it's own volume or one litre.
A26	Light the fuse at both ends.
A27	The third person (C) must be wearing a BLUE hat.
A28	The simplest way to think of this is that each hour is made up of 30° and that the hour hand will have moved one quarter of an hour past three o'clock. ¼ x 30° = 7.5°
A29	The kid told the man to remove one nut from each of the other three wheels and use them to secure the new tyre.
A30	Prince Charming visited the witch's shack in September. After that, it took him a hundred days to reach the river. Which means that, by the time he got there, it was already mid-winter. The river was iced over and he simply walked across it to the other bank!
A31	It is yellow. As we already know, at the outset, the number of rabbits in the green hutch was twice as large as the number of rabbits in the yellow hutch. This means that the number of rabbits in the green hutch was an even number. After the farmer removed five rabbits from the left-side hutch, the number of rabbits that remained there also became an even number (this is proven by the fact that it was divisible by two). Therefore, before those five were removed, the left-side hutch contained an uneven number of rabbits. Hence, the left-side hutch can't be the green colored one. But, based on the information we've got - it can't be the red colored one, either!
A32	Age/Get older.
A33	Yes. If Anne is married, then she is married and looking at George, who is unmarried. If Anne is unmarried, then Jack, who is married, is looking at her. Either way, the statement is correct.
A34	40 socks. If he takes out 38 socks (adding the two biggest amounts, 21 and 17), although it is very unlikely, it is possible they could all be blue and red. To make 100 percent certain that he also has a pair of black socks he must take out a further two socks.
A35	Friday. The "day before tomorrow" is today; "the day before two days after" is really one day after. So if "one day after today is Saturday," then it must be Friday.
A36	Because they both burn inconsistently, you can't just light one end of a rope and wait until it's 75 percent of the way through. But, this is what you can do: Light the first rope at both ends, and light the other rope at one end, all at the same time. The first rope will take 30 minutes to burn (even if one side burns faster than the other, it still takes 30 minutes). The moment the first rope goes out, light the other end of the second rope. Because the time elapsed of the second rope burning was 30 minutes, the remaining rope will also take 30 minutes; lighting it from both ends will cut that in half to 15 minutes, giving you 45 minutes all together.
A37	"Which direction do you live?" Someone from the City of Lies will lie and point to the City of Truth; someone from the City of Truth would tell the truth and also point to the City of Truth.
A38	First, the farmer takes the goat across. The farmer returns alone and then takes the wolf across, but returns with the goat. Then the farmer takes the cabbage across, leaving it with the wolf and returning alone to get the goat.
A39	Yes. Before he spins, there's a one in six chance of a bullet being fired. After he spins, one of those chances has been taken away, leaving a one in five chance and making it more likely a bullet will be fired. Best to spin again.
A40	Eleven. Because Lisa lost three games to Susan, she had lost $3 ($1 per game). So, she had to win back that $3 with three more games, then win another five games to win $5.
A41	Five minutes. Using the information we know, it would take one cat 25 minutes to catch all five mice (5×5=25). Then working backward and dividing 25 by five, we get five minutes for one cat to catch each mouse.
A42	Tilt the barrel until the wine barely touches the lip of the barrel. If the bottom of the barrel is visible then it is less than half full. If the barrel bottom is still completely covered by the wine, then it is more than half full.
A43	2 out of 3. You know you don't have Bag B. But because Bag A has two white marbles, you could have picked either marble; if you think of it as four marbles in total from Bags A and C, three white and one black, you'll have a greater chance of picking another white marble.
A44	Black. The man in front knew he and the middle man aren't both wearing white hats or the man in the back would have known he had a black hat (since there are only two white hats). The man in front also knows the middle man didn't see him with a white hat because if he did, based on the tallest man's answer, the middle man would have known he himself was wearing a black hat. So, the man in front knows his hat must be black.

A45	Pick a fruit from the crate marked Apples and Oranges. If that fruit is an apple, you know that the crate should be labeled Apples because all of the labels are incorrect as they are. Therefore, you know the crate marked Apples must be Oranges (if it were labeled Apples and Oranges, the Oranges crate would be labeled correctly, and we know it isn't), and the one marked Oranges is Apples and Oranges. Alternately, if you picked an orange from the crate marked Apples and Oranges, you know that crate should be marked Oranges, the one marked Oranges must be Apples, and the one marked Apples must be Apples and Oranges.
A46	Dog. Albert knows right away because he has one of the unique letters that only appear once in all the words: c o h s x i. So, we know the word is not "tag." All of these unique letters appear in different words, except for "h" and "s" in "has," and Bernard can figure out what the word is from the unique letters that are left: t, g, h, s. This eliminates "max" and "dim." Cheryl can then narrow it down the same way. Because there is only one unique letter left, the letter "d," the word must be "dog." (For more on this answer, watch the video below.)
A47	Check boxes 2, 3, and 4 in order until you find him. Here's why: He's either in an odd or even numbered box. If he's in an even box (box 2 or 4) and you check box 2 and here's there, great; if not you know he was in box 4, which means the next night he will move to box 3 or 5. The next morning, check box 3; if he's not there that means he was in box 5 and so the next night he'll be in box 4, and you've got him. If he was in an odd numbered box to begin with (1, 3, or 5), though, you might not find him in that first round of checking boxes 2, 3 and 4. But if this is the case, you know that on the fourth night he'll have to be in an even-numbered box (because he switches every night: odd, even, odd, even), so then you can start the process again as described above. This means if you check boxes 2, 3, and 4 in that order, you will find him within two rounds (one round of 2, 3, 4; followed by another round of 2, 3, 4). For more on this answer, watch the video below.
A48	You should switch. At the beginning, your choice starts out as a one in three chance of picking the car; the two doors with goats contain 2/3 of the chance. But since Monty knows and shows you where one of the goats is, that 2/3 chance now rests solely with the third door (your choice retains its original 1/3 chance; you were more likely to pick a goat to begin with). So, the odds are better if you switch.
A49	We know Ben isn't telling the truth, because if he was, there would be two knights; so Ben could be either the knave or the spy. Cody also can't be the knight, because then his statement would be a lie. So that must mean Alex is the knight. Ben, therefore, must be the spy, since the spy sometimes tells the truth; leaving Cody as the knave.
A50	Before getting to the answer, let's think of a hypothetical question you know the answer to, such as "Does two plus two equal four?" Then, phrase it so you're asking it as an embedded question: "If I asked you if two plus two equals four, would you answer ja?" If ja means yes, Truth would answer ja, but so would False (he always lies, so he'd say ja even though he really would answer da). If ja means no, they both would still answer ja—in this case, False would answer the embedded question with ja, but saying da to the overall question would be telling the truth, so he says ja. (Random's answer would be meaningless because we don't know whether he lies or tells the truth.) But what if you said, "If I asked you if two plus two equals five, would you answer ja?" If ja means yes, Truth would answer da, as would False; if ja means no, they'd also both answer da. So, you know that if the embedded question is correct, Truth and False always answer with the same word you use; if the embedded question is incorrect, they always answer with the opposite word. You also know they always answer with the same word as each other. With this reasoning, ask the god in the middle your first question: "If I asked you whether the god on my left is Random, would you answer ja?" If the god answers ja and you're talking to either Truth or False, following the above logic you know the embedded question is correct, and the god to the left is Random. It's also possible that you're speaking to Random; but you know no matter who you're talking to, the god on the right is not Random. If the answer is da, the opposite is the case, and you know the god on the left isn't Random. Next, you can ask the god you definitely know isn't Random a question using the same structure: "If I were to ask you if you are Truth, would you say ja?" If they answer ja, you know you're talking to Truth; if they answer da you know you're talking with False. Then once you've identified that god as True or False, you can ask the same god a final question to identify Random: "If I asked you if the god in the middle is Random, would you say ja?" By process of elimination, you can then identify the last god.
A51	The boy lived before Christ. Therefore, in 1995 B.C. he was 10 years old, and in 1990 he turned 15.
A52	E = easier in "1", H = heavier in "1". 1: Weight 4:4. If they balance go to "2", if they don't balance, go to "3". 2: Balance 1:1 of the pills you didn't weight yet. Then weight one you didn't weight and one you did weight. If they balanced in the first weighing, and balanced in the second weighing, the last pill is the right one. If they balanced in the first weighing and didn't balance in the second, the one you didn't use before is the right pill. If they didn't balance at all, it's the pill you weighed twice. If they didn't balance in the first weighing, but balanced in the second, it is the first pill. 3: Weight EHH : EHH. If they balance, weight one you already weighed, with an unweighed and go to "4". If they don't balance go to "5". 4: If they balance, the one you didn't weight at all is the right pill. If they don't balance, the one you only weighed once is the right one. 5: Give away every pill that was once easier AND once heavier. You should only have EHH left. Weight H:H. If they balance, E is the right one. If the don't balance, the one which was only heavier the whole time, is the right pill.
A53	The woman was watching the jury and not the doors because she knew that her husband wouldn't walk through them because she had killed him. If she has really missed him like she said, she would have been watching the doors.
A54	The best answer from the choices is the owner lost $100. The $100 bill that was stolen was then given back to the owner. What the owner loses is the $70 worth of goods and the $30 in change, which makes for a total of $70 + $30 = $100. The owner has lost $100. Technically, the owner lost $30 plus the value, V, of the $70 of goods. Since stores typically sell goods at a markup, the value may be less than $70. But in the case of a loss leader, the owner may have lost more than $70.
A55	Because the clocks went back. Samuel Peterson was born on 1.39am on Sunday, November 6. His brother Ronan, meanwhile, was born 31 minutes later, but by then daylight saving hours had ended, and the clock was turned back one hour. So while Ronan was in a sense born at 2:10 am on November 6, his official time of birth is actually 1:10 am.

What Am I?

Q1	It's sometimes sharp, And good at being lead, Using this will help things to be read.
Q2	I am beautiful, up in the sky. I am magical, yet I cannot fly. To people I bring luck, to some people, riches. The boy at my end does whatever he wishes. What am I?
Q3	You saw me where I could not be. Yet, often you see me. What am I?
Q4	Reaching stiffly for the sky, I bare my fingers when its cold. In warmth I wear an emerald glove and in between I dress in gold.
Q5	His eyes were raging, that scraggly beast. His lips were bursting, with rows of angry teeth. Upon his back a razor was found. It was a fearsome battle we fought, my life – or his, one would be bought. And when we were through, and death chilled the air, we cut out his heart, and ate it with flair.

Q6	I am the fountain from which no one can drink. For many I am considered a necessary link. Like gold to all I am sought for, but my continued death brings wealth for all to want more.
Q7	The beginning of eternity, the end of time and space, the beginnings of every end, the end of every place. What am I?
Q8	White flesh above and brown gills below. Never moving an inch, and in darkness I grow.
Q9	Red as blood and sweet as wine. A hard hard heart within flesh sublime.
Q10	I touch the Earth, I touch the sky, But if I touch you, you'll surely die.
Q11	My feet stay warm, but my head is cold. No one can move me, I'm just too old.
Q12	I have an eye but cannot see. You'll head inside when you see me.
Q13	They try to beat me, they try in vain. And when I win, I end the pain.
Q14	They made me a mouth but didn't give me breath. Water gives me life but the sun brings me death.
Q15	I always run but never walk, i sometimes sing but cannot talk, no head on which a hat to place, you always look me in the face.
Q16	Tread on the living, they make not a mumble. Tread on the dead, they mutter and grumble. What are they?
Q17	With thieves I consort, With the Vilest, in short, I'm quite at ease in depravity, Yet all divines use me, And savants can't lose me, For I am the century of gravity. I am?
Q18	Alive as you but without breath, As cold in my life as in my death; Never a thirst though I always drink, Dressed in a mail but never a clink. I am a?
Q19	I go up and I go down, towards the sky and the ground. I'm present and past tense too, Let's go for a ride, me and you. What am I?
Q20	I live in the oceans, the rivers and the seas, when I'm cold I float, when I'm hot I'm free.
Q21	What flattens all mountains, wipes out all species, destroy every building, and turns everything into pieces?
Q22	I am a 8 Letter Word. I am kept Secret from Everyone. My 2nd, 3rd, 4th Letter Spell an Animal. My 4th, 5th, 6th, 7th, 8th Letter is a Weapon. My 1st, 2nd, 8th Letter is used for Writing an Exam. My 3rd, 4th Letters are the Same. Who am I?

What Am I? Answers

A1	A Pencil
A2	Rainbow
A3	Reflection
A4	Tree
A5	Boar
A6	Oil
A7	The Letter E
A8	A Mushroom
A9	Cherry
A10	Lightning
A11	A Mountain
A12	A Storm
A13	Death
A14	A Snowman
A15	A Clock
A16	Leaves. They're soft and silent when they're alive but crunchy when dead.
A17	The letter V
A18	Fish
A19	A Seesaw
A20	Water
A21	Time
A22	Password

2 Trivia

ENTERTAINMENT Brain Teasers Trivia Preparedness Trivia

Trivia can keep your mind occupied during tough situations. Below are a variety of questions on a multitude of topics. The answers are in the sections below each trivia section.

Preparedness Trivia

Q1	If you are inside, what action should you take during an earthquake?
Q2	A shelter-in-place emergency kit should have a minimum of how much water, per person, per day?
Q3	In a power outage, a full freezer will keep food safe for up to...?
Q4	What other location, besides your home, should you store an emergency kit?
Q5	If you encounter floodwater while driving, what should you do?
Q6	How long can the human live without water in a survival situation?
Q7	Can you tell whether or not water is contaminated with parasites by its color and clarity?
Q8	What are the 4 steps to being prepared?
Q9	Pets should be included in emergency plans?
Q10	How far from the storm can lightning strike?
Q11	What items (at minimum) should you have in your car kit?
Q12	If you're very thirsty, is it worth drinking water contaminated with Giardia (a water born parasite) over going without drinking?
Q13	True or False, eating more food in a survival situation will result in depleting valuable water out of your digestive system.
Q14	True or False, During an emergency, its best to communicate with family or friends by calling them on your cell phone?
Q15	What is the best way to cook food in a survival situation?
Q16	How often should you update your emergency kit?
Q17	True or False, the best place to obtain water that is likely parasite-free is out in the middle of a lake and if possible a few feet down from the surface.
Q18	How long do you need to boil water to purify it?
Q19	True or False, you must always cook wild meat found or caught in a survival situation.
Q20	True or False, shelter is the most important and first consideration in a survival ordeal.
Q21	How thick should your survival "mattress" (of leaves or whatever) be?
Q22	How long can a person go without food?
Q23	If you are running low on water and only have 200ml (0.5 pints) left, is it better to ration it out or consume it?
Q24	How can you extract freshwater from saltwater?
Q25	What is a way to collect dew from plants?
Q26	What is a warning sign that an insect might be poisonous to eat?
Q27	True or False, insulation from the ground is just as important as the insulation around and on top of the shelter.
Q28	True or False, if you happen to have alcohol, it is good to drink it to absorb water into your system.
Q29	How many calories per day might you use if you are working very hard at survival?
Q30	What is the best location for a shelter in terms of hilly (small hills, not mountainous) terrain?
Q31	True or False, in a survival situation, should you attempt to break into a cabin or cottage if you come across one?
Q32	Which is better in a survival ordeal, passive patience or proactive actions?
Q33	In this day and age, is a paper map and use of a compass necessary anymore?
Q34	What is kindling wood?
Q35	What fire starting method is the best to carry which produces a fire easily?
Q36	If you are in a group, should you make one big shelter or individual shelters?
Q37	True or False, fire is one of the most important survival skills anyone should master.
Q38	True or False, it's a better practice to put your fire out at night and re-start it each morning.
Q39	What is the best location for a fire inside a shelter?
Q40	What is the main problem with handheld GPS satellite units? A) Patchy Satellite Signal, B) Dead Batteries, C) Lack of Current Maps, D) They are Difficult to Use.

ENTERTAINMENT Brain Teasers Trivia Preparedness Trivia Answers

Preparedness Trivia Answers

A1	Drop, cover, hold on!
A2	3.7L (1 Gallon)
A3	Food is safe in a full freezer for 36 to 48 hours.
A4	Car or work
A5	Turn around and find an alternative route
A6	About 3 days. After 3 to 5 days you will be incapacitated and between 6 and 12 days you will likely die of dehydration
A7	No, some of the cleanest looking water can still make you ill.
A8	Be Informed, Make a Plan, Build a Kit, Be Involved
A9	Yes
A10	Lightning can strike as far as 16km (10 miles) from where you can hear thunder or the area where it is raining.
A11	Jumper cables, blankets, flares, batteries, phone charger, car brush, good walking shoes, first aid kit
A12	You will die much quicker from dehydration than Giardia. You won't even know you have it for at least a week and it's cured by a few pills.
A13	True, digestion always requires water from your body to work.
A14	False. Texting is best because it uses less data and can get through quickly.
A15	Boil it. Boiling is helpful as you can then also drink the broth getting additional nutrients.
A16	At least once or twice per year.
A17	True.
A18	You only need to bring it to a boil.
A19	False. Although there are some parasites on wild meat, you're better off eating it raw to keep yourself from starving.
A20	False, there are many other considerations to put ahead of shelter.
A21	1 Meter (3 Feet) thick.
A22	About 3 weeks. You start to become incapacitated long before 30 days, but most people last that long and sometimes longer.
A23	Drink it. You don't have enough for rationing it out to make sense. Get it into your system now.
A24	Distill it. The steam will be evaporated and condense as pure water free of salt.
A25	Tie rags around your legs and walk through the morning grass. Then wring out the wet rags into a receptacle.
A26	It's brightly coloured.
A27	True. Insulation from the ground is the most important. It will suck the heat out of you quickly and may cause hypothermia.
A28	False, Never drink alcohol as it is a dieretic and will deplete your body of precious water.
A29	As many as 5,000. This number will be higher in the winter.
A30	The middle of the hill. The cold air will sink to the bottom and you are exposed to the wind at the top.
A31	True. In most places it's actually considered legal to 'break and enter' if you're in a survival situation.
A32	Proactive Actions. Passive patience is only utilized best in the beginning as you carry out your assessments.
A33	Yes. There is much more to map and compass skills than just finding your direction.
A34	Any very small dry and split wood or branches used to get bigger flames when starting or stoking a fire.
A35	A lighter.
A36	One large shelter.
A37	True. It cooks food, warms you, brings you comfort, signals rescue and can be used to make tools amongst so much more.
A38	False. Try and keep the fire going 24/7 if possible.
A39	The lowest part of the shelter.
A40	B) Dead batteries.

Animal Trivia

Animal Trivia

Q1	Which sea creature has three hearts?
Q2	What is the only bird known to fly backwards?
Q3	What breed of horse is best known for its use in racing?
Q4	What is largest living bird by wingspan?
Q5	What is the name for a dog created by crossing a Labrador Retriever and a Poodle?
Q6	What chemical element gives the blood of a lobster a bluish tint?
Q7	What is the name for the offspring of a male donkey and a female horse?
Q8	Which snake, who's untreated bite is almost 100 percent fatal, is the world's fastest snake on land?
Q9	The llama is a domesticated camelid that is native to which continent?
Q10	What is the common term for bovine spongiform encephalopathy, a disease that causes degeneration of the brain and spinal cord in cattle?
Q11	A panda's daily diet consists almost entirely of what plant?
Q12	What is the largest species of terrestrial crab in the world?
Q13	What is the name for a male bee that comes from an unfertilized egg?
Q14	Cynophobia is the fear of what kind of animal?
Q15	The term wake, kettle, or committee refers to a group of what bird?
Q16	Which of the traditional five senses are dolphins believed not to possess?
Q17	A flamboyance is a group of what animal?

ENTERTAINMENT | Brain Teasers | Trivia | Animal Trivia

Q18	What is a group of whales called?
Q19	What is the national animal of Scotland?
Q20	What is a group of lions called?
Q21	The longest snake ever held in captivity belongs to what species?
Q22	What is the sleepiest animal in the world, sleeping around 22 hours each day?
Q23	Polar bears feed mainly on what animal?
Q24	What is a group of rhinoceros called?
Q25	The Alaskan Malamute is a type of what?
Q26	What is the fastest fish in the Ocean?
Q27	Which animal has the most legs?
Q28	What are baby beavers called?
Q29	What is the fastest land snake in the world?
Q30	What is a group of owls called?
Q31	Which mammal has the longest gestation period?
Q32	The Arabian camel, also called dromedary, has how many humps?
Q33	Snoopy from the comic peanuts is what breed of dog?
Q34	What is the proper term for a group of parrots?
Q35	The Passenger Pigeon, now extinct, was endemic to which continent?
Q36	What is a group of owls called?
Q37	What is the fastest bird in the world when in its hunting dive?
Q38	What is a baby swan called?
Q39	What is a flock of crows called?

Animal Trivia Answers

ENTERTAINMENT | Brain Teasers | Trivia | Animal Trivia Answers

A1	Octopus
A2	Hummingbirds
A3	Thoroughbred
A4	Wandering Albatross
A5	Labradoodle or labrapoodle
A6	Copper
A7	Mule
A8	Black Mamba
A9	South America
A10	Mad cow disease
A11	Bamboo
A12	The coconut crab (Birgus latro)
A13	Drone
A14	Dogs
A15	Vulture
A16	Smell
A17	Flamingos
A18	A pod
A19	Unicorn
A20	A pride
A21	Reticulated python
A22	Koala
A23	Seals
A24	A "crash"
A25	Dog
A26	Sailfish
A27	Millipede
A28	Kittens or Kits
A29	Black Mamba
A30	A parliament
A31	Elephants
A32	One
A33	Beagle
A34	Pandemonium

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A35	North America
A36	A parliament
A37	The Peregrine Falcon
A38	A cygnet
A39	A Murder

Art Trivia

Q1	The Van Gogh museum is located in what European capital city?
Q2	The ancient Greek statue Ahprodite of Milos, better known as Venus de Milo, is currently on display in what museum?
Q3	The Starry Night is an oil on canvas painted by which post-impressionist painter?
Q4	Who painted a late 15th-century mural known as the Last Supper?
Q5	Which artist is credited with developing linear perspective?
Q6	What French sculptor created the Statue of Liberty?
Q7	Which artist created the sculpture "The Thinker"?
Q8	Who painted the famous Dutch Golden age painting "The Night Watch"?
Q9	Who was the Spanish surrealist painter best known for his work "The Persistence of Memory"?
Q10	The art of paper folding is known as what?
Q11	How many paintings did Vincent Van Gogh sell during his lifetime?
Q12	Which painter started the impressionist movement?
Q13	Who painted the Sistine Chapel?
Q14	What painter is famous for cutting off part of his ear?

Art Trivia Answers

A1	Amsterdam
A2	The Louvre in Paris, France
A3	Vincent van Gogh
A4	Leonardo da Vinci
A5	Brunelleschi
A6	Frédéric Auguste Bartholdi
A7	Auguste Rodin
A8	Rembrandt
A9	Salvador Dalí
A10	Origami
A11	One, "The Red Vineyard at Arles".
A12	Claude Monet
A13	Michelangelo
A14	Vincent Van Gogh

Bible Trivia

Q1	In what city was Jesus born?
Q2	How many books are in the New Testament?
Q3	What type of insect did John the Baptist eat in the desert?
Q4	Who were the first apostles called to follow Jesus?
Q5	How many people did Jesus feed with five loaves of bread and two fish?
Q6	After Jesus was arrested, which apostle disowned him three times?
Q7	Who recognized Jesus as the Messiah when he was presented at the Temple as a baby?
Q8	Who asked Pilate for Jesus' body after the crucifixion?
Q9	Paul was shipwrecked on what island?
Q10	What is the shortest book in the New Testament?
Q11	Who is the author of the Book of Revelation?
Q12	Matthew was a _________.
Q13	To what city was Saul traveling when he encountered a great and blinding light?
Q14	Who was the first person to come upon the injured man in the parable of the Good Samaritan?
Q15	Finish this verse. "In every battle you will need faith as your ______ to stop the fiery arrows aimed at you by Satan."

Q16	Whose example does Paul say Christians should follow in Chapter 5 of Ephesians?
Q17	After Jesus fed 5,000+ people with two fish and five loaves of bread, how many baskets were left over?
Q18	What does Paul say may "abound more and more in knowledge and in all judgment?"
Q19	What tribe is Paul from?
Q20	According to the Beatitudes who will be filled?
Q21	What does Simon Peter do for a living before he becomes an apostle?
Q22	In the Gospel of Mark, how does the Virgin Mary learn of her pregnancy?
Q23	Who is Stephen in Acts of the Apostles?
Q24	By what name is Paul of Tarsus known before he begins his missionary activity?
Q25	According to Paul's formulation in 1 Corinthians, which is the greatest of the imperishable qualities?
Q26	Who is the high priest of Jerusalem who put Jesus on trial?
Q27	In the Gospel According to John, which of the apostles doubts Jesus's resurrection until he sees Jesus with his own eyes?
Q28	According to the Gospel of Matthew, where does Jesus's first public sermon take place?
Q29	How does Judas signal Jesus's identity to the Roman officials?
Q30	Who murders John the Baptist?
Q31	When Christians observe Palm Sunday, what biblical narrative are they celebrating?
Q32	According to the Gospels, what is the unique literary genre Jesus employs to preach his message?
Q33	Which Gospel is most concerned with the mystery and identity of the person of Jesus?
Q34	Who baptizes Jesus?
Q35	Who takes Jesus's body off the cross?
Q36	Who is the first apostle to deny Jesus?
Q37	Which Gospel is written by a doctor?
Q38	What is the common name given to the first four books of the New Testament?
Q39	Who wrote most of the books in the New Testament?
Q40	Who wrote the Acts of the Apostles?
Q41	On what day of Creation did God create man?
Q42	What was the name of Adam's third son?
Q43	What was the first of the Ten Commandments?
Q44	In what language was the Old Testament written?
Q45	From which country did Moses help the Israelites escape from their lives of slavery?
Q46	Who wrote the first five books of the Old Testament?
Q47	From which part of Adam's body did God create Eve?
Q48	In what was baby Moses hidden?
Q49	What was the first plague the Lord sent on Egypt?
Q50	On what mountain did Moses receive the law from God?

Bible Trivia Answers

A1	Bethlehem
A2	27
A3	Locusts
A4	Peter and Andrew
A5	About 5000 men
A6	Peter
A7	Simeon
A8	Joseph of Arimathea
A9	Malta
A10	2 John
A11	John
A12	Tax collector

ENTERTAINMENT Brain Teasers Trivia Bible Trivia Answers

A13	Damascus
A14	Priest
A15	Shield
A16	Christ's
A17	12
A18	Love
A19	Benjamin
A20	Those who hunger and thirst for righteousness
A21	He was a fisherman
A22	From the angel Gabriel
A23	The first Christian martyr
A24	Saul
A25	Love
A26	Caiaphas
A27	Thomas
A28	On the mount
A29	He kisses him
A30	Herod Antipas
A31	Jesus's triumphant entry into Jerusalem
A32	The parable
A33	John
A34	John the Baptist
A35	Joseph of Arimathea
A36	Peter
A37	Luke
A38	The Gospels
A39	Paul
A40	Luke
A41	Sixth Day
A42	Seth
A43	You shall have no other gods before me
A44	Hebrew
A45	Egypt
A46	Moses
A47	Rib
A48	An ark of bulrushes
A49	Water turned into blood
A50	Mount Sinai

Computer Trivia

Q1	Regarding data storage, what does the acronym SSD stand for?
Q2	Created in 2009, what was the first decentralized cryptocurrency?
Q3	What does the acronym USB stand for when referring to a computer port?
Q4	What do you call the small image icons used to express emotions or ideas in digital communication?
Q5	When referring to a computer monitor, what does the acronym LCD stand for?
Q6	When talking about computer memory, what does the acronym ROM stand for?
Q7	In 1975 an engineer created the first electronic camera while working for what company?
Q8	Nintendo is a consumer electronics and video game company founded in what country?
Q9	In a photo editing program, what do the letters RGB stand for?
Q10	HTML and CSS are computer languages used to create what?
Q11	What do the letters in the acronym CD-ROM stand for?
Q12	What does the acronym "lol" stand for when used in phone texts and on the internet?
Q13	In what year was the first Apple computer released?
Q14	In a website browser address bar what does "www" stand for?
Q15	Steve Jobs, Steve Wozniak, and Ronald Wayne founded what company in 1976?
Q16	What year was Facebook founded?
Q17	In computer science, what does "GUI" stand for?
Q18	In database programming, SQL is an acronym for what?
Q19	CERN launched the very first website in what year?

Q20	The companies HP, Microsoft and Apple were all started in a what?
Q21	Fonts that contain small decorative lines at the end of a stroke are known as what?
Q22	In what year was the iPhone first released?
Q23	When referring to computer memory, what does that acronym RAM stand for?
Q24	What do the letters HTML, a markup language used to create web pages, stand for?
Q25	With over 17 million units produced, what was the highest selling single model of personal computer ever?
Q26	Who is credited with inventing the first mechanical computer?
Q27	1,024 Gigabytes is equal to one what?
Q28	What is the name given to an ancient analog computer that was discovered by divers off a Greek island in 1900?
Q29	What Harvard dropout co-founded Microsoft?
Q30	What was the name of the first electronic general-purpose computer?
Q31	What does HTTP stand for in a website address?
Q32	What is the hard disk drive interface that preceded SATA?
Q33	One kilobyte is equal to how many bytes?
Q34	What is the name of the American animated sci-fi sitcom about the misadventures of a mad scientist and his grandson?
Q35	Torchwood" is an anagram and spin-off of what popular British sci-fi series?
Q36	Star Trek: The Next Generation originally aired in what year?
Q37	What is the unit of length that is approximately 3.26 light-years?
Q38	Bruce Willis played a convict turned time traveller in what 1995 movie?
Q39	In our solar system which two planets rotate clockwise?
Q40	What is name of the world's largest and most powerful particle accelerator?
Q41	The largest volcano ever discovered in our solar system is located on which planet?
Q42	What 2013 science fiction blockbuster starred Sandra Bullock and George Clooney?
Q43	What digital currency is Satoshi Nakamoto credited with inventing?
Q44	What former planet was demoted to a dwarf planet in 2006?

Computer Trivia Answers

A1	Solid State Drive
A2	Bitcoin
A3	Universal Serial Bus
A4	Emoji
A5	Liquid Crystal Display
A6	Read-only memory
A7	Kodak
A8	Japan
A9	Red, Green & Blue
A10	Websites
A11	Compact Disk Read Only Memory
A12	Laugh out loud
A13	1976
A14	World Wide Web
A15	Apple Computer, Inc.
A16	2004
A17	Graphical user interface
A18	Structured Query Language
A19	1990
A20	Garage
A21	Serif Fonts
A22	2007
A23	Random Access Memory
A24	Hypertext Markup Language
A25	The Commodore 64
A26	Charles Babbage
A27	Terabyte
A28	Antikythera mechanism
A29	Bill Gates

ENTERTAINMENT | Brain Teasers | Trivia | Computer Trivia Answers

A30	ENIAC
A31	HyperText Transfer Protocol
A32	IDE
A33	1024
A34	Rick and Morty
A35	Doctor Who
A36	1987
A37	Parsec
A38	12 Monkeys
A39	Venus & Uranus
A40	The Large Hadron Collider
A41	Mars
A42	Gravity
A43	Bitcoin
A44	Pluto

Food Trivia

Q1	A Moscow Mule is a type of cocktail popularly served in what?
Q2	Founded in 1921, this company was credited with being the first "fast food" chain?
Q3	Sukiyaki is a popular hot pot dish from what country?
Q4	The Cajun holy trinity of cooking consists of what three vegetables?
Q5	Sriracha is type of hot sauce named after a city located in what country?
Q6	Malbec, Sangiovese, and Syrah are all a type of what?
Q7	What common kitchen item is made up of sodium and chlorine atoms?
Q8	Champagne is a sparkling wine made from grapes grown in the Champagne region of which country?
Q9	In which country did cheddar cheese originate?
Q10	What are the three main ingredients in the campfire treat known as a "s'more"?
Q11	Mexican tortillas were originally made from the grain of which plant?
Q12	What dish, made from crushed durum wheat, is a staple of western North Africa?
Q13	Celebrity chef Gordon Ramsay opened his first restaurant in what city?
Q14	Sushi is a type of cuisine that originated in what country?
Q15	To be legally sold as bourbon, a whiskey's mash must contain at least 51% of what grain?
Q16	The original Starbucks was established in 1971 in what U.S. city?
Q17	When found on a beer bottle, what does the acronym IPA stand for?
Q18	The first McDonald's restaurant opened in which U.S. state?
Q19	Roquefort is a French blue cheese made from the milk of what animal?
Q20	What fast food franchise has the most worldwide locations?
Q21	Dijon mustard originated in the city of Dijon, located in what country?
Q22	Pupusas, handmade thick stuffed corn tortillas, are a traditional dish from what country?
Q23	What is the colloquial term for a rotating tray often placed on a table to aid in distributing food?
Q24	What popular soda beverage was originally developed as a mixer for whiskey?
Q25	What was the original flavour of the filling in Twinkies?
Q26	Sauerkraut is made from what finely cut vegetable?
Q27	What is the name for a confection that consists primarily of sugar or honey and almond meal?
Q28	The cooking technique that involves submerging food in a liquid at a relatively low temperature is called what?
Q29	In what type of restaurant would you typically find the condiment wasabi?
Q30	What do the letters of the popular fast food chain KFC stand for?
Q31	Mr. Pibb was a soft drink created by the Coca-Cola Company to compete with what other soft drink?
Q32	What is name of the scale used to measure the spicy heat of peppers?
Q33	Pho is a popular noodle soup from what country?

Q34	Red Vines is a popular brand of what type of candy?
Q35	The taste that allows us to taste savoury foods is called what?
Q36	Chimichurri is a green sauce that originated in what country?
Q37	What is a traditional fermented Korean side dish made seasoned vegetables and salt?
Q38	A teetotaler is a person that never drinks what?
Q39	A tandoor is a type of what?
Q40	Kopi luwak is a very expensive type of what?
Q41	Guinness beer was first brewed in which country?
Q42	Gumbo is a stew that originated in which state?
Q43	The meat of a game animal, such as deer, is called what?
Q44	What ingredient in bread causes it to rise?

Food Trivia Answers

A1	Copper Mug
A2	White Castle
A3	Thailand
A4	Onions, bell peppers and celery.
A5	Thailand
A6	Wine
A7	Salt
A8	France
A9	England
A10	Marshmallow, chocolate and graham cracker
A11	Corn
A12	Couscous
A13	London, England
A14	Japan
A15	Corn
A16	Seattle, Washington
A17	India Pale Ale
A18	California
A19	Sheep
A20	Subway
A21	France
A22	El Salvador
A23	Lazy Susan
A24	Mountain Dew
A25	Banana cream
A26	Cabbage
A27	Marzipan
A28	Poaching
A29	Japanese
A30	Kentucky Fried Chicken
A31	Dr Pepper
A32	Scoville scale
A33	Vietnam
A34	Red liquorice
A35	Umami
A36	Argentina
A37	Kimchi
A38	Alcohol
A39	Oven
A40	Coffee
A41	Ireland
A42	Louisiana
A43	Venison
A44	Yeast

Geography Trivia

Q1	Montevideo is the capital city of which South American country?
Q2	What is the official language of Greenland?
Q3	If you were in the city of Turin, what country would you be in?
Q4	What is the capital city of Canada's Yukon territory?

ENTERTAINMENT	Brain Teasers	Trivia	Geography Trivia	Q5	Macau is an autonomous territory belonging to which country?
				Q6	What are the colours that appear on the flag of France?
				Q7	Which sea separates the East African coast and the Saudi Arabian peninsula?
				Q8	The archaeological site Gobekli Tepe is located in what country?
				Q9	What country's current capital city is an anagram of its former capital city?
				Q10	What is the name for the monetary unit used in Thailand?
				Q11	Hiragana, Katakana and Kanji are the names for writing systems used in which country?
				Q12	The island of Cozumel, a popular cruise ship port in the Caribbean, is part of which country?
				Q13	Chile shares the majority of its border with which other South American country?
				Q14	Which Scandinavian nation lies between Norway and Finland?
				Q15	What famous building would you find located at 1600 Pennsylvania Avenue?
				Q16	Alkebulan is the oldest indigenous name for which continent?
				Q17	What island state was formerly known by the name Formosa?
				Q18	The Principality of Monaco is a sovereign city-state bordered on three sides by which country?
				Q19	Tierra del Fuego is an archipelago located off the southernmost tip of which continent?
				Q20	In which country would you find the Panama Canal?
				Q21	Originally a Viking fishing village, Copenhagen became the capital city of what country?
				Q22	Burkina Faso is a landlocked country located on which continent?
				Q23	What U.S. state has the nickname "Land of 10,000 Lakes"?
				Q24	Suriname is a country located on which continent?
				Q25	Wellington is the capital city of which island nation?
				Q26	Atlantic City is a popular entertainment destination located in what U.S. state?
				Q27	The Mexican city of Tijuana borders what U.S city?
				Q28	The avocado is a tree that is thought to have originated in what country?
				Q29	In what country would you find the temple complex Angkor Wat?
				Q30	What is the largest ocean on planet Earth?
				Q31	Carved stone human figures with large heads, known as Moai, can be found on what Poloneysian island?
				Q32	What is the name of the official currency of Costa Rica?
				Q33	What is the name of the longest mountain range in North America?
				Q34	In which South American country would you find the ancient Incan citadel Machu Picchu?
				Q35	What is the colour of the five stars found on the flag of China?
				Q36	San Marino is a microstate in Europe completely surrounded by what country?
				Q37	What is the Easternmost point on the North American continent?
				Q38	The St. Lawrence River forms part of the border between which two countries?
				Q39	Sardinia, the second largest island in the Mediterranean Sea, is an autonomous region of what country?
				Q40	Beirut is the capital and largest city of what country?
				Q41	Located in North-western Turkey, which strait separates Europe and Asia?
				Q42	South Africa completely surrounds which other African nation?
				Q43	Europe is separated from Asia by which mountain range?
				Q44	Formerly known as Bedloe's Island, what is the current name of the island where the Statue of Liberty is located?
				Q45	What is the national language of India?
				Q46	What is the largest island in the Caribbean Sea?
				Q47	In what city would you find the La Brea Tar Pits?

ENT | Brain Teasers | Trivia | Geography Trivia

Q48	What city is the capital of China?
Q49	What city is the capital of Canada?
Q50	Yerevan, one of the world's oldest continuously inhabited cities, is the capital of what country?
Q51	Portugal is bordered by what other country?
Q52	How many times zones are in Canada?
Q53	What is the name of the deepest known location in the Earth's oceans?
Q54	What is the largest lake in Africa?
Q55	What is the capital of Iceland?
Q56	Which is the most abundant metal in the earth's crust?
Q57	What is the second most abundant element in the earth's atmosphere?
Q58	What is the world's largest ocean?
Q59	In what month is the Earth closest to the sun?
Q60	How fast does the earth move around the sun?
Q61	How far is the Earth from the Sun?
Q62	What was the hottest temperature recorded on earth?
Q63	What percentage of the Earth's freshwater does the Antarctic ice gap contain?
Q64	How deep is the deepest point on the ocean floor?
Q65	How much gold is said to be in the sea?
Q66	What was the lowest temperature ever recorded?

Geography Trivia Answers

A1	Uruguay
A2	Greenlandic
A3	Italy
A4	Whitehorse
A5	China
A6	Blue, white & red
A7	Red Sea
A8	Turkey
A9	Japan (Kyoto/Tokyo)
A10	Thai Bhat
A11	Japan
A12	Mexico
A13	Argentina
A14	Sweden
A15	The White House
A16	Africa
A17	Taiwan (Republic of China)
A18	France
A19	South America
A20	Panama
A21	Denmark
A22	Africa
A23	Minnesota
A24	South America
A25	New Zealand
A26	New Jersey
A27	San Diego
A28	Mexico
A29	Cambodia
A30	Pacific Ocean
A31	Easter Island (Rapa Nui)
A32	Costa Rican Colón
A33	Rocky Mountains
A34	Peru
A35	Yellow
A36	Italy
A37	Cape Spear, Newfoundland, Canada
A38	The United States & Canada
A39	Italy

ENTERTAINMENT Brain Teasers Trivia Geography Trivia Answers

A40	Lebanon
A41	Bosphorus Strait
A42	Lesotho
A43	Ural Mountains
A44	Liberty Island
A45	Hindi
A46	Cuba
A47	Los Angeles
A48	Beijing
A49	Ottawa
A50	Armenia
A51	Spain
A52	Six
A53	Challenger Deep
A54	Lake Victoria
A55	Reykjavik
A56	Aluminium
A57	Oxygen
A58	The Pacific Ocean
A59	January
A60	67,000 miles per hour
A61	93 million miles
A62	57.7°C (136°F)
A63	0.7
A64	35,813 feet (10.91 km)
A65	About 20 million tons.
A66	-89.2°C (-128.6°F)

History Trivia

Q1	Who was president of the United States when bombs were dropped on Hiroshima and Nagasaki?
Q2	In 1513, who became the first European explorer to set eyes on the Pacific Ocean?
Q3	What was the name of the ship on which Charles Darwin served as a naturalist during a voyage to South America and around the world?
Q4	What is the name for the military nobility and officer caste that existed in medieval and early-modern Japan?
Q5	Before the introduction of the euro, what was the name for the basic monetary unit used in the Netherlands?
Q6	Who were there first two astronauts that landed on the moon in 1969?
Q7	Which major battle of WWII started on August 23, 1942 and was fought in what is now the city of Volgograd?
Q8	What three countries were part of the Axis powers in World War II?
Q9	The Battle of Jutland was a naval battle that occurred during which war?
Q10	The RMS Olympic and HMHS Britannic were sister ships to which other British passenger liner?
Q11	The penny-farthing was a popular type of what?
Q12	The period of European history that lasted from the 14th to the 17th century is known as what?
Q13	What Byzantine city was renamed Istanbul after being captured by the Ottoman Empire?
Q14	Marie Antoinette was born an Archduchess of what country?
Q15	What is the acronym for the intergovernmental military alliance based on the North Atlantic Treaty, signed in 1949?
Q16	What was the name of the currency used in Spain before the euro?
Q17	What battle was fought on June 18th, 1815 in present-day Belgium?
Q18	Jean-Paul Sartre and Le Duc Tho both declined to accept what famous international award?
Q19	The first human-made object to land on the moon was launched by what country?
Q20	The inventor Nikola Tesla was born on July 10th 1856 in what modern day country?
Q21	Ruling for 64 years, which Queen was the longest-reigning British monarch before Queen Elizabeth II?
Q22	In 1867 the United States purchased Alaska from what country?
Q23	Who was the Prime Minister of Italy during WWII?
Q24	In 1783, the first free flight of a hot air balloon carrying a human occurred in what city?
Q25	What famous dictator was assassinated on the Ides of March?
Q26	The Great Pyramid of Giza is located in what Egyptian city?

Q27	What does the Statue of Liberty hold in her right hand?
Q28	What was the name of the U.S. research and development project to create nuclear weapons in WWII?
Q29	Brazil was once a colony of which European country?
Q30	In what year did India gain its independence from Britain?
Q31	The United Kingdom's withdrawal from the European Union is commonly known as what?
Q32	Which Christopher Columbus ship ran aground on his first voyage?
Q33	Who was the first Tudor monarch in England?
Q34	What event triggered the start of World War 1?
Q35	In what year did World War II end?
Q36	The second atomic bomb ever used in war-time was dropped on what city?
Q37	What date did World War 1 End?
Q38	What Civil War general graduated first in the West Point class of 1829?
Q39	What two continents have never been the site of a major military conflict?
Q40	What is the slang military term for the distance of one kilometre?
Q41	The US military installation Area 51 is located in which state?
Q42	World War I flying ace Manfred von Richthofen is known by what nickname?
Q43	What does the military acronym HALO stand for?
Q44	What is the highest enlisted rank a soldier can hold in the United States Army?
Q45	During Operation Neptune, informally known as D-Day, Allied troops invaded: A) The Sudetenland, B) The Rhineland, C) Normandy, D) The Potomac

History Trivia Answers

A1	Harry S. Truman
A2	Vasco Núñez de Balboa
A3	HMS Beagle
A4	Samurai
A5	Guilder
A6	Neil Armstrong and Buzz Aldrin
A7	The Battle of Stalingrad
A8	German, Italy, and Japan
A9	World War I
A10	RMS Titanic
A11	Bicycle
A12	The Renaissance
A13	Constantinople
A14	Austria
A15	NATO
A16	Pesetas
A17	The Battle of Waterloo
A18	The Nobel Prize
A19	The Soviet Union
A20	Croatia
A21	Queen Victoria
A22	Russia
A23	Benito Amilcare Andrea Mussolin
A24	Paris, France
A25	Julius Caesar
A26	Giza
A27	A torch
A28	Manhattan Project
A29	Portugal
A30	1947
A31	Brexit
A32	La Santa Maria
A33	Henry VII
A34	The assassination of Archduke Franz Ferdinand of Austria
A35	1945
A36	Nagasaki
A37	June 28, 1919
A38	Robert E. Lee
A39	Antarctica and Australia

A40	Klick
A41	Nevada
A42	The Red Baron
A43	High Altitude-Low Opening
A44	Sergeant Major of the Army
A45	C) Normandy

Language Trivia

Q1	What is the meaning of the French expression "c'est la vie"?
Q2	In China, what number is considered unlucky because its pronunciation is similar to that for the word "death"?
Q3	The term "déjà vu" comes from what language?
Q4	What is the main dialect of Chinese spoken in Hong Kong by the majority of the locals?
Q5	How do you say "hello" in Swedish?
Q6	What is the Japanese word that means "empty orchestra"?
Q7	What is the plural of the word crisis?
Q8	How do you say hello in Mandarin Chinese?
Q9	In Russia, a woman's last name usually ends in what letter?
Q10	How do you say goodbye in Spanish?
Q11	Which is the most widely spoken language in the world?
Q12	A Shakespearean sonnet consists of how many lines?
Q13	Which American author wrote the non-fiction novel "In Cold Blood"?
Q14	"Call me Ishmael" is the opening line from what novel?
Q15	Who was the author of the children's fantasy novel The Lion, the Witch and the Wardrobe?
Q16	How the Grinch Stole Christmas is a children's book written by which American author?
Q17	Which American writer wrote the narrative poem "The Raven"?
Q18	In Shakespeare's tragedy Romeo and Juliet, what's Romeo's last name?
Q19	Which American author wrote the novel "The Great Gatsby", published in 1922?
Q20	Who wrote the young adult vampire-romance novel "Twilight"?
Q21	Which British author wrote the popular children's novel "James and the Giant Peach"?
Q22	War and Peace, originally published in 1869, is a novel written by which Russian author?

Language Trivia Answers

A1	That's life
A2	Four (四,sì)
A3	French
A4	Cantonese
A5	Hej
A6	Karaoke
A7	Crises
A8	Ni Hao
A9	A
A10	Adiós
A11	Mandarin Chinese
A12	Fourteen
A13	Truman Capote
A14	Moby Dick
A15	C.S. Lewis
A16	Dr. Seuss (Theodor Seuss Geisel)
A17	Edgar Allan Poe
A18	Montague
A19	F. Scott Fitzgerald
A20	Stephenie Meyer
A21	Roald Dahl
A22	Leo Tolstoy

Movie & Tv Trivia

Q1	In the 1997 American science fiction comedy Men in Black, which actor played Agent K?

ENTERTAINMENT	Brai	Trivia	Movie & Tv Trivia	Q2	What is the favourite food of the Teenage Mutant Ninja Turtles?
				Q3	Jim Carrey and Renee Zellweger starred in what comedy film, released in 2000, about a cop with dissociative identity disorder?
				Q4	In the movie The Terminator, what is the name of the company that created Skynet?
				Q5	I'd buy that for a dollar", is a catchphrase from what 1987 action movie set in Detroit, Michigan, in the near future.
				Q6	As a protest to Hollywood's portrayal of Native Americans in film, Marlon Brando declined an Academy Award for his performance in what movie?
				Q7	Who produced and directed the American epic aviation war film "Hell's Angels", released in 1930?
	Teasers	Trivia	Movie & Tv Trivia	Q8	Bruce Banner turns into what fictional superhero when he becomes angry?
				Q9	Who played the female lead in the 1990 romantic comedy Pretty Woman?
				Q10	Which actor played Marty McFly in the 1980s sci-fi classic "Back to the Future"?
				Q11	Who played the lead role in the 1982 American comedy Tootsie?
				Q12	Who played the female lead in the dystopian political thriller "V for Vendetta"?
				Q13	Tyler Durden is a fictional character appearing as the central protagonist and antagonist in what 1999 American film?
				Q14	In Disney's "The Little Mermaid" what is the name of the human that Ariel falls in love with?
				Q15	Who played the female lead in the 1942 film Casablanca?
				Q16	In movie ratings what do the letters PG stand for?
			Movie & Tv Trivia	Q17	In the Star Wars universe, who is Luke Skywalker's mother?
				Q18	In the "Lord of the Rings" film series which actor plays the character of Saruman?
				Q19	The first movie of the Fast and Furious franchise was released in what year?
ENTERTAINMENT				Q20	In the 2016 American fantasy adventure film, "The Jungle Book", what is the name of the orphaned human boy?
				Q21	In the movie "The Wizard of Oz", what did the Scarecrow want from the wizard?
	Brain	Trivia	Movie & Tv Trivia	Q22	Which actress played identical twins in the 1998 movie remake of The Parent Trap?
				Q23	In which 1993 thriller does the protagonist violently lose his cool when a fast food restaurant will not let him order from the breakfast menu?
				Q24	What is the name of the 1978 movie, starring Brad Davis, about an American college student who is sent to a Turkish prison for attempting to smuggle hashish out of Turkey?
				Q25	In what year was Alfred Hitchcock's psychological thriller "Psycho" released?
				Q26	In the Disney movie "Beauty and the Beast", what is the name of Gaston's bumbling sidekick?
				Q27	What are the four houses at Hogwarts School of Witchcraft and Wizardry?
				Q28	Who played James Bond in the 1969 film "On Her Majesty's Secret Service"?
				Q29	Keiko is the name of a whale that appeared in what 1993 American family drama film?
				Q30	What sunglasses did Tom Cruise wear in the 1986 movie "Top Gun"?
				Q31	What is the name of the actress who played the Unsinkable Molly Brown in the 1997 movie Titanic?
			Movie & Tv Trivia	Q32	What was the name of The Lone Ranger's horse that he saved from an enraged buffalo?
				Q33	What later "Star Wars" actress had an early role in the movie "Léon: The Professional"?
				Q34	Robin Williams won an Academy Award for best supporting actor in which 1997 film about a South Boston janitor?
				Q35	What is the name of Mickey Mouse´s dog?
ENTERTAINMENT	Teasers	Trivia		Q36	Tom Hanks played "Captain Miller" in what legendary World War II movie?
				Q37	BB-8 is an astromech droid from what film franchise?
				Q38	The original Ghostbusters movie was released in June of what year?
				Q39	Orson Welles provided the voice for which Transformer in "The Transformers: The Movie" released in 1986?
				Q40	Who played Dracula in the 1931 vampire-horror film "Dracula"?
			Movie & Tv Trivia	Q41	Who was the female lead in the movie "Titanic"?
				Q42	Which actor that once played James Bond previously competed in the Mr. Universe bodybuilding competition?
				Q43	Who played the fictional anti hero Deadpool in the 2016 movie?
				Q44	Which actor played the main character in the 1990 film "Edward Scissorhands"?

ENTERTAINMENT	Brain Teasers	Trivia	Movie & Tv Trivia	Q45	Superman is a fictional superhero from what fictional planet?
				Q46	Who directed the movie "Reservoir Dogs"?
				Q47	In the 1986 blockbuster "Top Gun" which actress played Goose's wife?
				Q48	Who played Batman in the 1989 Tim Burton version of the film?
				Q49	What did the famous Hollywood sign, located in Los Angeles, originally say?
				Q50	Which Teenage Mutant Ninja Turtle always wears red bandanas?
				Q51	In movies, a clue or piece of information which is intended to be misleading, is known as what?
				Q52	In what year was the movie "Grease" released?
				Q53	What was the name of the 1999 American found footage horror film about three student filmmakers that disappeared in the woods?
				Q54	Who is the voice of SpongeBob SquarePants?
				Q55	Which Olympic sport was featured in the movie "Cool Runnings"?
				Q56	What was the first feature film originally presented with sound?
				Q57	In what year was the original "Jurassic Park" film released?
				Q58	In the movie "Back to the Future", what speed did the DeLorean need to reach in order to achieve time travel?
				Q59	What popular movie musical, directed by John Hutson, was released in 1982?
				Q60	In the movie "The Lion King", what was Simba's mother's name?
				Q61	Which actor was the voice of Darth Vader in the original Star Wars films?
				Q62	In the movie "Bambi", what type of animal is Bambi's friend Flower?
				Q63	Which actress played the role of Mary (adult) in the movie "It's a Wonderful Life"?
				Q64	What full length movie is generally considered as the first to have full colour?
				Q65	Which action movie star was the voice of the Iron Giant?
				Q66	In which Star Wars film did the Ewoks first appear?
				Q67	What was first feature length animated film?
				Q68	What is the job title of the person in charge of the camera and lighting crews working on a film?
				Q69	Which 1979 film included a spaceship called Nostromo?
				Q70	In 1939, the movie The Wizard of Oz lost the Academy Award for best picture to what film?
				Q71	What catch phrase is most commonly associated with the actor Arnold Schwarzenegger?
				Q72	Who directed the 1977 movie Star Wars?
				Q73	Who was the male lead in the 1996 summer blockbuster Independence Day?
				Q74	What movie did Elvis Presley first appear in?
				Q75	What are the names of the 7 dwarfs from the Disney movie "Snow White and the Seven Dwarfs"?
				Q76	What 2013 science fiction blockbuster starred Sandra Bullock and George Clooney?
				Q77	Which famous singer appeared in the movie Mad Max: Beyond Thunderdome?
				Q78	How many castaways were there on the American sitcom Gilligan's Island?
				Q79	Orphan Black is a sci-fi television series filmed in which country?
				Q80	Which actress plays the female lead in the American crime thriller television series "The Blacklist"?
				Q81	What is the longest running U.S. primetime television show of all time?
				Q82	Rod Serling created what famous science fiction television show?
				Q83	In what city does SpongeBob Squarepants live?
				Q84	On the hit show Seinfeld what was Kramer's first name?
				Q85	Who was the first actor to play Doctor Who in the television series?
				Q86	Which actor played the captain of the Enterprise in the television series "Star Trek the Next Generation"?
				Q87	What are the names of the two Muppet characters that heckle the rest of the cast from their balcony seats?

Q88	How many fingers do the Simpsons cartoon characters have?
Q89	What was Walt Disney's middle name?
Q90	What is the first "themed land" just inside the main entrance of Disneyland?
Q91	What is the name of the animated science fiction comedy-drama film released in 2002 about a Hawaiian girl and her unusual pet?
Q92	In Disney's 1959 animated film Sleeping Beauty, who is Princess Aurora is betrothed to?
Q93	What is the name of the Disney cartoon character that is the girlfriend to Donald Duck?
Q94	In Disney's "The Little Mermaid" what is the name of the human that Ariel falls in love with?
Q95	In the Disney movie "Beauty and the Beast", what is the name of Gaston's bumbling sidekick?
Q96	What was the name of the kleptomaniac monkey in the Disney movie "Aladdin"?
Q97	What are the names of the three fairies in the Disney classic "Sleeping Beauty"?
Q98	What was the first ever series to air on the Disney Channel?
Q99	What is the name of Mickey Mouse´s dog?

Movie & Tv Trivia Answers

A1	Tommy Lee Jones
A2	Pizza
A3	Me, Myself & Irene
A4	Cyberdyne Systems
A5	Robocop
A6	The Godfather
A7	Howard Hughes
A8	The Hulk
A9	Julia Roberts
A10	Michael J. Fox
A11	Dustin Hoffman
A12	Natalie Portman
A13	Fight Club
A14	Prince Eric
A15	Ingrid Bergman
A16	Parental Guidance
A17	Padmé Amidala
A18	Christopher Lee
A19	2001
A20	Mowgli
A21	A brain
A22	Lindsay Lohan
A23	Falling Down
A24	Midnight Express
A25	1960
A26	LeFou
A27	Gryffindor, Ravenclaw, Hufflepuff, & Slytherin
A28	George Robert Lazenby
A29	Free Willy
A30	Ray Ban Aviator (RB 3025)
A31	Kathy Bates
A32	Silver
A33	Natalie Portman
A34	Good Will Hunting
A35	Pluto
A36	Saving Private Ryan
A37	Star Wars
A38	1984
A39	Unicron
A40	Bela Lugosi
A41	Kate Winslet
A42	Sean Connery
A43	Ryan Reynolds
A44	Johnny Depp
A45	Krypton
A46	Quentin Tarantino
A47	Meg Ryan
A48	Michael Keaton
A49	Hollywoodland
A50	Raphael
A51	Red Herring

ENTERTAINMENT Brain Teasers Trivia Movie & Tv Trivia Answers

A52	1978
A53	The Blair Witch Project
A54	Tom Kenny
A55	Bobsledding
A56	The Jazz Singer, released in 1927.
A57	1993
A58	88 mph
A59	Annie
A60	Sarabi
A61	James Earl Jones
A62	Skunk
A63	Donna Reed
A64	Becky Sharp
A65	Vin Diesel
A66	Episode VI: Return of the Jedi
A67	El Apóstol
A68	Cinematographer
A69	Alien
A70	Gone with the Wind
A71	I'll be back
A72	George Lucas
A73	Will Smith
A74	Love Me Tender
A75	Happy, Sleepy, Sneezy, Dopey, Grumpy, Bashful and Doc
A76	Gravity
A77	Tina Turner
A78	Seven
A79	Canada
A80	Megan Boone
A81	The Simpsons
A82	The Twilight Zone
A83	Bikini Bottom
A84	Cosmo
A85	William Hartnell
A86	Patrick Stewart
A87	Statler and Waldorf
A88	Four
A89	Elias
A90	Main Street, U.S.A.
A91	Lilo & Stitch
A92	Prince Phillip
A93	Daisy Duck
A94	Prince Eric
A95	LeFou
A96	Abu
A97	Flora, Fauna and Merryweather
A98	Good Morning, Mickey
A99	Pluto

Music Trivia

Q1	Who was the first performer at the 1969 Woodstock festival?
Q2	Houses of the Holy is the fifth studio album by which English rock band?
Q3	What American music duo released the studio album "Sounds of Silence" in 1966?
Q4	What is the name of the first album released by American rock band Bon Jovi?
Q5	Who interrupted Taylor Swift's acceptance speech at the 2009 Video Music Awards?
Q6	Who was the oldest member of the rock band The Beatles?
Q7	What Broadway musical broke the record for Tony nominations in 2016?
Q8	Who is the former drummer for Nirvana that went on to become the frontman for the Foo Fighters?
Q9	How old was American musician Jimi Hendrix when he passed away in 1970?
Q10	Victoria Beckham was a member of which all girl English pop group formed in 1994?
Q11	The first Eurovision song contest was held in what year?
Q12	Who was the original singer for the American punk rock band The Misfits?
Q13	What was the name of the Eminem single that set the world's record in 2013 for the most words used in a song?

Q14	Released in 1992, what is the best selling soundtrack album of all time?
Q15	Who played lead guitar for the British rock band Queen?
Q16	Which of the Beatles is barefoot on the Abbey Road album cover?
Q17	K-pop is a genre of music that originated in what country?
Q18	Award winning Latina pop artist Shakira was born in raised in what Country?
Q19	A Grammy is an award to recognize outstanding achievement in what industry?
Q20	"Stairway to Heaven" a song by English rock band Led Zeppelin was originally released on which of their albums?
Q21	What American punk rock band released their best selling album "Dookie" in 1994?
Q22	In music, the space between one musical pitch and another with double its frequency is called what?
Q23	American singer-songwriter Johnny Cash passed away in what year?
Q24	Who is the Canadian singer-songwriter best known for her hit song, "Call Me Maybe"?
Q25	Who is the lead singer for the American rock band Pearl Jam?
Q26	What was the name of Seattle grunge band Nirvana's first album, released in 1989?
Q27	What American singer-songwriter wrote and first recorded the song "Blue Suede Shoes" in 1955?
Q28	Who played the title character in the teen sitcom musical comedy "Hannah Montana"?
Q29	Who wrote and recorded the one hit wonder "Spirit in the Sky" released in late 1969?
Q30	What was the highest selling album of the 1980s in the United States?
Q31	"Hallelujah" is a song written by which Canadian recording artist?
Q32	"All Shook Up" is a song that topped the U.S. Billboard Hot 100 on April 13, 1957. Who was the singer?
Q33	What song by Michael Jackson contains the lyrics "Annie are you OK?
Q34	What was the name of Michael Jackson's first solo album as an adult?
Q35	In what city was Ludwig van Beethoven born?
Q36	In what year did Paul McCartney announce he was quitting the Beatles?
Q37	Where was the very first Hard Rock Cafe opened?
Q38	How many keys are on most baby grand pianos?
Q39	Who was the lead singer of the band Audioslave?
Q40	New Orleans is known as the birthplace of what type of music?
Q41	ABBA was a pop group from what country?
Q42	What was the first music video played on MTV?
Q43	Which band sang the hit "Hey There Delilah", which reached No. 1 on the Billboard Hot 100 in 2007?
Q44	Which famous American musician was fatally shot by his father on April 1, 1984?

Music Trivia Answers

A1	Richie Havens
A2	Led Zeppelin
A3	Simon & Garfunkel
A4	Bon Jovi
A5	Kanye West
A6	Ringo Starr
A7	Hamilton (16 nominations)
A8	David Grohl
A9	27
A10	The Spice Girls
A11	1956
A12	Glenn Danzig
A13	Rap God
A14	The Bodyguard
A15	Brian May
A16	Paul McCartney
A17	South Korea
A18	Colombia
A19	Music

A20	Their untitled fourth studio album commonly referred to as "Led Zeppelin IV".
A21	Green Day
A22	An octave
A23	2003
A24	Carly Rae Jepsen
A25	Eddie Vedder
A26	Bleach
A27	Carl Perkins
A28	Miley Cyrus
A29	Norman Greenbaum
A30	Thriller by Michael Jackson
A31	Leonard Cohen
A32	Elvis Presley
A33	Smooth Criminal
A34	Off The Wall
A35	Bonn, Electorate of Cologne
A36	1970
A37	Piccadilly, London
A38	88
A39	Chris Cornell
A40	Jazz
A41	Sweden
A42	Video Killed the Radio Star
A43	Plain White T's
A44	Marvin Gaye

Political Trivia

Q1	The Bill of Rights contains how many of the first amendments to the United States Constitution?
Q2	Who was the first U.S. president that was born a citizen of the United States?
Q3	Who won the nomination of the Democratic Party to run for president in 2016?
Q4	Who was the vice president that served under President Barack Obama?
Q5	What late American singer was the mayor of Palm Springs California from 1988 to 1992?
Q6	Who was vice president of the United States when Lincoln was assassinated?
Q7	Who is the oldest person to be elected to the office of President of the United States?
Q8	The oldest parliament in the world belongs to what country?
Q9	The United Kingdom's withdrawal from the European Union is commonly known as what?
Q10	Who assassinated President Abraham Lincoln?
Q11	Who was the first Roman Catholic to be Vice President of the United States of America?
Q12	Who was the first First Lady to be elected to public office?
Q13	How many US Supreme Court justices are there?
Q14	Which US president was known as "The Great Communicator"?
Q15	How many states are needed to ratify an amendment for it to become part of the constitution?
Q16	The Electoral College in the United States is made up of how many electors?
Q17	Which political party promotes individual liberty, free markets, non-interventionism and limited government?
Q18	In What state was President Barack Obama born?
Q19	What animal is the symbol of the United States democratic party?
Q20	Who is next in line to succeed the President, after the Vice President?
Q21	In 1893, which country became the first to give women the right to vote?
Q22	How old must a person be to run for President of the United States?
Q23	The teddy bear was named after what famous American politician?
Q24	Who was the first president of the United States to live in the White House?
Q25	What politician and U.S. President said, "You let a bully come into your front yard, and the next day he'll be on your porch"?
Q26	In the mid 60s, who was the head of the political wing of the Vietcong?
Q27	What's the name of the British political regime 1649-60 established by Oliver Cromwell?

Q28	What country had rampant political corruption that was investigated by the Mani pulite, or "Clean Hands," of the 1990s?
Q29	Who was the second president of the United States?
Q30	What famous actor became Governor of California in 2003?
Q31	In what year was the US Constitution written?
Q32	Abraham Lincoln, Theodore Roosevelt and Herbert Hoover all belonged to which political party?
Q33	Who is the only US president to serve more than two terms?

Political Trivia Answers

A1	Ten
A2	Martin Van Buren
A3	Hillary Clinton
A4	Joe Biden
A5	Sonny Bono
A6	Andrew Johnson
A7	Donald Trump
A8	Iceland
A9	Brexit
A10	John Wilkes Booth
A11	Joe Biden
A12	Hillary Rodham Clinton
A13	9
A14	Ronald Regan
A15	Three-fourths of the states (38 of 50)
A16	538
A17	Libertarian
A18	Hawaii
A19	Donkey
A20	The Speaker of the House
A21	New Zealand
A22	35
A23	Theodore Roosevelt
A24	President John Adams
A25	Lyndon Johnson
A26	Nguyenh Huu Tho
A27	The Commonwealth
A28	Italy
A29	John Adams
A30	Arnold Schwarzenegger
A31	1787
A32	Republican
A33	President Franklin Delano Roosevelt

Psychology Trivia

Q1	Psychology originally emerged from what two disciplines?
Q2	The unconscious mind plays an important role in which school of thought in psychology?
Q3	The variable that is manipulated in an experiment is known as the?
Q4	Which type of research study takes place over a long period of time, often lasting months or even years?
Q5	Which area of the brain is associated with reasoning, motor skills, higher lever cognition and expressive language?
Q6	Which area of the brain is responsible for controlling hunger, thirst, emotions, temperature and circadian rhythms?
Q7	In classical conditioning, the learned response to the previously neutral stimulus is known as the?
Q8	In operant conditioning, the removal of an unfavourable event or outcome after the display of a behaviour is known as?
Q9	In Freud's theory, which part of personality is focused on fulfilling the most primal and basic urges?
Q10	Which stage of psychosocial development focuses on developing a greater sense of personal control?
Q11	What is at the peak of Maslow's hierarchy of needs?
Q12	Dendrophobia is the fear of what?
Q13	Cynophobia is the fear of what kind of animal?
Q14	Which psychologist investigated obedience using electric shocks?
Q15	Who is considered the father of psychoanalysis?

Q16	What is the fear of clowns called?
Q17	Gymnophobia is the fear of what?
Q18	The psychological test of human emotions and personality, using inkblots, is formally known as what?
Q19	The desire to eat strange things that are non-nutritive is known as what?
Q20	If Fred's eyes look to the left when asked a direct question, what is he doing?
Q21	What theory did MacIntyre et al.(1998) suggest that influences attitudes to food and eating behaviours?
Q22	Who suggested that romantic relationships form because two people are similar, or become similar, in personality and attitudes?

Psychology Trivia Answers

A1	Philosophy and Biology
A2	Psychoanalysis
A3	Independent Variable
A4	Longitudinal Study
A5	The Frontal Lobe
A6	Hypothalamus
A7	Conditioned Response
A8	Negative Reinforcement
A9	The ID
A10	Assimilation
A11	Self-Actualizing Needs
A12	Trees
A13	Dogs
A14	Stanley Milgram
A15	Sigmund Freud
A16	Coulrophobia
A17	Nudity
A18	The Rorschach Test
A19	Pica
A20	Recalling Facts
A21	Social Learning Theory
A22	Byrne, Clore and Smeaton (1986)

Science Trivia

Q1	What is the most common blood type in humans?
Q2	Which gland in the human body regulates metabolism?
Q3	What is the name for the specialized nerve cell that transmits information chemically and electrically throughout the body?
Q4	The molecule "haemoglobin" is used in which type of cells?
Q5	What is the common name for the third and final set of molars that most people develop?
Q6	In humans, what is the only internal organ capable of regenerating lost tissue?
Q7	Approximately 2% of all people have what eye colour?
Q8	How many pairs of chromosomes are in found in the average human?
Q9	What vitamin is produced when a person is exposed to sunlight?
Q10	What is the name for a protein that acts as a biological catalyst?
Q11	What is the largest internal organ of the human body?
Q12	What does the acronym DNA stand for?
Q13	A person able to use both hands with equal skill is called what?
Q14	Most adults have how many canine teeth?
Q15	Which shark is the biggest?
Q16	What is the perceived decrease in air temperature felt by the body due to the flow of air known as?
Q17	How many chambers are there in a dog's heart?
Q18	What is known as the "master gland" of the human body?
Q19	What animal has the fastest metabolism?
Q20	Which animal has the largest brain?
Q21	Which bone is the longest bone in the human body?

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Q22	What blood type do you need to be a universal donor?
Q23	Diamonds are made up almost entirely of what element?
Q24	What is the chemical symbol for Helium?
Q25	How many hydrogen atoms are in one molecule of water?
Q26	What is the chemical formula for ozone?
Q27	What is the chemical symbol for table salt?
Q28	Who is generally acknowledged as the “father” of the modern periodic table?
Q29	Which element, previously used in the production of felt, lead to the expression "mad as a hatter"?
Q30	Which elements symbol is the letter K on the periodic table?
Q31	What is the chemical symbol for iron?
Q32	What is the most abundant element in the earth's atmosphere?
Q33	What is the first element on the periodic table?
Q34	Who came up with the theories of General and Special relativity?
Q35	Which branch of physics is devoted to the study of heat and related phenomena?
Q36	According to physics, what are the four fundamental forces in nature?
Q37	Schrödinger's cat is a thought experiment dealing with which type of mechanics?
Q38	Who is the author of the book "A Brief History of Time"?
Q39	What four states of matter are observable in everyday life?
Q40	What is the speed of light?
Q41	What is the Kármán line?
Q42	How fast must a plane be travelling to break the sound barrier?
Q43	Which law of physics makes a perpetual motion machine impossible?
Q44	What physics law describes how light acts in a prism?

Science Trivia Answers

ENTERTAINMENT | Brain Teasers | Trivia | Science Trivia Answers

A1	O+
A2	Thyroid
A3	Neuron
A4	Red blood cells
A5	Wisdom Teeth
A6	The Liver
A7	Green
A8	Twenty-three
A9	Vitamin D
A10	Enzyme
A11	Liver
A12	Deoxyribonucleic acid
A13	Ambidextrous
A14	Four
A15	The whale shark
A16	Wind chill
A17	Four
A18	The pituitary gland
A19	Hummingbird
A20	The sperm whale has the largest brain weighing around 17 pounds.
A21	Femur
A22	Type O-
A23	Carbon
A24	He
A25	Two
A26	O3
A27	NaCl
A28	Russian chemist Dmitri Mendeleev
A29	Mercury
A30	Potassium
A31	Fe
A32	Nitrogen

A33	Hydrogen
A34	Albert Einstein
A35	Thermodynamics
A36	Strong Force, Electromagnetic Force, Weak Force, Gravitational Force
A37	Quantum Mechanics
A38	Stephen Hawking
A39	Solid, Liquid, Gas and Plasma
A40	299,792,458 m/s
A41	The differentiation between earth and space
A42	660mph
A43	The first and second laws of thermodynamics
A44	Snell's Law

Sports Trivia

Q1	What is Canada's national summer sport?
Q2	What NBA player was known as "The Pearl"?
Q3	What is the national sport of Japan?
Q4	What NHL hockey player was nicknamed "The Golden Jet"?
Q5	What is the most popular spectator sport in Australia?
Q6	Which NFL team overcame a 25-point deficit to win the 2017 Super Bowl?
Q7	The Heisman Memorial Trophy is awarded annually to the most outstanding player in which college sport?
Q8	Who was the first golfer to win the Masters Tournament two years in a row?
Q9	Bobby Fischer is considered by many to be the greatest player of all time in which game?
Q10	Anthony Jerome "Spud" Webb retired from what professional sport in 1997?
Q11	Who is the longest reigning heavyweight boxing champion with 25 successful defences?
Q12	Barry Bonds currently holds the Major League Baseball home run record with how many home runs?
Q13	What is professional wrestler John Cena's famous catchphrase?
Q14	Which tennis player has won the most men's Grand Slam titles?
Q15	In hockey, how many players from each team are allowed to be on the ice at the same time?
Q16	According to NBA rules how long does a player have after catching the ball to shoot a free throw?
Q17	What is the real name of the former wrestler turned actor who went by the ring name "The Rock"?
Q18	In sports, what does the acronym MVP stand for?
Q19	What country was host to the 1930 inaugural FIFA Football World Cup?
Q20	The Stanley Cup is a championship trophy awarded annually to the playoff winner in what sport?
Q21	What sport does Cristiano Ronaldo play?
Q22	In what year was the "Perfect 10" scoring system in gymnastics abandoned?
Q23	What is the highest score possible in 10 pin bowling?
Q24	Which five-times Grand Slam tennis champion tested positive for a banned substance at the 2016 Australian Open?
Q25	What is the regulation height for a basketball hoop?
Q26	The Kangaroo Hoppet is a long distance cross-country skiing race that is held in which county?
Q27	In what year was the 4 minute mile first achieved?
Q28	The Grand Slam tournaments are the four most import annual events in which two sports?
Q29	NASCAR is an acronym for what family-owned and operated business?
Q30	Tiger Woods became a professional golfer in what year?
Q31	The Walker Law passed in 1920 in New York was a law regulating which sport?
Q32	Where did the sport of curling originate?
Q33	A shuttlecock is used in what sport?
Q34	Which baseball team won the first World Series championship in 1903?
Q35	What was major league baseball's Yogi Berra's real name?

ENTERTAINMENT | Brain Teasers | Trivia | Sports Trivia

Q36	What is the most common type of pitch thrown by pitchers in baseball?
Q37	Barry Bonds currently holds the Major League Baseball home run record with how many home runs?
Q38	What is the name of Atlanta's major league baseball team?
Q39	Who is the only athlete ever to play in a Super Bowl and a World Series?
Q40	Which team did the Chicago Cubs play in the 1945 World Series?
Q41	Who was the first Latin American born player to play in Major League Baseball?
Q42	Who was the first pinch hitter to score a home run in World Series play?
Q43	In 1998, what Major League Baseball player broke the single season home run record previously set by Roger Maris?
Q44	What type of animal is the mascot for the Oakland Athletics baseball team?
Q45	What NBA player was known as "The Pearl"?
Q46	Who is the all time leading point scorer in NBA history?
Q47	Who is the only head basketball coach to win both an NCAA national championship and an NBA title?
Q48	According to NBA rules how long does a player have after catching the ball to shoot a free throw?
Q49	What is the regulation height for a basketball hoop?
Q50	Who was the shortest player ever to play in the NBA?
Q51	Which basketball team did Michael Jordan play for in college?

Sports Trivia Answers

ENTERTAINMENT | Brain Teasers | Trivia | Sport Trivia Answers

A1	Lacrosse
A2	Earl Monroe
A3	Sumo
A4	Bobby Hull
A5	Australian Rules Football
A6	New England Patriots
A7	Football
A8	Jack Nicklaus
A9	Chess
A10	Basketball
A11	Joe Louis
A12	762
A13	You can't see me!
A14	Roger Federer
A15	Six
A16	10 seconds
A17	Dwayne Douglas Johnson
A18	Most valuable player
A19	Uruguay
A20	Hockey
A21	Soccer (football)
A22	2006
A23	300
A24	Maria Sharapova
A25	10 feet (3.048 m)
A26	Australia
A27	1954 by Roger Bannister in 3:59.4
A28	Tennis & Golf
A29	The National Association for Stock Car Auto Racing
A30	1996
A31	Boxing
A32	Scotland
A33	Badminton
A34	Boston Americans
A35	Lawrence Peter Berra
A36	Fastball
A37	762
A38	Atlanta Braves
A39	Deion Sanders
A40	Detroit Tigers
A41	Luis Manuel Castro
A42	Yogi Berra
A43	Mark McGwire
A44	Elephant

A45	Earl Monroe
A46	Kareem Abdul-Jabbar
A47	Larry Brown
A48	10 seconds
A49	10 feet (3.048 m)
A50	Tyrone Bogues, better known as Muggsy Bogues
A51	University of North Carolina at Chapel Hill

Transport Trivia

Q1	What does the acronym for the German multinational company BMW stand for?
Q2	The vehicle manufacturer Volvo was founded in what country?
Q3	What do the letters "PT" stand for in the name of Chrysler's family car, the PT Cruiser?
Q4	The first generation of the Chevrolet Corvette was introduced in what year?
Q5	In most modern vehicles, the carburettor has been replaced with what?
Q6	What luxury British automobile brand was purchased by Tata motors in 2008?
Q7	In what year was the Chevrolet Chevelle first produced?
Q8	What is the three letter airport code for the Los Angeles International Airport?
Q9	In what year did the aviator Charles A. Lindbergh cross the Atlantic Ocean?
Q10	Who was the first woman pilot to fly solo across the Atlantic?
Q11	What was the nickname for the Hughes H-4 Hercules aircraft that made a single flight in 1947?

Transport Trivia Answers

A1	Bavarian Motor Works (Bayerische Motoren Werke)
A2	Sweden
A3	Personal Transport
A4	1953
A5	Fuel Injection
A6	Jaguar
A7	1964
A8	LAX
A9	1927
A10	Amelia Earhart
A11	Spruce Goose

Video Game Trivia

Q1	What was the first console video game that allowed the game to be saved?
Q2	The first person shooter video game Doom was first released in what year?
Q3	In the world of video games, what does NES stand for?
Q4	In what year did Nintendo release its first game console in North America?
Q5	What was the best-selling video game console of all-time?
Q6	In what year was the Nintendo 64 officially released?
Q7	In the game HALO, what is the name of Master Chief's AI sidekick?
Q8	Who is the Most Famous Video Game Character of all Time?
Q9	In what Game Series are Golden Rings used as Life-energy and Money
Q10	What was Mario's name in Donkey Kong?
Q11	What time travelling device appears in Assassin's Creed?
Q12	Which of these characters never speaks? A. Nathan Drake, B. Mario, C. Link, D. Master Chief
Q13	Which came first: A. Mortal Kombat the game, B. Mortal Kombat the movie
Q14	Why did Princess Peach invite Mario to the castle in Mario 64?
Q15	Do you ever see Gordon Freeman's face in the Half-Life series?
Q16	What is Mega Man called in Japan?
Q17	What does Pokémon stand for?
Q18	What was the first video game console?

Q19	Could you select your character in the original Doom?
Q20	Which of these ships played a key role in Mass Effect 2? A. Hyperion, B. Valkyrie, C. Lewis and Clark, D. SSV Normandy
Q21	Which Grand Theft Auto game was the first to offer playable female characters?
Q22	Who helped created Mario, Zelda, and Star Fox?

Video Game Trivia Answers

A1	The Legend of Zelda
A2	1993
A3	Nintendo Entertainment System
A4	1985
A5	PlayStation 2
A6	1996
A7	Cortana
A8	Mario
A9	Sonic the Hedgehog
A10	Jumpman
A11	Animus
A12	C. Link
A13	Mortal Kombat the game
A14	She baked him a cake
A15	No
A16	Rock Man
A17	Pocket Monsters
A18	Magnavox Odyssey
A19	No
A20	D. SSV Normandy
A21	Grand Theft Auto
A22	Sigeru Miyamoto

3 Facts

Astonishing pieces of information you aren't likely to have known prior.

General Facts

Boring, Oregon and Dull, Scotland have been sister cities since 2012. In 2017, they added Bland Shire, Australia to their "League of Extraordinary Communities."

Amelia Earhart and Eleanor Roosevelt once sneaked out of a White House event, commandeered an airplane, and went on a joyride to Baltimore.

During Prohibition, moonshiners would wear "cow shoes." The fancy footwear left hoofprints instead of footprints, helping distillers and smugglers evade police.

In 1974, the Journal of Applied Behaviour Analysis published a paper titled "The Unsuccessful Self-Treatment of a Case of 'Writer's Block.'" It contained a total of zero words.

Guinness estimates that 93,000 litres of beer are lost in facial hair each year in the UK alone.

Some cats are allergic to humans.

Queen Elizabeth II is a trained mechanic.

Volvo gave away the 1962 patent for their revolutionary three-point seat belt for free, in order to save lives.

Tsundoku is the act of acquiring books and not reading them.

Ravens in captivity can learn to talk better than parrots.

In Great Britain and Japan, black cats are perceived as auspicious. In the English Midlands, new brides are given black cats to bless their marriage, and the Japanese believe that black cats are good luck—particularly for single women.

Donkey Kong got his name because the creator believed 'donkey' meant 'stupid' in English and wanted to convey the impression that the character was a "Stupid Ape".

The medicinal name for a butt crack is "intergluteal cleft".

People can suffer from a psychological disorder called Boanthropy that makes them believe that they are a cow. They try to live their life as a cow.

Mr Potato Head was the first toy to be advertised on TV.

A duel between three people is actually called a truel.

In South Korea there is an emergency number (113) to report spies.

There are no bridges over the Amazon River.

The process by which bread toasts is called the "Maillard Reaction".

The human nose can remember 50,000 different scents.

Daddy longlegs have penises, which technically makes them not a spider.

The television was invented only two years after the invention of sliced bread.

Bullfrogs do not sleep.

In 2005, a fortune cookie company called Wonton Food Inc correctly foretold lottery numbers, resulting in 110 winners and an investigation. No fraud was involved.

The dark region on the north pole of Pluto's moon, Charon, is called Mordor.

In 2015, a silver coin with Superman on the heads side was made which is legal tender in Canada. There was only 350,000 produced.

Two PlayStation 1 games, Fifa 2001 and Gran Turismo 2 have scratch and sniff discs. The FIFA 2001 smells like a soccer field, while Gran Turismo 2 smelled like car tires.

In 2014, Sony made a cassette tape that can store 185TB of data.

If you die in Amsterdam with no next of kin, and no friends or family to prepare funeral or mourn over the body, a poet will write a poem for you and recite it at your funeral.

It took the creator of the Rubik's Cube, Erno Rubik, one month to solve the cube after he created it; the current world record is 5.55 seconds.

In 2014, a missing woman on a vacation in Iceland was found when it was discovered that she was in the search party looking for herself.

If you sneeze while travelling at ~100kmh (60 mph) your eyes are closed for an average of 15 meters (50 ft).

Both Nicholas Cage and Michael Jackson shared the same wife, Elvis Presley's daughter, Lisa Marie Presley.

Alligators will give manatees the right of way if they are swimming near each other.

The I'm Feeling Lucky feature in Google search actually costs Google $110 million a year, as 1% of all searches use this feature and bypass all advertising.

Magpies are considered one of the most intelligent animals in the world, and the only non-mammal species able to recognize itself in a mirror test.

Baked beans are actually not baked, but stewed.

Rowan Atkinson also known as Mr. Bean is the voice of Zazu in The Lion King.

The term "footage" comes from films being measured in feet, when being edited in the early days of film making.

In 2005, Mark Zuckerberg unsuccessfully tried to sell Facebook for $75 million. Back then it was called TheFacebook.

There is an opposite of albino animals, which aren't white, but black. These are known as Melanistic animals.

Some areas in Scotland and Japan switched to blue street lights at night, and saw a decrease in crime and suicide rates.

There are cells in human body called Faggot cells which cause leukaemia.

Elephants make friends, bury their dead, travel for "funerals", speak to each other, and show extreme intelligence.

Cat breeds (called Puppy Cats) are bred specifically to exhibit dog-like behaviour.

Bluetooth technology was named after a 10th century king, King Harold Bluetooth. He united Denmark and Norway, just like the wireless technology united computers and cell phones.

Banks have therapists known as "wealth psychologists" who help ultra-rich clients, who are unable to mentally cope with their immense wealth.

In 1999 hackers revealed a security flaw in Hotmail that permitted anybody to log into any Hotmail account using the password 'eh'. At the time it was called the most widespread security incident in the history of the web.

The state of Ohio gives out different coloured license plates for those convicted of DUI.

In Japan, you are equally likely to die from being struck by lightning as you are from being shot by a gun.

If you made $1 every second, it would take you 2,511 years to have more money than Bill Gates (over $79.2 billion dollars).

Guy Fawkes is the reason guys are called "guys".

Samuel Jackson has a clause in his film contracts that allows him to play golf during film shoots whenever he wants.

Restaurants can sing "Happy Birthday" now because the copyrights claims are now invalid. Judge George H. King ruled that a copyright filed in 1935, granted only the rights to specific piano arrangements of the music, not the song itself.

Although Australia is home to the largest number of venomous snakes in the world, it averages only one fatal snake bite per year.

Bela Lugosi was buried in full Dracula costume—cape and all.

A teacher wrote of a young Roald Dahl on his school report card: "I have never met anybody who so persistently writes words meaning the exact opposite of what is intended."

Blood donors in Sweden receive a thank you text when their blood is used.

Kea parrots warble together when they're in a good mood, making them the first known non-mammal species to communicate with infectious laughter.

Long before rap battles, there was "flyting": the exchange of witty, insulting verses. The verbal throwdowns were popular in England and Scotland from the 5th to 16th centuries.

Melbourne gave some of its trees email addresses so residents could report problems. Instead, the trees received love letters.
An estimated 1 million dogs in the U.S. have been named primary beneficiary in their owners' wills.
The Russians showed up 12 days late to the 1908 Olympics in London because they were using the Julian calendar instead of the Gregorian calendar.
In Japan, letting a sumo wrestler make your baby cry is considered good luck.
Count von Count's love of numbers isn't just a quirky character trait—in traditional vampire folklore, the bloodsuckers have arithmomania, a compulsion to count.
Portland was named by a coin flip. Had the coin landed the other way, the city would be Boston, Oregon.
Sleep literally cleans your brain. During slumber, more cerebrospinal fluid flushes through the brain to wash away harmful proteins and toxins that build up during the day.
Neil Armstrong's astronaut application arrived a week past the deadline. A friend slipped the tardy form in with the others.
Due to the restaurant's reputation for staying open in extreme weather, the so-called “Waffle House Index” is informally used by FEMA to gauge storm severity.
The manchineel tree is nicknamed the "Tree of Death" for good reason: Touching it can leave chemical burns on your skin, its fruit is toxic, and its bark—when burned—can cause blindness.
If drivers adhere to the 45 mph speed limit on a stretch of Route 66 in New Mexico, the road's rumble strips will play a rendition of "America the Beautiful."
Russian cosmonauts used to pack a shotgun in case they landed in Siberia and had to fend off bears.
Space has a distinct smell: a bouquet of diesel fumes, gunpowder, and barbecue. The aroma is mostly produced by dying stars.
The annual number of worldwide shark bites is 10 times less than the number of people bitten by other people in New York.
In 1997 a Louisville woman left actor Charles Bronson all of her money in a handwritten will—a total of about $300,000. She'd never met him; she was just a fan.
Ben & Jerry learned how to make ice cream by taking a $5 correspondence course offered by Penn State. (They decided to split one course.)
After an online vote in 2011, Toyota announced that the official plural of Prius was Prii.
Big Ben (Elizabeth Tower) in London is leaning over so much it can now be seen with the naked eye. In 4000 years it will be at the same angle as the tower in Pisa is now.
It was Nicholas Cage who first advised Johnny Depp to pursue a career in acting, during the mid 1980's.
The directors of the film Despicable Me actually wrote their own language for the Minions called Minionise.
The mayor of the Alaskan town, Talkeetna, is called Stubbs and has been mayor of the town since July 1997. Stubbs is a cat.
Due to the humid and moist conditions that a sloth lives in, moss and other similar plants will sometimes grow in its hair. Sloth's also have very bad eyesight. These two factors can sometimes culminate in a sloth grabbing its own arm, whilst thinking it is a branch, and falling to its death!
Viagra, when dissolved in water, can make cut-flowers stay erect for up to a week longer than they usually would.
Catnip is ten-times more effective at repelling mosquitoes than DEET, the main substance used in insect repellents.
There is a 51% chance that a flipped coin will land on the side that was facing up when it was flipped.
The human brain remember more negative memories than positive ones. This is due to the negativity bias the brain sets up as a defence mechanism.
Swans form monogamous pair bonds that last for many years. If one swan dies, its partner may mourn or at least remain celibate for several seasons.
Cookie Monster's real name is Sid.
When Canada's Northwest Territories considered renaming itself in the 1990s, one name that gained support was "Bob."
Tootsie Rolls were added to soldiers' rations in World War II for their durability in all weather conditions.
After OutKast sang "Shake it like a Polaroid picture," Polaroid released a statement: "Shaking or waving can actually damage the image."
Marie Curie remains the only person to earn Nobel prizes in two different sciences.
The Starry Night depicts Vincent van Gogh's view from the Saint-Paul de Mausole asylum.
Army ants that misinterpret the scent trails left by other ants will sometimes break from the crowd and march in circles. If enough ants join, they can form massive "death spirals."
A solar eclipse helped end a six-year war in 585 BCE. When the sky suddenly darkened during a battle between the Lydians and the Medes in modern Turkey, soldiers took it as a sign to cease fighting.
Dogs are capable of understanding up to 250 words and gestures. The average dog is as intelligent as a two-year-old child.
Scientists have found evidence of take-out restaurants in the remains of Pompeii.
Peter Durand patented the tin can in 1810. Ezra Warner patented a can opener in 1858. In between, people used chisels and hammers.
Goats have rectangular pupils.
The heart of a blue whale is so big, a human can swim through the arteries.
Vending machines are twice as likely to kill you than a shark is.

ENTERTAINMENT	Brain Teasers	Facts	General Facts	Not once in the Humpty Dumpty nursery rhyme does it mention that he's an egg.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	France was still executing people with a guillotine when the first Star Wars film came out.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Nintendo was founded as a trading card company back in 1889.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	A billion seconds is about 32 years.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	For every human on Earth there are approximately 1.6 million ants. The total weight of all those ants is approximately the same as the total weight of all the humans on Earth.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Mario hits blocks with his hand, not his head.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	One in every 5,000 babies is born with a condition known as "imperforate anus." This means the baby is born without an anus and has to have one created manually in the hospital.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	You can't hum while holding your nose.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	The dot over an "i" is called a "tittle."
ENTERTAINMENT	Brain Teasers	Facts	General Facts	After It's the Great Pumpkin, Charlie Brown aired, Charles Schulz was overwhelmed with candy shipments sent from kids who were concerned for Charlie, who got rocks instead of treats in his Halloween sack.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	One of the world's largest stockpiles of nuclear weapons—a U.S. Navy base near Seattle—is partially defended by trained dolphins.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	It's illegal for supermarkets in France to waste food. Supermarkets must either compost it or donate unsold or nearly expired goods to charity.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	A new baby can cost new parents 750 hours of sleep in the first year.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	When Gene Wilder accepted the role of Willy Wonka, he had one condition: In his first appearance, Wilder wanted Wonka to limp toward the crowd with a cane in hand before falling into a perfect somersault and jumping back up. The reason? “Because from that time on, no one will know if I’m lying or telling the truth.”
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Dr. Seuss said he expected to spend "a week or so" writing The Cat in the Hat. It actually took a year and a half.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Apollo 17 astronaut Harrison Schmitt was allergic to moon dust.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	"Bloodcurdling" isn't just an expression: Research shows that watching horror movies can increase a certain clotting protein in our bloodstreams.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	An episode of Peppa Pig was pulled from Australian television for teaching children not to fear spiders.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	A group of pugs is called a grumble.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	In 1998, the U.S. Army tried developing a telepathic ray gun "where words could be transmitted to be heard like the spoken word, except that it could only be heard within a person’s head."
ENTERTAINMENT	Brain Teasers	Facts	General Facts	A giraffe can clean its ears with its 21-inch tongue.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Chewing gum while peeling onions will keep you from crying.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	The founder of Match.com Gary Kremen, lost his girlfriend to a guy she met on Match.com.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Iran arrested 14 squirrels on suspicion of espionage.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Peanuts are one of the ingredients in dynamite.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	One in every 4 Americans has appeared on television.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Over 1,000 birds a year die from smashing into windows.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Lightning strikes about 6,000 times per minute on this planet.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Owls are the only birds who can see the colour blue.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	It's against the law to slam your car door in Switzerland.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	A company in Taiwan makes dinnerware out of wheat, so you can eat your plate.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	After leaving office, Ronald Reagan was offered the role of Hill Valley's mayor in Back to the Future III.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	In 1967, the Nigerian Civil War ground to a halt for two days because both sides wanted to watch Pelé play in an exhibition soccer match.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Before the Nazis invaded Paris, H.A. and Margret Rey fled on bicycles. They were carrying the manuscript for Curious George.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	In colonial America, lobster wasn't exactly a delicacy. It was so cheap and plentiful it was often served to prisoners.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Truman Show Delusion is a mental condition marked by a patient's belief that he or she is the star of an imaginary reality show.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Cookie Monster is not changing his name. In a 2012 episode he said, "We've got to stop this Veggie Monster rumour before me reputation ruined."
ENTERTAINMENT	Brain Teasers	Facts	General Facts	The medical term for ice cream headaches is sphenopalatine ganglioneuralgia.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Although Dr. James Naismith invented basketball, he’s the only Kansas Jayhawks basketball coach with a losing record.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	In 1999, the U.S. government paid the Zapruder family $16 million for the film of JFK's assassination.
ENTERTAINMENT	Brain Teasers	Facts	General Facts	Before he became president, Abraham Lincoln was wrestling champion of his county. He fought in nearly 300 matches and lost only one.

ENTERTAINMENT

Teasers

Brain

Facts

General Facts

In Switzerland, it's illegal to own only one guinea pig.

The most common name in the world is Mohammed.

Q is the only letter in the alphabet that does not appear in the name of any of the United States.

Fortune cookies were actually invented in America, in 1918, by Charles Jung.

Bats always turn left when exiting a cave.

In England, in the 1880's, "Pants" was considered a dirty word.

It is believed that Shakespeare was 46 around the time that the King James Version of the Bible was written. In Psalms 46, the 46th word from the first word is "shake" and the 46th word from the last word is "spear".

The drive-through line on opening day at the McDonald's restaurant in Kuwait City, Kuwait was at times seven miles long.

The Pentagon in Washington, D. C. has five sides, five stories, and five acres in the middle.

There is an ATM at McMurdo Station in Antarctica, which has a winter population of 200.

One out of three employees who received a promotion use a coffee mug with the company logo on it.

If you know a (male) millionaire who happens to be married, The most likely profession of his wife is a teacher.

Foreign Accent Syndrome is a rare side effect of brain trauma. Patients speak their native language in a foreign accent.

Queen Elizabeth II has had over 30 corgis in her lifetime.

In 2016, a rogue bloodhound named Ludvine joined a half-marathon in Alabama. She ran the entire 13.1 miles and finished in 7th place.

The Library of Congress regularly receives requests for books that don't exist. The most common is the President's Book of Secrets, from the 2007 movie, National Treasure: Book of Secrets.

In 2014, Tinder made its first match on the continent of Antarctica. Not surprisingly, both parties involved were research scientists.

When times get tough, elephants will comfort each other by stroking loved ones with their trunks and emitting small chirps.

A double rainbow occurs when sunlight is reflected twice inside a raindrop. If you look closely, you can see that the colours of the secondary rainbow appear in reverse order.

There's a Nikola Tesla statue in Palo Alto that provides free Wi-Fi.

The Mobile Phone Throwing World Championships are held in Finland. One winner (not pictured) said he prepared for the event by "mainly drinking."

Frank Sinatra has three stars on the Hollywood Walk of Fame: one for film, one for music, and one for television.

One April day in 1930, the BBC reported, "There is no news." Instead they played piano music.

Continental plates drift as fast as fingernails grow.

Elvis Presley's manager sold "I Hate Elvis" badges as a way to make money off of people who weren't buying his merchandise.

LEGO has a temperature-controlled underground vault in Denmark with nearly every set they've ever made.

A reindeer's eyes change colour through the seasons. They're gold during the summer and blue in the winter.

An avocado never ripens on the tree, so farmers can use trees as storage and keep avocados fresh for up to seven months.

In The Empire Strikes Back, an extra can be seen running with what appears to be an ice cream maker. The character became legendary among fans, and was eventually given a name (Willrow Hood) and a backstory.

Salvador Dali avoided paying restaurant tabs by using checks. He would draw on the back as the waiter watched, knowing no one would ever cash the art.

China owns all of the pandas in the world. They rent them out for about $1 million a year.

10% of all photos in the world have been taken in the past 12 months.

If you earn more than $18,000 USD a year, you're among the 4% of the richest people on Earth. (2012)

61,000 people are airborne over the US at any given time.

WW1 Facts

WW1 Facts

Officially a British soldier had to be 19 years old to serve overseas but many lied about their age. About 250,000 under-age boys served. The youngest was discovered to be just 12.

Average life expectancy in the trenches was about six weeks. Junior officers and stretcher bearers were some of the people most at risk.

During four years 25 million tons of supplies were shipped to the British forces on the Western Front including three million tons of food and five million tons of oats and hay for the horses.

As the war went on the amount of food given to soldiers was reduced. A common meal in the trenches was maconochie - a stew of turnips, potatoes and carrots. Other rations included bully beef and even Marmite. There was a small rum ration but tea tasted horrible thanks to the chloride of lime used to purify the water.

The war claimed the lives of at least 6,000 men a day. More than nine million soldiers died during the fighting.

ENTERTAINMENT

Brain

Teasers

Facts

WW1 Facts

An incredible 65 million men from 30 countries fought.
Some 25,000 miles of zig-zagging trenches were dug on the Western Front alone. Many had nicknames like Bond Street or Death Valley. German lines were given names like Pilsen Trench.
German trenches were far superior to Allied ones. Built to last some had shuttered windows and even doorbells. At Hooge, near Ypres, opposing trenches were 50 yards apart.
A soldier spent 15 per cent of the year on the frontline, usually for no more than two weeks at a time.
At the Battle of Mons in 1914, the British infantry fired their Lee-Enfield rifles so efficiently that the Germans thought they were facing machine guns.
At Christmas 1914 an unofficial truce was observed along two--thirds of the Western Front. Near Ypres, Belgium, some German and British troops played a football match in No Man's Land. Germany won 3--2 (but not on penalties).
Sixty per cent of casualties on the Western Front came from shellfire. There were also 80,000 recorded cases of shell shock.
In 1917 anti--German sentiment forced George V to change the Royal Family's name from Saxe--Coburg and Gotha to Windsor. Many road names in Britain were changed too.
Famous people who served include the writers AA Milne, creator of Winnie The Pooh, Lord Of The Rings author JRR Tolkien, sculptor Henry Moore and the actor Basil Rathbone.
None of the soldiers had metal helmets in 1914. The French were the first to introduce them, in 1915. Future prime minister Winston Churchill wore a French one during his time on the front in 1916.
Air raids on Britain, carried out by Zeppelins and aircraft, along with the naval shelling of Scarborough, Hartlepool and Whitby, killed more than 700 people.
Disease accounted for a third of deaths during the war. Duck boards eventually helped ease cases of trench foot, an infection caused by damp and cold. But with semi--sanctioned brothels being set up behind the frontline a massive 150,000 British soldiers came down with venereal infections.
A total of 346 British soldiers were shot by their own side, mostly for desertion. Another sanction, called Field Punishment No 1, saw offenders strapped to a gun wheel or post, sometimes within range of enemy fire.
As well as taking up thousands of male jobs at home some 9,000 women served in France as part of the Women's Army Auxiliary Corps working in such roles as cooks and drivers.
There were 16,000 British conscientious objectors who refused to fight. Many received white feathers as a sign of cowardice. Some were given non--combatant roles, others were imprisoned.
During World War I, a Canadian soldier made a black bear his pet and named her Winnipeg. “Winnie” was later a resident of the London Zoological Gardens where she was an adored attraction, especially to a boy named Christopher Robin, son of author A.A. Milne. The boy even named his teddy bear after her.
By the end of 1915, 2,446,719 Brits had volunteered. But conscription was still needed. It was introduced for 18-41 year olds during 1916.
The Victoria Cross was awarded 628 times. The youngest recipient was Jack Cornwell, 16, who remained at his post during the Battle of Jutland despite suffering ultimately fatal injuries.
One of the biggest blasts of the war occurred when the British detonated a million pounds of explosives under the Germans at Messines Ridge, in Belgian West Flanders. The resulting explosion could be heard 150 miles away in London.
In 1917 food shortages at home caused by the loss of British shipping to German U--boats meant the government banned the use of rice at weddings and the feeding of pigeons.
At the height of the war the British Army had 870,000 horses. Dead ones were melted down for fat which was later used for making explosives.
Periscope rifles were developed to see over the 12ft trenches. Other new weapons included flame throwers and tanks - the first tank, in 1915, was called Little Willie. Tanks were split into males (armed with cannons) and females (with machine guns).
Trench language contributed many words to the English language: lousy and crummy for the lice that infested soldiers as well as dud, bumf and blotto. Trench butterflies were bits of toilet paper blowing around the battlefield.
The Eiffel Tower intercepted German radio messages that led to the execution of Dutch dancer and German spy Mata Hari. British nurse Edith Cavell was shot for helping soldiers escape behind German lines.
Initially the only protection against gas attacks was a cloth soaked in a soldier's own urine. British officer Edward Harrison invented the first practical gas mask, saving thousands of lives.
The Defence Of The Realm Act 1914 included stopping Britons from talking on the phone in a foreign language, buying binoculars or hailing a cab at night. Alcoholic drinks were watered down and pubs had to close at 10pm.
The war in the air saw Germany's Baron von Richthofen, dubbed the Red Baron, shoot down 80 Allied aircraft. The top British ace, Major Edward Mannock, shot down 61 enemy planes. Both later died in action.
When soldiers returned there was a baby boom. Births increased by 45 per cent between 1918 and 1920. But the 1918 influenza pandemic killed more people worldwide than the war.

Weird

4 Weird Facts

ENTERTAINMENT Teasers Weird Facts

- Monroe Isadore, a 107-year-old man from Arkansas, died during a shootout.
- Owning 55,000 of them, Ted Turner has the world's largest private collection of bison.
- A study published in the journal Anthrozoo reported that cows produce 5% more milk when they are given names.
- In 2002, Bruce Willis sent 12,000 boxes of girl scout cookies to U.S. soldiers in Afghanistan.
- The electric chair was invented by a professional dentist named Alfred Southwick.
- A man in L.A. was arrest at a police-sponsored gun buyback when, instead of a gun, he tried to sell the cops a pipe bomb.
- CELEBRITY TWEET! 9:43 PM - 1 Oct 13 @MikeTyson tweeted, "I'm a bad bowler."
- ~~8-0 is the obscure emoticon that stands for bad hair day.
- Only about 14 games were ever made for the Gizmondo game system including the game sticky Balls."
- On November 12, 1970, George Thornton, a highwat engineer in Oregon, had the unusual job of blowing up a dead whale.
- People in Damariscotta, Maine hold an annual race where they use pumpkins as boats.

Brain Weird Facts

- Leo Granit Kraft is a world champion in an unusual sport that combines boxing and chess.
- Andrew Wilson, a man from Branson, Missouri, legally changed his name to simply "they".
- As a young student in Buenos Aires, Pope Francis worked as a bouncer.
- Dasypygal is an adjective meaning "having hairy buttocks."
- A woman in Muncie, Indiana was hospitalized after trying to remove a callus on her foot with a shotgun.
- Sponsored by the Calvary Lutheran Church, people in Fort Worth Texas can now attend the unconventional Church-in-a-pub.
- Famed American poet Charles Bukowski's tombstone is engraved with the words "Don't try."
- Jacobite Cruises purchased unusual insurance to protect it from damage caused by the loch ness monster.
- El Colacho is a Spanish festival where people dress up like the devil and jump over babies.
- Utah's Lehi City Council approved a request to change the name of morning glory road because it sounded sort of dirty.
- Cheap Chic Weddings is an annual contest in which participants make wedding dresses out of toilet paper.

Weird Facts

- Marcella Hazan is the culinary guru who pioneered the unusual technique of cooking duck with a hair dryer.
- The sound of E.T. walking was made by someone squishing jello.
- The first item listed on eBay was a broken laser pointer.
- Oddly enough, Albert Einstein's eyeballs can be found in a safe deposit box in New York City.
- In 2013, a wealthy Michagan man bought the house next to his ex -wife and erected a giant bronze statue of a middle finger.
- For $180, the Shizuka New York skin care salon offers the unusual but traditional Japanese facial that is part rice bran and part bird poop.
- The shape of wombat poop is a cube.
- The first reporting on the Wright .rothers' flights appeared not in a newspaper or on radio, but in a small journal dedicated to the topic of beekeeping.
- The band Queen's original name was "Smile".
- There's a novelty museum in Arlington, Massachusetts that only collects food that has been burnt.
- A group of porcupines is called a prickle.

ENTERTAINMENT Teasers Weird Facts

- The name of the dog that won the 2012 World's Ugliest Dog Competition was "Mugly".
- Dr. Seuss is credited with coining the derogatory term "nerd" in his 1950 book If I Ran the Zoo.
- Prop comic Gallagher, known for smashing watermelons with a sledgehammer, earned a college degree in the field of chemical engineering.
- Google was originally going to be called backrub.
- In 1976 boxing legend Muhammad Ali released an education children's album titled "Ali and His Gang Vs. Mr. Tooth Decay".
- The name of the dildo resembling Queen Elizabeth II that's sold by the Company Masturpieces is called Buckingham Phallus.
- On January 13, 2014, U.S. Secretary of State John Kerry presented to Russian Foreign Minister Sergei Lavrow the odd gift of two very large potatoes.
- The name of the Star Trek starship in creator Gene Roddenberry's original script was called Yorktown.
- In the 16th century, gin was referred to as the Mother's ruin.
- Larry is the name of the man on the Quaker Oats label.
- During a famous fire in 1567, a Norwegian man named Hans Steininger died after tripping over bread.

Weird Facts

- The fishing company E21 makes a very peculiar fishing rod that is composed of 70% carrots.
- During the mid to late-nineties, the English town of Glastonbury was on a manhunt for the old house intruder known as "The Tickler".
- Suffering from an extremely rare side effect after getting hip surgery in 2010, a Dutch man has alienated his family because he cannot stop laughing.
- According to the National Oceanic and Atmospheric Association, small icebergs are officially called "growlers." Medium icebergs go by the strange, two-word name "Bergy Bits."
- It's weird work but Jackie Samuel charges $60 an hour to snuggle.
- Huggies Brazil developed a phone app that tells you when a baby's diaper is wet. It's called tweetpee.
- Michael J. Fox's middle name is actually Andrew.
- Ben and Jerry only started making ice cream because it was too expensive to make bagels.
- A spectator in an Illinois courtroom was sentenced to six months in jail for yawning during a trial.
- "Ham" was the name of the first chimp sent into space.
- The sports teams at Freeport High School in Illinois are oddly named after an inanimate object. The teams are called the Freeport Pretzels.

Brain Weird Facts

- The inventor of the laxative Ex-Lax has the unusual name Max Kiss.
- Britt, Iowa annually crowns a King and Queen hobo.
- Tashirojima is an island off of Japan that is complete overrun by cats.
- For his voiceover work in Texas Chainsaw Massacre, John Larroqueet was paid not with money, but with marijuana.
- The fans of musician Josh Groban are called Grobanites.
- Jim Begelow, Ph.D., wrote a book called The Joy of Uncircumcising!
- While president of the United States, John Adams had a dog named Juno and a dog named Satan.
- The British call the "Hokey Pokey" the "Hokey Cokey".
- A Kickstarter campaign met its $30,000 goal on April 7, 2012 for its shoes designed for atheists.
- In 2007, Golden Laurel Entertainment published a violent board game called Kill the Hippies.
- In 2012, a 26-year-old man from London went on a mission to lick every cathedral in the United Kingdom.

ENTERTAINMENT Weird Facts

- Maryland's official state sport is jousting.
- In 2003, Morocco made the highly unusual offer to send 2,000 monkeys to assist the United States' war efforts in Iraq.
- Romano Mussolini, son of the fascist dictator Benito Mussolini, did not follow in his father's footsteps. Instead, he made his living as a jazz musician.
- Patented in 1890, U.S. Patent US435748 is for a moustache guard.
- Miley Cyrus's real first name is Destiny.
- In 2007, to make a point, Nebraskain State Sen. Ernie Chambers filed a frivolous lawsuit against God.
- When in Nepal, visit the village of Parsawa and Laxmipur, where you can enjoy the slightly off-putting 10 day cursing festival.
- A group known as the "Robin Hooders" in Keene, New Hampshire pay for other people's parking meters.
- At 65% alcohol by volume, Brewmesiter brews the world's strongest beer, which goes by armageddom.
- In an effort to push "slow TV," Norway had a 12-hour block of programming in 2013 dedicated to knitting.
- Belmont University in Nashville has offered a class called "Oh, Look, a Chicken".

ENTERTAINMENT Brain Teasers Weird Facts

- The area in the Pacific Ocean where great white sharks congregate every spring is called the White Shark Café.
- Reg Mellor is the reigning champion of a sport that just involves keeping a ferret in your pants.
- Harry Houdini once threatened to shoot all psychics.
- During the summer of 2007, Pepsi sold a green-tinted coal in Japan called Pepsi Ice Cucumber.
- Under Peter the Great, noblemen had to pay 100 rubles a year for a beard license.
- In 2000, Australia had its largest ever online petition, which called for an end to rising beer prices.
- Although very unconventional, farmer William von Schneidau feeds his pigs marijuana.
- When Paul Nelson and Andrew Hunter climbed Britain's highest mountain in 2006, they made an unusual discovery hidden behind a pile of stones. It was a piano.
- At 2:45 a.m. one day in June 2013, a man in Orlando, Florida was arrested for walking up to a police officer and punching his horse.
- Before he became pope, Pope Pius II wrote an erotic novel titled The Tale of the Two Lovers.
- A 2013 Pakistani game show caused a controversy when their grand prize was a baby.
- In 2013, two teens from Sequoyah High School near Atlanta, Georgia won $50,000 scholarships for wearing duct tape to prom.
- Since 2000, a couple in Queens, New York has been living rent-free in a cemetery in exchange for taking care of it.
- For a story he was reporting on in 1955, Dan Rather tried heroin for the first time.
- Chosen, Shunned and Reckoning are all books in an unusual series about Amish vampires.
- In 2013, a 51-year-old Swedish inmate broke out of prison a day before his scheduled release so he could go see a dentist.
- There is a riot police unit in the Russian town of Rostov-na-Donu that is comprised entirely of twins.
- In 1980, Saddam Hussein was named an honorary citizen of Detroit.
- A neurology professor at Albany Medical College documented in a 1991 medical journal that one of his patients had seizures when she heard Mary Hart's voice.
- In 2008, a couple was killed in South Africa while having sex on a railroad track.
- CELEBRITY TWEET! 2:49 PM - 15 Nov 13 Richard Simmons' Twitter handle @TheWeightSaint tweeted: "At the airport hugging everyone."
- In 2010, Customs officers on the Norway-Sweden border intercepted a truck trying to smuggle 28 tons of garlic from China.
- In 2012, a teenager from Weslaco, Texas claimed the reason he stabbed his friend was because a ouija board made him do it.
- In school, Sylvester Stallone was voted by his teachers as most likely to go to the electric chair.
- While in Alliance, Nebraska, you can visit the Stonehenge replica made out of cars.
- As a way to protest Belarus' police state, a Swedish group dropped hundreds of teddy bears from an airplane.
- Tara Reid once said, "I make Jessica Simpson look like a rock scientist."
- Advanced Comfort Technology makes waterbeds for cows.
- To make it extremely difficult for telemarketers to pronounce, Tim Price changed his name in 2012 to Tim Pppppppppprice.
- The first text message was by Neil Papworth in 1992. He texted, "Merry Christmas."
- The movie G.I. Janes was translated to Satan Female Soldier in China.
- According to the nonfiction book The Man-Eating Tigers of Sundarbans, tiger urine "smells sort of like buttered popcorn."
- At the Meitestu-Nagoya train station in Japan, there's an odd vending machine that sells porn.

- Located within the municipal boundaries of Kirkland Lake, Ontario, there lies the controversially name village of swastika.
- Located near the town of Stanley, there's a small village in England called No Place.
- The Lehigh Valley IronPigs, a minor league baseball team, held a contest where the prize was a voucher for a funeral.
- Every year residents in Ivrea, Italy re-enact a historical battle of their region, and instead of replica weapons, they use oranges.

5 Mythbusters Results

ENTERTAINMENT Brain Teasers Mythbusters Results Hidden Dangers

The MythBusters tested over 1,000 distinct myths in 271 hour-long episodes spanning 14 years, resulting in a vast amount of information about common myths and interesting phenomena. The following overview attempts to summarize and categorize the results of the entire MythBusters series as succinctly as possible.

Hidden Dangers

- A rock kicked up by a lawnmower can deliver the same force as a bullet.
- A pane of plate glass dropped from sufficient height can cut a person in half, but tempered glass will just crush the person.
- Spray sunscreens can be flammable due to the propellants.
- A railroad tanker car can implode after being steam cleaned and then sealed and cooled, but only if it has prior damage.
- A faulty water heater can explode and shoot through the roof of a house, even a two-story house. (The phenomenon can also be used to partially extinguish a house fire or to power a cannon.)
- A dog bowl can focus enough sunlight to start a fire.
- A high-rise office worker can accidentally run through a plate-glass window and fall to their death.
- If a car is driven into water, there is very little time to open the doors before the water pressure becomes too great. The pressure will also prevent the windows from being rolled down, and keys, cell phones, and steel-toed boots will be ineffective at breaking the windows. Once the car interior is flooded, the doors can be opened again.
- Under the right circumstances, a taser may ignite someone who has just been pepper sprayed.
- If a hunting revolver is held improperly when fired, escaping gases can blow the hunter's fingers off.
- A person's tongue can instantly stick to a freezing pole.
- The vortex from a passing train will not suck a person into the tracks.
- A large number of cigarette lighters in a hot car could lead to a lethal explosion.
- A cigarette lighter is not likely to explode in a pocket, in a laundry dryer, or on a car dashboard, but it is likely explode when hit with a golf club or when placed near welding tools.
- If a steel cable snaps, it will not cut a person in two.
- A lava lamp or a can of beans heated on a stove can explode with lethal force. A glass jug of milk and a can of potted meat will also explode, but less forcefully.
- A passing snowplow does not move enough air to flip a car.
- If denim pants are soaked in certain farm chemicals, they can spontaneously combust.
- A heavy insect hitting a motorcycle rider in the right spot could kill the rider.
- Steel toe boots will not amputate someone's toes when a heavy object is dropped on them.
- A boom lift cannot throw its operator great distances.
- An MRI scanner will not cause tattoos to explode, nor will a radio transmitter.
- A falling icicle can kill a person.
- Microwaving a jawbreaker can result in an explosion of molten sugar when the jawbreaker is bitten.
- Sandblasting a PVC pipe will not build up a lethal static charge.
- Using a cell phone while pumping gas will not cause an explosion.
- A penny dropped from a skyscraper will not gain enough speed to kill a pedestrian.
- Vacuuming up black powder will not cause an explosion.
- If two hammers strike each other they will not shatter with lethal force, nor will a hammer that strikes an anvil.

Counterintuitive Phenomena

ENTERTAINMENT Teasers Mythbusters Results Counterintuitive Phenomena Mythbust

- A household vacuum cleaner can lift a car via suction.
- A hovercraft can be used to cross a minefield safely.
- The tip of a whip breaks the sound barrier when it cracks.
- A piano dropped on a house will not easily fall through the roof.
- A ping pong ball can be shot a supersonic speed, but it still won't be a lethal weapon.
- Chrome ball-chain can appear to levitate as it falls from a container.
- Water falling in front of a speaker can appear to freeze in place on camera.
- A vehicle with square wheels can provide a smooth ride if driven fast, but square wheels do not give an advantage in hill climbing.
- A sailboat stranded in calm water can move forward using an on-board fan to blow air into its own sail.
- A foam cup filled with soda and ice that is thrown from a car could pierce another car's windshield, but it won't necessarily cause lethal injury.
- A person can briefly wet their hand and dip it into molten lead without injury.

- Two phone books with interlocked pages require on the order of 8,000 pounds of force to be separated.
- An airplane can take off from a runway that is moving backwards like a treadmill.
- It is possible to make a balloon out of lead.
- You can experience a smoother ride on a rough road by driving faster.
- It is not easy to light a pool of gasoline using a cigarette.
- The area near a fireplace is colder than the rest of the room while a fire is burning.

Idioms

Brain Mythbusters Results Idioms

- It is easy to punch out of a paper bag.
- 10 pounds of poop will not fit in a 5-pound bag.
- People can easily recognize the backs of their own hands.
- Taking candy from a baby is not as easy as it sounds.
- People may literally get cold feet when they are scared/timid.
- If poop hits a fan it can indeed create a large mess.
- You can teach an old dog new tricks.
- With an enormous amount of force, it is possible to literally knock someone's socks off.
- In a race, it is not literally better to hit the ground running.
- You can polish poop.
- Shooting fish in a barrel is fairly easy; the shock wave from a bullet can be enough to kill the fish.

- A bull in a china shop will actively avoid hitting the shelves.
- A rolling stone truly gathers no moss.
- Finding a needle in a haystack is difficult, even with modern technology.

Movie Myths

ENTERTAINMENT Mythbusters Results Movie Movie Myths

- The scene in Cliffhanger in which the hero leaps to safety from a collapsing rope bridge is not feasible.
- In Titanic, Jack may have been able to survive by joining Rose on the floating debris.
- Jason Bourne blowing up a house with a gas leak and a magazine in Bourne Supremacy is not feasible.
- Shooting at a scuba tank in a shark's mouth will not blow up the shark, as seen in Jaws.
- Water can quickly slow a bullet to non-lethal speeds, as seen in Mission Impossible: Ghost Protocol.
- Realistic face masks like those in the Mission Impossible series may be effective at fooling people.
- In Pirates of the Caribbean: Dead Man's Chest, the group of people in a suspended cage could not have swung to side of the ravine, but they may have been able to grab the vines and climb to the top.
- The pirates in Pirates of the Caribbean: The Curse of the Black Pearl could not have improvised a submarine by holding a rowboat upside down as they walked underwater.
- It's not feasible for a group of cars to stir up enough dust to blind a surveillance drone, as seen in Body of Lies.

Teasers Mythbusters Results Movie Myths

- It is not possible to hold a bullet over a fire and discharge it toward an enemy, as seen in Shoot 'Em Up.
- A merry-go-round cannot be started spinning by shooting at it with a handgun, as seen in Shoot 'Em Up.
- A spear with a shotgun shell on its tip is not a feasible weapon, as seen in The Grey.
- A car halfway into an elevator won't be cut in half when the elevator moves, as seen in The Green Hornet.
- With some modifications, the front half of a car cut in two can be driven, as seen in The Green Hornet.
- Explosives cannot be used to throw a bulldozer off a car without hurting passengers in the car, as seen in The Green Hornet.
- A superhuman punch to the hood of a moving SUV will not cause it to somersault, as seen in Hellboy.
- In a car crash, a surfboard on the roof of one car will not fly through the windshield of another car, as seen in Lethal Weapon 2.
- A carton of milk will not contain the muzzle flash of a pistol, as seen in Kiss the Girls.
- A bus could not jump a 50-foot gap and keep driving, as seen in Speed.
- The passengers in a city bus do not need to move to one side during a fast, sharp turn to prevent the bus from flipping over, as seen in Speed.

- A laser can pop popcorn, but popcorn could not break open a house as seen in Real Genius.
- Bullets cannot be curved around an obstacle by swinging a gun, as seen in Wanted.
- A C-4 explosion will not knock a golf ball into the hole as seen in Caddyshack.
- Liquid nitrogen can be used to cool a pressure-triggered bomb and delay its detonation, as seen in Lethal Weapon 2.
- Sea water will not conduct electricity from a car battery as seen in Deep Blue Sea, nor can a person survive an underwater explosion at close distances.
- Having a conversation while skydiving is not feasible and the fall wouldn't last as long as depicted in Point Break.
- A car that jumps off a ramp will not land with little damage, as see in The Dukes of Hazard.
- Shooting a lock with handguns will not break it, as seen in Big Trouble in Little China, but shooting it with shotgun slugs or a high-power rifle could.
- It is feasible to equip a car with a discreet seat ejector, as seen in Austin Powers in Goldmember.
- A person cannot escape through a floor by shooting a ring around themself, as seen in Underworld.
- A sword cannot cut off the blade of another sword, as seen in The Count of Monte Cristo.

ENTERTAINMENT Brain Mythbusters Results Movie Myths

- Using a system of mirrors to light an underground passage with sunlight, as seen in The Mummy, is extremely difficult.
- A human head dipped in liquid nitrogen for five seconds will not shatter when hit, as seen in Jason X.
- A sports car at high speed can skip across a lake, as seen in Cannonball, but launching off a ramp is counterproductive.
- A urine-soaked silk shirt will not bend prison bars when wrapped around and twisted, as seen in Shanghai Noon.
- A cable attaching the rear axle of a car to a light post will not yank the rear axle out, as seen in American Graffiti.
- A car cannot fire a grappling hook around a pole to make a sharp turn, as seen in Batman.
- Making a usable candle out of earwax, as seen in Shrek, is not possible.
- It is not possible for a person to punch out of a coffin as depicted in Kill Bill and it is only possible to dig out of a shallow grave with an open coffin.

Movie Clichés

ENTERTAINMENT
Teasers
Brain
Mythbusters Results
Movie Myths

- A car will not necessarily end up on fire after crashing down a cliff.
- The shock wave from an explosion will not throw a person long distances through the air.
- A car's fuel tank will not explode if shot with a normal bullet, but it may explode if shot with a tracer round.
- A person will not be thrown backwards when struck by a bullet.
- During a rooftop chase, jumping into a dumpster may allow survival.
- Falling or jumping through glass windows without injury is not realistic.
- Quicksand does not exist with the characteristics show in movies.
- Carrying a dead body is reasonably easy, but digging a shallow grave is not.
- An axe is a more effective weapon against zombies than a gun.
- It would be difficult to outrun a large zombie horde, but a barricaded door could stop them.
- If a car crashes through a sheet of glass held by workers, the workers will likely be injured.

- A large truck cannot plow through two lanes of traffic and continue undeterred, but it can if it has a steel wedge attached to its front.
- Most movie sound effects for punches and explosions are not realistic, but the sound effects for rattle snakes and silenced guns are realistic.
- It is not easy to drive a car and shoot a gun while the passenger steers.
- A driver and passenger in a car can switch seats while moving at speed, and the passenger can push out an incapacitated driver and continue driving.
- A car cannot realistically be driven through a fruit stand or a camper trailer, but it could be driven through a chain link gate or under a semi-trailer.
- A person can hold onto the roof or hood of a car while it crashes through cardboard boxes or goes through a car wash, but not while it makes a big turn or zig-zags. If the windows are down, it is easier to hold on to the roof. During a sudden stop, the hood can be held onto but not the bare roof.
- Movie gun fights are unrealistically long and running through gunfire does not protect a person from being hit.
- Neon signs will not explode in a shower of sparks if struck by a bullet.
- It is possible to quickly reload and fire a pistol, as seen in movies.
- A person can only hang on to a thin ledge briefly before falling, but it is possible for a single person to rescue someone hanging from a ledge.

- An SUV will not flip over if hit by an RPG.
- A car in free fall will not stay upright.
- A person can hang off the landing skid of a helicopter and climb into it.

Indiana Jones

- Throwing a wooden pole into the spokes of a motorcycle will not cause it to flip, as seen in Indiana Jones and the Last Crusade.
- Indiana Jones running through a corridor of dart launchers without getting injured in Raiders of the Lost Ark is plausible.
- It is plausible to disarm a pistol-wielding opponent using a whip, as seen in Raiders of the Lost Ark.
- It may be possible to snag a branch with a whip and swing across a chasm, as seen in Raiders of the Lost Ark.
- A person may be able to survive falling through layers of awnings, as seen in Indiana Jones and the Temple of Doom.
- Jumping from a plane and floating to earth safely in an inflatable life raft, as seen in Indiana Jones and the Temple of Doom, is not possible.

James Bond

- The ballpoint pen bomb seen in Golden Eye could be fatal, but not as powerful as depicted.
- Being completely covered in gold paint will not kill a person by skin asphyxiation, as seen in Goldfinger.
- A tuxedo worn under a dry suit can still be presentable after a scuba dive, as seen in Goldfinger.
- A metal-brimmed hat could not be thrown to knock the head off a statue, as seen in Goldfinger.
- A person with metal teeth could not bite through a steel cable, as seen in Moonraker.
- Bond's wristwatch with electromagnets could not deflect bullets, as seen in Live and Let Die.
- Shooting at a propane tank will not cause it to explode, as seen in Casino Royale.
- In Live and Let Die, the speedboat jumping off a ramp and continuing on is feasible.
- In Die Another Day, Bond's rocket-powered seat ejector would not be able to right his upside-down car.

Star Wars

- Dodging Stormtrooper blaster fire is not feasible.
- Luke Skywalker swinging across a chasm using his grappling hook is feasible, as seen in A New Hope.
- The Ewoks could crush an AT-ST between two logs if it flies into the trap, as seen in Return of the Jedi.
- In The Empire Strikes Back, Han Solo using a Tauntaun carcass (or any large mammal) to keep Luke warm is feasible.

Television

- A stick of dynamite dropped in a bucket of paint will not fully paint the room, as seen in Mr. Bean.
- A shotgun plugged by a finger will not backfire and injure the shooter, as seen in cartoons.
- A line of black powder leaking from a barrel may be able to function like a fuse, as seen in cartoons.
- A banana peel on the ground is not guaranteed to make someone fall when they step on it, as seen in cartoons.
- A car can drive into a moving semi-trailer via a ramp, as seen in Knight Rider.
- The scene in The Simpsons where Homer blocks a wrecking ball with his body has some feasibility.
- The crab pots used on Deadliest Catch are not indestructible.
- A manhole cover could potentially be launched by an explosion to disable a vehicle, as seen in The A-Team.
- The improvised cannon made of a log in The A-Team is not feasible.
- A mattress floating on water is not effective at cushioning a three-story fall, as seen in Burn Notice.
- In Breaking Bad, Walt's machine gun booby trap could work as depicted, but hydrofluoric acid will not fully decompose a body and eat through a bathtub, and Mercury fulminate will not explode if thrown on the floor.

MacGyver

- A burnt-out fuse can be repaired with tin foil, as shown in MacGyver.
- MacGyver could have stopped an acid leak with a chocolate bar.
- A bomb in a truck filled with cement will damage the truck and injure bystanders, not be fully contained as shown in MacGyver.
- The makeshift ultralight airplane in MacGyver is not feasible.
- Spraying a light bulb with liquid from a spray bottle can break it, as shown in MacGyver.
- It may be possible to blow open a lock with black powder from revolver cartridges, but it is not as easy as shown in MacGyver.

Implausible Events

ENTERTAINMENT
Teasers
Mythbusters Results
Implausible Events

- A limousine balanced on the edge of a cliff will not topple if a bird lands on it.
- A soldier who strapped jet-assisted take-off (JATO) rockets to his car could not have soared over a mile through the air.
- A person in a lawn chair can be lifted by weather balloons and a child can be lifted by a huge number of party balloons.
- Transforming a broken-down car into a working motorcycle with only basic hand tools is not feasible.
- A drum filled with methanol can't be fitted with wheels and ignited to propel itself at high speed.
- If a truck filled with bottled wine catches fire, the corks will blow out and sound like a machine gun.
- An arrow with dynamite attached will not split a tree down the middle when it explodes.
- Sliding down a supersized water slide and launching large distances into a kiddie pool is not feasible.
- A stick of dynamite thrown under a car on a frozen lake will not cause the car to sink.
- If a person is dragged by a horse, their jeans will not catch fire.
- A person wearing jeans cannot be killed from the jeans shrinking excessively in a hot bath.
- A car airbag cannot launch a toothpick into a person's skull.
- A trombonist could not have launched his mute with a firecracker, knocking over the conductor and blowing open his trombone.
- A Corvette cannot act as a ramp enabling another car to do a barrel roll.
- It is not possible for a person to catch a bullet with their teeth.
- Illegal immigrants could not be launched over the U.S. border using a giant slingshot.
- A woman could not have been impregnated by a bullet which had also hit a man's groin during the American Civil War.
- Overusing "bug bombs" can cause a house to explode.
- The Red Cross does not implant microchips in your bloodstream when you donate blood.
- Pyramid power, primary perception, and psionic helmets have no basis in science.
- A scuba diver cannot be sucked up by a firefighting helicopter and dumped onto a fire.
- A certain series of Rube Goldberg-like accidents involving a barrel of bricks is not realistic.
- Launching a human with water bottle rockets is not feasible.
- An umbrella that shoots poison capsules could be a lethal weapon.

Surviving Falls

- Falling out of an airplane is not survivable if a bomb explodes below you.
- A person cannot survive a free-falling elevator by jumping at the last moment before it hits the ground.
- A high fall over water cannot be survived by throwing a hammer to break the surface tension of the water.
- It is not feasible to improvise a parachute from materials in a hotel room.
- A person falling from a building cannot survive by holding a large sheet of plywood above their head or by opening an umbrella.
- An inflatable Zorb ball is not effective at cushioning a fall.
- A person wrapped in bubble wrap will not survive a significant fall.
- A skydiver could not have fallen onto a seesaw and safely launched a child to the top of a seven-story building.

Crime & Criminals

Brain
Crime & Criminals

- Driving at night without headlights is not an effective way to smuggle contraband.
- A car door cannot be unlocked using a tennis ball to force air into the lock.
- Some optical fingerprint readers can be fooled by a fingerprint etched in latex, a fingerprint in ballistics gel, and a paper copy that has been licked.
- A heat detector can be fooled using a sheet of glass or a fire proximity suit. It will not be fooled by cooling one's body or heating the room, by being covered in mud, or by wearing a diving suit.
- A motion detector can be fooled by moving very slowing or by holding a bed sheet in front of you, but not by wearing heavily-padded clothing.
- Laser beam detectors cannot be dodged using night vision goggles or cosmetic powder to reveal them, or by pointing another laser at the detector.
- A thief may be able to fill a safe with water and open it using an explosive, without damaging the contents.
- A police speed radar/lidar cannot be beaten by: jingling a set of keys, hanging a disco ball or CDs from the rear-view mirror, covering hubcaps with foil, lining the license plate with LEDs, using a magnetron, releasing tin foil as chaff, or painting the car matte black.
- Climbing an air duct using magnets or suction cups is possible, but too noisy to be useful. Suction cups could also be used to climb a building.

- Glass cannot be silently cut open by gently cutting a circle and removing it with a suction cup, but drilling a hole does work without too much noise.
- A pressure sensor under an item could be carefully squeezed with knife and then held down with tape while the item is taken.
- A modern safe cannot be cracked using a stethoscope, but it could be cracked by drilling a hole and visually aligning the tumblers.

Escaping Prison

- Escaping from Alcatraz using rafts made from rain ponchos is feasible.
- It could be possible, over years, to corrode prison bars using salsa.
- Steel prison bars can be cut using dental floss and toothpaste, but it takes a very long time.
- Dissolving a stockpile of antacid tablets to generate pressure will not help someone bust out of jail.
- A prisoner could not have escaped alive by loading ball-and-chain into a cannon and firing himself over the prison wall.
- A horse could not pull the bars out a prison window.
- A stick of dynamite would more likely kill a prisoner than help the prisoner escape.
- A prison inmate may be able to make a lethal crossbow out of newspaper.

Weather & Natural Phenomena

Teasers
Weather & Natural Phenomena

- A person will stay drier by running in the rain than by walking.
- Standing in a doorway is not the safest thing to do in an earthquake; rather: "drop, cover, and hold on."
- An extreme hail storm may be able to sink a boat.
- The equinoxes are not the only days you can balance an egg on its end.
- Specially built vehicles can withstand tornadoes and it is possible to build a portable tornado shelter.
- A tornado can propel window glass with enough speed to decapitate a person.
- It is not best to leave windows open during a hurricane.
- Metal body piercings do not attract lighting, nor do metal-cleated shoes.
- An avalanche will not be caused by a person yodeling, the sound of whip cracking, or people firing small guns at the mountain.
- A piece of straw will not penetrate through a palm tree if propelled by hurricane-force winds.
- Wind alone cannot blow the feathers off a chicken.

- A tidal whirlpool cannot sink a container ship or fishing trawler, but it could sink a person.
- During a lightning storm, a person can be electrocuted by talking on a corded phone and possibly by taking a shower.
- Lightning striking a kite has fatal results; Benjamin Franklin may have experimented with a kite but he probably was not struck by lightning.

Physical Sciences & Conundrums

ENTERTAINMENT | Brain Teasers | Mythbusters Results | Physical Sciences & Conundrums

- A truck carrying birds will not be lighter if the birds are flying instead of standing.
- A bullet fired into the surface of a frozen lake can spin like a top after impact.
- Swimming in bubbling water may be impossible.
- Folding a piece of paper in half more than seven times is possible.
- A ball thrown backwards from a moving vehicle, at the same speed as the vehicle, will fall straight down.
- A lock becomes easier to break when frozen with liquid nitrogen.
- Objects of different mass fall at the same rate.
- A bullet fired horizontally will land at the same time as a bullet dropped from the same height.
- Diamonds cannot be fabricated by combining chemicals in a pressure cooker, by putting charcoal and peanut butter in a microwave, or by cooling molten graphite and iron. Diamonds can be made, however, by compressing graphite with a huge amount of explosives.
- Pykrete is stronger than ice and it can be used to make a functional, but impractical, boat.

- The tensioned strings in a burning piano will not pop.
- A small car can be lifted into the air by fire hoses.
- Greenhouse gases do increase the amount of heat absorbed by air.
- Cows emit greenhouse gases and cow manure can be used to generate electricity.
- An RFID tag will not explode if placed inside an MRI scanner.
- Sound waves can put out a flame, but an unamplified human voice cannot.
- Anti-gravity is not possible.
- A pool of dense gas can make a tin foil boat appear to float in the air.
- A compressed air cylinder can blast itself through a concrete wall, but a boat cannot be effectively powered by one.
- A car sound system cannot quickly shatter all the windows; when one window breaks the pressure has a path to escape.
- A black car will heat up faster than a white one.

- A train will not be derailed if coins are placed on the tracks.
- Metronomes will synchronize on a sliding platform, but an excessive number will not.
- Soldiers marching on a bridge could cause a harmonic oscillation resulting in a collapse, but it is very unlikely.
- A frozen chicken penetrates aircraft and train windshields better than a thawed one.
- A glass of water can superheat in a microwave and boil over dangerously when removed.
- Walking over hot coals is possible because ash forms an insulating layer and because the contact time is brief.
- If thrown into a fire, a fire extinguisher can explode and put the fire out, depending on the type of fire extinguisher.
- Making a stun gun that delivers a shock over a stream of water is possible but highly impractical.
- An oversized Newton's cradle using wrecking balls will not work.
- Fire can be started by a bullet fired from a musket, by polishing a soda can with chocolate, by rubbing two sticks together, by a car battery and steel wool, or by focusing light with ice.

- It is possible to get free energy using a coil of wire under a power line, but getting enough to power a house is not practical.
- Dropping alkali metals into water will not create huge explosions, and sodium and water will not blow a hole in a wall.
- Sounds cannot be recovered from the grooves of old pottery.
- Water that has been microwaved (and cooled) is not harmful to plants.
- Falling from great heights onto water can be highly destructive, but it still is not as bad as falling onto pavement.

Household & Everyday

ENTERTAINMENT | Brain Teasers | Mythbusters Results | Household & Everyday

- A huge ball made of Legos will break apart when it is rolled downhill.
- A needle thrown at glass cannot pierce the glass without shattering it.
- A whole coconut can be mailed without packaging.
- A strike-anywhere match can be lit by a bullet fired from a pistol.
- The heads of many matches can be collected to create a large fireball.
- Pouring water on a grease fire will cause a large fireball, but a very large quantity of water can put a grease fire out.
- A single grocery line leading to multiple checkouts is slower but fairer than multiple lines.
- An MP3 player cannot be charged by simply plugging it into an onion.
- A lock can be picked using filaments from a light bulb.
- A car door cannot be unlocked by transmitting the keyless entry signal through a cell phone call.
- A frozen can of shaving cream will not fill up a car if cut open and thawed.

- Leaving a light on is not more efficient than turning it off and back on.
- To keep needles from falling out a Christmas tree, Viagra, bleach, and hairspray may work, but urethane, pain reliever medicine, soda, and fertilizer will not.
- The heat from Christmas lights will not ignite a Christmas tree.
- Performing a 360° loop on a standard swing set is not possible under one's own power, but it is possible on a rigid-arm swing set.
- A shop vacuum will not act like a jet engine if it sucks up gasoline.
- A clothed snowman melts slower than a naked one.
- A regular house fan cannot cause decapitation.
- Noise may help plants grow.
- An ordinary playing card cannot be thrown with enough power to be lethal.
- Dropping an electrical appliance into a bath can be deadly, but modern GFCI devices prevent this.
- A makeshift hovercraft can be built for under $500.

- A working speaker cannot be improvised from a paper plate, a penny, a mini jack, and tin foil.
- A CD can shatter if spun too fast, but CD-ROMs do not spin fast enough to cause this.
- A household washing machine does not have the strength to spin a flailing man.
- Microwaving metal will not blow up the microwave.
- Superglue can be used to attach a furniture to a ceiling, creating the illusion of an upside-down room.

Food & Drink

ENTERTAINMENT Teasers Mythbusters Food & Drink

- Eating poppy seeds can lead to a positive drug test for opioids.
- It may be possible to liquefy the inside of a whole fruit with an explosion and drink from it with a straw.
- It is possible to cook a meal using a car's engine compartment.
- The tryptophan in turkey is not what makes people tired.
- Not everything tastes like chicken; it is easy to differentiate chicken from other meats.
- You cannot pop popcorn instantly with an explosion, and popping popcorn with a pressure vessel is not the fasted method due to the required preparation.
- It is not possible to swallow a spoonful of ground cinnamon without drinking water.
- A beef steak can be tenderized using explosives, a cannon, or a laundry dryer.
- Swallowing both Mentos and Diet Coke will not make a person's stomach explode, nor will swallowing too much Pop Rocks and soda.
- A frozen turkey can crush your foot if dropped, and possibly your dog too.
- A turkey cannot be cooked using a microwave radio or a radar antenna.

Brain Mythbusters Results Food & Drink

- A cereal box does not have more nutritional value than the cereal within it.
- Food cannot be launched in the air through ingredients and flames and land fully cooked.
- Toast is not inherently more likely to land buttered-side down, but it could be more likely to when pushed from the height of a standard table.
- Dropping a frozen turkey into a deep fryer is very dangerous, but the turkey will not explode.
- A tin of biscuit dough can explode in a hot car, but aerosol spray and cola cans will not.
- Cola can be used as a cleaning agent to remove bloodstains or clean chrome, battery terminals, or a penny. Cola will not clean rust or greasy/oily things. It will not dissolve a steak or a tooth overnight and it will not kill sperm.
- A six-pack of beer or soda will not be quickly cooled by burying it in sand and igniting gasoline on top of it; salty ice water is the most practical solution.
- Pain from eating hot peppers can be relieved with milk, but not with water, beer, tequila, toothpaste, petroleum jelly, or wasabi.

Alcohol

ENTERTAINMENT Mythbusters Results Food & Drink

- Placing a silver spoon in a bottle of champagne will not keep it bubblier.
- Beating a breathalyzer test is not possible by eating an onion, eating breath mints, drinking mouthwash, or placing a penny in the mouth.
- A moonshine still can malfunction and explode.
- A modern car can run on moonshine.
- Filtering vodka through a charcoal filter will not improve its quality.
- Vodka will not cure poison oak or kill bees but it can help relieve the pain of a jellyfish sting, remove a bandage, clean a bathroom, remove odors from clothes and feet, and remedy bad breath.
- Rum is not better at cleaning clothes than detergent.
- Beer can instantly freeze solid after being removed from a freezer and given a shock.
- Drinking brandy may make a person trapped in the cold feel warmer, but it will actually make them die sooner.
- Alcohol does make people look more attractive.
- A hangover caused by mixing beer and liquor is not worse than one caused by beer alone.

Toilets and Bodily Functions

Teasers Mythbusters Results Toilets and Bodily Functions

- A fart cannot be seen on an infrared camera.
- A cherry bomb flushed down a toilet will not send water shooting out of all the neighboring toilets.
- Pouring gasoline down a toilet and igniting it will not cause an explosion.
- Doing the "potty dance" may help alleviate the urge to urinate.
- Flatulence can be induced by consuming beans or soft drinks, but not beef.
- Pretty girls do pass gas.
- It is not possible for a person to fart so much that they suffocate from the gases.
- A fart can be lit on fire.
- A match can be lit to mask the smell of a fart, but it does not actually burn the odorous gases.
- Lighting a cigarette in a porta-potty will not cause an explosion.
- An inaudible "brown note" will not make a person lose control of their bowels.

- During winter, a stream of urine will not freeze midair.
- Urinating on an electric fence can cause electrocution, but urinating on the third rail of a train track will not.

Germs & Health

ENTERTAINMENT Brain Mythbusters Results Germs & Health

- "Double dipping" food items is not as bad as putting all of the dip in your mouth.
- The "five second rule" is not valid when food is dropped on the floor.
- Many objects that people touch every day are dirtier than a toilet seat, including cash, keyboards, and kitchen sponges. In fact, a toilet seat may be one of the cleanest surfaces in a house.
- Toothbrushes are generally contaminated with fecal coliform, but not to a dangerous degree.
- Hot-air hand dryers are less sanitary than paper towels.
- In public restrooms, the stall closest to the door is used the least and stays the cleanest.
- Covering a sneeze with your inner elbow is more sanitary than using your hand or a handkerchief.
- A person's eyes will not fly out if they sneeze with their eyes open.
- A sneeze does not travel at 100 mph (160 km/h); it's more like 37 mph (60 km/h).
- Healthy people cannot easily avoid germs if a sick person makes no effort to contain them.

- The top of a soda can is not likely to be contaminated with rat urine, and dangerous viruses could not be transmitted that way.
- A defibrillator may burn someone who is wearing an underwire bra or a nipple piercing, but it is not likely. A defibrillator will not make a nitroglycerin chest patch explode.
- Being hit on the head with an empty beer bottle will not cause more damage than being hit by a full bottle.
- A person buried up to their neck in wet sand will not be able to escape without aid.

Cars & Driving

Mythbusters Results Cars & Driving

- Drifting is not the fastest way to race through corners, not even on dirt roads.
- It is possible, but difficult, to drift into a parallel parking space.
- It is possible to drive in reverse at high speeds.
- One car braking in traffic can cause a ripple effect that persists.
- Changing lanes frequently in traffic can save you time.
- Roundabouts are more efficient than four-way stops.
- It is not difficult to push one moving car off the road with another.
- During a car chase, the fleeing car could escape by deploying a smokescreen or an oil slick.
- A hood-mounted machine gun is an effective weapon in a car chase.
- Hollow road spikes are effective at stopping a car, but solid spikes are not reliable because they can stick in the tires.
- It is quite difficult to drive a car balanced on two wheels.

ENTERTAINMENT Brain Teasers Mythbusters Results Cars & Driving

- Driving with a full bladder is not as dangerous as driving drunk.
- Two cars stuck together nose-to-nose can drive in a straight line and spin 180°, but they can't go around a 90° turn.
- A burst of flame can be used to re-seat a tire on its rim, but another method is still needed to inflate the tire.
- An out-of-control car can be safely stopped by pulling in front of it with another car and slowing down.
- A car with a flat tire can temporarily be driven on the bare rim, or the wheel can be replaced by a manhole cover, stuffed with straw, or replaced with a carved log.
- Older sports cars were not so badly designed that they are more aerodynamic if the body is turned backward.
- Driving while tired or driving while using a cell phone can be more dangerous than driving under the influence of alcohol.
- Using a hands-free cell phone while driving is just as dangerous as holding the phone.
- A motorcycle cannot yank the cloth off a banquet table without disturbing the place settings.
- Driving a convertible through rain at high speed may prevent the driver from getting wet.
- A long, fast burnout will not cause a tire to catch fire.

Mythbusters Results Cars & Driving

- Two semi trucks that collide head-on will not stay fused together and conceal another car crushed between them.
- A blind person can drive safely by following instructions from a passenger.
- Electric cars are not more sluggish than gasoline cars.
- A speed camera cannot be beaten by a reflective license plate cover, a magnified cover, a crystallized cover, a commercial spray, plastic wrap, or hair spray. It could be beaten by an extraordinarily fast car.
- Shifting into reverse will not stop a runaway car.
- Driving backwards does not improve traction on an icy road.
- Bracing a windshield with your hand will not keep it from shattering when struck.
- An engine cannot run on gunpowder alone.
- Used cooking oil can be used as fuel in a diesel engine.
- A toy car can beat a full-size car in a short, unpowered downhill race, but it will fall behind in a longer race.

Mythbusters Results Cars & Driving

- Driving in heels or snow boots does not significantly impair a driver.
- A broken drive shaft dragging on the ground will not cause a car to pole vault end-over-end if it strikes a pothole.
- A car's engine will not be destroyed if sugar or drain cleaner are put in the fuel tank, if a coin falls in the carburetor, or if the tailpipe is plugged. It could be destroyed if bleach is put in the fuel tank or oil tank.
- A cracked egg can plug a radiator leak and cola can be used as an emergency coolant.
- Adding mothballs to a car's fuel tank may increase its horsepower.
- A car can be destroyed by a decomposing body and the smell may never go away, but a buyer could still be found.

Car Crashes

- Two cars crashing into each other will each experience the same force as a single car hitting a wall.
- A car passenger seated between two heavyset people will not be protected in a crash.
- In a car crash, a large number of party balloons will not act similarly to an airbag.
- In a car fire, the bumper can explode and present a danger, but only at short range.
- Neither carburetor magnets nor acetone in the gas tank will improve a car's fuel efficiency.
- A tissue box in the back seat of a car will not become a deadly projectile during a crash.
- A semi truck's tires can explode with lethal force.
- During a car crash, an airbag will not rip off the driver's thumbs.
- Spray-on truck bed liner resin can withstand a dog bite and even an explosion, but it will not significantly protect a car during a crash.
- A car could not be split in half with a snowplow while the occupants remain unharmed.

Fuel Efficiency

ENTERTAINMENT Brain Teasers Mythbusters Results Cars & Driving

- Driving with the windows down is more fuel-efficient at slow speeds; above roughly 50 mph (80 km/h), air conditioning becomes more efficient.
- Driving a route with only right-hand turns more efficient than driving a normal route.
- Hypermiling techniques can significantly improve, but not double, fuel efficiency.
- Although they are more fuel-efficient, motorcycles emit more air pollution than cars.
- Higher-than-normal tire pressure improves fuel efficiency.
- A driver will use more fuel when angry.
- Although dangerous and often illegal, cars and bicyclists can draft a semi truck to improve efficiency.
- It is not more fuel-efficient to drive a pick-up truck with the tailgate down. A plastic mesh tailgate is the most efficient configuration.
- A dirty car is not more fuel-efficient a clean one, but a car with dimples like a golf ball could be more fuel-efficient than a smooth one.

Aviation & Aircraft

Mythbusters Results Aviation & Aircraft

- Boarding an airplane from back-to-front is the slowest method and there are several better alternatives.
- Playing tennis on the wing of a slow-flying airplane is possible.
- Airplanes can save fuel by flying in a V-formation like birds.
- A person could improvise an aircraft powered by many fireworks, but it would be extremely unsafe.
- If the contents of an airplane toilet leak, they can freeze and cause damage by falling to the ground.
- Getting stuck on an airline vacuum toilet is not possible.
- The U-2 spy plane is challenging to operate, but fun to ride in.
- A large multirotor drone could cause serious injury with its propellers.
- The sonic boom from a fighter jet will only break glass if it occurs at a very low altitude.
- An untrained person could be instructed to successfully land an airplane over the radio.
- The jet wash from a Boeing 747 can flip a taxi, a school bus, and a small plane.

Mythbusters Results Aviation & Aircraft

- Placing a stamp on the rotor of a helicopter will not unbalance the rotors and cause a crash.
- A life raft filled with helium cannot be flown.
- Cell phones were not banned on planes to sell more in-flight phone calls.
- For short journeys, driving can be faster than flying.
- The empennage of a plane can be shredded by another plane's propeller.
- If a bullet is fired through the fuselage of airplane, the plane will not explosively decompress.
- A person strapped into the rear stewardess seat may be able to survive the destruction of an airplane in flight.
- Building an inexpensive jet pack from online plans is not feasible.
- Hair gel will not explode and decapitate a pilot in an oxygen-rich fighter jet cockpit.
- Jumping with an inflatable escape slide could make a fall from an airplane survivable, but it wouldn't be possible to inflate it and get strapped in while the plane is moving.

- Making a glider from concrete is possible but impractical.
- The airplane brace position is effective and was not deviously designed by the airline industry to kill passengers.
- Breast implants will not explode on an airplane, nor will an inflatable bra.

Boats

ENTERTAINMENT | Teasers | Mythbusters Results | Boats

- A huge number of ping pong balls can be used to raise a sunken ship.
- A boat will not be split in half if it hits a channel marker head-on.
- A ginger pill or a placebo can prevent seasickness, but cinnamon, magnets, and electroshock treatments will not.
- A large explosion cannot lift a boat out of the water without also destroying it.
- The wake from a sharply turning jet boat can put out a fire on another boat.
- A fisherman could be pulled to the bottom of the sea if his leg is caught in a rope.
- Slowing a fall by sticking a knife into a boat's sail is not effective.
- A boat can be driven with its trailer still attached.
- A sinking boat will not create enough suction to pull someone underwater.

Sports & Outdoors

Brain | Mythbusters Results | Sports & Outdoors

- A corked baseball bat will not hit a baseball farther than a normal bat.
- A baseball pitcher's fastball cannot lift itself higher into the air.
- In baseball, it is faster to slide into bases that can't be overrun.
- Practicing golf in a video game will not make you better at playing actual golf.
- Hitting golf balls through the foliage of a tree is not easier than going around it.
- A racecar does not generate enough downforce/suction to lift a manhole cover.
- A racecar driver may lose 10 pounds of water weight over a 3-hour race.
- A fish cannot pull out a fishing line so fast that the reel catches on fire.
- The black paint worn by baseball players could reduce glare from the sun.
- Escaping a ski lift by sliding down the cable using a pair of pants does not work.
- One skydiver can catch up to another by streamlining their body.
- A baseball's stitches will not tear off, even if the ball is thrown and hit with super-human strength.

- An NFL football filled with helium will not fly farther than one filled with regular air.
- Jimmy Hoffa was not buried in the Giants Stadium.

Water Activities

ENTERTAINMENT | Mythbusters Results | Sports & Outdoors

- It is possible to ride a bike underwater.
- A bicycle can be modified to operate on the surface of water relatively easily.
- It is not feasible to bob for apples while bungee jumping.
- A fast-moving motorcycle can ride across the surface of a lake.
- Surfing on still water with rockets is only possible with a highly-modified surf board.
- The body of a pre-SCUBA diver could be pushed into the helmet if the surface air supply failed.
- A harpoon gun is accurate from a distance of 100 feet (30 m).
- Water skiing behind a cruise ship is possible, and so is skiing behind a rowing team.
- It is not feasible to stay underwater by breathing air from a car tire.
- Running across the surface of water is not possible.
- A person could not surf on a wave generated by explosives.

Animals

Teasers | Mythbusters Results | Animals

- It is not possible to herd cats.
- Cats are not deterred by lion feces, aluminum foil, or water bottles.
- Snakes are not deterred by cat litter, mothballs, hemp rope, or cayenne pepper.
- Bears are deterred by cayenne pepper, but not by ammonia.
- Hanging bags of water from the ceiling will not repel flies.
- It is possible to catch a greased pig.
- One thousand honey bees cannot lift a laptop.
- Trained bloodhounds are amazingly effective and they will not be fooled by a wide array of deceptions and concealments.
- Law-enforcement "sniffer dogs" will not be fooled by covering contraband with food or masking agents, nor will they or their handler be easily distracted.
- A person may be able to get past a guard dog by travelling inside a barrel or metal sphere or by distracting it with food, a robotic cat, or certain types of urine.

Animals

- Goats can be startled into fainting.
- Cockroaches cannot survive a nuclear blast.
- Elephants may be afraid of mice; they will avoid one, but not panic.
- The color red does not make a bull charge.
- Crocodiles won't chase someone; they are ambush predators.
- A dog's mouth has less bacteria than a human's.
- The smell of skunk musk cannot be removed with beer or a douche, but tomato juice and commercial cleaners may help and a custom mixture with hydrogen peroxide is the most effective.
- Daddy longlegs spiders do not have the most potent venom of all spiders, but their bite can pierce human skin.
- A goldfish's memory is not limited to three seconds.
- Dog urine does not react with bleach to cause an explosion.
- A fertilized octopus egg could not gestate after being swallowed by a woman.

Brain | Mythbusters Results | Animals

- A wallet made of electric eel skin will not ruin a credit card's magnetic strip.
- A duck's quack does echo.

Sharks

ENTERTAINMENT | Animals

- Sharks are repelled by the scent of a dead shark and by dolphins.
- Sharks are not repelled by the sound of orca whales or by chili peppers.
- Some sharks are deterred by magnets, but not all species and not when there is food present.
- Playing dead can help prevent at shark attack. Also punching a shark in the nose, eyes, and gills may help deter an attack, and it is feasible to find and gouge a shark's eyes in the frenzy of an attack.
- Sharks are not attracted to a dog in the water but they are attracted to the sound of a flapping fish and flashlights at night.
- Most sharks won't asphyxiate if they stop moving.
- Sharks cannot detect a single drop of blood at the opposite end of a swimming pool.
- Shark skin can be used as sandpaper.
- Sharks do not sense low frequency sounds but they do sense electromagnetic fields.
- A great white shark has the strength to pull flotation barrels underwater but not to hold them there. It does not have the strength to pull a boat backwards rapidly. It does have the strength to break a lure made of piano wire.

Results

- Sharks can see food above the surface of water and will attack it.
- A great white shark can potentially penetrate a dive cage and punch a hole in a boat.
- A knight's suit of armor seems to attract sharks, so it is not a suitable as protection.

Human Behavior & Physiology

- People don't get dumber when in the presence of the opposite gender.
- Men are not more attracted to blonde women.
- Waitresses with larger breasts receiver higher tips.
- Pheromone sprays are not effective for humans.
- Women are more attracted to financially successful men.
- Taking 20-minute naps can double performance during extended sleep deprivation.
- In a Monte Hall Problem, most people don't change their decision, even though they should.
- Slapping someone in the face does help make them more alert.
- Humans use more than 10% of their brains.
- Women and redheads appear to have higher pain tolerance than others and cursing aloud can increase a person's pain tolerance.
- Humans may give off a scent when scared.
- Wearing an eyepatch over one eye does help preserve night vision.
- Dipping a sleeping person's hand into warm water will not cause them to urinate.
- Exercising vigorously and getting slapped in the face may help a drunk person sober up, but drinking coffee or ice water will not.
- Cabin fever appears to be a real phenomenon.
- It may be possible to fool a lie detector test by controlling thoughts or by self-inflicting pain.
- Hypnosis will not make someone act against their will, but it can help them remember things. Self-hypnosis will not cure seasickness, change one's eye color, or eliminate the fear of bees.
- There is not an inaudible sound that makes people feel uneasy.
- Yawning could be contagious.
- A tooth filling will not pick up radio signals.
- Tanning too often will not cook a person's internal organs.
- Mind control of another person is not possible via subliminal sounds or magnetic fields.

Gender Differences

- Men are not inherently better at throwing a ball than women, but they do generally receive more training.
- Women are better at multitasking, reading emotions based on people's eyes, and possibly observing details.
- Men are better at driving and packing for a road trip.
- Men and women do the follow equally well: parallel parking, following maps, and cooking on a grill.
- Women break the speed limit more often than men do.
- Men ask for directions sooner than women do.

Physical Feats

- A fit person may be able to carry large amounts of weapons and supplies, as seen in FPS video games.
- A human cannot outrun a race car in a 30-foot race.
- It is not possible to walk, swim, or drive in a straight line when blindfolded.
- It may be possible to swim through syrup as quickly as through water.
- Surviving for long periods when buried alive is not possible.
- Using grappling hooks to quickly scale a wall is not feasible.
- A punch will not leave a scar that matches the imprint on a ring.
- A person singing at the right tone can break a wine glass.
- An average man can break through a wooden doorframe using his own power.
- A ninja cannot catch an arrow in mid-flight, catch a sword between his palms, slap a bullet out of the air, or run across water.
- A ninja can deflect an arrow with a sword and may be able to knock out a person with a one-inch punch and hit a target with a blowgun from underwater.

War & Armaments

- It is not difficult to hold a hand grenade for a long time after the pin has been removed.
- Lying flat on the ground will not protect a person from grenade shrapnel.
- A grenade can be neutralized by placing it in a bucket of water or by covering it with a body, but not by throwing it inside a refrigerator.
- It is not feasible to shoot a handgun at an oncoming RPG and escape unharmed, but it may be possible to shoot a hand grenade in midair and render it harmless.
- It may be possible to dodge a bullet from a sniper rife that is over 500 yards (457 m) away if you see the muzzle flash, but a sniper could make sure you don't see the flash.
- Building battlefield trenches with sharp corners helps reduce the spread of a shock wave.
- Operation Valkyrie would not have been successful if Hitler's meeting remained underground.
- The wooden shrapnel from a cannonball impact does not cause more damage than the cannonball itself.
- Archers on a galloping horse will have more powerful arrow shots, but not double the power of when standing still.
- A form of torture in which bamboo slowly grows through a person's body is feasible.
- Chinese water torture could drive someone insane.
- A sniper could have shot straight through another sniper's scope during the Vietnam War.
- A wooden arrow cannot be fully split in half by a direct hit in the tail from another arrow.
- A normal fire extinguisher can't hold off an attack from a flamethrower.

Swords & Knives

- At close quarters, a fighter with a knife can defeat one with a gun.
- Slicing through real fruit with a sword is not as easy as it seems in the game Fruit Ninja.
- Having higher ground in a sword fight is not a significant advantage.
- Attacking first in a sword fight is not a disadvantage.
- A hardcover book is effective at stopping a sword thrust, while coins will just deflect the thrust.
- Cutting a machine gun in two with a sword is not possible.

Guns & Bullets

- A bullet fired straight up can still be lethal when it falls to the ground.
- It is possible to shoot a bullet through a wall and hit a moving target.
- A rifle with a bent barrel can still fire lethally.
- A rifle with a boresight left in the barrel could backfire and explode.
- Guns work underwater and would also work in the vacuum of space.
- A gun that is dropped in a deep fryer will discharge.
- A pistol dropped down a flight of stairs is not likely to discharge.
- A nail gun is not an effective weapon.
- Equally-matched opponents in a fast draw gunfight would likely kill each other.
- Silver bullets don't work well, but lead bullets can be engraved and still fire accurately.
- A bullet can't be fired at a road surface to ricochet up through a car's floorboard.
- The standard two-handed stance is the best way to hold a gun.

- It is more accurate to fire two guns simultaneously than to alternate left- and right-hand shots in a two-handed stance.
- A handgun can be used to shoot a dropped handgun out of reach of an adversary.
- A bullet may be able to ricochet three times and return to the shooter, but it will not have lethal velocity.
- It is not possible to shoot a gun out of a person's hand without injuring them.
- Guns can be shot around corners with special devices.
- A person can shoot a target while airborne after jumping.
- The sonic boom from a supersonic bullet will not break glass.
- A loud car stereo system will not cause a rifle to misfire, but the shock wave from a bomb can.
- Davy Crocket could have shot a musket and split the bullet on a distant axe blade.
- A tree can be cut down with machine gun fire.
- Cigarette butts fired from a gun can be lethal.
- You cannot shoot a hat off a person's head; the bullet will not transfer enough energy.

- A bullet can be shot into the empty chamber of another revolver, and two bullets can collide in midair and fuse together.
- An Old West gunslinger could not have shot a hole through a silver dollar, fired five times before a coin was dropped to the ground, or saved a man from hanging by shooting the rope.
- Bullets can generate sparks when they ricochet, but it's not common.
- A bullet could serve as a replacement electronic fuse and eventually heat up enough to discharge.
- Loose bullets in a hot oven or a fire will explode, but they will not have lethal velocity. However, a loaded gun in a hot oven can fire a lethal bullet.

What is Bulletproof

- Things that can stop bullets: a fish tank, a block of pykrete, inch-thick polycarbonate, and possibly a police badge, a belt buckle, certain bathroom tiles, and several pizzas in a warming bag.
- Things that are not bulletproof: a tape measure, a golf ball, a wallet, a hair weave, a refrigerator door, a car door, a car covered with phone books, an iPod, human fat, human muscle, a mixture of cornstarch and water, an over door, a deck of playing cards, a book, and ¼-inch polycarbonate.
- Three watermelons can stop a .50 caliber bullet.
- A metal cigarette lighter can stop a bullet only if the bullet has already ricocheted off another surface.
- A laptop may be able to block a shotgun blast.
- A person can hide underwater as protection from bullets.

Explosives & Explosions

- Standing between two identical explosions is not safe; rather, the shock waves accumulate.
- A vehicle containing flammable gas can explode when it receives a keyless remote signal.
- C-4 plastic explosive is stable enough to burn without exploding, even when subjected to falling anvils, gun shots, and thermite.
- C-4 will detonate in a microwave only if it is wired with a blasting cap.
- Binary explosives (Tannerite) in the trunk of a car will not detonate if the car is rear-ended.
- When exposed to fire, a small propane tank can explode and fly high into the air.
- Igniting thermite on top of ice will cause an explosion.
- A large fireball can be created by a cloud of saw dust or powdered creamer.
- If a trail of gas from a leaking car is lit on fire, the fire will not catch up to the car and blow it up.
- Diving underwater could make an above-water explosion more survivable.
- A person can float on his/her back at the surface to improve the survivability of an underwater explosion.
- A person can outrun a trail of burning gunpowder and kick it out before it reaches the source.

- Aerosol cans and beer kegs will explode in an open fire, and a keg exploding could cause lethal injury.
- A stick of dynamite might be able to help clean out a cement truck, but it will not remove a solid slab of concrete.
- A person who lights gasoline in a culvert will be burned, but not blasted out a great distance.
- A methane explosion can launch a manhole cover into the air.
- A Christmas tree doused with liquid nitrogen will not explode.
- It not possible to flatten a car using explosives without obliterating it.
- An aquarium, a garbage truck, and a bed can effectively contain an explosion, but a filing cabinet and a steel safe cannot.
- A wooden table, a car, a metal dumpster, and a cinder block wall can all protect someone from the shock wave of a bomb.
- Dry ice bombs are very dangerous.

Unusual Materials & Uses

- Bullets made of ice cannot be used to kill someone without leaving a trace, nor can bullets made of meat, gelatin, teeth, or bone.
- Gummy bears, poop, and salami can each be turned into rocket fuels.
- A cannon made of ice is not feasible, nor is a cannon made from a bamboo stalk.
- Cannonballs made of stone could be effective and disintegrate on impact, leaving the enemy nothing to fire back.
- Pirates could have improvised an effective cannonball using chains, nails, or steak knives, but not using bottles of rum, cutlery, or a wooden leg.
- A block of cheese can be fired from a cannon with enough force to shred a ship's sail.
- Warm clothing can be made of bubble wrap.
- Bed sheets can be used to make an improvised rope, and ropes made of toilet paper or hair are also plausible.
- An excavator can load itself into a truck, use its bucket as an oar to row a barge, and spin in place to allow a person to wakeboard on surrounding water. Furthermore, a skilled operator can use an excavator to thread a needle or pour a glass of wine.

Duct Tape

- Duct tape can be used to make a large trebuchet, shelter, rope, kayaks, clothing, canoes, a bridge, a sail boat, a cannon, and even a full-scale airplane.
- Duct tape can be used to lift a car, temporarily seal leaks in a boat, hold a disassembled car together, and hold a car to a pole so it can't drive away, but it is not feasible to stop a moving car with duct tape.
- Duct tape cannot be used to make an effective seat belt, nor can super glue.

Historical Feats

ENTERTAINMENT | Teasers | Mythbusters Results | Historical Feats

- The Apollo moon landings were not faked; there are not discrepancies in the photos, a flag can flap in a vacuum, a footprint can be made on the moon, the video footage is not slowed down, and the astronauts did leave behind equipment that we can detect.
- The Hindenburg was destroyed because of hydrogen gas, not its paint.
- Nikola Tesla probably did not build an earthquake machine.
- The Confederates in the American Civil War may have built a steam-powered machine gun, but it would not have been effective or reliable. They could not have launched a two stage rocket from Richmond to D.C.
- An Ottoman Turk in the 17th century could not have made the first manned rocket flight.
- A two-stage missile with rocket-propelled arrows could have been made in 14th-century China. In 18th-century China, a throwing weapon that could decapitate an opponent and return to the thrower could have been made. Neither weapon, however, would have been reliable in combat.
- 13th-century Syrians could have made a torpedo-like weapon that traveled over the surface water and exploded on impact.
- A medieval army could not have improvised a catapult built from trees and used it to hurl corpses over a castle wall.
- A 15th-century astrologer could not have made it to space on a throne powered by bamboo rockets.

Ancients

- A medieval clan could have built a cannon out of a tree that exploded and destroyed part of their own town.
- Archimedes could not have built a powerful steam cannon.
- An army of 500 people holding mirrors cannot focus enough sunlight to set a wooden ship on fire.
- The ancient people of Babylon could have created a crude battery for various uses.
- Using a drum submerged in a shaft, the ancient Chinese may have been able detect the tunneling of invading armies.
- Ancient Chinese armies could have made effective body armor from paper.
- The ancient Greeks could have built a fully-automatic weapon that fired arrows.
- Ancient armies could not have built a cannon completely out of leather.
- An ancient Korean hwacha could have fired 200 arrows that exploded on impact.

6 Jokes

ENTERTAINMENT | Brain Teasers | Jokes | Bad Jokes

All kinds of jokes from Dad jokes to long jokes.

Bad Jokes

What's the best thing about Switzerland?	I don't know, but the flag is a big plus.
I invented a new word!	Plagiarism!
Did you hear about the mathematician who's afraid of negative numbers?	He'll stop at nothing to avoid them.
Why do we tell actors to "break a leg?"	Because every play has a cast.
Helvetica and Times New Roman walk into a bar.	"Get out of here!" shouts the bartender. "We don't serve your type."
Yesterday I saw a guy spill all his Scrabble letters on the road.	I asked him, "What's the word on the street?"
Hear about the new restaurant called Karma?	There's no menu: You get what you deserve.
A woman in labour suddenly shouted, "Shouldn't! Wouldn't! Couldn't! Didn't! Can't!"	"Don't worry," said the doc. "Those are just contractions."
A bear walks into a bar and says, "Give me a whiskey and . . . . cola."	"Why the big pause?" asks the bartender. The bear shrugged. "I'm not sure; I was born with them."
Did you hear about the actor who fell through the floorboards?	He was just going through a stage.
Did you hear about the claustrophobic astronaut?	He just needed a little space.
Why don't scientists trust atoms?	Because they make up everything.
Why did the chicken go to the séance?	To get to the other side.
Where are average things manufactured?	The satisfactory.
How do you drown a hipster?	Throw him in the mainstream.
What sits at the bottom of the sea and twitches?	A nervous wreck.
What does a nosy pepper do?	Gets jalapeño business!
How does Moses make tea?	He brews.
Why can't you explain puns to kleptomaniacs?	They always take things literally.
How do you keep a bagel from getting away?	Put lox on it.
A man tells his doctor, "Doc, help me. I'm addicted to Twitter!"	The doctor replies, "Sorry, I don't follow you …"
What kind of exercise do lazy people do?	Diddly-squats.
Why don't Calculus majors throw house parties?	Because you should never drink and derive.
What do you call a parade of rabbits hopping backwards?	A receding hare-line.
What does Charles Dickens keep in his spice rack?	The best of thymes, the worst of thymes.
What's the different between a cat and a comma?	A cat has claws at the end of paws; A comma is a pause at the end of a clause.
Why should the number 288 never be mentioned?	It's two gross.
What did the Tin Man say when he got run over by a steamroller?	"Curses! Foil again!"

What did the bald man exclaim when he received a comb for a present?	Thanks— I'll never part with it!
What did the Buddhist say to the hot dog vendor?	Make me one with everything.
What did the left eye say to the right eye?	Between you and me, something smells.
What do you call a fake noodle?	An impasta.
How do you make a tissue dance?	Put a little boogie in it.
What did the 0 say to the 8?	Nice belt!
What do you call a pony with a cough?	A little horse.
What did one hat say to the other?	You wait here. I'll go on a head.
What do you call a magic dog?	A labracadabrador.
What did the shark say when he ate the clownfish?	This tastes a little funny.
What's orange and sounds like a carrot?	A parrot.
Why can't you hear a pterodactyl go to the bathroom?	Because the "P" is silent.
What do you call a woman with one leg?	Eileen.
What did the pirate say when he turned 80?	Aye matey.
Why did the frog take the bus to work today?	His car got toad away.
What did the buffalo say when his son left for college?	Bison.
What is an astronaut's favourite part on a computer?	The space bar.
Why did the yogurt go to the art exhibition?	Because it was cultured.
What do you call an apology written in dots and dashes?	Re-Morse code.
Why did the hipster burn his mouth?	He drank the coffee before it was cool.
Once my dog ate all the Scrabble tiles.	He kept leaving little messages around the house.
If love is "grand," what is divorce?	A hundred grand, or more.
What is the biggest lie in the entire universe?	"I have read and agree to the Terms & Conditions."
What is a Queens favourite kind of weather?	Reign!
Why should you stand in the corner if you get cold?	It's always 90 degrees.
Which thrill ride does a wine glass love to go on the most?	A coaster!
How does a computer get drunk?	It takes screenshots.

Realistic Jokes

Why are iPhone chargers not called Apple Juice?!
Marriage is a three-ring circus: engagement ring, wedding ring, and suffering.
I just got fired from my job at the keyboard factory. They told me I wasn't putting in enough shifts.
Have you heard of that new band "1023 Megabytes"? They're pretty good, but they don't have a gig just yet.
I tried to say, "I'm a functional adult," but my phone changed it to "fictional adult," and I feel like that's more accurate.
I saw a driver texting and driving. It made me so mad I threw my beer at him.
Anyone who thinks "talk is cheap"… obviously didn't pay my daughter's last mobile phone bill!
Instagram is just Twitter for people who go outside.
You would think that taking off a snail's shell would make it move faster, but it actually just makes it more sluggish.
My boyfriend told me to stop acting like a flamingo. So I had to put my foot down.
An extensive government study has revealed that the leading cause of cancer in laboratory rats is scientists.
Client: We need you to log into YouTube and make all our company videos viral.

Dad Jokes

Dad, can you put the cat out?	I didn't know it was on fire.
The shovel was a ground-breaking invention.	

I wouldn't buy anything with velcro. It's a total rip-off.	
What did the grape do when he got stepped on?	He let out a little wine
Why couldn't the bicycle stand up by itself?	It was two tired.
What do you call cheese that isn't yours?	Nacho Cheese.
Want to hear a joke about construction?	I'm still working on it.
What do you call an elephant that doesn't matter?	An irrelephant.
I'll call you later. Don't call me later, call me Dad.	
Why don't skeletons ever go trick or treating?	Because they have no body to go with.
Why did the scarecrow win an award?	Because he was outstanding in his field.
Dad, can you put my shoes on?	No, I don't think they'll fit me.
Dad, did you get a haircut?	No, I got them all cut.
How does a penguin build its house?	Igloos it together.
Why did the coffee file a police report?	It got mugged.
I just watched a program about beavers. It was the best dam program I've ever seen.	
Want to hear a joke about paper?	Nevermind it's tearable.
How many apples grow on a tree?	All of them.
What do you call a fake noodle?	An Impasta.
Did you hear about the restaurant on the moon?	Great food, no atmosphere.
Did you hear about the cheese factory that exploded in France?	There was nothing left but de Brie.
I've just been diagnosed as colour blind. I know, it really came out of the purple.	
I hate jokes about German sausage. They're the wurst.	
Why did the can-crusher quit his job?	Because it was soda-pressing.
I'm reading a book about anti-gravity. It's impossible to put down!	
You're American when you go into the bathroom, and you're American when you come out, but do you know what you are while you're in there?	European.
If you see a robbery at an Apple Store does that make you an iWitness?	
Spring is here! I got so excited I wet my plants!	
A ham sandwich walks into a bar and orders a beer. The bartender says, "Sorry we don't serve food here."	
CASHIER: "Would you like the milk in a bag, sir?"	DAD: "No, just leave it in the carton!"
Did you hear about the guy who invented Lifesavers?	They say he made a mint.
I bought some shoes from a drug dealer. I don't know what he laced them with, but I was tripping all day!	

Long Jokes

4 Complex Concepts

The following are complicated subjects to wrap your head around but still possible given enough time. They are aimed at distracting you from what may be going on around you and to utilize the conceptual part of your brain.

Complex Questions

Do astronauts age more slowly?

Yes. According to Einstein's special theory of relativity, all processes slow down when a system moves at high speed. The result applies to astronauts since they are moving rapidly. The amount of slowing is so slight as to be imperceptible for ordinary speeds. It becomes very significant when we get close to the speed of light:	**Car at 100 miles per hour** Lose 0.35 seconds in 1,000,000 years **Rocket at earth's escape velocity (7 miles per second)** Lose 0.022 seconds in 1 year (Astronaut is 0.022 seconds younger on returning after a one year trip.)	**Rocket at 100,000 miles per second (53% speed of light)** Astronaut metabolism slows to 84% of normal. **Rocket at 185,800 miles per second (99% speed of light)** Astronaut metabolism slows to 4.5% of normal. (One year journey=aging 16 days)

How can special relativity know that these effects will happen? They arise directly from the basic supposition of the theory: all uniformly moving observers must measure the same speed for light.--186,000 miles per second.

At first this seems impossible. Say I send out a light signal from earth. I measure its speed at 186,000 miles per second.

What about another observer that chases after the light signal at, say, half the speed of light? Shouldn't that observer see the light signal slowed to half its speed? All our common sense says yes. Special relativity says no. How can that be? Something in our common sense assumptions must be wrong. There is not much room to look for the mistake. We find the speed of the light signal with just two instruments: a measuring rod to determine how far the light signal goes; and a clock to measure how long it takes to go that far.

Classically we assume that neither is affected by rapid motion. At least one of these assumptions must be wrong if the speed of light is to remain constant. When we work through the details we find that both are: the rod shrinks in the direction of motion and the clock slows. So rapidly moving clocks slow. How does that get to a rapidly moving astronaut aging more slowly. An astronaut's metabolism is a clock. You can use your pulse to time things if you like. So that metabolism clock must slow too. The legend is that Galileo used his pulse to time the period of a slowly swinging lamp while not attending to a cathedral mass and thereby arrived at the famous result of the isochrony of the pendulum, which just says that the period of a pendulum is fixed by its length. His pulse was the simple clock used to time the pendulum.

Can a finite universe have no edge?

Yes. The question is asking whether we could have a universe with a finite volume. That means if I ask "How many cubic miles of space are there?" the answer is not "infinity" but some definite number. It might be a big number. Say 63 kazillion cubic miles. But it is still a definite number, so that if you started to count off the cubic miles in space, you would eventually come to an end. At the same time it is asking if this finite universe could have no edge. An edge is just what you think. It is a place you get to where you run out of space.

Can both be possible at the same time? Can you run out of space in the sense that you count off all the cubic miles--but you never come to an edge?

Both can indeed happen in a more restricted way in a very familiar example. Consider motions on the surface of the earth. If you start in Pittsburgh, choose any direction you like and keep moving straight ahead, you will eventually come back to where you started. There will be no edge for you to fall off. So the surface of the earth has the sort of properties we are looking for. It is finite in area. It is just 196,000,000 square miles. But it has no edge.

Of course the example seems strained. While we come back to where we started, we are really not going in a straight line, but in a big circle. While the two dimensional surface of the earth is finite without edge, it gets these properties because it is really curved into a third dimension. Does that fact really make such a difference to the possibility of a surface of finite area but no edge? What if we were flat beings trapped in the two dimensional surface of the earth, unable to sense the existence of this third dimension. All we know about the surface of the earth was what can be read off our two dimensional maps. Then all we would know was that we lived in a finite two dimensional space with no edge. That a third dimension might have something to do with this, to us would be speculation of little practical importance. We would have no way of accessing this third dimension.

Could the analogous thing happen for a three dimensional space? One of the big discoveries of 19th century geometry was that this is entirely possible. To get us started, imagine that there is a fourth dimension of space into which our three dimensions curve. Then we might end up with a three dimensional space which has finite volume but no edge. No matter which way you voyage in a spaceship, you will eventually come back to where you started, without hitting an edge. We satisfied ourselves that this is possible by imagining a fourth dimension of space. How seriously should we take this fourth dimension? Our two dimensional surface dwellers could ignore the possibility of a third dimension in doing their geometry. All that mattered to them were the geometrical facts of the earth's surface that they could measure. In the three dimensional case, it is the same. All that matters are the geometrical facts about our three dimensional space that are accessible to us three dimensional beings. In the end, this fourth dimension of space becomes a comfortable fable to help us get used to the idea that a finite three dimensional space without edge is entirely possible.

In the 19th century, this sort of space was an interesting mathematical curiosity. In 1917, shortly after Einstein had completed his general theory of relativity, he proposed that our cosmic space was really like this. This was the first relativistic cosmology. Whether space has this structure remains one of the most interesting of the open questions of modern cosmology. In Einstein's original universe, space had a finite volume: 1,000,000,000,000,000,000,000,000,000,000 cubic light years. That's a one followed by 30 zeros. But there is no edge.

Can time have a beginning?

Yes. At first this seems impossible. If time has a beginning, there must be a first event or at least a clustering of events near it. Surely something must have happened before them? Einstein's cosmology of 1917 was the first of many ever stranger cosmologies to be devised on the basis of his general theory of relativity. Einstein's first universe was static in time. The cosmologies that followed, starting in the 1920s, were not. They portrayed space itself as continually expanding. We can think of Einstein's universe as a three dimensional analog of a two dimensional spherical surface, somewhat like a balloon. Then this expansion simply corresponds to the inflation of the balloon.

Here is a picture of this expansion. The universe is represented by a sphere and time advances up the screen. So the small universe of long ago grows up the page to the universe of the present. Now imagine this expansion in reverse. As we look further and further back in time, the balloon gets smaller and smaller. In the typical cosmologies considered nowadays, not too long into the past the balloon would have shrivelled to nothing. At that point in our story, space would have ceased to be. One might try to image times before that moment. But it would be futile, since there is no space associated with the time. Indeed there is something highly suspect about the moment at which the balloon shrivels to a point. Then the curvature of the space becomes infinite and the basic equations of Einstein's theory break down.

This first moment is not really a moment in time at all. It really amounts to a lower bound on our projections into the past. If we think of it as "time=0," then only moments with a time coordinate greater than 0 have physical meaning.

It is the beginning of 'known' time and is known as the creation or if you will, "the big bang".

Is time travel possible?

Yes. The "yes" is intriguing, but there is a catch. The question did not ask if there really is time travel; it asked only if it is possible. Something can be possible without actually happening. It is possible for our earth to have two moons. In fact it has only one. While we have no evidence that time travel actually occurs, all our latest work in theories of space and time tell us that it is entirely possible. Broadly speaking, there are two senses of time travel, both possible.

1. The first sense is the H. G. Wells sense. This one is named after the author of the most famous story about time travel in which a voyager hops into a machine and travels about in time. Special relativity has room for something close. If we had things that travelled faster than light, then, for some observers, they would travel backwards in time. These faster than light objects are "tachyons." For some observers, they would leave today and arrive yesterday. Of course how we could get ourselves to travel faster than light is an unsolved problem! We cannot accelerate through the speed of light. But is there some way to recreate ourselves travelling faster than light? If so, some observers would judge us to be travelling backwards in time.

"There was a young lady named Bright,
Whose speed was far faster than light.
She set out one day
In a relative way,
And returned home the previous night."
Arthur Henry Reginald Buller

2. The second sense is more topological and has been called "Goedelian" (by John Earman) in honour of the great logician Kurt, Goedel, who was a friend of Einstein's and did pioneering work on spacetimes that admit time travel.

We can imagine space and time as forming a huge sheet of paper. the vertical line is the complete history through time of a person, experiencing the years ..., 1980, 1981, ... etc.

What Einstein did in 1917 was to get us to wrap up the sheet of paper in the spatial direction so travel in the direction "left" is wrapped around to meet travel in the direction "right". That way we always end up where we started.

What Einstein's theory also allows is that travel into the future of time can be wrapped around to connect with the past, so that if we persist long enough in time we end up back at the present.

This is not a type of time travel that we create with a machine. There's no device we can build that could somehow turn our spacetime into one that has this global structure. The best advice to someone who wants to travel in time this way is that they should be sure to be born into the right universe! However there are special circumstances that might bring about the wrapping around of future into the past at least locally. It might happen near black holes generated by gravitational collapse. It also may happen if we get very dense, very rapidly rotating matter.

Does the moon change because a mouse looks at it?

Yes. This "yes" depends upon quantum mechanics, in whose founding Einstein played a major role. It is our best theory of matter and is usually applied to deal with matter in the very small, that is, little particles like electrons. It tells us that matter in the very small has properties quite unlike the ones we are used to with ordinary objects. We are used to the idea that ordinary objects are either particles or waves. It turns out that in the small, particles are both particles and waves. They have a dual character that is quite perplexing when you first learn of it and, as far as I can tell, that perplexity never really goes away, even if you know a lot about them. Take electrons, for example. They are familiar to us from old-fashioned television tubes. The electrons are fired from a glowing element at the back of the tube. They are formed into a beam by deflecting magnetic fields.

When the electron is in flight in the beam, it behaves just like a wave. It spreads out in space, has a wavelength and frequency and can produce all sorts of wavelike phenomena, like interference patterns. These are just like the rippled patterns that water waves make on the surface of a pond when pebbles are dropped in. We can only get them because the waves are spread out in space. When these electrons strike the screen of the TV tube, they behave very differently. According to the standard text book accounts of quantum mechanics, they instantly cease to be wave. They collapse to a point, so they are now behaving like a particle. We see that localization through the emitting of a brief flash of light from just one point on the screen. (Many of those flashes combine to make the images we watch.) So sometimes an electron behaves like a wave; and sometimes like a particle. So what? The odd part is what decides whether the electron behaves like a wave or a particle. In the standard text book treatments, we decide by the act of observing the electron. An electron left to itself behaves like a wave. The moment we observe it--for example by having it smash into the screen of a TV tube so that we can see where it is from the flash of light produced--then it behaves like a particle.

That means that the second picture is incomplete. The electron will only cede its wavelike character if there is someone there observing it. Only then does it collapse.

That is the odd part. Standard, text book quantum mechanics tells us that the act of our observing the electron has caused it to collapse to a point. This astonishing idea troubled Einstein very greatly and he could never accept it. What difference does it make to the electron if we observe it or not? What Einstein also saw was that the difficulty could not be confined to minute objects like electrons. If individual particles have this dual wave-particle, then so do collections of particles. Our observing of them will also cause them to collapse. Big objects like steam locomotives, moons and planets are just many, many particles all in one place. They will also have a slight wave character, too small for us to notice, but there nonetheless. And when we observe them, they will collapse!

His collaborator and biographer Abraham Pais reports
"...during one walk, Einstein suddenly stopped, turned to me, and asked whether I really believed that the moon exists only when I look at it."
Abraham Pais, Subtle is the Lord. Oxford: Clarendon Press, 1982. p.5.

The famous physicist (and inventor of the name "black hole") John Wheeler also reported of Einstein
"...No one can forget how he expressed his discomfort about the role of the observer, 'When a mouse observes, does that change the state of the universe?' "
John A.Wheeler, "Memoir", pp. 21-22 in A. P. French, Einstein: A Centenary Volume. Cambridge: Harvard Univ. Press, 1979, on p. 22.

This question is a combination of these two remarks and the answer of yes is just standard text book physics.

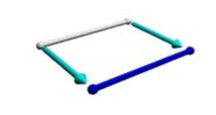
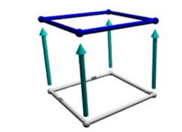
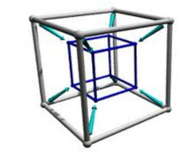
Fourth Dimension

"A fourth dimensional being can see all the sides of a three dimensional shape at once - irrelevant of how complex it is."

While giving someone a definition of the fourth dimension is relatively easy, giving someone an intuitive understanding of the fourth dimension can be quite difficult. A definition of the fourth dimension could go like this: The fourth dimension is all space that one can get to by travelling in a direction perpendicular to three-dimensional space. Whenever an uninitiated person hears this, they start pointing their finger around in the air, trying to figure out how it's possible for such a direction to exist.

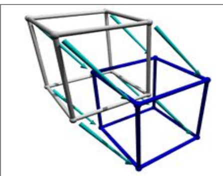
Such a short explanation gives them no intuitive feeling of the fourth dimension. In order to give you a better understanding the fourth dimension, I will begin with a method that follows a sequence of n-hypercubes that starts with the zeroth dimension and progresses up to the fourth dimension. An n-hypercube is the generalization of the cube within n dimensions, with a 3-hypercube just being the traditional cube. By seeing each n-hypercube build up from the previous one, you should have a better understanding of the final step, from the third dimension to the fourth dimension.

Step 1 **Zeroth Dimension**	Imagine a point in space. It is a 0-hypercube. A point is zero dimensional because it has no width, length, or height, and is infinitely small. Every point is exactly the same and has the same measurements, because it has no dimension.	

Step 2 **First Dimension**	Take the zero-dimensional point and extrude it in any direction, creating a line segment, which is a 1-hypercube. All line segments are one-dimensional because they differ in size by only one measurement, length. They all have the same width and height, which is infinitely small. If you expanded the line infinitely, it would cover one-dimensional space.	
Step 3 **Second Dimension**	Now take the line segment and extrude it in any direction that is perpendicular to the first direction, creating a square, which is a 2-hypercube. All squares are two dimensional because they differ with each other in size by two measurements, width and length. They all have the same height, which is infinitely small. All of the edges are the same length, and all of the angles are right angles. If you expanded the square infinitely, it would cover two-dimensional space.	
Step 4 **Third Dimension**	Take the non-infinite square and extrude it in a third direction, perpendicular to both of the first two directions, creating a cube, which is a 3-hypercube. All cubes are three dimensional because they differ with each other in size by all of the three measurements that we know of - width, length, and height. Just like the square, all of the edges within a single cube are the same length, and all of the angles are right angles. If you expanded the cube infinitely in all directions, it would cover three-dimensional space.	
Step 5 **Fourth Dimension**	Now, the final step. Take the non-infinite cube and extrude it in yet another direction perpendicular to the first three. But how can we do this? It is impossible to do within the restrictions of the third dimension (which will I refer to as realmspace in this webpage). However, within the fourth dimension, it is possible. The shape that results from this extrusion of a cube into tetraspace is called a tesseract, which is a 4-hypercube. All tesseracts differ from other tesseracts in size by four measurements (equal to each other within a single tesseract) - width, length, height, and a fourth measurement, trength.	

Looking back to the previous n-dimensional cubes, they all have the same trength, which is infinitely small. Just like the cube and square, all of the edges within a single tesseract are the same length, and all of the angles are right angles. If you expanded the tesseract infinitely, it would cover four-dimensional space. There are several ways to view the tesseract, and I will show three of them here. The first one is called an inner projection, and it is formed from a projecting the tesseract into realmspace with a perspective projection. The parts of the original tesseract that are farther away appear smaller in the inner projection. The original cube cell that existed before the extrusion into a tesseract is in gray, the paths of the vertices are in teal, and the stopping point of the extruded cube cell is in blue. The real tesseract isn't shaped like the inner projection shown above - the inner projection is a very distorted "image" of the original tesseract. All of the edges you see in the image are actually the same length as each other, and all angles between edges are right angles.

The second way to view a tesseract isn't actually a normal tesseract, but a parallel projection of a skewed tesseract. To make this shape, first you make a tesseract, then shift the top cube cell a short distance in a diagonal direction, parallel to realmspace. Since this shift is parallel to realmspace, it can actually be in any direction that you can point to. After the shift, you trace the shadow of the skewed tesseract's edges. The result is a shape that has two cubes with their vertices connected together. In the original shape, all of the edges within the cube cells are the same length and have right angles with each other. However, they don't have right angles with the teal connection edges, and the teal connection edges are slightly longer than the cube cells' edges.



The third way to view a tesseract is a parallel projection into realmspace. It is the same as a skewed tesseract, but without the top cube cell shifted. Since the edges of the tesseract were extruded in a direction perpendicular to realmspace, when the shape is projected back into realmspace, the edges of the blue cube cell are projected straight back onto the gray cube cell's edges. The resulting projection is a simple cube. This didn't happen with the inner projection, because that projection was a perspective projection. This last step of trying to view a tesseract shows the difficulties in portraying objects from tetraspace within the limitations of realmspace - there is an extra perpendicular direction that we can't depict within our own space without distorting the original object.

Because of these problems, it takes many examples in order to begin understanding the nature of the fourth dimension. You have now seen a glimpse of the fourth dimension. This is only the beginning - there are many more aspects of the fourth dimension to explore.

In the rest of these pages, I will discuss many properties of the fourth dimension - rotation, flatness, levitation, shapes, water, and many others. By the time you are finished, you should have learned many interesting things about the fourth dimension, and maybe you will have even made some discoveries of your own.

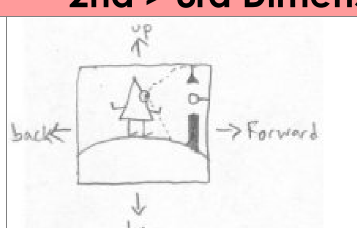
Tetraspace (four dimensional space) is a fascinating place. Events that would be bizarre and mind-bending to us puny little realmic beings would be common-place and taken for granted in tetraspace. Jumping straight into thinking about tetraspace is enough to boggle any human mind. An indirect route must be taken if there is any hope of understanding the possibilities of tetraspace. The method I use here is the one pioneered by the books Flatland and Sphereland, and is the one used in just about every other text about the fourth dimension.

First, the I tell of the adventures of a planar being (a two-dimensional being) attempting to understand realmspace. Going from planespace (two-dimensional space) to realmspace will shed light on how to conceptualize going from realmspace to tetraspace. While going from planespace to realmspace may seem overly simple, it is necessary to understand exactly what is happening so that you can understand the process of going from realmspace to tetraspace.

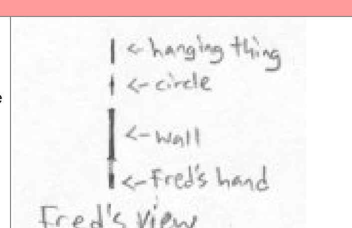
Just as tetraspace is mind-boggling to us realmic beings, realmspace is mind-boggling to planar beings. Things we take for granted are extremely difficult for planar beings to conceptualize. The only thing a planar being can see of our realmic objects is their planar cross sections in his planespace, and the effects of them rotating. At first, he will only be able to conceptualize the effects in planespace of realmic objects. He will only see planar objects in his mind. Eventually, with much deep thought and introspection, he may be able to conceptualize the realmic object itself. Similarly, when starting to think about tetraspace, we will only be able to conceptualize the effects of tetral (four-dimensional) objects in realmspace. We will only be able to see realmic objects in our mind at first. But, by the effects we see, we can carve a sculpture in our minds of how the full object really looks like, and conceptualize the whole of the tetral object.

2nd > 3rd Dimension

The name of our planar subject is "Fred". He lives in a plane called Flatland. The only directions that Fred knows of are forward, backward, up, and down. Fred has no concept of right or left. His viewing area is merely a vertical line. Here is a picture of Fred in his native habitat:

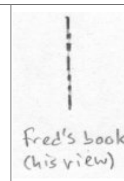


Since Fred's viewing area is only a line, he can't see as much at once as we can. Here is the view that Fred would see if he was in the picture here:



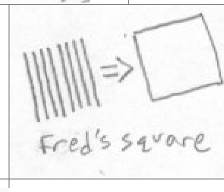
Unfortunately for Fred, he can't see backwards - he can only see forwards. It is impossible for him to simply spin around and face the opposite direction. It is easy for beings in realmspace to face a different direction because they can just spin around, left or right. The only way for beings in planespace to face a different direction though is to turn their head down and heels up. Fred either has to stand upside down to be able to see what is behind him, or he has to walk backwards blind because he only has an eye on his front side.

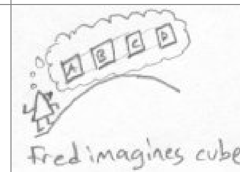
Fred's writing system is very rudimentary, since a linear surface doesn't allow much detail. His writing system looks somewhat like Morse code. Here is what a page from one of his books looks like, in his view:

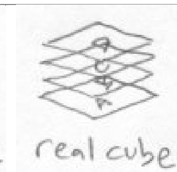


Fred understands the concept of a square. It can be imagined as a series of lines stacked side by side, so that the resulting shape has four sides. He has no concept of what a cube would look like, though. The best he could do is imagine a succession of squares next to each other. As you can see, this is far from the actual representation of a cube. A cube is a series of squares stacked on top of the other:

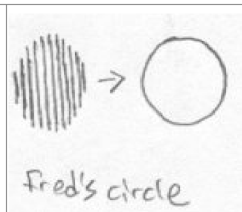
Fred understands the concept of a square. It can be imagined as a series of lines stacked side by side, so that the resulting shape has four sides. He has no concept of what a cube would look like, though. The best he could do is imagine a succession of squares next to each other. As you can see, this is far from the actual representation of a cube. A cube is a series of squares stacked on top of the other:



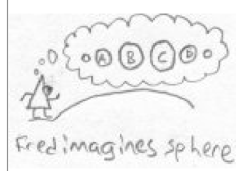




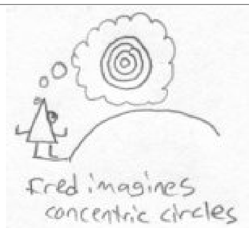
Fred also understands what a circle looks like. It can be imagined as a series of lines stacked side by side in the way that a square is formed, but the lines start small and expand to a certain size, then shrink down again at other side.



Fred can't understand what a sphere really looks like, though. He can imagine it as a series of circles, starting small and expanding, then shrinking down again. Here is how he might picture it:

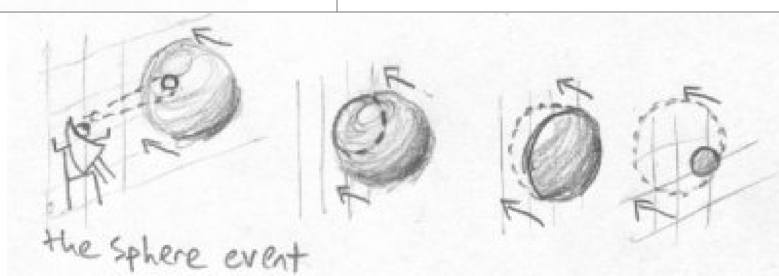


Or, he might decide to picture it as a group of concentric circles (circles with the same centre):



But, as you can see, that's not really what a sphere looks like. Now imagine Fred one day is sitting in his living room, and a sphere from realmspace passes through the air right before his eyes. To him, it will appear as if a circle appeared out of nowhere in front of him. It expands rapidly, and Fred fears that it is going to devour him and his house with him. But to his relief, its growth slows down and stops. Then, the circle starts shrinking again, but slowly. Then it starts to shrink faster and faster until it quickly disappears.

Here is what the event looks like:

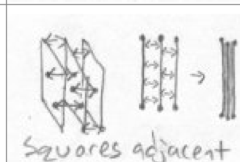


3rd > 4th Dimension

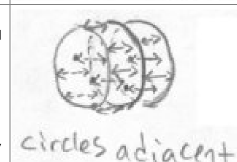
In realmspace, there is a character named Bob. He is basically your average guy - two legs, two eyes, a brain, all the usual body parts. His view of his world is a 2 dimensional plane, one dimension more than Fred has. Here is Bob in his native habitat, and his view of that habitat:

Since Bob has one dimension more than Fred has, his writing system can be more elaborate. He can write on a 2 dimensional surface. Instead of only one line of text on a page, there can be multiple lines. This allows a lot more text to me stored in a realmic book. Here is what a page from one of his books looks like:

Bob fully understands the concept of a cube. A cube is a sequence of squares laying top to bottom flat on top of each other. For any one square in this cube, every point on one surface of the square touches every other point on the surface of the square above it, and on the other side, touches every point on surface of the square below it. Here is an illustration:

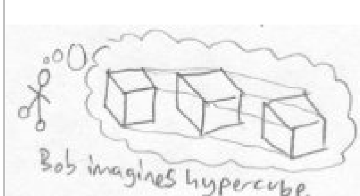


Bob also understands the concept of a sphere. A sphere is a sequence of concentric circles laying top to bottom on each other, as with a square. Like a square, adjacent slices of the circle touch each other at every point. Here is an illustration:



Bob has troubles imagining a tetracube, however. Here is the best he can do to imagine a tetracube:

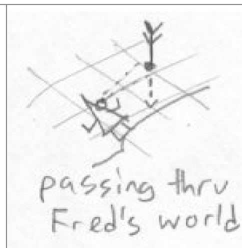
A tetracube is actually a sequence of cubes, where every part of a cube in this tetracube (all the insides of it) touch all the insides of the cube to its right and to its left (or its up and down, or its front and back).

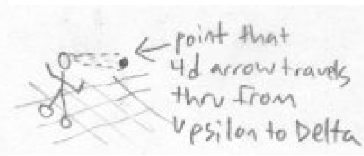


In actuality, the direction of the adjacent cubes are not imaginable in terms of 3d directions. I will call one of the directions into tetraspace Upsilon (for up) and the other Delta (for down). If Bob was viewing Fred's planar world, he would see that there are two sides to it. Bob could either be on top of Flatland or below it, but in order to get to the other side, Bob must go through Flatland.

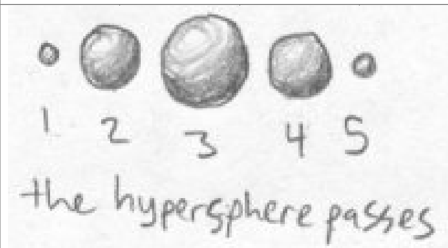
There is no other way to get to the other side. Planespace separates realmspace into two separate parts. In the same way, a tetral character (Let's call her Emily) would see that she is on one side of realmspace, and she'd have to pass through Bob's world to get to the other side of it. Realmspace separates tetraspace into two separate parts.

In the first illustration below, an arrow shows the path from one side of Flatland to the other. If the arrow was an object, Fred would only see a small point. In the second illustration, a tetral arrow that passes from one side of realmspace to the other would intersect realmspace with a small point. Bob doesn't see any other part of the arrow but this:





One day, Bob is innocently sitting in his living room (as Fred was that one day), and all of a sudden, in the middle of the air, a sphere appears and grows rather rapidly. Its size levels off at a point, then starts shrinking slowly. Its shrinking quickens until it completely disappears. Bob just experienced the passage of a tetrasphere (four dimensional sphere) through realmspace.

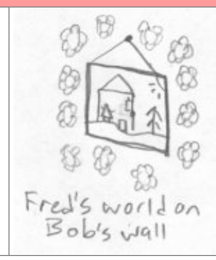


This is a table showing the relationship between the dimensions:

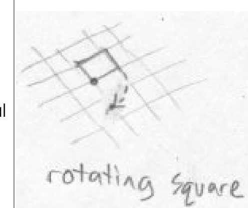
Person	Dimension	View	Rotation Axis
-	1st	Point(0D)	*None*
Fred	2nd	Line(1D)	Point(0D)
Bob	3rd	Plane(2D)	Line(1D)
Emily	4th	Realm(3D)	Plane(2D)

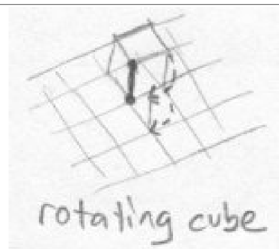
Rotation

I'm now going to describe in more detail the worlds of Fred, Bob, and Emily. Fred doesn't actually have much of an area to live in. His little 2D plane is actually hanging on the wall of Bob's living room. Bob can walk over and observe Fred any time he likes. Fred's world has a ceiling, a front, a back, and a floor. Bob's world, actually, isn't very big either. He has a ceiling, 4 walls, and a floor. His 3-D world is also hanging on a wall: in Emily's living room. Emily's world could also be hanging on someone else's wall, and so on. Here is Fred's world on Bob's wall:

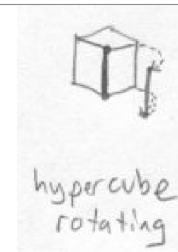


If a square is rotated in Fred's world, it rotates around a single point. This means that only a single point on the square stays at its original location as the square spins around. Thus, the axis of an object in planespace is zero-dimensional.

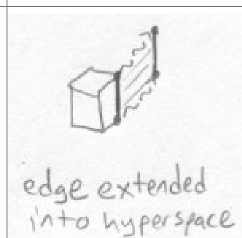




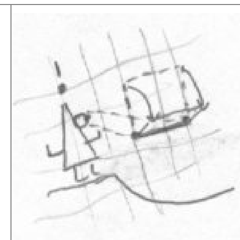
Now imagine that Emily lays Bob's world flat on a tetral table. The direction towards the table from Bob's world is delta (down in tetraspace), and the opposite direction into the air above the table is upsilon (up in tetraspace). Emily places a tetracube on top of Bob's world on the upsilon side of it. Bob's world is now sandwiched between the tetral table and the tetracube. The tetracube is intersected with Bob's world, so Bob sees a cube floating in mid-air. Now let's say that Emily rotates her tetracube around one of it's edges. Bob will only see a cube rotating, but the tetracube it's attached to is rotating with it. The axis of rotation for the tetracube isn't a line, though. It's a plane formed by extending the linear edge of the cube into Emily's world, perpendicular to realmspace. All of the points on this square stay in place as the tetracube rotates in tetraspace. Thus, the axis of an object in tetraspace is two-dimensional.



Imagining how the linear axis of a cube could extend into tetraspace is hard. We can try to picture it by imagining its axis shifting off in a random direction as pictured below, even though this isn't what is truly happening:

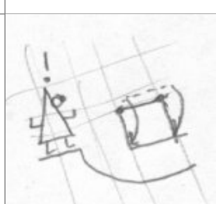


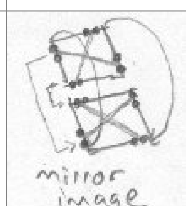
Fred is sitting in his living room the next day, and there is a square object floating in front of him in mid-air. Bob decides to play a trick on Fred. He grabs an edge of the square and pulls it into realmspace, leaving a linear edge in Fred's universe remaining. Fred only sees a line left of the original square. Here is what Bob just did:

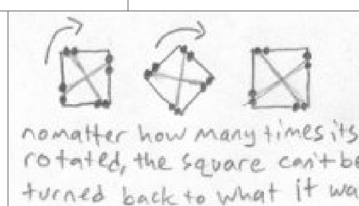


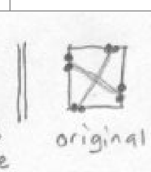
Bob completes the rotation and places the square fully back into Fred's world. But, now the edge that had disappeared is on the opposite side. Fred is now astonished to see that the square has been completely inverted.

Such an action would be impossible in a two dimensional world. Fred tries to invert the square back to its normal state, but no matter how many times he turns the square around, it doesn't work:

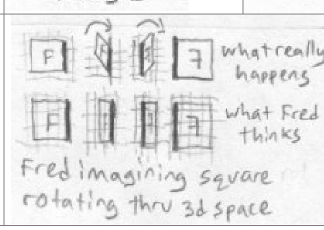




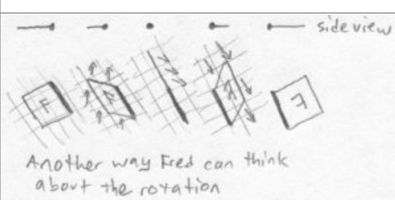




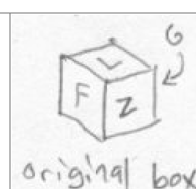
The square has become its mirror image, with its left and right sides swapped. Fred has difficulty understanding how this could have happened to his square. The first way he tries to imagine it is to imagine that one of the sides has been pushed through the middle of the square and to the opposite side, making everything inverted. This is how he imagines it:

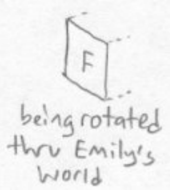


Fred contemplates what happened some more, but can't quite wrap his mind around it. He thinks about another way it might have happened. One side could have been shifted upwards and towards the other one until one side was above the other, then shifted further until it came into place on the other side. The moved side would have made a half circle around the side that stayed. Here is how he imagines it this time:

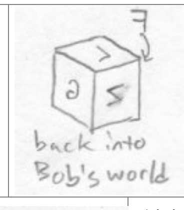


But, this is not what really happened. It is merely a futile attempt of Fred's to understand what's happened in the third dimension using only what he knows of the second dimension. The effects of Bob's actions are easy to see, but explaining them to Fred is not. Emily sees what Bob did to Fred, and decides to play a similar trick on him. Bob is sitting on his floor staring at a box that he has just filled with his favourite sentimental possessions, when all of a sudden the whole box except one of its sides disappears. Here is what he sees:



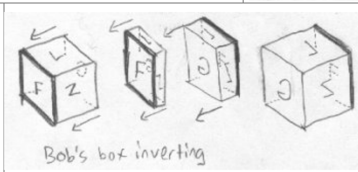


He stares at it astonished, and is even more surprised when all of a sudden the rest of the box appears again. But, the box has just appeared on the opposite side of the face that had remained. All of the lettering on the box has been turned into its mirror image. Here is what the box looks like afterwards:

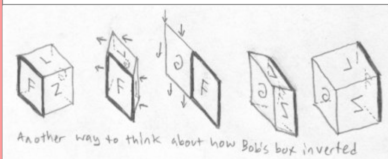


Bob looks into the box, and finds that something has happened to all the letters in the books that were in the box - they are all their mirror images! He takes one of the books and puts it up to a mirror, and finds that the mirror reverses the letters back to their original state.

As Fred did, Bob tries to understand how this could possibly occur. He tries to imagine one side of the box being squished into its opposite side, but being pushed further until it comes into place on the other side of the box from where it was before. All of the letters have been inversed:



This is analogous to Fred's solution with the disappearing side being squished through the remaining side. It isn't what really happened in tetraspace, though. Bob contemplates further, and again conceives of another idea like Fred did. Maybe one face of the box was shifted in a half circle around the side that remained. All the letters would end up being reversed just like in the previous theory:



As we know by looking at Fred's example, the size and shape of the square don't actually change as it's rotated through realmspace. The only ways that Fred has thought of to explain what happened involve the square changing shape. The real event doesn't require the square to change shape at all. It is the same situation with the cube. As it is rotated through tetraspace, the actual shape of it isn't changed at all; it remains a perfect cube. The only way we can imagine the result, however, is by distortions in realmspace.

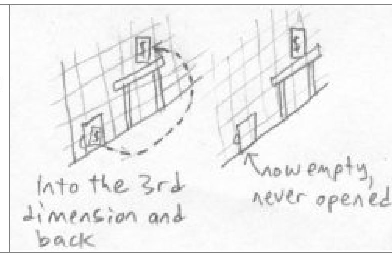
Flatness & Levitation

When Bob watches Fred's world, he can see every point in his world at once. He can see Fred's insides, what's inside his safe, what's underground, where the quarter he lost is, everything. Fred is basically naked to Bob, even though he has clothes on. Bob would be able to touch Fred's insides without having to go through Fred's skin, and there's nothing Fred would be able to do about it to stop him.

Bob doesn't realize it yet, but he is also exposed. Emily can see every part of his world at once. She can see inside his tightly locked safe, into his refrigerator, into his desk drawers, and she can see his insides. Bob is basically naked to Emily, even though he feels fully clothed. She can touch any part of his insides without having to go through his skin or his clothes. One day, Bob is feeling particularly devious and decides to remove the contents out of Fred's safe. He walks over to Fred's world, removes Fred's money from inside the safe and sticks it onto Fred's table.

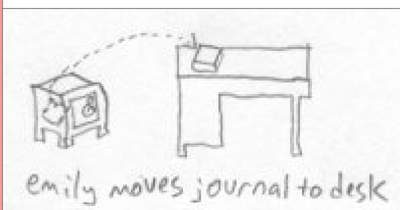
Bob doesn't have to open the safe because he can just bring it out of planespace into realmspace, move it, and then put it back into planespace. The money doesn't have to go through the walls of the safe because it can just pass "over" its walls in realmspace. Fred comes in from a leisurely walk in the woods and is astonished to see all his money lying on the table. He was sure he had put it in the safe the night before.

He checks out his safe, but nothing has happened to it. He opens it up, and it's empty. He sticks the money back into the safe, and makes sure it's closed securely. As soon as Fred closes the safe, Bob grabs the money again and puts it on the table behind Fred. Fred turns around to see the money he had just secured now lying behind him. Now Fred thinks he is going crazy.

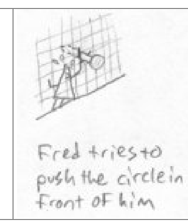


Emily has seen what Bob did to Fred, so she decides to teach him a lesson by doing the same thing to him. Bob has his journal locked up in his safe, which has both a combination lock and a key lock on it. Bob knows his safe is secure because he bought the best safe on the market and only he knows the combination to it. Emily removes the book from the safe by pulling it into tetraspace. She moves it over to Bob's desk and reinserts it back into realmspace. The book didn't have to go through the walls of the safe because it could go "over" its walls in tetraspace. Bob is reading another book and looks up to see his journal sitting right in front of him.

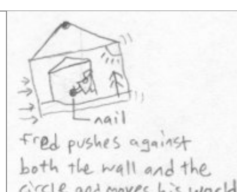
He is quite stunned and confused, because he was sure he had put the journal into his safe. He checks out the safe, and there seems to be nothing wrong with it. He takes the journal and puts it back into his safe, making sure it's definitely locked. He even ties a rope around the safe so that he can see if anyone tampers with it. He returns to his desk and resumes his reading. Emily grabs the journal again, moving it to tetraspace and inserting it back on the table in front of him. When Bob looks down and sees the journal in front of him again, he thinks he is going crazy. He looks back to see the rope still tied around the safe, exactly the way he left it. Then he remembers what he did to Fred, and realizes that someone else may be doing the same thing to him.



Bob decides to have some more fun and tease Fred again. Fred's world is hanging on Bob's wall, but not tightly. Bob takes a nail, and right in front of Fred's view, he hammers the nail right through Fred's world. All of a sudden Fred sees a circle appear in mid-air. He decides to investigate, so he grabs it and tries to move it, but it won't move. It is thoroughly fastened in mid air.

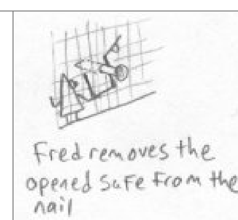


This is rather bizarre and he decides to try some things with the floating circle. He sits against a wall of his house and pushes against the circle with his feet. It requires a lot of effort, but the circle moves. It feels like he is holding up the whole world, and in reality that is what he is doing. When Fred lets go of the circle, it swings back to its original position and Fred falls to the ground.

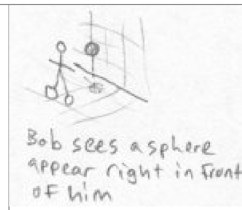


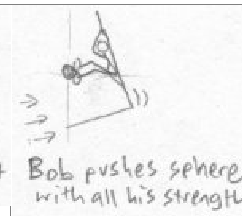
Bob removes the nail, so Fred sees the circle suddenly vanish. Bob raises Fred's safe into the air and drives a nail through the middle of it. He lets it go, and the safe hangs in mid air on the nail. The nail didn't have to go through any of the walls of the safe in order for the safe to be hanging.

The nail just went through the air through the inside of the safe. This is similar to hanging a loop with a nail on the wall in realmspace - the loop itself doesn't have to be pierced, but the nail has to go through the area in the middle of the loop. To Fred, the circle was just a strange object hanging in mid-air, but now Fred's own safe is hovering. Fred opens his safe and looks inside, and to his surprise he sees that the circle has reappeared, but now his safe is hanging on it. Fred removes the safe from the "hook" and puts it back on the ground. This has been enough bizarre events for one day, so he goes outside to get a breath of fresh air.



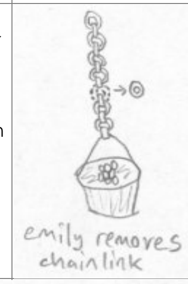
Emily sees that Bob hasn't learned his lesson. She does the same type of thing to Bob with the hope that Bob will realize what's happening to him. She has Bob's world hanging on her wall and she drives a "tetranail" (four-dimensional nail) through his world. Bob sees a sphere suddenly appear in mid-air near a wall. He remembers what he just did to Fred, and to test out his hypothesis he does the same thing that Fred did. He sits back against the wall and pushes against the sphere with all his strength. He succeeds in pushing it a few inches, but it requires a lot of effort. When he lets go, the sphere swings back to its original position and he falls on the floor. Bob is starting to realize that something else is out there.

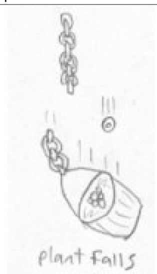




Emily also performs the "Levitating Safe" trick. She raises Bob's safe into the air and drives the tetranail through the air in the middle of it. Emily didn't have to pierce any of the sides of the safe in order to hang the Bob's safe on her wall. Bob opens the safe and sees that the safe is hanging on the sphere, just like Fred's safe was hanging on the circle. He pulls the safe off of the levitating sphere and places it back on the floor.

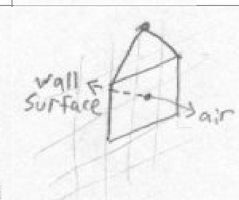
Emily decides to play another trick on Bob. Bob has a plant hanging from his ceiling by a chain. Emily holds the plant in the air while she pulls one of the chain links into tetraspace. She puts the chain link back into realmspace at a different location and lets both the plant and the chain link drop to the floor. Bob sees this and walks over cautiously to inspect the scene. He sees a plant on the ground with dirt everywhere, a single chain link intact sitting next to the plant, and the rest of the chain hanging from the ceiling, intact. None of the chains had to be bent or broken open for Emily to perform her trick. Bob couldn't have played this particular trick on Fred because chains aren't possible in planespace.



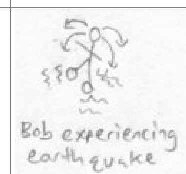


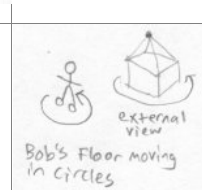
Bob decides to continue playing tricks on Fred so that he can see what the equivalent is in his own world. Bob decides to try rocking Fred's world back and forth along the wall. Since Fred's world is swaying back and forth, he can't hold his balance and falls over.

One surface of Fred's world scrapes against the wall, but on the other side is only in contact with the air in Bob's world. Fred's world can only move two directions and still be in contact with the wall. If Fred's world is moved in a third direction (outward), it is no longer in contact with Bob's wall.



Emily watches what Bob has done and does the same thing to Bob. She has 4 directions she can push Bob's world to and still have it scrape against her wall. First she pushes it front and back, then left and right. To Bob it feels like there's an earthquake happening. Emily stops Bob's world from moving, then starts it moving around in circles. This whole time, all of Bob's world is scraping against Emily's wall, not falling off. If Emily moves Bob's world in a fifth direction (outward), then it is no longer in contact with her wall.





5 Card Games

A form of entertainment for hundreds of years with almost unlimited games to play either solo or together. A pack of cards is probably the heaviest form of entertainment you want to carry. For a lighter form of playing cards, check out 'Air Deck'. They're half the width of regular cards and waterproof.

Subheadings

1. Solitaire	**2. Klondike**	**3. Spider Solitaire**	**4. FreeCell**
5. Hearts	**6. Spades**	**7. Rummy**	**8. President**
9. Cold Hands Poker	**10. Streets and Alleys**	**11. Sixty-Six**	**12. Guts**
13. Bingo	**14. Six Card Golf**	**15. Linger Longer**	**16. Bridge**
17. Authors	**18. Indian Poker**	**19. Hold 'Em**	**20. Poker Hands**
21. Other Card Games			

1 Solitaire

Solitare	**Age:** 8+ **Players:** 1	**Duration:** 15m	**Cards:** 52 Card Deck	**Card Rank (L > H):** A, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K
Aim	The first objective is to release and play into position certain cards to build up each foundation, in sequence and in suit, from the ace through the king. The ultimate objective is to build the whole pack onto the foundations, and if that can be done, the Solitaire game is won.			
Card Rank	The rank of cards in Solitaire games is: K (high), Q, J, 10, 9, 8, 7, 6, 5, 4, 3, 2, A (low).			
Dealing	1. The Tableau: Seven piles that make up the main table. 2. The Foundations: Four piles on which a whole suit or sequence must be built up. In most Solitaire games, the four aces are the bottom card or base of the foundations. The foundation piles are hearts, diamonds, spades, and clubs. 3. The Stock (or "Hand") Pile: If the entire pack is not laid out in a tableau at the beginning of a game, the remaining cards form the stock pile from which additional cards are brought into play according to the rules. 4. The Talon (or "Waste") Pile: Cards from the stock pile that have no place in the tableau or on foundations are laid face up in the waste pile. To form the tableau, seven piles need to be created. Starting from left to right, place the first card face up to make the first pile, deal one card face down for the next six piles. Starting again from left to right, place one card face up on the second pile and deal one card face down on piles three through seven. Starting again from left to right, place one card face up on the third pile and deal one card face down on piles four through seven. Continue this pattern until pile seven has one card facing up on top of a pile of six cards facing down. The remaining cards form the stock (or "hand") pile and are placed above the tableau. When starting out, the foundations and waste pile do not have any cards.			

Solitaire	
Playing	The initial array may be changed by "building" - transferring cards among the face-up cards in the tableau. Certain cards of the tableau can be played at once, while others may not be played until certain blocking cards are removed. For example, of the seven cards facing up in the tableau, if one is a nine and another is a ten, you may transfer the nine to on top of the ten to begin building that pile in sequence. Since you have moved the nine from one of the seven piles, you have now unblocked a face down card; this card can be turned over and now is in play. As you transfer cards in the tableau and begin building sequences, if you uncover an ace, the ace should be placed in one of the foundation piles. The foundations get built by suit and in sequence from ace to king. Continue to transfer cards on top of each other in the tableau in sequence. If you can't move any more face up cards, you can utilize the stock pile by flipping over the first card. This card can be played in the foundations or tableau.

If you cannot play the card in the tableau or the foundations piles, move the card to the waste pile and turn over another card in the stock pile. If a vacancy in the tableau is created by the removal of cards elsewhere it is called a "space", and it is of major importance in manipulating the tableau. If a space is created, it can only be filled in with a king. Filling a space with a king could potentially unblock one of the face down cards in another pile in the tableau. Continue to transfer cards in the tableau and bring cards into play from the stock pile until all the cards are built in suit sequences in the foundation piles to win!

2 Klondike

Klondike	**Age:** **Players:** 1	**Duration:**	**Cards:** 52 Card Deck	**Card Rank (L > H):**
Aim	The goal is to get the four suits built onto the foundations from aces up through kings.			
Dealing	Deal out 28 cards in seven piles as follows: The first pile is one card; the second pile has two cards, and so on up to seven in the last pile. The top card of each pile is face up; all others are face down.			
Playing	The four aces form the foundations. As it becomes available, each ace must be played to a row above the piles. Cards in the appropriate suit are then played on the aces in sequence - the two, then the three, and so on - as they become available. Any movable card may be placed on a card next-higher in rank if it is of opposite colour. Example: A black five may be played on a red six. If more than one card is face up on a tableau pile, all such cards must be moved as a unit. When there is no face-up card left on a pile, the top face-down card is turned up and becomes available. Only a king may fill an open space in the layout. The player turns up cards from the top of the stock in groups of three, and the top card of the three may be used for building on the piles, if possible, played on a foundation. If a card is used in this manner, the card below it becomes available for play. If the up-card cannot be used, the one, two, or three cards of the group are placed face up on the waste pile, and the next group of three cards is turned up.			

3 Spider Solitaire

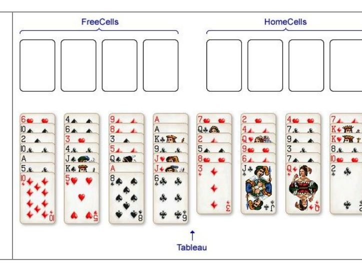
Solitare	**Age:** **Players:** 1	**Duration:**	**Cards:** 2x 52 Card Deck	**Card Rank (L > H):**
Aim	The goal is to assemble 13 cards of a suit, in ascending sequence from ace through king, on top of a pile. Whenever a full suit of 13 cards is so assembled, it is lifted off and discarded from the game. The game is won if all eight suits are played out.			
Dealing	Ten piles of five cards each are dealt by rows. The first four cards of each pile are dealt face down, the top cards face up.			
Playing	The top card of a pile may be moved, together with all face-up cards below it that follow in ascending suit and sequence. A sequence of available cards may be broken at any point by leaving some cards behind. Example: If a pile from top down shows 4, 5, 6, 7, either the first one, two, or three cards may be moved as a unit, but the 7 may not be moved until the covering three cards are removed. When all face-up cards on a pile are removed, the next card below is turned face up and becomes available. A movable unit of cards may be placed either in a space or on a card of the next-higher rank to the bottom card of the unit, regardless of colour or suit. Example: If the bottom card of a unit is the J, it may be moved onto any one of the four queens. A king can be moved only onto a space. Alternatively, the spaces may be filled with any movable unit. When all possible or desired moves come to a standstill, the player deals another row of ten cards face up. However, before such a deal may be made, all spaces must be filled. The final deal consists of only four cards, which are placed on the first four piles.			

4 FreeCell

FreeCell	**Age:** 8+ **Players:** 1	**Duration:** 15-30m	**Cards:** 52 Card Deck	**Card Rank (L > H):** A, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K

FreeCell is a solitaire card game played using the standard 52-card deck. It is fundamentally different from most solitaire games in that very few deals are unsolvable, and all cards are dealt face-up from the very beginning of the game.

Aim	The object of the game is to build the four HomeCells up in ascending suit sequence from Ace to King. e.g. A♦, 2♦, 3♦, 4♦, 5♦, 6♦, 7♦, 8♦, 9♦, 10♦, J♦, Q♦, K♦ with cards of identical suit.
Setup	The game is played with a single pack of 52 playing cards. After thoroughly shuffling the deck, a row of eight cards is dealt face up to start the tableau. A further five rows of eight cards are dealt face up on top of the first to form eight columns of six cards each. The final four cards are dealt to the first four columns so that the first four columns in the tableau each contain seven cards and the last four columns on the right each contain six cards.

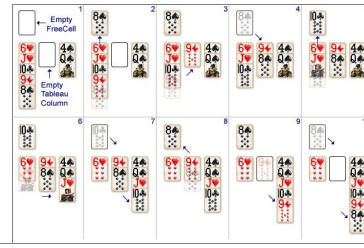


Playing	The exposed card at the end of each tableau column is available for play. You may move it to an empty FreeCell at any time to release the card beneath, but it's a good idea to keep the FreeCells empty for as long as possible. As each Ace becomes available it may be transferred to one of the HomeCells. The HomeCells are built up in ascending suit sequence to the King. You may move an exposed card from end of a tableau column or from a FreeCell to another tableau column if it will form a descending sequence of alternating colours, e.g. 6 on 7 or Q on K just like in Klondike. Empty spaces in the Tableau can be filled by any card you like, but don't waste them as empty tableau spaces are very powerful as we will see later. You keep moving single cards, one at a time, until the game either blocks or comes out.

Moving a Sequence of Cards
Although the rules of FreeCell permit you to move just one card at a time, the empty FreeCells allow you to move an entire sequence of packed cards:

Consider the arrangement of cards to the right, where you would like to move the packed sequence of five cards J♥, 10♣, 9♦, 8♠, 7♥ from the first tableau column to the exposed Q♠ at the end of the second column. If all four FreeCells are empty then you can achieve this by moving the 7♥ to the first FreeCell, the 8♠ to the second FreeCell, the 9♦ to the third and finally the 10♣ to the forth FreeCell. This releases the J♥, allowing it to be built onto the Q♠ at the end of the second column. You can then move the 10♣ down from its FreeCell to pack onto the J♥ followed by the 9♦, the 8♠ and finally the 7♥, effectively transferring the entire packed column over while keeping to the FreeCell rules that state you can only move one card at a time.

Now imagine if one of the above FreeCells were already occupied by a card leaving only three empty. It wouldn't be possible to transfer a five card sequence with single card movements; you could only move four. As a rule of thumb, the size of the packed column that you can transfer is equal to the number of empty FreeCells plus one (this increases if you have empty tableau columns as we will see later). It would be rather tedious if you had to juggle all these cards around manually in order to move a packed sequence which is why the digital versions of the game automate this process for you.



Supermoves
Usually, the maximum number of cards you can move at once is equal to the number of empty FreeCells plus one. However, this number doubles for every empty tableau column (unless you're moving the sequence to an empty tableau column, then that column doesn't count). This is because an empty tableau column acts like an extra FreeCell, only it's more powerful because you can pack extra cards onto it.

If you had four empty FreeCells and an empty tableau column then you would be able to move a sequence of ten cards rather than five, by moving the first five packed cards to the empty tableau column using the four FreeCells as temporary storage space as in the above example.

You then move the remaining five cards to their destination column by using the four FreeCells and finally you move the five cards you packed into the empty tableau column over to the destination column, again using the four FreeCells as temporary storage space. Whenever you move a sequence of cards using an empty tableau column, it's called a "Supermove".

One of the most common uses for a Supermove is to move a four card sequence from one column to another when there is only one empty FreeCell but you have an empty tableau column. The following set of diagrams illustrate how it's possible to move the packed J♥, 10♣, 9♦, 8♠ sequence from the first tableau column to the exposed Q♠ at the end of the second column using a single empty FreeCell and an empty tableau column:

5 Hearts

Hearts	Age: Players:	Duration:	Cards:	Card Rank (L > H):

Hearts is an "evasion-type" trick-taking playing card game for four players, although variations can accommodate between three and six players. The game is also known as Black Lady, Black Maria, Black Widow, and Slippery Bitch, though any of these may refer to the similar but differently-scored game Black Lady.

Aim	
Dealing	
Playing	

6 Spades

Spades	Age: Players:	Duration:	Cards:	Card Rank (L > H):

Spades is a trick-taking card game devised in the United States in the 1930s. It can be played as either a partnership or solo/"cutthroat" game. The object is to take at least the number of tricks that were bid before play of the hand began.

Aim	
Dealing	

ENTERTAINMENT

Spades	
Playing	

7 Rummy

Rummy	**Age:** **Players:**	**Duration:**	**Cards:**	**Card Rank (L > H):**

Rummy is a group of matching card games notable for similar gameplay based on matching cards of the same rank or sequence and same suit.

Aim	
Dealing	
Playing	

8 President (Warlords and Scumbags)

President	**Age:** 5+ **Players:** 4-7	**Duration:**	**Cards:** 52 or 54 Card Deck	**Card Rank (L > H):**

Aim	Gameplay is similar to Dai Hin Min, in which players attempt to get rid of their cards first. It is generally played as an aces-high game, although 2s are often played as being higher than aces (so that the 3 is the lowest card).
Special Titles	There may be many titles used by players during the game. Often, players move seats to sit in the order of their place, so as not to forget the order. There is at least a President and Scum. The rankings for four players are as follows: ♣ **President / Warlord** - The winner of the previous round. ♣ **Vice President** - Second place. ♣ **Vice Scum** - Next-to-last place. ♣ **Scum** - Last place in the previous round.

For games with six or more players, more titles can be added. Common extra titles include the Secretary one level below VP, Citizens, Middle-men, Normals, Neutrals or Average Joes in between the high and low named ranks, and Clerk one level above Vice-Scum. Other ranking systems use the presidential line of succession. Rules regarding card passing or drinks can be changed to accommodate these two positions if desired. A large and/or odd number of players generally calls for having at least one Average Joe, but there can be as many as needed.

Dealing	The person who is President shuffles and deals the cards. All the cards are dealt as evenly as possible in clockwise rotation. After cards are dealt, the Scum must hand over his best two cards to the President, while the Vice-Scum must hand over his best card to the Vice President. In any event, the players who receive cards from the bottom positions always hand back an equal number of any "junk" cards they do not want. They are not obliged to pass back their lowest cards, but often do.
Playing	The player on the dealer's left begins by leading any number of cards of the same rank (1-4; 5 or more are possible with wildcards, jokers or multiple decks). The player on the left may then play an equal number of matching cards with a higher face value, or may pass. Note that the same number of cards as the lead must be played. If the leader starts with a pair, only pairs may be played on top of it. If three-of-a-kind is led, only three-of-a-kinds can be played on top of it. The next player may do the same, and so on. This continues until all players have had a turn.
Notes	♣ The ordering of the face values is a little different from most American card games - the deuce (2) is the highest value (besides the joker, if that card is used) and is unbeatable, though certain variants allow a single 2 to be topped by a pair of 2s. The ace is next highest, the King the next highest, etc. with the 3 being the lowest. A few variants allow a single deuce to be played on top of any other combination, but typically games require the same number of deuces to be played as were originally led. In a few variants, the 2 (and no other card) can be placed at any time, even if it is not the player's turn.

♣ When players pass, this does not limit them in any way from playing later, even during the same trick. This can be critical, because it is highly important to be the player who plays last on any given trick. (For instance, if Alice plays a queen, and Bob holds a king and a 2, he might not want to play either card right away. His king is likely to be taken by an ace, and his 2 would be "wasted" on a mere queen.) In some variants, however, a player actually cannot play on a trick in which he or she passed previously.
♣ Players can pass at any time, even if the player has cards that could be played.
♣ The number of cards that can be led to begin any trick is only dependent on the cards in the player's hand and his/her strategy. In a game with two decks, it is absolutely legal to start out a trick with, say, seven 5's. (In this case, obviously, seven 5's are only possible if the owner of those seven 5's is the one who begins the trick. This adds to the necessity to "capture" tricks by being the one to play the highest card.)

Round End	When one player runs out of cards, he/she is out of play for the rest of the round, but the other players can continue to play to figure out the titles. A few versions hold that once a player goes out, players count remaining card values to establish titles, or simply count the number of cards remaining in each player's hand, and other versions have one player left with cards at the end.
First Turn	The very first round of the game normally begins with whoever has the 3 of spades, since there is no sitting President. If playing with more than four players and more than one deck of cards, another opener will be decided by the players. The 3 of diamonds may be played with other 3's. After the first round has determined player rank, subsequent hands are opened by the President.

Trading	After the President (or whoever deals) has dealt and everyone has received their decks, the players are able to trade cards with one another. In a group of four, the President gives two cards of his choice to Scum (who responds with his two very best), and the VP gives one card of her choosing to Vice Scum, who responds with her very best card. In some variants, the President may choose to allow a Black Market, in which any player can trade with any other player. When this happens, the President usually has a poor hand and needs better cards.

9 Cold Hands Poker

Cold Hands Poker	Age: Players: 1-5+	Duration:	Cards: 52 Card Deck	Card Rank (L > H):
Aim	The goal of each player is to win the pot, which contains all the bets that the players have made in any one deal. A player makes a bet in hopes that he has the best hand, or to give the impression that he does. In most Poker versions, the top combination of five cards is the best hand.			
Playing	Each player puts up an agreed ante. Five cards are dealt to each player, one at a time, face up and the highest hand takes the pot. There is no draw and there are no rounds of betting.			

Hands

No Pair	This very common hand contains "nothing." None of the five cards pair up, nor are all five cards of the same suit or consecutive in rank. When more than one player has no pair, the hands are rated by the highest card each hand contains, so that an ace-high hand beats a king-high hand, and so on.
One Pair	This frequent combination contains just one pair with the other three cards being of different rank. An example is 10, 10, K, 4, 3.
Two Pairs	This hand contains a pair of one rank and another pair of a different rank, plus any fifth card of a different rank, such as Q, Q, 7, 7, 4.
Three of a Kind	This combination contains three cards of the same rank, and the other two cards each of a different rank, such as three jacks, a seven, and a four.
Straight	Five cards in sequence, but not all of the same suit is a straight. An example is 9♥, 8♣, 7♠, 6♦, 5♥.
Flush	Five cards all of the same suit, but not all in sequence, is a flush. An example is Q, 10, 7, 6, and 2 of clubs.
Full House	This colourful hand is made up of three cards of one rank and two cards of another rank, such as three 8s and two 4s.
Four of a Kind	This is the next highest hand. An example is four aces or four 3s.
Straight Flush	This is the highest possible hand when only the standard pack is used, and there are no wild cards. A straight flush consists of five cards of the same suit in sequence, such as 10, 9, 8, 7, 6 of hearts.
Five of a Kind	This is the highest possible hand and can occur only where at least one card is wild, such as a joker. Examples of five of a kind would be four 10s and a wild card or two queens and three wild cards.

10 Streets and Alleys

Streets and Alleys	Age: Players: 1	Duration:	Cards: 52 Card Deck	Card Rank (L > H):
Aim	The goal is to get all cards built onto the foundations.			
Dealing	A column of four cards is dealt to the centre of the table, slightly to the left. A column of four cards is then dealt to the right of centre, leaving room between these two columns for another column. All cards are dealt face up. The player continues dealing the cards in columns of four alternately to the left and right, overlapping outward from the centre with the cards already dealt. The entire pack is dealt out, so that each row on the left will contain seven cards and each row on the right, six cards.			
Foundations	The four aces form the foundations. As each ace is released, it is moved into the centre between the left and right rows that were dealt. The foundations are built up in suit and sequence.			
Building	Only the outermost card of each row is available for transfer. A card may be moved onto the outer end of a row, provided that it is in descending sequence with the card there, regardless of suit. Example: The 5 may be placed on 6♦, 6♥, 6♣, or 6♠. Any available card may be placed on a space.			

11 Sixty-Six

Sixty-Six	Age: Players: 2	Duration:	Cards: 9, 10, J, Q, K, A of each suit	Card Rank (L > H): 9, J, Q, K, 10, A
Dealing	Deal six cards each, three at a time, beginning with your opponent. The thirteenth card is turned up for trump and laid beside undealt cards, which become the stock.			

ENTERTAINMENT

Sixty-Six

Aim	The goal is to score 66 points as follows: ♣ Marriage in trumps (K, Q announced) 40 ♣ Marriage in any other suit (K, Q announced) 20 ♣ Each ace (taken in on tricks) 11 ♣ Each ten (taken in on tricks) 10 ♣ Each king (taken in on tricks) 4 ♣ Each queen (taken in on tricks) 3 ♣ Each jack (taken in on tricks) 2 ♣ Winning last trick 10
Playing	The non-dealer leads first. No one is obligated to follow suit. The higher card of the suit led, or a trump played to a plain-suit lead, wins the trick. The winner of the trick draws the top card of the stock (the opponent taking the next card), and leads for the next trick. Either player holding the nine of trumps may exchange it for a higher trump card at any time, provided he has previously won a trick, unless the nine is the last card in the stock. A "marriage" is announced by showing the appropriate king and queen and leading one of those cards. Marriages may be announced only when one of the two cards is played - unless a player by showing a marriage makes his score 66 or more. The non-dealer may announce a marriage on his first lead and score it after he wins a trick. After the stock is exhausted or closed, the non-leader on each trick must follow suit if possible. Marriages may still be scored.
Closing	Either player may close (end the game), when he has the lead, either before or after drawing, by turning down the trump card. Thereafter, no cards are drawn, and the last trick does not score 10 points. If either player announces during play that his score is 66 or more, the play immediately stops and the game is "closed.
Keeping Score	The player who first reaches 66 scores 1 game point. If he reaches 66 before the opponent gets 33 (a "schneider"), he scores 2 game points; if before the opponent gets a trick (a "schwarz"), he scores 3 game points. If neither player scores 66, or each has scored 66 or more without announcing it, no one scores in that hand and 1 game point is added to the score of the winner of the next hand. If a player "closing" gets 66 or more, he scores the same as if the game had been played out. If the player fails, the opponent scores 2 points. If a player closes before his opponent has taken a trick, but fails to score 66, the opponent scores 3 points. The player who scores 7 game points first, wins.

12 Guts

Guts	**Age:** **Players:** 2-5+	**Duration:**	**Cards:** 52 Card Deck	**Card Rank (L > H):**
Dealing	Each player is dealt 2 cards; face down, starting with the player to the left of the dealer.			
Playing	Each round starts with an ante. Starting with the player to dealer's left and continuing clockwise around the table, ending with the dealer, each player in turn says either "in" or "out." Players who say "out" cannot win the pot, but do not lose any extra money. If more than one player says "in," all those who are "in" show their cards, and the player with the best cards wins the pot.			
Scoring	♣ Aces are high ♣ Any pair of equal cards beats any two unequal cards ♣ A higher pair beats a lower pair ♣ Between two non-pair hands, the hand with the highest card wins ♣ If two hands have equal high cards, the hand whose other card is higher wins.			

13 Bingo

Bingo	**Age:** **Players:** 2-5+	**Duration:**	**Cards:** 2x 52 Card Deck	**Card Rank (L > H):**
Dealing	From the first deck of cards, five cards are dealt to each player face up. There will be players and one "Caller" who will call out the card values that players must match in order to complete their "Bingo" hand.			
Playing	From the second deck of cards, the "Caller" will select a card, one at a time, and call out the rank and suit of the card - for example "queen of hearts." The player with the called card turns it face down. The first player to turn all their cards face down wins.			

14 Six Card Golf

Six Card Golf	**Age:** **Players:** 2-4	**Duration:**	**Cards:** 52 Card Deck	**Card Rank (L > H):**
Dealing	Each player is dealt 6 cards face down from the deck. The remainder of the cards are placed face down, and the top card is turned up to start the discard pile beside it. Players arrange their 6 cards in 2 rows of 3 in front of them and turn 2 of these cards face up. The remaining cards stay face down and cannot be looked at.			
Playing	The object is for players to have the lowest value of the cards in front of them by either swapping them for lesser value cards or by pairing them up with cards of equal rank. Beginning with the player to the dealer's left, players take turns drawing single cards from either the stock or discard piles. The drawn card may either be swapped for one of that player's 6 cards, or discarded. If the card is swapped for one of the face down cards, the card swapped in remains face up. The round ends when all of a player's cards are face-up. A game is nine "holes" (deals), and the player with the lowest total score is the winner.			
Scoring	♣ Each ace counts 1 point. ♣ Each 2 counts minus 2 points. ♣ Each numeral card from 3 to 10 scores face value. ♣ Each jack or queen scores 10 points. ♣ Each king scores zero points. ♣ A pair of equal cards in the same column scores zero points for the column (even if the equal cards are 2s).			

15 Linger Longer

Linger Longer	Age: Players: 4-5+	Duration:	Cards: 52 Card Deck	Card Rank (L > H):
Dealing	Each player receives as many cards as there are players in the game. For example, if there are five players, each player gets five cards. The dealer shuffles the cards and deals them one at a time face down to the players. The remaining cards are placed in a stack in the centre of the players. This stack becomes the stock. Once all players have their cards, the dealer takes the last card they dealt to themselves and turns it over, showing all the other players, then places it back into their hand. The card shown is the trump suit for the game.			
Playing	The player directly to the left of the dealer goes first, putting any card in the trump suit in the middle of the table. If a trump card cannot be played, the player can play any card in his hand. The next player goes by playing the suit or a trump card. You are trying to win the trick, so play the highest ranking card possible. Play continues to the left until every player has played their card. Whichever player played the highest card or highest trump card, if a trump card was played, wins the trick. The cards from the finished trick are placed to the side and the winner of the trick takes the top card from the stock adding it to their hand. The winner then plays the first card starting the next trick. If at any time during the game a player runs out of cards, they immediately withdraw from the game			

16 Bridge

Bridge	Age: Players: 4	Duration:	Cards: 52 Card Deck	Card Rank (L > H): ♣ > ♦ > ♥ > ♠ & 3, 2, 3, 4, 5, 6, 7 ,8 ,9, 10, J, Q, K, A
Dealing	The dealer distributes 13 cards to each player, one card at a time, face down, beginning with the player on his left.			
Aim	Each partnership attempts to score points by making its bid, or by defeating the opposing partnership's bid. At the end of play, the side with the most points wins.			
The Bidding	Calls - Once the cards are dealt, each player picks up his hand and, beginning with the dealer, makes a call (pass, bid, double or redouble).			
Passing	When a player does not wish to bid, double, or redouble, he says, "Pass." If all four players pass in the first round, the deal is "passed out," and the next dealer in turn deals a new hand.			
Bidding a Suit	♣ Bid a number of tricks greater than six that the bidder expects to win, and a suit which will become the trump suit. ♣ Ex. = "One Spade" is a bid to win seven tricks (6+1) with spades as trumps. ♣ A bid may be made in "No-trump", meaning that there will be no trump suit. The lowest possible bid is one, and the highest possible bid is seven. Each bid must name a greater number of odd tricks than the last bid, or an equal number but in a higher denomination. No-trump is the highest denomination, outranking spades. Ex. = "Two No-trump" will overcall a bid of "Two Hearts", and a bid of "Four Clubs" is required to overcall a bid of "Three No-trump".			
Doubling and Redoubling	♣ Any player may double the last preceding bid if it was made by an opponent. ♣ Any player may redouble the last preceding bid if it was made by his side and doubled by an opponent. A doubled or redoubled bid may be overcalled by any bid, which would have been sufficient to overcall the same contract undoubled. Ex. = "Two Spades" is doubled and redoubled, it may still be overcalled by a bid of "Two No-trump," a bid of "Three Clubs," or by any other higher bid.			
Final Bid and the Declarer	When a bid, double, or redouble is followed by three consecutive passes, the bidding is closed. The final bid in the auction becomes the contract. The player who, for his side, first bid the denomination named in the contract becomes the "declarer." If the contract names a trump suit, every card of that suit becomes a trump. The declarer's partner becomes the "dummy," and the opposing players become the "defenders."			
Playing	Take a card and place it, face up, in the centre of the table. Four cards so played, one from each hand in rotation, constitute a trick. The first card played to a trick is a lead. The leader to a trick may lead any card. The other three hands must follow suit if they can. If a player is unable to follow suit, he may play any card. For the first trick, the defender on the declarer's left makes the first lead (the opening lead).			
Facing The Dummy Hand	As soon as the opening lead has been made, the dummy then spreads his hand face up, grouped in suits, with each suit vertically arranged so that the other three players can easily view all 13 cards. The suits may be placed in any order as long as the trump suit (if any) is placed to the declarer's left. There is no particular order for placing the suits down in a No-trump bid.			
Winning of Tricks	A trick containing a trump is won by the hand playing the highest trump. A trick not containing a trump is won by the hand playing the highest card of the suit led. The winner of each trick leads next.			
Declarer's Play	The declarer plays his own cards and the dummy's cards, but each in proper turn, since the dummy does not take an active part in the play.			
Played Card	The declarer plays a card from his own hand when he places it on the table or when it is named as an intended play. When the declarer touches a card in the dummy hand, it is considered played (except when he is merely arranging the dummies cards). Alternatively, the declarer may name a card in the dummy and such a card must be played. A defender plays a card when he exposes it so that the other defender can see its face. A card once played may not be withdrawn, except to correct a revoke or other irregularity.			
Taking in Tricks Won	A completed trick is gathered and turned face down on the table. The declarer and one of the defenders should keep all tricks won in front of them, and the tricks should be arranged so that the quantity and the order of the tricks played are apparent.			
Keeping Score	When the last (13th) trick has been played, the tricks taken by the respective sides are counted, and the points earned are then entered to the credit of that side on the score sheet. Any player may keep score. If only one player keeps score, both sides are equally responsible to see that the score for each deal is correctly entered. The score sheet is ruled with a vertical line making two columns that are titled They and We. The scorekeeper enters all scores made by his side in the We column and all scores made by the opponents in the They column. A little below the middle of the score sheet is a horizontal line. Scores designated as "trick score" are entered below the line; all other scores are "premium scores" and are written above the line.			
Trick Score	If the declarer fulfils his bid by winning as many or more odd-tricks as the contract called for, his side scores below the line for every odd-trick named in the contract. Thus, if the declarer wins eight tricks and the bid is Two Hearts, the score for making "two" in a bid of hearts would be credited, as per the Scoring Table.			
Overtricks	Odd-tricks won by the declarer in excess of the contract are called "overtricks" and are scored to the credit of his side as premium score.			

The Game	When a side has scored 100 or more points below the line, it has won a "game." To show this, the scorekeeper draws a horizontal line across the score sheet, below the score that ended the game. This signifies that the next game will begin. A game may be made in more than one deal, such as by scoring 60 and later 40, or it may be scored by making a larger bid and earning 100 or more points in a single deal. Once the next game begins, if the opponents had a score below the line for making a bid, such as 70, this score does not carry over, and each side needs the full 100 points to win the next game.
Vulnerable	A side that has won its first game becomes "vulnerable," and that side's objective is to win a second game and thus earn a bonus for the "rubber." When a side scores its second game, the rubber is over, and the scores are totalled. The winning partnership is the side with the most points. A vulnerable side is exposed to increased penalties if it fails to fulfil a future bid, but receives increased premiums for certain other bids that are fulfilled.
Honours	When there is a trump suit, the ace, king, queen, jack, and ten of trumps are "honours." If a player holds four of the five trump honours, that partnership scores 100 above the line; all five honours in one hand score 150. If the contract is in No-trump, a player holding all four aces scores 150 above the line for his side. Note that the points for honours are the same whether the side is not vulnerable or vulnerable, and that the defenders can also score for honours.
Slam Bonuses	Other premium scores are awarded for bidding and making a "small slam" (a bid at the six-level, such as Six Hearts) or a "grand slam" (a contract at the seven-level, such as Seven Spades or Seven No-trump).
Unfinished Rubber	If the players are unable to complete a full rubber and only one side has a game, that side scores a 300 bonus. If only one side has a part score, that side earns a 100 bonus.
Back Score	After each rubber, each player's standing, plus (+) or minus (-), in even hundreds of points, is entered on a separate score called the "back score." An odd 50 points or more count 100, so if a player wins a rubber by 950 he is +10, if he wins it by 940 the player is +9.

17 Authors

Authors	**Age:** **Players:** 2-5+	**Duration:**	**Cards:** 52 Card Deck	**Card Rank (L > H):**
Dealing	The whole deck is dealt, as nearly evenly as possible.			
Playing	Beginning with the player to the left of the dealer, each player requests a desired card by rank and suit. Example "Give me the Queen of Diamonds". If the opponent has the card, they must hand it over. The player's turn continues so long as the player receives the card requested. If not, the turn passes to the left. As soon as a player collects four cards of the same rank, such as four 3s or four Queen, he lays them face down. The game continues until all cards have been laid down.			

18 Indian Poker

Indian Poker	**Age:** **Players:** 4-5+	**Duration:**	**Cards:** 52 Card Deck	**Card Rank (L > H):**
Aim	The goal of each player is to win the pot, which contains all the bets that the players have made in any one deal. A player makes a bet in hopes that he has the best hand, or to give the impression that he does.			
Dealing	A single card is dealt face down to each player.			
Playing	On a signal from the dealer, each player simultaneously lifts their card, placing it on their forehead so that all of the other players can see it, but the player cannot see his own. There is a single round of betting and then a show down. In some games the suits have rank - Spades (high), Hearts, Diamonds, Clubs - so that the Ace of Spades would be the highest card, the Ace of Hearts the next highest, and so on.			

19 Hold 'Em

Hold 'Em	**Age:** **Players:** 2-5+	**Duration:**	**Cards:** 52 Card Deck	**Card Rank (L > H):**
Aim	The goal of each player is to win the pot which contains all the bets that the players have made in any one deal. A player makes a bet in hopes that he has the best hand, or to give the impression that he does. The top combination of five cards is the best hand and winner for that deal. The winner gets all the chips in the pot at the end of the round.			
Scoring	(Below in Poker Hands)			
Dealing	For this version of High Low Poker, each player receives two cards face down, and five cards are dealt face down to the centre of the table.			
Playing	Once the cards are dealt, the person to the left of the dealer begins the first round of betting. Players have the option to check, bet, raise or fold after each deal. ♣ Check: A nominal bet; usually one that does not require any chip to be put in the pot. ♣ Bet: Put a number of chips in the pot based on your likeliness of having the best hand and winning. ♣ Raise: Put more chips in the pot than are needed to meet the previous bet. ♣ Fold: Withdraw from the current deal, as signified by turning one's cards face down. After the first betting interval, three of the five centre cards are turned face up in the centre. Then there is a second betting interval, followed by one more centre card being turned up. Then there is a third betting interval, and the last centre card is turned up. Then there is a final betting round. The player must use his best five cards, taken from the two in his hand and the five turned up in the centre of the table to form the best poker hand possible. The player with the best hand wins the pot.			

20 Poker Hands

These are the different hands you can have in poker, ordered from worst to best.

No Pair	This very common hand contains nothing. None of the five cards pair up, nor are all five cards of the same suit or consecutive in rank. When more than one player has no pair, the hands are rated by the highest card each hand contains, so that an ace-high hand beats a king-high hand, and so on.
One Pair	This frequent combination contains just one pair with the other three cards being of different rank. An example is 10, 10, K, 4, 3.
Two Pairs	This hand contains a pair of one rank and another pair of a different rank, plus any fifth card of a different rank, such as Q, Q, 7, 7, 4.
Three of a Kind	This combination contains three cards of the same rank, and the other two cards each of a different rank, such as three jacks, a seven, and a four.
Straight	Five cards in sequence, but not all of the same suit is a straight. An example is 9♥, 8♣, 7♠, 6♦, 5♥.
Flush	Five cards all of the same suit, but not all in sequence, is a flush. An example is Q, 10, 7, 6, and 2 of clubs.
Full House	This colourful hand is made up of three cards of one rank and two cards of another rank, such as three 8s and two 4s.
Four of a Kind	This is the next highest hand. An example is four aces or four 3s.
Straight Flush	This is the highest possible hand when only the standard pack is used, and there are no wild cards. A straight flush consists of five cards of the same suit in sequence, such as 10, 9, 8, 7, 6 of hearts.

21 Other Card Games

These are other card games you could bring when bugging out to provide some entertainment. A pack of cards is still reasonably light and could provide endless entertainment, however the traditional pack of 'playing cards' can be used for a huge variety of games.

UNO	Uno is an American shedding-type card game that is played with a specially printed deck. A highly recommended card game for children which is easy to learn, can also be played as snap.
Exploding Kittens	Exploding Kittens is a card game designed by Elan Lee. A great card game for kids if they are bored of the classic UNO.
Pokémon	The Pokémon Trading Card Game, is a collectible card game, based on the Pokémon franchise of video games and anime, first published in October 1996 by Media Factory in Japan. Basically everyone has heard of Pokémon and this game will be perfect for kids of all ages.
Magic: The Gathering	Magic: The Gathering is both a trading card and digital collectible card game created by Richard Garfield. Released in 1993 by Wizards of the Coast, Magic was the first trading card game created and it continues to thrive, with approximately twenty million players as of 2015, and over twenty billion Magic cards produced in the period of 2008 to 2016 alone. One of the most popular card games around, will be perfect for teens to adults.

Pack O Game

A series of easily portable card-based strategy micro card games in a gum-sized tuck box with a variety of mechanics, complexity and theme.
Can be bought from: www.perplext.com/packogame

HUE	Secretly choose 3 colors and build the largest color sections in this fast-playing, tile-laying strategy game. Players build an area of color sections together. In the end, the winner is the player who chose the most valuable 3 colors.	Players: 2-5 Ages: 8+ Length: 10 Min. Level 2: Intermediate
TKO	Compete for the TKO Belt as you maneuver around the ring in this clever boxing game. You'll need more than brute strength to get inside your opponent's head. Choose from 8 different fighters and keep it clean out there! Fight!	Players: 2 Ages: 8+ Length: 10 Min. Level 1: Casual
GEM	Players are jewel collectors in this tense auction game of asset leverage and wit. In the end, the player who is most effective with his money and cunning in his collecting, will amass the most prestigious and valuable jewel collection.	Players: 2-4 Ages: 12+ Length: 30 Min. Level 3: Challenging
FLY	Get swattin' in this exciting dexterity, set-collecting game! Players take turns dropping the fly swatter card on the table to swat flies with like colors and symbols. You'll need at least 3 of the same color or symbol in order for a fly to count. Perfect for portable family FUN.	Players: 2-4 Ages: 8+ Length: 10 Min. Level 1: Casual
TAJ	Players assume the roles of ancient rug collectors vying to display their collection in the Taj Mahal. Vote on proposals made by opponents to shift rugs in the display to gain prestige for rugs displaying your secret color scheme.	Players: 2-4 Ages: 12+ Length: 10 Min. Level 3: Challenging
SHH	Players cooperate as a single team to spell words in order to rid their hands of as many letters as possible. The catch? Silent play proves challenging when one doesn't know his teammate's hand. Shh!	Players: 2-4 Ages: 10+ Length: 10 Min. Level 2: Intermediate
LIE	Be the last liar playing in this game of cunning speculation. If you get caught overbidding, you lose a card; but when you're caught telling the truth, your challenger pays!	Players: 2-6 Ages: 12+ Length: 20 Min. Level 2: Intermediate
BUS	You'll need absolute effiency in this quick, "Pick up and Deliver" game of balancing speed and maximum capacity. Don't get too distracted dropping off passengers, because your opponents might beat you to the bus stop or change your route through road construction.	Players: 2-3 Ages: 8+ Length: 20 Min. Level 2: Intermediate

ORC	Players use Orc clans to dominate territories and earn the most victory points in this strategy game for 2 players. You'll need to carefully plan your attacks and balance your hand of Orcs in order to beat your opponent and win!	Players: 2 Ages: 8+ Length: 5 Min. Level 2: Intermediate
GYM	Play alone or as a team and pick the best kids to compete in gym sporting events. Brats will influence which events you'll play and each kid's special actions will help you earn the most points and win the game!	Players: 2, 4, 6 Ages: 10+ Length: 15 Min. Level 3: Challenging
RUM	Argh! Players are pirates rummaging through a shipwreck. Collect sets of rum and press your luck to earn points. But watch out for the parrot, who will steal your booty! The pirate with the most points wins the game!	Players: 2-4 Ages: 10+ Length: 15 Min. Level 2: Intermediate
DIG	Each player is a dog, digging for bones and returning them to dog bowls. Bones will have different values based on the activity in the yard. The dog with the most valuable bones is the champ!	Players: 2-4 Ages: 10+ Length: 15 Min. Level 1: Casual
BOX	Players create squares with 4 corner dots of their secret color in this challenging, strategy game. The bigger the square, the greater the points! Play alone or in teams and win with the most points!	Players: 2, 3, 4, 6 Ages: 10+ Length: 20 Min. Level 3: Challenging
SPY	Protect your Top Secret plans and expose your enemies in this elegant card game of deduction. No need for a table, as the action takes place in players' hands only! Clever tactics will lead your spy to victory.	Players: 2-4 Ages: 10+ Length: 10 Min. Level 3: Challenging
SOW	Each player must use the rhythm of nature to plant seeds and grow flowers in order to collect the most beautiful bouquet. Earn the most points to win this Mandala-Inspired gardening game for 2 to 4 green thumbs.	Players: 2-4 Ages: 10+ Length: 20 Min. Level 3: Challenging
BOO	Two players battle for the graveyard in this spooky, tactical game. Players place cards to flip as many ghosts of their color face-up. In the end, the winner is the player with the most ghosts of their color!	Players: 2 Ages: 10+ Length: 15 Min. Level 2: Intermediate

6 Board Games

Generally more complicated than card games and often require more then one player, however DnD will keep a solo person occupied for many months. Board games are also cumbersome to transport and often only have little more enjoyment then the much more compact card games. However they are included because they are generally replicatable in the wild.

Subheadings

1. Chess	2. Checkers / Draughts	3. Monopoly	4. Scrabble
5. Codenames	6. Go	7. Backgammon	8. Dominos
9. Chinese Checkers	10. Mancala	11. Risk	12. Cluedo
13. Ticket to Ride			

1 Chess

Chess is a two-player strategy board game played on a chessboard, a chequered game board with 64 squares arranged in an 8×8 grid. A game semi-easily created from bush materials if you didn't pack one.

2 Checkers / Draughts

Draughts (British English) or checkers (American English) is a group of strategy board games for two players which involve diagonal moves of uniform game pieces and mandatory captures by jumping over opponent pieces. A game easily created from rocks and sticks if you didn't pack one.

3 Monopoly

Monopoly is a board game where players roll two six-sided dice to move around the game board, buying and trading properties, and develop them with houses and hotels. One of the most popular games of all time, quite hefty to carry around but worthwhile in a BOL. The game board has been included below so you can either play off a tablet screen or redraw it.

Game Pieces

Tokens		Bank Cash	Other Pieces		
● Battleship ● Boot ● Cannon ● Horse & Rider ● Iron	● Racecar ● Dog ● Thimble ● Top Hat ● Wheelbarrow	● 30 x $500 Bills ● 30 x $100 Bills ● 30 x $50 Bills ● 30 x $20 Bills ● 30 x $10 Bills ● 30 x $1 Bills	● 32 x Houses ● 12 x Hotels ● The Board		

Preparation

Preparation
To begin, place the game board on the table. Each player selects a token. Then they place their token on the table near the space labelled Go, placing it on Go only when their first turn to move arrives. One player becomes the Banker, who distributes assets from the Bank to the players. Only the player in question can use their money, money can only be lent via the Banker or by the player money.

Each player is given $1,500 in cash divided as follows: two each of $500s, $100's and $50's; six $20's, five each of $10's, $5's and $1's. All remaining cash and other equipment go to the Bank. The Banker may play too but must keep his personal funds from the bank. He/she also needs to make sure that they collect $200 when they pass GO.

Gameplay

● On a player's turn, the player must roll the dice and move his/her token forward the number of spaces as rolled on the dice. In some editions, players must do any trades, building improvements etc. at the start of their turn before rolling the dice.
● If the player lands on an unowned property, the player may buy it for the price listed on that property's space. If he or she agrees to buy it, he or she pays the Bank the amount shown on the property space and receives the deed for that property. If he or she refuses to buy the property for the amount stated on the deed, the property is auctioned. Bidding may start at any price, and all players may bid. The highest bidder wins the property and pays the Bank the amount bid and receives the property's title deed. Railroads and utilities are also considered properties.
● If the player lands on an unmortgaged property owned by another player, he or she pays rent to that person, as specified on the property's deed. It is the property owner's responsibility to demand rent, and he or she has until the beginning of the second following player's turn to do so.
● If the player lands on his or her own property, or on property which is owned by another player but currently mortgaged, nothing happens.
● If the player lands on Luxury Tax/Super Tax, he or she must pay the Bank $100 (in some editions of the game, only $75).
● If the player lands on Income Tax he or she must pay the Bank either $200 or 10% of his or her total assets (cash on hand, property, houses and hotels). In some editions of the game, this is a flat rate of $200.
● If the player lands on a Chance or Community Chest, the player takes a card from the top of the respective pack and performs the instruction given on the card.
● If the player lands on the Jail space, he or she is "Just Visiting". No penalty applies.
● If the player lands on the Go to Jail square, he or she must move his token directly to Jail.
● If the player lands on or passes Go in the course of his or her turn, he or she receives $200 from the Bank. A player has until the beginning of his or her next turn to collect this money.
● You may sell houses back to the Bank for half the purchase price or sell property deeds to other players in the game.
● Players may not loan money to other players. Only the Bank can loan money, and only through mortgaging properties.
● If a player skips another player's turn and is caught, the turn is transferred back to the player whose turn was skipped.

Doubles
When doubles are rolled, the player resolves the roll as normal (including purchase, renting or passing "GO"), but must roll the dice again for another turn. The player again moves forward as directed by the dice, and if this is also doubles, rolls again. If the third dice roll is doubles, the player is instead moved directly to jail. The sole exception is rolling doubles to exit jail, which doesn't allow for an additional turn.

Railroad
The rent a player charges for landing on a railroad varies with the number of railroads that are also owned by a player. The rent is as follows: Charge $25 if one is owned, $50 if two are owned, $100 if three are owned, $200 if all four are owned.

Utility Rent
For utilities, after a player lands on one to owe rent, the rent is 4 times the amount rolled, if the player owns one utility. If the player possesses both utilities, the rent is 10 times the amount rolled. In some editions, the rents are flat.

Jail
When landing on the square marked "Go to Jail", drawing a card marked "Go to Jail", or rolling three consecutive doubles when moving in a turn, the player is placed directly in the jail cell, and does not get any benefit for passing "GO". A player that lands normally in the Jail square is in the "Just Visiting" section, and is unhindered. In some editions, players in jail may not buy and sell properties, or collect rent on them. In others, this is allowed.

When in jail, a player may use a get out of jail free card (either owned, or purchased from another player), or pay the $50 fine or skips one turn. Otherwise, the player can attempt to escape jail by trying to roll doubles - if successful, the player moves the number of squares but doesn't get the extra turn. If the player fails to roll doubles for three turns, he or she must pay the ₩50 fine and then moves the number shown on the dice or skip one turn.

Properties, Rents, and Construction
● If a player lands on property he/she may buy it at the listed price. If the player refuses to buy it, then the bank sells it at auction to the highest bidder. All players, including the one who chose to not buy it, may bid on the property. Properties are arranged in "color groups" of two or three properties.
● Once a player owns all properties of a colour group (a monopoly), the rent is now doubled on all unimproved lots of that color group, even if any of the properties are mortgaged to the bank or if other properties in the group have houses.
● The player may purchase up to four houses or one hotel per property (and only if there are properties to hold the houses), which raise the rents that must be paid when other players land on the property.
● If a player wishes to buy a house/hotel for a property, it is not necessary to wait for their turn. The player can buy houses/hotels even if it is not their turn. The player does not need to be on the property they wish to put the house/hotel on.
● The properties in a color group must be developed evenly, i.e. each house that is built must go on a property in the group with the fewest number of houses on it so far.
● If a player owns all the lots of any colour-group, the rent is doubled on unimproved lots in that group.
● A hotel may be built on a color group only after all properties in the group have four houses. A player purchases a hotel by paying the price of an additional house, and returning the four houses on that property to the Bank in exchange for a hotel.
● If a property is owned by a player and another player lands on the property and the owner does not realize it before the second following player rolls the dice then the player does not have to pay the owner.
● At any time a player may, to raise cash, sell hotels and houses back to the Bank for half the purchase price of the houses or hotels.
● Also, properties with no houses or hotels may be mortgaged for half of the property price. A property does not collect rent while mortgaged and may not be developed. To de-mortgage a property a player must pay interest of 10% in addition to the mortgage price. Whenever a mortgaged property changes hands between players, either through a trade, sale or by bankruptcy, the new owner must immediately pay 10% interest on the mortgage and at their option may pay the principal or hold the property. If the player holds the property and later wishes to lift the mortgage they must pay an additional 10% interest at that time.
● Building Shortage: When the Bank has no houses to sell, players wishing to build must wait for some player to return or sell his/her houses to the Bank before building. If there are a limited number of houses and hotels available and two or more players wish to buy more than the Bank has, the houses or hotels must be sold at auction to the highest bidder.

Monopoly Board

	Free Parking	**The Strand (Kentucky Avenue) Buy: $220 Rent: $18 With 1 House: $90 With 2 Houses: $250 With 3 Houses: $700 With 4 Houses: $875 With Hotel: $1050 With Skyscraper: $2050 Mortgage: $110 Houses: $150 ea**	**Chance**	**Fleet Street (Indiana Avenue) Buy: $220 Rent: $18 With 1 House: $90 With 2 Houses: $250 With 3 Houses: $700 With 4 Houses: $875 With Hotel: $1050 With Skyscraper: $2050 Mortgage: $110 Houses: $150 ea**	**Trafalgar Square (Illinois Avenue) Buy: $240 Rent: $20 With 1 House: $100 With 2 Houses: $300 With 3 Houses: $750 With 4 Houses: $925 With Hotel: $1100 With Skyscraper: $2100 Mortgage: $120 Houses: $150 ea**	**Fenchurch St. Station (B. & O. Railroad) Buy: $200 Rent: $25 2 RR's Owned: $50 3 RR's Owned: $100 4 RR's Owned: $200 Mortgage: $100**	**Leicester Square (Atlantic Avenue) Buy: $260 Rent: $22 With 1 House: $110 With 2 Houses: $330 With 3 Houses: $800 With 4 Houses: $975 With Hotel: $1150 With Skyscraper: $2150 Mortgage: $130 Houses: $150 ea**	**Coventry Street (Ventnor Avenue) Buy: $260 Rent: $22 With 1 House: $110 With 2 Houses: $330 With 3 Houses: $800 With 4 Houses: $975 With Hotel: $1150 With Skyscraper: $2150 Mortgage: $130 Houses: $150 ea**	**Water Works Buy: $150 Rent: 4x Dice Roll 2 Owned: 10x Dice Roll Mortgage: $75**	**Piccadilly (Marvin Gardens) Buy: $280 Rent: $24 With 1 House: $120 With 2 Houses: $360 With 3 Houses: $850 With 4 Houses: $1025 With Hotel: $1200 With Skyscraper: $2200 Mortgage: $140 Houses: $150 ea**	**Go to Jail**
	Vine Street (New York Avenue) Buy: $200 Rent: $16 With 1 House: $80 With 2 Houses: $220 With 3 Houses: $600 With 4 Houses: $800 With Hotel: $1000 With Skyscraper: $1500 Mortgage: $100 Houses: $100 ea	**Chance Cards**	Advance to "Go". (Collect $200)		Advance to Illinois Ave. If you pass Go, collect $200.		Advance to St. Charles Place. If you pass Go, collect $200.		Advance token to nearest Utility. If unowned, you may buy it from the Bank. If owned, throw dice and pay owner a total 10 times the amount thrown.		**Regent Street (Pacific Avenue) Buy: $300 Rent: $26 With 1 House: $130 With 2 Houses: $390 With 3 Houses: $900 With 4 Houses: $1100 With Hotel: $1275 With Skyscraper: $2275 Mortgage: $150 Houses: $200 ea**
	Marlborough Street (Tennessee Avenue) Buy: $180 Rent: $14 With 1 House: $70 With 2 Houses: $200 With 3 Houses: $550 With 4 Houses: $750 With Hotel: $950 With Skyscraper: $1450 Mortgage: $90 Houses: $100 ea		Advance token to the nearest Railroad and pay owner twice the rental to which he/she is otherwise entitled. If Railroad is unowned, you may buy it from the Bank.		Bank pays you dividend of $50.		Get out of Jail Free. This card may be kept until needed, or traded/sold.		Go Back Three Spaces.		**Oxford Street (North Carolina Avenue) Buy: $300 Rent: $26 With 1 House: $130 With 2 Houses: $390 With 3 Houses: $900 With 4 Houses: $1100 With Hotel: $1275 With Skyscraper: $2275 Mortgage: $150 Houses: $200 ea**
	Community Chest		Go to Jail. Go directly to Jail. Do not pass GO, do not collect $200.		Make general repairs on all your property: For each house pay $25, For each hotel pay $100.		Pay poor tax of $15		Take a trip to Reading Railroad. If you pass Go, collect $200.		**Community Chest**
	Bow Street (St. James Place) Buy: $180 Rent: $14 With 1 House: $70 With 2 Houses: $200 With 3 Houses: $550 With 4 Houses: $750 With Hotel: $950 With Skyscraper: $1450 Mortgage: $90 Houses: $100 ea		Take a walk on the Boardwalk. Advance token to Boardwalk.		You have been elected Chairman of the Board. Pay each player $50.		Your building loan matures. Receive $150.		You have won a crossword competition. Collect $100.		**Bond Street (Pennsylvania Avenue) Buy: $320 Rent: $28 With 1 House: $150 With 2 Houses: $450 With 3 Houses: $1000 With 4 Houses: $1200 With Hotel: $1400 With Skyscraper: $2400 Mortgage: $160 Houses: $200 ea**
	Marylebone Station (Pennsylvania Railroad) Buy: $200 Rent: $25 2 RR's Owned: $50 3 RR's Owned: $100 4 RR's Owned: $200 Mortgage: $100	**Community Chest Cards**	Advance to "Go". (Collect $200)		Bank error in your favour. Collect $200.		Doctor's fees. Pay $50.		From sale of stock you get $50.		**Liverpool St. Station (Short Line) Buy: $200 Rent: $25 2 RR's Owned: $50 3 RR's Owned: $100 4 RR's Owned: $200 Mortgage: $100**
	Northumberland Avenue (Virginia Avenue) Buy: $160 Rent: $12 With 1 House: $60 With 2 Houses: $180 With 3 Houses: $500 With 4 Houses: $700 With Hotel: $900 With Skyscraper: $1400 Mortgage: $80 Houses: $100 ea		Get Out of Jail Free. This card may be kept until needed or sold/traded.		Go to Jail. Go directly to jail. Do not pass Go, Do not collect $200.		Grand Opera Night Collect $50 from every player for opening night seats.		Holiday Fund matures. Receive $100.		**Chance**
	Whitehall (States Avenue) Buy: $140 Rent: $10 With 1 House: $50 With 2 Houses: $150 With 3 Houses: $450 With 4 Houses: $625 With Hotel: $750 With Skyscraper: $1250 Mortgage: $70 Houses: $100 ea		Income tax refund. Collect $20.		It's your birthday. Collect $10 from every player.		Life insurance matures – Collect $100.		Hospital Fees. Pay $50.		**Park Lane (Park Place) Buy: $350 Rent: $35 With 1 House: $175 With 2 Houses: $500 With 3 Houses: $1100 With 4 Houses: $1300 With Hotel: $1500 With Skyscraper: $2500 Mortgage: $175 Houses: $200 ea**
	Electric Company Buy: $150 Rent: 4x Dice Roll 2 Owned: 10x Dice Roll Mortgage: $75		School fees. Pay $50.		Receive $25 consultancy fee.		You are assessed for street repairs: Pay $40 per house and $115 per hotel you own.		You have won second prize in a beauty contest. Collect $10.		**Super Tax Pay $100**
	Pall Mall (St. Charles Place) Buy: $140 Rent: $10 With 1 House: $50 With 2 Houses: $150 With 3 Houses: $450 With 4 Houses: $625 With Hotel: $750 With Skyscraper: $1250 Mortgage: $70 Houses: $100 ea		You inherit $100.								**Mayfair (Boardwalk) Buy: $400 Rent: $50 With 1 House: $200 With 2 Houses: $600 With 3 Houses: $1400 With 4 Houses: $1700 With Hotel: $2000 With Skyscraper: $3000 Mortgage: $200 Houses: $200 ea**
	In Jail / Just Visiting	**Pentonville Road (Connecticut Avenue) Buy: $120 Rent: $8 With 1 House: $40 With 2 Houses: $100 With 3 Houses: $300 With 4 Houses: $450 With Hotel: $600 With Skyscraper: $1100 Mortgage: $60 Houses: $50 ea**	**Euston Road (Vermont Avenue) Buy: $100 Rent: $6 With 1 House: $30 With 2 Houses: $90 With 3 Houses: $270 With 4 Houses: $400 With Hotel: $550 With Skyscraper: $1050 Mortgage: $50 Houses: $50 ea**	**Chance**	**The Angel Islington (Oriental Avenue) Buy: $100 Rent: $6 With 1 House: $30 With 2 Houses: $90 With 3 Houses: $270 With 4 Houses: $400 With Hotel: $550 With Skyscraper: $1050 Mortgage: $50 Houses: $50 ea**	**King's Cross Station (Reading Railroad) Buy: $200 Rent: $25 2 RR's Owned: $50 3 RR's Owned: $100 4 RR's Owned: $200 Mortgage: $100**	**Income Tax Pay $200**	**Whitechapel Road (Baltic Avenue) Buy: $60 Rent: $4 With 1 House: $20 With 2 Houses: $60 With 3 Houses: $180 With 4 Houses: $320 With Hotel: $450 With Skyscraper: $950 Mortgage: $30 Houses: $50 ea**	**Community Chest**	**Old Kent Road (Mediterranean Avenue) Buy: $60 Rent: $2 With 1 House: $10 With 2 Houses: $30 With 3 Houses: $90 With 4 Houses: $160 With Hotel: $250 With Skyscraper: $750 Mortgage: $30 Houses: $50 ea**	**GO Collect $200 Salary as you pass**

4 Scrabble

Scrabble is a word game in which two to four players score points by placing tiles bearing a single letter onto a board divided into a 15×15 grid of squares. Keep your mind active and your wits sharp in this multiplayer word joining game.

Letter Distributions	**0 Points** Blank Tiles	**1 Point** E×12, A×9, I×9, O×8, N×6, R×6, T×6, L×4, S×4, U×4	**2 Points** D×4, G×3	**3 Points** B×2, C×2, M×2, P×2	**4 Points** F×2, H×2, V×2, W×2, Y×2	**5 Points** K×1	**8 Points** J×1, X×1	**10 Points** Q×1, Z×1	The total number of points is 187.

Scrabble Board

Only half the board is displayed because it is too large for the cells. However for the full board just mirror it horizontally on the 'Start' axis so that there's only one start square in the middle of the board.

	Triple Word Score				Double Letter Score			Triple Word Score			
			Triple Letter Score				Double Word Score				
		Double Letter Score				Double Word Score					
	Double Letter Score				Double Word Score			Double Letter Score			
				Double Word Score							
			Triple Letter Score				Triple Letter Score				
		Double Letter Score				Double Letter Score					
	Start				Double Letter Score			Triple Word Score			
		Double Letter Score				Double Letter Score					
			Triple Letter Score				Triple Letter Score				
				Double Word Score							
	Double Letter Score				Double Word Score			Double Letter Score			
		Double Letter Score				Double Word Score					
			Triple Letter Score				Double Word Score				
	Triple Word Score				Double Letter Score			Triple Word Score			

5 Codenames

Codenames is a 2015 card game for 4–8 players designed by Vlaada Chvátil and published by Czech Games. Two teams compete by each having a Spymaster give one word clues which can point to multiple words on the board. The other players on the team attempt to guess their team's words while avoiding the words of the other team. In the 2–3 player variant, one Spymaster gives clues to the other player or players. Even though it's listed under 'Boardgames' it's technically a card game as it doesn't use a typical game board.

Rules

Codenames is a game of guessing which code names (words) in a set are related to a hint-word given by another player. Players split into two teams: red and blue. One player of each team is selected as the team's spymaster; the others are field operatives. Twenty-five Codename cards, each bearing a picture, are laid out in a 5×5 rectangular grid, in random order. A number of these words represent red agents, a number represent blue agents, one represents an assassin, and the others represent innocent bystanders.

The teams' spymasters are given a randomly-dealt map card showing a 5×5 grid of 25 squares of various colours, each corresponding to one of the code name cards on the table. Teams take turns. On each turn, the appropriate spymaster gives a verbal hint about the words on the respective cards. Each hint may only consist of one single word and a number. The spymaster gives a hint that is related to as many of the words on his/her own agents' cards as possible, but not to any others – lest they accidentally lead their team to choose a card representing an innocent bystander, an opposing agent, or the assassin. The hint's word can be chosen freely, as long as it is not (and does not contain) any of the words on the code name cards still showing at that time. Code name cards are covered as guesses are made.

Codenames

The hint's number tells the field operatives how many words in the grid are related to the word of the clue. It also determines the maximum number of guesses the field operatives may make on that turn, which is the hint's number plus one. Field operatives must make at least one guess per turn, risking a wrong guess and its consequences. They may also end their turn voluntarily at any point thereafter.

After a spymaster gives the hint with its word and number, their field operatives make guesses about which code name cards bear words related to the hint and point them out, one at a time. When a code name card is pointed out, the spymaster covers that card with an appropriate identity card – a blue agent card, a red agent card, an innocent bystander card, or the assassin card – as indicated on the spymasters' map of the grid. If the assassin is pointed out, the game ends immediately, with the team who identified him losing. If an agent of the other team is pointed out, the turn ends immediately, and that other team is also one agent closer to winning. If an innocent bystander is pointed out, the turn simply ends.

The game ends when all of one team's agents are identified (winning the game for that team), or when one team has identified the assassin (losing the game).

6 Go

Go is an abstract strategy board game for two players, in which the aim is to surround more territory than the opponent. It is generally too hefty to carry around when bugging out but the digital form can be carried free.

7 Backgammon

Backgammon is one of the oldest known board games. Its history can be traced back nearly 5,000 years to archaeological discoveries in the Middle East. A game easily created from bush materials if you didn't pack one.

8 Dominos

Dominoes is a family of tile-based games played with rectangular "domino" tiles. Each domino is a rectangular tile with a line dividing its face into two square ends. Quite lightweight if you get thin dominos and provides access to many game types.

9 Chinese Checkers

Chinese checkers is a strategy board game of German origin which can be played by two, three, four, or six people, playing individually or with partners. Requires a large board and coloured pieces but fun if you have multiple players.

10 Mancala

Mancala is one of the oldest known games to be played. Mancala is a generic name for a family of 2-player turn-based strategy board games played with small stones, beans, or seeds and rows of holes or pits in the earth, a board or other playing surface. A game easily created from bush materials if you didn't pack one.

11 Risk

Fairly difficult to transport, but you can draw custom maps in the dirt if need be, as well as using sticks and rocks as units.

12 Cluedo

Cluedo, known as Clue in North America, is a murder mystery game for three to six players that was devised by Anthony E. Pratt from Birmingham, England. Fun to play but requires a board and lots of cards.

13 Ticket to Ride

Ticket to Ride is a railway-themed German-style board game designed by Alan R. Moon, Illustrated by Julien Delval and Cyrille Daujean, published in 2004 by Days of Wonder. Fun to play but requires a board and lots of cards.

7 Electronic Entertainment

Electronic entertainment is in every modern household today, most people at some point have played a digital game, watched a Tv series or even the news. People today almost have an addition to noise, sound, music and entertainment and when this is gone it will be a real shock to hear -silence- for once. Having a few form of this entertainment will let people escape into these digital worlds once again or be able to slowly pry themselves from this vice which is in everyone's lives.

Types of Electronic Entertainment
- Radio
- Television
- Handheld Games
- Console Games
- Computers

Subheadings

1. Radio	2. Television	3. Audio	4. E-readers
5. Phone / Tablet Apps	6. Handheld Games	7. Game Consoles	8. Computer Entertainment
9. Other Entertainment			

1 Radio

FM Radio	Listening to nearby stations can keep you up to date with the weather and news as well as providing a nice selection of music without as much distortion as other radio broadcasts.
AM Radio	AM radio can provide a different yet pleasant listening experience over much larger ranges than FM.
Shortwave Radio	Shortwave radio stations can usually be heard across most of the world but require a special type of radio to pick up this signal. They have a large range of stations to listen to from a multitude of countries - some of which may not be in English.
HAM Radio	A HAM radio (with a licence) can be used to communicate with other amateur radio users across the country.

2 Television

There is unlikely to be live television in a SHTF disaster so if you wish to watch anything it should be pre-recorded or downloaded and stored on a USB or SD card.

Movies

Movies are great to distract you from reality for an hour and a half.

Recommened Movies

• The Dark Knight • Fight Club • Pulp Fiction • Forrest Gump • The Lord of the Rings	• Saving Private Ryan • Avatar • Gladiator • Good Will Hunting • Braveheart	• The Usual Suspects • Inception • There Will Be Blood • No Country for Old Men • Se7en	• The King's Speech • Titanic • The Matrix • Interstellar • City of God	• The Departed • American Gangster • Django Unchained • The Insider • The Shawshank Redemption	
• Donnie Darko • American History X • Memento • Moulin Rouge! • Chicago	• Shakespeare in Love • The Queen • Life Is Beautiful • L.A. Confidential • Mystic River	• Heat • The Thin Red Line • Letters from Iwo Jima • The Sixth Sense • The Pianist	• Casino • Gangs of New York • The Green Mile • A Bronx Tale • WALL-E	• American Beauty • Toy Story • Finding Nemo • The Lion King • The Curious Case of Benjamin Button	

Tv Series

Tv series are probably the best source of entertainment as they last longer than movies and can be broken up more readily.

Recommended Tv Shows

Science Fiction • Westworld • Doctor Who • Battlestar Galactica • Stranger Things • Black Mirror • Star Trek: TNG	**Science Fiction** • The X-Files • Supernatural • The Walking Dead • Vikings • Star Trek Voyager	**Comedy** • The Office • Parks and Recreation • The Simpsons • Fawlty Towers • Rick and Morty • Mr Bean	**Comedy** • Black Books • Brooklyn Nine-Nine • I.T. Crowd • Miranda • Regular Show	**Murder & Crime** • Murdoch Mysteries • Poirot • Breaking Bad • The Wire • Better Call Saul • Sherlock	**Murder & Crime** • The Sopranos • Fargo • Narcos • Dexter
Drama • Game of Thrones • Twin Peaks • House M.D. • Firefly • House of Cards • Mr. Robot • Torchwood	**Kids** • Avatar: The Last Airbender • Gravity Falls • Adventure Time • My Little Pony • Scooby Doo	**Kids** • SpongeBob Squarepants • Veggietales • Wallace and Gromit • Arthur • Paw Patrol	**Sitcom** • Seinfeld • Arrested Development • It's Always Sunny in Philadelphia • Friends	**Animated** • Death Note • Attack on Titan • One Punch Man • Archer (Sitcom)	**Historical & Other** • Downton Abbey • Rome (Historical) • The Paradise (Drama) • Top Gear (Motoring) • Hannibal (Horror Thriller) • Mythbusters

Documentaries

If you'd prefer a hit of reality or to learn some fascinating facts you should watch a documentary.

Recommended Documentaries

• Blue Planet • Little Pyongyang • Free Solo • Louis Theroux: LA Stories • World's Scariest Drug	• An Open Secret • Free to Play • 3D Printed Guns • Welcome to Leith • The Agenda - Curtis Bowers	• Seven Worlds, One Planet • 8 Days: to the Moon and Back • Jim: The James Foley Story • WIRED's 'Holy Land: Startup Nations' • WIRED's 'Shenzhen: The Silicon Valley of hardware'	• • • • •

3 Audio

Audio is any form of sound that is listened to for pleasure.

Audio Formats

This is a list of the most common audio formats today.

File Type	Creator	Description
.aa	Audible.com (Amazon.com)	A low-bitrate audiobook container format with DRM, containing audio encoded as either MP3 or the ACELP speech codec.
.aac		The Advanced Audio Coding format is based on the MPEG-2 and MPEG-4 standards. AAC files are usually ADTS or ADIF containers.
.aax	Audible.com (Amazon.com)	An Audiobook format, which is a variable-bitrate (allowing high quality) M4B file encrypted with DRM. MPB contains AAC or ALAC encoded audio in an MPEG-4 container. (More details below.)
.aiff	Apple	A standard uncompressed CD-quality, audio file format used by Apple. Established 3 years prior to Microsoft's uncompressed version wav.
.flac		A file format for the Free Lossless Audio Codec, an open-source lossless compression codec.

.gsm		Designed for telephony use in Europe, gsm is a very practical format for telephone quality voice. It makes a good compromise between file size and quality. Note that wav files can also be encoded with the gsm codec.
.m4a		An audio-only MPEG-4 file, used by Apple for unprotected music downloaded from their iTunes Music Store. Audio within the m4a file is typically encoded with AAC, although lossless ALAC may also be used.
.m4b		An Audiobook / podcast extension with AAC or ALAC encoded audio in an MPEG-4 container. Both M4A and M4B formats can contain metadata including chapter markers, images, and hyperlinks, but M4B allows "bookmarks" (remembering the last listening spot), whereas M4A does not.
.m4p	Apple	A version of AAC with proprietary Digital Rights Management developed by Apple for use in music downloaded from their iTunes Music Store.
.mmf	Yamaha, Samsung	A Samsung audio format that is used in ringtones. Developed by Yamaha (SMAF stands for "Synthetic music Mobile Application Format", and is a multimedia data format invented by the Yamaha Corporation, .mmf file format).
.mp3		MPEG Layer III Audio. It is the most common sound file format used today.
.mpc		Musepack or MPC (formerly known as MPEGplus, MPEG+ or MP+) is an open source lossy audio codec, specifically optimized for transparent compression of stereo audio at bitrates of 160–180 kbit/s.
.msv	Sony	A Sony proprietary format for Memory Stick compressed voice files.
.nmf	NICE	NICE Media Player audio file
.ogg / .oga / .mogg	Xiph.Org Foundation	A free, open source container format supporting a variety of formats, the most popular of which is the audio format Vorbis. Vorbis offers compression similar to MP3 but is less popular. Mogg, the "Multi-Track-Single-Logical-Stream Ogg-Vorbis", is the multi-channel or multi-track Ogg file format.
.opus	Internet Engineering Task Force	A lossy audio compression format developed by the Internet Engineering Task Force (IETF) and made especially suitable for interactive real-time applications over the Internet. As an open format standardised through RFC 6716, a reference implementation is provided under the 3-clause BSD license.
.ra / .rm	RealNetworks	A RealAudio format designed for streaming audio over the Internet. The .ra format allows files to be stored in a self-contained fashion on a computer, with all of the audio data contained inside the file itself.
.raw		A raw file can contain audio in any format but is usually used with PCM audio data. It is rarely used except for technical tests.
.tta		The True Audio, real-time lossless audio codec.
.voc	Creative Technology	The file format consists of a 26-byte header and a series of subsequent data blocks containing the audio information
.vox		The vox format most commonly uses the Dialogic ADPCM (Adaptive Differential Pulse Code Modulation) codec. Similar to other ADPCM formats, it compresses to 4-bits. Vox format files are similar to wave files except that the vox files contain no information about the file itself so the codec sample rate and number of channels must first be specified in order to play a vox file.
.wav		Standard audio file container format used mainly in Windows PCs. Commonly used for storing uncompressed (PCM), CD-quality sound files, which means that they can be large in size—around 10 MB per minute. Wave files can also contain data encoded with a variety of (lossy) codecs to reduce the file size (for example the GSM or MP3 formats). Wav files use a RIFF structure.
.wma	Microsoft	Windows Media Audio format, created by Microsoft. Designed with Digital Rights Management (DRM) abilities for copy protection.
.webm		Royalty-free format created for HTML5 video.

Audio Components

Audio components are the different ways of encoding the sound to create different depths of audio.

Hertz (Hz)	The hertz is the derived unit of frequency in the International System of Units (SI) and is defined as one cycle per second. Some of the unit's most common uses are in the description of sine waves and musical tones, particularly those used in radio- and audio-related applications. It is also used to describe the speeds at which computers and other electronics are driven. Hertz are commonly expressed in multiples: kilohertz (103 Hz, kHz), megahertz (106 Hz, MHz), gigahertz (109 Hz, GHz), terahertz (1012 Hz, THz), petahertz (1015 Hz, PHz), and exahertz (1018 Hz, EHz).
Bit Depth	In digital audio using pulse-code modulation (PCM), bit depth is the number of bits of information in each sample, and it directly corresponds to the resolution of each sample. Examples of bit depth include Compact Disc Digital Audio, which uses 16 bits per sample, and DVD-Audio and Blu-ray Disc which can support up to 24 bits per sample. In basic implementations, variations in bit depth primarily affect the noise level from quantization error—thus the signal-to-noise ratio (SNR) and dynamic range. However, techniques such as dithering, noise shaping and oversampling mitigate these effects without changing the bit depth. Bit depth also affects bit rate and file size. Bit depth is only meaningful in reference to a PCM digital signal. Non-PCM formats, such as lossy compression formats, do not have associated bit depths.
Sampling	In signal processing, sampling is the reduction of a continuous-time signal to a discrete-time signal. A common example is the conversion of a sound wave (a continuous signal) to a sequence of samples (a discrete-time signal). A sample is a value or set of values at a point in time and/or space. A sampler is a subsystem or operation that extracts samples from a continuous signal. A theoretical ideal sampler produces samples equivalent to the instantaneous value of the continuous signal at the desired points. Sampling can be done for functions varying in space, time, or any other dimension, and similar results are obtained in two or more dimensions. For functions that vary with time, let s(t) be a continuous function (or "signal") to be sampled, and let sampling be performed by measuring the value of the continuous function every T seconds, which is called the sampling interval or the sampling period. Then the sampled function is given by the sequence: s(nT), for integer values of n. The sampling frequency or sampling rate, fs, is the average number of samples obtained in one second (samples per second), thus fs = 1/T.

Music

Music can evoke a range of emotion and take your mind off anything that may be happening around you. Songs can come in a tiny format which allows a lot of them to be squeezed onto a fairly small storage space.

Recommended Music

• • • • •	• • • • •	• • • • •	• • • • •	• • • • •	• • • • •

ENTERTAINMENT
Electronic Entertainment
Audio
Music

File Size

The following tables are the approximate different sizes of audio files based on their format and bitrate.	**Mp3** **Bitrate - Size/Minute** ● 8 Kbps - 60 KB ● 16 Kbps - 120 KB ● 32 Kbps - 240 KB ● 40 Kbps - 300 KB ● 48 Kbps - 360 KB ● 56 Kbps - 420 KB ● 64 Kbps - 480 KB ● 80 Kbps - 600 KB	● 96 Kbps - 720 KB ● 112 Kbps - 840 KB ● 128 Kbps - 960 KB ● 160 Kbps - 1.2 MB ● 192 Kbps - 1.44 MB ● 224 Kbps - 1.68 MB ● 256 Kbps - 1.92 MB ● 320 Kbps - 2.40 MB	**FLAC (24 bits)** **Sampling - Size/Minute** ● 44.1 kHz - 5.58 Mb ● 48 kHz - 6.16 Mb ● 88.2 kHz - 11.26 Mb ● 96 kHz - 12.28 Mb ● 176.4 kHz - 34 Mb ● 192 kHz - 39 Mb	**Wav (24 bit)** **Bitrate - Size/Minute** ○

Electronic Entertainment
Audio
Podcast

Podcast

A podcast is an episodic series of digital audio files which a user can download in order to listen.

Recommended Podcasts

● The Survival Podcast (TSP) ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●

Electronic Entertainment
Audio
Audiobooks

Audiobooks

Lay back and immerse yourself into an alternative world with an audiobook. It doesn't take as much brainpower as reading and you don't need any light in case you're in a stealth situation. Also take a look at the "Reading" section below for more on books.

Recommended Audiobooks

It's hard to recommend audiobooks because of the vast number of books in existence and the fact that you can download programs to read out to you any content you have on your device. In a survival situation prepping eBooks would be best to listen to.

Non-Fiction
Non-fiction or nonfiction is content (sometimes, in the form of a story) whose creator, in good faith, assumes responsibility for the truth or accuracy of the events, people, or information presented.

Fiction
Literature in the form of prose, especially novels, that describes imaginary events and people.

Non-Fiction Categories ● Autobiography ● Biography ● Diary ● Dictionary ● Encyclopedia ● Guide ● Health ● History	● Journal ● Memoir ● Prayer ● Religion ● Science ● Travel ● True Crime	**Fiction Categories** ● Action ● Adventure ● Alternate History ● Children's ● Comic Book ● Crime ● Drama	● Fairytale ● Fantasy ● Graphic Novel ● Horror ● Mystery ● Poetry ● Romance	● Science Fiction ● Short Story ● Suspense ● Thriller ● Young Adult	

ENTERTAINMENT
Electronic Entertainment
E-readers

4 E-readers

An e-reader, also called an e-book reader or e-book device, is a mobile electronic device that is designed primarily for the purpose of reading digital e-books and periodicals. Any device that can display text on a screen may act as an e-reader, but specialized e-reader devices may optimize portability, readability (especially in sunlight), and battery life for this purpose. Their main advantages over printed books are portability since an e-reader is capable of holding thousands of books while weighing less than one and the convenience provided due to add-on features in these devices. An e-reader is a device designed as a convenient way to read e-books. It is similar in form factor to a tablet computer, but features electronic paper rather than an LCD screen. This yields much longer battery life —the battery can last for several weeks— and better readability, similar to that of paper even in sunlight. Drawbacks of this kind of display include a slow refresh rate and (usually) a grayscale-only display, which makes it unsuitable for sophisticated interactive applications as those found on tablets. The absence of such apps may be perceived as an advantage, as the user may more easily focus on reading.

E-readers can hold thousands of books (limited only by their memory) and use the same physical space as a conventional book. E-ink displays are not back-illuminated as normal LCD screens and therefore have a longer battery life and put less strain on eyes. LCD screens trigger a higher perceived and physical visual fatigue in comparison with the E-ink technology and conventional paper books. It is therefore less tiring to read on an E-ink display then on a paper book or LCD screen. Features as the possibility to adjust font size and spacing can help people with difficulty of reading or dyslexia. Some E-readers (e.g Kindle e-readers) provide the possibility of (Wikipedia) definitions, translations or dictionary lookups of key words.

Many of the major book retailers and third-party developers offer e-reader applications for desktops, tablets and mobile devices, to allow the reading of e-books and other documents independently of dedicated e-book devices. The e-reader applications are available for the Mac and PC computers as well as for Android, iOS and Windows devices.

Electronic Entertainment
Phone / Tablet Apps

5 Phone / Tablet Apps

If your phone is with you, fill it with free games prior to bugging out. Try not to choose 3D games as it will drain the battery much faster.

Recommended Games

My Boy! - GBA Emulator: Play games from the Gameboy era with this great emulator. The game file sizes are tiny at around 16mb max.
DraStic - NDS Emulator: Play any games from the Nintendo DS with this app.
The Room (1-3): 3D puzzle solving games where you manipulate objects to uncover secrets and get to the centre.
Angry Birds: The classic game of flinging birds at pigs. Should be free on most platforms and provide lots of fun during SHTF.
Cut the Rope: A cute little game where you cut a rope and try to get the lolly into the mouth of a cute critter.

Other Recommended Games

Duolingo (Free & Paid): Learn a language from scratch, however only the paid version lets you do this offline.
For prepping related apps see the ADDENDUM > Media section.

ENTERTAINMENT
Electronic Entertainment
Handheld Games

6 Handheld Games

Mini portable electronic games are lightweight and ideal for bugging out with as will provide a level of modern entertainment.

Tamagotchi: A virtual pet you feed, play with and clean up after. 5-8 Months Battery Life
Raspberry Pi: Great for emulating games from NES, SNES, Gameboy, PS1 and N64.
Pokémon Mini: A mini handheld system with Pokémon minigames.
NanoLite: A collection of 129 retro games.

Console	Description	Recommended Games
Game Boy	The first form of the Game Boy console, B/W with some good games.	• Pokémon Red / Blue • LoZ Link's Awakening • Super Mario Bros. • Tetris • Wario Land 3
Game Boy Colour	Uses large cartridges and now in colour, but hard to see in the dark.	• Pokémon Gold/Silver • LoZ Link's Awakening DX • Super Mario Bros DX • Metal Gear Solid • Stranded Kids
Game Boy Advance	Some of the best games are on the Advance from Pokémon to Mario.	• Pokémon Ruby/Sapphire • LoZ A Link to the Past • Wario Ware Twisted • Pokémon Fire/Leaf • Advance Wars
Game Boy Advance SP	More compact console with backlighting and a self-contained battery.	• Pokémon Ruby/Sapphire • LoZ A Link to the Past • Wario Ware Twisted • Pokémon Fire/Leaf • Advance Wars
Nintendo DS	A dual-screen console with more modern titles and non physical games.	• Pokémon Black/White • New Super Mario Bros. • Mario Kart DS • Pokémon Gold/Silver • Animal Crossing
Nintendo 3DS	Almost entirely non physical games and presents a 3D image on the screen. Internet required for non physical games.	• LoZ Link Between Worlds • Super Mario 3D Land • Fire Emblem: Awakening • Bravely Default • Pokémon Sun and Moon
Nintendo Switch	Downloadable games and a modular controller with a large screen. Does not need internet to play physical games.	• Super Mario Odyssey • LoZ Breath of the Wild • Mario Kart 8 • Splatoon 2 • Stardew Valley

Electronic Entertainment
Game Consoles

7 Game Consoles

Viable if you have a constant supply of electricity such as solar with a battery bank and the disaster wasn't an EMP. It's recommended to choose retro consoles as opposed to more modern ones as they use much less electricity and you don't need internet access to check keys and update games.

Console	Description	Recommended Games
SNES (Released 1990)	Uses cartridges, expensive games, fairly compact, requires Tv.	• Super Mario World • LoZ - A Link to the Past • Chrono Trigger • Final Fantasy III • Super Metroid
Playstation 1 (Released 1994)	Uses discs, great games, very small, requires Tv.	• Metal Gear Solid • Tony Hawks Pro Skater 2 • Silent Hill • Crash Bandicoot 3 • Spyro the Dragon
Nintendo 64 (Released 1996)	Uses cartridges, expensive games, amazing games, fairly compact, 6w electricity use, requires Tv. Can be adapted into a handheld console.	• Banjo Kazooie • Super Mario 64 • Mario Party 2 • Goldeneye 007 • LoZ - Ocarina of Time
Playstation 2 (Released 2000)	Fair sized console, uses discs, requires Tv.	• GTA San Andreas • Final Fantasy X • Gran Turismo 3 • Metal Gear Solid 2 • GTA Vice City
Original Xbox (Released 2001)	Large console, uses discs, great games, requires Tv. Uses 50w of power. Can be hardmodded with a new drive to put hundreds of games on it.	• Halo • Halo 2 • Star Wars KOTOR • TES Morrowind • Splinter Cell Chaos Theory
Xbox 360 (Released 2005)	More modern console with huge variety of games.	• Halo 3 • Fallout 3 • Skyrim • Portal 2 • Red Dead Redemption

Playstation 3 (Released 2006)	Fair sized console, uses discs, requires Tv.	• GTA V • The Last of Us • Uncharted 2 • Red Dead Redemption • Metal Gear Solid 4
Wii (Released 2006)	A fairly modern console that uses discs and tactile controllers.	• Wii Sports • Super Mario Galaxy • Super Mario Galaxy 2 • Super Smash Bros. Brawl • LoZ Skyward Sword
Wii-U (Released 2012)	A fairly modern console that uses discs and tactile controllers.	• Super Mario 3D World • Mario Kart 8 • Super Mario Bros. U • Xenoblade Chronicles • Splatoon
Playstation 4 (Released 2013)	A modern console with great graphics and hungry for power. **Requires Internet.**	• Horizon Zero Dawn • Uncharted 4 • Bloodborne • The Witcher 3 • Overwatch
Xbox One (Released 2013)	A modern console hungry for power but has great graphics. **Requires Internet.**	• Forza Horizon 3 • Fortnite • Halo 5 • Overwatch • The Witcher 3

8 Computer Entertainment

Computers, including laptops are generally too bulky to bug out with. Netbooks, Mobiles, Tablets and E-readers are a much smaller form factor with better battery life. If you have the power requirements to run a Pc then you have a huge selection of games you could play. The only restrictions are online or networked co-op games.

Uses

Typing / Documenting	Creating new documents such as a log so you can keep track of projects, mental notes or other survival requirements.
Reading	You can read documents on a pc.
Gaming	Pcs are much faster than portable devices so you're able to play more demanding games.
Programming	Program some applications or games if you wish.

Recommended Games

Skyrim	A hugely immersive and addictive game with weeks of gameplay, quests and items to collect.
Fallout 3	Made by the creators of Skyrim and is basically Skyrim with guns.
Age of Empires 2	The same as 1 but more civilizations to choose from and a lot more units.
Terraria	Very similar to minecraft but 2D and with more of an emphasis on bosses and progression.
Stardew Valley	A 2D exploration game where you live in a small village and have daily interactions with the locals.

9 Other Entertainment

Portable Entertainment Other electronic entertainment which is easily portable.	**Teenage Engineering: PO-16** Create whole songs on this compact digital music station.		

Virtual Reality

VR systems can provide a high level of immersion to take you out of the horrible situation which may be unravelling around you. The following list is of various VR systems and their advantages and disadvantages.

Samsung Gear VR	Uses a mobile device as the screen. More comfortable than Google Cardboard but isn't as light and can't be folded down to a tiny size.
Google Cardboard	Extremely cheap and light VR system which uses your mobile as a screen.
HTC Vive	Designed for video gaming this headset must be plugged into a PC.
Oculus Rift	Designed for video gaming this headset must be plugged into a PC.

8 Solo Entertainment

You may be alone in your bug out situation and have no survival needs to worry about. This section should hopefully assist in relieving your boredom.

Subheadings

1. Solo Activities	**2. Make A Time Capsule**	**3. Act Like a Kid Again**	**4. Teaching**
5. Learning	**6. Poetry**	**7. Storywriting**	**8. Letterwriting**

		9. Journaling	**10. Reading**	**11. Survival Stories**	**12. War Stories**		
		13. Robinson Crusoe	**14. Back to the Future I**	**15. Conspiracies**			

1 Solo Activities

Dining	Food passes the time if enjoyed and savoured as well as providing a degree of pleasure. If you have saved a rare or tasty type of food when all you have been eating is slop, treat yourself and pull out all the stops. Make sure you go the distance with a set table, proper lighting and cutlery as the anticipation can be just as good. Just be sure not to burn it.			
Relaxation / Pamper	Treating yourself to something special such as a bubble bath, spa or that bottle of wine you've been saving for 10 years. These can relax you and help pass the time.			
Taming An Animal	There may be a lot of wildlife around you but you haven't given thought to having one as a pet. Taming requires a bit of skill, patience and the means to care for the animal.	**Tame-able Animals** ● Dogs ● Cats ● Goat ● Pig ● Sheep ● Bird ● Cattle ● Chicken	**Tame-able Animals** ● Donkey ● Duck ● Camel ● Horse ● Goose ● Llama ● Ferret ● Rabbit	**Tame-able Animals** ● Fish ● Mouse ● Fox ● Hedgehog ● Ostrich ● Elephant ● Kangaroo ● Cockatoo
Complete a Project	Finish a project that has been sitting idly which you haven't wanted to finish. Finishing it will give you a sense of accomplishment and often provides you with something in return.			
Start a Big Project	If you're going to be living alone in a SHTF scenario for a while it would be beneficial to build a larger - more reinforced house or a new storage building. Not only will a new project keep your mind occupied but you'll also end up with a useful item by the end.			
Pondering Religion	Whether it's in a church or under a tree in your backyard, ponder faith, religion, God, and the purpose of life, and do some digging so you know for sure you're forming your own opinion without the input from family, friends, or peers. You can't really own your faith, or lack of faith, unless it's something you choose to believe, not something you were raised to believe. Take a look at the "Religion" section for more information about them.			
Stargaze	Lie back on the grass and look out into the sky, try to identify the star systems you know. If you want a hint there is a list of the star groups in the "Navigation" section. Wonder in awe at how big the universe is and how small you are in comparison.			
Imagining	Sit back and imagine you're on a tropical island and are surrounded by all your favourite foods which never gets cold (or hot). Pretend there's a dragon attacking your camp and you have to run around hiding from dragon breath. The floor is lava and you have to get to high ground! A beautiful man/woman has entered your camp and starts talking seductively to you.			
Fancy Dinner	If you've been saving a precious morsel for consumption at a later date now is the time to eat it. Pull out some bacon, eggs, sausage, wine or whatever you've been saving as well as some candles, a table cloth and cook up a treat. Use a knife and fork and savour the meal, don't just wolf it down.			
List Your Goals	First consider what you want to achieve, and then commit to it. Set SMART (specific, measureable, attainable, relevant and time-bound) goals that motivate you and write them down to make them feel tangible. Then plan the steps you must take to realize your goal, and cross off each one as you work through them. Goal setting is a powerful process for thinking about your ideal future, and for motivating yourself to turn your vision of this future into reality. The process of setting goals helps you choose where you want to go in life. By knowing precisely what you want to achieve, you know where you have to concentrate your efforts. You'll also quickly spot the distractions that can, so easily, lead you astray.			**Types of Goals** ● Career ● Financial ● Education ● Family ● Artistic ● Attitude ● Physical ● Pleasure ● Public Service
Create Some Artwork	Art is an inspired medium from which creativity and emotion flows. It often displays the design, thought and feelings of the artist to the world and can often be very abstract. Try picking one of the following art forms and giving it a go. Move out of your comfort zone into another field if you're feeling bored of painting or drawing all the time. If it's a 3D form of art - they can be hung around your house or even integrated with it.		**Types of Art** ● Ceramics ● Drawing ● Painting ● Sculpture ● Printmaking ● Designs	**Types of Art** ● Crafts ● Photography ● Video ● Filmmaking ● Literature ● Architecture
Invention	Have you been going through the same dreary routine every day? Try to invent something that will make your life easier and ease the daily burden of daily tasks. It doesn't have to be a revolutionary idea or concept, but something that was simple in modern life may be much more difficult now that SHTF.			**Ideas** ● Easier way to Fish ● Indoor Toilet ● Bird Trap ● Generating Electricity
Keep a Journal	If you don't already have a journal of the events that have happened to you I highly recommend keeping one. It could be a worldwide best seller one day of your survival tales and how you made it though the worst catastrophe of the century. You can also jot down notes of which plants are edible and keep other helpful hints like keeping track of what day it is.			
A Long Walk / Expedition	Walking somewhere where you haven't been before will switch your mind on as you have to remember the way you've taken. It will also provide you with new opportunities and possibly some new food to eat or sighting new animals.			

2 Make A Time Capsule

ENTERTAINMENT

Entertainment

Solo

Make A Time Capsule

Creating a time capsule will not only pass the time but give you (or someone else) something to look forward to opening in 10+ years - hopefully after this disaster has blown over. Ensure it's airtight and waterproof and that none of the contents will spoil over that timeframe. Following is a list of ideas of what you can put in.

News
- A local daily newspaper
- A videotape of the local nightly news
- A national newspaper (USA Today)
- A television guide
- A weekly news magazine (Time, Newsweek)
- An entertainment magazine (People, US)
- Special interest magazines (Sports Illustrated)
- Messages/Letters to the Future
- A copy of a future-oriented magazine
- Your favourite magazine
- Year-in-review issues of magazines or newspapers

Collectables
- Newspaper front pages with major headlines
- Ticket stubs (concerts, movies, sporting events, etc.)
- Sports trading cards (or other collectibles)
- A list of popular expressions (slang)
- A popular toy or doll (Beanie Babies, Pet Rock, etc.)
- A sample of product packaging (empty Coke can, etc.)
- An extended family tree

What to Put In
- A floor plan of your home
- A menu from a favourite restaurant
- Items from your job or school (business card, etc.)

Photos
- Downtown or suburban skyline and storefronts
- Advertising billboards
- Scenes from your neighbourhood
- The outside of your favourite restaurant
- Movie theatre marquee with movies listed
- Anything that you think is likely to change
- Interior and exterior shots of your home
- Photos of you in your favourite daily clothes
- Photos of your car(s)
- Photos of your workplace/School
- Vacation or fun-time photos

Video
- A video tour of your home
- A video tour of your work
- A video tour of your daily life
- A Predictions for the Future session with friends in front of the camera
- Family history interviews
- Video Messages to the Future

From TV/DVD
- Popular or favourite TV shows
- Year-in-review specials (usually in December)
- Major sporting events (Super Bowl, etc.)
- Major news events
- Music videos
- Awards programs (Academy Awards, etc.)
- Popular cartoons

Audio
- Top-10 music hits
- 45 or 90 minutes of radio programming
- Audio Messages to the Future
- A popular CD or taped radio show (top-10 music hits)

Documents
- A paycheck stub or utility bill
- A copy of a tax return
- A copy of a credit card bill
- A voided personal check

3 Act Like a Kid Again

Being an adult sucks sometimes. There's always work to be done. A lot is expected of you. You have to pay for food, and then when you eat it, your body does stupid things like give you heartburn. The benefits of a childlike perspective on the world are well documented. Whether it's the cardiovascular boost from a sense of wonderment or the stress-relieving properties of playfulness and laughter, studies show that going back to your youth isn't just fun: It's good for you.

Arts and crafts
Kids are inherently creative, but it's a skill that tends to drop off over time, as the vicissitudes of adult life compete for time and attention. Which is a shame, as research shows there are many cognitive benefits to maintaining a creative hobby in adulthood.

Build a Fort
Remember cozying up on a rainy day in your very own fort? Pillows and blankets stretched out across chairs, with a fat cat sprawled somewhere in the middle? That doesn't have to stop just because you're old now. In fact, it can be a downright awesome way to spend a romantic evening.

ENTERTAINMENT | Entertainment | Act Like a Kid Again

Hit the Playground
In 1995, artists Bob and Gail Cassilly launched a crazy project: turning an abandoned St. Louis shoe factory into a massive adult playground. It was a laughable idea, but upon its opening in 1997, City Museum was embraced with gusto, and today the cherished landmark draws more than 300,000 visitors a year.

Build a Treehouse
As an adult, your treehouse options expand dramatically, with the introduction of a key missing element: power tools. If you're a homeowner, building a treehouse is an awesome summer project that also boosts your property value, and it's not as expensive as you might think.

Make a Sand Castle
If you live near the beach, sandcastle building is probably a nostalgic pastime–but did you know it's also a serious craft? In the same vein as ice-sculpting or wood-carving, sandcastle building has its own associations and even major contests. Forget golf: Grab your shovel and pail, head down to the beach, and take up a hobby that's way more interesting.

Play Pretend
Playing pretend is a hobby shared by children all across the world, because it promotes creative thinking and fosters social cohesion. It's a shame, then, that it's a hobby we tend to abandon as we grow older–but it doesn't have to be. With just a handful of good friends and a bottle of cheap tequila, you too can play pretend.

Get Dirty
Rolling around in the mud and jumping in puddles is always fun for kids - not the parents. But since you're now a kid again you should go find a big hole of mud or a deep puddle to splash in.

4 Teaching

ENTERTAINMENT | Solo | Teaching

If the disaster you're facing is for the long term you will need to train up people in how to survive, especially your kids and giving them the education they deserve. TPE is aimed at proving this knowledge to anyone and everyone who will read it and will be an excellent resource in teaching people how to survive, including a lot of other topics. I also recommend having a collection of EBooks on various subjects such as Math, Physics and Chemistry to assist in teaching younger generations how the world works.	**Subjects** ● Science ● Technology ● History ● Geography ● Art ● Music ● Physical Education ● Religious Education	**Other Subjects** ● PSHE (personal, social and health education) ● Citizenship ● Modern Foreign Language

Teaching Subjects	**Science:** Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. **Technology:** The application of scientific knowledge for practical purposes, especially in industry. **History:** History is the study of the past as it is described in written documents. **Geography:** Geography is a field of science devoted to the study of the lands, features, inhabitants, and phenomena of Earth. **Art:** Art is a diverse range of human activities in creating visual, auditory or performing artefacts (artworks), expressing the author's imaginative, conceptual idea, or technical skill, intended to be appreciated for their beauty or emotional power. **Music:** Music is an art form and cultural activity whose medium is sound organized in time. **Physical Education:** Physical education, also known as Phys Ed., PE, gym, or gym class is an educational course related of maintaining the human body through physical exercises. **Religious Education:** Religious education is the teaching of a particular religion and its varied aspects: its beliefs, doctrines, rituals, customs, rites, and personal roles.

Physical Science Physical science is an encompassing term for the branches of natural science and science that study non-living systems, in contrast to the life sciences.	**Physics:** Physics is a natural science that involves the study of matter and its motion through spacetime, along with related concepts such as energy and force. More broadly, it is the general analysis of nature, conducted in order to understand how the universe behaves. **Chemistry:** Chemistry is the science of matter and the changes it undergoes. **Earth Science:** Earth science (also known as geoscience) is an all-embracing term for the sciences related to the planet Earth. **Ecology:** Ecology is the scientific study of the relationships that living organisms have with each other and with their abiotic environment. **Oceanography:** Oceanography, or marine biology, is the branch of Earth science that study of the ocean. **Geology:** Geology is the science comprising the study of solid Earth, the rocks of which it is composed, and the processes by which they change. **Meteorology:** Meteorology is the interdisciplinary scientific study of the atmosphere. **Astronomy:** Space science or Astronomy is the study of everything in outer space.
Life Science Life science comprises the branches of science that involve the scientific study of living organisms, like plants, animals, and human beings.	**Biology:** Biology is the branch of natural science concerned with the study of life and living organisms, including their structure, function, growth, origin, evolution, distribution, and taxonomy. **Zoology:** Zoology, is the branch of science that relates to the animal kingdom, including the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct. **Human Biology:** Human biology is an interdisciplinary academic field of biology, biological anthropology, nutrition and medicine which focuses on humans; it is closely related to primate biology, and a number of other fields. **Botany:** Botany, plant science, or plant biology is a branch of biology that involves the scientific study of plant life.
Social Sciences The social sciences are the fields of scholarship that study society. "Social science" is commonly used as an umbrella term to refer to a plurality of fields outside of the natural sciences.	**Anthropology:** Anthropology is the study of humans and human behaviour and societies in the past and present. **Archaeology:** Archaeology, is the study of human activity through the recovery and analysis of material culture. **Business Administration:** Business administration is management of a business. It includes all aspects of overseeing and supervising business operations and related fields which include accounting, finance and marketing. **Communication:** Communication is the act of conveying meanings from one entity or group to another through the use of mutually understood signs and semiotic rules. **Criminology:** Study of the nature, causes, control, consequences, and prevention of criminal behaviour. **Economics:** Studies the production, distribution, and consumption of goods and services. **Education:** Education is the process of facilitating learning, or the acquisition of knowledge, skills, values or beliefs. **Government:** A government is the system or group of people governing an organized community, often a state. **Linguistics:** Linguistics is the scientific study of language form, language meaning, and language in context. **Political Science:** Deals with systems of governance, and the analysis of political activities, thoughts, and behaviour.

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Formal Sciences Unlike other sciences, the formal sciences are not concerned with the validity of theories based on observations in the real world (empirical knowledge), but rather with the properties of formal systems based on definitions and rules.	**Decision Theory:** Or the theory of choice, is the study of the reasoning underlying an agent's choices. **Logic:** A subject concerned with the most general laws of truth and valid inference. **Mathematics:** Mathematics is the study of such topics as quantity, structure, space, and change. **Statistics:** Statistics is a branch of mathematics dealing with the collection, organization, analysis, interpretation and presentation of data. **Systems Theory:** Systems theory is the interdisciplinary study of systems. A system is a cohesive conglomeration of interrelated and interdependent parts that is either natural or man-made. **Theoretical Computer Science:** Theoretical computer science, or TCS, is a subset of general computer science and mathematics that focuses on more mathematical topics of computing and includes the theory of computation. **Information Theory:** Information theory studies the quantification, storage, and communication of information. **Theoretical Linguistics:** Theoretical linguistics, or general linguistics, is the branch of linguistics which inquires into the nature of language itself and seeks to answer fundamental questions as to what language is.
Applied Sciences Applied science is the application of scientific knowledge transferred into a physical environment. Examples include testing a theoretical model through the use of formal science or solving a practical problem through the use of natural science.	**Engineering:** Engineering is the creative application of science, mathematical methods, and empirical evidence to the innovation, design, construction, operation and maintenance of structures, machines, materials, devices, systems, processes, and organizations. **Applied Mathematics:** Applied mathematics is the application of mathematical methods by different fields such as science, engineering, business, computer science, and industry. **Applied Physics:** Applied physics is intended for a particular technological or practical use. It is usually considered as a bridge or connection between physics and engineering. **Medicine:** Medicine is the science and practice of the diagnosis, treatment, and prevention of disease. **Computer Science:** Computer science is the study of the theory, experimentation, and engineering that form the basis for the design and use of computers.

5 Learning

Learning

There are plenty of skills you can learn in the wild. Take a look at the "Skills" section and pick a category you want to delve into. From there pick one of the individual skills you've always been interested in but never had the time to try and learn. If you're lucky there may even be enough information in this spreadsheet to get you started, like if you picked blacksmithing.

Educate Yourself
Keeping your mind active is the best way to avoid boredom and learning something new will do this and provide you with knowledge you can use. This is different to the "Learn A Skill" distraction in the way that what you learn can't be created with your hands.

Learn an Instrument If you have access to an instrument or the ability to make one yourself you can learn to play. Be sure the instrument of your choice won't attract unwanted attention, or that you're far from civilization.	**Instruments to Learn** ● Piano ● Guitar ● Violin ● Drums ● Clarinet ● Saxophone ● Trumpet ● Banjo	**Compact Instruments** ● Recorder ● Flute ● Fiddle / Mandolin ● Ukulele ● Guitalele ● Harmonica ● Ocarina ● Erhu ● Kalimba ● Jew's Harp

6 Poetry

Poetry | Solo

Poetry is a form of literature that uses aesthetic and rhythmic qualities of language—such as phonaesthetics, sound symbolism, and metre—to evoke meanings in addition to, or in place of, the prosaic ostensible meaning.

Write Poems

A poem is an expression of art in written form, You can write them anywhere, even in your dorm!
They help you express emotions unspeakably deep, And often change others lives so they too shall weep.

Below are some various types of poems you may wish to write during SHTF, and some examples to help you get started.

Types of Poems

Poem Type	Poem Description	Example	
Sonnet	A short rhyming poem with 14 lines. The original sonnet form was invented in the 13/14th century by Dante and an Italian philosopher named Francisco Petrarch. The form remained largely unknown until it was found and developed by writers such as Shakespeare. Sonnets use iambic meter in each line and use line-ending rhymes.	**Visions (By Francesco Petrarch)** "Being one day at my window all alone, So manie strange things happened me to see, As much as it grieveth me to thinke thereon. At my right hand a hynde appear'd to mee, So faire as mote the greatest god delite; Two eager dogs did her pursue in chace. Of which the one was blacke, the other white:	With deadly force so in their cruell race They pincht the haunches of that gentle beast, That at the last, and in short time, I spide, Under a rocke, where she alas, oppress, Fell to the ground, and there untimely dide. Cruell death vanquishing so noble beautie Oft makes me wayle so hard a desire."
Limerick	A five-line witty poem with a distinctive rhythm. The first, second and fifth lines, the longer lines, rhyme. The third and fourth shorter lines rhyme. (A-A-B-B-A).	**To Miss Vera Beringer (By Lewis Carroll)** "There was a young lady of station 'I love man' was her sole exclamation; But when men cried: 'You flatter,' She replied, 'Oh! no matter Isle of Man is the true explanation.'"	

Haiku	This ancient form of poem writing is renowned for its small size as well as the precise punctuation and syllables needed on its three lines. It is of ancient Asian origin. Haiku's are composed of 3 lines, each a phrase. The first line typically has 5 syllables, second line has 7 and the 3rd and last line repeats another 5. In addition there is a seasonal reference included.	**Dust of Summers (By Ludmila Balabanova)** "Twilight… his voice deep purple" **Thirds (By Jeffrey Winke)** "Song birds at the train yard's edge two cars coupling"
Villanelle	A nineteen-line poem divided into five tercets (three-line stanzas) and a closing quatrain (four-line stanza), the villanelle is further constrained by a regular rhyming scheme and two refrains that are echoed in each stanza.	**Do not go gentle into that good night (By Dylan Thomas)** Do not go gentle into that good night, Old age should burn and rave at close of day; Rage, rage against the dying of the light. Though wise men at their end know dark is right, Because their words had forked no lightning they Do not go gentle into that good night. Good men, the last wave by, crying how bright Their frail deeds might have danced in a green bay, Rage, rage against the dying of the light. Wild men who caught and sang the sun in flight, And learn, too late, they grieved it on its way, Do not go gentle into that good night. Grave men, near death, who see with blinding sight Blind eyes could blaze like meteors and be gay, Rage, rage against the dying of the light. And you, my father, there on the sad height, Curse, bless, me now with your fierce tears, I pray. Do not go gentle into that good night. Rage, rage against the dying of the light.
Elegy	The word elegy does not describe the form of a poem, but rather its content. Elegies are poems written to lament someone's death, such as Walt Whitman's "O Captain! My Captain!" written in honour of President Lincoln. The long-standing tradition of this type of poem traces back to ancient Greece, when elegies were sung to the accompaniment of an aulos (a double-reed instrument). Elegies are distinct from short epitaphs, laudatory odes, and eulogies, which fall into the category of prose.	**In Memory of W.B. Yeats (By W.H. Auden)** "With the farming of a verse Make a vineyard of the curse, Sing of human unsuccess In a rapture of distress; In the deserts of the heart Let the healing fountain start, In the prison of his days Teach the free man how to praise."
Ballad	The ballad's lyrical rhythm and rhyme nod to the fact that this poetic form is rooted in song. The traditional ballad was performed at dances in time with the music, and the term ultimately derives from the Latin word ballāre meaning "to dance." This form of narrative poem is structured with an unspecified number of rhymed quatrains (four-line stanzas).	**Drover (By Elton John)** "From the sunburnt plains of far off North Australia Came a fella born to ride the wide brown land Oh he grew up running wil But soon by all was styled As the country's greatest-ever droving man" **Rime of an Ancient Mariner (By Samuel Taylor Coleridge)** "Day after day, day after day We stuck nor breathe, nor motion; As idle as a painted ship Upon a painted ocean."
Epic	Much like a ballad, an epic is a narrative poem that spins a tale—a lengthy one—of a hero's great valour and adventure. Much like the elegy, epics derive from ancient Greece, where epikós meant "speech," "tale," or "song," and applied not only to the subject matter but to a specific type of meter, the Epic meter.	**The Iliad (800 BCE) (By Homer)** Iliad is an example of an epic. It was written by the popular Greek poet, Homer. It relates the story of the Trojan wars, involving themes of courage, boldness, love for one's country and nostalgia of family. However, it describes many legends related to the siege of Troy, the events took place before the siege, the gathering of the warriors prior to the siege and the causes of the war. Later, the epic foretold the looming death of Achilles and the destruction of Troy. The style of narration is grand, and suits an epic poem — the reason that it is still one the most celebrated work of antiquity.
Sestina	The sestina took its name from the Italian word for "six," the number at the core of the poem's structure. This usually unrhymed poem consists of six six-line stanzas and a three-line envoy, or a short concluding stanza, at the end. Each stanza repeats the end words of the lines of the first stanza, but in a different order. Then, the envoy uses those six words again, three in the middle of the lines and three in the end.	**A Miracle for Breakfast (By Elizabeth Bishop)** "At six o'clock we were waiting for coffee, waiting for coffee and the charitable crumb that was going to be served from a certain balcony —like kings of old, or like a miracle. It was still dark. One foot of the sun steadied itself on a long ripple in the river …"
Free Verse	A Free Verse Poem does not follow any rules. Their creation is completely in the hands of the author. Rhyming, syllable count, punctuation, number of lines, number of stanzas, and line formation can be done however the author wants in order to convey the idea. There is no right or wrong way to create a Free Verse poem.	**The Garden (By Ezra Pound)** "Like a skein of loose silk blown against a wall She walks by the railing of a path in Kensington Gardens, And she is dying piece-meal of a sort of emotional anemia. And round about there is a rabble Of the filthy, sturdy, unkillable infants of the very poor. They shall inherit the earth. In her is the end of breeding. Her boredom is exquisite and excessive… will commit that indiscretion."

Read Poems

The best way to learn how to write poems is reading other's creations first and seeing what subject matter they write about. Below are some of the top rated poems from familyfriendpoems.com on a variety of subjects. Read them from left to right, top to bottom.

Read the poems from left to right and then drop a cell and continue.

Our Hearts Will Always Touch

By Ranja Kujala
Published: Sep 2007
Category: Cancer

When I lay there beside you,
Could you feel me there?
My arms were wrapped around you,
And I was stroking your hair.

I was talking about all the good times,
For me they were every single day.
I wanted you to feel love and comfort,
And happy in some way.

I watched your every breath,
And prayed that each one wasn't your last.
The time we got to share together,
Went by too quick...Too fast.

I wanted you to wake up,
Please Mum...Open your eyes.
Tell me this is a nightmare,
And not our goodbyes.

As your last breath grew closer,
We lay there peacefully together.
My heart continually breaking,
Because I wanted you forever.

Then there it was,
Your final breath of air.
I didn't want to believe it,
This is so cruel and not fair.

I held your beautiful face,
And prayed you'd breath again.
I wasn't ready for you to go,
I couldn't admit that this was the end.

But then I realized that you were now in peace,
And not suffering anymore.
You were beginning the life of an Angel,
And your body would no longer be sore.

I held you close and squeezed you tight,
And tried to say goodbye.
I've lost my Mum and my number one best friend,
All my heart could do is cry.

I slowly got up,
I wanted so much to stay.
I leaned over and gave you one more kiss,
It was so hard to walk away.

Mum, you are my entire world,
And I miss you so very much.
I wish I could feel your lovable cuddle,
And your soft and gentle touch.

But for now I have to wait,
Until we meet again.
You will always be in my heart and thoughts,
My dear Mum and best friend.

Always and Forever,
Our hearts will always touch.
Always and Forever,
Your baby girl loves you so much.

Because He Loves Cocaine

Melissa Scott
Published: Aug 2009
Category: Addiction

I can see it in his eyes
when he comes creeping in.
He's been somewhere he promised me
he'd never go again.

He thinks that I won't know it.
He thinks that I can't tell.
But he forgets how many times
he's put me through this hell.

The deceit is never-ending.
The betrayal. Silly lies.
How can he even sit there
and look me in the eyes?

I've cried so many tears.
I feel all alone.
He's sitting right beside me,
but he's not really home.

This drug has taken over him.
It's eating up his soul.
It's made his heart so ugly.
Black, like a piece of coal.

I try to stand beside him.
I try to give him love.
I beg him to love me more than it,
but I'm not good enough.

This burden is so heavy.
I cannot tell my friends.
I pray to God to help him.
I pray it someday ends.

Please God hear me praying.
Please God help him soon.
We have a little baby
who thinks he hung the moon.

He is just 8 months old
and I think it would be sad,
If a kid as great as him
has to grow up without a dad.

But his daddy is slowly dying.
Killing himself, without a care.
I wish that he could understand
that this just isn't fair.

I have no happiness anymore.
It's killing me as well.
We always fight. We never laugh.
We only scream and yell.

This is our lives he's tearing apart.
It's not a funny game.
It's destroyed our family and killed our love.
Because he loves "Cocaine."

Growing Up With Grandma

By Candy Canan
Published: Feb 2006
Category: Adoption

I don't know when it happened.
I don't know when she came,
But she's the one I always knew.
Grandma was her name.

She taught me how to tie my shoes.
She taught me how to talk,
And though I can't remember,
I think she taught me how to walk.

When all the other kids in school
Would talk about Mom and Dad,
I wondered where my parents were;
That made me kinda sad.

And sometimes there were days I'd cry
Or hide my head in shame.
But Grandma took it all in stride
And loved me all the same.

She'd wrap her arms around me
And kiss me on the head.
She'd tell me that she loved me
When she tucked me into bed.

To have a regular family,
Some siblings, a mom, and a dad.
What had I done to deserve less than others?
Sometimes I felt so mad.

Being a teen, I remember the days
When being with friends was more fun.
And I wondered what it would have been like
To actually be someone's son,

"It's alright, it's okay," Grandma would say.
"One day you'll understand why.
Life just isn't fair to everyone, you see.
It's always okay to cry."

And when I went off to college,
I met the love of my life.
It was Grandma who was the first I told
That I planned to make her my wife.

A little girl to share her name,
For all that she'd given me.
So much I owed to Grandma.
That was plain to see.

Soon after I'd become a father,
For that I could hardly wait.
To have a child of my very own,
And to make my Grandma a "Great."

As time passed and life grew short
I hoped my Grandma knew
That it was her love and her support
That always got me through.

If I could tell her one more thing,
"Thanks Grandma," is what I 'd say,
"For loving me and making me
The man I am today."

To Our Ellis

By Pamela A. Snow
Published: Feb 2006
Category: Prayer

How does a loving mother explain
Heaven to her dying child?
Please give me the words, O Lord, and
let me say them with a smile…

There is a place called heaven, Son,
beyond the skies above,
It is the place where GOD is watching,
His heart so full of love.

He watches all His children, Son,
He watches you and me,
He wants to know we love Him, and
hopes that we will be…

Always strong and healthy, always
kind and free!

But sometimes things do happen, Son,
and sickness takes a hold,
It might be something serious, it
might be just a cold.

GOD sends His special angels,
to watch over us and pray,
And by our side they linger, they
are never far away.

They lift us up on angels' wings when
we are all too weak,
And, oh!, they pray so softly, Son,
with gentle whispers do they speak.

So, have no fear, my darling, should
GOD come to take you home,
For it is up there in that heaven,
Son, where you will run and laugh
and roam!

You will hear that angel choir rejoice
in praises to the LORD,
And my darling precious child, you
never will be sick again...
No, never, anymore!!

But, most of all, you will meet the
King, our Saviour, your Best Friend, oh my!,
If I could see him take your hand, I
know that I would cry!!

You have fought so long, you gave your
all..GOD says it's time to rest,
We will always love and miss you, Ellis,
but GOD...He knows what's best!

In Your Heart

By Thomas S. Carver
Published: Feb 2006
Category: Daughter

He was so proud of his little girl.
It was her very first day of school.
He walked with her to school that day,
And she held his hand all the way.

They walked together quiet and sad,
A little girl and her loving dad.
Into the school her father led,
But he almost cried when she said,

"Daddy, Daddy, please don't go.
Don't leave me here all alone.
I'll miss you if you go away,
And I might need you; can't you stay?"

"Little Daughter, please don't cry.
You'll be okay, so dry your eyes.
You have our memories in your heart.
We're together though we're apart."

He sat up front on her wedding day
And cried as his daughter walked away.
Later that night he watched her dance.
He sat there waiting for his chance.

The band started to play their song.
Father and daughter danced along.
She looked at him and saw a tear
Then leaned and whispered in his ear,

"Daddy, Daddy, I have to go.
I hate to leave you all alone.
I'll miss you when I go away,
But if you need me then I'll stay."

"Little Daughter, I'll be just fine.
I'll love you always; you are mine.
I have our memories in my heart.
We're together though we're apart."

She came in his room and kissed his head
Then sat next to his hospital bed.
He took her hand and held it tight
And wished he had the strength to fight.

They sat together, quiet and sad,
A daughter and her dying dad.
He saw the tears she tried to hide.
She looked at him and then she cried.

"Daddy, Daddy, please don't go.
Don't leave me here all alone.
I'll miss you when you go away.
I still need you; you have to stay."

"Little Daughter, I love you so.
I want to stay but have to go.
I'll always be here in your heart.
We're together though we're apart."

Seasons of Grief

By Belinda Stotler
Published: Feb 2012
Category: Grief

Shall I wither and fall like an autumn leaf,
From this deep sorrow - from this painful grief?
How can I go on or find a way to be strong?
Will I ever again enjoy life's sweet song?

Sometimes a warm memory sheds light in the dark
And eases the pain like the song of a Meadow Lark.
Then it flits away on silent wings and I'm alone;
Hungering for more of the light it had shone.

Shall grief's bitter cold sadness consume me,
Like a winter storm on the vast angry sea?
How can I fill the void and deep desperate need
To replant my heart with hope's lovely seed?

Then I look at a photo of your playful smiling face
And for a moment I escape to a serene happy place;
Remembering the laughter and all you would do,
Cherishing the honest, caring, loving spirit of you.

Shall spring's cheerful flowers bring life anew
And allow me to forget the agony of missing you?
Will spring's burst of new life bring fresh hope
And teach my grieving soul how to cope?

Sometimes I'll read a treasured card you had given me
And each word's special meaning makes me see,
The precious gift of love I was fortunate to receive,
And I realize you'd never want to see me grieve.

Shall summer's warm brilliant sun bring new light,
And free my anguished mind of its terrible plight?
Will its gentle breezes chase grief's dark clouds away,
And show me a clear path towards a better day?

When I visit the grave where you lie in eternal peace,
I know that death and heaven brought you release;
I try to envision your joy on that shore across the sea,
And, until I join you, that'll have to be enough for me.

For all the remaining seasons of my life on earth,
There'll be days I'll miss your merriment and mirth,
And sometimes I'll sadly long for all the yesterdays;
Missing our chats and your gentle understanding ways.

Yet, the lessons of kindness and love you taught me,
And the good things in life you've helped me to see;
Linger as lasting gifts that comfort and will sustain,
Until I journey to that peaceful shore and see you again.

United

By Erica
Published: Dec 11, 2017
Category: Inspirational

Do we stay silent
Or raise our voices?
Do we give in
Or make our choices?

This is our chance.
This is our threat.
This is our choice.
And we're not finished yet.

We stand together
And await the light
This is our chance,
This is our fight.

Here we're standing,
United and strong.
We're not giving this up.
We're not moving on.

This is our voice;
This is what we came to show.
This is our choice,
And we're not letting go

This is our word.
You give what you get.
This is our world,
And we're not finished yet.

We stand beside you,
Ready to pay our debt
We stand united
Because we're not finished yet.

Children are born every day,
Waiting for someone to trust.
Dreams are dreamed every day
But left alone to rust.

Raise your voices; stand up tall.
You know this is unjust.
Make your choices; stand from the fall,
Because dreams are counting on us.

I know that you are scared to be strong.
You have every right to be.
Show the dreamers that you care.
Come and stand with me.

Think of our future; think of the truth.
Think of the lives we share.
Think of our beginnings; think of our youth.
We're all just a kid from somewhere.

Standing together, holding hands,
We all came from the same place.
Joined we are forever;
We are running the same race.

Stand with me; we're not through yet.
We are getting what we gave.
Hand in hand with me, strongest together.
This can all be saved.

This is like our lifetimes;
This is more than just a game.
This is more than just the money,
More than ourselves, more than fame.

Speak up for what matters,
Because now it does; this love is caving.
Speak up before we shatter.
Think of all the dreams we're saving.

There are kids like us in Texas,
Out in Utah, up in Maine.
There are kids that are the future Crosby,
Skinner, Matthews, Kane.

From the mountains, valleys, cities,
Suburbs, hamlets and countryside,
There are the children of this future.
All around us they reside.

On the Pittsburgh Penguins, Boston Bruins,
The Canes and Minnesota Wild.
We often forget that before they were champions,
Each one was just a child

They once stood watching,
Dreaming with this light inside their eyes.
Together we can save that light,
And return it to more lives.

Here we're standing, grasping hands;
Here we're standing strong.
This time we're not giving in,
And we're not moving on.

THIS is our voice;
This is what we came to show.
This is our choice,
And we're not letting go.

This is the world we live in.
You must give what you get.
This is our word we're giving.
We're not finished yet.

We stand together, united.
This is our chance to repay this debt.
We stand beside you all, united.
We're not finished yet.

Reflections

By David John Love
Published: Mar 2015
Category: Death

Remember all those happy days, those times she called our own
In all those well-loved places where you now grieve alone.
And those small endearing gestures, which you thought you knew so well,
Are fading, as time passes, with her words, her kiss, her smell.

Are fading, as time passes, with her words, her kiss, her smell.
But then there is that moment, that time within the day,
When you feel she is beside you in that old familiar way.

But as you turn to see her smile or receive a tender touch,
There's only a dark shadow of the one you loved so much.
And tears begin to fall in that hole of deep despair,
And memories overwhelm you - more than your heart can bear.

As you remember her gentle grace and her love so soft but strong,
Your heart will simply miss a beat as you miss her life, her song.
You want to rewind the clock and say how much you care;
You want to silence the talk that she's not there to share.

But you smile and chat amiably to family and friends
And hope they do not notice your world is at an end.
But she knows that you will carry on because she told you true
That if she had to choose again, she would still choose you.

Imagine

By Shelby S.
Published: May 2013
Category: Alone

Imagine yourself
Alone in your head.
You're hanging, dangling
From a silver thread.

Empty, alone
With the monsters within.
Internally screaming,
You just want to give in.

Now imagine that's you
Every day, every hour.
Forever sinking
Like a wilting flower.

You try to tell your dad
And you try to tell your mom,
But they say you're being silly,
You've just got to move on.

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Because teens don't know sorrow
Nor the hardships of life.
They're just kids with imaginations
Just looking for attention, right?

You think that there's none
Who knows how you feel.
You're just so alone,
But the feelings- they're real.

Useless,
Neglected,
Forgotten,
Distressed.

Alone,
Afraid,
But mostly
Depressed.

And you're friends,
They go on
Like nothing has changed.

"They must not care,"
Your thoughts whisper,
The lies in your brain.

You can't escape it,
Trapped in your own skin.
You're ugly,
You're hated,
But you mask it with a grin.

You hate what you feel,
So instead you feel nothing.
Your insides are numb,
Your confidence crumbling.

You look to other things
To stop the pain.
Cutting, pills,
But it gives you no gain.

And the people around you
Shout abuse your way.
"You're hurting yourself, stop it!"
That's all they ever say.

No matter how you plead
That you're broken inside,
They turn the other way,
They run, they hide.

They say you're just foolish,
It's all in your head.
What they don't know is inside
You're already dead.

It's Me

By Jacqueline Grieve
Published: Mar 2011
Category: Addiction

Hey, you guys, don't feel guilty,
It was just my time to go.
I can see you're all feeling sad,
I can see the tears still flow.

My life's journey ended early,
The path I chose was short.
You all tried your best to change it,
But in the end it was for me to sort.

I know I caused you sadness,
I know caused you pain,
But I was captured by these demons,
They wouldn't set me free again.

They took away my freedom,
They took away my choice,
And when they got their hooks in,
You could hear it in my voice.

There were times I tried to fight them,
There was a time I nearly won,
But they came back and overpowered me,
I had nowhere left to run.

I haven't really left you guys,
I am closer than you know,
I will be the whisper in the wind,
I will be everywhere you go.

One day you will all forgive me
One day you will understand
And when your time on earth is done
I will be waiting to take your hand.

Can I Carry You?

By Brad Anderson
Published: Feb 2006
Category: Family

I guess that I can hold you
one more time before you grow
and tell you that I love you
so that you will always know.

Please let me tie your shoe again.
One day you'll tie your own.
And when you think back to this time
I hope it's love I've shown.

Can I help you put your coat on?
Can I please cut up your meat?
Can I pull you in the wagon?
Can I pick you out a treat?

One day you might just care for me,
so let me care for you.
I want to be a part
of every little thing you do.

Tonight could I please wash your hair?
Can I put toys in the bath?
Can I help you count your small ten toes
before I teach you math?

Before you join a baseball team
can I pitch you one more ball?
And one more time can I stand near
to make sure you don't fall?

Let's take another space-ship ride
Up to the Planet Zoor.
Before our Cardboard Rocket
doesn't fit us anymore.

Please let me help you up the hill.
while you're still too small to climb.
And let me read you stories
while you're young and have the time.

I know the day will come
when you will do these things alone.
Will you recall the shoulder rides
and all the balls we've thrown?

I want you to grow stronger
than your Dad could ever be.
And when you find success
there will be no soul more proud than me.

So will you let me carry you?
One day you'll walk alone.
I cannot bear to miss one day
from now until you've grown.

My Best Friends Departure

By Carina Spencer
Published: Nov 2011
Category: Suicide

I jumped, you caught me.
I laughed, you joked.
I was down, you picked me up.
I crumbled, you glued me back together.
I loved you, you loved me back.

You jumped, I couldn't catch you.
You forgot to laugh, I couldn't remind you.
You were down, I couldn't hold you.
You crumbled, I had no glue.
You loved me, I still love you.

Without no warning or sign,
You ventured to a world divine.
I refused to say goodbye,
Yet tonight I cry.
My tears are for you my friend,
But our legacy will not end.

For I shall see you soon,
But first I have living to do.
I promise I won't forget,
Your face is embedded in my heart.

Scars

By Laura R
Published: Oct 2015
Category: Sad

Here on my arm lies a mark that I made.
When I was so low, I cut with a blade
To punish my body for being a mess,
Though here is my testament, I must confess…

That seeing these scars left on my arms, legs, and chest
Makes me realize I was in a place of no rest;
I feel guilty inside for leaving this token.
Now I will see and remember that I was so broken.

But seeing these scars helps me see
That I survived so much trauma and now I am free.
So I ask you now to stand with me and fight,
To show all these demons what they're doing is not right.

You won the battle of good versus bad.
You are still alive and are no longer sad.
Here on my arm lies a mark of survival.
I got through my hate and beat my self-rival.

The Siren

By YoungPoet
Published: May 2011
Category: Heartbreak

He wrote her a song, but it never got finished
They both fell in love, but it was soon diminished
She sits on his bed and cries in his lap
He cries back at her, knowing they can't go back.

Hours go by and neither one can accept
That by letting go they are doing what's best
At the end of the day, comes the part which he fears
To let her go without shedding a tear

Never again will he kiss her goodbye
And just that thought makes him start to cry
Now he'll finish that song, and he'll write it today
This is the start and here's what it says

"You are my siren, you drew me in
With a voice like an angel and the softest skin
Your eyes shine like diamonds and your smile melts my heart
I know that nothing could tear us apart"

That's what he wrote and let me just say
That he'd never do anything to throw that away
But that's not how it works; this world's bitter and harsh
And then something happened, which drew them apart

An old boyfriend showed up and that's when he knew
That her feelings for him were not shiny and new
This person left her and crushed her heart
But she had loved him since the very start.

When our boy came along she saw a way
To end her pain and make it all go away
But by loving this person through thick and through thin
She looked at our boy and wished it was him

Now this is where the second verse starts
It's about how she seemed to break his heart
He found out her feelings, it went straight to his head
So he carried on writing and here's what he said

"You make me smile when no one else can
It just makes me happy to be your man
But it hurts me deeply that you long for his heart
I thought we would last, but this breaks us apart"

He sat in his room and just wished he
Could be just like her ex so that they could be
But as long as he was there they could never be true
So he'd sit in his room feeling sad and blue

Now comes the part where she's crying in his lap
They both just decided to never go back
The pain is immense but it's saving his heart
Because staying with her would rip him apart

Here's where he decides to finish the song
The story of how it all went wrong
He starts the last verse with tears dripping off his nose
The papers all wet but here's how it goes.

"You were my siren, you drew me in
You taught me to love and you taught me to sin
I never thought you could break my heart
But I guess we were wrong right from the start"

"You were my siren, now I'm dead at sea
You drew me in, but you didn't want me
I just wish I knew where it all went wrong
But now another lost sailor can hear your song"

My Promise

By Dan P. Brown
Published: Feb 10, 2018
Category: Romance

If you were my rose, then I'd be your sun,
painting you rainbows when the rains come.
I'd change my orbit to banish the night,
as to keep you in my nurturing light.

If you were my world, then I'd be your moon,
your silent protector, a night-light in the gloom.
Our fates intertwined, two bodies in motion
through time and space, our dance of devotion.

If you were my island, then I'd be your sea,
caressing your shores, soft and gentle I'd be.
My tidal embrace would leave gifts on your sands,
but by current and storm, I'd ward your gentle lands.

If you were love's promise, then I would be time,
your constant companion till stars align.
And though we are mere mortals, true love is divine,
and my devotion eternal, to my one valentine.

She Doesn't Know I Love Her

By Baller327
Published: Oct 2008
Category: Love

When did my feelings get so deep?
Why did they take that big long leap?
Going from friend to crush,
What a rush,

And I don't think she knows.

Since when did her smile make me go weak?
Since when did her tears make mine start to leak?
Why does this happen when I'm always so strong?
When people called me Superman I guess they were wrong,

And I don't think she knows.

When she talks I can't help but watch her lips,
To notice their shape and curves when they dip.
Wait, why am I looking? I don't even know.
And I can't help but wonder if she even knows.

Her beautiful eyes are nothing like ours.
They're so deep and bright; you'd believe they were stars
They pour forth emotions in raging rivers.
They could make even me believe that Santa always delivers,

And still she has no idea.

Her body is perfection, though she denies it.
It makes my head spin with every glance I give.
She could put any man under her spell,
But she doesn't know how I feel, and I don't think I'll tell.

I love how she looks and who she is
And how she makes me feel like this.
I love how she's beautiful and smart with a heart so strong
And how she lives every day like nothing could go wrong.

Still she hasn't got a clue.

Now school is at an end on the 11th at noon.
I wonder if she cares that I'm moving soon.
We're parting that day after school for many months.
I just wish I could have kissed her just once.

Now that I've said it with my poetic skill,
I don't think she knew, and now she never will.

If

By Rudyard Kipling
Published: N/A
Category: Famous

If you can keep your head when all about you
Are losing theirs and blaming it on you;
If you can trust yourself when all men doubt you,
But make allowance for their doubting too:

If you can wait and not be tired by waiting,
Or, being lied about, don't deal in lies,
Or being hated don't give way to hating,
And yet don't look too good, nor talk too wise;

If you can dream - and not make dreams your master;
If you can think - and not make thoughts your aim,
If you can meet with Triumph and Disaster
And treat those two impostors just the same:.

If you can bear to hear the truth you've spoken
Twisted by knaves to make a trap for fools,
Or watch the things you gave your life to, broken,
And stoop and build'em up with worn-out tools;

If you can make one heap of all your winnings
And risk it on one turn of pitch-and-toss,
And lose, and start again at your beginnings,
And never breathe a word about your loss:

If you can force your heart and nerve and sinew
To serve your turn long after they are gone,
And so hold on when there is nothing in you
Except the Will which says to them: "Hold on!"

If you can talk with crowds and keep your virtue,
Or walk with Kings - nor lose the common touch,
If neither foes nor loving friends can hurt you,
If all men count with you, but none too much:

If you can fill the unforgiving minute
With sixty seconds' worth of distance run,
Yours is the Earth and everything that's in it,
And - which is more - you'll be a Man, my son!

Survival Poems (Gnomic Poetry)

The essence of gnomic poetry is to provide serious, meaningful advice. These poems are based around survival to help you memorise various aspects of surviving. These are hard to find on the internet, any help is appreciated.

Snake Identification

Red touch yellow, kill a fellow; red touch black, friend of Jack.	This old poem was devised to help distinguish between coral snakes (Micrurus fulvius), in which the red and yellow body rings come in contact, and (primarily) the nonvenomous scarlet king snake (Lampropeltis triangulum elapsoides) in which the red and yellow (or white) body rings always are separated by black. The scarlet snake (Cemophora coccinea), which is unrelated to the king and milk snakes, also is considered a mimic by some authors.

Wood Poem

These hardwoods burn well and slowly, Ash, beech, hawthorn oak and holly. Softwoods flare up quick and fine, Birch, fir, hazel, larch and pine. Elm and willow you'll regret, Chestnut green and sycamore wet.	Beechwood fires are bright and clear If the logs are kept a year. Chestnut's only good, they say, If for long 'tis laid away. But Ash new or Ash old Is fit for a queen with crown of gold. Birch and fir logs bum too fast Blaze up bright and do not last. It is by the Irish said Hawthorn bakes the sweetest bread.	Elm wood burns like churchyard mould, E ' en the very flames are cold. But Ash green or Ash brown Is fit for a queen with golden crown. Poplar gives a bitter smoke, Fills your eyes and makes you choke. Apple wood will scent your room With an incense like perfume. Oaken logs. if dry and old. Keep away the winter's cold	But Ash wet or Ash dry A king shall warm his slippers by. Beechwood logs burn bright and clear, If the wood is kept a year Store your Beech for Christmas-tide, With new-cut holly laid aside Chestnut's only good, they say If for years it's stored away Birch and Fir wood burn too fast, Blaze too bright, and do not last
Flames from larch will shoot up high, And dangerously the sparks will fly.... But Ashwood green, And Ashwood brown Are fit for Queen with golden crown.	Oak logs will warm you well That are old and dry Logs of pine will sweetly smell But the sparks will fly Birch logs will burn too fast Chestnut scarce at all sir Hawthorn logs are good to last That are cut well in the fall sir	Holly logs will burn like wax You could burn them green Elm logs burn like smouldering flax With no flame to be seen Beech logs for winter time Yew logs as well sir Green elder logs it is a crime For any man to sell sir	Beechwood fires burn bright and clear If the logs are kept a year Store your beech for Christmastide With new holly laid beside Chestnuts only good they say If for years tis stayed away Birch and firwood burn too fast Blaze too bright and do not last
Flames from larch will shoot up high Dangerously the sparks will fly But Ashwood green and Ashwood brown Are fit for a Queen with a golden crown Oaken logs, if dry and old Keep away the winters cold Poplar gives a bitter smoke Fills your eyes and makes you choke	Elmwood burns like churchyard mould Even the very flames burn cold Hawthorn bakes the sweetest bread So it is in Ireland said Applewood will scent the room Pears wood smells like a flower in bloom But Ashwood wet and Ashwood dry A King may warm his slippers by.	Pear logs and apple logs They will scent your room And cherry logs across the dogs They smell like flowers of broom	But Ash logs smooth and grey Buy them green or old, sir And buy up all that come your way They're worth their weight in gold sir
Logs to Burn, Logs to burn, Logs to burn, Logs to save the coal a turn, Here's a word to make you wise, When you hear the woodman's cries. Never heed his usual tale, That he has good logs for sale, But read these lines and really learn, The proper kind of logs to burn.	Oak logs will warm you well, If they're old and dry. Larch logs of pine will smell, But the sparks will fly. Beech logs for Christmas time, Yew logs heat well. "Scotch" logs it is a crime, For anyone to sell.	Birch logs will burn too fast, Chestnut scarce at all. Hawthorn logs are good to last, If you cut them in the fall. Holly logs will burn like wax, You should burn them green, Elm logs like smouldering flax, No flame to be seen.	Pear logs and apple logs, They will scent your room, Cherry logs across the dogs, Smell like flowers in bloom But ash logs, all smooth and grey, Burn them green or old; Buy up all that come your way, They're worth their weight in gold.

7 Storywriting

Writing a story can be a great experience even if you've never attempted it before or believe you can't do it. Below are some tips for you to write a great novel.

The First Paragraph

In today's fast-moving world, the first sentence of your narrative should catch your reader's attention with the unusual, the unexpected, an action, or a conflict. Begin with tension and immediacy. Remember that short stories need to start close to their end.
"I heard my neighbour through the wall."

Dry. Nothing sparks the reader's imagination.
"The neighbour behind us practiced scream therapy in his shower almost every day."

The second sentence catches the reader's attention. Who is this guy who goes in his shower every day and screams? Why does he do that? What, exactly, is "scream therapy"? Let's keep reading…

"The first time I heard him, I stood in the bathroom listening at our shared wall for ten minutes, debating the wisdom of calling the police. It was very different from living in the duplex over middle-aged Mr. and Mrs. Brown and their two young sons in Duluth."

The rest of the paragraph introduces I and an internal conflict as the protagonist debates a course of action and introduces an intriguing contrast of past and present setting.

"It is important to understand the basic elements of fiction writing before you consider how to put everything together. This process is comparable to producing something delectable in the kitchen–any ingredient that you put into your bowl of dough impacts your finished loaf of bread. To create a perfect loaf, you must balance ingredients baked for the correct amount of time and enhanced with the right polishing glaze."
Laurel Yourke

Developing Characters

"Your job, as a writer of short fiction–whatever your beliefs–is to put complex personalities on stage and let them strut and fret their brief hour. Perhaps the sound and fury they make will signify something that has more than passing value–that will, in Chekhov's words, "make (man) see what he is like.""
Rick Demarnus

In order to develop a living, breathing, multi-faceted character, it is important to know way more about the character than you will ever use in the story. Here is a partial list of character details to help you get started.

● Name ● Age ● Job ● Ethnicity ● Appearance ● Residence ● Pets ● Religion	● Hobbies ● Single or married? ● Children? ● Temperament ● Favourite colour ● Friends ● Favourite foods ● Drinking patterns	● Phobias ● Faults ● Something hated? ● Secrets? ● Strong memories? ● Any illnesses? ● Nervous gestures? ● Sleep patterns	

Imagining all these details will help you get to know your character, but your reader probably won't need to know much more than the most important things in four areas:

● Appearance. Gives your reader a visual understanding of the character.
● Action. Show the reader what kind of person your character is, by describing actions rather than simply listing adjectives.
● Speech. Develop the character as a person — don't merely have your character announce important plot details.
● Thought. Bring the reader into your character's mind, to show them your character's unexpressed memories, fears, and hopes.

For example, let's say I want to develop a college student persona for a short story that I am writing. What do I know about her?

Her name is Jen, short for Jennifer Mary Johnson. She is 21 years old. She is a fair-skinned Norwegian with blue eyes, long, curly red hair, and is 5 feet 6 inches tall. Contrary to the stereotype about redheads, she is actually easygoing and rather shy. She loves cats and has two of them named Bailey and Allie. She is a technical writing major with a minor in biology. Jen plays the piano and is an amateur photographer. She lives in the dorms at the University of Wisconsin-Eau Claire. She eats pizza every day for lunch and loves Red Rose tea. She cracks her knuckles when she is nervous. Her mother just committed suicide.

Choose a Point of View

Point of view is the narration of the story from the perspective of first, second, or third person. As a writer, you need to determine who is going to tell the story and how much information is available for the narrator to reveal in the short story. The narrator can be directly involved in the action subjectively, or the narrator might only report the action objectively.

First Person	The story is told from the view of "I." The narrator is either the protagonist (main character) and directly affected by unfolding events, or the narrator is a secondary character telling the story revolving around the protagonist. "I saw a tear roll down his cheek. I had never seen my father cry before. I looked away while he brushed the offending cheek with his hand." This is a good choice for beginning writers because it is the easiest to write. (But if your viewpoint character is too much like you, a first-person story might end up being a too-transparent exercise in wish-fulfilment, or score-settling.)
Second Person	The story is told directly to "you", with the reader as a participant in the action. "You laughed loudly at the antics of the clown. You clapped your hands with joy."
Third Person	The story tells what "he", "she," or "it" does. The third-person narrator's perspective can be limited (telling the story from one character's viewpoint) or omniscient (where the narrator knows everything about all of the characters). "He ran to the big yellow loader sitting on the other side of the gravel pit shack." Your narrator might take sides in the conflict you present, might be as transparent as possible, or might advocate a position that you want your reader to challenge (this is the "unreliable narrator" strategy).

Yourke on point of view:
● First Person. "Unites narrator and reader through a series of secrets" when they enter one character's perceptions. However, it can "lead to telling" and limits readers connections to other characters in the short story.
● Second Person. "Puts readers within the actual scene so that readers confront possibilities directly." However, it is important to place your characters "in a tangible environment" so you don't "omit the details readers need for clarity."
● Third Person Omniscient. Allows you to explore all of the characters' thoughts and motivations. Transitions are extremely important as you move from character to character.
● Third Person Limited. "Offers the intimacy of one character's perceptions." However, the writer must "deal with character absence from particular scenes."

Write Meaningful Dialogue

"Make your readers hear the pauses between the sentences. Let them see characters lean forward, fidget with their cuticles, avert their eyes, uncross their legs."
-Jerome Stern

Each speaker gets his/her own paragraph, and the paragraph includes whatever you wish to say about what the character is doing when speaking.

Bad Example
"Where are you going?" John cracked his knuckles while he looked at the floor. "To the racetrack." Mary edged toward the door, keeping her eyes on John's bent head. "Not again," John stood up, flexing his fingers. "We are already maxed out on our credit cards."

The above paragraph is confusing, because it is not clear when one speech stops and the other starts.

ENTERTAINMENT Solo Storywriting Write M

Questionable Example
"Where are you going?" John asked nervously.
"To the racetrack," Mary said, trying to figure out whether John was too upset to let her get away with it this time.
"Not again," said John, wondering how they would make that month's rent. "We are already maxed out on our credit cards."

The second example is mechanically correct, since it uses a separate paragraph to present each speaker's turn advancing the conversation. But the narrative material between the direct quotes is mostly useless.

Write Meaningful Dialogue Labels
"John asked nervously" is an example of "telling." The author could write "John asked very nervously" or "John asked so nervously that his voice was shaking," and it still wouldn't make the story any more effective.

How can the author convey John's state of mind, without coming right out and telling the reader about it? By inference. That is, mention a detail that conjures up in the reader's mind the image of a nervous person.

Good Examples
John sat up. "Wh– where are you going?"
Good Example "Where are you going?" John stammered, staring at his Keds.
Good Example Deep breath. Now or never. "Where are you going?"

Bad Example
John sat up and took a deep breath, knowing that his confrontation with Mary had to come now, or it would never come at all. "Wh– where are you going?" he stammered nervously, staring at his Keds.

Beware — a little detail goes a long way. Why would your reader bother to engage with the story, if the author carefully explains what each and every line means?

Use Setting and Context

"Setting moves readers most when it contributes to an organic whole. So close your eyes and picture your characters within desert, jungle, or suburb–whichever setting shaped them. Imagining this helps balance location and characterization. Right from the start, view your characters inhabiting a distinct place."
Laurel Yourke

Setting includes the time, location, context, and atmosphere where the plot takes place.
● Remember to combine setting with characterization and plot.
● Rather than feed your readers information about the weather, population statistics, or how far it is to the grocery store, substitute descriptive details so your reader can experience the location the way your characters do.
● Include enough detail to let your readers picture the scene but only details that actually add something to the story. (For example, do not describe Mary locking the front door, walking across the yard, opening the garage door, putting air in her bicycle tires, getting on her bicycle–none of these details matter except that she rode out of the driveway without looking down the street.)
● Use two or more senses in your descriptions of setting.

Good Example
Our sojourn in the desert was an educational contrast with its parched heat, dust storms, and cloudless blue sky filled with the blinding hot sun. The rare thunderstorm was a cause for celebration as the dry cement tunnels of the aqueducts filled rapidly with rushing water. Great rivers of sand flowed around and through the metropolitan inroads of man's progress in the greater Phoenix area, forcefully moved aside for concrete and steel structures. Palm trees hovered over our heads and saguaro cactuses saluted us with their thorny arms.

Set Up the Plot

Plot is what happens, the storyline, the action. Jerome Stern says it is how you set up the situation, where the turning points of the story are, and what the characters do at the end of the story.	*A plot is a series of events deliberately arranged so as to reveal their dramatic, thematic, and emotional significance."* ***Janet Burroway***

Understanding these story elements for developing actions and their end results will help you plot your next short story.
● Explosion or "Hook." A thrilling, gripping, stirring event or problem that grabs the reader's attention right away.
● Conflict. A character versus the internal self or an external something or someone.
● Exposition. Background information required for seeing the characters in context.
● Complication. One or more problems that keep a character from their intended goal.
● Transition. Image, symbol, dialogue, that joins paragraphs and scenes together.
● Flashback. Remembering something that happened before the short story takes place.
● Climax. When the rising action of the story reaches the peak.
● Falling Action. Releasing the action of the story after the climax.
● Resolution. When the internal or external conflict is resolve.

Brainstorming. If you are having trouble deciding on a plot, try brainstorming. Suppose you have a protagonist whose husband comes home one day and says he doesn't love her any more and he is leaving. What are actions that can result from this situation?

1. She becomes a workaholic.
2. Their children are unhappy.
3. Their children want to live with their dad.
4. She moves to another city.
5. She gets a new job.
6. They sell the house.
7. She meets a psychiatrist and falls in love.
8. He comes back and she accepts him.
9. He comes back and she doesn't accept him.
10. She commits suicide.
11. He commits suicide.
12. She moves in with her parents.

The next step is to select one action from the list and brainstorm another list from that particular action.

Create Conflict and Tension

"Conflict is the fundamental element of fiction, fundamental because in literature only trouble is interesting. It takes trouble to turn the great themes of life into a story: birth, love, sex, work, and death."
-Janet Burroway

Conflict produces tension that makes the story begin. Tension is created by opposition between the character or characters and internal or external forces or conditions. By balancing the opposing forces of the conflict, you keep readers glued to the pages wondering how the story will end.

Possible Conflicts
● The protagonist against another individual
● The protagonist against nature (or technology)
● The protagonist against society
● The protagonist against God
● The protagonist against himself or herself.

Yourke's Conflict Checklist
● Mystery. Explain just enough to tease readers. Never give everything away.
● Empowerment. Give both sides options.
● Progression. Keep intensifying the number and type of obstacles the protagonist faces.
● Causality. Hold fictional characters more accountable than real people. Characters who make mistakes frequently pay, and, at least in fiction, commendable folks often reap rewards.
● Surprise. Provide sufficient complexity to prevent readers predicting events too far in advance.
● Empathy. Encourage reader identification with characters and scenarios that pleasantly or (unpleasantly) resonate with their own sweet dreams (or night sweats).
● Insight. Reveal something about human nature.
● Universality. Present a struggle that most readers find meaningful, even if the details of that struggle reflect a unique place and time.
● High Stakes. Convince readers that the outcome matters because someone they care about could lose something precious. Trivial clashes often produce trivial fiction.

Build to a Crisis or Climax

This is the turning point of the story–the most exciting or dramatic moment.	*"The crisis may be a recognition, a decision, or a resolution. The character understands what hasn't been seen before, or realizes what must be done, or finally decides to do it. It's when the worm turns. Timing is crucial. If the crisis occurs too early, readers will expect still another turning point. If it occurs too late, readers will get impatient–the character will seem rather thick."* ***Jerome Stern***

Jane Burroway says that the crisis "must always be presented as a scene. It is "the moment" the reader has been waiting for. In Cinderella's case, "the payoff is when the slipper fits."

While a good story needs a crisis, a random event such as a car crash or a sudden illness is simply an emergency –unless it somehow involves a conflict that makes the reader care about the characters.

Find a Resolution
The solution to the conflict. In short fiction, it is difficult to provide a complete resolution and you often need to just show that characters are beginning to change in some way or starting to see things differently. Yourke examines some of the options for ending a story:

● Open. Readers determine the meaning. "Brendan's eyes looked away from the priest and up to the mountains."
● Resolved. Clear-cut outcome.
While John watched in despair, Helen loaded up the car with her belongings and drove away.
● Parallel to Beginning. Similar to beginning situation or image.
They were driving their 1964 Chevrolet Impala down the highway while the wind blew through their hair.
Her father drove up in a new 1964 Chevrolet Impala, a replacement for the one that burned up.
● Monologue. Character comments. "I wish Tom could have known Sister Dalbec's prickly guidance before the dust devils of Sin City battered his soul."
● Dialogue. Characters converse.
● Literal Image. Setting or aspect of setting resolves the plot.
The aqueducts were empty now and the sun was shining once more.
● Symbolic Image. Details represent a meaning beyond the literal one.
Looking up at the sky, I saw a cloud cross the shimmering blue sky above us as we stood in the morning heat of Sin City.

8 Letterwriting

If you have been separated from a loved one you can write them a letter to give to them when you see them again. There's many other forms of letters you can write, as long as you know who it's destined for you can write it.

Love Letter

1	Start off by stating the purpose of your letter. You want your love to know right away that this is a love letter and not a note to give her the brush off or to voice some kind of displeasure with the relationship. Begin with something like, "I was thinking today about how very much I love you, and how I really don't tell you that enough. So I wanted to sit down and let you know how truly in love with you I really am."
2	Recall a romantic memory. What's special about couplehood is that the two of you have a shared history, a history that is unique to you and your love. Thus the best way to start a love letter is to refer to a shared memory; this conjures up feelings of your history together and scores you points for remembering details of your past. For example, begin by saying, "I still remember clearly the moment when you walked into Rob's party, wearing that stunning red dress. You were smiling ear-to-ear and absolutely lit up the room. I knew immediately that I had to meet you. I went to the bathroom to try to summon up my courage and think of what to say. But it was no use; I was totally tongue tied when I approached you. I was smitten from the very start."
3	Now transition to a section about the things you love about her. Move from your memory to the present with a line like, "And here we are more than a decade later, and you still leave me weak in the knees."
4	Tell her all the things you love about her. Before you write this section, make a list on a separate sheet of paper of all the things you that you love about your significant other. Think about her physical characteristics, her personality, her character, and all the wonderful things she does for you. Then, turn the things you listed into sentences. "I truly think you are the most beautiful women in the world. I love the feeling of your legs intertwined with mine and the smell of your hair and skin. Your smile lifts my spirits on even my worst days. I love your laugh and your ability to find humour in every situation. I'm so grateful for everything you do for me, from your delicious dinners to your magnificent backrubs."

5	Tell her how your life has changed since meeting her. “You truly complete me. These last few years have been the happiest of my life. I can’t tell you how lucky I feel to always have my best friend by my side.”
6	Reaffirm your love and commitment. “I will always love you, no matter what happens, through thick and thin. I will be absolutely true and faithful to you forever.”
7	End with a line that sums up your love. “I can’t wait to grow old with you.” “My love for you will never end.” “You are my best friend and soul mate and I will love you until the end of our lives.”

9 Journaling

Journaling generally involves the practice of keeping a diary or journal that explores thoughts and feelings surrounding the events of your life. There are several different ways to do this. Journaling, as a stress management and self-exploration tool, works best when done consistently, but even occasional, sporadic journaling can be stress relieving when the practice is focused on gratitude or emotional processing. One of the most effective ways to reduce stress with journaling is to write in detail about feelings and thoughts related to stressful events, as one would discuss topics in therapy, and brainstorm solutions, but there are several different ways to practice journaling. The method you choose can depend on your needs at the time, and your personality; just do what feels right.

Benefits	Journaling allows people to clarify their thoughts and feelings, thereby gaining valuable self-knowledge. It’s also a good problem-solving tool; oftentimes, one can hash out a problem and come up with solutions more easily on paper. Journaling about traumatic events helps one process them by fully exploring and releasing the emotions involved, and by engaging both hemispheres of the brain in the process, allowing the experience to become fully integrated within one’s mind. Journaling can also help you to focus on areas of your life that you're like to focus on more often, as is the case with gratitude journaling or even coincidence journaling. As for the health benefits of journaling, they've been scientifically proven. Research shows the following: ● Journaling decreases the symptoms of asthma, arthritis, and other health conditions. ● It improves cognitive functioning. ● It strengthens the immune system, preventing a host of illnesses. ● It counteracts many of the negative effects of stress.
Journaling Strategies	Journaling is a highly effective tool for stress relief and can take several forms, so there are multiple options that can work for you. If you already have a favourite journaling habit, by all means, keep it up! But you may want to try something new in addition to it. And if you're new to journaling, here are several practices to try.

Types of Journals

Gratitude Journal	Some people keep a daily gratitude journal where they list three or more aspects of each day for which they are grateful. This is a highly effective strategy for relieving stress because it helps you to focus on the resources you have in your life already and create a more positive mood at the moment, both of which have been shown to build long-term resilience. A bonus benefit is that you are left with a record of the many nice things that have happened throughout your days, so if you're feeling down in the future, you can cheer yourself up with a few pages of reminders for the things you have to appreciate in life.
Emotional Release	You may also write about your emotional responses to events that have happened throughout the day as a way of coping with the stress. This can help you to process what you are feeling and perhaps even explore more positive reframing options. When writing about positive experiences, this allows you the ability to maximize and savour the positive feelings you may have for the good things that have happened in your day. This is also a great way to expand on the positive and manage the negative things that happen in your life, increasing your positivity ratio, which is an important aspect of stress management.
Bullet Journal or Personal Planning Journal	Some people simply keep journals to track what they need to do each day, goals they have, memories they create, and other things they don't want to forget. Because writing things down can help keep your mind uncluttered and help you to remember what's important to you, this can relieve stress as well. Being more organized and balanced is a great way to feel less stressed.

10 Reading

Reading was the most popular past-time in recent history before the invention of television, portable music and social media. If you don't have your own books to read, below is a collection of stories ranging from a few minutes to read to a full novel entitled "Robinson Crusoe".

Types of Books

	Non-Fiction	Non-Fiction	Fiction	Fiction
Non-Fiction Non-fiction is content whose creator, in good faith, assumes responsibility for the truth or accuracy of the events, people, or information presented. **Fiction** Literature in the form of prose, especially novels, that describes imaginary events and people.	● Art ● Autobiography ● Biography ● Cookbook ● Diary ● Dictionary ● Encyclopedia ● Guide ● Health	● History ● Journal ● Math ● Memoir ● Prayer ● Religion ● Science ● Travel ● True Crime	● Action ● Adventure ● Alternate History ● Children's ● Comic Book ● Crime ● Drama ● Fairytale ● Fantasy ● Graphic Novel	● Horror ● Mystery ● Picture Book ● Poetry ● Romance ● Science Fiction ● Short Story ● Suspense ● Thriller ● Young Adult

11 Survival Stories

These are true stories about people thrown into survival situations.

12 War Stories

True stories about various historical wars which will engage your mind.

Short Stories

Operation FALCONER

ENT Entertainment War Stories Short Stories

Trooper X's patrol was tasked with clearing an Iraqi installation, to prevent it being used for the command and control of Iraqi theatre ballistic missiles. Trooper X was the machine gunner in the exposed .50 Calibre mounting ring in his patrol vehicle. During the action, an enemy special operations force of two vehicles and up to 20 heavily armed personnel engaged the SAS patrol. Whilst in contact with numerically superior enemy forces, Trooper X's actions in destroying the enemy vehicles gave the Australian force the freedom of movement to complete the mission. In a hazardous situation and under fire, Trooper X immediately engaged and destroyed the first enemy vehicle with his Javelin missile system. Having limited the enemy's ability to manoeuvre, the patrol assaulted forward and Trooper X engaged a further Iraqi position located to the south with his machine gun.

Trooper X re-engaged the enemy with his machine gun, demonstrating great composure. Trooper X then re-engaged and destroyed the second enemy vehicle with the Javelin, dispersing nearby enemy soldiers who were setting up a mortar position. Subsequently, as the patrol closed on the enemy position, Trooper X engaged a mortar tube with his sniper rifle, hitting the tube with his first round and causing the weapon to explode. At this stage individual enemy started to surrender, creating a situation where surrendering soldiers were intermingled with other enemy who were still engaging the SAS patrol. Trooper X then judiciously placed well aimed shots within close proximity of the enemy that were still engaging from concealed positions, forcing them to surrender.

John Babington GC

In late 1940, a German mine landed in Chatham Dockyard in Kent, bringing the place to a standstill. Such was the size and weight of the mine it had driven itself into the ground and ended up in a 16-feet-deep pit. It was fitted with a new type of anti-handling fuse, which made it a particularly dangerous prospect for bomb disposal. A few weeks earlier, an RAF officer had died trying to disarm a similar device. Ignoring the danger, Sub Lieutenant John Babington volunteered to tackle the mine. He was lowered into the pit. Babington attached a line to the head of the fuse to remove it, but it broke. Although the device could have detonated at any moment, he went into the pit three times, but each time the line broke. Finally, he succeeded and had the bomb lifted out and safely destroyed.

His bravery helped the bomb disposal authorities in understanding how to deal with the mechanisms of these new devices. John Babington was a sub lieutenant in the Royal Naval Volunteer Reserve who worked in bomb disposal during the Second World War. He had a scientific background and was teaching physics when war broke out. A calm, thoughtful man, he put his skills to good use in the dangerous and high-risk field of bomb disposal. Throughout the war, he passed on his knowledge in tackling devices to others. Babington survived the war and went back to teaching. He died in 1992. John Babington's George Cross is on display in the Lord Ashcroft Gallery: Extraordinary Heroes at IWM London.

Working Through the Air Raid

In November 1940, three women of the Women's Auxiliary Air Force (WAAF) were awarded 50% of all the Military Medals (MM) received by members of that service during the Second World War. They were stationed at RAF Biggin Hill in Kent, which suffered some of the worst air raids during the Battle of Britain. In a devastating attack on 30 August, 39 people were killed. The next morning, those who had survived reported for duty as usual, at the start of a day that would see further air raids. Sergeant Joan Mortimer, Flight Officer Elspeth Henderson and Sergeant Helen Turner were all WAAF teleprinter operators who stayed at their posts during the heavy Luftwaffe (German Air Force) attacks on 1 September. Elspeth Henderson continued her work keeping in contact with Fighter Command Headquarters, Uxbridge while the raid was on. She carried on even after she was knocked to the ground as the operations room where she was working took a direct hit.

Helen Turner was the switchboard operator and also kept working as the building was hit and bombs fell nearby. It was only when a fire broke out and they were ordered to leave that the two women finally abandoned their posts. Sergeant Joan Mortimer was in the armoury when the air raid started. Although surrounded by several tons of high explosive, she remained at her telephone switchboard relaying messages to the defence posts around the airfield. Mortimer then picked up a bundle of red flags and hurried out to mark the numerous unexploded bombs scattered around the area. Even when one went off close by, she carried on. For the bravery all three WAAFs displayed in their determination to carry out their duties during such danger, each was awarded a Military Medal in November 1940.

Putting Out Flames with Bare Hands

On 15 September 1940, Flight Sergeant John Hannah was the wireless operator and air gunner in a Hampden bomber that was carrying out a raid on German invasion barges at Antwerp, Belgium. After releasing its bombs, the Hampden quickly came under attack from anti-aircraft guns. It took a direct hit, which started a fierce fire that soon engulfed the whole fuselage. Gunner George James bailed out after the floor melted beneath him in the intense heat. Surrounded by flames, Hannah would have been justified in following him. But instead he began trying to put out the fire with the aircraft's two fire extinguishers. When those were empty, he used his log book and then his own hands to stop the spread of the blaze. He worked for ten minutes in the blistering heat, as ammunition exploded around him and another member of the crew bailed out of the stricken aircraft.

Hannah managed to stop the fire, but suffered burns to his eyes and face in the process. He then crawled through to the pilot, Connor, to tell him the inferno was out. On discovering they were the only two left on board, Hannah took over the navigation while Connor flew the badly-damaged bomber (pictured here) back to their base. Hannah was taken to hospital for emergency treatment where he learned on 1 October that he had been awarded a Victoria Cross (VC), the highest decoration for gallantry, for his incredible bravery. He was just 18 years old at the time. Hannah recovered and remained in the RAF, but contracted tuberculosis and was discharged in 1942. He died just five years later and is buried in Leicester.

Saving a Village

Pilot Officer Bill Millington was flying as part of a section on aerodrome guard patrol over Kent on 31 August 1940. A large number of German Dornier and Messerschmitt aircraft were sighted and the RAF pilots went into the attack. Millington managed to cause damage to one of the Dornier bombers but he soon found himself under fire from three Messerschmitts. He quickly put one out of action and shook off the other two. Millington was now outnumbered by the Luftwaffe aircraft but he didn't leave the fight, and instead fired on the bombers. Now the Messerschmitt fighters began to target him, and he drew on all his flying skills to evade one and shoot another down. But as he did so, one more fired a cannon shell into the engine of his Hurricane, which also wounded him in the thigh. With his aircraft ablaze and his leg in agony, Millington knew he would have to abandon the battle.

His immediate thought was to bail out and parachute to safety – but he noticed that, if he did so, his aircraft would almost certainly crash into a small village. Despite his injuries, the intense danger of remaining in his rapidly burning aircraft and the difficulties of controlling it, Millington stayed in the cockpit. He managed to crash-land his Hurricane clear of the village and escape from it before it exploded. For his determination to avoid causing harm to others, whilst placing himself at risk, Millington was awarded the Distinguished Flying Cross (DFC) in October 1940. Bill Millington was born in Britain but emigrated with his family to Australia in 1926. With the Second World War imminent, he joined the RAF in 1939 and served with 79 Squadron during the Battle of Britain. Following his crash-landing on 31 August, he was treated for severe burns in hospital. After recovering, he continued to fly successful missions until he was shot down over the Channel on 30 October 1940.

Robert Davies GC

On 12 September 1940, in a night of heavy raids over London, a huge bomb fell to the ground and became buried almost underneath St Paul's Cathedral. Lieutenant Robert Davies of the Royal Engineers was sent to tackle the unexploded device. The bomb had fallen at 2.25 am and forced its way 8 metres down into the ground. It could not be disarmed, and detonating it would have destroyed the cathedral. The only option was to remove it intact. Davies led a team of men in their painstaking task of digging out the bomb, which took them three days to complete. They had to be extremely careful, as one wrong move could have set it off. Damaged electrical cables and ruptured gas mains made the work even more dangerous. Once Davies and his men had successfully excavated the massive bomb, they used two lorries to pull it carefully from the ground. St Paul's Cathedral was safe, but the bomb, now loaded onto one of the lorries, was still very dangerous.

To protect his men from any further risk, Davies decided to drive it away himself to be disposed of. He took the wheel and drove on his own, quickly but carefully, to Hackney Marshes in East London. This was the nearest bomb 'cemetery', a place designated for destroying fuses or exploding live devices. In the middle of the marshes, he detonated the bomb, which blew a 30-metre-wide crater. Robert Davies and his team of Royal Engineers became the 'bomb squad which saved St Paul's' and were widely congratulated for their life-saving actions. If such an important London landmark had been seriously damaged, it would have had a crushing impact on British morale. Davies was awarded the newly-established George Cross in September 1940. He later emigrated to Australia, where he died in 1975. Robert Davies's George Cross is on display in the Lord Ashcroft Gallery: Extraordinary Heroes at IWM London.

Flying Blind

Flying Officer Gordon Cleaver was defending his base, RAF Tangmere, from intense Luftwaffe air raids on 15 August 1940. Cleaver was an experienced fighter pilot who had already destroyed a number of enemy aircraft in operations over France. During the raid, he led his section with courage and determination against the German bombers. Cleaver went into the attack and destroyed one of the German aircraft. But his Hurricane was hit – a cannon shell smashed into it, shattering the cockpit's hood and sending Perspex splinters into Cleaver's eyes.

With his aircraft damaged and his sight severely impaired, the obvious choice would have been to bail out. But he refused to abandon his aircraft and instead, with great difficulty, made a successful landing. Cleaver was rushed to hospital where his sight was partially saved, but he was unable to continue his flying career in the RAF. In September 1940, he was awarded the Distinguished Flying Cross for his bold bravery in attacking the enemy bombers and in saving his aircraft despite such painful, impairing injuries.

Not Giving Up

Flight Lieutenant James Nicolson was on patrol near Southampton on 16 August 1940, when his Hawker Hurricanewas fired on by a German fighter aircraft. Making the 'loudest noises [he] had ever heard', four cannon shells thudded into his cockpit, damaging his machine, setting his petrol tank alight and wounding him in the eye, leg and heel. Surrounded by flames and with blood pouring down him from his injuries, Nicolson prepared to bail out. But just as he did so, he spotted a Messerschmitt Bf 110 ahead. Despite being in severe pain, he put down his parachute and reached instead for his gun controls. He poured fire into the German aircraft, keeping up his assault even as it tried to turn and twist away from him. As he attacked, Nicolson noticed that the intense heat of the cockpit was burning his flesh.

Only then did he abandon his Hurricane. After giving the Messerschmitt one last burst, he struggled free of his blazing cockpit and tumbled out into the sky. Nicolson deployed his parachute and, as he fell, he took stock of his extensive injuries, noticing that he could see the bones of his left hand showing through the knuckles. He managed to land in a field and was rushed to hospital, where his life hung in the balance. After several weeks, he had recovered enough to make it out of danger, but the burns he had received took much longer to heal. Nicolson was awarded the Victoria Cross, which he received from King George VI at Buckingham Palace in November 1940.

Brandon Moss GC

The city of Coventry suffered particularly badly during the Blitz. On the night of 14--15 November 1940, German bombs rained down for 11 hours in one of the most devastating attacks on the English city. Brandon Moss was on duty that night. He was a Special Constable throughout the Second World War, serving with the defence forces. After working a 12-hour shift in a factory, he went out at night to help during air raids. It was a dangerous job and Moss narrowly escaped death a number of times. During the 14-15 November raid, a house was demolished by a direct hit. Knowing there were three people trapped inside, Moss ignored the threat of further attacks to clear a tunnel to them. He led a rescue party in highly dangerous conditions that included collapsing debris and a gas leak. When the situation became too perilous, the other rescuers gave up. But Moss kept going alone. His tireless efforts paid off and he finally freed all three people.

Moss then learned that more people were trapped in the neighbouring house. Trying to reach them again meant risking the falling beams and rubble of the bomb-hit home. Fighting sheer exhaustion, Moss worked alone throughout the night to rescue another person. Moss's 'superhuman' efforts to save these people were carried out between 11.00 at night and 6.30 the next morning. Further explosives fell while he was working, and it was known that a delayed-action bomb had fallen nearby. The following month, Brandon Moss became the first Special Constable to earn a George Cross. He continued his dangerous voluntary work for the rest of the war. He retired from the Special Constabulary in 1948 and died in Coventry aged 90. Brandon Moss's George Cross is on display in the Lord Ashcroft Gallery: Extraordinary Heroes at IWM London.

Reginald Ellingworth GC

Reginald Ellingworth served with the Royal Navy during the First World War. By the Second World War, he was a torpedo specialist based in the shore establishment HMS Vernon. He became part of a Rendering Mines Safe team, working closely with Lieutenant-Commander Richard Ryan. During the Blitz, the pair specialised in defusing unexploded magnetic mines. It was dangerous work, where any movement could restart the mines' timers. On 21 September 1940, Ellingworth and Ryan were called to defuse a German mine in Dagenham in East London. They had already cleared several mines that day, including one at nearby Hornchurch that threatened the airfield and an explosives factory there.

The Dagenham mine was hanging from the roof of a house in a densely-populated area. Undeterred by the danger, the two men strode confidently towards the mine. But as they were working to make it safe, the mine suddenly exploded, killing both men. Ellingworth and Ryan were both awarded a posthumous George Cross for their bravery. Reginald Ellingworth's George Cross is on display in the Lord Ashcroft Gallery: Extraordinary Heroes at IWM London.

Untrained Pilot

Among the many airfields targeted in raids on 15 August 1940 was RAF Driffield in Yorkshire. As part of 219 Squadron, which was stationed nearby, Sergeant Oswald Dupee and Sergeant Thomas Banister were scrambled to intercept the incoming Luftwaffe force. Dupee was the pilot and Banister the air gunner of their Blenheim bomber. They engaged a German aircraft off the Yorkshire coast, but it soon stopped returning fire on them. Dupee closed in and was about to continue to attack the German aircraft when it opened its guns on them once more. The Blenheim's front windscreen was smashed and Dupee was severely injured in his arm.

They were now in a dangerous position – Dupee was unable to keep control of the aircraft and they were still vulnerable to enemy attack. Banister crawled forward, helped Dupee from his seat and took charge of the Blenheim. Banister was untrained as a pilot and the aircraft he was flying was badly damaged. Dupee's strength was failing through loss of blood, but he managed to give enough help and directions to Banister to enable him to get them back. Banister made a forced landing at RAF Driffield, with only minor damage to the aircraft despite doing so with the wheels up. Both Dupee and Banister were awarded the Distinguished Flying Medal for their actions.

Arthur Merriman GC

During the Second World War, Arthur Merriman's experience as a science teacher was put to good use. In early 1939, he began work as Assistant Director Bomb Disposal with the Directorate of Scientific Research. He soon became Joint Secretary of the Unexploded Bomb Committee and began to undertake a great deal of research work in connection with bombs. As the war escalated, his work took him around the country. To carry out his job, he often went 'under cover', using the story that he was an air raid inspector. In reality, he had a far more dangerous – and hands-on – role in bomb disposal. In the early hours of 11 September 1940, just days into the Blitz, a 550-lb bomb landed on London's Regent Street but didn't explode. After the area had been evacuated, Arthur Merriman arrived on the scene. The unexploded bomb started ticking and he knew he would have to work against the clock to make it safe. Merriman carefully began removing the highly explosive material inside, making it steadily less dangerous.

But he didn't know how long he had until it detonated so he worked as quickly as he could to extract the explosive. He drew on his scientific knowledge to estimate how long he had. When he felt the bomb was significantly safer, he withdrew to a safe distance. Soon afterwards, it exploded. Thanks to Merriman's skilful work, instead of the mass casualties and huge damage the bomb could have caused, just a few windows were shattered nearby. Merriman earned a George Cross for his coolness and brave determination in saving London's West End from imminent disaster. Soon after, he was commissioned into the Royal Engineers. As a technical adviser in bomb disposal, his expert knowledge was much sought after and he travelled to various locations to examine explosive devices. Arthur Merriman survived the war and died in 1972.

Selby Armitage GC

As an officer in the Royal Naval Volunteer Reserve, Lieutenant Selby Armitage was mobilised for war in 1939. He went to HMS Vernon, the Royal Navy's torpedo and mine school in Portsmouth. There he learned about dangerous mines and soon became an expert in defusing them. When the Germans dropped huge bombs known as parachute mines during the Blitz in 1940, he was called on to deal with them. Parachute mines often landed in awkward places and Armitage tackled one that had fallen on the roof of a factory. Another mine he dealt with was found hanging in a tree in Orpington in Kent. He could only reach it by climbing up an unsteady ladder, which would have made escape impossible had it started ticking. But Armitage worked with cool determination despite the danger and managed to successfully defuse the bomb.

The huge mines were very unstable. When one he was working on started ticking, Armitage had only run 25 metres before it exploded. Despite this near miss, he was back on duty next day. For undertaking months of this dangerous work, he was awarded the George Cross in December 1940. He was one of only eight people ever to receive both the George Cross and the George Medal, which he received in 1944. Selby Armitage survived the war. He died in 1982. Selby Armitage's George Cross is on display in the Lord Ashcroft Gallery: Extraordinary Heroes at IWM London.

Running on Empty

Acting Flight Lieutenant Jack Adams of 29 Squadron RAF was on a night patrol on 20 August 1940 when he saw a German aircraft around a mile in front of him. He had spotted a light in the rear gunner position, making it possible for him to follow it, in his Blenheim bomber, for 50 minutes. During this time, he lost communication with his base, RAF Digby, but carried on in spite of this, determined to destroy the German aircraft. Finally, he made contact with it off the south coast, near the Isle of Wight. Adams went in for the attack, skilfully shooting at the aircraft over the sea and destroying it. He then returned to his base. When he landed, it was discovered that both of his petrol gauges were at nil – he'd been running on empty.

On 24 September 1940, it was announced that Adams had been awarded the Distinguished Flying Cross for his bravery. The official report for this also stated that Adams had been 'continuously employed on night flying duties' since the start of the war and had always shown 'conspicuous devotion to duty'. Adams had joined the RAF in 1936 and had a successful career in the service, retiring in 1958 as a Wing Commander.

Harold Newgass GC

Harold Newgass joined the Royal Naval Volunteer Reserve when the Second World War broke out. He never went to sea, but instead volunteered for special duties in bomb disposal. By late 1940, Newgass was an expert in rendering unexploded German parachute mines safe. He was commanding a naval bomb disposal party working to clear these mines in Liverpool. On the night of 28 November 1940, the city was hit by a particularly devastating air raid. During this attack, a large mine fell through the roof of a gasholder in Garston in Merseyside.

Its parachute became tangled in the hole in the roof and it failed to explode. The gasometer held some 2 million cubic feet of gas, meaning the gas supply for half of Liverpool was threatened. Had the mine exploded, it would have caused great damage and destroyed many homes. The whole surrounding area came to a halt, industry was paralysed and 6,000 people were evacuated. Before the mine could be dealt with, the base of the gasometer had to be drained of the 1.25 million gallons of water that was there and a hole cut in the top for access.

Despite these preparations, which took several days, it was clearly still going to be an extremely perilous operation. Although he knew that the mine would be difficult and dangerous to defuse, Harold Newgass decided to tackle it on his own. On 3 December he went into the gasometer. He had to wear an oxygen cylinder inside as the air was unsafe. Each cylinder lasted 30 minutes and, had the mine begun to tick, he would not have had time to climb out and escape before it exploded. Newgass made six trips down into the gasholder.

He first assessed the situation and planned his approach, then took down the necessary equipment he'd need. He then placed sandbags around the mine, lashed it securely, and turned the mine so he could access the fuse. He was then able to remove the fuse, detonator and primer. On his last oxygen cylinder, he finally withdrew the timer and made the bomb safe. Newgass had shown great bravery and endurance in undertaking this exhausting work. He was awarded the George Cross in March 1941.

Michael Gibson GC

Soon after the outbreak of the Second World War, Sergeant Michael Gibson was transferred from the Durham Light Infantry to the Royal Engineers. He was posted to the No 9 Bomb Disposal Company, based in Birmingham. It was responsible for dealing with unexploded devices across the West Midlands. A Luftwaffe raid on Coventry on 14 September 1940 resulted in two unexploded bombs in a factory complex in the city. Sergeant Michael Gibson and other members of his company were sent to deal with them. One of the devices exploded but, luckily, no-one was harmed. Gibson's team then worked to uncover the other bomb from the rubble.

Suddenly, they heard it emitting 'an unusual hissing noise'. It seemed highly probable that it could detonate at any moment. Fully aware of the dangers, Gibson sent the rest of his team away to safety and worked by himself to extract the fuse. This he managed to do and the bomb was removed from the factory, saving many lives. Michael Gibson earned a George Cross for the bravery he displayed on 14 September. A month later, he was back in action after another air raid on Coventry. Along with six other bomb disposal men, on 18 October Gibson went to deal with a 550-lb bomb from a housing estate. They transported it to an open space to defuse it. But as they were unloading it, the bomb exploded, killing them all. A memorial plaque in Coventry commemorates Michael Gibson's wartime bravery.

A Close Escape

As well as the danger that pilots faced in aerial combat, there were also risks involved in taking off and landing aircraft at their bases. As the Battle of Britain reached its peak, one pilot took off from RAF Biggin Hill (pictured here) but lost control of his aircraft, which crash-landed and turned over in the garden of the house next door to Sergeant Arthur Cole of the Kent Special Constabulary. The pilot was trapped in the stricken aircraft, hanging upside down and kept in place by his harness. Despite the chance that the plane could catch fire and explode at any moment, Cole immediately rushed to help. Working quickly and calmly, he freed the pilot and dragged him away to safety. Cole's swift actions undoubtedly saved the pilot's life – just minutes after he rescued him, the aircraft's petrol tank ignited and there was a huge explosion. For his bravery, Sergeant Cole was awarded the British Empire Medal.

Francis Brooke-Smith GC

Francis Brooke-Smith served with the merchant navy and the Royal Naval Reserve before the Second World War. In 1940, Brooke-Smith, now a sub-lieutenant, volunteered for mine disposal work. He travelled where he was needed around Britain to defuse German parachute mines. In December, a mine fell on the deck of a fire-float on the Manchester Ship Canal. It ended up wedged awkwardly near the engine, in a way that presented a considerable challenge to Brooke-Smith, whose task it was to disarm it. Firstly, he lifted the mine out of where it had lodged. This helped him, but he still had to lie in an uncomfortable position to work on the device.

But, just as he began to do so, the fuse clock started to whir. Brooke-Smith stayed calm and tried to stop the timer before it detonated. Due to the position of the bomb, he had to work purely by touch, at full stretch, and using a new, unfamiliar piece of equipment in order to make it safe. Despite these difficulties and the pressure of the situation, Brooke-Smith stopped the clockwork in time. A month later, he disarmed a highly unstable mine buried nearly two metres down in an East London allotment. In all, Francis Brooke-Smith defused 16 mines during the Second World War. For his cool courage, he received the George Cross.

Bennett Southwell GC

A German mine fell on a house in Shoreditch, East London on 17 October 1940 and failed to explode. Ordinary Seaman Bennett Southwell and his commanding officer, Sub Lieutenant Jack Easton, went to deal with it. The mine had fallen through the roof of a house and the surrounding area had been evacuated. It had come to rest in an awkward position so Easton decided to try to defuse it where it was, to avoid disturbing it. As he worked, Southwell stayed close by and passed him the tools he needed. Easton had not been working for long when suddenly the device dropped. It started ticking. Knowing that they had only 12 seconds until it detonated, they both fled the scene.

Southwell ran full pelt down the street, while Easton dived for cover. Easton was buried under rubble from the blast but was eventually freed. The mine generated a huge explosion, which destroyed a large area of housing. Southwell was caught in the blast and died. Such was the devastation that it was six weeks until his body was found. Both Bennett Southwell and Jack Easton were awarded the George Cross for their actions. Bennett had only started work in bomb disposal a month before he was killed. His widow, Marion, collected his posthumous GC from King George VI at Buckingham Palace in October 1941. Bennett Southwell's George Cross is on display in the Lord Ashcroft Gallery: Extraordinary Heroes at IWM London.

In war, the best of you shines

There was actually one dog that we almost had to shoot because he was standing next to a body, eating it, and as we went to go pick it up he stood there growling at us and he wouldn't let us come near it. I think someone threw a rock or something and shooed him away. But then there were other dogs that would run through the city with human feet in their mouths and other things. I was pretty desensitized at the time. It actually didn't register as it should have. ... I mean, a dog running through the city with a femur in its mouth. It should have registered as something a lot more than it actually did. It just seemed reasonable at the time that a dog would try to chew on the bodies. Dominick King, 7th Marine Regiment, 1st Marine Division, August 2004-March 2005.

Long Stories

Twice Bailed Out of Burning Bombers

Leonard Siegfried, son of a bricklayer, grew up in the Hecktown section of Lower Nazareth Township. He studied machining at Bethlehem Technical High School while working part time at a lumber company and was drafted into the Army as World War II raged. In the summer of 1944, he was a 19-year-old sergeant in the 15th Air Force, flying as a nose turret gunner in B-24 Liberator bombers from a base in Italy. Our second mission, on Aug. 27, we got shot down on the border between Austria and Yugoslavia. We were at maybe 25,000 feet, on our way to a target to drop bombs. I was sitting right outside the nose turret. We got into clouds and couldn't see.

They used to instruct our pilots: Stick your left wing into the next guy's waist window. That's how close they wanted us to fly, because the German fighters used to come in from the top and go straight down through the formation. Pretty soon, another ship and ours bumped together. The whole plane rocked, but there was no damage that we knew of. Right away, the pilot peeled off to the left and we came down about 4,000 feet and broke out of the clouds. That put us in more danger. Now we were a target. We got hit by antiaircraft fire. Our right outboard engine caught fire. I saw the engine burning. The pilot tried different things but couldn't put it out, so he came on the intercom and said, "Pilot to crew: Stand by to bail out."

I put my chute on and went back to where the waist gunners are — in the middle of the plane. The radio operator was laying on the floor. A piece of shrapnel got him in the kidney, a big hole. He knew what was going on — he was conscious but bleeding badly. "We're going to push you out," we said, and we put his hand on the chute handle. "You pull the cord." There's a door on each side under the waist windows. I sat down and grabbed my ankles and rolled out. My chute opened. I'm looking up and counting chutes. Where's the pilot? Then I see his chute open, and he's floating down and the plane is making circles. I thought, oh my God, that's getting close! But he made it OK. The plane crashed into the side of a mountain and just wiped the trees off for about a mile.

As I'm coming down, I started looking for a place to hide as quick as I got down there because there were Germans all around. So I steered into a fence line, which was fairly close to a farmhouse, and I landed right on the side of the wooden fence, with trees around. I hit the ground hard, whacked the back of my head. I pulled the chute down quick, crawled in the fence line. I'm sitting there thinking I'm in Austria, only a short distance away from Yugoslavia — a partner to America. I'm going to stay in here until just about dark and then head south and I should be able get to friendly people.

I didn't see the nine other guys from my crew. Pretty soon, I looked out and there was a field that had rows of plants, and here's a woman hoeing at the other end of the field. I thought, she isn't cutting weeds, she's walking too fast. And here she knew where I was. She came to warn me. She said in German, "Stay there, the Germans are all around you." I'm Pennsylvania Dutch, so I knew what she was saying. I thanked her and stayed put. Just before dark, a man comes out and he spoke English. He's calling me, "American flier, American flier." I waited until he got pretty close and I said, "I'm here." "Come on, we've got to go fast, the Germans know you're in this area."

We went to the farmhouse and he put me right down in the cellar and brought a plate down and I ate. He says, "OK, we've got to go. We're going to head for the border." We took a trail on the side of a mountain. He whispered: "We're getting close to the Germans' lookout station. You're going to have to stay with me and bend down when you pass the windows. Don't let them see you. There are four soldiers in there. They're always playing pinochle. Follow me close and stay down quiet, and don't go to your right because it's a drop-off cliff."

After that, we met Yugoslav soldiers on a trail, and the Austrian guy turned around and went back. The soldiers took me to a cabin up in the mountain, where there were five or six wounded partisans and some women soldiers. We slept on the floor under old parachutes that were infected with lice. The Yugoslavs had a telephone on a tree in the woods, and a guy would stand there cranking, trying to get somebody to talk on the phone and find out what's happening. The next day, the Yugoslav captain says, "You've got to stay here. We're going down to meet the German troops that are coming up the valley." I said, "Give me a gun, I'll help you." "No, we'll be back."

There were six or seven of them, and they were so confident. I'm thinking, if they get beat, what do I do? But after two hours, here they came tramping up the mountain. Later, one of the Yugoslavs said, "If you hurry up and go down to the valley, some of your planes will be landing to take our wounded soldiers to Italy." There were three C-47s plus two fighter planes. The fighters kept circling the area. The C-47s landed in a pasture. I helped load the wounded and jumped on board. All the guys from my crew made it back to Italy, and they gave us a new plane and we had practice runs to see whether we could do battle again — and we could.

So we were back on missions. As you were going to a target, you'd pick up 50 planes at a certain city, now you go for 20 minutes and you pick up another 25. A lot of our planes flew out of England and joined up with us. By the time you got to the target, you could look out your window and it looked like a black highway, planes as far as you could see, like 600 B-17s and B-24s. We had the German air force beaten. We would see their fighters way up above us, just tracking where we were going, but they no longer attacked us. We had our own fighters following with us. Above 12,000 feet, we put oxygen on. The fellas in the turrets like myself had electric suits to keep us warm — it would get to 35 below — because we couldn't get into the turrets with heavy wool suits. I didn't go into the turret until we saw enemy fighters.

It was a place you didn't want to be, out there sitting on a ball. They had to lock me in, and I couldn't get out by myself. There were double doors, a door on the turret and then there's another door on the body of the plane. The bombardier and the navigator are in that compartment behind me, so they've got to open the doors if anything happens. I always said I had it worse in the nose than the guy in the tail because the antiaircraft shells came up three at a time. So in the nose, I'd see the explosion, a black puff, and know the next one is going to be closer than that, and the next one even closer. But the tail gunner would see one puff and think, oh boy, that's passed. He was happy.

Besides manning the .50-caliber machine guns in the turret, I was the assistant engineer, so I had to do the running. The pilot would call and say, "Siegfried, arm the bombs." We had 10 bombs, five on the rack on this side and five on the rack on that side, and they had a 9-inch-wide catwalk going down the belly. They'd open the bomb bay doors in case I had trouble and they could get rid of the bombs. That used to be a frightening thing. To arm the bombs, I had to pull their pins, but the pins stayed hanging on a chain.

On one of the early missions, after I'd done that, the pilot called and said we were going to change targets. So I had to go out on that catwalk again with the bomb bay doors open and put the pins back in. And when we got close to the second target, it was: "Siegfried, go arm the bombs." ^On our ninth mission, Oct. 17, we got hit with ack-ack [antiaircraft fire] before we reached the target and the right outboard engine caught fire — same as before. In fact, part of the wing was gone. I was in the bombardier's compartment. A piece of flak got me in the left leg above the knee. We had to bail out again over Austria.

Coming down in the chute, I saw the German soldiers running out of their camp, trying to get my direction. I landed on a dirt road, and the Germans were running toward me. When I stood up, a guy reached from behind me and took my pistol from my shoulder holster. I didn't even know he was there. It was that quick. They took me into a country house for interrogation. A German captain talked to me in English. He wanted to know how many planes we had up there. I didn't have any idea about any of that. He had my pistol and said, "Take the gun apart for me. We know you soldiers are all trained to clean your guns." I took it apart. He said, "Now put it back together." I said, "I don't know how to do that."

I did know, but I was afraid he'd use it on me. He laughed and then got mad and whacked me on the side of the head with his own pistol. I went down off my chair. They put me on a truck. I sat in the centre of the flatbed on a folding chair with German guys on each side with their rifle barrels against my ribs. It was a bumpy ride. Each time I bounced, I got a gun pushed in me. I expected one to go off any minute. When I arrived at Stalag Luft IV, up near the Baltic Sea, there was no bed for me in the barracks. "You have to sleep on the table." We usually started the day by eating two slices of brown German bread with spreads from the parcels and a cup of coffee. Noon brought us a meal of thin soup, one cup per man, except for about every 10th day when we might get millet or barley.

At 2 o'clock, the kitchen gave us enough hot water for another brew. Supper at 6 o'clock was usually boiled spuds, one bucket for the 24 men in my barracks. With all this, we received a half-Red Cross parcel per man per week. We were fenced in, but some escaped. Some in my barracks had been digging a tunnel. It must have been during the night when the rest of us were sleeping. I was out of the camp before I even heard about it. They had the floorboards up under one bed. The guys would bring the dirt up, and they carried it in their pockets as they walked around the camp. They'd pull a drawstring and lose it on the ground. I think some guys did get out, but a few were caught.

We heard that two prisoners got under the fence once, but they got shot from the towers as they were running for the woods. On Feb. 6, they started moving us out of camp — 8,000 of us. They said they were going to move us to a new camp. They had us in columns, five guys across and five rows deep, with a rope separating each group of 25 men so you couldn't run for it. The guards walked on both sides, and they had police dogs on short leashes. If a column didn't move fast enough, they'd have the dogs nip at the guys in the back rows. It was the dead of winter, one of the worst winters they ever had in Europe. I had a German overcoat on. The Germans gave overcoats to any fliers who had electric suits on. Those that had the heavy wool suits didn't get them. I had my Army shoes, and I got frostbite in my right foot.

The first night out, it was snowing, and the German leader told us to dig a hole in the snow, which was 16 inches deep, and lay two guys back to back or we'll freeze by morning. I dug a hole with another guy, kicking the snow away, and we crawled in and we're back to back. He says, "Where are you from?" "Pennsylvania." The first night out, it was snowing, and the German leader told us to dig a hole in the snow, which was 16 inches deep, and lay two guys back to back or we'll freeze by morning. I dug a hole with another guy, kicking the snow away, and we crawled in and we're back to back. He says, "Where are you from?" "Pennsylvania." He said, "So am I? What city?" "Bethlehem." He said, "So am I." I said, "Where in Bethlehem?" "A sporting goods store on the South Side." I said, "Tachovsky!" He said, "That's me!" He was Harry Tachovsky.

One day we were strafed by an American fighter plane. We were walking on this dirt road. A truck passed us with three German soldiers sitting on the tailgate. I saw this P-38 way off, and I yelled, "American plane coming!" I jumped a barbed-wire fence. When the pilot started strafing, a pig got hit with one of those bullets, and he squealed, and I didn't know he was even in there with me. The truck was destroyed, and the guys on it got blown to smithereens.

As we walked down the road, we saw pieces of their bodies. We stopped at places where the Germans put us in a barn overnight. They'd call ahead to the farmers, who would put a big black kettle on the fireplace and put potatoes in so that when we got there, they'd hand them out as we walked by — two or three pig potatoes, an inch-and-a-half long or so, and a slice of bread.

Once, two guys stole a lot of gallon cans of meat from a farmhouse cellar where the Germans had stored them. The guys handed them to everybody who was in the barn we were staying in — most of us were up in the hay mow. But around midnight, the Germans caught these guys in the cellar and knew how many cans of meat were stolen from the army's supply. In the barn, they called to us, "Throw them down to the floor, because if we don't get the same count, we're going to start shooting." Empty cans, full cans, we were all throwing them down, and the Germans counted them and they were satisfied. The next morning, they had the two guys tied to a tree. And after we left, we heard shots. We figured they waited till we were gone and they killed those guys. I'm sure of it.

One time, we came to get on a train in a town. The guards lined us up against the wall at the side of the railroad station, waiting for the train to get in. The hospital in that town had been hit by American bombs. A school was hit, I guess, and a church. And then the townspeople heard that American fliers were there. Imagine how they wanted us! Well, these people were in an uproar. They came out to see us, and it was pretty scary. We had our backs to the wall, and they were coming toward us — until the guards clipped the bayonets on their rifles. That kept them away. I don't know how long we were on the train or where it took us.

The Russians were to the east, and the Americans and British were to the west. Every time we heard guns getting close, the Germans would change our direction. We'd turn and go south for a while, and pretty soon you heard guns from the east, and they'd turn us again. They were afraid if the Russians got us, they would arm us. We covered 600 miles. The guards used to tell us: "The war is almost over. We lose, you win." We walked to Stalag XI-B, a tent camp. It was in terrible shape. The next morning I heard a commotion going on. The Germans had wagons and horses parked out in front of the tent, and as they found these people who didn't make it through the night, they carried the bodies out and put them on the wagons. They disappeared over a hill, going to a pit where they buried the dead.

Every morning, they came to take the dead that were lying on the ground — rows, just rows of them. I was glad when the Germans called out names of prisoners to move on and I was one of them. That was after about a week. They marched us north toward Luebeck. One day we were in a barn. German troops were guarding us. All of a sudden there were tanks and trucks moving behind the barn. And the first thing you know, the guards who had been around the barn were gone. The British had circled around and captured those guards, pulled them away. They were in trucks and gone. The British told us: "You're free to go. We can't help you with food right now, but just stay on this main road for maybe a couple of days and we'll have a food truck to meet you." We walked the rest of that day, and the next day we started walking again, and we finally hit the food truck.

It was loaded with pea soup and some doughnuts. The doughnuts didn't last long. The first guys gulped them down. I didn't get any. Good old pea soup. I got that. At Camp Lucky Strike, France, they fed us, built us up. Any prisoner of war could go to the kitchen any time of the day or night. Only trouble is, it was always turkey. They kept us on a turkey diet for weeks. And the funny part is, I still like turkey — and pea soup.

Epilogue
Siegfried weighed 100 pounds at war's end. He had lost 50 pounds since he was taken prisoner. He and his fellow POWs were liberated by the British 2nd Army. He had kept notes in a logbook throughout his captivity and recorded the exact time and place: 12:29 p.m. May 2, 1945, at Boizenburg, Germany, near the Elbe River and about 40 miles southeast of Hamburg. That was six days before the war against Germany ended. The prisoners' zigzag trek from Stalag Luft IV was called the Black March, begun by the Germans to escape the Soviet army approaching from the east. It took them from the camp at Gross Tychow in Pomerania, a Third Reich province now in Poland, to Stalag XI-B near Fallingbostel, east of Bremen. The subsequent forced march from Stalag XI-B toward Luebeck lasted three weeks. Altogether, the POWs were on the road for almost three months. Hundreds of Americans died. Siegfried's friend, Harry Tachovsky, who is 92 and lives in east Allentown, remembers their comradeship on the road from Stalag Luft IV: "We buddied up in the snow and got to know each other on the march." Siegfried flew with the 762nd Squadron, 460th Bombardment Group, based at Spinazzola, Italy. He has two Air Medals for meritorious achievement in flight, and a Purple Heart for the flak wound he suffered Oct. 17, 1944 — the second time he had to bail out of a flaming B-24.

In June 1945, he was sent home aboard the troopship USS General H.W. Butner. He took a train from Virginia to Bethlehem, and then a taxi to Newburg in Lower Nazareth, where his parents had moved while he was in the service. Though he'd written to them while a POW, the latest Army telegram they received said he had been killed in action. He knocked on their door at 2:30 in the morning. "They were really shocked. They thought I was a ghost." He went back to Brown-Borhek lumber company in Bethlehem, where he met Gloria Meese, who worked in the office and sent him candy in the lumber yard, where he was the foreman. They were married May 21, 1955. Gloria became a secretary for the Lehigh Valley Railroad and Conrail. Leonard got a job at Bethlehem Steel in 1960 and retired from there 31 years later. He also serviced Lower Nazareth's water system. The couple had a daughter, Tina Siegfried of Lower Nazareth, and a son, Alan, in Woodbine, Md., and two grandsons. Gloria died in 2005 at age 81. In the 1950s, Siegfried pitched in the East Penn softball league, baffling batters with his knuckleball. He played golf in the Coke Plant League for many years. Now 90 and still living in Lower Nazareth, he is stoic about his wartime brushes with death, saying he is "not an excitable guy" and that he took it all in stride.

"There's an old friend of the family, she's my age and quite often I stop to see her, and she always says, 'You know, a cat has nine lives, but from the stories I hear, you have more lives than a cat.' "I was well taken care of from up above."

Morris Metz recalls the Battle of the Bulge

When Morris Metz was about 6, his father lost his job in a lumber mill, so the family of six baked bread, Dutch cakes and cinnamon buns to sell. They had chickens and a garden, but it was still difficult at times to put food on the table. Metz, who was a longtime Forks Township public official and leader of the Lehigh Valley Chapter of Veterans of the Battle of the Bulge, remembers growing up in Wind Gap during the Great Depression and fighting his way across Europe during World War II. In our small town, Trinity Union Church of Wind Gap was the centre of activity. They had parties, concerts with the choir. They had Easter egg hunts and picnics in the summer and plays. Every Christmas you got an orange and a bag of chocolates. You went to Sunday school and church. We were taught the sanctity of life: Thou shalt not kill. Love thy neighbour. There was a Sunday school teacher by the name of Claude Steiner, and when I was about 10 years old he introduced me to the promises of the 91st Psalm. Several of them were really relevant to being in combat:

Thou shall not be afraid for the terror by night, nor for the arrow that flieth by day; … nor for the destruction that wasteth at noonday. A thousand shall fall at thy side, and 10 thousand at thy right hand; but it shall not come nigh thee….There shall no evil befall thee.

Words like that, when you're in a foxhole and you hear the artillery shells and the screaming meemies [German rockets], it's comforting to think about those words. I was always a dreamer. I used to get up early in the morning and stand in the sun and think about being a cowboy. And I used to fish and hunt and trap animals. If you got $3 for a muskrat pelt or $12 for a mink pelt, it helped the family at a difficult time. I had a newspaper route, delivering the Allentown Morning Call on a bicycle at 5 in the morning. The Wind Gap school system was independent at that time, offering elementary school and junior high. The school was centrally located, so no matter where you lived, you had to walk.

No snow days. Your responsibility was to get there. We had a large playground but no cafeteria, so we either walked home for lunch or brought a lunch in our book bags. We were big shots when we took the bus to Pen Argyl High School. That was a really great school. We Windy Gappers, as we were called, blended in with our schoolmates from Pen Argyl. Marcus Stopp, a mathematics teacher, inspired me to love math. I was the recipient of the Rensselaer Polytechnic Institute medal for excellence in mathematics. Edna Imhof, our homeroom teacher and Latin teacher, demanded respect.

My biggest regret is that when I got home from the war, I didn't go visit Edna Imhof. When I was 17, I tried to enlist in the Navy, but they rejected me because I had bad eyes. I graduated June 10, 1943, turned 18 on July 10, had a part-time summer job until I received a letter from the president of the United States ordering me to report for induction at 5:45 a.m. Sept. 21, 1943, in Bangor. I wanted to get into the service. I loved adventure. But I realized my eyes were a problem, so I memorized the eye chart, thanks to my doctor. I took the physical and all the other examinations, and on Sept. 21 raised my right hand and became a member of the United States Army.

In New Cumberland, we traded in our civvies for a uniform, went through the Army general classification tests. We were encouraged when we were kids in my family to study, study, study. I breezed through the tests and I was eligible for the Army Specialized Training Program. There were 200 of us assigned to Fort Benning, Ga., for basic training. It was a gruelling 15 weeks — calisthenics, marching, obstacle courses, 25-mile hikes with full field packs. It changed you from a boy into a man. I was scheduled to go to Washington University in St. Louis to study engineering. I got my orders, everything was ready to go and nothing happened. The cadre said, "You guys ain't going to school, you're going to war."

The invasion of Europe was just over the horizon. The program was disbanded, all the boys who were in school were pulled out, and a group of us was assigned to the 94th Infantry Division in Camp McCain, Miss. I was assigned to an anti-tank unit with Headquarters Company, 3rd Battalion, 301st Infantry Regiment. We had a 57 mm anti-tank gun and a bazooka. It was a strange transformation, because like I said before, when we were kids we were taught the sanctity of life. All of a sudden, we had to learn to kill and destroy. One of the experiences I totally dreaded was bayonet practice. They had bags filled with straw and you had to stab at them.

Years earlier, Life magazine had a picture of a Japanese soldier using a trussed-up Chinese prisoner for bayonet practice. I'll never forget that. I often thought if I have to die, I hope it's not with a bayonet, and I hoped I'd never hear the command, "Fix bayonets!" It was the possibility of slaughtering another human being or being slaughtered yourself. We were in Camp McCain training until early July 1944, when our division was moved to Camp Shanks in New York, up on the Hudson. While we were there, the last Saturday in July, I got a 12-hour pass. I had this crazy notion I was going to get to Wind Gap and see my parents, because it could've been the last time I ever saw them. So I took a train from Camp Shanks down to New York City, a half-hour trip.

When I got to Grand Central Station, I said, "Is there anything for Easton, Pennsylvania?" "Black Diamond, just boarding." Got a ticket, jumped on the train and I was on my way. Got in Easton around 8 o'clock, just getting dusk, and my thought was to walk up Third Street to the foot of College Hill and hitchhike. There was a minimum of traffic. I thought I might be in trouble. I saw a single car drive up and stop, back up into a parking spot. It's a green LaSalle! My sister, Sarah, was getting out of the back door, "Morris," she screamed. "What are you doing here?" My older brother Harold, it was his car, and they took me home and I was there for about an hour with Mom and Dad, and Harold and Sarah. We all drove back to Easton and I got the last bus out. I have no idea how I got from the New York bus terminal to Camp Shanks, 5:30 in the morning.

Early in September, our units moved from England to France and were assigned to what's been called the forgotten war. There were 60,000 Germans trapped in the area of Lorient and St. Nazaire, the submarine ports. It was our assignment for 111 days. There were confrontations every day, men were killed, wounded. In December, the 66th Division relieved us in Brittany. Simultaneous with that, the Battle of the Bulge started, and when they recognized the significance and magnitude of the German attack, we were assigned to Patton's 3rd Army and moved up to the battle in early January in Luxembourg.

I remember the intense cold and the danger. Oh, the cold! At night, you took off your shoes. We had a truck to pull our 57 mm gun. We were fortunate; we could sit in back of the truck. You'd take off your shoes and socks and you'd massage your feet. Then you put on fresh socks. You put the old socks between your shirt and your undershirt. Next day, the socks you had there overnight would be dry, so you put those on and put the others inside your shirt.

In January, we captured Nennig [in Germany's Saarland]. We moved in at 10 o'clock at night and set up our weapons in case there was a counterattack the next day. Dave Kaplan and I were in a foxhole together, cold as hell. We had our overcoats laying over us. As soon as it was daylight we got up and walked around just to see where we were and what the situation was. Over there was a dead American soldier. He'd been running and was hit and laid there and froze to death. There was a German tank in the middle of the town, burned out, the crew was laying there dead, their uniforms burned. There were about six other American soldiers dead, one shot between the eyes.

For a while, I was assigned to a machine gun with K Company in the 301st. We were involved in what I thought was closer to hell than you could possibly be. Horrible, horrible! I'll never forget these medics running out carrying this litter with a guy with his leg blown off, and the smoke. They claim that one of our bazooka men fired at a tank, and it didn't disable it, and the Germans lowered their main gun and fired directly at him and blew him to bits. Along the road, there was a jeep that had six litters, three on each side, that had been carrying wounded men to the aid station. The jeep had been strafed. Its driver and all six men were dead. There were so many incidents. You forget, conveniently I guess, some of those experiences. But there were cases where shells would land over there instead of here. There shall no evil befall thee. Maybe I'm naive, but 405,399 Americans died. I could've been 405,400.

One of our greatest accomplishments was Trier, a critical city that had to be prevented from capture by the Germans. The 94th Division and the 10th Armoured Division captured Trier [on March 2, 1945]. Patton got orders from HQ: Don't attempt to capture Trier until we get two more divisions up there. Patton responded, "We've already captured it with two divisions. Do you want us to give it back?" I did something that you never do, I volunteered when they needed someone to carry messages from a gun emplacement to battalion headquarters because our communications were out.

Here I was, 19 years old and I thought to myself: These guys are married, I don't want them running around and getting killed. So I volunteered. There was another feller, too, Joe Burke.

On the last trip Joe and I made back to battalion, we got ambushed. There was a hail of bullets. We were in a farm area, animals running around. We hit the deck. Afterward, there was a pig laying next to me, dead. I expected to hear boots walking toward us and "Are they dead?" and being kicked in the head and shot. After the war, I got a Bronze Star for valour for carrying the messages, and I was embarrassed when I read the certificate: "Pvt. Metz voluntarily carried messages from the guns to the command post [on March 4, 1945, near Zerf, Germany] disregarding his own personal safety. He exposed himself many times to the incessant rain of shrapnel to deliver vital messages.

I remembered the event but I didn't think it was worthy of any award. I thought that's what you were supposed to do. After we captured Zerf, I walked into this barn and there was a big pile of loose hay and a pitchfork nearby. Just for fun I was poking around and I hit something solid. It was a cask with a big cork in the top. I went to Sgt. Reynolds: "I want to show you something." He came into the barn, uncorked the cask. "Metz, this is schnapps!" I was a hero for a day. We were one of the first to reach the Rhine [on March 21].

We captured Ludwigshafen, the chemical centre of Germany, and then Duesseldorf. We were pulled back out of combat and billeted in a town called Solingen, where I was when the war ended. We took over homes and I was assigned to a small room. When the war against Germany was over [May 8], it was a peaceful day so I took a walk after breakfast. I heard music and I walked on, and a couple of doors away there was this record player sitting on a sidewalk, playing Strauss waltzes. And I just stood there, amazed, and listened until it was over. Then I walked back slowly to the house I lived in and I thanked God it was over.

I went from Solingen to occupation duty in Czechoslovakia — Kienberg, on the Moldau River. The 15th of September in 1945, they had a ceremonial day, a review, we were all lined up and Gen. Patton drove up in a Packard, got out with his riding crop, walked down, reviewed us. He stopped about five men from me, I heard him talk but I didn't understand what he was saying. Years later, Tony Pagano joined our [Bulge veterans] chapter. "You know what, Morris? I was reviewed by Gen. Patton in Czechoslovakia.

He stopped right in front of me and said, 'Where are you from, soldier?' I said, 'Roseto, Pennsylvania, sir.' He said, 'Where in the hell is that?'" I said, "Tony, you were here, and I was here. If I would've heard you say Roseto, Pennsylvania!" After I came home from overseas, I was sent to Fort Indiantown Gap for dental work and discharged Feb. 6, 1946, as a sergeant. That morning I took a Greyhound bus home. It was a local. It stopped at Wind Gap. I got off the bus around 11:30, walked down West Third Street with my duffel bag on my back.

My mom was out sweeping the porch. "Hi Mom, I'm home." She started crying. Fortunately, I wasn't wounded in the war, though I had some close calls. No one in our squad was ever wounded or killed, and I credit that to the 91st Psalm: There shall no evil befall thee. To my knowledge, I never killed anyone. We fired our weapons at stationary targets — pillboxes and gun emplacements. I never aimed a weapon at another person, I never had to fix bayonet. My conscience is clear.

Epilogue
On July 30, 1946, Metz's older brother, Harold, asked him if he'd like to go to the Henryville House Resort in the Poconos, where his younger brother orchestra used to play. A classmate of Metz's joined them. "We drove up and we were sitting there having a drink and Harold said, 'There's three young ladies over there. Let's ask them to dance.' I picked out this young lady, Dottie Hoferer, and we danced, and immediately I sensed that she was special. We put our tables together and chatted. We found out there were four of them — Dottie and her sister, and each had a friend. But Dottie's sister didn't feel well and stayed in her room.

If there'd been four of them at their table, it would've been awkward. "We went back again two nights later and again there were three of them at a table. I asked Dottie if she'd like to go horseback riding the next day. We went riding, had dinner together and I kissed her for the first time. We exchanged addresses and she went home to New York. She'd come to Pennsylvania and I'd go to New York. "My grandfather was a lover of mules, and Dottie was one who always helped.

She never had to be asked if she saw that something had to be done. My grandfather observed, 'She's just like a mule. She gets right into the harness and starts pulling.' And that was the ultimate compliment." Morris and Dottie were married Aug. 23, 1947, in New York. They rented an apartment on the 100 block of Spring Garden Street in Easton. After starting at what was then the State Teachers College at East Stroudsburg, Metz switched to Lafayette College and graduated in 1950 with a Bachelor of Arts in psychology. The next year, he got a job at Mack Printing in Easton. He worked there for the next 35 years as a proofreader, assistant production manager, superintendent of pre-press and director of quality control.

When he was in a foxhole during the Bulge, he dreamed of living in the country. That came true in 1952, when he and Dottie moved to an 1840 farmhouse in Forks Township. They accumulated 35 acres. Metz served on the Forks Recreation Board in 1966-67 and the Planning Commission for 10 years, until 1982. Then he was appointed to the Board of Supervisors and twice won election. He served until 1995. Dottie worked for the Easton Area School District for 33 years as secretary/bookkeeper for the athletic director. The couple have a daughter, Debbie Zarate, and a son, Doug, both of whom live in Forks near their parents; five grandchildren; and four great-grandchildren. In May 1998, Morris and Dottie attended the first meeting of what would become the Lehigh Valley Chapter, Veterans of the Battle of the Bulge, at the Terrace Restaurant in Walnutport. It was called by Peter Leslie Jr. The group was chartered the following October. Seventy Bulge veterans who belonged to the group have since died. Twenty remain.

Metz led VBOB from 2003 until stepping down last year and taking the title president emeritus. He is 89. Dottie was the group's historian and archivist. Members have done hundreds of programs in schools to teach young people that "freedom is not free." They speak to other groups as well, Metz said, and have "enriched the lives of over 100,000 people."

One of his favourite stories, he said, illustrates the power of prayer. During the Bulge, Patton grew impatient for good weather that would allow planes to support his troops. He asked a chaplain to compose a prayer, which was distributed to every man in the 3rd Army. "Miraculously, the skies cleared," Metz said. "We wreaked havoc on the Germans, killed thousands of troops, knocked out much of their equipment." He said he always ends his talks with this thought: "When the power of love overcomes the love of power, there can be peace." After one high school speaking engagement, he said, "I got a letter from a young lady. She said, 'In a short two hours you have impacted the way I look at this country and I thank you for that.'

"It doesn't get any better than that," Metz said.

Marine Veteran, Recalls Battle for Iwo Jima

Charlie Gubish grew up in the Wassergass section of Lower Saucon Township, the sixth of seven children born to dairy farmers. His mother died when he was 5. He attended the South-eastern School on Hellertown-Ironville Road through sixth grade, then left to help on the farm. In 1937, when he was 18, he got a job in the soaking pits at Bethlehem Steel. Two years later, he started driving trucks in the company's fire department. He married, lived in an apartment on Mechanic Street in south Bethlehem and had two sons. The war against Germany and Japan had been raging for several years when Gubish signed up for the Marines, leaving his young family in the early summer of 1944. The 3rd Marine Division, in which Gubish served, landed on Iwo Jima on Feb. 24, 1945. The famous flag-raising on Mount Suribachi had taken place the day before. The first Marines on the island came ashore Feb. 19.

The day I was supposed to go in, we were on this big troopship. We had to go down the ropes on the side of the ship into these Higgins boats, and these boats would take us in to the beach. We went around in circles in groups of four or five boats. I was in a special group. I was a private, 26 years old, in the 134th Replacement Draft. They used to call me Pop, because I was a lot older than most of the guys — they were only 18, 19. We weren't supposed to do no fighting. We were going in to help unload ships wherever they needed us. But they couldn't land us because the beach was so tied up, with smashed equipment and whatnot.

The next day we go in on this LST [landing ship, tank], and it was cold that day, drizzling, foggy. That LST got us onto the beach. They opened the plank, I run off, all of us were running off, jumping off the big gate. So now when half of us were off, the LST was starting to go back in the ocean. He went way out, we could hardly see him. We're standing there. We didn't know what the hell to do. We had no officers or nothing. Somebody said, "Look at those dead Japs laying there." They were on a pile about 3 feet high, with rubber ponchos on top of them. All we could see was their shoes sticking out. One guy said, "What the hell, they've got shoes like we do." And their leggings were the same. We pulled the ponchos up a little higher. They were dead Marines. All of a sudden we see this LST coming back, back, back. And then the rest of the group got off. Then it was almost dark. That was a day that if a Japanese would've come up to me and shot me, I would've thanked him.

I was so disgusted, cold, wet. An officer told us we should dig in for the night. But the dead Marines were laying so thick on the beach, we could hardly find a space to dig a foxhole. It was awful. My foxhole buddy and me saw there was something like a pillbox made out of blocks. And boy we thought all we had to do was dig out the sand a little and put our poncho over the top and we'd have a nice hole. But there was a dead Marine on the pillbox with his head hanging down.

Well, I didn't want to move him and my buddy didn't want to move him. We dug another hole. Our job was to unload these LSTs, be a stretcher bearer, carry supplies to the front line. We'd roll 50-gallon oil drums down the ramp of the LST. We'd take the food off the ship and make piles on the beach. We did that for so many days. Then we had to go pick up the dead, take off their dog tags. That was a hard job to do. I did that for two, three days. I hoped that I never did it again. We picked the dead up and put them on payloaders, a couple at a time, then the payloaders buried them in that sand. The tanks, alligators and ducks [amphibious tractors and transports] didn't want to drive over the dead.

I saw Japanese — and some of our men — squashed as flat as the palm of my hand. One time it was pretty close to getting dark and a captain said, "Hey Gubish, take your squad and some other men and take some supplies up to B Company." I just happened to see a corporal walk by. Nobody liked to lead because they're the ones that got hit — sometimes the Japanese snuck up and stabbed you in the back. I said, "There's a corporal, why should I lead?" He called the corporal over. So we went up a ridge, and the fighting was up on a second ridge.

I'm behind the corporal carrying a box, and it was dark now but you could still see. We just got up to this coral rock, and a Japanese stepped out in front of it. The corporal saw him and I saw him too. We both dropped. We fired our rifles, emptying the clips. Then we're laying there waiting five, 10 minutes. Nothing moves. We pick our stuff up, and we're walking with our rifles slung over our shoulders. Then we come back down, and we're all afraid to go by this rock, and there was nothing there. But the next morning, Marines that were in the outfit up on the ridge found five dead Japanese. One had a rifle and one had a pistol. I think they wanted to surrender but we never gave them the chance. Why would one guy step out there like that and they have one rifle and one pistol between the five of them?

I don't know anything about the flag-raising [Feb. 23]. All I know is that somebody said there was a flag up on Mount Suribachi. There was so much stuff going on, you had no time to think. You were watching every move, your head's going back and forth to make sure there's no Japanese coming at you. Sometimes you didn't know who your officers were, because they got killed and somebody else would come in, and they got killed. When I was wounded, we had to go up to relieve B Company on the second ridge, so we were travelling through an open area. A big guy we used to call Texas was leading and there was about 10 guys behind him, and my squad of six was behind them.

We were 5 to 8 feet apart all the time when we walked. That morning, before we left the command post, my foxhole buddy said, "Charlie, if something happens to me, see that my father gets this pocket watch." The watch had some kind of medal on it. I said, "What are you talking about, Graeter?" He said, "Every day, somebody gets it." I took it that he thought he was going to get killed. I didn't want to listen to him. But anyway, as we're walking, they were joking and laughing up front. I couldn't see them.

A mortar shell exploded on the right-hand side of me about 50 feet away. Nobody paid any attention to it. At the same time, I saw there was some kind of a motor laying near me, from maybe an airplane. And before I knew, a mortar landed on the left-hand side about the same distance. I thought the first was one of ours that fell short, but when I saw the second one land at the same distance, I figured that was for us, so I hollered "Hit the deck!" I'm diving down to lay alongside this motor, and that's all I remember. The shell hit between my foxhole buddy and my other buddy in the squad. It knocked me out.

Somebody must've called the command post. A corpsman saw me laying there and he went past me — he was treating some others. When I came to, I couldn't talk. I was in shock. I seen my foxhole buddy laying dead, and my other buddy laying dead. I got up. The corpsman saw me and come running back. He said, "I thought you were dead." Something was burning me on my left side. He saw that I had my hand on it, and the blood. He quick cut my jacket away and put a compress on it. That was about 10 o'clock in the morning. From that time on, I didn't know anything. The next morning when I wake up, I'm on a hospital ship in a big ward with maybe 50 other wounded and some nurse going around with a needle injecting the guys with antibiotics. To this day, I don't know how the hell I got on that hospital ship.

My one buddy, his head was split open, blood running out. He was from Boston. My foxhole buddy would have lived, the way a corpsman told me later on, because he only had a shrapnel wound in his leg, but the concussion killed him. Son of a gun, when he told me I should send that pocket watch to his father, he was right about getting killed. He was only 19, but he'd watched over me. He did. All I knew was he came from Dayton, Ohio, and his last name, Graeter. I didn't get his watch — we'd left our stuff in the command post — and I could never find his parents. That bothers me, about his pocket watch. Every Memorial Day, Veterans Day, that comes in my mind. I just can't talk about it.

They sent me to Guam and I was in a fleet hospital for two weeks. Then they put me in the 9th Marines a short period, until they found out I couldn't hear. My eardrums were broken from that mortar shell, so they sent me to the division hospital on Guam. From there they took me out of the combat area and put me in the Guam fire department, and I was there until the war ended. I had it good in the fire department. We were right next to a B-29 base. There was no windows on the firehouse. When the B-29s took off, you'd think they were coming right through the building. The pilots used to come down to the firehouse and ask for Coke. We could get all the Coke we wanted. They could get all the booze they wanted, but they couldn't get Coke. We used to trade — a bottle of booze for a case of Coke.

In December [1945], we were in San Diego for two weeks trying to get home, but the troop trains were full. Then they took us up to Great Lakes, Ill. We were discharged and put on trains Christmas Day, and we didn't get to Philadelphia until 2 o'clock the next morning. How are we going to get home? The place was dead. There was no trolleys, nothing. Four of us got together and chipped in for a taxi. That was our Christmas gift.

Epilogue
Gubish, a rifleman with sharpshooter and expert badges, was honourably discharged as a private first class. He has a Purple Heart medal for the wound he suffered March 13, 1945, three days before Iwo Jima was secured. "The Japanese must've had good steel, because for 70 years I'm carrying their shrapnel in my chest," he said. "The doctors said they couldn't take it out of me because it was too close to my heart. It would either kill me or come out. I can still feel it, right on the edge of my skin." American casualties on Iwo Jima totaled nearly 7,000 dead and 20,000 wounded.

Eighteen thousand Japanese were killed. Gubish returned to the fire department at Bethlehem Steel, working there until his retirement. His wife, Ethel, whom he married in 1940, worked for many years at Modern Slacks in Allentown. She died in 1998 at age 78. Their sons are Charles and Richard, both in Bethlehem. Gubish lives in the Sterling Heights retirement community in Hanover Township, Northampton County. He is 96 and has seven grandchildren, 14 great-grandchildren and six great-great-grandchildren.

"I don't know why I'm still here," he said. "Maybe the Lord or the devil don't want me." He belongs to the American Legion, the Veterans of Foreign Wars and the Disabled American Veterans. His name is on a brick in the Pacific War Memorial's Walkway of Honour at the entrance to Marine Corps Base Hawaii. His foxhole buddy, Marine Pvt. Herman R. Graeter, who died in the mortar blast that wounded Gubish, is buried in the National Memorial Cemetery of the Pacific in Honolulu.

13 Robinson Crusoe

Robinson Crusoe's seafaring adventures are abruptly ended when he is shipwrecked, the solitary survivor on a deserted island. He gradually creates a life for himself, building a house, cultivating the land, and making a companion from the native whose life he saves. Daniel Defoe's enthralling story-telling and imaginatively detailed descriptions have ensured that his fiction masquerading as fact remains one of the most famous stories in English literature.

On one level a simple adventure story, the novel also raises profound questions about moral and spiritual values, society, and man's abiding acquisitiveness. The book has 20 chapters. I recommend rotating the screen into landscape to make reading easier. Hopefully the book will keep you occupied and even give you ideas on your own survival situation.

Book Title
Robinson Crusoe

Author
Daniel Defoe

Published
25 April 1719

Chapter 1 - Start In Life

I was born in the year 1632, in the city of York, of a good family, though not of that country, my father being a foreigner of Bremen, who settled first at Hull. He got a good estate by merchandise, and leaving off his trade, lived afterwards at York, from whence he had married my mother, whose relations were named Robinson, a very good family in that country, and from whom I was called Robinson Kreutznaer; but, by the usual corruption of words in England, we are now called—nay we call ourselves and write our name—Crusoe; and so my companions always called me.

I had two elder brothers, one of whom was lieutenant-colonel to an English regiment of foot in Flanders, formerly commanded by the famous Colonel Lockhart, and was killed at the battle near Dunkirk against the Spaniards. What became of my second brother I never knew, any more than my father or mother knew what became of me.

Being the third son of the family and not bred to any trade, my head began to be filled very early with rambling thoughts. My father, who was very ancient, had given me a competent share of learning, as far as house-education and a country free school generally go, and designed me for the law; but I would be satisfied with nothing but going to sea; and my inclination to this led me so strongly against the will, nay, the commands of my father, and against all the entreaties and persuasions of my mother and other friends, that there seemed to be something fatal in that propensity of nature, tending directly to the life of misery which was to befall me.

My father, a wise and grave man, gave me serious and excellent counsel against what he foresaw was my design. He called me one morning into his chamber, where he was confined by the gout, and expostulated very warmly with me upon this subject. He asked me what reasons, more than a mere wandering inclination, I had for leaving father's house and my native country, where I might be well introduced, and had a prospect of raising my fortune by application and industry, with a life of ease and pleasure. He told me it was men of desperate fortunes on one hand, or of aspiring, superior fortunes on the other, who went abroad upon adventures, to rise by enterprise, and make themselves famous in undertakings of a nature out of the common road; that these things were all either too far above me or too far below me; that mine was the middle state, or what might be called the upper station of low life, which he had found, by long experience, was the best state in the world, the most suited to human happiness, not exposed to the miseries and hardships, the labour and sufferings of the mechanic part of mankind, and not embarrassed with the pride, luxury, ambition, and envy of the upper part of mankind.

He told me I might judge of the happiness of this state by this one thing—viz. that this was the state of life which all other people envied; that kings have frequently lamented the miserable consequence of being born to great things, and wished they had been placed in the middle of the two extremes, between the mean and the great; that the wise man gave his testimony to this, as the standard of felicity, when he prayed to have neither poverty nor riches.

He bade me observe it, and I should always find that the calamities of life were shared among the upper and lower part of mankind, but that the middle station had the fewest disasters, and was not exposed to so many vicissitudes as the higher or lower part of mankind; nay, they were not subjected to so many distempers and uneasinesses, either of body or mind, as those were who, by vicious living, luxury, and extravagances on the one hand, or by hard labour, want of necessaries, and mean or insufficient diet on the other hand, bring distemper upon themselves by the natural consequences of their way of living; that the middle station of life was calculated for all kind of virtue and all kind of enjoyments; that peace and plenty were the handmaids of a middle fortune; that temperance, moderation, quietness, health, society, all agreeable diversions, and all desirable pleasures, were the blessings attending the middle station of life; that this way men went silently and smoothly through the world, and comfortably out of it, not embarrassed with the labours of the hands or of the head, not sold to a life of slavery for daily bread, nor harassed with perplexed circumstances, which rob the soul of peace and the body of rest, nor enraged with the passion of envy, or the secret burning lust of ambition for great things; but, in easy circumstances, sliding gently through the world, and sensibly tasting the sweets of living, without the bitter; feeling that they are happy, and learning by every day's experience to know it more sensibly.

After this he pressed me earnestly, and in the most affectionate manner, not to play the young man, nor to precipitate myself into miseries which nature, and the station of life I was born in, seemed to have provided against; that I was under no necessity of seeking my bread; that he would do well for me, and endeavour to enter me fairly into the station of life which he had just been recommending to me; and that if I was not very easy and happy in the world, it must be my mere fate or fault that must hinder it; and that he should have nothing to answer for, having thus discharged his duty in warning me against measures which he knew would be to my hurt; in a word, that as he would do very kind things for me if I would stay and settle at home as he directed, so he would not have so much hand in my misfortunes as to give me any encouragement to go away; and to close all, he told me I had my elder brother for an example, to whom he had used the same earnest persuasions to keep him from going into the Low Country wars, but could not prevail, his young desires prompting him to run into the army, where he was killed; and though he said he would not cease to pray for me, yet he would venture to say to me, that if I did take this foolish step, God would not bless me, and I should have leisure hereafter to reflect upon having neglected his counsel when there might be none to assist in my recovery.

I observed in this last part of his discourse, which was truly prophetic, though I suppose my father did not know it to be so himself—I say, I observed the tears run down his face very plentifully, especially when he spoke of my brother who was killed: and that when he spoke of my having leisure to repent, and none to assist me, he was so moved that he broke off the discourse, and told me his heart was so full he could say no more to me.

I was sincerely affected with this discourse, and, indeed, who could be otherwise? and I resolved not to think of going abroad any more, but to settle at home according to my father's desire. But alas! a few days wore it all off; and, in short, to prevent any of my father's further importunities, in a few weeks after I resolved to run quite away from him. However, I did not act quite so hastily as the first heat of my resolution prompted; but I took my mother at a time when I thought her a little more pleasant than ordinary, and told her that my thoughts were so entirely bent upon seeing the world that I should never settle to anything with resolution enough to go through with it, and my father had better give me his consent than force me to go without it; that I was now eighteen years old, which was too late to go apprentice to a trade or clerk to an attorney; that I was sure if I did I should never serve out my time, but I should certainly run away from my master before my time was out, and go to sea; and if she would speak to my father to let me go one voyage abroad, if I came home again, and did not like it, I would go no more; and I would promise, by a double diligence, to recover the time that I had lost.

This put my mother into a great passion; she told me she knew it would be to no purpose to speak to my father upon any such subject; that he knew too well what was my interest to give his consent to anything so much for my hurt; and that she wondered how I could think of any such thing after the discourse I had had with my father, and such kind and tender expressions as she knew my father had used to me; and that, in short, if I would ruin myself, there was no help for me; but I might depend I should never have their consent to it; that for her part she would not have so much hand in my destruction; and I should never have it to say that my mother was willing when my father was not.

Though my mother refused to move it to my father, yet I heard afterwards that she reported all the discourse to him, and that my father, after showing a great concern at it, said to her, with a sigh, "That boy might be happy if he would stay at home; but if he goes abroad, he will be the most miserable wretch that ever was born: I can give no consent to it."

It was not till almost a year after this that I broke loose, though, in the meantime, I continued obstinately deaf to all proposals of settling to business, and frequently expostulated with my father and mother about their being so positively determined against what they knew my inclinations prompted me to. But being one day at Hull, where I went casually, and without any purpose of making an elopement at that time; but, I say, being there, and one of my companions being about to sail to London in his father's ship, and prompting me to go with them with the common allurement of seafaring men, that it should cost me nothing for my passage, I consulted neither father nor mother any more, nor so much as sent them word of it; but leaving them to hear of it as they might, without asking God's blessing or my father's, without any consideration of circumstances or consequences, and in an ill hour, God knows, on the 1st of September 1651, I went on board a ship bound for London. Never any young adventurer's misfortunes, I believe, began sooner, or continued longer than mine. The ship was no sooner out of the Humber than the wind began to blow and the sea to rise in a most frightful manner; and, as I had never been at sea before, I was most inexpressibly sick in body and terrified in mind. I began now seriously to reflect upon what I had done, and how justly I was overtaken by the judgment of Heaven for my wicked leaving my father's house, and abandoning my duty. All the good counsels of my parents, my father's tears and my mother's entreaties, came now fresh into my mind; and my conscience, which was not yet come to the pitch of hardness to which it has since, reproached me with the contempt of advice, and the breach of my duty to God and my father.

All this while the storm increased, and the sea went very high, though nothing like what I have seen many times since; no, nor what I saw a few days after; but it was enough to affect me then, who was but a young sailor, and had never known anything of the matter. I expected every wave would have swallowed us up, and that every time the ship fell down, as I thought it did, in the trough or hollow of the sea, we should never rise more; in this agony of mind, I made many vows and resolutions that if it would please God to spare my life in this one voyage, if ever I got once my foot upon dry land again, I would go directly home to my father, and never set it into a ship again while I lived; that I would take his advice, and never run myself into such miseries as these any more. Now I saw plainly the goodness of his observations about the middle station of life, how easy, how comfortably he had lived all his days, and never had been exposed to tempests at sea or troubles on shore; and I resolved that I would, like a true repenting prodigal, go home to my father.

These wise and sober thoughts continued all the while the storm lasted, and indeed some time after; but the next day the wind was abated, and the sea calmer, and I began to be a little inured to it; however, I was very grave for all that day, being also a little sea-sick still; but towards night the weather cleared up, the wind was quite over, and a charming fine evening followed; the sun went down perfectly clear, and rose so the next morning; and having little or no wind, and a smooth sea, the sun shining upon it, the sight was, as I thought, the most delightful that ever I saw.

I had slept well in the night, and was now no more sea-sick, but very cheerful, looking with wonder upon the sea that was so rough and terrible the day before, and could be so calm and so pleasant in so little a time after. And now, lest my good resolutions should continue, my companion, who had enticed me away, comes to me; "Well, Bob," says he, clapping me upon the shoulder, "how do you do after it? I warrant you were frighted, wer'n't you, last night, when it blew but a capful of wind?" "A capful d'you call it?" said I; "'twas a terrible storm." "A storm, you fool you," replies he; "do you call that a storm? why, it was nothing at all; give us but a good ship and sea-room, and we think nothing of such a squall of wind as that; but you're but a fresh-water sailor, Bob. Come, let us make a bowl of punch, and we'll forget all that; d'ye see what charming weather 'tis now?" To make short this sad part of my story, we went the way of all sailors; the punch was made and I was made half drunk with it: and in that one night's wickedness I drowned all my repentance, all my reflections upon my past conduct, all my resolutions for the future. In a word, as the sea was returned to its smoothness of surface and settled calmness by the abatement of that storm, so the hurry of my thoughts being over, my fears and apprehensions of being swallowed up by the sea being forgotten, and the current of my former desires returned, I entirely forgot the vows and promises that I made in my distress. I found, indeed, some intervals of reflection; and the serious thoughts did, as it were, endeavour to return again sometimes; but I shook them off, and roused myself from them as it were from a distemper, and applying myself to drinking and company, soon mastered the return of those fits—for so I called them; and I had in five or six days got as complete a victory over conscience as any young fellow that resolved not to be troubled with it could desire.

But I was to have another trial for it still; and Providence, as in such cases generally it does, resolved to leave me entirely without excuse; for if I would not take this for a deliverance, the next was to be such a one as the worst and most hardened wretch among us would confess both the danger and the mercy of. The sixth day of our being at sea we came into Yarmouth Roads; the wind having been contrary and the weather calm, we had made but little way since the storm. Here we were obliged to come to an anchor, and here we lay, the wind continuing contrary—viz. at south-west—for seven or eight days, during which time a great many ships from Newcastle came into the same Roads, as the common harbour where the ships might wait for a wind for the river.

We had not, however, rid here so long but we should have tided it up the river, but that the wind blew too fresh, and after we had lain four or five days, blew very hard. However, the Roads being reckoned as good as a harbour, the anchorage good, and our ground-tackle very strong, our men were unconcerned, and not in the least apprehensive of danger, but spent the time in rest and mirth, after the manner of the sea; but the eighth day, in the morning, the wind increased, and we had all hands at work to strike our topmasts, and make everything snug and close, that the ship might ride as easy as possible. By noon the sea went very high indeed, and our ship rode forecastle in, shipped several seas, and we thought once or twice our anchor had come home; upon which our master ordered out the sheet-anchor, so that we rode with two anchors ahead, and the cables veered out to the bitter end.

By this time it blew a terrible storm indeed; and now I began to see terror and amazement in the faces even of the seamen themselves. The master, though vigilant in the business of preserving the ship, yet as he went in and out of his cabin by me, I could hear him softly to himself say, several times, "Lord be merciful to us! we shall be all lost! we shall be all undone!" and the like. During these first hurries I was stupid, lying still in my cabin, which was in the steerage, and cannot describe my temper: I could ill resume the first penitence which I had so apparently trampled upon and hardened myself against: I thought the bitterness of death had been past, and that this would be nothing like the first; but when the master himself came by me, as I said just now, and said we should be all lost, I was dreadfully frighted. I got up out of my cabin and looked out; but such a dismal sight I never saw: the sea ran mountains high, and broke upon us every three or four minutes; when I could look about, I could see nothing but distress round us; two ships that rode near us, we found, had cut their masts by the board, being deep laden; and our men cried out that a ship which rode about a mile ahead of us was foundered. Two more ships, being driven from their anchors, were run out of the Roads to sea, at all adventures, and that with not a mast standing. The light ships fared the best, as not so much labouring in the sea; but two or three of them drove, and came close by us, running away with only their spritsail out before the wind. Towards evening the mate and boatswain begged the master of our ship to let them cut away the fore-mast, which he was very unwilling to do; but the boatswain protesting to him that if he did not the ship would founder, he consented; and when they had cut away the fore-mast, the main-mast stood so loose, and shook the ship so much, they were obliged to cut that away also, and make a clear deck.

Any one may judge what a condition I must be in at all this, who was but a young sailor, and who had been in such a fright before at but a little. But if I can express at this distance the thoughts I had about me at that time, I was in tenfold more horror of mind upon account of my former convictions, and the having returned from them to the resolutions I had wickedly taken at first, than I was at death itself; and these, added to the terror of the storm, put me into such a condition that I can by no words describe it. But the worst was not come yet; the storm continued with such fury that the seamen themselves acknowledged they had never seen a worse. We had a good ship, but she was deep laden, and wallowed in the sea, so that the seamen every now and then cried out she would founder. It was my advantage in one respect, that I did not know what they meant by founder till I inquired. However, the storm was so violent that I saw, what is not often seen, the master, the boatswain, and some others more sensible than the rest, at their prayers, and expecting every moment when the ship would go to the bottom. In the middle of the night, and under all the rest of our distresses, one of the men that had been down to see cried out we had sprung a leak; another said there was four feet water in the hold. Then all hands were called to the pump. At that word, my heart, as I thought, died within me: and I fell backwards upon the side of my bed where I sat, into the cabin. However, the men roused me, and told me that I, that was able to do nothing before, was as well able to pump as another; at which I stirred up and went to the pump, and worked very heartily. While this was doing the master, seeing some light colliers, who, not able to ride out the storm were obliged to slip and run away to sea, and would come near us, ordered to fire a gun as a signal of distress.

I, who knew nothing what they meant, thought the ship had broken, or some dreadful thing happened. In a word, I was so surprised that I fell down in a swoon. As this was a time when everybody had his own life to think of, nobody minded me, or what was become of me; but another man stepped up to the pump, and thrusting me aside with his foot, let me lie, thinking I had been dead; and it was a great while before I came to myself.

We worked on; but the water increasing in the hold, it was apparent that the ship would founder; and though the storm began to abate a little, yet it was not possible she could swim till we might run into any port; so the master continued firing guns for help; and a light ship, who had rid it out just ahead of us, ventured a boat out to help us. It was with the utmost hazard the boat came near us; but it was impossible for us to get on board, or for the boat to lie near the ship's side, till at last the men rowing very heartily, and venturing their lives to save ours, our men cast them a rope over the stern with a buoy to it, and then veered it out a great length, which they, after much labour and hazard, took hold of, and we hauled them close under our stern, and got all into their boat. It was to no purpose for them or us, after we were in the boat, to think of reaching their own ship; so all agreed to let her drive, and only to pull her in towards shore as much as we could; and our master promised them, that if the boat was staved upon shore, he would make it good to their master: so partly rowing and partly driving, our boat went away to the northward, sloping towards the shore almost as far as Winterton Ness.

We were not much more than a quarter of an hour out of our ship till we saw her sink, and then I understood for the first time what was meant by a ship foundering in the sea. I must acknowledge I had hardly eyes to look up when the seamen told me she was sinking; for from the moment that they rather put me into the boat than that I might be said to go in, my heart was, as it were, dead within me, partly with fright, partly with horror of mind, and the thoughts of what was yet before me.

While we were in this condition—the men yet labouring at the oar to bring the boat near the shore—we could see (when, our boat mounting the waves, we were able to see the shore) a great many people running along the strand to assist us when we should come near; but we made but slow way towards the shore; nor were we able to reach the shore till, being past the lighthouse at Winterton, the shore falls off to the westward towards Cromer, and so the land broke off a little the violence of the wind. Here we got in, and though not without much difficulty, got all safe on shore, and walked afterwards on foot to Yarmouth, where, as unfortunate men, we were used with great humanity, as well by the magistrates of the town, who assigned us good quarters, as by particular merchants and owners of ships, and had money given us sufficient to carry us either to London or back to Hull as we thought fit.

Had I now had the sense to have gone back to Hull, and have gone home, I had been happy, and my father, as in our blessed Saviour's parable, had even killed the fatted calf for me; for hearing the ship I went away in was cast away in Yarmouth Roads, it was a great while before he had any assurances that I was not drowned.

But my ill fate pushed me on now with an obstinacy that nothing could resist; and though I had several times loud calls from my reason and my more composed judgment to go home, yet I had no power to do it. I know not what to call this, nor will I urge that it is a secret overruling decree, that hurries us on to be the instruments of our own destruction, even though it be before us, and that we rush upon it with our eyes open. Certainly, nothing but some such decreed unavoidable misery, which it was impossible for me to escape, could have pushed me forward against the calm reasonings and persuasions of my most retired thoughts, and against two such visible instructions as I had met with in my first attempt.

My comrade, who had helped to harden me before, and who was the master's son, was now less forward than I. The first time he spoke to me after we were at Yarmouth, which was not till two or three days, for we were separated in the town to several quarters; I say, the first time he saw me, it appeared his tone was altered; and, looking very melancholy, and shaking his head, he asked me how I did, and telling his father who I was, and how I had come this voyage only for a trial, in order to go further abroad, his father, turning to me with a very grave and concerned tone "Young man," says he, "you ought never to go to sea any more; you ought to take this for a plain and visible token that you are not to be a seafaring man." "Why, sir," said I, "will you go to sea no more?" "That is another case," said he; "it is my calling, and therefore my duty; but as you made this voyage on trial, you see what a taste Heaven has given you of what you are to expect if you persist. Perhaps this has all befallen us on your account, like Jonah in the ship of Tarshish. Pray," continues he, "what are you; and on what account did you go to sea?" Upon that I told him some of my story; at the end of which he burst out into a strange kind of passion: "What had I done," says he, "that such an unhappy wretch should come into my ship? I would not set my foot in the same ship with thee again for a thousand pounds." This indeed was, as I said, an excursion of his spirits, which were yet agitated by the sense of his loss, and was farther than he could have authority to go. However, he afterwards talked very gravely to me, exhorting me to go back to my father, and not tempt Providence to my ruin, telling me I might see a visible hand of Heaven against me. "And, young man," said he, "depend upon it, if you do not go back, wherever you go, you will meet with nothing but disasters and disappointments, till your father's words are fulfilled upon you."

We parted soon after; for I made him little answer, and I saw him no more; which way he went I knew not. As for me, having some money in my pocket, I travelled to London by land; and there, as well as on the road, had many struggles with myself what course of life I should take, and whether I should go home or to sea.

As to going home, shame opposed the best motions that offered to my thoughts, and it immediately occurred to me how I should be laughed at among the neighbours, and should be ashamed to see, not my father and mother only, but even everybody else; from whence I have since often observed, how incongruous and irrational the common temper of mankind is, especially of youth, to that reason which ought to guide them in such cases—viz. that they are not ashamed to sin, and yet are ashamed to repent; not ashamed of the action for which they ought justly to be esteemed fools, but are ashamed of the returning, which only can make them be esteemed wise men.

In this state of life, however, I remained some time, uncertain what measures to take, and what course of life to lead. An irresistible reluctance continued to going home; and as I stayed away a while, the remembrance of the distress I had been in wore off, and as that abated, the little motion I had in my desires to return wore off with it, till at last I quite laid aside the thoughts of it, and looked out for a voyage.

Chapter 2 - Slavery and Escape

That evil influence which carried me first away from my father's house—which hurried me into the wild and indigested notion of raising my fortune, and that impressed those conceits so forcibly upon me as to make me deaf to all good advice, and to the entreaties and even the commands of my father—I say, the same influence, whatever it was, presented the most unfortunate of all enterprises to my view; and I went on board a vessel bound to the coast of Africa; or, as our sailors vulgarly called it, a voyage to Guinea.

It was my great misfortune that in all these adventures I did not ship myself as a sailor; when, though I might indeed have worked a little harder than ordinary, yet at the same time I should have learnt the duty and office of a fore-mast man, and in time might have qualified myself for a mate or lieutenant, if not for a master. But as it was always my fate to choose for the worse, so I did here; for having money in my pocket and good clothes upon my back, I would always go on board in the habit of a gentleman; and so I neither had any business in the ship, nor learned to do any.

It was my lot first of all to fall into pretty good company in London, which does not always happen to such loose and misguided young fellows as I then was; the devil generally not omitting to lay some snare for them very early; but it was not so with me. I first got acquainted with the master of a ship who had been on the coast of Guinea; and who, having had very good success there, was resolved to go again. This captain taking a fancy to my conversation, which was not at all disagreeable at that time, hearing me say I had a mind to see the world, told me if I would go the voyage with him I should be at no expense; I should be his messmate and his companion; and if I could carry anything with me, I should have all the advantage of it that the trade would admit; and perhaps I might meet with some encouragement.

I embraced the offer; and entering into a strict friendship with this captain, who was an honest, plain-dealing man, I went the voyage with him, and carried a small adventure with me, which, by the disinterested honesty of my friend the captain, I increased very considerably; for I carried about £40 in such toys and trifles as the captain directed me to buy. These £40 I had mustered together by the assistance of some of my relations whom I corresponded with; and who, I believe, got my father, or at least my mother, to contribute so much as that to my first adventure.

This was the only voyage which I may say was successful in all my adventures, which I owe to the integrity and honesty of my friend the captain; under whom also I got a competent knowledge of the mathematics and the rules of navigation, learned how to keep an account of the ship's course, take an observation, and, in short, to understand some things that were needful to be understood by a sailor; for, as he took delight to instruct me, I took delight to learn; and, in a word, this voyage made me both a sailor and a merchant; for I brought home five pounds nine ounces of gold-dust for my adventure, which yielded me in London, at my return, almost £300; and this filled me with those aspiring thoughts which have since so completed my ruin.

Yet even in this voyage I had my misfortunes too; particularly, that I was continually sick, being thrown into a violent calenture by the excessive heat of the climate; our principal trading being upon the coast, from latitude of 15 degrees north even to the line itself.

I was now set up for a Guinea trader; and my friend, to my great misfortune, dying soon after his arrival, I resolved to go the same voyage again, and I embarked in the same vessel with one who was his mate in the former voyage, and had now got the command of the ship. This was the unhappiest voyage that ever man made; for though I did not carry quite £100 of my new-gained wealth, so that I had £200 left, which I had lodged with my friend's widow, who was very just to me, yet I fell into terrible misfortunes. The first was this: our ship making her course towards the Canary Islands, or rather between those islands and the African shore, was surprised in the grey of the morning by a Turkish rover of Sallee, who gave chase to us with all the sail she could make. We crowded also as much canvas as our yards would spread, or our masts carry, to get clear; but finding the pirate gained upon us, and would certainly come up with us in a few hours, we prepared to fight; our ship having twelve guns, and the rogue eighteen. About three in the afternoon he came up with us, and bringing to, by mistake, just athwart our quarter, instead of athwart our stern, as he intended, we brought eight of our guns to bear on that side, and poured in a broadside upon him, which made him sheer off again, after returning our fire, and pouring in also his small shot from near two hundred men which he had on board. However, we had not a man touched, all our men keeping close. He prepared to attack us again, and we to defend ourselves. But laying us on board the next time upon our other quarter, he entered sixty men upon our decks, who immediately fell to cutting and hacking the sails and rigging. We plied them with small shot, half-pikes, powder-chests, and such like, and cleared our deck of them twice. However, to cut short this melancholy part of our story, our ship being disabled, and three of our men killed, and eight wounded, we were obliged to yield, and were carried all prisoners into Sallee, a port belonging to the Moors.

The usage I had there was not so dreadful as at first I apprehended; nor was I carried up the country to the emperor's court, as the rest of our men were, but was kept by the captain of the rover as his proper prize, and made his slave, being young and nimble, and fit for his business. At this surprising change of my circumstances, from a merchant to a miserable slave, I was perfectly overwhelmed; and now I looked back upon my father's prophetic discourse to me, that I should be miserable and have none to relieve me, which I thought was now so effectually brought to pass that I could not be worse; for now the hand of Heaven had overtaken me, and I was undone without redemption; but, alas! this was but a taste of the misery I was to go through, as will appear in the sequel of this story.

As my new patron, or master, had taken me home to his house, so I was in hopes that he would take me with him when he went to sea again, believing that it would some time or other be his fate to be taken by a Spanish or Portugal man-of-war; and that then I should be set at liberty. But this hope of mine was soon taken away; for when he went to sea, he left me on shore to look after his little garden, and do the common drudgery of slaves about his house; and when he came home again from his cruise, he ordered me to lie in the cabin to look after the ship.

Here I meditated nothing but my escape, and what method I might take to effect it, but found no way that had the least probability in it; nothing presented to make the supposition of it rational; for I had nobody to communicate it to that would embark with me—no fellow-slave, no Englishman, Irishman, or Scotchman there but myself; so that for two years, though I often pleased myself with the imagination, yet I never had the least encouraging prospect of putting it in practice.

After about two years, an odd circumstance presented itself, which put the old thought of making some attempt for my liberty again in my head. My patron lying at home longer than usual without fitting out his ship, which, as I heard, was for want of money, he used constantly, once or twice a week, sometimes oftener if the weather was fair, to take the ship's pinnace and go out into the road a-fishing; and as he always took me and young Maresco with him to row the boat, we made him very merry, and I proved very dexterous in catching fish; insomuch that sometimes he would send me with a Moor, one of his kinsmen, and the youth—the Maresco, as they called him—to catch a dish of fish for him.

It happened one time, that going a-fishing in a calm morning, a fog rose so thick that, though we were not half a league from the shore, we lost sight of it; and rowing we knew not whither or which way, we laboured all day, and all the next night; and when the morning came we found we had pulled off to sea instead of pulling in for the shore; and that we were at least two leagues from the shore. However, we got well in again, though with a great deal of labour and some danger; for the wind began to blow pretty fresh in the morning; but we were all very hungry.

But our patron, warned by this disaster, resolved to take more care of himself for the future; and having lying by him the longboat of our English ship that he had taken, he resolved he would not go a-fishing any more without a compass and some provision; so he ordered the carpenter of his ship, who also was an English slave, to build a little state-room, or cabin, in the middle of the long-boat, like that of a barge, with a place to stand behind it to steer, and haul home the main-sheet; the room before for a hand or two to stand and work the sails. She sailed with what we call a shoulder-of-mutton sail; and the boom jibed over the top of the cabin, which lay very snug and low, and had in it room for him to lie, with a slave or two, and a table to eat on, with some small lockers to put in some bottles of such liquor as he thought fit to drink; and his bread, rice, and coffee.

We went frequently out with this boat a-fishing; and as I was most dexterous to catch fish for him, he never went without me. It happened that he had appointed to go out in this boat, either for pleasure or for fish, with two or three Moors of some distinction in that place, and for whom he had provided extraordinarily, and had, therefore, sent on board the boat overnight a larger store of provisions than ordinary; and had ordered me to get ready three fusees with powder and shot, which were on board his ship, for that they designed some sport of fowling as well as fishing.

I got all things ready as he had directed, and waited the next morning with the boat washed clean, her ancient and pendants out, and everything to accommodate his guests; when by-and-by my patron came on board alone, and told me his guests had put off going from some business that fell out, and ordered me, with the man and boy, as usual, to go out with the boat and catch them some fish, for that his friends were to sup at his house, and commanded that as soon as I got some fish I should bring it home to his house; all which I prepared to do.

This moment my former notions of deliverance darted into my thoughts, for now I found I was likely to have a little ship at my command; and my master being gone, I prepared to furnish myself, not for fishing business, but for a voyage; though I knew not, neither did I so much as consider, whither I should steer—anywhere to get out of that place was my desire.

My first contrivance was to make a pretence to speak to this Moor, to get something for our subsistence on board; for I told him we must not presume to eat of our patron's bread. He said that was true; so he brought a large basket of rusk or biscuit, and three jars of fresh water, into the boat. I knew where my patron's case of bottles stood, which it was evident, by the make, were taken out of some English prize, and I conveyed them into the boat while the Moor was on shore, as if they had been there before for our master. I conveyed also a great lump of beeswax into the boat, which weighed about half a hundred-weight, with a parcel of twine or thread, a hatchet, a saw, and a hammer, all of which were of great use to us afterwards, especially the wax, to make candles. Another trick I tried upon him, which he innocently came into also: his name was Ismael, which they call Muley, or Moely; so I called to him—"Moely," said I, "our patron's guns are on board the boat; can you not get a little powder and shot? It may be we may kill some alcamies (a fowl like our curlews) for ourselves, for I know he keeps the gunner's stores in the ship." "Yes," says he, "I'll bring some;" and accordingly he brought a great leather pouch, which held a pound and a half of powder, or rather more; and another with shot, that had five or six pounds, with some bullets, and put all into the boat. At the same time I had found some powder of my master's in the great cabin, with which I filled one of the large bottles in the case, which was almost empty, pouring what was in it into another; and thus furnished with everything needful, we sailed out of the port to fish. The castle, which is at the entrance of the port, knew who we were, and took no notice of us; and we were not above a mile out of the port before we hauled in our sail and set us down to fish.

The wind blew from the N.N.E., which was contrary to my desire, for had it blown southerly I had been sure to have made the coast of Spain, and at least reached to the bay of Cadiz; but my resolutions were, blow which way it would, I would be gone from that horrid place where I was, and leave the rest to fate.

After we had fished some time and caught nothing—for when I had fish on my hook I would not pull them up, that he might not see them—I said to the Moor, "This will not do; our master will not be thus served; we must stand farther off." He, thinking no harm, agreed, and being in the head of the boat, set the sails; and, as I had the helm, I ran the boat out near a league farther, and then brought her to, as if I would fish; when, giving the boy the helm, I stepped forward to where the Moor was, and making as if I stooped for something behind him, I took him by surprise with my arm under his waist, and tossed him clear overboard into the sea. He rose immediately, for he swam like a cork, and called to me, begged to be taken in, told me he would go all over the world with me. He swam so strong after the boat that he would have reached me very quickly, there being but little wind; upon which I stepped into the cabin, and fetching one of the fowling-pieces, I presented it at him, and told him I had done him no hurt, and if he would be quiet I would do him none. "But," said I, "you swim well enough to reach to the shore, and the sea is calm; make the best of your way to shore, and I will do you no harm; but if you come near the boat I'll shoot you through the head, for I am resolved to have my liberty;" so he turned himself about, and swam for the shore, and I make no doubt but he reached it with ease, for he was an excellent swimmer.

I could have been content to have taken this Moor with me, and have drowned the boy, but there was no venturing to trust him. When he was gone, I turned to the boy, whom they called Xury, and said to him, "Xury, if you will be faithful to me, I'll make you a great man; but if you will not stroke your face to be true to me"—that is, swear by Mahomet and his father's beard—"I must throw you into the sea too." The boy smiled in my face, and spoke so innocently that I could not distrust him, and swore to be faithful to me, and go all over the world with me.

While I was in view of the Moor that was swimming, I stood out directly to sea with the boat, rather stretching to windward, that they might think me gone towards the Straits' mouth (as indeed any one that had been in their wits must have been supposed to do): for who would have supposed we were sailed on to the southward, to the truly Barbarian coast, where whole nations of negroes were sure to surround us with their canoes and destroy us; where we could not go on shore but we should be devoured by savage beasts, or more merciless savages of human kind.

But as soon as it grew dusk in the evening, I changed my course, and steered directly south and by east, bending my course a little towards the east, that I might keep in with the shore; and having a fair, fresh gale of wind, and a smooth, quiet sea, I made such sail that I believe by the next day, at three o'clock in the afternoon, when I first made the land, I could not be less than one hundred and fifty miles south of Sallee; quite beyond the Emperor of Morocco's dominions, or indeed of any other king thereabouts, for we saw no people.

Yet such was the fright I had taken of the Moors, and the dreadful apprehensions I had of falling into their hands, that I would not stop, or go on shore, or come to an anchor; the wind continuing fair till I had sailed in that manner five days; and then the wind shifting to the southward, I concluded also that if any of our vessels were in chase of me, they also would now give over; so I ventured to make to the coast, and came to an anchor in the mouth of a little river, I knew not what, nor where, neither what latitude, what country, what nation, or what river. I neither saw, nor desired to see any people; the principal thing I wanted was fresh water. We came into this creek in the evening, resolving to swim on shore as soon as it was dark, and discover the country; but as soon as it was quite dark, we heard such dreadful noises of the barking, roaring, and howling of wild creatures, of we knew not what kinds, that the poor boy was ready to die with fear, and begged of me not to go on shore till day. "Well, Xury," said I, "then I won't; but it may be that we may see men by day, who will be as bad to us as those lions." "Then we give them the shoot gun," says Xury, laughing, "make them run wey." Such English Xury spoke by conversing among us slaves. However, I was glad to see the boy so cheerful, and I gave him a dram (out of our patron's case of bottles) to cheer him up. After all, Xury's advice was good, and I took it; we dropped our little anchor, and lay still all night; I say still, for we slept none; for in two or three hours we saw vast great creatures (we knew not what to call them) of many sorts, come down to the sea-shore and run into the water, wallowing and washing themselves for the pleasure of cooling themselves; and they made such hideous howlings and yellings, that I never indeed heard the like.

Xury was dreadfully frighted, and indeed so was I too; but we were both more frighted when we heard one of these mighty creatures come swimming towards our boat; we could not see him, but we might hear him by his blowing to be a monstrous huge and furious beast. Xury said it was a lion, and it might be so for aught I know; but poor Xury cried to me to weigh the anchor and row away; "No," says I, "Xury; we can slip our cable, with the buoy to it, and go off to sea; they cannot follow us far." I had no sooner said so, but I perceived the creature (whatever it was) within two oars' length, which something surprised me; however, I immediately stepped to the cabin door, and taking up my gun, fired at him; upon which he immediately turned about and swam towards the shore again.

But it is impossible to describe the horrid noises, and hideous cries and howlings that were raised, as well upon the edge of the shore as higher within the country, upon the noise or report of the gun, a thing I have some reason to believe those creatures had never heard before: this convinced me that there was no going on shore for us in the night on that coast, and how to venture on shore in the day was another question too; for to have fallen into the hands of any of the savages had been as bad as to have fallen into the hands of the lions and tigers; at least we were equally apprehensive of the danger of it.

Be that as it would, we were obliged to go on shore somewhere or other for water, for we had not a pint left in the boat; when and where to get to it was the point. Xury said, if I would let him go on shore with one of the jars, he would find if there was any water, and bring some to me. I asked him why he would go? why I should not go, and he stay in the boat? The boy answered with so much affection as made me love him ever after. Says he, "If wild mans come, they eat me, you go wey." "Well, Xury," said I, "we will both go and if the wild mans come, we will kill them, they shall eat neither of us." So I gave Xury a piece of rusk bread to eat, and a dram out of our patron's case of bottles which I mentioned before; and we hauled the boat in as near the shore as we thought was proper, and so waded on shore, carrying nothing but our arms and two jars for water.

I did not care to go out of sight of the boat, fearing the coming of canoes with savages down the river; but the boy seeing a low place about a mile up the country, rambled to it, and by-and-by I saw him come running towards me. I thought he was pursued by some savage, or frighted with some wild beast, and I ran forward towards him to help him; but when I came nearer to him I saw something hanging over his shoulders, which was a creature that he had shot, like a hare, but different in colour, and longer legs; however, we were very glad of it, and it was very good meat; but the great joy that poor Xury came with, was to tell me he had found good water and seen no wild mans.

But we found afterwards that we need not take such pains for water, for a little higher up the creek where we were we found the water fresh when the tide was out, which flowed but a little way up; so we filled our jars, and feasted on the hare he had killed, and prepared to go on our way, having seen no footsteps of any human creature in that part of the country.

As I had been one voyage to this coast before, I knew very well that the islands of the Canaries, and the Cape de Verde Islands also, lay not far off from the coast. But as I had no instruments to take an observation to know what latitude we were in, and not exactly knowing, or at least remembering, what latitude they were in, I knew not where to look for them, or when to stand off to sea towards them; otherwise I might now easily have found some of these islands. But my hope was, that if I stood along this coast till I came to that part where the English traded, I should find some of their vessels upon their usual design of trade, that would relieve and take us in.

By the best of my calculation, that place where I now was must be that country which, lying between the Emperor of Morocco's dominions and the negroes, lies waste and uninhabited, except by wild beasts; the negroes having abandoned it and gone farther south for fear of the Moors, and the Moors not thinking it worth inhabiting by reason of its barrenness; and indeed, both forsaking it because of the prodigious number of tigers, lions, leopards, and other furious creatures which harbour there; so that the Moors use it for their hunting only, where they go like an army, two or three thousand men at a time; and indeed for near a hundred miles together upon this coast we saw nothing but a waste, uninhabited country by day, and heard nothing but howlings and roaring of wild beasts by night.

Once or twice in the daytime I thought I saw the Pico of Teneriffe, being the high top of the Mountain Teneriffe in the Canaries, and had a great mind to venture out, in hopes of reaching thither; but having tried twice, I was forced in again by contrary winds, the sea also going too high for my little vessel; so, I resolved to pursue my first design, and keep along the shore.

Several times I was obliged to land for fresh water, after we had left this place; and once in particular, being early in morning, we came to an anchor under a little point of land, which was pretty high; and the tide beginning to flow, we lay still to go farther in. Xury, whose eyes were more about him than it seems mine were, calls softly to me, and tells me that we had best go farther off the shore; "For," says he, "look, yonder lies a dreadful monster on the side of that hillock, fast asleep." I looked where he pointed, and saw a dreadful monster indeed, for it was a terrible, great lion that lay on the side of the shore, under the shade of a piece of the hill that hung as it were a little over him. "Xury," says I, "you shall on shore and kill him." Xury, looked frighted, and said, "Me kill! he eat me at one mouth!"—one mouthful he meant. However, I said no more to the boy, but bade him lie still, and I took our biggest gun, which was almost musket-bore, and loaded it with a good charge of powder, and with two slugs, and laid it down; then I loaded another gun with two bullets; and the third (for we had three pieces) I loaded with five smaller bullets. I took the best aim I could with the first piece to have shot him in the head, but he lay so with his leg raised a little above his nose, that the slugs hit his leg about the knee and broke the bone. He started up, growling at first, but finding his leg broken, fell down again; and then got upon three legs, and gave the most hideous roar that ever I heard. I was a little surprised that I had not hit him on the head; however, I took up the second piece immediately, and though he began to move off, fired again, and shot him in the head, and had the pleasure to see him drop and make but little noise, but lie struggling for life.

Then Xury took heart, and would have me let him go on shore. "Well, go," said I: so the boy jumped into the water and taking a little gun in one hand, swam to shore with the other hand, and coming close to the creature, put the muzzle of the piece to his ear, and shot him in the head again, which despatched him quite.

This was game indeed to us, but this was no food; and I was very sorry to lose three charges of powder and shot upon a creature that was good for nothing to us. However, Xury said he would have some of him; so he comes on board, and asked me to give him the hatchet. "For what, Xury?" said I. "Me cut off his head," said he. However, Xury could not cut off his head, but he cut off a foot, and brought it with him, and it was a monstrous great one.

I bethought myself, however, that, perhaps the skin of him might, one way or other, be of some value to us; and I resolved to take off his skin if I could. So Xury and I went to work with him; but Xury was much the better workman at it, for I knew very ill how to do it. Indeed, it took us both up the whole day, but at last we got off the hide of him, and spreading it on the top of our cabin, the sun effectually dried it in two days' time, and it afterwards served me to lie upon.

Chapter 3 - Wrecked On A Desert Island

After this stop, we made on to the southward continually for ten or twelve days, living very sparingly on our provisions, which began to abate very much, and going no oftener to the shore than we were obliged to for fresh water. My design in this was to make the river Gambia or Senegal, that is to say anywhere about the Cape de Verde, where I was in hopes to meet with some European ship; and if I did not, I knew not what course I had to take, but to seek for the islands, or perish there among the negroes. I knew that all the ships from Europe, which sailed either to the coast of Guinea or to Brazil, or to the East Indies, made this cape, or those islands; and, in a word, I put the whole of my fortune upon this single point, either that I must meet with some ship or must perish.

When I had pursued this resolution about ten days longer, as I have said, I began to see that the land was inhabited; and in two or three places, as we sailed by, we saw people stand upon the shore to look at us; we could also perceive they were quite black and naked. I was once inclined to have gone on shore to them; but Xury was my better counsellor, and said to me, "No go, no go." However, I hauled in nearer the shore that I might talk to them, and I found they ran along the shore by me a good way.

I observed they had no weapons in their hand, except one, who had a long slender stick, which Xury said was a lance, and that they could throw them a great way with good aim; so I kept at a distance, but talked with them by signs as well as I could; and particularly made signs for something to eat: they beckoned to me to stop my boat, and they would fetch me some meat.

Upon this I lowered the top of my sail and lay by, and two of them ran up into the country, and in less than half-an-hour came back, and brought with them two pieces of dried flesh and some corn, such as is the produce of their country; but we neither knew what the one or the other was; however, we were willing to accept it, but how to come at it was our next dispute, for I would not venture on shore to them, and they were as much afraid of us; but they took a safe way for us all, for they brought it to the shore and laid it down, and went and stood a great way off till we fetched it on board, and then came close to us again.

We made signs of thanks to them, for we had nothing to make them amends; but an opportunity offered that very instant to oblige them wonderfully; for while we were lying by the shore came two mighty creatures, one pursuing the other (as we took it) with great fury from the mountains towards the sea; whether it was the male pursuing the female, or whether they were in sport or in rage, we could not tell, any more than we could tell whether it was usual or strange, but I believe it was the latter; because, in the first place, those ravenous creatures seldom appear but in the night; and, in the second place, we found the people terribly frighted, especially the women.

The man that had the lance or dart did not fly from them, but the rest did; however, as the two creatures ran directly into the water, they did not offer to fall upon any of the negroes, but plunged themselves into the sea, and swam about, as if they had come for their diversion; at last one of them began to come nearer our boat than at first I expected; but I lay ready for him, for I had loaded my gun with all possible expedition, and bade Xury load both the others.

As soon as he came fairly within my reach, I fired, and shot him directly in the head; immediately he sank down into the water, but rose instantly, and plunged up and down, as if he were struggling for life, and so indeed he was; he immediately made to the shore; but between the wound, which was his mortal hurt, and the strangling of the water, he died just before he reached the shore.

It is impossible to express the astonishment of these poor creatures at the noise and fire of my gun: some of them were even ready to die for fear, and fell down as dead with the very terror; but when they saw the creature dead, and sunk in the water, and that I made signs to them to come to the shore, they took heart and came, and began to search for the creature. I found him by his blood staining the water; and by the help of a rope, which I slung round him, and gave the negroes to haul, they dragged him on shore, and found that it was a most curious leopard, spotted, and fine to an admirable degree; and the negroes held up their hands with admiration, to think what it was I had killed him with.

The other creature, frighted with the flash of fire and the noise of the gun, swam on shore, and ran up directly to the mountains from whence they came; nor could I, at that distance, know what it was. I found quickly the negroes wished to eat the flesh of this creature, so I was willing to have them take it as a favour from me; which, when I made signs to them that they might take him, they were very thankful for. Immediately they fell to work with him; and though they had no knife, yet, with a sharpened piece of wood, they took off his skin as readily, and much more readily, than we could have done with a knife.

They offered me some of the flesh, which I declined, pointing out that I would give it them; but made signs for the skin, which they gave me very freely, and brought me a great deal more of their provisions, which, though I did not understand, yet I accepted. I then made signs to them for some water, and held out one of my jars to them, turning it bottom upward, to show that it was empty, and that I wanted to have it filled. They called immediately to some of their friends, and there came two women, and brought a great vessel made of earth, and burnt, as I supposed, in the sun, this they set down to me, as before, and I sent Xury on shore with my jars, and filled them all three. The women were as naked as the men.

I was now furnished with roots and corn, such as it was, and water; and leaving my friendly negroes, I made forward for about eleven days more, without offering to go near the shore, till I saw the land run out a great length into the sea, at about the distance of four or five leagues before me; and the sea being very calm, I kept a large offing to make this point. At length, doubling the point, at about two leagues from the land, I saw plainly land on the other side, to seaward; then I concluded, as it was most certain indeed, that this was the Cape de Verde, and those the islands called, from thence, Cape de Verde Islands. However, they were at a great distance, and I could not well tell what I had best to do; for if I should be taken with a fresh of wind, I might neither reach one or other.

In this dilemma, as I was very pensive, I stepped into the cabin and sat down, Xury having the helm; when, on a sudden, the boy cried out, "Master, master, a ship with a sail!" and the foolish boy was frighted out of his wits, thinking it must needs be some of his master's ships sent to pursue us, but I knew we were far enough out of their reach. I jumped out of the cabin, and immediately saw, not only the ship, but that it was a Portuguese ship; and, as I thought, was bound to the coast of Guinea, for negroes. But, when I observed the course she steered, I was soon convinced they were bound some other way, and did not design to come any nearer to the shore; upon which I stretched out to sea as much as I could, resolving to speak with them if possible.

With all the sail I could make, I found I should not be able to come in their way, but that they would be gone by before I could make any signal to them: but after I had crowded to the utmost, and began to despair, they, it seems, saw by the help of their glasses that it was some European boat, which they supposed must belong to some ship that was lost; so they shortened sail to let me come up. I was encouraged with this, and as I had my patron's ancient on board, I made a waft of it to them, for a signal of distress, and fired a gun, both which they saw; for they told me they saw the smoke, though they did not hear the gun. Upon these signals they very kindly brought to, and lay by for me; and in about three hours; time I came up with them.

They asked me what I was, in Portuguese, and in Spanish, and in French, but I understood none of them; but at last a Scotch sailor, who was on board, called to me: and I answered him, and told him I was an Englishman, that I had made my escape out of slavery from the Moors, at Sallee; they then bade me come on board, and very kindly took me in, and all my goods.

It was an inexpressible joy to me, which any one will believe, that I was thus delivered, as I esteemed it, from such a miserable and almost hopeless condition as I was in; and I immediately offered all I had to the captain of the ship, as a return for my deliverance; but he generously told me he would take nothing from me, but that all I had should be delivered safe to me when I came to the Brazils. "For," says he, "I have saved your life on no other terms than I would be glad to be saved myself: and it may, one time or other, be my lot to be taken up in the same condition. Besides," said he, "when I carry you to the Brazils, so great a way from your own country, if I should take from you what you have, you will be starved there, and then I only take away that life I have given. No, no," says he: "Seignior Inglese" (Mr. Englishman), "I will carry you thither in charity, and those things will help to buy your subsistence there, and your passage home again."

As he was charitable in this proposal, so he was just in the performance to a tittle; for he ordered the seamen that none should touch anything that I had: then he took everything into his own possession, and gave me back an exact inventory of them, that I might have them, even to my three earthen jars.

As to my boat, it was a very good one; and that he saw, and told me he would buy it of me for his ship's use; and asked me what I would have for it? I told him he had been so generous to me in everything that I could not offer to make any price of the boat, but left it entirely to him: upon which he told me he would give me a note of hand to pay me eighty pieces of eight for it at Brazil; and when it came there, if any one offered to give more, he would make it up. He offered me also sixty pieces of eight more for my boy Xury, which I was loth to take; not that I was unwilling to let the captain have him, but I was very loth to sell the poor boy's liberty, who had assisted me so faithfully in procuring my own. However, when I let him know my reason, he owned it to be just, and offered me this medium, that he would give the boy an obligation to set him free in ten years, if he turned Christian: upon this, and Xury saying he was willing to go to him, I let the captain have him.

We had a very good voyage to the Brazils, and I arrived in the Bay de Todos los Santos, or All Saints' Bay, in about twenty-two days after. And now I was once more delivered from the most miserable of all conditions of life; and what to do next with myself I was to consider.

The generous treatment the captain gave me I can never enough remember: he would take nothing of me for my passage, gave me twenty ducats for the leopard's skin, and forty for the lion's skin, which I had in my boat, and caused everything I had in the ship to be punctually delivered to me; and what I was willing to sell he bought of me, such as the case of bottles, two of my guns, and a piece of the lump of beeswax—for I had made candles of the rest: in a word, I made about two hundred and twenty pieces of eight of all my cargo; and with this stock I went on shore in the Brazils.

I had not been long here before I was recommended to the house of a good honest man like himself, who had an ingenio, as they call it (that is, a plantation and a sugar-house). I lived with him some time, and acquainted myself by that means with the manner of planting and making of sugar; and seeing how well the planters lived, and how they got rich suddenly, I resolved, if I could get a licence to settle there, I would turn planter among them: resolving in the meantime to find out some way to get my money, which I had left in London, remitted to me. To this purpose, getting a kind of letter of naturalisation, I purchased as much land that was uncured as my money would reach, and formed a plan for my plantation and settlement; such a one as might be suitable to the stock which I proposed to myself to receive from England.

I had a neighbour, a Portuguese, of Lisbon, but born of English parents, whose name was Wells, and in much such circumstances as I was. I call him my neighbour, because his plantation lay next to mine, and we went on very sociably together. My stock was but low, as well as his; and we rather planted for food than anything else, for about two years. However, we began to increase, and our land began to come into order; so that the third year we planted some tobacco, and made each of us a large piece of ground ready for planting canes in the year to come. But we both wanted help; and now I found, more than before, I had done wrong in parting with my boy Xury.

But, alas! for me to do wrong that never did right, was no great wonder. I hail no remedy but to go on: I had got into an employment quite remote to my genius, and directly contrary to the life I delighted in, and for which I forsook my father's house, and broke through all his good advice. Nay, I was coming into the very middle station, or upper degree of low life, which my father advised me to before, and which, if I resolved to go on with, I might as well have stayed at home, and never have fatigued myself in the world as I had done; and I used often to say to myself, I could have done this as well in England, among my friends, as have gone five thousand miles off to do it among strangers and savages, in a wilderness, and at such a distance as never to hear from any part of the world that had the least knowledge of me.

In this manner I used to look upon my condition with the utmost regret. I had nobody to converse with, but now and then this neighbour; no work to be done, but by the labour of my hands; and I used to say, I lived just like a man cast away upon some desolate island, that had nobody there but himself. But how just has it been—and how should all men reflect, that when they compare their present conditions with others that are worse, Heaven may oblige them to make the exchange, and be convinced of their former felicity by their experience—I say, how just has it been, that the truly solitary life I reflected on, in an island of mere desolation, should be my lot, who had so often unjustly compared it with the life which I then led, in which, had I continued, I had in all probability been exceeding prosperous and rich.

I was in some degree settled in my measures for carrying on the plantation before my kind friend, the captain of the ship that took me up at sea, went back—for the ship remained there, in providing his lading and preparing for his voyage, nearly three months—when telling him what little stock I had left behind me in London, he gave me this friendly and sincere advice:—"Seignior Inglese," says he (for so he always called me), "if you will give me letters, and a procuration in form to me, with orders to the person who has your money in London to send your effects to Lisbon, to such persons as I shall direct, and in such goods as are proper for this country, I will bring you the produce of them, God willing, at my return; but, since human affairs are all subject to changes and disasters, I would have you give orders but for one hundred pounds sterling, which, you say, is half your stock, and let the hazard be run for the first; so that, if it come safe, you may order the rest the same way, and, if it miscarry, you may have the other half to have recourse to for your supply."

This was so wholesome advice, and looked so friendly, that I could not but be convinced it was the best course I could take; so I accordingly prepared letters to the gentlewoman with whom I had left my money, and a procuration to the Portuguese captain, as he desired.

I wrote the English captain's widow a full account of all my adventures—my slavery, escape, and how I had met with the Portuguese captain at sea, the humanity of his behaviour, and what condition I was now in, with all other necessary directions for my supply; and when this honest captain came to Lisbon, he found means, by some of the English merchants there, to send over, not the order only, but a full account of my story to a merchant in London, who represented it effectually to her; whereupon she not only delivered the money, but out of her own pocket sent the Portugal captain a very handsome present for his humanity and charity to me.

The merchant in London, vesting this hundred pounds in English goods, such as the captain had written for, sent them directly to him at Lisbon, and he brought them all safe to me to the Brazils; among which, without my direction (for I was too young in my business to think of them), he had taken care to have all sorts of tools, ironwork, and utensils necessary for my plantation, and which were of great use to me.

When this cargo arrived I thought my fortune made, for I was surprised with the joy of it; and my stood steward, the captain, had laid out the five pounds, which my friend had sent him for a present for himself, to purchase and bring me over a servant, under bond for six years' service, and would not accept of any consideration, except a little tobacco, which I would have him accept, being of my own produce.

Neither was this all; for my goods being all English manufacture, such as cloths, stuffs, baize, and things particularly valuable and desirable in the country, I found means to sell them to a very great advantage; so that I might say I had more than four times the value of my first cargo, and was now infinitely beyond my poor neighbour—I mean in the advancement of my plantation; for the first thing I did, I bought me a negro slave, and an European servant also—I mean another besides that which the captain brought me from Lisbon.

But as abused prosperity is oftentimes made the very means of our greatest adversity, so it was with me. I went on the next year with great success in my plantation: I raised fifty great rolls of tobacco on my own ground, more than I had disposed of for necessaries among my neighbours; and these fifty rolls, being each of above a hundredweight, were well cured, and laid by against the return of the fleet from Lisbon: and now increasing in business and wealth, my head began to be full of projects and undertakings beyond my reach; such as are, indeed, often the ruin of the best heads in business. Had I continued in the station I was now in, I had room for all the happy things to have yet befallen me for which my father so earnestly recommended a quiet, retired life, and of which he had so sensibly described the middle station of life to be full of; but other things attended me, and I was still to be the wilful agent of all my own miseries; and particularly, to increase my fault, and double the reflections upon myself, which in my future sorrows I should have leisure to make, all these miscarriages were procured by my apparent obstinate adhering to my foolish inclination of wandering abroad, and pursuing that inclination, in contradiction to the clearest views of doing myself good in a fair and plain pursuit of those prospects, and those measures of life, which nature and Providence concurred to present me with, and to make my duty.

As I had once done thus in my breaking away from my parents, so I could not be content now, but I must go and leave the happy view I had of being a rich and thriving man in my new plantation, only to pursue a rash and immoderate desire of rising faster than the nature of the thing admitted; and thus I cast myself down again into the deepest gulf of human misery that ever man fell into, or perhaps could be consistent with life and a state of health in the world.

To come, then, by the just degrees to the particulars of this part of my story. You may suppose, that having now lived almost four years in the Brazils, and beginning to thrive and prosper very well upon my plantation, I had not only learned the language, but had contracted acquaintance and friendship among my fellow-planters, as well as among the merchants at St. Salvador, which was our port; and that, in my discourses among them, I had frequently given them an account of my two voyages to the coast of Guinea: the manner of trading with the negroes there, and how easy it was to purchase upon the coast for trifles—such as beads, toys, knives, scissors, hatchets, bits of glass, and the like—not only gold-dust, Guinea grains, elephants' teeth, &c., but negroes, for the service of the Brazils, in great numbers.

They listened always very attentively to my discourses on these heads, but especially to that part which related to the buying of negroes, which was a trade at that time, not only not far entered into, but, as far as it was, had been carried on by assientos, or permission of the kings of Spain and Portugal, and engrossed in the public stock: so that few negroes were bought, and these excessively dear.

It happened, being in company with some merchants and planters of my acquaintance, and talking of those things very earnestly, three of them came to me next morning, and told me they had been musing very much upon what I had discoursed with them of the last night, and they came to make a secret proposal to me; and, after enjoining me to secrecy, they told me that they had a mind to fit out a ship to go to Guinea; that they had all plantations as well as I, and were straitened for nothing so much as servants; that as it was a trade that could not be carried on, because they could not publicly sell the negroes when they came home, so they desired to make but one voyage, to bring the negroes on shore privately, and divide them among their own plantations; and, in a word, the question was whether I would go their supercargo in the ship, to manage the trading part upon the coast of Guinea; and they offered me that I should have my equal share of the negroes, without providing any part of the stock.

This was a fair proposal, it must be confessed, had it been made to any one that had not had a settlement and a plantation of his own to look after, which was in a fair way of coming to be very considerable, and with a good stock upon it; but for me, that was thus entered and established, and had nothing to do but to go on as I had begun, for three or four years more, and to have sent for the other hundred pounds from England; and who in that time, and with that little addition, could scarce have failed of being worth three or four thousand pounds sterling, and that increasing too—for me to think of such a voyage was the most preposterous thing that ever man in such circumstances could be guilty of.

But I, that was born to be my own destroyer, could no more resist the offer than I could restrain my first rambling designs when my father's good counsel was lost upon me. In a word, I told them I would go with all my heart, if they would undertake to look after my plantation in my absence, and would dispose of it to such as I should direct, if I miscarried. This they all engaged to do, and entered into writings or covenants to do so; and I made a formal will, disposing of my plantation and effects in case of my death, making the captain of the ship that had saved my life, as before, my universal heir, but obliging him to dispose of my effects as I had directed in my will; one half of the produce being to himself, and the other to be shipped to England.

In short, I took all possible caution to preserve my effects and to keep up my plantation. Had I used half as much prudence to have looked into my own interest, and have made a judgment of what I ought to have done and not to have done, I had certainly never gone away from so prosperous an undertaking, leaving all the probable views of a thriving circumstance, and gone upon a voyage to sea, attended with all its common hazards, to say nothing of the reasons I had to expect particular misfortunes to myself. But I was hurried on, and obeyed blindly the dictates of my fancy rather than my reason; and, accordingly, the ship being fitted out, and the cargo furnished, and all things done, as by agreement, by my partners in the voyage, I went on board in an evil hour, the 1st September 1659, being the same day eight years that I went from my father and mother at Hull, in order to act the rebel to their authority, and the fool to my own interests.

Our ship was about one hundred and twenty tons burden, carried six guns and fourteen men, besides the master, his boy, and myself. We had on board no large cargo of goods, except of such toys as were fit for our trade with the negroes, such as beads, bits of glass, shells, and other trifles, especially little looking-glasses, knives, scissors, hatchets, and the like.

The same day I went on board we set sail, standing away to the northward upon our own coast, with design to stretch over for the African coast when we came about ten or twelve degrees of northern latitude, which, it seems, was the manner of course in those days. We had very good weather, only excessively hot, all the way upon our own coast, till we came to the height of Cape St. Augustino; from whence, keeping further off at sea, we lost sight of land, and steered as if we were bound for the isle Fernando de Noronha, holding our course N.E. by N., and leaving those isles on the east. In this course we passed the line in about twelve days' time, and were, by our last observation, in seven degrees twenty-two minutes northern latitude, when a violent tornado, or hurricane, took us quite out of our knowledge. It began from the south-east, came about to the north-west, and then settled in the north-east; from whence it blew in such a terrible manner, that for twelve days together we could do nothing but drive, and, scudding away before it, let it carry us whither fate and the fury of the winds directed; and, during these twelve days, I need not say that I expected every day to be swallowed up; nor, indeed, did any in the ship expect to save their lives.

In this distress we had, besides the terror of the storm, one of our men die of the calenture, and one man and the boy washed overboard. About the twelfth day, the weather abating a little, the master made an observation as well as he could, and found that he was in about eleven degrees north latitude, but that he was twenty-two degrees of longitude difference west from Cape St. Augustino; so that he found he was upon the coast of Guiana, or the north part of Brazil, beyond the river Amazon, toward that of the river Orinoco, commonly called the Great River; and began to consult with me what course he should take, for the ship was leaky, and very much disabled, and he was going directly back to the coast of Brazil.

I was positively against that; and looking over the charts of the sea-coast of America with him, we concluded there was no inhabited country for us to have recourse to till we came within the circle of the Caribbee Islands, and therefore resolved to stand away for Barbadoes; which, by keeping off at sea, to avoid the indraft of the Bay or Gulf of Mexico, we might easily perform, as we hoped, in about fifteen days' sail; whereas we could not possibly make our voyage to the coast of Africa without some assistance both to our ship and to ourselves.

With this design we changed our course, and steered away N.W. by W., in order to reach some of our English islands, where I hoped for relief. But our voyage was otherwise determined; for, being in the latitude of twelve degrees eighteen minutes, a second storm came upon us, which carried us away with the same impetuosity westward, and drove us so out of the way of all human commerce, that, had all our lives been saved as to the sea, we were rather in danger of being devoured by savages than ever returning to our own country.

In this distress, the wind still blowing very hard, one of our men early in the morning cried out, "Land!" and we had no sooner run out of the cabin to look out, in hopes of seeing whereabouts in the world we were, than the ship struck upon a sand, and in a moment her motion being so stopped, the sea broke over her in such a manner that we expected we should all have perished immediately; and we were immediately driven into our close quarters, to shelter us from the very foam and spray of the sea.

It is not easy for any one who has not been in the like condition to describe or conceive the consternation of men in such circumstances. We knew nothing where we were, or upon what land it was we were driven—whether an island or the main, whether inhabited or not inhabited. As the rage of the wind was still great, though rather less than at first, we could not so much as hope to have the ship hold many minutes without breaking into pieces, unless the winds, by a kind of miracle, should turn immediately about. In a word, we sat looking upon one another, and expecting death every moment, and every man, accordingly, preparing for another world; for there was little or nothing more for us to do in this. That which was our present comfort, and all the comfort we had, was that, contrary to our expectation, the ship did not break yet, and that the master said the wind began to abate.

Now, though we thought that the wind did a little abate, yet the ship having thus struck upon the sand, and sticking too fast for us to expect her getting off, we were in a dreadful condition indeed, and had nothing to do but to think of saving our lives as well as we could. We had a boat at our stern just before the storm, but she was first staved by dashing against the ship's rudder, and in the next place she broke away, and either sunk or was driven off to sea; so there was no hope from her. We had another boat on board, but how to get her off into the sea was a doubtful thing. However, there was no time to debate, for we fancied that the ship would break in pieces every minute, and some told us she was actually broken already.

In this distress the mate of our vessel laid hold of the boat, and with the help of the rest of the men got her slung over the ship's side; and getting all into her, let go, and committed ourselves, being eleven in number, to God's mercy and the wild sea; for though the storm was abated considerably, yet the sea ran dreadfully high upon the shore, and might be well called den wild zee, as the Dutch call the sea in a storm.

And now our case was very dismal indeed; for we all saw plainly that the sea went so high that the boat could not live, and that we should be inevitably drowned. As to making sail, we had none, nor if we had could we have done anything with it; so we worked at the oar towards the land, though with heavy hearts, like men going to execution; for we all knew that when the boat came near the shore she would be dashed in a thousand pieces by the breach of the sea. However, we committed our souls to God in the most earnest manner; and the wind driving us towards the shore, we hastened our destruction with our own hands, pulling as well as we could towards land.

What the shore was, whether rock or sand, whether steep or shoal, we knew not. The only hope that could rationally give us the least shadow of expectation was, if we might find some bay or gulf, or the mouth of some river, where by great chance we might have run our boat in, or got under the lee of the land, and perhaps made smooth water. But there was nothing like this appeared; but as we made nearer and nearer the shore, the land looked more frightful than the sea.

After we had rowed, or rather driven about a league and a half, as we reckoned it, a raging wave, mountain-like, came rolling astern of us, and plainly bade us expect the coup de grâce. It took us with such a fury, that it overset the boat at once; and separating us as well from the boat as from one another, gave us no time to say, "O God!" for we were all swallowed up in a moment.

Nothing can describe the confusion of thought which I felt when I sank into the water; for though I swam very well, yet I could not deliver myself from the waves so as to draw breath, till that wave having driven me, or rather carried me, a vast way on towards the shore, and having spent itself, went back, and left me upon the land almost dry, but half dead with the water I took in. I had so much presence of mind, as well as breath left, that seeing myself nearer the mainland than I expected, I got upon my feet, and endeavoured to make on towards the land as fast as I could before another wave should return and take me up again; but I soon found it was impossible to avoid it; for I saw the sea come after me as high as a great hill, and as furious as an enemy, which I had no means or strength to contend with: my business was to hold my breath, and raise myself upon the water if I could; and so, by swimming, to preserve my breathing, and pilot myself towards the shore, if possible, my greatest concern now being that the sea, as it would carry me a great way towards the shore when it came on, might not carry me back again with it when it gave back towards the sea.

The wave that came upon me again buried me at once twenty or thirty feet deep in its own body, and I could feel myself carried with a mighty force and swiftness towards the shore—a very great way; but I held my breath, and assisted myself to swim still forward with all my might. I was ready to burst with holding my breath, when, as I felt myself rising up, so, to my immediate relief, I found my head and hands shoot out above the surface of the water; and though it was not two seconds of time that I could keep myself so, yet it relieved me greatly, gave me breath, and new courage. I was covered again with water a good while, but not so long but I held it out; and finding the water had spent itself, and began to return, I struck forward against the return of the waves, and felt ground again with my feet.

I stood still a few moments to recover breath, and till the waters went from me, and then took to my heels and ran with what strength I had further towards the shore. But neither would this deliver me from the fury of the sea, which came pouring in after me again; and twice more I was lifted up by the waves and carried forward as before, the shore being very flat.

The last time of these two had well-nigh been fatal to me, for the sea having hurried me along as before, landed me, or rather dashed me, against a piece of rock, and that with such force, that it left me senseless, and indeed helpless, as to my own deliverance; for the blow taking my side and breast, beat the breath as it were quite out of my body; and had it returned again immediately, I must have been strangled in the water; but I recovered a little before the return of the waves, and seeing I should be covered again with the water, I resolved to hold fast by a piece of the rock, and so to hold my breath, if possible, till the wave went back.

Now, as the waves were not so high as at first, being nearer land, I held my hold till the wave abated, and then fetched another run, which brought me so near the shore that the next wave, though it went over me, yet did not so swallow me up as to carry me away; and the next run I took, I got to the mainland, where, to my great comfort, I clambered up the cliffs of the shore and sat me down upon the grass, free from danger and quite out of the reach of the water.

I was now landed and safe on shore, and began to look up and thank God that my life was saved, in a case wherein there was some minutes before scarce any room to hope. I believe it is impossible to express, to the life, what the ecstasies and transports of the soul are, when it is so saved, as I may say, out of the very grave: and I do not wonder now at the custom, when a malefactor, who has the halter about his neck, is tied up, and just going to be turned off, and has a reprieve brought to him—I say, I do not wonder that they bring a surgeon with it, to let him blood that very moment they tell him of it, that the surprise may not drive the animal spirits from the heart and overwhelm him.

"For sudden joys, like griefs, confound at first."

I walked about on the shore lifting up my hands, and my whole being, as I may say, wrapped up in a contemplation of my deliverance; making a thousand gestures and motions, which I cannot describe; reflecting upon all my comrades that were drowned, and that there should not be one soul saved but myself; for, as for them, I never saw them afterwards, or any sign of them, except three of their hats, one cap, and two shoes that were not fellows.

I cast my eye to the stranded vessel, when, the breach and froth of the sea being so big, I could hardly see it, it lay so far of; and considered, Lord! how was it possible I could get on shore?

After I had solaced my mind with the comfortable part of my condition, I began to look round me, to see what kind of place I was in, and what was next to be done; and I soon found my comforts abate, and that, in a word, I had a dreadful deliverance; for I was wet, had no clothes to shift me, nor anything either to eat or drink to comfort me; neither did I see any prospect before me but that of perishing with hunger or being devoured by wild beasts; and that which was particularly afflicting to me was, that I had no weapon, either to hunt and kill any creature for my sustenance, or to defend myself against any other creature that might desire to kill me for theirs.

In a word, I had nothing about me but a knife, a tobacco-pipe, and a little tobacco in a box. This was all my provisions; and this threw me into such terrible agonies of mind, that for a while I ran about like a madman. Night coming upon me, I began with a heavy heart to consider what would be my lot if there were any ravenous beasts in that country, as at night they always come abroad for their prey.

All the remedy that offered to my thoughts at that time was to get up into a thick bushy tree like a fir, but thorny, which grew near me, and where I resolved to sit all night, and consider the next day what death I should die, for as yet I saw no prospect of life. I walked about a furlong from the shore, to see if I could find any fresh water to drink, which I did, to my great joy; and having drank, and put a little tobacco into my mouth to prevent hunger, I went to the tree, and getting up into it, endeavoured to place myself so that if I should sleep I might not fall.

And having cut me a short stick, like a truncheon, for my defence, I took up my lodging; and having been excessively fatigued, I fell fast asleep, and slept as comfortably as, I believe, few could have done in my condition, and found myself more refreshed with it than, I think, I ever was on such an occasion.

Chapter 4 - First Weeks On The Island

When I waked it was broad day, the weather clear, and the storm abated, so that the sea did not rage and swell as before. But that which surprised me most was, that the ship was lifted off in the night from the sand where she lay by the swelling of the tide, and was driven up almost as far as the rock which I at first mentioned, where I had been so bruised by the wave dashing me against it. This being within about a mile from the shore where I was, and the ship seeming to stand upright still, I wished myself on board, that at least I might save some necessary things for my use.

When I came down from my apartment in the tree, I looked about me again, and the first thing I found was the boat, which lay, as the wind and the sea had tossed her up, upon the land, about two miles on my right hand. I walked as far as I could upon the shore to have got to her; but found a neck or inlet of water between me and the boat which was about half a mile broad; so I came back for the present, being more intent upon getting at the ship, where I hoped to find something for my present subsistence.

A little after noon I found the sea very calm, and the tide ebbed so far out that I could come within a quarter of a mile of the ship. And here I found a fresh renewing of my grief; for I saw evidently that if we had kept on board we had been all safe—that is to say, we had all got safe on shore, and I had not been so miserable as to be left entirely destitute of all comfort and company as I now was. This forced tears to my eyes again; but as there was little relief in that, I resolved, if possible, to get to the ship; so I pulled off my clothes—for the weather was hot to extremity—and took the water. But when I came to the ship my difficulty was still greater to know how to get on board; for, as she lay aground, and high out of the water, there was nothing within my reach to lay hold of. I swam round her twice, and the second time I spied a small piece of rope, which I wondered I did not see at first, hung down by the fore-chains so low, as that with great difficulty I got hold of it, and by the help of that rope I got up into the forecastle of the ship. Here I found that the ship was bulged, and had a great deal of water in her hold, but that she lay so on the side of a bank of hard sand, or, rather earth, that her stern lay lifted up upon the bank, and her head low, almost to the water. By this means all her quarter was free, and all that was in that part was dry; for you may be sure my first work was to search, and to see what was spoiled and what was free. And, first, I found that all the ship's provisions were dry and untouched by the water, and being very well disposed to eat, I went to the bread room and filled my pockets with biscuit, and ate it as I went about other things, for I had no time to lose. I also found some rum in the great cabin, of which I took a large dram, and which I had, indeed, need enough of to spirit me for what was before me. Now I wanted nothing but a boat to furnish myself with many things which I foresaw would be very necessary to me.

It was in vain to sit still and wish for what was not to be had; and this extremity roused my application. We had several spare yards, and two or three large spars of wood, and a spare topmast or two in the ship; I resolved to fall to work with these, and I flung as many of them overboard as I could manage for their weight, tying every one with a rope, that they might not drive away. When this was done I went down the ship's side, and pulling them to me, I tied four of them together at both ends as well as I could, in the form of a raft, and laying two or three short pieces of plank upon them crossways, I found I could walk upon it very well, but that it was not able to bear any great weight, the pieces being too light.

So I went to work, and with a carpenter's saw I cut a spare topmast into three lengths, and added them to my raft, with a great deal of labour and pains. But the hope of furnishing myself with necessaries encouraged me to go beyond what I should have been able to have done upon another occasion.

My raft was now strong enough to bear any reasonable weight. My next care was what to load it with, and how to preserve what I laid upon it from the surf of the sea; but I was not long considering this. I first laid all the planks or boards upon it that I could get, and having considered well what I most wanted, I got three of the seamen's chests, which I had broken open, and emptied, and lowered them down upon my raft; the first of these I filled with provisions—viz. bread, rice, three Dutch cheeses, five pieces of dried goat's flesh (which we lived much upon), and a little remainder of European corn, which had been laid by for some fowls which we brought to sea with us, but the fowls were killed. There had been some barley and wheat together; but, to my great disappointment, I found afterwards that the rats had eaten or spoiled it all. As for liquors, I found several, cases of bottles belonging to our skipper, in which were some cordial waters; and, in all, about five or six gallons of rack. These I stowed by themselves, there being no need to put them into the chest, nor any room for them. While I was doing this, I found the tide begin to flow, though very calm; and I had the mortification to see my coat, shirt, and waistcoat, which I had left on the shore, upon the sand, swim away. As for my breeches, which were only linen, and open-kneed, I swam on board in them and my stockings. However, this set me on rummaging for clothes, of which I found enough, but took no more than I wanted for present use, for I had others things which my eye was more upon—as, first, tools to work with on shore. And it was after long searching that I found out the carpenter's chest, which was, indeed, a very useful prize to me, and much more valuable than a shipload of gold would have been at that time. I got it down to my raft, whole as it was, without losing time to look into it, for I knew in general what it contained.

My next care was for some ammunition and arms. There were two very good fowling-pieces in the great cabin, and two pistols. These I secured first, with some powder-horns and a small bag of shot, and two old rusty swords. I knew there were three barrels of powder in the ship, but knew not where our gunner had stowed them; but with much search I found them, two of them dry and good, the third had taken water. Those two I got to my raft with the arms. And now I thought myself pretty well freighted, and began to think how I should get to shore with them, having neither sail, oar, nor rudder; and the least capful of wind would have overset all my navigation.

I had three encouragements—1st, a smooth, calm sea; 2ndly, the tide rising, and setting in to the shore; 3rdly, what little wind there was blew me towards the land. And thus, having found two or three broken oars belonging to the boat—and, besides the tools which were in the chest, I found two saws, an axe, and a hammer; with this cargo I put to sea. For a mile or thereabouts my raft went very well, only that I found it drive a little distant from the place where I had landed before; by which I perceived that there was some indraft of the water, and consequently I hoped to find some creek or river there, which I might make use of as a port to get to land with my cargo.

As I imagined, so it was. There appeared before me a little opening of the land, and I found a strong current of the tide set into it; so I guided my raft as well as I could, to keep in the middle of the stream.

But here I had like to have suffered a second shipwreck, which, if I had, I think verily would have broken my heart; for, knowing nothing of the coast, my raft ran aground at one end of it upon a shoal, and not being aground at the other end, it wanted but a little that all my cargo had slipped off towards the end that was afloat, and to fallen into the water. I did my utmost, by setting my back against the chests, to keep them in their places, but could not thrust off the raft with all my strength; neither durst I stir from the posture I was in; but holding up the chests with all my might, I stood in that manner near half-an-hour, in which time the rising of the water brought me a little more upon a level; and a little after, the water still-rising, my raft floated again, and I thrust her off with the oar I had into the channel, and then driving up higher, I at length found myself in the mouth of a little river, with land on both sides, and a strong current of tide running up. I looked on both sides for a proper place to get to shore, for I was not willing to be driven too high up the river: hoping in time to see some ships at sea, and therefore resolved to place myself as near the coast as I could.

At length I spied a little cove on the right shore of the creek, to which with great pain and difficulty I guided my raft, and at last got so near that, reaching ground with my oar, I could thrust her directly in. But here I had like to have dipped all my cargo into the sea again; for that shore lying pretty steep—that is to say sloping—there was no place to land, but where one end of my float, if it ran on shore, would lie so high, and the other sink lower, as before, that it would endanger my cargo again.

All that I could do was to wait till the tide was at the highest, keeping the raft with my oar like an anchor, to hold the side of it fast to the shore, near a flat piece of ground, which I expected the water would flow over; and so it did. As soon as I found water enough—for my raft drew about a foot of water—I thrust her upon that flat piece of ground, and there fastened or moored her, by sticking my two broken oars into the ground, one on one side near one end, and one on the other side near the other end; and thus I lay till the water ebbed away, and left my raft and all my cargo safe on shore.

My next work was to view the country, and seek a proper place for my habitation, and where to stow my goods to secure them from whatever might happen. Where I was, I yet knew not; whether on the continent or on an island; whether inhabited or not inhabited; whether in danger of wild beasts or not. There was a hill not above a mile from me, which rose up very steep and high, and which seemed to overtop some other hills, which lay as in a ridge from it northward.

I took out one of the fowling-pieces, and one of the pistols, and a horn of powder; and thus armed, I travelled for discovery up to the top of that hill, where, after I had with great labour and difficulty got to the top, I saw my fate, to my great affliction—viz. that I was in an island environed every way with the sea: no land to be seen except some rocks, which lay a great way off; and two small islands, less than this, which lay about three leagues to the west.

I found also that the island I was in was barren, and, as I saw good reason to believe, uninhabited except by wild beasts, of whom, however, I saw none. Yet I saw abundance of fowls, but knew not their kinds; neither when I killed them could I tell what was fit for food, and what not. At my coming back, I shot at a great bird which I saw sitting upon a tree on the side of a great wood. I believe it was the first gun that had been fired there since the creation of the world. I had no sooner fired, than from all parts of the wood there arose an innumerable number of fowls, of many sorts, making a confused screaming and crying, and every one according to his usual note, but not one of them of any kind that I knew. As for the creature I killed, I took it to be a kind of hawk, its colour and beak resembling it, but it had no talons or claws more than common. Its flesh was carrion, and fit for nothing.

Contented with this discovery, I came back to my raft, and fell to work to bring my cargo on shore, which took me up the rest of that day. What to do with myself at night I knew not, nor indeed where to rest, for I was afraid to lie down on the ground, not knowing but some wild beast might devour me, though, as I afterwards found, there was really no need for those fears. However, as well as I could, I barricaded myself round with the chest and boards that I had brought on shore, and made a kind of hut for that night's lodging. As for food, I yet saw not which way to supply myself, except that I had seen two or three creatures like hares run out of the wood where I shot the fowl.

I now began to consider that I might yet get a great many things out of the ship which would be useful to me, and particularly some of the rigging and sails, and such other things as might come to land; and I resolved to make another voyage on board the vessel, if possible. And as I knew that the first storm that blew must necessarily break her all in pieces, I resolved to set all other things apart till I had got everything out of the ship that I could get. Then I called a council—that is to say in my thoughts—whether I should take back the raft; but this appeared impracticable: so I resolved to go as before, when the tide was down; and I did so, only that I stripped before I went from my hut, having nothing on but my chequered shirt, a pair of linen drawers, and a pair of pumps on my feet.

I got on board the ship as before, and prepared a second raft; and, having had experience of the first, I neither made this so unwieldy, nor loaded it so hard, but yet I brought away several things very useful to me; as first, in the carpenters stores I found two or three bags full of nails and spikes, a great screw-jack, a dozen or two of hatchets, and, above all, that most useful thing called a grindstone. All these I secured, together with several things belonging to the gunner, particularly two or three iron crows, and two barrels of musket bullets, seven muskets, another fowling-piece, with some small quantity of powder more; a large bagful of small shot, and a great roll of sheet-lead; but this last was so heavy, I could not hoist it up to get it over the ship's side.

Besides these things, I took all the men's clothes that I could find, and a spare fore-topsail, a hammock, and some bedding; and with this I loaded my second raft, and brought them all safe on shore, to my very great comfort.

I was under some apprehension, during my absence from the land, that at least my provisions might be devoured on shore: but when I came back I found no sign of any visitor; only there sat a creature like a wild cat upon one of the chests, which, when I came towards it, ran away a little distance, and then stood still. She sat very composed and unconcerned, and looked full in my face, as if she had a mind to be acquainted with me. I presented my gun at her, but, as she did not understand it, she was perfectly unconcerned at it, nor did she offer to stir away; upon which I tossed her a bit of biscuit, though by the way, I was not very free of it, for my store was not great: however, I spared her a bit, I say, and she went to it, smelled at it, and ate it, and looked (as if pleased) for more; but I thanked her, and could spare no more: so she marched off.

Having got my second cargo on shore—though I was fain to open the barrels of powder, and bring them by parcels, for they were too heavy, being large casks—I went to work to make me a little tent with the sail and some poles which I cut for that purpose: and into this tent I brought everything that I knew would spoil either with rain or sun; and I piled all the empty chests and casks up in a circle round the tent, to fortify it from any sudden attempt, either from man or beast.

When I had done this, I blocked up the door of the tent with some boards within, and an empty chest set up on end without; and spreading one of the beds upon the ground, laying my two pistols just at my head, and my gun at length by me, I went to bed for the first time, and slept very quietly all night, for I was very weary and heavy; for the night before I had slept little, and had laboured very hard all day to fetch all those things from the ship, and to get them on shore.

I had the biggest magazine of all kinds now that ever was laid up, I believe, for one man: but I was not satisfied still, for while the ship sat upright in that posture, I thought I ought to get everything out of her that I could; so every day at low water I went on board, and brought away something or other; but particularly the third time I went I brought away as much of the rigging as I could, as also all the small ropes and rope-twine I could get, with a piece of spare canvas, which was to mend the sails upon occasion, and the barrel of wet gunpowder. In a word, I brought away all the sails, first and last; only that I was fain to cut them in pieces, and bring as much at a time as I could, for they were no more useful to be sails, but as mere canvas only.

But that which comforted me more still, was, that last of all, after I had made five or six such voyages as these, and thought I had nothing more to expect from the ship that was worth my meddling with—I say, after all this, I found a great hogshead of bread, three large runlets of rum, or spirits, a box of sugar, and a barrel of fine flour; this was surprising to me, because I had given over expecting any more provisions, except what was spoiled by the water. I soon emptied the hogshead of the bread, and wrapped it up, parcel by parcel, in pieces of the sails, which I cut out; and, in a word, I got all this safe on shore also.

The next day I made another voyage, and now, having plundered the ship of what was portable and fit to hand out, I began with the cables. Cutting the great cable into pieces, such as I could move, I got two cables and a hawser on shore, with all the ironwork I could get; and having cut down the spritsail-yard, and the mizzen-yard, and everything I could, to make a large raft, I loaded it with all these heavy goods, and came away. But my good luck began now to leave me; for this raft was so unwieldy, and so overladen, that, after I had entered the little cove where I had landed the rest of my goods, not being able to guide it so handily as I did the other, it overset, and threw me and all my cargo into the water. As for myself, it was no great harm, for I was near the shore; but as to my cargo, it was a great part of it lost, especially the iron, which I expected would have been of great use to me; however, when the tide was out, I got most of the pieces of the cable ashore, and some of the iron, though with infinite labour; for I was fain to dip for it into the water, a work which fatigued me very much. After this, I went every day on board, and brought away what I could get.

I had been now thirteen days on shore, and had been eleven times on board the ship, in which time I had brought away all that one pair of hands could well be supposed capable to bring; though I believe verily, had the calm weather held, I should have brought away the whole ship, piece by piece.

But preparing the twelfth time to go on board, I found the wind began to rise: however, at low water I went on board, and though I thought I had rummaged the cabin so effectually that nothing more could be found, yet I discovered a locker with drawers in it, in one of which I found two or three razors, and one pair of large scissors, with some ten or a dozen of good knives and forks: in another I found about thirty-six pounds value in money—some European coin, some Brazil, some pieces of eight, some gold, and some silver.

I smiled to myself at the sight of this money: “O drug!” said I, aloud, “what art thou good for? Thou art not worth to me—no, not the taking off the ground; one of those knives is worth all this heap; I have no manner of use for thee—e’en remain where thou art, and go to the bottom as a creature whose life is not worth saying.” However, upon second thoughts I took it away; and wrapping all this in a piece of canvas, I began to think of making another raft; but while I was preparing this, I found the sky overcast, and the wind began to rise, and in a quarter of an hour it blew a fresh gale from the shore.

It presently occurred to me that it was in vain to pretend to make a raft with the wind offshore; and that it was my business to be gone before the tide of flood began, otherwise I might not be able to reach the shore at all. Accordingly, I let myself down into the water, and swam across the channel, which lay between the ship and the sands, and even that with difficulty enough, partly with the weight of the things I had about me, and partly the roughness of the water; for the wind rose very hastily, and before it was quite high water it blew a storm.

But I had got home to my little tent, where I lay, with all my wealth about me, very secure. It blew very hard all night, and in the morning, when I looked out, behold, no more ship was to be seen! I was a little surprised, but recovered myself with the satisfactory reflection that I had lost no time, nor abated any diligence, to get everything out of her that could be useful to me; and that, indeed, there was little left in her that I was able to bring away, if I had had more time. I now gave over any more thoughts of the ship, or of anything out of her, except what might drive on shore from her wreck; as, indeed, divers pieces of her afterwards did; but those things were of small use to me.

My thoughts were now wholly employed about securing myself against either savages, if any should appear, or wild beasts, if any were in the island; and I had many thoughts of the method how to do this, and what kind of dwelling to make—whether I should make me a cave in the earth, or a tent upon the earth; and, in short, I resolved upon both; the manner and description of which, it may not be improper to give an account of.

I soon found the place I was in was not fit for my settlement, because it was upon a low, moorish ground, near the sea, and I believed it would not be wholesome, and more particularly because there was no fresh water near it; so I resolved to find a more healthy and more convenient spot of ground.

I consulted several things in my situation, which I found would be proper for me: 1st, health and fresh water, I just now mentioned; 2ndly, shelter from the heat of the sun; 3rdly, security from ravenous creatures, whether man or beast; 4thly, a view to the sea, that if God sent any ship in sight, I might not lose any advantage for my deliverance, of which I was not willing to banish all my expectation yet.

In search of a place proper for this, I found a little plain on the side of a rising hill, whose front towards this little plain was steep as a house-side, so that nothing could come down upon me from the top. On the one side of the rock there was a hollow place, worn a little way in, like the entrance or door of a cave but there was not really any cave or way into the rock at all.

On the flat of the green, just before this hollow place, I resolved to pitch my tent. This plain was not above a hundred yards broad, and about twice as long, and lay like a green before my door; and, at the end of it, descended irregularly every way down into the low ground by the seaside. It was on the N.N.W. side of the hill; so that it was sheltered from the heat every day, till it came to a W. and by S. sun, or thereabouts, which, in those countries, is near the setting.

Before I set up my tent I drew a half-circle before the hollow place, which took in about ten yards in its semi-diameter from the rock, and twenty yards in its diameter from its beginning and ending.

In this half-circle I pitched two rows of strong stakes, driving them into the ground till they stood very firm like piles, the biggest end being out of the ground above five feet and a half, and sharpened on the top. The two rows did not stand above six inches from one another.

Then I took the pieces of cable which I had cut in the ship, and laid them in rows, one upon another, within the circle, between these two rows of stakes, up to the top, placing other stakes in the inside, leaning against them, about two feet and a half high, like a spur to a post; and this fence was so strong, that neither man nor beast could get into it or over it. This cost me a great deal of time and labour, especially to cut the piles in the woods, bring them to the place, and drive them into the earth.

The entrance into this place I made to be, not by a door, but by a short ladder to go over the top; which ladder, when I was in, I lifted over after me; and so I was completely fenced in and fortified, as I thought, from all the world, and consequently slept secure in the night, which otherwise I could not have done; though, as it appeared afterwards, there was no need of all this caution from the enemies that I apprehended danger from.

Into this fence or fortress, with infinite labour, I carried all my riches, all my provisions, ammunition, and stores, of which you have the account above; and I made a large tent, which to preserve me from the rains that in one part of the year are very violent there, I made double—one smaller tent within, and one larger tent above it; and covered the uppermost with a large tarpaulin, which I had saved among the sails.

And now I lay no more for a while in the bed which I had brought on shore, but in a hammock, which was indeed a very good one, and belonged to the mate of the ship.

Into this tent I brought all my provisions, and everything that would spoil by the wet; and having thus enclosed all my goods, I made up the entrance, which till now I had left open, and so passed and repassed, as I said, by a short ladder.

When I had done this, I began to work my way into the rock, and bringing all the earth and stones that I dug down out through my tent, I laid them up within my fence, in the nature of a terrace, so that it raised the ground within about a foot and a half; and thus I made me a cave, just behind my tent, which served me like a cellar to my house.

It cost me much labour and many days before all these things were brought to perfection; and therefore I must go back to some other things which took up some of my thoughts. At the same time it happened, after I had laid my scheme for the setting up my tent, and making the cave, that a storm of rain falling from a thick, dark cloud, a sudden flash of lightning happened, and after that a great clap of thunder, as is naturally the effect of it. I was not so much surprised with the lightning as I was with the thought which darted into my mind as swift as the lightning itself—Oh, my powder! My very heart sank within me when I thought that, at one blast, all my powder might be destroyed; on which, not my defence only, but the providing my food, as I thought, entirely depended. I was nothing near so anxious about my own danger, though, had the powder took fire, I should never have known who had hurt me.

Such impression did this make upon me, that after the storm was over I laid aside all my works, my building and fortifying, and applied myself to make bags and boxes, to separate the powder, and to keep it a little and a little in a parcel, in the hope that, whatever might come, it might not all take fire at once; and to keep it so apart that it should not be possible to make one part fire another. I finished this work in about a fortnight; and I think my powder, which in all was about two hundred and forty pounds weight, was divided in not less than a hundred parcels. As to the barrel that had been wet, I did not apprehend any danger from that; so I placed it in my new cave, which, in my fancy, I called my kitchen; and the rest I hid up and down in holes among the rocks, so that no wet might come to it, marking very carefully where I laid it.

In the interval of time while this was doing, I went out once at least every day with my gun, as well to divert myself as to see if I could kill anything fit for food; and, as near as I could, to acquaint myself with what the island produced. The first time I went out, I presently discovered that there were goats in the island, which was a great satisfaction to me; but then it was attended with this misfortune to me—viz. that they were so shy, so subtle, and so swift of foot, that it was the most difficult thing in the world to come at them; but I was not discouraged at this, not doubting but I might now and then shoot one, as it soon happened; for after I had found their haunts a little, I laid wait in this manner for them: I observed if they saw me in the valleys, though they were upon the rocks, they would run away, as in a terrible fright; but if they were feeding in the valleys, and I was upon the rocks, they took no notice of me; from whence I concluded that, by the position of their optics, their sight was so directed downward that they did not readily see objects that were above them; so afterwards I took this method—I always climbed the rocks first, to get above them, and then had frequently a fair mark.

The first shot I made among these creatures, I killed a she-goat, which had a little kid by her, which she gave suck to, which grieved me heartily; for when the old one fell, the kid stood stock still by her, till I came and took her up; and not only so, but when I carried the old one with me, upon my shoulders, the kid followed me quite to my enclosure; upon which I laid down the dam, and took the kid in my arms, and carried it over my pale, in hopes to have bred it up tame; but it would not eat; so I was forced to kill it and eat it myself. These two supplied me with flesh a great while, for I ate sparingly, and saved my provisions, my bread especially, as much as possibly I could.

Having now fixed my habitation, I found it absolutely necessary to provide a place to make a fire in, and fuel to burn: and what I did for that, and also how I enlarged my cave, and what conveniences I made, I shall give a full account of in its place; but I must now give some little account of myself, and of my thoughts about living, which, it may well be supposed, were not a few.

I had a dismal prospect of my condition; for as I was not cast away upon that island without being driven, as is said, by a violent storm, quite out of the course of our intended voyage, and a great way, viz. some hundreds of leagues, out of the ordinary course of the trade of mankind, I had great reason to consider it as a determination of Heaven, that in this desolate place, and in this desolate manner, I should end my life. The tears would run plentifully down my face when I made these reflections; and sometimes I would expostulate with myself why Providence should thus completely ruin His creatures, and render them so absolutely miserable; so without help, abandoned, so entirely depressed, that it could hardly be rational to be thankful for such a life.

But something always returned swift upon me to check these thoughts, and to reprove me; and particularly one day, walking with my gun in my hand by the seaside, I was very pensive upon the subject of my present condition, when reason, as it were, expostulated with me the other way, thus: "Well, you are in a desolate condition, it is true; but, pray remember, where are the rest of you? Did not you come, eleven of you in the boat? Where are the ten? Why were they not saved, and you lost? Why were you singled out? Is it better to be here or there?" And then I pointed to the sea. All evils are to be considered with the good that is in them, and with what worse attends them.

Then it occurred to me again, how well I was furnished for my subsistence, and what would have been my case if it had not happened (which was a hundred thousand to one) that the ship floated from the place where she first struck, and was driven so near to the shore that I had time to get all these things out of her; what would have been my case, if I had been forced to have lived in the condition in which I at first came on shore, without necessaries of life, or necessaries to supply and procure them? "Particularly," said I, aloud (though to myself), "what should I have done without a gun, without ammunition, without any tools to make anything, or to work with, without clothes, bedding, a tent, or any manner of covering?" and that now I had all these to sufficient quantity, and was in a fair way to provide myself in such a manner as to live without my gun, when my ammunition was spent: so that I had a tolerable view of subsisting, without any want, as long as I lived; for I considered from the beginning how I would provide for the accidents that might happen, and for the time that was to come, even not only after my ammunition should be spent, but even after my health and strength should decay.

I confess I had not entertained any notion of my ammunition being destroyed at one blast—I mean my powder being blown up by lightning; and this made the thoughts of it so surprising to me, when it lightened and thundered, as I observed just now.

And now being about to enter into a melancholy relation of a scene of silent life, such, perhaps, as was never heard of in the world before, I shall take it from its beginning, and continue it in its order. It was by my account the 30th of September, when, in the manner as above said, I first set foot upon this horrid island; when the sun, being to us in its autumnal equinox, was almost over my head; for I reckoned myself, by observation, to be in the latitude of nine degrees twenty-two minutes north of the line.

After I had been there about ten or twelve days, it came into my thoughts that I should lose my reckoning of time for want of books, and pen and ink, and should even forget the Sabbath days; but to prevent this, I cut with my knife upon a large post, in capital letters—and making it into a great cross, I set it up on the shore where I first landed—"I came on shore here on the 30th September 1659."

Upon the sides of this square post I cut every day a notch with my knife, and every seventh notch was as long again as the rest, and every first day of the month as long again as that long one; and thus I kept my calendar, or weekly, monthly, and yearly reckoning of time.

In the next place, we are to observe that among the many things which I brought out of the ship, in the several voyages which, as above mentioned, I made to it, I got several things of less value, but not at all less useful to me, which I omitted setting down before; as, in particular, pens, ink, and paper, several parcels in the captain's, mate's, gunner's and carpenter's keeping; three or four compasses, some mathematical instruments, dials, perspectives, charts, and books of navigation, all which I huddled together, whether I might want them or no; also, I found three very good Bibles, which came to me in my cargo from England, and which I had packed up among my things; some Portuguese books also; and among them two or three Popish prayer-books, and several other books, all which I carefully secured.

And I must not forget that we had in the ship a dog and two cats, of whose eminent history I may have occasion to say something in its place; for I carried both the cats with me; and as for the dog, he jumped out of the ship of himself, and swam on shore to me the day after I went on shore with my first cargo, and was a trusty servant to me many years; I wanted nothing that he could fetch me, nor any company that he could make up to me; I only wanted to have him talk to me, but that would not do. As I observed before, I found pens, ink, and paper, and I husbanded them to the utmost; and I shall show that while my ink lasted, I kept things very exact, but after that was gone I could not, for I could not make any ink by any means that I could devise.

And this put me in mind that I wanted many things notwithstanding all that I had amassed together; and of these, ink was one; as also a spade, pickaxe, and shovel, to dig or remove the earth; needles, pins, and thread; as for linen, I soon learned to want that without much difficulty.

This want of tools made every work I did go on heavily; and it was near a whole year before I had entirely finished my little pale, or surrounded my habitation. The piles, or stakes, which were as heavy as I could well lift, were a long time in cutting and preparing in the woods, and more, by far, in bringing home; so that I spent sometimes two days in cutting and bringing home one of those posts, and a third day in driving it into the ground; for which purpose I got a heavy piece of wood at first, but at last bethought myself of one of the iron crows; which, however, though I found it, made driving those posts or piles very laborious and tedious work.

But what need I have been concerned at the tediousness of anything I had to do, seeing I had time enough to do it in? nor had I any other employment, if that had been over, at least that I could foresee, except the ranging the island to seek for food, which I did, more or less, every day.

I now began to consider seriously my condition, and the circumstances I was reduced to; and I drew up the state of my affairs in writing, not so much to leave them to any that were to come after me—for I was likely to have but few heirs—as to deliver my thoughts from daily poring over them, and afflicting my mind; and as my reason began now to master my despondency, I began to comfort myself as well as I could, and to set the good against the evil, that I might have something to distinguish my case from worse; and I stated very impartially, like debtor and creditor, the comforts I enjoyed against the miseries I suffered, thus:—

Evil	Good
I am cast upon a horrible, desolate island, void of all hope of recovery.	But I am alive; and not drowned, as all my ship's company were.
I am singled out and separated, as it were, from all the world, to be miserable.	But I am singled out, too, from all the ship's crew, to be spared from death; and He that miraculously saved me from death can deliver me from this condition.
I am divided from mankind—a solitaire; one banished from human society.	But I am not starved, and perishing on a barren place, affording no sustenance.
I have no clothes to cover me.	But I am in a hot climate, where, if I had clothes, I could hardly wear them.
I am without any defence, or means to resist any violence of man or beast.	But I am cast on an island where I see no wild beasts to hurt me, as I saw on the coast of Africa; and what if I had been shipwrecked there?
I have no soul to speak to or relieve me.	But God wonderfully sent the ship in near enough to the shore, that I have got out as many necessary things as will either supply my wants or enable me to supply myself, even as long as I live.

Upon the whole, here was an undoubted testimony that there was scarce any condition in the world so miserable but there was something negative or something positive to be thankful for in it; and let this stand as a direction from the experience of the most miserable of all conditions in this world: that we may always find in it something to comfort ourselves from, and to set, in the description of good and evil, on the credit side of the account.

Having now brought my mind a little to relish my condition, and given over looking out to sea, to see if I could spy a ship—I say, giving over these things, I began to apply myself to arrange my way of living, and to make things as easy to me as I could.

I have already described my habitation, which was a tent under the side of a rock, surrounded with a strong pale of posts and cables: but I might now rather call it a wall, for I raised a kind of wall up against it of turfs, about two feet thick on the outside; and after some time (I think it was a year and a half) I raised rafters from it, leaning to the rock, and thatched or covered it with boughs of trees, and such things as I could get, to keep out the rain; which I found at some times of the year very violent.

I have already observed how I brought all my goods into this pale, and into the cave which I had made behind me. But I must observe, too, that at first this was a confused heap of goods, which, as they lay in no order, so they took up all my place; I had no room to turn myself: so I set myself to enlarge my cave, and work farther into the earth; for it was a loose sandy rock, which yielded easily to the labour I bestowed on it: and so when I found I was pretty safe as to beasts of prey, I worked sideways, to the right hand, into the rock; and then, turning to the right again, worked quite out, and made me a door to come out on the outside of my pale or fortification. This gave me not only egress and regress, as it was a back way to my tent and to my storehouse, but gave me room to store my goods.

And now I began to apply myself to make such necessary things as I found I most wanted, particularly a chair and a table; for without these I was not able to enjoy the few comforts I had in the world; I could not write or eat, or do several things, with so much pleasure without a table: so I went to work. And here I must needs observe, that as reason is the substance and origin of the mathematics, so by stating and squaring everything by reason, and by making the most rational judgment of things, every man may be, in time, master of every mechanic art. I had never handled a tool in my life; and yet, in time, by labour, application, and contrivance, I found at last that I wanted nothing but I could have made it, especially if I had had tools.

However, I made abundance of things, even without tools; and some with no more tools than an adze and a hatchet, which perhaps were never made that way before, and that with infinite labour. For example, if I wanted a board, I had no other way but to cut down a tree, set it on an edge before me, and hew it flat on either side with my axe, till I brought it to be thin as a plank, and then dub it smooth with my adze. It is true, by this method I could make but one board out of a whole tree; but this I had no remedy for but patience, any more than I had for the prodigious deal of time and labour which it took me up to make a plank or board: but my time or labour was little worth, and so it was as well employed one way as another.

However, I made me a table and a chair, as I observed above, in the first place; and this I did out of the short pieces of boards that I brought on my raft from the ship. But when I had wrought out some boards as above, I made large shelves, of the breadth of a foot and a half, one over another all along one side of my cave, to lay all my tools, nails and ironwork on; and, in a word, to separate everything at large into their places, that I might come easily at them. I knocked pieces into the wall of the rock to hang my guns and all things that would hang up; so that, had my cave been to be seen, it looked like a general magazine of all necessary things; and had everything so ready at my hand, that it was a great pleasure to me to see all my goods in such order, and especially to find my stock of all necessaries so great.

And now it was that I began to keep a journal of every day's employment; for, indeed, at first I was in too much hurry, and not only hurry as to labour, but in too much discomposure of mind; and my journal would have been full of many dull things; for example, I must have said thus: "30th.—After I had got to shore, and escaped drowning, instead of being thankful to God for my deliverance, having first vomited, with the great quantity of salt water which had got into my stomach, and recovering myself a little, I ran about the shore wringing my hands and beating my head and face, exclaiming at my misery, and crying out, 'I was undone, undone!' till, tired and faint, I was forced to lie down on the ground to repose, but durst not sleep for fear of being devoured."

Some days after this, and after I had been on board the ship, and got all that I could out of her, yet I could not forbear getting up to the top of a little mountain and looking out to sea, in hopes of seeing a ship; then fancy at a vast distance I spied a sail, please myself with the hopes of it, and then after looking steadily, till I was almost blind, lose it quite, and sit down and weep like a child, and thus increase my misery by my folly.

But having gotten over these things in some measure, and having settled my household staff and habitation, made me a table and a chair, and all as handsome about me as I could, I began to keep my journal; of which I shall here give you the copy (though in it will be told all these particulars over again) as long as it lasted; for having no more ink, I was forced to leave it off.

Chapter 5 - Builds A House - The Journal

September 30, 1659.—I, poor miserable Robinson Crusoe, being shipwrecked during a dreadful storm in the offing, came on shore on this dismal, unfortunate island, which I called "The Island of Despair"; all the rest of the ship's company being drowned, and myself almost dead.

All the rest of the day I spent in afflicting myself at the dismal circumstances I was brought to—viz. I had neither food, house, clothes, weapon, nor place to fly to; and in despair of any relief, saw nothing but death before me—either that I should be devoured by wild beasts, murdered by savages, or starved to death for want of food. At the approach of night I slept in a tree, for fear of wild creatures; but slept soundly, though it rained all night.

October 1.—In the morning I saw, to my great surprise, the ship had floated with the high tide, and was driven on shore again much nearer the island; which, as it was some comfort, on one hand—for, seeing her set upright, and not broken to pieces, I hoped, if the wind abated, I might get on board, and get some food and necessaries out of her for my relief—so, on the other hand, it renewed my grief at the loss of my comrades, who, I imagined, if we had all stayed on board, might have saved the ship, or, at least, that they would not have been all drowned as they were; and that, had the men been saved, we might perhaps have built us a boat out of the ruins of the ship to have carried us to some other part of the world. I spent great part of this day in perplexing myself on these things; but at length, seeing the ship almost dry, I went upon the sand as near as I could, and then swam on board. This day also it continued raining, though with no wind at all.

From the 1st of October to the 24th.—All these days entirely spent in many several voyages to get all I could out of the ship, which I brought on shore every tide of flood upon rafts. Much rain also in the days, though with some intervals of fair weather; but it seems this was the rainy season.

Oct. 20.—I overset my raft, and all the goods I had got upon it; but, being in shoal water, and the things being chiefly heavy, I recovered many of them when the tide was out.

Oct. 25.—It rained all night and all day, with some gusts of wind; during which time the ship broke in pieces, the wind blowing a little harder than before, and was no more to be seen, except the wreck of her, and that only at low water. I spent this day in covering and securing the goods which I had saved, that the rain might not spoil them.

Oct. 26.—I walked about the shore almost all day, to find out a place to fix my habitation, greatly concerned to secure myself from any attack in the night, either from wild beasts or men. Towards night, I fixed upon a proper place, under a rock, and marked out a semicircle for my encampment; which I resolved to strengthen with a work, wall, or fortification, made of double piles, lined within with cables, and without with turf.

From the 26th to the 30th I worked very hard in carrying all my goods to my new habitation, though some part of the time it rained exceedingly hard.

The 31st, in the morning, I went out into the island with my gun, to seek for some food, and discover the country; when I killed a she-goat, and her kid followed me home, which I afterwards killed also, because it would not feed.

November 1.—I set up my tent under a rock, and lay there for the first night; making it as large as I could, with stakes driven in to swing my hammock upon.

Nov. 2.—I set up all my chests and boards, and the pieces of timber which made my rafts, and with them formed a fence round me, a little within the place I had marked out for my fortification.

Nov. 3.—I went out with my gun, and killed two fowls like ducks, which were very good food. In the afternoon went to work to make me a table.

Nov. 4.—This morning I began to order my times of work, of going out with my gun, time of sleep, and time of diversion—viz. every morning I walked out with my gun for two or three hours, if it did not rain; then employed myself to work till about eleven o'clock; then eat what I had to live on; and from twelve to two I lay down to sleep, the weather being excessively hot; and then, in the evening, to work again. The working part of this day and of the next were wholly employed in making my table, for I was yet but a very sorry workman, though time and necessity made me a complete natural mechanic soon after, as I believe they would do any one else.

Nov. 5.—This day went abroad with my gun and my dog, and killed a wild cat; her skin pretty soft, but her flesh good for nothing; every creature that I killed I took of the skins and preserved them. Coming back by the sea-shore, I saw many sorts of sea-fowls, which I did not understand; but was surprised, and almost frightened, with two or three seals, which, while I was gazing at, not well knowing what they were, got into the sea, and escaped me for that time.

Nov. 6.—After my morning walk I went to work with my table again, and finished it, though not to my liking; nor was it long before I learned to mend it.

Nov. 7.—Now it began to be settled fair weather. The 7th, 8th, 9th, 10th, and part of the 12th (for the 11th was Sunday) I took wholly up to make me a chair, and with much ado brought it to a tolerable shape, but never to please me; and even in the making I pulled it in pieces several times.

Note.—I soon neglected my keeping Sundays; for, omitting my mark for them on my post, I forgot which was which.

Nov. 13.—This day it rained, which refreshed me exceedingly, and cooled the earth; but it was accompanied with terrible thunder and lightning, which frightened me dreadfully, for fear of my powder. As soon as it was over, I resolved to separate my stock of powder into as many little parcels as possible, that it might not be in danger.

Nov. 14, 15, 16.—These three days I spent in making little square chests, or boxes, which might hold about a pound, or two pounds at most, of powder; and so, putting the powder in, I stowed it in places as secure and remote from one another as possible. On one of these three days I killed a large bird that was good to eat, but I knew not what to call it.

Nov. 17.—This day I began to dig behind my tent into the rock, to make room for my further conveniency.

ENTERTAINMENT Solo Robinson Crusoe Chapter 5

Note.—Three things I wanted exceedingly for this work—viz. a pickaxe, a shovel, and a wheelbarrow or basket; so I desisted from my work, and began to consider how to supply that want, and make me some tools. As for the pickaxe, I made use of the iron crows, which were proper enough, though heavy; but the next thing was a shovel or spade; this was so absolutely necessary, that, indeed, I could do nothing effectually without it; but what kind of one to make I knew not.

Nov. 18.—The next day, in searching the woods, I found a tree of that wood, or like it, which in the Brazils they call the iron-tree, for its exceeding hardness. Of this, with great labour, and almost spoiling my axe, I cut a piece, and brought it home, too, with difficulty enough, for it was exceeding heavy. The excessive hardness of the wood, and my having no other way, made me a long while upon this machine, for I worked it effectually by little and little into the form of a shovel or spade; the handle exactly shaped like ours in England, only that the board part having no iron shod upon it at bottom, it would not last me so long; however, it served well enough for the uses which I had occasion to put it to; but never was a shovel, I believe, made after that fashion, or so long in making.

I was still deficient, for I wanted a basket or a wheelbarrow. A basket I could not make by any means, having no such things as twigs that would bend to make wicker-ware—at least, none yet found out; and as to a wheelbarrow, I fancied I could make all but the wheel; but that I had no notion of; neither did I know how to go about it; besides, I had no possible way to make the iron gudgeons for the spindle or axis of the wheel to run in; so I gave it over, and so, for carrying away the earth which I dug out of the cave, I made me a thing like a hod which the labourers carry mortar in when they serve the bricklayers. This was not so difficult to me as the making the shovel: and yet this and the shovel, and the attempt which I made in vain to make a wheelbarrow, took me up no less than four days—I mean always excepting my morning walk with my gun, which I seldom failed, and very seldom failed also bringing home something fit to eat.

Nov. 23.—My other work having now stood still, because of my making these tools, when they were finished I went on, and working every day, as my strength and time allowed, I spent eighteen days entirely in widening and deepening my cave, that it might hold my goods commodiously.

Note.—During all this time I worked to make this room or cave spacious enough to accommodate me as a warehouse or magazine, a kitchen, a dining-room, and a cellar. As for my lodging, I kept to the tent; except that sometimes, in the wet season of the year, it rained so hard that I could not keep myself dry, which caused me afterwards to cover all my place within my pale with long poles, in the form of rafters, leaning against the rock, and load them with flags and large leaves of trees, like a thatch.

December 10.—I began now to think my cave or vault finished, when on a sudden (it seems I had made it too large) a great quantity of earth fell down from the top on one side; so much that, in short, it frighted me, and not without reason, too, for if I had been under it, I had never wanted a gravedigger. I had now a great deal of work to do over again, for I had the loose earth to carry out; and, which was of more importance, I had the ceiling to prop up, so that I might be sure no more would come down.

Dec. 11.—This day I went to work with it accordingly, and got two shores or posts pitched upright to the top, with two pieces of boards across over each post; this I finished the next day; and setting more posts up with boards, in about a week more I had the roof secured, and the posts, standing in rows, served me for partitions to part off the house.

Dec. 17.—From this day to the 20th I placed shelves, and knocked up nails on the posts, to hang everything up that could be hung up; and now I began to be in some order within doors.

Dec. 20.—Now I carried everything into the cave, and began to furnish my house, and set up some pieces of boards like a dresser, to order my victuals upon; but boards began to be very scarce with me; also, I made me another table.

Dec. 24.—Much rain all night and all day. No stirring out.

Dec. 25.—Rain all day.

Dec. 26.—No rain, and the earth much cooler than before, and pleasanter.

Dec. 27.—Killed a young goat, and lamed another, so that I caught it and led it home in a string; when I had it at home, I bound and splintered up its leg, which was broke.

N.B.—I took such care of it that it lived, and the leg grew well and as strong as ever; but, by my nursing it so long, it grew tame, and fed upon the little green at my door, and would not go away. This was the first time that I entertained a thought of breeding up some tame creatures, that I might have food when my powder and shot was all spent.

Dec. 28, 29, 30.—Great heats and no breeze, so that there was no stirring abroad except in the evening for food; this time I spent in putting all my things in order within doors.

January 1.—Very hot still: but I went abroad early and late with my gun, and lay still in the middle of the day. This evening, going farther into the valleys which lay towards the centre of the island, I found there were plenty of goats, though exceedingly shy, and hard to come at; however, I resolved to try if I could not bring my dog to hunt them down.

Jan. 2.—Accordingly, the next day I went out with my dog, and set him upon the goats, but I was mistaken, for they all faced about upon the dog, and he knew his danger too well, for he would not come near them.

Jan. 3.—I began my fence or wall; which, being still jealous of my being attacked by somebody, I resolved to make very thick and strong.

N.B.—This wall being described before, I purposely omit what was said in the journal; it is sufficient to observe, that I was no less time than from the 2nd of January to the 14th of April working, finishing, and perfecting this wall, though it was no more than about twenty-four yards in length, being a half-circle from one place in the rock to another place, about eight yards from it, the door of the cave being in the centre behind it.

All this time I worked very hard, the rains hindering me many days, nay, sometimes weeks together; but I thought I should never be perfectly secure till this wall was finished; and it is scarce credible what inexpressible labour everything was done with, especially the bringing piles out of the woods and driving them into the ground; for I made them much bigger than I needed to have done.

When this wall was finished, and the outside double fenced, with a turf wall raised up close to it, I perceived myself that if any people were to come on shore there, they would not perceive anything like a habitation; and it was very well I did so, as may be observed hereafter, upon a very remarkable occasion.

During this time I made my rounds in the woods for game every day when the rain permitted me, and made frequent discoveries in these walks of something or other to my advantage; particularly, I found a kind of wild pigeons, which build, not as wood-pigeons in a tree, but rather as house-pigeons, in the holes of the rocks; and taking some young ones, I endeavoured to breed them up tame, and did so; but when they grew older they flew away, which perhaps was at first for want of feeding them, for I had nothing to give them; however, I frequently found their nests, and got their young ones, which were very good meat. And now, in the managing my household affairs, I found myself wanting in many things, which I thought at first it was impossible for me to make; as, indeed, with some of them it was: for instance, I could never make a cask to be hooped. I had a small runlet or two, as I observed before; but I could never arrive at the capacity of making one by them, though I spent many weeks about it; I could neither put in the heads, or join the staves so true to one another as to make them hold water; so I gave that also over. In the next place, I was at a great loss for candles; so that as soon as ever it was dark, which was generally by seven o'clock, I was obliged to go to bed. I remembered the lump of beeswax with which I made candles in my African adventure; but I had none of that now; the only remedy I had was, that when I had killed a goat I saved the tallow, and with a little dish made of clay, which I baked in the sun, to which I added a wick of some oakum, I made me a lamp; and this gave me light, though not a clear, steady light, like a candle. In the middle of all my labours it happened that, rummaging my things, I found a little bag which, as I hinted before, had been filled with corn for the feeding of poultry—not for this voyage, but before, as I suppose, when the ship came from Lisbon.

The little remainder of corn that had been in the bag was all devoured by the rats, and I saw nothing in the bag but husks and dust; and being willing to have the bag for some other use (I think it was to put powder in, when I divided it for fear of the lightning, or some such use), I shook the husks of corn out of it on one side of my fortification, under the rock.

It was a little before the great rains just now mentioned that I threw this stuff away, taking no notice, and not so much as remembering that I had thrown anything there, when, about a month after, or thereabouts, I saw some few stalks of something green shooting out of the ground, which I fancied might be some plant I had not seen; but I was surprised, and perfectly astonished, when, after a little longer time, I saw about ten or twelve ears come out, which were perfect green barley, of the same kind as our European—nay, as our English barley.

It is impossible to express the astonishment and confusion of my thoughts on this occasion. I had hitherto acted upon no religious foundation at all; indeed, I had very few notions of religion in my head, nor had entertained any sense of anything that had befallen me otherwise than as chance, or, as we lightly say, what pleases God, without so much as inquiring into the end of Providence in these things, or His order in governing events for the world. But after I saw barley grow there, in a climate which I knew was not proper for corn, and especially that I knew not how it came there, it startled me strangely, and I began to suggest that God had miraculously caused His grain to grow without any help of seed sown, and that it was so directed purely for my sustenance on that wild, miserable place.

This touched my heart a little, and brought tears out of my eyes, and I began to bless myself that such a prodigy of nature should happen upon my account; and this was the more strange to me, because I saw near it still, all along by the side of the rock, some other straggling stalks, which proved to be stalks of rice, and which I knew, because I had seen it grow in Africa when I was ashore there.

I not only thought these the pure productions of Providence for my support, but not doubting that there was more in the place, I went all over that part of the island, where I had been before, peering in every corner, and under every rock, to see for more of it, but I could not find any. At last it occurred to my thoughts that I shook a bag of chickens' meat out in that place; and then the wonder began to cease; and I must confess my religious thankfulness to God's providence began to abate, too, upon the discovering that all this was nothing but what was common; though I ought to have been as thankful for so strange and unforeseen a providence as if it had been miraculous; for it was really the work of Providence to me, that should order or appoint that ten or twelve grains of corn should remain unspoiled, when the rats had destroyed all the rest, as if it had been dropped from heaven; as also, that I should throw it out in that particular place, where, it being in the shade of a high rock, it sprang up immediately; whereas, if I had thrown it anywhere else at that time, it had been burnt up and destroyed.

I carefully saved the ears of this corn, you may be sure, in their season, which was about the end of June; and, laying up every corn, I resolved to sow them all again, hoping in time to have some quantity sufficient to supply me with bread. But it was not till the fourth year that I could allow myself the least grain of this corn to eat, and even then but sparingly, as I shall say afterwards, in its order; for I lost all that I sowed the first season by not observing the proper time; for I sowed it just before the dry season, so that it never came up at all, at least not as it would have done; of which in its place.

Besides this barley, there were, as above, twenty or thirty stalks of rice, which I preserved with the same care and for the same use, or to the same purpose—to make me bread, or rather food; for I found ways to cook it without baking, though I did that also after some time.

But to return to my Journal.

I worked excessive hard these three or four months to get my wall done; and the 14th of April I closed it up, contriving to go into it, not by a door but over the wall, by a ladder, that there might be no sign on the outside of my habitation.

April 16.—I finished the ladder; so I went up the ladder to the top, and then pulled it up after me, and let it down in the inside. This was a complete enclosure to me; for within I had room enough, and nothing could come at me from without, unless it could first mount my wall.

The very next day after this wall was finished I had almost had all my labour overthrown at once, and myself killed. The case was thus: As I was busy in the inside, behind my tent, just at the entrance into my cave, I was terribly frighted with a most dreadful, surprising thing indeed; for all on a sudden I found the earth come crumbling down from the roof of my cave, and from the edge of the hill over my head, and two of the posts I had set up in the cave cracked in a frightful manner. I was heartily scared; but thought nothing of what was really the cause, only thinking that the top of my cave was fallen in, as some of it had done before: and for fear I should be buried in it I ran forward to my ladder, and not thinking myself safe there neither, I got over my wall for fear of the pieces of the hill, which I expected might roll down upon me.

I had no sooner stepped down upon the firm ground, than I plainly saw it was a terrible earthquake, for the ground I stood on shook three times at about eight minutes' distance, with three such shocks as would have overturned the strongest building that could be supposed to have stood on the earth; and a great piece of the top of a rock which stood about half a mile from me next the sea fell down with such a terrible noise as I never heard in all my life. I perceived also the very sea was put into violent motion by it; and I believe the shocks were stronger under the water than on the island.

I was so much amazed with the thing itself, having never felt the like, nor discoursed with any one that had, that I was like one dead or stupefied; and the motion of the earth made my stomach sick, like one that was tossed at sea; but the noise of the falling of the rock awakened me, as it were, and rousing me from the stupefied condition I was in, filled me with horror; and I thought of nothing then but the hill falling upon my tent and all my household goods, and burying all at once; and this sunk my very soul within me a second time.

After the third shock was over, and I felt no more for some time, I began to take courage; and yet I had not heart enough to go over my wall again, for fear of being buried alive, but sat still upon the ground greatly cast down and disconsolate, not knowing what to do. All this while I had not the least serious religious thought; nothing but the common "Lord have mercy upon me!" and when it was over that went away too.

While I sat thus, I found the air overcast and grow cloudy, as if it would rain. Soon after that the wind arose by little and little, so that in less than half-an-hour it blew a most dreadful hurricane; the sea was all on a sudden covered over with foam and froth; the shore was covered with the breach of the water, the trees were torn up by the roots, and a terrible storm it was. This held about three hours, and then began to abate; and in two hours more it was quite calm, and began to rain very hard.

All this while I sat upon the ground very much terrified and dejected; when on a sudden it came into my thoughts, that these winds and rain being the consequences of the earthquake, the earthquake itself was spent and over, and I might venture into my cave again. With this thought my spirits began to revive; and the rain also helping to persuade me, I went in and sat down in my tent. But the rain was so violent that my tent was ready to be beaten down with it; and I was forced to go into my cave, though very much afraid and uneasy, for fear it should fall on my head. This violent rain forced me to a new work—viz. to cut a hole through my new fortification, like a sink, to let the water go out, which would else have flooded my cave.

After I had been in my cave for some time, and found still no more shocks of the earthquake follow, I began to be more composed. And now, to support my spirits, which indeed wanted it very much, I went to my little store, and took a small sup of rum; which, however, I did then and always very sparingly, knowing I could have no more when that was gone. It continued raining all that night and great part of the next day, so that I could not stir abroad; but my mind being more composed, I began to think of what I had best do; concluding that if the island was subject to these earthquakes, there would be no living for me in a cave, but I must consider of building a little hut in an open place which I might surround with a wall, as I had done here, and so make myself secure from wild beasts or men; for I concluded, if I stayed where I was, I should certainly one time or other be buried alive.

With these thoughts, I resolved to remove my tent from the place where it stood, which was just under the hanging precipice of the hill; and which, if it should be shaken again, would certainly fall upon my tent; and I spent the two next days, being the 19th and 20th of April, in contriving where and how to remove my habitation. The fear of being swallowed up alive made me that I never slept in quiet; and yet the apprehension of lying abroad without any fence was almost equal to it; but still, when I looked about, and saw how everything was put in order, how pleasantly concealed I was, and how safe from danger, it made me very loath to remove.

In the meantime, it occurred to me that it would require a vast deal of time for me to do this, and that I must be contented to venture where I was, till I had formed a camp for myself, and had secured it so as to remove to it. So with this resolution I composed myself for a time, and resolved that I would go to work with all speed to build me a wall with piles and cables, &c., in a circle, as before, and set my tent up in it when it was finished; but that I would venture to stay where I was till it was finished, and fit to remove. This was the 21st.

April 22.—The next morning I begin to consider of means to put this resolve into execution; but I was at a great loss about my tools. I had three large axes, and abundance of hatchets (for we carried the hatchets for traffic with the Indians); but with much chopping and cutting knotty hard wood, they were all full of notches, and dull; and though I had a grindstone, I could not turn it and grind my tools too. This cost me as much thought as a statesman would have bestowed upon a grand point of politics, or a judge upon the life and death of a man. At length I contrived a wheel with a string, to turn it with my foot, that I might have both my hands at liberty. Note.—I had never seen any such thing in England, or at least, not to take notice how it was done, though since I have observed, it is very common there; besides that, my grindstone was very large and heavy. This machine cost me a full week's work to bring it to perfection.

April 28, 29.—These two whole days I took up in grinding my tools, my machine for turning my grindstone performing very well.

April 30.—Having perceived my bread had been low a great while, now I took a survey of it, and reduced myself to one biscuit cake a day, which made my heart very heavy.

May 1.—In the morning, looking towards the sea side, the tide being low, I saw something lie on the shore bigger than ordinary, and it looked like a cask; when I came to it, I found a small barrel, and two or three pieces of the wreck of the ship, which were driven on shore by the late hurricane; and looking towards the wreck itself, I thought it seemed to lie higher out of the water than it used to do.

I examined the barrel which was driven on shore, and soon found it was a barrel of gunpowder; but it had taken water, and the powder was caked as hard as a stone; however, I rolled it farther on shore for the present, and went on upon the sands, as near as I could to the wreck of the ship, to look for more.

Chapter 6 - Ill And Conscience-Stricken

When I came down to the ship I found it strangely removed. The forecastle, which lay before buried in sand, was heaved up at least six feet, and the stern, which was broke in pieces and parted from the rest by the force of the sea, soon after I had left rummaging her, was tossed as it were up, and cast on one side; and the sand was thrown so high on that side next her stern, that whereas there was a great place of water before, so that I could not come within a quarter of a mile of the wreck without swimming I could now walk quite up to her when the tide was out. I was surprised with this at first, but soon concluded it must be done by the earthquake; and as by this violence the ship was more broke open than formerly, so many things came daily on shore, which the sea had loosened, and which the winds and water rolled by degrees to the land.

This wholly diverted my thoughts from the design of removing my habitation, and I busied myself mightily, that day especially, in searching whether I could make any way into the ship; but I found nothing was to be expected of that kind, for all the inside of the ship was choked up with sand. However, as I had learned not to despair of anything, I resolved to pull everything to pieces that I could of the ship, concluding that everything I could get from her would be of some use or other to me.

May 3.—I began with my saw, and cut a piece of a beam through, which I thought held some of the upper part or quarter-deck together, and when I had cut it through, I cleared away the sand as well as I could from the side which lay highest; but the tide coming in, I was obliged to give over for that time.

May 4.—I went a-fishing, but caught not one fish that I durst eat of, till I was weary of my sport; when, just going to leave off, I caught a young dolphin. I had made me a long line of some rope-yarn, but I had no hooks; yet I frequently caught fish enough, as much as I cared to eat; all which I dried in the sun, and ate them dry.

May 5.—Worked on the wreck; cut another beam asunder, and brought three great fir planks off from the decks, which I tied together, and made to float on shore when the tide of flood came on.

May 6.—Worked on the wreck; got several iron bolts out of her and other pieces of ironwork. Worked very hard, and came home very much tired, and had thoughts of giving it over.

May 7.—Went to the wreck again, not with an intent to work, but found the weight of the wreck had broke itself down, the beams being cut; that several pieces of the ship seemed to lie loose, and the inside of the hold lay so open that I could see into it; but it was almost full of water and sand.

May 8.—Went to the wreck, and carried an iron crow to wrench up the deck, which lay now quite clear of the water or sand. I wrenched open two planks, and brought them on shore also with the tide. I left the iron crow in the wreck for next day.

May 9.—Went to the wreck, and with the crow made way into the body of the wreck, and felt several casks, and loosened them with the crow, but could not break them up. I felt also a roll of English lead, and could stir it, but it was too heavy to remove.

May 10–14.—Went every day to the wreck; and got a great many pieces of timber, and boards, or plank, and two or three hundredweight of iron.

May 15.—I carried two hatchets, to try if I could not cut a piece off the roll of lead by placing the edge of one hatchet and driving it with the other; but as it lay about a foot and a half in the water, I could not make any blow to drive the hatchet.

May 16.—It had blown hard in the night, and the wreck appeared more broken by the force of the water; but I stayed so long in the woods, to get pigeons for food, that the tide prevented my going to the wreck that day.

May 17.—I saw some pieces of the wreck blown on shore, at a great distance, near two miles off me, but resolved to see what they were, and found it was a piece of the head, but too heavy for me to bring away.

May 24.—Every day, to this day, I worked on the wreck; and with hard labour I loosened some things so much with the crow, that the first flowing tide several casks floated out, and two of the seamen's chests; but the wind blowing from the shore, nothing came to land that day but pieces of timber, and a hogshead, which had some Brazil pork in it; but the salt water and the sand had spoiled it. I continued this work every day to the 15th of June, except the time necessary to get food, which I always appointed, during this part of my employment, to be when the tide was up, that I might be ready when it was ebbed out; and by this time I had got timber and plank and ironwork enough to have built a good boat, if I had known how; and also I got, at several times and in several pieces, near one hundredweight of the sheet lead.

June 16.—Going down to the seaside, I found a large tortoise or turtle. This was the first I had seen, which, it seems, was only my misfortune, not any defect of the place, or scarcity; for had I happened to be on the other side of the island, I might have had hundreds of them every day, as I found afterwards; but perhaps had paid dear enough for them.

June 17.—I spent in cooking the turtle. I found in her three-score eggs; and her flesh was to me, at that time, the most savoury and pleasant that ever I tasted in my life, having had no flesh, but of goats and fowls, since I landed in this horrid place.

June 18.—Rained all day, and I stayed within. I thought at this time the rain felt cold, and I was something chilly; which I knew was not usual in that latitude.

June 19.—Very ill, and shivering, as if the weather had been cold.

June 20.—No rest all night; violent pains in my head, and feverish.

June 21.—Very ill; frighted almost to death with the apprehensions of my sad condition—to be sick, and no help. Prayed to God, for the first time since the storm off Hull, but scarce knew what I said, or why, my thoughts being all confused.

June 22.—A little better; but under dreadful apprehensions of sickness.

June 23.—Very bad again; cold and shivering, and then a violent headache.

June 24.—Much better.

June 25.—An ague very violent; the fit held me seven hours; cold fit and hot, with faint sweats after it.

June 26.—Better; and having no victuals to eat, took my gun, but found myself very weak. However, I killed a she-goat, and with much difficulty got it home, and broiled some of it, and ate, I would fain have stewed it, and made some broth, but had no pot.

June 27.—The ague again so violent that I lay a-bed all day, and neither ate nor drank. I was ready to perish for thirst; but so weak, I had not strength to stand up, or to get myself any water to drink. Prayed to God again, but was light-headed; and when I was not, I was so ignorant that I knew not what to say; only I lay and cried, "Lord, look upon me! Lord, pity me! Lord, have mercy upon me!" I suppose I did nothing else for two or three hours; till, the fit wearing off, I fell asleep, and did not wake till far in the night. When I awoke, I found myself much refreshed, but weak, and exceeding thirsty. However, as I had no water in my habitation, I was forced to lie till morning, and went to sleep again. In this second sleep I had this terrible dream: I thought that I was sitting on the ground, on the outside of my wall, where I sat when the storm blew after the earthquake, and that I saw a man descend from a great black cloud, in a bright flame of fire, and light upon the ground. He was all over as bright as a flame, so that I could but just bear to look towards him; his countenance was most inexpressibly dreadful, impossible for words to describe. When he stepped upon the ground with his feet, I thought the earth trembled, just as it had done before in the earthquake, and all the air looked, to my apprehension, as if it had been filled with flashes of fire. He was no sooner landed upon the earth, but he moved forward towards me, with a long spear or weapon in his hand, to kill me; and when he came to a rising ground, at some distance, he spoke to me—or I heard a voice so terrible that it is impossible to express the terror of it. All that I can say I understood was this: "Seeing all these things have not brought thee to repentance, now thou shalt die;" at which words, I thought he lifted up the spear that was in his hand to kill me.

No one that shall ever read this account will expect that I should be able to describe the horrors of my soul at this terrible vision. I mean, that even while it was a dream, I even dreamed of those horrors. Nor is it any more possible to describe the impression that remained upon my mind when I awaked, and found it was but a dream.

I had, alas! no divine knowledge. What I had received by the good instruction of my father was then worn out by an uninterrupted series, for eight years, of seafaring wickedness, and a constant conversation with none but such as were, like myself, wicked and profane to the last degree. I do not remember that I had, in all that time, one thought that so much as tended either to looking upwards towards God, or inwards towards a reflection upon my own ways; but a certain stupidity of soul, without desire of good, or conscience of evil, had entirely overwhelmed me; and I was all that the most hardened, unthinking, wicked creature among our common sailors can be supposed to be; not having the least sense, either of the fear of God in danger, or of thankfulness to God in deliverance.

In the relating what is already past of my story, this will be the more easily believed when I shall add, that through all the variety of miseries that had to this day befallen me, I never had so much as one thought of it being the hand of God, or that it was a just punishment for my sin—my rebellious behaviour against my father—or my present sins, which were great—or so much as a punishment for the general course of my wicked life. When I was on the desperate expedition on the desert shores of Africa, I never had so much as one thought of what would become of me, or one wish to God to direct me whither I should go, or to keep me from the danger which apparently surrounded me, as well from voracious creatures as cruel savages.

But I was merely thoughtless of a God or a Providence, acted like a mere brute, from the principles of nature, and by the dictates of common sense only, and, indeed, hardly that. When I was delivered and taken up at sea by the Portugal captain, well used, and dealt justly and honourably with, as well as charitably, I had not the least thankfulness in my thoughts. When, again, I was shipwrecked, ruined, and in danger of drowning on this island, I was as far from remorse, or looking on it as a judgment. I only said to myself often, that I was an unfortunate dog, and born to be always miserable.

It is true, when I got on shore first here, and found all my ship's crew drowned and myself spared, I was surprised with a kind of ecstasy, and some transports of soul, which, had the grace of God assisted, might have come up to true thankfulness; but it ended where it began, in a mere common flight of joy, or, as I may say, being glad I was alive, without the least reflection upon the distinguished goodness of the hand which had preserved me, and had singled me out to be preserved when all the rest were destroyed, or an inquiry why Providence had been thus merciful unto me. Even just the same common sort of joy which seamen generally have, after they are got safe ashore from a shipwreck, which they drown all in the next bowl of punch, and forget almost as soon as it is over; and all the rest of my life was like it.

Even when I was afterwards, on due consideration, made sensible of my condition, how I was cast on this dreadful place, out of the reach of human kind, out of all hope of relief, or prospect of redemption, as soon as I saw but a prospect of living and that I should not starve and perish for hunger, all the sense of my affliction wore off; and I began to be very easy, applied myself to the works proper for my preservation and supply, and was far enough from being afflicted at my condition, as a judgment from heaven, or as the hand of God against me: these were thoughts which very seldom entered my head.

The growing up of the corn, as is hinted in my Journal, had at first some little influence upon me, and began to affect me with seriousness, as long as I thought it had something miraculous in it; but as soon as ever that part of the thought was removed, all the impression that was raised from it wore off also, as I have noted already. Even the earthquake, though nothing could be more terrible in its nature, or more immediately directing to the invisible Power which alone directs such things, yet no sooner was the first fright over, but the impression it had made went off also. I had no more sense of God or His judgments—much less of the present affliction of my circumstances being from His hand—than if I had been in the most prosperous condition of life. But now, when I began to be sick, and a leisurely view of the miseries of death came to place itself before me; when my spirits began to sink under the burden of a strong distemper, and nature was exhausted with the violence of the fever; conscience, that had slept so long, began to awake, and I began to reproach myself with my past life, in which I had so evidently, by uncommon wickedness, provoked the justice of God to lay me under uncommon strokes, and to deal with me in so vindictive a manner. These reflections oppressed me for the second or third day of my distemper; and in the violence, as well of the fever as of the dreadful reproaches of my conscience, extorted some words from me like praying to God, though I cannot say they were either a prayer attended with desires or with hopes: it was rather the voice of mere fright and distress. My thoughts were confused, the convictions great upon my mind, and the horror of dying in such a miserable condition raised vapours into my head with the mere apprehensions; and in these hurries of my soul I knew not what my tongue might express.

But it was rather exclamation, such as, "Lord, what a miserable creature am I! If I should be sick, I shall certainly die for want of help; and what will become of me!" Then the tears burst out of my eyes, and I could say no more for a good while. In this interval the good advice of my father came to my mind, and presently his prediction, which I mentioned at the beginning of this story—viz. that if I did take this foolish step, God would not bless me, and I would have leisure hereafter to reflect upon having neglected his counsel when there might be none to assist in my recovery. "Now," said I, aloud, "my dear father's words are come to pass; God's justice has overtaken me, and I have none to help or hear me.

I rejected the voice of Providence, which had mercifully put me in a posture or station of life wherein I might have been happy and easy; but I would neither see it myself nor learn to know the blessing of it from my parents. I left them to mourn over my folly, and now I am left to mourn under the consequences of it. I abused their help and assistance, who would have lifted me in the world, and would have made everything easy to me; and now I have difficulties to struggle with, too great for even nature itself to support, and no assistance, no help, no comfort, no advice." Then I cried out, "Lord, be my help, for I am in great distress." This was the first prayer, if I may call it so, that I had made for many years.

But to return to my Journal.

June 28.—Having been somewhat refreshed with the sleep I had had, and the fit being entirely off, I got up; and though the fright and terror of my dream was very great, yet I considered that the fit of the ague would return again the next day, and now was my time to get something to refresh and support myself when I should be ill; and the first thing I did, I filled a large square case-bottle with water, and set it upon my table, in reach of my bed; and to take off the chill or aguish disposition of the water, I put about a quarter of a pint of rum into it, and mixed them together.

Then I got me a piece of the goat's flesh and broiled it on the coals, but could eat very little. I walked about, but was very weak, and withal very sad and heavy-hearted under a sense of my miserable condition, dreading, the return of my distemper the next day. At night I made my supper of three of the turtle's eggs, which I roasted in the ashes, and ate, as we call it, in the shell, and this was the first bit of meat I had ever asked God's blessing to, that I could remember, in my whole life.

After I had eaten I tried to walk, but found myself so weak that I could hardly carry a gun, for I never went out without that; so I went but a little way, and sat down upon the ground, looking out upon the sea, which was just before me, and very calm and smooth. As I sat here some such thoughts as these occurred to me: What is this earth and sea, of which I have seen so much? Whence is it produced? And what am I, and all the other creatures wild and tame, human and brutal? Whence are we? Sure we are all made by some secret Power, who formed the earth and sea, the air and sky. And who is that? Then it followed most naturally, it is God that has made all. Well, but then it came on strangely, if God has made all these things, He guides and governs them all, and all things that concern them; for the Power that could make all things must certainly have power to guide and direct them. If so, nothing can happen in the great circuit of His works, either without His knowledge or appointment.

And if nothing happens without His knowledge, He knows that I am here, and am in this dreadful condition; and if nothing happens without His appointment, He has appointed all this to befall me. Nothing occurred to my thought to contradict any of these conclusions, and therefore it rested upon me with the greater force, that it must needs be that God had appointed all this to befall me; that I was brought into this miserable circumstance by His direction, He having the sole power, not of me only, but of everything that happened in the world.

Immediately it followed: Why has God done this to me? What have I done to be thus used? My conscience presently checked me in that inquiry, as if I had blasphemed, and methought it spoke to me like a voice: "Wretch! dost thou ask what thou hast done? Look back upon a dreadful misspent life, and ask thyself what thou hast not done? Ask, why is it that thou wert not long ago destroyed? Why wert thou not drowned in Yarmouth Roads; killed in the fight when the ship was taken by the Sallee man-of-war; devoured by the wild beasts on the coast of Africa; or drowned here, when all the crew perished but thyself? Dost thou ask, what have I done?"

I was struck dumb with these reflections, as one astonished, and had not a word to say—no, not to answer to myself, but rose up pensive and sad, walked back to my retreat, and went up over my wall, as if I had been going to bed; but my thoughts were sadly disturbed, and I had no inclination to sleep; so I sat down in my chair, and lighted my lamp, for it began to be dark. Now, as the apprehension of the return of my distemper terrified me very much, it occurred to my thought that the Brazilians take no physic but their tobacco for almost all distempers, and I had a piece of a roll of tobacco in one of the chests, which was quite cured, and some also that was green, and not quite cured.

I went, directed by Heaven no doubt; for in this chest I found a cure both for soul and body. I opened the chest, and found what I looked for, the tobacco; and as the few books I had saved lay there too, I took out one of the Bibles which I mentioned before, and which to this time I had not found leisure or inclination to look into. I say, I took it out, and brought both that and the tobacco with me to the table. What use to make of the tobacco I knew not, in my distemper, or whether it was good for it or no: but I tried several experiments with it, as if I was resolved it should hit one way or other. I first took a piece of leaf, and chewed it in my mouth, which, indeed, at first almost stupefied my brain, the tobacco being green and strong, and that I had not been much used to. Then I took some and steeped it an hour or two in some rum, and resolved to take a dose of it when I lay down; and lastly, I burnt some upon a pan of coals, and held my nose close over the smoke of it as long as I could bear it, as well for the heat as almost for suffocation. In the interval of this operation I took up the Bible and began to read; but my head was too much disturbed with the tobacco to bear reading, at least at that time; only, having opened the book casually, the first words that occurred to me were these, "Call on Me in the day of trouble, and I will deliver thee, and thou shalt glorify Me." These words were very apt to my case, and made some impression upon my thoughts at the time of reading them, though not so much as they did afterwards; for, as for being delivered, the word had no sound, as I may say, to me; the thing was so remote, so impossible in my apprehension of things, that I began to say, as the children of Israel did when they were promised flesh to eat, "Can God spread a table in the wilderness?" so I began to say, "Can God Himself deliver me from this place?"

And as it was not for many years that any hopes appeared, this prevailed very often upon my thoughts; but, however, the words made a great impression upon me, and I mused upon them very often. It grew now late, and the tobacco had, as I said, dozed my head so much that I inclined to sleep; so I left my lamp burning in the cave, lest I should want anything in the night, and went to bed. But before I lay down, I did what I never had done in all my life—I kneeled down, and prayed to God to fulfil the promise to me, that if I called upon Him in the day of trouble, He would deliver me. After my broken and imperfect prayer was over, I drank the rum in which I had steeped the tobacco, which was so strong and rank of the tobacco that I could scarcely get it down; immediately upon this I went to bed.

I found presently it flew up into my head violently; but I fell into a sound sleep, and waked no more till, by the sun, it must necessarily be near three o'clock in the afternoon the next day—nay, to this hour I am partly of opinion that I slept all the next day and night, and till almost three the day after; for otherwise I know not how I should lose a day out of my reckoning in the days of the week, as it appeared some years after I had done; for if I had lost it by crossing and recrossing the line, I should have lost more than one day; but certainly I lost a day in my account, and never knew which way. Be that, however, one way or the other, when I awaked I found myself exceedingly refreshed, and my spirits lively and cheerful; when I got up I was stronger than I was the day before, and my stomach better, for I was hungry; and, in short, I had no fit the next day, but continued much altered for the better. This was the 29th.

The 30th was my well day, of course, and I went abroad with my gun, but did not care to travel too far. I killed a sea-fowl or two, something like a brandgoose, and brought them home, but was not very forward to eat them; so I ate some more of the turtle's eggs, which were very good. This evening I renewed the medicine, which I had supposed did me good the day before—the tobacco steeped in rum; only I did not take so much as before, nor did I chew any of the leaf, or hold my head over the smoke; however, I was not so well the next day, which was the first of July, as I hoped I should have been; for I had a little spice of the cold fit, but it was not much.

July 2.—I renewed the medicine all the three ways; and dosed myself with it as at first, and doubled the quantity which I drank.

July 3.—I missed the fit for good and all, though I did not recover my full strength for some weeks after. While I was thus gathering strength, my thoughts ran exceedingly upon this Scripture, "I will deliver thee"; and the impossibility of my deliverance lay much upon my mind, in bar of my ever expecting it; but as I was discouraging myself with such thoughts, it occurred to my mind that I pored so much upon my deliverance from the main affliction, that I disregarded the deliverance I had received, and I was as it were made to ask myself such questions as these—viz.

Have I not been delivered, and wonderfully too, from sickness—from the most distressed condition that could be, and that was so frightful to me? and what notice had I taken of it? Had I done my part? God had delivered me, but I had not glorified Him—that is to say, I had not owned and been thankful for that as a deliverance; and how could I expect greater deliverance? This touched my heart very much; and immediately I knelt down and gave God thanks aloud for my recovery from my sickness.

July 4.—In the morning I took the Bible; and beginning at the New Testament, I began seriously to read it, and imposed upon myself to read a while every morning and every night; not tying myself to the number of chapters, but long as my thoughts should engage me. It was not long after I set seriously to this work till I found my heart more deeply and sincerely affected with the wickedness of my past life. The impression of my dream revived; and the words, "All these things have not brought thee to repentance," ran seriously through my thoughts. I was earnestly begging of God to give me repentance, when it happened providentially, the very day, that, reading the Scripture, I came to these words: "He is exalted a Prince and a Saviour, to give repentance and to give remission."

I threw down the book; and with my heart as well as my hands lifted up to heaven, in a kind of ecstasy of joy, I cried out aloud, "Jesus, thou son of David! Jesus, thou exalted Prince and Saviour! give me repentance!" This was the first time I could say, in the true sense of the words, that I prayed in all my life; for now I prayed with a sense of my condition, and a true Scripture view of hope, founded on the encouragement of the Word of God; and from this time, I may say, I began to hope that God would hear me.

Now I began to construe the words mentioned above, "Call on Me, and I will deliver thee," in a different sense from what I had ever done before; for then I had no notion of anything being called deliverance, but my being delivered from the captivity I was in; for though I was indeed at large in the place, yet the island was certainly a prison to me, and that in the worse sense in the world. But now I learned to take it in another sense: now I looked back upon my past life with such horror, and my sins appeared so dreadful, that my soul sought nothing of God but deliverance from the load of guilt that bore down all my comfort.

As for my solitary life, it was nothing. I did not so much as pray to be delivered from it or think of it; it was all of no consideration in comparison to this. And I add this part here, to hint to whoever shall read it, that whenever they come to a true sense of things, they will find deliverance from sin a much greater blessing than deliverance from affliction.

But, leaving this part, I return to my Journal.

My condition began now to be, though not less miserable as to my way of living, yet much easier to my mind: and my thoughts being directed, by a constant reading the Scripture and praying to God, to things of a higher nature, I had a great deal of comfort within, which till now I knew nothing of; also, my health and strength returned, I bestirred myself to furnish myself with everything that I wanted, and make my way of living as regular as I could.

From the 4th of July to the 14th I was chiefly employed in walking about with my gun in my hand, a little and a little at a time, as a man that was gathering up his strength after a fit of sickness; for it is hardly to be imagined how low I was, and to what weakness I was reduced. The application which I made use of was perfectly new, and perhaps which had never cured an ague before; neither can I recommend it to any to practise, by this experiment: and though it did carry off the fit, yet it rather contributed to weakening me; for I had frequent convulsions in my nerves and limbs for some time. I learned from it also this, in particular, that being abroad in the rainy season was the most pernicious thing to my health that could be, especially in those rains which came attended with storms and hurricanes of wind; for as the rain which came in the dry season was almost always accompanied with such storms, so I found that rain was much more dangerous than the rain which fell in September and October.

Chapter 7 - Agricultural Experience

I had now been in this unhappy island above ten months. All possibility of deliverance from this condition seemed to be entirely taken from me; and I firmly believe that no human shape had ever set foot upon that place. Having now secured my habitation, as I thought, fully to my mind, I had a great desire to make a more perfect discovery of the island, and to see what other productions I might find, which I yet knew nothing of.

It was on the 15th of July that I began to take a more particular survey of the island itself. I went up the creek first, where, as I hinted, I brought my rafts on shore. I found after I came about two miles up, that the tide did not flow any higher, and that it was no more than a little brook of running water, very fresh and good; but this being the dry season, there was hardly any water in some parts of it—at least not enough to run in any stream, so as it could be perceived. On the banks of this brook I found many pleasant savannahs or meadows, plain, smooth, and covered with grass; and on the rising parts of them, next to the higher grounds, where the water, as might be supposed, never overflowed, I found a great deal of tobacco, green, and growing to a great and very strong stalk. There were divers other plants, which I had no notion of or understanding about, that might, perhaps, have virtues of their own, which I could not find out. I searched for the cassava root, which the Indians, in all that climate, make their bread of, but I could find none. I saw large plants of aloes, but did not understand them. I saw several sugar-canes, but wild, and, for want of cultivation, imperfect.

I contented myself with these discoveries for this time, and came back, musing with myself what course I might take to know the virtue and goodness of any of the fruits or plants which I should discover, but could bring it to no conclusion; for, in short, I had made so little observation while I was in the Brazils, that I knew little of the plants in the field; at least, very little that might serve to any purpose now in my distress.

The next day, the sixteenth, I went up the same way again; and after going something further than I had gone the day before, I found the brook and the savannahs cease, and the country become more woody than before. In this part I found different fruits, and particularly I found melons upon the ground, in great abundance, and grapes upon the trees. The vines had spread, indeed, over the trees, and the clusters of grapes were just now in their prime, very ripe and rich. This was a surprising discovery, and I was exceeding glad of them; but I was warned by my experience to eat sparingly of them; remembering that when I was ashore in Barbary, the eating of grapes killed several of our Englishmen, who were slaves there, by throwing them into fluxes and fevers. But I found an excellent use for these grapes; and that was, to cure or dry them in the sun, and keep them as dried grapes or raisins are kept, which I thought would be, as indeed they were, wholesome and agreeable to eat when no grapes could be had.

I spent all that evening there, and went not back to my habitation; which, by the way, was the first night, as I might say, I had lain from home. In the night, I took my first contrivance, and got up in a tree, where I slept well; and the next morning proceeded upon my discovery; travelling nearly four miles, as I might judge by the length of the valley, keeping still due north, with a ridge of hills on the south and north side of me. At the end of this march I came to an opening where the country seemed to descend to the west; and a little spring of fresh water, which issued out of the side of the hill by me, ran the other way, that is, due east; and the country appeared so fresh, so green, so flourishing, everything being in a constant verdure or flourish of spring that it looked like a planted garden. I descended a little on the side of that delicious vale, surveying it with a secret kind of pleasure, though mixed with my other afflicting thoughts, to think that this was all my own; that I was king and lord of all this country indefensibly, and had a right of possession; and if I could convey it, I might have it in inheritance as completely as any lord of a manor in England. I saw here abundance of cocoa trees, orange, and lemon, and citron trees; but all wild, and very few bearing any fruit, at least not then. However, the green limes that I gathered were not only pleasant to eat, but very wholesome; and I mixed their juice afterwards with water, which made it very wholesome, and very cool and refreshing. I found now I had business enough to gather and carry home; and I resolved to lay up a store as well of grapes as limes and lemons, to furnish myself for the wet season, which I knew was approaching. In order to do this, I gathered a great heap of grapes in one place, a lesser heap in another place, and a great parcel of limes and lemons in another place; and taking a few of each with me, I travelled homewards; resolving to come again, and bring a bag or sack, or what I could make, to carry the rest home.

Accordingly, having spent three days in this journey, I came home (so I must now call my tent and my cave); but before I got thither the grapes were spoiled; the richness of the fruit and the weight of the juice having broken them and bruised them, they were good for little or nothing; as to the limes, they were good, but I could bring but a few.

The next day, being the nineteenth, I went back, having made me two small bags to bring home my harvest; but I was surprised, when coming to my heap of grapes, which were so rich and fine when I gathered them, to find them all spread about, trod to pieces, and dragged about, some here, some there, and abundance eaten and devoured. By this I concluded there were some wild creatures thereabouts, which had done this; but what they were I knew not. However, as I found there was no laying them up on heaps, and no carrying them away in a sack, but that one way they would be destroyed, and the other way they would be crushed with their own weight, I took another course; for I gathered a large quantity of the grapes, and hung upon the out-branches of the trees, that they might cure and dry in the sun; and as for the limes and lemons, I carried as many back as I could well stand under.

When I came home from this journey, I contemplated with great pleasure the fruitfulness of that valley, and the pleasantness of the situation; the security from storms on that side of the water, and the wood: and concluded that I had pitched upon a place to fix my abode which was by far the worst part of the country. Upon the whole, I began to consider of removing my habitation, and looking out for a place equally safe as where now I was situate, if possible, in that pleasant, fruitful part of the island.

This thought ran long in my head, and I was exceeding fond of it for some time, the pleasantness of the place tempting me; but when I came to a nearer view of it, I considered that I was now by the seaside, where it was at least possible that something might happen to my advantage, and, by the same ill fate that brought me hither might bring some other unhappy wretches to the same place; and though it was scarce probable that any such thing should ever happen, yet to enclose myself among the hills and woods in the centre of the island was to anticipate my bondage, and to render such an affair not only improbable, but impossible; and that therefore I ought not by any means to remove. However, I was so enamoured of this place, that I spent much of my time there for the whole of the remaining part of the month of July; and though upon second thoughts, I resolved not to remove, yet I built me a little kind of a bower, and surrounded it at a distance with a strong fence, being a double hedge, as high as I could reach, well staked and filled between with brushwood; and here I lay very secure, sometimes two or three nights together; always going over it with a ladder; so that I fancied now I had my country house and my sea-coast house; and this work took me up to the beginning of August.

I had but newly finished my fence, and began to enjoy my labour, when the rains came on, and made me stick close to my first habitation; for though I had made me a tent like the other, with a piece of a sail, and spread it very well, yet I had not the shelter of a hill to keep me from storms, nor a cave behind me to retreat into when the rains were extraordinary.

About the beginning of August, as I said, I had finished my bower, and began to enjoy myself. The 3rd of August, I found the grapes I had hung up perfectly dried, and, indeed, were excellent good raisins of the sun; so I began to take them down from the trees, and it was very happy that I did so, for the rains which followed would have spoiled them, and I had lost the best part of my winter food; for I had above two hundred large bunches of them. No sooner had I taken them all down, and carried the most of them home to my cave, than it began to rain; and from hence, which was the 14th of August, it rained, more or less, every day till the middle of October; and sometimes so violently, that I could not stir out of my cave for several days.

In this season I was much surprised with the increase of my family; I had been concerned for the loss of one of my cats, who ran away from me, or, as I thought, had been dead, and I heard no more tidings of her till, to my astonishment, she came home about the end of August with three kittens. This was the more strange to me because, though I had killed a wild cat, as I called it, with my gun, yet I thought it was quite a different kind from our European cats; but the young cats were the same kind of house-breed as the old one; and both my cats being females, I thought it very strange. But from these three cats I afterwards came to be so pestered with cats that I was forced to kill them like vermin or wild beasts, and to drive them from my house as much as possible.

From the 14th of August to the 26th, incessant rain, so that I could not stir, and was now very careful not to be much wet. In this confinement, I began to be straitened for food: but venturing out twice, I one day killed a goat; and the last day, which was the 26th, found a very large tortoise, which was a treat to me, and my food was regulated thus: I ate a bunch of raisins for my breakfast; a piece of the goat's flesh, or of the turtle, for my dinner, broiled—for, to my great misfortune, I had no vessel to boil or stew anything; and two or three of the turtle's eggs for my supper.

During this confinement in my cover by the rain, I worked daily two or three hours at enlarging my cave, and by degrees worked it on towards one side, till I came to the outside of the hill, and made a door or way out, which came beyond my fence or wall; and so I came in and out this way. But I was not perfectly easy at lying so open; for, as I had managed myself before, I was in a perfect enclosure; whereas now I thought I lay exposed, and open for anything to come in upon me; and yet I could not perceive that there was any living thing to fear, the biggest creature that I had yet seen upon the island being a goat.

Sept. 30.—I was now come to the unhappy anniversary of my landing. I cast up the notches on my post, and found I had been on shore three hundred and sixty-five days. I kept this day as a solemn fast, setting it apart for religious exercise, prostrating myself on the ground with the most serious humiliation, confessing my sins to God, acknowledging His righteous judgments upon me, and praying to Him to have mercy on me through Jesus Christ; and not having tasted the least refreshment for twelve hours, even till the going down of the sun, I then ate a biscuit-cake and a bunch of grapes, and went to bed, finishing the day as I began it. I had all this time observed no Sabbath day; for as at first I had no sense of religion upon my mind, I had, after some time, omitted to distinguish the weeks, by making a longer notch than ordinary for the Sabbath day, and so did not really know what any of the days were; but now, having cast up the days as above, I found I had been there a year; so I divided it into weeks, and set apart every seventh day for a Sabbath; though I found at the end of my account I had lost a day or two in my reckoning.

A little after this, my ink began to fail me, and so I contented myself to use it more sparingly, and to write down only the most remarkable events of my life, without continuing a daily memorandum of other things. The rainy season and the dry season began now to appear regular to me, and I learned to divide them so as to provide for them accordingly; but I bought all my experience before I had it, and this I am going to relate was one of the most discouraging experiments that I made.

I have mentioned that I had saved the few ears of barley and rice, which I had so surprisingly found spring up, as I thought, of themselves, and I believe there were about thirty stalks of rice, and about twenty of barley; and now I thought it a proper time to sow it, after the rains, the sun being in its southern position, going from me. Accordingly, I dug up a piece of ground as well as I could with my wooden spade, and dividing it into two parts, I sowed my grain; but as I was sowing, it casually occurred to my thoughts that I would not sow it all at first, because I did not know when was the proper time for it, so I sowed about two-thirds of the seed, leaving about a handful of each. It was a great comfort to me afterwards that I did so, for not one grain of what I sowed this time came to anything: for the dry months following, the earth having had no rain after the seed was sown, it had no moisture to assist its growth, and never came up at all till the wet season had come again, and then it grew as if it had been but newly sown.

Finding my first seed did not grow, which I easily imagined was by the drought, I sought for a moister piece of ground to make another trial in, and I dug up a piece of ground near my new bower, and sowed the rest of my seed in February, a little before the vernal equinox; and this having the rainy months of March and April to water it, sprung up very pleasantly, and yielded a very good crop; but having part of the seed left only, and not daring to sow all that I had, I had but a small quantity at last, my whole crop not amounting to above half a peck of each kind. But by this experiment I was made master of my business, and knew exactly when the proper season was to sow, and that I might expect two seed-times and two harvests every year.

While this corn was growing I made a little discovery, which was of use to me afterwards. As soon as the rains were over, and the weather began to settle, which was about the month of November, I made a visit up the country to my bower, where, though I had not been some months, yet I found all things just as I left them. The circle or double hedge that I had made was not only firm and entire, but the stakes which I had cut out of some trees that grew thereabouts were all shot out and grown with long branches, as much as a willow-tree usually shoots the first year after lopping its head. I could not tell what tree to call it that these stakes were cut from.

I was surprised, and yet very well pleased, to see the young trees grow; and I pruned them, and led them up to grow as much alike as I could; and it is scarce credible how beautiful a figure they grew into in three years; so that though the hedge made a circle of about twenty-five yards in diameter, yet the trees, for such I might now call them, soon covered it, and it was a complete shade, sufficient to lodge under all the dry season. This made me resolve to cut some more stakes, and make me a hedge like this, in a semi-circle round my wall (I mean that of my first dwelling), which I did; and placing the trees or stakes in a double row, at about eight yards distance from my first fence, they grew presently, and were at first a fine cover to my habitation, and afterwards served for a defence also, as I shall observe in its order.

I found now that the seasons of the year might generally be divided, not into summer and winter, as in Europe, but into the rainy seasons and the dry seasons, which were generally thus:—The half of February, the whole of March, and the half of April—rainy, the sun being then on or near the equinox.

The half of April, the whole of May, June, and July, and the half of August—dry, the sun being then to the north of the line.

The half of August, the whole of September, and the half of October—rainy, the sun being then come back.

The half of October, the whole of November, December, and January, and the half of February—dry, the sun being then to the south of the line.

The rainy seasons sometimes held longer or shorter as the winds happened to blow, but this was the general observation I made. After I had found by experience the ill consequences of being abroad in the rain, I took care to furnish myself with provisions beforehand, that I might not be obliged to go out, and I sat within doors as much as possible during the wet months. This time I found much employment, and very suitable also to the time, for I found great occasion for many things which I had no way to furnish myself with but by hard labour and constant application; particularly I tried many ways to make myself a basket, but all the twigs I could get for the purpose proved so brittle that they would do nothing.

It proved of excellent advantage to me now, that when I was a boy, I used to take great delight in standing at a basket-maker's, in the town where my father lived, to see them make their wicker-ware; and being, as boys usually are, very officious to help, and a great observer of the manner in which they worked those things, and sometimes lending a hand, I had by these means full knowledge of the methods of it, and I wanted nothing but the materials, when it came into my mind that the twigs of that tree from whence I cut my stakes that grew might possibly be as tough as the sallows, willows, and osiers in England, and I resolved to try. Accordingly, the next day I went to my country house, as I called it, and cutting some of the smaller twigs, I found them to my purpose as much as I could desire; whereupon I came the next time prepared with a hatchet to cut down a quantity, which I soon found, for there was great plenty of them.

These I set up to dry within my circle or hedge, and when they were fit for use I carried them to my cave; and here, during the next season, I employed myself in making, as well as I could, a great many baskets, both to carry earth or to carry or lay up anything, as I had occasion; and though I did not finish them very handsomely, yet I made them sufficiently serviceable for my purpose; thus, afterwards, I took care never to be without them; and as my wicker-ware decayed, I made more, especially strong, deep baskets to place my corn in, instead of sacks, when I should come to have any quantity of it.

Having mastered this difficulty, and employed a world of time about it, I bestirred myself to see, if possible, how to supply two wants. I had no vessels to hold anything that was liquid, except two runlets, which were almost full of rum, and some glass bottles—some of the common size, and others which were case bottles, square, for the holding of water, spirits, &c. I had not so much as a pot to boil anything, except a great kettle, which I saved out of the ship, and which was too big for such as I desired it—viz. to make broth, and stew a bit of meat by itself. The second thing I fain would have had was a tobacco-pipe, but it was impossible to me to make one; however, I found a contrivance for that, too, at last. I employed myself in planting my second rows of stakes or piles, and in this wicker-working all the summer or dry season, when another business took me up more time than it could be imagined I could spare.

Chapter 8 - Surveys His Position

I mentioned before that I had a great mind to see the whole island, and that I had travelled up the brook, and so on to where I built my bower, and where I had an opening quite to the sea, on the other side of the island. I now resolved to travel quite across to the sea-shore on that side; so, taking my gun, a hatchet, and my dog, and a larger quantity of powder and shot than usual, with two biscuit-cakes and a great bunch of raisins in my pouch for my store, I began my journey. When I had passed the vale where my bower stood, as above, I came within view of the sea to the west, and it being a very clear day, I fairly descried land—whether an island or a continent I could not tell; but it lay very high, extending from the W. to the W.S.W. at a very great distance; by my guess it could not be less than fifteen or twenty leagues off.

I could not tell what part of the world this might be, otherwise than that I knew it must be part of America, and, as I concluded by all my observations, must be near the Spanish dominions, and perhaps was all inhabited by savages, where, if I had landed, I had been in a worse condition than I was now; and therefore I acquiesced in the dispositions of Providence, which I began now to own and to believe ordered everything for the best; I say I quieted my mind with this, and left off afflicting myself with fruitless wishes of being there.

Besides, after some thought upon this affair, I considered that if this land was the Spanish coast, I should certainly, one time or other, see some vessel pass or repass one way or other; but if not, then it was the savage coast between the Spanish country and Brazils, where are found the worst of savages; for they are cannibals or men-eaters, and fail not to murder and devour all the human bodies that fall into their hands.

With these considerations, I walked very leisurely forward. I found that side of the island where I now was much pleasanter than mine—the open or savannah fields sweet, adorned with flowers and grass, and full of very fine woods. I saw abundance of parrots, and fain I would have caught one, if possible, to have kept it to be tame, and taught it to speak to me. I did, after some painstaking, catch a young parrot, for I knocked it down with a stick, and having recovered it, I brought it home; but it was some years before I could make him speak; however, at last I taught him to call me by name very familiarly. But the accident that followed, though it be a trifle, will be very diverting in its place.

I was exceedingly diverted with this journey. I found in the low grounds hares (as I thought them to be) and foxes; but they differed greatly from all the other kinds I had met with, nor could I satisfy myself to eat them, though I killed several. But I had no need to be venturous, for I had no want of food, and of that which was very good too, especially these three sorts, viz. goats, pigeons, and turtle, or tortoise, which added to my grapes, Leadenhall market could not have furnished a table better than I, in proportion to the company; and though my case was deplorable enough, yet I had great cause for thankfulness that I was not driven to any extremities for food, but had rather plenty, even to dainties.

I never travelled in this journey above two miles outright in a day, or thereabouts; but I took so many turns and re-turns to see what discoveries I could make, that I came weary enough to the place where I resolved to sit down all night; and then I either reposed myself in a tree, or surrounded myself with a row of stakes set upright in the ground, either from one tree to another, or so as no wild creature could come at me without waking me.

As soon as I came to the sea-shore, I was surprised to see that I had taken up my lot on the worst side of the island, for here, indeed, the shore was covered with innumerable turtles, whereas on the other side I had found but three in a year and a half. Here was also an infinite number of fowls of many kinds, some which I had seen, and some which I had not seen before, and many of them very good meat, but such as I knew not the names of, except those called penguins.

I could have shot as many as I pleased, but was very sparing of my powder and shot, and therefore had more mind to kill a she-goat if I could, which I could better feed on; and though there were many goats here, more than on my side the island, yet it was with much more difficulty that I could come near them, the country being flat and even, and they saw me much sooner than when I was on the hills.

I confess this side of the country was much pleasanter than mine; but yet I had not the least inclination to remove, for as I was fixed in my habitation it became natural to me, and I seemed all the while I was here to be as it were upon a journey, and from home. However, I travelled along the shore of the sea towards the east, I suppose about twelve miles, and then setting up a great pole upon the shore for a mark, I concluded I would go home again, and that the next journey I took should be on the other side of the island east from my dwelling, and so round till I came to my post again.

I took another way to come back than that I went, thinking I could easily keep all the island so much in my view that I could not miss finding my first dwelling by viewing the country; but I found myself mistaken, for being come about two or three miles, I found myself descended into a very large valley, but so surrounded with hills, and those hills covered with wood, that I could not see which was my way by any direction but that of the sun, nor even then, unless I knew very well the position of the sun at that time of the day. It happened, to my further misfortune, that the weather proved hazy for three or four days while I was in the valley, and not being able to see the sun, I wandered about very uncomfortably, and at last was obliged to find the seaside, look for my post, and come back the same way I went: and then, by easy journeys, I turned homeward, the weather being exceeding hot, and my gun, ammunition, hatchet, and other things very heavy.

ENTERTAINMENT Solo Robinson Crusoe Chapter 8

In this journey my dog surprised a young kid, and seized upon it; and I, running in to take hold of it, caught it, and saved it alive from the dog. I had a great mind to bring it home if I could, for I had often been musing whether it might not be possible to get a kid or two, and so raise a breed of tame goats, which might supply me when my powder and shot should be all spent. I made a collar for this little creature, and with a string, which I made of some rope-yam, which I always carried about me, I led him along, though with some difficulty, till I came to my bower, and there I enclosed him and left him, for I was very impatient to be at home, from whence I had been absent above a month.

I cannot express what a satisfaction it was to me to come into my old hutch, and lie down in my hammock-bed. This little wandering journey, without settled place of abode, had been so unpleasant to me, that my own house, as I called it to myself, was a perfect settlement to me compared to that; and it rendered everything about me so comfortable, that I resolved I would never go a great way from it again while it should be my lot to stay on the island.

I reposed myself here a week, to rest and regale myself after my long journey; during which most of the time was taken up in the weighty affair of making a cage for my Poll, who began now to be a mere domestic, and to be well acquainted with me. Then I began to think of the poor kid which I had penned in within my little circle, and resolved to go and fetch it home, or give it some food; accordingly I went, and found it where I left it, for indeed it could not get out, but was almost starved for want of food.

I went and cut boughs of trees, and branches of such shrubs as I could find, and threw it over, and having fed it, I tied it as I did before, to lead it away; but it was so tame with being hungry, that I had no need to have tied it, for it followed me like a dog: and as I continually fed it, the creature became so loving, so gentle, and so fond, that it became from that time one of my domestics also, and would never leave me afterwards.

The rainy season of the autumnal equinox was now come, and I kept the 30th of September in the same solemn manner as before, being the anniversary of my landing on the island, having now been there two years, and no more prospect of being delivered than the first day I came there, I spent the whole day in humble and thankful acknowledgments of the many wonderful mercies which my solitary condition was attended with, and without which it might have been infinitely more miserable.

I gave humble and hearty thanks that God had been pleased to discover to me that it was possible I might be more happy in this solitary condition than I should have been in the liberty of society, and in all the pleasures of the world; that He could fully make up to me the deficiencies of my solitary state, and the want of human society, by His presence and the communications of His grace to my soul; supporting, comforting, and encouraging me to depend upon His providence here, and hope for His eternal presence hereafter.

It was now that I began sensibly to feel how much more happy this life I now led was, with all its miserable circumstances, than the wicked, cursed, abominable life I led all the past part of my days; and now I changed both my sorrows and my joys; my very desires altered, my affections changed their gusts, and my delights were perfectly new from what they were at my first coming, or, indeed, for the two years past.

Before, as I walked about, either on my hunting or for viewing the country, the anguish of my soul at my condition would break out upon me on a sudden, and my very heart would die within me, to think of the woods, the mountains, the deserts I was in, and how I was a prisoner, locked up with the eternal bars and bolts of the ocean, in an uninhabited wilderness, without redemption. In the midst of the greatest composure of my mind, this would break out upon me like a storm, and make me wring my hands and weep like a child. Sometimes it would take me in the middle of my work, and I would immediately sit down and sigh, and look upon the ground for an hour or two together; and this was still worse to me, for if I could burst out into tears, or vent myself by words, it would go off, and the grief, having exhausted itself, would abate.

But now I began to exercise myself with new thoughts: I daily read the word of God, and applied all the comforts of it to my present state. One morning, being very sad, I opened the Bible upon these words, "I will never, never leave thee, nor forsake thee." Immediately it occurred that these words were to me; why else should they be directed in such a manner, just at the moment when I was mourning over my condition, as one forsaken of God and man? "Well, then," said I, "if God does not forsake me, of what ill consequence can it be, or what matters it, though the world should all forsake me, seeing on the other hand, if I had all the world, and should lose the favour and blessing of God, there would be no comparison in the loss?"

From this moment I began to conclude in my mind that it was possible for me to be more happy in this forsaken, solitary condition than it was probable I should ever have been in any other particular state in the world; and with this thought I was going to give thanks to God for bringing me to this place. I know not what it was, but something shocked my mind at that thought, and I durst not speak the words. "How canst thou become such a hypocrite," said I, even audibly, "to pretend to be thankful for a condition which, however thou mayest endeavour to be contented with, thou wouldst rather pray heartily to be delivered from?"

So I stopped there; but though I could not say I thanked God for being there, yet I sincerely gave thanks to God for opening my eyes, by whatever afflicting providences, to see the former condition of my life, and to mourn for my wickedness, and repent. I never opened the Bible, or shut it, but my very soul within me blessed God for directing my friend in England, without any order of mine, to pack it up among my goods, and for assisting me afterwards to save it out of the wreck of the ship.

Thus, and in this disposition of mind, I began my third year; and though I have not given the reader the trouble of so particular an account of my works this year as the first, yet in general it may be observed that I was very seldom idle, but having regularly divided my time according to the several daily employments that were before me, such as: first, my duty to God, and the reading the Scriptures, which I constantly set apart some time for thrice every day; secondly, the going abroad with my gun for food, which generally took me up three hours in every morning, when it did not rain; thirdly, the ordering, cutting, preserving, and cooking what I had killed or caught for my supply; these took up great part of the day. Also, it is to be considered, that in the middle of the day, when the sun was in the zenith, the violence of the heat was too great to stir out; so that about four hours in the evening was all the time I could be supposed to work in, with this exception, that sometimes I changed my hours of hunting and working, and went to work in the morning, and abroad with my gun in the afternoon.

To this short time allowed for labour I desire may be added the exceeding laboriousness of my work; the many hours which, for want of tools, want of help, and want of skill, everything I did took up out of my time. For example, I was full two and forty days in making a board for a long shelf, which I wanted in my cave; whereas, two sawyers, with their tools and a saw-pit, would have cut six of them out of the same tree in half a day.

My case was this: it was to be a large tree which was to be cut down, because my board was to be a broad one. This tree I was three days in cutting down, and two more cutting off the boughs, and reducing it to a log or piece of timber. With inexpressible hacking and hewing I reduced both the sides of it into chips till it began to be light enough to move; then I turned it, and made one side of it smooth and flat as a board from end to end; then, turning that side downward, cut the other side til I brought the plank to be about three inches thick, and smooth on both sides. Any one may judge the labour of my hands in such a piece of work; but labour and patience carried me through that, and many other things. I only observe this in particular, to show the reason why so much of my time went away with so little work—viz. that what might be a little to be done with help and tools, was a vast labour and required a prodigious time to do alone, and by hand. But notwithstanding this, with patience and labour I got through everything that my circumstances made necessary to me to do, as will appear by what follows.

I was now, in the months of November and December, expecting my crop of barley and rice. The ground I had manured and dug up for them was not great; for, as I observed, my seed of each was not above the quantity of half a peck, for I had lost one whole crop by sowing in the dry season. But now my crop promised very well, when on a sudden I found I was in danger of losing it all again by enemies of several sorts, which it was scarcely possible to keep from it; as, first, the goats, and wild creatures which I called hares, who, tasting the sweetness of the blade, lay in it night and day, as soon as it came up, and eat it so close, that it could get no time to shoot up into stalk.

This I saw no remedy for but by making an enclosure about it with a hedge; which I did with a great deal of toil, and the more, because it required speed. However, as my arable land was but small, suited to my crop, I got it totally well fenced in about three weeks' time; and shooting some of the creatures in the daytime, I set my dog to guard it in the night, tying him up to a stake at the gate, where he would stand and bark all night long; so in a little time the enemies forsook the place, and the corn grew very strong and well, and began to ripen apace.

But as the beasts ruined me before, while my corn was in the blade, so the birds were as likely to ruin me now, when it was in the ear; for, going along by the place to see how it throve, I saw my little crop surrounded with fowls, of I know not how many sorts, who stood, as it were, watching till I should be gone. I immediately let fly among them, for I always had my gun with me. I had no sooner shot, but there rose up a little cloud of fowls, which I had not seen at all, from among the corn itself.

This touched me sensibly, for I foresaw that in a few days they would devour all my hopes; that I should be starved, and never be able to raise a crop at all; and what to do I could not tell; however, I resolved not to lose my corn, if possible, though I should watch it night and day. In the first place, I went among it to see what damage was already done, and found they had spoiled a good deal of it; but that as it was yet too green for them, the loss was not so great but that the remainder was likely to be a good crop if it could be saved.

I stayed by it to load my gun, and then coming away, I could easily see the thieves sitting upon all the trees about me, as if they only waited till I was gone away, and the event proved it to be so; for as I walked off, as if I was gone, I was no sooner out of their sight than they dropped down one by one into the corn again. I was so provoked, that I could not have patience to stay till more came on, knowing that every grain that they ate now was, as it might be said, a peck-loaf to me in the consequence; but coming up to the hedge, I fired again, and killed three of them. This was what I wished for; so I took them up, and served them as we serve notorious thieves in England—hanged them in chains, for a terror to others. It is impossible to imagine that this should have such an effect as it had, for the fowls would not only not come at the corn, but, in short, they forsook all that part of the island, and I could never see a bird near the place as long as my scarecrows hung there. This I was very glad of, you may be sure, and about the latter end of December, which was our second harvest of the year, I reaped my corn.

I was sadly put to it for a scythe or sickle to cut it down, and all I could do was to make one, as well as I could, out of one of the broadswords, or cutlasses, which I saved among the arms out of the ship. However, as my first crop was but small, I had no great difficulty to cut it down; in short, I reaped it in my way, for I cut nothing off but the ears, and carried it away in a great basket which I had made, and so rubbed it out with my hands; and at the end of all my harvesting, I found that out of my half-peck of seed I had near two bushels of rice, and about two bushels and a half of barley; that is to say, by my guess, for I had no measure at that time.

However, this was a great encouragement to me, and I foresaw that, in time, it would please God to supply me with bread. And yet here I was perplexed again, for I neither knew how to grind or make meal of my corn, or indeed how to clean it and part it; nor, if made into meal, how to make bread of it; and if how to make it, yet I knew not how to bake it. These things being added to my desire of having a good quantity for store, and to secure a constant supply, I resolved not to taste any of this crop but to preserve it all for seed against the next season; and in the meantime to employ all my study and hours of working to accomplish this great work of providing myself with corn and bread.

It might be truly said, that now I worked for my bread. I believe few people have thought much upon the strange multitude of little things necessary in the providing, producing, curing, dressing, making, and finishing this one article of bread.

I, that was reduced to a mere state of nature, found this to my daily discouragement; and was made more sensible of it every hour, even after I had got the first handful of seed-corn, which, as I have said, came up unexpectedly, and indeed to a surprise.

First, I had no plough to turn up the earth—no spade or shovel to dig it. Well, this I conquered by making me a wooden spade, as I observed before; but this did my work but in a wooden manner; and though it cost me a great many days to make it, yet, for want of iron, it not only wore out soon, but made my work the harder, and made it be performed much worse. However, this I bore with, and was content to work it out with patience, and bear with the badness of the performance. When the corn was sown, I had no harrow, but was forced to go over it myself, and drag a great heavy bough of a tree over it, to scratch it, as it may be called, rather than rake or harrow it.

When it was growing, and grown, I have observed already how many things I wanted to fence it, secure it, mow or reap it, cure and carry it home, thrash, part it from the chaff, and save it. Then I wanted a mill to grind it, sieves to dress it, yeast and salt to make it into bread, and an oven to bake it; but all these things I did without, as shall be observed; and yet the corn was an inestimable comfort and advantage to me too. All this, as I said, made everything laborious and tedious to me; but that there was no help for. Neither was my time so much loss to me, because, as I had divided it, a certain part of it was every day appointed to these works; and as I had resolved to use none of the corn for bread till I had a greater quantity by me, I had the next six months to apply myself wholly, by labour and invention, to furnish myself with utensils proper for the performing all the operations necessary for making the corn, when I had it, fit for my use.

Chapter 9 - A Boat

But first I was to prepare more land, for I had now seed enough to sow above an acre of ground. Before I did this, I had a week's work at least to make me a spade, which, when it was done, was but a sorry one indeed, and very heavy, and required double labour to work with it. However, I got through that, and sowed my seed in two large flat pieces of ground, as near my house as I could find them to my mind, and fenced them in with a good hedge, the stakes of which were all cut off that wood which I had set before, and knew it would grow; so that, in a year's time, I knew I should have a quick or living hedge, that would want but little repair. This work did not take me up less than three months, because a great part of that time was the wet season, when I could not go abroad. Within-doors, that is when it rained and I could not go out, I found employment in the following occupations—always observing, that all the while I was at work I diverted myself with talking to my parrot, and teaching him to speak; and I quickly taught him to know his own name, and at last to speak it out pretty loud, "Poll," which was the first word I ever heard spoken in the island by any mouth but my own.

This, therefore, was not my work, but an assistance to my work; for now, as I said, I had a great employment upon my hands, as follows: I had long studied to make, by some means or other, some earthen vessels, which, indeed, I wanted sorely, but knew not where to come at them. However, considering the heat of the climate, I did not doubt but if I could find out any clay, I might make some pots that might, being dried in the sun, be hard enough and strong enough to bear handling, and to hold anything that was dry, and required to be kept so; and as this was necessary in the preparing corn, meal, &c., which was the thing I was doing, I resolved to make some as large as I could, and fit only to stand like jars, to hold what should be put into them.

It would make the reader pity me, or rather laugh at me, to tell how many awkward ways I took to raise this paste; what odd, misshapen, ugly things I made; how many of them fell in and how many fell out, the clay not being stiff enough to bear its own weight; how many cracked by the over-violent heat of the sun, being set out too hastily; and how many fell in pieces with only removing, as well before as after they were dried; and, in a word, how, after having laboured hard to find the clay—to dig it, to temper it, to bring it home, and work it—I could not make above two large earthen ugly things (I cannot call them jars) in about two months' labour.

However, as the sun baked these two very dry and hard, I lifted them very gently up, and set them down again in two great wicker baskets, which I had made on purpose for them, that they might not break; and as between the pot and the basket there was a little room to spare, I stuffed it full of the rice and barley straw; and these two pots being to stand always dry I thought would hold my dry corn, and perhaps the meal, when the corn was bruised.

Though I miscarried so much in my design for large pots, yet I made several smaller things with better success; such as little round pots, flat dishes, pitchers, and pipkins, and any things my hand turned to; and the heat of the sun baked them quite hard.

But all this would not answer my end, which was to get an earthen pot to hold what was liquid, and bear the fire, which none of these could do. It happened after some time, making a pretty large fire for cooking my meat, when I went to put it out after I had done with it, I found a broken piece of one of my earthenware vessels in the fire, burnt as hard as a stone, and red as a tile. I was agreeably surprised to see it, and said to myself, that certainly they might be made to burn whole, if they would burn broken.

This set me to study how to order my fire, so as to make it burn some pots. I had no notion of a kiln, such as the potters burn in, or of glazing them with lead, though I had some lead to do it with; but I placed three large pipkins and two or three pots in a pile, one upon another, and placed my firewood all round it, with a great heap of embers under them. I plied the fire with fresh fuel round the outside and upon the top, till I saw the pots in the inside red-hot quite through, and observed that they did not crack at all. When I saw them clear red, I let them stand in that heat about five or six hours, till I found one of them, though it did not crack, did melt or run; for the sand which was mixed with the clay melted by the violence of the heat, and would have run into glass if I had gone on; so I slacked my fire gradually till the pots began to abate of the red colour; and watching them all night, that I might not let the fire abate too fast, in the morning I had three very good (I will not say handsome) pipkins, and two other earthen pots, as hard burnt as could be desired, and one of them perfectly glazed with the running of the sand.

After this experiment, I need not say that I wanted no sort of earthenware for my use; but I must needs say as to the shapes of them, they were very indifferent, as any one may suppose, when I had no way of making them but as the children make dirt pies, or as a woman would make pies that never learned to raise paste.

No joy at a thing of so mean a nature was ever equal to mine, when I found I had made an earthen pot that would bear the fire; and I had hardly patience to stay till they were cold before I set one on the fire again with some water in it to boil me some meat, which it did admirably well; and with a piece of a kid I made some very good broth, though I wanted oatmeal, and several other ingredients requisite to make it as good as I would have had it been.

My next concern was to get me a stone mortar to stamp or beat some corn in; for as to the mill, there was no thought of arriving at that perfection of art with one pair of hands. To supply this want, I was at a great loss; for, of all the trades in the world, I was as perfectly unqualified for a stone-cutter as for any whatever; neither had I any tools to go about it with. I spent many a day to find out a great stone big enough to cut hollow, and make fit for a mortar, and could find none at all, except what was in the solid rock, and which I had no way to dig or cut out; nor indeed were the rocks in the island of hardness sufficient, but were all of a sandy, crumbling stone, which neither would bear the weight of a heavy pestle, nor would break the corn without filling it with sand.

So, after a great deal of time lost in searching for a stone, I gave it over, and resolved to look out for a great block of hard wood, which I found, indeed, much easier; and getting one as big as I had strength to stir, I rounded it, and formed it on the outside with my axe and hatchet, and then with the help of fire and infinite labour, made a hollow place in it, as the Indians in Brazil make their canoes. After this, I made a great heavy pestle or beater of the wood called the iron-wood; and this I prepared and laid by against I had my next crop of corn, which I proposed to myself to grind, or rather pound into meal to make bread.

ENTERTAINMENT
Entertainment
Robinson Crusoe
Chapter 9

My next difficulty was to make a sieve or searce, to dress my meal, and to part it from the bran and the husk; without which I did not see it possible I could have any bread. This was a most difficult thing even to think on, for to be sure I had nothing like the necessary thing to make it—I mean fine thin canvas or stuff to searce the meal through. And here I was at a full stop for many months; nor did I really know what to do. Linen I had none left but what was mere rags; I had goat's hair, but neither knew how to weave it or spin it; and had I known how, here were no tools to work it with. All the remedy that I found for this was, that at last I did remember I had, among the seamen's clothes which were saved out of the ship, some neckcloths of calico or muslin; and with some pieces of these I made three small sieves proper enough for the work; and thus I made shift for some years: how I did afterwards, I shall show in its place.

The baking part was the next thing to be considered, and how I should make bread when I came to have corn; for first, I had no yeast. As to that part, there was no supplying the want, so I did not concern myself much about it. But for an oven I was indeed in great pain. At length I found out an experiment for that also, which was this: I made some earthen-vessels very broad but not deep, that is to say, about two feet diameter, and not above nine inches deep. These I burned in the fire, as I had done the other, and laid them by; and when I wanted to bake, I made a great fire upon my hearth, which I had paved with some square tiles of my own baking and burning also; but I should not call them square.

When the firewood was burned pretty much into embers or live coals, I drew them forward upon this hearth, so as to cover it all over, and there I let them lie till the hearth was very hot. Then sweeping away all the embers, I set down my loaf or loaves, and whelming down the earthen pot upon them, drew the embers all round the outside of the pot, to keep in and add to the heat; and thus as well as in the best oven in the world, I baked my barley-loaves, and became in little time a good pastrycook into the bargain; for I made myself several cakes and puddings of the rice; but I made no pies, neither had I anything to put into them supposing I had, except the flesh either of fowls or goats.

It need not be wondered at if all these things took me up most part of the third year of my abode here; for it is to be observed that in the intervals of these things I had my new harvest and husbandry to manage; for I reaped my corn in its season, and carried it home as well as I could, and laid it up in the ear, in my large baskets, till I had time to rub it out, for I had no floor to thrash it on, or instrument to thrash it with.

And now, indeed, my stock of corn increasing, I really wanted to build my barns bigger; I wanted a place to lay it up in, for the increase of the corn now yielded me so much, that I had of the barley about twenty bushels, and of the rice as much or more; insomuch that now I resolved to begin to use it freely; for my bread had been quite gone a great while; also I resolved to see what quantity would be sufficient for me a whole year, and to sow but once a year.

Upon the whole, I found that the forty bushels of barley and rice were much more than I could consume in a year; so I resolved to sow just the same quantity every year that I sowed the last, in hopes that such a quantity would fully provide me with bread, &c.

All the while these things were doing, you may be sure my thoughts ran many times upon the prospect of land which I had seen from the other side of the island; and I was not without secret wishes that I were on shore there, fancying that, seeing the mainland, and an inhabited country, I might find some way or other to convey myself further, and perhaps at last find some means of escape.

But all this while I made no allowance for the dangers of such an undertaking, and how I might fall into the hands of savages, and perhaps such as I might have reason to think far worse than the lions and tigers of Africa: that if I once came in their power, I should run a hazard of more than a thousand to one of being killed, and perhaps of being eaten; for I had heard that the people of the Caribbean coast were cannibals or man-eaters, and I knew by the latitude that I could not be far from that shore. Then, supposing they were not cannibals, yet they might kill me, as many Europeans who had fallen into their hands had been served, even when they had been ten or twenty together—much more I, that was but one, and could make little or no defence; all these things, I say, which I ought to have considered well; and did come into my thoughts afterwards, yet gave me no apprehensions at first, and my head ran mightily upon the thought of getting over to the shore.

Now I wished for my boy Xury, and the long-boat with shoulder-of-mutton sail, with which I sailed above a thousand miles on the coast of Africa; but this was in vain: then I thought I would go and look at our ship's boat, which, as I have said, was blown up upon the shore a great way, in the storm, when we were first cast away. She lay almost where she did at first, but not quite; and was turned, by the force of the waves and the winds, almost bottom upward, against a high ridge of beachy, rough sand, but no water about her. If I had had hands to have refitted her, and to have launched her into the water, the boat would have done well enough, and I might have gone back into the Brazils with her easily enough; but I might have foreseen that I could no more turn her and set her upright upon her bottom than I could remove the island; however, I went to the woods, and cut levers and rollers, and brought them to the boat resolving to try what I could do; suggesting to myself that if I could but turn her down, I might repair the damage she had received, and she would be a very good boat, and I might go to sea in her very easily.

I spared no pains, indeed, in this piece of fruitless toil, and spent, I think, three or four weeks about it; at last finding it impossible to heave it up with my little strength, I fell to digging away the sand, to undermine it, and so to make it fall down, setting pieces of wood to thrust and guide it right in the fall.

But when I had done this, I was unable to stir it up again, or to get under it, much less to move it forward towards the water; so I was forced to give it over; and yet, though I gave over the hopes of the boat, my desire to venture over for the main increased, rather than decreased, as the means for it seemed impossible.

This at length put me upon thinking whether it was not possible to make myself a canoe, or periagua, such as the natives of those climates make, even without tools, or, as I might say, without hands, of the trunk of a great tree. This I not only thought possible, but easy, and pleased myself extremely with the thoughts of making it, and with my having much more convenience for it than any of the negroes or Indians; but not at all considering the particular inconveniences which I lay under more than the Indians did—viz. want of hands to move it, when it was made, into the water—a difficulty much harder for me to surmount than all the consequences of want of tools could be to them; for what was it to me, if when I had chosen a vast tree in the woods, and with much trouble cut it down, if I had been able with my tools to hew and dub the outside into the proper shape of a boat, and burn or cut out the inside to make it hollow, so as to make a boat of it—if, after all this, I must leave it just there where I found it, and not be able to launch it into the water?

One would have thought I could not have had the least reflection upon my mind of my circumstances while I was making this boat, but I should have immediately thought how I should get it into the sea; but my thoughts were so intent upon my voyage over the sea in it, that I never once considered how I should get it off the land: and it was really, in its own nature, more easy for me to guide it over forty-five miles of sea than about forty-five fathoms of land, where it lay, to set it afloat in the water.

I went to work upon this boat the most like a fool that ever man did who had any of his senses awake. I pleased myself with the design, without determining whether I was ever able to undertake it; not but that the difficulty of launching my boat came often into my head; but I put a stop to my inquiries into it by this foolish answer which I gave myself—"Let me first make it; I warrant I will find some way or other to get it along when it is done."

This was a most preposterous method; but the eagerness of my fancy prevailed, and to work I went. I felled a cedar-tree, and I question much whether Solomon ever had such a one for the building of the Temple of Jerusalem; it was five feet ten inches diameter at the lower part next the stump, and four feet eleven inches diameter at the end of twenty-two feet; after which it lessened for a while, and then parted into branches. It was not without infinite labour that I felled this tree; I was twenty days hacking and hewing at it at the bottom; I was fourteen more getting the branches and limbs and the vast spreading head cut off, which I hacked and hewed through with axe and hatchet, and inexpressible labour; after this, it cost me a month to shape it and dub it to a proportion, and to something like the bottom of a boat, that it might swim upright as it ought to do.

It cost me near three months more to clear the inside, and work it out so as to make an exact boat of it; this I did, indeed, without fire, by mere mallet and chisel, and by the dint of hard labour, till I had brought it to be a very handsome periagua, and big enough to have carried six-and-twenty men, and consequently big enough to have carried me and all my cargo.

When I had gone through this work I was extremely delighted with it. The boat was really much bigger than ever I saw a canoe or periagua, that was made of one tree, in my life. Many a weary stroke it had cost, you may be sure; and had I gotten it into the water, I make no question, but I should have begun the maddest voyage, and the most unlikely to be performed, that ever was undertaken.

But all my devices to get it into the water failed me; though they cost me infinite labour too. It lay about one hundred yards from the water, and not more; but the first inconvenience was, it was up hill towards the creek. Well, to take away this discouragement, I resolved to dig into the surface of the earth, and so make a declivity: this I began, and it cost me a prodigious deal of pains (but who grudge pains who have their deliverance in view?); but when this was worked through, and this difficulty managed, it was still much the same, for I could no more stir the canoe than I could the other boat. Then I measured the distance of ground, and resolved to cut a dock or canal, to bring the water up to the canoe, seeing I could not bring the canoe down to the water. Well, I began this work; and when I began to enter upon it, and calculate how deep it was to be dug, how broad, how the stuff was to be thrown out, I found that, by the number of hands I had, being none but my own, it must have been ten or twelve years before I could have gone through with it; for the shore lay so high, that at the upper end it must have been at least twenty feet deep; so at length, though with great reluctancy, I gave this attempt over also.

This grieved me heartily; and now I saw, though too late, the folly of beginning a work before we count the cost, and before we judge rightly of our own strength to go through with it.

In the middle of this work I finished my fourth year in this place, and kept my anniversary with the same devotion, and with as much comfort as ever before; for, by a constant study and serious application to the Word of God, and by the assistance of His grace, I gained a different knowledge from what I had before. I entertained different notions of things. I looked now upon the world as a thing remote, which I had nothing to do with, no expectations from, and, indeed, no desires about: in a word, I had nothing indeed to do with it, nor was ever likely to have, so I thought it looked, as we may perhaps look upon it hereafter—viz. as a place I had lived in, but was come out of it; and well might I say, as Father Abraham to Dives, "Between me and thee is a great gulf fixed."

In the first place, I was removed from all the wickedness of the world here; I had neither the lusts of the flesh, the lusts of the eye, nor the pride of life. I had nothing to covet, for I had all that I was now capable of enjoying; I was lord of the whole manor; or, if I pleased, I might call myself king or emperor over the whole country which I had possession of: there were no rivals; I had no competitor, none to dispute sovereignty or command with me: I might have raised ship-loadings of corn, but I had no use for it; so I let as little grow as I thought enough for my occasion. I had tortoise or turtle enough, but now and then one was as much as I could put to any use: I had timber enough to have built a fleet of ships; and I had grapes enough to have made wine, or to have cured into raisins, to have loaded that fleet when it had been built.

But all I could make use of was all that was valuable: I had enough to eat and supply my wants, and what was all the rest to me? If I killed more flesh than I could eat, the dog must eat it, or vermin; if I sowed more corn than I could eat, it must be spoiled; the trees that I cut down were lying to rot on the ground; I could make no more use of them but for fuel, and that I had no occasion for but to dress my food.

In a word, the nature and experience of things dictated to me, upon just reflection, that all the good things of this world are no farther good to us than they are for our use; and that, whatever we may heap up to give others, we enjoy just as much as we can use, and no more. The most covetous, griping miser in the world would have been cured of the vice of covetousness if he had been in my case; for I possessed infinitely more than I knew what to do with. I had no room for desire, except it was of things which I had not, and they were but trifles, though, indeed, of great use to me. I had, as I hinted before, a parcel of money, as well gold as silver, about thirty-six pounds sterling.

Alas! there the sorry, useless stuff lay; I had no more manner of business for it; and often thought with myself that I would have given a handful of it for a gross of tobacco-pipes; or for a hand-mill to grind my corn; nay, I would have given it all for a sixpenny-worth of turnip and carrot seed out of England, or for a handful of peas and beans, and a bottle of ink. As it was, I had not the least advantage by it or benefit from it; but there it lay in a drawer, and grew mouldy with the damp of the cave in the wet seasons; and if I had had the drawer full of diamonds, it had been the same case—they had been of no manner of value to me, because of no use.

I had now brought my state of life to be much easier in itself than it was at first, and much easier to my mind, as well as to my body. I frequently sat down to meat with thankfulness, and admired the hand of God's providence, which had thus spread my table in the wilderness. I learned to look more upon the bright side of my condition, and less upon the dark side, and to consider what I enjoyed rather than what I wanted; and this gave me sometimes such secret comforts, that I cannot express them; and which I take notice of here, to put those discontented people in mind of it, who cannot enjoy comfortably what God has given them, because they see and covet something that He has not given them. All our discontents about what we want appeared to me to spring from the want of thankfulness for what we have.

Another reflection was of great use to me, and doubtless would be so to any one that should fall into such distress as mine was; and this was, to compare my present condition with what I at first expected it would be; nay, with what it would certainly have been, if the good providence of God had not wonderfully ordered the ship to be cast up nearer to the shore, where I not only could come at her, but could bring what I got out of her to the shore, for my relief and comfort; without which, I had wanted for tools to work, weapons for defence, and gunpowder and shot for getting my food.

I spent whole hours, I may say whole days, in representing to myself, in the most lively colours, how I must have acted if I had got nothing out of the ship. How I could not have so much as got any food, except fish and turtles; and that, as it was long before I found any of them, I must have perished first; that I should have lived, if I had not perished, like a mere savage; that if I had killed a goat or a fowl, by any contrivance, I had no way to flay or open it, or part the flesh from the skin and the bowels, or to cut it up; but must gnaw it with my teeth, and pull it with my claws, like a beast.

These reflections made me very sensible of the goodness of Providence to me, and very thankful for my present condition, with all its hardships and misfortunes; and this part also I cannot but recommend to the reflection of those who are apt, in their misery, to say, "Is any affliction like mine?" Let them consider how much worse the cases of some people are, and their case might have been, if Providence had thought fit.

I had another reflection, which assisted me also to comfort my mind with hopes; and this was comparing my present situation with what I had deserved, and had therefore reason to expect from the hand of Providence. I had lived a dreadful life, perfectly destitute of the knowledge and fear of God. I had been well instructed by father and mother; neither had they been wanting to me in their early endeavours to infuse a religious awe of God into my mind, a sense of my duty, and what the nature and end of my being required of me. But, alas! falling early into the seafaring life, which of all lives is the most destitute of the fear of God, though His terrors are always before them; I say, falling early into the seafaring life, and into seafaring company, all that little sense of religion which I had entertained was laughed out of me by my messmates; by a hardened despising of dangers, and the views of death, which grew habitual to me by my long absence from all manner of opportunities to converse with anything but what was like myself, or to hear anything that was good or tended towards it.

So void was I of everything that was good, or the least sense of what I was, or was to be, that, in the greatest deliverances I enjoyed—such as my escape from Sallee; my being taken up by the Portuguese master of the ship; my being planted so well in the Brazils; my receiving the cargo from England, and the like—I never had once the words "Thank God!" so much as on my mind, or in my mouth; nor in the greatest distress had I so much as a thought to pray to Him, or so much as to say, "Lord, have mercy upon me!" no, nor to mention the name of God, unless it was to swear by, and blaspheme it.

I had terrible reflections upon my mind for many months, as I have already observed, on account of my wicked and hardened life past; and when I looked about me, and considered what particular providences had attended me since my coming into this place, and how God had dealt bountifully with me—had not only punished me less than my iniquity had deserved, but had so plentifully provided for me—this gave me great hopes that my repentance was accepted, and that God had yet mercy in store for me.

With these reflections I worked my mind up, not only to a resignation to the will of God in the present disposition of my circumstances, but even to a sincere thankfulness for my condition; and that I, who was yet a living man, ought not to complain, seeing I had not the due punishment of my sins; that I enjoyed so many mercies which I had no reason to have expected in that place; that I ought never more to repine at my condition, but to rejoice, and to give daily thanks for that daily bread, which nothing but a crowd of wonders could have brought; that I ought to consider I had been fed even by a miracle, even as great as that of feeding Elijah by ravens, nay, by a long series of miracles; and that I could hardly have named a place in the uninhabitable part of the world where I could have been cast more to my advantage; a place where, as I had no society, which was my affliction on one hand, so I found no ravenous beasts, no furious wolves or tigers, to threaten my life; no venomous creatures, or poisons, which I might feed on to my hurt; no savages to murder and devour me.

In a word, as my life was a life of sorrow one way, so it was a life of mercy another; and I wanted nothing to make it a life of comfort but to be able to make my sense of God's goodness to me, and care over me in this condition, be my daily consolation; and after I did make a just improvement on these things, I went away, and was no more sad. I had now been here so long that many things which I had brought on shore for my help were either quite gone, or very much wasted and near spent.

My ink, as I observed, had been gone some time, all but a very little, which I eked out with water, a little and a little, till it was so pale, it scarce left any appearance of black upon the paper. As long as it lasted I made use of it to minute down the days of the month on which any remarkable thing happened to me; and first, by casting up times past, I remembered that there was a strange concurrence of days in the various providences which befell me, and which, if I had been superstitiously inclined to observe days as fatal or fortunate, I might have had reason to have looked upon with a great deal of curiosity.

First, I had observed that the same day that I broke away from my father and friends and ran away to Hull, in order to go to sea, the same day afterwards I was taken by the Sallee man-of-war, and made a slave; the same day of the year that I escaped out of the wreck of that ship in Yarmouth Roads, that same day-year afterwards I made my escape from Sallee in a boat; the same day of the year I was born on—viz. the 30th of September, that same day I had my life so miraculously saved twenty-six years after, when I was cast on shore in this island; so that my wicked life and my solitary life began both on a day.

The next thing to my ink being wasted was that of my bread—I mean the biscuit which I brought out of the ship; this I had husbanded to the last degree, allowing myself but one cake of bread a-day for above a year; and yet I was quite without bread for near a year before I got any corn of my own, and great reason I had to be thankful that I had any at all, the getting it being, as has been already observed, next to miraculous.

My clothes, too, began to decay; as to linen, I had had none a good while, except some chequered shirts which I found in the chests of the other seamen, and which I carefully preserved; because many times I could bear no other clothes on but a shirt; and it was a very great help to me that I had, among all the men's clothes of the ship, almost three dozen of shirts. There were also, indeed, several thick watch-coats of the seamen's which were left, but they were too hot to wear; and though it is true that the weather was so violently hot that there was no need of clothes, yet I could not go quite naked—no, though I had been inclined to it, which I was not—nor could I abide the thought of it, though I was alone.

The reason why I could not go naked was, I could not bear the heat of the sun so well when quite naked as with some clothes on; nay, the very heat frequently blistered my skin: whereas, with a shirt on, the air itself made some motion, and whistling under the shirt, was twofold cooler than without it. No more could I ever bring myself to go out in the heat of the sun without a cap or a hat; the heat of the sun, beating with such violence as it does in that place, would give me the headache presently, by darting so directly on my head, without a cap or hat on, so that I could not bear it; whereas, if I put on my hat it would presently go away.

Upon these views I began to consider about putting the few rags I had, which I called clothes, into some order; I had worn out all the waistcoats I had, and my business was now to try if I could not make jackets out of the great watch-coats which I had by me, and with such other materials as I had; so I set to work, tailoring, or rather, indeed, botching, for I made most piteous work of it. However, I made shift to make two or three new waistcoats, which I hoped would serve me a great while: as for breeches or drawers, I made but a very sorry shift indeed till afterwards.

I have mentioned that I saved the skins of all the creatures that I killed, I mean four-footed ones, and I had them hung up, stretched out with sticks in the sun, by which means some of them were so dry and hard that they were fit for little, but others were very useful. The first thing I made of these was a great cap for my head, with the hair on the outside, to shoot off the rain; and this I performed so well, that after I made me a suit of clothes wholly of these skins—that is to say, a waistcoat, and breeches open at the knees, and both loose, for they were rather wanting to keep me cool than to keep me warm. I must not omit to acknowledge that they were wretchedly made; for if I was a bad carpenter, I was a worse tailor. However, they were such as I made very good shift with, and when I was out, if it happened to rain, the hair of my waistcoat and cap being outermost, I was kept very dry.

After this, I spent a great deal of time and pains to make an umbrella; I was, indeed, in great want of one, and had a great mind to make one; I had seen them made in the Brazils, where they are very useful in the great heats there, and I felt the heats every jot as great here, and greater too, being nearer the equinox; besides, as I was obliged to be much abroad, it was a most useful thing to me, as well for the rains as the heats. I took a world of pains with it, and was a great while before I could make anything likely to hold: nay, after I had thought I had hit the way, I spoiled two or three before I made one to my mind: but at last I made one that answered indifferently well: the main difficulty I found was to make it let down. I could make it spread, but if it did not let down too, and draw in, it was not portable for me any way but just over my head, which would not do. However, at last, as I said, I made one to answer, and covered it with skins, the hair upwards, so that it cast off the rain like a pent-house, and kept off the sun so effectually, that I could walk out in the hottest of the weather with greater advantage than I could before in the coolest, and when I had no need of it could close it, and carry it under my arm.

Thus I lived mighty comfortably, my mind being entirely composed by resigning myself to the will of God, and throwing myself wholly upon the disposal of His providence. This made my life better than sociable, for when I began to regret the want of conversation I would ask myself, whether thus conversing mutually with my own thoughts, and (as I hope I may say) with even God Himself, by ejaculations, was not better than the utmost enjoyment of human society in the world?

Chapter 10 - Tames Goats

I cannot say that after this, for five years, any extraordinary thing happened to me, but I lived on in the same course, in the same posture and place, as before; the chief things I was employed in, besides my yearly labour of planting my barley and rice, and curing my raisins, of both which I always kept up just enough to have sufficient stock of one year's provisions beforehand; I say, besides this yearly labour, and my daily pursuit of going out with my gun, I had one labour, to make a canoe, which at last I finished: so that, by digging a canal to it of six feet wide and four feet deep, I brought it into the creek, almost half a mile.

As for the first, which was so vastly big, for I made it without considering beforehand, as I ought to have done, how I should be able to launch it, so, never being able to bring it into the water, or bring the water to it, I was obliged to let it lie where it was as a memorandum to teach me to be wiser the next time: indeed, the next time, though I could not get a tree proper for it, and was in a place where I could not get the water to it at any less distance than, as I have said, near half a mile, yet, as I saw it was practicable at last, I never gave it over; and though I was near two years about it, yet I never grudged my labour, in hopes of having a boat to go off to sea at last.

However, though my little periagua was finished, yet the size of it was not at all answerable to the design which I had in view when I made the first; I mean of venturing over to the terra firma, where it was above forty miles broad; accordingly, the smallness of my boat assisted to put an end to that design, and now I thought no more of it. As I had a boat, my next design was to make a cruise round the island; for as I had been on the other side in one place, crossing, as I have already described it, over the land, so the discoveries I made in that little journey made me very eager to see other parts of the coast; and now I had a boat, I thought of nothing but sailing round the island.

For this purpose, that I might do everything with discretion and consideration, I fitted up a little mast in my boat, and made a sail too out of some of the pieces of the ship's sails which lay in store, and of which I had a great stock by me. Having fitted my mast and sail, and tried the boat, I found she would sail very well; then I made little lockers or boxes at each end of my boat, to put provisions, necessaries, ammunition, &c., into, to be kept dry, either from rain or the spray of the sea; and a little, long, hollow place I cut in the inside of the boat, where I could lay my gun, making a flap to hang down over it to keep it dry.

I fixed my umbrella also in the step at the stern, like a mast, to stand over my head, and keep the heat of the sun off me, like an awning; and thus I every now and then took a little voyage upon the sea, but never went far out, nor far from the little creek. At last, being eager to view the circumference of my little kingdom, I resolved upon my cruise; and accordingly I victualled my ship for the voyage, putting in two dozen of loaves (cakes I should call them) of barley-bread, an earthen pot full of parched rice (a food I ate a good deal of), a little bottle of rum, half a goat, and powder and shot for killing more, and two large watch-coats, of those which, as I mentioned before, I had saved out of the seamen's chests; these I took, one to lie upon, and the other to cover me in the night.

It was the 6th of November, in the sixth year of my reign—or my captivity, which you please—that I set out on this voyage, and I found it much longer than I expected; for though the island itself was not very large, yet when I came to the east side of it, I found a great ledge of rocks lie out about two leagues into the sea, some above water, some under it; and beyond that a shoal of sand, lying dry half a league more, so that I was obliged to go a great way out to sea to double the point.

When I first discovered them, I was going to give over my enterprise, and come back again, not knowing how far it might oblige me to go out to sea; and above all, doubting how I should get back again: so I came to an anchor; for I had made a kind of an anchor with a piece of a broken grappling which I got out of the ship.

Having secured my boat, I took my gun and went on shore, climbing up a hill, which seemed to overlook that point where I saw the full extent of it, and resolved to venture.

In my viewing the sea from that hill where I stood, I perceived a strong, and indeed a most furious current, which ran to the east, and even came close to the point; and I took the more notice of it because I saw there might be some danger that when I came into it I might be carried out to sea by the strength of it, and not be able to make the island again; and indeed, had I not got first upon this hill, I believe it would have been so; for there was the same current on the other side the island, only that it set off at a further distance, and I saw there was a strong eddy under the shore; so I had nothing to do but to get out of the first current, and I should presently be in an eddy.

I lay here, however, two days, because the wind blowing pretty fresh at ESE., and that being just contrary to the current, made a great breach of the sea upon the point: so that it was not safe for me to keep too close to the shore for the breach, nor to go too far off, because of the stream.

The third day, in the morning, the wind having abated overnight, the sea was calm, and I ventured: but I am a warning to all rash and ignorant pilots; for no sooner was I come to the point, when I was not even my boat's length from the shore, but I found myself in a great depth of water, and a current like the sluice of a mill; it carried my boat along with it with such violence that all I could do could not keep her so much as on the edge of it; but I found it hurried me farther and farther out from the eddy, which was on my left hand. There was no wind stirring to help me, and all I could do with my paddles signified nothing: and now I began to give myself over for lost; for as the current was on both sides of the island, I knew in a few leagues distance they must join again, and then I was irrecoverably gone; nor did I see any possibility of avoiding it; so that I had no prospect before me but of perishing, not by the sea, for that was calm enough, but of starving from hunger. I had, indeed, found a tortoise on the shore, as big almost as I could lift, and had tossed it into the boat; and I had a great jar of fresh water, that is to say, one of my earthen pots; but what was all this to being driven into the vast ocean, where, to be sure, there was no shore, no mainland or island, for a thousand leagues at least?

And now I saw how easy it was for the providence of God to make even the most miserable condition of mankind worse. Now I looked back upon my desolate, solitary island as the most pleasant place in the world and all the happiness my heart could wish for was to be but there again. I stretched out my hands to it, with eager wishes—"O happy desert!" said I, "I shall never see thee more. O miserable creature! whither am going?" Then I reproached myself with my unthankful temper, and that I had repined at my solitary condition; and now what would I give to be on shore there again! Thus, we never see the true state of our condition till it is illustrated to us by its contraries, nor know how to value what we enjoy, but by the want of it. It is scarcely possible to imagine the consternation I was now in, being driven from my beloved island (for so it appeared to me now to be) into the wide ocean, almost two leagues, and in the utmost despair of ever recovering it again. However, I worked hard till, indeed, my strength was almost exhausted, and kept my boat as much to the northward, that is, towards the side of the current which the eddy lay on, as possibly I could; when about noon, as the sun passed the meridian, I thought I felt a little breeze of wind in my face, springing up from SSE. This cheered my heart a little, and especially when, in about half-an-hour more, it blew a pretty gentle gale. By this time I had got at a frightful distance from the island, and had the least cloudy or hazy weather intervened, I had been undone another way, too; for I had no compass on board, and should never have known how to have steered towards the island, if I had but once lost sight of it; but the weather continuing clear, I applied myself to get up my mast again, and spread my sail, standing away to the north as much as possible, to get out of the current.

Just as I had set my mast and sail, and the boat began to stretch away, I saw even by the clearness of the water some alteration of the current was near; for where the current was so strong the water was foul; but perceiving the water clear, I found the current abate; and presently I found to the east, at about half a mile, a breach of the sea upon some rocks: these rocks I found caused the current to part again, and as the main stress of it ran away more southerly, leaving the rocks to the north-east, so the other returned by the repulse of the rocks, and made a strong eddy, which ran back again to the north-west, with a very sharp stream.

They who know what it is to have a reprieve brought to them upon the ladder, or to be rescued from thieves just going to murder them, or who have been in such extremities, may guess what my present surprise of joy was, and how gladly I put my boat into the stream of this eddy; and the wind also freshening, how gladly I spread my sail to it, running cheerfully before the wind, and with a strong tide or eddy underfoot.

This eddy carried me about a league on my way back again, directly towards the island, but about two leagues more to the northward than the current which carried me away at first; so that when I came near the island, I found myself open to the northern shore of it, that is to say, the other end of the island, opposite to that which I went out from.

When I had made something more than a league of way by the help of this current or eddy, I found it was spent, and served me no further. However, I found that being between two great currents—viz. that on the south side, which had hurried me away, and that on the north, which lay about a league on the other side; I say, between these two, in the wake of the island, I found the water at least still, and running no way; and having still a breeze of wind fair for me, I kept on steering directly for the island, though not making such fresh way as I did before.

About four o'clock in the evening, being then within a league of the island, I found the point of the rocks which occasioned this disaster stretching out, as is described before, to the southward, and casting off the current more southerly, had, of course, made another eddy to the north; and this I found very strong, but not directly setting the way my course lay, which was due west, but almost full north. However, having a fresh gale, I stretched across this eddy, slanting north-west; and in about an hour came within about a mile of the shore, where, it being smooth water, I soon got to land.

When I was on shore, God I fell on my knees and gave God thanks for my deliverance, resolving to lay aside all thoughts of my deliverance by my boat; and refreshing myself with such things as I had, I brought my boat close to the shore, in a little cove that I had spied under some trees, and laid me down to sleep, being quite spent with the labour and fatigue of the voyage.

I was now at a great loss which way to get home with my boat! I had run so much hazard, and knew too much of the case, to think of attempting it by the way I went out; and what might be at the other side (I mean the west side) I knew not, nor had I any mind to run any more ventures; so I resolved on the next morning to make my way westward along the shore, and to see if there was no creek where I might lay up my frigate in safety, so as to have her again if I wanted her. In about three miles or thereabouts, coasting the shore, I came to a very good inlet or bay, about a mile over, which narrowed till it came to a very little rivulet or brook, where I found a very convenient harbour for my boat, and where she lay as if she had been in a little dock made on purpose for her. Here I put in, and having stowed my boat very safe, I went on shore to look about me, and see where I was.

I soon found I had but a little passed by the place where I had been before, when I travelled on foot to that shore; so taking nothing out of my boat but my gun and umbrella, for it was exceedingly hot, I began my march. The way was comfortable enough after such a voyage as I had been upon, and I reached my old bower in the evening, where I found everything standing as I left it; for I always kept it in good order, being, as I said before, my country house.

I got over the fence, and laid me down in the shade to rest my limbs, for I was very weary, and fell asleep; but judge you, if you can, that read my story, what a surprise I must be in when I was awaked out of my sleep by a voice calling me by my name several times, "Robin, Robin, Robin Crusoe: poor Robin Crusoe! Where are you, Robin Crusoe? Where are you? Where have you been?"

I was so dead asleep at first, being fatigued with rowing, or part of the day, and with walking the latter part, that I did not wake thoroughly; but dozing thought I dreamed that somebody spoke to me; but as the voice continued to repeat, "Robin Crusoe, Robin Crusoe," at last I began to wake more perfectly, and was at first dreadfully frightened, and started up in the utmost consternation; but no sooner were my eyes open, but I saw my Poll sitting on the top of the hedge; and immediately knew that it was he that spoke to me; for just in such bemoaning language I had used to talk to him and teach him; and he had learned it so perfectly that he would sit upon my finger, and lay his bill close to my face and cry, "Poor Robin Crusoe! Where are you? Where have you been? How came you here?" and such things as I had taught him.

However, even though I knew it was the parrot, and that indeed it could be nobody else, it was a good while before I could compose myself. First, I was amazed how the creature got thither; and then, how he should just keep about the place, and nowhere else; but as I was well satisfied it could be nobody but honest Poll, I got over it; and holding out my hand, and calling him by his name, "Poll," the sociable creature came to me, and sat upon my thumb, as he used to do, and continued talking to me, "Poor Robin Crusoe! and how did I come here? and where had I been?" just as if he had been overjoyed to see me again; and so I carried him home along with me.

I had now had enough of rambling to sea for some time, and had enough to do for many days to sit still and reflect upon the danger I had been in. I would have been very glad to have had my boat again on my side of the island; but I knew not how it was practicable to get it about. As to the east side of the island, which I had gone round, I knew well enough there was no venturing that way; my very heart would shrink, and my very blood run chill, but to think of it; and as to the other side of the island, I did not know how it might be there; but supposing the current ran with the same force against the shore at the east as it passed by it on the other, I might run the same risk of being driven down the stream, and carried by the island, as I had been before of being carried away from it: so with these thoughts, I contented myself to be without any boat, though it had been the product of so many months' labour to make it, and of so many more to get it into the sea.

In this government of my temper I remained near a year; and lived a very sedate, retired life, as you may well suppose; and my thoughts being very much composed as to my condition, and fully comforted in resigning myself to the dispositions of Providence, I thought I lived really very happily in all things except that of society.

I improved myself in this time in all the mechanic exercises which my necessities put me upon applying myself to; and I believe I should, upon occasion, have made a very good carpenter, especially considering how few tools I had.

Besides this, I arrived at an unexpected perfection in my earthenware, and contrived well enough to make them with a wheel, which I found infinitely easier and better; because I made things round and shaped, which before were filthy things indeed to look on. But I think I was never more vain of my own performance, or more joyful for anything I found out, than for my being able to make a tobacco-pipe; and though it was a very ugly, clumsy thing when it was done, and only burned red, like other earthenware, yet as it was hard and firm, and would draw the smoke, I was exceedingly comforted with it, for I had been always used to smoke; and there were pipes in the ship, but I forgot them at first, not thinking there was tobacco in the island; and afterwards, when I searched the ship again, I could not come at any pipes.

In my wicker-ware also I improved much, and made abundance of necessary baskets, as well as my invention showed me; though not very handsome, yet they were such as were very handy and convenient for laying things up in, or fetching things home. For example, if I killed a goat abroad, I could hang it up in a tree, flay it, dress it, and cut it in pieces, and bring it home in a basket; and the like by a turtle; I could cut it up, take out the eggs and a piece or two of the flesh, which was enough for me, and bring them home in a basket, and leave the rest behind me. Also, large deep baskets were the receivers of my corn, which I always rubbed out as soon as it was dry and cured, and kept it in great baskets.

I began now to perceive my powder abated considerably; this was a want which it was impossible for me to supply, and I began seriously to consider what I must do when I should have no more powder; that is to say, how I should kill any goats. I had, as is observed in the third year of my being here, kept a young kid, and bred her up tame, and I was in hopes of getting a he-goat; but I could not by any means bring it to pass, till my kid grew an old goat; and as I could never find in my heart to kill her, she died at last of mere age.

But being now in the eleventh year of my residence, and, as I have said, my ammunition growing low, I set myself to study some art to trap and snare the goats, to see whether I could not catch some of them alive; and particularly I wanted a she-goat great with young. For this purpose I made snares to hamper them; and I do believe they were more than once taken in them; but my tackle was not good, for I had no wire, and I always found them broken and my bait devoured.

At length I resolved to try a pitfall; so I dug several large pits in the earth, in places where I had observed the goats used to feed, and over those pits I placed hurdles of my own making too, with a great weight upon them; and several times I put ears of barley and dry rice without setting the trap; and I could easily perceive that the goats had gone in and eaten up the corn, for I could see the marks of their feet. At length I set three traps in one night, and going the next morning I found them, all standing, and yet the bait eaten and gone; this was very discouraging. However, I altered my traps; and not to trouble you with particulars, going one morning to see my traps, I found in one of them a large old he-goat; and in one of the others three kids, a male and two females.

As to the old one, I knew not what to do with him; he was so fierce I durst not go into the pit to him; that is to say, to bring him away alive, which was what I wanted. I could have killed him, but that was not my business, nor would it answer my end; so I even let him out, and he ran away as if he had been frightened out of his wits. But I did not then know what I afterwards learned, that hunger will tame a lion. If I had let him stay three or four days without food, and then have carried him some water to drink and then a little corn, he would have been as tame as one of the kids; for they are mighty sagacious, tractable creatures, where they are well used.

However, for the present I let him go, knowing no better at that time: then I went to the three kids, and taking them one by one, I tied them with strings together, and with some difficulty brought them all home.

It was a good while before they would feed; but throwing them some sweet corn, it tempted them, and they began to be tame. And now I found that if I expected to supply myself with goats' flesh, when I had no powder or shot left, breeding some up tame was my only way, when, perhaps, I might have them about my house like a flock of sheep. But then it occurred to me that I must keep the tame from the wild, or else they would always run wild when they grew up; and the only way for this was to have some enclosed piece of ground, well fenced either with hedge or pale, to keep them in so effectually, that those within might not break out, or those without break in.

This was a great undertaking for one pair of hands yet, as I saw there was an absolute necessity for doing it, my first work was to find out a proper piece of ground, where there was likely to be herbage for them to eat, water for them to drink, and cover to keep them from the sun.

Those who understand such enclosures will think I had very little contrivance when I pitched upon a place very proper for all these (being a plain, open piece of meadow land, or savannah, as our people call it in the western colonies), which had two or three little drills of fresh water in it, and at one end was very woody—I say, they will smile at my forecast, when I shall tell them I began by enclosing this piece of ground in such a manner that, my hedge or pale must have been at least two miles about. Nor was the madness of it so great as to the compass, for if it was ten miles about, I was like to have time enough to do it in; but I did not consider that my goats would be as wild in so much compass as if they had had the whole island, and I should have so much room to chase them in that I should never catch them.

My hedge was begun and carried on, I believe, about fifty yards when this thought occurred to me; so I presently stopped short, and, for the beginning, I resolved to enclose a piece of about one hundred and fifty yards in length, and one hundred yards in breadth, which, as it would maintain as many as I should have in any reasonable time, so, as my stock increased, I could add more ground to my enclosure.

This was acting with some prudence, and I went to work with courage. I was about three months hedging in the first piece; and, till I had done it, I tethered the three kids in the best part of it, and used them to feed as near me as possible, to make them familiar; and very often I would go and carry them some ears of barley, or a handful of rice, and feed them out of my hand; so that after my enclosure was finished and I let them loose, they would follow me up and down, bleating after me for a handful of corn.

This answered my end, and in about a year and a half I had a flock of about twelve goats, kids and all; and in two years more I had three-and-forty, besides several that I took and killed for my food. After that, I enclosed five several pieces of ground to feed them in, with little pens to drive them to take them as I wanted, and gates out of one piece of ground into another.

But this was not all; for now I not only had goat's flesh to feed on when I pleased, but milk too—a thing which, indeed, in the beginning, I did not so much as think of, and which, when it came into my thoughts, was really an agreeable surprise, for now I set up my dairy, and had sometimes a gallon or two of milk in a day. And as Nature, who gives supplies of food to every creature, dictates even naturally how to make use of it, so I, that had never milked a cow, much less a goat, or seen butter or cheese made only when I was a boy, after a great many essays and miscarriages, made both butter and cheese at last, also salt (though I found it partly made to my hand by the heat of the sun upon some of the rocks of the sea), and never wanted it afterwards.

How mercifully can our Creator treat His creatures, even in those conditions in which they seemed to be overwhelmed in destruction! How can He sweeten the bitterest providences, and give us cause to praise Him for dungeons and prisons! What a table was here spread for me in the wilderness, where I saw nothing at first but to perish for hunger!

Chapter 11 - Finds Print Of Man's Foot On The Sand

It would have made a Stoic smile to have seen me and my little family sit down to dinner. There was my majesty the prince and lord of the whole island; I had the lives of all my subjects at my absolute command; I could hang, draw, give liberty, and take it away, and no rebels among all my subjects. Then, to see how like a king I dined, too, all alone, attended by my servants! Poll, as if he had been my favourite, was the only person permitted to talk to me. My dog, who was now grown old and crazy, and had found no species to multiply his kind upon, sat always at my right hand; and two cats, one on one side of the table and one on the other, expecting now and then a bit from my hand, as a mark of especial favour.

But these were not the two cats which I brought on shore at first, for they were both of them dead, and had been interred near my habitation by my own hand; but one of them having multiplied by I know not what kind of creature, these were two which I had preserved tame; whereas the rest ran wild in the woods, and became indeed troublesome to me at last, for they would often come into my house, and plunder me too, till at last I was obliged to shoot them, and did kill a great many; at length they left me. With this attendance and in this plentiful manner I lived; neither could I be said to want anything but society; and of that, some time after this, I was likely to have too much.

I was something impatient, as I have observed, to have the use of my boat, though very loath to run any more hazards; and therefore sometimes I sat contriving ways to get her about the island, and at other times I sat myself down contented enough without her. But I had a strange uneasiness in my mind to go down to the point of the island where, as I have said in my last ramble, I went up the hill to see how the shore lay, and how the current set, that I might see what I had to do: this inclination increased upon me every day, and at length I resolved to travel thither by land, following the edge of the shore. I did so; but had any one in England met such a man as I was, it must either have frightened him, or raised a great deal of laughter; and as I frequently stood still to look at myself, I could not but smile at the notion of my travelling through Yorkshire with such an equipage, and in such a dress. Be pleased to take a sketch of my figure, as follows.

I had a great high shapeless cap, made of a goat's skin, with a flap hanging down behind, as well to keep the sun from me as to shoot the rain off from running into my neck, nothing being so hurtful in these climates as the rain upon the flesh under the clothes.

I had a short jacket of goat's skin, the skirts coming down to about the middle of the thighs, and a pair of open-kneed breeches of the same; the breeches were made of the skin of an old he-goat, whose hair hung down such a length on either side that, like pantaloons, it reached to the middle of my legs; stockings and shoes I had none, but had made me a pair of somethings, I scarce knew what to call them, like buskins, to flap over my legs, and lace on either side like spatterdashes, but of a most barbarous shape, as indeed were all the rest of my clothes.

I had on a broad belt of goat's skin dried, which I drew together with two thongs of the same instead of buckles, and in a kind of a frog on either side of this, instead of a sword and dagger, hung a little saw and a hatchet, one on one side and one on the other. I had another belt not so broad, and fastened in the same manner, which hung over my shoulder, and at the end of it, under my left arm, hung two pouches, both made of goat's skin too, in one of which hung my powder, in the other my shot. At my back I carried my basket, and on my shoulder my gun, and over my head a great clumsy, ugly, goat's-skin umbrella, but which, after all, was the most necessary thing I had about me next to my gun.

As for my face, the colour of it was really not so mulatto-like as one might expect from a man not at all careful of it, and living within nine or ten degrees of the equinox. My beard I had once suffered to grow till it was about a quarter of a yard long; but as I had both scissors and razors sufficient, I had cut it pretty short, except what grew on my upper lip, which I had trimmed into a large pair of Mahometan whiskers, such as I had seen worn by some Turks at Sallee, for the Moors did not wear such, though the Turks did; of these moustachios, or whiskers, I will not say they were long enough to hang my hat upon them, but they were of a length and shape monstrous enough, and such as in England would have passed for frightful.

But all this is by-the-bye; for as to my figure, I had so few to observe me that it was of no manner of consequence, so I say no more of that. In this kind of dress I went my new journey, and was out five or six days. I travelled first along the sea-shore, directly to the place where I first brought my boat to an anchor to get upon the rocks; and having no boat now to take care of, I went over the land a nearer way to the same height that I was upon before, when, looking forward to the points of the rocks which lay out, and which I was obliged to double with my boat, as is said above, I was surprised to see the sea all smooth and quiet—no rippling, no motion, no current, any more there than in other places.

I was at a strange loss to understand this, and resolved to spend some time in the observing it, to see if nothing from the sets of the tide had occasioned it; but I was presently convinced how it was—viz. that the tide of ebb setting from the west, and joining with the current of waters from some great river on the shore, must be the occasion of this current, and that, according as the wind blew more forcibly from the west or from the north, this current came nearer or went farther from the shore; for, waiting thereabouts till evening, I went up to the rock again, and then the tide of ebb being made, I plainly saw the current again as before, only that it ran farther off, being near half a league from the shore, whereas in my case it set close upon the shore, and hurried me and my canoe along with it, which at another time it would not have done.

This observation convinced me that I had nothing to do but to observe the ebbing and the flowing of the tide, and I might very easily bring my boat about the island again; but when I began to think of putting it in practice, I had such terror upon my spirits at the remembrance of the danger I had been in, that I could not think of it again with any patience, but, on the contrary, I took up another resolution, which was more safe, though more laborious—and this was, that I would build, or rather make, me another periagua or canoe, and so have one for one side of the island, and one for the other.

You are to understand that now I had, as I may call it, two plantations in the island—one my little fortification or tent, with the wall about it, under the rock, with the cave behind me, which by this time I had enlarged into several apartments or caves, one within another. One of these, which was the driest and largest, and had a door out beyond my wall or fortification—that is to say, beyond where my wall joined to the rock—was all filled up with the large earthen pots of which I have given an account, and with fourteen or fifteen great baskets, which would hold five or six bushels each, where I laid up my stores of provisions, especially my corn, some in the ear, cut off short from the straw, and the other rubbed out with my hand.

As for my wall, made, as before, with long stakes or piles, those piles grew all like trees, and were by this time grown so big, and spread so very much, that there was not the least appearance, to any one's view, of any habitation behind them.

Near this dwelling of mine, but a little farther within the land, and upon lower ground, lay my two pieces of corn land, which I kept duly cultivated and sowed, and which duly yielded me their harvest in its season; and whenever I had occasion for more corn, I had more land adjoining as fit as that.

Besides this, I had my country seat, and I had now a tolerable plantation there also; for, first, I had my little bower, as I called it, which I kept in repair—that is to say, I kept the hedge which encircled it in constantly fitted up to its usual height, the ladder standing always in the inside. I kept the trees, which at first were no more than stakes, but were now grown very firm and tall, always cut, so that they might spread and grow thick and wild, and make the more agreeable shade, which they did effectually to my mind. In the middle of this I had my tent always standing, being a piece of a sail spread over poles, set up for that purpose, and which never wanted any repair or renewing; and under this I had made me a squab or couch with the skins of the creatures I had killed, and with other soft things, and a blanket laid on them, such as belonged to our sea-bedding, which I had saved; and a great watch-coat to cover me. And here, whenever I had occasion to be absent from my chief seat, I took up my country habitation.

Adjoining to this I had my enclosures for my cattle, that is to say my goats, and I had taken an inconceivable deal of pains to fence and enclose this ground. I was so anxious to see it kept entire, lest the goats should break through, that I never left off till, with infinite labour, I had stuck the outside of the hedge so full of small stakes, and so near to one another, that it was rather a pale than a hedge, and there was scarce room to put a hand through between them; which afterwards, when those stakes grew, as they all did in the next rainy season, made the enclosure strong like a wall, indeed stronger than any wall.

This will testify for me that I was not idle, and that I spared no pains to bring to pass whatever appeared necessary for my comfortable support, for I considered the keeping up a breed of tame creatures thus at my hand would be a living magazine of flesh, milk, butter, and cheese for me as long as I lived in the place, if it were to be forty years; and that keeping them in my reach depended entirely upon my perfecting my enclosures to such a degree that I might be sure of keeping them together; which by this method, indeed, I so effectually secured, that when these little stakes began to grow, I had planted them so very thick that I was forced to pull some of them up again.

In this place also I had my grapes growing, which I principally depended on for my winter store of raisins, and which I never failed to preserve very carefully, as the best and most agreeable dainty of my whole diet; and indeed they were not only agreeable, but medicinal, wholesome, nourishing, and refreshing to the last degree.

As this was also about half-way between my other habitation and the place where I had laid up my boat, I generally stayed and lay here in my way thither, for I used frequently to visit my boat; and I kept all things about or belonging to her in very good order. Sometimes I went out in her to divert myself, but no more hazardous voyages would I go, scarcely ever above a stone's cast or two from the shore, I was so apprehensive of being hurried out of my knowledge again by the currents or winds, or any other accident. But now I come to a new scene of my life.

It happened one day, about noon, going towards my boat, I was exceedingly surprised with the print of a man's naked foot on the shore, which was very plain to be seen on the sand. I stood like one thunderstruck, or as if I had seen an apparition. I listened, I looked round me, but I could hear nothing, nor see anything; I went up to a rising ground to look farther; I went up the shore and down the shore, but it was all one; I could see no other impression but that one. I went to it again to see if there were any more, and to observe if it might not be my fancy; but there was no room for that, for there was exactly the print of a foot—toes, heel, and every part of a foot. How it came thither I knew not, nor could I in the least imagine; but after innumerable fluttering thoughts, like a man perfectly confused and out of myself, I came home to my fortification, not feeling, as we say, the ground I went on, but terrified to the last degree, looking behind me at every two or three steps, mistaking every bush and tree, and fancying every stump at a distance to be a man. Nor is it possible to describe how many various shapes my affrighted imagination represented things to me in, how many wild ideas were found every moment in my fancy, and what strange, unaccountable whimsies came into my thoughts by the way.

When I came to my castle (for so I think I called it ever after this), I fled into it like one pursued. Whether I went over by the ladder, as first contrived, or went in at the hole in the rock, which I had called a door, I cannot remember; no, nor could I remember the next morning, for never frightened hare fled to cover, or fox to earth, with more terror of mind than I to this retreat.

I slept none that night; the farther I was from the occasion of my fright, the greater my apprehensions were, which is something contrary to the nature of such things, and especially to the usual practice of all creatures in fear; but I was so embarrassed with my own frightful ideas of the thing, that I formed nothing but dismal imaginations to myself, even though I was now a great way off. Sometimes I fancied it must be the devil, and reason joined in with me in this supposition, for how should any other thing in human shape come into the place? Where was the vessel that brought them? What marks were there of any other footstep? And how was it possible a man should come there?

But then, to think that Satan should take human shape upon him in such a place, where there could be no manner of occasion for it, but to leave the print of his foot behind him, and that even for no purpose too, for he could not be sure I should see it—this was an amusement the other way. I considered that the devil might have found out abundance of other ways to have terrified me than this of the single print of a foot; that as I lived quite on the other side of the island, he would never have been so simple as to leave a mark in a place where it was ten thousand to one whether I should ever see it or not, and in the sand too, which the first surge of the sea, upon a high wind, would have defaced entirely. All this seemed inconsistent with the thing itself and with all the notions we usually entertain of the subtlety of the devil.

Abundance of such things as these assisted to argue me out of all apprehensions of its being the devil; and I presently concluded then that it must be some more dangerous creature—viz. that it must be some of the savages of the mainland opposite who had wandered out to sea in their canoes, and either driven by the currents or by contrary winds, had made the island, and had been on shore, but were gone away again to sea; being as loath, perhaps, to have stayed in this desolate island as I would have been to have had them.

While these reflections were rolling in my mind, I was very thankful in my thoughts that I was so happy as not to be thereabouts at that time, or that they did not see my boat, by which they would have concluded that some inhabitants had been in the place, and perhaps have searched farther for me. Then terrible thoughts racked my imagination about their having found out my boat, and that there were people here; and that, if so, I should certainly have them come again in greater numbers and devour me; that if it should happen that they should not find me, yet they would find my enclosure, destroy all my corn, and carry away all my flock of tame goats, and I should perish at last for mere want.

Thus my fear banished all my religious hope, all that former confidence in God, which was founded upon such wonderful experience as I had had of His goodness; as if He that had fed me by miracle hitherto could not preserve, by His power, the provision which He had made for me by His goodness. I reproached myself with my laziness, that would not sow any more corn one year than would just serve me till the next season, as if no accident could intervene to prevent my enjoying the crop that was upon the ground; and this I thought so just a reproof, that I resolved for the future to have two or three years' corn beforehand; so that, whatever might come, I might not perish for want of bread.

How strange a chequer-work of Providence is the life of man! and by what secret different springs are the affections hurried about, as different circumstances present! To-day we love what to-morrow we hate; to-day we seek what to-morrow we shun; to-day we desire what to-morrow we fear, nay, even tremble at the apprehensions of. This was exemplified in me, at this time, in the most lively manner imaginable; for I, whose only affliction was that I seemed banished from human society, that I was alone, circumscribed by the boundless ocean, cut off from mankind, and condemned to what I call silent life; that I was as one whom Heaven thought not worthy to be numbered among the living, or to appear among the rest of His creatures; that to have seen one of my own species would have seemed to me a raising me from death to life, and the greatest blessing that Heaven itself, next to the supreme blessing of salvation, could bestow; I say, that I should now tremble at the very apprehensions of seeing a man, and was ready to sink into the ground at but the shadow or silent appearance of a man having set his foot in the island.

Such is the uneven state of human life; and it afforded me a great many curious speculations afterwards, when I had a little recovered my first surprise. I considered that this was the station of life the infinitely wise and good providence of God had determined for me; that as I could not foresee what the ends of Divine wisdom might be in all this, so I was not to dispute His sovereignty; who, as I was His creature, had an undoubted right, by creation, to govern and dispose of me absolutely as He thought fit; and who, as I was a creature that had offended Him, had likewise a judicial right to condemn me to what punishment He thought fit; and that it was my part to submit to bear His indignation, because I had sinned against Him. I then reflected, that as God, who was not only righteous but omnipotent, had thought fit thus to punish and afflict me, so He was able to deliver me: that if He did not think fit to do so, it was my unquestioned duty to resign myself absolutely and entirely to His will; and, on the other hand, it was my duty also to hope in Him, pray to Him, and quietly to attend to the dictates and directions of His daily providence.

These thoughts took me up many hours, days, nay, I may say weeks and months: and one particular effect of my cogitations on this occasion I cannot omit. One morning early, lying in my bed, and filled with thoughts about my danger from the appearances of savages, I found it discomposed me very much; upon which these words of the Scripture came into my thoughts, "Call upon Me in the day of trouble, and I will deliver thee, and thou shalt glorify Me." Upon this, rising cheerfully out of my bed, my heart was not only comforted, but I was guided and encouraged to pray earnestly to God for deliverance: when I had done praying I took up my Bible, and opening it to read, the first words that presented to me were, "Wait on the Lord, and be of good cheer, and He shall strengthen thy heart; wait, I say, on the Lord." It is impossible to express the comfort this gave me. In answer, I thankfully laid down the book, and was no more sad, at least on that occasion.

In the middle of these cogitations, apprehensions, and reflections, it came into my thoughts one day that all this might be a mere chimera of my own, and that this foot might be the print of my own foot, when I came on shore from my boat: this cheered me up a little, too, and I began to persuade myself it was all a delusion; that it was nothing else but my own foot; and why might I not come that way from the boat, as well as I was going that way to the boat? Again, I considered also that I could by no means tell for certain where I had trod, and where I had not; and that if, at last, this was only the print of my own foot, I had played the part of those fools who try to make stories of spectres and apparitions, and then are frightened at them more than anybody.

Now I began to take courage, and to peep abroad again, for I had not stirred out of my castle for three days and nights, so that I began to starve for provisions; for I had little or nothing within doors but some barley-cakes and water; then I knew that my goats wanted to be milked too, which usually was my evening diversion: and the poor creatures were in great pain and inconvenience for want of it; and, indeed, it almost spoiled some of them, and almost dried up their milk. Encouraging myself, therefore, with the belief that this was nothing but the print of one of my own feet, and that I might be truly said to start at my own shadow, I began to go abroad again, and went to my country house to milk my flock: but to see with what fear I went forward, how often I looked behind me, how I was ready every now and then to lay down my basket and run for my life, it would have made any one have thought I was haunted with an evil conscience, or that I had been lately most terribly frightened; and so, indeed, I had.

However, I went down thus two or three days, and having seen nothing, I began to be a little bolder, and to think there was really nothing in it but my own imagination; but I could not persuade myself fully of this till I should go down to the shore again, and see this print of a foot, and measure it by my own, and see if there was any similitude or fitness, that I might be assured it was my own foot: but when I came to the place, first, it appeared evidently to me, that when I laid up my boat I could not possibly be on shore anywhere thereabouts; secondly, when I came to measure the mark with my own foot, I found my foot not so large by a great deal. Both these things filled my head with new imaginations, and gave me the vapours again to the highest degree, so that I shook with cold like one in an ague; and I went home again, filled with the belief that some man or men had been on shore there; or, in short, that the island was inhabited, and I might be surprised before I was aware; and what course to take for my security I knew not.

Oh, what ridiculous resolutions men take when possessed with fear! It deprives them of the use of those means which reason offers for their relief. The first thing I proposed to myself was, to throw down my enclosures, and turn all my tame cattle wild into the woods, lest the enemy should find them, and then frequent the island in prospect of the same or the like booty: then the simple thing of digging up my two corn-fields, lest they should find such a grain there, and still be prompted to frequent the island: then to demolish my bower and tent, that they might not see any vestiges of habitation, and be prompted to look farther, in order to find out the persons inhabiting.

These were the subject of the first night's cogitations after I was come home again, while the apprehensions which had so overrun my mind were fresh upon me, and my head was full of vapours. Thus, fear of danger is ten thousand times more terrifying than danger itself, when apparent to the eyes; and we find the burden of anxiety greater, by much, than the evil which we are anxious about: and what was worse than all this, I had not that relief in this trouble that from the resignation I used to practise I hoped to have. I looked, I thought, like Saul, who complained not only that the Philistines were upon him, but that God had forsaken him; for I did not now take due ways to compose my mind, by crying to God in my distress, and resting upon His providence, as I had done before, for my defence and deliverance; which, if I had done, I had at least been more cheerfully supported under this new surprise, and perhaps carried through it with more resolution.

This confusion of my thoughts kept me awake all night; but in the morning I fell asleep; and having, by the amusement of my mind, been as it were tired, and my spirits exhausted, I slept very soundly, and waked much better composed than I had ever been before. And now I began to think sedately; and, upon debate with myself, I concluded that this island (which was so exceedingly pleasant, fruitful, and no farther from the mainland than as I had seen) was not so entirely abandoned as I might imagine; that although there were no stated inhabitants who lived on the spot, yet that there might sometimes come boats off from the shore, who, either with design, or perhaps never but when they were driven by cross winds, might come to this place; that I had lived there fifteen years now and had not met with the least shadow or figure of any people yet; and that, if at any time they should be driven here, it was probable they went away again as soon as ever they could, seeing they had never thought fit to fix here upon any occasion; that the most I could suggest any danger from was from any casual accidental landing of straggling people from the main, who, as it was likely, if they were driven hither, were here against their wills, so they made no stay here, but went off again with all possible speed; seldom staying one night on shore, lest they should not have the help of the tides and daylight back again; and that, therefore, I had nothing to do but to consider of some safe retreat, in case I should see any savages land upon the spot.

Now, I began sorely to repent that I had dug my cave so large as to bring a door through again, which door, as I said, came out beyond where my fortification joined to the rock: upon maturely considering this, therefore, I resolved to draw me a second fortification, in the manner of a semicircle, at a distance from my wall, just where I had planted a double row of trees about twelve years before, of which I made mention: these trees having been planted so thick before, they wanted but few piles to be driven between them, that they might be thicker and stronger, and my wall would be soon finished. So that I had now a double wall; and my outer wall was thickened with pieces of timber, old cables, and everything I could think of, to make it strong; having in it seven little holes, about as big as I might put my arm out at.

In the inside of this I thickened my wall to about ten feet thick with continually bringing earth out of my cave, and laying it at the foot of the wall, and walking upon it; and through the seven holes I contrived to plant the muskets, of which I took notice that I had got seven on shore out of the ship; these I planted like my cannon, and fitted them into frames, that held them like a carriage, so that I could fire all the seven guns in two minutes' time; this wall I was many a weary month in finishing, and yet never thought myself safe till it was done.

When this was done I stuck all the ground without my wall, for a great length every way, as full with stakes or sticks of the osier-like wood, which I found so apt to grow, as they could well stand; insomuch that I believe I might set in near twenty thousand of them, leaving a pretty large space between them and my wall, that I might have room to see an enemy, and they might have no shelter from the young trees, if they attempted to approach my outer wall.

Thus in two years' time I had a thick grove; and in five or six years' time I had a wood before my dwelling, growing so monstrously thick and strong that it was indeed perfectly impassable: and no men, of what kind soever, could ever imagine that there was anything beyond it, much less a habitation. As for the way which I proposed to myself to go in and out (for I left no avenue), it was by setting two ladders, one to a part of the rock which was low, and then broke in, and left room to place another ladder upon that; so when the two ladders were taken down no man living could come down to me without doing himself mischief; and if they had come down, they were still on the outside of my outer wall.

Thus I took all the measures human prudence could suggest for my own preservation; and it will be seen at length that they were not altogether without just reason; though I foresaw nothing at that time more than my mere fear suggested to me.

Chapter 12 - A Cave Retreat

While this was doing, I was not altogether careless of my other affairs; for I had a great concern upon me for my little herd of goats: they were not only a ready supply to me on every occasion, and began to be sufficient for me, without the expense of powder and shot, but also without the fatigue of hunting after the wild ones; and I was loath to lose the advantage of them, and to have them all to nurse up over again.

For this purpose, after long consideration, I could think of but two ways to preserve them: one was, to find another convenient place to dig a cave underground, and to drive them into it every night; and the other was to enclose two or three little bits of land, remote from one another, and as much concealed as I could, where I might keep about half-a-dozen young goats in each place; so that if any disaster happened to the flock in general, I might be able to raise them again with little trouble and time: and this though it would require a good deal of time and labour, I thought was the most rational design.

Accordingly, I spent some time to find out the most retired parts of the island; and I pitched upon one, which was as private, indeed, as my heart could wish: it was a little damp piece of ground in the middle of the hollow and thick woods, where, as is observed, I almost lost myself once before, endeavouring to come back that way from the eastern part of the island. Here I found a clear piece of land, near three acres, so surrounded with woods that it was almost an enclosure by nature; at least, it did not want near so much labour to make it so as the other piece of ground I had worked so hard at.

I immediately went to work with this piece of ground; and in less than a month's time I had so fenced it round that my flock, or herd, call it which you please, which were not so wild now as at first they might be supposed to be, were well enough secured in it: so, without any further delay, I removed ten young she-goats and two he-goats to this piece, and when they were there I continued to perfect the fence till I had made it as secure as the other; which, however, I did at more leisure, and it took me up more time by a great deal.

All this labour I was at the expense of, purely from my apprehensions on account of the print of a man's foot; for as yet I had never seen any human creature come near the island; and I had now lived two years under this uneasiness, which, indeed, made my life much less comfortable than it was before, as may be well imagined by any who know what it is to live in the constant snare of the fear of man. And this I must observe, with grief, too, that the discomposure of my mind had great impression also upon the religious part of my thoughts; for the dread and terror of falling into the hands of savages and cannibals lay so upon my spirits, that I seldom found myself in a due temper for application to my Maker; at least, not with the sedate calmness and resignation of soul which I was wont to do: I rather prayed to God as under great affliction and pressure of mind, surrounded with danger, and in expectation every night of being murdered and devoured before morning; and I must testify, from my experience, that a temper of peace, thankfulness, love, and affection, is much the more proper frame for prayer than that of terror and discomposure: and that under the dread of mischief impending, a man is no more fit for a comforting performance of the duty of praying to God than he is for a repentance on a sick-bed; for these discomposures affect the mind, as the others do the body; and the discomposure of the mind must necessarily be as great a disability as that of the body, and much greater; praying to God being properly an act of the mind, not of the body.

But to go on. After I had thus secured one part of my little living stock, I went about the whole island, searching for another private place to make such another deposit; when, wandering more to the west point of the island than I had ever done yet, and looking out to sea, I thought I saw a boat upon the sea, at a great distance. I had found a perspective glass or two in one of the seamen's chests, which I saved out of our ship, but I had it not about me; and this was so remote that I could not tell what to make of it, though I looked at it till my eyes were not able to hold to look any longer; whether it was a boat or not I do not know, but as I descended from the hill I could see no more of it, so I gave it over; only I resolved to go no more out without a perspective glass in my pocket.

When I was come down the hill to the end of the island, where, indeed, I had never been before, I was presently convinced that the seeing the print of a man's foot was not such a strange thing in the island as I imagined: and but that it was a special providence that I was cast upon the side of the island where the savages never came, I should easily have known that nothing was more frequent than for the canoes from the main, when they happened to be a little too far out at sea, to shoot over to that side of the island for harbour: likewise, as they often met and fought in their canoes, the victors, having taken any prisoners, would bring them over to this shore, where, according to their dreadful customs, being all cannibals, they would kill and eat them; of which hereafter.

When I was come down the hill to the shore, as I said above, being the SW. point of the island, I was perfectly confounded and amazed; nor is it possible for me to express the horror of my mind at seeing the shore spread with skulls, hands, feet, and other bones of human bodies; and particularly I observed a place where there had been a fire made, and a circle dug in the earth, like a cockpit, where I supposed the savage wretches had sat down to their human feastings upon the bodies of their fellow-creatures.

I was so astonished with the sight of these things, that I entertained no notions of any danger to myself from it for a long while: all my apprehensions were buried in the thoughts of such a pitch of inhuman, hellish brutality, and the horror of the degeneracy of human nature, which, though I had heard of it often, yet I never had so near a view of before; in short, I turned away my face from the horrid spectacle; my stomach grew sick, and I was just at the point of fainting, when nature discharged the disorder from my stomach; and having vomited with uncommon violence, I was a little relieved, but could not bear to stay in the place a moment; so I got up the hill again with all the speed I could, and walked on towards my own habitation.

When I came a little out of that part of the island I stood still awhile, as amazed, and then, recovering myself, I looked up with the utmost affection of my soul, and, with a flood of tears in my eyes, gave God thanks, that had cast my first lot in a part of the world where I was distinguished from such dreadful creatures as these; and that, though I had esteemed my present condition very miserable, had yet given me so many comforts in it that I had still more to give thanks for than to complain of: and this, above all, that I had, even in this miserable condition, been comforted with the knowledge of Himself, and the hope of His blessing: which was a felicity more than sufficiently equivalent to all the misery which I had suffered, or could suffer.

In this frame of thankfulness I went home to my castle, and began to be much easier now, as to the safety of my circumstances, than ever I was before: for I observed that these wretches never came to this island in search of what they could get; perhaps not seeking, not wanting, or not expecting anything here; and having often, no doubt, been up the covered, woody part of it without finding anything to their purpose. I knew I had been here now almost eighteen years, and never saw the least footsteps of human creature there before; and I might be eighteen years more as entirely concealed as I was now, if I did not discover myself to them, which I had no manner of occasion to do; it being my only business to keep myself entirely concealed where I was, unless I found a better sort of creatures than cannibals to make myself known to.

Yet I entertained such an abhorrence of the savage wretches that I have been speaking of, and of the wretched, inhuman custom of their devouring and eating one another up, that I continued pensive and sad, and kept close within my own circle for almost two years after this: when I say my own circle, I mean by it my three plantations—viz. my castle, my country seat (which I called my bower), and my enclosure in the woods: nor did I look after this for any other use than an enclosure for my goats; for the aversion which nature gave me to these hellish wretches was such, that I was as fearful of seeing them as of seeing the devil himself. I did not so much as go to look after my boat all this time, but began rather to think of making another; for I could not think of ever making any more attempts to bring the other boat round the island to me, lest I should meet with some of these creatures at sea; in which case, if I had happened to have fallen into their hands, I knew what would have been my lot.

Time, however, and the satisfaction I had that I was in no danger of being discovered by these people, began to wear off my uneasiness about them; and I began to live just in the same composed manner as before, only with this difference, that I used more caution, and kept my eyes more about me than I did before, lest I should happen to be seen by any of them; and particularly, I was more cautious of firing my gun, lest any of them, being on the island, should happen to hear it.

It was, therefore, a very good providence to me that I had furnished myself with a tame breed of goats, and that I had no need to hunt any more about the woods, or shoot at them; and if I did catch any of them after this, it was by traps and snares, as I had done before; so that for two years after this I believe I never fired my gun once off, though I never went out without it; and what was more, as I had saved three pistols out of the ship, I always carried them out with me, or at least two of them, sticking them in my goat-skin belt. I also furbished up one of the great cutlasses that I had out of the ship, and made me a belt to hang it on also; so that I was now a most formidable fellow to look at when I went abroad, if you add to the former description of myself the particular of two pistols, and a broadsword hanging at my side in a belt, but without a scabbard.

Things going on thus, as I have said, for some time, I seemed, excepting these cautions, to be reduced to my former calm, sedate way of living. All these things tended to show me more and more how far my condition was from being miserable, compared to some others; nay, to many other particulars of life which it might have pleased God to have made my lot. It put me upon reflecting how little repining there would be among mankind at any condition of life if people would rather compare their condition with those that were worse, in order to be thankful, than be always comparing them with those which are better, to assist their murmurings and complainings.

As in my present condition there were not really many things which I wanted, so indeed I thought that the frights I had been in about these savage wretches, and the concern I had been in for my own preservation, had taken off the edge of my invention, for my own conveniences; and I had dropped a good design, which I had once bent my thoughts upon, and that was to try if I could not make some of my barley into malt, and then try to brew myself some beer. This was really a whimsical thought, and I reproved myself often for the simplicity of it: for I presently saw there would be the want of several things necessary to the making my beer that it would be impossible for me to supply; as, first, casks to preserve it in, which was a thing that, as I have observed already, I could never compass: no, though I spent not only many days, but weeks, nay months, in attempting it, but to no purpose.

In the next place, I had no hops to make it keep, no yeast to make it work, no copper or kettle to make it boil; and yet with all these things wanting, I verily believe, had not the frights and terrors I was in about the savages intervened, I had undertaken it, and perhaps brought it to pass too; for I seldom gave anything over without accomplishing it, when once I had it in my head to began it. But my invention now ran quite another way; for night and day I could think of nothing but how I might destroy some of the monsters in their cruel, bloody entertainment, and if possible save the victim they should bring hither to destroy.

It would take up a larger volume than this whole work is intended to be to set down all the contrivances I hatched, or rather brooded upon, in my thoughts, for the destroying these creatures, or at least frightening them so as to prevent their coming hither any more: but all this was abortive; nothing could be possible to take effect, unless I was to be there to do it myself: and what could one man do among them, when perhaps there might be twenty or thirty of them together with their darts, or their bows and arrows, with which they could shoot as true to a mark as I could with my gun?

Sometimes I thought if digging a hole under the place where they made their fire, and putting in five or six pounds of gunpowder, which, when they kindled their fire, would consequently take fire, and blow up all that was near it: but as, in the first place, I should be unwilling to waste so much powder upon them, my store being now within the quantity of one barrel, so neither could I be sure of its going off at any certain time, when it might surprise them; and, at best, that it would do little more than just blow the fire about their ears and fright them, but not sufficient to make them forsake the place: so I laid it aside; and then proposed that I would place myself in ambush in some convenient place, with my three guns all double-loaded, and in the middle of their bloody ceremony let fly at them, when I should be sure to kill or wound perhaps two or three at every shot; and then falling in upon them with my three pistols and my sword, I made no doubt but that, if there were twenty, I should kill them all.

This fancy pleased my thoughts for some weeks, and I was so full of it that I often dreamed of it, and, sometimes, that I was just going to let fly at them in my sleep. I went so far with it in my imagination that I employed myself several days to find out proper places to put myself in ambuscade, as I said, to watch for them, and I went frequently to the place itself, which was now grown more familiar to me; but while my mind was thus filled with thoughts of revenge and a bloody putting twenty or thirty of them to the sword, as I may call it, the horror I had at the place, and at the signals of the barbarous wretches devouring one another, abetted my malice.

Well, at length I found a place in the side of the hill where I was satisfied I might securely wait till I saw any of their boats coming; and might then, even before they would be ready to come on shore, convey myself unseen into some thickets of trees, in one of which there was a hollow large enough to conceal me entirely; and there I might sit and observe all their bloody doings, and take my full aim at their heads, when they were so close together as that it would be next to impossible that I should miss my shot, or that I could fail wounding three or four of them at the first shot. In this place, then, I resolved to fulfil my design; and accordingly I prepared two muskets and my ordinary fowling-piece. The two muskets I loaded with a brace of slugs each, and four or five smaller bullets, about the size of pistol bullets; and the fowling-piece I loaded with near a handful of swan-shot of the largest size; I also loaded my pistols with about four bullets each; and, in this posture, well provided with ammunition for a second and third charge, I prepared myself for my expedition.

After I had thus laid the scheme of my design, and in my imagination put it in practice, I continually made my tour every morning to the top of the hill, which was from my castle, as I called it, about three miles or more, to see if I could observe any boats upon the sea, coming near the island, or standing over towards it; but I began to tire of this hard duty, after I had for two or three months constantly kept my watch, but came always back without any discovery; there having not, in all that time, been the least appearance, not only on or near the shore, but on the whole ocean, so far as my eye or glass could reach every way.

As long as I kept my daily tour to the hill, to look out, so long also I kept up the vigour of my design, and my spirits seemed to be all the while in a suitable frame for so outrageous an execution as the killing twenty or thirty naked savages, for an offence which I had not at all entered into any discussion of in my thoughts, any farther than my passions were at first fired by the horror I conceived at the unnatural custom of the people of that country, who, it seems, had been suffered by Providence, in His wise disposition of the world, to have no other guide than that of their own abominable and vitiated passions; and consequently were left, and perhaps had been so for some ages, to act such horrid things, and receive such dreadful customs, as nothing but nature, entirely abandoned by Heaven, and actuated by some hellish degeneracy, could have run them into.

But now, when, as I have said, I began to be weary of the fruitless excursion which I had made so long and so far every morning in vain, so my opinion of the action itself began to alter; and I began, with cooler and calmer thoughts, to consider what I was going to engage in; what authority or call I had to pretend to be judge and executioner upon these men as criminals, whom Heaven had thought fit for so many ages to suffer unpunished to go on, and to be as it were the executioners of His judgments one upon another; how far these people were offenders against me, and what right I had to engage in the quarrel of that blood which they shed promiscuously upon one another.

I debated this very often with myself thus: "How do I know what God Himself judges in this particular case? It is certain these people do not commit this as a crime; it is not against their own consciences reproving, or their light reproaching them; they do not know it to be an offence, and then commit it in defiance of divine justice, as we do in almost all the sins we commit. They think it no more a crime to kill a captive taken in war than we do to kill an ox; or to eat human flesh than we do to eat mutton."

When I considered this a little, it followed necessarily that I was certainly in the wrong; that these people were not murderers, in the sense that I had before condemned them in my thoughts, any more than those Christians were murderers who often put to death the prisoners taken in battle; or more frequently, upon many occasions, put whole troops of men to the sword, without giving quarter, though they threw down their arms and submitted. In the next place, it occurred to me that although the usage they gave one another was thus brutish and inhuman, yet it was really nothing to me: these people had done me no injury: that if they attempted, or I saw it necessary, for my immediate preservation, to fall upon them, something might be said for it: but that I was yet out of their power, and they really had no knowledge of me, and consequently no design upon me; and therefore it could not be just for me to fall upon them; that this would justify the conduct of the Spaniards in all their barbarities practised in America, where they destroyed millions of these people; who, however they were idolators and barbarians, and had several bloody and barbarous rites in their customs, such as sacrificing human bodies to their idols, were yet, as to the Spaniards, very innocent people; and that the rooting them out of the country is spoken of with the utmost abhorrence and detestation by even the Spaniards themselves at this time, and by all other Christian nations of Europe, as a mere butchery, a bloody and unnatural piece of cruelty, unjustifiable either to God or man; and for which the very name of a Spaniard is reckoned to be frightful and terrible, to all people of humanity or of Christian compassion; as if the kingdom of Spain were particularly eminent for the produce of a race of men who were without principles of tenderness, or the common bowels of pity to the miserable, which is reckoned to be a mark of generous temper in the mind.

These considerations really put me to a pause, and to a kind of a full stop; and I began by little and little to be off my design, and to conclude I had taken wrong measures in my resolution to attack the savages; and that it was not my business to meddle with them, unless they first attacked me; and this it was my business, if possible, to prevent: but that, if I were discovered and attacked by them, I knew my duty. On the other hand, I argued with myself that this really was the way not to deliver myself, but entirely to ruin and destroy myself; for unless I was sure to kill every one that not only should be on shore at that time, but that should ever come on shore afterwards, if but one of them escaped to tell their country-people what had happened, they would come over again by thousands to revenge the death of their fellows, and I should only bring upon myself a certain destruction, which, at present, I had no manner of occasion for.

Upon the whole, I concluded that I ought, neither in principle nor in policy, one way or other, to concern myself in this affair: that my business was, by all possible means to conceal myself from them, and not to leave the least sign for them to guess by that there were any living creatures upon the island—I mean of human shape. Religion joined in with this prudential resolution; and I was convinced now, many ways, that I was perfectly out of my duty when I was laying all my bloody schemes for the destruction of innocent creatures—I mean innocent as to me.

As to the crimes they were guilty of towards one another, I had nothing to do with them; they were national, and I ought to leave them to the justice of God, who is the Governor of nations, and knows how, by national punishments, to make a just retribution for national offences, and to bring public judgments upon those who offend in a public manner, by such ways as best please Him. This appeared so clear to me now, that nothing was a greater satisfaction to me than that I had not been suffered to do a thing which I now saw so much reason to believe would have been no less a sin than that of wilful murder if I had committed it; and I gave most humble thanks on my knees to God, that He had thus delivered me from blood-guiltiness; beseeching Him to grant me the protection of His providence, that I might not fall into the hands of the barbarians, or that I might not lay my hands upon them, unless I had a more clear call from Heaven to do it, in defence of my own life.

In this disposition I continued for near a year after this; and so far was I from desiring an occasion for falling upon these wretches, that in all that time I never once went up the hill to see whether there were any of them in sight, or to know whether any of them had been on shore there or not, that I might not be tempted to renew any of my contrivances against them, or be provoked by any advantage that might present itself to fall upon them; only this I did: I went and removed my boat, which I had on the other side of the island, and carried it down to the east end of the whole island, where I ran it into a little cove, which I found under some high rocks, and where I knew, by reason of the currents, the savages durst not, at least would not, come with their boats upon any account whatever. With my boat I carried away everything that I had left there belonging to her, though not necessary for the bare going thither—viz. a mast and sail which I had made for her, and a thing like an anchor, but which, indeed, could not be called either anchor or grapnel; however, it was the best I could make of its kind: all these I removed, that there might not be the least shadow for discovery, or appearance of any boat, or of any human habitation upon the island. Besides this, I kept myself, as I said, more retired than ever, and seldom went from my cell except upon my constant employment, to milk my she-goats, and manage my little flock in the wood, which, as it was quite on the other part of the island, was out of danger; for certain, it is that these savage people, who sometimes haunted this island, never came with any thoughts of finding anything here, and consequently never wandered off from the coast, and I doubt not but they might have been several times on shore after my apprehensions of them had made me cautious, as well as before.

Indeed, I looked back with some horror upon the thoughts of what my condition would have been if I had chopped upon them and been discovered before that; when, naked and unarmed, except with one gun, and that loaded often only with small shot, I walked everywhere, peeping and peering about the island, to see what I could get; what a surprise should I have been in if, when I discovered the print of a man's foot, I had, instead of that, seen fifteen or twenty savages, and found them pursuing me, and by the swiftness of their running no possibility of my escaping them!

The thoughts of this sometimes sank my very soul within me, and distressed my mind so much that I could not soon recover it, to think what I should have done, and how I should not only have been unable to resist them, but even should not have had presence of mind enough to do what I might have done; much less what now, after so much consideration and preparation, I might be able to do. Indeed, after serious thinking of these things, I would be melancholy, and sometimes it would last a great while; but I resolved it all at last into thankfulness to that Providence which had delivered me from so many unseen dangers, and had kept me from those mischiefs which I could have no way been the agent in delivering myself from, because I had not the least notion of any such thing depending, or the least supposition of its being possible.

This renewed a contemplation which often had come into my thoughts in former times, when first I began to see the merciful dispositions of Heaven, in the dangers we run through in this life; how wonderfully we are delivered when we know nothing of it; how, when we are in a quandary as we call it, a doubt or hesitation whether to go this way or that way, a secret hint shall direct us this way, when we intended to go that way: nay, when sense, our own inclination, and perhaps business has called us to go the other way, yet a strange impression upon the mind, from we know not what springs, and by we know not what power, shall overrule us to go this way; and it shall afterwards appear that had we gone that way, which we should have gone, and even to our imagination ought to have gone, we should have been ruined and lost. Upon these and many like reflections I afterwards made it a certain rule with me, that whenever I found those secret hints or pressings of mind to doing or not doing anything that presented, or going this way or that way, I never failed to obey the secret dictate; though I knew no other reason for it than such a pressure or such a hint hung upon my mind. I could give many examples of the success of this conduct in the course of my life, but more especially in the latter part of my inhabiting this unhappy island; besides many occasions which it is very likely I might have taken notice of, if I had seen with the same eyes then that I see with now.

But it is never too late to be wise; and I cannot but advise all considering men, whose lives are attended with such extraordinary incidents as mine, or even though not so extraordinary, not to slight such secret intimations of Providence, let them come from what invisible intelligence they will. That I shall not discuss, and perhaps cannot account for; but certainly they are a proof of the converse of spirits, and a secret communication between those embodied and those unembodied, and such a proof as can never be withstood; of which I shall have occasion to give some remarkable instances in the remainder of my solitary residence in this dismal place.

I believe the reader of this will not think it strange if I confess that these anxieties, these constant dangers I lived in, and the concern that was now upon me, put an end to all invention, and to all the contrivances that I had laid for my future accommodations and conveniences. I had the care of my safety more now upon my hands than that of my food. I cared not to drive a nail, or chop a stick of wood now, for fear the noise I might make should be heard: much less would I fire a gun for the same reason: and above all I was intolerably uneasy at making any fire, lest the smoke, which is visible at a great distance in the day, should betray me. For this reason, I removed that part of my business which required fire, such as burning of pots and pipes, &c., into my new apartment in the woods; where, after I had been some time, I found, to my unspeakable consolation, a mere natural cave in the earth, which went in a vast way, and where, I daresay, no savage, had he been at the mouth of it, would be so hardy as to venture in; nor, indeed, would any man else, but one who, like me, wanted nothing so much as a safe retreat.

The mouth of this hollow was at the bottom of a great rock, where, by mere accident (I would say, if I did not see abundant reason to ascribe all such things now to Providence), I was cutting down some thick branches of trees to make charcoal; and before I go on I must observe the reason of my making this charcoal, which was this—I was afraid of making a smoke about my habitation, as I said before; and yet I could not live there without baking my bread, cooking my meat, &c.; so I contrived to burn some wood here, as I had seen done in England, under turf, till it became chark or dry coal: and then putting the fire out, I preserved the coal to carry home, and perform the other services for which fire was wanting, without danger of smoke. But this is by-the-bye.

While I was cutting down some wood here, I perceived that, behind a very thick branch of low brushwood or underwood, there was a kind of hollow place: I was curious to look in it; and getting with difficulty into the mouth of it, I found it was pretty large, that is to say, sufficient for me to stand upright in it, and perhaps another with me: but I must confess to you that I made more haste out than I did in, when looking farther into the place, and which was perfectly dark, I saw two broad shining eyes of some creature, whether devil or man I knew not, which twinkled like two stars; the dim light from the cave's mouth shining directly in, and making the reflection. However, after some pause I recovered myself, and began to call myself a thousand fools, and to think that he that was afraid to see the devil was not fit to live twenty years in an island all alone; and that I might well think there was nothing in this cave that was more frightful than myself.

Upon this, plucking up my courage, I took up a firebrand, and in I rushed again, with the stick flaming in my hand: I had not gone three steps in before I was almost as frightened as before; for I heard a very loud sigh, like that of a man in some pain, and it was followed by a broken noise, as of words half expressed, and then a deep sigh again. I stepped back, and was indeed struck with such a surprise that it put me into a cold sweat, and if I had had a hat on my head, I will not answer for it that my hair might not have lifted it off. But still plucking up my spirits as well as I could, and encouraging myself a little with considering that the power and presence of God was everywhere, and was able to protect me, I stepped forward again, and by the light of the firebrand, holding it up a little over my head, I saw lying on the ground a monstrous, frightful old he-goat, just making his will, as we say, and gasping for life, and, dying, indeed, of mere old age. I stirred him a little to see if I could get him out, and he essayed to get up, but was not able to raise himself; and I thought with myself he might even lie there—for if he had frightened me, so he would certainly fright any of the savages, if any of them should be so hardy as to come in there while he had any life in him.

I was now recovered from my surprise, and began to look round me, when I found the cave was but very small—that is to say, it might be about twelve feet over, but in no manner of shape, neither round nor square, no hands having ever been employed in making it but those of mere Nature. I observed also that there was a place at the farther side of it that went in further, but was so low that it required me to creep upon my hands and knees to go into it, and whither it went I knew not; so, having no candle, I gave it over for that time, but resolved to go again the next day provided with candles and a tinder-box, which I had made of the lock of one of the muskets, with some wildfire in the pan.

Accordingly, the next day I came provided with six large candles of my own making (for I made very good candles now of goat's tallow, but was hard set for candle-wick, using sometimes rags or rope-yarn, and sometimes the dried rind of a weed like nettles); and going into this low place I was obliged to creep upon all-fours as I have said, almost ten yards—which, by the way, I thought was a venture bold enough, considering that I knew not how far it might go, nor what was beyond it. When I had got through the strait, I found the roof rose higher up, I believe near twenty feet; but never was such a glorious sight seen in the island, I daresay, as it was to look round the sides and roof of this vault or cave—the wall reflected a hundred thousand lights to me from my two candles. What it was in the rock—whether diamonds or any other precious stones, or gold which I rather supposed it to be—I knew not.

The place I was in was a most delightful cavity, or grotto, though perfectly dark; the floor was dry and level, and had a sort of a small loose gravel upon it, so that there was no nauseous or venomous creature to be seen, neither was there any damp or wet on the sides or roof. The only difficulty in it was the entrance—which, however, as it was a place of security, and such a retreat as I wanted; I thought was a convenience; so that I was really rejoiced at the discovery, and resolved, without any delay, to bring some of those things which I was most anxious about to this place: particularly, I resolved to bring hither my magazine of powder, and all my spare arms—viz. two fowling-pieces—for I had three in all—and three muskets—for of them I had eight in all; so I kept in my castle only five, which stood ready mounted like pieces of cannon on my outmost fence, and were ready also to take out upon any expedition.

Upon this occasion of removing my ammunition I happened to open the barrel of powder which I took up out of the sea, and which had been wet, and I found that the water had penetrated about three or four inches into the powder on every side, which caking and growing hard, had preserved the inside like a kernel in the shell, so that I had near sixty pounds of very good powder in the centre of the cask. This was a very agreeable discovery to me at that time; so I carried all away thither, never keeping above two or three pounds of powder with me in my castle, for fear of a surprise of any kind; I also carried thither all the lead I had left for bullets.

I fancied myself now like one of the ancient giants who were said to live in caves and holes in the rocks, where none could come at them; for I persuaded myself, while I was here, that if five hundred savages were to hunt me, they could never find me out—or if they did, they would not venture to attack me here. The old goat whom I found expiring died in the mouth of the cave the next day after I made this discovery; and I found it much easier to dig a great hole there, and throw him in and cover him with earth, than to drag him out; so I interred him there, to prevent offence to my nose.

Chapter 13 - Wreck Of A Spanish Ship

I was now in the twenty-third year of my residence in this island, and was so naturalised to the place and the manner of living, that, could I but have enjoyed the certainty that no savages would come to the place to disturb me, I could have been content to have capitulated for spending the rest of my time there, even to the last moment, till I had laid me down and died, like the old goat in the cave. I had also arrived to some little diversions and amusements, which made the time pass a great deal more pleasantly with me than it did before—first, I had taught my Poll, as I noted before, to speak; and he did it so familiarly, and talked so articulately and plain, that it was very pleasant to me; and he lived with me no less than six-and-twenty years. How long he might have lived afterwards I know not, though I know they have a notion in the Brazils that they live a hundred years. My dog was a pleasant and loving companion to me for no less than sixteen years of my time, and then died of mere old age. As for my cats, they multiplied, as I have observed, to that degree that I was obliged to shoot several of them at first, to keep them from devouring me and all I had; but at length, when the two old ones I brought with me were gone, and after some time continually driving them from me, and letting them have no provision with me, they all ran wild into the woods, except two or three favourites, which I kept tame, and whose young, when they had any, I always drowned; and these were part of my family. Besides these I always kept two or three household kids about me, whom I taught to feed out of my hand; and I had two more parrots, which talked pretty well, and would all call "Robin Crusoe," but none like my first; nor, indeed, did I take the pains with any of them that I had done with him.

I had also several tame sea-fowls, whose name I knew not, that I caught upon the shore, and cut their wings; and the little stakes which I had planted before my castle-wall being now grown up to a good thick grove, these fowls all lived among these low trees, and bred there, which was very agreeable to me; so that, as I said above, I began to be very well contented with the life I led, if I could have been secured from the dread of the savages. But it was otherwise directed; and it may not be amiss for all people who shall meet with my story to make this just observation from it: How frequently, in the course of our lives, the evil which in itself we seek most to shun, and which, when we are fallen into, is the most dreadful to us, is oftentimes the very means or door of our deliverance, by which alone we can be raised again from the affliction we are fallen into. I could give many examples of this in the course of my unaccountable life; but in nothing was it more particularly remarkable than in the circumstances of my last years of solitary residence in this island.

It was now the month of December, as I said above, in my twenty-third year; and this, being the southern solstice (for winter I cannot call it), was the particular time of my harvest, and required me to be pretty much abroad in the fields, when, going out early in the morning, even before it was thorough daylight, I was surprised with seeing a light of some fire upon the shore, at a distance from me of about two miles, toward that part of the island where I had observed some savages had been, as before, and not on the other side; but, to my great affliction, it was on my side of the island.

I was indeed terribly surprised at the sight, and stopped short within my grove, not daring to go out, lest I might be surprised; and yet I had no more peace within, from the apprehensions I had that if these savages, in rambling over the island, should find my corn standing or cut, or any of my works or improvements, they would immediately conclude that there were people in the place, and would then never rest till they had found me out. In this extremity I went back directly to my castle, pulled up the ladder after me, and made all things without look as wild and natural as I could.

Then I prepared myself within, putting myself in a posture of defence. I loaded all my cannon, as I called them—that is to say, my muskets, which were mounted upon my new fortification—and all my pistols, and resolved to defend myself to the last gasp—not forgetting seriously to commend myself to the Divine protection, and earnestly to pray to God to deliver me out of the hands of the barbarians. I continued in this posture about two hours, and began to be impatient for intelligence abroad, for I had no spies to send out. After sitting a while longer, and musing what I should do in this case, I was not able to bear sitting in ignorance longer; so setting up my ladder to the side of the hill, where there was a flat place, as I observed before, and then pulling the ladder after me, I set it up again and mounted the top of the hill, and pulling out my perspective glass, which I had taken on purpose, I laid me down flat on my belly on the ground, and began to look for the place. I presently found there were no less than nine naked savages sitting round a small fire they had made, not to warm them, for they had no need of that, the weather being extremely hot, but, as I supposed, to dress some of their barbarous diet of human flesh which they had brought with them, whether alive or dead I could not tell.

They had two canoes with them, which they had hauled up upon the shore; and as it was then ebb of tide, they seemed to me to wait for the return of the flood to go away again. It is not easy to imagine what confusion this sight put me into, especially seeing them come on my side of the island, and so near to me; but when I considered their coming must be always with the current of the ebb, I began afterwards to be more sedate in my mind, being satisfied that I might go abroad with safety all the time of the flood of tide, if they were not on shore before; and having made this observation, I went abroad about my harvest work with the more composure.

As I expected, so it proved; for as soon as the tide made to the westward I saw them all take boat and row (or paddle as we call it) away. I should have observed, that for an hour or more before they went off they were dancing, and I could easily discern their postures and gestures by my glass. I could not perceive, by my nicest observation, but that they were stark naked, and had not the least covering upon them; but whether they were men or women I could not distinguish.

As soon as I saw them shipped and gone, I took two guns upon my shoulders, and two pistols in my girdle, and my great sword by my side without a scabbard, and with all the speed I was able to make went away to the hill where I had discovered the first appearance of all; and as soon as I got thither, which was not in less than two hours (for I could not go quickly, being so loaded with arms as I was), I perceived there had been three canoes more of the savages at that place; and looking out farther, I saw they were all at sea together, making over for the main. This was a dreadful sight to me, especially as, going down to the shore, I could see the marks of horror which the dismal work they had been about had left behind it—viz. the blood, the bones, and part of the flesh of human bodies eaten and devoured by those wretches with merriment and sport.

I was so filled with indignation at the sight, that I now began to premeditate the destruction of the next that I saw there, let them be whom or how many soever. It seemed evident to me that the visits which they made thus to this island were not very frequent, for it was above fifteen months before any more of them came on shore there again—that is to say, I neither saw them nor any footsteps or signals of them in all that time; for as to the rainy seasons, then they are sure not to come abroad, at least not so far. Yet all this while I lived uncomfortably, by reason of the constant apprehensions of their coming upon me by surprise: from whence I observe, that the expectation of evil is more bitter than the suffering, especially if there is no room to shake off that expectation or those apprehensions.

During all this time I was in a murdering humour, and spent most of my hours, which should have been better employed, in contriving how to circumvent and fall upon them the very next time I should see them—especially if they should be divided, as they were the last time, into two parties; nor did I consider at all that if I killed one party—suppose ten or a dozen—I was still the next day, or week, or month, to kill another, and so another, even ad infinitum, till I should be, at length, no less a murderer than they were in being man-eaters—and perhaps much more so. I spent my days now in great perplexity and anxiety of mind, expecting that I should one day or other fall into the hands of these merciless creatures; and if I did at any time venture abroad, it was not without looking around me with the greatest care and caution imaginable.

And now I found, to my great comfort, how happy it was that I had provided a tame flock or herd of goats, for I durst not upon any account fire my gun, especially near that side of the island where they usually came, lest I should alarm the savages; and if they had fled from me now, I was sure to have them come again with perhaps two or three hundred canoes with them in a few days, and then I knew what to expect. However, I wore out a year and three months more before I ever saw any more of the savages, and then I found them again, as I shall soon observe. It is true they might have been there once or twice; but either they made no stay, or at least I did not see them; but in the month of May, as near as I could calculate, and in my four-and-twentieth year, I had a very strange encounter with them; of which in its place.

The perturbation of my mind during this fifteen or sixteen months' interval was very great; I slept unquietly, dreamed always frightful dreams, and often started out of my sleep in the night. In the day great troubles overwhelmed my mind; and in the night I dreamed often of killing the savages and of the reasons why I might justify doing it.

But to waive all this for a while. It was in the middle of May, on the sixteenth day, I think, as well as my poor wooden calendar would reckon, for I marked all upon the post still; I say, it was on the sixteenth of May that it blew a very great storm of wind all day, with a great deal of lightning and thunder, and; a very foul night it was after it. I knew not what was the particular occasion of it, but as I was reading in the Bible, and taken up with very serious thoughts about my present condition, I was surprised with the noise of a gun, as I thought, fired at sea. This was, to be sure, a surprise quite of a different nature from any I had met with before; for the notions this put into my thoughts were quite of another kind. I started up in the greatest haste imaginable; and, in a trice, clapped my ladder to the middle place of the rock, and pulled it after me; and mounting it the second time, got to the top of the hill the very moment that a flash of fire bid me listen for a second gun, which, accordingly, in about half a minute I heard; and by the sound, knew that it was from that part of the sea where I was driven down the current in my boat.

I immediately considered that this must be some ship in distress, and that they had some comrade, or some other ship in company, and fired these for signals of distress, and to obtain help. I had the presence of mind at that minute to think, that though I could not help them, it might be that they might help me; so I brought together all the dry wood I could get at hand, and making a good handsome pile, I set it on fire upon the hill. The wood was dry, and blazed freely; and, though the wind blew very hard, yet it burned fairly out; so that I was certain, if there was any such thing as a ship, they must needs see it. And no doubt they did; for as soon as ever my fire blazed up, I heard another gun, and after that several others, all from the same quarter. I plied my fire all night long, till daybreak: and when it was broad day, and the air cleared up, I saw something at a great distance at sea, full east of the island, whether a sail or a hull I could not distinguish—no, not with my glass: the distance was so great, and the weather still something hazy also; at least, it was so out at sea.

I looked frequently at it all that day, and soon perceived that it did not move; so I presently concluded that it was a ship at anchor; and being eager, you may be sure, to be satisfied, I took my gun in my hand, and ran towards the south side of the island to the rocks where I had formerly been carried away by the current; and getting up there, the weather by this time being perfectly clear, I could plainly see, to my great sorrow, the wreck of a ship, cast away in the night upon those concealed rocks which I found when I was out in my boat; and which rocks, as they checked the violence of the stream, and made a kind of counter-stream, or eddy, were the occasion of my recovering from the most desperate, hopeless condition that ever I had been in in all my life.

Thus, what is one man's safety is another man's destruction; for it seems these men, whoever they were, being out of their knowledge, and the rocks being wholly under water, had been driven upon them in the night, the wind blowing hard at ENE. Had they seen the island, as I must necessarily suppose they did not, they must, as I thought, have endeavoured to have saved themselves on shore by the help of their boat; but their firing off guns for help, especially when they saw, as I imagined, my fire, filled me with many thoughts. First, I imagined that upon seeing my light they might have put themselves into their boat, and endeavoured to make the shore: but that the sea running very high, they might have been cast away. Other times I imagined that they might have lost their boat before, as might be the case many ways; particularly by the breaking of the sea upon their ship, which many times obliged men to stave, or take in pieces, their boat, and sometimes to throw it overboard with their own hands. Other times I imagined they had some other ship or ships in company, who, upon the signals of distress they made, had taken them up, and carried them off. Other times I fancied they were all gone off to sea in their boat, and being hurried away by the current that I had been formerly in, were carried out into the great ocean, where there was nothing but misery and perishing: and that, perhaps, they might by this time think of starving, and of being in a condition to eat one another.

As all these were but conjectures at best, so, in the condition I was in, I could do no more than look on upon the misery of the poor men, and pity them; which had still this good effect upon my side, that it gave me more and more cause to give thanks to God, who had so happily and comfortably provided for me in my desolate condition; and that of two ships' companies, who were now cast away upon this part of the world, not one life should be spared but mine. I learned here again to observe, that it is very rare that the providence of God casts us into any condition so low, or any misery so great, but we may see something or other to be thankful for, and may see others in worse circumstances than our own. Such certainly was the case of these men, of whom I could not so much as see room to suppose any were saved; nothing could make it rational so much as to wish or expect that they did not all perish there, except the possibility only of their being taken up by another ship in company; and this was but mere possibility indeed, for I saw not the least sign or appearance of any such thing.

I cannot explain, by any possible energy of words, what a strange longing I felt in my soul upon this sight, breaking out sometimes thus: "Oh that there had been but one or two, nay, or but one soul saved out of this ship, to have escaped to me, that I might but have had one companion, one fellow-creature, to have spoken to me and to have conversed with!" In all the time of my solitary life I never felt so earnest, so strong a desire after the society of my fellow-creatures, or so deep a regret at the want of it.

There are some secret springs in the affections which, when they are set a-going by some object in view, or, though not in view, yet rendered present to the mind by the power of imagination, that motion carries out the soul, by its impetuosity, to such violent, eager embracings of the object, that the absence of it is insupportable. Such were these earnest wishings that but one man had been saved. I believe I repeated the words, "Oh that it had been but one!" a thousand times; and my desires were so moved by it, that when I spoke the words my hands would clinch together, and my fingers would press the palms of my hands, so that if I had had any soft thing in my hand I should have crushed it involuntarily; and the teeth in my head would strike together, and set against one another so strong, that for some time I could not part them again. Let the naturalists explain these things, and the reason and manner of them. All I can do is to describe the fact, which was even surprising to me when I found it, though I knew not from whence it proceeded; it was doubtless the effect of ardent wishes, and of strong ideas formed in my mind, realising the comfort which the conversation of one of my fellow-Christians would have been to me. But it was not to be; either their fate or mine, or both, forbade it; for, till the last year of my being on this island, I never knew whether any were saved out of that ship or no; and had only the affliction, some days after, to see the corpse of a drowned boy come on shore at the end of the island which was next the shipwreck. He had no clothes on but a seaman's waistcoat, a pair of open-kneed linen drawers, and a blue linen shirt; but nothing to direct me so much as to guess what nation he was of. He had nothing in his pockets but two pieces of eight and a tobacco pipe—the last was to me of ten times more value than the first.

It was now calm, and I had a great mind to venture out in my boat to this wreck, not doubting but I might find something on board that might be useful to me. But that did not altogether press me so much as the possibility that there might be yet some living creature on board, whose life I might not only save, but might, by saving that life, comfort my own to the last degree; and this thought clung so to my heart that I could not be quiet night or day, but I must venture out in my boat on board this wreck; and committing the rest to God's providence, I thought the impression was so strong upon my mind that it could not be resisted—that it must come from some invisible direction, and that I should be wanting to myself if I did not go.

Under the power of this impression, I hastened back to my castle, prepared everything for my voyage, took a quantity of bread, a great pot of fresh water, a compass to steer by, a bottle of rum (for I had still a great deal of that left), and a basket of raisins; and thus, loading myself with everything necessary. I went down to my boat, got the water out of her, got her afloat, loaded all my cargo in her, and then went home again for more. My second cargo was a great bag of rice, the umbrella to set up over my head for a shade, another large pot of water, and about two dozen of small loaves, or barley cakes, more than before, with a bottle of goat's milk and a cheese; all which with great labour and sweat I carried to my boat; and praying to God to direct my voyage, I put out, and rowing or paddling the canoe along the shore, came at last to the utmost point of the island on the north-east side.

And now I was to launch out into the ocean, and either to venture or not to venture. I looked on the rapid currents which ran constantly on both sides of the island at a distance, and which were very terrible to me from the remembrance of the hazard I had been in before, and my heart began to fail me; for I foresaw that if I was driven into either of those currents, I should be carried a great way out to sea, and perhaps out of my reach or sight of the island again; and that then, as my boat was but small, if any little gale of wind should rise, I should be inevitably lost.

These thoughts so oppressed my mind that I began to give over my enterprise; and having hauled my boat into a little creek on the shore, I stepped out, and sat down upon a rising bit of ground, very pensive and anxious, between fear and desire, about my voyage; when, as I was musing, I could perceive that the tide was turned, and the flood come on; upon which my going was impracticable for so many hours. Upon this, presently it occurred to me that I should go up to the highest piece of ground I could find, and observe, if I could, how the sets of the tide or currents lay when the flood came in, that I might judge whether, if I was driven one way out, I might not expect to be driven another way home, with the same rapidity of the currents. This thought was no sooner in my head than I cast my eye upon a little hill which sufficiently overlooked the sea both ways, and from whence I had a clear view of the currents or sets of the tide, and which way I was to guide myself in my return. Here I found, that as the current of ebb set out close by the south point of the island, so the current of the flood set in close by the shore of the north side; and that I had nothing to do but to keep to the north side of the island in my return, and I should do well enough.

Encouraged by this observation, I resolved the next morning to set out with the first of the tide; and reposing myself for the night in my canoe, under the watch-coat I mentioned, I launched out. I first made a little out to sea, full north, till I began to feel the benefit of the current, which set eastward, and which carried me at a great rate; and yet did not so hurry me as the current on the south side had done before, so as to take from me all government of the boat; but having a strong steerage with my paddle, I went at a great rate directly for the wreck, and in less than two hours I came up to it. It was a dismal sight to look at; the ship, which by its building was Spanish, stuck fast, jammed in between two rocks. All the stern and quarter of her were beaten to pieces by the sea; and as her forecastle, which stuck in the rocks, had run on with great violence, her mainmast and foremast were brought by the board—that is to say, broken short off; but her bowsprit was sound, and the head and bow appeared firm. When I came close to her, a dog appeared upon her, who, seeing me coming, yelped and cried; and as soon as I called him, jumped into the sea to come to me. I took him into the boat, but found him almost dead with hunger and thirst. I gave him a cake of my bread, and he devoured it like a ravenous wolf that had been starving a fortnight in the snow; I then gave the poor creature some fresh water, with which, if I would have let him, he would have burst himself. After this I went on board; but the first sight I met with was two men drowned in the cook-room, or forecastle of the ship, with their arms fast about one another. I concluded, as is indeed probable, that when the ship struck, it being in a storm, the sea broke so high and so continually over her, that the men were not able to bear it, and were strangled with the constant rushing in of the water, as much as if they had been under water.

Besides the dog, there was nothing left in the ship that had life; nor any goods, that I could see, but what were spoiled by the water. There were some casks of liquor, whether wine or brandy I knew not, which lay lower in the hold, and which, the water being ebbed out, I could see; but they were too big to meddle with. I saw several chests, which I believe belonged to some of the seamen; and I got two of them into the boat, without examining what was in them. Had the stern of the ship been fixed, and the forepart broken off, I am persuaded I might have made a good voyage; for by what I found in those two chests I had room to suppose the ship had a great deal of wealth on board; and, if I may guess from the course she steered, she must have been bound from Buenos Ayres, or the Rio de la Plata, in the south part of America, beyond the Brazils to the Havannah, in the Gulf of Mexico, and so perhaps to Spain. She had, no doubt, a great treasure in her, but of no use, at that time, to anybody; and what became of the crew I then knew not.

I found, besides these chests, a little cask full of liquor, of about twenty gallons, which I got into my boat with much difficulty. There were several muskets in the cabin, and a great powder-horn, with about four pounds of powder in it; as for the muskets, I had no occasion for them, so I left them, but took the powder-horn. I took a fire-shovel and tongs, which I wanted extremely, as also two little brass kettles, a copper pot to make chocolate, and a gridiron; and with this cargo, and the dog, I came away, the tide beginning to make home again—and the same evening, about an hour within night, I reached the island again, weary and fatigued to the last degree. I reposed that night in the boat and in the morning I resolved to harbour what I had got in my new cave, and not carry it home to my castle. After refreshing myself, I got all my cargo on shore, and began to examine the particulars. The cask of liquor I found to be a kind of rum, but not such as we had at the Brazils; and, in a word, not at all good; but when I came to open the chests, I found several things of great use to me—for example, I found in one a fine case of bottles, of an extraordinary kind, and filled with cordial waters, fine and very good; the bottles held about three pints each, and were tipped with silver. I found two pots of very good succades, or sweetmeats, so fastened also on the top that the salt-water had not hurt them; and two more of the same, which the water had spoiled. I found some very good shirts, which were very welcome to me; and about a dozen and a half of white linen handkerchiefs and coloured neckcloths; the former were also very welcome, being exceedingly refreshing to wipe my face in a hot day. Besides this, when I came to the till in the chest, I found there three great bags of pieces of eight, which held about eleven hundred pieces in all; and in one of them, wrapped up in a paper, six doubloons of gold, and some small bars or wedges of gold; I suppose they might all weigh near a pound.

In the other chest were some clothes, but of little value; but, by the circumstances, it must have belonged to the gunner's mate; though there was no powder in it, except two pounds of fine glazed powder, in three flasks, kept, I suppose, for charging their fowling-pieces on occasion. Upon the whole, I got very little by this voyage that was of any use to me; for, as to the money, I had no manner of occasion for it; it was to me as the dirt under my feet, and I would have given it all for three or four pair of English shoes and stockings, which were things I greatly wanted, but had had none on my feet for many years. I had, indeed, got two pair of shoes now, which I took off the feet of two drowned men whom I saw in the wreck, and I found two pair more in one of the chests, which were very welcome to me; but they were not like our English shoes, either for ease or service, being rather what we call pumps than shoes. I found in this seaman's chest about fifty pieces of eight, in rials, but no gold: I supposed this belonged to a poorer man than the other, which seemed to belong to some officer. Well, however, I lugged this money home to my cave, and laid it up, as I had done that before which I had brought from our own ship; but it was a great pity, as I said, that the other part of this ship had not come to my share: for I am satisfied I might have loaded my canoe several times over with money; and, thought I, if I ever escape to England, it might lie here safe enough till I come again and fetch it.

Chapter 14 - A Dream Realised

Having now brought all my things on shore and secured them, I went back to my boat, and rowed or paddled her along the shore to her old harbour, where I laid her up, and made the best of my way to my old habitation, where I found everything safe and quiet. I began now to repose myself, live after my old fashion, and take care of my family affairs; and for a while I lived easy enough, only that I was more vigilant than I used to be, looked out oftener, and did not go abroad so much; and if at any time I did stir with any freedom, it was always to the east part of the island, where I was pretty well satisfied the savages never came, and where I could go without so many precautions, and such a load of arms and ammunition as I always carried with me if I went the other way.

I lived in this condition near two years more; but my unlucky head, that was always to let me know it was born to make my body miserable, was all these two years filled with projects and designs how, if it were possible, I might get away from this island: for sometimes I was for making another voyage to the wreck, though my reason told me that there was nothing left there worth the hazard of my voyage; sometimes for a ramble one way, sometimes another—and I believe verily, if I had had the boat that I went from Sallee in, I should have ventured to sea, bound anywhere, I knew not whither.

I have been, in all my circumstances, a memento to those who are touched with the general plague of mankind, whence, for aught I know, one half of their miseries flow: I mean that of not being satisfied with the station wherein God and Nature hath placed them—for, not to look back upon my primitive condition, and the excellent advice of my father, the opposition to which was, as I may call it, my original sin, my subsequent mistakes of the same kind had been the means of my coming into this miserable condition; for had that Providence which so happily seated me at the Brazils as a planter blessed me with confined desires, and I could have been contented to have gone on gradually, I might have been by this time—I mean in the time of my being in this island—one of the most considerable planters in the Brazils—nay, I am persuaded, that by the improvements I had made in that little time I lived there, and the increase I should probably have made if I had remained, I might have been worth a hundred thousand moidores—and what business had I to leave a settled fortune, a well-stocked plantation, improving and increasing, to turn supercargo to Guinea to fetch negroes, when patience and time would have so increased our stock at home, that we could have bought them at our own door from those whose business it was to fetch them? and though it had cost us something more, yet the difference of that price was by no means worth saving at so great a hazard.

But as this is usually the fate of young heads, so reflection upon the folly of it is as commonly the exercise of more years, or of the dear-bought experience of time—so it was with me now; and yet so deep had the mistake taken root in my temper, that I could not satisfy myself in my station, but was continually poring upon the means and possibility of my escape from this place; and that I may, with greater pleasure to the reader, bring on the remaining part of my story, it may not be improper to give some account of my first conceptions on the subject of this foolish scheme for my escape, and how, and upon what foundation, I acted.

I am now to be supposed retired into my castle, after my late voyage to the wreck, my frigate laid up and secured under water, as usual, and my condition restored to what it was before: I had more wealth, indeed, than I had before, but was not at all the richer; for I had no more use for it than the Indians of Peru had before the Spaniards came there.

It was one of the nights in the rainy season in March, the four-and-twentieth year of my first setting foot in this island of solitude, I was lying in my bed or hammock, awake, very well in health, had no pain, no distemper, no uneasiness of body, nor any uneasiness of mind more than ordinary, but could by no means close my eyes, that is, so as to sleep; no, not a wink all night long, otherwise than as follows:

It is impossible to set down the innumerable crowd of thoughts that whirled through that great thoroughfare of the brain, the memory, in this night's time. I ran over the whole history of my life in miniature, or by abridgment, as I may call it, to my coming to this island, and also of that part of my life since I came to this island. In my reflections upon the state of my case since I came on shore on this island, I was comparing the happy posture of my affairs in the first years of my habitation here, with the life of anxiety, fear, and care which I had lived in ever since I had seen the print of a foot in the sand. Not that I did not believe the savages had frequented the island even all the while, and might have been several hundreds of them at times on shore there; but I had never known it, and was incapable of any apprehensions about it; my satisfaction was perfect, though my danger was the same, and I was as happy in not knowing my danger as if I had never really been exposed to it.

This furnished my thoughts with many very profitable reflections, and particularly this one: How infinitely good that Providence is, which has provided, in its government of mankind, such narrow bounds to his sight and knowledge of things; and though he walks in the midst of so many thousand dangers, the sight of which, if discovered to him, would distract his mind and sink his spirits, he is kept serene and calm, by having the events of things hid from his eyes, and knowing nothing of the dangers which surround him.

After these thoughts had for some time entertained me, I came to reflect seriously upon the real danger I had been in for so many years in this very island, and how I had walked about in the greatest security, and with all possible tranquillity, even when perhaps nothing but the brow of a hill, a great tree, or the casual approach of night, had been between me and the worst kind of destruction—viz. that of falling into the hands of cannibals and savages, who would have seized on me with the same view as I would on a goat or turtle; and have thought it no more crime to kill and devour me than I did of a pigeon or a curlew. I would unjustly slander myself if I should say I was not sincerely thankful to my great Preserver, to whose singular protection I acknowledged, with great humanity, all these unknown deliverances were due, and without which I must inevitably have fallen into their merciless hands.

When these thoughts were over, my head was for some time taken up in considering the nature of these wretched creatures, I mean the savages, and how it came to pass in the world that the wise Governor of all things should give up any of His creatures to such inhumanity—nay, to something so much below even brutality itself—as to devour its own kind: but as this ended in some (at that time) fruitless speculations, it occurred to me to inquire what part of the world these wretches lived in? how far off the coast was from whence they came? what they ventured over so far from home for? what kind of boats they had? and why I might not order myself and my business so that I might be able to go over thither, as they were to come to me?

I never so much as troubled myself to consider what I should do with myself when I went thither; what would become of me if I fell into the hands of these savages; or how I should escape them if they attacked me; no, nor so much as how it was possible for me to reach the coast, and not to be attacked by some or other of them, without any possibility of delivering myself; and if I should not fall into their hands, what I should do for provision, or whither I should bend my course; none of these thoughts, I say, so much as came in my way; but my mind was wholly bent upon the notion of my passing over in my boat to the mainland. I looked upon my present condition as the most miserable that could possibly be; that I was not able to throw myself into anything but death, that could be called worse; and if I reached the shore of the main I might perhaps meet with relief, or I might coast along, as I did on the African shore, till I came to some inhabited country, and where I might find some relief; and after all, perhaps I might fall in with some Christian ship that might take me in: and if the worst came to the worst, I could but die, which would put an end to all these miseries at once. Pray note, all this was the fruit of a disturbed mind, an impatient temper, made desperate, as it were, by the long continuance of my troubles, and the disappointments I had met in the wreck I had been on board of, and where I had been so near obtaining what I so earnestly longed for—somebody to speak to, and to learn some knowledge from them of the place where I was, and of the probable means of my deliverance. I was agitated wholly by these thoughts; all my calm of mind, in my resignation to Providence, and waiting the issue of the dispositions of Heaven, seemed to be suspended; and I had as it were no power to turn my thoughts to anything but to the project of a voyage to the main, which came upon me with such force, and such an impetuosity of desire, that it was not to be resisted.

When this had agitated my thoughts for two hours or more, with such violence that it set my very blood into a ferment, and my pulse beat as if I had been in a fever, merely with the extraordinary fervour of my mind about it, Nature—as if I had been fatigued and exhausted with the very thoughts of it—threw me into a sound sleep. One would have thought I should have dreamed of it, but I did not, nor of anything relating to it, but I dreamed that as I was going out in the morning as usual from my castle, I saw upon the shore two canoes and eleven savages coming to land, and that they brought with them another savage whom they were going to kill in order to eat him; when, on a sudden, the savage that they were going to kill jumped away, and ran for his life; and I thought in my sleep that he came running into my little thick grove before my fortification, to hide himself; and that I seeing him alone, and not perceiving that the others sought him that way, showed myself to him, and smiling upon him, encouraged him: that he kneeled down to me, seeming to pray me to assist him; upon which I showed him my ladder, made him go up, and carried him into my cave, and he became my servant; and that as soon as I had got this man, I said to myself, "Now I may certainly venture to the mainland, for this fellow will serve me as a pilot, and will tell me what to do, and whither to go for provisions, and whither not to go for fear of being devoured; what places to venture into, and what to shun." I waked with this thought; and was under such inexpressible impressions of joy at the prospect of my escape in my dream, that the disappointments which I felt upon coming to myself, and finding that it was no more than a dream, were equally extravagant the other way, and threw me into a very great dejection of spirits.

Upon this, however, I made this conclusion: that my only way to go about to attempt an escape was, to endeavour to get a savage into my possession: and, if possible, it should be one of their prisoners, whom they had condemned to be eaten, and should bring hither to kill. But these thoughts still were attended with this difficulty: that it was impossible to effect this without attacking a whole caravan of them, and killing them all; and this was not only a very desperate attempt, and might miscarry, but, on the other hand, I had greatly scrupled the lawfulness of it to myself; and my heart trembled at the thoughts of shedding so much blood, though it was for my deliverance. I need not repeat the arguments which occurred to me against this, they being the same mentioned before; but though I had other reasons to offer now—viz. that those men were enemies to my life, and would devour me if they could; that it was self-preservation, in the highest degree, to deliver myself from this death of a life, and was acting in my own defence as much as if they were actually assaulting me, and the like; I say though these things argued for it, yet the thoughts of shedding human blood for my deliverance were very terrible to me, and such as I could by no means reconcile myself to for a great while. However, at last, after many secret disputes with myself, and after great perplexities about it (for all these arguments, one way and another, struggled in my head a long time), the eager prevailing desire of deliverance at length mastered all the rest; and I resolved, if possible, to get one of these savages into my hands, cost what it would. My next thing was to contrive how to do it, and this, indeed, was very difficult to resolve on; but as I could pitch upon no probable means for it, so I resolved to put myself upon the watch, to see them when they came on shore, and leave the rest to the event; taking such measures as the opportunity should present, let what would be.

With these resolutions in my thoughts, I set myself upon the scout as often as possible, and indeed so often that I was heartily tired of it; for it was above a year and a half that I waited; and for great part of that time went out to the west end, and to the south-west corner of the island almost every day, to look for canoes, but none appeared. This was very discouraging, and began to trouble me much, though I cannot say that it did in this case (as it had done some time before) wear off the edge of my desire to the thing; but the longer it seemed to be delayed, the more eager I was for it: in a word, I was not at first so careful to shun the sight of these savages, and avoid being seen by them, as I was now eager to be upon them. Besides, I fancied myself able to manage one, nay, two or three savages, if I had them, so as to make them entirely slaves to me, to do whatever I should direct them, and to prevent their being able at any time to do me any hurt. It was a great while that I pleased myself with this affair; but nothing still presented itself; all my fancies and schemes came to nothing, for no savages came near me for a great while.

About a year and a half after I entertained these notions (and by long musing had, as it were, resolved them all into nothing, for want of an occasion to put them into execution), I was surprised one morning by seeing no less than five canoes all on shore together on my side the island, and the people who belonged to them all landed and out of my sight. The number of them broke all my measures; for seeing so many, and knowing that they always came four or six, or sometimes more in a boat, I could not tell what to think of it, or how to take my measures to attack twenty or thirty men single-handed; so lay still in my castle, perplexed and discomforted. However, I put myself into the same position for an attack that I had formerly provided, and was just ready for action, if anything had presented.

Having waited a good while, listening to hear if they made any noise, at length, being very impatient, I set my guns at the foot of my ladder, and clambered up to the top of the hill, by my two stages, as usual; standing so, however, that my head did not appear above the hill, so that they could not perceive me by any means. Here I observed, by the help of my perspective glass, that they were no less than thirty in number; that they had a fire kindled, and that they had meat dressed. How they had cooked it I knew not, or what it was; but they were all dancing, in I know not how many barbarous gestures and figures, their own way, round the fire.

While I was thus looking on them, I perceived, by my perspective, two miserable wretches dragged from the boats, where, it seems, they were laid by, and were now brought out for the slaughter. I perceived one of them immediately fall; being knocked down, I suppose, with a club or wooden sword, for that was their way; and two or three others were at work immediately, cutting him open for their cookery, while the other victim was left standing by himself, till they should be ready for him. In that very moment this poor wretch, seeing himself a little at liberty and unbound, Nature inspired him with hopes of life, and he started away from them, and ran with incredible swiftness along the sands, directly towards me; I mean towards that part of the coast where my habitation was.

I was dreadfully frightened, I must acknowledge, when I perceived him run my way; and especially when, as I thought, I saw him pursued by the whole body: and now I expected that part of my dream was coming to pass, and that he would certainly take shelter in my grove; but I could not depend, by any means, upon my dream, that the other savages would not pursue him thither and find him there. However, I kept my station, and my spirits began to recover when I found that there was not above three men that followed him; and still more was I encouraged, when I found that he outstripped them exceedingly in running, and gained ground on them; so that, if he could but hold out for half-an-hour, I saw easily he would fairly get away from them all.

There was between them and my castle the creek, which I mentioned often in the first part of my story, where I landed my cargoes out of the ship; and this I saw plainly he must necessarily swim over, or the poor wretch would be taken there; but when the savage escaping came thither, he made nothing of it, though the tide was then up; but plunging in, swam through in about thirty strokes, or thereabouts, landed, and ran with exceeding strength and swiftness. When the three persons came to the creek, I found that two of them could swim, but the third could not, and that, standing on the other side, he looked at the others, but went no farther, and soon after went softly back again; which, as it happened, was very well for him in the end. I observed that the two who swam were yet more than twice as strong swimming over the creek as the fellow was that fled from them. It came very warmly upon my thoughts, and indeed irresistibly, that now was the time to get me a servant, and, perhaps, a companion or assistant; and that I was plainly called by Providence to save this poor creature's life. I immediately ran down the ladders with all possible expedition, fetched my two guns, for they were both at the foot of the ladders, as I observed before, and getting up again with the same haste to the top of the hill, I crossed towards the sea; and having a very short cut, and all down hill, placed myself in the way between the pursuers and the pursued, hallowing aloud to him that fled, who, looking back, was at first perhaps as much frightened at me as at them; but I beckoned with my hand to him to come back; and, in the meantime, I slowly advanced towards the two that followed; then rushing at once upon the foremost, I knocked him down with the stock of my piece.

I was loath to fire, because I would not have the rest hear; though, at that distance, it would not have been easily heard, and being out of sight of the smoke, too, they would not have known what to make of it. Having knocked this fellow down, the other who pursued him stopped, as if he had been frightened, and I advanced towards him: but as I came nearer, I perceived presently he had a bow and arrow, and was fitting it to shoot at me: so I was then obliged to shoot at him first, which I did, and killed him at the first shot. The poor savage who fled, but had stopped, though he saw both his enemies fallen and killed, as he thought, yet was so frightened with the fire and noise of my piece that he stood stock still, and neither came forward nor went backward, though he seemed rather inclined still to fly than to come on. I hallooed again to him, and made signs to come forward, which he easily understood, and came a little way; then stopped again, and then a little farther, and stopped again; and I could then perceive that he stood trembling, as if he had been taken prisoner, and had just been to be killed, as his two enemies were. I beckoned to him again to come to me, and gave him all the signs of encouragement that I could think of; and he came nearer and nearer, kneeling down every ten or twelve steps, in token of acknowledgment for saving his life. I smiled at him, and looked pleasantly, and beckoned to him to come still nearer; at length he came close to me; and then he kneeled down again, kissed the ground, and laid his head upon the ground, and taking me by the foot, set my foot upon his head; this, it seems, was in token of swearing to be my slave for ever. I took him up and made much of him, and encouraged him all I could.

But there was more work to do yet; for I perceived the savage whom I had knocked down was not killed, but stunned with the blow, and began to come to himself: so I pointed to him, and showed him the savage, that he was not dead; upon this he spoke some words to me, and though I could not understand them, yet I thought they were pleasant to hear; for they were the first sound of a man's voice that I had heard, my own excepted, for above twenty-five years. But there was no time for such reflections now; the savage who was knocked down recovered himself so far as to sit up upon the ground, and I perceived that my savage began to be afraid; but when I saw that, I presented my other piece at the man, as if I would shoot him: upon this my savage, for so I call him now, made a motion to me to lend him my sword, which hung naked in a belt by my side, which I did. He no sooner had it, but he runs to his enemy, and at one blow cut off his head so cleverly, no executioner in Germany could have done it sooner or better; which I thought very strange for one who, I had reason to believe, never saw a sword in his life before, except their own wooden swords: however, it seems, as I learned afterwards, they make their wooden swords so sharp, so heavy, and the wood is so hard, that they will even cut off heads with them, ay, and arms, and that at one blow, too. When he had done this, he comes laughing to me in sign of triumph, and brought me the sword again, and with abundance of gestures which I did not understand, laid it down, with the head of the savage that he had killed, just before me. But that which astonished him most was to know how I killed the other Indian so far off; so, pointing to him, he made signs to me to let him go to him; and I bade him go, as well as I could.

When he came to him, he stood like one amazed, looking at him, turning him first on one side, then on the other; looked at the wound the bullet had made, which it seems was just in his breast, where it had made a hole, and no great quantity of blood had followed; but he had bled inwardly, for he was quite dead. He took up his bow and arrows, and came back; so I turned to go away, and beckoned him to follow me, making signs to him that more might come after them. Upon this he made signs to me that he should bury them with sand, that they might not be seen by the rest, if they followed; and so I made signs to him again to do so. He fell to work; and in an instant he had scraped a hole in the sand with his hands big enough to bury the first in, and then dragged him into it, and covered him; and did so by the other also; I believe he had him buried them both in a quarter of an hour. Then, calling away, I carried him, not to my castle, but quite away to my cave, on the farther part of the island: so I did not let my dream come to pass in that part, that he came into my grove for shelter. Here I gave him bread and a bunch of raisins to eat, and a draught of water, which I found he was indeed in great distress for, from his running: and having refreshed him, I made signs for him to go and lie down to sleep, showing him a place where I had laid some rice-straw, and a blanket upon it, which I used to sleep upon myself sometimes; so the poor creature lay down, and went to sleep.

He was a comely, handsome fellow, perfectly well made, with straight, strong limbs, not too large; tall, and well-shaped; and, as I reckon, about twenty-six years of age. He had a very good countenance, not a fierce and surly aspect, but seemed to have something very manly in his face; and yet he had all the sweetness and softness of a European in his countenance, too, especially when he smiled. His hair was long and black, not curled like wool; his forehead very high and large; and a great vivacity and sparkling sharpness in his eyes. The colour of his skin was not quite black, but very tawny; and yet not an ugly, yellow, nauseous tawny, as the Brazilians and Virginians, and other natives of America are, but of a bright kind of a dun olive-colour, that had in it something very agreeable, though not very easy to describe. His face was round and plump; his nose small, not flat, like the negroes; a very good mouth, thin lips, and his fine teeth well set, and as white as ivory.

After he had slumbered, rather than slept, about half-an-hour, he awoke again, and came out of the cave to me, for I had been milking my goats which I had in the enclosure just by: when he espied me he came running to me, laying himself down again upon the ground, with all the possible signs of an humble, thankful disposition, making a great many antic gestures to show it. At last he lays his head flat upon the ground, close to my foot, and sets my other foot upon his head, as he had done before; and after this made all the signs to me of subjection, servitude, and submission imaginable, to let me know how he would serve me so long as he lived. I understood him in many things, and let him know I was very well pleased with him. In a little time I began to speak to him; and teach him to speak to me; and first, I let him know his name should be Friday, which was the day I saved his life; I called him so for the memory of the time. I likewise taught him to say Master; and then let him know that was to be my name; I likewise taught him to say Yes and No and to know the meaning of them.

I gave him some milk in an earthen pot, and let him see me drink it before him, and sop my bread in it; and gave him a cake of bread to do the like, which he quickly complied with, and made signs that it was very good for him. I kept there with him all that night; but as soon as it was day I beckoned to him to come with me, and let him know I would give him some clothes; at which he seemed very glad, for he was stark naked. As we went by the place where he had buried the two men, he pointed exactly to the place, and showed me the marks that he had made to find them again, making signs to me that we should dig them up again and eat them. At this I appeared very angry, expressed my abhorrence of it, made as if I would vomit at the thoughts of it, and beckoned with my hand to him to come away, which he did immediately, with great submission.

I then led him up to the top of the hill, to see if his enemies were gone; and pulling out my glass I looked, and saw plainly the place where they had been, but no appearance of them or their canoes; so that it was plain they were gone, and had left their two comrades behind them, without any search after them.

But I was not content with this discovery; but having now more courage, and consequently more curiosity, I took my man Friday with me, giving him the sword in his hand, with the bow and arrows at his back, which I found he could use very dexterously, making him carry one gun for me, and I two for myself; and away we marched to the place where these creatures had been; for I had a mind now to get some further intelligence of them. When I came to the place my very blood ran chill in my veins, and my heart sunk within me, at the horror of the spectacle; indeed, it was a dreadful sight, at least it was so to me, though Friday made nothing of it. The place was covered with human bones, the ground dyed with their blood, and great pieces of flesh left here and there, half-eaten, mangled, and scorched; and, in short, all the tokens of the triumphant feast they had been making there, after a victory over their enemies.

I saw three skulls, five hands, and the bones of three or four legs and feet, and abundance of other parts of the bodies; and Friday, by his signs, made me understand that they brought over four prisoners to feast upon; that three of them were eaten up, and that he, pointing to himself, was the fourth; that there had been a great battle between them and their next king, of whose subjects, it seems, he had been one, and that they had taken a great number of prisoners; all which were carried to several places by those who had taken them in the fight, in order to feast upon them, as was done here by these wretches upon those they brought hither.

I caused Friday to gather all the skulls, bones, flesh, and whatever remained, and lay them together in a heap, and make a great fire upon it, and burn them all to ashes. I found Friday had still a hankering stomach after some of the flesh, and was still a cannibal in his nature; but I showed so much abhorrence at the very thoughts of it, and at the least appearance of it, that he durst not discover it: for I had, by some means, let him know that I would kill him if he offered it.

When he had done this, we came back to our castle; and there I fell to work for my man Friday; and first of all, I gave him a pair of linen drawers, which I had out of the poor gunner's chest I mentioned, which I found in the wreck, and which, with a little alteration, fitted him very well; and then I made him a jerkin of goat's skin, as well as my skill would allow (for I was now grown a tolerably good tailor); and I gave him a cap which I made of hare's skin, very convenient, and fashionable enough; and thus he was clothed, for the present, tolerably well, and was mighty well pleased to see himself almost as well clothed as his master. It is true he went awkwardly in these clothes at first: wearing the drawers was very awkward to him, and the sleeves of the waistcoat galled his shoulders and the inside of his arms; but a little easing them where he complained they hurt him, and using himself to them, he took to them at length very well.

The next day, after I came home to my hutch with him, I began to consider where I should lodge him: and that I might do well for him and yet be perfectly easy myself, I made a little tent for him in the vacant place between my two fortifications, in the inside of the last, and in the outside of the first. As there was a door or entrance there into my cave, I made a formal framed door-case, and a door to it, of boards, and set it up in the passage, a little within the entrance; and, causing the door to open in the inside, I barred it up in the night, taking in my ladders, too; so that Friday could no way come at me in the inside of my innermost wall, without making so much noise in getting over that it must needs awaken me; for my first wall had now a complete roof over it of long poles, covering all my tent, and leaning up to the side of the hill; which was again laid across with smaller sticks, instead of laths, and then thatched over a great thickness with the rice-straw, which was strong, like reeds; and at the hole or place which was left to go in or out by the ladder I had placed a kind of trap-door, which, if it had been attempted on the outside, would not have opened at all, but would have fallen down and made a great noise—as to weapons, I took them all into my side every night. But I needed none of all this precaution; for never man had a more faithful, loving, sincere servant than Friday was to me: without passions, sullenness, or designs, perfectly obliged and engaged; his very affections were tied to me, like those of a child to a father; and I daresay he would have sacrificed his life to save mine upon any occasion whatsoever—the many testimonies he gave me of this put it out of doubt, and soon convinced me that I needed to use no precautions for my safety on his account.

This frequently gave me occasion to observe, and that with wonder, that however it had pleased God in His providence, and in the government of the works of His hands, to take from so great a part of the world of His creatures the best uses to which their faculties and the powers of their souls are adapted, yet that He has bestowed upon them the same powers, the same reason, the same affections, the same sentiments of kindness and obligation, the same passions and resentments of wrongs, the same sense of gratitude, sincerity, fidelity, and all the capacities of doing good and receiving good that He has given to us; and that when He pleases to offer them occasions of exerting these, they are as ready, nay, more ready, to apply them to the right uses for which they were bestowed than we are. This made me very melancholy sometimes, in reflecting, as the several occasions presented, how mean a use we make of all these, even though we have these powers enlightened by the great lamp of instruction, the Spirit of God, and by the knowledge of His word added to our understanding; and why it has pleased God to hide the like saving knowledge from so many millions of souls, who, if I might judge by this poor savage, would make a much better use of it than we did.

From hence I sometimes was led too far, to invade the sovereignty of Providence, and, as it were, arraign the justice of so arbitrary a disposition of things, that should hide that sight from some, and reveal it to others, and yet expect a like duty from both; but I shut it up, and checked my thoughts with this conclusion: first, that we did not know by what light and law these should be condemned; but that as God was necessarily, and by the nature of His being, infinitely holy and just, so it could not be, but if these creatures were all sentenced to absence from Himself, it was on account of sinning against that light which, as the Scripture says, was a law to themselves, and by such rules as their consciences would acknowledge to be just, though the foundation was not discovered to us; and secondly, that still as we all are the clay in the hand of the potter, no vessel could say to him, "Why hast thou formed me thus?"

But to return to my new companion. I was greatly delighted with him, and made it my business to teach him everything that was proper to make him useful, handy, and helpful; but especially to make him speak, and understand me when I spoke; and he was the aptest scholar that ever was; and particularly was so merry, so constantly diligent, and so pleased when he could but understand me, or make me understand him, that it was very pleasant for me to talk to him. Now my life began to be so easy that I began to say to myself that could I but have been safe from more savages, I cared not if I was never to remove from the place where I lived.

Chapter 15 - Friday's Education

After I had been two or three days returned to my castle, I thought that, in order to bring Friday off from his horrid way of feeding, and from the relish of a cannibal's stomach, I ought to let him taste other flesh; so I took him out with me one morning to the woods. I went, indeed, intending to kill a kid out of my own flock; and bring it home and dress it; but as I was going I saw a she-goat lying down in the shade, and two young kids sitting by her. I catched hold of Friday. "Hold," said I, "stand still;" and made signs to him not to stir: immediately I presented my piece, shot, and killed one of the kids. The poor creature, who had at a distance, indeed, seen me kill the savage, his enemy, but did not know, nor could imagine how it was done, was sensibly surprised, trembled, and shook, and looked so amazed that I thought he would have sunk down. He did not see the kid I shot at, or perceive I had killed it, but ripped up his waistcoat to feel whether he was not wounded; and, as I found presently, thought I was resolved to kill him: for he came and kneeled down to me, and embracing my knees, said a great many things I did not understand; but I could easily see the meaning was to pray me not to kill him.

I soon found a way to convince him that I would do him no harm; and taking him up by the hand, laughed at him, and pointing to the kid which I had killed, beckoned to him to run and fetch it, which he did: and while he was wondering, and looking to see how the creature was killed, I loaded my gun again. By-and-by I saw a great fowl, like a hawk, sitting upon a tree within shot; so, to let Friday understand a little what I would do, I called him to me again, pointed at the fowl, which was indeed a parrot, though I thought it had been a hawk; I say, pointing to the parrot, and to my gun, and to the ground under the parrot, to let him see I would make it fall, I made him understand that I would shoot and kill that bird; accordingly, I fired, and bade him look, and immediately he saw the parrot fall. He stood like one frightened again, notwithstanding all I had said to him; and I found he was the more amazed, because he did not see me put anything into the gun, but thought that there must be some wonderful fund of death and destruction in that thing, able to kill man, beast, bird, or anything near or far off; and the astonishment this created in him was such as could not wear off for a long time; and I believe, if I would have let him, he would have worshipped me and my gun. As for the gun itself, he would not so much as touch it for several days after; but he would speak to it and talk to it, as if it had answered him, when he was by himself; which, as I afterwards learned of him, was to desire it not to kill him.

Well, after his astonishment was a little over at this, I pointed to him to run and fetch the bird I had shot, which he did, but stayed some time; for the parrot, not being quite dead, had fluttered away a good distance from the place where she fell: however, he found her, took her up, and brought her to me; and as I had perceived his ignorance about the gun before, I took this advantage to charge the gun again, and not to let him see me do it, that I might be ready for any other mark that might present; but nothing more offered at that time: so I brought home the kid, and the same evening I took the skin off, and cut it out as well as I could; and having a pot fit for that purpose, I boiled or stewed some of the flesh, and made some very good broth. After I had begun to eat some I gave some to my man, who seemed very glad of it, and liked it very well; but that which was strangest to him was to see me eat salt with it. He made a sign to me that the salt was not good to eat; and putting a little into his own mouth, he seemed to nauseate it, and would spit and sputter at it, washing his mouth with fresh water after it: on the other hand, I took some meat into my mouth without salt, and I pretended to spit and sputter for want of salt, as much as he had done at the salt; but it would not do; he would never care for salt with meat or in his broth; at least, not for a great while, and then but a very little.

Having thus fed him with boiled meat and broth, I was resolved to feast him the next day by roasting a piece of the kid: this I did by hanging it before the fire on a string, as I had seen many people do in England, setting two poles up, one on each side of the fire, and one across the top, and tying the string to the cross stick, letting the meat turn continually. This Friday admired very much; but when he came to taste the flesh, he took so many ways to tell me how well he liked it, that I could not but understand him: and at last he told me, as well as he could, he would never eat man's flesh any more, which I was very glad to hear.

The next day I set him to work beating some corn out, and sifting it in the manner I used to do, as I observed before; and he soon understood how to do it as well as I, especially after he had seen what the meaning of it was, and that it was to make bread of; for after that I let him see me make my bread, and bake it too; and in a little time Friday was able to do all the work for me as well as I could do it myself.

I began now to consider, that having two mouths to feed instead of one, I must provide more ground for my harvest, and plant a larger quantity of corn than I used to do; so I marked out a larger piece of land, and began the fence in the same manner as before, in which Friday worked not only very willingly and very hard, but did it very cheerfully: and I told him what it was for; that it was for corn to make more bread, because he was now with me, and that I might have enough for him and myself too. He appeared very sensible of that part, and let me know that he thought I had much more labour upon me on his account than I had for myself; and that he would work the harder for me if I would tell him what to do.

This was the pleasantest year of all the life I led in this place. Friday began to talk pretty well, and understand the names of almost everything I had occasion to call for, and of every place I had to send him to, and talked a great deal to me; so that, in short, I began now to have some use for my tongue again, which, indeed, I had very little occasion for before. Besides the pleasure of talking to him, I had a singular satisfaction in the fellow himself: his simple, unfeigned honesty appeared to me more and more every day, and I began really to love the creature; and on his side I believe he loved me more than it was possible for him ever to love anything before.

I had a mind once to try if he had any inclination for his own country again; and having taught him English so well that he could answer me almost any question, I asked him whether the nation that he belonged to never conquered in battle? At which he smiled, and said—"Yes, yes, we always fight the better;" that is, he meant always get the better in fight; and so we began the following discourse:—

Master.—You always fight the better; how came you to be taken prisoner, then, Friday?

Friday.—My nation beat much for all that.

Master.—How beat? If your nation beat them, how came you to be taken?

Friday.—They more many than my nation, in the place where me was; they take one, two, three, and me: my nation over-beat them in the yonder place, where me no was; there my nation take one, two, great thousand.

Master.—But why did not your side recover you from the hands of your enemies, then?

Friday.—They run, one, two, three, and me, and make go in the canoe; my nation have no canoe that time.

Master.—Well, Friday, and what does your nation do with the men they take? Do they carry them away and eat them, as these did?

Friday.—Yes, my nation eat mans too; eat all up.

Master.—Where do they carry them?

Friday.—Go to other place, where they think.

Master.—Do they come hither?

Friday.—Yes, yes, they come hither; come other else place.

Master.—Have you been here with them?

Friday.—Yes, I have been here (points to the NW. side of the island, which, it seems, was their side).

By this I understood that my man Friday had formerly been among the savages who used to come on shore on the farther part of the island, on the same man-eating occasions he was now brought for; and some time after, when I took the courage to carry him to that side, being the same I formerly mentioned, he presently knew the place, and told me he was there once, when they ate up twenty men, two women, and one child; he could not tell twenty in English, but he numbered them by laying so many stones in a row, and pointing to me to tell them over.

I have told this passage, because it introduces what follows: that after this discourse I had with him, I asked him how far it was from our island to the shore, and whether the canoes were not often lost. He told me there was no danger, no canoes ever lost: but that after a little way out to sea, there was a current and wind, always one way in the morning, the other in the afternoon. This I understood to be no more than the sets of the tide, as going out or coming in; but I afterwards understood it was occasioned by the great draft and reflux of the mighty river Orinoco, in the mouth or gulf of which river, as I found afterwards, our island lay; and that this land, which I perceived to be W. and NW., was the great island Trinidad, on the north point of the mouth of the river. I asked Friday a thousand questions about the country, the inhabitants, the sea, the coast, and what nations were near; he told me all he knew with the greatest openness imaginable. I asked him the names of the several nations of his sort of people, but could get no other name than Caribs; from whence I easily understood that these were the Caribbees, which our maps place on the part of America which reaches from the mouth of the river Orinoco to Guiana, and onwards to St. Martha. He told me that up a great way beyond the moon, that was beyond the setting of the moon, which must be west from their country, there dwelt white bearded men, like me, and pointed to my great whiskers, which I mentioned before; and that they had killed much mans, that was his word: by all which I understood he meant the Spaniards, whose cruelties in America had been spread over the whole country, and were remembered by all the nations from father to son.

ENTERTAINMENT
Entertainment
Crusoe
Chapter 15

I inquired if he could tell me how I might go from this island, and get among those white men. He told me, "Yes, yes, you may go in two canoe." I could not understand what he meant, or make him describe to me what he meant by two canoe, till at last, with great difficulty, I found he meant it must be in a large boat, as big as two canoes. This part of Friday's discourse I began to relish very well; and from this time I entertained some hopes that, one time or other, I might find an opportunity to make my escape from this place, and that this poor savage might be a means to help me.

During the long time that Friday had now been with me, and that he began to speak to me, and understand me, I was not wanting to lay a foundation of religious knowledge in his mind; particularly I asked him one time, who made him. The creature did not understand me at all, but thought I had asked who was his father—but I took it up by another handle, and asked him who made the sea, the ground we walked on, and the hills and woods. He told me, "It was one Benamuckee, that lived beyond all;" he could describe nothing of this great person, but that he was very old, "much older," he said, "than the sea or land, than the moon or the stars." I asked him then, if this old person had made all things, why did not all things worship him? He looked very grave, and, with a perfect look of innocence, said, "All things say O to him." I asked him if the people who die in his country went away anywhere? He said, "Yes; they all went to Benamuckee." Then I asked him whether those they eat up went thither too. He said, "Yes."

From these things, I began to instruct him in the knowledge of the true God; I told him that the great Maker of all things lived up there, pointing up towards heaven; that He governed the world by the same power and providence by which He made it; that He was omnipotent, and could do everything for us, give everything to us, take everything from us; and thus, by degrees, I opened his eyes. He listened with great attention, and received with pleasure the notion of Jesus Christ being sent to redeem us; and of the manner of making our prayers to God, and His being able to hear us, even in heaven. He told me one day, that if our God could hear us, up beyond the sun, he must needs be a greater God than their Benamuckee, who lived but a little way off, and yet could not hear till they went up to the great mountains where he dwelt to speak to them.

I asked him if ever he went thither to speak to him. He said, "No; they never went that were young men; none went thither but the old men," whom he called their Oowokakee; that is, as I made him explain to me, their religious, or clergy; and that they went to say O (so he called saying prayers), and then came back and told them what Benamuckee said. By this I observed, that there is priestcraft even among the most blinded, ignorant pagans in the world; and the policy of making a secret of religion, in order to preserve the veneration of the people to the clergy, not only to be found in the Roman, but, perhaps, among all religions in the world, even among the most brutish and barbarous savages.

I endeavoured to clear up this fraud to my man Friday; and told him that the pretence of their old men going up to the mountains to say O to their god Benamuckee was a cheat; and their bringing word from thence what he said was much more so; that if they met with any answer, or spake with any one there, it must be with an evil spirit; and then I entered into a long discourse with him about the devil, the origin of him, his rebellion against God, his enmity to man, the reason of it, his setting himself up in the dark parts of the world to be worshipped instead of God, and as God, and the many stratagems he made use of to delude mankind to their ruin; how he had a secret access to our passions and to our affections, and to adapt his snares to our inclinations, so as to cause us even to be our own tempters, and run upon our destruction by our own choice.

I found it was not so easy to imprint right notions in his mind about the devil as it was about the being of a God. Nature assisted all my arguments to evidence to him even the necessity of a great First Cause, an overruling, governing Power, a secret directing Providence, and of the equity and justice of paying homage to Him that made us, and the like; but there appeared nothing of this kind in the notion of an evil spirit, of his origin, his being, his nature, and above all, of his inclination to do evil, and to draw us in to do so too; and the poor creature puzzled me once in such a manner, by a question merely natural and innocent, that I scarce knew what to say to him. I had been talking a great deal to him of the power of God, His omnipotence, His aversion to sin, His being a consuming fire to the workers of iniquity; how, as He had made us all, He could destroy us and all the world in a moment; and he listened with great seriousness to me all the while.

After this I had been telling him how the devil was God's enemy in the hearts of men, and used all his malice and skill to defeat the good designs of Providence, and to ruin the kingdom of Christ in the world, and the like. "Well," says Friday, "but you say God is so strong, so great; is He not much strong, much might as the devil?" "Yes, yes," says I, "Friday; God is stronger than the devil—God is above the devil, and therefore we pray to God to tread him down under our feet, and enable us to resist his temptations and quench his fiery darts." "But," says he again, "if God much stronger, much might as the wicked devil, why God no kill the devil, so make him no more do wicked?" I was strangely surprised at this question; and, after all, though I was now an old man, yet I was but a young doctor, and ill qualified for a casuist or a solver of difficulties; and at first I could not tell what to say; so I pretended not to hear him, and asked him what he said; but he was too earnest for an answer to forget his question, so that he repeated it in the very same broken words as above. By this time I had recovered myself a little, and I said, "God will at last punish him severely; he is reserved for the judgment, and is to be cast into the bottomless pit, to dwell with everlasting fire." This did not satisfy Friday; but he returns upon me, repeating my words, "'Reserve at last!' me no understand—but why not kill the devil now; not kill great ago?" "You may as well ask me," said I, "why God does not kill you or me, when we do wicked things here that offend Him—we are preserved to repent and be pardoned." He mused some time on this.

"Well, well," says he, mighty affectionately, "that well—so you, I, devil, all wicked, all preserve, repent, God pardon all." Here I was run down again by him to the last degree; and it was a testimony to me, how the mere notions of nature, though they will guide reasonable creatures to the knowledge of a God, and of a worship or homage due to the supreme being of God, as the consequence of our nature, yet nothing but divine revelation can form the knowledge of Jesus Christ, and of redemption purchased for us; of a Mediator of the new covenant, and of an Intercessor at the footstool of God's throne; I say, nothing but a revelation from Heaven can form these in the soul; and that, therefore, the gospel of our Lord and Saviour Jesus Christ, I mean the Word of God, and the Spirit of God, promised for the guide and sanctifier of His people, are the absolutely necessary instructors of the souls of men in the saving knowledge of God and the means of salvation.

I therefore diverted the present discourse between me and my man, rising up hastily, as upon some sudden occasion of going out; then sending him for something a good way off, I seriously prayed to God that He would enable me to instruct savingly this poor savage; assisting, by His Spirit, the heart of the poor ignorant creature to receive the light of the knowledge of God in Christ, reconciling him to Himself, and would guide me so to speak to him from the Word of God that his conscience might be convinced, his eyes opened, and his soul saved. When he came again to me, I entered into a long discourse with him upon the subject of the redemption of man by the Saviour of the world, and of the doctrine of the gospel preached from Heaven, viz. of repentance towards God, and faith in our blessed Lord Jesus. I then explained to him as well as I could why our blessed Redeemer took not on Him the nature of angels but the seed of Abraham; and how, for that reason, the fallen angels had no share in the redemption; that He came only to the lost sheep of the house of Israel, and the like.

I had, God knows, more sincerity than knowledge in all the methods I took for this poor creature's instruction, and must acknowledge, what I believe all that act upon the same principle will find, that in laying things open to him, I really informed and instructed myself in many things that either I did not know or had not fully considered before, but which occurred naturally to my mind upon searching into them, for the information of this poor savage; and I had more affection in my inquiry after things upon this occasion than ever I felt before: so that, whether this poor wild wretch was better for me or no, I had great reason to be thankful that ever he came to me; my grief sat lighter, upon me; my habitation grew comfortable to me beyond measure: and when I reflected that in this solitary life which I have been confined to, I had not only been moved to look up to heaven myself, and to seek the Hand that had brought me here, but was now to be made an instrument, under Providence, to save the life, and, for aught I knew, the soul of a poor savage, and bring him to the true knowledge of religion and of the Christian doctrine, that he might know Christ Jesus, in whom is life eternal; I say, when I reflected upon all these things, a secret joy ran through every part of My soul, and I frequently rejoiced that ever I was brought to this place, which I had so often thought the most dreadful of all afflictions that could possibly have befallen me.

I continued in this thankful frame all the remainder of my time; and the conversation which employed the hours between Friday and me was such as made the three years which we lived there together perfectly and completely happy, if any such thing as complete happiness can be formed in a sublunary state. This savage was now a good Christian, a much better than I; though I have reason to hope, and bless God for it, that we were equally penitent, and comforted, restored penitents. We had here the Word of God to read, and no farther off from His Spirit to instruct than if we had been in England. I always applied myself, in reading the Scripture, to let him know, as well as I could, the meaning of what I read; and he again, by his serious inquiries and questionings, made me, as I said before, a much better scholar in the Scripture knowledge than I should ever have been by my own mere private reading. Another thing I cannot refrain from observing here also, from experience in this retired part of my life, viz. how infinite and inexpressible a blessing it is that the knowledge of God, and of the doctrine of salvation by Christ Jesus, is so plainly laid down in the Word of God, so easy to be received and understood, that, as the bare reading the Scripture made me capable of understanding enough of my duty to carry me directly on to the great work of sincere repentance for my sins, and laying hold of a Saviour for life and salvation, to a stated reformation in practice, and obedience to all God's commands, and this without any teacher or instructor, I mean human; so the same plain instruction sufficiently served to the enlightening this savage creature, and bringing him to be such a Christian as I have known few equal to him in my life.

As to all the disputes, wrangling, strife, and contention which have happened in the world about religion, whether niceties in doctrines or schemes of church government, they were all perfectly useless to us, and, for aught I can yet see, they have been so to the rest of the world. We had the sure guide to heaven, viz. the Word of God; and we had, blessed be God, comfortable views of the Spirit of God teaching and instructing by His word, leading us into all truth, and making us both willing and obedient to the instruction of His word. And I cannot see the least use that the greatest knowledge of the disputed points of religion, which have made such confusion in the world, would have been to us, if we could have obtained it. But I must go on with the historical part of things, and take every part in its order.

After Friday and I became more intimately acquainted, and that he could understand almost all I said to him, and speak pretty fluently, though in broken English, to me, I acquainted him with my own history, or at least so much of it as related to my coming to this place: how I had lived there, and how long; I let him into the mystery, for such it was to him, of gunpowder and bullet, and taught him how to shoot. I gave him a knife, which he was wonderfully delighted with; and I made him a belt, with a frog hanging to it, such as in England we wear hangers in; and in the frog, instead of a hanger, I gave him a hatchet, which was not only as good a weapon in some cases, but much more useful upon other occasions.

I described to him the country of Europe, particularly England, which I came from; how we lived, how we worshipped God, how we behaved to one another, and how we traded in ships to all parts of the world. I gave him an account of the wreck which I had been on board of, and showed him, as near as I could, the place where she lay; but she was all beaten in pieces before, and gone. I showed him the ruins of our boat, which we lost when we escaped, and which I could not stir with my whole strength then; but was now fallen almost all to pieces. Upon seeing this boat, Friday stood, musing a great while, and said nothing.

I asked him what it was he studied upon. At last says he, "Me see such boat like come to place at my nation." I did not understand him a good while; but at last, when I had examined further into it, I understood by him that a boat, such as that had been, came on shore upon the country where he lived: that is, as he explained it, was driven thither by stress of weather. I presently imagined that some European ship must have been cast away upon their coast, and the boat might get loose and drive ashore; but was so dull that I never once thought of men making their escape from a wreck thither, much less whence they might come: so I only inquired after a description of the boat.

Friday described the boat to me well enough; but brought me better to understand him when he added with some warmth, "We save the white mans from drown." Then I presently asked if there were any white mans, as he called them, in the boat. "Yes," he said; "the boat full of white mans." I asked him how many. He told upon his fingers seventeen. I asked him then what became of them. He told me, "They live, they dwell at my nation."

This put new thoughts into my head; for I presently imagined that these might be the men belonging to the ship that was cast away in the sight of my island, as I now called it; and who, after the ship was struck on the rock, and they saw her inevitably lost, had saved themselves in their boat, and were landed upon that wild shore among the savages. Upon this I inquired of him more critically what was become of them. He assured me they lived still there; that they had been there about four years; that the savages left them alone, and gave them victuals to live on. I asked him how it came to pass they did not kill them and eat them. He said, "No, they make brother with them;" that is, as I understood him, a truce; and then he added, "They no eat mans but when make the war fight;" that is to say, they never eat any men but such as come to fight with them and are taken in battle.

It was after this some considerable time, that being upon the top of the hill at the east side of the island, from whence, as I have said, I had, in a clear day, discovered the main or continent of America, Friday, the weather being very serene, looks very earnestly towards the mainland, and, in a kind of surprise, falls a jumping and dancing, and calls out to me, for I was at some distance from him. I asked him what was the matter. "Oh, joy!" says he; "Oh, glad! there see my country, there my nation!" I observed an extraordinary sense of pleasure appeared in his face, and his eyes sparkled, and his countenance discovered a strange eagerness, as if he had a mind to be in his own country again.

This observation of mine put a great many thoughts into me, which made me at first not so easy about my new man Friday as I was before; and I made no doubt but that, if Friday could get back to his own nation again, he would not only forget all his religion but all his obligation to me, and would be forward enough to give his countrymen an account of me, and come back, perhaps with a hundred or two of them, and make a feast upon me, at which he might be as merry as he used to be with those of his enemies when they were taken in war. But I wronged the poor honest creature very much, for which I was very sorry afterwards. However, as my jealousy increased, and held some weeks, I was a little more circumspect, and not so familiar and kind to him as before: in which I was certainly wrong too; the honest, grateful creature having no thought about it but what consisted with the best principles, both as a religious Christian and as a grateful friend, as appeared afterwards to my full satisfaction.

While my jealousy of him lasted, you may be sure I was every day pumping him to see if he would discover any of the new thoughts which I suspected were in him; but I found everything he said was so honest and so innocent, that I could find nothing to nourish my suspicion; and in spite of all my uneasiness, he made me at last entirely his own again; nor did he in the least perceive that I was uneasy, and therefore I could not suspect him of deceit.

One day, walking up the same hill, but the weather being hazy at sea, so that we could not see the continent, I called to him, and said, "Friday, do not you wish yourself in your own country, your own nation?" "Yes," he said, "I be much O glad to be at my own nation." "What would you do there?" said I. "Would you turn wild again, eat men's flesh again, and be a savage as you were before?" He looked full of concern, and shaking his head, said, "No, no, Friday tell them to live good; tell them to pray God; tell them to eat corn-bread, cattle flesh, milk; no eat man again." "Why, then," said I to him, "they will kill you." He looked grave at that, and then said, "No, no, they no kill me, they willing love learn." He meant by this, they would be willing to learn. He added, they learned much of the bearded mans that came in the boat. Then I asked him if he would go back to them. He smiled at that, and told me that he could not swim so far. I told him I would make a canoe for him. He told me he would go if I would go with him.

"I go!" says I; "why, they will eat me if I come there." "No, no," says he, "me make they no eat you; me make they much love you." He meant, he would tell them how I had killed his enemies, and saved his life, and so he would make them love me. Then he told me, as well as he could, how kind they were to seventeen white men, or bearded men, as he called them who came on shore there in distress.

From this time, I confess, I had a mind to venture over, and see if I could possibly join with those bearded men, who I made no doubt were Spaniards and Portuguese; not doubting but, if I could, we might find some method to escape from thence, being upon the continent, and a good company together, better than I could from an island forty miles off the shore, alone and without help. So, after some days, I took Friday to work again by way of discourse, and told him I would give him a boat to go back to his own nation; and, accordingly, I carried him to my frigate, which lay on the other side of the island, and having cleared it of water (for I always kept it sunk in water), I brought it out, showed it him, and we both went into it. I found he was a most dexterous fellow at managing it, and would make it go almost as swift again as I could.

So when he was in, I said to him, "Well, now, Friday, shall we go to your nation?" He looked very dull at my saying so; which it seems was because he thought the boat was too small to go so far. I then told him I had a bigger; so the next day I went to the place where the first boat lay which I had made, but which I could not get into the water. He said that was big enough; but then, as I had taken no care of it, and it had lain two or three and twenty years there, the sun had so split and dried it, that it was rotten. Friday told me such a boat would do very well, and would carry "much enough vittle, drink, bread;" this was his way of talking.

Chapter 16 - Rescue Of Prisoners From Cannibals

Upon the whole, I was by this time so fixed upon my design of going over with him to the continent that I told him we would go and make one as big as that, and he should go home in it. He answered not one word, but looked very grave and sad. I asked him what was the matter with him. He asked me again, "Why you angry mad with Friday?—what me done?" I asked him what he meant. I told him I was not angry with him at all. "No angry!" says he, repeating the words several times; "why send Friday home away to my nation?" "Why," says I, "Friday, did not you say you wished you were there?" "Yes, yes," says he, "wish we both there; no wish Friday there, no master there." In a word, he would not think of going there without me. "I go there, Friday?" says I; "what shall I do there?" He turned very quick upon me at this. "You do great deal much good," says he; "you teach wild mans be good, sober, tame mans; you tell them know God, pray God, and live new life." "Alas, Friday!" says I, "thou knowest not what thou sayest; I am but an ignorant man myself." "Yes, yes," says he, "you teachee me good, you teachee them good." "No, no, Friday," says I, "you shall go without me; leave me here to live by myself, as I did before." He looked confused again at that word; and running to one of the hatchets which he used to wear, he takes it up hastily, and gives it to me. "What must I do with this?" says I to him. "You take kill Friday," says he. "What must kill you for?" said I again. He returns very quick—"What you send Friday away for? Take kill Friday, no send Friday away." This he spoke so earnestly that I saw tears stand in his eyes. In a word, I so plainly discovered the utmost affection in him to me, and a firm resolution in him, that I told him then and often after, that I would never send him away from me if he was willing to stay with me.

Upon the whole, as I found by all his discourse a settled affection to me, and that nothing could part him from me, so I found all the foundation of his desire to go to his own country was laid in his ardent affection to the people, and his hopes of my doing them good; a thing which, as I had no notion of myself, so I had not the least thought or intention, or desire of undertaking it. But still I found a strong inclination to attempting my escape, founded on the supposition gathered from the discourse, that there were seventeen bearded men there; and therefore, without any more delay, I went to work with Friday to find out a great tree proper to fell, and make a large periagua, or canoe, to undertake the voyage. There were trees enough in the island to have built a little fleet, not of periaguas or canoes, but even of good, large vessels; but the main thing I looked at was, to get one so near the water that we might launch it when it was made, to avoid the mistake I committed at first. At last Friday pitched upon a tree; for I found he knew much better than I what kind of wood was fittest for it; nor can I tell to this day what wood to call the tree we cut down, except that it was very like the tree we call fustic, or between that and the Nicaragua wood, for it was much of the same colour and smell. Friday wished to burn the hollow or cavity of this tree out, to make it for a boat, but I showed him how to cut it with tools; which, after I had showed him how to use, he did very handily; and in about a month's hard labour we finished it and made it very handsome; especially when, with our axes, which I showed him how to handle, we cut and hewed the outside into the true shape of a boat. After this, however, it cost us near a fortnight's time to get her along, as it were inch by inch, upon great rollers into the water; but when she was in, she would have carried twenty men with great ease.

When she was in the water, though she was so big, it amazed me to see with what dexterity and how swift my man Friday could manage her, turn her, and paddle her along. So I asked him if he would, and if we might venture over in her. "Yes," he said, "we venture over in her very well, though great blow wind." However I had a further design that he knew nothing of, and that was, to make a mast and a sail, and to fit her with an anchor and cable. As to a mast, that was easy enough to get; so I pitched upon a straight young cedar-tree, which I found near the place, and which there were great plenty of in the island, and I set Friday to work to cut it down, and gave him directions how to shape and order it. But as to the sail, that was my particular care. I knew I had old sails, or rather pieces of old sails, enough; but as I had had them now six-and-twenty years by me, and had not been very careful to preserve them, not imagining that I should ever have this kind of use for them, I did not doubt but they were all rotten; and, indeed, most of them were so. However, I found two pieces which appeared pretty good, and with these I went to work; and with a great deal of pains, and awkward stitching, you may be sure, for want of needles, I at length made a three-cornered ugly thing, like what we call in England a shoulder-of-mutton sail, to go with a boom at bottom, and a little short sprit at the top, such as usually our ships' long-boats sail with, and such as I best knew how to manage, as it was such a one as I had to the boat in which I made my escape from Barbary, as related in the first part of my story.

I was near two months performing this last work, viz. rigging and fitting my masts and sails; for I finished them very complete, making a small stay, and a sail, or foresail, to it, to assist if we should turn to windward; and, what was more than all, I fixed a rudder to the stern of her to steer with. I was but a bungling shipwright, yet as I knew the usefulness and even necessity of such a thing, I applied myself with so much pains to do it, that at last I brought it to pass; though, considering the many dull contrivances I had for it that failed, I think it cost me almost as much labour as making the boat.

After all this was done, I had my man Friday to teach as to what belonged to the navigation of my boat; though he knew very well how to paddle a canoe, he knew nothing of what belonged to a sail and a rudder; and was the most amazed when he saw me work the boat to and again in the sea by the rudder, and how the sail jibed, and filled this way or that way as the course we sailed changed; I say when he saw this he stood like one astonished and amazed. However, with a little use, I made all these things familiar to him, and he became an expert sailor, except that of the compass I could make him understand very little. On the other hand, as there was very little cloudy weather, and seldom or never any fogs in those parts, there was the less occasion for a compass, seeing the stars were always to be seen by night, and the shore by day, except in the rainy seasons, and then nobody cared to stir abroad either by land or sea.

I was now entered on the seven-and-twentieth year of my captivity in this place; though the three last years that I had this creature with me ought rather to be left out of the account, my habitation being quite of another kind than in all the rest of the time. I kept the anniversary of my landing here with the same thankfulness to God for His mercies as at first: and if I had such cause of acknowledgment at first, I had much more so now, having such additional testimonies of the care of Providence over me, and the great hopes I had of being effectually and speedily delivered; for I had an invincible impression upon my thoughts that my deliverance was at hand, and that I should not be another year in this place. I went on, however, with my husbandry; digging, planting, and fencing as usual. I gathered and cured my grapes, and did every necessary thing as before.

The rainy season was in the meantime upon me, when I kept more within doors than at other times. We had stowed our new vessel as secure as we could, bringing her up into the creek, where, as I said in the beginning, I landed my rafts from the ship; and hauling her up to the shore at high-water mark, I made my man Friday dig a little dock, just big enough to hold her, and just deep enough to give her water enough to float in; and then, when the tide was out, we made a strong dam across the end of it, to keep the water out; and so she lay, dry as to the tide from the sea: and to keep the rain off we laid a great many boughs of trees, so thick that she was as well thatched as a house; and thus we waited for the months of November and December, in which I designed to make my adventure.

When the settled season began to come in, as the thought of my design returned with the fair weather, I was preparing daily for the voyage. And the first thing I did was to lay by a certain quantity of provisions, being the stores for our voyage; and intended in a week or a fortnight's time to open the dock, and launch out our boat. I was busy one morning upon something of this kind, when I called to Friday, and bid him to go to the sea-shore and see if he could find a turtle or a tortoise, a thing which we generally got once a week, for the sake of the eggs as well as the flesh. Friday had not been long gone when he came running back, and flew over my outer wall or fence, like one that felt not the ground or the steps he set his foot on; and before I had time to speak to him he cries out to me, "O master! O master! O sorrow! O bad!"—"What's the matter, Friday?" says I. "O yonder there," says he, "one, two, three canoes; one, two, three!" By this way of speaking I concluded there were six; but on inquiry I found there were but three. "Well, Friday," says I, "do not be frightened." So I heartened him up as well as I could. However, I saw the poor fellow was most terribly scared, for nothing ran in his head but that they were come to look for him, and would cut him in pieces and eat him; and the poor fellow trembled so that I scarcely knew what to do with him. I comforted him as well as I could, and told him I was in as much danger as he, and that they would eat me as well as him. "But," says I, "Friday, we must resolve to fight them. Can you fight, Friday?" "Me shoot," says he, "but there come many great number." "No matter for that," said I again; "our guns will fright them that we do not kill." So I asked him whether, if I resolved to defend him, he would defend me, and stand by me, and do just as I bid him. He said, "Me die when you bid die, master."

So I went and fetched a good dram of rum and gave him; for I had been so good a husband of my rum that I had a great deal left. When we had drunk it, I made him take the two fowling-pieces, which we always carried, and loaded them with large swan-shot, as big as small pistol-bullets. Then I took four muskets, and loaded them with two slugs and five small bullets each; and my two pistols I loaded with a brace of bullets each. I hung my great sword, as usual, naked by my side, and gave Friday his hatchet. When I had thus prepared myself, I took my perspective glass, and went up to the side of the hill, to see what I could discover; and I found quickly by my glass that there were one-and-twenty savages, three prisoners, and three canoes; and that their whole business seemed to be the triumphant banquet upon these three human bodies: a barbarous feast, indeed! but nothing more than, as I had observed, was usual with them. I observed also that they had landed, not where they had done when Friday made his escape, but nearer to my creek, where the shore was low, and where a thick wood came almost close down to the sea. This, with the abhorrence of the inhuman errand these wretches came about, filled me with such indignation that I came down again to Friday, and told him I was resolved to go down to them and kill them all; and asked him if he would stand by me. He had now got over his fright, and his spirits being a little raised with the dram I had given him, he was very cheerful, and told me, as before, he would die when I bid die.

In this fit of fury I divided the arms which I had charged, as before, between us; I gave Friday one pistol to stick in his girdle, and three guns upon his shoulder, and I took one pistol and the other three guns myself; and in this posture we marched out. I took a small bottle of rum in my pocket, and gave Friday a large bag with more powder and bullets; and as to orders, I charged him to keep close behind me, and not to stir, or shoot, or do anything till I bid him, and in the meantime not to speak a word. In this posture I fetched a compass to my right hand of near a mile, as well to get over the creek as to get into the wood, so that I could come within shot of them before I should be discovered, which I had seen by my glass it was easy to do.

While I was making this march, my former thoughts returning, I began to abate my resolution: I do not mean that I entertained any fear of their number, for as they were naked, unarmed wretches, it is certain I was superior to them—nay, though I had been alone. But it occurred to my thoughts, what call, what occasion, much less what necessity I was in to go and dip my hands in blood, to attack people who had neither done or intended me any wrong? who, as to me, were innocent, and whose barbarous customs were their own disaster, being in them a token, indeed, of God's having left them, with the other nations of that part of the world, to such stupidity, and to such inhuman courses, but did not call me to take upon me to be a judge of their actions, much less an executioner of His justice—that whenever He thought fit He would take the cause into His own hands, and by national vengeance punish them as a people for national crimes, but that, in the meantime, it was none of my business—that it was true Friday might justify it, because he was a declared enemy and in a state of war with those very particular people, and it was lawful for him to attack them—but I could not say the same with regard to myself. These things were so warmly pressed upon my thoughts all the way as I went, that I resolved I would only go and place myself near them that I might observe their barbarous feast, and that I would act then as God should direct; but that unless something offered that was more a call to me than yet I knew of, I would not meddle with them.

With this resolution I entered the wood, and, with all possible wariness and silence, Friday following close at my heels, I marched till I came to the skirts of the wood on the side which was next to them, only that one corner of the wood lay between me and them. Here I called softly to Friday, and showing him a great tree which was just at the corner of the wood, I bade him go to the tree, and bring me word if he could see there plainly what they were doing. He did so, and came immediately back to me, and told me they might be plainly viewed there—that they were all about their fire, eating the flesh of one of their prisoners, and that another lay bound upon the sand a little from them, whom he said they would kill next; and this fired the very soul within me. He told me it was not one of their nation, but one of the bearded men he had told me of, that came to their country in the boat. I was filled with horror at the very naming of the white bearded man; and going to the tree, I saw plainly by my glass a white man, who lay upon the beach of the sea with his hands and his feet tied with flags, or things like rushes, and that he was an European, and had clothes on.

There was another tree and a little thicket beyond it, about fifty yards nearer to them than the place where I was, which, by going a little way about, I saw I might come at undiscovered, and that then I should be within half a shot of them; so I withheld my passion, though I was indeed enraged to the highest degree; and going back about twenty paces, I got behind some bushes, which held all the way till I came to the other tree, and then came to a little rising ground, which gave me a full view of them at the distance of about eighty yards.

I had now not a moment to lose, for nineteen of the dreadful wretches sat upon the ground, all close huddled together, and had just sent the other two to butcher the poor Christian, and bring him perhaps limb by limb to their fire, and they were stooping down to untie the bands at his feet. I turned to Friday. "Now, Friday," said I, "do as I bid thee." Friday said he would. "Then, Friday," says I, "do exactly as you see me do; fail in nothing." So I set down one of the muskets and the fowling-piece upon the ground, and Friday did the like by his, and with the other musket I took my aim at the savages, bidding him to do the like; then asking him if he was ready, he said, "Yes." "Then fire at them," said I; and at the same moment I fired also.

Friday took his aim so much better than I, that on the side that he shot he killed two of them, and wounded three more; and on my side I killed one, and wounded two. They were, you may be sure, in a dreadful consternation: and all of them that were not hurt jumped upon their feet, but did not immediately know which way to run, or which way to look, for they knew not from whence their destruction came. Friday kept his eyes close upon me, that, as I had bid him, he might observe what I did; so, as soon as the first shot was made, I threw down the piece, and took up the fowling-piece, and Friday did the like; he saw me cock and present; he did the same again. "Are you ready, Friday?" said I. "Yes," says he. "Let fly, then," says I, "in the name of God!" and with that I fired again among the amazed wretches, and so did Friday; and as our pieces were now loaded with what I call swan-shot, or small pistol-bullets, we found only two drop; but so many were wounded that they ran about yelling and screaming like mad creatures, all bloody, and most of them miserably wounded; whereof three more fell quickly after, though not quite dead.

"Now, Friday," says I, laying down the discharged pieces, and taking up the musket which was yet loaded, "follow me," which he did with a great deal of courage; upon which I rushed out of the wood and showed myself, and Friday close at my foot. As soon as I perceived they saw me, I shouted as loud as I could, and bade Friday do so too, and running as fast as I could, which, by the way, was not very fast, being loaded with arms as I was, I made directly towards the poor victim, who was, as I said, lying upon the beach or shore, between the place where they sat and the sea. The two butchers who were just going to work with him had left him at the surprise of our first fire, and fled in a terrible fright to the seaside, and had jumped into a canoe, and three more of the rest made the same way. I turned to Friday, and bade him step forwards and fire at them; he understood me immediately, and running about forty yards, to be nearer them, he shot at them; and I thought he had killed them all, for I saw them all fall of a heap into the boat, though I saw two of them up again quickly; however, he killed two of them, and wounded the third, so that he lay down in the bottom of the boat as if he had been dead.

While my man Friday fired at them, I pulled out my knife and cut the flags that bound the poor victim; and loosing his hands and feet, I lifted him up, and asked him in the Portuguese tongue what he was. He answered in Latin, Christianus; but was so weak and faint that he could scarce stand or speak. I took my bottle out of my pocket and gave it him, making signs that he should drink, which he did; and I gave him a piece of bread, which he ate. Then I asked him what countryman he was: and he said, Espagniole; and being a little recovered, let me know, by all the signs he could possibly make, how much he was in my debt for his deliverance. "Seignior," said I, with as much Spanish as I could make up, "we will talk afterwards, but we must fight now: if you have any strength left, take this pistol and sword, and lay about you." He took them very thankfully; and no sooner had he the arms in his hands, but, as if they had put new vigour into him, he flew upon his murderers like a fury, and had cut two of them in pieces in an instant; for the truth is, as the whole was a surprise to them, so the poor creatures were so much frightened with the noise of our pieces that they fell down for mere amazement and fear, and had no more power to attempt their own escape than their flesh had to resist our shot; and that was the case of those five that Friday shot at in the boat; for as three of them fell with the hurt they received, so the other two fell with the fright.

I kept my piece in my hand still without firing, being willing to keep my charge ready, because I had given the Spaniard my pistol and sword: so I called to Friday, and bade him run up to the tree from whence we first fired, and fetch the arms which lay there that had been discharged, which he did with great swiftness; and then giving him my musket, I sat down myself to load all the rest again, and bade them come to me when they wanted. While I was loading these pieces, there happened a fierce engagement between the Spaniard and one of the savages, who made at him with one of their great wooden swords, the weapon that was to have killed him before, if I had not prevented it. The Spaniard, who was as bold and brave as could be imagined, though weak, had fought the Indian a good while, and had cut two great wounds on his head; but the savage being a stout, lusty fellow, closing in with him, had thrown him down, being faint, and was wringing my sword out of his hand; when the Spaniard, though undermost, wisely quitting the sword, drew the pistol from his girdle, shot the savage through the body, and killed him upon the spot, before I, who was running to help him, could come near him.

Friday, being now left to his liberty, pursued the flying wretches, with no weapon in his hand but his hatchet: and with that he despatched those three who as I said before, were wounded at first, and fallen, and all the rest he could come up with: and the Spaniard coming to me for a gun, I gave him one of the fowling-pieces, with which he pursued two of the savages, and wounded them both; but as he was not able to run, they both got from him into the wood, where Friday pursued them, and killed one of them, but the other was too nimble for him; and though he was wounded, yet had plunged himself into the sea, and swam with all his might off to those two who were left in the canoe; which three in the canoe, with one wounded, that we knew not whether he died or no, were all that escaped our hands of one-and-twenty. The account of the whole is as follows: Three killed at our first shot from the tree; two killed at the next shot; two killed by Friday in the boat; two killed by Friday of those at first wounded; one killed by Friday in the wood; three killed by the Spaniard; four killed, being found dropped here and there, of the wounds, or killed by Friday in his chase of them; four escaped in the boat, whereof one wounded, if not dead—twenty-one in all.

Those that were in the canoe worked hard to get out of gun-shot, and though Friday made two or three shots at them, I did not find that he hit any of them. Friday would fain have had me take one of their canoes, and pursue them; and indeed I was very anxious about their escape, lest, carrying the news home to their people, they should come back perhaps with two or three hundred of the canoes and devour us by mere multitude; so I consented to pursue them by sea, and running to one of their canoes, I jumped in and bade Friday follow me: but when I was in the canoe I was surprised to find another poor creature lie there, bound hand and foot, as the Spaniard was, for the slaughter, and almost dead with fear, not knowing what was the matter; for he had not been able to look up over the side of the boat, he was tied so hard neck and heels, and had been tied so long that he had really but little life in him.

I immediately cut the twisted flags or rushes which they had bound him with, and would have helped him up; but he could not stand or speak, but groaned most piteously, believing, it seems, still, that he was only unbound in order to be killed. When Friday came to him I bade him speak to him, and tell him of his deliverance; and pulling out my bottle, made him give the poor wretch a dram, which, with the news of his being delivered, revived him, and he sat up in the boat.

But when Friday came to hear him speak, and look in his face, it would have moved any one to tears to have seen how Friday kissed him, embraced him, hugged him, cried, laughed, hallooed, jumped about, danced, sang; then cried again, wrung his hands, beat his own face and head; and then sang and jumped about again like a distracted creature. It was a good while before I could make him speak to me or tell me what was the matter; but when he came a little to himself he told me that it was his father.

It is not easy for me to express how it moved me to see what ecstasy and filial affection had worked in this poor savage at the sight of his father, and of his being delivered from death; nor indeed can I describe half the extravagances of his affection after this: for he went into the boat and out of the boat a great many times: when he went in to him he would sit down by him, open his breast, and hold his father's head close to his bosom for many minutes together, to nourish it; then he took his arms and ankles, which were numbed and stiff with the binding, and chafed and rubbed them with his hands; and I, perceiving what the case was, gave him some rum out of my bottle to rub them with, which did them a great deal of good. This affair put an end to our pursuit of the canoe with the other savages, who were now almost out of sight; and it was happy for us that we did not, for it blew so hard within two hours after, and before they could be got a quarter of their way, and continued blowing so hard all night, and that from the north-west, which was against them, that I could not suppose their boat could live, or that they ever reached their own coast.

But to return to Friday; he was so busy about his father that I could not find in my heart to take him off for some time; but after I thought he could leave him a little, I called him to me, and he came jumping and laughing, and pleased to the highest extreme: then I asked him if he had given his father any bread. He shook his head, and said, "None; ugly dog eat all up self." I then gave him a cake of bread out of a little pouch I carried on purpose; I also gave him a dram for himself; but he would not taste it, but carried it to his father. I had in my pocket two or three bunches of raisins, so I gave him a handful of them for his father. He had no sooner given his father these raisins but I saw him come out of the boat, and run away as if he had been bewitched, for he was the swiftest fellow on his feet that ever I saw: I say, he ran at such a rate that he was out of sight, as it were, in an instant; and though I called, and hallooed out too after him, it was all one—away he went; and in a quarter of an hour I saw him come back again, though not so fast as he went; and as he came nearer I found his pace slacker, because he had something in his hand. When he came up to me I found he had been quite home for an earthen jug or pot, to bring his father some fresh water, and that he had got two more cakes or loaves of bread: the bread he gave me, but the water he carried to his father; however, as I was very thirsty too, I took a little of it. The water revived his father more than all the rum or spirits I had given him, for he was fainting with thirst.

When his father had drunk, I called to him to know if there was any water left. He said, "Yes"; and I bade him give it to the poor Spaniard, who was in as much want of it as his father; and I sent one of the cakes that Friday brought to the Spaniard too, who was indeed very weak, and was reposing himself upon a green place under the shade of a tree; and whose limbs were also very stiff, and very much swelled with the rude bandage he had been tied with. When I saw that upon Friday's coming to him with the water he sat up and drank, and took the bread and began to eat, I went to him and gave him a handful of raisins. He looked up in my face with all the tokens of gratitude and thankfulness that could appear in any countenance; but was so weak, notwithstanding he had so exerted himself in the fight, that he could not stand up upon his feet—he tried to do it two or three times, but was really not able, his ankles were so swelled and so painful to him; so I bade him sit still, and caused Friday to rub his ankles, and bathe them with rum, as he had done his father's.

I observed the poor affectionate creature, every two minutes, or perhaps less, all the while he was here, turn his head about to see if his father was in the same place and posture as he left him sitting; and at last he found he was not to be seen; at which he started up, and, without speaking a word, flew with that swiftness to him that one could scarce perceive his feet to touch the ground as he went; but when he came, he only found he had laid himself down to ease his limbs, so Friday came back to me presently; and then I spoke to the Spaniard to let Friday help him up if he could, and lead him to the boat, and then he should carry him to our dwelling, where I would take care of him.

But Friday, a lusty, strong fellow, took the Spaniard upon his back, and carried him away to the boat, and set him down softly upon the side or gunnel of the canoe, with his feet in the inside of it; and then lifting him quite in, he set him close to his father; and presently stepping out again, launched the boat off, and paddled it along the shore faster than I could walk, though the wind blew pretty hard too; so he brought them both safe into our creek, and leaving them in the boat, ran away to fetch the other canoe. As he passed me I spoke to him, and asked him whither he went. He told me, "Go fetch more boat;" so away he went like the wind, for sure never man or horse ran like him; and he had the other canoe in the creek almost as soon as I got to it by land; so he wafted me over, and then went to help our new guests out of the boat, which he did; but they were neither of them able to walk; so that poor Friday knew not what to do.

To remedy this, I went to work in my thought, and calling to Friday to bid them sit down on the bank while he came to me, I soon made a kind of hand-barrow to lay them on, and Friday and I carried them both up together upon it between us.

But when we got them to the outside of our wall, or fortification, we were at a worse loss than before, for it was impossible to get them over, and I was resolved not to break it down; so I set to work again, and Friday and I, in about two hours' time, made a very handsome tent, covered with old sails, and above that with boughs of trees, being in the space without our outward fence and between that and the grove of young wood which I had planted; and here we made them two beds of such things as I had—viz. of good rice-straw, with blankets laid upon it to lie on, and another to cover them, on each bed.

My island was now peopled, and I thought myself very rich in subjects; and it was a merry reflection, which I frequently made, how like a king I looked. First of all, the whole country was my own property, so that I had an undoubted right of dominion. Secondly, my people were perfectly subjected—I was absolutely lord and lawgiver—they all owed their lives to me, and were ready to lay down their lives, if there had been occasion for it, for me. It was remarkable, too, I had but three subjects, and they were of three different religions—my man Friday was a Protestant, his father was a Pagan and a cannibal, and the Spaniard was a Papist. However, I allowed liberty of conscience throughout my dominions. But this is by the way.

As soon as I had secured my two weak, rescued prisoners, and given them shelter, and a place to rest them upon, I began to think of making some provision for them; and the first thing I did, I ordered Friday to take a yearling goat, betwixt a kid and a goat, out of my particular flock, to be killed; when I cut off the hinder-quarter, and chopping it into small pieces, I set Friday to work to boiling and stewing, and made them a very good dish, I assure you, of flesh and broth; and as I cooked it without doors, for I made no fire within my inner wall, so I carried it all into the new tent, and having set a table there for them, I sat down, and ate my own dinner also with them, and, as well as I could, cheered them and encouraged them. Friday was my interpreter, especially to his father, and, indeed, to the Spaniard too; for the Spaniard spoke the language of the savages pretty well.

After we had dined, or rather supped, I ordered Friday to take one of the canoes, and go and fetch our muskets and other firearms, which, for want of time, we had left upon the place of battle; and the next day I ordered him to go and bury the dead bodies of the savages, which lay open to the sun, and would presently be offensive. I also ordered him to bury the horrid remains of their barbarous feast, which I could not think of doing myself; nay, I could not bear to see them if I went that way; all which he punctually performed, and effaced the very appearance of the savages being there; so that when I went again, I could scarce know where it was, otherwise than by the corner of the wood pointing to the place.

I then began to enter into a little conversation with my two new subjects; and, first, I set Friday to inquire of his father what he thought of the escape of the savages in that canoe, and whether we might expect a return of them, with a power too great for us to resist. His first opinion was, that the savages in the boat never could live out the storm which blew that night they went off, but must of necessity be drowned, or driven south to those other shores, where they were as sure to be devoured as they were to be drowned if they were cast away; but, as to what they would do if they came safe on shore, he said he knew not; but it was his opinion that they were so dreadfully frightened with the manner of their being attacked, the noise, and the fire, that he believed they would tell the people they were all killed by thunder and lightning, not by the hand of man; and that the two which appeared—viz. Friday and I—were two heavenly spirits, or furies, come down to destroy them, and not men with weapons.

This, he said, he knew; because he heard them all cry out so, in their language, one to another; for it was impossible for them to conceive that a man could dart fire, and speak thunder, and kill at a distance, without lifting up the hand, as was done now: and this old savage was in the right; for, as I understood since, by other hands, the savages never attempted to go over to the island afterwards, they were so terrified with the accounts given by those four men (for it seems they did escape the sea), that they believed whoever went to that enchanted island would be destroyed with fire from the gods. This, however, I knew not; and therefore was under continual apprehensions for a good while, and kept always upon my guard, with all my army: for, as there were now four of us, I would have ventured upon a hundred of them, fairly in the open field, at any time.

Chapter 17 - Visit Of Mutineers

In a little time, however, no more canoes appearing, the fear of their coming wore off; and I began to take my former thoughts of a voyage to the main into consideration; being likewise assured by Friday's father that I might depend upon good usage from their nation, on his account, if I would go. But my thoughts were a little suspended when I had a serious discourse with the Spaniard, and when I understood that there were sixteen more of his countrymen and Portuguese, who having been cast away and made their escape to that side, lived there at peace, indeed, with the savages, but were very sore put to it for necessaries, and, indeed, for life.

I asked him all the particulars of their voyage, and found they were a Spanish ship, bound from the Rio de la Plata to the Havanna, being directed to leave their loading there, which was chiefly hides and silver, and to bring back what European goods they could meet with there; that they had five Portuguese seamen on board, whom they took out of another wreck; that five of their own men were drowned when first the ship was lost, and that these escaped through infinite dangers and hazards, and arrived, almost starved, on the cannibal coast, where they expected to have been devoured every moment. He told me they had some arms with them, but they were perfectly useless, for that they had neither powder nor ball, the washing of the sea having spoiled all their powder but a little, which they used at their first landing to provide themselves with some food.

I asked him what he thought would become of them there, and if they had formed any design of making their escape. He said they had many consultations about it; but that having neither vessel nor tools to build one, nor provisions of any kind, their councils always ended in tears and despair. I asked him how he thought they would receive a proposal from me, which might tend towards an escape; and whether, if they were all here, it might not be done. I told him with freedom, I feared mostly their treachery and ill-usage of me, if I put my life in their hands; for that gratitude was no inherent virtue in the nature of man, nor did men always square their dealings by the obligations they had received so much as they did by the advantages they expected.

I told him it would be very hard that I should be made the instrument of their deliverance, and that they should afterwards make me their prisoner in New Spain, where an Englishman was certain to be made a sacrifice, what necessity or what accident soever brought him thither; and that I had rather be delivered up to the savages, and be devoured alive, than fall into the merciless claws of the priests, and be carried into the Inquisition. I added that, otherwise, I was persuaded, if they were all here, we might, with so many hands, build a barque large enough to carry us all away, either to the Brazils southward, or to the islands or Spanish coast northward; but that if, in requital, they should, when I had put weapons into their hands, carry me by force among their own people, I might be ill-used for my kindness to them, and make my case worse than it was before.

He answered, with a great deal of candour and ingenuousness, that their condition was so miserable, and that they were so sensible of it, that he believed they would abhor the thought of using any man unkindly that should contribute to their deliverance; and that, if I pleased, he would go to them with the old man, and discourse with them about it, and return again and bring me their answer; that he would make conditions with them upon their solemn oath, that they should be absolutely under my direction as their commander and captain; and they should swear upon the holy sacraments and gospel to be true to me, and go to such Christian country as I should agree to, and no other; and to be directed wholly and absolutely by my orders till they were landed safely in such country as I intended, and that he would bring a contract from them, under their hands, for that purpose.

Then he told me he would first swear to me himself that he would never stir from me as long as he lived till I gave him orders; and that he would take my side to the last drop of his blood, if there should happen the least breach of faith among his countrymen. He told me they were all of them very civil, honest men, and they were under the greatest distress imaginable, having neither weapons nor clothes, nor any food, but at the mercy and discretion of the savages; out of all hopes of ever returning to their own country; and that he was sure, if I would undertake their relief, they would live and die by me.

Upon these assurances, I resolved to venture to relieve them, if possible, and to send the old savage and this Spaniard over to them to treat. But when we had got all things in readiness to go, the Spaniard himself started an objection, which had so much prudence in it on one hand, and so much sincerity on the other hand, that I could not but be very well satisfied in it; and, by his advice, put off the deliverance of his comrades for at least half a year. The case was thus: he had been with us now about a month, during which time I had let him see in what manner I had provided, with the assistance of Providence, for my support; and he saw evidently what stock of corn and rice I had laid up; which, though it was more than sufficient for myself, yet it was not sufficient, without good husbandry, for my family, now it was increased to four; but much less would it be sufficient if his countrymen, who were, as he said, sixteen, still alive, should come over; and least of all would it be sufficient to victual our vessel, if we should build one, for a voyage to any of the Christian colonies of America; so he told me he thought it would be more advisable to let him and the other two dig and cultivate some more land, as much as I could spare seed to sow, and that we should wait another harvest, that we might have a supply of corn for his countrymen, when they should come; for want might be a temptation to them to disagree, or not to think themselves delivered, otherwise than out of one difficulty into another. "You know," says he, "the children of Israel, though they rejoiced at first for their being delivered out of Egypt, yet rebelled even against God Himself, that delivered them, when they came to want bread in the wilderness."

His caution was so seasonable, and his advice so good, that I could not but be very well pleased with his proposal, as well as I was satisfied with his fidelity; so we fell to digging, all four of us, as well as the wooden tools we were furnished with permitted; and in about a month's time, by the end of which it was seed-time, we had got as much land cured and trimmed up as we sowed two-and-twenty bushels of barley on, and sixteen jars of rice, which was, in short, all the seed we had to spare: indeed, we left ourselves barely sufficient, for our own food for the six months that we had to expect our crop; that is to say reckoning from the time we set our seed aside for sowing; for it is not to be supposed it is six months in the ground in that country.

Having now society enough, and our numbers being sufficient to put us out of fear of the savages, if they had come, unless their number had been very great, we went freely all over the island, whenever we found occasion; and as we had our escape or deliverance upon our thoughts, it was impossible, at least for me, to have the means of it out of mine. For this purpose I marked out several trees, which I thought fit for our work, and I set Friday and his father to cut them down; and then I caused the Spaniard, to whom I imparted my thoughts on that affair, to oversee and direct their work. I showed them with what indefatigable pains I had hewed a large tree into single planks, and I caused them to do the like, till they made about a dozen large planks, of good oak, near two feet broad, thirty-five feet long, and from two inches to four inches thick: what prodigious labour it took up any one may imagine.

At the same time I contrived to increase my little flock of tame goats as much as I could; and for this purpose I made Friday and the Spaniard go out one day, and myself with Friday the next day (for we took our turns), and by this means we got about twenty young kids to breed up with the rest; for whenever we shot the dam, we saved the kids, and added them to our flock. But above all, the season for curing the grapes coming on, I caused such a prodigious quantity to be hung up in the sun, that, I believe, had we been at Alicant, where the raisins of the sun are cured, we could have filled sixty or eighty barrels; and these, with our bread, formed a great part of our food—very good living too, I assure you, for they are exceedingly nourishing.

It was now harvest, and our crop in good order: it was not the most plentiful increase I had seen in the island, but, however, it was enough to answer our end; for from twenty-two bushels of barley we brought in and thrashed out above two hundred and twenty bushels; and the like in proportion of the rice; which was store enough for our food to the next harvest, though all the sixteen Spaniards had been on shore with me; or, if we had been ready for a voyage, it would very plentifully have victualled our ship to have carried us to any part of the world; that is to say, any part of America. When we had thus housed and secured our magazine of corn, we fell to work to make more wicker-ware, viz. great baskets, in which we kept it; and the Spaniard was very handy and dexterous at this part, and often blamed me that I did not make some things for defence of this kind of work; but I saw no need of it.

And now, having a full supply of food for all the guests I expected, I gave the Spaniard leave to go over to the main, to see what he could do with those he had left behind him there. I gave him a strict charge not to bring any man who would not first swear in the presence of himself and the old savage that he would in no way injure, fight with, or attack the person he should find in the island, who was so kind as to send for them in order to their deliverance; but that they would stand by him and defend him against all such attempts, and wherever they went would be entirely under and subjected to his command; and that this should be put in writing, and signed in their hands.

How they were to have done this, when I knew they had neither pen nor ink, was a question which we never asked. Under these instructions, the Spaniard and the old savage, the father of Friday, went away in one of the canoes which they might be said to have come in, or rather were brought in, when they came as prisoners to be devoured by the savages. I gave each of them a musket, with a firelock on it, and about eight charges of powder and ball, charging them to be very good husbands of both, and not to use either of them but upon urgent occasions.

This was a cheerful work, being the first measures used by me in view of my deliverance for now twenty-seven years and some days. I gave them provisions of bread and of dried grapes, sufficient for themselves for many days, and sufficient for all the Spaniards—for about eight days' time; and wishing them a good voyage, I saw them go, agreeing with them about a signal they should hang out at their return, by which I should know them again when they came back, at a distance, before they came on shore. They went away with a fair gale on the day that the moon was at full, by my account in the month of October; but as for an exact reckoning of days, after I had once lost it I could never recover it again; nor had I kept even the number of years so punctually as to be sure I was right; though, as it proved when I afterwards examined my account, I found I had kept a true reckoning of years.

It was no less than eight days I had waited for them, when a strange and unforeseen accident intervened, of which the like has not, perhaps, been heard of in history. I was fast asleep in my hutch one morning, when my man Friday came running in to me, and called aloud, "Master, master, they are come, they are come!" I jumped up, and regardless of danger I went, as soon as I could get my clothes on, through my little grove, which, by the way, was by this time grown to be a very thick wood; I say, regardless of danger I went without my arms, which was not my custom to do; but I was surprised when, turning my eyes to the sea, I presently saw a boat at about a league and a half distance, standing in for the shore, with a shoulder-of-mutton sail, as they call it, and the wind blowing pretty fair to bring them in: also I observed, presently, that they did not come from that side which the shore lay on, but from the southernmost end of the island.

Upon this I called Friday in, and bade him lie close, for these were not the people we looked for, and that we might not know yet whether they were friends or enemies. In the next place I went in to fetch my perspective glass to see what I could make of them; and having taken the ladder out, I climbed up to the top of the hill, as I used to do when I was apprehensive of anything, and to take my view the plainer without being discovered. I had scarce set my foot upon the hill when my eye plainly discovered a ship lying at anchor, at about two leagues and a half distance from me, SSE., but not above a league and a half from the shore. By my observation it appeared plainly to be an English ship, and the boat appeared to be an English long-boat.

I cannot express the confusion I was in, though the joy of seeing a ship, and one that I had reason to believe was manned by my own countrymen, and consequently friends, was such as I cannot describe; but yet I had some secret doubts hung about me—I cannot tell from whence they came—bidding me keep upon my guard. In the first place, it occurred to me to consider what business an English ship could have in that part of the world, since it was not the way to or from any part of the world where the English had any traffic; and I knew there had been no storms to drive them in there in distress; and that if they were really English it was most probable that they were here upon no good design; and that I had better continue as I was than fall into the hands of thieves and murderers.

Let no man despise the secret hints and notices of danger which sometimes are given him when he may think there is no possibility of its being real. That such hints and notices are given us I believe few that have made any observation of things can deny; that they are certain discoveries of an invisible world, and a converse of spirits, we cannot doubt; and if the tendency of them seems to be to warn us of danger, why should we not suppose they are from some friendly agent (whether supreme, or inferior and subordinate, is not the question), and that they are given for our good?

The present question abundantly confirms me in the justice of this reasoning; for had I not been made cautious by this secret admonition, come it from whence it will, I had been done inevitably, and in a far worse condition than before, as you will see presently. I had not kept myself long in this posture till I saw the boat draw near the shore, as if they looked for a creek to thrust in at, for the convenience of landing; however, as they did not come quite far enough, they did not see the little inlet where I formerly landed my rafts, but ran their boat on shore upon the beach, at about half a mile from me, which was very happy for me; for otherwise they would have landed just at my door, as I may say, and would soon have beaten me out of my castle, and perhaps have plundered me of all I had. When they were on shore I was fully satisfied they were Englishmen, at least most of them; one or two I thought were Dutch, but it did not prove so; there were in all eleven men, whereof three of them I found were unarmed and, as I thought, bound; and when the first four or five of them were jumped on shore, they took those three out of the boat as prisoners: one of the three I could perceive using the most passionate gestures of entreaty, affliction, and despair, even to a kind of extravagance; the other two, I could perceive, lifted up their hands sometimes, and appeared concerned indeed, but not to such a degree as the first. I was perfectly confounded at the sight, and knew not what the meaning of it should be. Friday called out to me in English, as well as he could, "O master! you see English mans eat prisoner as well as savage mans." "Why, Friday," says I, "do you think they are going to eat them, then?" "Yes," says Friday, "they will eat them." "No no," says I, "Friday; I am afraid they will murder them, indeed; but you may be sure they will not eat them."

All this while I had no thought of what the matter really was, but stood trembling with the horror of the sight, expecting every moment when the three prisoners should be killed; nay, once I saw one of the villains lift up his arm with a great cutlass, as the seamen call it, or sword, to strike one of the poor men; and I expected to see him fall every moment; at which all the blood in my body seemed to run chill in my veins. I wished heartily now for the Spaniard, and the savage that had gone with him, or that I had any way to have come undiscovered within shot of them, that I might have secured the three men, for I saw no firearms they had among them; but it fell out to my mind another way. After I had observed the outrageous usage of the three men by the insolent seamen, I observed the fellows run scattering about the island, as if they wanted to see the country. I observed that the three other men had liberty to go also where they pleased; but they sat down all three upon the ground, very pensive, and looked like men in despair. This put me in mind of the first time when I came on shore, and began to look about me; how I gave myself over for lost; how wildly I looked round me; what dreadful apprehensions I had; and how I lodged in the tree all night for fear of being devoured by wild beasts. As I knew nothing that night of the supply I was to receive by the providential driving of the ship nearer the land by the storms and tide, by which I have since been so long nourished and supported; so these three poor desolate men knew nothing how certain of deliverance and supply they were, how near it was to them, and how effectually and really they were in a condition of safety, at the same time that they thought themselves lost and their case desperate.

So little do we see before us in the world, and so much reason have we to depend cheerfully upon the great Maker of the world, that He does not leave His creatures so absolutely destitute, but that in the worst circumstances they have always something to be thankful for, and sometimes are nearer deliverance than they imagine; nay, are even brought to their deliverance by the means by which they seem to be brought to their destruction.

It was just at high-water when these people came on shore; and while they rambled about to see what kind of a place they were in, they had carelessly stayed till the tide was spent, and the water was ebbed considerably away, leaving their boat aground. They had left two men in the boat, who, as I found afterwards, having drunk a little too much brandy, fell asleep; however, one of them waking a little sooner than the other and finding the boat too fast aground for him to stir it, hallooed out for the rest, who were straggling about: upon which they all soon came to the boat: but it was past all their strength to launch her, the boat being very heavy, and the shore on that side being a soft oozy sand, almost like a quicksand. In this condition, like true seamen, who are, perhaps, the least of all mankind given to forethought, they gave it over, and away they strolled about the country again; and I heard one of them say aloud to another, calling them off from the boat, "Why, let her alone, Jack, can't you? she'll float next tide;" by which I was fully confirmed in the main inquiry of what countrymen they were.

All this while I kept myself very close, not once daring to stir out of my castle any farther than to my place of observation near the top of the hill: and very glad I was to think how well it was fortified. I knew it was no less than ten hours before the boat could float again, and by that time it would be dark, and I might be at more liberty to see their motions, and to hear their discourse, if they had any. In the meantime I fitted myself up for a battle as before, though with more caution, knowing I had to do with another kind of enemy than I had at first. I ordered Friday also, whom I had made an excellent marksman with his gun, to load himself with arms. I took myself two fowling-pieces, and I gave him three muskets. My figure, indeed, was very fierce; I had my formidable goat-skin coat on, with the great cap I have mentioned, a naked sword by my side, two pistols in my belt, and a gun upon each shoulder.

It was my design, as I said above, not to have made any attempt till it was dark; but about two o'clock, being the heat of the day, I found that they were all gone straggling into the woods, and, as I thought, laid down to sleep. The three poor distressed men, too anxious for their condition to get any sleep, had, however, sat down under the shelter of a great tree, at about a quarter of a mile from me, and, as I thought, out of sight of any of the rest. Upon this I resolved to discover myself to them, and learn something of their condition; immediately I marched as above, my man Friday at a good distance behind me, as formidable for his arms as I, but not making quite so staring a spectre-like figure as I did.

I came as near them undiscovered as I could, and then, before any of them saw me, I called aloud to them in Spanish, "What are ye, gentlemen?" They started up at the noise, but were ten times more confounded when they saw me, and the uncouth figure that I made. They made no answer at all, but I thought I perceived them just going to fly from me, when I spoke to them in English. "Gentlemen," said I, "do not be surprised at me; perhaps you may have a friend near when you did not expect it." "He must be sent directly from heaven then," said one of them very gravely to me, and pulling off his hat at the same time to me; "for our condition is past the help of man." "All help is from heaven, sir," said I, "but can you put a stranger in the way to help you? for you seem to be in some great distress. I saw you when you landed; and when you seemed to make application to the brutes that came with you, I saw one of them lift up his sword to kill you."

The poor man, with tears running down his face, and trembling, looking like one astonished, returned, "Am I talking to God or man? Is it a real man or an angel?" "Be in no fear about that, sir," said I; "if God had sent an angel to relieve you, he would have come better clothed, and armed after another manner than you see me; pray lay aside your fears; I am a man, an Englishman, and disposed to assist you; you see I have one servant only; we have arms and ammunition; tell us freely, can we serve you? What is your case?" "Our case, sir," said he, "is too long to tell you while our murderers are so near us; but, in short, sir, I was commander of that ship—my men have mutinied against me; they have been hardly prevailed on not to murder me, and, at last, have set me on shore in this desolate place, with these two men with me—one my mate, the other a passenger—where we expected to perish, believing the place to be uninhabited, and know not yet what to think of it." "Where are these brutes, your enemies?" said I; "do you know where they are gone? There they lie, sir," said he, pointing to a thicket of trees; "my heart trembles for fear they have seen us and heard you speak; if they have, they will certainly murder us all." "Have they any firearms?" said I. He answered, "They had only two pieces, one of which they left in the boat." "Well, then," said I, "leave the rest to me; I see they are all asleep; it is an easy thing to kill them all; but shall we rather take them prisoners?" He told me there were two desperate villains among them that it was scarce safe to show any mercy to; but if they were secured, he believed all the rest would return to their duty. I asked him which they were. He told me he could not at that distance distinguish them, but he would obey my orders in anything I would direct. "Well," says I, "let us retreat out of their view or hearing, lest they awake, and we will resolve further." So they willingly went back with me, till the woods covered us from them.

"Look you, sir," said I, "if I venture upon your deliverance, are you willing to make two conditions with me?" He anticipated my proposals by telling me that both he and the ship, if recovered, should be wholly directed and commanded by me in everything; and if the ship was not recovered, he would live and die with me in what part of the world soever I would send him; and the two other men said the same. "Well," says I, "my conditions are but two; first, that while you stay in this island with me, you will not pretend to any authority here; and if I put arms in your hands, you will, upon all occasions, give them up to me, and do no prejudice to me or mine upon this island, and in the meantime be governed by my orders; secondly, that if the ship is or may be recovered, you will carry me and my man to England passage free."

He gave me all the assurances that the invention or faith of man could devise that he would comply with these most reasonable demands, and besides would owe his life to me, and acknowledge it upon all occasions as long as he lived. "Well, then," said I, "here are three muskets for you, with powder and ball; tell me next what you think is proper to be done." He showed all the testimonies of his gratitude that he was able, but offered to be wholly guided by me. I told him I thought it was very hard venturing anything; but the best method I could think of was to fire on them at once as they lay, and if any were not killed at the first volley, and offered to submit, we might save them, and so put it wholly upon God's providence to direct the shot. He said, very modestly, that he was loath to kill them if he could help it; but that those two were incorrigible villains, and had been the authors of all the mutiny in the ship, and if they escaped, we should be undone still, for they would go on board and bring the whole ship's company, and destroy us all. "Well, then," says I, "necessity legitimates my advice, for it is the only way to save our lives." However, seeing him still cautious of shedding blood, I told him they should go themselves, and manage as they found convenient.

In the middle of this discourse we heard some of them awake, and soon after we saw two of them on their feet. I asked him if either of them were the heads of the mutiny? He said, "No." "Well, then," said I, "you may let them escape; and Providence seems to have awakened them on purpose to save themselves. Now," says I, "if the rest escape you, it is your fault." Animated with this, he took the musket I had given him in his hand, and a pistol in his belt, and his two comrades with him, with each a piece in his hand; the two men who were with him going first made some noise, at which one of the seamen who was awake turned about, and seeing them coming, cried out to the rest; but was too late then, for the moment he cried out they fired—I mean the two men, the captain wisely reserving his own piece. They had so well aimed their shot at the men they knew, that one of them was killed on the spot, and the other very much wounded; but not being dead, he started up on his feet, and called eagerly for help to the other; but the captain stepping to him, told him it was too late to cry for help, he should call upon God to forgive his villainy, and with that word knocked him down with the stock of his musket, so that he never spoke more; there were three more in the company, and one of them was slightly wounded. By this time I was come; and when they saw their danger, and that it was in vain to resist, they begged for mercy. The captain told them he would spare their lives if they would give him an assurance of their abhorrence of the treachery they had been guilty of, and would swear to be faithful to him in recovering the ship, and afterwards in carrying her back to Jamaica, from whence they came. They gave him all the protestations of their sincerity that could be desired; and he was willing to believe them, and spare their lives, which I was not against, only that I obliged him to keep them bound hand and foot while they were on the island.

While this was doing, I sent Friday with the captain's mate to the boat with orders to secure her, and bring away the oars and sails, which they did; and by-and-by three straggling men, that were (happily for them) parted from the rest, came back upon hearing the guns fired; and seeing the captain, who was before their prisoner, now their conqueror, they submitted to be bound also; and so our victory was complete.

It now remained that the captain and I should inquire into one another's circumstances. I began first, and told him my whole history, which he heard with an attention even to amazement—and particularly at the wonderful manner of my being furnished with provisions and ammunition; and, indeed, as my story is a whole collection of wonders, it affected him deeply. But when he reflected from thence upon himself, and how I seemed to have been preserved there on purpose to save his life, the tears ran down his face, and he could not speak a word more. After this communication was at an end, I carried him and his two men into my apartment, leading them in just where I came out, viz. at the top of the house, where I refreshed them with such provisions as I had, and showed them all the contrivances I had made during my long, long inhabiting that place.

All I showed them, all I said to them, was perfectly amazing; but above all, the captain admired my fortification, and how perfectly I had concealed my retreat with a grove of trees, which having been now planted nearly twenty years, and the trees growing much faster than in England, was become a little wood, so thick that it was impassable in any part of it but at that one side where I had reserved my little winding passage into it. I told him this was my castle and my residence, but that I had a seat in the country, as most princes have, whither I could retreat upon occasion, and I would show him that too another time; but at present our business was to consider how to recover the ship.

He agreed with me as to that, but told me he was perfectly at a loss what measures to take, for that there were still six-and-twenty hands on board, who, having entered into a cursed conspiracy, by which they had all forfeited their lives to the law, would be hardened in it now by desperation, and would carry it on, knowing that if they were subdued they would be brought to the gallows as soon as they came to England, or to any of the English colonies, and that, therefore, there would be no attacking them with so small a number as we were.

I mused for some time on what he had said, and found it was a very rational conclusion, and that therefore something was to be resolved on speedily, as well to draw the men on board into some snare for their surprise as to prevent their landing upon us, and destroying us. Upon this, it presently occurred to me that in a little while the ship's crew, wondering what was become of their comrades and of the boat, would certainly come on shore in their other boat to look for them, and that then, perhaps, they might come armed, and be too strong for us: this he allowed to be rational. Upon this, I told him the first thing we had to do was to stave the boat which lay upon the beach, so that they might not carry her of, and taking everything out of her, leave her so far useless as not to be fit to swim. Accordingly, we went on board, took the arms which were left on board out of her, and whatever else we found there—which was a bottle of brandy, and another of rum, a few biscuit-cakes, a horn of powder, and a great lump of sugar in a piece of canvas (the sugar was five or six pounds): all which was very welcome to me, especially the brandy and sugar, of which I had had none left for many years.

When we had carried all these things on shore (the oars, mast, sail, and rudder of the boat were carried away before), we knocked a great hole in her bottom, that if they had come strong enough to master us, yet they could not carry off the boat. Indeed, it was not much in my thoughts that we could be able to recover the ship; but my view was, that if they went away without the boat, I did not much question to make her again fit to carry as to the Leeward Islands, and call upon our friends the Spaniards in my way, for I had them still in my thoughts.

Chapter 18 - The Ship Recovered

While we were thus preparing our designs, and had first, by main strength, heaved the boat upon the beach, so high that the tide would not float her off at high-water mark, and besides, had broke a hole in her bottom too big to be quickly stopped, and were set down musing what we should do, we heard the ship fire a gun, and make a waft with her ensign as a signal for the boat to come on board—but no boat stirred; and they fired several times, making other signals for the boat. At last, when all their signals and firing proved fruitless, and they found the boat did not stir, we saw them, by the help of my glasses, hoist another boat out and row towards the shore; and we found, as they approached, that there were no less than ten men in her, and that they had firearms with them.

As the ship lay almost two leagues from the shore, we had a full view of them as they came, and a plain sight even of their faces; because the tide having set them a little to the east of the other boat, they rowed up under shore, to come to the same place where the other had landed, and where the boat lay; by this means, I say, we had a full view of them, and the captain knew the persons and characters of all the men in the boat, of whom, he said, there were three very honest fellows, who, he was sure, were led into this conspiracy by the rest, being over-powered and frightened; but that as for the boatswain, who it seems was the chief officer among them, and all the rest, they were as outrageous as any of the ship's crew, and were no doubt made desperate in their new enterprise; and terribly apprehensive he was that they would be too powerful for us.

I smiled at him, and told him that men in our circumstances were past the operation of fear; that seeing almost every condition that could be was better than that which we were supposed to be in, we ought to expect that the consequence, whether death or life, would be sure to be a deliverance. I asked him what he thought of the circumstances of my life, and whether a deliverance were not worth venturing for? "And where, sir," said I, "is your belief of my being preserved here on purpose to save your life, which elevated you a little while ago? For my part," said I, "there seems to be but one thing amiss in all the prospect of it." "What is that?" say he. "Why," said I, "it is, that as you say there are three or four honest fellows among them which should be spared, had they been all of the wicked part of the crew I should have thought God's providence had singled them out to deliver them into your hands; for depend upon it, every man that comes ashore is our own, and shall die or live as they behave to us." As I spoke this with a raised voice and cheerful countenance, I found it greatly encouraged him; so we set vigorously to our business.

We had, upon the first appearance of the boat's coming from the ship, considered of separating our prisoners; and we had, indeed, secured them effectually. Two of them, of whom the captain was less assured than ordinary, I sent with Friday, and one of the three delivered men, to my cave, where they were remote enough, and out of danger of being heard or discovered, or of finding their way out of the woods if they could have delivered themselves. Here they left them bound, but gave them provisions; and promised them, if they continued there quietly, to give them their liberty in a day or two; but that if they attempted their escape they should be put to death without mercy. They promised faithfully to bear their confinement with patience, and were very thankful that they had such good usage as to have provisions and light left them; for Friday gave them candles (such as we made ourselves) for their comfort; and they did not know but that he stood sentinel over them at the entrance.

The other prisoners had better usage; two of them were kept pinioned, indeed, because the captain was not able to trust them; but the other two were taken into my service, upon the captain's recommendation, and upon their solemnly engaging to live and die with us; so with them and the three honest men we were seven men, well armed; and I made no doubt we should be able to deal well enough with the ten that were coming, considering that the captain had said there were three or four honest men among them also. As soon as they got to the place where their other boat lay, they ran their boat into the beach and came all on shore, hauling the boat up after them, which I was glad to see, for I was afraid they would rather have left the boat at an anchor some distance from the shore, with some hands in her to guard her, and so we should not be able to seize the boat. Being on shore, the first thing they did, they ran all to their other boat; and it was easy to see they were under a great surprise to find her stripped, as above, of all that was in her, and a great hole in her bottom. After they had mused a while upon this, they set up two or three great shouts, hallooing with all their might, to try if they could make their companions hear; but all was to no purpose. Then they came all close in a ring, and fired a volley of their small arms, which indeed we heard, and the echoes made the woods ring. But it was all one; those in the cave, we were sure, could not hear; and those in our keeping, though they heard it well enough, yet durst give no answer to them. They were so astonished at the surprise of this, that, as they told us afterwards, they resolved to go all on board again to their ship, and let them know that the men were all murdered, and the long-boat staved; accordingly, they immediately launched their boat again, and got all of them on board.

The captain was terribly amazed, and even confounded, at this, believing they would go on board the ship again and set sail, giving their comrades over for lost, and so he should still lose the ship, which he was in hopes we should have recovered; but he was quickly as much frightened the other way.

They had not been long put off with the boat, when we perceived them all coming on shore again; but with this new measure in their conduct, which it seems they consulted together upon, viz. to leave three men in the boat, and the rest to go on shore, and go up into the country to look for their fellows. This was a great disappointment to us, for now we were at a loss what to do, as our seizing those seven men on shore would be no advantage to us if we let the boat escape; because they would row away to the ship, and then the rest of them would be sure to weigh and set sail, and so our recovering the ship would be lost. However we had no remedy but to wait and see what the issue of things might present. The seven men came on shore, and the three who remained in the boat put her off to a good distance from the shore, and came to an anchor to wait for them; so that it was impossible for us to come at them in the boat.

Those that came on shore kept close together, marching towards the top of the little hill under which my habitation lay; and we could see them plainly, though they could not perceive us. We should have been very glad if they would have come nearer us, so that we might have fired at them, or that they would have gone farther off, that we might come abroad. But when they were come to the brow of the hill where they could see a great way into the valleys and woods, which lay towards the north-east part, and where the island lay lowest, they shouted and hallooed till they were weary; and not caring, it seems, to venture far from the shore, nor far from one another, they sat down together under a tree to consider it. Had they thought fit to have gone to sleep there, as the other part of them had done, they had done the job for us; but they were too full of apprehensions of danger to venture to go to sleep, though they could not tell what the danger was they had to fear.

The captain made a very just proposal to me upon this consultation of theirs, viz. that perhaps they would all fire a volley again, to endeavour to make their fellows hear, and that we should all sally upon them just at the juncture when their pieces were all discharged, and they would certainly yield, and we should have them without bloodshed. I liked this proposal, provided it was done while we were near enough to come up to them before they could load their pieces again. But this event did not happen; and we lay still a long time, very irresolute what course to take. At length I told them there would be nothing done, in my opinion, till night; and then, if they did not return to the boat, perhaps we might find a way to get between them and the shore, and so might use some stratagem with them in the boat to get them on shore. We waited a great while, though very impatient for their removing; and were very uneasy when, after long consultation, we saw them all start up and march down towards the sea; it seems they had such dreadful apprehensions of the danger of the place that they resolved to go on board the ship again, give their companions over for lost, and so go on with their intended voyage with the ship.

As soon as I perceived them go towards the shore, I imagined it to be as it really was that they had given over their search, and were going back again; and the captain, as soon as I told him my thoughts, was ready to sink at the apprehensions of it; but I presently thought of a stratagem to fetch them back again, and which answered my end to a tittle. I ordered Friday and the captain's mate to go over the little creek westward, towards the place where the savages came on shore, when Friday was rescued, and so soon as they came to a little rising round, at about half a mile distant, I bid them halloo out, as loud as they could, and wait till they found the seamen heard them; that as soon as ever they heard the seamen answer them, they should return it again; and then, keeping out of sight, take a round, always answering when the others hallooed, to draw them as far into the island and among the woods as possible, and then wheel about again to me by such ways as I directed them.

They were just going into the boat when Friday and the mate hallooed; and they presently heard them, and answering, ran along the shore westward, towards the voice they heard, when they were stopped by the creek, where the water being up, they could not get over, and called for the boat to come up and set them over; as, indeed, I expected. When they had set themselves over, I observed that the boat being gone a good way into the creek, and, as it were, in a harbour within the land, they took one of the three men out of her, to go along with them, and left only two in the boat, having fastened her to the stump of a little tree on the shore. This was what I wished for; and immediately leaving Friday and the captain's mate to their business, I took the rest with me; and, crossing the creek out of their sight, we surprised the two men before they were aware—one of them lying on the shore, and the other being in the boat. The fellow on shore was between sleeping and waking, and going to start up; the captain, who was foremost, ran in upon him, and knocked him down; and then called out to him in the boat to yield, or he was a dead man. They needed very few arguments to persuade a single man to yield, when he saw five men upon him and his comrade knocked down: besides, this was, it seems, one of the three who were not so hearty in the mutiny as the rest of the crew, and therefore was easily persuaded not only to yield, but afterwards to join very sincerely with us. In the meantime, Friday and the captain's mate so well managed their business with the rest that they drew them, by hallooing and answering, from one hill to another, and from one wood to another, till they not only heartily tired them, but left them where they were, very sure they could not reach back to the boat before it was dark; and, indeed, they were heartily tired themselves also, by the time they came back to us.

We had nothing now to do but to watch for them in the dark, and to fall upon them, so as to make sure work with them. It was several hours after Friday came back to me before they came back to their boat; and we could hear the foremost of them, long before they came quite up, calling to those behind to come along; and could also hear them answer, and complain how lame and tired they were, and not able to come any faster: which was very welcome news to us. At length they came up to the boat: but it is impossible to express their confusion when they found the boat fast aground in the creek, the tide ebbed out, and their two men gone. We could hear them call one to another in a most lamentable manner, telling one another they were got into an enchanted island; that either there were inhabitants in it, and they should all be murdered, or else there were devils and spirits in it, and they should be all carried away and devoured. They hallooed again, and called their two comrades by their names a great many times; but no answer. After some time we could see them, by the little light there was, run about, wringing their hands like men in despair, and sometimes they would go and sit down in the boat to rest themselves: then come ashore again, and walk about again, and so the same thing over again. My men would fain have had me give them leave to fall upon them at once in the dark; but I was willing to take them at some advantage, so as to spare them, and kill as few of them as I could; and especially I was unwilling to hazard the killing of any of our men, knowing the others were very well armed. I resolved to wait, to see if they did not separate; and therefore, to make sure of them, I drew my ambuscade nearer, and ordered Friday and the captain to creep upon their hands and feet, as close to the ground as they could, that they might not be discovered, and get as near them as they could possibly before they offered to fire.

They had not been long in that posture when the boatswain, who was the principal ringleader of the mutiny, and had now shown himself the most dejected and dispirited of all the rest, came walking towards them, with two more of the crew; the captain was so eager at having this principal rogue so much in his power, that he could hardly have patience to let him come so near as to be sure of him, for they only heard his tongue before: but when they came nearer, the captain and Friday, starting up on their feet, let fly at them. The boatswain was killed upon the spot: the next man was shot in the body, and fell just by him, though he did not die till an hour or two after; and the third ran for it. At the noise of the fire I immediately advanced with my whole army, which was now eight men, viz. myself, generalissimo; Friday, my lieutenant-general; the captain and his two men, and the three prisoners of war whom we had trusted with arms. We came upon them, indeed, in the dark, so that they could not see our number; and I made the man they had left in the boat, who was now one of us, to call them by name, to try if I could bring them to a parley, and so perhaps might reduce them to terms; which fell out just as we desired: for indeed it was easy to think, as their condition then was, they would be very willing to capitulate. So he calls out as loud as he could to one of them, "Tom Smith! Tom Smith!" Tom Smith answered immediately, "Is that Robinson?" for it seems he knew the voice.

The other answered, "Ay, ay; for God's sake, Tom Smith, throw down your arms and yield, or you are all dead men this moment." "Who must we yield to? Where are they?" says Smith again. "Here they are," says he; "here's our captain and fifty men with him, have been hunting you these two hours; the boatswain is killed; Will Fry is wounded, and I am a prisoner; and if you do not yield you are all lost." "Will they give us quarter, then?" says Tom Smith, "and we will yield." "I'll go and ask, if you promise to yield," said Robinson: so he asked the captain, and the captain himself then calls out, "You, Smith, you know my voice; if you lay down your arms immediately and submit, you shall have your lives, all but Will Atkins."

Upon this Will Atkins cried out, "For God's sake, captain, give me quarter; what have I done? They have all been as bad as I:" which, by the way, was not true; for it seems this Will Atkins was the first man that laid hold of the captain when they first mutinied, and used him barbarously in tying his hands and giving him injurious language. However, the captain told him he must lay down his arms at discretion, and trust to the governor's mercy: by which he meant me, for they all called me governor. In a word, they all laid down their arms and begged their lives; and I sent the man that had parleyed with them, and two more, who bound them all; and then my great army of fifty men, which, with those three, were in all but eight, came up and seized upon them, and upon their boat; only that I kept myself and one more out of sight for reasons of state.

Our next work was to repair the boat, and think of seizing the ship: and as for the captain, now he had leisure to parley with them, he expostulated with them upon the villainy of their practices with him, and upon the further wickedness of their design, and how certainly it must bring them to misery and distress in the end, and perhaps to the gallows. They all appeared very penitent, and begged hard for their lives. As for that, he told them they were not his prisoners, but the commander's of the island; that they thought they had set him on shore in a barren, uninhabited island; but it had pleased God so to direct them that it was inhabited, and that the governor was an Englishman; that he might hang them all there, if he pleased; but as he had given them all quarter, he supposed he would send them to England, to be dealt with there as justice required, except Atkins, whom he was commanded by the governor to advise to prepare for death, for that he would be hanged in the morning.

Though this was all but a fiction of his own, yet it had its desired effect; Atkins fell upon his knees to beg the captain to intercede with the governor for his life; and all the rest begged of him, for God's sake, that they might not be sent to England.

It now occurred to me that the time of our deliverance was come, and that it would be a most easy thing to bring these fellows in to be hearty in getting possession of the ship; so I retired in the dark from them, that they might not see what kind of a governor they had, and called the captain to me; when I called, at a good distance, one of the men was ordered to speak again, and say to the captain, "Captain, the commander calls for you;" and presently the captain replied, "Tell his excellency I am just coming." This more perfectly amazed them, and they all believed that the commander was just by, with his fifty men. Upon the captain coming to me, I told him my project for seizing the ship, which he liked wonderfully well, and resolved to put it in execution the next morning. But, in order to execute it with more art, and to be secure of success, I told him we must divide the prisoners, and that he should go and take Atkins, and two more of the worst of them, and send them pinioned to the cave where the others lay. This was committed to Friday and the two men who came on shore with the captain. They conveyed them to the cave as to a prison: and it was, indeed, a dismal place, especially to men in their condition. The others I ordered to my bower, as I called it, of which I have given a full description: and as it was fenced in, and they pinioned, the place was secure enough, considering they were upon their behaviour.

To these in the morning I sent the captain, who was to enter into a parley with them; in a word, to try them, and tell me whether he thought they might be trusted or not to go on board and surprise the ship. He talked to them of the injury done him, of the condition they were brought to, and that though the governor had given them quarter for their lives as to the present action, yet that if they were sent to England they would all be hanged in chains; but that if they would join in so just an attempt as to recover the ship, he would have the governor's engagement for their pardon.

Any one may guess how readily such a proposal would be accepted by men in their condition; they fell down on their knees to the captain, and promised, with the deepest imprecations, that they would be faithful to him to the last drop, and that they should owe their lives to him, and would go with him all over the world; that they would own him as a father to them as long as they lived. "Well," says the captain, "I must go and tell the governor what you say, and see what I can do to bring him to consent to it." So he brought me an account of the temper he found them in, and that he verily believed they would be faithful.

However, that we might be very secure, I told him he should go back again and choose out those five, and tell them, that they might see he did not want men, that he would take out those five to be his assistants, and that the governor would keep the other two, and the three that were sent prisoners to the castle (my cave), as hostages for the fidelity of those five; and that if they proved unfaithful in the execution, the five hostages should be hanged in chains alive on the shore. This looked severe, and convinced them that the governor was in earnest; however, they had no way left them but to accept it; and it was now the business of the prisoners, as much as of the captain, to persuade the other five to do their duty.

Our strength was now thus ordered for the expedition: first, the captain, his mate, and passenger; second, the two prisoners of the first gang, to whom, having their character from the captain, I had given their liberty, and trusted them with arms; third, the other two that I had kept till now in my bower, pinioned, but on the captain's motion had now released; fourth, these five released at last; so that there were twelve in all, besides five we kept prisoners in the cave for hostages.

ENTERTAINMENT
Solo
Crusoe
Robinson
Chapter 18

I asked the captain if he was willing to venture with these hands on board the ship; but as for me and my man Friday, I did not think it was proper for us to stir, having seven men left behind; and it was employment enough for us to keep them asunder, and supply them with victuals. As to the five in the cave, I resolved to keep them fast, but Friday went in twice a day to them, to supply them with necessaries; and I made the other two carry provisions to a certain distance, where Friday was to take them.

When I showed myself to the two hostages, it was with the captain, who told them I was the person the governor had ordered to look after them; and that it was the governor's pleasure they should not stir anywhere but by my direction; that if they did, they would be fetched into the castle, and be laid in irons: so that as we never suffered them to see me as governor, I now appeared as another person, and spoke of the governor, the garrison, the castle, and the like, upon all occasions.

The captain now had no difficulty before him, but to furnish his two boats, stop the breach of one, and man them. He made his passenger captain of one, with four of the men; and himself, his mate, and five more, went in the other; and they contrived their business very well, for they came up to the ship about midnight. As soon as they came within call of the ship, he made Robinson hail them, and tell them they had brought off the men and the boat, but that it was a long time before they had found them, and the like, holding them in a chat till they came to the ship's side; when the captain and the mate entering first with their arms, immediately knocked down the second mate and carpenter with the butt-end of their muskets, being very faithfully seconded by their men; they secured all the rest that were upon the main and quarter decks, and began to fasten the hatches, to keep them down that were below; when the other boat and their men, entering at the forechains, secured the forecastle of the ship, and the scuttle which went down into the cook-room, making three men they found there prisoners. When this was done, and all safe upon deck, the captain ordered the mate, with three men, to break into the round-house, where the new rebel captain lay, who, having taken the alarm, had got up, and with two men and a boy had got firearms in their hands; and when the mate, with a crow, split open the door, the new captain and his men fired boldly among them, and wounded the mate with a musket ball, which broke his arm, and wounded two more of the men, but killed nobody. The mate, calling for help, rushed, however, into the round-house, wounded as he was, and, with his pistol, shot the new captain through the head, the bullet entering at his mouth, and came out again behind one of his ears, so that he never spoke a word more: upon which the rest yielded, and the ship was taken effectually, without any more lives lost.

As soon as the ship was thus secured, the captain ordered seven guns to be fired, which was the signal agreed upon with me to give me notice of his success, which, you may be sure, I was very glad to hear, having sat watching upon the shore for it till near two o'clock in the morning. Having thus heard the signal plainly, I laid me down; and it having been a day of great fatigue to me, I slept very sound, till I was surprised with the noise of a gun; and presently starting up, I heard a man call me by the name of "Governor! Governor!" and presently I knew the captain's voice; when, climbing up to the top of the hill, there he stood, and, pointing to the ship, he embraced me in his arms, "My dear friend and deliverer," says he, "there's your ship; for she is all yours, and so are we, and all that belong to her." I cast my eyes to the ship, and there she rode, within little more than half a mile of the shore; for they had weighed her anchor as soon as they were masters of her, and, the weather being fair, had brought her to an anchor just against the mouth of the little creek; and the tide being up, the captain had brought the pinnace in near the place where I had first landed my rafts, and so landed just at my door. I was at first ready to sink down with the surprise; for I saw my deliverance, indeed, visibly put into my hands, all things easy, and a large ship just ready to carry me away whither I pleased to go. At first, for some time, I was not able to answer him one word; but as he had taken me in his arms I held fast by him, or I should have fallen to the ground. He perceived the surprise, and immediately pulled a bottle out of his pocket and gave me a dram of cordial, which he had brought on purpose for me. After I had drunk it, I sat down upon the ground; and though it brought me to myself, yet it was a good while before I could speak a word to him.

All this time the poor man was in as great an ecstasy as I, only not under any surprise as I was; and he said a thousand kind and tender things to me, to compose and bring me to myself; but such was the flood of joy in my breast, that it put all my spirits into confusion: at last it broke out into tears, and in a little while after I recovered my speech; I then took my turn, and embraced him as my deliverer, and we rejoiced together. I told him I looked upon him as a man sent by Heaven to deliver me, and that the whole transaction seemed to be a chain of wonders; that such things as these were the testimonies we had of a secret hand of Providence governing the world, and an evidence that the eye of an infinite Power could search into the remotest corner of the world, and send help to the miserable whenever He pleased. I forgot not to lift up my heart in thankfulness to Heaven; and what heart could forbear to bless Him, who had not only in a miraculous manner provided for me in such a wilderness, and in such a desolate condition, but from whom every deliverance must always be acknowledged to proceed.

When we had talked a while, the captain told me he had brought me some little refreshment, such as the ship afforded, and such as the wretches that had been so long his masters had not plundered him of. Upon this, he called aloud to the boat, and bade his men bring the things ashore that were for the governor; and, indeed, it was a present as if I had been one that was not to be carried away with them, but as if I had been to dwell upon the island still. First, he had brought me a case of bottles full of excellent cordial waters, six large bottles of Madeira wine (the bottles held two quarts each), two pounds of excellent good tobacco, twelve good pieces of the ship's beef, and six pieces of pork, with a bag of peas, and about a hundred-weight of biscuit; he also brought me a box of sugar, a box of flour, a bag full of lemons, and two bottles of lime-juice, and abundance of other things. But besides these, and what was a thousand times more useful to me, he brought me six new clean shirts, six very good neckcloths, two pair of gloves, one pair of shoes, a hat, and one pair of stockings, with a very good suit of clothes of his own, which had been worn but very little: in a word, he clothed me from head to foot. It was a very kind and agreeable present, as any one may imagine, to one in my circumstances, but never was anything in the world of that kind so unpleasant, awkward, and uneasy as it was to me to wear such clothes at first.

ENTERTAINMENT
Entertainment
Crusoe
Chapter 18

After these ceremonies were past, and after all his good things were brought into my little apartment, we began to consult what was to be done with the prisoners we had; for it was worth considering whether we might venture to take them with us or no, especially two of them, whom he knew to be incorrigible and refractory to the last degree; and the captain said he knew they were such rogues that there was no obliging them, and if he did carry them away, it must be in irons, as malefactors, to be delivered over to justice at the first English colony he could come to; and I found that the captain himself was very anxious about it. Upon this, I told him that, if he desired it, I would undertake to bring the two men he spoke of to make it their own request that he should leave them upon the island. "I should be very glad of that," says the captain, "with all my heart." "Well," says I, "I will send for them up and talk with them for you." So I caused Friday and the two hostages, for they were now discharged, their comrades having performed their promise; I say, I caused them to go to the cave, and bring up the five men, pinioned as they were, to the bower, and keep them there till I came. After some time, I came thither dressed in my new habit; and now I was called governor again. Being all met, and the captain with me, I caused the men to be brought before me, and I told them I had got a full account of their villainous behaviour to the captain, and how they had run away with the ship, and were preparing to commit further robberies, but that Providence had ensnared them in their own ways, and that they were fallen into the pit which they had dug for others.

I let them know that by my direction the ship had been seized; that she lay now in the road; and they might see by-and-by that their new captain had received the reward of his villainy, and that they would see him hanging at the yard-arm; that, as to them, I wanted to know what they had to say why I should not execute them as pirates taken in the fact, as by my commission they could not doubt but I had authority so to do.

One of them answered in the name of the rest, that they had nothing to say but this, that when they were taken the captain promised them their lives, and they humbly implored my mercy. But I told them I knew not what mercy to show them; for as for myself, I had resolved to quit the island with all my men, and had taken passage with the captain to go to England; and as for the captain, he could not carry them to England other than as prisoners in irons, to be tried for mutiny and running away with the ship; the consequence of which, they must needs know, would be the gallows; so that I could not tell what was best for them, unless they had a mind to take their fate in the island. If they desired that, as I had liberty to leave the island, I had some inclination to give them their lives, if they thought they could shift on shore. They seemed very thankful for it, and said they would much rather venture to stay there than be carried to England to be hanged. So I left it on that issue.

However, the captain seemed to make some difficulty of it, as if he durst not leave them there. Upon this I seemed a little angry with the captain, and told him that they were my prisoners, not his; and that seeing I had offered them so much favour, I would be as good as my word; and that if he did not think fit to consent to it I would set them at liberty, as I found them: and if he did not like it he might take them again if he could catch them. Upon this they appeared very thankful, and I accordingly set them at liberty, and bade them retire into the woods, to the place whence they came, and I would leave them some firearms, some ammunition, and some directions how they should live very well if they thought fit. Upon this I prepared to go on board the ship; but told the captain I would stay that night to prepare my things, and desired him to go on board in the meantime, and keep all right in the ship, and send the boat on shore next day for me; ordering him, at all events, to cause the new captain, who was killed, to be hanged at the yard-arm, that these men might see him.

When the captain was gone I sent for the men up to me to my apartment, and entered seriously into discourse with them on their circumstances. I told them I thought they had made a right choice; that if the captain had carried them away they would certainly be hanged. I showed them the new captain hanging at the yard-arm of the ship, and told them they had nothing less to expect.

ENTERTAINMENT Robinson Chapter 18

When they had all declared their willingness to stay, I then told them I would let them into the story of my living there, and put them into the way of making it easy to them. Accordingly, I gave them the whole history of the place, and of my coming to it; showed them my fortifications, the way I made my bread, planted my corn, cured my grapes; and, in a word, all that was necessary to make them easy. I told them the story also of the seventeen Spaniards that were to be expected, for whom I left a letter, and made them promise to treat them in common with themselves. Here it may be noted that the captain, who had ink on board, was greatly surprised that I never hit upon a way of making ink of charcoal and water, or of something else, as I had done things much more difficult.

I left them my firearms—viz. five muskets, three fowling-pieces, and three swords. I had above a barrel and a half of powder left; for after the first year or two I used but little, and wasted none. I gave them a description of the way I managed the goats, and directions to milk and fatten them, and to make both butter and cheese. In a word, I gave them every part of my own story; and told them I should prevail with the captain to leave them two barrels of gunpowder more, and some garden-seeds, which I told them I would have been very glad of. Also, I gave them the bag of peas which the captain had brought me to eat, and bade them be sure to sow and increase them.

Chapter 19 - Return To England

Having done all this I left them the next day, and went on board the ship. We prepared immediately to sail, but did not weigh that night. The next morning early, two of the five men came swimming to the ship's side, and making the most lamentable complaint of the other three, begged to be taken into the ship for God's sake, for they should be murdered, and begged the captain to take them on board, though he hanged them immediately. Upon this the captain pretended to have no power without me; but after some difficulty, and after their solemn promises of amendment, they were taken on board, and were, some time after, soundly whipped and pickled; after which they proved very honest and quiet fellows.

Some time after this, the boat was ordered on shore, the tide being up, with the things promised to the men; to which the captain, at my intercession, caused their chests and clothes to be added, which they took, and were very thankful for. I also encouraged them, by telling them that if it lay in my power to send any vessel to take them in, I would not forget them.

When I took leave of this island, I carried on board, for relics, the great goat-skin cap I had made, my umbrella, and one of my parrots; also, I forgot not to take the money I formerly mentioned, which had lain by me so long useless that it was grown rusty or tarnished, and could hardly pass for silver till it had been a little rubbed and handled, as also the money I found in the wreck of the Spanish ship. And thus I left the island, the 19th of December, as I found by the ship's account, in the year 1686, after I had been upon it eight-and-twenty years, two months, and nineteen days; being delivered from this second captivity the same day of the month that I first made my escape in the long-boat from among the Moors of Sallee. In this vessel, after a long voyage, I arrived in England the 11th of June, in the year 1687, having been thirty-five years absent.

When I came to England I was as perfect a stranger to all the world as if I had never been known there. My benefactor and faithful steward, whom I had left my money in trust with, was alive, but had had great misfortunes in the world; was become a widow the second time, and very low in the world. I made her very easy as to what she owed me, assuring her I would give her no trouble; but, on the contrary, in gratitude for her former care and faithfulness to me, I relieved her as my little stock would afford; which at that time would, indeed, allow me to do but little for her; but I assured her I would never forget her former kindness to me; nor did I forget her when I had sufficient to help her, as shall be observed in its proper place. I went down afterwards into Yorkshire; but my father was dead, and my mother and all the family extinct, except that I found two sisters, and two of the children of one of my brothers; and as I had been long ago given over for dead, there had been no provision made for me; so that, in a word, I found nothing to relieve or assist me; and that the little money I had would not do much for me as to settling in the world.

I met with one piece of gratitude indeed, which I did not expect; and this was, that the master of the ship, whom I had so happily delivered, and by the same means saved the ship and cargo, having given a very handsome account to the owners of the manner how I had saved the lives of the men and the ship, they invited me to meet them and some other merchants concerned, and all together made me a very handsome compliment upon the subject, and a present of almost £200 sterling.

But after making several reflections upon the circumstances of my life, and how little way this would go towards settling me in the world, I resolved to go to Lisbon, and see if I might not come at some information of the state of my plantation in the Brazils, and of what was become of my partner, who, I had reason to suppose, had some years past given me over for dead. With this view I took shipping for Lisbon, where I arrived in April following, my man Friday accompanying me very honestly in all these ramblings, and proving a most faithful servant upon all occasions. When I came to Lisbon, I found out, by inquiry, and to my particular satisfaction, my old friend, the captain of the ship who first took me up at sea off the shore of Africa. He was now grown old, and had left off going to sea, having put his son, who was far from a young man, into his ship, and who still used the Brazil trade. The old man did not know me, and indeed I hardly knew him. But I soon brought him to my remembrance, and as soon brought myself to his remembrance, when I told him who I was.

After some passionate expressions of the old acquaintance between us, I inquired, you may be sure, after my plantation and my partner. The old man told me he had not been in the Brazils for about nine years; but that he could assure me that when he came away my partner was living, but the trustees whom I had joined with him to take cognisance of my part were both dead: that, however, he believed I would have a very good account of the improvement of the plantation; for that, upon the general belief of my being cast away and drowned, my trustees had given in the account of the produce of my part of the plantation to the procurator-fiscal, who had appropriated it, in case I never came to claim it, one-third to the king, and two-thirds to the monastery of St. Augustine, to be expended for the benefit of the poor, and for the conversion of the Indians to the Catholic faith: but that, if I appeared, or any one for me, to claim the inheritance, it would be restored; only that the improvement, or annual production, being distributed to charitable uses, could not be restored: but he assured me that the steward of the king's revenue from lands, and the providore, or steward of the monastery, had taken great care all along that the incumbent, that is to say my partner, gave every year a faithful account of the produce, of which they had duly received my moiety. I asked him if he knew to what height of improvement he had brought the plantation, and whether he thought it might be worth looking after; or whether, on my going thither, I should meet with any obstruction to my possessing my just right in the moiety.

He told me he could not tell exactly to what degree the plantation was improved; but this he knew, that my partner was grown exceeding rich upon the enjoying his part of it; and that, to the best of his remembrance, he had heard that the king's third of my part, which was, it seems, granted away to some other monastery or religious house, amounted to above two hundred moidores a year: that as to my being restored to a quiet possession of it, there was no question to be made of that, my partner being alive to witness my title, and my name being also enrolled in the register of the country; also he told me that the survivors of my two trustees were very fair, honest people, and very wealthy; and he believed I would not only have their assistance for putting me in possession, but would find a very considerable sum of money in their hands for my account, being the produce of the farm while their fathers held the trust, and before it was given up, as above; which, as he remembered, was for about twelve years.

I showed myself a little concerned and uneasy at this account, and inquired of the old captain how it came to pass that the trustees should thus dispose of my effects, when he knew that I had made my will, and had made him, the Portuguese captain, my universal heir, &c.

He told me that was true; but that as there was no proof of my being dead, he could not act as executor until some certain account should come of my death; and, besides, he was not willing to intermeddle with a thing so remote: that it was true he had registered my will, and put in his claim; and could he have given any account of my being dead or alive, he would have acted by procuration, and taken possession of the ingenio (so they call the sugar-house), and have given his son, who was now at the Brazils, orders to do it. "But," says the old man, "I have one piece of news to tell you, which perhaps may not be so acceptable to you as the rest; and that is, believing you were lost, and all the world believing so also, your partner and trustees did offer to account with me, in your name, for the first six or eight years' profits, which I received. There being at that time great disbursements for increasing the works, building an ingenio, and buying slaves, it did not amount to near so much as afterwards it produced; however," says the old man, "I shall give you a true account of what I have received in all, and how I have disposed of it."

After a few days' further conference with this ancient friend, he brought me an account of the first six years' income of my plantation, signed by my partner and the merchant-trustees, being always delivered in goods, viz. tobacco in roll, and sugar in chests, besides rum, molasses, &c., which is the consequence of a sugar-work; and I found by this account, that every year the income considerably increased; but, as above, the disbursements being large, the sum at first was small: however, the old man let me see that he was debtor to me four hundred and seventy moidores of gold, besides sixty chests of sugar and fifteen double rolls of tobacco, which were lost in his ship; he having been shipwrecked coming home to Lisbon, about eleven years after my having the place. The good man then began to complain of his misfortunes, and how he had been obliged to make use of my money to recover his losses, and buy him a share in a new ship. "However, my old friend," says he, "you shall not want a supply in your necessity; and as soon as my son returns you shall be fully satisfied." Upon this he pulls out an old pouch, and gives me one hundred and sixty Portugal moidores in gold; and giving the writings of his title to the ship, which his son was gone to the Brazils in, of which he was quarter-part owner, and his son another, he puts them both into my hands for security of the rest.

I was too much moved with the honesty and kindness of the poor man to be able to bear this; and remembering what he had done for me, how he had taken me up at sea, and how generously he had used me on all occasions, and particularly how sincere a friend he was now to me, I could hardly refrain weeping at what he had said to me; therefore I asked him if his circumstances admitted him to spare so much money at that time, and if it would not straiten him? He told me he could not say but it might straiten him a little; but, however, it was my money, and I might want it more than he.

Everything the good man said was full of affection, and I could hardly refrain from tears while he spoke; in short, I took one hundred of the moidores, and called for a pen and ink to give him a receipt for them: then I returned him the rest, and told him if ever I had possession of the plantation I would return the other to him also (as, indeed, I afterwards did); and that as to the bill of sale of his part in his son's ship, I would not take it by any means; but that if I wanted the money, I found he was honest enough to pay me; and if I did not, but came to receive what he gave me reason to expect, I would never have a penny more from him.

When this was past, the old man asked me if he should put me into a method to make my claim to my plantation. I told him I thought to go over to it myself. He said I might do so if I pleased, but that if I did not, there were ways enough to secure my right, and immediately to appropriate the profits to my use: and as there were ships in the river of Lisbon just ready to go away to Brazil, he made me enter my name in a public register, with his affidavit, affirming, upon oath, that I was alive, and that I was the same person who took up the land for the planting the said plantation at first. This being regularly attested by a notary, and a procuration affixed, he directed me to send it, with a letter of his writing, to a merchant of his acquaintance at the place; and then proposed my staying with him till an account came of the return.

Never was anything more honourable than the proceedings upon this procuration; for in less than seven months I received a large packet from the survivors of my trustees, the merchants, for whose account I went to sea, in which were the following, particular letters and papers enclosed:—

First, there was the account-current of the produce of my farm or plantation, from the year when their fathers had balanced with my old Portugal captain, being for six years; the balance appeared to be one thousand one hundred and seventy-four moidores in my favour.

Secondly, there was the account of four years more, while they kept the effects in their hands, before the government claimed the administration, as being the effects of a person not to be found, which they called civil death; and the balance of this, the value of the plantation increasing, amounted to nineteen thousand four hundred and forty-six crusadoes, being about three thousand two hundred and forty moidores.

Thirdly, there was the Prior of St. Augustine's account, who had received the profits for above fourteen years; but not being able to account for what was disposed of by the hospital, very honestly declared he had eight hundred and seventy-two moidores not distributed, which he acknowledged to my account: as to the king's part, that refunded nothing.

There was a letter of my partner's, congratulating me very affectionately upon my being alive, giving me an account how the estate was improved, and what it produced a year; with the particulars of the number of squares, or acres that it contained, how planted, how many slaves there were upon it: and making two-and-twenty crosses for blessings, told me he had said so many Ave Marias to thank the Blessed Virgin that I was alive; inviting me very passionately to come over and take possession of my own, and in the meantime to give him orders to whom he should deliver my effects if I did not come myself; concluding with a hearty tender of his friendship, and that of his family; and sent me as a present seven fine leopards' skins, which he had, it seems, received from Africa, by some other ship that he had sent thither, and which, it seems, had made a better voyage than I. He sent me also five chests of excellent sweetmeats, and a hundred pieces of gold uncoined, not quite so large as moidores. By the same fleet my two merchant-trustees shipped me one thousand two hundred chests of sugar, eight hundred rolls of tobacco, and the rest of the whole account in gold.

I might well say now, indeed, that the latter end of Job was better than the beginning. It is impossible to express the flutterings of my very heart when I found all my wealth about me; for as the Brazil ships come all in fleets, the same ships which brought my letters brought my goods: and the effects were safe in the river before the letters came to my hand. In a word, I turned pale, and grew sick; and, had not the old man run and fetched me a cordial, I believe the sudden surprise of joy had overset nature, and I had died upon the spot: nay, after that I continued very ill, and was so some hours, till a physician being sent for, and something of the real cause of my illness being known, he ordered me to be let blood; after which I had relief, and grew well: but I verily believe, if I had not been eased by a vent given in that manner to the spirits, I should have died.

I was now master, all on a sudden, of above five thousand pounds sterling in money, and had an estate, as I might well call it, in the Brazils, of above a thousand pounds a year, as sure as an estate of lands in England: and, in a word, I was in a condition which I scarce knew how to understand, or how to compose myself for the enjoyment of it. The first thing I did was to recompense my original benefactor, my good old captain, who had been first charitable to me in my distress, kind to me in my beginning, and honest to me at the end. I showed him all that was sent to me; I told him that, next to the providence of Heaven, which disposed all things, it was owing to him; and that it now lay on me to reward him, which I would do a hundred-fold: so I first returned to him the hundred moidores I had received of him; then I sent for a notary, and caused him to draw up a general release or discharge from the four hundred and seventy moidores, which he had acknowledged he owed me, in the fullest and firmest manner possible. After which I caused a procuration to be drawn, empowering him to be the receiver of the annual profits of my plantation: and appointing my partner to account with him, and make the returns, by the usual fleets, to him in my name; and by a clause in the end, made a grant of one hundred moidores a year to him during his life, out of the effects, and fifty moidores a year to his son after him, for his life: and thus I requited my old man.

I had now to consider which way to steer my course next, and what to do with the estate that Providence had thus put into my hands; and, indeed, I had more care upon my head now than I had in my state of life in the island where I wanted nothing but what I had, and had nothing but what I wanted; whereas I had now a great charge upon me, and my business was how to secure it. I had not a cave now to hide my money in, or a place where it might lie without lock or key, till it grew mouldy and tarnished before anybody would meddle with it; on the contrary, I knew not where to put it, or whom to trust with it. My old patron, the captain, indeed, was honest, and that was the only refuge I had. In the next place, my interest in the Brazils seemed to summon me thither; but now I could not tell how to think of going thither till I had settled my affairs, and left my effects in some safe hands behind me. At first I thought of my old friend the widow, who I knew was honest, and would be just to me; but then she was in years, and but poor, and, for aught I knew, might be in debt: so that, in a word, I had no way but to go back to England myself and take my effects with me.

It was some months, however, before I resolved upon this; and, therefore, as I had rewarded the old captain fully, and to his satisfaction, who had been my former benefactor, so I began to think of the poor widow, whose husband had been my first benefactor, and she, while it was in her power, my faithful steward and instructor. So, the first thing I did, I got a merchant in Lisbon to write to his correspondent in London, not only to pay a bill, but to go find her out, and carry her, in money, a hundred pounds from me, and to talk with her, and comfort her in her poverty, by telling her she should, if I lived, have a further supply: at the same time I sent my two sisters in the country a hundred pounds each, they being, though not in want, yet not in very good circumstances; one having been married and left a widow; and the other having a husband not so kind to her as he should be. But among all my relations or acquaintances I could not yet pitch upon one to whom I durst commit the gross of my stock, that I might go away to the Brazils, and leave things safe behind me; and this greatly perplexed me.

I had once a mind to have gone to the Brazils and have settled myself there, for I was, as it were, naturalised to the place; but I had some little scruple in my mind about religion, which insensibly drew me back. However, it was not religion that kept me from going there for the present; and as I had made no scruple of being openly of the religion of the country all the while I was among them, so neither did I yet; only that, now and then, having of late thought more of it than formerly, when I began to think of living and dying among them, I began to regret having professed myself a Papist, and thought it might not be the best religion to die with.

But, as I have said, this was not the main thing that kept me from going to the Brazils, but that really I did not know with whom to leave my effects behind me; so I resolved at last to go to England, where, if I arrived, I concluded that I should make some acquaintance, or find some relations, that would be faithful to me; and, accordingly, I prepared to go to England with all my wealth.

In order to prepare things for my going home, I first (the Brazil fleet being just going away) resolved to give answers suitable to the just and faithful account of things I had from thence; and, first, to the Prior of St. Augustine I wrote a letter full of thanks for his just dealings, and the offer of the eight hundred and seventy-two moidores which were undisposed of, which I desired might be given, five hundred to the monastery, and three hundred and seventy-two to the poor, as the prior should direct; desiring the good padre's prayers for me, and the like. I wrote next a letter of thanks to my two trustees, with all the acknowledgment that so much justice and honesty called for: as for sending them any present, they were far above having any occasion of it. Lastly, I wrote to my partner, acknowledging his industry in the improving the plantation, and his integrity in increasing the stock of the works; giving him instructions for his future government of my part, according to the powers I had left with my old patron, to whom I desired him to send whatever became due to me, till he should hear from me more particularly; assuring him that it was my intention not only to come to him, but to settle myself there for the remainder of my life. To this I added a very handsome present of some Italian silks for his wife and two daughters, for such the captain's son informed me he had; with two pieces of fine English broadcloth, the best I could get in Lisbon, five pieces of black baize, and some Flanders lace of a good value.

Having thus settled my affairs, sold my cargo, and turned all my effects into good bills of exchange, my next difficulty was which way to go to England: I had been accustomed enough to the sea, and yet I had a strange aversion to go to England by the sea at that time, and yet I could give no reason for it, yet the difficulty increased upon me so much, that though I had once shipped my baggage in order to go, yet I altered my mind, and that not once but two or three times.

It is true I had been very unfortunate by sea, and this might be one of the reasons; but let no man slight the strong impulses of his own thoughts in cases of such moment: two of the ships which I had singled out to go in, I mean more particularly singled out than any other, having put my things on board one of them, and in the other having agreed with the captain; I say two of these ships miscarried. One was taken by the Algerines, and the other was lost on the Start, near Torbay, and all the people drowned except three; so that in either of those vessels I had been made miserable.

Having been thus harassed in my thoughts, my old pilot, to whom I communicated everything, pressed me earnestly not to go by sea, but either to go by land to the Groyne, and cross over the Bay of Biscay to Rochelle, from whence it was but an easy and safe journey by land to Paris, and so to Calais and Dover; or to go up to Madrid, and so all the way by land through France. In a word, I was so prepossessed against my going by sea at all, except from Calais to Dover, that I resolved to travel all the way by land; which, as I was not in haste, and did not value the charge, was by much the pleasanter way: and to make it more so, my old captain brought an English gentleman, the son of a merchant in Lisbon, who was willing to travel with me; after which we picked up two more English merchants also, and two young Portuguese gentlemen, the last going to Paris only; so that in all there were six of us and five servants; the two merchants and the two Portuguese, contenting themselves with one servant between two, to save the charge; and as for me, I got an English sailor to travel with me as a servant, besides my man Friday, who was too much a stranger to be capable of supplying the place of a servant on the road.

In this manner I set out from Lisbon; and our company being very well mounted and armed, we made a little troop, whereof they did me the honour to call me captain, as well because I was the oldest man, as because I had two servants, and, indeed, was the origin of the whole journey.

As I have troubled you with none of my sea journals, so I shall trouble you now with none of my land journals; but some adventures that happened to us in this tedious and difficult journey I must not omit.

When we came to Madrid, we, being all of us strangers to Spain, were willing to stay some time to see the court of Spain, and what was worth observing; but it being the latter part of the summer, we hastened away, and set out from Madrid about the middle of October; but when we came to the edge of Navarre, we were alarmed, at several towns on the way, with an account that so much snow was falling on the French side of the mountains, that several travellers were obliged to come back to Pampeluna, after having attempted at an extreme hazard to pass on.

When we came to Pampeluna itself, we found it so indeed; and to me, that had been always used to a hot climate, and to countries where I could scarce bear any clothes on, the cold was insufferable; nor, indeed, was it more painful than surprising to come but ten days before out of Old Castile, where the weather was not only warm but very hot, and immediately to feel a wind from the Pyrenean Mountains so very keen, so severely cold, as to be intolerable and to endanger benumbing and perishing of our fingers and toes.

Poor Friday was really frightened when he saw the mountains all covered with snow, and felt cold weather, which he had never seen or felt before in his life. To mend the matter, when we came to Pampeluna it continued snowing with so much violence and so long, that the people said winter was come before its time; and the roads, which were difficult before, were now quite impassable; for, in a word, the snow lay in some places too thick for us to travel, and being not hard frozen, as is the case in the northern countries, there was no going without being in danger of being buried alive every step. We stayed no less than twenty days at Pampeluna; when (seeing the winter coming on, and no likelihood of its being better, for it was the severest winter all over Europe that had been known in the memory of man) I proposed that we should go away to Fontarabia, and there take shipping for Bordeaux, which was a very little voyage. But, while I was considering this, there came in four French gentlemen, who, having been stopped on the French side of the passes, as we were on the Spanish, had found out a guide, who, traversing the country near the head of Languedoc, had brought them over the mountains by such ways that they were not much incommoded with the snow; for where they met with snow in any quantity, they said it was frozen hard enough to bear them and their horses. We sent for this guide, who told us he would undertake to carry us the same way, with no hazard from the snow, provided we were armed sufficiently to protect ourselves from wild beasts; for, he said, in these great snows it was frequent for some wolves to show themselves at the foot of the mountains, being made ravenous for want of food, the ground being covered with snow.

We told him we were well enough prepared for such creatures as they were, if he would insure us from a kind of two-legged wolves, which we were told we were in most danger from, especially on the French side of the mountains. He satisfied us that there was no danger of that kind in the way that we were to go; so we readily agreed to follow him, as did also twelve other gentlemen with their servants, some French, some Spanish, who, as I said, had attempted to go, and were obliged to come back again.

Accordingly, we set out from Pampeluna with our guide on the 15th of November; and indeed I was surprised when, instead of going forward, he came directly back with us on the same road that we came from Madrid, about twenty miles; when, having passed two rivers, and come into the plain country, we found ourselves in a warm climate again, where the country was pleasant, and no snow to be seen; but, on a sudden, turning to his left, he approached the mountains another way; and though it is true the hills and precipices looked dreadful, yet he made so many tours, such meanders, and led us by such winding ways, that we insensibly passed the height of the mountains without being much encumbered with the snow; and all on a sudden he showed us the pleasant and fruitful provinces of Languedoc and Gascony, all green and flourishing, though at a great distance, and we had some rough way to pass still.

We were a little uneasy, however, when we found it snowed one whole day and a night so fast that we could not travel; but he bid us be easy; we should soon be past it all: we found, indeed, that we began to descend every day, and to come more north than before; and so, depending upon our guide, we went on.

It was about two hours before night when, our guide being something before us, and not just in sight, out rushed three monstrous wolves, and after them a bear, from a hollow way adjoining to a thick wood; two of the wolves made at the guide, and had he been far before us, he would have been devoured before we could have helped him; one of them fastened upon his horse, and the other attacked the man with such violence, that he had not time, or presence of mind enough, to draw his pistol, but hallooed and cried out to us most lustily. My man Friday being next me, I bade him ride up and see what was the matter. As soon as Friday came in sight of the man, he hallooed out as loud as the other, "O master! O master!" but like a bold fellow, rode directly up to the poor man, and with his pistol shot the wolf in the head that attacked him.

It was happy for the poor man that it was my man Friday; for, having been used to such creatures in his country, he had no fear upon him, but went close up to him and shot him; whereas, any other of us would have fired at a farther distance, and have perhaps either missed the wolf or endangered shooting the man.

But it was enough to have terrified a bolder man than I; and, indeed, it alarmed all our company, when, with the noise of Friday's pistol, we heard on both sides the most dismal howling of wolves; and the noise, redoubled by the echo of the mountains, appeared to us as if there had been a prodigious number of them; and perhaps there was not such a few as that we had no cause of apprehension: however, as Friday had killed this wolf, the other that had fastened upon the horse left him immediately, and fled, without doing him any damage, having happily fastened upon his head, where the bosses of the bridle had stuck in his teeth. But the man was most hurt; for the raging creature had bit him twice, once in the arm, and the other time a little above his knee; and though he had made some defence, he was just tumbling down by the disorder of his horse, when Friday came up and shot the wolf.

It is easy to suppose that at the noise of Friday's pistol we all mended our pace, and rode up as fast as the way, which was very difficult, would give us leave, to see what was the matter. As soon as we came clear of the trees, which blinded us before, we saw clearly what had been the case, and how Friday had disengaged the poor guide, though we did not presently discern what kind of creature it was he had killed.

Chapter 20 - Fight Between Friday And A Bear

But never was a fight managed so hardily, and in such a surprising manner as that which followed between Friday and the bear, which gave us all, though at first we were surprised and afraid for him, the greatest diversion imaginable. As the bear is a heavy, clumsy creature, and does not gallop as the wolf does, who is swift and light, so he has two particular qualities, which generally are the rule of his actions; first, as to men, who are not his proper prey (he does not usually attempt them, except they first attack him, unless he be excessively hungry, which it is probable might now be the case, the ground being covered with snow), if you do not meddle with him, he will not meddle with you; but then you must take care to be very civil to him, and give him the road, for he is a very nice gentleman; he will not go a step out of his way for a prince; nay, if you are really afraid, your best way is to look another way and keep going on; for sometimes if you stop, and stand still, and look steadfastly at him, he takes it for an affront; but if you throw or toss anything at him, though it were but a bit of stick as big as your finger, he thinks himself abused, and sets all other business aside to pursue his revenge, and will have satisfaction in point of honour—that is his first quality: the next is, if he be once affronted, he will never leave you, night or day, till he has his revenge, but follows at a good round rate till he overtakes you.

My man Friday had delivered our guide, and when we came up to him he was helping him off his horse, for the man was both hurt and frightened, when on a sudden we espied the bear come out of the wood; and a monstrous one it was, the biggest by far that ever I saw. We were all a little surprised when we saw him; but when Friday saw him, it was easy to see joy and courage in the fellow's countenance. "O! O! O!" says Friday, three times, pointing to him; "O master, you give me te leave, me shakee te hand with him; me makee you good laugh."

I was surprised to see the fellow so well pleased. "You fool," says I, "he will eat you up."—"Eatee me up! eatee me up!" says Friday, twice over again; "me eatee him up; me makee you good laugh; you all stay here, me show you good laugh." So down he sits, and gets off his boots in a moment, and puts on a pair of pumps (as we call the flat shoes they wear, and which he had in his pocket), gives my other servant his horse, and with his gun away he flew, swift like the wind.

The bear was walking softly on, and offered to meddle with nobody, till Friday coming pretty near, calls to him, as if the bear could understand him. "Hark ye, hark ye," says Friday, "me speakee with you." We followed at a distance, for now being down on the Gascony side of the mountains, we were entered a vast forest, where the country was plain and pretty open, though it had many trees in it scattered here and there. Friday, who had, as we say, the heels of the bear, came up with him quickly, and took up a great stone, and threw it at him, and hit him just on the head, but did him no more harm than if he had thrown it against a wall; but it answered Friday's end, for the rogue was so void of fear that he did it purely to make the bear follow him, and show us some laugh as he called it. As soon as the bear felt the blow, and saw him, he turns about and comes after him, taking very long strides, and shuffling on at a strange rate, so as would have put a horse to a middling gallop; away reins Friday, and takes his course as if he ran towards us for help; so we all resolved to fire at once upon the bear, and deliver my man; though I was angry at him for bringing the bear back upon us, when he was going about his own business another way; and especially I was angry that he had turned the bear upon us, and then ran away; and I called out, "You dog! is this your making us laugh? Come away, and take your horse, that we may shoot the creature." He heard me, and cried out, "No shoot, no shoot; stand still, and you get much laugh:" and as the nimble creature ran two feet for the bear's one, he turned on a sudden on one side of us, and seeing a great oak-tree fit for his purpose, he beckoned to us to follow; and doubling his pace, he got nimbly up the tree, laying his gun down upon the ground, at about five or six yards from the bottom of the tree.

The bear soon came to the tree, and we followed at a distance: the first thing he did he stopped at the gun, smelt at it, but let it lie, and up he scrambles into the tree, climbing like a cat, though so monstrous heavy. I was amazed at the folly, as I thought it, of my man, and could not for my life see anything to laugh at, till seeing the bear get up the tree, we all rode near to him.

When we came to the tree, there was Friday got out to the small end of a large branch, and the bear got about half-way to him. As soon as the bear got out to that part where the limb of the tree was weaker, "Ha!" says he to us, "now you see me teachee the bear dance:" so he began jumping and shaking the bough, at which the bear began to totter, but stood still, and began to look behind him, to see how he should get back; then, indeed, we did laugh heartily. But Friday had not done with him by a great deal; when seeing him stand still, he called out to him again, as if he had supposed the bear could speak English, "What, you come no farther? pray you come farther;" so he left jumping and shaking the tree; and the bear, just as if he understood what he said, did come a little farther; then he began jumping again, and the bear stopped again. We thought now was a good time to knock him in the head, and called to Friday to stand still and we should shoot the bear: but he cried out earnestly, "Oh, pray! Oh, pray! no shoot, me shoot by and then:" he would have said by-and-by.

However, to shorten the story, Friday danced so much, and the bear stood so ticklish, that we had laughing enough, but still could not imagine what the fellow would do: for first we thought he depended upon shaking the bear off; and we found the bear was too cunning for that too; for he would not go out far enough to be thrown down, but clung fast with his great broad claws and feet, so that we could not imagine what would be the end of it, and what the jest would be at last. But Friday put us out of doubt quickly: for seeing the bear cling fast to the bough, and that he would not be persuaded to come any farther, "Well, well," says Friday, "you no come farther, me go; you no come to me, me come to you;" and upon this he went out to the smaller end, where it would bend with his weight, and gently let himself down by it, sliding down the bough till he came near enough to jump down on his feet, and away he ran to his gun, took it up, and stood still.

"Well," said I to him, "Friday, what will you do now? Why don't you shoot him?" "No shoot," says Friday, "no yet; me shoot now, me no kill; me stay, give you one more laugh:" and, indeed, so he did; for when the bear saw his enemy gone, he came back from the bough, where he stood, but did it very cautiously, looking behind him every step, and coming backward till he got into the body of the tree, then, with the same hinder end foremost, he came down the tree, grasping it with his claws, and moving one foot at a time, very leisurely.

At this juncture, and just before he could set his hind foot on the ground, Friday stepped up close to him, clapped the muzzle of his piece into his ear, and shot him dead. Then the rogue turned about to see if we did not laugh; and when he saw we were pleased by our looks, he began to laugh very loud. "So we kill bear in my country," says Friday. "So you kill them?" says I; "why, you have no guns."—"No," says he, "no gun, but shoot great much long arrow." This was a good diversion to us; but we were still in a wild place, and our guide very much hurt, and what to do we hardly knew; the howling of wolves ran much in my head; and, indeed, except the noise I once heard on the shore of Africa, of which I have said something already, I never heard anything that filled me with so much horror.

These things, and the approach of night, called us off, or else, as Friday would have had us, we should certainly have taken the skin of this monstrous creature off, which was worth saving; but we had near three leagues to go, and our guide hastened us; so we left him, and went forward on our journey.

The ground was still covered with snow, though not so deep and dangerous as on the mountains; and the ravenous creatures, as we heard afterwards, were come down into the forest and plain country, pressed by hunger, to seek for food, and had done a great deal of mischief in the villages, where they surprised the country people, killed a great many of their sheep and horses, and some people too.

We had one dangerous place to pass, and our guide told us if there were more wolves in the country we should find them there; and this was a small plain, surrounded with woods on every side, and a long, narrow defile, or lane, which we were to pass to get through the wood, and then we should come to the village where we were to lodge.

It was within half-an-hour of sunset when we entered the wood, and a little after sunset when we came into the plain: we met with nothing in the first wood, except that in a little plain within the wood, which was not above two furlongs over, we saw five great wolves cross the road, full speed, one after another, as if they had been in chase of some prey, and had it in view; they took no notice of us, and were gone out of sight in a few moments. Upon this, our guide, who, by the way, was but a fainthearted fellow, bid us keep in a ready posture, for he believed there were more wolves a-coming. We kept our arms ready, and our eyes about us; but we saw no more wolves till we came through that wood, which was near half a league, and entered the plain. As soon as we came into the plain, we had occasion enough to look about us. The first object we met with was a dead horse; that is to say, a poor horse which the wolves had killed, and at least a dozen of them at work, we could not say eating him, but picking his bones rather; for they had eaten up all the flesh before. We did not think fit to disturb them at their feast, neither did they take much notice of us. Friday would have let fly at them, but I would not suffer him by any means; for I found we were like to have more business upon our hands than we were aware of.

We had not gone half over the plain when we began to hear the wolves howl in the wood on our left in a frightful manner, and presently after we saw about a hundred coming on directly towards us, all in a body, and most of them in a line, as regularly as an army drawn up by experienced officers. I scarce knew in what manner to receive them, but found to draw ourselves in a close line was the only way; so we formed in a moment; but that we might not have too much interval, I ordered that only every other man should fire, and that the others, who had not fired, should stand ready to give them a second volley immediately, if they continued to advance upon us; and then that those that had fired at first should not pretend to load their fusees again, but stand ready, every one with a pistol, for we were all armed with a fusee and a pair of pistols each man; so we were, by this method, able to fire six volleys, half of us at a time; however, at present we had no necessity; for upon firing the first volley, the enemy made a full stop, being terrified as well with the noise as with the fire.

Four of them being shot in the head, dropped; several others were wounded, and went bleeding off, as we could see by the snow. I found they stopped, but did not immediately retreat; whereupon, remembering that I had been told that the fiercest creatures were terrified at the voice of a man, I caused all the company to halloo as loud as they could; and I found the notion not altogether mistaken; for upon our shout they began to retire and turn about. I then ordered a second volley to be fired in their rear, which put them to the gallop, and away they went to the woods. This gave us leisure to charge our pieces again; and that we might lose no time, we kept going; but we had but little more than loaded our fusees, and put ourselves in readiness, when we heard a terrible noise in the same wood on our left, only that it was farther onward, the same way we were to go.

The night was coming on, and the light began to be dusky, which made it worse on our side; but the noise increasing, we could easily perceive that it was the howling and yelling of those hellish creatures; and on a sudden we perceived three troops of wolves, one on our left, one behind us, and one in our front, so that we seemed to be surrounded with them: however, as they did not fall upon us, we kept our way forward, as fast as we could make our horses go, which, the way being very rough, was only a good hard trot. In this manner, we came in view of the entrance of a wood, through which we were to pass, at the farther side of the plain; but we were greatly surprised, when coming nearer the lane or pass, we saw a confused number of wolves standing just at the entrance. On a sudden, at another opening of the wood, we heard the noise of a gun, and looking that way, out rushed a horse, with a saddle and a bridle on him, flying like the wind, and sixteen or seventeen wolves after him, full speed: the horse had the advantage of them; but as we supposed that he could not hold it at that rate, we doubted not but they would get up with him at last: no question but they did.

But here we had a most horrible sight; for riding up to the entrance where the horse came out, we found the carcasses of another horse and of two men, devoured by the ravenous creatures; and one of the men was no doubt the same whom we heard fire the gun, for there lay a gun just by him fired off; but as to the man, his head and the upper part of his body was eaten up. This filled us with horror, and we knew not what course to take; but the creatures resolved us soon, for they gathered about us presently, in hopes of prey; and I verily believe there were three hundred of them. It happened, very much to our advantage, that at the entrance into the wood, but a little way from it, there lay some large timber-trees, which had been cut down the summer before, and I suppose lay there for carriage.

I drew my little troop in among those trees, and placing ourselves in a line behind one long tree, I advised them all to alight, and keeping that tree before us for a breastwork, to stand in a triangle, or three fronts, enclosing our horses in the centre. We did so, and it was well we did; for never was a more furious charge than the creatures made upon us in this place. They came on with a growling kind of noise, and mounted the piece of timber, which, as I said, was our breastwork, as if they were only rushing upon their prey; and this fury of theirs, it seems, was principally occasioned by their seeing our horses behind us. I ordered our men to fire as before, every other man; and they took their aim so sure that they killed several of the wolves at the first volley; but there was a necessity to keep a continual firing, for they came on like devils, those behind pushing on those before.

When we had fired a second volley of our fusees, we thought they stopped a little, and I hoped they would have gone off, but it was but a moment, for others came forward again; so we fired two volleys of our pistols; and I believe in these four firings we had killed seventeen or eighteen of them, and lamed twice as many, yet they came on again. I was loth to spend our shot too hastily; so I called my servant, not my man Friday, for he was better employed, for, with the greatest dexterity imaginable, he had charged my fusee and his own while we were engaged—but, as I said, I called my other man, and giving him a horn of powder, I had him lay a train all along the piece of timber, and let it be a large train.

He did so, and had but just time to get away, when the wolves came up to it, and some got upon it, when I, snapping an unchanged pistol close to the powder, set it on fire; those that were upon the timber were scorched with it, and six or seven of them fell; or rather jumped in among us with the force and fright of the fire; we despatched these in an instant, and the rest were so frightened with the light, which the night—for it was now very near dark—made more terrible that they drew back a little; upon which I ordered our last pistols to be fired off in one volley, and after that we gave a shout; upon this the wolves turned tail, and we sallied immediately upon near twenty lame ones that we found struggling on the ground, and fell to cutting them with our swords, which answered our expectation, for the crying and howling they made was better understood by their fellows; so that they all fled and left us.

We had, first and last, killed about threescore of them, and had it been daylight we had killed many more. The field of battle being thus cleared, we made forward again, for we had still near a league to go. We heard the ravenous creatures howl and yell in the woods as we went several times, and sometimes we fancied we saw some of them; but the snow dazzling our eyes, we were not certain. In about an hour more we came to the town where we were to lodge, which we found in a terrible fright and all in arms; for, it seems, the night before the wolves and some bears had broken into the village, and put them in such terror that they were obliged to keep guard night and day, but especially in the night, to preserve their cattle, and indeed their people.

The next morning our guide was so ill, and his limbs swelled so much with the rankling of his two wounds, that he could go no farther; so we were obliged to take a new guide here, and go to Toulouse, where we found a warm climate, a fruitful, pleasant country, and no snow, no wolves, nor anything like them; but when we told our story at Toulouse, they told us it was nothing but what was ordinary in the great forest at the foot of the mountains, especially when the snow lay on the ground; but they inquired much what kind of guide we had got who would venture to bring us that way in such a severe season, and told us it was surprising we were not all devoured.

When we told them how we placed ourselves and the horses in the middle, they blamed us exceedingly, and told us it was fifty to one but we had been all destroyed, for it was the sight of the horses which made the wolves so furious, seeing their prey, and that at other times they are really afraid of a gun; but being excessively hungry, and raging on that account, the eagerness to come at the horses had made them senseless of danger, and that if we had not by the continual fire, and at last by the stratagem of the train of powder, mastered them, it had been great odds but that we had been torn to pieces; whereas, had we been content to have sat still on horseback, and fired as horsemen, they would not have taken the horses so much for their own, when men were on their backs, as otherwise; and withal, they told us that at last, if we had stood altogether, and left our horses, they would have been so eager to have devoured them, that we might have come off safe, especially having our firearms in our hands, being so many in number. For my part, I was never so sensible of danger in my life; for, seeing above three hundred devils come roaring and open-mouthed to devour us, and having nothing to shelter us or retreat to, I gave myself over for lost; and, as it was, I believe I shall never care to cross those mountains again: I think I would much rather go a thousand leagues by sea, though I was sure to meet with a storm once a-week.

I have nothing uncommon to take notice of in my passage through France—nothing but what other travellers have given an account of with much more advantage than I can. I travelled from Toulouse to Paris, and without any considerable stay came to Calais, and landed safe at Dover the 14th of January, after having had a severe cold season to travel in.

I was now come to the centre of my travels, and had in a little time all my new-discovered estate safe about me, the bills of exchange which I brought with me having been currently paid.

My principal guide and privy-counsellor was my good ancient widow, who, in gratitude for the money I had sent her, thought no pains too much nor care too great to employ for me; and I trusted her so entirely that I was perfectly easy as to the security of my effects; and, indeed, I was very happy from the beginning, and now to the end, in the unspotted integrity of this good gentlewoman.

And now, having resolved to dispose of my plantation in the Brazils, I wrote to my old friend at Lisbon, who, having offered it to the two merchants, the survivors of my trustees, who lived in the Brazils, they accepted the offer, and remitted thirty-three thousand pieces of eight to a correspondent of theirs at Lisbon to pay for it.

In return, I signed the instrument of sale in the form which they sent from Lisbon, and sent it to my old man, who sent me the bills of exchange for thirty-two thousand eight hundred pieces of eight for the estate, reserving the payment of one hundred moidores a year to him (the old man) during his life, and fifty moidores afterwards to his son for his life, which I had promised them, and which the plantation was to make good as a rent-charge. And thus I have given the first part of a life of fortune and adventure—a life of Providence's chequer-work, and of a variety which the world will seldom be able to show the like of; beginning foolishly, but closing much more happily than any part of it ever gave me leave so much as to hope for.

Any one would think that in this state of complicated good fortune I was past running any more hazards—and so, indeed, I had been, if other circumstances had concurred; but I was inured to a wandering life, had no family, nor many relations; nor, however rich, had I contracted fresh acquaintance; and though I had sold my estate in the Brazils, yet I could not keep that country out of my head, and had a great mind to be upon the wing again; especially I could not resist the strong inclination I had to see my island, and to know if the poor Spaniards were in being there.

My true friend, the widow, earnestly dissuaded me from it, and so far prevailed with me, that for almost seven years she prevented my running abroad, during which time I took my two nephews, the children of one of my brothers, into my care; the eldest, having something of his own, I bred up as a gentleman, and gave him a settlement of some addition to his estate after my decease. The other I placed with the captain of a ship; and after five years, finding him a sensible, bold, enterprising young fellow, I put him into a good ship, and sent him to sea; and this young fellow afterwards drew me in, as old as I was, to further adventures myself.

In the meantime, I in part settled myself here; for, first of all, I married, and that not either to my disadvantage or dissatisfaction, and had three children, two sons and one daughter; but my wife dying, and my nephew coming home with good success from a voyage to Spain, my inclination to go abroad, and his importunity, prevailed, and engaged me to go in his ship as a private trader to the East Indies; this was in the year 1694.

In this voyage I visited my new colony in the island, saw my successors the Spaniards, had the old story of their lives and of the villains I left there; how at first they insulted the poor Spaniards, how they afterwards agreed, disagreed, united, separated, and how at last the Spaniards were obliged to use violence with them; how they were subjected to the Spaniards, how honestly the Spaniards used them—a history, if it were entered into, as full of variety and wonderful accidents as my own part—particularly, also, as to their battles with the Caribbeans, who landed several times upon the island, and as to the improvement they made upon the island itself, and how five of them made an attempt upon the mainland, and brought away eleven men and five women prisoners, by which, at my coming, I found about twenty young children on the island.

Here I stayed about twenty days, left them supplies of all necessary things, and particularly of arms, powder, shot, clothes, tools, and two workmen, which I had brought from England with me, viz. a carpenter and a smith.

Besides this, I shared the lands into parts with them, reserved to myself the property of the whole, but gave them such parts respectively as they agreed on; and having settled all things with them, and engaged them not to leave the place, I left them there.

From thence I touched at the Brazils, from whence I sent a bark, which I bought there, with more people to the island; and in it, besides other supplies, I sent seven women, being such as I found proper for service, or for wives to such as would take them. As to the Englishmen, I promised to send them some women from England, with a good cargo of necessaries, if they would apply themselves to planting—which I afterwards could not perform. The fellows proved very honest and diligent after they were mastered and had their properties set apart for them. I sent them, also, from the Brazils, five cows, three of them being big with calf, some sheep, and some hogs, which when I came again were considerably increased.

But all these things, with an account how three hundred Caribbees came and invaded them, and ruined their plantations, and how they fought with that whole number twice, and were at first defeated, and one of them killed; but at last, a storm destroying their enemies' canoes, they famished or destroyed almost all the rest, and renewed and recovered the possession of their plantation, and still lived upon the island.

All these things, with some very surprising incidents in some new adventures of my own, for ten years more, I shall give a farther account of in the Second Part of my Story.

14 Back to the Future I Script

This is the Back to the Future I script for you to read over if you're bored. It helps to follow along if you've seen the movie too! There are quite a few differences to the film which you might pick up on while reading, but it's essentially the same story. Read it from left to right, top to bottom. Scene changes are in **bold** and names of speakers are underlined. O.S. means 'Offscreen' - when someone outside the shot is talking. (a beat) signifies a time gap or a moment of silence.

BACK TO THE FUTURE
Written by
Robert Zemeckis & Bob Gale

Introductions

INT. HIGH SCHOOL CLASSROOM – DAY
A weird flickering white light strobes the screen, accompanied by projector noise and an offscreen control voice.

CONTROL VOICE
5...4...3...2...1...detonate!

The light becomes brighter as we pan over to MARTY MCFLY, 17, a good looking kid wearing Porsche mirrored sunglasses. The mirrored lenses reflect the mushroom cloud of an atomic explosion. The red hot openeing music kicks in; Main titles begin.

Marty starts bopping along to the rock and roll: he's plugged into a walkman stereo. We are in a contemporary high school classroom where 30-odd students are watching a 16mm documentary about nuclear tests of the 1950's.

SERIES OF SHOTS — MAIN TITLE SEQUENCE
BORED STUDENTS watch the black and white movie. Only MARTY is enjoying himself as he listens to his stereo. MARTY'S FOOT taps in time to the music. The teacher, MRS. WOODS, 45, looks around the classroom, making sure the students are paying attention. She has her “Classroom Planner” in hand.

The DOCUMENTARY depicts preparations for another atomic test, noting that as many as 20 were done per year in the 1950's. Footage shows how tract houses were constructed and peopled with mannequins to measure the effects of radiation.

MARTY continues bopping along. MRS. WOODS notices the one head in the classroom bobbing. MARTY'S foot continues tapping in time. Now a pair of woman's shoes step into FRAME. MRS. WOODS is standing next to Marty, arms crossed, staring at him. But Marty is oblivious to her. SUZY PARKER, 17, an attractive girl, looks over at the situation in horror.

Mrs. Woods waves her hand in front of Marty's sunglasses. No reaction. Suzy turns her head — she can't bear to watch. Mrs. Woods gently removes Marty's sunglasses. His eyes are closed. Now Marty opens his eyes. He looks up at Mrs. Woods and smiles weakly.

Mrs. Woods does not smile back. She rips the headphones off — the MUSIC abruptly stops.

CUT TO: INT. STRICKLAND'S OFFICE — DAY
Close on Marty's walkman in a pair of elderly male hands being placed in a woodworking vise mounted on the corner of a desk.

STRICKLAND'S OFFICE
Marty fidgets uneasily in an uncomfortable wooden chair in the sparse office as MR. STRICKLAND, a humorless disciplinarian, tightens the vise. Strickland looks 60, but he could be 160 — he was born old and stayed that way, and has been at this school forever.

Strickland gazes at Marty, then gives the vise a hard, mean wrench. The walkman crunches... it sounds like bones breaking.

Marty cringes. Strickland smiles sadistically and hands it back to him.

MR. STRICKLAND
That's number three, isn't it, McFly?

MARTY
Four.

MR. STRICKLAND
You don't like school, do you, McFly?
Marty rolls his eyes. Is this question for real?

MARTY
Oh, no. sir. I LOVE school.

MR. STRICKLAND
(snaps at him)
You've got a real attitude problem, you know that?
(opens a file on his desk)
You're a slacker, McFly. You've got aptitude, but you don't apply yourself. You remind me of your father: He was a slacker, too.
Marty just sits there, bored.

MR. STRICKLAND
Now, for slacking off in class and for having a serious attitude problem, your punishment is two weeks in detention, with me, starting this afternoon.

MARTY
This afternoon? But I can't! Me and my band have an audition at 3:45 for the YMCA dance. It's really important that I be there — they're counting onme. I gotta be there at 3:45.

MR. STRICKLAND
Too bad, McFly. I guess this isn't your day.
Marty is sick.

CUT TO: INT. DETENTION CLASSROOM — ON A WALL CLOCK — DAY
It's 3:28.

A regular math classroom used as detention after hours. Again, we see signs of an old school dressed to be more modern: green chalkboards, repainted walls, new desks, and a sprinkler system. 8 or 10 STUDENTS are seated far apart from each other throughout the room. All are supposedly studying. One of them has a skateboard along with his books.

MARTY is at the pencil sharpener in the back, sharpening a pencil...but the look on his face indicates he's up to something. He looks at the clock, looks up at the SPRINKLER PIPE, then glances toward the front of the room. MR. STRICKLAND sits at the teacher's desk, grading a large stack of papers.

Marty finishes at the sharpener. He sticks a piece of gum in his mouth and starts chewing like mad. Then he steps alongside the carousel slide projector and surreptitiously sneaks the lens into his jacket pocket. He quickly returns to his seat.

Now, Strickland stands up and starts toward Marty! Did he see Marty swipe the lens? No, he's merely “patrolling” the room. When Strickland isn't looking, Marty produces a matchbook and a rubber band from the pencil pouch of his loose leaf binder. He opens the matchbook cover and sticks his gum to the backside. He waits for Strickland to walk past him, then quickly, Marty stands and, using the rubber band, fires the matchbook at the ceiling.

Strickland whirls around upon hearing the snap, but Marty is already seated, "studying." Strickland looks around suspiciously, but sees nothing. He continues along.

Marty glances up: The gum is holding the matchbook on the ceiling, right near the sprinkler valve. He smiles. Now Marty sets his mirrored sunglasses on his leg positioning them to reflect the rays of the sun up at the matchbook. That done, he pulls the lens out of his pocket and focuses the beam onto the matchbook. He adjusts the lens ever so slightly... there! Perfect! A hot white pinpoint of light is focused on the matchbook.

MR. STRICKLAND returns to his paper grading. He marks an entire set of answers wrong and puts "F" at the top of a paper. The next paper has two right. Strickland gives it an "F+." MARTY continues holding the lens as steady as he can, watching anxiously for results. Above there is a faint trace of smoke on the matchbook.

The clock now reads 3:37. STRICKLAND grades his last paper, then stands up and starts pulling down the window shades! MARTY is horrified! Strickland is 3 shades away from Marty's window. Marty looks anxiously up at the matchbook.

MARTY
(under his breath)
Come on, come on...!
Strickland pulls down the next shade. There is more smoke from the matchbook...

MARTY
Burn, you sucker...!
Strickland pulls down another shade. The next one is Marty's... Strickland steps toward it... Suddenly the matchbook ignites! FIRE! Immediately the fire alarm sounds and the sprinklers go off!

MARTY
FIRE!!!
Students jump up and scream as water sprays all over them! They rush for the door. MARTY grabs the kid with the skateboard, named WEEZE.

MARTY
Weeze — let me borrow this! I'll bring it back tomorrow!
Marty takes the skateboard and dashes out.

MR. STRICKLAND
Stop! Wait! We must file out in an orderly fashion!
Another sprinkler goes off and sprays Strickland right in the face!

EXT. HILL VALLEY HIGH SCHOOL — DAY
It's a classic WPA style high school, built in the 1930's. Marty dashes out, jumps on the skateboard, and skateboards down the front steps!

EXT. HILLY RESIDENTIAL STREET — DAY
Marty comes from around the corner, skateboards down a hill, weaving through traffic. He skateboards like a champ.

EXT. STREET — TOWN SQUARE — DAY
This is HILL VALLEY, a northern California town; it's October. The town has been here a while — and its town square business district is beginning to deteriorate... undoubtedly because there's a mall someplace. The old courthouse, now the Department of Social Services, has a clock tower — but the clock is stopped at 10:02. A time and temperature clock on the BANK reads 3:43. MARTY skateboards down the business street and across traffic, narrowly missing being hit by a car!

INT. YMCA — STAGE — DAY
3 members of the PINHEADS rock band, keyboards, bass and drums, exchange nervous glances, repeatedly checking their watches. They're all set up on stage. SUZY PARKER is also here — but she's not part of the band. Suddenly, Marty skateboards onto the stage.

SUZY
Marty! Marty gives her a wink; she smiles.

Marty's guitar, amp and microphone have already been set up for him. He picks up the guitar and tunes up, then looks over at Suzy. Suzy smiles and holds up her crossed fingers. Marty grins back. Clearly, they're "an item." Marty practices a riff...and he's great. You can't tell where the guitar ends and the man begins. He turns and addresses the dance committee.

MARTY
All right, we're the Pinheads, and we're gonna rock 'n roll! They kick into a red hot number. Marty's fingers dance across the strings and frets in a complicated lead line. He's terrific, and the band sounds great. They get only about 25 seconds into the number when a VOICE calls out.

DANCE COMMITTEEMAN
That's enough. Thank you.
Marty and the group stop playing, exchanging bewildered glances.

CUT TO: EXT. TOWN SQUARE — DAY
On some of the boarded up buildings are election posters: "RE-ELECT MAYOR 'GOLDIE' WILSON: HONESTY, DECENCY, INTEGRITY" and a picture of the incumbent.
Mayor Wilson is black, about 45, with a gold front tooth. MARTY and SUZY are walking together. She carries her schoolbooks: he has the skateboard. And he's depressed.

SUZY
Marty, one rejection isn't the end of the world.

MARTY
I don't know. Maybe I'm just not cut out for music.

SUZY
But you're good, Marty. You're really good. And this audition tape of yours is great... (she gives him back a cassette tape) You've got to send it in to that record company.

MARTY
But what if they hate it? What if they say, "get outta here, kid, you got no future?" Why should I put myself through all that anxiety? (He sighs.) I'm sorry. I guess I sound like some kinda schizoid neurotic.

SUZY
Well, according to my shrink, all of our emotional anxieties are a direct result of the influence our parents had in our childhood.

MARTY
In that case, you can kiss me off right now. You've met my old man. You know what a zero he is.
Suzy nods knowingly. They are walking past a Totota dealership.

SUZY
At least he's letting you borrow the car tomorrow night. That's a step in the right direction.

MARTY
Hey, I'm taking the car tomorrow night. That way it saves him the anxiety of making a decision.

Marty spots a tricked-out black supra in the showroom.

MARTY
Hey, check out that tricked-out Supra. Now that's a car. (sighs, admiring it longingly) Someday, Suzy, someday...

SUZY
What about your mother? Does she know?

MARTY
Are you kidding? She thinks I'm going camping with the guys. If she found out I was going camping with you, she'd go crazy.

Marty sprays some BINACA in his mouth.

'SUZY
(nods knowingly) My shrink says a lot of parents are sexually repressed.

MARTY
My mom's not sexually repressed. How can you be repressed about something you know absolutely nothing about? They pause across from the former courthouse building.

SUZY
(flirting) She's just trying to keep you respectable.

MARTY
(flirting back) She's not doing a very good job, is she?
They move closer...

SUZY
Terrible...
They're about to kiss…

CLOCK WOMAN (O.S.)
Save the Clock Tower!

Marty and Suzy turn. A middle-aged church group type woman has a donation can and an armful of printed flyers.

CLOCK WOMAN
Please make a donation to save the clock tower.

MARTY
Lady, can't you see I'm busy here?

CLOCK WOMAN
Mayor Wilson is sponsoring an initiative to repair that clock...
She points to the stopped clock on the old courthouse building.

CLOCK WOMAN
(continuing)
We at the Hill Valley Preservation Society think it should be preserved exactly the way it is.

MARTY
But it doesn't tell time. What good is it?

CLOCK WOMAN
It's part of our history. Here — it's all in this flyer. (gives Marty one) 30 years ago, lightning struck that clock tower, and the clock hasn't run since. We at the society feel it's a landmark of scientific importance, attesting to the power of the Almighty.

MARTY
All right, lady. Here's a quarter. Marty drops a quarter into her can.
She nods and moves along to bother someone else.

MARTY
(to Suzy)
Now... you were saying that my mother wasn't doing a very good job...
They move closer again as before, about to kiss...
Suddenly, a male voice booms out over a P.A.

SPEAKER VOICE (O.S.)
Marty! Marty McFly!
Marty turns. A medium sized RV with speakers mounted on the side is idling across the street. The vehicle is quite used. It's towing a tarped vehicle on a trailer. Marty recognizes it, and rolls his eyes.

MARTY
Doc, I'm busy.

DRIVER
It'll only take a minute...

MARTY
(to Suzy)
Come on, you should see what's inside this thing.
They go over and step inside.

INT. RV — TOWN SQUARE — DAY
The driver is DR. EMMETT BROWN, about 65. He looks like an old hippie, with shoulder length white hair, Hawaiian shirt, faded jeans, an Indian turquoise around his neck and lively — almost wild — eyes. He's full of energy, full of life, talks fast, and is immediately likable for his eccentricities.

With him in the RV is his big dog, "Einstein." The inside of the vehicle is full of clocks — every imaginable type, a Cuckoo, a Grandfather, even a classic "Felix the Cat with moving eyes". All of them are in dead sync. There is also a bank of state-of-the-art component video and audio equipment.

The 25-inch monitor is tuned to MTV. There are discarded fast food cartons, and a spilled box of sugar coated cereal, an unmade bed, a doggie dish, and tools and electronic parts. We might also notice a lead canister with purple radiation symbols.

MARTY
What's up, Doc?

BROWN
One a.m., right, Marty? You're gonna be there, right? Twin Pines Mall.

MARTY
Yeah, right.
Brown takes the "Save the Clock" flyer out of Marty's hand.

BROWN
Let me write it down for you so you don't forget... (writes on the back) "Twin Pines Mall... one a.m." Twin Pines Mall — remember when that used to be Peabody's farm? It was all farmland out there. No — I guess that was before your time, Marty.
He folds the flyer and sticks it in Marty's pocket.

BROWN
(continuing)
You're feeling all right, Marty? You've been getting plenty of rest?

MARTY
Yeah, but Doc, exactly what are we gonna do at one a.m.?

BROWN
You want me to spoil it for you? Don't worry about it — it'll be great.

MARTY
You're not planning on breaking into another power plant or something...? That was kinda risky.

BROWN
That's the point, Marty. Risk. Risk makes life worth living. What would you rather do, sleep?

Brown checks one of the 4 watches on his arm.

BROWN
(sudden urgency)
It's almost time — quiet!
Suzy gives Marty a bewildered look, but Marty knows what's about to happen...
It's exactly 4 o'clock, and all of the clocks chime at once — dings, dongs, electronic tones, cuckoo birds... Brown loves it — he drinks it up like a proud father.

BROWN
I love that!

MARTY
Look, Doc, we've gotta go. I'll...see you tonight.

BROWN
Yes! At one a.m.! It could change your life.
Marty and Suzy step out of the RV.

EXT. STREET — TOWN SQUARE — DAY
Marty and Suzy watch the RV go.

SUZY
I don't know if you should be hanging out with a guy like that after midnight.

MARTY
Doc Brown's all right — he's just a little hung up on time. A couple of years ago, he showed up at my house and hired me to sweep out this garage of his. He pays me 50 bucks a week, gives me free beer... and gives me total access to his record collection — he's got this great old record collection.

(a beat)

Hard to believe he was one of the world's greatest nuclear physicists.
Down the street, Brown's RV waits for an elderly man to hobble across the street. Brown's voice booms out over his P.A.

BROWN (V.O. P.A.)
Let's move it, Gramps! You're not that old!
Suzy gives Marty a look of disbelief.

MARTY
(shrugs)
Too much radiation, I guess.
(a beat, moves closer to her)
Where were we?
She smiles and moves toward him.

SUZY
I think we were right here...
Again they're about to kiss...
A car horn honks loudly. Suzy turns away.

SUZY
That's my Dad. See you tomorrow.
She hops into the waiting car. Marty watches it go.

MARTY
This is not my day.

EXT. MCFLY HOUSE — DUSK
A WRECKER is in the McFly driveway with a 1979 Plymouth Reliant in tow: its front end is completely smashed, as if someone rammed it into a brick wall. The truck driver is unhitching it. Looking on with horror is timid GEORGE McFLY, 47, a balding, boring, uninspired man who wears a suit he bought at Sears 4 years ago.

Next to him is BIFF TANNEN, 48, an intimidating lout, who wears gold chains and pinky rings, with sartorial taste to match. MARTY skateboards up to the scene and is shocked. He listens as Biff lambasts his father.

BIFF
I can't believe you did this, McFly. I can't believe you loaned me your car without telling me it had a blind spot. I could have been killed!

GEORGE
Biff, I never noticed any blind spot before.

BIFF
It's there, McFly. How else can you explain this?

GEORGE
Can I assume that your insurance will pay for this?

BIFF
My insurance? It's your car. Your insurance should pay for it. I wanna know who's gonna pay for THIS! (indicates his stained suit) I spilled beer all over it when that car hit me. Who's gonna pay the cleaning bill?

George hesitates, then meekly pulls out his wallet.

GEORGE
Do you think 20 dollars will cover it?
Biff snatches the 20 dollar bill out of George's hand.

BIFF
It's a start. And hey... where's my reports?

GEORGE
Well, I haven't finished them yet. I figured since they weren't due till Monday…

BIFF
(knocks on George's head)
Hello? Anybody home? Think, McFly, think! I've gotta have time to get 'em retyped. If I turn in my reports in your handwriting, I'll get fired.

GEORGE
Okay, I'll finish them tonight and run them over first thing in the morning.

BIFF
Not too early — I sleep in on Saturday.
(about to leave)
Oh, hey, McFly: your shoe's untied.

GEORGE
(falling for it)
Huh?
He looks down and Biff hits him on the chin. Biff laughs loudly.

BIFF
Don't be so gullible, McFly!
Biff walks over to his sparkling year old cadillac on the street. He spots Marty.
Hiya, kid. How do you like my new paint job?
Marty doesn't. He steps over to his father, outraged. He's about to say something, but George raises his hands and cuts him off.

GEORGE
I know what you're going to say, son, and you're right. You're right. But he happens to be my supervisor, and I'm afraid I'm just not very good at confrontations.

MARTY
Dad, look at the car! Look what he did to the car!

GEORGE
I know. And I know you were counting on using it, and I'm sorry.

MARTY
Do you have any idea how important this was to me, Dad? Do you have any idea at all?

GEORGE
(shrugs)
Well... I guess I don't...
Biff screeches out in his Cadillac.

MARTY
Dad, did it ever occur to you to say "no?" To just once try saying "no?"

GEORGE
Son, I know it's hard for you to understand, but the fact is, I'm just not a fighter.

MARTY
Try it once, Dad. Just one time, say "no."
Now the next door neighbor sticks his head out the window of the adjacent house. He's 40, pot-bellied, named HOWARD.

HOWARD
Hey, McFly! My kid's selling Girl Scout cookies! I told her you'd be good for a case.
Marty shakes his head. George gulps, then calls back.

GEORGE
Well... okay.
Marty shakes his head hopelessly.

CUT TO: INT. AT THE McFLY DINNER TABLE — NIGHT
The McFly family is dining on meat loaf, Kraft macaroni and cheese, Bird's Eye mixed vegetables, and French's instant mashed potatoes. Marty's mother, LORRAINE, 47, was once very attractive. Now she's overweight, in a rut, a victim of suburban stagnation. She has more food on her plate than anyone else, and a glass of vodka.

GEORGE has papers in front of him instead of food: he's doing the work Biff gave him. He's also glancing at the TV, which is tuned to a "Honeymooners" rerun. Sister LINDA, 19, is cute but wears too much eye makeup; brother DAVE, 22, wears a MdDonald's uniform and is wolfing down his food.

GEORGE
(to Marty)
Believe me, son, you're better off not having the aggravation of dealing with that YMCA dance. You'd have to worry about getting all your equipment there, making contingency plans in case someone got sick, making sure you got paid correctly, settling with the Musician's union... and what if you were so good that other people wanted to hire you? You'd have to worry about scheduling your jobs around school. Believe me, son, you're better off without those headaches.

MARTY
Thanks for the pep talk, Dad.

LORRAINE
Kids, your Uncle Joey didn't make parole again. I think it would be nice if you all dropped him a line.

MARTY
Uncle "Jailbird Joey"?

DAVE
He's your brother, Mom.

LINDA
Yeah. I think it's a major embarrassment having an uncle in prison.

LORRAINE
We all make mistakes in life, children.

DAVE
(checks watch)
Damn, I'm late.
He wipes his mouth and hurries off.

LORRAINE
Please watch your language, David.

LINDA
(to Marty)
Suzy Parker called... wants you to call her back.

LORRAINE
I don't like her, Marty. Any girl who calls up a boy is looking for trouble. Pass the mashed potatoes, please.
Marty passes them and Lorraine takes a big helping.

LINDA
Oh, Mother, there's nothing wrong with calling a boy.

LORRAINE
Well, I think it's terrible, girls chasing boys. I never chased a boy when I was your age. I never called a boy, or asked a boy on a date, or sat in a parked car with a boy. Because when you behave like that, boys won't respect you, Linda. They'll think you're cheap.

Linda rolls her eyes. She's heard this a million times.

LINDA
Then how are you ever supposed to meet anybody?

LORRAINE
It'll just happen. Like the way I met your father.

LINDA
But that was so stupid! Grandpa hit him with his car.

LORRAINE
It was meant to be.

LINDA
I still don't understand what Dad was doing in the middle of the street.

LORRAINE
What was it, George? Birdwatching?

GEORGE
(absorbed in his work)
Huh? Did you say something, Lorraine?

LORRAINE
(to Linda and Marty)
Anyway, Grandpa hit him with the car and brought him into the house. He seemed so helpless... like a little lost dog. And my heart just went out to him.

LINDA
Yeah, Mom, you've told us a million times: "Florence Nightingale to the rescue."

LORRAINE
(thoughtfully, remembering)
The next weekend, we went on our first date: the "Enchantment Under the Sea" school dance. I'll never forget it — it was the night of that terrible thunderstorm. Remember, George?

GEORGE
What's that, dear?

LORRAINE
(ignores him; to Marty and Linda)
Your father kissed me for the very first time on the dance floor... and that was when I realized I was going to spend the rest of my life with him. Marty and Linda exchange a look and shake their heads.

LINDA
I can't believe Dad actually got up enough nerve to kiss you in public.

LORRAINE
Well, I may have encouraged him a little...

MARTY
I'll bet you had to practically jump on his bones.
Marty gets up, finished eating.

LORRAINE
You watch your mouth, young man. And excuse yourself when you get up from the table.

Marty is already out of the room.

MARTY (O.S.)
May I be excused?

The DeLorean Test

CUT TO: INT. MARTY'S BEDROOM — NIGHT
Marty's walls are covered with posters of rock stars and cars — particularly Toyota Supras. There is also a portable home synthesizer, a tape recorder, and a stack of lead sheets. Marty sits at his desk, with an submission form that has an "R & G RECORDS" letterhead, an envelope, and the cassette tape Suzy Parker gave him. There's also a picture of Suzy there. He signs the form and puts it in the envelope, along with the cassette tape. He is about to seal it — then he hesitates, and ponders a moment. He stares at the envelope — it's addressed to the "R & G RECORDS, NEW TALENT DIVISION." He sighs, shakes his head, pulls the tape out and chucks the envelope and application into the trash can.

CUT TO: INT. MARTY'S BEDROOM — CLOCK ON MARTY'S NIGHTSTAND
It's almost 12:30. Camera pans to pick up Marty lying asleep on the bed fully clothed. Now Marty's cordless phone beeps. Marty stirs and answers it.

MARTY
(into phone)
Hello?
(a beat, rolls his eyes)
No, I haven't forgotten, Doc. One a.m., Twin Pines Mall.
He hangs up and shakes his head.

CUT TO: EXT. TWIN PINES MALL PARKING LOT — NIGHT
Camera pan from the lit entrance sign, depicting 2 pine trees with "Twin Pines Mall" in lettering below (along with a digital clock at 12:59) to pick up MARTY on his skateboard with another walkman (it's a different brand than the one Strickland smashed). Marty skateboards around a corner of the mall and sees Brown's RV on the vast, sodium vapor lit parking lot. DR. BROWN is clad in a white radiation suit, hood off, (still with his Indian turquoise around his neck) and Einstein, are both next to a sleek, stainless steel DeLorean sports car. It's been modified with some wicked looking units on its rear engine, giving it a particularly dangerous feel. There are coils along the front and rear decks.

There are also several small cases of supplies and equipment, and a piece of American Tourister luggage around the RV. Marty skateboards over, totally blown away by the car.

MARTY
Jeez, Doc, a DeLorean! What the hell did you do to it?

BROWN
Grab the camera and start taping, Marty. I'll explain as we go.
Brown indicates a home video camera nearby. Marty picks it up.

MARTY
And what's with the Devo suit?
Brown lifts open the driver's side gull wing door.

BROWN
Come on, Einstein. Get in, boy.

The dog obediently jumps in and sits in the driver's seat. Brown buckles him in with the shoulder harness. The dog has a battery operated digital clock hanging around his neck. Marty begins taping, handheld, cinema verite style.

BROWN
(to Marty and video camera)
All right, this is test #1. Please note that Einstein's clock here is in precise synchronization with my control watch.

Brown holds up a digital watch next to Einstein's clock; indeed, the two are in dead sync.

BROWN
(to the dog)
Good luck, Einie.

Brown reaches in and starts the ignition. The DeLorean engine ROARS to life. Brown turns on the headlights and lowers the gull wing door, sealing Einstein in. He steps back and picks up a remote control unit, similar to one for a radio controlled toy car. There are buttons labeled “Accelerator” and “Brake”, a joystick, and an L.E.D. digital readout labeled “Miles Per Hour.”

Brown flicks the power switch on and, using the accelerator button and joystick for steering, sends the DeLorean down to the far, far end of the parking lot. He turns the car around so that it's pointing toward them, idling.

BROWN
Here we go, Marty. If my calculations are correct, when the car hits 88 miles an hour, you're gonna see some serious s***.

Brown takes a deep breath, then pushes the accelerator button. The DeLorean takes off, shifting gears automatically. The L.E.D. speedometer passes 30. The stainless steel vehicle zooms faster... past 40... Marty is getting it all on tape. Brown watches intently. The speedometer climbs past 60.

In the car, Einstein remains calmly in the driver's seat. Gauges and instrument lights mounted behind him begin flashing. Brown's finger holds the accelerator button down. The meter passes 75. The DeLorean keeps accelerating, approaching Marty and Brown. The coils mounted around the car begin glowing.

EXT. MALL, DELOREAN — NIGHT
The speedometer hits 85... 86... 87... 88…

The automobile is suddenly engulfed by a blinding white glow — then, BLAM! It's gone, a trail of fire left in its wake. Brown and Marty are hit by a sharp blast of air. Marty blinks in disbelief: it's as if the car never existed. Only the license plate is left behind — a vanity plate: “NO TIME.”

BROWN
(elated)
What'd I tell you? 88 miles per hour! Temporal displacement occurred at (checks watch) exactly 1:02 a.m. and zero seconds.

MARTY
(shocked)
Oh my god! You disintegrated Einstein!

BROWN
Calm down, Marty. I didn't disintegrate anything. The molecular structure of both Einstein and the car are completely intact.

MARTY
Then where the hell are they?

BROWN
The appropriate question is: WHEN the hell are they. You see, Einstein has just become the world's first time traveler. I sent him into the future — one minute into the future, to be exact. And at exactly 1:03 a.m. and zero seconds, we shall catch up to him... and the time machine.

MARTY
Time machine? Are you trying to tell me you built a time machine out of a DeLorean?

BROWN
(smiles, modestly)
The way I figured it, if you're gonna build a time machine into a car, why not do it with some style? Besides, the stainless steel construction made the flux dispersal—
(his digital watch beeps)

Ten seconds! Roll tape — and brace yourself for a sudden displacement of air. Marty aims the camera right where the DeLorean disappeared. Brown grips the remote control unit tightly and counts down.

BROWN
5...4...3...2...1...
Their hair stands up on end, charged up with static electricity... Suddenly, a sharp blast of wind comes up out of nowhere, along with a deafening sonic boom — and the DeLorean reappears right where it vanished, still going 88 m.p.h.!

Brown hits the brake button. The car wheels lock up and the DeLorean comes to a screeching halt, smoke pouring off the body. Brown and Marty rush over to the car. Brown approaches cautiously and reaches for the door handle. He touches it and recoils in pain.

MARTY
Is it hot?

BROWN
It's cold. Damned cold.
Brown raises the driver's side door: there sits Einstein, none the worse for wear. Brown again compares his watch with Einstein's.
Einstein's reads 1:02:10; Brown's is 1:03:10.

BROWN
Exactly one minute difference — and still ticking!

MARTY
Is Einstein all right?
Brown unbuckles the shoulder harness, and Einstein bounds out, happy and playful. Brown gives the dog a Milk Bone reward.

BROWN
Good boy, Einie!

(to Marty)
He's fine. And he's completely unaware that anything happened. As far as he's concerned, the trip was instantaneous. That's why his watch is a minute behind mine — he “skipped over” that minute to instantly arrive at this moment in time. Come here, let me show you how it works...

Marty is still a bit skeptical, uneasy. Brown waves him over, like a kid who wants to show off a new toy. Marty approaches cautiously.

BROWN
First, you turn the time circuits on...
Brown flips the labeled switch. An array of indicator lights go on inside.

BROWN
(continuing)
This readout, tells you where you're going, this one tells you where you are, this one tells you where you were. The three readouts are respectively labeled “DESTINATION TIME,” “PRESENT TIME” and “LAST TIME DEPARTED.”

BROWN
(continuing)
You input your destination time on this keypad. Want to see the signing of the Declaration of Independence?
He punches 7-4-1776. The “DESTINATION TIME” readout lights up with the date.

BROWN (continuing) Or witness the birth of Christ? He punches in 12-25-0. BROWN (continuing) Here's a red letter date in the history of science: March 19, 1955... He pauses, realizing something — as if something suddenly makes sense to him. BROWN Yes, of course... March 19, 1955...	MARTY What happened then? BROWN That was the day I invented time travel. Actually, it was night. I remember it vividly: I got hit over the head, and when I came to, I had a revelation — a vision — a picture in my head. A picture of THIS... Brown points to a particular centerpiece unit mounted inside the DeLorean. Marty aims the video camera and gets it on tape. He continues taping as Dr. Brown explains.
BROWN This is what makes time travel possible: the Flux Capacitor. MARTY Flux Capacitor, huh? How'd you get beaned? BROWN Well, I was trying to— (stops short, thinking better of it) Well, it's not important. What is important is that it works. It's taken me over 30 years to fulfill the vision of that night. He faces the DeLorean proudly.	MARTY Heavy duty, Doc. And it runs on, like, regular unleaded gasoline? Unfortunately, no. It requires something with a little more kick… Brown indicates a container with purple radioactivity symbols on it. MARTY (reads the label) Plutonium?! You mean this sucker's nuclear?
BROWN Electrical. But I need a nuclear reaction to generate the 1.21 jigowatts of electricity I need. The Flux Capacitor stores it, then discharges it all at once, like a gigantic bolt of lightning. Oh, you'd better put on this radiation suit before I reload. Not that there's any danger, but it never hurts to take precautions. Brown hands him the YELLOW RADIATION SUIT which is near the RV. Marty puts the camera down.	MARTY Hold the phone, Doc — plutonium's illegal. Did you rip it off? BROWN No, of course not. Here, let me help you with that. Brown helps Marty get into the suit. BROWN Put your hood up, Marty, while I reload... and keep Einstein covered, too. Marty and Brown both pull their hoods over their heads. Marty covers Einstein with a sheet of the same radiation proof material.
Brown opens the container and removes a 4-inch clear cylinder with a plutonium rod within (it's surrounded by water), then closes the container. Brown steps over to the rear of the DeLorean and places the plutonium cylinder into the loading hopper. The plutonium rod drops down into the reactor, which then seals shut. BROWN (removes his hood) It's safe now. Everything is lead lined. Marty removes his hood and releases Einstein. He picks up the video camera and starts taping again.	BROWN Oh — I mustn't forget my luggage... Brown grabs his suitcase and puts it in the trunk (it's in the front). BROWN Who knows if they'll have cotton underwear in the future? I'm allergic to all synthetics. Brown slams the trunk shut. MARTY The future? Is that where you're going?
BROWN That's right. 25 years into the future. I've always dreamed of seeing the future — looking beyond my years, observing the progress of mankind. It's almost like cheating death. (pauses, then smiles wryly) I'll also be able to find out who wins the next 25 World Series. Suddenly, Einstein starts BARKING at something. BROWN What is it, Einie? Brown turns, and reacts with horror to an approaching pair of headlights: it's an ominous van.	BROWN Oh, no — they found me. I don't know how, but they found me. MARTY Who? BROWN The Libyans! MARTY What Libyans?
BROWN The Libyans who got me the Plutonium! They wanted me to build 'em a bomb — I told 'em I would, but I lied! The van side door slides open and a swarthy character who resembles Yasser Arafat leans out with an AK 47 submachine gun. He opens fire. BROWN Run for it, Marty! I'll draw their fire!	Brown pulls a .45 revolver from inside his radiation suit and fires at the van! He then breaks for the mall, a good 500 yards away. The terrorist van screeches around sharply and gives chase. The terrorist fires a machine gun blast. MARTY Doc — no! Wait! But Brown keeps running and firing — and the van closes the distance. No way can Brown outrun it to the mall.
The Terrorist gunner screams a Libyan curse, then fires a burst at Brown. The bullets rip into Brown's chest and the scientist goes down. Marty stands frozen in horror, video camera still in hand. Doc! Oh my God! (at the terrorists) You bastards! As if hearing Marty, the van makes a U-turn: it's coming for Marty! Marty looks around. He's out in the open, and has only one chance: The DeLorean. Marty dashes for it, even as the van accelerates toward him, and dives into the still open driver's door.	**IN THE CAR** Marty swings the door shut, then looks over the array or switches and buttons on the console with frightened bewilderment: how do you start this thing? Then he spots the keys in the ignition on the steering column, just like any other car. He turns it over and shifts into first. He floors it. **EXT. — CHASE** The DeLorean roars off! The van gives chase.

The speedometer approaches 40.
The Terrorist Gunner leans out of the van and takes aim.
MARTY looks into the side view mirror to see the Libyan gunner taking aim.
The speedometer climbs past 50.

The gunner fires. Bullets rip into the parking lot just behind the speeding DeLorean.
Marty has the pedal to the metal.
The speedometer hits 75.
Marty again checks the side view mirror.
The van is still keeping up.

MARTY
Let's see if you bastards can do 90…

The DeLorean continues accelerating.
The van continues pursuit, but begins to lose ground.

The speedometer passes 85!

Gauges and indicators light up behind Marty's head, just as they did before Einstein traveled through time — the Flux Capacitor. is about to kick in! The speedometer climbs...86...87...88...

Entering 1955

INT. MOVING DELOREAN, BEHIND MARTY, THROUGH THE WINDSHIELD
The mall parking lot is suddenly changed into an open field with a scarecrow in the middle of it! Marty is speeding toward it at 88 miles an hour — he hits it! The scarecrow's face is hideously smashed against the windshield. Marty continues toward a haystack! He's completely disoriented.

EXT. FARM FIELD AND BARN — NIGHT
The DeLorean speeds right through the haystack, and then into an open barn. We hold on the barn exterior — we hear a crash; hay and dust are kicked up out the
door... then a crack of wood — and a large section of the barn roof caves in! We hold on the barn. We hear a dog start barking.

EXT. NEARBY FARM HOUSE — NIGHT
A light goes on in the nearby farm house. Now, farmer PA PEABODY, 45, comes out in his red flannels, carrying a lantern. Behind him is his wife, MA; their buxom 14 year old DAUGHTER, and lively 11 year old son SHERMAN. They approach the barn and cautiously enter through the rear doors.

'INT. BARN — NIGHT
The Peabodys stare in open-mouthed astonishment: The stainless steel vehicle faces them head on, headlight beams shining through the dust. With its wheels buried in the straw and amber hazard lights blinking, it looks like a SPACE SHIP! The COWS in the barn don't seem to care much, but Ma and Pa look up at the hole where the roof caved in, then exchange an uneasy look.

MA
What is it, Pa?

PA
Looks like an airplane...without wings…

SHERMAN
Airplane? It's a flying saucer, Pa! From outer space! The driver's gull wing door rises slowly... just like a hatch. Pa motions them all back. They watch expectantly, uneasily, with expressions of curiosity mixed with fear. Now Marty steps out, dazed — he's in the radiation suit, and the hood is down giving him the appearance of an alien! Ma screams and faints!

PA
Run, children! Run for your lives!
They all run like hell out of the barn! Marty takes a few steps, then removes the hood.

MARTY
Hey! Hello? Where am I?
Marty looks around. The cows in the barn just chew their cud. Marty shakes his head, then steps out the barn door.

EXT. BARNYARD — NIGHT
Marty steps out into the barnyard.

MARTY
Excuse me! Anybody here?

EXT. FARM HOUSE — NIGHT
PA busts out of the farmhouse with a double-barreled shotgun. Sherman is right behind him, with something rolled up in his hand.

SHERMAN
Look, Pa — it's already mutated into human form! Shoot it!
Pa raises his shotgun and FIRES! Buckshot cracks into the barn wall behind Marty.

PA
Take that, you mutated son-of-a-bitch!
He squeezes off the second barrel! Shot explodes in the dirt near Marty's feet! He dashes back into the barn! Pa breaks the gun and reloads, then moves cautiously toward the barn. Just as he's about to enter, the delorean thunders out! Pa Peabody jumps back!

The car spins around in the barnyard, and smashes through a white picket fence surrounding 2 newly planted pine trees in a line, just like on the sign at "TWIN PINES MALL." The DeLorean takes out one of the small trees, then finds the dirt access road and ROARS AWAY.

PA
You space bastard! You killed one of my pines!
Pa FIRES both barrels at the departing vehicle, then runs over to his "pine grove."

PA
(extremely upset)
Now I only got one.
Now he looks up and sees Ma coming out of the barn. She's dazed, rubbing her head.

PA
Ma! Are you all right!
Sherman runs over, terrified, with a rolled up something in his hand.

SHERMAN
Pa! No! Don't go near her! She's a zombie! She's got no more free will! The spaceman took over her brain!

PA
What the hell are you talking', boy?

SHERMAN
Read this! It's all right here!

Sherman shows him his weird science comic book: On the cover is a space ship that resembles a 50's version of the DeLorean. An alien is stepping out who looks
something like Marty in the radiation suit, and he appears to have enslaved several human females. The title of the story is "Space Zombies From Pluto." Pa looks at it, then glances over at his wife with trepidation.

CUT TO: EXT. THE DELOREAN — MORNING tears along the dirt road and out onto the main paved road.

EXT. STREET — DAY
The DeLorean pulls into frame and stops. The gull wing door opens, revealing Marty's shocked expression as he sees his own house — (matte painting) brand new, freshly painted — a model home, complete with colored pennants and "model home" signs... without any landscaping. Next to it is a large sign with an artist's rendering of an idyllic home, nestled between magnificent oak trees, with a proud family of four beside their Cadillac. Below, in big block letters: "Live in the home of tomorrow...today! Lyon Estates, scheduled completion, This Winter." Beyond it is vacant land, with some of it graded for construction. There are a few foundations and perhaps a wood frame or two... and the familiar high tension wires.

MARTY
is in shock. He looks at the dashboard readouts.

The date on the "Destination time" is Saturday, 3-19-1955, 5:35 a.m.... and that matches the date on "Present time." ("Last Time Departed" is 10—5 1985, 1:11 a.m.)
Below, the "Plutonium Chamber" light flashes "EMPTY."

MARTY
1955? 1 don't believe it!
He turns on the car radio and tunes in a newscast.

NEWSCASTER (V.O.)
...and President Eisenhower predicted that 1955 would see an increase in housing starts…

MARTY
Eisenhower?

Marty spots a page of discarded NEWSPAPER on the sidewalk in front of his house-to-be. He gets out of the car and picks it up.

The date is March 18, 1955.

MARTY
This is definitely not my day.

On the back of the newspaper is an AUTOMOBILE ADVERTISEMENT with a picture of a "new" 1955 Studebaker. The copy clearly says "YOU'LL BE NOTICED driving the car of the future — the All New 1955 Studebaker." Marty looks at the DeLorean, looks again at the ad copy, then looks at the garage door of his house-to-be.

MARTY
Why not...?

He tries to open the garage door: it's locked. Then he reaches in his pocket and pulls out his KEYS. He tries one in the garage lock. It works! Marty smiles and opens the garage door.

ANGLE ON THE OPEN GARAGE — DAY
The DeLorean backs into the garage.
Marty is about to turn off the car when he hears the RADIO DJ from the car radio.

DJ (V.O. RADIO)
And now, one of the top records of the week...
Marty turns up the volume: he wants to hear this. "Papa Loves Mambo" by Perry Como starts playing. Marty can't believe what he is hearing. He shakes his head.

MARTY
This is not a good year.

Music becomes score and continues over the next sequence.

EXT. STREET IN FRONT OF MARTY'S (MODEL) HOME — MATTE SHOT — DAY
MARTY walks down the street toward Hill Valley. He's out of the radiation suit and in his street clothes.

CUT TO: EXT. HILL VALLEY TOWN SQUARE — DAY
The town square is immediately recognizable because the courthouse clock tower is now working. In 1955, the town square is a healthy, vibrant center of commerce. The same buildings are well kept and clean, and the street bustles with Saturday morning activity. Marty notices THE MOVIE THEATER is now playing "Cattle Queen of Montana" starring Barbara Stanwyck and Ronald Reagan. THE TOYOTA DEALERSHIP is now a STUDEBAKER DEALERSHIP selling new 1955 cars. AN APPLIANCE STORE is selling "modern" small appliances.

A WOMAN'S STORE displays tie latest fashions. A TRAVEL AGENCY advertises "Fabulous Vacations in Cuba." THE BANK has a round clock instead of the digital version of 1985. A sign in the window promotes "Passbook Savings at 2-1/4%." A RECORD STORE displays the latest records and albums: Eddie Fisher, Perry Como, Pat Boone. There is no Rock and Roll. AN ELECTION POSTER: "Re-elect Mayor Frank 'Red' Thomas. Honesty, Decency, Integrity." With the exception of the name and face, it's the same as the "Goldie Wilson" poster of 1985. MARTY walks along tie street staring at the places and people. The people stare at him too, particularly his green shoes. The previously boarded up CAFÉ is now open for business. Marty notices a PUBLIC TELEPHONE SIGN on the window: he's got an idea. He enters.

INT. CAFE — DAY
A typical café/soda fountain of the period; 2 or 3 CUSTOMERS are at the counter. Marty stares at the signs advertising menu items: Hamburger — 25 cents. Ham & Cheese — 30 cents. Chocolate Sundae — 15 cents. A sign over the cigarette display says "All Brands 20 cents." LOU, the counterman, spots Marty.

LOU
Lookin' for something, kid?

MARTY
Uh, the telephone?
Lou points it out, in back: a phone booth

MARTY goes into the phone booth and flips through the directory. Marty's finger comes to rest at "Brown, Emmett L. (Scientist)." 1640 Riverside Dr. HIllside 3-4385.
MARTY smiles — just what he was hoping for. The sign on the phone says "Local Calls — 5 cents." Marty digs out a nickel and dials the number. It rings...and rings... and rings. No answer.

He hangs up.

MARTY
Not my day.
He rips the page out.

INT. CAFÉ
Marty saunters out of the phone booth and takes a seat at the counter. A NERDY LOOKING KID is seated nearby, sipping a soda and reading a comic book. Marty looks at Lou, indicating the address on the phone book page.

MARTY
Can you tell me where 1640 Riverside—

LOU
You gonna order something, kid?

MARTY
Uh, yeah. Gimme a Pepsi Free.

LOU
Kid, if you want a Pepsi, you gotta pay for it.

MARTY
No, a Pepsi Free — you know, diet soda?
Lou looks at him like he's from another planet.

LOU
No, I don't know.

MARTY
Uh, well, just give me something to drink that doesn't have sugar in it.
Lou gives him a look, then puts a cup of coffee in front of him. Marty looks at the bowl of sugar cubes in front of him.

MARTY
Have you got any Sweet 'N Low?

LOU
Sweet and what?
(eyeing him suspiciously)
Say, kid, you'd better pay for this right now.

MARTY
Okay.

He pulls out his wallet and gives Lou a crisp, new 20 dollar bill. Lou's eyes nearly fall out of his head.

LOU
A 20? What do you think this is, a bank? I can't break a 20 for a nickel cup of coffee. (suddenly suspicious) Say, what's a kid your age doing with a 20 dollar bill anyway?

Marty gulps, pulls a nickel out of his pocket and takes back his 20. Lou gives him a look, then walks away. Marty raises his coffee cup and just as he's about to take a sip...

VOICE (O.S.)
Hey, McFly!

MARTY
Huh?
He spins around on his stool.

The voice came from a PUNK, 17; behind him are 3 OTHER PUNKS. The lead punk is coming right toward Marty... no, he's stepping over to the NERDY KID next to him.

NERDY KID
Uh, hi, Biff, how's it going?

Yes, the punk is BIFF TANNEN, aged 17! And the nerdy kid is GEORGE McFLY, also 17. Biff takes George's soda and drinks it all. Biff's boys buy cigarettes at the counter. They are MATCH, perpetually chewing a wooden matchstick; SKINHEAD, who has a crewcut just this side of being bald; and 3-D, who always wears red-green 3-D glasses. Marty watches the exchange between Biff and George with utter amazement.

BIFF
You got my homework finished, McFly?

GEORGE
Well, no. I figured since it's not due till Monday...
Biff knocks on George's head.

BIFF
Hello? Anybody home? Think, McFly, think! I've gotta have time to recopy it. Do you realize what would happen if I turned in MY homework in YOUR handwriting? I'd get kicked out of school!

(notices Marty staring at him)
What are you lookin' at, dips***?

SKINHEAD
Biff — get a load of his shoes. This dork thinks he's a leprechaun — he painted 'em green!
They all laugh. Biff turns back to George.

BIFF
So how about my homework, McFly?

GEORGE
Um, okay, Biff, I'll do it tonight and bring it over first thing tomorrow.

BIFF
Not too early — I sleep in on Sundays. Oh, hey, McFly — your shoe's untied.

GEORGE
(looks down, falls for it)
Huh?
Biff hits him in the chin. He laughs loudly, as do his cronies... and they leave. Marty, still in disbelief, turns to George.

MARTY
I don't believe it. You're George McFly...?

GEORGE
Uh-huh.

MARTY
Your birthday's August 18th, and your mother's name is Sylvia?

GEORGE
Uh-huh. Who are you?

MARTY
I'm a relative of yours. A very distant relative.
A black busboy has been sweeping up in the background, making his way over. He looks at George. As he talks, we see he has a gold front tooth — it's Goldie Wilson, aged 22!

GOLDIE
Say, what do let that boy push you around for?

GEORGE
Well, uh, he's bigger than me...

GOLDIE
Stand tall, boy. Have some respect for yourself. You let people walk over you now, they'll be walkin' over you for the rest of your life. Look at me. You think I'm gonna spend the rest of my life in this slophouse?

LOU
(has heard the remark)
Watch it, Goldie.

GOLDIE
(he's on a roll) No, sir! I'm gonna make something of myself! I'm going to night school — I'm gonna be somebody!

MARTY
That's right — he's gonna be Mayor someday.
This is an idea that's never occurred to Goldie.

GOLDIE
Mayor? That's a good idea! I could run for mayor!
George slips out as the conversation continues.

LOU
Ha! A colored mayor! That'll be the day!

GOLDIE
You wait and see, Mr. Carruthers. I'm gonna be mayor.

LOU
Just keep sweeping, Goldie.
Now Marty notices that George has left. He goes out after him.

GOLDIE
(to himself)
"Mayor Goldie Wilson." I like the sound of that.

EXT. — HILL VALLEY TOWN SQUARE
Marty looks around and sees George bicycling down the street.

MARTY
George! Hey, George! I want to talk to you!
But George doesn't hear him. He disappears around a corner. Marty runs after him.

EXT. — A RESIDENTIAL STREET — DAY
The homes evoke pleasant nostalgia: front porches and white picket fences. MARTY comes from around the corner and sees GEORGE'S BIKE parked underneath a tree. Marty looks around, then spots GEORGE up in the tree, precariously out on a branch overhanging the street, about 12 feet up.

George has a pair of binoculars trained on a second story window in the house across the street. MARTY can't figure it out. He moves closer for a better view. GEORGE focuses the binoculars. GEORGE'S P.O.V. through binoculars of a naked girl in the 2nd story bedroom window, dressing. MARTY watches in disbelief as he realizes what George is doing.

MARTY
He's a peeping tom!

GEORGE'S P.O.V.
as the girl moves closer to the window. GEORGE tries to move closer, but loses his balance — he tumbles into the street!

WIDER
MARTY watches as George groans, then slowly tries to get up. Now a CAR comes from around the corner. George doesn't see it, but Marty can see that it's going to hit George.

MARTY
Dad! Look out!
But George is still dazed. Marty dashes into the street, and in a spectacular flying leap, knocks him out of the path of the oncoming car. As Marty moves to avoid the car, the car swerves in the same direction — there's a screech of brakes, and the car hits Marty!

George, never one to get involved, grabs his bike and pedals off, leaving Marty lying in the street, unconscious.

DISSOLVE TO: INT. DARKENED BEDROOM — NIGHT
MARTY is lying in bed, lit by ambient light from a doorway. FEMALE HANDS place a cold compress on the bruise on his forehead. Marty groans and stirs.

MARTY
Mom? Is that you?

WOMAN
Ssshhh. Everything's going to be all right.
It sounds like his mother. He opens his eyes. All he can see is her silhouette.

MARTY
God, what a horrible nightmare. I dreamt I went way back in time...
He starts to sit up.

WOMAN
Take it easy, now... you've been asleep for almost 9 hours.

ENTERTAINMENT | Solo | Back to the Future I Script | Entering 1955

MARTY
It was terrible. It was a terrible place to be. The music was awful — they didn't have rock. The cars were ugly. My neighborhood hadn't been built yet, and everything was so weird looking.

WOMAN
Well, you're safe and sound, back where you belong, in good old 1955.

MARTY
1955!
She turns on the bedside lamp. It's the same girl George was spying on, and Marty recognizes her just as we do...

MARTY
Oh my God. You're — you're my— my—

LORRAINE
My name's Lorraine. Lorraine Baines.
Marty stares at her for a long moment.

MARTY
But — but you're so thin!

LORRAINE
Just relax, Calvin. You got quite a bruise on your head.

MARTY
(looks under the blankets)
Uh... where are my pants?

LORRAINE
(points)
Over there on the chair.
(notices the color of his underwear)
I've never seen red underwear before, Calvin.
Marty covers himself up.

MARTY
Calvin? Why are you calling me Calvin?

LORRAINE
Well, isn't that your name — Calvin Klein? It's written in your underwear.
(suddenly realizing) Oh — I guess people call you Cal.

MARTY
No, well, actually people call me Marty.

LORRAINE
Well, I'm pleased to meet you, Marty.
She comes over and sits on the bed right next to him. She's very interested in him.

LORRAINE
Mind if I sit here?

MARTY
(gulps, nervous)
Uh... no...
Marty moves as far away as he can without falling off the bed. He holds the blanket tight around his waist. She looks at him, fascinated.

LORRAINE
That is quite a bruise there...
She gently strokes his bruised forehead... and then runs her hand through his hair. Marty moves even further — and falls off the bed! He covers himself with the blankets.

STELLA (O.S.)
Lorraine? Are you up there?
We hear FOOTSTEPS coming up the stairs.

LORRAINE
(to Marty)
It's my mother! Quick, put your pants back on!
She throws him his pants.

CUT TO: INT. DINING ROOM — NIGHT
Marty takes a seat at the dinner table next to Lorraine as MRS. STELLA BAINES, 40 and pregnant, makes the introductions to the kids. The chair at the head of the table is empty.

STELLA
That's Milton, that's Sally, that's Toby...
MILTON, 12, wears a Davy Crockett coonskin cap; SALLY is 6, TOBY is 4.
(continuing)
...and next to you there in the playpen is little Joey.
Marty turns and looks with amazement at 11-month old JOEY rattling the bars of his playpen.

MARTY
(whispers to him)
So you're my Uncle Joey. Get used to those bars, kid.

STELLA
Oh, yes, little Joey loves being in his pen. He actually cries when we take him out, so we leave him in there all the time — it seems to make him happy. Have some meat loaf, Marty.

She hands him a plate of meat loaf. It looks like the same meat loaf he had for dinner in 1985... in fact, the whole dinner is the same!

STELLA
(calls into the other room)
Sam, would you quit fiddling with that thing and come in here and eat?
(to Milton) Milton, don't eat so fast!
(to Lorraine) Lorraine, you're not eating enough. Have some mashed potatoes.

LORRAINE
No thanks, Mom.
Now gruff SAM BAINES, 45, rolls in a brand new television, on a plywood dolly of his own construction.

SAM
Look at this: it rolls. Now we can watch Jackie Gleason while we eat.

MILTON
Oh boy!

Sam fiddles with the rabbit ears and brings in a rather muddy image of a cigarette commercial. ON TV a SURGEON steps out of an operating room, lights up a cigarette, and turns to do a testimonial.

DOCTOR (on TV)
After facing the tension of doing 3 lung operations in a row, I like to relax by lighting up a "Sir Randolph." I know its fine tobacco taste will soothe my nerves and improve my circulation...

SAM
Look at that picture: crystal clear! Why would anybody want to go to the movies when you can see this in your own home — free!

LORRAINE
(to Marty, explaining)
Our first television set. Dad picked it up today. Do you have a television?

MARTY
Uh... yeah... two of 'em.

MILTON
Wow! You must be rich!

STELLA
Milton, he's teasing you. Nobody has two television sets.
"The Honeymooners" has resumed — the classic "Man From Space" episode.

MARTY
Hey, I've seen this one — this is a good one. This is where Ralph dresses up as "the man from space."

MILTON
What do you mean, you've seen it? It's brand new.

MARTY
I saw it on a rerun.

MILTON What's a rerun? MARTY You'll find out. SAM Quiet! I want to hear this! STELLA Marty, I'd like to give your mother a call and let her know you're all right.	MARTY (gives Lorraine a glance) Uh, well, no — you can't. STELLA Why not? MARTY Uh — she's out of town. With my Dad. (pulls out the phone book page) Could you tell me where Riverside Drive is?
SAM Riverside? Sure, it's on the east end of town, a block past Maple. MARTY A block past Maple? But that's Kennedy Drive. SAM Pardon me? MARTY That's John F. Kennedy Drive.	SAM Who in the world is John F. Kennedy? MARTY (realizes the problem) Never mind. LORRAINE Mother, with Marty's parents out of town, don't you think he should spend the night here? I'd hate for anything to happen to him with that bruise on his head. She gives him a flirtatious smile.
STELLA Marty, Lorraine is right. You must spend the night. You're our responsibility. MARTY Uh, gee, I don't know… LORRAINE And he can sleep in my room. Under the table, Lorraine puts her hand on Marty's leg. Marty immediately jumps to his feet.	MARTY Uh, actually, I've really gotta be going... (he's backing out, toward the front door) So, thank you for everything, and I'll see you all later. Much later. He turns and hurries out of the house. Lorraine sighs romantically.

Doc Brown

CUT TO: EXT. DR. BROWN'S HOUSE The house at 1640 Riverside Drive is spectacular, the home of a very wealthy man. Marty ogles it as he walks up to the front door. He checks the address against the page he ripped out of the phone book: it checks. All the lights are on — a party is going on inside. Marty rings the doorbell. It's answered by DR. BROWN, aged 35. Brown is dressed in evening clothes, and is flanked by two lovely girls. BROWN Hiya, kid. Looking for somebody?	MARTY Uhhh, Dr. Brown — yeah, you ARE Dr. Brown... Boy, am I glad to see you. BROWN Do I know you, kid? MARTY Well, not exactly — that is, not yet. My name's Marty — Marty McFly. Now what I'm about to say is going to sound incredible, but you're the only man on earth who'll believe it... (he takes a deep breath) I'm from the future.
BROWN (smiles) Great sales pitch, kid — terrific. So what are you selling? Floor wax? MARTY No, I'm serious! You've gotta believe me! You're the only one who can get me back home! BROWN Get you back home? Kid, I think you got me confused with the Wizard of Oz.	MARTY Look, I can prove I'm from 1985! Marty pulls out his wallet and starts showing the contents to Brown. MARTY See this? My driver's license — expires 1987. Look at my birthdate — I haven't even been born yet. (pulls out a 20 dollar bill) Look at this money: "Series 1981." (pulls out a color snapshot)
Here's a picture of me, my sister, and my brother. Look at her sweatshirt: it says "Class of '84." Brown gives it all a cursory look, particularly the snapshot. BROWN Oh, I get it — you're selling trick film. This is great — it really looks like the guy's got no head. Very clever. MARTY Huh? Brown hands it back to Marty. Marty looks at it.	Sure enough, the image of Dave in the photo has no head. It's not torn, or rubbed off — the figure genuinely is headless. **EXT. BROWN'S HOUSE — ON MARTY AND BROWN** Marty stares at it, unable to figure it out. BROWN (continuing) I'd buy a roll, but I'm not much of a photographer. MARTY Doctor Brown, this is no trick. I really am from the future. Brown rolls his eyes.
BROWN Well then, tell me something, young man from the future: who's the president of the United States in 1985? MARTY Ronald Reagan. Brown and the girls burst out laughing. BROWN That's a good one! The kid's a riot! A regular riot!	(pulls out his wallet) Here's 5 bucks, kid! Thanks for the laughs! He hands Marty a five, then closes the door. Marty sighs, then walks around the side of the house and looks in the window. **MARTY'S P.O.V. THROUGH THE WINDOW — BROWN'S LIVING ROOM** The party is an eclectic collection of society types college types, beat generation types, and lots of attractive women. Brown wanders over to the best looking woman in the place. Brown whispers into her ear. She responds by hitting him in the head with a beer bottle! Brown goes down, dazed. She walks off in a huff. Brown rubs his head... then his eyes open wide in the same crazed expression we've seen in 1985.

BROWN
Of course. Of course! It's so obvious!
(jumps to his feet, shouts)
All right, the party's over! Everybody go home! I have work to do!
The guests exchange looks.

BROWN
Go home! Everybody out! I need quiet!
Some of the guests begin to leave.

EXT. BROWN'S HOUSE — ON MARTY
Marty realizes what has just happened. He gets an idea.

CUT TO: INT. BROWN'S GARAGE/WORKSHOP — NIGHT
It's a large closed garage, with a PACKARD CONVERTIBLE and a large work area, organized and well-kept. A clock shows the time is 12:45.

BROWN is hunched over his workbench, furiously scribbling down notes and plans. He's disheveled — he's been here for a while. Brown's DOG is sitting near its "bed." The name on the dog dish is "COPERNICUS." Copernicus suddenly reacts to something...

MARTY appears at a partially open WINDOW. He opens it the rest of the way and climbs in.

MARTY
Doc, listen, you gotta hear me out—

BROWN
Get lost kid! I'm working!

MARTY
I know! And I know what you're doing — you're inventing time travel. It came to you in a vision when you got hit over the head with that beer bottle. And that thing you're drawing is the Flux Capacitor!
Brown is totally astonished.

BROWN
My God. How did you know that?

MARTY
I told you — I'm from the future.
With that, he walks over to the garage door and raises the overhead door, revealing the DeLorean sitting there in the driveway.

Brown's mouth falls open as he stares at it — and the mechanism visible through the open gull wing door. He grabs the drawing he's been working on and runs over to the DeLorean to compare it.
It's a drawing of the Flux Capacitor! It matches the real thing perfectly.

CUT TO: INT. BROWN'S GARAGE — A LITTLE LATER — NIGHT
The DeLorean is now in the garage; the garage door is closed. The 1985 suitcase is open, and we can see its contents — clothes, toilet articles, and a CONAIR (battery) hair dryer.

MARTY is busily attaching the video camera into a 1953 model TV.

MARTY
Okay, Doc. Take a look at this...
Brown comes over and Marty rolls the tape he shot in the mall parking lot where Brown is explaining the operation of the time machine. Brown is amazed to see himself as a man of 65.

BROWN
Why — that's me! I'm an old man! Incredible! Thank God I've still got my hair... baldness runs in my family, you know. But what on earth am I wearing?

MARTY
A radiation suit!

BROWN
Of course, because of all the fallout from the Atomic wars. And what's that thing around my neck?

MARTY
Indian jewelry.

BROWN
I'm not even gonna ask.

ON TV
The part of the tape comes up about the Plutonium. We see the image of the Plutonium cannister with old Dr. Brown next to it.

MARTY (V.O. tape)
Plutonium? You mean this sucker's nuclear?

OLD BROWN (on TV)
Electrical. But I need a nuclear reaction to generate the 1.21 jigowatts of electricity I need...
Young Brown is taken aback.

BROWN
1.21 JIGOWATTS? Kid, you're outta gas, going no place fast.

MARTY
Huh?

BROWN
Look, I'm sure that in 1985, plutonium is available in any corner drug store. But in 1955, it's a little hard to come by. And unless you figure on driving out into a nuclear test site while an A-bomb's going off, I'm afraid you're stuck here.

MARTY
But isn't there some other way to generate that kind of power?

BROWN
1.21 jigowatts? Oh, sure. We can tie into Hoover Dam with a very long cable. Or we build a turbine on the back of this thing and you can drive it over Niagara Falls. Or you can drive across the country at 88 miles an hour and hope that you get struck by a bolt of lightning.

MARTY
Lightning! Hold the phone, Doc — check this out!

Marty pulls out the "Save the Clock Tower" flyer from his pocket (with it is the mysterious "headless snapshot" we saw earlier). Marty shows the flyer to Brown. It includes a photocopy of a NEWSPAPER ARTICLE, dated March 27, 1955, with a picture of the clock tower stopped at 10:02."

The headline: "CLOCK TOWER STRUCK BY LIGHTNING. CLOCK STOPPED AT 10:02."

Brown reads it, nodding. He's getting an idea.

BROWN
Kid, if this is true, we just might be able to get your ass back to the future! It's totally insane, but it's certainly no crazier than building a nuclear reactor onto the back of a car... According to this, we know the exact moment lightning will strike a specific spot — at 10:02 p.m. and 11 seconds on next Saturday. All I have to do is rig up a conducting system that'll channel the lightning directly into the Flux Capacitor. As long as you're doing 88 miles an hour when it happens... See you later, alligator.
But Marty isn't paying attention. He's looking at the snapshot again, and he's quite concerned.

BROWN
What's wrong, kid?

MARTY I don't know, but something weird is going on with this picture. My brother — he's fading out… BROWN Lemme see that... Brown studies it. He too reacts with concern. Indeed, more of Dave has faded away — his neck is gone, along with part of his shoulders.	MARTY It looks like he's being erased or something… BROWN Erased from existence... (to Marty, urgently) Kid — we've gotta get you some new clothes!

The Plan

CUT TO: EXT. HILL VALLEY HIGH SCHOOL — DAY Hill Valley High looks pretty much the same in 1955, but with a little less graffiti. There is not much activity in front — school is in session. BROWN'S Packard pulls up and DR. BROWN and MARTY get out. Marty is now dressed in total 1955 period garb. He and Brown ascend the school steps. Marty seems unsure and confused. MARTY Are you sure about this?	BROWN Figure it out, kid. Your old man was supposed to get hit by your Grandpa's car, not you — therefore, you interfered in your parents' first meeting. If they don't meet, they don't fall in love; if they don't fall in love, they don't get married; if they don't get married they don't have kids. That's why your older brother's fading out — he's being erased from existence. He's first, since he's the oldest. Your sister'll be next... and then you... unless you repair the damage by getting your folks back together. Once you introduce 'em to each other, nature will take its course.
(a beat) I hope. Marty pauses to check his reflection in the windowed door. He combs back his slicked down hair in a ducktail, only to get a handful of "greasy kid stuff." MARTY I can't believe you actually put this crap in your hair.	BROWN Come on kid, let's get this over with. Brown pulls him inside. P.O.V. through a classroom door on the students of an ordinary 1955 History class, taking a test. LORRAINE can be clearly seen. MARTY and DR. BROWN are watching from the hall. MARTY (points her out to Brown) That's her — in the 2nd row... Jesus! She's cheating!
THEIR P.O.V. OF LORRAINE, copying an answer from the boy sitting next to her. The school bell rings in the hall. It's passing period. Another classroom door opens and students head out for the next class. GEORGE McFLY is one of them. His shirt tail is out, his hair is poorly combed, and papers are practically falling out of his 3-ring binder. MARTY AND DR. BROWN watch from down the hall. BROWN So which one's your father? MARTY (points) That's him...	As GEORGE walks down the hall, students laugh at him behind his back, and some of the boys kick him in the ass. George turns. He has a "KICK ME" sign hooked on his collar. DR. BROWN shakes his head at this pathetic sight. BROWN (to Marty) Are you sure you're not adopted? Now a hand yanks George by the arm: MR. STRICKLAND — and he looks exactly the same! Marty is amazed.
STRICKLAND McFly! Shape up, man! He pulls the sign off George's shirt and shows it to him. You're a slacker! Do you want to be a slacker for the rest of your life? George shakes his head unconvincingly. Marty and Brown look down the hall in the opposite direction where LORRAINE is at her locker, giggling with a girl friend.	**ON MARTY AND BROWN** BROWN Looks like a match made in heaven. MARTY My mom always said it was meant to be. I sure hope she's right... Marty takes a deep breath and starts walking toward George. MARTY George! Hey, buddy, you're just the guy I wanted to see! You remember me — from Saturday? I saved your life, remember?
GEORGE Oh...yeah… MARTY Listen, there's somebody I want you to meet. C'mere... He pulls him down the hall to Lorraine, who has her back to them. MARTY Excuse me, Lorraine... Lorraine turns.	LORRAINE Calvin! I mean, Marty! She's so delighted to see Marty, she drops her books. MARTY Oh, let me get those... He picks up her books and gives them back to her. She's totally infatuated. LORRAINE Thank you.
MARTY Lorraine, I want to introduce you to someone. This is my good friend, George McFly. George, this is Lorraine. GEORGE Hi. It's really a pleasure to meet you. Lorraine doesn't pay George the slightest bit of attention. She only has eyes for Marty. LORRAINE Oh, Marty, I was so worried about you running off like that the other night with that bruise on your head. Is it all right?	MARTY Um, yeah.... The BELL RINGS. LORRAINE I'm late. See you later. She hurries off down the hall, joining a girl friend. They pass by Dr. Brown. LORRAINE (to her friend) Isn't he a dreamboat?

George has run off in the opposite direction. Marty stands in the middle of the hall, completely bewildered. Brown joins him. MARTY She didn't even look at him! BROWN Obviously, you being in the picture is a real distraction for her. You've got to get him to ask her out on a date — so they can be alone together.	MARTY A date? What kinda date? I don't know what kids do in the 50's. BROWN What do they do in the 80's? MARTY Sex and drugs and rock 'n roll.
BROWN No comment, kid. Brown notices a hand-painted banner in the hall announcing the "Enchantment Under The Sea Dance" this Saturday night. BROWN Look — there's a dance coming up. Get him to take her to that. Marty sees the sign and has a revelation.	MARTY That's right! "Enchantment Under The Sea!" They're SUPPOSED to go to that dance — that's where they kiss for the first time! BROWN Well then, kid, you gotta make sure they go to that dance. Together. **CUT TO: INT. SCHOOL CAFETERIA** GEORGE is seated at a table, having lunch and writing furiously. He has a copy of amazing stories science fiction magazine with his books. MARTY comes over and sits down next to him.
MARTY Hi, George. What are you writing? GEORGE Stories. MARTY Yeah? What kind of stories? GEORGE Science fiction stories... about space travel... and visitors from other planets coming to earth.	MARTY I never knew you did anything creative. How about letting me read one of 'em? GEORGE Oh, no. I never let anybody read my stories. MARTY How come?
GEORGE What if they didn't like 'em? What if they told me I was not good? I couldn't take that kind of rejection. Marty's having a bad case of deja vu. GEORGE (continuing) My father's always telling me that if I never let anyone read my work, I'll have no future as a writer. I know he's right... but I guess that's just the way I am.	(a beat) This must be pretty hard for you to understand, huh? MARTY No, George, it's not that hard at all. There is a long moment as Marty looks at George in a new light... and sees himself. MARTY Listen, George, you know that girl I introduced you to? Lorraine? She really likes you. And I think you should ask her to the "Enchantment Under The Sea" dance. I think you'd have a great time with her.
GEORGE Well, I really couldn't ask her. MARTY Why not? GEORGE What if she says "no?" I'd hate to be rejected. Marty is starting to get exasperated.	MARTY George, I'm telling you, if you don't ask Lorraine to that dance, you're gonna regret it for the rest of your life... and I'm gonna regret if for the rest of mine. GEORGE Well, it's not like I don't want to... It's just that I kinda think she'd rather go out with somebody else. MARTY Who?
GEORGE (points) Biff. Marty looks and reacts with horror **AT ANOTHER TABLE** BIFF is trying to put his hands on LORRAINE. She's trying to push him away. LORRAINE Quit pawing me, Biff! Leave me alone.	BIFF Come on, Lorraine, You want it, you know you want it, and you know you want me to give it to you. LORRAINE Shut your filthy mouth! I'm not that kinda girl! BIFF Maybe you are and you just don't know it yet.
LORRAINE Get your hands off me! But Biff persists. MARTY (O.S.) She said to get your hands off her. Biff turns to find himself facing Marty. BIFF What's it to you, dips***? You know, you've been looking for— MR. STRICKLAND approaches behind Marty. Biff sees him and plays it cool.	BIFF Since you're new here, I'll give you a break. Today. But if you don't shape up, I'm shippin' you out. Biff walks off. Lorraine looks at Marty and sighs with infatuation. LORRAINE Oh, Marty, that was wonderful! Thank you. MARTY Oh, yeah. You're welcome.

CUT TO: INT. BROWN'S LIVING ROOM — DAY
Marty is on the phone.

MARTY
What do you mean, She's not your type? It's destiny, George. You and Lorraine are meant for each other.
(pause, listens)

Look, I'll give you 20 dollars if you take her to that dance. 20 whole dollars.
(sighs, disappointed)
Okay, George. I'll see you tomorrow.

Marty hangs up, exasperated. He pulls out the snapshot again. All that's left of Dave are his feet! MARTY reacts uneasily.

CUT TO: INT. BROWN'S GARAGE — DAY
Brown is fiddling with the video camera, playing the end section of the mail tape over his TV set. Brown seems particularly curious about what happens at the end, why it cuts off so abruptly.

MARTY enters as the tape reaches the end...

ON TV
OLD BROWN reacts to the dog barking.

OLD BROWN
(on TV)
What is it, Einie?
(reacting with horror)
Oh, no, they found me! I don't know how—

The tape ends abruptly.

MARTY reacts with pain, remembering what followed.

MARTY
Say, Doc—
Brown turns, surprised that Marty has been watching.

BROWN
Oh, hi, kid.
(indicates video camera)
Fascinating device, this camera. I can't believe it's made in Japan.

MARTY
Doc, there's something I haven't told you about what happens... (gulps) ...on the night we make that tape...

BROWN
Hold it right there, kid. Don't tell me anything, I don't want to take any more chances of screwing up the space-time Continuum. No man should know too much about his own destiny. If I know too much about the future, I could endanger my own existence. Besides, I've always hated fortune tellers.
(a beat)
And speaking of endangered species, how did it go today with your pop?

MARTY
Terrible. He just doesn't want to go out with my mom. I tried everything. I reasoned with him, begged him, pleaded with him, yelled at him... I even tried bribing him. The only thing I haven't tried is scaring him—
Marty stops short. He's getting an idea...

CUT TO: EXT. GEORGE'S HOUSE — NIGHT
All is quiet; the house is dark.

INT. GEORGE'S BEDROOM
Close on a clock on the nightstand. It's almost 1:30. We pan over to GEORGE'S FACE. He's sleeping soundly, in bed. Now a pair of gloved hands place featherweight headphones on George's ears. George doesn't stir.

The hands now insert a cassette tape labeled "VAN HALEN" into a Walkman. A finger dials the volume level to "10," then presses "PLAY."

GEORGE AWAKENS SCREAMING! He opens his eyes and reacts in further terror: He sees A FRIGHTENING YELLOW MONSTER... Marty, in full radiation suit... at the foot of his bed! Marty turns off the music. When he talks, his voice is distorted through the mouth filter in the hood. An open window indicates how Marty got in.

MARTY
Silence, Earthling!

GEORGE
Who — who are you?

MARTY
(imitating Darth Vader)
My name is Darth Vader. I am an extra-terrestrial from the planet Vulcan.

GEORGE
I must be dreaming...

MARTY
This is no dream! You are having a Close Encounter of the Third Kind! You have reached the Outer Limits of the Twilight Zone!

GEORGE
Mom! Dad!
George throws off the covers, but Marty pulls the portable hair dryer (from Brown's suitcase) out of his belt like a gun. He fires a blast of heat at George.

MARTY
Silence! My heat ray will vaporize you if you do not obey me!
George raises his hands in surrender.

GEORGE
All right! I surrender! Turn it off!
Marty lowers it. Now his digital watch alarm begins BEEPING. Marty raises his wrist as if it were a radio.

MARTY
Silence! I am receiving a transmission from the Battlestar Galactica!
(after several more beeps)
You, George McFly, have created a rift in the space-time continuum. The Supreme Klingon hereby commands you to take the female earth-person called "Baines Lorraine" to the location known to you as Hill Valley High School exactly 4 earth cycles from now — Saturday night in your language.

GEORGE
You mean, take Lorraine to the dance?

MARTY
Affirmative.

GEORGE
But I don't know if I'll be able—
Marty turns on the Walkman again. George SCREAMS!

GEORGE
Turn if off! Please, turn it off!
Marty turns it off.

MARTY
Insolent Earthling! Do you wish me to melt your brain?

GEORGE
No! Please! I'm sorry, I'll do it! I'll take her to the dance — but please don't turn that noise on again.

MARTY
Very good, Earthling. You will tell no one of this visit. Now, close your eyes, and see me no more....

GEORGE
Okay, Okay.
George closes his eyes. Marty holds a vial under George's nose and George passes out. Marty removes the featherweight headphones from George's head, takes off his hood, and goes back out the window.

EXT. GEORGE'S HOUSE — NIGHT Marty climbs down a trellis and jumps down into Dr. Brown's waiting Packard convertible. BROWN How'd it go? MARTY Great! That chloroform sure put him out — I hope I didn't overdo it.	

Fighting Biff

CUT TO: EXT. TOWN SQUARE — DAY MARTY is loitering in the grassy town square. Now GEORGE comes running up from the street. He's disheveled and wild-eyed. MARTY (spots him) George! You weren't at school. Where've you been all day? GEORGE I just woke up — I overslept. Look, you've gotta help me! I want to ask Lorraine out, but I don't know how to do it.	MARTY All right, keep your pants on. She's over there in the café, having a soda. Come on... They head across the street toward the CAFÉ — it's the local teen after school hangout. TWO KIDS on homemade scooters (roller skates nailed to a 2 x 4 with an orange crate on top) cruise down the sidewalk past them. Marty points through the café window.
MARTY Look, there she is. Their P.O.V. through the window of Lorraine, seated with 2 girlfriends (BETTY and BABS) in a booth, sipping ice cream sodas and talking. MARTY It's simple, George. You just go in there and invite her. GEORGE All right. but what do I say?	MARTY Say whatever feels natural — whatever comes to your mind. George thinks about this a moment, then shrugs. GEORGE Nothing's coming to my mind. MARTY Gee, it's a miracle I was even born. GEORGE Huh?
MARTY Nothing. Just tell her destiny has brought you to her and you think she's the most beautiful girl you've ever seen. Girls like to hear that — what are you doing, George? George has taken out pencil and paper and is writing. GEORGE I'm writing it down. This is good stuff.	**INT. CAFÉ — DAY** The place is really jumping — it's full of kids. A jukebox is playing. Marty enters with George. MARTY There she is. Just go and ask her. Marty points George in the right direction, and takes a stool at the counter, out of Lorraine's immediate view.
George looks at his "script" and mouths the words to himself. He gets up his nerve and approaches Lorraine. Despite his awkwardness and fear, there's something endearing about him, like a lost dog. GEORGE Uh, Lorraine... (reads) "My density has brought me to you." LORRAINE I beg your pardon?	GEORGE Oh — what I mean to say is... LORRAINE (looks at him curiously) Haven't I seen you somewhere? GEORGE (big smile) Yes! I'm George. George McFly. I'm your density — I mean, destiny. Lorraine giggles with her girl friends. We hear the sound of the door being thrown open and a familiar VOICE calls to George.
BIFF (O.S.) McFly, I thought I told you never to come in here! George turns and sees Biff and his gang standing there. He shudders. Marty drops his head in his hands and sighs. BIFF Well, it's gonna cost you, McFly. How much money you got on you?	GEORGE (quickly pulls out his wallet) How much do you want, Biff? As Biff starts to walk toward George, Marty sticks out his leg and trips him! Everyone in the malt shop laughs, but Biff doesn't think it's very funny. Now Biff sees who tripped him. BIFF YOU! (getting up)
All right, wise ass, it's fat lip time... Marty jumps off his stool, ready for action. Biff throws a punch which Marty easily avoids; then Marty delivers a left jab to Biff's gut, and slams a right into his face, sending Biff reeling backward into a table. Match, 3-D and Skinhead rush Marty. Marty doesn't like the odds. He bolts out. The 3 guys pull Biff to his feet and they all run out after Marty. LORRAINE (to her girlfriends) That's Calvin Klein! Oh, God, he's a dream!	**EXT. CAFÉ AND STREET** Marty dashes down the street, followed by Biff and the boys. Most of the kids in the café hurry outside to watch, including LORRAINE and her friends. Marty looks behind him — Biff and company are gaining. Then one of the kids on the scooters comes by. Thinking quickly, Marty yanks the scooter out from under him, kicks off the orange crate and creates a homemade skateboard! Marty hops on it and sails off down the sidewalk! Biff and the boys have never seen anything like it — nor has the kid whose scooter it was! Everyone stares as Marty whizzes down the sidewalk.

KID
Wow! Look at him go!

ANOTHER KID
What is that thing?

BIFF
(to his boys)
In the car!

Biff and the gang jump into Biff's convertible parked nearby. Biff peels out after Marty.

FURTHER DOWN THE STREET
Marty looks over his shoulder and sees the convertible closing in. He cuts a sharp turn into the street, crossing right in front of Biff's car, and heads back in the opposite direction.

INT. BIFF'S MOVING CONVERTIBLE
Biff and the boys are stunned!

EXT. STREET
Another car comes up from behind Marty. As it passes, Marty grabs onto the back and hooks a ride! Biff cuts a U-Turn and continues the pursuit.

EXT. CAFÉ
Marty, towed by the car, zooms past the café. The spectators are truly amazed. Lorraine stares in open-mouthed awe.

LORRAINE
He's an absolute dream...!

Now Biff's convertible comes racing after Marty.
MARTY again looks over his shoulder and sees that Biff is closing in, fast. Things don't look good. Up ahead is an intersecting street: Hill Street.

Marty lets go of the car and cuts a sharp left onto Hill Street. BIFF is coming too fast to make the turn. He overshoots the intersection and has to make another U. His boys are watching Marty with amazement.

MATCH
What is that thing he's on?

SKINHEAD
It's a board with a roller skate nailed under it.

3-D
Hey — we could build those things and sell 'em — we could call 'em "Roller Boards!"

EXT. HILL STREET
It's an incredibly steep hill, and at the bottom is a railroad crossing. Marty accelerates and he coasts down. Now Biff's convertible shoots onto Hill Street, actually lifting off the ground as it comes over the hill! Biff drives like hell after Marty and he's closing fast. Then Marty drops into a crouch, cuts his wind resistance and speeds away!

AT THE RAILROAD CROSSING, the warning bells start ringing and the gate begins to lower. Marty reacts with fear. A Diesel Freight is approaching. The gate drops all the way down.

Biff speeds up to stay on Marty's tail. Marty has no choice — he vaults over the crossing gate and lands back on his "skateboard," crossing the tracks just inches in front of the barreling Diesel! Biff slams on his brakes. His wheels lock up and rubber SCREECHES across the pavement... but nevertheless, he CRASHES through the crossing gate, coming to a stop right at the edge of the tracks... and the Diesel engine runs over his front bumper!

MARTY continues on with a euphoric yell as the train roars on behind him, completely cutting off Biff's pursuit.
ON THE OTHER SIDE OF THE TRACKS, BIFF is pissed.

BIFF
I'm gonna get that son of a bitch.

CUT TO: EXT. TOWN SQUARE — LATER
Time has passed; things are quiet at the café. Marty comes gliding down the street on his "skateboard," looking around for somebody. He hops off and sticks his head in the café.

MARTY
George?

VOICE (O.S.)
Hi, Calvin — I mean, Marty.
Marty turns: LORRAINE is standing on the sidewalk behind him.

MARTY
Oh, hi.

LORRAINE
You know, you're the first person who's ever given Biff a taste of his own medicine.
Marty shrugs if off as no big deal. She moves toward him. He backs away.

LORRAINE
Marty, this may seem a little forward, but I was hoping you might take me to the "Enchantment Under the Sea" Dance on Saturday.

MARTY
Uh, well, funny you should bring that up, because you know who really wants to take you, and I really think you'd hit it off with him, is George McFly.

LORRAINE
Yeah, he asked me, but I turned him down.

MARTY
You did WHAT?

LORRAINE
George just isn't my type. He's sort of cute and all, but he's such a... well, you know, a chicken.
(moving closer to him)

'I think a man should be strong...so he can protect the woman he loves. Don't you?
She moves closer. Marty gulps. This is REALLY getting out of hand!

LORRAINE
So what do you say about Saturday?

MARTY
Uh...well...yeah, sure. Okay. It'll be...great. You and me... on a...
(coughs, nearly chokes)
...date.

CUT TO: INT. BROWN'S GARAGE — NIGHT
Brown is shocked to hear what Marty has just told him.

BROWN
What do you mean you said "yes"?

MARTY
I had to. At least that way I'll know she'll be there. Now all I've gotta do is figure out some way to make her end up with George.

BROWN
You're not gonna have much time, kid. You've gotta make everything happen by 9:30 — 9:45 at the latest — because you've gotta beat it back to the courthouse square in time for the fireworks. Come here, I'll show you the set-up.
Brown takes him over to a CRUDE PLYWOOD TABLETOP MODEL of Hill Valley town square which he's constructed himself.

A "lightning rod" (a nail) has been attached to the top of the "clock tower" (a piece of wood with a watch strapped around it). A wire runs down from the "lightning rod," across "town square" and between two "lamp posts" (candles in candlesticks) across the "street." Brown explains the layout to Marty.

ENTERTAINMENT | Solo | Back to the Future | Fighting Biff

BROWN
We put a lightning rod on the clock tower and we run some industrial strength electrical cable from the lightning rod, across the street. Meanwhile, we've outfitted your car with a big hook directly connected into the Flux Capacitor....

Brown brings out a wind-up toy car with a wire sticking straight up from the back. There's a hook on the top of it. (There is a similar rig on the real DeLorean, visible in the background.) Brown winds up the toy car.

(continuing)
On a signal, you'll take off down the street toward the cable, accelerating to 88...
Brown releases the toy car from one end of the model, toward the strung wire...
He picks up a stripped wire, plugged into the AC outlet and brings it toward the "lightning rod."

BROWN
(continuing)
Lightning strikes, electrifying the cable, just in time to...
He touches the live wire to the nail. The toy car's antenna snags the cable.
SPARKS FLY, and the toy car catches FIRE! It flies off the table top, into some drapes, and they catch fire as well!

Brown grabs a FIRE EXTINGUISHER and puts everything out. Marty shakes his head.

MARTY
You're instilling me with a lot of confidence here, Doc.

BROWN
Don't worry. I'll take care of the lightning. You just take care of your old man.
Marty has another look at the fateful snapshot. Dave is entirely gone, and now Linda's head is beginning to go.

MARTY
gulps

MARTY
Yeah...

CUT TO: EXT. GEORGE'S BACKYARD — DAY
GEORGE seems very bewildered about what MARTY has been trying to explain to him.

GEORGE
I still don't understand. How can I go to the dance with her if she's going with YOU?

MARTY
She wants to go with YOU George — she just doesn't know it yet. That's why we've gotta convince her that you're not a chicken — so she'll realize that. Now come on, hit me in the stomach. Right here, go ahead.

Marty makes himself a target, but George seems quite unwilling. In the background, a homemade body bag (a duffel bag filled with clothes) is hanging from a clothesline pole.

'GEORGE
I don't want to hit you in the stomach.

MARTY
You're not gonna hurt me. Just give me a punch.

GEORGE
Look, I'm not a fighter.

MARTY
How many times do I have to explain it to you? We know you're not a fighter. You know it, I know it...but she doesn't know it. That's why we've gotta make you look like a fighter, somebody who'll stand up for her, somebody who'll protect her. And you're not gonna look like a fighter if you can't hit me in the stomach.

GEORGE
But I've never picked a fight in my life!

MARTY
You're not picking a fight, you're coming to her rescue. Maybe we'd better go over the plan again. Where are you gonna be at 8:55?

GEORGE
At the dance.

MARTY
And where am I gonna be?

GEORGE
In the parking lot, with her.

MARTY
Okay. So right around 9:00, she's gonna get very angry with me—

GEORGE
Why?

MARTY
Why what?

GEORGE
Why is she gonna get angry with you?

MARTY
(it's hard for him to say)
Well...because...well, nice girls get angry at guys who... who try to take advantage of 'em.

GEORGE
You mean you're gonna—

MARTY
George, don't worry about it. Just remember that at 9 o'clock, you'll be strolling through the parking lot and you'll see us...
(gulps)
...struggling in the car, you'll run over, open the door, and say...?
George doesn't say anything.

MARTY
Your line, George.

GEORGE
Oh. Uh... "Hey, you! Get your damn hands off her." You really think I should swear?

MARTY
Yes, definitely, George, swear. Then you hit me in the stomach, I go down for the count, and you and Lorraine live happily ever after.

GEORGE
You make it sound so easy. I wish I wasn't so scared.

MARTY
There's nothing to be scared of. Now come on and hit me in the stomach.
George takes a deep breath and throws a flimsy punch into Marty's gut.

MARTY
No, George, put a little emotion into it. A little hostility, a little anger.
George tries to get himself angry. He makes some faces and throws another punch. It's not much better.

MARTY
Anger, George, anger.

GEORGE
Maybe if I used my left...

MARTY
No, George. Just concentrate on the anger. Anger.
George throws another punch. This one is slightly better than the last one.

MARTY
(sighs)
Well... I think you're starting to get the hang of it. Just keep practicing. I'll see you later. Remember, anger, George. Anger.
Marty walks off, leaving George with the body bag. He stares at it, trying to make himself mad.

GEORGE
...anger...
He hits it. He hits it again, harder... again... harder... again — he hits the tree!
George howls in pain!

GEORGE
Yeeeowww!! Goddammit!!

He's really angry now, and he socks the bag with his left — and KNOCKS IT CLEAR OFF THE TREE!
George is astonished!

Preparations

EXT. TOWN SQUARE CLOCK TOWER — NIGHT
It's a few minutes before 8 o'clock.

We hear a radio weather forecast as the camera takes us from the lightning rod atop the clock tower, along the cable strung down across the square, to the street where Brown's Packard is parked nearby — the weather report emanates from the car radio. BROWN is on a ladder; he's connecting the paddle plug end of the clock tower cable to the socket on an extension cable tied around a lamp post. The DeLorean is nearby covered with a tarp. MARTY arrives, dressed up for the dance.

FORECASTER (V.O. radio)
Area weather on this Saturday night: An electrical storm in the vicinity will bypass Hill Valley, but we can expect continued cloudiness and some light rain...
Brown reacts to the weather report.

BROWN
Kid, are you sure about this storm?

MARTY
Doc, since when can a weatherman predict the weather — let alone the future?
Brown smiles. He plugs in the cables, then descends the ladder.

BROWN
Right.

(a beat)

You know, kid, I... well, I'm gonna be sad to see you go. You've really made a difference in my life — you've given me something to shoot for. Just knowing that I'm gonna live to see 1985... that I'll succeed in this... that I'll get a chance to travel through time... well, it's just gonna be hard for me to wait 30 years before we can talk about everything that's happened in the past few days. I'm gonna really miss you.

Marty is particularly uncomfortable, knowing the fate of Dr. Brown.

MARTY
Yeah... uh, Doc, about the future...

BROWN
No, kid. We've already agreed that having knowledge of the future can be extremely dangerous. Even if your intentions are good, it could backfire drastically. Whatever it is you want to tell me, I'll find out through the natural course of time.

This is not what Marty wanted to hear, but he can see there's no arguing with Brown.

MARTY
(sighs)
Yeah... Listen, I'm gonna get a candy bar or something. You want anything?

BROWN
No thanks.

CUT TO: INT. CAFÉ
A hand with a pen writes on a letter.

INT. CAFÉ — WIDE ANGLE — NIGHT
MARTY is sitting at a booth writing. He reads it over.

MARTY
"Dr. Brown, on October 5, 1985, at about 1:30 a.m., you will be shot by terrorists. Please take whatever precautions are necessary to prevent this terrible disaster. Your friend, Marty. March 26, 1955."

Satisfied, Marty folds the letter, puts it in an envelope, and writes something on it.
"Dr. Brown: do not open until October 1, 1985."

CUT TO: EXT. ON STREET — NIGHT
Brown is on the ladder stringing electrical cable across the street, between the two lamp posts. MARTY returns with a candy bar. Brown's trenchcoat is laying on the tarped DeLorean. Making sure that Brown isn't watching, Marty surreptitiously places the ENVELOPE into a pocket.

Now a COP meanders over and watches.

COP
Evening, Dr. Brown. What's with the wire?

BROWN
Oh, I'm just doing a little weather experiment.

COP
(notices the tarped DeLorean)
And what's under here?

BROWN
Some new specialized weather sensing equipment.
Brown comes down from the ladder.

COP
You got a permit for this?

BROWN
(smiles)
Of course I do... right here.
He takes out his wallet and gives the cop a 50 dollar bill.

COP
(hesitant)
You're... not going to set anything on fire this time, are you, Dr. Brown?
Brown looks to Marty for guidance. Marty shakes his head.

BROWN
(to cop)
Naw.

COP
In that case, good luck.
He continues down the street.

BROWN
Thank you, officer.

(to Marty)
Say, kid, you'd better pick up your mom and get going.
Marty is about to get into the Packard. He hesitates and pulls the snapshot out of his pocket. Marty is the only one in the picture now, it's as if his siblings never existed. Marty stares at it, then puts it back in his pocket. He is uneasy and scared.

BROWN
You look a little pale. Are you okay?

MARTY
Oh sure, I feel great. Why shouldn't I? I'm going on a hot date with my mother.

Enchantment Under the Sea

CUT TO: INT. SCHOOL GYMNASIUM — DANCE — NIGHT
"Enchantment Under The Sea" is well underway. On stage is the band: Marvin Berry and the Midnighters. They're all black. Marvin plays lead guitar and sings; there is also a drummer, piano player, sax and bass.

They're playing "3 Coins In The Fountain." The gym has been decorated in an undersea motif: seaweed, fish on the walls, a paper mache sunken ship, a "treasure chest," and a single school locker labeled "Davey Jones." There is also a BUBBLE MACHINE, ala Lawrence Welk.

As usual at school dances, there are teachers acting as chaperones (including Mr. Strickland), a busy refreshment table (including a cake in the shape of a fish), and
wallflowers on the sidelines. GEORGE is on the sidelines, bopping out of time to the music. He's quite nervous.

EXT. SCHOOL PARKING LOT
Brown's Packard pulls into the lot and parks.

INT. PACKARD — MARTY, LORRAINE
Marty, at the wheel, is very uneasy; Lorraine next to him looks beautiful in her best party dress. Marty glances at the clock on the dashboard. It's 8 minutes before 8

ENTERTAINMENT Solo Back to the Future | Script Enchantment Under the Sea

MARTY Uh, you don't mind if we, uh, park for a few minutes...? LORRAINE Why do you think I'd mind? MARTY Well, I don't know, some girls just don't like to… LORRAINE Marty, I'm almost 18 years old. It's not like I've never parked before. She scoots over, very close to him. Marty fidgets. Boy, is he nervous!	LORRAINE You seem nervous, Marty. Is anything wrong? MARTY Uh, no… LORRAINE Have some of this — it'll help you relax. She pulls a pint bottle of gin out of her purse. Marty is shocked.
MARTY What are you doing with that? LORRAINE I swiped it from the old man's liquor cabinet. She takes a nip. MARTY Lorraine, you shouldn't drink! LORRAINE Why not?	MARTY Well, it's just not healthy. LORRAINE Don't be so square, Marty. Everybody who's anybody does it. She hands it to him. MARTY Maybe I could use a hit.... Just as he takes a swig, she pulls out a pack of cigarettes and lights up. Marty spits out the gin in surprise.
MARTY Geez — you smoke, too? LORRAINE Now, Marty, you're not going to tell me that smoking is unhealthy. Everyone knows that it calms your nerves and it's good for the circulation. MARTY It'll give you cancer!	LORRAINE You know, you sound just like my mother. When I have kids. I'm gonna let them do anything they want. Anything. MARTY I'd sure like to have that in writing. The comment goes right past Lorraine. LORRAINE So what are your parents like? Are they as square as mine?
MARTY Lorraine, lately I've come to the conclusion that I don't know anything about 'em. **INT. SCHOOL GYMNASIUM — THE DANCE** Marvin Berry and the Midnighters finish up a number. Everyone applauds. Marvin steps up to the microphone. MARVIN We're gonna take a break now, but we'll be back in just a little while, so don't go away. The band members leave their instruments on the stage and head out a side door.	GEORGE now glances at the clock in the gym. It says "8:59." Alarmed, he checks his own watch which reads "8:55." GEORGE is even more alarmed. He runs over to a nearby student. GEORGE What time do you have? STUDENT Five after nine. George is panic stricken! He runs like hell out of the gym!
INT. PACKARD — MARTY, LORRAINE — NIGHT Marty fidgets and looks at the clock again. LORRAINE Marty, why are you so nervous? Marty takes a deep breath. MARTY Well, have you ever been in a situation where, well, you know you have to act a certain way, but when you get there, you don't know if you can go through with it?	LORRAINE You mean like how you're supposed to act with someone on a first date? MARTY Well, sort of… LORRAINE I think I know exactly what you mean. MARTY You do?
LORRAINE (nods) And you know what I do in those situations? Marty looks at her. LORRAINE I don't worry about it! And with that, she throws herself on him, kissing him passionately. Marty is absolutely shocked!	**INT. SCHOOL HALL — NIGHT** George is in a phone booth dialing a number. It rings and a woman answers. WOMAN (V.O. phone) At the tone, the time will be nine o'clock, exactly.... A KID named dixon (class prankster type) sticks a broom through the phone booth door handle. George tries to get out, but he's trapped. Dixon LAUGHS loudly.
George jerks the door frantically, and Dixon just laughs louder. **INT. PACKARD — NIGHT** Lorraine continues her passionate assault of Marty — then abruptly stops and pushes him away. She's very confused. LORRAINE This isn't right. (sighs)	I don't know what it is, but... when I kiss you, something's wrong. I almost feel like... like I was kissing my brother... or my father. I don't understand it, but I just know it's wrong. I guess that doesn't make any sense, does it? MARTY Believe me, it makes perfect sense. We hear the sounds of APPROACHING FOOTSTEPS on gravel. LORRAINE Sounds like somebody's coming. Marty hears it too. He looks at the dashboard clock: 9:00. He sighs with defeat.

MARTY
Yeah... I know...
Suddenly the driver's door is opened, an arm reaches in, yanks Marty out, and Marty finds himself face to face with BIFF!

Match, 3-D and Skinhead are with him.

BIFF
You caused $300 damage to my car, dips***. And I'm gonna take it outta your ass... Hold him, guys.

Biff shoves him roughly into the arms of Skinhead. Marty struggles, but Skinhead and Match grab him and restrain him

LORRAINE
Let go of him! Leave him alone, Biff! You're drunk.
Biff takes a look at Lorraine in the car.

BIFF
Well, lookee what we have here. Maybe I'll take it out of your ass...
She lunges at her door to escape, but Biff grabs her and climbs into the car.

BIFF
Oh, no, you're stayin' right here with me.
Biff pulls her toward him.

MARTY
Get you hands off her, you son-of-a-bitch.
Biff leers at Marty.

BIFF
I'll take care of you after I take care of her. (to his boys) Take him around back. I'll be there in a minute.

(a beat)
Go on! This ain't no peepshow!

They drag Marty away. Biff shuts the car door and tries to kiss her. She struggles, and in a moment, all we can see through the windshield are tussling arms and legs, accompanied by Lorraine's muffled screams.

EXT. SIDE OF SCHOOL
Skinhead, Match and 3-D drag Marty around the corner to the side of the school where a cadillac is parked with its trunk open.

SKINHEAD
Hey — let's lock him in that trunk!

They throw Marty into the car trunk and slam the lid shut. Then, the Cadillac's driver's door is thrown open and the DRUMMER from the band steps out. He's smoking a reefer.

DRUMMER
Say, what you messin' with my car for?

3-D
Beat it, spook, this don't concern you!

The other 3 car doors open, and MARVIN BERRY and the other band members get out. They look real "bad" with their processed hair.

MARVIN
Who you callin' "spook," peckerwood?
Biff's boys exchange worried looks as the band members advance on them.

SKINHEAD
Hey, I don't want to mess with no reefer addicts!

Biff's boys take off (in the opposite direction from the Packard), but Marvin and the band manage to kick 'em all in the ass as they run away. Now we hear beating on the trunk from the inside, and Marty's muffled voice.

MARTY'S VOICE
Lemme out! Lemme out!

MARVIN
Hey, Reginald, where's your keys?
The drummer checks his pockets, and inside the car. He can't find them.

MARTY'S VOICE
They're in here! The keys are in here!

MARVIN
Dammit, boy, you left them suckers in the trunk!

INT. — PACKARD
Lorraine is trying to fight off Biff. It's a real struggle for her.

EXT. PARKING LOT — ON THE PACKARD
Through the windshield we see arms and legs flailing about in a struggle. We hear SCREAMING.

Now GEORGE arrives. He spots the car and goes into his act. He adjusts his pants, strides to the car like John Wayne, and opens the driver's door.

GEORGE
Hey, you! Get your damn hands — uh, oh!

George realizes he's facing Biff. Now he's really scared.

BIFF
I think you got the wrong car, McFly.

LORRAINE
George! Help me!
George doesn't know what to do. He stares in dumbfounded amazement.

BIFF
Just close the door, McFly and walk away.

GEORGE
Uh, okay, Biff...
He turns and takes a few steps.

LORRAINE
George! Please! Help me!
George can't stand it. He stops and goes back. He takes a deep breath.

GEORGE
All right, Biff. You let her alone.

BIFF
Who's gonna make me?

GEORGE
(gulps)
I am.
Biff steps out of the car and laughs loudly.

'BIFF
Yeah? You and what army, McFly?
George balls his right hand into a fist and takes a swing at Biff — but Biff grabs his arm and starts twisting it. George grimaces.

EXT. AT THE CADILLAC
Meanwhile, Marvin is trying to pop the trunk lock with a screwdriver. He's not having much luck.

EXT. PACKARD
Biff twists George's arm harder.

LORRAINE
Stop it, Biff! You'll break his arm!

She tries to pull him away. He slaps her backhand, knocking her down.
Biff laughs. George's expression immediately goes from pain to rage — intense rage... and George lets go with a TREMENDOUS LEFT HOOK, SMACK INTO BIFF'S FACE!
Biff hits the ground, out cold! George can't believe he did it! He looks at his fist, looks down at Biff, and grins widely.

LORRAINE
Oh, George, you were wonderful!
She looks at him with adoring eyes.

AT THE CADILLAC
Marvin has his screwdriver in the lock. He gives it a hard jerk: the trunk pops open, but he puts a big gash in his hand.

MARVIN
Damnit — I sliced my hand!
Marty jumps out of the trunk.

MARTY
Thanks a lot!
He dashes back toward the Packard.

MARTY rushes onto the parking lot and is astonished to see GEORGE AND LORRAINE EMBRACING... and BIFF out cold on the ground. He keeps his distance, allowing them to have their moment.

Nearby, a few kid bystanders come over to them.

BYSTANDER #1
George, we never knew you had it in you!

BYSTANDER #2
Yeah! Ever think about going out for the team?

BYSTANDER #3
How about running for class president?

GEORGE
Well, I'll have to think about it.
Marty can't believe what he's hearing.
Now George and Lorraine head for the school.

EXT. FRONT OF SCHOOL
George and Lorraine go up the front stairs. Marty watches from a safe distance away. Just as they're about to go in, Lorraine turns and sees Marty. She smiles. He smiles back. Now Marty pulls out the snapshot and takes a look. Marty's own image is beginning to fade.

In the background, we hear distant thunder.
MARTY is shocked. He considers the situation a moment, then realizes the answer. He runs back toward the Cadillac.

AT THE CADILLAC
Marvin is wrapping a handkerchief around his cut hand while the band looks on. Marty runs over to them.

MARTY
Hey, you guys, you've gotta get back in there and finish the dance!

MARVIN
Sorry, my friend, but we're through for tonight.

MARTY
What do you mean, you're through?

DRUMMER
Look at Marvin's hand! He can't play with it like that. And we can't play without Marvin.

MARTY
But you've gotta play! That's where they kiss for the first time — on the dance floor! If there's no music, they won't dance, they won't kiss, they won't fall in love.., and I'm a goner!

DRUMMER
Hey, man, the dance is over... unless you know somebody who can play guitar.

Marty looks at Marvin and smiles.

CUT TO: INT. SCHOOL GYM
Marty is playing the guitar with the Midnighters, in a version of "Earth Angel." George and Lorraine are on the floor, dancing. Marty looks at them, then looks at the back of his guitar where, attached with chewing gum.

He glances at the snapshot, nothing has changed. Marty watches his parents. He's getting nervous.
GEORGE AND LORRAINE are looking at each other as they dance. George seems a little unsure of himself.

LORRAINE
Aren't you going to kiss me, George?

GEORGE
(uncertain)
Well... I don't know...
Now DIXON butts in.

DIXON
Beat it, McFly, I'm cuttin' in.

He pushes George out of the way. On stage, Marty reacts with horror. He looks at the snapshot. Marty's image is definitely fading! MARTY blinks his eyes and start hitting wrong notes. He doesn't seem to be able to play the guitar anymore. The DRUMMER notices this.

DRUMMER
Hey, man...what's wrong?

MARTY
I can't play! I don't know how to play the guitar!
On the dance floor, Dixon has his hands all over Lorraine. Lorraine doesn't like it. She looks to George with pleading eyes. MARTY is turning pale. He can barely stand up.

MARTY
I don't feel so good...
The band keeps on playing.
GEORGE sees Dixon with Lorraine. His anger rises and he strides over the them.

GEORGE
(to Dixon)
Get lost, jerk!

He yanks Dixon away from Lorraine and shoves him hard, sending him sprawling into the refreshment table — right into the punch bowl! George takes Lorraine in his arms and kisses her!

ON STAGE
Marty immediately recovers! He jumps up, full of life, wired with energy. The color returns to his face, and he looks at the snapshot. Marty's image is now sharp and clear, and his sister and brother are fading back in!

ON THE DANCE FLOOR
George and Lorraine are dancing very close. From the looks on their faces, there can be no doubt: they're in love.

GEORGE
You know, I'm gonna write all this up in a story and send it in for publication.

LORRAINE
I thought you only wrote science fiction.

GEORGE
It IS science fiction.

The photo is now as it was originally, with Marty, Linda and Dave all "back in existence."

ON STAGE
Marty is euphoric. He remembers how to play, and jumps into the opening riff of "Johnny B. Goode!"

MARTY
(to the band)
Follow me, fellas! Let's rock 'n roll!
The band joins in.

SERIES OF SHOTS — DANCE NUMBER
On the dance floor, heads turn. There are reactions of astonishment from everyone — and the kids start dancing.

Marty euphorically begins cavorting around like Little Richard! The band is really getting into it. And the kids all go nuts, jumping and screaming. Mr. Strickland, however, just shakes his head with disgust. Marty whips off his sport coat and throws it into the crowd!

INT. BACK STAGE — PUBLIC TELEPHONE
MARVIN BERRY is on the phone.

MARVIN
(into phone)
Chuck? This is Marvin!
(pauses)
Marvin Berry! Your cousin! Now, listen — I think this is the sound you've been looking for…
He holds the phone toward the music.

INT. SCHOOL GYM
The pandemonium continues.
Now Marty tears open his shirt and does some Elvis pelvis moves. Girls scream! Marty's movements become Mick Jaggeresque, then take on a Michael Jackson style...

Finally he drifts into pure heavy metal, puts his guitar next to the amp, making feedback. This goes a little too far for 1955 musical tastes — the band stops playing, and the kids stop dancing. They all watch Marty, not sure what to think. Marty suddenly realizes he's gone too far. He smiles sheepishly and steps up to the microphone.

MARTY
Uh, sorry, you guys aren't ready for that yet. But your kids are gonna love it.
He picks up the song again with the band. They do one more chorus. Marty wraps up the song with a final riff, and the students all go berserk with applause!

Return to 1985

CUT TO: EXT. CLOCK TOWER — NIGHT
It's 4 minutes before 10:00.

ON THE STREET
BROWN, wearing the trenchcoat, paces back and forth anxiously. The wind is picking up, and we hear distant thunder. The entire "lightning rod setup" is complete, with the cable strung across the street between the two lampposts.
Brown checks his wristwatch: 9:56.

BROWN
Damn! Where is that kid?

Brown pulls out a pocket watch and checks it: 9:56.

BROWN
Damn!

Brown checks a wristwatch on his other wrist. It's 9:56.

BROWN
Damn!

At last, the Packard pulls up across the street from the tarped DeLorean. Marty jumps out, dressed in his 1985 clothes.

BROWN
You're late! Do you have no concept of time?
Brown pulls the tarp off the DeLorean and raises the "trolley hook" on back to its full height.

MARTY
Take it easy, Doc! I had to change my clothes. Everything's cool — they're back together...and here's the proof.

Marty shows him the fully restored snapshot.

MARTY
Yeah, old George really came through. Laid out Biff with one punch — cold cocked him... and I had to miss it. I never knew he had it in him. Hell, my old man's never stood up to Biff in his life.
Brown opens the DeLorean door.

BROWN
All right, let's set your destination time. This is the exact time you left...

On a readout labeled "Last Time of Departure" is "OCTOBER 5, 1985, 1:11 A.M."
BROWN punches the appropriate keypad.

BROWN
(continuing)
Let's send you home 10 minutes later...
The readout labeled "Destination Time" lights up to read "OCTOBER 5, 1985, 1:21 A.M." We can see that the two readouts differ by 10 minutes.

EXT. ON BROWN AND MARTY
BROWN
(continuing)
Ten minutes isn't long enough for you to be missed. Now, I've painted a white line on the street up there — that's where you start from.
(continuing)
I've calculated the precise distance, taking into account the acceleration speed and wind resistance retroactive from the moment the lightning will strike...
He picks up a wind-up alarm clock.

BROWN
(continuing)
When this alarm goes off, you hit the gas.
Brown gives it a wind, then sets it on the DeLorean dashboard. Brown looks around, then sighs.

BROWN
Well, I guess that's everything.
Marty extends his hand.

MARTY
Doc, thanks for everything.
They shake hands.

BROWN
Thank YOU. I'll see you in about 30 years.
Marty sighs, again thinking of Brown's destiny and the letter.

MARTY
I... I hope so.

BROWN
Don't worry. As long as you hit that wire with this hook, everything'll be fine.

MARTY
Right...
Brown puts his hands in his pockets and withdraws the letter Marty put there. He looks at it curiously. Marty turns away.

BROWN
What's the meaning of this?

MARTY
You'll find out in 30 years.

BROWN
It's about the future, isn't it? Information about the future?

MARTY
You'll find out in 30 years.

BROWN
I warned you about this, kid. The consequences could be disastrous.

MARTY
You've gotta take that risk, Doc. Your life depends on it.

BROWN
(shakes his head)
No. I'm not going to accept the responsibility.
Brown tears up the envelope and shoves the pieces into the Packard ashtray.

MARTY
All right, Doc, in that case, I'll just have to tell you straight out—

But before Marty can get the words out, a tremendous gust of wind comes up accompanied by a loud crack! They turn: A tree limb in the square has blown down right on top of the cable between the clock tower and the first lamp post! The paddle-plug attached to the lightning rod on the clock tower is yanked out, and the cable drops down from the clock tower!

BROWN
Great Scott! Kid — find the end of that cable — I'll throw the rope down to you!

Brown grabs a big coil of rope and dashes into the courthouse. Marty gulps. He takes a look at the fallen tree branch on the cable, then goes hunting for the end of it. The wind is picking up, and the sound of THUNDER approaches.

INT. CLOCK TOWER STAIRS — NIGHT
Brown charges up the several flights of stairs like a madman!

EXT. COURTHOUSE SQUARE
Marty pulls in the cable, hunting for the end of it. At last he finds it. He looks up at the clock tower.

EXT. ON THE CLOCK TOWER
A door opens up, giving access to the ledge below the clock. BROWN steps out. His hair blows wildly in the wind, and lightning flashes in the distance. He looks up.
BROWN'S P.O.V. OF the connecting socket, dangling on its cable between the "1" and "2" on the huge clock face. Its other end is attached to the lightning rod on the tower above. BROWN looks down.

BROWN'S P.O.V. of MARTY, 5 stories below, waving with the paddle plug in hand. BROWN tosses one end of the rope down. The coil unravels. The rope drops to the ground. Marty runs over, grabs it, and ties it to the paddle plug. He waves back to Brown. BROWN nods and starts pulling the rope with the cable back up.

MARTY watches anxiously as the cable goes back up. He yells up at Brown.
MARTY
Doc! I gotta tell you about the future!
But Brown can barely hear him.

BROWN
What??

MARTY
The future! On the night I travel back in time, the terrorists show up and you get—
BONG! It's exactly 10:00 — and the clock bells strike ten! Marty can't be heard over the sound!

Brown almost loses his balance with the huge bells tolling so close! He regains his footing, then pulls the rope up the rest of the way. He's got the paddle plug in hand.
Brown yells at Marty, but he can't be heard over the bells. Brown gestures that he's got the cable and that Marty should go. MARTY hesitates, but Brown gestures adamantly. At last Marty nods and runs to the DeLorean.

BROWN
unties the rope from the end of the paddle plug and looks up at its socket mate dangling on the clock face. He reaches up for it, but he can't quite get it. He'll have to move across the ledge to get closer to it.

MARTY climbs into the DeLorean and closes the gull wing door.

INT. DELOREAN
Marty turns the key in the ignition and revs it up. He puts the car in gear.

EXT. STREET — TOWN SQUARE
The DeLorean takes off.

EXT. CLOCK TOWER
Brown looks down and sees the DeLorean heading down the street. Brown moves along the ledge. He reaches up but he's still not close enough to grab the dangling socket. Lightning and thunder move ever closer.

EXT. STREET
The DeLorean passes a hand-painted white line on the street — Brown has also painted the words "START HERE" for Marty's benefit. Marty makes a U-turn and pulls up to it, like a starting line.

Marty has an anxious expression on his face.

MARTY
Dammit, Doc, why'd you have to tear up that letter? If only there was a little more time— Marty glances down at the 2 readouts, "Destination Time," and "Last Time Departed." The "Destination Time" is set for "1:21 A.M.," 10 minutes later than the "Last Time Departed," which is at "1:11 A.M."

MARTY has an idea.

MARTY
More time! I'll give myself some more time!
He pushes the appropriate buttons on the keypad.

The "minutes" indicator on the "Destination Time" begins counting backwards: 1:21...1:20...1:19...

EXT. CLOCK TOWER
Brown, with the cable in his left hand, moves a little further along the ledge.

Suddenly, the ledge cracks and crumbles beneath his feet! Brown drops the cable and grabs onto the clock hands to save himself! The cable drops onto his left foot!
Brown hangs precariously from the clock face like Harold Lloyd, wind blowing his hair, and lightning, cracking in the sky! Brown carefully moves his right foot toward the intact section of ledge while trying to keep the cable balanced on his left foot. His right foot moves closer... at last it finds safe footing.

Brown takes a deep breath, then hops over onto the ledge. He kicks the cable up with his left foot and catches it in his hand. He sighs relief. Everything is all right. He reaches up with his right hand and is able to grab the dangling socket.

INT. DELOREAN
Marty is still fiddling with destination time. The destination time drops back to 1:12... 1:11... 1:10... 1:09... 1:08... 1:07— Suddenly the engine dies! MARTY tries to restart it but it won't turn over.

MARTY
Come on, come on...!

EXT. CLOCK TOWER
Brown has the plug in his left hand, the socket in his right. He brings them toward each other to plug them in — but they won't reach! Both ends are taut, but he's about a foot short!

Brown looks down. His P.O.V. of the tree limb caught on the cable — which is the reason there's no slack!

BROWN jerks the end of the cable, trying to free it from the limb. Brown tries to disengage the cable from the limb but can't free it. His face takes on intense determination, exaggerated by the wind and lightning. He gives the cable a tremendous yank. The cable jerks free from the tree — but the plug at the other end is wrenched out of the connecting socket on the lamp post!

BROWN reacts with horror. He now has a useless plug in his hand. Lightning cracks even closer!

INT. DELOREAN
Marty is still trying to get the car restarted. Now the alarm clock rings!

MARTY
S***!

At last the engine roars to life! Marty switches THE TIME CIRCUITS ON! The various indicators light up! Marty puts the car in gear. Marty's foot hits the gas pedal.

The DeLorean peels out!

EXT. THE CLOCK TOWER
Brown looks at the two cables in his hand, and the loose end below: how can he get everything connected? Suddenly he realizes what he must do. He ties the two of them tightly together, then plugs them in.

The DeLorean accelerates...
The speedometer passes 40 mph.

EXT. CLOCK TOWER
Brown tests the tied connected cable ends to make sure they won't come apart: they're secure. He takes a deep breath, then grips the line tightly. He jumps!
BROWN slides down the cable!

EXT. COURTHOUSE SQUARE
Brown drops down to the ground! He runs with the cable toward the lamp post!

EXT. STREET
The DELOREAN approaches the square!

INT. MOVING DELOREAN
Marty drives with determination.
The speedometer passes 65.
MARTY'S P.O.V. OF the approaching wire strung across the street.

BROWN gets to the plug end of the cable! It's dislodged from the tree limb, so he has enough slack. He races to the lamp post and the dangling socket.
The DeLorean continues accelerating!

The speedometer passes 85!
The indicator lights behind MARTY begin registering.

BROWN grabs the socket cable and plugs his cable in!
The speedometer hits 88!

THE MOST SPECTACULAR BOLT OF LIGHTNING STRIKES THE LIGHTNING ROD!

The connecting cable becomes electrified!
The DeLorean passes under the cable between the lamp posts.
The trolley hook on the DeLorean makes contact with the electrified cable!
The Flux Capacitor glows and discharges!
The DeLorean's time coils light up and the vehicle is sent BACK TO THE FUTURE!

DR. BROWN
lets out a whoop of delight and relief as he's drenched by the deluge.

THE CABLE ACROSS THE STREET has wrenched the trolley pole out of the rear of the DeLorean. It's left there, swinging from the cable.

BROWN looks up at the clock tower. THE CLOCK is stopped at 10:02
Lightning cracks behind it and we DISSOLVE TO:

1985

THE CLOCK — OCTOBER 5, 1985 — NIGHT
The storm dissolves away into an ordinary night sky. The clock tower shows 30 years of additional age…

Camera cranes down to reveal Hill Valley town square, as we saw it in the beginning. All is quiet — it's late. A raggedy bum is asleep on a bench.
Suddenly his hair begins to stand on end… He's lit by an offscreen flash of light, accompanied by a sonic boom and a sharp blast of wind. We hold on him as we hear a screech of tires and an offscreen crash. The bum awakens and looks up to see...

EXT. THE BOARDED UP MOVIE THEATER — BUM'S P.O.V.
There is a big hole in the front of what used to be the theater.
Suddenly, the DeLorean backs out and onto the street!

THE BUM shakes his head.

BUM
Crazy drunk driver.
He goes back to sleep.

INT. DELOREAN
MARTY looks at the readouts.

"Present Time" now matches "Destination Time" at OCTOBER 5, 1985, 1:07 A.M. "Last
Time Departed" is now MARCH 26, 1955; 10:02 P.M."
MARTY is delighted.

MARTY
All right!
He turns on the car radio. A contemporary rock tune comes on.

MARTY
All right!
He puts the car into forward gear. The engine dies!

MARTY
Aw, s***!
He tries to start it again, but he can't get it to turn over.

MARTY
Come on, come on—
He looks up and sees out the windshield...

MARTY'S P.O.V. THROUGH THE WINDSHIELD — NIGHT
The terrorist van, cruising down the street and around a corner.
MARTY is horrified.

MARTY
The terrorists!
(tries starting the car again)
Damn, it's frozen!

EXT. STREET IN FRONT OF THEATER, DELOREAN — NIGHT
Marty gets out of the DeLorean and runs like hell down the street after the terrorist van.

CUT TO: EXT. THE MALL — NIGHT
as MARTY arrives at the Mall. He keeps on running, past the entrance sign that reads "LONE PINE MALL" (with an image of a single pine tree), into the parking lot, just in time to see, a good 150 yards away... MARTY'S P.O.V. OF the Terrorist van chasing down Dr. Brown — with Marty's younger self watching frozen in horror. MARTY is both horrified and amazed — horrified at being too late; amazed at seeing himself, and to be seeing something he's already experienced from a third person point of view.

MARTY
Oh, God, no, I'm too late!

HIS P.O.V.
The Terrorist leans out of the van with the machine gun.

TERRORIST
Dr. Brown, you American dog, you have betrayed our cause! For that you die!
He BLASTS Dr. Brown in the chest. Brown goes down. Everything is as it already happened.

MARTY
Oh, no!

HIS P.O.V.
The Terrorist van turns and goes after the younger Marty. Just as before, Marty dives into the DeLorean and roars off. Marty watches himself chased by the terrorists.

The DeLorean accelerates, even as it's being shot at, going faster and faster until it's enveloped in the blinding white glow and vanishes! But the terrorist van drives into the white glow; we hear cursing as the blinded driver loses control of the van. It swerves and goes out of control, hitting a parking median and flipping over on its side.
MARTY now runs toward the fallen Dr. Brown, lying face down in the parking lot.

He reaches him, along with Einstein the faithful dog. Marty turns Brown over, tears in his eyes.

MARTY
Doc, no...
Suddenly, BROWN openms his eyes and smiles!

MARTY
You're alive!
Brown stands.

BROWN
Of course, I'm alive.

MARTY
But you were shot — I saw it! I saw it twice!
Brown rips open his radiation suit revealing a bullet proof vest.

BROWN
It's the latest fashion in personal protection. It'll stop a slug from an elephant rifle at 30 yards.

MARTY
But how did you know?

Brown smiles, reaches into his pocket and pulls out the LETTER THAT MARTY WROTE — SCOTCH TAPED TOGETHER! It's yellow and brittle: 30 years old!

MARTY
(smiles, shaking his head)
After all that lecturing about screwing up future events and the space-time continuum...

BROWN
(shrugs)
Yeah, well, I figured, what the hell.
We hear approaching police sirens.

CUT TO: EXT. MARTY'S HOUSE — NIGHT
The DeLorean pulls up to the darkened house. The gull wing passenger door opens and Marty gets out. Brown is driving and Einstein takes Marty's seat.
Marty turns to talk to Brown.

INTERCUT WITH BROWN IN THE DELOREAN
MARTY
So how far ahead are you going?

BROWN
I figure I'll take it slow at first...go about 30 years, just to get my feet wet; then maybe see what's shaking in the 22nd or 23rd century.

MARTY
Well... good luck. And if you get a chance, look me up. I'll be... 47 years old.

BROWN
I will. Funny... I had to wait 30 years to catch up to you. Now you've gotta wait 30 years to catch up to me. Ain't life weird.
Brown gives him a wink. Marty closes the door.

EXT. MARTY'S HOUSE — NIGHT
Marty waves Brown off and heads toward his front door. In the background, the DeLorean zooms off, and we see light from the offscreen time travel glow.
Marty is hit by the sharp blast of wind.

A Changed World

CUT TO: INT. MARTY'S BEDROOM — DAY
MARTY is on top of the bed, asleep in his clothes. Morning light streams in through the bedroom window; he stirs and opens his eyes. He blinks several times, as if getting his bearings, then sits up and looks around.

Yes, it's his room all right, and everything seems the same, from the Z-28 posters to his audio equipment. Marty looks at the clock: 8:30. He looks at the wall calendar: the first four days of October are X'ed off — today is the 5th. Could it have all been a dream?

He gets out of bed and looks at himself in the mirror, then pinches himself to make sure he's real. He is. On the nightstand is a framed 5 x 7 version of the snapshot with he and his siblings. it looks the same.

He reaches into his waste can and pulls out the submission form to the record company. He looks at it, then decisively pulls the cassette tape out of his drawer, and puts it in the envelope with the form.

INT. BEDROOM CORRIDOR — DAY
MARTY comes out of his room with the envelope. He goes down the hall and stops short as he enters.

INT. DINING ROOM — DAY
LINDA and DAVE are seated at the dining room table which has been beautifully set for breakfast. The 5 table settings are elegant; Dave is eating a half of grapefruit; Linda has eggs benedict. Dave is wearing an expensive tailored suit and reads the business section of the morning paper.

MARTY
Say, are we having company or something?

LINDA
Not that I know of.

MARTY
Dave, aren't you working today?

DAVE
Sure, I always work on Saturday.

MARTY
Then what's with the fancy suit?

DAVE
(confused, doesn't understand)
Marty, are you all right?

MARTY
Yeah. Are YOU guys all right?

DAVE
Sure, never better. Here, let me take that — I'll mail it from the office.

Dave takes Marty's envelope. Marty nods uneasily and takes his place at the table. A bowl of fresh strawberries is waiting for him. Now GEORGE and LORRAINE enter from outside. They're tanned and healthy in tennis outfits with tennis rackets.

George carries himself with an air of confidence, and Lorraine looks terrific — thin and svelte, radiantly healthy and positive. This is a happy marriage.
Marty can't believe how good his mother looks.

MARTY
Mom! You look — great!!

LORRAINE
Why, thank you, Marty. Say, tonight's the big night, right? Your big date with Suzy Parker? Such a nice girl, I sure like her.

MARTY
(can't believe it's his mother talking)
Pardon me, Ma?

LORRAINE
You're going up to the lake tonight, aren't you? Haven't you been planning it for 2 weeks?

MARTY
Mom, we went through this last night. How can I go if Dad's car is wrecked?

GEORGE
Wrecked? There's nothing wrong with my car. In fact, Biff is out there waxing it right now.

INT./EXT. MCFLY KITCHEN — P.O.V — DAY
George opens the curtains, revealing BIFF waxing a new Lincoln Continential in the driveway. Biff is working diligently; his rough edges and arrogance are all gone.
George opens the window.

GEORGE
Hey, Biff, don't forget to wax the inside of the wheel covers. You forgot that last time.

BIFF
(friendly, eager to please)
Yes, sir, you're the boss, sir!
Marty is absolutely astonished.

GEORGE
(sitting back down)
Some employees will get away with murder if you don't stay on 'em. I've had to keep him in line ever since high school. Although if it wasn't for him, your mother and I would have never met.

LINDA
Yeah, Dad, you've told us a million times: you beat him up when he was bothering Mom and that's how the two of you fell in love.

ENTERTAINMENT | Solo | Back to the Future | Script | A Changed World

LORRAINE It was more than that. Your father literally came to my rescue. (sighs) It was so romantic! LINDA (rolls her eyes) Cornball city. Marty nods with complete understanding. GEORGE (calls into the kitchen) Bertha, how about bringing Marty his French Toast?	A uniformed maid enters with a tray and sets a lovely plate of French Toast in front of Marty. Marty is too dumbfounded to speak. GEORGE Well, Bertha, you won't have to put up with that tiny kitchen much longer. BERTHA When will the new house be ready, sir?
GEORGE Just as soon as they finish painting the tennis court and re-tiling the swimming pool. It'll be sad to leave this place, though. So many memories... of you kids, and of my days as a struggling writer. BIFF ENTERS and hands George a hardback book. BIFF Oh, Mr. McFly, this just came in: It's the British edition of your current best seller. How many has it sold so far? A million?	It's called "A Match Made in Space," and the cover shows a bedroom with a space alien talking to a couple in bed — very reminiscent of Marty's "Darth Vader" visitation to George. The style indicates it's a science-fiction romance novel. The author's name, GEORGE McFLY, is in big letters. GEORGE Two million, hard cover. BIFF Oh, Marty — here's your keys. Your car is all waxed and ready for tonight. Biff tosses him a set of keys.
MARTY My car? CUT TO: EXT. McFLY HOUSE — DAY Marty comes out of the house and opens the garage door, revealing a tricked out black supra, just like he saw in the showroom. MARTY can't believe it. The personalized license plate says "MARTY I." Marty approaches his new car. VOICE (O.S.) How about a ride, mister? Marty turns — it's SUZY PARKER. She looks just the same: great.	MARTY Suzy! Are you ever a sight for sore eyes! Let me look at you! Marty looks at her, as if trying to make sure she's real. Suzy is hard-pressed to understand why Marty is making such a big deal about this. SUZY Marty, are you okay? You're acting like you haven't seen me in a week. MARTY I haven't. He pulls her toward him... they're about to kiss... closer, closer... And just as they kiss, their hair stands up on end. Marty's eyes widen with the inevitable expectation...
MARTY Oh, no... not again... We hear a sonic boom, and Marty turns — the DeLorean streaks up in front of the house. DR. BROWN jumps out, more wild-eyed and frantic than we've ever seen him. His clothes are particularly bizarre — a weird mixture of past and future: a cowboy hat, a strange variation on a Roman tunic, a cape, and striped plastic pants. BROWN Marty — you've gotta come with me — back to the future!	MARTY Doc, I've got Suzy here. I was just gonna try out my new wheels. BROWN Well, bring her along — this concerns her, too. Brown opens the passenger gull wing door for him. Marty and Suzy approach cautiously. MARTY What do you mean? What happens?
(sudden alarm) Does something happen to us? Do we turn into assholes or something? BROWN No, you and Suzy both turn out fine. But your kids, Marty — something's gotta be done about your kids! Brown gets back in the DeLorean.	**INT. DELOREAN** Marty gets in, and Suzy sits on his lap. She closes the door. BROWN Okay, here we go… MARTY You'd better back this thing up, Doc. We haven't got enough road to get up to 88.
BROWN Where we're going, we don't need roads. Brown hits a new switch on the dashboard: "Westinghouse Fusion Energizer." **EXT. STREET** The DeLorean speeds down the street, then blasts off into the sky like a streak! Once again, the coils glow and the DeLorean is enveloped in the familiar white glow and disappears into the future…	

15 Conspiracies

Conspiracies

The aim of conspiracies is to provide a perspective on the removal of God from society, the decline of morality, values and ethics and to provide hope when the world is spiralling into the depths of socialism, hedonism and one-worldism. If anything else, it will keep you engaged, asking questions and pondering the issues of our day.

Introduction

We live in a world which is deteriorating rapidly with violence, riots, thievery, terrorism and natural disasters occurring on an increasingly frequent basis. These disasters - but particularly the natural disasters - are not only becoming more frequent but are also increasing in power, duration, size and magnitude. A few examples of the current decline of our world today would be; COVID-19, Colossal plagues of locusts in the middle east; Hurricanes Katrina, Maria, Harvey and Sandy; The Australian Bushfires; The many volcanic eruptions occurring more frequently; The economic crash of many governments such as Venezuela and Lebanon, and the multitudes of increasing earthquakes around the globe.

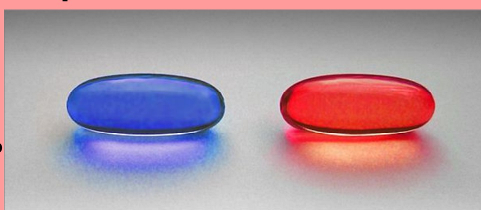
The man-made disasters are also at record highs; The continual riots and unrest around the world such as Hong Kong and the Yellow-Vests in Britain; Nazism, White Supremacy, Occult Practises, Satan worship and Witchcraft are on the rise; Terrorism is becoming more frequent but less broadcasted; Pollution of the land, seas and sky is on a sharp increase; Stealing is commonplace in California if the total is under $950; The continued violence and bombings in the Middle East - Specifically in Iraq, Iran, Yemen, Israel and Turkey, and so much more... The media commonly labels these as "disasters of biblical proportions" which isn't actually far from the truth if you've ever read Revelation in the Bible.

Not only are the two linked, but it's becoming increasingly evident that as the morality and values of humanity degrades - so too does the weather and the people. Our planet is in trouble and people need to start waking up and looking at the signs occurring on literally every continent and every corner of the world.

The values and ethics of our ancestors and of those who built our great countries of America, Australia and Britain are being eroded - not by mere chance, but a planned assault on our once great countries. This category will explain **who** is instigating this attack, **why** they are attempting to change the world, **how** they are conducting it and what their endgame **goals** are - all backed up by historical, current and tangible, REAL evidence. The category title is partially incorrect as this isn't a section for multiple conspiracies but one huge overarching conspiracy designed to keep the elites and those with money controlling the system and the lives of the population, in a world where this is now technologically possible.

Today, the term conspiracy often comes with negative connotations with many believing that they simply aren't true because of what they've been told. The definition of a conspiracy is "a secret plan by a group to do something unlawful or harmful". Nothing to do with its validity but a conspiracy is simply an evil plot done in secret. I understand this category won't be adopted well by many but this massive shift in our culture is worth taking a look at even if you appreciate the new direction of this future "New World Order". It is best read from start to end like a book as it's formatted to flow from one point to the next slowly building on the premise.

1 The Agenda



"You take the blue pill...the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill...you stay in Wonderland, and I show you how deep the rabbit hole goes."
Morpheus

Throughout history there have always been those with an intent to conquer the world. They feel a compulsive urge to be the most powerful person on the planet and nothing short of sitting on a throne, being worshiped by every person on earth is good enough. Genghis Khan, Alexander the Great, Cyrus the Great, Caesar Augustus and recently Adolf Hitler are all examples of individuals who either tried - or came very close to achieving this goal, however nobody has successfully ruled the entire world yet. The techniques and tactics of these men were legendary and often far beyond their time, however they all had one thing in common - they all used brute force to achieve their goals unlike the subtle invasion of our world today. You can't (easily) get subservience of an entire planet through a violent conquering of nations, the loyalty simply won't be there when the dust settles.

Therefore a new tactic was developed by the most elite and powerful to deceive the peoples and nations of this world without them even realizing they are under attack. A tactic that warps and dements the very foundation on which our great countries were founded. This is an invasion of the mind and a twisting of true ethics and morality of the population. Their aim is to slowly tear down the most powerful and godly countries on earth, to impose their socialist and communistic agendas on the world - while keeping them at the top.

The communists primary purpose is a vision of a completely new society - one of a socioeconomic order structured upon the ideas of common ownership of production and the absence of social classes, money and the state with them sitting right at the top. To achieve this vision they realized that the current Judeo-Christian values which our countries were founded on, and which make us so strong, are a direct conflict to their own goals so they must be eliminated by any means possible.

If the Government is big enough to give you everything you want,
it is big enough to
take away everything you have.
John F. Parker

These values are: Loving your neighbour; the value of every life; the knowledge and love of God; the sanctity of marriage and the institution of nations and families. It is only within the last 100 years we have seen the collapse of every single one of these values. In place of them they have instituted their own form of morality which they are imposing onto the world today - a value of "Do whatever pleases you".

To misquote the Joker: "~~Madness~~ Sin as you know, is like gravity, all it takes is a little push". Through experience we can clearly see that there's been a lot more than a 'little push' to get us to the stage we're at now. Like a virus, it spreads throughout the world, gaining momentum and supporters who don't know any better, all because of a few truly evil communistic individuals, who want to get rich, stay rich and rule the world.

The first step of achieving a form of control over a population is to make people discontent with their current lives. Today this is accomplished via a multitude of ways easily observable in society today:

- Feminism causes women to be discontent with their marriage and family.
- The LGBTI movement causes discontent with their birth gender and those opposed to their way of life.
- Models, photoshop and magazines cause discomfort in one's own body.
- Materialism and advertisements cause discontent with what we own.
- A lack of money or high debt causes discontent towards those high earners and capitalism.
- A hatred of capitalism causes a hatred of one's nation, one's leaders and a love of socialism and 'equality'.
- Pornography causes discontent in marriage and relationships.
- Abortion causes murder, contention, anguish and the destruction of the family unit and stems from a view of selfishness.
- Political and environmental misinformation such as global warming leads to contention between different generations.
- Indoctrination and schooling misinformation such as evolution causes deception resulting in contention between parents and elders.
- Class separation maintains hatred between whites and blacks... And too many more to list...

What is Socialism?

Let's start with one of the above, the problem of a lack of money, debt and indoctrination. This causes thinking to warp as individuals begin to want what someone else has without any of the effort, bringing us to a socialism mindset. Sure, it starts with often 'pure' ambitions such as helping those in poverty, but eventually socialism corrupts every part of society until you have an all-powerful government taking from whoever they want and giving it to anyone they please.

Socialism is a range of economic and social systems characterised by social ownership of the means of production and workers' self-management as well as the political theories and movements associated with them. Social ownership can be public, collective or cooperative ownership, or citizen ownership of equity. There are many varieties of socialism and there is no single definition encapsulating all of them, with social ownership being the common element shared by its various forms.

Value	Capitalism	Socialism	Communism
Definition	Private ownership and investment of money to make a profit	Some production is owned by the public and operate for the welfare of all	All production is owned by the people, all goods and services are shared equally
Government	Democracy	Democracy, Invasive government	Dictatorship, Invasive government
Asset Division	Each person gains assets and wealth according to the work they put in. incentivizes hard work.	From each according to their ability, to each according to their contribution. Rewards laziness. Redistributes wealth. Kills incentive.	From each according to their ability, to each according to their needs. No incentive.
Production Ownership	Means of production and distribution of goods are owned by individuals and corporations	Collective ownership. Means of key production industries are owned by the government or state	All means of production are owned by the government or state.
Classes	Features a class-based society	Rejects the necessity of a class-based society in favour of a society of equals	Classless society. 'Equality'
Atmosphere	Fosters a competitive atmosphere in which workers and companies are encouraged to work hard to achieve personal success	Encourages an atmosphere of cooperation in which no matter how hard a person works, he or she reaps the same benefits as everyone else.	Encourages an atmosphere of cooperation and equality in which no matter how hard a person works, he or she reaps the same benefits as everyone else
Private Property	Ownership of private property is encouraged	Ownership of private property is largely forbidden	Ownership of private property is forbidden.
Production	Produces goods based on the law of supply and demand	Government mandates production and prices	Government mandates all production and prices based on its needs rather than on products the consumer might want
Countries	• United States • United Kingdom • Australia • Canada	• Sweden • Venezuela • Denmark • Armenia	• China • Cuba • Former Soviet Union • Vietnam

In the classic view of communism, a communist society was the ultimate goal and destination for humankind. Followers of classic communism realized that it would be impossible to switch to communism directly from a capitalistic system they deemed immoral. They believed that society needed time for transition. During that transition, called socialism, the representatives of people should be in charge of the means of production, and guide the society toward communism. This was the essence of the very existence of the Union of Soviet Socialist Republics. They had their Communist Party of the Soviet Union, but the longer they were in power, the less they talked about transition to communism. In China, their communist party ended up leading the transition to capitalism.

"Socialism is the plundering of the productive by the unaccountable"
Chuck Missler

Communism as a political system never was implemented anywhere. Cuba was flirting with it within the first few years after the revolution. China tried to move in that direction during the Cultural Revolution. North Korea might make some claims, too. But, in reality, all of these countries always have been socialistic countries. Communism as a political reality existed mostly in the minds of undereducated American politicians and commentators.

Capitalism just happened. It emerged from a spontaneous technological progress and associated with it, social and political developments. Socialism is a human invention; it represents a human desire to take control of the social progress. It is no coincidence that many socialists call themselves “progressives.” This approach is sometimes called a “scientific socialism“ as it means that for the first time in the history of humankind, people take a systematic critical view of the existing political order and by collective action decide to change it.

Socialists take a lot of pride and satisfaction from forming and implementing policies that change the world, presumably for the better. Marx said it the best: “The philosophers have only interpreted the world, in various ways; the point is to change it.” Critics see this as hubris, as playing god, because humans and societies are part of nature; hence, we have no power to change the rules of nature and we never will know them well enough to play safely with the social order.

The socialistic system as established almost 100 years ago in the Soviet Union was intended as an egalitarian society run by people’s representatives in the best interests of all. It does not sound too bad, and has some connotations to the American political system. The difference is in the freedoms of individuals. In socialism, by definition, the good of the society as a whole is collectively defined, and the representatives are given powers to implement it. Those powers imply suppression of the rights and aspirations of individuals who are perceived as not going along with what is believed as the good of the society at the time.

In the Soviet Union, the right to own private property was one of these rights not recognized there. The freedom of expression was another one, as it was perceived as disturbing people’s minds with obsolete and immoral capitalistic ideas. In capitalism, personal freedoms - in particular, protection of private property, freedom of enterprise and freedom of expression - are essential; people should be free in pursuing their economic interests. In the capitalistic system, the government’s role should be solely in guaranteeing safety and equal freedoms for everyone.

The concept is that the good of the society as a whole is achieved optimally if people are free from government coercion in pursuing their personal goals, be it economic, ideological, scientific, religious, philanthropic, or any other activity. Government should not be involved in any of these activities. This concept of the free market society (this is how capitalism was labelled before the term “capitalism” came into existence) to a great extent was adopted as the base of the political system in the Unites States at the time of its inception.

This section by Marion Smith March 22, 2016

In 1936, when Franklin Roosevelt sought re-election to the presidency, some of his critics labelled him a “socialist.” The charge was so incendiary that the White House moved quickly to rebut it, labelling it an accusation “which no patriotic, honourable, decent citizen would purposefully inject into American affairs.”

That was then. Today, in America, for the first time in nearly a century, socialism is not a dirty word, or a shunned label, for many people. On the contrary. President Barack Obama, with a minimum of controversy, has reopened relations with the unabashedly socialist regime in Cuba, demanding almost no concessions in exchange for becoming the first U.S. president in 88 years to visit the island. (Indeed, on the eve of the president’s arrival, Cuba’s Ministry of Foreign Affairs declared that Cuba—together with China—was committed to the “irreversibility of socialism.”)

Meanwhile, the overwhelming and seemingly improbable support among America’s youth for the 74-year-old Bernie Sanders—a self-described democratic socialist who once proudly defended communist dictatorships across the world—is the latest example of a historical illiteracy that treats socialism as a benign economic system that is more equitable and fair than capitalism.

A Pew poll from June 2015 shows a staggering 69% of voters under 30 expressing a willingness to vote for a socialist for president of the United States. This was well before Sanders’ electoral successes in the early Democratic primaries. A more recent YouGov survey found that voters under 30 actually have a higher opinion of socialism (43 percent in favour) than they do of capitalism (32 percent in favour).

“For older people, socialism is associated with communism and the Soviet Union and the Cold War,” says Michelle Diggles, a senior policy analyst at Third Way, a liberal D.C. think tank. “The oldest millennials were 8 years old when the Berlin Wall fell. They have never known a world where the Soviet Union exists. … The connotations associated with the word ‘socialism’ just don't exist with millennials.”

Watching the false hope of socialism be resurrected amid ignorance of basic 20th century history is particularly distressing for me. I am a millennial American myself, but I am also head of the Victims of Communism Memorial Foundation. I have dedicated my professional life to honouring the millions who paid with their lives so that totalitarian leaders could build their socialist “utopias.”

Many are still paying. Today, 20 percent of the world’s population continues to live under communist regimes, in China, Vietnam, Cuba, Laos and North Korea. These countries are some of the worst violators of human rights in history. China operates its own “gulag” system of labour camps for political prisoners. The Castros in Cuba—the Obama administration’s newest friends—routinely throw their opponents in prison, despite Raúl Castro’s misleading comments at his news conference with Obama on Monday. There remain more than 50 political prisoners in Cuba, which the Castro government denies.

Maybe we should have seen this loss of historical memory coming nearly 25 years after the collapse of the Soviet Union. Perhaps we should have heard the alarm bells of a 2011 Newsweek survey that reported 73 percent of Americans “couldn’t correctly say why we fought the Cold War” in response to a question taken from the official test for U.S. citizenship. Ignorance of socialism and America’s decades long struggle against it has become the norm, and the data suggest this norm will only harden as a generation of Americans pass away and national memory fades.

For a generation with no memory of bomb shelter drills or sledgehammers smashing the Berlin Wall to pieces, the sad reality of life under socialist rule has been forgotten, and the lessons of the Cold War have been relegated to the “ash heap of history” alongside communism. Instead, the concept of socialism has often been confused with liberalism. Socialism seems like a fine idea that means a more social equitable society for everyone—free health care and free education for starters. Socialism conjures the image of a place like Sweden and Denmark, which contrary to popular belief, are not socialist systems at all. In fact, Danish Prime Minster Lars Lokke Rasmussen responded to claims by Senator Bernie Sanders that the Scandinavian countries were socialist by saying: “Denmark is far from a socialist planned economy. Denmark is a market economy.”

Socialism is not roads, welfare, and free education. Socialism has always had a more ominous goal and shares close historical and ideological connections with more reviled terms: Marxism and communism. Karl Marx took socialism to what he viewed as its natural conclusion: The “abolition of private property.”

Class warfare is a long-running theme in socialism, even in this country. American socialist (and failed presidential candidate) Eugene Debs promised a world where “no man will work to make a profit for another.” Even earlier, French socialist Jean Jaurès lamented: “All this misery, all this injustice and disorder, results from the fact that one class monopolizes the means of production and of life, and imposes its laws on another class and on society as a whole.” Jaurés said that to equalize things, “to break down the supremacy of one class,” the ultimate “aim of socialism, whether collectivist or communist, is to transform capitalist property into social property.”

The process of transforming “capitalist property”—that is, something legitimately purchased, inherited or otherwise earned—into “social property” for everyone is when socialism becomes sinister. This promise of redistribution always involves winners and losers picked by the government. What if one has acquired capitalist property and does not wish it to become “social property?” Well, then the government might have to step in and take it.

The loss of private property—which ensures one’s independent livelihood—perforce erodes one’s ability to exercise free speech. What if the owner of some capitalist property taken by the government dares to protest its seizure? That sort of dissent must be stifled to maintain order, so free speech is replaced by government-sanctioned propaganda. Unpopular opinions are shamed, and those expressing them are barred from forums like colleges and universities.

How do we know? Because we’ve seen it happen time and again. Ninety-nine years ago the Bolshevik Revolution in Russia showed the danger of combining socialist ideas with totalitarian violence, which created modern totalitarian communism. It was Bolshevik leader Vladimir Lenin who expressed a sort of unifying theory, finally achieving Marx’s goals. “In striving for socialism,” Lenin said in 1917, “we are convinced it will develop into communism.” The result in more than 40 national experiments since then has been either totalitarian dictatorship or economic collapse, costing some 100 million lives before the communist experiment collapsed in Europe and the Soviet Union.

To be sure, not everyone in these societies was a loser, which gets at one of the great paradoxes of all socialist systems: the extreme inequality that allows a cabal of party members to control the political and economic power in a country to the exclusion of an overwhelming majority of the citizens. Only socialist countries have achieved the tragic distinction of launching rockets into outer space while millions of their citizens starve to death in famine. Now that’s inequality!

The Centre for Global Policy at George Mason University has recorded an interesting historical development. Its Political Instability Task Force plotted a chart showing the percentage of countries in which mass killings were occurring from the end of World War II until the present day. For most of the second half of the 20th century, that percentage increased steadily. Then, in the early 1990s, a precipitous drop occurred, and in the 2010s we have seen the lowest percentage of countries on Earth with ongoing mass killings ever recorded. What happened in the early 1990s? The Cold War ended and millions were freed from behind communist walls and secret police holding cells. This was also when our millennial generation was born.

Indeed, there is very much a generation gap in today’s socialist resurgence. Nate Silver points out that while polling from May 2015 shows a plurality of voters under 30 supporting socialism, that figure drops to a mere 15 percent among those over 65. The reason for this is not difficult to see. It reflects a difference in personal experience.

Millennials either missed the Cold War entirely or were young children in its final years, with little or no conception of the triumph of liberty achieved with the fall of the Berlin Wall and the collapse of the Union of Soviet Socialist Republics (USSR). They do not understand the menace that socialism— combined with power—posed to the people it enslaved and to the free nations that it threatened. The violence and brutality of the communist regimes of the past are irrelevant, just lines in the history book somewhere between the Spanish-American War and 9/11.

It's more personal for older Americans. Perhaps some of their friends or neighbours—or they themselves—arrived in this country just ahead of Soviet tanks that were rolling into their homeland. Perhaps they remember the stories of citizens of these supposed utopian socialist prison states arrested, "disappeared," tortured, or shot simply for trying to cross a border. Perhaps they remembered cowering under their school desks during drills in case of a nuclear attack, planned in communist Russia and launched from communist Cuba.

This is the context young American voters should know as they prepare to cast their vote—many of them for the first time. We should all be mindful of the power of words and ideologies, and how discredited ideas can flourish again as memories of their failure fade. We cannot forget the lessons of history. All of us, but especially the youngest among us who will have to live in that world for the longest, should make this election about the future by rejecting the ugly, violent legacy of socialism's past.

3 The Plot

Now that we know the basic premise of socialism and the fact that the elites are trying to make everyone discontent with their current lives and indirectly - capitalism, we should look at their own goals they've stated in detail.

Communist Goals

This is a list of communist goals from the book "The Naked Communist". Written by W. Cleon Skousen and published in 2007. These are the introductory passages to give an insight into the book and give an introduction on their purpose. All italicized text is quoted from this book.

The Naked Communist Excerpts
By W. Cleon Skousen

"One of the most fantastic phenomena of modern times has been the unbelievable success of the Communist conspiracy to enslave mankind. Part of this has been the result of two species of ignorance -- ignorance concerning the constitutional requirements needed to perpetuate freedom, and secondly, ignorance concerning the history, philosophy and strategy of World Communism. This study is designed to bring the far-flung facts about Communism into a single volume. It contains a distillation of more than one hundred books and treatises -- many of them written by Communist authors. It attempts to present the Communist in his true native elements, stripped of propaganda and pretense. Hence, the title, "The Naked Communist.""

It is a terrible and awesome thing when a man sets out to create all other men in his own image. Such became the goal and all consuming ambition of Karl Marx. Not that he would have made each man equal to himself; in fact, it was quite the contrary. The image he hoped to construct was a great human colossus with Karl Marx as the brain and builder and all other men serving him as the ears and eyes, feet and hands, mouth and gullet. In other words, Marx surveyed the world and dreamed of the day when the whole body of humanity could be forced into a gigantic social image which conformed completely to Marx's dream of a perfect society. To achieve his goal, Marx required two things: First, the total annihilation of all opposition, the downfall of all existing governments, all economies and all societies. "Then," he wrote, "I shall stride through the wreckage a creator!" The second thing he needed was a new kind of human being.

I highly recommend purchasing the complete book and reading it in it's entirety as it will open your eyes to the current predicament of the world.
The Naked Communist is a 1958 book by American political theorist W. Cleon Skousen, a former FBI employee. The book has been highly praised by American conservatives Glenn Beck and Ben Carson, the latter of whom stated, "The Naked Communist lays out the whole progressive plan. It is unbelievable how fast it has been achieved."

"Lest we forget at least an over the shoulder acknowledgment to the very first radical: from all our legends, mythology and history, the very first radical known to man who rebelled against the establishment and did it so effectively that he at least won his own kingdom - Lucifer."
Saul D. Alinsky

Saul is one of the evil men who helped push America towards the corrupt, immoral and wicked nation it is today, by re-packaging Antonio Gramsci and The Fabian Socialists ideas and selling them to the 60's radicals.

The Naked Communist Goals

These 45 goals are all part of the campaign to soften America and other Christian based nations for the final takeover. Below we begin exploring their goals outlined by them back in the early 1900s. It should be kept in mind that many loyal Americans/Australians are working for these same objectives because they're not aware that these objectives are designed to destroy them and their country. Generally only those who were alive between 1940-1960 can see the immense shift our culture has gone through where almost every value has been rewritten.

"My object in life is to dethrone God and destroy capitalism."
Karl Marx
(Father of Communism)

1	U.S. acceptance of coexistence as the only alternative to atomic war.	**In Progress**	With "coexistence" comes a degradation of values and ethics to appease the other side. Nations should be individual and have their own values.
2	U.S. willingness to capitulate (yield) in preference to engaging in atomic war.	**In Progress**	Americas ability to defend itself if the need arises is a cornerstone of what makes it the strongest nation on earth.
3	Develop the illusion that total disarmament by the United States would be a demonstration of moral strength.	**In Progress**	The disarmament agreement with Russia is progressing as planned but they still are a way off. USA: 6,185 current nukes with 2,385 awaiting disarmament. *"A few easily concealed or clandestinely manufactured weapons would, in a totally disarmed world, give one nation decisive military power over others.... A totally disarmed world is also one in which Communists' characteristics of secrecy and of a society organized along military lines would give them maximum advantage."*
4	Permit free trade between all nations regardless of Communist affiliation and regardless of whether or not items could be used for war.	**In Progress**	President Trump has raised tariffs to most external suppliers particularly communist China.
5	Extension of long-term loans to Russia and Soviet Satellites.	**In Progress**	
6	Provide American aid to all nations regardless of Communist domination.	**In Progress**	President Trump has raised tariffs to most external suppliers particularly communist China and cut off funding to the U.N.

7	Grant recognition of Red China. Admission of Red China to the U.N.	**In Progress**	
8	Set up East and West Germany as separate states in spite of Khrushchev's promise in 1955 to settle the Germany question by free elections under supervision of the U.N.	**In Progress**	"30 years after the Berlin Wall came down, East and West Germany are still divided". The latest news article on the issue.
9	Prolong the conferences to ban atomic tests because the U.S. has agreed to suspend tests as long as negotiations are in progress.	**Successful**	America hasn't tested a nuclear weapon since 1992 as per the Comprehensive Test Ban Treaty.
10	Allow all Soviet satellites individual representation in the U.N.	**In Progress**	
11	Promote the U.N. as the only hope for mankind. If its charter is rewritten, demand that it be set up as one-world government with its own independent armed forces. (Some Communist leaders believe the world can be taken over as easily by the U.N. as by Moscow)	**In Progress**	The U.N. is fast becoming the "Go-To" system of government as the world collapses. They concoct and attempt to push out worldwide solutions to further their agenda of a global government with climate change at their forefront.
12	Resist any attempt to outlaw the Communist Party.	**In Progress**	This one will always be 'In Progress' until they succeed.
13	Do away with all loyalty oaths.	**In Progress**	Some courts have removed loyalty oaths before they begin but they are working on replicating this for the whole country. They have recently removed swearing on the Bible in courts of law.
14	Continue giving Russia access to the U.S. Patent office.	**In Progress**	Russia still has access to the U.S. patent office allowing them to utilize any patents they wish to further their communist goals.
15	Capture one or both of the political parties in the United States.	**Successful**	They have entire control of the left wing party, but have also been successful in pushing both political parties to the left of their origin.
16	Use technical decisions of the courts to weaken basic American institutions by claiming their activities violate civil rights.	**In Progress**	The courts are in the process of reducing religious freedoms so it's illegal to utilize the Bible to bring people to faith. They are also attempting to take away tax exempt status from churches who don't comply with their demands. Euthanasia and abortion are other court rulings which demoralise the population.
17	Get control of the schools. Use them as transmission belts for socialism and current Communist propaganda. Soften the curriculum. Get control of teachers' associations. Put the party line in textbooks.	**Successful**	Schools have been hijacked so much that the kids who graduate have no use of the information given to them. God has been removed from the schools and replaced by evolution and other religions. They know that if you get to kids from a young age they can shape their beliefs and values for the rest of their life.
18	Gain control of all student newspapers.	**Successful**	This is part of the previous goal where they utilize papers for their own goals such as climate change which has no real evidence.
19	Use student riots to foment public protests against programs or organizations which are under Communist attack.	**Successful**	An example is the climate change debacle. They first lie to kids in school about climate change and then set them loose on the world to protest.
20	Infiltrate the press. Get control of book-review assignments, editorial writing, and policy-making positions.	**Successful**	There used to be 30+ news reporting mediums 100 years ago and now there is 3 major companies controlling every one of them, feeding the population false facts and junk to control them. They attempt to further their goals through this medium. It's obvious today how disguising movies, Tv, internet and music has become when only 50 years ago every single show was wholesome and family friendly.
21	Gain control of key positions in radio, TV and motion pictures.	**Successful**	
22	Continue discrediting American culture by degrading all forms of artistic expression. An American Communist cell was told to "eliminate all good sculpture from parks and buildings, substitute shapeless, awkward and meaningless forms."	**Successful**	Many of the christian sculptures, paintings and historical statues such as the confederate memorials have been removed and replaced with abstract, meaningless art.
23	Control art critics and directors of art museums. "Our plan is to promote ugliness, repulsive meaningless art."	**Successful**	
24	Eliminate all laws governing obscenity by calling them "censorship" and a violation of free speech and free press.	**Successful**	This goal has been somewhat amended to alter the obscenity law to incorporate hate speech against transgender, abortion etc.
25	Break down cultural standards of morality by promoting pornography and obscenity in books, magazines, motion pictures, radio and TV.	**Successful**	One simply needs to take a look at any Tv shows or movies to see the promiscuity that runs rampant. People believe sex outside of marriage is a norm.
26	Present homosexuality, degeneracy and promiscuity as "normal, natural, and healthy."	**Successful**	This has been so successful that the people are siding with "their right" to do what they want with their body. Gay marriage has been made legal.

27	Infiltrate the churches and replace revealed religion with "social" religion. Discredit the Bible and emphasize the need for intellectual maturity which does not need a "religious crutch."	**Successful**	Highly successful with many churches becoming apostate and interpreting incorrectly the facts laid out in the Bible. More and more people are leaving Christianity which is the foundation of America.
28	Eliminate prayer or any phase of religious expression in the schools on the ground that it violates the principle of "separation of church and state."	**Successful**	The interpretation of "separation of church and state" has been twisted. Thomas Jefferson said: "Make no law respecting an establishment of religion, or prohibiting the free exercise thereof". This means that the state shouldn't be solely giving funds to a single church denomination, as during the 1800's people were paying taxes which were given to churches the taxpayer didn't agree with. All public, private and some christian schools have now removed religious expression from their curriculums.
29	Discredit the American Constitution by calling it inadequate, old-fashioned, out of step with modern needs, a hindrance to cooperation between nations on a world-wide basis.	**Successful**	Since the 20th Century, Marxist men have publically and privately discredited the United States Constitution as "old fashioned that Needs to be changed to reflect the current times".
30	Discredit the American founding fathers. Present them as selfish aristocrats who had no concern for the "common man."	**Successful**	If you've been watching the decline on America lately you would know that there has been an incredible push to remove the entire history of the country and this includes the founding fathers.
31	Belittle all forms of American culture and discourage the teaching of American history on the ground that it was only a minor part of "the big picture." Give more emphasis to Russian history since the Communists took over.	**Successful**	This goal is in alignment with #17 as a means to avoid teaching American history and pushing them towards global goals. Lately the BLM protests have been utterly destroying America's culture and history in the fight against what they see as 'racism'.
32	Support any socialist movement to give centralized control over any part of the culture -- education, social agencies, welfare programs, mental health clinics, etc.	**Successful**	Obama attempted to instigate multiple socialist schemes during his time in office. "Voters under 30 actually have a higher opinion of socialism (43% in favour) than they do of capitalism (32% in favour)." Due to an infiltration in the schools as per #17.
33	Eliminate all laws or procedures which interfere with the operation of the Communist apparatus.	**Successful**	Law and Order is discredited and US departments have been taken over and rendered ineffective, particularly the US Justice Department. Such agencies fly in the face of the communist goals and their intent of government control and world domination. An example of law enforcement infiltration and the process to render agencies ineffective are areas where stories of police brutality is claimed to be widespread.
34	Eliminate the House Committee on Un-American Activities.	**Successful**	
35	Discredit and eventually dismantle the FBI.	**Successful**	The FBI has been discredited multiple times recently with debacles such as the Hillary Clinton email controversy, Andrew McCabe dismissal and the James Comey dismissal. It's also closely related to #34.
36	Infiltrate and gain control of more unions.	**Successful**	Most of the biggest unions in the world have been taken control of and run by these communist individuals which they use to further their agendas.
37	Infiltrate and gain control of big business.	**Successful**	Google, Microsoft, Apple, Amazon, Facebook, Twitter, Instagram etc, have all been infiltrated by communists seeking power. They do this through the subtle (and lately the not so subtle) influence social networks and other media have on our lives the same way Tv and movies do. They can use personal data and preferences to influence the outcomes of elections such as sending a "don't forget to vote" message only to democrats. A method which can't be traced back to them.
38	Transfer some of the powers of arrest from the police to social agencies. Treat all behavioural problems as psychiatric disorders which no one but psychiatrists can understand or treat.	**Successful**	The Nixon administration attempted to fund the health department to conduct psychological testing on all children between the ages of 6 and 8 in the country to see if any of them have been "Genetically-Marked" for any future criminal activity. "The aim is to prevent a child with a delinquent character structure from being allowed to grow into a full-fledged teen-age delinquent or adult criminal."
39	Dominate the psychiatric profession and use mental health laws as a means of gaining coercive control over those who oppose Communist goals.	**Successful**	
40	Discredit the family as an institution. Encourage promiscuity and easy divorce.	**Successful**	The family unit is one of the basic foundations given to us by God and by destroying it, families disintegrate along with society. Children are taught their own values in schools controlled by communists, contradicting their parents. This leads to a lack of respect and breaks the family unit.
41	Emphasize the need to raise children away from the negative influence of parents. Attribute prejudices, mental blocks and retarding of children to suppressive influence of parents.	**Successful**	This one is easy to recognise how successful it's been by looking at families today. Divorce, religion, domestic violence and even political-correctness has been breaking families. The aim is to discredit the parents beliefs, ethics and religion to be able to mould the child the way they want to create someone dependant on the system.
42	Create the impression that violence and insurrection are legitimate aspects of the American tradition; that students and special-interest groups should rise up and use "united force" to solve economic, political or social problems.	**Successful**	Through the means of goal #17, kids are taught that they should do whatever is necessary to "fix the planet" themselves by uniting through protests, clashes or riots. Anything besides peaceful objections. Take a look at where we are after the George Floyd riots.

43	Overthrow all colonial governments before native populations are ready for self-government.	Unsuccessful	These colonial governments are the individual states who have their own Governors, Attorney Generals, Legislatures and Senate that govern their own activities in their own states. In the 20's-40's the communists advocated for a Negro Soviet Republic in the southern state of America which if it was successful, the idea was that the African-Americans living in those designated states would rise-up, overthrow the state governments and run them under the direction of the Soviet Union.
43	Internationalize the Panama Canal.	In Progress	It is currently managed and operated by the government-owned Panama Canal Authority.
45	Repeal the Connally Reservation so the U.S. cannot prevent the World Court from seizing jurisdiction over domestic problems. Give the World Court jurisdiction over nations and individuals alike.	In Progress	The Connally Reservation was set up to keep The World Court (United Nations) from interfering with American matters on; tariffs, immigration laws, school curriculums, gun control, etc. It states that America will always decide what its business is and what is the world's business. It is that very law and the only law, that "legally" protects the US from being taken over by the UN, a predominantly muslim organization that believes in Sharia Law. This goal has not yet been successful, but it may have been shifted in an attempt to take down America and get this as a bonus.

	Totals	Successful =	28	In Progress =	16	Unsuccessful =	1

People need to wake up and take a closer look at this MASSIVE cultural shift which has slowly taken place over the course of 100 years. As you can see from the list of goals above, almost every one of them is in direct opposition to the Bible and the biblical values once held by almost every nation on earth. The goals above have been designed to lead the majority of people astray into a culture glorifying themselves and giving them pleasure over doing what's right.

Research what life was like before your generation because almost every single aspect has changed. Nearly everyone used to go to church on Sunday and shops were closed to respect the sabbath. Citizens were better behaved, dressed well, were polite and courteous to each other and children were disciplined when they strayed from the Christian values which everyone held because America was founded on the principles of God and Christianity. People didn't need to lock their homes when because everyone was (fairly) trustworthy and thieves were few and far between. You don't have to believe in God to see that the direction in which we're hurtling towards can only be disastrous for humanity.

Agenda Documentary

I highly recommend watching "The Agenda - Grinding America Down" documentary by Curtis Bowers. It basically outlines this entire category in better terms than I could ever put it. Curtis has also recently released "The Agenda 2" which further expands on the points in the first DVD.

"Socialism, by whatever name, and in all its forms is the ultimate evil. Sooner or later it destroys everything in its path, law, morality, family, prosperity, productivity, education, incentive and finally life itself."
Curtis Bowers - The Agenda

The Agenda (Grinding America Down)
By Curtis Bowers

Screenshot above from "The Agenda", by Curtis Bowers.

For an updated Christian based news source describing the times in which we live, take a look at "The McAlvany Intelligence Advisor". Their tagline is: "Contrarian Geopolitical & Financial Intelligence. Every Month. Without Fail." This monthly update is sure to wake you up to what's happening in our world today and show you in vivid detail what is likely to follow.

"Our mission is to awaken, equip and mobilize multiple generations with an absolute objective truth-grid in the digital information age and empower you to prosper in ever-changing geopolitical, cultural and financial ecosystems. With over four decades of battle-tested experience, we know the ropes of gathering and delivering timely global intel."

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Georgia Guidestones

The Georgia Guidestones are another display of the 'goals of the enlightened' (the illuminati) and the communists, as the communists have been infiltrated by the illuminati because of their aligning goals. The guidestones consist of a granite monument erected 22 March 1980 in Elbert County, Georgia, in the United States. A set of 10 guidelines is inscribed on the structure in eight modern languages and a shorter message is inscribed at the top of the structure in four ancient language scripts.

One slab stands in the center, with four arranged around it. A capstone lies on top of the five slabs, which are astronomically aligned. An additional stone tablet, which is set in the ground a short distance to the west of the structure, provides some notes on the history and purpose of the guidestones. Just by reading the goals engraved on these stones you can tell their aims are sinister.

1	Maintain humanity under 500,000,000 in perpetual balance with nature.

Simply put, they are aiming at killing about 7.3 Billion people. They've already put multiple plans into motion to achieve this goal, but describing them takes us too far down the rabbit hole and would almost be unbelievable to anyone reading what they are planning to do. Have you looked at any world population growth charts recently? The rate was increasing for the entirety of human history up until 1968 where we peak at 2.1% growth per year. Lately however we've been dipping lower and lower and are currently at 1% growth rate.

Experts predict that by the year 2100 the growth rate will be 0.1%. If you look at the changes in our society since the 60s, there are some pretty substantial differences which have occurred, most of which are linked with the communism values above. Other recent trends can easily be linked with this population decline such as new abortion and euthanasia policies. It's not hard to see how these both fit nicely into their 500 million population goal.

2	Guide reproduction wisely — improving fitness and diversity.

This goal entails an implementation of reproduction limits. Basically either allowing people to have a child or forbidding it. This also flows from the first goal meaning that if you have a child and the population is over 500 million then they will murder them. By extension, anyone who is opposed to their 'New World Order', such as christians, will have no place in it and will be 'removed'.

The second half is even scarier - 'improving fitness' means genetically modifying human DNA to produce superior beings which is already being experimented with. To have a diverse population would mean having people from all over the world living together harmoniously, unfortunately that means that some countries such as China and India have too large a population - but according to their first goal anyway MOST countries have too high a population.

3	Unite humanity with a living new language.

This "Living, New Language" is in fact as old as time itself. It is the language of the emotions, appealing to the flesh through the five senses. It is about making life defining moral decisions based not upon the absolute truths of God's law, but feelings and perception. It is doing whatever feels good in the moment without regard for the long term consequences. Another expression of a living language is music. The Bible tells us that Satan was created as a living musical instrument. Within his body is the means to produce both rhythm and melody. Music is also used to great effect to manipulate the masses, such as those celebrities today who have sold their soul to the devil quite literally.

Or perhaps it speaks of an actual new language which will be implemented when the new world order arrives which everyone on earth has to learn? Only time will tell, because unfortunately they will succeed with their globalism goal.

4	Rule passion — faith — tradition — and all things with tempered reason.

A tempered reason could mean that rulings are decided justly, but it probably refers to a judgement based on the goals and values of the illuminati therefore condemning those harshly who oppose them. We know that literal beheadings will occur in the tribulation for all those who refuse to take the mark of the beast, which doesn't sound very 'tempered' to me.

5	Protect people and nations with fair laws and just courts.

This assumes that the court is a global court as per the wording and 'commandment' 6 below. Again, like number 4, the rulings will be based on their twisted values. Therefore 'fair' is not what anyone opposed to their values would call them.

6	Let all nations rule internally resolving external disputes in a world court.

Another plug at a global government led by the illuminati to guide the nations in their own understanding. Nations should govern and guide other nations otherwise it's a dictatorship on the entire planet. If a nation steps out of line, one or more nations band together to help put them back in place. How can this be done if the global government IS the corrupt one?

7	Avoid petty laws and useless officials.

This rule seems a bit unimportant and obvious to be able to go into much detail about what they mean by it, but useless officials could be those opposed to their goals. It could also mean that there will be very few rules to follow besides those they institute, which means anyone can basically do whatever they desire in the moment.

8	Balance personal rights with social duties.

This assumes that socialism or communism has been instituted in a nation already. A point to note is that the **system** is governing the personal rights and not the individual. It basically forces the population to do what the country needs when it needs it.

9	Prize truth — beauty — love — seeking harmony with the infinite.

'Truth', that's a laugh coming from those who use deception, trickery and lies to attain this goal of the new world order. Their entire founding is based on lying to further their goals, so naturally they are always going to have to hide the truth from their subjects - or risk an uprising. Prizing beauty seems a bit vain. Are they going to murder all those who don't have natural beauty or are disabled? That sounds a lot like Nazism. Prizing love is what they're already pushing with their twisted LGBTI agenda - which in the end, ends up hurting themselves and any children involved.

"The Infinite" is a plug to the otherworldly forces which they follow. In particular satan, as written by Albert Pike in his book "Morals and Dogma". Below is an excerpt from his book:
"Lucifer, the Son of the Morning! Is it he who bears the Light, and with its splendors intolerable blinds feeble, sensual, or selfish Souls? Doubt it not!""

10	Be not a cancer on the earth — Leave room for nature — Leave room for nature.

A further extension of the first rule by keeping the worlds population low by murdering those opposed to them and their goals. One of their primary themes has been the protection of the earth to save humanity from 'climate change'.

Plot Quotes

These are quotes by famous individuals highlighting the validity and truth of this shadow government.

If I Were The Devil

During the height of some of the fiercest geopolitical turmoil in 1965, Paul Harvey on his radio broadcast told the truth about many of the issues of his day through the means of a poem named "If I were the Devil". It clearly mirrors the 45 goals of communism listed above and how far they're progressing - even back in 1965.

If I were the devil … If I were the Prince of Darkness, I'd want to engulf the whole world in darkness. And I'd have a third of its real estate, and four-fifths of its population, but I wouldn't be happy until I had seized the ripest apple on the tree — Thee. So I'd set about however necessary to take over the United States. I'd subvert the churches first — I'd begin with a campaign of whispers. With the wisdom of a serpent, I would whisper to you as I whispered to Eve: 'Do as you please'.

To the young, I would whisper that 'The Bible is a myth.' I would convince them that man created God instead of the other way around. I would confide that what's bad is good, and what's good is 'square.' And the old, I would teach to pray, after me, 'Our Father, which art in Washington…'

And then I'd get organized. I'd educate authors in how to make lurid literature exciting, so that anything else would appear dull and uninteresting. I'd threaten TV with dirtier movies and vice versa. I'd pedal narcotics to whom I could. I'd sell alcohol to ladies and gentlemen of distinction. I'd tranquilize the rest with pills.

If I were the devil I'd soon have families at war with themselves, churches at war with themselves, and nations at war with themselves; until each in its turn was consumed. And with promises of higher ratings I'd have mesmerizing media fanning the flames. If I were the devil I would encourage schools to refine young intellects, but neglect to discipline emotions — just let those run wild, until before you knew it, you'd have to have drug sniffing dogs and metal detectors at every schoolhouse door.

Within a decade I'd have prisons overflowing, I'd have judges promoting pornography — soon I could evict God from the courthouse, then from the schoolhouse, and then from the houses of Congress. And in His own churches I would substitute psychology for religion, and deify science. I would lure priests and pastors into misusing boys and girls, and church money. If I were the devil I'd make the symbols of Easter an egg and the symbol of Christmas a bottle.

If I were the devil I'd take from those who have, and give to those who want until I had killed the incentive of the ambitious.

And what do you bet I could get whole states to promote gambling as the way to get rich? I would caution against extremes and hard work in Patriotism, in moral conduct. I would convince the young that marriage is old-fashioned, that swinging is more fun, that what you see on the TV is the way to be. And thus, I could undress you in public, and I could lure you into bed with diseases for which there is no cure. In other words, if I were the devil I'd just keep right on doing what he's doing." - ***Paul Harvey***

It's shocking that this is exactly what's been happening in the world the past hundred years, slowly at first but at a break-neck speed today. Satan has been slowly gaining ground in every part of society, from the church to the media to the schools until today, corruption and deceit reigns and there's no such thing as God.

The President and the Press

Below is the summary of a famous speech by President John F. Kennedy on the nature of the press, the shadow government and the communists.

President John F. Kennedy
Waldorf-Astoria Hotel, New York City
27 April 1961

Here's a summary of the speech above if you don't wish to read the whole article, three dots means a jump in the speech:
The very word "secrecy" is repugnant in a free and open society; and we are as a people inherently and historically opposed to secret societies, to secret oaths and to secret proceedings...Our way of life is under attack. Those who make themselves our enemy are advancing around the globe...no war ever posed a greater threat to our security.

If you are awaiting a finding of "clear and present danger," then I can only say that the danger has never been more clear and its presence has never been more imminent...For we are opposed around the world by a monolithic and ruthless conspiracy that relies primarily on covert means for expanding its sphere of influence–on infiltration instead of invasion, on subversion instead of elections, on intimidation instead of free choice, on guerrillas by night instead of armies by day.

It is a system which has conscripted vast human and material resources into the building of a tightly knit, highly efficient machine that combines military, diplomatic, intelligence, economic, scientific and political operations. Its preparations are concealed, not published. Its mistakes are buried, not headlined. Its dissenters are silenced, not praised. No expenditure is questioned, no rumor is printed, no secret is revealed.

Only headings 1-3 are included here. The rest can be downloaded from my online archives.

9 Interaction

This section is for interaction between something else as a form of entertainment such as humans, animals and AI.

Subheadings

1. Speech	**2. Sex**	**3. Cooperation**	**4. Competition**
5. Animal Interaction	**6. Robotic Interaction**		

1 Speech

An invigorating conversation which is interesting for all participants can often go on for hours. The following are different forms of speech.

- Dictating
- Debate
- Discussion
- Deliberation
- Dialog

- Bonding
- Romance

Topic Starters

Preparedness/Survival Related Questions

- If starving extended family members came knocking on your door asking for food in a major shortage, would you give them any?
- If you had to evacuate your home with only what you could carry on your back, what five essential items would you prioritize?
- What's the most valuable survival skill that can't be bought or packed? How do you cultivate it?
- In a long-term grid-down scenario, what modern convenience would you miss the most, and how would you adapt without it?
- If you found yourself unexpectedly stranded in the wilderness, what's the very first thing you would do, and why is that your priority?
- How do you think living in an urban, suburban, or rural environment impacts your preparedness strategies for different types of emergencies?
- What's a common misconception about survival that you believe could put people at risk?
- What role does community play in effective disaster preparedness and recovery?
- If you could only learn one method of primitive skill (e.g., fire starting, water purification, shelter building), which would you choose and why?
- What's the psychological impact of a prolonged survival situation, and how would you try to maintain morale and mental well-being?
- How do you assess risk in your daily life, and how does that influence your approach to preparedness?
- If you had to teach someone only one critical piece of advice about self-reliance in a crisis, what would it be?

- How do personal values, ethics, and morality play a role when considering difficult decisions in a survival scenario?
- How do you balance the desire to be prepared for potential crises with avoiding a life dominated by fear or anxiety about them?
- How do you discern reliable information from misinformation during a global emergency when traditional news sources might be compromised?
- What's a historical event or real-life survival story that offers profound lessons for modern preparedness?
- What ethical dilemmas might arise when resources are scarce, and how would you navigate them?
- How do you prepare for the unforeseen or "black swan" events, rather than just the commonly anticipated disasters?
- What role does hope play in survival, and how can it be maintained in the face of overwhelming odds?
- If you could only keep five tools from your current household for survival, what would they be and what makes them indispensable?
- What's one aspect of modern society that you believe makes us inherently less prepared for genuine adversity than past generations?
- How would you introduce the concept of preparedness to someone who finds it overwhelming or dismisses it as unnecessary?
- How do you plan for the emotional toll of a prolonged crisis, not just the physical demands?
- If a crisis forced people to re-evaluate what truly matters, what do you think would become humanity's most cherished non-material possessions?

Other Questions

- If you could have a one-hour conversation with any historical figure, living or dead, who would it be and what would be your first question?
- What makes a person truly evil? Are they born that way or did their environment make them that way?
- What are the highest and lowest points of your life?
- How have your strengths help you to succeed? How have your faults hindered you?
- What are your biggest goals for your life? What progress have you made in attaining them?
- Who are you really? Who is behind the mask that you show to the rest of the world?
- What is holding you back from being the person you want to be?
- How do you think you will die?
- Is human nature constant or is it moulded by culture? Can human nature be completely changed by culture or society?
- If pressing a button meant you received 5 million dollars but it also killed 5 people somewhere in the world, would you press it? What if it killed only 1 person or killed 20 people? What if the people were those you were friends with on social media?
- What aspects of humans have made us a successful species?
- If you could perfectly understand and communicate with any animal, which would it be and why?
- What is a belief you once held very strongly that you've since changed your mind about? What caused that shift?
- If happiness were the national currency, what kind of work would guarantee you the most wealth?
- What do you believe is the most significant challenge facing humanity in the next 50 years, and how do you think it can be addressed?
- If you could choose to erase one memory from your life, what would it be and why? How do you think your life would be different without it?
- What does "legacy" mean to you, and what kind of legacy, if any, do you hope to leave behind?
- In what ways do you think technology is enhancing or detracting from genuine human connection?
- If you had to teach one thing to every child in the world, what universal lesson would you choose?
- What is a personal truth you've discovered that profoundly changed your perspective on life, love, or the universe?
- How do you define "freedom," and do you believe true freedom is attainable in modern society?
- What role do you think art and creativity play in understanding the human condition?
- Where's your life headed?
- If you were stuck on a desert island forever, what book and food would you want and who would you want there with you?
- If you could design your ideal society from scratch, what three core principles would it be built upon?
- What's a hidden talent or passion you have that most people don't know about, and what draws you to it?
- How do you reconcile the pursuit of individual happiness with the responsibility we have to the collective good?
- What is your greatest regret in life?
- If you could perfectly master one skill instantly, what would it be and how would you use it to make a positive impact?
- What's a small act of kindness you've witnessed or experienced that had a surprisingly big impact on you?
- If you could have a "reset" button for one aspect of your life (career, relationships, health, etc.), would you press it? Why or why not?
- What's a common piece of advice you hear that you strongly disagree with, and what's your alternative perspective?
- When do you feel most authentically yourself? What are you doing, and who are you with?
- If you had to give up all but three modern conveniences, which would you keep and why?
- What's something you've learned recently that challenged a long-held assumption you had about the world?
- How do you distinguish between what you truly want and what society or others tell you should want?
- What's a book, movie, or piece of music that profoundly changed the way you see the world?
- If you could send a single message back in time to your younger self, what wisdom would you impart?
- What's a small decision you made that, in hindsight, had a surprisingly large impact on your life's trajectory?
- If you could observe any historical event without being able to intervene, which one would you choose and why?
- How do you personally define "success," and has that definition changed over time for you?
- What's a skill or hobby you've always wanted to learn, and what holds you back from pursuing it?
- If you could instigate one widespread cultural shift, what would it be and what impact do you hope it would have?
- What's something you believe is often misunderstood about your generation?
- What's a piece of advice you'd give to someone struggling to find their purpose or passion?
- If you could create a new national holiday, what would it celebrate and how would people observe it?
- If you could instantly solve one global problem, but it required a significant personal sacrifice, would you do it?

ENTERTAINMENT Interaction Speech Topic Starters

- Is what we perceive reality or just a construct of our minds? Can our minds correctly interpret reality or is reality subjective?
- What makes people believe absurd conspiracy theories?
- What's something terrifying that we've all come to accept as a fact of life?
- What does honour mean to you? How important is it to you? Does your culture value honour? What exemplifies honour in your culture?
- How important are morals in a healthy society? What are the most important morals for citizens to have?
- What is a miracle that happens every day?
- What are the most important factors in maintaining a well functioning society? What does it mean for a society to function well?
- Do people have an obligation to help others or should people be responsible for helping themselves?
- Can people with vastly different cultural backgrounds live together peacefully? How?
- What is a year of life worth? How about a day?
- If sacrificing your own life would save the lives of a specific number of strangers, how many strangers would need to be saved for you to sacrifice your own life? What if the people were friends? How about family?
- If you died today, how would you be remembered?
- Are some lives more valuable than others?
- What does it mean to die well?
- If you were given an envelope with the time and date of your death inside, would you open it?
- If you died today, what regrets would you have about your life?
- Is taking a life ever justified? If so, where is the line? When is a person's life considered forfeit?
- What do you think about the singularity? The idea that eventually artificial intelligence will advance to the point where computers are more intelligent than humans.
- What are the pros and cons of colonizing other planets? How could this help or hurt the human race?
- Will humans as a species ever be able to work together as a whole to achieve a goal? What is holding humans back from working together on a global scale?
- Are emotions necessary for human survival? Why or why not?
- What is the most beneficial emotion? How about the most destructive?

2 Sex

Sexual intercourse (or coitus or copulation) is principally the insertion and thrusting of the penis, usually when erect, into the vagina for sexual pleasure, reproduction, or both.

Bandoleer	While the woman lays on her back and lifts both knees up towards her chest, the man kneels facing her. She can then rest her feet on his chest, while he places his forearms on her knees. The woman can then grab the man's thighs and pull him closer for deeper penetration. The more he presses down on her knees, the greater the pleasure for her. A relatively simple sex position, which doesn't require too much flexibility.
Afternoon Delight	The man lays on his side, while the woman lays on her back at a right angle to her partner. She puts her knees over his hip to allow easy penetration. Extremely easy and perfect for a lazy Sunday afternoon or if you need to slow it down a bit during a long sex session.
The Eagle	The woman lays on her back with her legs in the air and knees slightly bent (she may need a cushion under her bottom to make it more comfortable). The man then kneels between her legs and holds onto her ankles while he enters her. Relatively easy and deep penetration.
The Visitor	This position is ideal for an impromptu sex session. The man and the woman stand face to face and he stimulates her genitals with his penis before penetrating her. An easy position if the woman is a similar height to the man (or wearing heels), but if not a table or work surface will help!
The Clasp	He stands and she wraps her legs around his waist while he supports her by holding her bottom and back. For more support and deeper penetration she can rest her back against a wall. Ideal for anytime/anywhere sex, but does require a certain degree of strength and energy from both the man and woman.
The Toad	The woman lies back with her legs open, while the man lies between her legs and slowly penetrates her. For greater intimacy, she can wrap her legs around him and control the pressure of his grinding by gently pressing on his buttocks with her feet. Simple and an ideal sex position for a slower pace of lovemaking.
The Classic	While similar to the missionary, the classic position involves the woman laying on her back with a cushion under her bottom. This slight tilt of the pelvis allows for deeper penetration as the man places himself between her legs and enters her.
The Snail	The woman lies on her back and pulls her knees up to her chest. The man kneels down and enters her. She can then rest her feet on his shoulders, while he supports himself with his hands either side of her shoulders. The penetration is very deep in his sex position, so be careful not to go too fast as it may cause pain for the woman.
From Behind	The man stands behind the woman and enters her. He's in control of the thrusts. She may find it easier to balance with a wall to lean against. This sex position is easy for some, but doesn't work so well if you're not similar heights.
Balancing Act	The man lies on his back with his legs apart while the woman sits down between his thighs. The woman must then curl her body up into a ball while the man supports her. Her hands are free to touch herself or touch his perineum. This position requires a certain degree of strength from both parties.
The Frog	The man sits on the edge of the bed with his feet on the floor while the woman crouches (like a frog) on his lap. She can then move up and down to control the penetration, while pressing on his thighs for support. An easy position for the man, but requires strength and balance from the woman.
The Column	The woman stands in front of the man with her back to him and their arms intertwined. The man can then penetrate the woman from behind. The woman may find it easier to lean on a table.
The Basket	The man sits with one leg stretched out and the other leg bent at the knee to help him balance. The woman sits on his lap. While she can control most of the movement, he also has some control with his hands on her hips. He is also in the ideal position to kiss and suck her nipples while having sex.
The Kneel	In this sex position the woman and the man both kneel. The woman puts her legs either side of the man's so he can penetrate her. They can both wrap their arms around each other. A relatively easy, and yet extremely passionate position.
The Reverse Cowgirl	The reverse cowgirl involves the man laying on his back with the woman sitting astride him with her back to him. The woman is in full control of all the movements. A really simple sex position, which almost anyone can do. Go on, give it a go!
The Lotus Blossom	The man sits with his legs crossed while the woman sits on his lap with her legs wrapped around his waist. An easy, intimate sex position if you are relatively flexible.
The Close-Up	The man and woman both lie on their sides with their legs pulled up to their chests. The woman faces away from the man and pushes her hips down into his crotch. A very easy, gentle sex position, which can be extremely intimate too.

Doggy Style	A classic position which almost anyone can do. The woman crouches on all fours, taking her weight on her hands, while her partner enters her from behind. While the woman can press back into him, the man is in control of most of the movement.
The Padlock	The woman sits on the edge of a high piece of furniture, for example a table or a washing machine. She leans back and supports herself with her arms. The man stands in front of her. She can wrap her legs around his waist as he enters her.
The Crossed Keys	The woman lies on her back with her legs in the air. Her bottom needs to be at the edge of the bed and her legs must be crossed. The man stands facing her and holds onto her legs while he penetrates her.
The Crisscross	The woman lays on her side facing away from the man with her legs slightly parted. The man also lays on his side, but at a right angle to the woman, and slides in between her legs to enter her.
The Erotic V	The woman sits on the edge of a table and the man stands in front of her. The woman needs to lift her legs right up and rest the back of her knees on the man's shoulders. She can also wrap her arms around his neck for support, while he can grip her bottom to help control the motion.
The X-Rated	The man lies flat on his back with a pillow under his head. The woman lies on top of him facing away from him with her legs either side of his waist and her arms wrapped around his legs. She is in the perfect position to slide up and down, while he has an x-rated view.
The Seduction	The woman lays on her back with her legs bent underneath her body - only attempt this if you are quite flexible. The man then lays on top of the woman to penetrate her.
The Lustful Leg	Another position which requires a great deal of flexibility. The man and the woman both stand facing each other. The woman starts by placing her leg on the bed so the man can enter her. Once inside he can slowly help her to raise her leg onto his shoulder. Careful not to lose your balance and topple over!
The Butterfly	Similar to the mermaid, the butterfly position involves having sex while the woman lays on a relatively low table with her bottom right on the edge. The man stands and helps her raise her hips with his hands. He penetrates her while she rests her legs on his shoulders.
The Side Saddle	An easy sex position and great if you fancy trying some a little bit different, which doesn't require too much effort. The man lays on his back, with a pillow behind his head and his legs stretched out. The woman sits across him with her legs on one side of his waist and her hands on the other, supporting her weight. As he penetrates her she can slowly open and close her legs, while making swivelling motions to drive him wild.
The G-Force	In this sex position the woman lays on her back and pulls her knees right up to her chest. The man kneels behind her and lifts her torso off the ground so her back is parallel to his thighs. She can help herself balance by holding onto his legs, while he holds onto her feet and penetrates her.

3 Cooperation

The action or process of working together to the same end.

4 Competition

An event or contest in which people take part in order to establish superiority or supremacy in a particular area.

5 Animal Interaction

Animals provide more then just meat and resources, you can talk to them, be their best friend, teach them tricks which will all help keep you sane.

Cuddling	Sometimes you just need a good cuddle with a pet, especially when there's nobody else around.
Games	A simple game of throwing an object and having it returned to you by the animal.
Taming	If you don't have an animal, you could always find one in the wild and domesticate it.
Training	You could train pets to attack a target or assist you around the campsite.
Hunting	Hunted for entertainment, as opposed to hunted for food.
Competing	Watched when they compete with each other
Care	Having something to look after and take care of gives a sense of purpose and drive in life.

6 AI/Robotic Interaction

Robotic interaction is becoming more and more common as AI learns to interpret and understand more language and have conversations based on your input.

AI Chatbots	There's a lot of Artificial Intelligence chat engines you can talk to today. Many of them can be downloaded and used completely offline if you have a sufficiently powerful PC. All you need is an interpreter such as Jan on PC or Layla on Android and an 'Instruct' GGUF file.
Game NPC	If you have access to modern games, you can play something like Halo or Skyrim and respond to the retorts of the Non-Player-Characters. In Skyrim you can even take a wife/husband and role-play a completely different life to take your mind off the world.
Spoken	There are a couple of ways you can speak to an AI assistant now, although generally it requires you to have a goal in mind to accomplish such as asking what the weather is. Unfortunately they often require the internet.

10 Live Entertainment

Any form of entertainment which is participated in or viewed while it's occurring, such as a dance, sport or cinema.

Live Entertainment

Live entertainment is a public event featuring people showcasing talents or feats that is watched and contributed to in person. It can include magic shows, theatres, circus etc.

Circus	A circus is a special type of theatrical performance, involving a variety of physical skills such as acrobatics and juggling and sometimes performing animals.
Banquets	Banquets have been a venue for entertainment since ancient times, continuing until the 21st century, when they are still being used for many of their original purposes – to impress visitors, especially important ones; to show hospitality; as an occasion to showcase supporting entertainments such as music or dancing, or both.
Music	Music is a supporting component of many kinds of entertainment and most kinds of performance. For example, it is used to enhance storytelling, it is indispensable in dance and opera, and is usually incorporated into dramatic film or theatre productions. E.g. Concerts and Orchestras.
Dance	The many forms of dance provide entertainment for all age groups and cultures. Dance can be serious in tone, such as when it is used to express a culture's history or important stories; it may be provocative; or it may put in the service of comedy.
Fairs & Fetes	Fairs and exhibitions have existed since ancient and medieval times, displaying wealth, innovations and objects for trade and offering specific entertainments as well as being places of entertainment in themselves.
Magic Shows	The form of entertainment known as stage magic or conjuring and recognisable as performance, is based on traditions and texts of magical rites and dogmas that have been a part of most cultural traditions since ancient times.
Street Performance	Street entertainment, street performance or "busking" are forms of performance that have been meeting the public's need for entertainment for centuries.
Parade	Parades are held for a range of purposes, often more than one. Whether their mood is sombre or festive, being public events that are designed to attract attention and activities that necessarily divert normal traffic, parades have a clear entertainment value to their audiences.
Performance	Live performances before an audience constitute a major form of entertainment, especially before the invention of audio and video recording. E.g. Fashion Shows.
Comedy Shows	Comedy is both a genre of entertainment and a component of it, providing laughter and amusement, whether the comedy is the sole purpose or used as a form of contrast in an otherwise serious piece.
Public Punishment	Although most forms of entertainment have evolved and continued over time, some once-popular forms are no longer as acceptable. For example, during earlier centuries in Europe, watching or participating in the punishment of criminals or social outcasts was an accepted and popular form of entertainment.
Sport	Sporting competitions have always provided entertainment for crowds. To distinguish the players from the audience, the latter are often known as spectators.
Shopping & Markets	Whether in a medieval market or a small shop, "shopping always offered forms of exhilaration that took one away from the everyday".

Exhibition Entertainment

An exhibition is a public event of artform observation where pictures or other non-living objects are displayed with occasional interaction, for example at an art gallery or science centre.

Storytelling	The "ancient craft of communicating events and experiences, using words, images, sounds and gestures" by telling a story is not only the means by which people passed on their cultural values and traditions and history from one generation to another, it has been an important part of most forms of entertainment ever since the earliest times. Stories are still told in the early forms, for example, around a fire while camping, or when listening to the stories of another culture as a tourist. The earliest storytelling sequences we possess, now of course, committed to writing, were undoubtedly originally a speaking from mouth to ear and their force as entertainment derived from the very same elements we today enjoy in films and novels."
Showcase	Showcases and exhibitions have existed since ancient and medieval times, displaying wealth, innovations and objects for trade and offering specific entertainments as well as being places of entertainment in themselves. E.g: Museums and Art Shows.
Theatre	Theatre performances, typically dramatic or musical, are presented on a stage for an audience and have a history that goes back to Hellenistic times when "leading musicians and actors" performed widely at "poetical competitions", for example at "Delphi, Delos, Ephesus".
Cinema	Films are a major form of entertainment, although not all films have entertainment as their primary purpose: documentary film, for example, aims to create a record or inform, although the two purposes often work together.
Fireworks	Fireworks are a part of many public entertainments and have retained an enduring popularity since they became a "crowning feature of elaborate celebrations" in the 17th century.

Transport

How to use any air, sea or land transportation

"Success is a journey. The best form of transport is happiness."
Roy Smoothe

Introduction

A category about every method of transport and information on how to drive, maintain and repair them.

Purpose	The aim of TRANSPORT is to provide information of modern transportation systems and how to drive and control each one.
Lost?	• For military transportation systems, see the WARFARE section. • For information on scavenging items from vehicles, see the LOCATIONS section. • To find your position, see the NAVIGATION section. • For air communications, see the COMMUNICATION section. • For information on stealth driving, see the SECURITY section. • For information on the different terrain types when driving off-road, see the SURVIVAL section.

Contents

1 Transport Type

Transport Type

Preppers weigh the impact of the disaster and decide to bug-in or bug-out. Be a grey man in a disaster, blend in to avoid suspicion. Work out how long this disaster will last and calculate how long your supplies will last. Get your group together and discuss a plan of action for the disaster. Get as much knowledge about the disaster as possible and keep listening via radio.

Transports

The first decision you need to make is whether to bug-in or bug-out and weigh the options for each. If you've decided to bug out the next step is choosing a method of bugging out which isn't easy because the variables could be changing often. You need to have multiple contingency plans for the various types of disasters that are possible in your area.

2 On Foot

Techniques on walking and hiking through any terrain.

Walking

Navigation	● Know how to read maps, topography and compasses. ● Know how to navigate via your watch and the stars. ● Don't rely on a GPS and use landmarks for storing caches. ● Ensure highest perception when navigating to avoid dangerous situations. See the NAVIGATION section for more.	**O.O.D.A Loop** ● Observation ● Orientation ● Decision ● Action
Walking	● Ensure you're able to carry your BOB the distance you're walking prior to the event. ● Have a hiking plan set out with checkpoints to rest at. ● Have hidden caches along the way to avoid carrying heavy water and food.	

On Short Grass

Short grass is any grass up to about 10cm (4 in) long. This is probably the easiest medium to walk on as it provides a good amount of traction and won't slow you down like taller grass. It also much harder for critters such as ticks and leeches to grab hold of your pants as you walk. It's safer as well due to snakes not being able to easily hide in short grass.

In Long Grass

Grass becomes 'long' around 10cm (4 in) high all the way to about 40cm (15.7 in).

In Tall Grass

Grass becomes 'tall' around 40cm (15.7 in) high and up. In tall grass your ability to navigate it is severely impeded if you want to remain safe from snakes. It's recommended that you stomp as you walk to ward off any creatures that are sleeping nearby which can cause you harm - however there are some that won't get out of the way even if they know you're there.

On Concrete & Bitumen

The second easiest terrain to walk on. Concrete eliminates the risks of uneven terrain and usually provides paths or roads for many miles in multiple directions. The only risks could be falling and scraping your skin or at worst, breaking a bone. Another risk could be the heat radiated from it on a hot summers day in warm climates, but this would only apply if you aren't wearing shoes.

On Rocks

Rocks can come in a variety of different sizes, from 1x1cm ones to pebbles, to 1x1m rocks. As you probably know, the easiest ones to walk on are the small ones, the bigger the rocks get, the more skill it will take to balance on the irregular shapes they make. Be careful when walking on large rocks as your weight could throw off their weight distribution and cause them to roll over, bringing you down with them. Rocks can also be extremely slippery when they are found near a source of water such as lakes, rivers or the beach. Don't walk on submerged rocks which have the green algae on them as you will slip off almost instantly.

In Rain

Rain isn't a type of terrain you can walk on but it still provides a vastly different experience if you're hiking in it. When hiking in rain you will generally want to be wearing a poncho to help reduce the amount of water caught by your clothes. A backpack poncho will also be essential in keeping your gear dry and to help prevent degradation of gear such as rust on metal. If your socks get damp during the hike, be sure to take them off when you reach camp and dry out your feet - and the socks to help prevent fungal diseases. Take care in the rain as rocks can become very slippery and can easily cause a broken bone when slipped on. Hypothermia is also a risk in colder climates if you're hiking for long periods in a cold, wet environment. If you're starting to go numb, take a break, or set up camp for the night and dry off and recover your body.

In Shallow Water

Shallow water is any stream or lake up to knee height. After this it slowly merges into deep water. Leeches can be found in slow-moving shallow water, so be sure to wear full length pants tucked into your socks if you're in warm weather, or take your long trowsers off while you cross in cold weather and check yourself thoroughtly once you emerge the other side before drying yourself off and putting them back on.

In Deep Water

Deep water is considered anything over knee height, but particularly waist height for an average adult. If you're planning on crossing water by swimming, see the SURVIVAL section. There are a lot of dangers to crossing deep water such as alligators, crocodiles, unknown objects under the water - such as rusty wire, even sharks could potentially hide themselves.

On Sand

Sand is notoriously unstable, every step you take will shift the ground you walk on and make hiking much slower and burning more calories. In deserts, sand is extremely fine and can find its way into every crack of your boots and into your backpack.

On Dirt

Dirt is the third easiest medium to walk on after grass and cement and is generally level and stable. Keep your eye out for rain which can quickly turn dirt into much through and make hiking much harder and slower.

In Thick Undergrowth

Walking through thick undergrowth such as in a jungle can prove challenging to anybody regardless of their experience level. Your legs can get easily cut up and exposed to bacteria and viruses without the proper protection. It's recommended to have at least one pair of thick full-length pants which are resistant to tearing. A pair of gaiters is virtually essential in undergrowth such as in a jungle without any form of natural path. They will not only protect your legs from scratches but also small animals you may encounter which are startled by your presence. Tuck your pants into your socks to help prevent bugs such as ticks and leeches getting in easily and it's recommended to wear white clothes to spot them easier. 30 minutes or so you should stop and do a tick and leech check, just in case one is working its way up your pants.

In Mud

If you're planning on walking through any form of thick mud, be sure to bring a good pair of gumboots to protect your other pair of shoes. Try to work out the depth of the mud before entering it as it may look quite shallow at first, but sometimes can be knee, or even waist deep after entering. Walk with a long poking stick to test the depth ahead of you and make alterations to your course if it becomes too deep. In general you should try to go around any regions of mud as it will slow you down greatly and will often make your clothes and bag much harder to clean.

On Light Snow

Snow is considered 'Light Snow' if it's ankle height or less. Light snow generally isn't much of a problem for walking through if you can tolerate the cold. There's always the chance you can slip though and you won't have the depth of snow to help break your fall, so arguably light snow is more dangerous than deep snow.

In Deep Snow

Snow would be considered deep when your feet sink down to the height of your ankle or calf without snowshoes. If you're doing long distance hiking it's recommended you use snowshoes or use a form of makeshift snowshoes to make walking on deep snow easier and to prevent your legs getting cold.

Hiking

Hiking differs from walking mainly due to the terrain and distance covered. Hiking is generally out in the bush, following trails or walking anywhere where there's no set paths or roads.

Pacing

Appalachian Trail Markings

Distance between blazes varies, but if you have gone a few hundred yards without seeing a blaze, stop. Retrace your steps until you locate a blaze. Then, check to make sure you haven't missed a turn. When your map or guidebook indicates one route, and the blazes show another, follow the blazes.

Single White Blazes	These 2 inch by 6 inch vertical rectangles are painted in white paint on trees, rocks, and sign posts, showing hikers the Appalachian Trail. White blazes may be located on trees, rocks, posts or guardrails, among other places.
Double White Blazes	Two white blazes, one above the other, signal an obscure turn, route changes, an incoming side trail or other situation that requires you to be especially alert to changes in direction. Sometimes the two blazes will be offset in the direction of the turn.
Blue Blazes	A Blue Blaze is a spur trail branching off of the Appalachian Trail. Blue blazed trails could lead to a vista, water source, shelter or campground, or some unusual natural feature.
Rock Cairns	These rock piles identify the route above treeline and where snow and fog may obscure paints blazes.

Swimming

See the SURVIVAL section on various swimming and river crossing techniques.

3 Animal

Any animals which can be used as transport.

Horse

Horses were one of the first methods of transportation and is still the most popular non-technology form of transportation. They require loving and taking care of and you can't push them too hard for too long but their strength comes when technology is useless.

Saddle a Horse

Learn to tack and bridle your horse. Before you ride, a horse needs to be outfitted with a saddle and bridle.
- To saddle a horse, position the saddle blanket above the horse's withers and push it back toward the hind-legs to smooth the hair. Place the saddle behind the shoulder and pull the blanket into the empty area at the front of the saddle.
- Attach the cinch or girth and tighten it gently, allowing the horse enough room to exhale comfortably. You should be able to fit two fingers under the cinch or girth, but no more.
- Make sure you've got a bridle appropriate for your horse's size. Gently place the bit near the horses mouth. Most horses will open their mouths as they're used to bridles, but if your horse doesn't gently push your fingers into the sides of the horse's mouth. Slip the bit in slowly, then slip the top of the bridle over the horse's ears. Secure all the straps and buckles, buckling tight enough that you can only comfortably fit one finger under the straps.

Mounting a Horse

1	Mount your horse. The first thing you'll want to do when riding a horse is to do some groundwork. You don't need to do heaps and make your horse tired, but you only need to do a little bit of groundwork! The next thing you will want to do is mount your horse correctly! Many people are intimidated by the idea of mounting a horse but if you stay calm it should be fun and easy. ● If you're a first time rider, it's not a bad idea to use a mounting block. This is a small wooden structure that you can use to stand on in order to mount the horse. You should also ask someone to hold the horse's head as you mount. Mount the horse from its left near side. Place your left foot in the left stirrup and launch your body up and over. Next, lift the right leg gently over the horse's back and insert your right foot into the right stirrup. ● Select a well-trained horse if you're a beginner. Horses that are younger or poorly trained may shift and move during mounting. Choose an older horse with a reputation for being calm and cooperative during rides. ● If someone doesn't hold the horse's head as you mount, you should hold the reins tightly in your left hand, but not so tightly that the horse backs away from the pressure
2	Position yourself for balance. Once in the saddle, take a moment to make sure you're in the proper position for balance. Keep your back straight. Keep in mind when you ride a horse you should be able to draw a straight line through your ear, shoulder, hip, and heel. Keep your shoulders even and straight as well, with the bulk of your weight resting on your seat bones in your buttocks
3	Get your legs in the right position. Once you feel securely balanced, get your legs into the proper position. This can be particularly difficult for beginning riders so take time to make sure your legs are positioned properly. Keep your heels right under your hips. ● Your legs should be turned inward. Many beginning riders have their legs turned outward, as this can feel more natural, with their knees sticking out. Remember, you're sort of hugging the horse with your legs. You shouldn't squeeze the horse too tightly, but have your legs curved inwards towards the horse. ● Your toes should rest higher than your heels. An easy stretch or practice for this is to stand on something higher than the ground or even a staircase and push your heels down keeping the balls of your feet on the staircase.
4	Hold the reins properly. Once your legs are in the right position, make sure you're holding the reins properly. How you hold the reins depends on whether you're riding English or Western. ● For English style, make a fist and then pass the reins through the fist so the loop of the reins faces upward. Then, remove both your pinky fingers from the fist and place them on the outside of the reins. Place your thumbs on top of the reins, securing them in place. ● In Western, the reins do not form a loop. The western bridle has reins that are knotted at the top. Keep the reins loose at all times and hold them in two fists.

Riding a Horse

1	Learn the different ways to signal your horse to move. When riding English style, there are a variety of ways you can signal your horse to move. ● Starting off, try gently squeezing your horse's side with your legs. This should signal your horse to walk. ● If your horse does not respond to this, he may need further prompting. You can gently kick your horse with your heels. Do not kick too hard, however. While horses have thick hides, they may experience pain if you kick with too much force. A gentle tapping is generally all it takes to get a horse to walk. ● Verbal cues also help in some cases. Depending on how a horse was trained, he may respond to clicking of the tongue and other noises. Ask the horse's trainer if there are any noises he responds to.
2	Follow the movements of a horses head with your arms. When a horse walks, canters, or gallops, his head moves back and forth with the rhythm of his body. Allow your hands to bob back and forth with the horse's head. Not following the horse's movements can hurt the horse.
3	Learn to steer. It's important you learn how to steer your horse. Steering in English style if fairly self explanatory. ● You keep more contact with the horse's mouth while riding English. To signal the horse to turn right, very lightly pull back with your right hand. To signal the horse to turn left, very lightly pull back with your left hand. If the horse does not respond to the lighter pulling, you can gradually begin to pull slightly harder until the horse responds. ● You should also use your legs and body to signal a horse to move. Looking in the direction you wish to move helps. Horse's can feel your seat bones move. You should also gently squeeze your legs to signal a horse to change direction. For example, squeeze your left leg if you want your horse to turn right as the horse will want to move away from the pressure.
4	Learn how to trot. Once you're confident at the walk, gently press your legs into the horse's sides to cue the horse to trot. Sit deep in the saddle and keep contact with your legs. Be careful to keep your elbows relaxed, so you don't jerk on your horse's mouth. ● Some riders prefer to do a "posting trot" as opposed to a sitting trot. This can be more comfortable as a trot is a bouncing gait. To do a "posting trot" simply rise when the horses outside shoulder moves forwards, and gently sit back down in the saddle, as to avoid bouncing heavily on the horses back.
5	Move your outside leg back and squeeze to canter the horse. Cantering is a quicker three-beat speed that's natural to all horses. When you canter, your seat will roll with the canter and you stay in the position you normally ride in. Before you canter, make sure you are comfortable with both posting trot and sitting trot as both of these are major key points. Getting the timing right to get a horse to canter takes time. ● Try not to tense up. Most beginners will find it beneficial to hold onto a saddle or neck strap while learning to canter to help with their balance so they don't fall. ● If your horse just moves into a faster trot when you signal it to canter, ask your horse to walk and continue asking him to canter from the walk instead of the trot. Before learning to canter make sure you know posting trot, and sitting trot. Before cantering, gently squeeze your outside rein to slow your horse to a half halt in a trot before using your inside leg by the girth and then soon adding your outside leg behind the girth to give your horse a bit of a push forward.
6	Practice more advanced riding as you feel ready. Galloping, jumping, and dressage tricks are all fun to learn in English style. However, you should hold off until you've mastered the basics. Spend at least a few months practicing the above techniques before trying anything new. Galloping and jumping especially can be dangerous if you're inexperienced.

Riding a Horse (Western Style)

1	Learn to neck rein. Steering is slightly different in Western style than it is in English style When riding Western, you use a technique called "neck reining." ● Neck reining means you hold the reins loosely and gently touch the horse's neck to signal movements. ● To turn right, move the reins across the horse's neck to the right. To go left, move the reins across the horse's neck to the left. ● Always hold the reins in your left hand. Keep your right hand on your right thigh. ● As with English riding, make sure you use your full body to steer as well. Use your legs and seat bones in addition to your hands.
2	Direct rein during emergencies. If you need to steer your horse quickly, it's recommended you momentarily switch to English style steering. If your horse is not responding to neck reining, grab the reins in both hands. Gently pull or squeeze the left rein to turn left and the right rein to turn right.
3	Walk your horse. Start out walking gently. In Western, you also squeeze your horse to get him to walk. You should follow the motion of his head again, but as you hold the reins looser you might not move your hands as much as you would in English.
4	Jog your horse. While your horse is walking, squeeze his sides gently to signal to him to jog. Trotting is not usually a part of Western style riding. ● A jog is a slow, steady gait. It's a little quicker paced than a walk but not as jaunty as an English trot. ● You can easily sit in a Western jog. Posting trot is not necessary when riding western style.

Camel

How to ride a camel.

Riding a Camel

1	Wear long pants and long socks to protect your skin. Camels have an odd, side-to-side gait that causes a lot of friction if you aren't prepared. And the last thing you want is rough, straw-like camel hairs grinding up and down your soft legs. Your socks should come up as high as you can get them since the motion often hikes your pants up uncomfortably. Other clothing essentials include: ● A hat and sunglasses to protect your face from the sun. ● A long scarf or bandanna to protect your face in case of a dust storm. ● Dust goggles, especially if the forecast hints at possible storms.
2	Approach the sitting camel from the side, slowly and confidently. Don't look it in the eyes if you're nervous. Just stride up to it purposefully, coming from a diagonal angle. Unless you're a pro or have help, you're only going to mount the camel if the beast is sitting. With most guides and groups, the chance of agitating a camel is pretty low. However, there is no reason to take unnecessary risks.
3	Throw your leg over the middle of the humps and quickly mount it. Getting on the camel is the hardest part of riding. Do it quickly, using your momentum as a guide. There is usually a stirrup on one side for your foot. Step up on this stirrup and get your other leg over and around. ● You want to be straddling the camel to keep your balance as you start riding. Once the camel stands up you can then move your legs to get more comfortable. ● There will be a handle on the front of the saddle to help you hold on as you get up. ● Some people actually mount by "leapfrogging" from behind the camel. Trust your guide's judgement if he/she suggests this — they know their animals best.
4	Lean backwards as the camel starts to stand. Camels stand up with their back legs first. If you're not careful, they'll throw you face first into their necks. Hold onto the saddle and lean back to counteract the camel's motion.
5	Slowly lean forward as it gets onto its front legs. Once it has sure footing with the back legs, it will move to the front. Slowly lean forward as the camel pushes up so that you end up with your back straight.
6	Cross one or both legs up on the saddle. While straddling the beast like a horse may seem more natural, camel riders have far more comfort when their legs are up and crossed. This better distributes your weight along the humps, saving your tailbone from unnecessary pain. Wrap one or both legs around the saddle post to look like a pro. ● Without your legs clamped to the sides, you can sway with the camel's natural gait much more freely. ● If you're more comfortable straddling, that's fine! The leg cross is not an absolute must, although it is more comfortable on long rides.
7	Let yourself sway with the camel. A camel's walk is odd, irregular, and herky-jerky. It is not like the measured gait of a horse, so you need to ride accordingly. Instead of fighting it, let your body swing back and forth, holding onto the saddle post for support. ● There is often another post behind your seat. Holding on to both of them, with a hand in front and a hand behind, puts you in line with the camel's body and makes it easier to work with its movements. ● Tie in any valuables and electronics. This movement can easily cause things to shake loose and fall if you're not careful.
8	Do not try and control the animal. Unfortunately, camels won't listen. Camels will listen to their master, however, and follow the line in front of them. While they may respond to the occasional tug or push, you shouldn't try to steer or direct them — they'll just be unhappy with it.
9	Relax. This isn't just for your peace of mind. Loosening your muscles and taking a deep breath will also calm the animal down. Other camels may nip or play with your ride, but if you keep calm and cool, nothing will get out of hand. Panicking, however, may cause the creatures to panic as well. The calmer you are the calmer your ride will be. ● Once you get used to the gait, relax your grip a bit. Take a deep breath. ● Let yourself move around, but trust that you won't fall off. You'll get used to it quickly enough.
10	Wait out any spooked or panicked camels with calm, even words. If the camel gets spooked or starts moving too quickly, stay calm. Keep a firm, but not tugging, grip on the reins and speak calmly until the camel relaxes. If you can, try to use the reins to pull the camera into a circle, so that it rides in small area until it calms.
11	Get comfortable being uncomfortable. If you've never partnered with a camel before, know that this is not going to be the most pleasant ride of your life. You will have some pain in your tailbone, as it's not used to this sort of movement and pressure. Pop a couple of over-the-counter pain relievers thirty minutes before you go, or have some on hand to manage the pain later.
12	Dismount when the camel sits back down. Getting off is much easier than getting off. Use the saddle handles to push yourself up, then swing your leg over the hump to one side. You can simply jump off.

Dog Sled

Pony / Donkey / Mule

Donkeys are gentle, steady creatures that may be saddled and ridden in a similar fashion to horses. The average donkey is too small to be ridden by adults, but mammoth donkeys are sufficiently large in stature to bear as much weight as a small horse could handle. They can be a pleasure to ride as long as you aren't in a hurry and don't attempt to push them out of their comfort zone.

1	Learn the difference between riding donkeys and horses. Many think of donkeys as smaller, more docile version of horses, but in fact donkeys are their own species and have very different personalities and abilities. Riding a donkey is its own unique experience that's especially pleasurable when you don't have the same expectations you would for a horse. ● Donkeys are less responsive to training, so they don't have fancy gaits. A slow, plodding walk is the most comfortable gait for a donkey. ● Donkeys are extremely reliable and gentle, and aren't as finicky as horses. Donkeys are great for kids to ride. ● Dressage training is increasingly popular among donkey riders. Donkey dressage is similar to horse dressage but it showcases donkeys' unique traits and abilities.
2	Know what situations are right for riding donkeys. Donkeys are hard workers with big energy reserves. Because they were originally desert animals, they're adept at moving through tough terrain without very many breaks. They like plenty of exercise and are usually game for a long trail ride or a simple walk around the property. ● Donkeys are wonderful to ride on long trails, where the pace is slow and steady. Because of their great endurance, they have often been used as pack animals and used to traverse tough hiking trails. ● Donkeys can help in work situations, especially with herding goats and sheep. They are excellent herders. For this reason, it's a good idea to always keep a fence between donkeys and other farm animals unless they're actively herding.

3	Understand donkeys' limitations. The experience of riding a donkey is pleasant, but not necessarily exciting. Unlike horses, they won't be interested in jumping logs or galloping across fields. If you try to encourage them to do so, they usually just stand still and won't budge, which is probably why they have a reputation for being stubborn. ● Donkeys have a shorter stride than horses and tend to move slowly. They aren't physically capable of performing feats of agility the way horses can. ● Donkeys like familiarity and get their reputation for stubbornness because they don't react well to unfamiliar situations. They like to have time to consider a given situation, and hurrying them along doesn't do much good.
4	Get to know their training needs. Donkeys should be trained by someone familiar with their temperaments and abilities. Training a donkey is similar to training a horse, but since donkeys have different abilities, they need a trainer who knows what he or she is doing. Donkeys should first learn to be led on a halter, then how to carry a saddle and take riding commands.
5	Find one that's the right size. Donkeys are commonly too small to be ridden. It's very important not to ride a donkey that's too small to carry your weight, since that could injure the donkey. A good rule of thumb to follow is that a donkey can safely carry 20 percent of its body weight. ● Miniature donkeys are not suitable to be ridden, unless you want to have your toddler ride one under supervision. ● Mid-sized donkeys are fine for children, but as the children grow up they will need to find a larger donkey. ● Mammoth donkeys are large enough to carry adults.
6	Take sex and temperament into account. Like horses, donkeys' temperaments differ according to their sex. Finding a donkey with a good riding temperament will have a big impact on the riding experience. Here are the three types of donkeys and their temperaments: ● Geldings are male donkeys that have been castrated. They tend to have a mild temperament well-suited to being ridden. ● Jennys are female donkeys. They usually have a gentle, domesticated temperament as well. ● Jacks are uncastrated males. They are typically too wild to ride.
7	Make sure the donkey has received training. Many donkeys make great pets, but not all are cut out for being ridden. Find out whether the donkey was trained to carry a saddle and follow riding commands. Get a donkey that has been trained to be ridden, not just walked on a lead.
8	Find a good match for your personality and needs. Donkeys have a reputation for being stubborn, but really they just need time to assess each situation and decide how to respond. They're deep thinkers. This can be frustrating when you're on a donkey's back and would like it to move forward. If you're planning to purchase a donkey spend time walking and riding the donkey to make sure it's a good fit. ● Patience is a virtue when it comes to riding donkeys. Try to gain an understanding of the donkey's personality so you can work as a team and have a much more pleasant ride together. ● If you're not the patient type, you'll need a donkey that's exceptionally responsive. You may instead want to consider choosing a small horse or pony.
9	Use equipment made for donkeys. Donkeys' bodies are structured differently from horses' bodies. Get a saddle and other equipment made for donkeys or burros, rather than one for horses. Donkeys can carry a lot of weight, but their backs are wider than horses' backs, so the saddle construction is different. A saddle that doesn't fit correctly can lead to health problems for the donkey. ● Bits and other tack should also be fitted to your donkey's needs. ● Blinders are commonly used to keep donkeys focused on the path ahead, but some donkey trainers recommend against using them. ● If you want to use heavy saddle bags, have the donkey practice with them at home before setting off on a long trail ride.
10	Learn to give a donkey riding commands. If you've never had riding lessons, it's a good idea to take some so you can learn the proper way to command a donkey for a smoother ride. The most important thing to remember is that you shouldn't try to make a donkey to do something it doesn't want to do. You must gently coax the donkey to keep moving instead of using force. ● Verbal commands and nonverbal commands like hand signals and touching the donkey are ways to let it know what you want it to do. ● Whipping and harsh kicking are ineffective, and will serve only to erode the trust you have with your donkey. Treat your donkey gently and patiently as you ride.
11	Take good care of your donkey. Make sure your donkey is healthy so he doesn't get injured when you go for a ride. Donkeys need dry, warm shelter, proper feed and plenty of water, and attention to their hooves and teeth. Make sure you attend to the donkey's health before taking it out for a long ride. ● Donkeys' hooves must be kept dry, or they will begin to rot. Donkeys need to overnight in a dry shelter. If you're doing an overnight trail ride, make sure there's a dry shelter where the donkey can stay overnight. ● When it comes to food, donkeys need plenty of grass, and not much else. They are prone to getting overweight easily, so make sure the donkey is getting plenty of exercise.

Cattle / Yak / Buffalo

Elephant

Ostrich

4 Land

Any forms of transport which are used on land.

Subheadings

1 Simple Transport

These are simple, unpowered forms of transport which could help speed up a bug-out scenario when on foot.

Heelys

These are those kids shoes that have wheels in the heel, if you tilt your feet up the wheels make contact and can be used to roll around. These only have little benefit on flat or almost flat ground and are generally used as a fashion or 'cool' statement. They are also generally ineffective on coarse bitumen.

Rollerskates

Rollerskates are the shoes with a rectangular set of 4 wheels on each side allowing more stability than rollerblades. They would allow a decently quicker form of transportation over walking but are often heavy, and require you to carry an additional pair of shoes.

Rollerblades

Rollerblades are the shoes that have all four wheels in a line on one side - like a blade, as opposed to rollerskates. Like rollerskates, these would speed up a bug-out scenario but are cumbersome to carry and you would need to carry a regular pair of shoes to swap back to.

Skateboard / Longboard

Skateboards are fairly lightweight and can be used to travel relatively short distances with ease, particularly on flat concrete. It could have a place in a solo bug out scenario if you're leaving the suburbs to save your energy when going down slopes.

Sled

2 Scooter

Kick Push Scooter

Generally used by kids to play with on the street, but they could come in handy during bug out if you're hiking and plan to go down a lot of bitumen hills. It would certainly save a lot of time and would be worth having one in your car if you live a long way from work.

One-Wheeled Scooter

An electric self-balancing one-wheeled scooter. They are good for short commutes but probably have no place in a preparedness situation besides gliding around a prepper village. They would also require a strong and steady source of power to continually use it. One advantage it does have is that it would keep both your hands free, thereby allowing you to (dangerously) handle a gun and chase attackers...

Electric Scooter

These are the same as the kick push scooters you stand on, but have motors in them. Don't be confused with the other form of electric (or petrol) scooters you sit on today which generally are used to deliver food. Electric scooters are quite viable in a bug out scenario due to their small frame and incredible power and battery life. Some models can reach a top speed of 80km/h (49.7 mph), with some even reaching up to 120km/h (74.5 mph). They often have ranges up to 70km (43.4 mi), but real world tests are likely to get a bit less than that depending on how old the battery pack is, how heavy the rider is and the type of terrain.

A disadvantage (besides the price) for these scooters is that they can weigh up to 40kg (88 lbs) and therefore aren't easy to carry once they run out of battery. If you live fairly close to your bug out shelter this may be an ideal solution to get you there quickly if you're solo or have one other person. Some scooters can support a rider up to 120kg (264 lbs) therefore if two people combined comes in under this total (such as 70 & 50kgs), you would in theory only need one scooter to bug out with - at the cost of speed and distance - however don't forget to weigh your Bug-Out bags.

I would highly recommend an electric scooter as a bug out vehicle because it's fast, it can go down narrow alleys to avoid people in cars, and it can keep up with, and sometimes exceed the speed a regular car, especially if it's stop start traffic - such as what you would expect in an emergency. It's great on all forms of terrain (except mud) and can be folded up and carried as a last resort - however you would likely keep the scooter in the car during the bug out and only use it in the last stage of a bug out plan.

Elderly Scooter

Elderly scooters are the ones you see in supermarkets whizzing around the place. They generally have a low top speed but are still fairly small and can therefore fit in elevators. They have a lot of storage space over a regular scooter at the cost of portability. These are not recommended for bugging out in unless you want to see the sights and get there reeeallly slowly.

Segway

Just no, these would not make a useful bug out vehicle - but they may come in handy around a large estate you have to defend.

3 Bike

A bicycle, also called a bike or cycle, is a human-powered or motor-powered, pedal-driven, single-track vehicle, having two wheels attached to a frame, one behind the other. A bicycle rider is called a cyclist, or bicyclist. Bicycles were introduced in the 19th century in Europe, and by the early 21st century, more than 1 billion were in existence at a given time. These numbers far exceed the number of cars, both in total and ranked by the number of individual models produced. They are the principal means of transportation in many regions. They also provide a popular form of recreation, and have been adapted for use as children's toys, general fitness, military and police applications, courier services, bicycle racing, and bicycle stunts.

The basic shape and configuration of a typical upright or "safety bicycle", has changed little since the first chain-driven model was developed around 1885. However, many details have been improved, especially since the advent of modern materials and computer-aided design. These have allowed for a proliferation of specialized designs for many types of cycling. The bicycle's invention has had an enormous effect on society, both in terms of culture and of advancing modern industrial methods. Several components that eventually played a key role in the development of the automobile were initially invented for use in the bicycle, including ball bearings, pneumatic tires, chain-driven sprockets and tension-spoked wheels.

A bike would make an ideal bug out vehicle due to low/easy maintenance, no fuel and their ability to easily go around traffic or fallen trees. Disadvantages include their slipperiness in rainy, snowy and icy conditions, being exposed to the elements while riding and you can't carry as much gear as a car. Bikes are also quite heavy to carry unless you buy a small, folding one instead.

Advantages	• No Fuel Requirement • Simple to Repair • Stealthier than Cars • Smaller/Compact • Utilise Off-road Tracks
Accessories	• Lights • Reflectors (Unless SHTF) • Dynamo Generator • Repair Kit • Bike Bags (Pannier/Saddlebag, Frame Bag, Rigid Seat Rack) • Bike Trailers (Single or Double Wheel, should attach to back wheel frame)
Frame Materials	• Carbon Steel • Chromoly Steel • Aluminium • Titanium • Carbon Fibre

Riding a Bike

1	Begin on a flat surface. Flat surfaces such as a driveway, sidewalk, quiet road, or park trail are stable. There are no slopes, so the falls are shorter and you will have an easier time balancing and coming to a stop.
2	Adjust the bike seat. Lower the bike seat far enough that whoever's riding can put both of their feet flat on the ground while seated. A low seat allows you to stop yourself with your feet before you fall. Adults don't need to use training wheels, but young children can use these or specialty balance bikes.
3	Test the brakes. Find out how the brakes work on the bicycle. Stay off the bicycle. Keep it next to you and walk it. Push the brake buttons to get used to their location, how they feel, and how the bike reacts to them. Once you've learned this, you'll feel more comfortable because you'll be able to make an emergency stop when needed.
4	Plant one foot on the ground. It doesn't matter which side you choose, but your dominant side will feel more natural. A right-handed person, for instance, can stand on the left side of the bike. Lift up your right leg, reach it over the bike, and put it on the ground on the other side of the bike. Hold the bike upwards between your legs.
5	Start gliding. Rather than pedal, push yourself off by foot. Tuck your feet upwards and onto the pedals. While in motion, maintain the bike's balance as long as you can. Once you feel the bike beginning to tip, catch it by putting one foot to the ground, then push off again.
6	Keep your eyes straight ahead. When you look at obstacles, your bike heads towards them. Concentrate on looking towards where you want the bike to go. It takes some practice to avoid distractions from road hazards or other sights.
7	Start pedalling. Start with one foot on the ground. Your other foot should be flat on a pedal pointed upwards. Push off, put that foot on the other pedal, and go! Keep going as long as you can maintain balance.
8	Dismount from the bike. Don't stop by foot. A better practice is stop by using the brakes. Stop pedalling, shift your weight onto the lowest pedal, and squeeze both handbrakes, if the bike has them. Once the bike has stopped, raise yourself a little and step off onto the ground.

Bicycle Repairs

Be sure to have a bike pump and a few repair kits for punctures for all wheels.

Redundancies	• Spare Tyre • Chain Repair Kit • Spare Pump • Chain • Brake Replacements

Bicycle Tips

Ensure bag straps don't come into contact with the wheels while riding.

Use an alternator on the wheel to generate electricity while moving.

4 Motorbike

The best solo bug-out vehicle for speed and avoiding traffic.

Riding a Motorbike

1	Learn the controls. Familiarize yourself with the basic controls before riding. When you're actually riding you will have to think quickly, if you're not familiar with the operations it could be dangerous. ● The hand clutch lever is typically located on the left handlebar and is used to disengage the power from the rear wheel when shifting gears. ● The gear shifter is typically located by your left foot and is used to shift one gear up or down while you're pulling the clutch lever. ● The throttle is on the right handlebar and used to accelerate. The handbrake, which applies the brakes to the front wheel, is the lever on the right handlebar. ● The lever on the right side of the bike near your foot works the rear brake. ● As a rule, the left side of your motorcycle controls gears, while the right side controls acceleration and braking.
2	Get on the bike. To properly get on your bike, face the motorcycle from the left side. Grab the left handlebar, and swing your right leg over the seat. Plant your feet firmly on the ground. ● The best way to get to know how a bike operates is to sit on it and go over the functions of the controls before starting it up. ● Get a feel for how you fit on the motorcycle. Grip the handlebars, clutch lever and brake lever. Make sure you can reach these controls comfortably. Your arms should have a slight bend in the elbow when gripping the handlebars. Switches should be within easy reach of your fingers. ● Make sure you can easily plant your feet on the ground. Get a feel for the weight of the bike underneath you. Additionally, you should be able to operate the rear shifter without lifting or sliding foot off the peg.
3	Practice getting a feel for the clutch. The clutch is used to change gears. When you pull the clutch in, you're releasing the engine from the transmission. This action puts your bike in neutral, allowing you to shift gears. ● Think of your clutch as a dimmer switch when using it. Unlike an "On-Off" switch, you want to gradually and smoothly pull and release the clutch to prevent your bike from stalling. ● When starting, pull in the clutch lever and put the bike into 1st gear by pushing down on the gear shifter with your left foot. You may have to push down several times. You'll know you're in 1st when you don't feel any more resistance or indication the gears are moving. ● Most motorcycles operate in a "1 down, 5 up" shifting pattern. The pattern is typically 1st gear, neutral, 2nd gear, 3rd gear, and so on. When shifting gears you will see the appropriate number light up on your gauge. ● When you're driving, you should shift gears by first pulling on your clutch with your left hand to disengage the rear wheel. As you pull the clutch, reduce the throttle. Reducing the throttle will prevent your bike from jerking as you re-engage the rear wheel. Continue by shifting gears with your left foot. Feather the throttle with your right hand to keep the transmission smooth. Finally, release the clutch, engaging the rear tire.
4	Start your engine. Pull the clutch lever in and locate your kill switch. This is usually a red switch located on the right handlebar. Flip it down into the "on" position. Most modern bikes don't require you to kick start your engine, but if you have an older bike you may have to. The kick start lever, if you have one, can be found behind the foot peg on the right side of your bike. ● Turn your key to the "ignition" position and check to make sure the lights and gauges are on and operating. ● Put your bike into neutral. The easiest way to do this is to downshift to 1st gear then shift up once. Look for the "N" on your gauge to light up. ● With your right thumb, push the "Start" button. This is usually located under the kill switch. Start buttons are often identified by a circular arrow with a lightening bolt in the middle. ● Once the engine has turned over, let your bike warm up for about 45 seconds so the engine will work properly. ● When your feet are flat on the ground, pull the clutch lever back in. Then roll back onto your heels and repeat until you have a good feel for the clutch.
5	Try "power walking" the bike. Start with your feet in front of you and on the ground. Slowly let the clutch out until the bike starts to pull itself forward. ● Using only the clutch, walk the bike forward, keeping it steady with your feet. ● Repeat this until you can keep the bike upright when you pull your feet off the ground. You want to get a good sense of balance on your bike.
6	Begin driving your motorcycle. Once the engine has started and warmed up, you can begin to ride. This is done by shifting down into 1st gear and letting the clutch lever out while simultaneously pulling back on the throttle. ● Make sure your kickstand isn't out. ● Slowly let out the clutch lever until the bike starts to roll forward. ● You may have to pull back on the throttle slightly to prevent your bike from stalling while releasing the clutch. ● Once you are moving, accelerate slightly and pull you feet up onto the pegs. ● Try straight line riding. As you let the clutch out and slowly roll the throttle back to pick up a little speed, continue riding in a straight line. When you are ready to stop, pull in the clutch lever, and slowly apply the front and rear brakes simultaneously. Use your left foot to steady the bike at a stop. When you are stopped, put your right foot on the ground.
7	Practice shifting gears. Once you're able to start riding in a straight line, get a feel for shifting. Get a feel for the "friction zone". The friction zone is the area of resistance created as the clutch becomes engaged. This area allows for the transfer of power from the engine to the rear wheel. Motorcycle transmissions are sequential, meaning that you have to shift one gear in a consecutive order, whether shifting up or down. It will take some practice to be able to feel and hear when it's time to shift. The engine will start revving at higher rpms when it's time to shift. ● With your bike on, shift all the way down into 1st gear. You'll know you're in 1st gear when the shift pedal doesn't click down anymore. You should hear a bit of a clicking noise when in 1st. ● Very slowly let your clutch out until the bike starts moving forward. When you want to start moving faster, pull back on the throttle slightly as you let out the clutch. ● To get to 2nd gear, pull the clutch back, ease off the gas, and pull up firmly on your shifter to move through neutral. Check to make sure your neutral light is not on. Let the clutch out and engage the throttle again. Repeat this process to shift through higher gears.
● After 2nd gear, you don't have to pull up with your left toe quite as hard since you're not going through neutral. ● To downshift, release the throttle, squeezing the brake lever slightly. Pull your clutch in and press down on your shifter. Then let out your clutch. ● Once you get a hang of downshifting, you can come to a stop while in second gear. Then, once at a stop, shift down again into 1st.	
8	Practice turning. Much like a bicycle, a motorcycle is turned, once you're at about 10 mph or higher, by counter steering. Push down on the handgrip on the side of the bike you want to turn. Look up and through your turn. ● As you enter your turn, remember to slow down. Don't apply the brakes during your turn. Release the throttle and break if you have to before you start your turn. ● Keep your head up and look through the turn. Press the handlebar in the direction you want to go. Slowly roll on the throttle as you glide through the turn to keep momentum. ● As you slow down, turn your head to look to the end of the turn. Your bike will follow your eyes. Find a point at the end of your turn to aim for and keep your eyes on it. Never look at the ground or down into your turn. Though you may feel weird and want to watch your turn, this is dangerous and can cause you to not complete your turn properly. ● Press on the side you want to turn. If you are making a left turn, push away from yourself on the right side of the handlebar. This will cause the bike to lean to the left. Lean with it and slowly roll on the throttle to slightly increase your speed. As you come out of the turn, keep the throttle steady or add a bit more gas while you lean back up. Let the bike right itself, don't jerk the handlebars.

9	Practice slowing down and stopping. Finally, now that you've practiced starting, shifting, and turning your bike, you need to know how to slow down and come to a stop. Remember that the lever on the right handlebar operates your front brake, while the brake by your right foot operates the brake for the back wheel. As a general rule, you want to begin braking with your front brake and employ your rear brake after to help you slow and stop. ● When coming to a full stop, it's best to begin with your front brake and apply the rear brake after you've slowed down some. ● As you slow down, make sure you downshift. You don't always need to go all the way into 1st gear. You can downshift into 2nd gear and stop before shifting down to 1st. ● Pull in the clutch when braking and gearing down. ● Apply pressure to both your front and rear brake as you slow down and begin braking. Make sure you aren't pulling back on the throttle. This is made easy by the fact that the front brake handle is situated so that you have to roll your hand forward to reach it. ● Gradually increase pressure on your brakes, don't engage the brakes completely, this can cause your bike to stop abruptly and jolt. ● Once you are at a stop, keep the front brake engaged, and plant your feet firmly on the ground. Start with your left foot, then your right.

5 Quad Bike

Quad Bike

The ideal vehicle for moving around a homestead. They can come in electric or fuel varieties and can easily climb steep hills and tackle all forms of terrain.

Golf Buggy

Ride-On Mower

6 Car

Any type of car whether it runs on petrol, diesel or electricity. Electric cars are at the bottom of this section.

Driving a Manual Car

This is how to drive a manual car if you need to during an emergency.

1	Start on level ground with the car off. Especially if this is your first time driving a car with a manual transmission, start slowly and methodically. Put your seat belt on once you sit down. While learning, it can be useful to roll down the windows. This helps you hear the sound of the engine revving and to shift gears accordingly. ● The pedal on the left is the clutch, the middle one is the brake, and the accelerator is on the right (remember it, from left to right, as C-B-A). This layout is the same for both left-hand drive and right-hand drive vehicles.
2	Learn what the clutch does. Before you start pushing down on this unfamiliar pedal on the left, take a moment to figure out the basics of its function. ● The clutch disengages the engine from the wheels. When one or both are spinning, the clutch allows you to switch gears without grinding the teeth of each separate gear. ● Before you change gears (either to move up or down), the clutch must be depressed (pushed).
3	Adjust the seat position so you can access the clutch pedal's full range of motion. Slide forward enough to allow you to press the clutch pedal (the left pedal, next to the brake pedal) fully to the floor with your left foot.
4	Press the clutch pedal and hold it to the floor. This would also be a good time to take note of how the travel of the clutch pedal differs from that of the brake and gas. It's also a good opportunity to get used to slowly and steadily releasing the clutch pedal. ● If you've only ever driven automatic cars, it might feel awkward to use your left foot to push a pedal. With practice, you'll get used to using both feet in concert.
5	Move the gearstick into neutral. This is the middle position that feels free when moved from side to side. The vehicle is considered out of gear when: ● The gearstick is in the neutral position, and/or ● The clutch pedal is fully depressed. ● Don't try to use the gearstick without having the clutch pedal depressed, because it simply won't work.
6	Start the engine with the key in the ignition, making sure the gear stick is still in neutral. Make sure the handbrake is on before starting the car, especially if you are a novice. ● Some cars will start up in neutral without the clutch depressed, but some newer cars will not.
7	Remove your foot from the clutch pedal with the car still in neutral. If you're on level ground, you should remain stationary; you'll start rolling if you're on a hill. If you're ready to move on to actually driving, make sure to release the handbrake (if it's engaged) before you drive off.
8	Press the clutch to the floor and move the gearstick into first gear. It should be the upper-left position, and there should be some kind of visual layout of the gear pattern on top of the gearstick. ● Gear patterns can vary, so take some time beforehand to study your car's gear layout. You may want to practice shifting through the various gears with the engine switched off (and the clutch engaged).
9	Slowly lift your foot up from the clutch pedal. Continue until you hear the engine speed begin to drop, then push it back in. Repeat this several times until you can instantly recognize the sound. This is the friction point. ● When you're shifting gears to start or keep moving, this is the point at which you'll want to have the accelerator depressed enough to provide power.
10	Let up on the clutch while pushing down on the accelerator. In order to get moving, lift your left foot up from the clutch pedal until the RPMs drop slightly. At the same instant, apply light pressure to the accelerator with your right foot. Balance the light downward pressure on the accelerator with slowly releasing pressure on the clutch pedal. You will probably have to do this several times to find the right combination of up and down pressure. ● Another way of doing it; is to release the clutch until the point the engine revs down a little, and then applying pressure on the accelerator as the clutch engages. At this point the car will start to move. It is best to have the engine rev just enough to prevent stalling as the clutch pedal is let up. This process may be a little difficult at first because you are new to the extra pedal in a manual car. ● Release the clutch fully (that is, slowly remove your foot from the pedal) once you start moving forward under control in first gear.

11	Expect to stall at least a few times when you're first starting out. If you release the clutch too quickly the engine will stall. If the engine sounds like it is going to stall, hold the clutch where it is or push down a bit further. If you do stall, depress the clutch fully, apply the handbrake, put the car in neutral, switch the engine off and restart the car as normal. Don't panic. ● Revving the engine while the clutch is between fully up and fully depressed will wear out the clutch parts prematurely, resulting in slippage or smoking of the clutch parts at the transmission. This is called riding the clutch and should be avoided.
12	Recognize when it's time to shift up to a higher gear. When your RPM reaches about 2500 to 3000 while the car is in motion, it is time to shift to the next gear — for example, second gear if you are currently in first. The actual RPMs at which shifting is required will vary by the car you are driving, however. Your engine will begin to race and speed up, and you must learn to recognize this noise. ● Depress the clutch pedal until it disengages and guide the gearstick straight down from first gear into the bottom-left position (which is second gear in most configurations). ● Some cars have a "Shift Light" or indications on the tachometer that will tell you when you need to shift, so you don't rev the engine too fast.
13	Push down on the accelerator very slightly and slowly release the clutch pedal. Shifting gears in motion is the same as shifting into first from a stationary position. It's all about listening, looking, and feeling for the engine's cues and getting the up-and-down timing of your feet on the pedals correct. Keep practicing and you'll get the hang of it. ● Once in gear and on the accelerator, you should completely remove your foot from the clutch pedal. Resting your foot on the clutch pedal is a bad habit, as it applies pressure to the clutch mechanism — and the increased pressure will cause the clutch to wear out prematurely.
14	Shift down into a lower gear as you slow down. If you are going too slow for the current gear you're in, your car will shudder as if it's about to stall. To shift down gears while in motion, follow the same process of depressing the clutch and releasing the accelerator, shifting gears (say, from third to second), and letting off the clutch while depressing the accelerator.
15	Come to a complete stop. To come to a stop in a fully controlled manner, shift down gradually until you reach first gear. When it's time to come to a complete stop, move your right foot from the accelerator to the brake pedal and press down as much as is required. As you slow to about 10 mph (16 km/h), the car will be on the verge of shaking and vibrating. Press the clutch pedal fully down and move the gearstick into neutral to prevent stalling the car. Use the brake pedal to stop completely. ● You can also stop while in any gear by depressing the clutch fully and using the brake while shifting into neutral. This should only be done when you need to stop quickly, though, as it puts you in less control of the vehicle.

Driving an Automatic Car

This is how to drive an automatic car if you need to during an emergency.

1	Identify the controls. It essential to find the accelerator and brake pedals, the steering wheel, the gear selector lever, the light controls, the defroster, and the windshield wipers before you begin. ● The brake and accelerator pedals are located at the bottom front of the area where your feet are. The brake pedal is on the left, the accelerator is on the right. ● The steering wheel is the large wheel in the centre of the driver's console. Turn it to the left and right to turn the wheels of the vehicle. ● Located on the steering column (usually on the left side) is a small lever that has a rest position in the middle and two locking positions above and below. This is the turn signal. Often on the left side of the steering wheel mounted into the console or a knob on one of the levers on the steering column is the control which turns the headlights on and off. ● The gear selector lever will usually be in one of two places: it is either mounted to the right side of the steering column or in-between the driver's and passenger's seats. It will have a display showing gear indicators, usually marked with the letters "P", "D", "N", and "R" and a few numbers. On steering-column shifting levers, this display is usually located on the instrument panel, underneath the speedometer.
2	Start the car. Place your right foot on the brake pedal and push it down, then insert the key and turn it clockwise to start the vehicle.
3	Select your gear. Keep your foot on the brake pedal and shift the gear lever into "Drive." This gear is marked with a "D" on the display panel, and will be highlighted when you've successfully selected it. ● For shift levers mounted on the steering column, pull the lever towards you before moving it up and down to select a gear. ● For shift levers mounted on the floor, there is usually a side button to unlock the lever. It can then be moved along its track into position.
4	Release the parking brake. This is either a lever between the two front seats or a pedal on the far left side of the foot area. There may be a release lever above the lower parking brake or a button to push on the topside model before you can disengage it.
5	Check your surroundings. Look all around the car, including blind spots, to see if there are any moving objects or beings in the vicinity. Make sure to keep your eyes mainly on the direction you're moving.
6	Get your car moving. Slowly release pressure on the brake pedal and the car will start to move slowly. Take your foot off the brake, use the same foot to press the gas pedal gently, and the car will begin to move faster. There is no need to change gears in relation to speed in regular road driving.
7	Turn the steering wheel to turn the car. In "drive," turn it to the left to turn the car left and turn it to the right to turn the car right.
8	Apply the brakes to slow or stop the car. Take your right foot off the accelerator pedal and move it to the brake, applying gradual pressure so as not to jerk to a halt. When you wish to start again, switch your foot back to the accelerator.
9	Park the car. When you have reached your destination, bring the vehicle to a complete stop by applying gradual pressure to the brake pedal and slide the shift lever back into the "P" position. Turn off the engine by turning the key counter-clockwise. Don't forget to turn off the headlights and apply the parking brake before getting out of the car.
10	Travel in Reverse. If you need to travel backward, make sure the vehicle is at a complete stop before changing gears in or out of "reverse." Slide the gear shift to select the gear marked "R" and check behind/ around you for any possible obstructions. Gently remove your foot from the brake and place it on the accelerator. ● When turning in Reverse, your car will turn in the same direction that you turn the wheel. You're just going backwards, so the end of the car will swing in that direction, rather than the front.
11	Use "neutral." The "neutral" gear is only to be used when you have no need to control the speed of your car, not when driving regularly. Examples of this include when idling parked for a short time or when being pushed/towed.
12	Use the lower gears. The gears marked "1," "2," and "3" are known as lower gears. These can work as a sort of in-engine brake system when you need to save your actual brakes. Going down steep hills is a good use of this technique. 1st gear, however, is only to be used when you must go very slowly. There is no need to stop when shifting between these gears and Drive.

Fuel Conservation

When travelling to your bug out shelter, unless you're being pursued or have to get there as fast as possible you should try to conserve your fuel. There are a variety of ways you can accomplish this which are found below. You shouldn't conserve fuel by cutting "corners" such as using main roads instead of back roads which dramatically increase your risk of being attacked during a SHTF situation.

- Accelerate gradually. Avoid jackrabbit starts.
- Anticipate your stops. When approaching a red light, let your foot off the gas as early as possible.
- In summer, drive during cooler parts of the day. Cooler, denser air can boost power and mileage.
- Avoid long warm-ups in the morning. They're unnecessary and waste fuel.
- Maintain recommended tire pressure. Low pressure reduces fuel economy and can damage tires.
- Keep the air filter clean. Clogged filters reduce fuel economy and increase exhaust emissions.
- Reduce speed - you can reduce your fuel consumption by as much as 25% by taking 20 km/h off your speed.
- Keep the windows up and use the ventilation system when travelling over about 50 km/h, if your car doesn't have air conditioning.
- Use your car's air conditioner sparingly.
- If your car's transmission has power and economy modes, use the economy mode to ensure the transmission up-shifts earlier.

Adverse Conditions

Night Driving

- Do not overdrive the vehicle headlights. This means only drive as fast as the vehicle can be stopped within the headlight illumination distance.
- Slow down at night. Most drivers have a false sense of security believing that they can drive as fast at night as they can during daylight.
- Keep the windshield, headlights, rear lights and marker lights clean.
- Use the vehicle high beams when able to do so.
- Avoid looking directly into oncoming headlights.
- More than one half of all traffic deaths occur at night, despite the fact that fewer miles are driven.
- The average glare recovery time (the time it takes your eyes to recover after being blinded by oncoming headlights) is 5 to 7 seconds. With a glare recovery time of 5 seconds, a driver travelling at 80km/h (50 Mph), will travel approximately 111 Metres (365 feet) in total blindness.
- Tinted glass cuts visibility.
- Headlights do not shine around curves, therefore you will be turning into darkness.

Wet Driving

- Rain mixes with oil, dust and dirt to form slippery road surfaces, especially at the beginning of the rain event, until the rain washes away the slippery material.
- Rain reduces vision, especially at night.
- Rain causes glare from the roadway.
- Rain causes hydroplaning. If this occurs take your foot off of the accelerator and do not make any sudden steering or braking manoeuvres until the vehicle tires make contact with the roadway.
- Increase following distances. Use the four or six second rule, depending on the driving conditions. The rule for judging following distances on a road with no adverse driving conditions is called the "Two Second Rule".

Snow Driving

- Snow and ice decrease visibility and hide hazards.
- Snow and ice cause a very low coefficient of friction leaving it very easy to skid.
- Increase following distance and anticipate stopping.
- Clean snow/ice from all windows and lights before driving.
- Watch for ice or frozen spots on the road.
- If the vehicle is equipped with anti-lock brakes, depress the brakes and wait for the vehicle to stop. Do not pump the brakes. Anti-lock brakes also allow the vehicle to be steered during heavy breaking.
- If the vehicle is not equipped with anti-lock brakes, pump or modulate the brakes if needed when the vehicle begins to skid.
- Drive on rough snow for better traction for accelerating and braking surfaces.
- Take advantage of clear spots in the roadway for heavy braking.
- Beware of black ice. An area that appears clear may not be.
- If the vehicle begins to skid, take your foot off of the brake and/or accelerator, quickly look and steer in the direction that you want the vehicle to go.

Car Maintenance

Basic Maintenance

Basic car checks that should be done before driving a vehicle a long distance:

- Check all exterior lights are working.
- Check that glass surfaces (including the mirrors) are clean and free from chips, cracks, and scratches.
- Check that the windscreen wipers and washers operate efficiently.
- Make sure the horn works.
- Test the handbrake to ensure it 'holds' the car on steep hills.
- Check the condition of the seat belts.
- Check tyre pressures, condition, and tread wear and depth.
- Watch for oil or coolant spots on the garage floor.
- Check the fuel level.

Intermediate Maintenance

More advanced car checks that take more time and require additional skills to complete:

- Check the oil level.
- Check the radiator coolant level.
- Check the power steering fluid.
- Check the brake and clutch fluid.
- Check the washer fluid level.
- Check the battery fluid levels.

Skilled Maintenance

- Oil Change
- Air Filter Change

Troubleshooting

These are simple car troubleshooting tips anyone can follow.

Engine Won't Start	
Brakes Are Weak	
Engine Overheating	
Key Won't Turn	To fix a key you can't turn in the ignition, try wiggling the steering wheel left and right while turning the key.
Noisy Brakes	
Lost Keys / No Keys	See the Hotwiring section in SECURITY > Infiltration.

Repairs

These are simple car repairs and troubleshooting which can be done by anyone.

Change a Tyre	1. Pull over in a safe location with ample room around the car and turning on the hazard lights if required. 2. Check you have the basic tools required: A Spare Tyre, A Lug Wrench and a Car Jack. 3. Apply the parking brake and wheel wedges if you have some. 4. Remove the hubcap or wheel cover 5. Loosen the lug nuts about ¼ to ½ of a turn, using the lug wrench which is the one shaped like a '+'. 6. Place the jack under the vehicle frame alongside the tire that's flat. (Make sure it's stable and won't fall) 7. Raise the vehicle with the jack by turning the lever until the tyre is about 15cm (6 in) off the ground. 8. Unscrew the lug nuts all the way and set them down beside you. 9. Remove the flat tyre and set it on its side so it doesn't roll away. 10. Mount the spare tyre on the lug bolts. 11. Tighten the lug nuts by hand

12. Lower the vehicle enough so it isn't fully resting its weight on the new tyre and tighten the nuts all the way using the lug wrench.
13. Lower the vehicle completely
14. Replace the hub cap.
15. Check the tyre pressure is adequate.

Jump Starting	If either vehicle has an electronic ignition system or is an alternatively fueled vehicle, the use of jumper cables may damage it. 1. Take out your jumper cables. 2. Place both vehicles in Park or Neutral and shut off the ignition in both cars. 3. Attach one of the red clips to the positive terminal of your battery. 4. Attach the other red clip to the positive terminal of the other car. 5. Attach one of the black clips to the negative terminal on the other battery. 6. Attach the last black clip to an unpainted metal surface on your car that isn't near the battery. **DO NOT connect the black cable to the negative terminal on the discharged battery as this may cause a dangerous spark** 7. Start the working vehicle and let the engine run for a few minutes. 8. Try to start your vehicle.
Replace a Battery	1. Pop the hood (Use the hood lever to open the clasp and then use the metal arm to hold it in place - if it has one) 2. Disconnect Battery (Remove the negative first, then the positive) 3. Remove Battery Restraints 4. Remove the Battery (Keep the battery upright at all times) 5. Inspect And Clean Terminals (Check for damage and corrosion and clean them if necessary) 6. Install the New Battery 7. Reconnect Battery Terminals (Make sure the positive and negative terminals are on the correct side) 8. Drop the hood back down (Ensure the newly installed battery terminals aren't making contact with the hood)

Other Car Tips

- Camouflage your vehicles with branches, bushes and leaves when stopped to avoid attention.

Electric Car

Electric cars are so substantially different from fuel cars that they merit their own section.

Power
Unlike being able to simply carry a canister of fuel around with you, you will need a way to charge your car with a high voltage power source. The grid is perfect for this at the moment, but in a SHTF situation you won't have any reliable to recharge it. The most viable option for generating enough electricity is to have a large solar panel array and to charge it during the day.

7 Trailer

Could be a bike or car trailer. Make sure it fits for the correct vehicle you have. Find the rated load limit and don't exceed it as it may shorten the trailer's life. Use the trailer for the largest and heaviest items to avoid strain on the shoulders.

Driving with a Trailer

1	Make sure your vehicle is rated for towing the load. You probably can't tow an 8,000 pound full-size camper trailer with a Honda Civic. Depending upon the particular trailer you need to haul, you need to check to determine the weight limits in the owner's manual and determine the appropriate hitch to have installed. ● The weight should be generally specified by the manufacturer and listed in the owner's manual. Look online if you're missing the manual, or check at an auto shop. ● You need to find two numbers, the gross trailer weight (GTW), which is the combined weight of the trailer and the gear on it, and the maximum tongue weight for your vehicle to determine the class of hitch you'll need to tow the load.
2	Get the appropriate class of hitch for your load installed. Generally, you'll get a hitch receiver installed that you can use for different size trailer hitches, for class 3 and up. These receivers include a removable draw-bar that you can use to install different sized hitches for different loads you might use. If you get the largest receiver installed on your vehicle, you'll be ready for any sized load your vehicle can handle, classified according to the following specs: ● Class 1: 2000 pounds GTW/200 pounds tongue weight ● Class 2: 3500 pounds GTW/350 pounds tongue weight ● Class 3: 5000 pounds GTW/500 pounds tongue weight ● Class 4: 7500 pounds GTW/750 pounds tongue weight ● Class 5: 10,000 pounds GTW/1000 pounds tongue weight
3	Get the right-sized ball for the trailer. The larger the ball, the more weight it can carry. Basically, the ball of the hitch will come in one of three sizes: ● 1 7⁄8 inch (4.8 cm) ● 2 inch (5.1 cm) ● 2 5⁄16 inch (5.9 cm)
4	Attach the trailer to the vehicle. Use the tongue jack to raise the trailer and align it with the ball. Make sure that the hitch lock is unlocked before lowering the trailer onto the ball and securing the tongue. Cross the safety chains to the hooks near the vehicle hitch or the vehicle frame, making sure there is enough slack in the chains but not so much that they drag on the ground. ● Using the tongue jack, try to raise the tongue off of the ball. If you are able to do this, the ball and tongue sizes do not match, or the ball is not locked properly. In this case, replace the ball with the correct size, or lock it properly and try again. ● Once the tongue of the trailer is on the ball, you can lock it in place by placing a bolt or padlock through the ball lock mechanism to prevent it from accidentally opening.
5	Attach the lights with the wiring harness. Generally, these employ a simple colour-coded connection that makes it easy to hook up the lights to the harness should make it easy to install the connector properly to the tow vehicle's harness. ● After you've hooked up the lights, do a quick brake check to make sure everything is functioning properly. It's critical to make sure that your turn signals and brakes work on the back of the trailer to ensure a safe trip (as well as no traffic tickets). ● To keep the connection from corroding, you might consider spraying the contacts with a small amount of dielectric grease.
6	Check the tongue weight. You want the amount of weight resting on the hitch to be roughly 10 to 12 percent of the total weight of the trailer. You can use a regular bathroom scale to place under the beam to check. ● If the weight out-weighs your scale (which is likely for 4000 lb. and up trailers) place the scale farther up the trailer to get a smaller measurement. If you go a third of the way up, triple the weight on the scale to get the approximate weight. ● Depending on the weight of the trailer, you might consider using an equalizing bar to even out the pressure on the hitch. These are generally long metal brackets that transfer a bit of the weight more toward your vehicle's front axle. If you're hauling at the upper end of the specs, use an equalizer.
7	Secure your load. Depending on the load you're hauling, you might need to use a tarp to secure loose objects in boats or refuse trailers, since you're responsible for anything that flies out and causes damage. ● You can also take this opportunity to make sure the hitch height is set correctly, your trailer's tires are inflated to the appropriate specifications, and that you haven't overloaded the trailer in such a way as to negate the careful checks you've already performed.
8	Get familiar with the clearance of your new rig. Before you hit the road, get out your tape measure. Does the trailer make your rig considerably taller? By how much? How much length is added to the back of your car or truck? These will be important considerations any time you're trying to park somewhere you normally wouldn't give a second thought to squeezing into. ● If it's your first time towing a trailer, it's best to practice some in a big empty parking lot before taking it out on the road. You want to be as familiar as possible with the vehicle's response time and turning radius.
9	Accelerate and brake slowly. You must always compensate for the extra weight, especially when slowing down, and especially when driving on inclines. Play it safe and be cautious. You also need to pay especially close attention to the added length of your rig anytime you're: ● Changing lanes ● Merging ● Exiting the interstate ● Parking ● Stopping for gas ● Pulling over
10	Prepare for the difference in fuel economy. Towing a significant amount of weight will negatively effect your fuel economy, so keep a close eye on the gauge. Making frequent pull-offs in crowded gas stations can be stressful for first-time towers, so try to anticipate your fuel needs ahead of time to avoid difficult manoeuvres.
11	Stop frequently and check the connection. Even if you checked and doubled checked your connections and everything is up to code, there's always the possibility that something in the road will jostle the trailer lose a bit. It's best to stop sometimes, especially on long or especially bumpy trips, to make sure everything's still hooked up. Seeing your trailer careen off the road isn't the time to double-check.
12	Stay calm if you take a turn too narrowly. It'll probably happen eventually that you'll mis-time a turn, or lack sufficient space to clear a turn like you figured you would. Don't panic. Make sure there isn't traffic behind you and back up slowly and as straight as possible to give yourself the clearance you need. Get a passenger to hop out and watch the trailer from a different angle to give you steering tips, and use your mirrors judiciously.

Reversing with a Trailer

1	Backing up a trailer is one of the most difficult driving manoeuvres there is, but it's easy to master with the right technique and a bit of smarts. To get ready, roll down your windows and kick a passenger out to act as a spotter. It might take a few runs before you get it perfect, so it helps to have another set of eyes.
2	Set yourself up for success by getting perpendicular. To get yourself oriented properly, pull more or less straight perpendicular to where you want the back end of the trailer to go, keeping the truck and the trailer straight. Pull past the spot by 8–10 feet (2.4–3.0 m) to give yourself adequate room to back up. ● When you've got it lined up, turn your wheel opposite the direction of the parking spot. So, in other words, if you've pulled up perpendicular to a spot on your passenger side, enough ahead of the spot to back up, stop the car and jack the wheel to the left, or the driver's side.
3	When you've got it lined up, turn your wheel opposite the direction of the parking spot. So, in other words, if you've pulled up perpendicular to a spot on your passenger side, enough ahead of the spot to back up, stop the car and jack the wheel to the left, or the driver's side. ● Go extremely slowly. If you're in an automatic transmission, the idling speed should be plenty fast to make you nervous. Use gas only sparingly and don't make unnecessary or fast changes. ● Avoid jack-knifing. If, at any point, the angle of the truck to the trailer becomes smaller than a right angle, straight it back out and give it another go. Don't try to force it, because it won't work.
4	Don't neglect your front end. Make friends with your side mirrors so you can keep an eye on where your front end is at all times, taking special caution to watch out for parking obstacles and bumps that might mess up your approach and be a problem when you're trying to straighten back out. Drive like a pro and use your side mirrors. ● Your rear-view will be basically useless in the task. Use the help of a spotter and your side-mirrors to back up correctly.

8 Bus

A bus would be an ideal bug-out vehicle for a whole family with plenty of room for supplies. Reinforce the insides of the bus to shield from gunfire if on the run. Use the available roof space for solar panels to charge batteries.

Driving a Bus

1	Adjust your seat, steering wheel, and mirrors. Just like in a car, you need to adjust your seat when you get in. This step is especially important when driving buses, as other people may be driving the same bus when you're not on shift. Also, adjust the steering wheel so you can comfortably control it. ● Adjusting the mirrors is also essential. Make sure that you can see the rear wheels in the outside ones, as well as the road behind it. On the inside mirror, you should be able to see the inside of the bus and the road behind the bus. ● The cross-view mirrors should help you see the front of the bus, what you can't see from your seat without mirrors.
2	Start the engine. Put the parking brake on if it is not already set. Stomp on the clutch pedal if your bus is a standard rather than an automatic. Change gears to neutral before turning the ignition key.
3	Push the starter. In most buses, you'll now need to push the starter button. However, with some engines, you'll need to wait about five minutes before you push the starter. For instance, if your engine is diesel and has an inlet heater or glow plugs, that means these parts need to warm up before the engine is started. There should be an indicator light that turns off when you can push the starter.
4	Position your hands correctly. Like cars, you should position your hands in a particular way for the best grip on the steering wheel. On the bus, the recommendation is at 9 and 3, meaning that if you imagine the steering wheel as a clock, your hands will be where the 9 and the 3 are. Another way of looking at is your hands should be in the centre on either side of the wheel.
5	Identify the gears on your bus if it is a standard. If your bus is automatic, you don't need to worry about this method, but if it's a standard, you do. Start by establishing how many gear positions your bus has, usually four or five for driving forward, plus neutral and reverse. ● You should be able to find a diagram on your bus. If you can't, find someone more experienced to tell you about the gears on the bus. ● Once someone shows you, you may want to make your own chart just in case you forget.
6	Shift into motion. Start by pressing your left foot down on the clutch, which is the pedal to the left of the brake. Next, place your right foot on the brake, and shift into second gear, which will be your starting gear. ● Next, undo the parking brake. Slowly lift your foot off the clutch until it reaches the friction point then stop. You'll know you've hit the friction point because the bus will start to move forward. Move your foot to the accelerator. ● As you start to accelerate, release the clutch with your left foot, pushing further down on the accelerator with your right foot.
7	Shift to other gears. As you drive and need to go faster, you'll need to shift up. The process is similar to how you shifted to put the bus in motion. Once again, if you are driving an automatic, you can skip this step. ● Push the clutch in with your left foot. As you do, take your right foot off the accelerator. ● Shift up into the next gear. ● Next, take your foot off the clutch, and press down on the accelerator. You'll need to do this step a bit faster than when you started the bus moving. ● Use the same method to shift down.
8	Pick the most comfortable turning method. Just like in a car, you can use one of two methods when turning the wheel. You either move hand over hand to turn the wheel or push with one hand and pull with the other without crossing over. Hand over hand can be a bit smoother, but if you're more comfortable with the push-pull method, it can be just as effective.
9	Brake before curves. If you try to slow down in the middle of a curve, it can be disastrous in a bus. You can cause the bus to skid, for instance. You may even lose control of the bus. Therefore, when approaching a curve, consider whether you will need to slow down, and do so before you hit the curve.
10	Hug the opposite edge of the lane. That is, you need to give yourself as much space as you can to make the curve. Because of that, you need to move to the edge of the lane, giving you more space. ● For example, if the curve is going to the left, you'll be moving toward the right side of the lane. ● If the curve is going to the right, you'll be moving towards the left side of the lane.
11	Accelerate out of curves. This move is just like a car. That is, as you reach the middle of the curve, it's time to start accelerating again. Move back up to speed as you end the curve.
12	Make a right turn. While left turns are generally pretty easy, right turns can be more difficult, given the length of the bus. Approach an intersection as you would in a car, getting in the correct lane and slowing down. ● Do not swing out into the lane to your left, as you could swing into a car. Hug that side of the lane only. ● If you must take extra space to make a turn, do so in the lanes that you're turning into. That is, as you turn right, you can swing out a little into the far lane next to your new lane if you need to, then return to the proper lane. Just be sure to watch for other vehicles and pedestrians.

13	Check for blind spots when changing lanes. As you enter traffic, it's important to not rely solely on your mirrors if you can. Of course, your blind spots are in slightly different places on a bus. Once you put on your turn signal, wait a few seconds before merging, to give other drivers a chance to honk if you don't see them. ● When you're merging left, your blind spot is near the back of the bus on the left side. ● Make sure you move your whole head and body to see around people to check out the back and sides and to see all you can in mirrors. ● Before merging, make sure you have 1 1/2 bus lengths between you and the next vehicle.
14	Stop at train tracks in most states in school buses. Most states have a law about school buses and train tracks. In other words, you must stop, open the door, and look to see if anything is coming on the tracks. Usually, you must take this precaution even if you have no passengers on the bus. ● You'll need to turn on your hazard lights before breaking, as cars might not expect you to stop. ● Stop close enough to get a clear view, but try not to stop within 15 feet or so. ● Stay stopped if you see a train coming. Don't try to race the train. If you don't see a train, proceed across the tracks.
15	Back up with assistance. Avoid backing up whenever possible, as it's always safest to go forward on a vehicle like a bus. However, when you must go backward, it's best to get someone to help you, if someone is around. Have them stand where you can see them, and then they can help guide you into place. ● Before backing up, honk your horn. Also, turn on your hazards and the audible signal that indicates you're backing up. ● Only back up in a straight line. Reverse the bus, and move back slowly until the person tells you to stop. If no one is around, use your mirrors to guide you.
16	Stop the bus. Remember that a bus is very heavy. It can weigh as much as 9 tons with no one even on it. With a full bus, it can weigh as much as 15 tons. That means that it's going to take you much longer to stop in a bus than it would in a car. ● Downshift to 4th gear when you've slowed below 30. ● Press the clutch in as you are stopping. Slowly ease down on the break until you come to a complete stop.
17	Park the bus. Find a suitable place to park. If you're pulling into a gas station, for instance, you should choose one built for trucks and buses, as some parking lots are not made for vehicles that large. Once you've found a place, put the bus in neutral. ● Unless your bus is turned uphill, turn your wheels to the right. If your bus is facing uphill, your wheels should be facing left. ● Engage the parking brake, and turn the key to shut off the ignition. Always take the key out of the ignition.

9 Truck

This is how to drive a truck if you need to in an emergency.

Driving a Truck

1	Understand how the gear shift differs from a normal vehicle's shifter. If you're familiar with a manual transmission, the basic principles of the Eaton-Fuller Transmission shifter–the style used in many commercial trucks today–is similar, but more complex. Basically, it's oriented like a five-speed, but with a total of four different ratios at each position, which you toggle by a combination of switches and positions. This results in a total combination of 18 different speeds. ● The shift knob has two switches controlling air-actuated gears. One is the range switch, which needs to be set on "Low" for gears Lo-4, and the other is the high/low splitter, which is used to toggle between the low and high setting at each gear. Your index finger operates the range switch, which allows you to flip between high and low at each gear position with your thumb.
2	Learn the gear shift pattern. Most gear shifts have a diagram displaying the shifting pattern, which will help to clue you into the organization of the gears. The low gears are usually differentiated from the high gears by colour, and reverse is indicated by an "R." ● Gears 1-4 should all be straightforward, but then to shift into fifth gear, you shift back to the first position, and the pattern repeats. First gear is in the same position as fifth, second in the same as sixth, and so on. ● Remember, at each position, you also have a total of four different speeds, though only two will be accessible, depending on where you shift from. In first gear, you've got 1L and 1H, as well as 5L and 5H.
3	Practice the gear pattern of the semi while the truck is stopped. This allows you to become familiar with the gear pattern so you can shift up and down without looking. This will help you keep your eyes safely on the road while driving. ● Grip the gear shift so that your index finger is available to work the range switch, and the middle and thumb can work the high/low splitter. ● If you don't have experience operating the clutch and driving a manual transmission vehicle, shifting a semi truck is going to have a much larger learning curve. Operating the gear shifter by itself is challenging enough, so you need to be very comfortable operating the clutch on a regular vehicle before you attempt to drive a semi. Practice on a regular car.
4	Start the truck. Hold the clutch pedal to the floor, as you would to start a normal manual transmission vehicle. This stops the transmission gears from turning, which allows the shifter to slide into gear. Select "LoL" by moving the shifter into the Lo-gear position, usually left and back. ● Check to make sure the range switch is in the low position (down), and the splitter is also on "L" and you'll be ready to start the vehicle.
5	Push down the accelerator and slowly release the clutch. As you might guess when the vehicle's got 18 different speeds, getting the truck into Lo gear on Low setting will get you going about one mile per hour, if that. Once you've slid into it, release the clutch and you'll probably be ready to shift into Lo-H. ● To shift into Lo-H, you'll change the splitter to High gear to shift into high. You need to depress the clutch slightly, but not all the way to floor, then let it out to shift into Lo-H.
6	Double-clutch to shift into first gear, low setting. Depress the clutch again slightly (not to the floor) when the RPMs reach first-gear range, and switch the splitter back to "L," then pull the gear shift into the neutral position and release the clutch. Depress the clutch again, all the way, and push the gear shift into first, as you release the clutch. ● This is called double-clutching, and it's necessary because you can't split between low and high on the splitter while you're in neutral, meaning that you have to toggle from "H" back to "L," then shift into neutral, then operate the clutch again to get it into first. It's a lot of work.
7	Continue this pattern through the first half of the gears. After you shift into 1-L you can flip the high/low switch up into the high position, continuing to accelerate and continuing this basic pattern through the upper gears. ● Repeat the previous steps through 1-H, 2-L, 2-H, 3-L, 3-H, 4-L, and 4-H. To make the half steps, continue pushing the splitter button, releasing the accelerator, pushing in, and releasing the clutch.
8	Switch over to fifth gear when you're ready. With the splitter switch in "L," flip up the range selector to 5-H, which will allow you to avoid grinding gears when you switch back into the first position. This is absolutely essential. Switch the range, then double-clutch-shift back to where 1 was before, and it will be fifth gear.
9	Continue shifting through the higher gears. The basic principles now repeats itself. Continue shifting and toggling between "L" and "H," shifting up through 5-H, 6-L, 6-H, 7-L, 7-H, 8-L, and, finally, 8-H.

10	Use the colour indicators on the tachometer. Most RPM gauges should be colour-coded, with 1500 rpms at about the top (12 o'clock) of the gauge, which is typically coloured green. This is the ideal place to shift between gears. ● 1700-2100 is typically beyond the point where you should be shifting, with the exception of going downhill. This region is typically coloured Yellow, with anything above coloured red. ● If you're less than 1200 rpm and try to shift, the engine is likely to splutter and possibly stall.
11	Get used to the general shifting conditions. After a while, you'll be able to familiarize yourself with the general positions that you need to shift, but in instruction school, you learn a few basic rules of thumb. ● Be in top gear at 50 mph (80.5 km/h) or greater. Generally speaking, if you're travelling at highway speeds or greater, you should be at top gear always. ● Be in fifth or sixth gear for sharp turns in city conditions. To avoid stalling, it's good to be switched over into the upper gears. ● Other general speed guidelines will vary from transmission to transmission, for different trucks. You'll need to ask your instructor or other experienced drivers for tips.
12	Downshift whenever you're slowing down. To downshift, you need to slow down to the rolling speed by hitting the brake, then select the gear for that range. Typically, you need to rev up to 1400-1600rpm, then slip the transmission into the proper gear for that speed range.

10 House Trailer / Caravan

A transportable house to easily evacuate in an impending disaster.

Driving with a Long Load

Reversing with a Trailer / Caravan

11 Tram

This is how to drive a tram if you ever need to.

Driving a Tram

12 Train

This is how to drive different types of trains if the need arises.

Driving a Steam Train

1	Push the reverser/Johnson bar forward - grip the very large lever that rises from near the floor in front or beside you, squeeze the release handle and shove it all the way forward, and let go of the release handle to lock it into place.
2	Open the cylinder cocks - find a medium size valve in front of you on the boiler, or a thin lever on the floor in front of you. Turn the valve all the way clockwise, or pull the lever back.
3	Turn the front headlight on - above you on the ceiling, there will be a large, flat, half-round box or on the side of the cab wall . Slide the knob on the round side of the box all the way to front.
4	Blow the whistle code for forward movement - there will be either a cable, cables or whistle handles, above your head or in front of you on the boiler. Quickly pull down on the cable (or push the lever) twice in quick succession to make the steam whistle sound out two short blasts.
5	Release the engine brakes - two brass horizontal levers will be near your left hand. The top one must be moved from right to left to release the brakes on the engine.
6	Open the throttle to start the engine moving - the very long lever close to your face and hanging from the cab roof is the throttle. Grip it firmly and give it a yank towards you. As you feel the engine move slightly, shove it back in most of the way, so that it does not gather speed too fast. Gradually open throttle as the locomotive approaches track speed.
7	Observe cylinder cock exhaust and close them when only steam is emitted. Move the Johnson bar slowly back toward vertical, but never too close to vertical. This is like the gear shift of your car and admits less steam per cylinder stroke. In turn, this increases the efficiency of steam usage so you don't over work the poor guy throwing coal into the fire (and to conserve fuel and water!) If the locomotive's wheels slip, close throttle most of the way immediately. Allowing the wheels to slip will not render any tractive effort and will damage the locomotive's driving (powered) wheels if done continuously (also "tears" holes in a coal fired locomotive, or in an oil burning locomotive, can cause hollow booms much like an explosion). Wheelslip, as it's called, may cause excess damage if allowed for too long. This includes damage to the firebox itself, which may or may not result in the locomotive exploding. Blow the whistle and ring bell at all crossings of all types and DO NOT EXCEED TRACK SPEED. That is very dangerous, as derailments due to excess speed may occur, even on straight track. This too can cause boiler explosions. See the Wreck of the Old 97 for example.

Driving a Diesel Train

- To start your engines, first check that your gear lever is in neutral and throttle in the "engine idling " position.
- Press the engine starter buttons the lamps alongside these buttons will prove that all your engines have kicked into life and are correctly engaged to the final drive to the road wheels.
- The guard's given you the " right away " on the inter-com. bell.
- Take off the brake the vacuum brake gauge is just above it
- Push the gear lever into first and gently open the throttle.
- Now watch the engine r.p.m. gauge. When its needle enters a sector marked " change up ", shut the throttle to "engine idling".
- Change to second gear, pause briefly to let the self-change gearbox mechanism engage the new gear, then gently reopen the throttle. A glance at your rail speed indicator shows that all this has happened at about 15 m.p.h.
- You'll find you have to make your next gear-change at 25-30 m.p.h. and the last, from third to top, at about 40 m.p.h. your engine speed indicator needle will also tell you just when to change down during deceleration.

- Always keep a grip on your throttle, for a " dead man's handle " is built into it; if you let go for more than five seconds the brakes will automatically go on, after the engines have shut down. This is a protection against any sudden illness attacking the driver, and don't forget to keep an eye on the signals and the track ahead will you.
- Other items marked in the photograph are the Electro-pneumatic control air pressure dial and the train lighting switches.

Driving an Electric Train

Driving an electric train is a pointless article to write in a SHTF situation where the grid is likely to be down, thus not letting the train draw power either at one point of multiple sections of track. What follows is a simple overview anyway. Steering is not required in a locomotive because navigation is achieved by the rails/tracks. Talking in a conventional sense, you will have an acceleration lever and a brake lever. The acceleration lever will have several notches and you need to move the acceleration lever to one notch to maintain a particular speed. Typically a diesel loco may have up to less than 10 notches. Electric loco may have more. The driving aspects vary from one loco to another. But driving a train is nevertheless simpler because you need to pay attention to signals, maintain the appropriate speed based on speed directives for that particular segment and adhere to a schedule.

5 Sea

Any forms of transport which are used on or in the ocean.

Subheadings

1. Raft	2. Canoe	3. Speedboat	4. Sailboat
5. Liveaboard	6. Abandoning Ship	7. Adrift	8. Landing
9. Boating Safety			

1 Raft

A raft can be constructed from any material that floats but most commonly by wood. Controlling the direction on a raft may be tricky but it generally used for slow moving wide rivers to travel faster than on foot.

2 Canoe

3 Speedboat

A boat may not be docked where you left it in a SHTF scenario, plan for alternative routes. A boat would be an ideal bug-out vehicle as you can traverse great distances over water where other's can't and reach isolated islands. Have at least 3x the amount of fuel required to get to your destination stored in different locations.

Driving a Powered Boat

4 Sailboat

Piloting a Sailboat

5 Liveaboard

Living life on a ship with everything you need to survive while sailing where you please. See the SURVIVAL > Water Survival > Ocean Crossing section for more info on crossing the ocean in a boat.

6 Abandoning Ship

When and how to abandon your ship safely if the situation arises.

Inflating a Dinghy

Lower a Rowboat

In the Water

What steps you should take if you've abandoned a boat and you're floating in the water.

7 Adrift

How to survive when you're adrift in a dinghy, rowboat or other unpowered or dead boat.

8 Landing

The approach and landing on solid ground with your temporary sea craft.

9 Boating Safety

How to operate boats safely and what to have aboard.

6 Air

Any forms of transport which are used in the sky.

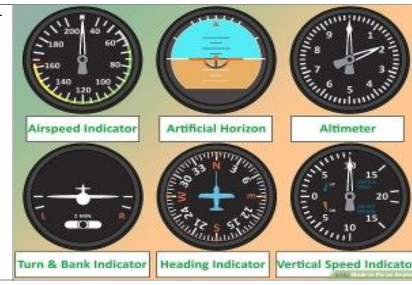
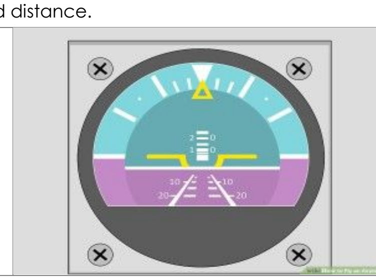
Light Aircraft

Much larger expense then other transport methods and requires a licence to practise. Most versatile and fastest transport system allowing travel of great distances to your bug out location. Have a pre-set destination landing strip and make sure it's clear of debris, have a back-up as well.

Piloting a Light Aircraft

How to pilot a light aircraft if the need arises.

1	Perform an inspection of the aircraft before getting in. Before taking off, it's important to perform a walk-around examination called a "pre-flight." This is a visual inspection of the aircraft to verify that the airplane components are in good working order. You should have an operating checklist for the plane and this will tell you exactly what to do in each phase of flight, even pre-flight. The basics of pre-flight: ● Check control surfaces. Remove any control locks and make sure your ailerons, flaps, and rudder are moving freely and smoothly. ● Visually check your fuel tanks and oil. Make sure they're filled to the specified levels. To check the fuel level, you'll need a clean fuel measuring rod. To check oil, there's a dipstick in the engine compartment. ● Check for fuel contaminants. This is done by draining a small amount of fuel into a special glass container tool, and looking for water or dirt in the fuel. ● Fill out a weight and balance sheet which helps ensure that you are not flying outside the capabilities of your airplane. ● Look for nicks, dings, and any other type of body damage. These small imperfections might inhibit your aircraft's flying ability, especially if the prop is compromised. Always check props before an engine start. Use caution around airplane props. - If there are electrical issues with the plane, the prop could turn over unexpectedly, causing severe injury.
● Check emergency supplies. There is always the possibility of something going wrong with the aircraft. Make sure there is a supply of food, water, and first aid items. Also ensure that you have an operating radio, flashlight, and batteries. A weapon may be needed along with standard repair parts for the plane.	
2	Locate the flight control (column) in the cockpit. When you take your seat in the cockpit, all of the systems and gauges will look complicated, but they'll look much simpler once you become familiar with what they do. In front of you will be a flight control that looks like a modified steering wheel. ● This control, more commonly called the yoke, works like a steering wheel in a car. It controls the pitch of the nose (up or down) and banking of the wings. Get a feel for the yoke. Push to go down, pull to go up, and use left and right to roll, unsurprisingly, left and right. Don't use too much force when flying. - It doesn't take much to control the plane.
3	Locate the throttle and fuel mixture controls. They are usually located between the two seats in the cockpit. The throttle is black, and the mixture knob is red. In General Aviation, they are usually just push/pull knobs. ● Thrust is controlled by the throttle and the mixture knob adjusts the fuel-to-air ratio (lean or rich in gas).

4	Familiarize yourself with the flight instruments. On most aircraft, there are six primary flight instruments located along two horizontal rows. These indicators are often referred to as the six pack and show, among other things, altitude, attitude (orientation of the aircraft relative to Earth's horizon), compass heading, and speed—both forward and up or down (rate of climb).
	● Top left - The "Airspeed Indicator" shows aircraft airspeed, usually in knots. (A knot is one nautical mile per hour—about 1.15 MPH or 1.85km/h). ● Top centre - The "Artificial Horizon" shows the aircraft attitude, that is, whether the plane is climbing or descending and how it is banking - left or right. ● Top right - The "Altimeter" shows the height (altitude) of the aircraft, in feet MSL—feet above mean, or average, sea level. ● Lower left - The "Turn and Bank Indicator" is a dual instrument which tells how fast you are changing the compass heading (rate of turn) and also whether you are in co-ordinated flight, This is also called the "Turn and Slip Indicator" or "Needle Ball." ● Lower centre is the "Heading Indicator" which shows your aircraft current compass heading. This instrument should be calibrated (every 15 minutes). To calibrate, adjust the instrument to agree with the compass. This is done on the ground or only in straight and level flight. 
	● Lower right is the "Vertical Speed Indicator" which tells how fast you are climbing or descending in feet per minute. Zero means that you are maintaining altitude and are neither climbing nor descending.
5	Locate the landing gear controls. Many small planes have fixed gear, in which case you will not have a landing gear control knob. For airplanes that do have a landing gear control, the location varies, but it usually has a white rubber handle. You will be using this after you take off and before you land and taxi the plane. It may deploy any non-fixed landing gear—wheels, skis, skids, or floats beneath. 
6	Place your feet on the rudder pedals. These are a set of pedals at your feet used to control the rudder which is attached to the vertical stabilizer. When you want to make minor adjustments to go left or right on the ''vertical'' axis, use the rudder pedals. Basically, the rudder controls the yawing aspect of turning the aircraft. Turning on the ground is also controlled by the rudder pedals and/or the brakes, not by the yoke.
7	Adjust the flaps to the proper angle for takeoff. Usually 10 degrees of flaps are used to help increase lift. Check your aircraft manual, though. - Some aircraft do not use flaps for takeoff.
8	Perform an aircraft run-up procedure. Before you reach the runway, stop at the run-up area. You'll have to perform the engine run-up procedure here. This helps insure that your aircraft is ready to fly safely.
9	Start the take-off run. Push the fuel mixture knob completely in and advance the throttle slowly. This will increase the engine RPMs (revolutions per minute), generating thrust and the airplane will start to move. Note, though, that the plane will want to go left when you do this, so add proper rudder to stay on the runway centreline. ● If there's a crosswind, you will need to turn the yoke, carefully, into the wind. As you pick up speed, slowly decrease this correction. ● You'll need to control the yaw (twisting on a vertical axis) with the rudder pedals. If the plane starts doing twisting, use the foot pedals to control it.
10	Get up to speed. In order to take off into the air, the plane needs to achieve a certain speed to create enough lift. The throttle should be full on in most aircraft, though some will have a maximum setting to reduce over torquing. You will gradually build enough airspeed to become airborne (usually around 60 knots for small planes). The airspeed indicator will tell you when you have reached this speed. ● When the plane gets enough lift, you'll notice the nose lifting off the ground a bit. Pull gently back on the flight control, being sure to maintain the proper climb rate for the particular aircraft.
11	Pull back on the yoke at this point. This will cause the whole airplane to leave the runway and rise into the air. ● Remember to maintain climb speed and apply proper rudder. ● When at a safe height above the ground and you have a positive rate of climb as indicated by the VSI (Vertical Speed Indicator), return the flaps and landing gear to neutral position. This will reduce drag and extend the safe flying time and distance.
12	Line up the artificial horizon, or attitude indicator. This will keep the plane level. If you fall below the artificial horizon, pull back to raise the nose of the airplane, lifting it. Again, be gentle. - It doesn't need much. ● The best way to keep the plane at the right altitude is making sure you constantly scan the attitude indicator and the altimeter, as well as the rest of the six pack. Get in the habit of scanning so that you don't fixate on any single instrument for an extended time. 
13	Bank (turn) the plane. If you have a wheel in front of you (the yoke), turn it. If it's a stick, move it to the left or right to turn. Stay in coordinated flight by using the needle ball (turn coordinator). This gauge depicts a little airplane with a level line and a black ball along it. Keep the black ball in the centre by adjusting the rudder so your turns feel smooth (coordinated). ● A useful learning aid is think step on the ball to know which rudder pedal to step on when co-ordinating a turn. ● The ailerons "control" the bank angle and work in conjunction with the rudder. When turning, coordinate the rudder and ailerons by keeping the turn and bank instrument ball centred, remembering to keep an eye on your altitude and air speed by scanning the six pack.
14	Manage the speed of the airplane. Every airplane has an engine power setting optimized for the cruise phase of flight. Once you've reached your desired altitude, this power should be set to around 75%. Trim the aircraft for straight and level flight. You will feel the controls become smoother as you trim the plane. You'll also find on some aircraft that this power setting is in the torque free zone, where no rudder input is required to maintain straight line flight. ● At maximum power you may find that the nose drifts laterally due to the engine torque and requires an opposite rudder correction. Similarly, you may find that the opposite rudder input is required at flight idle power setting. ● To keep the plane steady, it's necessary to maintain sufficient airflow and speed. Flying too slowly or at overly steep angles can cause the plane to lose airflow and stall. This is most dangerous during takeoff and landing, but it's also important to keep the plane at the appropriate speed during flight. ● Just as you would wear out your car engine if you drove with your foot planted to the floor, you'll do the same to the plane's engine. Only increase power to maintain airspeed in a climb and reduce power to descend without accelerating.

15	Fly with a light touch on the controls. If (and when) you experience extreme turbulence, it is critical not to over-correct. Sudden, large changes in the control surface orientations can push the aircraft past its structural limits, causing damage to the plane and, potentially, compromising its ability to continue flying. ● Another issue is carburettor icing. There is a small knob labelled "carb heat". Apply carb heat for short periods of time, about every ten minutes or so, especially at the high relative humidity levels that encourage icing. Note: This only applies for planes with a carburettor. ● Don't zone out. – You still need to be scanning for other aircraft and keeping an eye on the six pack.
16	Set the cruising engine speed. Once you get a constant cruising speed, you can set the controls and lock them, so the plane will remain at a constant power and you can focus on keeping it level. At this stage, reduce the power on the throttle to about 75% of where it was set. For a single engine Cessna, this should be somewhere around 2400 RPM. ● Next set the trim. The trim is a small surface on the edge of the elevator. It can be moved from within the cockpit. Setting it correctly will prevent the plane from climbing or descending while in cruise flight. ● There are different kinds of trim systems. Some consist of a wheel, lever, or crank which pulls a cable or rod attached to a trim surface bell-crank. Another is a jackscrew and rod. And yet others are an electrical system (which is the easiest to use). The trim setting on each plane has a corresponding speed that the aircraft will seek and hold. It varies by weight, plane design, centre of gravity, and carrying weight (cargo plus passengers).
17	Reduce the airspeed. To do this, reduce power and lower the flaps to the appropriate level. Do not deploy flaps at excessively high speeds (only when airspeed is within the white arch on the airspeed instrument). Stabilize the airspeed and rate of descent by applying back pressure on the control wheel. Knowing if you're right just takes practice. ● Pick your aiming point and begin your descent.
18	Get the right angle of descent and airspeed. This is controlled by a mixture of throttle and yoke. Once you've found a runway, you need to have the combination exactly right to land. When it comes to flying an airplane, this is the hardest part. ● A general rule is that the best approach speed is 1.3 multiplied by the stalling speed of the aircraft. This should be indicated on the ASI. However, always take into account wind speed, too.
19	Lower the nose and watch the numbers on the runway. Those are there for a reason: They tell the pilot whether he or she is going to overshoot or land short. Lower the nose, keeping the numbers right on your horizon. ● If the numbers start to disappear under the aircraft nose, you are landing long. ● If the number distance themselves from the aircraft nose, you are landing short. ● As you get closer to the ground, you will experience the "ground-effect." This will be explained by your instructor in detail, but basically the ground effect causes the plane to float a bit because of reduced drag near the ground.
20	Reduce the throttle to idle. Raise the nose slowly by pulling back on the yoke, until the two main wheels touch down. Continue holding the nose wheel off the ground; it will settle to the ground by itself.
21	Come to a stop. Once the nose wheel has touched down, you can apply brakes to slow for exiting the runway. Exit as soon as possible on the off ramp specified by the tower. Never stop on a runway.

Helicopter

Helicopters can be a valuable asset in a SHTF situation. You can get out of town much faster than in a car and the air can't be blocked by traffic. They can be expensive to maintain and a lot of land will need to be owned but options include keeping it at an airfield. You may want to rethink air travel however if there's an airborne disease prevalent as the rotors will kick it up everywhere.

Piloting a Helicopter

1	Familiarize yourself with the helicopter components and controls. Read your individual aircraft's operating handbook. Here are some of the basic controls you'll need to know to operate the helicopter: ● The collective is the lever mounted on the cabin floor to left side of the pilot's seat. ● The throttle is the twistable grip at the end of the collective. ● The cyclic is the "stick" located directly in front of the pilot's seat. ● The tail rotor is controlled by the two pedals on the floor also known as anti-torque pedals.
2	Understand the helicopter's capabilities and limitations. The majority of accidents are caused when the rotor system gets overloaded. When pilots attempt manoeuvres that require more lift than the rotor system can produce or more power than the helicopter's power-plant can provide to maintain lift.
3	Operate the collective control with your left hand. ● Raise the collective to make the helicopter rise, and lower it to make it go down. The collective changes the main rotor's blade angle collectively. The main rotor is on top of the helicopter. ● Adjust the throttle. As you raise the collective, you need to increase engine speed. Decrease speed as you lower the collective. Throttle is directly linked to the position of the collective lever so that the RPM is always in line with the collective setting. You will only need to make adjustments when necessary.
4	Operate the cyclic control with your right hand. The cyclic is similar to a joystick, but sensitive, so make very small movements. ● Push the cyclic forward to move forward, back to move backward, and to either side to travel sideways. The cyclic does not change the direction in which the front of the helicopter points, but it does cause the helicopter to tilt forward and back (pitch) or to the right and left (roll).
5	Operate the tail rotor pedals with your feet. These two pedals (or anti-torque pedals) control the direction in which the helicopter is pointing, more or less having the same effect as the yaw pedals in an airplane. ● Gently increase pressure on the left pedal to swing the nose left, or increase pressure right to swing the nose right. ● The yaw pedals increase or decrease the force that the tail rotor produces, thereby controlling the yaw. Without a tail rotor to counteract main rotor torque, the helicopter will naturally spin in the opposite direction of the main rotor.
6	Take off. Follow these steps to perform a standard takeoff: ● First, open the throttle slowly until you reach proper operating RPM. ● Pull the collective gradually up. As collective pitch increases, push the left pedal (right pedal for clockwise rotating main rotors). Continue pulling on the collective and depressing the left pedal. Adjust the pedal if the aircraft is turning to the left or right. ● The helicopter will leave the ground and you'll be able to use the cyclic. As you continue to pull the collective and depress the pedal, adjust the cyclic to level the aircraft as you take off. Push forward slightly to start moving forward. ● As the helicopter transitions from vertical to forward motion, it will shudder and the nose will pull up. Push the cyclic forward a little more to make sure you keep going forward. The phenomenon that causes the shudder is called effective translational lift (ETL). ● As speed increases the Rotor blades lift becomes more effective. It is important to anticipate for this phenomenon and correct for them. ● As you progress through ETL, reduce the collective lever and apply less pressure to the pedal. Push the cyclic forward to avoid an abrupt nose high attitude and reduction in forward speed.

TRANSPORT | Air | Helicopter | Piloting a Helicopter

	• Once you've taken off, slightly release forward cyclic pressure. The aircraft will then begin to climb and gain airspeed. From this point, the pedals are primarily used to trim the aircraft. Most manoeuvres will only require a combination of the cyclic and collective controls.
7	Hover by finding a balance between the collective, cyclic and tail rotor controls. • Learn to do this with an instructor, who can operate the other controls while you practice them 1 at a time, and then in combination. You must learn to anticipate the time lag between when you adjust the controls and the helicopter's reaction.
8	Climb and descend using speeds according to your pilot operating handbook. This will vary depending on terrain. Maintain 15-20 knots during a steep climb. Carefully increase collective and be sure not to exceed the yellow limit of the torque gauge.
9	Land, taking care to always have your landing target in sight, normally slightly to your right (pilots side). This may mean that you have adjust your trim so you are turned slightly to one side as you approach. • Try to be around 200–500 feet (61.0–152.4 m) above ground or any obstacles when you are .5 kilometres from your landing area. • Watch your airspeed. At around .2km from the landing area slow the aircraft to 40 knots and begin to descend. Check your descent rate. Be careful not to let your vertical speed go over 300 feet (91.4 m) per minute. Vertical speed can be adjusting by applying the necessary amount of collective. • As you approach the edge of the landing area, gradually slow to 30, then 20 knots. You may need to bring the nose up to decrease airspeed. Doing so will momentarily obscure your sight of the landing area. • Keep moving forward when you get to the landing area, since it's much harder to control drift and land on the target if you hover first. Once the spot you want to land appears to slide beneath the nose of the aircraft you can then reduce the collective. • Arm the parking brake. Ease the cyclic back to reduce momentum and then forward to level the altitude. Keep rate of descent as low as possible — adjust the collective appropriately.
	• Once you have made contact with the ground, check that your parking brake is armed and then reduce all power.

TRANSPORT | Space

7 Space

Any form of transport which is used in space.

Navigation

How to find your way across the globe

"I'm not lost, I'm exploring."
Unknown

Introduction

This category involves navigation over all forms of terrain using various methods of pinpointing your current location.

Purpose	The aim of NAVIGATION is to help the reader navigate around the world using a range of various navigating instruments and techniques. It gives a foundational understanding of compass and GPS basics, how to read the sun and stars to find the date and time and how someone can keep track of their position using what's around them.
Lost?	• For information on the different types of terrain, see the SURVIVAL section. • For information on countries and nations, see the GEOGRAPHY section. • For the different types of transportation while navigating, see the TRANSPORT section. • If you want to know about the different buildings and locations in an area, see the LOCATIONS section.

Contents

1 Location Basics

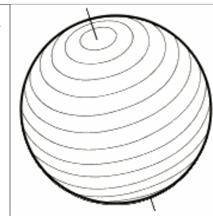
Lat & Long

Latitude

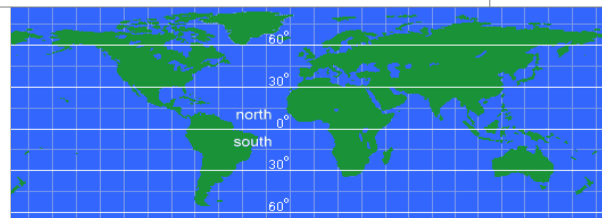
Our coordinate system is going to be based on the spinning earth. The earth spins around on its axis. One end of the axis is the North Pole and the other is the South Pole. These are the two most important points on earth as far as directions and navigating are concerned. The most important number for figuring out locations is 360. There are 360 degrees in a circle and that is the shape of our world, no matter how you slice it.

If you could stand at the centre of the earth, you could look out at the surface of the earth all around you. With the North Pole directly above your head, if you looked straight ahead in any direction, you would be looking at the equator. This imaginary line is exactly halfway between the north and south poles and has a latitude of 0 degrees because you are looking straight ahead at an angle of 0 degrees. If you look up a bit, maybe at an angle of 30 degrees, you have increased your latitude to 30 degrees North.

Continue to look up higher and higher until you are looking straight above you at the north pole which is 90 degrees North. The same thing happens if you look down under the equator. The degrees increase until you are looking straight below you at the south pole which is at 90 degrees south latitude. Just like the equator is a line drawn around the earth at 0 degrees latitude, you can draw a line around the earth at any latitude. Draw a lot of these lines and you will see something like this:

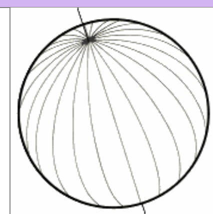


90 degrees north and 90 degrees south are actually just points, not circles. Notice that each latitude is parallel to all others. The actual distance between latitudes is always the same. But, since greater latitudes are closer to the poles, circumferences get smaller as latitudes increase. Drawing those latitude lines onto a map would look like this:

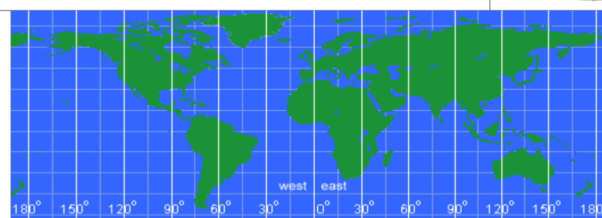


Longitude

Longitude is the angle east or west around the earth, just like latitude is the angle north and south. Longitude lines are called meridians. For latitudes, we have two fixed points - the north and south poles - that we use as end points. But, going around the earth, there is no start or stop, it just keeps spinning and spinning. So, an arbitrary spot was chosen to be the Start point for longitudes. This spot is the Royal Observatory in Greenwich, UK. The longitude line that runs through it is called the Prime Meridian and is longitude zero degrees.

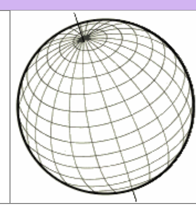


Notice that longitude lines are not parallel. The closer to the poles you get, the shorter the distance between meridians until they all actually converge at the poles. Drawing those longitude lines onto a map would look like this:



Combination

Combining latitude and longitude results in a grid that covers the globe. Every point can be defined by a north/south degree and an east/west degree. For example, Seattle, Washington, USA is at latitude 47.6° North and longitude 122.33° West. From the centre of the earth, look up 47.6° from the equator and turn right (west) 122.33° from the Prime Meridian and you will be looking directly at Seattle. Well, degrees are fine and good, but the earth is almost 25000 miles around so dividing that into 360 pieces means each degree is about 69 miles wide around the equator. That isn't very precise. To help with that, each degree is divided into 60 minutes and each minute is divided into 60 seconds. These used to be used all the time, but now fractional degrees are more common.



For example, the location of the White House in Washington, DC is:
Decimal Degrees (Deg:Min:Sec)
Lat: 38.898648N (38° 53' 55.133" N)
Lon: 77.037692W (77° 02' 15.691" W)

USGS topographic maps are called 7.5 minute maps because they span 7.5 minutes of latitude and 7.5 minutes of longitude. The most common latitude and longitude map is a 1:24,000 scale and the actual map size is about 22 inches by 27 inches. It takes about 57,000 of these maps to cover the entire US and you can buy any of them you want.

Tips
- Latitude is always given before longitude (49° N 100° E)
- Latitudes are parallel, but longitudes are not
- Degrees West and South are sometimes referred to as negative degrees (-12° -23° is the same as 12 S 23 W)
- A place's latitude effects its climate, but its longitude does not
- Key longitude lines are the Prime Meridian (0°) and the International Date Line (180°)
- Key latitude lines include the equator (0°), tropic of cancer (23° 26' N), tropic of Capricorn (23° 26' S), the arctic circle (66° 33' N), and the Antarctic circle (66° 33' S)

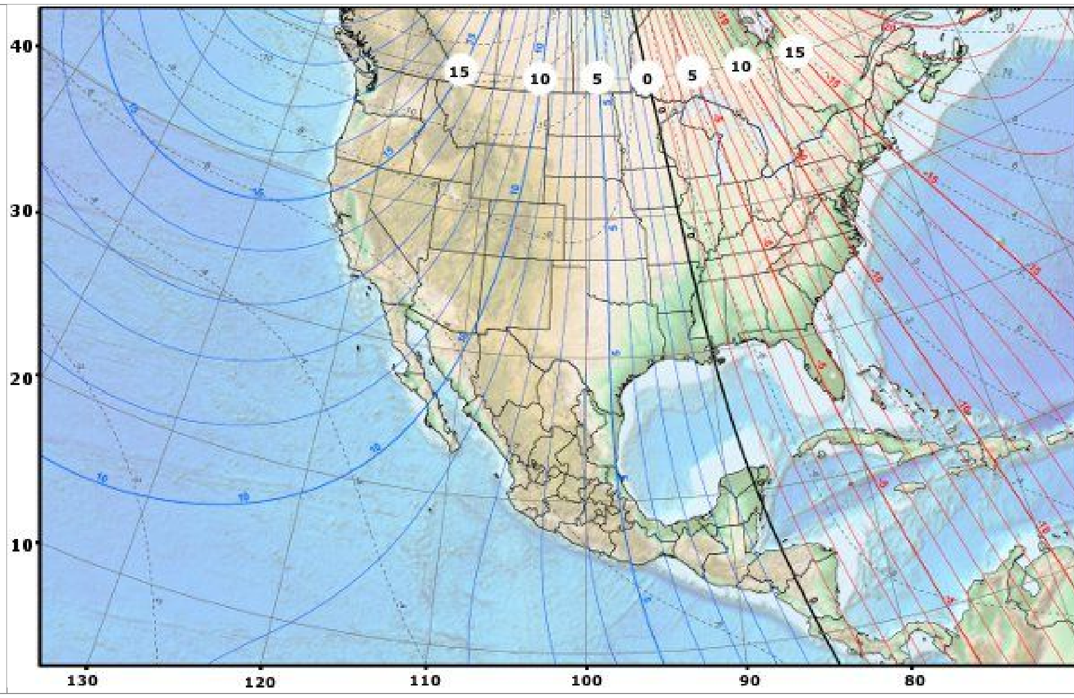
Magnetic Declination

Two North Poles
There are actually two north poles - the Geographic north pole which is the axis around which the earth spins, and the Magnetic north pole which is where compass needles point. Why are there two different poles?

The magnetic north and south poles are the ends of the magnetic field around the earth. The magnetic field is created by magnetic elements in the earth's fluid outer core and this molten rock does not align perfectly with the axis around which the earth spins. There are actually many different sources of magnetic activity around and in the world. All those influencing factors combine to create the north and south attractions at each spot on the globe. The actual strength and direction of 'north' is slightly different everywhere, but it is generally towards the 'top' of the planet.

The difference between the north geographic pole and the north magnetic pole is called magnetic declination or usually just declination.

Depending on where you are on the earth, the angle of declination will be different - from some locations, the geographic and magnetic poles are aligned so declination is minimal, but from other spots, the angle between the two poles is pretty big. To the right is a map of the angles of declination for the U.S. as of 2010.

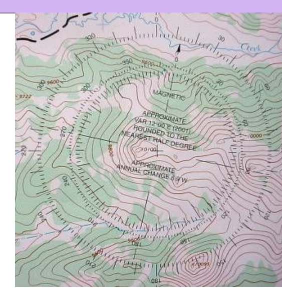


Along the black line with 0° on it running down the Mississippi river, both the geographic and magnetic north poles are in alignment so there is no declination. If you move East of this line, the magnetic north pole will pull your compass needle further and further to the West of geographic north - the angle of compass declination is West Declination. Moving west of the Mississippi river will pull your compass needle further and further to the East.

Compass Declination

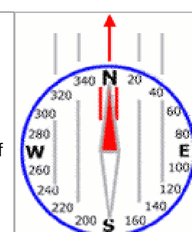
This makes it a bit more challenging to find your way because your compass tells you North is a different direction, depending on where you are. Topographic maps used for navigating should have the declination printed on them like this example. This declination is for an area in the Bighorn Mountains in Wyoming where the declination is 12 degrees East in 2001, when the map was made. It also says that the declination is changing 6.9 minutes West each year.

Using this old map, the declination would be about 11 degrees East in 2010 - about 1 degree less than the map has printed. Unfortunately, the rate of declination change changes over time. When the map was printed, the rate of change was 6.9 minutes West each year. But, it has now sped up to 9 minutes West each year.

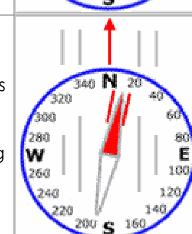


This has been changing every year since the map was printed so the current declination for this area is 10 degrees 41 minutes East. That is already a larger change than what we would expect for 2010, based on the map's information. You should only use recently published maps or know the current declination for the area and use that information for your navigation. There are a few ways to solve this extra challenge of finding true north - either changing your compass or using math in your head.

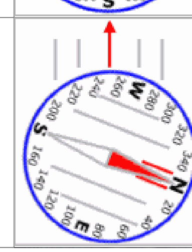
Adjusting Your Compass Declination Adjustment
On many compasses, you are able to adjust the declination by twisting a ring, using a screw, or some other method of changing where the orienting arrow sits in relation to the ring. If you used a compass set with 0 degrees declination in Wyoming where the declination is 12 degrees East, the compass would tell you that you're heading North when you're actually heading 12 degrees East of North. You'd quickly wind up off course and lost.



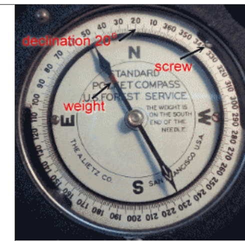
By adjusting the compass to match the declination on our map, the orienting arrow now appears to be off-centre from North, which is how it should be. Now, when you put RED in the SHED (needle inside orienting arrow), the North indicated at the index pointer is true north and matches your map. You can continue to check your location and chart your course correctly. Whenever you stop and check your heading or take a bearing on a distant object, the degrees read on the dial will be the actual true degrees. The only thing that looks a bit odd is that the north end of the compass needle does not point directly at the N when you are heading due North.



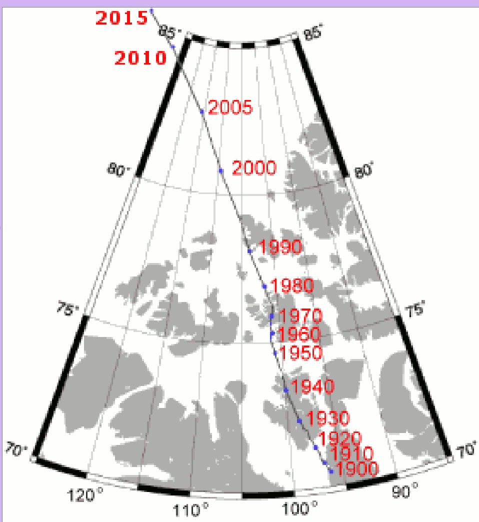
If you have a compass with no declination adjustment or you just like math, then you can do the declination calculations in your head. If you are in Wyoming with a 12 degree East declination, add 12 degrees to the heading you read on your compass dial to determine your true heading. In this example, the reading is 250 degrees. But, you are actually facing 262 degrees. So, to actually head 250 degrees, you need to get a reading of 238 degrees and then you're heading the right way.



Inclination
Inclination is the angle of pull down toward the earth that the magnetic field exerts on a compass needle. At the north magnetic pole, the north end of the needle is pulled straight down toward earth. The compass doesn't do much good if it is pointing straight down. And, actually, for hundreds of miles around the magnetic poles, compasses are worthless. For even more hundreds of miles around that, compasses can be erratic. So, if you are planning an arctic or Antarctic expedition, don't count on your Silva or Brunton for getting you there and back. Not only that, but there are southern hemisphere and northern hemisphere compasses. There is a Forest Service compass shown to the right which has a weight on the southern end to offset the inclination pull in the northern hemisphere. If this compass is taken to the southern hemisphere, the weight would cause it to drag and not balance properly. You might also notice the two declination adjustment screws and the fact that it is currently set for about 20 degrees East declination. This is not a good compass for mountaineering for many reasons.



Drifting Poles



Back to the magnetic north and south poles - which are caused by the earth's molten outer core which is always shifting and churning. As the liquid rock moves, so does the magnetic field. The map to the left shows how the north magnetic pole has shifted over the past century. It has picked up speed lately and has moved more in the last 15 years than in the 50 years before that, it's now moving about 40km (25 miles) per year on its way out of Canada towards Russia.

Therefore if you follow your compass north this year, you will be drawn towards a different place than 15 years ago. Declinations are constantly changing and that means what is written on a map you buy this year will be incorrect next year. The difference depends on where the north pole moves to and what your current declination is.

For example, if you pointed north from Fairbanks, Alaska in 2006, you would follow Line #1. 100 years ago, you would have followed Line #2.

From other places, such as Winnipeg, Manitoba, Line #3 in 2006 and Line #4 100 years ago are nearly the same. These moving magnetic poles continually effect navigation. It's more serious for airplanes and ships, but even for hikers and backpackers, it causes problems. Using a 10 or 15 year old map is a bad idea since the declinations are no longer accurate. If the north pole movement continues at its present speed, it moves 402 km (250 mi) every 10 years. That's about 40 km or 25 miles every year), but lately it has been speeding up so no one knows what the next 10 or 20 years hold in store. Historically, the magnetic field of the earth has churned over and reversed and some scientists say we are well overdue for such a reversal.

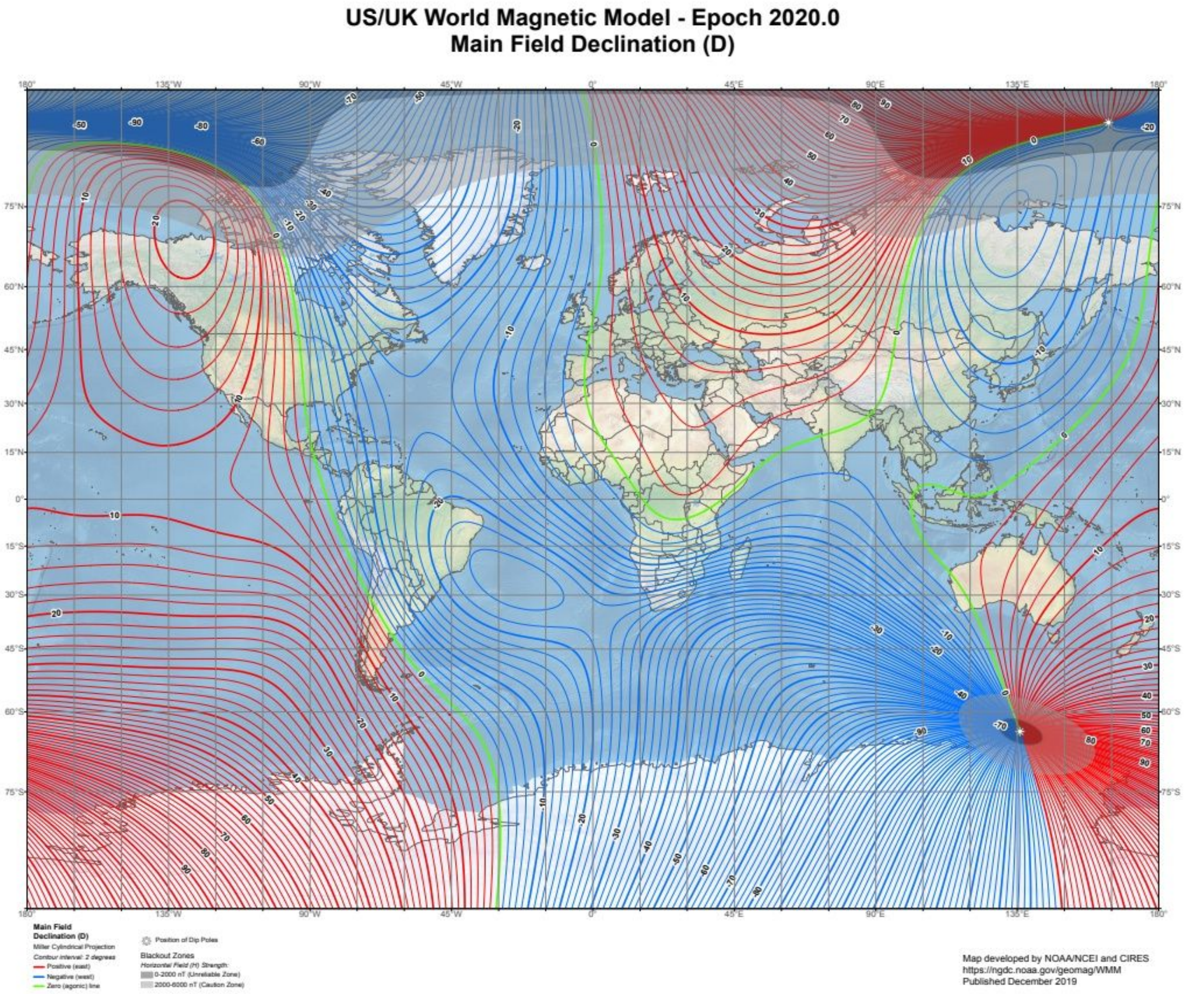
Current Declination Map
https://maps.ngdc.noaa.gov/viewers/historical_declination/

2020 Declination Map

The world magnetic declination map for 2020^n. Red is a positive declination and requires adjusting actual north to the left and blue is a negative reading and north need to be adjusted to the right.

Thick lines are increments of 10° and thin lines are single degrees. Do not use this map to calculate local declinations as they will have changed!

If you must, use it as a general guide only if the internet is out as it will still most likely get you where you're going. Below are declination readings from major cities, adjust in the opposite direction to what is shown.



2018^n City Readings America
- Los Angeles +12°E
- Seattle +16°E
- Houston +2°E
- Austin +4°E
- Chicago +4°W
- Nashville +4°W
- Atlanta +5°W
- Columbus +7°W
- Washington +11°W
- Philadelphia +12°W

2018^n City Readings America
- New York +13°W
- Miami +7°W
- Honolulu +10°E
- Anchorage +16°E

2018^n City Readings Australia
- Canberra +13°E
- Sydney +13°E
- Melbourne +12°E
- Hobart +15°E
- Brisbane +11°E
- Adelaide +8°E
- Alice Springs +5°E
- Darwin +3°E
- Perth +1°W

2018^n City Readings United Kingdom
- London +0°
- Manchester +1°W
- Edinburgh +2°W
- Dublin +3°W

2018^n City Readings Canada
- Vancouver +16°E
- Edmonton +14°E
- Regina +9°E
- Winnipeg +3°E
- Ottawa +13°W
- Montreal +15°W
- Quebec +16°W
- Halifax +17°W
- St John's +18°W

2018^n City Readings New Zealand
- Dunedin +26°E
- Christchurch +24°E
- Wellington +23°E
- Auckland +20°E

2018^n City Readings Other Countries
- Tokyo +7°W
- Beijing +7°W
- Singapore +0°E
- Mumbai +0°E
- Dubai +2°E
- Johannesburg +20°W
- Cairo +5°E

2018^n City Readings Other Countries
- Moscow +11°E
- Stockholm +6°E
- Berlin +4°E
- Jerusalem +4°E
- Paris +1°E
- Lisbon +2°W

2018^n City Readings Other Countries
- Reykjavik +14°W
- Recife +22°W
- Belém +20°W
- Montevideo +10°W
- Quito +4°W
- Guatemala +0°E
- Mexico City +4°E
- Havana +5°E

2 Compass Basics

The basics of a compass and how to use one properly.

Compass Types

Two main types of the compass are magnetic compass and gyro compass. First one has a magnetic element (needle or a card) that aligns itself with magnetic lines of Earth's magnetic field to point to the magnetic poles of the Earth. Gyro compass has a rapidly spinning wheel whose rotation interacts with the rotation of the earth until its axis of rotation is parallel with the Earth's and points to the Earth's rotational poles. This compass points to the true poles of the Earth.

Liquid Compass	Has a magnetized needle or card immersed in fluid. This method lessens excessive swing and wobble and improves readability while reducing wear.

Marine Compass / Card Compass	This type of compass has a needle that is fixed and a compass card that is mounted in fluid and rotates according to orientation. It is used on boats because the moving card absorbs much of the motion of a boat which makes it easier to read than a needle compass.
Prismatic Compass / Lensatic Compass	They have a glass prism or a lens and a lid that has a hairline. These are used for lining up with an object whose bearing is sought. It also has compass card which rotates in the base. When the compass card stops, the required bearing is read off through the prisms or lens. Some of them have liquid as a damping mechanism while other use electromagnetic induction for the same purpose. Some also have tritium and a combination of phosphors which help to read of the compass in the dark.
Base Plate Compass / Orienteering Compass	It is a liquid filled compass placed on the rectangular base made of transparent plastic so a map can be read through it. It often has a magnifying lens for map reading, some sort of light for low light conditions and a ruler. It is often used for plotting.
Thumb Compass	Is a variant of base plate compass but smaller. It is fixed on the thumb (as its name says) which leaves one hand free.
Solid State Compass	They are found in electric devices. They often have two or three magnetic field sensors from which microprocessor reads data about the orientation of the device. They can often be found in clocks, mobile phones and tablets.
GPS Compass	Uses satellites in a geo synchronous orbit over the Earth to show exact location and direction of movement of bearer.
Astrocompass	Uses positions of various astronomical bodies to find true north. It is used in polar regions where magnetic compasses and gyrocompasses are unreliable. It uses current time and geographical position in the form of latitude and longitude. According to this information, it is sighted on to any astronomical object with a known position to give an extremely accurate reading.

Improvised Compass

Make a Compass
A compass acts as a pointer to magnetic north because the magnetized needle aligns itself with the lines of the Earth' magnetic field. Magnetism and the Earth's poles making a compass in the wild requires a magnetic needle and something to allow it to pivot. Ferrous metal that is un-magnetized can be used and magnetized later. Metal such as a needle or razor blade will suffice and can be suspended from a piece of thread or long hair. You can magnetize (or polarize) a ferrous metal object by slowly stroking it in one direction on a piece of silk or through your own hair. Metal can also be magnetized by stroking it at one end with a magnet. Always stroke in the same direction. As an alternative, insulated wire can be coiled around the metal object and both ends attached to a battery. Then repeatedly insert one end of the metal object in and out of the coil. This will magnetize the metal object. Once the object has been magnetized, suspend if from a piece of non-metallic string or floated on a small piece of wood, cork, or leaf in water (or some other low friction surface). The metal object will align itself with a north-south line.

Materials ● Needle / Ferrous Metal ● Magnet / Silk / Hair ● Leaf ● Water	You can construct a more elaborate improvised compass using a sewing needle or thin metallic object, a non-metallic container (for example, the cut-off bottom of a plastic container or soft drink bottle), and the silver tip from a pen. To construct this compass, take an ordinary sewing needle and break in half. One half will form your direction pointer and the other will act as the pivot point. Push the portion used as the pivot point through the bottom centre of your container; this portion should be flush on the bottom and not interfere with the lid. Attach the centre of the other portion (the pointer) of the needle on the pen's silver tip using glue, tree sap, or melted plastic. Magnetize one end of the pointer and rest it on the pivot point. The needle will align itself on a north-south line.

Using a Compass

Cardinal Directions
There are four cardinal points on a compass - North, South, East, and West. When reading a compass, and telling other people directions, you need to wipe "right" and "left" out of your vocabulary. Right and Left are relative directions and differ depending on your location and direction, but the cardinal points are constant. The direction halfway between North and East is an intercardinal point and is called Northeast. The other three intercardinal points are Southeast, Southwest, and Northwest. Finally, there are secondary intercardinal points halfway between each cardinal point and intercardinal point. These are North-Northeast, East-Northeast, East-Southeast, South-Southeast, ... and so on.

With these directions, you can give someone a fairly good idea of what direction they need to go. We could add additional points, continuing to break each section in half over and over, but telling someone to go East-EastEastNorthEast-EastNorthEast would not be fun. Since there IS a need for more precise directions, the circle of a compass face is split into 360 marks called degrees. For rough directions, go ahead and use North or Northwest. But, for finding your way or locating destinations in the wild, use degrees as you'll see in a bit.

Compass Anatomy

Base Plate
A typical orienteering compass will be rectangular in shape and be approximately 2-by-4 inches in size. The base plate of the unit will be made of clear plastic and marked along the sides with ruler increments. There will also be a direction of travel arrow printed on the centre of the base plate which is used for course plotting. There will also be a small magnification window for reading fine print and is also handy for starting fires in a survival situation. There is also an index pointer at the base of the compass that aligns with the direction of travel arrow and ends at the edge of the compass heading dial for determining degree headings.

Compass Housing
The housing is the raised portion of the compass which contains the direction needle and is filled with liquid. The needle is a magnetized piece of metal with one end painted red to indicate north. The needle rests on a small point which allows for unrestricted free movement. The bubble of air is left as an aid in levelling. The compass should be held so that the bubble is centred over the centre point of the needle where it rotates. Underneath the bubble may be orienting lines that are used to align the compass to lines on a map. This will usually be a starting reference point for reading a map.

Other Compass Features
Other types of compasses may have features that aid in orienteering. A sighting window allows the user to hold the compass at eye level and get a visual fix on a distant object. A mirror may also be featured on some models which you to see reference an object and see the heading at the same time. The mirror is also useful as a signalling device in an emergency situation.

Compass Units

There are a few different ways a compass is divided into units. Depending on the use for the compass, different units of measure may be more useful:

Points	Cheap, basic compasses may be marked with the cardinal points of North, East, West, and South with the intercardinal points of North East, South East, South West, and North West between them. These compasses just provide your general direction when accuracy is not necessary.

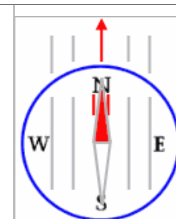
Degrees	A compass divided into 360 degrees is the most common unit of measurement. Each degree is divided into 60 minutes, each minute into 60 seconds. A handheld compass is not able to measure down to a minute, let alone a second, but those units are used for precise locations using latitude and longitude. North is at 0 degrees (and 360 degrees), East is 90 degrees, South is 180 degrees, and West is 270 degrees. Some compasses may be marked in degrees only from 0 to 90. See this example. It has 0 to 90 degrees from North to East. It also has 0 to 90 degrees from South to East, South to West, and North to West. With this style of compass, readings such as North 20 degrees East are used. That means 20 degrees towards East from North. A bearing of South 70 degrees West would be the same as 250 degrees on a normal 360 degree compass (180 degrees for South plus 70 degrees).
Mils	Another unit of measure, the radian, is used mainly by militaries in artillery, tank, and mortar gunnery. There are 2 PI radians in a circle. PI is a constant of approximately 3.1416. That is 2 * 3.1416, or 6.283 radians. Divide each radian into 1000 mil-radians and you see there are 6283 mil-radians in a circle. Mil-radians are called mils for short. 17.78 mils equal 1 degree. Compass use of mils typically rounds 6283 to 6400 for simplification. Some foreign militaries have simplified the other direction and divided the compass face into 6000 units, exactly like the face of a watch, with 100 units the same angle as a minute on the watch face. Using mils, the actual size of an object observed in the field can be estimated. An object that appears to be n mils wide when it is 1000 units away from you, is actually n units wide - the units used does not matter, feet, yards, meters, miles. A vehicle that appears to be 15 mils long and is 1000 feet distant is actually 15 feet long. Or, two vehicles that appear to be 100 mils apart and are 1000 meters away, are actually 100 meters apart. Conversely, if you know the size of an object, you can estimate its distance from you. If the tops of two mountains are 1 mile apart on your map, but they appear to be 100 mils apart, you must be 10 miles away. Sighting on a man (approximately 6 feet tall) who appears to be 12 mils tall must be about 500 feet away. If he seemed 3 mils tall, he'd be 2000 feet away.
Grads	The grad is a metric unit of measure, not commonly used. There are 400 grads in a circle. Each grad can be divided into 100 centigrads. Each centigrad can be divided into 100 milligrads.

Reading a Compass

No matter the compass, one end of the needle always points North. On our mountaineering compasses, it is almost always the RED end, but its a good idea to test your compass before starting to use it.
If you are north of the equator, stand facing the sun around lunchtime with your compass resting in your hand in front of you. Whichever end of the needle points towards the sun is South and the end that points at you is North.
If you're 'down under' the North end points towards the sun and the South end points at you.

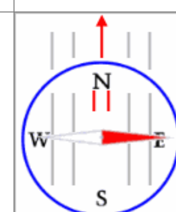
To read your compass
- Hold your compass steadily in your hand so the baseplate is level and the direction-of-travel arrow is pointing straight away from you.
- Hold it about halfway between your face and waist in a comfortable arm position with your elbow bent and compass held close to your stomach.
- Look down at the compass and see where the needle points.
- Turn your body while keeping the compass in front of you.
- Notice that as the compass rotates, the needle stays pointing the same direction.
- Keep turning until the needle points to East on the compass, keeping the direction-of-travel arrow and North mark facing straight in front of you.

This compass is pointing due North (also 0 degrees)

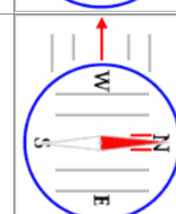


The compass needle is pointing towards East so I must be pointing East, right? No, To find my direction, I must turn the compass dial until the North mark and the "Orienting Arrow" are lined up with the North end of the needle. Then I can read the heading that is at the Index Pointer spot (the butt of the direction-of-travel arrow).
Since the Orienting Arrow is usually two parallel lines on the floor of the compass housing, a good thing to memorize is: RED IN THE SHED

The needle on this compass is pointing East (90 degrees)

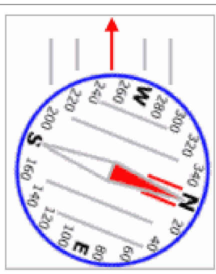


Now we know we are really heading West (270 degrees)



Take a Bearing

By simply moving your compass with your body and using the N-E-S-W markings, you can get a good idea which way you are going. This is often all you need from your compass. But, you've probably noticed on your compass, there are also numbers and tiny lines. These represent the 360 degrees in a circle that surrounds you no matter where you are.



When you need to find your way from one particular place to another, you need to use these numbers to find out the bearing to that remote place. The direction you are going is called your heading. Heading and Bearing are pretty much the same thing. The image above is a heading of about 250 degrees.

Reading Tips
- Hold the compass level - if tilted, the needle will touch the lid and won't move correctly.
- Read the correct end of the needle.
- Knowing that if you are in the northern hemisphere and heading anywhere towards the sun during the middle of the day, you are heading in a southerly direction. If you are in the southern hemisphere and heading towards the sun, you are heading in a northerly direction. (If in the tropics, between the Tropic of Cancer at 23.5 degrees North of the equator and the Tropic of Capricorn at 23.5 degrees South of the equator, this tip should not be used. The sun can be either north or south of you, depending on the time of year.)
- RED IN THE SHED!
- Keep the compass away from metal objects - even a knife, flashlight, or keychain can cause a false reading if too close to the compass.

Finding Direction

To determine the direction, or bearing, from one point to another, you need a compass as well as a map. Most compasses are marked with the four cardinal points —north, east, south, and west—but some are marked additionally with the number of degrees in a circle (360 north is 0 or 360, east is 90, south is 180, and west is 270). Both kinds are easy to use with a little practice. The illustrations on the reverse side show how to read direction on the map. One thing to remember is that a compass does not really point to true north, except by coincidence in some areas. The compass needle is attracted by magnetic force, which varies in different parts of the world and is constantly changing. When you read north on a compass, you're really reading the direction of the magnetic north pole.

A diagram in the map margin will show the difference (declination) at the centre of the map between compass north (magnetic north indicated by the MN symbol) and true north (polar north indicated by the "star" symbol). This diagram also provides the declination between true north and the orientation of the Universal Transverse Mercator (UTM) grid north (indicated by the GN symbol).

The declination diagram is only representational, and true values of the angles of declination should be taken from the numbers provided rather than from the directional lines. Because the magnetic declination is computed at the time the map is made, and because the position of magnetic north is constantly changing, the declination factor provided on any given map may not be current. Contact the National Geophysical Data Centre (NGDC) to obtain current and historical magnetic declination information for any place in the United States.

Taking a compass bearing from a map
- Draw a straight line on the map passing through your location and your destination and extending across any one of the map borders.
- Centre the compass where your drawn line intersects the map border, align the compass axis N-S or E-W with the border line, and read on the compass circle the true bearing of your drawn line. Be careful to get the bearing in the correct sense because a straight line will have two values 180° apart. Remember north is 0, east is 90, and so on.
- To use this bearing, you must compensate for magnetic declination. If the MN arrow on the map magnetic declination diagram is to the right of the true north line, subtract the MN value. If the arrow is to the left of the line, add the value.

Reading a Heading

- Lay your map on the ground - it can be facing any old direction.
- Find your current location on the map and where you want to go.
- Lay your compass on the map so one edge makes a perfect line from where you are to where you want to be. If the distance is too far, use a straight-edge of some kind to line up the two points - a piece of paper, edge of another map, tent pole, anything that is straight. Then, place your compass edge up against this line.
- Holding the compass in place, turn the compass dial until the orienting lines are parallel to the north-south meridian lines on the map. This is making North on your compass dial match North on the map. (don't worry about the needle yet)
- Now, you have taken the bearing. The direction at the index pointer is the direction in which you must head to reach your destination. In this case, it is about 85 degrees.
- Pick up your map and put it away.
- Now you need to pay attention to your compass needle! Hold your compass flat in your hand and turn your body and compass until RED is in the Shed. Of course, you are now facing the direction in which you need to travel.

Orient the Map

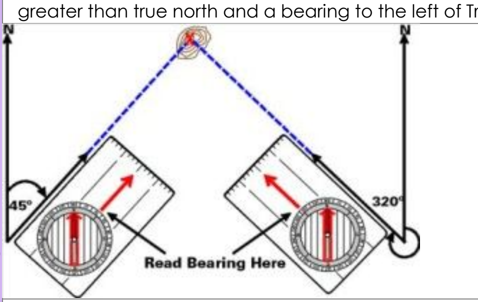
A map represents the real world. By orienting a map, you are positioning it so its North is actually pointing north. When you orient a map and know where you are on the map, you can look in a certain direction and see a real landmark and find it on the map. Orienting, or aligning, the map is really easy with just 4 steps:
- Lay your map out on a relatively flat, smooth surface.
- Turn your declination-adjusted compass dial so due North is at the index pointer.
- Place your compass on your map with the edge of the baseplate parallel to the north-south meridians on the map. Notice the orienteering lines and direction-of-travel arrow are all parallel with the map lines.
- Turn the map and compass together until the compass needle is "boxed" in the orienting arrow (Red in the Shed).

Now, the map is oriented to the real world. If you know where you are on the map, you should be able to look in any direction and see the objects represented on the map in the same direction. If you know where you are on your map, you can also orient your map by distant features. If you can see a known mountain in one direction and a lake off another way, then just lay the map out and turn it so the corresponding marks on the map align with the distant features.

Finding Direction

The first thing you need to know is where you are in relation to magnetic north. You can find this information by looking on your map legend. If you look at a map of North America you will see the line roughly marking 0° declination. If you are on the line where the declination is 0 degrees, then you don't have to worry about any of this, since magnetic north and map north are equivalent. If you are to the right of that line, your compass will point toward the line (to the left) and hence the declination is to the west. If you are to the left of the line, your compass will point toward the line (to the right) and hence the declination is to the east. The compass is used primarily to take bearings. A bearing is a horizontal angle measured clockwise from north (either magnetic north or true north) to some point (either a point on a map or a point in the real world).

Bearings are used to accurately travel to a destination or to locate your position. If you are working from your map, it is called a map bearing and the angle you are measuring is the angle measured clockwise from true north on your map to this other point on the map. If you are taking a bearing off a real point on the landscape with a compass, you are using your compass to measure the angle clockwise from magnetic north to this point on the landscape. This is called a magnetic bearing. Remember that the bearing is measured clockwise. If you think of true north as 12 o'clock then a bearing to the right of that (1 o'clock) is greater than true north and a bearing to the left of True north (11 o'clock) is less than true north.



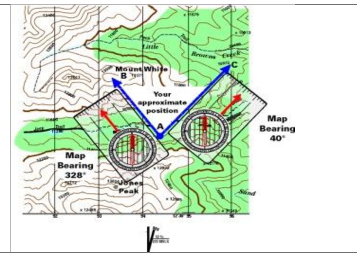
Adjusting for the Local Declination
Another way to deal with declination is to adjust your compass. Some compasses have an outer degree ring that can be unlocked either with a set screw or a latch. This allows you to reset the compass to account for declination. For example, if the declination were 14 degrees East, you could rotate the degree dial to the right so that the magnetic needle was pointing to 14 degrees instead of 360 degrees.

Once you do this, you will no longer have to add or subtract for declination because your compass is aligned to true north. Now when the compass needle is inside the orienting needle, the compass bearing that you read off your compass will be in relation to true north instead of magnetic north. If you have a fixed-ring compass, you can mark the declination angle on the compass ring with a piece of tape.

Make it a habit of keeping your map and compass handy and refer to them every hour or so to locate your position (more often in low visibility). Keep track of your starting time, rest breaks and lunch stops, and general hiking pace. This will also give you an idea of how far you have travelled. Compass readings are also affected by the presence of iron and steel objects. Be sure to look out for—and stay away from—pocket knives, belt buckles, railroad tracks, trucks, electrical lines, and so forth when using a compass in the field.

Position Triangulation

Triangulation is used to locate your position when two or more prominent landmarks are visible. Even if you are not sure where you are, you can find your approximate position as long as you can identify at least 2 prominent landmarks (mountain, end of a lake, bridge, etc.) both on the land and on your map.



1. Orient the map.
2. Look around and locate prominent landmarks.
3. Find the landmarks on the map (preferably at least 90 degrees apart).
4. Determine the bearing of one of the landmarks.
5. Place the compass on the map so that one side of the base plate points toward the landmark.
6. Keeping the edge of the base plate on the symbol, turn the entire compass on the map until the orienting arrow and the compass needle point to north on the map.
7. Draw a line on the map along the edge of the base plate, intersecting the prominent landmark symbol. Your position is somewhere along this line.
8. Repeat this procedure for the other prominent landmark. The second landmark should be as close to 90 degrees from the first as possible. Your approximate position is where the two lines intersect.
9. You can repeat this process a third time to show an area bounded by three lines. You are located within this triangle.
10. If you are located on a prominent feature marked on the map such as a ridge, stream, or road, only one calculation from a prominent landmark should be necessary. Your position will be approximately where the drawn line intersects this linear feature.

Magnetic Variance

True North: (also known as Geographic North or Map North) is the geographic north pole where all longitude lines meet. All maps are laid out with true north directly at the top. Unfortunately for the wilderness traveller, true north is not at the same point on the earth as the magnetic north Pole which is where your compass points.
Magnetic North: Think of the earth as a giant magnet. The shape of the earth's magnetic field is roughly the same shape as the field of a bar magnet. However, the earth's magnetic field is inclined at about 11° from the axis of rotation of the earth, so this means that the earth's magnetic pole doesn't correspond to the Geographic North Pole and because the earth's core is molten, the magnetic field is always shifting slightly.
Grid North: The direction of a grid line which is parallel to the central meridian on the National Grid.

Differences in Norths
The horizontal angular difference between True North and Magnetic North is called MAGNETIC VARIATION or DECLINATION. The horizontal angular difference between Grid North and Magnetic North is called GRID MAGNETIC ANGLE. It is this angle which needs to be applied when converting between magnetic and grid bearings. Differences between the three north's are given on our 1:50 000 scale OS Landranger and OS Explorer 1:25 000 maps. On OS Landranger Maps, the difference between True North and Grid North is given for each corner of the map and is shown in the legend as is the difference between True North and Magnetic North. The information is shown diagrammatically in the middle of the North margin. In both cases the year for which the value was compiled is given and once its value has been corrected for the current year, its value can be accepted for the whole sheet.

Calculate Magnetic Variation
Example – Penzance
The Magnetic North to Grid North is predicted to be 0° 00' west of grid north at the centre of the sheet in July 2014, with an estimated rate of change of 11' east a year. The difference between True North and Grid North at the sheet corners are given and, by interpolation, the difference at Penzance (approximately central to the map), is that True North is 2° 40' east of Grid North. Thus the predicted difference in 2014 between Magnetic North and True North is 2° 40' – 0° 00' plus 2° 40'.

Example – Lowestoft
Magnetic North to Grid North is predicted to be 3° 18' west of grid north at the centre of the sheet in July 2014, with an estimated rate of change of 10' east a year. The difference between True North and Grid North at the sheet corners are given and, by interpolation, the difference at Lowestoft, which is close to the SE corner, is that True North is 3° 00' west of Grid North. Thus the difference between Magnetic North and True North is predicted to be 0° 18' in 2014 – 3° 18' minus 3° 00'.

Grid Magnetic Angle Calculator
The magnetic data shown on Ordnance Survey maps are supplied by the British Geological Survey (BGS). The BGS website includes a tool which will calculate the angle between grid north (British National Grid) and magnetic north at a given location from either coordinates or post code.

Declination
The angular difference between true north and magnetic north is known as the declination and is marked in degrees on your map. Depending on where you are, the angle between true north and magnetic north is different. In the U.S., the angle of declination varies from about 20 degrees west in Maine to about 21 degrees east in Washington. The magnetic field lines of the earth are constantly changing, moving slowly westward (½to 1 degree every five years). This is why it is important to have a recent map. An old map will show a declination that is no longer accurate, and all your calculations using that declination angle will be incorrect. As you will see, understanding this distinction becomes important when navigating with a map and a compass.

Which North to Use
So we have two types of north to contend with. When you look at your map, it is drawn in relation to true north;, when you look at your compass, it points to magnetic north. T to make the map and compass work together you must decide on one North as your point of reference and base all your calculations on that. As you can see the following chart, failure to take declination into account can put you way off target.

Declination or Degrees Off Course
- 1° = 920 ft (280m)
- 5° = 4,600 ft (1,402m)
- 10° = 9,170 ft (2,795m)

Lensatic Compass

The lensatic compass--also called a military compass--is a precision instrument that when used with a topographical map can guide the adventurous off marked trails into wilderness areas with confidence. The lensatic compass is used to set course bearings, orient yourself to a map and follow a course over land. Carrying and being able to navigate with a map and lensatic compass is a good idea, even when you are travelling with a GPS unit. Electronics do fail, so being able to get to your destination safely with a map and compass is an invaluable skill.

Taking a Compass Bearing	**Step 1:** Open the lensatic compass so that the cover is at a 90 degree angle and the lens bracket is at a 30 degree angle to the case. Check to make sure the dial is floating freely. **Step 2:** Insert your thumb into the thumb loop. **Step 3:** Hold the lensatic compass so it is resting on your thumb and bent index finger. **Step 4:** Raise the compass to eye level. **Step 5**: Line up a distant object with the sight wire and the centre of the sighting groove in the lens bracket. **Step 6:** Read the course bearing (azimuth) while keeping your head and compass still. There are two sets of numbers; degrees are in red and mils are in black.
Setting a Course	**Step 1:** Open the lensatic compass completely. **Step 2:** Place the compass on a level map with the azimuth directly under the index line. If you want to follow a 90 degree bearing, put the 90 degree mark under the index line. **Step 3:** Hold the compass in this position and rotate the bezel until the luminous indicator is over the north "N" arrow. The course is now set. To check your course, open the compass and line up the luminous indicator with the "N" arrow. Do not move the bezel.
Following a Course	**Step 1:** Open the lensatic compass with the cover at a 90 degree angle and the lens bracket at a 30 degree angle to the case. **Step 2:** Point the compass along the desired course bearing. **Step 3:** Line up an easily identifiable object with the sighting groove and the sighting wire. **Step 4:** Keep this object in sight as you travel.
Tips & Warnings	● Practice using the lensatic compass using known courses. ● If you lose sight of your distant object when following a course, immediately stop and locate a new object to guide you. ● If there are no objects to sight when following a course, find one to the side. When you reach the object, travel perpendicular to your course of travel to get back on course. Sight a new object and resume travel. ● Never use a compass on or near metal or magnetic fields. This will affect the accuracy of your readings.

3 Maps

Types of Maps

Physical Map	A physical map shows the most used features of an area and covers most aspects of the other types of maps. ● It shows the physical features of a place or country, like rivers, mountains, forests and lakes as well as man-made features like hospitals, police stations and shops. ● The physical features are usually shown in different colours. ● Rivers and lakes are shown in blue, places of low elevation are shown in dark green and as the elevation increases, the colour becomes light green and eventually orange. ● Mountains are shown in brown.
Planimetric Map	A planimetric map presents only the horizontal positions for the features represented. It is distinguished from a topographic map by the omission of relief, normally represented by contour lines. Sometimes, it is called a line map.
Topographic Map	A topographic map shows the terrain features and elevations for 4WDing, hiking and exploration. In topographic maps, differences in elevation and changes in landscape are shown with the help of contour lines and their spacing's. This map type is the most valuable in a SHTF situation where you're bugging out on foot or in a vehicle. It can be used for finding alternative routes on foot if one of them becomes impassable.
Geographic Maps	Geographic maps provide an overall idea of the mapped area in relation to climate, population, relief, vegetation, and hydrography. They also show the general location of major urban areas.
Satellite Map	A satellite map shows the terrain features via images taken from space and stitched together and often has the most detail. It does not contain place names. You can see everything in great detail from 3x3m ponds, houses with solar panels to cars parked on the street. This type of map can be valuable in a SHTF situation to spot resources you wouldn't see on any other map. Aerial photographs can be used as map supplements or substitutes to help you analyse the terrain, plan your route, or guide your movement.
Photomap	A photomap is a reproduction of an aerial photograph upon which grid lines, marginal data, place names, route numbers, important elevations, boundaries, and approximate scale and direction have been added. It's basically a satellite map with place and street names overlayed for easier reading.
Photomosaic	A photomosaic is an assembly of aerial photographs that is commonly called a mosaic in topographic usage. Mosaics are useful when time does not permit the compilation of a more accurate map. The accuracy of a mosaic depends on the method employed in its preparation and may vary from simply a good pictorial effect of the ground to that of a planimetric map.
Joint Operations Graphics	Joint operations graphics are based on the format of standard 1:250,000 medium-scale military topographic maps, but they contain additional information needed in joint air-ground operations. Along the north and east edges of the graphic, detail is extended beyond the standard map sheet to provide overlap with adjacent sheets. These maps are produced both in ground and air formats. Each version is identified in the lower margin as either joint operations graphic (air) or joint operations graphic (ground). The topographic information is identical on both, but the ground version shows elevations and contour in meters and the air version shows them in feet. Layer (elevation) tinting and relief shading are added as an aid to interpolating relief. Both versions emphasize air landing facilities (shown in purple), but the air version has additional symbols to identify aids and obstructions to air navigation.
City/Utility Maps	City/utility maps are maps of urban areas showing streets, water ducts, electricity and telephone lines, and sewers.
Military City Map	A military city map is a topographic map (usually at 1:12,550 scale, sometimes up to 1:5,000), showing the details of a city. It delineates streets and shows street names, important buildings, and other elements of the urban landscape important to navigation and military operations in urban terrain. The scale of a military city map depends on the importance and size of the city, density of detail, and available intelligence information.

Special Maps	Special maps are for special purposes such as trafficability, communications, and assault maps. They are usually in the form of an overprint in the scales smaller than 1:100,000 but larger than 1:1,000,000. A special purpose map is one that has been designed or modified to give information not covered on a standard map. The wide range of subjects that could be covered under the heading of special purpose maps prohibits, within the scope of this manual, more than a brief mention of a few important ones.	**Subjects** ● Terrain features ● Drainage characteristics ● Vegetation ● Climate ● Coasts and landing beaches ● Roads and bridges ● Railroads ● Airfields	● Urban areas ● Electric power ● Fuels ● Surface water resources ● Ground water resources ● Natural construction materials ● Cross-country movements ● Suitability for airfield construction ● Airborne operations

Resource Map	Resource maps pinpoint resources in a certain area such as woodland, crops, gold mines and local wildlife. Economic or resource maps show the different resources present in the area or economic activity prevalent. They show the kind of crops that are grown and the minerals found in places. Symbols and letters are used to depict the activity or resource present in the area.
Road Map	Road maps show all the roads in varying colours based on importance and helps you reach a destination. It is known in some countries as a refidex. Road map is the most widely used map which shows different roads, highways or railways present in the area. It is a very detailed map and is generally used for direction purposes. Road maps are usually made individually, city-wise. There are road maps present for an entire country too, but they cannot be made very detailed.
Symbol Maps	Symbol maps are often used in specialized places such as national parks, walking tracks and theme parks to show you where you are and points of interest. On maps different symbols represent different things, for example black dots represent cities, circled stars represent capitals. Different types of lines represent roads, highways and railways. Trees and forests are depicted in green, mountains in brown and rivers and lakes in blue. This done for making it easier for us to spot these features and study the map.
Atlases	Atlases are collections of maps of regions, countries, continents, or the world. Such maps are accurate only to a degree and can be used for general information only.

Map Features

These are the map features that can be found on most maps.

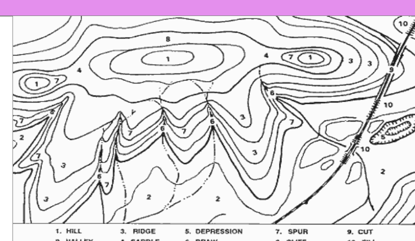
Sheet Name	The sheet name is found in bold print at the centre of the top and in the lower left area of the map margin. A map is generally named for the largest settlement contained within the area covered by the sheet, or for the largest natural feature located within the area at the time the map was drawn.
Sheet Number	The sheet number is found in bold print in both the upper right and lower left areas of the margin, and in the centre box of the adjoining sheets diagram, which is found in the lower right margin. It is used as a reference number to link specific maps to overlays, operations orders, and plans. For maps at 1:100,000 scale and larger, sheet numbers are based on an arbitrary system that makes possible the ready orientation of maps at scales of 1:100,000, 1:50,000, and 1:25,000.
Series Name	The map series name is found in bold print in the upper left corner of the margin. The name given to the series is generally that of a major political subdivision such as a state within the United States or a European nation. A map series usually includes a group of similar maps at the same scale and on the same sheet lines or format designed to cover a particular geographic area. It may also be a group of maps that serve a common purpose such as the military city maps.
Scale	The scale is found both in the upper left margin after the series name, and in the centre of the lower margin. The scale note is a representative fraction that gives the ratio of a map distance to the corresponding distance on the earth's surface. For example, the scale note 1:50,000 indicates that one unit of measure on the map equals 50,000 units of the same measure on the ground.
Series Number	The series number is found in both the upper right margin and the lower left margin. It is a sequence reference expressed either as a four-digit numeral (1125) or as a letter, followed by a three- or four-digit numeral (M661, T7110).
Edition Number	The edition number is found in bold print in the upper right area of the top margin and the lower left area of the bottom margin. Editions are numbered consecutively; therefore, if you have more than one edition, the highest numbered sheet is the most recent. Most military maps are now published by the NGA, but older editions of maps may have been produced by the U.S. Army Map Service. Still others may have been drawn, at least in part, by the U.S. Army Corps of Engineers, the U.S. Geological Survey, or other agencies affiliated or not with the United States or allied governments. The credit line, telling who produced the map, is just above the legend. The map information date is found immediately below the word "LEGEND" in the lower left margin of the map. This date is important when determining how accurately the map data might be expected to match what you will encounter on the ground.
Index to Boundaries	The index to boundaries diagram appears in the lower or right margin of all sheets. This diagram, which is a miniature of the map, shows the boundaries that occur within the map area such as county lines and state boundaries.
Adjoining Sheets Diagram	Maps at all standard scales contain a diagram that illustrates the adjoining sheets. On maps at 1:100,000 and larger scales and at 1:1,000,000 scale, the diagram is called the index to adjoining sheets. It consists of as many rectangles representing adjoining sheets as are necessary to surround the rectangle that represents the sheet under consideration. The diagram usually contains nine rectangles, but the number may vary depending on the locations of the adjoining sheets. All represented sheets are identified by their sheet numbers. Sheets of an adjoining series, whether published or planned, that are at the same scale are represented by dashed lines. The series number of the adjoining series is indicated along the appropriate side of the division line between the series.
Elevation Guide	The elevation guide is normally found in the lower right margin. It is a miniature characterization of the terrain shown. The terrain is represented by bands of elevation, spot elevations, and major drainage features. The elevation guide provides the map reader with a means of quick recognition of major landforms.
Declination Diagram	The declination diagram is located in the lower margin of large-scale maps and indicates the angular relationships of true north, grid north, and magnetic north. On maps at 1:250,000 scale, this information is expressed as a note in the lower margin. In recent edition maps, there is a note indicating the conversion of azimuths from grid to magnetic and from magnetic to grid next to the declination diagram.
Bar Scales	Bar scales are located in the centre of the lower margin. They are rulers used to convert map distance to ground distance. Maps have three or more bar scales, each in a different unit of measure. Care should be exercised when using the scales, especially in the selection of the unit of measure that is needed.
Contour Interval Note	The contour interval note is found in the centre of the lower margin normally below the bar scales. It states the vertical distance between adjacent contour lines of the map. When supplementary contours are used, the interval is indicated. In recent edition maps, the contour interval is given in meters instead of feet.

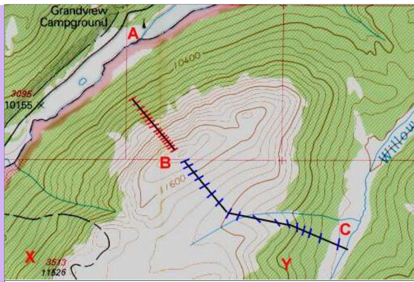
Spheroid Note	The spheroid note is located in the centre of the lower margin. Spheriods (ellipsoids) have specific parameters that define the X Y Z axis of the earth. The spheriod is an integral part of the datum.
Grid Note	The grid note is located in the centre of the lower margin. It gives information pertaining to the grid system used and the interval between grid lines, and it identifies the UTM grid zone number.
Projection Note	The projection system is the framework of the map. For military maps, this framework is of the conformal type; that is, small areas of the surface of the earth retain their true shapes on the projection; measured angles closely approximate true values; and the scale factor is the same in all directions from a point. The projection note is located in the centre of the lower margin. Between 80 degrees south and 84 degrees north, maps at scales larger than 1:500,000 are based on the transverse Mercator projection. The note reads TRANSVERSE MERCATOR PROJECTION.
Vertical Datum Note	The vertical datum note is located in the centre of the lower margin. The vertical datum or vertical-control datum is defined as any level surface taken as a surface of reference from which to determine elevations. In the United States, Canada, and Europe, the vertical datum refers to the mean sea level surface. However, in parts of Asia and Africa, the vertical-control datum may vary locally and is based on an assumed elevation that has no connection to any sea level surface. Map readers should habitually check the vertical datum note on maps, particularly if the map is used for low-level aircraft navigation, naval gunfire support, or missile target acquisition.
Horizontal Datum Note	The horizontal datum note is located in the centre of the lower margin. The horizontal datum or horizontal-control datum is defined as a geodetic reference point (of which five quantities are known: latitude, longitude, azimuth of a line from this point, and two constants, which are the parameters of reference ellipsoid). These are the basis for horizontal-control surveys. The horizontal-control datum may extend over a continent or be limited to a small local area. Maps and charts produced by NGA are produced on 32 different horizontal-control data. Map readers should habitually check the horizontal datum note on every map or chart, especially adjacent map sheets, to ensure the products are based on the same horizontal datum. If products are based on different horizontal-control data, coordinate transformations to a common datum must be performed. UTM coordinates from the same point computed on different data may differ as much as 900 meters.
Control Note	The control note is located in the centre of the lower margin. It indicates the special agencies involved in the control of the technical aspects of all the information that is disseminated on the map.
Preparation Note	The preparation note is located in the centre of the lower margin. It indicates the agency responsible for preparing the map.
Printing Note	The printing note is also located in the centre of the lower margin. It indicates the agency responsible for printing the map and the date the map was printed. The printing data should not be used to determine when the map information was obtained.
Grid Reference Box	The grid reference box is normally located in the centre of the lower margin. It contains instructions for composing a grid reference.
Unit Imprint and Symbol	The unit imprint and symbol is on the left side of the lower margin. It identifies the agency that prepared and printed the map with its respective symbol. This information is important to the map user in evaluating the reliability of the map.
Legend	The legend is located in the lower left margin. It illustrates and identifies the topographic symbols used to depict some of the more prominent features on the map. The symbols are not always the same on every map. Always refer to the legend to avoid errors when reading a map.
Glossary	The glossary is an explanation of technical terms or a translation of terms on maps of foreign areas where the native language is other than English.
Classification	Certain maps require a note indicating the security classification. This is shown in the upper and lower margins.
Protractor Scale	The protractor scale may appear in the upper margin on some maps. It is used to lay out the magnetic-grid declination for the map, which, in turn, is used to orient the map sheet with the aid of the lensatic compass.
Coverage Diagram	On maps at scales of 1:100,000 and larger, a coverage diagram may be used. It is normally in the lower or right margin and indicates the methods by which the map was made, dates of photography, and reliability of the sources. On maps at 1:250,000 scale, the coverage diagram is replaced by a reliability diagram.
Special Notes	A special note is any statement of general information that relates to the mapped area. It is normally found in the lower right margin. For example: This map is red-light readable.
User's Note	The user's note is normally located in the lower right-hand margin. It requests cooperation in correcting errors or omissions on the map. Errors should be marked and the map forwarded to the agency identified in the note.
Conversion Graph	Normally found in the right margin, the conversion graph indicates the conversion of different units of measure used on the map.

Reading Maps

A Topographic Map includes contour lines drawn to represent changes in elevation. When you follow a path on a topographic map that crosses these contour lines, you will be either climbing or descending. A path running parallel to contour lines is relatively flat. When reading a topographic map, you need to visualize in your mind's eye a 3-dimensional view of what the symbols and contour lines are representing. The most important thing to remember is that CLOSE contour lines mean STEEP terrain and OPEN contour lines mean FLAT terrain. Shaded relief added to a topographic map makes it more realistic and helps visualize the real landscape.

This example of a very simple topographic map shows many common features. Keep your eyes open to see these features on other maps and you will start to understand how a topo map works.





Even without elevation numbers, clues that #1 is a hill include streams converging away from the hilltop, contour lines pointing sharply towards the hilltop (indicating draws), contour lines pointing widely away from the hilltop (indicating rounded ridges). Using contour lines, you can tell a lot about the terrain, including steepness, ruggedness, and ground cover. On the image above, look at point A. There are no contour lines around this location so it is relatively flat here and a good place for a campground by the lake. You can tell from the elevation listed at marker 3095 that the campground is at 10155 feet. You can also tell the elevation change between each contour line by looking at the Index lines. Notice that the Index line near point B is labelled 11600 feet and the one due north of it is labelled 10400 feet - that is a difference of 1200 feet. Between these two Index lines are two more Index lines so each index line represents a change in 400 feet of elevation - 10400, 10800, 11200, and 11600.

Count the lines between two index lines and you should see there are 4 lines which cause the 400 feet between the two index lines to be divided into 5 intervals, each one being 80 feet in elevation. So, now we know that on this map every contour line represents 80 feet of elevation change. If you follow a single contour line, your elevation remains constant. For example, starting at point X and following the Index line to the Northeast, around, and down South to point Y, you would stay at about 10,800 feet.

When you cross contour lines, you are either hiking up or down. Look at the two routes to get to the peak at point B - the red route and the blue route. Each path reaches the top, but the blue route is three times as long as the red route. That means it covers more distance to gain the same elevation so it is a more gradual slope - and probably an easier hike. Going up the red route may require a lot of scrambling and hard work.

Using the map above, pretend you are camped at the Grandview Campground but you heard there is great fishing in Willow Creek at point C over the mountain to the Southeast. How could you get there? Well, a straight line to the Southeast would be shortest on the map, but would include a climb of over 1500 feet! Instead, heading East from camp and circling the north side of the mountain will result in a longer distance covered but only about 325 feet in elevation! That may be a much better hike.

One other thing to take into consideration. Notice that the ground is coloured green up to about the 10,800 foot index line. The white area above that is open ground while the green area is forested. This can be good or bad. The forest can offer shade and coolness, but on the other hand it may be thick and difficult to navigate.

Map Scale

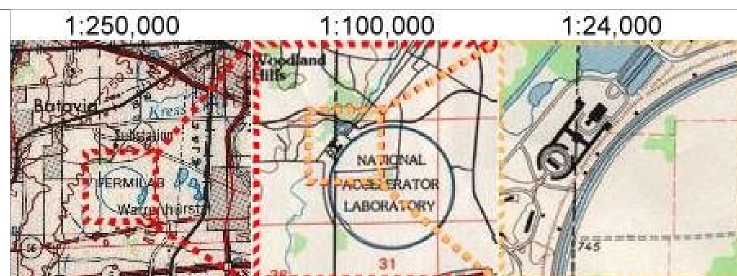
Any scale can be used for a map, but a few common scales have been settled on for use by most organizations:

- 1:24,000 - primary scale used by USGS for mapping the United States in topographic form. 1 inch on the map equals 24000 inches in the real world, or in metric 1 meter equals 24km. This scale is used on the over 54,000 quadrangle maps covering America.
- 1:63,360 - 1 inch equals 1 mile
- 1:50,000
- 1:250,000
- 1:1,000,000

The smaller the number on the bottom of the map scale, the more detailed the map will be. A 1:10,000 map will show objects 100 times as large as a 1:100,000 map but will only show 1/100th the land area on the same sized piece of paper. Here is an example of a Bar Scale found on a map. The scale shows that about 1.25 inches equals 5 miles. The smaller increments to the left of zero are each 1 mile and are used to estimate smaller distances. Notice the scale is 1/250000 - that means 1 inch on the map is equal to 250,000 inches on the real land. (5 miles = 5*5280 feet = 5*5280*12 inches = 316800 inches. 316800 inches / 250000 = 1.27 inches). By including a map scale, if the map is photocopied and reduced in size, the scale can still be used. Otherwise, 1 inch would no longer equal what it should.

Maps are considered large scale maps or small scale maps. A large scale map shows greater detail because the scale is a larger fraction than a small scale map.
Large scale maps have a scale of 1:50,000 or greater (1:24,000, 1:10,000, etc). Maps with scales from 1:50,000 to 1:250,000 are considered intermediate.

Small scale maps are those with scales smaller than 1:250,000. A map of the world that fits on two pages of letter sized paper would be very small scale with a scale of around 1:100,000,000. Right are 3 views of the same location on maps with different scales.



Digital Scale

The following table shows the map scale compared to a digital maps zoom rating. However this may vary based on your screens DPI and other varying factors. The scale depends on your monitor's PPI and on the latitude (because of the Mercator projection).

1	Find the size of your display and calculate the ppi. W = 2.45in ÷ 1080px = 441ppi H = 4.35in ÷ 1920px = 441ppi (441ppi)
2	After finding the ppi of the screen the map is on convert that to pixels/cm. (1 Inch = 2.54 cm) ppi ÷ 2.54 (173.62 pp/cm)
3	Divide 1 cm by the number of pixels. (1 / 173.62 = 0.0057597...)
4	Multiply that by 256 which is the pixels in 1 tile. (0.005759… x 256 = 1.4744845...) This returns the distance on screen for 256 pixels or 1 tile.
5	Convert the result into m by dividing by 100. (0.0147448...m)
6	Divide the equator diameter (40,075,160m) by the result from the last sum. (40,075,160 / 0.0147448… = 2,717,909,874.68...)
7	The result from the last sum is the scale of the map for a computer monitor with 441ppi.

8	To return the scale for other zoom levels simply divide the zoom 0 level by 2 to go up a zoom level. (Zoom 0 / 2 = Zoom 1) (Zoom 1 / 2 = Zoom 2)

Scale Levels

Zoom Level	Zoom 0	Zoom 1	Zoom 2	Zoom 3	Zoom 4	Zoom 5	Zoom 6	Zoom 7	Zoom 8	Zoom 9	Zoom 10
Scale 96 ppi	1:554,678,932	1:277,339,466	1:138,669,733	1:69,334,866	1:34,667,433	1:17,333,716	1:8,666,858	1:4,333,429	1:2,166,714	1:1,083,357	1:541,678
Scale 120 ppi	1:739,571,909	1:369,785,954	1:184,892,977	1:92,446,488	1:46,223,244	1:23,111,622	1:11,555,811	1:5,777,905	1:2,888,952	1:1,444,476	1:722,238
Scale 570 ppi	1:3,512,986,158	1:1,756,493,079	1:878,246,539	1:439,123,269	1:219,561,634	1:109,780,817	1:54,890,408	1:27,445,204	1:13,722,602	1:6,861,301	1:3,430,650
Zoom Level	**Zoom 11**	**Zoom 12**	**Zoom 13**	**Zoom 14**	**Zoom 15**	**Zoom 16**	**Zoom 17**	**Zoom 18**	**Zoom 19**	**Zoom 20**	
Scale 96 ppi	1:270,839	1:135,419	1:67,709	1:33,854	1:16,927	1:8,463	1:4,231	1:2,115	1:1057	1:528	
Scale 120 ppi	1:361,119	1:180,559	1:90,279	1:45,139	1:22,569	1:11,284	1:5,642	1:2,821	1:1,410	1:705	
Scale 570 ppi	1:1,715,325	1:857,662	1:428,831	1:214,415	1:107,207	1:53,603	1:26,801	1:13,400	1:6,700	1:3,350	

Digital Map Tiles

This table shows the number of map tiles covering the entire globe when using a digital map at a certain zoom level.

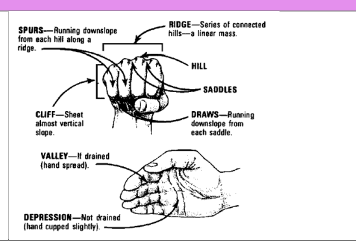
- Zoom Level 0 - 1 Tile
- Zoom Level 1 - 4 Tiles
- Zoom Level 2 - 16 Tiles
- Zoom Level 3 - 64 Tiles
- Zoom Level 4 - 256 Tiles
- Zoom Level 5 - 1,024 Tiles
- Zoom Level 6 - 4,096 Tiles
- Zoom Level 7 - 16,384 Tiles
- Zoom Level 8 - 65,536 Tiles
- Zoom Level 9 - 262,144 Tiles
- Zoom Level 10 - 1,048,576 Tiles
- Zoom Level 11 - 4,194,304 Tiles
- Zoom Level 12 - 16,777,216 Tiles
- Zoom Level 13 - 67,108,864 Tiles
- Zoom Level 14 - 268,435,456 Tiles
- Zoom Level 15 - 1,073,741,824 Tiles
- Zoom Level 16 - 4,294,967,296 Tiles
- Zoom Level 17 - 17,179,869,184 Tiles
- Zoom Level 18 - 68,719,476,736 Tiles
- Zoom Level 19 - 274,877,906,944 Tiles
- Zoom Level 20 - 1,099,511,627,776 Tiles

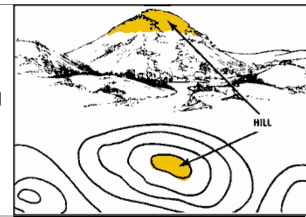
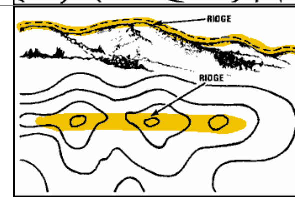
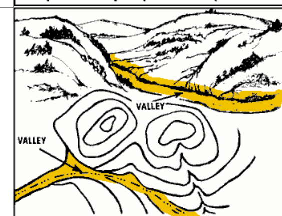
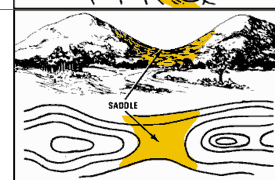
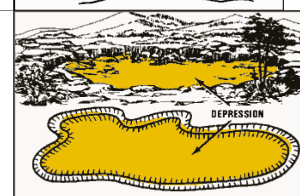
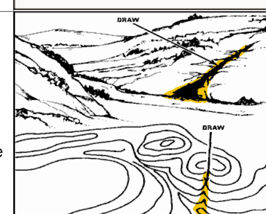
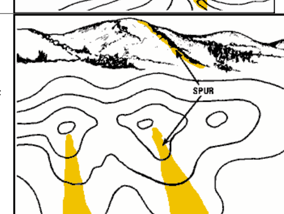
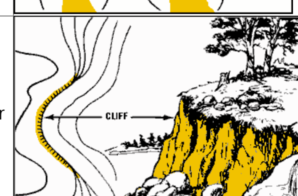
Map Symbols

Topographic Contours	**Index** Number written on line	**Intermediate** Between Index lines	**Supplementary** Added to flat areas to show measurements	**Depression** Such as volcano top or crater	**Cut; Fill** Roadway levelling terrain						
Vegetation	**Woodland** Trees at least 6feet tall	**Scrub** Low brush	**Orchard** Planted vegetation	**Vineyard** Cultivated vines	**Mangrove** Dense, tropical trees						
Surface Features	**Levee**	**Sand or mud area** dunes or shifting sand	**Intricate Surface Area**	**Gravel Beach or Glacial Moraine**	**Tailings Pond**						
Mines and Caves	**Quarry or Open Pit Mine**	**Gravel, Sand, Clay, or Borrow Pit**	**Mine Tunnel or Cave Entrance**	**Prospect; Mine Shaft**	**Mine Dump**	**Mine Tailings**					
Glaciers and Snowfields	**Limit** Blue denotes coverage	**Form Lines** Show shape, not elevation									
Buildings and Related	**Building**	**School; Church**	**Built-Up Area**	**Racetrack**	**Airport**	**Landing Strip**	**Well (Other than Water); Windmill**	**Tanks**	**Covered Reservoir**	**Campground / Picnic**	**Cemetery: Small; Large** Cem
Roads and Related	**Primary Highway**	**Secondary Highway**	**Light Duty Road**	**Unimproved Road**	**Trail**	**Dual Highway**	**Dual Highway with Median Strip**	**Road Under Construction** U. C.	**Underpass; Overpass**	**Bridge**	**Tunnel**
Railroads and Related	**Standard Gauge Single Track; Station**	**Standard Gauge Multiple Track**	**Abandoned**	**Under Construction**	**Narrow Gauge Single Track**	**Narrow Gauge Multiple Track**	**Railroad in Street**	**Juxtaposition**	**Roundhouse / Turntable**		
Transmission Lines / Pipes	**Power Transmission Line: Pole; Tower**	**Telephone Line** Telephone	**Aboveground Oil or Gas Pipeline**	**Underground Oil or Gas Pipeline** Pipeline							
Boundaries	**National**	**State or Territorial**	**County**	**Civil Township**	**Incorporated City**	**Park, Reservation, or Monument**	**Small Park**				
Rivers / Lakes	**Intermittent Stream**	**Intermittent River**	**Disappearing Stream**	**Perennial Stream**	**Perennial River**	**Small Falls; Small Rapids**	**Large Falls; Large Rapids**	**Masonry Dam**	**Dam with Rock**	**Dam Carrying Road**	**Perennial Lake; Intermittent Lake or Pond**
Rivers / Lakes	**Dry Lake**	**Narrow Wash**	**Wide Wash** Wash	**Canal, Flume, or Aqueduct with Lock**	**Elevated Aqueduct, Flume or Conduit**	**Aqueduct Tunnel**	**Well or Spring**				
Submerged Areas / Bogs	**Marsh or Swamp**	**Submerged Marsh or Swamp**	**Wooded Marsh or Swamp**	**Submerged Wooded Marsh or Swamp**	**Rice Field** Rice	**Land Subject to Inundation**					

Identify Terrain Features

Terrain features are identified in the same manner on all maps, regardless of the contour interval, but you must realize that a hill in the Rocky Mountains will be much bigger than one in south Florida. You must be able to recognize all the terrain features to locate a point on the ground or to navigate from one point to another. The five major terrain features are: Hill, Ridge, Valley, Saddle, and Depression. The three minor terrain features are: Draw, Spur and Cliff. Terrain features can be learned using the fist or hand to show what each would look like on the ground.

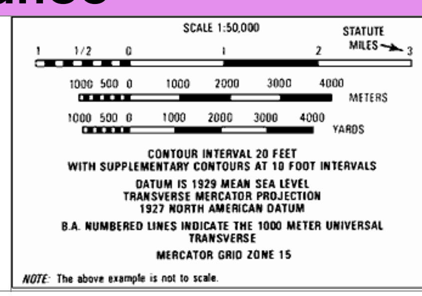


Hill	A point or small area of high ground. When you are on a hilltop, the ground slopes down in all directions.	
Ridge	A line of high ground with height variations along its crest. The ridge is not simply a line of hills; all points of the ridge crest are higher than the ground on both sides of the ridge.	
Valley	Reasonably level ground bordered on the sides by higher ground. A valley may or may not contain a stream course. A valley generally has manoeuvre room within its confines. Contour lines indicating a valley are U-shaped and tend to parallel a stream before crossing it. The course of the contour line crossing the stream always points upstream.	
Saddle	A dip or low point along the crest of a ridge. A saddle is not necessarily the lower ground between two hilltops; it may be a break along an otherwise level ridge crest.	
Depression	A low point or hole in the ground, surrounded on all sides by higher ground.	
Draw	Similar to a valley, except that it normally is a less developed stream course in which there is generally no level ground and, therefore, little or no manoeuvre room. The ground slopes upward on each side and toward the head of the draw. Draws are caused by flash floods and can be found on flat terrain but are more often found along the sides of ridges. Contour lines indicating a draw are shaped like a "V" with the point of the "V" toward the head of the draw (high ground).	
Spur	A usually short, continuously sloping line of higher ground, normally jutting out from the side of a ridge. A spur is often formed by two thoroughly parallel streams cutting draws down the side of a ridge	
Cliff	A vertical or near-vertical slope. A cliff may be shown on a map by contour lines being close together, touching, or by a ticked "carrying" contour line. The ticks always point toward lower ground.	

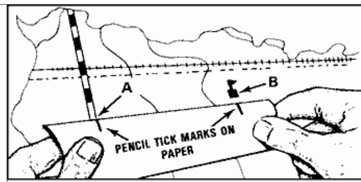
Measure Distance

Measure distance on a military map using ruler or paper and the bar scales. Soldiers can use their maps to measure the distance between two places. The maps are drawn to scale. This means that a certain distance on a map equals a certain distance on the earth.

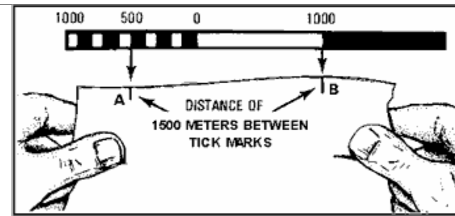
The scale is printed at the bottom and top of each map (Scale 1:50,000). This means that 1 inch on the map equals 50,000 inches on the ground. To change map distance to miles, meters, or yards, use the bar scales at the bottom of the map.



Take a ruler or the edge of a piece of paper and mark on it the straight line distance between your two points.



Then, put the ruler or the paper just under one of the bar scales and read the ground distance in miles, meters, or yards. The bar scale here shows a ground distance of 1,500 meters.

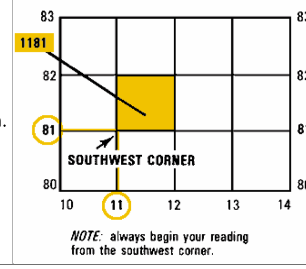


4 Finding Location

Finding Location Using Grid Coordinates

The map has vertical lines (top to bottom) and horizontal lines (left to right). These lines form small squares 1,000 meters on each side called grid squares. The lines that form grid squares are numbered along the outside edge of the map picture. No two grid squares have the same number. The precision of a point location is shown by the number of digits in the coordinates: the more digits, the more precise the location.

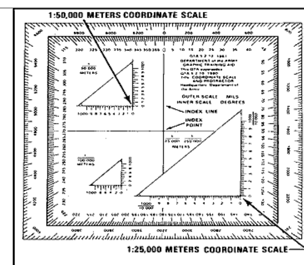
1996-a 1,000 meter grid square.
192961-to the nearest 100 meters.
19269614-to the nearest 10 meters.



Your address is grid square 1181. How do you know this? Start from the left and read right until you come to 11, the first half of your address. Then read up to 81, the other half. Your address is somewhere in grid square 1181.

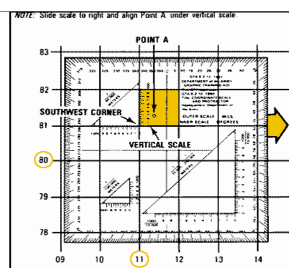
Grid square 1181 gives your general neighbourhood, but there is a lot of ground inside that grid square. To make your address more accurate, just add another number to the first half and another number to the second half-so your address has six numbers instead of four. To get those extra numbers, pretend that each grid square has ten lines inside it running north and south, and another 10 running east and west. This makes 100 smaller squares. You can estimate where these imaginary lines are. Suppose you are halfway between grid line 11 and grid line 12. Then the next number is 5 and the first half of your address is 115. Now suppose you are also 3/10 of the way between grid line 81 and grid line 82. Then the second half of your address is 813. (If you were exactly on line 81, the second part would be 810). Your address is 115813.

The most accurate way to determine the coordinates of a point on a map is to use a coordinate scale. You do not have to use imaginary lines; you can find the exact coordinates using a Coordinate Scale and Protractor. This device has two coordinating scales, 1:25,000 meters and 1:50,000 meters. Make sure you use the correct scale.



First, locate the grid square in which the point (for example, Point A, Figure 2) is located (the point should already be plotted on the map).

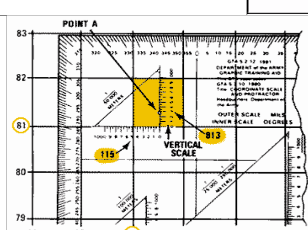
The number of the vertical grid line on the left (west) side of the grid square is the first and second digits of the coordinates. The number of the horizontal grid line on the bottom (south) side of the grid square is the fourth and fifth digits of the coordinates.



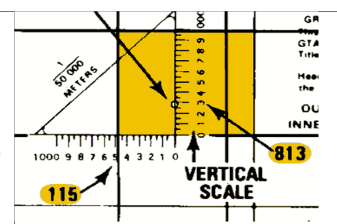
To determine the third and sixth digits of the coordinates, place the coordinate scale on the bottom horizontal grid line of the grid square containing Point A.

Check to see that the zeros of the coordinate scale are in the lower left hand (southwest) corner of the map grid square.

Slide the scale to the right, keeping the bottom of the scale on the bottom grid line until Point A is under the vertical (right hand) scale (Figures 3 and 4).



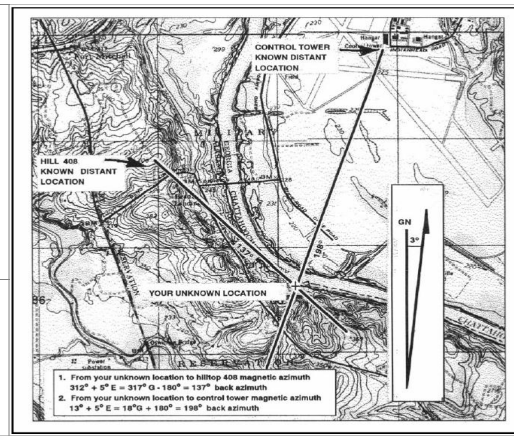
On the bottom scale, the 100 meter mark nearest the vertical grid line provides the third digit, 5. On the vertical scale, the 100 meter mark nearest Point A provides the sixth digit, 3. Therefore, the six-digit grid coordinate is 115813



Finding Location Using Resection

Resection is the method of locating one's position on a map by determining the grid azimuth to at least two well-defined locations that can be pinpointed on the map. For greater accuracy, the desired method of resection would be to use three or more well-defined locations.

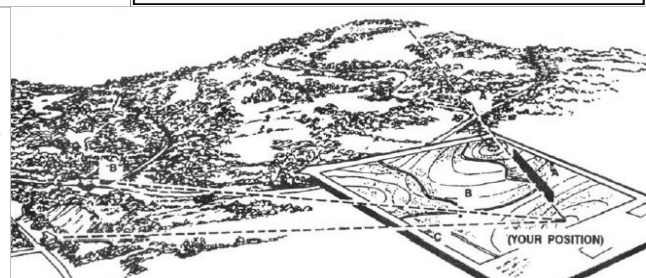
When using the map and compass method:
1. Orient the map using the compass.
2. Identify two or three known distant locations on the ground and mark them on the map.
3. Measure the magnetic azimuth to one of the known positions from your location using a compass.
4. Convert the magnetic azimuth to a grid azimuth.
5. Convert the grid azimuth to a back azimuth. Using a protractor, draw a line for the back azimuth on the map from the known position back toward your unknown position.
6. Repeat 3, 4, and 5 for a second position and a third position, if desired.
7. The intersection of the lines is your location. Determine the grid coordinates to the desired accuracy.



Map text to the right (If it's not readable)
1. From your unknown location to hilltop 408 magnetic azimuth 312° + 5° E = 317°G - 180° = 137° back azimuth.

2. From your unknown location to control tower magnetic azimuth 13° + 5° E = 18°G + 180° = 198° back azimuth.

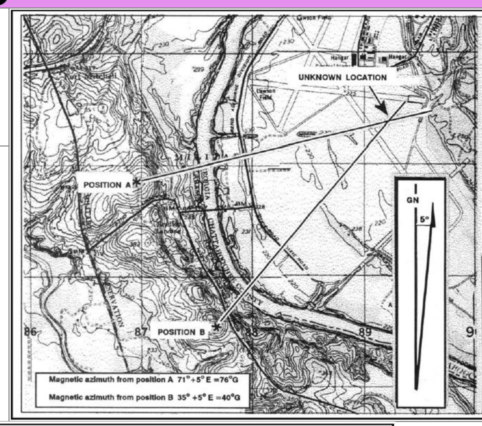
When using the straightedge method:
1. Orient the map on a flat surface by the terrain association method.
2. Locate at least two known distant locations or prominent features on the ground and mark them on the map.
3. Lay a straightedge on the map using a known position as a pivot point. Rotate the straightedge until the known position on the map is aligned with the known position on the ground.
4. Draw a line along the straightedge away from the known position on the ground toward your position.
5. Repeat 3 and 4 using a second known position.
6. The intersection of the lines on the map is your location. Determine the grid coordinates to the desired accuracy.



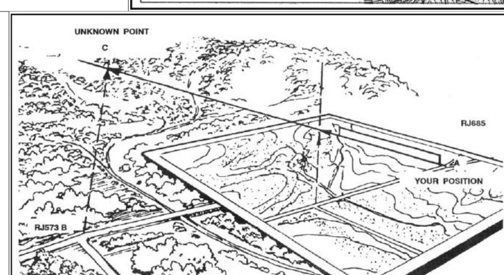
Finding Location Using Intersection

Intersection is the location of an unknown point by successively occupying at least two (preferably three) known positions on the ground and then map sighting on the unknown location. It is used to locate distant or inaccessible points or objects such as enemy targets and danger areas. There are two methods of intersection: the map and compass method and the straightedge method.

When using the map and compass method:
1. Orient the map using the compass.
2. Locate and mark your position on the map.
3. Determine the magnetic azimuth to the unknown position using the compass.
4. Convert the magnetic azimuth to grid azimuth.
5. Draw a line on the map from your position on this grid azimuth.
6. Move to a second known point and repeat steps 1, 2, 3, 4, and 5.
7. The location of the unknown position is where the lines cross on the map. Determine the grid coordinates to the desired accuracy.



The straight edge method is used when a compass is not available. When using it:
1. Orient the map on a flat surface by the terrain association method.
2. Locate and mark your position on the map.
3. Lay a straight edge on the map with one end at the user's position (A) as a pivot point; then, rotate the straightedge until the unknown point is sighted along the edge.
4. Draw a line along the straight edge.
5. Repeat the above steps at position (B) and check for accuracy.
6. The intersection of the lines on the map is the location of the unknown point. Determine the grid coordinates to the desired accuracy.



5 Hiking

Pace Counting

What is a pace?
A pace is equivalent to two natural steps. Starting with your right foot as the first step, when your left foot hits the ground you can count that as one pace.

Why should you know your pace?
Your pace can be used to keep track of distances travelled while hiking. Most people won't use pacing to record long distances but it is possible if you have a system (pacing beads, etc.) to help you keep a pace count.

You will most likely use your pacing skills while backpacking when you find yourself needing to choose a campsite a certain distance such as 200 to 400 feet away from water, trails, or historical sites because of backcountry regulations or general leave no trace practices. A single pace is the stepping of both feet (left and right) one time each incrementing the pace each time the same foot hits the ground.

A pace is equal to one natural step, about 30 inches (76cm) long. To accurately use the pace count method, you must know how many paces it takes you to walk 100 meters. To determine this, you must walk an accurately measured course and count the number of paces you take. A pace course can be as short as 100 meters or as long as 600 meters. The pace course, regardless of length, must be on similar terrain to that you will be walking over. It does no good to walk a course on flat terrain and then try to use that pace count on hilly terrain.

To determine your pace count on a 600-meter course, count the paces it takes you to walk the 600 meters, then divide the total paces by 6. The answer will give you the average paces it takes you to walk 100 meters. It is important that each person who navigates while dismounted knows his pace count. There are many methods to keep track of the distance travelled when using the pace count. Some of these methods are: put a pebble in your pocket every time you have walked 100 meters according to your pace count; tie knots in a string; or put marks in a notebook. Do not try to remember the count; always use one of these methods or design your own method.

Certain conditions affect your pace count in the field, and you must allow for them by making adjustments.

Slopes: Your pace lengthens on a down slope and shortens on an upgrade. Keeping this in mind, if it normally takes you 120 paces to walk 100 meters, your pace count may increase to 130 or more when walking up a slope.
Winds: A head wind shortens the pace and a tail wind increases it.
Surfaces: Sand, gravel, mud, snow, and similar surface materials tend to shorten the pace.
Elements: Falling snow, rain, or ice cause the pace to be reduced in length.
Clothing: Excess clothing and boots with poor traction affect the pace length.
Visibility: Poor visibility, such as in fog, rain, or darkness, will shorten your pace.

Planning Routes

With a map, a compass, some time, and all the knowledge you've learned so far, you can plan out your next wilderness trek from the comfort of your own warm home. Why bother doing this?

● You'll know how far each day's hike will be.
● You'll know where to set up camp.
● You'll know when to expect strenuous and easy terrain.
● You'll be more familiar with the area in general so if you do get lost or injured, you have better chances for survival.
● You'll leave a copy of your trek plan with other people to help with rescue efforts if things go wrong.

Waiting for water to boil for dinner is a great time to check out tomorrow's route and discuss what to expect on the trail ahead. Every day on the trail should include a time to review how well you are following your plan and what adjustments need to be made.

● Get oriented with where you are on the map - your current position.
● Figure out where on the map you want to go - your destination.
● Examine the space between the two points. Look for obstacles such as swamps, lakes, rivers, cliffs, mountains, and such that you may need to go around rather than through or over.
● Find the easiest, prettiest, shortest, or in some way best path to your destination - its up to you.
● From your starting point, put your compass on your map and Read your Heading for the first leg of your trek by adjusting the orienting lines of the compass with the meridian lines on the map and reading the direction at the index pointer.
● Using the map scale, estimate how far this leg will be.
● Considering the contour lines and terrain features, estimate how long this leg will take to cover. Remember, going uphill will take longer. Higher elevations will take longer. Having no trail will take longer. Thick forests, large rock fields, sand, ... will take longer.
● Record your details on your trek plan and repeat for each leg of your trek.

Switchbacks

A switchback is a trail up a steep hill or mountain that is like a zigzag pattern instead of a straight trail. The zigzag pattern protects the hill and the trail from excessive erosion. Trails that go straight up and down steep hills don't stay nice trails for long. Erosion turns those trails into gullies because water moves faster down steep straight-aways and it hollows out the trail and washes all the soil and vegetation down hill. Switchbacks help prevent erosion because they help keep the trail at a consistent gradient. Trail planners build other erosion control devices like rolling grade dips into switchbacks also. Switchbacks are also good because they make it easier to climb steep hills. "Short-cutting" a switchback is bad trail etiquette because it kills vegetation and loosens soil creating a new trail straight up and down the hill, which will in time get large and hollowed out from erosion. Do your part to keep our trails beautiful and control erosion. Walk softly, Leave No Trace, and stay on the designated trail.

6 Navigating

Piloting

Piloting (also called pilotage) involves navigating an aircraft by visual reference to landmarks, or a water vessel in restricted waters and fixing its position as precisely as possible at frequent intervals. More so than in other phases of navigation, proper preparation and attention to detail are important. Procedures vary from vessel to vessel, and between military, commercial, and private vessels. A military navigation team will nearly always consist of several people. A military navigator might have bearing takers stationed at the gyro repeaters on the bridge wings for taking simultaneous bearings, while the civilian navigator must often take and plot them himself. While the military navigator will have a bearing book and someone to record entries for each fix, the civilian navigator will simply pilot the bearings on the chart as they are taken and not record them at all.

If the ship is equipped with an ECDIS, it is reasonable for the navigator to simply monitor the progress of the ship along the chosen track, visually ensuring that the ship is proceeding as desired, checking the compass, sounder and other indicators only occasionally. If a pilot is aboard, as is often the case in the most restricted of waters, his judgement can generally be relied upon, further easing the workload. But should the ECDIS fail, the navigator will have to rely on his skill in the manual and time-tested procedures.

Celestial Navigation

Celestial navigation systems are based on observation of the positions of the Sun, Moon, Planets and navigational stars. Such systems are in use as well for terrestrial navigating as for interstellar navigating. By knowing which point on the rotating earth a celestial object is above and measuring its height above the observer's horizon, the navigator can determine his distance from that subpoint. A nautical almanac and a marine chronometer are used to compute the subpoint on earth a celestial body is over, and a sextant is used to measure the body's angular height above the horizon. That height can then be used to compute distance from the subpoint to create a circular line of position. A navigator shoots a number of stars in succession to give a series of overlapping lines of position. Where they intersect is the celestial fix. The moon and sun may also be used. The sun can also be used by itself to shoot a succession of lines of position (best done around local noon) to determine a position.

Marine Chronometer
In order to accurately measure longitude, the precise time of a sextant sighting (down to the second, if possible) must be recorded. Each second of error is equivalent to 15 seconds of longitude error, which at the equator is a position error of .25 of a nautical mile, about the accuracy limit of manual celestial navigation. The spring-driven marine chronometer is a precision timepiece used aboard ship to provide accurate time for celestial observations. A chronometer differs from a spring-driven watch principally in that it contains a variable lever device to maintain even pressure on the mainspring, and a special balance designed to compensate for temperature variations. A spring-driven chronometer is set approximately to Greenwich mean time (GMT) and is not reset until the instrument is overhauled and cleaned, usually at three-year intervals. The difference between GMT and chronometer time is carefully determined and applied as a correction to all chronometer readings. Spring-driven chronometers must be wound at about the same time each day. Quartz crystal marine chronometers have replaced spring-driven chronometers aboard many ships because of their greater accuracy. They are maintained on GMT directly from radio time signals. This eliminates chronometer error and watch error corrections. Should the second hand be in error by a readable amount, it can be reset electrically.

The basic element for time generation is a quartz crystal oscillator. The quartz crystal is temperature compensated and is hermetically sealed in an evacuated envelope. A calibrated adjustment capability is provided to adjust for the aging of the crystal. The chronometer is designed to operate for a minimum of 1 year on a single set of batteries. Observations may be timed and ship's clocks set with a comparing watch, which is set to chronometer time and taken to the bridge wing for recording sight times. In practice, a wrist watch coordinated to the nearest second with the chronometer will be adequate. A stop watch, either spring wound or digital, may also be used for celestial observations. In this case, the watch is started at a known GMT by chronometer, and the elapsed time of each sight added to this to obtain GMT of the sight. All chronometers and watches should be checked regularly with a radio time signal. Times and frequencies of radio time signals are listed in publications such as Radio Navigational Aids.

The Marine Sextant
The second critical component of celestial navigation is to measure the angle formed at the observer's eye between the celestial body and the sensible horizon. The sextant, an optical instrument, is used to perform this function. The sextant consists of two primary assemblies. The frame is a rigid triangular structure with a pivot at the top and a graduated segment of a circle, referred to as the "arc", at the bottom. The second component is the index arm, which is attached to the pivot at the top of the frame. At the bottom is an endless vernier which clamps into teeth on the bottom of the "arc". The optical system consists of two mirrors and, generally, a low power telescope.

One mirror, referred to as the "index mirror" is fixed to the top of the index arm, over the pivot. As the index arm is moved, this mirror rotates, and the graduated scale on the arc indicates the measured angle ("altitude"). The second mirror, referred to as the "horizon glass", is fixed to the front of the frame. One half of the horizon glass is silvered and the other half is clear. Light from the celestial body strikes the index mirror and is reflected to the silvered portion of the horizon glass, then back to the observer's eye through the telescope.

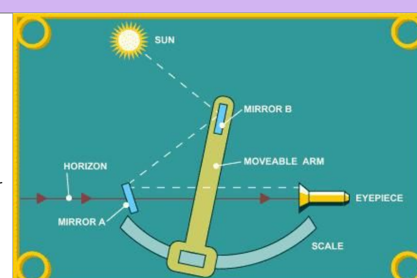
The observer manipulates the index arm so the reflected image of the body in the horizon glass is just resting on the visual horizon, seen through the clear side of the horizon glass. Adjustment of the sextant consists of checking and aligning all the optical elements to eliminate "index correction". Index correction should be checked, using the horizon or more preferably a star, each time the sextant is used. The practice of taking celestial observations from the deck of a rolling ship, often through cloud cover and with a hazy horizon, is by far the most challenging part of celestial navigation.

Sextant
A sextant is a doubly reflecting navigation instrument that measures the angular distance between two visible objects. The primary use of a sextant is to measure the angle between an astronomical object and the horizon for the purposes of celestial navigation. The estimation of this angle, the altitude, is known as sighting or shooting the object, or taking a sight. The angle, and the time when it was measured, can be used to calculate a position line on a nautical or aeronautical chart—for example, sighting the Sun at noon or Polaris at night (in the Northern Hemisphere) to estimate latitude. Sighting the height of a landmark can give a measure of distance off and, held horizontally, a sextant can measure angles between objects for a position on a chart. A sextant can also be used to measure the lunar distance between the moon and another celestial object (such as a star or planet) in order to determine Greenwich Mean Time and hence longitude.

Using a Sextant

The sextant makes use of two mirrors. With this sextant, one of the mirrors (mirror A in the diagram) is half-silvered, which allows some light to pass through. In navigating, you look at the horizon through this mirror. The other mirror (mirror B in the diagram) is attached to a movable arm. Light from an object, let's say the sun, reflects off this mirror.

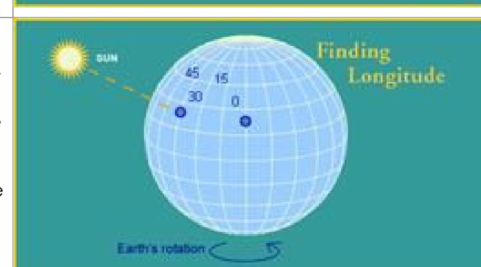
The arm can be moved to a position where the sun's reflection off the mirror also reflects off mirror A and through the eyepiece. What you see when this happens is one object (the sun) superimposed on the other (the horizon). The angle between the two objects is then read off the scale. What makes a sextant so useful in navigation is its accuracy. It can measure an angle with precision to the nearest ten seconds. (A degree is divided into 60 minutes; a minute is divided into 60 seconds.)



There's no way around it: Celestial navigation using a sextant is a complex and involved process that involves a fair amount of calculating, correcting, referring to tables, knowledge of the heavens and the Earth, as well as a lot of common sense. (No wonder it's been so quickly replaced by the satellite-dependent Global Positioning System, or GPS). But the basic principles behind celestial navigation are fairly straightforward. Here are a few examples that show how a sextant can be used to find location...

Finding latitude is easy enough. The first thing you need to do is measure the angle between the horizon and the sun when the sun is at its highest point, which is right around noontime on your watch. A quick look at your trusty tables tells you which line of latitude the sun should be above on that particular day. For example, let's say it's noon on December 21, and the sun is directly overhead. Well, on that day the sun is above the Tropic of Capricorn, so your latitude would have to be 23.5 degrees S. It's a good thing, if you're a navigator, that the Earth spins around at such an even pace.

Every hour it moves 15 degrees. This means that if the sun is above the longitude of 0 degrees at noon, one hour later it will be above 15 degrees West. Now if you have a chronometer (this is just a fancy name meaning "extremely accurate clock"), you can find your longitude. Let's say that the sun is directly overhead and your chronometer, which was set to noon when you were at 0 degrees, says it's 3 o'clock position.



This means that three hours ago the sun was overhead at this latitude at 0 degrees longitude. In those three hours, the sun moved 15 degrees 3 times, or 45 degrees. So you're at 45 degrees West. Of course, the fact that the sun was directly overhead (which very rarely happens) made it especially convenient for finding your longitude, but you could have found your longitude anyway, with the help of your tables. Celestial navigation is the process whereby angles between objects in the sky (celestial objects) and the horizon are used to locate one's position on the globe. At any given instant of time, any celestial object (e.g. the Moon, Jupiter, navigational star Spica) will be located directly over a particular geographic position on the Earth.

This geographic position is known as the celestial object's sub-point, and its location (e.g. its latitude and longitude) can be determined by referring to tables in a nautical or air almanac. The measured angle between the celestial object and the horizon is directly related to the distance between the subpoint and the observer, and this measurement is used to define a circle on the surface of the Earth called a celestial line of position (LOP). The size and location of this circular line of position can be determined using mathematical or graphical methods (discussed below). The LOP is significant because the celestial object would be observed to be at the same angle above the horizon from any point along its circumference at that instant.

Finding Angle of Object

The sextant is a navigational aid that consists of a small sighting scope, mirrors, a movable arm, and a mirror 60-degree wooden or metal arc (a sixth of a circle, from which the instrument's name is derived). You can use a sextant to determine the position (called the "shoot") in the sky of the sun, moon, or other celestial body, as well as your longitude. Although its design looks complicated, with an understanding of how it works and practice, you can reliably use it to find your position.

1	Know, if possible, your position above sea level. If you're not using the sextant from aboard a ship at sea, you'll have to correct your sighting for your height above sea level. We'll discuss the correction later; for now, you just need to know your elevation above sea level.
2	Sight the horizon by looking through the horizon mirror. The horizon mirror is only partially silvered, allowing you to look through it and through the sighting scope beyond it. ● The horizon line forms the baseline for the angle of elevation for the object you're determining the position of. ● Your sextant may not regard the horizon line as being 0 degrees. If it doesn't, you'll have to correct the angle measure of the object you're trying to determine by the same amount as the horizon line error. This error is called index error.
3	Move the sextant's index arm until the object you're trying to find the position of is also visible on the horizon. A second mirror, the index mirror, is mounted on the moving arm. Moving the arm rotates the disk the index mirror is on until light hitting the index mirror hits the reflective portion of the horizon mirror, making the object the light comes from appear to rest on the horizon. ● Sextants designed for looking at the sun include shade glasses to protect your eyes from the sun's rays.
4	Clamp the index arm in place. The clamp is a flip-lock that prevents the arm from moving freely.
5	Fine-tune the position of the arm by turning the micrometre knob until the object rests on the horizon. Make the adjustments gradually while swaying the sextant from side to side until the object just touches the horizon.
6	Record the time at which you made your sighting. You'll need to record the time in hours, minutes, and seconds, starting with the seconds first to avoid errors. ● Quickly recording the time is especially important if you're using a sextant in marine navigation.
7	Record the angle measure. You can read the angle of elevation for the object as follows: ● The degrees of elevation will be at the centre of the index bar (the part of the index arm the clamp and micrometre knob are attached to) in a window over the sextant arc. The index bar may have a small magnifying glass to help you read the graduations on the sextant arc. ● The minutes and seconds can be read from the graduations on the micrometre knob.
8	Correct the angle measure according to your position and the object you're sighting. The angle measure you found with the sextant needs to be corrected for each of the following things: ● Index error. This error is caused when your sextant doesn't read the horizon as 0 degrees, but as more or less than 0. If your sextant reads the horizon angle as greater than 0 (a positive), subtract the horizon angle from the angle measure of the object. If your sextant reads the horizon angle as less than 0 (a negative), add the number of degrees difference to the angle measure of the object. ● Dip. This correction adjusts for your position above sea level. Find your elevation in feet (if in meters, multiply by 3.28), then multiply the square root of your elevation by 0.98 to find the amount to correct the angle measure by. ● Refraction. Light rays bend when passing through a substance; this bending is called refraction. The thicker the atmosphere, the greater the refraction. You can get the correct refraction correction for where you are by consulting the Nautical Almanac. ● Parallax. You need to correct for parallax if you're observing the sun, moon, or a planet with your sextant. This correction factor is available from the Nautical Almanac.

● Semi-diameter. If you're observing an object with a significant apparent diameter (the sun or moon), you need to find the apparent distance from its edge to its centre. This correction factor is available from the Nautical Almanac.
When all of these corrections are applied, you have the object's angle of elevation.

Finding Your Latitude at Daytime

1	Find the sun's angle of elevation at its highest point. This occurs at noon, local time (standard time). Follow the instructions in "Part One: Finding Angle of Elevation for an Observed Object."
2	Consult reference tables to find the latitude the sun should be directly over on the day you're observing. The sun appears directly overhead (at zenith, 90 degrees elevation) at the equator (0 degrees latitude) on the vernal and autumnal equinoxes (the first days of spring and fall). ● From the March equinox, the place where the sun appears directly overhead moves northward until the June solstice, then it moves back toward the equator until the September equinox. The latitude where the sun is directly overhead on the June solstice is the Tropic of Cancer, 23.5 degrees North latitude. ● From the September equinox, the place where the sun appears directly overhead moves southward until the December solstice, then it moves back toward the equator until the March equinox. The latitude where the sun is directly overhead on the December solstice is the Tropic of Capricorn, 23.5 degrees South latitude. ● If you are north of the Tropic of Cancer, the sun will always appear south of you at its highest point. If you are south of the Tropic of Capricorn, the sun will always appear north of you at its highest point. If you are between the tropics, the sun may appear either to your north or south at its highest point, or directly overhead, given the time of year.

3	Find the difference between the elevation angle of the sun and the zenith. If the sun appears south of you at an elevation angle of 49 degrees, subtract 49 from 90 to produce a difference of 41. ● If you are making this observation on either the June or September equinox, this difference is your latitude, in this case 41 degrees North latitude. If the sun had appeared north of you at this same elevation on either of the equinoxes, your latitude would be 41 degrees South latitude. If it isn't one of the equinoxes, you have more work to do. ● If the latitude at which the sun is directly overhead is north of the equator and the sun appears to your south at its highest point, add this latitude (the solar declination) to the remaining angle to get your latitude. If the sun appeared overhead at a latitude of 20 degrees North latitude when you saw it at an elevation of 49 degrees from your position, your latitude would be 61 degrees North latitude (90 – 49 + 20). Likewise, if the latitude at which the sun is directly overhead is south of the equator and the sun appears to your north at its highest point, you would add the latitude to the remaining angle to get your latitude.

● If the latitude at which the sun is directly overhead is south of the equator and the sun appears to your south at its highest point, subtract this latitude from the remaining angle to get your latitude. If the sun appeared overhead at a latitude of 20 degrees South latitude when you saw it at an elevation of 49 degrees from your position, your latitude would be 21 degrees North latitude (90 – 49 – 20). Likewise, if the latitude at which the sun is directly overhead is north of the equator and the sun appears to your north at its highest point, you would subtract the latitude from the remaining angle to get your latitude.

Finding Your Latitude at Night

1. Find Polaris, the North Star. Polaris is the brightest star in the constellation Ursa Minor (the Little Bear, Little Dipper). It is located at the end of the Little Bear's tail/Little Dipper's handle. If you have trouble spotting it, there are two ways to find it.
● Sight along the two stars at the outer end of the bowl in the Big Dipper in the direction the bowl opens. These pointer stars will lead your eye to Polaris.
● Sight from the Great Square in Pegasus through the constellation Cassiopeia (resembling an "M" or "W," depending on its position in the sky). When the Big Dipper is below the horizon, this is a substitute method to find Polaris.

Find Polaris' altitude with your sextant. See "Part One: Finding Angle of Elevation for an Observed Object" for instructions for how to do this. The angle of elevation for Polaris will be the same as your latitude.
● This method works only for locations in the Northern Hemisphere, as Polaris is not visible for locations south of the equator.

Sextant Almanacs

● The almanacs are vital in finding your location around the world and are updated yearly.
http://www.backbearing.com/almanac.html
The file size of the Sun Almanac is around 300kb.

● Sight Reduction Tables and others can be found at http://www.backbearing.com/tables.html. They also have excel sheets which automatically calculate a few of the fields.

The Nautical Almanac
● https://www.nauticalalmanac.it/en/navigation-astronomy/the-nautical-almanac.html

Inertial Navigation

Dead Reckoning
o

Inertial Navigation
Inertial navigation system is a dead reckoning type of navigation system that computes its position based on motion sensors. Once the initial latitude and longitude is established, the system receives impulses from motion detectors that measure the acceleration along three or more axes enabling it to continually and accurately calculate the current latitude and longitude.

Electronic Navigation

Radio Navigation

A radio direction finder or RDF is a device for finding the direction to a radio source. Due to radio's ability to travel very long distances "over the horizon", it makes a particularly good navigation system for ships and aircraft that might be flying at a distance from land. RDFs works by rotating a directional antenna and listening for the direction in which the signal from a known station comes through most strongly. This sort of system was widely used in the 1930s and 1940s.

RDF antennas are easy to spot on German World War II aircraft, as loops under the rear section of the fuselage, whereas most US aircraft enclosed the antenna in a small teardrop-shaped fairing. In navigational applications, RDF signals are provided in the form of radio beacons, the radio version of a lighthouse. The signal is typically a simple AM broadcast of a morse code series of letters, which the RDF can tune in to see if the beacon is "on the air". Most modern detectors can also tune in any commercial radio stations, which is particularly useful due to their high power and location near major cities.

Radar Navigation

When a vessel is within radar range of land or special radar aids to navigation, the navigator can take distances and angular bearings to charted objects and use these to establish arcs of position and lines of position on a chart. A fix consisting of only radar information is called a radar fix. Types of radar fixes include "range and bearing to a single object," "two or more bearings," "tangent bearings," and "two or more ranges." Parallel indexing is a technique defined by William Burger in the 1957 book The Radar Observer's Handbook. This technique involves creating a line on the screen that is parallel to the ship's course, but offset to the left or right by some distance. This parallel line allows the navigator to maintain a given distance away from hazards.

Some techniques have been developed for special situations. One, known as the "contour method," involves marking a transparent plastic template on the radar screen and moving it to the chart to fix a position. Another special technique, known as the Franklin Continuous Radar Plot Technique, involves drawing the path a radar object should follow on the radar display if the ship stays on its planned course. During the transit, the navigator can check that the ship is on track by checking that the pip lies on the drawn line.

Satellite Navigation

Global Navigation Satellite System or GNSS is the term for satellite navigation systems that provide positioning with global coverage. A GNSS allow small electronic receivers to determine their location (longitude, latitude, and altitude) to within a few metres using time signals transmitted along a line of sight by radio from satellites. Receivers on the ground with a fixed position can also be used to calculate the precise time as a reference for scientific experiments. As of October 2011, only the United States NAVSTAR Global Positioning System (GPS) and the Russian GLONASS are fully globally operational GNSSs. The European Union's Galileo positioning system is a next generation GNSS in the initial deployment phase, scheduled to be operational by 2013. China has indicated it may expand its regional Beidou navigation system into a global system.

More than two dozen GPS satellites are in medium Earth orbit, transmitting signals allowing GPS receivers to determine the receiver's location, speed and direction. Since the first experimental satellite was launched in 1978, GPS has become an indispensable aid to navigation around the world, and an important tool for map-making and land surveying. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications networks. Developed by the United States Department of Defence, GPS is officially named NAVSTAR GPS (NAVigation Satellite Timing And Ranging Global Positioning System). The satellite constellation is managed by the United States Air Force 50th Space Wing. The cost of maintaining the system is approximately US$750 million per year, including the replacement of aging satellites, and research and development. Despite this fact, GPS is free for civilian use as a public good. Modern smartphones act as personal GPS navigators for civilians who own them. Typically a compass is also provided to determine direction when not moving.

7 Navigation Instruments

Some of the instruments used in navigation.

Charts / Maps	A map is a symbolic depiction emphasizing relationships between elements of some space, such as objects, regions, or themes.
Magnetic Compass	A compass is an instrument used for navigation and orientation that shows direction relative to the geographic cardinal directions (or points).
Gyro Compass	A gyrocompass is a type of non-magnetic compass which is based on a fast-spinning disc and the rotation of the Earth (or another planetary body if used elsewhere in the universe) to find geographical direction automatically.
Sextant	A sextant is a doubly reflecting navigation instrument that measures the angular distance between two visible objects. The primary use of a sextant is to measure the angle between an astronomical object and the horizon for the purposes of celestial navigation.
GPS	A GPS navigation device, GPS receiver, or simply GPS is a device that is capable of receiving information from GPS satellites and then to calculate the device's geographical position.
Binoculars	

8 Day Navigation

Sun Movement
It is taken for granted the sun rises in the east and sets in the west. This is quite misleading. In fact, depending on an observer's latitude and the season, the sun could rise and set up to 50 degrees off of true east and west.

● Summer/Winter Solstice: (21 June/21 December) Two times during the year when the sun has no apparent northward or southward motion.
● Vernal/Autumnal Equinox: (20 March/23 September) Two times during the year when the sun crosses the celestial equator and the length of day and night are approximately equal.

Watch Compass

Using a watch to determine direction within the tropics is more complicated, since there are two solar maxima. The sun may lie to the north or south (or at midday be directly overhead), depending upon the time of the year. Because time on our planet is divided into 24 broad time zones, the sun is not normally directly south or at its highest point in the sky at exactly midday. The watch-as-compass method is therefore an approximate guide to direction only. The most exact method of finding direction without using a compass is to mark and measure the shadows that occur around midday. The shortest shadow cast by an object always points exactly north. The watch method can be in error, especially in the lower latitudes, and may cause circling. To avoid this, make a shadow clock and set your watch to the time indicated. After travelling for an hour, take another shadow-clock reading. Reset your watch if necessary.

Northern Hemisphere
To use your watch as an approximate compass outside of the tropics in the northern hemisphere, hold the watch horizontal and point the hour hand at the sun. Half way between that point and the twelve o'clock mark on your watch points to the south.

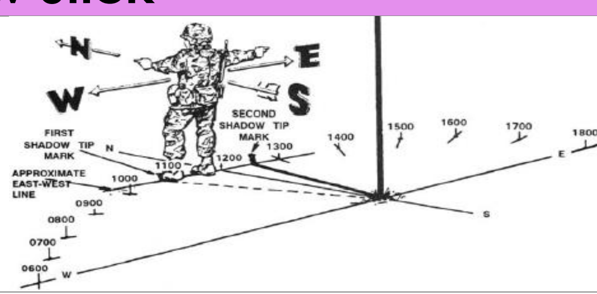
Aim Hour Hand at Sun
Between Hour Hand and 12 is South.

Southern Hemisphere
Hold the watch horizontal and point the twelve o'clock mark in the direction of the sun. The north-south line is half way between the hour hand and the twelve o'clock mark.

Aim 12 at Sun
Between Hour Hand and 12 is North.

Shadow Stick

This technique will achieve a cardinal direction within 10 degrees of accuracy if done within two hours of local apparent noon. This technique may be impractical near the polar regions as shadows tend to be very long; similarly, in the tropics shadows are generally very small.



1. Get a straight, 3-6 foot stick free of branches and pointed at the ends and 3-5 small markers: i.e. sticks, rocks.
2. Place the stick upright in the ground and mark the shadow tip with a marker.
3. Wait 10-15 minutes and mark shadow tip again with a marker.
4. Repeat this until all of the markers are used.
5. Draw a line connecting the marks.
6. The markers will form a West—East line.
7. Put your left foot on the first marker and your right foot on the last marker, you will then be facing north.

9 Night Navigation

Whenever using any type of shadow casting device to determine direction, “local apparent noon” (or the sun’s highest point during the day) must be known. Local apparent noon can be determined by the following methods.

1. Knowing sunrise and sunset from mission orders, i.e., sunrise 0630 and sunset 1930. Take the total amount of daylight (13 hours), divide by 2 (6 hours 30 minutes), and add to sunrise (0630 plus 6 hours 30 minutes). Based on this example, local apparent noon would be 1300.
2. Using the string method. The string method is used to find two equidistant marks before and after estimated solar noon. The centre point between these two marks represents local apparent noon.

Constellation Identification

The official definition of a constellation is an area of the sky with defined boundaries, all stars and any other objects within that boundary are considered part of the constellation. In modern scientific language stars that form patterns are known as asterisms, asterisms usually fall within a single constellation and bare the same name but they can also be part of multiple constellations. There are 88 official constellations which are recognized by the International Astronomical Union.

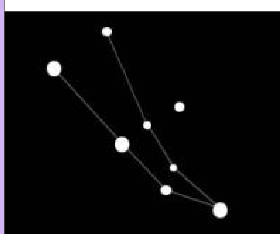
Brightness
The number next to each star in the pictures below is its apparent magnitude, its brightness from our point of view on Earth, the lower the number the brighter the star in the night sky.

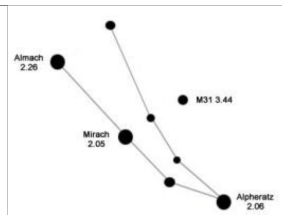
Position Description
Dec: NH 10p > NWH 1a
OH = Overhead
Means this system is only seen in December on the North Horizon at 10pm moving to the North West Horizon and will disappear at 1am.
No > means only partially visible.

Some constellations are only visible in the northern hemisphere, while others are only visible in the southern hemisphere. Constellations that are visible in both hemispheres may appear upside down in the southern hemisphere. A few constellations can be viewed all year long but most are seasonal and can only be viewed at certain times of the year. Distant galaxies and nebulae also form parts of constellations. The sun is the only known star in our galaxy which is not part of a constellation.

Andromeda

Andromeda is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Andromeda can be seen from August to February. In the Southern hemisphere the constellation can be viewed from October to December.



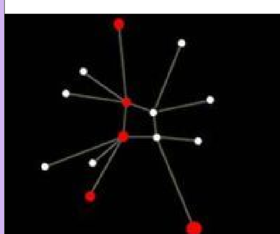


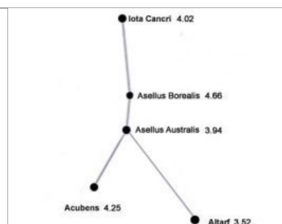
Northern Hemis Position
Country: U.S.A
Aug-Sep: NEH 10p > OH
Oct-Nov: E 8p > NWH
Jan-Dec: OH 6p > NW

Southern Hemis Position
Country: A.U.S
Oct-Nov: NEH 10p > NWH
Dec: NH 10p > NWH 1a

Cancer

Cancer is visible in both the Northern and Southern hemispheres. In the Northern hemisphere the constellation can be seen from late autumn to spring. In the Southern hemisphere Cancer can be seen in the summer and autumn months, note that it will appear upside down. Most of the stars that make up Cancer are quite faint, as a result it is one of the dimmest constellations.



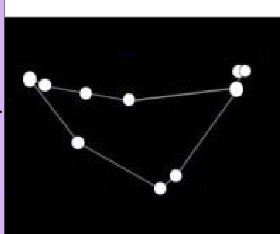


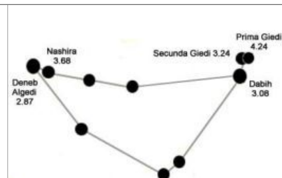
Northern Hemis Position
Country: U.S.A
Dec: E 10p > W 7a
Jan-Feb: E 6p > 6a
Apr-Jun: SW 9a > 1a

Southern Hemis Position
Country: A.U.S
Jan-Mar: NEH 11p > W
Apr-May: N 7p > 10p-2a

Capricornus

The constellation of Capricornus, more commonly known as Capricorn, is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Capricornus can be seen from July to November. In the Northern hemisphere you will need a clear view of the southern horizon to observe the constellation. In the Southern hemisphere Capricornus can be viewed from early winter to late spring.





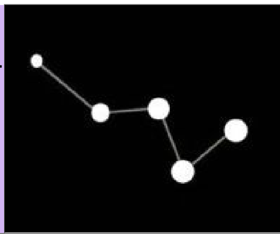
Northern Hemis Position
Country: U.S.A
Jul: SEH 12a > W
Aug-Sep: SE 10p > SWH 4a
Oct-Nov: S 8p > SWH 12a

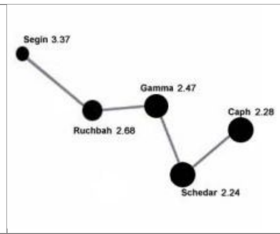
Southern Hemis Position
Country: A.U.S
Jul: EH 10p > OH > WH 3a
Aug-Sep: E 8p > W
Oct-Dec: N 10p > W 3a

Cassiopeia

Cassiopeia is visible all year in the Northern hemisphere. The constellation is visible in some northerly regions of the Southern hemisphere in late spring. The combination of its simple 'w' shape and the brightness of its stars makes Cassiopeia one of the most easily recognizable constellations in the night sky.

Cassiopeia





Northern Hemis Position
Country: U.S.A

Jan-Mar: OH 6p > NW
Apr-Jun: NWH 9p > E
Jul-Sep: NE 10p > OH
Oct-Dec: NE 6p > NW

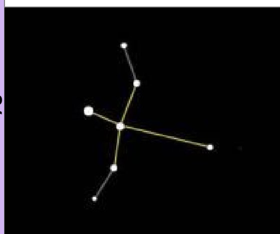
Southern Hemis Position
Country: A.U.S

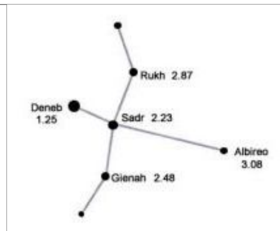
Nov-Dec: N 10p > W 2a

Cygnus

Cygnus is one the most easily recognizable and brightest constellations in the night sky. The constellation is prominent in the Northern hemisphere but can also be viewed in the Southern hemisphere. In the Northern hemisphere the constellation can be seen from June to December. In the Southern hemisphere Cygnus can be viewed low on the northern horizon in the winter months.

Cygnus





Northern Hemis Position
Country: U.S.A

Jun-Jul: NE 10p > OH 2a
Aug-Sep: E 9p > NW
Oct-Nov: OH 7p > NWH
Dec-Jan: W 6p > W 10p

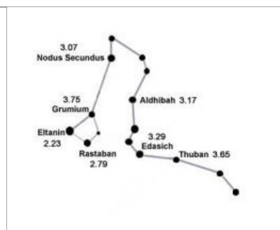
Southern Hemis Position
Country: A.U.S

Jul-Aug: NEH 10p > W
Sep-Oct: NEH 7p > NW 12a

Draco

The Draco constellation never sets below the horizon, as a result it is visible all year in the Northern hemisphere. Constellations that don't set are known as circumpolar constellations. Draco is one of five circumpolar constellations in the Northern hemisphere. The constellation of Draco is only partially visible in some northerly regions of the Southern hemisphere during the winter months. Despite being one of the largest constellations it is not particularly noticeable in the night sky due to the dimness of most of its stars.

Draco



Northern Hemis Position
Country: U.S.A

Jan-Mar: NH 6p > 7a
Apr-Jun: NE 9p > NW 6a
Jul-Sep: OH 10p > NW 5a
Oct-Dec: NW 6p > NE

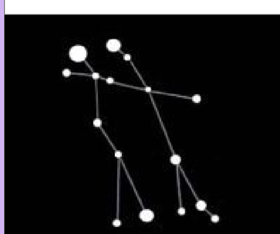
Southern Hemis Position
Country: A.U.S

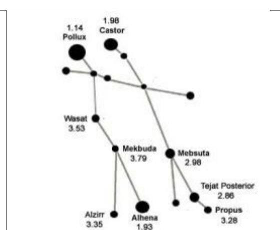
Jul-Sep: NH 7p > 2a

Gemini

Gemini is visible in the Northern hemisphere and most of the Southern hemisphere. In the Northern hemisphere the constellation can be seen from winter to spring. In the Southern hemisphere Gemini can be seen in the summer months.

Gemini





Northern Hemis Position
Country: U.S.A

Dec: E 9pm > W 7a
Jan-Mar: E 7p >4a
Apr: OH 8p > 2a

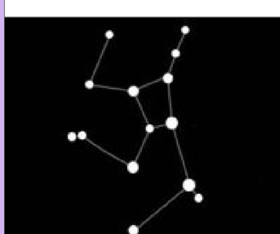
Southern Hemis Position
Country: A.U.S

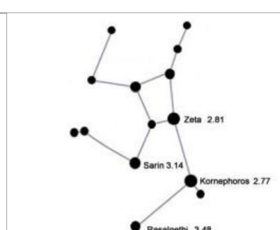
Dec: NE 1a > W 6a
Jan-Mar: NE 10p > 4a
Apr: N 8p > 12a

Hercules

Hercules is one of the largest constellations in the night sky but doesn't contain any very bright stars. The constellation is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Hercules can be seen from April to November. In the Southern hemisphere Hercules can be viewed from June to September. In the Southern hemisphere Hercules will appear upside down.

Hercules





Northern Hemis Position
Country: U.S.A

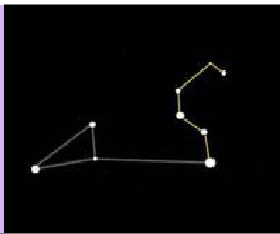
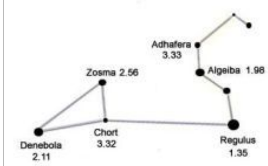
Apr: NEH 11p > OH
May-Jun: NE 10p
Jul-Aug: OH 10p > NW

Southern Hemis Position
Country: A.U.S

Jun: NE 9p > NWH 4a
Jul-Aug: NE 7p > NWH 12a
Sep: N 7p > NWH 10p

Leo

Leo contains several bright stars making it one the most easily recognizable constellations in the night sky. The constellation is visible in both the Northern and Southern hemispheres. In the Northern hemisphere the constellation can be seen from January to June. The stars that make up the bowl of the 'Big Dipper' asterism point towards the constellation in the Northern hemisphere.

Northern Hemis Position
Country: U.S.A

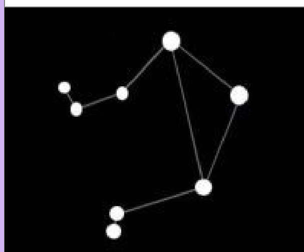
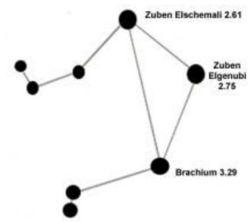
Jan: E 11p > W 7p
Feb-Apr: E 8p > W
May-Jun: W 10p > W

Southern Hemis Position
Country: A.U.S

Feb-Mar: NEH 9p > NWH
Apr-Jun: NE 6p > NWH 9p

Libra

Libra is a fairly small and dim constellation with no very bright stars. The constellation is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Libra can be seen from April to July. In the Southern hemisphere the constellation can be viewed in the autumn and winter months. Locating the bright star Arcturus in the neighbouring constellation of Scorpius makes it easier to find Libra, follow the star up and to the west.

Northern Hemis Position
Country: U.S.A

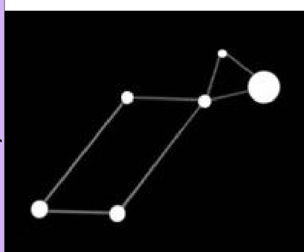
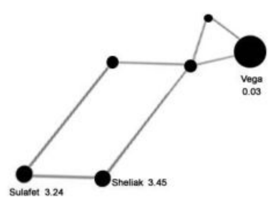
Apr: SEH 12a > SH
May-Jun: SEH 10p > SW 4a
Jul: SH 10p > SWH 4a

Southern Hemis Position
Country: A.U.S

Apr: E 10p > OH 3a
May-Jun: E 8p > WH
Jul-Aug: N 8p > WH
Sep: W 8p > WH 12a

Lyra

Lyra is visible in both the Northern and Southern hemispheres. In the Northern hemisphere the constellation can be seen from April to December. In the Southern hemisphere Lyra can be viewed low on the northern horizon in the winter months. The brightest star in this small constellation is Vega, which is also the fifth brightest star in the night sky.

Northern Hemis Position
Country: U.S.A

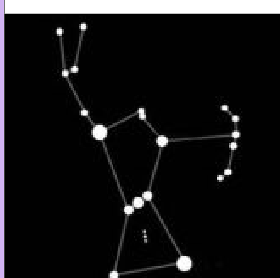
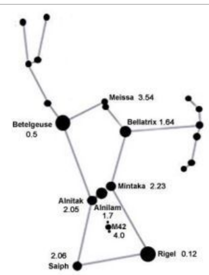
Apr-May: NEH 11p > OH
Jun-Jul: E 10p > OH
Aug-Sep: OH 10p > NW 1a
Oct-Dec: W 7p > 2a

Southern Hemis Position
Country: A.U.S

Jul-Aug: NH 11p > W 4a

Orion

Orion is visible in both the Northern and Southern hemispheres. In the Northern hemisphere the constellation can be seen from late autumn to early spring. In the Southern hemisphere Orion can be seen in the summer months, note that it will appear upside down. The constellation mainly consists of bright blue supergiant stars, the most notable exception being the red supergiant Betelgeuse which lies on Orion's shoulder. Betelgeuse is also the largest star in the constellation, it has 1,000 times the radius of the sun.

Northern Hemis Position
Country: U.S.A

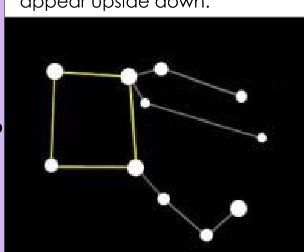
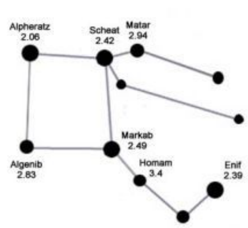
Dec: E 8p > W 6a
Jan-Mar: SE 6p > 2a
Apr: SW 9p > H 12a

Southern Hemis Position
Country: A.U.S

Dec: EH 10p > W 6a
Jan-Mar: NE 10p > H 4a
Apr: NW 8p > H 12a

Pegasus

Pegasus is a large constellation and easily identifiable due to its bright asterism known as "The Square of Pegasus". Asterisms are groups of stars that form simple patterns but are part of one or more constellations. Pegasus is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Pegasus can be seen from July to January. In the Southern hemisphere the constellation can be viewed from August to December. In the Southern hemisphere Pegasus will appear upside down.

Northern Hemis Position
Country: U.S.A

Jul-Aug: EH 10p > OH 4a
Sep-Oct: E 8p > NWH 12a
Nov-Jan: E 6p > W

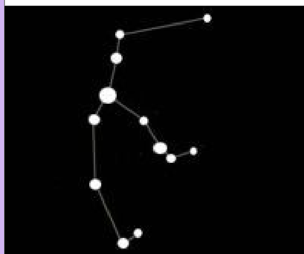
Southern Hemis Position
Country: A.U.S

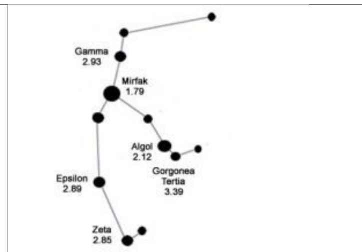
Aug: NEH 11p > N 3a
Sep-Oct: NE 8p > N
Nov-Dec: NW 10p > H 1a

Perseus

Perseus

Perseus is visible from August to March in the Northern hemisphere. It is visible in northerly areas of the Southern hemisphere from mid spring to early summer. Perseus is relatively bright and can be at least partially viewed even in well lit areas. The annual Perseids meteor shower emanates from the direction of the constellation. The Perseids occur from mid July to mid August, at times one meteor can be seen every minute. The shower happens as a result of Earth passing through a trail of debris left by the comet Swift-Tuttle.





Northern Hemis Position
Country: U.S.A

Aug-Sep: NEH 11p > OH
Oct-Nov: NEH 8p > NWH 3a
Dec-Jan: E 6p > NWH
Feb-Mar: OH 7p > NWH

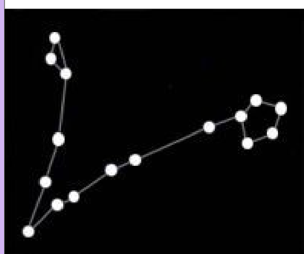
Southern Hemis Position
Country: A.U.S

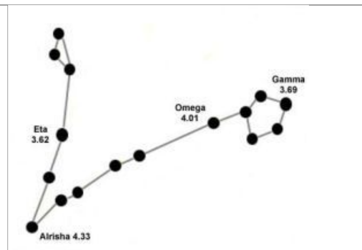
Nov: NEH 10p > W
Dec-Jan: NE 10p > NW

Pisces

Pisces is a large but faint constellation containing no bright stars. The constellation is only fully visible in areas away from light pollution. Pisces is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Pisces can be seen from August to January. In the Southern hemisphere Pisces can be viewed in the months of Spring, it will appear upside down in comparison to how it appears in the Northern hemisphere.

Pisces





Northern Hemis Position
Country: U.S.A

Aug-Sep: EH 11p > WH 3a
Oct: EH 8p > W
Nov: E 7p > S 10p
Dec-Jan: S 7p > WH 12a

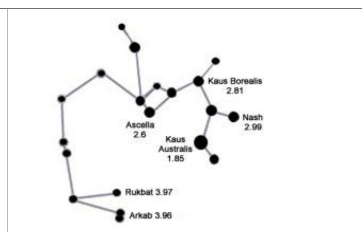
Southern Hemis Position
Country: A.U.S

Oct: EH 9p > WH 5a
Nov: NE 10p > WH 4a
Dec: NW 11p-2a

Sagittarius

Sagittarius is a relatively large constellation which is mainly visible in the southern hemisphere. In the Northern hemisphere the constellation can be viewed low on the horizon from August to October. In the Southern hemisphere Sagittarius can be viewed from June to November. The constellation of Sagittarius is often depicted as a teapot shaped asterism in star maps.

Sagittarius



Northern Hemis Position
Country: U.S.A

Aug: S 10p-2a
Sep: S 9p-12a
Oct: S 8p-10p

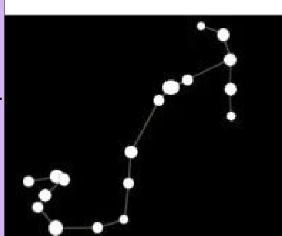
Southern Hemis Position
Country: A.U.S

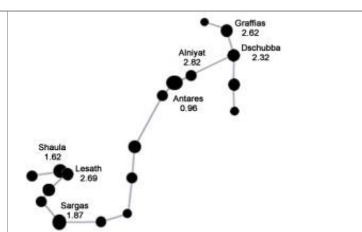
Jun-Jul: SE 9p > SWH 6a
Aug-Sep: SE 8p > SW
Oct-Nov: W 10p > SWH 1a

Scorpius

Scorpius is a large and bright constellation which is mainly visible in the southern hemisphere. In the Northern hemisphere the constellation can be seen in July and August. In the Southern hemisphere Scorpius can be viewed from March to October. In the Southern hemisphere Scorpius lies within the centre of the Milky Way, appearing as a faint band stretching across the sky.

Scorpius





Northern Hemis Position
Country: U.S.A

Jul-Aug: SH 10p-12a

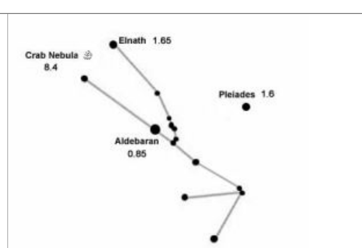
Southern Hemis Position
Country: A.U.S

Mar-Apr: SE 11p > 4a
May-Jun: SE 7p > SWH
Jul-Aug: E 7p > SWH 2a
Sep-Oct: W 8a > SWH 11a

Taurus

Taurus is visible in both the Northern and Southern hemispheres. In the Northern hemisphere the constellation can be seen through the autumn and winter months. In the Southern hemisphere Taurus can be seen from late spring and throughout the summer, note that it will appear upside down. Taurus is one of the largest constellations in the night sky.

Taurus



Northern Hemis Position
Country: U.S.A

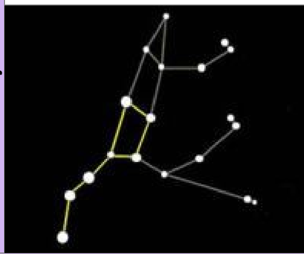
Oct-Nov: E 10p > W
Dec-Jan: NE 6p > NWH 6a
Feb-Mar: OH 7p > 2a

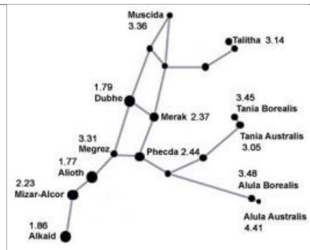
Southern Hemis Position
Country: A.U.S

Dec-Jan: NEH 10p > W 6a
Feb-Mar: NW 9p > 2a

Ursa Major

Ursa Major is visible all year in the Northern hemisphere. The constellation is partially visible in some northerly regions of the Southern hemisphere. Ursa Major is Latin for Great Bear, although the constellation is based on Greek mythology. Ursa Major is associated with the nearby constellation of Ursa Minor (Little Bear). The 'Big Dipper', which is part of the Ursa Major constellation, is highlighted in yellow in the first picture.





Northern Hemis Position
Country: U.S.A

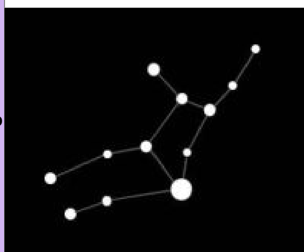
Jan-Mar: NE 6p > NW
Apr-Jun: OH 9p > NWH 6a
Jul-Sep: NW 10p > N 6a
Oct-Dec: NWH 6p > E 6a

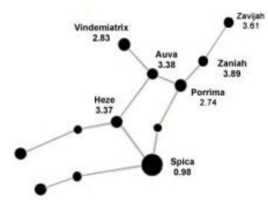
Southern Hemis Position
Country: A.U.S

Jan-Mar: NE 11p > 6a
Apr-Jun: NE 7p > W 2a
Jul-Sep: NW 7-8p
Oct-Dec: NE 5-6p

Virgo

Virgo is the second largest constellation and is visible in both the Northern and Southern hemispheres. In the Northern hemisphere Virgo can be seen from March to July. In the Southern hemisphere the constellation can be viewed in the Autumn and Winter months, it will appear upside down in comparison with the Northern hemisphere. The constellation of Virgo is highly populated with galaxies, there are several galaxy clusters located within its boundaries, each of which is home to hundreds or even thousands of galaxies.





Northern Hemis Position
Country: U.S.A

Mar-Apr: E 9p > WH
May-Jun: S 10p > WH
Jul: W 10p-1a

Southern Hemis Position
Country: A.U.S

Mar: EH 12a > N 4a
Apr: EH 9p > WH
May-Jun: NE 8p > WH
Jul-Aug: NW 8p > WH 12a

Star Navigation

Finding North (Northern Hemisphere)

Less than 60 of about 5,000 stars visible to the eye are used by navigators. The stars seen as we look up at the sky at night are not evenly scattered across the whole sky. Instead they are in groups called constellations. The constellations that we see depends partly on where we are located on the earth, the time of the year, and the time of the night. The night changes with the seasons because of the journey of the earth around the sun, and it also changes from hour to hour because the turning of the earth makes some constellations seem to travel in a circle. But there is one star that is in almost exactly the same place in the sky all night long every night.

It is the North Star, also known as the Polar Star or Polaris. The North Star is less than 1 degree off true north and does not move from its place because the axis of the earth is pointed toward it. The North Star is in the group of stars called the Little Dipper. It is the last star in the handle of the dipper. There are two stars in the Big Dipper, which are a big help when trying to find the North Star. They are called the Pointers, and an imaginary line drawn through them five times their distance points to the North Star. Many stars are brighter than the North Star, but none is more important because of its location. However, the North Star can only be seen in the northern hemisphere so it cannot serve as a guide south of the equator. The farther one goes north, the higher the North Star is in the sky, and above latitude 70 degrees, it is too high in the sky to be useful.

Finding North (Southern Hemisphere)

10 Date & Time

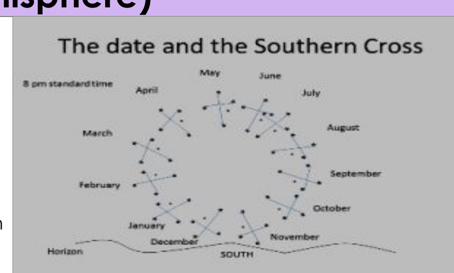
Date

(Northern Hemisphere)

Southern Cross Date (Southern Hemisphere)

To find the Southern Cross look for the two bright stars known as the Pointers that always point to the Cross. The two stars are Alpha Centauri and Beta Centauri, which is the one closer to the Cross in the sky. There are a number of other stars in the shape of a cross in the vicinity such as the ones making up the False Cross, but they are less bright than the stars of the Southern Cross, have a less compact grouping and do not have the Pointer stars. The diagram at the top shows the position of the Southern Cross at 8 pm standard time (or 9 pm daylight savings time) for each month of the year.

The Southern Cross not only spins around the southern sky once a year, it also does a complete circle each 24 hours. Actually it makes the complete circle in 23 hours 56 minutes and 4 seconds or one sidereal day.



The approximately four minutes difference between an ordinary day and a sidereal day is significant for it makes the Southern Cross rise four minutes earlier each day, which is 30 minutes a week or two hours per month. And that two hours a month leads to the monthly change in orientation illustrated at the top.

Time

Sometimes you may have no clock nearby to tell the time with if SHTF. The following tips will help you calculate the time to a fairly accurate degree.

Using Fingers

Start by planting your feet towards the sun, extending one arm fully in front of you, and rotating your wrist so your palm is facing you horizontally. Close your fingers together and align your pinky with the horizon. Now, count how many finger widths it takes to reach the sun. Depending on the season and time of day, you may need to continue stacking one hand over the other to keep count. Four finger widths represent one hour of sunlight, so unless you have exceptionally thin (or thick!) fingers, a count of eight finger widths during a southern Ontario July would equal two hours of remaining sunlight (roughly 7:30 p.m.).

Using Sun's Position

The sun rises in the east and sets in the west. Know the number of daylight hours in your location based on season. With this in mind, you can divide the sky into an imaginary arc from east to west consisting of 16 equal segments to represent the approximate time. An example being - sunrise would be due east at about 5:30 a.m. and sunset would be due west towards 9:30 p.m.

Using Shadows

The position of the sun in the sky overhead causes our shadows to be shortest around noon, and longest in the early morning and late evening. Shadows move and if you can manage to find north, you can use a stick as a makeshift sundial, reading the direction and length of your shadow to get a rough estimate of the time of day.

Shadow Stick

An extension of the shadow stick method for finding North.
1. Find North as per usual using the Shadow Stick method as seen in the Day Navigation section.
2. To find the time of day, move the stick to the intersection of the east-west line and the north-south line, and set it vertically in the ground. The west part of the east-west line indicates 0600 hours, and the east part is 1800 hours, anywhere on earth, because the basic rule always applies.
3. The north-south line now becomes the noon line. The shadow of the stick is an hour hand in the shadow clock, and with it you can estimate the time using the noon line and the 6 o'clock line as your guides. Depending on your location and the season, the shadow may move either clockwise or counter clockwise, but this does not alter your manner of reading the shadow clock.

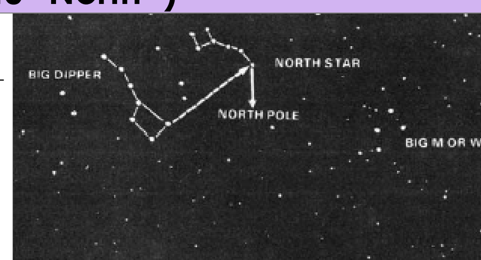
Shadow Stick

The shadow clock is not a timepiece in the ordinary sense. It makes every day 12 unequal hours long, and always reads 0600 hours at sunrise and 1800 hours at sunset. The shadow clock time is closest to conventional clock time at midday, but the spacing of the other hours compared to conventional time varies somewhat with the locality and the date. However, it does provide a satisfactory means of telling time in the absence of properly set watches. The shadow-tip system is not intended for use in polar regions, which the Department of Defence defines as being above 60 degrees latitude in either hemisphere. Distressed persons in these areas are advised to stay in one place so that search/rescue teams can easily find them. The presence and location of all aircraft and ground parties in polar regions are reported to and checked regularly by governmental or other agencies, and any need for help becomes quickly known.

Using Stars (Northern Hemisphere) (40° North+)

Before you begin learning how to tell time using the Big Dipper and the North Star, keep in mind that because these are mostly Northern Hemisphere stars. Those residing in mid-Northern Hemisphere latitudes – 40 degrees North and above – are best positioned to use them to tell time. Find the Big Dipper and the North Star. To locate the North Star, trace an imaginary line extending from the two outermost stars in the bowl of the Big Dipper.

Now, picture a clock with the North Star at its centre, and draw an imaginary line starting from the North Star through the 2 pointer stars of the Big Dipper – Dubhe and Merak. Assume that this is the hour hand of your imaginary star clock. The clock you created in the sky is a 24-hour clock.



Unlike on a regular analog clock face where an hour takes up 30 degrees of a full circle, the imaginary hour hand on the star clock moves only 15 degrees per hour. What's more, this hour hand moves counter-clockwise. Draw another imaginary line straight up from the North Star. This line will mark midnight or the passing of 24 hours. To tell time, look at where the hour hand points to in relation to the reference line. Remember, each 15-degree movement corresponds with the passing of 1 hour.

Using Stars (Northern Hemisphere) (40° North+)

Now, look at the calendar for the date. If it is March 6, you do not need to do any calculations. The time on your imaginary clock will be the actual time.

For example, if the pointer hour hand points straight to the top of the imaginary clock, the time will be midnight. If it points 30 degrees to the right of the reference line, the time would be 22:00 or 10 pm.

To account for Daylight Saving Time (DST), add 1 hour to the calculation in the months that DST is in place at your location.

Using Stars (Southern Hemisphere)

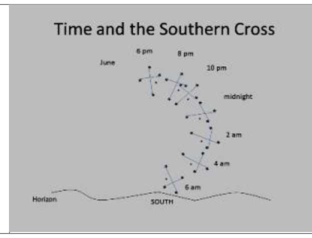
NAVIGATION

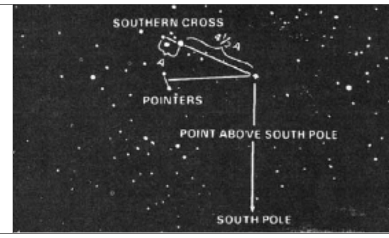
Date & Time

Time

Using Stars (Southern Hemisphere)

As the Southern Cross spins around the sky once a day we can use it to find the time as long as we know the date. The diagram above illustrates how the Cross changes its orientation during a night in mid June. A similar scheme can be used during other months. For example, for August subtract four hours from the times shown on the diagram so that then the Cross is in the same orientation at 8 pm as it is at midnight in June.





Depending on the star selected for navigation, azimuth checks are necessary. A star near the north horizon serves for about half an hour. When moving south, azimuth checks should be made every 15 minutes. When travelling east or west, the difficulty of staying on azimuth is caused more by the likelihood of the star climbing too high in the sky or losing itself behind the western horizon than it is by the star changing direction angle. When this happens, it is necessary to change to another guide star. The Southern Cross is the main constellation used as a guide south of the equator, and the general directions for using north and south stars are reversed. When navigating using the stars as guides, the user must know the different constellation shapes and their locations throughout the world.

NAVIGATION

Technology

11 Technology

Navigation technology.

Geography

Locations around the world and the risks associated with them

"Without Geography, You're Nowhere."
Unknown

Introduction

This section contains every country on earth categorized by continent and contains the risks and vital information about each. Each country contains Crime, Threats, Laws, Health Risks, Weather, Lat/Long and GPS Position.

Purpose	The aim of GEOGRAPHY is to provide details of the countries, crime, laws, health risks and weather around the planet. The information is designed to help you understand different cultures and to help you survive in another country if you have to travel. It also includes a highly detailed world map for a better insight into where each country is located.
Lost?	• If you need to translate words or sentences, see the LANGUAGE section. • If you're looking for a list of common buildings today, see the LOCATIONS section. • For information on the different types of terrain, see the SURVIVAL section. • If you're looking for information on the different types of populations that make up the world, see the POPULATION section. • For information on navigating around the globe, see the NAVIGATION section.

Contents

1 The World

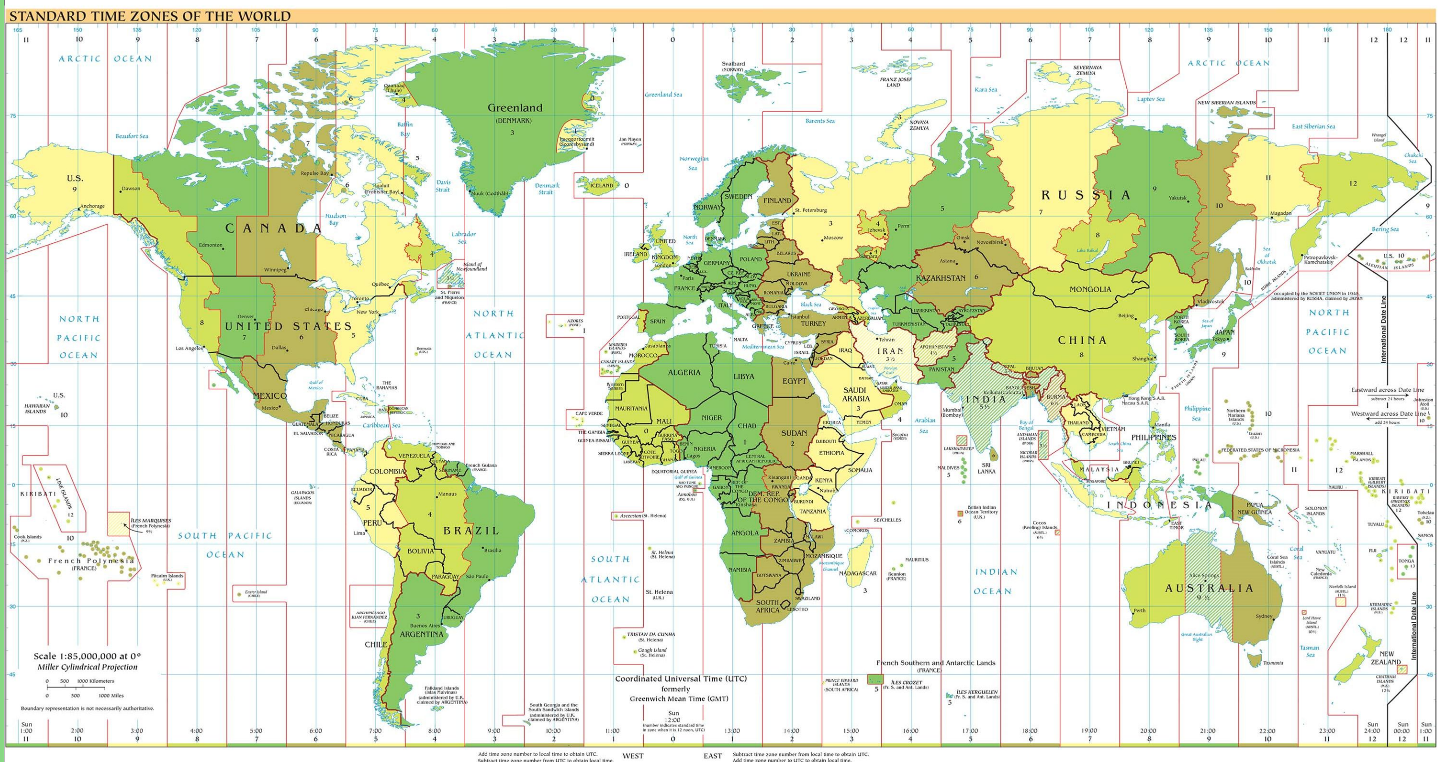
This is a detailed world map split in half, consisting of 110 pieces to retain the detail. This can be used for finding your position or taking note of where events are happening in the world. It could also be used as a basic bug out route map if you have lost your main map and don't have digital backups. This map takes up about 3.75Mb so these pages can be deleted if you want a smaller file size. It's split into 20 columns with 10 rows and allows two extra rows of overlap between the sections for easier reading.

Western Hemisphere

Eastern Hemisphere

Time Zones

These are the different time zones around the world. The colours of the divisions refer to the time zone colours at the bottom. Some zones may be out of sync slightly depending on when you're reading this.

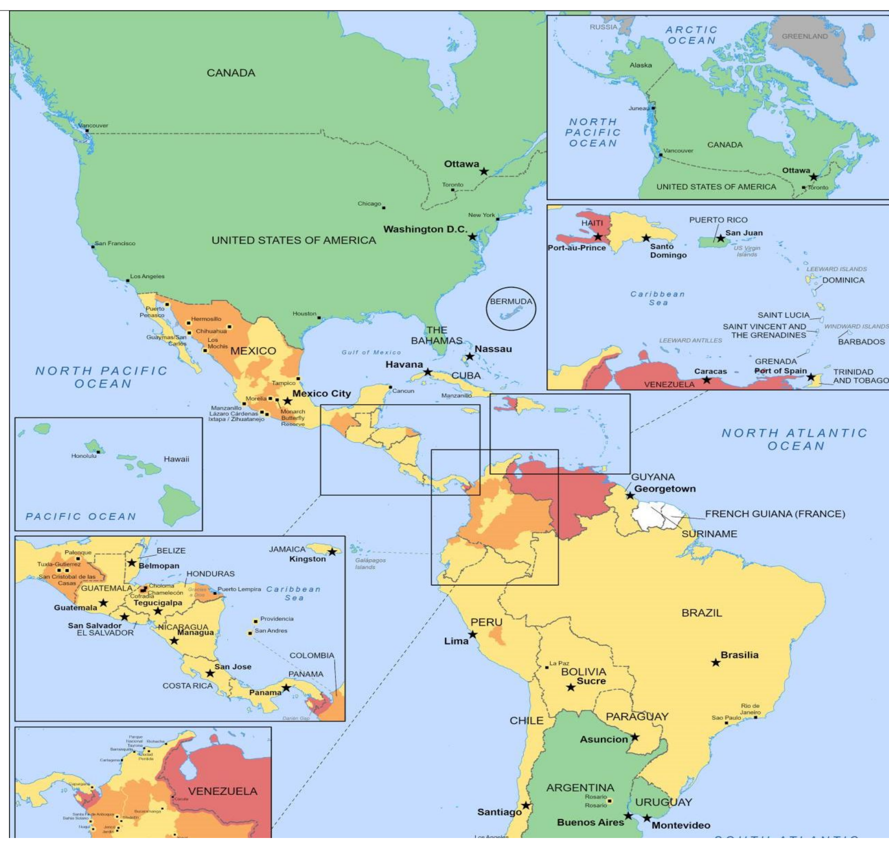


2 Americas

North America, South America, Central America and the Caribbean.

The colour shading and travel advice on the map is the advice given by the Australian Government and is accurate as of the 20th Feb 2025.

However countries risk ratings rarely change so this could be considered accurate advice going into the forseeable future.



This map is presented for information only. The Department of Foreign Affairs and Trade accepts no responsibility for errors or omission of any geographic feature. Nomenclature and territorial boundaries may not necessarily reflect Australian Government policy. For the more detailed travel advice, including intra-country levels visit smartraveller.gov.au. Provided by the Commonwealth of Australia under Creative Commons Attribution 3.0 Australia licence.

Subheadings

		1. Caribbean	2. Central America	3. North America	4. South America		

1 Caribbean

Antigua and Barbuda

	**Threat Level** N/A	**Latitude / Longitude** **Antigua** 17.074656, -61.817521 **Barbuda** 17.626624, -61.771303 **GPS Position** 17° 37' 35.8464" N 61° 46' 16.6908" W
Crime	There have been incidents of violent crime including murder, armed robbery and sexual assault in Antigua and Barbuda. ● Make sure your accommodation is secure – this also applies if you are staying on a yacht . ● Take care when walking alone off the busy main roads. ● Avoid isolated areas, including beaches, particularly after dark. ● Only use licensed taxis. ● Take particular care around large gatherings, including street and beach parties, especially after dark or during the festival season. ● Do not carry large amounts of cash or jewellery. ● Leave valuables and travel documents in a safety deposit box or secure hotel safe.	
Laws	● It is illegal to possess drugs. There are severe penalties for all drug offences. Pack all luggage yourself and do not carry anything through customs for anyone else. ● It is illegal for anyone, including children, to dress in camouflage clothing. ● Attitudes towards the LGBT+ community are mostly conservative in the Caribbean. ● Antigua and Barbuda no longer has legislation against same-sex sexual acts. However, showing affection in public may attract unwanted and negative attention. It is uncommon for opposite or same-sex couples to show affection in public.	
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). We recommend that you take precautions against being bitten by mosquitoes, including using insect repellent at all times, wearing long, loose-fitting, light coloured clothing and ensuring your accommodation is mosquito proof. Seek medical advice if you have a fever, muscle pain, rash or severe headaches as they are symptoms of both dengue fever and the chikungunya virus. ● Zika virus ● Dengue Fever ● Chikungunya	
Weather	**Hurricanes** The hurricane season in the Caribbean normally runs from June to November. Monitor local and international weather updates from the Antigua and Barbuda Meteorological Services, the World Meteorological Organization and the US National Hurricane Center and follow the advice of the local authorities, including any evacuation orders. The island of Barbuda was hit by hurricanes in 2017. Many buildings were destroyed and reconstruction work is still taking place. If you're planning to visit Barbuda, you should: ● Monitor local and international weather updates , follow the advice of the local authorities, make sure your accommodation is secure. **Earthquakes** Earthquakes are a risk in Antigua and Barbuda. Tremors are felt occasionally in the Caribbean. The US Federal Emergency Management Agency website has advice about what to do before, during and after an earthquake.	
Other	N/A	

Aruba

	**Threat Level** N/A	**Latitude / Longitude** 12.521110, -69.968338 **GPS Position** 12° 31' 15.996" N 69° 58' 6.0168" W
Crime	There is a risk of petty theft and there are occasionally incidents of street crime. To reduce the risk to yourself and your belongings: ● Avoid walking in remote areas at night ● Do not take valuables or cash to the beach ● Do not leave bags in your vehicle ● Make sure purses and bags are closed and not easy to grab Although there is no recent history of terrorism in Aruba, attacks cannot be ruled out. Aruba is used as a drug passageway from South America to Europe and North America. There can be drug-related violent crime.	
Laws	● It's a legal requirement to carry ID. Always keep a copy of your passport with you. ● There are severe penalties for all drug offences. Do not leave bags unattended or agree to carry a package for anyone. ● Taxis are not metered. To avoid being overcharged, agree the fare in local currency with the driver before you set off. Only use licensed taxis.	
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya	
Weather	● The hurricane season is June to November. Monitor local media reports and follow the instructions of local emergency officials. Most hurricanes pass to the north of Aruba, which has no record of a recent major hurricane. There are occasional tropical storms.	

Other	● If you're travelling through Aruba, you need to fill in an embarkation/disembarkation card.

The Bahamas

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.		Exercise a high degree of caution in the Bahamas because of high levels of serious crime, mainly on the islands of New Providence and Grand Bahama. Pay close attention to your personal security at all times.	**Latitude / Longitude** 24.696627, -78.038849 **GPS Position** 24° 41' 47.8572'' N 78° 2' 19.8564'' W

Crime

Crime	● The Bahamas has high levels of violent crime, including muggings, armed robbery, home invasion and sexual assault. This increases during the holidays. Be aware of your surroundings, even in areas normally considered safe. ● Avoid downtown Nassau, as murders are common. New Providence and Grand Bahama are also violent crime hotspots. Never get out of your car to remove items blocking the road.

Laws

Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include fines and long prison sentences. ● Serious crimes can attract the death penalty, including aggravated murder, terrorism, treason and war crimes. ● American authorities may conduct thorough drug searches in The Bahamas. Pack your own luggage. Don't carry anything through customs for other people. ● The legal age for same-sex relations is 18. However, it's still not widely accepted. Avoid being affectionate in public.

Health Risks

Health Risks	● Health risks in The Bahamas are similar to those in Australia and U.S.A. Medical services are limited. If you're severely ill or injured, you might need evacuation to the US. Make sure your travel insurance covers this.

Weather

Weather	● In September 2019, Hurricane Dorian caused severe damage to the Abaco Islands and Grand Bahama. There are shelter, food, water and medical shortages and power and communication outages. The ports and airports on these islands are closed. Follow the advice of local authorities. ● Sexual assault is common. Don't visit deserted beaches or walk alone, especially after dark. ● Food and drink spiking is a risk in tourist resorts. Never leave your food or drink unattended. ● Natural disasters, such as hurricanes, occur in The Bahamas. Medical facilities can't handle major emergencies. Be prepared to evacuate at short notice.

Other

Other	● Travellers visiting for 90 days or less with a valid return or onward ticket don't need a visa. ● Bahmanian dollars (BSD) and US dollars are both accepted currencies. Exchange currency at commercial banks or currency exchange offices. It's illegal to leave The Bahamas with more than BSD200. ● Many places accept credit cards. There are ATMs on the larger islands. Only use ATMs in controlled areas such as airports, banks, casinos and hotels. ● Use registered taxis. Taxis don't use meters. Negotiate the price before you leave. ● Carry your yellow fever vaccination certificate. You may need to show it to enter.

Barbados

	**Threat Level** N/A	**Latitude / Longitude** 13.193887, -59.543198 **GPS Position** 13° 11' 37.9932'' N 59° 32' 35.5128'' W

Crime	There have been incidents of violent crime, including: ● Armed robbery ● Sexual assault ● Gang-related shootings There has been an increase in gang-related murders involving guns. Some incidents have taken place in populated and public areas.
Laws	● It is illegal to possess drugs. There are severe penalties for all drug offences. Pack your luggage yourself and do not carry anything through customs for anyone else. ● It is illegal for anyone, including children, to wear camouflage clothing.
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya ● Swimming is not recommended on many of the east-coast beaches where currents are particularly strong. Follow local warnings.
Weather	● All oceanic regions of the world can experience tsunamis, including the Caribbean. ● The hurricane season normally runs from June to November. ● Earthquakes are a potential risk in Barbados, and there are occasional tremors. Follow the advice of the local authorities. ● Check the alert level of the underwater volcano 'Kick 'em Jenny', located 5 miles off the coast of Grenada.
Other	● Fire: 311, Police: 211, Ambulance: 511

Cuba

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 21.521757, -77.781167 **GPS Position** 21° 31' 18.3252'' N 77° 46' 52.2012'' W

Crime	● Violent crime, such as robbery and assault, occurs. Be aware of your surroundings. ● Petty crime, such as theft, is common on public transport, in tourist areas and at the airport. Only use established tour operators and registered taxis. Don't put valuables in your checked luggage.

Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences. Always carry photo ID. Officials can detain you if you don't have it. ● It's illegal to photograph military or police sites, harbours, and rail and airport facilities. Check with officials before taking photos. ● Get local legal advice before preaching a religion or importing religious material. It may be illegal. ● Cuba doesn't recognise dual nationality. Dual nationals may need permission to enter the country. Contact a Cuban embassy or consulate for details before you travel.
Health Risks	● Many medications are in short supply or unavailable. Ensure you bring enough for your entire trip. ● Insect-borne diseases, including dengue and chikungunya, are common. Ensure your accommodation is insect-proof. Use insect repellent. ● Zika virus is a risk, but isn't widespread. If you're pregnant, discuss your travel plans with your doctor. ● Waterborne, foodborne and other infectious diseases are common. These include typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Public medical facilities in Havana are basic. Private clinics are well-equipped, but only one in Havana treats foreigners. All clinics require upfront payment. Ensure your travel insurance covers medical evacuation.
Weather	● The hurricane season is June to November. Hurricanes can cause flooding and disrupt services. Know your hotel or cruise ship's evacuation plan. Find your nearest shelter. ● Cuba is in an active earthquake zone. Tsunamis can also happen. Know the tsunami warning signs and move to high ground straight away. Don't wait for official alerts.
Other	● You need a visa to enter. If you're a tourist, get a tourist card through your travel agent, airline or a Cuban embassy or consulate. For other types of visits, get a visa through a Cuban embassy or consulate. ● Ensure you have comprehensive travel insurance. You'll need to show proof to enter the country. ● Cuba has 2 official currencies: the Cuban Convertible Peso (CUC) and the National Peso (CUP). Foreigners will always use the CUC. Don't take CUC bills out of the country. ● Cuba's complicated banking arrangements can make it hard to access money. Carry cash, cards and traveller's cheques from non-US banks. Take an emergency supply of cash, including enough to leave Cuba if your bank cards don't work. ● Avoid public transport. Many vehicles are poorly maintained.

Dominica

	Threat Level N/A							**Latitude / Longitude** 15.414999, -61.370976 **GPS Position** 15° 24' 53.9964" N 61° 22' 15.5136" W

Crime	● Although there's no recent history of terrorism in Dominica, attacks cannot be ruled out. ● Protests and demonstrations sometimes occur in Dominica. There have been instances of police using tear gas to disperse protesters.
Laws	● To enter Dominica, you must have a certificate to prove you've had a yellow fever vaccination if you're coming from a country listed as a transmission risk. It is illegal for anyone, including children, to dress in camouflage clothing. There are severe penalties for drug offences. Pack all your luggage yourself and do not carry anything through customs for anyone else.
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya
Weather	● The hurricane season is June to November when landslides, mudslides, flooding and disruptions to essential services may occur.
Other	● There is a departure tax of 86 East Caribbean dollars or 33 US dollars. It is usually included in the cost of your plane ticket. You also need to pay departure tax if travelling by ferry. ● Declare cash or travellers cheques if the value is 10,000 East Caribbean dollars or more. You will get a certified declaration to show you brought it in with you. ● Take care when swimming. Currents can be stronger than they look and not all beaches have lifeguards or warning flags.

Dominican Republic

Threat Level Moderate threat level to personal safety, take extra precautions here.							**Latitude / Longitude** 18.735693, -70.162651 **GPS Position** 18° 44' 8.4948" N 70° 9' 45.5436" W

Crime	● The violent crime rate is high. Crime occurs in tourist areas. Conceal your valuables. Don't use public transport. ● Women are at risk of sexual assault. Avoid travelling alone. ● Credit card and ATM fraud are common. Use ATMs in daylight hours at hotels, shopping centres or other controlled areas. ● Bank card cloning and identity theft are a risk in the Dominican Republic. ● When travelling to the airport, use official airport taxis. Travel during daylight hours.
Laws	● Don't carry or use illegal drugs. There are severe penalties for drug offences, including long prison sentences. ● Don't drive if you've used alcohol or drugs. You could be arrested and detained. ● If you're a dual national, travel on your other passport. ● Always carry copies of the photo page of your passport and entry stamp with you.
Health Risks	● HIV/AIDS infection rates are high. If you're involved in high-risk activities, take precautions. ● Cholera and other waterborne and foodborne diseases are common. Boil drinking water or drink bottled water. Avoid ice cubes. ● Mosquito-borne illnesses are common during the wet season from May to November. These include dengue and malaria. Check your accommodation is insect-proof. Use insect repellent. ● Zika virus is widespread. If you're pregnant, discuss your travel plans with your doctor. ● Rabies is a high risk. It can be fatal if left untreated. Avoid contact with animals, especially dogs, cats and mongooses (small cat-like animals). If you're bitten or scratched, get immediate medical attention.
Weather	● The hurricane season in the Caribbean normally runs from June to November. ● Earthquakes are a risk in the Dominican Republic. If an earthquake happens, follow the advice of the local authorities. ● There is a risk of tsunamis from earthquakes at sea. Follow the instructions of the local authorities if there are warnings of an approaching tsunami.
Other	● When you arrive, you must buy a tourist card. It's valid for 30 days. Check with your nearest Dominican Republic embassy or consulate for up-to-date visa rules. ● Strict exit requirements apply to children aged under 18 who are travelling alone, with one parent or with another adult. Ask your nearest Dominican Republic embassy or consulate about the regulations before you travel. ● You can't exchange Australian dollars for Dominican Pesos (DOP). You can exchange US dollars at banks or official exchange offices. Take US dollars with you. ● Use a pre-booked taxi or those provided by hotels. Don't use unofficial taxis or 'carros publicos'. Travellers have been robbed and assaulted in unofficial taxis. ● Take particular care if riding a motorbike or scooter. The Dominican Republic has a high death rate from road accidents involving motorbikes and scooters. ● If you're involved in a road accident, you must file a report with the Dominican Republic authorities.

Grenada

	**Threat Level** N/A	**Latitude / Longitude** 12.116500, -61.679 **GPS Position** 12° 6' 59.4" N 61° 40' 44.4" W

GEOGRAPHY · Americas · Caribbean · Grenada

Crime	● Although there's no recent history of terrorism in Grenada, attacks cannot be ruled out. ● Most crime in Grenada is non-violent and opportunistic, such as thefts of unattended items or burglaries from villas or cars. There are occasional violent crimes including armed robbery and sexual assault.
Laws	● To enter Grenada, you must have a certificate to prove you've had a yellow fever vaccination if you're coming from a country listed as a transmission risk. ● There are strict rules about goods you can take into or out of Grenada. You must declare anything that may be prohibited or subject to tax or duty. ● It's illegal for anyone, including children, to dress in camouflage clothing. ● There are severe penalties for all drug offences. Pack all luggage yourself and do not carry anything through customs for anyone else.
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya
Weather	● The hurricane season is June to November when landslides, mudslides, flooding and disruptions to essential services may occur. Monitor local media reports and follow the instructions of local emergency officials. All oceanic regions of the world can experience tsunamis, including the Caribbean.
Other	● You can visit Grenada without a visa. On entry, you'll be allowed to stay for a maximum period of 3 months. ● Taxis are not metered. There are standard taxi fares for most destinations. To avoid being overcharged, agree the fare in local currency with the driver before you set off. You can often pay in US dollars as well as East Caribbean dollars.

Haiti

GEOGRAPHY · Americas · Caribbean · Haiti

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Areas of Bel Air, Carrefour, Cité Soleil and Martissant in Port au Prince, reconsider your need to travel.		**Latitude / Longitude** 18.971187, -72.285215 **GPS Position** 18° 58' 16.2732" N 72° 17' 6.774" W

Crime	● Violent crime is common in Haiti, including murder, armed robbery, kidnapping, assault, sexual assault and carjacking. The risk increases at night and in isolated areas. Be alert to your surroundings. Don't go out after dark. ● Public transport is unsafe. Avoid taxis, tap taps (vans with a covered tray area) and motorcycle taxis. ● Ask permission before taking photos, especially in remote areas. Travellers have been assaulted for taking photos. ● Demonstrations, protests and strikes happen often. These can turn violent. Avoid crowds. Carry ID and documents for your vehicle, in case you pass a security checkpoint.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. Conditions in Haitian prisons are very poor. ● LGBTI traveller's rights aren't legally restricted. But there's significant social stigma. LGBTI travellers may face discrimination, harassment or violence. Avoid being affectionate in public.
Health Risks	● The rate of HIV/AIDS infection is high. Take precautions if you're engaging in high-risk activities. ● Insect-borne illnesses include malaria, dengue and Zika virus. Ensure your accommodation is insect-proof. Use insect repellent. If you're pregnant, talk to your doctor about Zika virus before you travel. ● Haiti has had an ongoing cholera outbreak since 2010. Other common foodborne and waterborne diseases include hepatitis and typhoid. Drink boiled or bottled water with intact seals. Avoid raw or undercooked food. ● Disease outbreaks are common and medical facilities are scarce. If you become seriously ill or injured, you'll need medical evacuation to the US. Get comprehensive travel insurance.
Weather	● The Atlantic hurricane season runs from June to November. During this period, tropical storms can quickly develop into major hurricanes. ● Earthquakes are a risk in Haiti.
Other	● Travel requirements can change at short notice. Contact your nearest embassy or the Consulate of Haiti for the latest updates. ● Be aware of entry fees. Foreign visitors must pay an arrival fee at the airport. Visitors crossing by land from the Dominican Republic must pay a tourist fee. ● If you're planning to do volunteer work, arrange a placement before you go. You're unlikely to find one when you arrive. ● If you're travelling to Haiti via the US, you must also meet US entry or transit requirements. Contact your nearest US embassy or consulate for advice. ● You may need a valid yellow fever vaccination certificate if you're travelling to Haiti from a country with a risk of yellow fever. Get vaccinated before you travel. ● The local currency is the Haitian Gourde (HTG). US dollars are also widely accepted. Change foreign currency and traveller's cheques at established banks. Don't exchange money on the street. ● Road travel is dangerous. If you're driving, keep your fuel tank at least half-full. Fuel supply is often disrupted. ● Be careful if driving to the Dominican Republic. Vehicles have been carjacked on the Dominican side of the border. Queues at the border crossings are long. Make sure you and any passengers have the correct vehicle and travel documents.

Jamaica

GEOGRAPHY · Americas · Caribbean · Jamaica

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.		**Latitude / Longitude** 18.109581, -77.297508 **GPS Position** 18° 6' 34.4916" N 77° 17' 51.0288" W

Crime	● Violent crime is a serious problem. Crimes include gang-related armed robbery and murder. Be alert. Don't carry valuables. Avoid walking alone or on beaches at night. ● If you're attacked or robbed, don't resist. Criminals are often armed. You could be killed or seriously injured. ● Avoid Mountain View Avenue when going to and from Norman Manley International Airport. ● Food and drink spiking happens. This can lead to sexual assault, robbery and other crimes. Don't leave your food or drink unattended. ● Crime often occurs on public transport and in unofficial taxis. Use only established tour operators and registered taxis.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. You can be jailed for having illegal drugs. You'll be screened for drugs when leaving Jamaica. ● Know the local laws before you travel. Same-sex relationships, swearing and public nudity are illegal. It's also illegal to buy, sell or wear camouflage-style clothing. ● Wear an appropriate helmet on a moped, motor scooter or motorbike. It's against the law not to. ● Jamaica has the death penalty for serious crimes, such as murder.

Health Risks	● HIV/AIDS is widespread in Jamaica. Take precautions if you're engaging in high-risk activities. ● Mosquito-borne illnesses, especially dengue, are common. Check your accommodation is insect-proof. Use insect repellent. ● Cases of Zika virus have been reported. If you're pregnant, discuss travel plans with your doctor before you leave. ● Foodborne and waterborne diseases are common. Drink only bottled water. Get your vaccinations up to date before you travel.
Weather	● Hurricane season is normally from June to November. We are seeing more uncharacteristic weather in Jamaica and the region is increasingly vulnerable to climate change impacts.
Other	● You don't need a visa if you're travelling for leisure and staying less than 6 months. ● You don't need a visa if you're travelling for business and staying less than 30 days. ● ATMs aren't widely available outside Kingston and Montego Bay. Only use ATMs in secure locations, such as hotels. ● Travellers using unofficial taxis have been robbed and assaulted. Use taxis authorised by the Jamaican United Travellers' Association. ● Carry your yellow fever vaccination certificate. You may need to show it to enter Jamaica.

Puerto Rico

Threat Level
High threat level to personal safety, take a range of extra precautions here.

Latitude / Longitude
18.220833, -66.590149

GPS Position
18° 13' 14.9988'' N
66° 35' 24.5364'' W

Crime	
Laws	
Health Risks	
Weather	
Other	

Saint Kitts and Nevis

Threat Level
N/A

Latitude / Longitude
17.357822, -62.782998

GPS Position
17° 21' 28.1592'' N
62° 46' 58.7928'' W

Crime	● Although there is no recent history of terrorism in St Kitts and Nevis, attacks cannot be ruled out. ● There have been incidents of serious crime including murder, armed robbery and sexual assault.
Laws	● It is illegal for anyone, including children, to dress in camouflage clothing. You could get a 250 Eastern Caribbean dollar (EC dollar) fine and 3 months in prison. ● There are severe penalties for all drug offences, particularly drug trafficking. If convicted at Magistrates Court, you could get a fine of up to 400,000 EC dollars or 3 times the street value, whichever is higher, and up to 10 years in prison.
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya
Weather	● All oceanic regions of the world can experience tsunamis, including the Caribbean. ● The hurricane season runs from June to November. ● During especially hot and dry periods, a single spark or flame can start a wildfire. Report any fires to the emergency services immediately. If you start a wildfire (or attempt to start one), you can get up to 10 years in prison. ● Earthquakes are a risk in St Kitts and Nevis. ● Mount Liamuiga is a potentially active volcano and is likely to erupt in the future. The University of West Indies (UWI) Seismic Research Centre monitors volcanic activity on St Kitts and Nevis.
Other	● Emergencies: Call 911 and ask for an ambulance.

Saint Lucia

Threat Level
N/A

Latitude / Longitude
13.909444, -60.978893

GPS Position
13° 54' 33.9984'' N
60° 58' 44.0148'' W

Crime	● Although there's no recent history of terrorism in St Lucia, attacks cannot be ruled out. ● Most visits are trouble free but robberies and opportunistic crime may occur during the periods of and around large-scale events such as the Saint Lucia Jazz and Arts Festival in May and Saint Lucia Carnival in July. If you are attending a large-scale event take sensible precautions and be aware of your surroundings at all times. Avoid displaying jewellery or valuable items that may attract attention of criminals. Do not leave your drinks unattended, practice caution at crowded events and have a clear plan to return home safely after attending any events. ● There have been incidents of crime in St Lucia including murder, armed robbery and sexual assault. ● There is a continuing serious risk of homicides, primarily gang related and involving guns. Some incidents have taken place in public areas.
Laws	● It's illegal for anyone, including children, to dress in camouflage clothing. ● There are severe penalties for all drug offences. Pack all luggage yourself and do not carry anything through customs for anyone else. ● Travellers without a St Lucian driving licence must get a temporary driving permit. ● Taxis are not metered. Standard taxi fares exist for most destinations. Agree the fare in local currency with the driver before you set off. You can often pay in US dollars as well as East Caribbean dollars.
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya ● The main government hospital can cope with many types of treatment, but serious cases may mean emergency evacuation.

Weather	● All oceanic regions of the world can experience tsunamis, including the Caribbean. ● The hurricane season in the Caribbean normally runs from June to November. ● Earthquakes are a risk in the Caribbean and tremors are occasionally felt in St Lucia. ● Check the alert level of the underwater volcano 'Kick 'em Jenny', located 5 miles off the coast of Grenada. ● Check the alert level for La Soufriere volcano, located on the nearby island of St Vincent. Its eruption in 2021 sent ash over St Lucia, which caused some disruption.
Other	● Medical treatment in St Lucia can be expensive. Make sure you have adequate travel health insurance and accessible funds to cover the cost of any medical treatment and repatriation.

Saint Vincent and the Grenadines

	**Threat Level** N/A								**Latitude / Longitude** 13.247433, -61.190967 **GPS Position** 13° 14' 50.7588" N 61° 11' 27.4812" W

Crime	● Most visits are trouble-free, but there have been crimes including murder, armed robbery and assault. ● St Vincent and the Grenadines' Vincy Mas carnival takes place in early July. Theft and opportunistic crime may increase during carnival. Only use licensed taxis and take particular care at late-night street parties. ● Drink spiking - Do not leave drinks unattended.
Laws	● There are severe penalties for all drug offences. Pack your own luggage and do not carry anything through customs for anyone else. ● It's illegal for anyone, including children, to dress in camouflage clothing.
Health Risks	● Mosquito-borne illnesses, such as Zika virus, dengue and chikungunya, occur commonly in the Caribbean region, especially during the rainy season (June to December). ● Zika virus ● Dengue Fever ● Chikungunya
Weather	● All oceanic regions of the world can experience tsunamis, including the Caribbean. ● There was a lot of damage to tourist infrastructure on Mayreau and Union caused by Hurricane Beryl which struck the islands in July 2024. Smaller islands are also still affected such as the atolls of Palm Island and Petit St Vincent in Tobago Cays. This has affected hotel availability and other facilities including services at the airport. If you plan to visit Mayreau, Union or the smaller islands, confirm arrangements with your travel agent or accommodation provider. ● Earthquakes are a risk. ● The last explosive eruption of La Soufrière volcano on St Vincent was in 2021. You should also monitor the alert level of the underwater volcano Kick 'em Jenny, located 5 miles off the coast of nearby Grenada.
Other	

Trinidad and Tobago

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.							**Latitude / Longitude** 10.691803, -61.222503 **GPS Position** 10° 41' 30.4908" N 61° 13' 21.0108" W

Crime	● Violent crime such as murder, kidnapping, shootings, armed robbery, rape, carjacking and home invasions are common. Take care at all times, when travelling by road and when using ATMs, especially after dark. ● Bag snatching, pickpocketing and theft from cars is common. Keep valuables out of sight, your car doors locked and car windows up. ● A terrorist attack could happen at any time. Be alert to possible threats, monitor the media and follow the advice of local authorities.
Laws	● Travellers leaving Trinidad and Tobago are thoroughly screened for drugs. ● Serious crimes, including murder and treason, can attract the death penalty. ● Same-sex relationships are illegal. Other illegal activities include public nudity, indecent language, and civilians wearing army or police clothes. ● Carrying ammunition when you enter, exit or travel around Trinidad and Tobago is illegal. This includes bullets, bullet casings and spent ammunition. Be careful what you buy. Items such as jewellery and key rings may contain these materials.
Health Risks	● HIV/AIDS infection rates are high. Take precautions if you're engaging in high-risk activities. ● Insect-borne diseases like yellow fever, Zika virus, chikungunya and dengue are widespread. Get vaccinated against yellow fever. If you're pregnant, ask your doctor about the risk of Zika virus before you travel. Protect yourself from mosquitos. ● Foodborne, waterborne, parasitic and infectious diseases like hepatitis A are common. Boil drinking water or drink bottled water. ● Medical facilities vary in quality. You may need to pay before doctors will treat you.
Weather	● Hurricanes and severe weather can cause flooding, landslides and mudslides. This may affect travel or disrupt access to services. Know evacuation plans and the location of your local shelter. ● Earthquakes can occur. Be aware of safety measures for each place you visit.
Other	● You don't need a visa to travel to Trinidad and Tobago as a tourist. You'll have to pay a visa waiver fee when you arrive. For other travel reasons, you'll need a visa. ● Carry your yellow fever vaccination certificate. You may need to show it to enter. ● ATMs are widely available. You can exchange foreign currency at commercial banks and official exchange bureaux. ● To drive you'll need both a valid driver's licence and a valid International Driving Permit (IDP). Get your IDP before you leave your country. Avoid driving at night or in the early morning. ● Avoid public transport, maxi taxis and shared taxis.

2 Central America

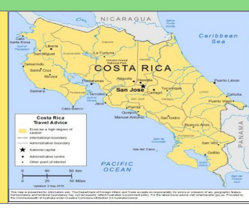
Belize

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.								**Latitude / Longitude** 17.189877, -88.49765 **GPS Position** 17° 11' 23.5572" N 88° 29' 51.54" W

Crime	● Violent crime may affect foreigners in Belize. There's gang-related violence in the southern parts of Belize City. Don't travel alone, especially after dark. ● Avoid demonstrations and large public gatherings. These can turn violent. ● Although there is no recent history of terrorism in Belize, attacks cannot be ruled out. ● Political demonstrations take place in Belize City and Belmopan, but most are peaceful. ● Belize has one of the highest per capita murder rates in the world. Other violent crime, including armed robbery, shootings, domestic abuse and sexual assault are also a concern. ● Serious gang-related violence occurs most frequently in Belize City, particularly in the area to the south of the Haulover Creek (known as Southside). Tourists are not normally the targets of gang violence, but anyone near an incident could be affected. ● Armed criminals have been active in the remote forested areas of Belize, particularly the border area with Guatemala and close to tourist sites there. However, the area is patrolled by the Belize Defence Force and there have been no reported incidents involving tourists. ● Tourists, in general, are vulnerable to theft of cash, credit cards, phones and other personal belongings, including in tourist destinations such as San Pedro, Caye Caulker, Placencia and San Ignacio.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences include long sentences in local jails. Marijuana is illegal. ● Belize has the death penalty for serious crimes, such as treason and murder. ● Find out about local laws before you go. It's illegal to carry pre-Columbian artefacts without a permit. It's also illegal to photograph official buildings. ● Same-sex relationships were decriminalised in 2016. LGBTI travellers face discrimination and violence in some regions. Avoid public displays of affection.
Health Risks	● The rate of HIV/AIDS infection is high. Take precautions if you're engaging in high-risk activities. ● Some cases of Zika virus have been reported. If you're pregnant, discuss your travel plans with your doctor before you travel. ● Insect-borne diseases, including chikungunya and malaria, occur in Belize. Check your accommodation is insect-proof. Use insect repellent. ● Waterborne, foodborne and other infectious diseases are common. Drink boiled or bottled water. Get your vaccinations up to date before you travel.
Weather	● Monitor local weather reports for hurricanes and other natural disasters.
Other	● You need a visa to enter Belize. You can get a tourist visa on arrival. ● If you're not visiting as a tourist, you need to apply for a visa in advance. Contact the Consulate of Belize for up-to-date information on visas. ● If you're travelling via the US, ensure you also meet US entry or transit requirements. ● Children aged 17 and under who are travelling on their own, or with an adult who is not their parent, must carry a notarised letter to prove parental responsibility, or consent to travel from the parent or guardian. ● Carry your yellow fever vaccination certificate. You'll need to show it if you're coming from a country where yellow fever is a risk. ● If you leave Belize by land, or by water crossing to Guatemala or Mexico, you must pay a departure tax of 40 Belize dollars or 20 US dollars at the border. If leaving by air, the tax is usually included in the airfare. ● Driving conditions may be hazardous, especially during the rainy season, due to: Roads with potholes, unpaved dirt shoulders and few lane markings, narrow or unpaved roads, roads often unlit, lack of emergency road assistance, flooded temporary bridges and causeways during severe weather in southern parts of the country, particularly in Stann Creek and Toledo.

Costa Rica

Threat Level
Moderate threat level to personal safety, take extra precautions here.



Latitude / Longitude
9.748917, -83.753428

GPS Position
9° 44' 56.1012" N
83° 45' 12.3408" W

Crime	● Violent crime is common in Costa Rica, including carjackings and 'express kidnappings'. Criminals often target tourist areas, resorts, transport hubs and public transport. Drink spiking with methanol is common and has killed people. Be aware of your surroundings. Plan to arrive or leave the airport during daylight hours. Don't leave your drinks unattended, especially in stores or bars. ● Petty crime is common. Avoid carrying valuables where possible. Use established tour operators and officially registered taxis. ● Credit card fraud is a risk. Street money changers often pass fake currency. Only change money at banks or official exchanges. ● Nationwide strikes and roadblocks have occurred since September 2018. Public gatherings sometimes turn violent. Don't attempt to cross roadblocks or protests. Make alternative transport plans in case of disruptions. ● Muggings and theft are significant problems, particularly on the Atlantic coast. ● There have been incidents where thieves slash a tyre and then offer to help change it, while an accomplice steals from the car. ● Avoid walking alone in poorly lit or remote areas at night. Gangs occasionally carry out muggings and armed robberies. A number of foreign nationals including one British national have gone missing in recent years, with some incidents related to criminal activity. ● If you're using a hire car, do not stop your car for strangers signalling for help – they could be carjackers. ● Criminals sometimes cause deliberate collisions to stop vehicles and commit robberies or other crimes. If you think a collision was a deliberate act by another driver to make you stop, drive on until you reach a safe place like a police station or garage. You will need to be able to explain your actions to the traffic police. ● Rapes and sexual assaults have increased, some of which appear targeted toward tourists. Avoid leaving drinks unattended in bars.
	● People, have died or suffered serious illness caused by alcoholic drinks containing methanol. Criminal gangs have apparently used methanol in the manufacture of cheap brands of local spirits, including vodka and 'guaro' (cane liquor). Take care when buying spirit-based drinks. The Pan American Health Organisation (PAHO) says that methanol can cause headaches, dizziness, nausea and vomiting, seriously damage the optic nerve, and can cause respiratory or cardiac failure. If you, or someone you are travelling with, shows signs of methanol poisoning, seek immediate medical attention. To protect yourself from methanol poisoning: Buy alcoholic beverages only from licensed liquor stores, buy drinks only at licensed bars and hotels, avoid home-made alcoholic drinks, check bottle seals are intact, check labels for poor print quality or incorrect spelling
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long sentences in local jails. It's illegal to photograph public buildings in Costa Rica. If you're unsure about a site, ask an official before you take photos. ● Get permission before photographing anyone, especially women and children.
Health Risks	● Malaria is a serious risk in Limon and Puntarenas, including near the border with Panama. Consider taking anti-malarial medication if you're travelling to these areas. ● Cases of Zika virus have been reported. If you're pregnant, talk to your doctor about your travel plans. ● Risk of mosquito-borne illnesses increases during the wet season from April to November. Make sure your accommodation is insect-proof. Use insect repellent. ● Common waterborne, foodborne and other infectious diseases include tuberculosis, typhoid, hepatitis and rabies. Boil drinking water or drink bottled water. Get your vaccinations up to date before you travel. ● While swimming on any beach in Costa Rica, bear in mind that rip currents are very common and there are often no lifeguards. Seek reliable local advice. Drownings are the second most common cause of accidental death and in recent years have averaged 50 to 60 per year, a third of whom were tourists.
Weather	● The hurricane season usually runs from June to November – the same as the hurricane season in the Caribbean. ● The June-November period is also the peak rainy season. Flooding and landslides may occur, resulting in road closures and driving hazards. ● There is a risk of earthquakes: movements greater than magnitude 6 occur periodically. Local infrastructure is well-prepared, and earthquakes seldom have widespread effects. ● Costa Rica has 16 volcanoes, several of which are considered active. The risk of eruptions is always present. The most recent significant eruption was at Volcan Rincon de la Vieja on 21 April 2023. Check news reports and follow local advice before travelling to any areas around volcanoes. Avoid volcanic areas during and immediately after heavy rainfall when there's increased risk of lava flows. Ash plumes can affect air quality and have an impact on health. If you have any pre-existing respiratory conditions, you might be at increased risk of triggering or worsening your symptoms. A properly fitted face mask may provide some protection.
Other	● If you're travelling via the US, ensure you also meet US entry or transit requirements. ● Check the travel requirements for children. You may need extra documents if only one parent or guardian is travelling with a child. Children with dual Costa Rican nationality need notarised written consent from both parents to leave the country. ● Carry your yellow fever vaccination certificate. You may need to show it when you arrive. ● Have several ways to access money. You can't exchange Australian dollars for Costa Rican Colones, but you can exchange US dollars. Credit cards are widely accepted. ● Due to the risk of robbery and assault in unofficial taxis, only use licensed taxis. You can buy prepaid vouchers for airport taxis in front of the San José airport terminal.

El Salvador

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
13.794185, -88.89653

GPS Position
13° 47' 39.066'' N
88° 53' 47.508'' W

Crime

- El Salvador has until recently had one of the highest crime rates in Latin America. The risks of violent and petty crime remain, despite recent progress.
- Violent crime, often involving guns and street gangs, is widespread. It increases at night. Don't travel alone or after dark.
- Gang-related crime is common. Gangs have killed police, bombed cars and public transport, and set grenades in public places. Pay close attention to your surroundings. Ensure your accommodation is secure.
- Petty crime is common around transport hubs and tourist areas. Safeguard your belongings.
- Road travel outside the capital, San Salvador, is dangerous. Criminals target highways and the road to the international airport. Plan to arrive or depart the airport during the day. Keep vehicle doors and windows locked.
- There is a small risk of unexploded weapons, such as landmines, in remote areas. If you're going off-road, take local advice and avoid such areas if warned.
- Protests and public gatherings can turn violent. Don't take part in any political activities. Authorities may detain or deport you.
- There have been isolated attacks on tourists, including robberies, carjackings and violent assaults. Within San Salvador, the areas of Santa Elena, San Benito and Maquilishuat have better security, as do most of the larger shopping malls.
- The risk of kidnapping to foreigners or visitors is relatively low, despite an increase in kidnapping of Salvadorans. You might wish to share your location or plans with a trusted person, particularly if taking public transport or a taxi. Kidnap gangs generally target rich Salvadorans rather than visitors.
- Scam artists target foreign visitors and residents. Scams come in many forms and can cause great financial loss. Warn your friends and family to be sceptical if they're asked to transfer funds to you in El Salvador. Tell them to contact you to check you've made this request.

- El Salvador's government has declared a state of exception (emergency) in response to a sharp rise in gang-related murders. The state of exception started in 2022 and has remained in place since. The murder rate has fallen significantly, but the authorities are concerned the gangs could regroup. The state of exception gives police additional powers, resulting in a much higher number of arrests, sometimes without much evidence. It also allows police to detain people for much longer before trial. Many ordinary legal safeguards have also been weakened or removed. For example, joint legal hearings for over 100 people are common. Some embassies have struggled to get consular access to their citizens. If you're arrested, the El Salvador government may not allow the British Embassy to give you consular assistance or make sure you receive legal representation. Mistreatment and human rights violations, sometimes resulting in death, happen in detention facilities. Security operations and gang-related violence do not usually affect tourists and visitors. Security operations have taken place across the country, particularly in Soyapango, Ilopango, Mejicanos, San Martin and San Marcos. In 2022 the Salvadoran Legislative Assembly designated gang members as terrorists and established harsher penalties for them. Government communications and social media posts now sometimes refer to suspected gang members as terrorists.

Laws

- Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences.
- Take care when driving. If you injure or kill someone in a road accident, authorities may arrest or detain you for a local trial.
- It's illegal to photograph official buildings. Check with local authorities before taking photos.
- Dual nationals may have to complete national service. Contact the El Salvador embassy or consulate before you travel.

Health Risks

- Insect-borne illnesses are common, especially during the wet season. Chikungunya is widespread. Malaria is a risk in rural areas. Use insect repellent. Ensure your accommodation is insect-proof.
- Zika virus is widespread. If you're pregnant, discuss your travel plans with your doctor. Consider deferring non-essential travel.
- HIV/AIDS is a significant risk. Take precautions if you're taking part in high-risk activities.
- Other common infectious diseases include tuberculosis, hepatitis, typhoid and rabies. Drink boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get medical help immediately.
- Medical facilities are basic. If you're seriously ill or injured, you'll need medical evacuation to the US. Ensure your travel insurance covers this.
- Rivers tend to be contaminated and unsafe to swim or bathe in.

Weather

- The hurricane season is from June to November. Hurricanes can disrupt essential services. Know where your nearest shelter is.
- The rainy season normally runs from June to November – the same time as the hurricane season in the Caribbean. During the rainy season you can expect frequent, heavy rain, thunderstorms and possible tropical depressions. Landslides and flooding can affect roads. Mountain areas are particularly vulnerable to landslides.
- El Salvador has active volcanoes. Ask local authorities about safe areas to trek or climb.
- There are frequent minor earth tremors and occasional earthquakes in El Salvador.
- Fire risk increases during the dry season, particularly in San Salvador. During especially hot and dry periods a single spark or flame can start a wildfire.

Other

- You need a visa to enter El Salvador. You can get a Central American Border Control Agreement (CA-4) visa on arrival if you're staying as a tourist for 90 days or less.
- If you're travelling for other reasons or staying longer than 90 days, get a visa before you arrive. Contact the embassy or consulate of El Salvador for up-to-date information.
- You'll need to show your valid yellow fever vaccination certificate to enter El Salvador.
- The official currency is the US Dollar. Exchange for other currencies isn't available. Most places don't accept credit cards. ATMs can be unreliable. Only change money and use ATMs in banks, hotels or shopping malls.
- Landmines and unexploded remnants of war are common in rural El Salvador. Chalatenango and Morazán districts are high-risk. Use only paved roads and well-travelled paths.
- Avoid using public transport. It's often overcrowded, poorly maintained and unsafe.
- Take particular care when driving to or from the border with Guatemala. There have been violent attacks on vehicles, particularly on the Guatemalan side of the border. Criminals often target vehicles with El Salvador number plates. It's better to cross borders in the morning, giving you time to reach your destination before dark. Borders sometimes close in the early evening.

Guatemala

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
15.783471, -90.230759

GPS Position
15° 47' 0.4956'' N
90° 13' 50.7324'' W

Crime

- Guatemala has one of the highest violent crime rates in Latin America. Although most of the serious crime involves local gangs, you could be caught up in incidents as they can happen in tourist areas. No parts of Guatemala City are free from crime, including Zone 10 (Zona Viva), which is popular with tourists and foreign residents. Take care in Zone 1 where tourists have been targeted by criminals, this is the historical centre where cheaper hotels are located and several bus routes end.
- There is a state of emergency in the departments of Alta Verapeaz, El Progreso, Izabal, Peten and Zacapa. Follow instructions issued by local authorities, carry your personal identification with you and approach checkpoints cautiously.
- Violent crime, including murder, carjacking and kidnapping, is common. It increases at night. Take extra care after dark. Only use ATMs during daylight.
- Border crossings have a high crime rate. Only cross during daylight hours. Allow enough time to reach a major city before dark.
- Criminals target travellers at the airport and driving to hotels. Use only pre-paid or radio taxis. Don't flag taxis on the street or use taxi stands. Always keep vehicle windows and doors locked, even when moving.
- Violent attacks, including sexual assault and gun crime, can take place anywhere and any time . Attackers have killed and injured victims who resisted. There is a low arrest and conviction rate. Carjacking and armed robbery are common on the main road (Carretera Salvador) leading from Guatemala City to the border with El Salvador.
- Scams involving tourist vehicles are common. Be wary of strangers offering a service you didn't ask for.
- Incidents of political violence, strikes and large demonstrations can occur, often with little or no notice. Most demonstrations are peaceful, but they can turn violent. Protestors may block roads and public facilities, including the international airport, without notice.
- Criminals may attack motorised boats or sailing boats in Rio Dulce and Livingston. Before you book boat travel, check the company has good security measures.

- Avoid travelling on public buses (repainted US school buses). There has been an increase in armed attacks by local gangs on bus drivers and conductors, often resulting in serious injury or death. These attacks have included the use of explosives. There have also been violent muggings, rapes and assaults against foreigners. Private intercity coach services are generally safer, but gangs have also attacked these during daylight hours, even on main roads.
- Criminals posing as police officers have committed theft, extortion and sexual assault against visitors to Guatemala.
- Foreign visitors are at risk of scams. Scams come in many forms and can lead to great financial loss. Warn your friends and family to be sceptical if they're asked to transfer funds to you in Guatemala. Tell them to contact you to check that you've made this request.
- Express kidnappings – short term opportunistic abductions, aimed at extracting cash from the victim – are common in Guatemala. Victims can be targeted or selected at random. They are held while criminals withdraw money from their bank accounts using their cash cards. Many cases involve victims that have been picked up by taxis (registered or illegal) hailed from the street. Be aware of your surroundings and always let someone you trust know your whereabouts, especially after dark. Business people and visitors perceived to be wealthy may be targeted by kidnappers in search of payouts. Be discreet about discussing your financial or business affairs in places where you may be overheard by others, and when arranging meetings use a secure location. If you are a victim of kidnapping, follow the kidnapper's instructions.

Laws	● You must pay airport departure tax of 30 US dollars (or the same amount in Guatemalan quetzal). This is normally included in the price of your ticket. ● Check with local officials before taking photos. It's illegal to photograph government buildings, military sites, the Presidential Palace and airports. ● Ask permission before taking photos of women and children. ● There are severe penalties for drug trafficking and the use of drugs. Guatemalan prisons are overcrowded, violent and dirty. ● To enter or exit Guatemala, children aged 17 and under travelling alone or with only one parent or legal guardian must have a notarised letter in Spanish from the parents or guardians not travelling with them. ● All male Guatemalan citizens aged between 18 and 50 must complete military service. This includes dual nationals. If you're a male dual citizen, contact an embassy or consulate of Guatemala before you travel. ● Same-sex relationships are mostly accepted in Guatemala City. In other parts of Guatemala, this may not be the case. Consider avoiding public displays of affection if you're outside the capital. ● It is a legal requirement to always carry ID. ● It is illegal to sell alcoholic and fermented beverages from 1am to 6am.
Health Risks	● Zika virus is widespread. If you're pregnant, discuss your travel plans with your doctor. ● Malaria occurs year-round in areas below 1500m. Consider taking anti-malarial medication if you're travelling to these areas. ● Other insect-borne diseases include dengue, Chagas disease, river blindness and leishmaniasis. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is a significant risk. Take precautions if you're taking part in high-risk activities. ● Foodborne, waterborne and other infectious diseases include hepatitis, typhoid and tuberculosis. Drink boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities in Guatemala City are adequate. They're limited elsewhere. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.
Weather	● The hurricane season is June to November, but storms can happen at any time. The wet season is May to November. Landslides, mudslides and flooding may occur. ● Guatemala has 4 active volcanoes. Know where your nearest shelter is. Know how to protect yourself in the event of an eruption. If you climb a volcano, use experienced guides and follow local advice. ● The rainy season in Guatemala normally runs from June to November – the same time as the hurricane season in the Caribbean. Heavy rains cause frequent flooding and landslides, and roads and bridges often collapse. ● There are frequent minor earth tremors and there is a risk of earthquakes in Guatemala. ● There is a risk of volcanic eruptions in Guatemala.
Other	● You won't need a visa if you're a tourist staying 90 days or less. You'll need to show a return ticket and proof that you have enough money for your visit. ● Guatemalan customs or immigration officials sometimes ask travellers crossing land borders to pay an 'entry fee'. This is illegal. If you are asked to pay a fee, ask for an official receipt. ● If you're travelling for other reasons or want to stay longer, you'll need a visa. Contact an embassy or consulate of Guatemala for details. ● If you're visiting a country where yellow fever is present, carry your yellow fever vaccination certificate. You'll need to show it to enter Guatemala. ● The local currency is the Guatemala Quetzal. You can't import or export the Quetzal. Exchange US dollars for local currency once you arrive. ● Have multiple ways to access money. ATMs can be unreliable, but most places accept credit cards. ● Inter-city travel after dark anywhere in Guatemala is dangerous. If you're driving, get local advice on road conditions, including security risks. ● Public buses and chicken buses (converted school buses) are often unsafe. Avoid these. Gangs have also attacked tour buses and luxury coaches. Only travel on tour buses and inter-city buses with good security arrangements. ● Check ATMs for evidence of tampering. Affected machines may not be easy to spot. It's safer to change money in hotels, at banks or at foreign exchange offices.

Honduras

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** The Department of Gracias a Dios, Chamelećon, Choloma and Cofradia, reconsider your need to travel.				**Latitude / Longitude** 15.199999, -86.241905 **GPS Position** 15° 11' 59.9964" N 86° 14' 30.858" W

Crime	● Violent crime, often involving street gangs, is widespread. Carjackers and armed robbers may target people travelling to and from the airport or at traffic lights. Arrive and depart the airport in daylight. Always keep vehicle doors and windows locked. Don't walk or travel alone or after dark. ● Cross-border drug smuggling increases the risk of violent crime in remote and border areas. Use only official border crossings. Cross during daytime. ● Incidents of food and drink spiking are increasing. Never leave your food or drinks unattended. ● Petty crime, including robbery at ATMs, is common. Only use ATMs in secure areas, such as hotels, banks and shopping centres, during daytime. ● Demonstrations can turn violent. It's illegal for foreigners to take part in political protests. Avoid large public gatherings. ● Protests can happen anywhere in Honduras. Although normally peaceful, these can rapidly turn violent with a general breakdown in law and order, including looting. The police have frequently responded with tear gas and there have been deaths and injuries. ● There are high levels of crime in Honduras. Most serious crime does not affect tourists, but there have been attacks on foreigners, including armed robbery and sexual assault. Attacks can take place anywhere at any time. ● Petty theft is a problem in cities and tourist areas, including the Bay Islands (Roatán, Utila and Guanaja). Avoid walking around Tegucigalpa, San Pedro Sula and other main towns and cities in mainland Honduras. Be particularly careful at bus stations, airports, isolated beaches, tourist sites and on public transport. Keep your valuables locked away in a safe if possible. Avoid displaying valuable items like jewellery, cameras, tablets, laptops and mobile phones. ● Take care if you're travelling alone. In remote areas it may be safer to travel with others or join a tour. Do not accept lifts from strangers or hitchhike.
Crime	● Criminals have robbed foreigners after they've withdrawn money at ATMs. ATMs are available in the major towns. Check with your hotel which ATMs to use, especially in Roatán. It is safer to withdraw money from ATMs in shopping centres and to change money in hotels or banks. Check ATMs for evidence of tampering, although affected machines may not be easy to spot. Do not withdraw a lot of money at one time and avoid withdrawals at night. People have been killed and injured resisting criminals. It is useful to carry a small amount of money to hand out if you're robbed. ● There have been violent attacks on people in cars and buses. Using a reputable tour company for longer journeys may reduce the risks. For shorter distances, use radio-dispatched taxis or hotel taxis. It is generally safer to travel on main roads between major cities and tourist destinations. ● Avoid travelling on public buses (repainted US school buses). There has been an increase in armed attacks by local gangs on bus drivers and conductors, often resulting in serious injury or death. There have been violent muggings, rape and assault against foreigners on these buses. Private intercity coach services are safer but not immune from attack. There have been attacks on roads: From Limones to La Union, from Olancho via Salama to Saba, from Gualaco to San Esteban, from La Esperanza to Gracias, in the Department of Santa Barbara, in and around Tela, La Ceiba, Trujillo and El Progreso. ● Scam artists target foreign visitors and residents. The scams come in many forms and can cause great financial loss. Warn your friends and family to be sceptical if they're asked to transfer funds to you in Honduras. Tell them to contact you to check that you've made this request. ● As part of its plan to address extortion, the Honduras government announced a state of exception (emergency) in December 2022. This measure has been repeatedly extended and remains in place, affecting over 100 municipalities across the country. During this time there may be restrictions on freedom of movement and other rights in the affected municipalities. Get more advice from your travel operator. You must always carry ID and be prepared for checkpoints.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● Understand the rules on exporting and importing. It's illegal to import religious materials. It's also illegal to export firearms, pre-colonial antiques or artefacts, and some birds, feathers, plants and animals. ● To enter or exit Honduras, people aged 20 and under travelling alone or with only one parent or legal guardian must have a notarised letter in Spanish from the parents or guardians not travelling with them. ● It's illegal to photograph public buildings in Honduras. Ask an official before you take photos. ● Get permission before photographing anyone, especially women and children. ● You will get a 30-day visit entry stamp in your passport when you arrive. Make sure the border control officer puts a stamp in your passport otherwise you may get a fine.
Health Risks	● Zika virus is widespread. If you're pregnant, discuss your travel plans with your doctor before you leave. ● Malaria is a risk throughout Honduras, including the Bay Islands. This increases during the rainy season (May to November). Consider taking anti-malaria medication. ● Other insect-borne diseases include dengue and chikungunya. Use insect repellent. Ensure your accommodation is insect-proof. ● HIV/AIDS is common. Take precautions if you're taking part in high-risk activities. ● Other infectious diseases include hepatitis and typhoid. Drink boiled or bottled water. Avoid raw or undercooked food. ● Air pollution is severe during the dry season. If you have breathing problems, talk to your doctor before you travel.
Weather	● The hurricane season is June to November. Hurricanes can cause landslides, mudslides and flooding. Know where your nearest shelter is. ● Drought, forest fires and flash flooding are common in Honduras. ● Earthquakes are a risk in Honduras.

Other

● If you're a tourist and staying less than 90 days, you don't need a visa. If you're travelling for other purposes, you'll need a visa. Contact the nearest embassy or consulate of Honduras for details.
● Everyone aged over 12 years must pay an airport service fee when leaving the country. Check if your ticket includes this. If not, pay at the airport using US dollars or local currency.
● You'll need to show your yellow fever vaccination certificate if you're arriving from a country where it's a risk. Get vaccinated before you travel.
● Both sides of the Honduras-Nicaragua border have unmarked minefields. Don't leave known safe roads and areas.
● Use only airport or pre-booked taxis. Avoid hailing taxis from the street and public transport. Vehicles are often poorly serviced and drivers aren't trained.
● Take care when travelling by sea. Honduras and Nicaragua have an ongoing maritime boundary dispute. Criminals also operate in Honduran waters.

Mexico

	Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Tamaulipas, Michoacán (except the cities of Morelia, Lázaro Cardenas and the Monarch butterfly reserves), reconsider your need to travel.	**Threat Level** Michoacán (except the cities of Morelia, The Sierra Madre Occidental Mountains in southern Chihuahua, north-eastern Sinaloa, north-western Durango and south-eastern Sonora (except the Chihuahua-Pacific Railway), Lázaro Cardenas and the Monarch butterfly reserves), reconsider your need to travel.		**Latitude / Longitude** 23.634501, -102.552784 **GPS Position** 23° 38' 4.2036'' N 102° 33' 10.0224'' W

Crime

● Avoid protests and large public gatherings. These can become violent. It's also against the law for foreigners to participate in political activity.
● Mexico has a high risk of violent crime, such as murder, armed robbery, sexual assault and kidnapping. Don't travel at night outside major cities.
● Kidnapping is a serious risk. Don't draw attention to your money or business affairs. Only use ATMs in shopping centres during daytime.
● Drug-related violence is widespread. Stop at all roadblocks or you risk being killed.
● Crime is a risk to foreign nationals in Mexico, particularly in major cities and tourist resort areas. Street crime is a serious issue in these places. Many Mexican and foreign businesses choose to hire private security. You should: Research your destination thoroughly, only travel during daylight hours when possible, monitor local media, tell trusted contacts your travel plans.
● Take care withdrawing money from ATMs or using exchange offices (bureau de change). Criminals have targeted people using these services. It's generally safer to use ATMs during daylight hours inside shops or malls. Avoid withdrawing large amounts and watch who is around you while you are at an ATM.
● Pickpocketing and theft are common, including on public transport. You should: Avoid wearing expensive-looking clothing, jewellery or watches, limit the amount of cash or credit and debit cards you carry, watch your luggage, even in apparently secure places like the lobby of your hotel.
● Be wary of criminals posing as police officers and trying to fine or arrest you for no reason. They have targeted travellers driving rental cars. Some genuine police officers have extorted money from tourists for alleged minor offences or traffic violations.
● Do not leave food and drinks unattended in bars and restaurants. Criminals have robbed or assaulted travellers after drugging them.
● Tainted alcohol has caused illness or blackouts. If you have any concerns, get advice from your tour operator or the local authorities.

● Sexual offences have been reported in tourist areas. Take care even in areas close to hotels, and especially after dark.
● Kidnapping is more common in some areas of Mexico than others. See Regional risks for areas of higher risk. While tourists are not usually targeted, you should always remain aware of your surroundings. Short-term opportunistic kidnapping (called 'express kidnapping') can happen, particularly in urban areas. Kidnappers force victims to withdraw money at an ATM to secure their release.
● Drug-related violence in Mexico has increased over recent years. Do not become involved with drugs of any kind. Some areas of Mexico have a high crime rate due to fighting between rival organised crime gangs. In these areas, there is a risk of being caught in the crossfire or of being mistaken for a gang member. While risks are lower in tourist areas, you should: Take advice from local authorities or your hotel, be aware of your surroundings at all times, use reputable tourism or transport companies, travel during the daytime where possible.
● Stay away from isolated roads and use toll roads ('cuotas') whenever possible. Keep car doors locked and windows closed, especially at traffic lights. Violent carjackings and robberies happen along the Pacific Highway. If you suspect someone is following or watching you, drive to a police station or another safe place. Criminals have targeted large camper vans and sports utility vehicles (SUVs). Criminals can deliberately cause traffic accidents to make insurance claims or get cash from the other party. They sometimes threaten violence or intimidation. Contact the authorities for support if necessary.
● In remote areas, you may come across unofficial roadblocks, including on main roads. Local groups seeking money for an unofficial toll control these roadblocks. They can become violent and deny entry.

● Unlicensed taxi drivers have robbed and assaulted passengers, including in Mexico City. Use the better regulated 'sitio' taxis from authorised taxi ranks or ask your hotel to order you a taxi. At airports, only use authorised pre-paid airport taxi services. Licensed taxi drivers protesting about Uber have blocked roads near Cancun's hotels. The protesters have pulled tourists from Uber taxis. Tourists have also missed flights due to roadblocks. Protests can happen without notice. Look for local announcements and follow your hotel's advice on how to avoid protests.
● Be alert on public transport, at airports and in bus stations. Theft on buses is common, so keep your belongings safe. There is a risk of bus hijacking. Try to travel on first-class buses using toll roads, which have a lower rate of incidents than second and third-class buses travelling on the less secure free ('libre') roads. Most first-class bus companies perform security checks when passengers board the bus. Women travelling alone on public transport have been harassed, robbed and sexually assaulted.
● The Mexican government makes efforts to protect major tourist destinations, including: Cancun, Tulum, Cozumel, Los Cabos, Nuevo Vallarta, Playa del Carmen, Puerto Vallarta. Criminals have physically and sexually assaulted British travellers in these locations. In some cases, hotel employees, taxi drivers and security personnel were involved. Hotel staff have sometimes been unhelpful and tried to convince victims not to contact police. Rival criminal gangs have clashed in popular Cancun tourist destinations and surrounding areas. Gangs have not targeted tourists, but violent incidents could affect anyone nearby. Since 2021, several shootings have affected tourists. Be very cautious after dark in downtown areas of Cancun, Tulum and Playa del Carmen. Stay in well-lit pedestrian streets and tourist zones. Follow advice from the local authorities and your tour operator.

Laws

● Get legal advice before buying or investing in property. This includes time-shares. Mexican property law is complex.
● Some activities are illegal for foreigners in Mexico. These include political activity, driving without insurance, and failing to report a road accident. Ensure you understand and follow local laws.
● It is illegal to bring e-cigarettes, vaping devices and solutions into Mexico or to buy and sell them.
● Possessing or exporting ancient Mexican artefacts and carrying firearms or ammunition without a permit are also illegal. Apply for a firearm permit at a Mexican embassy or consulate before you arrive.
● It is illegal for foreign nationals to participate in political activities in Mexico. If you join demonstrations, the Mexican authorities may detain and deport you.

Health Risks

● Malaria and Zika virus are risks in Mexico. If you're pregnant, ask your doctor about the risk of Zika virus before you travel.
● Mexico has insect-borne diseases, such as dengue fever, chikungunya, Chagas disease and leishmaniasis. Ensure your accommodation is insect-proof. Use insect repellent.
● Parts of Mexico are at high altitudes. Air pollution can also cause health issues, particularly over winter (December to February). Talk to your doctor before you travel if you have heart, lung or breathing issues.
● In some hotels, balcony railings are low and there is a risk of falling.
● Shark attacks are rare in Mexico, but you should take care, particularly when surfing. Research the area and follow local advice. Crocodiles normally live in lagoons and coastal areas in Mexico, including Cancun and Pacific coast resorts. Respect warning signs around lagoons in these areas and do not walk close to the water. Crocodiles have attacked and seriously injured tourists in the past.

Weather

● The hurricane season in Mexico normally runs from June to November and can affect the Pacific and Atlantic coasts. Tropical storms and hurricanes cause floods, landslides and disruption to local services, including transport networks. After a hurricane there can still be continued flooding, high winds and rainfall. In 2023, Hurricane Otis hit the south coast near Acapulco. This Category 5 hurricane seriously damaged infrastructure along the coast, in Acapulco and between Zihuatenejo and Punta Maldonado. Reconstruction efforts continue to disrupt tourism, and the security situation is unpredictable. FCDO advises against all but essential travel to the city of Acapulco.
● There is a risk of earthquakes in most parts of Mexico. Tremors happen regularly, particularly in the states of Oaxaca and Guerrero.
● The volcanoes Popocatépetl and Colima are active and closed to the public. The danger zones around both volcanoes change depending on the current level of activity. There is currently a 7-mile (12km) exclusion zone around Popocatépetl and the alert level is level 2 of the amber tier. Ash fall from Popocatépetl has previously disrupted air travel and caused flight cancellations at Benito Juarez International Airport in Mexico City. Check your flight status with your airline or operator. You can also follow Benito Juárez airport on X. Falling volcanic ash and toxic fumes can affect your health, especially if you suffer from a respiratory condition.

Other

● Ensure you understand Mexico's entry requirements. If you're visiting for 180 days or less, you generally won't need a visa.
● Make sure you get your passport stamped on entry and exit.
● Check the requirements if you're travelling with children. Minors with Mexican dual nationality or residency will need a specific form (SAM) from the Embassy of Mexico.
● Exchange other currencies for US dollars before you travel. Tourist areas and resorts accept US dollars, but you generally can't exchange Australian and Canadian dollars and traveller's cheques.
● Most international hotels and tourist facilities accept credit and debit cards. ATMs are widely available in urban areas, but carry cash if you're travelling to rural areas.
● To drive in Mexico you need either a valid driver's licence. Learn local road safety and driving laws before driving.
● If you're taking public transport or taxis, use only first-class buses and official taxis. Crime levels on intercity buses are high, especially after dark.
● You may need to pay a departure tax when leaving Mexico by air or land. The cost can vary, and some airports or border crossings only accept cash.

Nicaragua

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
12.865416, -85.207229

GPS Position
12° 51' 55.4976'' N
85° 12' 26.0244'' W

Crime	● Nicaragua has a high crime rate, including armed robbery, assault and express kidnapping. There aren't many police outside major urban areas. Avoid remote locations. Don't go out alone or at night. Only travel to tourist areas. ● Violent crime occurs in unofficial taxis. Use only official taxis with a red number plate, or radio-dispatched taxis. Avoid public transport. ● Armed gangs operate along the Honduran border. Only use highways that cross the border at Guassaule, El Espino or Las Manos. ● Violent protests that began in April 2018 have eased. But tension remains. Avoid large public gatherings and anti-government activities. ● Demonstrations and gatherings can turn violent. It is illegal for foreigners to take part in any sort of political activity in Nicaragua. ● Foreign nationals have been affected by violent crime in Nicaragua. Criminals often carry out attacks on people in vehicles. To reduce the risk to yourself and your belongings: Keep the windows of your car closed and the doors locked, avoid public transport after dark. ● Take care when walking around markets, bus stations, around the old cathedral in Managua and in the poorer areas of towns. Do not visit these areas after dark on foot. If you are robbed, do not resist, as many criminals carry weapons. If you report the incident to the police, get a signed and stamped copy of the police report. ● There is a risk of 'express kidnapping' if you use an unauthorised taxi. You could be taken hostage and forced to pay cash for your release. Reduce the risk by: Using a radio-dispatched taxi or an authorised taxi with red plates, making sure the driver's ID number, name and photograph are clearly visible on the dashboard, making a note of the colour and number of the vehicle before you get in. ● It is a common local practice to share taxis with strangers, but tourists have been robbed when taking taxis called by strangers. Do not take a taxi if it has been called for you by someone you do not know well. You should also avoid using 'colectivos' (minibuses).
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences. ● It's illegal to photograph official buildings. Check with officials before taking photos. ● Take care when driving. If you kill or injure someone in an accident, officials may detain you until your court case finishes. ● There is a ban on electronic smoking devices such as e-cigarettes in Nicaragua. You cannot import, export, sell, store or use these devices, with or without nicotine. ● You must pay an arrival tax of 10 US dollars in cash. There is also a departure tax of 35 US dollars, which is normally included in the price of your air ticket. ● There is a prohibition on the possession and use of drones. Law 1230 introduced in December 2024 requires people in possession of drones to hand them in to the authorities.
Health Risks	● Malaria is a risk in rural areas, including the outskirts of Managua. Consider taking anti-malaria medication. ● Insect-borne diseases, including dengue, chikungunya, Chagas disease and leishmaniasis, are widespread. Ensure your accommodation is insect-proof. Use insect repellent. ● Zika virus is also widespread. If you're pregnant, discuss your travel plans with your doctor. ● Foodborne, waterborne and other infectious diseases are common. These include tuberculosis, typhoid, hepatitis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. If you're bitten or scratched by an animal, get immediate medical help. ● Medical facilities are good in Managua, but very limited elsewhere. There are no emergency ambulance services. If you're seriously ill or injured, you may need medical evacuation out of the country. Ensure your travel insurance covers this. ● There have been fatalities from scuba diving off Nicaragua's Caribbean coast. If you want to dive, contact a reputable diving company to find out about Nicaraguan waters. Nicaragua's only hyperbaric chamber is in Puerto Cabezas, a 5-hour speedboat ride from Corn Island.
Weather	● Hurricane season is from June to November. Hurricanes can cause flooding and disrupt services. Know your hotel or cruise ship's evacuation plan. Find your nearest shelter. ● A group of volcanoes, several of which are active, stretches the length of the country, in particular San Cristóbal, Masaya, Cerro Negro, and Telica and Concepción on Ometepe Island. Follow media reports and listen to local authorities if you intend to visit the area. Don't hike near volcanoes or visit remote areas without an experienced guide. ● There is a risk of earthquakes.
Other	● If you're a tourist, you can visit for up to 90 days. Purchase a tourist card (CA-4 visa) at the airport. ● If you're visiting for another reason, you'll need a visa. Contact the Nicaraguan Embassy in Japan for details. ● You may need a yellow fever vaccination certificate to enter Nicaragua. ● If you're travelling via the US or Canada, you must meet their entry or transit requirements. Check these with the US Embassy or Canadian High Commission. ● Have multiple ways to access money. The only foreign currency you can exchange in Nicaragua is US dollars. ATMs have low daily withdrawal limits. ● Pacific coast beaches have strong currents and undertows. Check conditions with locals before swimming. ● Driving in Nicaragua can be dangerous. Travel only during daylight hours. Don't leave main roads in the northern border region, as there are unmarked landmines.

Panama

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Darien Gap beyond Yaviza, do not travel.

Latitude / Longitude
8.537981, -80.782127

GPS Position
8° 32' 16.7316'' N
80° 46' 55.6572'' W

Crime	● Panama has high crime rates. Petty crime is more common than violent crime. Take care of your belongings, especially in transport hubs. ● Violent crime includes armed robbery and muggings. Avoid high-crime areas of Panama City. Only use ATMs in banks or shopping centres. Don't go out alone. ● Colombian guerrilla groups and drug traffickers are active in the Darien Gap, near the Colombian border. Violent crime is common. Don't travel to this area. ● Popular protest areas include the University of Panama, the National Assembly, the Presidential Palace, and main roads. Protests can turn violent. Avoid large public gatherings. ● If you're the victim of a crime in Panama and want to report the incident, do so before you leave the country, otherwise the police may not investigate. Street crime can happen anywhere, but these areas of Panama City have higher levels of crime: San Miguelito, El Chorrillo, Río Abajo, 24 de Diciembre, Santa Ana, Juan Diaz. ● There is a risk of pickpocketing in busy areas, on buses and at bus stations. ● People have been attacked after withdrawing cash from ATMs. Where possible, use an ATM inside a bank or shopping centre. Take sensible precautions to avoid mugging, particularly in main shopping areas and tourist sites, including: Albrook Mall in Panama City, Via España and Avenida Central in Panama City, the area of Calidonia in Panama City, the old town (Casco Viejo) in Panama City, the old Panama ruins (Panama Viejo) in Panama City, the Madden Dam area – off the main Panama to Colón road, the city of Colón ● Be wary if visitors approach you to get access to your accommodation. Criminal gangs have used this method to commit burglaries. If you're in any doubt, call the police. ● There have been incidents of targeted gang assassinations, some in tourist areas. Most of these crimes are between members of rival drug gangs.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences. Officials may also arrest you if you're with someone who's using drugs. ● You can visit Panama for up to 3 months without a visa if you arrive by land or air. There are different visa requirements for sea arrivals. ● Always carry photo identification, such as a certified copy of your passport. ● Understand and follow local laws. It's illegal to take photos of official buildings. If you're in a traffic accident, you must wait with your vehicle until traffic police arrive. ● Ask for permission before photographing anyone, especially women and children. ● At Panamanian border control, you may need to: Give the address of your accommodation and a contact telephone number, show a return or onward ticket – particularly if you arrive by land from Costa Rica and are not a legal resident of Costa Rica, prove you have at least 1000 US dollars (or the same amount in other currencies) or a credit card. ● In August 2024, Panama introduced a night-time curfew for unaccompanied minors under the age of 18 in Colón province. Limited exceptions apply. This is part of government efforts to tackle criminal groups and organised crime. In Colón the curfew is from Sundays to Thursdays from 8pm to 4am and on Fridays and Saturdays from 9pm to 5am. Unaccompanied minors who do not comply with the curfew face arrest by the police.

Health Risks	● Yellow fever is widespread. Get vaccinated before you travel. ● Malaria is a year-round risk in Bocas del Toro, Darien and San Blas. It's not a risk in Panama City. Consider taking anti-malarial medication. ● Other insect-borne diseases include Zika virus, dengue and chikungunya. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is common. Take precautions if you're taking part in high-risk activities. ● Waterborne, foodborne and other infectious diseases include hantavirus, hepatitis, tuberculosis, rabies and brucellosis. Drink boiled or bottled water. Avoid raw or undercooked food. If you're bitten or scratched by an animal, get immediate medical help. ● Some private hospitals and clinics are good. Facilities outside Panama City are limited. If you're seriously ill or injured, you'll need medical evacuation to the United States (US). Ensure your travel insurance covers this.
Weather	● The hurricane season is from June to November, but storms can happen year-round. They can cause flooding and landslides, and disrupt services. Know your hotel or cruise ship's evacuation plan. Find your nearest shelter. ● Panama experiences earthquakes. Tsunamis can also happen. Know the tsunami warning signs and move immediately to high ground. Don't wait for official alerts.
Other	● If you arrive by air or land, you'll be granted a 180-day stay on arrival. Ensure you have a return or onward ticket and at least $US500. ● If you're arriving by cruise ship, you'll be granted a 90-day stay on arrival. If you're arriving by any other sea vessel, you'll need a visa. Contact your nearest Panamanian embassy or consulate for details. ● Carry your yellow fever vaccination certificate. You may need it to enter Panama. ● The local coin currency is the Panama Balboa. The banknote currency is the US dollar. Beware of counterfeit currency, especially US$50 and US$100 notes. ● Avoid public transport. Local buses don't follow set routes and they're poorly maintained. ● The Bay of Panama is highly polluted. There are also strong rips and currents. Check conditions with locals before swimming. Never swim alone.

3 North America

Bermuda

	Threat Level N/A	**Latitude / Longitude** 32.307800, -64.7505 **GPS Position** 32° 18' 28.08'' N 64° 45' 1.8'' W
Crime		
Laws		
Health Risks		
Weather	● The hurricane season in Bermuda normally runs from June to November. Tropical storms and hurricanes regularly hit the island which may bring hazardous sea and weather conditions to Bermuda. All those in Bermuda should closely monitor the process of storms on the Bermuda Weather and National Hurricane Centre websites.	
Other		

Canada

	Threat Level Exercise normal safety precautions.	**Latitude / Longitude** 56.130366, -106.346771 **GPS Position** 56° 7' 49.3176'' N 106° 20' 48.3756'' W
Crime	● Canada has a similar crime rate to Australia and the U.S. Crime is more likely to occur in larger cities. ● Petty crime can occur in tourist areas and on public transport. Look after your belongings. ● Theft from cars is common in larger cities. Don't leave valuables in your car. ● Credit card scams and fraud occur. Check your statements often.	
Laws	● The legal drinking age varies across the country. Check local laws before buying or drinking alcohol. ● It's legal to use marijuana (cannabis) in Canada, subject to local restrictions. Check local laws on legal age, possession and other restrictions. It's illegal to take marijuana out of the country. ● Canada recognises dual nationality. Travel on your Canadian passport. Make sure your passports are valid for your entire trip.	
Health Risks	● Health risks in Canada are similar to those in Australia and the U.S. ● Australia and Canada don't have a reciprocal health care agreement. You won't get free health care unless you're a local resident. Ensure your travel insurance covers medical costs.	
Weather	● Canada can experience severe weather. This includes tornadoes and hurricanes in summer, and severe cold, ice and heavy snowfalls in winter. Monitor the media and official sources for weather alerts.	
Other	● Get an electronic travel authorisation (eTA) before you travel to Canada by air. If you have a criminal record, including a drink driving conviction, you may not be allowed into the country. ● If you're travelling to Canada through the US, you must meet US entry and transit requirements. Check with an embassy or consulate of the US. ● You may need documents to travel with children or pets, or bring goods into Canada. Check with the Canada Border Services Agency (CBSA). ● Driving in winter can be dangerous. Use snow tyres and drive to conditions. Carry food, water and blankets. ● If you're travelling to the Arctic by ship, ask about on-board medical facilities. It can take several days for emergency help to arrive. Ensure your travel insurance covers evacuation, treatment, and the cost of returning home. ● Bears and other dangerous wildlife live in forested areas. Get local advice before hiking. ● Winter sports can be dangerous, even fatal. Some areas experience avalanches. Check that your travel insurance covers your chosen activity. Follow the advice of local officials.	

United States of America

	Threat Level Exercise normal safety precautions.	**Latitude / Longitude** 37.090240, -95.712891 **GPS Position** 37° 5' 24.864'' N 95° 42' 46.4076'' W

Crime	● The US has a heightened risk of terrorist attacks. Terrorists may use vehicles, knives, homemade bombs, and poisons or toxins. Be alert, particularly in public places and at events. ● Violent crime is more common than in Australia and Canada and gun crime is possible in all areas. Follow local guidance and instructions. If you live in the US, learn active shooter drills. ● Thieves target travellers. Take care on public transport. Don't leave valuables in your rental car. ● Protests and demonstrations are common. They can turn violent. Monitor the news for information. Avoid protests and obey any local restrictions or curfews.
Laws	● Check local drug laws, including on the possession and use of marijuana. These vary across states. It's illegal to possess prescription medication without a prescription. Penalties include mandatory minimum sentences. ● The federal age for buying and drinking alcohol is 21, but it may vary in different states. Check relevant state laws. ● Get legal advice before you enter into a commercial surrogacy arrangement. ● Some states have laws that may affect LGBTI travellers. ● Dual nationality is recognised. Travel with both your passports. Enter and exit the US on your US passport.
Health Risks	● Insect-borne illnesses are a risk in parts of the US. These include West Nile virus, Heartland virus and Zika virus. Make sure your accommodation is insect-proof. Use insect repellent. ● The US is currently experiencing outbreaks of measles. Make sure your vaccinations are up-to-date before you travel and follow advice from local health authorities. ● Medical costs are high. You may need to pay up-front. Ensure you have comprehensive travel insurance.
Weather	● Extreme weather and natural hazards include earthquakes and tsunamis, wildfires, hurricanes and floods, tornadoes, volcanic eruptions, and blizzards. Monitor weather conditions and follow any mandatory evacuation orders.
Other	● Check US entry, transit and exit requirements. If you're visiting for less than 90 days, you may be eligible for the Electronic System for Travel Authorisation (ESTA) and be able to enter under the Visa Waiver Program. If you're not eligible, you'll need a visa. ● Each traveller, including children, must have their own ESTA and visa waiver, or visa. ● The US restricts travel to and from Cuba. Make sure you meet all requirements. US authorities may question you when you arrive in the US. ● Most places accept credit and debit cards. ● To drive in the US, you need an International Driving Permit (IDP). Get your IDP before you leave your country. Some states may let you drive on an Australian driver's licence. Learn local traffic rules and driving conditions before you drive.

4 South America

Argentina

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
-38.416097, -63.616672

GPS Position
38° 24' 57.9492'' S
63° 37' 0.0192'' W

Crime	● Petty crime, such as robbery and bag snatching, is common. Take care on public transport and in tourist areas. ● Violent crimes are common in the tourist areas of Buenos Aires, Rosario and Mendoza. These include armed robbery and express kidnapping. Only use ATMs in banks and shopping centres. If you're held up, don't resist. ● Thieves often target cars stopped at traffic lights. Crime also occurs in taxis. Use only 'radio taxis'. Keep doors and windows locked when driving. ● Protests are common, especially in major cities. These can turn violent. In Buenos Aires, protests often occur in Plaza De Mayo and Congreso. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● Respect national symbols. Offences committed against them carry a penalty of 6 months to 4 years in jail. ● Dual nationals staying in Argentina for more than 180 days must leave Argentina on an Argentine passport. Make sure you have one before you travel.
Health Risks	● Insect-borne diseases are common the north of Argentina. These include dengue and chikungunya. Ensure your accommodation is insect-proof. Use insect repellent. ● Zika virus occurs in some regions. If you're pregnant, discuss your travel plans with your doctor before you leave. ● Yellow fever is a risk in Misiones and Corrientes. If you're travelling there, get vaccinated before you leave. ● Hantavirus is widespread in some regions. It's spread through contact with infected rodents. Avoid contact with live or dead rodents, nests, burrows and droppings. ● Parts of Argentina are at high altitudes. You can develop altitude sickness above 2500m. If you're travelling to these areas, consult your doctor before you leave. Ensure your travel insurance covers mountain rescue.
Weather	
Other	● Tourists can stay for up to 90 days without a visa. You'll need a visa to work or study in Argentina. You'll also need one if you're travelling on a diplomatic or official passport. ● Some entry ports collect biometric data. Your thumbprint will be scanned and your face photographed. ● Some airlines require a valid yellow fever vaccination certificate to depart Argentina. Check the yellow fever requirements for Argentina and all countries you'll enter or transit through. ● Have multiple ways to access money. Most major hotels in Buenos Aires will exchange US dollars. They may not accept traveller's cheques. Carry a copy of your passport if you plan to use a credit card. You may need to show this to use it. ● Hiking in the mountains can be dangerous. Research your destination. Register your details with local park authorities. Carry emergency and first aid equipment. ● People with disabilities may have trouble with accessibility in Argentina. Check with your accommodation provider before you travel.

Bolivia

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
-16.290154, -63.588653

GPS Position
16° 17' 24.5544'' S
63° 35' 19.1508'' W

Crime	● Political tensions are ongoing. Roadblocks, demonstrations, violent protests and strikes could occur at any time. Don't cross roadblocks set up by protesters. Avoid crowds. They could become violent. ● Anti-narcotics activities in coca-growing areas can lead to violence. Chapare and the Yungas regions are most affected. Take care in these areas.Travellers can be victims of drug-related crime near the Brazil border. Take extra precautions in this area. ● Petty theft is common in tourist areas and bus stations. Be alert to attempts to distract your attention from your luggage.Violent crime against foreigners has increased. This includes armed robbery, assault, and food and drink spiking. Don't leave your food or drink unattended. ● Use experienced, well-known tour guides for hiking trips. ● Criminals can pose as taxi drivers. Use only well-known radio taxi companies with the phone number displayed on the vehicle's roof. Don't hail taxis off the streets.

Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● You must carry photo identification. This can be a photocopy of your passport. ● Understand local laws. It's illegal to remove local treasures. It's also illegal to excavate or collect fossils without written approval. ● Dual national males older than 18 must complete military service upon arrival. Contact an embassy or consulate of Bolivia for details. ● Photography may upset locals. Ask permission before taking photos of children and in remote areas. ● Same-sex relationships are legal, but aren't widely accepted. Consider limiting public displays of affection.
Health Risks	● Yellow fever is a risk. Get vaccinated before you travel. ● Zika virus is also a risk. If you're pregnant, discuss your travel plans with your doctor before you leave. ● In areas below 2500m, there's a risk of malaria and dengue. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malaria medication. ● Other infectious diseases include hepatitis, tuberculosis, typhoid and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get urgent medical help. ● Many parts of Bolivia are at high altitudes. You can suffer altitude sickness above 2500m. If you plan to travel to these areas, consult your doctor before you leave. Get travel insurance to cover emergency evacuation from altitude and related medical costs.
Weather	● Landslides, blocked roads and flooding are common in the rainy season from November to March. Follow local officials' advice.
Other	● If you're visiting for less than 90 days, you won't need a visa. Contact an embassy or consulate of Bolivia for details. If you're travelling via the US, you must meet US entry or transit requirements. Check these with a US embassy or consulate in advance. ● Carry your yellow fever vaccination certificate. You may need to show it to enter and leave the country. ● Have different ways to access money. US dollars are the most easily exchangeable foreign currency. ATMs are in most cities. Many businesses accept international credit cards. ● If you're visiting the Uyuni salt plains, choose a tour operator with a CB radio or satellite phone. There's limited mobile phone coverage. Be prepared for delays from melting snow and snowfalls. ● Know the local traffic laws before you drive. It's illegal to drive with a blood alcohol level greater than zero. ● Avoid public transport where possible. It's often unsafe due to poor roads, driving and vehicle maintenance standards.

Brazil

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
-14.235004, -51.92528

GPS Position
14° 14' 6.0144" S
51° 55' 31.008" W

Crime	● Violent crime, such as mugging, armed robbery and carjacking, is common. It occurs more often in large cities and during festivals, such as Carnaval. Don't go out alone or at night. Avoid isolated areas, including beaches. ● Crime rates are particularly high in shanty towns, or 'favelas'. Don't enter favelas, even with a tour group, especially at night. ● Crime on roads and in taxis is common. Use only prepaid or official taxis. Taxi Apps sucha s uber nand cabify are a safe option. If you're driving, keep doors and windows locked. Ensure your route avoids favelas. ● Large-scale protests and strikes are common, especially around holidays. These can turn violent. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● You must have proof of identity. Always carry a photocopy of your passport and some original photo ID, such as a driver's licence. ● Dual nationals must enter Brazil on their Brazilian passport. If you're male and aged over 18, you may need to do military service. Contact a Brazilian embassy or consulate for advice. ● Same-sex relationships are legal, but aren't always accepted in rural communities. Avoid public displays of affection.
Health Risks	● There's currently a yellow fever outbreak in Brazil. Get vaccinated at least 10 days before you travel. ● Common insect-borne diseases include Zika virus, malaria, dengue, chikungunya, filariasis and leishmaniasis. Ensure your accommodation is insect-proof and use insect repellent. Consider taking anti-malarial medication. ● HIV/AIDS is a serious risk. Take precautions if you're taking part in high-risk activities. ● There's a current measles outbreak in Brazil. Check your vaccination status with your doctor before you travel. ● Foodborne, waterborne and other infectious diseases include cholera, typhoid and hepatitis. Drink boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water.
Weather	● The rainy season is from December to March. Landslides and flooding can occur. Severe storms often delay flights. Be prepared to adjust your travel plans.
Other	● You don't need a visa to enter Brazil for tourism, business, transit or artistic and sporting activities. For other types of visit, apply for a visa through an embassy or consulate of Brazil. ● Carry your yellow fever vaccination certificate. You may need it to enter Brazil.and fr regional /onwards travel. ● The local currency is the Brazilian Real. US dollars are the easiest currency to exchange. Many places accept credit cards, but ATMs can be unreliable. Have multiple ways to access money. ● Use an experienced guide if you travel to remote areas, including the Amazon border regions and the Pantanal wetlands. You may get lost or injured without one. ● Public transport vehicles are often poorly maintained. There's also a risk of petty crime. Be alert when using public transport, especially during busy times and at night.

Chile

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
-35.675147, -71.542969

GPS Position
35° 40' 30.5292" S
71° 32' 34.6884" W

Crime	● Protests have occurred in the areas of Las Condes, Providencia and Vitacura. Take care around the area of Plaza Baquedano/Plaza Italia in central Santiago, and the centre of Valparaiso. ● Local law prohibits political activity by foreign nationals. Participation in protests or demonstrations may result in detention or deportation. Avoid protests and large public gatherings. These can become violent. Authorities may use tear gas and water cannons. ● Mugging, armed robbery, pickpocketing and bag snatching are common. Don't walk alone, especially at night. ● Domestic terrorist acts sometimes occur, mostly by anarchist groups in Santiago. They may use explosives. Be alert and report anything suspicious. ● Robberies can occur on inter-city buses, while passengers are sleeping. Keep valuables with you and check everything before you leave the bus.
Laws	● Don't use or carry illegal drugs. Drug offences carry severe penalties, including long prison terms. ● Chile doesn't recognise dual nationality. Check your citizenship status and any entry or exit requirements with an Embassy or Consulate of Chile. Do this before you travel.

Chile

Health Risks	● Altitude sickness is a risk to anyone travelling above 2,500 metres. Get advice from your doctor. Make sure your travel insurance covers medical evacuation from high altitude. ● Easter Island has had outbreaks of Zika virus and dengue. If you're pregnant, ask your doctor about the risk of Zika virus before you travel. Make sure your accommodation is insect-proof. Use insect repellent. ● Common infectious diseases include hepatitis, typhoid, influenza and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. If you're bitten or scratched by an animal, get medical help straight away. ● Levels of air pollution are high in Santiago from April to October. Dust levels can be high between December and March. If you have breathing problems, take care when there's an air contamination alert. ● Private hospital facilities are good in Santiago and other major cities. Treatment is expensive. You may need to pay cash before treatment.
Weather	● Natural disasters such as fires, earthquakes, volcanic eruptions, flooding and tsunamis occur. Monitor local media and follow the advice of local authorities.
Other	● If you're visiting Chile for tourism for 90 days or less, you can get a visa on arrival. ● You may need extra documents if you're travelling with a child aged under 18 years. Check entry and exit requirements. ● Land mines are a danger in some northern border areas. Get local advice before you travel. Obey all warning signs. ● Prepaid official taxis are available at the airport. You can also use rideshare apps. Don't hail taxis on the street. Ask your hotel to book you a taxi. Make sure they use their meter and check your change.

Colombia

Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** The departments of Antioquia (except Medellín), Arauca, Caquetá, Cauca (except Popayan), Chocó (except its capital Quibdó and the whale-watching towns of Nuqui, Bania Solano and Capurganá), Guainía, Guaviare, Meta, (except Villavicencio and the tourist site of Caño Cristales), Nariño (except Pasto and the border crossing of Ipiales), Norte de Santander, Putumayo, Valle	**Threat Level** Areas within 20 kms of Venezu and Ecuador, except the Pa American Highway crossing Ipiales, Cities of Buenaventur and Tumaco do not travel		**Latitude / Longitude** 4.570868, -74.297333 **GPS Position** 4° 34' 15.1248'' N 74° 17' 50.3988'' W

Crime	● Demonstrations continue across the country. Avoid protests and large gatherings, as they can turn violent. Expect traffic and transport disruptions in major cities. Contact your airline or tour operator. Be prepared to adjust your travel plans. Monitor local media and follow advice from local authorities. ● Violent crime and gang activity is common. Criminals may pose as police officers or spike drinks and food. Don't travel alone or at night. Don't accept food or drink from strangers. ● Drug-related crime, terrorism and civil unrest make some areas very dangerous. These include the regions within 20km of the Venezuelan and Ecuadorian borders, and the cities of Buenaventura and Tumaco. Avoid these areas. ● There's a high risk of terrorism. Groups often target government infrastructure and Western companies. Be alert to possible threats. Follow official advice. ● Colombia has one of the highest rates of kidnappings in the world. If you're travelling to an area with a high risk of kidnapping, seek professional security advice. ● Hikers are sometimes robbed at gunpoint. Hire a reputable, experienced guide. Petty crime, such as theft, occurs in tourist areas.
Laws	● Don't use or carry illegal drugs. Penalties are severe and include long prison sentences. ● It's illegal to photograph military bases and strategic sites. Check with officials before taking photos. ● If you're a dual national, you must enter on your Colombian passport. If you're male and aged over 18, you may need to complete national service. Contact the Embassy of Colombia for details.
Health Risks	● Yellow fever is widespread. Get vaccinated before you travel. ● Zika virus is also widespread. If you're pregnant, discuss your travel plans with your doctor. ● Malaria is a risk in areas below 800m. This doesn't include Bogotá. Consider taking anti-malarial medication if travelling to these areas. ● Altitude sickness is a risk to anyone above 2500m. Get advice from your doctor. Make sure your travel insurance covers medical evacuation from high altitude. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● The standard of private hospitals in Bogotá and other major cities is reasonable. Medical facilities are limited elsewhere. You'll need to pay upfront. Check your travel insurance covers medical evacuation.
Weather	
Other	● If you're visiting for tourism and staying less than 90 days, you generally won't need a visa. Ensure you have a return or onward ticket. For other types of visits, you'll need a visa. Contact a Colombian embassy or consulate for details. ● Carry your yellow fever vaccination certificate. You'll need it to enter Colombia. ● The Puente Internacional de Rumichaca border crossing between Colombia and Ecuador closes from 10pm to 6am. Allow enough time for border-crossing formalities. ● The local currency is the Colombian Peso. Exchange US dollars at official exchange bureaus or banks. Major hotels and tourist facilities accept credit cards. ● You can drive in Colombia with an Australian driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. ● Criminals target taxis. Use a phone dispatch service or taxi service app to book a licensed taxi.

Ecuador

Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Sucumbios province, reconsider your need to travel.	**Threat Level** Areas within 20 kilometres of Colombia, except the official border crossing at Tulcán, do not travel.		**Latitude / Longitude** -1.831239, -78.183406 **GPS Position** 1° 49' 52.4604'' S 78° 11' 0.2616'' W

Crime	● Violent crime and theft are common. Thieves target travellers. Distraction is a common tactic. Be careful when using ATMs and credit cards. ● The risk of violent crime increases when you travel alone or after dark. Criminals target taxis, buses, transport hubs and crowded areas. Northern regions bordering Colombia and Peru are particularly dangerous. Avoid going out at night. Keep vehicle doors and windows locked, and valuables out of sight, even when moving. ● Kidnappings for ransom happen in major cities and places frequented by foreigners. If you decide to travel to an area where there's a threat of kidnapping, get professional security advice. ● Ayahuasca tourism is a growing industry. Serious assaults and robbery occur. Thoroughly research ayahuasca tour operators before you sign up. ● Political activity by foreigners is illegal. This includes joining protests. If you take part, officials may detain or deport you. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● Always carry photo ID. Officials may detain you if you don't have it. ● Male dual nationals must complete compulsory military service. Seek advice from an embassy or consulate of Ecuador well before you travel.

Health Risks	● Many parts of Ecuador are at high altitudes. You can develop altitude sickness above 2500m. If you're travelling to these areas, consult your doctor before you leave. Ensure your travel insurance covers emergency evacuation from altitude and related medical costs. ● Yellow fever is common. Get vaccinated before you travel. ● In areas below 1500m, there's a risk of other insect-borne diseases. These include malaria and dengue. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malaria medication. ● Zika virus is widespread. If you're pregnant, discuss your travel plans with your doctor before you leave. ● HIV/AIDS is common. Take precautions before doing anything that puts you at risk of infection.
Weather	● Ecuador has several active volcanoes. Before you travel to the areas around Tungurahua volcano, including Baños, check with local officials. If you're in Baños, make sure you know evacuation procedures.
Other	● Passport holders can stay for up to 90 days without a visa. Get a visa before you travel if you want to stay longer. ● You can visit the Galapagos Islands for tourism for up to 60 days. For other reasons, you must get a visa or special permission before you arrive in Ecuador. ● Get your passport stamped on entry. If it isn't stamped, you could be deported or delayed leaving. ● Carry your yellow fever vaccination certificate. You may need it to enter and leave the country. Check your countries re-entry requirements following exposure to yellow fever. ● The US Dollar is the official currency. ATMs are available, but many places won't change large banknotes. Restaurants and tourist facilities usually accept credit cards. ● Unmarked minefields are in the Cordillera del Condor region near the Peruvian border. Seek local advice before travelling there.

Guyana

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.							**Latitude / Longitude** 4.860416, -58.93018 **GPS Position** 4° 51' 37.4976'' N 58° 55' 48.648'' W

Crime	● Violent crime such as armed robberies, kidnapping, shootings and carjackings are a risk. These can result in injury or death. Risks increase after dark. Take care around crime hotspots. ● Hotels may not meet fire safety standards. Know your hotel's evacuation plans and talk to hotel staff.
Laws	● Drug offences can lead to long prison terms in local jails. Conditions are harsh, and pre-trial detention can last for years. ● Guyana doesn't recognise same-sex marriage. Same-sex relationships are illegal. You will have no legal protection from discrimination. ● Serious crimes, such as murder, can attract the death penalty. ● Guyana recognises dual nationality.
Health Risks	● Malaria is a risk at all times of year. Risk of other insect-borne diseases increases in the rainy seasons. Make sure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is common. Take precautions to protect yourself from the risk of infection. ● Waterborne, foodborne and other infectious diseases are common. This includes typhoid, hepatitis, leptospirosis, rabies. Boil drinking water or drink bottled water. Avoid undercooked food. ● Medical facilities have poor hygiene standards, lack equipment and trained staff. You may need to seek treatment outside Guyana.
Weather	● Rainy seasons can cause flooding, particularly in coastal areas. Roads may not be safe. Follow the advice of local authorities.
Other	● You'll need a yellow fever vaccination certificate. You have to present one when you arrive in Guyana, if you're travelling from a country where yellow fever is widespread. Some airlines require one before you can board flights out of Guyana. ● Border disputes take place on the Suriname–Guyana and Venezuela–Guyana borders. Only use official crossing points. ● Road travel can be dangerous, due to aggressive drivers and poor quality roads and cars. Crime increases at night, especially between Georgetown and the international airport. Avoid travelling at night. ● Don't use minibuses. They are involved in most road accidents, including fatal ones. ● Piracy occurs along Guyana's coast. Don't use a water taxi to travel to another country.

Paraguay

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.						**Latitude / Longitude** -23.442503, -58.443832 **GPS Position** 23° 26' 33.0108'' S 58° 26' 37.7952'' W

Crime	● Theft, armed assault, kidnapping and other violent crimes occur in Paraguay. This includes in tourist areas. Pickpocketing and drug trafficking are also common. Ask your hotel about areas to avoid. Secure your valuables. ● Avoid large public gatherings and protests. These can turn violent. They may also lead to roadblocks and congestion. Don't cross roadblocks, even if they're unattended. ● Be alert when travelling to the interior parts of the country, including San Pedro and Concepción. A small guerrilla-style group, Ejercito del Pueblo Paraguayo (EEP), operates in these regions. Kidnappings have also occurred.
Laws	● Same-sex relationships are legal in Paraguay. However, the country is very conservative. Same-sex marriages aren't recognised. Discrimination based on sexual orientation and gender identity isn't illegal. Avoid public displays of affection. ● Paraguay has severe penalties for drug offences. These include prison sentences and heavy fines. Don't use or carry illegal drugs. ● Don't photograph airports, military sites, police stations or government buildings. It's illegal. ● Other illegal activities include importing or exporting firearms, medications, toys that look like weapons and protected species. ● Check if you're a dual citizen. Paraguay doesn't recognise dual nationality.
Health Risks	● There's a risk of yellow fever in Paraguay. Yellow fever can be fatal. Get vaccinated before you travel. ● Travellers are also at risk of other insect-borne diseases, like malaria and dengue. The worst outbreaks have occurred in Asunción, Concepción and Ciudad del Este. Check that your accommodation is insect-proof. Use insect repellent. ● Zika virus is common in Paraguay. If you're pregnant, discuss your travel plans with your doctor before you leave. ● HIV/AIDS is a significant risk. Take precautions if you're engaging in high-risk activities. ● Foodborne, waterborne and other infectious diseases are prevalent. These include hepatitis A, typhoid and rabies. Check your vaccinations are up to date before you travel. Boil drinking water or drink bottled water. Avoid ice cubes.
Weather	

Paraguay	
Other	● You need a visa to enter Paraguay. If you enter the country at Asunción International Airport, you can pay cash for a 90-day multiple-entry visa. Otherwise, you'll need to get a visa before you arrive. Contact an embassy or consulate of Paraguay for up-to-date visa regulations. ● Children aged under 18 travelling alone or with one parent may need special documents. Check with the nearest embassy or consulate of Paraguay. ● Check the yellow fever entry requirements by contacting the nearest embassy or consulate of Paraguay. Some airlines may want to see your yellow fever vaccination certificate as you leave. ● Check US entry or transit requirements if you're travelling to or from Paraguay via the US. ● Fake bank notes are common. Use only registered banks or exchange bureaus to change money.Carry identification with you. You may need to show it when paying with a credit or debit card. Traveller's cheques aren't widely accepted. ● Use only registered taxi companies. Book taxis at major hotels or by phone, especially after dark.Some unregistered taxis may appear to be official. Passengers have been robbed in unregistered taxis

Peru

Peru							
	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Areas bordering Ecuador in the regions of Loreto, Amazonas and Cajamarca, reconsider your need to travel	**Threat Level** Areas bordering Colombia (within 80kms), do not travel.				**Latitude / Longitude** -9.189967, -75.015152 **GPS Position** 9° 11' 23.8812'' S 75° 0' 54.5472'' W

Peru	
Crime	● Violent crime is common, particularly in Lima, Cusco and Arequipa. Don't go out alone, especially at night. Petty crime is common in public areas, hotels and restaurants. Thieves are often well-dressed. Keep your belongings close. ● Travellers using unlicensed taxis have been victims of robbery, assault and rape. Don't hail taxis from the street. Criminals target cars stopped at traffic lights. Keep your doors and windows locked, even when moving. ● Robberies and assaults occur on intercity buses. Avoid placing personal belongings on overhead racks or under your seats. Use only reputable bus companies. ● Ayahuasca tourism is a growing industry. Serious assaults and robbery occur. Thoroughly research ayahuasca tour operators before you book. ● Members of a local terrorist group may still be active in areas of the Southern Highlands. Take care when travelling to this region. ● The Inca Trail closes in February each year for maintenance. Heavy rainfall can make parts of it impassable and dangerous. Use an experienced guide.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. Officials use up-to-date technology to detect drugs. ● You must carry photo identification. ● Be careful when taking photos. It's illegal to photograph infrastructure, and military or police sites and personnel. ● Always behave respectfully. Indecent behaviour, such as not showing respect at cultural, historical or sacred sites, is against the law. ● It's illegal to export antiques and artefacts from pre-colonial Peru. If you want to buy and export a reproduction, use a reputable dealer who can provide the right documents. ● Dual nationals aged under 18 must travel with both their passports.
Health Risks	● Many parts of Peru are at high altitudes. You can develop altitude sickness above 2500m. If you're travelling to these areas, consult your doctor before you leave. Ensure your travel insurance covers emergency evacuation from altitude and related medical costs. ● Yellow fever is widespread. Get vaccinated before you travel. ● Zika virus is common. If you're pregnant, discuss your travel plans with your doctor before you leave. ● Malaria, dengue and other insect-borne diseases are also common. Use insect repellent. Make sure your accommodation is insect-proof. Consider taking medication to prevent malaria. ● Other infectious diseases include cholera, hepatitis, tuberculosis, typhoid and rabies. Drink boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get immediate medical help.
Weather	
Other	● If you're a tourist, you can stay up to 6 months without a visa. You can't extend this. For other types of visits, contact an embassy or consulate of Peru. ● Get your passport stamped by immigration when you arrive. If you don't, you may have trouble leaving. You could also face fines. ● Carry your yellow fever vaccination certificate. You may need to show it to enter and leave Peru. You may also need to show it to re-enter your country. ● Landmines are a threat in some regions, especially near the Ecuador border. Only cross Peru's borders at official checkpoints. ● Light aircraft and helicopter flights can be dangerous. Only book scenic flights with licensed operators with good safety records.

Suriname

Suriname								
	**Threat Level** N/A							**Latitude / Longitude** 3.919305, -56.027783 **GPS Position** 3° 55' 9.498'' N 56° 1' 40.0188'' W

Suriname	
Crime	
Laws	N/A
Health Risks	● Malaria ● Yellow Fever ● Zika Virus ● Dengue Fever ● Chikungunya
Weather	N/A
Other	

Uruguay

Uruguay							
	**Threat Level** Exercise normal safety precautions.						**Latitude / Longitude** -32.522779, -55.765835 **GPS Position** 32° 31' 22.0044'' S 55° 45' 57.006'' W

Crime	● Petty crime, such as pickpocketing and bag snatching, occurs in Uruguay. Avoid using ATMs on the street. ● Thieves often target cars stopped at traffic lights. Lock doors and keep windows up, even when moving. Don't leave valuables in your car. ● During summer (December to March), thieves target resort areas such as Punta del Este. Other crime hotspots in Montevideo include Plaza Independencia, La Ciudad Vieja and Avenida 18 de Julio. Avoid the Cerro neighbourhood. Don't walk alone in the downtown or port area. ● Protests can turn violent. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences and heavy fines. ● Don't buy, use or carry marijuana. Since 2013, Uruguayan citizens and permanent residents can legally cultivate and sell marijuana. However, it's still illegal for visitors to buy or possess it. ● Uruguay has strict import and export laws. If you plan to import or export goods, ensure you understand local customs laws. Officials enforce these laws. ● Same-sex relationships and marriage are legal in Uruguay. There are also laws banning discrimination based on sexual orientation.
Health Risks	● HIV/AIDS is a significant risk. Take precautions if you're taking part in activities that may expose you to infection. ● Foodborne, waterborne and other infectious diseases include typhoid, hepatitis and rabies. Drink boiled or bottled water. Avoid raw or undercooked food. If you're bitten or scratched by an animal, get medical attention straight away. ● Make sure you have comprehensive travel insurance. Medical care is expensive and you may have to pay upfront, even in an emergency.
Weather	● Floods may disrupt local transport and damage roads. Check weather forecasts when you plan your travel.
Other	● Tourists can stay in Uruguay without a visa for up to 90 days. If you're visiting for other reasons, contact your nearest Uruguayan embassy or consulate for visa advice. ● You don't need a yellow fever vaccination to enter or leave Uruguay. But you need it for other countries in the region. ● If you're travelling via the US, you must meet US entry and transit requirements. Contact your nearest US embassy or consulate for advice. ● Bring your driver's licence with you. You may be able to use it to drive in Uruguay for one year after entry. You must be at least 21 years old to rent a car. ● Learn the local road rules before you drive. By law, you must use dimmed headlights when driving during the day. ● Access for people with disabilities to buildings, footpaths and road crossings may be difficult. When you book your hotel, check it's accessible.

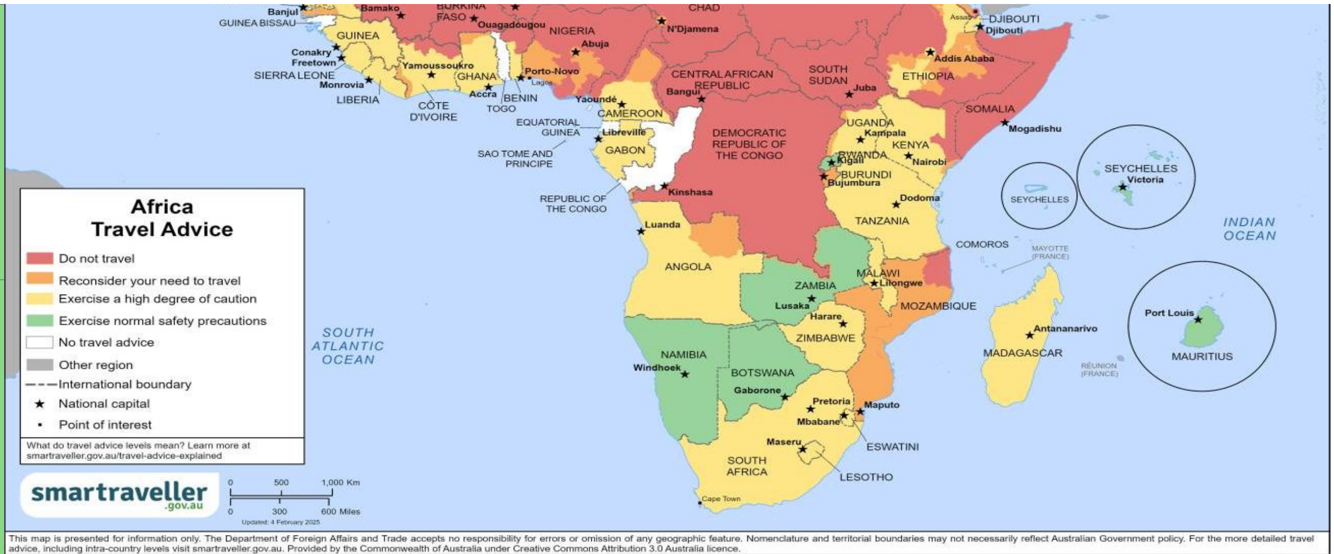
Venezuela

	Threat Level High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Border areas with Colombia (within 80kms), do not travel				**Latitude / Longitude** 6.423750, -66.58973 **GPS Position** 6° 25' 25.5" N 66° 35' 23.028" W

Crime	● Common violent crime includes murder, armed robbery, drive-by shootings, sexual assault and carjackings. Criminals are often armed. Avoid walking in isolated areas, especially at night. ● Kidnapping is a serious threat. The risk is higher along airport routes and in border regions. Only use official taxis organised through your hotel. Avoid kidnapping hotspots. ● Venezuela's political situation is volatile. Demonstrations and protests are common and can turn violent. If you're in an affected area, leave if it's safe to do so. ● Shortages of basic goods can result in long line-ups at stores. This can lead to fighting, looting and theft. Be ready to change travel plans. Keep extra supplies of food, water, medicines and other necessities. ● Terrorist groups and criminal gangs are active along Venezuela's borders with Colombia, Brazil and Guyana.
Laws	● Don't use or carry illegal drugs. Severe penalties for drug offences include long jail sentences. Carrying even a small amount of marijuana can result in jail time. Jails in Venezuela are dangerous and among the worst in the world. ● Drug trafficking in Venezuela is a big problem. Authorities screen travellers at the airport when they arrive and leave. ● It's illegal to photograph military sites and installations, sites of strategic importance and airports. Be careful when taking photos.
Health Risks	● Most pharmacies in Venezuela no longer stock basic medicines due to short supply. Take extra medicine to last longer than your expected stay. ● Serious outbreaks of insect-borne diseases can occur, including yellow fever and malaria. Get vaccinated against yellow fever. Consider taking medicine to prevent malaria. Use insect repellent. ● Zika virus can occur. If you're pregnant, talk to your doctor about the risk of Zika virus. HIV/AIDS is common. Take steps to reduce your risk of exposure to the virus. ● Other infectious diseases include typhoid, hepatitis, tuberculosis, Venezuelan haemorrhagic fever, measles, mumps, rubella, bilharzia and rabies. Boil drinking water or drink bottled water. Don't swim in fresh water. ● Medical services, medical supplies, medicines and emergency services are limited. Private hospitals are good but expensive. Get appropriate travel insurance. If you become seriously ill or injured, you'll need to be evacuated. Make sure your insurance covers medical evacuation.
Weather	● Severe weather, earthquakes, hurricanes, tropical storms, flooding and landslides can occur. The rainy season is from May to December. Monitor local media and the Global Disaster Alert and Coordination System for updates.
Other	● If you travel to Venezuela and you're travelling via the US, you must meet all US entry and transit requirements. Contact your nearest US embassy or consulate for advice. ● Carry your yellow fever vaccination certificate. You may need to show it to enter Venezuelaand fro regional / onwards travel. ● In some cases, a child cannot enter or exit Venezuela without written permission from both parents. If you're travelling with a child, you may need a letter of consent for travel. ● Driving in Venezuela is dangerous. Police and National Guard checkpoints are common. Slow down at checkpoints or stop as directed. Ask for local advice about your route before you drive.

3 Africa

The African region. The colour shading and travel advice on the map is the advice given by the Australian Government and is accurate as of the 20th Feb 2025. However countries risk ratings rarely change so this could be considered accurate advice going into the forseeable future.



Subheadings

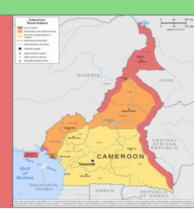
		1. Central Africa	2. East Africa	3. North Africa	4. Southern Africa		
		5. West Africa					

1 Central Africa

Angola

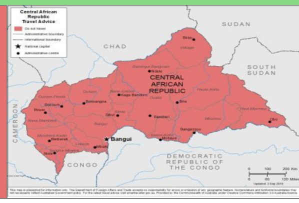
	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Cabinda, Lunda Norte and Sul, reconsider your need to travel.					**Latitude / Longitude** -11.202692, 17.873887 **GPS Position** 11° 12' 9.6912'' S 17° 52' 25.9932'' E
Crime							
Laws							
Health Risks							
Weather							
Other							

Cameroon

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** North and Adamaoua regions, Northwest and Southwest regions, reconsider your need to travel.	**Threat Level** Far North region and within 40 kms of borders with Central African Republic, within 40 kms of the border with Nigeria in the Bakassi Peninsula region, Chad and Nigeria's Adamawa state, do not travel				**Latitude / Longitude** 7.369722, 12.354722 **GPS Position** 7° 22' 10.9992'' N 12° 21' 16.9992'' E
Crime	● Terrorists from Nigeria's Boko Haram group are active in the far north. This includes around Lake Chad and the Nigerian border. Public places and government buildings are potential targets. Be very alert to suspicious behaviour and unattended items. ● Kidnapping and ongoing violence occurs, especially in the Far North, Northwest and Southwest regions, and near the Nigerian border. Avoid these areas. If you do travel there, take personal safety measures. ● Violent crime is common in residential centres and on rural highways. Avoid travel after dark, especially outside city limits. Keep car doors locked, windows up and valuables out of sight. ● Commercial and internet fraud often comes from West African countries, such as Cameroon. Scams can lead to physical and financial harm. Be wary of requests to send money to or meet someone in Cameroon. ● Ask local authorities before climbing Mount Cameroon. It may experience volcanic explosions and lava flows.						
Laws	● Always carry proof of your identity. This can be your residence permit or a certified copy of your passport. ● Same-sex relationships are illegal. Penalties include 6 months to 5 years jail and a fine of 20,000 to 200,000 francs. ● Be careful when taking photos. It's illegal to photograph military zones, assets or personnel. Taking photos of government buildings, airports and ports is also illegal. ● Dress and behaviour standards are conservative. Always dress appropriately.						
Health Risks	● Malaria is widespread throughout the year. Consider taking medicine to prevent it. ● Other insect-borne diseases include dengue, African sleeping sickness, loiasis and river blindness. Use insect repellent. Ensure your accommodation is insect-proof. ● Yellow fever occurs in Cameroon. It can be fatal. Get vaccinated before you travel. ● Cameroon has a high rate of HIV/AIDS infection. Take precautions if you're engaging in high-risk activities. ● Other infectious diseases include cholera, hepatitis and tuberculosis. Boil drinking water or drink bottled water. Avoid ice cubes.						
Weather							

Other	● Show a valid yellow fever vaccination certificate to enter Cameroon and neighbouring countries. ● Hotels accept US dollars and Euros. You can exchange them for local currency. Some hotels accept traveller's cheques. ● Most ATMs don't accept foreign cards. You can't use credit cards in many places. ● The land border with Gabon is difficult to cross due to very poor road conditions. Plan carefully and travel in convoy if possible. Take a VHF radio and satellite phone. ● Consider avoiding taxis due to high crime levels. If you choose to travel by taxi, use only trusted taxis. Arrange for someone to meet you on arrival at the airport.

Central African Republic

	Threat Level Extreme threat to personal safety, recommended not to travel here.						**Latitude / Longitude** 6.611111, 20.939444 **GPS Position** 6° 36' 39.9996'' N 20° 56' 21.9984'' E

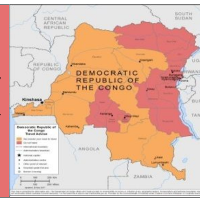
Crime	● Leave the Central African Republic (CAR) if you can. Tensions are high. Armed groups operate across the country. They've killed foreigners, including aid workers and peacekeepers. Areas outside the capital are lawless. ● If you do stay, take personal safety measures. Law enforcement and peacekeepers can't ensure your safety. ● The Lord's Resistance Army (LRA) regularly attacks civilians in the southeast of the CAR, especially Haut-Mbomou province. Be alert to possible threats. ● Kidnapping and violent crime occur. Kidnappers can target foreigners. Seek professional security advice. ● Bandit groups are common. They target aid groups to get cash, vehicles and equipment. Be very careful when carrying large amounts of cash. If possible, split it between your travelling companions.
Laws	● Always carry proof of identity. This can be a notarised copy. Police might detain or fine you if you can't show them your documents. ● You need a government permit to take photos. Unauthorised photography is illegal. Don't photograph military zones, assets or personnel, government buildings or mining leases. ● You need a licence to buy or sell gems. There are heavy penalties for illegally exporting precious gems.
Health Risks	● Medical facilities in the CAR are limited. If you're seriously ill or injured, you may need to be evacuated. Check your travel insurance covers this. ● Yellow fever is widespread. It can be fatal. Get vaccinated before you travel. You must show a valid vaccination certificate to enter the CAR. ● Insect-borne diseases, including malaria, filariasis and African sleeping sickness, are common. Use insect repellent. Ensure your accommodation is insect-proof. ● Infectious diseases are widespread. These include hepatitis, typhoid and cholera. Boil drinking water or drink bottled water. Avoid ice and raw or undercooked food.
Weather	
Other	● If you decide to travel to the CAR, contact the nearest Embassy or Consulate of the Central African Republic for details of visa and entry requirements. The Consulate-General of France in Sydney may be able to help you get your visas for the CAR. ● Land border crossings may close at short notice. Plan your travel accordingly. ● Bangui is the only city where you can change money. You can usually convert euros or US dollars into local currency. Keep alert when changing money. ● There are very few ATMs and banks in Bangui. There are several Western Union offices. You'll need to pay cash in hotels and restaurants. ● Travel throughout the CAR is dangerous. Military personnel and civilians have been killed while travelling in convoys. Take security precautions when travelling.

Chad

	Threat Level Extreme threat to personal safety, recommended not to travel here.	**Threat Level** N'Djamena, reconsider your need to travel					**Latitude / Longitude** 15.454166, 18.732207 **GPS Position** 15° 27' 14.9976'' N 18° 43' 55.9452'' E

Crime	● Chad is extremely dangerous due to the risk of terrorism, kidnapping, unrest and violent crime. If you decide to go anyway, seek professional security advice. ● Terrorist attacks are a major risk in Chad, especially by the Nigerian militant group Boko Haram. Be alert to possible threats. Use effective personal security measures. ● Kidnapping is a risk in remote areas. Kidnappers may target aid workers. Seek professional security advice. ● Security in Chad is volatile. Hotspots include the country's east and near the borders with Libya, Sudan and the Central African Republic. Protests can turn violent. Avoid large public gatherings. ● Violent crime, such as armed robbery and carjacking, is increasing. Local security forces, or people posing as them, may try to extort money from foreigners. Don't carry large amounts of cash. Avoid travelling at night. Don't walk around N'Djamena, even for short distances. ● There is a state of emergency is in place in the western Tibesti region bordering Niger and the eastern Sila and Ouaddai regions bordering Sudan.
Laws	● Don't use or carry illegal drugs. Penalties are severe. ● Chad is a mainly Muslim country with conservative standards. Dress and behave discreetly. ● Always carry identification. You must produce it if asked by the police. ● Be careful when taking photos. You must get a government permit to take any type of photo. Even with one, it's illegal to photograph military and police assets and personnel, airports and government buildings. ● It's illegal to perform some sexual acts between members of the same sex. Same-sex relationships aren't widely accepted. Avoid public displays of affection. ● Be aware of laws regarding precious gems. It's illegal to buy or sell them without a licence or export them without permission.
Health Risks	● Yellow fever is common. Get vaccinated before you travel. ● Malaria is widespread year-round. Consider taking anti-malarial medication. ● Other insect-borne diseases include filariasis and African sleeping sickness. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● Waterborne, foodborne and other infectious diseases include typhoid, cholera, tuberculosis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. If you're bitten or scratched by an animal, get immediate medical help. ● N'Djamena has a private hospital with international-standard facilities. Other medical facilities are poor. Ensure your travel insurance covers medical evacuation.
Weather	
Other	● If you decide to travel to Chad, you need a visa. Contact your nearest embassy or consulate of Chad for up-to-date advice. ● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● Chad's official currency is the Central African CFA Franc. US dollars and euros are also accepted. Chad is a mainly cash economy. Only Air France and some hotels in N'Djamena accept credit cards or traveller's cheques. Bring enough cash to meet all your needs. ● Driving in Chad is dangerous due to crime, flooding and other hazards. If you intend to travel by road, hire a car and driver from a reputable company.

Democratic Republic of the Congo

	Threat Level High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Provinces of Kasai, Kasai Central, Kasai Oriental, Sud-Kivu, Nord-Kivu, Ituri, Maniema, Tanganyika, Bas-Uélé and Haut-Uélé, do not travel.						**Latitude / Longitude** -4.038333, 21.758664 **GPS Position** 4° 2' 17.9988'' S 21° 45' 31.1904'' E
Crime	● The security situation in the Democratic Republic of the Congo (DRC) is volatile. Conflict between government forces and armed groups is ongoing. Regularly review your contingency plans and be ready to leave the country at short notice. ● Large-scale protests could occur at any time. These can turn violent quickly. Avoid large public gatherings. ● Kidnappers often target foreigners. The risk is highest in the east and north-east regions. If you're travelling to these areas, seek professional security advice. ● Crime rates are very high, especially in Kinshasa and the country's east. Risks increase after dark. Ensure your accommodation is secure. Don't walk alone in Kinshasa, even during the day.								
Laws	● The death penalty applies to a number of offences. ● Always carry your passport and visa or immigration permit. It's illegal not to show them if officials ask. ● Be careful when taking photos. It's illegal to photograph presidential or official motorcades. It's also illegal to take photos near government buildings or other infrastructure, including airports. ● If you're walking or driving, stop for motorcades and flag ceremonies. Failing to stop is illegal. ● The DRC doesn't recognise dual nationality. If you're a dual national, make sure you enter and exit the country on the same passport.								
Health Risks	● There is an ongoing Ebola virus disease (EVD) outbreak in eastern DRC, primarily affecting North Kivu, South Kivu, and Ituri provinces. In July 2019, the WHO classified this outbreak as a 'Public Health Emergency of International Concern'. There's no vaccine or effective treatment. Avoid contact with EVD patients as the disease is spread through bodily fluids. ● Ensure you've been vaccinated against polio before you travel. Carry proof of vaccination with you. ● Some insect-borne disease such as yellow fever and malaria are widespread. Ensure your accommodation is insect-proof and use insect repellent. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● Foodborne, waterborne and other infectious diseases include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Medical facilities are basic in Kinshasa and inadequate elsewhere. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.								
Weather	● The DRC has active volcanoes. If there's an eruption, avoid contact with ash. Seek medical help if you have breathing problems. ● In the rainy season, landslides and flooding can disrupt transport networks. Be prepared to change your travel plans.								
Other	● If you decide to travel to DRC you'll need a visa. Get one from your nearest DRC embassy before you travel. ● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● Military and police roadblocks are common. Always carry your government-issued identification, insurance card (carte rose), registration (carte grise) and driver's licence. ● Don't use public transport. Bus and rail services are unsafe due to poor safety standards and crime.								

Equatorial Guinea

	Threat Level N/A								**Latitude / Longitude** 1.650801, 10.267895 **GPS Position** 1° 39' 2.8836'' N 10° 16' 4.422'' E
Crime									
Laws	N/A								
Health Risks	● Yellow Fever								
Weather	N/A								
Other									

Gabon

	Threat Level Moderate threat level to personal safety, take extra precautions here.							**Latitude / Longitude** -0.803689, 11.609444 **GPS Position** 0° 48' 13.2804'' S 11° 36' 33.9984'' E
Crime	● Petty crime, including pickpocketing, bag snatching and vehicle break-ins, is common in Gabon. Keep your valuables out of sight. ● Violent crime, including robberies and armed attacks, occurs, especially in Libreville and Port Gentil. Don't walk alone or at night. Avoid isolated areas, including beaches. ● There has been a military presence on the streets since a failed coup in January 2019. Protests can turn violent. Avoid large public gatherings.							
Laws	● Don't use or carry illegal drugs. Penalties include long prison sentences. ● Be careful when taking photos. It's illegal to photograph military sites, government buildings, border posts, airports and the Presidential Palace. ● Don't buy or sell endangered wildlife products, including rhino horn and ivory. It's illegal to do so without a licence. ● Same-sex relations are legal, but same-sex relationships aren't legally recognised. There have been attempts to charge people in same-sex marriages under public order and obscenity laws. Avoid public displays of affection.							
Health Risks	● Insect-borne diseases such as yellow fever and malaria occur throughout the year. Ensure your accommodation is insect-proof and use insect repellent. ● Gabon has had cases of Zika virus. If you're pregnant, discuss your travel plans with your doctor. ● HIV/AIDS is common. Take precautions if you're taking part in high-risk activities. ● Foodborne, waterborne and other infectious diseases include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities are adequate in major cities, but basic or unavailable in rural areas. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.							
Weather	● Flooding occurs during the rainy seasons. Check local conditions before driving. You may need a 4WD vehicle on some roads.							

Other	• You need a visa to enter Gabon. Contact your nearest embassy or consulate of Gabon for advice. • Carry proof of your yellow fever and cholera vaccinations. • Gabon is a largely cash-based economy. The local currency is the Central African CFA franc (XAF). Credit cards are not widely accepted. There are ATMs in major centres. • Be prepared if you're planning to drive in rural areas. Travel outside of major urban centres usually requires a 4WD vehicle. Towing and repair services aren't common outside Libreville. • Taxis are generally safe, but they often pick up multiple passengers and take indirect routes. Negotiate the fare with the driver before entering the taxi. • Piracy and armed robbery occurs in Gabon's coastal waters and in the Gulf of Guinea. Check International Maritime Bureau piracy reports before you travel.

The Republic of the Congo

	**Threat Level** N/A							**Latitude / Longitude** -0.228021, 15.827659 **GPS Position** 0° 13' 40.8756'' S 15° 49' 39.5724'' E

Crime	
Laws	N/A
Health Risks	• Yellow Fever
Weather	N/A
Other	

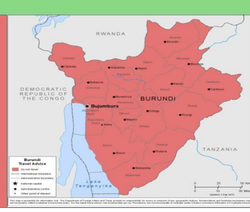
Sao Tome and Principe

	**Threat Level** N/A							**Latitude / Longitude** 0.186360, 6.613081 **GPS Position** 0° 11' 10.896'' N 6° 36' 47.0916'' E

Crime	
Laws	N/A
Health Risks	N/A
Weather	• Possible Tsunamis
Other	

2 East Africa

Burundi

	**Threat Level** Extreme threat to personal safety, recommended not to travel here.						**Latitude / Longitude** -3.373056, 29.918886 **GPS Position** 3° 22' 23.0016'' S 29° 55' 7.9896'' E

Crime	• The security situation is unstable. Violent attacks on individuals are common. Get expert security advice or leave as soon as possible. • Terrorism is a significant threat. Arrange personal security measures and be alert to threats. • Violent crime is widespread and often involves weapons. Foreigners can be a target of kidnapping. Be alert to carjacking and other threats. Don't travel after dark.
Laws	• Penalties for drug offences are severe and include long prison terms and large fines. • It's illegal to take photos of sensitive buildings in Burundi. Don't photograph airports, military sites or government buildings. • Same-sex relationships are illegal and penalties include jail terms. Avoid public displays of affection.
Health Risks	• Yellow fever is common. You'll need a valid yellow fever vaccination certificate to enter Burundi. • HIV/AIDS is widespread. Take precautions to reduce your risk of infection. • Outbreaks of cholera and malaria occurred in 2017 and 2018. Waterborne, foodborne and other infectious diseases are common. Use insect repellent. Only drink boiled or bottled water. • Health facilities are limited. If you're ill or injured, you'll need to be evacuated. Make sure your insurance covers this.
Weather	• Earthquakes occur. Flash flooding and mudslides are common from February to mid-May.
Other	• If you decide to travel to Burundi you'll need a visa to enter. Apply before you leave. • The Burundi international airport and land borders can close without warning. Contact your airline for advice on how you can leave the country. • Landmines have exploded in areas popular with travellers. • Travelling by road is dangerous. Traffic accidents and crime are common. Check local security and road conditions. Get security advice from an expert.

Comoros

Comoros

	**Threat Level** N/A	**Latitude / Longitude** -11.645500, 43.3333 **GPS Position** 11° 38' 43.8'' S 43° 19' 59.88'' E
Crime		
Laws		
Health Risks	N/A	
Weather	● All oceanic regions of the world can experience tsunamis, but in the Indian and Pacific Oceans, there is a more frequent occurrence of large, destructive tsunamis because of the many large earthquakes along major tectonic plate boundaries and ocean trenches. If an earthquake, tsunamis or other natural disaster occurs, follow the advice of local authorities.	
Other		

Djibouti

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Within 10 kilometres of the border with Eritrea , do not travel.		**Latitude / Longitude** 11.825138, 42.590275 **GPS Position** 11° 49' 30.4968'' N 42° 35' 24.99'' E
Crime	● Militant group Al-Shabaab intends to target Djibouti. Public places, tourist areas, embassies and airports are potential terrorist targets. Check security alerts before you visit potential targets. ● There's a high risk of kidnapping within 10km of Djibouti's border with Somalia. Don't travel to this area. ● Regional conflict can cause unrest. Public gatherings can turn violent. Avoid protests. ● Petty crime occurs. Risks increase at night and in isolated locations. Don't walk alone after dark. ● Bandit groups operate in lawless areas outside the capital. Only drive outside the capital during daylight hours and in a convoy.			
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. The narcotic khat is legal in Djibouti, but is illegal in many other countries. ● Understand and follow local laws. Hunting, being drunk in public, and photographing infrastructure or military personnel are illegal. ● Follow local customs. Djibouti is a mostly Muslim country. It has conservative dress and behavioural standards. ● Same-sex relationships are legal, but locals don't accept them. ● The Islamic holy month of Ramadan is one of Djibouti's most important religious dates. Don't eat, drink or smoke in public or around people who are fasting.			
Health Risks	● Insect-borne diseases, including malaria, dengue and filariasis are prevalent. Use insect repellent. Ensure your accommodation is insect-proof. ● Recent polio outbreaks have occurred in countries across the Horn of Africa. If you aren't vaccinated, complete the full course of vaccinations before you travel. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● Djibouti's high temperatures can cause dehydration and heat stroke. Drink plenty of water.			
Weather	● From May to October, Djibouti can experience dust storms and temperatures over 50°C. Be prepared for impacts to essential services, including food and water availability.			
Other	● You need a visa to visit Djibouti. See the official e-visa portal for information. ● You may need a valid yellow fever vaccination certificate to enter the country. ● You can exchange traveller's cheques at major banks. Credit cards aren't widely accepted. There aren't many ATMs and they often don't work. Have several ways to access money. ● Djibouti is a 'mine-safe' country. This means landmines have been identified and marked, but haven't been removed. Remain on sealed roads. ● Remote areas aren't safe. Don't travel within 10 km of the borders with Somalia or Eritrea. Avoid other remote areas, including the region bordering Ethiopia. ● There's a high risk of piracy in Djibouti's coastal waters and the Gulf of Aden. Check the International Maritime Bureau's piracy reports if you're planning boat travel.			

Eritrea

	**Threat Level** High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Regions bordering Ethiopia, Sudan and Djibouti, do not travel.		**Latitude / Longitude** 15.367007, 38.950120 **GPS Position** 15° 22' 1.2252'' N 38° 57' 0.432'' E
Crime	● Public protests can turn violent. Avoid large public gatherings. ● There's a risk of kidnapping in Eritrea. If you choose to travel to high-risk regions, get professional security advice. ● Landmines are found within 25km of Eritrea's border with Ethiopia, except for the town of Senafe. Take care when walking or hiking in rural areas due to unmarked minefields. ● There's a high risk of robbery, violence and bomb attacks in areas bordering Sudan, except for the road to, and main town of, Teseney. ● Military tensions exist between Eritrea and Djibouti. Robbery and violence are common within 25km of the border. ● Street crime is rare but occurs. Don't walk alone late at night. ● Robbery and violence are common along the coast north of Massawa and on some rural roads. Take care when travelling in these areas.			
Laws	● Serious crimes may attract the death penalty or physical punishment. ● Understand local laws. Same-sex relationships and taking photos of government buildings or military sites are illegal. ● Eritrea doesn't recognise dual nationality. Male dual nationals may need to enter military service when they return to Eritrea. Get advice from the nearest embassy or consulate of Eritrea before you travel. ● Eritrea has strict standards of dress and behaviour. Dress appropriately.			

GEOGRAPHY	Africa	East Africa	Eritrea	**Health Risks**	● Parts of Eritrea, including Asmara, are at high altitudes. This can lead to altitude sickness. If you have a heart condition or high blood pressure, get medical advice before you travel. ● Malaria occurs throughout the year. Yellow fever is also a risk. Consider taking anti-malarial medication. Get vaccinated for yellow fever before you travel. ● Other insect-borne diseases include dengue fever and filariasis. Use insect repellent. Ensure your accommodation is insect-proof. ● HIV/AIDS is a risk. Take precautions if you're doing anything that might expose you to infection. ● Polio outbreaks have occurred across the Horn of Africa. Check your vaccination status with a doctor before you travel. ● Other infectious diseases include cholera and hepatitis. Boil drinking water or drink bottled water. Avoid raw or undercooked foods. ● There are currently drinking water supply problems being experienced across Eritrea due to the closure by the Eritrean Government of many of the water purification and bottling plants. You should be aware of this shortage when planning your visit. ● Medications are often unavailable and can be expensive. Carry a comprehensive medical pack if you travel away from large towns.
GEOGRAPHY	Africa	East Africa	Eritrea	**Weather**	
GEOGRAPHY	Africa	East Africa	Eritrea	**Other**	● You need a visa to enter Eritrea. Contact the nearest embassy of Eritrea for details. ● Carry your yellow fever vaccination certificate. You may need to show it when you arrive in and leave Eritrea. ● You need an exit permit to leave Eritrea. It can take a long time to get one. Apply well before your departure date. ● There are no ATMs in Eritrea. You can't use credit cards, except in some hotels. Check with your hotel before travelling to find out the best way to pay. ● Change foreign currency at a branch of the state foreign currency exchange in Himbol. It's illegal to use foreign currencies or to change foreign currency anywhere else. ● You may not be able to get international roaming on your mobile phone. Contact your phone provider before you travel. ● You need a permit to leave Asmara and the surrounding province of Zoba Maekel. Apply before you travel. Permits usually take around 24 hours to process. ● Tourists may not be able to use public transport to travel outside of Asmara. You may need to rent a limousine or use a private taxi. ● If you're travelling to Eritrea by sea, get permission and an entry visa before you arrive. Take precautions against piracy. There's a high threat in Eritrean coastal waters.

Ethiopia

GEOGRAPHY	Africa	East Africa	Ethiopia						
				(flag)	**Threat Level** High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Border areas with Sudan and South Sudan, including the Gambella region, Border area with Eritrea, including the Danakil desert area, Border areas with Somalia and Kenya, including the Somali region, do not travel.			**Latitude / Longitude** 9.145000, 40.489673 **GPS Position** 9° 8' 42'' N 40° 29' 22.8228'' E

GEOGRAPHY	Africa	East Africa	Ethiopia	**Crime**	● Protests and events that draw large crowds can turn violent. Expect heightened security measures and disruption to services. ● Terrorists have reportedly been planning attacks in Ethiopia. Possible targets include hotels, markets, places of worship, government buildings, transport hubs and aircraft. Be alert when near possible targets and on days of national significance. Take official warnings seriously. ● The risk of kidnapping is high in the Somali region and near the borders with South Sudan and Kenya. If you're travelling to an area where there's a threat of kidnapping, get professional security advice. ● Violent assaults can accur and foreigners are often targets. Be aware in areas around the Hilton and Sheraton hotels, Entoto and the Bole Road. Don't walk alone or at night. ● Highway robberies and armed carjackings have occurred outside the main urban centres. Keep your doors and windows locked, even when moving. Keep valuables out of sight.
GEOGRAPHY	Africa	East Africa	Ethiopia	**Laws**	● Ethiopian family and business law can be quite different from Australia, the U.K, Canada and the U.S. Get professional advice if you're involved in business or family law matters. ● If you're in a road accident, don't move your vehicle before a police officer arrives. It's illegal to do so. ● Understand and follow local laws. It's illegal to buy or remove cultural artefacts without a permit, or export certain amounts of precious stones. It's also illegal to own ivory or to interact with beggars or vendors in traffic. ● Be careful when taking photos. It's illegal to photograph the Presidential Palace, and military sites and personnel. ● Same-sex sexual acts are illegal. Ethiopia also has conservative dress and behaviour standards. ● Parts of Ethiopia use different calendars and time measurements. To avoid confusion, always check bookings and appointments.
GEOGRAPHY	Africa	East Africa	Ethiopia	**Health Risks**	● Yellow fever is widespread in Ethiopia. Get vaccinated before you travel. Malaria is present everywhere in Ethiopia except Addis Ababa and areas above 2000m. Consider taking anti-malarial medication. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● Ethiopia's polio outbreak has ended. However, the disease may still come in from nearby countries. Check your vaccinations are up to date before you travel. ● Parts of Ethiopia are at high altitudes. Altitude sickness can affect anyone, even healthy people. If you get severe altitude sickness, get to lower ground as soon as possible. ● Health facilities are limited in Addis Ababa. In rural areas, facilities are inadequate. If you're seriously ill or injured, you'll need medical evacuation out of the country. Ensure your health insurance covers this.
GEOGRAPHY	Africa	East Africa	Ethiopia	**Weather**	● Ethiopia can experience extreme weather. Parts of the country are in severe drought, leading to food and water shortages. In the rainy season (July to September), flooding can cut off roads. Monitor local media and follow official advice.
GEOGRAPHY	Africa	East Africa	Ethiopia	**Other**	● If you enter the country at Bole International Airport, you can get a visitor visa on arrival. If you're arriving elsewhere or you're not a tourist, get a visa before you travel. USD or Euros are required. Contact the Embassy of Ethiopia for details. ● All travellers are screened for Ebola virus on entry. If you have a high temperature, you may be quarantined. ● Carry your yellow fever vaccination certificate. You may need to show it to enter and leave the country. ● The official currency is the Ethiopian Birr (ETB). You can exchange US dollars at the international airport, major banks and hotels. Major banks will change traveller's cheques. ATMs issue small amounts of local currency, not many places accept credit cards. Have multiple ways to access money. ● Landmines are a hazard in the border areas with Eritrea, Sudan and Somalia. If you travel near these borders stick to well-travelled roads.

Kenya

GEOGRAPHY	Africa	East Africa	Kenya						
				(flag)	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Coastal areas from Lamu county to Mombasa and outskirts, A2 highway from Isiolo to Moyale, reconsider your need to travel.	**Threat Level** Border regions with Somalia, South Sudan and Ethiopia, do not travel.		**Latitude / Longitude** -0.023559, 37.906193 **GPS Position** 0° 1' 24.8124'' S 37° 54' 22.2948'' E

GEOGRAPHY	Africa	East Africa	Kenya	**Crime**	● There is a high threat of terrorist attack. Extremists may target Westerners. Risky areas include Nairobi, coastal areas, Naivasha and Nanyuk. Be alert in public places. Avoid areas prone to attack. ● Westerners are kidnapping targets. The borders with Somalia, Ethiopia and South Sudan are high-risk areas. Don't travel to these regions. If you do go there, get professional security advice. ● Westerners in Nairobi are the targets of violent crime, including armed carjackings, kidnapping and home invasions. Don't walk after dark. If you live in Kenya, invest in strong personal security measures. ● Scams are common. Criminals often use fake police, hotel or government identification to extort money from travellers. Be wary of anyone asking for money, even if they seem official.

Laws	● It's illegal to work or volunteer without a valid work permit. To work in the charity sector, get a valid work permit through the Charity Register. ● Know and follow local laws. It's illegal to destroy local currency. It's also illegal to smoke outside designated areas, possess ivory, and distribute religious material without a licence.Its illegal to use single-use plastic bags. ● Get advice before taking photos. It's illegal to take photos of official buildings. ● It's illegal for men to have same-sex relations. ● Kenya recognises dual nationality, but it hasn't fully enacted laws around this.
Health Risks	● Malaria is widespread except in Nairobi and places above 2500m. Consider taking anti-malarial medication.Yellow Fever is widespread.Get Vaccinated before you travel. ● Other insect-borne diseases include dengue, Rift Valley fever, filariasis and African sleeping sickness. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS infection rates are high. Take precautions if you're taking part in high-risk activities. ● Polio outbreaks occur in Kenya. Check your vaccinations are up to date at least 6 weeks before you travel. ● Foodborne, waterborne and other infectious diseases include hepatitis, meningococcal disease, measles and cholera. Drink only boiled or bottled water. Avoid raw or undercooked food.
Weather	● Kenya can experience natural disasters and severe weather. Know the warning signs and safety measures for earthquakes and tsunamis.
Other	● You need a visa to travel to Kenya. Kenya has an e-visa portal for tourists and other visitors. Contact the Kenyan High Commission for further details. ● Carry your yellow fever vaccination certificate. You may need to show it to enter and leave the country. ● If you're a foreign resident, always carry your alien identity card. You could be fined or detained you if you don't. ● Only use radio taxis via callout. Always use a reputable tour or taxi company, especially to and from Nairobi's airports at night. ● Piracy occurs in the waters off northern Kenya. Don't sail within 1000 nautical miles (1850km) of the Somali coast.

Madagascar

Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Batterie Beach, do not travel.			**Latitude / Longitude** -18.766947, 46.869107 **GPS Position** 18° 46' 1.0092'' S 46° 52' 8.7852'' E

Crime	● Political unrest can erupt without warning. Avoid large public gatherings. ● Violent clashes between bandit groups and security forces are common in the southern region of Anosy. Bandits have also attacked people in the Ankazoabo region. Get local security advice before you travel to these areas. ● Violent crime includes kidnapping, armed robbery, carjackings and home invasions.
Laws	● Don't use or carry illegal drugs. Penalties include prison sentences. ● Always carry original photo identification. Police may ask you for it, especially if you're out late at night. ● Know and follow local laws. It's illegal to take photos of military installations or wear military-style clothing. There are also strict laws around exporting protected plants or animals, gemstones and vanilla. ● Same-sex relationships are legal but not widely accepted in Malagasy society, so avoid public displays of affection. The age of consent for same-sex relations is 21.
Health Risks	● Bubonic and pneumonic plague are both widespread. Pneumonic plague is fatal if left untreated. If you have flu-like symptoms, visit a doctor right away. ● Measles outbreaks can occur in the country. Make sure your vaccinations are up to date before you travel. ● Malaria and other insect-borne diseases (including dengue and chikungunya) are common. Ensure your accommodation is insect-proof and use insect repellent. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● Foodborne, waterborne and other infectious diseases include cholera, hepatitis and bilharzia are common. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Medical facilities in Antananarivo and elsewhere are limited. Most visitors seek treatment at private clinics that require up-front payments. If you're seriously ill or injured, you'll need medical evacuation, usually to South Africa or Réunion. Ensure your travel insurance covers this.
Weather	● The cyclone season is from November to April. Cyclones can disrupt essential services. Know your accommodation or cruise ship's evacuation plan. ● Madagascar can experience tsunamis. Know the warning signs and move immediately to high ground. Don't wait for official alerts.
Other	● You can get a tourist visa when you arrive, for a non-resident this can be extending up to 90 days. Ensure you have proof of onward travel. If you're travelling for other reasons, apply for a visa through a Malagasy embassy or consulate before you travel. ● Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is present. You may need to show it when you arrive and leave. ● Only use hire cars and limousines from providers with a good reputation. Avoid 'taxi be' and 'taxi brousse' due to the risk of bandit attacks. ● Avoid public transport. It's often unsafe and poorly maintained. ● Piracy occurs in the waters north of Madagascar, especially near Somalia and the Gulf of Aden. Don't sail within 1000 nautical miles (1850km) off the Somali coast.

Malawi

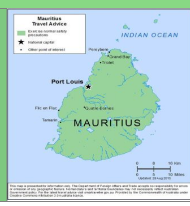
Threat Level Exercise normal safety precautions.	**Threat Level** Mulanje district, exercise a high degree of caution.			**Latitude / Longitude** -13.254308, 34.301525 **GPS Position** 13° 15' 15.5088'' S 34° 18' 5.49'' E

Crime	● Petty crime, such as bag snatching and theft, is common, including on public transport. Keep your valuables out of sight. ● Violent crime includes burglary, carjacking and food and drink spiking. Crime hotspots include bus and ferry terminals, and the walk between Lilongwe Old Town and the Capital City. Avoid walking at night, particularly in urban areas. Don't accept food or drink from strangers. ● The Mulanje district is a high-risk area for crime. Dangers include unrest, property damage, intimidation and violence. Before climbing Mount Mulanje, contact the Mountain Club of Malawi for safety advice. ● Protests often occur in market areas. They can turn violent. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs, including cannabis. Penalties include long prison sentences. ● Always carry your passport and visa or immigration permit with you. You'll need to show it if a police officer or immigration official asks. ● Follow local laws. It's illegal to buy or export uncut precious stones, import ivory or import pornography. ● Take care when taking photos. It's illegal to photograph government buildings, airports, places of worship, bridges and military installations. ● Same-sex relationships are illegal. Avoid public displays of affection. ● Some areas have conservative dress and behaviour standards. If you're a woman, wear loose-fitting clothing that covers your legs and shoulders.

Health Risks	• Malaria is common and occurs year-round. Consider taking anti-malarial medication. • Other insect-borne diseases include filariasis, plague and African sleeping sickness. Ensure your accommodation is insect-proof. Use insect repellent. • Lake Malawi contains schistosomiasis. Take precautions if you visit the lake region. • The risk of HIV/AIDS is high. Take precautions if you're taking part in activities that could expose you to the virus. • Foodborne, waterborne and other infectious diseases include cholera, hepatitis, tuberculosis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked foods. • Public medical facilities are limited. Private facilities in Lilongwe and Blantyre may not meet first world standards. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	
Other	• Visitor visas can be purchased on arrival in Malawi. For further information on fees see Department of Immigration and Citizenship Services Republic of Malawi. • If you're coming from a country where yellow fever is present, carry your yellow fever vaccination certificate. You'll need to show it to enter Malawi. • The local currency is the Malawi Kwacha (MWK). Declare all your foreign currency when you arrive and depart. When you leave, officials will take any that you didn't declare on entry. • You might be able to drive in Malawi with your current driver's licence and an International Driving Permit (IDP). Get your IDP before leaving your country. • While driving, always carry your driver's licence and a copy of your passport and visa or residence permit. You may need to show them if you're stopped at a police roadblock. • Use local guides on Mount Mulanje.

Mauritius

Threat Level
Exercise normal safety precautions.



Latitude / Longitude
-20.348404, 57.552152

GPS Position
20° 20' 54.2544'' S
57° 33' 7.7472'' E

Crime	• Crime levels are low. But petty crime occurs, including pickpocketing and bag snatching. Don't walk alone after dark. Use ATMs in banks, hotels and shops, not on the street. • Some travellers have been robbed and assaulted in unregistered beachside bungalows. Stay in accommodation that's registered by local authorities. • Rallies and protests occur sometimes. These can turn violent. Avoid large public gatherings.
Laws	• Don't use or carry illegal drugs. Penalties for drug offences include prison sentences of up to 60 years and heavy fines. • Know and follow local laws. It's illegal to buy counterfeit or pirated goods. It's also illegal to own cigarette papers or rolling machines used to make cigarettes. • If you break the law, you may need to stay in Mauritius to wait for your court hearing. • Same-sex relations are legal, but it's illegal to take part in sodomy, regardless of gender. • Mauritius has conservative dress and behaviour standards. Take care not to offend, especially when visiting rural areas or religious sites, and attending religious events.
Health Risks	• Insect-borne diseases include dengue, malaria and chikungunya. The risk of malaria is low. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. • HIV/AIDS is a risk. Take precautions if you're taking part in high-risk activities. • Swine flu (influenza H1N1), occurs. Consider getting vaccinated before you travel. • Foodborne, waterborne and other infectious diseases include hepatitis and tuberculosis. Drink only boiled or bottled water. Avoid raw or undercoooked food. • The standard of public medical facilities varies. Most travellers go to private doctors or clinics. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.
Weather	• Cyclone season is from November to May, but cyclones can happen at any time. Cyclones and heavy rainfall can cause flooding and disrupt services. Know how to evacuate from your hotel or cruise ship. • Mauritius can experience tsunamis. Know the warning signs and move to high ground straight away. Don't wait for official alerts.
Other	• You can get a 'free of charge' visa on arrival if you're staying less than 60 days. For other types of visits, you'll need a visa. Contact your nearest Mauritian embassy or consulate for details. • If you can't show proof of an accommodation booking, immigration officials may not let you enter Mauritius. • If you've come from a country known to have malaria, the Mauritian Health Department will ask you to do a blood test. • Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is present. You'll need to show it to enter. • Transport and tour operators may not follow safety or maintenance standards. For water-based activities, ask if your operator has a valid Ministry of Tourism permit. Also ask if they are able to contact the coast guard if necessary. • There have been no pirate attacks in Mauritius's waters, however piracy is a major threat in the Indian Ocean. If you're travelling by boat, check the International Maritime Bureau's piracy reports.

Mozambique

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
EN1 between the Save River and Muxungue and from Gorongosa to Caia, EN6 between Beira and Chimoio, reconsider your need to travel.

Latitude / Longitude
-18.665695, 35.529562

GPS Position
18° 39' 56.502'' S
35° 31' 46.4232'' E

Crime	• Kidnapping is a danger in Maputo, Beira and Cabo Delgado. If you're travelling to these areas, get professional security advice. • Political tensions have triggered armed clashes, especially in Cabo Delgado. Protests can occur with little warning and can turn violent. Avoid large public gatherings. • Violent attacks, including sexual assaults, occur. Crime increases at night and during holidays. Don't go out after dark, even in tourist areas, and avoid isolated locations. Armed robbery, break-ins and carjackings are common. Keep your accommodation and car doors locked. • Petty crime, such as bag snatching, is common. Carry only what you need, leaving valuables in a secure place. • Kidnapping is a danger in Maputo and Beira. If you're travelling to these areas, get professional security advice.
Laws	• Don't use or carry illegal drugs. Penalties for drug offences are severe and include prison sentences. • Always carry photo identification with you. You must do so by law. • Be careful when taking photos. You must have permission from the Ministry of Information to photograph officials, government buildings and other infrastructure. • Don't buy endangered wildlife products, such as ivory and rhino horn. It's illegal to purchase or trade them without a licence. • It's illegal to import or export local currency. • Same-sex relations are legal, but there are local sensitivities. Avoid public displays of affection.
Health Risks	• Malaria occurs year-round, particularly outside Maputo. Consider taking anti-malarial medication. • Other insect-borne diseases include filariasis, plague and African sleeping sickness. Ensure your accommodation is insect-proof. Use insect repellent. • The HIV/AIDS risk is high. Take precautions if you're taking part in high-risk activities. • Foodborne, waterborne and other infectious diseases include cholera, hepatitis, tuberculosis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. • Medical facilities are limited. If you're seriously ill or injured, you'll need medical evacuation to South Africa. Ensure your travel insurance covers this.

Mozambique	
Weather	● Mozambique experiences flooding, cyclones, mudslides and earthquakes. These can disrupt services. The rainy season is November to April. Know your hotel or cruise ship's evacuation plan and safety measures.
Other	● You'll need a visa to enter Mozambique. You may be able to get one on arrival. Contact your nearest Mozambique embassy or consulate for details. ● Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is present. You may need it to enter Mozambique. ● If you're travelling via South Africa, you may need to bring extra documents. See our South Africa travel advisory. ● Although all known minefields have been cleared, there's still a risk of landmines. Stick to well-travelled roads, particularly in the central and southern provinces. ● If you plan to travel outside Maputo during the rainy season, you'll need a 4WD vehicle. Get local advice on road conditions before you leave. ● Piracy is a threat in the Indian Ocean. If you're planning boat travel, check the International Maritime Bureau's piracy reports.

Reunion

	**Threat Level** N/A							**Latitude / Longitude** -21.115141, 55.536384 **GPS Position** 21° 6' 54.5076'' S 55° 32' 10.9824'' E

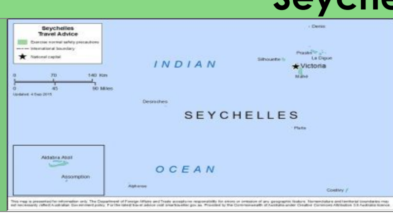
Reunion	
Crime	
Laws	N/A
Health Risks	● Chikungunya
Weather	● All oceanic regions of the world can experience tsunamis, but in the Indian and Pacific Oceans, there is a more frequent occurrence of large, destructive tsunamis because of the many large earthquakes along major tectonic plate boundaries and ocean trenches.
Other	

Rwanda

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Within 10 kilometres of the border with Burundi, within 10 kilometres of the border the Democratic Republic of the Congo, including towns of Gisenyi, Kibuye and Cyangugu, reconsider your need to travel.					**Latitude / Longitude** -1.940278, 29.873888 **GPS Position** 1° 56' 25.0008'' S 29° 52' 25.9968'' E

Rwanda	
Crime	● The security situation near Rwanda's borders with Burundi and the Democratic Republic of the Congo is volatile. Reconsider your need to travel within 10km of these borders. Don't cross the borders. ● There's a risk of rebel attack in the Volcanoes National Park (Parc National des Volcans). Only visit the park as part of an organised tour group. ● Grenade attacks and other violent incidents occur from time to time, including in Kigali. Targets include genocide memorials, markets and transport hubs. Be alert to possible threats. ● Petty crime is quite rare, but theft from hotel rooms, homes and vehicles can occur. Keep valuables out of sight. When driving, lock your windows and doors.
Laws	● Don't use or carry illegal drugs. Penalties include long prison sentences and heavy fines. ● Same-sex relations are legal. However, LGBTI travellers may be harassed by the public and police. Avoid public displays of affection. ● Be careful when taking photos. It's illegal to photograph government buildings. ● Plastic bags are banned. Officials may fine you for having them.
Health Risks	● Medical facilities are very limited. If you're ill or injured, you may need medical evacuation to Kenya. Check your travel insurance covers this. ● Malaria occurs across the country, including in Kigali. Consider taking anti-malaria medication. ● Other insect-borne diseases also occur. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS occurs. Take precautions if you're taking part in high-risk activities. ● Foodborne, waterborne and other infectious diseases include meningitis, meningococcal disease, tuberculosis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food.
Weather	● The rainy seasons are from February to May and September to December. Flooding and mudslides can make roads unusable. Be prepared to alter your travel plans.
Other	● You can get a visa when you arrive. You'll have to pay a fee. Contact the High Commission of Rwanda in Singapore for visa information. ● Carry your yellow fever vaccination certificate if you're coming from a country with a risk of yellow fever. You'll need to show it to enter Rwanda. ● Carry cash, as Rwanda is a cash-based society. Only large hotels accept credit cards. Not many ATMs accept international cards. You can only exchange traveller's cheques at commercial banks. ● Main roads between Kigali and other major towns are generally good. You'll probably need a 4WD on unsealed roads. Don't drive at night, especially outside Kigali. ● Use only licensed orange-striped taxis. Avoid minivans (shared taxis) and motorbikes as they're often unsafe. ● The border between Rwanda and Uganda regularly closes for extended periods.

Seychelles

	**Threat Level** Exercise normal safety precautions.					**Latitude / Longitude** -4.679574, 55.491977 **GPS Position** 4° 40' 46.4664'' S 55° 29' 31.1172'' E

Seychelles	
Crime	● There's a risk of theft, especially in tourist hubs, such as Beau Vallon and the capital, Victoria. Thieves also target parked cars. Pay attention to your belongings. ● Violent crime is less common but can occur, especially on beaches and walking trails. Avoid back streets. Avoid beaches after dark.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences, including using and smuggling, are severe. ● Seychelles recognises dual citizenship. ● Same-sex relations are legal in the Seychelles. However, the society is conservative. All travellers, regardless of gender or sexuality, should avoid public displays of affection. ● Public nudity isn't accepted. Don't sunbathe topless or naked on beaches.

Health Risks	• Insect-borne diseases, including dengue and chikungunya, are common. Ensure your accommodation is insect-proof. Use insect repellent. • Medication available over the counter or by prescription may be illegal in the Seychelles. Check if your medication is legal before you travel and carry copies of your prescription and a letter from your doctor. • Medical facilities in the Seychelles are limited, especially on the more-remote islands. The island of Mahé has several clinics and a state-owned hospital. The main hospital is in Victoria. • If you're seriously ill or injured, you'll need medical evacuation to Mauritius, South Africa or India. Ensure your travel insurance covers this.
Weather	• Seychelles' beaches, including Beau Vallon, often have strong currents and rips. Drownings occur at popular tourist beaches. There may not be safety information at beaches. Get local advice before swimming. • The Seychelles can experience severe weather, especially during the wet season (December to February). The country is prone to tsunamis. Know the tsunami warning signs and move to high ground straight away. Don't wait for official alerts.
Other	• You don't need a visa to enter the Seychelles as a tourist. You will receive a visitor's permit on arrival which can be extended to a maximum period of 6 months. Carry proof of your hotel booking as you may need to show it on entry. For other situations, contact your nearest Seychelles embassy or consulate for visa details. • Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is present. You may need it to enter the Seychelles. • The currency of the Seychelles is the Seychellois Rupee (SCR). Most tourist services, including hotels, accept euros. Exchange money at banks, the international airport, licensed bureaus, hotels and resorts. ATMs are not generally found outside the major tourist destinations of Mahé, Praslin or La Dique, and will only dispense SCR. • You might be able to drive in the Seychelles with a driver's licence or an International Driving Permit (IDP). Get your IDP before you travel. However, driving is only practical on the islands of Mahé and Praslin. Roads are mountainous, narrow and winding. Don't drink and drive or you will be subject to a fine or imprisonment. • Piracy is a threat in the Indian Ocean. There have been attacks inside the Seychelles' exclusive economic zone (EEZ). Avoid sailing more than 12 nautical miles from the shore.

Somalia

Threat Level
Extreme threat to personal safety, recommended not to travel here.

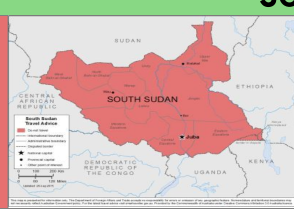
Latitude / Longitude
5.152149, 46.199616

GPS Position
5° 9' 7.7364'' N
46° 11' 58.6176'' E

Crime	• Terror attacks happen often in Somalia. Possible targets include Mogadishu International Airport, government officials and buildings, hotels, restaurants, foreigners and foreign interests, and UN workers. Don't travel to Somalia. If you're in the country, leave as soon as possible. If you decide to stay, get professional security advice. • The kidnapping risk is very high in all parts of Somalia. This includes Puntland and Somaliland. Vary your routines so your movements aren't predictable. • Residential areas and markets in south-central Somalia have experienced shootings and grenade attacks. Avoid areas of conflict and large public gatherings. • Somalia has no effective police force. Law and order has broken down. Drought, food shortages and military attacks have compounded the unstable security situation. Arrange personal security measures and seek professional advice.
Laws	• Courts operate under both Somali and sharia law. In areas under Al-Shabaab control, sentences include flogging and the death penalty. Get local legal advice, especially on matters such as divorce, child custody and child support. • Don't use or carry illegal drugs. Penalties for drug offences are severe. They include prison sentences and heavy fines. • Same-sex relations are illegal in Somalia. Under sharia law, punishments include flogging and death. • It's illegal to preach a religion other than Islam in Somaliland and Puntland. • Dual nationals are treated as Somali. Consular help may be limited.
Health Risks	• Malaria occurs across the country. Consider taking anti-malaria medication. • Other insect-borne diseases include dengue, yellow fever, filariasis and leishmaniasis. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against yellow fever before you travel. • Somalia continues to have cases of polio. Ensure your vaccinations are up to date before you travel. Carry proof of vaccination. • Somalia has a high rate of HIV/AIDS. Take precautions if you're taking part in high-risk activities. If you're a victim of violent crime, including rape, get medical help as soon as possible. • Foodborne, waterborne and other infectious diseases include cholera, hepatitis and meningococcal disease. Drink only boiled or bottled water. Avoid raw or undercooked food. • Medical facilities in Somalia are extremely limited. If you're ill or injured, you'll need medical evacuation out of the country. This is expensive and difficult to organise.
Weather	• Somalia has extreme weather, including severe droughts, heatwaves and floods. It's also prone to tsunamis. During a natural disaster, monitor local and international media. Follow local advice.
Other	• Visa conditions and validity can change. Your visa might not be recognised in areas where the central government's authority is challenged. • The local currency is the Somali Shilling (SOS). Most other currencies, credit cards and traveller's cheques aren't accepted. US dollars are widely accepted. • Road travel is dangerous due to terrorism, poor conditions, landmines and crime. • Piracy is a serious threat in and around Somalia's waters, the Indian Ocean and the Gulf of Aden. Don't travel in Somali waters. Stay more than 1000 nautical miles (1850km) from the coast of the Horn of Africa.

South Sudan

Threat Level
Extreme threat to personal safety, recommended not to travel here.



Latitude / Longitude
6.876992, 31.306979

GPS Position
6° 52' 37.1712'' N
31° 18' 25.1244'' E

Crime	• Fighting and instability continues across the country. The situation is volatile and can worsen without warning. Border areas are especially dangerous. If you're in South Sudan, leave as soon as possible. • Kidnapping, murder, shootings, home invasions, armed robbery, carjacking and sexual assault are common throughout South Sudan, including in Juba. Get professional security advice. • Petty crime, such as theft and fraudulent currency exchange, is common. Safeguard your belongings. • Terrorist attacks could occur without warning. Public places, hotels, restaurants and government buildings are targets. Airports and transport hubs may also be targets. Be alert in public places. Report any suspicious items or activity to police.
Laws	• Don't use or carry illegal drugs. Penalties for drug offences are severe. They may include the death penalty. • The legal systems in South Sudan are basic. Penalties for criminal offences include long jail sentences, corporal punishment and the death penalty. Get professional advice if you're involved in local legal matters, especially regarding family law. • It's illegal to perform same-sex sexual acts. LGBTI travellers may be harassed by the public or the police. • It's illegal to take any photos, including on a mobile phone, without a permit from the Ministry of Information. • The South Sudanese Government recognises dual nationality but considers its dual citizens as South Sudanese first.

GEOGRAPHY | Africa | East Africa | South Sudan

Health Risks	● There are ongoing polio outbreaks in South Sudan and other countries across the Horn of Africa. Check your vaccinations are up to date at least 8 weeks before you travel. ● Yellow fever is widespread, so get vaccinated before you travel. Malaria is common year-round. Consider taking anti-malarial medication. ● Other insect-borne diseases include dengue, filariasis and leishmaniasis. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is common. Take precautions if you're taking part in high-risk activity. If you're a victim of a violent crime, seek immediate medical assistance. ● Waterborne, foodborne, parasitic and other infectious diseases include typhoid, cholera and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Medical facilities are basic in Juba and extremely limited elsewhere. If you're seriously ill or injured, you'll need medical evacuation.
Weather	● Be prepared for extreme weather. Flooding occurs during the rainy season (July to November). It can disrupt services and cause disease outbreaks. In summer, temperatures in northern areas can reach 50˚C.
Other	● If you travel to South Sudan get a visa before you go. You can't fly to Juba without one. ● Carry your yellow fever vaccination certificate. You may need it to enter the country. ● South Sudan's borders can close with little or no warning. Check with your security provider for updates and security assessments on entry points to South Sudan. ● Landmines and unexploded remnants of war are a danger throughout South Sudan. Use only main roads and paths labelled as cleared by a competent de-mining authority. ● Road travel is very dangerous due to poor road conditions and the security environment. If you need to travel by road, seek professional security advice.

Tanzania

GEOGRAPHY | Africa | East Africa | Tanzania

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
-6.369028, 34.888822

GPS Position
6° 22' 8.5008'' S
34° 53' 19.7592'' E

Crime	● Violent armed robbery, petty theft and threats of violence are common in Tanzania, especially in Dar es Salaam. Be extra careful in and around Arusha in northern Tanzania. Armed robberies, carjackings and home invasions have happened. Bag snatching from moving vehicles is increasing. Victims can be injured or killed by being dragged behind vehicles. Don't resist bag-snatch attempts. ● Only use registered taxis. Travellers have been targeted by criminals while using unlicensed taxis. ● Bandit attacks occur along the borders with Rwanda, Burundi and the Democratic Republic of the Congo. Armed bandits have also been reported in the provinces of Kigoma and Kagera and around Mount Kilimanjaro and the Serengeti and Arusha National Parks. Pay attention to your personal security.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● It's illegal to possess pornographic material. ● Plastic bags are banned in Tanzania. ● Same-sex relations are illegal and punishable by up to 30 years in jail. Authorities have targeted LGBTI rights activists. ● Don't photograph military zones, weapons or personnel. It's illegal. ● Dress and behaviour standards are conservative in Tanzania, especially in Zanzibar. If you're female, don't wear shorts or sleeveless tops outside resorts.
Health Risks	● Medical facilities are limited and medicines are often not available. If you get injured or become ill, you may need to be evacuated to another country. This is expensive. ● Malaria, including chloroquine-resistant strains, occurs year-round, except in areas above 1800m. Consider taking anti-malarial medication. ● Yellow fever occurs, so get vaccinated before you travel. Other insect-borne diseases include Zika virus, dengue, filariasis and East African trypanosomiasis (sleeping sickness). Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is widespread. Take precautions if you're taking part in high-risk activities. ● Altitude sickness can affect anyone at heights over 2500m. If you plan to climb Mt Kilimanjaro (5895m), make sure you're physically fit and in good health. Talk to your doctor before you travel.
Weather	● During the rainy seasons (March to May and November to December) floods can block roads. The monsoon occurs in coastal and island areas from July to October. Cyclones can also happen in coastal areas. Follow the advice of local officials.
Other	● You need a visa to enter Tanzania. Contact your nearest embassy or consulate of Tanzania for details. ● Carry your yellow fever vaccination certificate. You'll need it to enter Tanzania. ● There's a risk of credit card fraud. Be careful when using credit cards and always keep your credit card in sight. Don't use ATMs on the street. ● Use only well-maintained public transport and taxis. This includes long-distance buses. Ferries can be unseaworthy. Don't board any vessel that's overloaded or in bad condition. ● All ships, cruise liners and commercial vessels are targets for Somali pirates. Many attacks and kidnappings have happened off the Tanzanian coast. Be alert and exercise extreme caution anywhere in coastal waters. Don't leave sight of the coastline. ● Follow local wildlife laws. Keep a safe and legal distance when looking at animals. Don't swim in lakes and rivers due to the risk of animal attack and waterborne disease.

Uganda

GEOGRAPHY | Africa | East Africa | Uganda

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Within 50 kilometres of the border with the Democratic Republic of the Congo, reconsider your need to travel.

Threat Level
Within 50 kilometres of the border with South Sudan, Karamoja region, do not travel.

Latitude / Longitude
1.373333, 32.290275

GPS Position
1° 22' 23.9988'' N
32° 17' 24.99'' E

Crime	● Uganda has increased security arrangements in public places due to the threat of terrorist attacks. Expect body, car and luggage checks when travelling. Take official warnings seriously and follow advice. ● Violent protests occur. These have included clashes between armed groups and security forces, between political opponents, and between tribal groups. Avoid affected areas and follow advice from local authorities. ● Security is usually required when gorilla trekking due to the risk of armed attack. For your safety, don't take gorilla trekking tours that cross into the Democratic Republic of the Congo (DRC). ● Petty crime and violent crime can happen. Always be alert. Don't walk in isolated areas or along dark streets at night. ● The security situation in the neighbouring DRC is very unstable and volatile. You may be kidnapped or caught up in violence. If you're travelling near the border, seek professional security advice.
Laws	● Penalties are severe for possession, use or trafficking of illegal drugs. If you're convicted, you'll face a long jail sentence and heavy fines. ● Serious crimes can attract the death penalty or corporal punishment. It's illegal to perform same-sex sexual acts, take photos of certain buildings and areas, or wear military-style or camouflage clothing.
Health Risks	● Many medications are in short supply or not available in Uganda. Take enough legal medicine for your trip. ● The first cases of Ebola were detected in Western Uganda in June 2019. Protect yourself against the disease by practising good hygiene. ● Yellow fever and malaria are common. Other insect-borne diseases can occur. Make sure your accommodation is insect proof. Use insect repellent. ● Cases of avian influenza (H5N1, 'bird flu') occurred in parts of Uganda in 2017. Avoid contact with dead and living birds. ● HIV/AIDS is a risk. Take steps to reduce your risk of exposure to the virus. ● Medical facilities are very limited outside Kampala. If you become seriously ill or injured, you'll be evacuated to Kenya or another destination. Make sure your insurance covers this.

GEOGRAPHY | Africa | East Africa | Uganda

Weather	
Other	● You need a visa to visit Uganda. Use Uganda's online visa application. ● You may need a valid yellow fever vaccination certificate to enter and leave Uganda. ● You must declare all foreign currency on arrival. If you don't, you may have issues taking it when you leave. ● It may be difficult to access money. Traveller's cheques, credit cards and debit cards aren't widely accepted. Bring enough cash with you. ● Long-distance bus travel can be dangerous. Accidents are common and some overnight buses have been robbed.

GEOGRAPHY | Africa | East Africa | Zambia

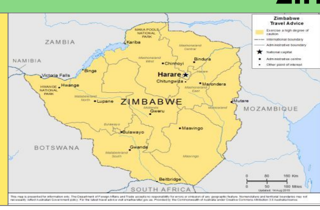
Zambia

		Threat Level Exercise normal safety precautions.	**Threat Level** Border areas with the Democratic Republic of Congo, Angola and Mozambique, reconsider your need to travel.				**Latitude / Longitude** -13.133897, 27.849332 **GPS Position** 13° 8' 2.0292'' S 27° 50' 57.5952'' E

Crime	● Crime is common. Security risks increase after dark, especially in tourist areas and city centres. Stay alert to your surroundings. Avoid walking alone or travelling after dark. ● Avoid all demonstrations, political rallies and large public gatherings as they can turn violent. ● There have been violent robberies (some involving fatalities) along the Cairo Road area of Lusaka, including Chachacha, Freedom Way and Lumumba Roads. Keep vehicle doors locked, windows up and valuables out of sight, even when moving. ● Date-rape drugs have been used in bars and restaurants in Lusaka. Always keep a close eye on your food and drinks. If you're not sure it's safe, leave it. ● Commercial fraud scams are common in Zambia. Don't send money to anyone in Zambia until you've undertaken proper checks.
Laws	● You are subject to all local laws and penalties. ● Zambian authorities don't always contact your embassy when they detain or arrest travellers. ● Police and border officials can ask to see your passport and immigration stamp or visa at any time. They could detain or arrest you if you don't have them. ● Same-sex sexual activity is illegal in Zambia.
Health Risks	● Medications containing diphenhydramine are illegal in Zambia. ● The rate of HIV/AIDS infection in Zambia is high. Take steps to reduce your risk of exposure to the virus. If you're the victim of a violent crime, see a doctor straight away. ● Malaria and other insect-borne diseases occur. Use insect repellent. ● Cholera and other infectious diseases are common. Boil all drinking water or drink bottled water in rural areas. Avoid contact with animals. Don't swim in fresh water. ● The standard of medical facilities in Zambia is poor and medical supplies are limited. Make sure you know your blood type. Carry a medical kit.
Weather	
Other	● You need a visa to enter Zambia. For short stays of under 90 days, get a 30-day visa when you arrive. You can extend it twice. In other cases, you'll need to apply for an entry visa before you go. ● You need a valid yellow fever vaccination certificate if you're arriving from a country with widespread yellow fever. ● If you're travelling from an Ebola-affected area, you may be subject to a medical check at the Zambian border. ● Landmines and other remnants of war make Zambia's borders with the Democratic Republic of Congo, Angola and Mozambique unsafe. Off-road travel is dangerous. Ask local authorities about possible routes.

GEOGRAPHY | Africa | East Africa | Zimbabwe

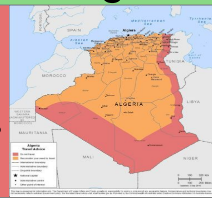
Zimbabwe

		Threat Level Moderate threat level to personal safety, take extra precautions here.					**Latitude / Longitude** -19.015438, 29.154857 **GPS Position** 19° 0' 55.5768'' S 29° 9' 17.4852'' E

Crime	● There are shortages of food, water, medicine and fuel. Basic services, such as electricity supply, are unreliable. The security situation is volatile. Violent protests are common. Avoid large public gatherings. ● Petty crime, such as mugging and bag snatching, is common. Don't carry bags that are easy to snatch. ● Violent crime, such as assault and armed robbery, occurs. The risk increases at night, in city centres and in open areas such as parks and fields. Keep your accommodation locked, even when you're in it. Don't walk at night. ● Land confiscation, wildlife poaching and violence against farmers has caused unrest. Get up-to-date security advice before you visit national parks, game farms, lodges or hunting areas. ● Theft from vehicles is common. Thieves target cars stopped at intersections, especially on the way to Harare Airport. Minimise the amount of time you have to stop. Approach red lights slowly. Keep vehicle doors locked and windows up.
Laws	● Always carry ID, such as a copy of your passport. Police and immigration officials may ask to see it. ● Understand and follow local laws. It's illegal to kill, capture or trade a protected animal or its parts without a licence. It's also illegal to wear camouflage clothing. Don't possess or trade counterfeit or pirated goods, or pornographic material. You must have paperwork to possess precious or semi-precious stones. ● Same-sex relations are illegal in Zimbabwe, and can attract criminal penalties. ● Be careful when taking photos. It's illegal to photograph airports, military establishments, government offices, the President's residence and security forces. ● Avoid political activity and any activities that officials could view as political. These include discussions, commentary and protests. It's illegal to criticise or insult the President or be in possession of material considered offensive to the President's office.
Health Risks	● Malaria is a risk everywhere except Harare and Bulawayo. Consider taking anti-malarial medication. ● Other parasitic and insect-borne diseases occur include filariasis and schistosomiasis. Ensure your accommodation is insect-proof. Use insect repellent. ● The rate of HIV/AIDS infection is very high. Take precautions if you're engaging in activities that expose you to risk of infection. ● Outbreaks of foodborne, waterborne, and other infectious diseases also occur. These include typhoid, hepatitis, tuberculosis and cholera. Drink only boiled or bottled water. Avoid raw or undercooked food. Ensure your vaccinations are up-to-date. ● Don't swim in lakes and rivers, due to the risk of waterborne diseases. ● Medical facilities are generally poor to average standard. Outside of Harare and Bulawayo facilities are even more limited. Public hospitals, including in Harare, suffer from serious shortages. If you're seriously ill or injured, you may need medical evacuation out of Zimbabwe. Ensure your travel insurance covers this.
Weather	● Flooding can occur during the rainy season (November to April). Eastern Zimbabwe is still recovering from Cyclone Idai, which hit in March 2019. Infrastructure remains damaged. If you're travelling to this area, take extra care.
Other	● You need a visa to enter Zimbabwe. Most travellers, including tourists, can get either a 30-day visa-on-arrival or a KAZA UniVisa. A KAZA UniVisa allows you to travel between Zimbabwe, Zambia and Botswana. Make sure the entry stamp in your passport is legible. Officials will ask to see it when you leave. Contact an embassy or consulate of Zimbabwe for details. ● The only legal tender in Zimbabwe is the 'Zimbabwe Dollar (ZWL)'. A limited number of vendors will accept payments using international credit cards. Zimbabwe is experiencing a cash crisis. You can't withdraw money from ATMs using an international card. Take enough cash to cover your stay. ● Check with hotels and other providers whether they accept card payments, especially outside of Harare. It is illegal to exchange foreign currency anywhere other than at officially licensed banks and bureaux de change. ● It is illegal to leave Zimbabwe with more than USD 2,000 (or equivalent) in cash. This amount is subject to change with little prior notice. ● Parts of the country have unexploded landmines. If you're driving in these areas, stick to main roads. ● Flight options into and out of Zimbabwe are limited. Air Zimbabwe is banned from flying into the EU due to safety concerns.

3 North Africa

Algeria

	**Threat Level** High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Within 450 kilometres of borders with Mali and Niger, Within 100 kilometres of borders with Mauritania, Libya and Tunisia, do not travel.					**Latitude / Longitude** 28.033886, 1.659626 **GPS Position** 28° 2' 1.9896'' N 1° 39' 34.6536'' E

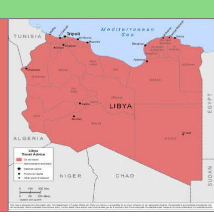
Crime	● Avoid large public gatherings and follow the advice of local authorities. ● There are frequent protests in Algeria that can become violent. Civil unrest is on the rise. Avoid political events, protests, and other public gatherings. Be careful before, during and after Friday prayers. ● Risk of terrorist attack is very high. Avoid travelling to remote areas. Monitor the news and other sources for information about threats. ● Risk of kidnapping is very high in some parts of Algeria. If you travel to these areas, seek professional security advice and have effective personal security measures in place. ● Be aware of bandits in deserted beach areas, even during daylight hours. Keep car doors locked and windows up, even when moving.
Laws	● Same-sex sexual activity is illegal. Photographing sensitive sites or military or security personnel is illegal. ● Algeria doesn't recognise dual nationality. ● Male Algerian nationals must complete a period of compulsory military service. This includes dual nationals. Make sure you understand your obligations before you travel to Algeria. ● Dress and behaviour standards are conservative. Men and women should avoid physical contact with each other in public. Women should consider wearing a headscarf.
Health Risks	● Insect-borne diseases include leishmaniasis, West Nile fever and malaria. Use insect repellent. Ensure your accommodation is insect-proof. Consider taking medication to prevent malaria. ● Tuberculosis, typhoid, hepatitis, meningitis, rabies are also common. Boil drinking water or drink bottled water. Avoid bathing in freshwater sources. ● The standard of medical facilities can vary. Medical facilities in remote areas are limited or non-existent. Consider carrying some medical supplies for personal use. If you're seriously ill or injured, you'll be evacuated. Get adequate travel insurance.
Weather	● Earthquakes and flooding can occur. Monitor the Global Disaster Alert and Coordination System for updates. Follow the advice of local authorities.
Other	● You need a visa to enter Algeria. Apply in advance. Contact the nearest embassy or consulate for entry and exit conditions. ● If you're travelling on a cruise ship, you can apply for your visa on arrival. ● You need a valid yellow fever vaccination certificate to enter Algeria if you arrive from a country where yellow fever is endemic. ● Only change money at an exchange bureau at international airports or in large hotels, and at commercial banks in major cities. ● Road and traffic conditions are very dangerous. Road accidents cause many deaths and injuries each year. Armed groups and bandits make road travel risky. Avoid travel by road.

Egypt

	**Threat Level** High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Within 50kms of Egypt's border with Libya and Governorate of North Sinai, including the Taba-Suez Road , do not travel.					**Latitude / Longitude** 26.820553, 30.802498 **GPS Position** 26° 49' 13.9908'' N 30° 48' 8.9928'' E

Crime	● Terrorists have attacked places popular with tourists in recent years. People have been killed and injured. More attacks are likely. Be alert to possible threats. ● Terrorist groups in Egypt have also targeted Christians in recent years. Take care during major religious periods and at religious sites. ● Egypt enacted a state of emergency in April 2017. This gives authorities more powers to search, detain and arrest people. It also limits gatherings and demonstrations, and makes it illegal for foreigners to participate. Monitor local media for possible unrest. ● Kidnapping is a risk for travellers in Egypt. ● Violent crime can happen. Take extra care if you're a women and alone. Don't leave valuables unsecured in your hotel room or unattended in a public place.
Laws	● It can be illegal to make public comments that criticise the Egyptian government, security forces or religion. Police have arrested foreign visitors who published critical social media posts. ● Carrying illegal drugs can lead to the death penalty, long prison sentences or deportation. ● Egyptian family law differs from most first world law. Before you become involved in a local legal matter, get legal advice. This includes family and business legal matters. ● Same-sex relationships are legal in Egypt, but not socially tolerated. Sex outside of marriage is illegal. ● Dress standards are conservative, particularly for women. Wear modest clothes that cover your legs and upper arms.
Health Risks	● Infectious diseases are common. These include hepatitis, filariasis and rabies. Boil drinking water or drink bottled water. Avoid contact with dogs and cats. ● Don't swim in fresh water, including the Nile River, to avoid waterborne diseases, such as bilharzia (schistosomiasis). ● Dengue and malaria can occur. Make sure your accommodation is insect-proof. Use insect repellent. ● Cairo can have high levels of pollution and dust. If you suffer from breathing difficulties or a lung condition, seek medical advice.
Weather	
Other	● If you decide to travel to Egypt you'll need a visa to visit Egypt. Get a tourist visa online or on arrival. ● Foreign journalists must get accreditation from the Egyptian Press Centre before arrival. There are severe punishments for journalists working without accreditation. ● You need approval to bring satellite phones and radio communications equipment into Egypt. Apply to the Ministry of Communications and Information Technology before you leave. The use of other technology, including drones, is illegal. ● There are landmines in some areas. Get advice from local authorities before you travel. ● Be aware of checkpoints around Egypt. Foreigners are sometimes harassed and detained.

Libya

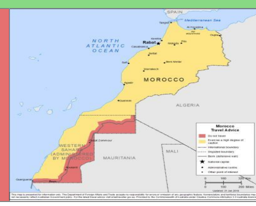
	**Threat Level** Extreme threat to personal safety, recommended not to travel here.							**Latitude / Longitude** 26.335100, 17.228331 **GPS Position** 26° 20' 6.36'' N 17° 13' 41.9916'' E

Crime	● Violent fighting is widespread and ongoing in Libya. The security situation is very unstable. There's a high threat of terrorist attack, kidnapping and crime. Don't travel to Libya. If you stay in Libya seek professional security advice. Monitor the media for possible risks. ● Areas of Libya that border with Algeria, Niger, Chad and Sudan are very dangerous. Bandits and armed tribal groups operate in these areas. There's also a very high threat of kidnapping. Avoid cross-border travel between Libya and these countries.

Laws	● The rule of law has not been re-established in Libya. Police services may not be operating in all parts of the country. ● Penalties for drug offences are severe. They include the death penalty or life in jail. More serious crimes may attract the death penalty. ● If you're involved in a business dispute, officials may seize your passport. They may not let you leave Libya until the dispute is settled. ● Many activities are illegal in Libya. This includes same-sex sexual activity and drinking alcohol. You could be jailed for having sex outside marriage. ● Islamic law decides child custody. A child born to a Libyan father is a Libyan citizen. They need their father's permission to leave Libya.
Health Risks	● Waterborne, foodborne, parasitic and other infectious diseases are common. They include typhoid, hepatitis, tuberculosis, plague and measles. Boil drinking water or drink bottled water. Don't swim in fresh water. ● Medical facilities in Libya are limited. Some medicines are in short supply. Carry some medical supplies for personal use. ● If you are seriously ill or injured, you may need to be evacuated to a place with better facilities. Make sure your insurance covers this.
Weather	● Libya experiences severe weather. If you travel to Libya follow regional weather forecasts and plan accordingly.
Other	● If you decide to travel to Libya ask your insurer if you need special travel insurance to cover your trip. ● Airports and land border crossings can close without warning. Plan for delays and temporary closures. ● Trying to leave Libya via land borders is very dangerous. There's a very high threat of kidnapping in regions bordering Algeria, Chad, Sudan and Niger. Don't try to leave Libya through these countries. ● Officials may detain you if you can't prove you entered Libya at an official border crossing. ● You must always carry ID documents. Register your passport with a police station. If you don't, you may be fined. You could have problems during your stay or on departure.

Morocco

	Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Within 30 kilometres of the northern or western side of the Berm, all areas of the Western Sahara south and east of the Berm, do not travel.				**Latitude / Longitude** 31.791702, -7.09262 **GPS Position** 31° 47' 30.1272'' N 7° 5' 33.432'' W



Crime	● Terrorism is a risk in Morocco. Tourist areas and public places are possible targets. Be alert to possible threats. Avoid known targets. ● Westerners are at risk of kidnapping across North Africa. In Morocco, the risk increases in remote mountain areas, the south and border areas. Get professional security advice if you travel to these areas. Don't hike alone in mountain areas. ● Petty crime, such as pickpocketing and bag snatching, is common. Tourists have been mugged when walking at night. Keep your belongings close. Don't walk in isolated areas or along dark streets at night. ● Tourists may face aggressive begging and harassment, particularly near ATMs. Female travellers may be sexually harassed. Take care when using ATMs. If you're female, avoid walking or travelling alone. ● Scams and fraud are common. These include double-charging credit cards, and replacing your purchased goods with lower-quality ones. Keep your credit card in sight during all transactions. Check all goods you buy. Don't send money to anyone in Morocco until you make proper checks. ● Large public gatherings and protests can turn violent. Avoid demonstrations. Take care on weekends and around Friday prayers.
Laws	● Morocco has the death penalty for serious crimes, including high treason, terrorism, multiple murder and rape. ● Sexual acts between members of the same sex, or outside marriage, are illegal. Possessing pornographic material is also illegal. ● Understand and follow local laws. Morocco has strict laws around religion, the monarchy, alcohol, photography and drone use. ● Morocco recognises dual nationality, but Moroccan citizenship takes precedence. This can affect child custody disputes and military service requirements. ● Moroccan society is conservative. Avoid public displays of affection. In some parts of Morocco, women should wear loose fitting clothes that cover their arms and legs.
Health Risks	● Common insect-borne diseases include leishmaniasis and typhus. Malaria is less common. Use insect repellent. Ensure your accommodation is insect-proof. ● Waterborne, foodborne and other infectious diseases are common. Boil drinking water or drink bottled water. Avoid raw or undercooked food. ● Avoid black henna temporary tattoos. These often contain a dye that can irritate the skin.
Weather	
Other	● You don't need a visa to visit Morocco if you're going for less than 3 months. For longer trips, you'll need one. Contact the Embassy of Morocco for details. ● Get your passport stamped when you enter Morocco. You may find it difficult to leave the country if you don't. ● The land border with Algeria is closed. Don't attempt to travel to Algeria by land. ● Only exchange currency at commercial banks and licensed exchange bureaus. You can use credit cards in larger towns and tourist areas. ATMs are widely available in cities and most larger towns. ● To drive in Morocco you need your driver's licence and an International Driving Permit (IDP). Get your IDP before you leave your country.

Sudan

	Threat Level High threat level to personal safety, take a range of extra precautions here.	**Threat Level** North, South and West Darfur, Abyei region, North and South Kordufan, Blue and White Nile State, Sennar State, Areas within 15km of the border with Eritrea and Ethiopia, do not travel.				**Latitude / Longitude** 12.862807, 30.217636 **GPS Position** 12° 51' 46.1052'' N 30° 13' 3.4896'' E

Crime	● There is a threat of terrorism. They could occur at any time. Avoid crowded areas and known targets. Be alert to possible threats. ● Political and anti-Western rallies can turn violent. Avoid large public gatherings. Avoid public spaces around Friday prayers. ● Sudan is currently under a state of emergency. The government has banned unauthorised public gatherings. Observe all curfews. ● Ongoing violence in Sudan includes border disputes with South Sudan, and clashes between government forces and rebels. Civilians and foreigners could be victims of violence directed at others. Avoid areas of unrest and take security measures. ● Kidnapping is a serious risk. Kidnappers often target foreigners. Seek professional security advice if you're travelling to high-risk areas. ● Violent crime is high risk, especially in Darfur. Don't travel to North, South and West Darfur. Outside Darfur, you're less likely to encounter violent crime.
Laws	● Sudan follows Islamic sharia law. Seek legal advice about family law matters, including divorce, custody and child support. ● Serious crimes attract the death penalty. Other crimes are punishable by lashes. Same-sex relations, extra-marital relations, importing or drinking alcohol, and trying to convert a Muslim to Christianity are all illegal. ● Be careful when taking photographs. You need a permit for any photography. Even with a permit, it's illegal to photograph certain areas, including military installations, infrastructure and slums. ● Sudan has strict Islamic dress codes. Women should wear a headscarf and loose clothing covering the arms and legs.
Health Risks	● Yellow fever is widespread in Sudan. Other insect-borne diseases include malaria, Zika virus and dengue. Ensure your accommodation is insect-proof. Get vaccinated against yellow fever. ● HIV/AIDS is common. Take precautions if you're engaging in high-risk activities. If you think you may have been infected, seek immediate medical help outside Sudan. ● Other infectious diseases, including cholera, hepatitis, typhoid and polio, are common. Drink only bottled water. Ensure your vaccinations are up to date. ● Medical facilities are basic in Khartoum and inadequate elsewhere. You may need to get medical help outside Sudan.
Weather	

Other	• You need a visa to enter Sudan. Getting one can take several months. You may be unable to enter the country if your passport has an Israeli visa, entry or exit stamp. Plan ahead. • You may need to show your yellow fever vaccination certificate when entering and leaving Sudan. Check your countries re-entry requirements following exposure to yellow fever. • Don't plan to travel to Sudan by land. The only open border crossing is the Wadi Halfa ferry across Lake Nasser from Egypt. This can close without notice. • It's illegal to import or export Sudanese currency. Bring US dollars to change when you arrive. You'll also need US dollars to pay in some hotels. You can't use credit cards, debit cards or traveller's cheques anywhere. • Landmines and unexploded remnants of war are a risk. Use main roads and paths labelled as cleared by a competent de-mining authority. • You may need a permit for all travel outside Khartoum. Register with local authorities within 24 hours of arriving anywhere outside Khartoum.

Tunisia

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Areas south of, and including, the towns of Nefta, Douz, Medenine, and Zaris, Governorates of Kasserine, Le Kef, Jendouba and Sidi Bouzid, reconsider your need to travel.	**Threat Level** Militarised zone south of the towns of El Borma and Dhehiba, Within 30 kilometres of the border with Algeria, Mount Chaambi National Park area, including the town of Kasserine, Within 30 kilometres of the rest of the Libya border area north of Dhehiba, including the town of Ben Guerdane and immediate surrounding area, do not travel.				**Latitude / Longitude** 33.886917, 9.537499 **GPS Position** 33° 53' 12.9012" N 9° 32' 14.9964" E

Crime	• Terrorist attacks are a high risk in Tunisia, including at tourist sites. Local authorities have increased security. Be alert to possible threats. • Instability in Libya and Algeria has made Tunisia less safe. Kidnapping is a high risk near the borders. If you plan to travel there, seek professional security advice. • Civil unrest is common and protests can turn violent. Avoid large public gatherings, especially on days of national significance and around Friday prayers. • There is a state of emergency currently in place. • Petty crime, including pickpocketing and bag-snatching, occurs. Don't leave valuables in parked cars or unsecured in your hotel room. • Women may be sexually harassed on the street. Take care when travelling alone or at night.
Laws	• It's illegal to live or stay as an unmarried couple, or to try to convert a Muslim to another religion. It's also illegal to import or export Tunisian currency. • Be careful when taking photos. It's illegal to take photos of government and military sites, infrastructure or places around them. • Same-sex sexual activity is illegal. Avoid public displays of affection. Victims of same-sex sexual assault may be charged and imprisoned. • Tunisian dress and behavioural standards are conservative. Dress appropriately. If you're visiting religious sites or remote areas, wear clothes that cover your arms and legs. • If you're a dual national, you may need to complete national service. Check with the Embassy or Consulate of Tunisia before you travel.
Health Risks	• Insect-borne diseases are common, including leishmaniasis and West Nile fever. Use insect repellent. Ensure your accommodation is insect-proof. • Other infectious diseases include typhoid, hepatitis and rabies. Boil drinking water or drink bottled water. Avoid ice cubes. • If a dog, monkey or other mammal bites or scratches you, get medical help at once. • Medical facilities in Tunisia's major centres are generally a good standard. French and Arabic are the main languages. Not many staff speak English. Medical care can be expensive. Get appropriate travel insurance.
Weather	
Other	• If you're visiting for 90 days or less, you could get a visa exemption. For all other travel, get a visa before you arrive. • Declare all foreign currency when you arrive in Tunisia. Keep the declaration receipt so you can change your Tunisian currency back before you depart. • You can exchange foreign currency for Tunisian dinars (TND) at authorised banks or dealers. Keep all receipts. • Libya and Algeria are becoming more dangerous. Border crossings with these countries may close at short notice. Consult local authorities and read the travel advisories for Algeria and Libya before deciding whether to travel. • Get permission from Tunisian authorities before travelling to desert areas in the south, including the Sahara. You must have a licensed guide.

4 Southern Africa

Botswana

	**Threat Level** Exercise normal safety precautions.								**Latitude / Longitude** -22.328474, 24.684866 **GPS Position** 22° 19' 42.5064" S 24° 41' 5.5176" E

Crime	• Attacks on tourists are rare. But violent crime, break-ins and carjackings can happen. Be alert, particularly if you're out after dark. • Criminals have robbed travellers around Gaborone Dam and Kgale Hill. Be careful in these areas. • Wildlife attacks and waterborne diseases can happen. Don't swim in freshwater lakes and rivers.
Laws	• Botswana has the death penalty for serious crimes, including murder and treason. • Exporting elephant hair, ivory, and rhinoceros horn products is illegal. You need a permit or receipt from a licensed store to export animal souvenirs or 'trophies'. • Some crimes, such as serious assaults, attract physical punishment. • It's illegal to possess pornography or take photos of military or government installations. • Same-sex relationships were decriminalised in June 2019. • Botswana only recognises dual nationality up to the age of 21.
Health Risks	• The HIV/AIDS infection rate is very high. Take steps to reduce your risk of exposure to the virus. If you're sexually or otherwise assaulted, seek medical help straight away. • A yellow fever vaccination certificate is required if you are over 1 year old and travelling from a country where yellow fever is widespread. Get vaccinated before you travel. • Malaria is present in Botswana and widespread in the north. Other insect-borne diseases including filariasis (commonly known as elephantiasis) occur. Make sure your accommodation is insect-proof. Use insect repellent. • Waterborne, foodborne and other infectious diseases are widespread. Boil drinking water or drink bottled water. Some drug-resistant tuberculosis cases have recently occurred in Botswana. • Medical facilities outside urban areas are limited. If you're seriously ill or injured, you may be evacuated.
Weather	
Other	• You don't need a visa if you're a tourist visiting for up to 90 days. If travelling with children you'll need extra documents. • You need a visa to travel to Botswana on an emergency passport. Apply at the nearest embassy or consulate of Botswana. • If you enter Botswana from Ebola-affected countries you may be screened. You may be denied entry or quarantined on arrival. • Immigration regulations apply to children younger than 18. If you don't comply with regulations, you might be deported on arrival or stopped from boarding your plane. • Special rules apply if you're going to or from Botswana through South Africa, including transiting. Read the Travel section of the travel advice for South Africa. • Respect wildlife laws and keep a safe and legal distance when watching wildlife. Only use reputable guides or tour operators. Follow park regulations and wardens advice.

Eswatini

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** -26.522503, 31.465866 **GPS Position** 26° 31' 21.0108'' S 31° 27' 57.1176'' E

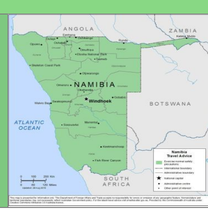
Crime	
Laws	
Health Risks	
Weather	
Other	

Lesotho

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.		**Latitude / Longitude** -29.609988, 28.233608 **GPS Position** 29° 36' 35.9568'' S 28° 14' 0.9888'' E

Crime	● Violent and petty crime is common in Lesotho. Gun-related crimes and break-ins have targeted travellers. Security risks increase at night and on weekends. Avoid walking alone or at night. If you're a victim of violent crime, including rape, seek immediate medical help. ● Political protests may occur in Maseru. Avoid demonstrations and large public gatherings as they can become violent.
Laws	● Penalties for drug offences are severe and include long prison sentences. ● Serious crimes, such as murder and rape, can attract the death penalty. ● Same-sex relationships are illegal. Avoid public displays of affection. ● It's illegal to take photos around military or government buildings.
Health Risks	● The rate of HIV/AIDS infection is very high. Take precautions if you engage in any high-risk activities. ● Waterborne, foodborne and other infectious diseases are common. Boil all drinking water. Drink bottled water with intact seals. ● Medication may be in short supply. Take enough legal medication for your trip. ● Medical facilities in Lesotho are basic. Use facilities in Bloemfontein, South Africa, 140km from Maseru. If you become seriously ill or injured, you will be evacuated. Make sure your travel insurance covers this.
Weather	
Other	● Tourists can visit Lesotho for up to 14 days without a visa. For other situations, apply for a visa before you go. ● You need a valid yellow fever vaccination certificate to enter Lesotho from a country where yellow fever occurs. ● The local currency is the Lesotho Loti (LSL). South African Rand is widely accepted. ● Road travel can be dangerous in the winter months. You may need a 4WD to drive in rural areas. Be prepared to drive on icy or snow-covered roads. Get updates on road conditions before driving in the mountains. ● Respect wildlife laws. Use reputable and professional guides or tour operators. Follow park regulations and the advice of the wardens.

Namibia

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** -22.957640, 18.49041 **GPS Position** 22° 57' 27.504'' S 18° 29' 25.476'' E

Crime	● Petty crime is common. It includes pickpocketing, bag-snatching and car break-ins. Don't leave valuables in your car. Always keep vehicle doors locked and windows up, even when moving. ● Violent crime includes muggings and robberies. Tourists have been robbed after stopping for hitchhikers or to help people. Avoid walking alone in large towns, particularly at night. Don't pick up strangers. ● Taxi drivers have robbed travellers. Don't hail unmarked taxis on the street. Use taxis with the Namibia Bus and Taxi Association logo. Book taxis through your hotel or a taxi company. ● Credit card skimming occurs. Always keep your card in sight. Check your statements often for fraudulent transactions.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences. ● Ask permission before taking photos. It's illegal to take photos of government and military sites. ● Trading in endangered wildlife products, such as ivory and rhino horn, is illegal. ● Trading in diamonds and precious stones is against the law. Only buy from licensed shops. ● Namibia doesn't recognise dual nationality. This may limit the help we can give to dual nationals. ● Same-sex relationships are legal in Namibia, but they aren't widely accepted. Avoid public displays of affection.
Health Risks	● Anyone aged over 9 months and travelling from a country where yellow fever is widespread must present a yellow fever vaccination certificate on arrival. Get vaccinated before you travel. ● The rate of HIV/AIDS infection is very high. Take precautions if you engage in high risk activities. ● Malaria is common in northern Namibia. Consider taking anti-malarial medication if you're travelling to this area. ● Other insect-borne diseases include leishmaniasis. Ensure your accommodation is insect-proof. Use insect repellent. ● Waterborne, foodborne, parasitic and other infectious diseases are common. They include typhoid, hepatitis and meningitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities are limited outside major urban centres. If you're seriously ill or injured, you'll need evacuation, probably to South Africa. Ensure your travel insurance covers this.
Weather	● Flooding may happen in the rainy season from November to April. Floods can block roads. Follow local advice.

Other	● Tourists can visit for up to 3 months without a visa. For other situations, get a visa in advance. Contact the Namibian Consulate-General for advice. ● Children who aren't accompanied by one or both parents must carry a full birth certificate and an affidavit which must follow strict guidelines. Check the rules and requirements with the nearest Namibian High Commission or Consulate. ● Carry your yellow fever vaccination certificate if you're coming from a country where there's a risk of yellow fever. You'll need it to enter Namibia. ● The official currency is the Namibian Dollar (NAD). You can also use South African rand (ZAR). You can use credit cards in major centres. ATMs are available in cities, but not always in remote areas. ● Unexploded landmines are a danger in some parts of Namibia. These include East and West Kavango, the Zambezi regions in the north-east, and areas bordering Angola. ● Avoid public transport. Vehicles are often poorly maintained. Local buses don't follow permanent routes.

South Africa

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
-30.559482, 22.937506

GPS Position
30° 33' 34.1352" S
22° 56' 15.0216" E

Crime	● Crime and violence are serious issues in South Africa. Crimes include murder, rape, assault, food and drink spiking, robbery and carjacking. ● Criminals target travellers and their bags at airports and on public transport. Vehicles parked or stopped at intersections are often targeted. Criminals have posed as fake tourist police to extort and rob tourists. Be alert in major city centres and township areas after dark. ● ATM and credit card fraud are common. Criminals wait near ATMs to rob people who have withdrawn cash. Only withdraw small amounts. Keep your credit card with you at all times. ● Scams occur often. If you're a victim of a scam, don't travel to South Africa. The risk of assault is high. ● Avoid protests and large public gatherings. These can become violent. Don't take photos or video footage.
Laws	● Drug offences carry severe penalties, including long jail terms. ● Dual nationals must enter and exit South Africa on their South African passport. Penalties for travelling on another passport include fines, refusal of entry and jail.
Health Risks	● You must present a yellow fever vaccination certificate, if you're over 1 year old and travelling from a country where yellow fever is widespread. Get vaccinated before you travel. ● HIV/AIDS infection rates are high in South Africa. Take steps to reduce your risk of exposure. ● Malaria and other insect-borne diseases, such as filariasis, are common. Make sure your accommodation is insect-proof. Use insect repellent. ● Cholera is mostly a risk in rural areas. Other waterborne, food-borne and infectious diseases are prevalent. Boil drinking water or drink bottled water. Avoid raw or undercooked food. Avoid contact with animal tissues or blood at game reserves or farms. ● Private hospitals are generally better equipped than public facilities. Medical evacuation is your only option in remote areas.
Weather	
Other	● You don't need a visa if you're a tourist visiting for up to 90 days. If you're arriving with children, you'll need extra documents. Some visa regulations have changed. Check with the South African Department of Home Affairs. ● Rolling blackouts affect parts of South Africa. This can leave areas without power for hours and cause travel delays. ● Avoid using minibuses. Ask your hotel for advice on a reputable provider. Don't catch a rideshare service near metered taxis. Tensions between drivers can escalate to violence. ● To drive in South Africa, you must be 18 years old and have a valid driver's licence. Hazards on the road include speeding, poor driving, pedestrians and animals on roads, and drink driving. ● Respect local wildlife laws. Only use professional guides or tour operators. Follow park regulations and advice from wardens. Don't swim in lakes and rivers, due to the risk of wildlife attacks and disease.

5 West Africa

Benin

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
9.307690, 2.315834

GPS Position
9° 18' 27.684" N
2° 18' 57.0024" E

Crime	● Violent crime is common in Benin, especially in Cotonou and regions bordering Nigeria. Robberies, carjackings and pickpocketing also occur. Don't walk alone, after dark or in poorly lit areas. ● Scams and internet fraud are common in West African countries. Scam victims often lose money. Be wary of messages from people you don't know. Don't travel to Benin to meet someone you have only interacted with online. ● Terrorist activity and kidnappings in nearby countries may spill over into Benin. Be alert to possible threats, especially in public places. Take official warnings seriously and follow advice from local authorities.
Laws	● It's illegal to take photos of government buildings, military zones, assets and personnel. ● Benin recognises dual nationality. If you're a dual national, you may have to perform civil or military service in Benin. Check with an embassy or consulate of Benin before you travel. ● Benin is very conservative. Take care not to offend. ● Same-sex relationships aren't illegal, but locals are often intolerant of them. Avoid open displays of affection.
Health Risks	● Yellow fever, malaria and other tropical diseases are common. Get a yellow fever vaccination before you travel and consider taking medication to prevent malaria. Use insect repellent. ● HIV/AIDS infection rates are high. Take steps to reduce your risk of exposure to the virus. ● Infectious diseases can occur. There were 100s of cases of cholera in 2016. Boil drinking water or drink bottled water. Avoid ice cubes, raw and undercooked food. ● Medical facilities in major towns are limited. Rural areas may have basic care, or none at all. If you're seriously ill or injured, you'll be evacuated.
Weather	● During rainy seasons, severe weather and flooding can damage bridges and roads. Depending on the region, the rainy season can happen from April to October. Monitor the Global Disaster Alert and Coordination System for updates.
Other	

Burkina Faso

Threat Level
High threat level to personal safety, take a range of extra precautions here.

Threat Level
All areas along the border with Mali, W National Park, do not travel.

Latitude / Longitude
12.238333, -1.561593

GPS Position
12° 14' 17.9988" N
1° 33' 41.7348" W

Crime	● Terrorist attacks and kidnapping are high risks in Burkina Faso. Many people have been killed or injured in terrorist attacks and kidnappings in recent years. Follow advice from local authorities. Obey curfews. Get professional security advice. ● Protests or other civil unrest may occur. These can turn violent. ● Airports and land borders may close at short notice. You'll have limited access to consular help if this happens. ● Avoid rallies, protests and large crowds. Monitor the media for news of unrest. ● Petty crime and violent crime are common. Security risks increase at night. Avoid travelling alone or after dark.
Laws	● It's illegal to take photos of military zones, assets or personnel. ● Burkina Faso has conservative standards of dress and behaviour. ● Same-sex relationships are legal, but locals are often intolerant of them.
Health Risks	● The Ebola virus disease (EVD) outbreak in West Africa is now over, but more cases may occur. ● Yellow fever, malaria and other insect-borne diseases are common. Make sure your accommodation is insect-proof. Use insect repellent. ● The rate of HIV/AIDS infection is high. Take steps to reduce your risk of exposure. ● Medical facilities are poor and emergency services are very limited. If you become seriously ill or injured, you'll be evacuated. Get insurance to cover this.
Weather	
Other	● If you decide to travel to Burkina Faso contact an embassy or consulate of Burkina Faso for details about visas. Conditions can change at short notice. ● You need a valid yellow fever vaccination certificate to enter Burkina Faso. Some airlines may want to see one when you leave. ● It's illegal to export art without government approval. This can include old or traditional artist works and all old material of national cultural significance. ● Road travel is dangerous. Don't drive at night. Don't use public transport due to the risk of crime.

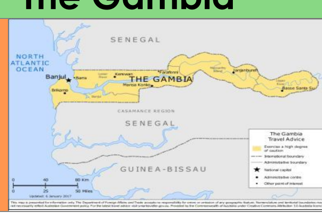
Cabo Verde

	**Threat Level** N/A								**Latitude / Longitude** 16.741155, -22.939825 **GPS Position** 16° 44' 28.158" N 22° 56' 23.37" W
Crime									
Laws	N/A								
Health Risks	● Zika Virus ● Dengue Fever								
Weather	N/A								
Other									

Côte d'Ivoire

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Dix-Huit Montagnes, Haut-Sassandra, Moyen-Cavally and Bas-Sassandra, reconsider your need to travel.						**Latitude / Longitude** 7.539989, -5.54708 **GPS Position** 7° 32' 23.9604" N 5° 32' 49.488" W
Crime	● Terrorist attacks are a risk. Follow the advice of local authorities. ● Violence due to civil unrest is a high risk. Public protests and events can turn violent. People have been killed in militia attacks near the Liberian border. Monitor the local media for updates. ● Armed robbery and violent crime are common. Armed bandits have attacked travellers along roads. Pedestrians have also been attacked. Plan road journeys carefully and take safety precautions. Conceal your valuables. ● Commercial and internet fraud occurs. Fake internet friendship, dating and marriage schemes also operate from some African countries. ● Swimming in beaches is dangerous due to strong coastal currents. Ask for local advice before entering the water.							
Laws	● Same-sex relationships are legal. However, members of the same sex can be convicted of an 'offence against public decency'. Penalties include fines and jail terms of up to two years. Avoid public displays of affection. ● It's illegal to take photos near sensitive areas, such as military sites and government buildings. ● Dual nationality isn't recognised in Côte d'Ivoire. ● Standards of dress and behaviour are conservative in Côte d'Ivoire. Take care not to offend.							
Health Risks	● Health facilities outside of Abidjan are very limited. If you become seriously ill or injured, you'll need to be evacuated. Make sure your insurance covers this. ● The rate of HIV/AIDS infection is high. Take precautions before you do anything that puts you at risk of infection. ● Yellow fever is widespread in Côte d'Ivoire. Malaria and other tropical diseases are common. Make sure your accommodation is insect proof. Use insect repellent.							
Weather								
Other	● To drive in Côte d'Ivoire, you must have an International Driving Permit (IDP), registration papers and Economic Community of West African States (ECOWAS) Brown Card insurance. Get your IDP before leaving your country. You need an exit permit from the National Museum to take art objects from Côte d'Ivoire. ● You need a valid yellow fever vaccination certificate to enter Côte d'Ivoire. Some airlines may want to see one when you leave. ● The ATMs in Abidjan may not be reliable. ATMs are rare outside of Abidjan. Bring enough cash with you.							

The Gambia

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Overland travel through the Casamance region in southern Senegal, reconsider your need to travel.					**Latitude / Longitude** 13.443182, -15.310139 **GPS Position** 13° 26' 35.4552" N 15° 18' 36.5004" W

Crime	● There's been an increased security presence in The Gambia since elections in 2017. The situation is now stable, but protests may turn violent. Avoid large public gatherings. ● Theft from hotel rooms and vehicles happens. Pickpocketing occurs in crowded market areas, on ferries and tourist beaches. Muggings sometimes occur on beaches at night. Avoid being alone outside at night, especially on beaches. Lock your hotel room, even when you're in it. ● Young men known as 'bumsters' may approach tourists, particularly on beaches. They often use romance to get money or other help from you. Politely decline their offers, advances or attempts at conversation. Take care not to offend. ● Credit card fraud is a risk. Always keep your card in sight when shopping. Check your statements often. ● Online friendship, romance or business scams often start in West Africa, including The Gambia. People who visit The Gambia to meet someone they've met online are at risk of kidnapping, assault or robbery. Be wary of contact from people you don't know. Don't send money to anyone in The Gambia until you've confirmed their identity.
Laws	● The Gambian Government often blocks consular access to foreigners in detention. ● Don't use or carry illegal drugs. Penalties include lengthy jail terms. Westerners have been jailed for up to 10 years for carrying small amounts of cannabis. ● The Gambia has the death penalty for serious crimes, including arson, murder and treason. Corporal punishment applies for some crimes, such as assault, sexual assault, theft and serious driving offences. ● Some prescription and over-the-counter drugs available in first world countries are illegal in The Gambia. It's illegal to import, use or carry medications containing certain ingredients, including codeine, diazepam and some corticosteroids. Penalties can include jail terms and heavy fines. Check your medication is legal with a high commission or consulate of The Gambia before you travel. ● Same-sex relations are illegal. Penalties include jail sentences ranging from five years to life. ● Dress and behaviour standards are conservative. Take care not to offend.
Health Risks	● Yellow fever is widespread. Get vaccinated before you travel. ● Malaria is common. Other insect-borne diseases include dengue. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. ● The HIV/AIDS infection rate is high. Take precautions if you engage in high-risk activities. ● Waterborne, foodborne, parasitic and other infectious diseases are common. These include typhoid, hepatitis, leptospirosis and bilharzia (schistosomiasis). Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Medical facilities in The Gambia are limited. You'll probably have to pay cash up-front. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● The rainy season is June to October. Floods may block roads. Follow the advice of local officials.
Other	● You may need a visa to enter The Gambia. Contact your nearest Gambian high commission or consulate for details. ● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● The local currency is the Gambian Dalasi (GMD). It can be difficult to exchange foreign currency other than British pounds sterling (GBP). The Gambia is a cash-based economy. Not many places accept credit cards and there aren't many ATMs. Ensure you have enough cash for your stay. ● You might be able to drive on your current driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. Police roadblocks are common. Always carry photo ID and vehicle registration and ownership papers. ● There isn't much public transport available. Safety and maintenance standards are unreliable. ● Travel on river boats, including ferries and canoes, is dangerous. Avoid boat travel at night. Never board an overloaded boat. If the boat doesn't have proper safety equipment, use another operator or a different form of transport.

Ghana

Threat Level
Exercise normal safety precautions.

Threat Level
Bawku, Tamale municipality, Yendi District and Bimbilla area in northern Ghana, exercise a high degree of caution.

Latitude / Longitude
7.946527, -1.023194

GPS Position
7° 56' 47.4972" N
1° 1' 23.4984" W

Crime	● Large public events and intercommunity disputes can turn violent. Avoid demonstrations and protests. Be cautious around large crowds, like football matches. ● Travellers are a target for crime, including kidnapping and robbery. Security risks increase if you're a solo woman. Take particular care in and around Accra. ● Internet scams often originate in West African countries. Criminals may ask for details of safe bank accounts to transfer large amounts of money. Criminals often meet their victims through internet dating sites or chat rooms. Be wary of online contact from people you don't know. Don't send money until you've checked who you're sending it to. Don't travel to Ghana to get your money back or to get revenge. ● Power outages may occur after dark. This often leads to more crime, especially if street and traffic lights fail. ● Thieves may pose as police officers or airport staff. Legitimate airport staff wear a current ID card with their name and photograph.
Laws	● Penalties for drug offences are severe. They include mandatory jail terms. ● The death penalty can apply for serious offences, such as murder. ● Same-sex relations are illegal. Avoid open displays of affection, especially in rural areas. ● Ghana recognises dual nationality.
Health Risks	● Yellow fever, malaria and other insect-borne diseases are common. Make sure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is common in Ghana. Take precautions if you're engaging in high-risk activities. ● Common waterborne, foodborne, and other infectious diseases include cholera, hepatitis, meningococcal meningitis, bilharzia (schistomiasis) and tuberculosis. Boil drinking water or drink bottled water. Avoid ice cubes, and raw and undercooked food. Don't swim in fresh water. ● Medical facilities are basic in urban areas and limited in rural areas. The standard of care may be less than what you would expect in first world countries. If you're seriously ill or injured, you may need to be evacuated.
Weather	
Other	● You need a visa to travel to Ghana. If you're staying for more than 90 days in 12 months, you must register for a National Identification Authority Non-citizen Ghanacard. Contact an embassy or high commission of Ghana for advice. ● You need to show a valid yellow fever vaccination certificate to enter Ghana. You may also need to show it when you leave. ● You can't exchange Australian dollars in Ghana. However, you can easily exchange US dollars and euros for GHS at commercial banks and exchange services. ● Road safety and driving in Ghana can be dangerous. Police roadblocks are common. Carry photo ID, vehicle registration and ownership papers. Be alert to hazards, especially at night. ● Ferry travel is risky due to low safety standards and adverse weather. Always wear a life jacket. ● Only use registered taxis and limousines. If you can, arrange these through your hotel. Don't use taxis hailed on the street, rideshares or public transport due to safety and security concerns.

Guinea

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Border areas with Cote d'Ivoire, Liberia and Sierra Leone, reconsider your need to travel.

Latitude / Longitude
9.945587, -9.696645

GPS Position
9° 56' 44.1132" N
9° 41' 47.922" W

Crime	● Since 14 October, there have been violent protests in Conakry and other towns, resulting in several deaths. Avoid protests and public gatherings. ● Border regions are dangerous. Armed robbery, conflict, and cross-border military and rebel activity are common in these regions. ● There's a risk of violent and petty crime. Keep car windows up and doors locked, even when moving. Stay alert after dark or if there's a power outage. ● Internet scams often originate in West African countries. Be wary of online contact from people you don't know. Don't send money until you've checked who you're sending it to. Don't travel to Guinea to get your money back or to get revenge. ● Piracy has been reported in the coastal waters. Check the International Maritime Bureau for piracy reports.

Laws	• Always carry original ID documents with you. Police and law enforcement can ask to see them. • Serious crimes like murder and armed robbery can attract the death penalty. • Penalties for drug offences are severe and include prison sentences in local jails. • Same-sex relationships are illegal. Fines or jail sentences may apply. • You can't export precious stones from Guinea without a licence. If you can't show a licence, you may be jailed. It's also illegal to take photos or videos of military or government buildings.
Health Risks	• Yellow fever, malaria, filariasis and other insect-borne diseases are common. Make sure your accommodation is insect-proof. Use insect repellent. • HIV/AIDS is common in Guinea. Take precautions if engaging in high-risk activities. • Guinea has been Ebola-free since 1 June 2016. However, further ebola outbreaks could occur. • There's a lack of medical equipment and medicine in Guinea. If you are seriously ill or injured, you'll be evacuated for treatment. Make sure your insurance covers this.
Weather	
Other	• You need a valid yellow fever vaccination certificate to enter and exit Guinea. • Road travel can be dangerous, especially after dark. Robberies, accidents and fuel shortages are common. • Traveller's cheques and credit cards are accepted at most major hotels in Conakry. Outside of the capital, banks are limited and you may need to use cash.

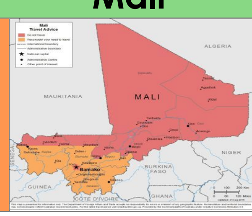
Guinea-Bissau

	**Threat Level** N/A								**Latitude / Longitude** 11.803749, -15.180413 **GPS Position** 11° 48' 13.4964" N 15° 10' 49.4868" W
Crime									
Laws	N/A								
Health Risks	• Zika Virus • Dengue Fever • Yellow Fever								
Weather	N/A								
Other									

Liberia

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Grand Gedeh and River Gee counties, reconsider your need to travel.					**Latitude / Longitude** 6.428055, -9.429499 **GPS Position** 6° 25' 40.998" N 9° 25' 46.1964" W
Crime	• Liberia is recovering from civil war. Some sensitive political issues persist. Avoid public protests and large public gatherings. They can turn violent. Don't talk about political issues. • Armed groups operate in the areas bordering Côte d'Ivoire (Ivory Coast). Cross border attacks could happen. • Muggings, burglary and armed robbery can happen. The police can't always help or protect you. Be aware of your surroundings. Don't travel alone or after dark. • Internet scams often originate in West African countries. Be wary of online contact from people you don't know. Don't send money until you've checked who you're sending it to. Don't travel to Guinea to get your money back or to get revenge.						
Laws	• Illegal drug offences attract serious penalties, including large fines and long jail terms. • Same-sex relationships are illegal. Avoid public displays of affection. • It's illegal to have pornographic material. It's illegal to take photos around military and government buildings, airports and ports. It's illegal to export diamonds, unless you follow local export laws. • Society is conservative, especially in areas outside Monrovia. Take care not to offend. • Local women wear loose-fitting clothes that cover the upper arms and legs. Consider modest clothing choices.						
Health Risks	• The World Health Organization (WHO) declared Liberia free from Ebola virus disease on 9 June 2016. However, further Ebola outbreaks are expected to occur. • The rate of HIV/AIDS infection is high. Take precautions to reduce your risk of exposure to the virus. • Yellow fever is widespread. Get vaccinated before you travel. • Malaria and other mosquito-borne illnesses are also common. Make sure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. • Common waterborne, foodborne, parasitic and other infectious diseases can occur. Boil drinking water or drink bottled water. Don't swim in fresh water.						
Weather							
Other	• Be prepared for health checks at border crossings. If you have a fever or Ebola-like symptoms, you may be quarantined and denied entry or exit. • You need a valid yellow fever vaccination certificate to enter Liberia. Some airlines may want to see one when you leave. • Always carry photo ID. Officials at security checkpoints will ask to see it. • Driving in Liberia is dangerous, especially after dark. Make sure your insurance covers you for this.						

Mali

	**Threat Level** Extreme threat to personal safety, recommended not to travel here.	**Threat Level** Koulikoro, except the capital, Bamako, Kayes, Sikasso and the region of Segou south of the Niger River, reconsider your need to travel.					**Latitude / Longitude** 17.570692, -3.996166 **GPS Position** 17° 34' 14.4912" N 3° 59' 46.1976" W

Mali

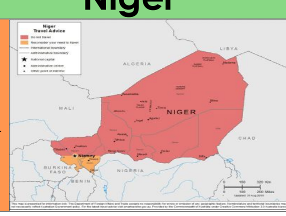
Crime	● Mali is currently under a state of emergency. There's a heavy security presence, including global peacekeepers. The security situation is volatile, especially in the northern and central regions. Be ready to leave the country at short notice. ● Terrorist attacks have increased since 2015. Most target security forces and peacekeepers. Venues used by foreigners are also targets. Avoid public places. Take official warnings seriously. ● There's a high risk of kidnapping in Mali. Armed robbery and carjackings also occur, particularly in the north. Several groups target foreigners. Ransoms paid to kidnappers fund terrorism. Get professional security advice before you travel. Keep vehicle doors and windows locked, even when moving. ● Fake internet friendship, dating and marriage schemes operate from Mali. These scams usually start via internet dating sites or chat rooms. People have been assaulted, kidnapped or killed after travelling to Mali to meet someone they met online. Be wary of contact from people you don't know in Mali.
Laws	● Don't use or carry illegal drugs. Penalties include heavy fines and long prison sentences. ● Inciting rebellion against the government attracts the death penalty. ● Be careful when taking photos. It's illegal to photograph military zones, assets and personnel. It's also illegal to take photos of transport facilities and government buildings. ● Same-sex sexual activity isn't explicitly illegal. However, it's illegal to act in a way that's 'contrary to accepted standards of behaviour.' Same-sex relations may fall into this category. ● Mali recognises dual nationality. ● Islamic codes of dress and behaviour apply. Take care not to offend.
Health Risks	● Yellow fever occurs throughout Mali. Get vaccinated before you travel. ● Other insect-borne diseases include dengue and malaria. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. ● The HIV/AIDS infection rate is high. Take precautions if you're taking part in high-risk activities. ● Common waterborne, foodborne, parasitic and other infectious diseases include cholera, hepatitis and meningitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities and expertise in Bamako are limited. They're worse in rural areas. If you're seriously ill or injured, you'll need medical evacuation. Ensure you have enough money to cover this.
Weather	● Flooding can disrupt services during the rainy season (June to September). Follow local advice.
Other	● If you decide to travel to Mali, you'll need to get a visa. Contact your nearest Malian embassy for details. ● Carry your yellow fever vaccination certificate. You'll need it to enter Mali. ● The local currency is the West African CFA Franc (XOF). Exchange traveller's cheques at major banks. ATMs are limited. Some major hotels in Bamako accept credit cards, but not many places outside the capital do. Make sure you have enough cash. ● To drive you need a driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. Only travel by road if you have proper security measures in place. Get professional security advice. ● Public transport is dangerous due to the security environment. Don't use it.

Mauritania

Threat Level High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Provinces of Tiris Zemmour, Adrar, Tagant, Hidh ech Chargui, Hodh El Gharbi, Assaba and Guidimaka, Within 25 kilometres of Mauritania's northern border with Western Sahara, do not travel.					**Latitude / Longitude** 21.007890, -10.940835 **GPS Position** 21° 0' 28.404" N 10° 56' 27.006" W

Crime	● Terrorists could attack places popular with foreigners or linked to the government. Avoid places visited by foreigners. Don't sit in open terraces or cafes. ● Kidnapping is a threat across the country. Westerners are mainly kidnapped from remote or desert areas. If you decide to travel to Mauritania, get professional security advice. Avoid unnecessary travel to remote areas. Arrange personal security measures. ● Armed thieves often attack people in cars and beach areas. Carjackings by people smugglers are increasing. Keep car doors locked and windows up, even when moving. ● Pickpocketing and other petty crimes are common. Keep valuables out of sight. Pay close attention to your personal safety. ● Fake internet friendship, dating and marriage schemes operate from West African countries. Be wary of requests to send money or travel to Mauritania from someone you met online. ● Protests have happened across Mauritania since 2012, including in the capital, Nouakchott. These can turn violent. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Penalties can include heavy fines or prison sentences, including for possessing small amounts of drugs. ● Same-sex sexual activity is illegal. ● Be careful when taking photos. It's illegal to photograph military sites, airports, and government and religious buildings without permission. ● Mauritania has strict religious laws. It's illegal to import non-Islamic religious materials or preach non-Islamic religion. ● Importing alcohol, pork products or firearms is against the law. It's also illegal for anyone to transport any form of alcohol, unless authorised. ● Dress and behaviour standards are conservative, especially for women. Avoid physical contact between men and women in public. Take care not to offend.
Health Risks	● Get full travel insurance before you leave, including medical costs and evacuation. You'll likely need a special policy that covers travel to high-risk places. Most policies won't cover you for travel to Mauritania. ● Malaria is a risk year-round in most areas. Consider taking anti-malarial medication. ● Other insect-borne diseases include dengue, Rift Valley fever and yellow fever. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against yellow fever before you travel. ● HIV/AIDS is a risk. Take precautions if you engage in high-risk activities. ● Waterborne, foodborne, parasitic and other infectious diseases are common. They include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Medical facilities are limited, particularly outside Nouakchott. If you're seriously ill or injured, you'll need medical evacuation. Make sure your insurance covers this.
Weather	
Other	● Contact your nearest Mauritanian embassy for visa details. ● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● The local currency is the Mauritanian Ouguiya (UM). Some businesses that serve foreigners may accept euros, but most shops and restaurants prefer ouguiyas. ● Mauritania is a mainly cash economy. Not many places accept credit cards. You can't exchange traveller's cheques. Some ATMs in Nouakchott accept foreign cards. ● If you're travelling beyond Nouakchott register your plans with the local police or gendarmes. All travel outside of Nouakchott should be in a convoy with proper security. Check the credentials and references of desert guides. ● Unexploded landmines near the Western Sahara border can shift in sandstorms. Stick to well-travelled roads.

Niger

Threat Level Extreme threat to personal safety, recommended not to travel here.	**Threat Level** Niamey and areas south of the latitude of Niamey in the regions of Dosso and Tillaberi, reconsider your need to travel.					**Latitude / Longitude** 17.607789, 8.081666 **GPS Position** 17° 36' 28.0404" N 8° 4' 53.9976" E

Crime	● Terrorists are planning attacks against Westerners in Niger, including in Niamey. Terrorists could target places visited by foreigners, including hotels, cafes and restaurants. If you decide to travel to Niger avoid possible targets. Be alert to threats. Take official warnings seriously. ● Kidnapping is a risk across Niger, especially outside Niamey. Westerners are particularly at risk. Foreigners may be kidnapped from their homes, vehicles and workplaces. Get professional security advice. Arrange personal security measures. ● Violent clashes have occurred between security forces and armed groups in Agadez, Diffa, Zinder, Maradi and Tahoua. Many towns have curfews. Obey all curfews. ● Violent crime, including armed home invasions, kidnapping, carjacking and mugging, is common. Don't travel alone or after dark. ● Scams are common in West African countries, including Niger. Don't give out personal data or throw away personal documents.
Laws	● Don't use, carry or traffic illegal drugs. Severe penalties include heavy fines and long prison sentences. ● Always carry your passport with a valid visa or residence permit. ● Be careful when taking photos. It's illegal to photograph military personnel, zones and assets, radio and television stations, and airports. It's also illegal to take photos of the Presidency Building and diplomatic buildings, the Kennedy Bridge and political demonstrations. Ask permission before taking photos of locals. ● Niger doesn't recognise dual nationality. ● Standards of dress and behaviour are conservative. If you're a woman, wear a headscarf and loose clothes that cover your arms and legs.
Health Risks	● Yellow fever and malaria are common. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against yellow fever before you travel. Consider taking anti-malarial medication. ● The HIV/AIDS infection rate is high. Take precautions if you engage in high-risk activities. ● Waterborne, foodborne and other infectious diseases are common. These include cholera, rabies, hepatitis, polio and bilharzia. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. Ensure your polio vaccinations are up to date. ● Medial facilities in Niamey, including emergency help, are limited and poor-quality. Outside the capital, they're inadequate or non-existent. If you're seriously ill or injured, you'll need medical evacuation. ● Get full travel insurance that covers medical costs and evacuation. You'll probably need a special policy that covers travel to high-risk places. Most policies won't cover you for travel to Niger.
Weather	● Floods and landslides may block roads during the rainy season (June to October). During the dry season (November to May), Niger can be affected by the Harmattan. This seasonal wind causes sand and dust storms. It may affect you if you have a breathing condition. Follow the advice of local officials.
Other	● If you travel to Niger you'll need a visa. Contact your nearest Nigerien embassy or consulate for details. ● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● Niger is a cash-based society. You generally can't use credit cards, even in hotels and restaurants. There aren't any ATMs. Bring enough cash to cover your needs. ● Landmines are a risk throughout the country, including in Niamey. Talak Plains and the Agadez region are dangerous. ● You'll need a 4WD to travel outside the capital. If you decide to travel outside south-west Niger, drive in a convoy with a local guide. Only travel during daylight. Carry a satellite phone and first-aid kit. ● Taxis are old and in poor condition. Don't use public transport due to poor road conditions and the risk of violent crime. Hire a private car with a professional driver.

Nigeria

	Threat Level Edo, Ekiti, Kwara, Lagos, Ogun, Ondo, Osun and Oyo states, exercise a high degree of caution.	**Threat Level** High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Adamawa, Bauchi, Borno, Gombe, Kano, Kaduna and Yobe states, Riverine areas (coastal) of Akwa Ibom, Bayelsa, Cross Rivers, Delta and Rivers states, do not travel.	 	**Latitude / Longitude** 9.081999, 8.675277 **GPS Position** 9° 4' 55.1964'' N 8° 40' 30.9972'' E

Crime	● There's a high risk of terrorist attacks in Nigeria by militant groups. Possible targets include government and security sites, international organisations, embassies, oil infrastructure, tourist and public areas, transport and airports. Avoid popular hotels and crowds. If you must visit a crowded place, have a clear exit plan. ● The kidnapping threat is high. If you travel to a high-risk area, get professional security advice. ● Political gatherings and protests happen often in major cities. Long-standing tribal, religious, political and community arguments may also turn violent. Be prepared for disruptions. Avoid large gatherings. ● Nigeria's crime rate is high. Crime increases at night and includes assault, armed robbery, home invasions and carjacking. Assaults and robberies are common on public transport and in taxis. Petty crime is common in crowds. Don't travel after dark. Don't visit banks or use ATMs alone. ● Criminals may pose as police or military, or company representatives at airports and hotels. Arrange pick-ups with someone you know. Always keep your car doors locked and windows up, even when moving. ● Internet romance, friendship and employment scams often start in Nigeria. If you travel to Nigeria as a scam victim, you may be in danger. Be wary of online contact from people you don't know. Don't send money until you've checked who you're sending it to.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences and large fines. ● Serious crimes, such as murder and armed robbery, can attract the death penalty. ● Nigeria has strict laws against same-sex activity. Avoid public displays of affection and cross-dressing. Under Sharia law, same-sex activity is punishable by death in many northern states. There are also harsh punishments for stealing and adultery. ● Be careful when taking photos. It's illegal to photograph government or military sites, diplomatic premises, airports and bridges. Smoking in public and littering are also against the law. ● Get written permission from the Department of Antiquities if you want to export African art or antiques. Nigeria also has restrictions on importing some foods and drinks, as well as textiles, jewellery and precious metals. ● Behave and dress conservatively, especially outside of urban areas.
Health Risks	● HIV/AIDS is common. Take precautions if you engage in high-risk activities. ● Yellow fever is widespread. Get vaccinated before you travel. ● Other common insect-borne diseases include malaria and dengue. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. ● Lassa fever may be a risk in several states. Foodborne, waterborne and other infectious diseases include cholera, typhoid, hepatitis and monkeypox. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Polio is widespread. Check your vaccinations are up to date before you travel. ● Medical facilities outside Nigeria's major cities are basic. You may need to pay up-front. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	
Other	● You need a visa or residence permit to visit Nigeria. Some travellers can get a visa on arrival. But you need to get a letter of approval before you travel. Contact a Nigerian embassy or consulate for advice. ● If you have HIV/AIDS, you may not be able to enter Nigeria. You may need an HIV test if you plan to marry a Nigerian citizen. Carry your yellow fever vaccination certificate. ● The local currency is the Nigerian Naira (NGN). Nigeria is a mainly cash economy. It's difficult to change traveller's cheques or Australian dollars. Exchange US dollars at major hotels, banks and foreign exchange services. You generally can't use foreign credit and debit cards. ● Get a local driver's licence if you want to drive. Always carry your ID and car registration to show at checkpoints. Carry extra fuel and don't drive at night. When travelling outside major cities, carry bottled water, a full first aid kit and multiple ways to communicate. ● Regular taxis and motorcycle taxis are dangerous. Use car hire services with a local driver. These are available at most major hotels. Don't use public transport due to safety issues and the risk of crime. ● Piracy, hijacking, kidnapping and armed robbery occur in Nigerian waters. Check the International Maritime Bureau's piracy reports.

Senegal

	Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Casamance region of southern Senegal, except Cap Skirring, Ziguinchor and the main road between these cities, reconsider your need to travel.						**Latitude / Longitude** 14.497401, -14.452362 **GPS Position** 14° 29' 50.6436'' N 14° 27' 8.5032'' W

Crime	● Protests are common near government buildings and in public areas. These can turn violent. Avoid large public gatherings. ● Civil unrest occurs near the border with Guinea. Military operations sometimes happen. Take care if you travel to this area. ● Armed bandits and separatist groups operate in the Casamance region. Landmines are in this area, especially near the Guinea-Bissau border. The risk is lower in the cities of Cap Skirring and Ziguinchor. If you travel to these cities, travel directly by air, sea or only on the main road between them. If you travel elsewhere in the Casamance region, don't travel after dark. Be aware of your personal security. ● Pickpockets, bag snatchers and thieves on motorbikes are common in large crowds. Muggings and robberies occur. Criminals target foreigners, especially at night. Don't walk after dark. Always lock your doors, even when you're inside. ● Online friendship, romance and business scams often start in West Africa, including Senegal. Scammers may ask you to send money or meet them in Africa. Be wary of online contact from people you don't know. Don't send money until you've checked who you're sending it to. ● Terrorism is a threat. Possible targets include hotels and other places Westerners visit. Remote regions are also vulnerable to terror attacks, including near the borders with Mauritania and Mali. Always have an exit plan if you have to visit a possible terror target.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long jail terms. ● Always carry photo ID. Officials can detain you if you can't show it on request. ● Don't drink and drive. Driving after drinking any amount of alcohol is illegal. ● Same-sex relations are against the law. ● Be careful when taking photos. It's illegal to photograph government buildings, official facilities and airports. ● Get customs approval if you want to import auto parts, computers and computer parts, stereo equipment or video cameras. ● Senegal's dress and behaviour standards are conservative. If in doubt, seek local advice.
Health Risks	● Yellow fever is common in Senegal. Get vaccinated before you travel. ● Other insect-borne diseases include malaria and dengue. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. ● The rate of HIV/AIDS infection is high. Take precautions if you're taking part in high-risk activities. ● Common waterborne, foodborne and other infectious diseases include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities in Senegal are limited, especially outside Dakar. You may need to pay cash up-front, even in an emergency. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	
Other	● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● The local currency is the Central African Franc (CFA Franc or XAF). ● It's difficult to exchange Australian dollars. Exchange US dollars and euros at commercial banks and exchange services. Major hotels in Dakar accept credit cards. There are ATMs in Dakar, but not outside the capital. Bring enough cash to cover your stay. ● Only use registered taxis and limousines. Arrange these through your hotel. ● Don't use public transport. Vehicles are poorly maintained and roads are unsafe. ● Ferry travel is risky due to low safety standards and bad weather. There may be too many passengers and not enough life jackets. Always wear a life jacket, even if others don't.

Sierra Leone

	Threat Level Moderate threat level to personal safety, take extra precautions here.							**Latitude / Longitude** 8.460555, -11.779889 **GPS Position** 8° 27' 37.998'' N 11° 46' 47.6004'' W

Crime	● Crime levels are high, including in Freetown. Common crimes include armed robbery, violent assault, burglary, pickpocketing and bag snatching. Crime increases at night. Criminals sometimes target foreigners. Don't walk in isolated areas or along dark streets. Lock your doors, even when you're inside. ● Refugees and displaced people cross the border between Sierra Leone and Guinea. Smugglers and criminal gangs operate in border areas. Violent clashes can occur. There's also unrest near the border with Liberia. ● Online friendship, romance or business scams often start in West Africa, including Sierra Leone. People who travel to meet someone they've met online are at risk of kidnapping, assault or robbery. Be wary of contact from people you don't know in Sierra Leone. Don't send money to anyone in Sierra Leone until you've confirmed their identity.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences include mandatory jail terms. ● It's illegal to export precious minerals without a licence from the Ministry of Mines and Resources. ● Be careful when taking photos. It's illegal to take photos or videos of government buildings, airports or bridges. These areas may not have signs. If you're unsure, don't take photos. ● It's illegal to engage in same-sex relationships. ● Sierra Leone doesn't recognise dual nationality. ● Dress and behaviour standards are conservative, particularly for women. Take care not to offend.
Health Risks	● Lassa fever is a risk in all West African countries. The virus can be fatal and there's no vaccine. It passes to humans via contact with food or household items contaminated with rodent droppings. Avoid contact with rodents. Ensure food is well-cooked and covered. ● In 2016, an Ebola outbreak occurred. If there's another outbreak, your access to medical care may be severely limited. Ensure your insurance covers healthcare or medical evacuation costs if you get Ebola. ● Yellow fever, malaria and other insect-borne diseases are common. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated before you travel. Consider taking anti-malarial medication. ● The HIV/AIDS infection rate is high. Take precautions if you engage in high-risk activities. ● Common foodborne, waterborne, parasitic and other infectious diseases include cholera, hepatitis, bilharzia (schistosomiasis) and tuberculosis. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. ● Medical facilities are limited in Sierra Leone. You'll have to pay up-front. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● Sierra Leone has strong coastal currents. There are no lifeguards or emergency services to rescue swimmers. Get local advice before swimming. Don't swim alone. ● The rainy season is November to May. Floods can block roads, destroy infrastructure and displace people. Monitor weather reports and be prepared to change your travel plans.
Other	● You'll need a visa to enter Sierra Leone. Contact your nearest embassy or consulate of Sierra Leone for details. ● Carry your yellow fever vaccination certificate. You'll need it to enter the country. ● The local currency is the Sierra Leone Leone (SLL). Euros and US dollars are the easiest foreign currencies to exchange. Only exchange money at banks and official exchange bureaus. Most places won't accept credit cards. There aren't many ATMs in Freetown. Ensure you have enough cash to meet your needs. ● All transport options between Lungi International Airport and Freetown carry risks, including overcrowding, poor maintenance and crime. Risks increase after dark. If you arrive at night, stay overnight at Lungi and transfer to Freetown the next morning. Arrange airport accommodation and transfers before you travel. ● Road travel outside the Freetown Peninsula is dangerous, especially at night. Always carry ID, vehicle registration and ownership papers. Keep your windows up and doors locked, even when moving. ● Ferry travel is risky due to low safety standards, overcrowding and bad weather. Always wear a life jacket, even if others don't.

Togo

Togo								
	Threat Level N/A							**Latitude / Longitude** 8.619543, 0.824782 **GPS Position** 8° 37' 10.3548" N 0° 49' 29.2152" E
Crime								
Laws	N/A							
Health Risks	• Yellow Fever							
Weather	N/A							
Other								

4 Asia

The Asian region. The colour shading and travel advice on the map is the advice given by the Australian Government and is accurate as of the 20th Feb 2025. However countries risk ratings rarely change so this could be considered accurate advice going into the forseeable future.

Subheadings

		1. Central Asia		**2. North Asia**	**3. South Asia**	**4. South East Asia**		

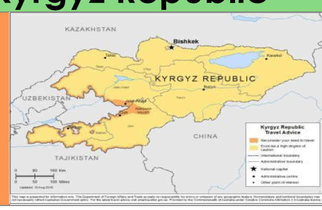
1 Central Asia

Kazakhstan

	Threat Level Exercise normal safety precautions.							**Latitude / Longitude** 48.019573, 66.923684 **GPS Position** 48° 1' 10.4628" N 66° 55' 25.2624" E

Crime	● Theft, pickpocketing, bag-snatching, assaults, drink spiking and carjacking occur. The risk of crime increases at night. Avoid walking alone at night. Monitor the media for new safety risks. Never leave your drink or food unattended. ● Expats have been the victims of violent attacks and muggings. Criminals have targeted expat communities in Atyrau and Aktau in western Kazakhstan. ● Thieves posing as police officers or 'meet-and-greet' drivers at airports have robbed travellers. Pre-arrange your transport if you can. If approached by a police officer, driver or official, ask to see their ID. ● There have been tensions around the border with the Kyrgyz Republic. Avoid large gatherings and protests. Keep up to date on new security risks in the border regions. ● Terrorism is a threat in Kazakhstan. Targets may include places popular with foreigners. Be alert to possible threats, especially in public places. Monitor the media for new threats.
Laws	● Penalties for drug offences are severe and include long prison sentences. Serious crimes, such as murder, may attract the death penalty. ● Be careful when taking photos. It's illegal to take photos of airport facilities, near military and security establishments and near border areas. It's also illegal to take photos near some official buildings. Some places, including larger shops and supermarkets, ban photography. ● You may need to get official documents before you travel if you plan to live or work for long periods in Kazakhstan or you plan to marry there. Contact an embassy or consulate of Kazakhstan before you travel. ● Always carry your passport or a certified copy with your registration. Identity checks by police are common. ● It's illegal to drive if your blood alcohol exceeds 0%. ● Kazakhstan doesn't recognise dual nationality. This may limit the consular help you can access.
Health Risks	● Ticks are common in forested areas, especially from spring to autumn. Tick bites can expose you to disease. Regularly check your body for ticks during and after visits to forest areas. ● Declare all prescription medication and other restricted items on arrival. You could face charges if you don't declare medication or if you exceed the legal limit. ● HIV/AIDS is prevalent. Take precautions if engaging in activities that expose you to the virus. ● Other infectious diseases include typhoid, hepatitis, haemorrhagic fever, tuberculosis, brucellosis, leishmaniasis and rabies. Drink only boiled or bottled water. Avoid ice cubes in rural areas. Avoid unpasteurised dairy products and raw or undercooked food. If an animal bites or scratches you, get immediate medical help. ● Medical facilities in Kazakhstan are below first world standards. Basic drugs and equipment are in short supply. You may need to pay up-front for treatment, including for emergency care.
Weather	● Earthquakes and severe weather occur. People have died in snow-related accidents in recent years. Monitor local media and other sources, such as the Global Disaster Alert and Coordination System.
Other	● You don't need a visa to stay up to 30 days. For longer stays, you'll need to get a visa before you travel. You'll also need a medical certificate of a negative HIV test. If you overstay your visa or breach your visa conditions, authorities may fine, imprison or deport you. Contact the nearest embassy or consulate for details. ● Officials will issue you with a migration card when you enter. You'll need it to check into hotels, to conduct any official business and to leave Kazakhstan. If you didn't get a migration card or your card contains only 1 stamp, contact the nearest Migration Police office. ● Strict border controls apply to road travel between Almaty in Kazakhstan and Bishkek in the Kyrgyz Republic. You need permission from the Kazakh government before you travel to certain regions and towns. ● Declare amounts over $US10,000 on arrival and departure. Cash payments are preferred. Only change your money at commercial banks and exchange bureaus. ● Use only registered taxis and limousines. Avoid public transport. Local buses and mini-buses have poor safety standards and maintenance. Rail travel can be unreliable and dangerous due to petty crime.

Kyrgyz Republic

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Kyrgyz-Uzbek and Kyrgyz-Tajik border areas and the Ferghana Valley, reconsider your need to travel.				**Latitude / Longitude** 41.204380, 74.766098 **GPS Position** 41° 12' 15.768'' N 74° 45' 57.9528'' E

Crime	● Security is volatile in the Kyrgyz-Uzbek and Kyrgyz-Tajik border areas. This includes the Ferghana Valley. Crime, civil unrest, terrorist activity, clashes and landmines are a risk. Security forces monitor border areas and often conduct operations there. ● Violent crime, kidnapping, robbery, mugging and pickpocketing occur. Criminals can pose as police or 'meet-and-greet' drivers at the airport. The risk of crime increases at night. Always be alert to your surroundings. Avoid walking at night, especially if you're alone. ● Terrorist attacks have happened in Kyrgyzstan. Targets have included places popular with foreigners. Be alert to possible threats, especially in public places. ● Cases of unauthorised withdrawals are reported after people have used ATMs or EFTPOS machines. Use ATMs in controlled areas, such as in banks or large hotels. Check for skimming devices. Keep your credit card in sight when paying for things. ● Drink spiking is a risk. Don't accept food, drinks, gum or cigarettes from strangers. Never leave your food or drink unattended.
Laws	● Don't use or carry illegal drugs. Severe penalties include long prison sentences and heavy fines. ● You need a Certificate of No Impediment to Marriage if you're planning to get married in the Kyrgyz Republic. ● It's illegal to drive with a blood alcohol reading over 0%. It's illegal to take photos of military and security establishments. Always carry your passport, or a certified copy, at all times. It's the law and ID checks by police are common. ● Standards of dress and behaviour are conservative. Displays of affection, even between married couples, can offend. Police may harass or detain you. Take care not to offend. If in doubt, dress modestly and seek local advice.
Health Risks	● Malaria is common in the southern and western parts of the country. Other insect-borne diseases occur, including leishmaniasis. Use insect repellent. Make sure your accommodation is insect-proof. Consider taking anti-malarial medication. ● Ticks carrying encephalitis are common in forested areas from spring to autumn. Check your body for ticks during and after visits to forest areas. ● Other infectious diseases include typhoid, hepatitis, meningitis, tuberculosis, brucellosis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food and unpasteurised dairy products. If an animal bites or scratches you, get immediate medical help. ● Medical facilities in Bishkek are limited. In remote areas, they're basic. Medical equipment and medicines are in short supply.
Weather	● There's a high risk of earthquakes in the Kyrgyz Republic. Tremors, avalanches and landslides are common. People have died in snow-related accidents in recent years. Monitor local media and other sources, such as the Global Disaster Alert and Coordination System.
Other	● You don't need a tourist visa to stay up to 60 days. You can apply for an e-visa for tourism and business for up to 90 days. You may need to register your details with the State Registration Service if you'll stay longer than 60 days. ● There are some HIV/AIDS restrictions for visitors and residents. You'll need an HIV test to apply for a work visa. Check with an embassy or consulate of the Kyrgyz Republic before you travel. ● Kyrgyzstan's borders can close without notice. Strict border controls apply on the road between Bishkek and Almaty in Kazakhstan. Expect delays at border crossings. Check the border conditions with local authorities. ● The economy is mostly cash-based. Only a few of the major hotels accept traveller's cheques and credit cards. ● Local buses, minibuses and taxis are often poorly maintained. Use registered taxis or authorised limousines arranged through your hotel.

Tajikistan

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Border regions with the Kyrgyz Republic, Uzbekistan and Afghanistan, Gorno Badakhshan Autonomous Oblast, reconsider your need to travel.				**Latitude / Longitude** 38.861034, 71.276093 **GPS Position** 38° 51' 39.7224'' N 71° 16' 33.9348'' E

Crime	● Terrorist attacks have happened in Tajikistan. There have also been explosions in some locations, including Dushanbe, in recent years. Be alert to possible threats, especially in public places. Be cautious when visiting possible terrorist targets. Take official warnings seriously and follow the advice of local authorities. ● Political violence has happened in the Gorno-Badakhshan Autonomous Oblast (GBAO). Extra security measures are in place. ● Clashes have occurred in north-east Afghanistan close to the border with Tajikistan. The region bordering Afghanistan is also a transit point for drugs and other smuggled goods. Armed conflict continues and may affect regions of Tajikistan. ● Pickpocketing is common in Dushanbe and on international rail services. Women can be verbally and physically harassed. Criminal activity increases after dark. Take particular care if travelling alone or at night.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences include lengthy imprisonment in local jails. ● You must carry a copy of your current passport and visa at all times. ● It's illegal to drive with a blood alcohol level above zero. It's illegal to smoke on the street. It's illegal to take artefacts or cultural items out of Tajikistan without official permission. ● Be careful when taking photos. It's illegal to photograph sensitive sites, including transport facilities, government buildings and military zones, assets and personnel. ● Tajikistan doesn't recognise dual nationality. Tajik authorities may insist you enter Tajikistan on your Tajik passport.
Health Risks	● Some sleeping tablets and medication containing codeine are restricted in Tajikistan. If you intend to bring medication, confirm it's legal and check the rules that apply. Declare all medications and other restricted items on arrival. If you don't, or if the amount you're carrying is over the legal limits, you could face charges. ● Malaria is a risk. Ticks are very common in forests and country areas from spring to autumn. Check your body for ticks during and after travel in forests. Ensure your accommodation is insect-proof. Use insect repellent. ● Other infectious diseases include tuberculosis, cholera, typhoid, brucellosis, hepatitis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get immediate medical help. ● Unprotected uranium and pesticide waste dumps in the northern Sughd Region may pose a health risk. Seek local advice. ● Medical facilities and services are limited in Tajikistan, and there's a shortage of equipment and medications. Hygiene is poor. Doctors require up-front payment before providing treatment.
Weather	● Earthquakes, avalanches, mudslides and floods happen in Tajikistan. Closely monitor local media and other sources, like the Global Disaster Alert and Coordination System. Follow the advice of local authorities.
Other	● You need a visa to visit Tajikistan. Your passport must be valid for at least 6 months and have 2 empty pages. You can get a standard sticker visa at an embassy or consulate of Tajikistan, or an electronic visa through eVisa system. ● You need to register with the local Visa and Registration Office if you're staying in Tajikistan for more than 3 days and haven't entered on a 30-day tourist visa. You can also ask your hotel to register you. ● You need a permit to visit the GBAO. If you decide to travel to Tajikistan apply at the Ministry of Foreign Affairs or OVIR in Tajikistan. ● Tajikistan's borders can close without notice. Ask local authorities which border crossings are open and if you can use them. ● Declare any money you bring into Tajikistan on arrival. Present your customs declaration form when you leave. ● Public transport is often overcrowded and unsafe. Bus and train services are unreliable. Train travel can also be dangerous due to criminal activity. Use taxis booked through your hotel.

Turkmenistan

	**Threat Level** Exercise normal safety precautions.	**Threat Level** Turkmenistan/Afghanistan Border, do not travel.				**Latitude / Longitude** 38.969719, 59.556278 **GPS Position** 38° 58' 10.9884'' N 59° 33' 22.6008'' E

Crime	● Pickpocketing, mugging and theft occur. The risk is higher on trains and at markets. Don't go out alone, especially at night. ● Criminals target travellers using unofficial taxis. Always book a licensed taxi. Don't get into taxis that are already occupied. ● Police and other local officials have reportedly harassed, mistreated and extorted foreigners. ● Bandit gangs are active in the south-eastern area of the country. ● If you travel to the region bordering Afghanistan monitor local and international media for updates. The security situation is extremely dangerous. Consular help is extremely limited.
Laws	● You must always carry ID. Security officials often ask for proof of identity. Ask for identification if you are unsure the person is an official. ● Penalties for drug offences are severe. They include long prison sentences. ● It's illegal to have sexual relations between males. It's illegal to drive with a blood alcohol reading over 0%. It's illegal to smoke in restaurants, hotels and public spaces or gift tobacco. ● It's illegal to photograph sensitive sites. Take care when taking photos of infrastructure. Always check with local authorities beforehand. ● Turkmenistan doesn't recognise dual nationality. This may limit consular help we can give to dual nationals who travel on a Turkmen passport. ● Obvious displays of affection, even between married couples, may offend. Police may harass or detain you.
Health Risks	● Some sleeping tablets and medications containing codeine may be restricted. Check legal limits before you travel and declare all prescription medication and other restricted items on arrival. ● Infectious diseases include cholera, hepatitis, measles, tuberculosis and typhoid. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities are limited. Medicines and equipment are often in short supply. You may need to pay cash up-front to receive treatment.
Weather	● Earthquakes are a higher risk in the south-west and north-east regions. Register with the Global Disaster Alert and Coordination System to receive alerts on major disasters.
Other	● You need a visa for Turkmenistan, even if you're only transiting. Get a visa before you arrive. There are penalties for overstaying your visa. ● When you arrive, you must present a migration card. Pay a registration fee and register with the State Migration Service within 3 working days of arrival. ● If you're travelling with a child, you may need evidence of parental, custodial or access rights. You may also need a letter of consent from any non-travelling parent. ● Customs rules control the import or export of items, including jewellery, musical instruments, antiques and protected animals. It's illegal to export artefacts or cultural items, including carpets, without a certificate from the Ministry of Culture. ● You must declare any foreign currency when you arrive and depart. Exchange any unspent local currency before you leave. You may not be able to exchange local currency outside Turkmenistan. ● Designated restricted zones are closed to foreigners who don't have government permission.

Uzbekistan

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Andijan and the eastern region of the Ferghana Valley; Regions bordering Tajikistan, Kyrgyz Republic and Afghanistan, reconsider your need to travel.				**Latitude / Longitude** 41.377491, 64.585262 **GPS Position** 41° 22' 38.9676'' N 64° 35' 6.9432'' E

Crime	● Terrorist attacks have happened in Uzbekistan. Future terrorist attacks could target places popular with foreigners. Be alert to possible threats, especially in public places. ● Security threats are more severe in Uzbekistan's border regions. Landmines are also a risk. If you decide to travel to border regions pay close attention to your personal security. Monitor the media for new risks. ● Demonstrations can turn violent. Violent protests are more common in Andijan and the eastern region of the Ferghana Valley. Avoid large gatherings and protests. Follow the advice of local authorities. ● Pickpocketing and robbery can occur. Thieves target travellers. The risk is higher on trains and in unofficial taxis. More crimes happen at night. Carry only what you need and don't walk alone. ● Some criminals pose as police officers to rob people. There have been reports of harassment, mistreatment and extortion by police and other local officials.
Laws	● Penalties for drug offences are severe and include long jail terms. ● Always carry your passport and visa. Police often ask for proof of identity. ● It's illegal to have sex outside of marriage or to have same-sex relations. ● It's illegal to take photos of government or military buildings and public transport sites. ● Uzbekistan doesn't recognise dual citizenship. This may limit the consular help we can provide. Dual nationals need a permit to depart Uzbekistan. They may also need to do national service. ● Standards of behaviour and dress are conservative. Take care not to offend. If in doubt, ask locals for advice.
Health Risks	● Uzbekistan has strict controls on importing certain medicines, including psychotropic medication. Sleeping tablets or medicines containing codeine may also be restricted. Declare all medication and other restricted items on arrival. ● HIV/AIDS is prevalent. Take steps to reduce your risk of exposure to the virus. ● Malaria and other insect-borne diseases occur. Use insect repellent. Make sure your accommodation is insect-proof. Consider taking anti-malarial medication. ● Ticks are active in country areas from spring to autumn. They can spread disease. Regularly check your body for ticks during and after visits to forest areas. Remove ticks from your body as soon as possible. ● Other infectious diseases include tuberculosis, typhoid, brucellosis, hepatitis and rabies. Drink only boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get immediate medical help. ● Medical facilities are limited and medicines and equipment are often in short supply. You may need to pay cash up-front before receiving treatment.
Weather	
Other	● You can enter Uzbekistan once and stay up to 30 days without a visa. You'll need a visa if you're staying longer than 30 days or if you need multiple entries. Check your visa details when you get it. The length of stay on your visa might differ from the length you applied for. ● If you'll stay 3 or more days, you'll need to register with local authorities. Register in each city you stay in. Check if your hotel has done this for you. ● Borders with neighbouring countries can close without notice. Some border crossings may only be open to local residents. Ask local authorities about border conditions before you travel.

2 North Asia

China

	Threat Level Exercise normal safety precautions.	**Threat Level** Tibet, Xinjiang, exercise a high degree of caution.				**Latitude / Longitude** 35.861660, 104.195397 **GPS Position** 35° 51' 41.976" N 104° 11' 43.4292" E

Crime	● Petty crime occurs. Criminals target travellers in crowded areas, including on public transport. Resisting can lead to violence. ● Scams targeting travellers can lead to loss of money, violence and serious assault. Report scams to the nearest police station. ● Armed attacks are a risk in remote border regions. Be careful if travelling in these areas. ● The Chinese Government strictly controls demonstrations. Authorities may arrest protesters. Avoid protests and large gatherings. Don't photograph or video protests. ● Security in the Xinjiang region is unstable due to ethnic tensions. Increased security measures are in place. Be ready to show photo ID if asked. ● There's civil unrest and political tension in Tibet. Get permission from Chinese authorities before you go. You can only travel to Tibet as part of an organised tour.
Laws	● Governments can't intervene in the Chinese justice process and can't help if you're a dual national and you don't travel on your other passport. ● Chinese law, treats a person aged 14 years and older as an adult. China has strict laws and severe punishments for crime including the death penalty and life imprisonment. ● You must always carry identification and show it to police if they ask. ● Chinese authorities undertake random drug testing on foreign nationals and can prosecute individuals who return a positive test result regardless of when or where drugs were taken. ● Many business and employment issues may be considered criminal matters in China. Penalties are severe. Get professional legal advice before entering into any employment or commercial contract in China. ● If you're a former Chinese citizen, authorities may treat you as a citizen and refuse access to consular services. Get legal advice if you're not sure of your citizenship status under Chinese law.
Health Risks	● Tap water in China may not be safe to drink, depending on your location. Drink only bottled water with intact seals. ● People have died from bird flu in China. Stay away from live poultry. When preparing food, handle poultry properly and make sure it is thoroughly cooked. ● HIV/AIDS is a significant risk in China. Take precautions if engaging in activities that expose you to risk of infection. Ask for sterilised equipment when receiving medical treatment. ● Animal and human rabies and hand, foot and mouth disease are common. Be careful with both wild and domestic animals in China. Wash your hands carefully and regularly. Take other hygiene precautions. ● High pollution levels are a problem in major cities. Follow advice from local authorities on days with bad pollution.
Weather	
Other	● You may need a full visa for travel to China, even as a tourist. Make sure you leave China before your visa expires. Strict penalties can apply. ● Authorities may not allow you to leave China if you're involved in a local legal matter. Get legal advice and be aware of your rights and responsibilities. ● If you're planning to visit Hong Kong or Macau from mainland China, you may need a new visa to re-enter mainland China. ● You must register your place of residence with the local Public Security Bureau. If you're staying at a hotel, this will be part of the normal check-in process. ● Authorities restrict travel by foreigners in China. If you plan to travel outside major tourist areas, check that the area is 'open to foreigners'.

Hong Kong

	Threat Level Exercise normal safety precautions.						**Latitude / Longitude** 22.396428, 114.109497 **GPS Position** 22° 23' 47.1408" N 114° 6' 34.1892" E

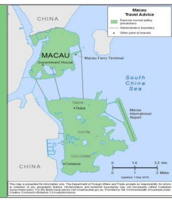
Crime	● Protests continue. There's a risk of violent confrontation between protesters and police, opposing groups or criminally-linked individuals. 'Flash mob' demonstrations can take place with little or no warning, with instances of violence and vandalism. Police have used tear gas, live ammunition, rubber bullets and pepper spray, including in popular tourist, residential and enclosed areas. ● Road closures, transport disruptions, including to the MTR and Airport Express, and closures of shopping centres and businesses can happen at short notice. If you are in Hong Kong, be alert. Plan ahead to avoid demonstrations by monitoring local media, including key online sources. If there are signs of disorder, move away quickly to a safe place. ● Violent crime is rare, but some petty crime happens. Thieves target tourist spots and crowded places, such as markets and trains. Take care of your belongings. ● Travellers have had drinks spiked in bars and nightclubs. This may lead to theft or credit card fraud. Don't accept food, drink, cigarettes or gum from strangers. Don't leave your drinks unattended. ● Scams are increasing. Scammers may ask for help carrying luggage, or ask for money. Fake arrests, lotteries, or schemes involving property, holiday clubs or timeshares occur. Never carry anything for someone you don't know. Do thorough research. Get legal advice before sending money or signing documents.
Laws	● Don't use, carry or traffic illegal drugs. Penalties include heavy fines and jail time. ● It's illegal to take part in public demonstrations without government approval. Avoid large public gatherings. ● Strict laws control importing or possessing weapons and items that look like weapons. Get a permit if you want to buy or carry such items legally. ● Importing or re-exporting elephant ivory products is illegal. Penalties include fines and jail time. ● Chinese law doesn't recognise dual nationality. But Hong Kong law allows dual nationals of Chinese descent to register their nationality with the Immigration Department.
Health Risks	● It's illegal to carry sleeping tablets and some medication without a prescription. Carry a copy of your prescription or a letter from your doctor. ● Hong Kong has very high humidity from May to October. Reduce physical and outdoor activities on very humid days. ● Hong Kong can have very high pollution levels. If you have a heart or breathing condition, do less physical activity when the air quality index health risk is high. ● Hand, foot and mouth disease (HFMD) is common. It mostly affects children aged under 10 years, but adult cases occur, particularly in young adults. Wash your hands thoroughly and often. ● Waterborne, foodborne and other infectious diseases including bird flu sometimes occur. Drink only boiled or bottled water from bottles with sealed lids. Avoid raw or undercooked food. Avoid contact with animals. ● Hong Kong's Department of Health checks for Middle East respiratory syndrome coronavirus at border control points. If you have flu-like symptoms, officials may send you to a public hospital until you test negative for it.
Weather	● Hong Kong experiences typhoons. If the warning level is Typhoon 8 or above, businesses, transport services and consulates will close. Follow advice from local officials. Contact your travel operator about delays.
Other	● Hong Kong has separate immigration regulations to China. You generally won't need a tourist visa if you stay less than 90 days. In all other cases, you'll need a visa. Contact the Hong Kong Economic and Trade Office in Sydney for details. ● If you're travelling from Hong Kong to the China (PRC), you'll need a PRC visa. If you enter the Shenzhen Special Economic Zone, you can apply for a visa at the Shenzhen-Hong Kong border. ● Cheap unlicensed guesthouses operate in Hong Kong. They may not have the same safety and security standards as licensed ones. If you stay in a guesthouse, make sure it's licensed. ● Use only licensed taxis and reputable limousine services. Insist taxi drivers use the meter. If you have a dispute with a taxi driver about the fare, ask for a receipt. Record the taxi driver's licence number and contact the police.

Japan

	**Threat Level** Exercise normal safety precautions.	**Threat Level** Areas 1 and 2 near the Fukushima Dai-ichi power plant, exercise a high degree of caution.	**Threat Level** Area 3 near the Fukushima Dai-ichi power plant, do not travel.			**Latitude / Longitude** 36.204824, 138.252924 **GPS Position** 36° 12' 17.3664'' N 138° 15' 10.5264'' E

Crime	● You must carry your passport (or Japanese residency card) at all times. ● Regional tensions, including with North Korea, could worsen with little warning. Review Japan's preparing for emergencies advice. ● Japan has a low crime rate. Petty theft happens, such as bag snatching at popular tourist attractions. ● There's a risk of crime in bars and nightclubs. Crimes include overcharging, credit card fraud, drink spiking and assault. Avoid street touts who try to get you into venues. Don't carry credit cards or lots of cash to bars, clubs or parties.
Laws	● Don't use or carry illegal drugs. Authorities can charge you if they find trace amounts of illegal drugs in your blood or urine. ● Japanese family law, including divorce and child custody, is very different to first world law. If you're involved in custody or other family disputes, consult a lawyer before you leave your country. ● Some employment agents mislead and encourage foreigners to work in Japan without the correct paperwork. If you want to work in Japan, verify the work offered. Get the correct visa. Get legal advice before signing a contract. ● If you're visiting for less than 90 days, always carry your passport. If you live in Japan, always carry your residence card. ● Japan has strict alcohol laws. The legal drinking age is 20. It's illegal to drive with any alcohol in your bloodstream. Allowing someone who has been drinking to drive is also illegal. ● Smoking on the street is illegal in Tokyo and some other cities. ● It's illegal to fly drones without a permit in many areas of Japan. ● Laws introduced in 2019 restrict alcohol consumption in specific areas on certain days, such as in Shibuya on Halloween night (31 October) and New Year's Eve.
Health Risks	● Japan has strict rules about bringing medicine into the country, including some ingredients in ADHD and cold and flu medication. If you plan to bring medication, check if it's legal before you travel. ● Restricted zones exist around the Fukushima Dai-ichi nuclear power plant. The 2011 earthquake caused the release of lethal radiation. Radiation levels in most parts of Japan, including Tokyo, are within the normal range. ● Japanese encephalitis occurs in rural areas. Ensure your accommodation is insect-proof. Get vaccinated against Japanese encephalitis. ● Outbreaks of measles and rubella have been reported in recent years. Make sure your vaccinations are up to date before you travel. ● Medical facilities are of a high standard. You can find English-speaking medical staff in most major cities. You may need to pay up-front before you're treated.
Weather	● The typhoon season is from May to November. Follow local media updates. Maintain a basic emergency supply kit. Know where your nearest shelter is. ● There's a constant risk of earthquakes and tsunamis. Get emergency plans for your area from local or prefectural government offices. Know where your local shelter is. Move to higher ground straight away if you're in a coastal region after a major earthquake. ● Japan experiences heavy snowfalls and extremely low temperatures in winter. If you're skiing in Japan, use protective equipment. Only visit areas that local authorities mark as safe.
Other	● In some cases, you don't need a visa if you're visiting for fewer than 90 days. These include tourism, business or family visits. Carry proof of your funding, an onward or return ticket, and your accommodation bookings. ● For other situations, contact the nearest Japanese embassy or consulate to check if you need a visa. If you work in Japan on a tourist visa, authorities could prosecute you. ● The local currency is the Japanese Yen (JPY). Most places prefer cash. Hotels accept major credit cards, but many shops and services don't, especially outside major cities. Some ATMs at banks and convenience stores don't accept foreign cards. ● Don't climb Mount Fuji from September to June. This is when it's most dangerous. ● You can drive for up to 1 year with a driver's licence and an International Driving Permit. If you're staying longer, get a local licence. Heavy snowfalls and ice in the winter can make driving dangerous.

Macau

	Threat Level Exercise normal safety precautions.		**Latitude / Longitude** 22.198745, 113.543873 **GPS Position** 22° 11' 55.482'' N 113° 32' 37.9428'' E

Crime	● Violent crime is low in Macau. Pickpocketing and bag snatching occurs. Thieves target people in crowded places, such as shopping centres, markets, the airport and casinos. Watch your belongings, especially in crowds. ● Drink spiking happens. Don't accept food, drink, cigarettes or gum from strangers. Don't leave your food or drinks unattended. ● Be careful when using ATMs, as theft happens. Use ATMs in shops or banks rather than on the street. If someone approaches you, cancel your transaction before talking to them. ● Protests can turn violent. It's illegal to protest without government approval. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Penalties include heavy fines and jail terms. ● Macau has strict laws around importing and possessing weapons and items that resemble weapons. Get a permit if you want to import, carry or buy these items, including in local markets. ● Be careful when taking photos. It's illegal to photograph military sites. ● Always stay in licensed accommodation. If you don't, authorities may fine you. ● If you're a dual national of Chinese descent, you can register your citizenship with the Macau Identification Bureau. If you're travelling to mainland China, use your own countries passport.
Health Risks	● Macau can have severe air pollution. If you have a heart or breathing condition, avoid exercising or going outside on days of high pollution. ● Macau sometimes has outbreaks of dengue. Japanese encephalitis is also a risk. Ensure your accommodation is insect-proof. Get vaccinated against Japanese encephalitis before you travel. ● Hand, foot and mouth disease is common. It mostly affects children younger than 10, but adult cases occur, particularly in young adults. Wash your hands thoroughly and often. ● Waterborne, foodborne and other infectious diseases include tuberculosis and hepatitis. Avoid raw or undercooked food. ● Macau's medical facilities are adequate. You may need to pay up-front. If you're seriously ill or injured, you may need medical evacuation to Hong Kong. Ensure your travel insurance covers this.
Weather	● Macau experiences typhoons and severe weather. These can disrupt transport and essential services. Typhoon season is between May and October. Follow the advice of local officials.
Other	● Macau has separate immigration rules to China and Hong Kong. Tourists visiting for less than 30 days generally won't need a visa. In other situations, get a visa from your nearest PRC embassy or consulate. ● You must have a visa to travel between Macau and mainland China. Get a multiple-entry visa for China if you plan to return there after visiting Macau. ● The local currency is the Macanese Pataca (MOP). Some shops also accept Hong Kong dollars and Chinese yuan. Most places accept credit cards. ● Only use licensed taxis or reputable limousine services. Insist on using the meter. Ridesharing services are illegal. ● Public buses are cheap and frequent, but they can be hard to find outside tourist areas.

Mongolia

	Threat Level Exercise normal safety precautions.		**Latitude / Longitude** 46.862496, 103.846656 **GPS Position** 46° 51' 44.9856'' N 103° 50' 47.9616'' E

Crime	● Violent crime is increasing in Mongolia, particularly in Ulaanbaatar. Criminals have assaulted and sexually harassed foreigners during the day and in busy areas. Crime is more common during major festivals and the summer tourist season. Be aware of your surroundings. ● Pickpocketing and bag snatching are common, especially on public transport and in crowded areas. Criminals posing as police have robbed travellers in the Sukhbaatar Square area of Ulaanbaatar. Be alert to thieves, especially on public transport. ● Protests can turn violent. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs. Severe penalties include long jail terms. ● Always carry your passport. If you live in Mongolia, also carry your residency card. ● Mongolia doesn't recognise dual nationality. Always travel on your primary passport. Dual nationals living in Mongolia may need to do national service. Contact the nearest Mongolian embassy for details. ● Same-sex relationships are legal. However, LGBTI travellers may face violence, discrimination and harassment. Avoid public displays of affection.
Health Risks	● Rabies is a risk. It's fatal without immediate treatment. Avoid dogs, monkeys and other mammals. Get medical help straight away if an animal bites or scratches you. ● HIV/AIDS is common. Take precautions if engaging in activities that expose you to the virus. ● Waterborne, foodborne and other infectious diseases are common. These include hand, foot and mouth disease (HFMD), hepatitis and measles. Drink only boiled or bottled water. Avoid raw or undercooked food. ● During winter, the air in Ulaanbaatar is very polluted. If you have breathing problems, speak to your doctor before you travel. ● The standard of medical care is poor, particularly outside Ulaanbaatar. Bring basic medical supplies with you. You'll have to pay up-front, even in an emergency. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● Mongolia's weather is extreme. Temperatures vary from 35°C in summer to -40°C in winter. Winter lasts from October to March. Snowstorms can also happen outside winter months. Make sure you have adequate clothing and footwear year-round. Weather conditions can change quickly. ● Earthquakes, flooding and fires sometimes occur. Follow the advice of local officials.
Other	● You need a visa to enter. Contact the nearest Mongolian embassy for details. Carry proof of your onward or return ticket. You'll need it to enter the country. ● If you're staying longer than 30 days, register with the Office of Immigration in Ulaanbaatar. You must do this within 7 days of arriving. If you're on a working visa, ensure your employer has registered for you. Working visa holders must de-register before leaving the country. ● If you're travelling to Mongolia by car, get approval from Mongolian Customs Office (English) before you enter. ● Most driver's licences and international driving permits aren't valid in Mongolia. For short trips, use taxis or hire a car with a driver. If you're staying more than 12 months, apply for a Mongolian driver's licence. ● Take care as a pedestrian. Drivers don't always give way, even at marked pedestrian crossings. Heavy snow can cause black ice on footpaths and road crossings. ● Authorities sometimes restrict access to some regional districts for quarantine reasons. Speak to Mongolian authorities or the nearest Embassy of Mongolia if you plan to travel to regional areas.

North Korea

	Threat Level High threat level to personal safety, take a range of extra precautions here.		**Latitude / Longitude** 40.339852, 127.510093 **GPS Position** 40° 20' 23.4672'' N 127° 30' 36.3348'' E

Crime	● North Korea and South Korea are technically at war. Military exchanges are rare, but tensions are still high. They could increase with little warning. North Korea sometimes conducts missile tests or other provocations. Monitor developments. ● The North Korean Government restricts information, especially about domestic politics and international relations. You can usually access international satellite TV channels at tourist hotels. However, if the government shuts these down in a crisis, you may not know what's happening. If you travel to North Korea, don't stay long. Monitor state broadcasts and, if possible, international media for signs of increasing tensions. ● Crime against travellers is rare. However, some travellers have reported petty crimes. Keep your passport and belongings close, especially at Pyongyang Airport and in public markets.
Laws	● Travelling as part of a tour or with a guide doesn't give you special protection from North Korean laws. Authorities may arrest, detain or expel you for activities that aren't crimes in your country. They may also search your belongings and monitor your communications. ● Don't use or carry illegal drugs. Penalties for drug offences are severe and parole is unlikely. Drug traffickers can get indefinite jail sentences. ● Authorities may judge many activities as spying. Be very careful when taking photos. It's illegal to photograph anything other than designated public tourist sites. Always ask your North Korean guide for permission before taking photos. ● North Korea has strict laws about what you can bring into the country. It's illegal to bring in religious, pornographic or political items. Declare all published material and electronic devices when you arrive. It's also illegal to knowingly or unknowingly possess items that breach North Korean law. ● Be careful who you talk to and what you say. It's illegal to show disrespect or make jokes about North Korea, current or former leaders or their families. It's also illegal to talk to North Koreans without authorisation. Authorities may consider it spying if you do. Only shop at stores designated for foreigners. ● Same-sex relations are legal, but authorities don't accept them. Avoid public displays of affection.
Health Risks	● Medications can be very hard to get in North Korea. If you plan to bring medication, check if it's legal. Take enough legal medicine for your trip. ● Malaria is a risk, especially in the south from May to September. Japanese encephalitis is also a risk. Ensure your accommodation is insect-proof. Consider taking anti-malarial medication. Get vaccinated against Japanese encephalitis before you travel. ● Waterborne, foodborne, and other infectious diseases include tuberculosis, typhoid and hepatitis. Intestinal worm infections, such as roundworm, are also common. Drink only boiled or bottled water. Avoid raw or undercooked food. Get advice on preventative medication for intestinal worms. ● Hand, foot and mouth disease (HFMD) is common. It mostly affects children younger than 10, but adult cases occur. Wash your hands thoroughly and often. ● From March to May, strong winds carry yellow dust to the Korean Peninsula from Mongolia and China. This can cause eye, nose, mouth and throat irritations. Get medical advice if you have heart or breathing problems. ● Medical facilities are basic, including in Pyongyang, and hygiene is poor. Avoid surgery unless you need it to leave North Korea. If you're seriously ill or injured, you'll need medical evacuation to China. Contact the Swedish Embassy in Pyongyang to arrange it. Medical evacuations are very expensive and difficult to organise. Ensure your travel insurance covers this.
Weather	● The monsoon season is from late June to late August. Typhoons can occur between August and September. Flooding may disrupt essential services. Know your hotel's evacuation plan. ● Some countries near North Korea experience large earthquakes. This makes destructive tsunamis more likely. Don't wait for official warnings, alarms or sirens. Know the tsunami warning signs and move to high ground straight away if you're on the coast.
Other	● You need a visa for all types of travel to North Korea. You may need to travel to another country, such as China, to get your visa. If you're travelling for business, you'll need a North Korean sponsor and permission from the Ministry of Foreign Affairs. Journalists must get a special visa. ● You'll probably have to travel via Beijing. Get a double- or multiple-entry visa for China. ● Travellers must register with government authorities within 24 hours of arriving. Do this through your host organisation or hotel. ● The local currency is the North Korean Won. Foreigners can't use it. The Euro is the most widely accepted foreign currency. US dollars and Chinese yuan are also widely accepted. Exchanging currencies is difficult. You can't use ATMs, traveller's cheques, or debit and credit cards. Take enough foreign currency for your trip, in small denominations. ● You can only travel on an official tour. An official guide must always accompany you. Charges for travel can be high, including for taxis, guides, tolls and permits. ● Assume authorities are monitoring all your phone conversations, including your mobile. It's not possible to phone South Korea. Internet access is severely restricted. ● Tourists generally can't drive. Tour operators or sponsors usually provide road transport. Delays for checkpoints are common. ● Flights are often delayed. North Korean airlines are affected by sanctions. Check with your tour operator or airline before you travel.

South Korea

Threat Level
Exercise normal safety precautions.

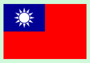
Latitude / Longitude
35.907757, 127.766922

GPS Position
35° 54' 27.9252'' N
127° 46' 0.9192'' E

Crime	● South Korea and North Korea are technically at war. Military exchanges are rare, but tensions are still high. The situation could worsen with little warning. North Korea sometimes conducts missile tests or other provocations. Monitor developments. Consider downloading the South Korean Government's 'Emergency Ready' app. ● Large-scale public gatherings and protests are common, particularly in Seoul. These can turn violent. Avoid large public gatherings. ● The crime rate in South Korea is low. However, petty crime happens, especially in major cities such as Seoul and Busan. Watch your belongings. ● Travellers have reported sexual assaults, drink spiking and other violent crimes. Don't accept food, drink, gum or cigarettes from strangers. Take care when walking alone at night.
Laws	● Don't use, carry or traffic illegal drugs. Penalties include long jail sentences, heavy fines and deportation. ● It's illegal to work or volunteer in South Korea if it's not specified in your visa. If you plan to work, arrange a work visa through a South Korean embassy or consulate before you travel. ● Disputes over expected working and living conditions for teaching English in South Korea is common. Research your employer and employment agent. Get legal advice before you sign a contract. ● Be careful when taking photos. It's illegal to photograph military zones, assets or personnel and official buildings. ● South Korea has strict anti-corruption laws for officials. Public officials and their spouses can't accept meals, gifts or other benefits above set limits. ● This includes journalists, teachers and employees of government-owned or funded companies. Get legal advice to make sure you don't breach these laws. ● South Korea doesn't recognise dual nationality. If you're a male South Korean dual national, you may have to do military service when you arrive. This could happen even if you travel on your countries passport. Get advice from an embassy or consulate of the Republic of Korea before you travel.
Health Risks	● There's an outbreak of Hepatitis A in South Korea. Boil tap water before drinking or cooking. ● Malaria is a risk in the demilitarised zone and rural areas in the north of Gyonggi and Gangwon provinces. Japanese encephalitis is also a risk. Ensure your accommodation is insect-proof. Get vaccinated against Japanese encephalitis before you travel. Consider taking anti-malarial medication. ● Waterborne, foodborne, and other infectious diseases include tuberculosis, typhoid and hepatitis. When outside major cities, drink only boiled, bottled or filtered water, and avoid raw or undercooked food. ● Hand, foot and mouth disease is common. It mostly affects children younger than 10, but adult cases occur. Wash your hands thoroughly and often. ● South Korea is susceptible to high levels of pollution from March to May. During this time, strong winds from Mongolia and China also carry yellow dust to the Korean Peninsula. This can cause eye, nose, mouth and throat irritations. Get medical advice if you have heart or breathing problems. ● The standard of medical facilities in South Korea is usually good, but few staff speak English. You'll probably have to pay up-front. Ensure your travel insurance covers all medical costs. ● South Korea is a popular destination for medical tourism. If you're travelling for a procedure, research and choose your medical service providers carefully. Don't use discount or uncertified providers. Ensure your travel insurance covers complications from surgery.
Weather	● The monsoon season is from late June to late August. Typhoons can happen in August and September. Flooding and mudslides may happen. Identify your local shelter (identified by the word 대피소). Follow the advice of local officials. ● Earthquakes and tsunamis are a risk. Know the tsunami warning signs and move to high ground straight away. Don't wait for official alerts, warnings or sirens.

Other	● You can get a visa on arrival for stays of up to 90 days. For other situations, get a visa before you travel. Contact your nearest embassy or consulate of the Republic of Korea for details. ● The local currency is the Korean Won (KRW). Exchange your dollars at banks or money changers. ATMs are available in cities and larger towns, but they may not accept some debit cards. Hotels, restaurants and high-end shops usually accept credit cards. Be aware of card skimming. ● You can drive with a licence and an International Driving Permit (IDP). Get your IDP before you travel. If you live in South Korea or are staying more than 90 days, get a local licence. ● South Korea has one of the highest rates of traffic deaths for a developed country, especially for pedestrians. If you're walking, look out for motorcyclists, even on footpaths. Don't expect traffic to stop at pedestrian crossings. ● Always insist the driver uses the meter. International taxi services may have English-speaking drivers. ● Public transportation in and between major urban areas is good. Most major transportation systems have signs in English. ● Ferry services operate between most large coastal cities and other domestic and international ports. Safety standards have improved since the Sewol ferry disaster.

Taiwan



Threat Level
Exercise normal safety precautions.

Latitude / Longitude
23.697810, 120.960515

GPS Position
23° 41' 52.116" N
120° 57' 37.854" E

Crime	● Protests happen sometimes. They're usually peaceful but can turn violent. Avoid large public gatherings. ● Crime rates are low, including for petty crime. Taxi drivers have sometimes assaulted passengers. However, taxis are usually safe. Use radio taxis, or arrange taxis online or through your hotel. ● Extortion scams occur. These include minor car accidents and claims of sexual assault at nightclubs. Report suspicious behaviour.
Laws	● Don't use or carry illegal drugs, including illegal prescription medication. Penalties for drug offences are severe. They include the death penalty, life in prison, long jail terms and heavy fines. ● Taiwan recognises dual nationality. Taiwanese males older than 18 years must do military service. Some exemptions are available to overseas residents. If you're not exempt, you may have to serve when you arrive.
Health Risks	● Some prescription medications are illegal in Taiwan. Authorities may jail or fine you if you have them. Before you travel, check Taiwan Customs for limits and documents you'll need. ● Dengue occurs, especially in the tropical southern and central regions. Japanese encephalitis is also a risk. Ensure your accommodation is insect-proof. Get vaccinated against Japanese encephalitis before you travel. ● Cases of Zika virus were reported in 2016. If you're pregnant, discuss your travel plans with your doctor. ● Hand, foot and mouth disease is common. It mostly affects children younger than 10, but adult cases occur, particularly in young adults. Wash your hands thoroughly and often. ● Waterborne, foodborne and other infectious diseases are common. Drink only boiled or bottled water. Avoid ice cubes. ● The standard of public hospitals in major cities is good. Wait times are often long. Some hospitals have English-speaking private clinics, but these can be expensive. You may have to pay up-front, even for emergency care. Ensure your travel insurance covers all medical costs.
Weather	● The typhoon season is May to November. Flooding and mudslides are common. Businesses and government offices close on 'typhoon days'. Follow local advice to prepare for a disaster. Listen to FM100.7 for English-language updates. ● Earthquakes happen often. Get advice on being in an earthquake-prone region. Tsunamis also happen. Know the tsunami warning signs and move to high ground straight away. Don't wait for official alerts.
Other	● You don't need a tourist or business visa to stay up to 90 days. Ensure you have a return or onward ticket and your passport is valid for at least 6 months. In other situations, you'll need a visa. Contact the Taipei Economic and Cultural Office for details. ● The local currency is the New Taiwan Dollar (NTD). ATMs are available in cities and provincial centres. Hotels, restaurants and higher-end shops usually accept credit cards. Be aware of card skimming. ● You can drive for up to 30 days with a driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. You need a local or international motorcycle licence to hire a motorbike. ● Although roads and vehicles are well-maintained, scotters and motorcycles often weave in and out of traffic and vehicles might not stop at pedestrian crossings. Look before stepping onto the road. ● Taiwan has well-developed rail and bus services. Petty crime happens, so take care of your belongings.

3 South Asia

Afghanistan

Threat Level
Extreme threat to personal safety, recommended not to travel here.

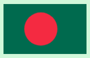
Latitude / Longitude
33.939110, 67.709953

GPS Position
33° 56' 20.796" N
67° 42' 35.8308" E

Crime	● Afghanistan is extremely dangerous. If you travel to or stay in Afghanistan despite our strong advice, consult a reputable security company. Arrange personal security measures, including at your accommodation. Monitor local information sources and have a plan in place if you need to leave quickly. ● Avoid large public gatherings. If you're caught in an affected area, find a safe place and stay indoors. ● The frequency of attacks in Kabul, and across the country, has continued to increase with many killed and wounded. There are credible reports of imminent attacks. Large scale attacks in July, August and September 2019 resulted in hundreds killed and injured in each instance. ● Kidnapping is a serious and ongoing threat. Terrorists and criminal groups target foreigners. Get professional security advice. ● Aid workers are not safe from the threat of terrorism. Attacks continue to target both local and foreign NGO operations across the country and within Kabul. This includes through both politically motivated and kidnap-for-ransom abductions.
Laws	● De facto relationships, close contact between unmarried men and women, adultery and same-sex relations are illegal. Penalties are severe. ● Preaching a religion other than Islam and renouncing Islam is illegal. ● Be careful when taking photos. It's illegal to photograph checkpoints, government buildings, palaces, and security or military sites. Ask permission before taking photos of people. ● Afghanistan has strict rules that control importing alcohol and pork products. ● There are strong codes of dress and behaviour. Avoid public displays of affection. Wear clothing that covers the legs. Cover your arms and consider wearing a headscarf if you're a woman. ● During the Islamic holy month of Ramadan, avoid eating, drinking and smoking in public.
Health Risks	● Get comprehensive travel insurance before you leave. Your policy needs to cover all overseas medical costs, including medical evacuation. You'll probably need a special insurance policy for high-risk destinations. ● Medical facilities are limited. Sanitation and hygiene are poor. Some private medical clinics in Kabul are fine for routine health issues. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this. ● Malaria outbreaks, including chloroquine-resistant strains, can occur between April and September. Consider taking anti-malarial medication. ● Other insect-borne diseases, including leishmaniasis, are common. Ensure your accommodation is insect-proof. Use insect repellent. ● Waterborne, foodborne, parasitic and other infectious diseases are widespread. These include typhoid, hepatitis, measles and tuberculosis. Drink only boiled or bottled water with sealed lids. Avoid raw or undercooked food. ● Polio is widespread. Before you travel, make sure your polio vaccinations are up to date. Carry proof of vaccination if you're staying longer than 4 weeks.
Weather	● Flooding and landslides can occur between March and June. Avalanches and heavy snowfalls occur in some mountain areas. Follow the advice of local officials.

Other	• Visa conditions can change at short notice. Contact your nearest embassy of Afghanistan for details. If you're planning to travel via Pakistan, get a multiple-entry visa for Pakistan. Get entry and exit stamps in your passport at the border. If you don't, you could find it difficult to leave Afghanistan. • The local currency is the Afghani (AFN). Many places also accept US dollars. There are very few ATMs in Kabul. Few places accept credit cards and it is unlikely Traveller's Cheques will be accepted. • If you're travelling by road, only travel in secure transport using reputable local drivers and guides. Have evacuation plans. Unexploded weapons and landmines are dangers on and near roads. Don't leave sealed roads. • Kabul International Airport may close at short notice. The roads leading to the Airport are a potential terror attack target. Check with your airline before going to the airport.

Bangladesh



Threat Level
High threat level to personal safety, take a range of extra precautions here.

Latitude / Longitude
23.684994, 90.356331

GPS Position
23° 41' 5.9784'' N
90° 21' 22.7916'' E

Crime	• Exercise a high degree of caution in Bangladesh. Pay close attention to your personal security at all times. Monitor media for the latest information about safety and security risks. • Avoid protests, demonstrations and rallies, as these can turn violent without warning. • Random attacks with small improvised explosive devices happen from time to time. Avoid large public gatherings. Be alert around nationally significant dates. • We continue to receive information indicating terrorists may be planning attacks in Bangladesh. Attacks could occur anywhere, anytime. Bangladesh authorities continue to arrest terrorists in the advanced stages of attack planning. Be particularly vigilant at places of worship and during significant national holidays. • Political violence and kidnapping happen in the Chittagong Hill Tracts region. Reconsider your need to travel to this area. • Violence and robberies are common across Bangladesh. Petty crime, such as pickpocketing and snatch-and-grab attacks, is also common. Thieves target rickshaws, taxis and motorised rickshaws. Keep your doors, windows and gates locked, even if you have a security guard. Keep your car doors locked and windows up, even when moving.
Laws	• Don't use or carry illegal drugs. Severe penalties include mandatory sentences for small amounts and the death penalty. Hookah or smoking pipes are common and may be spiked with illegal drugs. Avoid using these pipes. • Bangladesh has the death penalty for some serious crimes. Corporal punishment (whipping) is a possible sentence. • Local authorities can demand to see your ID. Always carry a copy of your passport, even if you're a dual national. • The Bangladeshi Government may consider you a Bangladeshi citizen if you or your parents are of Bangladeshi origin, even if you've never held a Bangladeshi passport. It's illegal for Bangladeshi citizens to purchase, carry, possess, transport or consume alcohol without a permit. • Dress and behaviour standards are conservative. Don't wear shorts. If you're a woman, wear a scarf around your neck and shoulders. Avoid public displays of affection. • During Ramadan, Muslims must not eat, drink and smoke between sunrise and sunset. Authorities can detain you if you eat, drink or smoke in public during this time. They may even deport you.
Health Risks	• Insect-borne diseases occur, including chikungunya, malaria, dengue, Japanese encephalitis and Zika virus. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against Japanese encephalitis before you travel. Consider taking anti-malarial medication. If you're pregnant, discuss your travel plans with your doctor. • HIV/AIDS is a risk. Take precautions if you engage in high-risk activities. • Waterborne, foodborne and other infectious diseases include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. • Outbreaks of coetaneous anthrax have occurred in the past and may occur again. Avoid handling raw meat. Only eat fully cooked beef from reliable suppliers. • Avoid temporary black henna tattoos. They often contain a dye that can cause serious skin reactions. • The standard of medical facilities is poor. Medical facilities outside Dhaka are very limited. You'll probably need to pay up-front. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	• The monsoon season is from June to September. The cyclone seasons are from May to June and from October to November. During these times, flooding and landslides can happen with little warning. They can disrupt essential services. Be prepared for major emergencies. Keep an emergency kit on hand.
Other	• You need a visa to enter Bangladesh. Arrange it before you travel. Contact the Bangladesh High Commission for details. • If you're working, make sure you get either an Income Tax Clearance Certificate or an Income Tax Exemption Certificate. You'll need to show it each time you leave the country. • The local currency is the Bangladesh Taka (BDT). You can use credit cards and ATM facilities in major centres. Be aware of credit card fraud. Check your statements often. • Driving can be dangerous due to chaotic traffic, road closures and severe weather. Don't drive at night if possible. • Don't use public transport, taxis or ride-sharing service due to safety issues. Be careful if travelling on boats. Boats may be overloaded and not have life-saving equipment. Fatal accidents are common. Piracy occurs in coastal areas. • Hazrat Shahjalal International Airport has extra security measures. Leave enough time to clear checkpoints.

Bhutan

Threat Level
Exercise normal safety precautions.

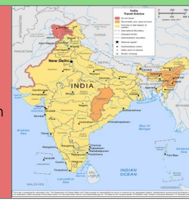
Latitude / Longitude
27.514162, 90.433601

GPS Position
27° 30' 50.9832'' N
90° 26' 0.9636'' E

Crime	• Bhutan's crime rate is low. Violent crime is rare. Petty crime happens, such as burglary, theft, pickpocketing and bag snatching. Look after your belongings. Use licensed tour operators. • Rebels are active in southern border regions. Armed groups could clash with Bhutanese and Indian security forces or kidnap foreigners. Exercise a high degree of caution in the border regions with India and China.
Laws	• Don't use or carry illegal drugs. Severe penalties include long jail terms and heavy fines. • It's illegal to sell and buy tobacco products. You can take a limited amount of tobacco products for personal use. You'll pay a sales tax and customs duty. Keep the receipt. • Same-sex sexual activity is illegal, but prosecutions are rare. Avoid public displays of affection. • Standards of dress and behaviour are conservative, especially at religious sites. Dress modestly. Long pants are best for men and long skirts for women.
Health Risks	• Altitude sickness is a risk above 2500m. It can be life-threatening. It can affect anyone, even people who are physically fit. If you plan to travel to high-altitude areas, discuss your travel plans with a doctor. Ensure your travel insurance covers medical evacuation from altitude. • Outbreaks of dengue and malaria occur. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. • Hospital and medical facilities are fine for routine procedures. If you're seriously ill or injured, you may need medical evacuation. Make sure your travel insurance covers this.
Weather	• Flooding and landslides happen. In the monsoon season from June to September, transport and services can be affected. Check with your tour operator for possible disruptions. Earthquakes can happen at any time. Follow the advice of local officials.

Bhutan	
Other	● You need a visa to visit Bhutan. Government-licensed tour operators must arrange this. The Tourism Council of Bhutan publishes a list of licensed tour operators. You can't travel by yourself unless you have a long-term visa. ● The official currency is the Bhutanese Ngultrum (BTN). The Indian Rupee (INR) is also legal tender. ATMs are common in towns. EFTPOS is available, including at most hotels. Major hotels accept credit cards. ● You're not allowed to trek alone. Use reputable trekking companies with professional guides. Ensure your travel insurance covers emergency evacuation. ● You have to live in Bhutan for at least 1 month to get your driver's licence endorsed. Travellers usually use organised tours and local drivers. ● Flights to and from Paro Airport only occur in daylight hours. They depend on good weather conditions. Contact your airline or tour operator to find out if your travel has been disrupted.

India

	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** North-eastern states (Assam (except Guwahati), Nagaland and Manipur) and Chhattisgarh and the border areas of neighbouring states, Cities of Jammu and Srinagar, reconsider your need to travel.	**Threat Level** State of Jammu and Kashmir (except Ladakh region, Jammu and Srinagar) and India-Pakistan border (except Atari crossing), do not travel.			**Latitude / Longitude** 20.593684, 78.96288 **GPS Position** 20° 35' 37.2624'' N 78° 57' 46.368'' E

India	
Crime	● Terrorist attacks could occur anywhere at any time. They may target foreigners and popular tourist areas. Avoid possible targets. Take official warnings seriously. ● Violent protests sometimes occur throughout India. Large crowds at religious ceremonies and gatherings can also be dangerous. People have been killed in stampedes. Avoid large public gatherings. ● Women may be verbally and physically harassed or sexually assaulted. Avoid travelling alone, even in major cities and tourist sites. ● Travellers have been robbed and assaulted after consuming spiked drinks or food. Don't leave your food or drinks unattended. Don't accept food or drinks from strangers. ● Petty theft is common in crowded areas such as markets and on public transport. Thieves on motorbikes snatch bags and jewellery. Carry only what you need. Pay close attention to your belongings. ● Scams are common. These can involve fake tour guides, ATM and credit card skimming, and fraudulent access to government services. If you're a scam victim, report it to police to get an official report for your travel insurer.
Laws	● Always carry your passport and ensure you have a valid visa. It's illegal not to. Conducting missionary work without a proper visa is also illegal. ● Don't use or carry illegal drugs. Penalties for drug offences include mandatory sentences and the death penalty. ● Check local alcohol laws before you visit. Laws on the legal drinking age and alcohol purchase vary between states. It's illegal to fly drones and other unmanned aircraft without official permission. Contact local police for advice. It's illegal to carry or export antiquities without a permit. Contact your nearest Indian embassy or consulate for advice. It's illegal to photograph airports, military sites and dams. Some places of worship also prohibit photography. ● Cows roam freely in India. It's illegal to deliberately maim or kill them. In some states, the penalty is up to 5 years in jail. ● India has strict dress and behaviour codes, especially at religious sites. Physical contact between men and women in public might be considered inappropriate.
Health Risks	● Swine flu is widespread during winter. Talk to your doctor about flu shots before you travel. ● Malaria is a risk in many parts of India, including major cities. Dengue is widespread during monsoon season. Zika virus cases are increasing in Rajasthan and surrounding states. Other insect-borne diseases include Japanese encephalitis, chikungunya and filariasis. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated before you travel. If you're pregnant, discuss your travel plans with your doctor. ● HIV/AIDS is widespread. Take precautions if you engage in high-risk activities. ● Waterborne, foodborne, parasitic and other infectious diseases are very common. These include cholera, typhoid and hepatitis. Drink only treated or bottled water. Avoid raw or undercooked food. ● Air pollution can reach dangerous levels, especially in winter. It can disrupt transport and cause breathing problems. If you have an existing health condition, discuss your travel plans with a doctor. ● Foreigners travelling for medical tourism at discount or uncertified clinics have had life-threatening complications. Research and choose your medical providers carefully.
Weather	● Severe weather is common. This includes heatwaves and dust storms in summer, and flooding during the monsoon season. Check with your tour operator for possible disruptions.
Other	● You need a visa to enter India. Arrange it before you travel.You can only enter on an e-Visa at certain airports. ● If you're planning to stay more than 180 days, register within 14 days of arrival. If you don't, you could be fined or jailed. ● The local currency is the Indian Rupee (INR). ATMs that accept international cards are common in major cities and towns. They're hard to find in rural areas and may have cash shortages. Beware of counterfeit currency. ● Touts at airports, bus stations and train stations may pressure you to buy tour tickets. They may overcharge you. Always check the operator's credentials and safety standards before you book. ● You may need permission from Indian authorities to visit some areas, particularly in the north-east. Apply at least 4 weeks in advance. ● Use a pre-paid taxi service when you arrive at the airport. Use taxis booked from hotels or taxi stands. Don't hail taxis on the street or use private vehicles as taxis.

Maldives

	**Threat Level** Exercise normal safety precautions.	**Threat Level** Malé Island, exercise a high degree of caution.						**Latitude / Longitude** 3.202778, 73.22068 **GPS Position** 3° 12' 10.0008'' N 73° 13' 14.448'' E

Maldives	
Crime	● Malé has frequent protests and demonstrations. Avoid affected areas. ● Drug-related crime and gang-related violence occurs in urban areas, including Malé. Petty theft happens on beaches and in hotel rooms. Leave your valuables in a secure location. Monitor local media to avoid trouble spots.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and can include life imprisonment. ● Serious crimes, such as murder, can attract the death penalty. ● It's illegal to import or drink alcohol unless you're on a resort island. ● It's illegal to publicly observe any religion other than Islam. Don't import pornography or pork products. ● The Maldives doesn't recognise dual citizenship. We may only be able to give limited consular help if you're arrested or detained. ● Standards of dress and behaviour are conservative in Male and non-resort islands. Dress modestly in Malé and non-resort islands. Take care not to offend. Same-sex relationships are against the law.
Health Risks	● Insect-borne diseases are a risk, including dengue, Zika virus and chikungunya. Use insect repellent. ● Hepatitis and rabies (including from dogs) are also a risk. Boil drinking water or drink bottled water. ● Medical services, including emergency services and decompression chambers, are limited. It can take several hours to reach medical facilities. If you become ill or injured, you'll need to be evacuated. This can be very expensive.
Weather	● The monsoon season is from mid-May to November. Strong winds, rough seas and torrential rain can occur. Tsunamis can also occur. Keep in contact with friends and family. Follow the advice of local authorities. ● The sea around the Maldives can have strong tidal currents. Take appropriate precautions.
Other	● You can get a 30-day tourist visa on arrival, but conditions apply. In other situations, you'll need to get a visa before you travel. ● The local currency is the Maldivian Rufiyaa (MVR). ● You can change money and use ATMs in Malé and many larger islands. Take cash if you're travelling to other areas. ● If you ride a motorbike, always wear a helmet.

Nepal

NP

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
28.394857, 84.124008

GPS Position
28° 23' 41.4852'' N
84° 7' 26.4288'' E

Crime

- Small-scale explosive attacks occur throughout Nepal, including in Kathmandu. In November 2019, there have been a number of small-scale explosions in Pokhara. Attacks increase during periods of political tension, such as elections. Don't visit government buildings during political unrest.
- Political protests and strikes sometimes happen. Strikes can disrupt essential services. During strikes, make sure you have enough water, food, batteries, cash and medication.
- Pickpocketing and petty theft is common. Bag-snatching and 'snatch-and-grab' attacks by thieves on motorbikes occur. Keep your belongings close. Don't travel alone, especially if you're female.
- Travellers have been victims of armed robberies and assaults, including sexual assaults. Drink spiking often occurs before sexual assault. Never accept food, drinks, gum or cigarettes from strangers. Don't leave your food or drinks unattended.

Laws

- Don't use or carry illegal drugs. You may be offered illegal drugs in tourist areas. Penalties for drug offences are severe, including for possessing small amounts.
- Be careful when taking photos. It's illegal to photograph army barracks, checkpoints and military personnel.
- It's illegal to convert people from their religion. Punishment can include jail. If you're suspected of trying to convert people, you will likely be deported and banned from re-entering Nepal.
- Same-sex relations are legal. However, society is conservative. LGBTI travellers have reported harassment and discrimination. Avoid public displays of affection.
- Nepal doesn't recognise dual nationality.
- Tourist areas of Kathmandu and Pokhara have relatively relaxed dress codes. Other parts of the country are more conservative. Dress modestly.

Health Risks

- Some towns, including Kathmandu, experience high levels of seasonal smog and pollution. Get medical advice if you have breathing difficulties.
- Altitude sickness is a risk above 2500m. It can be life-threatening. It can affect anyone, even people who are physically fit. Discuss your plans with your doctor. Ensure your travel insurance covers medical evacuation from altitude.
- Malaria is a risk in the Terai (plains) and Hill districts and Chitwan National Park. Consider taking anti-malarial medicine for these areas. Other mosquito-borne diseases occur, including in Kathmandu. These include dengue and Japanese encephalitis. Ensure your accommodation is insect-proof. Get vaccinated against Japanese encephalitis before you travel.
- HIV/AIDS is common. Take steps to reduce your risk of exposure to the virus. Waterborne, foodborne, parasitic and other infectious diseases are common. These include typhoid, cholera and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food.
- Rabies is common. It's fatal without immediate treatment. Avoid dogs, monkeys and other mammals. Get medical help straight away if an animal bites or scratches you.
- Medical facilities in Nepal are very limited, especially outside Kathmandu. In Kathmandu, treatment at high-standard clinics is expensive. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.

Weather

- Nepal experiences earthquakes, landslides, floods and severe weather. Be prepared for a major emergency. Keep an emergency kit that includes first aid supplies and bottled water.

Other

- You need a visa to enter Nepal. You can get a tourist visa when you arrive. The maximum stay is 150 days per calendar year. In other situations, get a visa before you travel. Contact an embassy or consulate of Nepal for details. You need a valid visa in your passport to leave Nepal.
- The local currency is the Nepalese Rupee (NPR). Exchange foreign currency for NPR at banks and exchange bureaus in major centres. Major hotels and commercial centres accept credit cards. ATMs are uncommon in remote areas. Carry enough cash to cover your needs.
- Some trekking companies or guides may offer condensed treks. These may not give you enough time to get used to high altitude. Research trekking conditions, permits and routes. Hire a company with a good reputation and professional guides. Don't trek alone.
- If you become ill while trekking, confirm if your insurance covers evacuation costs. Do this yourself if possible, before you agree to a helicopter evacuation. Sometimes guides pressure trekkers into taking expensive helicopter evacuations.
- Only use registered taxis and authorised limousines. Taxi drivers often refuse to use meters and overcharge travellers. Negotiate the fare with the driver before you go. Avoid public buses and vans. They're overcrowded and poorly maintained. Intercity buses often have serious accidents. Women may be harassed on public buses.
- Domestic flight cancellations and delays are common, especially during tourist seasons and in bad weather. The monsoon season is from June to September. Always check flights with your airline or tour operator. Due to safety concerns, the European Union has banned all Nepali airlines from flying in its airspace.

Pakistan

Threat Level
High threat level to personal safety, take a range of extra precautions here.

Threat Level
Balochistan, Federally-Administered Tribal Areas, Khyber-Pakhtunkhwa (excluding Chitral district), Border areas with Afghanistan and India (excluding Lahore, Wagah, Kasur, Narowal and Sialkot), do not travel.

Latitude / Longitude
30.375321, 69.345116

GPS Position
30° 22' 31.1556'' N
69° 20' 42.4176'' E

Crime

- Many terrorist groups hostile to Western interests operate in Pakistan. Don't travel to Balochistan or Khyber-Pakhtunkhwa (except Chitral district) where the risk of attacks is highest. If you travel to other parts of Pakistan, be cautious. Avoid crowded places and possible targets. Always have an exit plan.
- Violent crime, including armed robbery, assault, carjacking and kidnapping, occurs across Pakistan. The risk of kidnapping is very high in Balochistan and Khyber-Pakhtunkhwa. If you travel to these areas, get professional security advice. If you must go to Chitral district or Gilgit Baltistan, travel by commercial aircraft and not by road.
- Political and religious protests are common and can turn violent. Political, sectarian and gang violence occurs often in Karachi. Avoid large public gatherings. If you're caught in a rally, find a safe place and stay indoors.
- The Afghanistan border area is volatile. Foreigners must not travel within 50km of the Afghanistan border in Gilgit Baltistan or within 15km of the Kashmir Line of Control or the entire border with India except at official crossings. If you're in an area close to the border, consider leaving.
- Firing guns into the air in celebration is illegal but common. People have died as a result. Be careful of celebratory gunfire, especially around major holidays, celebrations and after sporting victories.

Laws

- Don't use or carry illegal drugs. Penalties for drug offences are severe. They include the death penalty, large fines and long prison sentences.
- Corporal punishment applies for some offences, including robbery, public drunkenness, and drinking alcohol if you're Muslim.
- Same-sex relations are illegal. It's also illegal for unmarried heterosexual couples to live together.
- Be aware of religious sensitivities. It's illegal to import alcohol or pork products. It's illegal to try to convert a Muslim or to encourage them to abandon their religion. Blasphemy can attract the death penalty.
- Strong Islamic codes of dress and behaviour exist in Pakistan. Don't wear shorts or short-sleeved clothes. Avoid physical contact between men and women in public. Women may be harassed, especially if they're alone.
- People of Pakistani origin have sometimes had trouble leaving Pakistan with their children. This occurs when one parent refuses to let the children return to another country and keeps their passports. If you think this could happen to you, get legal advice before leaving.

Health Risks

- Pakistan is experiencing an outbreak of extensively drug-resistant typhoid fever. Before you travel, ask your doctor about getting vaccinated. Avoid anyone who is or has recently been sick.
- Insect-borne diseases including malaria, dengue, Japanese encephalitis and Crimean-Congo haemorrhagic fever occur. Drug-resistant strains of malaria have been reported. Consider taking anti-malarial medication. Ensure your accommodation is insect-proof. Use insect repellent. Consider getting vaccinated against Japanese encephalitis.
- HIV/AIDS is common. Take precautions if you engage in high-risk activities.
- Polio is endemic. Ensure your vaccinations are up to date. If you're staying longer than 4 weeks, carry evidence of your polio vaccination.
- Waterborne, foodborne, parasitic and other infectious diseases are prevalent. They include hepatitis, tuberculosis and measles. Drink only boiled or bottled water listed as 'safe' by the Pakistan Council of Research in Water Resources. Avoid raw or undercooked food.
- Facilities at some clinics and hospitals in major cities are close to Western standards. In most towns, and in rural and remote areas, medical facilities are extremely limited. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.

Weather	• Earthquakes are common. Flooding, landslides and tsunamis can occur. Essential services may be disrupted and the risk of disease can increase during the monsoon season (July to September). Follow the advice of local officials.
Other	• Carry your yellow fever vaccination certificate if you're coming from a country with a risk of yellow fever. You may need it to enter Pakistan. • Some provinces and cities require you to register with local authorities when you arrive. Check and follow local registration procedures. • The local currency is the Pakistan Rupee (PKR). US dollars and euros are the easiest currency to convert. Pakistan is a mostly cash-based economy. Have enough cash to meet your needs. • Don't use taxis or public transport due to safety and security concerns. Never hail a taxi on the street. Use transport services from accredited tour operators and hotels.

Sri Lanka

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
7.873054, 80.771797

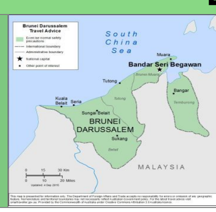
GPS Position
7° 52' 22.9944'' N
80° 46' 18.4692'' E

Crime	• Terrorism is a threat in Sri Lanka. Attacks could happen anywhere at any time. Terrorists may target tourist areas. Avoid crowds. Follow the advice of local officials. • Security has increased across the country following the 21 April 2019 terrorist attacks. Always carry travel and identification documents. Allow additional time to clear security checks, especially at airports. • There are marked and unmarked minefields and unexploded weapons in the Northern Province and parts of the Eastern Province. Stay on main roads. Pay close attention to landmine warning signs. • Violent crime, including sexual assault, harassment and robbery, occurs. If you're a woman travelling alone, arrange travel through a reputable company. • Scams and fraud are common, including credit card fraud, overcharging and fake goods. Be alert to fake goods, especially jewellery and gems. Check your bank statements often.
Laws	• Always carry photo identification. If you don't, officials may detain you. It's illegal to cover your face in a way that prevents identification. • The legal drinking age is 21. It is illegal to drink alcohol or smoke in public. • Be careful when taking photos. You must not photograph or video inside High-Security Zones (HSZs). These include military sites, some government buildings and official residences. HSZs aren't always marked. • Respect the local culture. It's illegal to mistreat Buddhist images. This includes posing for photos with Buddha statues, or wearing tattoos, clothing or jewellery associated with Buddhism. Get local advice before photographing places of worship. • Sri Lanka has conservative dress and behaviour standards. Take care not to offend.
Health Risks	• Outbreaks of dengue are common. Use mosquito repellent. If you have a fever, get medical help. • Other insect-borne diseases include chikungunya, Japanese encephalitis and filariasis. Use mosquito and insect repellent. Get vaccinated for Japanese encephalitis before you travel. • Foodborne, waterborne and other infectious diseases include typhoid, hepatitis, leptospirosis. Drink only boiled or bottled water. Rabies is present in dogs, monkeys and bats. • Medical services in Colombo are below first world standards. Outside Colombo, they're limited. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	• Flooding and landslides occur during the monsoon season. This is December to March in the north-east and May to October in the south-west. Be prepared to change your travel plans.
Other	• You need an Electronic Travel Authority (ETA) to travel to Sri Lanka. Select the correct visa category for your travel. If you breach your visa conditions, authorities could detain or deport you. • Carry your yellow fever vaccination certificate if you're coming from a country with a risk of yellow fever. You'll need it to enter Sri Lanka. If you're coming from a country with cholera, you'll need to show you've been vaccinated. • The local currency is the Sri Lankan Rupee (LKR). Exchange dollars at the airport or commercial banks in major centres. Most major towns and cities have ATMs, but not all accept international cards. Hotels and major shops accept credit cards. • To drive in Sri Lanka, you need either an International Driving Permit (IDP) or a temporary Sri Lankan licence. Your IDP must be endorsed by the Automobile Association of Sri Lanka. Get your temporary licence from the Department of Motor Traffic in Colombo.

4 South East Asia

Brunei Darussalam

Threat Level
Exercise normal safety precautions.



Latitude / Longitude
4.535277, 114.727669

GPS Position
4° 32' 6.9972'' N
114° 43' 39.6084'' E

Crime	• Serious crime is rare in Brunei. Travellers are sometimes victims of petty crime such as theft and burglary. Keep your valuables secure. Lock your accommodation, even when you're in. • Civil unrest is rare, but all protests have the potential to turn violent. Avoid large public gatherings.
Laws	• Brunei is a Muslim country and has strict religious laws. These include laws around fasting during Ramadan, preaching other religions, and Muslim religious observance. Know and follow these laws. • Brunei's Sharia (Syariah) Penal Code took full effect in April 2019. It applies to everyone, including foreigners and non-Muslims. Some crimes, including blasphemy, sodomy and adultery attract the death penalty under sharia law. Understand the law before you travel. • Selling alcohol is against the law. Smoking is illegal in most public places. It's also illegal to import alcohol and tobacco products above legal limits. If you import alcohol, keep the paperwork to prove it's legal. Check with the Brunei Customs and Excise Department before brining alcohol or tobacco into to Brunei. • Don't use or carry illegal drugs. Some drug offences have mandatory death penalty sentences. Other penalties include long prison sentences or physical punishment.
Health Risks	• Smoke haze is usual from June to October, but can occur at any time of year. • Insect-borne diseases occur. Make sure your accommodation is insect-proof. Use insect repellent. Get vaccinated before you travel. • HIV/AIDS is a risk. Take precautions if you engage in high-risk activities. • Foodborne, waterborne and other infectious diseases include hepatitis, hand, foot and mouth disease (HFMD) and tuberculosis. Avoid raw and undercooked foods. • When red algae reaches dangerous levels, local authorities may issue Red Tide warnings. These include warnings about swimming in certain areas or eating certain types of seafood. Check local media for Red Tide alerts. • Brunei's public hospitals are of reasonable standard. Private hospitals are of a high standard. If you're seriously ill or injured, you may need medical evacuation to Singapore or Australia. Ensure your travel insurance covers this.
Weather	• Flooding and mudslides are common during the wet seasons (September to January and May to July). During a natural disaster, follow local officials' advice. Keep your passport in a secure, waterproof place.

Other	• Visa and other entry and exit conditions can change at short notice. Contact the nearest Brunei High Commission or Brunei Ministry of Foreign Affairs • The local currency is the Brunei Dollar (BND). You can also use Singapore dollars. You can use credit cards in some places. Exchange dollars in banks, hotels and authorised bureaus. • You can drive for up to a year with a driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. Get a local licence if you're staying longer than a year. • Only use registered taxis and authorised limousines arranged via your hotel, the Brunei International Airport or DART Taxi online.

Cambodia

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
12.565679, 104.990963

GPS Position
12° 33' 56.4444'' N
104° 59' 27.4668'' E

Crime	• 'Snatch-and-grab' crimes against travellers are common. Thieves often travel on motorbikes and target pedestrians or people in open taxis. Don't carry bags that are easy to steal. Walk away from the curb with your bag on the opposite side to the traffic. • Theft from hotel rooms and luggage in buses is common. Always keep an eye on your belongings. • Sexual assault occurs in tourist areas. Stick with people you trust in nightclubs, bars and taxis. • Many people in Cambodia own guns. Gun crime, violent disputes and shootouts are common. • Don't travel alone at night. At night, travel only in well-lit public areas. Use cars rather than motorcycle taxis or tuktuks. • Scams, credit card fraud and ATM fraud are common. Check for card-skimming devices before using ATMs. • Be wary of invitations from strangers. Never carry parcels or luggage for others. Check for card-skimming devices before using ATMs. • Protests can turn violent. Avoid large public gatherings. Officials may deport foreigners involved in protests.
Laws	• Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences, even for small amounts. • Understand and follow local laws. It's illegal to criticise or insult the King. Lying to police, public nudity, and possessing or producing pornography are illegal. • Child sex offences are punishable under Cambodian law. • Cambodian authorities enforce 'modesty' laws at religious sites, such as Angkor Wat. Wear clothing that covers your knees and shoulders. • Be careful when taking photos. Don't photograph people, including monks, without permission. Don't take photos near sensitive sites, such as military areas, transport hubs or government buildings.
Health Risks	• Take care buying medication in Cambodia. Local pharmacies may sell fake medication. Carry enough medication for your trip. • Don't drink homemade or unlabelled alcohol in Cambodia. It may contain harmful substances, particularly methanol. Get medical help if you have symptoms of methanol poisoning, including fatigue, headaches, nausea and vision problems. • Insect-borne diseases include dengue, Japanese encephalitis and malaria. Use insect repellent. Get vaccinated before you travel and ensure your accommodation is insect-proof. Consider taking anti-malarial medication. • Animals across Cambodia carry rabies. Rabies is fatal without immediate treatment. Get medical attention straight away if an animal scratches or bites you. • Outbreaks of hand, foot and mouth disease (HFMD) are common. It mainly affects children and young adults. Other foodborne, waterborne, parasitic and infectious diseases include hepatitis, tuberculosis and typhoid. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in fresh water. • Avoid elective and cosmetic surgery in Cambodia. Medical care doesn't meet international standards and can lead to life-threatening complications.
Weather	• Severe storms and flooding can occur during the wet season (July to November). These can disrupt services and travel, including on the Mekong River. Check with your tour operator for updates.
Other	• You need a visa to enter Cambodia. Tourists can apply for an e-visa online or get a tourist visa on arrival. These are valid for 30 days. For longer stays or other situations, get a visa through an embassy or consulate of Cambodia. Don't overstay your visa. This is a serious offence. Penalties include fines, prison sentences and deportation. • Be careful when visiting regions near the border with Thailand. Landmines and unexploded remnants of war are a risk. Stay on marked roads if you're travelling in the north and north-west. • The official currency is the Cambodian Riel (KHR). US dollars are also legal tender. You'll need US dollars for most purchases. Take enough US dollars for basic expenses. You may not be able to find ATMs or use credit cards outside tourist areas. • Check your travel insurance covers motorcycles. Under Cambodian law, you can ride a motorcycle up to 125cc engine capacity without a licence. For larger motorcycles, get a local licence. • Official metered taxis are generally safe and convenient. Before using a moto, tuktuk or rickshaw, agree on the fare or use a ride sharing app.

Indonesia

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Central Sulawesi, Papua and West Papua provinces, reconsider your need to travel.

Latitude / Longitude
-0.789275, 113.921327

GPS Position
0° 47' 21.39'' S
113° 55' 16.7772'' E

Crime	• There's a high risk of terrorist attack in Indonesia. Many have been killed and injured in past attacks. Be aware of dates and places that could be terrorist targets. • There has been increased tension, including demonstrations and violence, in towns in Papua and West Papua provinces since August 2019. • Petty and violent crime occur in Indonesia. Drinks may be spiked or mixed with toxic substances. Crimes involving taxis and taxi drivers occur. Solo women are at higher risk. Be alert in taxis, crowds, bars and nightclubs. • Legal disputes over real estate are common. Before entering into an agreement or providing financial details, do your research and get legal advice.
Laws	• Penalties for drug offences include heavy fines, long prison sentences and the death penalty. Police target tourist destinations. • The death penalty exists for many crimes in Indonesia. • Gambling is illegal. • Standards of dress and behaviour are conservative in many parts of Indonesia. Learn about local customs. Take care not to offend. • Aceh province upholds some aspects of sharia law. Sharia law applies to everyone, including travellers. Inform yourself about the laws. If in doubt, seek local advice.
Health Risks	• Some medications, including drugs for attention deficit hyperactivity disorder (ADHD), are illegal in Indonesia. Harsh penalties can apply even if you have a prescription. Make sure your medication is legal in Indonesia. • Polio, measles and rabies occur in Indonesia. Make sure your vaccinations are up to date. Avoid direct contact with animals, including dogs and monkeys. • Don't consume magic mushrooms. They're illegal and can make you seriously ill. • Zika virus, malaria and other insect-borne illnesses can occur. Protect yourself from mosquito bites. If you're pregnant, ask your doctor about the risk of Zika virus before you travel. • HIV/AIDS is a risk for travellers, particularly in Bali. Take steps to reduce your risk of exposure to the virus.
Weather	• Natural disasters such as floods, earthquakes, volcanoes and tsunamis occur. Domestic and international flights can be disrupted. Follow the advice of local authorities. Monitor media for updates.

Other	● You can visit visa-free for up to 30 days or pay for a visa for up to 60 days. Apply for the right visa if you plan to stay longer. ● You may not be allowed into Indonesia if you have a criminal record. Contact an embassy or consulate of Indonesia before you travel. ● If you're staying in a private residence, not a hotel, register when you arrive with the local Rukun Tetangga Office and police. ● You need a permit to travel to some areas of Papua and West Papua. ● Motorcycle accidents have killed and injured many. If you hire a motorbike, make sure your insurance policy covers you. Always wear a helmet. ● Travel by ferry or boat can be dangerous. Make sure any boat you board has appropriate safety equipment and life jackets.

Laos

Threat Level Exercise normal safety precautions.	**Threat Level** Travel in Xaisomboun Province, east of Vang Vieng, reconsider your need to travel.			**Latitude / Longitude** 19.856270, 102.495496 **GPS Position** 19° 51' 22.572" N 102° 29' 43.7856" E

Crime	● Opportunistic violent crime, such as robbery, occurs occasionally in urban areas. Muggings and sexual assaults are reported. Pay attention to your personal security, especially at night. ● Petty crime, such as theft and bag snatching, is common in tourist areas. Theft and violent crime increase in the lead-up to festivals, such as Lao New Year in April. Safeguard your belongings in crowded areas. ● Several fatal shootings and explosions have occurred in Xaisomboun province, east of Vang Vieng. Reconsider your need to travel there. ● Some restaurants sell food and drink containing potentially harmful drugs. Travellers have been assaulted after accepting spiked food or drinks. Some have died from drug-related incidents. Never accept food or drinks from strangers. Don't leave food or drinks unattended. ● Scams and fraud are common Some motorbike rental companies run scams that could cost you 1000s of dollars. Use a well-known hire company. ● Don't use your passport as a deposit or guarantee. Check for skimming machines before using ATMs and keep your credit card protected at all times. ● Protests and demonstrations are illegal in Laos. Avoid any protests, demonstrations or political activity.
Laws	● Don't use or carry illegal drugs. Severe penalties for drug offences include the death sentence. ● Intimate relationships between Lao citizens and foreigners who are not married are illegal. This includes sexual relationships and living together. Marriages between Lao citizens and foreigners must be pre-approved. If you don't register a relationship, authorities could fine or jail you. ● Be careful when taking photos. It's illegal to photograph or visit military sites. ● Preaching religion without permission, including giving out religious material, is illegal. It's also illegal to visit temples or cultural sites after 10.30pm, and to publish material or speak against Laos. ● Don't camp in public spaces, along riverbanks or near forests. Public nudity is also illegal. ● Laos doesn't recognise dual nationality.
Health Risks	● Malaria is a risk in rural areas. Dengue is a risk everywhere in Laos, especially in the wet season from May to November. Other insect-borne diseases include Zika virus and Japanese encephalitis. Take precautions and protect yourself from disease. ● Tropical storms, typhoons, flooding and landslides happen during the wet season from May to November. Follow the advice of local officials. ● HIV/AIDS is common. Take precautions if you engage in high-risk activities. ● Dogs throughout Laos carry rabies. Rabies is fatal if you don't get vaccinated or don't get medical treatment quickly. See a doctor straight away if an animal scratches or bites you. ● Common waterborne, foodborne and other infectious diseases include cholera, hepatitis and tuberculosis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities are extremely basic. Travel to medical services in Thailand if you can. If you're seriously ill or injured, you'll need medical evacuation to Thailand. Ensure your travel insurance covers this.
Weather	
Other	● You need a visa to enter Laos. You may be able to get a 30-day visa on arrival at Vientiane or Luang Prabang international airports. They're also available at some land border crossings. You can apply for these visas through the Lao government e-visa website. Lao immigration authorities will stop issuing on-arrival visas at a number of entry points from 31 December 2019. Apply for other visas from an embassy of Laos before you travel. ● The local currency is the Lao Kip (LAK). Only exchange money at official outlets. ATMs are available in major cities. High-end hotels and restaurants accept credit cards. ● Take extra care along the Mekong Riverbank in Vientiane. It's the border between Laos and Thailand, and a known smuggling route. If you're in the area after 10.30pm, authorities could fine, question, arrest or detain you. ● Many parts of Laos have unexploded bombs. High-risk areas include Xieng Khouang province and the Lao-Vietnamese border areas along the Ho Chi Minh Trail. Always stay on established walking paths and roads. Don't touch unknown metal objects. ● You can drive in Laos with a driver's licence and an International Driving Permit (IDP). Road travel in Laos can be dangerous. This includes travelling by long-distance bus. The number of road accidents and deaths is increasing each year. Avoid driving at night if you can, especially on rural roads. ● Boat travel can be dangerous. Boats travelling on the Mekong River in the 'Golden Triangle' area have been robbed and shot at. 'Fast boats' can be dangerous due to excessive speed and natural hazards. Wear a life jacket, even if others don't.

Malaysia

Threat Level Exercise normal safety precautions.	**Threat Level** Coastal region of eastern Sabah including nearby islands and dive sites, reconsider your need to travel.		**Latitude / Longitude** 4.210484, 101.975766 **GPS Position** 4° 12' 37.7424" N 101° 58' 32.7576" E

Crime	● There's an ongoing threat of terrorism, including in Kuala Lumpur and other major cities. Be alert to possible threats, especially in public places. Take official warnings seriously. ● There's a high threat of kidnapping in the coastal areas of eastern Sabah. There have been a number of attempted and successful kidnappings. This includes islands, dive sites and tourist facilities. The risk increases on the water and waterfront after dark. If you travel to these areas, get professional security advice. Obey all local governments' curfews. ● Petty crime is common. Bag-snatching including by thieves on motorbikes happens often. When walking hold your bag on the opposite side to the traffic. Safeguard your belongings, especially in shopping centres, at the airport and on trains. Credit card fraud is common. Always keep your credit card in sight when paying for purchases. ● Drink spiking can occur, even at reputable places. Never accept food, drinks, cigarettes or gum from strangers. Don't leave your food or drinks unattended. ● Taxi drivers have assaulted travellers, especially in downtown Kuala Lumpur. Book taxis by phone at a shopping centre taxi desk. Don't hail them on the street. Check the driver's licence details. Sit in the back seat. ● Piracy in South-East Asian waters is an ongoing problem. Reconsider your need to travel by boat in the southern Sulu Sea. If you travel in the region by boat check the International Maritime Bureau's piracy reports. Arrange personal security measures.
Laws	● Don't use, carry or traffic illegal drugs. Punishments include the death penalty. ● It's unclear if surrogacy is legal under Malaysian civil law and what conditions apply. Get legal advice before arranging a surrogacy. ● Malaysia is a multicultural but mostly Islamic country. Many areas have conservative standards of dress and behaviour. This includes at religious sites. Get advice on local customs. ● Malaysia enforces some aspects of sharia law. Kelantan and Terengganu states are stricter than others. These laws apply to all Muslims, including visitors. Research laws that apply to you before you travel. ● Same-sex relations are illegal for both men and women. Punishment can include whipping and up to 20 years in jail. ● It's illegal to drive after drinking any amount of alcohol. Authorities strictly enforce these laws. ● Malaysia doesn't recognise dual nationality. If Malaysian authorities find out you're a dual citizen, you may need to renounce one of your citizenships immediately.

Health Risks	● Strict rules control the importation of prescription and non-prescription medication. If you plan to bring medication, check if it's legal in Malaysia. ● Smoke haze often happens from June to October, but it can happen at any time. Limit outdoor activity when haze levels are high. ● Dengue is common, including in major urban areas. Zika virus is also a risk. If you're pregnant, discuss your travel plans with your doctor. ● Malaria is a risk in rural areas. It's less common in urban and coastal areas. Consider taking anti-malarial medication. ● Other insect-borne diseases include chikungunya, filariasis and Japanese encephalitis. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against Japanese encephalitis before you travel. ● Rabies is present in Malaysia. The most recent cases were in Sarawak. It's fatal without immediate treatment. Avoid dogs, monkeys and other mammals. Get medical help straight away if an animal bites or scratches you. ● Waterborne, foodborne, parasitic and other infectious diseases are common. These include hepatitis, tuberculosis, typhoid and cholera. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Private hospitals in major cities are of an international standard. You'll need to pay up-front at all hospitals. Services are more limited in rural areas. ● Medical tourism, including for cosmetic surgery, is common. Surgery at discount or uncertified clinics can lead to life-threatening complications. Research and choose medical service providers carefully. Check your travel insurance covers complications from surgery.
Weather	
Other	● You might be able to get a 90-day tourist visa on arrival with a passport. In other situations, get a visa before you travel. Contact your nearest Malaysian embassy or high commission for details. ● Local authorities require you to always carry photo ID. You need your passport to travel between Peninsular Malaysia and East Malaysia (Sabah and Sarawak). ● The official currency is the Malaysian Ringgit (MYR). ATMs are widely available. ● You can drive in Malaysia with a driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. If you don't have an IDP, apply for a local licence. ● Ask taxi drivers to use the meter, or agree the fare, before you go. Take note of the driver's name, vehicle number and taxi company number. The taxi regulator has an English-language hotline for reporting problems. ● If you plan to travel by bus, choose a company with a good reputation. Avoid overnight travel. Long-distance tour buses have had fatal accidents, especially at night and in bad weather. ● Before booking tickets on a passenger ferry, speedboat or other vessel, check there's appropriate safety equipment available. Don't travel on any vessel that looks overloaded or in poor condition. Always wear a life jacket. ● National parks are protected areas. Some are home to ethnic minority groups. Respect the law and customs in these areas. If in doubt, seek local advice.

Myanmar

	**Threat Level** Cities of Yangon, Mandalay, Bagan, Nay Pyi Taw and Inle Lake, exercise normal safety precautions.	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Rakhine State (except resort areas at Ngapali Beach); Northern and Central Shan State, Kachin State, Areas bordering China, Laos, Thailand, Bangladesh and India, Paletwa township, southern Chin State, reconsider your need to travel.	**Threat Level** Townships of Maungdaw, Buthidaung and Rathedaung in northern Rakhine State, do not travel.		**Latitude / Longitude** 21.916221, 95.955974 **GPS Position** 21° 54' 58.3956'' N 95° 57' 21.5064'' E

Crime	● Protests happen often in Myanmar, including in tourist areas. Authorities sometimes respond with force. Political violence also happens, often on or around public holidays. Avoid large public gatherings. Don't take photos of rallies, the military or police. ● There are several active conflicts between armed groups and security forces. Some townships in Rakhine State, southern Chin State and northern Shan State are particularly dangerous. There's also been armed conflict in Kachin State and a risk of conflict in southern Rakhine State. ● Armed groups operate along Myanmar's borders with China, Thailand, Laos, Bangladesh and India. This includes at official border crossings. There are also unmarked landmines. If you choose to travel there despite the risks, carefully assess the security situation, including curfews and travel restrictions. Stick to main highways and urban areas. ● Myanmar has experienced terrorist attacks. Be alert to possible threats. Take official warnings seriously. ● Crime rates in Myanmar are lower than many nearby countries. But some crime, such as mugging, petty theft and burglary, occurs. Safeguard your belongings, especially in crowds. Check for skimming devices before you use credit cards.
Laws	● Don't use or carry illegal drugs. Punishments include the death penalty. Drinking alcohol in public places, such as parks, religious buildings or compounds, is illegal. ● Same-sex relations and adultery are illegal. ● Be careful when taking photos. It's illegal to photograph military personnel or sites. Myanmar has strict communications laws. Don't post negative comments about individuals or Myanmar on social media. ● Myanmar has strict religious laws. It's illegal to take religious materials in or out of the country without approval. Preaching or handing out religious material without approval is also illegal. There's also a law against 'insulting religion', including mistreating images of Buddha. Cover any Buddha tattoos. ● People in Myanmar are deeply respectful of their religious and cultural traditions. Don't wear shorts or sleeveless tops, especially at religious sites. Always remove your shoes and socks before entering a site. ● Customs rules are restrictive. Seek prior permission to import drones or radio equipment. Drones have been seized by customs officials and tourists have been arrested for operating drones. ● There are also strict rules about exporting gems, antiques and images of Buddha. Check items are legal before you buy them.
Health Risks	● Get comprehensive travel insurance before you leave. If you travel to high-risk areas you may need a special insurance policy. Most policies won't cover you. ● Medical facilities in Myanmar are extremely limited, particularly outside Yangon. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this. Be cautious if you have an existing medical condition. ● Medicines sold in Myanmar can be fake. Take enough legal medication for your trip. ● Common insect-borne diseases include malaria, dengue, chikungunya and Japanese encephalitis. Ensure your accommodation is insect-proof. Consider taking anti-malarial medicine. Get vaccinated against Japanese encephalitis before you travel. ● Many animals in Myanmar carry rabies. It's fatal without immediate treatment. Don't feed, pat or tease dogs or monkeys. Get medical help straight away if an animal bites or scratches you. ● Polio is a risk. Hepatitis-A and typhoid also occur. Talk to your doctor about vaccinations before you travel. If you're staying for more than 4 weeks, carry proof of your polio vaccination. Waterborne, foodborne and other infectious diseases such as hepatitis, typhoid and tuberculosis are common. Drink only boiled or bottled water. Avoid raw or undercooked food. HIV/AIDS is common. Take steps to reduce your risk of exposure to the virus.
Weather	● Severe storms, floods, landslides and cyclones can happen during the monsoon season from May to October. These can disrupt transport and essential services. Take official warnings seriously. Myanmar is sometimes subject to serious earthquakes. Know your hotel's evacuation plans.
Other	● You need a visa to enter Myanmar. Apply for one at your nearest Myanmar embassy or consulate. If you're travelling for tourism or business, you can apply for an e-Visa online. Beware of unofficial websites that claim to offer e-Visas. You can apply for a tourist visa on arrival at Yangon, Mandalay and Naypyitaw airports. Ppeople who were born in Myanmar are not eligible for visa on arrival. ● Travellers must stay in registered hotels and guesthouses. Register your address with immigration authorities if you're staying for more than 90 days. ● Let them know if you change hotels or will be away from your address. ● The government restricts travel in parts of the country, including to and from land border crossings. If you plan to visit areas other than popular tourist areas, check the list of restricted areas. Carry your passport or Foreigners Registration Card. Officials may ask to see it. ● It's illegal to drive cars or motorbikes on another countries or international licence. Apply for a local licence through the Road Transport Administration Department (Burmese). Don't drive in the countryside at night, including on the Yangon–Naypyitaw–Mandalay highway. Don't leave the scene of an accident. ● Public transport, including buses, boats and trains, doesn't meet international safety standards. Fatal accidents have occurred, especially on overnight trips.

Philippines

	Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Eastern Mindanao, reconsider your need to travel.	**Threat Level** Central and western Mindanao, including the Zamboanga Peninsula, and the Sulu Archipelago and southern Sulu Sea area, do not travel.			**Latitude / Longitude** 12.419866, 122.574646 **GPS Position** 12° 25' 11.5176'' N 122° 34' 28.7256'' E

Crime	● Terrorist attacks could occur anywhere in the Philippines. Possible targets include public transport, hotels, shopping malls, restaurants, schools, events, places of worship and tourist areas. Be alert to possible threats. ● The threat of kidnapping and piracy in the southern Philippines is very high, especially in coastal resorts, coastal waters and isolated locations. Kidnappers may target popular tourist areas. If you travel to the southern Philippines get professional security advice. Ensure your accommodation has proper security measures. Don't travel by boat. ● Protests can turn violent. It's illegal to take part in political rallies if you're not Filipino. Avoid large public gatherings. ● Violent and other serious crime is common. Many crimes involve guns. Gunfights between criminals and police are common. Gangs often drug tourists before robbing or assaulting them. Pickpocketing, bag snatching and scams are common. Don't leave food or drinks unattended. Don't use public transport. Be careful in crowded shopping malls and other public places. Only use ATMs in secure locations.
Laws	● If you're accused of a crime, authorities may not let you leave the Philippines until investigations and legal proceedings are finished. These can take a long time, sometimes years. ● Don't use or carry illegal drugs. Penalties are severe and police are strictly enforcing laws. Mandatory sentences are common for possessing small amounts of drugs. ● The Philippines has strong laws against child sex crimes and human trafficking. ● Local laws don't protect LGBTI rights. Consider avoiding public displays of affection.
Health Risks	● Medical facilities are adequate in major cities. However, facilities are limited in country areas and remote islands. Ensure your travel insurance covers medical evacuation. ● There are measles and polio outbreaks across the country, including in Manila. Get vaccinated before you travel. ● Malaria and dengue are common, especially in many provincial areas. Zika virus is widespread. Other insect-borne diseases include Japanese encephalitis and filariasis. Consider taking anti-malarial medication. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against Japanese encephalitis before you travel. If you're pregnant, discuss your travel plans with your doctor. ● Foodborne, waterborne and other infectious diseases include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. Don't swim in lakes or rivers. ● Bird flu occurs in farm birds. Don't visit live bird and animal markets, including 'wet' markets and poultry farms. Cook all poultry thoroughly. ● HIV/AIDS is a risk. Transmission rates between men who have sex with men are high. Take precautions if you engage in high-risk activities.
Weather	● Severe currents and rips are common in coastal areas. Many travellers have drowned, including in popular resorts. Some swimmers also get ill from pollution. Get local advice before swimming. Don't swim where there are red flags on the beach. ● Philippines experiences typhoons, tropical storms, flooding, landslides, earthquakes, volcanic eruptions and tsunamis. These may disrupt essential services. Know your accommodation's evacuation plan. Monitor the media and follow the advice of local officials.
Other	● You won't need a visa for business or tourist trips of less than 30 days. If you're travelling for another reason or staying longer, get a visa from your nearest Philippines embassy or consulate. ● Keep your visa up-to-date or risk lengthy detention for overstaying or violating your visa. ● Carry proof of your onward or return ticket. Immigration officials may ask to see it. ● You can drive for up to 90 days using a driver's licence. After that, get a Philippines licence. ● Roads are often congested. Drivers often break the road rules. Stick to national highways and other sealed roads, especially at night. Always wear a helmet when riding a motorcycle as accidents are common. ● Use rideshare apps and Grab taxis sourced from hotels. They're more reliable than taxis hailed on the street. ● Avoid ferries if you can. If you must travel by ferry, use a ferry service with a good reputation and well-maintained vessels. Take your own life jacket.

Singapore

	Threat Level Exercise normal safety precautions.						**Latitude / Longitude** 1.352083, 103.819836 **GPS Position** 1° 21' 7.4988'' N 103° 49' 11.4096'' E

Crime	● Unauthorised public demonstrations are illegal. You need a police permit for public gatherings of more than 4 people. If you're travelling as a group of 5 or more, be careful to not get in the way of others. Public demonstrations are only allowed at Speakers' Corner in Hong Lim Park. If you're not a permanent resident, you need a permit to join these. ● Violent crime against tourists is rare. Petty crime, such as theft and pickpocketing, happens at the airport, in tourist areas and on public transport. Safeguard your belongings. ● Scammers pretend to be landlords on property websites and offer fake rental properties. Research the property and landlord before agreeing to a property rental or sale contract. ● Terrorism is a threat. Possible targets include businesses and public areas popular with foreigners. Take official warnings seriously.
Laws	● Don't use or carry illegal drugs. It's illegal to have drugs in your system. You can be charged for consuming drugs even if you took them outside Singapore. Penalties include caning and the death sentence for serious drug offences. ● Singapore has strict laws for 'outrage of modesty' offences. These include offences as a result of being drunk, men behaving inappropriately towards women, swearing and inappropriate touching. Penalties include jail, fines and caning. ● Singapore has strict laws and penalties for things that are legal or are minor offences in other countries. These include smoking in public places or restaurants, spitting, importing or chewing gum, chewing tobacco, littering and jaywalking. Be careful when taking photos. It's illegal to photograph official buildings where there are signs banning photos. ● Penalties are severe for crimes that affect social, racial or ethnic harmony. These include racial insults, and promoting ill-will and hostility between different races or classes. Apply for a Miscellaneous Work Pass from the Ministry of Manpower if you want to speak publicly on racial, communal, religious or political topics. ● Strict laws control alcohol and e-cigarettes or vaporisers. It's illegal to drink in public between 10:30pm and 7am, or in Liquor Control Zones. Importing vaporisers, including for your own use, is also illegal. ● Same-sex acts between men are illegal. Penalties include jail sentences. There is no specific law against same-sex acts between women, but there are local sensitivities. Behaviour standards are conservative. Public displays of affection may offend.
Health Risks	● Singapore restricts some substances in medications. The Singapore Health Sciences Authority has a list of controlled substances and explains how to get approval. Carry your permit with you. ● Zika virus is a risk. If you're pregnant, discuss your travel plans with your doctor. Other insect-borne diseases include dengue, chikungunya and Japanese encephalitis. Ensure your accommodation is insect-proof. Use insect repellent. Get vaccinated against Japanese encephalitis before you travel. ● Cases of dengue have significantly increased in 2019. Follow the National Environment Agency's advice for the prevention and identification of dengue infection. ● Smoke haze happens from June to October. The National Environment Agency gives updates and health warnings. ● Hand, foot and mouth disease (HFMD) is common. Outbreaks usually start in March or April and peak in May but can continue until October. It mainly affects children aged under 10, but can also affect adults. Wash your hands thoroughly and often. ● Singaporean officials screen passengers for Middle East respiratory syndrome coronavirus (MERS-CoV) at Changi Airport. If you have symptoms, they may send you to hospital you until you test negative for MERS-CoV. If you've been in close contact with someone who has symptoms, authorities may quarantine you. ● The standard of medical facilities and care is similar to or higher than in first world countries however the cost is much higher. Ensure your travel insurance covers medical costs.
Weather	● Strong winds and heavy rain happen during the monsoon seasons from December to March and from June to September. Follow the advice of local officials.

Other	● You won't need a tourist or business visa to stay up to 90 days. For work or study, apply for a visa before you travel. Contact the nearest embassy or consulate of Singapore for details. ● The local currency is the Singapore Dollar (SGD). You can easily exchange dollars. ATMs are available across the country. Hotels, restaurants and shops accept international credit cards. ● You can drive for up to 12 months with a driver's licence. After this time, you'll need to get a local licence. Road conditions and driving practices are similar to those found in first world cities. ● Safe, metered taxis are available from official taxi ranks. Rideshare services are legal. ● Singapore has an efficient public transport network, including rail and bus services. ● Piracy occurs in the coastal areas around Singapore. If you're travelling by boat, take safety precautions.

GEOGRAPHY / Asia / South East Asia / Thailand

Thailand

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Yala, Pattani, Narathiwat and Songkhla, do not travel.

Latitude / Longitude
15.870032, 100.992541

GPS Position
15° 52' 12.1152" N
100° 59' 33.1476" E

Crime	● Popular tourist areas in Thailand may be the target of terrorist attacks. Thai authorities have warned of possible bombings on symbolic dates or holidays. Be alert to possible threats. Take official warnings seriously and follow the advice of local authorities. ● The security situation in Thailand can be unpredictable. Protests have turned violent, causing deaths and injuries. Avoid public gatherings. Take official warnings seriously and follow the advice of local authorities. ● Border areas near Cambodia, Myanmar and Malaysia are dangerous due to violence, armed conflict and landmines. Pay close attention to your personal security. ● Don't travel to the 4 most southern provinces of the Thailand-Malaysia border: Yala, Pattani, Narathiwat and Songkhla. These areas experience frequent violence and bombings. If you're there, consider leaving. ● Sexual assault, assault, robbery and drink spiking can happen to tourists. Never leave your drink unattended. Stick with people you trust at parties, in bars, nightclubs and taxis.
Laws	● Penalties for drug offences are severe. They include the death penalty. ● Commercial surrogacy is illegal. E-cigarettes, e-baraku, vaporisers and refills are illegal. Smoking on some beaches is illegal. Travel without carrying identification is illegal. ● Penalties for breaking the law can apply to anyone aged under 18 years. Penalties for children can include detention in a juvenile or adult prison. ● Thailand has the death penalty for serious crimes, including murder, attempted murder and rape. Crimes against the state and offences against the monarchy can also attract the death penalty. Take care not to cause offence about the monarchy, including on social media.
Health Risks	● Travellers have been arrested for carrying medicine they bought at a Thai pharmacy without a prescription. Get medical advice before buying medicine. ● Insect-borne diseases include malaria, Zika virus, dengue, chikungunya, Japanese encephalitis and filariasis. Use insect repellent. Ensure your accommodation is insect-proof as possible. ● Animals in parts of Thailand can carry rabies. Don't ever feed, pat or tease monkeys. If you're bitten or scratched by a dog, monkey or other animal, get treatment immediately. ● Thailand has high levels of air pollution. Air pollution can make bronchial, sinus or asthma conditions worse. Check air quality levels on the World Air Quality Index. ● Medical tourism is common. Avoid discount and uncertified medical establishments. Their standards can be poor. Research medical service providers and choose with care.
Weather	
Other	● Tourists might be able to get a visa exemption for up to 30 days. In other circumstances, you'll need to apply for a visa before you travel. ● If you overstay your visa, you'll need to pay a fine before you can leave. You may also be arrested, prosecuted, jailed and deported. ● Safety standards for adventure activities may not be adequate. Make sure you have adequate travel insurance. Always insist on, and use, safety equipment. ● Thailand has one of the highest traffic-related fatality rates in the world. Be extra careful during holidays. Don't drink and drive. ● Motorcyclists are most at risk on the road. If you're in an accident, police may detain or arrest you. If you hire a motorbike, make sure you have a valid motorcycle licence and insurance. Always wear a helmet.

GEOGRAPHY / Asia / South East Asia / Timor-Leste

Timor-Leste

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Latitude / Longitude
-8.874217, 125.727539

GPS Position
8° 52' 27.1812" S
125° 43' 39.1404" E

Crime	● Local unrest happens, including street gang fighting and political demonstrations. Minor disputes can become violent. Tourists have been harassed because of their nationality. Avoid large public gatherings. In Dili, be careful around Tasi Tolu, Comoro and other crowded areas. ● Violent and petty crime aren't common. But the risk increases at night and if you're travelling alone. Criminals sometimes target foreigners. Lock your accommodation, even when you're in it. Drive with doors locked and windows up. ● Travellers can experience sexual harassment, including lewd remarks and indecent exposure. Although offenders mostly target women, they may harass men. Sexual assault can happen in public places, such as Beach Road in Dili. Travel as a group if you can, including when exercising outdoors. Don't use public transport or taxis alone, especially at night. ● Crocodile attacks are reported in the eastern districts and along the southern coast. Crocodiles have been seen on beaches and inland waterways, including in Dili. Follow local advice.
Laws	● Don't use or carry illegal drugs. There are serious penalties for drug offences. ● Don't interfere in local political processes or take part in political activity. If you do, you'll face fines, detention or deportation. ● Timor-Leste doesn't recognise de facto or same-sex relationships. Social and cultural attitudes towards same-sex relationships are conservative. Avoid public displays of affection. ● Dress and behaviour standards are conservative. Don't wear revealing clothing in public places, churches or markets. Public displays of affection aren't socially acceptable. Loud noise and foolish behaviour on religious days are offensive.
Health Risks	● While cases of malaria are not common, other mosquito-borne disease can be found in Timor-Leste. Ensure your accommodation is insect-proof. ● Rabies is not confirmed in Timor-Leste, but it's found on neighbouring islands. Doctors have treated suspected cases in Dili. Rabies is fatal without immediate treatment. Avoid dogs, monkeys and other mammals. Get medical help straight away if an animal bites or scratches you. ● Waterborne, foodborne and other infectious diseases are widespread. These include gastroenteritis, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Tuberculosis is widespread. Healthcare workers are at risk. If you're a healthcare worker, get tested for tuberculosis before you travel and after you leave. ● Fish sold on the roadside may be contaminated with formaldehyde. Follow local warnings and advice. ● Medical facilities are limited, including at Dili National Hospital, which treats most emergency cases. Dental facilities are extremely limited. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● Severe storms occur during the wet season, from November to April. Flooding and landslides can damage roads and disrupt services. Follow the advice of local officials. ● Timor-Leste can experience earthquakes and tsunamis. Know the tsunami warning signs and move to high ground straight away. Don't wait for official alerts.

GEOGRAPHY | Asia | South East Asia | Timor-Leste

Other	● For a fee in US dollars, tourists can get a 30-day visa on arrival if they enter through Nicolau Lobato International Airport or Dili Seaport. In other situations, you'll need to get a visa before you arrive. Contact your nearest Timorese embassy or consulate for details. ● The official currency is the US Dollar (USD). You can't use notes issued before 2000. Most places won't take credit cards, including hotels, shops and restaurants. Bring enough USD in cash to meet your needs. You may not be able to exchange Australian dollars. ● You need permission to visit some places that have special religious or cultural importance. Check with local authorities before you visit. ● You can drive for up to 3 months with a driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. After 3 months, get a local licence. Outside of Dili, travel in convoy if you can. Don't drive at night. ● Many taxis are in poor condition. You're at risk of robbery, sexual harassment and sexual assault in taxis. Avoid using taxis, especially if you're female. ● Boats are often unsafe and overcrowded. Before booking sea travel, make sure that the company has good maintenance and safety standards. Always wear a life jacket. Don't board or stay on an overcrowded vessel.

Vietnam

GEOGRAPHY | Asia | South East Asia | Vietnam

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
14.058324, 108.277199

GPS Position
14° 3' 29.9664" N
108° 16' 37.9164" E

Crime	● Road accidents are a major cause of injury. Be alert at all times on the roads. ● Petty theft, including bag slashing, is common in tourist areas and crowded places, especially at holiday times. Snatch-and-grab theft by thieves on motorcycles is also common. Hold bags and backpacks in front of you to make them harder to steal. Be aware of motorbikes approaching as you walk. ● Aggravated theft, sexual assault and assault happen. Travellers have been assaulted after having their food or drinks spiked. Pay attention when your drinks are being mixed. Get urgent medical help if you suspect drink spiking. ● Personal or commercial disputes sometimes lead to threats of physical violence or death. Have a clear agreement on the expected level of service. Report any threats to police. ● Travellers have been robbed withdrawing money from ATMs. Credit and debit card fraud and card skimming happen across Vietnam. Taxi and gambling scams are also common. Only use ATMs in banks and shopping centres. Always keep your credit card in sight. Use official or prearranged taxis, especially at airports. Report gambling scams to police.
Laws	● Don't use or carry illegal drugs, including marijuana. Penalties for drug offences include the death penalty and life imprisonment. Never carry parcels or luggage for others. ● Get professional legal advice before signing any contract. If you're in a business or civil dispute, officials could stop you leaving Vietnam until it's resolved. ● It's illegal to gamble in non government-licensed casino or possess pornography. Non-state sanctioned political or religious activity or material is also illegal. It's illegal to export antiques without a permit. Get a permit from the Ministry of Culture, Sports and Tourism (Vietnamese). It's illegal to photograph border areas or military sites. Be careful when taking photos. ● Vietnam recognises dual nationality in limited situations. You may need to do compulsory military service. Contact your nearest Vietnamese embassy or consulate for details.
Health Risks	● Zika virus is a risk. Other insect-borne diseases include dengue, Japanese encephalitis and malaria. If you're pregnant, discuss your travel plans with your doctor. Use insect repellent. Get vaccinated before you travel. Consider taking anti-malarial medication. ● Rabies occurs in Vietnam, especially in the north. It's fatal without treatment. If you're bitten or scratched by an animal, get medical help straight away. ● HIV/AIDS is a risk. Take precautions if you're taking part in high-risk activities. ● Hand, foot and mouth disease (HFMD) is common. It mainly affects children and young adults. Foodborne, waterborne, parasitic and other infectious diseases include cholera, hepatitis and typhoid. Wash your hands well and often. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Foreign private medical clinics may not meet first world standards. Public hospitals are of poor standard. You'll need to pay up-front, even for emergencies. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.
Weather	● During the rainy season (June to November), floods, typhoons and severe weather can disrupt essential services. Follow the advice of local officials.
Other	● To enter Vietnam you need either a visa, a visa exemption certificate or approval for a visa-on-arrival. Apply via the e-visa portal or via a Vietnamese embassy or consulate. Only apply for visas through official Vietnamese Government websites or offices. Travellers have been scammed by private online visa services and travel agents. ● Vietnam restricts how much prescription medication you can import and export. Check with your nearest Vietnamese embassy or consulate for details. ● Register your place of residence with the local police within 24 hours of arrival. Check that your hotel does this as part of the check-in process. Register at the local police station if you're staying in private accommodation. ● Unexploded weapons and landmines are a danger in former battlefields, especially in central Vietnam and along the Laos border. Stick to marked roads and paths. ● You must have a valid Vietnamese driver's licence to drive in Vietnam. This includes for motorcycles of 50cc or more. If you're in an accident, you could face criminal charges even if you're not at fault. If you're not familiar with local conditions, don't drive or ride a motorbike. ● You need to show your luggage tags when leaving Vietnamese airports. Always carry your airline luggage receipt.

GEOGRAPHY | Europe

5 Europe

The European region. The colour shading and travel advice on the map is the advice given by the Australian Government and is accurate as of the 20th Feb 2025. However countries risk ratings rarely change so this could be considered accurate advice going into the forseeable future.

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Subheadings

		1. Eastern Europe	2. Northern Europe	3. Southern Europe	4. Western Europe		

1 Eastern Europe

Armenia

	**Threat Level** Exercise normal safety precautions.	**Threat Level** Nagorno-Karabakh and surrounding military occupied areas, do not travel.				**Latitude / Longitude** 40.069099, 45.038189 **GPS Position** 40° 4' 8.7564'' N 45° 2' 17.4804'' E

Crime	● Protests occur in Yerevan, Gyumri and other major cities. These can turn violent. Avoid large public gatherings. ● Regular armed clashes occur in the buffer zone between the closed Armenia-Azerbaijan border and the ceasefire line. Conflict also occurs in the disputed enclave of Nagorno-Karabakh and its surrounding military zone. All these areas have unmarked landmines. If you travel to these areas, get professional security advice. ● Petty crime, such as pickpocketing and theft from cars, is common. Be careful on trains to and from Georgia.
Laws	● Don't use or carry illegal drugs. Penalties include long prison sentences. ● Some medicines are illegal in Armenia, such as some sleeping tablets and medicines containing codeine. Check your medication is legal before you travel. ● Always carry a copy of your passport. Show it to police if they ask. ● Be careful when taking photos. It's illegal to photograph government or military sites, monuments or officers in uniform. ● Armenia recognises dual nationality. A child born to an Armenian parent is automatically a dual citizen. If you're a dual national, you must travel on your Armenian passport. If you're male and aged between 18 and 27, you may need to do military service. Check with your nearest Armenian embassy or consulate before you travel. ● Same-sex relationships are legal but aren't socially acceptable. Discrimination against LGBTI people is common. Avoid public displays of affection.
Health Risks	● Malaria is a risk in the western border areas. Consider taking anti-malarial medication if you're travelling to these areas. Other insect-borne diseases are also a risk. Ensure your accommodation is insect-proof. Use insect repellent. ● Common foodborne, waterborne and other infectious diseases include typhoid, hepatitis and tuberculosis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● HIV/AIDS is a risk. Take precautions if you engage in high-risk activities. ● Standards in public hospitals are basic, especially outside Yerevan. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● Armenia is in an active earthquake zone. Landslides may occur. Follow the advice of local officials.
Other	● You don't need a visa if you're staying for 180 days or less. If you're staying longer, get a visa before you travel. You'll also need to register with the police when you arrive. Contact your nearest Armenian embassy or consulate for details. ● Armenia has strict import and export rules. These include for antiques, firearms, pornographic material, communication equipment and cash amounts over $US10,000. Get approval from the Armenian Ministry of Culture to export antiques or other items that could have historical value. Keep all receipts to show to customs officials when you leave. ● The local currency is the Armenian Dram (AMD). Exchange US dollars and euros at banks. ATMs and credit card facilities are available in Yerevan but are less common outside major towns. ● Armenia's land borders with Azerbaijan and Turkey are closed. The main road between Armenia and Georgia is also closed. Get local advice on different routes. To drive, you'll need both a driver's licence and an International Driving Permit. ● Use registered taxis. Get your hotel to arrange one. Don't hail taxis in the street. Sit in the back seat. ● Public transport is overcrowded and isn't well-maintained. Minibuses are particularly dangerous.

Azerbaijan

	**Threat Level** Exercise normal safety precautions.	**Threat Level** Nagorno-Karabakh and surrounding military occupied areas, Armenia-Azerbaijan border areas, do not travel.				**Latitude / Longitude** 40.143105, 47.576927 **GPS Position** 40° 8' 35.178'' N 47° 34' 36.9372'' E

Crime	● Protests can turn violent. Avoid large public gatherings. ● Regular armed clashes occur in the buffer zone between the closed Armenia-Azerbaijan border and the ceasefire line. Conflict also occurs in the disputed Armenian enclave of Nagorno-Karabakh and its surrounding military zone. It's illegal to enter Nagorno-Karabakh without a permit. All these areas have unmarked landmines. If you travel to these areas, get professional security advice. ● Violent crime is rare in Azerbaijan. But foreigners have reported serious crime, including home burglaries, robbery and assault. Be alert when walking after dark, including near hotels and in residential areas. Don't use unofficial taxis. Don't use ATMs on the street. ● Food and drink spiking occurs in bars and nightclubs in Baku. Don't leave your food or drinks unattended. ● Petty crime, such as pickpocketing, can happen. Take care at outdoor markets and on public transport. Thieves may pose as police officers and demand money.

Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include long prison sentences and heavy fines. ● Always carry a copy of your passport and visa. The police can fine or detain you if you don't show a valid travel document when asked. ● Ensure you have the proper permits if you're buying antiques or cultural artefacts. It's also illegal to export them without an official certificate and receipt of purchase. Export rules apply to religious objects, carpets, artworks and caviar. Check with local authorities before you export any items. ● It's illegal to convert a person to another faith. ● Most of Azerbaijan is conservative. Public displays of affection may not be welcome. Same-sex relations are legal but aren't widely accepted. LGBTI people may face discrimination, intolerance or violence based on sexuality and gender identity.
Health Risks	● Malaria is a risk in the southern lowland areas. The risk is higher in summer from June to August. Consider taking anti-malarial medication if you're travelling to these areas. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is common. Take precautions if you engage in high-risk activities. ● Foodborne, waterborne and other infectious diseases include typhoid, hepatitis and brucellosis. Drink only boiled or bottled water. Avoid raw or undercooked food. Avoid unpasteurised dairy products. ● Private hospitals in Baku are of similar standard to those in first world countries. Services in government hospitals and in rural areas are often limited. You'll probably have to pay up-front. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	
Other	● You need a visa to enter Azerbaijan. You can apply for an electronic visa (e-visa) for single entry, 30-day stays. Do this online through Azerbaijan's State Agency for Public Service and Social Innovations. Make sure your passport is valid for at least 3 months from the e-visa's expiry date. For other situations, contact your nearest Azerbaijani embassy or consulate. ● If you plan to stay in Azerbaijan for over 15 days, you must register with local police. Do this within 15 days of arrival. If you don't, you'll be fined and may have trouble leaving the country. ● Travel restrictions may apply to tourists planning to travel overland from Azerbaijan to neighbouring countries. Check with your nearest Azerbaijani embassy or consulate for any travel restrictions. Also check the rules of neighbouring countries. ● Learn the road rules before you drive. It's illegal to drive with a blood alcohol level over zero. Look out for pedestrians, livestock and farm equipment, particularly in rural areas. ● Azerbaijani domestic airlines may not meet international maintenance and safety standards. They can also be overcrowded and overbooked. Cancellations and delays are common.

Belarus

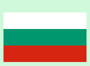
Threat Level
Exercise normal safety precautions.

Latitude / Longitude
53.709807, 27.953389

GPS Position
53° 42' 35.3052" N
27° 57' 12.2004" E

Crime	● Large protests occur in Minsk and other cities in Belarus. Avoid protests and obey local authorities. ● Crimes against travellers can happen. Take care on sleeper trains and in or near bars and hotels visited by foreigners. Watch out for drink or food-spiking. You're at higher risk of theft if you've been drugged. ● You may not be able to trust police and other local officials. People have reported harassment, mistreatment and extortion by officials. ● Terrorist attacks have occurred in Belarus. More attacks are possible in the future. ● People are injured or killed in snow-related accidents every winter from December to February. Take care in severe conditions.
Laws	● Serious crimes, such as murder, can attract the death penalty. Penalties for drug offences are severe. They include long prison sentences. ● Always carry your passport, original visa and migration card. Authorities can ask for ID at any time. They will not accept copies. ● It's illegal to drive with a blood alcohol level above zero. ● Some religious activities are illegal. ● It's illegal to take photos of certain sites, buildings, monuments and officials. Other rules or fees can apply to photography in public areas. ● Same-sex relationships are legal, but aren't widely accepted.
Health Risks	● You must have medical insurance to enter Belarus. Get comprehensive travel insurance before you travel. ● Ticks are common in forest and rural areas from spring to autumn. Tick-borne encephalitis and other tick-borne diseases are a risk. ● There's a radiation exclusion zone around Chernobyl. Authorities may restrict travel in this region. Foods may have high levels of radiation. Avoid eating local foods. ● Foodborne, waterborne and other diseases are common. Boil tap water or drink bottled water. Avoid ice cubes, unpasteurised dairy products, and raw and undercooked food. ● Healthcare in Belarus is below first world standard. If you become seriously ill or injured, you'll need medical evacuation. Make sure your travel insurance covers this.
Weather	
Other	● You can get a 30-day visa-free entry into Belarus. You can stay up to 90 days per calendar year. You must enter through Minsk International Airport. Other entry conditions apply, such as compulsory medical insurance. ● Belarus has strict entry and exit conditions. Visa-free entry does not apply to travellers coming from, or traveling to Russia. ● Authorities don't permit foreigners to cross the land border between Belarus and Russia. You must only travel between Belarus and Russia by air. ● Some areas in Belarus have limited entry border zones. To enter these zones, you need a special permit. ● Strict rules control the export of antiques, icons and items of historic significance.

Bulgaria



Threat Level
Exercise normal safety precautions.

Latitude / Longitude
42.733883, 25.48583

GPS Position
42° 44' 1.9788" N
25° 29' 8.988" E

Crime	● Pickpocketing and bag snatching occur in crowded areas and on public transport. Take care of your belongings. ● Car theft and break-ins are common. Park in secure car parks. Keep valuables out of sight. ● Watch out for drink spiking. Don't leave your food or drinks unattended. ● Bombings, shootouts and gang wars can occur. Always be aware of your surroundings. Monitor the media for risks.
Laws	● Don't use or carry illegal drugs. Penalties include heavy fines and prison sentences. ● Always carry original photo ID. ● It's illegal to cover your face in public. Don't wear a balaclava or full veil. ● It's also illegal to take photos of military sites. ● It's illegal to have sex with someone under 18. ● Same-sex relationships are legal in Bulgaria, but aren't widely accepted. Avoid public displays of affection.
Health Risks	● Rabies is common. Watch out for feral dogs. Get medical help straight away if you're bitten. ● Take care in forests and rural areas where ticks carry encephalitis. Ticks are active from April to October. ● Tuberculosis, typhoid, measles and hepatitis are common. Drink only boiled or bottled water. Avoid raw or undercooked food. ● West Nile virus can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. ● Health care standards are well below those in first world countries Medical supplies can be limited. Major cities have good hospitals. If you're seriously ill or injured, you may need to be evacuated. Make sure your insurance covers this.
Weather	● Earth tremors are common. Large earthquakes are rare. Avalanches, landslides and flooding can occur. Wildfires and fast-spreading fires occur from June to October. Monitor the media for updates.

Other	● If you're a tourist, you can stay up to 90 days without a visa. Get a visa for other situations. ● Bulgaria is part of the EU, but it's not in the Schengen area. Carry your passport when you cross borders. ● There are strict rules for children under 18, including dual nationals, who leave Bulgaria without both parents. Make sure you follow them. ● Driving on rural and secondary roads is hazardous due to poor conditions and driving standards. Police strictly enforce traffic laws and conduct frequent checks. These include radar speed checks.

Czech Republic

	**Threat Level** Exercise normal safety precautions.	 	**Latitude / Longitude** 49.817492, 15.472962 **GPS Position** 49° 49' 2.9712'' N 15° 28' 22.6632'' E

Crime	● Petty crime is common in Prague, including passport theft. Be wary of strangers who offer help or ask to see your passport. Only use ATMs in secure places, such as banks, shops and shopping centres. ● Drink spiking can happen. Keep an eye on your food and drink. Stay with people you trust in bars and nightclubs. ● Public protests and events that draw large groups of people can turn violent. Monitor the media for possible unrest. Avoid demonstrations and crowds. ● Terrorist attacks have occurred in some European cities. Be alert, especially in places known to be possible targets.
Laws	● Penalties for drug offences are severe and may include long prison sentences. ● It's illegal to photograph some buildings, including indoor shopping centres. If in doubt, ask local authorities before you take a photo.
Health Risks	● Ticks are common in forest and country areas from spring to autumn. They can cause disease, such as tick-borne encephalitis. Check your body for ticks and remove them quickly. ● The standard of medical facilities is similar to Australia and the U.S. However, you may need to pay for healthcare upfront, even in an emergency.
Weather	
Other	● The Czech Republic is a part of the Schengen area. In some cases you can enter without a visa. Contact the nearest embassy or consulate of the Czech Republic for details. ● Children under the age of 18 travelling alone must have a letter of consent from a parent. ● You need travel insurance with health cover to enter the Czech Republic. ● If you're staying for more than three days, you must register with the local Foreigner's Police Branch. It's usually part of the check-in process for paid accommodation. Make sure your host registers you. ● Border crossings can be strictly controlled. Carry your passport when crossing borders, even within the Schengen area. ● You need a motorway sticker on your car to travel on major highways. Buy the sticker at petrol stations.

Georgia

	**Threat Level** Exercise normal safety precautions.	**Threat Level** Pankisi Gorge north of Akhmeta, reconsider your need to travel.	**Threat Level** South Ossetia and Abkhazia (including adjacent areas) , do not travel.	 	**Latitude / Longitude** 42.177911, 43.512880 **GPS Position** 42° 10' 40.4796'' N 43° 30' 46.368'' E

Crime	● Political rallies are common in Georgia, including Tbilisi. They can turn violent. Monitor the media. Avoid public protests and rallies. ● Don't travel to South Ossetia or Abkhazia. There's a high risk of terrorist attack, unexploded landmines and violence in these regions. ● Violent crime can occur. Financial, import and export scams also occur. Be wary of strangers. Be extra careful when walking after dark.
Laws	● Penalties for drug offences are severe. They can include heavy fines and long prison sentences. ● If you plan to engage in surrogacy in Georgia, be aware of all the risks. Get legal advice. ● Always carry your passport, visa or migration card (or copies). ● It's illegal to take photos near military or strategic sites, such as airports. It's also illegal to export items of national heritage without a licence. ● Georgia doesn't recognise dual nationality. If you're a dual national, get advice from an embassy or consulate of Georgia before you travel.
Health Risks	● Malaria is a risk in south-eastern Georgia. Make sure your accommodation is insect-proof. Use insect repellent. ● Waterborne, foodborne, and other infectious diseases occur. Boil drinking water or drink bottled water. Avoid ice cubes, unpasteurised dairy products, and raw and undercooked food. ● Medical care is limited and of poor quality. If you become ill or injured, you may need to be evacuated. Make sure your travel insurance covers this.
Weather	● Earthquakes and floods can happen in Georgia. Monitor the media. Follow the advice of local authorities.
Other	● You need travel insurance in Georgia. Check the Ministry of Foreign Affairs of Georgia e-Visa Portal for details. ● You can visit Georgia for up to 12 months without a visa. You need a visa for longer stays. ● Children under 18 years travelling alone or with one parent need a copy of their birth certificate and passport. They may also need a letter of consent from the non-travelling parent or parents. Check with an embassy or consulate of Georgia. ● Don't enter or exit Georgia via land borders with Russia. It's illegal to enter Georgia via Abkhazia or South Ossetia. There's no official border control in these regions.

Hungary

	**Threat Level** Exercise normal safety precautions.	 	**Latitude / Longitude** 47.162494, 19.503304 **GPS Position** 47° 9' 44.9784'' N 19° 30' 11.8944'' E

Crime	● Petty crime occurs in Hungary. Theft from vehicles and highway robberies also happen. Be careful on public transport, in tourist areas, at petrol stations and in highway parking areas. Use secure parking facilities. ● Some clubs and restaurants overcharge. Disputes about overcharging can lead to violence. Always check the price of food and drinks before you order. Be aware that taxi drivers may get a commission for taking you to these places. ● Drink spiking can happen in Budapest bars and nightclubs. Stick with people you trust when you go out. Never accept food or drinks from strangers or leave your drink unattended. ● If you're travelling on overnight trains, always lock your cabin. Never leave your bags unattended.
Laws	● Penalties for drug crimes can be severe. They include long prison sentences and heavy fines. ● Local authorities can ask to see your ID at any time. Always carry your passport. A photocopy is not acceptable. ● Smoking is banned in some places. Large fines apply. ● Heavy fines exist for minor driving infringements. Penalties for serious driving offences include jail.

Health Risks	● Ticks are common in country and forested areas from spring to autumn. Tick-borne encephalitis is a risk. After visiting forests, check your body for ticks. Remove ticks as soon as possible. Watch tick sites for signs of infection. ● West Nile virus (WNV) occurs throughout Hungary. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. ● Medical treatment is adequate but many medical facilities are below standard. Facilities are limited in rural and border areas. Doctors may expect up-front cash payment.
Weather	
Other	● Hungary is part of the Schengen area with some other European countries. In some cases, you can enter Hungary without a visa. Contact the nearest embassy or consulate of Hungary for advice. ● Hungary has strengthened border controls. Expect delays at these border crossings. Monitor the media. Ask transport providers about border conditions. ● Make sure you get a clear entry stamp in your passport. Get this when you enter any country in the Schengen area. ● You won't be allowed to enter if you have failed to pay a fine previously issued in Hungary. Contact the nearest embassy or consulate of Hungary for advice on paying fines before you travel. ● It's illegal to drive with a blood alcohol level above 0%. Police can take your licence away.

GEOGRAPHY – Europe – Eastern Europe – Hungary

Moldova

Threat Level Exercise normal safety precautions.	**Threat Level** Transnistria, reconsider your need to travel.			**Latitude / Longitude** 47.411631, 28.369885 **GPS Position** 47° 24' 41.8716'' N 28° 22' 11.586'' E

Crime	● Large political protests have occurred. Public protests and events can turn violent and attract a heavy police presence. Monitor the media. Avoid protests and rallies. ● The security situation in Transnistria is fragile. Transnistria is not controlled by the government. Reconsider non-essential travel to this region. ● Petty crime, including pickpocketing and bag snatching, is common, particularly in Chisinau. Criminals target trains and hotel rooms. Keep your personal belongings close. ● Police officers, or people posing as police, may ask for bribes. Ask to see ID. Offer to go to a police station to pay any fines. ● Online dating and marriage scams can happen. Be wary of business, dating or marriage proposals from people you've met online.
Laws	● Penalties for drug crimes are severe. They include long jail sentences and heavy fines. ● Always carry ID documents. If you can't show them when asked, police can detain and fine you. ● It's illegal to drive with a blood alcohol level over 0%. It's also illegal to take photos of military sites, government buildings and other infrastructure. ● It's illegal to operate a business without first registering it. Register with the State Registration Chamber of the Ministry of Informational Development. ● Same-sex relationships are legal in Moldova, but aren't widely accepted. Avoid public displays of affection.
Health Risks	● Tick-borne diseases are a risk. Ticks are active in forested areas from spring to autumn. Check your body for ticks if you travel to forests. ● Waterborne, foodborne and infectious diseases are common. Boil tap water or drink bottled water. Avoid ice cubes, unpasteurised dairy products, and raw or undercooked food. ● Medical facilities and supplies are limited. If you become seriously ill or injured, you'll need to be evacuated. Make sure your insurance covers this.
Weather	● Moldova is in an earthquake zone. Register with the Global Disaster Alert and Coordination System to receive alerts on major disasters.
Other	● Avoid entering or exiting through Transnistria. If you decide to travel through Transnistria ask your insurer if you need special travel insurance for your trip. ● If you're visiting for up to 90 days in a 6-month period, you won't need a visa. For longer stays, you'll need a visa. ● Record your entry date, and check your visa dates carefully. If you overstay, authorities may deport you. ● Strict regulations cover the export of antiques, artworks and items of historical significance. Get approval from the Moldovan Department of Monuments. ● Border controls can be strict. Always carry your passport when you cross. Monitor the media. Ask transport providers for updates on border conditions.

GEOGRAPHY – Europe – Eastern Europe – Moldova

Poland

Threat Level Exercise normal safety precautions.			**Latitude / Longitude** 51.919438, 19.145136 **GPS Position** 51° 55' 9.9768'' N 19° 8' 42.4896'' E

Crime	● Muggings, carjackings and theft from vehicles occur in large cities. Petty crime, such as pickpocketing, is common. Thieves often work in small groups. Take care in tourist areas and near hotels, markets, ATMs, currency exchange bureaus and public transport. ● Check your bank card statement often. Report any suspicious activity to your bank. ● Ask about the price of drinks before you order in bars and nightclubs. Check the bill amount and currency carefully. Some bars overcharge. ● Be careful of drink spiking. Don't leave drinks or food unattended. There have been reports of drink spiking and credit card overcharging in tourist hotspots. If you believe you are a victim, report it to local police and contact your bank.
Laws	● Penalties for drug offences include mandatory jail sentences. ● There are strict alcohol laws in Poland. There's zero tolerance for drink driving. The blood alcohol limit is 0.02%. It's illegal to drink or be drunk in public. You may be arrested or taken to a facility to sober up. ● It's illegal to take photos of some buildings. Look for signs on buildings that forbid photos and check with local authorities. ● Poland doesn't recognise dual nationality. This may limit the consular help we can provide. By law, dual nationals must enter and exit Poland on their Polish passport.
Health Risks	● Tick-borne encephalitis is a risk. Ticks are active in forests and rural areas from spring to autumn. Regularly check your body for ticks during and after visits to forest areas. ● H1NI (swine flu) has been reported. Get the annual seasonal flu shot to lower your risk. ● Air pollution levels can be very high in winter. Get medical advice if you have a heart or lung condition. ● Public hospitals are reasonable in large cities. Services are limited in rural and border regions. Most doctors and hospitals will need payment up-front or evidence of medical insurance, before treating you.
Weather	● Heavy snowfalls can disrupt train and road travel. Severe flooding happens, particularly in spring. Register with the Global Disaster Alert and Coordination System to receive alerts.
Other	● Poland is part of the Schengen area. This may allow you to enter without a visa in some cases. Carry your passport when crossing borders, even within the Schengen area. ● If you'll stay longer than 14 days, you must register within four days of arrival. Check that your hotel has registered you. ● Cross-border road and rail transport services can be disrupted. If travelling by road or train, allow extra time and expect delays. Make plans in case you can't cross the border. ● Road rules are different. If you drive, always keep your headlights on. Use winter tyres and carry chains in winter and in mountain areas. Know the road rules before you use any vehicle, to avoid fines and insurance issues. ● Unofficial taxis often overcharge passengers. Pre-book official taxis using an app or ask hotel staff to do it for you.

GEOGRAPHY – Europe – Eastern Europe – Poland

Romania

	Threat Level Exercise normal safety precautions.	

Latitude / Longitude	45.943161, 24.96676
GPS Position	45° 56' 35.3796'' N 24° 58' 0.336'' E
Crime	● Pickpocketing and bag-snatching occur. Thefts from hotel rooms are common. Assault and theft happen on intercity trains. Keep your personal belongings close. Lock hotel and train compartment doors from the inside. ● Drink spiking is an issue, especially in Bucharest's Old Town. Don't accept food, drinks, gum or cigarettes from people you've just met. ● Thieves posing as police officers may ask to see your ID and wallet. Romanian police won't stop you at random to do this. If you suspect someone is posing as a police office, ask to see their identification. ● Financial, dating and marriage scams occur. Only use ATMs in banks, shops and shopping centres, especially at night. Always keep your credit card in sight. Be wary of people you've met online.
Laws	● Penalties for drug offences are severe. They can include jail sentences of up to 20 years. By law, you must always carry photo ID. Keep your passport in a safe place. Carry a photocopy. ● It's illegal to take photos of airports, military sites or other secure locations. ● It's illegal to engage in sex work or have sexual relations with a person under 18. ● Same-sex relationships are legal in Romania, but not widely accepted.
Health Risks	● Rabies is widespread. Get vaccinated before you travel. If an animal scratches or bites you, get medical treatment immediately. ● Ticks are common in forests and country areas from spring to autumn. Tick-borne encephalitis is a risk. ● West Nile virus can occur. Make sure your accommodation is insect-proof. Use insect repellent. ● Measles has occurred in recent years. Ensure your vaccinations are up to date before you travel. ● Waterborne, foodborne and other infectious diseases are common. Drink boiled or bottled water. Avoid ice cubes and raw or undercooked food. ● Medical facilities and supplies are limited. If you become seriously ill or injured, you will need to be evacuated. Makes sure your insurance covers this.
Weather	
Other	● You don't need a visa if you're a tourist staying for less than 90 days. For other situations, you'll need to get a visa. ● Special rules apply to children aged under 18 who travel to Romania. A child must be accompanied by an adult and carry specific documents. ● Transport and tour operators don't always follow recommended safety standards. Always use available safety equipment. If appropriate safety equipment isn't available, use another provider. ● It's illegal to drive with a blood alcohol level above 0% or refuse to take a breathalyser test.

Russia

	Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Regions bordering the Ukrainian provinces of Donetsk, Lugansk and Kharkiv , reconsider your need to travel.	**Threat Level** North Caucasus, do not travel.	

Latitude / Longitude	61.524010, 105.318756
GPS Position	61° 31' 26.436'' N 105° 19' 7.5216'' E
Crime	● Terrorists have staged attacks in Russian cities, including Moscow and St Petersburg. More attacks are likely, particularly in the North Caucasus region and the Georgia-Russia border area. We may only be able to provide limited consular help in these areas. Targets may include tourist spots and transport. Always be alert to possible threats and have a clear exit plan. ● Protests are illegal in Russia. Avoid protests and rallies. ● Petty crime, pickpocketing, mugging and drink spiking are common. Thieves often steal passports. Don't accept food or drinks from strangers. Keep your belongings close, particularly in tourist areas. ● Money-exchange scams and credit card and ATM fraud are common. Large, organised internet dating scams operate from Russia. Only exchange money at banks. Only use ATMs inside banks. Be wary of people you meet in online chat rooms. ● Kidnapping is a risk in parts of the Northern Caucasus. If you travel here despite the risks, get professional security advice.
Laws	● Don't use or carry any illegal drugs. Penalties are severe. ● Carry your passport, visa and migration card. Authorities won't accept copies. ● Don't take photos of military places or sensitive areas, such as passport control. It's also illegal to use commercial film, television or camera equipment in public without permission. Hand-held video cameras are legal. ● Russia doesn't recognise dual nationals. We can only provide limited consular to dual nationals that are arrested or detained. You'll need a valid Russian passport to leave. ● Same-sex relationships are legal, but are not widely accepted. Violence against members of the LGBTI community occurs. Don't say anything to promote LGBTI issues. It could be illegal to do so.
Health Risks	● Laws about the import and use of medicines are strict. You need a doctor's letter and a notarised translation confirming your need for each medication that contains restricted substances. Contact the Embassy of Russia for details. ● Rabies and tick-borne encephalitis are on the rise. Ticks are common from April to October. Take care when travelling through forests. ● Infectious diseases such as typhoid, hepatitis, diphtheria, measles and tuberculosis are a risk. Boil drinking water or drink bottled water. ● Public medical facilities in Russian cities are below U.S. standards and basic in rural areas.
Weather	● Severe weather can disrupt travel. Wind, snow and ice-related accidents cause death and serious injury. Take care when walking in snow. Use winter tyres or chains when driving.
Other	● You need a visa to enter Russia, unless you're travelling on some commercial cruise ships. You may need to provide biometric fingerprints for your visa. Check that your visa type and all details are correct. You can't change visa details once you're in Russia. ● You'll get a migration card when you arrive. This covers both Russia and Belarus. If you receive a paper card, keep the stamped exit portion of the card with your passport. You'll need this when you leave. ● The government strictly controls the import of electrical and some high technology equipment. ● You can only travel between Russia and Belarus by air. Get visas for both countries before travelling. ● If you stay more than seven days, you have to register with the Russian Ministry of Internal Affairs. Your hotel should do this for you. Check that they have. ● Russia has strict regulations covering the export of antiques, artworks and items of historical significance. Keep your receipts. Make sure you have the relevant paperwork.

Slovakia

Threat Level	N/A
Latitude / Longitude	48.669026, 19.699024
GPS Position	48° 40' 8.4936'' N 19° 41' 56.4864'' E
Crime	
Laws	N/A

Health Risks	N/A
Weather	N/A
Other	

Ukraine

	Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Crimea, Regions of Donetsk and Luhansk, do not travel.			**Latitude / Longitude** 48.379433, 31.16558 **GPS Position** 48° 22' 45.9588" N 31° 9' 56.088" E

Crime	● Ongoing armed conflict makes Donetsk and Luhansk dangerous. Foreigners have been threatened, detained and kidnapped in these regions. Landmines are present throughout Donetsk and Luhansk. Crimea is not under Ukrainian Government control and our ability to provide consular help in Crimea is extremely limited. If you're in these areas, leave by commercial means if it's safe to do so. If you're unable to leave, limit your movements. ● The security situation in Ukraine is generally calm, but it can deteriorate quickly. Assassinations involving guns or car bombs have occurred in Ukraine in recent years. Public protests and events that draw large groups of people can turn violent. Avoid large public gatherings. Check local media and follow advice from local authorities. ● Serious crime against foreigners is not frequent but robberies, pickpocketing and bag snatching do occur. Street crime and muggings increase at night. Cases of drink spiking are followed by robbery. Never accept food or drink from people you don't know. Don't leave food or drinks unattended. Don't carry bags that are easy to snatch. ● Be careful with your credit card. Scams occur, including with ATMs. Street scams are very common. Be aware of bogus internet friendship, dating and marriage schemes coming from Ukraine.
Laws	● Always carry your passport. Local police may ask to see your passport and visa. ● Ukraine doesn't recognise dual nationality. We may not be able to help you if you travel on a Ukrainian passport. Under Ukrainian law, you may be a Ukrainian citizen if you were either born in Ukraine or have a parent born in Ukraine. ● Same-sex activity is legal in Ukraine but local attitudes are less tolerant than in the U.S.A and Australia. Violence has occurred at some gay pride events and gay venues in Kyiv.
Health Risks	● Tick-borne diseases are a risk in forested areas. Ticks are common from spring to autumn. Use insect repellent. Check your body for ticks during and after travel in forested areas. ● HIV/AIDS is a risk. Take steps to reduce your risk of exposure to the virus. ● Other infectious diseases include tuberculosis, measles, diphtheria, hepatitis, rabies and polio. Drink only boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get immediate medical help. Check you're up to date with your polio vaccinations. ● Chernobyl is open to tourism but remains radioactive. If you visit, go with a reputable tour operator and obey safety instructions. In areas surrounding Chernobyl, avoid dairy products, wild fowl, game, fruit and vegetables unless they're imported. ● Outside major cities, the standard of state medical facilities is low. There are frequent shortages of medical supplies.
Weather	
Other	● You need a visa to enter Ukraine. You can't get visa on arrival. Apply for an e-Visa from the Ministry of Foreign Affairs. ● Foreigners who enter Ukraine through a separatist-controlled checkpoint won't be allowed through any government-controlled checkpoints that follow. You can't enter Ukrainian-controlled territory if you enter Crimea from any other country. ● Declare cash and jewellery on arrival in Ukraine. Customs rules apply to the export of currency, antiques, art and historic items. ● Don't travel to the crash site of Malaysia Airlines flight MH17 crash site, due to ongoing armed conflict. If you go to the crash site, take personal security measures.

2 Northern Europe

Denmark

	Threat Level Exercise normal safety precautions.						**Latitude / Longitude** 56.263920, 9.501785 **GPS Position** 56° 15' 50.112" N 9° 30' 6.426" E

Crime	● Denmark's terror threat level is 'significant'. Terrorists are likely to plan attacks. Be alert to possible threats, especially in public places. ● Pickpocketing is on the rise in tourist areas. Take care of your personal belongings, especially on public transport, at national landmarks, and in museums, railway stations and restaurants. ● Gang-related crime and civil unrest can happen in Copenhagen, especially in Christiania. There's a 'no photography' policy in Christiania. Travellers have been assaulted and robbed for taking photographs. Don't take photos in Christiania.
Laws	● Penalties for all drug offences are severe. Even possession of small amounts can attract heavy fines, jail or immediate deportation. ● Penalties for vandalism, such as graffiti, may include fines, jail or deportation. ● Penalties for drink driving or speeding may include heavy fines or jail. ● If you're convicted of a crime, you may be banned from entering the Schengen area for up to 6 years.
Health Risks	● The standard of medical facilities is similar to the U.S. and Australia. Major hospitals are in Copenhagen, Aarhus and the Odense area.
Weather	
Other	● Denmark is part of the Schengen area. You can enter Denmark without a visa in some cases. Check the Schengen Convention before you travel. ● Denmark has temporary border controls. This includes ports with ferry connections to Sweden and Germany. It also includes the Danish-German land border. Carry your passport or Danish residency permit when entering and exiting. ● Be careful of cyclists when driving. They might have the right of way. Take care not to walk on cycle lanes. ● The weather is extreme in Greenland. Flights can often be delayed or cancelled at short notice. There are no roads or railways between towns. Travel is by air, sea, ski, snowmobile or dogsled only.

Estonia

	Threat Level Exercise normal safety precautions.						**Latitude / Longitude** 58.595272, 25.013607 **GPS Position** 58° 35' 42.9792" N 25° 0' 48.9852" E

Crime	• Civil unrest is rare. But public protests and events that draw large groups of people can turn violent. Monitor local media for possible action. • Bag snatching, pickpocketing, mugging and petty theft occur. Pickpockets target people at airports, train stations, parks, routes to major hotels and the Old Town in Tallinn. They often work in small groups. Keep an eye on your belongings. • Credit card fraud occurs in tourist areas. Watch your credit card during transactions. • Drink spiking happens in bars and casinos. Don't leave drinks unattended. • Car theft is common, especially in Tallinn. Use secure, well-lit carparks. Don't leave valuables in vehicles. • Internet crimes have been reported. Be wary of online dating and scams involving money.
Laws	• Penalties for drug offences include heavy fines and jail, even for possession of small amounts. • Same-sex relationships are legal, but attitudes can be conservative. Avoid public displays of affection. • Estonia recognises dual nationality in some situations. This may limit consular help from us. Dual nationals may have to do military service.
Health Risks	• HIV/AIDS is widespread. Take precautions if you engage in high-risk activities. • Tick-borne encephalitis and other tick-borne diseases are a risk in forested areas. Ticks are common in spring from March to November. Use insect repellent. Wear long, loose, light-coloured clothing. • Infectious diseases include hepatitis and rabies. Water contamination may be a problem in rural areas. Drink only boiled or bottled water. Avoid raw or undercooked food. If an animal bites or scratches you, get immediate medical help. • Medical facilities at the main hospitals are good. However, facilities can be limited in rural areas. You may need to pay up-front before treatment.
Weather	
Other	• Estonia is part of the Schengen area. In some cases, you can enter Estonia without a visa. In other situations, you'll need a visa. Always carry your passport, even within the Schengen area. • You must have valid travel and health insurance that covers you for the equivalent of 30,000 euros during your stay. If can't prove you have the right insurance, immigration authorities might deny you entry. • By law, pedestrians must wear reflectors at night. If you don't, you may be fined. • Learn the road rules for Estonia. Headlights must always be on. Winter tyres must be fitted from 1 December to 1 March. There's zero tolerance for drink driving. If your blood alcohol content is greater than 0%, penalties include heavy fines and jail.

Finland

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
61.924110, 25.748151

GPS Position
61° 55' 26.796'' N
25° 44' 53.3436'' E

Crime	• Finland's terrorist threat level is 'elevated' (level 2 of 4). Be alert to possible threats, especially in public places. • Protests or demonstrations could take place. They can turn violent. Monitor the media and avoid affected areas. • Pickpocketing and purse snatching is common. Credit card theft and skimming also happens. Check for card-skimming devices before using ATMs. Monitor the media for news on crime.
Laws	• Penalties for drug offences, even for possession of small amounts, include heavy fines and jail. • Dual nationals who are registered residents of Finland may need to do national service. Check with the Finnish Defence Forces.
Health Risks	• You can't bring some prescribed narcotics into Finland. Check rules with the Finnish Customs Authority. You can bring in up to a 3-month supply of personal medicine. • Ticks are common in rural and forest areas from March to November. Tick-borne encephalitis is a risk. If you visit these areas, check yourself and remove any ticks as soon as possible. Keep checking the tick site for infection. • The standard of medical facilities is similar to the U.S. and Australia. The main hospitals are in the Helsinki, Tampere and Turku area. • A reciprocal health care agreement allows tourists who visit for fewer than 90 days to access emergency medical services for free. This doesn't replace the need for travel insurance.
Weather	• Winters are extremely cold and there's heavy snowfall, including in metropolitan areas. Finland also experiences severe storms, rockslides, floods and strong winds. Monitor the media, and follow the advice of local authorities.
Other	• Finland is part of the Schengen area. You can enter Finland without a visa in some cases. Contact the nearest embassy or consulate of Finland for updates. • Always carry your passport. If you have one, always carry your Finnish residency permit. Authorities may ask you to verify your identity. • If you plan to drive, learn the local rules. Headlights must always be on, even during daylight hours. Winter tyres must be fitted.

Greenland

Threat Level
N/A

Latitude / Longitude
71.706936, -42.604303

GPS Position
71° 42' 24.9696'' N
42° 36' 15.4908'' W

Crime	
Laws	N/A
Health Risks	None
Weather	N/A
Other	

Iceland

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
64.963051, -19.020835

GPS Position
64° 57' 46.9836'' N
19° 1' 15.006'' W

Crime	• Petty theft can happen. Pay close attention to your belongings. • Peaceful demonstrations sometimes occur. Monitor the media and avoid affected areas. • Iceland's climate is unpredictable. Iceland experiences snow, sand storms and ash storms. Check local sources for weather and updates about road closures and other disruptions.

Laws	• Penalties for drug offences are severe. Even possession of a small amount of drugs can attract heavy fines, jail or deportation. • Always carry ID, such as your passport or driver's licence. • Penalties for driving infringements are severe and include heavy fines, jail and deportation.
Health Risks	• Health risks in Iceland are similar to those in first world countries. • The standard of health facilities and care is high. However, services can be limited in areas with fewer people. • Healthcare costs are the same as, or more expensive than, private treatment in the U.S. and Australia. Make sure you have adequate travel insurance.
Weather	• Iceland has active volcanoes. It's also in an active earthquake zone. Tsunamis are a threat in coastal areas. Monitor the local media. • Some places in the Arctic are a long way from help in an emergency. If you need help, you may have to wait a long time. Only book travel with companies that have on-board medical help.
Other	• Iceland is part of the Schengen area. This means you can enter Iceland without a visa in some cases. Contact an embassy or consulate of Iceland for details. • Hazards at natural attractions rarely have warning signs or safety barriers. Stay on marked paths. If you visit geysers, take care to avoid injuries from steam and hot water. • If you plan to do an adventure or trekking activity, get local advice on routes and the weather before setting out. Use an experienced and well-known trekking company.

GEOGRAPHY — Europe — Northern Europe — Iceland

Ireland

	Threat Level Exercise normal safety precautions.		**Latitude / Longitude** 53.142367, -7.692054 **GPS Position** 53° 8' 32.5212" N 7° 41' 31.3944" W

Crime	• Petty crime is common, particularly in urban areas and places popular with tourists. There's a moderate risk of serious violent crime. Watch your belongings, especially on public transport and in crowded places. Avoid secluded parks and unlit areas. • Car theft and break-ins are increasing. Thieves target rental cars, mostly in Dublin and tourist areas, especially in secluded scenic areas. Use secure parking lots and keep luggage and valuables out of sight. • Credit card fraud and ATM scams are becoming more common. Check ATMs before use. Don't use machines that look unusual. • Public protests and events that draw large groups of people can turn violent. Avoid protests and demonstrations.
Laws	• Having even a small amount of illegal drugs can lead to a long jail sentence. • Don't carry items for anyone when you enter or leave Ireland.
Health Risks	• Health risks in Ireland are similar to those in first world countries. • The standard of health care is similar to that in first world countries.
Weather	
Other	• You don't need a visa for tourist visits of less than 90 days. For longer visits, or if you want to work or study, you'll need to apply for your visa before you leave the country. • If you plan to work, you'll need an employment permit. • Immigration authorities have strict entry requirements for children under 18 years. Authorities may ask the child, or adults accompanying them, to show extra documents. • You can use a driver's licence for up to 12 months. After this, you'll need to get an Irish licence. Learn local road rules and practices. • Serious penalties for drink driving include heavy fines and jail sentences. • Dublin promotes a green bicycle culture. You can hire public bicycles to navigate the city. Ensure you follow road safety rules and are aware of other road users. Helmets are not compulsory but are highly recommended.

GEOGRAPHY — Europe — Northern Europe — Ireland

Latvia

	Threat Level Exercise normal safety precautions.		**Latitude / Longitude** 56.879635, 24.603189 **GPS Position** 56° 52' 46.686" N 24° 36' 11.4804" E

Crime	• Petty crime is common, particularly in Riga. This includes bag snatching, pickpocketing and muggings. Hotspots include Old Town, the central train and bus stations, the Central Market, parks, and routes to major hotels. Take care of your belongings. • Check the price of drinks before ordering. Tourists are sometimes overcharged. Credit card fraud also occurs in shops, restaurants, bars and nightclubs. Watch your card during transactions. Don't sign blank credit card slips. • Criminals may spike drinks in bars and casinos. Don't leave your drinks unattended. • Car theft is common. Use secure and well-lit car parks. Don't leave valuables in your vehicle.
Laws	• Don't use or carry illegal drugs. Penalties are severe, even for small amounts. They include jail terms and heavy fines. • Don't drink alcohol in public, except in designated areas. Authorities may fine you for carrying open beer or wine containers. • Check with local officials before you export religious materials or antiques. There are restrictions on what you can export. • Latvia recognises dual nationality. Contact the nearest Latvian embassy or consulate for details.
Health Risks	• Tick-borne encephalitis and other tick-borne diseases are a risk in forest areas. Ticks are active from March to November. Use insect repellent. Check your body for ticks during and after visits to forests. • Hepatitis A and tuberculosis are concerns in Latvia. Waterborne, foodborne, parasitic and other infectious diseases can also occur. Water contamination may be a problem in rural areas. Drink only boiled or bottled water. Avoid raw or undercooked food. • Public medical facilities are good in larger cities, but more limited in rural areas. Private facilities are of a similar standard to those in first world countries. You may need to pay up-front. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.
Weather	• Severe weather can disrupt transport and infrastructure. Latvia experiences extremely cold winters and heavy snowfall. Flooding can occur in spring, from March to May. Follow the advice of local authorities.
Other	• Latvia is part of the Schengen area, which means you may be able to enter without a visa. If you need one, the Austrian Embassy in Canberra issues Latvian visas. Carry your passport when you're entering and leaving Latvia, even if you're travelling from or to another Schengen country. • Always carry your passport and your Latvian residency permit if you have one. Officials may ask to see them. • Make sure you have a travel insurance policy with medical cover. You need it to enter Latvia. • Driving in winter can be dangerous due to icy roads and low visibility. Legally, you must fit winter tyres from around 1 December to 1 March. Always drive with your headlights on. Blood alcohol limits are 0.02% if you've been driving for less than 2 years, and 0.05% for everyone else.

GEOGRAPHY — Europe — Northern Europe — Latvia

Lithuania

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 55.169438, 23.881275 **GPS Position** 55° 10' 9.9768'' N 23° 52' 52.59'' E

Crime	● Take care on public transport and at bars and restaurants, where pickpocketing and bag snatching can happen. Drink spiking is a problem. Don't accept food or drink from strangers. Be careful on trains where scammers may befriend you before robbing you. Keep your car locked, even when driving. ● Be aware of terrorism. Terrorists have attacked a number of European cities.
Laws	● Penalties for drug offences are severe. Don't use or carry illegal drugs. ● The blood alcohol limit is 0.04%. Penalties include heavy fines and imprisonment. Don't drink and drive. ● Lithuania recognises dual nationals in some situations. If you're a dual national, we can only give limited consular help if you're arrested or detained.
Health Risks	● Watch out for ticks in forests. Ticks are common from spring to autumn. ● Swine flu is a risk. Get the annual seasonal flu shot. ● Standards are good at private medical facilities but lower at public facilities. Doctors may need up-front payment before treating you.
Weather	● Winters are cold. Wind, snow and ice-related accidents cause death and injury. Take care when walking in snow or sleet. Use winter tyres or chains when driving.
Other	● Lithuania is part of the Schengen area. You can enter Lithuania without a tourist visa in some cases. In other situations, you'll need to get a visa. ● Rules apply to children who live in Lithuania travelling alone or with an unrelated adult. You must provide a consent letter from at least one of the parents. ● If you're a non-EU citizen, you must have travel insurance. If you do not already have insurance, you may be directed to buy it at the border. ● Border crossings may be delayed or temporarily blocked. Always carry your passport when crossing borders, even within the Schengen area. Check local media and transport providers for information on any border disruptions. ● Driving is dangerous, particularly in winter. Keep your headlights on. Use winter tyres from 10 November to 1 April.

Norway

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 60.472024, 8.468946 **GPS Position** 60° 28' 19.2864'' N 8° 28' 8.2056'' E

Crime	● Terrorists have attacked some European cities. Targets have included public places that foreigners visit. Monitor the news and follow advice from local authorities. ● Serious crime is rare. However, there have been sexual assaults against foreigners and violent, gang-related crimes. Avoid walking alone in isolated places or at night. ● Petty crime is common. The risk rises during the peak tourist season from May to September. Thieves often work together and use tricks to distract travellers. Be careful in airports, train stations, hotel lobbies and restaurants.
Laws	● Penalties for drug offences include heavy fines and imprisonment. ● If you assault someone, however minor, you may face jail. ● The blood alcohol limit for drivers is 0.02%. There are frequent roadside checks for drink driving. ● Norway doesn't recognise dual nationality. If you're male and also a Norwegian citizen, you may have to do national service.
Health Risks	● Hospitals in cities offer a high standard of care. Many medical staff speak English. However, services are limited in rural and remote areas. ● If you need treatment in remote areas, you may need to be evacuated. Make sure you have appropriate travel insurance.
Weather	● Avalanches and rockslides can happen in some mountain areas. Extreme weather, floods and landslides can also occur. Check advice on weather and safety conditions before skiing or mountaineering. ● The northernmost parts of Norway are in the Arctic Circle. Be careful in these areas. Follow instructions from local authorities. If you're travelling by ship, check the onboard medical care.
Other	● Norway is part of the Schengen area. You can enter Norway without a visa in some situations. In other situations, you'll need a visa. ● The Norwegian territory of Svalbard is not part of the Schengen area. If you're travelling to Svalbard, you need a valid passport to enter. ● By law, when driving, headlights must be on at all times and it's illegal to use your mobile phone. Winter tyres must be fitted from 1 November to the first Monday after Easter Monday. ● In Svalbard, polar bears have killed travellers. Avalanches and accidents on glaciers and boats have also killed travellers. Follow local safety advice.

Sweden

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 60.128161, 18.643501 **GPS Position** 60° 7' 41.3796'' N 18° 38' 36.6036'' E

Crime	● There's a threat of terrorist attack. Use caution in places that could be terrorist targets. Monitor the media for new threats. Take official warnings seriously. ● You might encounter protests or demonstrations. These can become violent. Monitor the media for possible unrest. Avoid crowds, protests and demonstrations. ● Petty crime is common. Take care in hotels and restaurants. Thieves may blend in and steal bags and purses when you're distracted.
Laws	● It's illegal to use physical punishment on children. This includes threatening a child with physical punishment. Local authorities can take custody of your child and prosecute you if you do. ● Penalties for drug offences, even possession of small amounts, include heavy fines and jail. ● Sweden recognises dual nationality.
Health Risks	● Ticks are very common in country areas from March to November. Tick-borne encephalitis and Lyme disease are risks. Check your body and remove any ticks as soon as you can. Monitor the tick site for signs of infection. ● You can bring a 3-month supply of medicine for personal use into Sweden. ● Swedish medical facilities have standards similar to first world countries. However, emergency services are limited in remote areas.
Weather	● Winter is extremely cold with heavy snowfalls. There can be severe transport delays and temporary closures of infrastructure. Check the media and other local sources for updates.
Other	● Sweden is part of the Schengen area. You can enter Sweden without a tourist visa in some situations. ● Border controls are in place in Sweden for people travelling to Denmark. ID checks apply at land and sea borders. Always carry your passport and/or Swedish residency permit when entering and exiting Sweden. ● When driving, keep your headlights on at all times. Winter tyres must be fitted from 1 December, or when it first snows, until 31 March or later if roads are still icy. The legal blood alcohol limit for drivers is 0.02%.

United Kingdom

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
55.378051, -3.435973

GPS Position
55° 22' 40.9836'' N
3° 26' 9.5028'' W

Crime	● International terrorists have staged attacks in the UK. Extreme right-wing ideology and the status of Northern Ireland both contribute to the threat. ● Always be alert to terrorism. Take official warnings seriously. ● Violent clashes occur as a result of civil unrest. Tensions can rise in Northern Ireland from April to August. Take extra care in the weeks leading up to 12 July every year. Avoid all protests. ● Petty crime occurs. Beware of pickpockets in tourist areas, at restaurants and bars, and on transport. Take care when using ATMS and credit cards. ● Drink spiking happens. Don't accept drinks from strangers. Be aware of knife-related crime.
Laws	● Penalties for drug offences are severe. Don't use or carry illegal drugs.
Health Risks	● Health risks are similar to those in the U.S. and Australia. Measles occurs. Make sure your vaccinations are up to date. ● The standard of medical facilities is good. ● We have a reciprocal healthcare agreement with the UK. Some GP and hospital treatments are free if you're in the UK for a short visit. If you're staying more than 6 months, you'll pay a surcharge when you apply for your visa.
Weather	● Severe weather can disrupt transport. Monitor local weather reports.
Other	● If you're a tourist, you can stay up to 6 months without a visa. Get a visa if you're planning to do paid or unpaid work, volunteer or get married. ● Tourists older than 12 with an ePassport can use eGates on arrival in the UK. You don't need to complete a landing card. If you don't have an ePassport, you'll need to get your passport stamped. ● UK airports have strict security procedures. Allow extra times for screening and checks. ● If you're travelling to or from a non-European Union (EU) country, declare cash of 10,000 euros or more. ● You can drive a car or motorbike in the UK for up to 12 months with an Australian licence.

3 Southern Europe

Albania

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
41.153332, 20.168331

GPS Position
41° 9' 11.9952'' N
20° 10' 5.9916'' E

Crime	● Political protests take place in central Tirana. Most demonstrations are peaceful, but they can turn violent. Monitor local media. ● Always be alert to terrorism. Terrorists have targeted European cities, including transport hubs and places visited by travellers. Take official warnings seriously. ● Theft from vehicles is common. Petty crime occurs. Take care of your belongings on public transport.
Laws	● Don't use or carry illegal drugs. Penalties are severe and can include jail sentences and heavy fines. ● Always carry identification. It's the law. ● It's illegal to take photos of military sites and personnel. ● The Albanian Government considers you an Albanian citizen if you were born in Albania or you have an Albanian parent. If you're a man, you may have to do military service. ● Same-sex relationships are legal in Albania, but aren't widely accepted. Avoid public displays of affection.
Health Risks	● Take care in forests and rural areas where ticks carry encephalitis. Ticks are active from spring to autumn. Check your body for ticks and remove them as soon as possible. ● Sandflies are active along the coast. They carry disease. Use insect repellent. Make sure your accommodation is insect-proof. ● Tuberculosis, typhoid, hepatitis, brucellosis and rabies are common. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities don't always have access to equipment, medicine and specialist doctors. Ambulances are limited. If you need to be evacuated, it can be expensive. Make sure your insurance covers this.
Weather	● Severe weather occurs, mainly from December to February. This may cause flooding, particularly in northern Albania. If this happens, monitor local media. Stay in touch with friends and family.
Other	● You don't need a visa for visits of up to 90 days. Get a visa for longer stays. ● The local currency is the Albanian Lek (ALL). Declare amounts equivalent to $US20,000 when you arrive or leave. ● You can find ATMs and credit card facilities in larger cities and tourist spots. Exchange currencies at banks and authorised bureaus. Many businesses prefer cash. Watch out for credit card fraud. ● Severe weather, flooding and snowfall may disrupt travel, particularly in northern Albania. Driving in Albania is hazardous. Use snow chains in winter. Take care from December to February and monitor local media for updates. ● Watch out for landmines in the north-east border areas, particularly near Kosovo. Look for and obey warning signs.

Andorra

Threat Level
N/A

Latitude / Longitude
42.506285, 1.521801

GPS Position
42° 30' 22.626'' N
1° 31' 18.4836'' E

Crime	
Laws	N/A
Health Risks	N/A
Weather	N/A
Other	

Bosnia and Herzegovina

GEOGRAPHY | Europe | Southern Europe | Bosnia and Herzegovina

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 43.915886, 17.679076 **GPS Position** 43° 54' 57.1896" N 17° 40' 44.6736" E
Crime	● Ethnic and religious tensions may result in demonstrations. Stay away from protests as they could turn violent. ● Pickpocketing and bag snatching are common. Take care on public transport and in crowds. ● Many locals have firearms. You might be caught in the wrong place. Monitor the media for updates on areas with gun violence. ● Always be alert to terrorism. Terrorists have targeted European cities, including transport hubs and places visited by travellers. Take official warnings seriously.		
Laws	● Don't use or carry illegal drugs, including marijuana. Penalties include heavy fines and prison sentences. ● Always carry ID. ● It's illegal to take photos of military and police personnel, buildings, vehicles or equipment. ● Bosnia and Herzegovina recognises dual nationality only in certain circumstances. This limits the consular help we can give. ● Same-sex relationships are legal but not widely accepted. Avoid public displays of affection.		
Health Risks	● Take care in forests and rural areas where ticks carry encephalitis. Ticks are active from spring to autumn. Check your body for ticks and remove them as soon as possible. ● West Nile virus (WNV) can occur. There's no vaccine to prevent WNV. Use insect repellent. Make sure your accommodation is insect-proof. ● Hepatitis, trichinellosis, brucellosis and rabies are common. Avoid raw or undercooked food. ● Medical facilities in Bosnia and Herzegovina aren't up to first world standards. Check your insurance covers medical evacuation.		
Weather	● Earthquakes, flooding and landslides occur. Watch out for bush and forest fires in summer. Follow the advice of local authorities.		
Other	● You don't need a visa for visits of up to 90 days. Get a temporary residence permit for longer visits. ● Get your passport stamped when you enter the country. Otherwise you may have trouble leaving. ● Register with the local police within 48 hours of arriving. Check your hotel has done this for you. ● Avoid forests and isolated areas. Landmines are scattered throughout the country. ● Driving can be hazardous. Be careful in winter and spring when black ice, fog and landslides occur. Always have your headlights on. Use winter tyres or snow chains from 15 November to 15 April. You need to have the correct insurance cover to enter Bosnia and Herzegovina in a vehicle.		

Croatia

GEOGRAPHY | Europe | Southern Europe | Croatia

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 45.100000, 15.2 **GPS Position** 45° 6' 0" N 15° 11' 60" E
Crime	● Pickpocketing and other petty crime can occur. Take care at tourist spots, the beach and on public transport. ● Drink spiking can happen. Don't leave food or drinks unattended. ● Avoid injuries. Don't jump off rocks and cliffs along the coast. Party boats and other venues, such as nightclubs, might not have the same safety standards as first world countries. ● If you intend to trek in the mountains or rock climb never do so alone.		
Laws	● Don't use or carry illegal drugs. Penalties include imprisonment. ● Police issue on-the-spot fines for some minor offences. They may hold your passport if you challenge them or don't pay. ● Dress codes apply in some popular tourist areas. Police may fine you if you're shirtless or wearing swimwear in towns with signs banning this. ● Foreigners have been involved in lengthy disputes about the validity of property titles. Get independent legal advice before signing a contract. ● Always carry ID. ● Same-sex sexual activity is legal, but attitudes can vary.		
Health Risks	● Health care on the mainland is generally good. Services on the islands are limited. If you need to be evacuated, this can be expensive. Make sure your travel insurance covers this. ● There are decompression chambers in Dubrovnik, Split, Rijeka and Pula. ● Take care in forests. Lyme disease and tick-borne encephalitis are risks. Ticks are more common from March to September. Check your body for ticks. Remove any whole ticks as soon as possible. ● West Nile virus can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof.		
Weather	● Earthquakes, floods and landslides can occur. Forest fires are common from June to September. Monitor the media for updates.		
Other	● If you're a tourist, you don't need a visa to stay up to 90 days in 6 months. For other situations, contact an embassy or consulate of Croatia. ● Croatia is a member of the European Union but it is not part of the Schengen area. A passport is required to travel between Croatia and other European countries. ● You must register with local police within 48 hours of arriving. Check your hotel will do this for you. Failure to register may lead to fines or deportation from Croatia. ● Driving can be hazardous and traffic accidents are common. Many country roads lack guardrails. Use headlights from the last weekend in October to the last weekend in March. Use winter tyres from 15 November to 15 April.		

Cyprus

GEOGRAPHY | Europe | Southern Europe | Cyprus

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 35.126413, 33.429859 **GPS Position** 35° 7' 35.0868" N 33° 25' 47.4924" E
Crime	● A UN peacekeeping force maintains a buffer zone between northern and southern Cyprus. The Government of the Republic of Cyprus controls the southern part of the island. The self-proclaimed 'Turkish Republic of Northern Cyprus' ('TRNC') controls the north. ● Violent incidents can occur in the UN buffer zone, especially during public demonstrations. Avoid protests. ● Watch out for bag-snatching and pickpocketing, particularly in tourist areas.		
Laws	● Cypriot authorities don't always advise your countries authorities when they arrest you. ● Don't use or carry illegal drugs. Carrying even small amounts can result in jail time. ● Property disputes are common. You could face criminal proceedings for intending to purchase a disputed property. Get legal advice before buying any property, particularly in the north. ● It's illegal to take photos of the military and installations or the UN buffer zone. ● You could be a national of Cyprus if you have a family connection to Cyprus. ● You may have to do military service if you have a family connection to Cyprus. Check with the Ministry of Foreign Affairs (Republic of Cyprus). If you have a Turkish Cypriot background, check with relevant authorities before you travel.		
Health Risks	● Make sure your insurance covers travel to both northern and southern parts of Cyprus. ● Avoid contact with rodents, bats and other vermin. They carry disease. There have been reported cases of West Nile Virus in Cyprus. ● Medical facilities in the Republic of Cyprus's main cities are adequate but expensive. Medical services in the north are basic.		

Weather	● Cyprus experiences earth tremors and violent storms. Forest fires are common from May to October. Monitor local media for updates.
Other	● You can stay up to 90 days in a 6-month period without a tourist visa. Get a visa if you plan to stay longer. ● You can only enter Cyprus through the south. It's illegal to enter or leave via northern Cyprus. If you arrive in Cyprus legally in the south, you can cross into the north through formal crossing points. Turkish-Cypriot authorities may stamp your passport. ● Authorities may not let you enter Cyprus if they have concerns about your travel to the north. They might be worried about your planned commercial, academic or employment activities. ● If you are carrying goods between the north and the south, be aware that strict controls apply. ● The official currency of the Republic of Cyprus is the Euro. In the north, it's the Turkish Lira. ● The UN restricts access to the roads in the UN buffer zone. Parts of the zone have landmines. You are only allowed to transit the UN Buffer Zone at formal crossing points.

Gibraltar

Threat Level
N/A

Latitude / Longitude
36.140751, -5.353585

GPS Position
36° 8' 26.7036'' N
5° 21' 12.906'' W

Crime	
Laws	N/A
Health Risks	N/A
Weather	N/A
Other	

Greece

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
39.074208, 21.824312

GPS Position
39° 4' 27.1488'' N
21° 49' 27.5232'' E

Crime	● Petty crime and theft are serious issues in tourist areas and on buses and trains. Pickpocketing, bag snatching and slashing luggage to steal belongings are common. ● Physical and sexual assaults occur, particularly on the islands during summer. Don't walk alone in isolated areas at night. ● Drink spiking is a risk. Don't accept drinks from strangers or leave drinks unattended. ● Terrorists have attacked popular tourist areas in central Athens. Always be alert. Take official warnings seriously. ● Protests mainly take place in central Athens. Rioting can break out with little warning. Avoid affected areas. Take care on days of national significance.
Laws	● Don't use or carry illegal drugs. Even small amounts can lead to heavy fines and prison sentences. ● Always carry ID, such as a photocopy of your passport. ● It's illegal to take photos of military sites and personnel. It's also illegal to smoke indoors. ● If you're a male dual national, you may have to do military service. If you're of Greek descent born outside of Greece, get advice from the nearest Greek embassy or consulate before you travel. ● Same-sex relationships are legal in Greece, attitudes vary throughout the country. Avoid public displays of affection, especially in rural areas. Attitudes are generally more accepting on many Greek islands such as Mykonos and Ios.
Health Risks	● Medications such as codeine are subject to special rules. Carry a prescription and a letter from your doctor. ● Measles is common in Greece. Make sure your vaccinations are up-to-date. ● West Nile virus (WNV) can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. ● Foodborne diseases such as brucellosis occur. Avoid uncooked and undercooked food. ● The standard of medical care varies. Public hospitals are short on medical supplies and provide limited nursing care. Family or friends usually provide care. ● Private hospitals are expensive. If you're seriously ill or injured on an island, you might be evacuated to Athens. Make sure your travel insurance covers this.
Weather	● Bush and forest fires are common from June to September. Earthquakes can happen. Monitor the media for updates.
Other	● Greece is a part of the Schengen area. You can enter Greece without a visa in some cases. In other situations, you'll need a visa. ● You may have problems entering Greece if you were born in Greece at a place no longer recognised by Greece. You may also have problems if you're entering Greece from the Republic of North Macedonia. ● Driving in Greece is hazardous. Take care when crossing the road, even at pedestrian crossings. ● Quad bike accidents cause a lot of serious injuries and deaths. Always wear a helmet.

Italy

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
41.871940, 12.56738

GPS Position
41° 52' 18.984'' N
12° 34' 2.568'' E

Crime	● Petty crime is common. Be aware of pickpockets and bag-snatchers at tourist spots and on transport. Thieves often work in groups on trains. Take care of your belongings. ● Serious assaults occur after food and drink spiking. Never accept drinks from strangers. Don't leave food and drinks unattended. ● Protests and strikes cause building closures and transport delays and cancellations. Check the Ministry of Infrastructure and Transport (Italian) for details on upcoming strikes. ● Bombings against political targets happen. Avoid protests and crowds. Monitor local news. ● Always be alert to terrorism. Terrorists have targeted European cities, including transport hubs and places visited by travellers. Take official warnings seriously.
Laws	● Don't use or carry drugs. Penalties are severe and include long jail sentences. ● You may be fined for littering, sitting, eating or drinking near churches and public buildings or in public spaces. Obey signs about conduct. ● Organised pub crawls are banned in some cities, including Rome. ● It's illegal to take photos of official buildings and military areas. Check with local authorities first. ● Don't buy fake brands and products from illegal street vendors. It's against the law.

GEOGRAPHY | Europe | Southern Europe | Italy

Health Risks	• Measles is on the rise. Make sure your vaccinations are up to date. • West Nile virus (WNV) can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. • Medical facilities are good in major cities and limited in rural areas. • We have a Reciprocal Health Care Agreement with Italy. You can get treated in public medical facilities if you show your Medicare card and passport. You still need travel insurance.
Weather	• Italy experiences earthquakes and volcanic activity. Large earthquakes cause landslides and avalanches. Forest fires are common from June to September. Monitor the media and follow the advice of local authorities.
Other	• Italy is part of the Schengen area. You can enter Italy without a visa in some cases. In other situations, you'll need to get a visa before you travel. • Apply for a 'Permit to Stay' (dichiarazione di presenza) if you're not staying in commercial accommodation. Do this at the local police station within 8 days of arriving. • Italy has a Working Holiday Visa program. Get the appropriate visa before you arrive. If you're staying more than 90 days, you might have to register with police. • Driving can be dangerous and chaotic. Always have your headlights on when you're on highways or main roads outside cities. Use snow chains in some mountainous regions. • Some cities have traffic restricted zones. Check with your hotel about traffic restrictions.

GEOGRAPHY | Europe | Southern Europe | Kosovo

Kosovo

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Leposavic, Zubin Potok and Zvecan municipalities and North Mitrovica, reconsider your need to travel.

Latitude / Longitude
42.602636, 20.902977

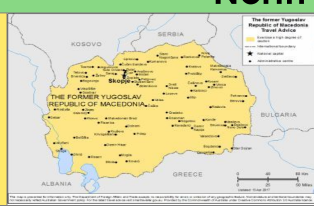
GPS Position
42° 36' 9.4896'' N
20° 54' 10.7172'' E

Crime	• Two authorities work to maintain security — the Kosovo Police Force and the Kosovo Force, led by NATO. • Serious unrest exists between ethnic Serbs and Kosovo Albanians. Sudden, violent, armed conflict occurs. Reconsider travel to the city of Mitrovica and other places in the north. • Locals discharge firearms on holidays and other occasions. Be careful of celebratory gunfire, especially around major holidays, celebrations and after sporting victories. • Petty crime includes pickpocketing and bag snatching. Look after your belongings.
Laws	• It's illegal to take photos of military or police facilities and buildings. • Always carry photo ID. • Same-sex sexual activity is legal, but not widely accepted. Avoid public displays of affection.
Health Risks	• Air pollution is a problem, particularly in winter. If you have breathing difficulties, get medical advice before you travel. • Take care in forests. Tick-borne encephalitis and Crimean Congo haemorrhagic fever are risks. Ticks are common from spring to autumn. Check for ticks and carefully remove the whole tick. • West Nile virus can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. • Outbreaks of hepatitis A, trichinellosis, brucellosis and rabies can occur. Drink bottled water. Avoid raw and undercooked food. • Medical facilities are poor. If you become seriously ill or injured, you'll need to be evacuated. Make sure your travel insurance covers this.
Weather	• Bush and forest fires can occur from June to September. Large earthquakes are rare, but earth tremors are common. Monitor the news and follow the advice of local authorities.
Other	• You don't need a tourist visa to stay less than 90 days. You may need to show proof of the reason for your visit. • Security along the Kosovo-Serbia border is unpredictable. Serbia doesn't recognise entry points direct from Kosovo. Don't try to enter Serbia from Kosovo unless you initially travelled into Kosovo from Serbia. • Landmines are present. Don't travel off-road. Don't hike in woodlands. • You need compulsory third-party vehicle insurance to drive. If you hire a car in Kosovo, hire car companies might not let you cross the border.

GEOGRAPHY | Europe | Southern Europe | North Macedonia

North Macedonia

Threat Level
Moderate threat level to personal safety, take extra precautions here.



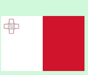
Latitude / Longitude
41.608635, 21.745275

GPS Position
41° 36' 31.086'' N
21° 44' 42.99'' E

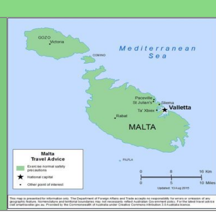
Crime	
Laws	
Health Risks	
Weather	
Other	

GEOGRAPHY | Europe | Southern Europe | Malta

Malta



Threat Level
Exercise normal safety precautions.



Latitude / Longitude
35.937496, 14.375416

GPS Position
35° 56' 14.9856'' N
14° 22' 31.4976'' E

Crime	• Bag-snatching, pickpocketing and other petty crime occur. Be careful at ATMs, on buses and at popular tourist spots. • It can get rowdy around nightclubs. Stay with people you trust. Avoid confrontations. • Always be alert to terrorism. Terrorists have targeted European cities, including transport hubs and places visited by travellers. Take official warnings seriously.
Laws	• Don't use or carry illegal drugs. Penalties are severe. • Malta recognises dual nationals. Dual citizens don't have to do military service.
Health Risks	• Traffic congestion and dust storms from North Africa can cause bad pollution. This might cause breathing problems. Follow advice from local authorities. • Medical care and facilities are good in Malta. • We have a Reciprocal Health Care Agreement with Malta. This means you can get treated in public medical facilities. You still need travel insurance.

Weather	
Other	● Malta is part of the Schengen area. You can enter Malta without a visa in some cases. In other situations, you'll need to get a visa. ● Declare all amounts over 10,000 euros or foreign currency equivalent. ● Locals like to hunt with firearms. Hunting areas are rarely marked and can overlap with camping and public areas. Hunting seasons are in April, and September to January. Be aware of hunters. ● Use your driver's licence to drive in Malta for 1 year from your arrival. After that, you'll need a Maltese licence. ● Only use registered taxis and authorised limousines arranged through your hotel. Taxis don't have meters. You'll need to agree on a fare with the driver.

Montenegro

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
42.708678, 19.37439

GPS Position
42° 42' 31.2408'' N
19° 22' 27.804'' E

Crime	● Security in the Kosovo border area is unpredictable. Take care if you are travelling there. ● Protests and rallies can occur. Avoid crowds and demonstrations. ● Petty crime and credit card fraud are common. Take care in crowded places. Always keep your credit card in sight. ● Targeted bomb attacks and gun violence can occur. Be alert to suspicious behaviour.
Laws	● Don't use or carry illegal drugs. Penalties are severe. ● It's illegal to photograph military and police personnel and facilities. ● Montenegro doesn't recognise dual nationality. ● Same sex relationships are legal but not widely accepted. Avoid public displays of affection.
Health Risks	● Medical facilities are poor. If you are seriously ill or injured, you may need to be evacuated. Make sure your travel insurance covers this.
Weather	● Earthquake tremors can occur. Bushfires occur in summer. Flooding happens in summer or autumn. Snow and ice can make the roads dangerous. Monitor local media for updates.
Other	● You can stay up to 90 days without a tourist visa. For longer stays, you'll need to apply for a Temporary Residence Permit. ● Register your local address with local police or a tourist organisation within 24 hours of arriving. If you are staying in a hotel they should do this for you. ● Always carry ID, such as a driver's licence or passport. ● You must declare cash and valuables valued over 10,000 euros, or foreign currency equivalent, on arrival.

Portugal

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
39.399872, -8.224454

GPS Position
39° 23' 59.5392'' N
8° 13' 28.0344'' W

Crime	● Bag snatching, pickpocketing and theft from cars occur. Pay attention to your belongings at beaches, tourist spots and on public transport. ● Violent crime, such as robberies and assaults, happen. Drink spiking is also a risk. Don't accept drinks from strangers or leave drinks unattended. ● Be aware of accommodation scams, these are on the rise, use official websites when booking accommodation. ● Strikes and protests can affect transport. Avoid demonstrations and check local media. ● People drown at Portuguese beaches. Obey lifeguard warnings. A red flag means 'danger, don't enter the water'. Pay attention to signs about cliff erosion.
Laws	● Don't use or carry illegal drugs. ● Gambling is legal in official casinos and licensed venues. It's illegal elsewhere. Check that you're entering a licensed venue. ● Always carry photo identification. ● Don't ride an e-scooter or e-bike under the influence of alcohol. You can be fined. ● Portugal recognises dual nationality.
Health Risks	● You may need an import permit to get medications by post. ● Private medical facilities provide good quality care but may require payment upfront. Standards in public facilities and in rural areas vary. ● Medical treatment is expensive.
Weather	● Portugal experiences earthquakes. Bushfires are common inland. Monitor local media.
Other	● Portugal is part of the Schengen area. If you stay longer than 90 days, you may need a visa. ● Get a clear entry stamp when you first enter the Schengen area. You need proof of entry or airlines might refuse to transport you. ● Foreign bank cards aren't widely accepted in smaller shops, restaurants, towns or rural areas. You can use credit cards at larger places. ● Driving can be dangerous. Drivers speed. Roads are not always well marked. Occasional rock falls occur along the coast. Report traffic incidents to the police and avoid making compensation payments privately. ● Tuktuks are common in large tourist areas. Always use a seatbelt and make sure your insurance covers you.

San Marino

Threat Level
N/A

Latitude / Longitude
43.942360, 12.457777

GPS Position
43° 56' 32.496'' N
12° 27' 27.9972'' E

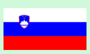
Crime	
Laws	N/A
Health Risks	N/A
Weather	N/A
Other	

Serbia

Serbia

	**Threat Level** Exercise normal safety precautions.	
		Latitude / Longitude 44.016521, 21.005859 **GPS Position** 44° 0' 59.4756" N 21° 0' 21.0924" E
Crime	● There have been regular protests in Belgrade and other towns since late 2018. They are usually peaceful, but any demonstration could turn violent. Avoid large crowds and demonstrations. Demonstrations might disrupt transport. Monitor local media for information. ● Serbia doesn't recognise Kosovo's independence. The security situation along the border can be volatile and unpredictable. Be cautious travelling in the Kosovo border area. ● The area of Southern Serbia bordering Kosovo has unexploded landmines. Only use well-known roads and paths. ● Violent attacks sometimes occur near nightclubs. Targeted bomb attacks and gun violence can occur. Many Serbians own guns. Be alert to suspicious behaviour and avoid trouble spots.	
Laws	● Don't use or carry illegal drugs. Penalties are severe. ● It's illegal to photograph military and police personnel and equipment. ● Serbia recognises dual nationality. You may have to complete outstanding military service obligations if you're a dual citizen. Check with an embassy or consulate of Serbia. ● Same-sex relationships are legal but not widely accepted. Avoid public displays of affection.	
Health Risks	● Air pollution has been measured as high in some cities in Serbia, including Belgrade. If you have a breathing condition, talk to your doctor before you travel. ● Tick-borne encephalitis is a risk. Ticks are common from spring to autumn. Check for ticks and carefully remove the whole tick. Take care in forests and fields in particular. ● West Nile virus can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. ● Outbreaks of trichinellosis, brucellosis and rabies sometimes occur. Avoid raw and undercooked food. ● Medical facilities are below first world standards. If you become seriously ill or injured, you may need to be evacuated. Make sure your insurance covers this.	
Weather	● Earth tremors and flooding can occur. Bushfires happen in summer. Snow and ice can be a danger in winter. Monitor the media for updates.	
Other	● As a tourist, you can stay up to 90 days without a visa. For other situations, contact an embassy or consulate of Serbia. ● Don't enter Serbia from Kosovo unless you first travelled into Kosovo from Serbia. ● Register your address at a police station within 24 hours of arriving. Or check that your hotel will do this. ● On arrival, declare currency and valuables with a value of 10,000 euros or equivalent. ● Driving can be dangerous due to poorly maintained vehicles, roads and poor driving habits. Take extra care after bad weather.	

Slovenia

	**Threat Level** N/A	**Latitude / Longitude** 46.151241, 14.995463 **GPS Position** 46° 9' 4.4676" N 14° 59' 43.6668" E
Crime		
Laws	● Due to the influx of asylum seekers, borders are increasingly under tight restrictions	
Health Risks	N/A	
Weather	N/A	
Other		

Spain

	**Threat Level** Exercise normal safety precautions.	
		Latitude / Longitude 40.463667, -3.74922 **GPS Position** 40° 27' 49.2012" N 3° 44' 57.192" W
Crime	● Terror attacks have occurred. Authorities have stopped some attacks. Spain's terrorism alert is at level 4 of 5 (high). Always be aware of possible threats. Take official warnings seriously. ● Demonstrations and strikes disrupt transport. Sometimes protesters clash with police. Avoid unrest. ● Watch out for bag snatching, pickpocketing and theft from cars in large cities. Petty crime is a serious problem in Barcelona. Take care at tourist spots, beaches and on transport. ● Taking part in the Running of the Bulls in Pamplona is dangerous. Check your travel insurance covers you.	
Laws	● Always carry personal ID. Police can detain you until they can confirm your identity. ● Don't photograph military sites. ● Spain doesn't recognise dual nationality.	
Health Risks	● Health risks are similar to those in first world countries. ● The standard of medical facilities is high.	
Weather	● Spain experiences earthquakes, severe storms and forest fires. Monitor local media for updates.	
Other	● Spain is part of the Schengen area. You can enter Spain without a visa in some cases. In other situations, you'll need a visa. ● Get a legible entry stamp when you first enter the Schengen area. ● If you're travelling to or from any non-European Union country, declare funds of 10,000 euros or more. ● Carry your passport when crossing borders, even within the Schengen area. ● If you're driving, carry 2 red warning triangles and a reflective jacket. You must use these if you have an accident or breakdown.	

Turkey

🇹🇷	**Threat Level** Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Provinces of Batman, Bingol, Bitlis, Gaziantep, Hakkari, Hatay, Kilis, Mardin, Sanliurfa, Siirt, Sirnak, Tunceli and Van, Ankara and Istanbul, reconsider your need to travel.	**Threat Level** Areas within 10 kilometres of the border with Syria, Diyarbakir, do not travel.		**Latitude / Longitude** 38.963745, 35.243322 **GPS Position** 38° 57' 49.482'' N 35° 14' 35.9592'' E

Crime	● There's a high threat of terrorist attacks in Turkey, particularly in the south-east. Possible targets include diplomatic missions, tourist areas, transport networks, shopping malls, Western hotels and entertainment precincts. Avoid crowds and possible targets, especially on significant dates and anniversaries. ● The risk of violence and acts of war is high along the borders with Syria and Iraq. Threats include rocket attacks, terrorist attacks and kidnapping. If you decide to travel to these areas, seek professional security advice. ● Protests happen often in major cities. They can turn violent. Extremists have targeted political protests. Avoid large public gatherings. ● Muggings and assaults are common, especially in Istanbul's tourist areas. Avoid travelling alone, especially after dark. Be wary of new friends and acquaintances. ● Food and drink spiking is an issue. Don't accept food, drinks, gum or cigarettes from strangers. Don't leave your food or drinks unattended. ● Scams are common among restaurants, taxis and carpet traders. Be wary of friendly locals who offer to take you to a bar for food and drinks. Insist taxi drivers use the meter. Be wary of deals where a carpet trader offers to send you goods by post.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe and include long prison sentences. ● Always carry photo ID, such as a copy of your passport. Keep the original in a safe place. ● It's illegal to 'insult' Turkey, the Turkish flag, the President or government, and the country's founder, Mustafa Kemal Atatürk. Don't make insulting comments, including on social media. It's illegal to photograph military sites. ● Get a receipt and an official certificate if you want to export cultural artefacts or antiquities. Exporting them without a permit is illegal. Other illegal activities include using a metal detector to search for artefacts, and defacing or destroying Turkish currency. ● Turkey recognises dual citizenship, but dual nationals are viewed as Turkish citizens in legal matters. If you're a male dual national, you may have to do military service. Check with a Turkish embassy or consulate before you travel. ● Many parts of Turkey have conservative dress and behaviour standards. Dress modestly, particularly at mosques and shrines. Respect religious and social traditions. Avoid public displays of affection.
Health Risks	● Malaria is a risk from May to October in Amikova, Çukurova Plain and the south-east. Consider taking anti-malarial medication. ● Other insect-borne diseases include leishmaniasis and Crimean-Congo haemorrhagic fever. Ensure your accommodation is insect-proof. Use insect repellent. ● People have died from bird flu in Turkey. Ask your doctor about vaccination before you travel. ● Foodborne, waterborne and other infectious diseases include tuberculosis, typhoid, hepatitis, measles and rabies. Drink only boiled or bottled water. Avoid raw or undercooked foods. ● Alcoholic drinks may be mixed with toxic substances, including methanol. Drink only at reputable venues. Avoid home-made alcohol. Get medical help straight away if you suspect poisoning. ● Private hospitals in major cities often have good medical facilities. Services elsewhere are limited. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.
Weather	● Drought conditions in some cities can affect water supply. Running water may not be available in many places, including in hotels and accommodation.
Other	● You may be able to get an e-visa if staying for less than 90 days in a 180-day period. Apply through the official e-visa website only. Otherwise, arrange your visa through a Turkish embassy or consulate before you travel. ● Tourists arriving by sea may be able to stay for up to 72 hours without a visa. Ask your travel agent for details. ● Be prepared for a range of weather conditions at the Gallipoli Peninsula Peace Park and Anzac Cove. Winter storms and heavy traffic seriously affect many coastal roads in the region. Stay on marked roads and tracks. ● Don't ride motorcycles due to the poor standard of driving and road maintenance. ● Use only licensed taxis. Insist the driver uses the meter. Using a rideshare service is illegal and could result in fines. ● Accidents are common on Turkey's inter-city bus network. Train travel is usually safe and efficient. ● Security at major airports is tight due to terrorist attacks in recent years. This can cause crowds and delays. Ensure you leave plenty of time to check in.

4 Western Europe

Austria

🇦🇹	**Threat Level** Exercise normal safety precautions.						**Latitude / Longitude** 47.516231, 14.550072 **GPS Position** 47° 30' 58.4316'' N 14° 33' 0.2592'' E

Crime	● Always be alert to terrorism. Terrorists have targeted European cities, including transport hubs and places visited by travellers. Take official warnings seriously. ● Petty crime, such as bag snatching and pickpocketing, is on the rise. Be careful on public transport and in areas popular with tourists. Take care using ATMs.
Laws	● Don't carry or use illegal drugs. Penalties are severe. ● Always carry your ID. ● It's illegal to cover your face in public places to hide your identity. ● Dual nationals may have to complete national service. Check with the embassy or consulate of Austria.
Health Risks	● Take care in forests where tick-borne encephalitis is a risk. Ticks are active from spring to autumn. Check your body for ticks and remove them as soon as possible. ● West Nile virus can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof. ● Health care standards are high. So are medical costs. Most doctors speak English.
Weather	● Avalanches, flash floods and mudslides occur in alpine areas. Monitor local weather. Follow the advice of local authorities. Stick to marked slopes and trails when skiing.
Other	● Austria is part of the Schengen area. You can enter Austria without a visa in some cases. In other situations, you'll need to get a visa. ● Get a clear entry stamp when you first enter the Schengen area. Some road and rail border crossings have immigration controls. Always carry your passport when you cross the border. ● A child travelling without both parents may need a letter of consent. Check with the embassy or consulate of Austria. ● Register the location with local authorities if you're staying in private accommodation for more than 3 days. ● Take care on alpine roads in winter. You must have winter tyres from 1 November to 15 April when driving in winter conditions. Carry snow chains if you're driving in the mountains.

Belgium

Belgium	**Threat Level** Moderate threat level to personal safety, take extra precautions here.		**Latitude / Longitude** 50.503887, 4.469936 **GPS Position** 50° 30' 13.9932'' N 4° 28' 11.7696'' E

Crime	● There's an ongoing threat of terrorism in Belgium. A higher threat applies in some areas. Terrorists have staged attacks and may plan more. Crowded places, such as tourist areas, shopping areas and transport hubs, are possible targets. Keep alert. Report anything suspicious to the police. ● Petty crime, such as mugging, pickpocketing and bag snatching, occur. Thieves often try to distract you. Take care at tourist spots, on public transport and at train stations. ● Demonstrations are common. Belgium hosts large international meetings. Increased security can disrupt transport. Avoid affected areas.
Laws	● Always carry your passport or Belgian government-issued ID.
Health Risks	● Medical care and facilities are similar to the U.S. and Australia.
Weather	
Other	● Belgium is part of the Schengen area. You can enter without a visa in some cases. In other situations, you'll need to get a visa. ● To drive, you'll need both an International Driving Permit and a valid driver's licence. ● Only use licensed, official taxis. Assaults and robberies have occurred in unlicensed taxis. ● There's increased security at airports and train stations. Contact your airline or travel agent for updates. ● In Belgium, vehicles must give way to the right at intersections or from side roads. Instances of road rage are common. Penalties for traffic infringements are severe. Learn local road rules before you drive.

France

France	**Threat Level** Moderate threat level to personal safety, take extra precautions here.		**Latitude / Longitude** 46.227638, 2.213749 **GPS Position** 46° 13' 39.4968'' N 2° 12' 49.4964'' E

Crime	● There's a high risk of terrorist attacks in France. Be cautious around locations known to be targets. Authorities have extra counter-terrorism powers. They may restrict your access to some places or search you. Take official warnings seriously. ● Large-scale strike action began on 5 December and may continue for some time. Expect significant disruptions to local transport, including train, air and cross-Channel ferry services. Eurostar and other international train services (including those to the Netherlands and Belgium) are also expected to be affected. Monitor local media and contact your travel provider for updates. Large demonstrations and gatherings are expected as part of the strike. Avoid protests and demonstrations, exercise caution and follow the advice of local authorities. ● Organised strikes happen often. They can disrupt transport, including flights. ● Violent attacks against tourists have increased, especially late at night in tourist areas. Don't walk in quiet or poorly lit streets at night. ● Violent theft on public transport has significantly increased, especially in Paris. Robbery and muggings are common on trains to Paris airports. Conceal your valuables. ● Vehicle crime is common in the south of France and on the Remembrance Trail. Always keep your windows up and doors locked. ● Credit card and ATM fraud is increasing. Check your bank statements often. Identity theft also occurs through accommodation scams. Only book travel through reputable providers.
Laws	● Don't use or carry illegal drugs. Penalties for drug offences include long prison sentences. ● Always carry photo ID, such as your passport. Police conduct random checks, particularly at borders. ● Stop to help if you witness an accident or if someone asks for help. Report all accidents to emergency services. If you fail to help, officials could charge you, unless helping will risk your or others' safety. ● It's illegal to cover your face in public places or to force someone else to. ● Be careful when taking photos. It's illegal to photograph security forces, including police.
Health Risks	● Health risks in France are similar to those in first world countries. ● West Nile virus (WNV) has occurred throughout France. Ensure your accommodation is insect-proof. Use insect repellent. ● The standard of medical facilities is similar to first world countries. Public hospital stays can be expensive. Ensure your travel insurance covers this.
Weather	● Natural hazards include avalanches, mudslides, forest fires and flash flooding. Follow the advice of local officials.
Other	● France is part of the Schengen area. This means you can enter without a visa in some circumstances. If you're travelling for more than 90 days or for reasons other than tourism, you may need a visa. Contact your nearest French embassy or consulate for details. ● Since 2015, asylum-seeker movements have put significant pressure on border controls in Europe. Always carry your passport when you cross borders, including in the Schengen area. ● To drive in France, you need a valid driver's licence. You may also need an International Driving Permit (IDP) to rent a car. Get your IDP before leaving your country. ● If you use public transport, keep your ticket until you exit the system. Inspectors conduct random checks and can fine you if you don't have it.

Germany

Germany	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 51.165691, 10.451526 **GPS Position** 51° 9' 56.4876'' N 10° 27' 5.4936'' E

Crime	● Terrorists have staged attacks and threaten more. Recent attacks have targeted transport hubs and places visited by foreigners, including Christmas markets. Always be alert. Report anything suspicious to the police. ● Violent crime isn't common but does happen. Petty crime, such as pickpocketing and theft from cars and trains, is common. Take care of your belongings. ● Racial harassment occurs. Take care in cities particularly in the former East Germany. ● Watch out for drink spiking. It can lead to sexual assault. Stick with people you trust in bars.
Laws	● Nazi symbols, salutes, songs or material, such as flags or memorabilia, are all illegal. ● Always carry photo ID.
Health Risks	● Take care in forests, particularly in Bavaria and Baden-Württemberg. Tick-borne encephalitis is a risk. Ticks are active from spring to autumn. Check your body for ticks and remove them as soon as possible. ● Medical care and facilities are good. ● If you don't have insurance, hospitals may ask for up-front payment. Costs are higher than in first world countries.
Weather	

Other	• Germany is part of the Schengen area. You can enter Germany without a visa in some cases. In other situations, you'll need to get a visa. • Always carry your passport when crossing or travelling near the border, even in the Schengen area. • Learn the road rules before you drive. You'll usually need winter tyres between October and Easter. Bicycles usually have the right of way.

Liechtenstein

	**Threat Level** N/A	**Latitude / Longitude** 47.166000, 9.555373 **GPS Position** 47° 9' 57.6" N 9° 33' 19.3428" E

Crime	
Laws	N/A
Health Risks	None
Weather	N/A
Other	

Luxembourg

	**Threat Level** N/A	**Latitude / Longitude** 49.815273, 6.129583 **GPS Position** 49° 48' 54.9828" N 6° 7' 46.4988" E

Crime	
Laws	N/A
Health Risks	None
Weather	N/A
Other	

Monaco

	**Threat Level** N/A	**Latitude / Longitude** 43.738418, 7.424616 **GPS Position** 43° 44' 18.3048" N 7° 25' 28.6176" E

Crime	
Laws	N/A
Health Risks	None
Weather	N/A
Other	

Netherlands

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** 52.132633, 5.291266 **GPS Position** 52° 7' 57.4788" N 5° 17' 28.5576" E

Crime	• There's a significant threat of terrorism across the Netherlands. Terrorists have staged attacks. Tourist spots and public transport are possible targets. Always be alert. Report anything suspicious to the police. • Petty crime, such as pickpocketing and bag snatching, is common. Drink spiking is also a risk. • Watch out for thieves who pose as plain-clothes police officers. • Take care of your belongings, particularly at tourist spots and on public transport.
Laws	• Only Dutch residents can legally buy or use cannabis. It's against the law for non-residents. • Anyone aged over 14 years must carry ID.
Health Risks	• Medical care and facilities are good.
Weather	

Other	● The Netherlands is part of the Schengen area. You can enter the Netherlands without a visa in some cases. In other situations, you'll need a visa. ● Amsterdam's Schiphol Airport has strict security. Allow at least 2 hours for flights within Europe. Allow 3 hours for other international flights. ● A child travelling without both parents may need a 'Permission to Travel' form. ● Trams, cyclists and mopeds have right of way. Learn local road rules before you drive.

Switzerland

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
46.818188, 8.227512

GPS Position
46° 49' 5.4768" N
8° 13' 39.0432" E

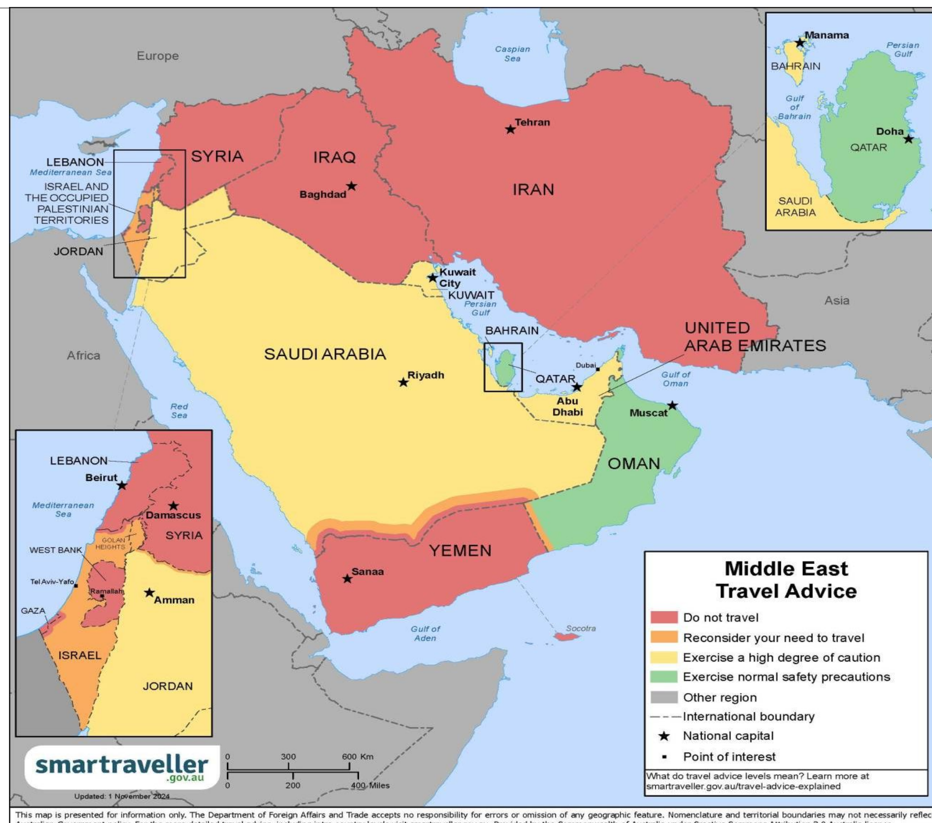
Crime	● Serious crime levels are low, but petty crime is on the rise. Take care at tourist spots and on transport, including overnight trains. Watch out for thieves who use distraction techniques. Keep your belongings close. ● Terrorists are likely to plan attacks targeting Switzerland. Terrorists have targeted European cities, including transport hubs and places visited by travellers. Always be alert. Take official warnings seriously.
Laws	● Don't use or carry drugs. Penalties are severe. ● If you're a foreigner convicted of a serious crime in Switzerland with at least a three year prison sentence, you can be deported. You might not be able to return for 5 to 15 years.
Health Risks	● Medical care and facilities are good. ● If you don't have insurance, hospitals may ask for up-front payment. Costs can be high.
Weather	● Avalanches, flash floods, rock falls and mudslides occur in alpine areas. Monitor local weather. Follow the advice of authorities. Stick to marked slopes and trails when skiing.
Other	● Switzerland is part of the Schengen area. You can enter and stay in Switzerland as a tourist without a visa for a period of 90 days in any 180-day period. In other situations, you'll need to get a visa. ● A child travelling without both parents may need a letter of consent. Check with the State Secretariat for Migration (SEM). ● Always carry your passport when crossing borders, even within the Schengen area. ● Road conditions are good. Be careful when driving in winter. Ask locals for advice on snow tyres and chains. Learn local road rules.

6 Middle East

The Middle East region.

The colour shading and travel advice on the map is the advice given by the Australian Government and is accurate as of the 20th Feb 2025.

However countries risk ratings rarely change so this could be considered accurate advice going into the forseeable future.



Middle East

Bahrain

Threat Level
High threat level to personal safety, take a range of extra precautions here.

Latitude / Longitude
26.066700, 50.5577

GPS Position
26° 4' 0.12" N
50° 33' 27.72" E

GEOGRAPHY | Middle East | Middle East

Bahrain

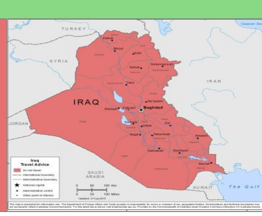
Crime	● Terrorist attacks have killed and injured people. Future attacks may happen. Avoid possible targets. Take official warnings seriously. ● Protests and clashes occur. Public rallies and meetings of large groups are illegal. Don't get caught up in demonstrations. Take care around Friday prayers due to the likelihood of unrest. ● The level of crime overall in Bahrain is low, although pickpocketing and bag snatching occur. Take care near the old market areas (souks).
Laws	● Always carry photo ID. You could be fined if you don't. ● Behaviour that's offensive but not criminal in your country can be illegal. Punishment may be severe. This applies even if you're transiting. Bahrain has the death penalty for murder and drug offences and corporal punishment for some offences such as stealing. ● It's illegal to publicly support Qatar. Don't speak against government policy, even on social media. It's also illegal to swear or make rude gestures. ● Dress modestly. Make sure you cover your elbows and knees. ● Same-sex relations are legal but aren't socially accepted. Avoid public displays of affection.
Health Risks	● Middle East respiratory syndrome coronavirus (MERS-CoV) is a risk. Other Middle Eastern countries have reported cases of MERS-CoV. ● The standard of medical care is high. ● You may have to pay up-front before doctors will treat you. Costs can be high. The government may ask you to repay the cost of emergency treatment. Ensure that your insurance can cover this.
Weather	● The weather is very hot from June to August. Sandstorms and dust storms are common. Monitor local media for updates.
Other	● You need a visa to enter Bahrain which can be obtained on-line. ● Authorities might not let you into Bahrain if you've been to Israel or have an emergency passport. ● The legal age of maturity in Bahrain is 21. A child of a Bahraini father does not need his permission to leave Bahrain unless there is a travel ban imposed on the child in connection with custody proceedings. ● Authorities may stop you from leaving Bahrain if you're involved in a business dispute. ● Bahrain's only land exit is into Saudi Arabia. The border can close without notice. ● Unsafe driving is common, especially speeding. Watch for roaming animals and drifting sands. Off-road driving can be dangerous. ● Sea travel can be hazardous due to territorial disputes and security issues. Piracy is a risk. If you travel by sea, monitor the International Maritime Bureau's piracy reports. Use safety equipment, even if others don't.

Iran

Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Border areas with Afghanistan, Pakistan and Iraq, do not travel.					**Latitude / Longitude** 32.427908, 53.688046 **GPS Position** 32° 25' 40.4688'' N 53° 41' 16.9656'' E

Crime	● Regional tensions have increased. This is due to the ongoing conflicts in Iraq and Syria, rising hostility between Iran and Israel and recent military tensions between Iran, the US and other countries in the Middle East. The Iran-Iraq border area is extremely dangerous. Don't travel to this area. ● Regional and international politics can trigger protests. These may target Western or UN diplomatic missions. They sometimes turn violent. Avoid large public gatherings. Be prepared to change your travel plans. ● Foreigners in Iran, risk arbitrary detention or arrest. The risk is greater if you're a dual citizen. We can't guarantee access to consular services or legal representation if you're detained or arrested. ● Terrorist attacks could happen anywhere in the country, including Tehran. They could occur at any time. Avoid possible targets and areas with a low level of security. Take official warnings seriously. ● Drug traffickers and bandits are active in the Afghanistan and Pakistan border areas. They often clash violently with security forces. Bombings and shootings occur. Be alert to your surroundings, especially at night. Outside these areas, the level of violent crime is low. ● Women can face unwanted attention and harassment. If you're a woman, take care when travelling alone, particularly at night.
Laws	● Don't use, carry or import illegal drugs. Punishments for drug offences are severe. They include the death penalty. ● Get professional advice if you're involved in local legal proceedings. In particular, seek advice on matters of family law, such as divorce, child custody and child support. ● Same-sex relations are illegal for both men and women. Penalties include corporal punishment and death. ● Iran has strict codes of dress and behaviour. Close contact between unmarried men and women is illegal, as is being in a de facto relationship. This is particularly the case for interactions between Muslims and non-Muslims. It's against the law to behave in a way that offends Islam, such as encouraging a Muslim to convert. ● Be careful when taking photos. It's illegal to photograph military or government sites, critical civil infrastructure and public protests. It's illegal to use drones without authorisation. ● Iran has strict importation laws. You can't import alcohol, pornography, pork products or short-wave radios. It's also illegal to import printed or recorded Western materials, including religious material. Get permission to bring in electronics, such as satellite phones, GPS trackers and walkie-talkies.
Health Risks	● Malaria is common outside major towns, especially in the south and west. Consider taking anti-malarial medication if you're travelling to these areas. ● Other insect-borne diseases are common, including leishmaniasis and tick-borne encephalitis. Ensure your accommodation is insect-proof. Use insect repellent. ● HIV/AIDS is a risk. Take precautions if you engage in high-risk activities. ● Waterborne, foodborne, parasitic and other infectious diseases occur. These include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Significant air pollution occurs in major cities. Sandstorms and dust storms happen often. Get medical advice if you have allergies or breathing difficulties.
Weather	
Other	● You'll need a visa to enter Iran. If you're a tourist, you can apply for a visa on arrival. You must be staying for 30 days or less and entering through an international airport. For other situations, get a visa before you travel. Contact your nearest Iranian embassy for details. ● If your passport contains Israeli stamps or visas, Iranian authorities will refuse you entry. ● The local currency is the Iranian Rial (IRR). Declare any foreign currency you have when you arrive in Iran. If you don't, authorities may confiscate it when you leave. You can exchange major currencies in all big cities. You can't use international credit or bank cards. You can't transfer money using commercial banks or money transfer companies. Bring enough cash to cover your stay. ● To drive in Iran, you need a driver's licence and an International Driving Permit (IDP). Get your IDP before you travel. Iran has one of the highest rates of road accidents in the world. Ensure you understand local road laws and practices before you drive. ● Public transport is limited. Consider hiring a car and driver for long-distance travel.

Iraq

Threat Level Extreme threat to personal safety, recommended not to travel here.						**Latitude / Longitude** 33.223191, 43.679291 **GPS Position** 33° 13' 23.4876'' N 43° 40' 45.4476'' E

Iraq

Crime

- The security situation is unstable. It could worsen with little warning. Leave as soon as possible. If you decide to travel to or stay in Iraq get professional security advice.
- There's a very high risk of kidnapping. Terrorists and criminal gangs may kidnap expats working in Iraq. Journalists and aid workers are at particular risk.
- Large, coordinated attacks by armed groups have killed and injured 1000s of people. Terrorist attacks occur often and without warning. Avoid possible targets. If you must visit them, always have an exit plan.
- Political rallies and protests often happen in Baghdad and other regions of Iraq. These grow quickly and can turn violent. Avoid large public gatherings. If you're caught in an affected area, stay indoors. Follow the advice of local authorities or your security provider.
- Violent crime and corruption are common. Crime includes kidnapping, murder and robbery. Organised criminal gangs, militia and tribal groups are significant threats. If you decide to travel to or stay in Iraq travel with your vehicle doors locked and windows up. Secure your accommodation against intruders.
- Be alert to scams. Scammers may claim to represent Iraqi governments, or say they're Iraqi importers. Get legal advice if an Iraqi importer contacts you or your company.

Laws

- Many laws in Iraq are different than in the U.S. and Australia. It's illegal to preach anywhere except in a place of worship. It's also illegal to attempt to convert a Muslim, or for Muslims to abandon their faith. Familiarise yourself before you go.
- Heavy penalities apply for murder, treason, drug offences and terrorism, including the death penalty.
- During the Islamic holy month of Ramadan, it's illegal to eat, drink or smoke in public during daylight hours.
- It's illegal to photograph or film government buildings, checkpoints, military bases and embassies. Get approval if you want to film in a public place. Journalists without approval have been arrested.
- The Minister for Foreign Affairs has declared Mosul an area where a terrorist organisation is taking part in a war-like activity.

Health Risks

- Get comprehensive travel insurance before you leave, including coverage for medical costs and evacuation. You'll probably need a special policy that covers travel to high-risk destinations. Most policies won't cover you.
- Insect-borne diseases are common. Malaria is widespread in the southern province of Basrah and areas below 1500m. Consider taking anti-malarial medicine if you're travelling to these areas. Ensure your accommodation is insect-proof. Use insect repellent.
- HIV/AIDS is common. Take steps to reduce your risk of exposure to the virus.
- Waterborne, foodborne and other infectious diseases are common. These include cholera, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked food.
- Iraq is no longer affected by wild poliovirus. However, the disease may still come in from nearby countries. Ensure your vaccinations are up to date before you travel.
- Health facilities in major cities are limited. In remote areas, they're very basic or not available. If you're seriously ill or injured, you'll need medical evacuation. Make sure your travel insurance covers it.

Weather

Other

- If you're in Iraq, leave straight away. If you travel there get a visa issued by the Iraqi Government before you arrive. If you're only travelling to the Kurdistan region, you may be able to get a 30-day visa on arrival. Contact an Iraqi embassy or consulate for details.
- There are security checkpoints throughout Iraq. Follow the instructions of officials at checkpoints. Criminals and terrorists have used false security checkpoints to stage kidnappings, robberies and murders or launch attacks.
- The local currency is the Iraqi Dinar (IQD). US dollars and euros are the easiest foreign currencies to exchange. Do this at commercial banks and exchange bureaus.
- Road travel is dangerous. Risks include roadside bombs, attacks at checkpoints and robberies. If you need to travel by road, get professional security advice from a reputable company.
- Airport closures or flight suspensions may occur with little notice. Check your flights well in advance. Aviation safety and security standards may not meet those set by the International Civil Aviation Organization.

Israel, the Gaza Strip and the West Bank

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
The West Bank, including Bethlehem, Jericho and Ramallah; all parts of Golan Heights east of Route 98, Areas within 5 kms of the border with the Gaza Strip, reconsider your need to travel.

Threat Level
Gaza Strip, do not travel.

Latitude / Longitude
Israel
31.046051, 34.851612

Gaza Strip
31.354676, 34.308826

GPS Position
Israel
31° 2' 45.7836'' N
34° 51' 5.8032'' E

Crime

- Israel is a target for terrorism, rocket fire and military confrontation. Terrorist attacks could happen at anytime or anywhere. Always be alert. Have an exit plan. Tension and security risks exist close to Israel's borders with Lebanon, Syria and Egypt. Rocket attacks and military activity are threats.
- Security in the West Bank is unpredictable. This includes Bethlehem, Hebron, Jericho and Ramallah. Tensions are high. Violence occurs. Take care around West Bank checkpoints and the Old City in Jerusalem. If you're in the West Bank during military action or civil unrest, stay in a safe place indoors. Monitor the media.
- Gaza, the Gaza border and waters off the coast of Gaza are extremely dangerous. Injuries occur during clashes. Demonstrations are common. We may not be able to provide consular help in Gaza.
- The threat of civil unrest is high. Security could worsen without warning. The Israeli Defence Force (IDF) may declare an area a closed military zone. Authorities can arrest civilians in these zones. Check the IDF Home Front Command.
- Demonstrations could happen anywhere in Israel and the Palestinian Territories. Avoid demonstrations.
- Kidnapping is a risk in Gaza, in the West Bank and near the boarder with Syria.

Laws

- The Sabbath in Israel happens from sunset Friday until sunset Saturday. In Orthodox neighbourhoods, driving or using a mobile phone or digital camera on the Sabbath may offend.
- Don't use or carry illegal drugs. Penalties are severe.
- You must always carry originals or copies of your passport, visa or entry permit in the Palestinian Territories.
- Palestinian law has the death penalty for some crimes including treason, helping an enemy and murder.
- Gaza has Islamic law. Drinking alcohol and homosexual acts are illegal.
- Take care not to offend in Gaza and the West Bank. Avoid public displays of affection. Dress conservatively.

Health Risks

- Infectious diseases are a risk. Drink boiled or bottled water.
- West Nile virus can occur. There's no vaccine to prevent it. Use insect repellent. Make sure your accommodation is insect-proof.
- The standard of medical facilities in Israel is reasonable.
- Facilities in the West Bank and Gaza are limited. If you become seriously ill or injured, you may need to be evacuated. Make sure your travel insurance covers this.

Weather

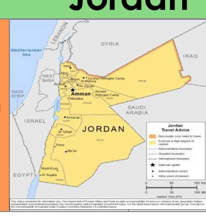
Other

- You can usually stay for up to 3 months without a tourist visa. Instead of an entry stamp, you'll get an entry card. Keep this with your passport.
- Authorities can subject you to a security and police record check when you're entering. They can refuse you entry or exit without a reason. They may question you at length and search your bags.
- Declare amounts of $US10,000 or more, or the equivalent in another currency.
- Take care when using public transport. It might not be safe.
- By law, you're considered Israeli if one or both of your parents are Israeli. Israeli citizens must enter ad leave on an Israeli passport. Authorities will consider you a Palestinian national if you currently hold, or used to hold, a Palestinian ID card. You may need to get a Palestinian travel document.
- Travel to Gaza is dangerous. Exiting can be difficult. Get a permit from Israeli authorities to use the Erez crossing. Get a permit from Egyptian authorities to use the Rafah crossing. We can only provide limited consular help in Gaza.

Jordan

Threat Level
Moderate threat level to personal safety, take extra precautions here.

Threat Level
Areas near the borders with Syria and Iraq, reconsider your need to travel.



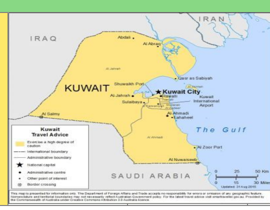
Latitude / Longitude
30.585164, 36.238414

GPS Position
30° 35' 6.5904'' N
36° 14' 18.2904'' E

Crime	● Protests are common in Jordan, including in Amman. They often occur after Friday midday prayers but can happen at other times. Most protests are peaceful, but some have turned violent. Avoid large public gatherings. ● Avoid Jordan's borders with Iraq and Syria. There's frequent military activity in these areas, including shelling and gunfire. ● Extremists plan to attack Westerners in Jordan. Stay at hotels with a visible security presence. Have an exit plan if you visit possible targets. ● Petty crime includes robbery with violence, bag snatching, theft from hotels and vehicles, and assault. Be alert in tourist areas, especially to pickpocketing, bag snatching and assault by unlicensed guides. ● Scammers operate in tourist areas. They often target single women. They promise companionship, marriage or offer joint business ideas. Credit card fraud, including card skimming, occurs. Be wary of approaches from friendly strangers. Always keep your card in sight when shopping. Check ATMs for card-skimming devices. ● Shooting guns to celebrate is illegal but common. It sometimes causes death and injury. Stay indoors and away from windows if people are celebrating with gunfire.
Laws	● Many laws in Jordan are different than in the U.S. and Australia, including for sex outside marriage, taking photos of embassies, military or security sites and religious activities. Familiarise yourself before you go. Get professional advice for local legal matters. You may be prevented from leaving the country until issues are resolved. ● Don't use or carry illegal drugs. Penalties for drug offences include life imprisonment. There are jail terms for possessing small amounts of drugs. Serious crimes attract the death penalty. These include terrorism, murder, treason and rape of a minor. Some offences, such as causing personal injury or property damage, are punishable by hard labour. ● Women may be verbally, sexually and physically harassed or sexually assaulted. Don't make eye contact with or talk to men you don't know. Don't walk or travel alone, especially after dark. Always ride in the back seat of taxis. ● Respect the Islamic holy month of Ramadan. During Ramadan, it's illegal to eat, drink and smoke in public during daylight hours. ● Local customs are conservative. Public affection between couples is unacceptable, as is unmarried couples living together or sharing accommodation. Same-sex relations are not socially acceptable. Always get consent before taking photos of people. ● If you're a dual national, authorities will consider you Jordanian. Men aged between 18 and 40 need to register for military service, although you don't have to complete it. If you don't register, authorities may not let you leave the country.
Health Risks	● Cases of Middle East respiratory syndrome coronavirus (MERS-CoV) are reported. Avoid consuming products contaminated with camel secretions. Wash hands regularly before and after touching animals. ● Waterborne, foodborne, insect-borne and other infectious diseases are prevalent. They include hepatitis, typhoid, measles and sandfly fever. Drink only boiled or bottled water. Avoid raw or undercooked foods. Ensure your accommodation is insect-proof. Use insect repellent. ● Amman has high-quality private medical services. Outside major cities, health services are basic. Paramedic and ambulance services are basic compared with first world countries. You may have to pay up-front. If you're seriously ill or injured, you might need medical evacuation. Ensure your travel insurance covers this.
Weather	
Other	● You need a visa to enter Jordan. Tourists can get a single-entry 30 days visa on arrival. These are available at airports or the Sheikh Hussein/North Border crossing from Israel. Register with the police if you're staying longer than 1 month. You may need to get medical and HIV tests. Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is a risk. In other situations, get a visa before you travel. ● Under Jordanian law, a husband can prevent his children from leaving Jordan. ● The local currency is the Jordanian Dinar (JOD). ATMs are available in Amman and in other major cities. They're less common in rural areas. Most petrol stations on major roads have ATMs. ● There are unexploded weapons and landmines in Jordan's border regions. Known minefields are usually fenced and marked, but warnings may not be obvious. Get local advice in these areas. ● Road rage incidents are common. They can escalate quickly. Road travel in remote desert areas is very risky. Don't drive outside cities at night. If you're in an accident, no matter how minor, stay at the scene until traffic police arrive. ● Use only licensed taxis or reputable limousine services arranged through your hotel. Avoid taxis that tout for business at airports, hotels and tourist attractions. They often try to charge high prices. Always insist drivers use the meter.

Kuwait

Threat Level
Moderate threat level to personal safety, take extra precautions here.

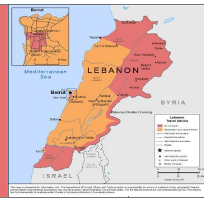


Latitude / Longitude
29.311660, 47.481766

GPS Position
29° 18' 41.976'' N
47° 28' 54.3576'' E

Crime	● Terrorist attacks are possible, especially against Western interests. Take official warnings seriously. Consider the level of security provided when visiting possible targets. ● Protests sometimes happen, usually on Fridays. They often occur in the Al-Qibla, Jahra and Sulaibaya areas. Protesters and security forces have clashed. Avoid large public gatherings. Take care around Friday prayer times. ● Kuwait's crime rate is low but rising. Women sometimes get verbally and physically harassed. In Jahra, attackers may be armed. Robberies are reported in Jleeb Al-Shuyoukh. Don't walk alone at night. If you're female, don't travel alone.
Laws	● Kuwaiti authorities don't normally notify the embasies if they detain or arrest tourists. Ask a family member, friend or colleague to inform the Embassy as soon as possible. ● Don't use or carry illegal drugs. Penalties include the death sentence. Get professional local legal advice for any business or family law matters. Some offences that aren't serious in other countries are extremely serious in Kuwait. ● Always carry ID, such as your passport or Kuwaiti civil ID card. Authorities conduct regular checks for illegal workers. ● Kuwait has strict laws regarding its Emir. It's illegal to challenge or insult the Emir in any way. It's also illegal to use social media to criticise regional political matters and figures, including the Emir. ● Kuwait has strict laws on relationships. Same-sex relations are illegal. It's against the law for unmarried couples to live together or stay together in hotel rooms. Public displays of affection are also illegal. ● Kuwait doesn't recognise dual nationality. ● Standards of dress and behaviour are conservative. Avoid wearing shorts or tight clothing if you're a woman. Take care in conservative areas like Jahra and Jleeb Al-Shuyoukh.
Health Risks	● Cases of Middle East respiratory syndrome coronavirus (MERS-CoV) are reported. Avoid contact with camels or products contaminated with camel secretions. ● Some Kuwaiti medical facilities offer high-quality services but other don't. Some hospitals, including some private hospitals, don't accept foreigners. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● Be prepared for extreme weather. Sand and dust storms occur regularly. In the hottest months, the temperature is often above 50°C. Flooding can happen, usually between December and January.
Other	● You need a visa to enter Kuwait. You can get a visa on arrival that's valid for 3 months. Pay for it in Kuwaiti dinars. You can get tourist, business and work visas online through the Kuwait e-Visa website. You'll still have to pay for them at Kuwait International Airport. For employment or residency visas, contact a Kuwaiti embassy or consulate. ● You may have trouble entering Kuwait if your passport has evidence of travel to Israel. ● The local currency is the Kuwait Dinar (KWD). ATMs are common. Many places accept credit cards, although some banks and shops won't accept foreign cards. ● Kuwait has unexploded weapons, including landmines, in desert areas and on some beaches. Stay on well-travelled roads. Don't pick up strange objects on beaches. ● It's illegal and dangerous to travel near the Iraq and Saudi Arabia borders without authorisation. Armed guards patrol border areas. Don't travel to Iraq. If you go there make sure you have correct documents authorising your movements. Only use official border crossings.

Lebanon

	Threat Level High threat level to personal safety, take a range of extra precautions here.	**Threat Level** Southern suburbs (Dahiyeh) of Beirut, including west of the airport road. Areas within five kms of the border with Syria, South of the Litani River, with the exception of the city of Tyre. Palestinian refugee camps, Tripoli and northern Lebanon north of a line from Tripoli to Sir Ed Dinniyeh and Arsal. Northern		**Latitude / Longitude** 33.854721, 35.862285 **GPS Position** 33° 51' 16.9956" N 35° 51' 44.226" E
Crime	● Lebanon's security situation is uncertain. This is due to conflict in Syria, the threat of terrorism, and political and religious tensions. Ensure your travel documents are up to date and be prepared to leave Lebanon quickly if necessary. Ensure you have passports for children born in Lebanon and current passports for all family members travelling with you. You are responsible for your own departure. ● Large protests happen. Tear gas, water cannons and live ammunition may be used to break up crowds. Avoid large public gatherings. Celebratory gunfire often occurs during and after political speeches. If you're caught in civil unrest, stay inside. Follow the advice of local officials ● Extremists may target Westerners, including in Beirut. Terrorist attacks are likely and could happen at any time and place. Kidnapping has occurred. Targets have included foreigners. Be alert to your personal security. ● Clashes between Lebanese security forces and militants are possible in the north-eastern Beka'a Valley region. Suicide bombings, rocket and IED attacks, air raids and kidnappings occur in this area. ● Don't visit Palestinian refugee camps in any part of Lebanon. Extremist groups operate from camps. Armed clashes and violent crime are common. ● South of the Litani River, there's a high threat of armed conflict. The United Nations Interim Force in Lebanon (UNIFIL) has a peacekeeping presence there. Israeli forces occupy the southern border town of Ghajar. Tensions are still high in the surrounding region, including the Shebaa Farms. Shelling is reported. Avoid areas where military activity is occuring. Be ready to leave at short notice.			
Laws	● Religious law has the same standing as civil law. All family law matters are based on local religious laws. If you're involved in divorce, custody or other family disputes, speak to a lawyer before you leave your country. ● Don't use or carry illegal drugs. Penalties are severe and include mandatory jail terms. ● Serious crimes, such as murder and treason, may attract the death penalty. ● Lebanon recognises dual nationality. However, Lebanese authorities treat Lebanese dual nationals as Lebanese citizens. This may limit our ability to help you if you're arrested or detained. ● Standards of dress and behaviour are modest in parts of Lebanon, particularly at religious sites. Public displays of affection may cause offence. Some hotels won't rent rooms to couples without proof of marriage. ● Be careful when taking photos. It's illegal to photograph military personnel or sites, government buildings and major civil infrastructure, such as power stations.			
Health Risks	● There are health risks related to Lebanon's ongoing waste disposal dispute. These include possible water contamination, waterborne illnesses and air pollution caused by burning waste. Keep away from uncollected waste. Drink only boiled or bottled water from bottles with sealed lids. ● Cases of Middle East respiratory syndrome coronavirus (MERS-CoV) are reported. Avoid contact with camels, camel products and anything contaminated with camel secretions. ● The standard of medical facilities and care in many of Lebanon's large hospitals is as good as it is in first world countries. Most recommended hospitals are private and expensive. You'll probably have to pay up-front. ● Be careful when taking photos. It's illegal to photograph military personnel or sites, government buildings and major civil infrastructure, such as power stations.			
Weather				
Other	● You might be able to get a tourist visa on arrival. Contact your nearest Lebanese embassy or consulate for details. It's against Lebanese law to travel to Israel. If there is evidence you have travelled to Israel or intend to do so, authorities will refuse you entry to Lebanon or deport you. ● Always carry ID. You'll need to show it at road checkpoints. Lebanese Border Control will check your name against a database of people wanted for or convicted of an offence. If your name matches an entry, you may be detained. You'll have to prove it if the record doesn't relate to you. Carry supporting documents, such as a copy of your birth certificate or other official documents. ● There are unexploded weapons, including cluster bombs and landmines, throughout Lebanon. Most are in the south, especially south of the Litani River. Minefields aren't always clearly marked. Follow local advice. Stay on sealed roads. Don't walk or drive cross-country. ● Don't use service (shared) taxis or taxis hailed on the street, especially late at night. There's a risk of armed robbery.			

Oman

	Threat Level Exercise normal safety precautions.	**Threat Level** Border areas with Yemen, reconsider your need to travel.		**Latitude / Longitude** 21.473533, 55.975413 **GPS Position** 21° 28' 24.7188" N 55° 58' 31.4868" E
Crime	● International terrorist groups are active in the Arabian Peninsula. Attacks against targets in Oman may happen. Take official warnings seriously. ● Protests can turn violent. Avoid large public gatherings. Take care around the time of Friday prayers. ● Armed conflict is ongoing in neighbouring Yemen. If you travel to border areas, be alert to possible threats. Seek local advice on safe routes. ● Oman has a low crime rate. Tourists are sometimes targets for burglaries and theft. Women and travellers camping in isolated areas have been assaulted. The risks increase at night. Secure your accommodation. Don't camp in isolated areas.			
Laws	● Local laws reflect that Oman is an Islamic country. Respect local traditions, customs, laws and religions at all times. ● Don't use or carry illegal drugs. Severe penalties for drug offences include the death sentence. Possessing even a small amount of drugs attracts a minimum 12-month jail sentence. ● Get professional legal advice if you're involved in legal matters, especially family or business law. Authorities may not let you leave Oman if you're involved in a dispute or have legal proceedings underway. They also may not let you depart if you have unpaid debts. ● Same-sex relationships, having sex outside of marriage and possessing pornography are illegal. Hotels may refuse accommodation to couples who can't prove they're married. Oman has strict Islamic dress codes. Dress modestly in public areas away from tourist beaches, hotels and resorts. Choose loose-fitting clothes that cover your shoulders and legs. Women wearing shorts or tight-fitting clothes are likely to attract attention. Its illegal to wear military or similar clothing and accessories. ● Oman also has a strict code of behaviour. Don't disrespect Islam. Avoid bad language, rude gestures and public displays of affection. Respect restrictions on alcohol and pork products. Take care during Ramadan and Shia festivals. Avoid eating and drinking in public during Ramadan. ● Oman has strict laws on public speech, including on social media. It's illegal to use aggressive, obscene or abusive language or gestures in public. It's also illegal to make offensive remarks about Oman, the royal family, Islam, the local government and their policies or local officials. ● It's illegal to take photos of or near government buildings or other sensitive infrastructure, including oilfields. Ask permission before taking photos of people.			
Health Risks	● Dengue, leishmaniasis and other insect-borne diseases occur in Oman, especially on the Musandam Peninsula. Ensure your accommodation is insect-proof. Use insect repellent. ● Malaria is a risk due to Oman's high temperature and humidity. Consider taking anti-malarial medication. ● Dehydration and heat stroke are a risk during summer. Drink plenty of water. Avoid long periods in the heat. ● Cases of Middle East respiratory syndrome (MERS) are reported. Get medical advice if you have a fever, cough, breathing difficulties or diarrhoea. ● Waterborne, foodborne and other infectious diseases occur. Drink only boiled or bottled water from bottles with sealed lids. Avoid raw or undercooked food. ● Health care is generally good but can vary between regions. Hospitals and clinics in larger cities are better equipped but can be expensive. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.			
Weather	● The monsoon season is from June to September. Flooding and cyclones can happen during this time. Sand and dust storms can occur during the drier months from October to May. Follow the advice of local officials.			

Other	● You need a visa to enter Oman. Apply for an e-visa online. Contact your nearest Omani embassy or consulate for updates. ● If your passport contains evidence of entry to Israel, authorities will deny you entry to Oman. They may not allow you to enter Oman from Yemen without prior approval. ● Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is a risk. ● The annual death toll on Omani roads is extremely high. The risk is higher if you drive outside major cities, especially after dark, and on unsealed roads. ● Use only registered taxis and limousines. Use metered taxis or agree on the fare before getting in the taxi. ● Sea travel near Oman is risky due to territorial disputes and security issues. The islands of Abu Musa and Tunbs in the southern Gulf are particularly dangerous. Piracy is a risk. Piracy occurs in the waters around Oman, Yemen and Saudi Arabia. If you travel by sea, monitor the International Maritime Bureau's piracy reports.

Qatar

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
25.354826, 51.183884

GPS Position
25° 21' 17.3736" N
51° 11' 1.9824" E

Crime	● There's a risk of terrorist attack anywhere, including in Qatar. Consider the level of security provided when visiting possible targets. ● Qatar has a low crime rate. Pickpocketing, bag snatching and other petty crimes are rare but can happen. Keep an eye on your belongings, especially in crowded places. ● Bank and credit card fraud can occur. Always keep your credit card in sight when shopping. ● Women may be verbally and physically harassed. Take care, especially at night.
Laws	● Many things are against the law in Qatar that are legal in other countries. Penalties include corporal punishment. These include laws around eating and drinking, buying and drinking alcohol, intimacy and obscenity. Same-sex relationships are illegal, as are public displays of affection. Qatar has strict laws regarding imports. ● Don't use or carry illegal drugs. Penalties for drug offences include long jail terms. Authorities can detain and deport you if you carry medication to treat HIV and hepatitis. This can also happen if you test positive to either illness. ● If you're involved in a commercial civil dispute, local firms or courts may take your passport. Authorities can stop you leaving Qatar until the dispute is resolved. If you owe money, you may go to jail until you settle your debts. Qatar has strict fraud laws. Offences include presenting a cheque that bounces, and failing to pay loans, bills or fines. You could go to jail. ● Sex outside of marriage is illegal. If you're the victim of a sexual assault, authorities may arrest, detain or prosecute you for adultery. If you're sexually assaulted in Qatar, ask us for consular help. We'll give you advice on support services. ● Qatar has strict Islamic codes of dress and behaviour. Wear clothes that cover your shoulders and knees. If you're at tourist attractions, shopping malls and other public places, check the specific dress codes at the venue or online.
Health Risks	● Cases of Middle East respiratory syndrome coronavirus are reported in Qatar. Avoid contact with camels and products contaminated with camel secretions. ● Qatar has high levels of air pollution. Sand and dust storms can also worsen breathing issues. Talk to your doctor before you travel if you have concerns. ● Public medical facilities in major cities are adequate. You'll need to pay up-front. If you're seriously ill or injured, you'll need medical evacuation. Ensure your travel insurance covers this.
Weather	● Be prepared for extreme weather. From June to September, temperatures can reach over 50˚C. Flash flooding can sometimes happen. Follow the advice of local officials.
Other	● You can get a free 30-day visa on arrival if your passport is valid for at least 6 months. Make sure you have a confirmed onward or return ticket. For other visas, contact your nearest Qatari embassy or consulate. ● Driving in Qatar can be difficult and dangerous. Make sure you understand local laws and practices. It's illegal to use obscene language or hand gestures in traffic. It's also illegal to drive after drinking any amount of alcohol. ● Many areas of the Gulf are sensitive to security issues and territorial disputes. There's also a risk of piracy. If you're planning sea travel, refer to the International Maritime Bureau's piracy reports.

Saudi Arabia

Threat Level
High threat level to personal safety, take a range of extra precautions here.

Threat Level
Areas within 30 kilometres of the border with Yemen, do not travel.

Latitude / Longitude
23.885942, 45.079162

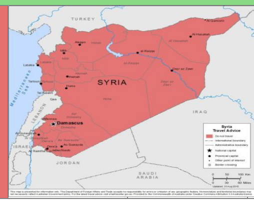
GPS Position
23° 53' 9.3912" N
45° 4' 44.9832" E

Crime	● Terrorists could strike anywhere, at any time. Attacks often target the minority Shia community. The threat is particularly high in and around the Eastern Province. If you go to Saudi Arabia despite the risks, avoid possible targets. Always have an exit plan. ● Saudi Arabia is in an ongoing conflict in Yemen. Cross-border action includes missile, rocket and drone attacks. Follow the advice of local officials. ● Protests are illegal but sometimes occur. They can turn violent. Avoid large public gatherings. Take care around Friday prayer times. ● Crime rates are low but theft happens, especially in crowded places and from vehicles. Keep vehicle doors locked and windows up, even when moving. Hide your valuables.
Laws	● Many laws in Saudi Arabia are different than in other countries. including for same-sex relations and abandoning the Islamic religion. Punishments include going to jail, public lashing and the death penalty. Familiarise yourself before you go. Get professional advice for local legal matters. You may be prevented from leaving the country until issues are resolved. ● It's illegal to mock, provoke or question public order, religious values or public morals. Criticising Saudi Arabia, the royal family, the leadership or Islam is also against the law. These laws extend to social media posts. ● It's against the law to have sexual relations or live together outside of marriage. If you're sexually assaulted, you may face criminal prosecution. Authorities may not consider you to be a victim of crime. ● Always carry your passport or residency card (iqama). There are checkpoints and identity checks can happen. It's an offence not to carry ID. ● The Saudi Government doesn't recognise dual nationality for its citizens. Authorities will seize extra passports if they find them. ● In Saudi Arabia, both men and women are asked to dress modestly in public. Avoid tight fitting clothes or clothes with profane language or images.
Health Risks	● Cases of Middle East respiratory syndrome are reported. Avoid contact with camels or products contaminated with camel secretions. ● Sandstorms and dust storms can cause allergies and breathing problems. Discuss your travel plans with a doctor if you have an existing condition. Malaria, including chloroquine-resistant strains, is present in south-western Saudi Arabia. Consider taking anti-malarial medication. ● Other insect-borne diseases include dengue and leishmaniasis. Ensure your accommodation is insect-proof. Use insect repellent. ● Foodborne, waterborne and other infectious diseases include typhoid, hepatitis, brucellosis and rabies. Drink only treated or bottled water. Avoid raw or undercooked food and unpasteurised dairy products. Don't swim in fresh water. ● Most medical facilities in major cities are of a high standard. Hospitals in minor towns and small cities can only do routine procedures. If you're seriously ill or injured, you may need medical evacuation. Ensure your travel insurance covers this.
Weather	● Be prepared for extreme weather. From June to August, temperatures can reach over 50°C. Sandstorms and dust storms are common. Driving can be hazardous. The annual road death toll is extremely high.

Other	● You need a visa to enter Saudi Arabia. You can apply for an online tourist visa. If you're visiting for Hajj or Umrah pilgrimage contact your nearest Saudi embassy or consulate for details. Check your visa conditions carefully. ● If you hold a work or residency permit, you'll need an exit/re-entry or final exit permit to leave the country. You'll need to apply through your sponsor to the Saudi Ministry of Interior. If you're on a single-visit or multiple entry business or tourist visa, you don't need one. ● Children up to the age of 21 living in Saudi households need permission from a male relative to leave Saudi Arabia. ● Carry your yellow fever vaccination certificate if you're coming from a country where yellow fever is a risk. You'll need it to enter Saudi Arabia. ● Authorities will scan your luggage on arrival for illegal items. These include alcohol, weapons, pork products and pornography – including images of scantily clad people. It's also illegal to import religious books and materials, other than those about Islam. ● If you're a woman travelling for the first time to Saudi Arabia to live and work, you may wish to arrange to be met by your work sponsor on arrival.

Syria

Threat Level
Extreme threat to personal safety, recommended not to travel here.



Latitude / Longitude
34.802075, 38.996815

GPS Position
34° 48' 7.47'' N
38° 59' 48.534'' E

Crime	● The security situation in Syria is extremely dangerous due to military conflict, including air strikes, and very high levels of violence, terrorism and kidnapping. Chemical weapons could be used in conflicts. If you're in Syria avoid possible terrorist targets. While you're there, seek professional security advice. Stay in a safe place and limit your movements. Keep stocks of food, water, fuel and toiletries. ● Many foreigners, especially aid workers and journalists, have been kidnapped. If you remain in Syria, vary your routines so your movements don't become obvious to others. ● Protests can turn violent. Authorities have arrested people near demonstrations, regardless of their citizenship. If you're in Syria avoid large public gatherings. This includes funerals and mourning processions. Avoid areas where people congregate after Friday prayers. ● Crime has increased, including violent robberies, kidnappings and carjackings. If you remain in Syria keep your vehicle doors locked and windows up, even when moving. Carry only what you need.
Laws	● Don't use or carry illegal drugs. Severe penalties for drug offences include the death sentence. ● Get local professional legal advice if you're involved in local legal matters, especially family or business law. ● Same-sex relations are illegal in Syria. ● Be careful when taking photos. It's illegal to photograph military and government buildings and other sensitive infrastructure. ● Always carry ID. It's against the law not to. ● Syria recognises dual nationality. If you're a male dual national, you may have to do military service if you go to Syria. Contact your nearest Syrian embassy or consulate for details.
Health Risks	● Get comprehensive travel insurance before you leave. Your policy needs to cover all overseas medical costs, including medical evacuation. You're likely to need a special insurance policy for travel to a high-risk destination. Some policies won't cover you. ● Medicines are in short supply. If you travel to Syria, carry enough medication for your trip. ● Cases of polio are reported. If you're staying longer than 4 weeks, you'll need to show proof on exit that you've had the polio vaccine or a booster within the past 12 months. ● Insect-borne diseases, such as leishmaniasis, are common. Malaria occurs in the northern border region, particularly Al Hasakah Province. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. ● Waterborne, foodborne, parasitic and other infectious diseases are common. These include brucellosis, typhoid and hepatitis. Drink only boiled or bottled water. Avoid raw or undercooked foods and unpasteurised dairy products. ● Access to hospitals may be limited due to the ongoing conflict. The quality of health care in Syria has deteriorated. If you're seriously ill or injured, you'll need medical evacuation. This could be difficult to arrange.
Weather	
Other	● Don't travel to Syria. If you travel to Syria without Syrian identity documents, you'll need a visa. This applies even if you're travelling to parts of the country not controlled by the government. Apply for a visa at your nearest Syrian embassy or consulate. ● Leave Syria immediately. Most commercial airlines have stopped flying to Syria. Other commercial air services and airports could be attacked or stop operating at any time. Roads and border crossings may be blocked without warning. Plan your exit carefully to minimise safety risks. ● Entry into Lebanon from Syria is restricted. ● The local currency is the Syrian Pound (SYP). It's illegal to change money on the streets. Some financial organisations have stopped doing business with Syrian companies due to sanctions. Your credit cards and ATM cards may not work. Carry enough US dollars or euros to cover your needs.

United Arab Emirates

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
23.424076, 53.847818

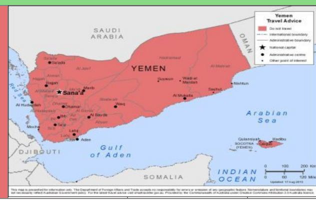
GPS Position
23° 25' 26.6736'' N
53° 50' 52.1448'' E

Crime	● Conflicts in the Middle East and Gulf region could affect the UAE. Monitor local and international media. If there's a security incident, follow the advice of local officials. ● Authorities have arrested several alleged terrorists for planning attacks. Avoid possible targets. Take official warnings seriously. ● The crime rate is low. Petty crime, such as pickpocketing and bag snatching, occurs but is rare. Drink spiking sometimes happens. Physical and verbal harassment and sexual assaults occur. Avoid walking alone after dark in isolated places, including pedestrian underpasses.
Laws	● Many things that are acceptable in other countries are illegal in the UAE. It's illegal to insult Islam, the UAE, the royal families/government officials or the UAE flag. Sex outside of marriage is illegal. It's illegal to share accommodation with someone of the opposite sex who isn't your spouse or a close relative. Punishments for same-sex relations and cross-dressing include prison sentences and fines. Familiarise yourself before you go. ● You can be charged with possession if trace amounts of drugs are found on your body, clothing or luggage. Penalties for drug offences include the death penalty or life in jail. ● Non-Muslim UAE residents need a liquor licence to buy, carry or drink alcohol, including drinking in your home. Only non-Muslim guests or licence-holders can drink in hotels. It's illegal to be drunk in public, including at airports across the UAE. It's illegal to consume alcohol in the Emirate of Sharjah. ● Be careful when taking photos. It's illegal to photograph airports and transport infrastructure, bridges, government buildings, embassies and palaces. It's also illegal to photograph anyone or post photos of people or their personal belongings (including vehicles) on social media without their consent. This includes people in the background of photos. ● The UAE doesn't recognise dual nationality. ● The UAE has strict dress and behaviour codes. Wear clothing that covers your shoulders and knees. Dress modestly, especially in the Emirates of Sharjah and Ajman, where Islamic law is strictly enforced. It's illegal to eat, drink or smoke in public between sunrise and sunset during Ramadan, the Islamic holy month.
Health Risks	● Cases of Middle East respiratory syndrome coronavirus (MERS-CoV) are reported. Avoid contact with camels and products contaminated with camel secretions. ● Waterborne, foodborne, parasitic and other infectious diseases sometimes occur. Get medical advice if you develop a fever or diarrhoea. ● Red algae or 'red tide' may sometimes affect beaches. This can cause skin and eye irritations, as well as breathing problems. Don't swim in affected water. ● The standard of public medical facilities in major cities is adequate. However, services might not be available in remote areas. You may have to pay up-front before treatment.
Weather	● Be prepared for extreme weather. Between June and September, temperatures can exceed 50°C. Sand and dust storms are also common. In extreme heat, stay out of the sun and drink plenty of water.

Other	● Some people can get a free 30-day tourist visitor visa on arrival. For other situations, contact your nearest UAE embassy or consulate-general. ● The UAE has strict laws about brining certain medications into the UAE. See Medications for more information. ● The UAE restricts the importation of certain items. These include pork, poppy seeds, pornography, weapons, items that resemble or display images of illegal substance such as marijuana, and some medication. ● The local currency is the United Arab Emirates Dirham (AED). ● You can drive in the UAE with an International Driving Permit (IDP). Get your IDP before you travel. If you're a UAE resident, you need a local licence. Drink-driving laws are strictly enforced. The blood alcohol limit is 0%. ● Many areas of the Gulf are sensitive to security issues and territorial disputes. There's also a risk of piracy. If you're planning sea travel, refer to the International Maritime Bureau's piracy reports.

Yemen

Threat Level
Extreme threat to personal safety, recommended not to travel here.



Latitude / Longitude
15.552727, 48.516388

GPS Position
15° 33' 9.8172'' N
48° 30' 58.9968'' E

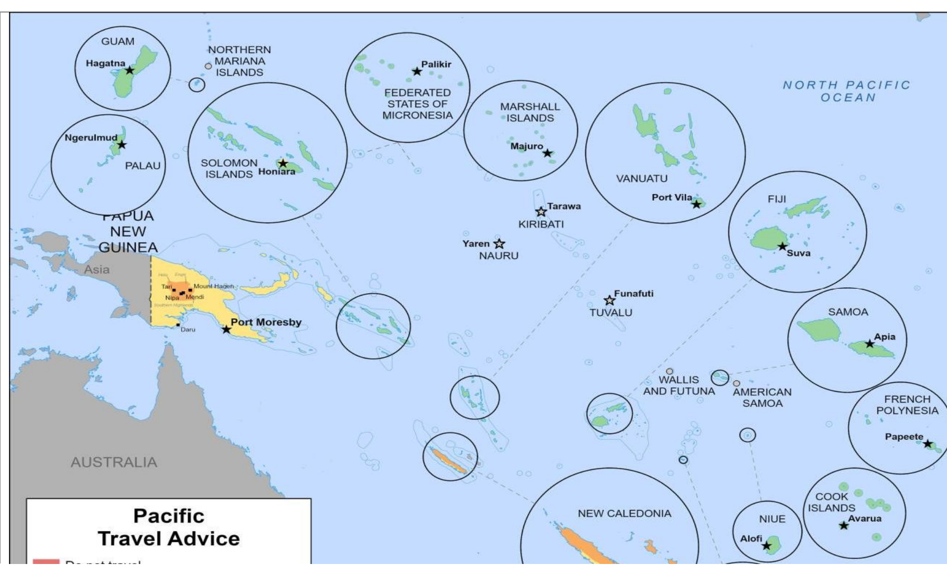
Crime	● Don't travel to Yemen because of the ongoing civil and international conflict. There's extreme political instability, military airstrikes and a very high threat of kidnapping and terrorism. You also may not be able to get enough food, water or medical care. ● Most international airlines no longer fly to Yemen. If you're in Yemen leave now. If you can't leave, shelter in a safe place. Follow the advice of local authorities or trusted security experts before trying to leave by road. ● There's a very high threat of kidnapping, including in Sana'a, Aden and Ta'iz. Keep a low profile and vary your routines and behaviours. There's also a very high threat of terrorism. Targets include Yemeni Government and Houthi interests, Westerners and Western interests. If you're in Yemen get professional security advice. Take extreme care near places that belong to Yemeni authorities. ● Important dates and political anniversaries, such as Unity Day on 22 May, can cause violence and civil unrest. Avoid large public gatherings. Be careful around Friday prayer times. ● Weapons are easily available. Tribes are often heavily armed. Armed carjacking is common. Always drive with your doors locked and windows up. Petty crime is rare.
Laws	● Get professional legal advice if you're involved in local legal matters, including family and business law. ● Don't use, carry or traffic illegal drugs. Severe penalties include jail terms and the death sentence. ● Same-sex relations are illegal. Penalties for acts of sodomy range from jail to death. ● Drinking alcohol in public, slander and adultery are all punishable by lashing. ● Be careful when taking photos. It's illegal to photograph government buildings, military personnel and sites, airports, equipment and other sensitive infrastructure. These may not be clearly marked. ● It's illegal to attempt to convert Muslims, or to preach a religion other than Islam, except in churches. Non-Muslims can't enter mosques. ● Yemen doesn't recognise dual nationality. Dual nationals may need to complete national service.
Health Risks	● Get comprehensive travel insurance before you leave. Your policy needs to cover all overseas medical costs, including medical evacuation. You'll probably need a special insurance policy that covers travel to high-risk destinations. Most policies won't cover you for travel to Yemen. ● Cases of Middle East respiratory syndrome coronavirus (MERS-CoV) are reported. Avoid contact with camels and products contaminated with camel secretions. ● The Sana'a region is at a high altitude. This may cause issues if you have lung, heart or chest problems. ● Malaria, including chloroquine-resistant strains, is common except in areas above 2000m. Other insect-borne diseases, such as dengue, filariasis and leishmaniasis, are common. Ensure your accommodation is insect-proof. Use insect repellent. Consider taking anti-malarial medication. ● Waterborne, foodborne, parasitic and other infectious diseases are common. These include cholera, typhoid, hepatitis and polio. Drink only boiled or bottled water. Avoid raw or undercooked food. Check your vaccinations are up to date before you travel. ● The standard of medical facilities is basic. It's difficult to access medical services in the current conflict, and medical facilities or services in Sana's, Aden, and elsewhere in the country may not be readily available or efficient. If you're seriously ill or injured, you'll need medical evacuation. This can be very expensive and difficult to arrange.
Weather	● Flooding can occur during the monsoon season from June to September. Sandstorms and dust storms also occur. Follow local advice.
Other	● We advise against all travel to Yemen, including the island of Socotra. If you're trying to leave, check exit requirements with local immigration authorities before you book your ticket. Tickets can take weeks to issue. ● A Yemeni husband may legally stop his wife from leaving the country, regardless of her nationality. Children aged under 18 years need their father's permission to leave the country, regardless of who has custody. ● Don't travel by road without expert local advice. You may need permission from local authorities to travel outside Sana'a and some other cities. Unexploded weapons and landmines are a high risk in the central highlands and southern and eastern regions, especially around Aden and in Sa'ada province. ● The waters around Yemen have sensitive security issues and territorial disputes. There's also a high threat of piracy in Yemeni waters and the Gulf of Aden. Get advice from authorities before entering Yemeni waters or ports.

7 Pacific

The Pacific region.

The colour shading and travel advice on the map is the advice given by the Australian Government and is accurate as of the 20th Feb 2025.

However countries risk ratings rarely change so this could be considered accurate advice going into the forseeable future.

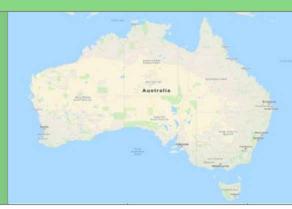


Pacific

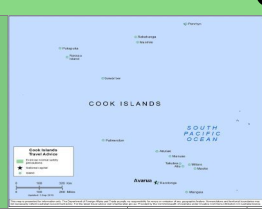
American Samoa

	**Threat Level** N/A								**Latitude / Longitude** -14.301830, -170.713119 **GPS Position** 14° 18' 6.588'' S 170° 42' 47.2284'' W
Crime									
Laws	N/A								
Health Risks	● Zika Virus ● Dengue Fever ● Chikungunya								
Weather	● Cyclone season is between November to April when flooding, landslides and disruptions to services can occur. However, tropical storms and cyclones may occur in other months. Tsunami Possibility.								
Other									

Australia

	**Threat Level** Exercise normal safety precautions.								**Latitude / Longitude** -25.274398, 133.775136 **GPS Position** 25° 16' 27.8328'' S 133° 46' 30.4896'' E
Crime	● Australia's crime rate is low.								
Laws	● Drug Penalties ● Homosexuality Legal								
Health Risks	● Venomous snakes and spiders are possible but rare to encounter in suburbia.								
Weather	● You could encounter tsunamis and severe weather in Australia.								
Other	Because the rest of the geographic information is from the Australian website - it does not cover Australia itself. However it is virtually the same recommendations as the United States.								

Cook Islands

	**Threat Level** Exercise normal safety precautions.								**Latitude / Longitude** -21.236736, -159.777671 **GPS Position** 21° 14' 12.2496'' S 159° 46' 39.6156'' W
Crime	● The Cook Islands' crime rate is low. Thieves sometimes target tourists, especially at the beach. Watch out for your belongings. Don't leave valuables in motor scooters or motorcycles.								
Laws	● If you're driving, monitor your alcohol intake. ● Same-sex sexual activity or 'acts of indecency' between men is illegal in the Cook Islands. Penalties include prison sentences of up to 7 years. ● The Cook Islands' standards of dress and behaviour are modest. Be careful not to offend, especially outside resort areas. Ask locals if you're unsure of customs.								
Health Risks	● Insect-borne illnesses include dengue and chikungunya. Ensure your accommodation is insect-proof. Use insect repellent. ● The Cook Islands has reported cases of Zika virus. If you're pregnant, discuss your travel plans with your doctor. ● Waterborne, foodborne, parasitic and other infectious diseases are common. Drink only boiled or bottled water. Avoid raw or undercooked food. ● Medical facilities are limited, especially on outer islands. If you're seriously ill or injured you'll need medical evacuation to New Zealand or Australia. Check your travel insurance covers this.								
Weather	● Cyclone season is November to April, but severe storms can happen at any time. Know your accommodation's evacuation plan and your nearest shelter. ● Earthquakes and tsunamis occur in the Cook Islands. Rarotonga has tsunami alert signs. If there's an alert, follow the advice of your host or hotel and local officials. Move to higher ground if you're near the beach or low-lying areas.								

Other	● If you're a tourist, you don't need a visa to stay up to 30 days. For other types of visits, get a visa before you travel. ● The Cook Islands has 2 official currencies: the Cook Islands Dollar and the New Zealand Dollar. You can't exchange Cook Islands dollars outside the country. The airport has a currency exchange bureau. ● Most shops and hotels accept credit cards. There aren't many ATMs outside Rarotonga and Aitutaki. Have several ways to access money. ● Plan your trip carefully. To enter the country you'll need an onward or return ticket. You'll also need to show you have enough money and accommodation booked. ● With an Australian driver's licence you can drive in the Cook Islands for up to 6 months. Only drive vehicles covered by your licence. ● You can get a temporary motorcycle or motor scooter licence in the Cook Islands. Apply at the police headquarters in Avarua. Check your travel insurance covers motorcycles before you apply.

Federated States of Micronesia

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
6.883815, 158.235969

GPS Position
6° 53' 1.734" N
158° 14' 9.4884" E

Crime	● The crime rate is low, but travellers have reported sexual and other physical assaults. Avoid walking alone at isolated locations and beaches, and walking alone at night. ● Beach and sea conditions can be dangerous. Ask locals before swimming or surfing. When travelling by sea, take appropriate safety precautions.
Laws	● Dress and behaviour standards are conservative. If you're a woman, wear clothing that covers your knees outside of resorts. ● Anti-LGBTI sentiment exists. Public displays of affection between same-sex partners may attract negative attention.
Health Risks	● There have been no recent reports of Zika virus. However, serious outbreaks of this and dengue can happen. If you're pregnant, discuss the risks with your doctor. Use insect repellent. ● Mumps is steadily increasing. Get vaccinated before you leave. ● Leptospirosis is common. Avoid contact with muddy water and local rivers. Store food in closed containers. ● Hospital and medical facilities are limited. Medical evacuation planes for serious illness or injuries can take at least 24 hours to arrive. Get adequate travel insurance.
Weather	● Natural disasters including tropical storms, flooding, typhoons, earthquakes and tsunamis can occur. Monitor local media or the Global Disaster Alert and Coordination System for updates. ● Tropical storms and typhoons are common from July to November. Be prepared for impacts to essential services, including food and water availability.
Other	● Tourist visas are valid for 30 days. Get a tourist visa when you arrive. ● ATMs aren't available at most airports. Carry cash with you. You must pay a cash departure fee in US dollars when you leave. ● A child cannot enter or exit FSM without a parent or legal guardian, or their written permission. If you're travelling with a child who is not your own, get a certified letter. ● Unexploded remnants of war still exist. Take extra care boating or diving around Yap harbour and nearby channels.

Fiji

Threat Level
Exercise normal safety precautions.

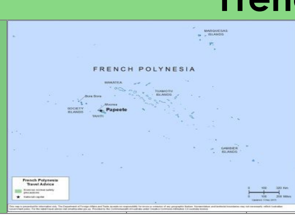
Latitude / Longitude
-17.713371, 178.065032

GPS Position
17° 42' 48.1356" S
178° 3' 54.1152" E

Crime	● Crime in Fiji includes robbery, theft, violent assault, sexual assault and home invasions. Most crime is opportunistic. The highest risk is in urban areas and at night. Be careful in downtown Suva after dark. ● Credit card fraud and ATM card skimming occur. Protect your PIN and be alert when using ATMs. Check your card and bank statements often for fraud. ● Avoid protests, street rallies and military activity areas. Protests can turn violent. Officials sometimes set up checkpoints and close roads. Follow their advice.
Laws	● Don't use or carry illegal drugs. Penalties include prison sentences, even for possessing small amounts of drugs. ● Fiji recognises dual nationality. ● Outside of tourist areas, Fiji's dress standards are conservative. Take care not to offend. ● Same-sex relationships are legal, but some locals don't accept them. Consider limiting public displays of affection, especially in rural areas.
Health Risks	● Get comprehensive travel insurance that covers medical evacuation, especially if you're going on a cruise. Some tourists have had to evacuate from cruise ships to Lautoka and Suva for medical care. ● Medical care standards in Fiji aren't as high as in first world countries. Medical facilities often lack services, equipment and drugs. You may have to pay up-front. If you're seriously ill or injured, you'll need medical evacuation to Australia. ● There's an outbreak of measles in Fiji. Make sure your vaccinations are up-to-date before you go. ● Mosquito-borne illnesses (including dengue fever and Zika) are common. Protect yourself against mosquito bites. ● Fiji has only one hyperbaric (decompression) chamber, located in Suva. It's undergoing long-term maintenance, so it may not be available. If you're diving, stay well within safety limits. ● Be careful if you're consuming kava. It can be dangerous if it reacts with alcohol or prescription medication, including antidepressants.
Weather	● November to April is cyclone season, but cyclones may occur at other times. They can cause flooding and disrupt essential services. Know your accommodation's evacuation plan. If a cyclone is approaching, find your nearest shelter and follow official advice. ● Flooding is common, especially in downtown Nadi and on the Coral Coast. Floods can cut off road access, including to the airport. Follow official advice.
Other	● If you're a tourist staying less than 4 months, you'll get a tourist visa on arrival. Carry proof of your accommodation booking and your return ticket. You may need a visa if you're travelling for other reasons. Contact your nearest embassy or consulate of Fiji for up-to-date details. ● There are strict customs regulations on importing food, weapons and sexually explicit material. Contact the Fiji Revenue and Customs Authority for details. ● The local currency in Fiji is the Fiji Dollar (FJD). You can easily exchange dollars at Nadi airport and local banks. ● ATMs are readily available at Nadi airport and shopping centres in Nadi, Suva and other larger towns. ● Always carry your driver's licence. You'll need an International Driving Permit to rent a vehicle. Get your IDP before you travel. ● Taxi and minibus quality varies. Use only licensed taxis and minibuses, which have yellow registration plates. Unlicensed minibuses may not have insurance.

French Polynesia

Threat Level
Exercise normal safety precautions.



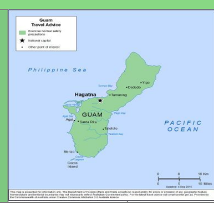
Latitude / Longitude
-17.679742, -149.406843

GPS Position
17° 40' 47.0712" S
149° 24' 24.6348" W

Crime	● Strikes and industrial disputes can lead to unrest and disrupt essential services including transport links. Protests can turn violent. Avoid large public gatherings. ● The rate of serious crime is low. But petty crime, including theft and drink spiking, occurs. Keep your belongings close, especially in crowded places. Don't leave food or drink unattended.
Laws	● Understand the local laws. French Polynesia is an overseas territory of France. A mix of French and local laws apply. ● Don't use or carry illegal drugs. You could face fines or imprisonment for having even small amounts. ● By law you must always have photo identification with you. ● Same-sex marriage is legal. However, outside the main tourist islands, you may encounter more conservative attitudes. ● Outside of tourist areas, standards of dress and behaviour are conservative. Take care not to offend.
Health Risks	● In April and July authorities declared a dengue type 2 epidemic on the island of Tahiti and Bora Bora. Other insect-borne diseases include chikungunya and filariasis. Ensure your accommodation is insect-proof. Use insect repellent. ● There have been cases of Zika virus. If you're pregnant, discuss your travel plans with your doctor before you travel. ● Leptospirosis occurs in French Polynesia. Wear closed-toed shoes when walking, and avoid contact with rivers or muddy water. Store food in sealed containers. ● Other infectious diseases include scabies, influenza and conjunctivitis. Attend to symptoms such as fever, itchiness and skin wounds. Tap water in Papeete is usually safe to drink. Avoid raw and undercooked food. Outside Papeete, drink boiled or bottled water. ● Medical facilities in Papeete are good, but those in outlying areas are basic. Ensure your travel insurance covers your condition and medical evacuation.
Weather	● French Polynesia has natural disasters, including cyclones, earthquakes and tsunamis. Check with the High Commission of France in French Polynesia (French) for updates. They also run a phone hotline during major emergencies. Your tour operator or accommodation provider may also be able to provide timely advice. ● Cyclone season is November to April. However, tropical storms and cyclones may occur at any time. Understand and follow French Polynesia's cyclone alert system. ● A tsunami can arrive within minutes of a tremor or earthquake. Get updates from the Pacific Tsunami Warning Center. Know the warning signs and move immediately to high ground.
Other	● If you're visiting for tourism for less than three months, you likely won't need a visa. In other situations, you may need one. Contact your nearest embassy or consulate of France for details. ● You can't bring certain goods into French Polynesia. Other goods require specific approvals or other formalities. Check local regulations before you travel. ● The local currency is the Pacific Franc. You can exchange dollars at most commercial banks, the international airport, licensed exchange bureaus, and hotels and resorts. You may not be able to use credit cards or find ATMs outside the main tourist areas. ● You can drive in French Polynesia with a valid driver's licence for up to one year after arrival. ● Hail taxis on the street in Papeete, at Centre Vaima station and at Boulevard Pomare station. Many outer islands don't have taxis. ● Major centres have a limited minibus network. Hail minibuses from the side of the road.

Guam

Threat Level
Exercise normal safety precautions.



Latitude / Longitude
13.444304, 144.793731

GPS Position
13° 26' 39.4944'' N
144° 47' 37.4316'' E

Crime	● Petty crime occurs in Guam. Use your common sense. ● Transport and tour operators may not follow safety precautions or maintain their equipment. Use reputable companies. Always use appropriate safety equipment.
Laws	● Penalties are severe for drug offences, including marijuana use. You may face a minimum mandatory jail term. ● The US recognises dual nationality. If you're an Australian-US dual citizen, you must travel with both passports and use your US passport to enter and exit Guam.
Health Risks	● Mosquitoes in Guam spread illnesses, including dengue. Use insect repellent. Make sure your accommodation is insect-proof. ● Medical costs in Guam are high. Get appropriate travel insurance. ● If you become seriously ill or injured, you may need to be evacuated. Make sure your travel insurance covers this. Medical evacuation can be delayed by limited flights leaving Guam.
Weather	● Guam can experience tropical storms, flooding, landslides, typhoons, earthquakes and tsunamis. Monitor the Global Disaster Alert and Coordination System for updates. Follow the advice of local authorities. ● Tropical storms and typhoons are most common from June to December. Know your evacuation plan and local shelter locations. Prepare for disruption to services, including air and sea travel.
Other	● Guam is an unincorporated US territory. You must meet US entry or transit requirements. ● Contact the nearest embassy or consulate of the United States for details of visa and entry requirements. ● Check the requirements for children travelling alone or with one parent or guardian. You may need a letter of travel permission. ● Driving in Guam can be dangerous. Avoid driving at night. Get appropriate travel insurance.

Kiribati

Threat Level
N/A

Latitude / Longitude
1.830943, -157.380349

GPS Position
1° 49' 51.3948'' N
157° 22' 49.2564'' W

Crime	
Laws	N/A
Health Risks	● Dengue Fever
Weather	● Tsunami Possibility.
Other	

Marshall Islands

Threat Level
Exercise normal safety precautions.

Latitude / Longitude
7.371509, 168.760437

GPS Position
7° 22' 17.4324'' N
168° 45' 37.5732'' E

Crime	● The Marshall Islands' crime rate is low, but petty crime, such as break-ins and theft occur, assaults also occur. Pay attention to your security, especially at night and in isolated areas.
Laws	● Don't use or carry illegal drugs, including marijuana. Penalties for drug offences are severe. They include long prison sentences and heavy fines. ● Same-sex relationships are legal, but cultural attitudes are conservative. Avoid public displays of affection. ● The Marshall Islands has conservative dress and behaviour standards. Outside resorts, women should wear clothing that covers the knees.
Health Risks	● Insect-borne diseases, such as dengue, are present in the Marshall Islands. Ensure your accommodation is insect-proof. Use insect repellent. ● Outbreaks of Zika virus occur. If you're pregnant, discuss your travel plans with your doctor. ● Cases of hepatitis A have been reported since 2017. Get vaccinated at least 4 weeks before you travel. Know and follow health advice to reduce your risk of exposure to hepatitis A. ● Outbreaks of mumps occurred in 2017. Get the measles-mumps-rubella (MMR) vaccine before you travel. ● Hospital facilities and medical supplies are limited. Bring enough medication for your whole trip. Ensure your travel insurance covers medical evacuation.
Weather	● Typhoon season is July to November, with peaks in August and September. However, typhoons can occur at any time. Know your accommodation's evacuation plan and where your local shelter is. ● The Marshall Islands is at risk of tsunamis. Know the evacuation plans for your accommodation.
Other	● The RMI government is restricting travel to islands other than Majuro and Ebeye in order to limit the spread of dengue fever to those destinations. ● Australians get a 30-day visitor visa on arrival. Pay to extend your visa at the Division of Immigration. ● Kwajalein Island hosts a US military base. If you want to travel to Kwajalein, you must have an entry authorisation from the US military. ● If you're travelling via the US, you must meet US entry or transit requirements. Contact your nearest US embassy or consulate for details. ● The local currency is the US Dollar. ● You can drive using a licence or International Driving Permit for up to 30 days. After 30 days, you'll need a local licence. Carry your licence when you drive.

Nauru

	**Threat Level** N/A	**Latitude / Longitude** -0.522778, 166.931503 **GPS Position** 0° 31' 22.0008'' S 166° 55' 53.4108'' E
Crime		
Laws	N/A	
Health Risks	● Dengue Fever	
Weather	N/A	
Other		

New Caledonia

	**Threat Level** Exercise normal safety precautions.		**Latitude / Longitude** -21.368737, 165.467649 **GPS Position** 21° 22' 7.4532'' S 165° 28' 3.5364'' E
Crime	● Roadside security incidents are rare but can occur without warning. Officials may also close roads. Strikes and industrial disputes can lead to unrest and disrupt essential services including transport links. Avoid large public gatherings and roadblocks. ● Serious crime is rare in New Caledonia, but car theft and vehicle break-ins occur. Look after your belongings and always lock your car.		
Laws	● Understand the local laws. New Caledonia is an overseas territory of France. A mix of French and local laws apply. By law, you must always have photo identification with you. ● Don't use or carry illegal drugs. Penalties include fines and prison sentences, even for small amounts. ● Same-sex marriage is legal, but same-sex relationships aren't widely accepted outside of Noumea. ● Outside of tourist areas, standards of dress and behaviour are conservative. Dress and behave appropriately. ● You need permission from customary authorities to visit certain areas. If in doubt, follow local advice.		
Health Risks	● New Caledonia is currently experiencing a dengue epidemic, especially in Greater Noumea. Ensure your accommodation is insect-proof. Use insect repellent. ● Other insect-borne diseases include Chikungunya and Zika viruses. If you're pregnant, discuss the risks of Zika virus with your doctor before you travel. ● Outbreaks of leptospirosis are common, especially after heavy rain. Wear closed-in shoes. Avoid swimming in rivers or muddy water. Store food in enclosed containers and use a straw when drinking from cans. ● Other foodborne, waterborne, parasitic and infectious diseases occur. These include influenza, scabies and conjunctivitis. Get treatment if you have itchiness or skin lesions. In rural areas, drink boiled or bottled water. Tap water is generally safe to drink in towns. ● The standard of medical facilities in Noumea is high, but those in outlying areas are basic. Medical treatment is expensive. Search and rescue facilities are limited. Some parts of New Caledonia don't have mobile phone coverage. Ensure your travel insurance your condition and covers medical evacuation.		
Weather	● Cyclone season is November to May, but cyclones can occur at any time. They can cause landslides and flooding, and may disrupt essential services. Ensure you understand New Caledonia's cyclone alert system. ● New Caledonia also experiences earthquakes, tsunamis and bushfires. A tsunami can arrive within minutes of a tremor or earthquake. Monitor the New Caledonian Department of Emergency Management and the New Caledonian Weather Bureau (both in French) for updates. Your tour operator or accommodation provider may also be able to provide timely advice.		
Other	● If you are visiting for tourism for less than three months, you likely won't need a visa. You'll need to have a return ticket. For other situations, you may need a visa and other authorisations. Contact your nearest embassy or consulate of France for details. ● You can't bring certain goods into New Caledonia. Other goods require specific approvals or other formalities. Check local regulations before you travel. ● The local currency is the Pacific Franc (XPF). Some businesses accept Australian dollars. Change Australian dollars at banks and authorised exchange bureaus. ● ATMs and credit card facilities are available in Noumea and other major centres. Carry cash if you're travelling to remote areas. ● You can drive in New Caledonia on a valid driver's licence for up to one year after your arrival. ● You can't hail taxis on the street. Use a taxi rank or make a phone booking. Book well in advance, as long delays are common.		

New Zealand

New Zealand									
	Threat Level Exercise normal safety precautions.								**Latitude / Longitude** -41.228525, 174.803574 **GPS Position** 41° 13' 42.69'' S 174° 48' 12.8664'' E
Crime	● Crime rates are similar to those in the U.S. and Australia. Thieves often target vehicles. Don't leave valuables in your car or campervan. ● Earthquakes are a constant risk. Large, damaging quakes can happen at any time. Know what to do during and after an earthquake. ● All of New Zealand's coastline is at risk of a tsunami. Know the tsunami warning signs and move to high ground immediately. Don't wait for official alerts.								
Laws	● Don't use or carry illegal drugs. Penalties may include fines and prison sentences, including for small amounts. ● Carry approved identification if you want to purchase alcohol or enter licensed premises. Approved ID includes your current passport, a current New Zealand driver's licence, or a Kiwi Access Card. You can't use external driver's licence.								
Health Risks	● There's an outbreak of measles in New Zealand. Make sure your vaccinations are up to date before you travel. ● Medical facilities and services are of a similar standard to those in first world countries.								
Weather	● New Zealand has several active volcanoes. A volcano erupted on White Island in the Bay of Plenty on 9 December 2019. Further eruptions are possible. Avoid the area and follow the advice of local authorities. ● Weather conditions can change quickly. Severe weather could leave you stranded or injured, especially in an isolated area. If you're climbing, hiking or in a remote area, register your trip with the Department of Conservation. Carry a personal locator beacon.								
Other	● Most Australian citizens and residents don't need a visa to enter. The exceptions are if you have a criminal record or if you've been deported from any country. From 1 October 2019, Australian permanent residents need a New Zealand Electronic Travel Authority (NZeTA). ● Australian permanent residents need to apply online for a New Zealand Electronic Travel Authority (NZeTA) to enter New Zealand. Australian citizens are exempt from this requirement. ● New Zealand has strict quarantine rules. Penalties for breaking them include heavy fines and prison sentences. ● The local currency is the New Zealand Dollar ($NZ). ATM availability is similar to the U.S. and Australia. You can use credit cards in most places. ● You can drive for up to 12 months with your Australian driver's licence. If you're staying longer, get a local licence. ● Drive to the conditions. Ice, snow, fog and high winds can be dangerous. Heavy rain can cause landslides across roads. There aren't many motorways outside major cities. Prepare for longer travel times than in Australia.								

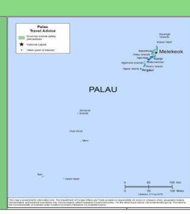
Niue

Niue									
	Threat Level N/A								**Latitude / Longitude** -19.054445, -169.867233 **GPS Position** 19° 3' 16.002'' S 169° 52' 2.0388'' W
Crime									
Laws	N/A								
Health Risks	N/A								
Weather	● Tsunami Possibility. Cyclone season is between November to April when flooding, landslides and disruptions to services can occur. However, tropical storms and cyclones may occur in other months. The direction and strength of tropical cyclones can change with little warning.								
Other									

Northern Mariana Islands

Northern Mariana Islands									
	Threat Level N/A								**Latitude / Longitude** 15.170024, 145.733638 **GPS Position** 15° 10' 12.0864'' N 145° 44' 1.0968'' E
Crime									
Laws	N/A								
Health Risks	N/A								
Weather	● Typhoon season is between June and December when flooding, landslides and disruptions to services can occur. However, tropical storms and typhoons may occur in other months.								
Other									

Palau

Palau									
	Threat Level Exercise normal safety precautions.								**Latitude / Longitude** 7.514980, 134.58252 **GPS Position** 7° 30' 53.928'' N 134° 34' 57.072'' E
Crime	● Palau has a low crime rate, but petty crime occurs. Protect your valuables.								

Laws	● Don't use or carry illegal drugs. Penalties for drug offences are severe. They include a mandatory 25-year prison sentence for possessing any amount of 'hard drugs' (heroin, cocaine and synthetics). ● Follow local alcohol laws. The legal drinking age is 21. It's illegal to drink alcohol in public places. ● It's illegal to disturb or take historical items, including from sunken vessels. ● Counterfeit and pirated goods are widely available. Buying, selling or having these is illegal. Don't buy or accept pirated or counterfeit goods. ● Palau has conservative dress and behaviour standards. Take care not to offend. ● Same-sex relationships are legal, but cultural attitudes can be conservative. Avoid public displays of affection.
Health Risks	● Insect-borne diseases include dengue. Ensure your accommodation is insect-proof. Use insect repellent. ● Palau has had recent cases of Zika virus. If you're pregnant, discuss your travel plans with your doctor. ● Hospital and medical facilities are limited. If you're seriously ill or injured, you'll need medical evacuation, probably to Guam. Ensure your travel insurance covers this.
Weather	● Palau experiences tropical storms. These can disrupt services. Know your hotel or cruise ship's evacuation plan. Find your nearest shelter. ● Palau is at risk of tsunamis. Know the warning signs and move immediately to higher ground. Don't wait for official alerts.
Other	● If you're visiting for up to 30 days, get a visitor visa on arrival. Ensure you have a return or onward ticket. ● If you're travelling with a child, carry evidence of your relationship. You may also need additional documents. ● If you're arriving via sea, you'll need an entry permit. Contact Palau Port Control before you arrive. ● There is unexploded ordnance in Palau left from World War II, especially Peleliu and Angaur. Be careful when diving or exploring caves. ● Palau has saltwater crocodiles. Often there are no warning signs. Ask locals about safe places to swim. ● Use licensed taxis and hire-car services. Local taxis have fixed fares between locations. Ask for the fare list.

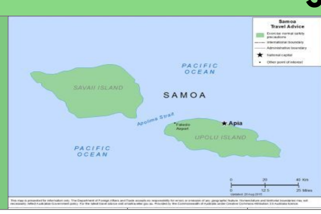
Papua New Guinea

Threat Level Moderate threat level to personal safety, take extra precautions here.	**Threat Level** Porgera Township, Tari in Hela Province, reconsider your need to travel.	**Latitude / Longitude** -6.314993, 143.95555 **GPS Position** 6° 18' 53.9748" S 143° 57' 19.98" E

Crime	● Voting in the Bougainville referendum will take place from 23 November to 7 December, with a 2 week period for counting to follow. Avoid political gatherings before, during and after the referendum. ● Risk of violent crime and sexual assault in PNG is high. Criminals often use 'bush knives' (machetes) and guns. Always be alert to your surroundings. ● Avoid going out after dark. ● Civil disorder and criminal activity has occurred at tourist resorts. Keep doors and windows locked, including when travelling by vehicle. Consider using private security. ● Civil unrest and violent tribal clashes can occur. Avoid protests and demonstrations. Check security conditions and tensions before travelling to new areas.
Laws	● PNG has the death penalty for serious crimes, including treason, piracy, murder, rape and robbery. ● Adultery and possessing or selling pornography or sex items are illegal. Same-sex relationships are illegal. Prison sentences may apply. ● PNG only recognises dual nationality in some situations. Our ability to help dual citizens may be limited. ● In PNG, the local custom of 'payback' includes violence or demands for money. ● Dress and behaviour standards are conservative. Take care not to offend. Ask permission before taking photos of people, cultural sites and spirit houses.
Health Risks	● Insect-borne diseases include malaria, Zika virus, dengue, chikungunya and Japanese encephalitis. Use insect repellent. Ensure your accommodation is insect-proof. If you're pregnant, ask your doctor about the risk of Zika virus before you travel. ● Poliovirus outbreaks have occurred. Make sure you're vaccinated against polio. ● Tuberculosis is common. Children under 5 years and people with with weakened immune systems are most at risk. If you think you have tuberculosis, get urgent medical treatment. ● HIV/AIDS and other sexually transmitted diseases are widespread. Take precautions to reduce your risk of infection. ● Dysentery, typhoid, hepatitis and waterborne parasites are also common. Boil drinking water or drink bottled water. Avoid bathing in freshwater sources. ● Medical facilities are poor.
Weather	● PNG can experience severe weather, heavy rains, flooding, landslides, earthquakes and tsunamis. Monitor the Global Disaster Alert and Coordination System for updates. Infrastructure can be damaged and roads can't be passed. Follow the advice of local authorities. ● Active volcanoes erupt regularly in PNG. Flights may be cancelled at short notice due to ash clouds. Check the Volcanic Ash Advisory Centre for updates.
Other	● You need a visa to enter PNG. You can get a tourist visa on arrival or can apply for tourist visas through the PNG eVisa portal. Contact embassy or consulate of Papua New Guinea for the latest visa and entry requirements. ● Permits are needed to trek the Kokoda track. Make sure you have a permit before you start trekking. Prepare for the demanding trek with extensive training. Get medical advice and fitness testing before you leave your country. ● Risks while trekking include dysentery, dehydration, serious crime, civil disorder and unexploded remnants of war. Use guides from reputable companies. Stay with your group. If you find a war remnant, don't touch it. ● Poor road maintenance and crime make road travel dangerous. Keep windows up and doors locked. Consider using a security escort. Avoid driving at night. Avoid travel by motorcycle, taxis and public transport. ● Travel by boat can be dangerous. Marine search and rescue services are limited in PNG. Consider alternative options.

Samoa

Threat Level Exercise normal safety precautions.	**Latitude / Longitude** -13.631734, -172.432159 **GPS Position** 13° 37' 54.2424" S 172° 25' 55.7724" W



Crime	● Crimes against travellers include robbery, assault, theft and break-ins. Avoid going out alone at night, especially in downtown Apia and harbour-front areas. ● Stray dogs are common. They can be vicious. Don't approach or touch dogs. ● Demonstrations sometimes happen. Protests can turn violent. Avoid large public gatherings.
Laws	● Don't use or carry illegal drugs, including marijuana. Penalties include prison sentences. It's also illegal to have equipment for making or using drugs. ● The legal drinking age is 21. Don't drink alcohol if you're under 21, even if you can legally drink in Australia where the legal drinking age is 18. ● Same-sex relationships are not recognised in Samoa and consensual sex between men is illegal. Samoan society is conservative. Avoid public displays of affection. ● Samoa has conservative dress and behaviour standards. Take care not to offend.
Health Risks	● There is a measles epidemic in Samoa. In response, the Government of Samoa declared a state of emergency, which is in effect until the end of December 2019. Make sure your vaccinations are up-to-date before you go. ● Hospital and medical facilities are limited in Samoa. The measles epidemic is placing an unprecedented burden on the Samoan health system. The hospital's focus is on treating measles cases. For medical emergencies patients may need to be medivaced to Australia or New Zealand. Make sure your travel insurance policy covers medical evacuations. ● Insect-borne diseases include dengue and chikungunya. Ensure your accommodation is insect-proof. Use insect repellent. ● Samoa has had outbreaks of Zika virus. If you're pregnant, discuss your travel plans with your doctor. ● Foodborne, waterborne and other infectious diseases include typhoid, hepatitis, filariasis and tuberculosis. Drink boiled or bottled water. Avoid raw or undercooked food.

Samoa	
Weather	• Cyclone season is November to April, but storms occur year-round. They can cause flooding and disrupt services. Know your hotel or cruise ship's evacuation plan. Find out where your local shelter is. • Earthquakes and aftershocks happen often. Ask your host or hotel about what to do if there's an earthquake. Samoa can experience tsunamis. Know the warning signs and move immediately to high ground. Don't wait for official alerts. • Samoa has strong tides and powerful currents. Ask locals about safe swimming areas.
Other	• If you're staying up to 90 days, you don't need a tourist visa. Ensure you have a return or onward ticket. Check that your passport will be valid for at least 6 months after you leave Samoa. • You can use credit cards at most resorts and large shops. Very few small retail businesses accept credit cards. Have multiple ways to access money. • If you want to drive in Samoa, buy a temporary Samoan licence. • Inter-island ferries may be old, overcrowded and unsafe. Check the operator's safety history and equipment before you book.

Solomon Islands

Threat Level
Exercise normal safety precautions.

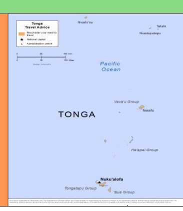
Latitude / Longitude
-9.645710, 160.156194

GPS Position
9° 38' 44.556'' S
160° 9' 22.2984'' E

Solomon Islands	
Crime	• Crimes that may affect you include petty crime, break-ins, robbery and sexual assault. Keep your accommodation locked. Lock your vehicle doors and windows, even while moving. • Political unrest can happen. It can happen during elections, sittings of Parliament, and times of political uncertainty. Demonstrations can turn violent. Avoid protests and political gatherings. • Be aware of local wildlife. Street dogs in Honiara can be vicious. Sharks and crocodiles are common. Get local advice before entering the water.
Laws	• It's illegal to import or possess pornographic material. • Dual nationality isn't recognised. We may only be able to offer limited consular assistance to dual nationals. • Solomon Islands society is conservative. Avoid swearing and being affectionate in public. Dress appropriately. • Solomon Islands law does not recognise same sex relationships. It is a criminal offence to engage in same-sex sexual activity and penalties include jail sentences.
Health Risks	• Measures are in place to ensure the measles outbreak in other Pacific countries does not spread to Solomon Islands. See Travel. • Malaria and dengue fever are widespread. Ensure your accommodation is insect-proof. Use insect repellent. • Fatal outbreaks of rotavirus have occurred. Children are most at risk but can be vaccinated. Wash your hands thoroughly with soap and water after going to the toilet and before preparing or eating food. • Zika virus is also present. If you're pregnant, discuss the risk of Zika virus with your doctor.
Weather	• Natural disasters, such as tropical cyclones, earthquakes and tsunamis, occur. Listen to Solomon Islands Broadcasting Corporation on radio station AM1035 for official updates.
Other	• From 28 December 2019, to enter Solomon Islands you will need to show proof of vaccination against measles. Failure to do so may result in deportation or being unable to board your inbound flight. Bring your official vaccination record with you. You must be vaccinated at least 15 days prior to arrival. • Solomon Islands like many other countries won't let you enter unless your passport is valid for 6 months after you plan to leave. • You can apply to get a visitor visa when you arrive if you're staying less than 90 days from Solomon Islands Immigration. • Only the major hotelsin Honiara accept international credit cards. Credit cards aren't usually accepted elsewhere. Have multiple ways to access money. • Some parts of the country still have unexploded weapons from World War II. Seek local advice and take care when hiking, boating or diving in these areas.

Tonga

Threat Level
High threat level to personal safety, take a range of extra precautions here.



Latitude / Longitude
-21.178986, -175.198242

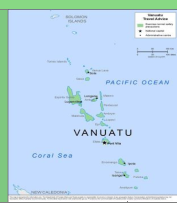
GPS Position
21° 10' 44.3496'' S
175° 11' 53.6712'' W

Tonga	
Crime	• Crime in Tonga includes robbery, assault, theft and break-ins. Thieves often target mobile phones, tablets and other portable electronics. Keep doors, windows and gates locked. Don't go out alone at night. • Civil unrest is rare, but protests could turn violent. Avoid large public gatherings.
Laws	• Sabbath laws strictly limit Sunday activities. Unless you're at a resort, activities such as playing sport, dancing, listening to loud music, and fishing are illegal on Sundays. • The blood alcohol limit for driving in Tonga is 0.015%. Don't drink and drive. • Sodomy is a criminal offence, punishable with a prison term. • Tonga is a conservative country. Dress modestly to avoid unwanted attention.
Health Risks	• There's an outbreak of measles in Tonga. Make sure your vaccinations are up to date before you go. • Insect-borne diseases include dengue and chikungunya. Ensure your accommodation is insect-proof. Use insect repellent. • Tonga has had outbreaks of Zika virus. If you're pregnant, discuss your travel plans with your doctor. • Foodborne, waterborne and other infectious diseases include tuberculosis, typhoid and filariasis. Drink boiled or bottled water. Avoid raw or undercooked food. • Eating reef fish and shellfish can lead to poisoning from naturally occurring toxins. Get urgent medical help if you suspect poisoning. • Hospital and medical facilities are limited. You may need medical evacuation to Australia or New Zealand for even minor issues. Ensure your travel insurance covers this.
Weather	• Tongan beaches can have strong rips that make swimming dangerous. Ask locals about safe swimming areas. • The cyclone season is November to April, but storms can happen year-round. They can cause flooding and disrupt services. Know your hotel or cruise ship's evacuation plan. Find your nearest shelter. • Tonga experiences earthquakes. Ask your host or hotel about what to do if there's an earthquake. Tsunamis can happen soon after an earthquake. Know the warning signs and move to high ground straight away. Don't wait for official alerts.
Other	• If you're a tourist staying up to 31 days, you can get a visa on arrival. Ensure you have a return or onward ticket. If you're travelling for other reasons, contact the High Commission of Tonga for visa requirements. • The local currency is the Tongan Pa'anga. Exchange dollars at local banks. • You can access ATMs on the main island of Tongatapu. Be careful not to expose your PIN when using ATMs, as card fraud occurs. • Local boats may be old, overcrowded and unsafe. Check the operator's safety history and equipment before you book. • Tonga doesn't recognise driver's licences or International Driving Permits. Get a temporary Tongan driver's licence if you want to hire a car or motor scooter.

Tuvalu

	Threat Level N/A	**Latitude / Longitude** -8.504121, 179.122840 **GPS Position** 8° 30' 14.8356'' S 179° 7' 22.224'' E
Crime		
Laws	N/A	
Health Risks	N/A	
Weather	● Cyclone season is between November to April when flooding, landslides and disruptions to services can occur. However, tropical storms and cyclones may occur in other months.	
Other		

Vanuatu

	Threat Level Exercise normal safety precautions.		**Latitude / Longitude** -15.376706, 166.959158 **GPS Position** 15° 22' 36.1416'' S 166° 57' 32.9688'' E
Crime	● Crime in Vanuatu is low. But it does increase in the lead-up to holidays such as Christmas and Independence Day (30 July). The risk is also higher at night or in isolated locations. Don't go out alone after dark or to isolated locations, especially on foot.		
Laws	● Don't use or carry illegal drugs. If you're convicted of a drug offence, you could face fines or jail time. ● Know the local laws. There are strict rules regarding obscene material. Penalties include prison sentences. ● Be aware of laws around alcohol. It's illegal for supermarkets to sell alcohol between midday Saturday and 7am Monday. You can still buy alcohol in hotels, bars and clubs during this time. ● Vanuatu recognises dual nationality. ● Vanuatu's standards of dress and behaviour are conservative. Take care not to offend. ● Same-sex relationships are legal. However, local attitudes are conservative. Avoid public displays of affection.		
Health Risks	● Malaria occurs in some areas, especially in the north. Consider taking anti-malaria medication if you are travelling to affected areas. ● Other insect-borne diseases include dengue and filariasis. Ensure your accommodation is insect-proof. Use insect repellent. ● Vanuatu has had cases of Zika virus, rubella, mumps, measles and chickenpox. Check your vaccinations are up to date before you travel. ● Waterborne, foodborne and other infectious diseases include hepatitis, tuberculosis and sexually transmitted infections. Avoid raw or undercooked food. Tap water in Port Vila and Luganville is generally safe to drink. Outside these areas, drink boiled or bottled water. ● Reef fish contain the natural toxin ciguatera. Get urgent medical help if you suspect poisoning. ● Medical facilities are limited. If you're ill or injured, you may need medical evacuation to Australia or New Zealand. Check your travel insurance covers this.		
Weather	● The cyclone season is November to May. But cyclones can happen at any time. Flooding and landslides can damage infrastructure and disrupt services. Know your accommodation's evacuation plan and where your local shelter is. ● Earthquakes occur regularly. Tsunamis happen but are infrequent. Port Vila has a tsunami warning system. If there's a long and strong tremor or you hear the warning sirens, move to higher ground. ● Vanuatu has several active volcanoes, including under-sea volcanoes. Contact the Vanuatu Meteorological and Geo-Hazards Department or the Vanuatu Tourism Office for advice before travelling to volcanic areas.		
Other	● If you're going to Vanuatu as a tourist, you can apply for a visitor visa on arrival. You must be visiting for 30 days or less and have an onward or return ticket. If you're staying longer or travelling for work or other reasons, get a visa before you travel. ● Be aware of what you can and can't bring into the country. Customs officials strictly enforce rules regarding food, weapons and obscene material. ● The local currency is the Vanuatu Vatu. Small shops and market stalls will only accept vatu. Some larger hotels, restaurants and shops in Port Vila also accept U.S. and Australian dollars. ● Not all beaches are public. Ask local landowners before going to non-public areas, including beaches. Some may charge an access fee. ● There's no formal public transport system. In Port Vila, Luganville and some other areas, there's a network of private trucks, small buses and vans. But these may be poorly maintained. ● Be very careful if travelling by boat or ferry. Many vessels don't have a current seaworthy certificate. Don't trust their safety.		

Wallis and Futuna

	Threat Level N/A	**Latitude / Longitude** -14.293800, -178.1165 **GPS Position** 14° 17' 37.68'' S 178° 6' 59.4'' W
Crime		
Laws	N/A	
Health Risks	● Dengue Fever	
Weather	● Tsunami Possibility. ● Cyclone season is between November to April when flooding, landslides and disruptions to services can occur. However, tropical storms and cyclones may occur in other months.	
Other		

Locations

Details the survival uses of modern buildings & vehicles

"Arrival at a new destination only occurs from leaving from current location."
Chris Hogan

Introduction

During disasters there will be chaos in the streets, destroyed and unstable buildings and it would likely be suicide to leave your house. Eventually your supplies will dwindle and if you plan on staying in the cities there are a lot of opportunities for scavenging what you need to survive. The following section contains a list of today's most common facilities and locations, and the potential loot they may contain. It also includes notable facts and information that may prove useful, such as how useful a shelter it would be. Know the difference between looting and scavenging.

Looting is the theft of someone else's property for personal gain, which they still own and are likely to return for later. Scavenging is the acquisition of discarded or abandoned items which you can utilize to survive. This guide does NOT condone looting in any form.

The section below provides a quick description of the terms used in the main content.

Usefulness The usefulness of this location in a post-disaster world.	1/5	2/5	3/5	4/5	5/5
Risk The risk this location will pose in a post-disaster world.	Very Low	Low	Moderate	High	Very High

Purpose	The aim of LOCATIONS is to inform the reader on the assets and equipment that can be found in the most common locations around the world, for the purposes of scavenging. It includes a component to help you to decide whether or not a location will be worth converting into a base of operations after the collapse.
Lost?	• For a complete list of the countries of the world, see GEOGRAPHY. • For information on utilizing different types of transport, see the TRANSPORT section. • For information on the different types of terrain, see the SURVIVAL section. • For information on setting up a town or base of operations, see LEADERSHIP. • For a list of locations to avoid, see the WARFARE > War Targets section. • For the navigation of modern cities without being seen, see the SECURITY section. • For a list of useful items to keep an eye out while scavenging, see the MATERIALS section.

Contents

1 Commercial Buildings

These buildings are used daily by the public and are often easily accessible.

Agricultural Buildings

Agricultural buildings will generally have stores of various foods on hand but will be quickly looted as people become hungry.

Barn

Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 1/5

A barn is an agricultural building usually on farms and used for various purposes. In the North American area, a barn refers to structures that house livestock, including cattle and horses, as well as equipment and fodder, and often grain.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not really worth looting except for animals if you're desperate for food. Not worth using as a shelter either.	Generally the best loot would be livestock which can be eaten.	• Hay • Farming Tools • Livestock	Not a very strong shelter as they are typically made from wood and wouldn't withstand any severe wind.	Few people would consider looting a barn.

Farm

Usefulness
4/5
Loot: 4/5
Shelter: 3/5
Risk: 3/5

A farm is an area of land that is devoted primarily to agricultural processes with the primary objective of producing food and other crops; it is the basic facility in food production.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Worth using as a base if there's nobody living there and the soil is fertile.	The most likely loot is grown food.	• Produce • Livestock • Farming Equipment • Hay	Generally farms have a house or two attached.	Quite a lot of people will head to farms, particularly if food is scarce. Farmers are likely to defend their fields by force to feed their own family.

Granary

Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 1/5

A granary is a storehouse or room in a barn for threshed grain or animal feed.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Worth a quick look to see what the silos store but not useful as a shelter.	If it stores edible grain it would be worth looting, as the amount of food would be nearly endless.	• Grains • Wheats • Food Products	The silos can't be used as a shelter but there should be nearby administration buildings which could be useful as a shelter.	Few people would look at looting a granary, if at all.

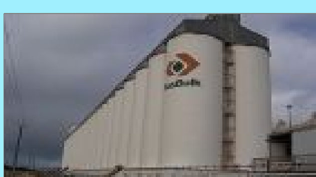
Greenhouse

Usefulness
3/5
Loot: 2/5
Shelter: 1/5
Risk: 1/5

A greenhouse is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Could be worth using if there's a stronger building nearby to use as a base and if you keep the crops watered.	Potentially food if the crops are near harvesting time.	• Produce • Plants • Farming Tools	A weak shelter which may blow away during a hurricane.	Greenhouses are likely to be targets if food is scarce.

Silo



Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 1/5

A silo is a structure for storing bulk materials. Silos are used in agriculture to store grain or fermented feed known as silage.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Worth a quick look to see what the silos store but not useful as a shelter.	If it stores edible grain it would be worth looting, as the amount of food would be nearly endless.	• Grain • Coal • Cement • Woodchips • Food Products • Sawdust	The silos can't be used as a shelter but there should be nearby administration buildings which could be useful as a shelter.	Very few people would seek to loot a silo, but depending on what is stored it could be quite valuable particularly if it's a type of edible grain.

Stable

Usefulness
1/5
Loot: 1/5
Shelter: 2/5
Risk: 1/5

A stable is a building in which livestock, especially horses, are kept. It most commonly means a building that is divided into separate stalls for individual animals.

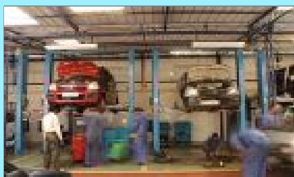
Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not worth looting or using as a shelter.	Little in the way of loot but it may contain some animal medicines which could be useful.	• Horses • Animal Tools • Hay • Animal Medicines	Not a very 'homely' shelter but can be used as one if required.	Few people would look to loot a stable.

Commercial Buildings

Usually the first buildings people think about looting as they contain food, water and sometimes medical supplies.

Types
- Service Centre
- Arcade
- Gas Station
- Hotel
- Market
- Skyscraper
- Shopping Mall
- Supermarket
- Warehouse
- Restaurant
- Offices
- Cinema
- Casino
- Bank

Service Centre



Usefulness
1/5
Loot: 1/5
Shelter: 2/5
Risk: 1/5

An automobile repair shop (also known regionally as a garage or a workshop) is an establishment where automobiles are repaired by auto mechanics and technicians.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not worth looting unless you need car parts or tools and not a very strong building.	Only car componentry, car cleaners and tools. There may be a vending machine on site.	• Tools • Car Parts • Tyres • Fuel • Car Oil	Generally a weak tin building which may get hot in summer.	Service centres will likely be abandoned as few items inside will help with a survival situation. However the items inside are generally fairly valuable.

Arcade

Usefulness
2/5
Loot: 1/5
Shelter: 3/5
Risk: 1/5

An amusement arcade is a venue where people play arcade games such as video games, pinball machines, electro-mechanical games, redemption games, merchandisers (such as claw cranes), or coin-operated billiards or air hockey tables.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Worth considering as a base but not worth looting beyond a few toys and candy.	Generally the only loot is a bit of money, electronics, childrens toys and some candy.	• Currency • Toys • Candy • Vending Machines	A decent shelter location which should keep your mind occupied even if there's no power. The machines can be moved to reinforce the entry.	A low risk due to the few items which can be looted.

Gas Station

Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 3/5

A filling station is a facility that sells fuel and engine lubricants for motor vehicles. The most common fuels sold in the 2010s are gasoline and diesel fuel.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not recommended for shelter but may be worth a look for some food items left behind.	Long life food is the most common item. Fuel can also be obtained directly from the underground canisters.	• Fuel • Vending Machines • Food • Water • Drinks	They have little shelter besides a small shop and the 'fuel roof' is likely to blow off in a hurricane.	There's a low risk of looting this facility once the initial looting is over. It becomes a 'moderate' risk in a disaster which makes fuel limited.

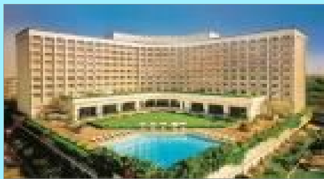
Motel

Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 2/5

A motel is a hotel designed for motorists and usually has a parking area for motor vehicles.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Not worth looting but could be used as a shelter if no other is available.	General hospitality loot such as toothbrush, soaps, towels etc.	• General Appliances • Sheets • Vending Machines	Basic shelter from the elements.	Likely to be occupied and the loot would be common items at best.

Hotel



Usefulness
4/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

A hotel is an establishment that provides paid lodging on a short-term basis. Facilities provided include a bed, dresser, refrigerator and other kitchen facilities, upholstered chairs, a flat screen television, and en-suite bathrooms.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
It could make a great place to live but the loot is unremarkable.	Mostly hospitality loot such as towels, soaps and vending machines. If there's a pool it can be used as water to purify.	• Food • Water • Vending Machines	Provides decent shelter depending on its construction. They often have great views and facilities such as a pool.	Very likely to be occupied due to the added facilities.

Market

Usefulness
1/5
Loot: 1/5
Shelter: 1/5
Risk: 1/5

A market, or marketplace, is a location where people regularly gather for the purchase and sale of provisions, livestock, and other goods.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Only worth looting early into a disaster, but the wood from the market stalls could be used for shelter building or repairs.	A wide selection of fruit, nuts and other long life foods are commonly available. You may also find the odd knick-knack or kids toy. Most food is home made and long life	• Food • Drinks • Firewood	Markets provide little shelter so seek alternative shelter against disasters.	Few people if any would likely hang around the market, particularly if it's already been looted.

Skyscraper

Usefulness
2/5
Loot: 1/5
Shelter: 2/5
Risk: 3/5

A skyscraper is a continuously habitable high-rise building that has over 40 floors and is taller than approximately 150m (492 ft). Historically, the term first referred to buildings with 10 to 20 floors in the 1880s. They often come in two different types, either business use or accommodation. These buildings are very tight and confining making chance of interation with other people very high, particularly with the elevators broken.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
The unit skyscrapers would likely have better loot but the business ones would be safer to live in.	General business and stationary based loot.	• Limted Food • Water • Vending Machines	Skyscrapers provide good shelter from many disasters, but be careful when there's hurricanes, wars, terrorism or earthquakes around.	For business use, the building should be abandoned, but watch out for skyscraper units which may be highly occupied.

Shopping Mall

Usefulness
4/5
Loot: 5/5
Shelter: 3/5
Risk: 4/5

A shopping mall is a modern, chiefly North American, term for a form of shopping precinct or shopping centre, in which one or more buildings form a complex of shops representing merchandisers with interconnecting walkways that enable customers to walk from unit to unit.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Not recommended for looting as everyone will likely head here.	Everything imaginable if you get there early.	• Food • Water • Drinks • Camping Gear • Electronics • Money • Everything Else	A risky place to make a shelter as some gangs may call them home. There may also be little light depending on the size of the mall.	A lot of people will head to malls due to the vast amounts of resources available. Even once it's been thoroughly looted it will still make a fairly strong base of operations.

Supermarket

Usefulness
4/5
Loot: 5/5
Shelter: 3/5
Risk: 4/5

A supermarket is a self-service shop offering a wide variety of food, beverages and household products, organized into sections and shelves.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Generally supermarkets will be picked bare during a disaster, but you could find uses for nearly every item there.	Almost every kind of food you could ever need.	• Food • Water • Drinks	Provides a decent amount of shelter but will likely be very dark without natural light.	A dangerous location as everyone will want to stock up on food during disasters. Violence will occur frequently.

Warehouse

Usefulness
4/5
Loot: 4/5
Shelter: 4/5
Risk: 2/5

A warehouse is a building for storing goods. Warehouses are used by manufacturers, importers, exporters, wholesalers, transport businesses, customs, etc.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Have a look to see what it contains and whether it could be suitable for a base of operations.	Depending on what the warehouse stores could mean the difference between valuable items such as camping gear and junk like toys.	• Unknown (Whatever the warehouse stores) • Boxes • Firewood (Pallets)	A warehouse could make a great shelter due to the space inside. It allows storage of a huge amount of supplies. The echos in the room would also make it easy to hear tresspassers.	Warehouses are likely to be looted quickly if they contain valuable items.

Restaurant

Usefulness
3/5
Loot: 2/5
Shelter: 3/5
Risk: 2/5

A restaurant, or an eatery, is a business which prepares and serves food and drinks to customers in exchange for currency.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Could be useful as a base of operations, but little in the way of loot.	Loot would come down to small remnants of food and general kitchen items.	• Some Food • Drinks • Cutlery	They are generally built well and the tables and chairs can be used as firewood or blocking up doors and windows.	There is little to loot in restaurants and all the food would have likely gone off making it a low target for others to loot.

Office

Usefulness
3/5
Loot: 2/5
Shelter: 3/5
Risk: 2/5

An office is generally a room or other area where an organization's employees perform administrative work in order to support and realize objects and goals of the organization.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Generally not worth heading to unless you want lots of furniture or wood to burn.	Little in the way of loot but there may be some food in people's desks or vending machines.	• Vending Machines • Tinder (Paper) • Stationary • Computers	Provides a basic level of shelter and contains useful facilities such as break rooms and toilets.	Little risk due to the lack of lootable gear. It's not the most ideal place for a shelter either.

Cinema

Usefulness
3/5
Loot: 1/5
Shelter: 4/5
Risk: 1/5

A movie theatre, cinema, or cinema hall, also known as a picture house or the pictures, is a building that contains an auditorium for viewing films for entertainment.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Could make a great base, particularly due to people having to enter on the ground floor which gives you a tactical advantage.	Virtually no loot except maybe for snacks and lollies.	• Snack Foods • Vending Machines • Films	Great shelter and sound dampening as well as comfy chairs. However there will be no natural light reaching these rooms.	People should have all but forgotten cinemas in a disaster which makes them a great place for a base. Cinema/mall combinations are a little more risky however.

Casino

Usefulness
3/5
Loot: 2/5
Shelter: 4/5
Risk: 3/5

A casino is a facility which houses and accommodates certain types of gambling activities.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
After the money has been looted it would make a great hideout due to the building strength.	A lot of money would be lootable if you can break open the machines. Vending machines may also be present.	• Food • Drinks • Money	This would make a fun base or hideout if you're into the atmosphere. Casinos are also generally built very strong and could withstand most disasters.	Quite likely to be looted early into a disaster but once the money has been taken then it would make a good base of operations due to the building strength.

Bank

Usefulness
4/5
Loot: 3/5
Shelter: 5/5
Risk: 4/5

A bank is a financial institution that accepts deposits from the public and creates credit.

Recommendation	Loot Description	Resources	Shelter	Risk - High
A perfect hideout if you can secure the whole building.	Lots of currency and possibly some gold, silver and jewels.	• Currency • Precious Metals • Jewellery	Generally a very strong structure able to withstand direct blasts and strong winds. The vault is the safest place during a hurricane.	The currency and other precious items are likely to be looted early on in any disaster and will be a hotspot for criminals.

Residential Buildings

Most people will bug-in inside their homes at first so these are off limits. Over time people will leave opening the ability to loot them.

Types
- Apartment Block
- Duplex
- House
- Townhouse
- Units

Apartment Block

Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

A high-rise building is a tall building, as opposed to a low-rise building and is defined by its height differently in various jurisdictions. It is used as a residential, office building, or other functions including hotel, retail, or with multiple purposes combined.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Avoid apartments as the occupants will likely be on guard and will defend their property.	Regular household items.	• Water • Food • Household Items	Decent for shelter, however avoid during earthquakes and cyclones.	The density of people nearby and the sheer amount of rooms would make this a risky base.

Duplex

Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

A duplex house plan has two living units attached to each other, either next to each other via townhouses or above each other like apartments.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Like apartments, these could be guarded by the occupants, but would make a decent base if they are abandoned.	Regular household items.	• Water • Food • Household Items	Good for sheltering if they are made from stong materials.	If they are abandoned then this would be a great location for a base or shelter.

House

Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

A house is a building that functions as a home. They can range from simple dwellings such as rudimentary huts of nomadic tribes and the improvised shacks in shantytowns to complex, fixed structures of wood, brick, concrete or other materials containing plumbing, ventilation, and electrical systems.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
The most common form of shelter, everyone will likely stay in their houses early in a disaster. A stronger structure would be better.	Regular household items.	• Water • Food • Household Items	A decent shelter based on the material of the house. Wood/Bricks/Metal.	If it is abandoned, a large house would make a great location for a base or shelter.

Townhouse

Usefulness **3/5** Loot: 3/5 Shelter: 3/5 Risk: 3/5	A townhouse, townhome, or town house as used in North America, Asia, Australia, South Africa and parts of Europe, is a type of terraced housing.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
These are often protected on both sides and would make a decent base if it is abandoned.	Regular household items.	● Water ● Food ● Household Items	Good for sheltering if they are made from stong materials.	The density of people nearby and the sheer amount of rooms would make this a risky base.

Unit

Usefulness **3/5** Loot: 3/5 Shelter: 3/5 Risk: 3/5	A housing unit, or dwelling unit. is a structure or the part of a structure or the space that is used as a home, residence, or sleeping place by one person or more people who maintain a common household.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Units are generally too small to make effective bases, but can offer shelter temporarily.	Regular household items.	● Water ● Food ● Household Items	Good for sheltering if it is made from stong materials.	The density of people nearby and the sheer amount of rooms would make this a risky base.

Industrial Buildings

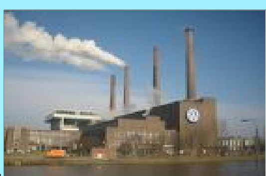
Description	Types
High in resources based on what the factory produces, these will typically be targeted first and looted quickly.	● Brewery ● Factory ● Winery ● Mill ● Refinery

Brewery

Usefulness **2/5** Loot: 1/5 Shelter: 3/5 Risk: 1/5	A brewery or brewing company is a business that makes and sells beer. The place at which beer is commercially made is either called a brewery or a beerhouse, where distinct sets of brewing equipment are called plant.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
It is a strong building to make a base from, but could be hazardous.	It could contain various alcoholic and non-alcoholic drinks and vending machines.	● Drinks ● Vending Machines	A decently strong shelter location but could be a maze inside.	Not a lot of people would think to loot a brewery, but factories can also be quite dangerous.

Factory



Usefulness **3/5** Loot: 2/5 Shelter: 3/5 Risk: 1/5	A factory or manufacturing plant is an industrial site, usually consisting of buildings and machinery, or more commonly a complex having several buildings, where workers manufacture goods or operate machines processing one product into another.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Would make a strong facility to live in, but could be dangerous depending on what item is made.	It really depends on what that type of facility builds.	● Unknown (Depends on the type of factory) ● Vending Machines	Generally factories are built quite strong to withstand winds and other disasters. It may be quite a maze inside.	Not a lot of people would loot a factory, unless it makes an item that people need to survive. Factories can also be quite dangerous.

Winery

Usefulness **4/5** Loot: 3/5 Shelter: 4/5 Risk: 2/5	A winery is a building or property that produces wine, or a business involved in the production of wine, such as a wine company.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Worth using as a base to shelter in and for looting due to the wine.	Mostly wine and barrels but the occasional food item as well.	● Wines ● Firewood (Barrels) ● Glass Bottles ● Cork	Generally wineries have a basement to keep the wines cooler, these would be perfect to shelter in during a disaster.	Wines are quite sought after during disasters which could make this location dangerous.

Mill

Usefulness 2/5 Loot: 1/5 Shelter: 3/5 Risk: 1/5	A gristmill (also: grist mill, corn mill, flour mill, feed mill or feedmill) grinds cereal grain into flour and middlings.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Worth a look around for loot but unlikely to have much of use. Useful as a base.	Little in the way of loot except for flour and some tools.	• Grains • Flour	Generally slightly stronger than regular buildings making it useful for shelter.	Few, if any people will want to loot factories including mills.

Refinery

Usefulness 2/5 Loot: 1/5 Shelter: 4/5 Risk: 1/5	A refinery is a production facility composed of a group of chemical engineering unit processes and unit operations refining certain materials or converting raw material into products of value.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
It would make a decent base of operations but you would need to bring your own food in. Little grass for crops.	Little loot if any beyond vending machines.	• Raw Materials • Refined Materials	It would make a decent shelter due to its metal construction.	Few people would venture into a refinery after a collapse due to the lack of useful resources and the maze-like construction.

2 Betterment Buildings

Buildings which are designed to improve people or make them healthy again.

Medical Buildings

These are the most desired resources and will be hit first if SHTF and the medical resources will be looted within a week.

Types
- Hospital
- Chemist
- Nursing Home
- Quarantine
- Asylum
- Doctor's Office
- Dentist

Hospital

Usefulness 4/5 Loot: 5/5 Shelter: 4/5 Risk: 4/5	A hospital is a health care institution providing patient treatment with specialized medical and nursing staff and medical equipment.

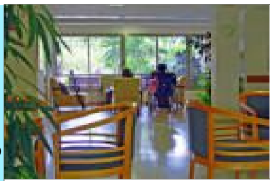
Recommendation	Loot Description	Loot	Shelter	Risk - Very High
Not recommended to go near due to the high risk of dying and the high chance it's already looted.	Stocked with medical gear which could save your life if needed. Lots of vending machines.	• First Aid Equipment • Trauma Equipment • Advanced Medical Eqp. • Vending Machines • Medical Books	Not a very useful location for a shelter as it will be hard to defend due to the many access points and everyone will try to loot what that can.	This is a high profile location and a lot of people will head there for treatment. There could be viruses in the air and it could be taken control of by gangs.

Chemist (Pharmacy)

Usefulness 4/5 Loot: 5/5 Shelter: 3/5 Risk: 4/5	Pharmacy is the science and technique of preparing, dispensing, and review of drugs and providing additional clinical services.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Definitely worth looting if there's some left over medication. Not so useful as a shelter.	Heaps of different kinds of medication and some various forms of snacky food and powders.	• Drugs • Medication • Medical Equipment • Snack Foods	A general type of shelter, although it would be dark due to chemists rarely having windows.	A very high risk building due to the rarity and usefulness of medications. It will be one of the first buildings looted in a disaster.

Nursing Home



Usefulness
3/5
Loot: 4/5
Shelter: 3/5
Risk: 1/5

Nursing homes, also known as old people's homes, care homes, rest homes, and convalescent homes, provide residential care for elderly or disabled people that often includes around-the-clock nursing care.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Worth taking a look in for medication if it's abandoned. Not as useful for shelter.	Most of the worthwhile loot would be the left over medication.	● Food ● Water ● Medical Kits ● Medication	General standards of building construction but without the stairs typically.	Few people would consider the medication stored in nursing homes for the elderly but would instead go for chemists making this a low risk place.

Asylum

Usefulness
4/5
Loot: 3/5
Shelter: 4/5
Risk: 1/5

Psychiatric hospitals, also known as mental hospitals, mental health units, mental asylums or simply asylums, are hospitals or wards specializing in the treatment of serious mental disorders, such as major depressive disorder, schizophrenia and bipolar disorder.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Would make a great base of operations due to having a variety of different rooms including a makeshift 'soft prison cell'.	Most of the worthwhile loot would be the medication for the patients.	● Food ● Water ● Medical Kits ● Medication	It would make a perfect shelter with all the requires amenities, good vantage points and a large campus.	People would consider an asylum as a good place for resources, this makes it a low risk. Some wouldn't want to enter simply because of what may have happened inside.

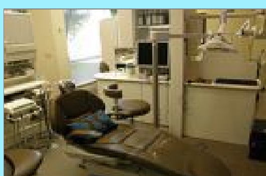
Doctor's Office

Usefulness
4/5
Loot: 4/5
Shelter: 4/5
Risk: 2/5

A doctor's office in American English, a doctor's surgery in British English, a doctor's room in Australian English or a doctor's practice, is a medical facility in which one or more medical doctors, usually general practitioners (GP), receive and treat patients.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Definitely worth taking a look around for any medical equipment left behind. Could also make a good base.	Great medical loot if it hasn't been taken already.	● Medical Equipment ● Trauma Equipment ● Medication ● Snack Foods	A typical modern building but with additional useful rooms such as the doctors office and treatment rooms.	Due to the amount of medical equipment in doctors offices this place will be hit hard and fast during disasters.

Dentist

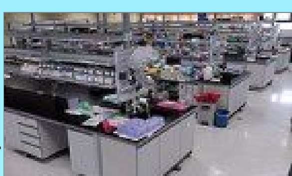


Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 2/5

A dentist, also known as a dental surgeon, is a surgeon who specializes in dentistry, the diagnosis, prevention, and treatment of diseases and conditions of the oral cavity.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Worth a look around for useful medical items, particularly if you have tooth problems.	Doesn't have as much useful equipment as a doctors office, but still useful medical items.	● Dental Equipment ● Medical Equipment ● Snack Foods	A typical modern building with few changes.	Due to the amount of medical equipment this place will also be looted quite early on.

Laboratory



Usefulness
2/5
Loot: 2/5
Shelter: 3/5
Risk: 1/5

A laboratory is a facility that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not really worth looting unless you are in need of some uncommon chemicals or compounds.	Very little loot which most people would want. The chemicals may be of interest to some preppers.	● Various Chemicals ● Medical Kits ● Vending Machines	A typical modern building with few changes.	Few, if any people would loot a laboratory.

Educational Buildings

These will be largely deserted due to the lack of resources (and teachers) available and people often don't think of books in disasters.

Types
- Archives
- University
- Library
- Museum
- School

Archive

Usefulness
2/5
Loot: 1/5
Shelter: 4/5
Risk: 1/5

An archive is an accumulation of historical records or the physical place they are located.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not worth looting but could be worth using as a base of operations if it has a basement.	Virtually nothing worth looting. The archives themselves could be used for burning.	• Tinder • Information	Due to the storage requirements of some information this building may have a basement where the archives are stored.	An extremely boring building which may be left untouched in a disaster.

Library

Usefulness
3/5
Loot: 2/5
Shelter: 3/5
Risk: 1/5

A library is a collection of sources of information and similar resources, made accessible to a defined community for reference or borrowing.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Could be worth looting if there's still books on survival or other topics you need.	Generally only books and perhaps a vendig machine or two. The books could be used for entertainment or burning.	• Information • Tinder • Vending Machines	A typical modern building with few changes.	Few people would loot a library early on in a disaster. Generally only the intelligent ones would come to a library for the information they need.

Museum

Usefulness
2/5
Loot: 2/5
Shelter: 3/5
Risk: 2/5

A museum is an institution that cares for (conserves) a collection of artefacts and other objects of artistic, cultural, historical, or scientific importance.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
It's not worth visiting a museum unless it's a sturdy structure which would suit as a base.	Little worth looting.	• Information • Vending Machines	An often reinforced structure with large rooms makes this an ideal shelter.	A museum won't be useful in the way of loot, but the structure could be fairly strong if it's an older style built of stone.

School

Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 3/5

A school is an educational institution designed to provide learning spaces and learning environments for the teaching of students under the direction of teachers. Most countries have systems of formal education, which is commonly compulsory.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Not worth looting or using as a shelter unless there's no others nearby.	The students of the school would know where the useful items are located and would be long gone by the time it's looted by others.	• Information • Vending Machines	Generally schools have slightly weaker buildings compared to others and wouldn't be useful in a disaster.	Students may have tendancies to return and destroy the school in a disaster. Some may be used as evac shelters.

University

Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

A university is an institution of higher education and research which awards academic degrees in various academic disciplines.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Worth using as a base of operations but little in the way of loot.	Not a lot in the way of loot but there is likely to be a lot of books and various teaching utensils.	• Information • Vending Machines	Universities may have strong stone buildings which would be great against any natural disaster.	They generally have stronger and more creative buildings than schools, but are often hubs of activity and the inititiation point for protests.

Religious Buildings

People will often gather to religious buildings in hard times and combined with few resources it's advised to keep away.

Types
- Church
- Mosque
- Monastery
- Shrine
- Temple

Church

Usefulness
3/5
Loot: 1/5
Shelter: 3/5
Risk: 2/5

A church building or church house, often simply called a church, is a building used for Christian religious activities, particularly for Christian worship services.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not worth looting but could serve as a shelter from disasters.	Little in the way of loot and not worth looting.	• Bibles • Pews / Chairs / Wood • Candles	Some churches are built with stone and are therefore stronger than modern buildings.	There's virtually nothing to loot in churches but people may come to them to seek God in times of hardship.

Mosque

Usefulness
3/5
Loot: 1/5
Shelter: 3/5
Risk: 3/5

A mosque is a place of worship for Muslims.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Avoid mosques due to little to loot and their potential to be used as a base by Muslims.	Little in the way of loot and not worth looting.	• Nothing	The structure could be fairly strong and may be used as a base.	There's little to loot in mosques and they are likely to be used as disaster hubs. May be guarded by radical Muslims.

Monastery

Usefulness
4/5
Loot: 4/5
Shelter: 4/5
Risk: 2/5

A monastery is a building or complex of buildings comprising the domestic quarters and workplaces of monastics, monks or nuns, whether living in communities or alone.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
These would make an ideal location for a shelter or home base due to having all the needed supplies for sustaining life.	Little in the way of loot, generally only basic household belongings.	• Household Items • Personal Belongings	The structure may be made of stone which is ideal for a long term survival solution.	Most people won't think of a monastery in a disaster and they are often isolated from society with famland nearby.

Shrine

Usefulness
3/5
Loot: 1/5
Shelter: 4/5
Risk: 2/5

A shrine is a holy or sacred place, which is dedicated to a specific deity, ancestor, hero, martyr, saint, daemon, or similar figure of awe and respect, at which they are venerated or worshipped.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not a very useful structure besides sheltering temporarily from a disaster.	Little in the way of loot and not worth looting.	• Little to no useful resources	The structure is often physically strong, but is often too small to be much use.	Few people are likely to head to, or use a shrine in a disaster besides basic sheltering from a current storm.

Temple

Usefulness
3/5
Loot: 1/5
Shelter: 4/5
Risk: 2/5

A temple is a structure reserved for religious or spiritual rituals and activities such as prayer and sacrifice.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
A great location for sheltering in and would make a decent base of operations.	Little in the way of loot and not worth looting.	• Possibly food offerings	A physically strong building which would make an excellent shelter.	Not many people are likely to use a temple during a disaster beyond the adherents.

3 Government Buildings

Government owned buildings which will generally be harder to access than commercial buildings.

Government Buildings

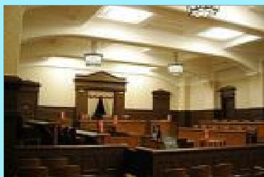
These often have good resources for a survival situation but will be first hit when SHTF.	**Types** • City Hall • Courthouse • Embassy • Water Treatment Plant	• Fire Station • Police Station • Post Office • Prison

City Hall

Usefulness **4/5** Loot: 2/5 Shelter: 5/5 Risk: 2/5	In local government, a city hall, town hall, civic centre, a guildhall, a Rathaus, or a municipal building, is the chief administrative building of a city, town, or other municipality.	

Recommendation	Loot Description	Resources	Shelter	Risk - Medium
An ideal building to use as a base if it is free and can be utilized.	Generic office supplies and vending machines.	• Office Supplies • Vending Machines	Generally very sturdy buildings, especially if made of stone. Perfect for sheltering in.	These are likely to be closed off or used to shelter evacuees during disasters. Either way they are likely to be populated.

Courthouse



Usefulness **2/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	A courthouse is a building that is home to a local court of law and often the regional county government as well, although this is not the case in some larger cities.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not very useful for a base due to its limited exits and lack of windows. They are often connected to other buildings as well.	Almost nothing worth looting.	• Tinder (Paper) • Wood Benches	Typically a sturdy structure which would be good to sheltering in.	Likely to be abandonded during any disasters after law and order has collapsed.

Embassy

Usefulness **2/5** Loot: 0/5 Shelter: 3/5 Risk: 2/5	A diplomatic mission or foreign mission is a group of people from one state or an organisation present in another state to represent the sending state/organisation officially in the receiving state.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Not worth your time, however the building is often physically strong.	Little worth looting beyond stationery.	• Tinder (Paper)	Embassies can be physically tough buildings, which would work for temp shelter.	An embassy may be targeted if individuals have grievances against the country this embassy is connected to.

Fire Station

Usefulness **4/5** Loot: 4/5 Shelter: 5/5 Risk: 4/5	A fire station is a structure or other area for storing fire fighting apparatus such as fire engines and related vehicles, personal protective equipment, fire hoses and other specialized equipment.

Recommendation	Loot Description	Resources	Shelter	Risk - High
An excellent and reinforced location if you can use one as a base. It has a high risk of being targeted by others though.	Decent loot, but the structure itself is more important.	• Water • Medical Equipment • Fire Resistant Suits • Tough Vehicles	Fire stations are perfect for a shelter location as they are often reinforced.	A target for both gangs and rogue groups if they aren't controlled by the government.

Police Station

Usefulness **5/5** Loot: 5/5 Shelter: 5/5 Risk: 5/5	A police station (sometimes called a "station house" in the US) is a building which serves to accommodate police officers and other members of staff.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Avoid this location unless you're sure it's unoccupied. The loot and shelter are well worth it if you can manage it.	Excellent loot, but will take some time to break into the vaults.	• Guns & Ammo • Comms • Defensive Weapons • Vehicles	Police stations are often built reinforced to withstand any kind of disaster.	This location will be targeted first by looters and will probably be occupied by someone, whether police or gangs at all times.

Post Office

Post Office

Usefulness
3/5
Loot: 1/5
Shelter: 2/5
Risk: 1/5

A Post office is a public department that services the people by transporting and delivering their mail across the country and between continents.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not really worth looting or using as a shelter, but it's likely to be fairly safe.	Loot can vary wildly and is based off what is inside the packages.	• Tinder (Paper) • Packages with unknown contents	Not a great shelter location, but the warehouses are often a decent size.	These will likely be forgotten about in a disaster so they are relatively safe beyond rogue individuals breaking in.

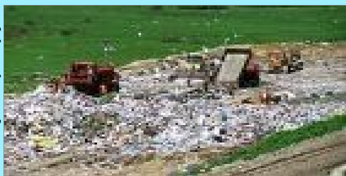
Prison

Usefulness
5/5
Loot: 5/5
Shelter: 5/5
Risk: 5/5

A prison, also known as a correctional facility, jail, penitentiary, detention centre, or internment facility is a facility in which inmates are forcibly confined and denied a variety of freedoms under the authority of the state.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
If you can get a prison, it is the ultimate in security and loot. However the risk is very high.	Everything you need to survive should be contained inside.	• Food & Water • Weapons • Medical Equipment	The ultimate shelter. Heavily reinforced with multiple layers of protection.	There may be dangerous prisoners hanging around during a disaster.

Landfill (Dump, Tip)



Usefulness
3/5
Loot: 4/5
Shelter: 2/5
Risk: 0/5

A landfill site is a site for the disposal of waste materials by burial. It is the oldest form of waste treatment.

Recommendation	Loot Description	Resources	Shelter	Risk - Very Low
This may be a decent location if there's a few buildings on site and the rubbish is separated into materials.	There is typically a lot of useful loot at the dump - you just have to find it.	• Wood • Metal • Electronics	Little to no shelter, although there is generally a structure on site somewhere.	The only real risk at dumps is cutting yourself on the landfill and the vermin which is likely to be present.

Military Buildings

Heavily fortified buildings with an abundance of survival resources, vehicles, medicine, weapons, food and water. Extremely dangerous areas.

Types
- Barracks
- Naval Base
- Air Base
- Bunker
- Missile Launch Facility

Castle

Usefulness
4/5
Loot: 3/5
Shelter: 5/5
Risk: 4/5

A castle is a type of fortified structure built during the Middle Ages by predominantly the nobility or royalty and by military orders.

Recommendation	Loot Description	Resources	Shelter	Risk - High
A brilliant location for a stronghold with lots of visibility and resistance to disasters.	Depending on what the castle is used for it may have different resources inside.	• Unknown	A location designed to be easily defendable combining thick walls with the ability to shoot back.	A lot of people will have the same idea and try to either loot or live in a castle so keep an eye out.

Military Base

Usefulness
5/5
Loot: 5/5
Shelter: 5/5
Risk: 5/5

A barracks is a building or group of buildings built to house soldiers.

Military Base

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
Barracks will be heavily defended during wars and they may not ask questions before opening fire so it's recommended to only loot these or use it as a base if it's been abandoned.	This is probably the most lucrative location for finding items you require from food, water, weapons, explosives, defensible positions, medical equipment and much more.	• Weapons • Ammo • MREs • Explosives • Food • Water • Medical Kits • Trauma Equipment • Vehicles	There should be multiple reinforced buildings on most barracks which will be perfect for a hideout and protect against natural disasters.	The hardest part is getting in safely and making sure that everyone else didn't have the same idea and is hiding somewhere on the base. People will constantly be trying to get in to the base so take care. It's also very likely to be a target during war.

Naval Base

Usefulness
4/5
Loot: 5/5
Shelter: 4/5
Risk: 5/5

A naval base, navy base, or military port is a military base, where warships and naval ships are docked when they have no mission at sea or want to restock. Another location that will be heavily defenced during wars and times of disaster so don't loot unless it looks safe or its been abandoned.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
Large ships will have the best supply of resources if you're able to find one and gain entry. This is due to the inhabitants needing to survive on the ocean for long periods without restocking.	Not as lucrative as a barracks but will still have a lot of similarly good loot. You will have to find a way to search the boats as well, and a grounded boat could serve as a great hide out location.	• Weapons • Ammo • MREs • Food • Water • Medical Kits • Trauma Equipment • Ships	There should be a few reinforced buildings on the base. Ships are designed to be resistant to gunfire and bombs and also make a good base, however be sure to check they aren't slowly sinking.	Getting in will be tough and there could already be people occupying the buildings and ships. A lot of people will have the same idea and will try to loot the base as well. Be careful the ships aren't damaged if you choose to live on them and ensure they aren't sinking slowly. It's also a likely target during war.

Air Base

Usefulness
5/5
Loot: 5/5
Shelter: 5/5
Risk: 5/5

An air base (sometimes referred to as a military air base, military airfield, or air force base) is an aerodrome used as a military base by a military force for the operation of military aircraft. Another location that will be heavily defenced during wars and times of disaster so don't loot unless it looks safe or its been abandoned.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
An excellent location if you can manage to loot it or use it as a base of operations. It will be a very high target for the opposition during a war and will be a target for gangs and the government as well.	Likely to have the least impressive loot out of the three bases, but it will still have some good items that could be used. It's less likely to have weapons and explosives, but may have missiles, bombs or even nukes.	• Weapons • Ammo • MREs • Missiles / Nukes • Food • Water • Medical Kits • Trauma Equipment • Planes • Vending Machines	The buildings on the flight line are generally reinforced and soundproofed and would make ideal shelter locations - the air traffic control tower in particular can be used to keep a look out.	A likely target during war. Be careful about people already occupying the air base as they could be military members and would be heavily armed. Many people are likely to try and loot the base after you so watch out for others.

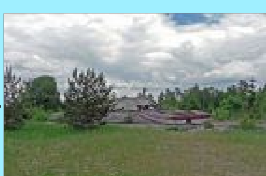
Bunker

Usefulness
5/5
Loot: 3/5
Shelter: 5/5
Risk: 5/5

A bunker is a defensive military fortification designed to protect people and valued materials from falling bombs or other attacks. Bunkers are mostly underground, in contrast to blockhouses which are mostly above ground.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
Perfect for a hideout if you can store vast amounts of food and water inside. You should secure the surrounding area so you can leave freely and get some sunlight too.	It may already contain food, water and weapons so be sure to have a look if you get the chance.	• Depends on what the bunker is being used as • Long Life Food • Long Life Water	The best shelter providing defence from direct blasts and gunfire. The best choice for a stronghold during a disaster.	Be careful not to be trapped underground as enemies may lure you in and then send in armed personnel to kill you. If you're sure the bunker is free from threats - reinforce/block any access points.

Missile Launch Facility



Usefulness
4/5
Loot: 2/5
Shelter: 5/5
Risk: 5/5

A missile launch facility, also known as an underground missile silo, launch facility (LF), or nuclear silo, is a vertical cylindrical structure constructed underground, for the storage and launching of intercontinental ballistic missiles (ICBMs). There won't be a lot in the way of loot but you could find something useful in the surrounding buildings. Its best use would be as a shelter if it's out in the middle of nowhere.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
Perfect for a hideout if you can store vast amounts of food and water inside, however it could be targeted during a war.	There may not be a lot in the way of loot, but	• Missiles / Nukes • Food • Water • Medical Kits	Provides the best shelter possible which should be able to sustain direct blasts. The best choice for a stronghold during a disaster.	Before you visit this location be sure that it's unlikely to be a target of enemy fire from ICBMs or Nukes. Gaining entry will be your first mission, especially if it's all locked up. Be careful if there's still a nuke or ICBM inside the silo as it could still be launched remotely.

Transport Buildings

All transport systems will be down and these will be largely deserted, however underground stations make strong bunkers and may be occupied.

Types
- Airport Terminal
- Bus Garage
- Train Station
- Lighthouse

Airport Terminal

Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 4/5

An airport terminal is a building at an airport where passengers transfer between ground transportation and the facilities that allow them to board and disembark from an aircraft.

Recommendation
Makes a good stronghold if you can secure the facility and have a group. Worth taking a look for loot such as luggage and mail.

Loot Description
You could potentially find a lot of air mail which has been abandoned as well as luggage people forgot to collect.

Resources
- Food (Snacks)
- Water & Drinks
- Snack Foods
- Vending Machines
- Mail
- Luggage

Shelter
They would provide a decent amount of protection from natural disasters and could make a good stronghold especially if you use the air traffic control tower to your advantage.

Risk - High
Terminals could be guarded for a long time into a disaster so it's recommended to avoid them. People will often come in looking for items to loot.

Hangar

Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

A hangar is a closed building structure to hold aircraft, or spacecraft. Hangars are built of metal, wood and concrete.

Recommendation
May be worth looting if you're in the area and especially if you need a plane, but not great as a shelter.

Loot Description
There won't be much to loot at hangars beside what's in the aircraft and the surroudning buildings.

Resources
- Aircraft Parts
- Tools

Shelter
Generally hangars can withstand strong wind and would make nice shelters.

Risk - Moderate
Smaller than an airport termal and therefore less likely to be stumbled upon by others, but still risky as people may want to access their personal planes to escape in.

Bus Garage

Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 1/5

A bus garage, also known as a bus depot, bus base or bus barn, is a facility where buses are stored and maintained.

Recommendation
It's not recommended to use this location as a base, but only give it a quick sweep for useful loot. It would be useful if you can fit out a few buses with prepper gear and use them for transportation.

Loot Description
Not a lot to loot here besides what you can find on buses and in the luggage compartments.

Resources
- Buses
- Vending Machines
- Car Batteries

Shelter
You could use the buses as shelter. This is best done by parking them in such a way to maximize the defensive perimeter.

Risk - Low
Not many people would head to a bus garage to loot it.

Train Station

Usefulness
3/5
Loot: 1/5
Shelter: 2-5/5
Risk: 3/5

A train station, railway station, railroad station, or depot is a railway facility or area where trains regularly stop to load or unload passengers or freight. It generally consists of at least one track-side platform and a station building providing such ancillary services as ticket sales and waiting rooms.

Recommendation
Underground stations are best utilized for a base. Above ground stations are best looted and left. Little, if any loot.

Loot Description
There would really only be vending machines at stations.

Resources
- Vending Machines

Shelter
The level of shelter depends on whether the station is underground or not. 2 for above ground to 5 if it's underground. Underground shelters would work well for bases.

Risk - Moderate
Because of the number of access points to stations the risk is high to run into other people. Most stations are on the surface and don't provide much protection from the elements.

Signal Box

Usefulness
1/5
Loot: 1/5
Shelter: 1/5
Risk: 1/5

On a rail transport system, signalling control is the process by which control is exercised over train movements by way of railway signals and block systems to ensure that trains operate safely, over the correct route and to the proper timetable.

LOCATIONS
Government Buildings
Transport Buildings

Recommendation Not very useful besides a temporary stop on your way to somewhere else. It may contain some food.	**Loot Description** Little in the way of loot besides stationery, tinder and food.	**Resources** • Phone • Paperwork • Computer • Snack Foods	**Shelter** Useful as a temporary shelter from the elements.	**Risk - Low** Likely to be uninhabited due to its size and proximity from anything.

Harbour

Usefulness
3/5
Loot: 3/5
Shelter: 2/5
Risk: 3/5

A harbour or harbour is a sheltered body of water where ships, boats, and barges can be docked.

Recommendation You wouldn't inhabit the harbour itself, but one of the boats docked. You should know how to drive a boat if you hang around here.	**Loot Description** Boats often contain the essentials of survival and therefore make good looting targets.	**Resources** • Food & Water • Medication • Batteries / Power	**Shelter** Little to no shelter, and boats can be dangerous places to be in strong wind.	**Risk - Moderate** A lot of people may have their house boats docked in the harbour, so it will likely be inhabited.

Shipyard

Usefulness
2/5
Loot: 3/5
Shelter: 0/5
Risk: 0/5

A shipyard (also called a dockyard) is a place where ships are built and repaired.

Recommendation Potentially a great place to use as a base, however it's a concrete jungle and growing food would be tricky.	**Loot Description** Not a lot of loot, the ships may have basic survival items.	**Resources** • Few, if any useful resources. • There could be items on the ships.	**Shelter** Not a lot of shelter if it's an outside shipyard.	**Risk - Moderate** Most people aren't likely to think about shipyards in a disaster so it should be relatively quiet.

Ferry/Cruise Terminal

Usefulness
2/5
Loot: 1/5
Shelter: 3/5
Risk: 1/5

A ferry terminal, which may also be known as a passenger terminal, cruise terminal, marine terminal or maritime passenger terminal, is a structure in a port where ferries and possibly cruise ships pick up and drop off passengers and vehicles.

Recommendation These are similar to airports and therefore aren't very useful in a survival situation beyond a shelter.	**Loot Description** Very little to no useful loot.	**Resources** • Little to no loot.	**Shelter** It's a decent sized shelter, there's not much else to it.	**Risk - Low** These are likely to be completely abandoned with no cruiseliners running.

Lighthouse

Usefulness
3/5
Loot: 1/5
Shelter: 3/5
Risk: 2/5

A lighthouse is a tower, building, or other type of structure designed to emit light from a system of lamps and lenses and to serve as a navigational aid for maritime pilots at sea or on inland waterways.

Recommendation May work well as a base and a lookout point. Little loot.	**Loot Description** Not a lot in the way of loot beyond a typical office.	**Resources** • Snacks	**Shelter** Could make a viable shelter giving an amazing line of sight, but they are quite cramped.	**Risk - Moderate** Being so prominent in a landscape they may be a target for people.

Space Port

Usefulness
2/5
Loot: 1/5
Shelter: 4/5
Risk: 4/5

A spaceport or cosmodrome is a site for launching (or receiving) spacecraft, by analogy to seaport for ships or airport for aircraft.

Recommendation There's nothing really here to be of use in a survival situation.	**Loot Description** No loot beyond office supplies and snacks.	**Resources** • Food • Water • Vending Machines	**Shelter** The buildings are likely to be slightly reinforced with nothing else special about them.	**Risk - High** This area may be locked down by the government and possibly patrolled. People are likely to wander in wanting a look.

Infrastructure

Possible targets in a war and SHTF. These are likely to become gang headquarters for protection and to sell off the resources at a high cost.

Types
- Water Treatment Facility
- Power Substation
- Nuclear Power Plant
- Solar Farm
- Dam
- Data Centre

Water Treatment Facility

Water Treatment

Usefulness
4/5
Loot: 2/5
Shelter: 3/5
Risk: 1/5

Water treatment is any process that improves the quality of water to make it more acceptable for a specific end-use.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Great to have an unlimited supply of water and would be very helpful if growing food. Overall a decent location.	Not much in the way of loot besides water.	• Infinite Water • Water Purifiers	Usually a decently constructed building.	If municipal systems break down this will likely be abandoned quickly.

Power Substation

Power Substation

Usefulness
1/5
Loot: 0/5
Shelter: 1/5
Risk: 1/5

A substation is a part of an electrical generation, transmission, and distribution system.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
These facilities are generally lightly protected by fences but usually have few useful resources and buildings.	None really.	• Snacks	o	It could be a target for local attacks, but most people would ignore these substations in disasters as the power is likely to have gone off long ago.

Nuclear Power Plant

Nuclear Power Plant

Usefulness
3/5
Loot: 1/5
Shelter: 4/5
Risk: 5/5

A nuclear power plant or nuclear power station is a thermal power station in which the heat source is a nuclear reactor.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
A nuclear power plant isn't a great choice for looting or using a a shelter due to the risks involved and the limited potential gains. Bring a radiation meter if you go.	Little usable loot.	• Snacks	They provide excellent shelter but at a large risk.	These plants could be targeted by enemies during a war. If hit, they will release radioactive particles for many kilometres, likely killing anyone in close proximity and irradiating crops & livestock.

Solar Farm

Solar Farm

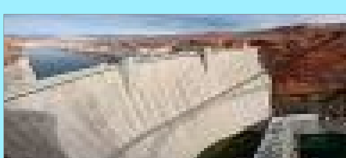
Usefulness
4/5
Loot: 4/5
Shelter: 1/5
Risk: 1/5

A photovoltaic power station, also known as a solar park, is a large-scale photovoltaic system (PV system) designed for the supply of merchant power into the electricity grid.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Using a solar farm as a base could work if you have some electrical knowledge and can use the panels to generate unlimited power.	You could potentially rewire the panels to generate unlimited solar power.	• Solar Panels • Unlimited Electricity	Limited to no shelter.	Almost no risk as they span such a wide location and won't be on people's minds.

Dam

Dam



Usefulness
4/5
Loot: 1/5
Shelter: 4/5
Risk: 3/5

A dam is a barrier that stops or restricts the flow of water or underground streams. Reservoirs created by dams not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use, aquaculture, and navigability.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
A dam would make a great base if it's a hydro-dam. You could have unlimited water and power and have a strong shelter.	No loot beyond basic office supplies.	• Unlimited Water • Possibly Unlimited Power • Allowing Crossings	A very sturdy shelter capable of withstanding most disasters.	There's a risk of the dam breaking and being a target of an attack. People may also use it to cross.

Data Centre

Data Centre

Usefulness
2/5
Loot: 1/5
Shelter: 2/5
Risk: 0/5

A data centre is a building, dedicated space within a building, or a group of buildings used to house computer systems and associated components, such as telecommunications and storage systems.

Recommendation	Loot Description	Resources	Shelter	Risk - Very Low
Not a very useful location overall, and there's no windows.	Nothing really.	• PCs & HDDs • Servers	It would provide a decent shelter location.	Nobody will care about a data centre in a collapse.

4 Other Structures

This section contains all those buildings or locations that aren't covered above that may be of benefit.

Non Buildings

Locations that people may inhabit but doesn't generally have an interior.

Types
- Bridge
- Arena
- Theme Park
- Park
- Well
- Cemetery
- Tunnel
- The Subway
- Docks
- ATM

Bridge

Usefulness
1/5
Loot: 0/5
Shelter: 2/5
Risk: 2/5

A bridge is a structure built to span physical obstacles without closing the way underneath such as a body of water, valley, or road, for the purpose of providing passage over the obstacle, usually something that can be detrimental to cross otherwise.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Only use bridges as temporary shelters. Nothing in the way of loot.	No loot. If it's made of wood it could be used as firewood.	• Water Nearby	There may be some shelter under the bridge but it's inadequate for a long term stay.	Not many people would use a bridge as shelter, however people may need to cross a river and this would raise the risk level.

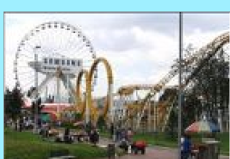
Arena

Usefulness
2/5
Loot: 0/5
Shelter: 0/5
Risk: 3/5

An arena, is an enclosed area, often circular or oval-shaped, designed to showcase theatre, musical performances, or sporting events.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Little - if any loot. Not suitable as a long term shelter due to the size and number of entrances.	Possibly vending machines and sporting merchandise.	• Growing Food • Vending Machines	Not ideal as a shelter if there's no roof. These are often opened as emergency shelters.	Others may have the same idea and shelter here. There are too many entrances to guard as a base.

Theme Park



Usefulness
3/5
Loot: 3/5
Shelter: 3/5
Risk: 3/5

An amusement park is a park that features various attractions, such as rides and games, as well as other events for entertainment purposes.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Not a lot of resources, but people may head here because of the 'thrill' factor. Could be a great base of operations if you control it all.	Theme parks generally only have packaged foods and a gift shop near the exit.	• Food • Long Life Foods • Toys • Collectables	Not a lot of shelter, but some of the underground rides would be good as a base of operations.	Because theme parks and disasters seem to by synonymous in movies these are likely to be frequently trafficked areas.

Park

Usefulness
2/5
Loot: 1/5
Shelter: 1/5
Risk: 3/5

A park is an area of natural, semi-natural or planted space set aside for human enjoyment and recreation or for the protection of wildlife or natural habitats.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Parks will attract a lot of people in disasters and should be avoided.	Almost nothing worth scavenging beside scrap metal.	• Scrap Metal • Wood	Limited use as a shelter. Structures could protect from the rain or hail.	During a disaster a lot of people are likely to head to the local park if their houses are damaged. They are also exposed from all sides.

Well

Well	**Usefulness** **2/5** Loot: 2/5 Shelter: 0/5 Risk: 1/5	A well is an excavation or structure created in the ground by digging, driving, or drilling to access liquid resources, usually water.

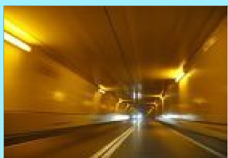
Recommendation	Loot Description	Resources	Shelter	Risk - Low
Not a location you would live around, but you could control the asset and sell the water once purified.	No loot besides the unpurified water.	● Unpurified Water	Provides no shelter.	o

Cemetery

Cemetery	**Usefulness** **1/5** Loot: 1/5 Shelter: 0/5 Risk: 0/5	A cemetery or graveyard is a place where the remains of dead people are buried or otherwise interred.

Recommendation	Loot Description	Resources	Shelter	Risk - Very Low
Not worth going to unless you want a location that will have extremely few people visiting.	No loot beyond gravestones, dirt and bits of metal.	● Stone ● Dirt ● Metal	There's very limited shelter in cemetaries beyond a few covered seats.	Few people, if any, would visit a cemetary in a disaster.

Tunnel



Tunnel	**Usefulness** **3/5** Loot: 1/5 Shelter: 5/5 Risk: 1/5	A tunnel is an underground passageway, dug through the surrounding soil/earth/rock and enclosed except for entrance and exit, commonly at each end.

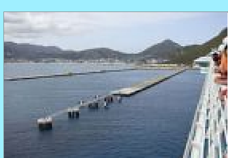
Recommendation	Loot Description	Resources	Shelter	Risk - Low
Useful as a temporary shelter from natural disasters and little more. Could be used as a base if both ends are blocked and guarded.	Little in the way of loot besides the contents of any vehicles inside.	● Vehicles and their contents	A tunnel would serve as an extremely strong shelter against natural disasters if used temporarily but aren't as useful as a base due to limited access points.	Few people would use a tunnel in a long term disaster particularly if there's no power. They are dangerous during heavy rain or earthquakes. Mind the carbon monoxide.

Metro (Subway, Underground)

Metro	**Usefulness** **4/5** Loot: 1/5 Shelter: 5/5 Risk: 3/5	Rapid transit or mass rapid transit (MRT), also known as heavy rail, metro, subway, tube, U-Bahn or underground, is a type of high-capacity public transport generally found in urban areas.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Excellent for a temporary shelter from disasters going on above ground, except for major flooding. It's not bad for use as a base.	Almost no loot except personal items on the abandoned trains and vending machines.	● Personal belongings ● Vending machines	Excellent shelter from the hazards going on above ground.	There are a few risks with the subway: Electrocution, oxygen deficiency, cave-ins, flooding and being cut off.

Dock



Dock	**Usefulness** **1/5** Loot: 0/5 Shelter: 1/5 Risk: 1/5	A dock is the area of water between or next to one or a group of human-made structures that are involved in the handling of boats or ships or such structures themselves.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
Too exposed to be a home base, but useful for fishing.	Docked boats may have some useful survival items on board.	● Boat Supplies ● Fish	Provides limited to no shelter.	Very few resources besides the opportunity for fishing, however you will be exposed and can be cut off from the mainland easily.

ATM

Usefulness **2/5** Loot: 4/5 Shelter: 0/5 Risk: 3/5	An automated teller machine (ATM) is an electronic telecommunications device that enables customers to perform financial transactions, such as cash withdrawals or obtaining account information.

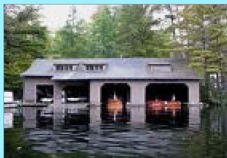
Recommendation It's recommended to ignore ATMs in a disaster as they are too high risk with little reward.	**Loot Description** Only contains money which may not be valuable in a long term disaster. Gear is much more important than money.	**Resources** • Currency	**Shelter** Provides no shelter.	**Risk - Moderate** A lot of people would go for ATMs in a disaster making this a moderate risk to try and loot. They are also often highly fixed down and have cameras focused on them.

Others

Little to no resources in these buildings. Most of what is scavenged will be from deserted vehicles.

Types
- Boathouse
- Repair Garage
- Hangar
- Parking Lot
- Oil Rig
- Community Centre
- Fast Food Restaurant
- Gym
- Workshop

Boathouse



Usefulness
2/5
Loot: 2/5
Shelter: 2/5
Risk: 0/5

A boathouse (or a boat house) is a building especially designed for the storage of boats, normally smaller craft for sports or leisure use.

Recommendation Not very useful unless you will be travelling via boat often to islands or something.	**Loot Description** Little to no loot besides what's on the boats. Use of the boats for travel is useful.	**Resources** • Boat Supplies • Fuel • Boat Parts	**Shelter** Provides limited shelter.	**Risk - Low** These will be generally overlooked in a disaster.

Parking Lot

Usefulness
1/5
Loot: 1/5
Shelter: 3/5
Risk: 0/5

A parking lot or car park, also known as a car lot, is a cleared area that is intended for parking vehicles. It could be a better base of operations if it's connected to a building and you have control of both the parking and building.

Recommendation Not useful for loot but may prove useful as a temporary shelter from incline weather.	**Loot Description** Little in the way of loot except for abandoned cars that may have been left there.	**Resources** • Abandoned Car Items • Fuel • Car Parts	**Shelter** Fair shelter if the car park is multi-storey but easy access from the ground and may not completely provide shelter from storms.	**Risk - Low** If the car park is underground, make sure it has sufficient drainage.

Self Storage

Usefulness
4/5
Loot: 5/5
Shelter: 3/5
Risk: 4/5

Self storage is an industry in which storage space, also known as "storage units" is rented to tenants, usually on a short-term basis.

Recommendation Worth taking a look in terms of looting and could also serve as a pretty good hideout with all the security cameras.	**Loot Description** Contains a huge range of various gear depending on what people store inside.	**Resources** • A little of everything	**Shelter** A decent shelter, no windows but plenty of storage space.	**Risk - High** Because people store their gear here, many people would want access to their stuff in a disaster. They also may have key access making it harder to defend.

Shed

Usefulness
2/5
Loot: 2/5
Shelter: 1/5
Risk: 0/5

A shed is typically a simple, single-story roofed structure in a back garden or on an allotment that is used for storage, hobbies, or as a workshop.

Recommendation Not a great shelter beyond a temporary one, no matter how big the shed.	**Loot Description** Various tools.	**Resources** • Tools • Vehicles	**Shelter** A flimsy shelter only useful for storage of items or getting out of the rain.	**Risk - Low** No risk.

Oil Rig

Usefulness
5/5
Loot: 4/5
Shelter: 5/5
Risk: 1/5

An oil platform, offshore platform, or offshore drilling rig is a large structure with facilities for well drilling to explore, extract, store, process petroleum and natural gas which lies in rock formations beneath the seabed. Oil rigs can be several hundred meters to over a kilometer long (around 1,000 feet to 3,000 feet).

Oil Rig				
Recommendation If you can make it to an oil rig you should be set for many months with all the resources that you need on board already.	**Loot Description** Because people have to survive on the rig for weeks at a time there should be ample supplies to get you started.	**Resources** • Food • Water • Various Tools • Medication	**Shelter** The ultimate shelter location from other people and also pretty resistant to natural disasters.	**Risk - Moderate** People may have the same idea as you and head to an oil rig. Also there may be people already bunking down on the rig. If you have complete control of it, it should be easy to defend.

Pub

Usefulness
3/5
Loot: 2/5
Shelter: 3/5
Risk: 3/5

A pub, or public house, is an establishment licensed to sell alcoholic drinks, which traditionally include beer and cider.

Recommendation Not the greatest choice as seen in Shaun of the Dead. They are often in town centres and may be frequented fairly often.	**Loot Description** Not a lot beyond simple foods and unhealthy drinks.	**Resources** • Snack Food • Drinks	**Shelter** Some pubs may be reinforced and would fair well in any disaster with strong wind.	**Risk - Moderate** People may head to the pub in times of disaster for a quick pint.

Community Centre

Usefulness
3/5
Loot: 0/5
Shelter: 0/5
Risk: 0/5

Community centres or community centres are public locations where members of a community tend to gather for group activities, social support, public information, and other purposes.

Recommendation A decent sized building for using as a base of operations which is often reasonably strong.	**Loot Description** Not a lot of loot beyond stationery and fliers.	**Resources** • Paper • Stationery	**Shelter** Often a reinforced building which is often used as an evac shelter.	**Risk - Moderate** This may be a hub of activity in the early stages of a disaster but will be forgotten soon after.

Fast Food Restaurant

Usefulness
3/5
Loot: 2/5
Shelter: 2/5
Risk: 1/5

A fast food restaurant, also known as a quick service restaurant (QSR) within the industry, is a specific type of restaurant that serves fast food cuisine and has minimal table service.

Recommendation It's best to avoid this if you have enough food stocked up. The food stored here will likely go off within a week.	**Loot Description** Generally food and kitchen utensils.	**Resources** • Food	**Shelter** It would only suffice as a temporary shelter.	**Risk - Low** If food is in shortage it will be looted early on in a disaster and then abandoned.

Gym

Usefulness
3/5
Loot: 1/5
Shelter: 2/5
Risk: 1/5

A gymnasium, also known as a gym, is a covered location for gymnastics, athletics, and gymnastic services.

Recommendation Not an ideal location to shelter in due to its many glass windows. It would likely be looted early on in a disaster.	**Loot Description** Only various types of health equipment.	**Resources** • Health Equipment • Snacks	**Shelter** It would only provide temporary shelter from the elements.	**Risk - Low** It is likely to be looted early on but then abandoned when there's nothing left.

Workshop

Usefulness
3/5
Loot: 4/5
Shelter: 3/5
Risk: 3/5

A workshop may be a room, rooms or building which provides both the area and tools that may be required for the manufacture or repair of manufactured goods.

Recommendation A workshop would be great to find a lot of tools but wouldn't work well as a base.	**Loot Description** Likely a good selection of useful tools which may be in high demand after a disaster.	**Resources** • Tools	**Shelter** A regular strength building for resisting natural disasters.	**Risk - Moderate** Depending on the tools inside, this may be a target for looters looking for valuable equipment. May be more prone to fires and chem leaks.

Folly

Usefulness
3/5
Loot: 2/5
Shelter: 2/5
Risk: 3/5

In architecture, a folly is a building constructed primarily for decoration, but suggesting through its appearance some other purpose, or of such extravagant appearance that it transcends the range of garden ornaments usually associated with the class of buildings to which it belongs.

Recommendation These kinds of buildings will attract people and could be dangerous.	**Loot Description** Not a lot of loot beyond general household equipment.	**Resources** • Household Items	**Shelter** Depending on the structure it could be a great location to shelter at.	**Risk - Moderate** Due to the unique design of structures like these, they will be targeted by gangs and individuals.

5 Transport

This contains any type of transport that may be abandoned which could have useful loot.

Abandoned Vehicles	**Bikes** • Bicycle • E-Scooter • Scooters • Mopeds • Motorbikes	**Cars** • Car • Electric Car • Tradesman Ute • Police Car • Roadside Assistance	**Light Rigid** • Minibus • Truck (General) • Ambulance • Parcel Van	**Medium Rigid** • Bus • Fire Engine • Garbage Truck	**Heavy Rigid** • Articulated Bus • Hauling Truck • Road Train	**Tram/Train** • Tram • Commuter Train • Sleeper Train • Freight Train	**Boats** • Light Boat • Ferry • Cruise Ship • Yacht • Hovercraft • Cargo Ship • Rescue Boats • Battleship • Aircraft Carrier	**Helicopters** • Private Helicopter • Tourism Helicopter • Transport Helicopter • Military Helicopter	**Planes** • Private Aircraft • Commercial Aircraft • Cargo Plane • Military Aircraft	**Military** • Light Utility Vehicle • APC • Tank

Bikes

Any type of vehicular transport which you mount and ride.

Bicycle

	Usefulness **4/5** Loot: 2/5 Shelter: 0/5 Risk: 1/5	**Description** A bicycle, also called a pedal cycle, bike, push-bike or cycle, is a human-powered or motor-assisted, pedal-driven, single-track vehicle, with two wheels attached to a frame, one behind the other. A bicycle rider is called a cyclist, or bicyclist.		
Recommendation The best unpowered transportation post-collapse.	**Loot Description** Not a lot unless you are looking to repair your own bike.	**Resources** • Bike Parts • Bike Torch • Water Bottle • Air Pump	**Shelter** Not useful as a shelter.	**Risk - Low** Bicycles are going to be a desirable item if there's no fuel or electricity available.

E-Scooter

	Usefulness **3/5** Loot: 1/5 Shelter: 0/5 Risk: 0/5	**Description** An e-scooter or electric kick scooter is an electric motorized scooter – a stand-up scooter powered by an electric hub motor in its front and/or rear wheel. It is generally designed with a large center deck on which the rider stands.		
Recommendation The best electric transportation post-collapse.	**Loot Description** The batteries (18650 cells) could be useful if taken out.	**Resources** • Batteries	**Shelter** Not useful as a shelter.	**Risk - Very Low** It will be hard to target a rider of an E-Scooter as they are pretty quick. The thief will also need the charger to make use of it.

Scooters

	Usefulness **4/5** Loot: 1/5 Shelter: 0/5 Risk: 0/5	**Description** A scooter (motor scooter) is a motorcycle with an underbone or step-through frame, a seat, a transmission that shifts without the operator having to operate a clutch lever, a platform for their feet, and with a method of operation that emphasizes comfort and fuel economy.		
Recommendation Probably the second best form of powered transport after a motorbike in a collapse. Nothing much to loot.	**Loot Description** Only fuel and the parts it contains.	**Resources** • Fuel • Scooter Parts	**Shelter** Not useful as a shelter.	**Risk - Very Low** o

Mopeds

	Usefulness **4/5** Loot: 1/5 Shelter: 0/5 Risk: 0/5	**Description** A moped is a type of small motorcycle, generally having a less stringent licensing requirement than full motorcycles or automobiles. Historically, the term exclusively meant a similar vehicle with both bicycle pedals and a motorcycle engine. Mopeds typically travel only slightly faster than bicycles on public roads.		
Recommendation o	**Loot Description** Only fuel and the parts it contains.	**Resources** • Fuel • Moped Parts	**Shelter** Not useful as a shelter.	**Risk - Very Low** o

Motorbikes

	Usefulness **4/5** Loot: 2/5 Shelter: 0/5 Risk: 0/5	**Description** A motorcycle (motorbike, bike, or, if three-wheeled, a trike) is a two or three-wheeled motor vehicle steered by a handlebar from a saddle-style seat. Motorcycle designs vary greatly to suit a range of different purposes: long-distance travel, commuting, cruising, sport (including racing), and off-road riding.		
Recommendation One of the best forms of powered transportation post-collapse, if you're alone.	**Loot Description** Only fuel and the parts it contains.	**Resources** • Fuel	**Shelter** Not useful as a shelter.	**Risk - Moderate** Because they would be desirable in a disaster, these will become a moderate risk to you.

Cars

A car, or an automobile, is a motor vehicle with wheels. Most definitions of cars state that they run primarily on roads, seat one to eight people.

Car

Usefulness **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A car, or an automobile, is a motor vehicle with wheels. Most definitions of cars state that they run primarily on roads, seat one to eight people, have four wheels, and mainly transport people rather than cargo.			
Recommendation Cars generally don't have a lot of loot in them but they would be excellent for finding parts for other vehicles.	**Loot Description** Mostly car parts but you can also siphon fuel find snacks and some tools.	**Resources** • Car Parts • Fuel • Car Battery	**Shelter** Cars provide limited shelter from disasters. Ideally you want a building.	**Risk - Low** o

Electric Car

Usefulness **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** An electric car or electric vehicle (EV) is a passenger automobile that is propelled by an electric traction motor, using electrical energy as the primary source of propulsion. The term normally refers to a plug-in electric vehicle, typically a battery electric vehicle (BEV), which only uses energy stored in on-board battery packs.			
Recommendation The batteries may be worth salvaging and it could be used for parts. Otherwise not useful for shelter.	**Loot Description** o	**Resources** • Batteries	**Shelter** No more protection over a regular car.	**Risk - Low** o

Tradesman Ute

Usefulness **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A ute, originally an abbreviation for "utility" or "coupé utility", is a term used in Australia and New Zealand to describe vehicles with a tonneau behind the passenger compartment, that can be driven with a regular driver's licence.			
Recommendation o	**Loot Description** o	**Resources** •	**Shelter** No more protection over a regular car.	**Risk - Moderate** o

Police Car

Usefulness **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A police car is an emergency vehicle used by police for transportation during patrols and responses to calls for service. A type of emergency vehicle, police cars are used by police officers to patrol a beat, quickly reach incident scenes, and transport and temporarily detain suspects.			
Recommendation o	**Loot Description** o	**Resources** • Fuel • Car Battery • Comms Equipment	**Shelter** No more protection over a regular car.	**Risk - High** Police cars will draw the attention of anyone nearby which raises your risk profile. They will be sought after by criminals.

Roadside Assistance

Usefulness **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** Roadside assistance, also known as breakdown coverage, is a service that assists motorists, motorcyclists, or bicyclists whose vehicles have suffered a mechanical failure that either cannot be resolved by the motorist, or has prevented them from reasonably or effectively transporting the vehicle to an automobile repair shop.			
Recommendation o	**Loot Description** o	**Resources** • Fuel • Car Battery • Mechanic Tools • First Aid Kit	**Shelter** No more protection over a regular car.	**Risk - Moderate** o

Light Rigid

A light rigid (LR) vehicle is a motor vehicle with a gross vehicle mass (GVM) of more than 4.5 tonnes but less than 8 tonnes. LR vehicles can also be vehicles that can carry more than 12 passengers, including the driver.

Minibus

Usefulness **-/5** Loot: 0/5 Shelter: 0/5 Risk: 3/5	**Description** o			
Recommendation Great if you can get it working to haul preps. Average shelter from the elements and little in the way of loot.	**Loot Description** o	**Resources** •	**Shelter** No more protection over a regular car.	**Risk - Moderate** Not much in the way of loot, but these are excellent to move people and resources.

Truck (General)

LOCATIONS Transport Light Rigid Truck (General)

	**Usefulness** **3/5** Loot: 3/5 Shelter: 2/5 Risk: 3/5	**Description** o

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
May be worth looting. These vehicles typically transport food.	o	• Food • Fuel • CB Radio	o	o

Ambulance

LOCATIONS Transport Light Rigid Ambulance

	**Usefulness** **5/5** Loot: 4/5 Shelter: 3/5 Risk: 4/5	**Description** An ambulance is a medically-equipped vehicle used to transport patients to treatment facilities, such as hospitals. Typically, out-of-hospital medical care is provided to the patient during the transport. Ambulances are used to respond to medical emergencies by emergency medical services (EMS).

Recommendation	Loot Description	Resources	Shelter	Risk - High
Definitely worth looting if it is safe to do so, however you will probably find the good stuff is already gone. Makes a decent shelter location.	Medical items will go quickly in any disaster and this has nearly everything you need.	• Medical Gear • Medications • Comms Equipment • Car Parts	A decent shelter location if you hang out in the back during harsh weather.	A very lucrative item to loot in a disaster.

Parcel Van

LOCATIONS Transport Light Rigid Parcel Van

	**Usefulness** **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A mail truck or post van is a type of delivery vehicle that is used to transport post.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
o	o	• Fuel	o	o

Medium Rigid

LOCATIONS Transport Medium Rigid

A "medium rigid vehicle" refers to a truck or bus with a Gross Vehicle Mass (GVM) exceeding 8 tonnes, but with only two axles, allowing it to carry moderate loads while still maneuvering relatively easily in urban areas.

Bus

LOCATIONS Transport Medium Rigid Bus

	**Usefulness** **-/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A bus is a motor vehicle that carries significantly more passengers than an average car or van, but fewer than the average rail transport. It is most commonly used in public transport, but is also in use for charter purposes, or through private ownership.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	•	o	o

Fire Engine

LOCATIONS Transport Medium Rigid Fire Engine

	**Usefulness** **3/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A fire engine or fire truck is a vehicle, usually a specially-designed or modified truck, that functions as a firefighting apparatus. The primary purposes of a fire engine include transporting firefighters and water to an incident as well as carrying equipment for firefighting operations in a fire drill.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	• Water / Foam • Fuel • Comms Equipment	Due to their weight they would make a sturdy temporary shelter.	Most people won't want to loot a fire engine, but it will draw attention being a service vehicle.

Garbage Truck

LOCATIONS Transport Medium Rigid Garbage Truck

	**Usefulness** **1/5** Loot: 0/5 Shelter: 0/5 Risk: 0/5	**Description** A garbage truck is a truck specially designed to collect municipal solid waste and transport it to a solid waste treatment facility, such as a landfill, recycling center or transfer station. In Australia they are commonly called rubbish trucks, or garbage trucks, while in the U.K. dustbin lorry, rubbish lorry or bin lorry is commonly used.

Recommendation	Loot Description	Resources	Shelter	Risk - Very Low
Possibly worth looting for the medical kit. It makes a decent temporary shelter too.	o	• Fuel	o	Very few people would likely loot a garbage truck when there are better options nearby.

Heavy Rigid

A heavy rigid vehicle (HR vehicle) is a truck or bus with a gross vehicle mass (GVM) of more than 8 tonnes and at least three axles. HR vehicles are used to transport goods, people, and livestock.

Articulated Bus

Usefulness	Description
2/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	An articulated bus, also referred to as a slinky bus, bendy bus, tandem bus, vestibule bus, stretch bus, or an accordion bus, is an articulated vehicle, typically a motor bus or trolleybus, used in public transportation.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	• Fuel	It will provide a decent amount of shelter if it's all you can find.	o

Hauling Truck

Usefulness	Description
4/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A truck or lorry is a motor vehicle designed to transport freight, carry specialized payloads, or perform other utilitarian work. Trucks vary greatly in size, power, and configuration, but the vast majority feature body-on-frame construction, with a cabin that is independent of the payload portion of the vehicle.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Worth looting if it's a food truck for a supermarket, and won't provide much shelter in a disaster.	o	• CB Radio	The cabin won't provide much more shelter than a car.	o

Road Train

Usefulness	Description
3/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A road train, also known as a land train or long combination vehicle (LCV) is a semi-trailer used to move road freight more efficiently than single-trailer semi-trailers. It consists of one semi-trailer or more connected together with or without a prime-mover. It typically has to be at least three trailers and one prime-mover.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Worth looting if it's got a resource that you need such as fuel, cattle or food.	You will likely get a LOT of a single type of item or resource such as fuel.	• Fuel • CB Radio	The cabin won't provide much more shelter than a car.	A road train is likely to be a high profile target in a disaster, particularly if it has a currently scarce resource.

Tram / Train

A train is a series of connected vehicles that run along a railway track and transport people or freight. Trains are typically pulled or pushed by locomotives (often known simply as "engines"), though some are self-propelled, such as multiple units or railcars.

Tram

Usefulness	Description
2/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A tram (also known as a streetcar or trolley in Canada and the United States) is an urban rail transit in which vehicles, whether individual railcars or multiple-unit trains, run on tramway tracks on urban public streets; some include segments on segregated right-of-way.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	•	Decent shelter from passing disasters and fairly wind resistant.	o

Commuter Train

Usefulness	Description
2/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A train is a series of connected vehicles that run along a railway track and transport people or freight. Trains are typically pulled or pushed by locomotives (often known simply as "engines"), though some are self-propelled, such as multiple units or railcars.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
o	o	• Few if any	Decent shelter from passing disasters and fairly wind resistant.	Early on, trains could be targeted, but when it's cooled down this will be a relatively safe location.

Sleeper Train

Usefulness	Description
3/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	The sleeping car or sleeper (often wagon-lit) is a railway passenger car that can accommodate all passengers in beds of one kind or another, for the purpose of sleeping.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	• Food	o	o

Freight Train

Usefulness	Description
4/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A freight train, also called a goods train or cargo train, is a railway train that is used to carry cargo, as opposed to passengers. Freight trains are made up of one or more locomotives which provide propulsion, along with one or more railroad cars (also known as wagons) which carry freight.

Recommendation	Loot Description	Resources	Shelter	Risk - High
Worthwhile looking in each of the shipping containers if you have the time, also makes a decent shelter from a passing disaster.	o	• Lots of misc cargo • Snacks • Diesel Fuel	A fairly strong shelter which should withstand most disasters, including strong wind.	Many others will likely see a freight train as an ideal thing to loot so you may run into others.

Boat

A boat is a watercraft of a large range of types and sizes, but generally smaller than a ship, which is distinguished by its larger size or capacity, its shape, or its ability to carry boats.

Light Boat

Usefulness 3/5 — Loot: 2/5, Shelter: 1/5, Risk: 0/5

Description
A boat is a watercraft of a large range of types and sizes, but generally smaller than a ship, which is distinguished by its larger size or capacity, its shape, or its ability to carry boats. Small boats are typically used on inland waterways such as rivers and lakes, or in protected coastal areas.

Recommendation	Loot Description	Resources	Shelter	Risk - Low
o	o	• Flares • Life Jackets • Fuel	Only really a good shelter from a flood, but you need to bail water.	o

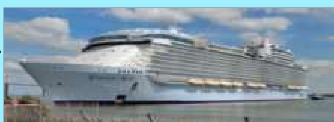
Ferry

Usefulness -/5 — Loot: 0/5, Shelter: 0/5, Risk: 0/5

Description
A ferry is a boat that transports passengers, and occasionally vehicles and cargo, across a body of water. A small passenger ferry with multiple stops, like those in Venice, Italy, is sometimes referred to as a water taxi or water bus.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	• Flares • Life Jackets • Fuel • First Aid Kit	o	o

Cruise Ship



Usefulness 5/5 — Loot: 5/5, Shelter: 5/5, Risk: 5/5

Description
Cruise ships are large passenger ships used mainly for vacationing. Unlike ocean liners, which are used for transport, cruise ships typically embark on round-trip voyages to various ports of call, where passengers may go on tours known as "shore excursions".

Recommendation	Loot Description	Resources	Shelter	Risk - High
If you can get to one, a cruise ship is an excellent thing to loot. It also makes a perfect shelter from a disaster.	Near everything you could need to survive.	• Food & Water • Bedding • Fuel • First Aid Kit	An excellent shelter location which will shield you from basically every disaster.	Cruise ships would be a high risk to loot due to the amount of lootable items on board and its sheer size.

Yacht

Usefulness 3/5 — Loot: 0/5, Shelter: 0/5, Risk: 0/5

Description
A yacht is a sail- or motor-propelled watercraft made for pleasure, cruising, or racing. There is no standard definition, though the term generally applies to vessels with a cabin intended for overnight use. To be termed a yacht, as opposed to a boat, such a pleasure vessel should be at least 33 feet (10 m) in length and have good aesthetic qualities.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	• Flares • Life Jackets • Fuel • First Aid Kit	o	o

Hovercraft

Usefulness 3/5 — Loot: 0/5, Shelter: 0/5, Risk: 0/5

Description
A hovercraft, also known as an air-cushion vehicle or ACV, is an amphibious craft capable of travelling over land, water, mud, ice, and various other surfaces.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	• Fuel	o	o

Cargo Ship

Usefulness 5/5 — Loot: 5/5, Shelter: 5/5, Risk: 5/5

Description
A cargo ship or freighter is a merchant ship that carries cargo, goods, and materials from one port to another. Thousands of cargo carriers ply the world's seas and oceans each year, handling the bulk of international trade.

Recommendation	Loot Description	Resources	Shelter	Risk - High
An excellent location for a base of operations which will have a huge amount of loot on board. Think "The Day After Tomorrow".	Near everything you could need to survive.	• Food & Water • Medicine & First Aid • Flares	Would make an excellent place to shelter from disasters.	Cargo ships would be a high risk to loot due to the amount of items on board and its sheer size.

Rescue Boats

Usefulness	Description
-/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A rescue boat is a boat rescue craft which is used to attend a vessel in distress, or its survivors, to rescue crew and passengers. It can be hand pulled, sail powered or powered by an engine. Lifeboats may be rigid, inflatable or rigid-inflatable combination-hulled vessels.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
o	o	● Flares ● Life Jackets ● Fuel ● First Aid Kit	o	o

Battleship

Usefulness	Description
5/5 Loot: 5/5 Shelter: 5/5 Risk: 5/5	A battleship is a large, heavily armored warship with a main battery consisting of large-caliber guns, designed to serve as capital ships with the most intense firepower. Before the rise of supercarriers, battleships were among the largest and most formidable weapon systems ever built.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
If docked, it's a perfect base of operations, huge amount of loot and complete protection from any disaster.	Military loot, weapons, long term food, water	● Weapons ● Food & Water ● Fuel	o	Battleships would be a very high risk to loot due to the amount of items on board, its military status and its sheer size.

Aircraft Carrier

Usefulness	Description
5/5 Loot: 5/5 Shelter: 5/5 Risk: 5/5	An aircraft carrier is a warship that serves as a seagoing airbase, equipped with a full-length flight deck and hangar facilities for supporting, arming, deploying and recovering shipborne aircraft. Typically it is the capital ship of a fleet, as it allows a naval force to project seaborne air power far from homeland.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
If docked, it's a perfect base of operations, huge amount of loot and complete protection from any disaster.	Military loot, weapons, long term food, water	● Weapons ● Food & Water ● Fuel	o	Aircraft Carriers would be a very high risk to loot due to the amount of items on board, its military status and its sheer size.

Submarine

Usefulness	Description
5/5 Loot: 5/5 Shelter: 5/5 Risk: 5/5	A submarine (or sub) is a watercraft capable of independent operation underwater. The term "submarine" is also sometimes used historically or informally to refer to remotely operated vehicles and robots, or to medium-sized or smaller vessels (such as the midget submarine and the wet sub).

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
If docked, this could make an excellent base of operations which is protected from virtually all disasters. Possible military loot.	Military loot, long term food, water	● Weapons ● Food & Water	o	Submarines would be a very high risk to loot due to the amount of items on board, its military status and its sheer size. Chance of sinking.

Helicopters

A helicopter is a type of rotorcraft in which lift and thrust are supplied by horizontally spinning rotors.

Private Helicopter

Usefulness	Description
2/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A helicopter is a type of rotorcraft in which lift and thrust are supplied by horizontally spinning rotors. This allows the helicopter to take off and land vertically, to hover, and to fly forward, backward and laterally. These attributes allow helicopters to be used in congested or isolated areas where fixed-wing aircraft cannot land without a runway.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Not very useful unless you can fly one. Little loot except for snacks.	o	● First Aid Kit	Don't use this for shelter if it's a wind based event as it may flip over.	o

Tourism Helicopter

Usefulness	Description
2/5 Loot: 0/5 Shelter: 0/5 Risk: 0/5	A helicopter is a type of rotorcraft in which lift and thrust are supplied by horizontally spinning rotors. This allows the helicopter to take off and land vertically, to hover, and to fly forward, backward and laterally. These attributes allow helicopters to be used in congested or isolated areas where fixed-wing aircraft cannot land without a runway.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
Not very useful unless you can fly one. Little loot except for snacks.	o	● First Aid Kit	Don't use this for shelter if it's a wind based event as it may flip over.	o

Transport Helicopter

Usefulness	Description
3/5 Loot: 2/5 Shelter: 2/5 Risk: 4/5	A cargo helicopter is a helicopter that is designed or converted for the carriage of cargo rather than passengers. Such aircraft generally feature one or more large doors for loading cargo. Passenger amenities are removed or not installed, although there are usually basic comfort facilities for the crew such as a galley, lavatory, and bunks.

Recommendation	Loot Description	Resources	Shelter	Risk - High
May have some useful cargo inside. Virtually impossible to fly yourself. Weak protection from disasters.	o	• First Aid Kit	Don't use this for shelter if it's a wind based event as it may flip over.	These are likely to be targets during long term disasters for having a military 'feel' to them which will draw people to loot it.

Military Helicopter

Usefulness
3/5
Loot: 2/5
Shelter: 2/5
Risk: 5/5

Description
A military helicopter is a helicopter that is either specifically designed for or converted for usage by a military. A military helicopter's mission is a function of its design or conversion. The most common use of military helicopters is airlift, but they can be modified or converted to perform other missions such as combat search and rescue (CSAR), medical evacuation (MEDEVAC), or armed with weapons for air support.

Recommendation	Loot Description	Resources	Shelter	Risk - Very High
May have some military items inside. Virtually impossible to fly yourself. Weak protection from disasters.	Very little, if any usable loot. People will look at it for the 'cool' factor.	• First Aid Kit • Survial Kit	Don't use this for shelter if it's a wind based event as it may flip over.	Military aircraft are priority targets in wars and for anyone wanting to take a closer look.

Planes

An aircraft is a vehicle that is able to fly by gaining support from the air. It counters the force of gravity by using either static lift or the dynamic lift of an airfoil, or, in a few cases, direct downward thrust from its engines.

Light Aircraft

Usefulness
4/5
Loot: 1/5
Shelter: 1/5
Risk: 3/5

Description
A light aircraft is an aircraft that has a maximum gross takeoff weight of 12,500 lb (5,670 kg) or less. Light aircraft are used as utility aircraft commercially for small-scale passenger and freight transport; for sightseeing, photography, cropdusting, and other aerial work.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
If you can get this going and can fly one, it would make an excellent form of transport, but otherwise it's not useful to loot.	o	• First Aid Kit	Don't use this for shelter if it's a wind based event as it will flip over.	These would be a moderate target by looters and those who may need a small plane.

Wreckage Loot

Loot From the Plane Fuselage/Cockpit
- Shelter: The intact part of the fuselage offers immediate protection from sun, rain, and wind. It can be insulated with other materials.
- Signaling: The large, metallic surface can be reflective, used to flash signals to aircraft. The bright colours of the plane (if any) can increase visibility.
- Water Collection: Tarps or large sections of metal can be angled to collect rainwater.
- Tools: Any remaining tools in the cockpit or cargo hold (e.g., wrenches, screwdrivers, fire extinguisher, small axe, first aid kit if present).
- Wiring/Cables: Can be used for cordage, snares, or electrical ignitions if carefully handled (though unlikely to be useful for power).
- Plexiglass/Windows: Can be broken to create sharp edges for cutting, or possibly used as a solar still component.
- Insulation: Found within the walls and ceiling of the plane, this can be pulled out and used for warmth, padding, or fire-starting tinder.
- Fuel (Jet Fuel/AvGas): Extremely Dangerous, but can be used as a fire accelerant.
- Batteries: If intact, they could potentially power small devices or provide a spark for fire starting.
- Metal Sheeting/Panels: Can be cut or torn to make tools, containers, or additional reflective signal panels.
- Rubber Hoses/Piping: Might be usable for siphoning water or as rudimentary cordage.

Plane Seats
- Cushions/Padding: Excellent for insulation from the ground or for comfortable bedding materials.
- Fabric: Can be torn into strips for bandages, cordage or rags.
- Metal Frames: Can be bent or broken to create makeshift tools, splints, or anchors.
- Seatbelts: Strong webbing for cordage, lashing, or tourniquets. The buckles can be used as heavy-duty clips.

Wing & Landing Gear (damaged)
- Metal Sections: Large reflective surfaces for signaling, or can be broken down for smaller metal pieces.
- Fuel Tanks (if any remaining): Again, handle fuel with extreme caution.
- Wiring/Piping: Similar to fuselage components.
- Metal Poles/Struts: Can be used as digging tools, splints, or supports for a lean-to.
- Rubber Tires: Can be cut to make shoe soles, or burned for smoke signals (toxic).
- First Aid Kits: Critical in any disaster scenario.
- Knives/Multi-tools: Invaluable for cutting, prying, and general utility.
- Flashlights/Headlamps: Essential for night operations.
- Lighters/Matches: Fire starting.
- Sunscreen/Insect Repellent: Protection from environmental hazards.
- Any medications: Especially if any party members have chronic conditions.
- Glasses/Mirrors: For signaling or starting fire.
- Pens/Paper: For communication or journaling.
- Plastic Bags/Tarps: For water collection, shelter, or waterproofing.
- Ropes/Cordage (e.g., shoelaces, paracord bracelets): Multi-purpose.
- Electronics (phones, power banks): For emergency calls, light, or signal.
- Watches & Jewelry: Timekeeping, possibly a reflective surface.

Commercial Aircraft

Usefulness
2/5
Loot: 2/5
Shelter: 1/5
Risk: 3/5

Description
An airliner is a type of airplane for transporting passengers and air cargo. Such aircraft are most often operated by airlines. The modern and most common variant of the airliner is a long, tube shaped, and jet powered aircraft. The largest of them are wide-body jets which are also called twin-aisle because they generally have two separate aisles running from the front to the back of the passenger cabin.

Recommendation	Loot Description	Resources	Shelter	Risk - Moderate
The only useful loot you could find is snack foods. Avoid using one as a shelter.	Not likely to have much beyond snack foods.	• First Aid Kit	Don't use this for shelter if it's a wind based event as it will likely flip over.	A cargo plane will be a high risk due to its sheer size.

Wreckage Loot

Essential Survival Loot
- First Aid Kit(s): Commercial aircraft are required to carry multiple first aid kits. These are your absolute top priority for Ben's injury. Search the cockpit, galleys, and overhead bins. They contain bandages, antiseptics, pain relievers, and possibly even more advanced medical supplies like IV kits (in Enhanced Emergency Medical Kits - EEMKs, usually found on larger aircraft).
- Fire Extinguishers: Aircraft carry various types (Halon, water-based). While primarily for fire suppression, the canisters are strong metal, and Halon (while toxic to breathe directly) could theoretically be released to scare off animals, or the canister itself could be a tool. The contents might be useful for other chemical reactions, but use with extreme caution.
- Life Vests/Flotation Devices: Every seat cushion is a flotation device. These are crucial if you need to enter the water. They also often have whistles and reflective strips for signaling.
- Emergency Locator Transmitter (ELT): This is usually located in the tail section. If it deployed and is transmitting, it's your primary means of rescue. Learn how to activate it if it isn't automatic. There might also be Portable ELTs (PLBs) in the cockpit or a pilot's survival kit.

Pilot's Flight Bag/Cockpit Contents
- Maps/Charts: Invaluable for navigation and identifying your location. Even old ones can show general terrain.
- Pens/Pencils/Paper: For leaving notes, tracking time, drawing maps.
- Flashlights/Headlamps: With batteries, critical for night operations.
- Multi-tool/Knife: If the pilot had one, it's a goldmine.
- Survival Kit: Some pilots carry personal survival kits with fire starters, fishing line, signaling mirrors, etc.
- Logbooks/Manuals: Paper for tinder, or for detailed information about the aircraft (less useful for survival, but might have diagrams).

Shelter & Insulation
- Fuselage/Wings: The main body of the aircraft itself provides significant shelter from rain, sun, and wind. Sections can be cut or broken off to extend a lean-to or provide additional cover.
- Seat Cushions: Excellent for insulating the ground, providing bedding, or as additional flotation.
- Blankets/Pillows: Found in overhead bins or seat pockets, provide warmth and comfort.
- Cabin Insulation: The fibrous material within the walls and ceiling of the aircraft. Can be pulled out for warmth, padding, or very effective tinder.
- Overhead Bins/Compartments: Can be detached and used as containers or for small shelter structures.
- Plastic Panels: From interior walls or ceiling, can be used for waterproofing, groundsheets, or water collection.

Fire & Signaling
- Metal from Fuselage/Wings: Large, shiny pieces of aluminum can be polished to create signal mirrors.
- Wiring: Small gauge wires can be stripped for tinder (if shorted with a battery), or used for snares or fishing line.
- Batteries: From emergency lights, radios, or cockpit. Can provide a spark for fire starting (carefully!).
- Plastic/Rubber: Parts of seats, wiring insulation, or tires can be cut and used as fire accelerants (will produce toxic smoke, use judiciously for signals).
- Fuel: EXTREMELY DANGEROUS. Jet fuel (kerosene-based) or AvGas (gasoline-based for smaller planes) is highly flammable. Use only with extreme caution and away from the wreckage. A tiny amount can be used as fire accelerant.
- Reflective Strips: From life vests or emergency exits, can be used as signaling material.
- Whistles: Often attached to life vests. Loud and effective for signaling.

Tools & Cordage
- Seatbelts/Webbing: Extremely strong material for cordage, lashing, tourniquets, or improvising restraints.
- Metal from Structure: Broken pieces of aluminum or steel from the frame, landing gear, or engine can be sharpened or reshaped into crude tools (knives, digging tools, hammers) with effort.
- Plexiglass/Windows: Shattered pieces can provide sharp edges for cutting.
- Wiring/Cables: Various gauges, can be stripped and used for cordage, snares, or fishing line.

Fasteners (Bolts, Screws, Rivets): Small metal pieces that can be fashioned into hooks or awls.
- Hydraulic Hoses/Pipes: Can be cut and used for siphoning or as containers.
- Fire Axe (if present): On larger aircraft, a crash axe is often located in the cockpit for emergency egress. Invaluable for cutting, breaking, and prying.
- Galley Carts/Containers: If relatively intact, these metal or plastic containers can be used for storage, water collection, or carrying items.
- Kitchen Utensils (if in galley): Knives, spoons, forks can be adapted for various tasks.

Water & Food
- Beverages from Galley/Passenger Luggage: Cans of soda, juice, or bottled water. Prioritize these immediately.
- Sealed Food Rations: Depending on the airline and flight length, emergency food bars or sealed snacks may be in crew areas or emergency kits.
- Water from Toilets (last resort): While unappetizing, the water in the toilet cisterns (before flushing) is usually clean. The blue additive is non-toxic in small amounts.
- Water from Hot Water Boilers (galley): If any water remained in the system, it could be a small source.
- Plastic Bags/Liners: From trash cans or seat pockets, can be used for water collection (dew, rain) or a solar still.

Other Useful Items
- Mirrors: From lavatories or personal compacts, for signaling.
- Pens/Pencils: For writing messages, drawing maps, or small tools.
- Paper/Magazines/Safety Cards: Excellent tinder for fire starting.
- Towels/Napkins: For cleaning, bandages, or tinder.
- Airline Branded Items: Any plastic cups, trays, utensils can be repurposed as containers.
- Electronics: Phones, tablets, power banks (if charged) for light or emergency calls (if signal exists). Batteries can be harvested.
- Passenger Luggage/Carry-ons: Contains personal items like clothing (for warmth, bandages), toiletries (soap, toothpaste - for hygiene), books/magazines, and any personal survival gear passengers might have carried.
- Plastic Sheeting (from packaging/covers): Can be used for water collection, shelter, or solar still.

Cargo Plane

	Usefulness **4/5** Loot: 4/5 Shelter: 3/5 Risk: 4/5	**Description** A cargo aircraft (also known as a freighter) is a fixed-wing aircraft that is designed or converted for the carriage of cargo rather than passengers. Such aircraft generally feature one or more large doors for loading cargo. Passenger amenities are removed or not installed, although there are usually basic comfort facilities for the crew such as a galley, lavatory, and bunks in larger planes.

Recommendation There could be decent loot inside based on what it was carrying, but otherwise it doesn't make a useful shelter.	**Loot Description** o	**Resources** ● First Aid Kit	**Shelter** Don't use this for shelter if it's a wind based event as it will likely flip over.	**Risk - High** A cargo plane will be a high risk due to the cargo it may have and its sheer size.

Military Aircraft

	Usefulness **3/5** Loot: 2/5 Shelter: 1/5 Risk: 5/5	**Description** A military aircraft is any fixed-wing or rotary-wing aircraft that is operated by a legal or insurrectionary military of any type. Some military aircraft engage directly in aerial warfare, while others take on non-combat roles.

Recommendation May have some military items inside. Virtually impossible to fly yourself. Weak protection from disasters.	**Loot Description** There is likely going to be a survival kit and medical kit in the ejector seat.	**Resources** • Survival Kit • Medical Kit	**Shelter** Don't use this for shelter if it's a wind based event as it will likely flip over.	**Risk - Very High** Military aircraft are priority targets in wars and for anyone wanting to take a closer look.

Military

A military vehicle is any vehicle for land-based military transport and activity, including combat vehicles, both specifically designed for or significantly used by military. Most military vehicles require off-road capabilities and/or vehicle armor, making them heavy.

Light Utility Vehicle

	Usefulness **4/5** Loot: 2/5 Shelter: 3/5 Risk: 4/5	**Description** Military light utility vehicle, or simply light utility vehicle (LUV), is a term used for the lightest weight class military vehicle category. A Jeep-like four-wheel drive vehicle for military use by definition lighter than other military trucks and vehicles, inherently compact and usually with light or no armour, with short body overhangs for nimble all-terrain mobility, and frequently around 4-passenger capacity.

Recommendation May have some military items inside but very uneconomical to run. Fair protection from disasters.	**Loot Description** o	**Resources** • Military Items	**Shelter** Fair protection from disasters.	**Risk - High** Any military vehicle will be a target by other nations, gangs and individuals.

APC

	Usefulness **4/5** Loot: 3/5 Shelter: 4/5 Risk: 4/5	**Description** An armoured personnel carrier (APC) is a broad type of armoured military vehicle designed to transport personnel and equipment in combat zones. Since World War I, APCs have become a very common piece of military equipment around the world.

Recommendation May have some military items inside but uneconomical to run. Great protection from disasters.	**Loot Description** o	**Resources** • Military Items • Long Life Food • Weapons • First Aid Kit	**Shelter** Good protection from disasters.	**Risk - High** Any military vehicle will be a target by other nations, gangs and individuals.

Tank

	Usefulness **3/5** Loot: 3/5 Shelter: 4/5 Risk: 5/5	**Description** A tank is an armoured fighting vehicle intended as a primary offensive weapon in front-line ground combat. Tank designs are a balance of heavy firepower, strong armour, and battlefield mobility provided by tracks and a powerful engine; their main armament is often mounted within a turret.

Recommendation May have some military items inside but very uneconomical to run. Excellent protection from disasters.	**Loot Description** o	**Resources** • Military Items • Long Life Food	**Shelter** Excellent protection from disasters except flooding.	**Risk - Very High** You have a high chance of being targeted by enemy nations, gangs and rogue individuals.

Lootable Vehicle Items

A list of items which can be generally scavenged from vehicles:
Fuel: Fuel may be siphoned from vehicles or puncturing the tank with a container below. It may be expired however.
Rubber: Tyres and hoses contain a lot of rubber which can be used for construction or creating signal fires.
Engine Oil: Can be reused if the contaminants are removed.
Water: If filtered and there's no additives, water from the washer bay can be drunk.

6 Looting

This section details how to loot, what to look for and what to be aware of.

Overview

Upon first thought anyone would jump to the conclusion that looting is a criminal act and conjure pictures of a violent bunch of people breaking into areas affected by a disaster and stealing TVs and electronics. In fact there is quite a variety of looting types. The scenario mentioned was an example of basic theft and not the one that is recommended as it's done only for monetary gain for oneself.

Looter Types

The following rows detail different ways looting can be perceived and the outcomes from it.

Monetary Looting	The type of looting is done only for ones self interests either for money or entertainment purposes.	**Example Loot** • Electronics • Currency • Precious Metals	• Jewelry • Other Valuables
Survival Looting	Closer to scavenging than looting, where individuals seek out any forms of food, water and items that may assist in survival.	**Example Loot** • Canned Food • Matches • Water Filters	• Batteries • Duct Tape • Gas • Books

LOCATIONS Looting Looter Types

General Looting	Usually done by a member of a group who's job it is to go out every day and find useful items for their village/group/gang.	**Example Loot** ● Anything that can be used by a group of survivors.	
Component Looting	These people are interested in reusing electronics and internal components from abandoned items that may be useful in other ways such as repairs.	**Example Loot** ● Broken Electronics ● Springs ● Capacitors	● Antennas

Siphoning Fuel

This section demonstrates how you can quickly and easily siphon fuel from a vehicle using a variety of different ways. This skill can be handy in all sorts of situations, whether you run out of gas miles from civilization, need to winterize a vehicle, or simply want to refill your lawnmower without having to make a trip to the gas station.

Manual Suction

How to siphon fuel with your mouth or another form of suction.

1	Place the container in which you want to store fuel below the gas tank
2	Open the gas tank and insert a long plastic tube inside. To check if it is submerged, blow air into it, and you should hear bubbling noises.
3	Create a loop in the pipe, such that the other end is facing upwards. This mechanism helps control the gas flow better while sucking.
4	Take the end of the pipe facing you and begin sucking carefully. The transparency of the pipe will allow you to see the gas flowing through it.
5	Keep sucking until the gas reaches the bottom of the loop, which should be a foot away from your mouth. Remove it from your mouth and plug it shut with a finger.
6	Carefully lower this end into the open container, without pulling the other end of the pipe from within the tank. Once inside the container, remove the finger from the pipe, which will cause the gas to flow into it.
7	When you have removed enough gas, or if the container is about to get full, again clamp the end of the pipe shut. Raise this end higher than the level of the tank and unplug it to drain off the remaining gas back into the tank. Fix the lid back on the tank.

Two Pipes

How to siphon fuel with two pipes.

1	Get two transparent plastic pipes, such that one is much longer than the other.
2	Insert the longer pipe deep into the tank, and put its other end into an open container placed at a lower level than the tank.
3	Take the shorter pipe and insert one of its ends deep within the tank, such that both pipes have one end inside the tank.
4	Now, seal the tank opening by plugging a large wet cloth in it. The aim is to make the opening air-tight, despite the pipes going inside.
5	Take the open end of the short hose in your mouth and blow air into it. This is relatively safer than sucking gas out of the tank, but for more safety, connect it to a vacuum pump.
6	Blowing air inside the tank raises the pressure in it since the opening is sealed. This pressure acts on the gas surface, and forces it out through the other pipe.
7	To stop the gas flow, plug a finger on the end of the long pipe, and raise it higher than the gas tank. Carefully release the finger to drain the remaining fuel back into the tank.

With a Pump

How to siphon fuel with a fuel pump.

1	A vacuum pump works the same way as manually sucking the gas out, but protects the user from ingesting gasoline or its fumes. It's the best and most reliable way to siphon gas.
2	First, identify the input and output ends of the pump. This is vital, as inserting the wrong end will blow air into the tank, rather than drawing gas out of it.
3	Place an open container below the gas tank. Then, remove the tank lid.
4	Insert the input end of the pipe inside the tank until it gets submerged or reaches the bottom. Then, place the output end of the pipe inside the container.
5	Depending on the type of vacuum pump, you may have to press a bulb or turn a squeeze-valve to begin transferring the gas. Some pumps require repeated pressing, while others are automatic.
6	When the container is full, close the valve or raise the output end higher than the gas tank, after clamping it shut with a finger. Drain off the gas remaining in the pipe back into the tank.

Car Tipping

If you have enough people, you can tip a car on its side and wait for the fuel to come out. This is a semi-destructive method, the car will still run afterwards once it has been refueled but the mirrors and other extruding components will break off, therefore only do it to abandoned cars.

1	Take the fuel cap off the car.
2	Attach a funnel to a tube which covers the fuel valve. Some cars may require you to push in the metal flap which prevents siphoning.
3	Tip the car on its side until the fuel comes out, be sure it doesn't tip completely over crushing the fuel retriever.
4	Once you have the fuel, put the car back down.

Hole Drilling

You can drill a hole in the fuel compartment to get to the fuel. This is a destructive method and the car will likely be un-usable once drilled unless it's plugged back up again, therefore only do this to abandoned cars. This is also a dangerous method to choose as the fuel gas could ignite and cause an explosion. It has also been shown on movies that you can make a hole with a screwdriver and hammer, this is possible but its very difficult to get enough force to pierce the fuel canister due to having to be on the underside of the car.

LOCATIONS | Looting | Siphoning Fuel | Hole Drilling

WARNING: It's not full gas tanks that scare mechanics to work on, it's near-empty ones. Sticking a drill in an almost-empty tank could create a combustible spark that could quickly incinerate them and the vehicle.

1	Locate the fuel tank.
2	Drill a hole in the tank with a container to collect the fuel underneath.

Siphon-Proof Cars

All modern cars come with a siphon-proof filter in the gas tank. This consists of a metal flap which clamps shut and prevents any hose from entering the tank. To siphon gas from such a tank, you can either use the manual suction method or the siphon pump method. But for it to work, the metal flap has to be held open using a long object like a screwdriver or a chopstick. Using metallic objects like a screwdriver is not recommended, as it can create a spark which can be deadly. In case you are using one, make sure it is grounded with the car body. The best option is to wedge a chopstick into the tank opening to hold the flap open. Now, this allows siphoning of gas with a hose.

If required, a friend can hold the chopstick in place. Some cars come with a ball-shaped anti-siphon valve, which, while allowing gas-filling, does not allow the entry of pipes. The above methods do not work on such cars. Many products like the GasTapper are available in the market, which can be used to siphon fuel from cars with ball-shaped valves. They have a thin inlet pipe which passes into the tank through the space around the ball valve, and is connected to a suction pump.

Natural Disasters

Preparing for and surviving any natural disasters

"Preparedness is the only way we can combat a natural disaster."
John Quinlan

Introduction

Natural disasters can happen to anyone at any time. The type of disaster is often based on locality as some disasters may be more prevalent in certain areas. Know which ones are common in your area and prepare for them specifically but also taking note of the uncommon or rare ones.

Purpose	The aim of NATURAL DISASTERS is to provide the reader with the types of different naturally occurring disasters including in-depth information on how to survive any that may arise.
Lost?	● Pandemics can be found in the MAN-MADE DISASTERS category even though they can also be considered 'natural' to some. ● For information on supervolcanos, world wars and other planet-altering disasters, see the MASS DESTRUCTION section. ● For information on minor acts of nature, see the METEOROLOGY section. ● For a list of the most likely natural disasters by country, see the GEOGRAPHY section. ● For any small scale natural disasters which only affect one person or family, see the PERSONAL DISASTERS section. ● For a distraction from the current turmoil of the world, see the ENTERTAINMENT section.

Contents

1 Overview

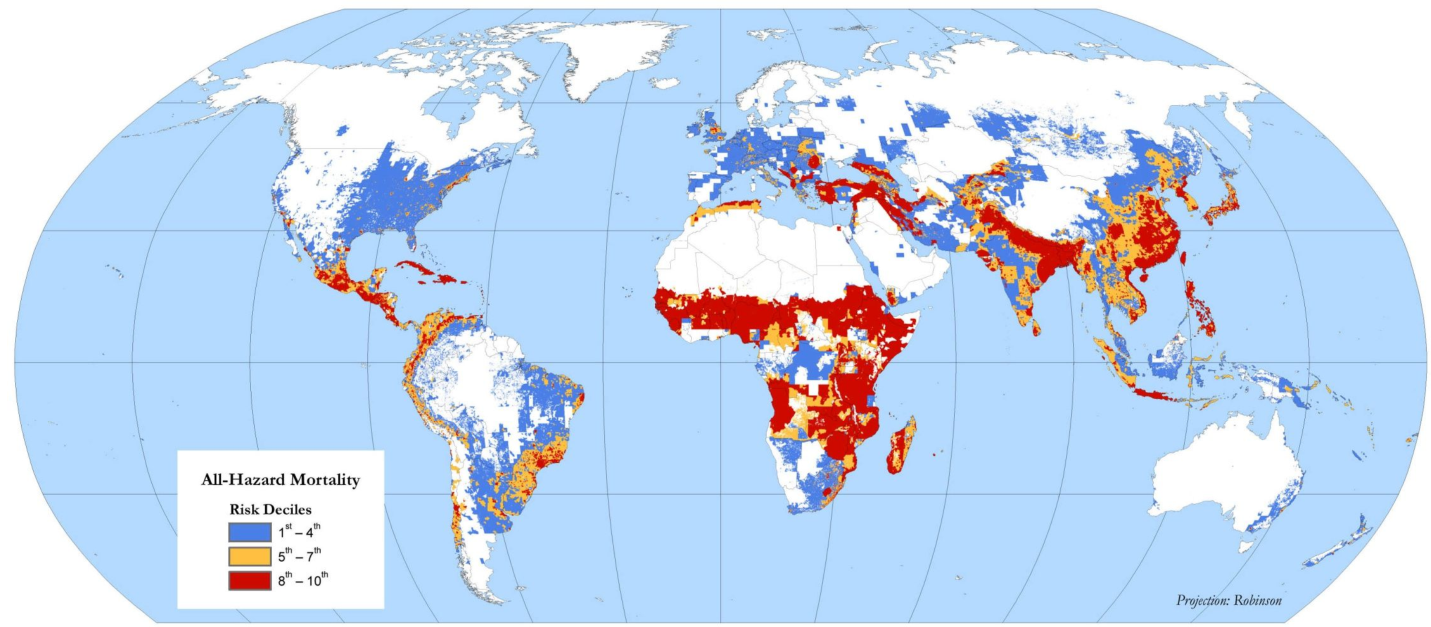
A natural disaster is a sudden event that causes widespread destruction, major collateral damage or loss of life, brought about by forces other than the acts of human beings. A natural disaster might be caused by earthquakes, flooding, volcanic eruption, landslide, hurricanes etc. To be classified as a disaster, it will have profound environmental effect and/or human loss and frequently causes financial loss.

Multihazard Risk Distribution

Below is a global multihazard mortality risks and distribution chart from 2005.

Multihazard risks were calculated by summing the vulnerability-weighed single-hazard mortality risk values for each grid cell across the six hazard types: Cyclones, Drought, Earthquakes, Floods, Landslides and Volcanoes.

I highly recommend moving out of any locations that are red or yellow.



2 Landslide

A landslide, also known as a landslip or mudslide, is a form of mass wasting that includes a wide range of ground movements, such as rockfalls, deep failure of slopes, and shallow debris flows. Landslides can occur underwater, in which case they are called submarine landslides, and in coastal and onshore environments. Although the action of gravity is the primary driving force for a landslide to occur, there are other contributing factors affecting slope stability. Typically, pre-conditional factors build up specific surface or sub-surface conditions that make a slope prone to failure, whereas the actual landslide often requires a trigger before being released.

Causes
Landslides occur when the slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, acting together or alone. Natural causes of landslides include:
● Groundwater (pore water) pressure acting to destabilize the slope
● Erosion of the toe of a slope by rivers or ocean waves
● Loss or absence of vertical vegetative structure, soil nutrients, and soil structure (e.g. after a wildfire – a fire in forests lasting for 3–4 days)
● Volcanic eruptions
● Weakening of a slope through saturation by snow melting, glaciers melting, or heavy rain
● Earthquakes adding loads to barely stable slope
● Earthquake-caused liquefaction destabilizing slopes

Landslide Aggravation
Landslides are aggravated by human activities such as:
● Deforestation, cultivation and construction, which destabilize the already fragile slopes
● Vibrations from machinery or traffic
● Earthwork which alters the shape of a slope, or which imposes new loads on an existing slope
● In shallow soils, the removal of deep-rooted vegetation that binds colluvium to bedrock
● Construction, agricultural or forestry activities (logging) which change the amount of water infiltrating the soil
● Blasting

Debris Flow
Slope material that becomes saturated with water may develop into a debris flow or mud flow. The resulting slurry of rock and mud may pick up trees, houses and cars, thus blocking bridges and tributaries causing flooding along its path. Debris flow is often mistaken for flash flood, but they are entirely different processes. Muddy-debris flows in alpine areas cause severe damage to structures and infrastructure and often claim human lives.

Muddy-debris flows can start as a result of slope-related factors and shallow landslides can dam stream beds, resulting in temporary water blockage. As the impoundments fail, a "domino effect" may be created, with a remarkable growth in the volume of the flowing mass, which takes up the debris in the stream channel. The solid–liquid mixture can reach densities of up to 2,000 kg/m3 (120 lb/cu ft) and velocities of up to 14 m/s (46 ft/s).

These processes normally cause the first severe road interruptions, due not only to deposits accumulated on the road (from several cubic metres to hundreds of cubic metres), but in some cases to the complete removal of bridges or roadways or railways crossing the stream channel. Damage usually derives from a common underestimation of mud-debris flows: in the alpine valleys, for example, bridges are frequently destroyed by the impact force of the flow because their span is usually calculated only for a water discharge.

For a small basin in the Italian Alps (area 1.76 km2 (0.68 sq mi)) affected by a debris flow, estimated a peak discharge of 750 m3/s (26,000 cu ft/s) for a section located in the middle stretch of the main channel. At the same cross section, the maximum foreseeable water discharge (by HEC-1), was 19 m3/s (670 cu ft/s), a value about 40 times lower than that calculated for the debris flow that occurred.

Earthflow
An Earthflow is the down slope movement of mostly fine-grained material. Earthflows can move at speeds within a very wide range, from as low as 1 mm/yr (0.039 in/yr) to 20 km/h (12.4 mph). Though these are a lot like mudflows, overall they are more slow moving and are covered with solid material carried along by flow from within. They are different from fluid flows which are more rapid.

Clay, fine sand and silt, and fine-grained, pyroclastic material are all susceptible to earthflows. The velocity of the earthflow is all dependent on how much water content is in the flow itself: the higher the water content in the flow, the higher the velocity will be. These flows usually begin when the pore pressures in a fine-grained mass increase until enough of the weight of the material is supported by pore water to significantly decrease the internal shearing strength of the material.

This thereby creates a bulging lobe which advances with a slow, rolling motion. As these lobes spread out, drainage of the mass increases and the margins dry out, thereby lowering the overall velocity of the flow. This process causes the flow to thicken. The bulbous variety of earthflows are not that spectacular, but they are much more common than their rapid counterparts.

They develop a sag at their heads and are usually derived from the slumping at the source. Earthflows occur much more during periods of high precipitation, which saturates the ground and adds water to the slope content. Fissures develop during the movement of clay-like material which creates the intrusion of water into the earthflows. Water then increases the pore-water pressure and reduces the shearing strength of the material.

Debris Slide
A debris slide is a type of slide characterized by the chaotic movement of rocks, soil, and debris mixed with water and/or ice. They are usually triggered by the saturation of thickly vegetated slopes which results in an incoherent mixture of broken timber, smaller vegetation and other debris. Debris avalanches differ from debris slides because their movement is much more rapid. This is usually a result of lower cohesion or higher water content and commonly steeper slopes. Steep coastal cliffs can be caused by catastrophic debris avalanches. These have been common on the submerged flanks of ocean island volcanos such as the Hawaiian Islands and the Cape Verde Islands.

Another slip of this type was Storegga landslide. Debris slides generally start with big rocks that start at the top of the slide and begin to break apart as they slide towards the bottom. This is much slower than a debris avalanche. Debris avalanches are very fast and the entire mass seems to liquefy as it slides down the slope. This is caused by a combination of saturated material, and steep slopes. As the debris moves down the slope it generally follows stream channels leaving a v-shaped scar as it moves down the hill. This differs from the more U-shaped scar of a slump. Debris avalanches can also travel well past the foot of the slope due to their tremendous speed.

Rock Avalanche
A rock avalanche, sometimes referred to as sturzstrom, is a type of large and fast-moving landslide. It is rarer than other types of landslides and therefore poorly understood. It exhibits typically a long run-out, flowing very far over a low angle, flat, or even slightly uphill terrain. The mechanisms favouring the long runout can be different, but they typically result in the weakening of the sliding mass as the speed increases.

Shallow Landslide
Landslide in which the sliding surface is located within the soil mantle or weathered bedrock (typically to a depth from few decimetres to some meters) is called a shallow landslide. They usually include debris slides, debris flow, and failures of road cut-slopes. Landslides occurring as single large blocks of rock moving slowly down slope are sometimes called block glides. Shallow landslides can often happen in areas that have slopes with high permeable soils on top of low permeable bottom soils. The low permeable, bottom soils trap the water in the shallower, high permeable soils creating high water pressure in the top soils. As the top soils are filled with water and become heavy, slopes can become very unstable and slide over the low permeable bottom soils. Say there is a slope with silt and sand as its top soil and bedrock as its bottom soil.

During an intense rainstorm, the bedrock will keep the rain trapped in the top soils of silt and sand. As the topsoil becomes saturated and heavy, it can start to slide over the bedrock and become a shallow landslide. R. H. Campbell did a study on shallow landslides on Santa Cruz Island, California. He notes that if permeability decreases with depth, a perched water table may develop in soils at intense precipitation. When pore water pressures are sufficient to reduce effective normal stress to a critical level, failure occurs.

Deep-Seated Landslide
Landslides in which the sliding surface is mostly deeply located below the maximum rooting depth of trees (typically to depths greater than ten meters). Deep-seated landslides usually involve deep regolith, weathered rock, and/or bedrock and include large slope failure associated with translational, rotational, or complex movement. This type of landslide potentially occurs in an tectonic active region like Zagros Mountain in Iran. These typically move slowly, only several meters per year, but occasionally move faster. They tend to be larger than shallow landslides and form along a plane of weakness such as a fault or bedding plane. They can be visually identified by concave scarps at the top and steep areas at the toe.

Tsunami
Landslides that occur undersea, or have impact into water e.g. significant rockfall or volcanic collapse into the sea, can generate tsunamis. Massive landslides can also generate mega tsunamis, which are usually hundreds of meters high. In 1958, one such tsunami occurred in Lituya Bay in Alaska.

Sinkhole

A sinkhole, also known as a cenote, sink, sink-hole, swallet, swallow hole, or doline (the different terms for sinkholes are often used interchangeably), is a depression or hole in the ground caused by some form of collapse of the surface layer. Most are caused by karst processes – the chemical dissolution of carbonate rocks or suffosion processes. Sinkholes vary in size from 1 to 600 m (3.3 to 2,000 ft) both in diameter and depth, and vary in form from soil-lined bowls to bedrock-edged chasms. Sinkholes may form gradually or suddenly, and are found worldwide.

Natural Processes

Sinkholes may capture surface drainage from running or standing water, but may also form in high and dry places in specific locations. Sinkholes that capture drainage can hold it in large limestone caves. These caves may drain into tributaries of larger rivers. The formation of sinkholes involves natural processes of erosion or gradual removal of slightly soluble bedrock (such as limestone) by percolating water, the collapse of a cave roof, or a lowering of the water table. Sinkholes often form through the process of suffosion. For example, groundwater may dissolve the carbonate cement holding the sandstone particles together and then carry away the lax particles, gradually forming a void. Occasionally a sinkhole may exhibit a visible opening into a cave below. In the case of exceptionally large sinkholes, such as the Minyé sinkhole in Papua New Guinea or Cedar Sink at Mammoth Cave National Park in Kentucky, an underground stream or river may be visible across its bottom flowing from one side to the other.

Sinkholes are common where the rock below the land surface is limestone or other carbonate rock, salt beds, or in other soluble rocks, such as gypsum, that can be dissolved naturally by circulating ground water. Sinkholes also occur in sandstone and quartzite terrains. As the rock dissolves, spaces and caverns develop underground. These sinkholes can be dramatic, because the surface land usually stays intact until there is not enough support. Then, a sudden collapse of the land surface can occur.

Artificial processes

Collapses, commonly incorrectly labeled as sinkholes also occur due to human activity, such as the collapse of abandoned mines and salt cavern storage in salt domes in places like Louisiana, Mississippi and Texas. More commonly, collapses occur in urban areas due to water main breaks or sewer collapses when old pipes give way. They can also occur from the overpumping and extraction of groundwater and subsurface fluids.

Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created; the substantial weight of the new material can trigger a collapse of the roof of an existing void or cavity in the subsurface, resulting in development of a sinkhole.

Warning Signs

Sinkholes rarely strike without giving some warning in the surrounding environment or in a nearby home. Here are signs to watch for that may indicate a problem:

- Trees or fence posts that tilt or fall
- Foundations that slant
- New small ponds that appear after rain
- Cracks in the ground
- Sudden drainage of a pond
- Rapid appearance of a hole in the ground
- Dips, depressions, slopes that appear in a yard
- Cracked tiles
- Cracked grout between tiles
- Dead patches of grass or plants
- Sinkholes in the neighbourhood
- Wilted vegetation in a limited area
- Well water that is discoloured or contaminated with debris
- Cracking or buckling of home's concrete slab
- Earthy odor in home after rain
- New or widening cracks
- Cracks in interior walls
- Cracks around door and window frames
- Presence of odd bugs like slugs and centipedes in the home
- Separation between walls and ceiling or floors
- Stairstep cracks in blocks or bricks
- Uneven floors, warping of hardwood, bulging or sagging sections
- Doors or windows that don't open or close easily
- Cracks in sheetrock near doors or windows

All homes are subject to some settling. Any of these signs could exist without the presence of a sinkhole; however, the presence of one or more calls for further careful observation and an abundance of caution.

Quicksand

Quicksand is a colloid consisting of fine granular material (such as sand, silt or clay) and water. Quicksand forms in saturated loose sand when the sand is suddenly agitated. When water in the sand cannot escape, it creates a liquefied soil that loses strength and cannot support weight. Quicksand can form in standing water or in upward flowing water (as from an artesian spring). In the case of upward flowing water, forces oppose the force of gravity and suspend the soil particles.

The saturated sediment may appear quite solid until a sudden change in pressure or shock initiates liquefaction. This causes the sand to form a suspension and lose strength. The cushioning of water gives quicksand, and other liquefied sediments, a spongy, fluid-like texture. Objects in liquefied sand sink to the level at which the weight of the object is equal to the weight of the displaced soil/water mix and the submerged object floats due to its buoyancy.

Soil liquefaction occurs in (partially) saturated soil when it is shaken by an earthquake or similar forces. The movement combined with an increase in pore pressure (of groundwater) leads to the loss of particle cohesion, causing buildings or other objects on that surface to sink. Quicksand condition occurs in upward flow when the Critical Hydraulic Gradient come in the Vicinity of unity.

Properties

Quicksand is a shear thinning non-Newtonian fluid: when undisturbed, it often appears to be solid ("gel" form), but a less than 1% change in the stress on the quicksand will cause a sudden decrease in its viscosity ("sol" form). After an initial disturbance—such as a person attempting to walk on it—the water and sand in the quicksand separate and dense regions of sand sediment form; it is because of the formation of these high volume fraction regions that the viscosity of the quicksand seems to decrease suddenly. Someone stepping on it will start to sink. To move within the quicksand, a person or object must apply sufficient pressure on the compacted sand to re-introduce enough water to liquefy it. The forces required to do this are quite large: to remove a foot from quicksand at a speed of 0.01 m/s would require the same amount of force as needed to lift a car.

It is impossible for a human to sink entirely into quicksand due to the higher density of the fluid. Quicksand has a density of about 2 grams per milliliter, whereas the density of the human body is only about 1 gram per milliliter. At that level of density, sinking beyond about waist height in quicksand is impossible. Even objects with a higher density than quicksand will float on it if stationary. Aluminum, for example, has a density of about 2.7 grams per milliliter, but a piece of aluminum will float on top of quicksand until motion causes the sand to liquefy.

Continued or panicked movement, however, may cause a person to sink further in the quicksand. Since this increasingly impairs movement, it can lead to a situation where other factors such as weather exposure, dehydration, hypothermia, tides or predators may harm a trapped person. Quicksand may be escaped by slow movement of the legs in order to increase viscosity of the fluid, and rotation of the body so as to float in the supine position (lying horizontally with the face and torso facing up).

An avalanche (also called a snowslide) is a cohesive slab of snow lying upon a weaker layer of snow in the snowpack that fractures and slides down a steep slope when triggered. Avalanches are typically triggered in a starting zone from a mechanical failure in the snowpack (slab avalanche) when the forces of the snow exceed its strength but sometimes only with gradual widening (loose snow avalanche). After initiation, avalanches usually accelerate rapidly and grow in mass and volume as they entrain more snow.

If the avalanche moves fast enough, some of the snow may mix with the air forming a powder snow avalanche, which is a type of gravity current. Slides of rocks or debris, behaving in a similar way to snow, are also referred to as avalanches. The remainder of this article refers to snow avalanches. The load on the snowpack may be only due to gravity, in which case failure may result either from weakening in the snowpack or increased load due to precipitation. Avalanches initiated by this process are known as spontaneous avalanches.

Avalanches can also be triggered by other loading conditions such as human or biologically related activities. Seismic activity may also trigger the failure in the snowpack and avalanches. Although primarily composed of flowing snow and air, large avalanches have the capability to entrain ice, rocks, trees, and other surficial material. However, they are distinct from mudslides which have greater fluidity, rock slides which are often ice free, and serac collapses during an icefall.

Avalanches are not rare or random events and are endemic to any mountain range that accumulates a standing snowpack. Avalanches are most common during winter or spring but glacier movements may cause ice and snow avalanches at any time of year. In mountainous terrain, avalanches are among the most serious objective natural hazards to life and property, with their destructive capability resulting from their potential to carry enormous masses of snow at high speeds.

Most avalanches occur spontaneously during storms under increased load due to snowfall. The second largest cause of natural avalanches is metamorphic changes in the snowpack such as melting due to solar radiation. Other natural causes include rain, earthquakes, rockfall and icefall. Artificial triggers of avalanches include skiers, snowmobiles, and controlled explosive work. Contrary to popular belief, avalanches are not triggered by loud sound; the pressure from sound is orders of magnitude too small to trigger an avalanche.

Avalanche initiation can start at a point with only a small amount of snow moving initially; this is typical of wet snow avalanches or avalanches in dry unconsolidated snow. However, if the snow has sintered into a stiff slab overlying a weak layer then fractures can propagate very rapidly, so that a large volume of snow, that may be thousands of cubic meters, can start moving almost simultaneously. A snowpack will fail when the load exceeds the strength. The load is straightforward; it is the weight of the snow.

However, the strength of the snowpack is much more difficult to determine and is extremely heterogenous. It varies in detail with properties of the snow grains, size, density, morphology, temperature, water content; and the properties of the bonds between the grains. These properties may all metamorphose in time according to the local humidity, water vapour flux, temperature and heat flux. The top of the snowpack is also extensively influenced by incoming radiation and the local air flow.

One of the aims of avalanche research is to develop and validate computer models that can describe the evolution of the seasonal snowpack over time. A complicating factor is the complex interaction of terrain and weather, which causes significant spatial and temporal variability of the depths, crystal forms, and layering of the seasonal snowpack.

Formation

Slab Avalanches	Slab avalanches form frequently in snow that has been deposited, or redeposited by wind. They have the characteristic appearance of a block (slab) of snow cut out from its surroundings by fractures. Elements of slab avalanches include the following: a crown fracture at the top of the start zone, flank fractures on the sides of the start zones, and a fracture at the bottom called the stauchwall. Slabs can vary in thickness from a few centimetres to three metres. Slab avalanches account for around 90% of avalanche-related fatalities in backcountry users.
Powder Snow Avalanches	The largest avalanches form turbulent suspension currents known as powder snow avalanches or mixed avalanches. These consist of a powder cloud, which overlies a dense avalanche. They can form from any type of snow or initiation mechanism, but usually occur with fresh dry powder. They can exceed speeds of 300 kilometres per hour (190 mph), and masses of 10000000 tonnes; their flows can travel long distances along flat valley bottoms and even uphill for short distances.
Wet Snow Avalanches	Wet snow avalanches are a low velocity suspension of snow and water, with the flow confined to the track surface. The low speed of travel is due to the friction between the sliding surface of the track and the water saturated flow. Despite the low speed of travel (~10–40 km/h), wet snow avalanches are capable of generating powerful destructive forces, due to the large mass and density. Wet snow avalanches can be initiated from either loose snow releases, or slab releases, and only occur in snow packs that are water saturated and isothermally equilibrated to the melting point of water.
Avalanche Pathway	As an avalanche moves down a slope it follows a certain pathway that is dependent on the slope's degree of steepness and the volume of snow/ice involved in the mass movement. The origin of an avalanche is called the Starting Point and typically occurs on a 30–45 degree slope. The body of the pathway is called the Track of the avalanche and usually occurs on a 20–30 degree slope. When the avalanche loses its momentum and eventually stops it reaches the Runout Zone. This usually occurs when the slope has reached a steepness that is less than 20 degrees.
Ice Avalanche	An ice avalanche occurs when a large piece of ice, such as from a serac or calving glacier, falls onto ice (such as the Khumbu Icefall), triggering a movement of broken ice chunks. The resulting movement is more analogous to a rockfall or a landslide than a snow avalanche. They are typically very difficult to predict and almost impossible to mitigate.

Terrain

Avalanche formation requires a slope shallow enough for snow to accumulate but steep enough for the snow to accelerate once set in motion by the combination of mechanical failure (of the snowpack) and gravity. The angle of the slope that can hold snow, called the angle of repose, depends on a variety of factors such as crystal form and moisture content. Some forms of drier and colder snow will only stick to shallower slopes, while wet and warm snow can bond to very steep surfaces.

In particular, in coastal mountains, such as the Cordillera del Paine region of Patagonia, deep snowpacks collect on vertical and even overhanging rock faces. The slope angle that can allow moving snow to accelerate depends on a variety of factors such as the snow's shear strength (which is itself dependent upon crystal form) and the configuration of layers and inter-layer interfaces. The snowpack on slopes with sunny exposures is strongly influenced by sunshine. Diurnal cycles of thawing and refreezing can stabilize the snowpack by promoting settlement. Strong freeze-thaw cycles result in the formation of surface crusts during the night and of unstable surface snow during the day. Slopes in the lee of a ridge or of another wind obstacle accumulate more snow and are more likely to include pockets of deep snow, wind slabs, and cornices, all of which, when disturbed, may result in avalanche formation.

Conversely, the snowpack on a windward slope is often much shallower than on a lee slope. Avalanches and avalanche paths share common elements: a start zone where the avalanche originates, a track along which the avalanche flows, and a runout zone where the avalanche comes to rest. The debris deposit is the accumulated mass of the avalanched snow once it has come to rest in the runout zone. For the image at left, many small avalanches form in this avalanche path every year, but most of these avalanches do not run the full vertical or horizontal length of the path.

The frequency with which avalanches form in a given area is known as the return period. The start zone of an avalanche must be steep enough to allow snow to accelerate once set in motion, additionally convex slopes are less stable than concave slopes, because of the disparity between the tensile strength of snow layers and their compressive strength. The composition and structure of the ground surface beneath the snowpack influences the stability of the snowpack, either being a source of strength or weakness.

Avalanches are unlikely to form in very thick forests, but boulders and sparsely distributed vegetation can create weak areas deep within the snowpack through the formation of strong temperature gradients. Full-depth avalanches (avalanches that sweep a slope virtually clean of snow cover) are more common on slopes with smooth ground, such as grass or rock slabs. Generally speaking, avalanches follow drainages down-slope, frequently sharing drainage features with summertime watersheds.

At and below tree line, avalanche paths through drainages are well defined by vegetation boundaries called trim lines, which occur where avalanches have removed trees and prevented regrowth of large vegetation. Engineered drainages, such as the avalanche dam on Mount Stephen in Kicking Horse Pass, have been constructed to protect people and property by redirecting the flow of avalanches. Deep debris deposits from avalanches will collect in catchments at the terminus of a runout, such as gullies and river beds.

Slopes flatter than 25 degrees or steeper than 60 degrees typically have a lower incidence of avalanches. Human-triggered avalanches have the greatest incidence when the snow's angle of repose is between 35 and 45 degrees; the critical angle, the angle at which human-triggered avalanches are most frequent, is 38 degrees. When the incidence of human triggered avalanches is normalized by the rates of recreational use, however, hazard increases uniformly with slope angle, and no significant difference in hazard for a given exposure direction can be found. The rule of thumb is: A slope that is flat enough to hold snow but steep enough to ski has the potential to generate an avalanche, regardless of the angle.

Snowpack Structure

The snowpack is composed of ground-parallel layers that accumulate over the winter. Each layer contains ice grains that are representative of the distinct meteorological conditions during which the snow formed and was deposited. Once deposited, a snow layer continues to evolve under the influence of the meteorological conditions that prevail after deposition. For an avalanche to occur, it is necessary that a snowpack have a weak layer (or instability) below a slab of cohesive snow.

In practice the formal mechanical and structural factors related to snowpack instability are not directly observable outside of laboratories, thus the more easily observed properties of the snow layers (e.g. penetration resistance, grain size, grain type, temperature) are used as index measurements of the mechanical properties of the snow (e.g. tensile strength, friction coefficients, shear strength, and ductile strength).

This results in two principal sources of uncertainty in determining snowpack stability based on snow structure: First, both the factors influencing snow stability and the specific characteristics of the snowpack vary widely within small areas and time scales, resulting in significant difficulty extrapolating point observations of snow layers across different scales of space and time. Second, the relationship between readily observable snowpack characteristics and the snowpack's critical mechanical properties has not been completely developed. While the deterministic relationship between snowpack characteristics and snowpack stability is still a matter of ongoing scientific study, there is a growing empirical understanding of the snow composition and deposition characteristics that influence the likelihood of an avalanche.

Observation and experience has shown that newly fallen snow requires time to bond with the snow layers beneath it, especially if the new snow falls during very cold and dry conditions. If ambient air temperatures are cold enough, shallow snow above or around boulders, plants, and other discontinuities in the slope, weakens from rapid crystal growth that occurs in the presence of a critical temperature gradient. Large, angular snow crystals are indicators of weak snow, because such crystals have fewer bonds per unit volume than small, rounded crystals that pack tightly together.

Consolidated snow is less likely to slough than loose powdery layers or wet isothermal snow; however, consolidated snow is a necessary condition for the occurrence of slab avalanches, and persistent instabilities within the snowpack can hide below well-consolidated surface layers. Uncertainty associated with the empirical understanding of the factors influencing snow stability leads most professional avalanche workers to recommend conservative use of avalanche terrain relative to current snowpack instability.

Weather

Avalanches can only occur in a standing snowpack. Typically winter seasons at high latitudes, high altitudes, or both have weather that is sufficiently unsettled and cold enough for precipitated snow to accumulate into a seasonal snowpack. Continentality, through its potentiating influence on the meteorological extremes experienced by snowpacks, is an important factor in the evolution of instabilities, and consequential occurrence of avalanches.

Conversely, proximity to coastal environments moderates the meteorological extremes experienced by snowpacks, and results in a faster stabilization of the snowpack after storm cycles. The evolution of the snowpack is critically sensitive to small variations within the narrow range of meteorological conditions that allow for the accumulation of snow into a snowpack.

Among the critical factors controlling snowpack evolution are: heating by the sun, radiational cooling, vertical temperature gradients in standing snow, snowfall amounts, and snow types. Generally, mild winter weather will promote the settlement and stabilization of the snowpack; conversely, very cold, windy, or hot weather will weaken the snowpack.

At temperatures close to the freezing point of water, or during times of moderate solar radiation, a gentle freeze-thaw cycle will take place. The melting and refreezing of water in the snow strengthens the snowpack during the freezing phase and weakens it during the thawing phase. A rapid rise in temperature, to a point significantly above the freezing point of water, may cause avalanche formation at any time of year.

Persistent cold temperatures can either prevent new snow from stabilizing or destabilize the existing snowpack. Cold air temperatures on the snow surface produce a temperature gradient in the snow, because the ground temperature at the base of the snowpack is usually around °C, and the ambient air temperature can be much colder.

When a temperature gradient greater than 10°C (50°F) change per vertical meter of snow is sustained for more than a day, angular crystals called depth hoar or facets begin forming in the snowpack because of rapid moisture transport along the temperature gradient. These angular crystals, which bond poorly to one another and the surrounding snow, often become a persistent weakness in the snowpack.

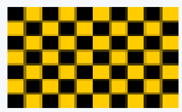
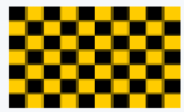
When a slab lying on top of a persistent weakness is loaded by a force greater than the strength of the slab and persistent weak layer, the persistent weak layer can fail and generate an avalanche. Any wind stronger than a light breeze can contribute to a rapid accumulation of snow on sheltered slopes downwind. Wind slab forms quickly and, if present, weaker snow below the slab may not have time to adjust to the new load. Even on a clear day, wind can quickly load a slope with snow by blowing snow from one place to another. Top-loading occurs when wind deposits snow from the top of a slope; cross-loading occurs when wind deposits snow parallel to the slope.

When a wind blows over the top of a mountain, the leeward, or downwind, side of the mountain experiences top-loading, from the top to the bottom of that lee slope. When the wind blows across a ridge that leads up the mountain, the leeward side of the ridge is subject to cross-loading. Cross-loaded wind-slabs are usually difficult to identify visually.

Snowstorms and rainstorms are important contributors to avalanche danger. Heavy snowfall will cause instability in the existing snowpack, both because of the additional weight and because the new snow has insufficient time to bond to underlying snow layers. Rain has a similar effect. In the short-term, rain causes instability because, like a heavy snowfall, it imposes an additional load on the snowpack; and, once rainwater seeps down through the snow, it acts as a lubricant, reducing the natural friction between snow layers that holds the snowpack together.

Most avalanches happen during or soon after a storm. Daytime exposure to sunlight will rapidly destabilize the upper layers of the snowpack if the sunlight is strong enough to melt the snow, thereby reducing its hardness. During clear nights, the snowpack can re-freeze when ambient air temperatures fall below freezing, through the process of long-wave radiative cooling, or both. Radiative heat loss occurs when the night air is significantly cooler than the snowpack, and the heat stored in the snow is re-radiated into the atmosphere.

European Avalanche Risk

Risk Level	Risk Level 1 (Low)	Risk Level 2 (Moderate)	Risk Level 3 (Considerable)	Risk Level 4 (High)	Risk Level 5 (Very High)
Snow Stability	Snow is generally very stable.	On some steep slopes the snow is only moderately stable. Elsewhere it is very stable.	On many steep slopes the snow is only moderately or weakly stable.	On most steep slopes the snow is not very stable.	The snow is generally unstable.
Flag					
Avalanche Risk	Avalanches are unlikely except when heavy loads are applied on a very few extreme steep slopes. Any spontaneous avalanches will be minor sloughs. In general, safe conditions.	Avalanches may be triggered when heavy loads are applied, especially on a few generally identified steep slopes. Large spontaneous avalanches are not expected.	Avalanches may be triggered on many slopes even if only light loads are applied. On some slopes, medium or even fairly large spontaneous avalanches may occur.	Avalanches are likely to be triggered on many slopes even if only light loads are applied. In some places, many medium or sometimes large spontaneous avalanches are likely.	Even on gentle slopes, many large spontaneous avalanches are likely to occur.

European Avalanche Size

Size	1 - Sluff	2 - Small	3 - Medium	4 - Large	
Runout	Small snow slide that cannot bury a person, though there is a danger of falling.	Stops within the slope.	Runs to the bottom of the slope.	Runs over flat areas (significantly less than 30°) of at least 50 m in length, may reach the valley bottom.	
Potential Damage	Unlikely, but possible risk of injury or death to people.	Could bury, injure or kill a person.	Could bury and destroy a car, damage a truck, destroy small buildings or break trees.	Could bury and destroy large trucks and trains, large buildings and forested areas.	
Physical Size	Length <50 m Volume <100 m³	Length <100 m Volume <1,000 m³	Length <1,000 m Volume <10,000 m³	Length >1,000 m Volume >10,000 m³	

4 Earthquake

An earthquake (also known as a quake, tremor or temblor) is the shaking of the surface of the Earth, resulting from the sudden release of energy in the Earth's lithosphere that creates seismic waves. Earthquakes can range in size from those that are so weak that they cannot be felt to those violent enough to toss people around and destroy whole cities. The seismicity, or seismic activity, of an area is the frequency, type and size of earthquakes experienced over a period of time. The word tremor is also used for non-earthquake seismic rumbling.

At the Earth's surface, earthquakes manifest themselves by shaking and displacing or disrupting the ground. When the epicentre of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. Earthquakes can also trigger landslides, and occasionally volcanic activity. In its most general sense, the word earthquake is used to describe any seismic event — whether natural or caused by humans — that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by other events such as volcanic activity, landslides, mine blasts, and nuclear tests. An earthquake's point of initial rupture is called its focus or hypocentre. The epicentre is the point at ground level directly above the hypocentre.

Subheadings

1. Phenomena	**2. Characteristics**	**3. Hazards**	**4. Earth Composition**
5. Waves	**6. Measurement**	**7. Seismograph**	**8. Earthquake History**
9. Prediction	**10. Preparation**	**11. Action**	**12. Post-Earthquake**

1 Phenomena

Foreshock

A foreshock is an earthquake that occurs before a larger seismic event (the mainshock) and is related to it in both time and space. The designation of an earthquake as foreshock, mainshock or aftershock is only possible after the full sequence of events has happened. Foreshock activity has been detected for about 40% of all moderate to large earthquakes, and about 70% for events of M>7.0. They occur from a matter of minutes to days or even longer before the main shock; for example, the 2002 Sumatra earthquake is regarded as a foreshock of the 2004 Indian Ocean earthquake with a delay of more than two years between the two events. Some great earthquakes (M>8.0) show no foreshock activity at all, such as the M8.6 1950 India - China earthquake. The increase in foreshock activity is difficult to quantify for individual earthquakes but becomes apparent when combining the results of many different events. From such combined observations, the increase before the mainshock is observed to be of inverse power law type. This may either indicate that foreshocks cause stress changes resulting in the mainshock or that the increase is related to a general increase in stress in the region.

The observation of foreshocks associated with many earthquakes suggests that they are part of a preparation process prior to nucleation. In one model of earthquake rupture, the process forms as a cascade, starting with a very small event that triggers a larger one, continuing until the main shock rupture is triggered. However, analysis of some foreshocks has shown that they tend to relieve stress around the fault. In this view, foreshocks and aftershocks are part of the same process. This is supported by an observed relationship between the rate of foreshocks and the rate of aftershocks for an event. An increase in seismic activity in an area has been used as a method of predicting earthquakes, most notably in the case of the 1975 Haicheng earthquake in China, where an evacuation was triggered by an increase in activity. However, most earthquakes lack obvious foreshock patterns and this method has not proven useful, as most small earthquakes are not foreshocks, leading to probable false alarms. Earthquakes along oceanic transform faults do show repeatable foreshock behaviour, allowing the prediction of both the location and timing of such earthquakes.

Aftershock

An aftershock is a smaller earthquake that occurs after a previous large earthquake, in the same area of the main shock. If an aftershock is larger than the main shock, the aftershock is redesignated as the main shock and the original main shock is redesignated as a foreshock. Aftershocks are formed as the crust around the displaced fault plane adjusts to the effects of the main shock. Most aftershocks are located over the full area of fault rupture and either occur along the fault plane itself or along other faults within the volume affected by the strain associated with the main shock.

Typically, aftershocks are found up to a distance equal to the rupture length away from the fault plane. The pattern of aftershocks helps confirm the size of area that slipped during the main shock. In the case of the 2004 Indian Ocean earthquake and the 2008 Sichuan earthquake the aftershock distribution shows in both cases that the epicentre (where the rupture initiated) lies to one end of the final area of slip, implying strongly asymmetric rupture propagation.

Aftershocks rates and magnitudes follow several well-established empirical laws:
- Omori's Law
- Båth's Law
- Gutenberg–Richter Law

Omori's Law
The frequency of aftershocks decreases roughly with the reciprocal of time after the main shock. This empirical relation was first described by Fusakichi Omori in 1894 and is known as Omori's law.

Båth's Law
The other main law describing aftershocks is known as Båth's Law and this states that the difference in magnitude between a main shock and its largest aftershock is approximately constant, independent of the main shock magnitude, typically 1.1–1.2 on the Moment magnitude scale.

Gutenberg–Richter Law
Aftershock sequences also typically follow the Gutenberg–Richter law of size scaling, which refers to the relationship between the magnitude and total number of earthquakes in a region in a given time period.

Dangers
Aftershocks are dangerous because they are usually unpredictable, can be of a large magnitude, and can collapse buildings that are damaged from the main shock. Bigger earthquakes have more and larger aftershocks and the sequences can last for years or even longer especially when a large event occurs in a seismically quiet area; see, for example, the New Madrid Seismic Zone, where events still follow Omori's law from the main shocks of 1811–1812. An aftershock sequence is deemed to have ended when the rate of seismicity drops back to a background level; i.e., no further decay in the number of events with time can be detected. Land movement around the New Madrid is reported to be no more than 0.2 mm (0.0079 in) a year, in contrast to the San Andreas Fault which averages up to 37 mm (1.5 in) a year across California. Aftershocks on the San Andreas are now believed to top out at 10 years while earthquakes in New Madrid are considered aftershocks nearly 200 years after the 1812 New Madrid earthquake.

Other Types

Blind Thrust
A blind thrust earthquake occurs along a thrust fault that does not show signs on the Earth's surface, hence the designation "blind". Such faults, being invisible at the surface, have not been mapped by standard surface geological mapping. Sometimes they are discovered as a by-product of oil exploration seismology; in other cases their existence is not suspected. Although such earthquakes are not amongst the most energetic, they are sometimes the most destructive, as conditions combine to form an urban earthquake which greatly affects urban seismic risk. Blind thrust faults generally exist near tectonic plate margins, in the broad disturbance zone.

They form when a section of the Earth's crust is under high compressive stresses, due to plate margin collision, or the general geometry of how the plates are sliding past each other. A weak plate under compression generally forms thrusting sheets, or overlapping sliding sections. This can form a hill and valley landform, with the hills being the strong sections, and the valleys being the highly disturbed thrust faulted and folded sections. After a long period of erosion the visible landscape may be flattened, with material eroded from the hills filling up the valleys and hiding the underlying hill-and-valley geology.

The valley rock is very weak and usually highly weathered, presenting deep, fertile soil; naturally, this is the area that becomes populated. Reflection seismology profiles show the disturbed rock that hides a blind thrust fault. If the region is under active compression these faults are constantly rupturing, but any given valley might only experience a large earthquake every few hundred years. Although usually of magnitude 6 to 7 compared to the largest magnitude 9 earthquakes of recent times, such a temblor is especially destructive because the seismic waves are highly directed, and the soft basin soil of the valley can amplify the ground motions tenfold or more. It is said that blind thrust earthquakes contribute more to urban seismic risk than the 'big ones' of magnitude 8 or more.

Doublet
Seismologists sometimes refer to a pair of similarly sized earthquake shocks that occur relatively closely spaced in time and location as an earthquake "doublet." This occurrence is distinct from the normal pattern of earthquake aftershocks. Aftershocks gradually diminish in magnitude and generally come from the same origin as a mainshock, whereas doublet earthquakes originate from a place other than the original earthquake rupture area. The first earthquake can be a considerable distance and time away from the second earthquake.

The magnitude of the second quake may even be slightly larger than the first. Earthquakes identified as doublets occur once or twice globally every year, making them far rarer than more typical earthquake patterns. In earthquake prone regions officials do not plan for doublet earthquakes occurring because they are so rare.

However, when they do occur, they have a high disaster potential. Some large earthquakes may be closely spaced doublet earthquakes, where the shaking from the rupture of the first fault or fault section overlaps with shaking from the rupture of a second fault section nearby. The two separate sources for these earthquakes are usually only identified by seismologists after extensive analysis, not in real time. Closely spaced doublet earthquakes could enhance tsunami risk or complicate tsunami warning efforts.

Interplate
An interplate earthquake is an earthquake that occurs at the boundary between two tectonic plates. Earthquakes of this type account for more than 90 percent of the total seismic energy released around the world. If one plate is trying to move past the other, they will be locked until sufficient stress builds up to cause the plates to slip relative to each other. The slipping process creates an earthquake with relative displacement on either side of the fault, resulting in seismic waves which travel through the Earth and along the Earth's surface.

Relative plate motion can be lateral as along a transform fault boundary, vertical if along a convergent boundary (i.e. subduction or thrust/reverse faulting) or a divergent boundary (i.e. rift zone or normal faulting), and oblique, with horizontal and lateral components at the boundary. Interplate earthquakes associated at a subduction boundary are called megathrust earthquakes, which are the most powerful earthquakes. Intraplate earthquakes are often confused with interplate earthquakes, but are fundamentally different in origin, occurring within a single plate rather than between two tectonic plates on a plate boundary.

The specifics of the mechanics by which they occur, as well as the intensity of the stress drop which occurs after the earthquake also differentiate the two types of events. Intraplate earthquakes have, on average, a higher stress drop than that of an interplate earthquake and generally higher intensity. Mechanically, interplate earthquakes differ from other seismic events in that they are caused by motion at the boundary between two tectonic plates. An interplate earthquake event occurs when the accumulated stress at a tectonic plate boundary are released via brittle failure and displacement along the fault.

There are three types of plate boundaries to consider in the context of interplate earthquake events:
● **Transform Plate Boundary:** Where two boundaries slide laterally relative to each other.
● **Divergent Plate Boundary:** Where two boundaries move apart.
● **Convergent Plate Boundary:** Where one plate moves towards, and potentially subducts beneath, another plate.

Precursory Tremors
Scientists have determined that interplate earthquakes are sometimes preceded by an irregular occurrence of small tremors. Precursory tremors are often associated with slow slip along a plate boundary. These precursory tremors can sometimes be identified within days or weeks of an interplate earthquake event and allow researchers to anticipate interplate earthquakes and introduce strategies to mitigate damage.

Intraplate
The term intraplate earthquake refers to a variety of earthquake that occurs within the interior of a tectonic plate; this stands in contrast to an interplate earthquake, which occurs at the boundary of a tectonic plate. Intraplate earthquakes are relatively rare compared to the more familiar boundary-located interplate earthquakes. Therefore, large intraplate earthquakes can inflict heavy damage with such areas' structures lacking seismic retrofitting. The surface of the Earth is made up of seven primary and eight secondary tectonic plates, plus dozens of tertiary microplates. The large plates move very slowly, owing to convection currents within the mantle below the crust.

Because they do not all move in the same direction, plates often directly collide or move laterally along each other, a tectonic environment that makes earthquakes frequent. Relatively few earthquakes occur in intraplate environments; most occur on faults near plate margins. By definition, intraplate earthquakes do not occur near plate boundaries, but along faults in the normally stable interior of plates. These earthquakes often occur at the location of ancient failed rifts, because such old structures may present a weakness in the crust where it can easily slip to accommodate regional tectonic strain.

Compared to earthquakes near plate boundaries, intraplate earthquakes are not well understood, and the hazards associated with them may be difficult to quantify. Many cities live with the seismic risk of a rare, large intraplate earthquake. The cause of these earthquakes is often uncertain. In many cases, the causative fault is deeply buried, and sometimes cannot even be found. Some studies have shown that it can be caused by fluids moving up the crust along ancient fault zones. Under these circumstances it is difficult to calculate the exact seismic hazard for a given city, especially if there was only one earthquake in historical times.

Megathrust
Megathrust earthquakes occur at subduction zones at destructive convergent plate boundaries, where one tectonic plate is forced underneath another. These interplate earthquakes are the planet's most powerful, with moment magnitudes (Mw) that can exceed 9.0. Since 1900, all earthquakes of magnitude 9.0 or greater have been megathrust earthquakes.

No other type of known terrestrial source of tectonic activity has produced earthquakes of this scale. During the rupture, one side of the fault is pushed upwards relative to the other, and it is this type of movement that is known as thrust. They are a type of dip-slip fault. A thrust fault is a reverse fault with a dip of 45° or less. Oblique-slip faults have significant components of different slip styles.

The term megathrust does not have a widely accepted rigorous definition, but is used to refer to an extremely large thrust fault, typically formed at the plate interface along a subduction zone such as the Sunda megathrust. The major subduction zone is associated with the Pacific and Indian Oceans and is responsible for the volcanic activity associated with the Pacific Ring of Fire. Since these earthquakes deform the ocean floor, they often generate a significant series of tsunami waves.

They are known to produce intense shaking for periods of time that can last for up to a few minutes. In Japan, the Nankai megathrust under the Nankai Trough is responsible for Nankai megathrust earthquakes and associated tsunamis. A study reported in 2016 found that the largest megathrust quakes are associated with downgoing slabs with the shallowest dip, so-called flat slab subduction.

Remotely Triggered
Remotely triggered earthquakes are a result of the effects of large earthquakes at considerable distance, outside of the immediate aftershock zone. The further one gets from the initiating earthquake in both space and time, the more difficult it is to establish an association. The physics involved in actually triggering an earthquake is complex. Most earthquake-generating zones are in a state of being close to failure. If such a zone were to be left completely alone, it would generate significant earthquakes spontaneously. Remote earthquakes, however, are in a position to disturb this critical state, either by shifting the stresses statically, or by dynamic change caused by passing seismic waves.

The first type of triggering may be due to static changes in the critical state. For example, after the magnitude 7.3 Landers earthquake struck California in 1992, it is said that "the earthquake map of California lit up like a Christmas tree". This event reinforced the idea of remotely triggered earthquakes, and pushed the hypothesis into the scientific mainstream. There is scientific evidence for a "long reach", mainly in the form of discrete element modelling used in the mining industry. If rock is modelled as discrete elements in a critical state, a single disturbance can influence a wide area. A smaller-scale example is when a small excavation in a valley triggers a landslide and brings down a whole mountainside.

Slow Earthquake
A slow earthquake is a discontinuous, earthquake-like event that releases energy over a period of hours to months, rather than the seconds to minutes characteristic of a typical earthquake. First detected using long term strain measurements, most slow earthquakes now appear to be accompanied by fluid flow and related tremor, which can be detected and approximately located using seismometer data filtered appropriately (typically in the 1–5 Hz band). That is, they are quiet compared to a regular earthquake, but not "silent" as described in the past. Slow earthquakes should not be confused with tsunami earthquakes, in which relatively slow rupture velocity produces tsunami out of proportion to the triggering earthquake. In a tsunami earthquake, the rupture propagates along the fault more slowly than usual, but the energy release occurs on a similar timescale to other earthquakes.

Causes
Earthquakes occur as a consequence of gradual stress increases in a region, and once it reaches the maximum stress that the rocks can withstand a rupture generates and the resulting earthquake motion is related to a drop in the shear stress of the system. Earthquakes generate seismic waves when the rupture in the system occurs, the seismic waves consist of different types of waves that are capable of moving through the Earth like ripples over water. The causes that lead to slow earthquakes have only been theoretically investigated, by the formation of longitudinal shear cracks that were analysed using mathematical models.

The different distributions of initial stress, sliding frictional stress, and specific fracture energy are all taken into account. If the initial stress minus the sliding frictional stress (with respect to the initial crack) is low, and the specific fracture energy or the strength of the crustal material (relative to the amount of stress) is high then slow earthquakes will occur regularly.

In other words, slow earthquakes are caused by a variety of stick-slip and creep processes intermediated between asperity-controlled brittle and ductile fracture. Asperities are tiny bumps and protrusions along the faces of fractures. They are best documented from intermediate crustal levels of certain subduction zones (especially those that dip shallowly — SW Japan, Cascadia, Chile), but appear to occur on other types of faults as well, notably strike-slip plate boundaries such as the San Andreas fault and "mega-landslide" normal faults on the flanks of volcanos.

Slow Earthquake
Faulting takes place all over Earth; faults can include convergent, divergent, and transform faults, and normally occur on plate margins. As of 2013 some of the locations that have been recently studied for slow earthquakes include: Cascadia, California, Japan, New Zealand, Mexico, and Alaska. The locations of slow earthquakes can provide new insights into the behaviour of normal or fast earthquakes. By observing the location of tremors associated with slow-slip and slow earthquakes, seismologists can determine the extension of the system and estimate future earthquakes in the area of study.

Types of Slow Earthquakes
- Low Frequency Earthquakes (LFE)
- Very Low Frequency Earthquakes (VLF)
- Slow Slip Events (SSE)
- Episodic Tremor and Slip (ETS)

Low Frequency Earthquakes
Low frequency earthquakes (LFEs) are seismic events defined by waveforms with periods far greater than those of ordinary earthquakes and abundantly occur during slow earthquakes. LFEs can be volcanic, semi-volcanic, or tectonic in origin, but only tectonic LFEs or LFEs generated during slow earthquakes are described here. Tectonic LFEs are characterized by generally low magnitudes ($M<3$) and have frequencies peaked between 1 and 3 Hz. They are the largest constituent of non-volcanic tremor at subduction zones, and in some cases are the only constituent.

Very Low Frequency Earthquakes
Very low frequency earthquakes (VLFs) can be considered a sub-category of low frequency earthquakes that differ in terms of duration and period. VLFs have magnitudes of approximately 3-3.5, durations around 20 seconds, and are further enriched in low frequency energy (0.03–0.02 Hz). VLFs predominantly occur with LFEs, but the reverse is not true. There are two major subduction zone settings where VLFs have been detected, 1) within the offshore accretionary prism and 2) at the plate interface down-dip of the seismogenic zone.

Slow Slip Events
Slow slip events (SSEs) are long lived shear slip events at subduction interfaces and the physical processes responsible for the generation of slow earthquakes. They are slow thrust-sense displacement episodes that can have durations up to several weeks, and are thus termed "slow". In many cases, the recurrence interval for slow slip events is remarkably periodic and accompanied by tectonic tremor, prompting seismologists to term episodic tremor and slip (ETS). Slow slip event's locus of displacement propagate along the strike of subduction interfaces at velocities of 5–10 kilometres per day during slow earthquakes in the Cascadia, and this propagation is responsible for the similar migration of LFEs and tremor.

Episodic Tremor and Slip
Slow earthquakes can be episodic (relative of plate movement), and therefore somewhat predictable, a phenomenon termed "episodic tremor and slip" or "ETS" in the literature. ETS events can last for weeks as opposed to "normal earthquakes" occur in a matter of seconds. Several slow-earthquake events around the world appear to have triggered major, damaging seismic earthquakes in the shallower crust. Conversely, major earthquakes trigger "post-seismic creep" in the deeper crust and mantle. Just like regular earthquakes, slow earthquakes can cause devastating tsunamis, such as the 2010 Mentawai earthquake and tsunami.

Submarine
A submarine, undersea, or underwater earthquake is an earthquake that occurs underwater at the bottom of a body of water, especially an ocean. They are the leading cause of tsunamis. The magnitude can be measured scientifically by the use of the moment magnitude scale and the intensity can be assigned using the Mercalli intensity scale. Understanding plate tectonics helps to explain the cause of submarine earthquakes. The Earth's surface or lithosphere comprises tectonic plates which average approximately 50 miles in thickness, and are continuously moving very slowly upon a bed of magma in the asthenosphere and inner mantle.

The plates converge upon one another, and one subducts below the other, or, where there is only shear stress, move horizontally past each other (see transform plate boundary below). Little movements called fault creep are minor and not measurable. The plates meet with each other, and if rough spots cause the movement to stop at the edges, the motion of the plates continue. When the rough spots can no longer hold, the sudden release of the built-up motion releases, and the sudden movement under the sea floor causes a submarine earthquake. This area of slippage both horizontally and vertically is called the epicentre, and has the highest magnitude, and causes the greatest damage.

As with a continental earthquake the severity of the damage is not often caused by the earthquake at the rift zone, but rather by events which are triggered by the earthquake. Where a continental earthquake will cause damage and loss of life on land from fires, damaged structures, and flying objects; a submarine earthquake alters the seabed, resulting in a series of waves, and depending on the length and magnitude of the earthquake, tsunami, which bear down on coastal cities causing property damage and loss of life.

Submarine earthquakes can also damage submarine communications cables, leading to widespread disruption of the Internet and international telephone network in those areas. This is particularly common in Asia, where many submarine links cross submarine earthquake zones such as the Ring of Fire.

Boundaries

The different ways in which tectonic plates rub against each other under the ocean or sea floor to create submarine earthquakes. The type of friction created may be due to the characteristic of the geologic fault or the plate boundary as follows. Some of the main areas of large tsunami producing submarine earthquakes are the Pacific Ring of Fire and the Great Sumatran fault.

Convergent Plate Boundary
The older, and denser plate moves below the lighter plate. The further down it moves, the hotter it becomes, until finally melting altogether at the asthenosphere and inner mantle and the crust is actually destroyed. The location where the two oceanic plates actually meet become deeper and deeper creating trenches with each successive action. There is an interplay of various densities of lithosphere rock, asthenosphere magma, cooling ocean water and plate movement for example the Pacific Ring of Fire.

Transform Plate Boundary
A transform-fault boundary, or simply a transform boundary is where two plates will slide past each other, and the irregular pattern of their edges may catch on each other. The lithosphere is neither added to from the asthenosphere nor is it destroyed as in convergent plate action. For example, along the San Andreas fault strike-slip fault zone, the Pacific Tectonic Plate has been moving along at about 5 cm/yr in a north-westerly direction, whereas the North American Plate is moving south-easterly.

Divergent Plate Boundary
Rising convection currents occur where two plates are moving away from each other. In the gap, thus produced hot magma rises up, meets the cooler sea water, cools, and solidifies, attaching to either or both tectonic plate edges creating an oceanic spreading ridge. When the fissure again appears, again magma will rise up, and form new lithosphere crust. If the weakness between the two plates allows the heat and pressure of the asthenosphere to build over a large amount of time, a large quantity of magma will be released pushing up on the plate edges and the magma will solidify under the newly raised plate edges, see formation of a submarine volcano.

Supershear

A supershear earthquake is an earthquake in which the propagation of the rupture along the fault surface occurs at speeds in excess of the seismic shear wave (S-wave) velocity. This causes an effect analogous to a sonic boom. During seismic events along a fault surface the displacement initiates at the focus and then propagates outwards.

Typically for large earthquakes the focus lies towards one end of the slip surface and much of the propagation is unidirectional (e.g. the 2008 Sichuan and 2004 Indian Ocean earthquakes). Theoretical studies have in the past suggested that the upper bound for propagation velocity is that of Rayleigh waves, approximately 0.92 of the shear wave velocity. However, evidence of propagation at velocities between S-wave and compressional wave (P-wave) values have been reported for several earthquakes in agreement with theoretical and laboratory studies that support the possibility of rupture propagation in this velocity range.

Evidence of rupture propagation at velocities greater than S-wave velocities expected for the surrounding crust have been observed for several large earthquakes associated with strike-slip faults. During strike-slip, the main component of rupture propagation will be horizontal, in the direction of displacement, as a Mode II (in-plane) shear crack. This contrasts with a dip-slip rupture where the main direction of rupture propagation will be perpendicular to the displacement, like a Mode III (anti-plane) shear crack.

The rupture velocity range between those of Rayleigh waves and shear waves remains forbidden for a Mode II crack (a good approximation to a strike-slip rupture). This means that a rupture cannot accelerate from Rayleigh speed to shear wave speed. In the "Burridge–Andrews" mechanism, supershear rupture is initiated on a 'daughter' rupture in the zone of high shear stress developed at the propagating tip of the initial rupture.

Because of this high stress zone, this daughter rupture is able start propagating at supershear speed before combining with the existing rupture. Experimental shear crack rupture, using plates of a photoelastic material, has produced a transition from sub-Rayleigh to supershear rupture by a mechanism that "qualitatively conforms to the well-known Burridge-Andrews mechanism".

The high rates of strain expected near faults that are affected by supershear propagation are thought to generate what is described as pulverized rocks. The pulverization involves the development of many small microcracks at a scale smaller than the grain size of the rock, while preserving the earlier fabric, quite distinct from the normal brecciation and cataclasis found in most fault zones. Such rocks have been reported up to 400 m away from large strike-slip faults, such as the San Andreas Fault. The link between supershear and the occurrence of pulverized rocks is supported by laboratory experiments that show very high strain rates are necessary to cause such intense fracturing.

Tsunami

A tsunami earthquake triggers a tsunami of a magnitude that is very much larger than the magnitude of the earthquake as measured by shorter-period seismic waves. The term was introduced by Hiroo Kanamori in 1972. Such events are a result of relatively slow rupture velocities. They are particularly dangerous as a large tsunami may arrive at a coastline with little or no warning.

A tsunami is a sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands. The distinguishing feature for a tsunami earthquake is that the release of seismic energy occurs at long periods (low frequencies) relative to typical tsunamigenic earthquakes. Earthquakes of this type do not generally show the peaks of seismic wave activity associated with ordinary events.

A tsunami earthquake can be defined as an undersea earthquake for which the surface wave magnitude Ms differs markedly from the moment magnitude Mw, because the former is calculated from surface waves with a period of about 20 seconds, whereas the latter is a measure of the total energy release at all frequencies.

The displacements associated with tsunami earthquakes are consistently greater than those associated with ordinary tsunamigenic earthquakes of the same moment magnitude, typically more than double. Rupture velocities for tsunami earthquakes are typically about 1.0 km per second, compared to the more normal 2.5–3.5 km per second for other megathrust earthquakes. These slow rupture speeds lead to greater directivity, with the potential to cause higher run-ups on short coastal sections. Tsunami earthquakes mainly occur at subduction zones where there is a large accretionary wedge or where sediments are being subducted, as this weaker material leads to the slower rupture velocities.

Analysis of tsunami earthquakes such as the 1946 Aleutian Islands earthquake shows that the release of seismic moment takes place at an unusually long period. Calculations of the effective moment derived from surface waves show a rapid increase with decrease in the frequency of the seismic waves, whereas for ordinary earthquakes it remains almost constant with frequency. The duration over which the seabed is deformed has little effect on the size of the resultant tsunami for times up to several minutes. The observation of long period energy release is consistent with unusually slow rupture propagation velocities.

Slow rupture velocities are linked to propagation through relatively weak material, such as poorly consolidated sedimentary rocks. Most tsunami earthquakes have been linked to rupture within the uppermost part of a subduction zone, where an accretionary wedge is developed in the hanging wall of the megathrust. Tsunami earthquakes have also been linked to the presence of a thin layer of subducted sedimentary rock along the uppermost part of the plate interface, as is thought to be present in areas of significant topography at the top of the oceanic crust, and where propagation was in an up-dip direction, possibly reaching the seafloor.

On 15 June 1896 the Sanriku coast was struck by a devastating tsunami with a maximum wave height of 38.2 m, which caused more than 22,000 deaths. The residents of the coastal towns and villages were taken completely by surprise because the tsunami had only been preceded by a relatively weak shock. The magnitude of the tsunami has been estimated as Mt=8.2 while the earthquake shaking only indicated a magnitude of Ms=7.2. This discrepancy in magnitude requires more than just a slow rupture velocity. Modelling of tsunami generation that takes into account additional uplift associated with deformation of the softer sediments of the accretionary wedge caused by horizontal movement of the 'backstop' in the overriding plate has successfully explained the discrepancy, estimating a magnitude of Mw=8.0–8.1.

Earthquake Swarm
Earthquake swarms are events where a local area experiences sequences of many earthquakes striking in a relatively short period of time. The length of time used to define the swarm itself varies, but may be of the order of days, weeks, or months. They are differentiated from earthquakes succeeded by a series of aftershocks by the observation that no single earthquake in the sequence is obviously the main shock. Between February and April 2008 a swarm of 1,000 small magnitude quakes in the United States, referred to as the 2008 Reno earthquakes began in February and ended in November. During the 2011–12 El Hierro eruption. From July 2011 until October 2011, hundreds of small earthquakes were measured. The accumulated energy released by the swarm increased dramatically on 28 September. The swarm was due to the movement of magma beneath the island, and on 9 October indications of a submarine volcanic eruption were detected.

Causes

Fault Movement
In geology, a fault is a planar fracture or discontinuity in a volume of rock, across which there has been significant displacement as a result of rock-mass movement. Large faults within the Earth's crust result from the action of plate tectonic forces, with the largest forming the boundaries between the plates, such as subduction zones or transform faults.

Volcanism
A volcano tectonic earthquake is an earthquake induced by the movement (injection or withdrawal) of magma. The movement results in pressure changes in the rock around where the magma has experienced stress. At some point, the rock may break or move. The earthquakes may also be related to dike intrusion and may occur as earthquake swarms.

Induced Seismicity
Induced seismicity refers to typically minor earthquakes and tremors that are caused by human activity that alters the stresses and strains on the Earth's crust. Most induced seismicity is of a low magnitude. A few sites regularly have larger quakes, such as The Geysers geothermal plant in California which averaged two M4 events and 15 M3 events every year from 2004 to 2009.

Characteristics

Epicentre
The epicentre, epicentre or epicentrum in seismology is the point on the Earth's surface directly above a hypocentre or focus, the point where an earthquake or an underground explosion originates.

Hypocentre
A hypocentre (or hypocentre) is the point of origin of an earthquake or a subsurface nuclear explosion. In seismology, it is a synonym of the focus. The term hypocentre is also used as a synonym for ground zero, the surface point directly beneath a nuclear airburst.

Shadow Zone
A seismic shadow zone is an area of the Earth's surface where seismographs can only barely detect an earthquake after its seismic waves have passed through the Earth. When an earthquake occurs, seismic waves radiate out spherically from the earthquake's focus.

Seismic Waves
Seismic waves are waves of energy that travel through the Earth's layers, and are a result of earthquakes, volcanic eruptions, magma movement, large landslides and large man-made explosions that give out low-frequency acoustic energy. Many other natural and anthropogenic sources create low-amplitude waves commonly referred to as ambient vibrations.

P-Wave
A P-wave is one of the two main types of elastic body waves, called seismic waves in seismology. P-waves travel faster than other seismic waves and hence are the first signal from an earthquake to arrive at any affected location or at a seismograph. P-waves may be transmitted through gases, liquids, or solids.

S-Wave
In seismology, S-waves, secondary waves, or shear waves are a type of elastic wave, and are one of the two main types of elastic body waves, so named because they move through the body of an object, unlike surface waves. The S-wave moves as a shear or transverse wave, so motion is perpendicular to the direction of wave propagation. The wave moves through elastic media, and the main restoring force comes from shear effects.

Measurement

Seismometer
A seismometer is an instrument that measures motion of the ground, caused by, for example, an earthquake, a volcanic eruption, or the use of explosives. Records of seismic waves allow seismologists to map the interior of the Earth and to locate and measure the size of events like these.

Seismic Magnitude Scales
Seismic magnitude scales are used to describe the overall strength or "size" of an earthquake. These are distinguished from seismic intensity scales that categorize the intensity or severity of ground shaking (quaking) caused by an earthquake at a given location. Magnitudes are usually determined from measurements of an earthquake's seismic waves as recorded on a seismogram. Magnitude scales vary on the type and component of the seismic waves measured and the calculations used.

Seismic Intensity Scales
Seismic intensity scales categorize the intensity or severity of ground shaking (quaking) at a given location, such as resulting from an earthquake. They are distinguished from seismic magnitude scales, which measure the magnitude or overall strength of an earthquake.

3 Hazards

Earthquakes pose little direct danger to a person. You can't be shaken to death by an earthquake. Some movies show scenes with the ground suddenly opening up and people falling into fiery pits, but this just doesn't happen in real life.

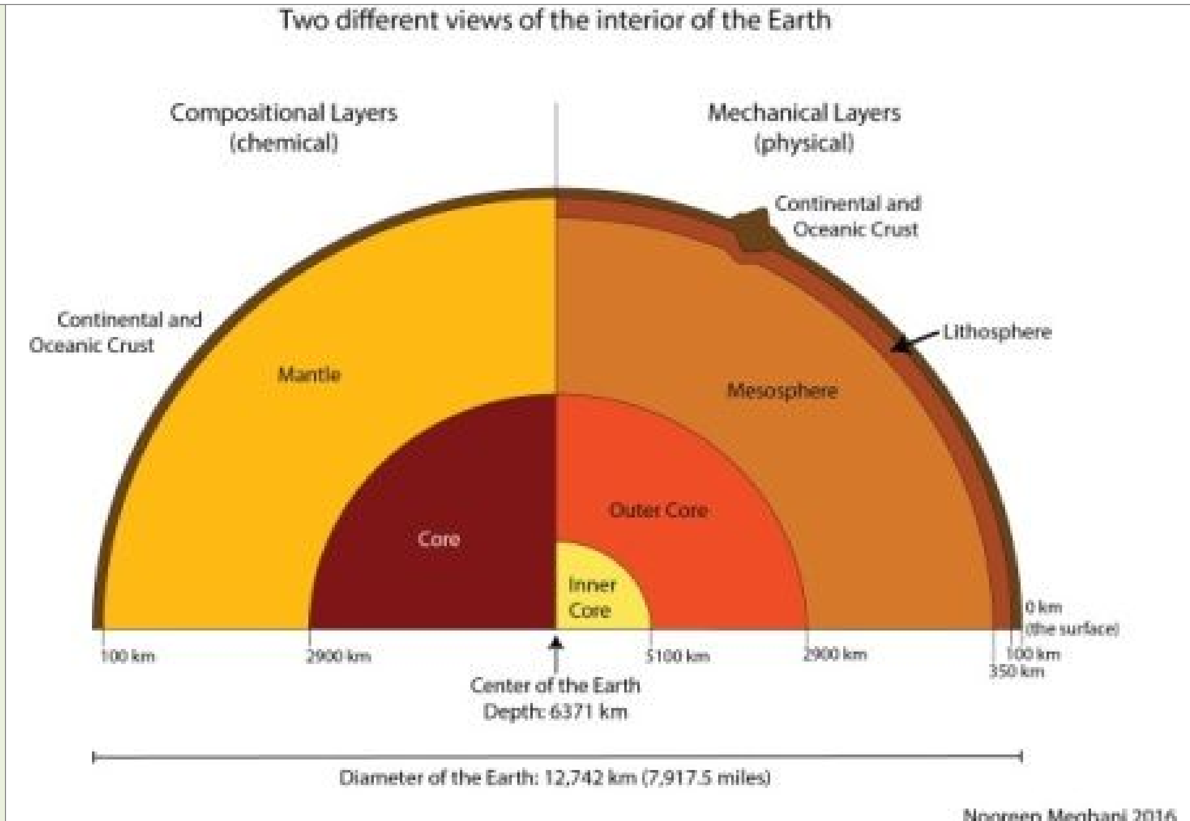
Ground Shaking	The first main earthquake hazard (danger) is the effect of ground shaking. Buildings can be damaged by the shaking itself or by the ground beneath them settling to a different level than it was before the earthquake (subsidence). Buildings can even sink into the ground if soil liquefaction occurs. Liquefaction is the mixing of sand or soil and groundwater (water underground) during the shaking of a moderate or strong earthquake. When the water and soil are mixed, the ground becomes very soft and acts similar to quicksand. If liquefaction occurs under a building, it may start to lean, tip over, or sink several feet. The ground firms up again after the earthquake has past and the water has settled back down to its usual place deeper in the ground. Liquefaction is a hazard in areas that have groundwater near the surface and sandy soil. Buildings can also be damaged by strong surface waves making the ground heave and lurch. Any buildings in the path of these surface waves can lean or tip over from all the movement. The ground shaking may also cause landslides, mudslides, and avalanches on steeper hills or mountains, all of which can damage buildings and hurt people.
Ground Displacement	The second main earthquake hazard is ground displacement (ground movement) along a fault. If a structure (a building, road, etc.) is built across a fault, the ground displacement during an earthquake could seriously damage or rip apart that structure.

Flooding	The third main hazard is flooding. An earthquake can rupture (break) dams or levees along a river. The water from the river or the reservoir would then flood the area, damaging buildings and maybe sweeping away or drowning people. Tsunamis and seiches can also cause a great deal of damage. A tsunami is what most people call a tidal wave, but it has nothing to do with the tides on the ocean. It is a huge wave caused by an earthquake under the ocean. Tsunamis can be tens of feet high when they hit the shore and can do enormous damage to the coastline. Seiches are like small tsunamis. They occur on lakes that are shaken by the earthquake and are usually only a few feet high, but they can still flood or knock down houses, and tip over trees.
Fire	The fourth main earthquake hazard is fire. These fires can be started by broken gas lines and power lines, or tipped over wood or coal stoves. They can be a serious problem, especially if the water lines that feed the fire hydrants are broken, too. For example, after the Great San Francisco Earthquake in 1906, the city burned for three days. Most of the city was destroyed and 250,000 people were left homeless. Most of the hazards to people come from man-made structures themselves and the shaking they receive from the earthquake. The real dangers to people are being crushed in a collapsing building, drowning in a flood caused by a broken dam or levee, getting buried under a landslide, or being burned in a fire.

4 Earth Composition

The structure of the Earth is divided into layers. These layers are both physically and chemically different. The Earth has an outer solid layer called the crust, a highly viscous layer called the mantle, a liquid layer that is the outer part of the core, called the outer core, and a solid centre called the inner core. The shape of the earth is an oblate spheroid, because it is slightly flattened at the poles and bulging at the equator. The boundaries between these layers were discovered by seismographs which showed the way vibrations bounced off the layers during earthquakes. Between the Earth's crust and the mantle is a boundary called the moho. It was the first discovery of a major change in the Earth's structure as one goes deeper.

Earth's Diameter
12,742 km
(7,917.5 mi)

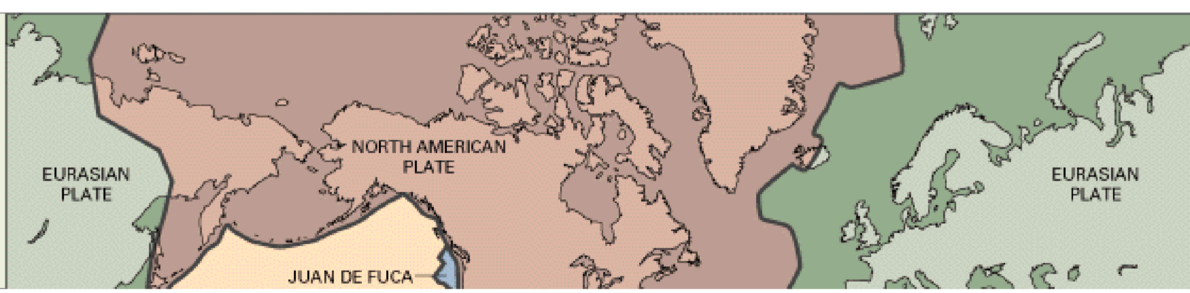


Lithosphere

A lithosphere is the rigid, outermost shell of a terrestrial-type planet, or natural satellite, that is defined by its rigid mechanical properties. On Earth, it is composed of the crust and the portion of the upper mantle that behaves elastically on time scales of thousands of years or greater. The lithosphere plates float on the semi-liquid aesthenosphere below. The Earth's crust ranges from 5–70 kilometres (3.1–43.5 mi) in depth and is the outermost layer. The thin parts are the oceanic crust, which underlie the ocean basins (5–10 km) and are composed of dense (mafic) iron magnesium silicate igneous rocks, like basalt. The uppermost mantle together with the crust constitutes the lithosphere. The crust-mantle boundary occurs as two physically different events.

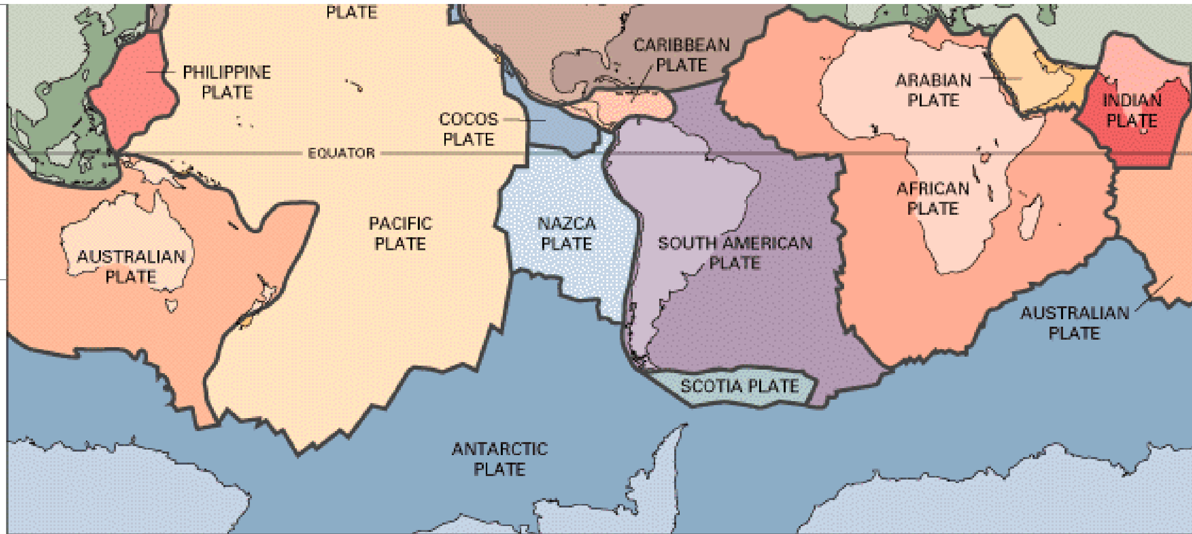
Depth
0-80km

Thickness
0-100kms



Composition
- Crust
- Moho

Right: The tectonic plates of the lithosphere on Earth.



The Crust (Lithosphere)

Depth 0-35km (0-22mi) **Thickness** 20-120kms **Temperature** 473-673K (200-400 °C) (392-752 °F)	The crust is the outermost layer of the Earth. It is made of solid rocks. It is mostly made of the lighter elements, silicon, oxygen, aluminium. Because of this, it is known as sial (silicon = Si; aluminium = Al) or felsic. The crust is a thin shell on the outside of the Earth, accounting for less than 1% of Earth's volume. It is the top component of lithosphere: a division of Earth's layers that includes the crust and the upper part of the mantle. The lithosphere is broken into tectonic plates that move, allowing heat to escape from the interior of the Earth into space. The crust lies on top of the mantle, a configuration that is stable because the upper mantle is made of peridotite and so is significantly denser than the crust. The boundary between the crust and mantle is conventionally placed at the Mohorovičić discontinuity, a boundary defined by a contrast in seismic velocity.

The crust of the Earth is of two distinctive types:
1. **Oceanic**: 5 km (3 mi) to 10 km (6 mi) thick and composed primarily of denser, more mafic rocks, such as basalt, diabase, and gabbro.
2. **Continental**: 30 km (20 mi) to 50 km (30 mi) thick and mostly composed of less dense, more felsic rocks, such as granite.

Because both continental and oceanic crust are less dense than the mantle below, both types of crust "float" on the mantle. This is isostasy, and it's also one of the reasons continental crust is higher than oceanic: continental is less dense and so "floats" higher. As a result, water pools in above the oceanic crust, forming the oceans.

The Moho (Mohorovičić Discontinuity)

Depth 35km (22mi) **Thickness** 500m	The moho, properly called the Mohorovičić discontinuity, is the boundary between the Earth's crust and the mantle. It was discovered by Croatian seismologist Andrija Mohorovičić in 1909. He discovered that seismograms of earthquakes showed two kinds of seismic waves. There is a shallow slower wave which arrives first, and a deep faster wave which arrives second. He reasoned that the deeper wave changed speed as it got just below the mantle. The reason it went faster was that the material of the mantle was different from that of the crust.

Mantle

Depth 35-2,890km **Thickness** 100-2,890km	**Composition** • Asthenosphere • Transition Zone • Upper Mantle • Lower Mantle • D" Layer	The mantle is the layer of the Earth right below the crust. It is made mostly of oxygen, silicon and the heavier element magnesium. It is known as sima (Si for silicon + ma for magnesium) or mafic. Earth's mantle extends to a depth of 2,890 km, making it the thickest layer of Earth. The mantle is divided into upper and lower mantle, which are separated by the transition zone. The mantle is composed of silicate rocks that are rich in iron and magnesium relative to the overlying crust. Although solid, the high temperatures within the mantle cause the silicate material to be sufficiently ductile that it can flow on very long timescales.

Asthenosphere

Depth 80-220km	The asthenosphere is underneath the lithosphere. It is about 100km thick, and is a region of the mantle that flows relatively easily. Reminder: It is not liquid. Something that appears to be solid on a short time scale can, in fact, be liquid. Glass is an example of an 'amorphous solid' – a material that is neither liquid nor solid. Over long periods of time glass can flow, forming (for example) windowpanes with thick bottoms and thin tops in old buildings. The mantle is like this. When it is under stress for long periods of time, it can flow. Due to the incredibly high temperatures and pressures near the centre of the Earth, the outer core is liquid iron and nickel, while the inner core is solid. The motion of the liquid outer core is what gives Earth its magnetic field.

Transition Zone

Depth 410-660km	The transition zone is the part of Earth's mantle that is located between the lower and the upper mantle, most strictly between the seismic-discontinuity depths of about 410 to 660 kilometres (250 to 410 mi), but more broadly defined as the zone encompassing those discontinuities, i.e., between about 300 and 850 kilometres (190 and 530 mi) depth. Earth's solid, rocky mantle, including the mantle transition zone (often abbreviated as MTZ), consists primarily of peridotite, an ultramafic igneous rock.

Upper Mantle

Depth 35-660km	**Temperature** 1,900K (1,626 °C) (2,958.8 °F)	The upper mantle of Earth is a very thick layer of rock inside the planet, which begins just beneath the crust (at about 10 km (6.2 mi) under the oceans and about 35 km (22 mi) under the continents) and ends at the top of the lower mantle at 670 km (420 mi). Temperatures range from approximately 500 K (227 °C; 440 °F) at the upper boundary with the crust to approximately 1,200 K (930 °C; 1,700 °F) at the boundary with the lower mantle. Upper mantle material that has come up onto the surface comprises about 55% olivine, 35% pyroxene, and 5 to 10% of calcium oxide and aluminum oxide minerals such as plagioclase, spinel, or garnet, depending upon depth.

Lower Mantle

Depth 660-2,890km	**Temperature** 1,900-3,000K (1,626-2,726 °C) (2,958-4939 °F)	The lower mantle, historically also known as the mesosphere, represents approximately 56% of Earth's total volume, and is the region from 660 to 2900 km below Earth's surface; between the transition zone and the outer core. The preliminary reference Earth model (PREM) separates the lower mantle into three sections, the uppermost (660–770 km), mid-lower mantle (770–2700 km), and the D layer (2700–2900 km). Pressure and temperature in the lower mantle range from 24–127 GPa and 1900–2600 K. It has been proposed that the composition of the lower mantle is pyrolitic, containing three major phases of bridgmanite, ferropericlase, and calcium-silicate perovskite. The high pressure in the lower mantle has been shown to induce a spin transition of iron-bearing bridgmanite and ferropericlase, which may affect both mantle plume dynamics and lower mantle chemistry.

D" Layer

Depth 2,740-2,890km	An approximately 200 km thick layer of the lower mantle directly above the CMB is referred to as the D" region ("D double-prime" or "D prime prime") and is sometimes included in discussions regarding the core–mantle boundary zone. The D" name originates from geophysicist Keith Bullen's designations for the Earth's layers. His system was to label each layer alphabetically, A through G, with the crust as 'A' and the inner core as 'G'.

Core

Core Total

Depth 2,890-6,360km	**Temperature** 3,000-7,000K (2,726-6,726 °C) (5,432-12,632 °F)	**Thickness** 2,890-6,360km	**Composition** ● Outer Core ● Inner Core

Outer Core

Depth 2,890-5,150km	**Temperature** 3,000-7,000K (2,726-6,726 °C) (5,432-12,632 °F)	The Earth's core is made of solid iron and nickel. Outer core is a liquid layer below the mantle. The average density of Earth is 5.515 g/cm3. Because the average density of surface material is only around 3.0 g/cm3, we must conclude that denser materials exist within Earth's core.

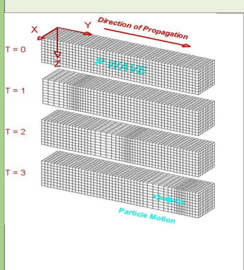
Inner Core

Depth 5,150-6,360km	**Temperature** 5,000-7,000K (4,726-6,726 °C) (9,032-12,632 °F)	The inner core was discovered in 1936 by Inge Lehmann and is generally believed to be composed primarily of iron and some nickel. Since this layer is able to transmit shear waves (transverse seismic waves), it must be solid. Inner core, is the very centre of the Earth.

5 Waves

Seismic waves are the waves of energy caused by the sudden breaking of rock within the earth or an explosion. They are the energy that travels through the earth and is recorded on seismographs. There are several different kinds of seismic waves, and they all move in different ways. The two main types of waves are body waves and surface waves. Body waves can travel through the earth's inner layers, but surface waves can only move along the surface of the planet like ripples on water. Earthquakes radiate seismic energy as both body and surface waves. Traveling through the interior of the earth, body waves arrive before the surface waves emitted by an earthquake. These waves are of a higher frequency than surface waves.

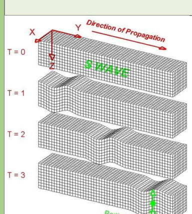
P Waves



The first kind of body wave is the P wave or primary wave. This is the fastest kind of seismic wave, and, consequently, the first to 'arrive' at a seismic station. The P wave can move through solid rock and fluids, like water or the liquid layers of the earth. It pushes and pulls the rock it moves through just like sound waves push and pull the air. Have you ever heard a big clap of thunder and heard the windows rattle at the same time? The windows rattle because the sound waves were pushing and pulling on the window glass much like P waves push and pull on rock.

Sometimes animals can hear the P waves of an earthquake. Dogs, for instance, commonly begin barking hysterically just before an earthquake 'hits' (or more specifically, before the surface waves arrive). Usually people can only feel the bump and rattle of these waves. P waves are also known as compressional waves, because of the pushing and pulling they do. Subjected to a P wave, particles move in the same direction that the wave is moving in, which is the direction that the energy is traveling in, and is sometimes called the 'direction of wave propagation'.

S Waves

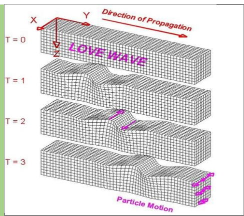


The second type of body wave is the S wave or secondary wave, which is the second wave you feel in an earthquake. An S wave is slower than a P wave and can only move through solid rock, not through any liquid medium. It is this property of S waves that led seismologists to conclude that the Earth's outer core is a liquid. S waves move rock particles up and down, or side-to-side--perpendicular to the direction that the wave is traveling in (the direction of wave propagation).

Surface Waves

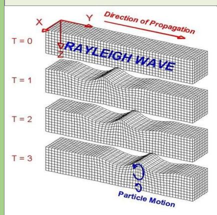
Travelling only through the crust, surface waves are of a lower frequency than body waves, and are easily distinguished on a seismogram as a result. Though they arrive after body waves, it is surface waves that are almost entirely responsible for the damage and destruction associated with earthquakes. This damage and the strength of the surface waves are reduced in deeper earthquakes.

Love Wave



The first kind of surface wave is called a Love wave, named after A.E.H. Love, a British mathematician who worked out the mathematical model for this kind of wave in 1911. It's the fastest surface wave and moves the ground from side-to-side. Confined to the surface of the crust, Love waves produce entirely horizontal motion.

Rayleigh Wave



The other kind of surface wave is the Rayleigh wave, named for John William Strutt, Lord Rayleigh, who mathematically predicted the existence of this kind of wave in 1885. A Rayleigh wave rolls along the ground just like a wave rolls across a lake or an ocean. Because it rolls, it moves the ground up and down, and side-to-side in the same direction that the wave is moving. Most of the shaking felt from an earthquake is due to the Rayleigh wave, which can be much larger than the other waves.

6 Measurement

Richter Scale

The Richter magnitude scale is a scale of numbers used to tell the size of earthquakes. Charles Richter developed the Richter Scale in 1935. His scale was based on the seismogram measured by a particular type of seismometer at a distance of 100 kilometres (62 mi) from the earthquake. Earthquakes 4.5 or higher on the Richter scale can be measured by tools all over the world. An earthquake a size that scores 3.0 is about 10 times the amplitude of one that scores 2.0. The energy that is released increases by a factor of about 32. Every increase of 1 on the Richter scale is 10, not 1, therefore it is a logarithmic scale. The earthquake with the biggest recorded magnitude was the Great Chilean Earthquake. It had a magnitude of 9.5 (approximately 9.5 on the Richter scale) and occurred in 1960. About 6,000 people died because of the earthquake.

Descriptor	Magnitude	Frequency	Damage
Micro	< 2.0	~8,000/Day	Micro (very small) earthquakes, people cannot feel these.
Very Minor	2.0-2.9	~1,000/Day	People do not feel these, but seismographs are able to detect them.
Minor	3.0-3.9	~134/Day	People often feel these, but they almost never cause damage.
Light	4.0-4.9	~17/Day	Objects inside houses are disturbed, causing noise. Things are rarely damaged.
Moderate	5.0-5.9	~2/Day	Buildings that are not built well may be damaged. Light objects inside a house may be moved.
Strong	6.0-6.9	~120/Year	Moderately powerful. May cause a lot of damage in a larger area.
Major	7.0-7.9	~18/Year	Can cause serious damage over larger areas.
Great	8.0-9.9	~1/20 Years	Massive damage is caused. Heavy objects are thrown into the air and cracks appear on the ground, as well as visible shockwaves. Overhead highways may be destroyed, and buildings are toppled.
Meteoric	10.0+	Unknown	There are no records of anything of this size. The vibration is about the same as that of a 24km (15 mile) wide meteor striking earth.

Mercalli Intensity Scale

The Mercalli intensity scale (or more precisely the Modified Mercalli intensity scale) is a scale to measure the intensity of earthquakes. Unlike with the Richter scale, the Mercalli scale does not take into account energy of an earthquake directly. Rather, they classify earthquakes by the effects they have (and the destruction they cause). When there is little damage, the scale describes how people felt the earthquake, or how many people felt it. Very often, non-geologists use this scale, because it is easier for people to describe what damage an earthquake caused, than to do calculations to get a value on the Richter scale.

Giuseppe Mercalli (1850-1914) originally developed the scale, with ten levels. In 1902, Adolfo Cancani extended the scale to include twelve levels. August Heinrich Sieberg completely rewrote the scale. For this reason, the scale is sometimes named Mercalli-Cancani-Sieberg scale, or MCS scale. The lower degrees of the Modified Mercalli Intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed damage to structures The large table gives Modified Mercalli scale intensities that are typically observed at locations near the epicentre of the earthquake.

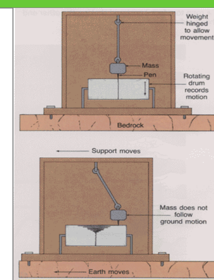
Mercalli Intensity Scale	Magnitude Correlation	Description
I. Not Felt	**<2.0**	Not felt by humans but technology is capable of sensing it.
II. Weak	**2.0 - 2.9**	Felt only by a few persons during sleep, especially on upper floors of buildings.
III. Weak	**2.0 - 3.9**	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV. Light	**3.9 - 4.9**	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V. Moderate	**4.0 - 5.9**	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI. Strong	**5.0 - 6.9**	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

VII. Very Strong	**6.0 - 7.9**	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII. Severe	**7.0 - 8.0+**	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX. Violent	**8.0+**	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X. Extreme	**8.0+**	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI. Extremely Dangerous	**9.0+**	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipe lines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII. Catastrophic	**10.0+**	Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into the air.

7 Seismograph

Most seismographs today are electronic, but a basic seismograph is made of a drum with paper on it, a bar or spring with a hinge at one or both ends, a weight, and a pen. The one end of the bar or spring is bolted to a pole or metal box that is bolted to the ground. The weight is put on the other end of the bar and the pen is stuck to the weight. The drum with paper on it presses against the pen and turns constantly. When there is an earthquake, everything in the seismograph moves except the weight with the pen on it. As the drum and paper shake next to the pen, the pen makes squiggly lines on the paper, creating a record of the earthquake.

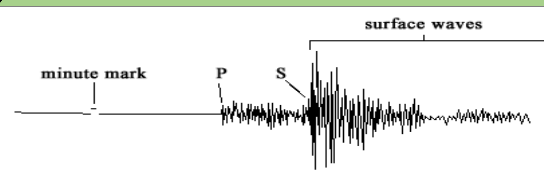
This record made by the seismograph is called a seismogram. By studying the seismogram, the seismologist can tell how far away the earthquake was and how strong it was. This record doesn't tell the seismologist exactly where the epicentre was, just that the earthquake happened so many miles or kilometres away from that seismograph. To find the exact epicentre, you need to know what at least two other seismographs in other parts of the country or world recorded. We'll get to that in a minute. First, you have to learn how to read a seismogram.



Reading a Seismogram

When you look at a seismogram, there will be wiggly lines all across it. These are all the seismic waves that the seismograph has recorded. Most of these waves were so small that nobody felt them. These tiny microseisms can be caused by heavy traffic near the seismograph, waves hitting a beach, the wind, and any number of other ordinary things that cause some shaking of the seismograph.

There may also be some little dots or marks evenly spaced along the paper. These are marks for every minute that the drum of the seismograph has been turning. How far apart these minute marks are will depend on what kind of seismograph you have.

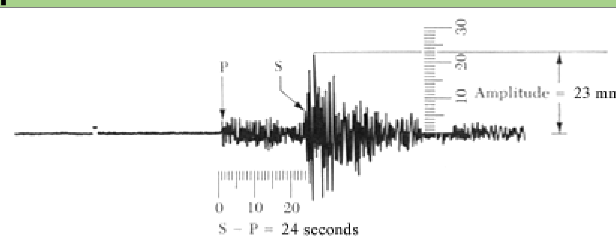


So which wiggles are the earthquake? The P wave will be the first wiggle that is bigger than the rest of the little ones (the microseisms). Because P waves are the fastest seismic waves, they will usually be the first ones that your seismograph records. The next set of seismic waves on your seismogram will be the S waves. These are usually bigger than the P waves. If there aren't any S waves marked on your seismogram, it probably means the earthquake happened on the other side of the planet. S waves can't travel through the liquid layers of the earth so these waves never made it to your seismograph. The surface waves (Love and Rayleigh waves) are the other, often larger, waves marked on the seismogram.

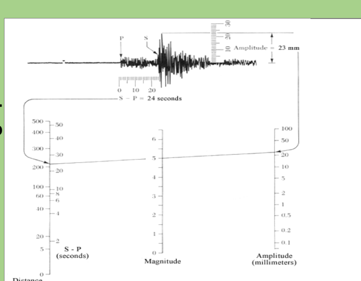
They have a lower frequency, which means that waves (the lines; the ups-and-downs) are more spread out. Surface waves travel a little slower than S waves (which, in turn, are slower than P waves) so they tend to arrive at the seismograph just after the S waves. For shallow earthquakes (earthquakes with a focus near the surface of the earth), the surface waves may be the largest waves recorded by the seismograph. Often they are the only waves recorded a long distance from medium-sized earthquakes.

Locating the Epicentre

To figure out just where that earthquake happened, you need to look at your seismogram and you need to know what at least two other seismographs recorded for the same earthquake. You will also need a map of the world, a ruler, a pencil, and a compass for drawing circles on the map. One minute intervals are marked by the small lines printed just above the squiggles made by the seismic waves (the time may be marked differently on some seismographs). The distance between the beginning of the first P wave and the first S wave tells you how many seconds the waves are apart. This number will be used to tell you how far your seismograph is from the epicentre of the earthquake.



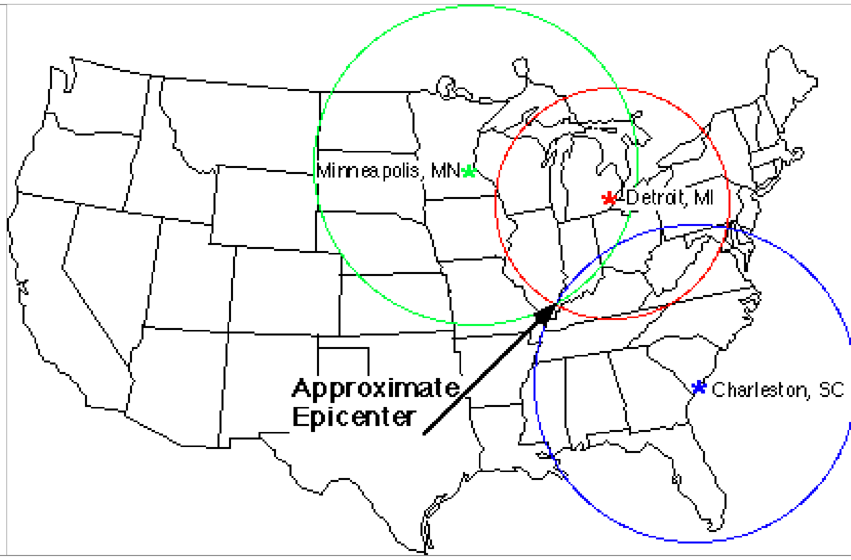
Finding Epicentre & the Magnitude



1. Measure the distance between the first P wave and the first S wave. In this case, the first P and S waves are 24 seconds apart.
2. Find the point for 24 seconds on the left side of the chart below and mark that point. According to the chart, this earthquake's epicentre was 215 kilometres away.
3. Measure the amplitude of the strongest wave. The amplitude is the height (on paper) of the strongest wave. On this seismogram, the amplitude is 23 millimetres. Find 23 millimetres on the right side of the chart and mark that point.
4. Place a ruler (or straight edge) on the chart between the points you marked for the distance to the epicentre and the amplitude. The point where your ruler crosses the middle line on the chart marks the magnitude (strength) of the earthquake. This earthquake had a magnitude of 5.0.

Finding the Epicentre

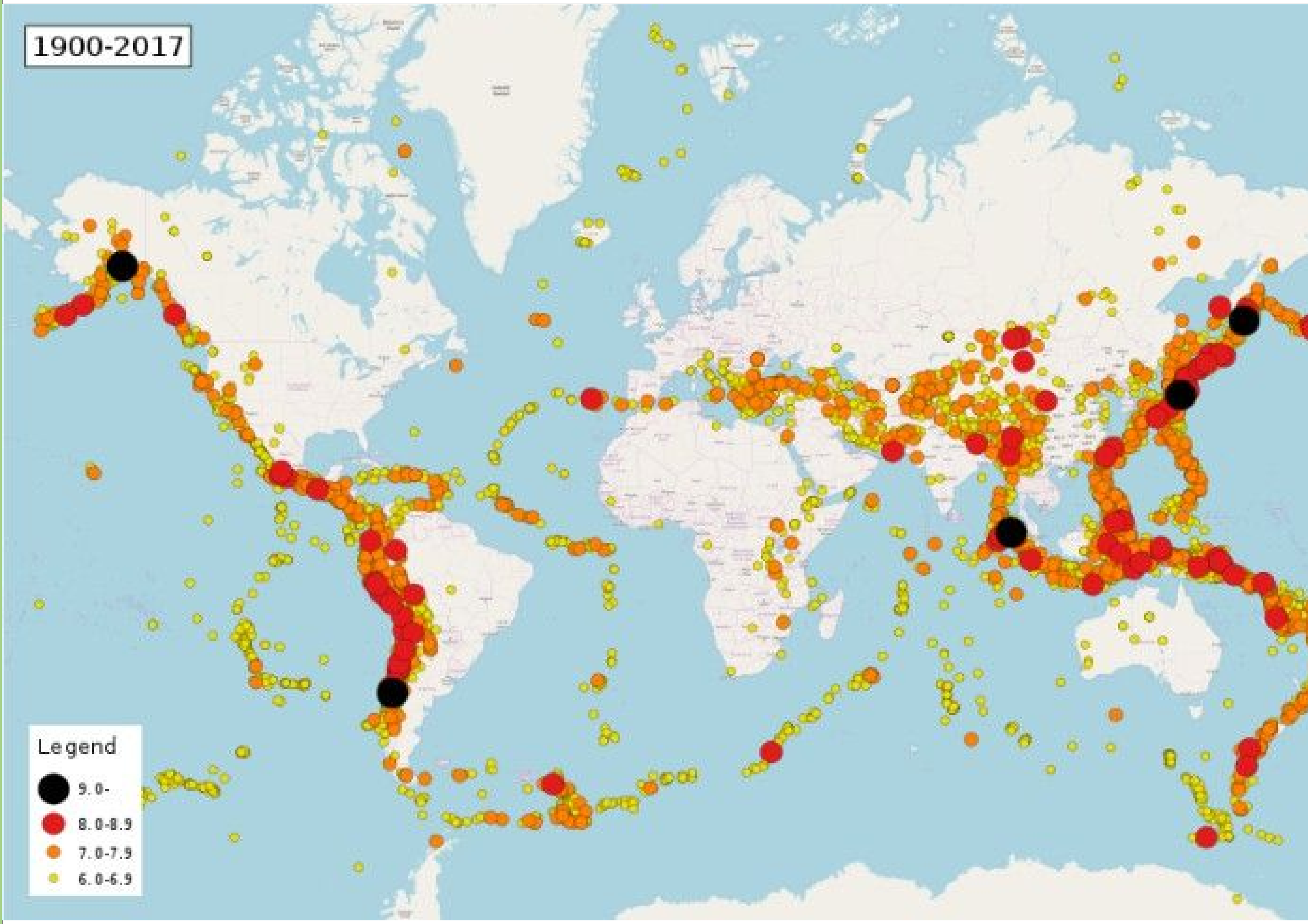
You have just figured out how far your seismograph is from the epicentre and how strong the earthquake was, but you still don't know exactly where the earthquake occurred. This is where the compass, the map, and the other seismograph records come in.



1	1. Check the scale on your map. It should look something like a piece of a ruler. All maps are different. On your map, one centimetre could be equal to 100 kilometres or something like that.
2	2. Figure out how long the distance to the epicentre (in centimetres) is on your map. For example, say your map has a scale where one centimetre is equal to 100 kilometres. If the epicentre of the earthquake is 215 kilometres away, that equals 2.15 centimetres on the map.
3	3. Using your compass, draw a circle with a radius equal to the number you came up with in Step #2 (the radius is the distance from the centre of a circle to its edge). The centre of the circle will be the location of your seismograph. The epicentre of the earthquake is somewhere on the edge of that circle.
4	4. Do the same thing for the distance to the epicentre that the other seismograms recorded (with the location of those seismographs at the centre of their circles). All of the circles should overlap. The point where all of the circles overlap is the approximate epicentre of the earthquake.

8 Earthquake History

Below is a map of all earthquakes 6.0 magnitude or higher since 1900. It's recommended to live somewhere far outside clusters of dots, but particularly the black and red ones.



Largest Earthquakes

A table of some of the biggest earthquakes ever recorded this century.

Location	Indonesia, Indian Ocean	Japan	Chile	Indonesia, Indian Ocean	Indonesia	Peru	Chile	Mexico	Peru	China	United States
Date	26 December 2004	11 March 2011	27 February 2010	11 April 2012	28 March 2005	23 June 2001	16 September 2015	8 September 2017	26 May 2019	12 May 2008	3 November 2002
Magnitude	9.2	9.1	8.8	8.6	8.6	8.4	8.3	8.2	8	7.9	7.9
Deaths	227,898	20,896	525	10	1300	100	14	98	2	87587	0

Frequency

These are the average frequencies of different sized earthquakes.

Magnitude	2-2.9	3-3.9	4-4.9	5-5.9	6-6.9	7-7.9	8+			
Annual Average	1,300,000	130,000	13,000	1,319	134	17	1			

9 Prediction

Earthquakes can't be precisely predicted, however you can estimate future quakes to a surprising level of accuracy by using a few basic techniques.

Earthquake Monitoring

The following is a list of websites you can monitor earthquakes from in real time. See the PREPAREDNESS > Situation Monitoring section for more monitoring programs related to other disasters.

Earthquake 3D (Online & Free)	http://www.earthquake3d.com/
Earthquake 3D Download (Free)	A downloadable earthquake viewer with only basic features. It still requires internet to download the latest earthquakes. http://www.wolton.net/quake.html

NATURAL DISASTERS | Earthquake | Prediction | Earthquake Monitoring

Earthquake 3D Enhanced ($20 USD)	A downloadable earthquake viewer with all the desired features. It still requires internet to download the latest earthquakes. http://www.wolton.net/quake.html
USGS (Online & Free)	https://earthquake.usgs.gov/earthquakes/map/
USGS (Online & Free)	https://earthquake.usgs.gov/earthquakes/map/
Earthquakes@GA (Online & Free)	https://earthquakes.ga.gov.au/
Latest Significant Earthquakes (Online & Free)	https://www.emsc-csem.org/Earthquake/significant_earthquakes.php

Deep Earthquakes

Prediction starts with locating deep earthquakes and their positioning on the planet. Deep earthquakes send shockwaves up to the surface over time and upon reaching the surface they manifest as surface quakes. Multiple deep earthquakes in close proximity start a relay effect which carries the wave across the globe setting off multiple quakes as it passes plates boundaries.

Quake Conversion
The depth of earthquakes has a substantial effect on future quake magnitudes in the same area. Find the depth of the quake then add the number to the strength of it and that's about the strength you should expect of a surface quake shortly after.

Depth - 150km Add - 0.3	Depth - 200km Add - 0.4	Depth - 250km Add - 0.5	Depth - 300km Add - 0.6	Depth - 350km Add - 0.7	Depth - 400km Add - 0.8	Depth - 450km Add - 0.9	Depth - 500km Add - 1.0	Depth - 550km Add - 1.1	Depth - 600km Add - 1.2	Depth - 650km Add - 1.3	Depth - 700km Add - 1.4

Dutchsinse (Michael Janitch) If trying to forecast earthquakes yourself is troublesome you should look up Dutchsinse's YouTube channel where he looks over all current earthquakes and offers his opinion.	**Website** www.dutchsinse.com/	**YouTube** https://www.youtube.com/channel/UCHE92x768p8h-fMrqhsnE1Q Or search for "Dutchsinse"

10 Preparation

How you can prepare for an earthquake of almost any scale in your area.

Earthquake Proofing

Look for any items around your home which may fall during an earthquake - particularly those which will cause hazards such as glass bottles. Go room-by-room and try shaking each piece of furniture, and securing anything that falls or is close to falling. If your area is particularly earthquake prone, designate a room where you'll head to. Have some mattresses ready which you can cover yourself with and some sort of reinforced frame to help prevent a roof collapse. Know how to turn off the electricity, water and gas. Have a pair of shoes handy in your preps to put on after an earthquake, as there's likely to be broken glass from windows and other unsecured items. Have a fire extinguisher in an accessible location and know how to use it. Take heavy objects off shelves. Fix or anchor tall furniture pieces to the wall so they can't fall.

11 Action

If You're Inside

- DROP to the ground; take COVER by getting under a sturdy table or other piece of furniture; and HOLD ON until the shaking stops. If there isn't a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.
- Stay away from glass, windows, outside doors and walls, and anything that could fall, such as lighting fixtures or furniture.
- Stay in bed if you are there when the earthquake strikes. Hold on and protect your head with a pillow, unless you are under a heavy light fixture that could fall. In that case, move to the nearest safe place.
- Do not use a doorway except if you know it is a strongly supported, load-bearing doorway and it is close to you. Many inside doorways are lightly constructed and do not offer protection.
- Stay inside until the shaking stops and it is safe to go outside. Do not exit a building during the shaking. Research has shown that most injuries occur when people inside buildings attempt to move to a different location inside the building or try to leave.
- Don't use elevators.
- Be aware that the electricity may go out or the sprinkler systems or fire alarms may turn on.

If You're Outside

- Stay outside.
- Move away from buildings, streetlights, and utility wires.
- Once in the open, stay there until the shaking stops. The greatest danger exists directly outside buildings, at exits and alongside exterior walls.

If You're in a Vehicle

Pull over to the side of the road, stop, and set the parking brake. Avoid overpasses, bridges, power lines, signs and other hazards. Stay inside the vehicle until the shaking stops, then proceed carefully by avoiding fallen debris, cracked or shifted payment, and emergency vehicles. If a power line falls on the car, stay inside until a trained person removes the wire.

If You're on the Shore

Follow instructions above for your particular location. Then as soon as shaking reduces such that you are able to stand, walk quickly to high ground or inland as a tsunami may arrive soon. Don't wait for officials to issue a warning. Walk, rather than drive, to avoid traffic, debris, and other hazards.

NATURAL DISASTERS Earthquake Action If You'

If you are near a large body of water (the ocean or a large lake), move to higher ground as soon as you can safely do so. Tsunami waves can arrive within minutes. Go on foot. Roads and bridges may be damaged. If evacuation is impossible, go to the third or higher floor of a sturdy building or climb a tree. This should only be used as a last resort. Stay away from the coast until officials tell you it is safe to return. The danger may last for days. If you are not in a tsunami zone, evacuate your home or office only if there is damage to the building or the surrounding area is unsafe. Consider relocating somewhere safer such as a friend's house or a community shelter. If the building is undamaged, it can be safe to remain, even if the power is out, but you will want to find an alternative location if power is not restored within a few days. If you need to evacuate to a shelter, take only your "grab-and-go" bag (Step 3) with essentials such as medication, important documents, prescription eye wear, etc. Shelters have limited space.

12 Post-Earthquake

NATURAL DISASTERS Earthquake Post-Earthquake

Trapped

Trapped

If you're trapped inside a house or under rubble after an earthquake:
● Do not light a match as there could be cut gas lines and it will consume your oxygen faster.
● Do not move around or kick up dust.
● Cover your mouth, nose and eyes with a handkerchief or clothing.
● Tap on a pipe or wall so rescuers can locate you. Use a whistle if one is available. Shout only as a last resort. Shouting can cause you to inhale dangerous amounts of dust.
● If you are bleeding, put pressure on the wound and elevate the injured part.

NATURAL DISASTERS Earthquake Post-Earthquake Risks

Risks

Fire	If you are trained and have a fire extinguisher handy, put out small fires in your home or neighbourhood immediately. Call for help, but don't wait for the fire department. Large fires are a sign to evacuate.
Downed Power Lines	If you see downed power lines, consider them energized and stay well away from them. Keep others away from them also. Never touch downed power lines or any objects in contact with them.
Damaged Wiring	Shut off power at the main breaker switch if there is any damage to your house wiring. Leave the power off until the damage is repaired.
Broken Appliances	Unplug these as they could start fires when electricity is restored.
Gas Leaks	Shut off the main gas valve only if you suspect a leak because of broken pipes, the odour or sound of leaking natural gas, or you see the meter spinning quickly. Only the gas company can turn the gas back on after they check for leaks, so shut it off only if necessary. The phone book has detailed information on this topic. Do not use candles or matches. You could start a fire and there may also be gas leaks. Use your flashlights, battery powered lights, and light sticks.
Fallen Items	Beware of items tumbling off shelves when you open the doors of closets and cupboards.
Spills	Use extreme caution. Clean up any spilled medicines, drugs, or other non-toxic substances. Potentially harmful materials such as bleach, lye, garden chemicals, and gasoline or other petroleum products should be isolated or covered with an absorbent such as dirt or cat litter. When in doubt, leave your home.
Damaged Masonry	Stay away from chimneys and walls made of brick or block. They may be weakened and could topple during aftershocks. Don't use a fireplace with a damaged chimney. It could start a fire or let poisonous gases into your home.

NATURAL DISASTERS Earthquake Post-Earthquake Risks

RAL DISASTERS Earthquake Post-Earthquake

Contact

Register on the Red Cross "Safe and Well" website so people will know you are okay: SafeAndWell.org. Phone service may be out. When possible, text or call your out-of-area contact and tell them where you are, then stay off the phone. This will allow calls to be made for emergencies. Surf the (battery-powered) radio dial to find a station that is on the air. Listen for public announcements and alerts. Listen to your NOAA Weather Radio for emergency information. Smart phones and computers are a great resource for information, as long as you have power or can recharge your batteries.

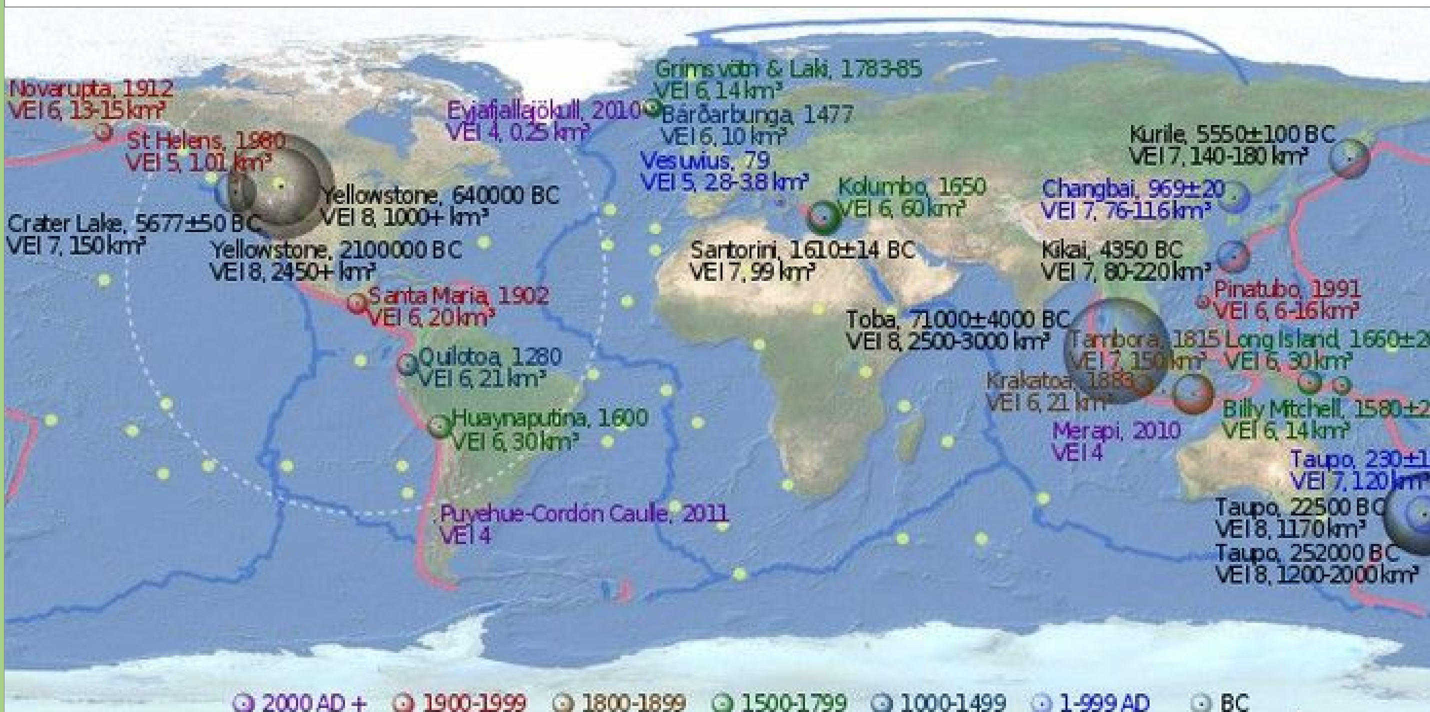
5 Volcano

A volcano is a rupture in the crust of a planetary-mass object, such as Earth, that allows hot lava, volcanic ash, and gases to escape from a magma chamber below the surface. Earth's volcanoes occur because its crust is broken into 17 major, rigid tectonic plates that float on a hotter, softer layer in its mantle. Therefore, on Earth, volcanoes are generally found where tectonic plates are diverging or converging, and most are found underwater. Volcanoes can also form where there is stretching and thinning of the crust's plates, e.g., in the East African Rift and the Wells Gray-Clearwater volcanic field and Rio Grande Rift in North America. This type of volcanism falls under the umbrella of "plate hypothesis" volcanism.

Volcanism away from plate boundaries has also been explained as mantle plumes. These so-called "hotspots", for example Hawaii, are postulated to arise from upwelling diapirs with magma from the core–mantle boundary, 3,000 km deep in the Earth. Volcanoes are usually not created where two tectonic plates slide past one another.

Erupting volcanoes can pose many hazards, not only in the immediate vicinity of the eruption. One such hazard is that volcanic ash can be a threat to aircraft, in particular those with jet engines where ash particles can be melted by the high operating temperature; the melted particles then adhere to the turbine blades and alter their shape, disrupting the operation of the turbine. Large eruptions can affect temperature as ash and droplets of sulfuric acid obscure the sun and cool the Earth's lower atmosphere (or troposphere); however, they also absorb heat radiated from the Earth, thereby warming the upper atmosphere (or stratosphere). Historically, volcanic winters have caused catastrophic famines.

This is a map of large volcano eruptions that have occured in the past. It's best to try and avoid living in these locations - just in case.



Previous Volcanos (By Date)	Mount Pinatubo Luzon, Philippines 1991, Jun 15 VEI 6 6-16 km3	Mount Tambora Lesser Sunda Islands, Indonesia 1815, Apr 10 VEI 7	Santa María Guatemala 1902, Oct 24 VEI 6	Krakatoa Indonesia 1883, Aug 26–27 VEI 6 At least 30,000 dead	Mount St. Helens Washington 1980 VEI 5 80,000-foot-tall plume of smoke, killing 57 people and destroying 200 homes

Categorisation

The Volcanic Explosivity Index (VEI) is a relative measure of the explosiveness of volcanic eruptions. They are logarithmic and each level in an increase by a factor of 10.

VEI Level	Description	Plume	Ejectable Material	Frequency	Tropo-spheric	Strato-spheric
VEI - 0	Effusive	<100m	0.00001 km³	Continuous	Negligible	None
VEI - 1	Gentle	100m-1km	0.001 km³	Daily	Minor	None
VEI - 2	Explosive	1km-5km	0.01 km³	2 Weeks	Moderate	None
VEI - 3	Catastrophic	3km-15km	0.1 km³	3 Months	Substantial	Possible
VEI - 4	Cataclysmic	>10km	1 km³	18 Months	Substantial	Definite
VEI - 5	Paroxysmic	>10km	10 km³	12 Years	Substantial	Significant
VEI - 6	Colossal	>20km	100 km³	50-100 Years	Substantial	Substantial
VEI - 7	Super-Colossal	>20km	500 km³	500-1,000 Years	Substantial	Substantial
VEI - 8	Mega-Colossal	>20km	1,000 km³	50,000 Years	Vast	Vast
VEI - 9	Extinction	>20km	10,000 km³	100,000 Years	Insane	Insane

Potential VEI 8 Supervolcano Locations

Yellowstone Caldera **Wyoming, United States**	The caldera and most of the park are located in the northwest corner of Wyoming. The major features of the caldera measure about 34 by 45 miles (55 by 72 km).
The Long Valley Caldera **California, United States**	The valley is one of the Earth's largest calderas, measuring about 20 miles (32 km) long (east-west), 11 miles (18 km) wide (north-south), and up to 3,000 feet (910 m) deep.

Valles Caldera Sandoval County, New Mexico, US	Last Eruption: 50,000–60,000 yrs. A 13.7-mile (22.0 km) wide volcanic caldera in the Jemez Mountains of northern New Mexico.
Lake Toba North Sumatra, Indonesia	The lake is about 100 kilometres (62 miles) long, 30 kilometres (19 mi) wide, and up to 505 metres (1,657 ft) deep.
Taupo Caldera New Zealand	
Aira Caldera	

Volcanic Components

Volcanic Ash (Tephra)

All explosive volcanic eruptions generate tephra, fragments of rock that are produced when magma or rock is explosively ejected. The largest fragments, blocks and bombs (>64 mm, 2.5 inches diameter), can be expelled with great force but are deposited near the eruptive vent. Lapilli-sized material (6-64 mm, 0.24-2.5 inches diameter) can be carried upward within in a volcanic plume and downwind in a volcanic cloud, but fall to the ground as the eruption cloud cools.

The smallest material, volcanic ash (<2 mm diameter) is both easily convected upward within the plume and carried downwind for very long distances; as it falls out of suspension it can potentially affect communities and farmland across hundreds, or even thousands, of square kilometres (miles). Ashfall rarely endangers human lives, but it can have devastating effects on the things that we rely upon from day to day. As a result of its fine-grained abrasive character and widespread distribution by wind, ashfall and volcanic ash clouds are a major hazard to aviation.

The primary hazard from Alaska volcanoes is ash clouds impacting aviation and ashfall reaching areas downwind, owing to widespread dispersal by wind. Ash fallout to the ground can pose significant disruption and damage to buildings, transportation, water and wastewater, power supply, communications equipment, agriculture, and primary production leading to potentially substantial societal impacts and costs, even at thicknesses of only a few millimetres or inches. Additionally, fine grained ash, when ingested can cause health impacts to humans and animals.

Impacts from ashfall are more complex and multi-faceted than for any of the other volcanic hazards. Variabilities include the distance from the eruption source, orientation and dispersion of the eruption cloud, the amount of ashfall received, physical and chemical properties of the ash, characteristics of the receiving environment (such as climate and land use), and the ability of affected community to adapt to ashfall.

Lava Flow

Lava flows are streams of molten rock that pour or ooze from an erupting vent. Lava is erupted during either nonexplosive activity or explosive lava fountains. The speed at which lava moves across the ground depends on several factors, including:
1. Type of lava erupted and its viscosity;
2. Steepness of the ground over which it travels;
3. Whether the lava flows as a broad sheet, through a confined channel, or down a lava tube; and
4. Rate of lava production at the vent.

Fluid basalt flows can extend tens of kilometres from an erupting vent. The leading edges of basalt flows can travel as fast as 10 km/h (6 mph) on steep slopes but they typically advance less than 1 km/h (0.27 m/s or about 1 ft/s) on gentle slopes. But when basalt lava flows are confined within a channel or lava tube on a steep slope, the main body of the flow can reach velocities >30 km/h (19 mph). Viscous andesite flows move only a few kilometres per hour (couple feet per second) and rarely extend more than 8 km (5 mi) from their vents.

Viscous dacite and rhyolite flows often form steep-sided mounds called lava domes over an erupting vent. Lava domes often grow by the extrusion of many individual flows >30 m (100 ft) thick over a period of several months or years. Such flows will overlap one another and typically move less than a few meters per hour. Everything in the path of an advancing lava flow will be knocked over, surrounded, buried, or ignited by the extremely hot temperature of lava. When lava erupts beneath a glacier or flows over snow and ice, meltwater from the ice and snow can result in far-reaching lahars.

If it enters a body of water or water enters a lava tube, the water may boil violently and cause an explosive shower of molten spatter over a wide area. Methane gas, produced as lava buries vegetation, can migrate in subsurface voids and explode when heated. Thick viscous lava flows, especially those that build a dome, can collapse to form fast-moving pyroclastic flows. Deaths caused directly by lava flows are uncommon because most move slowly enough that people can move out the way easily. Death and injury can result when onlookers approach an advancing lava flow too closely or their retreat is cut off by other flows. Deaths attributed to lava flows are often due to related causes, such as explosions when lava interacts with water, the collapse of an active lava delta that forms where lava enters a body of water, asphyxiation due to accompanying toxic gases, pyroclastic flows from a collapsing dome, and lahars from meltwater.

Other natural phenomena such as hurricanes, tornadoes, tsunami, fires, and earthquakes often destroy buildings, agricultural crops, and homes, but the owner(s) can usually rebuild or repair structures and their businesses in the same location. Lava flows, however, can bury homes and agricultural land under tens of meters of hardened black rock; landmarks and property lines become obscured by a vast, new hummocky landscape. People are rarely able to use land buried by lava flows or sell it for more than a small fraction of its previous worth.

Pyroclastic Flow

Pyroclastic flows contain a high-density mix of hot lava blocks, pumice, ash and volcanic gas. They move at very high speed down volcanic slopes, typically following valleys. Most pyroclastic flows consist of two parts: a lower (basal) flow of coarse fragments that moves along the ground, and a turbulent cloud of ash that rises above the basal flow. Ash may fall from this cloud over a wide area downwind from the pyroclastic flow.

Pyroclastic Flow Formation
● Collapse of eruption column: during a highly explosive eruption, the column ejected upwards into the atmosphere cools and can become too cool and dense to maintain upward momentum.
● "Boiling over" from eruptive vent: during an explosive eruption, material is erupted without forming a high plume and rapidly moves down slope.
● Collapse of lava domes or flows: The fronts of lava flows or domes can become so steep that they collapse due to gravitational force.

With rock fragments ranging in size from ash to boulders that travel across the ground at speeds typically greater than 80 km per hour (50 mph), pyroclastic flows knock down, shatter, bury or carry away nearly all objects and structures in their path. The extreme temperatures of rocks and gas inside pyroclastic flows, generally between 200-700°C (390-1300°F), can ignite fires and melt snow and ice. Pyroclastic flows vary considerably in size and speed, but even relatively small flows that move less than 5 km (3 mi) from a volcano can destroy buildings, forests, and farmland.

On the margins of pyroclastic flows, death and serious injury to people and animals may result from burns and inhalation of hot ash and gases. Pyroclastic flows generally follow valleys or other low-lying areas and, depending on the volume of rock debris carried by the flow, they can deposit layers of loose rock fragments to depths ranging from less than one meter to more than 200 m (up to about 700 ft).

Secondary hazards
● Eroding, melting and mixing with snow and ice, thereby sending a sudden torrent downstream.
● Damming or blocking streams in volcanic valleys, which may create lakes behind the blockage that eventually overtop and erode the blockage producing a rush of water and volcanic material downstream.
● Increasing the rate of stream runoff and erosion during rainstorms due to the creation of an easily eroded landscape with sparse vegetation.

Lahar

Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments that flows down the slopes of a volcano and typically enters a river valley. Small seasonal events are sometimes referred to as "debris flows", especially in the Cascades. Lahars generally occur on or near stratovolcanoes, such as those of the Aleutian volcanic arc in Alaska and the Cascade Range in the Western U.S. A moving lahar looks like a roiling slurry of wet concrete, and as it rushes downstream, the size, speed, and amount of material carried can constantly change.

The initial flow may be relatively small, but a lahar may grow in volume as it entrains and incorporates anything in its path – rocks, soil, vegetation, and even buildings and bridges. The flowing slurry may consume additional water through melting of snow and ice or by engulfing river or lake water. Voluminous lahars commonly grow to more than 10 times their initial size as they move downslope.

In steep areas, lahars can exceed speeds of 200 km/hr (120 mi/hr), but as they move farther away from a volcano and decelerate in lowland areas, they eventually begin to deposit some of the load and decrease in size. Eruptions may trigger lahars by melting snow and ice or by ejecting water from a crater lake. Pyroclastic flows can generate lahars when extremely hot, flowing rock debris erodes, mixes with, and melts snow and ice as it travel rapidly down steep slopes.

Lahars can also be formed when high-volume or long-duration rainfall occurs during or after an eruption. On steep slopes, rainwater can easily erode and transport fine-grained, loose volcanic sediment and form a slurry, especially if vegetation has not had time to grow back on recent volcanic deposits. Some of the largest lahars begin as landslides of wet, hydrothermally altered rock on the steep flanks of volcanoes. These types of collapse and resultant lahars are natural events during a stratovolcano's life history and can occur long after it stops erupting. Lake breakout floods that occur without an eruption can also lead to lahars.

They commonly occur after a stream becomes blocked by a volcanic landslide or pyroclastic flow that forms a natural dam. The most frequent cause of a lake breakout is the overflow of water across a newly formed natural dam, followed by rapid erosion of the loose rock debris. By further erosion and entrainment of sediment and water, the initial flood can transform into a slurry and increase in volume as it races downvalley. Large lahars can crush, abrade, bury, or carry away almost anything in their paths. Buildings and valuable land may be partially or completely buried.

By destroying bridges and roads, lahars can also trap people in areas vulnerable to other hazardous volcanic activity, especially if the lahars leave fresh deposits that are too deep, too soft, or too hot to cross. Over a period of weeks to years after a volcanic eruption, the erosion and transportation of loose volcanic deposits can lead to severe flooding in areas far downstream from a volcano. Intense rainfall easily erodes loose sediment on steep slopes to produce lahars that travel onto flood plains and bury entire towns and valuable agricultural land.

Carbon Dioxide Gas

In an average year, volcanoes release between about 180 and 440 million tonnes of carbon dioxide. When this colourless, odourless gas is emitted from volcanoes, it typically becomes diluted to low concentrations very quickly and is not life threatening. However, because cold carbon dioxide gas is heavier than air it can flow into in low-lying areas where it can reach much higher concentrations in certain, very stable atmospheric conditions. This can pose serious risks to people and animals. In volcanic or other areas where CO2 emissions occur, it is important to avoid small depressions and low areas that might be CO2 traps. The boundary between healthy air and lethal gas can be extremely sharp; even a single step upslope may be adequate to escape death.

Sulphur Dioxide Gas

Sulphur dioxide is a colourless gas with a pungent odor that irritates skin and the tissues and mucous membranes of the eyes, nose, and throat. SO2 emissions can cause acid rain and air pollution downwind of a volcano—at Kīlauea volcano in Hawaii, high concentrations of sulphur dioxide produce volcanic smog (VOG) causing persistent health problems for downwind populations. During very large eruptions, SO2 can be injected to altitudes of greater than 10km into the stratosphere. Here, SO2 is converted to sulphate aerosols which reflect sunlight and therefore have a cooling effect on the Earth's climate. They also have a role in ozone depletion, as many of the reactions that destroy ozone occur on the surface of such aerosols.

Hydrogen Sulfide Gas

Hydrogen sulfide is a colourless, flammable gas with a strong, offensive odor. It is sometimes referred to as sewer gas. Interestingly, the human nose is more sensitive to H2S than any gas monitoring instrument we have today: air mixtures with as little as 0.000001% H2S are associated with a rotten egg smell. Unfortunately, however, our sense of smell is not a reliable alarm - at mixing ratios above about 0.01%, H2S becomes odourless and very toxic, causing irritation of the upper respiratory tract and, during long exposure, pulmonary edema. Exposure to 500 ppm can cause a human to fall unconscious in 5 minutes and die in an hour or less.

Hydrogen Halides

When magma ascends close to the surface, volcanoes can emit the halogens fluorine, chlorine and bromine in the form of hydrogen halides (HF, HCl and HBr). These species are all strong acids and have high solubility; therefore they rapidly dissolve in water droplets within volcanic plumes or the atmosphere where they can potentially cause acid rain. In an ash-producing eruption, ash particles are also often coated with hydrogen halides. Once deposited, these coated ash particles can poison drinking water supplies, agricultural crops, and grazing land.

6 Flood

A flood is an overflow of water that submerges land that is usually dry. In the sense of "flowing water", the word may also be applied to the inflow of the tide. Floods are an area of study of the discipline hydrology and are of significant concern in agriculture, civil engineering and public health. Flooding may occur as an overflow of water from water bodies, such as a river, lake, or ocean, in which the water overtops or breaks levees, resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an areal flood. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, these changes in size are unlikely to be considered significant unless they flood property or drown domestic animals.

Floods can also occur in rivers when the flow rate exceeds the capacity of the river channel, particularly at bends or meanders in the waterway. Floods often cause damage to homes and businesses if they are in the natural flood plains of rivers. While riverine flood damage can be eliminated by moving away from rivers and other bodies of water, people have traditionally lived and worked by rivers because the land is usually flat and fertile and because rivers provide easy travel and access to commerce and industry. Some floods develop slowly, while others such as flash floods can develop in just a few minutes and without visible signs of rain. Additionally, floods can be local, impacting a neighborhood or community, or very large, affecting entire river basins.

For a simulation of flooding based on elevation, see **https://www.floodmap.net/**

Subheadings

1 Types

Areal

Floods can happen on flat or low-lying areas when water is supplied by rainfall or snowmelt more rapidly than it can either infiltrate or run off. The excess accumulates in place, sometimes to hazardous depths. Surface soil can become saturated, which effectively stops infiltration, where the water table is shallow, such as a floodplain, or from intense rain from one or a series of storms. Infiltration also is slow to negligible through frozen ground, rock, concrete, paving, or roofs. Areal flooding begins in flat areas like floodplains and in local depressions not connected to a stream channel, because the velocity of overland flow depends on the surface slope. Endorheic basins may experience areal flooding during periods when precipitation exceeds evaporation.

Riverine (Channel)

Floods occur in all types of river and stream channels, from the smallest ephemeral streams in humid zones to normally-dry channels in arid climates to the world's largest rivers. When overland flow occurs on tilled fields, it can result in a muddy flood where sediments are picked up by run off and carried as suspended matter or bed load. Localized flooding may be caused or exacerbated by drainage obstructions such as landslides, ice, debris, or beaver dams. Slow-rising floods most commonly occur in large rivers with large catchment areas. The increase in flow may be the result of sustained rainfall, rapid snow melt, monsoons, or tropical cyclones.

However, large rivers may have rapid flooding events in areas with dry climate, since they may have large basins but small river channels and rainfall can be very intense in smaller areas of those basins. Rapid flooding events, including flash floods, more often occur on smaller rivers, rivers with steep valleys, rivers that flow for much of their length over impermeable terrain, or normally-dry channels. The cause may be localized convective precipitation (intense thunderstorms) or sudden release from an upstream impoundment created behind a dam, landslide, or glacier.

In one instance, a flash flood killed eight people enjoying the water on a Sunday afternoon at a popular waterfall in a narrow canyon. Without any observed rainfall, the flow rate increased from about 50 to 1,500 cubic feet per second (1.4 to 42 m3/s) in just one minute. Two larger floods occurred at the same site within a week, but no one was at the waterfall on those days. The deadly flood resulted from a thunderstorm over part of the drainage basin, where steep, bare rock slopes are common and the thin soil was already saturated.

Flash floods are the most common flood type in normally-dry channels in arid zones, known as arroyos in the southwest United States and many other names elsewhere. In that setting, the first flood water to arrive is depleted as it wets the sandy stream bed. The leading edge of the flood thus advances more slowly than later and higher flows. As a result, the rising limb of the hydrograph becomes ever quicker as the flood moves downstream, until the flow rate is so great that the depletion by wetting soil becomes insignificant.

Estuarine and Coastal

Flooding in estuaries is commonly caused by a combination of sea tidal surges caused by winds and low barometric pressure, and they may be exacerbated by high upstream river flow. Coastal areas may be flooded by storm events at sea, resulting in waves over-topping defenses or in severe cases by tsunami or tropical cyclones. A storm surge, from either a tropical cyclone or an extratropical cyclone, falls within this category. Research from the NHC (National Hurricane Center) explains: "Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides. Storm surge should not be confused with storm tide, which is defined as the water level rise due to the combination of storm surge and the astronomical tide. This rise in water level can cause extreme flooding in coastal areas particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 20 feet or more in some cases."

Urban Flooding

Urban flooding is the inundation of land or property in a built environment, particularly in more densely populated areas, caused by rainfall overwhelming the capacity of drainage systems, such as storm sewers. Although sometimes triggered by events such as flash flooding or snowmelt, urban flooding is a condition, characterized by its repetitive and systemic impacts on communities, that can happen regardless of whether or not affected communities are located within designated floodplains or near any body of water. Aside from potential overflow of rivers and lakes, snowmelt, stormwater or water released from damaged water mains may accumulate on property and in public rights-of-way, seep through building walls and floors, or backup into buildings through sewer pipes, toilets and sinks.

In urban areas, flood effects can be exacerbated by existing paved streets and roads, which increase the speed of flowing water. The flood flow in urbanized areas constitutes a hazard to both the population and infrastructure. Some recent catastrophes include the inundations of Nîmes (France) in 1998 and Vaison-la-Romaine (France) in 1992, the flooding of New Orleans (USA) in 2005, and the flooding in Rockhampton, Bundaberg, Brisbane during the 2010–2011 summer in Queensland (Australia). Flood flows in urban environments have been studied relatively recently despite many centuries of flood events. Some recent research has considered the criteria for safe evacuation of individuals in flooded areas.

Catastrophic

Catastrophic riverine flooding is usually associated with major infrastructure failures such as the collapse of a dam, but they may also be caused by drainage channel modification from a landslide, earthquake or volcanic eruption. Examples include outburst floods and lahars. Tsunamis can cause catastrophic coastal flooding, most commonly resulting from undersea earthquakes.

2 Causes

Upslope Factors

The amount, location, and timing of water reaching a drainage channel from natural precipitation and controlled or uncontrolled reservoir releases determines the flow at downstream locations. Some precipitation evaporates, some slowly percolates through soil, some may be temporarily sequestered as snow or ice, and some may produce rapid runoff from surfaces including rock, pavement, roofs, and saturated or frozen ground. The fraction of incident precipitation promptly reaching a drainage channel has been observed from nil for light rain on dry, level ground to as high as 170 percent for warm rain on accumulated snow. Most precipitation records are based on a measured depth of water received within a fixed time interval. Frequency of a precipitation threshold of interest may be determined from the number of measurements exceeding that threshold value within the total time period for which observations are available. Individual data points are converted to intensity by dividing each measured depth by the period of time between observations. This intensity will be less than the actual peak intensity if the duration of the rainfall event was less than the fixed time interval for which measurements are reported.

Convective precipitation events (thunderstorms) tend to produce shorter duration storm events than orographic precipitation. Duration, intensity, and frequency of rainfall events are important to flood prediction. Short duration precipitation is more significant to flooding within small drainage basins. The most important upslope factor in determining flood magnitude is the land area of the watershed upstream of the area of interest. Rainfall intensity is the second most important factor for watersheds of less than approximately 30 square miles or 80 square kilometres. The main channel slope is the second most important factor for larger watersheds. Channel slope and rainfall intensity become the third most important factors for small and large watersheds, respectively. Time of Concentration is the time required for runoff from the most distant point of the upstream drainage area to reach the point of the drainage channel controlling flooding of the area of interest. The time of concentration defines the critical duration of peak rainfall for the area of interest. The critical duration of intense rainfall might be only a few minutes for roof and parking lot drainage structures, while cumulative rainfall over several days would be critical for river basins.

Downslope Factors

Water flowing downhill ultimately encounters downstream conditions slowing movement. The final limitation in coastal flooding lands is often the ocean or some coastal flooding bars which form natural lakes. In flooding low lands, elevation changes such as tidal fluctuations are significant determinants of coastal and estuarine flooding. Less predictable events like tsunamis and storm surges may also cause elevation changes in large bodies of water. Elevation of flowing water is controlled by the geometry of the flow channel and, especially, by depth of channel, speed of flow and amount of sediments in it.

Flow channel restrictions like bridges and canyons tend to control water elevation above the restriction. The actual control point for any given reach of the drainage may change with changing water elevation, so a closer point may control for lower water levels until a more distant point controls at higher water levels. Effective flood channel geometry may be changed by growth of vegetation, accumulation of ice or debris, or construction of bridges, buildings, or levees within the flood channel.

Coincidence

Extreme flood events often result from coincidence such as unusually intense, warm rainfall melting heavy snow pack, producing channel obstructions from floating ice, and releasing small impoundments like beaver dams. Coincident events may cause extensive flooding to be more frequent than anticipated from simplistic statistical prediction models considering only precipitation runoff flowing within unobstructed drainage channels. Debris modification of channel geometry is common when heavy flows move uprooted woody vegetation and flood-damaged structures and vehicles, including boats and railway equipment. Recent field measurements during the 2010–11 Queensland floods showed that any criterion solely based upon the flow velocity, water depth or specific momentum cannot account for the hazards caused by velocity and water depth fluctuations.

These considerations ignore further the risks associated with large debris entrained by the flow motion. Some researchers have mentioned the storage effect in urban areas with transportation corridors created by cut and fill. Culverted fills may be converted to impoundments if the culverts become blocked by debris, and flow may be diverted along streets. Several studies have looked into the flow patterns and redistribution in streets during storm events and the implication on flood modelling.

3 Effects

The primary effects of flooding include loss of life and damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. Floods also frequently damage power transmission and sometimes power generation, which then has knock-on effects caused by the loss of power. This includes loss of drinking water treatment and water supply, which may result in loss of drinking water or severe water contamination. It may also cause the loss of sewage disposal facilities. Lack of clean water combined with human sewage in the flood waters raises the risk of waterborne diseases, which can include typhoid, giardia, cryptosporidium, cholera and many other diseases depending upon the location of the flood.

Damage to roads and transport infrastructure may make it difficult to mobilize aid to those affected or to provide emergency health treatment. Flood waters typically inundate farm land, making the land unworkable and preventing crops from being planted or harvested, which can lead to shortages of food both for humans and farm animals. Entire harvests for a country can be lost in extreme flood circumstances. Some tree species may not survive prolonged flooding of their root systems.

Economic hardship due to a temporary decline in tourism, rebuilding costs, or food shortages leading to price increases is a common after-effect of severe flooding. The impact on those affected may cause psychological damage to those affected, in particular where deaths, serious injuries and loss of property occur. Urban flooding can cause chronically wet houses, leading to the growth of indoor mold and resulting in adverse health effects, particularly respiratory symptoms. Urban flooding also has significant economic implications for affected neighborhoods. In the United States, industry experts estimate that wet basements can lower property values by 10–25 percent and are cited among the top reasons for not purchasing a home. According to the U.S. Federal Emergency Management Agency (FEMA), almost 40 percent of small businesses never reopen their doors following a flooding disaster. In the United States, insurance is available against flood damage to both homes and businesses.

Benefits
Floods (in particular more frequent or smaller floods) can also bring many benefits, such as recharging ground water, making soil more fertile and increasing nutrients in some soils. Flood waters provide much needed water resources in arid and semi-arid regions where precipitation can be very unevenly distributed throughout the year and kills pests in the farming land. Freshwater floods particularly play an important role in maintaining ecosystems in river corridors and are a key factor in maintaining floodplain biodiversity.

Flooding can spread nutrients to lakes and rivers, which can lead to increased biomass and improved fisheries for a few years. For some fish species, an inundated floodplain may form a highly suitable location for spawning with few predators and enhanced levels of nutrients or food. Fish, such as the weather fish, make use of floods in order to reach new habitats. Bird populations may also profit from the boost in food production caused by flooding. Periodic flooding was essential to the well-being of ancient communities along the Tigris-Euphrates Rivers, the Nile River, the Indus River, the Ganges and the Yellow River among others. The viability of hydropower, a renewable source of energy, is also higher in flood prone regions.

4 Flood Safety Planning

At the most basic level, the best defense against floods is to seek higher ground for high-value uses while balancing the foreseeable risks with the benefits of occupying flood hazard zones. Critical community-safety facilities, such as hospitals, emergency-operations centers, and police, fire, and rescue services, should be built in areas least at risk of flooding. Structures, such as bridges, that must unavoidably be in flood hazard areas should be designed to withstand flooding. Areas most at risk for flooding could be put to valuable uses that could be abandoned temporarily as people retreat to safer areas when a flood is imminent. Planning for flood safety involves many aspects of analysis and engineering, including:

- Observation of previous and present flood heights and inundated areas,
- Statistical, hydrologic, and hydraulic model analyses,
- Mapping inundated areas and flood heights for future flood scenarios,
- Long-term land use planning and regulation,
- Engineering design and construction of structures to control or withstand flooding,
- Intermediate-term monitoring, forecasting, and emergency-response planning, and
- Short-term monitoring, warning, and response operations.

Each topic presents distinct yet related questions with varying scope and scale in time, space, and the people involved. Attempts to understand and manage the mechanisms at work in floodplains have been made for at least six millennia. In the United States, the Association of State Floodplain Managers works to promote education, policies, and activities that mitigate current and future losses, costs, and human suffering caused by flooding and to protect the natural and beneficial functions of floodplains – all without causing adverse impacts. A portfolio of best practice examples for disaster mitigation in the United States is available from the Federal Emergency Management Agency.

In many countries around the world, waterways prone to floods are often carefully managed. Defenses such as detention basins, levees, bunds, reservoirs, and weirs are used to prevent waterways from overflowing their banks. When these defenses fail, emergency measures such as sandbags or portable inflatable tubes are often used to try to stem flooding. Coastal flooding has been addressed in portions of Europe and the Americas with coastal defenses, such as sea walls, beach nourishment, and barrier islands.

In the riparian zone near rivers and streams, erosion control measures can be taken to try to slow down or reverse the natural forces that cause many waterways to meander over long periods of time. Flood controls, such as dams, can be built and maintained over time to try to reduce the occurrence and severity of floods as well. In the United States, the U.S. Army Corps of Engineers maintains a network of such flood control dams. In areas prone to urban flooding, one solution is the repair and expansion of man-made sewer systems and stormwater infrastructure.

Another strategy is to reduce impervious surfaces in streets, parking lots and buildings through natural drainage channels, porous paving, and wetlands (collectively known as green infrastructure or sustainable urban drainage systems (SUDS)). Areas identified as flood-prone can be converted into parks and playgrounds that can tolerate occasional flooding. Ordinances can be adopted to require developers to retain stormwater on site and require buildings to be elevated, protected by floodwalls and levees, or designed to withstand temporary inundation. Property owners can also invest in solutions themselves, such as re-landscaping their property to take the flow of water away from their building and installing rain barrels, sump pumps, and check valves.

Sandbagging

A simple guide on how to sandbag to protect a property against flooding. When placed correctly, sandbags can reduce the impact of flooding on your home or business. Sandbags will not stop the water completely but can reduce the amount of water entering your property.

Filling
- Only use sand to fill hessian bags. Do not use dirt.
- Only fill sandbag two-thirds full.
- Do not over fill the sandbag as it will be too heavy to carry.
- Do not tie the top of the sandbag, instead leave it open and place the next bag on top of the open end.
- Take care when filling and lifting the sandbag, to avoid injury.

Where
- Cover drainage holes in home e.g. showers, toilets, sinks to stop back flow of water.
- Place a small wall across doorways, at least the height of the expected water level. Be careful not to trap yourself inside.
- If available, plastic sheeting may be used under sandbags to reduce the seepage.
- For most buildings, to reduce the impact of flooding, sandbags should be placed over floor wastes and drains (e.g. laundry, shower and bath) to prevent backflow of grey water entering. Sandbags should be used in front of doorways /roller doors and brickwork vents.
- Most standard homes and buildings on a concrete slab can be protected with less than 25 sandbags.
- It is not always necessary to place a sandbag wall around your whole building to provide protection. This may only be necessary if it is on stumps or constructed of materials such as timber or bro sheeting. Before building a sandbag wall, consider how you would remove floodwater that could become trapped between the sandbag wall and your building. (e.g. pump, siphon or bailing bucket).

Where (cont.)
- Place a small sandbag wall across doorways. The number of layers required will be dependent on the expected flood height, however it is generally around two (2) sandbag rows high.
- Make sure that you have at least one doorway that you can use to access or exit the building – do this by building a wall that allows the door to still be opened (refer to photos overleaf).
- Air vents between brickwork may also require sandbags. Small vents may be covered with waterproof tape or plastic.
- Cover all drainage holes and floor drains to stop backflow of contaminated water.
- Protect air vents or drains with sandbags or tape.
- To avoid back flow of grey water block toilets with a small plastic bag of sand, weighed down by a larger sandbag.

Laying
- Lay sandbags like brickwork. Stagger rows so that the joins do not line up.
- Start at one end and work to the other end.
- Ensure the unfilled part of the bag is covered by the next bag.
- Tuck flap under the bag at the end of the row.
- If the sandbag wall is going to be more than five (5) bags high, you will need to lay two (2) rows wide.

TIP: Flattening the top of the sandbag row before adding the next row will help the structure.

Disposal
- Sturdy gloves should be worn when handling wet sandbags as they can contain chemicals, waste and diseases.
- Sandbags that have been in contact with floodwater need to be thrown away.
- Contact your local council to find out how to dispose of your sandbags safely.

Other Flood Protection

- Raising valuables off the floor may prevent damage to personal items from floodwater that may still enter.
- Lifting of curtains, rugs and bedding, and removing items from low cupboards may be necessary.
- Turn off power and gas at the mains.

5 History

This is a table of some of the deadliest floods in the world.

Event	1931 China Floods	1887 Yellow River Flood	1938 Yellow River Flood	Banqiao Dam Failure	2004 Indian Ocean Tsunami	1935 Yangtze River Flood	St. Felix's Flood, Storm Surge	Hanoi and Red River Delta Flood	1911 Yangtze River Flood	1911 Yangtze River Flood	
Location	China	China	China	China	Indonesia	China	Netherlands	North Vietnam	China	China	
Date	1931	1887	1938	1975	2004	1935	1530	1971	1911	1911	
Deaths	2.5m–3.7m	900K–2m	500K–700K	231K	230K	145K	100K+	100K	100K	100K	

6 Storm Surge

A storm surge, storm flood, tidal surge or storm tide is a coastal flood or tsunami-like phenomenon of rising water commonly associated with low pressure weather systems (such as tropical cyclones), the severity of which is affected by the shallowness and orientation of the water body relative to storm path, as well as the timing of tides. Most casualties during tropical cyclones occur as the result of storm surges. It is a measure of the rise of water beyond what would be expected by the normal movement related to tides. The two main meteorological factors contributing to a storm surge are a long fetch of winds spiraling inward toward the storm, and a low-pressure-induced dome of water drawn up under and trailing the storm's center.

Mechanics

At least five processes can be involved in altering tide levels during storms:

- The atmospheric pressure effect
- The direct wind effect
- The effect of the Earth's rotation
- The rainfall effect.
- The effect of waves near the shore

The pressure effects of a tropical cyclone will cause the water level in the open ocean to rise in regions of low atmospheric pressure and fall in regions of high atmospheric pressure. The rising water level will counteract the low atmospheric pressure such that the total pressure at some plane beneath the water surface remains constant. This effect is estimated at a 10 mm (0.39 in) increase in sea level for every millibar (hPa) drop in atmospheric pressure. Strong surface winds cause surface currents at a 45° angle to the wind direction, by an effect known as the Ekman Spiral. Wind stresses cause a phenomenon referred to as "wind set-up", which is the tendency for water levels to increase at the downwind shore and to decrease at the upwind shore.

Intuitively, this is caused by the storm blowing the water toward one side of the basin in the direction of its winds. Because the Ekman Spiral effects spread vertically through the water, the effect is proportional to depth. The pressure effect and the wind set-up on an open coast will be driven into bays in the same way as the astronomical tide. The Earth's rotation causes the Coriolis effect, which bends currents to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. When this bend brings the currents into more perpendicular contact with the shore, it can amplify the surge, and when it bends the current away from the shore it has the effect of lessening the surge.

The effect of waves, while directly powered by the wind, is distinct from a storm's wind-powered currents. Powerful wind whips up large, strong waves in the direction of its movement. Although these surface waves are responsible for very little water transport in open water, they may be responsible for significant transport near the shore. When waves are breaking on a line more or less parallel to the beach, they carry considerable water shoreward. As they break, the water particles moving toward the shore have considerable momentum and may run up a sloping beach to an elevation above the mean water line, which may exceed twice the wave height before breaking. The rainfall effect is experienced predominantly in estuaries. Hurricanes may dump as much as 12 in (300 mm) of rainfall in 24 hours over large areas and higher rainfall densities in localized areas. As a result, surface runoff can quickly flood Streams and rivers. This can increase the water level near the head of tidal estuaries as storm-driven waters surging in from the ocean meet rainfall flowing downstream into the estuary.

Extratropical Storms
Similar to tropical cyclones, extratropical cyclones cause an offshore rise of water. However, unlike most tropical cyclone storm surges, extratropical cyclones can cause higher water levels across a large area for longer periods of time, depending on the system. In North America, extratropical storm surges may occur on the Pacific and Alaska coasts, and north of 31°N on the Atlantic Coast. Coasts with sea ice may experience an "ice tsunami" causing significant damage inland. Extratropical storm surges may be possible further south for the Gulf coast mostly during the wintertime, when extratropical cyclones affect the coast, such as in the 1993 Storm of the Century.

Reverse Storm Surge
Water can also be sucked away from shore prior to a storm surge. This was the case on the western Florida coast in 2017, just before Hurricane Irma made landfall, uncovering land usually underwater. This phenomenon is known as a reverse storm surge, or a negative storm surge.

7 Cloudburst

A cloudburst is an extreme amount of precipitation in a short period of time, sometimes accompanied by hail and thunder, which is capable of creating flood conditions. A cloudburst can suddenly dump large amounts of water e.g. 25 mm of precipitation corresponds to 25,000 metric tons/km2 (1 inch corresponds to 72,300 short tons over one square mile). However, cloudbursts are infrequent as they occur only via orographic lift or occasionally when a warm air parcel mixes with cooler air, resulting in sudden condensation. At times, a large amount of runoff from higher elevations is mistakenly conflated with a cloudburst. The term "cloudburst" arose from the notion that clouds were akin to water balloons and could burst, resulting in rapid precipitation. Though this idea has since been disproven, the term remains in use.

Properties
Rainfall rate equal to or greater than 100 millimetres (3.9 in) per hour is a cloudburst. However, different definitions are used, e.g. the Swedish weather service SMHI defines the corresponding Swedish term "skyfall" as 1 mm/min for short bursts and 50 mm/h for longer rainfalls. The associated convective cloud can extend up to a height of 15 kilometres (9.3 mi) above the ground. During a cloudburst, more than 20 millimetres (0.79 in) of rain may fall in a few minutes. The results of cloudbursts can be disastrous. Cloudbursts are also responsible for flash flood creation. Rapid precipitation from cumulonimbus clouds is possible due to the Langmuir precipitation process in which large droplets can grow rapidly by coagulating with smaller droplets which fall down slowly. It is not essential that cloudbursts occur only when a cloud clashes with a solid body like a mountain. They can also occur when hot water vapor mingles into the cold resulting in sudden condensation.

Record Cloudbursts

Duration	1 minute	5.5 minutes	15 minutes	20 minutes	40 minutes	1 hour	1 hour	1.5 hours	5 hours	10 hours	
Rainfall	38.10 mm (1.5 inches)	61.72 mm (2.43 inches)	198.12 mm (7.8 inches)	205.74 mm (8.1 inches)	234.95 mm (9.25 inches)	250 mm (9.84 inches)	144 mm (5.67 inches)	182 mm (7.15 inches)	390 mm (15.35 inches)	1,448 mm (57.00 inches)	
Location	Basse-Terre, Guadeloupe	Port Bell, Panama	Plumb Point, Jamaica	Curtea de Argeș, Romania	Guinea, Virginia, United States	Leh, Jammu and Kashmir, India	Pune, Maharashtra, India	Pune, Maharashtra, India	La Plata, Buenos Aires, Argentina	Mumbai, Maharashtra, India	
Date	26-Nov-70	29-Nov-11	12-May-16	7-Jul-47	24-Aug-06	August 5, 2010	September 29, 2010	October 4, 2010	April 2, 2013	July 26, 2005	

Locations
In the Indian subcontinent, a cloudburst usually occurs when a monsoon cloud drifts northwards, from the Bay of Bengal or Arabian Sea across the plains, then onto the Himalayas and bursts, bringing rainfall as high as 75 millimetres per hour. The uplands adjacent to the Front Range of Colorado and the streams which drain the Front Range are subject to occasional cloudbursts and flash floods. This weather pattern is associated with upslope winds bringing moisture northwestward from the Gulf of Mexico.

8 Monsoon

Monsoon is traditionally defined as a seasonal reversing wind accompanied by corresponding changes in precipitation, but is now used to describe seasonal changes in atmospheric circulation and precipitation associated with the asymmetric heating of land and sea. Usually, the term monsoon is used to refer to the rainy phase of a seasonally changing pattern, although technically there is also a dry phase. The term is sometimes incorrectly used for locally heavy but short-term rains, although these rains meet the dictionary definition of monsoon. The major monsoon systems of the world consist of the West African and Asia-Australian monsoons. The inclusion of the North and South American monsoons with incomplete wind reversal has been debated. The term was first used in English in British India and neighbouring countries to refer to the big seasonal winds blowing from the Bay of Bengal and Arabian Sea in the southwest bringing heavy rainfall to the area.

Strength of Impact
The impact of monsoon on the local weather is different from place to place. In some places there is just a likelihood of having a little more or less rain. In other places, quasi semi-deserts are turned into vivid green grasslands where all sorts of plants and crops can flourish. The Indian Monsoon turns large parts of India from a kind of semi-desert into green lands. In the Western Ghats it is crucial for farmers to have the right timing for putting the seeds on the fields, as it is essential to use all the rain that is available for growing crops.

Process

Monsoons are large-scale sea breezes which occur when the temperature on land is significantly warmer or cooler than the temperature of the ocean. These temperature imbalances happen because oceans and land absorb heat in different ways. Over oceans, the air temperature remains relatively stable for two reasons: water has a relatively high heat capacity (3.9 to 4.2 J g−1 K−1), and because both conduction and convection will equilibrate a hot or cold surface with deeper water (up to 50 metres).

In contrast, dirt, sand, and rocks have lower heat capacities (0.19 to 0.35 J g−1 K−1), and they can only transmit heat into the earth by conduction and not by convection. Therefore, bodies of water stay at a more even temperature, while land temperature are more variable. During warmer months sunlight heats the surfaces of both land and oceans, but land temperatures rise more quickly. As the land's surface becomes warmer, the air above it expands and an area of low pressure develops. Meanwhile, the ocean remains at a lower temperature than the land, and the air above it retains a higher pressure.

This difference in pressure causes sea breezes to blow from the ocean to the land, bringing moist air inland. This moist air rises to a higher altitude over land and then it flows back toward the ocean (thus completing the cycle). However, when the air rises, and while it is still over the land, the air cools. This decreases the air's ability to hold water, and this causes precipitation over the land. This is why summer monsoons cause so much rain over land.

In the colder months, the cycle is reversed. Then the land cools faster than the oceans and the air over the land has higher pressure than air over the ocean. This causes the air over the land to flow to the ocean. When humid air rises over the ocean, it cools, and this causes precipitation over the oceans. (The cool air then flows towards the land to complete the cycle.) Most summer monsoons have a dominant westerly component and a strong tendency to ascend and produce copious amounts of rain (because of the condensation of water vapor in the rising air). The intensity and duration, however, are not uniform from year to year.

Winter monsoons, by contrast, have a dominant easterly component and a strong tendency to diverge, subside and cause drought. Similar rainfall is caused when moist ocean air is lifted upwards by mountains, surface heating, convergence at the surface, divergence aloft, or from storm-produced outflows at the surface. However the lifting occurs, the air cools due to expansion in lower pressure, and this produces condensation.

Global Monsoon Summaries

The summaries and typical timeframes of monsoons around the world.

Location	Monsoon Sub-System	Average Date of Arrival	Average Date of Withdrawal	Notes
Northern Mexico	North American/Gulf of California-Southwest USA	Late May	September	Incomplete Wind Reversal, Waves
Tucson, Arizona, USA	North American/Gulf of California-Southwest USA	Early July	September	Incomplete Wind Reversal, Waves
Central America	Central/South American Monsoon	April	October	True Monsoon
Amazon Brazil	South American Monsoon	September	May	
Southeast Brazil	South American Monsoon	November	March	
West Africa	West African	Jun 22	Sep/Oct	Waves
Southeast Africa	Southeast Africa monsoon w/ Harmattan	Jan	March	
Kelantan, Malaysia	Indo-Australian/Borneo-Australian	October	March	
Phuket, Thailand	Indo-Australian	February/March	December	
Bangkok, Thailand	Indo-Australian/Indian-Indochina	April-May	Oct/Nov	Persistent
Yangon, Myanmar	Indo-Australian/Indian-Indochina	May 25	Nov 1	
Colombo, Sri Lanka	Indo-Australian	May 25	Dec 15	Persistent
Kerala, India	Indian monsoon	Jun 1	Dec 1	Persistent
Jakarta, Indonesia	Indo-Australian/Borneo-Australian	November	March	Abrupt
Lahore, Pakistan	Indian monsoon	Late July	Sep 1	
Dhaka, Bangladesh	Indo-Australian/Indian-Indochina	Mid June	October	Abrupt
Cebu, Philippines	Indo-Australian/Borneo-Australian	October	March	Abrupt
Kaohsiung, Taiwan	East Asian monsoon	May 10		
Taipei, Taiwan	East Asian monsoon	May 20		
Kagoshima, Japan	East Asian monsoon	Jun 10		
Seoul, South Korea	East Asian monsoon	Jul 10		
Hanoi, Vietnam	East Asian monsoon	May 20		
Beijing, China	East Asian monsoon	Jul 20		
Karachi, Pakistan	Indian monsoon	Jul 15	August	
Mumbai, India	Indian monsoon	Jun 10	Oct 1	
Darwin, Australia	Australian monsoon	Oct	April	

Monsoon Regions

Africa (West African and Southeast African)

The monsoon of western Sub-Saharan Africa is the result of the seasonal shifts of the Intertropical Convergence Zone and the great seasonal temperature and humidity differences between the Sahara and the equatorial Atlantic Ocean. It migrates northward from the equatorial Atlantic in February, reaches western Africa on or near June 22, then moves back to the south by October. The dry, northeasterly trade winds, and their more extreme form, the harmattan, are interrupted by the northern shift in the ITCZ and resultant southerly, rain-bearing winds during the summer. The semiarid Sahel and Sudan depend upon this pattern for most of their precipitation.

North America

The North American monsoon (NAM) occurs from late June or early July into September, originating over Mexico and spreading into the southwest United States by mid-July. It affects Mexico along the Sierra Madre Occidental as well as Arizona, New Mexico, Nevada, Utah, Colorado, West Texas and California. It pushes as far west as the Peninsular Ranges and Transverse Ranges of Southern California, but rarely reaches the coastal strip (a wall of desert thunderstorms only a half-hour's drive away is a common summer sight from the sunny skies along the coast during the monsoon). The North American monsoon is known to many as the Summer, Southwest, Mexican or Arizona monsoon. It is also sometimes called the Desert monsoon as a large part of the affected area are the Mojave and Sonoran deserts. However, it is debatable whether the North and South American weather patterns with incomplete wind reversal should be counted as true monsoons.

Asia (South Asian Monsoon)

The monsoon of South Asia is among several geographically distributed global monsoons. It affects the Indian subcontinent, where it is one of the oldest and most anticipated weather phenomena and an economically important pattern every year from June through September, but it is only partly understood and notoriously difficult to predict. Several theories have been proposed to explain the origin, process, strength, variability, distribution, and general vagaries of the monsoon, but understanding and predictability are still evolving. The unique geographical features of the Indian subcontinent, along with associated atmospheric, oceanic, and geophysical factors, influence the behavior of the monsoon. Because of its effect on agriculture, on flora and fauna, and on the climates of nations such as Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka — among other economic, social, and environmental effects — the monsoon is one of the most anticipated, tracked, and studied weather phenomena in the region. It has a significant effect on the overall well-being of residents and has even been dubbed the "real finance minister of India".

Asia (Southwest Monsoon)

The southwestern summer monsoons occur from July through September. The Thar Desert and adjoining areas of the northern and central Indian subcontinent heat up considerably during the hot summers. This causes a low pressure area over the northern and central Indian subcontinent. To fill this void, the moisture-laden winds from the Indian Ocean rush into the subcontinent. These winds, rich in moisture, are drawn towards the Himalayas. The Himalayas act like a high wall, blocking the winds from passing into Central Asia, and forcing them to rise. As the clouds rise, their temperature drops, and precipitation occurs. Some areas of the subcontinent receive up to 10,000 mm (390 in) of rain annually. The southwest monsoon is generally expected to begin around the beginning of June and fade away by the end of September. The moisture-laden winds on reaching the southernmost point of the Indian Peninsula, due to its topography, become divided into two parts: the Arabian Sea Branch and the Bay of Bengal Branch.

Asia (Southwest Monsoon)

The Arabian Sea Branch of the Southwest Monsoon first hits the Western Ghats of the coastal state of Kerala, India, thus making this area the first state in India to receive rain from the Southwest Monsoon. This branch of the monsoon moves northwards along the Western Ghats (Konkan and Goa) with precipitation on coastal areas, west of the Western Ghats. The eastern areas of the Western Ghats do not receive much rain from this monsoon as the wind does not cross the Western Ghats. The Bay of Bengal Branch of Southwest Monsoon flows over the Bay of Bengal heading towards North-East India and Bengal, picking up more moisture from the Bay of Bengal. The winds arrive at the Eastern Himalayas with large amounts of rain. Mawsynram, situated on the southern slopes of the Khasi Hills in Meghalaya, India, is one of the wettest places on Earth. After the arrival at the Eastern Himalayas, the winds turns towards the west, travelling over the Indo-Gangetic Plain at a rate of roughly 1–2 weeks per state, pouring rain all along its way. June 1 is regarded as the date of onset of the monsoon in India, as indicated by the arrival of the monsoon in the southernmost state of Kerala.

Asia (Southwest Monsoon)

The monsoon accounts for nearly 80% of the rainfall in India. Indian agriculture (which accounts for 25% of the GDP and employs 70% of the population) is heavily dependent on the rains, for growing crops especially like cotton, rice, oilseeds and coarse grains. A delay of a few days in the arrival of the monsoon can badly affect the economy, as evidenced in the numerous droughts in India in the 1990s. The monsoon is widely welcomed and appreciated by city-dwellers as well, for it provides relief from the climax of summer heat in June. However, the roads take a battering every year. Often houses and streets are waterlogged and slums are flooded despite drainage systems. A lack of city infrastructure coupled with changing climate patterns causes severe economic loss including damage to property and loss of lives, as evidenced in the 2005 flooding in Mumbai that brought the city to a standstill. Bangladesh and certain regions of India like Assam and West Bengal, also frequently experience heavy floods during this season. Recently, areas in India that used to receive scanty rainfall throughout the year, like the Thar Desert, have surprisingly ended up receiving floods due to the prolonged monsoon season. The influence of the Southwest Monsoon is felt as far north as in China's Xinjiang. It is estimated that about 70% of all precipitation in the central part of the Tian Shan Mountains falls during the three summer months, when the region is under the monsoon influence; about 70% of that is directly of "cyclonic" (i.e., monsoon-driven) origin (as opposed to "local convection").

Asia (Northeast Monsoon)

Around September, with the sun fast retreating south, the northern land mass of the Indian subcontinent begins to cool off rapidly. With this air pressure begins to build over northern India, the Indian Ocean and its surrounding atmosphere still holds its heat. This causes cold wind to sweep down from the Himalayas and Indo-Gangetic Plain towards the vast spans of the Indian Ocean south of the Deccan peninsula. This is known as the Northeast Monsoon or Retreating Monsoon. While travelling towards the Indian Ocean, the dry cold wind picks up some moisture from the Bay of Bengal and pours it over peninsular India and parts of Sri Lanka. Cities like Chennai, which get less rain from the Southwest Monsoon, receive rain from this Monsoon. About 50% to 60% of the rain received by the state of Tamil Nadu is from the Northeast Monsoon. In Southern Asia, the northeastern monsoons take place from October to December when the surface high-pressure system is strongest. The jet stream in this region splits into the southern subtropical jet and the polar jet. The subtropical flow directs northeasterly winds to blow across southern Asia, creating dry air streams which produce clear skies over India. Meanwhile, a low pressure system known as a monsoon trough develops over South-East Asia and Australasia and winds are directed toward Australia.

Asia (East Asian Monsoon)

The East Asian monsoon affects large parts of Indo-China, Philippines, China, Taiwan, Korea and Japan. It is characterised by a warm, rainy summer monsoon and a cold, dry winter monsoon. The rain occurs in a concentrated belt that stretches east-west except in East China where it is tilted east-northeast over Korea and Japan. The seasonal rain is known as Meiyu in China, Jangma in Korea, and Bai-u in Japan, with the latter two resembling frontal rain. The onset of the summer monsoon is marked by a period of premonsoonal rain over South China and Taiwan in early May. From May through August, the summer monsoon shifts through a series of dry and rainy phases as the rain belt moves northward, beginning over Indochina and the South China Sea (May), to the Yangtze River Basin and Japan (June) and finally to North China and Korea (July). When the monsoon ends in August, the rain belt moves back to South China.

Australia

Also known as the Indo-Australian Monsoon. The rainy season occurs from September to February and it is a major source of energy for the Hadley circulation during boreal winter. The Maritime Continent Monsoon and the Australian Monsoon may be considered to be the same system, the Indo-Australian Monsoon. It is associated with the development of the Siberian High and the movement of the heating maxima from the Northern Hemisphere to the Southern Hemisphere. North-easterly winds flow down Southeast Asia, are turned north-westerly/westerly by Borneo topography towards Australia. This forms a cyclonic circulation vortex over Borneo, which together with descending cold surges of winter air from higher latitudes, cause significant weather phenomena in the region. Examples are the formation of a rare low-latitude tropical storm in 2001, Tropical Storm Vamei, and the devastating flood of Jakarta in 2007. The onset of the monsoon over the Maritime Continent tends to follow the heating maxima down Vietnam and the Malay Peninsula (September), to Sumatra, Borneo and the Philippines (October), to Java, Sulawesi (November), Irian Jaya and Northern Australia (December, January). However, the monsoon is not a simple response to heating but a more complex interaction of topography, wind and sea, as demonstrated by its abrupt rather than gradual withdrawal from the region. The Australian monsoon (the "Wet") occurs in the southern summer when the monsoon trough develops over Northern Australia. Over three-quarters of annual rainfall in Northern Australia falls during this time.

Europe

The European Monsoon (more commonly known as the return of the westerlies) is the result of a resurgence of westerly winds from the Atlantic, where they become loaded with wind and rain. These westerly winds are a common phenomenon during the European winter, but they ease as spring approaches in late March and through April and May. The winds pick up again in June, which is why this phenomenon is also referred to as "the return of the westerlies". The rain usually arrives in two waves, at the beginning of June and again in mid- to late June. The European monsoon is not a monsoon in the traditional sense in that it doesn't meet all the requirements to be classified as such. Instead the return of the westerlies is more regarded as a conveyor belt that delivers a series of low pressure centres to Western Europe where they create unsettled weather. These storms generally feature significantly lower than average temperatures, fierce rain or hail, thunder and strong winds. The return of the westerlies affects Europe's Northern Atlantic coastline, more precisely Ireland, Great Britain, the Benelux countries, Western Germany, Northern France and parts of Scandinavia.

7 Limnic Eruption

A limnic eruption, also referred to as a lake overturn, is a rare type of natural disaster in which dissolved carbon dioxide (CO2) suddenly erupts from deep lake waters, forming a gas cloud that can suffocate wildlife, livestock, and humans. Such an eruption may also cause tsunamis in the lake as the rising CO2 displaces water. Scientists believe earthquakes, volcanic activity, and other explosive events can serve as triggers for limnic eruptions. Lakes in which such activity occurs are referred to as limnically active lakes or exploding lakes. Some features of limnically active lakes include:

- CO2 saturated incoming water
- A cool lake bottom indicating an absence of direct volcanic interaction with lake waters
- An upper and lower thermal layer with differing CO2 saturations
- Proximity to areas with volcanic activity

Investigations of the Lake Monoun and Lake Nyos casualties led scientists to classify limnic eruptions as a distinct type of disaster event, even though they can be indirectly linked to volcanic eruptions.

History

Due to the largely invisible nature of the underlying cause (CO2 gas) behind limnic eruptions, it is difficult to determine to what extent eruptions have occurred in the past. In recent history, this phenomenon has been observed twice. The first recorded limnic eruption occurred in Cameroon at Lake Monoun in 1984, causing asphyxiation and death of 37 people living nearby. A second, deadlier eruption happened at neighbouring Lake Nyos in 1986, this time releasing over 80 million m3 of CO2, killing around 1,700 people and 3,500 livestock, again by asphyxiation. A third lake, Lake Kivu, rests on the border between the Democratic Republic of the Congo and Rwanda, and contains massive amounts of dissolved CO2. Sediment samples from the lake taken by Professor Robert Hecky (University of Michigan) showed an event caused living creatures in the lake to go extinct around every 1000 years, and caused nearby vegetation to be swept back into the lake. Limnic eruptions can be detected and quantified on a CO2 concentration scale by taking air samples of the affected region.

Causes

For a lake to undergo a limnic eruption, the water must be nearly saturated with gas. CO2 was the primary component in the two observed cases (Lake Nyos and Lake Monoun). In Lake Kivu, scientists are concerned about the concentrations of methane gas as well. CO2 may originate from volcanic gas emitted from under the lake or from decomposition of organic material. Before a lake is saturated, it behaves like an unopened carbonated beverage (e.g., a soft drink): the CO2 is dissolved in the water. In both the lake and the soft drink, CO2 dissolves much more readily at higher pressure (Henry's law). This is why bubbles in a can of soda form only after the can is opened; when the pressure is released, the CO2 comes out of solution. In the case of lakes, the bottom is at a much higher pressure; the deeper it is, the higher the pressure is at the bottom. Therefore huge amounts of CO2 can be dissolved in large, deep lakes. CO2 also dissolves more readily in cooler water, such as that found at a lake bottom. A small rise in water temperature can lead to the release of a large amount of CO2. Once a lake is saturated with CO2, it is very unstable, but a trigger is needed to set off an eruption. In the case of the 1986 Lake Nyos eruption, landslides were the suspected triggers, but a volcanic eruption, an earthquake, or even wind and rain storms are potential triggers.

Another possible cause of a limnic eruption is gradual gas saturation at specific depths which can trigger spontaneous gas development. For any of these cases, the trigger pushes some of the gas-saturated water higher in the lake, where pressure is insufficient to keep CO2 in solution. As bubbles start forming the water is lifted even higher in the lake (buoyancy), where yet more CO2 comes out of solution. This process forms a column of gas, at which point the water at the bottom of this column is pulled up by suction, and it, too, loses CO2 in a runaway process. This eruption discharges CO2 into the air and can even displace enough water to form a tsunami. Limnic eruptions are exceptionally rare for several reasons. First, a CO2 source must exist (regions with volcanic activity are most at risk). Second, the vast majority of lakes are holomictic (i.e., their layers mix regularly), preventing a buildup of dissolved gases. Only meromictic lakes do not mix and remain stratified, allowing CO2 to remain dissolved. It is estimated only one meromictic lake exists for every 1,000 holomictic lakes. Finally, a lake must be deep enough to have sufficient pressure to dissolve large amounts of CO2.

Consequences

Once an eruption occurs, a large CO2 cloud forms above the lake and expands to the surrounding region. Because CO2 is denser than air, it has a tendency to sink to the ground, simultaneously displacing breathable air, resulting in asphyxia. CO2 can make human bodily fluids highly acidic and potentially cause CO2 poisoning. As victims gasp for air, they actually accelerate asphyxia by inhaling CO2 gas. At Lake Nyos, the gas cloud descended into a nearby village where it settled, killing nearly everyone; casualties as far as 25 km (16 mi) were reportedcitation needed. A change in skin color on some bodies led scientists to hypothesize the gas cloud may have contained dissolved acid such as hydrogen chloride, though this hypothesis is disputed. Many victims were found with blisters on their skin, thought to have been caused by pressure ulcers, which were likely caused by low blood oxygen levels in those asphyxiated by carbon dioxide. Nearby vegetation was largely unaffected, except any growing immediately adjacent to the lake. There, vegetation was damaged or destroyed by a 24 m (79 ft) high tsunami caused by the violent eruption.

Degassing

Efforts are under way to develop a solution for removing the gas from these lakes and to prevent a build-up which could lead to another catastrophe. A team led by French scientist Michel Halbwachs began experimenting at Lake Monoun and Lake Nyos in 1990 using siphons to degas the waters of these lakes in a controlled manner. The team positions a pipe vertically in the lake with its upper end above the water surface. Water saturated with CO2 enters the bottom of the pipe and rises to the top. The lower pressure at the surface allows the gas to come out of solution. Only a small amount of water must be mechanically pumped initially through the pipe to start the flow. As saturated water rises, the CO2 comes out of solution and forms bubbles. The natural buoyancy of the bubbles draws the water up the pipe at high velocity resulting in a fountain at the surface.

The degassifying water acts like a pump, drawing more water into the bottom of the pipe, and creating a self-sustaining flow. This is the same process which leads to a natural eruption, but in this case it is controlled by the size of the pipe. Each pipe has a limited pumping capacity and several would be required for both Lake Monoun and Lake Nyos to degas a significant fraction of the deep lake water and render the lakes safe.

The deep lake waters are slightly acidic due to the dissolved CO2 which causes corrosion to the pipes and electronics, necessitating ongoing maintenance. There is some concern CO2 from the pipes could settle on the surface of the lake forming a thin layer of unbreathable air and thus potentially causing problems for wildlife.

Potential Danger

Lake Kivu is not only 2,000 times larger than Lake Nyos, but is also located in a far more densely populated area, with over two million people living along its shores, and the part within the Democratic Republic of the Congo is a site of active armed conflict and low state capacity for the DRC government. Lake Kivu has not reached a high level of CO2 saturation yet; if the water were to become heavily saturated, a limnic eruption would pose a great risk to human and animal life.

Two significant changes in Lake Kivu's physical state have brought attention to a possible limnic eruption: the high rates of methane dissociation and a rising surface temperature. Research investigating historical and present-day temperatures show Lake Kivu's surface temperature is increasing by about 0.12 °C per decade. Lake Kivu is in close proximity to potential triggers: Mount Nyiragongo (an active volcano which erupted in January 2002), an active earthquake zone, and other active volcanoes.

While the lake could be degassed in a manner similar to Lake Monoun and Lake Nyos, due to the size of Lake Kivu and the volume of gas it contains, such an operation would be expensive, running into the millions of dollars. A scheme initiated in 2010 to use methane trapped in the lake as a fuel source to generate electricity in Rwanda has led to a degree of CO2 degassing. During the procedure for extracting the flammable methane gas used to fuel power stations on the shore, some CO2 is removed in a process known as catalyst scrubbing. It is unclear whether enough gas will be removed to eliminate the danger of a limnic eruption at Lake Kivu.

8 Tsunami

A tsunami or tidal wave, also known as a seismic sea wave, is a series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean or a large lake. Earthquakes, volcanic eruptions and other underwater explosions (including detonations, landslides, glacier calvings, meteorite impacts and other disturbances) above or below water all have the potential to generate a tsunami. Unlike normal ocean waves, which are generated by wind, or tides, which are generated by the gravitational pull of the Moon and the Sun, a tsunami is generated by the displacement of water.

Tsunami waves do not resemble normal undersea currents or sea waves because their wavelength is far longer. Rather than appearing as a breaking wave, a tsunami may instead initially resemble a rapidly rising tide. For this reason, it is often referred to as a "tidal wave", although this usage is not favoured by the scientific community because it might give the false impression of a causal relationship between tides and tsunamis.

Tsunamis generally consist of a series of waves, with periods ranging from minutes to hours, arriving in a so-called "internal wave train". Wave heights of tens of metres can be generated by large events. Although the impact of tsunamis is limited to coastal areas, their destructive power can be enormous, and they can affect entire ocean basins. The 2004 Indian Ocean tsunami was among the deadliest natural disasters in human history, with at least 230,000 people killed or missing in 14 countries bordering the Indian Ocean.

Causes

The principal generation mechanism (or cause) of a tsunami is the displacement of a substantial volume of water or perturbation of the sea. This displacement of water is usually attributed to either earthquakes, landslides, volcanic eruptions, glacier calvings or more rarely by meteorites and nuclear tests. The waves formed in this way are then sustained by gravity.

Seismicity
Tsunami can be generated when the sea floor abruptly deforms and vertically displaces the overlying water. Tectonic earthquakes are a particular kind of earthquake that are associated with the Earth's crustal deformation; when these earthquakes occur beneath the sea, the water above the deformed area is displaced from its equilibrium position. More specifically, a tsunami can be generated when thrust faults associated with convergent or destructive plate boundaries move abruptly, resulting in water displacement, owing to the vertical component of movement involved. Movement on normal (extensional) faults can also cause displacement of the seabed, but only the largest of such events (typically related to flexure in the outer trench swell) cause enough displacement to give rise to a significant tsunami, such as the 1977 Sumba and 1933 Sanriku events. Tsunamis have a small amplitude (wave height) offshore, and a very long wavelength (often hundreds of kilometres long, whereas normal ocean waves have a wavelength of only 30 or 40 metres), which is why they generally pass unnoticed at sea, forming only a slight swell usually about 300 millimetres (12 in) above the normal sea surface. They grow in height when they reach shallower water, in a wave shoaling process described below. A tsunami can occur in any tidal state and even at low tide can still inundate coastal areas.

Landslides
In the 1950s, it was discovered that larger tsunamis than had previously been believed possible could be caused by giant submarine landslides. These rapidly displace large water volumes, as energy transfers to the water at a rate faster than the water can absorb. Their existence was confirmed in 1958, when a giant landslide in Lituya Bay, Alaska, caused the highest wave ever recorded, which had a height of 524 metres (over 1700 feet). The wave did not travel far, as it struck land almost immediately. Two people fishing in the bay were killed, but another boat managed to ride the wave. Another landslide-tsunami event occurred in 1963 when a massive landslide from Monte Toc entered the Vajont Dam in Italy.

The resulting wave surged over the 262 m (860 ft) high dam by 250 metres (820 ft) and destroyed several towns. Around 2,000 people died. Scientists named these waves megatsunamis. Some geologists claim that large landslides from volcanic islands, e.g. Cumbre Vieja on La Palma in the Canary Islands, may be able to generate megatsunamis that can cross oceans, but this is disputed by many others. In general, landslides generate displacements mainly in the shallower parts of the coastline, and there is conjecture about the nature of large landslides that enter the water.

This has been shown to subsequently affect water in enclosed bays and lakes, but a landslide large enough to cause a transoceanic tsunami has not occurred within recorded history. Susceptible locations are believed to be the Big Island of Hawaii, Fogo in the Cape Verde Islands, La Reunion in the Indian Ocean, and Cumbre Vieja on the island of La Palma in the Canary Islands; along with other volcanic ocean islands. This is because large masses of relatively unconsolidated volcanic material occurs on the flanks and in some cases detachment planes are believed to be developing. However, there is growing controversy about how dangerous these slopes actually are.

Meteorological
Some meteorological conditions, especially rapid changes in barometric pressure, as seen with the passing of a front, can displace bodies of water enough to cause trains of waves with wavelengths comparable to seismic tsunamis, but usually with lower energies. These are essentially dynamically equivalent to seismic tsunamis, the only differences being that meteotsunamis lack the transoceanic reach of significant seismic tsunamis and that the force that displaces the water is sustained over some length of time such that meteotsunamis can't be modelled as having been caused instantaneously. In spite of their lower energies, on shorelines where they can be amplified by resonance, they are sometimes powerful enough to cause localised damage and potential for loss of life. They have been documented in many places, including the Great Lakes, the Aegean Sea, the English Channel, and the Balearic Islands, where they are common enough to have a local name, rissaga. In Sicily they are called marubbio and in Nagasaki Bay, they are called abiki. Some examples of destructive meteotsunamis include 31 March 1979 at Nagasaki and 15 June 2006 at Menorca, the latter causing damage in the tens of millions of euros.

Man-Made or Triggered Tsunamis
There have been studies of the potential of the induction of and at least one actual attempt to create tsunami waves as a tectonic weapon. In World War II, the New Zealand Military Forces initiated Project Seal, which attempted to create small tsunamis with explosives in the area of today's Shakespear Regional Park; the attempt failed. There has been considerable speculation on the possibility of using nuclear weapons to cause tsunamis near an enemy coastline. Even during World War II consideration of the idea using conventional explosives was explored. Nuclear testing in the Pacific Proving Ground by the United States seemed to generate poor results. Operation Crossroads fired two 20 kilotonnes of TNT (84 TJ) bombs, one in the air and one underwater, above and below the shallow (50 m (160 ft)) waters of the Bikini Atoll lagoon. Fired about 6 km (3.7 mi) from the nearest island, the waves there were no higher than 3–4 m (9.8–13.1 ft) upon reaching the shoreline. Other underwater tests, mainly Hardtack I/Wahoo (deep water) and Hardtack I/Umbrella (shallow water) confirmed the results. Analysis of the effects of shallow and deep underwater explosions indicate that the energy of the explosions doesn't easily generate the kind of deep, all-ocean waveforms which are tsunamis; most of the energy creates steam, causes vertical fountains above the water, and creates compressional waveforms. Tsunamis are hallmarked by permanent large vertical displacements of very large volumes of water which do not occur in explosions.

Characteristics

Tsunamis cause damage by two mechanisms: the smashing force of a wall of water travelling at high speed, and the destructive power of a large volume of water draining off the land and carrying a large amount of debris with it, even with waves that do not appear to be large. While everyday wind waves have a wavelength (from crest to crest) of about 100 metres (330 ft) and a height of roughly 2 metres (6.6 ft), a tsunami in the deep ocean has a much larger wavelength of up to 200 kilometres (120 mi). Such a wave travels at well over 800 kilometres per hour (500 mph), but owing to the enormous wavelength the wave oscillation at any given point takes 20 or 30 minutes to complete a cycle and has an amplitude of only about 1 metre (3.3 ft). This makes tsunamis difficult to detect over deep water, where ships are unable to feel their passage.

The velocity of a tsunami can be calculated by obtaining the square root of the depth of the water in metres multiplied by the acceleration due to gravity (approximated to 10 m/s2). When the wave enters shallow water, it slows down and its amplitude (height) increases. For example, if the Pacific Ocean is considered to have a depth of 5000 metres, the velocity of a tsunami would be the square root of $\sqrt{(5000 \times 10)} = \sqrt{50000} = \sim 224$ metres per second (735 feet per second), which equates to a speed of ~806 kilometres per hour or about 500 miles per hour. This is the formula used for calculating the velocity of shallow-water waves.

Even the deep ocean is shallow in this sense because a tsunami wave is so long (horizontally from crest to crest) by comparison. The reason for the Japanese name "harbour wave" is that sometimes a village's fishermen would sail out, and encounter no unusual waves while out at sea fishing, and come back to land to find their village devastated by a huge wave. As the tsunami approaches the coast and the waters become shallow, wave shoaling compresses the wave and its speed decreases below 80 kilometres per hour (50 mph).

Its wavelength diminishes to less than 20 kilometres (12 mi) and its amplitude grows enormously – in accord with Green's law. Since the wave still has the same very long period, the tsunami may take minutes to reach full height. Except for the very largest tsunamis, the approaching wave does not break, but rather appears like a fast-moving tidal bore. Open bays and coastlines adjacent to very deep water may shape the tsunami further into a step-like wave with a steep-breaking front.

When the tsunami's wave peak reaches the shore, the resulting temporary rise in sea level is termed run up. Run up is measured in metres above a reference sea level. A large tsunami may feature multiple waves arriving over a period of hours, with significant time between the wave crests. The first wave to reach the shore may not have the highest run-up. About 80% of tsunamis occur in the Pacific Ocean, but they are possible wherever there are large bodies of water, including lakes. They are caused by earthquakes, landslides, volcanic explosions, glacier calvings, and bolides.

Drawback
All waves have a positive and negative peak; that is, a ridge and a trough. In the case of a propagating wave like a tsunami, either may be the first to arrive. If the first part to arrive at the shore is the ridge, a massive breaking wave or sudden flooding will be the first effect noticed on land. However, if the first part to arrive is a trough, a drawback will occur as the shoreline recedes dramatically, exposing normally submerged areas. The drawback can exceed hundreds of metres, and people unaware of the danger sometimes remain near the shore to satisfy their curiosity or to collect fish from the exposed seabed. A typical wave period for a damaging tsunami is about twelve minutes.

Thus, the sea recedes in the drawback phase, with areas well below sea level exposed after three minutes. For the next six minutes, the wave trough builds into a ridge which may flood the coast, and destruction ensues. During the next six minutes, the wave changes from a ridge to a trough, and the flood waters recede in a second drawback. Victims and debris may be swept into the ocean. The process repeats with succeeding waves.

Tsunami Heights

Several terms are used to describe the different characteristics of tsunami in terms of their height:

Amplitude, Wave Height, or Tsunami Height	Amplitude of Tsunami refers to its height relative to the normal sea level. It is usually measured at sea level, and it is different from the crest-to-trough height which is commonly used to measure other type of wave height.
Run-up Height, or Inundation Height	The height reached by a tsunami on the ground above sea level, Maximum run-up height refers to the maximum height reached by water above sea level, which is sometimes reported as the maximum height reached by a tsunami.
Flow Depth	Refers to the height of tsunami above ground, regardless of the height of the location or sea level.
(Maximum) Water Level	Maximum height above sea level as seen from trace or water mark. Different from maximum run-up height in the sense that they are not necessarily water marks at inundation line/limit.

Warnings and Predictions

Drawbacks can serve as a brief warning. People who observe drawback (many survivors report an accompanying sucking sound), can survive only if they immediately run for high ground or seek the upper floors of nearby buildings. In 2004, ten-year-old Tilly Smith of Surrey, England, was on Maikhao beach in Phuket, Thailand with her parents and sister, and having learned about tsunamis recently in school, told her family that a tsunami might be imminent. Her parents warned others minutes before the wave arrived, saving dozens of lives. She credited her geography teacher, Andrew Kearney. In the 2004 Indian Ocean tsunami drawback was not reported on the African coast or any other east-facing coasts that it reached. This was because the wave moved downwards on the eastern side of the fault line and upwards on the western side. The western pulse hit coastal Africa and other western areas.

A tsunami cannot be precisely predicted, even if the magnitude and location of an earthquake is known. Geologists, oceanographers, and seismologists analyse each earthquake and based on many factors may or may not issue a tsunami warning. However, there are some warning signs of an impending tsunami, and automated systems can provide warnings immediately after an earthquake in time to save lives. One of the most successful systems uses bottom pressure sensors, attached to buoys, which constantly monitor the pressure of the overlying water column. Regions with a high tsunami risk typically use tsunami warning systems to warn the population before the wave reaches land.

On the west coast of the United States, which is prone to Pacific Ocean tsunami, warning signs indicate evacuation routes. In Japan, the community is well-educated about earthquakes and tsunamis, and along the Japanese shorelines the tsunami warning signs are reminders of the natural hazards together with a network of warning sirens, typically at the top of the cliff of surroundings hills. The Pacific Tsunami Warning System is based in Honolulu, Hawaiʻi. It monitors Pacific Ocean seismic activity.

A sufficiently large earthquake magnitude and other information triggers a tsunami warning. While the subduction zones around the Pacific are seismically active, not all earthquakes generate a tsunami. Computers assist in analysing the tsunami risk of every earthquake that occurs in the Pacific Ocean and the adjoining land masses.

As a direct result of the Indian Ocean tsunami, a re-appraisal of the tsunami threat for all coastal areas is being undertaken by national governments and the United Nations Disaster Mitigation Committee. A tsunami warning system is being installed in the Indian Ocean. Computer models can predict tsunami arrival, usually within minutes of the arrival time. Bottom pressure sensors can relay information in real time. Based on these pressure readings and other seismic information and the seafloor's shape (bathymetry) and coastal topography, the models estimate the amplitude and surge height of the approaching tsunami.

All Pacific Rim countries collaborate in the Tsunami Warning System and most regularly practise evacuation and other procedures. In Japan, such preparation is mandatory for government, local authorities, emergency services and the population. Some zoologists hypothesise that some animal species have an ability to sense subsonic Rayleigh waves from an earthquake or a tsunami. If correct, monitoring their behaviour could provide advance warning of earthquakes, tsunami etc.

However, the evidence is controversial and is not widely accepted. There are unsubstantiated claims about the Lisbon quake that some animals escaped to higher ground, while many other animals in the same areas drowned. The phenomenon was also noted by media sources in Sri Lanka in the 2004 Indian Ocean earthquake. It is possible that certain animals (e.g., elephants) may have heard the sounds of the tsunami as it approached the coast. The elephants' reaction was to move away from the approaching noise. By contrast, some humans went to the shore to investigate and many drowned as a result. Along the United States west coast, in addition to sirens, warnings are sent on television and radio via the National Weather Service, using the Emergency Alert System.

Meteotsunami

A meteotsunami or meteorological tsunami is a tsunami-like sea wave of meteorological origin. Meteotsunamis are generated when rapid changes in barometric pressure cause the displacement of a body of water. In contrast to "ordinary" impulse-type tsunami sources, a traveling atmospheric disturbance normally interacts with the ocean over a limited period of time (from several minutes to several hours). Tsunamis and meteotsunamis are otherwise similar enough that it can be difficult to distinguish one from the other, as in cases where there is a tsunami wave but there are no seismic records of an earthquake.

Only about 3% of historical tsunami events are known to have meteorological origins, although their true prevalence may be considerably higher than this because 10% of historical tsunamis have unknown origins, tsunami events in the past are often difficult to validate, and meteotsunamis may have previously been misclassified as seiche waves. Meteotsunamis are restricted to local effects because they lack the energy available to significant seismic tsunami. However, when they are amplified by resonance they can be hazardous. A meteotsunami that struck Nagasaki Bay on 31 March 1979 achieved a maximum wave height of 5 meters; there were three fatalities. A three-meter wave that hit the Chicago waterfront in 1954 swept people off of piers, drowning seven.

9 Blizzard

For more blizzard-like tips, see the #13 'Polar Vortex' category below.

A blizzard is a severe snowstorm characterized by strong sustained winds of at least 35 mph (56 km/h) and lasting for a prolonged period of time—typically three hours or more. A ground blizzard is a weather condition where snow is not falling but loose snow on the ground is lifted and blown by strong winds. Blizzards can have an immense size and usually stretch to hundreds or thousands of kilometres.

In the United States, the National Weather Service defines a blizzard as a severe snow storm characterized by strong winds causing blowing snow that results in low visibilities. The difference between a blizzard and a snowstorm is the strength of the wind, not the amount of snow. To be a blizzard, a snow storm must have sustained winds or frequent gusts that are greater than or equal to 56 km/h (35 mph) with blowing or drifting snow which reduces visibility to 400 m or 0.25 mi or less and must last for a prolonged period of time—typically three hours or more.

While severe cold and large amounts of drifting snow may accompany blizzards, they are not required. Blizzards can bring whiteout conditions, and can paralyze regions for days at a time, particularly where snowfall is unusual or rare. A severe blizzard has winds over 72 km/h (45 mph), near zero visibility, and temperatures of −12 °C (10 °F) or lower.

In Antarctica, blizzards are associated with winds spilling over the edge of the ice plateau at an average velocity of 160 km/h (99 mph). Ground blizzard refers to a weather condition where loose snow or ice on the ground is lifted and blown by strong winds. The primary difference between a ground blizzard as opposed to a regular blizzard is that in a ground blizzard no precipitation is produced at the time, but rather all the precipitation is already present in the form of snow or ice at the surface. The Australia Bureau of Meteorology describes a blizzard as, "Violent and very cold wind which is laden with snow, some part, at least, of which has been raised from snow covered ground."

Blizzard Preparation

General Preparation

Tips to prepare for blizzards if you know they're coming.

Buy Firewood	If you have a fireplace keep a pile of logs in a dry, close location.

Store Water	Pipes are likely to freeze so be sure to have enough water to ride out the disaster - but it's best to fill every container you can find with water.
Store Food	If you have the ability, take a trip to the shops and buy long life food which lasts a week minimum.
Charge Electronics	If you have any electronics be sure to charge them so they will last through the blizzard.
Buy Fuel	If you have a generator, buy some additional fuel to be sure you can last through the blizzard.
Protect Pipes	Protect your pipes from freezing by letting them slowly drip. Wrap pipes in newspaper or fabric to help insulate them. Open doors to expose the pipes to the warmer temperatures of the living rooms.

Sheltering

House Shelter

These are tips for sheltering inside your house during a blizzard.

Know Hypothermia Signs	Know the signs of hypothermia so you can treat it before it gets too far.
Avoid Alcohol	Alcohol can make your body more vulnerable in extremely low temperatures as it causes you to feel warmer.
Cautious Shovelling	Be extra cautious when shovelling snow as you could destabilise it and cause a mini avalanche, particularly snow on your roof.
Layer Up	Wear as many layers as you can to keep warm, however don't overheat yourself as this will cause sweat which will cool you rapidly when the layers are gone.
Seal Gaps	Any gaps in a building will cause a rapid cooling inside an otherwise closed location. Use wooden planks, plastic and duct tape to seal holes where possible.
Use Lights	Candles can be knocked over and cause a fire or eventually use up all the oxygen in a sealed room. However a candle is better than nothing if you need to see or require a heat source.

Car Shelter

These are tips for sheltering inside your car during a blizzard if you're unable to make it to a building.

Clear Exhaust	A blocked exhaust can cause carbon monoxide to enter the car and cause death.
Stay Visible	Turn your hazard lights on to signal to others you are there and to help prevent others crashing into you.
Stay in the Car	Staying in your car will provide an additional level of protection from the storm and keep heat around you easier. It also eliminates the wind chill factor. Head to a building if there is one visible and you know you have access or can get access but do not lose the car.
Keep Active	Do small exercises, such as clapping your hands or wiggling in your seat. This will help keep your heart rate and circulation at a safe level. When stuck in a confined space like a car, you will be more prone to poor circulation. Poor circulation contributes to frostbite.
Run the Car	Start your engine once an hour to help stay warm. Run the heat for no more than 20 minutes at a time. Make sure to keep checking that your exhaust is clean.
Stay Hydrated	Drink from your bottled water regularly. Eat from your emergency supplies. This will help to prevent hypothermia.

Outdoor Shelter

These are tips for sheltering inside your outside during a blizzard when there's no other shelter nearby.

Seek Shelter	This should be your top priority. Look for nearby buildings and cars. If none are available, look for any structure you can huddle under to protect from the wind and snow. Stay there until the storm passes or help arrives.
Seek Help	If you have a cell phone with you, try calling both your city's emergency number and any loved ones who may be able to help. If cell towers are down, turn your phone off to conserve power and try again later. Periodically shout for help in case someone is nearby who can assist you.
Stay Hydrated	Staying hydrated will help to prevent hypothermia. If you have a water bottle with you, drink from it. However, do not eat snow, as this will drop your body temperature, and snow often contains chemicals such as car exhaustion. Find a means of melting it first, and boil it if possible to make sure it is clean.
Minor Exercise	Clap your hands, wave your arms, kick your legs. This will keep your heart rate up and keep the blood circulating in your extremities. Good circulation will help to prevent frostbite.

Blizzard History

Iran Blizzard
The deadliest blizzard on record happened in Iran in February 1972 when 4,000 lives were lost. The Iran Blizzard dropped more than 10 feet of snow and lasted for six days across the northern and central regions of the country. In southern Iran, however, the numbers were much more drastic. They received 26 feet of snow, and two towns had no survivors. The snow took out power lines, buried towns, and crushed transportation. People were left without food, water, heat, and medical supplies. When the storm finally stopped for a 24-hour period, rescue workers tried to retrieve survivors but were largely unsuccessful. The storms started again, and they were forced to abandon the mission and left behind bread for anybody who could dig their way out of the snow tombs.

Carolean Death March
The second worst blizzard in history was in 1719 when 3,000 people between Sweden and Norway were killed. Referred to as the Carolean Death March, this storm occurred during the Great Northern War after Sweden lost territory to Russia and decided to move in on Norway. This attempt was unsuccessful and after King Charles XII of Sweden died, Swedish troops were ordered back to Sweden. While crossing the mountains, the blizzard hit. On the first night, 200 soldiers died. Horses died, equipment was burned for warmth, and supplies were left behind as the remaining soldiers tried to escape. Left on the mountainside, another 3,000 soldiers froze to death as some of the men arrived at the nearest town. Over the next few days and after finding lodging, battle fatigued and malnourished, another 700 men died.

Afghanistan Blizzard
The 2008 Afghanistan Blizzard is the third deadliest on record. In February 2008, this blizzard claimed the lives of 926 people. With temperatures reaching -22 degrees fahrenheit and nearly 6 feet of snow on the ground, this was one of the harshest winters ever for the country. Mountain villages were cut off from larger cities and people who walked into towns were taken to hospitals where feet and hands were amputated. In addition to human lives, hundreds of thousands of sheep and cattle were killed, leaving the people who survived without their primary source of income after the storm.

Deadliest Blizards

Name	Location	Date	Deaths	Description
1972 Iran Blizzard	Iran	1972	4,000	A seven day snowstorm in February 1972 dropped between 3 to 8 meters of snow (10-26 feet) on the nation of Iran. During the storm, temperatures fell to as low as -13 degree Fahrenheit.
Carolean Death March	Sweden/Norway	1719	3,000	The Carolean Death March is the disastrous retreat by a Swedish-Carolean army under the command of Carl Gustaf Armfeldt across the Tydal mountain range in Trøndelag around the new year 1718–1719.
Afghanistan Blizzard	Afghanistan	2008	926	A fierce blizzard that struck Afghanistan on the 10th of January 2008. Temperatures fell to a low of -30 C, with up to 180 centimetres of snow in the more mountainous regions.
Great Blizzard	USA	1888	400	Great Blizzard of 1888, winter storm that pummeled the Atlantic coast of the United States, from the Chesapeake Bay to Maine, in March 1888. The blizzard caused more than $20 million in property damage in New York City alone.
1993 North American Storm Complex	USA	1993	318	A large cyclonic storm that occurred on March to March 15, 1993, on the East Coast of North America. It is unique both because of its intensity as well as its massive size and wide reaching effect.
Schoolhouse Blizzard	USA	1888	235	The Schoolhouse Blizzard, hit the U.S. plains states on January 12, 1888. The blizzard came unexpectedly on a relatively warm day, and many people were caught unaware, including children in one-room schoolhouses.
Hakkōda Mountains Incident	Japan	1902	199	A group of Imperial Japanese Army soldiers became lost in a blizzard on the Hakkōda Mountains in Aomori Prefecture in northern Honshu, Japan, en route to Tashiro Hot Spring located in the Hakkōda Mountains.
North American Blizzard	USA	1996	154	On January 6, 1996, snow begins falling in Washington, D.C., and up the Eastern seaboard, beginning a blizzard that kills 154 people and causes over $1 billion in damages before it ends.
Armistice Day Blizzard	USA	1940	144	The intense early-season "panhandle hook" winter storm cut a 1,000-mile-wide (1600 km) swath through the middle of the country from Kansas to Michigan.
2008 Chinese Winter Storms	China	2008	133	A series of winter storm events that affected large portions of southern and central China, where it does not usually snow severely or extensively, starting on 25 January 2008 until 6 February 2008.

10 Cyclone / Hurricane

A tropical cyclone or hurricane is a rapidly rotating storm system characterized by a low-pressure centre, a closed low-level atmospheric circulation, strong winds, and a spiral arrangement of thunderstorms that produce heavy rain. Depending on its location and strength, a tropical cyclone is referred to by different names, including hurricane, typhoon, tropical storm, cyclonic storm, tropical depression, and simply cyclone.

A hurricane is a tropical cyclone that occurs in the Atlantic Ocean and north-eastern Pacific Ocean, and a typhoon occurs in the north-western Pacific Ocean; while in the south Pacific or Indian Ocean, comparable storms are referred to simply as “tropical cyclones” or “severe cyclonic storms”. “Tropical” refers to the geographical origin of these systems, which form almost exclusively over tropical seas.

"Cyclone" refers to their winds moving in a circle, whirling round their central clear eye, with their winds blowing counter clockwise in the Northern Hemisphere and blowing clockwise in the Southern Hemisphere. The opposite direction of circulation is due to the Coriolis effect. Tropical cyclones typically form over large bodies of relatively warm water.

They derive their energy through the evaporation of water from the ocean surface, which ultimately recondenses into clouds and rain when moist air rises and cools to saturation. This energy source differs from that of mid-latitude cyclonic storms, such as nor'easters and European windstorms, which are fuelled primarily by horizontal temperature contrasts. Tropical cyclones are typically between 100 and 2,000 km (62 and 1,243 mi) in diameter.

The strong rotating winds of a tropical cyclone are a result of the conservation of angular momentum imparted by the Earth's rotation as air flows inwards toward the axis of rotation. As a result, they rarely form within 5° of the equator. Tropical cyclones are also almost completely absent from Earth's south-western quartersphere, mainly because the shapes of the African and South American continents permit the Benguela and Humboldt Currents to cover ocean basins as far north as 5˚N with excessively cool water. Coastal regions are particularly vulnerable to the impact of a tropical cyclone, compared to inland regions. The primary energy source for these storms is warm ocean waters, therefore these forms are typically strongest when over or near water, and weaken quite rapidly over land.

Coastal damage may be caused by strong winds and rain, high waves (due to winds), storm surges (due to severe pressure changes), and the potential of spawning tornadoes. Tropical cyclones also draw in air from a large area—which can be a vast area for the most severe cyclones—and concentrate the precipitation of the water content in that air into a much smaller area. This continual replacement of moisture-bearing air by new moisture-bearing air after its moisture has fallen as rain, may cause extremely heavy rain and river flooding up to 40 kilometres (25 mi) from the coastline.

Subheadings

1 Characteristics

Wind Field
The near-surface wind field of a tropical cyclone is characterized by air rotating rapidly around a centre of circulation while also flowing radially inwards. At the outer edge of the storm, air may be nearly calm; however, due to the Earth's rotation, the air has non-zero absolute angular momentum. As air flows radially inward, it begins to rotate cyclonically (counter-clockwise in the Northern Hemisphere, and clockwise in the Southern Hemisphere) in order to conserve angular momentum.

At an inner radius, air begins to ascend to the top of the troposphere. This radius is typically coincident with the inner radius of the eyewall, and has the strongest near-surface winds of the storm; consequently, it is known as the radius of maximum winds. Once aloft, air flows away from the storm's centre, producing a shield of cirrus clouds.

The previously mentioned processes result in a wind field that is nearly axisymmetric: Wind speeds are low at the centre, increase rapidly moving outwards to the radius of maximum winds, and then decay more gradually with radius to large radii. However, the wind field often exhibits additional spatial and temporal variability due to the effects of localized processes, such as thunderstorm activity and horizontal flow instabilities. In the vertical direction, winds are strongest near the surface and decay with height within the troposphere.

Eye and Centre
At the centre of a mature tropical cyclone, air sinks rather than rises. For a sufficiently strong storm, air may sink over a layer deep enough to suppress cloud formation, thereby creating a clear "eye". Weather in the eye is normally calm and free of clouds, although the sea may be extremely violent. The eye is normally circular in shape, and is typically 30–65 km (19–40 mi) in diameter, though eyes as small as 3 km (1.9 mi) and as large as 370 km (230 mi) have been observed. The cloudy outer edge of the eye is called the "eyewall".

The eyewall typically expands outward with height, resembling an arena football stadium; this phenomenon is sometimes referred to as the stadium effect. The eyewall is where the greatest wind speeds are found, air rises most rapidly, clouds reach to their highest altitude, and precipitation is the heaviest. The heaviest wind damage occurs where a tropical cyclone's eyewall passes over land.

In a weaker storm, the eye may be obscured by the central dense overcast, which is the upper-level cirrus shield that is associated with a concentrated area of strong thunderstorm activity near the centre of a tropical cyclone. The eyewall may vary over time in the form of eyewall replacement cycles, particularly in intense tropical cyclones.

Outer rainbands can organize into an outer ring of thunderstorms that slowly moves inward, which is believed to rob the primary eyewall of moisture and angular momentum. When the primary eyewall weakens, the tropical cyclone weakens temporarily. The outer eyewall eventually replaces the primary one at the end of the cycle, at which time the storm may return to its original intensity.

Rapid Deepening (Rapid Intensification)
Rapid intensification is a meteorological condition that occurs when a tropical cyclone intensifies dramatically in a short period of time. The United States National Hurricane Centre defines rapid intensification as an increase in the maximum sustained winds of a tropical cyclone of at least 30 knots (35 mph; 55 km/h) in a 24-hour period.

External Conditions
In order for rapid deepening to occur, several conditions must be in place. Water temperatures must be extremely warm (near or above 30°C (86°F)), and water of this temperature must be sufficiently deep such that waves do not churn deeper cooler waters up to the surface. Wind shear must be low; when wind shear is high, the convection and circulation in the cyclone will be disrupted.

Internal Conditions
Usually, an anticyclone in the upper layers of the troposphere above the storm must be present as well—for extremely low surface pressures to develop, air must be rising very rapidly in the eyewall of the storm, and an upper-level anticyclone helps channel this air away from the cyclone efficiently. Hot towers have been implicated in tropical cyclone rapid intensification, though diagnostically has seen varied skill across basins.

Size
There are a variety of metrics commonly used to measure storm size. The most common metrics include the radius of maximum wind, the radius of 34-knot wind (i.e. gale force), the radius of outermost closed isobar (ROCI), and the radius of vanishing wind. An additional metric is the radius at which the cyclone's relative vorticity field decreases to 1×10^{-5} s^{-1}.

Cyclone ROCI Diameter
<2° Lat = Very Small
2°-3° Lat = Small
3°-6° Lat = Medium
6°-8° Lat = Large
>8° Lat = Very Large

On Earth, tropical cyclones span a large range of sizes, from 100–2,000 kilometres (62–1,243 mi) as measured by the radius of vanishing wind. They are largest on average in the northwest Pacific Ocean basin and smallest in the north-eastern Pacific Ocean basin. If the radius of outermost closed isobar is less than two degrees of latitude (222 km (138 mi)), then the cyclone is "very small" or a "midget". A radius of 3–6 latitude degrees (333–670 km (207–416 mi)) is considered "average sized". "Very large" tropical cyclones have a radius of greater than 8 degrees (888 km (552 mi)).

Observations indicate that size is only weakly correlated to variables such as storm intensity (i.e. maximum wind speed), radius of maximum wind, latitude, and maximum potential intensity. Size plays an important role in modulating damage caused by a storm. All else equal, a larger storm will impact a larger area for a longer period of time. Additionally, a larger near-surface wind field can generate higher storm surge due to the combination of longer wind fetch, longer duration, and enhanced wave setup. The upper circulation of strong hurricanes extends into the tropopause of the atmosphere, which at low latitudes is 15,000–18,000 metres (50,000–60,000 ft).

2 Formation

Worldwide, tropical cyclone activity peaks in late summer, when the difference between temperatures aloft and sea surface temperatures is the greatest. However, each particular basin has its own seasonal patterns. On a worldwide scale, May is the least active month, while September is the most active month. November is the only month in which all the tropical cyclone basins are active. In the Northern Atlantic Ocean, a distinct cyclone season occurs from June 1 to November 30, sharply peaking from late August through September. The statistical peak of the Atlantic hurricane season is September 10.

The Northeast Pacific Ocean has a broader period of activity, but in a similar time frame to the Atlantic. The Northwest Pacific sees tropical cyclones year-round, with a minimum in February and March and a peak in early September. In the North Indian basin, storms are most common from April to December, with peaks in May and November. In the Southern Hemisphere, the tropical cyclone year begins on July 1 and runs all year-round encompassing the tropical cyclone seasons, which run from November 1 until the end of April, with peaks in mid-February to early March.

The formation of tropical cyclones is the topic of extensive ongoing research and is still not fully understood. While six factors appear to be generally necessary, tropical cyclones may occasionally form without meeting all of the following conditions. In most situations, water temperatures of at least 26.5°C (79.7°F) are needed down to a depth of at least 50 m (160 ft); waters of this temperature cause the overlying atmosphere to be unstable enough to sustain convection and thunderstorms. Another factor is rapid cooling with height, which allows the release of the heat of condensation that powers a tropical cyclone.

High humidity is needed, especially in the lower-to-mid troposphere; when there is a great deal of moisture in the atmosphere, conditions are more favourable for disturbances to develop. Low amounts of wind shear are needed, as high shear is disruptive to the storm's circulation. Tropical cyclones generally need to form more than 555 km (345 mi) or five degrees of latitude away from the equator, allowing the Coriolis effect to deflect winds blowing towards the low pressure centre and creating a circulation.

Lastly, a formative tropical cyclone needs a pre-existing system of disturbed weather. Tropical cyclones will not form spontaneously. Low-latitude and low-level westerly wind bursts associated with the Madden-Julian oscillation can create favourable conditions for tropical cyclogenesis by initiating tropical disturbances.

3 Movement

Locations

Most tropical cyclones form in a worldwide band of thunderstorm activity near the equator, referred to as the Intertropical Front (ITF), the Intertropical Convergence Zone (ITCZ), or the monsoon trough. Another important source of atmospheric instability is found in tropical waves, which contribute to the development of about 85% of intense tropical cyclones in the Atlantic Ocean and become most of the tropical cyclones in the Eastern Pacific. The majority forms between 10 and 30 degrees of latitude away of the equator, and 87% forms no farther away than 20 degrees north or south. Because the Coriolis effect initiates and maintains their rotation, tropical cyclones rarely form or move within 5 degrees of the equator, where the effect is weakest. However, it is still possible for tropical systems to form within this boundary as Tropical Storm Vamei and Cyclone Agni did in 2001 and 2004, respectively.

Movement

The movement of a tropical cyclone (i.e. its "track") is typically approximated as the sum of two terms: "steering" by the background environmental wind and "beta drift". Environmental steering is the dominant term. Conceptually, it represents the movement of the storm due to prevailing winds and other wider environmental conditions, similar to "leaves carried along by a stream". Physically, the winds, or flow field, in the vicinity of a tropical cyclone may be treated as having two parts: the flow associated with the storm itself, and the large-scale background flow of the environment in which the storm takes place. In this way, tropical cyclone motion may be represented to first-order simply as advection of the storm by the local environmental flow. This environmental flow is termed the "steering flow". Climatologically, tropical cyclones are steered primarily westward by the east-to-west trade winds on the equatorial side of the subtropical ridge—a persistent high-pressure area over the world's subtropical oceans.

In the tropical North Atlantic and Northeast Pacific oceans, the trade winds steer tropical easterly waves westward from the African coast toward the Caribbean Sea, North America, and ultimately into the central Pacific Ocean before the waves dampen out. These waves are the precursors to many tropical cyclones within this region. In contrast, in the Indian Ocean and Western Pacific in both hemispheres, tropical cyclogenesis is influenced less by tropical easterly waves and more by the seasonal movement of the Inter-tropical Convergence Zone and the monsoon trough. Additionally, tropical cyclone motion can be influenced by transient weather systems, such as extratropical cyclones. In addition to environmental steering, a tropical cyclone will tend to drift slowly poleward and westward, a motion known as "beta drift".

This motion is due to the superposition of a vortex, such as a tropical cyclone, onto an environment in which the Coriolis force varies with latitude, such as on a sphere or beta plane. It is induced indirectly by the storm itself, the result of a feedback between the cyclonic flow of the storm and its environment. Physically, the cyclonic circulation of the storm advects environmental air poleward east of centre and equatorial west of centre.

Because air must conserve its angular momentum, this flow configuration induces a cyclonic gyre equatorward and westward of the storm centre and an anticyclonic gyre poleward and eastward of the storm centre. The combined flow of these gyres acts to advect the storm slowly poleward and westward. This effect occurs even if there is zero environmental flow.

Multiple Storm Interaction

A third component of motion that occurs relatively infrequently involves the interaction of multiple tropical cyclones. When two cyclones approach one another, their centres will begin orbiting cyclonically about a point between the two systems. Depending on their separation distance and strength, the two vortices may simply orbit around one another or else may spiral into the centre point and merge. When the two vortices are of unequal size, the larger vortex will tend to dominate the interaction, and the smaller vortex will orbit around it. This phenomenon is called the Fujiwhara effect, after Sakuhei Fujiwhara.

4 Landfall

The landfall of a tropical cyclone occurs when a storm's surface centre moves over a coastline. Storm conditions may be experienced on the coast and inland hours before landfall; in fact, a tropical cyclone can launch its strongest winds over land, yet not make landfall. NOAA uses the term "direct hit" to describe when a location (on the left side of the eye) falls within the radius of maximum winds (or twice that radius if on the right side), whether or not the hurricane's eye made landfall.

Dissipation
A tropical cyclone can cease to have tropical characteristics in several different ways. One such way is if it moves over land, thus depriving it of the warm water it needs to power itself, quickly losing strength. Most strong storms lose their strength very rapidly after landfall and become disorganized areas of low pressure within a day or two, or evolve into extratropical cyclones. There is a chance a tropical cyclone could regenerate if it managed to get back over open warm water. If it remains over mountains for even a short time, weakening will accelerate. Many storm fatalities occur in mountainous terrain, when diminishing cyclones unleash their moisture as torrential rainfall. This rainfall may lead to deadly floods and mudslides, as was the case with Hurricane Mitch around Honduras in October 1998. Without warm surface water, the storm cannot survive.

A tropical cyclone can dissipate when it moves over waters significantly below 26.5°C (79.7°F). This will cause the storm to lose its tropical characteristics, such as a warm core with thunderstorms near the centre, and become a remnant low-pressure area. These remnant systems may persist for up to several days before losing their identity.

This dissipation mechanism is most common in the eastern North Pacific. Weakening or dissipation can occur if it experiences vertical wind shear, causing the convection and heat engine to move away from the centre; this normally ceases development of a tropical cyclone. In addition, its interaction with the main belt of the Westerlies, by means of merging with a nearby frontal zone, can cause tropical cyclones to evolve into extratropical cyclones.

This transition can take 1–3 days. Even after a tropical cyclone is said to be extratropical or dissipated, it can still have tropical storm force (or occasionally hurricane/typhoon force) winds and drop several inches of rainfall.

In the Pacific Ocean and Atlantic Ocean, such tropical-derived cyclones of higher latitudes can be violent and may occasionally remain at hurricane or typhoon-force wind speeds when they reach the west coast of North America. These phenomena can also affect Europe, where they are known as European windstorms; Hurricane Iris's extratropical remnants are an example of such a windstorm from 1995. A cyclone can also merge with another area of low pressure, becoming a larger area of low pressure. This can strengthen the resultant system, although it may no longer be a tropical cyclone. Studies in the 2000s have given rise to the hypothesis that large amounts of dust reduce the strength of tropical cyclones.

5 Effects

Tropical cyclones out at sea cause large waves, heavy rain, flood and high winds, disrupting international shipping and, at times, causing shipwrecks. Tropical cyclones stir up water, leaving a cool wake behind them, which causes the region to be less favourable for subsequent tropical cyclones. On land, strong winds can damage or destroy vehicles, buildings, bridges, and other outside objects, turning loose debris into deadly flying projectiles. The storm surge, or the increase in sea level due to the cyclone, is typically the worst effect from landfalling tropical cyclones, historically resulting in 90% of tropical cyclone deaths. The broad rotation of a landfalling tropical cyclone, and vertical wind shear at its periphery, spawns tornadoes.

Tornadoes can also be spawned as a result of eyewall mesovortices, which persist until landfall. Over the past two centuries, tropical cyclones have been responsible for the deaths of about 1.9 million people worldwide. Large areas of standing water caused by flooding lead to infection, as well as contributing to mosquito-borne illnesses. Crowded evacuees in shelters increase the risk of disease propagation. Tropical cyclones significantly interrupt infrastructure, leading to power outages, bridge destruction, and the hampering of reconstruction efforts.

On average, the Gulf and east coasts of the United States suffer approximately US $5 billion (1995 US $) in cyclone damage every year. The majority (83%) of tropical cyclone damage is caused by severe hurricanes, category 3 or greater. However, category 3 or greater hurricanes only account for about one-fifth of cyclones that make landfall every year.

Although cyclones take an enormous toll in lives and personal property, they may be important factors in the precipitation regimes of places they impact, as they may bring much-needed precipitation to otherwise dry regions. Tropical cyclones also help maintain the global heat balance by moving warm, moist tropical air to the middle latitudes and polar regions, and by regulating the thermohaline circulation through upwelling.
The storm surge and winds of hurricanes may be destructive to human-made structures, but they also stir up the waters of coastal estuaries, which are typically important fish breeding locales. Tropical cyclone destruction spurs redevelopment, greatly increasing local property values. When hurricanes surge upon shore from the ocean, salt is introduced to many freshwater areas and raises the salinity levels too high for some habitats to withstand.

Some are able to cope with the salt and recycle it back into the ocean, but others can not release the extra surface water quickly enough or do not have a large enough freshwater source to replace it. Because of this, some species of plants and vegetation die due to the excess salt. In addition, hurricanes can carry toxins and acids onto shore when they make landfall. The flood water can pick up the toxins from different spills and contaminate the land that it passes over. The toxins are very harmful to the people and animals in the area, as well as the environment around them. The flooding water can also spark many dangerous oil spills.

6 Forecasting

Intense tropical cyclones pose a particular observation challenge, as they are a dangerous oceanic phenomenon, and weather stations, being relatively sparse, are rarely available on the site of the storm itself. In general, surface observations are available only if the storm is passing over an island or a coastal area, or if there is a nearby ship. Real-time measurements are usually taken in the periphery of the cyclone, where conditions are less catastrophic and its true strength cannot be evaluated. For this reason, there are teams of meteorologists that move into the path of tropical cyclones to help evaluate their strength at the point of landfall. Tropical cyclones far from land are tracked by weather satellites capturing visible and infrared images from space, usually at half-hour to quarter-hour intervals. As a storm approaches land, it can be observed by land-based Doppler weather radar.

Radar plays a crucial role around landfall by showing a storm's location and intensity every several minutes. Because of the forces that affect tropical cyclone tracks, accurate track predictions depend on determining the position and strength of high- and low-pressure areas, and predicting how those areas will change during the life of a tropical system. The deep layer mean flow, or average wind through the depth of the troposphere, is considered the best tool in determining track direction and speed.

If storms are significantly sheared, use of wind speed measurements at a lower altitude, such as at the 70 kPa pressure surface (3,000 metres or 9,800 feet above sea level) will produce better predictions. Tropical forecasters also consider smoothing out short-term wobbles of the storm as it allows them to determine a more accurate long-term trajectory. High-speed computers and sophisticated simulation software allow forecasters to produce computer models that predict tropical cyclone tracks based on the future position and strength of high- and low-pressure systems. Combining forecast models with increased understanding of the forces that act on tropical cyclones, as well as with a wealth of data from Earth-orbiting satellites and other sensors, scientists have increased the accuracy of track forecasts over recent decades.

However, scientists are not as skilful at predicting the intensity of tropical cyclones. The lack of improvement in intensity forecasting is attributed to the complexity of tropical systems and an incomplete understanding of factors that affect their development. New tropical cyclone position and forecast information is available at least every twelve hours in the Southern Hemisphere and at least every six hours in the Northern Hemisphere from Regional Specialized Meteorological Centres and Tropical Cyclone Warning Centres.

Long-Term Trends
While the number of storms in the Atlantic has increased since 1995, there is no obvious global trend; the annual number of tropical cyclones worldwide remains about 87 ± 10 (Between 77 and 97 tropical cyclones annually). However, the ability of climatologists to make long-term data analysis in certain basins is limited by the lack of reliable historical data in some basins, primarily in the Southern Hemisphere, while noting that a significant downward trend in tropical cyclone numbers has been identified for the region near Australia (based on high quality data and accounting for the influence of the El Niño-Southern Oscillation).

In spite of that, there is some evidence that the intensity of hurricanes is increasing. Kerry Emanuel stated, "Records of hurricane activity worldwide show an upswing of both the maximum wind speed in and the duration of hurricanes. The energy released by the average hurricane (again considering all hurricanes worldwide) seems to have increased by around 70% in the past 30 years or so, corresponding to about a 15% increase in the maximum wind speed and a 60% increase in storm lifetime.

Atlantic storms are becoming more destructive financially, as evidenced by the fact that five of the ten most expensive storms in United States history have occurred since 1990. According to the World Meteorological Organization, "recent increase in societal impact from tropical cyclones has been caused largely by rising concentrations of population and infrastructure in coastal regions."

The number and strength of Atlantic hurricanes may undergo a 50–70 year cycle, also known as the Atlantic Multidecadal Oscillation. Nyberg et al. reconstructed Atlantic major hurricane activity back to the early 18th century and found five periods averaging 3–5 major hurricanes per year and lasting 40–60 years, and six other averaging 1.5–2.5 major hurricanes per year and lasting 10–20 years.

7 Classifications

Tropical cyclones are classified into three main groups, based on intensity: tropical depressions, tropical storms, and a third group of more intense storms, whose name depends on the region. For example, if a tropical storm in the North-western Pacific reaches hurricane-strength winds on the Beaufort scale, it is referred to as a typhoon; if a tropical storm passes the same benchmark in the Northeast Pacific Basin, or in the North Atlantic, it is called a hurricane. In the Southern Hemisphere or the Indian Ocean storms of a tropical nature are referred to as tropical cyclones.

Tropical Depression	A tropical depression or tropical low is a tropical disturbance that has a clearly defined surface circulation with maximum sustained winds of less than 34 kn (39 mph; 63 km/h). Within the Southern Hemisphere, the depression can have gale force or stronger winds in one or more quadrants, but not near the centre.
Tropical Storm	A tropical storm is an organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds between 34 knots (63 km/h) and 64 knots (119 km/h). At this point, the distinctive cyclonic shape starts to develop, although an eye is not usually present. Government weather services first assign names to systems that reach this intensity (thus the term named storm). Although tropical storms are less intense than a hurricane they can produce significant damage. The shear force of winds can blow off shingles, and air borne objects can cause damage to power lines, roofing and siding. More dangerous is the heavy rainfall causing inland flooding.

Continental Classifications

<table>
<tr><th>Beaufort Scale</th><th>1-minute sustained winds</th><th>10-minute sustained winds</th><th>NE Pacific & N Atlantic</th><th>NW Pacific</th><th>NW Pacific</th><th>N Indian Ocean</th><th>SW Indian Ocean</th><th>Australia & S Pacific</th></tr>
<tr><td>0–7</td><td><32 knots
37 mph
59 km/h</td><td><28 knots
32 mph
52 km/h</td><td rowspan="2">Tropical Depression</td><td rowspan="2">Tropical Depression</td><td rowspan="3">Tropical Depression</td><td>Depression</td><td>Zone of Disturbed Weather</td><td rowspan="3">Tropical Disturbance
Tropical Depression
Tropical Low</td></tr>
<tr><td>7</td><td>33 knots
38 mph
61 km/h</td><td>28–29 knots
32–33 mph
52–54 km/h</td><td rowspan="2">Deep Depression</td><td>Tropical Disturbance</td></tr>
<tr><td>8</td><td>34–37 knots
39–43 mph
63–69 km/h</td><td>30–33 knots
35–38 mph
56–61 km/h</td><td rowspan="3">Tropical Storm</td><td rowspan="3">Tropical Storm</td><td>Tropical Depression</td></tr>
<tr><td>9-10</td><td>38–54 knots
44–62 mph
70–100 km/h</td><td>34–47 knots
39–54 mph
63–87 km/h</td><td>Tropical Storm</td><td>Cyclonic Storm</td><td>Moderate Tropical Storm</td><td>Category 1 Tropical Cyclone</td></tr>
<tr><td>11</td><td>55–63 knots
63–72 mph
102–117 km/h</td><td>48–55 knots
55–63 mph
89–102 km/h</td><td rowspan="2">Severe Tropical Storm</td><td rowspan="2">Severe Cyclonic Storm</td><td rowspan="2">Severe Tropical Storm</td><td rowspan="2">Category 2 Tropical Cyclone</td></tr>
<tr><td rowspan="4"></td><td>64–71 knots
74–82 mph
119–131 km/h</td><td>56–63 knots
64–72 mph
104–117 km/h</td><td rowspan="2">Category 1 Hurricane</td><td rowspan="4">Typhoon</td></tr>
<tr><td>72–82 knots
83–94 mph
133–152 km/h</td><td>64–72 knots
74–83 mph
119–133 km/h</td><td rowspan="3"></td><td rowspan="3">Very Severe Cyclonic Storm</td><td rowspan="3">Tropical Cyclone</td><td rowspan="3">Category 3 Severe Tropical Cyclone</td></tr>
<tr><td>83–95 knots
96–109 mph
154–176 km/h</td><td>73–83 knots
84–96 mph
135–154 km/h</td><td>Category 2 Hurricane</td></tr>
<tr><td>96–97 knots
110–112 mph
178–180 km/h</td><td>84–85 knots
97–98 mph
156–157 km/h</td><td>Category 3 Major</td></tr>
</table>

Beaufort Scale	1-minute sustained winds	10-minute sustained winds	NE Pacific & N Atlantic	NW Pacific	NW Pacific	N Indian Ocean	SW Indian Ocean	Australia & S Pacific
12+	98–112 knots 113–129 mph 181–207 km/h	86–98 knots 99–113 mph 159–181 km/h	Major Hurricane		Typhoon	Extremely Severe Cyclonic Storm	Intense Tropical Cyclone	Category 4 Severe Tropical Cyclone
	113–122 knots 130–140 mph 209–226 km/h	99–107 knots 114–123 mph 183–198 km/h						
	123–129 knots 142–148 mph 228–239 km/h	108–113 knots 124–130 mph 200–209 km/h	Category 4 Major Hurricane					
	130–136 knots 150–157 mph 241–252 km/h	114–119 knots 131–137 mph 211–220 km/h		Super Typhoon		Super Cyclonic Storm	Very Intense Tropical Cyclone	Category 5 Severe Tropical Cyclone
	>137 knots 158 mph 254 km/h	>120 knots 140 mph 220 km/h	Category 5 Major Hurricane					

11 Drought

A drought is a period of below-average precipitation in a given region, resulting in prolonged shortages in the water supply, whether atmospheric, surface water or ground water. A drought can last for months or years, or may be declared after as few as 15 days. It can have a substantial impact on the ecosystem and agriculture of the affected region and harm to the local economy. Annual dry seasons in the tropics significantly increase the chances of a drought developing and subsequent bush fires. Periods of heat can significantly worsen drought conditions by hastening evaporation of water vapour.

Many plant species, such as those in the family Cactaceae (or cacti), have drought tolerance adaptations like reduced leaf area and waxy cuticles to enhance their ability to tolerate drought. Some others survive dry periods as buried seeds. Semi-permanent drought produces arid biomes such as deserts and grasslands. Prolonged droughts have caused mass migrations and humanitarian crisis. Most arid ecosystems have inherently low productivity. The most prolonged drought ever in the world in recorded history occurred in the Atacama Desert in Chile (400 Years).

Causes

Precipitation Deficiency
Mechanisms of producing precipitation include convective, stratiform, and orographic rainfall. Convective processes involve strong vertical motions that can cause the overturning of the atmosphere in that location within an hour and cause heavy precipitation, while stratiform processes involve weaker upward motions and less intense precipitation over a longer duration. Precipitation can be divided into three categories, based on whether it falls as liquid water, liquid water that freezes on contact with the surface, or ice. Droughts occur mainly in areas where normal levels of rainfall are, in themselves, low. If these factors do not support precipitation volumes sufficiently to reach the surface over a sufficient time, the result is a drought.

Drought can be triggered by a high level of reflected sunlight and above average prevalence of high pressure systems, winds carrying continental, rather than oceanic air masses, and ridges of high pressure areas aloft can prevent or restrict the developing of thunderstorm activity or rainfall over one certain region. Once a region is within drought, feedback mechanisms such as local arid air, hot conditions which can promote warm core ridging, and minimal evapotranspiration can worsen drought conditions.

Dry Season
Within the tropics, distinct, wet and dry seasons emerge due to the movement of the Intertropical Convergence Zone or Monsoon trough. The dry season greatly increases drought occurrence, and is characterized by its low humidity, with watering holes and rivers drying up. Because of the lack of these watering holes, many grazing animals are forced to migrate due to the lack of water in search of more fertile lands. Examples of such animals are zebras, elephants, and wildebeest. Because of the lack of water in the plants, bushfires are common. Since water vapor becomes more energetic with increasing temperature, more water vapor is required to increase relative humidity values to 100% at higher temperatures (or to get the temperature to fall to the dew point). Periods of warmth quicken the pace of fruit and vegetable production, increase evaporation and transpiration from plants, and worsen drought conditions.

El Niño
Drier and hotter weather occurs in parts of the Amazon River Basin, Colombia, and Central America during El Niño events. Winters during the El Niño are warmer and drier than average conditions in the Northwest, northern Midwest, and northern Mideast United States, so those regions experience reduced snowfalls. Conditions are also drier than normal from December to February in south-central Africa, mainly in Zambia, Zimbabwe, Mozambique, and Botswana. Direct effects of El Niño resulting in drier conditions occur in parts of Southeast Asia and Northern Australia, increasing bush fires, worsening haze, and decreasing air quality dramatically. Drier-than-normal conditions are also in general observed in Queensland, inland Victoria, inland New South Wales, and eastern Tasmania from June to August. As warm water spreads from the west Pacific and the Indian Ocean to the east Pacific, it causes extensive drought in the western Pacific. Singapore experienced the driest February in 2014 since records began in 1869, with only 6.3 mm of rain falling in the month and temperatures hitting as high as 35 °C on 26 February. The years 1968 and 2005 had the next driest Februaries, when 8.4 mm of rain fell.

Erosion and Human Activities
Human activity can directly trigger exacerbating factors such as over farming, excessive irrigation, deforestation, and erosion adversely impact the ability of the land to capture and hold water. In arid climates, the main source of erosion is wind. Erosion can be the result of material movement by the wind. The wind can cause small particles to be lifted and therefore moved to another region (deflation). Suspended particles within the wind may impact on solid objects causing erosion by abrasion (ecological succession). Wind erosion generally occurs in areas with little or no vegetation, often in areas where there is insufficient rainfall to support vegetation. Loess is a homogeneous, typically nonstratified, porous, friable, slightly coherent, often calcareous, fine-grained, silty, pale yellow or buff, windblown (Aeolian) sediment. It generally occurs as a widespread blanket deposit that covers areas of hundreds of square kilometers and tens of meters thick. Loess often stands in either steep or vertical faces. Loess tends to develop into highly rich soils. Under appropriate climatic conditions, areas with loess are among the most agriculturally productive in the world. Loess deposits are geologically unstable by nature, and will erode very readily. Therefore, windbreaks (such as big trees and bushes) are often planted by farmers to reduce the wind erosion of loess. Wind erosion is much more severe in arid areas and during times of drought. For example, in the Great Plains, it is estimated that soil loss due to wind erosion can be as much as 6100 times greater in drought years than in wet years.

Climatic Changes
Activities resulting in global climate change are expected to trigger droughts with a substantial impact on agriculture throughout the world, and especially in developing nations. Overall, global warming will result in increased world rainfall. Along with drought in some areas, flooding and erosion will increase in others. Paradoxically, some proposed solutions to global warming that focus on more active techniques, solar radiation management through the use of a space sunshade for one, may also carry with them increased chances of drought.

Types

As a drought persists, the conditions surrounding it gradually worsen and its impact on the local population gradually increases. People tend to define droughts in three main ways:

1	Meteorological drought occurs when there is a prolonged time with less than average precipitation. Meteorological drought usually precedes the other kinds of drought.
2	Agricultural droughts affect crop production or the ecology of the range. This condition can also arise independently from any change in precipitation levels when soil conditions and erosion triggered by poorly planned agricultural endeavors cause a shortfall in water available to the crops. However, in a traditional drought, it is caused by an extended period of below average precipitation.
3	Hydrological drought is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs fall below the statistical average. Hydrological drought tends to show up more slowly because it involves stored water that is used but not replenished. Like an agricultural drought, this can be triggered by more than just a loss of rainfall. For instance, around 2007 Kazakhstan was awarded a large amount of money by the World Bank to restore water that had been diverted to other nations from the Aral Sea under Soviet rule. Similar circumstances also place their largest lake, Balkhash, at risk of completely drying out.

Consequences

One can divide the effects of droughts and water shortages into three groups: environmental, economic and social.

Environmental Effects	Lower surface and subterranean water-levels, lower flow-levels (with a decrease below the minimum leading to direct danger for amphibian life), increased pollution of surface water, the drying out of wetlands, more and larger fires, higher deflation intensity, loss of biodiversity, worse health of trees and the appearance of pests and dendroid diseases.
Economic Losses	Economic losses include lower agricultural, forests, game and fishing output, higher food-production costs, lower energy-production levels in hydro plants, losses caused by depleted water tourism and transport revenue, problems with water supply for the energy sector and for technological processes in metallurgy, mining, the chemical, paper, wood, foodstuff industries etc., disruption of water supplies for municipal economies.
Social Costs	Social costs include the negative effect on the health of people directly exposed to this phenomenon (excessive heat waves), possible limitation of water supplies, increased pollution levels, high food-costs, stress caused by failed harvests, etc. This explains why droughts and fresh water shortages operate as a factor which increases the gap between developed and developing countries.

Effects vary according to vulnerability. For example, subsistence farmers are more likely to migrate during drought because they do not have alternative food-sources. Areas with populations that depend on water sources as a major food-source are more vulnerable to famine. Drought can also reduce water quality, because lower water-flows reduce dilution of pollutants and increase contamination of remaining water-sources. Common consequences of drought include:

● Diminished crop growth or yield productions and carrying capacity for livestock
● Dust bowls, themselves a sign of erosion, which further erode the landscape
● Dust storms, when drought hits an area suffering from desertification and erosion
● Famine
● Habitat damage, affecting both terrestrial and aquatic wildlife.
● Diminished crop growth or yield productions and carrying capacity for livestock
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● Famine
● Habitat damage, affecting both terrestrial and aquatic wildlife.
● Hunger – drought provides too little water to support food crops.
● Malnutrition, dehydration and related diseases
● Mass migration, resulting in internal displacement and international refugees
● Reduced electricity production due to reduced water-flow through hydroelectric dams
● Shortages of water for industrial users.
● Snake migration, which results in snake-bites
● Social unrest
● War over natural resources, including water and food
● Wildfires, such as Australian bushfires, become more common during times of drought and may cause human deaths.
● Exposure and oxidation of acid sulfate soils due to falling surface- and ground-water levels.
● Cyanotoxin accumulation within food chains and water supply (some are among the most potent toxins known to science) can cause cancer with low exposure over the long term. High levels of microcystin appeared in San Francisco Bay Area salt-water shellfish and fresh-water supplies throughout California in 2016.

Protection

Agriculturally, people can effectively mitigate much of the impact of drought through irrigation and crop rotation. Failure to develop adequate drought mitigation strategies carries a grave human cost in the modern era, exacerbated by ever-increasing population densities. President Roosevelt on April 27, 1935, signed documents creating the Soil Conservation Service (SCS)—now the Natural Resources Conservation Service (NRCS). Models of the law were sent to each state where they were enacted. These were the first enduring practical programs to curtail future susceptibility to drought, creating agencies that first began to stress soil conservation measures to protect farm lands today. It was not until the 1950s that there was an importance placed on water conservation was put into the existing laws (NRCS 2014). Strategies for drought protection, mitigation or relief include:

Dams	Many dams and their associated reservoirs supply additional water in times of drought.
Cloud Seeding	A form of intentional weather modification to induce rainfall. This remains a hotly debated topic, as the United States National Research Council released a report in 2004 stating that to date, there is still no convincing scientific proof of the efficacy of intentional weather modification.
Desalination	Use of sea water for irrigation or consumption.

Drought Monitoring	Continuous observation of rainfall levels and comparisons with current usage levels can help prevent man-made drought. For instance, analysis of water usage in Yemen has revealed that their water table (underground water level) is put at grave risk by over-use to fertilize their Khat crop. Careful monitoring of moisture levels can also help predict increased risk for wildfires, using such metrics as the Keetch-Byram Drought Index or Palmer Drought Index.
Land Use	Carefully planned crop rotation can help to minimize erosion and allow farmers to plant less water-dependent crops in drier years.
Outdoor Water-Use Restriction	Regulating the use of sprinklers, hoses or buckets on outdoor plants, filling pools, and other water-intensive home maintenance tasks. Xeriscaping yards can significantly reduce unnecessary water use by residents of towns and cities.
Rainwater Harvesting	Collection and storage of rainwater from roofs or other suitable catchments.
Recycled Water	Former wastewater (sewage) that has been treated and purified for reuse.
Transvasement	Building canals or redirecting rivers as massive attempts at irrigation in drought-prone areas.

12 Thunderstorm

A thunderstorm, also known as an electrical storm, lightning storm, or thundershower, is a storm characterized by the presence of lightning and its acoustic effect on the Earth's atmosphere, known as thunder. Relatively weak thunderstorms are sometimes called thundershowers. Thunderstorms occur in a type of cloud known as a cumulonimbus. They are usually accompanied by strong winds, and often produce heavy rain and sometimes snow, sleet, or hail, but some thunderstorms produce little precipitation or no precipitation at all. Thunderstorms may line up in a series or become a rainband, known as a squall line. Strong or severe thunderstorms include some of the most dangerous weather phenomena, including large hail, strong winds, and tornadoes. Some of the most persistent severe thunderstorms, known as supercells, rotate as do cyclones. While most thunderstorms move with the mean wind flow through the layer of the troposphere that they occupy, vertical wind shear sometimes causes a deviation in their course at a right angle to the wind shear direction. Thunderstorms result from the rapid upward movement of warm, moist air, sometimes along a front. As the warm, moist air moves upward, it cools, condenses, and forms a cumulonimbus cloud that can reach heights of over 20 kilometres (12 mi).

As the rising air reaches its dew point temperature, water vapor condenses into water droplets or ice, reducing pressure locally within the thunderstorm cell. Any precipitation falls the long distance through the clouds towards the Earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft as it pulls cold air with it, and this cold air spreads out at the Earth's surface, occasionally causing strong winds that are commonly associated with thunderstorms. Thunderstorms can form and develop in any geographic location but most frequently within the mid-latitude, where warm, moist air from tropical latitudes collides with cooler air from polar latitudes. Thunderstorms are responsible for the development and formation of many severe weather phenomena. Thunderstorms, and the phenomena that occur along with them, pose great hazards. Damage that results from thunderstorms is mainly inflicted by downburst winds, large hailstones, and flash flooding caused by heavy precipitation. Stronger thunderstorm cells are capable of producing tornadoes and waterspouts.

There are four types of thunderstorms: single-cell, multi-cell cluster, multi-cell lines and supercells. Supercell thunderstorms are the strongest and most severe. Mesoscale convective systems formed by favorable vertical wind shear within the tropics and subtropics can be responsible for the development of hurricanes. Dry thunderstorms, with no precipitation, can cause the outbreak of wildfires from the heat generated from the cloud-to-ground lightning that accompanies them. Several means are used to study thunderstorms: weather radar, weather stations, and video photography. Past civilizations held various myths concerning thunderstorms and their development as late as the 18th century. Beyond the Earth's atmosphere, thunderstorms have also been observed on the planets of Jupiter, Saturn, Neptune, and, probably, Venus.

Subheadings

1 Life Cycle

Warm air has a lower density than cool air, so warmer air rises upwards and cooler air will settle at the bottom (this effect can be seen with a hot air balloon). Clouds form as relatively warmer air, carrying moisture, rises within cooler air. The moist air rises, and, as it does so, it cools and some of the water vapor in that rising air condenses. When the moisture condenses, it releases energy known as latent heat of condensation, which allows the rising packet of air to cool less than the cooler surrounding air continuing the cloud's ascension.

If enough instability is present in the atmosphere, this process will continue long enough for cumulonimbus clouds to form and produce lightning and thunder. Meteorological indices such as convective available potential energy (CAPE) and the lifted index can be used to assist in determining potential upward vertical development of clouds. Generally, thunderstorms require three conditions to form:

1. Moisture
2. An unstable airmass
3. A lifting force (heat)

All thunderstorms, regardless of type, go through three stages: the developing stage, the mature stage, and the dissipation stage. The average thunderstorm has a 24 km (15 mi) diameter. Depending on the conditions present in the atmosphere, each of these three stages take an average of 30 minutes.

Developing Stage

The first stage of a thunderstorm is the cumulus stage or developing stage. During this stage, masses of moisture are lifted upwards into the atmosphere. The trigger for this lift can be solar illumination, where the heating of the ground produces thermals, or where two winds converge forcing air upwards, or where winds blow over terrain of increasing elevation. The moisture carried upward cools into liquid drops of water due to lower temperatures at high altitude, which appear as cumulus clouds.

As the water vapor condenses into liquid, latent heat is released, which warms the air, causing it to become less dense than the surrounding, drier air. The air tends to rise in an updraft through the process of convection (hence the term convective precipitation). This process creates a low-pressure zone within and beneath the forming thunderstorm. In a typical thunderstorm, approximately 500 million kilograms of water vapor are lifted into the Earth's atmosphere.

Mature Stage

In the mature stage of a thunderstorm, the warmed air continues to rise until it reaches an area of warmer air and can rise no farther. Often this 'cap' is the tropopause. The air is instead forced to spread out, giving the storm a characteristic anvil shape. The resulting cloud is called cumulonimbus incus. The water droplets coalesce into larger and heavier droplets and freeze to become ice particles. As these fall, they melt to become rain. If the updraft is strong enough, the droplets are held aloft long enough to become so large that they do not melt completely but fall as hail. While updrafts are still present, the falling rain drags the surrounding air with it, creating downdrafts as well.

The simultaneous presence of both an updraft and a downdraft marks the mature stage of the storm and produces cumulonimbus clouds. During this stage, considerable internal turbulence can occur within, which manifests as strong winds, severe lightning, and even tornadoes. Typically, if there is little wind shear, the storm will rapidly enter the dissipating stage and 'rain itself out', but, if there is sufficient change in wind speed or direction, the downdraft will be separated from the updraft, and the storm may become a supercell, where the mature stage can sustain itself for several hours.

Dissipating Stage

In the dissipation stage, the thunderstorm is dominated by the downdraft. If atmospheric conditions do not support super cellular development, this stage occurs rather quickly, approximately 20–30 minutes into the life of the thunderstorm. The downdraft will push down out of the thunderstorm, hit the ground and spread out. This phenomenon is known as a downburst. The cool air carried to the ground by the downdraft cuts off the inflow of the thunderstorm, the updraft disappears and the thunderstorm will dissipate.

Thunderstorms in an atmosphere with virtually no vertical wind shear weaken as soon as they send out an outflow boundary in all directions, which then quickly cuts off its inflow of relatively warm, moist air, and kills the thunderstorm's further growth. The downdraft hitting the ground creates an outflow boundary. This can cause downbursts, a potential hazardous condition for aircraft to fly through, as a substantial change in wind speed and direction occurs, resulting in a decrease of airspeed and the subsequent reduction in lift for the aircraft. The stronger the outflow boundary is, the stronger the resultant vertical wind shear becomes.

2 Classification

There are four main types of thunderstorms: single-cell, multi-cell, squall line (also called multi-cell line) and supercell. Which type forms depends on the instability and relative wind conditions at different layers of the atmosphere ("wind shear"). Single-cell thunderstorms form in environments of low vertical wind shear and last only 20–30 minutes. Organized thunderstorms and thunderstorm clusters/lines can have longer life cycles as they form in environments of significant vertical wind shear, normally greater than 25 knots (13 m/s) in the lowest 6 kilometres (3.7 mi) of the troposphere, which aids the development of stronger updrafts as well as various forms of severe weather.

The supercell is the strongest of the thunderstorms, most commonly associated with large hail, high winds, and tornado formation. Precipitable water values of greater than 31.8 millimetres (1.25 in) favor the development of organized thunderstorm complexes. Those with heavy rainfall normally have precipitable water values greater than 36.9 millimetres (1.45 in). Upstream values of CAPE of greater than 800 J/kg are usually required for the development of organized convection.

Single-Cell
This term technically applies to a single thunderstorm with one main updraft. Also known as air-mass thunderstorms, these are the typical summer thunderstorms in many temperate locales. They also occur in the cool unstable air that often follows the passage of a cold front from the sea during winter. Within a cluster of thunderstorms, the term "cell" refers to each separate principal updraft. Thunderstorm cells occasionally form in isolation, as the occurrence of one thunderstorm can develop an outflow boundary that sets up new thunderstorm development. Such storms are rarely severe and are a result of local atmospheric instability; hence the term "air mass thunderstorm". When such storms have a brief period of severe weather associated with them, it is known as a pulse severe storm. Pulse severe storms are poorly organized and occur randomly in time and space, making them difficult to forecast. Single-cell thunderstorms normally last 20–30 minutes.

Multi-Cell Clusters
This is the most common type of thunderstorm development. Mature thunderstorms are found near the center of the cluster, while dissipating thunderstorms exist on their downwind side. Multicell storms form as clusters of storms but may then evolve into one or more squall lines. While each cell of the cluster may only last 20 minutes, the cluster itself may persist for hours at a time. They often arise from convective updrafts in or near mountain ranges and linear weather boundaries, such as strong cold fronts or troughs of low pressure. These type of storms are stronger than the single-cell storm, yet much weaker than the supercell storm. Hazards with the multicell cluster include moderate-sized hail, flash flooding, and weak tornadoes.

Multicell Lines
A squall line is an elongated line of severe thunderstorms that can form along or ahead of a cold front. In the early 20th century, the term was used as a synonym for cold front. The squall line contains heavy precipitation, hail, frequent lightning, strong straight line winds, and possibly tornadoes and waterspouts. Severe weather in the form of strong straight-line winds can be expected in areas where the squall line itself is in the shape of a bow echo, within the portion of the line that bows out the most. Tornadoes can be found along waves within a line echo wave pattern, or LEWP, where mesoscale low pressure areas are present. Some bow echoes in the summer are called derechos, and move quite fast through large sections of territory. On the back edge of the rain shield associated with mature squall lines, a wake low can form, which is a mesoscale low pressure area that forms behind the mesoscale high pressure system normally present under the rain canopy, which are sometimes associated with a heat burst. This kind of storm is also known as "Wind of the Stony Lake" in southern China.

Supercells
Supercell storms are large, usually severe, quasi-steady-state storms that form in an environment where wind speed or wind direction varies with height ("wind shear"), and they have separate downdrafts and updrafts (i.e., where its associated precipitation is not falling through the updraft) with a strong, rotating updraft (a "mesocyclone"). These storms normally have such powerful updrafts that the top of the supercell storm cloud (or anvil) can break through the troposphere and reach into the lower levels of the stratosphere, and supercell storms can be 24 kilometres (15 mi) wide. Research has shown that at least 90 percent of supercells cause severe weather. These storms can produce destructive tornadoes, extremely large hailstones (10 centimetres or 4 inches diameter), straight-line winds in excess of 130 km/h (81 mph), and flash floods. In fact, research has shown that most tornadoes occur from this type of thunderstorm. Supercells are generally the strongest type of thunderstorm.

Severe Thunderstorms
In the United States, a thunderstorm is classed as severe if winds reach at least 93 kilometres per hour (58 mph), hail is 25 millimetres (1 in) in diameter or larger, or if funnel clouds or tornadoes are reported. Although a funnel cloud or tornado indicates a severe thunderstorm, a tornado warning is issued in place of a severe thunderstorm warning. A severe thunderstorm warning is issued if a thunderstorm becomes severe, or will soon turn severe. In Canada, a rainfall rate greater than 50 millimetres (2 in) in one hour, or 75 millimetres (3 in) in three hours, is also used to indicate severe thunderstorms. Severe thunderstorms can occur from any type of storm cell. However, multicell, supercell, and squall lines represent the most common forms of thunderstorms that produce severe weather.

Mesoscale Convective Systems
A mesoscale convective system (MCS) is a complex of thunderstorms that becomes organized on a scale larger than the individual thunderstorms but smaller than extratropical cyclones, and normally persists for several hours or more. A mesoscale convective system's overall cloud and precipitation pattern may be round or linear in shape, and include weather systems such as tropical cyclones, squall lines, lake-effect snow events, polar lows, and mesoscale convective complexes (MCCs), and they generally form near weather fronts. Most mesoscale convective systems develop overnight and continue their lifespan through the next day. The type that forms during the warm season over land has been noted across North America, Europe, and Asia, with a maximum in activity noted during the late afternoon and evening hours. Forms of MCS that develop in the tropics are found in use either the Intertropical Convergence Zone or monsoon troughs, generally within the warm season between spring and fall. More intense systems form over land than over water. One exception is that of lake-effect snow bands, which form due to cold air moving across relatively warm bodies of water, and occurs from fall through spring. Polar lows are a second special class of MCS. They form at high latitudes during the cold season. Once the parent MCS dies, later thunderstorm development can occur in connection with its remnant mesoscale convective vortex (MCV). Mesoscale convective systems are important to the United States rainfall climatology over the Great Plains since they bring the region about half of their annual warm season rainfall.

Motion
The two major ways thunderstorms move are via advection of the wind and propagation along outflow boundaries towards sources of greater heat and moisture. Many thunderstorms move with the mean wind speed through the Earth's troposphere, the lowest 8 kilometres (5.0 mi) of the Earth's atmosphere. Weaker thunderstorms are steered by winds closer to the Earth's surface than stronger thunderstorms, as the weaker thunderstorms are not as tall. Organized, long-lived thunderstorm cells and complexes move at a right angle to the direction of the vertical wind shear vector. If the gust front, or leading edge of the outflow boundary, races ahead of the thunderstorm, its motion will accelerate in tandem. This is more of a factor with thunderstorms with heavy precipitation (HP) than with thunderstorms with low precipitation (LP). When thunderstorms merge, which is most likely when numerous thunderstorms exist in proximity to each other, the motion of the stronger thunderstorm normally dictates the future motion of the merged cell. The stronger the mean wind, the less likely other processes will be involved in storm motion. On weather radar, storms are tracked by using a prominent feature and tracking it from scan to scan.

Back-Building Thunderstorm
A back-building thunderstorm, commonly referred to as a training thunderstorm, is a thunderstorm in which new development takes place on the upwind side (usually the west or southwest side in the Northern Hemisphere), such that the storm seems to remain stationary or propagate in a backward direction. Though the storm often appears stationary on radar, or even moving upwind, this is an illusion. The storm is really a multi-cell storm with new, more vigorous cells that form on the upwind side, replacing older cells that continue to drift downwind. When this happens, catastrophic flooding is possible. In Rapid City, South Dakota, in 1972, an unusual alignment of winds at various levels of the atmosphere combined to produce a continuously training set of cells that dropped an enormous quantity of rain upon the same area, resulting in devastating flash flooding. A similar event occurred in Boscastle, England, on 16 August 2004, and over Chennai on 1 December 2015.

3 Hazards

Each year, many people are killed or seriously injured by severe thunderstorms despite the advance warning. While severe thunderstorms are most common in the spring and summer, they can occur at just about any time of the year.

Cloud-to-Ground Lightning

Cloud-to-ground lightning frequently occurs within the phenomena of thunderstorms and have numerous hazards towards landscapes and populations. One of the more significant hazards lightning can pose is the wildfires they are capable of igniting. Under a regime of low precipitation (LP) thunderstorms, where little precipitation is present, rainfall cannot prevent fires from starting when vegetation is dry as lightning produces a concentrated amount of extreme heat. Direct damage caused by lightning strikes occurs on occasion. In areas with a high frequency for cloud-to-ground lightning, like Florida, lightning causes several fatalities per year, most commonly to people working outside. Acid rain is also a frequent risk produced by lightning.

Distilled water has a neutral pH of 7. “Clean” or unpolluted rain has a slightly acidic pH of about 5.2, because carbon dioxide and water in the air react together to form carbonic acid, a weak acid (pH 5.6 in distilled water), but unpolluted rain also contains other chemicals. Nitric oxide present during thunderstorm phenomena, caused by the oxidation of atmospheric nitrogen, can result in the production of acid rain, if nitric oxide forms compounds with the water molecules in precipitation, thus creating acid rain. Acid rain can damage infrastructures containing calcite or certain other solid chemical compounds. In ecosystems, acid rain can dissolve plant tissues of vegetations and increase acidification process in bodies of water and in soil, resulting in deaths of marine and terrestrial organisms.

Hail

Any thunderstorm that produces hail that reaches the ground is known as a hailstorm. Thunderclouds that are capable of producing hailstones are often seen obtaining green coloration. Hail is more common along mountain ranges because mountains force horizontal winds upwards (known as orographic lifting), thereby intensifying the updrafts within thunderstorms and making hail more likely. One of the more common regions for large hail is across mountainous northern India, which reported one of the highest hail-related death tolls on record in 1888. China also experiences significant hailstorms. Across Europe, Croatia experiences frequent occurrences of hail.

In North America, hail is most common in the area where Colorado, Nebraska, and Wyoming meet, known as "Hail Alley". Hail in this region occurs between the months of March and October during the afternoon and evening hours, with the bulk of the occurrences from May through September. Cheyenne, Wyoming is North America's most hail-prone city with an average of nine to ten hailstorms per season.

In South America, areas prone to hail are cities like Bogotá, Colombia. Hail can cause serious damage, notably to automobiles, aircraft, skylights, glass-roofed structures, livestock, and most commonly, farmers' crops. Hail is one of the most significant thunderstorm hazards to aircraft. When hail stones exceed 13 millimetres (0.5 in) in diameter, planes can be seriously damaged within seconds. The hailstones accumulating on the ground can also be hazardous to landing aircraft.

Wheat, corn, soybeans, and tobacco are the most sensitive crops to hail damage. Hail is one of Canada's most costly hazards. Hailstorms have been the cause of costly and deadly events throughout history. One of the earliest recorded incidents occurred around the 9th century in Roopkund, Uttarakhand, India. The largest hailstone in terms of maximum circumference and length ever recorded in the United States fell in 2003 in Aurora, Nebraska, United States.

Tornadoes and Waterspouts

A tornado is a violent, rotating column of air in contact with both the surface of the earth and a cumulonimbus cloud (otherwise known as a thundercloud) or, in rare cases, the base of a cumulus cloud. Tornadoes come in many sizes but are typically in the form of a visible condensation funnel, whose narrow end touches the earth and is often encircled by a cloud of debris and dust.

Most tornadoes have wind speeds between 40 and 110 mph (64 and 177 km/h), are approximately 75 metres (246 ft) across, and travel several kilometers (a few miles) before dissipating. Some attain wind speeds of more than 300 mph (480 km/h), stretch more than 1,600 metres (1 mi) across, and stay on the ground for more than 100 kilometres (dozens of miles).

The Fujita scale and the Enhanced Fujita Scale rate tornadoes by damage caused. An EF0 tornado, the weakest category, damages trees but not substantial structures. An EF5 tornado, the strongest category, rips buildings off their foundations and can deform large skyscrapers. The similar TORRO scale ranges from a T0 for extremely weak tornadoes to T11 for the most powerful known tornadoes.

Doppler radar data, photogrammetry, and ground swirl patterns (cycloidal marks) may also be analyzed to determine intensity and award a rating. Waterspouts have similar characteristics as tornadoes, characterized by a spiraling funnel-shaped wind current that form over bodies of water, connecting to large cumulonimbus clouds. Waterspouts are generally classified as forms of tornadoes, or more specifically, non-supercelled tornadoes that develop over large bodies of water. These spiralling columns of air frequently develop within tropical areas close to the equator, but are less common within areas of high latitude.

Flash Flood

Flash flooding is the process where a landscape, most notably an urban environment, is subjected to rapid floods. These rapid floods occur more quickly and are more localized than seasonal river flooding or areal flooding and are frequently (though not always) associated with intense rainfall. Flash flooding can frequently occur in slow-moving thunderstorms and is usually caused by the heavy liquid precipitation that accompanies it. Flash floods are most common in densely populated urban environments, where few plants and bodies of water are present to absorb and contain the extra water. Flash flooding can be hazardous to small infrastructure, such as bridges, and weakly constructed buildings. Plants and crops in agricultural areas can be destroyed and devastated by the force of raging water. Automobiles parked within affected areas can also be displaced. Soil erosion can occur as well, exposing risks of landslide phenomena.

Downburst

Downburst winds can produce numerous hazards to landscapes experiencing thunderstorms. Downburst winds are generally very powerful, and are often mistaken for wind speeds produced by tornadoes, due to the concentrated amount of force exerted by their straight-horizontal characteristic. Downburst winds can be hazardous to unstable, incomplete, or weakly constructed infrastructures and buildings. Agricultural crops, and other plants in nearby environments can be uprooted and damaged. Aircraft engaged in takeoff or landing can crash. Automobiles can be displaced by the force exerted by downburst winds. Downburst winds are usually formed in areas when high pressure air systems of downdrafts begin to sink and displace the air masses below it, due to their higher density. When these downdrafts reach the surface, they spread out and turn into the destructive straight-horizontal winds.

Thunderstorm Asthma

Thunderstorm asthma is the triggering of an asthma attack by environmental conditions directly caused by a local thunderstorm. During a thunderstorm, pollen grains can absorb moisture and then burst into much smaller fragments with these fragments being easily dispersed by wind. While larger pollen grains are usually filtered by hairs in the nose, the smaller pollen fragments are able to pass through and enter the lungs, triggering the asthma attack.

Lightning

Lightning strikes the ground, the air, or inside clouds. There are roughly 5 to 10 times as many cloud flashes as there are cloud-to-ground flashes. There are two types of ground flashes: natural (those that occur because of normal electrification in the environment), and artificially initiated or triggered. Artificially initiated lightning includes strikes to very tall structures, airplanes, rockets and towers on mountains. Triggered lightning goes from ground to cloud, while "natural" lightning is cloud to ground.

In cloud-to-ground lightning (CG), a channel of negative charge, called a stepped leader, will zigzag downward in roughly 50-yard segments in a forked pattern. This stepped leader is invisible to the human eye, and shoots to the ground in less time than it takes to blink. As it nears the ground, the negatively charged stepped leader is attracted to a channel of positive charge reaching up, a streamer, normally through something tall, such as a tree, house, or telephone pole. When the oppositely-charged leader and streamer connect, a powerful electrical current begins flowing.

A return stroke of bright luminosity travels about 60,000 miles per second back towards the cloud. A flash consists of one or perhaps as many as 20 return strokes. We see lightning flicker when the process rapidly repeats itself several times along the same path. The actual diameter of a lightning channel is 2.5-5cm. (1-2 inches) A typical cloud-to-ground flash is a negative stepped leader that travels downward through the cloud, followed by an upward travelling return stroke. The net effect of this flash is to lower negative charge from the cloud to the ground. Less common, a downward travelling positive leader followed by an upward return stroke will lower positive charge to earth.

Cloud Flashes

Cloud flashes sometimes have visible channels that extend out into the air around the storm (cloud-to-air or CA), but do not strike the ground. The terms sheet lightning or intra-cloud lightning (IC) refers to lightning embedded within a cloud that lights up as a sheet of luminosity during the flash. A related term, heat lightning, is lightning or lightning-induced illumination that is too far away for thunder to be heard. Lightning can also travel from cloud-to-cloud (CC). Spider lightning refers to long, horizontally travelling flashes often seen on the underside of stratiform clouds.

Lightning Mapping Arrays provide three-dimensional mapping of lightning channel segments over the array. Up to thousands of points can be mapped for an individual lightning flash to reveal its location and the development of its structure. Large thunderstorms are capable of producing other kinds of electrical phenomena called transient luminous events (TLEs) that occur high in the atmosphere. They are rarely observed visually and not well understood. The most common TLEs include red sprites, blue jets, and elves.

Red Sprites can appear directly above an active thunderstorm as a large but weak flash. They usually happen at the same time as powerful positive CG lightning strokes. They can extend up to 60 miles from the cloud top. Sprites are mostly red and usually last no more than a few seconds, and their shapes are described as resembling jellyfish, carrots, or columns. Because sprites are not very bright, they can only be seen at night. They are rarely seen with the human eye, so they are most often imaged with highly sensitive cameras. Blue jets emerge from the top of the thundercloud, but are not directly associated with cloud-to-ground lightning.

They extend up in narrow cones fanning out and disappearing at heights of 25-35 miles. Blue jets last a fraction of a second and have been witnessed by pilots. Elves are rapidly expanding disk-shaped regions of glowing that can be up to 300 miles across. They last less than a thousandth of a second, and occur above areas of active cloud to ground lightning. Scientists believe elves result when an energetic electromagnetic pulse extends up into the ionosphere. Elves were discovered in 1992 by a low-light video camera on the Space Shuttle.

4 Preparedness

Most thunderstorms come and go fairly uneventfully; however, any thunderstorm can become severe, and all thunderstorms, by definition, present the danger of lightning. Thunderstorm preparedness and safety refers to taking steps before, during, and after a thunderstorm to minimize injury and damage. Preparedness refers to precautions that should be taken before a thunderstorm. Some preparedness takes the form of general readiness (as a thunderstorm can occur at any time of the day or year). Preparing a family emergency plan, for example, can save valuable time if a storm arises quickly and unexpectedly. Preparing the home by removing dead or rotting limbs and trees, which can be blown over in high winds, can also significantly reduce the risk of property damage and personal injury.

The National Weather Service (NWS) in the United States recommends several precautions that people should take if thunderstorms are likely to occur:

- Know the names of local counties, cities, and towns, as these are how warnings are described.
- Monitor forecasts and weather conditions and know whether thunderstorms are likely in the area.
- Be alert for natural signs of an approaching storm.
- Cancel or reschedule outdoor events (to avoid being caught outdoors when a storm hits).
- Take action early so you have time to get to a safe place.
- Get inside a substantial building or hard-topped metal vehicle before threatening weather arrives.
- If you hear thunder, get to the safe place immediately.
- Avoid open areas like hilltops, fields, and beaches, and don't be or be near the tallest objects in an area when thunderstorms are occurring.
- Don't shelter under tall or isolated trees during thunderstorms.
- If in the woods, put as much distance as possible between you and any trees during thunderstorms.
- If in a group, spread out to increase the chances of survivors who could come to the aid of any victims from a lightning strike.

Safety

While safety and preparedness often overlap, “thunderstorm safety” generally refers to what people should do during and after a storm. The American Red Cross recommends that people follow these precautions if a storm is imminent or in progress:
- Take action immediately upon hearing thunder. Anyone close enough to the storm to hear thunder can be struck by lightning.
- Avoid electrical appliances, including corded telephones. Cordless and wireless telephones are safe to use during a thunderstorm.
- Close and stay away from windows and doors, as glass can become a serious hazard in high wind.
- Do not bathe or shower, as plumbing conducts electricity.
- If driving, safely exit the roadway, turn on hazard lights, and park. Remain in the vehicle and avoid touching metal.

The NWS stopped recommending the "lightning crouch" in 2008 as it doesn't provide a significant level of protection and will not significantly lower the risk of being killed or injured from a nearby lightning strike.

5 Hailstorm

Hail is a form of solid precipitation. It is distinct from ice pellets (American sleet), though the two are often confused. It consists of balls or irregular lumps of ice, each of which is called a hailstone. Ice pellets fall generally in cold weather while hail growth is greatly inhibited during cold surface temperatures. Unlike other forms of water ice such as graupel, which is made of rime, and ice pellets, which are smaller and translucent, hailstones usually measure between 5 mm (0.2 in) and 15 cm (6 in) in diameter.

The METAR reporting code for hail 5 mm (0.20 in) or greater is GR, while smaller hailstones and graupel are coded GS. Hail is possible within most thunderstorms as it is produced by cumulonimbus, and within 2 nmi (3.7 km) of the parent storm. Hail formation requires environments of strong, upward motion of air with the parent thunderstorm (similar to tornadoes) and lowered heights of the freezing level. In the mid-latitudes, hail forms near the interiors of continents, while in the tropics, it tends to be confined to high elevations. There are methods available to detect hail-producing thunderstorms using weather satellites and weather radar imagery.

Hailstones generally fall at higher speeds as they grow in size, though complicating factors such as melting, friction with air, wind, and interaction with rain and other hailstones can slow their descent through Earth's atmosphere. Severe weather warnings are issued for hail when the stones reach a damaging size, as it can cause serious damage to human-made structures and, most commonly, farmers' crops.

Any thunderstorm which produces hail that reaches the ground is known as a hailstorm. Hail has a diameter of 5 millimetres (0.20 in) or more. Hailstones can grow to 15 centimetres (6 in) and weigh more than 0.5 kilograms (1.1 lb). Unlike ice pellets, hailstones are layered and can be irregular and clumped together. Hail is composed of transparent ice or alternating layers of transparent and translucent ice at least 1 millimetre (0.039 in) thick, which are deposited upon the hailstone as it travels through the cloud, suspended aloft by air with strong upward motion until its weight overcomes the updraft and falls to the ground.

Although the diameter of hail is varied, in the United States, the average observation of damaging hail is between 2.5 cm (1 in) and golf ball-sized (1.75 in). Stones larger than 2 cm (0.80 in) are usually considered large enough to cause damage. The Meteorological Service of Canada issues severe thunderstorm warnings when hail that size or above is expected.

The US National Weather Service has a 2.5 cm (1 in) or greater in diameter threshold, effective January 2010, an increase over the previous threshold of ¾-inch hail. Other countries have different thresholds according to local sensitivity to hail; for instance grape growing areas could be adversely impacted by smaller hailstones. Hailstones can be very large or very small, depending on how strong the updraft is: weaker hailstorms produce smaller hailstones than stronger hailstorms (such as supercells).

Formation
Hail forms in strong thunderstorm clouds, particularly those with intense updrafts, high liquid water content, great vertical extent, large water droplets, and where a good portion of the cloud layer is below freezing 0 °C (32 °F). These types of strong updrafts can also indicate the presence of a tornado. The growth rate of hailstones is impacted by factors such as higher elevation, lower freezing zones, and wind shear.

Size
The size of hailstones is best determined by measuring their diameter with a ruler. In the absence of a ruler, hailstone size is often visually estimated by comparing its size to that of known objects, such as coins. Using the objects such as hen's eggs, peas, and marbles for comparing hailstone sizes is imprecise, due to their varied dimensions. The UK organisation, TORRO, also scales for both hailstones and hailstorms. Terminal velocity of hail, or the speed at which hail is falling when it strikes the ground, varies. It is estimated that a hailstone of 1 centimetre (0.39 in) in diameter falls at a rate of 9 metres per second (20 mph), while stones the size of 8 centimetres (3.1 in) in diameter fall at a rate of 48 metres per second (110 mph). Hailstone velocity is dependent on the size of the stone, friction with air it is falling through, the motion of wind it is falling through, collisions with raindrops or other hailstones, and melting as the stones fall through a warmer atmosphere. As hail stones are not perfect spheres it is difficult to calculate their speed accurately.

Records

Megacryometeors, large rocks of ice that are not associated with thunderstorms, are not officially recognized by the World Meteorological Organization as "hail," which are aggregations of ice associated with thunderstorms, and therefore records of extreme characteristics of megacryometeors are not given as hail records.	**Heaviest Hail** 1.02 kg (2.25 lb); Gopalganj District, Bangladesh, 14 April 1986.	**Largest Diameter Officially Measured** 7.9 inches (20 cm) diameter, 18.622 inches (47.3 cm) circumference; Vivian, South Dakota, 23 July 2010.	**Largest Circumference Officially Measured** 18.74 inches (47.6 cm) circumference, 7.0 inches (17.8 cm) diameter; Aurora, Nebraska, 22 June 2003.	**Greatest Average Hail Precipitation** Kericho, Kenya experiences hailstorms, on average, 50 days annually. Kericho is close to the equator and the elevation of 7,200 feet contributes to it being a hot spot for hail. Kericho reached the world record for 132 days of hail in one year.

Hazards

NATURAL DISASTERS Thunderstorm Hailstorm Hazards

Hail can cause serious damage, notably to automobiles, aircraft, skylights, glass-roofed structures, livestock, and most commonly, crops. Hail damage to roofs often goes unnoticed until further structural damage is seen, such as leaks or cracks. It is hardest to recognize hail damage on shingled roofs and flat roofs, but all roofs have their own hail damage detection problems. Metal roofs are fairly resistant to hail damage, but may accumulate cosmetic damage in the form of dents and damaged coatings. Hail is one of the most significant thunderstorm hazards to aircraft. When hailstones exceed 0.5 inches (13 mm) in diameter, planes can be seriously damaged within seconds.

The hailstones accumulating on the ground can also be hazardous to landing aircraft. Hail is also a common nuisance to drivers of automobiles, severely denting the vehicle and cracking or even shattering windshields and windows. Wheat, corn, soybeans, and tobacco are the most sensitive crops to hail damage. Hail is one of Canada's most expensive hazards. Rarely, massive hailstones have been known to cause concussions or fatal head trauma. Hailstorms have been the cause of costly and deadly events throughout history. One of the earliest known incidents occurred around the 9th century in Roopkund, Uttarakhand, India, where 200 to 600 nomads seem to have died of injuries from hail the size of cricket balls.

Accumulations

NATURAL DISASTERS Thunderstorm Hailstorm Accumulations

Narrow zones where hail accumulates on the ground in association with thunderstorm activity are known as hail streaks or hail swaths, which can be detectable by satellite after the storms pass by. Hailstorms normally last from a few minutes up to 15 minutes in duration. Accumulating hail storms can blanket the ground with over 2 inches (5.1 cm) of hail, cause thousands to lose power, and bring down many trees. Flash flooding and mudslides within areas of steep terrain can be a concern with accumulating hail. Depths of up to 18 in (0.46 m) have been reported. A landscape covered in accumulated hail generally resembles one covered in accumulated snow and any significant accumulation of hail has the same restrictive effects as snow accumulation, albeit over a smaller area, on transport and infrastructure.

Accumulated hail can also cause flooding by blocking drains, and hail can be carried in the floodwater, turning into a snow-like slush which is deposited at lower elevations. On somewhat rare occasions, a thunderstorm can become stationary or nearly so while prolifically producing hail and significant depths of accumulation do occur; this tends to happen in mountainous areas, such as the July 29, 2010 case of a foot of hail accumulation in Boulder County, Colorado.

On June 5, 2015, hail up to four feet deep fell on one city block in Denver, Colorado. The hailstones, described as between the size of bumble bees and ping pong balls, were accompanied by rain and high winds. The hail fell in only the one area, leaving the surrounding area untouched. It fell for one and a half hours between 10 p.m. and 11:30 pm. A meteorologist for the National Weather Service in Boulder said, "It's a very interesting phenomenon. We saw the storm stall. It produced copious amounts of hail in one small area. It's a meteorological thing."

Tractors used to clear the area filled more than 30 dump-truck loads of hail. Research focused on four individual days that accumulated more than 5.9 inches (15 cm) of hail in 30 minutes on the Colorado front range has shown that these events share similar patterns in observed synoptic weather, radar, and lightning characteristics, suggesting the possibility of predicting these events prior to their occurrence. A fundamental problem in continuing research in this area is that, unlike hail diameter, hail depth is not commonly reported. The lack of data leaves researchers and forecasters in the dark when trying to verify operational methods. A cooperative effort between the University of Colorado and the National Weather Service is in progress. The joint project's goal is to enlist the help of the general public to develop a database of hail accumulation depths.

6 Derecho

NATURAL DISASTERS Thunderstorm Derecho

A derecho is a widespread, long-lived, straight-line wind storm that is associated with a fast-moving group of severe thunderstorms known as a mesoscale convective system and potentially rivaling hurricanic and tornadic forces.

Derechos can cause hurricane-force winds, tornadoes, heavy rains, and flash floods. In many cases, convection-induced winds take on a bow echo (backward "C") form of squall line, often forming beneath an area of diverging upper tropospheric winds, and in a region of both rich low-level moisture and warm-air advection. Derechos move rapidly in the direction of movement of their associated storms, similar to an outflow boundary (gust front), except that the wind remains sustained for a greater period of time (often increasing in strength after onset), and may exceed hurricane-force. A derecho-producing convective system may remain active for many hours and, occasionally, over multiple days.

A warm-weather phenomenon, derechos occur mostly in summer, especially during June, July, and August in the Northern Hemisphere, within areas of moderately strong instability and moderately strong vertical wind shear. However, derechos may occur at any time of the year, and can occur as frequently at night as during the day.

Various studies since the 1980s have shed light on the physical processes responsible for the production of widespread damaging winds by thunderstorms. In addition, it has become apparent that the most damaging derechos are associated with particular types of mesoscale convective systems that are self-perpetuating (meaning that the convective systems are not strongly dependent on the larger-scale meteorological processes such as those associated with blizzard-producing winter storms and strong cold fronts). In addition, the term "derecho" sometimes is misapplied to convectively generated wind events that are not particularly well-organized or long-lasting. For these reasons, a more precise, physically based definition of "derecho" has been introduced within the meteorological community.

Development

NATURAL DISASTERS Thunderstorm Derecho Development

Organized areas of thunderstorm activity reinforce pre-existing frontal zones, and can outrun cold fronts. The resultant mesoscale convective system (MCS) often forms at the point of the strongest divergence of the upper-level flow in the area of greatest low-level inflow and convergence. The convection tends to move east or toward the equator, roughly parallel to low-level thickness lines and usually somewhat to the right of the mean tropospheric flow. When the convection is strongly linear or slightly curved, the MCS is called a squall line, with the strongest winds typically occurring just behind the leading edge of the significant wind shift and pressure rise.

Classic derechos occur with squall lines that contain bow- or spearhead-shaped features as seen by weather radar that are known as bow echoes or spearhead echoes. Squall lines typically "bow out" due to the formation of a mesoscale high pressure system which forms within the stratiform rain area behind the initial convective line. This high pressure area is formed due to strong descending air currents behind the squall line, and could come in the form of a downburst. The size of the bow may vary, and the storms associated with the bow may die and redevelop.

During the cool season within the Northern Hemisphere, derechos generally develop within a pattern of mid-tropospheric southwesterly winds, in an environment of low to moderate atmospheric instability (caused by relative warmth and moisture near ground level, with cooler air aloft, as measured by convective available potential energy), and high values of vertical wind shear (20 m/s [72 km/h; 39 kn; 45 mph]) within the lowest 5 km [16,000 feet] of the atmosphere).

Warm season derechos in the Northern Hemisphere most often form in west to northwesterly flow at mid-levels of the troposphere, with moderate to high levels of thermodynamic instability. As previously mentioned, derechos favor environments of low-level warm advection and significant low-level moisture.

7 Microburst

A microburst is an intense small-scale downdraft produced by a thunderstorm or rain shower. There are two types of microbursts: wet microbursts and dry microbursts. They go through three stages in their cycle, the downburst, outburst, and cushion stages. A microburst can be particularly dangerous to aircraft, especially during landing, due to the wind shear caused by its gust front. Several fatal and historic crashes have been attributed to the phenomenon over the past several decades, and flight crew training goes to great lengths on how to properly recover from a microburst/wind shear event. When rain falls below the cloud base or is mixed with dry air, it begins to evaporate and this evaporation process cools the air. The cool air descends and accelerates as it approaches the ground. When the cool air approaches the ground, it spreads out in all directions.

High winds spread out in this type of pattern showing little or no curvature are known as straight-line winds. Dry microbursts produced by high based thunderstorms that generate little to no surface rainfall, occur in environments characterized by a thermodynamic profile exhibiting an inverted-V at thermal and moisture profile. Wet microbursts are downbursts accompanied by significant precipitation at the surface. These downbursts rely more on the drag of precipitation for downward acceleration of parcels as well as the negative buoyancy which tend to drive "dry" microbursts. As a result, higher mixing ratios are necessary for these downbursts to form (hence the name "wet" microbursts).

13 Polar Vortex

A polar vortex is an upper-level low-pressure area lying near one of the Earth's poles. There are two polar vortices in the Earth's atmosphere, overlying the North and South Poles. Each polar vortex is a persistent, large-scale, low-pressure zone that rotates counter-clockwise at the North Pole (called a cyclone) and clockwise at the South Pole, i.e., both polar vortices rotate eastward around the poles. The bases of the two polar vortices are located in the middle and upper troposphere and extend into the stratosphere. Beneath that lies a large mass of cold, dense Arctic air.

The interface between the cold dry air mass of the pole and the warm moist air mass farther south defines the location of the polar front. The polar front is centered, roughly at 60° latitude. A polar vortex strengthens in the winter and weakens in the summer due to its dependence on the temperature difference between the equator and the poles. The vortices span less than 1,000 kilometers (620 miles) in diameter, within which they rotate counter-clockwise in the Northern Hemisphere and in a clockwise fashion in the Southern Hemisphere. As with other cyclones, their rotation is driven by the Coriolis effect.

The vortices weaken and strengthen from year to year. When the vortex of the Arctic is strong, it is well defined, there is a single vortex, and the Arctic air is well contained; when weaker, which it generally is, it will break into two or more vortices; when very weak, the flow of Arctic air becomes more disorganized, and masses of cold Arctic air can push equatorward, bringing with them a rapid and sharp temperature drop. When the polar vortex is strong, there is a single vortex with a jet stream that is "well constrained" near the polar front. When the northern vortex weakens, it separates into two or more vortices, the strongest of which are near Baffin Island, Canada, and the other over northeast Siberia.

The Antarctic vortex of the Southern Hemisphere is a single low-pressure zone that is found near the edge of the Ross ice shelf, near 160 west longitude. When the polar vortex is strong, the mid-latitude Westerlies (winds at the surface level between 30° and 60° latitude from the west) increase in strength and are persistent. When the polar vortex is weak, high-pressure zones of the mid-latitudes may push poleward, moving the polar vortex, jet stream, and polar front equatorward. The jet stream is seen to "buckle" and deviate south. This rapidly brings cold dry air into contact with the warm, moist air of the mid-latitudes, resulting in a rapid and dramatic change of weather known as a "cold snap". Ozone depletion occurs within the polar vortices – particularly over the Southern Hemisphere – reaching a maximum depletion in the spring.

Identification

Polar cyclones are low-pressure zones embedded within the polar air masses, and exist year-round. The stratospheric polar vortex develops at latitudes above the subtropical jet stream. Horizontally, most polar vortices have a radius of less than 1,000 kilometres (620 mi). Since polar vortices exist from the stratosphere downward into the mid-troposphere, a variety of heights/pressure levels are used to mark its position. The 50 mb pressure surface is most often used to identify its stratospheric location. At the level of the tropopause, the extent of closed contours of potential temperature can be used to determine its strength. Others have used levels down to the 500 hPa pressure level (about 5,460 metres (17,910 ft) above sea level during the winter) to identify the polar vortex.

Duration & Power

Polar vortices are weakest during summer and strongest during winter. Extratropical cyclones that migrate into higher latitudes when the polar vortex is weak can disrupt the single vortex creating smaller vortices (cold-core lows) within the polar air mass. Those individual vortices can persist for more than a month. Volcanic eruptions in the tropics can lead to a stronger polar vortex during winter for as long as two years afterwards. The strength and position of the polar vortex shapes the flow pattern in a broad area about it. An index which is used in the northern hemisphere to gauge its magnitude is the Arctic oscillation. When the Arctic vortex is at its strongest, there is a single vortex, but normally, the Arctic vortex is elongated in shape, with two cyclone centers, one over Baffin Island in Canada and the other over northeast Siberia.

When the Arctic pattern is at its weakest, subtropic air masses can intrude poleward causing the Arctic air masses to move equatorward, as during the Winter 1985 Arctic outbreak. The Antarctic polar vortex is more pronounced and persistent than the Arctic one. In the Arctic the distribution of land masses at high latitudes in the Northern Hemisphere gives rise to Rossby waves which contribute to the breakdown of the polar vortex, whereas in the Southern Hemisphere the vortex is less disturbed. The breakdown of the polar vortex is an extreme event known as a sudden stratospheric warming, here the vortex completely breaks down and an associated warming of 30–50 °C (54–90 °F) over a few days can occur.

The waxing and waning of the polar vortex is driven by the movement of mass and the transfer of heat in the polar region. In the autumn, the circumpolar winds increase in speed and the polar vortex rises into the stratosphere. The result is that the polar air forms a coherent rotating air mass: the polar vortex. As winter approaches, the vortex core cools, the winds decrease, and the vortex energy declines. Once late winter and early spring approach the vortex is at its weakest. As a result, during late winter, large fragments of the vortex air can be diverted into lower latitudes by stronger weather systems intruding from those latitudes.

In the lowest level of the stratosphere, strong potential vorticity gradients remain, and the majority of that air remains confined within the polar air mass into December in the Southern Hemisphere and April in the Northern Hemisphere, well after the breakup of the vortex in the mid-stratosphere. The breakup of the northern polar vortex occurs between mid March to mid May. This event signifies the transition from winter to spring, and has impacts on the hydrological cycle, growing seasons of vegetation, and overall ecosystem productivity. The timing of the transition also influences changes in sea ice, ozone, air temperature, and cloudiness. Early and late polar breakup episodes have occurred, due to variations in the stratospheric flow structure and upward spreading of planetary waves from the troposphere.

As a result of increased waves into the vortex, the vortex experiences more rapid warming than normal, resulting in an earlier breakup and spring. When the breakup comes early, it is characterized by with persistent of remnants of the vortex. When the breakup is late, the remnants dissipate rapidly. When the breakup is early, there is one warming period from late February to middle March. When the breakup is late, there are two warming periods, one January, and one in March. Zonal mean temperature, wind, and geopotential height exert varying deviations from their normal values before and after early breakups, while the deviations remain constant before and after late breakups.

Scientists are connecting a delay in the Arctic vortex breakup with a reduction of planetary wave activities, few stratospheric sudden warming events, and depletion of ozone. Sudden stratospheric warming events are associated with weaker polar vortices. This warming of stratospheric air can reverse the circulation in the Arctic Polar Vortex from counter-clockwise to clockwise. These changes aloft force changes in the troposphere below. An example of an effect on the troposphere is the change in speed of the Atlantic Ocean circulation pattern.

A soft spot just south of Greenland is where the initial step of downwelling occurs, nicknamed the "Achilles Heel of the North Atlantic". Small amounts of heating or cooling traveling from the polar vortex can trigger or delay downwelling, altering the Gulf Stream Current of the Atlantic, and the speed of other ocean currents. Since all other oceans depend on the Atlantic Ocean's movement of heat energy, climates across the planet can be dramatically affected. The weakening or strengthening of the polar vortex can alter the sea circulation more than a mile beneath the waves. Strengthening storm systems within the troposphere that cool the poles, intensify the polar vortex. La Niña–related climate anomalies significantly strengthen the polar vortex.

Intensification of the polar vortex produces changes in relative humidity as downward intrusions of dry, stratospheric air enter the vortex core. With a strengthening of the vortex comes a longwave cooling due to a decrease in water vapor concentration near the vortex. The decreased water content is a result of a lower tropopause within the vortex, which places dry stratospheric air above moist tropospheric air. Instability is caused when the vortex tube, the line of concentrated vorticity, is displaced.

When this occurs, the vortex rings become more unstable and prone to shifting by planetary waves.The planetary wave activity in both hemispheres varies year-to-year, producing a corresponding response in the strength and temperature of the polar vortex. The number of waves around the perimeter of the vortex are related to the core size; as the vortex core decreases, the number of waves increase. The degree of the mixing of polar and mid-latitude air depends on the evolution and position of the polar night jet. In general, the mixing is less inside the vortex than outside. Mixing occurs with unstable planetary waves that are characteristic of the middle and upper stratosphere in winter.

Prior to vortex breakdown, there is little transport of air out of the Arctic Polar Vortex due to strong barriers above 420 km (261 miles). The polar night jet which exists below this, is weak in the early winter. As a result, it does not deviate any descending polar air, which then mixes with air in the mid-latitudes. In the late winter, air parcels do not descend as much, reducing mixing. After the vortex is broken up, the ex-vortex air is dispersed into the middle latitudes within a month. Sometimes, a mass of the polar vortex breaks off before the end of the final warming period. If large enough, the piece can move into Canada and the Midwestern, Central, Southern, and Northeastern United States.

This diversion of the polar vortex can occur due to the displacement of the polar jet stream; for example, the significant northwestward direction of the polar jet stream in the western part of the United States during the winters of 2013–2014, and 2014–2015. This caused warm, dry conditions in the west, and cold, snowy conditions in the north-central and northeast. Occasionally, the high-pressure air mass, called the Greenland Block, can cause the polar vortex to divert to the south, rather than follow its normal path over the North Atlantic.

14 Heatwave

A heat wave is a period of excessively hot weather, which may be accompanied by high humidity, especially in oceanic climate countries. While definitions vary, a heat wave is measured relative to the usual weather in the area and relative to normal temperatures for the season. Temperatures that people from a hotter climate consider normal can be termed a heat wave in a cooler area if they are outside the normal climate pattern for that area. The term is applied both to hot weather variations and to extraordinary spells of hot which may occur only once a century.

Severe heat waves have caused catastrophic crop failures, thousands of deaths from hyperthermia, and widespread power outages due to increased use of air conditioning. A heat wave is considered extreme weather, and a danger because heat and sunlight may overheat the human body. Heat waves can usually be detected using forecasting instruments so that a warning call can be issued.

A definition based on Frich et al.'s Heat Wave Duration Index is that a heat wave occurs when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5 °C (9 °F), the normal period being 1961–1990. To be a heat wave such a period should last at least one day, but conventionally it lasts from several days to several weeks. In 1900, A. T. Burrows more rigidly defined a “hot wave” as a spell of three or more days on each of which the maximum shade temperature reaches or exceeds 90 °F (32.2 °C). More realistically, the comfort criteria for any one region are dependent upon the normal conditions of that area.

The World Meteorological Organization, defines a heat wave as 5 or more consecutive days of prolonged heat in which the daily maximum temperature is higher than the average maximum temperature by 9 °F or more. However, some nations have come up with their own criteria to define a heat wave. In the United States, definitions also vary by region; however, a heat wave is usually defined as a period of at least two or more days of excessively hot weather.

In the Northeast, a heat wave is typically defined as three consecutive days where the temperature reaches or exceeds 90 °F (32.2 °C), but not always as this ties in with humidity levels to determine a heat index threshold. The same does not apply to drier climates. A heat storm is a Californian term for an extended heat wave. Heat storms occur when the temperature reaches 100 °F (37.8 °C) for three or more consecutive days over a wide area (tens of thousands of square miles). The National Weather Service issues heat advisories and excessive heat warnings when unusual periods of hot weather are expected.

In Adelaide, South Australia, a heat wave is defined as five consecutive days at or above 35 °C (95 °F), or three consecutive days at or over 40 °C (104 °F). The Australian Bureau of Meteorology defines a heat wave as "three days or more of maximum and minimum temperatures that are unusual for the location". Until the introduction of this new Pilot Heatwave Forecast there was no national definition that described heatwave or measures of heatwave severity.

Formation
Heat waves form when high pressure aloft (from 10,000–25,000 feet (3,000–7,600 metres)) strengthens and remains over a region for several days up to several weeks. This is common in summer (in both Northern and Southern Hemispheres) as the jet stream 'follows the sun'. On the equator side of the jet stream, in the upper layers of the atmosphere, is the high pressure area. Summertime weather patterns are generally slower to change than in winter. As a result, this upper level high pressure also moves slowly. Under high pressure, the air subsides (sinks) toward the surface, warming and drying adiabatically.

This warmer sinking air creates a high level inversion that acts as a dome capping the atmosphere, inhibiting convection, thereby trapping high humidity warm air below it. Typically, convection is present along the periphery of the cap where the pressure becomes less. This peripheral convection, however, can add to the high pressure dome by ventilating the upper level outflow of the thunderstorms into it. The end result is a continual build-up of heat at the surface that people experience as a heat wave.

In the Eastern United States a heat wave can occur when a high pressure system originating in the Gulf of Mexico becomes stationary just off the Atlantic Seaboard (typically known as a Bermuda High). Hot humid air masses form over the Gulf of Mexico and the Caribbean Sea while hot dry air masses form over the desert Southwest and northern Mexico. The SW winds on the back side of the High continue to pump hot, humid Gulf air northeastward resulting in a spell of hot and humid weather for much of the Eastern States.

Health Effects
The heat index (below) is a measure of how hot it feels when relative humidity is factored with the actual air temperature. Hyperthermia, also known as heat stroke, becomes commonplace during periods of sustained high temperature and humidity. Older adults, very young children, and those who are sick or overweight are at a higher risk for heat-related illness. The chronically ill and elderly are often taking prescription medications (e.g., diuretics, anticholinergics, antipsychotics, and antihypertensives) that interfere with the body's ability to dissipate heat.

Heat Index Table

Temp ► / Relative Humidity ▼	86°F (30°C)	88°F (31°C)	90°F (32°C)	92°F (33°C)	94°F (34°C)	96°F (36°C)	98°F (37°C)	100°F (38°C)	102°F (39°C)	104°F (40°C)	106°F (41°C)
40%	85°F (29°C)	88°F (31°C)	91°F (33°C)	94°F (34°C)	97°F (36°C)	101°F (38°C)	105°F (41°C)	109°F (43°C)	114°F (46°C)	119°F (48°C)	124°F (51°C)
45%	87°F (31°C)	89°F (32°C)	93°F (34°C)	96°F (36°C)	100°F (38°C)	104°F (40°C)	109°F (43°C)	114°F (46°C)	119°F (48°C)	124°F (51°C)	130°F (54°C)
50%	88°F (31°C)	91°F (33°C)	95°F (35°C)	99°F (37°C)	103°F (39°C)	108°F (42°C)	113°F (45°C)	118°F (48°C)	124°F (51°C)	131°F (55°C)	137°F (58°C)
55%	89°F (32°C)	93°F (34°C)	97°F (36°C)	101°F (38°C)	106°F (41°C)	112°F (44°C)	117°F (47°C)	124°F (51°C)	130°F (54°C)	137°F (58°C)	
60%	91°F (33°C)	95°F (35°C)	100°F (38°C)	105°F (41°C)	110°F (43°C)	116°F (47°C)	123°F (51°C)	129°F (54°C)	137°F (58°C)		
65%	93°F (34°C)	98°F (37°C)	103°F (39°C)	108°F (42°C)	114°F (46°C)	121°F (49°C)	128°F (53°C)	136°F (58°C)			
70%	95°F (35°C)	100°F (38°C)	105°F (41°C)	112°F (44°C)	119°F (48°C)	126°F (52°C)	134°F (57°C)				
75%	97°F (36°C)	103°F (39°C)	109°F (43°C)	116°F (47°C)	124°F (51°C)	132°F (56°C)					
80%	100°F (38°C)	106°F (41°C)	113°F (45°C)	121°F (49°C)	129°F (54°C)						
85%	102°F (39°C)	110°F (43°C)	117°F (47°C)	126°F (52°C)	135°F (57°C)						
90%	105°F (41°C)	113°F (45°C)	122°F (50°C)	131°F (55°C)							
95%	108°F (42°C)	117°F (47°C)	127°F (53°C)								
100%	112°F (44°C)	121°F (49°C)	132°F (56°C)								
Key	Caution	Extreme Caution	Danger	Extreme Danger							

Mortality

Heat waves are the most lethal type of weather phenomenon in the United States. Between 1992 and 2001, deaths from excessive heat in the United States numbered 2,190, compared with 880 deaths from floods and 150 from hurricanes. The average annual number of fatalities directly attributed to heat in the United States is about 400. The 1995 Chicago heat wave, one of the worst in US history, led to approximately 739 heat-related deaths over a period of five days. Eric Klinenberg has noted that in the United States, the loss of human life in hot spells in summer exceeds that caused by all other weather events combined, including lightning, rain, floods, hurricanes, and tornadoes. Despite the dangers, Scott Sheridan, professor of geography at Kent State University, found that less than half of people 65 and older abide by heat-emergency recommendations like drinking lots of water.

In his study of heat-wave behavior, focusing particularly on seniors in Philadelphia, Phoenix, Toronto, and Dayton, Ohio, he found that people over 65 "don't consider themselves seniors." One of his older respondents said: "Heat doesn't bother me much, but I worry about my neighbors." According to the Agency for Health care Research and Quality, about 6,200 Americans are hospitalized each summer due to excessive heat, and those at highest risk are poor, uninsured or elderly. More than 70,000 Europeans died as a result of the 2003 European heat wave.

Psychological and Sociological Effects

In addition to physical stress, excessive heat causes psychological stress, to a degree which affects performance, and is also associated with an increase in violent crime. High temperatures are associated with increased conflict both at the interpersonal level and at the societal level. In every society, crime rates go up when temperatures go up, particularly violent crimes such as assault, murder, and rape. Furthermore, in politically unstable countries, high temperatures are an aggravating factor that lead toward civil wars. Additionally, high temperatures have a significant effect on income. A study of counties in the United States found that economic productivity of individual days declines by about 1.7% for each degree Celsius above 15°C (59°F).

Power Outages

Abnormally hot temperatures can cause electricity demand to increase during the peak summertime hours of 4 to 7 p.m. when air conditioners are straining to overcome the heat. If a hot spell extends to three days or more, however, nighttime temperatures do not cool down, and the thermal mass in homes and buildings retains the heat from previous days. This heat build-up causes air conditioners to turn on earlier and to stay on later in the day. As a result, available electricity supplies are challenged during a higher, wider, peak electricity consumption period. Heat waves often lead to electricity spikes due to increased air conditioning use, which can create power outages, exacerbating the problem. During the 2006 North American heat wave, thousands of homes and businesses went without power, especially in California. In Los Angeles, electrical transformers failed, leaving thousands without power for as long as five days. The 2009 South Eastern Australia Heat Wave caused the city of Melbourne, Australia to experience some major power disruptions which left over half a million people without power as the heat wave blew transformers and overloaded a power grid.

Wildfires

If a heat wave occurs during a drought, which dries out vegetation, it can contribute to bushfires and wildfires. During the disastrous heat wave that struck Europe in 2003, fires raged through Portugal, destroying over 3,010 square kilometres (1,160 sq mi) or 301,000 hectares (740,000 acres) of forest and 440 square kilometres (170 sq mi) or 44,000 hectares (110,000 acres) of agricultural land and causing an estimated €1 billion worth of damage. High end farmlands have irrigation systems to back up crops with.

Physical Damage

Heat waves can and do cause roads and highways to buckle and melt, water lines to burst, and power transformers to detonate, causing fires. See the 2006 North American heat wave article about heat waves causing physical damage. Heat waves can also damage rail roads, such as buckling and kinking rails, which can lead to slower traffic, delays, and even cancellations of service when rails are too dangerous to traverse by trains. Sun kinking is caused when certain types of rail design like short section rails welded together or fish plate rails expand and push on other sections of rail causing them to warp and kink. Sun kinking can be a serious problem in hotter climates like Southern USA, parts of Canada, the Middle East, etc. In the 2013 heatwave in England, gritters (normally only seen in snow) were sent out to grit melting tarmac roads.

15 Cold Wave

A cold wave (known in some regions as a cold snap or cold spell) is a weather phenomenon that is distinguished by a cooling of the air. Specifically, as used by the U.S. National Weather Service, a cold wave is a rapid fall in temperature within a 24-hour period requiring substantially increased protection to agriculture, industry, commerce, and social activities. The precise criterion for a cold wave is determined by the rate at which the temperature falls, and the minimum to which it falls. This minimum temperature is dependent on the geographical region and time of year. In the United States, a cold spell is defined as the national average high temperature dropping below 20 °F (−7 °C). A cold wave of sufficient magnitude and duration may be classified as a cold air outbreak (CAO).

Effects

A cold wave can cause death and injury to livestock and wildlife. Exposure to cold mandates greater caloric intake for all animals, including humans, and if a cold wave is accompanied by heavy and persistent snow, grazing animals may be unable to reach needed food and die of hypothermia or starvation. They often necessitate the purchase of foodstuffs to feed livestock at considerable cost to farmers. Cold spells are associated with increased mortality rates in populations around the world. Both cold waves and heat waves cause deaths, though different groups of people may be susceptible to different weather events.

In developed countries, more deaths occur during a heat wave than in a cold snap, though the mortality rate is higher in undeveloped regions of the world. Globally, more people die during cold weather than hot weather, due to the rise in diseases like cold, flu, and pneumonia. Extreme winter cold often causes poorly insulated water pipelines and mains to freeze. Even some poorly protected indoor plumbing ruptures as water expands within them, causing much damage to property and costly insurance claims.

Demand for electrical power and fuels rises dramatically during such times, even though the generation of electrical power may fail due to the freezing of water necessary for the generation of hydroelectricity. Some metals may become brittle at low temperatures. Motor vehicles may fail when antifreeze fails or motor oil gels, producing a failure of the transportation system. To be sure, such is more likely in places like Siberia and much of Canada that customarily get very cold weather.

Fires become even more of a hazard during extreme cold. Water mains may break and water supplies may become unreliable, making firefighting more difficult. The air during a cold wave is typically denser and thus contains more oxygen, so when air that a fire draws in becomes unusually cold it is likely to cause a more intense fire. Winter cold waves that aren't considered cold in some areas, but cause temperatures significantly below average for an area, are also destructive.

Areas with subtropical climates may recognize unusual cold, perhaps barely freezing, temperatures, as a cold wave. In such places, plant and animal life is less tolerant of such cold as may appear rarely. The same winter temperatures that one associates with the norm for Colorado, Ohio, or Bavaria are catastrophic to winter crops in places like Florida, California, or parts of South America that grow fruit and vegetables in winter.

Cold waves that bring unexpected freezes and frosts during the growing season in mid-latitude zones can kill plants during the early and most vulnerable stages of growth, resulting in crop failure as plants are killed before they can be harvested economically. Such cold waves have caused famines. At times as deadly to plants as drought, cold waves can leave a land in danger of later brush and forest fires that consume dead biomass. One extreme was the so-called Year Without a Summer of 1816, one of several years during the 1810s in which numerous crops failed during freakish summer cold snaps after volcanic eruptions that reduced incoming sunlight.

Countermeasures

In some places, such as Siberia, extreme cold requires that fuel-powered machinery to be used even part-time must be run continuously. Internal plumbing can be wrapped, and persons can often run water continuously through pipes. Energy conservation, difficult as it is in a cold wave, may require such measures as collecting people (especially the poor and elderly) in communal shelters. Even the homeless may be arrested and taken to shelters, only to be released when the hazard abates. Hospitals can prepare for the admission of victims of frostbite and hypothermia; schools and other public buildings can be converted into shelters.

People can stock up on food, water, and other necessities before a cold wave. Some may even choose to migrate to places of milder climates, at least during the winter. Suitable stocks of forage can be secured before cold waves for livestock, and livestock in vulnerable areas might be shipped from affected areas or even slaughtered. Smudge pots can bring smoke that prevents hard freezes on a farm or grove. Vulnerable crops may be sprayed with water that will paradoxically protect the plants by freezing and absorbing the cold from surrounding air.

Most people can dress appropriately and can even layer their clothing should they need to go outside or should their heating fail. They can also stock candles, matches, flashlights, and portable fuel for cooking and wood for fireplaces or wood stoves, as necessary. However caution should be taken as the use of charcoal fires for cooking or heating within an enclosed dwelling is extremely dangerous due to carbon monoxide poisoning. Adults must remain aware of the exposure that children and the elderly have to cold.

History

2019	In late January, an extreme cold wave hit the midwest of the United States, bringing temperatures below −30 °C (−22 °F), with all-time record lows set in several cities.
2018	Late February and early–mid March 2018, Europe. Easterly winds created bitter conditions twice during early spring 2018. Snow fell during both events. Storm Emma, which affected southern areas of Great Britain, brought up to 50 centimetres (20 in) of snow. Overall, 93 people across Europe died; 27 deaths occurred in Poland and 17 in the UK.
2017–2018	Cold wave starting late December 2017 (December 24 respectively), North America. A persistent wave of temperature extremes, including a cold wave, took place in Canada and the northeastern and central areas of the United States from Northern Canada to Mississippi, with temperatures in much of Canada of around −29 °C (−20 °F) and as low as −39 °C (−38 °F) in New York state, and as high as 21 °C (70 °F) and 31 °C (88 °F) in Sandberg and Los Angeles, respectively, in California.
2017	January 2017 European cold wave – A cold wave hit Central and East Europe on January 5. The lowest temperature was −45.4 °C (−49.7 °F) degrees. The cold caused at least 60 deaths. There was also massive snowfall.
2016	January 2016 East Asia cold wave – Caused over 100 known deaths across East Asia, South Asia and Southeast Asia.
2014-2015	February 2015 North American cold wave – During the second half of February 2015, temperature records were broken in both sides of the spectrum. Extreme warm records were broken in the western half of the United States and extreme cold records were broken in the eastern half. In addition to the extreme cold wave at its most brutal in the Great Lakes, Mid-Atlantic, and New England, snowfall was reported as far south as Tupelo, Mississippi; Huntsville, Alabama; and Shreveport, Louisiana. The cold wave became widespread and all the remaining mild conditions from the west were pushed into northern Mexico. The cold wave even extended well into early March, with a part of every U.S. state except Florida reporting a snow cover by March 1, 2015.
2012	Early 2012 European cold wave – As of February 11, 2012 at least 590 people died during a cold snap with temperatures falling below −35 °C (−31 °F) in some regions. Ukraine was the worst hit, with over 100 deaths related to the cold.
2009-2010	A cold wave affected much of the Deep South in the United States and Florida in January and February 2010.
2008	2008 Alaska cold wave – In early February, Alaska experienced the coldest temperatures for eight years, with Fairbanks nearing −50 °F (−45.6 °C) and Chicken, Alaska bottoming out at −72 °F (−57.8 °C), a mere eight °F (4.4 °C) away from the record of −80 °F (−62.2 °C). The first half of January also brought unusual cold weather and heavy snow to widespread regions of China and the Middle East.
2007	2007 Northern Hemisphere cold wave – All of Canada and most of the United States underwent a freeze after a two-week warming that took place in late March and early April. Crops froze, wind picked up, and snow drizzled much of the United States. Some parts of Europe also experienced unusual cold winter-like temperatures, during that time.

16 Tornado

A tornado is a rapidly rotating column of air that is in contact with both the surface of the Earth and a cumulonimbus cloud or, in rare cases, the base of a cumulus cloud. They are often referred to as twisters, whirlwinds or cyclones. Winds blow counter clockwise in the Northern Hemisphere and clockwise in the Southern. Tornadoes come in many shapes and sizes, and they are often visible in the form of a condensation funnel originating from the base of a cumulonimbus cloud, with a cloud of rotating debris and dust beneath it. Most tornadoes have wind speeds less than 110 miles per hour (180 km/h), are about 250 feet (80 m) across, and travel a few miles (several kilometres) before dissipating. Various types of tornadoes include the multiple vortex tornado, landspout and waterspout. Waterspouts are characterized by a spiralling funnel-shaped wind current, connecting to a large cumulus or cumulonimbus cloud.

They are generally classified as non-supercellular tornadoes that develop over bodies of water. These spiralling columns of air frequently develop in tropical areas close to the equator, and are less common at high latitudes. Other tornado-like phenomena that exist in nature include the gustnado, dust devil, fire whirls, and steam devil.

Tornadoes occur in North America, particularly in the area of the United States known as tornado alley, as well as in northern and east-central South America, Southern Africa, north-western and southeast Europe, western and south-eastern Australia, and New Zealand. Most tornadoes take on the appearance of a narrow funnel, a few hundred yards (meters) across, with a small cloud of debris near the ground. Tornadoes may be obscured completely by rain or dust. These tornadoes are especially dangerous, as even experienced meteorologists might not see them. Tornadoes can appear in many shapes and sizes.

In the United States, tornadoes are around 500 feet (150 m) across on average and travel on the ground for 5 miles (8.0 km). However, there is a wide range of tornado sizes. Weak tornadoes, or strong yet dissipating tornadoes, can be exceedingly narrow, sometimes only a few feet or couple meters across. One tornado was reported to have a damage path only 7 feet (2.1 m) long. On the other end of the spectrum, wedge tornadoes can have a damage path a mile (1.6 km) wide or more.

In terms of path length, the Tri-State Tornado, which affected parts of Missouri, Illinois, and Indiana on March 18, 1925, was on the ground continuously for 219 miles (352 km). Many tornadoes which appear to have path lengths of 100 miles (160 km) or longer are composed of a family of tornadoes which have formed in quick succession. Tornadoes often develop from a class of thunderstorms known as supercells.

Supercells contain mesocyclones, an area of organized rotation a few miles up in the atmosphere, usually 1–6 miles (1.6–9.7 kilometres) across. Most intense tornadoes (EF3 to EF5 on the Enhanced Fujita Scale) develop from supercells. In addition to tornadoes, very heavy rain, frequent lightning, strong wind gusts, and hail are common in such storms. A multiple-vortex tornado is a type of tornado in which two or more columns of spinning air rotate about their own axis and at the same time around a common centre. A multi-vortex structure can occur in almost any circulation, but is very often observed in intense tornadoes. These vortices often create small areas of heavier damage along the main tornado path.

Enhanced Fujita Scale

The Enhanced Fujita scale (EF-Scale) rates the intensity of tornadoes in the United States and Canada based on the damage they cause.

EF Rating	Wind Speed	Damage Severity	Damage Description
EF0	105–137kmh 65–85mph	Minor or no damage	Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	138–177kmh 86–110mph	Moderate damage	Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	178–217kmh 111–135mph	Considerable damage	Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	218–266kmh 136–165mph	Severe damage	Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations are badly damaged.
EF4	267–322kmh 166–200mph	Devastating damage	Well-constructed and whole frame houses completely levelled; cars and other large objects thrown and small missiles generated.
EF5	>322kmh >200mph	Extreme damage	Strong-framed, well-built houses levelled off foundations are swept away; steel-reinforced concrete structures are critically damaged; tall buildings collapse or have severe structural deformations; some cars, trucks, and train cars can be thrown approximately 1 mile (1.6 km).

Tornado Protection

Protecting yourself from a tornado involves a multi-faceted approach, regardless of your specific region. It's about preparedness, rapid response, and knowing where to go when the threat is imminent.

Preparation

Understand Tornado Basics
- Tornado Watch: Conditions are favorable for tornadoes to develop in or near your area. This means "Be Prepared" and stay alert.
- Tornado Warning: A tornado has been sighted or indicated by radar. This means "Take Action Now" and seek immediate shelter.
- Tornadoes can be invisible (obscured by rain or at night) and can change direction quickly. Don't wait to see one.
- They are categorized by the Enhanced Fujita (EF) Scale based on damage caused (EF0 being weakest, EF5 strongest).

Develop a Family Emergency Plan
Designate a Safe Shelter. This is the most crucial step.
● Best Option: An underground area like a basement, storm cellar, or a specially constructed safe room. These offer the highest level of protection.
● Next Best: A small, interior room or hallway on the lowest level of a sturdy building, away from windows, doors, and outside walls. A bathroom, closet, or interior hallway often fits this description. The more walls between you and the outside, the better.
● Avoid: Mobile homes, manufactured homes (unless specifically anchored and reinforced to modern standards, but even then, evacuation is generally recommended), large open rooms (gyms, auditoriums), and areas directly under heavy objects on the floor above.
● Practice Drills: Regularly practice going to your designated safe place with all family members, including pets. Ensure everyone knows the plan.
● Account for Everyone: Have a plan for knowing who is where, especially if family members are separated (e.g., at work, school, daycare).
● Plan for Pets: Include pets in your plan; know where they will shelter (inside with you) and have their emergency supplies ready.

Prepare an Emergency Kit (Go-Bag / Disaster Kit): Keep essential items readily accessible in your designated shelter area or a grab-and-go bag
● Communication: Battery-powered or hand-crank radio (preferably a NOAA Weather Radio in the US), flashlight with extra batteries.
● Medical: Comprehensive first-aid kit, at least a 7-day supply of prescription medications, any necessary medical devices or supplies.
● Food & Water: At least 3 days' worth of non-perishable food that requires no cooking or refrigeration. 1 gallon (approx. 4 liters) of water per person per day. Manual can opener.
● Sanitation: Toilet paper, moist towelettes, garbage bags, ties for waste disposal.
● Safety: Whistle (to signal for help), dust mask (for debris), wrench or pliers (to turn off utilities), sturdy shoes, work gloves.
● Important Documents: Copies of identification, insurance policies, medical records, and emergency contacts in a waterproof container.
● Cash: ATMs and credit card machines may not work during power outages.
● Comfort Items: Blankets, sleeping bags, books/games for children, comfort items for pets.

Secure Your Property
● Loose Items: Secure or bring inside anything outdoors that could become a dangerous projectile in high winds (patio furniture, toys, garbage cans, grills, trampolines).
● Trees and Branches: Trim dead or weak branches from trees that are close to your home or overhanging power lines.
● Garage Doors: Reinforce garage doors, as they are often a weak point in homes during high winds.
● Roofs: While not "tornado-proofing," ensuring your roof is in good repair can help prevent some damage.

During a Tornado

Seek Shelter IMMEDIATELY: Do not wait until you see or hear the tornado. Tornadoes can be obscured by rain or occur at night. Time is of the essence.

At Home
● With a Basement/Storm Cellar: Go there immediately. Get under something sturdy (workbench, heavy table, stairs) and cover your head and neck with your arms, a mattress, heavy blankets, or a helmet (bicycle/motorcycle helmets can offer head protection).
● Without a Basement: Go to a small, interior room on the lowest level of your home, away from windows, doors, and outside walls. Examples include an interior closet, bathroom, or hallway. Get under sturdy furniture if possible. Protect your head and neck.
● Avoid: Windows, doors, outside walls, and large open rooms (e.g., living rooms, garages). Do not open windows – it doesn't help and wastes precious time.

In a Mobile Home or Manufactured Home
● EVACUATE IMMEDIATELY. These structures offer very little protection against tornadoes, even if anchored.
● Go to the nearest sturdy building, community storm shelter, or a designated safe room. If no solid shelter is nearby, lie flat in the nearest ditch or low-lying area and cover your head with your arms.

In a Vehicle
● Do NOT try to outrun a tornado in a vehicle. Cars, buses, and trucks are easily tossed. Tornadoes can move very quickly and change direction.
● If a sturdy building or designated shelter is nearby, get there immediately.
● If caught in extreme winds or flying debris, or if no sturdy shelter is available:
● Exit your vehicle and lie flat in a low-lying area like a ditch or ravine. Cover your head with your arms.
● Do NOT take shelter under an overpass or bridge. Wind speeds can actually increase due to a tunneling effect, making them extremely dangerous. You are safer in a low, flat location.
● As a last resort, if you cannot get out of the vehicle and into a lower area, stay in the vehicle, keep your seatbelt on, get as low as possible (below the windows), and cover your head with your arms or a blanket/jacket.

Outdoors (No Immediate Shelter)
● Get as low to the ground as possible. Lie down flat in a ditch, gully, or low spot.
● Protect your head and neck with your arms.
● Beware of rapid flooding from accompanying heavy rainfall.
● Stay away from trees, power lines, and anything that could become flying debris.

In Large Buildings (Schools, Hospitals, Stores, Office Buildings, Shopping Malls)
● Move to the innermost part of the building on the lowest possible floor.
● Stay away from windows and glass doorways.
● Avoid large, wide-span rooms (gymnasiums, auditoriums, large retail floors) as their roofs are more prone to collapse.
● Do not use elevators; use stairs.
● Crouch down and cover your head. If possible, get under something sturdy like a heavy counter or interior desk.

After the Tornado

1. Stay in Shelter
● Remain in your safe place until the tornado has fully passed and you receive an "all clear" from authorities. There might be more than one tornado.

2. Assess Injuries
● Check yourself and others for injuries. Provide first aid as needed. Call emergency services (e.g., 000 in Australia, 911 in North America) for serious injuries.

3. Be Aware of Hazards
● Stay clear of damaged buildings, downed power lines (assume they are live!), broken glass, and other debris.
● Be alert for fire hazards (gas leaks, broken wires).
● Use a flashlight, not candles, for light in damaged areas.

4. Communicate
- Use text messages or social media if phone lines are busy.
- Contact family and friends to let them know you are safe.
- Listen to battery-powered or hand-crank radio for official updates and instructions.

5. Safe Cleanup
- Wear sturdy shoes, long pants, work gloves, and masks when clearing debris.
- Do not eat or drink anything that has been impacted by the tornado or floodwaters.
- Document damage for insurance purposes with photos or videos.

Long Term Defence

Long Term Tornado Defence
Depending on location, various safe-haven areas have been prepared. The goal has been to avoid outer walls which might collapse when a roof section becomes airborne and the walls below lose their upper support: many interior rooms resist collapse longer, due to smaller walls interconnected to each other, while outer walls deflect the force of the winds. Because mobile homes typically lack foundation anchors and present a large surface-area sail (to catch wind), the advice has been to seek a safe haven elsewhere, such as in a stronger nearby building.

When a mobile home begins to roll, people have been injured by hitting objects inside, or being crushed when a trailer suddenly hits the ground and begins to collapse around them. In a multi-story building, an internal stairway (away from broken windows) often acts as a safe haven, due to the stairs reinforcing the walls and blocking any major debris falling from above. If a stairway is lined with windows, then there would be the danger of flying glass, so an interior stairway, or small inner room, would be preferable.

In private homes, some similar stairway rooms have been used, or an interior room/closet kept clear to quickly allow entry when a storm is seen or heard approaching (the wind roar intensifies, sounding like a swift "freight train" coming nearer, louder). With weeks or months to prepare, an interior safe room can be constructed, with space for emergency water, food and flashlights, and a telephone to call for rescue if the exit becomes blocked by falling debris.

Some above-ground safe rooms have been built with steel-rebar rods in cement-filled cinder blocks, to withstand winds of 250 miles per hour (400 km/h). Rural homes might have an outside storm cellar, or other external bunker, to avoid being trapped within a collapsing house. In rural homes, generators are also helpful to maintain power with enough fuel for a few days.

17 Wildfire

A wildfire or wildland fire is an uncontrolled fire in an area of combustible vegetation occurring in rural areas. Depending on the type of vegetation present, a wildfire can also be classified more specifically as a brush fire, bushfire, desert fire, forest fire, grass fire.

Wildfires can be characterized in terms of the cause of ignition, their physical properties, the combustible material present, and the effect of weather on the fire. Wildfires can cause damage to property and human life, although naturally occurring wildfires may have beneficial effects on native vegetation, animals, and ecosystems that have evolved with fire. High-severity wildfire creates complex early seral forest habitat (also called "snag forest habitat"), which often has higher species richness and diversity than unburned old forest. Many plant species depend on the effects of fire for growth and reproduction. Wildfires in ecosystems where wildfire is uncommon or where non-native vegetation has encroached may have strongly negative ecological effects.

Causes
- Arson
- Electronics Sparks
- Lightning
- Sparks from Rockfalls
- Spontaneous Combustion
- Volcanic Eruption

Wildfire behavior and severity result from a combination of factors such as available fuels, physical setting, and weather. Analyses of historical meteorological data and national fire records in western North America show the primacy of climate in driving large regional fires via wet periods that create substantial fuels, or drought and warming that extend conducive fire weather. Strategies for wildfire prevention, detection, and suppression have varied over the years. One common and inexpensive technique is controlled burning: intentionally igniting smaller fires to minimize the amount of flammable material available for a potential wildfire. Vegetation may be burned periodically to maintain high species diversity and limit the accumulation of plants and other debris that may serve as fuel.

Wildland fire use is the cheapest and most ecologically appropriate policy for many forests. Fuels may also be removed by logging, but fuels treatments and thinning have no effect on severe fire behavior when under extreme weather conditions. Wildfire itself is reportedly "the most effective treatment for reducing a fire's rate of spread, fireline intensity, flame length, and heat per unit of area", according to Jan Van Wagtendonk, a biologist at the Yellowstone Field Station. Building codes in fire-prone areas typically require that structures be built of flame-resistant materials and a defensible space be maintained by clearing flammable materials within a prescribed distance from the structure.

Subheadings

1. Physical Properties	**2. Wildfire Spread**	**3. Suppression**	**4. Airborne Hazards**
5. Preparation	**6. Evacuation**	**7. Post-Fire**	

1 Physical Properties

Wildfires occur when all the necessary elements of a fire triangle come together in a susceptible area: an ignition source is brought into contact with a combustible material such as vegetation, that is subjected to enough heat and has an adequate supply of oxygen from the ambient air. A high moisture content usually prevents ignition and slows propagation, because higher temperatures are needed to evaporate any water in the material and heat the material to its fire point.

Dense forests usually provide more shade, resulting in lower ambient temperatures and greater humidity, and are therefore less susceptible to wildfires. Less dense material such as grasses and leaves are easier to ignite because they contain less water than denser material such as branches and trunks. Plants continuously lose water by evapotranspiration, but water loss is usually balanced by water absorbed from the soil, humidity, or rain. When this balance is not maintained, plants dry out and are therefore more flammable, often a consequence of droughts.

A wildfire front is the portion sustaining continuous flaming combustion, where unburned material meets active flames, or the smoldering transition between unburned and burned material. As the front approaches, the fire heats both the surrounding air and woody material through convection and thermal radiation. First, wood is dried as water is vaporized at a temperature of 100 °C (212 °F). Next, the pyrolysis of wood at 230 °C (450 °F) releases flammable gases.

Finally, wood can smoulder at 380 °C (720 °F) or, when heated sufficiently, ignite at 590 °C (1,000 °F). Even before the flames of a wildfire arrive at a particular location, heat transfer from the wildfire front warms the air to 800 °C (1,470 °F), which pre-heats and dries flammable materials, causing materials to ignite faster and allowing the fire to spread faster. High-temperature and long-duration surface wildfires may encourage flashover or torching: the drying of tree canopies and their subsequent ignition from below.

Wildfires have a rapid forward rate of spread (FROS) when burning through dense uninterrupted fuels. They can move as fast as 10.8 kilometres per hour (6.7 mph) in forests and 22 kilometres per hour (14 mph) in grasslands. Wildfires can advance tangential to the main front to form a flanking front, or burn in the opposite direction of the main front by backing. They may also spread by jumping or spotting as winds and vertical convection columns carry firebrands (hot wood embers) and other burning materials through the air over roads, rivers, and other barriers that may otherwise act as firebreaks. Torching and fires in tree canopies encourage spotting, and dry ground fuels around a wildfire are especially vulnerable to ignition from firebrands.

Spotting can create spot fires as hot embers and firebrands ignite fuels downwind from the fire. In Australian bushfires, spot fires are known to occur as far as 20 kilometres (12 mi) from the fire front. Especially large wildfires may affect air currents in their immediate vicinities by the stack effect: air rises as it is heated, and large wildfires create powerful updrafts that will draw in new, cooler air from surrounding areas in thermal columns. Great vertical differences in temperature and humidity encourage pyrocumulus clouds, strong winds, and fire whirls with the force of tornadoes at speeds of more than 80 kilometres per hour (50 mph). Rapid rates of spread, prolific crowning or spotting, the presence of fire whirls, and strong convection columns signify extreme conditions.

Climate Effect
Heat waves, droughts, cyclical climate changes such as El Niño, and regional weather patterns such as high-pressure ridges can increase the risk and alter the behavior of wildfires dramatically. Years of precipitation followed by warm periods can encourage more widespread fires and longer fire seasons. Since the mid-1980s, earlier snowmelt and associated warming has also been associated with an increase in length and severity of the wildfire season, or the most fire-prone time of the year, in the Western United States.

Global warming may increase the intensity and frequency of droughts in many areas, creating more intense and frequent wildfires. A 2015 study indicates that the increase in fire risk in California may be attributable to human-induced climate change. A study of alluvial sediment deposits going back over 8,000 years found warmer climate periods experienced severe droughts and stand-replacing fires and concluded climate was such a powerful influence on wildfire that trying to recreate presettlement forest structure is likely impossible in a warmer future.

Intensity also increases during daytime hours. Burn rates of smoldering logs are up to five times greater during the day due to lower humidity, increased temperatures, and increased wind speeds. Sunlight warms the ground during the day which creates air currents that travel uphill. At night the land cools, creating air currents that travel downhill. Wildfires are fanned by these winds and often follow the air currents over hills and through valleys. Fires in Europe occur frequently during the hours of 12:00 p.m. and 2:00 p.m. Wildfire suppression operations in the United States revolve around a 24-hour fire day that begins at 10:00 a.m. due to the predictable increase in intensity resulting from the daytime warmth.

2 Wildfire Spread

Ground Fires	Fed by subterranean roots, duff and other buried organic matter. This fuel type is especially susceptible to ignition due to spotting. Ground fires typically burn by smouldering, and can burn slowly for days to months.
Crawling/Surface Fires	Fuelled by low-lying vegetation on the forest floor such as leaf and timber litter, debris, grass, and low-lying shrubbery. This kind of fire often burns at a relatively lower temperature than crown fires (<400°C (752°F)) and may spread at slow rate, though steep slopes and wind can accelerate the rate of spread.
Ladder Fire	Consume material between low-level vegetation and tree canopies, such as small trees, downed logs, and vines. Kudzu, Old World climbing fern, and other invasive plants that scale trees may also encourage ladder fires.
Crown/Canopy/Aerial Fires	Burn suspended material at the canopy level, such as tall trees, vines, and mosses. The ignition of a crown fire, termed crowning, is dependent on the density of the suspended material, canopy height, canopy continuity, sufficient surface and ladder fires, vegetation moisture content, and weather conditions during the blaze.

3 Suppression

Wildfire suppression depends on the technologies available in the area in which the wildfire occurs. In less developed nations the techniques used can be as simple as throwing sand or beating the fire with sticks or palm fronds. In more advanced nations, the suppression methods vary due to increased technological capacity. Silver iodide can be used to encourage snow fall, while fire retardants and water can be dropped onto fires by unmanned aerial vehicles, planes, and helicopters.

Complete fire suppression is no longer an expectation, but the majority of wildfires are often extinguished before they grow out of control. While more than 99% of the 10,000 new wildfires each year are contained, escaped wildfires under extreme weather conditions are difficult to suppress without a change in the weather. Wildfires in Canada and the US burn an average of 54,500 square kilometers (13,000,000 acres) per year.

Above all, fighting wildfires can become deadly. A wildfire's burning front may also change direction unexpectedly and jump across fire breaks. Intense heat and smoke can lead to disorientation and loss of appreciation of the direction of the fire, which can make fires particularly dangerous. For example, during the 1949 Mann Gulch fire in Montana, USA, thirteen smokejumpers died when they lost their communication links, became disoriented, and were overtaken by the fire. In the Australian February 2009 Victorian bushfires, at least 173 people died and over 2,029 homes and 3,500 structures were lost when they became engulfed by wildfire.

4 Airborne Hazards

The most noticeable adverse effect of wildfires is the destruction of property. However, the release of hazardous chemicals from the burning of wildland fuels also significantly impacts health in humans. Wildfire smoke is composed primarily of carbon dioxide and water vapor. Other common smoke components present in lower concentrations are carbon monoxide, formaldehyde, acrolein, polyaromatic hydrocarbons, and benzene. Small particulates suspended in air which come in solid form or in liquid droplets are also present in smoke. 80 -90% of wildfire smoke, by mass, is within the fine particle size class of 2.5 micrometers in diameter or smaller. Despite carbon dioxide's high concentration in smoke, it poses a low health risk due to its low toxicity.

Rather, carbon monoxide and fine particulate matter, particularly 2.5 µm in diameter and smaller, have been identified as the major health threats. Other chemicals are considered to be significant hazards but are found in concentrations that are too low to cause detectable health effects. The degree of wildfire smoke exposure to an individual is dependent on the length, severity, duration, and proximity of the fire. People are exposed directly to smoke via the respiratory tract though inhalation of air pollutants. Indirectly, communities are exposed to wildfire debris that can contaminate soil and water supplies.

5 Preparation

● Shut all windows and doors, leaving them unlocked. Remove flammable window shades, curtains and close metal shutters.
● Remove flammable window shades, curtains and close metal shutters.
● Move flammable furniture to the centre of the room, away from windows and doors.
● Leave your lights on so firefighters can see your house under smoky conditions.
● Gather up flammable items from the exterior of the house and bring them inside (patio furniture, children's toys, door mats, trash cans, etc.) or place them in your pool.
● Create and maintain an area approximately 30' away from you home that is free of anything that will burn, such as wood piles, dried leaves, newspapers, brush, and other landscaping that can burn.
● From 30 feet to 100 feet reduce or replace as much of the most flammable vegetation as possible and prune vegetation, create "fuel breaks," such as driveways, gravel walkways, and lawns.

● Work with neighbours to create spaces up to 200 feet around your homes where vegetation is thinned to remove underbrush and tall trees do not touch each other for continuous canopies.
● Connect garden hoses long enough to reach any area of the home and fill garbage cans, tubs, or other large containers with water.

Wildfire Evacuation Preparation
● Connect garden hoses to outside water valves or spigots for use by firefighters. Fill water buckets and place them around the house.
● Don't leave sprinklers on or water running, they can affect critical water pressure.
● Patrol your property and monitor the fire situation. Don't wait for an evacuation order if you feel threatened.
● Have a ladder available and place it at the corner of the house for firefighters to quickly access your roof.

6 Evacuation

There are only two options when it comes to wildfires. Staying in place or evacuating to a safer area.

● Cover-up to protect against heat and flying embers. Wear long pants, long sleeve shirt, heavy shoes/boots, cap, dry bandanna for face cover, goggles or glasses. 100% cotton is preferable.
● Ensure vehicle is full of fuel and ready to go with spare fuel if you are rural.
● Leave as soon as evacuation is recommended by fire officials to avoid being caught in fire, smoke or road congestion. Don't wait to be ordered by authorities to leave.
● Evacuating the forest fire area early also helps firefighters keep roads clear of congestion, and lets them move more freely to do their job. In an intense wildfire, they will not have time to knock on every door.
● Do not return to your home until fire officials determine it is safe. Notification that it is safe to return home will be given as soon as possible considering safety and accessibility.

7 Post-Fire

After a wildfire, hazards remain. Residents returning to their homes may be at risk from falling fire-weakened trees. Humans and pets may also be harmed by falling into ash pits.

Ash Pit

An ash pit is a remnant of a wildfire. It is a hole in the ground filled with ash, possibly containing hot embers beneath. It is one of the many hazards faced by those fighting wildfires. It is also a danger to residents and their pets returning after a wildfire has gone out. An ash pit may be imperceptible from the ground above, and can remain hot for days. Those accidentally walking into one may be severely burned or killed. After a wildfire has gone out, firefighters may detect ash pits from helicopters using infrared sensors. Then can then dig down into them, and extinguish them to prevent flare ups.

Causes
After a fire burns underground fuels, it can create a void that becomes filled with ash from the burned fuel. There are several environmental factors that increase the likelihood of an ash pit being formed. It may result from the presence of extensive root systems of trees and shrubs, as well as peat and deep duff covering mineral soil. Holes created by animals, such as coyote and badger dens, can become ash pits. Abandoned rodent holes can become filled with dry, organic debris. Once this debris is burned, an ash pit may be produced. Areas that have been modified by humans may also become hazardous ash pits. Examples include areas modified with heavy equipment, former bulldozer piles, as well as sawmill sites and timber yards.

Detection
An ash pit may sometimes be detected by the presence of white ash or swarms of insects hovering about. Nearly translucent smoke that quickly dissipates may be visible emanating from an ash pit when it is between the observer and the sun. Due to incomplete burning, an ash pit may also produce a smell of burning creosote or incomplete combustion.

Mitigation
Upon detection, marking or flagging ash pits is advised. Landscapes that have the potential to produce ash pits should be avoided.

18 Meteorite

A meteorite is a solid piece of debris from an object, such as a comet, asteroid, or meteoroid, that originates in outer space and survives its passage through the atmosphere to reach the surface of a planet or moon. When the object enters the atmosphere, various factors such as friction, pressure, and chemical interactions with the atmospheric gases cause it to heat up and radiate that energy.

It then becomes a meteor and forms a fireball, also known as a shooting star or falling star; astronomers call the brightest examples "bolides". Meteorites vary greatly in size. For geologists, a bolide is a meteorite large enough to create an impact crater. Meteorites that are recovered after being observed as they transit the atmosphere and impact the Earth are called meteorite falls. All others are known as meteorite finds.

As of August 2018, there were about 1,412 witnessed falls that have specimens in the world's collections. As of 2018, there are more than 59,200 well-documented meteorite finds. Meteorites have traditionally been divided into three broad categories: stony meteorites that are rocks, mainly composed of silicate minerals; iron meteorites that are largely composed of metallic iron-nickel; and stony-iron meteorites that contain large amounts of both metallic and rocky material.

Modern classification schemes divide meteorites into groups according to their structure, chemical and isotopic composition and mineralogy. Meteorites smaller than 2 mm are classified as micrometeorites. Extraterrestrial meteorites are such objects that have impacted other celestial bodies, whether or not they have passed through an atmosphere. They have been found on the Moon and Mars.

Subheadings

1. Fall Phenomena	**2. Meteorite Types**	**3. Meteorite Variations**	**4. Impact Damage**
5. Meteorite Protection			

1 Fall Phenomena

Most meteoroids disintegrate when entering the Earth's atmosphere. Usually, five to ten a year are observed to fall and are subsequently recovered and made known to scientists. Few meteorites are large enough to create large impact craters. Instead, they typically arrive at the surface at their terminal velocity and, at most, create a small pit. Large meteoroids may strike the earth with a significant fraction of their escape velocity (second cosmic velocity), leaving behind a hypervelocity impact crater. The kind of crater will depend on the size, composition, degree of fragmentation, and incoming angle of the impactor. The force of such collisions has the potential to cause widespread destruction. The most frequent hypervelocity cratering events on the Earth are caused by iron meteoroids, which are most easily able to transit the atmosphere intact.

Examples of craters caused by iron meteoroids include Barringer Meteor Crater, Odessa Meteor Crater, Wabar craters, and Wolfe Creek crater; iron meteorites are found in association with all of these craters. In contrast, even relatively large stony or icy bodies like small comets or asteroids, up to millions of tons, are disrupted in the atmosphere, and do not make impact craters. Although such disruption events are uncommon, they can cause a considerable concussion to occur; the famed Tunguska event probably resulted from such an incident.

Very large stony objects, hundreds of meters in diameter or more, weighing tens of millions of tons or more, can reach the surface and cause large craters, but are very rare. Such events are generally so energetic that the impactor is completely destroyed, leaving no meteorites. (The very first example of a stony meteorite found in association with a large impact crater, the Morokweng crater in South Africa, was reported in May 2006.

Several phenomena are well documented during witnessed meteorite falls too small to produce hypervelocity craters. The fireball that occurs as the meteoroid passes through the atmosphere can appear to be very bright, rivaling the sun in intensity, although most are far dimmer and may not even be noticed during daytime. Various colors have been reported, including yellow, green, and red. Flashes and bursts of light can occur as the object breaks up. Explosions, detonations, and rumblings are often heard during meteorite falls, which can be caused by sonic booms as well as shock waves resulting from major fragmentation events. These sounds can be heard over wide areas, with a radius of a hundred or more kilometers. Whistling and hissing sounds are also sometimes heard, but are poorly understood. Following passage of the fireball, it is not unusual for a dust trail to linger in the atmosphere for several minutes.

As meteoroids are heated during atmospheric entry, their surfaces melt and experience ablation. They can be sculpted into various shapes during this process, sometimes resulting in shallow thumbprint-like indentations on their surfaces called regmaglypts. If the meteoroid maintains a fixed orientation for some time, without tumbling, it may develop a conical "nose cone" or "heat shield" shape. As it decelerates, eventually the molten surface layer solidifies into a thin fusion crust, which on most meteorites is black (on some achondrites, the fusion crust may be very light colored). On stony meteorites, the heat-affected zone is at most a few mm deep; in iron meteorites, which are more thermally conductive, the structure of the metal may be affected by heat up to 1 centimetre (0.39 in) below the surface.

Reports vary; some meteorites are reported to be "burning hot to the touch" upon landing, while others are alleged to have been cold enough to condense water and form a frost. Meteoroids that experience disruption in the atmosphere may fall as meteorite showers, which can range from only a few up to thousands of separate individuals. The area over which a meteorite shower falls is known as its strewn field. Strewn fields are commonly elliptical in shape, with the major axis parallel to the direction of flight. In most cases, the largest meteorites in a shower are found farthest down-range in the strewn field.

When an asteroid (or comet) enters a planetary atmosphere at cosmic velocity, extremely high aerodynamic forces cause it to decelerate. The hypervelocity object also produces a strong shock wave as it passes through the atmosphere. Directly in front of it, at the apex of the bow shock, the atmosphere is compressed, heated, and ionized. Plasma temperatures can reach 25,000–30,000 K. The hot, opaque cap of plasma emits an enormous flux of thermal radiation that is absorbed by the leading surface of the impactor, causing rapid vaporization and ablation. If the body is small it completely ablates, leaving only a trail of ionized air and meteoritic vapor. If it is very large, it reaches the ground intact before a significant fraction of its mass can ablate and still moving at hypervelocity. It forms an impact crater.

2 Meteorite Types

Most meteorites are stony meteorites, classed as chondrites and achondrites. Only about 6% of meteorites are iron meteorites or a blend of rock and metal, the stony-iron meteorites. Modern classification of meteorites is complex. The review paper of Krot et al. (2007) summarizes modern meteorite taxonomy. About 86% of the meteorites are chondrites, which are named for the small, round particles they contain. These particles, or chondrules, are composed mostly of silicate minerals that appear to have been melted while they were free-floating objects in space. Certain types of chondrites also contain small amounts of organic matter, including amino acids, and presolar grains. Chondrites are typically about 4.55 billion years old and are thought to represent material from the asteroid belt that never coalesced into large bodies. Like comets, chondritic asteroids are some of the oldest and most primitive materials in the solar system.

Chondrites are often considered to be "the building blocks of the planets". About 8% of the meteorites are achondrites (meaning they do not contain chondrules), some of which are similar to terrestrial igneous rocks. Most achondrites are also ancient rocks, and are thought to represent crustal material of differentiated planetesimals.

One large family of achondrites (the HED meteorites) may have originated on the parent body of the Vesta Family, although this claim is disputed. Others derive from unidentified asteroids. Two small groups of achondrites are special, as they are younger and do not appear to come from the asteroid belt. One of these groups comes from the Moon, and includes rocks similar to those brought back to Earth by Apollo and Luna programs. The other group is almost certainly from Mars and constitutes the only materials from other planets ever recovered by humans.

About 5% of meteorites that have been seen to fall are iron meteorites composed of iron-nickel alloys, such as kamacite and/or taenite. Most iron meteorites are thought to come from the cores of planetesimals that were once molten. As with the Earth, the denser metal separated from silicate material and sank toward the center of the planetesimal, forming its core. After the planetesimal solidified, it broke up in a collision with another planetesimal.

Due to the low abundance of iron meteorites in collection areas such as Antarctica, where most of the meteoric material that has fallen can be recovered, it is possible that the percentage of iron-meteorite falls is lower than 5%. This would be explained by a recovery bias; laypeople are more likely to notice and recover solid masses of metal than most other meteorite types. The abundance of iron meteorites relative to total Antarctic finds is 0.4%. Stony-iron meteorites constitute the remaining 1%.

They are a mixture of iron-nickel metal and silicate minerals. One type, called pallasites, is thought to have originated in the boundary zone above the core regions where iron meteorites originated. The other major type of stony-iron meteorites is the mesosiderites. Tektites (from Greek tektos, molten) are not themselves meteorites, but are rather natural glass objects up to a few centimeters in size that were formed—according to most scientists—by the impacts of large meteorites on Earth's surface. A few researchers have favored tektites originating from the Moon as volcanic ejecta, but this theory has lost much of its support over the last few decades.

3 Meteorite Variations

This is a list of variables that can affect the damage of a meteorite.

Basic Variables

Diameter	Meteorites need to be around 20m (60ft) wide to make it to the ground intact, depending on what they are made of.
Density	
Shape	

Material	

Atmospheric Entry

Angle of Entry	
Velocity (Speed)	11km/s - 72km/s (60,000–69,000 km/h or 40,000–42,900 mph) is the average entry speed
Rotation	

Impact Damage

Energy	
Global Damage	
Crater	
Ejecta	

Post-Impact Damage

Thermal Radiation	
Seismic Effects	
Airblast	
Tsunami	

4 Impact Damage

The below table is the estimated damage for various sized meteorites upon impact. It is just a basic calculation and doesn't take into account many of the variables above.

Small

Diameter	2m (3.2ft)	3.3m (10.8 ft)	4m (13 ft)	5m (16 ft)	6.5m (21 ft)	8m (26 ft)	10m (32 ft)	13m (42 ft)	16m (52 ft)	20m (65 ft)	25m (82 ft)
Kinetic Energy (Megaton)	0.001	0.002	0.004	0.008	0.017	0.032	0.063	0.14	0.26	0.5	1
Airburst (Megaton)	0.001	0.002	0.004	0.008	0.017	0.032	0.063	0.14	0.26	0.5	1
Crater Size	0 km	0 km	0 km	0 km	0 km	0 km	0 km	0 km	0 km	0 km	0.5 km
Damage	None	Trivial	Very Small	Small	Notable	Notable		Window Breaker		Chelyabinsk	

Large

Diameter	33m (108 ft)	40m (131 ft)	50m (164 ft)	65m (213 ft)	80m (262 ft)	100m (328 ft)	125m (410 ft)	160m (524 ft)	200m (656 ft)	250m (820 ft)	
Kinetic Energy (Megaton)	2.2	4	7.8	17	32	63	122	256	500	977	
Airburst (Megaton)	1.5	2	2.8	4	6	8	11	16	22	31	
Crater Size	0.7 km	0.9 km	1.3 km	1.8 km	2.2 km	2.8 km	4 km	5 km	6 km	7 km	
Damage	Town Killer	Suburb Killer	City Killer	Tunguska		Metro Region Killer	State Disruption	Country Disruption		Subcontinent Disruption	

Insane

Diameter	330m (1082 ft)	400m (1312 ft)	500m (1640 ft)	650m (2132 ft)	800m (2624 ft)	1000m (3280 ft)	1250m (4101 ft)	1,600m (5249 ft)	2,000m (6561 ft)		
Kinetic Energy (Megaton)	2,246	4,000	7,813	17,164	32,000	62,500	122,070	256,000	500,000		
Airburst (Megaton)	47	63	88	131	179	250	349	506	707		
Crater Size	10 km	12 km	15 km	19 km	24 km	30 km	37 km	48 km	59 km		
Damage	Civilization Threat	Civilization Challenge	Civilization Disruption	Extinction Threat	Extinction Challenge	Climate Change	Climate Overturn	Regional Extinction			

Catastrophic

Diameter	2,500m (1.55 mi)	3,300m (2 mi)	4,000m (2.4 mi)	5,000m (3.1 mi)	6,500m (4 mi)	8,000m (4.9 mi)	10,000m (6.2 mi)				
Kinetic Energy (Megaton)	976,563	2,246,063	4,000,000	7,812,500	17,164,063	32,000,000	62,500,000				
Airburst (Megaton)	988	1,499	2,000	2,795	4,143	5,657	7,906				
Crater Size	74 km	98 km	119 km	149 km	193 km	238 km	298 km				
Damage	Extinction Event			Apocalyptic Extinction Event	Sterilization Threat		Planetary Sterilization				

Online Impact Calculators

Online Impact Calculators	If you still have internet access these calculators will prove useful in giving a rough damage estimate.
Calculators	**Impact Earth:** https://www.purdue.edu/impactearth/

5 Meteorite Protection

How you can protect yourself from a meteorite.

Flee	Generally the only sure way to defend yourself from a meteorite is to get out of its path if you know the trajectory long before it hits.
Bunkers	A deep underground bunker could survive a nearby meteorite impact, however you would need to know it's coming and be safe inside beforehand.
Space Programs	There are a number of space agencies looking into different ways they can divert or destroy incoming asteroids, however you should look into other alternatives for your personal safety.
Abandon Earth	If the world knows an impact is highly likely then they should do what they can to ensure humanities continued survival by sending ships into space and returning after the disaster.

19 Solar Flare

A solar flare is a sudden flash of increased Sun's brightness, usually observed near its surface. Flares are often, but not always, accompanied by a coronal mass ejection. Even the most powerful flares are barely detectable in the total solar irradiance (the "solar constant"). Solar flares occur in a power-law spectrum of magnitudes; an energy release of typically 1020 joules of energy suffices to produce a clearly observable event, while a major event can emit up to 1025 joules. Flares are closely associated with the ejection of plasmas and particles through the Sun's corona into outer space; flares also copiously emit radio waves. If the ejection is in the direction of the Earth, particles associated with this disturbance can penetrate into the upper atmosphere (the ionosphere) and cause bright auroras, and may even disrupt long range radio communication.

It usually takes days for the solar plasma ejecta to reach Earth. Flares also occur on other stars, where the term stellar flare applies. High-energy particles, which may be relativistic, can arrive almost simultaneously with the electromagnetic radiations. On July 23, 2012, a massive, potentially damaging, solar storm (solar flare, coronal mass ejection and electromagnetic radiation) barely missed Earth. According to NASA, there may be as much as a 12% chance of a similar event occurring between 2012 and 2022.

See **Mass Destruction > Space Event > Solar Flare** for more information.
Or see **Mass Destruction > EMP** for information on the effects of solar flares.

20 Geomagnetic Reversal

A geomagnetic reversal is a natural phenomenon where the Earth's magnetic north and south poles effectively swap places. It's not a sudden, instantaneous event, but rather a process that unfolds over hundreds to thousands of years.

If you're looking for the apocalyptic "Cataclysmic Pole Shift" event, head to the MASS DESTRUCTION section.

Our planet has a powerful magnetic field, which acts like a giant bar magnet, with a north magnetic pole and a south magnetic pole. This field is generated by the movement of molten iron in the Earth's outer core, a process known as the "geodynamo." During a geomagnetic reversal, the flow of molten iron in the core becomes unstable. This causes the magnetic field to weaken significantly – sometimes to less than 10% of its normal strength. During this weakening phase, the magnetic poles might wander erratically, even appearing in multiple locations, before eventually stabilizing in the opposite polarity.

So, where your compass needle currently points north, it would eventually point south. It's crucial not to confuse magnetic poles with geographic poles. The geographic poles are the points around which the Earth rotates (North Pole and South Pole), and they do not shift rapidly in a geomagnetic reversal. Geomagnetic reversals are a normal part of Earth's geological history. They have occurred many times in the past, but the timing is irregular and unpredictable.

The primary concerns during a geomagnetic reversal stem from the period when the magnetic field is significantly weakened.
● **Technology:** Earth's magnetic field acts as a shield, deflecting harmful charged particles from the sun (solar wind) and cosmic rays from deep space. A weakened field would allow more of this radiation to reach the Earth's upper atmosphere. This could disrupt or destroy satellites, which would impact GPS, satellite communications, weather forecasting, and other critical infrastructure. It could also induce strong currents in power grids on Earth's surface, potentially leading to widespread blackouts.
● **Navigation:** Compasses would become unreliable. Animals that use the Earth's magnetic field for navigation (like migratory birds, whales, and sea turtles) could become disoriented.
● **Human Health:** While the atmosphere still provides significant protection from cosmic radiation, some scientists suggest a very slight long-term increase in certain health risks, like skin cancer, due to increased radiation exposure at the surface. However, there's no evidence that past reversals have caused mass extinctions.

Overall, a geomagnetic reversal is a slow, natural process that the Earth has undergone many times. While it could pose significant challenges for our modern, technology-dependent civilization, it is not predicted to be an apocalyptic event for human life.

Protection

Protecting yourself from a geomagnetic reversal primarily involves preparing for the effects of a weakened or disrupted magnetic field, which are most likely to manifest as widespread power outages and technological disruptions. It's important to understand that a geomagnetic reversal is a very slow process (hundreds to thousands of years), not a sudden catastrophic event like an earthquake. However, the vulnerability to solar storms (which can happen at any time, but whose effects would be amplified during a weak magnetic field) is what most people are concerned about.

1. Prepare for Long-Term Power Outages
This is the most critical aspect of preparing for a geomagnetic reversal's effects.
● Emergency Kit (Go-Bag/Bug-Out Bag): Have a well-stocked kit with essentials for at least 3-5 days (food, water, first aid, shelter, warmth, comms).
● Water Storage & Purification: Store ample potable water (at least 4 liters per person per day for drinking and hygiene). Have water purification methods (filters, purification tablets, ability to boil water).
● Non-Perishable Food: Stock at least 2 weeks to a month's worth of non-perishable food that requires no cooking or refrigeration. Consider longer-term food storage options.
● Alternative Cooking Methods: Propane stove, rocket stove, BBQ, or ability to build a safe outdoor fire.
● Lighting: Flashlights, headlamps, lanterns (LED preferred) with plenty of spare batteries. Avoid candles for safety.
● Heating/Cooling: Non-electric heating options (e.g., wood stove if applicable and safe) and strategies for passive cooling.
● Hygiene & Sanitation: Soap, hand sanitizer, feminine hygiene products, waste disposal bags, camping toilet.
● First Aid & Medications: Comprehensive first aid kit, knowledge of basic first aid, and at least a month's supply of prescription medications.

NATURAL DISASTERS
Geomagnetic Reversal
Protection

2. Protect Electronics from Electromagnetic Pulses (EMPs) / Geomagnetically Induced Currents (GICs)
While a full geomagnetic reversal is slow, a severe solar storm (which could be more impactful during a reversal) can cause GICs that damage electronics.
● Faraday Cages: For truly critical electronics (e.g., a hand-crank radio, emergency charging devices, old laptop with important data), consider building or buying Faraday cages. These are enclosures made of conductive material that block electromagnetic fields. Simple ones can be made from metal trash cans with non-conductive lining.
● Surge Protectors: Install whole-house surge protectors and use high-quality surge protector power strips for sensitive electronics. This offers some protection from less severe surges, but won't stop a major GIC.
● Unplug Sensitive Electronics: During times of high solar activity warnings, unplug valuable electronics to isolate them from the grid.
● Hard Copies of Important Data: Don't rely solely on digital information. Print out essential documents, maps, survival guides, contact lists, and manuals.

3. Communication & Information
● Battery-Powered/Hand-Crank Radio: Crucial for receiving emergency broadcasts if regular communications fail.
● Two-Way Radios (Walkie-Talkies): For short-range communication with family members.
● Non-Cordless Landline Phone: If you still have a traditional landline, a non-cordless phone might work during a power outage.
● Family Communication Plan: Establish clear meeting points and out-of-area contacts in case local communication networks are down.
● Physical Maps & Compass: Learn how to use them for navigation as GPS might be unavailable.

4. Financial Preparedness
● Cash on Hand: Electronic banking and ATMs will be down during widespread power outages. Keep a significant amount of cash in small denominations.
● Emergency Fund: Have savings that can cover several months of expenses.

5. Vehicle Preparedness
● Keep Fuel Tank Full: Gas stations rely on electricity for pumps. A full tank ensures mobility if needed.
● Maintain Your Vehicle: Ensure your car is in good working order.

6. Skills and Knowledge
● Learn Basic Survival Skills: Fire starting, water purification, knot tying, basic first aid, shelter building.
● Gardening/Food Preservation: For long-term food security.
● Mechanical & Repair Skills: Ability to fix common household items or vehicles.
● Self-Defense: Basic self-defense knowledge.

7. Community & Networking
● Connect with Neighbors: Build relationships and identify skills within your community. Mutual aid networks can be invaluable.
● Join Local Preparedness Groups: Learn from others and share knowledge.

NATURAL DISASTERS
Geomagnetic Reversal
Protection
Protection

Man-Made Disasters

Surviving any man-made disasters you may encounter

"The object of war is not to die for your country but to make the other bastard die for his."
George S. Patton

Introduction

Another common set of disasters are those caused by man either purposefully or accidentally. Man made disasters can range from wars to shortages to economic crashes.

Purpose	The aim of MAN-MADE DISASTERS is to provide the reader with the types of different man-made disasters including in-depth information on how to survive any that mat arise.
Lost?	• For world wars and other planet-altering disasters, see the MASS DESTRUCTION section. • For wildfires, see the NATURAL DISASTERS section. • For disasters that are naturally occurring, see the NATURAL DISASTERS section. • For information on minor acts of nature, see the METEOROLOGY section. • For any small scale natural disasters which only affect one person or family, see the PERSONAL DISASTERS section. • For a distraction from the current turmoil of the world, see the ENTERTAINMENT section.

Contents

1 Doomsday Clock

The Doomsday Clock is a design that warns the public about how close we are to destroying our world with dangerous technologies of our own making. It is a metaphor, a reminder of the perils we must address if we are to survive on the planet. When the Doomsday Clock was created in 1947, the greatest danger to humanity came from nuclear weapons, in particular from the prospect that the United States and the Soviet Union were headed for a nuclear arms race. The Bulletin considered possible catastrophic disruptions from climate change in its hand-setting deliberations for the first time in 2007.

Current Time (2025)[n]
89 Seconds to Midnight

Timeline

1947	1949	1953	1960	1963	1968	1969	1972	1974	1980	1981	1984
7 Minutes to Midnight	3 Minutes to Midnight	2 Minutes to Midnight	7 Minutes to Midnight	12 Minutes to Midnight	7 Minutes to Midnight	10 Minutes to Midnight	12 Minutes to Midnight	9 Minutes to Midnight	7 Minutes to Midnight	4 Minutes to Midnight	3 Minutes to Midnight

1988 6 Minutes to Midnight	**1990** 10 Minutes to Midnight	**1991** 17 Minutes to Midnight	**1995** 14 Minutes to Midnight	**1998** 9 Minutes to Midnight	**2002** 7 Minutes to Midnight	**2007** 5 Minutes to Midnight	**2010** 6 Minutes to Midnight	**2012** 5 Minutes to Midnight	**2015** 3 Minutes to Midnight	**2016** 3 Minutes to Midnight	**2017** 2.5 Minutes to Midnight
2018 2 Minutes to Midnight	**2019** 2 Minutes to Midnight	**2020** 100 Seconds to Midnight	**2021** 100 Seconds to Midnight	**2022** 100 Seconds to Midnight	**2023** 90 Seconds to Midnight	**2024** 90 Seconds to Midnight	**2025** 89 Seconds to Midnight	**2026** TBA	**2027** TBA	**2028** TBA	**2029** TBA

2 Local Disasters

A local disaster is any disaster that occurs on a fairly small scale such as a single street, city or town or part of a single state. Any events that have the chance for impacts felt around the globe are outside this category.

Subheadings

1. Vehicle Crash	2. Air Crash
3. Oil / Chemical Spill	4. Dam Failure
5. Blackout	6. Nuclear Accident

1 Vehicle Crash

A collision between two road vehicles or a vehicle and a structure.

Crash Preparation

These are tips on how you can prepare for a crash beforehand.

Tips

Phone Emergency Details	Make sure your phone's emergency contact details are up to date. Anyone can access the contact you list and they don't need your phone PIN/combination to find it as it's on the lock screen.

Gear

Reflective Triangles	You should have a set of reflective road markers to alert oncoming vehicles that there is danger ahead.
High-Vis Vest	This can be a lifesaver in the dark or in foggy circumstances. Be sure to put it on before you step out of the vehicle.
Window Breaker	Have this handy in case you need to break a window to escape.
First Aid Kit	Every vehicle should have a first aid kit of some kind and be in easy reach.
Pen & Paper	Sometimes you need to quickly jot down some details such as a crash you witnessed or someone breaking the law.

After the Crash

This is what you should do if you're involved in a minor or moderate vehicle crash.

1	Try to stay calm and think clearly. Do not think about fault, now is the time to review any current risks and the heath of those involved.
2	Check yourself for injuries and whether you can move or not.
3	Turn on the car's hazard/warning lights. (If the car hasn't flipped or rolled onto its top)
4	Check on any other passengers in your vehicle. (If the vehicle isn't leaking fuel or has any other dangers)
5	Freeze/save your dash cam's video recording so it doesn't record over the crash.
6	Put on your high-vis vests, especially if it's dark, rainy or foggy.
7	Help your vehicle occupants get to a safe location.
8	Have someone call for the police and for an ambulance (if needed).
9	Check on the injuries and mental state of the individuals in the other car.
10	Set up some high-vis reflectors further back down the road 3m (10ft) and 30m (100ft) to warn other vehicles of the crash.
11	Take pictures and videos of the incident.
12	Move both vehicles to a safe location out of the flow of traffic.
13	Contact your insurer or a towing company of your choice to arrange for your vehicle to be towed. (if required)

MAN-MADE DISASTERS | Local Disasters | Air

14	Exchange details with the owner of the other vehicle and witnesses and leave the crash site.

2 Air Crash

A collision of any aircraft with the ground, sea, structure or another aircraft.

Crash Preparation

If you can reach the seat in front
● Feet Flat and Back: Place both feet flat on the floor, slightly behind your knees. This helps prevent your legs from flailing forward and impacting the seat in front.
● Bend Forward: Bend your upper torso well forward. The goal is to reduce the distance between your head and the seat in front.
● Head Against Seat in Front: Place your head against the backrest of the seat directly in front of you.
● Hands flat on the seat in front: Place hands flat to the left and right beside your head against the seat in front.
● Hands on top of your head: Place one hand on top of the other on the back of your head, tucking your elbows in. (Note: Some US airlines and the FAA advise against placing hands behind the neck due to potential spinal loading, suggesting hands on thighs or holding wrists instead).
● Holding ankles/lower legs: Some variations suggest bending forward and grasping your ankles or lower legs.

If you cannot reach the seat in front (e.g., bulkhead row, more legroom)
● Feet Flat and Back: Same as above.
● Bend Forward: Bend forward as much as possible, tucking your chin to your chest.
● Place your hands on top of your head, tucking elbows in.
● Bend forward and place your hands in your lap, or grasp the sides of your own seat.
● Bend forward and place arms at the sides of your lower legs or hold your lower legs.

For Rear-Facing Seats (less common for passengers)
● Slide well back into the seat with your back and head firmly against the backrest.
● Fasten your lap belt tightly.
● Cross your arms in front of your chest.
● Place your legs together, with lower legs flexed backward as far as possible, and only the tips of your toes on the floor.

Important Considerations
● Listen to the Cabin Crew: The flight attendants are trained for emergencies. They will shout commands like "Brace! Brace!" or "Heads down! Stay down!" and demonstrate the position. Follow their instructions immediately and precisely.
● Maintain the Position: Stay in the brace position until the aircraft has come to a complete stop and the crew tells you it's safe to move.
● Secure Loose Items: Any loose items can become dangerous projectiles during an impact. Ensure your carry-on luggage is properly stowed under the seat in front of you or in the overhead bin.
● Pillows/Blankets: Do not use pillows or blankets between your body and the bracing surface, as they offer little energy absorption and can increase injury risk.
● Child Restraint Systems: For young children, approved child restraint systems in their own seat offer the best protection. Follow the manufacturer's instructions for bracing with these devices.

After the Crash

Before Anything Else: Your Mindset
● Stay Calm (as much as possible): Panic is a killer. Take a deep breath. Focus on one step at a time.
● Listen: Listen for any instructions from the flight crew. They are trained for this.

Immediate Post-Impact Actions (The "30-Second Rule")
The first 90 seconds (often called the "30-second rule" which means 30 seconds to impact and 60 seconds after impact) are the most critical for survival.

1. Assess Yourself
● Are you injured? Can you move your limbs?
● Are you disoriented?
● Do you smell smoke or fuel?

2. Unfasten Your Seatbelt
This is crucial. If you're disoriented, locate the buckle and unfasten it immediately. Don't waste time looking for it.

3. Get Out Quickly
● Follow the Lighted Path: Aircraft floors have emergency lights that illuminate the path to the nearest exit. Follow them.
● Ignore Personal Belongings: Do NOT try to retrieve carry-on luggage or personal items. They will slow you down and endanger others. Your life is more valuable than any possession.
● Move Quickly, Not Frantically: Stay low if there's smoke. Crawl if necessary.
● Push Through Obstacles: If there's debris, try to move it. If there are people blocking the aisle, try to get around them, but do not push violently.
● Help Others (if safe and quick): If someone right next to you is clearly incapacitated or trapped, a quick assist is commendable, but your primary goal is to get yourself and others out of immediate danger. Do not become trapped yourself trying to free someone.
● Locate Exits: Look for the nearest emergency exit. Remember from the safety briefing that your nearest exit might be behind you.

Upon Reaching an Exit
1. Assess the Exit
● Look Outside: Check for fire, water, or other hazards outside before opening it or deploying a slide. If it's blocked or dangerous, change exits.
● Wait for Crew Instruction (if possible): Flight attendants are trained to open exits and deploy slides. Follow their lead.
● Open if Necessary: If the crew is incapacitated and the exit appears safe, open it yourself if you know how. Reviewing the safety card before the flight helps with this.

2. Use the Escape Slide (if present)
● Remove High Heels/Sharp Objects: If you are wearing high heels or have sharp objects in your pockets (like pens), remove them to avoid puncturing the slide.
● Slide Correctly: Sit at the edge, feet first, arms out in front, and slide down. Don't hesitate; others are behind you. Jump if told to.
● Clear the Area: Once you reach the ground, immediately move away from the aircraft to make room for others and to clear potential explosions.

MAN-MADE DISASTERS Local Disasters Air Crash After the Crash

After Evacuation (Once You Are Outside)
1. Move Upwind and Uphill:
Upwind: Get away from smoke and fumes.
Uphill: If the crash is on water, move to higher ground. If on land, it helps with visibility and avoiding any fuel spills that might flow downhill.
Maintain Distance: Move at least 500 feet (about 150 meters) away from the wreckage. Aircraft can explode or catch fire, and debris can fly.

2. Assemble at a Designated Meeting Point (if given)
The crew may direct survivors to a specific assembly point away from the wreckage. Stick together.

3. Render First Aid (if trained and able)
Once clear of immediate danger, if you have first aid knowledge, assist those who are injured. Use items from the plane's first aid kit if available, or improvise.

4. Signal for Help
Use any signaling devices you have (e.g., whistle from your life vest, mobile phone if it works and has signal).
Create large, visible signals on the ground if in a remote area.
Build a fire (carefully, away from wreckage) to create smoke if in a wilderness area and need to signal.

5. Stay with the Group
Unless you have a very clear and superior plan, stay with the other survivors. There is safety in numbers, and rescuers will be looking for a group.

6. Conserve Resources
If in a remote area, be mindful of water, food, and energy.

Things NOT to Do
- Don't Inflate Life Vest Inside: If the plane crashes into water, do NOT inflate your life vest until you are out of the aircraft. An inflated vest can trap you inside the cabin.
- Don't Re-enter the Aircraft: Never go back into the burning or damaged aircraft for any reason.
- Don't Panic: As stressed earlier, panic leads to irrational decisions.

3 Oil / Chemical Spill

A spill of oil or chemicals into the local environment.

Spill Preparation

After the Spill

4 Dam Failure

A dam failure is a catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. A dam is a barrier across flowing water that obstructs, directs or slows down the flow, often creating a reservoir, lake or impoundments. Most dams have a section called a spillway or weir over or through which water flows, either intermittently or continuously, and some have hydroelectric power generation systems installed. Dams are considered "installations containing dangerous forces" under International humanitarian law due to the massive impact of a possible destruction on the civilian population and the environment.

Dam failures are comparatively rare, but can cause immense damage and loss of life when they occur. In 1975 the failure of the Banqiao Reservoir Dam and other dams in Henan Province, China caused more casualties than any other dam failure in history. The disaster killed an estimated 171,000 people and 11 million people lost their homes.

Main Causes of Failure
- Sub-standard construction materials/techniques
- Spillway design error
- Geological instability caused by changes to water levels during filling or poor surveying
- Sliding of a mountain into the reservoir
- Poor maintenance, especially of outlet pipes
- Extreme inflow
- Human, computer or design error
- Internal erosion or piping, especially in earthen dams
- Earthquakes
- Intentional destruction (Operation Chastise)

Dam Failures

Dam	Statistics	Reason For Failure
Sempor Dam Central Java Province, Republic of Indonesia	Failure Date: 1967 Fatalities: 2,000	Flash floods over-topped the dam during construction.
Banqiao and Shimantan Dams Zhumadian, China	Failure Date: 1975 Fatalities: 171,000	Extreme rainfall, beyond the planned design capability of the dam, dumped on China by Typhoon Nina. 11 million people lost their homes. Dam would later be rebuilt between 1986 and 1993.
Machchu-2 Dam Morbi, India	Failure Date: 1979 Fatalities: 5,000	Heavy rain and flooding beyond spillway capacity. Old estimates were 1,800–25,000 but a 2011 book by Sandesara & Wooten refined the bracket to 5,000–10,000.

Val di Stava Dam Tesero, Italy	Failure Date: 1985 Fatalities: 268	Poor maintenance and low margin for error in design; outlet pipes failed leading to pressure on dam.
Gusau Dam Gusau, Nigeria	Failure Date: 2006 Fatalities: 40	Heavy flooding. Approximately 500 homes were destroyed, displacing 1,000 people.
Koshi Barrage Koshi Zone, Nepal	Failure Date: 2008 Fatalities: 250	Neglect ion of barrage and the building of barrage itself. The region however saw weak monsoon and multi-year drought preceding the barrage failure. The flood affected over 2.3 million people in the northern part of Bihar.
Kyzyl-Agash Dam Qyzylaghash, Kazakhstan	Failure Date: 2010 Fatalities: 43	Heavy rain and snowmelt. 300 people were injured and over 1000 evacuated from the village.
Mount Polley Tailings Dam Failure British Columbia, Canada	Failure Date: 4 Aug 2014 Fatalities: 0	Tailings dam collapse due to negligent operation; reservoir was overfilled beyond design parameters despite repeated warnings of the danger combined with a minor dam breach a few months before and fundamental design flaws.
Germano Mine Tailings Dams Mariana, Minas Gerais, Brazil	Failure Date: 5 Nov 2015 Fatalities: 24	One tailings dam collapse. One village destroyed, 600 people evacuated, 19 missing. Sixty-million cubic meters of iron waste sludge polluted Doce River, and the sea near the river's mouth.
Patel Dam Solai, Kenya	Failure Date: 10 May 2018 Fatalities: 47	Failed after several days of heavy rain.
Xe-Pian Xe-Namnoy Dam Attapeu Province, Laos	Failure Date: 23 Jul 2018 Fatalities: 36	Saddle dam under construction collapsed during rainstorms. 6600 people homeless, 98 missing.

Dam Failure Preparation

During a Dam Failure

5 Blackout

A power outage (also called a power cut, power failure or a blackout) is a short-term or a long-term loss of the electric power to a particular area. There are many causes of power failures in an electricity network. Examples of these causes include faults at power stations, damage to electric transmission lines, substations or other parts of the distribution system, a short circuit, or the overloading of electricity mains. Power failures are particularly critical at sites where the environment and public safety are at risk. Institutions such as hospitals, sewage treatment plants, mines, shelters and the like will usually have backup power sources such as standby generators, which will automatically start up when electrical power is lost. Other critical systems, such as telecommunication, are also required to have emergency power. The battery room of a telephone exchange usually has arrays of lead–acid batteries for backup and also a socket for connecting a generator during extended periods of outage.

Failure Types

Power outages are categorized into three different phenomena, relating to the duration and effect of the outage:

Permanent Fault	A permanent fault is a massive loss of power typically caused by a fault on a power line. Power is automatically restored once the fault is cleared.
Brownout	A brownout is a drop in voltage in an electrical power supply. The term brownout comes from the dimming experienced by lighting when the voltage sags. Brownouts can cause poor performance of equipment or even incorrect operation.
Blackout	A blackout is the total loss of power to an area and is the most severe form of power outage that can occur. Blackouts which result from or result in power stations tripping are particularly difficult to recover from quickly. Outages may last from a few minutes to a few weeks depending on the nature of the blackout and the configuration of the electrical network.

Causes of Failure

These are the different causes of power failures and their different chances of occurring in descending order.

Type	Percentage Chance	Example
Weather	42%	Weather of all types besides "Acts of God".
Malfunction	28%	A malfunction at any point along the distribution circuit.
Unknown	10.20%	Shutdowns that are never understood why they happened.
Human Error	8.40%	Errors such as accidentally pressing the wrong button.
Acts of God	4.70%	Include earthquakes, floods, landslides, vehicle accidents, and wildfires.
Explosion/Sabotage	1.90%	Terrorism, explosions or sabotage which destroy power assets.
Cyber Attack	1.90%	A digital attack on the power network to disable or shut it down.
Intentional Shutdown	1.90%	Planned maintenance and other intentional shutdowns.

Demand Overload	0.90%	When demand becomes too high, the network can shut itself down to preserve itself.

Restoring Power

Restoring power after a wide-area outage can be difficult, as power stations need to be brought back on-line. Normally, this is done with the help of power from the rest of the grid. In the total absence of grid power, a so-called black start needs to be performed to bootstrap the power grid into operation. The means of doing so will depend greatly on local circumstances and operational policies, but typically transmission utilities will establish localized 'power islands' which are then progressively coupled together. To maintain supply frequencies within tolerable limits during this process, demand must be reconnected at the same pace that generation is restored, requiring close coordination between power stations, transmission and distribution organizations.

Blackout Preparation

1. Create a Blackout Kit / Emergency Kit if you don't already
- Lighting
- Communication
- Food and Water
- First Aid & Medications
- Sanitation and Hygiene
- Warmth/Comfort
- Financial & Important Documents

2. Prepare Your Home
- Unplug electronics: Disconnect sensitive electronics (TVs, computers, routers) to protect them from power surges when electricity is restored.
- Keep refrigerator/freezer closed: Every time you open the door, cold air escapes.
- Know how to open garage doors manually: If they are electric.
- Gas stove safety: If you have a gas stove, you might be able to light the burners manually with a match (check your model's instructions). Ensure good ventilation.
- Alternative cooking: A BBQ, camp stove, or portable propane burner can be used outdoors only for cooking. Never use charcoal grills or fuel-burning stoves indoors due to carbon monoxide risk.

Heating (if in cold climate)
- Dress in layers.
- Close off unused rooms.
- Insulate windows with blankets or plastic sheeting.
- Safe alternative heaters (e.g., propane or kerosene heaters designed for indoor use with proper ventilation and a carbon monoxide detector). Never use outdoor heaters indoors.
- Fireplace (if you have one) with a supply of dry wood.

Cooling (if in hot climate)
- Open windows at night if cooler, close them during the day to keep heat out.
- Stay on lower floors.
- Take cool baths or showers if water is available.
- Wear light, loose clothing.

3. Develop a Family Plan
- Emergency meeting point: A safe place to meet if family members are separated.
- Out-of-area contact: A relative or friend outside your immediate area that family members can contact if local lines are down.
- Roles and responsibilities: Who does what during an outage (e.g., checking on neighbors, gathering supplies).
- Practice: Periodically review your plan and kit.

4. Before a Predicted Blackout
- Charge all devices: Phones, laptops, power banks, rechargeable batteries.
- Fill vehicle fuel tanks: Gas stations often cannot pump fuel without power.
- Fill bathtubs with water: For flushing toilets or non-drinking needs.
- Get cash.
- Check on vulnerable neighbours or family members.

During a Blackout

1. Stay Calm and Assess the Situation
- Don't Panic: Take a deep breath. Blackouts are often temporary.
- Determine the Scope: Is it just your house, or the whole street/neighborhood? Look out a window. If your neighbors also have no power, it's a larger outage. If not, check your circuit breaker (but only if it's safe and you know how).
- Safety First: Before doing anything else, ensure no immediate hazards like fallen power lines (stay far away from these!), gas leaks (smell for gas, listen for hissing, if detected, leave immediately and call emergency services from outside), or exposed wires.

2. Turn Off and Unplug Appliances
- Prevent Surges: Disconnect sensitive electronics (computers, TVs, gaming consoles, routers) to protect them from damage when power is restored, as surges can occur.
- Prevent Overload: Turn off light switches and major appliances (stoves, ovens, heaters, air conditioners). Leave just one light on in a visible location (like a lamp in the living room) so you know when power returns. This also prevents an overload when the power comes back on.

3. Provide Lighting
- Flashlights & Headlamps: Immediately grab your pre-staged flashlights or headlamps. Use these for general illumination.
- Battery-Powered Lanterns: Good for lighting a whole room.
- Avoid Candles: While they seem like an easy solution, candles are a significant fire risk, especially in the dark where you might knock them over. If you must use them, never leave them unattended and keep them away from anything flammable.

4. Maintain Communication
- Conserve Phone Battery: Limit phone use to essential calls. Texting often uses less battery and can get through when calls can't.
- Power Banks: Use your pre-charged power banks for your mobile phone.
- Car Charger: If your car has fuel, you can use it to charge devices (run the engine outdoors for ventilation, never in an enclosed space like a garage due to carbon monoxide risk).
- Battery-Powered Radio: Tune into local news or emergency broadcasts for updates on the outage and any safety instructions.
- Written Contacts: Have a physical list of emergency numbers (utility company, emergency services, family, neighbors).

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5. Manage Food and Water
- Refrigerator/Freezer: Keep doors closed! An unopened refrigerator will keep food cold for about 4 hours. A full freezer can maintain its temperature for approximately 48 hours (24 hours if half-full).
- Coolers: Use a cooler with ice (if available) for highly perishable items you might need to access frequently.
- Prioritize Food: Eat perishable foods from the fridge first. Non-perishable items from your emergency kit should be consumed later if the outage is prolonged.
- Water: Use your stored drinking water. If you rely on an electric pump for water, use water from your pre-filled bathtubs or other containers for flushing toilets or non-drinking needs.

6. Stay Warm or Cool (Depending on Climate)
Cold Climate
- Layer Up: Wear multiple layers of clothing.
- Blankets/Sleeping Bags: Use them for warmth.
- Close Off Rooms: Concentrate your activities in one room to conserve heat. Close doors to unused rooms.
- Insulate Windows: Hang blankets over windows to trap heat.
- Safe Heating: Only use alternative heaters (e.g., propane heaters) that are specifically designed for indoor use and ensure proper ventilation. Crucially, have a working carbon monoxide detector. Never use outdoor grills or generators indoors.

Hot Climate
- Stay Hydrated: Drink plenty of water.
- Close Curtains/Blinds: Block out sunlight during the day.
- Open Windows at Night: If it's cooler outside at night, open windows to let air circulate. Close them again before the sun gets strong in the morning.
- Cool Showers/Baths: If water is available.
- Light Clothing: Wear loose, light-colored clothing.
- Go to Cooler Areas: If possible, move to the lowest level of your home, as heat rises.

7. Safety and Well-being
- Carbon Monoxide: Be extremely cautious with any fuel-burning appliances (generators, grills, camp stoves). Always use them outdoors and far away from windows and doors. Carbon monoxide is an odorless, colorless, deadly gas. Have battery-powered carbon monoxide detectors.
- Check on Others: Reach out to elderly, ill, or vulnerable neighbors and family members who might need assistance.
- Entertainment: Have non-electronic forms of entertainment ready: books, board games, cards. It's a good time for conversation!
- Rest: Get sufficient rest.

8. When Power Returns
- Gradual Reconnection: Wait a few minutes after power is restored before plugging in sensitive electronics. Turn on appliances one by one to avoid overwhelming the circuit.
- Food Safety Check: Inspect refrigerated and frozen food. If perishable food has been at 40°F (4°C) or above for more than 4 hours, or if frozen food ● has thawed completely and been warm for more than 2 hours, throw it out. "When in doubt, throw it out!"

Check on Neighbours: Ensure they're okay and their power has returned safely.

6 Nuclear Accident

MAN-MADE DISASTERS | Local Disasters | Nuclear Accident

A nuclear accident such as Fukushima or Chernobyl.

INES Levels

The International Nuclear and Radiological Event Scale (INES) was introduced in 1990 by the International Atomic Energy Agency (IAEA) in order to enable prompt communication of safety-significant information in case of nuclear accidents. The scale is intended to be logarithmic, similar to the moment magnitude scale that is used to describe the comparative magnitude of earthquakes. Each increasing level represents an accident approximately ten times more severe than the previous level. Compared to earthquakes, where the event intensity can be quantitatively evaluated, the level of severity of a man-made disaster, such as a nuclear accident, is more subject to interpretation.

INES Level	Classification	Description & Impact
0	Deviation	No safety significance.
1	Anomaly	Overexposure of a member of the public in excess of statutory annual limits. Minor problems with safety components with significant defence-in-depth remaining. Low activity lost or stolen radioactive source, device or transport package.
2	Incident	Exposure of a member of the public in excess of 10 mSv. Exposure of a worker in excess of the statutory annual limits. Impact on radiological barriers and control: Radiation levels in an operating area of more than 50 mSv/h. Significant contamination within the facility into an area not expected by design. Impact on defence-in-depth: Significant failures in safety provisions but with no actual consequences. Found highly radioactive sealed orphan source, device or transport package with safety provisions intact. Inadequate packaging of a highly radioactive sealed source.
3	Serious Incident	Exposure in excess of ten times the statutory annual limit for workers. Non-lethal deterministic health effect (e.g., burns) from radiation. Impact on radiological barriers and control: Exposure rates of more than 1 Sv/h in an operating area. Severe contamination in an area not expected by design, with a low probability of significant public exposure. Impact on defence-in-depth: Near-accident at a nuclear power plant with no safety provisions remaining. Lost or stolen highly radioactive sealed source. Misdelivered highly radioactive sealed source without adequate procedures in place to handle it.
4	Accident with Local Consequences	Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls. At least one death from radiation. Impact on radiological barriers and control: Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory. Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

5	**Accident with Wider Consequences**	Limited release of radioactive material likely to require implementation of some planned countermeasures. Several deaths from radiation. Impact on radiological barriers and control: Severe damage to reactor core. Release of large quantities of radioactive material within an installation with a high probability of significant public exposure. This could arise from a major criticality accident or fire.
6	**Serious Accident**	Significant release of radioactive material likely to require implementation of planned countermeasures
7	**Major Accident**	Major release of radioactive material with widespread health and environmental effects requiring implementation of planned and extended countermeasures.

Notable Accidents

A table of the most notable nuclear accidents in history and their INES level.

Location & Date	INES Level	Description
Mayak, Kyshtym, Russia September 29, 1957	6	The Kyshtym disaster was a radiation contamination incident that occurred at Mayak, a Nuclear fuel reprocessing plant in the Soviet Union. Unknown dead.
Sellafield aka Windscale fire, Cumberland, United Kingdom October 10, 1957	5	A fire at the British atomic bomb project destroyed the core and released an estimated 740 terabecquerels of iodine-131 into the environment. A rudimentary smoke filter constructed over the main outlet chimney successfully prevented a far worse radiation leak and ensured minimal damage. 0 Dead
Idaho Falls, Idaho, United States January 3, 1961	4	Explosion at SL-1 prototype at the National Reactor Testing Station. All 3 operators were killed when a control rod was removed too far. 3 Dead
Lucens reactor, Vaud, Switzerland January 21, 1969	5	On January 21, 1969, it suffered a loss-of-coolant accident, leading to a partial core meltdown and massive radioactive contamination of the cavern, which was then sealed. 0 Dead
Jaslovské Bohunice, Czechoslovakia January 5, 1976	4	Malfunction during fuel replacement. Fuel rod ejected from reactor into the reactor hall by coolant (CO2). 2 Dead
Jaslovské Bohunice, Czechoslovakia February 22, 1977	4	Severe corrosion of reactor and release of radioactivity into the plant area, necessitating total decommission. 0 Dead
Three Mile Island, Pennsylvania, United States March 28, 1979	5	Loss of coolant and partial core meltdown due to operator errors. There is a small release of radioactive gases. See also Three Mile Island accident health effects. 0 Dead
Chernobyl April 26, 1986	7	Overheating, steam explosion, fire, and meltdown, necessitating the evacuation of 300,000 people from Chernobyl and dispersing radioactive material across Europe. 64 + 4,000 Dead.
Ibaraki Prefecture, Japan September 30, 1999	4	Tokaimura nuclear accident killed two workers, and exposed one more to radiation levels above permissible limits. 2 Dead.
Fukushima, Japan March 11, 2011	7	A tsunami flooded and damaged the plant's 5 active reactors, drowning two workers. Loss of backup electrical power led to overheating, meltdowns, and evacuations. One man died suddenly while carrying equipment during the clean-up. The plant's 6th reactor was inactive at the time. 2+ Dead.

Nuclear Accident Preparation

Develop an Emergency Plan
- Evacuation vs. Shelter-in-Place: Know the difference. Official instructions will tell you which to do.
- Evacuation: Leaving the area before fallout arrives.
- Shelter-in-Place: Staying indoors in a protected space during and immediately after fallout arrives.
- Designated Shelters: Identify the strongest, most interior part of your home (e.g., basement, inner room with no windows). This will be your fallout shelter.
- Meeting Points: Establish an out-of-area contact person and a meeting place for family members if separated.
- Pet Plan: Include plans for your pets' safety.

Prepare a Comprehensive Emergency Kit (Go-Bag & Shelter-in-Place Kit)
Your standard emergency kit is a great start, but a nuclear event requires specific additions:

Communication
- Battery-powered or Hand-crank Radio: Crucial for official emergency broadcasts (AM/FM, NOAA weather radio if applicable to your country).
- Whistle: For signaling for help.
- Fully Charged Mobile Phones & Power Banks: For initial communication, but expect networks to be overwhelmed or down.

Shelter-in-Place Specifics
- Duct Tape & Plastic Sheeting: To seal windows, doors, and vents in your designated fallout shelter to prevent airborne particles from entering.
- Portable Air Filter (HEPA-rated): If available, for your shelter space.

Personal Protection
- N95/P100 Masks: Or other effective respiratory protection to filter radioactive particles from the air.
- Eye Protection: Goggles or safety glasses.
- Gloves: Heavy-duty work gloves.
- Full-Body Coverings: Rain gear, overalls, or extra clothing (e.g., long-sleeved shirts, pants) that can be easily removed and disposed of.

Medical
- Standard First Aid Kit: Enhanced with any specific prescription medications (multi-week supply if possible).
- Potassium Iodide (KI) Tablets: Only take these if instructed by public health authorities. KI protects the thyroid gland from absorbing radioactive iodine, which is often a component of fallout. It does not protect against other radioactive elements. Store in a cool, dark place.

Food and Water
- Non-perishable food: At least a 2-week supply for shelter-in-place (more is better). Focus on items that require no cooking or refrigeration.
- Water: At least 4 litres per person per day for drinking and sanitation, stored in sealed containers. Have extra for decontamination.
- Manual Can Opener.

Sanitation & Hygiene
- Wet Wipes, Hand Sanitizer: For cleaning when water is scarce.
- Garbage Bags & Twist Ties: For waste disposal and potentially for sealing off contaminated clothing.
- Buckets with lids: For an emergency toilet.

Tools & Miscellaneous
- Multi-tool/Knife.
- Map of your area.
- Cash in small denominations.
- Pet supplies: Food, water, carrier, leash.

Strengthen Your Designated Fallout Shelter
- Location: The best protection is usually in the center of a basement or an interior room on a ground floor in a building with thick walls. The denser the material, the more radiation it blocks.
- Supplies: Stock your shelter with your kit items, and also:
- Water for flushing and washing.
- Books, games, or other activities to pass the time.
- Battery-powered fan for ventilation (if safe to use without drawing in outside air).
- Practice Sealing: Know how to quickly seal doors, windows, and vents with duct tape and plastic sheeting if instructed.

Stay Informed and Know Your Local Authority
- Identify Official Sources: Know the emergency management agency for your area.
- Emergency Alert Systems: Understand how emergency alerts are disseminated in your area (e.g., sirens, SMS alerts, radio broadcasts).

During a Nuclear Accident

What to Do During a Nuclear Accident (General Steps if one were to occur)
- Seek Immediate Shelter: Get inside the nearest substantial building. Do not stay outdoors.
- Go to Your Designated Fallout Shelter: The most interior part of your home, away from windows.
- Seal the Shelter: Close all windows and doors. Turn off fans, air conditioners, and forced-air heating systems that draw in outside air. Use duct tape and plastic sheeting to seal gaps around doors and windows.
- Stay Tuned: Listen to your battery-powered radio for official instructions (shelter-in-place duration, evacuation routes, safety information).
- Stay Inside: Remain in your shelter until authorities say it's safe to leave. This could be for 24-72 hours or longer, depending on the severity and type of event.
- Decontaminate (Upon Entering Shelter): If you were outside during fallout, immediately remove outer layers of clothing before entering your shelter or an inner room. Place contaminated clothing in a sealed plastic bag. Take a shower if possible, washing skin and hair with soap and water (avoid scrubbing).
- Conserve Resources: Ration food and water.

Post-Accident Considerations
- Decontamination: Follow official guidance on how to decontaminate your home and belongings.
- Mental Health: A nuclear event can be extremely traumatic. Be aware of the psychological impacts and seek support if needed.
- Long-Term Planning: Be prepared for potential disruptions to infrastructure, food supplies, and daily life for an extended period.

3 Disease

A disease is a particular abnormal condition that negatively affects the structure or function of part or all of an organism, and that is not due to any external injury. Diseases are often construed as medical conditions that are associated with specific symptoms and signs. A disease may be caused by external factors such as pathogens or by internal dysfunctions. For example, internal dysfunctions of the immune system can produce a variety of different diseases, including various forms of immunodeficiency, hypersensitivity, allergies and autoimmune disorders. In humans, disease is often used more broadly to refer to any condition that causes pain, dysfunction, distress, social problems, or death to the person afflicted, or similar problems for those in contact with the person.

In this broader sense, it sometimes includes injuries, disabilities, disorders, syndromes, infections, isolated symptoms, deviant behaviours, and atypical variations of structure and function, while in other contexts and for other purposes these may be considered distinguishable categories. Diseases can affect people not only physically, but also mentally, as contracting and living with a disease can alter the affected person's perspective on life.

Pandemic

A pandemic is an epidemic of infectious disease that has spread across a large region; for instance multiple continents, or even worldwide. A widespread endemic disease that is stable in terms of how many people are getting sick from it is not a pandemic. Further, flu pandemics generally exclude recurrences of seasonal flu. Throughout history, there have been a number of pandemics, such as smallpox and tuberculosis. One of the most devastating pandemics was the Black Death, which killed over 75 million people in 1350. The most recent pandemics include the HIV pandemic as well as the 1918 and 2009 H1N1 pandemics. Diseases are labelled as man-made as the host typically spreads the disease, often without realizing. Humans have also created a vast array of diseases for the purpose of war, eliminating a type of people or simple because they can.

A pandemic is an epidemic occurring on a scale which crosses international boundaries, usually affecting a large number of people. Pandemics can also occur in important agricultural organisms (livestock, crop plants, fish, tree species) or in other organisms. The World Health Organization (WHO) has a six-stage classification that describes the process by which a novel influenza virus moves from the first few infections in humans through to a pandemic. This starts with the virus mostly infecting animals, with a few cases where animals infect people, then moves through the stage where the virus begins to spread directly between people, and ends with a pandemic when infections from the new virus have spread worldwide and it will be out of control until we stop it. A disease or condition is not a pandemic merely because it is widespread or kills many people; it must also be infectious. For instance, cancer is responsible for many deaths but is not considered a pandemic because the disease is not infectious or contagious.

Current Pandemics
HIV originated in Africa, and spread to the United States via Haiti between 1966 and 1972. AIDS is currently a pandemic, with infection rates as high as 25% in southern and eastern Africa. In 2006, the HIV prevalence rate among pregnant women in South Africa was 29.1%. Effective education about safer sexual practices and bloodborne infection precautions training have helped to slow down infection rates in several African countries sponsoring national education programs. Infection rates are rising again in Asia and the Americas. The AIDS death toll in Africa may reach 90–100 million by 2025.

Notable Pandemics

There have been a number of significant pandemics recorded in human history, generally zoonoses which came about with the domestication of animals, such as influenza and tuberculosis. There have been a number of particularly significant epidemics that deserve mention above the "mere" destruction of cities.

Plague of Athens 430 BC	430 BC. Possibly typhoid fever killed a quarter of the Athenian troops, and a quarter of the population over four years. This disease fatally weakened the dominance of Athens, but the sheer virulence of the disease prevented its wider spread; i.e. it killed off its hosts at a rate faster than they could spread it. The exact cause of the plague was unknown for many years. In January 2006, researchers from the University of Athens analysed teeth recovered from a mass grave underneath the city, and confirmed the presence of bacteria responsible for typhoid.
Antonine Plague 165–180 AD	Possibly smallpox brought to the Italian peninsula by soldiers returning from the Near East; it killed a quarter of those infected, and up to five million in all. At the height of a second outbreak, the Plague of Cyprian (251–266), which may have been the same disease, 5,000 people a day were said to be dying in Rome.
Plague of Justinian From 541 to 750	This was the first recorded outbreak of the bubonic plague. It started in Egypt, and reached Constantinople the following spring, killing (according to the Byzantine chronicler Procopius) 10,000 a day at its height, and perhaps 40% of the city's inhabitants. The plague went on to eliminate a quarter to a half of the human population that it struck throughout the known world. It caused Europe's population to drop by around 50% between 550 AD and 700 AD.
Black Death From 1331 to 1353	The total number of deaths worldwide is estimated at 75 million people. Eight hundred years after the last outbreak, the plague returned to Europe. Starting in Asia, the disease reached Mediterranean and western Europe in 1348 (possibly from Italian merchants fleeing fighting in Crimea), and killed an estimated 20 to 30 million Europeans in six years; a third of the total population, and up to a half in the worst-affected urban areas. It was the first of a cycle of European plague epidemics that continued until the 18th century. There were more than 100 plague epidemics in Europe in this period.
The Third Plague Pandemic Started in 1855	Began in China and spread to India, where 10 million people died. During this pandemic, the United States saw its first outbreak: the San Francisco plague of 1900–1904. Today, isolated cases of plague are still found in the western United States.

Previous Threats

Cholera	Since it became widespread in the 19th century, cholera has killed tens of millions of people. ● 1846–1860 cholera pandemic. Deeply affected Russia, with over a million deaths. A two-year outbreak began in England and Wales in 1848 and claimed 52,000 lives. Throughout Spain, cholera caused more than 236,000 deaths in 1854–55. It claimed 200,000 lives in Mexico. ● In 1866, there was an outbreak in North America. It killed some 50,000 Americans. ● In 1892, cholera contaminated the water supply of Hamburg, and caused 8,606 deaths. ● 1899–1923 cholera pandemic. Had little effect in Europe because of advances in public health, but Russia was badly affected again (more than 500,000 people dying of cholera during the first quarter of the 20th century). The sixth pandemic killed more than 800,000 in India. The 1902–1904 cholera epidemic claimed over 200,000 lives in the Philippines. ● 1961–75 cholera pandemic. Began in Indonesia, called El Tor after the new biotype responsible for the pandemic, and reached Bangladesh in 1963, India in 1964, and the Soviet Union in 1966. Since then the pandemic has reached Africa, South America, and central America.
Influenza	The Greek physician Hippocrates, the "Father of Medicine", first described influenza in 412 BC. The first influenza pandemic was recorded in 1580, and since then, influenza pandemics occurred every 10 to 30 years. ● The 1889–1890 flu pandemic, also known as Russian Flu, was first reported in May 1889 in Bukhara, Uzbekistan. By October, it had reached Tomsk and the Caucasus. It rapidly spread west and hit North America in December 1889, South America in February–April 1890, India in February–March 1890, and Australia in March–April 1890. The H3N8 and H2N2 subtypes of the Influenza A virus have each been identified as possible causes. It had a very high attack and mortality rate, causing around a million fatalities. ● The "Spanish flu", 1918–1919. First identified early in March 1918 in US troops training at Camp Funston, Kansas. By October 1918, it had spread to become a worldwide pandemic on all continents, and eventually infected about one-third of the world's population (or ≈500 million persons). Unusually deadly and virulent, it ended nearly as quickly as it began, vanishing completely within 18 months.

● The "Asian Flu", 1957–58. An H2N2 virus caused about 70,000 deaths in the United States. First identified in China in late February 1957, the Asian flu spread to the United States by June 1957. It caused about 2 million deaths globally.
● The "Hong Kong Flu", 1968–69. An H3N2 caused about 34,000 deaths in the United States. This virus was first detected in Hong Kong in early 1968, and spread to the United States later that year. This pandemic of 1968 and 1969 killed approximately one million people worldwide.
● Influenza A (H3N2) viruses still circulate today.

Typhus	Typhus is sometimes called "camp fever" because of its pattern of flaring up in times of strife. (It is also known as "gaol fever" and "ship fever", for its habits of spreading wildly in cramped quarters, such as jails and ships.) Emerging during the Crusades, it had its first impact in Europe in 1489, in Spain. During fighting between the Christian Spaniards and the Muslims in Granada, the Spanish lost 3,000 to war casualties, and 20,000 to typhus. In 1528, the French lost 18,000 troops in Italy, and lost supremacy in Italy to the Spanish. In 1542, 30,000 soldiers died of typhus while fighting the Ottomans in the Balkans. During the Thirty Years' War (1618–1648), about 8 million Germans were killed by bubonic plague and typhus. The disease also played a major role in the destruction of Napoleon's Grande Armée in Russia in 1812. During the retreat from Moscow, more French military personnel died of typhus than were killed by the Russians. Of the 450,000 soldiers who crossed the Neman on 25 June 1812, fewer than 40,000 returned. More military personnel were killed from 1500–1914 by typhus than from military action. In early 1813, Napoleon raised a new army of 500,000 to replace his Russian losses. In the campaign of that year, over 219,000 of Napoleon's soldiers died of typhus.

Typhus played a major factor in the Irish Potato Famine. During World War I, typhus epidemics killed over 150,000 in Serbia. There were about 25 million infections and 3 million deaths from epidemic typhus in Russia from 1918 to 1922. Typhus also killed numerous prisoners in the Nazi concentration camps and Soviet prisoner of war camps during World War II. More than 3.5 million Soviet POWs died out of the 5.7 million in Nazi custody.

Smallpox	Smallpox was a contagious disease caused by the variola virus. The disease killed an estimated 400,000 Europeans per year during the closing years of the 18th century. During the 20th century, it is estimated that smallpox was responsible for 300–500 million deaths. As recently as the early 1950s, an estimated 50 million cases of smallpox occurred in the world each year. After successful vaccination campaigns throughout the 19th and 20th centuries, the WHO certified the eradication of smallpox in December 1979. To this day, smallpox is the only human infectious disease to have been completely eradicated, and one of two infectious viruses ever to be eradicated.

Measles	Historically, measles was prevalent throughout the world, as it is highly contagious. According to the U.S. National Immunization Program, 90% of people were infected with measles by age 15. Before the vaccine was introduced in 1963, there were an estimated 3–4 million cases in the U.S. each year. Measles killed around 200 million people worldwide over the last 150 years. In 2000 alone, measles killed some 777,000 worldwide out of 40 million cases globally. Measles is an endemic disease, meaning that it has been continually present in a community, and many people develop resistance. In populations that have not been exposed to measles, exposure to a new disease can be devastating. In 1529, a measles outbreak in Cuba killed two-thirds of the natives who had previously survived smallpox. The disease had ravaged Mexico, Central America, and the Inca civilization.
Tuberculosis	One-third of the world's current population has been infected with Mycobacterium tuberculosis, and new infections occur at a rate of one per second. About 5–10% of these latent infections will eventually progress to active disease, which, if left untreated, kills more than half of its victims. Annually, 8 million people become ill with tuberculosis, and 2 million people die from the disease worldwide. In the 19th century, tuberculosis killed an estimated one-quarter of the adult population of Europe; by 1918, one in six deaths in France were still caused by tuberculosis. During the 20th century, tuberculosis killed approximately 100 million people. TB is still one of the most important health problems in the developing world.
Leprosy	Leprosy, also known as Hansen's disease, is caused by a bacillus, Mycobacterium leprae. It is a chronic disease with an incubation period of up to five years. Since 1985, 15 million people worldwide have been cured of leprosy. Historically, leprosy has affected people since at least 600 BC. Leprosy outbreaks began to occur in Western Europe around 1000 AD. Numerous leprosaria, or leper hospitals, sprang up in the Middle Ages; Matthew Paris estimated that in the early 13th century, there were 19,000 of them across Europe.
Malaria	Malaria is widespread in tropical and subtropical regions, including parts of the Americas, Asia, and Africa. Each year, there are approximately 350–500 million cases of malaria. Drug resistance poses a growing problem in the treatment of malaria in the 21st century, since resistance is now common against all classes of antimalarial drugs, except for the artemisinins. Malaria was once common in most of Europe and North America, where it is now for all purposes non-existent. Malaria may have contributed to the decline of the Roman Empire. The disease became known as "Roman fever". Plasmodium falciparum became a real threat to colonists and indigenous people alike when it was introduced into the Americas along with the slave trade. Malaria devastated the Jamestown colony and regularly ravaged the South and Midwest of the United States. By 1830, it had reached the Pacific Northwest. During the American Civil War, there were over 1.2 million cases of malaria among soldiers of both sides. The southern U.S. continued to be afflicted with millions of cases of malaria into the 1930s.
Yellow Fever	Yellow fever has been a source of several devastating epidemics. Cities as far north as New York, Philadelphia, and Boston were hit with epidemics. In 1793, one of the largest yellow fever epidemics in U.S. history killed as many as 5,000 people in Philadelphia—roughly 10% of the population. About half of the residents had fled the city, including President George Washington. In colonial times, West Africa became known as "the white man's grave" because of malaria and yellow fever.
Ebola Virus	The Western African Ebola virus epidemic (2013–2016) was the most widespread outbreak of Ebola virus disease (EVD) in history—causing major loss of life and socioeconomic disruption in the region, mainly in the countries of Guinea, Liberia, and Sierra Leone. The first cases were recorded in Guinea in December 2013; later, the disease spread to neighbouring Liberia and Sierra Leone, with minor outbreaks occurring elsewhere. It caused significant mortality, with the case fatality rate reported which was initially considerable, while the rate among hospitalized patients was 57–59%, the final numbers 28,616 people, including 11,310 deaths, for a case-fatality rate of 40%. The number of cases peaked in October 2014 and then began to decline gradually, following the commitment of substantial international resources. As of 8 May 2016, the World Health Organization (WHO) and respective governments reported a total of 28,646 suspected cases and 11,323 deaths (39.5%), though the WHO believes that this substantially understates the magnitude of the outbreak. The outbreak left about 17,000 survivors of the disease, many of whom report post-recovery symptoms termed post-Ebola syndrome, often severe enough to require medical care for months or even years.
	An additional cause for concern is the apparent ability of the virus to "hide" in a recovered survivor's body for an extended period of time and then become active months or years later, either in the same individual or in a sexual partner. In December 2016, the WHO announced that a two-year trial of the rVSV-ZEBOV vaccine appeared to offer protection from the variant of EBOV responsible for the Western Africa outbreak. The vaccine has not yet been given regulatory approval, but it is considered to be effective and is the only prophylactic which offers protection hence 300,000 doses have been stockpiled.
Zika Virus	In early 2015, a widespread epidemic of Zika fever, caused by the Zika virus in Brazil, spread to other parts of South and North America. It also affected several islands in the Pacific, and Southeast Asia. In January 2016, the World Health Organization (WHO) said the virus was likely to spread throughout most of the Americas by the end of the year. In November 2016 WHO announced the end of the Zika epidemic. In February 2016, WHO declared the outbreak a Public Health Emergency of International Concern as evidence grew that Zika can cause birth defects as well as neurological problems. The virus can be transmitted from an infected pregnant woman to her fetus, then can cause microcephaly and other severe brain anomalies in the infant. Zika infections in adults can result in Guillain–Barré syndrome. Prior to this outbreak, Zika was considered a mild infection, as most Zika virus infections are asymptomatic, making it difficult to determine precise estimates of the number of cases. In approximately one in five cases, Zika virus infections result in Zika fever, a minor illness that causes symptoms such as fever and a rash.
	The virus is spread mainly by the Aedes aegypti mosquito, which is commonly found throughout the tropical and subtropical Americas. It can also be spread by the Aedes albopictus ("Asian tiger") mosquito, which is distributed as far north as the Great Lakes region in North America. Men infected with Zika can transmit the virus to their sexual partners. A number of countries have issued travel warnings, and the outbreak is expected to reduce tourism significantly. Several countries have taken the unusual step of advising their citizens to delay pregnancy until more is known about the virus and its impact on fetal development. Furthermore, the outbreak raised concerns regarding the safety of athletes and spectators at the 2016 Summer Olympics in Rio de Janeiro.

Future Threats

Viral Hemorrhagic Fevers	Viral hemorrhagic fevers such as Ebola virus disease, Lassa fever virus, Rift Valley fever, Marburg virus and Bolivian hemorrhagic fever are highly contagious and deadly diseases, with the theoretical potential to become pandemics. Their ability to spread efficiently enough to cause a pandemic is limited, however, as transmission of these viruses requires close contact with the infected vector, and the vector only has a short time before death or serious illness. Furthermore, the short time between a vector becoming infectious and the onset of symptoms allows medical professionals to quickly quarantine vectors, and prevent them from carrying the pathogen elsewhere. Genetic mutations could occur, which could elevate their potential for causing widespread harm; thus close observation by contagious disease specialists is merited.

Antibiotic Resistance	Antibiotic-resistant microorganisms, sometimes referred to as "superbugs", may contribute to the re-emergence of diseases which are currently well controlled. For example, cases of tuberculosis that are resistant to traditionally effective treatments remain a cause of great concern to health professionals. Every year, nearly half a million new cases of multidrug-resistant tuberculosis (MDR-TB) are estimated to occur worldwide. China and India have the highest rate of multidrug-resistant TB. The World Health Organization (WHO) reports that approximately 50 million people worldwide are infected with MDR TB, with 79 percent of those cases resistant to three or more antibiotics. In 2005, 124 cases of MDR TB were reported in the United States. Extensively drug-resistant tuberculosis (XDR TB) was identified in Africa in 2006, and subsequently discovered to exist in 49 countries, including the United States. There are about 40,000 new cases of XDR-TB per year, the WHO estimates.

In the past 20 years, common bacteria including Staphylococcus aureus, Serratia marcescens and Enterococcus, have developed resistance to various antibiotics such as vancomycin, as well as whole classes of antibiotics, such as the aminoglycosides and cephalosporins. Antibiotic-resistant organisms have become an important cause of healthcare-associated (nosocomial) infections (HAI). In addition, infections caused by community-acquired strains of methicillin-resistant Staphylococcus aureus (MRSA) in otherwise healthy individuals have become more frequent in recent years.

SARS	In 2003 the Italian physician Carlo Urbani (1956–2003) was the first to identify severe acute respiratory syndrome (SARS) as a new and dangerously contagious disease, although he became infected and died. It is caused by a coronavirus dubbed SARS-CoV. Rapid action by national and international health authorities such as the World Health Organization helped to slow transmission and eventually broke the chain of transmission, which ended the localized epidemics before they could become a pandemic. However, the disease has not been eradicated. It could re-emerge. This warrants monitoring and reporting of suspicious cases of atypical pneumonia.
Influenza	Wild aquatic birds are the natural hosts for a range of influenza A viruses. Occasionally, viruses are transmitted from these species to other species, and may then cause outbreaks in domestic poultry or, rarely, in humans.
H5N1 (Avian Flu)	In February 2004, avian influenza virus was detected in birds in Vietnam, increasing fears of the emergence of new variant strains. It is feared that if the avian influenza virus combines with a human influenza virus (in a bird or a human), the new subtype created could be both highly contagious and highly lethal in humans. Such a subtype could cause a global influenza pandemic, similar to the Spanish flu, or the lower mortality pandemics such as the Asian Flu and the Hong Kong Flu. From October 2004 to February 2005, some 3,700 test kits of the 1957 Asian Flu virus were accidentally spread around the world from a lab in the US. In May 2005, scientists urgently called upon nations to prepare for a global influenza pandemic that could strike as much as 20% of the world's population. Avian flu cannot yet be categorized as a "pandemic", because the virus cannot yet cause sustained and efficient human-to-human transmission.

Cases so far are recognized to have been transmitted from bird to human, but as of December 2006, there have been very few (if any) cases of proven human-to-human transmission. Regular influenza viruses establish infection by attaching to receptors in the throat and lungs, but the avian influenza virus can only attach to receptors located deep in the lungs of humans, requiring close, prolonged contact with infected patients, and thus limiting person-to-person transmission.

Zika Virus	An outbreak of Zika virus began in 2015 and strongly intensified throughout the start of 2016, with over 1.5 million cases across more than a dozen countries in the Americas. The World Health Organisation warned that Zika had the potential to become an explosive global pandemic if the outbreak was not controlled.

Pandemic Supplies

The recommended supplies to have in a pandemic situation.

Plastic Sheeting	One of the most important items to have an abundance of in the home. It can do things as simple as separate a few rooms to becoming a way to safely transport those who have died from the pandemic. The sheeting can also be used to cover windows and doors if the pandemic gets out of hand. Have at least 200' for all your needs.
Disposable Gloves	These should be used all the time in a pandemic situation especially when handling food or items which a sick person has touched.
Disposable Foot Protection	These can cover your feet or go over your shoes to help prevent viruses settling on you if you enter a hazardous location.
Disposable Aprons	Helps in protecting the wearers front from a patient who is commonly sneezing or any other form of moving pathogens.
N95 Respirator Masks	These help to prevent pathogens from being breathed in via the nose or mouth.
Antiviral Masks	These help to prevent pathogens from being breathed in via the nose or mouth but are designed particularly against viruses.
Eye Protection	Helps protect your eyes from airborne viruses and other pathogens in the air.
Thermometers	Used to monitor fevers of patients.
Soap	A basic component of any hygiene or pandemic kit which will assist in keeping your body clean and virus free,
Antibacterial Soap	Hand washing should be a frequent component of any pandemic and this will help kill bacteria.
Duct Tape	Duct tape can be used to help seal off rooms with the plastic sheeting and other gaps that may be locate around the house.
Throat Lozenge	Used to help kill germs in the throat and to prevent tonsillitis.
Electrolytes	Helps the absorption of water into the body and provides some essential minerals the body needs.
Vitamin C	Always handy for any sickness.
Echinacea	Echinacea activates chemicals in the body that decrease inflammation, which reduce cold and flu symptoms.
Water Storage	Large amounts of water will be used in a pandemic to wash and clean people, rooms and for general drinking and cooking uses.
Water Filter	A heavy duty water filter should be owned as a backup to your water supply. Ensure it filters out pathogens such as viruses.
Biohazard Bags	A biohazard bag provides a high density isolation liner to provide maximum film strength for tough applications. They also feature star seal bottoms which allow equal weight distribution and leak resistance. Additionally, bags are red to indicate use for infectious waste or hazardous waste to warn others. The red infectious waste bags, right, are for the contagion that you'll want to burn to help stop the pandemic.

Vomit (Emesis) Bags	Bags which one can vomit into and are quite portable.
Indoor Trash Bags	Used for disposing non biohazard waste.
Facial Tissues	Used for wiping fluids, blowing your nose etc.
Tyvek Suit	A whole suit designed to resist bacteria and viruses and should be used when entering a hazardous zone or room.
Bodily Fluids Cleanup Kit	Used to clean up spread bodily fluids which are potentially contaminated like blood, urine or snot.
Air Filter Pump	If a room is sealed off to prevent the ingress of viruses you will need an air filter pump to bring fresh air into the room which has been filtered of all pathogens.
Face Shields	Unlike face masks these are thin pieces of cotton to help keep the germs of a sick person on themselves, such as when they sneeze.
Antidiarrheal	Helps to prevent diarrhoea.
Antiseptics	Kills pathogens in open wounds and cuts which is one of the easiest ways for viruses to enter the body.
The Survival Medicine Handbook	An extremely useful book for how to handle medical situations when there's no doctor nearby or you are in a remote location.
The Doomsday Book of Medicine	Another great book of medicine when there's no doctor around.

Case Fatality Rate

A case fatality rate (CFR) — sometimes called case fatality risk or case fatality ratio — is the proportion of deaths from a certain disease compared to the total number of people diagnosed with the disease for a certain period of time. A CFR is conventionally expressed as a percentage and represents a measure of disease severity. CFRs are most often used for diseases with discrete, limited time courses, such as outbreaks of acute infections. A CFR can only be considered final when all the cases have been resolved (either died or recovered). The preliminary CFR, for example, during the course of an outbreak with a high daily increase and long resolution time would be substantially lower than the final CFR.

- The CFR for the Spanish (1918) flu was >2.5%, but about 0.1% for the Asian (1956-58) and Hong Kong (1968-69) flus, and <0.1% for other influenza pandemics.
- Legionnaires' disease has a CFR of ≈15%.
- Yellow fever, even with treatment, has CFRs in the range of 20-50%.
- Bubonic plague has the best prognosis of the three main variants of plague, but if left untreated, has a CFR >60%.
- Ebola virus is among the deadliest viruses, with a CFR as high as 90%.
- Naegleriasis (also known as primary amoebic meningoencephalitis), caused by the unicellular Naegleria fowleri (a.k.a. the brain-eating amoeba), nearly always results in death, and so has a CFR >99%.
- Rabies virus is almost invariably fatal if left untreated, and so has a CFR approaching 100%; however, patients generally respond well to prompt, same-day treatment.
- Prion diseases are progressive and always fatal, regardless of treatment.

Disease	Treatment	CFR	Notes
Transmissible Spongiform Encephalopathies	Currently Incurable	100%	Includes Creutzfeldt–Jakob disease and all its variants, fatal familial insomnia, kuru, Gerstmann–Sträussler–Scheinker syndrome and others.
African Trypanosomiasis	Untreated	~100%	
Visceral Leishmaniasis	Untreated	~100%	
Fibrodysplasia Ossificans Progressiva	Currently Incurable	~100%	Death almost always results from complications of FOP, life expectancy is about 40 years
Tay–Sachs Disease (pre-adult)	Currently Incurable	~100%	Even with the most high quality care, infants with Tay–Sachs disease usually die within a few years of displaying the first symptoms. Juvenile with the disease are likely to die from the ages 5–15, while those who develop the disease as adults will probably be largely unaffected.
Primary Amoebic Meningoencephalitis, Naegleria Fowleri	Untreated	~99%	Amphotericin B has shown efficacy in the limited survivorship population. Around 7 documented survivors
Rabies	Untreated	~99%	Preventable with vaccines down to ~0% CFR and treatable with PEP but, once the symptoms manifest, the CFR is near 100%. Around 16 documented survivors after symptom onset, all but 3 did not receive any Rabies (specific) treatment at any time before symptom onset. Of those 3, only 1 survived without the use of a therapeutic coma
Balamuthia	Opportunistic & Untreated	~99%	2 survivors, both have permanent brain damage.
Glanders, Septicemic	Untreated	0.95	The rate drops significantly to >50% with treatment.
Smallpox Variola Major Specifically the Malignant (flat) or Hemorrhagic type	Untreated	~95%	The rate drops significantly to 10% with effective treatments. Eradicated.
Ebola Virus Disease – Specifically EBOV	Untreated & Unvaccinated	83–90%	Prognosis improved by early supportive treatments as seen in the West African epidemic and the Kivu outbreak.
AIDS/HIV Infection	Untreated	80–90%	Data are counted during the first 5 years of infection in developed countries. HIV is not lethal on its own but patients are usually killed by respiratory diseases, such as flu or pneumonia because of immunodeficiency caused by HIV virus.
Anthrax, Specifically the Pulmonary Form	Untreated & Unvaccinated	>85%	Early treatments lower the CFR to 45% as seen in the 2001 AMERITHRAX letter attacks. Monoclonal antibodies (Obilotoxaximab & Raxibacumab) could lower this further.
Macanine Alphaherpesvirus 1	Untreated	~80%	Early treatment including aciclovir can improve prognosis.

Aspergillosis Invasive Pulmonary Form	Opportunistic w/COPD, Tuberculosis and Immunocompromised	50–90%	
Smallpox, Variola Major (In Pregnant Women)	Unvaccinated	>65%	
Cryptococcal Meningitis	Co-infection with HIV	40–60%	6 month mortality is >=60% with fluconazole-based therapy and 40% with amphotercin-based therapy in research studies in low and middle income countries.
Influenza A Virus Subtype H5N1		~60%	
Bubonic Plague	Untreated & Unvaccinated	5–60%	
Tularemia, Pneumonic	Untreated	≤60%	
Anthrax, Gastrointestinal, Intestinal Type	Untreated & Unvaccinated	>50%	
Marburg Virus Disease (All Outbreaks Combined)	Untreated	23–90%	23% in 1967 when it was first identified and 90% in 2004-2005 when the worst outbreak of the disease occurred. Galidesivir has shown promise in treating Filoviridae
Plague, Pneumonic	Untreated & Unvaccinated	50%	
Tetanus, Generalized	Untreated & Unvaccinated	50%	CFR drops to 10–20% with effective treatment.
Reye's Syndrome		>40%	
Baylisascariasis		~40%	With occurrence of Neural Larva Migrans; early, aggressive treatment necessary for survival, but only 2 full recoveries from NLM ever documented
Plague, Septicemic	Untreated & Unvaccinated	30–50%	
Middle Eastern Respiratory Syndrome (MERS)		35%	Galidesivir has shown promise in treating Coronaviridae
Tularemia, Typhoidal	Untreated	3–35%	
Eastern Equine Encephalitis Virus		~33%	
Anthrax, Gastrointestinal, Oropharyngeal Type		10–50%	
Tuberculosis, HIV Negative	Vaccine	43%	Vaccines have been developed but have been frequently dismissed for having received controversial and improper testing on African populations.
Smallpox, Variola Major	Unvaccinated	30%	
Varicella (chickenpox) (In Newborns)	Untreated	~30%	Where the mothers develop the disease between 5 days prior to, or 2 days after delivery.
Cancer (Overall)	Treated	30%	~97% will die within five years if untreated.
Dengue Haemorrhagic Fever (DHF)	Untreated	26%	Dengue haemorrhagic fever is also known as severe dengue.
Hantavirus Pulmonary Syndrome (HPS)	Untreated	~21%	Galidesivir has shown promise in treating Bunyavirales
Leptospirosis		<5–30%	
Legionellosis		~15%	
Anorexia Nervosa		16%	
Meningococcal Disease	Untreated & Unvaccinated	10–20%	
Typhoid Fever	Untreated & Unvaccinated	10–20%	
Severe Acute Respiratory Syndrome (SARS)		11%	Galidesivir has shown promise in treating Coronaviridae
Intestinal Capillariasis	Untreated	~10%	
Visceral Leishmaniasis		~10%	
Botulism	Treated	<10%	Untreated foodborne botulism is thought to be ~50%
Diphtheria, Respiratory	Untreated & Unvaccinated	~5–10%	
Yellow Fever	Unvaccinated	8%	
Pertussis (Whooping Cough), (Infants in Developing Countries)	Unvaccinated	~3.7%	
Smallpox, Variola Major	Vaccinated	3%	
Spanish (1918) Flu	Treated	>2.5%	
Angiostrongyliasis		~2.4%	From Hawaiian cases.
Measles (rubeola) (in Developing Countries)	Unvaccinated	~1–3%	May reach 10–30% in some localities.

Brucellosis	Untreated	≤2%	
Hepatitis A (Adults > 50 Years Old)	Unvaccinated	~1.8%	
Lassa Fever		~1%	15% in hospitalized patients; higher in some epidemics.
Mumps Encephalitis	Unvaccinated	~1%	
Pertussis (whooping cough) (Children in Developing Countries)	Unvaccinated	~1%	For children 1–4 years old.
Smallpox, Variola Minor	Unvaccinated	1%	
Venezuelan Equine Encephalitis (VEE)		<1%	
Anthrax, Cutaneous		<1%	
Malaria		~0.3%	
Hepatitis A	Unvaccinated	0.1–0.3%	
Asian (1956–58) Flu		~0.1%	
Hong Kong (1968–69) Flu		~0.1%	
Coronavirus Disease 2019 (COVID-19)		~0.1%	Global
Influenza A, Typical Pandemics		<0.1%	
Varicella (Chickenpox), Adults	Unvaccinated	0.02%	This is 1:5,000.
Hand, Foot and Mouth Disease Children < 5 Years Old		0.01%	This is 1:10,000.
Varicella (Chickenpox), Children	Unvaccinated	0.001%	This is 1:100,000.

Pandemic Severity Index

The pandemic severity index (PSI) was a proposed classification scale for reporting the severity of influenza pandemics in the United States. The PSI was accompanied by a set of guidelines intended to help communicate appropriate actions for communities to follow in potential pandemic situations. Released by the United States Department of Health and Human Services (HHS) on February 1, 2007, the PSI was designed to resemble the Saffir-Simpson Hurricane Scale classification scheme. The index was replaced by the Pandemic Severity Assessment Framework in 2017, which uses quadrants based on transmissibility and clinical severity rather than a linear scale.

Category	Case Fatality Ratio	Example
1	Less than 0.1%	Seasonal flu and swine flu
2	0.1–0.5%	Asian flu and Hong Kong flu
3	0.5–1%	
4	1.0–2.0%	
5	2.0% or higher	1918 influenza pandemic

Basic Reproduction Number

The basic reproduction number (sometimes called basic reproductive ratio, or incorrectly basic reproductive rate, and denoted R0, pronounced R nought or R zero) of an infection can be thought of as the expected number of cases directly generated by one case in a population where all individuals are susceptible to infection. The definition describes the state where no other individuals are infected or immunized (naturally or through vaccination).

Values of R0 of well-known infectious diseases:

Disease	Transmission	R0
Measles	Airborne	12–18
Polio	Fecal–oral route	5–7
Rubella	Airborne droplet	5–7
Mumps	Airborne droplet	4–7
Pertussis	Airborne droplet	5.5
Smallpox	Airborne droplet	3.5–6
HIV/AIDS	Body fluids	2–5
SARS	Airborne droplet	2–5
Diphtheria	Saliva	1.7–4.3
COVID-19	Airborne droplet	1.4–3.9
Influenza (1918 pandemic strain)	Airborne droplet	1.4–2.8
Ebola (2014 Ebola outbreak)	Body fluids	1.5–2.5
Influenza (2009 pandemic strain)	Airborne droplet	1.4–1.6
Influenza (seasonal strains)	Airborne droplet	0.9–2.1
MERS	Airborne droplet	0.3–0.8

Outdoor Protection

There are items that you can include for protection outside the home on a daily basis. These items would not be part of your EDC or every day carry but would be better suited in something like a get home bag.

1	One of the most important pieces to have in that bag when prepping for a Pandemic is the N95 respirator. These are not very expensive and will protect your nose and throat from pathogens.
2	You will also want some basic meds stored at in your car as well. These meds should be for dealing with symptoms. Meds that will fight fever, diarrhoea and something for sore throat would all be great options. A non-drowsy medication for congestion would also help.
3	A basic trauma kit will also be vital. Remember that pathogens can enter your body through any damage in your skin or any orifice. If you are cut during a pandemic it will be crucial that you clean and cover that cut ASAP.

Pandemic Practises

These are good practises to apply when a pandemic is occurring.

Isolation	Isolation and treatment of people who have suspected or confirmed cases of pandemic influenza.
Voluntary Quarantine	Voluntary home quarantine of household contacts of those with suspected or confirmed pandemic influenza.
Dismiss Groups & Classes	Dismissing school classes and closing daycare centres.
Avoid Gatherings	Changing work schedules and cancelling large public gatherings.
Stock Up	Stock up on the list of pandemic supplies especially if a large outbreak is occurring.
Take Probiotics	Improve your intestinal flora now and especially during an outbreak. Have plenty of probiotics on hand and increase your intake of probiotics in supplements and in the foods you eat, like Acidophilus in kefir and yogurts.
Reduce Dependency	Antibiotics are over used in the United States and this compounds the problem of adaptive micro-organisms.
Survival Prescription	Ask your doctor to prescribe Tamiflu or Relenza as either medication may effectively treat avian flu. Alternatively, consider Boiron Oscillococcinum for Flu-like Symptoms. This homeopathic product helps relieve body aches, headache, fever, chills and fatigue.
Avoid Touching Items	Avoid as much as possible contact with pencils and pens, elevator buttons, doorknobs, coins, handrails and places where many other hands have touched, particularly during the flu season.
Avoid Touching Others	Avoid common gestures like shaking hands, patting backs and kissing to deter the spread of viruses.
Wash Hands Frequently	Before eating and after having been out and about, make it a routine to wash your hands with warm hot water and clean under the fingernails. Recite the alphabet twice and you'll have washed your hands for an adequate time.
Minimise Spread	Cover your mouth when you sneeze to avoid spreading droplets to your family. Turn your body away from someone coughing or sneezing.
Avoid Touching Yourself	(No not in THAT way) We touch our face, arms and legs quite frequently throughout the day, generally without even realizing it which can spread germs that have been picked up via that body part.
Avoid People	It's best to avoid people completely if possible to do so.
Wear a Mask	Masks can help prevent the inhalation of viruses in the air, but ensure the filtration membrane is fine enough or rated to stop virus particles. Most masks on the market today will not stop virus particles.
Wear Biohazard Suit	Helps to prevent bacteria and viruses from reaching your body.
Wear Goggles	Helps prevent viruses in the air from entering through your eye.
Quarantine Sick	If you have family members who are sick they should be quarantined from healthy people as early as possible to avoid the spread of germs.
Record Sickness	If someone in your family is sick take note of when symptoms started and log the progression of health to refer back to.
Research Sickness	Research possible illnesses and as much as you can on the current pandemic situation beyond your doors. The more you know the more you're able to defend against it.

Vaccine Development

In the United States, vaccine development and testing follow a standard set of steps. The first stages are exploratory in nature. Regulation and oversight increase as the candidate vaccine makes its way through the process.

Exploratory Stage	This stage involves basic laboratory research and often lasts 2-4 years. Federally funded academic and governmental scientists identify natural or synthetic antigens that might help prevent or treat a disease. These antigens could include virus-like particles, weakened viruses or bacteria, weakened bacterial toxins, or other substances derived from pathogens.
Pre-Clinical Stage	Pre-clinical studies use tissue-culture or cell-culture systems and animal testing to assess the safety of the candidate vaccine and its immunogenicity, or ability to provoke an immune response. Animal subjects may include mice and monkeys. These studies give researchers an idea of the cellular responses they might expect in humans. They may also suggest a safe starting dose for the next phase of research as well as a safe method of administering the vaccine. Researchers may adapt the candidate vaccine during the pre-clinical state to try to make it more effective. They may also do challenge studies with the animals, meaning that they vaccinate the animals and then try to infect them with the target pathogen. Many candidate vaccines never progress beyond this stage because they fail to produce the desired immune response. The pre-clinical stages often lasts 1-2 years and usually involves researchers in private industry.

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IND Application	A sponsor, usually a private company, submits an application for an Investigational New Drug (IND) to the U.S. Food and Drug Administration. The sponsor describes the manufacturing and testing processes, summarizes the laboratory reports, and describes the proposed study. An institutional review board, representing an institution where the clinical trial will be conducted, must approve the clinical protocol. The FDA has 30 days to approve the application. Once the IND application has been approved, the vaccine is subject to three phases of testing.
Phase I Vaccine Trials	This first attempt to assess the candidate vaccine in humans involves a small group of adults, usually between 20-80 subjects. If the vaccine is intended for children, researchers will first test adults, and then gradually step down the age of the test subjects until they reach their target. Phase I trials may be non-blinded (also known as open-label in that the researchers and perhaps subjects know whether a vaccine or placebo is used). The goals of Phase 1 testing are to assess the safety of the candidate vaccine and to determine the type and extent of immune response that the vaccine provokes. In a small minority of Phase 1 vaccine trials, researchers may use the challenge model, attempting to infect participants with the pathogen after the experimental group has been vaccinated. The participants in these studies are carefully monitored and conditions are carefully controlled. In some cases, an attenuated, or modified, version of the pathogen is used for the challenge. A promising Phase 1 trial will progress to the next stage.
Phase II Vaccine Trials	A larger group of several hundred individuals participates in Phase II testing. Some of the individuals may belong to groups at risk of acquiring the disease. These trials are randomized and well controlled, and include a placebo group. The goals of Phase II testing are to study the candidate vaccine's safety, immunogenicity, proposed doses, schedule of immunizations, and method of delivery.
Phase III Vaccine Trials	Successful Phase II candidate vaccines move on to larger trials, involving thousands to tens of thousands of people. These Phase III tests are randomized and double blind and involve the experimental vaccine being tested against a placebo (the placebo may be a saline solution, a vaccine for another disease, or some other substance). One Phase III goal is to assess vaccine safety in a large group of people. Certain rare side effects might not surface in the smaller groups of subjects tested in earlier phases. For example, suppose that an adverse event related to a candidate vaccine might occur in 1 of every 10,000 people. To detect a significant difference for a low-frequency event, the trial would have to include 60,000 subjects, half of them in the control, or no vaccine, group. Vaccine efficacy is tested as well. These factors might include 1) Does the candidate vaccine prevent disease? 2) Does it prevent infection with the pathogen? 3) Does it lead to production of antibodies or other types of immune responses related to the pathogen?

After a successful Phase III trial, the vaccine developer will submit a Biologics License Application to the FDA. Then the FDA will inspect the factory where the vaccine will be made and approve the labeling of the vaccine. After licensure, the FDA will continue to monitor the production of the vaccine, including inspecting facilities and reviewing the manufacturer's tests of lots of vaccines for potency, safety and purity. The FDA has the right to conduct its own testing of manufacturers' vaccines.

Post-Licensure Monitoring of Vaccines	A variety of systems monitor vaccines after they have been approved. They include Phase IV trials, the Vaccine Adverse Event Reporting System, and the Vaccine Safety Datalink.
Phase IV Trials	Phase IV trial are optional studies that drug companies may conduct after a vaccine is released. The manufacturer may continue to test the vaccine for safety, efficacy, and other potential uses.
VAERS	The CDC and FDA established The Vaccine Adverse Event Reporting System in 1990. The goal of VAERS, according to the CDC, is "to detect possible signals of adverse events associated with vaccines." (A signal in this case is evidence of a possible adverse event that emerges in the data collected.) About 30,000 events are reported each year to VAERS. Between 10% and 15% of these reports describe serious medical events that result in hospitalization, life-threatening illness, disability, or death. VAERS is a voluntary reporting system. Anyone, such as a parent, a health care provider, or friend of the patient, who suspects an association between a vaccination and an adverse event may report that event and information about it to VAERS. The CDC then investigates the event and tries to find out whether the adverse event was in fact caused by the vaccination.

I highly recommend against taking the COVID-19 experimental vaccines. They haven't been extensively tested over a decade, it's an entirely new vaccine creation process and therefore issues could arise years after taking it. In the end however, it's your choice. For more information, see: https://christianity.fluidicice.com/vaccine

Zombie Apocalypse

MAN-MADE DISASTERS | Disease | Zombie Apocalypse

The proliferation of a virus turning people into zombies. Who knows, this may become a reality, or even something very similar but not quite zombies. The point is we have to be ready for anything and everything, plus this section was fun to make. A potential outbreak would likely be similar to one of the below scenarios so take note of how to deal with them. There may be a mix and match of zombies such as mostly conforming to "Walkers" but you don't need a shot to the head to kill them.

Zombie Attributes

Below is a list of the different types of zombie attributes that are likely to occur in an apocalypse. If an apocalypse occurs go through each category and highlight which ones apply to your scenario so you can prepare yourself. The left side categories are the easiest scenarios to survive while the further right you go the more likely you will die. Dot points are examples from Tv series and movies.

Zombie Origin

The origin of the infection. Not necessary to know but handy in developing an antidote.

Experimentation	A virus created in a lab either on purpose or by accident.
Animal Bite	Contracted from a bite of an infected animal.
Tainted Food	The disease was contracted from consuming something.
Radiation	The disease originated from a radioactive source.
Wireless	The disease originates from a wireless signal from a TV or radio station, effectively 'frenzying' anyone who is in its radius.
External Source	The disease originates from outside our planet.
Unknown	The origins of the disease is unknown.

Infection Spread

How the infection is spread.

No Spread	The infection can't be spread by any means.
Contraction Chance	On skin contact with the virus, there is a chance that you will contract the disease.

Blood Contact	The virus is spread by blood contact via open wounds or bites from anything that hosts the virus.
Air Spread	The virus is spread via air and anyone in the infected area contracts the disease.
Everyone Infected	Everyone is infected and becomes a zombie when they die regardless of contact.

Incubation Period

How fast the virus takes the person over from the point of infection.

Over a Week	You turn into a zombie in periods over a week. This makes it difficult to tell if you have the virus.
A Few Days	It takes a few days to become a zombie.
About 24 Hours	After contracting the virus it will takes about a day to become a zombie.
A Few Hours	It only takes a few hours to become a zombie.
About 15 Minutes	It takes about 15 minutes to become a zombie.
A Few Minutes	It takes a few minutes to become a zombie.
A Few Seconds	It takes a few seconds to become a zombie.
Instantly	You instantly turn into a zombie once bitten.

Incubation Signs

Any symptoms that show the conversion to zombie.

Death	The infected gets sicker until death.
Sickness	The infected become sicker and weaker as the disease ravages their body.
Viciousness	The infected person lashes out occasionally between periods of sanity.
Eye Changes	The eyes of the human change colour or become glazed as they turn.
No Symptoms	There are no signs that show someone is infected.

Zombie Conversion

In what form the conversion from human to zombie occurs.

Human Death	The human has to die first before becoming a zombie. ● Like Amy from the Walking Dead (Season 1)
Slow Conversion	The person slowly becomes more and more aggressive and zombie-like without dying first. ● Like Sam (The Dog) from I Am Legend
Instant Change	The person snaps instantly to become a zombie when the virus is contracted.

Zombie Speed

The speed is how fast the zombie moves when it's heading towards a target - such as prey.

Very Slow	The zombie has a hard time controlling its muscles so it ambles along slowly, easily walked away from.
Slow	The zombies can only move at a walking pace.
Average	They can move at about a power walking speed.
Fast	The zombies can run at a normal human pace.
Very Fast	The zombies can sprint at about a normal human sprinting speed.
Superhumanly Fast	The zombies can move faster then the normal human sprinting speed.

Zombie Intelligence

How smart the zombies are with relation to interacting with the environment.

Stupid	The zombies that head straight for you regardless of what's in the way, they can't interact with any items or climb.
Dull	Zombies that can navigate around objects and climb over small objects, they can climb simple objects.
Average	Average intelligence for a zombie which can climb some objects, open easy doors and navigate well and break into windows. They have average human smarts.
Smart	Zombies that can climb items which most humans can. They can also open doors and windows and break down weaker doors and some windows as well.
Genius	The zombies use tactics and can interact with all items normally. They can wield items and may attempt to ambush and flank you. (I Am Legend Zombies)

Zombie Powers

Any special powers the zombies have over regular people.

Super Strength	The zombies are able to lift heavy objects and tear people apart with their hands.
Super Jump	The zombies can jump unnaturally high.
Hive Mind	The zombies share a linked mind where they can use teamwork to accomplish things.

Zombie Needs

What the zombies need to survive.

Brains	The zombies can only eat brains to survive.
Food / Flesh	The zombies have to eat flesh to stay alive or it dies without nutrition.
Nothing	The zombies don't need any nutrition to stay alive and will stay alive indefinitely unless killed.

Zombie Desires

What the zombies want.

Animals	The zombies want to eat animals only.
Brains	The zombies want to eat brains only.
Flesh	The zombies want to eat any form of (living) flesh including animals, excluding other zombies.
All Flesh	The zombies want to eat any form of flesh including other zombies.

Dead Resurrection

If the virus can resurrect the human dead and recent dead.

No Resurrection	The virus can't resurrect the dead at all.

Recent Dead	The virus can resurrect the dead within a few days of dying.
Most Dead	The virus can resurrect everyone that has a semi-intact brain.

Animal Zombie

Can animals contract the virus and become animal zombies?

No	Animals can't contract the virus.
Yes	Animals can contract the virus and become animal zombies.

Zombie Survival

Whether the zombie can survive with missing limbs or not.

Complete	The zombie must be intact for it to survive. The regular rules of staying alive for humans apply.
Semi Complete	The zombie can be missing limbs such as arms or legs and still survive.
Quadriplegic	The zombie can be missing all of its limbs and still survive. (Must be beheaded to kill)
A Head	The zombie can be just a head and still survive.

Zombie Weaknesses

Any weaknesses the zombies may have.

Sunlight	The zombies cannot come in contact with sunlight or UV light. (I Am Legend zombies)
The Brain	If the zombies brain is destroyed, the zombie dies.
Fire	The zombies are repelled by fire. (Night of the Living Dead)
Lack of Vision	The zombies lose their ability to see over time. (High School of the Dead)
Coordination	The zombies can no longer perform coordinated motor skills such as climbing or open doors.

Zombie Death

If the zombie dies over a certain period.

Limited Life	The zombies have a limited lifespan and die as the brain degrades.
Limitless Life	The zombies have no lifespan and will stay alive until killed.

4 Civil Unrest

Civil disorder, also known as civil disturbance or civil unrest, is an activity arising from a mass act of civil disobedience (such as a demonstration, riot, or strike) in which the participants become hostile toward authority, and authorities incur difficulties in maintaining public safety and order, over the disorderly crowd. It is, in any form, prejudicial to public law and order.

The basic human element that ignites civil disorder is "the presence of a crowd." Individual behaviour is affected in a crowd because it provides a sense of anonymity. Members of a crowd often shift their moral responsibility from themselves to the crowd as a whole. The desire to imitate becomes stronger in a crowd, where those who are the least disciplined, or those who are weak in their convictions, will conform to a crowd's behaviour. This is true for both the crowd and the authorities in a civil disorder situation. Any number of things may cause civil disorder, whether it is a single cause or a combination of causes; however, most are born from political grievances, economic disputes or social discord, terrorism, or foreign agitators. Civil disorder arising from political grievances can include a range of events, from a simple protest to a mass civil disobedience. These events can be spontaneous, but are usually planned, and start out being non-violent. However, these events can turn violent when agitators attempt to provoke law enforcers into overreacting.

Civil disorder arising from economic disputes and social discord is usually emotionally charged. For example, impoverished people may protest actual, or perceived, injustices against them in respect to law enforcement, community services or political influence. The emotion of this protest is often amplified if cultural differences are present, which creates an atmosphere of scapegoating, animosity and mistrust. For example, tension between ethnic groups competing for jobs can erupt into civil disorder, which can be exasperated if jobs are scarce. In such emotionally charged environments, the likelihood of violence increases. Disaffected groups may organize civil disorder with the intent of provoking authorities to overreact, in order to embarrass the government, gain attention, or generate sympathy for their cause. Foreign nations may use surrogates to direct civil disorder, in order to advance a nation's interests. Surrogates can use overt or covert means to accomplish this end e.g. fund-raising, membership drives, infiltrating disaffected groups to increase their potential for violence, vandalism, crowd manipulation, etc. The goal is to provoke a target nation into overreacting, which creates a narrative of government repression, which can be used as propaganda.

Crowds

Formation

Exploiting a crowd's mood, radicals can manipulate and weaponize a crowd, using skilful agitation to coax the crowd's capacity for violence and turn it into a vengeful mob, directing the crowd's aggression and resentment at the agitator's chosen target. Tactical agitators can use media, and social media, to connect with potential crowd-members, and incite them to break the law, or to attempt to provoke others into doing so, without having any direct personal contact. Conversely, a skilled leader person can also calm, or divert, a crowd using strategic suggestions or commands, or appealing to them with reason in order to deescalate a situation.

Emotional contagion greatly influences crowd behaviour by providing the crowd a psychological sense of "unity." This sense may provide the crowd with the momentum to absorb a mob mentality, and to take on mob behaviour. Crowd-members feed off of each other's excitement, which produces a high state of collective emotion. The ideas crowd leaders rapidly transmit throughout the group, and also to bystanders, rubberneckers, and mass media.

When emotional contagion prevails, raw emotion is high while self-discipline is low. Personal prejudices and unsatisfied desires – usually restrained – are unabashedly released. This incentivizes crowd membership, as the crowd provides cover for individuals to do things they want to do, but would not dare try to do alone. This incentive can become greater for the crowd than its concern for law and authority, leading to unlawful and disruptive acts. Once the crowd engages in such acts, it effectively becomes a mob – a highly emotional, unreasonable, potentially violent crowd.

Behaviour

Crowd behaviour is the emotional needs, fears, and prejudices of the crowd members. It is driven by social factors such as the strength, or weakness, of leadership, moral perspective, or community uniformity, and also by psychological factors of suggestion e.g. imitation, anonymity, impersonality, emotional release, emotional contagion, panic, etc. During civil disorder, any crowd can be a threat to law enforcers because it is open to manipulation. This is because the behaviour of a crowd is under the direction of the majority of its members. While its members are usually inclined to obey the law, emotional stimuli, and the feeling of fearlessness that arises from being in a crowd, can cause crowd members to indulge in impulses, act on aggressions, and unleash rage. When law enforcement limits the full realization of these actions, the crowd will channel this hostility elsewhere, making the crowd a hostile and unpredictable threat to law enforcers. Crowds want to be directed, and can become frustrated by confusion and uncertainty; therefore, leadership can have a profound influence on the intensity and conduct of a crowd's behaviour.

The first person to authoritatively direct a crowd will likely be followed. Opportunity for radicals to take charge of a group emerge when no authoritative voice emerges, and the crowd becomes frustrated without direction. Panic, which is extremely and quickly contagious, also affects crowd behaviour by influencing their ability to reason, lending to frantic, irrational behaviour that cannot only endanger the crowd, but also others. During civil disorder, panic can set in when a crowd member realizes:

- He is in danger and fleeing is necessary to escape arrest or harm
- Few escape routes exist
- The few escape routes are congested with traffic
- His actions have caused harm to others
- When he has not dispersed the scene quickly enough, that his life, or freedom, is at risk from encroaching law enforcement agents

Tactics

The goal of demonstrators is to spur law enforcers to take actions that can be exploited as acts of brutality in order to generate sympathy for their cause, and/or to anger and demoralize the opposition. Crowds can use a range of tactics to evade law enforcement or to promote disorder, from verbal assault to distracting law enforcers to building barricades. The more well-planned tactics occur, the more purposeful the disorder.

For example, crowds may form human blockades to shut down roads, they may trespass on government property, they may try to force mass arrests, they may handcuff themselves to things or to each other, or they may lock arms, making it more difficult to separate them, or they might create confusion or diversions through the use of rock throwing, arson, or terrorist acts, making law enforcers seems forceful or excessive when trying to remove them.

Most participants of civil disorder engage on foot. However, organized efforts, often implore the use vehicles and wireless communication. Participants have been known to use scanners to monitor police frequencies, or transmitters to sabotage law enforcement communications. If a crowd turns violent, effectively becoming a "mob," it may execute physical attacks on people and property, such as by throwing homemade weapons like molotov cocktails, firing small arms, and planting improvised explosive devices.

If the violence is not pre-arranged, a crowd may resort to throwing rocks, bricks, bottles, etc. If violence is pre-arranged, the crowd can hide their weapons, or vandalism tools, well before the crowd formation, catching law enforcement by surprise.

Crowds may arm themselves with:

- Gas Masks
- Rocks
- Helmets
- Homemade Shields
- Improvised picket signs
- Molotov cocktails
- Paint bombs
- Pipes
- Safety goggles
- Wire cutters
- Umbrellas

A mob may erect barricades to impede, or prevent, the effectiveness of law enforcement. For example, they may use grappling hooks, chains, rope, or vehicles, to breach gates or fences. They may use sticks or poles to limit law enforcement's use of billy clubs and bayonets. They may overturn civilian vehicles to impede troops advancing to engage them, or vandalize law enforcement vehicles to try to spark over-reaction from law enforcement, or to incite further lawlessness from the mob.

Mobs often implore the use of fire or hidden explosive devices e.g. strapped to animals, masked in cigarette lighters or toys, rigged to directed vehicles, etc. Not only can they be used to create confusion or diversion, but they can also be used destroy property, and mask looting of mob participants, or provide cover for mob participants firing weapons at law enforcement. If law enforcement engages with the mob, in returning fire, any innocent casualties resulting from the chaos usually make law enforcement look undisciplined and oppressive.

Law Enforcement Behaviour

Like mob participants, law enforcers are also susceptible to crowd behaviour. Such tense confrontation can emotionally stimulate them, creating a highly emotional atmosphere all around. This emotional stimulation can become infectious throughout law enforcement agents, conflicting with their disciplined training. When emotional tension is high among law enforcement agents, they may breach their feeling of restraint and commit acts, against people in the mob, that they normally would suppress.

The emotional atmosphere can also make them highly susceptible to rumours and fear. Like mob members, law enforcement agents, acting as a group, can also lose their sense of individuality and develop a feeling of anonymity. Under emotional instability, individual prejudices, that any individual law enforcement agent may harbour against the mob, or against individual participants of the mob, may influence the behaviour of the law enforcement agent. Like the mob, these conditions make law enforcement actors more likely to imitate the behaviour of each other, which can result in a chain of biased, excessive, or otherwise, dangerous, behaviour in which law enforcement agents act upon mob agents as impersonal threats and not as human beings.

Such action is heightened in which law enforcement agents are monolithic, across race and ethnicity, as law enforcement will become more susceptible to framing the disorder as a confrontation between "them" and "us." Actions by law enforcement agents, motivated by emotion and prejudice, is often used as evidence against their ill will toward a crowd, or a mob, with their behaviour only further inflaming confrontation rather than reducing it. Under such situations, law enforcement agents are rarely held accountable for all their actions against a crowd.

Protest

A protest (also called a remonstrance, remonstration or demonstration) is an expression of bearing witness on behalf of an express cause by words or actions with regard to particular events, policies or situations. Protests can take many different forms, from individual statements to mass demonstrations. Protesters may organize a protest as a way of publicly making their opinions heard in an attempt to influence public opinion or government policy, or they may undertake direct action in an attempt to directly enact desired changes themselves. Where protests are part of a systematic and peaceful nonviolent campaign to achieve a particular objective, and involve the use of pressure as well as persuasion, they go beyond mere protest and may be better described as cases of civil resistance or nonviolent resistance. A protest itself may at times be the subject of a counter-protest. In such a case, counter-protesters demonstrate their support for the person, policy, action, etc. that is the subject of the original protest. In some cases, these protesters can violently clash.

Forms of Protest

These are some of the different forms of protest you may encounter.

Rally / Demonstration	Demonstration, rally, etc. without reference to marching or walking in a picket line or standing in a vigil. Reference to speeches, speakers, singing, preaching, often verified by indication of sound equipment of PA and sometimes by a platform or stage. Ordinarily will include worship services, speeches, briefings.
March	Reference to moving from one location to another; to be distinguished from rotating or walking in a circle with picket signs which by definition, constitutes a picket.

Vigil	These are almost always designated as such, although sometimes "silent witness," and "meditation" are code words; also see candlelight vigil; hunger/fasting vigil; If you find no designations re: vigils, meditations, silent witness, etc., but also no reference to sound systems or to marches, it may well be a vigil. Most vigils have banners, placards, or leaflets so that people passing by, despite silence from participants, can ascertain for what the vigil stands.
Picket	The modal activity is picketing; there may be references to picket line, to informational picketing; holding signs; "carrying signs and walking around in a circle". Holding signs or placards or banners is not the defining criteria; rather, it is holding or carrying those items and walking a circular route, a phrase sometimes surprisingly found in the permit application.
Civil Disobedience	Explicit protest that involves crossing barricade, sit-in of blacks where prohibited, use of "coloured" bathrooms, voter registration drives, crossing barricades, tying up phone lines.
Ceremony	These celebrate or protest status transitions ranging from birth, death dates of individuals, organizations or nations, seasons, to re-enlistment or commissioning of military personnel, to the anniversaries of same. These are sometimes referenced by presenting flowers or wreaths commemorating or dedicating or celebrating status transitions or its anniversary.
Motorcade	Electoral campaign and other issues.
Information Distribution	Tabling/ petition gathering, lobbying, letter-writing campaign, teach-ins.
Symbolic Display	Such as a Menorah, Creche Scene, graffiti, cross burnings, signs, standing displays.
Attack	A physical attack by a collective group (not-one-on-one assault, crime, rape). Boundary motivating attack is "other group's identity," as in gay-bashing, lynching. Can also include verbal attack and/or threats, too.
Riot / Melee	Large-scale (50+), use of violence by instigators against persons, property, police, or buildings separately or in combination, lasting several hours.
Strike / Slow Down	Regular air strike through failure of negotiations, or wildcat air strike. (Make note if a wildcat strike.)
Boycott	Organized refusal to buy or use a product or service, rent strikes.
Press Conference	If specifically named as such in report, and must be the predominant activity form. Could involve disclosure of information to "educate the public" or influence various decision-makers.
Organization Formation Announcement	Meeting or press conference to announce the formation of a new organization.
Conflict / Attack	This includes any boundary conflict in which no instigator can be identified, i.e. black/white conflicts, abortion/anti-abortion conflicts.
Lawsuit	Legal manoeuvre by social movement organization or group.

Typology

Abhishek Tiwari (8-B) and Lori Hall have devised a typology of six broad activity categories of the protest activities described in the Dynamics of Collective Action project.

Literal, Symbolic, Aesthetic and Sensory	Artistic, dramaturgical, and symbolic displays (street theatre, dancing, etc.). Use of images, objects, graphic arts, musical performances, or vocal/auditory exhibitions (speechmaking, chanting, etc.). Tactile exchanges of information (petitions, leaflets, etc.) and the destruction of objects of symbolic and/or political value. Highly visible and most diverse category of activity; impacts on society (police response, media focus, impact on potential allies, etc.) often are underestimated.
Solemnity and the Sacred	Vigils, prayer, rallies in format of religious service, candlelighting, cross carrying, etc., all directly related to Durkheimian sacred or some form of religious or spiritual practice, belief, or ideology. Events where sacred activity is the primary focus are rarely responded to by police with force or presence. Solemnity usually provides a distinct quietness or stillness, changing the energy, description, and interpretation of such events.
Institutional and Conventional	Institutionalized activity or activity highly dependent on formal political processes and social institutions (press conferences, lawsuits, lobbying, etc.). Often conflated with non-confrontational and nonviolent activities in research as the other or reference category. More acceptable because it operates, to some degree, within the system. Historically contentious issue in regard to the practice of protest due to this integration within the system.
Movement in Space	Marches or parades (processional activities) from one spatio-temporal location to another, with beginning or ending places sometimes chosen for symbolic reasons. Picket lines often used in labour strikes but can be used by nonlabor actors but the key differences between picket and processionals are the distance of movement. Events that take the form of a procession are logistically much more difficult to police (even if it is for the safety of protesters). Marches are some of the largest events in this period.
Civil Disobedience	Withholding obligations, sit-ins, blockades, occupations, bannering, camping, etc., are all specific activities which constitute the tactical form of civil disobedience. In some way, these activities directly or technically break the law. Usually given most attention by researchers, media, and authorities. Often conflated with violence and threats because of direct action and confrontational nature but should serve as a distinct category of action (both in the context of tactical/ strategic planning and in the control of activity).
Collective Violence and Threats	Collective violence such as pushing, shoving, hitting, punching, damaging property, throwing objects, verbal threats, etc., is usually committed by a relative few out of many protesters (even tens of thousands). Rare in occurrence, rarely condoned by the public or onlookers (particularly the media). Usually met with equivalent or overwhelming force in response to authorities. At times in U.S. history lauded as the only way to get results, but little empirical evidence violence succeeds in goal attainment.

Typology Examples

Direct Action

Some forms of direct action listed in this article are also public demonstrations or rallies.

- Protest march, a historically and geographically common form of nonviolent action by groups of people.
- Picketing, a form of protest in which people congregate outside a place of work or location where an event is taking place. Often, this is done in an attempt to dissuade others from going in ("crossing the picket line"), but it can also be done to draw public attention to a cause.
- Street protesters demonstrate in areas with high visibility, often employing handmade placards such as sandwich boards or picket signs in order to maximize exposure and interaction with the public.
- Lockdowns and lock-ons are a way to stop movement of an object, like a structure or tree and to thwart movement of actual protesters from the location. Users employ various chains, locks and even the sleeping dragon for impairment of those trying to remove them with a matrix of composted materials.
- Die-ins are a form of protest where participants simulate being dead (with varying degrees of realism). In the simplest form of a die-in, protesters simply lie down on the ground and pretend to be dead, sometimes covering themselves with signs or banners. Much of the effectiveness depends on the posture of the protesters, for when not properly executed, the protest might look more like a "sleep-in".

- Protest song is a song which protests perceived problems in society. Every major movement in Western history has been accompanied by its own collection of protest songs, from slave emancipation to women's suffrage, the labour movement, civil rights, the anti-war movement, the feminist movement, the environmental movement.
- Radical cheerleading. The idea is to ironically reappropriate the aesthetics of cheerleading, for example by changing the chants to promote feminism and left-wing causes. Many radical cheerleaders (some of whom are male, transgender or non-gender identified) are in appearance far from the stereotypical image of a cheerleader.
- Critical Mass bike rides have been perceived as protest activities. A 2006 New Yorker magazine article described Critical Mass' activity in New York City as "monthly political-protest rides", and characterized Critical Mass as a part of a social movement; and the UK e-zine Urban75, which advertises as well as publishes photographs of the Critical Mass event in London, describes this as "the monthly protest by cyclists reclaiming the streets of London."

Written Demonstration

Petitions	A petition is a request to do something, most commonly addressed to a government official or public entity. Petitions to a deity are a form of prayer called supplication.
Letters	To show political power by the volume of letters. For example, some letter writing campaigns especially with signed form letter.

Civil Disobedience Demonstrations

Public Nudity or Topfree	(to protest indecency laws or as a publicity stunt for another protest such as a war protest) or animal mistreatment (e.g. PETA's campaign against fur). See also Nudity and protest.
Sit-in	A sit-in or sit-down is a form of direct action that involves one or more people occupying an area for a protest, often to promote political, social, or economic change.
Photobombing	Photobombing or disrupting an event being broadcast live.
Raasta Roko	Raasta roko is a form of protest commonly practised in India. It usually involves large number of people preventing vehicular traffic from using a busy thoroughfare.
Silent Protest	Silent protest is an organized effort where the participants stay quiet to demonstrate disapproval. It is used as a form of civil disobedience and nonviolent resistance.

As a Residence

Peace Camp	Peace camps are a form of physical protest camp that is focused on anti-war activity. They are set up outside military bases by members of the peace movement who oppose either the existence of the military bases themselves, the armaments held there, or the politics of those who control the bases.
Formation of a Tent City	A tent city is a temporary housing facility made using tents or other temporary structures. State governments or military organizations set up tent cities to house evacuees, refugees, or soldiers. Informal tent cities may be set up without authorization by homeless people or protesters.
Camp for Climate Action	The Camps for Climate Action are campaign gatherings (similar to peace camps) that take place to draw attention to, and act as a base for direct action against, major carbon emitters, as well as to develop ways to create a zero-carbon society.

Destructive

Vandalism	Smashing windows or spraying graffiti is sometimes used as a form of protests, and is sometimes employed by black bloc groups.
Riot	Protests or attempts to end protests sometimes lead to rioting.
Self-Immolation	Self-immolation is the act of killing oneself for political or religious reasons particularly by burning, but also achieved through various means.
Suicide	The killing one oneself to make a point.
Hunger Strike	A hunger strike is a method of non-violent resistance or pressure in which participants fast as an act of political protest, or to provoke the feelings of guilt in others, usually with the objective to achieve a specific goal, such as a policy change. Most hunger strikers will take liquids but not solid food.
Bombing	The bombing of a significant location relating to the cause.

Non-Destructive

Silent Protests	Protests/Parades in which participants are nonviolent and usually silent, in attempt to avoid violent confrontation with Military or Police Forces. This tactic was effectively used during the Arab Spring in cities such as Tehran and Cairo.

Direct Action

Civil Resistance	Civil resistance is political action that relies on the use of nonviolent resistance by civil groups to challenge a particular power, force, policy or regime.
Nonviolent Resistance	Nonviolent resistance (NVR or nonviolent action) is the practice of achieving goals such as social change through symbolic protests, civil disobedience, economic or political noncooperation, satyagraha, or other methods, while being nonviolent.
Occupation	As an act of protest, occupation is a strategy often used by social movements and other forms of collective social action in order to take and hold public and symbolic spaces, buildings, critical infrastructure such as entrances to train stations, shopping centres, university buildings, squares, and parks.

Against a Government

Tax Resistance	Tax resistance is the refusal to pay tax because of opposition to the government that is imposing the tax, or to government policy, or as opposition to taxation in itself. Tax resistance is a form of direct action and, if in violation of the tax regulations, also a form of civil disobedience.
Conscientious Objector	A conscientious objector is an "individual who has claimed the right to refuse to perform military service" on the grounds of freedom of thought, conscience, or religion.
Flag Desecration	Flag desecration is a term that is applied to the desecration of flags, violation of flag protocol, or a various set of acts that intentionally destroy, damage, or mutilate a flag in public. In the case of a national flag, such action is often intended to make a political point against a country or its policies.
By Government Employees	
Bully Pulpit	A bully pulpit is a conspicuous position that provides an opportunity to speak out and be listened to.
Judicial Activism	Judicial activism refers to judicial rulings that are suspected of being based on personal opinion, rather than on existing law. It is sometimes used as an antonym of judicial restraint.
Job Action	
Strike Action	Strike action, also called labour strike, labour strike, or simply strike, is a work stoppage, caused by the mass refusal of employees to work. A strike usually takes place in response to employee grievances.
Walkout	In labour disputes, a walkout is a labour strike, the act of employees collectively leaving the workplace as an act of protest. A walkout can also mean the act of leaving a place of work, school, a meeting, a company, or an organization, especially if meant as an expression of protest or disapproval.
Work-to-Rule	Work-to-rule is an industrial action in which employees do no more than the minimum required by the rules of their contract, and precisely follow all safety or other regulations, which may cause a slowdown or decrease in productivity, as they are no longer working during breaks or during unpaid extended hours and weekends (checking email, for instance).
By Management	
Lockout	A lockout is a temporary work stoppage or denial of employment initiated by the management of a company during a labour dispute. That is different from a strike in which employees refuse to work. It is usually implemented by simply refusing to admit employees onto company premises and may include changing locks and hiring security guards for the premises.
By Tenants	
Rent Strike	A rent strike is a method of protest commonly employed against large landlords. In a rent strike, a group of tenants come together and agree to refuse to pay their rent en masse until a specific list of demands is met by the landlord.
By Consumers	
Boycott	A boycott is an act of voluntary and intentional abstention from using, buying, or dealing with a person, organization, or country as an expression of protest, usually for moral, social, political, or environmental reasons.
Consumer Court	Consumer Court is a special purpose court in India that deals with cases regarding consumer disputes, conflicts and grievances. They are judiciary hearings set up by the government to protect the consumers' rights.
Information	
Informative Letters	Informative letters, letter writing campaigns, letters to the editor.
Teach-in	A teach-in is similar to a general educational forum on any complicated issue, usually an issue involving current political affairs. The main difference between a teach-in and a seminar is the refusal to limit the discussion to a specific frame of time or a strict academic scope
Zine	A zine is a small-circulation self-published work of original or appropriated texts and images, usually reproduced via photocopier.
Soapboxing	A soapbox is a raised platform on which one stands to make an impromptu speech, often about a political subject. The term originates from the days when speakers would elevate themselves by standing on a wooden crate originally used for shipment of soap or other dry goods from a manufacturer to a retail store.
Civil Disobedience to Censorship	
Samizdat	Samizdat was a form of dissident activity across the Eastern Bloc in which individuals reproduced censored and underground publications by hand and passed the documents from reader to reader.
Graffiti	Graffit is writing or drawings made on a wall or other surface, usually as a form of artistic expression, without permission and within public view.
By Internet and Social Networking	
Blogging	Blogging and social networking have become effective tools to register protest and grievances. Protests can express views, news and use viral networking to reach out to thousands of people. With protests on the rise from the election season of 2016 going into 2017, protesters became aware that using their social media during protest could make them an easier target for government surveillance.
Literature, Art and Culture	
Culture Jamming	Culture jamming (sometimes guerrilla communication) is a tactic used by many anti-consumerist social movements to disrupt or subvert media culture and its mainstream cultural institutions, including corporate advertising.
Against Religious Institutions	
Recusancy	Recusancy was the state of those who refused to attend Anglican services during the history of England and Wales and of Ireland; these individuals were known as recusants.
Book Burning	Book burning is the ritual destruction by fire of books or other written materials, usually carried out in a public context. The burning of books represents an element of censorship and usually proceeds from a cultural, religious, or political opposition to the materials in question.

Strike

Strike action, also called labour strike, labour strike, or simply strike, is a work stoppage, caused by the mass refusal of employees to work. A strike usually takes place in response to employee grievances. Strikes became common during the Industrial Revolution, when mass labour became important in factories and mines. In most countries, strike actions were quickly made illegal, as factory owners had far more power than workers. Most Western countries partially legalized striking in the late 19th or early 20th centuries.

Strikes are sometimes used to pressure governments to change policies. Occasionally, strikes destabilize the rule of a particular political party or ruler; in such cases, strikes are often part of a broader social movement taking the form of a campaign of civil resistance. Notable examples are the 1980 Gdańsk Shipyard or 1981 Warning Strike, led by Lech Wałęsa. These strikes were significant in the long campaign of civil resistance for political change in Poland, and were an important mobilizing effort that contributed to the fall of the Iron Curtain and the end of communist party rule in eastern Europe.

Variations

Most strikes are undertaken by labour unions during collective bargaining as a last resort. The object of collective bargaining is for the employer and the union to come to an agreement over wages, benefits, and working conditions. A collective bargaining agreement may include a clause which prohibits the union from striking during the term of the agreement, known as a "no-strike clause". No-strike clauses arose in the United States immediately following World War II. Some in the labour movement consider no-strike clauses to be an unnecessary detriment to unions in the collective bargaining process. Generally, strikes are rare: according to the News Media Guild, 98% of union contracts in the United States are settled each of the 67 years without a strike. Occasionally, workers decide to strike without the sanction of a labour union, either because the union refuses to endorse such a tactic, or because the workers concerned are non-unionized. Such strikes are often described as unofficial. Strikes without formal union authorization are also known as wildcat strikes. In many countries, wildcat strikes do not enjoy the same legal protections as recognized union strikes, and may result in penalties for the union members who participate or their union. The same often applies in the case of strikes conducted without an official ballot of the union membership, as is required in some countries such as the United Kingdom.

A strike may consist of workers refusing to attend work or picketing outside the workplace to prevent or dissuade people from working in their place or conducting business with their employer. Less frequently workers may occupy the workplace, but refuse either to do their jobs or to leave. This is known as a sit-down strike. A similar tactic is the work-in, where employees occupy the workplace but still continue work, often without pay, which attempts to show they are still useful, or that worker self-management can be successful. For instance, this occurred with factory occupations in the Biennio Rosso strikes – the "two red years" of Italy from 1919 to 1920.

Another unconventional tactic is work-to-rule (also known as an Italian strike, in Italian: Sciopero bianco), in which workers perform their tasks exactly as they are required to but no better. For example, workers might follow all safety regulations in such a way that it impedes their productivity or they might refuse to work overtime. Such strikes may in some cases be a form of "partial strike" or "slowdown". During the development boom of the 1970s in Australia, the Green ban was developed by certain unions described by some as more socially conscious. This is a form of strike action taken by a trade union or other organized labour group for environmentalist or conservationist purposes. This developed from the black ban, strike action taken against a particular job or employer in order to protect the economic interests of the strikers.

Strikes may be specific to a particular workplace, employer, or unit within a workplace, or they may encompass an entire industry, or every worker within a city or country. Strikes that involve all workers, or a number of large and important groups of workers, in a particular community or region are known as general strikes. Under some circumstances, strikes may take place in order to put pressure on the State or other authorities or may be a response to unsafe conditions in the workplace. A sympathy strike is, in a way, a small scale version of a general strike in which one group of workers refuses to cross a picket line established by another as a means of supporting the striking workers.

Sympathy strikes, once the norm in the construction industry in the United States, have been made much more difficult to conduct due to decisions of the National Labour Relations Board permitting employers to establish separate or "reserved" gates for particular trades, making it an unlawful secondary boycott for a union to establish a picket line at any gate other than the one reserved for the employer it is picketing. A student strike has the students (sometimes supported by faculty) not attending schools. In some cases, the strike is intended to draw media attention to the institution so that the grievances that are causing the students to "strike" can be aired before the public; this usually damages the institution's (or government's) public image. In other cases, especially in government-supported institutions, the student strike can cause a budgetary imbalance and have actual economic repercussions for the institution.

Types

Strikebreakers
A strikebreaker (sometimes derogatorily called a scab, blackleg, or knobstick) is a person who works despite an ongoing strike. Strikebreakers are usually individuals who are not employed by the company prior to the trade union dispute, but rather hired after or during the strike to keep the organization running. "Strikebreakers" may also refer to workers (union members or not) who cross picket lines to work. Irwin, Jones, McGovern (2008) believe that the term "scab" is part of a larger metaphor involving strikes. They argue that the picket line is symbolic of a wound and those who break its borders to return to work are the scabs who bond that wound. Others have argued that the word is not a part of a larger metaphor but, rather, was an old-fashioned English insult whose meaning narrowed over time. "Blackleg" is an older word and is found in the late-nineteenth/early-twentieth century folk song from Northumberland, "Blackleg Miner". The term does not necessarily owe its origins to this tune of unknown origin. The song is, however, notable for its lyrics that encourage violent acts against strikebreakers.

Ani-Strike Action
Most strikes called by unions are somewhat predictable; they typically occur after the contract has expired. However, not all strikes are called by union organizations – some strikes have been called in an effort to pressure employers to recognize unions. Other strikes may be spontaneous actions by working people. Spontaneous strikes are sometimes called "wildcat strikes"; they were the key fighting point in May 1968 in France; most commonly, they are responses to serious (often life-threatening) safety hazards in the workplace rather than wage or hour disputes, etc. Whatever the cause of the strike, employers are generally motivated to take measures to prevent them, mitigate the impact, or to undermine strikes when they do occur.

Strike Preparation
Companies which produce products for sale will frequently increase inventories prior to a strike. Salaried employees may be called upon to take the place of strikers, which may entail advance training. If the company has multiple locations, personnel may be redeployed to meet the needs of reduced staff. Companies may also take out strike insurance prior to an anticipated strike, to help offset the losses which the strike would cause. One of the weapons traditionally wielded by already-established unions is strike action.

Some companies may decline entirely to negotiate with the union, and respond to the strike by hiring replacement workers. This may create a crisis situation for strikers – do they stick to their original plan and rely upon their solidarity, or is there a chance that the strike may be lost? How long will the strike last? Will strikers' jobs still be there if the strike fails? Are other strikers defecting from the strike?

Companies that hire strikebreakers typically play upon these fears when they attempt to convince union members to abandon the strike and cross the union's picket line. Unions faced with a strikebreaking situation may try to inhibit the use of strikebreakers by a variety of methods – establishing picket lines where the strikebreakers enter the workplace; discouraging strike breakers from taking, or from keeping, strikebreaking jobs; raising the cost of hiring strikebreakers for the company; or employing public relations tactics. Companies may respond by increasing security forces and seeking court injunctions.

Strike Breaking
Some companies negotiate with the union during a strike; other companies may see a strike as an opportunity to eliminate the union. This is sometimes accomplished by the importation of replacement workers, strikebreakers or "scabs". Historically, strike breaking has often coincided with union busting. It was also called 'Black legging' in the early 20th century, during the Russian socialist movement.

MAN-MADE DISASTERS | Civil Unrest | Strike | Types

Union Busting
One method of inhibiting or ending a strike is firing union members who are striking which can result in elimination of the union. Although this has happened it is rare due to laws regarding firing and "right to strike" having a wide range of differences in the US depending on whether union members are public or private sector. Laws also vary country to country. In the UK, "It is important to understand that there is no right to strike in UK law." Employees who strike risk dismissal, unless it is an official strike (one called or endorsed by their union) in which case they are protected from unlawful dismissal, and cannot be fired for at least 12 weeks. UK laws regarding work stoppages and strikes are defined within the Employment Relations Act 1999 and the Trade Union and Labour Relations (Consolidation) Act 1992. One of the most significant cases of mass-dismissals in the UK in 2005 involved the sacking of over 600 Gate Gourmet employees at Heathrow Airport, to which the media responded with outrage. Under the direction of Gate Gourmet's HR Director Andy Cook, according to BBC: "Gate Gourmet sacked more than 600 staff last week in a working practices row, prompting a walkout by British Airways ground staff that paralysed flights and stranded thousands of travellers in the UK." Andy Cook, Gate Gourmet's director of human resources at that time, said: "The company had not been looking to cut the size of the protests, only stop the minority engaged in harassment." Cook is now CEO of the UK labor relations advisory firm Marshall-James Global Solutions Ltd.

Lockout
Another counter to a strike is a lockout, the form of work stoppage in which an employer refuses to allow employees to work. Two of the three employers involved in the Caravan park grocery workers strike of 2003–2004 locked out their employees in response to a strike against the third member of the employer bargaining group. Lockouts are, with certain exceptions, lawful under United States labor law.

Violence
Historically, some employers have attempted to break union strikes by force. One of the most famous examples of this occurred during the Homestead Strike of 1892. Industrialist Henry Clay Frick sent private security agents from the Pinkerton National Detective Agency to break the Amalgamated Association of Iron and Steel Workers strike at a Homestead, Pennsylvania steel mill. Two strikers were killed, twelve wounded, along with two Pinkertons killed and eleven wounded. In the aftermath, Frick was shot in the neck and then stabbed by Alexander Berkman, surviving the attack, while Berkman was sentenced to 22 years in prison.

Riot

A riot is a form of civil disorder commonly characterized by a group lashing out in a violent public disturbance against authority, property or people. Riots typically involve theft, vandalism, and destruction of property, public or private. The property targeted varies depending on the riot and the inclinations of those involved. Targets can include shops, cars, restaurants, state-owned institutions, and religious buildings. Riots often occur in reaction to a grievance or out of dissent. Historically, riots have occurred due to poor people with no jobs or living conditions, governmental oppression, taxation or conscription, conflicts between ethnic groups, (race riot) or religions (sectarian violence, pogrom), the outcome of a sporting event (sports riot, football hooliganism) or frustration with legal channels through which to air grievances. While individuals may attempt to lead or control a riot, riots typically consist of disorganized groups that are frequently "chaotic and exhibit herd behavior."

However, there is a growing body of evidence to suggest that riots are not irrational, herd-like behavior, but actually follow inverted social norms. Today, some rioters have an improved understanding of the tactics used by police in riot situations. Manuals for successful rioting are available on the internet, with tips such as encouraging rioters to get the press involved, as there is more safety and attention with the cameras rolling.

Civilians with video cameras may also have an effect on both rioters and police. Dealing with riots is often a difficult task for police forces. They may use tear gas or CS gas to control rioters. Riot police may use less-than-lethal methods of control, such as shotguns that fire flexible baton rounds to injure or otherwise incapacitate rioters for easier arrest.

Classifications

These are the different classification of riots.

Police Riot	A police riot is a term for the disproportionate and unlawful use of force by a group of police against a group of civilians. This term is commonly used to describe a police attack on civilians, or provoking civilians into violence.
Prison Riot	A prison riot is a large-scale, temporary act of concerted defiance or disorder by a group of prisoners against prison administrators, prison officers, or other groups of prisoners. It is often done to express a grievance, force change or attempt escape.
Race Riot	In a race riot, race or ethnicity is the key factor. The term had entered the English language in the United States by the 1890s. Early use of the term referred to riots that were often a mob action by members of a majority racial group against people of other perceived races.
Religious Riot	In a religious riot, the key factor is religion. The rioting mob targets people and properties of a specific religion, or those believed to belong to that religion.
Student Riots	Student riots are riots precipitated by students, often in higher education, such as a college or university. Student riots in the US and Western Europe in the 1960s and the 1970s were often political in nature. Student riots may also occur as a result of oppression of peaceful demonstration or after sporting events. Students may constitute an active political force in a given country. Such riots may occur in the context of wider political or social grievances.
Urban Riots	Urban riots are riots in the context of urban decay, provoked by conditions such as discrimination, poverty, high unemployment, poor schools, poor healthcare, housing inadequacy and police brutality and bias. Urban riots are closely associated with race riots and police riots.
Sports Riots	Sports riots such as the Nika riots can be sparked by the losing or winning of a specific team or athlete. Fans of the two teams may also fight. Sports riots may happen as a result of teams contending for a championship, a long series of matches, or scores that are close. Sports are the most common cause of riots in the United States, accompanying more than half of all championship games or series. Almost all sports riots occur in the winning team's city.
Food Riots	Food and bread riots are caused by harvest failures, incompetent food storage, hoarding, poisoning of food, or attacks by pests like locusts. When the public becomes desperate from such conditions, groups may attack shops, farms, homes, or government buildings to obtain bread or other staple foods like grain or salt, as in the 1977 Egyptian Bread Riots.

Effects
The economic and political effects of riots can be as complex as their origins. Property destruction and harm to individuals are often immediately measurable. During the 1992 Los Angeles riots, 2,383 people were injured, 8,000 were arrested, 63 were killed and over 700 businesses burned. Property damage was estimated at over $1 billion. At least ten of those killed were shot by police or National Guard forces. Similarly, the 2005 civil unrest in France lasted over three weeks and spread to nearly 300 towns. By the end of the incident, over 10,000 vehicles were destroyed and over 300 buildings burned. Over 2,800 suspected rioters were arrested and 126 police and firefighters were injured. Estimated damages were over €200 Million. Many governments and political systems have fallen after riots, including:

- Russian Empire
- Ancien Régime
- British Raj in India, when bread and salt riots hastened the withdrawal in 1947

Riot Control and Laws
Riots are typically dealt with by the police, although methods differ from country to country. Tactics and weapons used can include attack dogs, water cannons, plastic bullets, rubber bullets, pepper spray, flexible baton rounds, and snatch squads. Many police forces have dedicated divisions to deal with public order situations. Some examples are the Territorial Support Group, Special Patrol Group, Compagnies Républicaines de Sécurité, Mobiele Eenheid, and Arrest units. The policing of riots has been marred by incidents in which police have been accused of provoking rioting or crowd violence. While the weapons described above are officially designated as non-lethal, a number of people have died or been injured as a result of their use. For example, seventeen deaths were caused by rubber bullets in Northern Ireland over the thirty five years between 1970 and 2005.

Risk of Arrest
A high risk of being arrested is even more effective against rioting than severe punishments. As more and more people join the riot, the risk of being arrested goes down, which persuades still more people to join. This leads to a vicious cycle, which is typically ended only by sufficient police or military presence to increase the risk of being arrested.

Civil War

A civil war, also known as an intrastate war in polemology, is a war between organized groups within the same state or country.The aim of one side may be to take control of the country or a region, to achieve independence for a region or to change government policies. The term is a calque of the Latin bellum civile which was used to refer to the various civil wars of the Roman Republic in the 1st century BC. A civil war is a high-intensity conflict, often involving regular armed forces, that is sustained, organized and large-scale.

Civil wars may result in large numbers of casualties and the consumption of significant resources. Most modern civil wars involve intervention by outside powers. According to Patrick M. Regan in his book Civil Wars and Foreign Powers (2000) about two thirds of the 138 intrastate conflicts between the end of World War II and 2000 saw international intervention, with the United States intervening in 35 of these conflicts. Civil wars since the end of World War II have lasted on average just over four years, a dramatic rise from the one-and-a-half-year average of the 1900–1944 period.

While the rate of emergence of new civil wars has been relatively steady since the mid-19th century, the increasing length of those wars has resulted in increasing numbers of wars ongoing at any one time. For example, there were no more than five civil wars underway simultaneously in the first half of the 20th century while there were over 20 concurrent civil wars close to the end of the Cold War. Since 1945, civil wars have resulted in the deaths of over 25 million people, as well as the forced displacement of millions more. Civil wars have further resulted in economic collapse; Somalia, Burma (Myanmar), Uganda and Angola are examples of nations that were considered to have had promising futures before being engulfed in civil wars.

Classification
James Fearon, a scholar of civil wars at Stanford University, defines a civil war as "a violent conflict within a country fought by organized groups that aim to take power at the center or in a region, or to change government policies". Ann Hironaka further specifies that one side of a civil war is the state. The intensity at which a civil disturbance becomes a civil war is contested by academics. Some political scientists define a civil war as having more than 1,000 casualties, while others further specify that at least 100 must come from each side. The Correlates of War, a dataset widely used by scholars of conflict, classifies civil wars as having over 1000 war-related casualties per year of conflict. This rate is a small fraction of the millions killed in the Second Sudanese Civil War and Cambodian Civil War, for example, but excludes several highly publicized conflicts, such as The Troubles of Northern Ireland and the struggle of the African National Congress in Apartheid-era South Africa.

Causes
According to a 2017 review study of civil war research, there are three prominent explanations for civil war: greed-based explanations which center on individuals' desire to maximize their profits, grievance-based explanations which center on conflict as a response to socioeconomic or political injustice, and opportunity-based explanations which center on factors that make it easier to engage in violent mobilization.

Greed
Scholars investigating the cause of civil war are attracted by two opposing theories, greed versus grievance. Roughly stated: are conflicts caused by who people are, whether that be defined in terms of ethnicity, religion or other social affiliation, or do conflicts begin because it is in the economic best interests of individuals and groups to start them? Scholarly analysis supports the conclusion that economic and structural factors are more important than those of identity in predicting occurrences of civil war.

Grievance
Most proxies for "grievance"—the theory that civil wars begin because of issues of identity, rather than economics—were statistically insignificant, including economic equality, political rights, ethnic polarization and religious fractionalization. Only ethnic dominance, the case where the largest ethnic group comprises a majority of the population, increased the risk of civil war. A country characterized by ethnic dominance has nearly twice the chance of a civil war. However, the combined effects of ethnic and religious fractionalization, i.e. the greater chance that any two randomly chosen people will be from separate ethnic or religious groups, the less chance of a civil war, were also significant and positive, as long as the country avoided ethnic dominance. The study interpreted this as stating that minority groups are more likely to rebel if they feel that they are being dominated, but that rebellions are more likely to occur the more homogeneous the population and thus more cohesive the rebels. These two factors may thus be seen as mitigating each other in many cases.

Opportunities
James Fearon and David Laitin find that ethnic and religious diversity does not make civil war more likely. They instead find that factors that make it easier for rebels to recruit foot soldiers and sustain insurgencies, such as "poverty—which marks financially & bureaucratically weak states and also favors rebel recruitment—political instability, rough terrain, and large populations" make civil wars more likely.

Other Causes

Other causes of civil war.

Bargaining Problems	In a state torn by civil war, the contesting powers often do not have the ability to commit or the trust to believe in the other side's commitment to put an end to war. When considering a peace agreement, the involved parties are aware of the high incentives to withdraw once one of them has taken an action that weakens their military, political or economical power.
Governance	Political scientist Barbara Walter suggests that most contemporary civil wars are actually repeats of earlier civil wars that often arise when leaders are not accountable to the public, when there is poor public participation in politics, and when there is a lack of transparency of information between the executives and the public.
Military Advantage	High levels of population dispersion and, to a lesser extent, the presence of mountainous terrain, increased the chance of conflict. Both of these factors favor rebels, as a population dispersed outward toward the borders is harder to control than one concentrated in a central region, while mountains offer terrain where rebels can seek sanctuary.
Population Size	The various factors contributing to the risk of civil war rise increase with population size. The risk of a civil war rises approximately proportionately with the size of a country's population.
Time	The more time that has elapsed since the last civil war, the less likely it is that a conflict will recur. The study had two possible explanations for this: one opportunity-based and the other grievance-based. The elapsed time may represent the depreciation of whatever capital the rebellion was fought over and thus increase the opportunity cost of restarting the conflict.

5 War

War is a state of armed conflict between states or societies. It is generally characterized by extreme aggression, destruction, and mortality, using regular or irregular military forces.

For Civil War see MAN-MADE DISASTERS > Civil Unrest > Civil War

Past Wars

War	Description
World War II 1939–1945 40-85mil Deaths Worldwide Fighting	World War II, also known as the Second World War, was a global war that lasted from 1939 to 1945. The vast majority of the world's countries—including all the great powers—eventually formed two opposing military alliances: the Allies and the Axis. A state of total war emerged, directly involving more than 100 million people from more than 30 countries. World War II was the deadliest conflict in human history, marked by 70 to 85 million fatalities, most of whom were civilians in the Soviet Union and China. It included massacres, the genocide of the Holocaust, strategic bombing, premeditated death from starvation and disease, and the only use of nuclear weapons in war.
World War I / Great War 1914–1918 20mil Deaths Worldwide Fighting	World War I also known as the First World War or the Great War, was a global war originating in Europe that lasted from 28 July 1914 to 11 November 1918. Contemporaneously described as "the war to end all wars", it led to the mobilisation of more than 70 million military personnel, including 60 million Europeans, making it one of the largest wars in history. It is also one of the deadliest conflicts in history, with an estimated nine million combatants and seven million civilian deaths as a direct result of the war, while resulting genocides and the resulting 1918 influenza pandemic caused another 50 to 100 million deaths worldwide.
Taiping Rebellion 1850–1864 20-100mil Deaths China	The Taiping Rebellion, which is also known as the Taiping Civil War or the Taiping Revolution, was a massive rebellion or civil war that was waged in China from 1850 to 1864 between the established Manchu-led Qing dynasty and the Hakka-led Taiping Heavenly Kingdom. Led by Hong Xiuquan, the self-proclaimed brother of Jesus Christ, the goals of the Taipings were religious, nationalist, and political in nature; they sought the conversion of the Chinese people to the Taiping's syncretic version of Christianity, the overthrow of the ruling Manchus, and a wholesale transformation and reformation of the state. Rather than simply supplanting the ruling class, the Taipings sought to upend the moral and social order of China.
Dungan Revolt 1862–1877 8-20mil Deaths China	The Dungan Revolt (1862–1877) or Tongzhi Hui Revolt was a mainly ethnic and religious war fought in 19th-century western China, mostly during the reign of the Tongzhi Emperor (r. 1861–1875) of the Qing dynasty. The term sometimes includes the Panthay Rebellion in Yunnan, which occurred during the same period. However, this article relates specifically to the uprising by members of the Muslim Hui and other Muslim ethnic groups in China's Shaanxi, Gansu and Ningxia provinces, as well as in Xinjiang, between 1862 and 1877.
Chinese Civil War 1927–1949 8mil Deaths China	The Chinese Civil War was a civil war in China fought between the Kuomintang (KMT)-led government of the Republic of China (ROC) and the Communist Party of China (CPC) lasting intermittently between 1927 and 1949. The war is generally divided into two phases with an interlude: from August 1927 to 1937, the KMT-CPC Alliance collapsed during the Northern Expedition, and the Nationalists controlled most of China. From 1937 to 1945, hostilities were put on hold, and the Second United Front fought the Japanese invasion of China with eventual help from the World War II Allies. The civil war resumed with the Japanese defeat, and the CPC gained the upper hand in the final phase of the war from 1945–1949, generally referred to as the Chinese Communist Revolution.
Russian Civil War 1917–1922 5-9mil Deaths Russia	The Russian Civil War was a multi-party civil war in the former Russian Empire immediately after the two Russian Revolutions of 1917, as many factions vied to determine Russia's political future. The two largest combatant groups were the Red Army, fighting for the Bolshevik form of socialism led by Vladimir Lenin, and the loosely allied forces known as the White Army, which included diverse interests favouring political monarchism, economic capitalism and alternative forms of socialism, each with democratic and anti-democratic variants. In addition, rival militant socialists and non-ideological Green armies fought against both the Bolsheviks and the Whites.
Napoleonic Wars 1803–1815 3.5-6mil Deaths Europe	The Napoleonic Wars (1803–1815) were a series of major conflicts pitting the French Empire and its allies, led by Napoleon I, against a fluctuating array of European powers formed into various coalitions, financed and usually led by the United Kingdom. The wars stemmed from the unresolved disputes associated with the French Revolution and its resultant conflict. The wars are often categorised into five conflicts, each termed after the coalition that fought Napoleon: the Third Coalition (1805), the Fourth (1806–07), the Fifth (1809), the Sixth (1813), and the Seventh (1815).
Second Congo War 1998–2003 2.5-5.4mil Deaths Central Africa	The Second Congo War (also known as the Great War of Africa or the Great African War, and sometimes referred to as the African World War) began in the Democratic Republic of the Congo in August 1998, little more than a year after the First Congo War, and involved some of the same issues. The war officially ended in July 2003, when the Transitional Government of the Democratic Republic of the Congo took power. Although a peace agreement was signed in 2002, violence has continued in many regions of the country, especially in the east. Hostilities have continued since the ongoing Lord's Resistance Army insurgency, and the Kivu and Ituri conflicts.
Bangladesh Liberation War 1971 2-3mil Deaths Bangladesh	The Bangladesh Liberation War, also known as the Bangladesh War of Independence, or simply the Liberation War in Bangladesh, was a revolution and armed conflict sparked by the rise of the Bengali nationalist and self-determination movement in what was then East Pakistan during the 1971 Bangladesh genocide. It resulted in the independence of the People's Republic of Bangladesh. The war began after the Pakistani military junta based in West Pakistan launched Operation Searchlight against the people of East Pakistan on the night of 25 March 1971. It pursued the systematic elimination of nationalist Bengali civilians, students, intelligentsia, religious minorities and armed personnel. The junta annulled the results of the 1970 elections and arrested Prime minister-designate Sheikh Mujibur Rahman. The war ended on 16 December 1971 after West Pakistan surrendered.
Vietnam War/Second Indochina War 1955–1975 800k-3.8mil Deaths Vietnam	The Vietnam War, also known as the Second Indochina War, and in Vietnam as the Resistance War Against America or simply the American War, was a conflict in Vietnam, Laos, and Cambodia from 1 November 1955 to the fall of Saigon on 30 April 1975. It was the second of the Indochina Wars and was officially fought between North Vietnam and South Vietnam. North Vietnam was supported by the Soviet Union, China, and other communist allies; South Vietnam was supported by the United States, South Korea, the Philippines, Australia, Thailand and other anti-communist allies. The war, considered a Cold War-era proxy war by some, lasted 19 years, with direct U.S. involvement ending in 1973, and included the Laotian Civil War and the Cambodian Civil War, which ended with all three countries becoming communist in 1975.

Mexican Revolution 1910–1920 1-2mil Deaths Mexico	The Mexican Revolution (Spanish: Revolución Mexicana) was a major armed struggle, lasting roughly from 1910-20, that transformed Mexican culture and government. Although recent research has focused on local and regional aspects of the Revolution, it was a genuinely national revolution. Its outbreak in 1910 resulted from the failure of the 31-year-long regime of Porfirio Díaz to find a managed solution to presidential succession. This meant there was a political crisis among competing elites and the opportunity for agrarian insurrection. Wealthy landowner Francisco I. Madero challenged Díaz in the 1910 presidential election, and following the rigged results, revolted under the Plan of San Luis Potosí. Armed conflict broke out in northern Mexico and Díaz was forced out. In the Treaty of Ciudad Juárez, Díaz resigned and went into exile, new elections were to occur in the fall, and an Interim Presidency under Francisco León de la Barra was installed. A new election was held in 1911, bringing Madero to the presidency.

Weapons

Hypersonic Missiles

A hypersonic weapon is a missile that travels at Mach 5 (6,174km/h, 3,836mph) or higher. That's at least five times the speed of sound, or about 1 mile per second. "Hypersonic weapons, however, are manoeuvrable and cruise at lower altitudes, making them more difficult to counter." For reference, commercial airliners fly subsonically, just below Mach 1 whereas modern fighter jets can travel supersonically at Mach 2 or Mach 3. "Once you reach Mach 5 you can't use your traditional jets and just make them go faster," Carrie Lee, a Rand Stanton Nuclear Fellow, explained. A traditional jet engine could operate up to Mach 3 or Mach 4 and so, anything travelling faster would need an altered system. You need a completely different design to unclutter the flow path and sustain combustion of the supersonic airflow inside the engine," said Rand senior engineer George Nacouzi.

The answer would then be a supersonic combustion ramjet (SCRAMJET), which can operate between Mach 5 and Mach 15. In order to maintain sustained hypersonic flight, a vehicle must also endure the extreme temperatures of flying at such speeds. "You can think of it as flying into a blowtorch," explained Rich Moore, senior engineer and Rand researcher. "The faster a vehicle flies, the pressure-temperature rises exponentially. So you have to have materials that can withstand high temperatures over a long period of time," Nacouzi added. "Hypersonic cruise missiles are powered all the way to their targets using an advanced propulsion system called a SCRAMJET. These are very, very fast. You may have six minutes from the time its launched until the time it strikes," Moore said. "We (The U.S.) don't currently have effective defences against hypersonic weapons because of the way they fly, i.e., they're manoeuvrable and fly at an altitude our current defence systems are not designed to operate at," he said. "Our whole defensive system is based on the assumption that you're gonna intercept a ballistic object."

Hypersonic Glide Vehicle

The Avangard (also known as Objekt 4202, Yu-71 and Yu-74) is a hypersonic glider, developed by Russia, that can be carried as a MIRV payload by the UR-100UTTKh, R-36M2 and RS-28 Sarmat heavy ICBMs. It can deliver both nuclear and conventional payloads. The system entered service in March 2018, and was unveiled by Russian President Vladimir Putin as one of the six new Russian strategic weapons.

Nuclear War

Nuclear warfare is a military conflict or political strategy in which nuclear weaponry is used to inflict damage on the enemy. Nuclear weapons are weapons of mass destruction; in contrast to conventional warfare, nuclear warfare can produce destruction in a much shorter time and can have a long-lasting radiological warfare result.

EMPs

An electromagnetic pulse (EMP), is a short burst of electromagnetic energy.
EMP interference is generally disruptive or damaging to electronic equipment, and at higher energy levels a powerful EMP event such as a lightning strike can damage physical objects such as buildings and aircraft structures.
See Mass Destruction > EMP for more.

6 Economy

Any economic based disasters.

Economic Collapse

Economic collapse is any of a broad range of bad economic conditions, ranging from a severe, prolonged depression with high bankruptcy rates and high unemployment, to a breakdown in normal commerce caused by hyperinflation, or even an economically caused sharp rise in the death rate and perhaps even a decline in population. Often economic collapse is accompanied by social chaos, civil unrest and a breakdown of law and order.

Cases
There are few well documented cases of economic collapse. One of the best documented cases of collapse or near collapse is the Great Depression, the causes of which are still being debated.

"To understand the Great Depression is the Holy Grail of macroeconomics." Ben Bernanke (1995)

Bernanke's comment addresses the difficulty of identifying specific causes when many factors may each have contributed to various extents. Past economic collapses have had political as well as financial causes. Persistent trade deficits, wars, revolutions, famines, depletion of important resources, and government-induced hyperinflation have been listed as causes.

In some cases blockades and embargoes caused severe hardships that could be considered economic collapse. In the U.S. the Embargo Act of 1807 forbade foreign trade with warring European nations, causing a severe depression in the heavily international trade-dependent economy, especially in the shipping industry and port cities, ending a great boom. The Union blockade of the Confederate States of America severely damaged the South's plantation owners; however, the South had little economic development. The blockade of Germany during World War I led to starvation of hundreds of thousands of Germans but did not cause economic collapse, at least until the political turmoil and the hyperinflation that followed. For both the Confederacy and Weimar Germany, the cost of the war was worse than the blockade.

Many Southern plantation owners had their bank accounts confiscated and also all had to free their slaves without compensation. The Germans had to make war reparations. Following defeat in war, the conquering country or faction may not accept paper currency of the vanquished, and the paper becomes worthless. (This was the situation of the Confederacy.) Government debt obligations, primarily bonds, are often restructured and sometimes become worthless. Therefore, there is a tendency for the public to hold gold and silver during times of war or crisis.

Effects of War & Hyperinflation on Wealth and Commerse
Hyperinflation, wars, and revolutions cause hoarding of essentials and a disruption of markets. In some past hyperinflations, workers were paid daily and immediately spent their earnings on essential goods, which they often used for barter. Store shelves were frequently empty. More stable foreign currencies, silver and gold (usually coins) were held and exchanged in place of local currency. The minting country of precious metal coins tended to be relatively unimportant. Jewelry was also used as a medium of exchange. Alcoholic beverages were also used for barter. Desperate individuals sold valuable possessions to buy essentials or traded them for gold and silver. In the German hyperinflation, stocks held much more of their value than paper currency. Bonds denominated in the inflating currency may lose most or all value.

Bank Holidays, Conversion or Confiscation of Accounts and New Currency
During severe financial crises, sometimes governments close banks. Depositors may be unable to withdraw their money for long periods, as was true in the United States in 1933 under the Emergency Banking Act. Withdrawals may be limited. Bank deposits may be involuntarily converted to government bonds or to a new currency of lesser value in foreign exchange. During financial crises and even less severe situations, capital controls are often imposed to restrict or prohibit transferring or personally taking money, securities or other valuables out of a country. To end hyperinflations a new currency is typically issued. The old currency is often not worth exchanging for new.

Examples

Weimar Germany

Following Germany's defeat in World War I, political instability resulted in murders and assassinations of hundreds of political figures. Germany's finances were heavily strained by the war and reparations in accordance with the Treaty of Versailles. Unable to raise enough in taxes to run the government and make war reparations, the government resorted to printing money which resulted in great hyperinflation. One book on the hyperinflation, which includes quotes and a few first hand accounts, is When Money Dies.

The hyperinflation eventually ended, it cleared government debt at the cost of the citizens' savings. Some believe that the hyperinflation of 1923 has helped fuel the eventual rise of the Nazi party and the rise of Hitler to power in 1933. Economists, however, tend to attribute Hitler's rise to the Deflation and the Great Depression beginning in 1929. Paul Krugman concluded that the 1923 hyperinflation didn't bring Hitler to power; it was the Brüning deflation and depression. Before 1929 the Nazi party was actually in decline with less than 3% of votes in the German federal election of 1928.

The Great Depression

While arguably not a true economic collapse, the decade of the 1930s witnessed the most severe worldwide economic contraction since the start of the Industrial Revolution. In the US, the Depression began in the summer of 1929, soon followed by the stock market crash of October 1929. American stock prices continued to decline in fits and starts until they hit bottom in July 1932. In the first quarter of 1933, the banking system broke down: asset prices had collapsed, bank lending had largely ceased, a quarter of the American work force was unemployed, and real GDP per capita in 1933 was 29% below its 1929 value.

The ensuing rapid recovery was interrupted by a major recession in 1937-38. The USA fully recovered by 1941, the eve of its entry in World War II, which gave rise to a boom as dramatic as the Depression that preceded it. While there were numerous bank failures during the Great Depression, most banks in developed countries survived, as did most currencies and governments. The most significant monetary change during the depression was the demise of the gold standard by most nations that were on it.

In the U.S., the dollar was redeemable in gold until 1933 when U.S. citizens were forced to turn over their gold (except for 5 ounces) for fiat currency (See: Executive Order 6102) and were forbidden to own monetary gold for the next four decades. Subsequently, gold was revalued from $20.67 per ounce to $35 per ounce. U.S. dollars remained redeemable in gold by foreigners until 1971. Gold ownership was legalized in the U.S. in 1974, but not with legal tender status.

As bad as the Great Depression was, it took place during a period of high productivity growth, which caused real wages to rise. The high unemployment was partly a result of the productivity gains, allowing the number of hours of the standard work week to be cut while restoring economic output to previous levels after a few years. Workers who remained employed saw their real hourly earnings rise because wages remained constant while prices fell; however, overall earnings remained relatively constant because of the reduced work week. Converting the dollar to a fiat currency and devaluing against gold ensured the end of deflation and created inflation, which made the high debt accumulated during the 1920s boom easier to repay, although some of the debt was written off.

Economic Collapse of Soviet Communism

During the 1980s, the Eastern Bloc, which relied on a stagnant form of planned economy, experienced a decade-long period of stagflation, and eventual collapse from which it did not recover, culminating with revolutions and the fall of communist regimes throughout Central and Eastern Europe and eventually in the Soviet Union. The process was accompanied by a gradual but important easing of restrictions on economic and political behaviour in the late 1980s, including the satellite states.

The collapse in the USSR was characterized by an increase in the death rate, especially by men over 50, with alcoholism a major cause. There was also an increase in violent crime and murder. The Russian population peaked in the 1990s and is lower today than two decades ago, as the demographics of Russia show. A firsthand account of conditions during the economic collapse was told by Dmitry Orlov, a former USSR citizen who became a US citizen but returned to Russia for a time during the crisis.

Russian Financial Crisis of 1998

After more or less stabilizing after the disintegration of the USSR, a severe financial crisis took place in the Russian Federation in August 1998. It was caused by low oil prices and government expenditure cuts after the end of the Cold War. Other nations of the former Soviet Union also experienced economic collapse, although a number of crises also involved armed conflicts, like in the break-away region Chechnya. The default by Russia on its government bonds in 1998 led to the collapse of highly leveraged hedge fund Long Term Capital Management, which threatened the world financial system. The U.S. Federal Reserve organized a bailout of LTCM which turned it over to a banking consortium.

Venezuela

Since 2013, Venezuela has been suffering an economic crisis. It's the worst in Venezuelan history, caused by the economic policies of the president, Nicolás Maduro the successor of Hugo Chávez, the fall in oil prices and internal and external factors. Since 2014, Venezuela's GDP has been in recession, falling more 40%. The economy has collapsed, causing shortages of basics goods, economic downturn and hyperinflation since 2017. Also, there are drastic increases in the crime, corruption, poverty and hunger. Thousands of Venezuelans have fled to neighboring countries.

Causes of the Great Depression

The causes of the Great Depression in the early 20th century have been extensively discussed by economists and remain a matter of active debate. They are part of the larger debate about economic crises. The specific economic events that took place during the Great Depression are well established. There was an initial stock market crash that triggered a "panic sell-off" of assets. This was followed by a deflation in asset and commodity prices, dramatic drops in demand and credit, and disruption of trade, ultimately resulting in widespread unemployment (over 13 million people were unemployed by 1932) and impoverishment. However, economists and historians have not reached a consensus on the causal relationships between various events and government economic policies in causing or ameliorating the Depression.

Current mainstream theories may be broadly classified into two main points of view. The first are the demand-driven theories, from Keynesian and institutional economists who argue that the depression was caused by a widespread loss of confidence that led to underconsumption. The demand-driven theories argue that the financial crisis following the 1929 crash led to a sudden and persistent reduction in consumption and investment spending.

Once panic and deflation set in, many people believed they could avoid further losses by keeping clear of the markets. Holding money therefore became profitable as prices dropped lower and a given amount of money bought ever more goods, exacerbating the drop in demand. Second, there are the monetarists, who believe that the Great Depression started as an ordinary recession, but that significant policy mistakes by monetary authorities (especially the Federal Reserve) caused a shrinking of the money supply which greatly exacerbated the economic situation, causing a recession to descend into the Great Depression.

Related to this explanation are those who point to debt deflation causing those who borrow to owe ever more in real terms. There are also several various heterodox theories that reject the explanations of the Keynesians and monetarists. Some new classical macroeconomists have argued that various labor market policies imposed at the start caused the length and severity of the Great Depression. The Austrian school of economics focuses on the macroeconomic effects of money supply and how central banking decisions can lead to malinvestment. Marxist economists view the Great Depression, with all other economic crises, as a symptom of the cyclical nature of capitalism and the instability that is inherent in the capitalist model.

The Black Swan Theory

The black swan theory or theory of black swan events is a metaphor that describes an event that comes as a surprise, has a major effect, and is often inappropriately rationalized after the fact with the benefit of hindsight. The term is based on an ancient saying that presumed black swans did not exist – a saying that became reinterpreted to teach a different lesson after black swans were discovered in the wild.

The theory was developed by Nassim Nicholas Taleb to explain:
1. The disproportionate role of high-profile, hard-to-predict, and rare events that are beyond the realm of normal expectations in history, science, finance, and technology.
2. The non-computability of the probability of the consequential rare events using scientific methods (owing to the very nature of small probabilities).
3. The psychological biases that blind people, both individually and collectively, to uncertainty and to a rare event's massive role in historical affairs.

Unlike the earlier and broader "black swan problem" in philosophy (i.e. the problem of induction), Taleb's "black swan theory" refers only to unexpected events of large magnitude and consequence and their dominant role in history. Such events, considered extreme outliers, collectively play vastly larger roles than regular occurrences.:xxi More technically, in the scientific monograph 'Silent Risk', Taleb mathematically defines the black swan problem as "stemming from the use of degenerate metaprobability".

Economic Bubble

An economic bubble or asset bubble (sometimes also referred to as a speculative bubble, a market bubble, a price bubble, a financial bubble, a speculative mania, or a balloon) is a situation in which asset prices appear to be based on implausible or inconsistent views about the future. It could also be described as trade in an asset at a price or price range that strongly exceeds the asset's intrinsic value. While some economists deny that bubbles occur, the causes of bubbles remain disputed by those who are convinced that asset prices often deviate strongly from intrinsic values.

Many explanations have been suggested, and research has recently shown that bubbles may appear even without uncertainty, speculation, or bounded rationality, in which case they can be called non-speculative bubbles or sunspot equilibria. In such cases, the bubbles may be argued to be rational, where investors at every point are fully compensated for the possibility that the bubble might collapse by higher returns. These approaches require that the timing of the bubble collapse can only be forecast probabilistically and the bubble process is often modelled using a Markov switching model. Similar explanations suggest that bubbles might ultimately be caused by processes of price coordination.

More recent theories of asset bubble formation suggest that these events are sociologically driven. For instance, explanations have focused on emerging social norms and the role that culturally-situated stories or narratives play in these events. Because it is often difficult to observe intrinsic values in real-life markets, bubbles are often conclusively identified only in retrospect, once a sudden drop in prices has occurred. Such a drop is known as a crash or a bubble burst. In an economic bubble, prices can fluctuate erratically and become impossible to predict from supply and demand alone.

Asset bubbles are now widely regarded as a recurrent feature of modern economic history dating back as far as the 1600s. The Dutch Golden Age's tulip mania (in the mid-1630s) is often considered the first recorded economic bubble. Both the boom and the burst phases of the bubble are examples of a positive feedback mechanism (in contrast to the negative feedback mechanism that determines the equilibrium price under normal market circumstances).

Types of Bubbles

These are the different types of economic bubbles.

Equity Bubble	An equity bubble is characterised by tangible investments and the unsustainable desire to satisfy a legitimate market in high demand. These kind of bubbles are characterised by easy liquidity, tangible and real assets, and an actual innovation that boosts confidence. Two instances of an equity bubble are the Tulip Mania and the dot-com bubble.
Debt Bubble	A debt bubble is characterised by intangible or credit based investments with little ability to satisfy growing demand in a non-existent market. These bubbles are not backed by real assets and are characterized by frivolous lending in the hopes of returning a profit or security. These bubbles usually end in debt deflation causing bank runs or a currency crisis when the government can no longer maintain the fiat currency. Examples include the Great Depression and The Great Recession.

Impact

The impact of economic bubbles is debated within and between schools of economic thought; they are not generally considered beneficial, but it is debated how harmful their formation and bursting is. Within mainstream economics, many believe that bubbles cannot be identified in advance, cannot be prevented from forming, that attempts to "prick" the bubble may cause financial crisis, and that instead authorities should wait for bubbles to burst of their own accord, dealing with the aftermath via monetary policy and fiscal policy.

In addition, the crash which usually follows an economic bubble can destroy a large amount of wealth and cause continuing economic malaise; this view is particularly associated with the debt-deflation theory of Irving Fisher, and elaborated within Post-Keynesian economics. A protracted period of low risk premiums can simply prolong the downturn in asset price deflation as was the case of the Great Depression in the 1930s for much of the world and the 1990s for Japan. Not only can the aftermath of a crash devastate the economy of a nation, but its effects can also reverberate beyond its borders.

Effect Upon Spending

Another important aspect of economic bubbles is their impact on spending habits. Market participants with overvalued assets tend to spend more because they "feel" richer (the wealth effect). Many observers quote the housing market in the United Kingdom, Australia, New Zealand, Spain and parts of the United States in recent times, as an example of this effect. When the bubble inevitably bursts, those who hold on to these overvalued assets usually experience a feeling of reduced wealth and tend to cut discretionary spending at the same time, hindering economic growth or, worse, exacerbating the economic slowdown.

In an economy with a central bank, the bank may therefore attempt to keep an eye on asset price appreciation and take measures to curb high levels of speculative activity in financial assets. This is usually done by increasing the interest rate (that is, the cost of borrowing money). Historically, this is not the only approach taken by central banks. It has been argued that they should stay out of it and let the bubble, if it is one, take its course.

MAN-MADE DISASTERS | Economy | Economic Collapse | Economic Bubble

Possible Causes

In the 1970s, excess monetary expansion after the U.S. came off the gold standard (August 1971) created massive commodities bubbles. These bubbles only ended when the U.S. Central Bank (Federal Reserve) finally reined in the excess money, raising federal funds interest rates to over 14%. The commodities bubble popped and prices of oil and gold, for instance, came down to their proper levels. Similarly, low interest rate policies by the U.S. Federal Reserve in the 2001–2004 are believed to have exacerbated housing and commodities bubbles. The housing bubble popped as subprime mortgages began to default at much higher rates than expected, which also coincided with the rising of the fed funds rate.

It has also been variously suggested that bubbles may be rational, intrinsic, and contagious. To date, there is no widely accepted theory to explain their occurrence. Recent computer-generated agency models suggest excessive leverage could be a key factor in causing financial bubbles. Puzzlingly for some, bubbles occur even in highly predictable experimental markets, where uncertainty is eliminated and market participants should be able to calculate the intrinsic value of the assets simply by examining the expected stream of dividends.

Nevertheless, bubbles have been observed repeatedly in experimental markets, even with participants such as business students, managers, and professional traders. Experimental bubbles have proven robust to a variety of conditions, including short-selling, margin buying, and insider trading. While there is no clear agreement on what causes bubbles, there is evidence to suggest that they are not caused by bounded rationality or assumptions about the irrationality of others, as assumed by greater fool theory. It has also been shown that bubbles appear even when market participants are well-capable of pricing assets correctly. Further, it has been shown that bubbles appear even when speculation is not possible or when over-confidence is absent.

More recent theories of asset bubble formation suggest that they are likely sociologically-driven events, thus explanations that merely involve fundamental factors or snippets of human behavior are incomplete at best. For instance, qualitative researchers Preston Teeter and Jorgen Sandberg argue that market speculation is driven by culturally-situated narratives that are deeply embedded in and supported by the prevailing institutions of the time. They cite factors such as bubbles forming during periods of innovation, easy credit, loose regulations, and internationalized investment as reasons why narratives play such an influential role in the growth of asset bubbles.

Liquidity

One possible cause of bubbles is excessive monetary liquidity in the financial system, inducing lax or inappropriate lending standards by the banks, which makes markets vulnerable to volatile asset price inflation caused by short-term, leveraged speculation. For example, Axel A. Weber, the former president of the Deutsche Bundesbank, has argued that "The past has shown that an overly generous provision of liquidity in global financial markets in connection with a very low level of interest rates promotes the formation of asset-price bubbles."

According to the explanation, excessive monetary liquidity (easy credit, large disposable incomes) potentially occurs while fractional reserve banks are implementing expansionary monetary policy (i.e. lowering of interest rates and flushing the financial system with money supply); this explanation may differ in certain details according to economic philosophy. Those who believe the money supply is controlled exogenously by a central bank may attribute an 'expansionary monetary policy' to said bank and (should one exist) a governing body or institution; others who believe that the money supply is created endogenously by the banking sector may attribute such a 'policy' with the behavior of the financial sector itself, and view the state as a passive or reactive factor.

This may determine how central or relatively minor/inconsequential policies like fractional reserve banking and the central bank's efforts to raise or lower short-term interest rates are to one's view on the creation, inflation and ultimate implosion of an economic bubble. Explanations focusing on interest rates tend to take on a common form, however: When interest rates are set excessively low, (regardless of the mechanism by which it is accomplished) investors tend to avoid putting their capital into savings accounts. Instead, investors tend to leverage their capital by borrowing from banks and invest the leveraged capital in financial assets such as stocks and real estate.

Risky leveraged behavior like speculation and Ponzi schemes can lead to an increasingly fragile economy, and may also be part of what pushes asset prices artificially upward until the bubble pops. Simply put, economic bubbles often occur when too much money is chasing too few assets, causing both good assets and bad assets to appreciate excessively beyond their fundamentals to an unsustainable level. Once the bubble bursts, the fall in prices causes the collapse of unsustainable investment schemes (especially speculative and/or Ponzi investments, but not exclusively so), which leads to a crisis of consumer (and investor) confidence that may result in a financial panic and/or financial crisis; if there is monetary authority like a central bank, it may be forced to take a number of measures in order to soak up the liquidity in the financial system or risk a collapse of its currency.

This may involve actions like bailouts of the financial system, but also others that reverse the trend of monetary accommodation, commonly termed forms of 'contractionary monetary policy'. Some of these measures may include raising interest rates, which tends to make investors become more risk averse and thus avoid leveraged capital because the costs of borrowing may become too expensive; others may include certain countermeasures that may be taken pre-emptively during periods of strong economic growth include having the central monetary authority increase capital reserve requirements and attempting to implement regulation that checks and/or prevents processes leading to over-expansion and excessive leveraging of debt.

Ideally, such countermeasures lessen the impact of a downturn by strengthening financial institutions while the economy is strong. Advocates of perspectives stressing the role of credit money in an economy often refer to (such) bubbles as "credit bubbles", and look at such measures of financial leverage as debt-to-GDP ratios to identify bubbles. Typically the collapse of any economic bubble results in an economic contraction termed (if less severe) a recession or (if more severe) a depression; what economic policies to follow in reaction to such a contraction is a hotly debated perennial topic of political economy.

Possible Causes (Social Psychology Factors)

Greater Fool Theory	Greater fool theory states that bubbles are driven by the behavior of perennially optimistic market participants (the fools) who buy overvalued assets in anticipation of selling it to other speculators (the greater fools) at a much higher price. According to this explanation, the bubbles continue as long as the fools can find greater fools to pay up for the overvalued asset. The bubbles will end only when the greater fool becomes the greatest fool who pays the top price for the overvalued asset and can no longer find another buyer to pay for it at a higher price. This theory is popular among laity but has not yet been fully confirmed by empirical research.
Extrapolation	Extrapolation is projecting historical data into the future on the same basis; if prices have risen at a certain rate in the past, they will continue to rise at that rate forever. The argument is that investors tend to extrapolate past extraordinary returns on investment of certain assets into the future, causing them to overbid those risky assets in order to attempt to continue to capture those same rates of return. Overbidding on certain assets will at some point result in uneconomic rates of return for investors; only then the asset price deflation will begin. When investors feel that they are no longer well compensated for holding those risky assets, they will start to demand higher rates of return on their investments.
Herding	Another related explanation used in behavioral finance lies in herd behavior, the fact that investors tend to buy or sell in the direction of the market trend. This is sometimes helped by technical analysis that tries precisely to detect those trends and follow them, which creates a self-fulfilling prophecy. Investment managers, such as stock mutual fund managers, are compensated and retained in part due to their performance relative to peers. Taking a conservative or contrarian position as a bubble builds results in performance unfavorable to peers. This may cause customers to go elsewhere and can affect the investment manager's own employment or compensation. The typical short-term focus of U.S. equity markets exacerbates the risk for investment managers that do not participate during the building phase of a bubble, particularly one that builds over a longer period of time. In attempting to maximize returns for clients and maintain their employment, they may rationally participate in a bubble they believe to be forming, as the risks of not doing so outweigh the benefits.

Moral Hazard	Moral hazard is the prospect that a party insulated from risk may behave differently from the way it would behave if it were fully exposed to the risk. A person's belief that they are responsible for the consequences of their own actions is an essential aspect of rational behavior. An investor must balance the possibility of making a return on their investment with the risk of making a loss – the risk-return relationship. A moral hazard can occur when this relationship is interfered with, often via government policy.

Stages of an Economic Bubble

According to the economist Charles P. Kindleberger, the basic structure of a speculative bubble can be divided into 5 phases:
- Substitution: increase in the value of an asset
- Takeoff: speculative purchases (buy now to sell in the future at a higher price and obtain a profit)
- Exuberance: a state of unsustainable euphoria.
- Critical stage: begin to shorten the buyers, some begin to sell.
- Pop (crash): Prices plummet

Identifying Asset Bubbles
Economic or asset price bubbles are often characterized by one or more of the following:

1	Unusual changes in single measures, or relationships among measures (e.g., ratios) relative to their historical levels. For example, in the housing bubble of the 2000s, the housing prices were unusually high relative to income. For stocks, the price to earnings ratio provides a measure of stock prices relative to corporate earnings; higher readings indicate investors are paying more for each dollar of earnings.
2	Elevated usage of debt (leverage) to purchase assets, such as purchasing stocks on margin or homes with a lower down payment.
3	Higher risk lending and borrowing behavior, such as originating loans to borrowers with lower credit quality scores (e.g., subprime borrowers), combined with adjustable rate mortgages and "interest only" loans.
4	Rationalizing borrowing, lending and purchase decisions based on expected future price increases rather than the ability of the borrower to repay.
5	Rationalizing asset prices by increasingly weaker arguments, such as "this time it's different" or "housing prices only go up."
6	A high presence of marketing or media coverage related to the asset.
7	Incentives that place the consequences of bad behavior by one economic actor upon another, such as the origination of mortgages to those with limited ability to repay because the mortgage could be sold or securitized, moving the consequences from the originator to the investor.
8	International trade (current account) imbalances, resulting in an excess of savings over investments, increasing the volatility of capital flow among countries. For example, the flow of savings from Asia to the U.S. was one of the drivers of the 2000s housing bubble.
9	A lower interest rate environment, which encourages lending and borrowing.

Examples of Asset Bubbles

- Cryptocurrency Bubble (2011–2018)
- Rhodium Bubble of 2008: (increase from $500/oz to $9000/oz in July 2008, then down to $1000/oz in January 2009)
- United States Housing Bubble (2002–2006)
- 1997 Asian Financial Crisis (1997)
- The Dot-Com Bubble (US) (1995–2000)
- Gold and Silver Bubble (1976–1980)

Examples of Aftermaths of Bubbles

- Panic of 1837
- Great Depression
- Lost Decade (Japan)
- Early 2000s recession
- Great Recession

Stock Market Crash

A stock market crash is a sudden dramatic decline of stock prices across a significant cross-section of a stock market, resulting in a significant loss of paper wealth. Crashes are driven by panic as much as by underlying economic factors. They often follow speculative stock market bubbles. Stock market crashes are social phenomena where external economic events combine with crowd behavior and psychology in a positive feedback loop where selling by some market participants drives more market participants to sell.

Generally speaking, crashes usually occur under the following conditions: a prolonged period of rising stock prices and excessive economic optimism, a market where P/E ratios (Price-Earning ratio) exceed long-term averages, and extensive use of margin debt and leverage by market participants. Other aspects such as wars, large-corporation hacks, changes in federal laws and regulations, and natural disasters of highly economically productive areas may also influence a significant decline in the stock market value of a wide range of stocks. All such stock drops may result in the rise of stock prices for corporations competing against the affected corporations.

There is no numerically specific definition of a stock market crash but the term commonly applies to steep double-digit percentage losses in a stock market index over a period of several days. Crashes are often distinguished from bear markets by panic selling and abrupt, dramatic price declines. Bear markets are periods of declining stock market prices that are measured in months or years. Crashes are often associated with bear markets, however, they do not necessarily go hand in hand. The crash of 1987, for example, did not lead to a bear market. Likewise, the Japanese bear market of the 1990s occurred over several years without any notable crashes.

Major Crashes in the U.S.

These are a list of major market crashes in the United States.

Panic of 1907	In 1907 and in 1908, the NYSE fell by nearly 50% due to a variety of factors, led by the manipulation of copper stocks by the Knickerbocker company. Shares of United Copper rose gradually up to October, and thereafter crashed, leading to panic. A number of investment trusts and banks that had invested their money in the stock market fell and started to close down. Further bank runs were prevented due to the intervention of J. P. Morgan. The panic continued to 1908 and led to the formation of the Federal Reserve in 1913.
Wall Street Crash of 1929	The economy had been growing for most of the Roaring Twenties. It was a technological golden age, as innovations such as the radio, automobile, aviation, telephone, and the power grid were deployed and adopted. Companies that had pioneered these advances, like Radio Corporation of America (RCA) and General Motors, saw their stocks soar. Financial corporations also did well, as Wall Street bankers floated mutual fund companies (then known as investment trusts) like the Goldman Sachs Trading Corporation. Investors were infatuated with the returns available in the stock market, especially by the use of leverage through margin debt.

October 19, 1987	The mid-1980s were a time of strong economic optimism. From August 1982 to its peak in August 1987, the Dow Jones Industrial Average (DJIA) grew from 776 to 2722. The rise in market indices for the 19 largest markets in the world averaged 296 percent during this period. The average number of shares traded on the NYSE(New York Stock Exchange) had risen from 65 million shares to 181 million shares.
Crash of 2008–2009	On September 16, 2008, failures of massive financial institutions in the United States, due primarily to exposure to packaged subprime loans and credit default swaps issued to insure these loans and their issuers, rapidly devolved into a global crisis. This resulted in a number of bank failures in Europe and sharp reductions in the value of stocks and commodities worldwide. The failure of banks in Iceland resulted in a devaluation of the Icelandic króna and threatened the government with bankruptcy. Iceland obtained an emergency loan from the International Monetary Fund in November. In the United States, 15 banks failed in 2008, while several others were rescued through government intervention or acquisitions by other banks. On October 11, 2008, the head of the International Monetary Fund (IMF) warned that the world financial system was teetering on the "brink of systemic meltdown". The economic crisis caused countries to close their markets temporarily. On October 8, the Indonesian stock market halted trading, after a 10% drop in one day.

The Times of London reported that the meltdown was being called the Crash of 2008, and older traders were comparing it with Black Monday in 1987. The fall that week of 21% compared to a 28.3% fall 21 years earlier, but some traders were saying it was worse. "At least then it was a short, sharp, shock on one day. This has been relentless all week." Business Week also referred to the crisis as a "stock market crash" or the "Panic of 2008".

Mitigation Strategies
One mitigation strategy has been the introduction of trading curbs, also known as "circuit breakers", which are a trading halt in the cash market and the corresponding trading halt in the derivative markets triggered by the halt in the cash market, all of which are affected based on substantial movements in a broad market indicator. Since their inception, circuit breakers have been modified to prevent both speculative gains and dramatic losses within a small time frame.

United States
There are three thresholds, which represent different levels of decline in the DJIA in terms of points. These thresholds are set at the beginning of each quarter to establish a specific point value. For example, in the second quarter of 2011, Threshold 1 was a drop of 1200 points, Threshold 2 was 2400 points, and Threshold 3 was 3600 points. If Threshold 2 is breached before 1 pm, the market closes for two hours. If such a decline occurs between 1 pm and 2 pm, there is a one-hour pause. The market would close for the day if stocks sank to that level after 2 pm. If Threshold 3 is breached, the market would close for the day, regardless of the time.

Hyperinflation

In economics, hyperinflation is very high and typically accelerating inflation. It quickly erodes the real value of the currency, as the prices of most or all goods increase. This causes people to minimize their holdings in that currency as they usually switch to more stable foreign currencies. Prices typically remain stable in terms of other currencies. Unlike low inflation, where the process of rising prices is protracted and not generally noticeable except by studying past market prices, hyperinflation sees a rapid and continuing increase in nominal prices, the nominal cost of goods, and in the supply of money. Typically, however, the general price level rises even more rapidly than the money supply as people try ridding themselves of the devaluing currency as quickly as possible. As this happens, the real stock of money (i.e., the amount of circulating money divided by the price level) decreases considerably.

Causes

While there can be a number of causes of high inflation, most hyperinflations have been caused by government budget deficits financed by money creation. A necessary condition for hyperinflation is the use of paper money, instead of gold or silver coins. Most hyperinflations in history, with some exceptions, such as the French hyperinflation of 1789-1796, occurred after the use of fiat currency became widespread in the late 19th century. Hyperinflation occurs when there is a continuing (and often accelerating) rapid increase in the amount of money that is not supported by a corresponding growth in the output of goods and services. The price increases that result from the rapid money creation creates a vicious circle, requiring ever growing amounts of new money creation to fund government deficits. Hence both monetary inflation and price inflation proceed at a rapid pace. Such rapidly increasing prices cause widespread unwillingness of the local population to hold the local currency as it rapidly loses its buying power.

Instead they quickly spend any money they receive, which increases the velocity of money flow; this in turn causes further acceleration in prices. This means that the increase in the price level is greater than that of the money supply. This results in an imbalance between the supply and demand for the money (including currency and bank deposits), causing rapid inflation. Very high inflation rates can result in a loss of confidence in the currency, similar to a bank run. Usually, the excessive money supply growth results from the government being either unable or unwilling to fully finance the government budget through taxation or borrowing, and instead it finances the government budget deficit through the printing of money. Governments have sometimes resorted to excessively loose monetary policy, as it allows a government to devalue its debts and reduce (or avoid) a tax increase. Inflation is effectively a regressive tax on the users of money, but less overt than levied taxes and is therefore harder to understand by ordinary citizens. Inflation can obscure quantitative assessments of the true cost of living, as published price indices only look at data in retrospect, so may increase only months later.

Effects

Hyperinflation effectively wipes out the purchasing power of private and public savings; distorts the economy in favour of the hoarding of real assets; causes the monetary base, whether specie or hard currency, to flee the country; and makes the afflicted area anathema to investment. One of the most important characteristics of hyperinflation is the accelerating substitution of the inflating money by stable money—gold and silver in former times, then relatively stable foreign currencies after the breakdown of the gold or silver standards (Thiers' Law).

If inflation is high enough, government regulations like heavy penalties and fines, often combined with exchange controls, cannot prevent this currency substitution. As a consequence, the inflating currency is usually heavily undervalued compared to stable foreign money in terms of purchasing power parity. So foreigners can live cheaply and buy at low prices in the countries hit by high inflation. It follows that governments that do not succeed in engineering a successful currency reform in time must finally legalize the stable foreign currencies (or, formerly, gold and silver) that threaten to fully substitute the inflating money. Otherwise, their tax revenues, including the inflation tax, will approach zero.

Enactment of price controls to prevent discounting the value of paper money relative to gold, silver, hard currency, or other commodities fail to force acceptance of a paper money that lacks intrinsic value. If the entity responsible for printing a currency promotes excessive money printing, with other factors contributing a reinforcing effect, hyperinflation usually continues. Hyperinflation is generally associated with paper money, which can easily be used to increase the money supply: add more zeros to the plates and print, or even stamp old notes with new numbers. Historically, there have been numerous episodes of hyperinflation in various countries followed by a return to "hard money". Older economies would revert to hard currency and barter when the circulating medium became excessively devalued, generally following a "run" on the store of value.

Aftermath

Hyperinflation is ended by drastic remedies, such as imposing the shock therapy of slashing government expenditures or altering the currency basis. One form this may take is dollarization, the use of a foreign currency (not necessarily the U.S. dollar) as a national unit of currency. An example was dollarization in Ecuador, initiated in September 2000 in response to a 75% loss of value of the Ecuadorian sucre in early 2000. But usually the "dollarization" takes place in spite of all efforts of the government to prevent it by exchange controls, heavy fines and penalties. The government has thus to try to engineer a successful currency reform stabilizing the value of the money. If it does not succeed with this reform the substitution of the inflating by stable money goes on.

Thus it is not surprising that there have been at least seven historical cases in which the good (foreign) money did fully drive out the use of the inflating currency. In the end the government had to legalize the former, for otherwise its revenues would have fallen to zero. Hyperinflation has always been a traumatic experience for the people who suffer it, and the next political regime almost always enacts policies to try to prevent its recurrence. Often this means making the central bank very aggressive about maintaining price stability, as was the case with the German Bundesbank, or moving to some hard basis of currency, such as a currency board. Many governments have enacted extremely stiff wage and price controls in the wake of hyperinflation, but this does not prevent further inflation of the money supply by the central bank, and always leads to widespread shortages of consumer goods if the controls are rigidly enforced.

Currency

In countries experiencing hyperinflation, the central bank often prints money in larger and larger denominations as the smaller denomination notes become worthless. This can result in the production of unusually large denominations of banknotes, including those denominated in amounts of 1,000,000,000 or more.

By late 1923, the Weimar Republic of Germany was issuing two-trillion mark banknotes and postage stamps with a face value of fifty billion marks. The highest value banknote issued by the Weimar government's Reichsbank had a face value of 100 trillion marks. At the height of the inflation, one US dollar was worth 4 trillion German marks. One of the firms printing these notes submitted an invoice for the work to the Reichsbank for 32,776,899,763,734,490,417 (33 quintillion) marks.

The largest denomination banknote ever officially issued for circulation was in 1946 by the Hungarian National Bank for the amount of 100 quintillion pengő (100,000,000,000,000,000,000, or 1020; 100 million million million) image. The banknotes did not show the numbers in full: "hundred million b.-pengő" ("hundred million trillion pengő") and "one milliard b.-pengő" were spelled out instead. This makes the 100,000,000,000,000 Zimbabwean dollar banknotes the note with the greatest number of zeros shown.

The Post-World War II hyperinflation of Hungary held the record for the most extreme monthly inflation rate ever – 41,900,000,000,000,000% (4.19 × 1016% or 41.9 quadrillion percent) for July 1946, amounting to prices doubling every 15.3 hours. By comparison, recent figures (as of 14 November 2008) estimate Zimbabwe's annual inflation rate at 89.7 sextillion (1021) percent. The highest monthly inflation rate of that period was 79.6 billion percent, and a doubling time of 24.7 hours. In figures, that is 79,600,000,000%.

Hyperinflation Examples

The following are examples of hyperinflation of other countries throughout recent history. These have been added to detail what happened and to educate you on how hyperinflation effects the economy. Understanding how it works will give you an upper hand in surviving in a country where your money is worth noticeably less every hour.

Austria	In 1922, inflation in Austria reached 1,426%, and from 1914 to January 1923, the consumer price index rose by a factor of 11,836, with the highest banknote in denominations of 500,000 Austrian krones. After World War I, essentially all State enterprises ran at a loss, and the number of state employees in the capital, Vienna, was greater than in the earlier monarchy, even though the new republic was nearly one-eighth of the size. Observing the Austrian response to developing hyperinflation, which included the hoarding of food and the speculation in foreign currencies, Owen S. Phillpotts, the Commercial Secretary at the British Legation in Vienna wrote: "The Austrians are like men on a ship who cannot manage it, and are continually signalling for help. While waiting, however, most of them begin to cut rafts, each for himself, out of the sides and decks. The ship has not yet sunk despite the leaks so caused, and those who have acquired stores of wood in this way may use them to cook their food, while the more seamanlike look on cold and hungry. The population lack courage and energy as well as patriotism."	**Start and End Date** Oct. 1921 – Sep. 1922 **Peak Month and Rate of Inflation** Aug. 1922, 129%
China	As the first user of fiat currency, China was also the first country to experience hyperinflation. Paper currency was introduced during the Tang Dynasty, and was generally welcomed. It maintained its value, as successive Chinese governments put in place strict controls on issuance. The convenience of paper currency for trade purposes led to strong demand for paper currency. It was only when discipline on quantity supplied broke down that hyperinflation emerged. The Yuan Dynasty (1271–1368) was the first to print large amounts of fiat paper money to fund their wars, resulting in hyperinflation. Much later, the Republic of China went through hyperinflation from 1948–49. In 1947, the highest denomination bill was 50,000 yuan. By mid-1948, the highest denomination was 180,000,000 yuan. The 1948 currency reform replaced the yuan by the gold yuan at an exchange rate of 1 gold yuan = 3,000,000 yuan. In less than a year, the highest denomination was 10,000,000 gold yuan.	**Start and End Date** Jul. 1943 – Aug. 1945 **Peak Month and Rate of Inflation** Jun. 1945, 302% **Start and End Date** Oct. 1947 – Mid. May 1949 **Peak Month and Rate of Inflation** Apr 5,070%

In the final days of the civil war, the Silver Yuan was briefly introduced at the rate of 500,000,000 Gold Yuan. Meanwhile, the highest denomination issued by a regional bank was 6,000,000,000 yuan (issued by Xinjiang Provincial Bank in 1949). After the renminbi was instituted by the new communist government, hyperinflation ceased, with a revaluation of 1:10,000 old Renminbi in 1955.

MAN-MADE DISASTERS | Economy | Hyperinflation | Hyperinflation Examples

Germany	By November 1922, the value in gold of money in circulation had fallen from £300 million before World War I to £20 million. The Reichsbank responded by the unlimited printing of notes, thereby accelerating the devaluation of the mark. In his report to London, Lord D'Abernon wrote: "In the whole course of history, no dog has ever run after its own tail with the speed of the Reichsbank." Germany went through its worst inflation in 1923. In 1922, the highest denomination was 50,000 Marks. By 1923, the highest denomination was 100,000,000,000,000 (1014) Marks. In December 1923 the exchange rate was 4,200,000,000,000 (4.2 × 1012) Marks to 1 US dollar. In 1923, the rate of inflation hit 3.25 × 106 percent per month (prices double every two days). Beginning on 20 November 1923, 1,000,000,000,000 old Marks were exchanged for 1 Rentenmark, so that 4.2 Rentenmarks were worth 1 US dollar, exactly the same rate the Mark had in 1914.	**Start and End Date** Jan. 1920 – Jan. 1920 **Peak Month and Rate of Inflation** Jan. 1920, 56.9% **Start and End Date** Aug. 1922 – Dec. 1923 **Peak Month and Rate of Inflation** Nov. 1923, 29,525%
Hungary	The Treaty of Trianon and political instability between 1919 and 1924 led to a major inflation of Hungary's currency. In 1921, in an attempt to stop inflation, the national assembly of Hungary passed the Hegedűs reforms, including a 20% levy on bank deposits. This action precipitated a mistrust of banks by the public, especially the peasants, and resulted in a reduction in savings and in the amount of currency in circulation. Unable to tax adequately, the government resorted to printing money, and in 1923 inflation in Hungary reached 98% per month. Between the end of 1945 and July 1946, Hungary went through the worst inflation ever recorded. In 1944, the highest denomination was 1,000 pengő. By the end of 1945, it was 10,000,000 pengő. The highest denomination in mid-1946 was 100,000,000,000,000,000,000 (1020) pengő. A special currency, the adópengő – or tax pengő – was created for tax and postal payments.	**Start and End Date** Aug. 1945 – Jul. 1946 **Peak Month and Rate of Inflation** Jul. 1946, 41.9 quadrillion percent

The value of the adópengő was adjusted each day, by radio announcement. On 1 January 1946 one adópengő equaled one pengő. By late July, one adópengő equaled 2,000,000,000,000,000,000,000 or 2×1021 (2 sextillion) pengő. When the pengő was replaced in August 1946 by the forint, the total value of all Hungarian banknotes in circulation amounted to 1/1,000 of one US dollar. This is the most severe known incident of inflation recorded, peaking at 1.3 × 1016 percent per month (prices double every 15 hours). The overall impact of hyperinflation: On 18 August 1946, 400,000,000,000,000,000,000,000,000,000 or 4×1029 pengő became 1 forint.

Venezuela	Venezuela's hyperinflation began in November 2016. Inflation of Venezuela's bolivar fuerte (VEF) in 2014 reached 69% and was the highest in the world. In 2015, inflation was 181%, the highest in the world and the highest in the country's history at that time, 800% in 2016 and over 4,000% in 2017, with Venezuela spiralling into hyperinflation. While the Venezuelan government "has essentially stopped" producing official inflation estimates as of early 2018, one estimation of the rate at that time was 5,220%, according to inflation economist Steve Hanke of Johns Hopkins University. Inflation has affected Venezuelans so much that in 2017, some people became video game gold farmers and could be seen playing games such as RuneScape to sell in-game currency or characters for real currency. In many cases, these gamers made more money than salaried workers in Venezuela even though they were earning just a few dollars per day.	**Start and End Date** Nov. 2016 – ongoing **Peak Month and Rate of Inflation** Apr. 2018, 234%

In the Christmas season of 2017, some shops would no longer use price tags since prices would inflate so quickly, so customers were required to ask staff at stores how much each item was. The International Monetary Fund estimated in 2018 that Venezuela's inflation rate would reach 1,000,000% by the end of the year. In July 2018, Hyperinflation in Venezuela was sitting 33,151%, "the 23rd most severe episode of hyperinflation in history".

Overpopulation

Human overpopulation occurs when the ecological footprint of a human population in a specific geographical location exceeds the carrying capacity of the place occupied by that group. Overpopulation can further be viewed, in a long term perspective, as existing when a population cannot be maintained given the rapid depletion of non-renewable resources or given the degradation of the capacity of the environment to give support to the population. The term human overpopulation also refers to the relationship between the entire human population and its environment: the Earth, or to smaller geographical areas such as countries.

Overpopulation can result from an increase in births, a decline in mortality rates, an increase in immigration, or an unsustainable biome and depletion of resources. It is possible for very sparsely populated areas to be overpopulated if the area has a meagre or non-existent capability to sustain life (e.g. a desert). Advocates of population moderation cite issues like quality of life, carrying capacity and risk of starvation as a basis to argue against continuing high human population growth and for population decline.

Scientists suggest that the human impact on the environment as a result of overpopulation, profligate consumption and proliferation of technology has pushed the planet into a new geological epoch known as the Anthropocene.

Peak Oil

Peak oil is the theorized point in time when the maximum rate of extraction of petroleum is reached, after which it is expected to enter terminal decline. Peak oil theory is based on the observed rise, peak, fall, and depletion of aggregate production rate in oil fields over time. It is often confused with oil depletion; however, whereas depletion refers to a period of falling reserves and supply, peak oil refers to peak, before terminal depletion occurs. The concept of peak oil is often credited to geologist M. King Hubbert whose 1956 paper first presented a formal theory. The concept of peak oil is often credited to geologist M. King Hubbert whose 1956 paper first presented a formal theory.

Some observers, such as petroleum industry experts Kenneth S. Deffeyes and Matthew Simmons, predicted there would be negative global economy effects after a post-peak production decline and subsequent oil price increase because of the continued dependence of most modern industrial transport, agricultural, and industrial systems on the low cost and high availability of oil. Predictions vary greatly as to what exactly these negative effects would be. While the notion that petroleum production must peak at some point is not controversial, the assertion that this must coincide with a serious economic decline, or even that the decline in production will necessarily be caused by an exhaustion of available reserves, is not universally accepted.

Oil production forecasts on which predictions of peak oil are based are sometimes made within a range which includes optimistic (higher production) and pessimistic (lower production) scenarios. A 2013 study concluded that peak oil "appears probable before 2030," and that there was a "significant risk" that it would occur before 2020, and assumed that major investments in alternatives will occur before a crisis, without requiring major changes in the lifestyle of heavily oil-consuming nations. Pessimistic predictions of future oil production made after 2007 state either that the peak has already occurred, that oil production is on the cusp of the peak, or that it will occur soon. The rate of discovery of new petroleum deposits peaked worldwide during the 1960s and has never approached these levels since.

Peak Coal

The term Peak coal is used to refer to the point in time at which coal production and consumption reaches its maximum, after which, it is assumed, production and consumption will decline steadily. The term was originally used in connection with M. King Hubbert's Hubbert peak theory, in which the finite nature of the resource determines a constraint on production. However, since the expansion of renewable energy particularly in electricity generation, the term is now commonly used with reference to a peak in coal demand, which may already have occurred. According to M. King Hubbert's Hubbert peak theory, peak coal is the point in time at which the maximum global coal production rate is reached, after which, according to the theory, the rate of production will enter a terminal decline. Coal is a fossil fuel formed from plant matter over the course of millions of years. It is a finite resource and thus considered to be a non-renewable energy source. There are two different possible peaks: one measured by mass (i.e. metric tons) and another by energy output (i.e. petajoules). The world average heat content per mass of mined coal rose from 8,020 BTU/lb. in 1989 to 9,060 BTU/lb. in 1999. Since 1999, the world average heat content of mined coal has been fairly steady, and was 9,030 BTU/lb. in 2011.

The estimates for global peak coal extraction vary wildly. Many coal associations suggest the peak could occur in 200 years or more, while scholarly estimates predict the peak to occur as soon as the immediate future. Research in 2009 by the University of Newcastle in Australia concluded that global coal extraction could peak sometime between the present and 2048. A 2007 study by the German Energy Watch Group predicted that global peak coal extraction may occur sometime around 2025 at 30 percent above the 2005 rate. Although reserves of coal remain abundant, consumption of coal has declined in many countries. In 2016 Scotland closed its last coal-fired power plant. This decline has resulted from the replacement of coal-fired electricity by gas and renewable energy, along with the decline of the steel industry in some countries. As a result, the term "peak coal" is now used primarily to refer to a peak and subsequent decline in global and national coal consumption. In 2016 experts estimated that China, the world's largest coal consumer, reached peak coal in 2013, and that the world may have passed peak coal.

However, in 2017, for the first time in four years, demand for coal rose. As of 2015, China accounted for 50.0 percent of world coal consumption. Chinese coal consumption fell in 2014 and 2015. The last previous decline in Chinese coal consumption had been in 1997 and 1998. While consumption in China and the United States declined in 2015, that of India continued to rise and, in 2015, India surpassed the United States and became the world's second-largest consumer of coal. As of 2011, the top coal-extracting countries were China (46% of world extraction), United States (13%), India (7.8%), Australia (5.4%), and Indonesia (4.9%). Four out of five of these largest coal-extracting countries, the exception being the United States, had experienced significant increases in coal extraction over the previous decade.

Peak Gas (Fuel)

Peak gas is the point in time at which the maximum global natural gas (fossil gas) production rate will be reached, after which the rate of production will enter its terminal decline. Natural gas is a fossil fuel formed from plant matter over the course of millions of years. It is a finite resource and thus considered to be a non-renewable energy source. The concept of peak gas follows from Hubbert peak theory, which is most commonly associated with peak oil. Hubbert saw gas, coal and oil as natural resources, each of which would peak in production and eventually run out for a region, a country, or the world.

Since Hubbert's initial predictions in 1956, "the proper application of ever more powerful statistical techniques has reduced much of the uncertainty about the supply of oil and natural gas". The world gets almost one quarter of its energy from natural gas. The consumption of natural gas has nearly doubled in the last 30 years. The most important energy agencies in the world are forecasting increases in natural gas demand in the next 20 years. The largest increments in future gas demand are expected to come from developing countries.

Hubbert's original peak theory predicts that natural gas will experience three equally spaced events: first, the rate of discoveries will peak, then X years later reserves will peak, and finally X years after peak reserves, gas production will peak at the same rate as the previous peak of discoveries.

7 Famine

A famine is a widespread scarcity of food, caused by several factors including war, inflation, crop failure, population imbalance, or government policies. This phenomenon is usually accompanied or followed by regional malnutrition, starvation, epidemic, and increased mortality. Every inhabited continent in the world has experienced a period of famine throughout history. In the 19th and 20th century, it was generally Southeast and South Asia, as well as Eastern and Central Europe that suffered the most deaths from famine. The numbers dying from famine began to fall sharply from the 2000s. Some countries, particularly in sub-Saharan Africa, continue to have extreme cases of famine. Since 2010, Africa has been the most affected continent in the world. As of 2017, the United Nations has warned some 20 million are at risk in South Sudan, Somalia, Nigeria and Yemen. The distribution of food has been affected by conflict. Most programmes now direct their aid towards Africa.

Definitions

According to the United Nations humanitarian criteria, even if there are food shortages with large numbers of people lacking nutrition, a famine is declared only when certain measures of mortality, malnutrition and hunger are met. The criteria are:

- At least 20% of households in an area face extreme food shortages with a limited ability to cope
- The prevalence of acute malnutrition in children exceeds 30%
- The death rate exceeds two people per 10,000 people per day

The declaration of a famine carries no binding obligations on the UN or member states, but serves to focus global attention on the problem.

Decline of Famine

In the 16th and 17th century, the feudal system began to break down, and more prosperous farmers began to enclose their own land and improve their yields to sell the surplus crops for a profit. These capitalist landowners paid their labourers with money, thereby increasing the commercialization of rural society. In the emerging competitive labour market, better techniques for the improvement of labour productivity were increasingly valued and rewarded. It was in the farmer's interest to produce as much as possible on their land in order to sell it to areas that demanded that product. They produced guaranteed surpluses of their crop every year if they could.

By the 1590s, these trends were sufficiently developed in the rich and commercialized province of Holland to allow its population to withstand a general outbreak of famine in Western Europe at that time. By that time, the Netherlands had one of the most commercialized agricultural systems in Europe. They grew many industrial crops such as flax, hemp and hops. Agriculture became increasingly specialized and efficient. The efficiency of Dutch agriculture allowed for much more rapid urbanization in the late sixteenth and early seventeenth centuries than anywhere else in Europe. As a result, productivity and wealth increased, allowing the Netherlands to maintain a steady food supply.

By 1650, English agriculture had also become commercialized on a much wider scale. The last peacetime famine in England was in 1623–24. There were still periods of hunger, as in the Netherlands, but no more famines ever occurred. Common areas for pasture were enclosed for private use and large scale, efficient farms were consolidated. Other technical developments included the draining of marshes, more efficient field use patterns, and the wider introduction of industrial crops. These agricultural developments led to wider prosperity in England and increasing urbanization. By the end of the 17th century, English agriculture was the most productive in Europe. In both England and the Netherlands, the population stabilized between 1650 and 1750, the same time period in which the sweeping changes to agriculture occurred. Famine still occurred in other parts of Europe, however. In Eastern Europe, famines occurred as late as the twentieth century.

During the 20th century, an estimated 70 million people died from famines across the world, of whom an estimated 30 million died during the famine of 1958–61 in China. The other most notable famines of the century included the Bengal famine of 1943 caused by the Japanese occupation of Burma and the policies of Churchill, famines in China in 1928 and 1942, and a sequence of famines in Russia and elsewhere in the Soviet Union, including the Russian famine of 1921–22 and Soviet famine of 1932–1933, caused by the policies of Lenin and Stalin. A few of the great famines of the late 20th century were: the Biafran famine in the 1960s, the Khmer Rouge-caused famine in Cambodia in the 1970s, the North Korean famine of the 1990s and the Ethiopian famine of 1983–85. The latter event was reported on television reports around the world, carrying footage of starving Ethiopians whose plight was centered around a feeding station near the town of Korem. This stimulated the first mass movements to end famine across the world.

BBC newsreader Michael Buerk gave moving commentary of the tragedy on 23 October 1984, which he described as a "biblical famine". This prompted the Band Aid single, which was organized by Bob Geldof and featured more than 20 pop stars. The Live Aid concerts in London and Philadelphia raised even more funds for the cause. Hundreds of thousands of people died within one year as a result of the famine, but the publicity Live Aid generated encouraged Western nations to make available enough surplus grain to end the immediate hunger crisis in Africa.

Until 2017, worldwide deaths from famine had been falling dramatically. The World Peace Foundation reported that from the 1870s to the 1970s, great famines killed an average of 928,000 people a year. Since 1980, annual deaths had dropped to an average of 75,000, less than 10% of what they had been until the 1970s. That reduction was achieved despite the approximately 150,000 lives lost in the 2011 Somalia famine. Yet in 2017, the UN officially declared famine had returned to Africa, with about 20 million people at risk of death from starvation in Nigeria, in South Sudan, in Yemen, and in Somalia.

Famine Scales

Paul Howe and Stephen Devereux set forth a measurement of famine with scales for both "intensity" and "magnitude", incorporating many of the developments of recent decades. The intensity scale is:

Famine Intensity Scale

Level	Phrase	Lives	Livelihood
0	Food Secure	Crude Mortality Rate (CMR) < 0.2/10,000/day and/or Wasting < 2.3%	Cohesive social system; food prices stable; Coping strategies not utilized
1	Food Insecure	0.2 <= CMR <0.5/10,000/day and/or 2.3% <= Wasting < 10%	Cohesive social system; Food prices unstable; Seasonal shortages; Reversible coping strategies taken
2	Food Crisis	0.5 <= CMR < 1/10,000/day, 10% <= Wasting < 20%, and/or prevalence of oedema	Social system stressed but largely cohesive; Dramatic rise in food and basic items prices; Adaptive mechanisms begin to fail; Increase in irreversible coping strategies
3	Famine	1 <= CMR < 5/10,000/day, 20% <= Wasting < 40%, and/or prevalence of oedema	Clear signs of social breakdown; markets begin to collapse; coping strategies exhausted and survival strategies (migration in search of help, abandonment of weaker members of the community) adopted; affected population identifies food scarcity as the major societal problem
4	Severe Famine	5 <= CMR <15/10,000/day, Wasting >= 40%, and/or prevalence of oedema	Widespread social breakdown; markets close; survival strategies widespread; affected population identifies food scarcity as the major societal problem
5	Extreme Famine	CMR >= 15/10,000/day	Complete social breakdown; widespread mortality; affected population identifies food scarcity as the major societal problem

Famine Magnitude Scale

Framework
Using this framework, each famine would receive a Magnitude designation, but locations within the affected region would be classified at varying Intensities. The 1998 southern Sudan famine would be a C: Major Famine, with an intensity of 5: Extreme famine in Ajiep village ranging to 3: Famine in Rumbek town. In comparison, the 2000 Ethiopian famine in Gode district would be classified as a B: Moderate famine, and would thus should demand proportionally less of the limited resources available for famine relief.

Category	Phrase	Mortality Range
A	Minor Famine	0-999
B	Moderate Famine	1,000-9,999
C	Major Famine	10,000-99,999
D	Great Famine	100,000-999,999
E	Catastrophic Famine	1,000,000 and over

While each organization working in famine-related areas has its own operational interpretation of specific indicators, the Howe-Devereaux framework has been widely adopted as a common framework by which famine warning and famine relief may be discussed worldwide, in particular in the use of the intensity scale. This has led organizations such as the World Food Programme to refrain from referring to the 2005 Niger food crisis as a famine, as indicators had not deteriorated into a Level 3: Famine.

Future Famines

The Guardian reports that in 2007 approximately 40% of the world's agricultural land is seriously degraded. If current trends of soil degradation continue in Africa, the continent might be able to feed just 25% of its population by 2025, according to UNU's Ghana-based Institute for Natural Resources in Africa. As of late 2007, increased farming for use in biofuels, along with world oil prices at nearly $100 a barrel, has pushed up the price of grain used to feed poultry and dairy cows and other cattle, causing higher prices of wheat (up 58%), soybean (up 32%), and maize (up 11%) over the year. In 2007 Food riots have taken place in many countries across the world.

An epidemic of stem rust, which is destructive to wheat and is caused by race Ug99, has in 2007 spread across Africa and into Asia. Beginning in the 20th century, nitrogen fertilizers, new pesticides, desert farming, and other agricultural technologies began to be used to increase food production, in part to combat famine. Between 1950 and 1984, as the Green Revolution influenced agriculture] world grain production increased by 250%. Developed nations have shared these technologies with developing nations with a famine problem.

However, as early as 1995, there were signs that these new developments may contribute to the decline of arable land (e.g. persistence of pesticides leading to soil contamination, salt accumulation due to irrigation, erosion). In 1994, David Pimentel, professor of ecology and agriculture at Cornell University, and Mario Giampietro, senior researcher at the National Research Institute on Food and Nutrition (INRAN), estimated the maximum U.S. population for a sustainable economy at 200 million.

According to geologist Dale Allen Pfeiffer, coming decades could see rising food prices without relief and massive starvation on a global level. Water deficits, which are already spurring heavy grain imports in numerous smaller countries, may soon do the same in larger countries, such as China or India. The water tables are falling in many countries (including Northern China, the US, and India) due to widespread overconsumption. Other countries affected include Pakistan, Iran, and Mexico. This will eventually lead to water scarcity and cutbacks in grain harvest. Even while overexploiting its aquifers, China has developed a grain deficit, contributing to the upward pressure on grain prices. Most of the three billion people projected to be added worldwide by mid-century will be born in countries already experiencing water shortages.

After China and India, there is a second tier of smaller countries with large water deficits – Algeria, Egypt, Iran, Mexico, and Pakistan. Four of these already import a large share of their grain. Only Pakistan remains marginally self-sufficient. But with a population expanding by 4 million a year, it will also soon turn to the world market for grain. According to a UN climate report, the Himalayan glaciers that are the principal dry-season water sources of Asia's biggest rivers – Ganges, Indus, Brahmaputra, Yangtze, Mekong, Salween and Yellow – could disappear by 2350 as temperatures rise and human demand rises.

Approximately 2.4 billion people live in the drainage basin of the Himalayan rivers. India, China, Pakistan, Afghanistan, Bangladesh, Nepal and Myanmar could experience floods followed by severe droughts in coming decades. In India alone, the Ganges provides water for drinking and farming for more than 500 million people.

Causes

Definitions of famines are based on three different categories—these include food supply-based, food consumption-based and mortality-based definitions. Some definitions of famines are:
- Blix – Widespread food shortage leading to significant rise in regional death rates.
- Brown and Eckholm – Sudden, sharp reduction in food supply resulting in widespread hunger.
- Scrimshaw – Sudden collapse in level of food consumption of large numbers of people.
- Ravallion – Unusually high mortality with unusually severe threat to food intake of some segments of a population.
- Cuny – A set of conditions that occurs when large numbers of people in a region cannot obtain sufficient food, resulting in widespread, acute malnutrition.

Food shortages in a population are caused either by a lack of food or by difficulties in food distribution; it may be worsened by natural climate fluctuations and by extreme political conditions related to oppressive government or warfare. The conventional explanation until 1981 for the cause of famines was the Food availability decline (FAD) hypothesis. The assumption was that the central cause of all famines was a decline in food availability. However, FAD could not explain why only a certain section of the population such as the agricultural laborer was affected by famines while others were insulated from famines. Based on the studies of some recent famines, the decisive role of FAD has been questioned and it has been suggested that the causal mechanism for precipitating starvation includes many variables other than just decline of food availability. According to this view, famines are a result of entitlements, the theory being proposed is called the "failure of exchange entitlements" or FEE. A person may own various commodities that can be exchanged in a market economy for the other commodities he or she needs. The exchange can happen via trading or production or through a combination of the two. These entitlements are called trade-based or production-based entitlements.

Per this proposed view, famines are precipitated due to a breakdown in the ability of the person to exchange his entitlements. An example of famines due to FEE is the inability of an agricultural laborer to exchange his primary entitlement, i.e., labor for rice when his employment became erratic or was completely eliminated. According to the Physicians for Social Responsibility (PSR), global climate change is additionally challenging the Earth's ability to produce food, potentially leading to famine. Some elements make a particular region more vulnerable to famine. These include poverty, population growth, an inappropriate social infrastructure, a suppressive political regime, and a weak or under-prepared government. According to a FEWSNET report, "Famines are not natural phenomena, they are catastrophic political failures."

Climate and Population Pressure
Thomas Malthus's Essay on the Principle of Population has made popular the theory that many famines are caused by imbalance of food production compared to the large populations of countries whose population exceeds the regional carrying capacity. However, Professor Alex de Waal, Executive Director of the World Peace Foundation, refutes the Malthus theory, looking instead to political factors as major causes of recent (over the last 150 years) famines. Historically, famines have occurred from agricultural problems such as drought, crop failure, or pestilence. Changing weather patterns, the ineffectiveness of medieval governments in dealing with crises, wars, and epidemic diseases such as the Black Death helped to cause hundreds of famines in Europe during the Middle Ages, including 95 in Britain and 75 in France. In France, the Hundred Years' War, crop failures and epidemics reduced the population by two-thirds. The failure of a harvest or change in conditions, such as drought, can create a situation whereby large numbers of people continue to live where the carrying capacity of the land has temporarily dropped radically.

Famine is often associated with subsistence agriculture. The total absence of agriculture in an economically strong area does not cause famine; Arizona and other wealthy regions import the vast majority of their food, since such regions produce sufficient economic goods for trade. Famines have also been caused by volcanism. The 1815 eruption of the Mount Tambora volcano in Indonesia caused crop failures and famines worldwide and caused the worst famine of the 19th century. The current consensus of the scientific community is that the aerosols and dust released into the upper atmosphere causes cooler temperatures by preventing the sun's energy from reaching the ground. The same mechanism is theorized to be caused by very large meteorite impacts to the extent of causing mass extinctions.

Famine Prevention

Relief technologies, including immunization, improved public health infrastructure, general food rations and supplementary feeding for vulnerable children, has provided temporary mitigation to the mortality impact of famines, while leaving their economic consequences unchanged, and not solving the underlying issue of too large a regional population relative to food production capability. Humanitarian crises may also arise from genocide campaigns, civil wars, refugee flows and episodes of extreme violence and state collapse, creating famine conditions among the affected populations. Despite repeated stated intentions by the world's leaders to end hunger and famine, famine remains a chronic threat in much of Africa, Eastern Europe, the Southeast, South Asia, and the Middle East.

In July 2005, the Famine Early Warning Systems Network labelled Niger with emergency status, as well as Chad, Ethiopia, South Sudan, Somalia and Zimbabwe. In January 2006, the United Nations Food and Agriculture Organization warned that 11 million people in Somalia,[Kenya, Djibouti and Ethiopia were in danger of starvation due to the combination of severe drought and military conflicts. In 2006, the most serious humanitarian crisis in Africa was in Sudan's region Darfur. Frances Moore Lappé, later co-founder of the Institute for Food and Development Policy (Food First) argued in Diet for a Small Planet (1971) that vegetarian diets can provide food for larger populations, with the same resources, compared to omnivorous diets.

Noting that modern famines are sometimes aggravated by misguided economic policies, political design to impoverish or marginalize certain populations, or acts of war, political economists have investigated the political conditions under which famine is prevented. Economist Amartya Sen states that the liberal institutions that exist in India, including competitive elections and a free press, have played a major role in preventing famine in that country since independence. Alex de Waal has developed this theory to focus on the "political contract" between rulers and people that ensures famine prevention, noting the rarity of such political contracts in Africa, and the danger that international relief agencies will undermine such contracts through removing the locus of accountability for famines from national governments. The demographic impacts of famine are sharp.

Mortality is concentrated among children and the elderly. A consistent demographic fact is that in all recorded famines, male mortality exceeds female, even in those populations (such as northern India and Pakistan) where there is a male longevity advantage during normal times. Reasons for this may include greater female resilience under the pressure of malnutrition, and possibly female's naturally higher percentage of body fat. Famine is also accompanied by lower fertility.

Famines therefore leave the reproductive core of a population—adult women—lesser affected compared to other population categories, and post-famine periods are often characterized a "rebound" with increased births. Even though the theories of Thomas Malthus would predict that famines reduce the size of the population commensurate with available food resources, in fact even the most severe famines have rarely dented population growth for more than a few years. The mortality in China in 1958–61, Bengal in 1943, and Ethiopia in 1983–85 was all made up by a growing population over just a few years. Of greater long-term demographic impact is emigration: Ireland was chiefly depopulated after the 1840s famines by waves of emigration.

Food Security
Long term measures to improve food security, include investment in modern agriculture techniques, such as fertilizers and irrigation, but can also include strategic national food storage. World Bank strictures restrict government subsidies for farmers, and increasing use of fertilizers is opposed by some environmental groups because of its unintended consequences: adverse effects on water supplies and habitat. The effort to bring modern agricultural techniques found in the Western world, such as nitrogen fertilizers and pesticides, to the Indian Sub-continent, called the Green Revolution, resulted in decreases in malnutrition similar to those seen earlier in Western nations.

This was possible because of existing infrastructure and institutions that are in short supply in Africa, such as a system of roads or public seed companies that made seeds available. Supporting farmers in areas of food insecurity, through such measures as free or subsidized fertilizers and seeds, increases food harvest and reduces food prices. The World Bank and some rich nations press nations that depend on them for aid to cut back or eliminate subsidized agricultural inputs such as fertilizer, in the name of privatization even as the United States and Europe extensively subsidized their own farmers.

Relief
There is a growing realization among aid groups that giving cash or cash vouchers instead of food is a cheaper, faster, and more efficient way to deliver help to the hungry, particularly in areas where food is available but unaffordable. The United Nations' World Food Program (WFP), the biggest non-governmental distributor of food, announced that it will begin distributing cash and vouchers instead of food in some areas, which Josette Sheeran, the WFP's executive director, described as a "revolution" in food aid.

The aid agency Concern Worldwide is piloting a method through a mobile phone operator, Safaricom, which runs a money transfer program that allows cash to be sent from one part of the country to another. However, for people in a drought living a long way from and with limited access to markets, delivering food may be the most appropriate way to help. Fred Cuny stated that "the chances of saving lives at the outset of a relief operation are greatly reduced when food is imported. By the time it arrives in the country and gets to people, many will have died."

US Law, which requires buying food at home rather than where the hungry live, is inefficient because approximately half of what is spent goes for transport. Fred Cuny further pointed out "studies of every recent famine have shown that food was available in-country—though not always in the immediate food deficit area" and "even though by local standards the prices are too high for the poor to purchase it, it would usually be cheaper for a donor to buy the hoarded food at the inflated price than to import it from abroad."

Deficient micronutrients can be provided through fortifying foods. Fortifying foods such as peanut butter sachets (see Plumpy'Nut) have revolutionized emergency feeding in humanitarian emergencies because they can be eaten directly from the packet, do not require refrigeration or mixing with scarce clean water, can be stored for years and, vitally, can be absorbed by extremely ill children. WHO and other sources recommend that malnourished children—and adults who also have diarrhea—drink rehydration solution, and continue to eat, in addition to antibiotics, and zinc supplements.

There is a special oral rehydration solution called ReSoMal which has less sodium and more potassium than standard solution. However, if the diarrhea is severe, the standard solution is preferable as the person needs the extra sodium. Obviously, this is a judgment call best made by a physician, and using either solution is better than doing nothing. Zinc supplements often can help reduce the duration and severity of diarrhea, and Vitamin A can also be helpful.

The World Health Organization underlines the importance of a person with diarrhea continuing to eat, with a 2005 publication for physicians stating: "Food should never be withheld and the child's usual foods should not be diluted. Breastfeeding should always be continued." Ethiopia has been pioneering a program that has now become part of the World Bank's prescribed recipe for coping with a food crisis and had been seen by aid organizations as a model of how to best help hungry nations. Through the country's main food assistance program, the Productive Safety Net Program, Ethiopia has been giving rural residents who are chronically short of food, a chance to work for food or cash. Foreign aid organizations like the World Food Program were then able to buy food locally from surplus areas to distribute in areas with a shortage of food.

Peak Food

Peak production refers to the point at which the growth in production of a crop, animal or other foodstuff begins to slow down. From this time, production will continue to increase but at a decelerating rate. This is the first stage of a process that typically continues with a flattening of production and then a decrease. Peak production is the point at which things begin to go wrong, acting as a warning signal of what is to come.

Peak Food Year The years at what foods reached their peaks.	• 1985 - Maize • 1988 - Rice • 1988 - Fish • 1989 - Dairy	• 1993 - Eggs • 1996 - Meat • 2000 - Vegetables • 2004 - Wheat	• 2004 - Milk • 2006 - Poultry • 2007 - Sugarcane • 2009 - Soybeans	

8 Terrorism

Terrorism is the use of intentionally indiscriminate violence as a means to create terror, or fear, to achieve a financial, political, religious or ideological aim. It is used in this regard primarily to refer to violence against peacetime targets or in war against non-combatants.

Bioterrorism (Biological Threat)

MAN-MADE DISASTERS · Terrorism · Bioterrorism

A biological attack is the intentional release of a pathogen (diseasecausing agent) or biotoxin (poisonous substance produced by a living organism) against humans, plants, or animals. An attack against people could be used to cause illness, death, fear, societal disruption, and economic damage. An attack on agricultural plants and animals would primarily cause economic damage, loss of confidence in the food supply, and possible loss of life. It is useful to distinguish between two kinds of biological agents:

- Transmissible agents that spread from person to person (e.g., smallpox, Ebola) or animal to animal (e.g., foot and mouth disease).
- Agents that may cause adverse effects in exposed individuals but that do not make those individuals contagious to others (e.g., anthrax, botulinum toxin).

Availability of Agents

The Centers for Disease Control and Prevention (CDC) lists the biothreat agents considered to pose the highest threat (see Table 1). Once obtained, agents must be cultured or grown in quantity and then processed for use in an attack ("weaponized"). Agents can be:

- Isolated from sources in nature. The threat agents in Table 1 are either biotoxins or agents that cause zoonotic diseases (that occur in wildlife and are transmissible to humans)—except for smallpox, which is solely a human disease and has been eradicated from nature.
- Acquired from laboratories or bioweapons stockpile. Smallpox virus is officially studied in only two laboratories in the world. Anthrax is widely studied in labs. Hemorrhagic fever viruses are studied only in limited high-security locations. Most high threat agents had been studied and stockpiled in bioweapons programs outside the United States until as recently as the 1990s.
- Synthesized or genetically manipulated in a laboratory. This would require expertise and access to advanced technology

How Biological Agents Could Be Disseminated

For an attack on people, biological agents could be disseminated in one or more of the following ways:

- Aerosol dissemination is the dispersal of an agent in air from sprayers or other devices. The agent must be cultured and processed to the proper size to maximize human infections, while maintaining the agent's stability and pathogenicity (ability to produce illness). An aerosol attack might take place outdoors in a populated area or indoors, e.g., in the ventilation system of a building, in the subway, on planes. It takes expertise to process biological agents to maximize the effect of aerosol dissemination, but even relatively crude devices could have an impact.
- Food or water, especially ready-to-eat food (vegetables, salad bars) could be intentionally contaminated with pathogens or toxins. The water supply is less vulnerable because dilution, filtration, and the addition of chlorine can kill most disease-causing organisms.
- Human carriers could spread transmissible agents by coughing, through body fluids, or by contaminating surfaces. Most agents would make people ill or incapacitated before they become highly contagious, thereby reducing transmission of the disease.
- Infected animals can cause people to become ill through contact with the animals or contaminated animal products.
- Insects naturally spread some agents such as plague bacteria (vector borne illnesses) and potentially could be used in an attack.
- Physically distributed through the U.S. mail or other means.

For an agricultural attack:

- A point introduction of an infected plant or animal or its fluids could spread disease through the rest of the crop or livestock. Agricultural biothreat agents (e.g., foot and mouth disease, avian influenza, soy bean rust, and karnal bunt of wheat) do not have to be aerosolized to be effectively disseminated.

Preparation

- Build an Emergency Supply Kit.
- Make a Family Emergency Plan.
- Check with your doctor to make sure everyone in your family has up-to-date immunizations.
- Consider installing a High-Efficiency Particulate Air (HEPA) filter in your furnace return duct, which will filter out most biological agents that may enter your house.

Table 1

Diseases/Agents Listed by the CDC as Potential Bioterror Threats (as of March 2005)

CATEGORY A: Easily disseminated and/or contagious; high mortality rates; might disrupt society; requires special action for public health preparedness.

Bacteria (single-celled organisms):
- Anthrax (Bacillus anthracis)
- Plague (Yersinia pestis)
- Tularemia (Francisella tularensis)

Viruses (DNA or RNA requiring other host cells to replicate):
- Smallpox (Variola major virus)
- Viral Hemorrhagic Fevers: Ebola, Marburg, Lassa,
- Machupo (various families of viruses)

Biotoxins (poisonous substances produced by living organisms):
- Botulism (Clostridium botulinum toxin)

CATEGORY B: Moderately easy to disseminate; moderate illness rates, low mortality; requires enhanced diagnostic capacity, surveillance.

Bacteria:
- Brucellosis (Brucella species)
- Glanders (Burkholderia mallei)
- Melioidosis (Burkholderia pseudomallei)
- Psittacosis (Chlamydia psittaci)
- Food safety threats (e.g., Salmonella species, Escherichia coli O157:H7, Shigella)
- Water safety threats (e.g., Vibrio cholerae, Cryptosporidium parvum)

Viruses:
- Viral encephalitis (Alphaviruses)

Rickettsia (micro-organisms that live in cells):
- Q fever (Coxiella burnetii)
- Typhus fever (Rickettsia prowazekii)

Biotoxins:
- Epsilon toxin of Clostridium perfringens
- Ricin toxin from castor beans
- Staphylococcal enterotoxin B

CATEGORY C: Emerging infectious diseases that could be a future threat. (not all-inclusive)

Viruses:
- Examples are Nipah virus and Hantavirus

Table 2

Onset, Health Impacts, and Treatments for Some Agents of Concern.

Disease (agent)	Incubation Period	Symptoms
HIGH THREAT AGENTS		
Anthrax (Bacillus anthracis) (inhalational)	Typically 1–6 days, but up to 42	Fever, cough, profound sweats malaise, fatigue, myalgiaus
Plague (Yersinia pestis)	1–7 days (usually 2–3 days)	Fever, cough, shortness of breath, sore lymph nodes
Tularemia (Francisella tularensis)	1–21 days (avg 3–6)	Fever, cough, pneumonia, headache
Marburg (Viral hemorrhagic fever)	4–21 days	Sudden onset, fever, headache, followed by vomiting and diarrhea, rash, generalized bleeding in severe cases
Ebola (Viral hemorrhagic fever)	4–21 days	Sudden onset, fever, headache, followed by vomiting and diarrhea, rash, generalized bleeding in severe cases
Smallpox (Variola major virus)	7–17 days (avg 12)	Fever, aches, after 2–4 days rash appears
Botulism (Clostridium botulinum toxin)	12 hours–5 days	Muscle paralyzing illness
LOWER THREAT AGENTS		
Cholera (Vibrio cholerae)	4 hours–5 days (usually 2–3 days)	Sudden onset of voluminous watery diarrhea, vomiting, cramps, dehydration
Glanders (Burkholderia mallel)	1–14 days via aerosol	Pneumonia with or without blood poisoning, ulcers in nose, mouth, throat and lungs
Q fever (Coxiella burnetii)	7–41 days	Flu-like illness that can lead to pneumonia and hepatitis
Encephalitis (Alphaviruses)	2–6 days	Fever, aches, pain behind the eye, nausea, vomiting
Ricin (Ricinus communis)	18–24 hours	Can shut down organ function

Impact of a Pathogen Release

• Detection of a Biological Attack
Unlike a chemical or nuclear attack, a biological attack may go undetected for hours, days, or potentially weeks (depending on the agent) until people, animals, or plants show symptoms of disease. If there are no immediate signs of the attack as with the anthrax letters, a biological attack will probably first be detected by local health care workers observing a pattern of unusual illness or by early warning monitoring systems that detect airborne pathogens. Evidence of an attack may appear in animals before humans.

• The Area Affected
For an aerosol release, the area affected would depend on the quantity of agent released, whether the release is indoors or outdoors, and weather conditions. Agents released outdoors would disperse roughly in the direction of the prevailing wind and could degrade with sunlight and by drying out from environmental exposure. Agents released indoors could initially have a higher concentration. Sometimes agents can be re-aerosolized by machinery, foot traffic, or other means.

• Finding the Cause and Source of Illness
There may be uncertainties about crucial facts such as the exact location or extent of the initial release, the type of biological agent used, and likelihood of additional releases. Laboratory scientists will work quickly to identify the specific agent. Epidemiologists will attempt to trace the path of infections back toward a single person, vector (insect or animal), vehicle (food or water), or other point of origin. Attribution of a biological attack is typically much more difficult than attribution of a conventional terrorist attack.

Dangers

Impact on Human Health
Biothreat agents have the potential to produce a life-threatening illness. Biotoxins are essentially poisons that can be fatal at high enough doses. Table 2 lists health impacts and medical treatments for the Category A and some Category B agents. Even a small amount of some biothreat agents released in air could result in significant loss of life, depending on a number of factors that include the:
- Infectivity of the agent (how many particles are needed to cause illness).
- Lethality of the agent.
- Length of time it takes to detect and treat those who are exposed or have become ill.

Dose Response in Humans
The exact infectious dose (the number or organisms needed to make one sick) of most biological agents is unknown; approximate doses are extrapolated from animal studies. Whether a person becomes ill after exposure to a biological agent depends on a number of factors including:
- Type and amount of agent taken into the body.
- Duration of exposure.
- Route of exposure (inhalation, ingestion, insect bite).
- “Host” factors (e.g., age, immune status, other illnesses of the person exposed).

MAN-MADE DISASTERS Terrorism Bioterrorism Dangers

Differences in Intentional vs. Natural Outbreaks of Disease
Naturally occurring outbreaks of category A agents have become rare because of improved living standards, hygiene, and health services in developed nations. For example, human bubonic plague,which was transmitted by rats and fleas to humans in past centuries resulting in large losses of life, has virtually been wiped out. However, agents used in an aerosol attack may act differently than naturally occurring outbreaks and could produce a form of the disease with a shorter time of onset of illness, making timely diagnosis, treatment, and containment more difficult.

Spread of Diseases
Some transmissible (contagious) diseases can spread through respiratory droplets from coughing and sneezing or when a person comes in contact with a surface harboring a virus or bacteria and then touches their mouth or nose. The viral hemorrhagic fevers and cholera are spread by direct contact with body fluids or feces. People infected with contagious diseases may widely disseminate the disease by travel.

Psychological Impact
Psychological responses following a bioterrorism event may include anger, fear, and social isolation. Following the 2001 anthrax attacks, thousands of people who thought they were infected sought treatment. Trying to distinguish those who haven't been infected could complicate medical centers' ability to treat those who have been exposed and infected, especially when diagnoses are unclear.

Protection

During a declared biological emergency:
1. People in the group or area that authorities have linked to exposure who have symptoms that match those described should seek emergency medical attention.
2. Use common sense, practice good hygiene and cleanliness to avoid spreading germs.

People who are potentially exposed should:
1. Follow instructions of health care providers and other public health officials.
2. Expect to receive medical evaluation and treatment. Be prepared for long lines. If the disease is contagious, persons exposed may be quarantined.

If people become aware of a suspicious substance nearby, they should:
1. Quickly get away.
2. Cover their mouths and noses with layers of fabric that can filter the air but still allow breathing.
3. Wash with soap and water.
4. Contact authorities.
5. Watch TV, listen to the radio, or check the Internet for official news and information including the signs and symptoms of the disease, if medications or vaccinations are being distributed, and where to seek medical attention if they become sick.
6. Seek emergency medical attention if they become sick.

Medical Treatment
Table 2 lists general medical treatments for several biothreat agents. In general, bacterial illnesses are treated with antibiotics, and viral illnesses are treated with supportive care, although there are a few specific medications to treat viral infections. Biotoxins are treated with antidotes or antitoxins, if available. Vaccines can prevent or mitigate the effects of a disease. The smallpox vaccine may provide protection even if given 1–4 days after exposure, and the anthrax vaccine can be given after inhalation exposure if accompanied by treatment with antibiotics for a number of weeks.

Controlling the Spread of Contagious Diseases
Methods to control contagious disease include isolation, quarantine, barrier methods (gloves, filter masks, eye protection), and hand washing. Rapid identification of potentially infected persons increases the effectiveness of these methods.

Long Term Consequences

Monitoring and Clean-up
After a biological agent has been identified, officials will take steps to characterize how long the agent will persist. Clean-up within buildings may entail the use of gas or liquid decontaminants to kill the agent. For example, chlorine dioxide gas was released through ventilation systems of buildings contaminated with anthrax. In some cases, multiple rounds of decontamination may be necessary. Decisions regarding how much clean-up is necessary will depend on:
● The amount of agent released.
● How far the agent has spread.
● How the space will be used following clean-up.

Long-term Health Consequences Following Exposure
The long-term health consequences for those who survive exposure to biological attack agents are unknown. A long-term medical surveillance program would likely be established to monitor potential health effects of those exposed.

Economic Impact of an Agricultural Attack
Once detected, an act of agricultural bioterrorism may quickly halt the movement and export of livestock or the affected crop, resulting in potentially severe economic consequences for producers, shippers, and consumers. It may also disrupt normal travel and commerce.

Anthrax

People in areas where anthrax is released would also need to know how to get antibiotics, how to create a family medical history, and how to recognize the symptoms of anthrax. In some cases, you may be able to pick up antibiotics for others in your household. If you live with family members, it's important to keep a medical history for each person in your family, including:

● Medical conditions
● Allergies
● Any medicines they are taking
● Each child's weight

Exposure

What to Do if You Think You Have Been Exposed to Anthrax
If you think you may have been exposed to anthrax, you need to go to a doctor right away and explain why you think you may have been exposed. Doctors can prescribe antibiotics to prevent you from getting sick. There is no test a doctor can give you that determines if you have been exposed to anthrax. The only way exposures can be determined is through a public health investigation.

If you already have symptoms of anthrax, it's important to get medical care as quickly as possible to have the best chances for a full recovery.

Anthrax is NOT contagious. You cannot catch anthrax from another person the way you might catch a cold or the flu. In rare cases, person-to-person transmission has been reported with cutaneous anthrax, where discharges from skin lesions might be infectious.

Symptoms

MAN-MADE DISASTERS Terrorism Bioterrorism Anthrax

The symptoms of anthrax depend on the type of infection and can take anywhere from 1 day to more than 2 months to appear. All types of anthrax have the potential, if untreated, to spread throughout the body and cause severe illness and even death.

Cutaneous anthrax symptoms can include:
- A group of small blisters or bumps that may itch
- Swelling can occur around the sore
- A painless skin sore (ulcer) with a black center that appears after the small blisters or bumps
  - Most often the sore will be on the face, neck, arms, or hand

Inhalation anthrax symptoms can include:
- Fever and chills
- Chest Discomfort
- Shortness of breath
- Confusion or dizziness
- Cough
- Nausea, vomiting, or stomach pains
- Headache
- Sweats (often drenching)
- Extreme tiredness
- Body aches

Gastrointestinal anthrax symptoms can include:
- Fever and chills
- Swelling of neck or neck glands
- Sore throat
- Painful swallowing
- Hoarseness
- Headache, Nausea and vomiting, especially bloody vomiting
- Diarrhea or bloody diarrhea
- Flushing (red face) and red eyes
- Stomach pain
- Fainting
- Swelling of abdomen (stomach)

Injection anthrax symptoms can include:
- Fever and chills
- A group of small blisters or bumps that may itch, appearing where the drug was injected
- A painless skin sore with a black center that appears after the blisters or bumps
- Swelling around the sore
- Abscesses deep under the skin or in the muscle where the drug was injected

Injection anthrax symptoms are similar to those of cutaneous anthrax, but injection anthrax can spread throughout the body faster and be harder to recognize and treat than cutaneous anthrax. Skin and injection site infections associated with injection drug use are common and do not necessarily mean the person has anthrax.

Antibiotics

Antibiotics can prevent anthrax from developing in people who have been exposed but have not developed symptoms. Antibiotics work in two main ways, by killing the anthrax or by stopping the anthrax from growing. When the anthrax can't grow anymore, it dies. Two of the antibiotics that could be used to prevent anthrax are:

- Ciprofloxacin
- Doxycycline

Each of these antibiotics offers the same protection against anthrax. Anthrax spores typically take 1 to 7 days to be activated, but some spores can remain inside the body and take up to 60 days or more before they are activated. Activated spores release toxins—or poisons—that attack the body, causing the person to become sick. That's why people who have been exposed to anthrax must take antibiotics for 60 days. This will protect them from any anthrax spores in their body when the spores are activated.

Anthrax spores can take up to 60 days or more to be activated in the body, therefore you should take antibiotics for the full 60 days.

What is the usual dose of doxycycline for PEP of anthrax?
The full PEP regimen is 60 days. During an anthrax emergency, recipients may receive an initial 10-day supply to begin doxycycline therapy; public health officials will announce whether recipients need more doxycycline and how to get additional quantities of the drug.

- Children weighing 76 lbs (35 kg) or more and Adults (≥ 18 years): Take one tablet (100 mg) by mouth every 12 hours (one tablet in the morning and one tablet in the evening) each day with a full glass of water (with or without food or milk). For those who cannot swallow tablets, provide the crushing and mixing directions (which can also be found by searching "doxycycline crushing instructions" on www.cdc.gov). These instructions are appropriate only for 100 mg tablets.
- Children weighing less than 76 lbs (35 kg): Weight-based dosing (2.2 mg/kg) every 12 hours (one dose in the morning and one dose in the evening) each day. Provide the crushing and mixing directions (which can also be found by searching "doxycycline crushing instructions" on www.cdc.gov). These instructions are appropriate only for 100 mg tablets.

- Children weighing less than 30 lbs (14kg): Children weighing less than 30 lbs (14 kg) should receive priority for doxycycline oral suspension, dosed by weight every 12 hours (one dose in the morning and one dose in the evening) each day. For convenience, the table below provides dosing by weight-range based on 2.2 mg/kg derived calculation.3 Doses in the table below are specific to doxycycline powder for oral suspension in the 25 mg/5 mL concentration only.

  - Follow the instructions provided with the oral suspension to mix the doxycycline powder with water before dispensing the drug to the recipient. Write the dose on the bottle and mark the dose with a line on the oral syringe.
  - Tell the recipient to shake the oral suspension very well (15 seconds) before each use.

Smallpox

Thanks to a successful worldwide vaccination effort in the 20th century, smallpox has been wiped out. No one has gotten smallpox naturally since 1977. However, it is possible that variola virus (the virus that causes smallpox) could be used in a biological attack (an intentional release of viruses, bacteria, or other germs that can sicken or kill people, livestock, or crops). Public health authorities prepare for a possible but unlikely biological attack that uses smallpox as a weapon.

There is no immediate, direct threat of a bioterrorist attack using smallpox. No bioterrorist attack using smallpox has happened in modern times. Throughout history, though, some people have used smallpox to their advantage by deliberately infecting their enemies with the disease.

Why is Smallpox a Concern?
Public health authorities are concerned about smallpox because it is a serious—even deadly—disease. Today, there are only two labs in the world that are approved to have the smallpox virus for research: the Centers for Disease Control and Prevention (CDC) in the United States and the Russian State Centre for Research on Virology and Biotechnology in the Russian Federation.

There is credible concern that in the past some countries made the virus into weapons, which may have fallen into the hands of terrorists or other people with criminal intentions. The last natural outbreak of smallpox in the United States happened in 1949. The last naturally spread case in the entire world happened in 1977. The World Health Assembly declared smallpox eradicated in 1980. Even a single confirmed case of smallpox today would be considered an emergency.

If the virus that causes smallpox were used in a bioterrorist attack, people who come into contact with the virus would be at risk of getting sick. By 1972, the smallpox vaccine was no longer given routinely in the United States. As a result, most people born in the United States after 1972 have not been vaccinated against the disease. Some people have been vaccinated through the military or because they were part of Smallpox Response Teams that were formed after the 9/11 terrorist attacks. These vaccination efforts are part of the larger plan to prepare for a bioterrorist attack. However, the vaccine does not give lifelong immunity, and people who have been vaccinated against smallpox before may still need to be revaccinated in a smallpox emergency.

Glanders

Glanders is a disease that usually affects horses, donkeys, and mules. While the disease still occurs in certain parts of the world, no animal in the United States has gotten sick with glanders since the 1940s. Though not common, people have gotten glanders from sick animals. People who are in close contact with animals that have glanders are more likely to get the disease than those who are not.

In the past, the germs that cause glanders, the bacteria called Burkholderia mallei, have been used as a biological weapon during war. It is possible that these germs could be used again in a biological attack. A biological attack is the intentional release of germs that can sicken or kill people, livestock, or crops. Public health authorities study this disease to be prepared if a biological attack ever happens.

Why might glanders be used as a weapon?
If people or groups wanted to use germs as a weapon, they might use the germs that causes glanders because they:

Cause a disease that can make people very sick. Without prompt treatment with specific antibiotics, people sick with glanders can die.
Cause a disease that is rare and not well-known, which might make it more difficult for healthcare providers to diagnose a person with glanders quickly and accurately.
Have been used as a biological weapon in the past.

How dangerous is glanders?
Glanders can be a serious disease. Without treatment with specific antibiotics, as many as 9 of every 10 people who get it die. When people with glanders get treatment with the correct antibiotics, up to 5 of 10 people die.

People sick with glanders often need to be hospitalized for treatment. Even after they are well enough to go home, people who have had glanders need to take antibiotics for several months. This long period of treatment makes sure the antibiotics kill all the glanders germs in the person's body and prevents the disease from coming back.

It can also be difficult to diagnose glanders quickly. The symptoms of glanders are the same as more common diseases like community-acquired pneumonia, the flu, or tuberculosis. Only a few people are diagnosed with glanders each year in the entire world. Because glanders in humans is so rare, most doctors are unfamiliar with the disease.

What might an attack with glanders look like?
A biological attack that releases glanders germs into the air, water, or food supply might put many people at risk for getting sick. For example, if the germs that cause glanders were released into the air in a crowded place, many people might inhale them. Or, if the germs were put into food, people who eat the contaminated food would eat the germs, too. Anyone who comes into contact with these germs is in danger of getting sick with glanders.

It might not be known right away that there had been an attack because you cannot see, smell, or taste the germs. An attack might not be noticed until doctors begin to see many people sick with fevers and respiratory illnesses. Once doctors diagnose patients with glanders, they will work with public health authorities to find out how the patients came into contact with the glanders germs.

Melioidosis

Melioidosis is a disease caused by germs that occur naturally in certain parts of the world, such as Southeast Asia and northern Australia. The only place these germs, called Burkholderia pseudomallei, occur naturally in the United States is Puerto Rico. Usually, people in the United States (outside of Puerto Rico) who get the disease have traveled and come into contact with the germs in one of these places where they occur naturally. One reason public health authorities study the disease is because it is possible that the germs that cause melioidosis might be used in a biological attack. A biological attack is the intentional release of germs that can sicken or kill people, livestock, or crops.

Why might germs that cause melioidosis be used as a weapon?
If people or groups wanted to use germs as a weapon, they might use the germs that cause melioidosis because:

- They are found in nature in certain parts of the world.
- They cause a disease that can make people very sick. Without prompt treatment with specific antibiotics, people sick with melioidosis can die.
- In the past, some countries that have used bioweapons during war have used germs closely related to the one that causes melioidosis.

How dangerous is melioidosis?
Melioidosis can be a serious disease. Melioidosis germs are naturally resistant to many commonly used antibiotics, which makes the disease difficult to treat. There are a few antibiotics that are effective, though. Without treatment, up to 9 out of every 10 people who get it die. When people with melioidosis get treatment with the correct antibiotics, fewer than 4 out of 10 people die. Medical treatment in an intensive care facility can decrease deaths even more. Only 2 out of 10 people die when they get this level of medical treatment.

People with certain medical conditions are more likely than others to get melioidosis if they come into contact with the germs that cause it. Some of these conditions are diabetes, heavy alcohol use, chronic lung disease, chronic kidney disease, and others that affect the immune system.

People sick with melioidosis frequently need to be hospitalized for treatment. Even after they are well enough to go home, people who have had melioidosis need to take antibiotics for several months. This long period of treatment makes sure the antibiotics kill all the melioidosis germs in the person's body and prevents the disease from coming back.

It can also be hard to diagnose melioidosis quickly. The symptoms of melioidosis are the same as more common diseases like community-acquired pneumonia, the flu, or tuberculosis. There are only a few people diagnosed with melioidosis each year in the United States. Those who get melioidosis usually come into contact with the germs that cause it when they are traveling or living in a country where it is found naturally. Because there are so few people in the United States who get melioidosis, most doctors are unfamiliar with the disease.

During a Biological Threat

The first evidence of an attack may be when you notice symptoms of the disease caused by exposure to an agent. In the event of a biological attack, public health officials may not immediately be able to provide information on what you should do. It will take time to figure out exactly what the illness is, how it should be treated and who is in danger.

During a Threat

- Watch TV, listen to the radio or check the Internet for official news and information including:
  - Signs and symptoms of the disease
  - Areas in danger
  - If medications or vaccinations are being distributed
  - Where to seek medical attention if you become ill
- If you become aware of a suspicious substance, quickly get away.

- Cover your mouth and nose with layers of fabric that can filter the air but still allow breathing. Examples include two to three layers of cotton such as a t-shirt, handkerchief or towel.
- Depending on the situation, wear a face mask to reduce inhaling or spreading germs.
- If you have been exposed to a biological agent, remove and bag your clothes and personal items. Follow official instructions for disposal of contaminated items.
- Wash yourself with soap and water and put on clean clothes.
- Contact authorities and seek medical assistance. You may be advised to stay away from others or even to quarantine.
- If your symptoms match those described and you are in the group considered at risk, immediately seek emergency medical attention.
- Follow the instructions of doctors and other public health officials.
- Avoid crowds.
- Wash your hands with soap and water frequently.
- Do not share food or utensils.

After a Biological Threat

Pay close attention to all official warnings and instructions on how to proceed. Medical services for a biological event may be handled differently due to increased demand. The basic procedures and medical protocols for handling exposure to biological agents are the same as for any infectious disease.

Chemical Threat

Modern Terrorism History

A list of some of the biggest modern history terrorist attacks.

Event	Country	Date	Deaths	Perpetrator
Cinema Rex Fire	Iran	1978	420	Unknown
Air India Flight 182 Bombing	Canada	1985	329	Babbar Khalsa
1990 Massacre of Sri Lankan Police Officers	Sri Lanka	1990	774	LTTE
Oklahoma City Bombing	United States	1995	168	Timothy McVeigh and Terry Nichols
September 11 Attacks	United States	2001	2,996	al-Qaeda
2007 Yazidi Communities Bombings	Iraq	2007	795+	Unknown
2008 Christmas Massacres	Uganda	2008	620	Lord's Resistance Army
Camp Speicher Massacre	Iraq	2014	1,566+	Islamic State of Iraq and the Levant
Baga Massacre	Baga, Borno State, Nigeria	Jan 3-7 2015	150+	Boko Haram
Bombing	Sinai, Egypt	31 Oct 2015	224	Islamic State
Bombing	Baghdad, Iraq	3 July 2016	342+	Islamic State
Suicide truck bombing	Mogadishu, Somalia	14 Oct 2017	655	Al-Shabaab (Suspected)
Car bombing and shooting	Bir al-Abed, Egypt	24 Nov 2017	311	Islamic State
Suicide bombings, shootings, hostage taking	As-Suwayda	25 Jul 2018	255	Islamic State

Civil Disorder

A form of collective violence interfering with the peace, security, and normal functioning of the community.

Political Terrorism

Violent criminal behaviour designed primarily to generate fear in the community, or substantial segment of it, for political purposes.

Non-Political Terrorism

Terrorism that is not aimed at political purposes but which exhibits "conscious design to create and maintain a high degree of fear for coercive purposes, but the end is individual or collective gain rather than the achievement of a political objective".

Quasi-Terrorism

The activities incidental to the commission of crimes of violence that are similar in form and method to genuine terrorism but which nevertheless lack its essential ingredient. It is not the main purpose of the quasi-terrorists to induce terror in the immediate victim as in the case of genuine terrorism, but the quasi-terrorist uses the modalities and techniques of the genuine terrorist and produces similar consequences and reaction. For example, the fleeing felon who takes hostages is a quasi-terrorist, whose methods are similar to those of the genuine terrorist but whose purposes are quite different.

Limited Political Terrorism

Genuine political terrorism is characterized by a revolutionary approach; limited political terrorism refers to "acts of terrorism which are committed for ideological or political motives but which are not part of a concerted campaign to capture control of the state".

Official or State Terrorism

Referring to nations whose rule is based upon fear and oppression that reach similar to terrorism or such proportions. It may be referred to as Structural Terrorism defined broadly as terrorist acts carried out by governments in pursuit of political objectives, often as part of their foreign policy.

9 Cyberattack

In computers and computer networks an attack is any attempt to expose, alter, disable, destroy, steal or gain unauthorized access to or make unauthorized use of an asset. A cyberattack is any type of offensive maneuver that targets computer information systems, infrastructures, computer networks, or personal computer devices. An attacker is a person or process that attempts to access data, functions or other restricted areas of the system without authorization, potentially with malicious intent. Depending on context, cyberattacks can be part of cyberwarfare or cyberterrorism. A cyberattack can be employed by sovereign states, individuals, groups, society or organizations, and it may originate from an anonymous source. A product that facilitates a cyberattack is sometimes called a cyberweapon.

A cyberattack may steal, alter, or destroy a specified target by hacking into a susceptible system. Cyberattacks can range from installing spyware on a personal computer to attempting to destroy the infrastructure of entire nations. Legal experts are seeking to limit the use of the term to incidents causing physical damage, distinguishing it from the more routine data breaches and broader hacking activities. Cyberattacks have become increasingly sophisticated and dangerous.

Attack Types

An attack can be active or passive.
● An "active attack" attempts to alter system resources or affect their operation.
● A "passive attack" attempts to learn or make use of information from the system but does not affect system resources (e.g., wiretapping).
An attack can be perpetrated by an insider or from outside the organization;

● An "inside attack" is an attack initiated by an entity inside the security perimeter (an "insider"), i.e., an entity that is authorized to access system resources but uses them in a way not approved by those who granted the authorization.
● An "outside attack" is initiated from outside the perimeter, by an unauthorized or illegitimate user of the system (an "outsider"). In the Internet, potential outside attackers range from amateur pranksters to organized criminals, international terrorists, and hostile governments.

Passive

● Computer and network surveillance
● Network
  ○ Wiretapping
  ○ Fiber tapping
  ○ Port scan
  ○ Idle scan
● Host
  ○ Keystroke logging
  ○ Data scraping
  ○ Backdoor

Active

● Denial-of-service attack
  ○ DDos or Distributed Denial of service attack is an attempt made by the hacker to block access to a server or a website that is connected to the Internet. This is achieved using multiple computerized systems, which overloads the target system with requests, making it incapable of responding to any query.
● Spoofing
● Mixed threat attack
● Network
  ○ Man-in-the-middle, Man-in-the-browser
  ○ ARP poisoning
  ○ Ping flood & Ping of death
  ○ Smurf attack

- Host
  - Buffer, Heap and Stack overflow
  - Format string attack

Syntactic Attacks

- **Viruses**

A virus is a self-replicating program that can attach itself to another program or file in order to reproduce. The virus can hide in unlikely locations in the memory of a computer system and attach itself to whatever file it sees fit to execute its code. It can also change its digital footprint each time it replicates making it harder to track down in the computer.

- **Worms**

A worm does not need another file or program to copy itself; it is a self-sustaining running program. Worms replicate over a network using protocols. The latest incarnation of worms make use of known vulnerabilities in systems to penetrate, execute their code, and replicate to other systems such as the Code Red II worm that infected more than 259,000 systems in less than 14 hours. On a much larger scale, worms can be designed for industrial espionage to monitor and collect server and traffic activities then transmit it back to its creator.

- **Trojan Horses**

A Trojan horse is designed to perform legitimate tasks but it also performs unknown and unwanted activity. It can be the basis of many viruses and worms installing onto the computer as keyboard loggers and backdoor software. In a commercial sense, Trojans can be imbedded in trial versions of software and can gather additional intelligence about the target without the person even knowing it happening. All three of these are likely to attack an individual and establishment through emails, web browsers, chat clients, remote software, and updates.

Semantic Attacks

Semantic attack is the modification and dissemination of correct and incorrect information. Information modified could have been done without the use of computers even though new opportunities can be found by using them. To set someone into the wrong direction or to cover your tracks, the dissemination of incorrect information can be utilized.

India and Pakistan

There were two such instances between India and Pakistan that involved cyberspace conflicts, started in 1990s. Earlier cyber attacks came to known as early as in 1999. Since then, India and Pakistan were engaged in a long-term dispute over Kashmir which moved into cyberspace. Historical accounts indicated that each country's hackers have been repeatedly involved in attacking each other's computing database system. The number of attacks has grown yearly: 45 in 1999, 133 in 2000, 275 by the end of August 2001. In 2010, Indian hackers laid a cyber attack at least 36 government database websites going by the name "Indian Cyber Army". In 2013, Indian hackers hacked the official website of Election Commission of Pakistan in an attempt to retrieve sensitive database information. In retaliation, Pakistani hackers, calling themselves "True Cyber Army" hacked and defaced ~1,059 websites of Indian election bodies.

Attack Process

Phases of the Intrusion Kill Chain

1. Reconnaissance	Research, identification and selection of targets.
2. Weaponization	Pairing remote access malware with exploit into a deliverable payload. (e.g. Adobe PDF and Microsoft Office files)
3. Delivery	Transmission of weapon to target. (e.g. Via email attachments, websites, links or USB drives)
4. Exploitation	Once delivered, the weapon's code is triggered, exploiting vulnerable applications or systems.
5. Installation	The weapon installs a backdoor on a target's system allowing persistent access.
6. Command & Control	Outside server communicates with the weapons providing "hands on keyboard access" inside the target's network.
7. Actions on Objective	The attacker works to achieve the objective of the intrusion, which can include destruction of data, or intrusion of another target.

Previous Attacks

China

China's People's Liberation Army (PLA) has developed a strategy called "Integrated Network Electronic Warfare" which guides computer network operations and cyberwarfare tools. This strategy helps link together network warfare tools and electronic warfare weapons against an opponent's information systems during conflict. They believe the fundamentals for achieving success is about seizing control of an opponent's information flow and establishing information dominance. The Science of Military and The Science of Campaigns both identify enemy logistics systems networks as the highest priority for cyber-attacks and states that cyberwarfare must mark the start if a campaign, used properly, can enable overall operational success.

Focusing on attacking the opponent's infrastructure to disrupt transmissions and processes of information that dictate decision-making operations, the PLA would secure cyber dominance over their adversary. The predominant techniques that would be utilized during a conflict to gain the upper hand are as follows, the PLA would strike with electronic jammers, electronic deception and suppression techniques to interrupt the transfer processes of information. They would launch virus attacks or hacking techniques to sabotage information processes, all in the hopes of destroying enemy information platforms and facilities.

The PLA's Science of Campaigns noted that one role for cyberwarfare is to create windows of opportunity for other forces to operate without detection or with a lowered risk of counterattack by exploiting the enemy's periods of "blindness", "deafness" or "paralysis" created by cyber-attacks. That is one of the main focal points of cyberwarefare, to be able to weaken your enemy to the full extent possible so that your physical offensive will have a higher percentage of success.

Estonia

The 2007 cyberattacks on Estonia were a series of cyberattacks which began on 27 April 2007 and targeted websites of Estonian organizations, including Estonian parliament, banks, ministries, newspapers and broadcasters, amid the country's disagreement with Russia about the relocation of the Bronze Soldier of Tallinn, an elaborate Soviet-era grave marker, as well as war graves in Tallinn. The attacks triggered a number of military organizations around the world to reconsider the importance of network security to modern military doctrine. The direct result of the cyberattacks was the creation of the NATO Cooperative Cyber Defence Centre of Excellence in Tallinn.

Ethiopia

In an extension of a bilateral dispute between Ethiopia and Egypt over the Grand Ethiopian Renaissance Dam, Ethiopian government websites have been hacked by the Egypt-based hackers in June 2020.

Iran
On 8 February 2020, the telecommunication network of Iran witnessed extensive disruptions at 11:44 a.m. local time, which lasted for about an hour. The Ministry of Information and Communications Technology of Iran confirmed it as a Distributed Denial of Service (DDoS) attack. The Iranian authorities activated the "Digital Fortress" cyber-defense mechanism to repel. Also known as DZHAFA, it led to a drop of 75 percent in the national internet connectivity.

Israel
In April 2020, there were attempts to hack into Israel's water infrastructure of the Sharon central region by Iran, which was thwarted by Israeli cyber defenses. The cyberattack intended to introduce dangerous levels of chlorine into the Israeli water supply.

Russia
During the 2018 FIFA World Cup, Russia countered and stopped around 25 million cyber attacks on IT Infrastructure.
In June 2019, Russia has conceded that it is "possible" its electrical grid is under cyberattack by the United States. The New York Times reported that American hackers from the United States Cyber Command planted malware potentially capable of disrupting the Russian electrical grid.

Ukraine
A series of powerful cyber attacks began 27 June 2017 that swamped websites of Ukrainian organizations, including banks, ministries, newspapers and electricity firms.

Infrastructure Targets

Once a cyber-attack has been initiated, there are certain targets that need to be attacked to cripple the opponent. Certain infrastructures as targets have been highlighted as critical infrastructures in times of conflict that can severely cripple a nation. Control systems, energy resources, finance, telecommunications, transportation, and water facilities are seen as critical infrastructure targets during conflict. A new report on the industrial cybersecurity problems, reportedly has found a 10-fold increase in the number of successful cyber-attacks on infrastructure Supervisory Control and Data Acquisition (SCADA) systems since 2000. Cyberattacks that have an adverse physical effect are known as cyber-physical attacks.

Control Systems	Control systems are responsible for activating and monitoring industrial or mechanical controls. Many devices are integrated with computer platforms to control valves and gates to certain physical infrastructures. Control systems are usually designed as remote telemetry devices that link to other physical devices through internet access or modems. Little security can be offered when dealing with these devices, enabling many hackers or cyberterrorists to seek out systematic vulnerabilities. Paul Blomgren, manager of sales engineering at cybersecurity firm explained how his people drove to a remote substation, saw a wireless network antenna and immediately plugged in their wireless LAN cards. They took out their laptops and connected to the system because it wasn't using passwords. "Within 10 minutes, they had mapped every piece of equipment in the facility," Blomgren said. "Within 15 minutes, they mapped every piece of equipment in the operational control network. Within 20 minutes, they were talking to the business network and had pulled off several business reports. They never even left the vehicle."
Energy	Energy is seen as the second infrastructure that could be attacked. It is broken down into two categories, electricity and natural gas. Electricity also known as electric grids power cities, regions, and households; it powers machines and other mechanisms used in day-to-day life. Using US as an example, in a conflict cyberterrorists can access data through the Daily Report of System Status that shows power flows throughout the system and can pinpoint the busiest sections of the grid. By shutting those grids down, they can cause mass hysteria, backlog, and confusion; also being able to locate critical areas of operation to further attacks in a more direct method. Cyberterrorists can access instructions on how to connect to the Bonneville Power Administration which helps direct them on how to not fault the system in the process. This is a major advantage that can be utilized when cyber-attacks are being made because foreign attackers with no prior knowledge of the system can attack with the highest accuracy without drawbacks. Cyberattacks on natural gas installations go much the same way as it would with attacks on electrical grids. Cyberterrorists can shutdown these installations stopping the flow or they can even reroute gas flows to another section that can be occupied by one of their allies. There was a case in Russia with a gas supplier known as Gazprom, they lost control of their central switchboard which routes gas flow, after an inside operator and Trojan horse program bypassed security.
Finance	Financial infrastructures could be hit hard by cyber-attacks as the financial system is linked by computer systems. Money is constantly being exchanged in these institutions and if cyberterrorists were to attack and if transactions were rerouted and large amounts of money stolen, financial industries would collapse and civilians would be without jobs and security. Operations would stall from region to region causing nationwide economic degradation. In the U.S. alone, the average daily volume of transactions hit $3 trillion and 99% of it is non-cash flow. To be able to disrupt that amount of money for one day or for a period of days can cause lasting damage making investors pull out of funding and erode public confidence. A cyberattack on a financial institution or transactions may be referred to as a cyberheist. These attacks may start with phishing that targets employees, using social engineering to coax information from them. They may allow attackers to hack into the network and put keyloggers on the accounting systems. In time, the cybercriminals are able to obtain password and keys information. An organization's bank accounts can then be accessed via the information they have stolen using the keyloggers. In May 2013, a gang carried out a US$40 million cyberheist from the Bank of Muscat.
Telecommunications	Cyberattacking telecommunication infrastructures have straightforward results. Telecommunication integration is becoming common practice, systems such as voice and IP networks are merging. Everything is being run through the internet because the speeds and storage capabilities are endless. Denial-of-service attacks can be administered as previously mentioned, but more complex attacks can be made on BGP routing protocols or DNS infrastructures. It is less likely that an attack would target or compromise the traditional telephony network of SS7 switches, or an attempted attack on physical devices such as microwave stations or satellite facilities. The ability would still be there to shut down those physical facilities to disrupt telephony networks. The whole idea on these cyber-attacks is to cut people off from one another, to disrupt communication, and by doing so, to impede critical information being sent and received. In cyberwarfare, this is a critical way of gaining the upper-hand in a conflict. By controlling the flow of information and communication, a nation can plan more accurate strikes and enact better counter-attack measures on their enemies.
Transportation	Transportation infrastructure mirrors telecommunication facilities; by impeding transportation for individuals in a city or region, the economy will slightly degrade over time. Successful cyber-attacks can impact scheduling and accessibility, creating a disruption in the economic chain. Carrying methods will be impacted, making it hard for cargo to be sent from one place to another. In January 2003 during the "slammer" virus, Continental Airlines was forced to shut down flights due to computer problems. Cyberterrorists can target railroads by disrupting switches, target flight software to impede airplanes, and target road usage to impede more conventional transportation methods. In May 2015, a man, Chris Roberts, who was a cyberconsultant, revealed to the FBI that he had repeatedly, from 2011 to 2014, managed to hack into Boeing and Airbus flights' controls via the onboard entertainment system, allegedly, and had at least once ordered a flight to climb. The FBI, after detaining him in April 2015 in Syracuse, had interviewed him about the allegations.
Water	Water as an infrastructure could be one of the most critical infrastructures to be attacked. It is seen as one of the greatest security hazards among all of the computer-controlled systems. There is the potential to have massive amounts of water unleashed into an area which could be unprotected causing loss of life and property damage. It is not even water supplies that could be attacked; sewer systems can be compromised too. There was no calculation given to the cost of damages, but the estimated cost to replace critical water systems could be in the hundreds of billions of dollars. Most of these water infrastructures are well developed making it hard for cyber-attacks to cause any significant damage, at most, equipment failure can occur causing power outlets to be disrupted for a short time.

MA	Cy	Inf		**Hospitals**	Hospital as an infrastructure is one of the major assets to have been impacted by cyberattacks. These attacks could "directly lead to deaths." The cyberattacks are designed to deny hospital workers access to critical care systems. Recently, there has been a major increase of cyberattacks against hospitals amid covid-19 pandemic. Hackers lock up a network and demand ransom to return access to these systems. The ICRC and other human rights group have urged law enforcement to take "immediate and decisive action" to punish such cyberattackers.

Personal Disasters

Disasters that can happen to you and your family personally

"You don't learn to fly if you're not prepared to crash."
Joe Brooks

Introduction

Personal Disasters typically only affect one household or one person, but can change that person's life forever. A personal crisis occurs when an individual can no longer cope with a situation. Personal disasters often come by surprise and have life-altering impacts and effects that can last decades.

Purpose	The aim of PERSONAL DISASTERS is to help the reader through any personal disasters they may be facing, such as house fires, bankruptcies, car crashes, illness and injuries, separation and abuse. It also contains a disaster recovery section which is aimed at providing useful goals in the event you are separated from society after an event such as a plane crash.
Lost?	• For information on minor acts of nature which could affect you personally, see the METEOROLOGY section. • See the MAN-MADE DISASTERS section for slightly larger personal disasters which affect more than a few people. • See the NATURAL DISASTERS section for information on catastrophies caused by nature. • For a distraction from the current turmoil of the world, see the ENTERTAINMENT section.

Contents

1 Property Loss

House Loss / Fire

A loss of an entire home and most assets inside is devastating and can make it impossible to recoup the loss without insurance.

Theft / Mugging

These can cause permanent trauma and an insecurity in public spaces.

PERSONAL DISASTERS

Property Lo

Vehicle Collision / Crash

Any form of vehicle crash such as a car, plane or boat - even if there's no physical injuries.

2 Illness & Injury

Death / Suicide

Traumatic grief and/or separation may include the death of a parent, primary caretaker, or sibling; abrupt and/or unexpected, accidental, or premature death or homicide of a close friend, family member, or other close relative.

Illness / Injury

Trauma can occur when a person experiences an unintentional injury or accident, a physical illness, or medical procedures that are extremely painful and/or life threatening.

3 Money

Bankruptcy

Bankruptcy is a legal process where you're declared unable to pay your debts. Your trustee can sell your assets including your house and property.

Job Loss

A job loss can be felt immediately and cause worry about how you will feed your family or whether you will lose your house.

Legal Conflict

An abrupt legal case for battle for possessions or being sued for cash.

4 Abuse

Physical Abuse / Assault

Physical abuse or assault is defined as the actual or attempted infliction of physical pain (with or without the use of an object or weapon), including the use of severe corporeal punishment. Federal law defines child abuse as any act, or failure to act, which results in death, serious physical or emotional harm, sexual abuse, or exploitation of a child.

Sexual Abuse / Rape

Sexual abuse or assault includes unwanted or coercive sexual contact, exposure to age-inappropriate sexual material or environments, and sexual exploitation. Any type of sexual contact or behaviour that occurs without the explicit consent of the recipient.

Emotional Abuse

Emotional abuse and psychological maltreatment are considered acts of commission (other than physical or sexual abuse) against an individual. These kinds of acts, which include verbal abuse, emotional abuse, and excessive demands or expectations, may cause an individual to experience conduct, cognitive, affective, or other mental disturbances.

Bullying

Bullying is unwanted, aggressive behaviour among school-aged children that involves a real or perceived power imbalance. The behaviour is repeated, or has the potential to be repeated, over time. Both kids who are bullied and who bully others may experience serious, lasting problems. Trauma can be a consequence of bullying, which can lead to mental health issues, substance use, and suicide, particularly if there is a prior history of depression or delinquency.

5 Trauma

Historical Trauma

Historical trauma is a form of trauma that impacts entire communities. It refers to the cumulative emotional and psychological wounding, as a result of group traumatic experiences, that is transmitted across generations within a community. Unresolved grief and anger often accompany this trauma and contribute to physical and behavioural health disorders. This type of trauma is often associated with racial and ethnic population groups in the United States who have suffered major intergenerational losses and assaults on their culture and well-being.

War / Terrorism / Violence

Exposure to acts of war-, terrorism-, or political-related violence such as bombing, shooting, and looting can cause trauma in an individual.

Military Trauma

Military trauma refers to both the impact of deployment and trauma-related stress on people who are deployed and their families. Significant numbers of returning service men and women experience mental and/or substance use disorders associated with military trauma and/or military sexual trauma.

6 Separation

Parent / Caretaker Separation

Abrupt, unexplained and/or indefinite separation from a parent, primary caretaker, sibling or possession due to uncontrollable circumstances.

Losing Friends

Losing close friends.

Losing Treasured Possessions

People can often feel a very strong attachment to items they treasure or which have an extremely sentimental value. This can be heartbreaking if you lose the item such as if it's destroyed in a fire, stolen or you're forced to part with it. Items may include gifts from lovers, rare valuables, childhood items, religious symbols, achievements, items from deceased people, collectables or photos of family. Nothing lasts forever and eventually every item will be destroyed in one way or another.

In some circumstances it's possible to recover the possessions you have lost. Below is a list of how this is possible.

Possession Loss	Recovery Options	Coping with the Loss
Theft	The police may be able to assist in the recovery of an item if you can provide enough information.	Generally thieves go for items which have a high value, so it's usually possible to purchase the item again after you save your money.
Lost / Missing	If an item is missing there is still the option you will find it again. Try to retrace your steps or stop and think where it could be. Look in places you haven't considered before.	Until you find the item, or have clear evidence it has been destroyed or stolen then there is always hope that you will find it again.
Burnt / Destroyed	There's little you can do to recover the item in this case. If it's partially burnt you may be able to recover some of the item.	At least you still have what's left of the item in your possession. Your only other option would be to recreate it or find something of similar sentimental value.

Forced Selling	Sometimes you are forced to sell an item because you're low on money. If you still have the details of the seller, you may be able to buy it back, or if you tell them what it means to you, they might even give it back.	If the buyer won't sell you the item back or return it then you have to accept that it is gone. Try not to dwell on the hope of one day getting it back since that will only cause more pain.
Corrupted	TPE has become corrupted many times and there are usually options you can try to recover the file depending on what file type it is. It's important to keep regular backups of important content, both nearby and off site.	You may need to accept the loss if you cannot recover the data. This may involve having to do a lot of the work over again.
Encrypted	There is always the option of data recovery companies if you can provide the device and any previously known passwords. Be sure to keep the 'key' file if you encrypt anything - which was my mistake.	If you aren't willing to pay to have the item recovered by an encryption service, or you can't afford it, then you may have to accept that those photos/videos/files are gone.
Deleted	Deleted items can usually be recovered if you haven't written more files to the drive. Find and install good file recovery software on a separate drive.	If the item has been permanently deleted you will have to try to obtain the file again or recreate it from what you can remember. Do this as early as you can while it's in your memory.
Broken & Unrepairable	If an item is unrepairable due to the parts for it not being made anymore you may be able to 3D print or have another company design a replacement part for it or recreate it entirely.	You could always keep the broken item if it means that much to you, or try to repair it in whatever way you can. At least you have the original item in your possession unlike some of the other ways above.

Forced Displacement

Forced displacement is a traumatic event that occurs when people face political persecution and are forced to relocate to a new home (as an immigrant or through political asylum) or become a refugee.

Neglect

Neglect is the most common form of abuse reported to child welfare authorities. However, it does not occur only with children. It can also happen when a primary caregiver fails to give an adult the care they need, even though the caregiver can afford to, or has the help to do so. Neglect also includes the failure to provide an individual with basic needs such as food, clothing, or shelter. It can also mean not providing medical or mental health treatment or prescribed medicines. Neglect also includes exposing someone to dangerous environments, abandoning a person, or expelling them from home.

Jail / Incarceration

Being jailed can cause trauma from an abrupt change in circumstances, scenery and people such as not being with your children or partner.

7 Other

Any other kinds of personal disasters which can affect someone.

Substance Addiction

An addiction usually stems from a primary event and can cause depression, suicide, violence and incarceration

Gambling Addiction

Self Harm

8 Disaster Recovery

You've just crash-landed on an island, there are multiple injuries among the passengers, the pilot and crew are dead - what do you do? It may sounds like a game we play where we have 5 items to take with us, but this has been a very real situation for many people. The below section will help you understand and cope with the situation until you are rescued.

This article will have a general flow and order of what to do to survive and get help as well as a section on each of the specialised incidents that can happen. It is assumed that the world is functioning as per normal with rescue services employed after realizing the plane never arrived at its destination. Remember that every situation is different and you should only use this as a general guide to help you plan your next move.

The approximate time each step will take and the estimated time into the disaster is labelled next to the step as follows:

(<10m,~5m)
< / > = Less / More Than
~ = Approximate

First Minutes

What you should do in the first few minutes of a disaster.

Step Name (Step Time, Time Into Disaster)	Summary	Description

Get out of danger

Step Name (Step Time, Time Into Disaster)	Summary	Description
Personal Safety Check (<30s,~0s)	Get out of danger	Ensure there's no risk of further injury to yourself. Risks may include: Explosions, drowning, aftershocks and extreme environments or conditions. If there is a risk of injury or death, immediately attempt to negate or reduce the effects of it. Like escaping from of a sinking plane or getting away from leaking fuel.

Check yourself for injuries

Step Name (Step Time, Time Into Disaster)	Summary	Description
Self Check (<1m,~30s)	Check yourself for injuries	Firstly check yourself for injuries including cuts, scrapes, broken bones, bruises and ensure your mental capacity is clear and you aren't in shock. There is no use assisting others if you aren't in a physical or mental state to help or you may make a huge mistake. Any cuts you have could get infected depending on where you are. Be sure to apply the proper treatment. If you aren't in a solid state of mind and body you won't have the capacity to continue the next steps.

Treat your physical and mental injuries

Step Name (Step Time, Time Into Disaster)	Summary	Description
Compose/ Treat Yourself (<1m,~2m)	Treat your own injuries, physical and mental	Ensure you are in a proper mental state to proceed especially if you have witnessed people dying or the death of someone you know. Without being in a correct state of mind you will only make mistakes from now on so try to push the shock of everything into the back of your mind until later. Only treat any major injuries you have which will prevent you from being fully effective in the future. This allows more time for medical triage on the others who are injured who may have life threatening injuries. Injuries which should be treated are heavy bleeding, concussions, dislocations, broken bones and anything that will render you unable to proceed.

Assess possible threats

Step Name (Step Time, Time Into Disaster)	Summary	Description	
General Safety Assessment (<3m,~2m)	Assess possible threats	Before doing anything else ensure there's no risk of further injury to you or anyone else. Note down the possible risks that could occur in your mind. This safety check only covers the current point in time ignoring future risks and extends to cover everyone else in the area.	**Possible Risks** ● Leaking Fuel ● Unstable Structure ● Aftershocks ● Falling Objects ● Crazed Individuals ● Electrocution ● Suffocation

Negate safety risks

Step Name (Step Time, Time Into Disaster)	Summary	Description
Safety Procedure (<2m,~5m)	Negate safety risks	If there are serious safety risks, attempt to negate them if possible. If there is fuel leaking after a plane crash, try to move people away from the crash unless it puts them in a greater risk such as freezing conditions. Attempt to put out any fires if you stay close to the wreckage.

First Hour

What you should do in the first hours of a disaster.

Evaluate situation and keep calm

Step Name (Step Time, Time Into Disaster)	Summary	Description
Evaluate (<2m,~7m)	Evaluate situation and keep calm	Do a quick scan of the assets nearby. If a precious resource like fuel or water is leaking - attempt to save it by putting a bucket underneath. The secondary objective is to find a medical kit if possible. This step should only take 2 minutes maximum as causalities will require medical assistance ASAP.

Assess the injuries of others using triage

Step Name (Step Time, Time Into Disaster)	Summary	Description
Medical Evaluation (<5m,~10m)	Assess the injuries of others using triage	There are bound to be some form of injuries in a disaster whether physical or emotional. Take notes on and check on the medical health of all the other people involved. Ask if they take any regular prescriptions at intervals which they need to survive such as insulin. Use the medical triage to categorise the injured. See the Medical section.

Treat others injuries

Step Name (Step Time, Time Into Disaster)	Summary	Description
Treat Injuries (<45m,~30m)	Treat others injuries	If you have the medical knowledge begin treating the wounded starting with the most dire first - unless they will die either way. If you don't have prior medical knowledge, do the best you can, most vehicles will have some sort of medical kit in them. Use the medical section in this document for a refresher. Lay the dead out together if applicable, as vermin and animals will likely feed on them overnight if left exposed. Take notes of the dead such as name, age and time of death for cataloguing later. Attempt to stabilize everyone if possible and get others to assist you by looking after other people.

PERSONAL DISASTERS | Disaster Recovery | First Hour

Signal for help

Contact Help (<45m,~30m)	Signal for help	If you are in an area with reception or see other aircraft or ships in the area attempt to signal them. Continue to the next step if there are no other people in sight and there's no mobile reception.

Turn off un-needed electronic devices

Resource Conservation (<45m,~30m)	Turn off un-needed electronic devices	Save all the electricity you can on every device you can, as you may need it later. Enable power saving features on the phones that need to be on. (Especially the one with this guide) The energy is limited and could be used later to power the more essential devices such as a radio and communication equipment. Close all un-needed apps and dim the screen to a level that is suitable. Transfer this guide and any other useful resources to an SD card or other removable device.

Establish a leader, a plan, and assign people to tasks

Establish a Leader (<15m,~1h)	Establish a leader, a plan, and assign people to tasks	It's important to have some form of leader in dangerous situations as it will ease people's minds. The leader does not have to be you, unless you wish to take up the role. Being a prepper and having this guide, I highly recommend you put yourself forward if you have the knowledge. If people fight for leadership, just drop the matter and continue to provide medical help to others and other skills you possess. If you are the leader, delegate tasks to other uninjured people around you who seem stable and ask everyone if they have any medical or other useful skills. Work out what the next steps are in your disaster plan. You can use this article as a guide if you possess it however keep in mind that it's not disaster specific.	**Tasks for Others** ● Resource Scavenging ● Scouting ● Medical Care ● Comforting ● Protection

First Days

What you should do in the first days of a disaster.

Work together to generate a plan to follow

Leadership Plan (<15m,~1h)	Work together to generate a plan to follow	Take note of what resources you have, how many people there are and what condition they are in, how many have died already, etc.	**Plan Topics** ● Sick People ● Troublesome People ● Resources ● Signalling ● Labour Division

Check Resources

Resource Audit (<30m,~1h 15m)	Check Resources	Establish what items and materials you have to work with and ensure they aren't wasted by desperate people. Recover any useful objects such as weapons, clothing and signalling devices and put them in a pile. Keep any food and water together and protected from the elements and those who will try to take it. Ration all food and water and have someone keep guard over it if necessary.

Cover bodies

Cover Bodies (<30m,~1h 15m)	Cover bodies	The bodies (if any) should be concealed for now to keep morale high and prevent predators. This may be difficult if there are people who have lost their grip on reality and are expecting their loved one to wake up.

Monitor health of individuals

Medical Monitoring (<15m,~1h 45m)	Monitor health of individuals	Keep monitoring the progress of patients every 15 minutes and attend them if they get worse. There should be a person other than the leader assigned to assisting the injured at all times.

Find bearings, look for resources

Minor Scouting (<15m,~2h)	Find bearings, look for resources	Try to find your bearings if possible and where you are in the world. Look around your location, is it day or night, winter or summer, what types of animals live around these parts, what's the weather, what climate is it etc.

Move to a secure location

Positioning (<15m,~2h)	Move to a secure location	After scouting work out whether you should move away from the current location or stay by the wreck. Staying by the wreck provides a lot of resources to scavenge, shelter and makes it easier for rescuers to find you. The reasons for leaving include possible chance of explosion, unsafe environment or threat of animals hunting the dead.

Build a campfire

Build a Fire (<30m,~2h)	Build a campfire	To cook food, restore morale, deter animals and sterilize. Use car or plane fuel to help start the fire.

Build a signal fire

Construct a Signal Fire (<30m,~3h)	Build a signal fire	Assemble a signal fire ready to light if an aircraft or boat approaches. Ensure you put leafy greens on top to provide the maximum amount of smoke. Keep a campfire lit at all times to make it easy to light the signal.

Build a SOS sign

Construct an SOS Sign (<30m,~3h)	Build a SOS sign	Using any materials available in an open space, create a large SOS or HELP sign on the ground. Make each letter many meters wide at a minimum to be visible from the sky. Use reflective materials if possible and ones that won't blow away in strong wind.

Construct a shelter

Construct Shelter (<1-2hrs,~4h)	Construct a shelter	If necessary, create a temporary shelter from nearby materials for weather protection. If it's night create a shelter anyway for a greater sense of protection and a defence against wild animals. The shelter time may vary wildly depending on how many people you need to shelter and how many people assist. Shelter also includes making temporary beds for the injured.	**Shelter Reasons** • Weather Protection • Animal Protection • Camouflage • Warmth

Protection from future threats

Future Threats (<30m,~5h)	Protection from future threats	After scouting you should know what possible threats may occur such as incline weather, wild animals or night. Begin setting up safeguards for threats such as building a shelter if there is no suitable place and night is approaching. After this step you should proceed with the most needed priorities first and focus on the others later.	**Priorities** • Safety • Air • Defence • Shelter • Water • Food

Acquire safe drinking water

Acquire Water	Acquire safe drinking water	By now the requirement for water will be rather high with a lot expended creating shelters. Look for an alternative source and attempt to set up water boiling points.

Distribute food and water

Distribute Food / Water	Distribute food and water	Hand out rationed amounts of food to everyone to keep energy levels up. Priority should be given for the sick, pregnant and the heavy lifters. Don't let people take more than they need or eat less than they should.

Have Communications Equipment Ready

Communications (<15m,~6h)	Have Communications Equipment Ready	If you have a form of communication such as a radio or signal flare attempt to use it to make contact to rescuers. Only use the signal flare if you can hear an aircraft - even if you can't see it or it's hidden by clouds - use it at night for the best effect. Delegate someone to the radio or communications method if possible to try and make contact.

Restore morale

Keep up Morale (<15m,~7h)	Restore morale	Chat with people and ask them about their lives, what skills they have and how they got here. Keep attending people's wounds and enquires if you are the leader.

First Weeks

What you should do in the first weeks of a disaster.

Organize a Night Watch

Night Watch (<12h,~Dusk)	Organize a Night Watch	As the night approaches organise a watch to take care of the injured, stoke the fire, watch for predators and keep an eye on the sky for search parties. A good watch should be taken in turns of about 3-4 hours which are easily divisible by 12 and will ensure the rest of each individual in the party.

Find food

PERSONAL DISASTERS
Disaster Recovery
First Week

Food Acquisition (<3h,~Dawn)	Find food	Some of the party should attempt to find food sources via foraging, hunting or fishing. This step could be held off until day 3 or so if necessary.

Clear land for heli/plane landing

Land Clearing (<1-3d,~Day 2+)	Clear land for heli/plane landing	You should clear a plot of land if required for a safe location for helicopters to land. 50-75m diameter should be wide enough. If you have ample time clearing a landing strip for aircraft may also be beneficial. It should be about 600m-1km long on flat ground. Ignore this if there's not enough land, it's too difficult or there's a lack of food or water.

Bury any bodies

Bury Bodies (<3h,~3d)	Bury any bodies	Bury any bodies and animals within three days to prevent the spread of disease and avoids attracting wild animals. This activity will consume a lot of effort and should only be done if food and water is ample. An alternate version of this could be moving the bodies out of sight and far from the camp site. Visible bodies will drain morale as well a introducing disease and predators. If desired animals can be eaten for food instead of buried.

First Months

What you should do in the first months of a disaster if you still haven't been rescued or there is nobody to rescue you.

First Years

What you should do in the first years of a disaster if you still haven't been rescued or there is nobody left to rescue you.

9 Specific Incidents

These are specific crash situations you may find yourself in. This section is designed to get you back to civilization.

Land Breakdown (Unknown Location)

Your car breaks down, you are unable to fix the problem and people rarely/never pass by.

Land Crash (Unknown Location)

Either a car crash between another vehicle or an obstacle and people rarely/never pass by.

Air Crash (Into Land)

A plane has crashed and you've been stranded in an unknown location on land.

Air Crash (Into Water)

A plane has crashed and you've been stranded in an unknown location at sea.

Adrift

You are adrift at sea in an uncontrollable floating object.

PERSONAL DISASTERS

Specific Incidents

Lost

Lost at Sea

You are lost at sea in a controllable boat.

Shipwrecked (Onto Land)

A boat crashes onto land, a sandbank or offshore rocks.

Disaster Triggers

Any adverse effects that may be triggered from disasters

"Worrying will never improve the outcome."
Unknown

Introduction

Disaster triggers are any adverse effects that <u>have been</u>, or <u>could be</u> triggered by a disaster such as power loss from a hurricane. They typically only arise from larger disasters that make news such as truck collisions, cyclones and pandemics. You can essentially use this category to predict what may occur from a disaster and plan ahead.

Purpose	The aim of DISASTER TRIGGERS is to provide a list of potential future outcomes to prepare for based on various current scenarios.
Lost?	• For a list of (non-world ending) natural disasters, see NATURAL DISASTERS. • For a list of (non-world ending) man-made disasters, see MAN-MADE DISASTERS. • For a distraction from the current turmoil of the world, see the ENTERTAINMENT section.

Contents

1 Conflict

These are any adverse effects that can come from conflict and violence during a disaster.

Terms Used	**Description:** A description of the disaster. **Causes:** What causes the disaster. **Symptoms:** What are the symptoms of this occurring. **Affects (Object):** The physical objects this disaster affects. **Effects (From):** The effects that occur from this disaster unfolding. **Alternatives:** Alternative solutions to this disaster. **Escalation:** Other effects this disaster may trigger. **Prepper Solution:** The solution most optimal for preppers.

Violence (Person to Person)

Conflict over resources whether it's food, water or precious metals.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Violence)	May Trigger
• Desperation • Hunger • Thirst • Hatred	• Arguments • Poised Body Position • Threats • A Direct Approach • Eye Contact • Clenched Fist	• Those Involved • Bystanders • Moral Ethics	• Injury • Death • Robbery • Emotional Trauma • Arrest	• Leave • Concede Defeat • Surrender • Win • Amicable Agreement	• Riots • Law Enforcement Action

Prepper Solution
Avoid confrontation to prevent injury and maintain your goods.

Looting & Theft

Stealing of resources from another person who is away from that location.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Desperation • Hunger • Thirst • Greed	• Suspicious Movements • Concealed Goods	• Recipient of Theft • Local Businesses • Local Customers	• Injury • Death • Emotional Trauma • Arrest	• Purchasing • Crafting Your Own	• Law Enforcement Action

Prepper Solution
Find out how much and what you have remaining and if you can survive off it, bug out if necessary.

Destruction

A person or group of people destroying cars, building and property.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Fun • Boredom • Sending a Message • Retaliation • Oppression	• Held Weapons • Chanting / Shouting	• The Destroyed Objects • Possessions Owner	• Injury • Death • Arrest • Violence	• Calming Activities • Supporting Yourself	• Fires • Explosions • Violence

Prepper Solution
Avoid confrontation unless your home is under threat, then use any necessary force if required.

Protests

A large gathering of people protesting a change, law, inequality or a decision.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Inequality • Anger • Frustration	• Picket Signs • Chanting • Mass Gathering • Similar Colours	• Objects of Protest	• Law Changes • Nothing • Violence • Arguments • Arrest	• Petitions • Change • Adapt	• Law Enforcement Action • Violence

Prepper Solution
Avoid protest areas and blend in to the environment, bug out if the situation is dangerous.

Riots (Group Violence)

A group of people protesting a common cause which often involves violence.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Sending a Message • Hatred • Change • Revolution • Fun	• Crowds in the Streets • Often Televised • Destruction	• Homes • Cars • Businesses • People	• Building Damage • Injury • Fires • Police Force • Arrest	• Protests • Petitions	• Law Enforcement Action • Fires • Violence

Prepper Solution
Avoid riot areas and blend in, bug out if the situation is dangerous or defend your home with force if needed.

Mugging & Robbery

A robbery of valuables from a person who is at the scene.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Desperation • Hunger • Thirst • Greed • Fun	• Being Alone • Night Situation • Being Followed	• The Muggee • Bystanders • Moral Ethics	• Injury • Death • Arrest	• Giving Freely • Fighting Back	• Violence • Injury

Prepper Solution
Comply with direction unless you see a way out. Restock supplies at home if possible.

2 Amenity Losses

The losses of any basic amenities such as electricity or water.

Electrical Loss

Electrical Grid Loss

A widespread loss of electricity from homes, businesses and shops.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Electricity)	May Trigger
• No Energy Source • Damaged Assets • Loss of Labour Force • Weather Events	• No Electricity	• All electrical appliances without a battery connected to mains	• No Light • No Heating / Cooling • Little Communication • No Elevators • No Automatic Doors	• Candles • Breeze / Blanket • Books • Solar Panels / Battery	• Phone Network Loss • Internet Loss • Tv / Radio Signal Loss • GPS Loss • Electronics Loss • Computer / ATM Loss • Retail Closures • Riots • Use of Generators

Prepper Solution
Use solar systems, use a generator, use less electricity or simplify your lifestyle.

EMP Electronics Loss

A widespread destruction of most electronic devices due to an electromagnetic pulse.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Electricity)	May Trigger
• No Energy Source • Damaged Assets • Loss of Labour Force • Weather Events	• No Electricity	• All electrical appliances without a battery connected to mains	• No Light • No Heating / Cooling • Little Communication • No Elevators • No Automatic Doors	• Candles • Breeze / Blanket • Books • Solar Panels / Battery	• Phone Network Loss • Internet Loss • Tv / Radio Signal Loss • GPS Loss • Electronics Loss • Computer / ATM Loss • Retail Closures • Riots • Use of Generators

Prepper Solution
Use solar systems, use a generator, use less electricity or simplify your lifestyle.

Water Loss

Water Loss

The loss of a clean water source to your house.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Tap Water)	May Trigger
• Loss of Labour Force • Damaged Assets • Lack of Water • Water Contamination • Weather Events	• No Water • Low Pressure • Dirty Water	• All taps and water distribution points	• No Drinking Water • Can't Clean • Can't Bathe • Fights for Water • Scouting for Water • Water Purification • Waterborne Illnesses	• Streams • Ocean • Lakes • House Water	• Thirst • Riots • Relocation • Water Purchases

Prepper Solution
Acquire water from clean rivers, streams or lakes and purify it at home.

Water Contamination

Any form of contaminated tap water by bacteria, colour, particles etc.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Tap Water)	May Trigger
• Floods • Terrorist Attack • Lack of Water • Malicious Intent • Poor Maintenance	• Particulate in Water • Muddy Water • Waterborne Illnesses • Coloured Water • No Visible Signs	• All taps and water distribution points	• No Drinking Water • Can't Clean • Can't Bathe • Fights for Water • Scouting for Water • Water Purification Req. • Waterborne Illnesses	• Streams • Ocean • Lakes • Filtration • Sterilization	• Thirst • Protests • Riots • Relocation • Water Purchases

Prepper Solution
Purify the water at home.

Gas (LPG) Loss

Gas (LPG) Loss

The loss of mains gas to your home.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Gas)	May Trigger
• Loss of Labour Force • Pipe Destruction	• No Gas • Low Pressure	• Gas Stoves • Some Hot Water Systems • Some Air Conditioners	• Can't Cook • Can't Heat	• Gas Canisters • Electrical Stoves • Fire	• Explosions • Protests • Heating Loss • Cooking Loss

Prepper Solution
Use canister gas, cook on electric systems or over a fire. Use solar or electric hot water.

Gas Pressure Loss

DISASTER TRIGGERS | Amenity Losses | Gas Loss | Gas Pressure Loss

The loss of mains gas to your home.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Gas)	May Trigger
• Loss of Labour Force • Pipe Destruction	• No Gas • Low Pressure	• Gas Stoves • Some Hot Water Systems • Some Air Conditioners	• Can't Cook • Can't Heat	• Gas Canisters • Electrical Stoves • Fire	• Explosions • Protests • Heating Loss • Cooking Loss

Prepper Solution
Use canister gas, cook on electric systems or over a fire. Use solar or electric hot water.

Sewage & Disposal Loss

Sewage Loss

The blockage of sewage pipes, drains and disposal systems.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Sewage Systems)	May Trigger
• Loss of Labour Force • Damaged Assets • Weather Events	• Toilet Blockage • Bad Smells • Waste Disposal in Yard	• Toilets • Water Disposal • Drains and Sinks	• Blocked Toilet • Bad Smells • Illnesses	• Dig a Hole • Portaloo • Camping Toilet	• Relocation • Unsanitary Conditions • Stench • Protests • Riots

Prepper Solution
Install a composting toilet or bury your waste.

Waste Disposal Loss

The halting of waste disposal services such as bin collection and recycling.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Waste Removal)	May Trigger
• Loss of Labour Force • No Fuel • Damaged Facilities	• Build up of waste in streets • Unsanitary conditions • Blocked streets • Proliferation of vermin	• Bins • Streets • Vermin Population • Illnesses	• Dumping of Rubbish • Living in Squalor	• Bury Rubbish • Use Biodegradable Items	• Unsanitary Conditions • Stench • Rubbish Dumping • Protests • Riots

Prepper Solution
Try not to generate waste, bury decomposable waste or recycle all items somewhere else.

Fuel Loss

Petrol (Gas) Loss

The lack of all forms of fuel for motor vehicles, planes and machinery.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Fuel)	May Trigger
• Peak Fuel • Lack of Fuel Imported • Mass Panic	• Fuel Stations Closed • Fuel Queues • Cars running out of fuel • Blocked Streets	• Cars • Buses • Trucks • Boats • Planes • Some Machinery	• No Transport • No Generators • No Food • No Shop Items	• Walk • Bike • Create Own Fuel • Electric Cars	• Protests • Riots • Food Hoarding • Violence • Crime

Prepper Solution
Use a vehicle that runs on a common fuel, no fuel (electric), fuel that can be stored years or a fuel which can be created at home.

Diesel Loss

The lack of all forms of fuel for motor vehicles, planes and machinery.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Fuel)	May Trigger
• Peak Fuel • Lack of Fuel Imported • Mass Panic	• Fuel Stations Closed • Fuel Queues • Cars running out of fuel • Blocked Streets	• Cars • Buses • Trucks • Boats • Planes • Some Machinery	• No Transport • No Generators • No Food • No Shop Items	• Walk • Bike • Create Own Fuel • Electric Cars	• Protests • Riots • Food Hoarding • Violence • Crime

Prepper Solution
Use a vehicle that runs on a common fuel, no fuel (electric), fuel that can be stored years or a fuel which can be created at home.

Oil Loss

The lack of all forms of fuel for motor vehicles, planes and machinery.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Fuel)	May Trigger
• Peak Fuel • Lack of Fuel Imported • Mass Panic	• Fuel Stations Closed • Fuel Queues • Cars running out of fuel • Blocked Streets	• Cars • Buses • Trucks • Boats • Planes • Some Machinery	• No Transport • No Generators • No Food • No Shop Items	• Walk • Bike • Create Own Fuel • Electric Cars	• Protests • Riots • Food Hoarding • Violence • Crime

Prepper Solution
Use a vehicle that runs on a common fuel, no fuel (electric), fuel that can be stored years or a fuel which can be created at home.

DISASTER TRIGGERS | Amenity Losses

Communication Loss

Phone Network Loss (Mobile Towers Only)

The loss of 2G, 3G, 4G, 4GX and 5G networks.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Mobiles)	May Trigger
• Network Damage • EMP • Solar Flare • CIA/FBI Safety Measure • Frequency Blocker	• No Reception	• Mobile Phones • Shop Wireless Payments	• Can't make calls • Can't receive calls • No Messages	• Two Way Radio • Own Network • HAM Radio • Local Internet (WiFi)	• Panic • Protests • Losing Direction

Prepper Solution
Use landline internet, HAM radio, CB radio, Local Messaging App or walkie-talkies instead.

Internet Loss (All Forms)

The loss of all forms of internet whether it's home cable, wifi or mobile internet.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Internet)	May Trigger
• Network Damage • Internet Censorship • Frequency Blocker	• No Connection	• Computers • Phones • Shops	• No News • No Data Acquisition	• Newspapers • Two Way Radio	• Panic • Protests

Prepper Solution
Predownload vital information while the internet is available. Or purchase my Prep Drive for a quick way to have offline prepper data.

Tv & Radio Signal Loss

The loss of airborne communication methods.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Tv / Radio)	May Trigger
• EMP • Solar Flare • Frequency Blocker	• Static	• Television • Radio	• No News • No Data Acquisition	• Newspapers	• Panic • Protests

Prepper Solution
Get your news via newspaper, internet and word of mouth instead.

GPS Loss

The loss of all navigation systems such as GPS, GNSS, GLONASS, BDS etc.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To GPS's)	May Trigger
• Satellite Destruction • Solar Flare	• No Positional Data	• GPS Devices • Mobile Phones • Vehicle Navigation	• No Positional Location	• Printed Maps • Offline Maps	• Plane Crashes • Losing Direction

Prepper Solution
Swap to paper maps and dead reckoning for position acquisition if bugging out. See the NAVIGATION section for more information.

Magnetic Shift

The loss or major alteration of earth's magnetic fields.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Compasses)	May Trigger
• Pole Shift	• No Compass Movement • Wrong Compass	• Compasses • Electromagnetism	• Becoming Lost	• Printed Maps • Offline Maps • GPS	• Losing Direction

Prepper Solution
Swap to paper maps and dead reckoning for position acquisition.

Electronics Loss

Electronics Loss

The loss of all electronic devices with a CPU or transistor.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Electrical Equipment)	May Trigger
• EMP • Solar Flare	• Electronics Fail to Function	• All electronics with a cup or transistor not inside a faraday cage	• No Transport • No Computers • No Communication • No Navigation	• Varies	• Panic • No Transport

Prepper Solution
Learn to survive without technology.

Computer Loss

The loss of computers and computation devices controlling security systems, automatic doors, boom gates, health systems, road signs, venting fans etc.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Shops)	May Trigger
● Hacking Attack ● Virus ● EMP ● Solar Flare	● Closing of Retailers ● Blocked Entry ● Theft ● Inaccessible Areas	● Security Cameras ● POS Machines ● Central Air Conditioners ● Elevators ● Escalators ● Automatic Doors ● Health Systems ● Boom Gates ● Venting Fans	● No Withdrawals ● No Card Transactions ● The Use of Cash ● No Automation	● Stock Up ● Have Cash On Hand ● Have Barter Items	● Panic ● Bank Shutdowns ● Economic Crash ● Starvation ● Becoming Trapped

Prepper Solution
Have cash on hand and a supply of resources at home to outlast the disaster.

Major Server Loss

Modern computers that rely on constant contact with the internet are uncontactable.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using ATMs or Shops)	May Trigger
● Hacking Attack ● Virus ● EMP ● Solar Flare	● Closing of Retailers ● Downed Websites ● Using Cash Only	● ATMs ● POS Machines ● Checkouts ● Online Shopping	● Few Withdrawals ● Few Card Transactions ● The Use of Cash ● No Automation	● Stock Up ● Have Cash On Hand ● Have Barter Items	● Panic ● Shop Closures ● Bank Shutdowns ● Economic Crash ● Starvation

Prepper Solution
Have cash on hand and a supply of resources at home to outlast the disaster.

Bank / Payment / ATM Loss

The loss of bank systems, payment facilities, ATMs and point of sale systems.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using ATMs or Banks)	May Trigger
● Hacking Attack ● Virus ● EMP ● Solar Flare	● Closing of Retailers ● Using Cash Only ● Theft	● ATMs ● POS Machines ● Checkouts ● Online Shopping	● No Withdrawals ● No Card Transactions ● The Use of Cash ● No Automation	● Stock Up ● Have Cash On Hand ● Have Barter Items	● Panic ● Bank Shutdowns ● Economic Crash ● Starvation

Prepper Solution
Have cash, bullion and barter items (food, water, alcohol, medical supplies) on hand plus a supply of resources at home to outlast the disaster.

Retail Closures

Retail Closures

The mass closure of retailers, shops and businesses.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Shops)	May Trigger
● Weather Events ● Economy Causes ● Loss of Labour Force ● Mass Panic	● Closed Signs ● Low Stock ● High Prices	● Shops ● Retailers ● Consumers	● Can't Buy Resources ● Looting ● Riots	● Use Stored Supplies ● Barter ● Forage	● Panic ● Starvation ● Riots ● Violence

Prepper Solution
Have food and water stores stocked up to last the entire disaster.

Bank Closures

Bank closures country-wide.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Banks)	May Trigger
● Economic Crash ● National Debt ● Weak Dollar ● Hacking ● No Electricity ● Strikes	● Closure of Smaller Banks ● Economic Depression	● Banks ● People's Money	● Can't Pay Bills ● Can't Purchase Items	● Bartering	● Riots ● Foreclosure ● Homelessness

Prepper Solution
Stock up on bullion, barter items and withdraw money early.

3 Physical Losses

The loss or destruction of any form of physical asset such as buildings, bridges or roads.

Highway Parking Lot

The roads are severely blocked.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Continuing On)	May Trigger
● Panic ● Crashes	● News Headlines ● Mandatory Evacuations	● Highways ● Roads ● Transport	● Road Rage ● People Shortcutting	● Drive Home ● Abandon Car ● Bug In	● Death by Extreme Weather

Prepper Solution
Find an alternate route or return home.

Road Destruction / Blockage

Destruction or blockage of major roads.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Continuing On)	May Trigger
• Earthquakes • Collisions • Stopped Vehicles • Trees	• Road Debris • Major Disaster • Car Queues	• All Transport	• Empty Shelves • No Fuel • Can't Travel	• Return Home • Alternate Route	• Food Shortages • Shop Closures • Riots

Prepper Solution
Stock up on supplies or bug out early.

Building Destruction

Destruction of buildings such as shops and other people's homes are destroyed beyond simple repairs.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Staying Put)	May Trigger
• Weather Event • Fire • Riots	• Approaching Storm • News Headlines • Street Gangs / Looters	• Other Homes • Businesses • Shops • Bridges	• Riots • Thieves • Destruction	• Bug Out	• Panic • Riots • Lootings • Muggings

Prepper Solution
Bug out or bug in if your building is standing. Stock up on supplies.

Home Loss

Your home is destroyed beyond simple repairs.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Living in Ruins)	May Trigger
• Weather Event • Fire • Riots • Repossession • Bankruptcy	• Approaching Storm • Street Gangs / Looters	• House • Possessions	• No Shelter • Elements Exposure • Injury / Death • Possessions Loss	• Find New Shelter • Rebuilding • Salvage Home	• Homelessness • Weather Effects

Prepper Solution
Bug out to your shelter or friends home or live off the land and build your own shelter.

Job Loss

Any way you can lose your job.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Having a Job)	May Trigger
• Failing Economy • Business Cutbacks • Workplace Destroyed • Unethical Behaviour	• Economic Instability • Bad Work Ethic • Falling Profits • Falling Shares	• The Individual • Their Family • The Company	• Lack of Money • Depression	• Self-Sufficiency • Use Saved Money • Retirement	• Homelessness • Divorce

Prepper Solution
Keep a stockpile of funds at home and become more self-sufficient.

4 Societal Breakdown

Any form of societal breakdown which affects the running of the country.

Government Shutdown

The shutdown of the government and other systems.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using a Government)	May Trigger
• Strikes • War • Invasion • Presidential Decree	• Chaos • Martial Law	• All Citizens	• No Gov. Pay • Monument Shutdown • Looting • Murders • Crime	• Custom Government • Citizen-maintained Resources • No Government	• Riots • Gang Violence • Protests • Violence

Prepper Solution
Protect your home and assets and start to develop a network for a street/suburb defence partnership.

Bank Shutdown

Banks failing or declaring bankruptcy.

DISASTER TRIGGERS | Societal Breakdown | Bank Shutdown

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Banks)	May Trigger
• Panic • Bankruptcy • Mismanagement • Fraud	• Halted Withdrawals	• Bank Customers • Shareholders	• Violence • Crime • Money Withdrawals • Potential Starvation	• Cash • Bullion (Gold/Silver) • Barter	• Civil Unrest • Riots • Protests • Violence • Bank Runs • Bank Shutdown • Banking Panic

Prepper Solution
Store money and bullion at home as well as tradable items.

Bank Run

DISASTER TRIGGERS | Societal Breakdown | Bank Run

A large number of people withdrawing their money from a single bank at the same time.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Banks)	May Trigger
• Panic • Bank Closures • Bankruptcy • Lockdowns • Impending Crash	• Long Bank Lines • Bank Closure • Chaos at Banks	• Banks • Bank Customers • Shareholders • Economy	• Violence • Crime • Money Withdrawals • ATM Vandalism • Potential Starvation	• Cash • Bullion (Gold/Silver) • Barter	• Riots • Protests • Violence • Bank Shutdown • Banking Panic

Prepper Solution
Store money and bullion at home as well as tradable items.

Banking Panic

DISASTER TRIGGERS | Societal Breakdown | Banking Panic

A large number of people withdrawing their money from multiple banks at the same time.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Banks)	May Trigger
• Declining Economy • Bank Closures • Market Crashing	• Long Bank Lines • Bank Closures • Chaos at Banks	• Banks • Bank Customers • Shareholders • Economy	• Violence • Crime • Money Withdrawals • Economic Collapse • Economic Depression • ATM Vandalism • Potential Starvation	• Cash • Bullion (Gold/Silver) • Barter	• Riots • Protests • Violence • Bank Runs • Systematic Banking Crisis

Prepper Solution
Store money and bullion at home as well as tradable items.

Withdrawl Suspension

DISASTER TRIGGERS | Societal Breakdown | Withdrawl Suspension

Banks prevent consumers from withdrawing their money or they set a minimum bank balance requirement.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Cash)	May Trigger
• Bank/ATM Runs • Banking Panic • Economic Collapse	• Long Bank Lines • Bank Closures • Chaos	• Banks • Bank Customers • Shareholders	• Violence • Crime • Money Withdrawals • Economic Collapse • Economic Depression • ATM Vandalism • Potential Starvation	• Cash • Bullion (Gold/Silver) • Barter	• Riots • Protests • Violence • Systematic Banking Crisis

Prepper Solution
Divide your money up between cash, bullion and the rest split up between multiple banks.

Systematic Banking Crisis

DISASTER TRIGGERS | Societal Breakdown | Systematic Banking Crisis

Wipeout of almost all banking capital resulting in a chain of bankruptcies.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Cash)	May Trigger
• Declining Economy • Economic Collapse	• Long Bank Lines • Bank Closures • Chaos	• Banks • Bank Customers • Shareholders • National Economy	• Violence • Crime • Money Withdrawals • Economic Collapse • Economic Depression • ATM Vandalism • Potential Starvation	• Cash • Bullion (Gold/Silver) • Barter	• Riots • Protests • Violence • Bank Runs

Prepper Solution
Store money and bullion at home as well as tradable items.

Hyperinflation

ER TRIGGERS | wn | Crisis

The inflation of a fiat currency due to mismanagement of the money supply.

DISASTER TRIGGERS | Societal Breakdown | Systematic Banking

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Money)	May Trigger
• Banking Mismanagement • Economic Collapse • Rapid Consumer Spending • Printing Money • COVID Spending	• Higher Prices • Rapidly Rising Prices • More Spending	• The Entire Nation • Those in Fiat Money	• Violence • Crime • Money Withdrawls • Worthless Currency • Banks Halt Trading • Money Spending • Great Depression	• Self Sufficiency • Use Bullion • Not Needing to Buy • Trading/Swapping	• Riots • Protests • Violence • Bank Runs • Rapid Spending

Prepper Solution
It's best to spend all the money you have while it's still worth something. Buy long life food, water and water purification filters, solar panels and anything that will help you live off the grid easier.

Military Shutdown

DISASTER TRIGGERS | Societal Breakdown | Military Shutdown

The shutdown of the military and defence systems.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To the Military)	May Trigger
• Strikes • War • Lack of Funds • Government Shutdown • Coup	• Lack of Military • Closed Barracks	• Military Personnel • Government Workers	• Invasion • Chaos • Crime • Looting	• Personal Self Defence • Neighbourhood Watch/Defence	• Riots • Gangs • Violence • Invasion

Prepper Solution
Flee to the quietest corner of the country as soon as possible and ride out the disaster.

Police Shutdown

DISASTER TRIGGERS | Societal Breakdown | Police Shutdown

The shutdown or closure of police stations.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Relying on the Police)	May Trigger
• Strikes • Too Few Police • Fear • Government Shutdown	• Increased Crime • Lack of Police • Slower Response Times	• Police Officers • Criminals	• Chaos • Crime • Looting • Violence	• Personal Self Defence • Instant Justice • Neighbourhood Watch/Defence	• Unrest • Riots • Violence

Prepper Solution
Be your own security, use surveillance and be ready with weapons loaded.

Prison Shutdown

Prison Shutdown

DISASTER TRIGGERS | Societal Breakdown | Prison Shutdown | Prison Shutdown

The closure or abandonment of prisons.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Living Near a Prison)	May Trigger
• Government Shutdown • Strikes • Too Few Staff	• Failing Government • Strikes	• Prisons • Guards • Criminals • General Population	• Chaos • Crime • Looting • Violence • Murder	• Leave the Area	• Riots • Gangs • Violence • Unrest

Prepper Solution
Take a note of all the local prisons and ensure you don't live too close and avoid the areas as much as possible.

Prison Break

DISASTER TRIGGERS | Societal Breakdown | Prison Shutdown | Prison Break

The escaping or release of convicts from a prison before their time has been served.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Living Near a Prison)	May Trigger
• Lack of Staff • Pandemic • Overpopulation • Building Weaknesses	• News Coverage • People Walking Out • Surge in Crime	• Nearby Population • Crime Statistics	• Rising Crime Rate • Murders	• Leave the Area • Buy a Weapon • Start a neighborhood watch	• Riots • Gangs • Violence • Unrest • Surge in Crime

Prepper Solution
o

Train / Tram / Subway Shutdown

DISASTER TRIGGERS | Societal Breakdown | Train / Tram / Subway

The shutdown of commercial trains and subway systems.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Trams and Trains)	May Trigger
• No Electricity • Lack of Utilization • Damaged Rail System • Rail Blockage • Government Shutdown • Pandemic	• Locked Gates • Closed Signs • No Lights or Staff	• Commuters • Drivers	• Becoming Stuck • Can't Travel • Change of Plans	• Walking • Driving • Boat • Cycling • Flying	• Being Stuck • Becoming Lost • Can't Travel

Prepper Solution
Use alternative transport such as buses, taxis, cycling or walking.

Ferry / Boat Shutdown

The shutdown of the commercial ferry and boating systems.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Ferries and Boats)	May Trigger
● Strikes ● Lack of Utilization ● No Fuel ● Flooded Rivers / Lakes ● Government Shutdown ● Pandemic	● Locked Gates ● Closed Signs ● No Lights or Staff	● Commuters ● Boat Drivers	● Becoming Stuck ● Can't Travel ● Change of Plans	● Walking ● Driving ● Train ● Cycling ● Flying	● Being Stuck ● Becoming Lost ● Can't Travel

Prepper Solution
Use alternative transport such as buses, taxis, cycling or walking.

Airline Shutdown

The shutdown of commercial airlines.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Flying)	May Trigger
● Terrorist Threats ● Lack of Utilization ● Struggling Economy ● Finance Problems ● No Aircraft Fuel ● Pandemic ● No Electricity	● Locked Doors ● Closed Signs ● No Lights or Staff	● Commuters ● Pilots	● Becoming Stuck ● Can't Travel ● Change of Plans	● Walking ● Driving ● Train ● Cycling ● Boat	● Being Stuck ● Becoming Lost

Prepper Solution
Use alternative transport such as buses, taxis, cycling or walking.

Total Transport Shutdown

The shutdown of all modes of transport.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Transport)	May Trigger
● Economy Problems ● Pandemic ● Terrorist Threats ● No Electricity	● Locked Doors ● Closed Signs ● No Lights or Staff	● Everyone ● Commuters	● Becoming Stuck ● Can't Travel ● Change of Plans	● Walking ● Possibly Driving	● Being Stuck ● Becoming Lost

Prepper Solution
The only alternative is walking to where you need to go, however it's recommended that you avoid moving.

Supermarket Closure

The closure of supermarkets and other food stores.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Using Supermarkets)	May Trigger
● Lack of Food ● Blocked Highways ● Farmer Strike ● No Electricity	● Locked Doors ● Closed Signs ● No Lights or Staff	● Shoppers ● Employees ● Truck Drivers ● Farmers	● Can't Buy Food ● Can't Buy Items ● Can't Buy Supplies	● Foraging ● Gardening ● Bartering	● Starvation ● Illness

Prepper Solution
Have a stockpile of food and water in your home to last the entirety of the disaster.

Hospital Closure

The closure of hospitals which may include the transfer of patients.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Hospitals)	May Trigger
● Over-Occupation ● Widespread Disease ● Pandemic ● Lack of Staff ● Medical Hazards ● Infiltration ● Lack of Security ● Government Shutdown ● No Electricity	● Long Waiting Lines ● Closed Gates ● Keep Out Signs ● No Lights or Staff ● No Ambulances	● Hospitals ● Medical Supplies ● Ambulances	● Death ● Illness ● Disease	● Self Medication ● Veterinarian	● Riots ● Pandemic

Prepper Solution
Know first aid and other medical procedures and have a stockpile of medicine and first aid kits.

School / TAFE / College Shutdown

The closure of schools.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives (To Learn With)	May Trigger
● Weather Disaster ● Fear ● Pandemic ● Threats ● Shootings ● Lack of Students	● Locked Gates ● Keep Out Signs ● No Lights or Staff	● Students ● Teachers	● Unable to Learn ● Loss of Teacher Jobs ● Less Intelligence	● Home Study ● Not Studying	● Riots

Prepper Solution
Home-schooling kids or self taught learning from books and the internet.

5 Suspended Rights

Any inalienable rights which you should be entitled to as a human, which have been suspended or removed.

Freedom of Speech

A principle that supports the freedom of an individual or a community to articulate their opinions and ideas without fear of retaliation, censorship, or sanction.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Increased Power • Political Correctness • Keep Truth Secret	• Censorship • Blocked Content	• Internet • Speeches	• New Laws • Internet Censorship	• Don't Speak Out • Meet in Person • Find Other Ways	• Riots • Violence • Civil Unrest

Prepper Solution
Download all the information you can while it's available and speak your mind when you have the chance.

Right of Grievance

The right to publicly show disapproval in the form of gatherings, strikes and petitions.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Past Grievances • Unrest at Events	• Strikes • Unrest • Riots	• Businesses • Employees • Payments	• Curfew • Ban on Strikes	• Quitting Your Job • Boycotting	• Riots • Violence • Destruction

Prepper Solution
Try to lay low and avoid standing out. Avoid use of systems where the strikes are occurring.

Right to Bear Arms

The right to possess a gun for your own defence.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Shootings • Law Change • New Leader	• Continual Shootings • Riots • Protests • News Announcements • Gun Shop Closures	• Weapons Bearers • Guns • Ammo	• New Gun Laws • Gun Hoarding • Violence • Riots	• Bows • Crossbows • Slingshots • Other Weapons • No Weapons	• Riots • Violence

Prepper Solution
Storing guns and ammo for future use, adapting to the new laws or building your own guns and ammo.

Martial Law

The imposition of direct military control of normal civilian functions of government, especially in response to a temporary emergency such as invasion or major disaster.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• Weather Events • Invasion • War • Military Coup	• Notification of Suspension • Riots	• All Citizens	• Possible Curfew • Civil Law Suspension • Civil Rights Suspension • Application of Military Justice on Citizens	• Comply • Rebel • Revolt	• Riots • Violence

Prepper Solution
As a prepper you will generally want to stay under the radar and inside your house.

Right to Information

The closing of schools and the withholding or censorship of knowledge.

Causes	Symptoms	Affects (Object)	Effects (From)	Alternatives	May Trigger
• New Leader • Leaked Information • To Withhold Power • High Intelligence Levels	• Closing of Schools • Internet Censorship • Book Burning	• Kids/Students • Internet • Books	• Decreased Knowledge • Internet Censorship	• Information Hoarding • Reading • Data Swapping • Knowledge Swapping • The Dark Web	• Riots • Violence • Dumber Generations

Prepper Solution
Educating yourself is the optimal solution to ensure your education is up to standards.

Right to Truth

Access to information such as news, weather, and worldwide events without them being altered in any way by higher authorities.

DISASTER TRIG	Suspended R	Right to Truth							
				Causes ● Making Money ● Power ● Avoiding Panic ● False Racism	**Symptoms** ● Lying Media ● Conflicting News ● Lack of News ● No News ● Book Burning	**Affects (Object)** ● Entire Population	**Effects (From)** ● We Become Pawns ● They Gain Power ● They Gain Money ● Mind Control	**Alternatives** ● Alternate News Outlets ● Don't Read News ● Research News Yourself ● Read the Bible	**May Trigger** ● Revolts ● Revolution ● Riots ● Destruction
				Prepper Solution We have to keep in mind that what we read may not be the complete truth and that there are objectives behind most news articles.					

Mass Destruction

Disasters that could end life on entire continents or earth completely

"We will not prematurely or unnecessarily risk the costs of worldwide nuclear war in which even the fruits of victory would be ashes in our mouth."
John F. Kennedy

Introduction

This section contains scenarios for mass destruction and are based around world altering or world destroying scenarios that can affect an entire continent such as huge meteors or supervolcanos. If you're looking for general information on wars, see the MAN-MADE DISASTERS category.

Purpose	The aim of MASS DESTRUCTION is to list plausible scenarios which can end life on entire continents or end life of earth completely. It also includes information on rebuilding society if one of these events does occur.
Lost?	• For a list of (non-world ending) natural disasters, see NATURAL DISASTERS. • For a list of (non-world ending) man-made disasters, see MAN-MADE DISASTERS. • For the weapons which are likely to cause this level of destruction, see WARFARE. • For a distraction from the current turmoil of the world, see the ENTERTAINMENT section. • If you're struggling with a chaotic world and can't see the good in it, see the RELIGION > Christianity section. • For a list of triggers which could cause a global war, see DISASTER TRIGGERS.

Contents

1 Natural Events

These are the natural events that could end life on an entire continent or the entire planet as opposed to regular natural disasters which generally only occur in a specific region.

Supervolcano

A supervolcano is a large volcano that has had an eruption of magnitude 8, which is the largest value on the Volcanic Explosivity Index (VEI). This means the volume of deposits for that eruption is greater than 1,000 cubic kilometres (240 cubic miles).

Supervolcanoes occur when magma in the mantle rises into the crust but is unable to break through it and pressure builds in a large and growing magma pool until the crust is unable to contain the pressure. This can occur at hotspots (for example, Yellowstone Caldera) or at subduction zones (for example, Toba). Large-volume supervolcanic eruptions are also often associated with large igneous provinces, which can cover huge areas with lava and volcanic ash. These can cause long-lasting climate change (such as the triggering of a small ice age) and threaten species with extinction. The Oruanui eruption of New Zealand's Taupo Volcano was the world's most recent VEI-8 eruption.

Known Supervolcanos
- Yellowstone (U.S.)
- Mount Vesuvius (Italy)
- Popocatepetl (Mexico)
- Sukurajima (Japan)
- Galeras (Colombia)
- Mount Marapi (Indonesia)
- Mount Nyiragongo (Kongo)
- Ulawun (Papua New Guinea)
- Taal (Phillipines)
- Mauna Loa (Hawaii)

See the NATURAL DISASTERS > Volcano section for more information on volcanos.

Megaquake

A megaquake is an earthquake with a magnitude of 9.0 or higher. These cause extreme damage and can be felt half way around the globe.

Megathrust Earthquake

Megathrust earthquakes occur at subduction zones at destructive convergent plate boundaries, where one tectonic plate is forced underneath another, caused by slip along the thrust fault that forms the contact between them. These interplate earthquakes are the planet's most powerful, with moment magnitudes (Mw) that can exceed 9.0. Since 1900, all earthquakes of magnitude 9.0 or greater have been megathrust earthquakes. No other type of tectonic activity of terrestrial origin has produced earthquakes of this scale.

Biblical Earthquakes

There's four colossal earthquakes found in the Bible which are still yet future. They start at about magnitude 8.5 and goes up to one that shakes the entire planet causing every mountain to crumble. They are found in the: 6th Seal, 7th Seal, 7th Trumpet and the 7th Bowl. The 7th Bowl is the one which shakes the entire planet. Watch out out for them, and if they happen, read Revelation.

Cataclysmic Pole Shift

The Cataclysmic Pole Shift Hypothesis is a claim that proposes a rapid and dramatic change in the Earth's geographic poles – meaning the physical North and South Poles where the planet's axis of rotation meets its surface.

Unlike a geomagnetic reversal (where only the magnetic poles swap), this hypothesis suggests the Earth's entire solid outer layer (the lithosphere, comprising the crust and upper mantle) somehow slips or shifts dramatically over the molten liquid outer core. This shift is proposed to happen very quickly, over days, weeks, or at most a few centuries, as opposed to the geological timescales of millions of years observed for accepted "true polar wander" (a very slow, continuous reorientation of the Earth's axis).

Consequences

Catastrophic Consequences Envisioned
If such a rapid shift were to occur, the imagined consequences are indeed cataclysmic:

● Massive Earthquakes and Volcanic Eruptions: The sudden displacement of the crust would cause unimaginable tectonic stress, leading to earthquakes of unprecedented magnitude and widespread volcanic activity.
● Gigantic Tsunamis: As continents are abruptly moved through the oceans, colossal tsunamis would be generated, potentially hundreds or thousands of meters high, inundating vast coastal and even inland areas.
● Radical Climate Change: Regions would instantly find themselves at vastly different latitudes. Tropical areas could be plunged into polar cold, and polar regions could move into the tropics, causing immediate and widespread devastation to ecosystems and life that cannot adapt fast enough.
● Global Flooding: Beyond tsunamis, proponents often suggest widespread global flooding as oceans are displaced.

2 War Events

This section focuses on war related events and nuclear weapons that could end life on a massive scale. Such as EMPs, Neutron Bombs and Radiation.

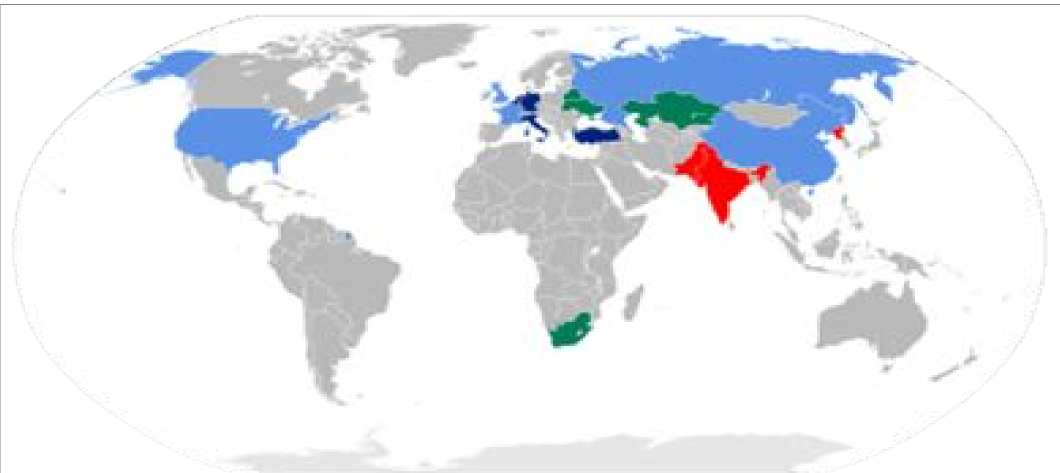
Subheadings

		1. Nuclear Weapons	**2. Neutron Bomb**	**3. EMP**	**4. Radiation**		

1 Nuclear Weapons

Any form of nuclear weapons which can destroy vast regions and render them uninhabitable. The Tsar Bomba is the largest bomb ever made and detonated in 1961. It contained 57 megatons of TNT.

Nuclear Country Map
A map of the nuclear countries around the world. Best utilized for looking for new places to live.



Map Legend	**Light Blue** NPT-designated nuclear weapon states (China, France, Russia, United Kingdom, United States)		**Red** Other states with nuclear weapons (India, North Korea, Pakistan)		**Yellow** Other states presumed to have nuclear weapons (Israel)		**Navy Blue** NATO member nuclear weapons sharing states (Belgium, Germany, Italy, Netherlands, Turkey)		**Green** States formerly possessing nuclear weapons (Belarus, Kazakhstan, South Africa, Ukraine)		
Warhead Count 2021[n]	**United States** 6,185	**Russia** 6,490	**United Kingdom** 215	**France** 280	**China** 320	**India** 170+	**Pakistan** 160	**North Korea** 40	**Israel** 90		

Nuclear Types

These are the types of nuclear weapons and nuclear particles.

A-Bombs	Fission (A-Bombs) are the most basic nuclear weapon and are incorporated into the other weapon classes. This bomb's power comes from splitting heavy nuclei (plutonium and uranium) with neutrons; as the uranium or plutonium split each atom releases great amounts of energy - and more neutrons. The daughter neutrons cause an extremely fast nuclear chain reaction. Fission bombs are the only type of nuclear bomb used in war so far. This is the most likely type of bomb to be used by terrorists.
H-Bombs	Fusion (H-Bombs), using the incredible heat of a fission bomb 'spark plug', compress and heat deuterium and tritium which fuse, releasing immense amounts of energy. Also known as thermonuclear weapons since high temperatures are required to fuse deuterium and tritium; such weapons are usually many hundreds of times more powerful than the bombs that destroyed Nagasaki and Hiroshima. The bulk of the US and Russian strategic arsenal are these types of bombs.
Alpha Particles	These are the weakest and, during an attack, are virtually non-existent as a threat. Alpha particles will survive for only a couple inches in the air before they are absorbed by the atmosphere. They possess a minuscule threat from the exterior, however, they will be fatal if ingested or inhaled. Standard clothing will help protect you from Alpha particles.
Beta Particles	These are faster than Alpha particles and can penetrate further. They will travel for up to 10 meters (10 yards) before they are absorbed into the atmosphere. Exposure to beta particles is not fatal unless exposed for prolonged periods; which may cause "Beta burns," almost like painful sunburn. They pose a serious threat, however, to the eyes, should they be exposed for a prolonged period. Once again this is harmful if ingested or inhaled, and clothing will help prevent Beta burns.
Gamma Rays	Gamma rays are the deadliest. They can travel for nearly a mile in the air and penetrate just about any kind of shielding. Therefore gamma radiation will cause severe damage to the internal organs even as an external source. Sufficient shielding will be required. A shelter's PF against radiation will tell you how many times less a person inside the shelter will receive radiation compared to open space. For example, RPF 300 means that you will receive 300 times less radiation in the shelter than in the open.
Exposure	Avoid exposure to Gamma radiation. Try not to spend more than 5 minutes exposed. If you are in a rural area, try finding a cave, or a fallen log into which you can crawl. Otherwise just dig a trench to lie in, with stacked earth around you.

Nuclear Damage Examples

These are the damage radii for the different components of surface blast nuclear explosions including the damage and the distance the resulting radiation fallout can travel.

50 Kilotonnes Fireball - 380m Air Blast 20psi - 0.8km Radiation - 1.64km Air Blast 5psi - 1.69km Thermal Radiation - 2.8km Air Blast 1psi - 4.33km 1000 Rads/h - 6.96km Max 100 Rads/h - 43km Max 10 Rads/h - 96km Max 1 Rad/h - 149km Max	**100 Kilotonnes** Fireball - 500m Air Blast 20psi - 1.01km Radiation - 1.82km Air Blast 5psi - 2.12km Thermal Radiation - 3.9km Air Blast 1psi - 5.46km 1000 Rads/h - 7.63km Max 100 Rads/h - 61.5km Max 10 Rads/h - 124km Max 1 Rad/h - 186km Max	**150 Kilotonnes** Fireball - 0.59km Air Blast 20psi - 1.16km Radiation - 1.94km Air Blast 5psi - 2.43km Thermal Radiation - 4.6km Air Blast 1psi - 6.25km 1000 Rads/h - 8.06km Max 100 Rads/h - 74.7km Max 10 Rads/h - 143km Max 1 Rad/h - 211km Max	**300 Kilotonnes** Fireball - 0.78km Air Blast 20psi - 1.46km Radiation - 2.14km Air Blast 5psi - 3.06km Thermal Radiation - 6.3km Air Blast 1psi - 7.88km 1000 Rads/h - 8.88km Max 100 Rads/h - 102km Max 10 Rads/h - 183km Max 1 Rad/h - 263km Max	**500 Kilotonnes** Fireball - 0.95km Air Blast 20psi - 1.73km Radiation - 2.29km Air Blast 5psi - 3.63km Thermal Radiation - 7.9km Air Blast 1psi - 9.34km 1000 Rads/h - 9.55km Max 100 Rads/h - 128km Max 10 Rads/h - 219km Max 1 Rad/h - 310km Max	**800 Kilotonnes** Fireball - 1.15km Air Blast 20psi - 2.02km Radiation - 2.43km Air Blast 5psi - 4.25km Thermal Radiation - 9.7km Air Blast 1psi - 10.9km 1000 Rads/h - 53.1km Max 100 Rads/h - 155km Max 10 Rads/h - 257km Max 1 Rad/h - 359km Max
1 Megatonne Fireball - 1.26km Air Blast 20psi - 2.18km Radiation - 2.5km Air Blast 5psi - 4.58km Thermal Radiation - 10.7km Air Blast 1psi - 11.8km 1000 Rads/h - 62.2km Max 100 Rads/h - 170km Max 10 Rads/h - 278km Max 1 Rad/h - 386km Max	**5 Megatonnes** Fireball - 2.39km Radiation - 3.05km Air Blast 20psi - 3.72km Air Blast 5psi - 7.83km Air Blast 1psi - 20.1km Thermal Radiation - 21km 1000 Rads/h - 159km Max 100 Rads/h - 319km Max 10 Rads/h - 480km Max 1 Rad/h - 641km Max	**15 Megatonnes** Radiation - 3.63km Fireball - 3.71km Air Blast 20psi - 5.37km Air Blast 5psi - 11.3km Air Blast 1psi - 29km Thermal Radiation - 34km 1000 Rads/h - 269km Max 100 Rads/h - 481km Max 10 Rads/h - 694km Max 1 Rad/h - 906km Max	**50 Megatonnes** Radiation - 5.05km Fireball - 6.01km Air Blast 20psi - 8.02km Air Blast 5psi - 16.9km Air Blast 1psi - 43.3km Thermal Radiation - 51km 1000 Rads/h - 455km Max 100 Rads/h - 744km Max 10 Rads/h - 1,030km Max 1 Rad/h - 1,320km Max	**100 Megatonnes** Radiation - 6.99km Fireball - 7.92km Air Blast 20psi - 10.1km Air Blast 5psi - 21.2km Air Blast 1psi - 54.6km Thermal Radiation - 64km 1000 Rads/h - 605km Max 100 Rads/h - 952km Max 10 Rads/h - 1,300km Max 1 Rad/h - 1,640km Max	

Blast Damage Descriptions

Radiation	500 rem radiation dose; without medical treatment, there can be expected between 50% and 90% mortality from acute effects alone. Dying takes between several hours and several weeks.
Fireball	Maximum size of the nuclear fireball; relevance to lived effects depends on height of detonation. If it touches the ground, the amount of radioactive fallout is significantly increased.
Air Blast 20psi	At 20 psi overpressure, heavily built concrete buildings are severely damaged or demolished; fatalities approach 100%. Often used as a standard benchmark for heavy damage in cities.
Air Blast 5psi	At 5 psi overpressure, most residential buildings collapse, injuries are universal, fatalities are widespread. Often used as a standard benchmark for medium damage in cities.
Air Blast 1psi	At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a standard benchmark for light damage in cities.
Thermal Radiation	Third degree burns extend throughout the layers of skin, and are often painless because they destroy the pain nerves. They can cause severe scarring or disablement, and can require amputation. 100% probability for 3rd degree burns at this yield is 9.5 cal/cm2.
1000 Rads/h	Estimated total-dose fallout contours- for a surface burst (52% fission) with a 24.14km/h (15 mph) (4 Beaufort Scale) wind.

MASS DESTRUCTION
War Events
Nuclear Weapons
Nuclear Damage Examples

100 Rads/h	Estimated total-dose fallout contours- for a surface burst (52% fission) with a 24.14km/h (15 mph) (4 Beaufort Scale) wind.
10 Rads/h	Estimated total-dose fallout contours- for a surface burst (52% fission) with a 24.14km/h (15 mph) (4 Beaufort Scale) wind.
1 Rads/h	Estimated total-dose fallout contours- for a surface burst (52% fission) with a 24.14km/h (15 mph) (4 Beaufort Scale) wind.

Nuclear Blast Protection (Within the damage zone of the explosion)

Blast Energy Distribution **Blast:** 40-50% **Thermal Radiation:** 30-50% **Ionizing Radiation:** 5% **Residual Radiation:** 5-10%	**Hydrodynamic Front** The thin, dense shell consisting of high temperatures and radiation which cause gas to move outward radially. The front acts like a piston that pushes against and compresses the surrounding medium to make a spherically expanding shock wave.	**Reinforce** If time permits, build up the bunker using as many dense materials on every wall as possible to reduce the levels of radiation.	If you're within the blast radiation radius or potential radiation range (factoring wind) - stay inside for 2 days absolute minimum.	**Blast Wave** **Static Overpressure:** The sharp increase in pressure exerted by the shock wave. **Dynamic Pressures:** drag exerted by the blast winds required to form the blast wave. These winds push, tumble and tear objects.

Radiation Exposure
If you believe you're in a radiation zone or will be exposed to radiation you should take a Potassium Iodide pill every 24 hours to saturate your thyroid gland. See the "Radiation" section below for more details.

2 Neutron Bomb

A neutron bomb is a low yield thermonuclear weapon designed to maximize lethal neutron radiation in the immediate vicinity of the blast while minimizing the physical power of the blast itself. This kills the living proteins in the area while leaving the real estate untouched, useful if the invader wants to move in to the existing structures afterwards. The neutron release generated by a nuclear fusion reaction is intentionally allowed to escape the weapon, rather than being absorbed by its other components. The neutron burst, which is used as the primary destructive action of the warhead, is able to penetrate enemy armour more effectively than a conventional warhead, thus making it more lethal as a tactical weapon.

Concept
In a standard thermonuclear design, a small fission bomb is placed close to a larger mass of thermonuclear fuel. The two components are then placed within a thick radiation case, usually made from uranium, lead or steel. The case traps the energy from the fission bomb for a brief period, allowing it to heat and compress the main thermonuclear fuel. The case is normally made of depleted uranium or natural uranium metal, because the thermonuclear reactions give off massive numbers of high-energy neutrons that can cause fission reactions in the casing material. These can add considerable energy to the reaction; in a typical design as much as 50% of the total energy comes from fission events in the casing. For this reason, these weapons are technically known as fission-fusion-fission designs.

Use
Neutron bombs are purposely designed with explosive yields lower than other nuclear weapons. Since neutrons are scattered and absorbed by air, neutron radiation effects drop off rapidly with distance in air. As such, there is a sharper distinction, relative to thermal effects, between areas of high lethality and areas with minimal radiation doses. All high yield (more than c. 10 kiloton) nuclear bombs, such as the extreme example of a device that derived 97% of its energy from fusion, the 50 megaton Tsar Bomba, are not able to radiate sufficient neutrons beyond their lethal blast range when detonated as a surface burst or low altitude air burst and so are no longer classified as neutron bombs, thus limiting the yield of neutron bombs to a maximum of about 10 kilotons. The intense pulse of high-energy neutrons generated by a neutron bomb is the principal killing mechanism, not the fallout, heat or blast. Although neutron bombs are commonly believed to "leave the infrastructure intact", with current designs that have explosive yields in the low kiloton range, detonation in (or above) a built-up area would still cause a sizable degree of building destruction, through blast and heat effects out to a moderate radius, albeit considerably less destruction, than when compared to a standard nuclear bomb of the exact same total energy release or "yield".

Effects

Upon detonation, a near-ground airburst of a 1 kiloton neutron bomb would produce a large blast wave and a powerful pulse of both thermal radiation and ionizing radiation, and non-ionizing radiation in the form of fast (14.1 MeV) neutrons. The thermal pulse would cause third degree burns to unprotected skin out to approximately 500 meters. The blast would create pressures of at least 4.6 psi out to a radius of 600 meters, which would severely damage all non-reinforced concrete structures. At the conventional effective combat range against modern main battle tanks and armoured personnel carriers (< 690–900 m), the blast from a 1 kt neutron bomb would destroy or damage to the point of nonusability almost all un-reinforced civilian buildings. Using neutron bombs to stop an enemy armoured attack by rapidly incapacitating crews with a dose of 8000+ rads of radiation would require exploding large numbers of them to blanket the enemy forces, destroying all normal civilian buildings within c. 600 meters of the immediate area. Neutron activation from the explosions could make many building materials in the city radioactive, such as zinc coated steel/galvanized steel (see area denial use below).

Because liquid-filled objects like the human body are resistant to gross overpressure, the 4–5 psi blast overpressure would cause very few direct casualties at a range of c. 600 m. The powerful winds produced by this overpressure, however, could throw bodies into objects or throw debris at high velocity, including window glass, both with potentially lethal results. Casualties would be highly variable depending on surroundings, including potential building collapses. The pulse of neutron radiation would cause immediate and permanent incapacitation to unprotected outdoor humans in the open out to 900 meters, with death occurring in one or two days. The median lethal dose (LD50) of 600 rads would extend to between 1350 and 1400 meters for those unprotected and outdoors, where approximately half of those exposed would die of radiation sickness after several weeks. A human residing within, or simply shielded by, at least one concrete building with walls and ceilings 30 cm (12 in) thick, or alternatively of damp soil 24 inches thick, would receive a neutron radiation exposure reduced by a factor of 10. Even near ground zero, basement sheltering or buildings with similar radiation shielding characteristics would drastically reduce the radiation dose. Furthermore, the neutron absorption spectrum of air is disputed by some authorities, and depends in part on absorption by hydrogen from water vapour. Thus, absorption might vary exponentially with humidity, making neutron bombs far more deadly in desert climates than in humid ones.

3 EMP

A nuclear electromagnetic pulse is a burst of electromagnetic radiation created by nuclear explosions. The resulting rapidly changing electric and magnetic fields may couple with electrical and electronic systems to produce damaging current and voltage surges. The specific characteristics of any particular nuclear EMP event vary according to a number of factors, the most important of which is the altitude of the detonation.

HEMP	In military terminology, a nuclear warhead detonated tens to hundreds of kilometres above the Earth's surface is known as a high-altitude electromagnetic pulse (HEMP) device. Effects of a HEMP device depend on factors including the altitude of the detonation, energy yield, gamma ray output, interactions with the Earth's magnetic field and electromagnetic shielding of targets.

Characteristics - E1	The E1 pulse is the very fast component of nuclear EMP. E1 is a very brief but intense electromagnetic field that induces very high voltages in electrical conductors. E1 causes most of its damage by causing electrical breakdown voltages to be exceeded. E1 can destroy computers and communications equipment and it changes too quickly (nanoseconds) for ordinary surge protectors to provide effective protection against it, although there are special fast-acting surge protectors (such as those using TVS diodes) that will block the E1 pulse. E1 is produced when gamma radiation from the nuclear detonation ionizes (strips electrons from) atoms in the upper atmosphere. This is known as the Compton effect and the resulting current is called the "Compton current". The electrons travel in a generally downward direction at relativistic speeds (more than 90 percent of the speed of light).
Characteristics - E2	The E2 component is generated by scattered gamma rays and inelastic gammas produced by neutrons. This E2 component is an "intermediate time" pulse that, by the IEC definition, lasts from about 1 microsecond to 1 second after the explosion. E2 has many similarities to lightning, although lightning-induced E2 may be considerably larger than a nuclear E2. Because of the similarities and the widespread use of lightning protection technology, E2 is generally considered to be the easiest to protect against.
Characteristics - E3	E3 is a very slow pulse, lasting tens to hundreds of seconds. It is caused by the nuclear detonation's temporary distortion of the Earth's magnetic field. Like a geomagnetic storm, E3 can produce geomagnetically induced currents in long electrical conductors, damaging components such as power line transformers. Because of the similarity between solar-induced geomagnetic storms and nuclear E3, it has become common to refer to solar-induced geomagnetic storms as "Solar EMP." "Solar EMP," however, does not include an E1 or E2 component.

Effects

Nuclear EMP Effects
An energetic EMP can temporarily upset or permanently damage electronic equipment by generating high voltage and high current surges; semiconductor components are particularly at risk. The effects of damage can range from imperceptible to the eye, to devices being literally blown apart. Cables, even if short, can act as antennas to transmit pulse energy to equipment.

Starfish Prime Example
1.44 megaton bomb detonated 400 kilometres (250 mi) above the mid-Pacific Ocean. It caused electrical damage in Hawaii, about 1,445 kilometres (898 mi) away from the detonation point, knocking out about 300 streetlights. A 10 kiloton bomb can easily be 40% as powerful as the 1.44 megaton Starfish Prime at producing EMP.

Below are the effects of an EMP.

Range	The pulse can easily span continent-sized areas, and this radiation can affect systems on land, sea, and air. A large device detonated at 400–500 km (250 to 312 miles) over Kansas would affect all of the continental U.S. The signal from such an event extends to the visual horizon as seen from the burst point.
Cars	An EMP would probably not affect most cars, despite modern cars' heavy use of electronics, because cars' electronic circuits and cabling are likely too short to be affected. In addition, cars' metallic frames provide some protection. However, even a small percentage of cars breaking down due to an electronic malfunction could cause traffic jams.
Humans & Animals	Although large amounts of voltage can get accumulated in electrical conductors after an EMP, it will generally not flow out into human or animal bodies, and thus contact is safe.
Small Electronics	An EMP has a smaller effect, the shorter the length of an electrical conductor; though other factors affect the vulnerability of electronics as well, so there is no one cutoff length that determines whether some piece of equipment will survive. However, small electronic devices, such as wristwatches and cell phones, would most likely withstand an EMP.
Effectiveness	Factors that control weapon effectiveness include altitude, yield, construction details, target distance, intervening geographical features, and local strength of the Earth's magnetic field.

Radar Blackout
Nuclear blackout, also known as fireball blackout or radar blackout, is an effect caused by explosions of nuclear weapons that disturbs radio communications and causes radar systems to be blacked out or heavily refracted so they can no longer be used for accurate tracking and guidance. Within the atmosphere, the effect is caused by the large volume of ionized air created by the energy of the explosion, while above the atmosphere it is due to the action of high-energy beta particles released from the decaying bomb debris. At high altitudes, the effect can spread over large areas, hundreds of kilometres. The effect slowly fades as the fireball dissipates.

Blackout is a special concern in missile defence systems, where the effect can be used to defeat ground based radars by producing large opaque areas behind which approaching warheads cannot be seen. Depending on the reaction time of the interceptors, this may render them useless as the approaching warheads re-appear too late for the interceptor to develop a track and fire its missile.

Protection

A Faraday cage or Faraday shield is an enclosure used to block electromagnetic fields. A Faraday shield may be formed by a continuous covering of conductive material or in the case of a Faraday cage, by a mesh of such materials. A Faraday cage operates because an external electrical field causes the electric charges within the cage's conducting material to be distributed such that they cancel the field's effect in the cage's interior. This phenomenon is used to protect sensitive electronic equipment from external radio frequency interference (RFI). Faraday cages are also used to enclose devices that produce RFI, such as radio transmitters, to prevent their radio waves from interfering with other nearby equipment.

Faraday cages cannot block stable or slowly varying magnetic fields, such as the Earth's magnetic field (a compass will still work inside). A common misconception is that a Faraday cage provides full blockage or attenuation; this is not true. The reception or transmission of radio waves, a form of electromagnetic radiation, to or from an antenna within a Faraday cage is heavily attenuated or blocked by the cage, however, a Faraday cage has varied attenuation depending on wave form, frequency or distance from receiver/transmitter, and receiver/transmitter power.

4 Radiation

Measuring Radioactivity
Ionizing radiation can be measured using units of electron volts, ergs, and joules. The electron-volt (abbreviated eV) is a unit of energy associated with moving electrons around.

Measuring Dose
Placing your body near a radioactive source results in exposure. To evaluate the hazard from this exposure one must compute the absorbed dose. This is defined as the energy imparted to a defined mass of tissue. Dose is generally not uniform over the body. A radioactive substance can be selectively taken up by different organs or tissue.

Radiation doses are often calculated in the units of rad (short for radiation absorbed dose). One rad is 100 ergs/gram, in other words, 100 ergs of energy absorbed by one gram of a given body tissue. An erg is one-ten-millionth of a joule. One hundred rad equals one Joule/kilogram (J/kg), which also equals one Gray (Gy), the standard international unit for measuring radiation dose.

Geiger Counter
Geiger counters are used to detect radioactive emissions, most commonly beta particles and gamma rays. Radioactivity can be measured in order to discover the amount of radiation a material emits or the amount of radiation absorbed by a human or mammal.

Geiger Counter Measurement
The unit for measuring radioactive emissions is the **Becquerel (Bq)**. The Bq indicates the number of decays per second. The **roentgen** equivalent in man (rem) is an older standardized unit for measuring absorbed dose. The **mrem**, 1000th of that unit, is the unit used today in medicine.

Radiation Measurements

Rem (Roentgen Equivalent Man) Dose Equivalent	A unit of equivalent absorbed dose of radiation which takes into account the relative biological effectiveness of different forms of ionizing radiation. Rem Dose = Rad Dose x Quality (Q) Millirem (mrem) - 1/1000 **Beta/Gamma Rads:** Q = 1, Q1 Means: 1 Rem = 1 Rad **Alpha Radiation:** Q = 20, Rems equal 20 times rads. **Neutrons:** Q = 10. **Equivalent:** rem = rad x Q
Sievert (Sv) Dose Equivalent	A unit of equivalent absorbed dose equal to 100 rem. **nanosievert (nSv)** - one thousand millionth of a sievert (1/1,000,000,000) **microsievert (µSv)** - one millionth of a sievert (1/1,000,000) **millisievert (mSv)** - one thousandth of a sievert (1/1,000) **Equivalent:** 1 Sv = 100 rem Sv = Gy x Q
Rad (Radiation Absorbed Dose) Absorbed Dose	A unit of absorbed dose of radiation. Rad is a measure of the amount of energy deposited in tissue. **Equivalent:** 1 rad = 100 erg/gram
Gray (Gy) Absorbed Dose	A unit of absorbed radiation dose equal to 100 rad. Gray is a measure of deposition of energy in tissue. **nanogray (nGy)** - one thousand millionth of a gray (1/1,000,000,000) **microgray (µGy)** - one millionth of a gray (1/1,000,000) **milligray (mGy)** - one thousandth of a gray (1/1,000) **Equivalent:** 1 Gy = 100 rad
Curies (Ci) Radioactivity	(Succeeded by Bq) The traditional unit of radioactivity, equal to the radioactivity of one gram of pure radium-226. **Equivalent:** 1 Ci = 37 billion dps = 37 billion Bq
Becquerels (Bq) Radioactivity	The standard international unit of radioactivity equal to one disintegration per second. **Equivalent:** 1 Bq = 27 pCi
Disintegrations Per Second (dps)	The number of subatomic particles (e.g. alpha particles) or photons (gamma rays) released from the nucleus of a given atom over one second. One dps = 60 dpm (disintegrations per minute). **Equivalent:** 1 dps = 1 Bq
Coulomb/kilogram (C/kg) Exposure	A SI derived unit of exposure to ionizing radiation equal to the amount of gamma or x-rays required to produce ions in an element of air resulting in a charge of one Coulomb per one kilogram of that element under standard conditions.
Roentgen (r) Exposure	The roentgen (symbol R) or röntgen (in German) is a legacy unit to measure radiation exposure. It was defined as the quantity of x-rays that produce 2.580 × 10-4 coulombs of charge collected per unit mass (kilograms) of air at standard temperature and pressure (STP): 1 R = 0.000258 coulombs per kilogram (Ckg-1) of air.

Nuclear Radiation Prevention

These are different methods of reducing radiation exposure.

Time	The longer that humans are subjected to radiation the larger the dose will be. The advice in the nuclear war manual entitled "Nuclear War Survival Skills" published by Cresson Kearny in the U.S. was that if one needed to leave the shelter then this should be done as rapidly as possible to minimize exposure.
Distance	Increasing distance from the radiation source reduces the dose according to the inverse-square law for a point source. Distance can sometimes be effectively increased by means as simple as handling a source with forceps rather than fingers.
Shielding	Matter attenuates radiation in most cases, so placing any mass (e.g., lead, dirt, sandbags, vehicles) between humans and the source will reduce the radiation dose. This is not always the case, however; care should be taken when constructing shielding for a specific purpose.
Reduction	Where radioactive contamination is present, a gas mask, dust mask, or good hygiene practices may offer protection, depending on the nature of the contaminant.
Tablets	Potassium iodide (KI) tablets can reduce the risk of cancer in some situations due to slower uptake of ambient radioiodine. Although this does not protect any organ other than the thyroid gland, their effectiveness is still highly dependent on the time of ingestion which would protect the gland for the duration of a twenty-four-hour period. They do not prevent acute radiation syndrome as they provide no shielding from other environmental radionuclides.
Fractation of Dose	If an intentional dose is broken up into a number of smaller doses, with time allowed for recovery between irradiations, the same total dose causes less cell death. Even without interruptions, a reduction in dose rate below 0.1 Gy/h also tends to reduce cell death. This technique is routinely used in radiotherapy.
Reinforcements	Begin reinforcing your shelter from the inside by stacking dirt around the walls or anything else you can find. If in a trench, then create a roof, but only if materials are nearby; don't expose yourself when not necessary. Canvas from a parachute or tent will help stop fallout debris from piling on you, though it will not stop Gamma rays. It is impossible, at a very fundamental physical level, to completely shield from all radiation. It can only be reduced to a tolerable level.

Radiation Reductions	**These Elements Reduce Radiation Penetration to 1/1000** **Steel:** 21 cm (0.7 feet) **Rock:** 90 cm (3 ft) **Concrete:** 66 cm (2.2 ft) **Wood:** 2.6 m (8.8 ft) **Soil:** 1 m (3.3 ft) **Ice:** 2 m (6.6 ft) **Snow:** 6 m (20-22 ft)
Tablets	**Potassium iodide (KI)** Take 1 IOSat tablet every 24 hours radiation is nearby.
Effective Dose	The probability of a harmful effect from radiation exposure depends on what part or parts of the body are exposed. Some organs are more sensitive to radiation than others. A tissue weighting factor (WT) is used to take this into account. When an equivalent dose to an organ is multiplied by the tissue weighting factor for that organ the result is the effective dose to that organ. The unit of effective dose is the sievert (Sv). **(Use weighting underneath)**
Tissue Weighting Factor	**Bone-marrow (red), colon, lung, stomach, breast, remaining tissues** (0.12,0.72) **Gonads** (0.08,0.08) **Bladder, oesophagus, liver, thyroid** (0.04,0.16) **Bone surface, brain, salivary glands, skin** (0.01,0.04)
Shelter Duration	Shelter for an absolute minimum of 28 hours (2 days) as most of the iodine will have decayed at that point. The reason for this is to avoid the "fission products" created by a nuclear blast. The most deadly of these is radioactive iodine. Iodine has a half life of 8 days - therefore 8 days shelter is recommended.
Clothing	Wear all clothing (hats, gloves, goggles, closed sleeve shirt, etc.), especially when outside to help prevent Beta burns. Decontaminate by shaking your clothes constantly and washing, with water, any exposed skin; settled residue will eventually cause burns.

Radiation Facts

Ionizing Radiation
Ionizing radiation is the high-energy radiation that causes most of the concerns about radiation exposure during military service. Ionizing radiation contains enough energy to remove an electron (ionize) from an atom or molecule and to damage DNA in cells.

Ionizing Sources
1. Nuclear Weapons
2. Radioactive Material
3. Calibration and Measurement Sources
4. X-rays
5. Space

Non-iodizing Radiation
Low-energy radiation that includes radiation from sources such as sunlight, microwaves, radio frequencies, radar and sonar.

Ground bursts start with a much higher initial radiation level because the materials destroyed and vaporized are mixed with the bomb debris. Another key contributor to this initial high level of radiation is the secondary activation of radiation caused by direct neutron interaction with these debris.

Radiation Diseases
- All cancers
- Non-malignant thyroid nodular disease
- Parathyroid adenoma
- Posterior subcapsular cataracts
- Tumors of the brain and central nervous system

Radiation 7/10 Rule
Every seven-fold increase in time reduces the radiation by a factor of 10.
7 hours - 1/10th.
49 Hours (2d) - 1/100th.
14 Weeks - 1/10,000th.

Never look at a nuclear weapon exploding as it will blind you. Based on the nuclear kt detonation of the explosion you want to get far away from the max distance radiation can travel.

Half-Life
- Iodine 131 - 8 Days
- Caesium 134 - 2Y
- Caesium 137 - 7Y
- Ruthenium 103 - 39 Days
- Ruthenium 106 - 1Y

Half-Life
- Strontium 90 - 30Y
- Plutonium 239 - 100Y
- Uranium 234 - 247k/Y
- Uranium 235 - 710m/Y
- Uranium 238 - 4.5b/y

Radiation Lethality Dose
Rads < 100: Typically produce no immediate symptoms other than blood changes.
Rads 100-200: Delivered to the entire body in less than a day may cause acute radiation syndrome, (ARS) but is usually not fatal.
Rads 200-1000: Delivered in a few hours will cause serious illness with poor outlook at the upper end of the range.
Rads > 1000: Whole body doses are almost invariably fatal.
See the MEDICAL section for more information.

3 Space Events

These are events of mass destruction that originate from space.

Solar Flare

A solar flare is a sudden flash of increased Sun's brightness, usually observed near its surface. Flares are often, but not always, accompanied by a coronal mass ejection. Even the most powerful flares are barely detectable in the total solar irradiance (the "solar constant"). Solar flares occur in a power-law spectrum of magnitudes; an energy release of typically 1020 joules of energy suffices to produce a clearly observable event, while a major event can emit up to 1025 joules. Flares are closely associated with the ejection of plasmas and particles through the Sun's corona into outer space; flares also copiously emit radio waves.

If the ejection is in the direction of the Earth, particles associated with this disturbance can penetrate into the upper atmosphere (the ionosphere) and cause bright auroras, and may even disrupt long range radio communication. It usually takes days for the solar plasma ejecta to reach Earth. Flares also occur on other stars, where the term stellar flare applies. High-energy particles, which may be relativistic, can arrive almost simultaneously with the electromagnetic radiations.

On July 23, 2012, a massive, potentially damaging, solar storm (solar flare, coronal mass ejection and electromagnetic radiation) barely missed Earth. According to NASA, there may be as much as a 12% chance of a similar event occurring between 2012 and 2022.

Solar flares affect all layers of the solar atmosphere (photosphere, chromosphere, and corona). The plasma medium is heated to tens of millions of kelvins, while electrons, protons, and heavier ions are accelerated to near the speed of light. Flares produce electromagnetic radiation across the electromagnetic spectrum at all wavelengths, from radio waves to gamma rays. Most of the energy is spread over frequencies outside the visual range and so the majority of the flares are not visible to the naked eye and must be observed with special instruments. Flares occur in active regions around sunspots, where intense magnetic fields penetrate the photosphere to link the corona to the solar interior. Flares are powered by the sudden (timescales of minutes to tens of minutes) release of magnetic energy stored in the corona. The same energy releases may produce coronal mass ejections (CMEs), although the relationship between CMEs and flares is still not well understood.

X-rays and UV radiation emitted by solar flares can affect Earth's ionosphere and disrupt long-range radio communications. Direct radio emission at decimetric wavelengths may disturb the operation of radars and other devices that use those frequencies. Solar flares were first observed on the Sun by Richard Christopher Carrington and independently by Richard Hodgson in 1859 as localized visible brightenings of small areas within a sunspot group. Stellar flares can be inferred by looking at the lightcurves produced from the telescope or satellite data of variety of other stars. The frequency of occurrence of solar flares varies, from several per day when the Sun is particularly "active" to less than one every week when the Sun is "quiet", following the 11-year cycle (the solar cycle). Large flares are less frequent than smaller ones.

Cause
Flares occur when accelerated charged particles, mainly electrons, interact with the plasma medium. Evidence suggests that the phenomenon of magnetic reconnection leads to this copious acceleration of charged particles. On the Sun, magnetic reconnection may happen on solar arcades – a series of closely occurring loops following magnetic lines of force. These lines of force quickly reconnect into a lower arcade of loops leaving a helix of magnetic field unconnected to the rest of the arcade. The sudden release of energy in this reconnection is the origin of the particle acceleration. The unconnected magnetic helical field and the material that it contains may violently expand outwards forming a coronal mass ejection.

This also explains why solar flares typically erupt from active regions on the Sun where magnetic fields are much stronger. Although there is a general agreement on the source of a flare's energy, the mechanisms involved are still not well understood. It is not clear how the magnetic energy is transformed into the kinetic energy of the particles, nor is it known how some particles can be accelerated to the GeV range (109 electron volt) and beyond. There are also some inconsistencies regarding the total number of accelerated particles, which sometimes seems to be greater than the total number in the coronal loop. Scientists are unable to forecast flares.

Measurement
The classification system for solar flares uses the letters A, B, C, M or X, according to the peak flux in watts per square metre. (W/m2) Each letter represents a 10-fold increase in energy output. So an X is ten times an M and 100 times a C. Within each letter class there is a finer scale from 1 to 9.

Classifications
Peak Flux Range at 100-800 picometre (watts/square metre)
A - < 10^−7
B - 10^−7 – 10^−6
C - 10^−6 – 10^−5
M - 10^−5 – 10^−4
X - > 10^−4

Effects	**A, B, C Class Flares** C-class and smaller flares are too weak to noticeably affect Earth.	**M Class Flares** Can produce minor radio disruptions.	**X Class Flares** Can overload the power grid causing widespread blackouts.	

Hazards
Solar flares strongly influence the local space weather in the vicinity of the Earth. They can produce streams of highly energetic particles in the solar wind or stellar wind, known as a solar proton event. These particles can impact the Earth's magnetosphere (see main article at geomagnetic storm), and present radiation hazards to spacecraft and astronauts. Additionally, massive solar flares are sometimes accompanied by coronal mass ejections (CMEs) which can trigger geomagnetic storms that have been known to disable satellites and knock out terrestrial electric power grids for extended periods of time.

The soft X-ray flux of X class flares increases the ionization of the upper atmosphere, which can interfere with short-wave radio communication and can heat the outer atmosphere and thus increase the drag on low orbiting satellites, leading to orbital decay. Energetic particles in the magnetosphere contribute to the aurora borealis and aurora australis. Energy in the form of hard x-rays can be damaging to spacecraft electronics and are generally the result of large plasma ejection in the upper chromosphere.

The radiation risks posed by solar flares are a major concern in discussions of a manned mission to Mars, the Moon, or other planets. Energetic protons can pass through the human body, causing biochemical damage, presenting a hazard to astronauts during interplanetary travel. Some kind of physical or magnetic shielding would be required to protect the astronauts. Most proton storms take at least two hours from the time of visual detection to reach Earth's orbit. A solar flare on January 20, 2005 released the highest concentration of protons ever directly measured, giving astronauts as little as 15 minutes to reach shelter.

Geomagnetic Storm Impacts

While geomagnetic storms don't affect human health, these events can affect power grids, communication devices and satellite operations and pose threats to any astronauts currently living in space. To that end, NOAA has developed a 5-level scale, ranging from G1 to G5, to rate any incoming geomagnetic activity, giving a crucial way to quantify the expected impacts.

G1 - Minor	G1 storms may trigger weak power grid fluctuations and have some minor impacts on satellite operations. But it means a good show of the Northern Lights up in Canada and Alaska. NOAA estimates G1 conditions may be in effect for 900 days per 11-year (roughly 4,000-day) solar cycle.
G2 - Moderate	NOAA suggests high-latitude power systems may experience voltage alarms while long-duration G2 storms may cause transformer damage. HF radio propagation may also fade at higher latitudes. Views of the Northern Lights eke down into the far northern reaches of the United States. These G2 conditions are around on average for about 360 days of the 11-year solar cycle.
G3 - Strong	Once storm levels reach G3, intermittent satellite navigation and low-frequency radio navigation problems may occur, and HF radio may be intermittent, NOAA says. Voltage corrections may be needed on power systems, and false alarms may be triggered on some protection devices. According to NOAA, the Northern Lights can reach as far south as Washington and Oregon, and Illinois with this kind of storm activity. Forecasters say these conditions may be observed on average about 130 days per 11-year solar cycle.

G4 - Severe	Power system administrators may be feeling like their hands are getting full as there could be widespread voltage control issues. Satellite and space operations may see surface charging and tracking issues. Satellite navigation could be degraded for hours, HF radio propagation would be sporadic, and low-frequency radio navigation could be disrupted. On the literal bright side, the Northern Lights may be seen as far south as Alabama and Northern California! Forecasters estimate these conditions occur on about 60 days total over any given 11-year solar cycle.
G5 - Extreme	Luckily, storm levels of this magnitude are relatively rare. Still, when they occur, power systems may see widespread voltage control problems and some grid systems may experience complete collapse or blackouts, and transformers may suffer damage. Pipeline currents could reach hundreds of amps, HF radio propagation may be impossible in many areas for 1-2 days, and satellite navigation may be degraded for days as well, NOAA says. But if the skies are clear, a brilliant and intense display of the Northern Lights may reach as far south as Florida and Texas. These kinds of strong geomagnetic conditions may only appear around four days per 11-year solar cycle.

Observations

Flares produce radiation across the electromagnetic spectrum, although with different intensity. They are not very intense in visible light, but they can be very bright at particular atomic lines. They normally produce bremsstrahlung in X-rays and synchrotron radiation in radio.

Optical Observations
Richard Carrington observed a flare for the first time on 1 September 1859 projecting the image produced by an optical telescope through a broad-band filter. It was an extraordinarily intense white light flare. Since flares produce copious amounts of radiation at Hα, adding a narrow (≈1 Å) passband filter centered at this wavelength to the optical telescope, allows the observation of not very bright flares with small telescopes. For years Hα was the main, if not the only, source of information about solar flares. Other passband filters are also used.

Radio Observations
During World War II, on February 25 and 26, 1942, British radar operators observed radiation that Stanley Hey interpreted as solar emission. Their discovery did not go public until the end of the conflict. The same year Southworth also observed the Sun in radio, but as with Hey, his observations were only known after 1945. In 1943 Grote Reber was the first to report radioastronomical observations of the Sun at 160 MHz. The fast development of radioastronomy revealed new peculiarities of the solar activity like storms and bursts related to the flares. Today ground-based radiotelescopes observe the Sun from c. 15 MHz up to 400 GHz.

Space Telescopes
Since the beginning of space exploration, telescopes have been sent to space, where they work at wavelengths shorter than UV, which are completely absorbed by the atmosphere, and where flares may be very bright. Since the 1970s, the GOES series of satellites observe the Sun in soft X-rays, and their observations became the standard measure of flares, diminishing the importance of the Hα classification. Hard X-rays were observed by many different instruments, the most important today being the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI).

Prediction
Current methods of flare prediction are problematic, and there is no certain indication that an active region on the Sun will produce a flare. However, many properties of sunspots and active regions correlate with flaring. For example, magnetically complex regions (based on line-of-sight magnetic field) called delta spots produce the largest flares. A simple scheme of sunspot classification due to McIntosh, or related to fractal complexity is commonly used as a starting point for flare prediction. Predictions are usually stated in terms of probabilities for occurrence of flares above M or X GOES class within 24 or 48 hours. The U.S. National Oceanic and Atmospheric Administration (NOAA) issues forecasts of this kind.

Gamma-Ray Burst

In gamma-ray astronomy, gamma-ray bursts (GRBs) are extremely energetic explosions that have been observed in distant galaxies. They are the brightest electromagnetic events known to occur in the universe. Bursts can last from ten milliseconds to several hours. After an initial flash of gamma rays, a longer-lived "afterglow" is usually emitted at longer wavelengths (X-ray, ultraviolet, optical, infrared, microwave and radio). The sources of most GRBs are billions of light years away from Earth, implying that the explosions are both extremely energetic (a typical burst releases as much energy in a few seconds as the Sun will in its entire 10-billion-year lifetime) and extremely rare (a few per galaxy per million years). The intense radiation of most observed GRBs is thought to be released during a supernova or superluminous supernova as a high-mass star implodes to form a neutron star or a black hole. A subclass of GRBs (the "short" bursts) appear to originate from the merger of binary neutron stars.

The cause of the precursor burst observed in some of these short events may be the development of a resonance between the crust and core of such stars as a result of the massive tidal forces experienced in the seconds leading up to their collision, causing the entire crust of the star to shatter. The sources of most GRBs are billions of light years away from Earth, implying that the explosions are both extremely energetic (a typical burst releases as much energy in a few seconds as the Sun will in its entire 10-billion-year lifetime) and extremely rare (a few per galaxy per million years).

All observed GRBs have originated from outside the Milky Way galaxy, although a related class of phenomena, soft gamma repeater flares, are associated with magnetars within the Milky Way. It has been hypothesized that a gamma-ray burst in the Milky Way, pointing directly towards the Earth, could cause a mass extinction event. GRBs were first detected in 1967 by the Vela satellites, which had been designed to detect covert nuclear weapons tests; this was declassified and published in 1973.

Following their discovery, hundreds of theoretical models were proposed to explain these bursts, such as collisions between comets and neutron stars. Little information was available to verify these models until the 1997 detection of the first X-ray and optical afterglows and direct measurement of their redshifts using optical spectroscopy, and thus their distances and energy outputs. These discoveries, and subsequent studies of the galaxies and supernovae associated with the bursts, clarified the distance and luminosity of GRBs, definitively placing them in distant galaxies.

Timing

Short Gamma-Ray Bursts
Events with a duration of less than about two seconds are classified as short gamma-ray bursts. These account for about 30% of gamma-ray bursts, but until 2005, no afterglow had been successfully detected from any short event and little was known about their origins. Since then, several dozen short gamma-ray burst afterglows have been detected and localized, several of which are associated with regions of little or no star formation, such as large elliptical galaxies and the central regions of large galaxy clusters. This rules out a link to massive stars, confirming that short events are physically distinct from long events. In addition, there has been no association with supernovae. The true nature of these objects was initially unknown, and the leading hypothesis was that they originated from the mergers of binary neutron stars or a neutron star with a black hole. Such mergers were theorized to produce kilonovae, and evidence for a kilonova associated with GRB 130603B was seen.

Long Gamma-Ray Bursts
Most observed events (70%) have a duration of greater than two seconds and are classified as long gamma-ray bursts. Because these events constitute the majority of the population and because they tend to have the brightest afterglows, they have been observed in much greater detail than their short counterparts. Almost every well-studied long gamma-ray burst has been linked to a galaxy with rapid star formation, and in many cases to a core-collapse supernova as well, unambiguously associating long GRBs with the deaths of massive stars. Long GRB afterglow observations, at high redshift, are also consistent with the GRB having originated in star-forming regions.

Ultra-Long Gamma-Ray Bursts
These events are at the tail end of the long GRB duration distribution, lasting more than 10,000 seconds. They have been proposed to form a separate class, caused by the collapse of a blue supergiant star, a tidal disruption event or a new-born magnetar. Only a small number have been identified to date, their primary characteristic being their gamma ray emission duration. The most studied ultra-long events include GRB 101225A and GRB 111209A. The low detection rate may be a result of low sensitivity of current detectors to long-duration events, rather than a reflection of their true frequency. A 2013 study, on the other hand, shows that the existing evidence for a separate ultra-long GRB population with a new type of progenitor is inconclusive, and further multi-wavelength observations are needed to draw a firmer conclusion.

Rate of Occurrence
Gamma ray bursts can have harmful or destructive effects on life. Considering the universe as a whole, the safest environments for life similar to that on Earth are the lowest density regions in the outskirts of large galaxies. Our knowledge of galaxy types and their distribution suggests that life as we know it can only exist in about 10% of all galaxies. Furthermore, galaxies with a redshift, z, higher than 0.5 are unsuitable for life as we know it, because of their higher rate of GRBs and their stellar compactness. All GRBs observed to date have occurred well outside the Milky Way galaxy and have been harmless to Earth. However, if a GRB were to occur within the Milky Way and its emission were beamed straight towards Earth, the effects could be harmful and potentially devastating for the ecosystems. Currently, orbiting satellites detect on average approximately one GRB per day. The closest observed GRB as of March 2014 was GRB 980425, located 40 megaparsecs (130,000,000 ly) away (z=0.0085) in an SBc-type dwarf galaxy. GRB 980425 was far less energetic than the average GRB and was associated with the Type Ib supernova SN 1998bw. Estimating the exact rate at which GRBs occur is difficult; for a galaxy of approximately the same size as the Milky Way, estimates of the expected rate (for long-duration GRBs) can range from one burst every 10,000 years, to one burst every 1,000,000 years. Only a small percentage of these would be beamed towards Earth. Estimates of rate of occurrence of short-duration GRBs are even more uncertain because of the unknown degree of collimation, but are probably comparable.

Energetics and Beaming

Gamma-ray bursts are very bright as observed from Earth despite their typically immense distances. An average long GRB has a bolometric flux comparable to a bright star of our galaxy despite a distance of billions of light years (compared to a few tens of light years for most visible stars). Most of this energy is released in gamma rays, although some GRBs have extremely luminous optical counterparts as well. GRB 080319B, for example, was accompanied by an optical counterpart that peaked at a visible magnitude of 5.8, comparable to that of the dimmest naked-eye stars despite the burst's distance of 7.5 billion light years. This combination of brightness and distance implies an extremely energetic source.

Assuming the gamma-ray explosion to be spherical, the energy output of GRB 080319B would be within a factor of two of the rest-mass energy of the Sun (the energy which would be released were the Sun to be converted entirely into radiation). Gamma-ray bursts are thought to be highly focused explosions, with most of the explosion energy collimated into a narrow jet. The approximate angular width of the jet (that is, the degree of spread of the beam) can be estimated directly by observing the achromatic "jet breaks" in afterglow light curves: a time after which the slowly decaying afterglow begins to fade rapidly as the jet slows and can no longer beam its radiation as effectively.
Observations suggest significant variation in the jet angle from between 2 and 20 degrees. Because their energy is strongly focused, the gamma rays emitted by most bursts are expected to miss the Earth and never be detected. When a gamma-ray burst is pointed towards Earth, the focusing of its energy along a relatively narrow beam causes the burst to appear much brighter than it would have been were its energy emitted spherically. When this effect is taken into account, typical gamma-ray bursts are observed to have a true energy release of about 1044 J, or about 1/2000 of a Solar mass (M⊙) energy equivalent—which is still many times the mass-energy equivalent of the Earth (about 5.5 × 1041 J).

This is comparable to the energy released in a bright type Ib/c supernova and within the range of theoretical models. Very bright supernovae have been observed to accompany several of the nearest GRBs. Additional support for focusing of the output of GRBs has come from observations of strong asymmetries in the spectra of nearby type Ic supernova and from radio observations taken long after bursts when their jets are no longer relativistic.

Effects on Earth

Earth's atmosphere is very effective at absorbing high energy electromagnetic radiation such as x-rays and gamma rays, so these types of radiation would not reach any dangerous levels at the surface during the burst event itself. The immediate effect on life on Earth from a GRB within a few parsecs would only be a short increase in ultraviolet radiation at ground level, lasting from less than a second to tens of seconds. This ultraviolet radiation could potentially reach dangerous levels depending on the exact nature and distance of the burst, but it seems unlikely to be able to cause a global catastrophe for life on Earth. The long-term effects from a nearby burst are more dangerous. Gamma rays cause chemical reactions in the atmosphere involving oxygen and nitrogen molecules, creating first nitrogen oxide then nitrogen dioxide gas. The nitrogen oxides cause dangerous effects on three levels.

First, they deplete ozone, with models showing a possible global reduction of 25-35%, with as much as 75% in certain locations, an effect that would last for years. This reduction is enough to cause a dangerously elevated UV index at the surface. Secondly, the nitrogen oxides cause photochemical smog, which darkens the sky and blocks out parts of the sunlight spectrum. This would affect photosynthesis, but models show only about a 1% reduction of the total sunlight spectrum, lasting a few years. Thirdly, the elevated nitrogen levels in the atmosphere would wash out and produce nitric acid rain. Nitric acid is toxic to a variety of organisms, including amphibian life, but models show that it cannot reach levels that would cause a serious global effect.

The nitrates might in fact be of benefit to some plants. All in all, a GRB within a few parsecs, with its energy directed towards Earth, will mostly damage life by raising the UV levels during the burst itself and for a few years thereafter. Models show that the destructive effects of this increase can cause up to 16 times the normal levels of DNA damage. In its worst form, a GRB will instantly evaporate anyone alive it comes into contact with and due to its distant origin by the time it reaches earth the divergence would likely encompass a whole side of it.

GRB Candidates
No gamma-ray bursts from within our own galaxy, the Milky Way, have been observed, and the question of whether one has ever occurred remains unresolved. In light of evolving understanding of gamma-ray bursts and their progenitors, the scientific literature records a growing number of local, past, and future GRB candidates. Long duration GRBs are related to superluminous supernovae, or hypernovae, and most luminous blue variables (LBVs), and rapidly spinning Wolf–Rayet stars are thought to end their life cycles in core-collapse supernovae with an associated long-duration GRB. Knowledge of GRBs, however, is from metal-poor galaxies of former epochs of the universe's evolution, and it is impossible to directly extrapolate to encompass more evolved galaxies and stellar environments with a higher metallicity, such as the Milky Way.

WR 104: A nearby GRB candidate
A Wolf–Rayet star in WR 104, about 8,000 light-years (2,500 pc) away, is considered a nearby GRB candidate that could have destructive effects on terrestrial life. It is expected to explode in a core-collapse-supernova at some point within the next 500,000 years and it is possible that this explosion will create a GRB. If that happens, there is a small chance that Earth will be in the path of its gamma ray jet.

Meteor/NEO

Disambiguation
How to tell the different space phenomenon apart.

Asteroid	A relatively small, inactive, rocky body orbiting the Sun.
Comet	A relatively small, at times active, object whose ices can vaporize in sunlight forming an atmosphere (coma) of dust and gas and, sometimes, a tail of dust and/or gas.
Meteoroid	A small particle from a comet or asteroid orbiting the Sun.
Meteor	The light phenomena which results when a meteoroid enters the Earth's atmosphere and vaporizes; a shooting star.

Meteorite	A meteoroid that survives its passage through the Earth's atmosphere and lands upon the Earth's surface.

Comet Size and Frequency

Impactor Diameter	Kinetic Energy at Atmospheric Entry	Kinetic Energy at Impact	Crater Diameter	Frequency (Years)
100m (330 ft)	47 Mt	3.8 Mt	1.2 km (0.75 mi)	5,200
130m (430 ft)	103 Mt	31.4 Mt	2 km (1.2 mi)	11,000
150m (490 ft)	159 Mt	71.5 Mt	2.4 km (1.5 mi)	16,000
200m (660 ft)	376 Mt	261 Mt	3 km (1.9 mi)	36,000
250m (820 ft)	734 Mt	598 Mt	3.8 km (2.4 mi)	59,000
300m (980 ft)	1,270 Mt	1,110 Mt	4.6 km (2.9 mi)	73,000
400m (1,300 ft)	3,010 Mt	2,800 Mt	6 km (3.7 mi)	100,000
700m (2,300 ft)	16,100 Mt	15,700 Mt	10 km (6.2 mi)	190,000
1,000m (3,300 ft)	47,000 Mt	46,300 Mt	13.6 km (8.5 mi)	440,000

Collision Effects

Assuming the colliding body is at least 1km+ diameter. Initial impact creates a vast fireball that kills anyone who can see it. Ejecta - material hurled into the air from the impact blasts into space and showers a large area--half of the world, perhaps--with flaming debris. The sky becomes filled with millions of small meteors, a shower of particles that burn up in the atmosphere on their way down. It is as if the sky itself has caught fire. The heat unleashed by this rain of incandescent debris ignites forests and cities, burning them to embers.

Then dust from the impact and smoke from the fires girdles the earth, plunging our planet into a so-called impact winter. Sunlight completely disappears for a month or so after a collision with a one-kilometre object; a 10-kilometer object might block out the sun for a year or more. Temperatures drop, and there is no light for photosynthesis. Plants die, animals die. Animals that happen to live underground, where roots and other food sources are not destroyed, have a relatively good chance of survival.

During the impact it unleashes billions of tons of sulphur-laden dust. The heat of the impact also creates nitrogen oxides. The sulphurous stuff and nitrogen oxides make a corrosive acid rain that strips bare any surviving vegetation. The acid rain runs into the oceans and kills marine organisms, especially along the continental shelves. Nitrogen oxides and debris tossed into the stratosphere by the initial blast would destroy the ozone layer within days. The impact and subsequent fires also release a tremendous amount of carbon dioxide into the atmosphere.

Asteroid Composition

An asteroid's composition is mainly determined by how close it is to the Sun. The asteroids that are nearest the Sun are mostly made of carbon, with smaller amounts of nitrogen, hydrogen and oxygen, while the ones further away are made up of silicate rock. Silicates are very common on Earth and in the Solar System. They are made up of oxygen and silicon, the number one and number two most abundant elements in the Earth's crust. The metallic asteroids are composed of up to 80% iron and 20% a mixture of nickel, iridium, palladium, platinum, gold, magnesium and other precious metals such as osmium, ruthenium and rhodium. There are a few that are made up of half silicate and half metallic.

The platinum group metals are some of the most rare and useful elements on Earth. According to Planetary Resources, a company that hopes to mine asteroids in space, those metals exist in such high concentrations on asteroids that a single 500-meter platinum-rich asteroid can contain more platinum group metals than have ever been mined on Earth throughout human history. Other minerals have been found on asteroids that have been visited by our spacecraft. For example, the Hayabusa spacecraft landed on Itokawa, a spud-shaped, near-Earth asteroid, and found it consists mainly of the minerals olivine and pyroxene, a mineral composition similar to a class of stony meteorites that have pelted Earth in the past.

In addition to the metals, the elements to create water are present in asteroids and there are indications that asteroids contain water or ice in their interiors, and there's even evidence that water may have flowed on the surface of at least one asteroid. Observations of Vesta from the Dawn mission show gullies that may have been carved by water. The theory is that when a smaller asteroid or comet slams into a bigger asteroid, the small asteroid or comet could release a layer of ice in the bigger asteroid.

The force of the impact briefly turned the ice into water, which flowed across the surface, creating the gullies. But asteroids may have changed over time. It is also thought that chemical reactions over the millennia or more recent impacts they may have endured also effects the composition of asteroids. Some experienced high temperatures after they formed and partly melted, with iron sinking to the centre and forcing basaltic (volcanic) lava to the surface. Only one such asteroid, Vesta, is known to have this type of surface.

Facts

- Every day, Earth is bombarded with more than 100 tons of dust and sand-sized particles.
- About once a year, an automobile-sized asteroid hits Earth's atmosphere, creates an impressive fireball, and burns up before reaching the surface.
- Every 2,000 years or so, a meteoroid the size of a football field hits Earth and causes significant damage to the area.
- Only once every few million years, an object large enough to threaten Earth's civilization comes along. Impact craters on Earth, the moon and other planetary bodies are evidence of these occurrences.
- Space rocks smaller than about 25 meters (about 82 feet) will most likely burn up as they enter the Earth's atmosphere and cause little or no damage.
- If a rocky meteoroid larger than 25 meters but smaller than one kilometre (a little more than 1/2 mile) were to hit Earth, it would likely cause local damage to the impact area.
- We believe anything larger than one to two kilometres (one kilometre is a little more than one-half mile) could have worldwide effects. At 5.4 kilometres in diameter, the largest known potentially hazardous asteroid is Toutatis.

Meteor/Comet Size Effects

These are the likely effects that a meteor or comet strike would have on the planet based on their size.

Meteor Size	Damage	Damage Description
<30m	No Damage	Airburst in upper atmosphere, no significant ground damage.
30m-100m	Airburst	Airburst in lower atmosphere, causes damage similar to nuclear bomb blast above ground. Over ocean, no damage.
100m-1km	Regional	Surface impact, on land, makes crater a couple to a couple of tens of km across. In the sea, raises a tsunami that can cause shoreline damage one to a few thousand km distance from the impact point.
1km-10km	Global	An impact into land or sea may raise enough dust into the stratosphere to cause global climatic catastrophe, leading to mass starvation, disease and general disruption of social order.
10km+	Extinction	Possible mass extinction, certainly to some species and possibly humans.

4 Lifeform Events

These are any forms of other life which try to eliminate humanity.

Artificial Intelligence

The rise and attempted take-over of artificial intelligence will ignite a war between humans and machines. See the WARFARE > Electronic Warfare section for details on types of AI technology and robots.

AI Home Invasion

An invasion of privacy in your home by a trusted insider such as a smart assistant.

Protecting Yourself

Human Controlled Uprising

A controlled uprising is the take-over of robots or artificial intelligence with a human behind them.

Conscious Uprising

A conscious uprising is the take-over of artificial intelligence who went rogue which have no controlling human force behind them. A movie example would be "I, Robot" or "The Matrix".

Disabling/Destroying AI

Modern Weapons

Guns are useful in most wars as the componentry of the robots can be shattered by bullets which should render them useless.

EMP

An imp is likely the best defence we have against the machines which will destroy their transistors.

Fluctuating-Pole Pulse
Modulates the general magnetic field to have a greater effect on electrons in surrounding conductive material.

Single-Pole Pulse

Explosively Pumped (EPFCG)
Uses a directed explosion to "force" the magnetic field in a linear direction.

See the ELECTRICITY section for details on building an EMP device.

Solar Flares

The only other method of strong defence against AI is a naturally occurring solar flare. Solar flares may be able to destroy AI, but flares are randomly timed and their strengths are often so weak they don't affect earth.

Power Removal

Power Source
A popular way to render AI helpless is to cut off their power supply in whatever form that would be. They are likely to find alternative sources immediately or have already been looking if their primary source is knocked out. Just make sure they don't turn to a 'human' source if you cut off their access to a power source.

Power Dependencies
- Solar
- Wind/Water
- Chemical
- Heat
- Nuclear
- Humans (The Matrix)

Extraterrestrial Life

Extraterrestrial life is hypothetical life which may occur outside Earth and which did not originate on Earth. Such life might range from simple prokaryotes (or comparable life forms) to intelligent beings and even sapient beings, possibly bringing forth civilizations which might be far more advanced than humanity. The science of extraterrestrial life in all its forms is known as astrobiology. Since the mid-20th century, active ongoing research has taken place to look for signs of extraterrestrial life. This encompasses a search for current and historic extraterrestrial life, and a narrower search for extraterrestrial intelligent life. Depending on the category of search, methods range from the analysis of telescope and specimen data to radios used to detect and send communication signals.

The concept of extraterrestrial life, and particularly extraterrestrial intelligence, has had a major cultural impact, chiefly in works of science fiction. Over the years, science fiction communicated scientific ideas, imagined a wide range of possibilities, and influenced public interest in and perspectives of extraterrestrial life. One shared space is the debate over the wisdom of attempting communication with extraterrestrial intelligence. Some encourage aggressive methods to try for contact with intelligent extraterrestrial life. Others—citing the tendency of technologically advanced human societies to enslave or wipe out less advanced societies—argue that it may be dangerous to actively call attention to Earth.

In Christianity the Bible describes a multitude of different life forms in higher dimensions such as angels, demons and cheribum. The foundational belief is that God created earth and the universe with humans as the only creation. However, in Revelation it outlines why demons will disrobe from their current dimension and enter ours in the last days claiming to be aliens. This will coincide with the disappearance of Christians from earth.

Hynek's Scale

MASS DESTRUCTION
Lifeform Events
Extraterrestrial Life
Hynek's Scale

These are the different 'close encounters' you can have with an alien lifeform.

1st	**Close Encounters of the First Kind**	Visual sightings of an unidentified flying object, seemingly less than 500 feet away, that show an appreciable angular extension and considerable detail.
2nd	**Close Encounters of the Second Kind**	A UFO event in which a physical effect is alleged. This can be interference in the functioning of a vehicle or electronic device; animals reacting; a physiological effect such as paralysis or heat and discomfort in the witness; or some physical trace like impressions in the ground, scorched or otherwise affected vegetation, or a chemical trace.
3rd	**Close Encounters of the Third Kind**	UFO encounters in which an animated creature is present. These include humanoids, robots, and humans who seem to be occupants or pilots of a UFO.
	Close Encounters of the Third Kind (Bloecher Subtypes)	**A:** An entity is observed only inside the UFO. **B:** An entity is observed inside and outside the UFO. **C:** An entity is observed near to a UFO, but not going in or out. **D:** An entity is observed. No UFOs are seen by the observer, but UFO activity has been reported in the area at about the same time. **E:** An entity is observed, but no UFOs are seen and no UFO activity has been reported in the area at that time. **F:** No entity or UFOs are observed, but the subject experiences some kind of "intelligent communication".
4th	**Close Encounters of the Fourth Kind**	A UFO event in which a human is abducted by a UFO or its occupants. This type was not included in Hynek's original close encounters scale. Hynek's erstwhile associate Jacques Vallee argued in the Journal of Scientific Exploration that the "Fourth Kind" should refer to "cases when witnesses experienced a transformation of their sense of reality", so as to also include non-abduction cases where absurd, hallucinatory or dreamlike events are associated with UFO encounters.
5th	**Close Encounters of the Fifth Kind**	A UFO event that involves direct communication between aliens and humans. This type of close encounter was named by Steven M. Greer's CSETI group and is described as bilateral contact experiences through conscious, voluntary, and proactive human-initiated cooperative communication with extraterrestrial intelligence.
6th	**Close Encounters of the Sixth Kind**	Death of a human or animal associated with a UFO sighting, although some might consider this as a more severe example of a second-kind encounter.
7th	**Close Encounters of the Seventh Kind**	The creation of a human/alien hybrid, either by sexual reproduction or by artificial scientific methods.

Unidentified Flying Objects (UFOs)

UFOs

An unidentified flying object (UFO) is any aerial phenomenon that cannot immediately be identified or explained. Most UFOs are identified on investigation as conventional objects or phenomena. The term is widely used for claimed observations of extraterrestrial spacecraft. UFOs can often be attributed with glowing lights, metallic objects or virtually any other shaped object floating in the sky. They may fly in a pattern, change lighting colours and be bigger than football fields. No UFOs have been deemed to come from outer space as it's known but instead from inner space as if from an alternative dimension.

Notable US Cases
- The Roswell UFO incident (1947) involved New Mexico civilians, local law enforcement officers, and the U.S. military, the latter of whom allegedly collected physical evidence from the UFO crash site.
- The Mantell UFO incident January 7, 1948
- The Betty and Barney Hill abduction (1961) was the first reported abduction incident.
- In the Kecksburg UFO incident, Pennsylvania (1965), residents reported seeing a bell shaped object crash in the area. Police officers, and possibly military personnel, were sent to investigate.
- The Travis Walton abduction case (1975): The movie Fire in the Sky (1993) was based on this event, but greatly embellished the original account.
- The "Phoenix Lights" March 13, 1997
- 2006 O'Hare International Airport UFO sighting
- The 2004 USS Nimitz UFO incident and 2014 USS Theodore Roosevelt UFO incidents

Identification of UFOs

Studies show that after careful investigation, the majority of UFOs can be identified as ordinary objects or phenomena. The most commonly found identified sources of UFO reports are:
- Astronomical objects (bright stars, planets, meteors, re-entering man-made spacecraft, artificial satellites, and the Moon)
- Aircraft (aerial advertising and other aircraft, missile launches)
- Balloons (toy balloons, weather balloons, large research balloons)
- Other atmospheric objects and phenomena (birds, unusual clouds, kites, flares)
- Light phenomena mirages, Fata Morgana, ball lightning, moon dogs, searchlights and other ground lights, etc.
- Hoaxes

A 1952–1955 study by the Battelle Memorial Institute for the USAF included these categories as well as a "psychological" one.

Less than one percent of cases Allan Hendry investigated were hoaxes and most sightings were actually honest misidentifications of prosaic phenomena. Hendry attributed most of these to inexperience or misperception.

Associated Claims

Besides anecdotal visual sightings, reports sometimes include claims of other kinds of evidence, including cases studied by the military and various government agencies of different countries (such as Project Blue Book, the Condon Committee, the French GEPAN/SEPRA, and Uruguay's current Air Force study). A comprehensive scientific review of cases where physical evidence was available was carried out by the 1998 Sturrock panel, with specific examples of many of the categories listed below.

● Radar contact and tracking, sometimes from multiple sites. These have included military personnel and control tower operators, simultaneous visual sightings, and aircraft intercepts. One such example were the mass sightings of large, silent, low-flying black triangles in 1989 and 1990 over Belgium, tracked by NATO radar and jet interceptors, and investigated by Belgium's military (included photographic evidence). Another famous case from 1986 was the Japan Air Lines flight 1628 incident over Alaska investigated by the Federal Aviation Administration (FAA).
● Photographic evidence, including still photos, movie film, and video.
● Claims of physical trace of landing UFOs, including ground impressions, burned or desiccated soil, burned and broken foliage, magnetic anomalies, increased radiation levels, and metallic traces. A well-known example from December 1980 was the USAF Rendlesham Forest incident in England. Another occurred in January 1981 in Trans-en-Provence and was investigated by GEPAN, then France's official government UFO-investigation agency. Project Blue Book head Edward J. Ruppelt described a classic 1952 CE2 case involving a patch of charred grass roots.
● Physiological effects on people and animals including temporary paralysis, skin burns and rashes, corneal burns, and symptoms superficially resembling radiation poisoning, such as the Cash-Landrum incident in 1980.
● Animal/cattle mutilation cases, which some feel are also part of the UFO phenomenon.

● Biological effects on plants such as increased or decreased growth, germination effects on seeds, and blown-out stem nodes (usually associated with physical trace cases or crop circles)
● Electromagnetic interference (EM) effects. A famous 1976 military case over Tehran, recorded in CIA and DIA classified documents, was associated with communication losses in multiple aircraft and weapons system failure in an F-4 Phantom II jet interceptor as it was about to fire a missile on one of the UFOs.
● Apparent remote radiation detection, some noted in FBI and CIA documents occurring over government nuclear installations at Los Alamos National Laboratory and Oak Ridge National Laboratory in 1950, also reported by Project Blue Book director Edward J. Ruppelt in his book.
● Claimed artifacts of UFOs themselves, such as 1957, Ubatuba, Brazil, magnesium fragments analyzed by the Brazilian government and in the Condon Report and by others. The 1964 Lonnie Zamora incident also left metal traces, analyzed by NASA. A more recent example involves a tear drop-shaped object recovered by Bob White and was featured in a television episode of UFO Hunters but was later found to be waste metal residue from a milling machine.
● Angel hair and angel grass, possibly explained in some cases as nests from ballooning spiders or chaff.

Conspiracy Theories

UFOs are sometimes an element of conspiracy theories in which governments are allegedly intentionally "covering up" the existence of aliens by removing physical evidence of their presence, or even collaborating with extraterrestrial beings. There are many versions of this story; some are exclusive, while others overlap with various other conspiracy theories.

In the U.S., an opinion poll conducted in 1997 suggested that 80% of Americans believed the U.S. government was withholding such information. Various notables have also expressed such views. Some examples are astronauts Gordon Cooper and Edgar Mitchell, Senator Barry Goldwater, Vice Admiral Roscoe H. Hillenkoetter (the first CIA director), Lord Hill-Norton (former British Chief of Defense Staff and NATO head), the 1999 French COMETA study by various French generals and aerospace experts, and Yves Sillard. It has also been suggested by a few paranormal authors that all or most human technology and culture is based on extraterrestrial contact.

Alien Sightings

An alien sighting is the visible seeing of an otherworldly creature other than of human origin. Aliens and UFOs have been known to have a sulphur smell, the exact same of demons.

Alien Invasion

An invasion of any non earth life form with the intention of eliminating human life on earth. The alien invasion is a common imagination of science fiction stories and film, in which extraterrestrials invade the Earth either to exterminate and supplant human life, enslave it under an intense state, harvest people for food, steal the planet's resources, or destroy the planet altogether. Assuming they are invading earth on space ships they must be far superior in technology to us which would give us little if no chance to survive.

If aliens have shown up to earth, 'abducted' millions of people (only believing Christians), they're all male and they come from inner-space or another dimension rather than outer space, read the rapture guide below. This was all foretold in the Bible…

5 The Rapture

This section is an excerpt from "The Rapture Survival Guide". Find the full version at: www.fluidicice.com/TRSG

So what is the Rapture?
The Rapture, otherwise known as "the Harpazo" is a Christian religious event in which the believers saved in Jesus Christ and those younger than the accountable age vanish from earth instantly "in the twinkling of an eye" meeting Jesus in the air. Those who aren't saved through Jesus and were left behind on earth will be subject to 7 years of the wrath of God, known as the Tribulation.

Following the instant disappearance of believers from earth, and consequently, the standing aside by the 'restrainer' (the Holy Spirit), there will be utter chaos in the world as people seek to recover from and understand what happened. If you're one of these people - you have found the answers to what's happening, along with the Bible as your primary source of proof. Be warned that there will be a "lie" (2 Thessalonians 2:11) that is so powerful it will deceive even the most intelligent people. Many Christians believe that this lie will be an alien abduction deception of some sort as it's the only other plausible reason that could explain the disappearance from a secular and scientific viewpoint. However since the Bible isn't explicit on what this 'lie' is, keep all other options open.

Immediately after the rapture, the antichrist (someone who puts themself in *place* of God) can begin their rise to power, gaining notoriety and influence all over the world and solving its problems with ease. Once he has gained notoriety on the world stage he will make an existing covenant with Israel - even more spectacular, allowing the Jews to build the third temple and worship again. This covenant initiates the 7 year tribulation which is the period God pours out plagues on the planet in an attempt to bring His nation of Israel and those who dwell on the earth back to Him. Three and a half years (halfway) into this covenant, the antichrist sits on the throne in this new temple in Jerusalem and declares himself to be god, initiating the second half of the tribulation.

At this point, the antichrist will double down on his intent to slaughter all Jews and newly converted Christians throughout the entire globe and all those who refuse to take his 'mark' - The Mark of the Beast, which will be *on or in* someone's right hand or forehead. The Bible says this mark (666) will need to be 'calculated' and won't be easily identifiable, but it will be his number and not your own personal identification number. (Revelation 13:18) You CAN become saved through Jesus after the rapture happens, but your life will be much tougher with the antichrist hunting down all those who oppose him.

During this rise and reign of the antichrist, God will be pouring out His just judgements on this increasingly sinful world which will cause utter devastation on the planet and ultimately cause the nations of the world to come together to battle God at Armageddon. Then comes Jesus' second triumphant return with all those who were raptured previously. Jesus will destroy all those who rejected Him and claim His throne in Jerusalem, ruling the world for 1,000 years known as the millennium.

That's the rapture and a summary of the end times as described in the Bible. You don't have to believe it, because it's certainly an unbelievable series of events, but when they start to fulfil themselves, come back and keep reading. "The only barrier to truth is the presumption that you already have it." - Chuck Missler

"The only barrier to truth is the presumption that you already have it."
Chuck Missler

I highly recommend watching the video below before you continue reading the remainder of this document. It will give you the basics of what just happened and what's coming in the future. Skip to 3:38 for the beginning of the dialogue.
- **"After the Rapture":** https://christianity.fluidicice.com/rapture
- **Direct Link:** https://christianity.fluidicice.com/downloads/rapture/after%20the%20rapture%20-%20left%20behind!!!.mp4

Subheadings

1 Introduction

The terms above are discussed in greater detail below to help you understand God's plan for the gentiles (non Jews) and the plan for His nation of Israel in the final chapter of earth. So keep reading and feel free to print, copy, email and disseminate this guide to anyone and everyone seeking truth in these 'biblical' times as there are no copyrights on it.

If some of these prophecies such as the rapture have already been fulfilled and you're seeking answers, please keep reading! If anything, the events in the book of Revelation can be used to verify that the Bible is absolute truth and given from a loving God *outside* of space and time. It's absolutely critical that you understand this before continuing on or you'll tend to disregard the essential points.

There are plenty of other events which have to be fulfilled in the near future such as the global government and the one world religion. However these three are very distinct events which will be hard to miss, as they will garner global media coverage when they occur. To find out more on these events, download 'The Rapture Survival Guide (TRSG)' at: **www.fluidicice.com/TRSG**

Millions Vanish From Earth!
Jesus calls the believing Christians home, before His wrath
(Download TRSG for this section)

The Destruction of Damascus
Damascus will be destroyed and never inhabited again
(Download TRSG for this section)

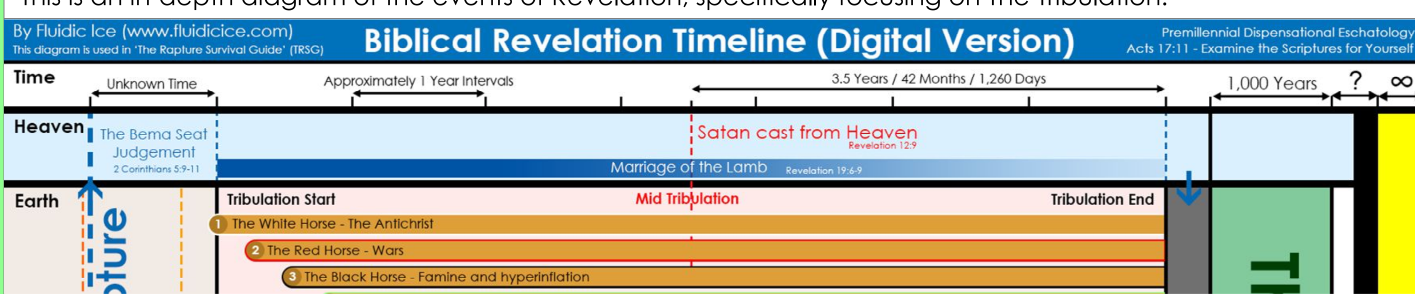
The Attempted Invasion of Israel
Russia, Iran, Turkey, Libya and Syria will surprise attack Israel simultaneously but utterly fail
(Download TRSG for this section)

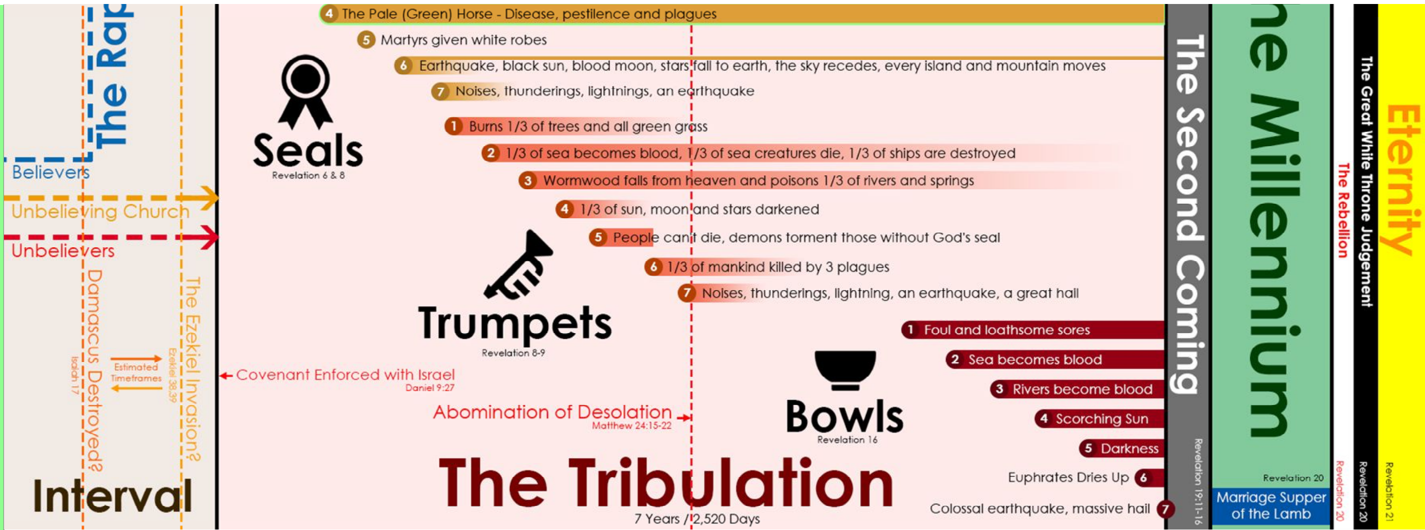
2 Timeline Diagram

Below is a diagram of how these end time events could unfold, based on a premillennial dispensational view of Christianity. It can be used to refer back to when reading through the rest of the guide as you won't understand each event without further study. The full diagram may be a bit daunting on first glance, but after reading the scriptures (mostly Revelation and 2 Thessalonians) you should slowly be able to work out what each event signifies and where you sit in God's end times timeline.

The Bible covers this 7 year tribulation period in better detail than any other time, however there still are a few gaps which must be 'guessed'. I recommend finding which Seal, Trumpet or Bowl the world is currently experiencing and read on - watching out for the next sign described in the Bible. If anything, it can be used to prove the validity and accuracy of God's word to help keep you strong in the faith. For previously fulfilled prophecies, take a look at the "Christianity > Evidence for God > Fulfilled Prophecies" section.

This is an in-depth diagram of the events of Revelation, specifically focusing on The Tribulation:





For an easier reading experience I recommend downloading the high-definition diagrams from my website www.fluidicice.com/TRSG. Or just do a web search for "fluidic ice revelation timeline" to find it.

TLDR Below: *The horizontal axis is time and the vertical axis splits up the events in heaven and on earth. If you draw a vertical line anywhere on the diagram, any horizontal lines that intersect with it* *may* *be occurring at that time. Colours have a relationship with anything else that colour.*

The Timeline Link

3 The Rapture

Left Behind?

So the rapture's happened, and the world is in absolute chaos! What do I do???

Left Behind?

Were you unsure about Christianity or even rejected God completely but have since seen that millions of people have vanished from the earth, who strangely were all born-again Christians and young children? This is the prophesised rapture or "harpazo" and it's the biblical event where God pulls his church from the earth so he can pour out his wrath on the nations and those who haven't accepted Him.

You've missed the bus, but that won't stop you from getting into heaven if you become a born again Christian and follow Jesus' teachings from now on. However it will be an extremely dangerous period of time and Christians will almost certainly be killed for their faith by their friends, neighbours, the global government and the antichrist, but isn't eternal life in heaven with God worth dying for? The fact that the Rapture even happened should be substantial evidence that there is a God. You may have even heard about the rapture previously but brushed it aside as a "tale of mythical proportions" or the "ranting of religious nuts".

With many hundreds of thousands to millions of people on earth instantly disappearing, chaos would have likely ensued across the entire planet as cars crash, planes will fall from the sky, utilities break down, homes engulfed in fires and utter chaos and panic everywhere as parents frantically look for their young children who are missing. The lack of people to fulfil jobs will delay production, and transportation across the country will grind to a halt, exacerbated by the array of crashed vehicles on the road. Some important leaders may also disappear, leaving nations leaderless for a period of time or causing people to fight for control. After people realize that millions are missing, looters may likely to go house to house hoping it won't be occupied. Many evildoers and spiritualists will rejoice that the people holding back the planet have been removed so they can continue to 'fix' the planet.

The rapture may have occurred prior to an election causing chaos and swaying the results tremendously in favour of someone else. With the withdrawal of the born-again Christians from earth, and consequentially the holy spirit who indwells them, the world will get out of hand rapidly as Christians were the salt and light of the earth. In the same way that salt slows meat from going rancid, so too will the earth rot and decay faster with a vertical plummet into evil and lawlessness worldwide.

The second the rapture happens, satan will kick his final plan into motion in an attempt to deceive everyone on earth who is left behind, to cover up the true reason of the disappearances. The last thing he wants is for people to realize this is the rapture and to turn back to God. As discussed above this deception will most likely involve an 'Alien Abduction' lie which will be caused by demons creating shapes and signs in the sky and will eventually lead to the 'landing' of a UFO. More on this is discussed below.

The fact that you've been left behind should be a wake up call that you aren't currently going to heaven if you die today or even when Jesus returns at His Second Coming.

The good news is that you have slightly longer than 7 years (from the rapture) before His return to commit your life to Him and become a Christian. However with the impending devastation that is to come, you likely have much less time to live than that...

Watch For
- The instant disappearance of millions of people from earth - born again believers in Christ, likely excluding much of the Catholic and other 'apostate' churches.
- The disappearance of all young children

Below is a list of notable people and groups who probably **won't** be taken in the rapture, so don't be deceived by anything they say if they remain behind:

The Pope	Contrary to what the world believes, the Pope is more ungodly than most other people on the planet. He doesn't talk about the blood of Jesus, he doesn't tell people they are sinful and need to be saved and he is trying to align all religions into a One World Religion.
The Catholic Church	The Catholic Church is unfortunately mislead by the pope today who picks and chooses what they believe in the Bible. Therefore many people who attend these catholic churches have never accepted Jesus into their life.
Other 'Christian' Churches	Other apostate Christian churches which believe in Jesus but have strayed from the truth likely won't be raptured. This could include: Seventh Day Adventists, Pentecostal Churches, Christian Science, Jehovah's Witnesses and more. It comes down to a personal belief in Jesus and not the church they are part of.

All Other Religions	People in all other religions such as Buddhism, Hinduism, Islam, Judaism, Sikhism, etc, won't be raptured.
These are the people who **will** be taken in the rapture:	
Born-Again Christians	All believers in Christ who have accepted Jesus as their Lord and Saviour, believing that He died and rose again will be taken. This includes Jews who have accepted Christ even though the majority of Israel will go through the tribulation.
Young Children	Young children who have not yet reached the "age of accountability" will also be taken in the rapture leaving parents frantic.
Unborn Babies	This isn't mentioned in the Bible, however can you imagine a scenario where Christ calls a believing mother home and not the baby inside her? Fetuses of non-believers are a grey area and could go either way. If unborn babies are included in the "Young Children" category - there's going to be a lot of miscarriages and vanishing fetuses at the time of the rapture.

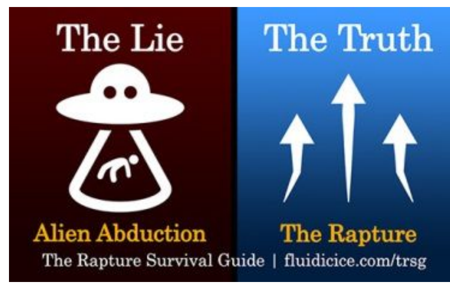
The Alien Deception

I can't overstate how important it is to NOT be deceived after the rapture. God Himself will send a strong delusion to deceive the world, which even the wise will find irresistible to believe. *"That they all may be condemned who did not believe the truth but had pleasure in unrighteousness."* (2 Thessalonians 2:11-12) The only plausible way to explain away the disappearance of millions from earth is to blame it on otherworldly beings such as aliens.

It's my personal conviction that when we're raptured and we meet Him in the air, we will shine brightly as many points of light (Matthew 13:43) in the sky, all across the globe, which could be "the lie" that explains away the disappearance of people. Each person a different brightness based on the works they did on earth during their life. (Daniel 12:3) But of course it could be something else entirely.

Don't believe any alien narrative that satan concocts to explain it away. Even the Catholic Church themselves said they are preparing to receive an alien into their midst which they will baptize. Spiritualists will also call the removal of Christians from the planet "good" because it's simply the earth cleansing itself from those who are a detriment to it.

Do not to be deceived by their lies - instead seek earnestly the word of God. Besides, isn't the rapture the ultimate proof that He exists? If you don't believe yet, keep reading to hear about more future events to validate the Bible. An example is that the future world leader - the antichrist, will have a deadly head/eye wound and a right arm wound which have been healed.



Have you noticed the sheer amount of Hollywood movies that involve aliens in recent years? How about the fact they usually prefer to take children for themselves?

This is no accident. This lie has been slowly planted in the hearts of those directing Hollywood movies by none other than satan himself to continue the grand deception God gives the world when the born-again believers leave.

People may not care much, or might even be thrilled about the disappearance of Christians from the earth, but when it comes to their own children they will be wanting answers!

The rapture, the disappearance of children, COVID-19, the civil unrest and the continuation of natural disasters on the planet will bring the world to its knees in desperation for a leader to end the suffering and unite the world. Enter the antichrist to provide all the answers people have been seeking.

An excellent video explaining how aliens are eluded to in the Bible can be found below, or scan the code to the right:

Return of the Nephilim Session 2

Chuck Missler - Return of the Nephilim Session 2
https://youtu.be/91wtHi-F0oM?t=2557 (Start at 42:37 for the part on aliens)

Why Aliens?
There are quite a number of reasons why the most likely cover-up for the rapture will be an alien abduction:
- The lie (2 Thessalonians 2) will need to be something otherworldly since no human technology can cause millions of people to vanish.
- Aliens have slowly been integrated with our culture by satan over hundreds of years until now. The thought of other life is now relatively accepted in society being backed by the lie of evolution.
- In the past, demons have frequently disguised themselves as aliens, and people who have encountered them (demons) have claimed abduction experiences which shares a common theme of possession when studied carefully.
- The Vatican has openly discussed baptising an alien. Because of this, it explains why the Pope and much of the Catholic church will be left behind.
- As of 2020, an Israeli space security chief has stated "They have been waiting until today for humanity to develop and reach a stage where we will understand, in general, what space and spaceships are".
- Daniel 2:43 "...They will mingle with the seed of men..." This implies that the 'they' aren't human.
- Governments currently claim that "aliens are real and secretly in contact with America and Israel".
- There was a committee comment in a COVID-19 relief bill giving the U.S. Government 180 days to reveal what they know on UFOs.

Be sure to read your Bible daily to solidify your faith in the rapture and to avoid the doctrines of demons which will undoubtedly take hold in those days. Whatever happens right after the rapture will be sent by God, to give those who rejected Him over to their depraved activities:

2 Thessalonians 2:11-12
11 *And for this reason God will send them strong delusion, that they should believe the lie,*
12 *that they all may be condemned who did not believe the truth but had pleasure in unrighteousness.*

Another point to note is that the Qanon movement is another group of people who believes that there may be a time coming where everyone on earth will be 'enlightened'. However they are just another medium of deception. Read the Bible.

I warn you about the coming King and the wrath of God because I am a watchman on the wall as per verse 6 below. If I see the destruction that's coming and don't warn others, God will require the blood of those people from me. Again I say, turn from your wicked ways, repent from your sins, believing and accepting that Jesus died and rose again on the third day. He Loves You!

Ezekiel 33:3-6
3 *When he sees the sword coming upon the land, if he blows the trumpet and warns the people,*
4 *then whoever hears the sound of the trumpet and does not take warning, if the sword comes and takes him away, his blood shall be on his own head.*
5 *He heard the sound of the trumpet, but did not take warning; his blood shall be upon himself. But he who takes warning will save his life.*
6 *But if the watchman sees the sword coming and does not blow the trumpet, and the people are not warned, and the sword comes and takes any person from among them, he is taken away in his iniquity; but his blood I will require at the watchman's hand.'*

Satan will also use the rapture to push for the formation of the one world government and the one world religion. The devil is the father of lies and he will do everything in his power to cause deception, even to the point of showing sightings of UFOs to appear in the sky for all to see in an attempt to bring everyone together under one banner.

Since all Christians would have been taken to meet Jesus in the air, and then to heaven, there will be nobody on earth to spread His gospel in a time when people will be most desperately seeking answers. So if you believe the disappearance must have been the rapture, and you believe in Jesus, please share this document everywhere possible so that others may be saved. Some recommendations include: Email, Facebook, Parler, Gab, Pocketnet.app, Facebook chat, YouTube, Rumble, Twitter, Instagram, Text Messages, Word of Mouth, Mail Drops, printed copies on the street, Reddit, personal websites, blogs, forums, whatsapp, tumblr, pinterest, LinkedIn, snapchat, billboards, TV advertisements and anything else you can think of. For my own tracts head to:
www.christianity.fluidicice.com/tracts

4 Post-Rapture

Post-Rapture

Post-Rapture

Lawlessness will rise daily and the world will become increasingly desperate for answers on what's happening across the planet. Millions of jobs will be left empty which will affect the food and produce markets, industrial, construction and every other facet of society today. The speed of the earth's downward trajectory will increase dramatically and the nations of the world will desperately seek a leader to lift the world out of these debilitating times.

It will get so bad that presidents and the elites will seek to form a global government to help kerb the natural and man made disasters. They will take away people's rights, lock them down, throw them in prison and will likely kill many who resist. People will literally go insane when the 'aliens' reveal themselves and will loot, burn and destroy what they can - believing the world is about to end. If you find yourself living in these perilous times, accept Jesus, because you may not live much longer considering the 'biblical' judgements to come.

For many weeks after the rapture, people will be in utter shock at what happened and is still happening around the planet! First the disappearance of millions of people and then the arrival of extraterrestrial life. By this point the aliens would have likely made contact with humanity 'revealing themselves' as peaceful beings who only wish to 'enlighten' the human race with advanced ideas to help solve the world's problems.

Satan is a master of deception and he's been plotting this lie for centuries to get the majority of the world to believe the rapture was of alien origin. Most people will believe it - since there will be some form of proof visible in the sky worldwide, as well as being broadcast on live TV. These 'aliens' will eventually reveal themselves and will probably speak on live interviews in human languages which they will probably explain by saying they've been monitoring humans for decades.

The part of the guide below is conjecture based off the verse in Daniel 2:43 that says "...they will mingle with the seed of men...". This means that 'they' can't be human. So according to this verse, the aliens will have to integrate themselves with humans until such as day they will have sexual relations with human women (and men) just like the days of Noah! Read Genesis 19 paying particular attention to verse 5 to realise that the inhabitants of Sodom wanted to have sexual relations with those angels.

Remember that in the Bible, angels are never referred to in any gender other than masculine. Therefore all fallen angels and demons are male and if these 'aliens' are all male too it would just prove even more that they're demons which have left their first habitation (Jude 1:6). By 'habitation' (or in the Greek "oiketerion"), the Bible means they disrobed from their spiritual body in higher dimensions to be able to enter our dimension.

The time between the rapture and the tribulation is unknown, but it likely won't be longer than a few years due to the dark powers that want to unite this planet under a global government for total control, and the sooner they achieve this, the sooner they control the planet. During this time, everyone will be trying to recover from the chaos of the rapture while allowing the antichrist - the mouthpiece of satan himself to rise to power with 'all the solutions'.

Deception

There will be a lot of theories and deception after the rapture occurs, as is stated in **2 Thessalonians 2:11-12**. If you're reading this and millions of people have vanished then take heed of what the Bible says and keep reading God's word. Throughout the Bible Jesus warns not to be deceived by anyone, but test what you're told to see if it's of the holy spirit or not. (Acts 17:11)

I'm writing this section in 2018 and I ***know*** the rapture will happen at some point in the future. I can't tell the future, I just put my faith in the word of God which has repeatedly proven itself with past and future prophecies. Satan is the price of the power of the air and if one thing is evil today - it's the broadcasts that are making their way into our homes which can only be described as the mouthpiece of the devil, so stay vigilant and away from these forms of technology which can flood your home with lies.

2 Thessalonians 2:11-12
11 *And for this cause God shall send them strong delusion, that they should believe a lie:*
12 *That they all might be damned who believed not the truth, but had pleasure in unrighteousness.*

Signs

A major sign of Christ's return post-rapture is war and dissension among groups of people. The book of Revelation tells us that the Tribulation Period is filled with constant war that will escalate until the entire world is involved. This war will be terrible, ceaseless and unending. The Bible says that as we move toward the end times, there will be many talks of conflicts, border skirmishes, race wars and national battles. World military spending has now reached one trillion dollars. The arms trade is big business and a world war with our current technology and nuclear/hypersonic weapons would be devastating to the entire planet.

As we get closer and closer to the end times, there will be ever frequent natural disasters, hunger and famine. If you look around the world right now, there are millions of people going hungry, despite God blessing us with a fertile and abundant planet. There will also be major earthquakes which scientists have said are overdue as well as the spread of new diseases. We have noticed an epidemic of new diseases breaking out that we have not been able to control the spread of such as ebola, COVID-19 and new strains of the flu.

Many wonder what the worlds current devastation is telling us. Combined, they should be fairly obvious signs of Christ's soon return which will be about 7 years after the enforcement of the covenant by the antichrist or 3.5 years after he declares himself as god in the temple. This gives those who are unsaved a second and even third checkpoint, showing there's not long until His return.

For the rest of this guide see 'The Rapture Survival Guide (TRSG)', downloadable at: https://fluidicice.com/TRSG

5 Accepting Jesus

This is absolutely the most important section in the entire guide, outlining the path to eternal salvation as described in the Bible. Your acceptance or denial of Jesus will affect where you spend eternity, and every soul lives forever, it's just a matter of location. A prerequisite for becoming saved is knowing that God exists and that He created you, the universe and heavens.

God wrote the Bible through man to *further* prove His existence to us alongside the wondrous and spectacular world around us. There are countless incredible facts about the Bible that prove it had to be designed outside of space and time. For a few of these amazing insights read the 'Evidence for God' section in 'Christianity'.

Salvation

A	**Admit that you are a sinner.** Any gap between God's perfect law and our imperfect obedience is called sin, which everyone has committed. ● "For all have sinned, and come short of the glory of God;" (Romans 3:23) ● "There is none righteous, no, not one;" (Romans 3:10) ● "If we say that we have not sinned, we make him a liar, and his word is not in us." (1 John 1:10) ● "For the wages of sin is death, but the gift of God is eternal life in Christ Jesus our Lord." (Romans 6:23)
B	**Believe in your heart that Jesus Christ died for your sins, was buried, and that God raised Jesus from the dead on the third day, taking the punishment you deserved.** Jesus said: "I am the way, the truth, and the life: no man comes unto the Father but by me." (John 14:6) Your own good works cannot save you, no matter how good a person you are, and wouldn't the creator of heaven set the bar for entry? ● "For God so loved the world, that he gave his only begotten Son, that whosoever believes in him should not perish, but have everlasting life." (John 3:16) ● "But God commends his love toward us, in that, while we were yet sinners. Christ died for us." (Romans 5:8)
C	**Call upon the name of the Lord and confess that Jesus Christ is Lord.** Through prayer, invite Jesus into your heart to become your personal Lord and Saviour. There is an example prayer below. ● "If you shall confess with your mouth the Lord Jesus, and shall believe in your heart that God raised him from the dead, you will be saved." (Romans 10:9)

The Sinner's Prayer
"Lord Jesus, I am a sinner and am in need your forgiveness. I believe you are the Son of God who died on the cross for my sins and rose from the dead on the third day. Thank you for bearing my sins and giving me the gift of eternal life. I am ready and willing to trust you as my Lord and Saviour and to turn from my sin. I now invite you into my heart as my personal Saviour. Amen."

"Whoever calls on the name of the Lord shall be saved."
Joel 2:32 / Acts 2:21 / Romans 10:13

Once you've prayed this prayer, believing it with all your heart, you're saved by the power of the blood of Jesus! He paid that ultimate price of our sin, sacrificing Himself so that we may live. However it's easy to say something with your mouth, what takes real effort is living out a life in pursuit of Jesus, walking according to His will for you and leaving your old sinful ways behind.

Below are some more verses related to salvation and justification, as well as some next steps you should take as a new Christian to help cement your faith. If there's one thing that satan despises, it's new Christians. So be prepared to battle against the spiritual forces of wickedness by praying and reading your Bible daily as well as putting on your spiritual armour.

- ***Ephesians 2:8-9*** *"For by grace you have been saved through faith, and that not of yourselves; it is the gift of God, not of works, lest anyone should boast."*
- ***2 Corinthians 5:17*** *"Therefore, if anyone is in Christ, he is a new creation; old things have passed away; behold, all things have become new."*
- ***Luke 13:5*** *"I tell you, no; but unless you repent you will all likewise perish."*
- ***Galatians 2:16*** *"Knowing that a man is not justified by the works of the law but by faith in Jesus Christ, even we have believed in Christ Jesus, that we might be justified by faith in Christ and not by the works of the law; for by the works of the law no flesh shall be justified."*
- ***1 Corinthians 15:3-4*** *"How that Christ died for our sins according to the scriptures; And that he was buried, and that he rose again the third day according to the scriptures"*

6 Links

These are links to my other content and backups.

Christian Content

Many people will realize that the Christians they ignored their whole life were right and will attempt to seek the truth of what happened in scripture and prophecy updates. Unfortunately this will be extremely difficult with possible electricity and internet outages, lies being proliferated by news outlets and the remaining spiritual leaders denying that it was the rapture. Christian content may be pulled from the entire internet by those in power further increasing the difficulty of finding truth. For an online list of my content backups (the same links as below), head to: **https://www.fluidicice.com/backups**

Google Backup

For off-site backups of my main content (in case my website goes down) see:
- **Google:** www.drive.google.com/drive/folders/1KVzoaRSuHUQl8Zj-mXPYIJ0iEi14PZc3
- **Box:** http://app.box.com/s/jplaw5euljmybbzqk02m0o3g4y2hcm84
- **Dropbox:** www.dropbox.com/sh/ljd2itt9tztzm1z/AADNRiWtvTr1zZ1nBVQbkkI3a

Keep in mind that some backups may be updated more frequently than others.

www.christianity.fluidicice.com

My Links
- For my site on everything Christian, head to: **www.christianity.fluidicice.com**
- Looking for the evidence for God? Search for it in this document under 'Christianity', or head to: **www.christianity.fluidicice.com/evidence**
- For information on salvation and being saved, see: **www.christianity.fluidicice.com/salvation**

6 Rebuilding Society

After destruction on a massive scale, society will need to be rebuilt from the ground up. This sections covers how that can be achieved and where to start.

Rebuild Your Life

Rebuild Your Neighbourhood

Rebuild Your Town

Addendum

A selection of additional information to compliment TPE

"The only place success comes before work is in the dictionary."
Vince Lombardi

Introduction

This category contains any extra information which doesn't belong to any another category but should still be included in the document. To search for terms you don't understand in the below dictionary use Ctrl+F or the programs/apps built in search feature. If you're looking for basic prepper terms you can find them under the preparedness heading below or the PREPAREDNESS category.

Purpose	The aim of ADDENDUM is to catalogue any additional information which compliments TPE into one location.
Lost?	• For reader tips and information on using this guide, see the PRELUDE section. • For a list of the categories in this document, see the CONTENTS section. • For a list of the wonderful people who made TPE possible, see the MAINTENANCE section. • For a list of updates made to this document, see the MAINTENANCE section.

Contents

1 Media

Keeping informed and media in general is vital in today's society, you need to know what's happening around you and getting advice, tips and making friends with other preppers. This section is aimed at keeping you informed and gaining more knowledge about preparedness as well as where to find fact during SHTF. If you're looking for monitoring websites to keep track of the world, see PREPAREDNESS > Situation Monitoring.

The following colours are a legend for all forms of media to help quality content stand out and to help assist readers find what they want quicker.

Blue - Quality Content
This content has: Clear audio, use of clip on mics, HD Cameras, short intros, well written, easy navigation, entertaining and above all - valuable information. Non quality channels may also have great content but their electronic gear, microphones and editing could be better. If your website or content isn't blue, chances are I haven't had time to look over it and see the content yet. Just send me an email requesting to consider your website for the quality background.

Subheadings

1 Media Today

Media is everywhere in the world today form the internet, Tv, radio, newspaper, verbal news etc. The sharing of knowledge, warnings and news helps us prepare for the future and know what's headed our way. Below is a selection of media forms in a functioning society.

Print / Written	Print media has dropped significantly over the last decade with the rise of digital news. If news has to travel from across the ocean, it will take many days if not weeks to be spread around the new shore.
Television	Television is the second most common proliferation source of news today.
Radio	Even though it's not as frequently used as television today, radio can provide some invaluable information during disasters and can be transmitted around the planet with ease.
Online	Currently online news is the most used source of news today due to its instant transmission time and ease of use.
Social	Social news is the verbal transmittal of news from person to person and currently is the third most used form of transferring news. This style of news will be vital in a world without electronics and most forms will regress to the days where legends were told over fires or in the street.
Research	Research is news that is conducted by yourself to determine the facts of the situation. This is extremely rare today but will probably be one of the highest ranking news methods in a SHTF situation. An example may be looking up what is likely to happen after a disaster or war, such as researching a tsunami and watching out for one then warning others if there is a chance of one.

2 Keeping Informed

Staying up to date with what's happening in the world when all the vital methods of communications are down is of utmost importance. Knowing about risks such as hurricanes, aftershocks, tsunami's and enemy bombers heading your way can keep you alive if you can be warned ahead of time. Simply because there's no conventional means of getting informed such as Tv or the internet doesn't mean that aren't people transmitting the information. The section below will help you find these communication methods or understanding and predicting the situation if there is nobody around.

For a list of useful news websites go to the PREPAREDNESS > Situation Monitoring section.

3 Websites

News

These are preparedness websites that are either entirely dedicated to the news or have a regularly updated news element.

Blacklisted News	Regularly updated news that may not be shown on regular news outlets.	https://www.blacklistednews.com/
Survival Pulse		https://survivalpulse.com/
SHTF Plan		http://www.shtfplan.com/
Activist Post		https://www.activistpost.com/
Infowars		https://www.infowars.com/
Alt-Markets		https://alt-market.us/
Doomsday Clock	The Doomsday Clock is a design that warns the public about how close we are to destroying our world with dangerous technologies of our own making.	https://thebulletin.org/doomsday-clock/timeline/

General Websites

Some general preparedness and survivalist oriented websites.

Doom and Bloom By - Joseph & Amy Alton	The website of the writers of the book "The Survival Medicine Handbook: A guide for when help is NOT on the way".	https://www.doomandbloom.net/
Steven1234 By - Steven Harris	A hub website linking to his other sites such as solar1234 and battery1234.	http://steven1234.com/
Survival Pulse		https://survivalpulse.com/
Off Grid Survival		https://offgridsurvival.com/
Survivopedia		https://www.survivopedia.com/
Ready Nutrition By - Tess Pennington		https://readynutrition.com/
American Preppers Network		http://americanpreppersnetwork.com/
Urban Survival Site		https://urbansurvivalsite.com/
Preparedness Advice		https://preparednessadvice.com/
Modern Survival Online By - Dan Stevens		https://modernsurvivalonline.com/
Off The Grid News		https://www.offthegridnews.com/
Doomsday Moose		https://www.doomsdaymoose.com/
Expert Prepper		http://expertprepper.com/

Imminent Threat Solutions		https://www.itstactical.com/
Backdoor Survival		https://www.backdoorsurvival.com/
Apartment Prepper By - Bernie Carr		https://apartmentprepper.com/
Prepper's Will By - Bob Rodgers		https://prepperswill.com/
Food Storage and Survival By - Angela		http://foodstorageandsurvival.com/
Living Life In Rural Iowa By - Erica N		https://www.livinglifeinruraliowa.com/
Northern Homestead		https://northernhomestead.com/
Mom With A Prep		https://momwithaprep.com/
Herbal Survival		http://herbalsurvival.blogspot.com/
The Frugal Chicken		https://thefrugalchicken.com/
Prepared Housewives		http://prepared-housewives.com/
The Survival Mom By - Lisa		https://thesurvivalmom.com/
The Organic Prepper By - Daisy Luther		https://www.theorganicprepper.com/
Ed that Matters By - Todd Sepulveda		https://www.edthatmatters.com/
LetsTalkSurvival By - Steve Ackerman		http://letstalksurvival.com/
Happy Preppers	An extremely useful site for all things prepping.	https://happypreppers.com/
Survivor's Fortress By - Conrad Novak	An amazing BOB gear list.	https://survivorsfortress.com/
Dave's Homestead By - David Nash		https://www.tngun.com/
True Prepper		https://www.trueprepper.com/
The Prepared	In-depth reviews, preparedness tips and gear comparisons.	https://theprepared.com/
Survivalist Websites		
Survival Sherpa **By - Todd Walker**		https://survivalsherpa.wordpress.com/
Graywolf Survival		https://graywolfsurvival.com/
Willow Haven Outdoor By - Creek Stewart		https://willowhavenoutdoor.com/
Outdoor Life		https://www.outdoorlife.com/
Army Study Guide		https://www.armystudyguide.com/
Gear Websites		
Woods Monkey		http://www.woodsmonkey.com/
Survivalist Prepper		https://survivalistprepper.net/
Wood Trekker By - Ross Gilmore		http://woodtrekker.blogspot.com/
BOBA Bug Out Bag Academy		https://bugoutbagacademy.com/
Australian Preppers		https://australianpreppers.com.au/
Tiny Real Estate	A website dedicated to planning and building tiny homes.	https://tinyhomeplans.co/

4 Blogs

Blogs based on prepping, survivalism, hiking or camping.

Adventures in Stoving By - Hikin' Jim		https://adventuresinstoving.blogspot.com/
More Than Just Surviving By - Thomas Xavier		https://morethanjustsurviving.com/
The Survival Blog		https://www.thesurvivalistblog.net/
The Prepper Journal		https://theprepperjournal.com/
Modern Survival Blog By - Ken Jorgustin		https://modernsurvivalblog.com/
The Economic Collapse		http://theeconomiccollapseblog.com/
SHTF Blog By - Joel / Jarhead		https://www.shtfblog.com/

Survival Blog By - James Wesley Rawles		https://survivalblog.com/
The American Dream		http://endoftheamericandream.com/

5 Podcasts

Podcasts on any topic relating to preparedness, survivalism etc.

The Survival Podcast By - Jack Spirko	An excellent blog for all things preparedness with new episodes weekly. (Free)	http://www.thesurvivalpodcast.com/
Prepper Broadcasting Network		https://prepperbroadcasting.com/
In The Rabbit Hole	An urban survival podcast.	https://www.intherabbithole.com/
POSH - Prepper Podcast		http://www.poshpreppers.com/
Prepper Recon Podcast		https://prepperrecon.com/
Survival Punk By - James Burnette		https://www.survivalpunk.com/
The Preparedness Podcast		http://www.thepreparednesspodcast.com/

6 YouTube

The following are YouTube channels related to preparedness, survival and offshoots of either of these topics. If you would like your channel added, please send me an email linking your channel name and content type and I'll add it to the next version if the content is preparedness related. See the introduction in the ADDENDUM > Media section for more information on quality content and how to obtain the status. To find a channel listed below just paste or type the name of the channel in bold into YouTube. I can't continuously update the Subs and Vids counter very often, however when they are updated, I update them all at once so the playing field remains level between the channels.

Of course to use this section when SHTF occurs I recommend either watching or downloading some videos to watch when there's no internet. Look up YouTube downloaders to find a variety of programs that can be used to snatch videos from the web and save them for later watching on your computer. 4K Video Downloader is quite cheap and and automatically download entire channels and any updates from then on.

News

Preparedness news done via video on YouTube.

DAHBOO77	News, Prepper News	350K Subs	3,523 Vids
FullSpectrumSurvival	News Deconstruction, Bushcraft, Preparedness	97k Subs	296 Vids
aminutetomidnite	Prepper News, Conspiracies	22k Subs	253 Vids
Reluctant Preppers	News Discussion, Conspiracies	36k Subs	686 Vids
Real World Prepper	News Discussion, Freedom, Politics	1k Subs	83 Vids

Prepping

YouTube channels related to prepping.

City Prepping	Socioeconomics of SHTF, BOB, Homesteading Tips	237k Sub	64 Vids
Canadian Prepper	Socioeconomics of SHTF, Gear Reviews	218k Subs	513 Vids
SensiblePrepper	Gear Reviews, Survival Hacks, BOB	437k Subs	317 Vids
Survival Know How	Preparedness, Survival Hacks, Skills	38k Subs	86 Vids
Penny University	Top 10 Prepper Lists, Tips, Low Cost Tips, Prepper Advice	41k Subs	62 Vids
The Prepared Mind	Prepper Advice, News Insight, SHTF Tips	69k Subs	864 Vids
The Survival Outpost	Gear Reviews, Shelter Construction, BOB Lists, Tactical Information, Skill Development	11k Subs	82 Vids
Reality Survival	Survival Tips, Top 10 Lists	56k Subs	649 Vids
Survival on Purpose	Outdoor Skills, Gear Reviews	103k Subs	858 Vids
preppernurse1	Prepping Advice, Home Projects	31K Subs	1385 Vids
VikingPreparedness	Gear Reviews, Preparedness Tips, Prepper News	121K Subs	1083 Vids
RealWorldSurvivor.com	Survival and Preparedness Lectures	13k Subs	44 Vids
Country Prepper	Gear Reviews, Prepper Tips, News	13k Subs	313 Vids
ThePatriotNurse	Medical Tips, Medical Gear, Vlogs	232k Subs	357 Vids
TheLordHumungus	Survival Tips, Gear Reviews, Prepper Lessons	44k Subs	460 Vids
Reality Survival & Prepping	Prepper Tips, Bushcraft Basics	76k Subs	642 Vids

Australian Survivalism	Prepping Tips, Foraging, Survival	2k Subs	45 Vids
Ethical Preparedness	SHTF Stories, Self Defence, Prepper Lessons	43k Subs	135 Vids
Prepper Princess	Preparedness Tips, News Chat, Foraging	89k Subs	194 Vids
TheUrbanPrepper	Preparedness Tips, Gear Reviews, EDCs, BOBs, Emergency Advice	131k Subs	467 Vids
Bear Independent	Tactical Reviews, Survival Skills, Gear Reviews	39k Subs	601 Vids
TheModernSurvivalist	Tactical Gear, Survival Advice, Gear Reviews, Guns	38k Subs	743 Vids
AlaskaGranny	Household Tips, Cooking, Prepping Food	35k Subs	1080 Vids
BlackScoutSurvival	Tactical, Survival Kits, Combat, BOB, Skills, Gear Reviews	309k Subs	733 Vids
Obsessive Prepper AZ	Cooking, Prepper Foods	21k Subs	163 Vids
Survivalist Prepper	Prepper Tips, Gear Reviews	14k Subs	223 Vids
HealthyPrepper	Prepping Tips, Food Advice, Food Storage	31k Subs	327 Vids
Casual Preppers Podcast	Prepper News, Tips and Gear Reviews	2k Subs	80 Vids
The Provident Prepper	Preparedness Tips, Food Storage, Household Tips	3k Subs	48 Vids
Admiral Preparedness	Prepper Tips, Current News, Prepping Lessons	3k Subs	619 Vids
Great Lakes Prepper	Gear Reviews, Prepper Tips	4k Subs	241 Vids

Survival & Outdoors

YouTube channels related to survival and outdoors.

TA Outdoors	Shelter Construction, Camp Economics	729k Subs	145 Vids
Karamat Wilderness Ways	Bushcraft, Survival, Tips	28k Subs	143 Vids
Funkyprepper	Outdoor Skills, Gear Reviews	51k Subs	159 Vids
KennethKramm	Outdoor Skills, Survival, Camping Etiquette	55k Subs	278 Vids
Tom McElroy-Wild Survival	Outdoor Survival	119k Subs	31 Vids
TheOutdoorGearReview	Gear Reviews, Outdoor Survival, Hiking	31k Subs	1069 Vids
Survival Lilly	Survival Tips and Lessons	724k Subs	333 Vids
Tube Unique Wilderness	Complex Shelter Creation, Living off the Land	1.6m Subs	36 Vids
The Wooded Beardsman	Survival, Hunting, Cooking	539k Subs	290 Vids
ReWildUniversity	Wilderness Skills, Fitness, Tracking	50k Subs	235 Vids
Bob Hansler	Survival Skills and Tips	201k Subs	210 Vids
Off Grid Warrior	Survival Shelters and Trips	23k Subs	44 Vids
Corporals Corner	Survival Skills, Shelters, DIY Projects	146k Subs	259 Vids
Bushcraft Survival Australia	Bushcraft, Survival, Skills	5k Subs	28 Vids
Fandabi Dozi	Survival, Hunting, Bushcraft, Hikes	13k Subs	51 Vids
Primitive Survival Tool	Elegant Shelter Building	2.8m Subs	59 Vids
Survivaland	Survival Tips, Adventures, Gear Reviews	22k Subs	52 Vids
StartUpSurvival	Knife Reviews, Survival Trips	10k Subs	235 Vids
Survival Know How	Survival Tips, Prepping Tips, Survival Skills, BOB Review	44k Subs	91 Vids
SNO Multimedia	Survival News, Prepper Tips, Product Reviews	43k Subs	181 Vids

Gear Reviews

YouTube channels related to gear and reviews.

CampingSurvival	Gear Reviews, Survival Advice	7k Subs	155 Vids
Step One Survival	Prepping Tips, Gear Reviews, Guns	68k Subs	818 Vids
EverydayTacticalVids	Reviews and Gear	141K Subs	925 Vids
BladeOps	Bladed Gear Reviews	47K Subs	1517 Vids

Iridium242	Gear Reviews, Preparedness	26k Subs	562 Vids
DropForgedSurvival	Gear Reviews Gear Testing	200k Subs	670 Vids
Living Survival	Gear Reviews	141k Subs	657 Vids
Dynamic Prepper	Gear Reviews, Subscription Box Reviews	61k Subs	343 Vids
PREPAREDMIND101	Gear Reviews, Knife Reviews	219k Subs	1,120 Vids
BudgetBugout	Knives, Tools, EDC Reviews	141k Subs	411 Vids
7 TRUMPETS PREPPER	Battlbox Reviews, Prepper News, Home DIY	58k Subs	738 Vids

Other Videos

Skills

MASK Tactical	Tactical Skills, Bushcraft	19k Subs	104 Vids
AlfieAesthetics	Gear Reviews, Survival, Camp Craft	193K Subs	74 Vids
Paul Elkins	DIY Vehicles	70K Subs	94 Vids
ITS Tactical / Imminent Threat Solutions	Gear Testing, Skills	249K Subs	600 Vids

Tiny Houses & Minimalism

Tiny House Expedition	Tiny Houses, Tiny House Legal Matters	23K Subs	54 Vids
Living Big In A Tiny House	Exploring Tiny Houses around the World	722K Subs	121 Vids
Tiny Real Estate	Tiny Houses in Australia	1K Subs	17 Vids
relaxshacksDOTcom	Building Tiny Houses	170K Subs	427 Vids
Tiny House Listings	Exploring Tiny Houses	442K Subs	472 Vids
Dirtpatcheaven	Tiny Houses and Homesteading	96K Subs	1641 Vids
Exploring Alternatives	Minimalist Living	432K Subs	161 Vids
Tiny House Giant Journey	Exploring Tiny Houses	212K Sub	86 Vids
Kirsten Dirksen	Revolutionary Tiny Houses	736K Subs	839 Vids
Tinyhouse Prepper	Tiny Houses, Tiny Living, Self Improvement	53k Subs	479 Vids

Gardening

MIGardener	Gardening, Tips, Tricks	247K Subs	1,010 Vids
Self Sufficient Me	Growing Food at Home	262K Subs	339 Vids
TIY: Tiny it Yourself	Building your own Tiny House	10K Subs	19 Vids
Green Gregs	Gardening, Prepper Foods	21k Subs	55 Vids
SurvivalistGardener	Gardening, Homesteading, Foraging, Raising Animals	Hidden	171 Vids

Homesteading

Homesteadonomics	DIY Off-Grid projects	135k Subs	195 Vids
Our Little Homstead!	Homesteading tips, canning, gardening	48k Subs	629 Vids
Guildbrook Farm - Off Grid Living	Simple Sustainable Living, Homesteading, Farming, Cooking	138K Subs	159 Vids
The Do It Yourself World	Homestead Modification, Animals, Tips	109K Subs	1967 Vids
Starry Hilder	Off Grid Homesteading	Hidden	767 Vids
LDSPrepper	Beekeeping, Off Grid Living, Greenhouses	163k Subs	207 Vids
Big Family Homestead	Homesteading Tips, Cooking	142k Subs	1626 Vids
southernprepper1	Homesteading Tips, Construction	122k Subs	603 Vids
homesteadprepper	Preparedness, Homesteading, DIY	29k Subs	302 Vids

Downloading YouTube Videos

As preppers, knowledge can be the biggest asset in a grid-down situation. It can allow you to 'loan' skills and ascertain quicker results than if we attempted to try things ourselves without any prior knowledge. One of these biggest hubs of knowledge right now is the video streaming website YouTube. I'm sure most of you visit daily and learn from some of the greats including Southern Prepper 1, Sensible Prepper, The Provident Prepper, City Prepping and Canadian Prepper.

However these essential resources aren't much use if the internet goes down. We need a way to store this information for use in a grid-down situation when we need it most. Below I will dive into how you can download videos to create an 'Offline Prepper Video Archive'.

I'm going to go ahead and predict that preparedness content won't be readily available for too much longer due to a range of storms heading our way, including:
- The internet won't last long in any major conflict, and we seem to be on the verge of a world war.
- Hacking and ransomware has become much more common which could easily take out the internet in an entire country.
- Big Tech companies are actively silencing those who don't agree with their agenda, and that includes Preppers.
- YouTube is taking steps to block third party downloaders like those mentioned below.
- Prepping is anti-mainstream and Governments certainly don't want their populations to be self-reliant as this means less income for them.
- Infrastructure is aging worldwide and isn't being maintained to the standards it should be, this includes electrical grids and internet networks.
- World Governments are actively censoring information and filtering it for their advantage – such as what currently occurs in China, Iran, North Korea and more.

Whatever the reason you want to download preparedness videos, there are a couple ways to achieve it. This list is by no means conclusive, as there are probably hundreds of different programs and websites that can download YouTube videos.

Download Videos on a Phone Using an App (NewPipe) (Single Videos Only, Easy to Use)
An easy way to download single videos is by using NewPipe. Just download and install the app and then search for a video you want to download and hit that download button. Then you just have to choose your settings like the quality of the video and whether you want the whole video or you just want to extract the audio from it.

Download Videos Using 4K Video Downloader (Paid) (Bulk Downloads, Easy to Use)
This is by far the simplest way to download a huge amount of videos at once and it doesn't require lots of setting up like JDownloader or Stacher below. All you have to do is paste anything from links to playlists by using the "Paste Link" button at the top and it will download each video in a playlist, one at a time – or even multiple at a time based on your settings. (Just don't download them too quickly or YouTube will block your IP address and then you won't be able to download or watch any videos!)

If you close the window 4K will resume where you left off which is an extremely handy feature so you don't lose track of where you're up to and what's been downloaded so far. The only issue I've found is that the video can sometimes fail to download correctly and ends up being unplayable. If this happens all I have to do is delete the unfinished file and copy and paste the link again. The title "4K Video Downloader" is a bit of a misnomer, since you can select any resolution you want to download in and not just 4K.

Download Videos Using JDownloader (Free) (Bulk Downloads, Precise Download Control, Complex)
JDownloader requires FFMPEG to be installed, but it can do this automatically with a connection to the internet.

To get started with JDownloader (called JD from here on), firstly install the software and then proceed with the FFMPEG installation which will pop up automatically if it's not already installed. Make sure JD is running and then head over to YouTube and copy the link to any video you want to download. Swap back to JD and you should see that it has automatically parsed the link you copied and populated the "LinkGrabber" tab up the top with a bunch of different files if you click the "+" to the left. You don't need most of these, so before we go further we're going to change some settings.

Head to 'Settings' and you should see the 'Plugins' section up the top. Click in the "Please choose a plugin" area and remove whatever's there, and start to type "YouTube" – clicking it when it shows up. When selected you will see a LOT of different options available to you which may seem daunting, but to keep it simple I will let you know my settings and you can work from there.

Under "Allowed Media Types":
(Just un-tick all the other options until only the below options remain)
- Type: Audio, Video
- Filetype: MP4
- 3D/360: 2D
- Image/Video Resolution: 480p (Or whatever your quality preference is)
- Fps: 60, 50, 30, 24

Go to "Settings" > "Settings" > "General" and at the very top you can set the folder where the downloads will be saved. It's best to create a new folder called "JDownloader" in a drive which has a good amount of space. (at least 10+ Gigabytes)

Once you've done that, head back to the "LinkGrabber" tab and delete the top row that has the box icon to the left of it by right-clicking it and going 'Delete'. Then re-copy the YouTube link you copied before and let it parse it. (If you've disabled the automatic link parsing, you can manually scan links with the "Add New Links" button in the bottom left. You should hopefully now only see one file available to download if the link you copied wasn't a playlist. If you're happy with the selection scheduled for download, you can press the blue download button on the far top left side under "File". Then just sit back and let the files download.

Once it reaches 100% it's downloaded and you can right click the video file and choose "Open Download Directory" to open the folder where you saved it. If you want you can also double click the file to play it from JD.

If you encounter any issues with the download, you should try updating to the latest JD version as YouTube often patches their website which breaks the download capabilities of most downloaders. If you still have issues you could search for the issue you are having in a search engine.

Download Videos Using Stacher (Free) (Bulk Downloads, Imprecise Control)
Stacher is a free program used to download YouTube videos and playlists. It requires FFMPEG like JDownloader above but unfortunately you have to install it manually this time. Just head to the link above and download the executable for your operating system. To install it, just use a browser to look up "how to install FFMPEG". But I have included a bried summary below:

FFMPEG Installation for Windows
Download the latest binaries from the yt-dlp maintained repo. Once downloaded, in Stacher click the 'Tools' menu and select the Import ffmpeg *.zip option. A dialog will appear where you can select your downloaded zip file. Once selected, wait for Stacher to extract the zip and install the files to the stacher home directory. When complete, you will get a message indicating ffmpeg has been set up.

Once installed and the FFMPEG files have been copied then you can start downloading after a few settings tweaks! First, click the little download icon in the top right corner to choose your video settings. You don't have much control over the quality, but at least it's easy use. I recommend just choosing "MP4" if you're a beginner. You should also set the download folder. To do so, click the "Stacher" button at the top and then choose "Settings". From there you can set the download folder where the videos will be saved – I recommend a folder called "Stacher" so it's obvious.

A little further down you will see the "Output Filename" option. If you want exactly the same filename as the video you are downloading, then click on the unlock icon, delete whatever text is in the field and click the "title" button below it. (Note: The button doesn't work unless you click the actual text of the button). Exit the settings menu using the pink button at the bottom and finally head to YouTube and copy the link to a video or playlist you want to download, then swap back to Stacher and paste it in the field at the top and press enter.

Stacher will parse the link and either begin the download if the link is for a single video or it will give you options to download any of the videos in the playlist link. In this case you just have to un-tick any videos you don't want to download and click the "Download Selected" button. That's about it for Stacher. If you have questions or issues, have a look at the Stacher Getting Started page.

Video Quality
There are usually a range of resolution choices when downloading videos which can be quite confusing if you aren't familiar with them. Below I'll quickly go over the most common ones so you have an idea of what type you want to go with to have the best medium between quality and low file size.

In general I try to match the type of content with the appropriate quality type. So I use 480p by default for 85% of everything I download and then bump it up to 720p for detailed tutorials and download in audio/MP3 for a couple which I don't need to see anything on. It may be worth considering using 360p as your default quality since having the video and trying to make out what is on-screen would be better than not having that video at all due to space issues. Just something to think about.

MP3	You don't have to download the entire video if you only need the audio. This is the most condensed way to convey information besides text and is recommended if you don't need to see what's happening. For example, some of Canadian Prepper's videos have the camera aimed at a book or the wall while he discusses various preparedness topics, this is one of the examples where downloading the video in MP3 would be ideal. Another would be video podcasts, where having the video isn't necessary as anything visual is generally explained in detail.
144p	The lowest video quality YouTube deals in. Extremely hard to make out detail on-screen. Not recommended to download videos in.
240p	It's watchable, but still quite useless if you need to see fine details such as a video on tying knots.
360p	This is the lowest quality I will download videos in. It's not bad if you are watching some wide-angle instructional videos.
480p	A decent quality to be able to see what you need, but also comes in a fairly small file size. I use this quality by default unless it's a video with fine details.
720p	HD Quality – This is probably the upper limit you would want to download the bulk of your videos in as they take up quite a bit of space. This quality is perfect for videos showing programming code, knitting tutorials or any videos where a whiteboard is drawn on.
1080p	Full HD Quality – Similar quality to what you get streamed to your TV at home. I would only download 1080p if you need to see ultra fine details such as soldering circuit boards.
4K	Ultra HD Quality – An insane quality and a waste of space for downloading prepping videos. Very few YouTubers upload videos in 4K too.

Video Frames Per Second (FPS)
Some videos give you the option to choose between 30 FPS and 60 FPS. This is the count of how many images are displayed on-screen within one second – hence 'Frames Per Second'. It makes the video appear smoother and more life-like. There's not really any need to download videos in 60 FPS, unless there's a lot of fast movements happening which you need to see in detail.

What to Download
When it comes choosing what you want to download you can pretty much download whatever takes your fancy, but in the interest of preparedness related topics, there's a few categories you definitely need to address, such as:
- Preparedness Topics – Gear, Water, Bugging In/Out, Shelter, Planning, SHTF
- Survival – Bushcraft, Foraging, Living off the land.
- Medical – First Aid, Trauma, iFAKs, Herbalism
- Homesteading – Animal Husbandry, Breeding, Land Management
- Gardening – Farming, Permaculture, Harvesting, Seeds
- Food – Cooking, Recipes, Preserving
- Tactical – Stealth, Combat, Tactics, Home Defence, Situational Awareness
- Weapons – Guns, Bows, Swords, Conceal Carry
- DIY – Carpentry, Welding, Plumbing, Electrical
- Education – Math, Physics, Science, Biology
- Entertainment – Cat Videos, Gaming Videos, (Whatever you enjoy watching on YouTube outside of prepping)
- Kids – Videos or TV shows for kids to keep them entertained.
- Faith – Religious Sermons, Bible Reading, Commentaries
- Truth – Always the first casualty in war, question everything for the sake of your personal health and look into both sides of any argument for any topic you support. Be your own expert and don't simply trust those who claim to be those experts

You will want to avoid downloading videos with limited SHTF use, such as current news updates. Focus more on the "How Do I" videos and tutorials rather than the here and now.

Recommended YouTubers
See the top of the Media section above for the recommended preparedness based YouTubers.

Storage Options
So, you've now downloaded a ton of prepper videos. How do you store all of this data? This becomes the primary issue after you've begun downloading entire channels every other week. I know I've filled an entire hard drive with YouTube videos, even downloading at just 480p. To answer this question I had to look at how I was planning on watching the videos. After some thought I figured I would be watching them on either my phone or tablet since there probably won't be AC power to run my desktop or laptop for any decent length of time. These devices both have USB-C connectors, so I knew I wanted a hard drive that could be plugged directly into them without the need for an external power brick like some hard drives have.

After some searching I found the one I was looking for, a Samsung 1TB T7 SSD. This hard drive is USB-C and can be plugged straight into my phone or tablet without the need for external power, and lets me watch any of the content on it directly. Sure, it drains my device's battery a little quicker, but I also have the option to copy some of the videos to my device's storage to watch later when I need it.

I managed to fit 15,388 videos onto my 1TB YouTube SSD with an average quality of 480p. So that means on average, each video is about 60mb. To utilize this data, I can either search for specific YouTube channels manually or search for a specific term like "water filter" to find what exactly I'm looking for in my archive. Overall it's the perfect solution for the problem I was looking to solve and now I feel much more prepared knowing that I have all of this knowledge readily accessible. Remember that this data is meant to be watched now so you have this knowledge BEFORE a disaster, don't just let it sit there collecting dust.

7 Books

Non-Fiction Survival

SAS Survival Guide (Full Size) By: John 'Lofty' Wiseman	The single most helpful book you could read on surviving outdoors.	**384 Pages**
SAS Survival Guide (Pocket Size) By: John 'Lofty' Wiseman	A condensed version of the book above, great to put in a BOB.	**Pages**
SAS Urban Survival Handbook By: John 'Lofty' Wiseman	Another great book by John 'Lofty' Wiseman on urban survival.	**644 Pages**
Bushcraft 101: A Field Guide to the Art of Wilderness Survival By: Dave Canterbury		**258 Pages**
Advanced Bushcraft: An Expert Field Guide to the Art of Wilderness Survival By: Dave Canterbury		**258 Pages**
The Bushcraft Field Guide to Trapping, Gathering, and Cooking in the Wild By: Dave Canterbury		**311 Pages**
Bushcraft First Aid: A Field Guide to Wilderness Emergency Care By: Dave Canterbury		**256 Pages**
Bushcraft Illustrated: A Visual Guide By: Dave Canterbury		**384 Pages**
Army Survival Guide	Reference guide for survival, evasion, first aid and recovery.	**Pages**
Cures A-Z	Ultimate guide to natural remedies.	**Pages**
Camping and Wilderness Survival Paul Tawrell	The ultimate outdoors book.	**Pages**
How to Survive the End of the World as We Know It James Wesley Rawles	A comprehensive guide to preparing for the apocalypse.	**Pages**

Fiction Post-Apocalyptic

Some fictional post-apocalyptic books relating to disasters.

One Second After William R. Forstchen	The novel deals with an unexpected electromagnetic pulse attack on the United States as it affects the people living in and around the small American town of Black Mountain, North Carolina.
One Year After William R. Forstchen	Two years since nuclear weapons were detonated above the United States and brought America to its knees. After months of suffering starvation, war, and countless deaths, the survivors of Black Mountain, North Carolina, are beginning to recover technology and supplies they had once taken for granted.
The Final Day William R. Forstchen	Since the detonation of nuclear weapons above the United States more than two years ago, the small town of Black Mountain, North Carolina has suffered famine, civil war, and countless deaths. Now, after defeating a new, tyrannical federal government, John Matherson and his community intend to restore their world to what it was before the EMP apocalypse. For the most part, they are succeeding.
Going Home A. American	When Morgan Carter's car breaks down 250 miles from his home, he figures his weekend plans are ruined. But things are about to get much, much worse: the country's power grid has collapsed. There is no electricity, no running water, no Internet, and no way to know when normalcy will be restored—if it ever will be. An avid survivalist, Morgan takes to the road with his prepper pack on his back.

Surviving Home A. American	In A. American's first novel, Going Home, readers were introduced to Morgan Carter, the resourceful, tough-as-nails survivalist who embarks on a treacherous 250-mile journey across Florida following the collapse of the nation's power grid. Now reunited with his loving wife and daughters in this follow-up to Going Home, Morgan knows that their happiness is fleeting, as the worst is yet to come. Though for years Morgan has been diligently preparing for emergency situations, many of his neighbours are completely unready for life in this strange new world—and they're starting to get restless.
Escaping Home A. American	After the collapse of the nation's power grid, America is under martial law—and safety is an illusion. As violence erupts around him, Morgan Carter faces one of his most difficult decisions yet: whether to stay and defend his home, or move to a more isolated area, away from the prying eyes of the government. He and his family are hesitant to leave their beloved Lake County, but with increasingly suspicious activities happening in a nearby refugee camp, all signs point towards defecting. Morgan and his friends aren't going to leave without a fight, though—and they'll do anything to protect their freedoms.
Alas, Babylon Pat Frank	"Alas, Babylon." Those fateful words heralded the end. When a nuclear holocaust ravages the United States, a thousand years of civilization are stripped away overnight, and tens of millions of people are killed instantly. But for one small town in Florida, miraculously spared, the struggle is just beginning, as men and women of all backgrounds join together to confront the darkness.
299 Days Glen Tate	299 Days: The Preparation, the first book in the 299 Days series, depicts the inner struggles Grant must face as he exists in a social system he recognizes as unsustainable and on the verge of collapse, but one in which he has built his life around. What begins as a return to his roots, self-sufficiency and independence, becomes a full blown move to prepare for what may come. It's not as well written as some of the other books here.
The Andromeda Strain Michael Crichton	The United States government is given a warning by the pre-eminent biophysicists in the country: current sterilization procedures applied to returning space probes may be inadequate to guarantee uncontaminated re-entry to the atmosphere. Two years later, seventeen satellites are sent into the outer fringes of space to collect organisms and dust for study. One of them falls to earth, landing in a desolate area of Arizona. Twelve miles from the landing site, in the town of Piedmont, a shocking discovery is made: the streets are littered with the dead bodies of the town's inhabitants, as if they dropped dead in their tracks.
Lights Out David Crawford	The novel examines how normal Americans might cope with a true national disaster shutting down the nations electrical grid and follows the downward spiral created by such an event.
Expatriates - A Novel of the Coming Global Collapse James Wesley Rawles	Since America's socioeconomic collapse, a newly radicalized Islamic government has swept through the Pacific southeast! The Jeffords---a family of Christian missionaries living in the Philippines---must use every survival skill they know if they're going to safely navigate through rough waters, food shortages, and enemy combatants. If they can reach Australia, will they be safe? And for how long?
The Old Man and the Wasteland Nick Cole	Forty years after the destruction of civilization... Man is reduced to salvaging the ruins of a broken world.
The Savage Boy Nick Cole	The second story in Nick Cole's suspenseful odyssey into the dark heart of the Post-Apocalyptic American Southwest.
The Road is a River Nick Cole	The Road is a River concludes Nick Cole's fantastic Wasteland Saga.

Permaculture

A list of the best permaculture books.

Introduction to Permaculture Bill Mollison	Introduction to Permaculture is an updated and revised version of the first two permaculture books, Permaculture One (Mollison and Holmgren, 1978) and Permaculture Two (Mollison, 1979), and replaces them.
Permaculture: A Designer's Manual Bill Mollison	Permaculture (permanent agriculture) is the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems. It is the harmonious integration of landscape and people providing their food, energy, shelter, and other material and non-material needs in a sustainable way. Without permanent agriculture there is no possibility of a stable social order. Permaculture design is a system of assembling conceptual, material, and strategic components in a pattern which functions to benefit life in all its forms.
Gaia's Garden Toby Hemenway	Many people mistakenly think that ecological gardening—which involves growing a wide range of edible and other useful plants—can take place only on a large, multiacre scale. As Hemenway demonstrates, it's fun and easy to create a "backyard ecosystem" by assembling communities of plants that can work cooperatively and perform a variety of functions.
Edible Forest Gardens Dave Jacke & Eric Toensmeier	One of the most thorough references for a permaculturist in North America's temperate climate. It is one of the few books on Permaculture which is not simply restating what has already been written. Instead it is intended for someone who already understands Permaculture. This book not only explains how to fill the niches needed in the design of properties, it includes a vast amount of information on over 600 plants and how they fill various niches.
The Ultimate Guide to Permaculture Nicole Faires	While this may not be the best Permaculture book when compared to all of the above, the distinct advantage of this book is its price. For the introduction to permaculture you get from this book it can often be found for significantly less than most of the books above in this list, anywhere from 50% to 85% less than some of the books above.
Restoration Agriculture Mark Shepard	Restoration Agriculture explains how we can have all of the benefits of natural, perennial ecosystems and create agricultural systems that imitate nature in form and function while still providing for our food, building, fuel and many other needs - in your own backyard, farm or ranch. This book, based on real-world practices, presents an alternative to the agriculture system of eradication and offers exciting hope for our future.
Sepp Holzer's Permaculture: A Practical Guide to Small-Scale, Integrative Farming and Gardening Sepp Holzer	Sepp Holzer farms steep mountainsides in Austria 1,500 meters above sea level. His farm is an intricate network of terraces, raised beds, ponds, waterways and tracks, well covered with productive fruit trees and other vegetation, with the farmhouse neatly nestling amongst them. This is in dramatic contrast to his neighbours' spruce monocultures. In this book, Holzer shares the skill and knowledge acquired over his lifetime. He covers every aspect of his farming methods, not just how to create a holistic system on the farm itself, but how to make a living from it.

Gardening

A list of some great gardening books.

The All You Can Eat Gardening Handbook Cam Mather	There's never been a better time to grow your own food as we face the converging challenges of the financial crisis, climate change, water shortages, peak oil, and 6.5 billion people worldwide competing for a limited amount of food.

All New Square Foot Gardening Mel Bartholomew	"Top 10 Gardening Best-Seller."-Publishers Weekly "This is a good, competent gardening book, well written & sensibly presented."-Library Journal "How to get more from less is one of life's major challenges today.
CA$H from Square Foot Gardening Mel Bartholomew	Demonstrates square foot gardening techniques, discusses planning, soil preparation, transplanting, and harvesting, and gives advice on selling surplus produce.
The Vegetable Gardener's Bible: Discover Ed's High-Yield W-O-R-D System for All North American Gardening Regions Edward C. Smith	A comprehensive guide to growing your own fruit and vegetables. It offers practical advice ranging from building raised beds, planning your veg patch to making your own compost.
The Botany of Desire Michael Pollan	The Botany of Desire: A Plant's-Eye View of the World is a 2001 nonfiction book by journalist Michael Pollan.

Homesteading

A list of some great homesteading books.

Strategic Relocation-North American Guide to Safe Places Joel Skousen	This is the long-awaited update of Mr. Skousen's classic book on relocation for security. Nearly 3/4 of this 3rd Edition is rewritten and it is expanded to 349 pages. In the process, the authors created all new graphics, charts and tables. There is also a new section on international retreat potential and 200 additional pages of analysis on every state and province of the US and Candada, complete with colour maps.
The Encyclopedia of Country Living Carla Emery	From craft culture to survivalists, preppers, homesteaders, urban farmers, and everyone in between there is a desire for a simpler way of life—a healthier, greener, more self-sustaining and holistic approach to modern life.
The Modern Survival Retreat Ragnar Benson	Modern retreaters have a new enemy to fear - our own government. In this companion to the classic book The Survival Retreat, Ragnar answers such vital questions as how to identify exactly who threatens your freedom, when to occupy your retreat and how to fight the government when it goes hard-core against you.
You Can Farm: The Entrepreneur's Guide to Start & Succeed in a Farming Enterprise Joel Salatin	Have you ever desired, deep within your soul, to make a comfortable full-time living from a farming enterprise? Too often people dare not even vocalize this desire because it seems absurd. It's like thinking the unthinkable.
Back to Basics: A Complete Guide to Traditional Skills (Back to Basics Guides) Abigail R. Gehring	Anyone who wants to learn basic living skills—the kind employed by our forefathers—and adapt them for a better life in the twenty-first century need look no further than this eminently useful, full-colour guide.
The Encyclopedia of Country Living, 40th Anniversary Edition Carla Emery	From craft culture to survivalists, preppers, homesteaders, urban farmers, and everyone in between there is a desire for a simpler way of life—a healthier, greener, more self-sustaining and holistic approach to modern life.

Firearms

A list of the best firearms books.

Boston's Gun Bible Boston T. Party	Boston's Gun Bible goes into great detail about the pros and cons of various defensive weaponry, equipment, and the philosophy behind their appropriate usage. The work is markedly political, obviously pro gun, and has a rather witty "screw the hoplophobes" tone.
Survival Guns Mel Tappan	Survival Guns remains the definitive book for anyone interested in the practical use of firearms and related weapons for defence, food gathering, and predator and pest control under conditions of long-term, self-sufficient living.
Blue Book of Gun Values S. P. Fjestad	The firearms industry standard is back with the new 38th Edition Blue Book of Gun Values! This edition has been updated with current market trends, values, and 2017 makes and models. With 2,512 pages covering 1,500+ manufacturers, nearly 30,000 gun model descriptions, and over 180,000 prices.
The Secure Home Joel Skousen	This book covers all the types of mechanical systems, including alternative equipment for heating, cooling, and power generation, using multiple sources - wood, water, wind, solar, and various types of combustible fuel. This new 4th edition is a complete textual update and contains all the latest technology on solar systems and lithium-ion batteries.
Flayderman's Guide to Antique American Firearms and Their Values Norm Flayderman	Contains gun identification for more than 4,000 antique American firearm models and variants, extensively described with all marks and specifications necessary for quick identification.
Ultimate Sniper 2006 Maj. John L. Plaster	An Advanced Training Manual for Military and Police Snipers
U.S. Army Ranger Handbook U.S. Army	This handbook offers the techniques and tactics that make U.S. Army Rangers the best soldiers in the world. These highly trained, easily deployable, and widely skilled infantrymen specialize in airborne assault, raids, recovery of personnel and equipment, and airfield seizure, among other difficult and dangerous missions.
Principles of Personal Defence Jeff Cooper	This new edition of Cooper's classic Principles of Personal Defence - with a fitting tribute by firearms expert Louis Awerbuck and all-new drawings by renowned illustrator Paul Kirchner - presents his timeless theory of individual defensive behaviour clearly, concisely and practically.

Health

A list of the best health books.

The Survival Medicine Handbook: A guide for when help is NOT on the way Joseph & Amy Alton	The Survival Medicine Handbook (tm) is not your standard first aid book. It assumes that no hospital or doctor is available in the aftermath of a catastrophic event. This book will give you the tools to handle injuries and illness for when YOU might be the end of the line with regards to your family's medical well-being.
Herbal First Aid and Health Care Kyle D. Christensen	Herbal First Aid is a first aid manual which describes the treatment and management of first aid emergencies and other primary and secondary care with an emphasis on the application of herbal medicine. This book includes detailed protocols in treating first aid emergencies as well as protocols for not so urgent care.
Special Operations Forces Medical Handbook U.S. Army	Nearly 140 comprehensive illustrations show the proper techniques for medical care, from basic first-aid and orthopedics to instructions for emergency war surgery and even veterinary medicine. Questions are listed so that the medic can obtain an accurate patient history and perform a complete physical examination.
The Herbal Medicine-Maker's Handbook: A Home Manual James Green	THE HERBAL MEDICINE-MAKER'S HANDBOOK is an entertaining compilation of natural home remedies written by one of the great herbalists, James Green, author of the best-selling THE MALE HERBAL. Writing in a delightfully personal and down-home style, Green emphasizes the point that herbal medicine-making is fundamental to every culture on the planet and is accessible to everyone.
Where There Is No Doctor: A Village Health Care Handbook David Werner	Useful for health workers, clinicians, and others involved in primary health care delivery and health promotion programs, with millions of copies in print in more than 75 languages, the manual provides practical, easily understood information on how to diagnose, treat, and prevent common diseases.
Where There Is No Dentist Murray Dickson	Community health workers, educators and individuals from around the world use Where There Is No Dentist to help people care for their teeth and gums. From preventing and treating common dental problems to making low-cost equipment, this title covers essential topics in oral health and hygiene.
Where There Is No Vet Bill Forse	Where There is No Vet is more than just a book on first aid for animals. It aims to help people keep their animals healthy. It covers a wide range of topics that affect the health of livestock, from diarrhoea to rinderpest, from helpful traditional remedies to the uses of modern medicines and vaccines. It includes advice on the care, feeding, and handling of animals.
Wilderness Medicine, 5th Edition Paul S. Auerbach	New chapters on judgment and decision-making and mental health. First-aid topics--patient assessment, shock, soft tissue injury, burns, fractures and dislocations, and chest, head, and abdominal injury. How to handle environmental problems--heat, cold, water, altitude, and poisonous plants and animals.

Classic Novels

Children's Books

A list of the best children's books.

Alice's Adventures in Wonderland Lewis Carroll	Alice eagerly delves into a rabbit hole of imagination, meeting some of the quirkiest characters in literature, from the Mad Hatter to the Queen of Hearts. This is Carroll's parody of Victorian society, and the complications of children growing up.
The Adventures of Tom Sawyer Mark Twain	Be transported back to the Mississippi towns of Twain's own childhood. The exciting adventures of Tom Sawyer are full of nostalgia for an innocent childhood, mixed with the tension of a worldly reality of poverty, superstition, and slavery.
Grimm's Fairy Stories Jacob Grimm	This classic children's book is a home to the world's most famous fairy tales. From Sleeping Beauty and Cinderella, to Rapunzel and Little Red Riding Hood, among many more.
Peter and Wendy J. M. Barrie	Barrie's imagination has brought joy to millions of children around the world. His tales of the boy who never grew up, Captain Hook, the Lost Boys, and, of course, Wendy, offer a perfect world in which to escape to.
Gulliver's Travels Jonathan Swift	When Lemuel Gulliver is cast adrift, he has to fight for his survival against a number of groups of strange and surreal societies. These societies are Swift holding a mirror up to ourselves, our own principles and values, and our own crude behaviours.
Charlie And The Chocolate Factory Roald Dahl	Mr Willy Wonka is the most extraordinary chocolate maker in the world. And do you know who Charlie is? Clutching their Golden Tickets, they arrive at Wonka's chocolate factory. But what mysterious secrets will they discover?

Literary Classics

A list of the best literary classics. Most of these are free to download from www.gutenberg.org/

A Tale of Two Cities Charles Dickens	A twisting and complex tale of London and Paris during the period of the French Revolution. This is a novel intertwined with sly humour, masterful prose, and a gang of Dickens' most loved characters.
Les Misérables Victor Hugo	An instantly popular novel showcasing the dark underbelly of 19th century Paris. Hugo makes clear his criticisms of the French political system throughout this dense web of larger-than-life characters and plot twists.
David Copperfield Charles Dickens	This tragi-comic novel was the novel Dickens' was most proud of. This is a story of a lowly peasant on a mission to become a successful novelist, passing through the lives of innumerable fascinating characters on the way.
Dracula Bram Stoker	A renowned Gothic horror, in which Stoker sets the benchmark for what vampires should be for modern authors. This is a tale of Count Dracula's migration from Transylvania to England, in search of fresh blood.
The Call of The Wild Jack London	Based on London's philosophy about life's struggles and nature's power, The Call of The Wild is an enduring masterpiece. Follow Buck, the central canine character, on his journey from luxury to slavery as he is passed between masters to endure conditions he could never have imagined.
The Iliad Homer	Written over 2000 years ago, The Iliad is one of the greatest war stories ever told. Through this sprawling epic, Greek mythology is interwoven with intense character development, as the Greeks make a final attack on Troy.
The Odyssey Homer	The Odyssey is in effect the sequel to The Iliad. This is an epic poem following the moral and physical endurance of Odysseus after the Trojan War, on his adventurous journey home.
Great Expectations Charles Dickens	Pip's desire to become a wealthy gentleman sees him caught up in crime, guilt, revenge, love, and "great expectations". This is not only a story of rags to riches, but also one of moral redemption.
Heart of Darkness Joseph Conrad	This dark, exciting allegory tells the story of seaman Marlow as he searches through the heart of Africa for the infamous ivory trader, Kurtz. Shining a glaring light on how Western civilization gained its power, this short novel forces us to question our values and principles in a fundamental way.
Ulysses James Joyce	Ulysses is a modernist novel, telling the story of Leopold Bloom and Stephen Dedalus in Dublin, 1904. Not for the faint-hearted, this is a book that is as elusive and difficult as it is rewarding.

Don Quixote Miguel de Cervantes Saavedra	Known as being the "first modern novel", this is an experimental tale of the adventures and misadventures of knight-errant Don Quixote and his squire. Influential to hoards of great writers, this 1000-page novel is well worth the effort.
Pride and Prejudice Jane Austen	A witty tale of love, fortune, and flirting between the ever popular Mr Darcy, and Elizabeth Bennet, as the latter struggles with the manners and morality of the early 19th century landed gentry.
Robinson Crusoe Daniel Defoe	Shipwrecked on an uninhabited island, Robinson Crusoe must learn to survive, with just his pipe, tobacco, and knife as tools. This is more than just a survival tale, with contemplation (and a Christian message) at the centre. This book can be found in its entirety in the ENTERTAINMENT section of this guide.
Treasure Island Robert Louis Stevenson	On a voyage to a faraway island, Jim is searching for his fortune. Along his journey, as he becomes a man, his friendship with his shipmates explores the complex relationship between good and evil.
Wuthering Heights Emily Brontë	The subject of this original English novel is the intense love between Heathcliff and Catherine Earnshaw. Unfortunately, that love is far from simple, destroying not just the lovers, but also those close to them.
The Thirty-Nine Steps John Buchan	Set in World War I, this is an espionage thriller that's unremittingly popular. From boredom in London, to hiding from the Germans in Scotland, this is a tale loved so much that it's been adapted to film many times over.
Moby Dick Herman Melville	A deep exploration into the human mind, and faith, Captain Ahab is on a quest against an allusive, terrifying creature. Packed with metaphors about life and society, this is a book that truly stands the test of time.
The Picture of Dorian Gray Oscar Wilde	Dorian Gray sells his soul so that his portrait will age, rather than himself. Free to act in as many sinful and hedonistic ways as possible, the only way Dorian can see the state of his soul, is to gather the courage to make eye contact with that fateful painting.
The Importance of Being Earnest Oscar Wilde	This satirical look at the social conventions of Victorian London tells a light-hearted story of mistaken identities and secret romances.
Frankenstein Mary Shelley	As life is given to the lifeless, a cautionary tale is told of the "progress" of science. Frankenstein is a being created from stolen body parts. A being that rapidly descends from innocence to evil to enact violent revenge on his creator.
The Adventures of Sherlock Holmes Sir Arthur Conan Doyle	A series of short stories, these detective tales show nothing but story-telling genius. Each tale keeps you hooked from the outset, as Sherlock Holmes solves one complex case after another.
The Great Gatsby F. Scott Fitzgerald	Much more than a novel, this is an allegory of the American Dream. You'll be transported to the decadent Jazz age of 1920s America as Jay Gatsby does all he can to win the affections of Daisy Buchanan.
The Scarlet Letter Nathaniel Hawthorne	This is the novel that introduces you to the first ever heroine of American literature: Hester Prynne, as she struggles with an illegitimate birth. It's this birth that causes two sides of Hester's self to clash, provoking a fascinating look at the relation one has with oneself.
Three Men in a Boat Jerome Klapka	This hilarious story of (you guessed it) three men in a boat is full of quips that'll leave you in stitches, even today. What's meant to be an enjoyable jaunt up the River Thames soon turns into a series of comic misadventures.

Sci-Fi

A list of the best sci-fi books.

The Time Machine H. G. Wells	A dystopian novella from 1895, this isn't just the novel that popularized the idea of time travel. It also earned H.G. Wells the title of "The Father of Science Fiction". This book is a must for any sci-fi geek.
The Iron Heel Jack London	London's critique of capitalist society is told alongside the struggles of a socialist revolution spearheaded by the infamous "Brotherhood of Man".
Around The World in 80 Days Jules Verne	Follow the misadventures of Phileas Fogg after he bets a friend that he can travel around the world in 80 days or less by any means possible (including elephant). This fast-paced voyage has gripped readers ever since the book was first published in 1872.
The Strange Case of Dr. Jekyll and Mr. Hyde Robert Louis Stevenson	This Gothic horror is known as one of the most original pieces of fiction ever written. A potion developed by Dr. Jekyll serves to transform the polite gentleman into something twisted and sinister. Something perhaps resembling the real self of Dr Jekyll?
The Coming Race Edward Bulwer-Lytton	Taking inspiration from Charles Darwin's theory of evolution, this is a dystopian view of a future world. A future world where subterranean populations show an imaginary future where technological progress and physical perfection are raised above all else.
The Lost World Arthur Conan Doyle	This mysterious island, home to prehistoric creatures, hasn't only inspired readers' imaginations since 1912. It's also the direct inspiration for the Jurassic Park movies. In a location that evolution has barely touched, follow journalist Malone and Professor Challenger as they explore this untouched land.

8 Documentaries

Disaster related documentaries which will provide some entertainment and possibly some advice.

American Blackout - National Geographic	The National Geographic Channel's fictionalized account of a 10-day blackout following a major cyber attack draws on previous events and expert opinions to paint a rather bleak picture. **https://www.youtube.com/watch?v=zNfJkMPTtWQ**	**Duration - 1h 27m**
After Armageddon - Full Movie	The plot centres around the Johnson family of Los Angeles, California, one of a small number of families to survive a global pandemic that, according to the opening of the film, occurs "sometime in the future..." The disease began as a particularly virulent flu strain in Southeast Asia. Efforts made to contain the virus in that portion of the world are ineffective as global transportation networks carry infected individuals all around the world. **https://www.youtube.com/watch?v=OtP80Z08lfg**	**Duration - 1h 27m**
The World Without Oil Documentary	A possible unfolding of how a world without oil would occur. **https://www.youtube.com/watch?v=WY4BB3HFi5g**	**Duration - 58m**

Aftermath - When the Earth Stops Spinning	An example of what disasters may occur if the earth stops spinning over a few years. **https://www.youtube.com/watch?v=m7ys1zrY7nc**	**Duration - 45m**
World War A - When Aliens Attack	Are there extraterrestrials and what will happen when aliens attack us? **https://www.youtube.com/watch?v=Lrfr06Sj3vQ**	**Duration - 52m**
San Andreas Fault Earthquake Prediction	In this edition of Documentary films, we are going to take you through a journey where you can learn about the San Andreas Fault earthquake prediction. **https://www.youtube.com/watch?v=LpFyWPTX2ug**	**Duration - 1h 0m**
Tsunami - Documentary Movie - Deadly Tsunamis and Mega Tsunamis	The unfolding of a tsunami and how it would affect life. **https://www.youtube.com/watch?v=-cezuj0wVC8**	**Duration - 50m**
MegaQuake Could Hit North America - BBC	A look at a possible mega earthquake in North America and how it would unfold. **https://www.youtube.com/watch?v=vEgLjgnv_3c**	**Duration - 47m**
National Geographic | Evacuate Earth - Documentary HD	How we would evacuate earth in the face of impending disaster. **https://www.youtube.com/watch?v=_obe0kziaxE**	**Duration - 1h 29m**
Life After People	How the world will unfold if humans just disappeared. **https://www.youtube.com/watch?v=GyEUyqfrScU**	**Duration - 1h 25m**
Last Days On Earth	The top 7 most likely ways the world could end. **https://www.youtube.com/watch?v=LWZSDi1TV8Y**	**Duration - 1h 22m**
Yellowstone Supervolcano	A detailed timeline of a supervolcano eruption at Yellowstone that will affect the world. **https://www.youtube.com/watch?v=WFaFfdOzPP8**	**Duration - 1h 27m**

9 Tv Series

Tv shows which have something to do with prepping or survival which may be of interest during any disaster, you may also learn something.

Doomsday Preppers (A Must Watch)	Doomsday Preppers was an American reality television series that aired on the National Geographic Channel from 2011 to 2014. The program profiles various survivalists, or "preppers", who are preparing to survive the various circumstances that may cause the end of civilization, including economic collapse, societal collapse, and electromagnetic pulse. The quality of their preparations is graded by the consulting company Practical Preppers, who provide analysis and recommendations for improvements.	**4 Seasons 54 Episodes**
The Walking Dead	The Walking Dead is an American post-apocalyptic horror television series that is based on the comic book series of the same name. Rick Grimes, awakens from a coma discovering a world overrun by zombies, commonly referred to as "walkers". Grimes reunites with his family and becomes the leader of a group he forms with other survivors. Together they struggle to survive and adapt in a post-apocalyptic world filled with walkers and opposing groups of survivors, who are often more dangerous than the walkers themselves.	**10 Seasons**
Survivorman	This poor guy is really out in the wild by himself. So he'd have to set up his camera, then redo whatever he was doing. It was a tirelessly long process for him. Yet, he'd do it just to show you that surviving on your own is actually something that can happen.	**8 Seasons 51 Episodes**
Man vs. Wild	Bear Grylls is going to appear on this list multiple times. The reason? He is a great survivalist. He usually films himself in a location where someone might end up stranded whether by an accident taking place or for any number of reasons really. Then he shows you how he would take on these situations. It is really quite interesting, and you could learn some tips from him as well.	**7 Seasons 73 Episodes**
Alone	Follows the self-documented daily struggles of 10 individuals (7 paired teams in season 4) as they survive in the wilderness for as long as possible using a limited amount of survival equipment. With the exception of medical check-ins, the participants are isolated from each other and all other humans. They may "tap out" at any time, or be removed due to failing a medical check-in. The contestant (or team in Season 4) who remains the longest wins a grand prize of $500,000.	**7 Seasons 76 Episodes**
Out of the Wild: The Alaska Experiment	This television show is one of many that is based around Alaska. It is one of the last true frontiers left in America. So people find it fascinating when people can survive the harsh conditions and actually learn to thrive in a place that can be both beautiful and unforgiving too.	**3 Seasons 16+ Episodes**
The Island	This is a TV show that is hosted by Bear Grylls. He sends a group of modern men to an island with nothing but the clothes they are wearing and a few survival tools. So they must hunt, gather, and build anything that they need and must survive in the wilderness. Plus, they have to videotape everything! This is a true test of what you are made of in this day in age.	**6 Seasons 38 Episodes**
Dude, You're Screwed	They take the best of the best in the world of survival and put them to the test. You have a group of well-versed outdoorsmen that take turns kidnapping one guy in the mix. Then they randomly drop the selected guy into a rough environment. They must survive until they find their pick-up location.	**2 Seasons 15 Episodes**
The Colony	This is a science-fiction drama Tv series that is based in the near future. A group of rebels decides to invade Los Angeles. Some people are going with those that invaded and some are fighting against them and paying a high price for doing so. But this story follows a couple who have to decide which side of the fence they are going to be on when it could determine if they ever see their son again, who they were separated from when the invasion happened.	**3 Seasons 36 Episodes**

ADDENDUM | Media | Tv Series

Extreme Survival	This television show is hosted by Ray Mears. He travels the globe in an effort to survive and explore many different locations. For example, some shows are filmed in the desert. While others are filmed in the jungle and Alaska as well.	**3 Seasons 18 Episodes**
Running Wild with Bear Grylls	Bear Grylls take Hollywood by storm and definitely jerks them out of their comfort zone. Actually, he takes really famous actors and plunges them into survival situations. They not only have to survive together, but he teaches the celebrities a thing or two along the way.	**5 Seasons 43 Episodes**
Beyond Survival	Les Stroud is Survivorman. On this new adventure, though, he isn't going it alone. He is taking some of his good friends with him. Then they travel to some really remote locations in Africa to meet with indigenous tribes. They learn new survival skills from these tribes and even get to participate in tribal ceremonies.	**1 Season 10 Episodes**
Survive This	This show is enough to send most modern kids into panic mode. Les Stroud takes a group of kids into the wilderness. But they must leave all electronics at home. He tests them and teaches them how to survive. It is really interesting to see how kids respond to this new reality.	**2 Seasons 26 Episodes**
Surviving Disaster	This is a show based around a Navy Seal, Cade Courtley. He teaches survival skills that many viewers will need if they find themselves in an unimaginable situation. So if you would like to stockpile some knowledge in the event you end up in a situation you never dreamed you would, then you'll want to check this show out.	**1 Season 10 Episodes**
Survival with Ray Mears	This is a three-part documentary where Ray Mears actually goes to different locations and tracks predatory animals in their natural habitats. So as you can imagine this is a fascinating series with some tense points considering the type of animals that are being tracked.	**2 Seasons 12 Episodes**
I Shouldn't Be Alive	Have you ever lived through something and thought, " I really shouldn't have survived that." If so, then you can probably identify with this show. Basically, they re-enact stories of people who were in difficult and unexpected survival situations who actually survived them.	**6 Seasons 58 Episodes**
Wild Food	This is actually a wildlife cooking show. Ray Mears travels the globe to go into natural habitats of natural cuisine. Then he discovers cooking methods from the locals and shares how you can prepare food from the wild as well.	**1 Season 5 Episodes**
Ray Mears' Bushcraft	Ray Mears continues on his journey to educate everyone about how to survive in the wild. He travels all over and puts himself in many different survival situations. So through his different journeys, hopefully, people can learn many different ways to survive no matter what situation they find themselves in.	**2 Seasons 10 Episodes**
Jeremiah	This is another science-fiction television show that many may love. It is about a boy who is living in a time when only a decade ago a virus came through and wiped out anyone above the age of puberty. Now, he is trying to find the safe haven his father once told him about so he can continue his survival.	**2 Seasons 35 Episodes**
Lone Target	Joel Lambert was a Navy Seal and is now starring in his own TV show where he has to evade being captured. So an elite squad of military trained people has to track him down in a remote location. Joel uses survival skills and evasion techniques to make it to his pick-up point.	**2 Seasons 12 Episodes**
Hunting Chris Ryan (Documentary)	Chris Ryan gets dumped into an extreme survival situation. In the midst of this situation, he is also being hunted by a trained 4 man team. So Chris must use his survival skills to survive, avoid capture, and make it to his rendezvous point on time.	**3 Episodes**
Survivorman Ten Days	Les Stroud is a survivalist. He is the Survivorman. In this miniseries, he shows you how to survive on your own in the wilderness. But he doesn't just show you how to survive for an evening. Oh no. In this series, he shows you how to survive for 10 whole days.	**1 Season 5 Episodes**
Storm Chasers	This is another excellent show that I love to watch. You have a group of scientists that go out into the world to chase down some of the deadliest storms. Then when they find one, they put down the claws on their specially made vehicle to collect scientific data. It is a wild ride!	**5 Seasons 36 Episodes**

10 Movies

Realistic End of the World

These are movies about a massive disaster or the end of the world with a plausible probability of them ever occurring on earth.

Supervolcano (2005) ?% Positive Reviews (Semi-Documentary)	Yellowstone is a park, but it's also the deadliest volcano on Earth. Beneath it, a sleeping 'dragon' is stirring. When an earthquake opens a crack for magma to seep through, other warning signs of an eruption start popping up, but they are ignored or dismissed as 'minor'. But when they learn an eruption will happen, panic breaks out through people of the USA and the world. This is a tale told from former Yellowstone scientists, who recall the final days before Yellowstone erupted, and everything changed forever.
The Day After Tomorrow (2004) 44% Positive Reviews	What if we are on the brink of a new Ice Age? This is the question that haunts climatologic Jack Hall. Hall's research indicates that global warming could trigger an abrupt and catastrophic shift in the planet's climate. While Jack warns the White House of the impending climate shift, his 17 year-old son Sam finds himself trapped in New York City where he and some friends have been competing in a high school academic competition. He must now cope with the severe flooding and plummeting temperatures in Manhattan.

Fictional End of the World

These are movies about a massive disaster or the end of the world with an extremely unlikely probability of them ever occurring on earth.

War of the Worlds (2005) 74% Positive Reviews	This is a contemporary retelling of H.G. Wells' seminal sci-fi classic. The adventure/thriller reveals humankind's extraordinary battle against an extra-terrestrial invasion fleet, as seen through the eyes of one American family. Located somewhere in the New England United States, the family -- like millions of others around the globe -- is forced to take refuge from the aliens' highly advanced weapons and impenetrable shields, which are unstoppable against anything that mankind can throw at them. Unable to fight back and finding it more and more difficult to remain hidden from the aliens, the human race faces the end of its existence.

2012 (2009) 40% Positive Reviews	Disaster movie maven Roland Emmerich (Independence Day, The Day After Tomorrow) crafts this apocalyptic sci-fi thriller following the prophecy stated by the ancient Mayan calendar, which says that the world will come to an end on December 21, 2012. When a global cataclysm thrusts the world into chaos, divorced writer and father Jackson Curtis (John Cusack) joins the race to ensure that humankind is not completely wiped out. Chiwetel Ejiofor, Danny Glover, Amanda Peet, Thandie Newton, and Oliver Platt round out the cast of this end-of-the-world thriller co-scripted by the director and his 10,000 B.C. writer/composer, Harald Kloser.
28 Days Later (2002) 86% Positive Reviews	After breaking into a primate research facility, a group of animal rights activists discover caged chimps chained up before banks of screens displaying horrifying, violent images. Ignoring the warnings of the terrified researcher who maintains that the chimps are infected, they begin to free the animals and are immediately subjected to a bloody attack from the enraged creatures. Twenty-eight days later, Cycle courier Jim awakes from a coma in the deserted intensive care unit of a London hospital. He wanders out into a church where he finds dead bodies piled in heaps on the chapel floor.
28 Weeks Later (2007) 71% Positive Reviews	The devastating rage virus that annihilated the British Isles mysteriously resurfaces in Goya Award-winning director Juan Carlos Fresnadillo's sequel to the Danny Boyle-directed horror hit that terrified audiences worldwide by offering a breathless new take on the familiar zombie mythos. Six months has passed since the rage virus caused British residents to indiscriminately murder and destroy everything in their paths, and now the U.S. military has declared victory in the war against the rapidly spreading infection.
The Road (2009) 73% Positive Reviews	"The Road" is a post-apocalyptic dramatic thriller about a father and his son walking alone through burned America. Nothing moves in the ravaged landscape save the ash on the wind. It is cold enough to crack stones, and when the snow falls it is gray. The sky is dark. Their destination is the coast, although they don't know what, if anything, awaits them there. They have nothing; just a pistol to defend themselves against the lawless bands that stalk the road, the clothes they are wearing, a cart of scavenged food -- and each other.
The Cabin in the Woods (2012) 92% Positive Reviews	Five friends go to a remote cabin in the woods. Bad things happen.
The Day (2011) 29% Positive Reviews	The Day follows a group of five survivors in a post-apocalyptic world as they travel through a bleak environment in an attempt to find food, shelter, and a safe place to stop running from tribes of savage cannibals that roam the country-side. They hope to plant two jars of seeds that they either stole or found during their journey. There was at some point twelve in their group, but it is not known how the others died or how long the remaining five have been on the run.
The Day the Earth Stood Still (2008) 21% Positive Reviews	In this contemporary reinvention of the 1951 science fiction classic, renowned scientist Dr. Helen Benson finds herself face to face with an alien called Klaatu, who travels across the universe to warn of an impending global crisis. When forces beyond Helen's control treat the extraterrestrials as a hostile and deny his request to address the world's leaders, she and her estranged stepson Jacob quickly discover the deadly ramifications of Klaatu's claim that he is "a friend to the Earth." Now Helen must find a way to convince the entity who was sent to destroy us that mankind is worth saving--but it may be too late. The process has begun.
The Happening (2008) 18% Positive Reviews	"The Happening" is a lightning-paced, heart-pounding paranoid thriller about a family on the run from an inexplicable and unstoppable event that threatens not only humankind, but the most basic human instinct of them all--survival.
Sunshine (2007) 76% Positive Reviews	As the sun begins to dim along with humankind's hope for the future, it's up to a desperate crew of eight astronauts to reach the dying star and reignite the fire that will bring life back to planet Earth in this tense psychological sci-fi thriller that re-teams 28 Days Later director Danny Boyle with writer Alex Garland and producer Andrew Macdonald. The skies are darkening, and the outlook for planet Earth is grim. Though the encroaching darkness at first seems unstoppable, scientists have concocted one desperate last-ditch plan to buy the human race a temporary reprieve from the grim future that looms just past the horizon.
I Am Legend (2007) 69% Positive Reviews	I Am Legend is a 2007 American post-apocalyptic science fiction horror drama film based on the novel of the same name, directed by Francis Lawrence and starring Will Smith, who plays US Army virologist Robert Neville. The story is set in New York City after a virus, which was originally created to cure cancer, has wiped out most of mankind, leaving Neville as the last human in New York, other than nocturnal mutants. Neville is immune to the virus and he works to develop a cure while defending himself against the hostile mutants.
30 Days of Night (2007) 51% Positive Reviews	30 Days of Night is a 2007 American horror film based on the comic book miniseries of the same name. The film is directed by David Slade and stars Josh Hartnett and Melissa George. The story focuses on an Alaskan town beset by vampires as it enters into a thirty-day long polar night.
Reign of Fire (2002) 40% Positive Reviews	In present-day London, twelve-year-old Quinn watches as his mother, a construction engineer inadvertently wakes an enormous fire-breathing beast from its centuries-long slumber. Twenty years later, much of the world has been scarred by the beast and its offspring. As a fire chief, Quinn is responsible for warding off the beasts and keeping a small community alive as they eke out a meagre existence. Into their midst comes a hotshot American, Van Zan, who says he has a way to kill the beasts and save mankind--a way Quinn's never seen done.
Geostorm 16% Positive Reviews	The Dutch Boy Program staves off natural disasters but somehow a Geostorm is approaching many countries. Jake Lawson, a technology designer, is tasked with saving the world from this disaster.

Comedic End of the World

Zombieland (2009) 90% Positive Reviews	A cowardly shut-in named Columbus (Jesse Eisenberg) is forced to join up with a seasoned zombie slayer named Tallahassee (Woody Harrelson) in order to survive the zombie apocalypse. As Tallahassee sets out on a mission to find the last Twinkie on Earth, the duo meets up with Wichita (Emma Stone) and Little Rock (Abigail Breslin), two young girls who have resorted to some rather unorthodox methods to survive amidst the chaos. Reluctant partners in the battle against the undead, all four soon begin to wonder if it might be better to simply take their chances alone.
Zombieland: Double Tap (2019) 67% Positive Reviews	Zombie slayers Tallahassee, Columbus, Wichita and Little Rock leave the confines of the White House to travel to Graceland in Memphis, Tenn. Along the way, they encounter other post-apocalyptic warriors and a group of survivors who find refuge in a commune. The scrappy fighters must now rely on their wits and weapons more than ever as they soon find themselves in a relentless battle against smarter, faster and seemingly indestructible zombies.
Cockneys vs Zombies (2012) 74% Positive Reviews	A bunch of east-easters fight their way out of a zombie infested London, lead by an unlikely gang of amateur banks robbers and foul-mouthed plucky pensioners. Starring Michelle Ryan, Honour Blackman and Harry Treadaway. The undead are brown bread.

Miracle Mile (1988) 88% Positive Reviews	Miracle Mile starts conventionally enough, with bashful musician Anthony Edwards going ga-ga over waitress Mare Winningham. After a pleasant if somewhat quirky day together, Edwards and Winningham plan a tete-a-tete at the all-night restaurant where the girl works. While preparing to call her on a pay phone, Edwards intercepts a frantic call from a soldier stationed at a Midwestern missile silo. The message: nuclear warheads have been launched, and it's only 70 minutes to Armageddon! This unsettling news casts severe doubts over the future of Edwards' and Winningham's relationship.

11 Programs

A list of useful computer programs that have something to do with preparedness in one way or another.

Pc Programs

Programs for personal computers that will be of benefit to preppers.

MOBAC (Mobile Atlas Creator) *Free*	Map creator for Pc allowing a maximum download of 500K tiles from a range of maps. Get version 1.8 for Google Maps and Google Terrain. Mobile Atlas Creator (formerly known as TrekBuddy Atlas Creator) is an open source (GPL) program which creates offline atlases for GPS handhelds and cell phone applications like TrekBuddy, AndNav and other Android and WindowsCE based applications. As source for an offline atlas Mobile Atlas Creator can use a large number of different online maps such as OpenStreetMap and other online map providers. I recommend version 1.8 because it has more map sources.
Winhttrack *Free*	HTTrack is a free (GPL, libre/free software) and easy-to-use offline browser and downloader utility. It allows you to download a Web site from the Internet to a local directory, building recursively all directories, getting HTML, images, and other files from the server to your computer. HTTrack arranges the original site's relative link-structure. Simply open a page of the "mirrored" website in your browser, and you can browse the site from link to link, as if you were viewing it online. HTTrack can also update an existing mirrored site, and resume interrupted downloads. HTTrack is fully configurable, and has an integrated help system.
GNU Wget *Free*	GNU Wget is a free software package for retrieving files using HTTP, HTTPS, FTP and FTPS the most widely-used Internet protocols. It is a non-interactive command line tool, so it may easily be called from scripts, cron jobs, terminals without X-Windows support, etc.

Offline Wikipedia Readers

These can be used for reading offline Wikipedia backups that have been previously downloaded.

XOWA	XOWA is a free, open-source application that helps download Wikipedia to a computer.
Kiwix	Kiwix is by far the largest offline distribution of Wikipedia to date. As an offline reader, Kiwix works with a library of contents that are zim files: you can pick & choose whichever Wikimedia content, as well as TED talks, PhET maths&physics simulations, etc.
WikiTaxi	WikiTaxi is an offline-reader for wikis in MediaWiki format. It enables users to search and browse popular wikis like Wikipedia, Wikiquote, or WikiNews, without being connected to the Internet.
Aarddict	Aard Dictionary is an Offline Wikipedia reader. No images. Cross-Platform for Windows, Mac, Linux, Android, Maemo.
BzReader	BzReader is an offline Wikipedia reader with fast search capabilities. It renders the Wiki text into HTML and doesn't need to decompress the database. Requires Microsoft .NET framework 2.0.

12 Apps

This section contains a list of a bunch of apps that will be lifesaving in a disaster situation. A lot will change if a SHTF event occurs and this will most certainly include the ceasing of the internet – at least on a local scale. Without this lifesaving resource we will have to either revert to books, shared experience or even trial and error again as this once operational collection of human knowledge will cease to exist.

Along with this, ALL technology that once relied on even a momentary connection to the internet will no longer work. You will be astonished to find out what seemingly 'offline' applications required this great resource. That's where the below list of apps comes in. I've done extensive testing on a huge array of preparedness related apps to see which ones can be used completely offline and which ones 'phone home' to check for Google Play, a license or which require additional downloads before they work.

I have left out a lot of the apps which come packaged with Android these days, such as a Light/Torch, Camera and Calculator. Generally these all work when your phone is 'offline' so there's no real need to download a backup – but it's still good to have a second option anyway.

AFWall+ (Free) (Root Required)	This is the first app I install onto any new phone. It's a firewall which can block any and ALL applications you wish. Since I use a Google keyboard for the swype texting capability, I first install this app and then set it to automatically block ALL newly installed apps so they can never connect to the internet. I also use this feature to test whether new apps require the internet or not.
Alpine Quest (Free/Paid $12 USD)	Simply put – it's the best mapping app that I've had the pleasure of using. It's online but can also be used completely offline if you have the maps pre-downloaded. You can draw points, lines, paths and areas on the map, measure distance, slopes, angles and auto route paths via roads. It supports an unlimited number of markers and allows sorting, activation and deactivation by folder or individually.
Kiwix (Free)	Kiwix is an offline Wikipedia reader. Again you will have to pre-download the data files (some are 80 GB+) but the information you have at your fingers will be life saving. There is a HUGE variety of data files you can download. I have included some of the most pertinent downloads below. All of these downloads are also free to use – there are no copyright restrictions so feel free to share them.

- The Complete Wikipedia Collection (No Pictures – a much smaller file size) (60 Gb)
- The Complete Wikipedia Collection (With Pictures) (109 Gb)
- Wikipedia Geography (No Pictures) (0.6 Gb)
- Wiktionary – The Complete English Dictionary (8.8 GB)
- OpenStreetMap Wiki – Information on geography (889 MB)
- iFixit Device Repair Manuals – Repair manuals for electronics (2.9 GB)
- Military Medicine Ebooks on military medicine (82 MB)
- Prunelle Books for Children (375 MB)
- Library of Knots (27 MB)
- Water Treatment Libray (20 MB)
- WikiMed Medical Encyclopedia (With Pics) (6 Gb)
- Cheatography – Cheat sheets on various topics (7.2 GB)

- Q&A Amateur Radio Guides – Questions asked by radio enthusiasts (65 MB)
- Wikispecies – Catalogue of all species (3 GB)
- Q&A Home Improvement – Questions asked about DIY (929 MB)
- Wikibooks – Open Source Books (4.6 GB)
- Off The Grid – Off-Grid Topics (172 MB)
- Food for Preppers – Food Preparation Skills & Recipes (97 MB)
- Prepper Medical Library (69 MB)
- Project Gutenberg Book Library – A collection of free books (74 GB)
- Project Gutenberg English Library – A collection of free books (May contain some or all of the above) (86.3 GB)
- Ready.gov – Emergency Management Planning (1.9 GB)
- Urban Prepper Topics (386 MB) (Videos)
- Canadian Prepper – Prepping Food Videos (4.6 GB) (Videos)
- Canadian Prepper – Winter Prepping Videos (3.4 GB) (Videos)
- Canadian Prepper – Bug Out Concepts Videos (8.4 GB) (Videos)
- TED Talks – Apocalypse Survival Guides (561 MB) (Videos)
- Q&A The Great Outdoors – Questions asked about camping, hiking, navigating etc (130 MB)
- WikiHow – How to do almost anything (51.2 GB)
- Kahn Academy – Tutorials on a wide range of topics (180 GB) (Videos)
- CrashCourse – Educational Videos (50 GB) (Videos)

There are a couple of downloads with the text "Videos" after them, this just means that it includes video files, however it's easier just to download any video files of preppers via a YouTube downloader. See my blog Here for info on how to get started downloading from YouTube.

There is SO MUCH MORE in the links below if you want to search for yourself for other topics of interest.

You can explore the Kiwix library at https://library.kiwix.org/. Click on the actual little blue 'Download' button to download the file. Here is the list of Wikipedia Kiwix dumps: https://dumps.wikimedia.org/other/kiwix/zim/wikipedia/. Note, if you speak English, be sure to download the ones that have "en" in them. There are also a lot of other websites hosting Kiwix files to download including torrents (since these are free to download), the most reliable would be Reddit.

LocalSend (Free)	LocalSend is a file transfer app which allows you to move apps, music, files or even movies between devices wirelessly without the need for the internet. You may not have a working computer in a SHTF situation and this would make it easier to transfer needed data across. I recommend having this app on a USB-C USB to give to friends and family so you can transfer wirelessly from then on.
KDE Connect (Free)	Another wireless file transfer program since you may have issues with one or the other,
Survival Manual (Free)	This is a survival manual built into an app. It has all the categories you would expect such as Power, Food, Water, Navigation, Signaling, Self Defense and is completely offline.
ReadEra (Free/Paid)	You're bound to have a lot of eBooks and PDFs on your device, so why not pair that with a good quality PDF/EPUB/MOBI reader? This one is one of the best rated out there and supports a lot of great features. The only downside I can see is that the paid version doesn't support offline use – however the free version has more than enough features for just reading books or how-to manuals on your device. I would also grab a second e-Reader like Lithium (EPUBs Only) or Moon+ Reader.
Bible (Free)	As a Christian one of the most important apps is going to be my Bible. This is a fully offline Bible once the translations are downloaded, and the downloads are free – so do that as soon as you install it. You have a good selection of translations, including some in other languages. A good alternative is the Blue Letter Bible (free) if you want to read the scriptures in KJV as this is the only pre-downloaded version. Another I like is e-Sword (Paid) which comes with KJV and KJV with Strong's Numbers pre-loaded so you don't have to download anything. An added benefit of e-Sword is that you can buy additional commentaries, devotionals and even biblical maps which can be used with the app to supplement your studies.
App Manager (Free) (Root Preferred)	App Manager is a powerful tool for managing the apps on your device. For starters it can backup entire apps to share with friends or to restore later. The backups include any extra downloaded files that come with the apps (if the right boxes are ticked) so if you have downloaded extras such as Bible translations in the app above, you can restore those without needing an internet connection again! It can also block trackers in apps and gives you a lot of useful information about the app, including what permissions it has – and even lets you turn on and off permissions manually with Root. Occasionally I need to grant storage access to Alpine Quest manually to be able to locate the maps I have on my phone, and this is the app I use to do so. Also, for particular apps with annoying sounds and music when I don't need to listen to I can disable the permission to output audio to silence it.
Binary Eye (Free)	Binary Eye is a FOSS (Free Open Source Software) barcode scanner. It can support every kind of barcode and QR code out there. This would be most useful if you have QR codes on all of your prepper containers so you can keep track of what's in them without everyone knowing.
Darker Pro (Paid – $3.00/Free)	Darker is an app which can lower the brightness of your screen far below what you normally can – down to 0 if you really want. Its primary purpose would be to reduce the amount of light your phone outputs to stay concealed if you're bugging out as well as saving your night vision partially. It would save a bit of battery life as well.
Pingcoin (Free)	This app can be used to verify the authenticity of silver and gold coins by 'pinging' it near the device's microphone. If the resonant frequency matches the data stored by the app, then it returns as positively identified. This would be great to use as an added layer of protection if you barter with precious metals in a grid down situation. To 'ping', hold the coin with your thumb and pointer in the center of the coin and with the other hand, flick your pointer nail on the edge of the coin to make a pinging sound.
Unit Converter (Free / Extra Purchases)	Everyone needs a good unit converter when SHTF. This one has a clean interface and as many conversions as you could ever need which are all offline.
A Compass (Free)	There are so many compass apps it's hard to pick just one. Give some a go and test it for it's offline capability. Some bonus features you will want to look for are altimeter, barometer, ruler and maybe GPS functionality.
NextRadio Free Live FM Radio (Free)	Unlike a lot of the other radios on the app store, this one is fully offline, however you need a U.S. smartphone that contains the FM Radio chipset (which may need to be activated). You also need wired earphones to act as the antenna to pick up the signals (and thus you need a phone with a 3.5mm audio jack). If you have a phone based outside the U.S. then it most likely won't have the FM chip required – but you can always check just in case.

Musicolet (Free)	You're most likely going to want to listen to music during a bug out situation to unwind. This app is not only fully offline but it's easily one of the best free music players out there. Just pre-load all your music and set up some playlists and you're good to go. A good runner up FOSS (Free Open Source Software) equivalent is Metro.
Games (2D / Low Battery Drain) (Free)	These are the 2D or 'low battery drain' games. A lot of games cause the battery to drain rapidly, so I have separated them into those which consume a lot of battery, and those that don't. ● Shattered Pixel Dungeon (Free) A fun little dungeon RPG game with lots of twists. ● Hashi (Bridges) (Free) A puzzle game where you connect each of the islands with the correct number of lines. ● Crossword (Just grab any which you like the look of and test it to see if it's offline capable) ● Sudoku (Same again here) ● Nonograms – A puzzle game where you have to fill in a board often to draw an image, using clues from around the edges. ● Okay? (Free/Donate) A simple yet addictive ball bouncing puzzle game. ● My Boy! (Free & Paid) A GameBoy Advance Emulator. (Supply your own game files) Play all the classic GBA games. ● DraStic (Paid) An NDS Emulator (Supply your own game files) A great emulator for playing all your favourite NDS games. ● Word Master Pro (Free & Paid) A fun scrabble remake with lots of customability. ● Gurgle (Free) 5 Letter Word Guessing Game. Similar to mastermind if you have ever played the popular board game. ● Grim Quest (Free & App Purchases) An Old School RPG
Games (3D / High Battery Drain) (Free)	Once in a while you may just need a 3D/Battery Intensive game to play to take your mind off the world. These are my favourites below: ● Tiny Room Stories Town Mystery (Free & Paid) A fantastic 3D puzzle 'escape room' style game. ● Golf Peaks (Paid) A neat little card golf game. ● 20 Minutes Till Dawn (Free & Paid) A bullet-hell style shooter. ● Meridian 157 Series A point and click series of games. (Free & Paid) ● Professor Layton Series Three amazing puzzle games which make you think alongside thrilling storylines. (Paid) ● The Room Series A series of 4 amazing 3D Puzzle Games. (Paid)
Emergency Apps	These apps are generally Australian based in nature, but you could find similar ones that suit your location better. ● My Bushfire Plan (Free) A bushfire emergency plan. This is an Australian based app, but the content is applicable wherever you live. ● What3Words (Free) An app to help you tell emergency services your location using 3 words. It's technically offline since you can find what 3 words apply to your current location, but you won't be able to see the map without internet. ● Australian Bites and Stings (Free) A little app to let you know what to do in the event of a bite, sting or attack from a wild animal in Australia.
Markor (Free)	Markor is an offline notepad based around privacy and ease of use. I use it day to day for my note-keeping and prepper 'todo' lists. Notes are stored as .txt files and are easily backed up.
Drugs Dictionary (Free)	This is a list of drugs available including information on the uses, side effects, interactions, overdoses and often more. There are multiple drug dictionary apps available which are pretty much all offline so you don't have to just stick with this one. Remember 2 is 1 and 1 is none, so get a few of these kinds of apps.
GPSTest (Free)	A great app which helps you identify issues with your GPS if you think it may be inaccurate or isn't working at all.
Offline Language Translator (Free)	Who knows, this may come in handy at one point or another if you're trying to communicate with someone and there's a language barrier. This app requires downloads before it works so be sure to download all of the languages you think you'll need. You can also back up the language packs using "App Manager" listed above to transfer the data to a new device or to give to someone else without the need for the internet to re-download them.
Suntimes (Free)	A nice little app to track the sun and moon risings and sets. It can help to know how long you have to find shelter and what time you should leave camp to stay concealed etc. Version 0.15.7 works for me offline.
Root Explorer (Free & Paid) (Root Required)	I use this all the time to search for files which are normally hidden to the average user, especially to back up add-ons to apps like the Offline Translator and the Bible apps above. However you need a phone that has been rooted and I understand not a lot would be as it's a complex process to do for the first time.
First Aid by the American Red Cross	Very useful for medical information and step by step guides.
First Aid – American Red Cross	A free first aid manual.
Pet First Aid – American Red Cross	A first aid manual for pets.
Repeater Book	A repeater book for operating HAM radios.
Cargo Decoder	A guide to what is in trucks or tankers nearby. Enter the 4 digit number from the DOT placard and learn about the substance.
TruckerPath	Find gas stations, bathrooms, food and rest areas.
Knots 3D (Free)	This app includes pretty much all of the knots you would ever need and lets you play the typing videos back slowly so you can see in detail how it's tied.
MSD Medical Apps (Free)	● MSD Manual Consumer, ● MSD Manual Professional, ● MSD Obstetrics, ● MSD Veterinary Manual These apps are basically medical textbooks in app form and are completely free to use. By default the Consumer and Professional apps come as text-only information but you have the ability to download all the pictures in one go for offline use. The pictures typically add a few hundred megabytes to the file size of the app. Furthermore you have the ability to download all of the videos used throughout the app for free too, however this comes at a much larger size cost. When I downloaded them all on the Consumer app, it came in at 8Gb. You can also use 'AppManager' to backup the apps pictures into an extractable archive format for re-adding the photos without an internet connection, or for sharing the app with others.

Testing Mobile Apps Offline

There are a lot of apps which fail to work offline for a multitude of reasons, generally these fall into the below categories:

The app is entirely online	These are apps such as Facebook, Instagram, Spotify, Amazon, YouTube, Gmail, etc – who's sole function is to communicate on the internet. It's obvious these won't work in a grid-down situation.

ADDENDUM Media Apps Testing Mobile Apps Offline

A paid or free offline app that uses Google Play	These are apps which have been bought, but when opened they check for a connection with Google Play to verify a license. Most often they close themselves after you tap the 'okay' button if it can't connect, so they can't be used. Some of these apps only try to validate a license once every so often, so they may trick you into thinking they can be used offline. This is why I recommend to test all your apps thoroughly BEFORE SHTF. Note: Some apps which even contain the word 'Offline' in the title may fall in this category and really aren't offline at all.
A paid or free app that checks for updates	Apps that are technically offline, but which try to connect to the internet on certain parts of the app to provide extra information. These apps may try to connect as soon as they are loaded up – which causes them to freeze unless they have connectivity. Others try to load on certain parts of the app and then throw an error on the screen and may kick you off the app if they can't find that connection. Generally these issues aren't app-breaking and it can still be used offline as long as that internet check isn't the first thing it attempts. My automation app Tasker has some extra online 'help' topics which can't be loaded, however everything else in the app works perfectly. Another example is the game Endurance: Dead Space, which used to load perfectly, but recent updates cause the game to freeze on boot-up due to a check for either Google Play or internet connectivity.
Apps that require additional data to be downloaded	There are some apps which work offline, but need additional data for them to function properly. Some example include Alpine Quest (needs maps), Bibles (Often come a single translation or none at all), Language Translators (Usually just let you download the data you need to save space)
Apps with In-App Purchases	These kind of apps are not offline friendly since to restore the data, an internet connection is requires to re-validate your purchases. Generally the free portion of the app works perfectly though, but don't go purchasing IAPs with the expectation that they will work offline.

App License Checks
Just because an app has been purchased doesn't mean that it's going to try to verify a license and therefore fail the offline check. (since they normally just close down if they aren't verified) I've purchased a lot of apps through Google Play which work flawlessly when downloaded via Aurora and transferred to my deGoogled phone. However about 50% of the time, they do try to verify their license and then I'm stuck with an app which I've paid for that doesn't work on my primary phone. In this case I look for a 'modded' version which will work offline and doesn't check for a license. It's a grey area, but since I've purchased the app anyway there should be no issues on the developer's end right?

Checking Offline Capability
If you have an app you use on a daily basis and want to find out whether it can be used offline, just install AFWall+ (if you phone is rooted/jailbroken) or NetGuard if it's not. Uninstall the app in question (backing any data up beforehand if required) and then reinstall it and block it with your firewall before you open it for the first time. To make testing offline capability easier, AFWall+ can be set to 'allow selected apps' which automatically blocks them (since they start unticked), rather than 'block selected apps' where the apps are only blocked if you select them.

Saving Apps for Offline Use (Root Required)
If you're downloading apps from the Google Play storefront you will notice that you can't save the .apk files to transfer to another device or to reinstall them later. This can be solved by using the 'App Manager' app and root access.

First install 'App Manager' if you haven't already. Then open it up and give it root access. You should be presented with a screen that shows all your installed apps alphabetically. Search for the app you want to backup and tap and hold on it to bring up an action menu. On the right you will see a 'Save APK" button, press that. Your app will be recompiled and saved into your main storage 'AppManager > apks' folder. That's your app, so move it from there if you want it elsewhere. This is when I would rename the app so I know where it came from and what version it is. E.g: "Alpine Quest v4.3.5". I also add other information such as where I downloaded it from (Google Play), whether it works offline or not, whether it has ADs or In-App Purchases, but you can make it your own and choose your own style.

13 Mapping

ADDENDUM Media Mapping

This section has info on how to download your own offline maps for your preferred mapping software using MOBAC.

So, you want to download some local maps for offline use during a disaster but aren't sure how to get started?

The aim of this blog is to let you know what you need, what's involved and how it all works when the internet has been taken offline. I will try to keep it as concise and simple as possible to support everyone, from the very beginner to someone who has used some offline mapping software before. It's written in a progressive order for beginners based around downloading offline maps in MOBAC (Mobile Atlas Creator), as well as some alternatives if that is too complex. You can also search for the heading you want to know more about if you've used MOBAC before, or want to use alternative map downloading methods – such as downloading maps in apps directly.

What are offline maps?
Offline maps are any saved digital maps which can be viewed without an internet connection. At its simplest level it could be a saved single picture of a map, such as a PNG or JPEG image. At its most complex level it's a downloaded array of tiny pieces of a larger map which can be be called upon to render a section of any location within its bounds. For example, if you open Google Maps you can zoom into any location and the online server will download the map pieces you need to view that area.

It does NOT download the entire map at once, as this can be many terabytes in size and would entirely fill your phone, tablet or laptop many, many times over. It would also take weeks to download even if you could. This is why we need to select a specific region to download. It gets more complex than this, such as differing levels of detail, but I will go into more depth later on this. Maps created in MOBAC can be easily updated if you retain the source tiles and don't delete the cache (previously downloaded information).

Why would I need a digital offline map?
As Steve Poplar from The Poplar Report says – "How long do you think the internet will stay up during World War 3?". It's a very good question, and one which I believe can only be truthfully answered with: "Less than 24 hours", and that's if it hasn't already been taken out long before an official 'announcement' of a global war.

Without the internet, almost everything we take for granted will be taken away from us instantly, including maps. Imagine being in a foreign city when the internet goes down and having to manually find your way back home. As one primarily focused on Digital Preparedness, I actively seek alternatives to being connected to the internet at every turn, so let's get started with offline maps.

How do offline maps work?
Generally when you open a map like Google Maps, your device sends a request to the internet server which replies with a bunch of tile images of the area you're looking at and arranges them in the correct order. An offline map is simply one which takes those same tiles from the local storage on your device, rather than the internet. However this requires having to download ALL the tiles beforehand, most likely including ones which you will never likely view.

The sizes of maps vary wildly, but generally the photographic maps (such as satellite view) take up 4x the space of the standard road maps (such as Google Maps). With this in mind, the biggest size a single map can get is about 5 Gigabytes if it's a satellite view of a very densely populated area. On average though standard maps are between 500 megabytes (Mb) to 700 Mb.

You may also be wondering whether your GPS (Global Positioning System) will work when there's no internet. It's a very good question, but put simply – Yes, GPS will work even when the internet is down since the GPS signals are broadcast by satellites down to earth 24/7 unlike telephone towers which supply the internet and are a likely target of hacking during civil, or world wars.

GPS transmitters are a one-way device – They can transmit but don't need to receive anything back from your device as your coordinates are calculated based on the data received from the satellites. Mobile towers on the other hand are in constant two-way communication since your device requests information from the towers multiple times for every web page, streamed video or streamed song that you play. To use the offline maps, you technically don't even need to utilize GPS since you could always use nearby landmarks and search the map manually to triangulate where you are.

If you're desperate, you can also use a sextant and charts to determine your location and enter them on your chosen navigation app to view where you are if you have the maps downloaded. However this is an extreme example, as it's very unlikely you will be SO lost that you have no idea where you are.

What can offline mapping software do?
Once you have a map downloaded then the real fun can begin! (Most of the features in this section are from Alpine Quest, however all of the other apps are likely to have the same features) Firstly you can position placemarks (AKA landmarks) to store important information at any specific location on a map. Placemarks can mark the position of a cache, remind you of hazards in an area, let you know that there are wild edibles here – the possibilities are limitless.

Placemarks aren't just 'dumb' markers either. They can be assigned a graphic, a comment and even a photograph or audio clip so you can remember what was at that location. They can be automatically interacted with so that if you walk within 50 meters of one, your phone will vibrate or send you an alert. They aren't limited to points either, you can create routes of multiple placemarks in a line which can show your bug-out route or any other route you want to track, such as railway lines, rivers or hiking tracks. You can also create a polygonal shapes using the area tool which you can fill in with a specified colour to highlight dangerous regions or mark territories.

In the hiking mode, the map can rotate with you so you can keep an eye on the landmarks you're headed towards. Oh and don't forget the driving mode which is basically Google Maps navigation (albeit a bit glitchier). Most mapping software also has route recording which can plot your current position over time including speed, altitude and more all presented in a fancy graph. The apps can also show your current position, your current bearing and the distance from your position to your destination. You can also 'track' loaded paths and be notified when you stray from them too far – a great help to prevent you getting too lost.

Any maps can also be modified in a number of ways to make life easier for you. They can be rotated, dimmed, or stacked with other maps if you need to view a few of them at once – such displaying as a mobile tower coverage map on top of a regular map. I know you're here for offline maps – but most of the software can also do online maps as well if you prefer to have the latest and greatest maps open and only want to switch to the downloaded ones once you lose the internet.

Should I just use paper maps?
The alternatives to digital maps such as printed road maps and topographic maps are definitely recommended to have as a backup to your digital maps. (Remember that EMPs are still a possibility, which can destroy any modern electronics). But in the words of other wise preppers, 2 is 1 and 1 is none. This simply refers to the need to have multiple backups for each of our preps, which includes maps. So yes, you should have a printed map of your local area in your Bug-Out-Bag, perhaps a printed road map in your car and a couple more printed maps of the regions around you in case your bug-out plans change.

Can I use offline Google Maps?
If you aren't familiar, Google maps can save a select location of a map to your phone's storage for use when there's no internet. There are however a lot of caveats with this approach which I will go into below:
1) Offline areas that you downloaded on your phone or tablet need to be updated at least every 30 days. This is the primary reason why using downloaded Google Maps won't work in an extended disaster, although it "should" work fine to find your way home in the early stages of a disaster. There is no way to extend or disable this timeframe as per the link below so as soon as you hit that 30 day limit, you lose access to everything.

Can You Stop Google Downloaded Maps Expiring?

2) You don't have precise control over the resolution or region of the map you want to download. It's really up to Google to determine how much data is downloaded and what zoom level it goes to. Additionally the downloaded maps are often more focused on the road and includes features for navigating by car and often leaves out a lot of other functionality.

3) Downloading offline areas isn't available in some regions because of contractual limitations, language support, address formats, or other reasons. Depending on where you are, you may not be able to download your regional maps at all.

4) It's not easy to export your placemarks, and the more you invest in Google's ecosystem the more trapped you become in it. For many reasons, I would advise against giving ANY kind of information to a major tech company, and by using Google Maps you are earning them revenue one way or another.

If you would like to download some Google Maps anyway, have a look at the links below:
Android – Downloading Maps with Google Maps (How To)
Apple – Downloading Maps with Google Maps (How To)

Types of Maps
There are a lot of different kinds of maps you can download which each have their benefits and specific uses. I will go into more detail about each type below so you can choose which one will best suit your requirements. I'm guessing you're looking to download a map of your local area for your bug-out route or to have the local terrain on hand for emergency navigation purposes.

In this case I recommend a few 'Road Maps' and some 'Topographic Maps'. You may also be looking to keep track of important landmarks or resources in an area such as wild edibles and to use for locating streams and avoiding populated areas. For this I recommend the Satellite Maps primarily and some topographic maps to supplement them.

● All-in-One Map / Road Map
These are shaded, polygonal maps which include all terrain features in detail including roads, parks and structures.

E.G. Google Maps
E.G. Bing Maps
E.G. Open Street Map

● Topographic Map
Similar to the all-in-one maps but these also include elevation contour lines or shading to show slopes. Generally they have less detail than the All-in-One maps due to not being able to zoom in as much.

E.G. Google Maps (Click "Layers" then "Terrain" to enable topo view)
E.G. NGMDB USA Topo
E.G. Australia QLD Topo

● Satellite Map
These maps show the satellite footage of the area. These are excellent for determining the flora of an area, showing paths, small rivers (which aren't visible on the above maps) and other useful landmarks. This map isn't as useful as the Satellite Hybrid map, since there are no labels, however in some circumstances the labels hide important terrain features. I don't recommend this above the below map unless you have specific reasons to avoid map labels.

E.G. Google Maps (Clicking "Layers" should turn on Satellite view automatically, and then hover over "Layers", click "More" and un-tick "Labels")
E.G. Bing Maps (Turn on "Satellite" in the menu in the top right and un-tick "Details".)

● Satellite Hybrid Map
The satellite hybrid map is the same as the regular satellite map except it includes labels overlaid on top so you can navigate easier.

E.G. Google Maps (Clicking "Layers" should turn on Satellite view automatically)
E.G. Bing Maps (Turn on "Satellite" in the menu in the top right)

● Other Maps
There are MANY more map types which you may be interested in, including maritime maps, hiking maps, 4WD maps, game maps, population density maps, hunting maps etc, but you can look into these for yourself if you are interested.

E.G. Open Street Maps (Turn on the map you want on the right side)
Note: 3D Maps such as Google Earth, cannot be downloaded in 3D.

If you would like more information on the maps above, or you want to download the .bsh files to download them yourself in MOBAC click here. BSH files are the files which populate the "Map Source" list in the top left of MOBAC – so if you're missing Google maps in the newer versions, you can download it from the link above and put it in the MOBAC "mapsources" folder. (Only works in some versions)

How do I use offline maps?
To get started in offline mapping you will need to work out how the maps will be viewed. My maps are stored on my Android phone and Android tablet on the internal memory. I then use the app "Alpine Quest" to act as the interface to view and manipulate the maps. So work out now what devices you will want to view the maps on, whether that's a smartphone, a tablet, an e-ink device or even a Garmin navigator. I haven't used Apple devices before, but all you need for offline maps to work is the ability to copy the downloaded maps to its storage, and of course the app itself which you will be using – so check the App Store for one of the below first.

If you aren't sure what mapping/navigation program you will be using, here are a few suggestions:
● Alpine Quest – $13 USD (4.6★) (Free Trial Available)
alpinequest.net
"AlpineQuest is the complete solution for all outdoor activities and sports, including hiking, running, trailing, hunting, sailing, geocaching, off-road navigation and much more. You can access and store locally a large range of on-line topographic maps, which will remain available even while being out of cell coverage. AlpineQuest also supports on-board file based maps, like MemoryMap maps."

An amazing mapping app which can be completely used offline or online if you wish. It's packed full of every feature you could ever need for navigation, mapping, exploration and prepping. You can purchase a copy directly from Google Play, or from their website above. I use this on all of my Android devices for tracking locations, routes and points of interest.

● OSMAnd – $30 USD (4.6★) (Free Trial Available)
osmand.net
"OsmAnd is a map and navigation app for Android and iOS. It uses the OpenStreetMap map database for its primary displays, but is an independent app not endorsed by the OpenStreetMap Foundation."
A second piece of mapping software I own. It's excellent, but I have grown accustomed to Alpine Quest for my primary mapping software.

● BackCountry Navigator TOPO GPS – $15 (3.7★) (Free Trial Available)
backcountrynavigator.com
"Download topographic maps for an offline outdoor navigator! Use your phone or tablet as an off-road topographic mapping handheld GPS! Explore beyond cell coverage for hiking and other recreation. Download topo maps in advance, so you won't need cell coverage for navigation. Use storage memory for maps."
I own this one too, but after using it for some time, I just preferred Alpine Quest.

● Orux Maps – $4.49 USD (4.4★)
oruxmaps.com
"Orux Maps is an Online and offline map viewer. You can use different map formats, like GeoPDF from USGS store, GeoTIFF maps, .ozf2, .img garmin (vectorial, no full support is provided), .mbtiles, and others."

● Garmin Devices
Creating Custom Maps to an Outdoor Handheld Garmin Device
You can create custom maps for some Garmin handheld navigation devices if you already own one, however you may be limited on storage space depending on the model you get – ideally you would want about 20 GB of storage for a good selection of maps.

There are more navigation apps than the ones listed above, but I'm sticking to a few well known ones which are also compatible with MOBAC (Mobile Atlas Creator) – the map creation software, but more on that later. If you want a wider selection, have a look at the compatible list on the MOBAC page. Keep in mind that any maps you download must be in one of the specific formats listed on MOBAC, and these mapping formats cannot (easily) be converted between different apps.

For example if I downloaded a map in the AlpineQuestMap format (AQM), I can only use that map with Alpine Quest and can't just use it with OSMAnd. (However once MOBAC has successfully downloaded a map in any format such as AQM, and has the downloaded tiles still in memory – you can then export those same tiles into a different format, for example OSMAND without having to download them all again – and the export will only take a minute)

While researching for this blog, I found this software which can apparently convert maps between different formats. It costs, so I would only look into buying it if you are REALLY into mapping.

How much detail do I need?
Downloading maps can become tremendously space intensive if you're looking to download them in the greatest detail on a wide scale. To put things into perspective, I will go over how many tiles are in the entire planet based on the zoom level (see the chart below). The zoom level is the depth to which a map can be zoomed into which provides more detail. Have you noticed that when you zoom into Google Maps, the last set of tiles disappears and new ones appear of the same region, but in more detail? This is going up a zoom level.

Some maps can be zoomed into 21 times which gives you extreme quality of information, but at the cost of using a lot more space. Other maps can only be zoomed into level 15 to provide a decent amount of detail but it may be hard to distinguish different buildings at that scale. The detail you want in a map is bound by limits on the the upper and lower bounds of the map (yes, some maps only start at a lower zoom level such as 4, which means you have to zoom in a bit before anything appears on the map).

Some maps only go to zoom level 15 – such as the Google Terrain map, so that will be your hard limit when deciding how deep to go, however you will be able to cover a wider area easier due to there being less tiles. Keep in mind that for every tile on a level, four tiles replace it on the zoom level lower than it – this is why the scale below id multiplied by 4 every level you go down.

Below is a chart of the number of tiles in the entire world at a particular zoom level:

Zoom	Total Worldwide Tiles	Map Scale	Zoom	Total Worldwide Tiles	Map Scale
z0	1	1:1,183,315,101	z11	4,194,304	1:577,790
z1	4	1:591,657,550	z12	16,777,216	1:288,895
z2	16	1:295,828,775	z13	67,108,864	1:144,447
z3	64	1:147,914,387	z14	268,435,456	1:72,223
z4	256	1:73,957,193	z15	1,073,741,824 (billion)	1:36,111
z5	1,024	1:36,978,596	z16	4,294,967,296	1:18,055
z6	4,096	1:18,489,298	z17	17,179,869,184	1:9,027
z7	16,384	1:9,244,649	z18	68,719,476,736	1:4,513
z8	65,536	1:4,622,324	z19	274,877,906,944	1:2,256
z9	262,144	1:2,311,162	z20	1,099,511,627,776 (trillion)	1:1,128
z10	1,048,576 (million)	1:1,155,581	z21	4,398,046,511,104	0.433333333

The hard limit to MOBAC's total downloadable tile count is 500,000, so according to the chart above, if you wanted to download the entire world, you can only download it at z9 as this is closest value lower than the 500k maximum.

For my Google Maps archive, I chose to go with zoom 18 since it's the first level where you can see the individual house numbers. I have included the other values I went with below to assist in your decision if you get stuck:
● Google Maps (Select Regions) – Zoom Level 18 (I can see the house numbers at this level)
● Google Terrain (Australia-Wide) – Zoom Level 15 (Good enough to hike with and see the terrain, also the maximum zoom)
● Microsoft Hybrid Satellite (Select Regions) – Zoom Level 17 (Good detail to file size ratio)
● Queensland Topographic (Entire State) – Zoom Level 15 (The maximum it zooms to)
● Worldwide Satellite Map – Zoom Level 9 (The maximum allowable limit in MOBAC) (I use this to find cities around the world if needed)

From now on I will refer to the different zoom levels as z then the level. E.G. z18 for Zoom Level 18.

Downloading Maps In-App
Rather than downloading maps via MOBAC (more details in the section below) which is a much more powerful (but complex) way to download maps, I will quickly touch on how you can download maps using the in-app downloaders which can save both time and effort if you want a less complex way to get started.

Most of the apps listed above support in-app downloads which are then stored in the app on the device's hard drive. Generally these maps must be downloaded every time you swap to a new phone or tablet unless you back them up manually and transfer them every time. However you may find that the stored files cannot be found or copied without rooting your phone.

I'm not able to go over how to download maps in all of the apps above, so I have included links on how to do it for the top two I use:
● Alpine Quest – Downloading a Map
● OSMAnd – Downloading Map Files (You download map 'packages' in this app rather than dragging a rectangular region to download)

What do you need to get started downloading with MOBAC?
If you're still reading then you must be interested in downloading some maps! Below are the physical items you will need to get started:
● An Internet Connection (ideally with 1-4 GB+ worth of data spare per map you want to download)
● A Laptop or Desktop PC running Windows
● A mobile device
● Between $5-$30 depending on which app you want to use (Or you can use the free versions)

What you should know before starting:
- What you want to do with the map?

Do you want to plot and store you bug-out route ready for emergencies? Store important locations for future recall, such as caches and wild edibles? Perhaps you just want it to be a bare map which you can navigate off in an emergency.
- What regions you want to download?

It's wise to have a couple of very detailed maps (z18) of your immediate area and your bug-out location(s) including frequently traveled routes. Some lower zoom levels (z15) of a wider diameter around your home including all of your bug out routes in their entirety. And finally some very low level zooms (z9) of the entire planet so you can track overseas events if necessary.
- Know the style of map you want to download (Road, Topographic, Satellite, etc)

Remember that there are a huge variety of maps that may interest you and will supplement your bug-out plan in an emergency. I have maps of cell phone tower coverage which can be placed partially transparent over any other map, as well as population density maps which can also go over other maps to show me the danger hot-spots that I should avoid when bugging out.

1. How do I download a map?

Firstly ensure you know the details of the maps you will be creating:
- What mapping software are you using? (Alpine Quest, OSMAnd, etc)
- What maps do I want to download? (Google Maps, Bing Maps, OpenStreetMaps, etc)

On your Windows PC, download the map creation software MOBAC. On the main page scroll down to "Download" and get the latest version. You may want to consider downloading version 1.8 if you want to download any of Google's maps, as they have been removed in the later versions – however the newer ones have less issues and support a wider range of mapping software file types. Newer versions may require an extra Java installation, but it will let you know on opening whether you need to downloading anything extra or not.

2. Extract & Open MOBAC

This should be pretty self-explanatory but if you have any issues, leave a comment below.
If you don't have extraction software, you will also need to download Zip Extractor.
(Note: Create a folder and put the .zip file inside it before extracting, or it will make a mess after extraction)

Open the application by double clicking on the "Mobile Atlas Creator.exe" file after extracting the archive in you preferred extractor tool such as WINRAR or Zip Extractor.

When you first open MOBAC you are presented with a selection to choose your atlas style, if you don't know what app you will be using yet you can just choose any for now. When that is closed you will see the map of the world on the right and all your settings for export on the left. (If you are seeing red X's on the map, try selecting the "OpenStreetMap Public Transport" map in the top left. Try moving around the map by holding the right mouse button and dragging to move the map where you want it. You can scroll to zoom in or out. Note how the map updates with new tiles as you zoom in and out.

These are the different zoom levels being downloaded from the internet and updated on your display in MOBAC. Up the top you will see the zoom level bar which shows you what your current zoom level is. What you see is the live version of the map – nothing is downloaded yet beyond what you request to see on-screen. Try changing the map style in the top left corner and seeing what different types there are. Some of the maps are only limited to a certain region such as Europe, the USA or Australia. So if you see red X's after clicking on a map – you are most likely zoomed into a region without coverage, so try zooming out.

3. Change the Map Settings for Download

First select the map source you want to download in the top drop-down, whether that's 'Google Maps' or something else. (Note: Only MOBAC 1.8 or earlier will have the Google Maps options)

Then tick ALL the boxes of the zoom levels that you want to download. If you want to download from z0 to z15, then tick each of them. The selectable zoom levels will change based upon your map selection above, so some will range from z0-z15 and others will go from z0 to z21. If a map only shows up to zoom level 15 then that's as detailed as that map can get. I recommend selecting from z0 up to and including z18 while you follow along with this tutorial as it will make it easier to understand how everything works.

4. Work out the Map Size

Next set the 'Grid Zoom' size at the top of the screen and set it to "12". This will give you a good range to select the areas you want while getting as close to MOBACs 500,000 maximum tile count as possible. If you don't select the Grid Zoom level then it's virtually impossible to have perfectly seamless tiles without downloading duplicate areas since you can drag and select any pixel on the screen. Now drag a rectangle across the map 10×9 squares across the region you want to download. This is the maximum number of squares you can download within MOBACs limit at this zoom level (z18). You can re-drag and select a shape as many times as you like until you've got it right, however you can only draw a single selection rectangle as it will remove your previous one. You can also modify the shape to suit different landmasses which have unique shapes. Some examples of other rectangles you can use are below:

Shape	Total Squares	Tile Count
30×3	90	491,538
22×4	88	480,640
18×5	90	491,538
15×6	90	491,538
13×7	91	497,001
11×8	88	480,612
10×9	90	491,538
9×9	81	442,391
9×10	90	491,538
8×11	88	480,612
7×13	91	497,001
6×15	90	491,538
5×18	90	491,538
4×22	88	480,640
3×30	90	491,538

So if you wanted to, according to the data above, you could use a bunch of 22W x 4H rectangles to save long strips of a map if you didn't want to use a more square-ish rectangle such as a 9×10. Keep in mind though that the 22×4 only covers 480,640 tiles, whereas the 9×10 gets a lot closer to the 500k maximum at 491,538 tiles. Therefore it's more efficient to choose grids that cover more tiles. There is no minimum tile selection, but it's recommended to select a few tiles to get the hang of how it works, and to save time waiting for the download. Try zooming into your home and selecting a 1×2 or 4×4 grid around it to start with.

Once you've made your selection, have a look at the tile count under the "Zoom Levels" menu in MOBAC. If your total tile count is under 500k then you can head on to the next step. If you are over, then you will have to either un-tick your highest zoom level as per the last step OR you can select less tiles to download.

5. Set the map name

If you create enough maps you will need a way to organize each section so you know what region each map covers, what zoom level it is and the date that it was created. To do this I have created a picture showing the coverage of any high zoom maps which I have downloaded. Whenever I want to update my maps, I use the corresponding picture as a guide to be sure I select the same regions I have previously so I don't overlap areas or miss some tiles. It's highly recommended you do something similar to keep track of your regions. All you really need to do is screenshot MOBAC and use paint to draw rectangles around the zones and then stick a name across it.

My formula for the map title is:
(State/Country) (Location) – (Map Type) (Zoom) (Date)
E.G: Australia QLD Brisbane – Google Maps z18 2024-01

I only really update my maps once or twice per year, so I have just included the year and the month, but if you want to be precise, then you can include the day as well.

ADDENDUM Media Mapping

6. Add the Map Selection to the Queue
Once you've decided on a naming format you can enter this into MOBAC's "Name" field and click "Add Selection". Then you can copy the same name, right click the "Unnamed Atlas" field with the purple icon, press "Rename" and paste the name again. The purple sphere where you pasted the second value is generally used for the over-arching type of map, much like a folder which holds lots of a similar files.

So if you want, you can specify the region you are downloading multiple files from, such as 'USA – Tennessee – Google Maps z18' which could have multiple Tennessee regions in it. You can add as many map selections you want under the purple icon to cover that whole region and they will all download in order, however let's just start with one for now.

7. Check the Settings
Before starting the download you should click the 'Settings' button. Have a browse through each of the settings and change any you want. Some you may want to change is:
● the 'Unit System' if you want Imperial measurements,
● the 'Map Sources' tab if you want to hide some of the mapping selections on the top left,
● the 'Tile Update' tab if you want your tiles to expire earlier,
● the 'Map Size' setting which I would set to the biggest size possible (1048575),
● the 'Directories' setting if you want to change the output folder and
● the 'Network' > 'Network Connections' setting to 4, 6, 8 or 10 to download the map a little faster at the risk of getting an IP ban. (An IP ban is when a server blocks your computer for accessing it's data due to misuse – which is technically what you are doing since downloading SOME maps violates the terms and conditions – for example, Google's maps. This is why I recommend only increasing it slightly to save a bit of time) (Note: This value is limited to 6 in the newer versions of MOBAC)

Another setting to make note of (but needs no modification at the moment) is the 'Tile Store' setting which allows you to see how much space the temporarily stored tiles are occupying. This is fine to delete if you have successfully created a map and aren't planning on using the tile data again to create another mapping format of the same region.

8. Create the Atlas
Once you've changed all the settings you want, then you can create the map!
First ensure that you have the correct profile selected for the mapping software you are using under 'Atlas Settings', so "AlpineQuestMap (AQM)" for Alpine Quest.

Then hit that 'Create Atlas' button and let it do its thing. (I recommend doing a very small test first to get used to how MOBAC downloads. My suggestion would be to do a single tile or two exactly above your location)

The download can take up to a few hours depending on how big your selection is, but you can watch the progress with the bar. (Note: The progress bar is glitched on the earlier versions of MOBAC, so 66% is technically 100% complete)

MOBAC Download Errors
Occasionally if you have a dodgy internet connection you will see (and hear – in the form of 'ping error sounds') that there are tile download errors. Don't worry about these until the end.

If you get enough errors on a single map download, it will pause the download and ask you if you want to continue to try and download the map. This is a good opportunity to check your internet connection and clicking continue.

Once you reach the end of the download, you will have a complete map which is ready to transfer to your device to test out. If you received more then about 10 tile errors then I recommend deleting that map from the hard drive and clicking 'Create Atlas' again. MOBAC will skip all the tiles which were successfully downloaded and only download the missing or expired ones. You can repeat this as many times as you wish until you have no (or very few) tile download failures.

9. Transfer to Device
Once you have a map file, all you need to do now is transfer it to your device and point the application to where your maps are stored. Most of the time you will have to give it access to your device's storage before it becomes visible, but it will usually ask you for this permission automatically.

10. Play with it!
That's all you need to do to have offline maps. Once the maps are loaded then you can play with the app to figure out what it can do and how you can use those maps. Try to plot your bug-out route on it and save a few important landmarks that will help you on your journey, such at the closest water sources, hazards and wild food.

How can I keep the MOBAC maps updated?
In step 7 of the process above you would have had a look at the Settings menu and might have seen the 'Tile Update' tab up the top. This is where you can set the expiry data on the tiles that are downloaded if no data has been supplied from the website during download. Simply set the expiry time you want, and then follow the steps above and MOBAC will automatically check whether each tile is up to date, and re-download it if it's not. This is the easiest way to update your stored map tiles and will generally save quite a bit of data. However this comes at the cost of having to store ALL of the downloaded tiles on your PC which can easily chew up a lot of space.

If you choose to delete the tile data between downloads you will just have to download all of the tiles again from scratch, but this isn't an issue especially if you only update your maps every year since they would have all expired by then anyway.

14 Mirroring Websites

Mirroring Websites

This is a selection of websites worth mirroring (downloading) in their entirety for use when the internet doesn't work. Website sizes can vary dramatically from 1Gb to over 100Gb. It depends if you download pictures or not. The websites with sizes under them are ones I've previously downloaded and should be around that size.

Downloader Programs
● HTTRACK
● Cyotek WebCopy
● PageNest
● Getleft

If using HTTRACK be sure to set the rules:
● Max Number of Links to 10,000,000
● Maximum External Depth to 0.
● Max Transfer Rate to 250,000.
● Keep the thread count low to ease server load,

Happy Preppers (4.1Gb)	A large collection of information on basically all topics prepping.	https://happypreppers.com/
Backdoor Survival	Various preparedness tips over hundreds of pages.	https://www.backdoorsurvival.com/
Modern Survival Blog	A blog dedicated to everything survival and prepping.	https://modernsurvivalblog.com/

ADDENDUM

Media

Mirroring Websites

True Prepper	Posting a few articles a day, this website covers nearly every prepping topic.	https://www.trueprepper.com/
Ready Nutrition	A website for all things preparedness and food related.	https://readynutrition.com/
The Prepper Journal	High quality content and a lot of blog posts.	https://theprepperjournal.com/
Graywolf Survival	Great advice, reviews and tips on preparedness.	https://graywolfsurvival.com/
Doom and Bloom	A huge array of medical advice.	https://www.doomandbloom.net/
Drugs.com (50gb+)	A list of all known drugs and compatibilities between them.	https://www.drugs.com/
CDC	A list of known medical ailments, symptoms and treatments.	https://www.cdc.gov/
Instructables	How to create almost anything.	https://www.instructables.com/
Art of Manliness	Tips on being a man as well as survival, shaving etc.	https://www.artofmanliness.com/
How Stuff Works	Information on how almost everything works.	https://www.howstuffworks.com/
Ehow	A guide on how to do anything yourself.	https://www.ehow.com/
WebMD	An online diagnoser website for every ailment.	https://www.webmd.com/
Encyclopedia Britannica	An encyclopedia for 'everything'.	https://www.britannica.com/
Survivopedia (8.8Gb)	Lots of blogs and details on becoming a better prepper.	https://www.survivopedia.com/
The Organic Prepper	Great blogs, lots of great information.	https://www.theorganicprepper.com/
The Old Farmer's Almanac	Complete database of farming almost all types of food.	https://www.almanac.com/
Plants For A Future	A database of all known "useful" plants with edible, medicinal and other uses.	https://pfaf.org/
Army Study Guide	A collection of military information to learn.	https://www.armystudyguide.com/

15 Collections

These are collections of resources such as books, apps, webpages, documents, eBooks, etc that can be downloaded together. They will prove useful in times of peril and help you to survive or rebuild humanity.

Wikipedia

Download the entirety of Wikipedia in English without pictures is about 12Gb - 226 Gb. All text content is multi-licensed under the Creative Commons Attribution-ShareAlike 3.0 License and the GNU Free Documentation License. For offline wikipedia readers look at the "Pc Programs" section to find offline Wikipedia readers. It's recommended to download it via a torrent to save Wikipedia's bandwidth.

Download: https://meta.wikimedia.org/wiki/Data_dump_torrents#enwiki

CD3WD

CD3WD was a project that focused on assisting in third world development by making technical documents and other relevant information easily available to all people. Created by Alex Weir in 2003, the concept was to share useful DIY guides and technical information for free using CDs. The name CD3WD comes from "CD for the Third World Development". In later versions of the project the archive was distributed on DVD. The last version that is available online (the 2012 version) was a total of 6 DVDs (core set) and 32 DVDs of extra educational content.

CD3WD March 2015 (13gb): Excellent database full of useful preparedness related topics, just make sure to change the folders name so all the links aren't broken.

Torrent Magnet Link: magnet:?xt=urn:btih:24E750EFD6640A89EB0D664633904F5BD0BA4AB6&dn=CD3WD+survival+skills+enc	The magnet link is too large to wrap so the cell is left unwrapped. Just copy the magnet link cell and remove the preceding text.

Alternative Download
An alternative download of 6 DVDs can be found at:
Link: https://ftpmirror.your.org/pub/misc/cd3wd/cd3wd%202012%206%20dvds/

A small selection of books from the collection can be found at:
Link: http://www.journeytoforever.org/farm_library/cd3wdbooks.html

Project Gutenberg

A collection of over 57,000 free eBooks on every subject. The books were written long ago and their copyrights have expired. Robinson Crusoe is included in the ENTERTAINMENT section if you want to read it.

https://www.gutenberg.org/

Pole Shift Survival Library

Pole Shift survival Lib, Mar 2015 (9.9gb).
https://pastebin.com/gxfm3J7b

Torrent Magnet Link: magnet:?xt=urn:btih:4AB61FA0458904380B542C6AAD5064DBE7DE247C&dn=PoleShift+Survival+Files&t	The magnet link is too large to wrap so the cell is left unwrapped. Just copy the magnet link cell and remove the preceding text.

Reddit Survival Library

A 30gb selection of all things survival related.

Link: https://www.reddit.com/r/Survival/comments/ug5v1/building_the_ultimate_survival_library_please/

196 Survival Ebooks

A nice selection of eBooks for end of the world scenarios to rebuild society.

Link: http://www.themodernsurvivalist.com/archives/2471

The Survivor Library

Thousands of public domain books to download for free or you can buy the collection on USB or Blu-Ray. They can be downloaded either individually or assisted with Jdownloader if you provide the link to the pages. There's 158 categories of books to download with on average 20 PDF's each page. (In Aug 2018)

Link: http://www.survivorlibrary.com/index.php/library-download

Dictionary Library

A database of most known words in .CSV format. Useful in SHTF if you're unfamiliar with a term. I have converted the .csv files to one .xlsx file to make them easier to search and removed the spaces which halved the file size. Unfortunately it was too big (7Mb) to include in the dictionary section of this sheet so it's an add-on.

Link: https://www.bragitoff.com/wp-content/uploads/2016/03/Dictionary-in-csv.zip

Ultimate Database

A list of the optimal information you would need for a worst case disaster including the rebuilding of humanity. If you want the most compact size possible, then I recommend a few of the basic sheets including TPE. Sizes below are recommendations of what you should have stored.

Essential Information

Essential Totals 1,330 Gb	**Wikipedia** A download of all the major articles on Wikipedia excluding pictures. (25gb)	**Survival/Preparedness Manuals** A large collection of manuals with information on how to live off the land. (50gb)	**How To Manuals** Information on how to perform tasks from brewing to medical to blacksmithing to construction. (500gb)	**Educational Books** Every educational topic that's possible to learn such as maths, chemistry, physics, history, languages etc. (500gb)	**Plant Database** A database of all edible and poisonous plants including pictures for identification which is easily searchable. (5gb)
Digital Maps Worldwide maps as well as detailed topographic local maps. Include satellite maps if possible. (250gb)					

Personal Information

Personal Totals 11 Gb	**Important Documents** Resume, Birth Certificate, Passport etc. (1gb)	**Photos** Family pictures and pictures of your life, etc. (10gb)			

Other Information

Other Totals 16,070 Gb	**Famous Texts** Shakespeare, Plato, Freud, etc. (10gb)	**Fictional Novels** To help pass the time and keep the mind occupied. (20gb)	**Historic/Religious Texts** Manuscriptures and very old scrolls. (10gb)	**Music Collection** Beethoven, Mozart, Bublé, Imagine Dragons etc. (1TB)	**Movie Collection** The most popular and influential movies of all time. (5TB)
Tv Collection The best rated Tv shows of all time. (10TB)	**News/Newspapers** To save the recent history of news which may have caused the disaster. (30gb)				

2 Conversions

Throughout this spreadsheet you'll likely need to be able to work out area, volume, size, ratio, angles and more, all of which follows below. Below are a multitude of conversions and formulas you can use on projects to adapt measurements to your local units. Most cells are small to keep this section compact, so zoom in to read them.

Subheadings

1. Constants	**2. Equivalencies**	**3. Equivalency Tables**	**4. Number Conversions**
5. Conversion Factor	**6. Shape Formulas**		

1 Constants

A mathematical constant is a number, which has a special meaning for calculations. For example, the constant π means the ratio of the length of a circle's circumference to its diameter which is the same for any circle.

Pi (to 100 Places)	3.1415926535 8979323846 2643383279 5028841971 6939937510 5820974944 5923078164 0628620899 8628034825 3421170679…	Pi is the key constant in any equation that involves circular or harmonic motion.
Euler's Number	2.7182818284 5904523536 02874713527…	Euler's number is used to determine compound interest, which is extremely vital in understanding the time value of money.
The Golden Ratio	1.61803398875…	The golden ratio is often used in financial technical analysis to attempt to determine when a market will continue its path or reverse. Observed very frequently in nature.
Planck's Constant	6.62607004 × 10-34 m2 kg / s	Some writers speculate that this Uncertainty Principle can be used to determine stability and sustainability of a financial instrument.
Avogadro's Constant	6.02214179×10^{23}	Avogadro's constant is an interesting relationship between a multitude of different chemical properties.
Speed of Light	• 299,792,458 m/s • 186,282 mi/s	The speed of light is used in many different mathematical formulas and in analysing space travel. N.B: The speed of light is actually slowing down.
Speed of Sound	• 343 m/s • 1,235 km/h • 1,125 ft/s • 767 mph	The speed of sound is the distance travelled per unit time by a sound wave as it propagates through an elastic medium.
Gravitational Constant (G)	6.67300 x 10^-11 m^3 kg^-1 s^-2	G helps determine the force between two masses. Knowledge of G is crucial for any civil, mechanical, or aerospace engineer.
Boltzmann's Constant	1.380650 x 10^23 joule per Kelvin	Boltzman constant explains why ice cubes melt in warm water, but are not spontaneously created in tepid water, among other uses.
Imaginary Unit I	i' equals the square root of -1, which means that i squared is equal to -1.	Negative numbers don't have square roots. Math had advanced to the point where saying 'there is no square root of negative numbers' was holding back a lot of progress.
Euler's Identity	e^(i*pi) = -1	What this conceptually describes is walking along the edge of a unit circle in the complex plane, half way around. Until the real value is -1.

2 Equivalencies

These are the conversions between numbers and similar unit types if you don't have time to utilize the formulas below.

Scientific Notation
Sometimes when a number is too large or small scientific notation is used to shorten the resulting answer. 1e+x simply means to move the decimal place to the right by x amount. 1e-x means to move the decimal place to the left by x amount.
- 1e+6 = 1,000,000 = One million
- 1e-6 = 0.000001 = A millionth
- 6.35e+9 = 6,350,000,000 = 6.35 Billion

Numbers

Small Numbers
Tenth - 0.1
Hundredth - 0.01
Thousandth - 0.001
Millionth - 0.000,001 - (1e-6)
Billionth - 0.000,000,001 - (1e-9)
Trillionth - 0.000,000,000,001 - (1e-12)
Quadrillionth - 0.000,000,000,000,001 - (1e-15)
Quintillionth - 0.000,000,000,000,000,001 - (1e-18)
Sextillionth - 0.000,000,000,000,000,000,001 - (1e-21)
Septillionth - 0.000,000,000,000,000,000,000,001 - (1e-24)
Octillionth - 0.000,000,000,000,000,000,000,000,001 - (1e-27)
Nonillionth - 0.000,000,000,000,000,000,000,000,000,001 - (1e-30)
Decillionth - 0.000,000,000,000,000,000,000,000,000,000,001 - (1e-33)

Large Numbers
One - 1
Ten - 10
Hundred - 100 - (1e+2)
Thousand - 1,000 - (1e+3)
Million - 1,000,000 - (1e+6)
Billion - 1,000,000,000 - (1e+9)
Trillion - 1,000,000,000,000 - (1e+12)
Quadrillion - 1,000,000,000,000,000 - (1e+15)
Quintillion - 1,000,000,000,000,000,000 - (1e+18)
Sextillion - 1,000,000,000,000,000,000,000 - (1e+21)
Septillion - 1,000,000,000,000,000,000,000,000 - (1e+24)
Octillion - 1,000,000,000,000,000,000,000,000,000 - (1e+27)
Nonillion - 1,000,000,000,000,000,000,000,000,000,000 - (1e+30)
Decillion - 1,000,000,000,000,000,000,000,000,000,000,000 - (1e+33)

Metric Prefix Negative
deci - 0.1
centi - 0.01
milli - 0.001
micro - 0.000,001
nano - 0.000,000,001
pico - 0.000,000,000,001
femto - 0.000,000,000,000,001

Metric Prefix Positive
deca - 10
hecto - 100
kilo - 1,000
mega - 1,000,000
giga - 1,000,000,000
tera - 1,000,000,000,000
peta - 1,000,000,000,000,000

Temperature (Approximate) °C/°F/°K

Subfreezing				**Boiling**
-100°C = -148°F = 173.15°K				80°C = 176°F = 353.15°K
-90°C = -130°F = 183.15°K				90°C = 194°F = 363.15°K
-80°C = -112°F = 193.15°K	**Cold**	**Average**	**Hot**	100°C = 212°F = 373.15°K
-70°C = -94°F = 203.15°K	-10°C = 14°F = 263.15°K	15°C = 59°F = 288.15°K	40°C = 104°F = 313.15°K	150°C = 302°F = 423.15°K
-60°C = -76°F = 213.15°K	-5°C = 23°F = 268.15°K	20°C = 68°F = 293.15°K	45°C = 113°F = 318.15°K	200°C = 392°F = 473.15°K
Freezing	0°C = 32°F = 273.15°K	25°C = 77°F = 298.15°K	50°C = 122°F = 323.15°K	**Molten**
-50C = -58°F = 223.15°K	5°C = 41°F = 278.15°K	30°C = 86°F = 303.15°K	60°C = 140°F = 333.15°K	300°C = 572°F = 573.15°K
-40°C = -40°F = 233.15°K	10°C = -50°F = 283.15°K	35°C = 95°F = 308.15°K	70°C = 158°F = 343.15°K	500°C = 932°F = 773.15°K
-30°C = -22°F = 243.15°K				800°C = 1472°F = 1073.15°K
-20°C = -4°F = 253.15°K				1000°C = 1832°F = 1273.15°K
-15°C = 5°F = 258.15°K				1200°C = 2192°F = 1473.15°K

Liquid Volume (Approximate)

5ml = 0.01 Pt	1.5L = 0.39 Gal	150L = 39.62 Gal	
10ml = 0.02 Pt	2L = 0.52 Gal	250L = 66.04 Gal	**Litre to US Liquid**
25ml = 0.05 Pt	3L = 0.79 Gal	500L = 132.08 Gal	1L = 202.884 Tsp
50ml = 0.10 Pt	5L = 1.32 Gal	750L = 198.12 Gal	1L = 67.628 Tbsp
100ml = 0.21 Pt	10L = 2.64 Gal	1,000L = 264.17 Gal	1L = 33.814 Fluid Ounces
200ml = 0.42 Pt	15L = 3.96 Gal	1,500L = 396.25 Gal	1L = 4.166 Cups
250ml = 0.52 Pt	25L = 6.60 Gal	2,500L = 660.43 Gal	1L = 2.113 Pt
500ml = 1.05 Pt	50L = 13.20 Gal	5,000L = 1,320.86 Gal	1L = 1.056 Qt
750ml = 1.58 Pt	75L = 19.81 Gal	7,500L = 1,981.29 Gal	1L = 0.264 Gal
1L = 0.26 Gal	100L = 26.41 Gal	10,000L = 2,641.72 Gal	

3 Equivalency Tables

Equivalency tables are designed to quickly and easily covert between different units of the same measurement type such as millimetres and centimetres which are both length measurements. Below is an example of an equivalency table for metric lengths. Put simply, the vertical columns show how many other units make up 1 of the bolded unit. So looking below, at the blue column, 1 centimetre equals 10,000 micrometres or 0.01 metres (1/100th).

The horizontal columns (in green below) are a bit more complex to understand and depend if you're in the whole numbers (right of the bold unit) or fractions (left of the bold unit). If you're in the whole numbers, that's how many bolded units it takes to make up the new unit type. An example of this is if you look right of the centimetre row you'll see that 100 centimetres equals 1 metre, you just have to ignore the bolded "1" if you decide to read it horizontally. Going left from the bolded row shows you how many one of the other unit type is in relation to your selected unit. For example if you go left from "1 Centimetre" you'll get to 0.1, this signifies that 1 millimetre is 0.1 of a centimetre, or 1/10th. Again, going left from 1 metre will give you 0.01, which means 1 centimetre is 0.01 of a metre or 1/100th.

If you want to convert a number from one unit to another, say 1587 millimetres to metres all you need to do is look in the vertical millimetre column and find the metre convergence cell (0.001). Make sure you don't use the horizontal table for conversions! Then multiply your original number (1587) by this factor (0.001). 1587 x 0.001 = 1.587 metres. The resulting answer will be in the unit you are converting to, in this case, metres. If you read it incorrectly you would have gotten 1,587,000.

Generally you will only want to use the vertical method to find and convert values.

Micrometre	**1 Micrometre**	1,000	10,000	1,000,000	**Micrometre**						
Millimetre	0.001	**1 Millimetre**	10	1,000	**Millimetre**						
Centimetre	0.000,1	0.1	**1 Centimetre**	100	**Centimetre**						
Metre	0.000,001 (millionth)	0.001 (1/1000th)	0.01 (1/100th)	**1 Metre**	**Metre**						

Metric Length

Picometre	**1 Picometre**	100	1,000	1,000,000	1,000,000,000	10,000,000,000	1,000,000,000,000	1,000,000,000,000,000			**Picometre**
Ångström	0.01	**1 Ångström**	10	10,000	10,000,000	100,000,000	10,000,000,000	10,000,000,000,000			**Ångström**
Nanometre	0.001	0.1	**1 Nanometre**	1,000	1,000,000	10,000,000	1,000,000,000	1,000,000,000,000			**Nanometre**
Micrometre	0.000,001	0.000,1	0.001	**1 Micrometre**	1,000	10,000	1,000,000	1,000,000,000			**Micrometre**
Millimetre	0.000,000,001	0.000,000,1	0.000,001	0.001	**1 Millimetre**	10	1,000	1,000,000			**Millimetre**
Centimetre	0.000,000,000,1	0.000,000,01	0.000,000,1	0.000,1	0.1	**1 Centimetre**	100	100,000			**Centimetre**
Metre	0.000,000,000,001	0.000,000,000,1	0.000,000,001	0.000,001	0.001	0.01	**1 Metre**	1000			**Metre**
Kilometre	0.000,000,000,000,001	0.000,000,000,000,1	0.000,000,000,001	0.000,000,001	0.000,001	0.000,01	0.001	**1 Kilometre**			**Kilometre**

Imperial Length

Thou	**1 Thou**	1,000	12,000	36,000	72,000	792,000	7,920,000	63,360,000	72,910,000	218,700,000	**Thou**
Inch	0.001	**1 Inch**	12	36	72	792	7,920.02	63,360	72,913.4	218,740	**Inch**
Feet	0.000083333	0.0833333	**1 Foot**	3	6	66	6,076.12	5,280	6,076.12	18,228.3	**Feet**
Yard	0.0000277778	0.0277778	0.333333	**1 Yard**	2	22	2,025.37	1,760	2,025.37	6,076.12	**Yard**
Fathom	0.0000138889	0.0138889	0.166667	0.5	**1 Fathom**	11	110	880	1,012.69	3,038.06	**Fathom**
Chain	0.00000126263	0.00126263	0.0151515	0.0454545	0.0909091	**1 Chain**	10	80	92.0624	276.187	**Chain**
Furlong	0.000000126262	0.000126262	0.00151515	0.00454545	0.00909089	0.0999998	**1 Furlong**	7.99998	9.20622	27.6187	**Furlong**
Mile	0.0000000157828	0.000015783	0.000189394	0.000568182	0.00113636	0.0125	0.125	**1 Mile**	1.15078	3.45234	**Mile**
Nautical Mile	0.0000000137149	0.000013715	0.000164579	0.000493737	0.000987473	0.0108622	0.108622	0.868976	**1 Nautical Mile**	3	**Nautical Mile**
League	0.00000000457163	0.00000457163	0.0000548596	0.000164579	0.000329158	0.00362073	0.0362074	0.289659	0.333333	**1 League**	**League**

Extreme Length

Kilometre	**1 Kilometre**	1.60934	299,792	17,990,000	149,600,000	1,079,000,000	25,900,000,000	9,460,528,000,000	946,052,800,000,000		**Kilometre**
Mile	0.6213712	**1 Mile**	186,282.39	11,180,000	92,960,000	670,600,000	16,090,000,000	5,878,499,817,000	587,849,981,700,000		**Mile**
Light Second	3.33564e-6	5.36819e-6	**1 Light Second**	60	499	3,600	86,400	31,560,000	3,156,000,000		**Light Second**
Light Minute	5.5594e-8	8.94699e-8	0.0166667	**1 Light Minute**	8.31675	60	1,440	525,960	52,596,000		**Light Minute**
Astro Unit	6.68459e-9	1.07578e-8	0.00200399	0.120239	**1 AU**	7.21436	173.145	63,241.1	63,241,100		**Astro Unit**
Light Hour	9.26567e-10	1.49116e-9	0.000277778	0.0166667	0.138612	**Light Hour**	24	8766	876,600		**Light Hour**
Light Day	3.8607e-11	6.21319e-11	1.15741e-5	0.000694444	0.00577552	0.0416667	**1 Light Day**	365.25	3,652,500		**Light Day**
Light Year	1.057e-13	1.70108e-13	3.16881e-8	1.90129e-6	1.58125e-5	0.000114077	0.00273785	**1 Light Year**	10,000		**Light Year**
Light Century								0.0001	**1 Light Century**		**Light Century**

Time (Small Units)

Yoctosecond	**1 Yoctosecond**	1,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000	1e+21	1e+24	6e+25	3.6e+27	8.64e+28	**Yoctosecond**
Zeptosecond	0.001	**1 Zeptosecond**	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000	1e+21	6e+22	3.6e+24	8.64e+25	**Zeptosecond**
Picosecond	1e-12	1e-9	**1 Picosecond**	1,000	1,000,000	1,000,000,000	1,000,000,000,000	60,000,000,000,000	3,600,000,000,000,000	86,400,000,000,000,000	**Picosecond**
Nanosecond	0.000000000000001	0.000000000001	0.001	**1 Nanosecond**	1,000	1,000,000	1,000,000,000	60,000,000,000	3,600,000,000,000	86,400,000,000,000	**Nanosecond**
Microsecond	0.000000000000000001	0.000000000000001	0.000001	0.001	**1 Microsecond**	1,000	1,000,000	60,000,000	3,600,000,000	86,400,000,000	**Microsecond**
Millisecond	0.000000000000000000001	0.000000000000000001	0.000000001	0.000,001	0.001	**1 Millisecond**	1,000	60,000	3,600,000	86,400,000	**Millisecond**
Second	1e-24	0.000000000000000000001	0.000000000001	0.000,000,001	0.000,001	0.001	**1 Second**	60	3,600	86,400	**Second**
Minute	1.6667e-26	1.6667e-23	0.0000000000000001666667	0.000,000,000,016,667	0.000,000,016,667	0.000,016,667	0.016,666,7	**1 Minute**	60	1,440	**Minute**
Hour	2.7778e-28	2.7778e-25	0.00000000000000277777833	0.000,000,000,000,277,78	0.000,000,000,277,78	0.000,000,277,78	0.000,277,778	0.016,666,7	**1 Hour**	24	**Hour**
Day	1.1574e-29	1.1574e-26	0.0000000000000000011574076375	0.000,000,000,000,011,574	0.000,000,000,011,574	0.000,000,011,574	0.000,011,574	0.000,694,444	0.041,666,7	**1 Day**	**Day**

Time (Large Units)

Time (Lo

Day	1 Day	7	30.4167	365	3,650	36,500	365,000	365,000,000	365,000,000,000	365,000,000,000,000	Day
Week	0.142,857	1 Week	4.34524	52.1429	521.429	5,214.29	52,142.9	52,142,900	52,142,900,000	52,142,900,000,000	Week
Month	0.032,876,7	0.230,137	1 Month	12	120	1,200	12,000	12,000,000	12,000,000,000	12,000,000,000,000	Month
Year	0.002,739,73	0.019,178,1	0.083,333,4	1 Year	10	100	1,000	1,000,000	1,000,000,000	1,000,000,000,000	Year
Decade	0.000,273,973	0.001,917,81	0.008,333,34	0.1	1 Decade	10	100	100,000	100,000,000	100,000,000,000	Decade
Century	0.000,027,397,3	0.000,191,781	0.000,833,334	0.01	0.1	1 Century	10	10,000	10,000,000	10,000,000,000	Century
Millennium	0.000,002,739,73	0.000,019,178	0.000,083,333,4	0.001	0.01	0.1	1 Millennium	1,000	1,000,000	1,000,000,000	Millennium
Mega-annum	0.000,000,002,739,73	0.000,000,019,178	0.000,000,083,333,4	0.000,001	0.000,01	0.000,1	0.001	1 Mega-annum	1,000	1,000,000	Mega-annum
Giga-annum	0.000,000,000,002,739,73	0.000,000,000,019,178	0.000,000,000,083,333,4	0.000,000,001	0.000,000,01	0.000,000,1	0.000,001	0.001	1 Giga-annum	1,000	Giga-annum
Tera-annum	0.000,000,000,000,002,739,73	0.000,000,000,000,019,178	0.000,000,000,000,083,333,4	0.000,000,000,001	0.000,000,000,01	0.000,000,000,1	0.000,000,001	0.000,001	0.001	1 Tera-annum	Tera-annum

Speed

Feet/Second	1 Feet/Second	0.592,484	0.304,8	0.000,888,63	0.000,304,8	0.000,189,394	0.000,000,001,01				Feet/Second
Knot	1.687,81	1 Knot	0.514,444	0.001,499,84	0.000,514,444	0.000,319,661	0.000,000,001,71				Knot
Metre/Second	3,280.84	1,943.84	1 Metre/Second	0.002,915,45	0.001	0.000,621,371	0.000,000,003,33				Metre/Second
Sound Speed	1,125.33	666.739	343	1 Sound Speed	0.343	0.213,13	0.000,001,14				Sound Speed
Kilometre/Sec	3,280.84	1,943.84	1,000	2,915.45	1 Kilometre/Sec	0.621,371	0.000,003,33				Kilometre/Sec
Mile/Second	5,280	3,128.31	1,609.34	4,691.97	1,609.34	1 Mile/Second	0.000,005,36				Mile/Second
Light Speed	983,571,056.43	582,700,000.0	299,792,458	874,030	299,792	186,282	1 Light Speed				Light Speed

Volume

Drop	1 Drop	20	98.5784	295.735	591.471	4,731.76	9,463.53	18,927.1	20,000	75,708.2	Drop
Millilitre	0.05	1 Millilitre	4.92892	14.7868	29.5735	236.588	473.176	946.353	1,000	3,785.41	Millilitre
US Teaspoon	0.0101442	0.202884	1 US Teaspoon	3	6	48	96	192	202.884	768	US Teaspoon
US Tablespoon	0.0033814	0.067628	0.333333	1 US Tablespoon	2	16	32	64	67.628	256	US Tablespoon
Fluid Ounce	0.0016907	0.033814	0.166667	0.5	1 Fluid Ounce	8	16	32	33.814	128	Fluid Ounce
Cup	0.000211338	0.00422675	0.0208333	0.0625	0.125	1 Cup	2	4	4.22675	16	Cup
Pint	0.000105669	0.00211338	0.0104167	0.03125	0.0625	0.5	1 Pint	2	2.11338	8	Pint
Quart	0.0000528344	0.00105669	0.00520833	0.015625	0.03125	0.25	0.5	1 Quart	1.05669	4	Quart
Litre	0.00005	0.001	0.00492892	0.0147868	0.0295735	0.236588	0.473176	0.946353	1 Litre	3.78541	Litre
Gallon (US)	0.0000132086	0.000264172	0.00130208	0.00390625	0.0078125	0.0625	0.125	0.25	0.264172	1 Gallon (US)	Gallon (US)

Digital Storage

Bit	1 Bit	8	8,000	8,000,000	8,000,000,000	8,000,000,000,000	8,000,000,000,000,000	8,000,000,000,000,000,000	8e+21	8e+24	Bit
Byte	0.125	1 Byte	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000	1e+21	1e+24	Byte
Kilobyte	0.000,125	0.001	1 Kilobyte	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000	1e+21	Kilobyte
Megabyte	0.000,000,125	0.000,001	0.001	1 Megabyte	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000	Megabyte
Gigabyte	0.000,000,000,125	0.000,000,001	0.000,001	0.001	1 Gigabyte	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	Gigabyte
Terabyte	0.000,000,000,000,125	0.000,000,000,001	0.000,000,001	0.000,001	0.001	1 Terabyte	1,000	1,000,000	1,000,000,000	1,000,000,000,000	Terabyte
Petabyte	0.000,000,000,000,000,125	0.000,000,000,000,001	0.000,000,000,001	0.000,000,001	0.000,001	0.001	1 Petabyte	1,000	1,000,000	1,000,000,000	Petabyte
Exabyte	1.25e-19	0.000,000,000,000,000,001	0.000,000,000,000,001	0.000,000,000,001	0.000,000,001	0.000,001	0.001	1 Exabyte	1,000	1,000,000	Exabyte
Zettabyte	1.25e-22	1e-21	0.000,000,000,000,000,001	0.000,000,000,000,001	0.000,000,000,001	0.000,000,001	0.000,001	0.001	1 Zettabyte	1,000	Zettabyte
Yottabyte	1.25e-25	1e-24	1e-21	0.000,000,000,000,000,001	0.000,000,000,000,001	0.000,000,000,001	0.000,000,001	0.000,001	0.001	1 Yottabyte	Yottabyte

Data Transfer Rate

Bits/sec	1 Bits/sec	8	1,000	8,000	1,000,000	8,000,000	100,000,000	8,000,000,000	1,000,000,000,000	8,000,000,000,000	Bits/sec
Bytes/sec	0.125	1 Bytes/sec	125	1,000	125,000	1,000,000	125,000,000	1,000,000,000	125,000,000,000	1,000,000,000,000	Bytes/sec
Kilobit/sec	0.001	0.008	1 Kilobit/sec	8	1,000	8,000	1,000,000	8,000,000	1,000,000,000	8,000,000,000	Kilobit/sec
Kilobyte/sec	0.000125	0.001	0.125	1 Kilobyte/sec	125	1,000	125,000	1,000,000	125,000,000	1,000,000,000	Kilobyte/sec
Megabit/sec	0.000001	0.000008	0.001	0.008	1 Megabit/sec	8	1,000	8,000	1,000,000	8,000,000	Megabit/sec
Megabyte/sec	0.000000125	0.000001	0.000125	0.001	0.125	1 Megabyte/sec	125	1,000	125,000	1,000,000	Megabyte/sec
Gigabit/sec	0.000000001	0.000000008	0.000001	0.000008	0.001	0.008	1 Gigabit/sec	8	1,000	8,000	Gigabit/sec
Gigabyte/sec	1.25e-10	0.000000001	0.000000125	0.000001	0.000125	0.001	0.125	1 Gigabyte/sec	125	1,000	Gigabyte/sec
Terabit/sec	1e-12	8e-12	0.000000001	0.000000008	0.000001	0.000008	0.001	0.008	1 Terabit/sec	8	Terabit/sec
Terabyte/sec	1.25e-13	1e-12	1.25e-10	0.000000001	0.000000125	0.000001	0.000125	0.001	0.125	1 Terabyte/sec	Terabyte/sec

Mass

Microgram	1 Microgram	1,000	200,000	1,000,000	28,350,000	31,100,000	4.536e+8	1,000,000,000	6.35e+9	1,000,000,000,000	Microgram
Milligram	0.001	1 Milligram	200	1,000	28,349.5	31,103.5	453592	1,000,000	6.35e+6	1,000,000,000	Milligram
Carat	0.000005	0.005	1 Carat	5	141.748	155.517	2267.96	5,000	31,751.5	5,000,000	Carat
Gram	0.000001	0.001	0.2	1 Gram	28.3495	31.1035	453.592	1,000	6,350.29	1,000,000	Gram
Ounce	0.000000035274	0.000035274	0.00705479	0.035274	1 Ounce	1.09714	16	35.274	224	35,274	Ounce
Troy Ounce	0.0000000321507	0.0000321507	0.00643015	0.0321507	0.911458	1 Troy Ounce	14.5833	32.1507	204.167	32,150.7	Troy Ounce
Pound	0.00000000220462	0.00000220462	0.000440925	0.00220462	0.0625	0.0685714	1 Pound	2.20462	14	2204.62	Pound
Kilogram	0.000000001	0.000001	0.0002	0.001	0.0283495	0.0311035	0.453592	1 Kilogram	6.35029	1,000	Kilogram
Stone	0.000000000157473	0.000000157473	0.0000314946	0.000157473	0.00446429	0.00489796	0.0714286	0.157473	1 Stone	157.473	Stone
Tonne	0.000000000001	0.000000001	0.0000002	0.000001	0.0000283495	0.0000311035	0.000453592	0.001	0.00635029	1 Tonne	Tonne

Area

Sq Millimetre	1 Sq Millimetre	100	645.16	92,903	1,000,000	25,290,000	4047000000	10,000,000,000	1,000,000,000,000	2,590,000,000,000	Sq Millimetre
Sq Centimeter	0.01	1 Sq Centimeter	6.4516	929.03	10,000	252,929	40470000	100,000,000	10,000,000,000	25,900,000,000	Sq Centimeter
Sq Inch	0.00155	0.155	1 Sq Inch	144	1,550	39,204	6,273,000	15,500,000	1,550,000,000	4,014,000,000	Sq Inch
Sq Foot	0.0000107639	0.00107639	0.00694444	1 Sq Foot	10.763	272.25	43,560	107,639	10,760,000	27,880,000	Sq Foot
Sq Meter	0.000001	0.0001	0.00064516	0.092903	1 Sq Meter	25.2929	4,046.86	10,000	1,000,000	2,590,000	Sq Meter
Sq Rod	3.95369e-8	3.95369e-6	0.0000255076	0.00367309	0.0395369	1 Sq Rod	160	395.369	39,536.9	102,400	Sq Rod
Acre	2.47105e-10	2.47105e-8	1.59423e-7	0.0000229568	0.000247105	0.00625	1 Acre	2.47105	247.105	640	Acre
Hectare	1e-10	1e-8	6.4516e-8	9.2903e-6	0.0001	0.00252929	0.404686	1 Hectare	100	258.99	Hectare
Sq Kilometer	1e-12	1e-10	6.4516e-10	9.2903e-8	0.000001	0.0000252929	0.00404686	0.01	1 Sq Kilometer	2.5899	Sq Kilometer
Sq Mile	3.86102e-13	3.86102e-11	2.49098e-10	3.58701e-8	3.86102e-7	9.76563e-6	0.0015625	0.00386102	0.386102	1 Sq Mile	Sq Mile

Angle

Microarcsecond	1 Microarcsec	206,264.8	1,000,000	60,000,000	206,264,806.2	3,239,999,952.1	3,600,000,000	206,264,806,247.1	1,296,000,970,929.7		Microarcsecond
Microradian	0.000004848	1 Microradian	4.8	290.8	1,000	15,707.963	17,453.2	1,000,000	6,283,190		Microradian
Arcsecond	0.000,001	0.20626479821012	1 Arcsecond	60	206.2	3,239.999	3,600	206,264.8	1,296,000.9174658		Arcsecond
Arcminute	1.6666678584197E-8	0.0034377492368197	0.016666679271747	1 Arcminute	3.437	54	60	3,437.7	21,600.031627293		Arcminute
Milliradian	4.8481368E-9	0.001	0.004848137	0.290888	1 Milliradian	15.7	17.453	1,000	6,283.19		Milliradian
Gradian	3.0864197986715E-10	6.3661978322714E-5	0.00030864199259955	0.018518505550338	0.063661978322714	1 Gradian	1.111	63.66	400.0003055775		Gradian
Degree	2.7777776630942E-10	5.729577727869E-5	0.00027777777776858	0.016666654061044	0.05729577727869	0.89999994954991	1 Degree	57.2	360.0002548397		Degree
Radian	4.8481368E-12	1.0E-6	4.848137E-6	0.000290888	0.001	0.015707963	0.0174	1 Radian	6.28319		Radian
Revolution	7.7160436020556E-13	1.5915482422145E-7	7.7160439203653E-7	4.629622850813E-5	0.00015915482422145	0.0024999980901421	0.0027777758114235	0.15915482422145	1 Revolution		Revolution

Power

Watt	1 Watt	745.7	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000			Watt
HP	0.00134102	1 HP	1.34102	1,341.02	1,341,000	1,341,000,000	1,341,000,000,000	1,341,000,000,000,000			HP
Kilowatt	0.001	0.7457	1 Kilowatt	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000			Kilowatt
Megawatt	0.000001	0.0007457	0.001	1 Megawatt	1,000	1,000,000	1,000,000,000	1,000,000,000,000			Megawatt
Gigawatt	0.000000001	0.0000007457	0.000001	0.001	1 Gigawatt	1,000	1,000,000	1,000,000,000			Gigawatt
Terawatt	0.000000000001	0.0000000007457	0.000000001	0.000001	0.001	1 Terawatt	1,000	1,000,000			Terawatt
Petawatt	0.000000000000001	0.0000000000007457	0.000000000001	0.000000001	0.000001	0.001	1 Petawatt	1,000			Petawatt
Exawatt	1e-18	0.0000000000000007457	0.000000000000001	0.000000000001	0.000000001	0.000001	0.001	1 Exawatt			Exawatt

Pressure

Hectopascal	1 Hectopascal	1	68.9476	100	1,000	1,013.25	10,000	10,000,000			Hectopascal
Millibar	1	1 Millibar	68.9476	100	1,000	1,013.25	10,000	10,000,000			Millibar
PSI	0.0145038	0.0145038	1 PSI	1.45038	14.5038	14.6959	145,038	145,038			PSI

Decibar	0.01	0.01	0.689476	1 Decibar	10	10.1325	100	100,000			Decibar
Bar	0.001	0.001	0.0689476	0.1	1 Bar	1.01325	10	10,000			Bar
Atmosphere	0.000986923	0.000986923	0.068046	0.0986923	0.986923	1 Atmosphere	9.86923	9,869.23			Atmosphere
Megapascal	0.0001	0.0001	0.00689476	0.01	0.1	0.101325	1 Megapascal	1,000			Megapascal
Gigapascal	1e-7	1e-7	6.89476e-6	1e-5	0.0001	0.000101325	0.001	1 Gigapascal			Gigapascal

Frequency

Microhertz	1 Microhertz	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000	1e+21			Microhertz
Millihertz	0.001	1 Millihertz	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000	1,000,000,000,000,000,000			Millihertz
Hertz	0.000001	0.001	1 Hertz	1,000	1,000,000	1,000,000,000	1,000,000,000,000	1,000,000,000,000,000			Hertz
Kilohertz	0.000000001	0.000001	0.001	1 Kilohertz	1,000	1,000,000	1,000,000,000	1,000,000,000,000			Kilohertz
Megahertz	0.000000000001	0.000000001	0.000001	0.001	1 Megahertz	1,000	1,000,000	1,000,000,000			Megahertz
Gigahertz	0.000000000000001	0.000000000001	0.000000001	0.000001	0.001	1 Gigahertz	1,000	1,000,000			Gigahertz
Terahertz	0.000000000000000001	0.000000000000001	0.000000000001	0.000000001	0.000001	0.001	1 Terahertz	1,000			Terahertz
Petahertz	1e-21	0.000000000000000001	0.000000000000001	0.000000000001	0.000000001	0.000001	0.001	1 Petahertz			Petahertz

Fuel Consumption

US Feet/Gallon	1 Foot/Gallon	12.419274734227	2,731.8554440133	5,279.9801376084	12,419.274734227	19,986.88527788					US Feet/Gallon
Metres/Litre	0.080519999871169	1 Metres/Litre	219.969	425.144	1,000	1,609.344					Metres/Litre
Km/Gallon	0.00036605157940968	0.0045460951315867	1 Km/Gallon	1.9327450686233	4.5460951315867	7.3162309234483					Km/Gallon
US Miles/Gallon	0.00018939465186188	0.0023521442146661	0.51739881075589	1 Miles/Gallon	2.3521442146661	3.7854091790076					US Miles/Gallon
Km/Litre	0.000080519999871169	0.001	0.219969	0.425144	1 Km/Litre	1.609344					Km/Litre
Miles/Litre	0.000050032808318898	0.00062137119223733	0.13668239978525	0.26417223415255	0.62137119223733	1 Miles/Litre					Miles/Litre

Absorbed Dose

Nanogray	1 Nanogray	1,000	1,000,000	10,000,000	10,000,000	1,000,000,000	10,000,000,000	1,000,000,000,000	10,000,000,000,000		Nanogray
Microgray	0.001	1 Microgray	1,000	10,000	10,000	1,000,000	10,000,000	1,000,000,000	10,000,000,000		Microgray
Milligray	0.000001	0.001	1 Milligray	10	10	1,000	10,000	1,000,000	10,000,000		Milligray
Centigray	0.0000001	0.0001	0.1	1 Centigray	1	100	1,000	100,000	1,000,000		Centigray
Rad	0.0000001	0.0001	0.1	1	1 Rad	100	1,000	100,000	1,000,000		Rad
Gray	0.000000001	0.000001	0.001	0.01	0.01	1 Gray	10	1,000	10,000		Gray
Kilorad	0.0000000001	0.0000001	0.0001	0.001	0.001	0.1	1 Kilorad	100	1,000		Kilorad
Kilogray	0.000000000001	0.000000001	0.000001	0.00001	0.00001	0.001	0.01	1 Kilogray	10		Kilogray
Megarad	0.0000000000001	0.0000000001	0.0000001	0.000001	0.000001	0.0001	0.001	0.1	1 Megarad		Megarad

4 Number Conversions

Exponential to Decimal

Negative Numbers
1e-11 = 0.000,000,000,01
1e-12 = 0.000,000,000,001
1e-13 = 0.000,000,000,000,1
1e-14 = 0.000,000,000,000,01
1e-15 = 0.000,000,000,000,001

Negative Numbers
1e-6 = 0.000,001
1e-7 = 0.000,000,1
1e-8 = 0.000,000,01
1e-9 = 0.000,000,001
1e-10 = 0.000,000,000,1

Negative Numbers
1e-1 = 0.1
1e-2 = 0.01
1e-3 = 0.001
1e-4 = 0.0001
1e-5 = 0.00001

Positive Numbers
1e+1 = 10
1e+2 = 100
1e+3 = 1,000
1e+4 = 10,000
1e+5 = 100,000

Positive Numbers
1e+6 = 1,000,000
1e+7 = 10,000,000
1e+8 = 100,000,000
1e+9 = 1,000,000,000
1e+10 = 10,000,000,000

Positive Numbers
1e+11 = 100,000,000,000
1e+12 = 1,000,000,000,000
1e+13 = 10,000,000,000,000
1e+14 = 100,000,000,000,000
1e+15 = 1,000,000,000,000,000

Decimals
4.71e+7 = 47,100,000
8.46e+12 = 8,460,000,000,000
2.12e+3 = 2,120
1.25e-5 = 0.000,012,5
5.11e-8 = 0.000,000,051,1
9.3e-2 = 0.093
1.6667e-5 = 0.000,016,667

Fraction to Decimal and Percentage

1/1 = 1.0 = 100%
1/2 = 0.5 = 50%
1/3 = 0.333333 = 33.3%
1/4 = 0.25 = 25%
1/5 = 0.2 = 20%
1/6 = 0.166667 = 16%
1/7 = 0.142857 = 14.28%
1/8 = 0.125 = 12.5%
1/9 = 0.111111 = 11.1111%
1/10 = 0.1 = 10%
1/11 = 0.090909 = 9.0909%
1/12 = 0.083333 = 8.3333%

1/16 = 0.0625 = 6.25%
1/32 = 0.03125 = 3.125%
2/3 = 0.666667 = 6.66667%
3/4 = 0.75 = 75%
2/5 = 0.4 = 40%
5/6 = 0.833333 = 83.3333%
2/7 = 0.285714 = 28.5714%
5/7 = 0.714286 = 71.4286%
3/8 = 0.375 = 37.5%
2/9 = 0.222222 = 22.2222%
7/9 = 0.777778 = 77.7778%
3/10 = 0.3 = 30%

2/11 = 0.181818 = 18.1818%
5/11 = 0.454545 = 45.4545%
8/11 = 0.727273 = 72.7273%
5/12 = 0.416667 = 41.6667%
3/16 = 0.1875 = 18.75%
11/16 = 0.6875 = 68.75%
3/32 = 0.09375 = 9.375%
9/32 = 0.28125 = 28.125%
15/32 = 0.46875 = 46.875%
21/32 = 0.65625 = 65.625%
3/5 = 0.6 = 60%
3/7 = 0.428571 = 42.8571%

6/7 = 0.857143 = 85.7143%
5/8 = 0.625 = 62.5%
4/9 = 0.444444 = 44.4444%
8/9 = 0.888889 = 88.8889%
7/10 = 0.7 = 70%
3/11 = 0.272727 = 27.2727%
6/11 = 0.545455 = 54.5455%
9/11 = 0.818182 = 81.8182%
7/12 = 0.583333 = 58.3333%
5/16 = 0.3125 = 31.25%
13/16 = 0.8125 = 81.25%
5/32 = 0.15625 = 15.625%

11/32 = 0.34375 = 34.375%
17/32 = 0.53125 = 53.125%
23/32 = 0.71875 = 71.875%
29/32 = 0.90625 = 90.625%
4/5 = 0.8 = 80%
4/7 = 0.571429 = 57.1429%
7/8 = 0.875 = 87.5%
5/9 = 555556 = 55.5556%
9/10 = 0.9 = 90%
4/11 = 0.363636 = 36.3636%
7/11 = 0.636364 = 63.6364%
10/11 = 0.909091 = 90.9091%

11/12 = 0.916667 = 91.6667%
7/16 = 0.4375 = 43.75%
15/16 = 0.9375 = 93.75%
7/32 = 0.21875 = 21.875%
13/32 = 0.40625 = 40.625%
19/32 = 0.59375 = 59.375%
25/32 = 0.78125 = 78.125%
31/32 = 0.96875 = 96.875%

5 Conversion Factor

These are conversion factors which you multiply the number with to get the result. Any conversions with "precise" under them are the entire conversion factor and 100% accurate. Useful for measuring precious metals. Conversions without "precise" are generally good enough to be used in home projects and may have dropped a few decimal places. The exchange rate of money and barterable goods is included to give a general idea of value.

Distance	**Inches to Cm** Inch x 2.54	**Cm to Inches** Cm x 0.3937	**Sq/cm to Sq/Inch** Sq/cm x 0.16	**Sq/Inch to Sq/cm** Sq/Inch x 6.45	**Feet to Metres** Feet x 0.3048	**Metres to Feet** Metres x 3.2808	**Yards to Metres** Yards x 0.9144	**Metres to Yards** Metre x 1.0936	**Miles to Kilometres** Miles x 1.6093	**Kilometres to Miles** Kilometre x 0.6214	
Volume	**Cubic Meter to Cubic Feet** Cubic Metre x 35.32	**Cubic Feet to Cubic Metre** Cubic Feet x 0.03	**Cubic Metre to Litre** Cubic Metre x 1000	**Litre to Cubic Metre** Litre x 0.001	**Litre to Cubic Decimetre** Litre x 1	**Litres to Gallons** Litres x 0.22	**Gallons to Litres** Gallons x 4.55	**Drops to Millilitres** Drops x 0.05	**Millilitres to Drops** Millilitres x 20		

Area	**Hectares to Acres** Hectares x 2.47	**Acres to Hectares** Acres x 0.41									
Angles	**Degrees to Radians** Degrees x 0.01745329252 (Precise)	**Radians to Degrees** Radians x 57.295779513 (Precise)									
Weight	**Grams to Ounces (oz)** Grams x 0.03527399072294 (Precise)	**Ounces to Grams** Ounces x 28.349523 (Precise)	**Grams to Troy Ounce** Grams x 0.032151 (Precise)	**Troy Ounce to Grams** Troy Ounce x 31.1034768 (Precise)	**Pounds to Kilograms** Pounds x 0.4536	**Kilograms to Pounds** Kilograms x 2.21					
Energy	**Horsepower to Kilowatts** Horsepower x 0.746	**Kilowatts to Horsepower** Kilowatts x 1.34									
Pressure	**Atmosphere to PSI** Atmosphere x 14.68	**Hectopascal to Millibars** Hectopascal x 1	**Megapascal to Bar** Megapascal x 0.1	**Pascal to Kilopascal** Pascal x 1000	**Pascal to Newton/m2** Pascal x 1	**Pascal to kg/cm2** Pascal x 0.00001	**Pascal to PSI** Pascal x 0.000142	**PSI to Pascal** PSI x 6894	**PSI to kg/cm2** PSI x 0.0703	**Kg/cm2 to PSI** Kg/cm2 x 14.223	
Atmosphere	**Inches to Millibars** Inches x 33.8637526 (Precise)		**Millibars to Inches** Millibars x 0.0295301 (Precise)								
Temperature	**Fahrenheit to Celsius** F - 32 x 5 / 9		**Celsius to Fahrenheit** C x 9 / 5 + 32		**Celsius to Kelvin** Celsius + 273.15		**Fahrenheit to Kelvin** Convert to Celsius + 273.15				
Money (As of 7 Mar 2018th)	1 USD = 1.28 AUD	1 USD = 0.000093 BTC	1 USD = 0.72 EUR	1 USD = 1.29 CAD	1 USD = 6.33 CNY (Yuan)	1 USD = 64.89 Rupee	1 USD = 105.71 Yen	1 USD = 18.3 Peso	1 USD = 1.37 NZD	1 USD = 56.82 Ruble	
Barter (As of 7 Mar 2018th)	**Gold .999 1oz** $1,326.35 USD		**Silver .999 1oz** $16.56 USD		**Platinum .999 1oz** $965.90 USD		**Palladium .999 1oz** $989.15 USD				
Electricity	**V** - (Voltage) **I** - (Current in Amps) **R** - (Resistance in Ohms) **P** - (Power in Watts)		**Find Volts (V)** V = I x R V = P ÷ I V = √(P x R)		**Find Amps (I)** I = V ÷ R I = P ÷ V I = √(P ÷ R)		**Find Resistance (RΩ)** R = V ÷ I R = P ÷ I² R = V² ÷ P		**Find Watts (P)** P = V x I P = V² ÷ R P = I² x R		
Radiation	**REM to** ● Sv = REM x 0.01 ● Rad (a) = REM x 0.05 ● Rad (b/g) = REM x 1 ● Rad (n) = REM x 0.1 ● Gy (a) = REM x 0.0005 ● Gy (b/g) = REM x 0.01 ● Gy (n) = REM x 0.001		**Sv to** ● REM = Sv x 100 ● Rad (a) = Sv x 5 ● Rad (b/g) = Sv x 100 ● Rad (n) = Sv x 10 ● Gy (a) = Sv x 0.05 ● Gy (b/g) = Sv x 1 ● Gy (n) = Sv x 0.1		**Rad (a,b/g,n) to** ● REM = Rad x (20,1,10) ● Sv = Rad x (0.2,0.01,0.1) ● Gy (a) = Rad x (0.01,0.0005,0.005) ● Gy (b/g) = Rad x (0.2,0.01,0.1) ● Gy (n) = Rad x (0.02,0.001,0.01)		**Gy (a,b/g,n) to** ● REM = Gy x (2000,100,1000) ● Sv (a) = Gy x (20,1,10) ● Rad (a) = Gy x (100,5,50) ● Rad (b/g) = Gy x (2000,100,1000) ● Rad (n) = Gy x (200,10,100)				
Radiation	**Ci to** ● Bq = Ci x 37,000,000,000 ● DPS = Ci x 37,000,000,000		**Bq to** ● Ci = Bq x .000000000027027027027 03 ● DPS = Bq x 1		**DPS to** ● Bq = DPS x 1 ● Ci = 2.702702702703e-11						

6 Shape Formulas

This section is formulas for finding perimeter, area, surface area and volume. Remember that two characters besides each other implies that they are multiplied.
Ex: bh = b h = b x h

Congruence	Two objects are congruent if one can be transformed into the other by a sequence of rotations, translations, and/or reflections.
Similarity	Two objects are similar if one can be transformed into the other by a uniform scaling, together with a sequence of rotations, translations, and/or reflections.
Isotopy	Two objects are isotopic if one can be transformed into the other by a sequence of deformations that do not tear the object or put holes in it.

2D Shapes

Circle	A circle is a shape consisting of all points in a plane that are a given distance from a given point, the centre; equivalently it is the curve traced out by a point that moves in a plane so that its distance from a given point is constant.
Square	In geometry, a square is a regular quadrilateral, which means that it has four equal sides and four equal angles (90-degree angles, or (100-gradian angles or right angles).
Rectangle	A rectangle is a quadrilateral with four right angles. It can also be defined as an equiangular quadrilateral, since equiangular means that all of its angles are equal (360°/4 = 90°).
Triangle	A triangle is a polygon with three edges and three vertices. It is one of the basic shapes in geometry.
Rhombus	A rhombus (plural rhombi or rhombuses) is a quadrilateral whose four sides all have the same length. Another name is equilateral quadrilateral
Parallelogram	A parallelogram is a simple (non-self-intersecting) quadrilateral with two pairs of parallel sides. The opposite or facing sides of a parallelogram are of equal length and the opposite angles of a parallelogram are of equal measure.
Kite	A kite is a quadrilateral whose four sides can be grouped into two pairs of equal-length sides that are adjacent to each other. In contrast, a parallelogram also has two pairs of equal-length sides

2D Sides

This is a list of two-dimensional geometric shapes in Euclidean and other geometries.

1 Side - Henagon	9 Sides - Nonagon	17 Sides - Heptadecagon	70 Sides - Heptacontagon
2 Sides - Digon	10 Sides - Decagon	18 Sides - Octadecagon	80 Sides - Octacontagon
3 Sides - Triangle	11 Sides - Hendecagon	19 Sides - Enneadecagon	90 Sides - Enneacontagon
4 Sides - Quadrilateral	12 Sides - Dodecagon	20 Sides - Icosagon	100 Sides - Hectogon
5 Sides - Pentagon	13 Sides - Tridecagon	30 Sides - Triacontagon	1,000 Sides - Chiliagon
6 Sides - Hexagon	14 Sides - Tetradecagon	40 Sides - Tetracontagon	10,000 Sides - Myriagon
7 Sides - Heptagon	15 Sides - Pentadecagon	50 Sides - Pentacontagon	1,000,000 Sides - Megagon
8 Sides - Octagon	16 Sides - Hexadecagon	60 Sides - Hexacontagon	Infinite - Apeirogon

2D Area

Square **a^2** a = height	**Rectangle** **ab** a = length b = height	**Parallelogram** **bh** b = width h = height	**Trapezoid** **$h/2\ (b1 + b2)$** h = height b1 = long side b2 = short side	**Circle** **πr^2** r = radius	**Ellipse** **$\pi\ r1\ r2$** r1 = long radius r2 = short radius
Triangle **(½b) h** b = the base side h = height	**Equilateral Triangle** **$\sqrt{3}/4\ (a^2)$** $\sqrt{3}/4$ = 0.433012701… a = any side	**Rhombus** **D d / 2** D = Large Diagonal d = Small Diagonal	**Regular Polygon** **(P / 2) a** P = Perimeter a = apothem		

2D Perimeter

Square **4s** s = side	**Rectangle** **2l + 2w** l = length w = width	**Triangle** **a + b + c**	**Circle (Circumference)** **$2\pi r$ or πd** d = diameter		

Oval/Ellipse Perimeter (Circumference) This row finds the circumference of an oval which is useful when finding the amount of material needed to drape over a hooped swag. This formula is only an approximation as the true formula would take much more calculating.	**Approximate Formula** P = 4 x (a + b) x (0.78539816339) Centre to Long Side: a Centre to Short Side: b	I have swapped out ($\pi \div 4$) with the 0.78… number in the previous cell to save a calculation.

3D Shapes

Tetrahedron Faces - 4 Face Shape - Triangle Edges - 6 Vertices - 4	**Hexahedron (Cube)** Faces - 6 Face Shape - Square Edges - 12 Vertices - 8	**Octahedron** Faces - 8 Face Shape - Triangle Edges - 12 Vertices - 6	**Dodecahedron** Faces - 12 Face Shape - Hexagon Edges - 30 Vertices - 20	**Icosahedron** Faces - 20 Face Shape - Triangle Edges - 30 Vertices - 12	

Triangles	• **Equilateral:** All three sides are equal • **Isosceles:** Two sides are equal • **Scalene:** All sides are different	• **Angle - Acute:** All angles are acute • **Angle - Obtuse:** One angle is obtuse • **Angle - Right:** One angle is right	

3D Surface Area

Cube **$6s^2$** s = side length	**Rectangular Prism** **2(lw + lh + wh)** l = length w = width h = height	**Prism** **2 x b + p x h** b = area of base p = perimeter of base h = height	**Cylinder** **$2\pi r\ (r + h)$** r = radius h = height	**Hollow Cylinder** **$2\pi rh + 2\pi Rh + 2(\pi R^2 - \pi r^2)$** R = radius of the outer r = radius of the inner h = height	**Cone** **$\pi r\ (r + s)$** r = radius h = height
Pyramid **ph / 2 + b** p = perimeter of the base h = the length of the slanted edge b = area of base	**Sphere** **$4\pi r^2$** r = radius	**Hemisphere** **$3\pi r^2$** r = radius			

3D Volume

Cube **s^3** s = side length	**Rectangular Prism** **l w h** l = length w = width h = height	**Prism** **b h** b = area of base h = height	**Cylinder** **$\pi\ r^2\ h$** r = radius h = height	**Hollow Cylinder** **$\pi h(R^2 - r^2)$** R = radius of the outer r = radius of the inner	**Cone** **$1/3\ \pi r^2\ h$** r = radius h = height
Pyramid **1/3 bh** b = area of base h = height	**Sphere** **$4/3\ \pi r^3$** r = radius	**Hemisphere** **$2/3\ \pi r^3$** r = radius	**Ellipsoid** **$4/3\ \pi\ a\ b\ c$** a = radius 1 b = radius 2 c = radius 3		

5 Other Functions

Algebra	• **Line Slope:** (y2 - y1) / (x2 - x1) • **Points Midpoint:** (x1 + x2) / 2 x (yz + y2) / 2 • **Point Distance:** sqrt((x2-x1)² + (y2-y1)²) • **Pythagorean Theorem:** $a^2 + b^2 = c^2$ • **Internal Triangle Angles** = 180°		
Statistics	• Speed = Distance / Time • Probability = Desired Outcomes / Possible Outcomes		
Percentages	• **% of Number:** n (x / 100) • **% of x into y:** (100x) / y • **What no n is x % of:** (100n) / x • **Percent to Fraction:** x% = x / 100		

Trigonometry

SOH CAH TOA
A helpful mnemonic for remembering the definitions of the trigonometric functions sine, cosine, and tangent.

Sine = Opposite / Hypotenuse
Opposite = the side of the triangle directly opposite the angle Θ
Hypotenuse = the longest side of the triangle

	Cosine = Adjacent / Hypotenuse Adjacent = the side of the triangle nearest the angle Θ (that creates the angle) that is not the hypotenuse Hypotenuse = the longest side of the triangle
	Tangent = Opposite / Adjacent Opposite = the side of the triangle directly opposite the angle Θ Adjacent = the side of the triangle nearest the angle Θ (that creates the angle) that is not the hypotenuse
	• Cosecant Θ = Hypotenuse / Opposite • Secant Θ = Hypotenuse / Adjacent • Cotangent Θ = Adjacent / Opposite • Sin^2 Θ + Cos^2 Θ = 1 • Sin Θ / Cos Θ = Tan Θ

Angle Relationships	sin(−a)=−sin a cos(−a)=cos a tan(−a)=−tan a sin(π−a)=sin a cos(π−a)=−cos a tan(π−a)=−tan a	sin(π+a)=−sina cos(π+a)=−cosa tan(π+a)=tana sin(π÷2−a) = cos a cos(π÷2−a) = sin a tan(π÷2−a) = 1÷ tan a	sin(π÷2+a)=cos a cos(π÷2+a)=−sin a tan(π÷2+a)=−1÷tan a sin(3π÷2−a)=−cos a cos(3π÷2−a)=−sin a tan(3π÷2−a)=1÷tan a	sin(3π÷2+a)=−cos a cos(3π÷2+a)=sin a tan(3π÷2+a)=−1÷tan a	
Formulas	**Sum Formulas** • sin(a + b) = sin a × cos b + sin b × cos a • cos(a + b) = cos a × cos b − sin a × sin b • tan(a + b) = (tana + tan b) ÷ (1 − tan a × tan b)		**Difference Formulas** • sin(a − b) = sin a × cos b − sin b × cos a • cos(a − b) = cos a × cos b + sin a × sin b • tan(a − b) = (tan a − tan b) ÷ (1 + tan a × tan b)		**Double Angle Formulas** • sin(2a) = 2 × sin a × cos a • cos(2a) = cos^2 a − sin^2 a • tan(2a) = (2 × tan a) ÷ (1 − tan^2 a)

Other

Geometry	**Euler's Polyhedral Formula** F + V = E + 2 F: Face V: Vertex E: Edge	**Sum of interior angles of a regular polygon** Si = (n − 2) × 180° n: Number of sides			
Consumer Math	• **Discount:** Price x Discount Rate • **Sale Price:** Price - Discount • **Discount Rate:** Discount / Price		• **Interest:** Principal x Interest Rate x Time • **Tips:** Cost x Tip Rate • **Commission:** Cost x Commission Rate		

Programming Functions

A function is a unit of code that is often defined by its role within a greater code structure. Specifically, a function contains a unit of code that works on various inputs, many of which are variables, and produces concrete results involving changes to variable values or actual operations based on the inputs.

3 Dictionary

This is the dictionary of most of the terms used in this document. Your best bet to find what you're looking for is by using 'Ctrl+F' on PCs or the built-in search function on any mobile PDF reader you're using. If you search from this point in the document on, you will almost only get dictionary results - unless you search from the top again. This is an intended feature so you don't get usage of the terms rather than the definition of it.

Animal Husbandry

Parturition	Act of giving birth.
Alpha Animal	The animal that ranks highest in its social group.
Aphagia	Unable to eat, due either to physical or neurological conditions.
Artificial Insemination	Placing semen into the female reproductive tract (usually the cervix or uterus) by means other than natural intromission. (also referred to as “service” or “cover”)
Autonomous	A species living or conducting itself completely independent of others: self-determining, subject to its own laws. When applied to the consideration of animals and their relationship to humans - are the animals free from dependence on humans for well-being? If so, they are autonomous.
Barrow	A young castrated male pig.
Battery Cages	Cages for housing of egg-laying chickens. The cages have water sources and feeders. Battery cages usually are placed on top of each other in such a way that there is a roof to prevent excretions from falling on birds below. The number of hens housed in each cage depends on its size and specified guidelines for space allowance.
Beak Trimming	Removal by laser or hot knife of the distal portion (tip) of the beak in chicks. This is done in some operations to reduce injuries from pecking by other birds.
Crate	A pen area that allows lying down and standing up but prevents the animal from turning around or leaving the crate. Gestation crates house pregnant sows (female pigs). Farrowing crates house sows near and after giving birth to off-spring (piglets). Veal crates are used to house some young diary calves being raised for the purpose of producing veal.
Declawing	Surgical removal of claws and last (most distal) bones of the toes of cats but has been used for other animals at times.
Dehorning	Removal of horns or horn buds of calves and goat kids.
Estrus	Period of sexual receptivity of females of several species and preparatory for mating activity. Sometimes called “heat.”
Ethology	The study of animal behavior.
Farrowing	The process of giving birth (parturition) in swine.
Feticide	Male harassment of pregnant females carrying the fetus of another male, apparently to cause abortion. Has been observed in wild or feral horses.

Fight/Flight Distance	Distance at which an organism will have a response (normally behavioral) upon the approach of another organism or object.
Gene Pharming	The use of transgenic animals (and sometimes plants) to produce medicines or other pharmaceutical products.
Gestation	Time elapsing from conception until birth.
Infanticide	Killing of young of the same species. An example would be a male bear killing cubs of a female. This will cause the female to come back into reproductive receptivity or estrus. Also seen with feral cats.
Kainism	Killing siblings.
Matriarch	A predominant female in a social hierarchy.
Non-Ambulatory Disabled Cattle	Cattle that cannot rise from a recumbent position or cannot walk, including, but not limited to, those with broken appendages, severed tendons or ligaments, nerve paralysis, fractured vertebral column or metabolic conditions.
Roughage	Feed that is high in fiber, low in digestible nutrients, and low in energy (e.g., hay, straw, silage, and pasture).
Sapience	Awareness of being aware that comes with sentience.
Speciesism	Placing the interest of one chosen species above the interests of another species.
Tail Biting	Mouthing, chewing, or rigorous biting of the tails of other pigs. Tail biting can lead to injury and death.
Veal	Meat from very young cattle (under 3 months of age). Veal typically comes from dairy bull calves.
Vivisection	Act of operating or experimenting on living animals.
Zoonosis	Animal disease (bacterial, fungal, parasitic, viral, or prion) transmissible to humans. Examples include tuberculosis and rabies.
Zoophobia	An excessive fear of animals by humans.

Animals

Aging	Process of determining time lapse since sign was made, taking into consideration vegetation damage, rain, sun, and other natural elements.
Backing	Walking, usually across a road or natural barrier, in a backward motion, generally in an attempt to camouflage track by an incorrect direction of travel.
Broken Twigs	Small particles or twigs, which are uniquely broken in such a way as to indicate damage from human footwear.
Bruising	Footfall damage to vegetation.
Brushing Out	Using a branch, grass, or clothing article, in an attempt to brush or erase tracks from an area.
Compressed Areas	Areas of ground surface compressed in a manner which give an indication of human footfalls.
Continuity of Sign	The evidence of footfalls in proper sequence along a line of sign, generally unidentifiable.
Counter-tracking	Countering a tracker's efforts to track you.
Crying	The natural weeping of vegetation fluids resulting from footfall damage.
Cutting for Sign	An operation used principally along natural barriers to locate human sign.
Deception (Camouflage)	Attempting to confuse, disguise or conceal sign by walking backward, brushing out, or other means. To deceive or confuse direction of travel, number of persons, or presence of sign.
False Trails	Leaving a good trail, or sign, into a poor sign area, then departing on another route.
Flagged	Leaves or grass turned in direction of travel, showing the underside surfaces.
Flankers	The two members to the right and left, behind a point person, who make up a tracking team.
Grass Trail	The bending, intertwining of grass or brush indicating human passage.
Heel Marks	The curved mark or depression on the ground surface made by the walking motion of the heel portion of the shoes.
Healing	A process with live vegetation in which human damage is repaired. Used to age sign.
Inventing Sign	Seeing sign that is not present, usually because of fatigue and/or a "need" to see it. To fabricate within the "mind's eye."
Light Angle	The correct angle for seeing sign utilizing the primary light source.
Line of Sign	The continuity of sign evidencing human passage.
Littering	Scattered debris, rubbish, or human feces that are sign of human presence.
Natural Barriers	Areas such as streams, banks, and roads, which generally interrupt human passage, and show sign well.
Place Last Seen (PLS)	Place where witness or evidence indicates the subject was last seen.
Perimeter Cut	A sign cut method of limiting a search area, or locating sign along natural barriers.
Point Person	The principal tracking person who is in front of other team members and generally (on the ground) identifying each footprint step-by-step.
Prime Sign Area	The area of correct size and location in relation to other sign, in which the next print should be located.
Sand Trap	Dirt areas, occurring naturally or man-made, which, by their nature, show sign well.
Scuff Mark	The mark or sign caused by footgear contacting the ground surface.
Shine	The light reflection from human footfall damage or compression.
Sign	Evidence of a person's passage.
Sign Cutting	The skill of locating, following and identifying evidence of human passage.
Sign Cutting Stick	A stick, or other suitable object, used as a sign cut aid for measuring, marking, and locating prime sign areas.
Signature Track	Footprint evidence clearly displaying unique characteristics so as to be unmistakably identifiable.
Stride	Sign cut measurement from tip of toe of one normal walking step to back of heel of the next successive step.
Toe Digs	The indented mark or sign left in a normal walking motion when one foot propels the body forward.
Tracking Team	Ideally, a three-person team, each with specific functions, following a line of sign.
Transfer	The evidence of dirt or debris being carried by footgear and re-deposited on succeeding footfalls.

Backpacks

MOLLE	MOLLE stands for Modular Lightweight Load-carrying Equipment and it is a convenient system invented by the military for Bugging Out. It replaced the ALICE system.
Base Weight	The weight of your backpack plus all the gear that's inside it, but not counting consumables like food, water and fuel. Your Base Weight is mostly determined by your "Big 3" items: sleeping bag, backpack and shelter. Most backpackers should shoot for a Base Weight of 15-20lbs. Ultralight backpackers have a Base Weight of 10-12lbs or less.

Bivy Sack (or Bivvy Sack)	A waterproof sack that goes over your sleeping bag to add warmth and protection from the elements. Some hikers carry them as an emergency shelter, while others hikers may use it as their primary shelter, or to add more protection and warmth to another tarp shelter.
Hump	To begrudgingly carry an excessively heavy load. It's often the responsibility of the guide or leader of a group to carry a ton of extra group gear that they wouldn't normally take. Climbers also often have to Hump in their entire gear rack until they get to the base of their climb.
Slackpacking	Carrying a minimal load of food, water and gear, usually because someone else in your group is Humping everything else, or because you're planning to stay in Huts along your route.
The Big Three (or 3)	The three most essential pieces of gear that any backpacker carries: sleeping bag, backpack and shelter. These items also tend to be the heaviest, so those looking to go Ultralight often look to these 3 items to cut the most from their Base Weight.
UL (or Ultralight)	The goal of going Ultralight is to carry a Base Weight of less than 10-12lbs. There are many reasons for going Ultralight and most of them boil down to the fact that you can hike farther, faster, and see more without getting as tired and with less chance of injury. The trade-off with carrying less gear is that you need more experience and skills (which weigh nothing).
Binding	Binding occurs in the inside of a backpack as a way to sew and attach different parts of the bag together, like the lining and inner compartments with a bag's outer shell.
Buckles	Buckles are used in a backpack that has a shoulder harness or sternum strap as a way to connect the harness to the strap.
D Ring	A D Ring is a part of a zipper puller, it refers to the "D" shaped piece that connects the zipper teeth to the puller and can be made in metal or plastic with a variety of color and aesthetic finishings.
Hip Padding	Padding that extends from the back of the backpack and straps in the front. Similar to the sternum strap and shoulder harness, hip padding is most commonly seen in outdoor and travel backpacks for weight distribution.
Lining	The lining in a backpack refers to the material that's used inside a backpack's compartments. These can vary depending on the bag's shape, price, and construction, but typically
Padded Shoulder Strap	A padded shoulder strap is when a strap has extra cushioning or support in the form of a padded material like foam (like EPE or EVA) or mesh as opposed to a strap only containing a singular material type.
Shoulder Harness	Upper section of the backpack straps that provides shoulder support. Commonly seen in outdoor backpacks or travel backpacks that require reduced weight load on the shoulders, but less seen in everyday or work backpacks.
Sternum Strap	A strap that extends across your chest when the backpack is worn. Similar to a shoulder harness, it's most commonly seen in larger backpacks for outdoors and travel.
Stitching	Stitching occurs throughout a backpack from the outer straps and materials to the inner main compartments. Some backpacks require different stitching methods from bar-tacking for extra durability and strength to leather backpacks that require more stitches per inch than a backpack made from a woven material like nylon or canvas.
Strap	A piece of woven fabric that connects the top to the back of the backpack that's made to fit around your shoulders. They can be made from different types of materials and commonly feature the same material as a bag's outer shell.
Strap Adjuster / Tri-Glide	A strap adjuster, also known as tri-glide, is a plastic or metal piece that is connected to a backpack's strap and allows for adjustment of a bag's webbing to change the height of how high or low a backpack lies on your back.
Trims	Trims are commonly seen in bags that feature leather and are used as an aesthetic detail inside a bag's compartments or on the outer facing areas like straps or pockets.
Water Bottle Pocket	A water bottle pocket can be found on the outside or inside of a backpack for storing water bottles. An outer pocket allows for easy, quick access on the go.
Webbing	Webbing in a backpack is a piece of woven material (often a type of nylon) that connects the bottom of a backpack's strap to the bottom base of a backpack. The webbing can be adjusted via a strap adjuster for changing how high or low the bag sits on your back.
Zipper	Metal or plastic piece that allows for the opening and closing of a bag or a bag's internal compartments. Zippers commonly come in either metal or nylon material and can also be made to be waterproof or finished with different color options (learn more about the history of the zipper).
Zipper Pullers	While a zipper refers to the entire zipper from the teeth to the puller, a zipper puller itself is the part of a zipper that one is able to grab to open and close a zipper's teeth. A zipper puller can be made from plastic, metal, or a range of materials including real leather and vegan leather.
Clamshell Opening	Backpack opens like a clamshell. Three sides can be upzipped, leaving one side to act like a hinge. Another name for this is suit-case style opening since the panel can lay flat. You'll most often see this on travel bags or backpacks of larger capacity.
Splayed Opening	Very similar to clamshell/suitcase openings except that they may not necessary open all the way. You'll see this often in techy backpacks—the splayed opening allows you to open a hard-shelled backpack. Some backpacks have a splayed opening that can be converted to clamshell.
Roll-Top Opening	Are tops that… roll down. Once rolled, these openings are usually held down by buckles or hooks on both sides. The benefit of these are that they allow you to expand the volume of the backpack upwards and are also more effective at keeping water out than zippers. Hence camping dry sacks are roll-tops. On the downside, they are not as convenient to open and close as zippers.
Drawstring Tops (or cinch cord)	Are tightened via a string that can be clamped to hold the opening closed. These are common in large trekking backpacks because they can open very wide to allow you to fit large items like tents and sleeping bags inside. They're often accompanied by a lid.
Lid	A cap that sits on the top of the backpack. Many trekking backpacks have this as a floating lid that provide a cap over drawstring openings to keep water out and are buckled down. Smaller backpacks with lids often use zippers instead.
Central Zipper	Some newer bags have a more unique design with zippers that open down the middle of the backpack's front face. This reduces the amount you need to unzip and opens up the bottom of the bag, allowing you to access contents near the bottom.
Kangaroo Pockets	Are elastic pouches that are frequently seen on the front face of hiking backpacks. They usually aren't secured by zippers or other hardware but are a really easy and quick place to stow small items or relatively flat items like a shovel. They're often stretchy so jackets can also be stowed there.

ADDENDUM Backpacks

Hydration Sleeve	Hold water bladders or pouches and are usually accompanied by some sort of port that allows you to thread the bladder's tube out of the bag and a clip on the shoulder strap to hold it in place.
Tech Sleeves / Laptop Sleeves	Hold modern electrical devices. One thing to look out for in the laptop sleeves is whether or not the laptop will have any padding on the bottom of the bag or if it's suspended from the bottom.
Load-Lifter Straps	(or sometimes called stabilizer) Relieve your shoulders from some of the weight of the backpack by bringing the bag forward to bring the center of mass inward.
Sternum Straps	Help disburse the weight of the backpack off your shoulders a little bit, but not very much. It's main purpose is to prevent the shoulder straps from sliding off your arms when moving around and to tug them inward a bit so your arms can move freely.
Additional Stabilizer Straps	Sometimes found on the waist belt. Similar to the load-lifter straps, these straps pull the backpack closer to you (in this case they pull the bottom of the back closer to your butt) to improve balance by bringing the center of gravity closer to where it would naturally be if you weren't wearing a backpack.
Pig Snout (lash point)	Those square/diamond-shaped patches with two-slits in them? They have a purpose! These are lash points and allow you to tie items to the outside of your backpack or hook up a carabiner. Remind you of a certain animal's nose?
Grab Handles / Haul Straps	Typically, a backpack will have some sort of handle at the top between the shoulder straps. These grab handles range from a simple layer of nylon webbing to fully-padded grips. Larger bags with more features may also have multiple grab handles around the other sides of the bag.
Compression Straps	Help reduce the size of your bag when it's not fully packed and minimize your bag's appearance. They're also useful lash points to attach/hold gear and are most typically on the sides of the bag, but can also be found on the bottom.
Gear Loops	Outdoorsy packs often have loops on the front face that allow you to strap in items like trekking poles, axes, shovels, or picks. To use the loop for axes and picks, drop the handle all the way through the loop and rotate the handle upward to be secured by the elastic hook at the top of the bag.
Lumbar Padding	Large trekking bags will often also have some sort of lumbar padding for your lower back. This point is where a lot of the weight of the pack might sit or rub against your body.
Air Flow Channels	Help ventilate your back and delay the onset of your sweaty mess. The ridges are typically shaped to try to balance comfort with airflow and also reduce the surface area of your back against the backpack. In hot weather, though, they won't be able to prevent your back from getting sweaty. But at least they'll delay it.
Daisy Chains	Are a number of webbing loops sewn in a linear series that are basically a whole bunch of lash points lined up. Useful for attaching small items when you're hiking.
MOLLE system / PALS	Like daisy chains, but on steroids. MOLLE is an acronym for modular lightweight load-carrying equipment and allows users to attached gear to an array of nylon webbing. These rows of webbing are called PALS (pouch attachment ladder system). MOLLE systems are a standard for tactical gear and are used by the current generation of backpacks used by the US Army and many other NATO armed forces.
Tie Out Loops	Can be used in place of daisy chains and are essentially a few tiny loops stitched around the perimeter of the bag. These loops can be used as attachment points for elastic cords or twine to hold gear and add virtually no weight to the bag.
Pass-Through / Eyelet / Hydration Port	All names for what is essentially a small hole in a backpack. They're intended to allow you to pass a cable, wire, or tube through the fabric of the backpack and can be seen with a variety of uses (e.g., tubes for water bladders or cables for headphones).
Rain Fly	Since some backpacks are not as water resistant as others, they may come with a rain fly. These rain ponchos for backpacks just provide an extra layer of protection from the elements. Some backpacks come with them included or attached, but you can also buy them separately.
Luggage Strap / Pass-Through	Travel backpacks usually have a wide strap on the back panel that allows you to attach it to the handle of a rolling luggage. It's a very convenient feature, but just be careful if you're using a large backpack. It may outweigh a small rolling luggage and cause it to tip forward if you try to stand it up.
Zipper Teeth	The small ridges that interlock to form a sealed chain.
Zipper Chain	The continuous piece formed when the two halves of teeth are interlocked.
Zipper Sliders	The device that moves up and down the chain to open and close the zipper.
Zipper Pull Tab	The "handle" that's used to pull the zipper up and down, often with an extension tied to it for easier use.
Zipper Tape	The fabric on the sides of the teeth and chain.
Zipper Stops	The parts at the top and bottom that prevent the zipper from sliding off the chain.
Zipper Garage	A covering at the end of zipper where the slider can be parked to prevent water from leaking through the slider.
Zipper Aqua Guard	A design that uses a polyurethane laminated tape that is more water resistant than traditional fabrics to improve the water-resistance of the zipper.
Hooks (G-hooks)	Around backpacks, you might also find various hooks, often in the shape of a "G". These have a variety of uses, but can be used on compression straps, for attachments like nets (e.g., the helmet net on the NYA-EVO), or even closing mechanisms like the Lander. The problem with G-hooks is that how well the operate often depends on how tightly the hooks fit into the loops.
Buckles	Are the hardware pieces that fasten together (e.g., on hip belts and sternum straps). They're usually made of plastic but you might occasionally see metals ones too, often something lightweight like aluminum.
Adjusters	Are what we call the hardware pieces used to adjust the length of the straps. They usually also have a tab that you can pull outward to make it easier to loosen the straps.
Magnets	Magnets are incorporated into buckles and lid flaps. Look for Fidlock components. They make smooth magnetic buckles that are just addictive to play with.
Frame	Many backpacks feature a frame to provide structural support and give the bags a consistent shape. Most frames are internal and can be either a a stiff tube that follows the perimeter of the bag or a sheet frame that's usually buried inside the back panel. External frames usually sit further away from your torso and while they increase the air ventilation against your back, but tend to be more top-heavy.

Barter

Barter	In trade, a system of exchange in which participants in a transaction directly exchange goods or services for other goods or services without using a medium of exchange, such as money. Economists distinguish barter from gift economies in many ways; barter, for example, features immediate reciprocal exchange that is not delayed in time. In most developed countries, barter usually only exists parallel to monetary systems to a very limited extent. Market actors use barter as a replacement for money as the method of exchange in times of monetary crisis, such as when currency becomes unstable (e.g. by hyperinflation or a deflationary spiral) or simply unavailable for conducting commerce.
Trade Dollars	The medium of exchange used between trade exchange members in place of cash in a non- reciprocal trade transaction. The IRS values a trade dollar the same as a U.S. Dollar.
Organized Barter	Networks that utilize a common medium of exchange.
Reciprocal Trade	A trade where two parties exchange products or services of equivalent values.
Non-Reciprocal Trade	An indirect exchange between two or more parties, usually accomplished through a third-party broker.
Cost of Goods	The direct cost required to replace that which is sold.
Cost of Trade Dollars	The direct cash cost incurred to use one trade dollar, usually the company's own wholesale cost of goods.
Wholesale Buying Power	The ability through trade to sell products or services to new customers at a price higher than the price paid for the product or service traded and therefore to receive in return a product or service of greater value than the cash dollar costs in the item originally traded.
Barter Leverage	The difference between the cash dollar amount invested in a product or service traded and the value received in the trade.
Deficit	Spending more trade dollars than you have earned, therefore having a negative trade balance. See IRTA's Advisory Memo on Deficits.
Arbitrage	The practice of taking advantage of a price difference between two or more markets by striking a combination of matching deals that capitalize upon the imbalance, with the profit being the difference between the market prices.
Trade	The cashless exchange or goods and services.

Blacksmithing

Forge	The setup for burning coal at a very high temperature in order to heat metal to a temperature that makes it malleable. A forge, if indoors or partially enclosed will have some kind of vent set up to guide the smoke and ash away from the blacksmith. And a forge has some kind of a blower that will blow air onto the hot coals (from underneath). This flow of air will raise the temperature of the coals.
Anvil	A large metal object that a blacksmith uses to hammer on.
Hardy Hole	This is a hole in the top of the anvil that you can insert tools into. These tools are called Hardy Tools. And they come in a wide variety of shapes and sizes. These hardy holes vary in size depending on the size of the anvil.
Borax	This is a commonly available cleaning compound that comes in powder form. It is used by blacksmiths as a flux to help in the process of forge welding.
Pritchel Hole	A round hole on the top surface of the anvil that is used as a punch so you can punch holes through metal.
Drawing Out	Extending the length of a piece of metal. This is done by heating and hammering.
Forging	The art and skill of heating metal and hammering it into shape and form.
Forge Welding	Heating two or more pieces of metal to the melting point where they will be joined together into a single piece of metal. They become homogenous.
Farrier	A blacksmith who specializes is shoeing horses and oxen.
Annealing	The process of heating up a metal so it is softer and malleable, able to be worked on the forge. Typically this is about 2/3rds of the melting point of the metal. With steel it is 50F above the temperature of final ferrite stability.
Bolster	A small piece of metal or wood on a knife where the blade meets the handle. The picture above shows a bolster.
Fuller	A groove down the length of a blade and usually on both sides. It makes the blade lighter and stronger with less whipping action upon swinging. The picture above shows a fuller in a Japanese Katana.
Scale	This is a layer of oxides that forms a black coating on the steel as it is heated. Hammering the steel breaks this off in flakes and it is easily brushed off with a wire brush.
Scarf Welding	This is a technique of welding two pieces of metal together where the joint is angular.
Butt Welding	The Parts are butted together
Lap Welding	The Parts are overlapped.

Camp Craft

Communication

RACES	Radio Amateur Civil Emergency Services
REACT	Radio Emergency Associated Communications Teams
ADSL	Asymmetric Digital Subscriber Line: A method for moving data over regular phone lines. An ADSL circuit carries much more data than a modem can encode on a regular phone connection. ADSL rides on the regular phone wires coming into the subscriber's premises (twisted pair copper).
AM	Amplitude Modulation: A modulation method in which the carrier amplitude changes with the input signal amplitude.
Bandwidth	1. Bandwidth (BW) is a range of frequencies, or information, that a circuit can handle or the range of frequencies that a signal contains or occupies. Example: An AM broadcast radio channel in the US has a bandwidth of 10kHz, meaning that it occupies a 10kHz-wide band, such as the frequencies from 760kHz to 770kHz.
Base Station	A base station (or basestation) is a wireless transceiver at a fixed location (e.g. atop a telephone pole) which is part of a wireless communications network, e.g. the cell phone network. Typically, the base station connects to any cell phones in its area and relays the calls to the wired network. A femto base station is a smaller, personal base station which might cover a home or building and connect via a DSL Internet connection.

Bluetooth	A technology that allows voice and data connections between a wide range of mobile and stationary devices through short-range digital two-way radio. For instance, it specifies how mobile phones, Wireless Information Devices (WIDs), computers and PDAs interconnect with each other, with computers, and with office or home phones.
Broadband	A transmission medium with enough bandwidth to carry multiple voice, video, or data channels simultaneously. This technique is used, for example, to provide fifty CATV channels on one coaxial cable; or to provide Internet access over cable TV; or to add DSL to a voice-grade telephone line.
CAT3	Category 3: Refers to Ethernet cabling that satisfies the criteria for the EIA/TIA-568 standard's Category 3, which allows data transfers up to 10Mbps.
CAT5	Category 5: Refers to Ethernet cabling that satisfies the criteria for the EIA/TIA-568 standard's Category 5, which allows data transfers up to 100Mbps.
DBS	Direct Broadcast Satellite: A system which broadcasts directly from satellite to the subscriber (end user). Prominent examples in the US are DirecTV and Dish network.
Class A	The simplest type of amplifier, class A amplifiers are those in which the output transistors conduct (i.e. do not fully turn off) irrespective of the output signal waveform. This type of amplifier is typically associated with high linearity but low efficiency.
Class AB	Class AB amplifiers combine Class A and Class B to achieve an amplifier with more efficiency than Class A but with lower distortion than class B. This is achieved by biasing both transistors so they conduct when the signal is close to zero (the point where class B amplifiers introduce non-linearities). The transistors transition to class B operation for large excursions.
Class B	Class B amplifiers are those in which the output transistors only conduct during half (180 degrees) of the signal waveform. To amplify the entire signal two transistors are used, one conducting for positive output signals and the other conducting for negative outputs. Class B amplifiers are much more efficient than class A amplifiers, but have high distortion due to the crossover point when the two transistors transition from on to off.
Class C	A class C amplifier is a form of switching amplifier in which the transistors are on for less than a half cycle (less than 180 degrees) -- often, much less. For instance, the transistor may be on only during the top 10% of the signal excursion, delivering just a pulse. Class C amps are very efficient because the transistors are off most of the time and when they are on, they are in full conduction. They deliver high distortion and are often used in RF circuits, where tuning circuits restore some of the original signal and reduce distortion. They are also used in low-fidelity applications where the distortion is not important, such as a siren speaker driver.
Class D	Class D amplifiers are those that output a switching waveform, at a frequency far higher than the highest audio signal that needs to be reproduced. The low-pass filtered, average value of this waveform corresponds to the actual required audio waveform. Class D amplifiers are highly efficient (often up to 90% or higher) since the output transistors are either fully turned on or off during operation. This completely eliminates the use of the linear region of the transistor which is responsible for the inefficiency of other amplifier types. Modern Class D amplifiers achieve fidelity comparable to class AB.
Class G	Class G amplifiers are similar to class AB amplifiers except they use two or more supply voltages. When operating at low signal levels, the amplifier uses a lower supply voltage. As the signal level increases, the amplifier automatically picks the appropriate supply voltage. Class G amplifiers are more efficient than class AB amplifiers since they use the maximum supply voltage only when required, while a class AB amplifier always uses the maximum supply voltage.
Class H	Class H amplifiers modulate the supply voltage to the amplifier output devices so that it is never higher than necessary to support the signal swing. This reduces dissipation across the output devices connected to that supply and allows the amplifier to operate with an optimized class AB efficiency regardless of output power level. Class H amplifiers are generally more complex than other designs, with extra control circuitry required to predict and control the supply voltage.
Click-and-Pop	Click-and-pop refers to the unwanted transient signals in the audio band that are reproduced by the headphone and/or speaker when the audio device driving it is either: powered up (power applied) powered down (power removed) brought out of shutdown (power applied previously) forced into shutdown (power still applied)
Click/Pop Reduction	A feature that eliminates "clicks" and "pops" — unwanted transient noise signals during power-up, shutdown, connection, etc.
dB	Decibels: A method for specifying the ratio of two signals. dB = 10 times the log of the ratio of the power of the two signals. This is equal to 20 times the ratio of their voltages, if the signals are driving equal impedances.
dBm	A unit that defines a signal level by comparing it to a reference level. The reference level of 0dBm is defined as 1mW. The signal level in dBm is 10 times the log of the signal's power over that of the 0dBm reference.
DDI	Digital Data Input
Distortion	In systems that handle electrical signals, distortion is a generally unwanted change in the signal. Not all signal alterations are considered distortion. For instance, a uniform delay or a linear attenuation or amplification would generally not be considered distortion.
Dithering	A common technique to improve digitizing when quantization noise (quantization error/noise) can no longer be treated as random. A small amount of random noise is added to the analog input signal. This added noise causes the digital output to randomly toggle between two adjacent codes, thereby avoiding thresholding effect.
Diversity	In radio systems, diversity is a method of improving the reliability and capacity by using multiple communication channels to carry each signal.
DMT	Discrete Multitone data Transmission
DSL	A mechanism for providing high-speed digital communications (e.g. Internet access) over a standard phone line.
DTMF	Dual Tone Multiple Frequency (DTMF) is a signaling method developed by Bell Labs for sending telephone dialing information over the same analog, voice-quality phones lines that carry voice. Each digit is encoded as the sum of two sine wave bursts, of different frequencies. The two-tone method was chosen because it can be reliably distinguished from voice and normal phone conversations are highly unlikely to falsely trigger the DTMF receiver.
DWDM	Dense Wave Division Multiplexing: The technology by which the frequencies of light carried on a single optical fiber are subdivided into discrete wavelengths, allowing for the greater transmission of data.
Dynamic Range	The range, in dB, between the noise floor of a device and its defined maximum output level.
Ethernet	A family of network protocols based on asynchronous frames. The Ethernet framing structure provides a flexible payload container with basic addressing and error detection mechanisms.

ADDENDUM

Dictionary

Communication

GHz	Gigahertz
Gigabit	1 billion bits-per-second.
GLONASS	The Russian Global Navigation Satellite System
GPS	Global Positioning System: A satellite- based navigation system in which two or more signals, received from satellites, are used to determine the receiver's position on the globe.
GSM	Global System for Mobile Communications: A land, mobile, pan-European, digital, cellular radio-communications system.
HDTV	High-definition television: an all-digital system for transmitting a TV signal with far greater resolution than the analog standards (PAL, NTSC, and SECAM). A high-definition television set can display several resolutions, (up to two million pixels versus a common television set's 360,000). HDTV offers other advantages such as greatly improved color encoding and the loss-free reproduction inherent in digital technologies.
HSDPA	High-Speed Downlink Packet Access (HSDPA) is a 3G radio interface standard in the HSPA family for wireless and cellular handsets or datacards that increase the datarate and improve the traffic handling of existing UMTS standards.
HSPA	High-Speed Packet Access (HSPA) is a collection of radio interface standards for wireless and cellular handsets or datacards that increase the datarate and improve the traffic handling of existing UMTS standards.
Internet Protocol (IP)	Standard method for data transfer used on the Internet. Also known as IP or TCP/IP.
IR	Infrared: Light that has a frequency below the visible light spectrum, used for remote controls, line-of-sight wireless data, and night vision applications, among others.
kHz	Kilohertz
LAN	Local Area Network: A computer network, usually within one building, that connects computers, file and mail servers, storage, peripherals, and other devices in a way that permits data interchange and sharing of resources. Ethernet and WiFi (802.11) are common examples.
LOP	Loss of power
LOS	Loss of signal
mA	Milliampere, or milliamp: 1/1000 of an Ampere. Ampere is the basic unit for measuring electrical current.
MHz	Megahertz (MHz): Measurement of frequency -- million cycles per second.
NTSC	NTSC is the color television standard established by the National Television Standards Committee in the United States in 1953. The NTSC standard's distinguishing feature was that it added color to the original 1941 black and white television standard in such a way that black and white TVs continued to work.
PAL	Phase alternate line: A television standard used in most of Europe. Similar to NTSC, but uses subcarrier phase alternation to reduce the sensitivity to phase errors that would be displayed as color errors. Commonly used with 626-line, 50Hz scanning systems, with a subcarrier frequency of 4.43362MHz.
Receiver	A circuit that accepts signals from a transmission medium (which can be wireless or wired) and decodes or translates them into a form that can drive local circuits.
RF	Radio Frequency: An AC signal of high enough frequency to be used for wireless communications.
RFI	Radio Frequency Interference: Unwanted noise from RF sources.
SDTV	Standard Definition Television: Digital formats that do not achieve the video quality of HDTV, but are at least equal, or superior to, NTSC pictures. SDTV may have either 4:3 or 16:9 aspect ratios, and includes surround sound. Variations of fps (frames per second), lines of resolution, and other factors of 480p and 480i make up the 12 SDTV formats in the ATSC standard.
T1	T1 is standard for digital transmission in the United States. It is a digital transmission link with a capacity of 1.544Mbps. T1 uses two pairs of normal twisted wires, the same as found in most residences. T1 normally handles 24 voice conversations, each one digitized at 64kbps. With more advanced digital voice encoding techniques, T1 can handle more voice channels.
T3	A type of data connection capable of transmitting a digital signal at 44Mbps. T3 lines are often used to link large computer networks, such as those that comprise the Internet.
TCP/IP	Transmission Control Protocol/Internet Protocol: The protocols or conventions that computers use to communicate over the Internet.
Television	A system for transmitting picture and sound over a distance, primarily via the standards for NTSC, PAL, or HDTV.
Transceiver	A device that contains both a transmitter and receiver. Common misspellings: Transciever, Tranceiver, Transeiver, Transiever, Tranciever, Transcever.
Transfer	Transfer refers to the amount of data transferred across a digital interface, exclusive of any extra bits used to encode the data. The number of data transfers is less than the number of bits transmitted when encoded data has more bits than the raw data. As an example, a PCIe serial bus uses 10 bits to encode eight data bits.
Transmitter	A circuit that accepts signals or data in and translates them into a form that can be sent across a medium (transmitted), usually over a distance. The medium can be wireless or wired.
Tx	Transmit
UWB	Ultra-Wideband (UWB) is a communications technology that employs a wide bandwidth (typically defined as greater than 20% of the center frequency or 500MHz). UWB is usually used in short-range wireless applications but can be sent over wires. Ultra-Wideband advantages are that it can carry high data rates with low power and little interference.
VLF	Very-low frequency
VoIP	Voice over Internet Protocol: Method for transmission of voice (or fax) calls over the Internet.
VU	Volume unit
WAN	Wide Area Network: Any Internet or network that covers an area larger than a single building.
WHDI	WHDI (Wireless Home Digital Interface) is a standard that enables wireless delivery of uncompressed HDTV throughout the home with video rates of up to 1080p in the 5GHz unlicensed band.
Wideband	A classification of the information capacity or bandwidth of a communication channel. Wideband is generally understood to mean a bandwidth between 64kbits/s and 2Mbit/s.
Wireless	Radio-frequency devices, circuits, or communications methods.
WLAN	Wireless Local Area Network
Rx	Receive
FM	Frequency Modulation: A modulation method in which the carrier frequency changes with the input signal amplitude.

Analogue	Analogue is a conventional method of transmitting data. Standard landline telephones use analogue technology. It is distinct from digital technology, which provides for greater quality and speed of data transmission.
Download	Downloading is the method by which users access and save or "pull down" software or other files to their own computers from a remote computer via the Internet.
Encryption	Encryption is the process of converting electronic data to an unrecognisable or encrypted form, one that cannot be easily understood by unauthorised parties.
FTP	File transfer protocol (FTP) is a common method of transferring files via the internet from one host to another host.
Internet	A set of interconnected networks that allow computers in different locations to exchange information. The Internet includes services such as the world wide web, electronic mail, file transfer protocol (FTP), chat and remote access to networks and computers.
Intranet	An intranet is basically a private, internal internet specific to an organisation or group.
Modem	A modem is a device that allows computers to transmit information to each other via ordinary telephone lines.
Phishing	Phishing is a type of email fraud in which the perpetrator sends out emails that appear to come from a legitimate service or reputable company, such as a bank or an email service provider. These emails aim to lure recipients to reveal confidential information that the perpetrator can use for their financial advantage - for example, online banking log-in details and passwords.
Malware	Malware is short for malicious software. It refers to a software program that has been developed to do harm to other computers. Types of malware include viruses, worms and spyware.
Server	A server is a computer that handles requests for data, email, file transfers, and other network services from other computers.
Virus	A virus is a piece of programming code inserted into other programming to cause damage. Viruses can be sent in many forms but are often transmitted via email messages that, when opened, may erase data or cause damage to your hard disk. Some viruses are able to enter your email system and send themselves to other people in your list of contacts.
Wi-Fi	Wi-Fi is a technology that allows computers and other devices to communicate via a wireless signal. Essentially, it means you can browse the internet without tripping over phone cords.
WPA	Wi-Fi protected access (WPA) is a security protocol used in wi-fi networks. It is an improvement on WEP because it offers greater protection through more sophisticated data encryption.

Contents

Addendum

Symbols	"÷" or "/" means divide, "x" or "*" means multiply
Apothem	The apothem (sometimes abbreviated as apo) of a regular polygon is a line segment from the centre to the midpoint of one of its sides. Equivalently, it is the line drawn from the centre of the polygon that is perpendicular to one of its sides.
Lateral Surface	The lateral surface of an object is the area of all the sides of the object, excluding the area of its base and top.
Acute Angle	An angle less than 90°.
Adjacent	Adjacent sides are next to each other and are joined by a common vertex.
Algebra	Algebra is the branch of mathematics where symbols or letters are used to represent numbers.
Angle	An angle is formed when two straight lines cross or meet each other at a point. The size of an angle is measured by the amount one line has been turned in relation to the other.
Approximate	An approximate value is a value that is close to the actual value of a number.
Arc	Part of a circumference of a circle.
Area	The amount of space a shape takes up. E.g. the area of the lawn is 35 square metres.
Asymmetrical	A shape which has no lines of symmetry.
Average	A value to best represent a set of data. There are three types of average - the mean, the median and the mode.
Axis	An axis is one of the lines used to locate a point in a coordinate system.
Bearing	A three digit angle measured from north in a clockwise direction.
BIDMAS	A way of remembering the order in which operations are carried out. It stands for Brackets - Indices - Division - Multiplication - Addition - Subtraction.
Bisect	To divide an angle or shape exactly in half.
Brackets	Used to determine the order in which operations are carried out.
Chord	A straight line drawn from one point on the edge of a circle to another.
Circumference	The perimeter of a circle.
Coefficient	The number in front of an algebraic symbol. For example the coefficient of 5x is 5.
Congruent	If you can place a shape exactly on top of another then they are said to be congruent. You may rotate, reflex or translate the shape.
Constant	A letter or symbol whose value always stays the same. The constant Π is a common example.
Cube Number	The product when an integer is multiplied by itself twice. For example 5 cubed = 5 x 5 x 5 = 125.
Cuboid	A 3D shape with all sides made from rectangles.
Cumulative Frequency	A running total of the frequencies, added up as you go along.
Decagon	A ten sided polygon.
Decimal	Not a whole number or integer. For example, 3.6 or 0.235.
Denominator	The bottom part of a fraction.
Diameter	The distance across a circle which passes through the centre.
Difference	Subtract the smaller value from the larger value to find the difference between two numbers.

ADDENDUM Dictionary Addendum

Distribution	How data is shared or spread out.
Equal	Used to show two quantities have the same value.
Equilateral Triangle	A triangle with all sides and angles the same size.
Estimate	To find an approximate answer to a more difficult problem. E.g. 31.2 x 5.94 is roughly equal to 30 x 6 = 180.
Expand	To multiply out brackets in an expression. For example, 2(3x + 7) = 6x + 14.
Expression	A collection of terms which can contain variables (letters) and numbers. E.g. 4pq - q + 7
Factor	A number that divides another number exactly. E.g. 4 is a factor of 12.
Factorise	To put an expression into brackets by taking out a common factor. For example, 20x + 15y = 5(4x + 3y).
Figures	Another name for numbers. For example one thousand and fifty in figures is 1050.
Formula	An equation used to describe a relationship between two or more variables.
Frequency	How many times something happens. Another word for 'total'.
Frequency Density	The frequency divided by the class width.
Gradient	How steep a line is. Found by dividing the distance up by the distance across.
HCF	Stands for 'highest common factor'. It is the largest factor common to a set of numbers. E.g. The HCF of 16 and 24 is 8.
Heptagon	A seven sided polygon.
Hexagon	A six sided polygon.
Histogram	A diagram drawn with rectangles where the area is proportional to the frequency and the width is equal to the class interval.
Hypotenuse	The longest side on a right angled triangle.
Increase	To make an amount larger.
Indices	Another name for powers such as ^{2} or ^{3}.
Integer	A whole number.
Inter-quartile range (IQR)	The difference between the upper and lower quartile.
Irrational	A decimal which is never ending. It must also not be a recurring decimal.
Justify	Another word for 'explain'. Often crops up on your maths exam. E.g. 'Calculate the mean and range for each player. Who is the better player Justify your answer.'
LCM	Stands for 'lowest common multiple'. It is the smallest multiple common to a set of numbers. E.g. The LCM of 3 and 4 is 12.
Locus	A collection of points which are the same distance from another point or line.
Lower Range	The smallest value in a set of data.
Mean	A type of average found by adding up a list of numbers and dividing by how many numbers are in the list.
Median	The middle value when a list of numbers is put in order from smallest to largest. A type of average.
Mode	The most common value in a list of numbers. If two values are tied then there is two modes. If more than two values are tied then there is no mode. A type ofaverage.
Multiple	A number which is part of another number's times table. E.g. 35 is a multiple of 5.
Natural Number	A positive integer.
Negative	A value less than zero.
Nonagon	A nine sided polygon.
Numerator	The top part of a fraction.
Obtuse Angle	An angle between 90° and 180°.
Octagon	An eight sided polygon.
Operation	An action which when applied to one or more values gives an output value. The four most common operations are addition. subtraction, multiplication and division.
Parallel	Two or more lines which are always the same distance apart.
Parallelogram	A quadrilateral with two pairs of parallel sides.
Pentagon	A five sided polygon.
Perimeter	The distance around a shape.
Perpendicular	Two or more lines which meet at right angles.
Pi (Π)	An irrational constant used when calculating the area and circumference of circles. It is approximately equal to 3.14.
Polygon	A shape made from straight lines.
Positive Number	A number greater than zero.
Prime	A number which has exactly two factors. The number one and itself.
Prism	A 3D shape with the same cross section all along its length.
Probability	A measure of how likely an event is to occur.
Product	The answer when two values are multiplied together.
Quadratic Equation	An equation where the highest power is two. For example $x^2 + 4x + 6 = 0$ is a quadratic equation.
Quadrilateral	A four sided polygon.
Radius	The distance from the centre of a circle to its circumference. The plural of radius is radii.
Random Sampling	A method of choosing people at random for a survey.
Range	The largest number take away the smallest value in a set of data.
Rational	A decimal number which ends or is recurring.
Reciprocal	The reciprocal of any number is 1 divided by the number. E.g. the reciprocal of 3 is 1/3., the reciprocal of 3/4 is 4/3.
Recurring	A decimal which never ends but repeats all or parts of the sequence of numbers after the decimal point. E.g 0.333333 or 0.141414.
Reflex Angle	An angle greater than 180°.
Regular	A shape with all sides and angles the same size.
Remainder	The amount left over when a number cannot be divided exactly. For example, 21 divided by 4 is 5 remainder 1.
Right Angle	An angle of 90°.
Rotation	To turn a shape using an angle, direction and centre of rotation.
Round	To reduce the amount of significant figures or decimal places a number has. For example £178 rounded to the nearest £10 is £180.
Scale Factor	How many times larger or smaller an enlarged shape will be.

Segment	An area of a circle enclosed by a chord.
Sequence	A list of numbers which follows a pattern. For example 6, 11, 16, 21, …
Simplify	To write a sum, expression or ratio in its lowest terms. For example 4:10:6 can be simplified to 2:5:3.
Solid	A 3D shape.
Solve	To find the missing value in an equation.
Speed	How fast an object is moving. Average speed = Total distance divided by time taken.
Square Number	The product when an integer is multiplied by itself. For example, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100.
Sum	The answer when two or more values are added together.
Surface Area	To total area of all sides on a 3D shape.
Symmetrical	A shape which has at least one line of symmetry.
Tally	A system of counting where every group of four vertical lines is followed by a horizontal line to easily count in steps of five.
Tangent	A straight line that just touches a point on a curve. A tangent to a circle is perpendicular to the radius which meets the tangent.
Term	A number, variable or combination of both which forms part of an expression.
Transformation	The collective name for reflections, rotations, translations and enlargements.
Translation	To move a shape from one position to another by sliding in the x-axis followed by the y-axis.
Trapezium	A quadrilateral with one pair of parallel sides.
Tree Diagram	A method of solving probability questions by listing all the outcomes of an event. Probabilities are calculated by multiplying down the branches.
Triangle	A three sided polygon.
Triangular Number	A sequence of numbers generated by adding one more than was added to find the previous term. For example, 1, 3, 6, 10, 15, 21, …
Units	A quantity used to describe a measurement. Examples are kilograms, metres and centilitres.
Upper Range	The largest value in a set of data.
Value	A numerical amount or quantity.
Variable	A letter which we don't know the value of.
Volume	The amount an object can hold. E.g. a bottle of cola has a volume of 2 litres.
X-Axis	The horizontal axis on a graph. The line going across the page.
Y-Axis	The vertical axis on a graph. The line going from top to bottom.
Y-Intercept	The value of the y-coordinate when a graph crosses the y-axis.
Z-Axis	Represents the depth of an object when working with 3D coordinates.
Amicable Numbers	Pairs of numbers for which the sum of the divisors of one number equals the other number, e.g. 220 and 284, 1184 and 1210.
Arithmetic	The part of mathematics that studies quantity, especially as the result of combining numbers (as opposed to variables) using the traditional operations of addition, subtraction, multiplication and division. (the more advanced manipulation of numbers is usually known as number theory)
Asymptote	A line that the curve of a function tends towards as the independent variable of the curve approaches some limit (usually infinity) i.e. the distance between the curve and the line approaches zero.
Axiom	A proposition that is not actually proved or demonstrated, but is considered to be self-evident and universally accepted as a starting point for deducing and inferring other truths and theorems, without any need of proof.
Base n	The number of unique digits (including zero) that a positional numeral system uses to represent numbers, e.g. base 10 (decimal) uses 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 in each place value position; base 2 (binary) uses just 0 and 1; base 60 (sexagesimal, as used in ancient Mesopotamia) uses all the numbers from 0 to 59; etc.
Bayesian Probability	A popular interpretation of probability which evaluates the probability of a hypothesis by specifying some prior probability, and then updating in the light of new relevant data
Bell Curve	The shape of the graph that indicates a normal distribution in probability and statistics
Coefficients	The factors of the terms (i.e. the numbers in front of the letters) in a mathematical expression or equation, e.g. in the expression 4x + 5y2 + 3z, the coefficients for x, y2 and z are 4, 5 and 3 respectively.
Combinatorics	The study of different combinations and groupings of numbers, often used in probability and statistics, as well as in scheduling problems and Sudoku puzzles.
Complex Number	A number expressed as an ordered pair comprising a real number and an imaginary number, written in the form a + bi, where a and b are real numbers, and i is the imaginary unit. (equal to the square root of -1)
Congruence	Two geometrical figures are congruent to one another if they have the same size and shape, and so one can be transformed into the other by a combination of translation, rotation and reflection.
Continued Fraction	A fraction whose denominator contains a fraction, whose denominator in turn contains a fraction, etc, etc.
Correlation	A measure of relationship between two variables or sets of data, a positive correlation coefficient indicating that one variable tends to increase or decrease as the other does, and a negative correlation coefficient indicating that one variable tends to increase as the other decreases and vice versa.
Cubic Equation	A polynomial having a degree of 3 (i.e. the highest power is 3), of the form ax3 + bx2 + cx + d = 0, which can be solved by factorization or formula to find its three roots.
Derivative	A measure of how a function or curve changes as its input changes, i.e. the best linear approximation of the function at a particular input value, as represented by the slope of the tangent line to the graph of the function at that point, found by the operation of differentiation.
Differential Equation	An equation that expresses a relationship between a function and its derivative, the solution of which is not a single value but a function. (has many applications in engineering, physics economics, etc)
Differentiation	The operation in calculus (inverse to the operation of integration) of finding the derivative of a function or equation.
Expected Value	The amount predicted to be gained, using the calculation for average expected payoff, which can be calculated as the integral of a random variable with respect to its probability measure. (the expected value may not actually be the most probable value and may not even exist, e.g. 2.5 children)

Exponentiation	The mathematical operation where a number (the base) is multiplied by itself a specified number of times (the exponent), usually written as a superscript an, where a is the base and n is the exponent, e.g. 43 = 4 x 4 x 4.
Factor	A number that will divide into another number exactly, e.g. the factors of 10 are 1, 2 and 5.
Factorial	The product of all the consecutive integers up to a given number (used to give the number of permutations of a set of objects), denoted by n!, e.g. 5! = 1 x 2 x 3 x 4 x 5 = 120.
Fibonacci Numbers (Series)	A set of numbers formed by adding the last two numbers to get the next in the series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, …
Function	A relation or correspondence between two sets in which one element of the second (codomain or range) set ƒ(x) is assigned to each element of the first (domain) set x, e.g. ƒ(x) = x2 or y = x2 assigns a value to ƒ(x) or y based on the square of each value of x.
Geometry	The part of mathematics concerned with the size, shape and relative position of figures, or the study of lines, angles, shapes and their properties.
Hyperbola	A smooth symmetrical curve with two branches produced by the section of a conical surface.
Hyperbolic Geometry	A non-Euclidean geometry based on a saddle-shaped plane, in which there are no parallel lines and the angles of a triangle sum to less than 180°.
Infinite Series	The sum of an infinite sequence of numbers (which are usually produced according to a certain rule, formula or algorithm).
Infinitesimal	Quantities or objects so small that there is no way to see them or to measure them, so that for all practical purposes they approach zero as a limit. (an idea used in the developement of infinitesimal calculus)
Infinity	A quantity or set of numbers without bound, limit or end, whether countably infinite like the set of integers, or uncountably infinite like the set of real numbers. (represented by the symbol ∞)
Irrational Numbers	Numbers that can not be represented as decimals (because they would contain an infinite number of non-repeating digits) or as fractions of one integer over another, e.g. π, √2, e.
Line	In geometry, a one-dimensional figure following a continuous straight path joining two or more points, whether infinite in both directions or just a line segment bounded by two distinct end points.
Linear Equation	An algebraic equation in which each term is either a constant or the product of a constant and the first power of a single variable, and whose graph is therefore a straight line, e.g. y = 4, y = 5x + 3.
Linear Regression	A technique in statistics and probability theory for modelling scattered data by assuming an approximate linear relationship between the dependent and independent variables.
Logarithm	The inverse operation to exponentiation, the exponent of a power to which a base (usually 10 or e for natural logarithms) must be raised to produce a given number, e.g. because 1,000 = 103, the log10 100 = 3.
Magic Square	A square array of numbers where each row, column and diagonal added up to the same total, known as the magic sum or constant. (a semi-magic square is a square numbers where just the rows and columns, but not both diagonals, sum to a constant)
Matrix	A rectangular array of numbers, which can be added, subtracted and multiplied, and used to represent linear transformations and vectors, solve equations, etc.
Mersenne Number	Numbers that are one less than 2 to the power of a prime number, e.g. 3 (22 - 1); 7 (23 - 1); 31 (25 - 1); 127 (27 - 1); 8,191 (213 - 1); etc.
Modulus	A number by which two given numbers can be divided by integer division, and produce the same remainder, e.g. 38 ÷ 12 = 3 remainder 2, and 26 ÷ 12 = 2 remainder 2, therefore 38 and 26 are congruent modulo 12, or (38 ≡ 26) mod 12.
Natural Numbers	The set of positive integers (regular whole counting numbers), sometimes including zero.
Negative Numbers	Any integer, ration or real number which is less than 0, e.g. -743, -1.4, -√5 (but not √-1, which is an imaginary or complex number).
Non-Euclidean Geometry	Geometry based on a curved plane, whether elliptic (spherical) or hyperbolic (saddle-shaped), in which there are no parallel lines and the angles of a triangle do not sum to 180°.
Normal (Gaussian) Distribution	A continuous probability distribution in probability theory and statistics that describes data which clusters around the mean in a curved “bell curve”, highest in the middle and quickly tapering off to each side.
Number Line	A line on which all points correspond to real numbers (a simple number line may only mark integers, but in theory all real numbers to +/- infinity can be shown on a number line).
Ordinal Numbers	An extension of the natural numbers (different from integers and from cardinal numbers) used to describe the order type of sets i.e. the order of elements within a set or series.
Parabola	A type of conic section curve, any point of which is equally distant from a fixed focus point and a fixed straight line.
Perfect Number	A number that is the sum of its divisors (excluding the number itself), e.g. 28 = 1 + 2 + 4 + 7 + 14.
Permutation	A particular ordering of a set of objects, e.g. given the set {1, 2, 3}, there are six permutations: {1, 2, 3}, {1, 3, 2}, {2, 1, 3}, {2, 3, 1}, {3, 1, 2}, and {3, 2, 1}.
Platonic Solids	The five regular convex polyhedra (symmetrical 3-dimensional shapes): the tetrahedron (made up of 4 regular triangles), the octahedron (made up of 8 triangles), the icosahedron (made up of 20 triangles), the cube (made up of 6 squares) and the dodecahedron (made up of 12 pentagons).
Polar Coordinates	A two-dimensional coordinate system in which each point on a plane is determined by its distance r from a fixed point (e.g. the origin) and its angle θ (theta) from a fixed direction (e.g the x axis).
Prime Numbers	Integers greater than 1 which are only divisible by themselves and 1.
Plane	A flat two-dimensional surface (physical or theoretical) with infinite width and length, zero thickness and zero curvature.
Pythagoras' (Pythagorean) Theorem	The square of the hypotenuse of a right angled triangle is equal to the sum of the squares of the two sides (a2 + b2 = c2).
Quadratic Equation	A polynomial equation with a degree of 2 (i.e. the highest power is 2), of the form ax2 + bx + c = 0, which can be solved by various methods including factoring, completing the square, graphing, Newton's method and the quadratic formula.

Quaternions	A number system that extends complex numbers to four dimensions (so that an object is described by a real number and three complex numbers, all mutually perpendicular to each other), which can be used to represent a three-dimensional rotation by just an angle and a vector.
Quintic Equation	A polynomial having a degree of 5 (i.e. the highest power is 5), of the form ax5 + bx4 + cx3 + dx2 + ex + f = 0, not solvable by factorization into radicals for all rational numbers.
Rational Numbers	Numbers that can be expressed as a fraction (or ratio) a/b of two integers (the integers are therefore a subset of the rationals), or alternatively a decimal which terminates after a finite number of digits or begins to repeat a sequence.
Real Numbers	All numbers (including natural numbers, integers, decimals, rational numbers and irrational numbers) which do not involve imaginary numbers (multiples of the imaginary unit i, or the square root of -1), may be thought of as all points on an infinitely long number line.
Reciprocal	A number which, when multiplied by x yields the multiplicative identity 1, and can therefore be thought of as the inverse of multiplication, e.g. the reciprocal of x is $1/x$, the reciprocal of $3/5$ is $5/3$.
Sequence	An ordered set whose elements are usually determined based on some function of the counting numbers, e.g. a geometric sequence is a set where each element is a multiple of the previous element; an arithmetic sequence is a set where each element is the previous element plus or minus a number.
Subset	A subsidiary collection of objects that all belong to, or is contained in, an original given set, e.g. subsets of {a, b} could include: {a}, {b}, {a, b} and {}.
Surd	The n-th root a number, such as $\sqrt{5}$, the cube root of 7, etc.
Tensor	A collection of numbers at every point in space which describe how much the space is curved, e.g. in four spatial dimensions, a collection of ten numbers is needed at each point to describe the properties of the mathematical space or manifold, no matter how distorted it may be.
Theorem	A mathematical statement or hypothesis which has been proved on the basis of previously established theorems and previously accepted axioms, effectively the proof of the truth of a statement or expression.
Transcendental Number	An irrational number that is "not algebraic", i.e. no finite sequence of algebraic operations on integers (such as powers, roots, sums, etc.) can be equal to its value, examples being π and e. For example, $\sqrt{2}$ is irrational but not transcendental because it is the solution to the polynomial x2 = 2.
Transfinite Numbers	Cardinal numbers or ordinal numbers that are larger than all finite numbers, yet not necessarily absolutely infinite.
Triangular Number	A number which can be represented as an equilateral triangle of dots, and is the sum of all the consecutive numbers up to its largest prime factor - it can also be calculated as $n(n + 1)/2$, e.g. $15 = 1 + 2 + 3 + 4 + 5 = 5(5 + 1)/2$.
Trigonometry	The branch of mathematics that studies the relationships between the sides and the angles of right triangles, and deals with and with the trigonometric functions (sine, cosine, tangent and their reciprocals).
Vector	A physical quantity having magnitude and direction, represented by a directed arrow indicating its orientation in space.
Vector Space	A three-dimensional area where vectors can be plotted, or a mathematical structure formed by a collection of vectors.
Addend	Any one of a set of numbers that are added. For example, in 5 + 3 + 1, the addends are 5, 3, and 1.

Cooking

Dutch Oven	A cast iron pot that can cook food on the hot coals of a campfire.
Solar Oven	A cardboard box lined with aluminium foil to bake food using the sun's energy.
Ghee	Ghee is clarified butter. The solids are removed from the butter, eliminating LDLs, or "bad" cholesterol.
Pressure Canner	A pressure canner is a safe way to fresh preserve foods and avoid botulism. Temperature and timing are crucial to achieve a delicious and safe finished product. While a water bath canner heats to 100°C (212°F) pressure canning brings the temperature to 115°C (240°F).
Vagabond Stove	Also called a "Buddy Burner," you can make this stove from a #10 can (about the size of an old fashioned coffee can).
Volcano Stove	A volcano stove is the brand name of a highly rated collapsible cook stove that takes three fuel sources. It's often called an "oven" though it's really a stove, because it's well suited to work with a Dutch Oven.
Al Dente	Italian term used to describe pasta that is cooked until it offers a slight resistance to the bite.
Bake	To cook by dry heat, usually in the oven.
Barbecue	Usually used generally to refer to grilling done outdoors or over an open charcoal or wood fire. More specifically, barbecue refers to long, slow direct- heat cooking, including liberal basting with a barbecue sauce.
Baste	To moisten foods during cooking with pan drippings or special sauce to add flavor and prevent drying.
Batter	A mixture containing flour and liquid, thin enough to pour.
Beat	To mix rapidly in order to make a mixture smooth and light by incorporating as much air as possible.
Blanch	To immerse in rapidly boiling water and allow to cook slightly.
Blend	To incorporate two or more ingredients thoroughly.
Boil	To heat a liquid until bubbles break continually on the surface.
Broil	To cook on a grill under strong, direct heat.
Caramelize	To heat sugar in order to turn it brown and give it a special taste.
Chop	To cut solids into pieces with a sharp knife or other chopping device.
Clarify	To separate and remove solids from a liquid, thus making it clear.
Cream	To soften a fat, especially butter, by beating it at room temperature. Butter and sugar are often creamed together, making a smooth, soft paste.
Cure	To preserve meats by drying and salting and/or smoking.
Deglaze	To dissolve the thin glaze of juices and brown bits on the surface of a pan in which food has been fried, sauteed or roasted. To do this, add liquid and stir and scrape over high heat, thereby adding flavor to the liquid for use as a sauce.
Degrease	To remove fat from the surface of stews, soups, or stock. Usually cooled in the refrigerator so that fat hardens and is easily removed.
Dice	To cut food in small cubes of uniform size and shape.
Dissolve	To cause a dry substance to pass into solution in a liquid.
Dredge	To sprinkle or coat with flour or other fine substance.

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Dictionary

Cooking

Drizzle	To sprinkle drops of liquid lightly over food in a casual manner.
Dust	To sprinkle food with dry ingredients. Use a strainer or a jar with a perforated cover, or try the good, old-fashioned way of shaking things together in a paper bag.
Fillet	As a verb, to remove the bones from meat or fish. A fillet (or filet) is the piece of flesh after it has been boned.
Flake	To break lightly into small pieces.
Flambe	To flame foods by dousing in some form of potable alcohol and setting alight.
Fold	To incorporate a delicate substance, such as whipped cream or beaten egg whites, into another substance without releasing air bubbles. Cut down through mixture with spoon, whisk, or fork; go across bottom of bowl, up and over, close to surface. The process is repeated, while slowing rotating the bowl, until the ingredients are thoroughly blended.
Fricassee	To cook by braising; usually applied to fowl or rabbit.
Fry	To cook in hot fat. To cook in a fat is called pan-frying or sauteing; to cook in a one-to-two inch layer of hot fat is called shallow-fat frying; to cook in a deep layer of hot fat is called deep-fat frying.
Garnish	To decorate a dish both to enhance its appearance and to provide a flavorful foil. Parsley, lemon slices, raw vegetables, chopped chives, and other herbs are all forms of garnishes.
Glaze	To cook with a thin sugar syrup cooked to crack stage; mixture may be thickened slightly. Also, to cover with a thin, glossy icing.
Grate	To rub on a grater that separates the food in various sizes of bits or shreds.
Gratin	From the French word for "crust." Term used to describe any oven-baked dish--usually cooked in a shallow oval gratin dish--on which a golden brown crust of bread crumbs, cheese or creamy sauce is form.
Grill	To cook on a grill over intense heat.
Grind	To process solids by hand or mechanically to reduce them to tiny particles.
Julienne	To cut vegetables, fruits, or cheeses into thin strips.
Knead	To work and press dough with the palms of the hands or mechanically, to develop the gluten in the flour.
Lukewarm	Neither cool nor warm; approximately body temperature.
Marinate	To flavor and moisturize pieces of meat, poultry, seafood or vegetable by soaking them in or brushing them with a liquid mixture of seasonings known as a marinade. Dry marinade mixtures composed of salt, pepper, herbs or spices may also be rubbed into meat, poultry or seafood.
Meuniere	Dredged with flour and sauteed in butter.
Mince	To cut or chop food into extremely small pieces.
Mix	To combine ingredients usually by stirring.
Pan-Broil	To cook uncovered in a hot fry pan, pouring off fat as it accumulates.
Pan-Fry	To cook in small amounts of fat.
Parboil	To boil until partially cooked; to blanch. Usually this procedure is followed by final cooking in a seasoned sauce.
Pare	To remove the outermost skin of a fruit or vegetable.
Peel	To remove the peels from vegetables or fruits.
Pickle	To preserve meats, vegetables, and fruits in brine.
Pinch	A pinch is the trifling amount you can hold between your thumb and forefinger.
Pit	To remove pits from fruits.
Planked	Cooked on a thick hardwood plank.
Plump	To soak dried fruits in liquid until they swell.
Poach	To cook very gently in hot liquid kept just below the boiling point.
Puree	To mash foods until perfectly smooth by hand, by rubbing through a sieve or food mill, or by whirling in a blender or food processor.
Reduce	To boil down to reduce the volume.
Refresh	To run cold water over food that has been parboiled, to stop the cooking process quickly.
Render	To make solid fat into liquid by melting it slowly.
Roast	To cook by dry heat in an oven.
Saute	To cook and/or brown food in a small amount of hot fat.
Scald / Coddle	To bring to a temperature just below the boiling point.
Scallop	To bake a food, usually in a casserole, with sauce or other liquid. Crumbs often are sprinkled over.
Score	To cut narrow grooves or gashes partway through the outer surface of food.
Sear	To brown very quickly by intense heat. This method increases shrinkage but develops flavor and improves appearance.
Shred	To cut or tear in small, long, narrow pieces.
Sift	To put one or more dry ingredients through a sieve or sifter.
Simmer	To cook slowly in liquid over low heat at a temperature of about 180°. The surface of the liquid should be barely moving, broken from time to time by slowly rising bubbles.
Skim	To remove impurities, whether scum or fat, from the surface of a liquid during cooking, thereby resulting in a clear, cleaner-tasting final produce.
Steam	To cook in steam in a pressure cooker, deep well cooker, double boiler, or a steamer made by fitting a rack in a kettle with a tight cover. A small amount of boiling water is used, more water being added during steaming process, if necessary.
Steep	To extract color, flavor, or other qualities from a substance by leaving it in water just below the boiling point.
Sterilize	To destroy micro organisms by boiling, dry heat, or steam.
Stew	To simmer slowly in a small amount of liquid for a long time.
Stir	To mix ingredients with a circular motion until well blended or of uniform consistency.
Toss	To combine ingredients with a lifting motion.
Truss	To secure poultry with string or skewers, to hold its shape while cooking.
Whip	To beat rapidly to incorporate air and produce expansion, as in heavy cream or egg whites.
Bone	To bone a piece of meat is to remove the bone from it.
Butterfly	Butterflying food refers to splitting it through the centre to thin it out, but not cutting through it entirely.

Cartouche	A cartouche refers to a piece of greaseproof or baking paper that is used to create a lid over a pot or saucepan. Usually cut in a circle and placed over a dish with a small amount of liquid. In the instance of poaching it stops steam from escaping, it can also prevent skins from developing on sauces.
Clarify	Most often refers to butter, where the milk solids and water are rendered from the butterfat. This is done by gently melting the butter, allowing the two to separate and then skimming off the solids.
Confit	Regularly recognised with duck, but can include other meats, where the meat is cooked in its own fat (or other fat if necessary) at a low heat.
Curdle	When egg-based mixtures are cooked too quickly and the protein separates from the liquids, leaving a lumpy mixture behind.
Cut In	A method of blending, usually for pastry, where a fat is combined with flour. The method often refers to using a pastry blender to mix butter or shortening into the flour until the mixture is the size of peas.
Dice	A knife skill cut – the exact measurement changes but the shape is always a small square.
Dollop	A small amount of soft food that has been formed into a round-ish shape. Yoghurt, whipped cream and mashed potatoes are all examples of foods that can be dolloped.
Dress	Dress has two definitions when it comes to cooking, firstly to coat foods (mostly salad leaves) in a sauce. It also refers to preparing poultry, fish and venison for cooking, which essentially is breaking them down off of their carcasses and sectioning the meat.
Deep Fry	To cook food in a deep layer of hot oil.
Infuse	To allow the flavour of an ingredient to soak into a liquid until the liquid takes on the flavour of the ingredient.
Julienne	Refers to a knife skill cut where the shape resembles matchsticks.
Macerate	The soaking of an ingredient, usually fruit, in a liquid so that it takes on the flavour of the liquid. Can also be used to soften dried fruit.
Pane	To coat in breadcrumbs.
Panade	A mixture of starch and liquid that's added to ground meat for hamburger patties/meatballs. Usually a mixture of bread, breadcrumbs or panko with milk, buttermilk or yoghurt.
Poach	To cook in gently bubbling liquids such as a stock or a broth.
Puree	Cooked food, usually vegetables, that have been mashed or blended to form a paste-like consistency.
Roux	A roux is a flour and fat mixture cooked together, which acts as a thickener in soups, stews and sauces.
Reconstitute	To restore a dried food to original consistency, or to change its texture, by letting it soak in warm water.
Steep	Similar to infuse, steeping is the process of allowing dried ingredients to soak in a liquid until the liquid has taken on the flavour of the ingredient.
Shallow Fry	To cook food in a shallow layer of preheated oil.
Sweat	This refers to the gentle cooking of vegetables in butter or oil under a lid, so that their natural liquid is released to aid the cooking process. Often vegetables cooked this way will end up looking translucent.
Temper	To temper is the process of adding a small quantity of a hot liquid to a cold liquid in order to warm the cold liquid slightly. This is often be done before adding delicate ingredients to a hot mixture, where their format may be affected. An example of this would be adding eggs to a hot mixture – in order to prevent them curdling or scrambling you would add a little of the hot mix to the eggs and incorporate before adding the eggs into the heated mixture. Another example would be adding a cornflour slurry to a hot mixture; a little of the hot mixture is added to the slurry to temper the temperature before adding the mix back to the main mixture.
Whisk	The process of using a whisk to incorporate air into food or to blend ingredients together smoothly.
Zest	Refers to removing the outer part of citrus (called the zest) either by using a grater, a peeler or a knife.

Defence

TDS	Time, Distance and Shielding. Three types of protective measures commonly associated with hazardous materials training.
TRACEM	Acronym used to identify the six types of harm one may encounter at a terrorist incident: Thermal, Radioactive, Asphyxiation, Chemical, Etiological and Mechanical.

Disaster Recovery

Disaster Triggers

DCO	Disaster Coordinating Office
EMA	Emergency Management Agency
EMI	Emergency Management Institute
EOC	Emergency Operations Centre
EOP	Emergency Operations Plan
EPIRB	Emergency Position Indicating Radio Beacon - The marine version of the "ELT". It will float and is manually activated or activated when submerged in the water.
ERT	Emergency Response Team (FBI)
FEMA	Federal Emergency Management Agency
IC	Incident Commander - The individual responsible for the management of all incident operations.
ICC	Incident Command Centre
ICISF	International Critical Incident Stress Foundation
ICP	Incident Command Post - That location at which the primary command functions are executed.
ICS	Incident Command System

ADDENDUM Dictionary Disaster Triggers

Incident Command Post	That location at which the primary command functions are executed.
IPP	Initial Planning Point
MERS	Mobile Emergency Response System (FEMA)
NDPO	National Domestic Preparedness Office
NERRTC	National Emergency Response and Rescue Training Centre
ROC	Regional Operations Centre (FEMA)
RRT	Regional Response Team
Sizeup	The rapid mental evaluation of the factors that influence an incident. Sizeup is the first step in determining a course of action.
VOAD	Voluntary Organizations Active in Disaster

Economy

Bank Run	A bank run (also known as a run on the bank) occurs when a large number of people withdraw their money from a bank, because they believe the bank may cease to function in the near future.
Capital Flight	Capital flight, in economics, occurs when assets or money rapidly flow out of a country, due to an event of economic consequence. Such events could be an increase in taxes on capital or capital holders or the government of the country defaulting on its debt that disturbs investors and causes them to lower their valuation of the assets in that country, or otherwise to lose confidence in its economic strength.
Bankruptcy	Bankruptcy is a legal status of a person or other entity who cannot repay debts to creditors. In most jurisdictions, bankruptcy is imposed by a court order, often initiated by the debtor.
Liquidation	Liquidation is the process in law and business by which a company is brought to an end in the United Kingdom, Republic of Ireland and United States. The assets and property of the company are redistributed. Liquidation is also sometimes referred to as winding-up or dissolution, although dissolution technically refers to the last stage of liquidation.
Insolvency	Insolvency is the state of being unable to pay the money owed, by a person or company, on time; those in a state of insolvency are said to be insolvent. There are two forms: cash-flow insolvency and balance-sheet insolvency.
Accounting Liquidity	In accounting, liquidity (or accounting liquidity) is a measure of the ability of a debtor to pay their debts as and when they fall due. It is usually expressed as a ratio or a percentage of current liabilities. Liquidity is the ability to pay short-term obligations.
Fractional-Reserve Banking	Fractional-reserve banking is the common practice by commercial banks of accepting deposits, and making loans or investments, while holding reserves at least equal to a fraction of the bank's deposit liabilities. Reserves are held as currency in the bank, or as balances in the bank's accounts at the central bank. Fractional-reserve banking is the current form of banking practiced in most countries worldwide.
Absolute Advantage	The ability of a party (whether an individual, firm, or country) to produce a greater quantity of a good, product, or service than competitors using the same amount of resources.
Adaptive Expectations	A hypothetical process by which people form expectations about what will happen in the future based on what has happened in the past.
Aggregate Demand (AD)	The total demand for final goods and services in an economy at a given time. It specifies the amounts of goods and services that will be purchased at all possible price levels. Aggregate demand can also be interpreted as the demand for the gross domestic product of a country. It is often called effective demand, though this term also has a distinct meaning.
Autarky	The quality of being self-sufficient; the term is usually applied to political states or their economic systems. Autarky exists whenever an entity can survive or continue its activities without external assistance or international trade. If a self-sufficient economy also deliberately refuses all trade with the outside world, then it is called a closed economy.
Average Cost	A quantity equal to the total cost divided by the number of goods produced (the output quantity, Q). It is also equal to the sum of variable costs (total variable costs divided by Q) plus average fixed costs (total fixed costs divided by Q).
Bank	A financial institution that accepts deposits from the public and creates credit. Lending activities can be performed either directly or indirectly through capital markets. Due to their importance in the financial stability of a country, banks are highly regulated in most countries. Most nations have institutionalized a system known as fractional reserve banking, under which banks hold liquid assets equal to only a portion of their current liabilities.
Bond	In finance, an instrument of indebtedness of the bond issuer to the holders. The most common types of bonds include municipal bonds and corporate bonds. The bond is a debt security, under which the issuer owes the holders a debt and (depending on the terms of the bond) is obliged to pay them interest (the coupon) or to repay the principal at a later date, termed the maturity date.
Break-Even	The point at which total cost and total revenue are equal, i.e. "even". There is no net loss or gain, and one has "broken even", though opportunity costs have been paid and capital has received the risk-adjusted, expected return. In short, all costs that must be paid are paid, and there is neither profit nor loss.
Budget Set	All possible consumption bundles that someone can afford given the prices of goods and the person's income level. The budget set is bounded above by the budget line. Graphically speaking, all the consumption bundles that lie inside and on the budget constraint form the budget set. By most definitions, budget sets must be compact and convex.
Capital	Any asset that can enhance one's power to perform economically useful work. Capital goods, real capital, or capital assets are already-produced, durable goods or any non-financial asset that is used in production of goods or services. Capital is distinct from land (or non-renewable resources) in that capital can be increased by human labor. At any given moment in time, total physical capital may be referred to as the capital stock (which is not to be confused with the capital stock of a business entity).
Capital Cost	A fixed, one-time expense incurred on the purchase of land, buildings, construction, and equipment used in the production of goods or in the rendering of services. In other words, it is the total cost needed to bring a project to a commercially operable status. Whether a particular cost is capital or not depends on many factors, such as accounting, tax laws, and materiality.
Capital Flight	Occurs when money or assets rapidly flow out of a country due to an event of economic consequence. Such events may include an increase in taxes on capital or capital holders or the government of the country defaulting on its debt that disturbs investors and causes them to lower their valuation of the assets in that country or otherwise to lose confidence in its economic strength.
Capital Good	A durable good that is used in the production of goods or services. Capital goods are one of the three types of producer goods, the other two being land and labour, which are also known collectively as primary factors of production. This classification originated with classical economics and has remained the dominant method for classification.

Central Bank	Commercial banking system of their respective countries. In contrast to a commercial bank, a central bank possesses a monopoly on increasing the monetary base in the state, and usually also prints the national currency, which usually serves as the state's legal tender. Central banks also act as a "lender of last resort" to the banking sector during times of financial crisis. Most central banks usually also have supervisory and regulatory powers to ensure the solvency of member institutions, prevent bank runs, and prevent reckless or fraudulent behavior by member banks.
Commodity	Is an economic good or service that has full or substantial fungibility: that is, the market treats instances of the good as equivalent or nearly so with no regard to who produced them.
Compound Interest	The addition of interest to the principal sum of a loan or deposit; it is often interpreted as "interest on interest". Compound interest is the result of reinvesting interest, rather than paying it out, so that interest in the next period is then earned on the principal sum plus any previously accumulated interest.
Consumer Confidence	An economic indicator that measures the degree of optimism that consumers feel about the overall state of the economy and their personal financial situation.
Consumption	According to mainstream economists, only the final purchase of goods and services by individuals constitutes consumption, while other types of expenditure — in particular, fixed investment, intermediate consumption, and government spending — are placed in separate categories (see consumer choice).
Consumption Function	A mathematical function which describes a relationship between consumption and disposable income. The concept is believed to have been introduced into macroeconomics by John Maynard Keynes in 1936, who used it to develop the notion of a government spending multiplier.
Creditor	A person or a firm that lends money to a borrower.
Currency	Money in any form when in actual use or circulation as a medium of exchange, especially circulating banknotes and coins. A more general definition is that a currency is a "system" of money (monetary units) in common use, especially within a particular nation.
Debt	Total money owed.
Debtor	A debtor is an entity that owes a debt to another entity.
Deflation	In economics, deflation is a decrease in the general price level of goods and services. Deflation occurs when the inflation rate falls below 0% (a negative inflation rate). Inflation reduces the value of currency over time, but deflation increases it.
Demand Shock	In economics, a demand shock is a sudden event that increases or decreases demand for goods or services temporarily. A positive demand shock increases aggregate demand (AD) and a negative demand shock decreases aggregate demand. Prices of goods and services are affected in both cases. When demand for goods or services increases, its price (or price levels) increases because of a shift in the demand curve to the right.
Depreciation	In economics, depreciation is the gradual decrease in the economic value of the capital stock of a firm, nation or other entity, either through physical depreciation, obsolescence or changes in the demand for the services of the capital in question.
Depression	In economics, a depression is a sustained, long-term downturn in economic activity in one or more economies. It is a more severe economic downturn than a recession, which is a slowdown in economic activity over the course of a normal business cycle.
Discretionary Income	Money available after one pays taxes.
Disinflation	Disinflation is a decrease in the rate of inflation – a slowdown in the rate of increase of the general price level of goods and services in a nation's gross domestic product over time. It is the opposite of reflation. Disinflation occurs when the increase in the "consumer price level" slows down from the previous period when the prices were rising.
Disposable Income	Money available after one pays taxes and obligatory bill payments.
Dissaving	Dissaving is negative saving. If spending is greater than disposable income, dissaving is taking place. This spending is financed by already accumulated savings, such as money in a savings account, or it can be borrowed.
Economic Growth	Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product, or real GDP.
Economy	An economy (from Greek οικος – "household" and νέμομαι – "manage") is an area of the production, distribution, or trade, and consumption of goods and services by different agents. Understood in its broadest sense, 'The economy is defined as a social domain that emphasize the practices, discourses, and material expressions associated with the production, use, and management of resources'.
Equilibrium	The point at which quantity demanded and quantity supplied are equal and both consumer and producer are satisfied.
Equilibrium Price	The market price at which both the supplier and consumer will trade and both are satisfied.
Equity	Equity or economic equality is the concept or idea of fairness in economics, particularly in regard to taxation or welfare economics. More specifically, it may refer to equal life chances regardless of identity, to provide all citizens with a basic and equal minimum of income, goods, and services or to increase funds and commitment for redistribution.
Exchange Rate	In finance, an exchange rate is the rate at which one currency will be exchanged for another. It is also regarded as the value of one country's currency in relation to another currency.
Excludability	In economics, a good or service is called excludable if it is possible to prevent people (consumers) who have not paid for it from having access to it. By comparison, a good or service is non-excludable if non-paying consumers cannot be prevented from accessing it.
Rivalrous	In economics, a good is said to be rivalrous or rival if its consumption by one consumer prevents simultaneous consumption by other consumers, or if consumption by one party reduces the ability of another party to consume it.
Federal Reserve System	The central bank of the United States, created by Congress in 1913 and charged with the duty of regulating the money supply and monitoring its member banks.
Finance	Finance is a field that is concerned with the allocation (investment) of assets and liabilities over space and time, often under conditions of risk or uncertainty. Finance can also be defined as the art of money management.
Financial Institution	Any firm, such as a bank, that is in the business of holding money for those who save and lending money to those who need loans.
Financial Risk	The risk assumed by a saver or investor on future outcomes that involve financial losses and gains.
Fixed Cost	In economics, fixed costs, indirect costs or overheads are business expenses that are not dependent on the level of goods or services produced by the business.

ADDENDUM Dictionary Economy

Foreign Exchange Market	The foreign exchange market (Forex, FX, or currency market) is a global decentralized or over-the-counter (OTC) market for the trading of currencies.
Free Market	In economics, a free market is a system in which the prices for goods and services are determined by the open market and by consumers. In a free market, the laws and forces of supply and demand are free from any intervention by a government or other authority and from all forms of economic privilege, monopolies and artificial scarcities.
Free Trade	Trading with other countries with little or no trade barriers.
Functions of Money	The four classic functions or uses of money as summarized by William Stanley Jevons in 1875: a medium of exchange, a common measure of value (or unit of account), a standard of value (or standard of deferred payment), and a store of value. This analysis later became a fundamental concept of macroeconomics. Most modern textbooks now list only three functions, that of medium of exchange, unit of account, and store of value, not considering a standard of deferred payment as a distinguished function, but rather subsuming it in the others.
Good	In economics, goods are materials that satisfy human wants and provide utility, for example, to a consumer making a purchase of a satisfying product. A common distinction is made between goods that are tangible property, and services, which are non-physical.
Government Revenue	The total revenue received by all three levels of government (federal, state, and local) in the form of taxes and tariffs.
Gross Domestic Product (GDP)	Gross domestic product (GDP) is a monetary measure of the market value of all the final goods and services produced in a period of time, often annually. GDP (nominal) per capita does not, however, reflect differences in the cost of living and the inflation rates of the countries; therefore using a basis of GDP per capita at purchasing power parity (PPP) is arguably more useful when comparing differences in living standards between nations.
Hyperinflation	Monetary inflation occurring at an extremely high rate.
Import	An import is a good brought into a jurisdiction, especially across a national border, from an external source. The party bringing in the good is called an importer. An import in the receiving country is an export from the sending country. Importation and exportation are the defining financial transactions of international trade.
Income Distribution	In economics, income distribution is how a nation's total GDP is distributed amongst its population. Income and its distribution have always been a central concern of economic theory and economic policy. Classical economists such as Adam Smith, Thomas Malthus, and David Ricardo were mainly concerned with factor income distribution, that is, the distribution of income between the main factors of production, land, labour and capital.
Income Effect	The change in consumption resulting from a change in income.
Inflation	Inflation is a sustained increase in the general price level of goods and services in an economy over a period of time. When the general price level rises, each unit of currency buys fewer goods and services; consequently, inflation reflects a reduction in the purchasing power per unit of money – a loss of real value in the medium of exchange and unit of account within the economy.
Interest	Interest, in finance and economics, is payment from a borrower or deposit-taking financial institution to a lender or depositor of an amount above repayment of the principal sum (that is, the amount borrowed), at a particular rate. It is distinct from a fee which the borrower may pay the lender or some third party.
Interest Rate	An interest rate is the amount of interest due per period, as a proportion of the amount lent, deposited or borrowed (called the principal sum). The total interest on an amount lent or borrowed depends on the principal sum, the interest rate, the compounding frequency, and the length of time over which it is lent, deposited or borrowed.
Investment	Spending for the production and accumulation of capital and additions to inventories.
Investment Fund	An investment fund is a way of investing money alongside other investors in order to benefit from the inherent advantages of working as part of a group.
Wage Labour	Wage labour (also wage labor in American English) is the socioeconomic relationship between a worker and an employer, where the worker sells their labour power under a formal or informal employment contract. These transactions usually occur in a labour market where wages or salaries are market-determined.
Law of Demand	An economic rule stating that quantity demanded and price move in opposite directions, i.e. as demand increases, price decreases, and vice versa.
Liability	In financial accounting, a liability is defined as the future sacrifices of economic benefits that the entity is obliged to make to other entities as a result of past transactions or other past events, the settlement of which may result in the transfer or use of assets, provision of services or other yielding of economic benefits in the future.
Loan	In finance, a loan is the lending of money by one or more individuals, organizations, or other entities to other individuals, organizations etc. The recipient (i.e. the borrower) incurs a debt, and is usually liable to pay interest on that debt until it is repaid, and also to repay the principal amount borrowed.
Marginal Cost	The incremental cost of producing one additional unit.
Marginal Revenue	The additional income from selling one more unit of a good; sometimes equal to price.
Market	A market is one of the many varieties of systems, institutions, procedures, social relations and infrastructures whereby parties engage in exchange. While parties may exchange goods and services by barter, most markets rely on sellers offering their goods or services (including labor) in exchange for money from buyers.
Market Failure	In economics, market failure is a situation in which the allocation of goods and services by a free market is not efficient, often leading to a net social welfare loss. Market failures can be viewed as scenarios where individuals' pursuit of pure self-interest leads to results that are not efficient – that can be improved upon from the societal point of view.
Market Structure	The structure of a market as a whole, taking into consideration two main factors: the number of firms in the market and whether goods offered are identical, similar, or differentiated.
Money	Money is any item or verifiable record that is generally accepted as payment for goods and services and repayment of debts, such as taxes, in a particular country or socio-economic context. The main functions of money are distinguished as: a medium of exchange, a unit of account, a store of value and sometimes, a standard of deferred payment. Any item or verifiable record that fulfils these functions can be considered as money.
Monopoly	A monopoly exists when a specific person or enterprise is the only supplier of a particular commodity. This contrasts with a monopsony which relates to a single entity's control of a market to purchase a good or service, and with oligopoly which consists of a few sellers dominating a market.
Mortgage Loan	A mortgage loan or, simply, mortgage is used either by purchasers of real property to raise funds to buy real estate, or alternatively by existing property owners to raise funds for any purpose, while putting a lien on the property being mortgaged. The loan is "secured" on the borrower's property through a process known as mortgage origination.

Mutual Fund	A mutual fund is a professionally managed investment fund that pools money from many investors to purchase securities. These investors may be retail or institutional in nature.
National Tax	Any tax paid to a national or federal government, e.g. income tax, tariffs, and social security taxes.
National Wealth	The total value of capital and private property that is owned within a country.
Natural Monopoly	A natural monopoly is a monopoly in an industry in which high infrastructural costs and other barriers to entry relative to the size of the market give the largest supplier in an industry, often the first supplier in a market, an overwhelming advantage over potential competitors. This frequently occurs in industries where capital costs predominate, creating economies of scale that are large in relation to the size of the market; examples include public utilities such as water services and electricity.
Rivalry	In economics, a good is said to be rivalrous or rival if its consumption by one consumer prevents simultaneous consumption by other consumers, or if consumption by one party reduces the ability of another party to consume it. A good is considered non-rivalrous or non-rival if, for any level of production, the cost of providing it to a marginal (additional) individual is zero.
Oligopsony	An oligopsony is a market form in which the number of buyers is small while the number of sellers in theory could be large. This typically happens in a market for inputs where numerous suppliers are competing to sell their product to a small number of (often large and powerful) buyers.
Per Capita	A unit of account per person, usually placed at the end of an economic indicator.
Perfect Competition	A market structure in which a large number of firms all produce identical products.
Personal Property	Possessions such as jewelry, furniture, and real estate that people can amass through time.
Physical Capital	All human-made goods that are used to produce other goods and services, such as tools, machines, and buildings.
Price	The amount of money it takes to buy a product or produce a product.
Price Ceiling	A government-regulated maximum price that can be legally charged for a good or service. Governments use price ceilings to protect consumers from conditions that could make commodities prohibitively expensive. Such conditions can occur during periods of high inflation, in the event of an investment bubble, or in the event of monopoly ownership of a product, all of which can cause problems if imposed for a long period without controlled rationing, leading to shortages.
Price Floor	A government-regulated minimum price that can be legally charged for a good or service. Two common price floors are minimum wage laws and supply management in Canadian agriculture.
Price Index	A normalized average of price relatives for a given class of goods or services in a given region and during a given period of time. It is a statistic designed to help to compare how these price relatives, taken as a whole, differ between geographical locations or time periods. Notable price indices include consumer price index, producer price index, and GDP deflator.
Profit	In economics, profit in the accounting sense of the excess of revenue over cost is the sum of two components: normal profit and economic profit. All understanding of profit should be broken down into three aspects: the size of profit, the portion of the total income, and the rate of profit (in comparison to the initial investment).
Progressive Tax	A tax schedule that states that the more income one earns, the higher the tax rate will be.
Proportional Tax (Flat Tax)	A tax schedule that states that regardless of income, the same tax rate will be applied to all income earners.
Quantity Demanded	The amount of a good or service that a consumer is able and willing to purchase at a given market price.
Quantity Supplied	The amount of a good or service that a supplier is able and willing to produce at a given market price.
Quantity Theory of Money	In monetary economics, the quantity theory of money (QTM) states that the general price level of goods and services is directly proportional to the amount of money in circulation, or money supply.
Quota	A limited quantity of a product that can be produced, imported, or exported.
Real GDP	Gross domestic product that has been adjusted for inflation by applying the price deflator.
Recession	Part of the business cycle in which a nation's output (real GDP) does not grow for at least six months.
Reflation	Reflation is the act of stimulating the economy by increasing the money supply or by reducing taxes, seeking to bring the economy (specifically price level) back up to the long-term trend, following a dip in the business cycle. It is the opposite of disinflation, which seeks to return the economy back down to the long-term trend.
Regressive Tax	A tax schedule that states that the more income one earns, the lower the tax burden.
Retail Sales	Purchases of finished goods and services by households and firms.
Revenue	Total income from sales of output.
Risk Aversion	In economics and finance, risk aversion is the behavior of humans (especially consumers and investors), who, when exposed to uncertainty, attempt to lower that uncertainty.
Saving	Saving is income not spent, or deferred consumption. Methods of saving include putting money aside in, for example, a deposit account, a pension account, an investment fund, or as cash. Saving also involves reducing expenditures, such as recurring costs.
Scarcity	Scarcity is the limited availability of a commodity, which may be in demand in the market. Scarcity also includes an individual's lack of resources to buy commodities.
Service	In economics, a service is a transaction in which no physical goods are transferred from the seller to the buyer. The benefits of such a service are held to be demonstrated by the buyer's willingness to make the exchange.
Shortage	In economics, a shortage or excess demand is a situation in which the demand for a product or service exceeds its supply in a market. It is the opposite of an excess supply (surplus).
Shrinkflation	In economics, shrinkflation is the process of items shrinking in size or quantity, or even sometimes reformulating or reducing quality while their prices remain the same or increase. In 2009 Mars reduced the size of their Mars bar from 62.5 grams to 58 grams, while the price remained at 37 pence. Tetley tea bags were sold in boxes of 88 instead of 100.
Stagflation	In economics, stagflation, or recession-inflation, is a situation in which the inflation rate is high, the economic growth rate slows, and unemployment remains steadily high. It presents a dilemma for economic policy, since actions intended to lower inflation may exacerbate unemployment, and vice versa.
Standard of Living	An individual's or a socioeconomic class's standard of living is the level of wealth, comfort, material goods, and necessities available to them in a certain geographic area, usually a country.
State Tax	Any tax paid to a state government, e.g. sales taxes, state income tax, and license plate fees.
Substitute Good	A product that can satisfy the utility of another.
Sunk Costs	In economics and business decision-making, a sunk cost (also known as retrospective cost) is a cost that has already been incurred and cannot be recovered.

ADDENDUM Dictionary Economy

Supply	The total amount of a certain type of good that has been produced and is available.
Supply and Demand	In microeconomics, supply and demand is an economic model of price determination in a market. It postulates that, holding all else equal, in a competitive market, the unit price for a particular good, or other traded item such as labor or liquid financial assets, will vary until it settles at a point where the quantity demanded (at the current price) will equal the quantity supplied (at the current price), resulting in an economic equilibrium for price and quantity transacted.
Supply Schedule	A chart that lists how much of a good a supplier will offer at different prices.
Supply Shock	A sudden shortage of a good.
Surplus	In mainstream economics, economic surplus, also known as total welfare or Marshallian surplus (after Alfred Marshall), refers to two related quantities. Consumer surplus or consumers' surplus is the monetary gain obtained by consumers because they are able to purchase a product for a price that is less than the highest price that they would be willing to pay.
Tariff	A tariff is a tax on imports or exports between sovereign states. It is a form of regulation of foreign trade and a policy that taxes foreign products to encourage or safeguard domestic industry. Tariffs are the simplest and oldest instrument of trade policy. Traditionally, states have used them as a source of income.
Tax	A tax is a compulsory financial charge or some other type of levy imposed upon a taxpayer (an individual or other legal entity) by a governmental organization in order to fund various public expenditures. A failure to pay, along with evasion of or resistance to taxation, is punishable by law.
Tax Rate	In a tax system, the tax rate is the ratio (usually expressed as a percentage) at which a business or person is taxed. There are several methods used to present a tax rate: statutory, average, marginal, and effective. These rates can also be presented using different definitions applied to a tax base: inclusive and exclusive.
Terms of Trade	The rules that countries impose on each other in order to trade with each other.
Total Cost	In economics, total cost (TC) is the total economic cost of production and is made up of variable cost, which varies according to the quantity of a good produced and includes inputs such as labour and raw materials, plus fixed cost, which is independent of the quantity of a good produced and includes inputs that cannot be varied in the short term: fixed costs such as buildings and machinery, including sunk costs if any. Since cost is measured per unit of time, it is a flow variable.
Trade	Trade involves the transfer of goods or services from one person or entity to another, often in exchange for money. A system or network that allows trade is called a market.
Transaction Cost	Is a cost in making any economic trade when participating in a market.
Trough	In economics, a trough is a low turning point or a local minimum of a business cycle. The time evolution of many variables of economics exhibit a wave like behaviour with local maxima (peaks) followed by local minima (troughs). A business cycle may be defined as the period between two consecutive peaks.
Underemployment	Working at a job for which one is overqualified, or working part-time when full-time work is desired.
Unemployment	Under-utilization of any factor of production, most commonly referring to labor.
Unskilled Labor	Labor that requires no specialized skills, education, or training to perform.
Utilitarianism	Utilitarianism is a family of consequentialist ethical theories that promotes actions that maximize happiness and well-being for the majority of a population.
Utility	The usefulness of a good or service in satisfying a need or a want.
Value	Economic value is a measure of the benefit provided by a good or service to an economic agent. It is generally measured relative to units of currency, and the interpretation is therefore "what is the maximum amount of money a specific actor is willing and able to pay for the good or service"?
Value-Added Tax (VAT)	A value-added tax (VAT), known in some countries as a goods and services tax (GST), is a type of tax that is assessed incrementally, based on the increase in value of a product or service at each stage of production or distribution. VAT essentially compensates for the shared services and infrastructure provided in a certain locality by a state and funded by its taxpayers that were used in the elaboration of that product or service.
Variable Cost	Any cost that changes in proportion to the amount of goods or services that a business produces. Variable costs are also the sum of marginal costs over all units produced.
Velocity of Money	Refers to how fast money passes from one holder to the next. It can refer to the income velocity of money, which is the frequency with which the average same unit of currency is used to purchase newly domestically produced goods and services within a given time period. In other words, it is the number of times one unit of money is spent to buy goods and services per unit time.
Wage	A wage is monetary compensation (or remuneration, personnel expenses, labor) paid by an employer to an employee in exchange for work done. Payment may be calculated as a fixed amount for each task completed (a task wage or piece rate), or at an hourly or daily rate (wage labour), or based on an easily measured quantity of work done.
Wealth	Wealth is the abundance of valuable financial assets or physical possessions which can be converted into a form that can be used for transactions. This includes the core meaning as held in the originating old English word weal, which is from an Indo-European word stem. A community, region or country that possesses an abundance of such possessions or resources to the benefit of the common good is known as wealthy.
Wealth Effect	The change in spending that accompanies a change in perceived wealth. Usually the wealth effect is positive: spending changes in the same direction as perceived wealth.
Welfare	Welfare is a type of government support for the citizens of that society. Welfare may be provided to people of any income level, as with social security (and is then often called a social safety net), but it is usually intended to ensure that the poor can meet their basic human needs such as food and shelter. Welfare attempts to provide poor people with a minimal level of well-being, usually either a free- or a subsidized-supply of certain goods and social services, such as healthcare, education, and vocational training.
Willingness to Accept	In economics, willingness to accept (WTA) is the minimum amount of money that a person is willing to accept to abandon a good or to put up with something negative, such as pollution.
Willingness to Pay	Willingness to pay (WTP) is the maximum price at or below which a consumer will definitely buy one unit of a product. This corresponds to the standard economic view of a consumer reservation price. Some researchers, however, conceptualize WTP as a range.
Yield	In finance, the yield on a security is the amount of cash (in percentage terms) that returns to the owners of the security, in the form of interest or dividends received from it. Normally, it does not include the price variations, distinguishing it from the total return. Yield applies to various stated rates of return on stocks (common and preferred, and convertible), fixed income instruments (bonds, notes, bills, strips, zero coupon), and some other investment type insurance products (e.g. annuities).

ADDENDUM Dictionary Ec

Zero-Sum	In game theory and economic theory, a zero-sum game is a mathematical representation of a situation in which each participant's gain or loss of utility is exactly balanced by the losses or gains of the utility of the other participants. If the total gains of the participants are added up and the total losses are subtracted, they will sum to zero. Thus, cutting a cake, where taking a larger piece reduces the amount of cake available for others, is a zero-sum game if all participants value each unit of cake equally (see marginal utility).

Electricity

Voltage (E)	The electric force of work required to move current through an electric circuit, measured in units of volts.
Voltage (V)	The unit of measurement of voltage in an electric circuit, denoted by the symbol V.
Current (I)	The flow of free electrons in one general direction, measured in units of amps.
Amp (A)	The unit of measurement of electric current, denoted by the symbol A.
Direct-Current (DC)	Current that flows continually in one direction.
Alternating-Current (AC)	Current that flows in a circuit in a positive direction and then reverses itself to flow in a negative direction.
Resistance (R)	The electrical “friction” that must be overcome through a device in order for current to flow when voltage is applied.
Ohm (Ω)	The unit of measurement of resistance in an electric circuit, denoted by the symbol Ω.
Inductance (H)	The property that causes the current to lag the voltage, measured in units of henries.
Capacitance (F)	The property that causes the current to lead the voltage, measured in units of farads.
Energy (Wh)	The amount of electric work (real power) consumed or utilized in an hour. The unit of measurement is the watt hour.
Power (P)	The combination of electric current and voltage causing electricity to produce work. Power is composed of two components: real power and reactive power
Volt-Ampere (VA)	The unit of both real and reactive power in an electric circuit.
Real Power	The resistive portion of a load found by taking the cosine of the angle that the current and voltage are out of phase.
Watt (W)	The unit of real power in an electric circuit.
Reactive Power	The reactive portion of a load, found by taking the sine of the angle that the current and voltage are out of phase.
Var (Q)	The unit of reactive power in an electric circuit.
Power Factor (pf)	The ratio of real power to reactive power.
Frequency (f)	The number of complete cycles made per second, measured in units of hertz.
Hertz (Hz)	Units of frequency (equal to 1 cycle per second)
Conductors	Materials that have many free electrons and are good transporters for the flow of electric current.
Insulators	Materials that have hardly any free electrons and inhibit or restrict the flow of electric current.
Series Resistive Circuit	All of the resistive devices are connected to each other so that the same current flows through all the devices.
Parallel Resistive Circuit	Each resistive device is connected across a voltage source. The current in the parallel path divides and only a portion of the current flows through each of the parallel paths.
AWG (American Wire Gauge)	A numbering system to classify wire size based upon the number of steps required to draw the wire as it is being manufactured. The greater the gage number of wire, the smaller the wire.
Circular Mil	The area contained in a circle having a diameter of 1/1000 inch. (0.0254mm)
Anode	A positively charged electrode.
Cathode	A negatively charged electrode.
Compound	A pure substance composed of more than one element.
Conductor	A substance or medium that conducts heat, light, sound, or especially an electric charge.
Electrode	A solid electric conductor through which an electric current enters or leaves an electrolytic cell.
Ion	A charged particle.
Oxidation	The loss of electrons by a compound or ion.
Reduction	The gain of electrons by a compound or ion.
HVAC	Heating, Ventilation and Air Conditioning
Alternator	A device which converts mechanical energy into electrical energy.
Ammeter	An instrument for measuring the flow of electrical current in amperes. Ammeters are always connected in series with the circuit to be tested.
Ampere-Hour	A unit of measure for battery capacity. It is obtained by multiplying the current (in amperes) by the time (in hours) during which current flows. For example, a battery which provides 5 amperes for 20 hours is said to deliver 100 ampere - hours.
Amplifier	A device of electronic components used to increase power, voltage, or current of a signal.
Amplitude	A term used to describe the maximum value of a pulse or wave. It is the crest value measured from zero.
Armature	The movable part of a generator or motor. It is made up of conductors which rotate through a magnetic field to provide voltage or force by electromagnetic induction. The pivoted points in generator regulators are also called armatures.
Capacitor	A device which stores electrical energy. Commonly used for filtering out voltage spikes.
Current	Movement of electricity along a conductor. Current is measured in amperes.
Cycle	The change in an alternating electrical sine wave from zero to a positive peak to zero to a negative peak and back to zero.
Cycling	The process by which a battery is discharged and recharged.
Discharge	To remove electrical energy from a charged body such as a capacitor or battery.
Electrical Field	The region around a charged body in which the charge has an effect.
Electrochemical	The relationship of electricity to chemical changes and with the conversions of chemical and electrical energy. A battery is an electrochemical device.

Electrolyte	Any substance which, in solution, is dissociated into ions and is thus made capable of conducting an electrical current. The sulfuric acid - water solution in a storage battery is an electrolyte.
Electromagnet	Core of magnetic material, generally soft iron, surrounded by a coil of wire through which electrical current is passed to magnetize the core.
Electromagnetic Induction	The process by which voltage is induced in a conductor by varying the magnetic field so that lines of force cut across the conductor.
Electronics	The control of electrons (electricity) and the study of their behavior and effects. This control is accomplished by devices that resist, carry, select, steer, switch, store, manipulate, and exploit the electron.
Frequency	The number of pulse or wave cycles that are completed in one second. Frequency is measured in Hertz, as in 60Hz (hertz) per second.
Gate	A logic circuit device which makes a YES or NO (one or zero) decision (output) based on two or more inputs.
Generator	A device which converts mechanical energy into electrical energy.
Grounded Circuit	A connection of any electrical unit to the frame, engine, or any part of the tractor or machine, completing the electrical circuit to its source.
Inductance	The property of an electric circuit by which an electromotive force (voltage) is induced in it by a variation of current either in the circuit itself or in a neighboring circuit.
Insulator	A substance or body that resists the flow of electrical current through it.
Integrated Circuit	An electronic circuit which utilizes resistors, capacitors, diodes, and transistors to perform various types of operations. The two major types are Analog and Digital Integrated Circuits.
Inverter	A device with only one input and one output; it inverts or reverses any input.
Ion	An atom having either a shortage or excess of electrons.
Isolation Diode	A diode placed between the battery and the alternator. It blocks any current flow from the battery back through the alternator regulator when the alternator is not operating.
Light Emitting Diode	A solid - state display device that emits infrared light when a forward - biased current flows through it.
Microprocessor	An integrated circuit combing logic, amplification and memory functions.
Milliampere	1/1,000,000 ampere.
Motor	A device which converts electric energy into mechanical energy.
Multimeter	A testing device that can be set to read ohms (resistance), voltage (force), or amperes (current) of a circuit.
Mutual Induction	Occurs when changing current in one coil induces voltage in a second coil.
Ohm's Law	Ohm's Law states that when an electric current is flowing through a conductor, such as a wire, the intensity of the current (in amperes) equals the electromotive force (volts) driving it, divided by the resistance of the conductor. The flow is in proportion to the electromotive force, or voltage, as long as the resistance remains the same.
Parallel Circuit	A circuit in which the circuit components are arranged in branches so that there is a separate path to each unit along which electrical current can flow.
Piezo Electric Device	A device made of crystalline materials, such as quartz, which bend or distort when force or pressure is exerted on them. This pressure forces the electrons to move.
Plate	A solid substance from which electrons flow. Batteries have positive plates and negative plates.
Polarity	A collective term applied to the positive (+) and negative (-) ends of a magnet or electrical mechanism such as a coil or battery.
Pole	One or two points of a magnet at which its magnetic attraction is concentrated.
Pole Shoes	Iron blocks fastened to the inside of a generator or motor housing around which the field or stator coils are wound. The pole shoes may be permanent or electro - magnets.
Potentiometer	A variable resistor used as a voltage divider.
Power Switch Transistor	The part responsible for switching off the primary circuit that causes high voltage induction in the secondary winding in an electronic ignition system.
Printed Circuit Board	A device used to hold integrated circuit components in place and provide current paths from component to component. Copper pathways are etched into the board with acid.
Proton	A particle which, together with the neutron constitutes the nucleus of an atom. It exhibits a positive charge of electricity.
Pulse	A signal that is produced by a sudden ON and OFF of direct current (DC) within a circuit.
Pulse-Width-Modulated	A digital electronic signal which consists of a pulse generated at a fixed frequency. The information transmitted by the signal is contained in the width of the pulse. The width of the pulse is changed (modulated) to indicate a corresponding change in the information being transmitted, such as throttle command.
Rectifier	A device (such as a vacuum tube, commutator, or diode) that converts alternating current into direct current.
Regulator	A device which controls the flow of current or voltage in a circuit to a certain desired level.
Relay	An electrical coil switch that uses a small current to control a much larger current.
Reluctance	The resistance that a magnetic circuit offers to lines of force in a magnetic field.
Resistance	The opposing or retarding force offered by a circuit or component of a circuit to the passage of electrical current through it. Resistance is measured in ohms.
Rheostat	A resistor used for regulating a current by means of variable resistance; rheostats allow only one current path.
Semiconductor	An element which has four electrons in the outer ring of its atoms. Silicon and germanium are examples. These elements are neither good conductors nor good insulators. Semiconductors are used to make diodes, transistors, and integrated circuits.
Sensor	A small coil of fine wire in the distributor on electronic ignition systems. The sensor develops an electromagnetic field that is sensitive to the presence of metal. In monitors and controllers, they sense operations of machines and relay the information to a console.
Series Circuit	A circuit in which the parts are connected end to end, positive pole to negative pole, so that only one path is provided for current flow.

Electricity

Series-Parallel Circuit	A circuit in which some of the circuit components are connected in series and others are connected in parallel.
Short	This occurs when one part of a circuit comes in contact with another part of the same circuit, diverting the flow of current from its desired path.
Shunt	A conductor joining two points in a circuit so as to form a parallel circuit through which a portion of the current may pass.
Slip-Ring	In a generator, motor, or alternator, one of two or more continuous conducting rings from which brushes take, or deliver to, current.
Solenoid	A tubular coil used for producing a magnetic field. A solenoid usually performs some type of mechanical work.
Solid-State Circuits	Electronic (integrated) circuits which utilize semiconductor devices such as transistors, diodes and silicon controlled rectifiers.
Stator	The stationary part of an alternator in which another part (the rotor) revolves.
Sulfation	The formation of hard crystals of lead sulfate on battery plates. The battery is then "sulfated."
Switch	A device which opens or closes electrical pathways in an electrical circuit.
Tachometer	An instrument for measuring rotary speed; usually revolutions per minute.
Transformer	A device made of two coil windings that transfers voltage from one coil to the next through electromagnetic induction. Depending upon the number of windings per coil, a transformer can be designed to step - up or step - down its output voltage from its input voltage. Transformers can only function with alternating current (AC).
Trimmer Resistor	A resistor used in applications where only a small resistance change is needed.
Volt	A unit of electrical pressure (or electromotive force) which causes current to flow in a circuit. One volt is the amount of pressure required to cause one ampere of current to flow against one ohm of resistance.
Voltage	That force which is generated to cause current to flow in an electrical circuit. It is also referred to as electromotive force or electrical potential. Voltage is measured in volts.
Voltage Regulator	A device that controls the strength of a magnetic field produced by a generator or alternator. It prevents the battery from being overor undercharged during high - or low - speed operation of the generator or alternator.
Voltmeter	An instrument for measuring the force in volts of an electrical current. This is the difference of potential (voltage) between different points in an electrical circuit. Voltmeters are connected across (parallel to) the points where voltage is to be measured.
Watt	A unit of measure for indicating the electrical power applied in a circuit. It is obtained by multiplying the current (in amperes) by the electrical pressure (in volts) which cause it to flow. That is: watts = amperes x volts.
Watt-Hour	A unit of electrical energy. It indicates the amount of work done in an hour by a circuit at a steady rate of one watt. That is, watthours = ampere - hours x volts.
Wave	A signal that is produced by varying a continuous flow of current within a circuit. Waveforms can be created by either AC or DC current.
Winding	The coiling of a wire about itself or about some object. Often identified as a series winding, a shunt winding, etc.

Entertainment

Field Dressing

Fire

Arson	The crime of intentionally or maliciously lighting structures, wildland areas, cars or other property on fire.
Auto Reignition	A process used in gas burners to control ignition devices based on whether a burner flame is lit.
Autoignition Temperature	The lowest temperature at which a substance will spontaneously ignite in a normal atmosphere without an external source of ignition, such as a flame or spark.
Campfire	A fire lit at a campsite, to serve the following functions: light, warmth, a beacon, an insect and/or apex predator deterrent, to cook, and for a psychological sense of security.
Char Cloth	A swatch of fabric made from vegetable fibre (such as linen, cotton or jute) that has been converted via pyrolysis into a slow-burning fuel of very low ignition temperature.
Ember	A glowing, hot coal made of greatly heated wood, coal, or other carbon-based material that remain after, or sometimes precede a fire.
Feather Stick	A length of wood which has been shaved to produce a head of thin curls. It is sometimes used when starting an outdoor fire or campfire when dry tinder is difficult to find. It is often used in conjunction with charcloth.
Ferrocerium	A man-made metallic material that gives off a large number of hot sparks at temperatures at 3,000°F (1,650°C) when scraped against a rough surface (pyrophoricity), such as ridged steel.
Fire Ring	A construction or device used to contain campfires and prevent them from spreading and turning into wildfires.
Fire Striker	A piece of high-carbon steel used for striking a spark, usually kept in a tinderbox together with flint and tinder.
Fire Triangle	A simple model for understanding the necessary ingredients for most fires. The triangle illustrates the three elements a fire needs to ignite: heat, fuel, and an oxidizing agent (usually oxygen).
Firelighter	Small solid fuel tablets sold as a consumer product and designed to replace kindling in starting a fire.
Flint	A hard, sedimentary cryptocrystalline form of the mineral quartz, categorized as a variety of chert. It occurs chiefly as nodules and masses in sedimentary rocks, such as chalks and limestones. Inside the nodule, flint is usually dark grey, black, green, white, or brown in colour, and often has a glassy or waxy appearance. A thin layer on the outside of the nodules is usually different in colour, typically white and rough in texture.

ADDENDUM | Dictionary | Fire

Flint Spark Lighter	A type of lighter used in many applications to safely light a gaseous fuel to start a flame. It is most commonly used for bunsen burners and oxyacetylene welding torches.
Fuel	Any material that stores energy that can later be extracted to perform mechanical work in a controlled manner. Most fuels used by humans undergo combustion, a redox reaction in which a combustible substance releases energy after it ignites and reacts with the oxygen in the air.
Gas Lighter	A device which is used to ignite the gas stove. It is used in gas stoves which do not have automatic ignition system. It uses a physical phenomenon called piezo-electric effect to generate an electric spark which ignites the combustible gas from the stove burner.
Lighter	A portable device used to generate a flame. It consists of a metal or plastic container filled with a flammable fluid or pressurized liquid gas, a means of ignition, and some provision for extinguishing the flame.
Match	A typical modern match is made of a small wooden stick or stiff paper. One end is coated with a material that can be ignited by frictional heat generated by striking the match against a suitable surface.
Potassium Permanganate	Sometimes included in survival kits as a fire starter, water sterilizer and for creating distress signals on snow.
Pyromania	Impulse control disorder in which individuals repeatedly fail to resist impulses to deliberately start fires, in order to relieve tension or for instant gratification.
Smoulder	The slow, low-temperature, flameless form of combustion, sustained by the heat evolved when oxygen directly attacks the surface of a condensed-phase fuel.
Sodium Permanganate	Chemically similar to potassium permanganate, but it is generally less desirable because it is more expensive to produce.
Solar Spark Lighter	A pocket-sized stainless steel parabolic mirror, shaped to concentrate sunlight on a small prong holding combustible material at the focal point.
Tinder	Easily combustible material used to ignite fires by rudimentary methods. A small fire consisting of tinder is then used to ignite kindling.
Tinderbox	A small container containing flint, firesteel, and tinder (typically char cloth, but possibly a small quantity of dry, finely-divided fibrous matter such as straw), used together to help kindle a fire. Tinderboxes fell out of general usage when matches were invented.
Wood Ash	The residue powder left after the combustion of wood. Main producers of wood ash are wood industries and power plants.
Wood Fuel	Wood used as fuel. The burning of wood is currently the largest use of energy derived from a solid fuel biomass.
Zip Cube	Packaged small blocks of solid fuel containing kerosene, sold as a firelighter.
Rattan	Rattan is the name for roughly 600 species of old world climbing palms belonging to subfamily Calamoideae. The rattan creepers are often used as rope in survival situations.
Air Attack	Using airplanes or helicopters to help control a ground cover fire. Aircraft can also be used logistically to transport crews, supplies, and equipment.
Air Tanker	Any fixed-wing aircraft used to drop retardant or water on a wildland fire.
Anchor Point	A term associated with attack methods. Refers to an advantageous location, usually one with a barrier to fire spread, from which to start constructing a fire line. Used to minimize the chance of being "flanked" by the fire while constructing the fire line. Most anchor points originate at or near the area of origin (rear of fire).
Aspect	A topography term for direction towards which a slope faces.
Backfiring	When attacking a wildland fire using the indirect attack method, intentionally setting fire to fuels inside the control line to reduce fuel and contain a rapidly spreading fire. Backfiring provides a wide defense perimeter and may be further employed to change the force of the fire's convective column.
Black Line	When putting in control lines, the process of burning out any pockets of unburned fuels.
Blowup	A dangerously rapid increase in fire spread.
Brush	Shrubs and stands of short, scrubby trees that do not reach merchantable size, generally 3' to 20' in height.
Brush Engine	Any light, mobile vehicle having limited pumping and water capacity, designed for initial attack knockdown of a small wildland fire.
Burning Out	When attack on the wildland fire is direct, or parallel with the control line, intentionally setting fire to unburned islands of fuel inside the control line to strengthen the line.
Candling	Burning aerial canopy of one single tree from ground up.
Canopy	The foliage or leaf covering on fuel stock.
Cat Line	A fire line constructed by a bulldozer.
Cat Pile	A berm left by a bulldozer that might contain smoldering fuels.
Chain	A fire behavior term used to figure fire perimeter size and rate of spread. One chain equals 66 feet.
Cold Trailing	To control a partly dead fire's edge by carefully inspecting and feeling with bare hands for any remaining embers or coals.
Conduction	The transfer of heat from one place to another without movement of the medium.
Conflagration	A raging, destructive fire. Often used to describe a fire burning under extreme fire weather. The term is also used when a wildland fire burns into a wildland/urban interface, destroying many structures.
Contain Fire	When firefighters or other resources stop the forward progress of a fire but have not put in all control lines.
Control Line	A term used for all constructed or natural fire barriers used to control a fire.
Control of Fire	When firefighters and/or other resources completely surround and leave no open line on the fire perimeter.
Convection	The transfer of heat by physical movement of a heated medium from one place to another. The convective column of a wildland fire can provide the medium.
Crown Fire	Any fire that advances from top to top of trees or brush that is more or less independent of the surface fire.
Direct Attack	Attacking the fire on its burning edge or close to it. A direct attack is usually made on a wildland fire that is moving slowly and is not too hot for firefighters to operate close to the fire's edge with equipment.
Division	The largest segment of a geographical fire perimeter. A division supervisor is in charge of operational activities with the division. Letters are assigned to describe a division.

Drift Smoke	Smoke that has drifted from its point of origin and lost its original billowing form. Drift smoke can fill in canyons under stable air masses and make it difficult to see spot fires.
Drop	A term associated with air attack. Refers to dropped cargo, firefighters, or retardant.
Dry Lightning Storm	A lightning storm where little or no rain reaches the ground.
Duff	Matted, partly decomposed leaves, twigs, and bark beneath trees and brush.
Extended Attack	Fires that go beyond three burning periods.
Extreme Fire Behavior	When a wildland fire is influenced by adverse winds, fuels, adverse topography, or any combination of the above. High rates of spread, spotting, and thermal outputs are associated with extreme fire behavior.
Fine Fuel Moisture	A term expressing the moisture level (in percentage) found in fine fuels (such as grass).
Finger	Long, narrow extensions from the main body of the fire.
Fire Behavior	The manner in which a wildland fire develops; how fuels ignite, flame development, and fire spread.
Fire Break	An existing barrier, man-made or natural, that will stop or slow an oncoming wildland fire.
Fire Flank	The sides of a wildland fire between the tail and the head. Can be identified with compass directions, left and right, hot or cold.
Fire Line	The part of a control line that is scraped or dug down to mineral soil.
Fire Perimeter	The entire length of the outer edge of the fire.
Fire Retardant	Any substance or chemical applied to wildland fuels to slow the rate of combustion or reduce flammability, generally expressed as long-term or short-term. Long-term retardants are generally chemical based, whereas short-term retardants are primarily thickened soapy water.
Fire Season	The period of the year when wildland fires are most likely to occur.
Fire Storm	Violent convective columns caused by large continuous areas of fire, often appearing as tornado-like whirls. Can also occur from uneven terrain as fire spreads through an area. Are associated with extreme fire behavior.
Firing Team	Experienced wildland firefighters and firing boss in charge of carrying out backfiring or burn-out function.
Firing Out	Also called firing. The intentional setting on fire of fuels between the control line and the main body of fire in either a backfiring or burning-out operation.
Flanking	Attacking a wildland fire by working the sides of the fire between the head and rear.
Flash Fuels	Fuels like grass, leaves, pine needles, and tree moss that ignite readily and burn rapidly. Also called fine fuels.
Gradient Winds	Wind created by differing barometric pressures between high and low air-pressure systems.
Head of a Fire	The most active part of a wildland fire. A developing wildland fire can have multiple heads.
Heavy Fuels	Fuels of large diameter such as logs, snags, and large tree limbs. These ignite slowly and burn slow but hot.
Hose Lay	Connecting sections of fire hose together from the fire pump to the fire location with designated sections of line controlled by use of water.
Incendiary Fire	A wildland fire willfully set by anyone to burn wildland or property not owned or leased by this person.
Indirect Attack	A method of attack in which the control line is located along a natural barrier, firebreak, creek, river, or paved road. This attack method may be used in conjunction with backfiring.
Initial Attack (IA)	The first-alarm assignment (resources and personnel) dispatched to a wildland incident.
Live Fuel Moisture (LFM)	A term describing moisture levels (expressed in percentage) found in brush and trees.
Local Wind	A wind whose velocity and direction is determined by local heating and cooling (diurnal cycle). Local winds are low velocity, averaging less than 10 mph.
Major Fire	Generally, a fire of the size or complexity that it requires a large force of fire resources and personnel and several days to control.
Mop-up	After the fire has been controlled, all actions required to make the fire "safe", prior to being called out. This includes trenching, falling snags, and checking all control lines.
Parallel Firing Method	A method where hand-tool crews operate 100 yards parallel to the fire's edge and burn out as they complete the fire line.
Progressive Hose Lay	A hose lay used on a wildland fire, usually on the flanks, to follow up a hand line made by crews or as a means of making a "wet line" along the fire's edge. Major components of this lay include 1 1/2-inch hose as a main feeder line with 1-inch hose branched off it, usually every 100 to 150 feet.
Project Fires	Fires that require a large amount of logistical and service support to suppress. Fires that need a supervisor in each of the five major functions of ICS.
Rate of Spread (ROS)	A fire behavior term used to express relative horizontal growth of a wildland fire. Expressed in total perimeter growth in chains per hour. One chain equals 66 feet.
Rear of Fire	The portion of a fire opposite the head. The slowest burning part of the fire.
Relative Humidity	A weather term. The amount of moisture in a given parcel of air expressed as a percentage of the maximum amount that parcel of air could hold at the same air temperature.
Surface Fire	A fire that burns surface litter like dry pine needles and leaves.
Thermal Belts	In mountainous regions, the middle third of the slopes that remain active with fire during evening hours. This is due to down-canyon "falling" winds that pool cooler air in canyon bottoms but leave the middle part of the slope active.
Topography	An accurate and detailed description of a place, including land surface configuration, both man-mad and natural. Topography can be described in terms like "level", "steep", "broken", or "rolling".
Trenching	The action of digging trenches on a side slope to catch any material that might roll across the control lines.
Undercut Line	A control line constructed below a fire on a slope.
Virga	A weather term describing moisture falling from clouds but not reaching the earth's surface.
Wet Line	Control line put in by means of a progressive hose lay using 1 1/2-inch feeder line with 1-inch branch lines every 100 to 150 feet.
Wye	A hose fitting permitting two or more lines to be taken from a single supply line. Used frequently in progressive hose lays on wildland fires.

Fishing

Action (Fishing Rod)	This has to do with the amount of flex in the rod and the way the rod curves when under load, i.e. fighting fish or casting. Defining rod action tends to get a bit confusing but in Australia I believe it can simply be applied to the type of game you're chasing. For example, big, hard fighting fish that need strong line and heavy lures will need a Heavy to Extra Heavy Action Rod. The opposite can apply to light action rods. Medium action rods lay in the middle and are the most common action fishing rod.
Action (Fishing Lure)	How the lure moves through the water.
Bait	This can be a general term to describe any natural or man made item used to attract fish. Or it can be applied specifically to natural food items that a fish would eat.
Barb (Hook)	Is a angular piece that juts out from a hook just below the point to make it harder for a fish to dislodge the hook once the hook has been set.
Barbless (Hook)	Does not have a "barb" to enable an easier removal of a hook, and less damage to fish.
Burn and Kill	This is a term used to describe a method of lure retrieval where you quickly retrieve the "bait" and then stop suddenly to let it pause in the water.
Butt (Fishing Rod)	This is the base or handle of the fishing rod.
Jigging	Is a method of using a "bait" in a vertical up and down motion by lifting and lowering the fishing rod to entice a fish to "strike".
Leader or Trace	These include fluorocarbon, monofilament and wire. They are the last length of line that connects to your hook, lure, fly etc.
Main Line	The is the bulk of fishing line that is wrapped around a fishing reel and provides the primary connection from reel to rig.
Memory	Memory refers to the lines ability to maintain a shape. Fishing line is usually wound around something round like a spool. You have probably noticed that monofilament line will have bends in it when relaxed. This is because it has "memory" of what it has been doing most of the time, which is wound in a circle around a spool. No memory allows better casting.
Blade Bait	A weighted, fish-shaped blade made with a swinging hook and designed for fishing deep.
Buzzbait	These "safety pin" wire lures for surface fishing have a propeller blade on one wire and a weighted body, skirt and hook on the other.
Casting Spoon	A spoon-shaped metal or hard plastic lure that wobbles to attract fish. They can be fitted with a fixed (solid) hook or swinging hook, that has a single, double or treble points.
Crankbait	A fish-like hard lure or plug designed to swim under the surface, often made of plastic or wood. Some are combined with replaceable soft plastic tails.
Chumming	A fishing technique by which bait or scent is released into the water to attract fish to take a lure or baited hook. Chum consists of live, dead, ground-up or prepared baits and scents and is used in fresh and saltwater.
Hook	A metal wire device shaped like a "J" with an opening or "eye" at one end to which the line is tied and a point at the other end to catch the fish. Circle hooks have an angled point. Double and treble hooks have two or three points, respectively.
Jig	Sometimes called "bucktails", these weighted-body (often lead) lures are molded on special hooks and rigged with a hair tail or soft plastic skirt or worm.
Line	Specialized "string" used for fishing. Nylon monofilament line is the most popular. Other lines are made of different materials, including braided fibers and wire. FLY LINE is a specialized line made of a plastic coating on a core, and often made tapered (changing diameter) to make fly casting easier. (To preserve good fishing, take any discarded line with you when you leave. Discarded line can snag and harm wildlife, and kill fish, turtles, frogs, birds and small mammals.)
Lure	Any artificial item designed to attract fish and fitted with hooks. These include flies, hard plastic or wood lures (or plugs), soft plastic imitations, large offshore skirted baits, metal spoons, lead-head lures (jigs), bladed lures, spinners, spinnerbaits.
Reel	A mechanical device for holding and spooling fishing line. Reels have a line spool, brake to slow running fish, handle to retrieve line and foot for clamping to a rod. Reel styles include CASTING (revolving spool), SPINNING (line coiling off stationary spool); SPINCAST, (like spinning but with a nose cone), and FLY (storing thick fly line/backing and to fight big fish).
Rod	A long lever, usually made of fiberglass, graphite or composite materials and used to catch fish. Different types are available, such as rods for spinning, fly fishing, spincast, bait casting, boat fishing, offshore trolling, surf fishing, jetty/pier fishing, etc. Most rods have a reel-holding clamp and guides through which the line runs.
Pelagic	Refers to fish who inhabit the open oceans and who are generally found in the middle or upper water column.
Rig	Is a collection of "terminal tackle" used together in an arrangement to target a fish species. Generally it will include at least 2, possibly all, of the following; line, hook/s, swivel/s, sinker and float.
Running Sinker	This is a "sinker" that is unrestricted and free to move up and down the main line.
Setting the Hook	Is about increasing tension on the fishing line to embed the hook in a fishes mouth when you feel the fish has engaged the "bait".
Sinker	Is a weight used to sink line and bait in the water.
Snag	Basically a "structure" that you have or could potentially hook on to.
Snap	Is a piece of equipment that is commonly used to attach fishing line to lures and enable quick lure changes.
Swivel	Is a piece of equipment that attaches two lines together and spins independently so that the line doesn't twist.
Strike (Angler)	This refers to "setting the hook" by pulling the fishing rod away from the fish (towards yourself) to tighten the line and hook the fish.
Strike (Fish)	Refers to a fish attacking the "bait".
Structure	Is the physical formation of an object/s or landscape in relation to fish habitat, either underwater, on or just above the waters surface. These can be natural or man made for example, trees, rocks, pylons, jetties, bridges, FADs, bomboras, reefs, rock shelfs, islands, mangroves, steep drop offs, breakwalls, reeds, even weed beds can fall under the "Structure" definition when fishing.
Sinker	A weight of lead or other metals designed to sink a hooked bait or lure.
Snap	A small device similar to a dog leash snap, tied to the line and used for attachment and quick release of hooks, rigs and lures.
Soft Plastic Lures	Made of a soft plastic to resemble a worm, lizard, crayfish, shrimp or generic wiggling creature. Often sold in bulk to be rigged on a hook by the angler.
Spinner	Spinner blades rotate around the straight wire shaft of these weighted-body treble-hook lures.
Spinnerbait	"Safety pin" style wire lures with one or more spinner blades on the end of one wire, and a weighted body, skirt and hook on the other. Used to fish around structure such as trees and stumps.
Strike	Any "hit" by a fish taking a lure or bait.

Structure Spoon	Both casting and vertical jigging techniques are used for fishing these swinging hook heavy metal lures.
Tackle Box	A box or bag with special compartments and features to hold terminal tackle, lures, hooks, and other fishing gear.
Terminal Tackle	A general term for describing bobbers, sinkers, hooks, rigs, snaps, swivels and other gear used at the end of a line.
Trolling	A method of slowly running a boat while trailing lures or bait. This fishing method is used to cover a lot of water and to find fish.
Trolling Spoon	A large spoon that is trailed, or trolled, behind a boat to catch fish.
Taper (Fishing Rod)	Rod taper refers to the way the rod narrows from butt to tip. This effects the action of a fishing rod. A rod that flexes mostly at the tip has a fast taper and a rod that flexes through it's entire length has a slow taper. Generally speaking fast taper is better for lure fishing and slow taper is better for bait fishing.
Terminal Tackle	This is a term used to describe any gear that is used at or near the end of a fishing line (the "fishy" end). Hooks, Sinkers, Jig Heads, Swivels, Snaps, Floats, Lures etc all fall into this category.
Trolling	It the process of dragging a type of "bait" behind a watercraft to catch fish.
Walk the Dog	Is used to describe a style of action that surface lures like pencils or stickbaits impart when being retrieved in combination with a special rod technique.
Topwater Lure	Lures made of hard plastic, wood, hollow rubber/plastic and designed to float on the surface to attract fish when twitched or moved.
Tube Bait	Made of soft plastic, these tubular lures are fished with special weighted hooks inserted into the hollow body.
Weedless Spoon	Wobbling spoons made with a fixed hook and guard for fishing weeds.

Fitness

Activities of Daily Living (ADLs)	Physical tasks of everyday living, such as bathing, and walking up the stairs. ADLs are usually factored in to a person's basal metabolic rate, so tracking calories burned for these types of movement isn't recommended when trying to lose weight.
Aerobic Exercise	Any rhythmic activity that increases the body's need for oxygen by using large muscle groups continuously for at least 10 minutes. The term aerobic means "with oxygen."
Agonist Muscle	A muscle that is very effective in causing a certain joint movement. Also called the prime mover.On a biceps curl, the biceps is the agonist muscle that flexes the elbow joint.
Amenorrhea	The absence of menstruation, commonly found in women with a very low body fat percentage and/or exercise excessively.
Anaerobic Exercise	Short lasting, high intensity activity, where the demand for oxygen from the exercise exceeds the oxygen supply.
Angina Pectoris	Chest pain due to lack of blood flow (oxygen) to the heart.
Antagonist Muscle	A muscle that causes movement at a joint in a direction opposite to that of the joint's agonist (prime mover).
Beta-Blockers	Type of medication that reduces heart rate. Exercisers who take beta-blockers will have a lower heart rate at rest and during exercise, so the target heart rate formula cannot be used in this case.
Bioelectrical Impedance	This method of measuring body composition is based on the fact that the lean tissue of the body is much more conductive due to its higher water content than fat tissue. The more lean tissue present in the body, the greater the conductive potential, measured in ohms.
Body Composition	Amount of fat vs. lean muscle tissue in the human body.
Body Mass Index (BMI)	Measure of the relationship between height and weight; calculated by dividing weight in kilograms by height in centimeters squared.
Caffeine	A stimulant found in coffee, tea, chocolate, and some soft drinks that increases heart contractions, oxygen consumption, metabolism, and urinary output.
Calisthenics	Exercising using one's own body weight which helps develop muscular tone.
Cardiorespiratory Fitness	Measure of the heart's ability to pump oxygen-rich blood to the muscles. Also called cardiovascular or aerobic fitness.
Cardiovascular System	A complex system consisting of the heart and blood vessels; transports nutrients, oxygen, and enzymes throughout the body and regulates temperature, water levels of cells, and acidity levels of body components.
Circuit Training	Takes the participant through a series of exercise stations (which could also include strength training), with relatively brief rest intervals between each station. The purpose is to keep the heart rate elevated near the aerobic level without dropping off. The number of stations may range from 4 to 10.
Concentric Muscle Action	Force produced while the muscle is shortening in length.
Continuous Training	This is the most common type of sustained aerobic exercise for fitness improvement, slowly adding more time to the workout to increase endurance.
Cool Down	Lowering of body temperature following vigorous exercise. The practice of cooling down after exercise involves slowing down your level of activity gradually.
Core	A muscle group comprised of the abdominals, lower back, obliques, and hips.
Cortisol	A hormone secreted by the adrenal gland that makes stored nutrients more readily available to meet energy demands. These hormone levels increase under stress, which can stimulate your appetite, leading to weight gain or difficulty losing weight.
Cross-Training	An individualized combination of all aerobic-training methods, characterized by a variety of intensities and modes.
Detraining Principle	This principle says that once consistent exercise stops, you will eventually lose the strength that you built up. Without overload or maintenance, muscles will weaken in two weeks or less.
Diastolic Blood Pressure	The pressure exerted by the blood on the vessel walls during the resting portion of the cardiac cycle, measured in millimeters of mercury.The diastolic number is the bottom of the fraction. 120/80 is an average value for normal blood pressure (80 is the diastolic number). Mild high blood pressure is considered to be between 140/90 and 160/95. High blood pressure is defined by a value greater than 160/95.
DOMS (Delayed Onset Muscle Soreness)	Muscle soreness or discomfort that appears 12 to 48 hours after exercise. It is most likely due to microscopic tears in the muscle tissue, and it usually requires a couple of days for the repair and rebuilding process to be completed. The muscle tissue grows back stronger, leading to increased muscle mass and strength.

Eccentric Contraction	A lengthening of the muscle during its contraction; controls speed of movement caused by another force.
Ectomorph	A body shape characterized by a narrow chest, narrow shoulders and long, thin muscles.
Electrolytes	Salts (ions) found in bodily fluids. Pertaining to exercise, your body loses electrolytes (sodium, potassium) when you sweat. These electrolytes need to be replaced to keep concentrations constant in the body, which is why many sports drinks include electrolytes.
Endomorph	A body shape characterized by a round face, short neck , wide hips, and heavy fat storage.
Endorphins	Opiate-like hormones that are manufactured in the body and contribute to natural feelings of well-being.
EPOC (Excess Post-Exercise Oxygen Consumption)	This explains why your breathing rate remains heavy for a few minutes after finishing a workout. Your body needs more oxygen after a workout in order to restore the oxygen stores in the blood and tissues, and to meet the oxygen requirements of the heart rate, which is still elevated.
Epinephrine	Also called adrenaline, a hormone that stimulates body systems in response to stress.
Ergogenic Aids	A substance, appliance, or procedure that improves athletic performance.
Eustress	"Good" stress that presents opportunities for personal growth. (Exercise is an example of this. It puts stress on the body and its systems, but the results of this stress are positive.)
Exercise metabolic rate (EMR)	The energy expenditure that occurs during exercise.
Fast Twitch Muscle Fibers	Fibers that are better-suited for high-force, short duration activities because they contain more stores for anaerobic energy utilization.
Fixed Resistance	Strength training exercises that provide a constant amount of resistance throughout the full range of motion. Examples include free weights and resistance bands.
Flexibility	The measure of the range of motion, or the amount of movement possible, at a particular joint.
Graded Exercise Test (Incremental Exercise Test)	An exercise test involving a progressive increase in work rate over time. Often graded exercise tests are used to determine the subject's maximum oxygen consumption or lactic threshold.
Heart Rate Reserve (HRR)	Difference between resting and maximal heart rate.
Heat Cramps	Muscle cramps that occur during or following exercise in warm or hot weather.
Heat Exhaustion	A heat stress illness caused by significant dehydration resulting from exercise in warm or hot conditions; frequent precursor to heat stroke.
Heat Stroke	A deadly heat stress illness resulting from dehydration and overexertion in warm or hot conditions; can cause body core temperature to rise from normal to 100 or 105 degrees Fahrenheit in just a few minutes.
High-Density Lipoprotein (HDL)	Retrieves cholesterol from the body's cells and returns it to the liver to be metabolized. Also referred to as "good" cholesterol.
High Impact	Activities that place more stress on the bones and joints, where your limbs are actually making contact with the ground or other surface with force. Examples include: walking, running, step aerobics, and sports that involve impact, like basketball or tennis.
Hydrostatic (Underwater) Weighing	This method of measuring body composition is considered the "gold standard" and is based on the assumption that density and specific gravity of lean tissue is greater than that of fat tissue. By comparing test subject's mass measured underwater and out of the water, body composition may be calculated.
Hyperplasia	An increase in the number of cells in a tissue; usually in reference to fat or muscle cells.
Hypertrophy	An increase in cell size (girth), usually in reference to fat or muscle cells.
Hypothermia	A life-threatening condition in which heat is lost from the body faster than it is produced.
Incremental Exercise Test (Graded Exercise Test)	An exercise test involving a progressive increase in work rate over time. Often these tests are used to determine the subject's maximum oxygen consumption or lactic threshold.
Interval Training	Repeated intervals of exercise interspersed with intervals of relatively light exercise. This type of training provides a means of performing large amounts of high-intensity exercise in a short period of time.
Isokinetic Exercise	Exercise in which the rate of movement is constantly maintained through a specific range of motion even though maximal force is exerted.
Isometric Exercise	Any activity in which the muscles exert force but do not visibly change in length. For example, pushing against a wall or carrying a bag of groceries.
Isotonic Exercise	Any activity in which the muscles exert force and change in length as they lift and lower resistance. For example, bicep curls or leg extensions.
Karvonen Formula	One of the most effective methods used to calculate target heart rate. It factors resting heart rate into the equation.
Ketosis	A condition in which the body adapts to prolonged fasting or carbohydrate deprivation by converting body fat to ketones, which can be used as fuel for some brain activity. The real danger in ketosis is that ketones are acidic, and high levels of ketones make the blood abnormally acid.
Lactic Acid	Once thought of as a waste substance that builds up in the muscles when they are not getting enough oxygen, leading to muscle fatigue and soreness. Now, experts believe that lactic acid is beneficial to the body, acting as a "fuel" to help people continue high-intensity (anaerobic) exercise even when oxygen consumption is low.
Lactic Threshold	The point at which the level of lactic acid in the blood suddenly increases (during exercise). This is a good indication of the highest sustainable work rate. Also known as anaerobic threshold.
Lean Mass	Total weight of your muscle, bone, and all other body organs. (Everything in the body besides fat.)
Low-Density Lipoprotein (LDL)	Transports cholesterol and triglycerides from the liver to be used in various cellular processes. Also referred to as "bad" cholesterol.
Low Impact	Activities that place less stress on the bones and joints. These are better for people with joint pain, and overweight individuals whose weight can hurt their joints. Examples include: swimming, elliptical, cycling, and other activities where your feet (or other body parts) aren't touching the ground with force or where you are somehow supported.
Max VO 2	(V02 Max) Highest amount of oxygen one can consume during exercise. The higher this number, the more you are cardiovascularly fit and capable of increased levels of intensity.
Mesomorph	A body shape characterized by a large chest, long torso, solid muscle structure and significant strength.

MET	An expression of the energy it takes to sit quietly. It is frequently used as a measure of intensity on cardiovascular machines (treadmill, stationary bike, etc.) For example, moderate intensity activities are those that get you moving fast enough or strenuously enough to burn off three to six times as much energy per minute as you do when you are sitting quietly, measured as 3-6 METs.
Moderate Intensity	Activities that range from 40-60% of max heart rate. These activities cause a slightly increased rate of breathing, and feel light to somewhat-hard. Individuals doing activity at this intensity can easily carry on a conversation.
Muscle Fibers	Individual muscle cells that are the functional components of muscles.
Muscular Endurance	The ability of the muscle to perform repetitive contractions over a prolonged period of time.
Muscular Strength	The ability of the muscle to generate the maximum amount of force.
Obesity	A weight disorder generally defined as an accumulation of fat beyond that considered normal for a person based on age, sex, and body type.
One-Rep Max (1 RM)	The amount of weight/resistance that can be lifted or moved once, but not twice; a common measure of strength.
Opposing Muscles	Muscles that work in opposition to the ones you are training. For example, the bicep is the opposing muscle to the triceps; the hamstring is the opposing muscle to the quadriceps.
Osteoporosis	A disease characterized by low bone mass and deterioration of bone tissue, which increases risk of fracture.
Overload Principle	This principle says that in order to train muscles, they must work harder than they are accustomed to. This “overload” will result in increased strength as the body adapts to the stress placed upon it.
Overuse Injuries	Injuries that result from the cumulative effects of repetitive (day-after-day) stresses placed on tendons, muscles, and joints.
Percent Grade	Measure of the elevation of a treadmill.
Physical Fitness	The ability to perform regular to vigorous physical activity without great fatigue.
Pilates	Exercise programs that combine dynamic stretching with movement against resistance.
Plateau	Point in an exercise program where no additional progress is being made (gains in strength, weight loss, increased endurance, etc). One way to break through a plateau is to change the kind of activity you are doing or something about your current activity- adding hills, increasing speed, increasing distance, etc.
PNF Stretching	Proprioceptive neuromuscular facilitation (PNF) stretching is a static stretch of a muscle immediately after maximally contracting it.
Primary Prevention	Actions designed to stop problems before they start.
Pronation	To turn or rotate (the foot) so that the inner edge of the sole bears the body's weight.
Plyometric Training	Exercises that enable a muscle to reach maximal force production in as short a time as possible. For example, jumping from a 3 ft. stool to the ground and immediately springing back up to another stool.
Rate of Perceived Exertion (RPE)	Scale of 1-10 that rates how you are feeling (both physically and mentally) as it relates to exercise fatigue.
Repetition	The number of times an exercise is repeated within a single exercise “set.”
Resting HR	Rate at which your heart beats at rest (while sitting or being inactive). Low resting heart rates are a good measure of health and fitness.
Resting Metabolic Rate (RMR)	Number of calories expended to maintain the body during resting conditions. Also referred to as basal metabolic rate.
Set	A basic unit of a workout containing the number of times (repetitions) a specific exercise is done (e.g. do 3 sets of 5 repetitions with 100 pounds).
Shin Splint	Generic term used to describe pain in the lower leg, either on the medial (inside) or lateral side (outside) of the shin bone.
Sit and Reach Test	A common fitness test that determines flexibility (of the hamstrings and lower back).
Skinfold Caliper Test	A method of determining body fat whereby folds of skin and fat at various points on the body are grasped between thumb and forefinger and measured with calipers.
Skin Fold Measurements	This method of measuring body composition assumes that substantial fat is proportional to overall body fat, and thus by measuring several sites, total body fat may be calculated.
Slow Twitch Muscle Fibers	Fibers that are better-suited for low-force, long duration activities because they possess more endurance enzymes.
Specificity of Training Principle	This principle says that only the muscle or muscle group you exercise will respond to the demands placed upon it. By regularly doing curls, for example, the muscles involved (biceps) will become larger and stronger, but curls will have no effect on the muscles that are not being trained. Therefore, when strength training, it is important to strengthen all of the major muscles.
Static Stretching	A low force, high-duration stretch where the muscle is held at the greatest possible length for up to 30 seconds.
Strength Training (Resistance Training)	The process of exercising with progressively heavier resistance for the purpose of strengthening the musculoskeletal system.
Systolic Blood Pressure	The pressure exerted on the vessel walls during ventricular contraction, measured in millimeters of mercury. The systolic number is the top of the fraction. 120/80 is an average value for normal blood pressure (120 is the systolic number). Mild high blood pressure is considered to be between 140/90 and 160/95. High blood pressure is defined by a value greater than 160/95.
Tai Chi	An ancient Chinese form of exercise, widely practiced in the West today, that promotes balance, coordination, stretching, and meditation.
Talk Test	Method to ensure you are working out at a level where you can answer a question but not comfortably carry on a conversation. This is a good intensity level for weight loss and improved physical fitness.
Tapering	The process athletes use to reduce their training load for several days prior to competition.
Target Heart Rate (THR)	The recommended range is 60-85% of your maximum heart rate. It represents a pace that ensures you are training aerobically and can reasonably be maintained.
Tension Principle	This principle says that tension is created by resistance, which can come from weights, bands, machines, or body weight.
Testosterone	The steroid hormone produced in the testes; involved in growth and development of muscle mass. Since men have more testosterone than women, they are able to gain muscle mass more easily.
Thyroid	Endocrine gland located in the neck that secretes T3 and T4 (hormones), which increase metabolic rate.
Type I Muscle Fibers	Fibers that contain large numbers of oxidative enzymes and are highly fatigue resistant (more prevalent in endurance athletes).
Type IIA Muscle Fibers	Fibers that contain biochemical and fatigue characteristics that are between Type IIB and Type I fibers (the best of both worlds).

Type IIB Muscle Fibers	Fibers that have a relatively small number of mitochondria, a limited capacity for aerobic metabolism, and are less resistant to fatigue than slow fibers (more prevalent in sprinters and power lifters).
Variable Resistance	Strength training exercises that change the amount of resistance throughout the full range of motion.
Vigorous Intensity	Activities above 60% of max heart rate. These activities cause an increased rate of breathing, sweating, and feel somewhat-hard to hard.
Waist to Hip Ratio	A calculation of the proportion of fat stored on your body around your waist and hips. Formula: waist measurement divided by hip measurement. Women should have a ratio of 0.8 or less; men should have a ratio of .95 or less.
Warm Up	To prepare for an athletic event (whether a game or a workout session) by exercising, stretching, or practicing for a short time beforehand.
Yoga	A variety of Indian traditions geared toward self-discipline and the realization of unity; includes forms of exercise widely practiced in the West today that promote balance, coordination, flexibility, and meditation.

Food

Food Grade Bucket	Food grade buckets are white buckets made specifically for food storage. They will help store food for upwards of 25-years, keeping food airtight, safe and dry.
Gamma Lid	An airtight lid that is used for plastic containers that are food grade.
Mason Jars	Simple glass jars that are used for canning food.
Mylar Bags	Bags that are used to provide a barrier between stored survival food and sunlight.
Oxygen Absorbers	When you use oxygen absorbers with proper packaging and sealing, you'll greatly reduce the oxygen in your food. It's important to use oxygen absorbers with gas flushing / vacuum packaging to absorb virtually all oxygen and absorb any oxygen that may permeate the package.
SuperPail	Brand name for a food grade bucket, which usually contains grains or freeze dried foods.
Zeer Pot	A zeer pot is a simple device to keep your foods cold without electricity. A zeer pot keeps it cool through evaporation. A zeer pot requires two clay pots (one nested inside the other with a layer of wet sand in between), water and a cover.
Ababai	Ababai comes from the Caricacae family of fruits, which also contains the Mau Mau, and some forms of papaya. It is considered an exotic fruit in the United States. It is imported from Chile, as Chile is the only country in the world that exports this luscious fruit. Very few countries grow Ababai and then only for their local market. It is a protected fruit in Chile and was only recently available for export.
Abais	A French term that describes puff pastry that has been rolled very thin or sponge cake that has been cut very thin for dessert preparation.
Abalone	Abalone are shellfish of the univalve family, meaning they only have one shell, unlike bivalves such as clams that consist of two shells. This edible gastropod belongs to the same family as the sea slug and is related to the snail. Out of its shell, it resembles a large scallop. They are found in United States, Japan, Australia, Mexico, and Indo-Pacific Region.
Absinthe (AB-sinth)	An anise-flavored liqueur that is made by steeping wormwood and other aromatic herbs (hyssop, lemon balm, and angelica) in alcohol. The drink is distinguished by its dazzling blue-green clarity due to its chlorophyll content.
Acetomel	A mixture of honey and vinegar that produces sweet-sour syrup. Traditionally used to preserve fruits.
Acidify	To add acid (lemon juice or vinegar) to a culinary preparation to made a dish slightly acid, sour, or piquant.
Acidulated Water	It is a solution of 5 to 6 parts water to 1 part acid (typically the acid ingredient is lemon juice or vinegar). Since the flesh of certain fruits and vegetables, such as apples and pears, will darken when exposed to air unless used immediately after cutting, they are dropped into an acidulated water to stop this process.
Aerate (ER-ayt)	Aerate means the same as "sift." To pass dry ingredients through a fine-mesh sifter so large pieces can be removed. The process also incorporates air to make ingredients like flour, lighter.
After Taste	Taste which returns to the mouth after ingestion of certain foods and beverages.
Agar-Agar	Processed seaweed, grayish white in color and comes in sticks, flakes, granules or powder. It is a vegetarian gelatin. After it is soaked in cold water, it becomes bouncy, resilient, and crisp . It is used mostly for cold oriental dishes that contain chicken, meat, and vegetables. In the old days, before the introduction of gelatin, agar-agar was also used as a thickening agent in making cold jellied dishes. Once soaked in boiling water, it melts into a gelatinous substance.
Ahi (AH-hee)	Ahi tuna is simply yellow fin tuna. It is a term used in Hawaii to describe this variety of tuna, which is distinguished from the other variety of tuna, known as blue fin.
Aiguillette	Long, thin slices of poultry of fish.
Aioli (eye-YO-lee)	The French word for garlic is "ail." Aioli is garlic-flavored mayonnaise made from pounded cloves of garlic, egg yolks, oil, and seasoning. Just before it is served, lemon juice and a little cold water are added. It is served as a sauce for a variety of garnishes and main courses. The Italian for aioli is "aglio," the Spanish is "ajo" and "allioil."
Akutaq	Also known as aqutuk, ackutuk, or Eskimo Ice Cream. Not the creamy ice cream as we know it, but a concoction made from reindeer fat or tallow, seal oil, freshly fallen snow or water, fresh berries, and sometimes ground fish. Air is whipped in by hand so that it slowly cools into foam. It is eaten as a desert, a meal, a snack, or a spread.
Al dente (ahl-DEN-tay)	In Italian the phrase means "to the tooth" and is a term used to describe the correct degree of doneness when cooking pasta, risotto, and vegetables. The food should have a slight resistance (chewy) when biting into it, but should not be soft, overdone, or have a hard center.
Al Forno (ahl FOHR-noh)	An Italian term to describe a dish that is "oven baked" or "oven roasted."
All-Purpose Flour	All-purpose flour is made from a blend of high-gluten hard wheat and low-gluten soft wheat. It is a fine-textured flour milled from the inner part of the wheat kernel and contains neither the germ (the sprouting section) nor the bran (the outer husk). By law, in the United States, all flours not containing wheat germ must have niacin, riboflavin, and thiamin added. Most all-purpose flours are labeled "enriched," indicating that these nutrients have been
Allspice	The dried, unripe berry of a small tree. It is available ground or in seed form. Allspice can be used in a variety of dishes such as pickles, casseroles, cakes, and puddings. Also known as Jamaica Pepper. It is the fruit of the evergreen pimiento tree. The flavor resembles a blend of cloves, cinnamon, and nutmeg. This spice is used in both sweet and savory cooking and can be purchased whole or ground.

Almond	It is the kernel of the fruit of the almond tree that is native of the warmer parts of western Asia and North Africa. It belongs to the same group of plants as the rose, plum, cherry, and peach. The seed is rounded at one end and pointed at the other, and covered with a thin brown coat.
Amaranth	Amaranth is from the Greek for "never-fading flower" or "everlasting." It is an annual herb, and therefore not a true grain. It has broad leaves and large flower heads that produce thousands of tiny, protein-rich seeds. There are hundreds of varieties of amaranth. It is grown for its leaves-some varieties are good in salad, some are delicious steamed or stir-fried-and its somewhat peppery seeds. Amaranth can be cooked as a cereal.
Anaheim Chile (An-uh-hime)	Mild, long green chile peppers that are named after the area near Los Angeles where they were first cultivated. Also known as Chile Verde (green), Chile Colorado (red) or the California Long Green, the Anaheim Chile is light green in color and slightly bent . It is the most commonly found variety in the United States.
Ancho Powder	It is ground ancho (pablano) chile peppers. In other words, it is a chile powder. Ancho Chili is a dark Smokey chili with a deep rich flavor and mild to medium heat. Their flavor is somewhat sweet and a little raisin like. This pepper is the most commonly used in authentic Mexican cooking and is a staple in red chili and tamales. Ancho Powder is a terrific choice for those who are looking for a "milder" taste in their cooking. Use Ancho Powder just as you would salt or pepper. Sprinkle on pasta, baked potatoes, vegetables, soups, pizza, popcorn and more. Also try it to season chicken, stews, potatoes, vegetables and, of course, Mexican dishes.
Angel Food Cake	Angel Food Cake is also known as foam-style cake. They are made with a large quantity of egg whites and no shortening or leavening. Angel Food or "angel cake" is thought to be a takeoff of the cornstarch cake and the sponge cake.
Angostura Bitters	Named after a town in Venezuela and made in Trinidad from roots, bark, leaves, and alcohol. It is used in small amounts to lend an aromatic and slightly bitter element to mixed drinks. It is best known as the essential ingredient of the popular cocktail called the "Manhattan."
Antipasto (ahn-tee-PAH-sto)	The term antipasto, usually translated as "appetizer" in English. It literally means "before the meal" and denotes a relatively light dish designed to stimulate the palate before the service of more substantial courses.
Appetizer (apy-tizer)	It is a small portion of bite-size food which is served before a main meal as the first course in order to stimulate the appetite. If served before a meal it should be small. They may be hot or cold, plated, or served as finger food. If served at a cocktail party, it is usually called hors d' oeuvres.
Apple Charlotte	Apple Charlotte consists of layers of cake or breadcrumbs, sugar, butter, and apples.
Applejack	A brandy made by distilling apple cider. The name is also given to a beverage produced by freezing hard cider.
Arracheras	The Mexican term for fajitas or skirt steak.
Arrack (Ah-RAK)	Also called arak. It is an anise-flavored liqueur, often homemade. It is a popular aperitif in the Middle East. It is a distilled from grapes, dates, and other fruits. In its countries of origin, it is included in cooking in some recipes for fish stews.
Arrowroot	A fine, dry white powdered starch made from a tropical root and exported from the British West Indies. It is named for its curative properties in treating arrow wounds.
Au Bleu	The French term for the method of preparing fish the instant after it is killed. Used especially for trout, as in "truite au blue," when the freshly killed fish is plunged into a boiling court bouillon, which turns the skin a metallic blue color.
Au (saw)	It is a French term that has the same meaning as "a la" meaning "in the manner of," "in the style of," and "according to" In cooking, this phrase designates the style of preparation or a particular garnish.
Au Beurre (bur)	Made with or in butter
Au Bleu (blo)	Means blue and describes the process where freshly killed fish is plunged into boiling water and poached until the skin of the fish has a bluish tinge.
Bagel (BAY-guhl)	Bagel derives from the Yiddish word beygl, which comes from the German word beugel meaning a "bracelet." Bagels are bread rolls in the shape of a doughnut or an old-fashioned curtain ring. The brown crust is obtained on the rolls by first boiling them in water and then baking them in an oven.
Baked Alaska	A dessert that consists of a sponge cake that is covered with ice cream, then with a layer of stiffly beaten egg whites, and lastly put in a hot oven to be browned. Also known as omelette la norvienne, Norwegian omelette, omelette surprise, and glace au four.
Baker's Dozen	The "baker's dozen" refers to providing 13 baked items for the price of 12. This originated as a way to avoid shortchanging the customer. Bakers who shorted (cheated) customers could be punished severely-such as losing a hand to an axe! This allowed that one of the 13 could be lost, eaten, burnt, or ruined in some way, leaving the baker with the original legal dozen. The practice can be seen in the Baker Guild codes of the Worshipful Company of Bakers in London, 12th century.
Baking Powder	It is a leavener that consists of a combination of baking soda, cream of tartar, and a moisture absorber (like cornstarch). It has the action of yeast but it acts much more quickly. It is used in batters where there is no acid present. Baking powder acts immediately upon addition of water, therefore a filler (usually cornstarch) is added to absorb the moisture and prevent premature activity. Various baking powders were sold in the first half of the 19th century. Check out the History of Baking Powder.
Baking Soda	Baking soda, which is the alkaline element bicarbonate of soda, is used solely as a chemical leavener in baking. Because it is not premixed with an acid, as is baking powder, it is used alone in baked goods where other ingredients, which also contain acid, are present (yogurt, buttermilk, lemon juice, or sour cream). When the baking soda and acid are combined, they neutralize each other, causing carbon dioxide gas bubbles to form. The bubbles make the dough or batter grow bigger, or rise. Baking soda is more volatile than baking powder because it begins to act the minute you moisten it with the wet ingredients. You must put whatever you are baking right in the oven once the baking soda has been activated. See also bicarbonate of soda.
Baklava (BAHK-lah-vah)	A popular middle eastern (especially Greece and Turkey) pastry that is made with buttered layers of phyllo dough. How it is traditionally made depends on the region. In some areas, it is made with walnuts; in other areas, it is made with pistachios or almonds. Sometimes dried fruit is added between the layers. Baklava consists of 30 or more sheets of phyllo dough brushed with lots of butter, and layered with finely chopped nuts. After baking, a syrup of honey, rose water and lemon juice (sometimes spiced with cinnamon, cardamom, cloves, etc) is poured over the pastry and allowed to soak in. This dessert is known as baglawa in Syrian and Lebanese.
Balti	Balti is an Indian dish, which may have originated in Northwest Pakistan. It is a form of a meat curry, but one that's cooked quickly (like a stir-fry. The spice mix used to flavor the dish is a combination of seeds (coriander, cardamom, cumin, black mustard, fennel, wild onion, and fenugreek). It can be made as either a masala paste or used dry.
Bard	Refers to the practice of surrounding or enveloping meat with pork fat. The fat keeps the meat moist while it cooks.

ADDENDUM Dictionary Food

Base	Base is a soup reduction paste similar to bouillon, but richer, more flavorful, and less salty. You can find it in the soup section of the super market. It comes in a jar and must be refrigerated after opening.
Baste	To spoon, brush or pour drippings or liquid over a food before or during cooking in order to prevent drying, to add flavor, or to glaze it.
Batter	The name of many semi-liquid, floury mixtures of flour, water or milk (or both) or some other liquid. It also usually includes sugar and eggs. Batters may be thin or thick (but even when thick, they must be fluid enough to drop from a spoon). When thin, they should pour out like creamy milk.
Bavarois	It is a light mousse, usually made with chocolate, praline or fruit.
Beaten Biscuit	Southerners describe beaten biscuits as a cross between a soda cracker and a baking powder biscuit. To achieve the right texture and lightness, the dough had to be beaten hard (usually with a mallet) for at least half an hours. The purpose of the beating was to incorporate air into the mixture (this was a time in history before the invention of baking powder). They were a very heavy biscuit, not like our present day baking powder biscuits.
Beef Stroganoff (STROH-guh-noff)	A dish that consists of thin slices of tender beef (usually tenderloin or top loin), onions, and sliced mushrooms. The ingredients are quickly sauteed in butter and combined with a sour-cream sauce. It is usually accompanied by rice pilaf.
Beef Wellington	It is a choice fillet of beef (often flambeed in brandy) that is covered with liver pate and sliced mushrooms. The meat is then placed in a case of puff pastry and baked in a hot oven.
Beignets (ben-YAYS)	Puffy squares of deep-fried dough dusted with powdered sugar. The word beignet comes from the early Celtic word “bigne” meaning “to raise.” Beignet is also French for “fritter.” It is a New Orleans specialty that is a fried, raised piece of yeast dough, usually about two inches in diameter or two inches square. After being fried, they are sprinkled with sugar or coated with various icings. It is like a sweet doughnut, which is square-shaped, and minus the hole. Traditional fare at New Orleans coffee houses, most notably Cafe du Monde in the French Quarter.
Beurre (burr)	This is the French word for “butter.”
Bias-Slice	Slicing a food crosswise at a 45-degree angle.
Bicarbonate of Soda	Another common name for baking soda is bicarb which is short for bicarbonate of soda or sodium bicarbonate. Baking soda, is a naturally occurring substance that is present in all living things. It helps living things maintain the pH balance necessary for life. Baking Soda is made from soda ash, also known as sodium carbonate. It is found in all grocery stores in the baking section.
Biscotti (bee-SKAWT-tee)	In Italian, biscotti means, “twice cooked.” The word biscotto is derived from bis (twice) and cotto (cooked). Biscotti is also the generic term for cookies in Italian. The dough is formed into logs and baked until golden brown. The logs are then sliced, and the individual biscotti are baked again to give them their characteristic dryness. The shelf life of biscotti are three to four months without preservatives or additives. Other countries have their version of this cookie – Dutch rusk, French biscotte, and the German zwieback.
Bisque (bisk)	A bisque is a thick, rich, creamy sauce in the form of a puree. Bisque in French means a “shellfish soup.” The word is a corruption of “biscuit,” as the soup was cooked twice to thicken it. Bisques in the 18th century were made of poultry and game, not with shellfish as they usually are today.
Bistro (BEES-troh)	(1) In France, a bistro used to be a bar that also sold wine. Sometimes, they would have one or two tables and the wife of the owner would have made a dish she would sell. Today a bistro is a small neighborhood restaurant with a comforting, predictable menu and reliable daily specials. It functions as a home away from home for many people, drawn by the familiar atmosphere, honest food and consistent prices. (2) Bistro also means a style of cooing (simple home cooking – it is similar to old-fashioned American food). It is a return to the era before fast food, before speed and convenience became more important than flavor and quality, but not quite to the complexity of old school French cooking.
Black/Blood Pudding	This is one of the famous blood dishes that Scottish people love. It usually accompanies other fried dishes, such as bacon and eggs. While it might seem shocking to eat blood, do not forget that all meat dishes contain blood and it’s the basis, with fat, of gravy. Blood dishes are popular all over Europe, especially in Transylvania.
Blackened	A cooking technique where meat or fish is usually seasoned with a Cajun spice mixture and then cooked in a cast-iron skillet that has been heated almost red-hot. This technique gives the food an extra crispy crust and sears in the juices. It is also guaranteed to set off your smoke detector–unless the battery is dead!
Bleu Cheese	Also called fromage bleu. It is the French name for a group of Roquefort-type (blue-veined) cheeses made in the Roquefort area in southeastern France. Roquefort-type cheeses made in the United States are called blue cheese.
Bloom	(1) To soften gelatin in cool liquid before using in the dish you are making. Blooming gelatin is a step integral to ensuring the smooth texture of a finished product. It involves sprinkling the powdered gelatin into a liquid and letting it sit for 3 to 5 minutes. Then, when the mixture is heated, the gelatin will dissolve evenly. You can bloom gelatin in just about any liquid. Avoid the fresh juices of tropical fruits such as papaya, kiwi, mango, and pineapple as they contain an enzyme that will eat the gelatin. Pasteurizing kills the enzymes in these fruits, so canned or frozen juices are fine. (2) The term is also used when allowing the casing on smoked sausage to darken at room temperature after it has been smoked.
Bocconcini	(1) Bocconcini means “a mouthful” and refers to small nuggets (about 1-inch in diameter) of fresh mozzarella. They are usually sold packed in whey or water. (2) It can also describe tempting Italian dishes.
Bombe (bahm)	Bombe is French for a “bomb” which was used in a cannon. In France, they had at one time, a spherical mold for food shaped like a round bomb. Originally it was made of copper and had a tight lid so that it could be buried with its contents in salted ice to keep the contents frozen. It is a dessert made with two different ice cream mixtures. The first is a simple plain ice cream, which is used to line a mold. T he second is a more elaborate ice cream mixture (usually with a strong flavoring), which, is used as a filling. The bombe is usually decorated when it is complete with crystallized fruit. It is then frozen and served cold as a dessert.
Bon Appetit (bon a-pet-tite)	French phrase that literally means “good appetite” or “enjoy your meal.”
Bonne Femme	A French phrase indicating that a dish has been cooked simply (with vegetables and stock).
Borscht	Also known as borsch and borsch. A beef soup that originated in Ukraine and is considered their national soup. his delicious soup is served in many variations with up to 25 different ingredients, which usually contain either beef, cabbage, or chicken with dumplings stuffed with meat, mushrooms, or vegetables. The best known of these soups is a cold version based on beets and served with sour cream, but hot versions are also very common.
Bottarga	Also known as bottarga di muggine. It is salted Mediterranean salted tuna or mullet roe. Bottarga is made with gray mullet in Sardinia and tuna in Sicily. The term Bottarga, from the Arabic bot-ah-rik, means “raw fish eggs. This delicacy is a specialty of the islands of Sardinia and Sicily.The mullet’s eggs, after being extracted, in their protective sacs, are washed and purified, put under salt, rinsed and laid to dry. The aging process takes four to five months. The dried eggs are then pressed and vacuum packed. The color of the roe goes from yellow-gold to dark amber; the change of color does not affect the quality or taste.

Boudin Noir	A blood sauce that is sometimes called "black pudding." It is served grilled and usually accompanied with mashed potatoes.
Boudin Rouge	Also called red boudin, it is a blood sausage.
Bouillabaisse (Boo-yuh-BAYS)	The name probably derives from the French phrase bouillepeis, meaning "bubble of fish." Although called a soup, this is really a main dish or a stew, a full meal in itself. Bouillabaisse has many regional variations based on the different local fish. The favorite place for bouillabaisse in Marseilles, France is the cabanon, a modest shed erected along the seashore by local people who used it for fishing, and gatherings with family and close friends.
Bouillon (BOO-yahn)	It is the French word for broth. It is a clear soup made from cooking meat, vegetables, poultry, or fish in water. The liquid that is strained after cooking is the bouillon, which can form the base for soups and sauces. Bouillon is available on the market in the liquid, cube, granule, and packet forms.
Braise (brayz)	Braising is basically a slow-cooking method for tough cuts of meat or poultry and even stringy vegetables. They are cooked slowly in a small amount of liquid in a covered pan. Stews and pot roasts are among the dishes prepared this way. Braising may be done in a covered container in the oven, on the range, or in a covered steam kettle or fry pan. In all the moist-heats methods of cooking, the moisture or liquid not only conducts heat to a product, but it interacts with the food being cooked and can influence the final taste and texture of a product.
Brine	Brining is like a marinade as it keeps food moist and tender. Brining or salting is a way of increasing the moisture holding capacity of meat resulting in a moister product when it is cooked. One of the great things about brining is that there are so few rules. Most brines start with water and salt — traditionally, 3/4 pound of salt per gallon of water, but since we're not concerned with the brine as a preservative, you can cut back on the salt.
Broccolini	A new hybrid vegetable that is sure to make a statement at your dinner table. Technically a cross between broccoli and Chinese kale, this vegetable looks more like a broccoli-asparagus mix. Broccolini comes in bunches of 17-20 stalks and has a shelf life of 2 weeks in the refrigerator from date of purchase. Broccolini is a great source of Vitamin C, Vitamin A and potassium, and has no fat. It can be cooked and eaten the same as broccoli: blanched, steamed, sauteed, poached, roasted, fried or grilled. It is 100% edible, so there's no need to remove any of the stems, making a wonderful presentation on the plate with its long slender stems.
Brochette	(1) Small portions of meat, chicken liver, or seafood that is coe on a skewer (usually sauteed or grilled). Food cooked "en brochette" is cooked on a skewer. Also known as kabob, a la broche, or shish ka bob. It is derived from the word "broche," meaning, "pointed tool." (2) Brochette is also used by confectioners to thread fruit in before candying them.
Brunch	A combination of the words for breakfast and lunch, and which is neither breakfast nor lunch, which combines some of the features of both and is served mid-morning.
Bruschetta (broo-SKEH-tah)	Traditional Italian garlic bread. Grilled slices of bread are brushed with extra-virgin olive oil and fresh garlic.
Bubble and Squeak	In English dish of equal parts mashed potatoes and chopped cooked cabbage mixed together and fried until well browned. Originally, the dish included chopped boiled beef. The name is said to come from the sounds the potato-cabbage mixture makes as it cooks (some say it's from the sounds one's stomach makes after eating bubble and squeak).
Bubble Tea	Bubble Tea is the catch-all name for endless unusual names of this drink such as: tapioca pearl drink, tapioca ball drink, pearl shake, pearl tea, black pearl tea, big pearl, boba tea, boba ice tea, boba nai cha, milk tea, bubble drink, zhen zhu nai cha, momi, momi milk tea, QQ, BBT, PT, and possibly many other names. This drink is far from the plain-looking tea that you are generally familiar with and it. It is non-alcoholic and non-carbonated.
Buckle/Crumble	Also called crumble. Is a type of cake made in a single layer with berries added to the batter. It is usually made with blueberries. The topping is similar to a streusel, which gives it a buckled or crumpled appearance.
Bulgogi	Bulgogi is marinated strips of beef cooked over charcoal on a grill. It is the best known and most popular of all Korean foods. Beef is most often identified with bulgogi, but even pork, chicken, lamb, squid, and octopus can be cooked bulgogi style. Foreigners consider it the national dish of Korea. It is often prepared at the table on small grills and accompanied by kimchi, a spicy pickled cabbage. In Korean, the word bul means "fire" and gogi means "meat." The word is commonly translated as Korean barbecue, thought it literally means "fire meat."
Bully Beef	A term used in Great Britain for corned beef.
Burgoo	Burgoo is a savory stew made from a varying array of ingredients that is popular in Kentucky. It is often cooked in enormous iron kettles outdoors over an open flame. Cooking can take as long as 30 hours and flavor improves as it ages. It has been said that burgoo is more of a concept than a recipe. This is because there are as many different ways to prepare burgoo as there are people who prepare it.
Burrito (burr-EE-toe)	A large (10") flour tortilla filled with any number of ingredients, which can include beans, beef, or pork. The tortillas are rolled and then sealed by tucking the ends under. They can be eaten like this or topped with salsa, lettuce, tomato, cheese, and guacamole.
Butter Ghee	Clarified butter and ghee are not the same. Ghee is clarified butter that has been cooked longer to remove all the moisture, and the milk solids are browned (caramelized) in the fat and then strained out. This gives a rich nutty taste. Ghee has a longer shelf life, both refrigerated and at room temperature. It is traditionally used in Indian cuisine.
Salted Butter	The most popular kind of butter in the U.S. is made from fresh cream with no less than 80 percent butterfat. This butter is lightly salted. Salted butter lasts longer than unsalted butter. When used for frying, salted butter scorches much more easily than unsalted.
Cafe Noir	French for black coffee (coffee without cream or milk).
Caffe (kah-FEH)	It is the Italian term for "coffee." In Italy, the term caffe usually refers to a small cup of espresso coffee.
Calzone (kahl-ZOH-nay)	An Italian word meaning "a trouser leg." It is a pizza crust rolled out and topped with all the ingredients of a normal pizza except tomato, then folded over to a half-moon or crescent-shaped turnover. The tomato sauce is sprinkled on top and it then goes into the oven. It is lightly drizzled with olive oil upon its emergence.
Canape (KAN-uh-pay)	A French term that consists of bite-size bits of savory food spread on edible bases (toasted or untoasted bread) and garnished or decorated. They are served as snacks (appetizers) at cocktail and buffet parties.
Candlenut	Candlenut is the name of a tropical nut used in Malaysian cuisine. It derives its peculiar name from the fact that the oil of the nut is also used to make candles. Candlenuts are available only roasted, whole, or in pieces, because raw they are highly toxic. The function of the candlenut in satays or curries is to flavor and thicken.
Cannellini Bean (kan-eh-LEE-nee)	A large white Italian kidney bean that's great in soups and stews.
Cannoli/Cannola (cah-KNOW-lee)	They are sometimes called "Turkish hats." The cannoli is perhaps the best-known Sicilian pastry and is part of Sicily's ancient tradition of pastry and dessert making. It is made by stuffing cylinders of fried dough (wafer shells) with a mixture of ricotta or custard, candied fruit, chocolate, and other ingredients. Originally, the pastry was flavored with wine, and in Sicily this is still done. They are traditionally prepared for festivities at Carnival time (though nowadays they are to be found all year round).

Cantaloupe (KAN-tuh-lohp)	A variety of muskmelon. It is found in many shapes and sizes. Because of trade usage, cantaloupe has become the name commonly applied to muskmelons grown in the U.S.
Capellini (ka-pel-LEE-nee)	In Italian, capellini means, "thin hair." This is one of the very thin varieties of flat spaghetti. Also called angel hair pasta.
Capers (KAY-per)	Capers are the unopened green flower buds of the Capparis Spinosa, a wild and cultivated bush grown mainly in the Mediterranean countries, notably southern France, Italy, and Algeria. They are now also grown in California. They range in size from that of a tiny peppercorn (the petite variety from southern France and considered the finest) to some as large as the tip of your little finger (from Italy). They generally come in brine but can also be found salted and sold in bulk. Either way, rinse before using to flush away as much salt as possible.
Caponate (kah-poh-NAH-tah)	A Sicilian vegetable dish made of various ingredients, but usually includes cooked eggplant, celery, capers, anchovies, chile peppers, olives, tomatoes, vinegar, and onions.
Caprese (kah-PREH-seh)	In the style of Capri. such a sauce is usually made from lightly cooked tomatoes, basil, olive oil, and mozzarella, to use on pastas, meats, fish, or salads. Check out this very easy-to-make Caprese salad: Mozzarella, Tomato and Basil Plate.
Carbonara	Carbonara in Italian means "charcoal" or "coal," and "alla carbonara" means "in the manner of the coal miners." In Italy, the names of dishes generally tell us where or with whom they originated: dishes called Bolognese come from Bologna, alla Romana from Rome, Neapolitan from Naples; anything marinara is prepared in the manner of sailors, puttanesca is favored by hookers, and carbonara comes to us from the charcoal makers or wood cutters. A classic Roman dish is Spaghetti alla Carbonara.
Carpaccio (karh-PAH-chee-oh)	Carpaccio is a classic Italian dish of paper-thin slices of raw beef, served with salt, pepper, and olive oil. The term also means very thin slices of meat, fish, and/or vegetables.
Cassata (kas-ata)	There are two theories on where cassata derives it name from; (1) A term in Arabic, "quas at," meaning the round bowl in which this sweet was originally made. (2) Other sources say that the word derives from the Latin word caseus (cheese) which would clearly refer to the ricotta cheese, one of the main ingredients needed for making cassata. Cassata is a spectacular Sicilian dessert of ricotta, candied fruit, pistachios, sugar, chocolate, liqueur soaked sponge cake and green pistachio icing.
Casserole (kasa-rol)	The word casserole is derived from the Old French word casse and the Latin word cattia meaning a "frying pan or saucepan." As often happens in history, the name of the cooking utensil was used for the dish name. (1) A casserole is an ovenproof or flameproof dish or pan that has a tight lid. It is used to cook meat and vegetables slowly. (2) A casserole is also a stew or ragout consisting of meat and vegetables, which are put in a casserole dish at the same time and cooked by stewing.
Caviar/Caviare (KA-vee-ahr)	Caviar is from the Persian word "khav-yar" meaning "cake of strength," because it was thought that caviar had restorative powers and the power to give one long life. Caviar is from the salted roe (eggs) of several species of sturgeon (it was originally prepared in China from carp eggs). The carp is really a goldfish and is the only fish besides the sturgeon that has gray colored eggs. Up until 1966, any fish roe that could be colored black was called caviar. Then the Food and Drug Administration defined the product, limiting it to sturgeon eggs. It takes up to twenty years for the female sturgeon fish to mature before it produces eggs (called berries).
Beluga (buh-LOO-guhl)	The Russian name for a sturgeon found in the Black and Caspian Seas (they can grow up to 2,000 pounds). It is the largest of the sturgeon family and is considered the finest caviar. The eggs are light to dark gray in color.
Malossol (MAHL-oh-sahl)	The Russian for "little salt" or "lightly salted." Only eggs in prime condition are prepared and labeled t his way (caviar prepared "malosol" are considered fresh).
Oscietre	This is spelled many ways, including "ossetra", "oestrova", and " osietr". This is the second largest species of sturgeon and is the Russian name for the Caspian Sea sturgeon roe that is dark brown to golden in color with large granules and a delicate skin.
Salmon Roe	The eggs of the Atlantic Salmon. They are large and bright red and they are excellent for garnishing dishes.
Sevruga	The smallest eggs of a sturgeon with a fine dark gray (almost black) color. It is considered of lower quality than the Beluga and Osetra caviar.
Tobiko	The Japanese name for a flying fish roe. They have very small red eggs with a crunchy texture
Cayenne Pepper (kiy-ann)	The cayenne is one of the most widely used peppers in the world. The cayenne is about 3 to 5 times hotter than the jalapeno, and when ripe, has it's own distinct, slightly fruity flavor. Heat range is 6-7.
Chafing Dish	The chafing dish is a metal pan, with a water basin, which is heated by an alcohol lamp and used for cooking at the table.
Chakalaka	A very hot and spicy South African cooked vegetable relish/sauce/salad (in some ways it is like a Mexican salsa) that usually includes tomatoes, garlic, chile peppers, grated carrots, and grated cabbage with beans or diced cauliflower. Preparing chakalaka is very much an individual thing, and depends on what you have available. A traditional dish with the black community that is now popular in the urban areas as well as a side dish at barbecues.
Champignon (sham-pee-NYOHN)	French word for an edible mushroom.
Chanterelle Mushrooms (shan-tuh-REHL)	These trumpet-shaped mushrooms flourish in the wilderness areas of the Pacific Northwest and a few places on the east coast. The European and Asian varieties are usually about the size of a thumb. But on the west coast, Chanterelles can be larger than a foot wide and heavier than two pounds. They smell a bit like apricots, have a mild, nutty flavor, and a chewy texture.
Chapon (shad-PONH)	A small piece from end of French loaf, a slice, or a cube of bread that has been rubbed over with a clove of garlic, first dipped in salt. Placed in bottom of salad bowl before arranging salad. A chapon is often used in vegetable salads and gives an agreeable additional flavor.
Chayote (chi-OH-tay)	The chayote is a pear-shaped member of the gourd family. Also called vegetable pear, mirliton (southern United States), choko (Australia and New Zealand). Several varieties of chayote exist, but the commonly available one has thick apple-green skin and generally weighs 1/2 to 1 pound. Thr crisp flesh is mild in flavor, falling somewhere between cucumber and summer squash.
Cheese	Cheese is a food made from the curds of milk pressed together to form a solid. Through the centuries, cheese has been made from the milk of any milk-producing animal, from the ass to the zebra. Today it is most commonly made from milk of cows, goats, or sheep, with a small fraction from water buffaloes. The differences in cheeses come from the way the curds are drained, cut, flavored, pressed, the bacteria involved, the type and length of curing in caves, cellars, or under refrigeration, and a host of other subtle to severe variations.
Soft Cheese	These include the fresh, unripened cheeses such as cottage, cream, farmer, or pot cheese that need only a starter, perhaps buttermilk, and a few hours before they're ready to eat. More complex soft cheeses include quickly ripened brie and camembert, as well as those made with added cream, known as double-cremes and triple-cremes; all have thin, white edible rinds with creamy to runny interiors and are ready to eat within a few days or weeks.
Semi-Soft Cheese	With this group are cheeses ripened three ways: bacteria- or yeast-ripened mildly flavored cheeses such as Italian fontina and Danish havarti. Also included are blue-veined cheeses such as gorgonzola, Roquefort, and English Stilton that are ripened by the presence of "penicillium" molds.

Firm Cheese	Originally termed "farmhouse cheese" but now mostly made in factories, these cheeses are formed into wheels or blocks, usually with a wax coating to seal out molds and external bacteria. This category includes cheddar, Edam, Gouda, Swiss cheese, Jarlsberg, etc. hese are generally aged a few weeks to more than a year.
Hard Cheese	These are the carefully aged cheeses with grainy textures that are primarily intended for grating. These include Asiago, Parmesan, and Romano. The aging process takes form one year to over seven years.
Sous-Chef	This position means "the under chief" in French. This is person is second in command and takes responsibility for the kitchen operations if the chef is absent.
Chef de Partie	Also known as a "station chef" or "line cook", is in charge of a particular area of production. In large kitchens, each station chef might have several cooks and/or assistants. In most kitchens however, the station chef is the only worker in that department. Line cooks are often divided into a hierarchy of their own, starting with "First Cook", then "Second Cook", and so on as needed. The Chef de Partie is in charge of any of the following kitchen positions:
Sauce Chef or Saucier	The person responsible for sauteed items and many different sauces. Traditionally, it is the third person in command. This is usually the highest position of all the stations:
Boulanger	The bread cook.
Confiseur	The candy cook.
Fish Cook/Poissonier	The fish cook – all fish and shellfish items and their sauces.
Friturier	The deep fry cook.
Grillardin	The grill cook.
Cherimoya (chehr-uh-MOY-ah)	The heart-shaped cherimoya is sometimes referred to as a custard apple, which describes its appearance and texture. The taste, however, is uniquely its own. Cherimoya combines the flavors of pineapple, mango, banana, and papaya into a slightly fermented flavor of the tropics. They are available November through April with the largest supply in February and March. Ripe cherimoyas are dull brownish-green in color and give to pressure when gently squeezed. Eat within a day or two. If fruit is pale green and firm, store at room temperature until slightly soft and then refrigerate, carefully wrapped individually in paper towels, for up to 4 days. Peel fruit with a sharp knife and cut into cubes, discarding the dark black seeds. Add to fruit salads or puree and incorporate into a mousse, custard, or pie filling.
Chervil (CHER-vuhl)	Chervil is a mild-flavored herb and a member of the parsley family. It has dark green curly leaves that have parsley-like flavor with overtones of anise. Chervil is generally used fresh rather than dried, although it is available in dried form. Though most chervil is cultivated for its leaves alone, the root is edible and was, in fact, enjoyed by early Greeks and Romans. It is one of the main classic ingredients in Fines Herbes (along with chives, parsley and tarragon), a finely chopped herb mixture that should be added to cooked foods shortly before serving because their delicate flavor can be diminished when boiled.
Chess Pie	Chess pies are a Southern specialty that has a simple filling of eggs, sugar, butter, and a small amount of flour. Some recipes include cornmeal and others are made with vinegar. Flavorings, such as vanilla, lemon juice, or chocolate are also added to vary the basic recipe.
Chevre Cheese (SHEHV-ruh)	Chevre is the French word for goat and for the fresh goat's milk cheese. Goat cheeses are not usually aged, so they are fresh and creamy looking with a fairly mild, salty flavor. They are French in origin. This cheese can be molded into any shape. They come plain or coated with herbs and pepper. Used for relishes, appetizers, sauces, and compliments any cheese board.
Chicken Cacciatora	Cacciatore means "hunter's style." See cacciatore. This dish developed in central Italy and has many variations. It is considered a country-style dish in which chicken pieces are simmered together with tomatoes and mushrooms. The dish originated in the Renaissance period (1450-1600) when the only people who could afford to enjoy poultry and the sport of hunting were the well to do, This dish developed in central Italy and has many variations.
Chicken Kiev (kee-EHV)	Also called Tsiplenokovo Po-Kievski. A boned and flattened chicken breast that is then rolled around a chilled piece of herbed butter. It is then breaded and fried. This poultry dish is also called "Chicken Supreme."
Chicken Marengo	Originally made with crayfish and chicken. Today, the crayfish is usually left out. Chicken Marengo today is chicken cut into pieces, browned in oil, and then cooked slowly with peeled tomatoes, crushed garlic, parsley, white wine and cognac, seasoned with crushed pepper and served with fried eggs on the side (with or without crayfish, also on the side) and toast or croutons, doubling as Dunand's army bread.
Chicory (chick-ory)	A herb of which the roots are dried, ground, and roasted. It is now used to flavor coffee (there is a popular belief that chicory smoothes out coffee).
Chiffonade (shihf-uh-NAHD	(1) This is a French word, which comes from the word "chiffon" which means, "rag". In culinary terms, a chiffonade describes a way of cutting herbs and lettuces into thin strips or shreds, which look a bit like rags. (2) Chiffonade is also a dish consisting of a mixture of green vegetables (such as spinach, lettuce, and sorrel) which are shredded or cut finely into ribbons (sometimes melted butter is added). It is used to form a bed for a dish such as egg mayonnaise or as a garnish for soups.
Chimichanga (chim-me-CHAN-gaz)	A burrito prepared with your choice of meat, vegetables, and spices that are rolled up to form a large spring roll, either deep fried or grilled deep-fried, and served on a bed of lettuce with cheese and mild sauce. The chimichanga or "chimi" is the quintessential Tucson, Arizona food item, which has achieved a cult status in that city. The residents of Tucson take their "chimis" very seriously and would prefer to pay more money so as not to be served a smaller one with fewer ingredients. They love the large, gigantic ones. Every restaurant and Mom and Pop eatery has his or her own version of this favorite dish.
Chipotle Chile (chih-POHT-lay)	A chipotle pepper is simply a smoked jalapeno pepper. These chilies are usually a dull tan to coffee color and measure approximately 2 to 4 inches in length and about an inch wide. It is sold either dried or canned with adobo sauce. Most of the natural heat of the jalapeno is retained in the process. Chipotle peppers are very hot, and they can easily over power dishes and recipes. Chipotles are available dried whole, powdered, pickled, and canned in Adobo sauce.
Converture	A term generally used to describe high-quality chocolate used by professional bakers in confectionery and baked products. It has more cocoa butter than regular chocolate. It's specially formulated for dipping and coating things like truffles.
Cholent (CHUH-lent)	Cholent is traditional Jewish cuisine served on the Sabbath. Whether the hamin of Sephardic communities, the cholent of Ashkenazic ones, or a fusion of the two, it is still favored by many for Shabbat, particularly on a cold winter day.
Chop Suey	Chop Suey is the English pronunciation of the Cantonese words tsap seui (tsa-sui in Mandarin), which means, "mixed pieces." It is a Chinese-American dish consisting of bits of meat or chicken, bean sprouts, onions, mushrooms, etc., cooked in its own juices and served with rice. Most Chinese are not fond of Chop Suey as it is mainly popular with non Chinese-Americans. According to the Chinese-Americans, its presence on a restaurant's menu is often times a harbinger of bad food to come . It is only served in Chinese restaurants that cater to American customers.
Chorizo (CHORE-ee-so)	A highly seasoned Mexican sausage that is made with ground pork and hot peppers. It is sold fresh or dried and usually encased in narrow casings, but also sold in bulk in some markets. Mexican chorizo is made with fresh pork, while the Spanish version uses smoked pork.

ADDENDUM	Dictionary	Food		**Choux Pastry (shoo)**	Choux derives from the French work "chou" which means "cabbage." It was used to describe layered pastry, as the layers were thought to resemble the leaves of cabbage. It is a kind of pastry made from smooth dough consisting of flour, water, salt, butter, eggs, and sometimes sugar. This pastry is used for cream puffs, eclairs, beignets, and other dishes requiring a puff pastry.
				Chowder	Chowder comes from the French word "cauldron," meaning a cooking kettle. Vegetables or fish stewed in a cauldron thus became know as chowder in English speaking nations (a corruption of the name of the pot or kettle in which they were cooked).
				Chow Mein	A Chinese-American dish consisting of stewed vegetables and meat with fried noodles. It comes from the Mandarin Chinese words ch'ao mien meaning "fried noodles." It is thought that this Chinese dish was brought to America by the Chinese laborers and cooks for the Transcontinental Railway in the 1850s.
				Chutney (CHUHT-nee)	The word comes from the Hindustani word chatni, which means "a hot, spicy condiment." Originally this word referred to a sweet and spicy preserve of fruit, vinegar, sugar, and spices that was used exclusively in Indian cooking. American chutneys are less spicy and very sweet. They are used more as jams or preserves. However, with the advent of "fusion cuisine" and with all culinary terms bandied about rather loosely these days, a chutney can be just about any topping or accompaniment, somewhat sweet, usually made with fruit and used the way we do salsas.
				Cilantro (SEE-lan-trow)	Cilantro is the Spanish word for coriander leaves. It is also sometimes called Chinese or Mexican parsley. Technically, coriander refers to the entire plant. It is a member of the carrot family. Chopped fresh leaves are widely used in Mexican and Tex-Mex cooking, where they are combined with chiles and added to salsas, guacamoles, and seasoned rice dishes. Most people either love it or hate it.
				Cincinnati Chili	The main differences between Cincinnati and Texas chili is that the Cincinnati Chili calls for some sweet spices and the way you start cooking the meat. The sauce has a thinner consistency that is more like a topping and is mixed with an unusual and secret blend of spices that includes cinnamon, chocolate, or cocoa, allspice, and Worcestershire sauce. Cincinnati Chili is truly the unofficial food of the city of Cincinnati, Ohio, and is the most chili-crazed city in the United States. Cincinnati prides itself on being a true chili capital with over 180 chili parlors.
				Cioppino (chuh-PEE-noh)	It is a fish stew that is considered San Francisco's signature dish. It is a descendant of the various regional fish soups and stews of Italian cooking. The best way to make Cioppino, is as you like it. It can by prepared with as many as a dozen kinds of fish and shellfish. It all depends on what the day's catch is like and what your own personal choice is. The origin of the word is something of a mystery and many historians believe that it is Italian-American for "chip in."
				Citron (SIHT-ron)	(1) Citron is a semi-tropical citrus fruit like a lemon, but larger and less acidic. It grows as an irregular, open-headed shrub or small tree with large, light green leaves. The flowers are purple on the outside and are followed by large, oblong or ellipsoid fruits. The peel is very thick and is rough and yellow on the outside and white inside. They were originally grown in Europe out of interest for its fragrant fruits, but later, the white pulp was used raw, being served as a salad or with fish.
				Citronella (sih-truh-NEHL-uh)	It is also known as lemongrass. It is a stiff tropical grass that resembles a large fibrous green onion. It is an essential herb in southeast Asian cooking. It adds a lemony flavor to dishes.
				Clotted Cream	Traditionally served with tea and scones in England. It is a 55% minimum milk fat product made by heating unpasturized milk to about 82 degrees C, holding them at this temperature for about an hour and then skimming off the yellow wrinkled cream crust that forms (until the cream separates and floats to the surface). It is also known as Devonshire cream. It will last up to four days if refrigerated in a tightly-sealed container.
				Club Sandwich	It is a sandwich with cooked chicken breast and bacon, along with juicy ripe tomatoes and crisp lettuce layered between two or three slices of toasted bread with mayonnaise.
				Cobb Salad	Typically a Cobb Salad consists of chopped chicken or turkey, bacon, hard cooked eggs, tomatoes, avocado, cheddar cheese, and lettuce. It is served with crumbled blue cheese and vinaigrette dressing. The original recipe for Cobb salad included avocado, celery, tomato, chives, watercress, hard-boiled eggs, chicken, bacon, and Roquefort cheese.
				Cobbler	(1) An iced drink made of wine or liqueur, sugar, and citrus fruit. Served in a Collins or highball glass garnished with fruit. (2) Cobblers are an American deep-dish fruit dessert or pie with a thick crust (usually a biscuit crust) and a fruit filling (such as peaches, apples, berries). Some versions are enclosed in the crust, while others have a drop-biscuit or crumb topping.
				Cochon De Lati	Translated from French to English, the word literally means, "pig in milk." To make this Cajun pig roast, use a suckling (young) pig to get the finest pork flavor. The Cajuns of southwest Louisiana have always enjoyed their pork, but consider a Cochon De Lait to be a special treat. Historically, men cooked the pig over an outdoor fire, while the women prepare other dishes inside the house. Many Cajuns consider the crackling skin the best part of the Cochon De Lait.
				Coffee Milk (kaw-fee milk)	A lot like chocolate milk but with coffee-flavored syrup. It is milk with sweet coffee syrup added (two tablespoons of coffee syrup to 8 ounces of milk). The drink is served either by the glass or the half-ping (in a waxed-cardboard carton). In 1993, after much political debate, it was made "The Official State Drink of Rhode Island." Rhode Island is the only place in the world where you can get this drink. If you travel more than ten miles from the state border, no one will know what you're talking about.
				Colcannon	Colcannon is a famous Irish dish using mashed potatoes and cabbage that is served in a fluffy pile with a well in the center filled with melted butter, so that you can dip each forkful into the butter before eating it. It gets its name from the old name "cole" for cabbage, which we still use in the term cole slaw or cabbage salad. In most Irish cookbooks, kale is used instead of cabbage. Also known as Kale Cannon or Kailkenny. In Scotland this dish is also known as Rumbledethumps. Traditionally eaten at Lughnasa or Samhain, the Irish version of Thanksgiving. Colcannon is a national Irish dish of sorts and it is traditional to put coins in the Colcannon (kids absolutely love this tradition).
				Coleslaw (kol-slaw)	A cold salad made with shredded cabbage mixed with mayonnaise as well as a variety of ingredients.
				Compote (KAHM-poht)	(1) Compote refers to a chilled dish of fresh or dried fruit that has been slowly cooked in sugar syrup, which may also contain alcohol or liqueur and sometimes spices. Slow cooking is important for the fruit to retain its shape. (2) Also called compotier. It refers to a deep, stemmed dish (usually silver or glass) used to hold fruit, nuts, or candy.
				Condensed Milk	Condensed Milk is pure cow's milk properly combined with unadulterated cane sugar. The waster content of the milk is evaporated.
				Confit (kon-FEE)	It is French term used to describe a way of preserving meat (usually pork, goose or duck). It is derived from an ancient method of preserving meat whereby it is salted and slowly cooked in its own fat. The meat or poultry is salted first and then slowly cooked in its own rendered fat. The resulting confit is then packed in crocks and sealed with more fat. Confit can be refrigerated up to 6 months. Confit d'oie and confit de canard are preserved goose and preserved duck, respectively. You can eat it cold, thinly sliced, in salads, or use it to add to hot dishes such as the French specialty "cassoulet".
				Consomme (kon-somay)	It is from the Latin word "consummare" meaning to "finish perfectly" and "raise to the highest point of achievement." Consomme is considered one of the finest of soups.It is a clear soup and it is essential to use stock made from raw meat, which has been clarified by the addition of beaten egg white and clean eggshells.

Consomme Diane -	It is made with game.
Consomme Amiral -	It is made with fish.
Consomme Madrilene -	It is a beef consomme with cubes of beef or chicken and vegetables julienne.
Banquet Consomme -	It contains vegetables julienne and smoked salmon.
Consomme Frappe -	Is an iced or chilled clear soup.

Fuel

CAS / CAS RN	A CAS Registry Number, also referred to as CASRN or CAS Number, is a unique numerical identifier assigned by the Chemical Abstracts Service (CAS) to every chemical substance described in the open scientific literature, including organic and inorganic compounds, minerals, isotopes, alloys and nonstructurable materials.

Gardening

Gear

Geography

Homesteading

Hunting

Antlers	The bony growths on a buck's head. They're called racks or horns too, but horns do not fall off; it's just a misnomer. Deer, elk, and moose have antlers.
Bag/Daily Limit	The legal number of animals of a certain species you can kill each day.
Bed	Where a deer actually lays down, they leave an oval depression in the grass or snow. Larger beds usually belong to bucks.
Bedding Area	A place where deer will rest and sleep during the day; usually this is found in dense thickets or places where they can easily hide.
Bleating	Does make a whiny bleat noise to communicate with each other and signal they are in estrous.
Blowing	Often following a "white flag", deer will snort loudly (i.e., "blow") to alert other deer about a threat.
Broadside	The most ethical shot at a deer is when they are standing perpendicular to you so you can see one entire side of their body. A broadside shot to the vitals is a quickly-killed deer.
Brow Tine	The first antler tine nearest to a buck's head.
Browsing	Deer are adapted to eat woody shrubs and herbaceous plants quickly by roughly tearing off large chunks and continuing on their walk.
Buck	A male deer.
Busted / Spooked	When deer or other game smell, see, or hear you, they will get nervous and/or leave the area quickly.
Button Back	A male fawn deer that only has little bumps for antlers in its first year. These are generally considered legal does because their antlers are less than 3 inches long and can be confused for does in the field.
Can Call	An accessory piece of hunting equipment, this call is typically in the shape or a small can and sounds like a doe bleating, which they use to communicate with other deer.
Doe	A female deer.
Estrous	When does are ready to mate, they are "in estrous", much like a dog is "in heat".
Fawn	A fawn is a deer that was born the spring of the same calendar year. Can be a newborn with spots or look like a small deer at 6 months old.
Feeding Area	A place where deer will eat during the night, whether that includes a corn field, food plot, young forest, or shrub patch.
Field Dressing	After shooting a deer, you need to remove the entrails quickly so the meat doesn't spoil. Also called "gutting".
Fork Buck / Forkhorn	A male deer with a forked tine on each side of its head, but no more than 4 points or tines.
Funnel	A narrow area where topography and/or habitat features cause deer to converge on a single trail. For example, where a forest is pinched by fields on each side.
Glassing	Using binoculars or a spotting scope to look for wild game from a good vantage point.
Grunt Tube	A tubular deer call that sounds like a buck grunting, which they typically do during the rut.
Grunting	Bucks make a low-pitched grunt at each other to signal aggression, especially during the breeding season (rut).
Gut Shot	The region of a deer that holds the stomach, intestines, liver, and various other organs. A gut shot is to be avoided as it is likely to slowly kill a deer, but it is extremely difficult to find them.
Harvest	A popular term in wildlife management circles, the act of killing or "taking" an animal. It's unpopular with many hunters due to the gardening analogy, whereas hunting is the act of taking a life.
Horns	A permanent bony protrusion from an animal's head. See the difference from "Antlers" above. Cows, sheep, goats, or antelope have horns.
Mast	The fruit or nuts of trees, including apples, pears, berries, grapes, acorns, walnuts, etc.

Mature	A deer is considered mature by most people when it reaches 3 1/2 years old.
Possession Limit	The legal number of animals of a certain species you can physically have in your possession (in the freezer, canned, etc.). This may be more than the daily bag limit.
Processing	The process of skinning, quartering, and cutting all the meat off of a deer carcass. Doing this yourself can be intimidating, but you know exactly how the meat is treated this way too.
Quartering / Butchering	The act of cutting the "quarters" off of a deer while processing/butchering it. The quarters include all four legs.
Quartering (Shot)	When a deer is slightly facing away from or towards you. Quartering away shots are great for bow hunters or gun hunters, but a quartering to shot should be avoided.
Rattling	A hunter uses two antlers to make it sound like bucks fighting, which can lure a mature buck into shooting range. Generally more useful in areas with little hunting pressure and lots of mature deer.
Rub	When a buck rubs its antlers against a tree to mark its territory, strengthen its neck, or remove its velvet, it scrapes the bark away. Commonly found in areas bucks like to hang out.
Ruminant	Like cows, deer quickly feed on plants while they can, and then lie down to chew their cud. This cud-chewing, combined with their four-chambered stomach, digests the food when they're in the safety of their bed.
Rut / Pre-Rut / Post-Rut	The rut is when deer enter the peak of their breeding season (i.e., they breed the most). The pre-rut includes the weeks leading up to the rut, while the post-rut includes the weeks after it.
Scent Drag	A piece of rope with a cloth at the end. The cloth is usually sprayed with a deer scent and drug through the woods behind a hunter to make it smell like a deer traveled the same path.
Scope	Magnifying optics usually mounted to the top of a rifle that allow you to make an accurate long-distance shot at an animal.
Scouting	The act of investigating a hunting property before you actually hunt it. A scouting trip helps you to find good hunting locations based off of wildlife sign.
Scrape	A scratched area on the ground (usually about 1-3 feet across) where a buck or doe leaves scent from its hooves and urinates into it to communicate to other deer in the area.
Shed / Shed Antler	As bucks enter late winter, the antlers on their head will fall off so they can start growing new ones in the spring.
Sign	The evidence left behind from animals, including tracks, trails, beds, rubs, scrapes, etc.
Spike Buck	A male deer with only one tine on each side of its head, forming a spike.
Stamp	Some wild game species (e.g., waterfowl, pheasants, etc.) may require you to purchase a special additional stamp. The proceeds from these stamps will generally support additional conservation efforts for that species.
Still-Hunting	Walking very slowly through the woods, trying to ambush an animal before they see/hear you.
Tag	In addition to your hunting license, you will have a field tag. This paper slip will contain basic harvest data about your animal, and serves to validate or fulfill your license.
Tines	The single bony extensions on an antler. Also called "points". For example, an 8-pointer would have 8 tines (4 on each antler).
Velvet	In the spring and summer, velvet is living tissue that covers the development of deer antlers, making it one of the fastest-growing tissue in the world. They usually shed this tissue before hunting season.
Venison	Meat from a deer is called venison.
Vitals	The chest cavity of a deer that holds the heart and lungs. A shot with a bow or rifle in the vitals will usually quickly kill a deer and is the most ethical shot.
White Flag	When white-tailed deer retreat, they raise their white tails to show a predator they were spotted. Not a good sign.

Hygiene

Adequate Hygiene	Level of hygiene sufficient for the prevention of public health risk.
Biohazard Bag	Bag used to secure biohazard waste that requires microbiological inactivation in an approved manner for final disposal. Such bags must be disposable and impervious to moisture and have sufficient strength to preclude tearing or bursting under normal conditions of usage and handling.
Cleaning	Removal of visible dirt or particles through mechanical action, normally undertaken on a routine and frequent basis. The cleaning process and some products used for cleaning also result in disinfection.
Disinfection	The procedure whereby measures are taken to control or kill infectious agents on a human or animal body, on a surface or in or on baggage, cargo, containers, conveyances and goods by direct exposure to chemical or physical agents.
Control Measures	Those steps in the drinking-water supply that directly affect drinking-water quality and that collectively ensure that drinking-water consistently meets health-based targets. They are activities and processes applied to prevent hazard occurrence.
Food Contact Surfaces	Surfaces of equipment and utensils with which food normally comes in contact. These include the areas of ice machines over the ice chute to the ice bins.
Food Handling Area	Any area where food is stored, processed, prepared or served.
Food Preparation Area	Any area where food is processed, cooked or prepared for service.
Food Service Area	Any area where food is presented to passengers or crew members (excluding individual cabin service).
Food Storage Area	Any area where food or food products are stored.
Food Transport Area	Any area through which unprepared or prepared food is transported during food preparation, storage and service operations (excluding individual cabin service).
Non-Food Contact Surfaces	All exposed surfaces, other than food contact or splash contact surfaces, of equipment located in food storage, preparation and service areas.
Non-Toxic Materials	Materials that, when used in the water distribution system, do not introduce harmful or injurious ingredients or substances into the water.

ADDENDUM | Dictionary | Hygiene

Sewage	Any liquid waste that contains animal or vegetable matter in suspension or solution, including liquids that contain chemicals in solution.
Splash Contact Surfaces	Surfaces that are subject to routine splash, spillage or other soiling during normal use.
Area Sampling	Collection and analysis of representative samples of air in common work areas to find out the concentrations of any contaminants that are present.
Contaminant	An unwanted substance (for example, radioactive, biological or chemical) that is likely to hurt the quality of the work environment. Chemicals that may be present in the form of dusts, fumes, gases or vapors are the most common workplace contaminants.
Hygiene Practices	A broad term for personal health practices that may reduce or prevent the exposure of a worker to chemical or biological substances. Hygiene practices include: not smoking, eating or drinking in the work area washing up before breaks and meals, removing contaminated clothing before leaving work, and keeping street clothes separate from contaminated work clothing.
Abrasion	The wearing away or cleaning by friction. Abrasion can also relate to the wearing away of a floor finish film by friction.
Abrasive	A product that works by abrasion. Products such as cleaners, polishes and pads may contain an abrasive.
Alcohols	Organic compounds that contain one or more hydroxyl groups (-OH functional groups) in each molecule. Alcohols used in cleaners include ethyl, methyl, propyl and butyl.
Aliphatic Solvents	These are sometimes referred to as paraffins. They are also referred to as straight chain or open chain solvents. Kerosene, Odorless Mineral Spirits and Mineral Seal Oil are examples of aliphatic solvents.
Ammonia	An alkaline gas composed of nitrogen and hydrogen. Aqueous solutions of with 5-10% ammonia are sold as household ammonia.
Build-Up	A heavy deposit of floor finish, wax, dirt and grime. It is caused by adding layer after layer of floor finish over dirt without deep scrubbing the old layers away first. These build-ups are frequently found along baseboards and corners.
Calcium Carbonate	An inorganic compound that occurs naturally as chalk and limestone. Its very slight solubility in water is a chief cause of "hardness" in water.
Caustic	Strong alkaline substance which irritates the skin.
Chlorinated Solvents	An organic solvent that contains chlorine atoms as part of the molecular structure. Examples include methylene chloride and trichloroethylene.
Chlorine Bleach	A group of strong oxidizing agents commonly sold in an approximately 5% solution of sodium hypochlorite. Care should be taken to never mix chlorine bleach with ammonia or hydrochloric acid.
Cleanser	A powdered or liquid cleaning product containing abrasives, surfactants and frequently a bleach.
Cloud Point	The temperature at which a surfactant becomes insoluble in water. This becomes important when designing detergents for use in hot water.
Coagulation	An irreversible process in which a number of emulsion droplets coalesce, leading to complete separation of the emulsion.
Defoamers	Substance used to reduce or eliminate foam.
Detergent	A washing and cleaning agent with a composition other than soap. Detergents unlike soaps are less sensitive to minerals in water.
Dispersing Agent	A material that reduces the cohesive attraction between like particles.
Dwell or Contact Time	Describes the time that a cleaning agent is left on a surface before rinsing.
Emulsification	The action of breaking up fats, oils and other soils into small particles which are then suspended in a solution.
Flocculation	A reversible process in which a number of emulsion droplets stick together to form a cluster which can be broken up by mechanical action restoring the emulsion to its original form.
Micelle	A spherical grouping of detergent molecules in water. Oils and greases dissolve in the hydrophobic center of the micelle.
Neutral Cleaner	A floor cleaner that has a pH that is compatible with the finish to be cleaned. Generally this means a pH of between 7-9. Higher pH floor cleaners can attack the floor finish and dull it.
Oxidation	To combine with oxygen. Slow oxidation is typified by the rusting of a metal.
Oxidizing Agent	A substance that accepts electrons in an oxidation-reduction reaction. A substance that causes the oxidation of a reactant molecule.
Phosphates	A substance that is added to a detergent to increase its water softening ability.
Porous	A surface that was many tiny openings. A porous surface will require more finish or sealer to fill and smooth out these openings.
Reagent	A substance used to start a chemical reaction. In the laboratory, hydrochloric acid, sulfuric acid and sodium hydroxide are reagents.
Saturated	Describes a solution that will not dissolve any more solute at a given temperature. Any more solute will remain as crystals.
Solvents	A liquid which dissolves another substance. Water is the most common solvent.
Surfactant	Substances which lower the surface tension of water. These surface-active agents modify the emulsifying, foaming, dispersing, spreading and wetting properties of a product.
Suspension	The process of a cleaning agent holding insoluble dirt particles in the cleaning solution and keeping them from redepositing on a clean floor.
Synergistic	Chemicals that when combined have a greater effect than the sum of the two independently.
Synthetic Detergents	These are sometimes called soapless detergents. They are typically made from by-products of refining crude oil. They do not form a scum in hard water and lather better than soaps.
Thinner	A liquid used to reduce the viscosity of a coating and that will evaporate before or during the cure of a film.
Titration	A procedure that uses a neutralization reaction to determine the normality (the number of equivalents per liter of solution) of an unknown acid or base solution.
Universal Solvent	Water is called the universal solvent because it dissolves both ionic compounds and polar molecular compounds. Water usually cannot dissolve nonpolar molecules.

Viscosity	The thickness of a liquid which determines pourability. Water has a viscosity of 1 centipoise. The resistance to flow is measured in relationship to water in centipoise.
Wetting Agent	A chemical which reduces surface tension of water, allowing it to spread more freely.

Knots

Bight	Any part of a rope between the ends. Also a curved section of a rope within a knot being tied.
Crossing Point	The place where ropes cross in the making of a loop.
Elbow	Two or more loops in close proximity to each other.
Loop	A bight becomes a loop when the two ropes cross. If the working end is crossed over the standing line, it is an overhand loop. It is an underhand loop if the working end runs under the standing part.
Working End	The active end being used to tie the knot.
Standing End	The end not being used in the tying of the knot. The rope part that is not being used is called the standing part.
UIAA	Union International des Associations d'Alpinisme

Language

Light

Zenith	The zenith is an imaginary point directly "above" a particular location, on the imaginary celestial sphere. "Above" means in the vertical direction opposite to the apparent gravitational force at that location. The opposite direction, i.e. the direction in which gravity pulls, is toward the nadir. The zenith is the "highest" point on the celestial sphere.

Boating

Adrift	Loose and out of control. Typically applied to a ship or vessel that has lost power and is unable to control its movement.
Aft	Any part of the ship closer to the stern than you currently are.
All Hands	The entire ship's crew to include all officers and enlisted.
Aye, Aye	Response acknowledging and understanding a command.
Bow	Front of the ship.
Below	Any deck beneath the one you are currently on.
Carry On	An order given to continue work or duties.
Cast Off	To throw off, to let go, to unfurl.
Colours	Raising and lowering of the National Ensign, the American flag and organization flags.
Fathom	Unit of measurement generally used for depth from sea level to sea floor.
General Quarters	Battle stations. Generally set when the ship is about to engage in battle or hostile activities.
Jettison	To throw or dispose of something over the side of ship.
Ladder	Also known as a ladder well. Much like civilian stairs however much steeper.
Leave	Vacation time nearly completely free unless an emergency recall occurs.
Shore Leave	Permission to leave the ship/base to enjoy non-work activities.
Mid-Watch	Tends to be the midnight to 0400 watch. Also known as "balls to four" due to military time equivalent 0000-0400.
Port Side	Left hand side of the ship.
Quarters	Generally the morning assembly of all hands for muster and accountability.
Starboard	Right hand side of the ship.
Stern	Rear of the ship.
Taps	Lights out, time to sleep.
Working Aloft	Working above the highest deck, generally performing maintenance on the ship's mast or antennas.
Sea Mine	A naval mine is a self-contained explosive device placed in water to damage or destroy surface ships or submarines.
Torpedo	A modern torpedo is a self-propelled weapon with an explosive warhead, launched above or below the water surface, propelled underwater towards a target, and designed to detonate either on contact with its target or in proximity to it.
Turret	A gun turret (or turret) is a location from which weapons can be fired that affords protection, visibility, and some cone of fire.
Aircraft Carrier	An aircraft carrier is a warship that serves as a seagoing airbase, equipped with a full-length flight deck and facilities for carrying, arming, deploying, and recovering aircraft.
Battleship	A battleship is a large armoured warship with a main battery consisting of large calibre guns.
Battlecruiser	The battlecruiser, or battle cruiser, was a type of capital ship of the first half of the 20th century. They were similar in size, cost, and armament to battleships, but they generally carried less armour in order to attain faster speeds.
Cruiser	A cruiser is a type of warship. The term has been in use for several hundred years, and has had different meanings throughout this period.
Destroyer	In naval terminology, a destroyer is a fast, manoeuvrable long-endurance warship intended to escort larger vessels in a fleet, convoy or battle group and defend them against smaller powerful short-range attackers.
Frigate	A frigate is any of several types of warship, the term having been used for ships of various sizes and roles over the last few centuries.
Hovercraft	A hovercraft, also known as an air-cushion vehicle or ACV, is a craft capable of travelling over land, water, mud, ice, and other surfaces.
Submarine	A submarine (or simply sub) is a watercraft capable of independent operation underwater. It differs from a submersible, which has more limited underwater capability.
Torpedo Boat	A torpedo boat is a relatively small and fast naval ship designed to carry torpedoes into battle.

ADDENDUM Dictionary

Leadership

Locations

Man-Made Disasters

Mass

Mass Destruction

B-NICE	Five categories of terrorist incidents: Biological, Nuclear, Incendiary, Chemical and Explosives.
CU	Weapons of Mass Destruction Countermeasures Unit (FBI)
WMD	Weapons of Mass Destruction
WMDOU	Weapons of Mass Destruction Operations Unit (FBI)

Materials

Media

Emotional

Medical

Medical

AED	Automated external defibrillator
ALS	Advanced Life Support
ARC	American Red Cross
AVPU	Alert / Voice / Pain / Unresponsive
BLS	Basic Life Support
BM	Boehringer Mannheim – Blood sugar levels
BP	Blood pressure
Burnout	Mental and emotional problems that occur soon after or even during a stressful incident or series of incidents.
CDC	Centre for Disease Control and Prevention
CFR	Community first responder
CPR	Cardiopulmonary Resuscitation
DNR	Do Not Resuscitate
D.O.	Doctor of Osteopathic Medicine
DOH	Department of Health
DVT	Deep Vein Thrombosis
ECP	Emergency Care Practitioner
EMS	Emergency Medical Service
EMT	Emergency Medical Technician
FAST	Face / Arms / Speech / Time
GCS	Glasgow Coma Scale
LoC	Loss of Consciousness / Level of consciousness
MI	Myocardial infarction (heart attack)
M.D.	Medical Doctor
NDMS	National Disaster Medical System
NKDA	No known drug allergies
PEARL	Pupils equal and reacting to light
PMDI	Pressurised metered dose inhaler
PT	Patient
TB	Tuberculosis
TIA	Transient Ischemic Attack
Triage	Sorting out the wounded at a major incident so that the most serious cases are treated first.
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia
Wilderness Medicine	The administration of first aid and medical protocols for emergency's where support is not immediately forthcoming. This type of "first aid" may differ significantly from standard first aid.

Illness

Injury

Medication

Natural Disasters

Natural Remedies

Navigation

Adjustable Compass	A compass whose azimuth circle can be rotated relative to the lubber's line.
Azimuth Circle	A circular compass scale graduated in angular units: degrees, cardinal points, or other units, usually clockwise from north or 0°.
Bearing	The angular direction to a landmark.
Boxing Mark	A box, arrow, line, or other mark permanently fixed to point to the N or 0° index on a compass azimuth circle. The boxing mark is usually part of the capsule. To "box" a compass, align the compass needle or card with the boxing mark, north-to-north, or with N or 0° on the azimuth circle.
Capsule	A sealed transparent case which houses the compass needle, the azimuth circle, and the boxing mark. The capsule may be filled with liquid to amp needle or card swinging.
Card	An azimuth circle mounted on a compass needle. The card rotates relative to the lubber's line.
Course	Angular direction of travel.
Fix	The position indicated by the intersection of two or more lines of bearing.
Landmark	A recognizable real object in the terrain.
Lubber's Line	A line or mark on the compass body that points toward the direction of travel. Simple compasses may use north or 0° on the azimuth circle as a lubber's line. On sighting compasses the sight centreline is the lubber's line.
Magnetic Declination	Easterly or westerly angular difference between the direction to the earth's geometric and magnetic poles.
Magnetic Inclination	The vertical component of the earth's magnetic field which causes compasses needles to dip.
Map Object	A picture or symbol used on a map to represent a landmark or other object.
Needle	A magnetized pointer resting on a pivot in the capsule, free to rotate relative to the lubber's line and azimuth circle.
North - Grid North	The direction to the earth's geometric north pole along a meridian.
North - Magnetic North	The apparent direction to the earth's magnetic north pole, not usually indicated by a grid on maps. This net magnetic north comprises all the magnetic effects acting on your compass.
True North	The direction to the earth's geographic north pole, indicated in life approximately by Polaris; indicated on maps by DMS scales and tick marks along the map borders.
Orienteering Compass	An adjustable compass with special features that make it more convenient to use in the field with maps.
Orienting Lines	Visible lines in the capsule engraved parallel to the boxing mark; used as reference lines when marking angles on the map with an orienting compass.
Sighting Compass	A compass with a mirror or peep sight aligned with the lubber's line.
Simple Compass	A compass with the lubber's line fixed at north or 0°, and a fixed azimuth circle.
Magnet	A body which has the property of at. tracting iron or other magnets. Its molecules are aligned.
Magnetic North	The direction sought by the north pole end of a magnet, such as a magnetic needle, in a horizontal position. It is near the geographic north pole of the Earth.
Magnetic South	The opposite direction from magnetic north towards which the south pole end of a magnet, such as a magnetic needle, is attracted when in a horizontal position. It is near the geographic south pole of the Earth.
Magnetism	The property inherent in the molecules of certain substances, such as iron, to become magnetized, thus making the substance into a magnet.
Natural Magnet	A magnet which occurs in nature, such as a lodestone. Its property of magnetism has been imparted by the magnetic effects of the Earth.

Nutrition

RDI	Recommended Dietary Intake. The Recommended Daily Intake is the daily intake level of a nutrient that is considered to be sufficient to meet the requirements of 97–98% of healthy individuals in every demographic in the United States.

Offence

Personal Disasters

Plants

Medicinal Uses

Acrid	Causes heat and irritation when applied to the skin.
Adaptogen	Helps the body 'rise' to normal stress situations, thus preventing the many chronic degenerative diseases.
Alterative	Causes a gradual beneficial change in the body, usually through improved nutrition and elimination, without having any marked specific action.
Anaesthetic	Numbs the feeling in a local or general area of the body.
Analgesic	Relieves pain.
Anaphrodisiac	Reduces sexual desire.
Anodyne	Relieves pain, it is milder than an analgesic.
Antacid	Counters excess acidity in the stomach.
Anthelmintic	Expels parasites from the gut.
Antiaphonic	Restores the voice.
Antiarthritic	Treats arthritis.
Antiasthmatic	Treats asthma.
Antibacterial	Kills bacteria.
Antibilious	Corrects the secretions of bile.
Antibiotic	An agent that inhibits or destroys a living organism. It usually refers to bacteria or other micro-organisms and is probably synonymous with Antibacterial.
Anticholesterolemic	Prevents the build up of cholesterol.
Anticoagulant	Removes blood clots.
Antidandruff	Treats dandruff.
Antidermatosic	Prevents or cures skin complaints.
Antidote	Counters poisoning.
Antiecchymotic	Prevents or treats bruising.
Antiemetic	Prevents vomiting.
Antifungal	An agent that inhibits or destroys fungi. Used in the treatment of various fungal problems such as candida.
Antihaemorrhoidal	Treats haemorrhoids (piles). This would probably be best added to another heading.
Antihalitosis	Reduces bad breath.
Antihydrotic	Reduces perspiration.
Antiinflammatory	Reduces inflammation of joints, injuries etc.
Antiperiodic	Counteracts recurring illnesses such as malaria.
Antiphlogistic	Reduces inflammation.
Antipruritic	Treats itching of the skin.
Antipyretic	Treats fevers.
Antirheumatic	Treats rheumatism.
Antipanic	Reduces panic and anxiety issues.
Antipsoriatic	Applied on the skins surface locally to treat psoriasis.
Antiseborrheic	Effective in seborrheic dermatitis (dandruff).
Antiarrhythmic	Suppresses abnormal rhythms of the heart (cardiac arrhythmias).
Antidepressant	Helps relieve symptoms of depression, social anxiety disorder and dysthymia.
Antidiarrhoeal	Provides symptomatic relief for diarrhoea.
Anticonvulsant	Used in the treatment of epileptic seizures.
Antineoplastics	Used in the treatment of metastatic colon cancer.
Appetite Stimulants	Appetite stimulants can help you eat more food and reduce your risk for malnutrition.
Appetite Suppressant	Can target both hunger and satiety to help you eat less.
Antianxiety	Is a medication or other intervention that inhibits anxiety.
Antiscorbutic	A plant rich in vitamin C that is used to counteract scurvy.
Antiscrophulatic	Counteracts scrofula. (TB, especially of the lymph glands)
Antiseptic	Preventing sepsis, decay or putrefaction, it destroys or arrests the growth of micro-organisms.
Antispasmodic	Relaxes muscular spasms and cramps, calming nervous irritation.
Antitumor	Preventing, or effective against, tumors, it is used in the treatment of cancer. Probably synonymous with Cytotoxic.
Antitussive	Prevents or relieves coughing.
Antivinous	Treats addiction to alcohol.
Antiviral	Treats virus diseases.
Aperient	A mild laxative.
Aphrodisiac	Increases the sexual appetite.
Appetizer	Improves the appetite.
Aromatherapy	Plants whose essential oils are used in Aromatherapy.
Aromatic	Having an agreeable odour and stimulant qualities.
Astringent	Produces contraction in living tissue, reducing the flow of secretions and discharges of blood, mucus, diarrhoea etc.
Bach	Plants used in the Bach flower remedies.
Balsamic	A healing and soothing agent.
Birthing Aid	Used in facilitating birth, but not just to cause uterine contrctions.

ADDENDUM Dictionary Plants Medicinal Uses

Bitter	Increases the appetite and stimulates digestion by acting on the mucous membranes of the mouth. Also increases the flow of bile, stimulates repair of the gut wall lining and regulates the secretion of insulin and glucogen.
Blood Purifier	Purifies the blood.
Blood Tonic	Support your immune defences and improve digestive function.
Cancer	Used in the treatment of cancer.
Cardiac	Used in the treatment of heart problems.
Cardiotonic	A tonic for the heart.
Carminative	Reduces flatulence and expels gas from the intestines.
Cathartic	A strong laxative but less violent than a purgative.
Cholagogue	Increases the flow of bile and its discharge from the body.
Contraceptive	Prevents fertilization occurring in females.
Cytostatic	Slows or controls the growth of tumours.
Cytotoxic	Destroys body cells. Used in the treatment of diseases such as cancer, where it is targeted against the cancer cells.
Decongestant	Removes phlegm and mucous, especially from the respiratory system.
Demulcent	Soothes, lubricates and softens irritated tissues, especially the mucous membranes.
Deobstruent	Clears obstructions from the natural ducts of the body.
Deodorant	Masks smells.
Depurative	Eliminates toxins and purifies the system, especially the blood.
Detergent	A cleansing agent, used on wounds etc. It removes dead and diseased matter.
Diaphoretic	Induces perspiration.
Digestive	Aids digestion.
Disinfectant	Used for cleaning wounds.
Diuretic	Acts on the kidneys, promoting the flow of urine.
Emetic	Induces vomiting.
Emmenagogue	Promotes or increases the menstrual flow. In early stages of pregnancy it can induce an abortion.
Emollient	Softens the skin, causing warmth and moisture.
Enuresis	Treats bed wetting.
Errhine	Produces sneezing.
Expectorant	Clears phlegm from the chest by inducing coughing.
Febrifuge	Reduces fevers.
Foot Care	Plants that are used in various ways to treat foot problems.
Galactofuge	Stops or reduces the flow of milk in a nursing mother.
Galactogogue	Promotes the flow of milk in a nursing mother.
Haemolytic	Breaks down red blood corpuscles to separate haemoglobin.
Haemostatic	Controls internal bleeding.
Hallucinogenic	Causes the mind to hallucinate.
Hepatic	Acts on the liver (for better or worse!).
Homeopathy	A plant used in homeopathic treatments.
Hydrogogue	A purgative that causes an abundant watery discharge.
Hypnotic	Induces sleep.
Hypoglycaemic	Reduces the levels of sugar in the blood.
Hypotensive	Reduces blood pressure, it is used in the treatment of high blood pressure.
Infertility	Used in treating problems of human fertility.
Irritant	Causes irritation or abnormal sensitivity in living tissue.
Kidney	Used in the treatment of kidney diseases.
Laxative	Stimulates bowel movements in a fairly gentle manner.
Lenitive	Soothing, palliative.
Lithontripic	Removes stones from the kidney, bladder etc.
Miscellany	Various medicinal actions that need more clarification.
Mouthwash	Treats problems such as mouth ulcers.
Mydriatic	Dilates the pupils of the eyes.
Narcotic	Relieves pain, induces drowsiness and gives a sense of well-being.
Nervine	Stimulates and calms the nerves.
Nutritive	A food for convalescents to help restore strength.
Odontalgic	Treats toothache (temporary measure only) and other problems of the teeth and gums.
Ophthalmic	Treats eye complaints.
Oxytoxic	Hastens parturition and stimulates uterine contractions. See also birthing aids.
Parasiticide	Treats external parasites such as ringworm.
Pectoral	Relieves respiratory diseases, a remedy for chest diseases.
Plaster	Used in the treatment of broken bones.
Poultice	A moist, usually warm or hot, mass of plant material applied to the skin in the treatment of burns etc.
Purgative	A drastic laxative causing a cleansing or watery evacuation of the bowels, usually with a griping pain.
Refrigerant	Cools the body.
Resolvent	Breaks down tumours. This might be placed under antitumor.
Restorative	Restores consciousness or normal physiological activity.
Rubefacient	A counter-irritant and external stimulant, it produces inflammation and redness of the skin.
Salve	Soothes and heals damaged skin.
Sedative	Gently calms, reducing nervousness, distress and irritation.
Sialagogue	Stimulates the secretion of saliva.
Skin	Plants used in miscellaneous treatments for the skin.
Sternutatory	Promotes sneezing and nasal discharges.

Stimulant	Excites or quickens activity of the physiological processes. Faster acting than a tonic but differing from a narcotic in that it does not give a false sense of well-being.
Stings	Used in the treatment of stings and insect bites.
Stomachic	Aids and improves the action of the stomach.
Styptic	An astringent that stops bleeding by contracting the blood vessels.
TB	Plants used in the treatment of tuberculosis.
Tonic	Improves general health. Slower acting than a stimulant, it brings steady improvement.
Uterine Tonic	A tonic for the uterus. See also oxytoxic.
Vasoconstrictor	Narrows the blood vessels, thereby increasing blood pressure.
Vasodilator	Widens the blood vessels, thereby reducing blood pressure.
VD	Used in the treatment of venereal disease.
Vermifuge	Expels and kills internal parasites.
Vesicant	A blistering agent.
Vulnerary	Promotes the healing of wounds.
Warts	Used in the treatment of warts, corns etc.
Women's Complaints	A very vague title, it deals with a miscellany of problems peculiar to the female sex.
Antiflatulent	Alleviation or prevention of excessive intestinal gas.
Antihistamine	Benadryl helps relieve runny nose, sneezing, itchy or watery eyes, and nose or throat itching.

Other Uses

Adhesive	Glues.
Alcohol	Used for fuel etc. (this is wood alcohol, it is not the sort that can be drunk.
Baby Care	Various plants that can be used in place of items such as nappies.
Basketry	Plant used in making baskets and other items such as chairs. Includes plants that are only used as an ornamental addition.
Beads	Used as necklaces etc.
Bedding	Used as a lining for sleeping on or putting fruits etc on.
Besom	A type of broom.
Biomass	Provides a large quantity of plant material that can be converted into fuel etc.
Blotting Paper	Plant that can be used to make blotting paper.
Bottles	Plants that can be used as bottles.
Broom	Used for sweeping the floor etc.
Brush	Used for cleaning clothes, as a paintbrush etc.
Buttons	Plants that can be used as buttons. Not including making buttons from wood.
Charcoal	Used for fuel, drawing, deodorant, filter, fertilizer etc.
Cleanser	For various materials. Perhaps best included under separate headings.
Compost	Plants used for activating compost heaps, providing biomass for composting, using as instant compost etc.
Containers	Plants, such as gourds, that can be used as containers. Does not include baskets or containers made from wood.
Cork	Including any plants used as a cork substitute. Cork is used for insulation (sound or heat), fire-retardant, bottle stops etc.
Cosmetic	Used to improve the physical appearance of a person.
Cotton Wool	Plants that can be used as substitutes for cotton wool.
Deodorant	A pleasant smelling plant that is used on the body to mask the human smell.
Disinfectant	Plants used for disinfecting.
Dye	Plants that provide dyes.
Essential	Essential oils that are used in perfumery, medicines, paint solvents, insect repellents etc.
Fencing	Plants that can be used for fencing.
Fertilizer	Provides a concentrated solid plant food.
Fibre	Used for making cloth, rope, paper etc.
Filter	Used to strain out particles from liquids.
Fire Retardant	Plants that do not easily burn and can be used in barrier plantings to limit the spread of forest fires.
Friction Sticks	Used for starting fires when there are no matches.
Fruit Ripening	Substances that promote the premature or rapid ripening of fruits.
Fuel	Usually wood, plant materials that have been mentioned as being a good fuel.
Fungicide	Arrests the growth of, or kills, fungi.
Furniture	A few miscellaneous uses that do not fit easily into other headings.
Green Manure	Fast-growing plants that can be used to increase the fertility of the soil.
Gum	Gums have a wide range of uses, especially as stabilizers, emulsifiers, thickening agents, adhesives etc.
Hair	Plants used as hair shampoos, tonics, to treat balding etc.
Hedge	Plants that can be grown as hedges.
Herbicide	Plants or plant extracts that can inhibit the growth of other plants.
Incense	Aromatic plants that can be burnt to impart a pleasant smell, repel insects and disinfect closed areas.
Ink	Plants that can be used as an ink.
Insecticide	Kills insects.
Insulation	Providing insulation against extremes of temperature, sound or electricity.
Kindling	Plant material that burns easily and can be used for starting fires.
Lacquer	A type of varnish.
Latex	A source of rubber.
Leather	Substitutes, that is.
Lighting	Plants that can be used as torches etc. See also Oil and Wax.
Lining	Used for lining boxes, baskets etc so that fragile items can be more safely carried in them.
Liquid Feed	Plants that can be used to make a liquid fertilizer.
Litmus	Used for testing whether a substance is acid or alkaline.
Miscellany	A rag-bag of items that are difficult to categorise.
Mordant	Used for making a dye more permanent, it also affects the colour of the dye.

Mulch	Used for covering the ground to conserve the nutrients in the soil.
Musical	Specific mention of plants used as musical instruments. Does not include the various woods that can be used for making musical instruments.
Nails	A few woods are tough enough to be used in place of metal nails in certain circumstances.
Needles	Used for sewing, darning etc.
Oil	Vegetable oils have many uses, as lubricants, lighting, soap and paint making, waterproofing etc. This does not include the edible oils unless they are also mentioned as having other uses.
Packing	Used as a filler in boxes etc in order to protect the contents.
Paint	Plants used directly as a paint. Does not include oil plants and dyes that can be used as ingredients in paints.
Paper	Related to the entry for Fibre, these plants have been specifically mentioned for paper making.
Parasiticide	Kills external body parasites such as hair lice.
Pectin	A substance that is used to thicken jams etc and as a culture medium in laboratories.
Pencil	A couple of plants especially mentioned for making the tubes that pencil leads fit into.
Pins	Used as needles and pins in sewing etc. Also used to lance boils, extract splinters from the skin etc.
Pioneer	Plants, usually trees and shrubs, that can be used to reforest land.
Pipes	For carrying water etc.
Pitch	Used for waterproofing, in paints etc.
Plant Breeding	Used in producing new species of plants or improved varieties.
Plant Support	Usually bamboos, used as canes in the garden for holding up plants.
Plaster	Used for covering walls.
Polish	Plants used to give a shine to metals, wood etc.
Pollution	Plants used to combat pollution.
Potash	Used for making glass, soap and as a fertilizer.
Pot-Pourri	Aromatic plants used to impart a pleasant smell to an area.
Preservative	For food, or for treating wood, ropes etc.
Raffia	A substitute for that material.
Repellent	Plants that are said to deter but not necessarily kill various mammals, birds, insects etc.
Resin	Used in perfumery, medicines, paints, soap making etc. This also includes turpentine, which is extracted from many resins and used as a preservative, water proofer etc.
Roofing	Used to give a waterproof roof to buildings. See also Thatching.
Rooting Hormone	Substances that can be used to promote the production of roots in plant cuttings.
Rootstock	Plants used as the rootstock for grafting scions onto.
Rust	Plants that can be used to prevent or treat rust.
Sandpaper	Plants used to smooth rough wooden surfaces by means of abrasion.
Scourer	Used for cleaning pots, pans, plates etc.
Shelterbelt	Wind resistant plants than can be grown to provide shelter in the garden etc.
Size	Used on materials, paper etc to give a surface that will take ink, dyes etc.
Soap	Plants used directly as a soap substitute.
Soap Making	Plants used as an ingredient in making soaps. Does not include the essential oils, dyes and oils that are also used in making soap.
Soil Conditioner	Plants grown to improve the structure of the soil. See also Green manures.
Soil Reclamation	Plants that can be grown in such circumstances an the spoil tips of mines in order to restore fertility.
Soil Stabilization	Plants that can be grown in places such as sand dunes in order to prevent erosion by wind, water or other agents.
Starch	Used as a fabric stiffener.
Straw	For drinking with.
Strewing	Plants, usually aromatic, that are strewn on the floor to give a nice smell, repel insects etc.
String	Plants that can be used as they are as a temporary string or can be easily made into a string. See also Fibre.
Stuffing	Used in making soft toys, mattresses, pillows etc.
Tannin	An astringent substance obtained from plants, it is used medicinally, as a dye and mordant, stabilizer in pesticide etc.
Teeth	Plants used to clean and care for the teeth.
Thatching	Used for making thatched roofs.
Tinder	Used for starting fires. See also Kindling.
Varnish	Plants that can be used as a varnish without any special treatment. Does not include varnishes made from oils etc.
Waterproofing	Does what it says. See also Pitch and Oil.
Wax	Used for making candles etc.
Waxed Paper	Substitutes that is.
Weather Forecasting	A few plants that are supposed to help us forecast the weather.
Weather Protection	Plants that can be used to give the body protection from severe weather.
Weaving	Items such as grass and palm leaves that are woven together for making mats, baskets etc. See also Basket making and Fibre.
Wick	Used as a wick for candles, lamps etc.
Wood	A list of the trees and shrubs that are noted for having useful wood.

Population

Preparedness

Alpha Strategy	The practice of storing extra consumable items, as a hedge against inflation, and for use in barter and charity. Coined by John Pugsley.
BO	Bug Out
BI	Bug In

ADDENDUM | Dictionary | Preparedness

BOB	Bug-out bag
BOL	Bug-out location
BOV	Bug-out vehicle
C.M.E	Coronal Mass Ejection
EDC	Everyday carry
E.M.P	Electromagnetic Pulse
EOTW	End of the world
EROL	Excessive rule of law. Describes a situation where a government becomes oppressive and uses its powers and laws to control citizens.
G.O.O.D.	Get out of Dodge (city). Fleeing urban areas in the event of a disaster. Coined by James Wesley Rawles.
I.N.C.H.	I'm Never Coming Home bag. Is a pack that has everything you need to walk out into the woods and never return to society.
Pollyanna or Polly	Someone who is in denial about the disruption that might be caused by the advent of a large scale disaster.
Prepper	A synonym for survivalist that came into common usage during the early 2000s. Used interchangeably with survivalist much as retreater was in the 1970s. Refers to one who is prepared or making preparations.
SHTF	S*** (or Stuff) hits the fan.
TEOTWAWKI	The end of the world as we know it
YOYO	You're on your own
M.R.E.	Meal Ready to Eat
I.F.A.K.	Individual First Aid Kit
J.I.C.	Just in case
WROL	Without rule of law. Describes a potential lawless state of society.
Sheeple	Sheeple refers to people who always follow the crowd and are mostly unable to think for themselves.
Grid Down	Means the power grid has gone down, likely as a result of a CME or EMP.
#10 can	Specially formulated for long term food storage, a #10 can is approximately 7 x 6-1/4 inches. The specification refers to the can's physical size and does not measure the can's contents, which may vary. A freeze dried pasta dish might contain 2 lbs. of food equivalent to 26-30 servings.
#2.5 can	2.5 can is about the size of a classic baking powder can. It's roughly 1/4 the size of a #10 can. Future Essentials offers a variety of #2.5 cans of freeze dried foods that are around .10 ounces.
Berkey	A "Big Berkey" water filtration system is a name brand for a popular gravity fed water filtration system that looks a bit like a coffee urn. A berkey can remove fluoride and other toxins. A Berkey is sufficient for everyday use and for filtering raw water from a lake or stream.
Bug Out	To bug out is to bail out of the current location of uncertain circumstance and potential danger and head to safer a territory. See also Bug Out Bag. Conversely, "bugging in" is hunkering down and staying at home in hiding.
Bug In	Bugging in means to stay at a specific current location until it is safer to move out. Although, it depends on the kind of SHTF situation, when in crises, bugging in, alongside bugging out, is among the first actions preppers consider.
Bug Out Bag	A bug out bag contains life essential gear pre-packed (usually in a backpack) in which a Prepper will use to escape. Included at minimum is a 72-hour supply of food and water per person.
MAG	Mutual Aid Group which consists of people who meet to discuss ideas, plans and strategies on emergencies in that particular area.
Peak Oil	Peak Oil is term used to describe a period in which the peak of the extraction of oil is reached, and what follows is a steady decline, until there is no more oil to be consumed. It follows a basic path; an observed rise in the aggregate production rate of oil, and then there is the period where the rise gradually climbs to a peak period, and after that there is a gradual fall into depletion.
P.E.R.K	This is an acronym for Personal Emergency relocation kit. This is a variant of a BOB that is used for an emergency relocation, maybe a retreat from imminent danger. Although preppers usually carry about E.D.C which includes things needed in day to day activities, bugged out Bags (See BOB above), and Personal Survival Kit (See PSK below), PERK is set of items that are needed for an emergency retreat.
PSK	This is an acronym that means Personal Survival Kit. It involves items needed to survive in harsh conditions.
SOL	This is an acronym that means Sh** out of luck. It is used to describe a helpless situation, and it is a variation of the phrase "out of luck".
BSTS	Better safe than sorry
BUG	Backup Gun
CCW	Concealed Carry Weapon
EOD	End of Days
EOTW	End of the world
FAK	First Aid Kit
GHB	Get Home Bag
HEMP	High Altitude Electromagnetic Pulse
JIC	Just In Case
NBC	Nuclear Biological Chemical
TPTB	The Powers That Be
YOYO	You're On Your Own
Big Berkey	A family water filtration system that can remove harmful bacteria and toxins from water
Doomer	Somebody who believes disaster is coming and chaos will ensue. These are hardcore preppers.
Survival Cache	A collection of survival items that you bury or hide at a location away from your home; the survival cache would ideally be buried in between your house and your bug out location so you can resupply yourself en route.
Faraday Cage	An improvised device that can shield the electronic items inside from an EMP attack or solar flare.
Two is One, One is None	When your life is on the line, you live by Murphy's Law (whatever can go wrong, will go wrong). That means a crucial piece of survival gear is going to break, so always have a second piece in case the first one fails.

Rendezvous Point	A pre-determined location where you meet up with your survival group before continuing to evacuate to your designated bug out location.
Rule of Threes	You can live for three minutes without oxygen, three hours without shelter in harsh environments, three days without water, and three weeks without food.
Off-Grid	Going off-grid is a lifestyle choice to live without electricity to be self reliant without any help from the outside. Many preppers choose to set up a homestead or compound without electricity, and complete with food and water sources to live a self-sufficient lifestyle.
Grid Down	A "Grid down" situation could be a simple blackout, or something more ominous as an Electro-Magnetic Pulse where civilization could take months or years to recover.
Molon Labe	A classic term used by patriots, Molon labe , means "Come and take them [my guns]." An expression of defiance, preppers use the Greek phrase to assert their Second Amendment rights. It's a declaration of warning to anyone who thinks they could confiscate the guns.
SCAR (Bag)	A term I coined meaning "Survival Comforts And Redundancies". This is a themed bag packed with preparedness gear that you don't necessarily need but will make your journey much easier. An example being a "barter" bag which only contains items you will trade, but can be abandoned if you lack the space in your vehicle.

Psychology

Recipes

Tsp	A Teaspoon or 4.9ml
Tbsp	A Tablespoon or 14.7ml
Pinch	Between 1/16 and 1/8 of a teaspoon
Bunch	4-7

Religion

Shelter

Shelter

Construction

Ant cap (ant capping or termite shield)	A metal shield, usually made of galvanised iron, that is placed on top of a wall, pier or stump supporting timber members. Ant caps extend on all open sides and are turned down at 45 degrees to expose and delay the movement of termites (white ants) from the soil to timber portions of a building.
Architrave (cover mould or door/window lining)	Moulding surrounding a door or window opening to cover the joint between the frame and the wall finish.
Baluster	A small post, often turned or decorated, used to support a handrail or fill the space below a handrail.
Balustrade	A series of balusters supporting stair handrail, landing, platform or bridge. They are also used as the collective name for the entire framed enclosure guarding the side of a stair, landing or platform.
Barge / Gable Boards	Sloping boards along a gable covering the ends of roof timbers and protecting them from rain. Old barge boards can be scallop shaped or otherwise decorated.
Batten	Timber member of small, rectangular cross-section. Sometimes used to screen the undercroft area.
Box Gutter	A gutter often with both sides built along the roof slope. Used in valleys or behind parapets.
Bearer	Sub-floor structural timber member supporting floor joists.
Cap (Capping)	Uppermost part on top of a piece of work, often used to provide a cover (ie. ridge capping).
Chimney Breast	Wall of the chimney that projects into the room and contains the fireplace and flues.
Cornice	Externally - overhanging moulding at the top of a wall to deflect dripping. Internally - plastered moulding covering the joint between the wall and ceiling.
Dado	Finishing of the lower part of an interior wall from skirting to waist height, usually in a darker colour then the rest of the wall.
Damp-Proof Course	Impermeable barrier just above ground level at the base of the wall to prevent rising damp. Modern damp-proof courses are generally made from 0.5 millimetre thick, black, polyethylene sheeting. One of the oldest types of damp-proof courses is made up of tar and sand. Another type of impermeable barrier that was traditionally used was glazed hard-burnt ceramic, similar in size and shape to bricks.
Door Furniture	Metal accessories for a door, including hinges, handles, locks, bolts, latches and escutcheons (a metal plate surrounding the keyhole, sometimes covered by a metal key drop for protection).
Dormer	Vertical window through a sloping roof, usually provided with its own pitched roof.
Drip Moulding	A groove or projection under an overhanging edge designed to throw water off at the outer edge so it does not flow back to the building.
Eaves	Lower edge of a roof which projects beyond the wall as an overhang.
Fanlight	Glazed opening over the door but within the doorframe.
Fascia Board	Board set on edge, fixed to the rafter ends, wall plate or wall to carry the gutter under the eaves.
Flashing	Strip of impervious material, usually flexible metal (such as galvanised iron, lead or copper) used to cover a joint where water could otherwise penetrate.

ADDENDUM | Dictionary | Shelter | Construction

Fretwork	Wood cut into decorative patterns (with a fret or jigsaw).
Gable	Triangular part of the end wall of a building with a sloping roof. A roof with a gable at one or both ends.
Hood (Window Hood)	Protecting and projecting element over the outside of an opening to throw off water.
Joist	Wooden or steel beam supporting a floor (floor joist) or ceiling (ceiling joist). Steel beam sections are generally called rolled steel joists (RSJs).
Mortar	Mix of sand, lime and sometimes cement used for rendering, pointing or laying bricks or stone.
Mullion	Vertical dividing member of a frame between door or window lights.
Parapet	Low wall guarding the edge of a roof, bridge, balcony, etc or part of a wall that extends above the roof.
Pediment	Gable-shaped, decorative feature above a parapet, portico, doors, windows, etc.
Pointing	Raking out mortar joints and pressing into them a surface mortar to finish a masonry wall.
Quoins	Dressed stones at the corners of buildings, usually laid so that their faces are alternately large and small. Originates from the French word 'coin' (corner)
Rafter	One of the sloping pieces of timber forming the roof framework and supporting the roof covering.
Rainwater Head (Rainwater Sump)	Funnel or box-shaped rainwater fitting for collecting and discharging roof water from a gutter into a downpipe.
S-trap	A trap in which the outlet leg is vertical and parallel with the inlet leg.
Sarking (Sarking Membrane)	Pliable, water-resistant membrane located beneath the roof covering or external wall cladding to collect and discharge water that may penetrate. often combined with reflective foil to provide thermal insulation benefits.
Sill	Lowest horizontal member at the bottom of a window or door frame.
Sash	Glass-fitted framed window unit which can be moved by pivoting or sliding, can be divided into smaller panes and is identified as top and bottom sash in a double-hung window.
String Course	Decorative, usually projecting, thin horizontal course of brick or stone, often continuing the line of the masonry window sills.
Threshold	Step or sill of timber or other material at the foot of an external door.
Transom	Horizontal dividing member of a frame between window lights or separating a door from a fanlight above.
Truss	Framework of timbers or metal bars, usually based on a series of triangles to create a rigid beam to the roof or span a space or form a bracket.
Ventilator	An implement for ventilating a roof to allow hot air to escape.
Wall Plate	Timber laid longitudinally on top of the wall where ends of rafters are placed.
Weep Hole	Small drain hole for water used to drain water collecting behind retaining walls and prevent hydrostatic pressure developing.
Window Furniture	Metal accessories for a window which include hinges, locks, stay bars (to hold casement windows in an open position) etc.
Accessory Dwelling Unit (ADU)	A self-contained apartment that is either attached to a principal dwelling or in a separate structure on the same property. Typically the principal dwelling is an owner-occupied single family house. Sometimes called an "in law" apartment.
Affordable Housing	Housing for someone earning less than 80% of the Area Median Income that they can afford. Housing is considered affordable if you spend less than 30% of your income on housing (for homeownership this is mortgage principal, interest, taxes, insurance and any mandatory association fees).
Cluster Development	Building homes on smaller lots so the same number of homes is clustered on a smaller portion of the total available land. The remaining land, which would have been allocated to individual home sites, is now converted into protected open space and shared by the residents of the subdivision and possibly the entire community. The main objective of cluster development is to allow residential, or even commercial, development while still protecting the area's environmental features, allowing for more open space, and protecting farmland and the character of rural communities.
Cohousing	Cohousing is an intentional community of private homes clustered around shared space. Each attached or single family home has traditional amenities, including a private kitchen. Shared spaces typically feature a common house, which may include a large kitchen and dining area, laundry, and recreational spaces. Shared outdoor space may include parking, walkways, open space, and gardens. Neighbors also share resources like tools and lawnmowers.
Community Land Trust	A model for affordable housing whereby a community-based non-profit owns land and leases it to homeowners with a 99 year renewable lease. This increases access to land and removes the land from speculation.
Compact Development	Aims for a more efficient use of land through higher-density planning. It can be applied in new urban development as well as redevelopment projects such as infill or brownfield development. Benefits of compact development include: reducing sprawl; reducing dependency on private car use; creating walkable environments; increasing economic efficiency in delivering basic urban services.
Cottage Housing	Is a new model of clustered single family housing that provides a transition between single family housing neighborhoods and higher density areas, creating a development pattern that maximizes land values, reduces infrastructure costs and provides housing next to services.
Density Bonuses	A zoning tool that permits developers to build more housing units, taller buildings, or more floor space than normally allowed, in exchange for provision of a defined public benefit, such as a specified number or percentage of affordable units included in the development.
Home Energy Rating System (HERS) Rater	Someone who analyzes the energy use of your planned building project before construction and then inspects and tests the home to see that it meets energy efficiency standards.
Inclusionary Zoning	A tool that can be used by municipalities to ensure adequate affordable housing is included in the normal course of real estate development. It requires a portion of the housing units in certain real estate developments to be reserved as affordable to low- and moderate-income households.
Infill Development	Building in areas that already have significant development vs. clearing natural spaces for construction. For small homes, this may mean looking for "back yards" or empty lots in existing neighborhoods big enough to create a new building lot or an ADU.
Manufactured Homes	A manufactured home is any home factory-built in the U.S. to the HUD Title 6 construction standards (commonly known as 'the HUD-code'). The HUD-code took effect June 15, 1976. A manufactured home is built on a permanent chassis to ensure transportability. However, typically a manufactured home is not moved from its initial installed site.
Modular Homes	A modular home is any home factory-built to a local state code. A modular home can be built as an "on-frame" or "off-frame" modular. On-frame will be built on a permanent chassis, whereas, the off-frame modular will be built with removal of the chassis frame in mind. An off-frame modular will usually require additional cranes to assist with home placement. Modular homes are, more often than not, attached to private land.

Mobile Home	A mobile home is a factory-built home that is 1) built before June 15, 1976, and 2) not built to a uniform building code.
Tiny House Movement	It is a social movement where people are choosing to downsize the space they live in. The typical American home is around 2,600 square feet, whereas the typical small or tiny house is between 100 and 400 square feet. Tiny houses come in all shapes, sizes, and forms, but they enable simpler living in a smaller, more efficient space. People are joining this movement for many reasons, but the most popular reasons include environmental concerns, financial concerns, and the desire for more time and freedom.
Small Homes	Small homes range anywhere between 400 to 1500 square feet depending on the number of inhabitants and their lifestyles. In most cases, though, 400 to 1000 square feet is what most people in the tiny housing world consider small but it's all really a matter of opinion. (Source: Tiny House Talk) For this project we are generally discussing homes in the 400-900 sq ft range. The average home size in the Northeast in 2010 was 2,613 sq ft.
Small Lot Zoning	Zoning that allows for greater density than typical suburban growth patterns and is often more consistent with historic development patterns of downtowns and villages. May allow for less frontage or acreage required per dwelling. Specific examples may include "flag lots" or other infill lots, zero lot line development, no frontage or acreage requirements, setting lot size per square feet of units instead of size by number of units, bonus densities, cottage housing development or other strategies that look at use intensity.
Smart Growth	Strategies that focus the creation of new homes in areas with infrastructure (sewer, water, transportation) and services (shopping, jobs, etc.).
Stationery Homes	House built on a permanent foundation, crawl space or on permanent piers approved by a building inspector.
YIMBY (Yes In My Back Yard)	A grassroots movement to promote the creation of new affordable housing through smart growth strategies in response to the "Not In My Back Yard" (NIMBY) attitudes that developers often face when new housing is planned.
Zero-Lot-Line Development	A development option where side yard restrictions are reduced and the building abuts a side lot line. Overall unit-lot densities are therefore increased. Zero-lot-line development can result in increased protection of natural resources.
Zero-Net Energy	A Zero-Net Energy building is one that is optimally efficient, and over the course of a year, generates energy onsite, using clean renewable resources, in a quantity equal to or greater than the total amount of energy consumed onsite.

Skills

Survival

Search & Rescue Terms

Survivalism	A primarily American movement of individuals or groups who actively prepare for emergencies, including possible disruptions in social or political order, on scales from local to international.
Aircraft Coordinator (ACO)	A person who coordinates the involvement of multiple aircraft in SAR operations.
Aeronautical Drift (Da)	Drift caused by bailout trajectory or aircraft gliding distance
Aeronautical Position	Initial position of a distressed aircraft at the time of re-entry, engine failure, aircrew ejection or bailout.
Aircraft Glide	Maximum ground distance an aircraft could cover during descent.
Alert Phase	A situation wherein apprehension exists as to the safety of an aircraft or marine vessel, and of the persons on board.
Alerting Post	Any facility intended to serve as an intermediary between a person reporting an emergency and a rescue coordination centre or rescue sub-centre.
ARGOS	A satellite-based location and data collection system.
AusSAR (see JRCC)	Australian Search and Rescue: a functional description of the Australian Maritime Safety Authority's role in maritime and aviation SAR coordination, communications, and the provision of SAR units. AusSAR does not exist a discrete entity inside AMSA. Whilst the description "AusSAR" is readily understood by other participants in SAR, the term JRCC Australia is preferred.
Awareness Range	Distance at which a search scanner can first detect something different from its surroundings but not yet recognise it.
Awareness Stage	A period during which the SAR system becomes aware of an actual or potential incident.
Captain	Master of a ship or pilot-in-command of an aircraft, commanding officer of a warship or an operator of any other vessel.
Checksum Digit	A digit that is appended to a numeric data element and used to verify its accuracy. Checksum digits are computed by adding the digits of the data element.
Coast Earth Station (CES)	Maritime name for an Inmarsat shore-based station linking ship earth stations with terrestrial communications networks.
Conclusion Stage	A period during a SAR incident when SAR facilities return to their regular location and prepare for another mission.
Coordinated Search Pattern	Multi-unit pattern using vessel(s) and aircraft.
Coordinated Universal Time (UTC)	International term for time at the prime meridian.
COSPAS-SARSAT System	An international satellite system designed to provide distress alert and location data from 406MHz distress beacon signals.
Course	The intended horizontal direction of travel of a craft
Coverage Factor (C)	For parallel sweep searches, Coverage Factor (C) is computed as the ratio of sweep width (W) to track spacing (S). C = W/S.
Craft	Any air or sea-surface vehicle, or submersible of any kind or size.
Datum	A geographic point, line, or area used as a reference in search planning
Datum Area	Area where it is estimated that the search object is most likely to be located.
Datum Line	A line, such as the distressed craft's intended track line or a line of bearing, which defines the centre of the area where it is estimated that the search object is most likely to be located.
Datum Point	A point, such as a reported or estimated position, at the centre of the area where it is estimated that the search object is most likely to be located.
Dead Reckoning (DR)	Determination of position of a craft by adding to the last fix the craft's course and speed for a given time.

Digital Selective Calling (DSC)	A technique using digital codes which enables a radio station to establish contact with, and transfer information to, another station or group of stations.
Direction of Current	Direction toward which a current is flowing. Also called set.
Direction of Waves, Well or Seas	Direction from which the waves, swells, or seas are moving.
Direction of Wind	Direction from which the wind is blowing.
Distress Phase	A situation wherein there is reasonable certainty that a vessel/aircraft, or person, is threatened by grave and imminent danger and requires immediate assistance.
Ditching	The forced landing of an aircraft on water.
Drift	The movement of a search object caused by environmental forces.
Drift Error (De)	See Total drift error.
Emergency Phase	Emergency phases are based on the level of concern for the safety of persons or craft that may be in danger. The three levels of emergency are classified as Uncertainty, Alert, and Distress.
False Alarm	Distress alert initiated for other than an appropriate test, by communications equipment intended for alerting, when no distress situation actually exists.
False Alert	Distress alert received from any source, including communications equipment intended for alerting, when no distress situation actually exists, and a notification of distress should not have resulted.
Fetch	The distance over which the wind blows in a constant direction, without obstruction.
Field Search Coordinator	Term for SMC who coordinates land searches only.
Field Search Headquarters	Land equivalent of a RCC
First RCC	RCC affiliated with the shore station that first acknowledges a distress alert, and which will accept responsibility for all subsequent SAR coordination unless and until coordination is transferred to another RCC.
Fix	A geographical position determined by visual reference to the surface, referencing to one or more radio navigation aids, celestial plotting, or other navigation device.
Forward Looking Infrared (FLIR)	An imaging system, mounted on board surface vessels or aircraft, designed to detect thermal energy (heat) emitted by targets and convert it into a visual display.
General Communications	Operational and public correspondence traffic other than distress, urgency and safety messages, transmitted or received by radio.
Global Maritime Distress and Safety System (GMDSS)	A global communications service based upon automated systems, both satellitebased and terrestrial, to provide distress alerting and promulgation of maritime safety information for mariners.
Global Navigation Satellite System (GNSS)	Worldwide position and time determination system that includes one or more satellite constellations and receivers.
Great Circle Route	The shortest course between two points on the surface of a sphere. It lies in a plane that intersects the sphere's centre.
Ground Speed (GS)	The speed an aircraft is making relative to the earth's surface.
Heading	The horizontal direction in degrees magnetic in which a craft is pointed.
Hypothermia	Abnormal lowering of internal body temperature (heat loss) from exposure to cold air, wind or water.
Indicated Air Speed (IAS)	The aircraft speed shown on the air speed indicator gauge. IAS corrected for instrument error and atmospheric density equals true air speed.
Initial Position Error (X)	The estimated probable error of the initially reported position of a SAR incident.
Inmarsat Ltd	Formally the International Maritime Satellite Organisation.
International Maritime Satellite Organisation (Inmarsat)	A system of geostationary satellites for worldwide mobile communications services, and which support the Global Maritime Distress and Safety System and other emergency communications systems.
Instrument Flight Rules (IFR)	Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.
Instrument Meteorological Conditions (IMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions.
Joint Rescue Coordination Centre (JRCC)	A rescue coordination centre responsible for both aeronautical and maritime search and rescue incidents.
Knot (kt)	A unit of speed equal to one nautical mile per hour.
Last Known Position (LKP)	The Last Known Position is a term used in search planning to indicate the last known location of the person, marine craft or aircraft the subject of a search and /or rescue mission. It is also known by its acronym LKP. The LKP may be a boat ramp where a small craft was launched, a reporting point or navigation aid where an aircraft last reported its position or the location where it can be confirmed a person was last sighted e.g., at the start of a walking track. The Last Known Position differs from the other term used in marine search planning of Splash Point or SP.
Leeway (LW)	The movement of a search object through water caused by winds blowing against exposed surfaces.
Land Earth Station (LES)	Land Earth Station (Inmarsat) – synonymous with CES.
Local User Terminal (LUT)	An earth receiving station that receives beacon signals relayed by COSPAS-SARSAT satellites, processes them to determine the location of the beacons, and forwards the signals.
MAYDAY	The distress signal "MAYDAY" is used to indicate that a craft or person is threatened by grave and imminent danger and requires immediate assistance. It has precedence over all other communications. The distress message is preceded by the word MAYDAY spoken three times. The word is pronounced 'Mayday' from the French m'aider (help me). Any subsequent messages including selfidentification, position, nature of distress and other useful information, forms the distress message.
MEDEVAC	Evacuation of a person for medical reasons.
Meteorological Visibility	The maximum range at which a large object, such as landmasses or mountains, can be seen. Also referred to as Meteorological Range.
Mission Control Centre (MCC)	Part of the COSPAS-SARSAT system that accepts alert messages from the local user terminal(s) and other mission control centres to distribute to the appropriate rescue coordination centres or other search and rescue points of contact.

Narrow-Band Direct Printing (NBDP)	Automated telegraphy, as used by the NAVTEX system and telex-over-radio.
NAVAREA	One of 16 areas into which the International Maritime Organization divides the world's oceans for dissemination of navigation and meteorological warnings.
NAVTEX	Telegraphy system for transmission of maritime safety information, navigation and meteorological warnings and urgent information to ships. NAVTEX is not provided in Australia - see SafetyNet.
On-scene	The search area or the actual distress site.
On-scene Coordinator (OSC)	A person designated to coordinate search and rescue operations within a specified area.
On-scene Endurance	The amount of time a facility may spend at the scene engaged in search and rescue activities.
Overall Coordination	The responsibility of the SAR authority to prosecute a SAR operation for a given target in accordance with Volume 1, Chapter 1, section 1.2, Appendix B or the SAR authority best placed to coordinate efforts of the response agencies that may become involved in a SAR action.
Overdue	A situation where a craft has failed to arrive at its intended destination when expected and remains missing.
PAN-PAN	The international radiotelephony urgency signal. When repeated three times, indicates uncertainty or alert, followed by nature of urgency. The urgency signal "PAN PAN" is used to indicate that the calling station has a very urgent message to transmit covering the safety of a ship, aircraft or person. It has precedence over all other communications, except distress traffic. The urgency message is preceded by the words 'PAN PAN' spoken three times. The words are pronounced 'Pan pan' from the French panne (a breakdown).
Personal Locator Beacon (PLB)	Personal radio distress beacon for alerting and transmitting homing signals.
Pilot-in-command	The pilot responsible for the operation and safety of the aircraft during flight time.
Planning Stage	A period during a SAR incident when an effective plan of operations is developed.
Position	A geographical location normally expressed in degrees and minutes of latitude and longitude.
Positioning	Process of determining a position that can serve as a geographical reference for conducting a search.
Possibility Area	(1) The smallest area containing all possible survivor or search object locations. (2) For a scenario, the possibility area is the smallest area containing all possible survivor or search object locations that are consistent with the facts and assumptions used to form the scenario.
Primary Swell	The swell system having the greatest height from trough to crest.
Probability Area	The area in which a missing craft and/or survivors are most likely to be found taking into account possible errors in the navigation of the missing craft and of the search craft.
Probability of Detection (POD)	The probability of the search object being detected, assuming it was in the areas that were searched. POD is a function of coverage factor, sensor, search conditions and the accuracy with which the search facility navigates its assigned search pattern. Measures sensor effectiveness under the prevailing search conditions.
Rescue	An operation to retrieve persons in distress, provide for their initial medical or other needs, and deliver them to a place of safety.
Rescue Coordination Centre (RCC)	The centre from which a SAR incident is controlled and coordinated. The Centre is known by various terms such as the Rescue Coordination Centre, Major Incident Room, Operations Room or Base Station. For the purposes of this manual these centres will be known generically as the Rescue Coordination Centre or RCC.
Rhumb Line	A line of constant bearing that cuts meridians at the same angle. It is a straight line between two points on a Mercator projection chart.
SafetyNET	Communications service provided via Inmarsat-C for promulgation of maritime safety information, including shore-to-shop relays of distress alerts and communications for search and rescue coordination.
SAR Datum Buoy	Droppable floating beacon used to determine actual sea current, or to serve as a location reference.
Scenario	A consistent set of known facts and assumptions describing what may have happened to the survivors and/or craft.
Sea	Condition of the surface resulting from waves and swells.
Sea Current (SC)	The residual current when currents caused by tides and local winds are subtracted from local current. It is the main, large-scale flow of ocean waters.
Search	An operation, normally coordinated by a rescue coordination centre, using available personnel and facilities to locate persons in distress.
Search and Rescue Authority	The authority within an Administration with overall responsibility for establishing and providing SAR services and ensuring that planning for those services is properly coordinated. The national SAR authority in Australia is the Australian Maritime Safety Authority with each of the States and Territories Polices services and the Department of Defence being the SAR Authorities within their jurisdictions. In Australia, the SAR Authority takes on the roles of the SAR Coordinator as described in the IAMSAR Manual.
Search Action Plan	Message, normally developed by the SMC, for passing instructions to SAR facilities and agencies participating in a SAR mission.
Search and Rescue Briefing Officer	An officer appointed, usually by the SMC, to brief departing SAR facilities and debrief returning SAR facilities.
Search and Rescue Case	Any potential or actual distress about which a facility opens a documentary file, whether or not SAR resources are dispatched.
Search and Rescue Coordinating Communications	Communications necessary for the coordination of facilities participating in a search and rescue operation.
Search and Rescue Facility	Any mobile resource, including designated search and rescue units, used to conduct search and rescue operations. The terms unit and asset maybe interchangeable with facility.
Search and Rescue Incident	Any situation requiring notification and alerting of the SAR system and which may require SAR operations.
Search and Rescue Liaison Officer	An officer assigned to promote coordination during a SAR mission.
Search and Rescue Mission Coordinator (SMC)	The suitably trained or qualified official temporarily assigned to coordinate a response to an actual or apparent distress situation. In Australia, the acronym SARMC is also used in some jurisdictions. Throughout this manual, the terms SMC and SARMC are synonymous. Some jurisdictions also use the term A/SARMC to describe the SMC's assistants.
Search and Rescue Plan	A general term used to describe documents which exist at all levels of the national and international search and rescue structure to describe goals, arrangements, and procedures which support the provision of search and rescue services.

ADDENDUM Dictionary Survival Search & Rescue Terms

Search and Rescue Point of Contact (SPOC)	Rescue coordination centres and other established and recognised national points of contact that can accept responsibility to receive COSPAS-SARSAT alert data to enable the rescue of persons in distress.
Search and Rescue Region (SRR)	An area of defined dimensions, associated with the national rescue coordination centre (JRCC Australia), within which search and rescue services are provided.
Search and Rescue Service	The performance of distress monitoring, communication, coordination and search and rescue functions, including provision of medical advice, initial medical assistance, or medical evacuation, through the use of public and private resources, including cooperating aircraft, vessels and other craft and installations.
Search and Rescue Stage	Typical steps in the orderly progression of SAR missions. These are normally Awareness, Initial Action, Planning, Operations, and Mission Conclusion.
Search and Rescue Unit (SRU)	An aircraft, vessel of search team with equipment suitable for the expeditious conduct of search and rescue operations.
Search Area	The area determined by the search planner to be searched. This area may be subdivided into search sub-areas for the purpose of assigning specific responsibilities to the available search facilities.
Search Endurance (T)	The amount of "productive" search time available at the scene also known as Available Search Hours (ASH). This figure is usually taken to be 85% of the on-scene endurance, leaving a 15% allowance for investigating sightings and navigating turns at the ends of search legs.
Search Facility Position Error (Y)	Probable error in a search craft's position, based on its navigational capabilities.
Search Object	A ship, aircraft, or other craft missing or in distress or survivors or related search objects or evidence for which a search is being conducted.
Search Pattern	A procedure assigned to an SRU for searching a specified area.
Search Radius	The actual search radius used to plan the search and to assign search facilities. It is usually based on adjustments to the optimal search radius that are needed for operational reasons.
Secondary Swells	Swell systems of less height than the primary swell.
SECURITE	The safety signal 'SECURITÉ' indicates that the station is about to transmit a message concerning the safety of navigation or providing an important meteorological warning. The safety message is preceded by the word "SECURITE" spoken three times. The word is pronounced 'See-cure-e-tay' from the French sécurité.
Sensors	Human senses (sight, hearing, touch, etc.), those of specially trained animals (such as dogs), or electronic devices used to detect the object of a search.
Set	Direction towards which a current flows
Situation Report (SITREP)	Reports, from the OSC to the SMC or the SMC to interested agencies, to keep them informed of on-scene conditions and mission progress.
Splash Point	A term used in marine search planning to indicate a known point of distress. Also referred to by its acronym SP.
SOS	Internationally recognised signal of distress, made by any method of signalling.
Surface Drift	Vector sum of total water current and leeway. Sometimes called Total Drift.
Surface Picture (SURPIC)	A list or graphic display from a ship reporting system of information about vessels in the vicinity of a distress situation that may be called upon to render assistance.
Surface Position	The position of the search object on the earth's surface at the time of initial distress, or its first contact with the earth's surface.
Sweep Width (W)	A measure of the effectiveness with which a particular sensor can detect a particular object under specific environmental conditions.
Swell	Condition of the surface caused by a distant wind system. The individual swell appears to be regular and smooth with considerable distance between rounded crests.
Swell Direction	The direction from which a swell is moving. The direction toward which a swell is moving is called the down swell direction.
Swell Face	The side of the swell toward the observer. The backside is the side away from the observer. These definitions apply regardless of the direction of swell movement.
Swell Velocity	Velocity with which the swells advance with relation to a fixed reference point, measured in knots.
Time of Closest Approach (TCA)	Time during a satellite pass when the satellite is closest to a signal source.
Total Drift Error (De)	Sum of the individual drift errors from the time of the incident until datum. Used when determining Total Probable Error (E).
Total Probable Error (E)	The estimated error in the datum position. It is the square root of the sum of the squares of the total drift error, initial position error, and search facility position error.
Total Water Current (TWC)	The vector sum of currents affecting search objects.
Track Spacing (S)	The distance between adjacent parallel search tracks.
Triage	The process of sorting survivors according to medical condition and assigning them priorities for emergency care, treatment, and evacuation.
True Air Speed (TAS)	The speed an aircraft is travelling through the air mass. TAS corrected for wind equals ground speed.
Uncertainty Phase	A situation wherein uncertainty exists as to the safety of an aircraft or a marine vessel, and of the persons on board.
Unreported	A situation where a craft has failed to report its location or status when expected and remains missing.
Vector	A graphic representation of a physical quantity or measurement, such as wind velocity, having both magnitude and direction.
Visual Flight Rules (VFR)	Rules governing procedures for conducting flight under visual meteorological conditions. In addition, used by pilots and controllers to indicate type of flight plan.
Visual Meteorological Conditions (VMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.
Wave (or Chop)	The condition of the surface caused by local wind and characterised by irregularity, short distance between crests, whitecaps, and breaking motion.
Wind-Corrected Heading	The actual heading an aircraft is required to fly to make good an intended course.

Wind Current (WC)	The water current generated by wind acting upon the surface of water over a period of time.

Security

General

Alert	Term used for physical signs a canine or horse gives when they are interested in something. Canines may alert by barking, horses may alert by placing their ears forward, distending their nostrils, focusing their eyes, stopping forward movement, etc.
Attraction Search	Search based on the idea that the victim is alive, willing to be found and will, upon hearing or seeing signs of rescue, make them self and their position known.
Bastard Search	A search in which, for one reason or another and unknown to the searchers, there is no subject, as the subject is elsewhere rather than in the search area.
Bloodhound	A search dog that is remarkable for its keen sense of smell and often used as tracking/trailing canines.
Briefing	A meeting before a search in which information is disclosed to the search teams in order to initiate and properly execute the search.
CISD	Critical Incident Stress Debriefing
Confinement Search	Also a containment measure. Search in which the object is to confine the subject to a specific area.
Debriefing	A meeting after a search or after a team has been called in, in which all information found is disclosed and where suggestions can be made for the future.
DOD	Department of Defence
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FBI	Federal Bureau of Investigation
FLIR	Forward Looking Infrared - A thermal imaging device designed to be aircraft mounted, usually on a helicopter, that can detect heat sources at night. Useful in locating persons on foot, in concealed vehicles, aircraft wreckage, and other heat sources.
FTL	Field Team Leader
FTM	Field Team Member
FRP	Federal Response Plan
Grid Search	All searchers move forward on a line. They are spaced closely together. This search is slow and methodical and takes a lot of time.
Handler	The person who controls and directs a canine during a search. This person is usually, but does not have to be, the owner or trainer of the canine.
Hasty Search	A search whose purpose is to cover the most obvious places a subject might be in the least time possible. Usually the first kind of search tactic to be utilized.
Helibase	A location within the general incident area for parking, fuelling, maintenance and loading of helicopters.
Helispot	A location where a helicopter can take off and land.
HRT	Hostage Rescue Team (FBI)
IC	Incident Commander
ICC	Incident Command Centre
ICISF	International Critical Incident Stress Foundation
ICP	Incident Command Post
ICS	Incident Command System
ISAR	Inland Search and Rescue – A search management class taught by the U.S. Coast Guard and U.S. Air Force OR Introduction to Search And Rescue - A basic search and rescue course taught by the National Association for Search and Rescue.
JIC	Joint Information Centre
JOC	Joint Operations Centre
JTF	Joint Task Force
JTTF	Joint Terrorism Task Force
LKP	Last Known Position - The last known location for the missing subject as determined by physical evidence such as a discarded object or a footprint. In the case of an aircraft, the LKP may be the last reported point or the last observed radar position.
MACC	Multi-Agency Coordination Centre
MATF	Multi-Agency Task Force
Mission Coordinator	The person designated by the legal responsible authority to coordinate and manage on-scene operations during a specific SAR incident. Depending upon the management system used and the organizations involved, this person may be called the Mission Coordinator, On-Scene Commander or Incident Commander.
MLPI	Managing the Lost Person Incident.
MLSO	Management of Land Search Operations.
Mock Search	Staged training that is set up to approximate as closely as possible, a real search effort.
Mountaineering	The art of mountain climbing usually for recreational purposes, but may be for rescue purposes.
Mutual Aid Search	A search that is too large scale to be handled by one organization. One or more organizations or groups outside the initial group are called in to assist in the effort.
NASAR	National Association for Search and Rescue
Night Vision	A monocular or binocular piece of equipment that allows you to see in near total darkness by intensifying existing light. It may also be utilized in total darkness with an infrared attachment. Night vision is very useful for search and rescue missions.
NRP	National Response Plan - A federally mandated plan that integrates domestic prevention, preparedness, response and recovery plans into one all-discipline, all-hazards plan.
NSARS	National Search and Rescue School - A national school which conducts search management programs administered by the U.S. Coast Guard and the U.S. Air Force.

Overhead Team	A highly trained, quick response SAR management team that can respond to assist with search planning, coordination and operations. The overhead team usually consists of a search manager and one or two assistants.
Perimeter Search	A search of an outside line that is believed to be across the direction of travel of the subject. The object is to cut the trail and find tracks or other evidence of the subject being there.
Plan of Action	A written document that consolidates all of the operational actions to be taken by various personnel in order to stabilize the incident.
PLB	Personal Locator Beacon - The personal version of the “ELT” designed to be carried by a person on foot. It is manually activated.
PLS	Point (or Place) Last Seen - The location where the missing subject was actually seen by another person.
POA or PA	Probability of Area (chances that the subject, or clues, are in the area being searched).
POD or PD	Probability of Detection (chances of finding the subject or clues given that they are in the area being searched).
POS or PS	Probability of Success (chances of being successful with a particular search in a given area).
Rural SAR	A search and rescue mission conducted in an area often given to farming or to woodland and is usually sparsely to moderately populated.
SAC	Special Agent in Charge
SAR	Search and Rescue
SAR Emergency	Any SAR incident, whether related to any other type of incident or not, that requires the utilization of resources to resolve, due to the threat or potential threat to human life.
Search Manager	The individual "managing" the search operations. Also known as “MSO” for Managing Search Operations or “MLPI” for Managing the Lost Person Incident or “ISAR” for Inland Search and Rescue Specialist or "NSARS" for National Search and Rescue School.
SIOC	Strategic Information and Operations Centre (FBI)
SOG	Standard Operating Guidelines
SOP	Standard Operating Procedures
Sound Sweep Search	An attraction search in which all searchers call out, whistle or make some other sound at a prescribed time and then are all quiet and listening for an answer during a second prescribed time.
Staging Area	That location where incident personnel and equipment gather and are assigned.
Strike Team	Specified combinations of the same kind and type of resources, with common communication and a leader.
Task Force	A combination of single resources assembled for a particular need.
Tracking Canine	A search dog that will follow the ground scent of a person who has passed through an area in which the dog is searching.
Trailing Canine	A search dog that will follow the scent trail of a specific individual, after the dog has been allowed to smell an article or object that has been in contact with that individual. The trailing dog is scent discriminating (the ability to distinguish the scent of one person and follow it).
Tracker	An individual who can detect and follow signs of human passage.
UC	Unified Command A method for all agencies or individuals who have jurisdictional responsibility at the incident, to contribute to determining overall objectives for the incident and selection of a strategy to achieve the objectives.
Unity of Command	The concept by which each person within an organization reports to one and only one designated person.
Urban Search and Rescue	A search and rescue mission conducted in moderately to heavily populated areas given primarily to business and residential development.
Urgency Profile	A way to determine the urgency of each individual search and rescue mission. The combination of factors affecting the urgency will help determine not only how quickly to respond, but the nature and level of response as well. On the Urgency Profile chart, the lower the numerical value, the more urgent the response should be.
USAR	Urban Search and Rescue
USFS	United States Fire Service
USSS	United States Secret Service
Wilderness SAR	A search and rescue mission conducted in an area generally uncultivated and uninhabited and often inaccessible by roads.
Area of Interest	The area of concern to a commander relative to the objectives of current or planned operations, including their areas of influence, operations and/or responsibility, and areas adjacent thereto.
Battlespace	Those geographical, physical and virtual areas; that includes the traditional domains of land, air and sea, space, the electromagnetic spectrum and cyberspace, which are of concern to a commander. Note: Also embraces the social, political and temporal contexts in which conflict is waged.
Close Combat	Combat carried out with direct fire weapons, against identifiable individuals, supported by indirect fire, air-delivered fires and non-lethal engagement means. Note: Close combat defeats or destroys the enemy forces or seizes and retains ground.
Engagement Area	A target area of interest, where action has been planned to reduce the effect of an adversary’s combat power.
Improvised Explosive Device (IED)	A device placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract. It may incorporate military stores, but is normally devised from non-military components.
Reconnaissance	A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area.
Rules of Engagement	Directives issued by a competent military authority, which specify the circumstances and limitations under which forces will initiate and/or continue combat engagement with other forces encountered.
Situational Awareness	Knowledge and understanding of the current situation, which promotes timely, relevant and accurate assessment of friendly, enemy and other options within the battlespace in order to facilitate decision making.
Standing Operating Procedure	A set of instructions covering those features of operations which lend themselves to a definite or standardised procedure without loss of effectiveness. The procedure is applicable unless ordered otherwise.

CGI	Corrugated Galvanised Iron
EA	Engagement Area
EOD	Explosive Ordnance Disposal
IED	Improvised Explosive Device
IR	Infra-red
NFE	Night Fighting Equipment
NTM	Notice To Move
NVG	Night Vision Goggles
OFOF	Orders For Opening Fire
OHP	Overhead Protection
OP	Observation Post
VBIED	Vehicle-Borne Improvised Explosive Device
ASAP	As Soon As Possible
BBDA	Back Blast Danger Area
Bde	Brigade
BMA	Brigade Maintenance Area
C/S	Call Sign
DUSTOFF	Dedicated Undying Support To Our Friendly Forces
DZ	Drop Zone
FARP	Forward Arming and Refuelling Point
fmn	Formation
HE	High Explosive
HEAT	High Explosive Antitank
HEDP	High Explosive Dual Purpose
INTSUM	Intelligence Summary
IPE	Individual Protection Equipment
LDFSW	Light Direct Fire Support Weapon
LOA	Left Of Arc
LP	Landing Point
LZ	Landing Zone
MDFSW	Medium Direct Fire Support Weapon
MOPP	Mission Oriented Protective Postures
PRI	Priority
PSM	Primary Speech Module
SMK	Smoke
ROA	Right Of Arc
WIA	Wounded In Action
KIA	Killed In Action

Administrative

Cantonment	A temporary or semi-permanent military quarters; in South Asia, the term cantonment also describes permanent military stations.
Logistics	Military logistics is the discipline of planning and carrying out the movement and maintenance of military forces.
Materiel	Materiel, more commonly matériel, refers to military technology and supplies in military and commercial supply chain management.
Military Supply Chain Management	Military supply chain management is a cross-functional approach to procuring, producing and delivering products and services for military applications.
Staging Area	In military usage, a staging area is a place where troops or equipment in transit are assembled or processed. Often and historically this military staging area has been termed a point d'appui, which is often on high ground and sometimes coincident with a significant prehistoric monument.

Intelligence

Signals Intelligence (SIGINT)	Is intelligence-gathering by interception of signals, whether communications between people or from electronic signals not directly used in communication.
Electronic Intelligence (ELINT)	Electronic signals intelligence (ELINT) refers to intelligence-gathering by use of electronic sensors. Its primary focus lies on non-communications signals intelligence.
High-frequency Direction Finding	(nicknamed huff-duff) is the common name for a type of radio direction finding employed especially during the two world wars.
Communications Intelligence (COMINT)	Is intelligence-gathering by interception of signals, whether communications between people or from electronic signals not directly used in communication.
Human Intelligence (HUMINT)	Human intelligence is intelligence gathered by means of interpersonal contact, as opposed to the more technical intelligence gathering disciplines such as signals intelligence (SIGINT), imagery intelligence (IMINT) and measurement and signature intelligence (MASINT).
Imagery Intelligence (IMINT)	Imagery intelligence (IMINT) is an intelligence gathering discipline which collects information via satellite and aerial photography.
Measurement and Signature Intelligence (MASINT)	Measurement and signature intelligence (MASINT) is a technical branch of intelligence gathering, which serves to detect, track, identify or describe the signatures (distinctive characteristics) of fixed or dynamic target sources.
Open-source Intelligence (OSINT)	Open-source intelligence (OSINT) is data collected from publicly available sources to be used in an intelligence context.

On Land

Demilitarized Zone (DMZ)	A demilitarized zone is an area in which treaties or agreements between nations, military powers or contending groups forbid military installations, activities or personnel.
No Man's Land	Land that is not occupied or, more specifically, land that is under dispute between countries or areas that will not occupy it because of fear or uncertainty, or for tactical or strategical considerations.
Artillery	Includes any engine used for the discharge of large projectiles in war.
Artillery Battery	An organized group of artillery pieces (previously artillery park).

Doctrinal

Ambush	Carrying out a surprise attack on an enemy that passes a concealed position.
Artillery Barrage	A line or barrier of exploding artillery shells, created by continuous and co-ordinated fire of a large number of guns.
Battalia	An army or a subcomponent of an army such as a battalion in battle array (common military parlance in the 17th century).
Blockade	A ring of naval vessels surrounding a specific port or even an entire nation. The goal is to halt the importation of goods which could help the blockaded nation's war effort.
Booby Trap	A booby trap is a device or setup that is intended to kill, harm, or surprise a person or animal, unknowingly triggered by the presence or actions of the victim.
Breach	A gap in fortified or battle lines.
Breakout	Exploiting a breach in enemy lines so that a large force (division or above) passes through.
Bridgehead	A bridgehead is the strategically important area of ground around the end of a bridge or other place of possible crossing over a body of water which at time of conflict is sought to be defended or taken over by the belligerent forces.
Charge	A large force heads directly to an enemy to engage in close quarters combat, with the hope of breaking the enemy line.
Chequered Retreat	A line or battalion, alternately retreating and facing about in the presence of an enemy, exhibiting a deployment like chequered squares.
Column	A military column is a formation of soldiers marching together in one or more files in which the file is significantly longer than the width of ranks in the formation.
Counterattack	A counterattack is a tactic employed in response to an attack, with the term originating in "war games". The general objective is to negate or thwart the advantage gained by the enemy during attack, while the specific objectives typically seek to regain lost ground or destroy the attacking enemy (this may take the form of an opposing sports team or military units).
Counter-Battery Fire	Counter-battery fire (sometimes called counter-fire) is a battlefield military activity to defeat the enemy's indirect fire elements (guns, rocket launchers, artillery and mortars), including their target acquisition, command and control components.
Coup De Grâce	A death blow intended to end the suffering of a wounded soldier; also applied to severely damaged ships (called scuttling when applied to friendly ships).
Coup De Main	A swift pre-emptive strike.
Debellatio	To end a war by complete destruction of a hostile state. More severe than sacking.
Decisive Victory	An overwhelming victory for one side, often shifting the course of conflict.
Defilade	A unit or position is "defiladed" if it is protected from direct exposure to enemy fire; see also Hull-down.
Dustoff	Medical evacuation of wounded from the field of battle by air, bringing them to a higher level of medical care and treatment, e.g. from an aid station to a combat support hospital or other treatment facilities.
Echelon Formation	A military formation in which members are arranged diagonal.
Encirclement	Encirclement is a military term for the situation when a force or target is isolated and surrounded by enemy forces.
Enfilade	A unit (or position) is "enfiladed" when enemy fire can be directed along the long axis of the unit. For instance, a trench is enfiladed if the enemy can fire down the length of the trench. May also refer to placing a unit in a position to enfilade, or the position so enfiladed.
Envelope	The pincer movement, or double envelopment, is a military manoeuvre in which forces simultaneously attack both flanks (sides) of an enemy formation.
Extraction Point	The location designated for reassembly of forces and their subsequent transportation out of the battle zone.
Fabian Strategy	Avoiding pitched battles to wear down the enemy in a war of attrition.
Fighting Withdrawal	Pulling back military forces while maintaining contact with the enemy.
File	A single column of soldiers.
Flanking Manoeuvre	To attack an enemy or an enemy unit from the side, or to manoeuvre to do so.
Forlorn Hope	A band of soldiers or other combatants chosen to take the leading part in a military operation, such as an assault on a defended position, where the risk of casualties is high.
Frontal Assault / Attack	An attack toward the front of an enemy force.
Garrison	A body of troops holding a particular location on a long-term basis.
Guerrilla Tactics	Attacking the enemy and the subsequent breaking off of contact and retreating; also referred to as "hit-and-run tactics".
Hors de combat	A unit out of the fight, surrendered, wounded (when incapacitated), and so on.
Infantry Square	Historically an infantry square, also known as a hollow square, is a combat formation an infantry unit forms in close order usually when threatened with cavalry attack.
Infiltration	In warfare, infiltration tactics involve small independent light infantry forces advancing into enemy rear areas, bypassing enemy front-line strongpoints, possibly isolating them for attack by follow-up troops with heavier weapons.
Interdiction	To attack and disrupt enemy supply lines.
Killing Field	A killing field, in military science, is an area in front of a defensive position that the enemy must cross during an assault and is specifically intended to allow the defending troops to incapacitate a large number of the enemy.
Lodgement	An enclave made by increasing the size of a bridgehead.
Melee	Melee or pell-mell battle generally refers to disorganized close combat in battles fought at abnormally close range with little central control once it starts.

Mobile Columns	Or movable columns - in contrast to stationary troops troupes sédentaire. This may be used as a bureaucratic description to describe the function for which troops are raised for example the regiments of the Highland Fencible Corps were raised for garrison duties while Scottish line regiments in the British Army were raised to fight anywhere; or it may be an operational description.
No Quarter Given	All enemy troops are to be killed, even those who surrender. Also referred to as "take no prisoners".
Overwatch	When one small unit provides support for another.
Patrolling	Patrolling is a military tactic. Small groups or individual units are deployed from a larger formation to achieve a specific objective and then return.
Parthian Shot	The Parthian shot is a light horse military tactic made famous in the West by the Parthians, an ancient Iranian people. While in real or feigned retreat their horse archers would turn their bodies back in full gallop to shoot at the pursuing enemy.
Phalanx	The phalanx was a rectangular mass military formation, usually composed entirely of heavy infantry armed with spears, pikes, sarissas, or similar pole weapons.
Pickets	Sentries or advance troops specifically tasked with early warning of contact with the enemy. A soldier who has this job is on "picket duty", and may also be referred to as a "lookout."
Pincer Manoeuvre	The pincer movement, or double envelopment, is a military manoeuvre in which forces simultaneously attack both flanks (sides) of an enemy formation.
Pitched Battle	A pitched battle or set piece battle is a battle in which both sides choose the fighting location and time. Either side has the option to disengage before the battle starts or shortly thereafter.
Pocket	A salient, also known as a bulge, is a battlefield feature that projects into enemy territory. The salient is surrounded by the enemy on multiple sides, making the troops occupying the salient vulnerable.
Pyrrhic Victory	A victory paid for so dearly that it potentially could lead to a later defeat ("a battle won, a war lost"). Raid.
Raid	Raiding, also known as depredation, is a military tactic or operational warfare mission which has a specific purpose and is not normally intended to capture and hold a location but instead finish with the raiding force quickly retreating to a previous defended position prior to enemy forces being able to respond in a coordinated manner or formulate a counter-attack.
Rank	A single line of soldiers.
Reconnaissance	In military operations, reconnaissance or scouting is the exploration outside an area occupied by friendly forces to gain information about natural features and other activities in the area.
Retreat	Withdrawal of troops from a battlefield (can be either orderly or unorderly; fighting or by rout).
Rout	Disorderly withdrawal of troops from a battlefield following a defeat, either real or perceived.
Sack	The destruction and looting of a city, usually after an assault.
Safe-Guard	Individual soldiers or detachments placed to prevent resources (often farms full of crops and livestock) from being looted or plundered.
Salients	A pocket or "bulge" in a fortified or battle line. The enemy's line facing a salient is referred to as a "re-entrant".
Scorched Earth	Deliberate destruction of resources, in order to deny their use to the enemy.
Scuttling	The deliberate destruction of a ship to prevent its capture and use by an enemy. Commonly used as a coup de grâce, but has also been a protest (as after the First World War).
Shield Wall	The massed use of interconnected shields to form a wall in battle.
Shield Wall (Fortification)	The highest and thickest wall of a castle protecting the main assault approach.
Shoot and Scoot	A type of fire-and-movement tactic used by artillery to avoid counter-battery fire.
Siege	A military blockade of a city or fortress with the intent of conquering by force or attrition, often accompanied by an assault in the later phase.
Siege en régle	A siege where a city or fortress is invested but no bombardment or assault takes place. Instead, the besieger attempts to persuade the defenders to surrender through negotiation, inducement, or through privations such as starvation. This may be done because the fortress is too strong for the attackers to capture through bombardment and assault.
Circumvallation	A line of fortifications built by the attackers around the besieged fortification facing towards it.
Contravallation	A second line of fortifications behind the circumvallation facing away from the enemy fort to protect the besiegers from attacks by allies of the besieged.
Escalade	The act of scaling defensive walls or ramparts with the aid of ladders, a prominent feature of siege warfare in medieval times.
Chevaux De Frise	Sword blades chained together to incapacitate people trying to charge into a breach in the walls.
Investment	Surrounding an enemy fort (or town) with armed forces to prevent entry or escape.
Military Mining	Undermining of defence positions either fortifications or enemy front line trenches.
Sapping	Digging approach trench towards enemy fortifications within range of the besieged guns.
Siege Engines	Specialised weapons used to overcome fortifications of a besieged fort or town; in modern times, the task has fallen to large artillery pieces.
Siege Train	Specialised siege artillery moved in a column by road or by rail.
Siege Tower	A wooden tower on wheels constructed to protect assailants and ladders while approaching the defensive walls of a fortification.
Sortie	A sudden attack against a besieging enemy from within a besieged fort or town.
Surrender at Discretion	Unconditional surrender instead of surrendering with terms.
Skirmish	Skirmishers are light infantry or cavalry soldiers in the role of skirmishing—stationed to act as a vanguard, flank guard, or rearguard, screening a tactical position or a larger body of friendly troops from enemy advances.
Vedette	A mounted sentry or outpost, who has the function of bringing information, giving signals or warnings of danger, etc.
Withdrawal	Retreat (i.e., pulling back) of troops from a battlefield (can be either orderly or unorderly; fighting or by rout)

Engineering

Banquette	A banquette is a small foot path or elevated step along the inside of a rampart or parapet of a fortification. Musketeers atop it were able to view the counterscarp, or fire on enemies in the moat.
Bartizan	A cylindrical turret or sentry post projecting beyond the parapet of a fort or castle
Bastion	A bastion or bulwark is a structure projecting outward from the curtain wall of a fortification, most commonly angular in shape and positioned at the corners.
Bastion Fortress	A star-shaped fortress surrounding a town or city.
Battery	An artillery position, which may be fortified.
Berm	A berm is a level space, shelf, or raised barrier (usually made of compacted soil) separating two areas. It can serve as a fortification line, a border/separation barrier, in industrial settings, or in many other applications.
Blast Wall	A barrier for protection from high explosive blast.
Blockhouse	a) Medieval and Renaissance - a small artillery tower, b) 18th and 19th centuries - a small colonial wooden fort, c) 20th century - a large concrete defensive structure.
Breastwork	A breastwork is a temporary fortification, often an earthwork thrown up to breast height to provide protection to defenders firing over it from a standing position.
Bunker	A heavily fortified, mainly underground, facility used as a defensive position; also commonly used as command centres for high-level officers.
Caponier	A defensive firing position either projecting into, or traversing the ditch of a fort.
Carnot Wall	A wall pierced with loopholes, sited above the scarp of a ditch but below the rampart.
Casemate	A vaulted chamber for protected storage, accommodation or if provided with an embrasure, for artillery.
Castle	A castle is a type of fortified structure built during the Middle Ages by predominantly the nobility or royalty and by military orders.
Arrow Slit	An arrowslit (often also referred to as an arrow loop, loophole or loop hole, and sometimes a balistraria) is a narrow vertical aperture in a fortification through which an archer can launch arrows.
Barbican	A barbican is a fortified outpost or gateway, such as an outer defence to a city or castle, or any tower situated over a gate or bridge which was used for defensive purposes.
Chemin de ronde	A chemin de ronde—also called an allure, alure or, more prosaically, a wall-walk—is a raised protected walkway behind a castle battlement.
Concentric Castle	A concentric castle is a castle with two or more concentric curtain walls, such that the inner wall is higher than the outer and can be defended from it. The word concentric does not imply that these castles were circular; in fact, if taken too literally, the term is quite misleading.
Drawbridge	A drawbridge or draw-bridge is a type of movable bridge typically associated with the entrance of a castle and a number of towers, surrounded by a moat.
Gatehouse	A gatehouse is an entry control point building, enclosing or accompanying a gateway for a town, religious house, castle, manor house, or other fortification building of importance.
Keep	A keep is a type of fortified tower built within castles during the Middle Ages by European nobility.
Moat	A moat is a deep, broad ditch, either dry or filled with water, that is dug and surrounds a castle, fortification, building or town, historically to provide it with a preliminary line of defence.
Machicolation	A machicolation is a floor opening between the supporting corbels of a battlement, through which stones or other material, such as boiling water or boiling cooking oil, could be dropped on attackers at the base of a defensive wall.
Murder-Hole	A murder hole or meurtrière is a hole in the ceiling of a gateway or passageway in a fortification through which the defenders could fire, throw or pour harmful substances or objects, such as rocks, arrows, scalding water, hot sand, quicklime, tar, or boiling oil, down on attackers.
Portcullis	A portcullis (from the French porte coulissante, "sliding door") is a heavy vertically-closing gate typically found in medieval fortifications, consisting of a latticed grille made of wood, metal, or a combination of the two, which slides down grooves inset within each jamb of the gateway.
Citadel	A citadel is the core fortified area of a town or city. It may be a fortress, castle, or fortified centre.
Counterscarp	The opposing side of a ditch in front of a fortification, i.e., the side facing it.
Counter Mine	Anti-siege tunnel dug by a fortification's defenders below an attacker's mine with the intent of destroying it before the attackers are able to damage (the foundations of) the fortification's walls.
Defensive Fighting Position	For example, a rifle pit, sangar or fox hole.
Dragon's Teeth	Triangular obstacles acting as roadblocks for armoured vehicles.
Dutch Water Line	A series of water-based defensive measures designed to flood large areas in case of attack.
Embrasure	An opening in a parapet or casemate, for a gun to fire through.
Fascine	Is a bundle of sticks or similar, were used in military defences for revetting (shoring up) trenches or ramparts, especially around artillery batteries, or filling in ditches and trenches during an attack.
Flèche	An arrow shaped outwork, smaller than a ravelin or a lunette, with 2 faces with a parapet and an open gorge.
Fort	A fortification is a military construction or building designed for the defence of territories in warfare, and is also used to solidify rule in a region during peacetime.
Gabion	A large basket filled with earth, used to form a temporary parapet for artillery.
Glacis	A bank of earth sloping away from the fort, to protect it from direct artillery fire.
Gorge	Opening at the rear of an outwork for access by defending troops from the main defensive position.
Lunette	An outwork consisting of a salient angle with two flanks and an open gorge.
Magazine	A protected place within a fort, where ammunition is stored and prepared for use.
Outwork	A minor defence, built or established outside the principal fortification limits, detached or semidetached.
Parapet	A wall at the edge of the rampart to protect the defenders.
Pillbox	A small concrete guard post.
Polygonal Fort	A later type of fort without bastions.

Rampart	The main defensive wall of a fortification.
Ravelin	A triangular fortification in front of bastion as a detached outwork.
Redan	A V-shaped salient angle toward an expected attack, made from earthworks or other material.
Redoubt	A fort or fort system usually consisting of an enclosed defensive emplacement outside a larger fort, which can be constructed of earthworks, stone or brick.
Reduit	An enclosed defensive emplacement inside a larger fort; provides protection during a persistent attack.
Sangar	A small temporary fortified position with a breastwork originally of stone, but built of sandbags and similar materials in modern times.
Sally Port	A sally port is a secure, controlled entryway to a fortification or prison. The entrance is usually protected by some means, such as a fixed wall on the outside, parallel to the door—which must be circumvented to enter and prevents direct enemy fire from a distance.
Sconce	A small protective fortification, such as an earthwork, often placed on a mound as a defensive work for artillery.
Sea Fort	A coastal fort entirely surrounded by the sea, either built on a rock or directly onto the sea bed.
Slighting	The deliberate destruction of an (abandoned) fortification without opposition from its (former) occupants and/or defenders.
Sortie	A sortie (from the French word meaning exit) is a deployment or dispatch of one military unit, be it an aircraft, ship, or troops, from a strongpoint.
Star Fort	A star-shaped fortress surrounding a town or city (also known as Bastion fortress or Trace italienne).
Tenaille	An advanced pincer-shaped defensive work in front of the main defences of a fortress.
Terreplein	The fighting platform on top of a rampart, behind the parapet.
Tête-de-pont	A temporary defensive work defending a bridge at the end closest to the enemy.
Trace Italienne	A star-shaped fortress surrounding a town or city (also known as Bastion fortress or star fort).
Trench	Trench warfare is a type of land warfare using occupied fighting lines consisting largely of military trenches, in which troops are well-protected from the enemy's small arms fire and are substantially sheltered from artillery.
Defile	A geographic term for a narrow pass or gorge between mountains. It has its origins as a military description of a pass through which troops can march only in a narrow column or with a narrow front.
Blockade	A blockade is an effort to cut off supplies, war material or communications from a particular area by force, either in part or totally.
Crossing the Tee	Crossing the T or capping the T is a classic naval warfare tactic used from the late 19th to mid 20th centuries, in which a line of warships crosses in front of a line of enemy ships, allowing the crossing line to bring all their guns to bear while receiving fire from only the forward guns of the enemy.
Vanguard	The leading part of an advancing military formation.
Line Astern	In naval warfare, the line of battle is a tactic in which a naval fleet of ships forms a line end to end. Its first use is disputed, variously claimed for dates ranging from 1502 to 1652, with line-of-battle tactics in widespread use by 1675.
Raking Fire	In sailing naval warfare, raking fire is fire directed perpendicular to the long axis of an enemy ship from ahead or astern.
Scuttling	Scuttling is the deliberate sinking of a ship by allowing water to flow into the hull.
Weather Gage	The weather gage (sometimes spelled weather gauge) is the advantageous position of a fighting sailing vessel relative to another.

Tools

Transport

DOT	Department of Transportation
ELT	Emergency Locator Transmitter - A low-power transmitting device carried on light aircraft as required by federal law, and on most military aircraft. It is impact activated and transmits a distinctive sweeping tone that can be detected by aircraft mounted or hand-held direction finding (DF) equipment.
100MW	The "100 Mile Wilderness" is a remote stretch of the AT in northern Maine. The 100 Mile Wilderness is known for being very remote and grueling, with limited resupply options along the way. It's on my list of best New England Hikes.
Alpine Zone	The area near the tops of tall peaks where it's too windy and the soil is too thin to allow trees or large plants to grow. The exact altitude where the alpine zone starts can vary between regions and even mountains in similar regions, due to local weather patterns. Alpine Zones are usually covered in snow fields or Talus.
AMC	The "Appalachian Mountain Club" has a huge presence in the White Mountains of New Hampshire, as well as throughout some of the more popular backcountry destinations across New England. The run a number of high-end Huts.
AT	The "Appalachian Trail," a 2,184 mile long trail between Springer Mountain in Georgia and Mount Katahdin in Maine.
Beta	Beta is specific, insider information about a hike, usually coming from someone who just completed it. A lot of times you can get good beta about an upcoming hike by talking to people in town or on message boards. They might tell you about specific tricky spots, shortcuts, Caches or other good-to-know information.
Biner	Short for carabiner, those metal clips that climbers use to secure rope, slings and other gear. Often used by hikers to attach things to their pack or hang things up around camp.
Blaze	A colored mark, usually painted or nailed to a tree, about 4 inches tall by 2 inches wide. These are used to help guide hikers if the trail gets hard to follow or makes an abrupt turn. Some areas use color-coded systems to help hikers figure out which trail they're on.
Bluebird Day	A day marked by completely cloudless, clear blue skies. Such great weather has been known to cause a strong sense of euphoria and a hearty fist pump, especially when hiking up in Alpine Zones.
Book Time	Book Time is a reference to the estimated amount of time a hike should take, following this simple formula: 30 minutes for each mile plus 30 minutes for each 1,000 feet of elevation gain along the hike. It's the formula that the AMC and many others use to provide a ballpark estimate of a hike's duration.

Bushwhack	Bushwhacking is the process of travelling off-trail, sometimes through dense trees, branches and bushes. While trails are usually wide and clear, Bushwacking off-trail may be much slower since the hiker is required to detour around — or fight their way through — the bushes and trees in their way.
Cache	A Cache is a place where you store gear, food and other supplies before a long trip. The Cache is usually on or near the trail, allowing you to resupply when you reach it.
Cairn	A structure made of rocks used to mark a trail where trees aren't present for Blazes, like in Alpine Zones. Some are just loose piles while others are more decorative.
Camel Up	Cameling Up is a process to help you stay hydrated without needing to carry lots of heavy water bottles during your hike. When you reach a water source, you refill quickly -- usually with an inline filter like a Sawyer Mini -- and then gulp down all the water immediately before heading off down the trail again. This allows you to get the water into your system quickly while avoiding the need to carry heavy, full water bottles (~2.5 pounds per liter!) on the hike. A technique commonly used by Ultralight hikers.
Cat Hole	A small hole that you dig in order to bury poop and toilet paper. Only use Cat Holes in areas with at least 6-8" of soil and Detritus. In Alpine Zones, deserts and other areas, you may be expected to pack out your human waste in a plastic bag.
CDT	The "Continental Divide Trail," a 3,100 mile long trail, following the Continental Divide along the Rocky Mountains and traversing Montana, Idaho, Wyoming, Colorado, and New Mexico.
Col (or "Notch")	A col is the lowest point on the ridge between two peaks. Sometimes referred to as a "Notch" or "Saddle," it is the point where you stop descending one peak and start ascending the next one.
Contour Lines	Contour Lines appear on Topographic Maps and represent a line between all nearby points at the same elevation. If Contour Lines are close together in an area, that means it changes elevation quickly and is very steep. Contour lines tend to form circles around mountains (if the inner lines are higher elevation) or lakes (if the inner ones are lower elevation), and also point upstream when crossing over rivers.
Cowboy Camping	Cowboy Camping entails setting up camp the way the cowboys did out west -- under the open sky. Generally it's a sleeping bag on the ground with no tarp or tent overhead. It can be a great way to enjoy a clear, starry night, but make sure there's no rain in the forecast so you don't wake up soaking wet!
Declination (or Magnetic Declination)	Declination refers to the angle between "Magnetic North" (where your compass needle points) and "True North" (a straight line from you towards the actual North Pole). Depending on where in the world you are, these two measurements can differ by as much as 50°, so it's important to know the local Declination if you'll be taking precise bearings or doing any serious map and compass navigation.
Detritus (or Duff)	All of the leaves, pine needles, branches, sticks and other dead and decaying plant materials that cover most forest floors. In autumn when the leaves have just fallen, this can be many inches thick.
Dirtbag	An avid outdoorsman or woman who eschews the comforts of civilization in order to more fully realize their outdoor passion. Often dirty with unkempt hair and living in a vehicle, they're usually seen wearing flannel shirts and ski boots or climbing shoes.
EMS	While it might sometimes refer to "Emergency Medical Services," if someone is talking about gear that they bought at EMS, they're probably referring to "Eastern Mountain Sports," an outdoor retailer based in New England.
False Peak (or False Summit)	Depending on the shape of a mountain, you may look up the trail and think you see the peak just ahead. But once you reach that spot, you may be dismayed to see that it was just a shoulder or small bump - a False Peak - and that the real peak still likes farther up the trail.
FKT	The "Fastest Known Time" is the record for completing a section of trail (usually a Thru Hike) in the shortest possible time. There usually isn't a single authority that tracks FKT, instead it's up to the community to verify GPS data or social media posts the hiker made along the way to ensure the new record is "legit," although FKT records can still be somewhat controversial.
Ford	A Ford is a river crossing that involves getting your feet wet. If you anticipate a Ford on your trip, you'll usually bring sandals or a change of footwear to use -- never barefoot! Ideally, the water won't come much higher than your knees so that there's less risk of being swept away. Make sure you have a plan in case you lose your footing so that you and your stuff don't wash away. Trekking poles can help with stability during Fords. If the water level is very low, a Ford may turn into a simple, quick Rock Hop.
Glissade	Sliding down a snow-covered field on your rear end, like sledding without the sled. A much faster (and more fun) way to descend steep snow fields, just be careful that you can control your speed and direction so you don't slide into a tree or off a cliff.
GORP	Traditionally, Good Old Raisins and Peanuts. Some claim it's Granola, Oats, Raisins, Peanuts. Either way, it's usually a big bag full of salty and savory snacks that you eat by the handful.
GPS	The "Global Positioning System" is a constellation of satellites run by the US Military that powers everything from the turn-by-turn directions in your phone to the location tracking in your favorite navigation device.
Herd Path	An unofficial trail that's formed when a large numbers of hikers decide to all follow a similar footpath over time, similar to how game trails are formed by animals. They're usually created as hikers take a natural shortcut or easier path around some obstacle.
Hut	Huts can vary from dilapidated old sheds to full-service hotels. They are a permanent backcountry shelter with four walls and roof that can sleep any number of backpackers, depending on their size.
HYOH	Meaning "Hike Your Own Hike," the idea that we should all live and let live on the trail.
JMT	The "John Muir Trail" is a 210 mile trail that follows a section of the PCT. Almost entirely above 8,000 ft of elevation, much of the trail is in the Alpine Zone, with gorgeous big-mountain views and wildflowers.
Lean-to (or Leanto)	A sturdy shelter built along popular trails that consists of a raised floor, roof and three walls. They usually fit anywhere from four to a dozen backpackers. With one wall left open, lean-tos allow you to escape wind and precipitation while still performing camp chores like cooking.
LNT (or Leave No Trace)	"Leave No Trace" is a series of 7 principles designed to help backpackers and campers think about ways to minimize the impact that their presence has on the natural environment.
MEC	"Mountain Equipment Co-op" is the largest outdoor retailer in Canada. Originally catering specifically to alpine mountaineers, they've been moving to focus on a wider audience of outdoor enthusiasts.
Monorail	Monorail is the term used to describe the narrow band of snow and ice that remains down the center of a trail into late spring, even after most of the other snow has melted. It forces hikers to either walk on it like a balance beam or else forces them into the mud on either side.
NOBO	Short for "North Bound." A term used to describe Thru Hikers that start at the southern terminus of a long trail and head north.

NOLS	The "National Outdoor Leadership School" is one of the largest and most well-known outdoor education programs. They lead trips all over the world for students and adults of all ages. The also teach a number of wilderness medicine classes like WFR through their Wilderness Medicine Institute (WMI).
NPS	The National Park Service in the United States, in charge of running and protecting the National Parks.
PCT	The "Pacific Crest Trail," a 2,654 miles long trail through Washington, Oregon, and California following the highest portion of the Sierra Nevada and Cascade Range.
Peak Bagging	The process of summiting (or "bagging") a collection of related peaks in an area. It's like going through a to-do list of challenging but rewarding hikes. Popular Peak Bagging lists include the "New Hampshire 4000 Footers" (48 peaks) and the "Colorado Fourteeners" (53 peaks).
Posthole	When hiking through fresh, deep snow, Postholing is when each step you take sinks far down into the snow, sometimes burying your entire leg. Postholing is extremely tiring and slow-going. Groups of hikers will often switch up the person in the front, allowing the old leader the easier task of following in the new leader's footsteps (or Postholes).
PUD	"Pointless Ups and Downs" are areas of annoyingly rolling terrain that don't actually result in any elevation gain. Despite some trails going up and over several 30' hills in a row, that section would appear as "flat" terrain on most Topographic Maps, causing extra frustration for any unsuspecting hikers. Knowing about PUDs ahead of time requires getting good Beta.
Redline	To have "Redlined" an area means that you've hiked every single inch of trail in it, including all of the major trails as well as all of the smaller connector sections. Print out a map of the area you want to Redline and trace all the trails you've already done with a red marker. Whatever is left uncovered is where you hike next. You've completed a Redline attempt when every section of every trail is "Redlined out". It's the ultimate measure of really knowing an area like the back of your hand.
Rock Hop	A Rock Hop is a river or stream crossing that can be done without getting your feet wet. Generally done by hopping from rock to rock through a low-running channel of water. A Rock Hop is generally faster and safer than a Ford.
SAR	Stands for "Search and Rescue," they're almost always volunteers who leave their families and careers behind when backcountry enthusiasts get themselves into trouble.
Scree	A field of loose rocks smaller than the size of your head. It can be very tricky to keep your footing in a Scree field. The small rocks will often move or slide underfoot, making it very tricky to avoid ankle or knee injuries.
Section Hike	When someone isn't able to complete a Thru Hike in one contiguous effort, they may instead choose to complete the trail over a longer period by hiking smaller sections of it and returning to society in between. A term popularized by Phillip Werner.
SOBO	Short for "South Bound." A term used to describe Thru Hikers that start at the northern terminus of a long trail and head south.
Stealth Camp (or Dispersed Camp)	To setup a low-impact campsite in a more pristine nook, away from more heavily-used campsites. It can be useful to help avoid bugs, bears, mice and other creatures that have become accustomed to campers' presence in a certain area. Stealth camping is frowned upon by many since it is hard to do well and truly Leave No Trace. In popular areas, it's better to centralize the human traffic to one area to avoid leaving marks and blemishes all over the landscape.
Switchbacks	When a trail zig-zags back-and-forth up a very steep section of terrain. It adds distance to a trail but also makes it easier to hike - think of climbing straight up a ladder versus covering the same height on a very long ramp. Switchbacks also help prevent erosion on steep slopes, so be sure to follow the trail and avoid the temptation to cut straight up.
Talus	A field of larger boulders that often requires hands and feed to scramble over. Route-finding can be very slow and laborious through Talus fields. Commonly found in Alpine Zones.
Thru Hike	Hiking an entire trail contiguously from end-to-end, usually at least 100 miles over more than a week. Famous Thru Hikes include the Appalachian Trail (AT) and Pacific Crest Trail (PCT).
Thru Hiker	Someone who is in the process of completing a Thru Hike.
Topo (or Topographic)	Topography focuses on the shape and features of the land — hills and valleys, rivers and lakes. A topographic map (or "Topo Map") is one that shows the natural features of a landscape, including Contour Lines of similar elevation.
Trail Angel	A local who isn't actively hiking the trail but does nice things for hikers who are. Trail Angels may run van shuttles from the trailhead into town, or leave Caches of snacks or beer along the trail.
Trail Name	Often Thru Hikers will adopt a moniker or nickname while they're on the trail. It usually has an interesting backstory and tends to be given by another Thru Hiker after a particularly memorable experience. It can be a way for the Thru Hiker to dissociate their "real" identity back home with the antics they're up to on the trail.
Trail Magic	Trail Magic is a surprise treat or Cache left on the trail for future hikers to enjoy. Sometimes they're intentionally left by Trail Angels and sometimes they're lost or discarded items that earlier hikers left behind.
Trailhead	The trailhead is the place where your hike starts or stops -- where you cross over from being in civilization to being in the backcountry. Most trailheads have a parking lot and many offer free maps or signs with information about the hikes you can access from them.
Triple Crown	The crowning accomplishment of Thru Hiking the AT, PCT. and CDT.
Zero Day (or Take a Zero)	A zero day is when you spend two nights in a row in the same campsite and don't do any hiking during the day. This can be used on longer Thru Hikes to help recover from injury, rest, or wait out a storm.

Warfare

Water

Adsorption	The process by which molecules of a substance, such as a gas or a liquid, collect on the surface of another substance, such as a solid. The molecules are attracted to the surface but do not enter the solid's minute spaces as in absorption.
Bacteria	Simple, single cell organisms that are found everywhere on earth. They are essential for maintaining life and performing essential "services", such as composting, aerobic degradation of waste, and digesting food in our intestines. Some types, however, can be pathogenic and cause mild to severe illnesses. Bacteria obtain nutrients from their environment by excreting enzymes that dissolve complex molecules into more simple ones, which can then pass through the cell membrane.

Biofilm	A thin, slimy film of bacteria that adheres to surfaces, which are regularly in contact with water. The structure of biofilms is quite complex consisting of colonies of bacteria and other microorganisms such as yeasts, fungi, and protozoa. Biofilms can be a problem for drinking water supply (pipe fouling). But they are also widely used water purification (e.g. biosand filters, slow sand filtration) or in biological wastewater treatment (e.g. rotating biological contactor, trickling filter). Synonyms: Schmutzdecke
Colloidal Silver	Colloidal silver are tiny silver particles suspended in liquids - commonly distilled water. They are used as disinfectant in ceramic filters, preventing bacterial growth and assisting inactivation of bacteria.
Cryptosporidium	Cryptosporidium is a protozoan that can cause gastro-intestinal illness with diarrhoea in humans.
Escherichia Coli	Escherichia Coli is a type of bacteria that inhabits the intestinal tract of humans and other mammals. It is not necessarily harmful, but it is used as an indicator of faecal contamination of water.
Evapotranspiration	The combined loss of water from a surface by evaporation and plant transpiration. It is the process by which water is transferred from vegetated soil to the atmosphere.
Filtration	A mechanical separation process using a porous medium (e.g., cloth, paper, sand bed, or mixed media bed) that captures particulate material and permits the liquid or gaseous fraction to pass through. The size of the pores of the medium determines what is captured and what passes through.
Giardia	Giardia lives inside the intestines of infected humans or other animals. Individuals become infected through ingesting or coming into contact with contaminated food, soil, or water. The Giardia parasite originates from contaminated items and surfaces that have been tainted by the faeces of an infected animal.
White Water	Untainted tap water.
Grey Water	Or 'sullage' is all wastewater generated in households or office buildings from streams without faecal contamination.
Black Water	Wastewater containing faeces, urine and flushwater from flush toilets along with anal cleansing water.
Kelly Kettle	Kelly Kettle is the trade name for a chimney style kettle intended for rapid boiling.
Soft Water	Soft water is surface water that contains low concentrations of ions and in particular is low in ions of calcium and magnesium. Soft water naturally occurs where rainfall and the drainage basin of rivers are formed of hard, impervious and calcium poor rocks.
Hard Water	Water that has high mineral content. Hard water is formed when water percolates through deposits of limestone and chalk which are largely made up of calcium and magnesium carbonates.
Potable Water	Any water that is fit for consumption.
Freshwater	Water that contains less than 1,000 mg per litre of dissolved solids. Generally more than 500mg/L is undesirable for drinking.
Artesian Water	Ground water that is under pressure when tapped by a well and is able to rise above the level at which it is first encountered.
Lentic Waters	Ponds or lakes, as in standing water.
Lotic Waters	Flowing waters, as in streams and rivers.
Saline Water	Water that contains significant amounts of dissolved solids. Fresh Water - <1k ppm Slightly Saline - 1k-3k ppm Moderate Saline - 3k-10k ppm Highly Saline - 10k-35k ppm
Desalinization	The removal of salts from saline water to provide freshwater.
Aquifier	A geologic formation(s) that is water bearing. A geological formation or structure that transmits water, such as to wells and springs.
Estuary	A place where fresh and salt water mix, such as bay, salt marsh or where a river enters an ocean.
Ground Water	Water that flows or seeps down and saturates soil or rock, supplying springs and wells. The upper surface of the saturate zone is called the water table.
Absorption Chiller	Absorption chillers are refrigerators that use heat energy as an input, rather than mechanical energy. Absorption chillers are useful, where electricity is no available or where there is an easily available source of heat (e.g. sun, hot water). The heat is used to evaporate a liquid to a gas. The gas then moves to the condenser where the heat dissipates and the gas is turned back into a liquid. Then, the cooled liquid is directed into the evaporator, where it turns into a gas and pulls heat from the air. Then the gas moves from the evaporator into the compressor and the process starts again.
Accumulation System	An accumulation tank or a continuously fed batch is characterised by an increasing effective reactor volume with time. When the reactor is full and reaction time is over, it is emptied and refilled again as batch reactors.
Acidic	Acidic is an adjective describing the properties of having a pH below 7. Its opposite is alkaline or basic.
Aeroponic	Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. The word "aeroponic" is derived from the Greek meanings of "aero" (air) and "ponos" (labour). Unlike hydroponics, which uses water as a growing medium and essential minerals to sustain plant growth, aeroponics is conducted without a growing medium. Aeroponic equipment involves the use of sprayers, misters, foggers, or other devices to create a fine mist of water to deliver nutrients to plant roots. Because water is used in aeroponics to transmit nutrients, it is sometimes considered a type of hydroponics.
Air Stripping	Air stripping is the transferring of volatile components of a liquid into an air stream. It is a chemical engineering technology used for the purification of groundwater and wastewater containing volatile compounds.
Algal Bloom	A rapid increase in the population of algae in an aquatic system, e.g. as a result of an excess of nutrients (particularly phosphorus and nitrogen). As more algae and plants grow, others die. This dead organic matter becomes food for bacteria that decompose it. With more food available, the bacteria increase in number and use up the dissolved oxygen in the water. When the dissolved oxygen content decreases, many fish and aquatic insects cannot survive.
Alkalinity	The alkalinity measures the capacity of water to neutralise acids. The alkalinity depends on amount of carbonates, bicarbonates, hydroxides, and occasionally borates, silicates and phosphates. Alkalinity stabilises water at pH levels around 7 (neutral). However, high water acidity decreases alkalinity and may cause harmful conditions for aquatic life. Alkalinity is expressed in ppm or mg of calcium carbonate per litre (mg/L $CaCO_3$).
Anaerobic Filter	An anaerobic filter is a fixed-bed biological reactor with one or more filtration chambers in series. As wastewater flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material. Anaerobic filters are similar to septic tank, with the difference, that wastewater, once entered into the tank must flow downwards (anaerobic downflow filter) or upwards through a filter media (anaerobic upflow filter). Anaerobic filters are used as secondary treatment in household-level or decentralised wastewater treatment systems. As for any anaerobic digestion process, biogas can be recovered and transformed to energy or light.

Anal Cleansing Water	Anal Cleansing Water is water used to cleanse oneself after defecating and/or urinating; it is generated by those who use water, rather than dry material, for anal cleansing. The volume of water used per cleaning typically ranges from 0.5 L to 3 L.
Aquaculture	Aquaculture refers to the controlled cultivation of aquatic plants and animals such as fish, crustaceans and aquatic plants. Aquaculture can be part of an integrated sanitation system making use of nutrients and heat from pre-treated wastewater.
Aquaponic	Aquaponics is the symbiotic cultivation of plants and aquatic animals in a recirculating environment. Aquaponic comes from the two words aquaculture and hydroponic. The main aim of such systems is the recycling of the nutrients contained in the water from aquatic animal effluent. The system contain of to interlinked compartement, one for growing plants and one for growing aquatic animals. The plants take up the nutrients, allowing them to grow and reducing or eliminating the water's toxicity for the aquatic animal. Thus the water can be recirculated back to the animal pond where it will be charged again by nutrients.
Aquifer	An aquifer is a wet underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can usefully be extracted using a water well.
Artesian Spring	Artesian springs occur when water is trapped between impervious layers and is forced to the surface under pressure. At these springs, the water comes out of the ground vertically.
Backwash	One of the best ways to clean a water system's filter is to backwash it, meaning reversing the flow and increasing the velocity at which water passes back through the filter. This, in effect, blasts the clogged particles off of the filter. Although every filter is unique, the principles of backwashing are similar for all of them. The disadvantage with backwashing is that it requires energy-driven pumps and the backwash water and sludge has to be treatment (e.g. in waste stabilisation ponds) before safe discharge or reuse.
Bacteria	Simple, single cell organisms that are found everywhere on earth. They are essential for maintaining life and performing essential "services", such as composting, aerobic degradation of waste, and digesting food in our intestines. Some types, however, can be pathogenic and cause mild to severe illnesses. Bacteria obtain nutrients from their environment by excreting enzymes that dissolve complex molecules into more simple ones, which can then pass through the cell membrane.
Bank Filtration	Bank filtration is the infiltration of surface water, mostly from a river system, into a groundwater system induced by water abstraction close to the surface water e.g. a river bank. This water abstraction is commonly done by operating wells. As the water flows through the soil, it is filtered and the quality is improved. In the context of developing or newly-industrialised countries, BF may bring relief by replenishing stressed groundwater resources with surface water, which receives treatment while percolating through the soil and is mixed with the groundwater aquifer.
Bio-Char	Bio-char is a fine-grained charcoal produced from pyrolysis: the slow burning of organic matter in a low- or no-oxygen environment. Bio-char is promoted as a soil additive in order to enhance the soil black carbon content and thus the soil water and nutrient retention capacity.
Biofilm	A thin, slimy film of bacteria that adheres to surfaces, which are regularly in contact with water. The structure of biofilms is quite complex consisting of colonies of bacteria and other microorganisms such as yeasts, fungi, and protozoa. Biofilms can be a problem for drinking water supply (pipe fouling). But they are also widely used water purification (e.g. biosand filters, slow sand filtration) or in biological wastewater treatment (e.g. rotating biological contactor, trickling filter).
Biogas	Biogas is the common name for the mixture of gases released from anaerobic digestion. Biogas is comprised of methane (50 to 75%), carbon dioxide (25 to 50%) and varying quantities of nitrogen, hydrogen sulphide, water vapour and other components. Biogas can be collected and burned for fuel (like propane).
Biological Treatment	The biological treatment of waste and wastewaters consist in the use of microbial activity (bacteria, funghi and other microorganisms) for the degradation and decomposing of biodegradable pollution. This is in contrast to chemical treatment, which relies on chemicals to transform or remove contaminants from waste.
Biomass	Biomass refers to plants or animals cultivated using the water and/or nutrients flowing through a sanitation system. It may include fish, insects, vegetables, fruit, forage or other beneficial crops, which can be utilized for food, feed, fibre and fuel production.
Biosolid	Biosolids, also referred to as treated sludge, is a term used to denote the by-product of wastewater treatment. Biosolids are generally rich in organic matter and nutrients and it can therefore be used as a soil amendment. Depending of the applied wastewater treatment, the resulting biosolids may require further treatment for the removal of pathogens before reuse.
Blackwater	Blackwater is the mixture of urine, faeces and flushwater along with anal cleansing water (if water is used for cleansing) and/or dry cleansing materials. Blackwater contains the pathogens of faeces and the nutrients of urine that are diluted in the flushwater.
Bottle Irrigation	The bottle is first filled up with water and then placed upside down in the ground next to the plant. Because of its density the water is only released slowly into the ground to reach the roots.
Bottled Water	Bottled water is widely available in both industrialised and developing countries. Consumers purchase packaged drinking-water for reasons such as taste, convenience or fashion, but safety and potential health benefits are also important considerations. Bottled water is most commonly sold in glass or disposable plastic bottles. Bottled water also comes in various sizes, from single servings to large carboys holding up to 80 litres.
Brackish Water	Brackish water contains more salt than fresh water and less than salt water. It is commonly found in estuaries, which are the lower courses of rivers where they meet the sea, and aquifers, which are stores of water underground.
Brownwater	Brownwater is the mixture of faeces and flushwater, and does not contain urine. It is generated by urine-diverting flush toilets and, therefore, the volume depends on the volume of the flushwater used. The pathogen and nutrient load of faeces is not reduced, only diluted by the flushwater. Brownwater may also include Anal Cleansing Water (if water is used for cleansing) and/or Dry Cleansing Materials.
Capillary Water	Capillary water is held in pores that are small enough to hold water against gravity, but not so tightly that roots cannot absorb it. This water occurs as a film around soil particles and in the pores between them and is the main source of plant moisture. As this water is withdrawn, the larger pores drain first. The finer the pores, the more resistant they are to removal of water. As water is withdrawn, the film becomes thinner and harder to detach from the soil particles. This capillary water can move in all directions in response to suction and can move upwards through soil for up to two meters, the particles and pores of the soil acting like a wick.
Capillary Zone	The capillary zone is the area in the soil where water can rise up slightly through the cohesive force of capillary action. It is generally an intermediate zone in the vadose zone between the dry zone, above the groundwater table.
Centralised Water Supply	Centralised (drinking) water supply refers to the centralised treatment and purification of water sources and subsequent distribution to different water users (households, industry, agriculture) through a large water distribution network.

ADDENDUM	Dictionary	Water	**Cesspit**	A cesspit is an ambiguous term either used to describe an underground holding tank or a soak pit. An underground pool (also called cesspool) is a tank pit used for the temporary collection and storage of faeces, excreta or faecal sludge. The pit is lined with bricks or concrete, covered with a slab and needs to be emptied frequently. When soil conditions allow, the pit is not constructed watertight (similar to a soak pit) allowing liquid to leach out, while solids decay and collect in the base. A soak pit requires less frequent emptying but leachate infiltration may cause groundwater pollution.
			Charcoal	Charcoal is a lightweight, black, porous material similar to coal. It consists of carbon (about 50 to 95 %) and volatile chemicals and ash. Charcoal is usually produced by slow pyrolysis, the heating of wood, sugar, bone char, or other substances in the absence of oxygen. It can also be produced by some enzymatic conversion of organic mater. The backbones of charcoal are polycondensed aromatic moieties which are chemically and biologically persistent. Charcoal is a valuable soil amendment (see also terra preta), retaining nutrients at their surface and improving the soil structure leading to enhanced water and air retention.
			Chemical Sedimentation	Chemical sedimentation is like normal sedimentation but coagulants are used in order to neutralise repelling surface charge of particles. Once these repelling surface charges are neutralised, the particles attach to each other forming clusters and flocs, which become heavier and therefore settle more easily to the bottom.
		Water	**Chemical Treatment**	Chemical treatment of wastewaters uses chemicals to degrade and remove pollutant or pathogens form wastewaters. In regard to wastewater, a typical chemical treatment is the co-precipitation of iron and phosphorus (e.g. in activated sludge systems). Other common chemical treatments are advanced oxidation processes (e.g. ozonation) used, where pollutants are toxic to bacteria and a biological treatment is not possible. A typical drinking water chemical treatment is chlorination
			Chlorination	Chlorination generally refers to the addition of chlorine to water or sewage in order to kill pathogen and achieve disinfection.
			Chlorine Residual	Chlorine residual is a level of chlorine remaining in water after initial treatment. It constitutes an important safeguard against the risk of subsequent microbial recontamination and inhibits the growth of bacteria.
			Coagulant	Coagulants are chemicals used to enhance sedimentation. Coagulants neutralise surface charges of repelling particules, allowing them to approach, attach and form clusters. The clusters are larger in size and heavier and thus more easy to settle and remove from the water. See also coagulation or chemical sedimentation.
		Water	**Coagulation**	The destabilization of particles in water by adding chemicals (e.g., aluminium sulphate or ferric chloride) so that they can aggregate and form larger flocs. Coagulation is often used in combination with flocculation.
ADDENDUM			**Coagulation-Flocculation**	Coagulation and floculation describe the chemical process of contact and adhesion whereby the particles of a dispersion (colloids) form larger-size cluster (flocs or flakes) allowing them to be more easely removed from water (e.g. by settling). The coagulation-flocculation processes facilitate the removal of suspended and colloidal particles. It's used in the first stage of solids-liquids separation: settling, flotation or filtration.
			Colloidal Silver	Colloidal silver are tiny silver particles suspended in liquids. They are used as disinfectant in ceramic filters, preventing bacterial growth and assisting inactivation of bacteria.
			Combined Sewer	Combined sewers collect blackwater, greywater and stormwater runoff in one ant the same single pipe system. Combined sewers provoke the pollution of little polluted water by mixing it with heavily polluted water. This particularly results in pollution when sewers overflow during heavy rain periods. As combined sewers need to be large, they can also be more expensive to install. Today, combined sewers are perceived as obsolete and in newer construction separated sewer systems are installed instead, although many systems remain combined as the replacement of an existing systems would be too expensive.
		Water	**Compost Filter**	A compost filter is a novel alternative pre-treatment method. Wastewaterflows through an aerobic filter. Solids (toilet paper, faeces) are held back in the filter, liquids are pumped to a secondary treatment facility (e.g. constructed wetland or waste stabilisation pond). There are two types of compost filters: chamber filter or hanging bags.
			Compressor	Compressors are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe. The increased pressure can directly be transformed into mechanical energy.
ADDENDUM			**Condominal Sewer**	Condominial sewerage is the application of simplified sewerage coupled with consultations and on-going interactions between users and agencies during planning and implementation. The term is used primarily in Latin America and is derived from the term condominio/condominium (housing block).
			Confined Aquifers	Saturated permeable soil (sand or gravel) capped by an impermeable layer.
		Water	**Conjunctiveuse**	Conjunctive use describes the combined use of groundwater and surface water. In order to achieve higher water reliability, the natural hydrologic connection between ground and surface water is used as efficiently as possible. The idea of this management approach is to use surface water when the water table is high and change to groundwater when the water table is low.
			Cooling Tower	Cooling towers are one of the most common water recycling technologies in use by industry today. By taking advantage of water's high heat of evaporation, cooling towers offer effective and relatively inexpensive cooling for a wide range of industrial uses. 2/3 industrial water is used for cooling water (removal of heat). In some industries such as electric power plants or oil refineries, even up to 90% of intake water is used for cooling. Cooling water is easy to treat and sometimes even of quite a good quality. It can therefore easily be reused for example for washing processes. However, once used for washing and eventually contaminated, an appropriate treatment system before reuse is required.
			Cooling Water	Cooling water is the water used in industry to remove heat from processes. 2/3 industrial water is used as cooling water (removal of heat). In some industries such as electric power plants or oil refineries, even up to 90% of intake water is used as cooling. Cooling water is often not much polluted and can easily be reused for instance for cleaning processes. The heat, stored in the water after cooling can also be reused in other industrial or agricultural processes that require heating instead of cooling.
ADDENDUM		Water	**Decentralised Water Supply**	Decentralised supply systems offer the possibility to provide safe drinking water where centralised supply systems are not feasible for economic or political reasons (e.g. in rural communities or informal settlements). Decentralised water supply refers to the small-scale purification and distribution o water. The decentralised treatment systems fall into three main categories: point-of-use systems (POU), point-of-entry systems (POE), and small-scale systems (SSS). POU and POE systems are designed for individual households while SSS can provide for community water supply, for emergency water supply in camps, or to purify water for sale in water kiosks. The choice of decentralised supply system depends on the local context and includes such factors as ease of use, maintenance needs, dependence on other utilities (e.g. electricity, fuel supply), and cost.
			Deep Dug Well	Deep dug wells are dug wells over 20 metres in depth, thus, unlikely to get contaminated but costly to construct.
		Water	**Deep Shaft**	Deep shafts are enhanced biological wastewater treatment systems. They are based on the process of activated sludge systems but particularly adapted where land is in short supply. Oxygen is injected into a return sewage stream, which is injected into the base of a deep columnar tank buried in the ground. As the sewage rises the oxygen forced into solution by the pressure at the base of the shaft breaks out as molecular oxygen providing a highly efficient source of oxygen for the microorganisms contained in the activated sludge. The rising oxygen and injected return sludge provide the physical mechanism for mixing. Mixed sludge and wastewater is decanted at the surface, the sludge is again enriched in oxygen while the supernatant continuously flows out of the system. The efficiency of deep shaft treatment can be high but they require high skilled labour for both, construction and operation and maintenance and large amount of energy.
			Deep Well	A deep well is a hand-dug water well ranging more than 7m in depth and about 1.5m in diameter.

Dehydration of Faeces	When faeces are stored in the absence of moisture (i.e., urine), they dehydrate into a crumbly, white-beige coarse, flaky material or powder. The moisture naturally present in the faeces evaporates and/or is absorbed by the drying material (e.g., ash, sawdust, lime) that is added to them. Dehydration by adding dry organic material and long-term storage at high ambient temperature is the simplest treatment in order to transform faeces into a product that is safe for reuse as soil conditioner or disposal.
Dehydration Vaults	Dehydration vaults are used to collect, store and dry (dehydrate) faeces. Faeces will only dehydrate when the vaults are well ventilated, watertight to prevent external moisture from entering, and when urine and anal cleansing water are diverted away from the vaults. See also dehydration of faeces.
Desludging	The process of removing the accumulated sludge from a sanitation storage or treatment facility (e.g. pit toilet, septic tank).
Dewatering	The process of reducing the water content of a sludge or slurry. Dewatered sludge may still have significant moisture content, but it typically is dry enough to be conveyed as a solid (e.g., shovelled).
Digestate	The solid and/or liquid material remaining after undergoing anaerobic digestion.
Dioxins	Dioxins are a class of chemical contaminants that are formed during combustion processes such as waste incineration, forest fires, and backyard trash burning, as well as during some industrial processes such as paper pulp bleaching and herbicide manufacturing. The most toxic chemical in the class is 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD). The highest environmental concentrations of dioxin are usually found in soil and sediment, with much lower levels found in air and water. Humans are primarily exposed to dioxins by eating food contaminated by these chemicals.
Direct Surface Groundwater Recharge	In direct groundwater recharge water moves from storage above-ground (e.g. a spreading basin or ditch) to the aquifer via soil percolation. Most of the existing large-scale artificial recharge schemes in Western countries make use of this technique. In general direct surface recharge systems based on percolation have relatively low construction costs and are easy to operate and maintain.
Disinfection	The elimination of (pathogenic) microorganisms by inactivation (using chemical agents, radiation or heat) or by physical separation processes (e.g., membranes). The process is used for water purification or for advanced or tertiary wastewater treatment.
Disinfection By-Product	The use of chemical disinfectants in water treatment usually results in the formation of chemical by-products, some of which are potentially hazardous. If chlorination is practised, the trihalomethanes, of which chloroform is the major component, are likely to be the main disinfection by-products, together with the chlorinated acetic acids in some instances. However, the risks to health from these by-products are extremely small in comparison with the risks associated with inadequate disinfection, and it is important that disinfection should not be compromised in attempting to control such by-products.
Dissolved Oxygen	The concentration of oxygen dissolved in water, expressed in mg/l or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given altitude and temperature.
Drinking Water	Freshwater that is chemically and biologically safe for human consumption, naturally or by purification.
Drip Irrigation	In drip irrigation, water flows through a filter into special drip pipes, with emitters located at different spacing. Water is discharged through the emitters directly into the soil near the plants through a special slow-release device. If properly designed, installed, and managed, drip irrigation may help achieve water conservation by reducing evaporation and deep drainage as compared to other types of irrigation such as flood or overhead sprinklers since water can be more precisely applied to the plant roots.
Dry Cleansing Material	Dry Cleansing Materials are solid materials used to cleanse one-self after defecating and/or urinating(e.g., paper, leaves, corncobs, rags or stones). Depending on the system, Dry Cleansing Materials may be collected and separately disposed of. Although extremely important, a separate menstrual hygiene products like sanitary napkins and tampons is often forgotten. In general (though not always), they should be treated along with the solid waste generated in the household.
Dry Toilet	A dry toilet is a toilet that operates without flushwater. The dry toilet may be a raised pedestal on which the user can sit, or a squat pan over which the user squats. In both cases, excreta (both urine and faeces) fall through a drop hole.
Drying Bed	Drying beds are either planted or unplanted sealed shallow ponds filled with several drainage layers and designed for the separation of the solid from the liquid fraction of (faecal) sludge from latrines, septic tanks, biogas reactors, trickling filters, etc. Sludge is dried naturally by a combination of percolation and evaporation and evapotranspiration. When drying beds are covered with plants, evaporation is enhanced by transpiration (evapotranspiration). See also planted drying beds and unplanted drying bed.
Effluent	Effluent is the general term for a liquid that leaves a technology, typically after blackwater or sludge has undergone solids separation or some other type of treatment. Effluent originates at either a collection and Storage or a (semi-) centralized treatment technology. Depending on the type of treatment, the effluent maybe completely sanitized or may require further treatment before it can be used or disposed of.
End-of-pipe	End-of-pipe techniques are methods used to remove already formed contaminants from a stream of air, water, waste, product or similar (instead of using cleaner production options). These techniques are called 'end-of-pipe' as they are normally implemented as a last stage of a process before the stream is disposed of or delivered.
Evaporation	The phase change from liquid to gas that takes place below the boiling temperature and normally occurs on the surface of a liquid.
Evaporation Bed	Evapotranspiration beds are an alternative secondary treatment solution for greywater, pre-treated effluents from septic tanks, anal cleansing water or urine from urine diversion toilets in areas with high groundwater tables, or with soils that prevent wastewater percolation and where the productive reuse of these wastewater flowstreams is not a preferred option. The respective wastewater effluents are discharged into sealed up receptacles where the water evaporates from the soil or transpires from the plants growing there in a process called evapotranspiration. The dissolved organic matter is removed by bacteria and the remaining nutrients are taken up by plants.
Evapotranspiration	The combined loss of water from a surface by evaporation and plant transpiration. It is the process by which water is transferred from vegetated soil to the atmosphere.
Excreta	Excreta consists of urine and faeces that is not mixed with any flushwater. Excreta is small in volume, but concentrated in both nutrients and pathogens. Depending on the quality of the faeces, it has a soft or runny consistency.
Facultative Pond	A lagoon that forms the second treatment stage in waste stabilisation ponds (WSPs). It is a shallow pond (1 to 2m) consisting of an aerobic zone close to the surface and a deeper, anaerobic zone. AS algae grow on the surface they produce oxygen, which is consumed by aerobic bacteria in the middle of the pond degrading the BOD. In the lower zones of the pond, anaerobic digestion takes place.
Faecal Coliform	Faecal coliforms are a group of bacteria (e.g. Escherichia coli) present in excreta. They are not necessarily harmful, but they are present in high numbers and relatively easy to detect. Therefore they are used to indicate the presence of other faecal bacteria, which may be present in small numbers only, but associated to a high health risk.

ADDENDUM	Dictionary	Water	**Faecal Sludge**	Faecal sludge comes from onsite sanitation technologies, and has not been transported through a sewer. It is raw or partially digested, a slurry or semisolid, and results from the collection, storage or treatment of combinations of excreta and blackwater, with or without greywater. Examples of onsite technologies include pit latrines, unsewered public ablution blocks, septic tanks, aqua privies, and dry toilets. Faecal sludge management includes the storage, collection, transport, treatment and safe enduse or disposal of faecal sludge. Faecal sludge is highly variable in consistency, quantity, and concentration.
ADDENDUM	Dictionary	Water	**Faeces**	Faeces refer to (semi-solid) excrement that is not mixed with urine or water. Depending on diet, each person produces approximately 50 L per year of faecal matter. Fresh faeces contain about 80% water. Of the total nutrients excreted, faeces contain about 12% N, 39% P, 26% K and have 107 to 109 faecal coliforms in100 mL.
ADDENDUM	Dictionary	Water	**Fermentation**	Fermentation is the second step of anaerobic digestion. Fermentative bacteria transform sugars and other monomeric organic products from hydrolysis into organic acids, alcohols, carbon dioxide (CO2), hydrogen (H) and ammonia (NH3).
ADDENDUM	Dictionary	Water	**Fertigation**	The combined irrigation and fertilisation is called fertigation. There are different way how fertigation can be done: mixing chemical fertiliser with irrigation water; using partly treated wastewater which contains still nutrients; mixing (separately collected) urine as a nutrient source and mixing it to the irrigation water. Fertigation helps saving freshwater resources and decreases the dependency on depleting mineral fertilisers. Generally, drip irrigation and subsurface drip irrigation are the most appropriate application method for fertigation.
ADDENDUM	Dictionary	Water	**Filter**	Water filters remove impurities (chemical, microbiological, physical etc.) from water. Different technologies are applied such as means of a fine physical barrier, a chemical process or a biological process.
ADDENDUM	Dictionary	Water	**Filtrate**	The liquid that has passed through a filter.
ADDENDUM	Dictionary	Water	**Filtration**	A mechanical separation process using a porous medium (e.g., cloth, paper, sand bed, or mixed media bed) that captures particulate material and permits the liquid or gaseous fraction to pass through. The size of the pores of the medium determines what is captured and what passes through.
ADDENDUM	Dictionary	Water	**First Flush Device**	First flush devices are used in rooftop rainwater harvesting (RTRWH) systems, in order to prevent debris, dirt, dust and droppings that collect on the catchment area from entering the collection and storage tank. Different types exist, such as float valve types, overflow flow types, flow rate types or electronic conductivity types. First flush diverter devices improve water quality, reduce tank maintenance and protect pumps.
ADDENDUM	Dictionary	Water	**Fixed-film System**	Fixed-film systems (also attached-growth systems) are biological wastewater treatment processes that employ a inert medium such as rock, plastic, wood, or other natural or synthetic solid material, that will support attached growth of biomass on its surface and within its porous structure. Wastewater comes into contact with the film contaiining the active fixed biomass either by pumping the water past the media in packed towers (i.e. trickling filter) or by moving the media past the wasewater to be treated (e.g. rotating biological contactor).
ADDENDUM	Dictionary	Water	**Floc**	A very fine, fluffy mass formed by the aggregation of fine suspended particles, as in a precipitate. See also flocculation.
ADDENDUM	Dictionary	Water	**Flocculation**	The process by which the size of particles increases as a result of particle collision. Particles form aggregates or flocs from finely divided particles and from chemically destabilized particles and can then be removed by settling or filtration. Flocculation is often used in combination with coagulation.
ADDENDUM	Dictionary	Water	**Flotation**	The process whereby lighter fractions of a wastewater, including oil, grease, soaps, etc., rise to the surface, and thereby can be separated.
ADDENDUM	Dictionary	Water	**Flush Urinal**	A flush urinal is a urinal used with water to flush away the urine. There are manual and automated flush techniques. Installing a flush urinal results in increased water consumption and the generation of the corresponding amount of wastewater. Waterless urinals, which work without water, have become increasingly popular.
ADDENDUM	Dictionary	Water	**Flushwater**	Flushwater is the water discharged into the User Interface to transport the content and/or clean it. Freshwater, rainwater, recycled Greywater, or any combination of the three can be used as a flushwater source.
ADDENDUM	Dictionary	Water	**Fog Drip**	Fog drip is a method to harvest the water contained in the fog. Fog harvesting provides a cheap complementary water source for arid and semiarid, rural regions. As the wind blows the fog through specially designed nets (fog collectors), tiny droplets of condensed water form on the mesh and are collected in a gutter and transported to a storage site. The collected water does meet the WHO standards and can be used as drinking water. One large fog collector, with a 40 m2 collecting surface, can produce up to an average of 200 litres per day throughout the year, costs around 1000 to 1500 USD each and can last 10 years.
ADDENDUM	Dictionary	Water	**Fossa Alterna**	The Fossa Alterna is a short cycle alternating, waterless (dry) double pit technology. Compared to the double VIP which is just designed to collect, store and partially treat excreta, the Fossa Alterna is designed to make an earth-like product that can be used as a nutrient-rich soil conditioner. The Fossa Alterna is dug to a maximum depth of 1.5 m and requires a constant input of cover material (soil, ash, and/or leaves).
ADDENDUM	Dictionary	Water	**Fouling**	Fouling refers to the accumulation of unwanted material on solid surfaces, most often in an aquatic environment. The fouling material can consist of either living organisms (biofouling) or a non-living substance (inorganic or organic). Fouling is usually distinguished from other surface-growth phenomena in that it occurs on a surface of a component, system or plant performing a defined and useful function, and that the fouling process impedes or interferes with this function.
ADDENDUM	Dictionary	Water	**Freshwater**	Water naturally occurring on the Earth's surface (lakes, rivers, etc) and underground (groundwater in aquifers and underground streams). Freshwater is characterized by having low concentrations of dissolved salts and other total dissolved solids. The term specifically excludes seawater and brackish water.
ADDENDUM	Dictionary	Water	**Gravel Pack**	Gravel pack is graded granular material placed in a thin zone around the screens in order to increase the effective hydraulic diameter of the borehole and to help inhibit the movement of sediments into the borehole. Gravel pack material should be chosen to retain most of the unconsolidated formation material, and screen openings are then selected to retain about 90% of the gravel pack. Gravel packs are 100- 200 mm thick.
ADDENDUM	Dictionary	Water	**Gravitational Water**	Gravitational water is held in large soil pores and rapidly drains out under the action of gravity within a day or so after rain. Plants can only make use of gravitational water for a few days after rain.
ADDENDUM	Dictionary	Water	**Gravity Spring**	Gravity springs flow on a natural underground slope to the surface. The water flows more or less horizontally out of the ground.
ADDENDUM	Dictionary	Water	**Grease Trap**	The goal of the grease trap is to trap oil and grease so that it can be easily collected and removed from water. Grease traps are chambers made out of brickwork, concrete or plastic, with an odour-tight cover. Baffles or tees at the inlet and outlet prevent turbulence at the water surface and separate floating components from the effluent. A grease trap can either be located directly under the sink, or, for larger amounts of oil and grease, a bigger grease interceptor can be installed outdoors. Generally grease traps are fitted at garages, restaurants and other commercial premises where large quantities of oil or grease are discharged into wastewater.
ADDENDUM	Dictionary	Water	**Green Water**	The precipitation on land that does not run off or recharge the groundwater but is stored in the soil or temporarily stays on top of the soil or vegetation. Eventually, this part of precipitation evaporates or transpires through plants. Green water can be made productive for crop growth (although not all green water can be taken up by crops, because there will always be evaporation from the soil and because not all periods of the year or areas are suitable for crop growth).

Grey Water Footprint	Grey water footprint is a concept used for water footprint accounting. It refers to the volume of water needed to dilute pollutants to such an extent that the quality of the ambient water remains above agreed water quality standards.
Greywater	Greywater is the total volume of water generated from washing food, clothes and dishware, as well as from bathing, but not from toilets. It may contain traces of Excreta (e.g., from washing diapers) and, therefore, also pathogens. Greywater accounts for approximately 65% of the wastewater produced in households with flush toilets.
Grit	Grit includes sand, gravel, cinder, or other heavy solid materials that are "heavier" (higher specific gravity) than the organic biodegradable solids in the waste water. Grit also includes eggshells, bone chips, seeds, coffee grounds, and large organic particles, such as food waste.
Grit Chamber	Where subsequent water or wastewater treatment technologies could be hindered or damaged by the presence of sand, grit chambers (or sand traps) allow for the removal of heavy inorganic fractions by settling. There are three general types of grit chambers: horizontal-flow, aerated, or vortex chambers. All of these designs allow heavy grit particles to settle out, while lighter, principally organic particles remain in suspension.
Groundwater	Water that is located beneath the earth's surface. The groundwater level may be located several centimetres, or up to a hundred metres below the surface. It is generally of good quality and can be used as drinking water. Therefore, care should be taken to not contaminate groundwater with leaching sewage.
Groundwater Dam	Groundwater dams store water under the ground in sufficient quantities for livestock and minor irrigation as well as domestic use. Groundwater dams can be divided into two types: sand dams and subsurface dams. This technology is used in arid and semi-arid regions, where water shortage is a problem during dry periods.
Groundwater Recharge	Treated effluent and/or stormwater can be directly discharged into receiving water bodies (such as rivers, lakes, etc.) or into the ground to recharge aquifers. Surface groundwater recharge is the planned, man-made increase of groundwater levels. By improving its natural replenishment capacities and percolation from surface waters into aquifers, the amount of groundwater available for abstraction is increased. This is particularly useful in areas where water and groundwater resources are heavily utilised and acute problems with dropping watersheds, soil salinization, saltwater intrusion in coastal areas or water scarcity in general exist. Subsurface groundwater recharge refers to the different recharge techniques (generally injection or recharge wells) that release treated effluent and/or collected stormwater underground and directly replenish groundwater aquifers (without soil percolation).
Hand Pump	Hand pumps (alias manual pumps or human-powered pumps) are a type of water-lifting device mainly serving community water supplies that can be operated manually. Human-powered pumps also include foot pumps and rope and bucket systems with or without a windlass or shadouf.
Hand-Dug Well	The traditional and still most common method of obtaining groundwater in rural areas of the developing world is by means of dug wells, mostly hand-dug wells. With the prior knowledge that groundwater is present and rather close to the surface, a hole (5-30 metres) is dug until the groundwater level is reached. Inflowing groundwater is collected and can be extracted with the help of pumps or buckets.
Heavy Metal	Heavy metals are relatively dense metals (e.g. cadmium, chromates, lead, and mercury). They are usually found in commercial and industrial wastewater. Many heavy metals can have a toxic effect on living beings and in wastewater treatment, they need the to be source controlled. Most biological wastewater treatment don't remove heavy metals (although phytoremediation can be used to remove the heavy metals from the water)
Helminth	A parasitic worm, i.e. one that lives in or on its host, causing damage. Some examples that infect humans are roundworms (e.g., Ascaris and hookworm) and tapeworms. The infective eggs of helminths can be found in excreta, wastewater and sludge. They are very resistant to inactivation and may remain viable in faeces and sludge for several years.
High-Strength Wastewater	High-strength wastewater means it contains greater amounts of organic components (such as fats, oils, and greases) than residential wastewater. It can also mean the effluent contains large quantities of suspended solids or high amounts of certain chemicals, such as disinfectants. Any or all of these components can interfere with the normal biological processes most onsite sanitation systems use. These characteristics vary from day to day, even from hour to hour, and they can have a major impact on how a biological system performs. The major concern of having high organic loading in wastewater is physical clogging. But high organic load may cause anaerobic conditions leading to odour problems and poor performance.
Household-level Drinking Water Treatment	Household-level approaches to drinking water treatment and safe storage are also commonly referred to as managing the water at the "point-of-use". This term or its abbreviation "POU" typically describe the same procedures as other abbreviations derived from household water treatment, like "HHWT" or "HWT" or "HWTS" (The "S" in "HWTS" refers to safe storage). "Household water management" is also commonly used, and can encompass both treatment and storage. All these terms can refer to a variety of treatment procedures, for example, with chlorine or other chemical disinfectants, sunlight or UV lamps, various filters, or flocculation-disinfection formulations.
Household-level Water Treatment and Safe Storage	Household-level approaches to drinking water treatment and safe storage are also commonly referred to as managing the water at the "point-of-use". This term or its abbreviation "POU" typically describe the same procedures as other abbreviations derived from household water treatment, like "HHWT" or "HWT" or "HWTS". (The "S" in "HWTS" refers to safe storage.) "Household water management" is also commonly used, and can encompass both treatment and storage. All these terms can refer to a variety of treatment procedures, for example, with chlorine or other chemical disinfectants, sunlight or UV lamps, various filters, or flocculation-disinfection formulations.
Human-Powered Water Distribution	Where there is no or no sufficient supply of fresh or drinking water, nor motorised vehicles to distribute it, water distribution is human-powered. Human-powered water distribution refers to the use of jerry cans and small recipients to fetch water from a centralised distribution point (e.g. river, lake, borehole, shallow well). Either people collect and transport the water themselves or they buy it from mobile vendors that often use small barrels on wheels to transport the water and sell it door-to-door. The effort of ensuring water supply can be high for single families or communities and its price is often higher than that of a well managed public piped distribution system.
Humification	Humification describes the process of sludge treatment in planted dewatering/drying beds. The sludge is loaded on the bed and dewatered by percolation in the filter and by evapotranspiration through the plants. The root system of the plants maintains the permeability of the sludge layer. The sludge is be added intermittently. Sludge has to be removed only once every 5 -10 years depending on design. The final product has is very well mineralized and has a soil-like structure. The long solids retention period and pathogen die-off and allows direct reuse of the solids in agriculture. Percolate quality considerably improves by the presence of plant (compared to unplanted drying beds) but may still require a polishing treatment.
Hydraulic Conductivity	Permeability in fluid mechanics and the earth sciences (commonly symbolised k). It is the measure of the ability of a porous material (often, a rock or unconsolidated material) to allow fluids (e.g. water) to pass through it.
Hydraulic Gradient	The hydraulic gradient is the difference of the height of the water table from one distance to another. The liquid will flow along the hydraulic gradient from where the hydraulic head is highest to where it is lowest by gravity due to the difference in pressure.

Hydrogen Peroxide	Hydrogen peroxide (H2O2), a colourless water-like liquid, is one of the most versatile, reliable and environmentally friendly oxidising agents. The relative safety and simplicity of its uses has led to the development of a number of applications in water treatment such as odour removal, disinfection or metal removal. Hydrogen peroxide is also used in advanced oxidation processes (AOP) and can be combined with catalysts or other oxidisers to produce reactive oxygen species (ROS) able to attack a wide range of organic compounds and microorganisms. The production of hydrogen peroxide is usually performed at industrial scale but can also be done directly in drinking water (or pre-treated wastewater) by electrolysis.
Hydrolysis	Hydrolysis describes the cleavage of a chemical compound through the reaction with water. Thereby, a hydrogen atom (H) is added to one part of the split chain, while the remaining hydroxyl group of the water (OH) is added to the other. Hydrolysis is the first step of anaerobic digestion in which insoluble complex molecules such as carbohydrates and fats are broken down to short sugars, fatty acids and amino acids.
Hydroponic	Hydroponic means the cultivation of plants in water without soil. Nutrients, essential for the growth of the plants are thereby provided from the water.
Hydropower	When the mechanical energy from flowing or falling water is used to produce energy, this is called hydropower.
Hydropower Small Scale	Hydropower uses the power of moving water (kinetic energy) to generate electricity. Small-scale hydropower produces between 1 and 30 MW. Small-scale hydropower systems can be installed in small rivers, streams or in the existing water supply networks, such as drinking water or wastewater networks. In contrast with large-scale hydropower systems, small-scale hydropower can be installed with little or negligible environmental impact on wildlife or ecosystems, mainly because the majority of small hydropower plants are run-of-river schemes or implemented in existing water infrastructure. Due to its versatility, low investment costs, and as a renewable energy source, small-scale hydropower is a promising option for producing sustainable, inexpensive energy in rural or developing areas.
Hydroxyapatite	Hydroxylapatite, also called hydroxyapatite, is a naturally occurring mineral form of calcium apatite with the formula $Ca_5(PO_4)_3$ but is usually written $Ca_{10}(PO_4)_6(OH)_2$ to denote that the crystal unit cell comprises two entities. HAP is a natural mineral and demonstrated to be a very effective and biocompatible adsorbent for fluoride removal from contaminated water (MOURABET et al. 2015; MOHAMMAD et al. 2017). Elevated concentrations of fluoride in drinking water are a serious health concern, with dental and skeletal fluorosis being the most commonly reported fluoride-related diseases.
Hyperthermophile	Hyperthermophiles are organisms (e.g. bacteria, worms, funghi etc.) that prefer extremely hot environments (80 to 120°C).
Imhoff Tank	The Imhoff tank is a primary treatment technology for raw wastewater, designed for solid-liquid separation and digestion of the settled sludge. It consists of a V-shaped settling compartment above a tapering sludge anaerobic digestion chamber with gas vents.
In Situ Rainwater Harvesting	In situ rainwater harvesting techniques are water catchment methods located within cropland. This is achieved by allowing rainwater to infiltrate into the soil and preventing water runoff. Ex situ systems on the other hand are located outside the field.
Industrial Wastewater	Industrial wastewater refers to water that has been used from industries and is refused. Industrial wastewater is either biodegradable and can be treated or reused similar to blackwater or greywater; or it contains pollutant that are not biodegradable and require an advanced oxidation process for treatment. Often, industrial wastewater also just contains heat, which can be reused for energy generation or other processes (e.g. aquaculture).
Infiltration Basins	Huge basins or ponds are used for collecting water for direct surface groundwater recharge via percolation. For effective artificial recharge highly permeable soils are suitable, but a water layer should always be maintenaned to ensure good infiltration. High turbidity of the water used for recharge can lead to clogging of the soil layer.
Influent	The general name for the liquid that enters into a system or process (e.g., wastewater). The effluent of one process is the influent of the next.
Ion Exchange	The exchange of ions of the same charge between an insoluble solid and a solution in contact with it, used in water-softening and other purification and separation processes.
Irrigation	Irrigation is the artificial application of water to land or soil especially to assist in growing agricultural crops in dry areas or during periods of inadequate rainfall. To reduce dependence on freshwater and maintain a constant source of water for irrigation throughout the year, wastewater that has had secondary treatment (i.e., physical and biological treatment) can be used for irrigation.
Jerrycan	Jerrycans are light, plastic containers that are readily available and can be easily carried by one person.
Lacto-Fermentation	The lacto-fermentation process (also lactic acid fermentation) is a biological anaerobic degradation process (similar to silage production process in agriculture), but without gas formation. During this process, sugars such as glucose, fructose, and sucrose, are converted into cellular energy and the metabolic by-product lactic acid. Lacto-fermentation is used throughout the world to preserve foods. When the acidity rises due to lactic acid fermenting organisms, many other pathogenic microorganisms are killed. Yogurt and sauerkraut are some of the most famous products produced by lacto-fermentation. Most lactic acid bacteria obtain energy only from the metabolism of sugars and hence are usually restricted to habitats in which sugars are present. The two most important subgroups of the lactic acid bacteria depend on the nature of the products formed from the fermentation of sugars: one group, called homofermentative, produces a single fermentation product, lactic acid, whereas the other group, called heterofermentative, produces other products, mainly ethanol and CO2 as well as lactate. Even though anaerobe, most lactic acid bacteria have the advantage not to be sensitive to O2, allowing them to grow in its presence as well as in its absence (they are aerotolerant anaerobes).
Lake	Lakes are discrete, largely isolated ecosystems in which the interplay between physical, biogeochemical and organismal processes can be studied, understood, and put to use in effective management.
Landfill	A landfill is a land disposal site for waste, which is designed to protect from environmental pollution and health risks. It is not the same as an open dump. Landfills are built to concentrate the waste in compacted layers to reduce the volume and monitored for the control of liquid and gaseous effluent in order to protect the environment and the human health. In reality, the term is often also used for unprotected waste dumping sites.
Leach Field	A leach field, or drainage field, is a network of perforated pipes that are laid in underground gravel-filled trenches to dissipate the effluent from a water-based collection and storage/treatment or (semi-)centralized treatment technology. They allow for a further treatment of the effluent and to recharge groundwater bodies.
Lime	The common name for calcium oxide (quicklime, CaO) or calcium hydroxide (slaked or hydrated lime, Ca(OH)2). It is a white, caustic and alkaline powder produced by heating limestone. Slaked lime is less caustic than quicklime and is widely used in water/wastewater treatment and construction (for mortars and plasters).
Low-Flush Toilet	A low-flush or low flow toilet is a flush toilet that uses significantly less water than a full-flush toilet. That means, they use 4 to 6 litres instead of the 8 to 20 litres. Low-flush toilets use a special design of the cistern and the siphon in order to allow the removal of faeces and excreta with less water. Most often, they also include a-dual flush system, with one flush being designed for urine only using less than half a litre for flushing. Today, there are many suppliers of different models of low-flush toilets all over the world. Low-flush toilets reduce the water consumption, however, low-flush toilet still require large amounts of fresh water and with certain models, users have to flush even twice in order to achieve the complete removal of faeces from the bowl.

ADDENDUM | Dictionary | Water

Low-Pressure Membranes	Low-pressure membranes are used for microfiltration and ultrafiltration.
Low-Rate Digestion	Low-rate anaerobic digestion processes do not retain biomass and the relatively long HRT is equal to the SRT. These processes are adapted for the treatment of homogeneous high-strength wastes, such as agricultural slurries or municipal organic wastes.
Low-Solids Digestion	Low-rate anaerobic digestion systems are classified according to the percentage of total solids (TS) in the waste stream. Wet digestion means that the TS content is lower than 20 %.
Managed Aquifer Recharge	Managed Aquifer Recharge (MAR) is a concept that seeks to deliberately increase the amount of water stored in an aquifer, which is then recovered by pumping. MAR comprises a large number of injection-recovery techniques. By storing water underground, loss of water to evaporation can be drastically reduced and the water savings returned to other users such as the environment, towns or irrigators. MAR offers several advantages when compared with the more traditional use of surface water reservoirs, the total volume of water that could be stored in aquifers worldwide is several orders of magnitude greater than that available in surface dams. MAR is often used as a synonym for "artificial groundwater recharge" (including recharge [2022-from the surface] and from [2023-below the surface]) despite the fact that it is not an artificial recharge of aquifers but a well controlled measure to replenish depleted and over-exploited aquifers.
Manhole	A manhole is the top opening to a sewer system. A person can enter it to maintain the sewer. If it is not in use, it is covered with a cap to avoid injuries.
Membrane	A pliable, sheet-like structure acting as a boundary, lining, or partition. Can be used for filtration. Depending on the pore size, different qualities of filtration can be reached.
Micro Basin	Micro basins are small rainwater catchment pools surrounded on all sides by stonewalls or earth ridges. This allows storing rainwater and using it for small-scale tree and bush planting, enabling increased growth of plants if there is moisture deficit.
Microcatchment	Microcatchments are contoured areas concentrating and infiltrating rainwater. Therefore, more water is protected from evaporation and available for plants.
Microfiltration	A kind of low-pressure membrane filtration process in which contaminants are removed from a fluid (liquid & gas) by passage through a microporous membrane (typically with a pore size of 0.1 to 10 micrometres).
Micron	Metric unit for linear dimensions. One micron or micrometer corresponds to 0.000001 m or 1x10^-6 m.
Microorganism	Any cellular or non-cellular microbiological entity capable of replication or of transferring genetic material (e.g., bacteria, viruses, protozoa, algae or fungi).
Micropollutant	Pollutant that despite their extremely low concentration have an significant effect (e.g., trace organic compounds) Pharmaceuticals and hormones are two groups of micropollutants which are causing increasing concern for their effects on the endocrine system and sexual development of aquatic animals.
Moisture Control	Moisture control in SSWM refers to the use of adapted methods of agriculture and forestry in order to minimise the loss of water from the soil.
Municipal Solid Waste	Municipal solid waste is all kind of waste generated by households (domestic wastes) and commercial establishments. The collection and safe treatment of municipal solid waste is a key factor of sanitation and improved health of citizens. In general the management of municipal solid waste includes its collection by the municipality or another governmental body and its appropriate treatment or reuse.
Municipal Wastewater	Municipal wastewater generally refers to the wastewater collected in sewer systems, including domestic wastewater (black- and greywater from households) as well as effluents from institutions, businesses and industries.
Nanofiltration	A kind of high-pressure membrane filtration process in which particles which are in the range of 1 to 10 nanometres are removed. Such particles are for instance ions of heavy metals. To remove all soluble particles, one would need an even finer process (i.e. reverse osmosis).
Natural Coagulant	Natural coagulants are coagulants derived from plants and other locally available materials from the surrounding nature. Typical natural coagulants are prickly pear cactus, moringa seeds, broad beans and fava beans, which can be used for enhanced sedimentation as a pre-treatment step of drinking water.
Natural Organic Matter	Natural organic matter is broken down organic matter that comes from plants and animals in the environment. Organic matter is a collective term, assigned to the realm of all of this broken down organic matter. Basic structures are created from cellulose, tannin, cutin, and lignin, along with other various proteins, lipids, and sugars. It is very important in the movement of nutrients in the environment and plays a role in water retention on the surface of the planet.
Natural Water Purification	Microorganisms in soils, wetlands and riparian areas utilise or break down numerous chemical and biological contaminants in the water and thereby purify it.
Nephelometric Turbidity Unit	The Nephelometric Turbidity Unit is used in water treatment in order to describe the turbidity of a liquid and is measured with a calibrated nephelometer, an instrument for measuring the size and concentration of particles suspended in a liquid or gas by means of the ligh it scatters.
Nitrogen	Nitrogen is a chemical element which can be found in fresh water and wastewater in many different forms. In wastewater for example mainly organic nitrogen which comes from the rejections of food can be found. This nitrogen is an essential nutrient and can lead to algal bloom, eutrophication and water pollution. In its reduced form (ammonium, NH_4^+ and ammonia NH_3), it is transformed into nitrate, a process which consumes a lot of oxygen leading to oxygen depletion in the water. Nitrate (NO_3^-) is also a drinking water pollutant while nitrite (NO_2^-) is toxic to fish. Nitrite can be transformed to nitrate and nitrate can be transformed to gazeous nitrogen gas (N_2) and released to the atmosphere (denitrification). Nitrogen is also an important constituent of fertilisers used for food production. Today, nitrogen used for food production is mainly mineral nitrogen which is mined consuming huge amounts of energy. By recycling nitrogen contained in wastewater, the pollution of ecosystems could be reduced and the energy consumption by nitrogen mining avoided.
Non-Biodegradable Wastewater	Wastewater from industry, businesses or agriculture, that contains chemical pollution, which is toxic for microorganisms and can therefore not be treated by biological wastewater treatment units. In order to degrade the toxic chemicals, other processes such as advanced oxidation processes (AOP) need to be applied. Often, it is possible to degrade first the toxics with AOPs after which the wastewater becomes biodegradable and can be treated as municipal wastewater. This can reduce costs, as generally AOPs require more technical know-how and energy.
Non-Planted Filter	Pre-treated greywater is applied intermittently to the surface of a filter media, percolates through an unsaturated filter zone where physical, biological and chemical processes treat the water. The treated greywater is collected in a drainage network or infiltrates the underlying soil.
Non-Point Pollution	Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" refers to any source of water pollution that does not meet the legal definition of "point source".

On-site Storage and Treatments	Human excreta and wastes, if not directly transported to a centralised sewer system, need to be collected in order to prevent odour, fly breeding and health risk from pathogens. Sometimes, such collection facilities also include directly a treatment or pre-treatment of the collected products.
On-site Wastewater Treatment	On-site wastewater treatment is used to treat wastewater from one or several households or institutions and business and to return treated wastewater back into the immediate environment. Such systems are based on the principle of low organisation and maintenance. The main advantage is the lower costs, because the systems do not require large collection networks and generally work without technical energy and are constructed with locally available materials.
Onsite Sanitation	A sanitation system in which excreta and wastewater are collected, stored and/or treated on the plot where they are generated. There are two main categories of on-site sanitation technologies: 'wet' which require water for flushing; and 'dry' which do not require any water for flushing.
Open Defecation Field	Excreta disposal system for ex-situ (camp) situations with the presence of a large number of people. It is only recommended as an extreme short-term solution and when enough space is available. In practice, this method does not seem to be very widely implemented. The system should also include hand-washing facilities, supervision, and excreta should be covered with soil as soon as possible.
Overhung Latrine	An overhung latrine consists of a superstructure and floor built over water. A squat hole in the floor allows excreta to fall directly, or via a chute into the water below. Overhung latrines are rarely appropriate (due to the direct pollution of water) and should only be considered if other options are not possible, such as in areas prone to continued flooding. The receiving water must be sufficiently deep throughout the year, preferably should be saline to prevent human consumption, and should be flowing away from settlements.
Oxidation	In chemistry, oxidation describes the process of combining or becoming combined with oxygen. Oxidation can take place chemically or it can be catalysed by a microbial process (by bacteria). In wastewater treatment, oxidation means when bacteria oxidise organic loads in the wastewater in a fast single step process leading to the production of CO2 and heat. The process rate increases along with increasing temperature. Examples of application of oxidation are Trickling Filters, Rotating Biological Contactors, Aerobic Ponds, Aerated ponds, Activated sludge, etc.
Ozonation	Ozonation is a water treatment process that destroys microorganisms and degrades organic pollutants through the infusion of ozone, a gas produced by subjecting oxygen molecules to high electrical voltage.
pH	The measure of acidity or alkalinity of a substance. A pH value below 7 indicates that it is acidic, a pH value above 7 indicates that it is basic (alkaline). It can be measured by a pH meter, titration, or indicator (e.g. litmus) stripes.
Parasite	An organism that lives on or in another organism (its host). Parasites exist in a huge variety, including animals, plants, and microorganisms. Ectoparasites live on the surface of the host (e.g., ticks, mites, lice, fleas, and many insects infesting plants). Endoparasites live in the gut or tissues (e.g., many kinds of worm), and cause varying degrees of damage or disease to the host. Parasite comes from the Greek words parasitos (eating at another's table), which is composed of para (alongside) and sitos (food).
Pasteurisation	Pasteurisation is a process of heating a food, typically liquid, to a specific temperature for a definite length of time. This process leads to the partial sterilisation of this food through reducing heat-sensitive vegetative cells to an extent that it is not harmful for human consumption and without major changes in the chemistry of the food. Unlike sterilisation, pasteurisation is not intended to kill all microorganisms in the food. Instead pasteurisation aims to reduce the number of viable pathogens so they are unlikely to cause disease. Pasteurisation is mostly known in connection with milk and is named after French microbiologist Louis Pasteur.
Pathogen	A microorganism or other agent that causes disease.
Percolation	The movement of liquid through a filtering medium with the force of gravity.
Permeate	The clear fluid that passes through the membrane in a membrane filtration process.
Persian Wheel	Device to lift water, particularly for agricultural purposes. It consists of an endless chain of buckets, typically with an individual capacity of 8-15 litres mounted on a drum and submerged in water to the required depth. The drum is connected to a toothed wheel held in a vertical plane by a long shaft usually kept below ground level. The vertical toothed wheel is geared with a large toothed horizontal wheel connected to a horizontal beam. This beam is yoked to a pair of animals. The animals move in a circle to turn the drum and raise the water. Water is released when the bucket reaches the top.The average discharge rate from a Persian wheel is about 160-170 litres/min from a depth of 9m with one pair of bullocks. The Persian wheel can be used to raise water from a depth of up to 20 m but its efficiency is reduced at depths below 7.5 metres.
Pit Composting Toilet	Composting toilets using a pit (above the ground) as a composting chamber. Typical pit composting toilets are the arborloo or the fossa alterna.
Pit Latrine	The single pit latrine is one of the most widely, cheapest and easiest used sanitation technologies. It is made out of a latrine superstructure, a slab and a pit. Excreta, along with anal cleansing materials (water/solids) are deposited in the pit. To avoid people falling in the pit and increase convenience and reduce odour, a slab with a hole is used to cover the pit. Lining the pit prevents it from collapsing and provides support to the superstructure but the underground of the latrine should be water pervious. When the latrine is filled up, it needs to be emptied or closed and relocated. By constructing twin pits (the double pit latrine), it should be possible to dig out a filled pit, after it has stood for a year, without any objectionable smell, whilst the other pit is in use. Pit latrines are part of the improved sanitation options. However, odour and fly nuisance are very common and due to soil infiltration there is danger of groundwater contamination, especially in densely populated areas.
Plankton	Plankton is the small and microscopic organisms drifting or floating in the sea or fresh water, consisting chiefly of diatoms, protozoans, small crustaceans, and the eggs and larval stages of larger animals. Many animals are adapted to feed on plankton, esp. by filtering the water.
Planted Drying Beds	A planted drying bed is similar to an Unplanted Drying Bed, but has the added benefit of transpiration and enhanced sludge treatment due to the plants. The key improvement of the planted bed over the unplanted bed is that the filters do not need to be desludged after each feeding/drying cycle. Fresh sludge can be directly applied onto the previous layer; the plants and their root systems maintain the porosity of the filter. The percolate or leachate needs to be collected and treated before reuse or disposal.
Planting Pits	Planting pits are used as a precipitation harvesting method preventing water runoff and thereby increasing infiltration and reducing soil erosion. Basically, holes are dug 50-100 cm apart from each other with a depth of 5-15 cm in order to prevent water runoff. Planting pits are most suitable on soil with low permeability, such as silt and clay. They are applicable for semi-arid areas for annual and perennial crops (such as sorghum, maize, sweet potato, bananas, etc.). One main advantage is their simple implementation and maintenance.
Pour Flush Toilet	A pour flush toilet is like a regular cistern flush toilet except that the water is poured in by the user, instead of coming from the cistern above. When the water supply is not continuous, any cistern flush toilet can become a pour flush toilet.
Pre-Treatment	Pre-treatment is the preliminary removal of wastewater or sludge constituents, such as oil, grease, and various solids (e.g., sand, fibres and trash). Built before a conveyance or treatment technology, pre-treatment units can retard the accumulation of solids and minimize subsequent blockages. They can also help reduce abrasion of mechanical parts and extend the life of the sanitation infrastructure. See also primary treatment.

Pre-Treatment Products	Pre-treatment products are materials separated from blackwater, brownwater, greywater or sludge in preliminary treatment units, such as screens, grease traps or grit chambers. Substances like fats, oil, grease, and various solids (e.g. sand, fibres and trash), can impair transport and/or treatment efficiency through clogging and wear. Therefore, early removal of these substances is crucial for the durability of a sanitation system.
Precipitation	Environment: any water that comes from the atmosphere: rainwater, stormwater, fog, dew, snow etc. OR Chemistry: when a solid substance is produced from a liquid during a chemical process
Precipitation Harvesting	Precipitation harvesting refers to the controlled collection of precipitation (rain, fog, dew, snow, etc.) to complement water supply.
Pressure Filter	Rapid sand filters can be constructed as pressure filters. They are used for water purification purposes and consist of closed vessels containing beds of sand or of other granular material through which water is forced under pressure. These filters are frequently used in certain industrial situations, and a number have been installed for public water supplies. As their initial cost may be high, especially when their component parts have to be imported, their principal use is in industrialised countries.
Pressure System Unit	A prefabricated pressure sewer unit (normally made from plastic) is designed for outside placement. The pressure unit includes a grinding pump which is activated as soon as the stored wastewater reaches a pre-defined level.
Pressurised Sewers	Pressurised sewers, or pressure sewers differ form conventional gravity collection systems, because they break down large solids in a grinder pumping station before they are transported through the collection system. The pressure sewer system consist of a series of centrifugal grinder pumps moving finely ground effluent and material along a network of sewers (generally small-diameter). The primary effluent is delivered to the dwelling tank by traditional gravity drainage methods before being ground. Their watertight design and the absence of manholes eliminate extraneous flows into the system. Thus, the systems are an effective solution where conventional systems are impractical such as rocky, hilly and/or water-charged terrain. Moreover, this system requires only shallow trenches and relatively small-diameter piping. Thus, it is also adapted to areas with housing density and where the terrain does not allow gravity flow.
Primary Disinfection	The application of a disinfectant at the drinking water treatment plant, with a primary objective to achieve the necessary microbial inactivation.
Primary Treatment	The first major stage in wastewater treatment that removes solids and organic matter mostly by the process of sedimentation or flotation. Examples of primary treatment technologies include septic tanks, biogas settlers, etc. See also pre-treatment.
Protozoa	A diverse group of unicellular eukaryotic organisms, including amoeba, ciliates, and flagellates. Some can be pathogenic and cause mild to severe illnesses.
Pyrolysis	Pyrolysis is the process of the heating biomass, in the absence of oxygen, transforming to charcoal. The fewer oxygen is present during the process, the more black carbon is contained in the charcoal. Black carbon, due to its polycyclic aromatic structure, is chemically and microbiologically stable and persists in the environment over centuries.
Rainwater Harvesting	Rainwater harvesting refers to the capturing and storing of rainwater and the taking of measures to keep it clean. Rainwater can be harvested through a variety of ways: capturing the rain on rooftops or its run-off (e.g. seasonal flood water) in local catchment systems (e.g. rock catchment, subsurface or surface dams). Rain collected from rooftops or small-scale rock catchments is generally used for domestic use, while large-scale rock catchment, ground catchment and dam catchment systems are used for livestock, nurseries, small-scale irrigation and only sometimes for domestic use.
Rapid Gravity Filters	Rapid sand filters can be constructed as gravity filters. They are used for water purification purposes and essentially consist of an open-topped box (usually made of concrete), drained at the bottom, and partly filled with a filtering medium. Fresh water is admitted to the space above the medium and flows downward under the action of gravity. Purification takes place during this downward passage and the treated water is discharged through the under-drains.
Rapid Sand Filter	Rapid sand filtration is a physical drinking water purification method. As freshwater flows through a sand- and gravel bed, the majority of suspended particles are removed. Rapid sand filters provide rapid and efficient removal of relatively large suspended particles but they cannot provide safe drinking water unless pre-treatment (i.e. coagulation-flocculation) and post-treated (e.g. chlorine disinfection) is applied.
Recharge Wells	Recharge or injection wells are subsurface groundwater recharge techniques used to directly discharge water into deep water-bearing zones. Recharge wells can be cased with the material covering the aquifer. If this material is unconsolidated, a screen can be placed in the well in the zone of injection. Recharge wells are suitable only in areas where a thick impervious layer exists between the surface of the soil and the aquifer that is to be replenished. They are also advantageous in areas where land is scarce (as [2022-surface groundwater recharge] requires large areas for infiltration). A relatively high rate of recharge can be attained with this method.
Reclaimed Water	Reclaimed water, sometimes called recycled water, is former wastewater (e.g. treated blackwater and greywater; stormwater) that has been treated to remove solids and certain organic or microbiological pollution in order to be used in agriculture, or to recharge groundwater aquifers. This is done for sustainability and water conservation, rather than discharging the treated wastewater to surface waters such as rivers and oceans.
Retention Basin	Retention basins are among the most frequently implemented storm water management systems. They are used to collect surface runoff and to improve water quality by natural processes such as sedimentation, decomposition, solar disinfection and soil filtration. In comparison to dry ponds (which hold runoff for a limited period of time and then release the stored water at once), retention basins constantly keep standing water allow for the development of an ecosystem. This allows settled particles to be treated biologically (GDSDS 2005). Water from retention ponds can be reused for groundwater recharge, irrigation or any other purpose, after further treatment if required. As a natural system, retention basins do not require energy or high-tech appliances. Primary implementation costs of retention basins are high and constant maintenance is inevitable, as otherwise pollutant export and erosion can occur (UNHSC 2010).
Reverse Osmosis	Osmosis is a natural phenomenon in which water passes through a semipermeable barrier from the side with lower solute concentration to the higher solute concentration side. Water flow continues until chemical potential equilibrium of the solvent is established. At equilibrium, the pressure difference between the two sides of the membrane is equal to the osmotic pressure of the solution. To reverse the flow of water (solvent), a pressure difference greater than the osmotic pressure difference is applied; as a result, separation of water from the solution occurs as pure water flows from the high concentration side to the low concentration side. This phenomenon is termed reverse osmosis (it has also been referred to as hyperfiltration). A reverse osmosis (R-O) membrane acts as the semipermeable barrier to flow in the R-O process, allowing selective passage of a particular species (solvent, usually water) while partially or completely retaining other species (solutes).
Rill Erosion	Rill erosion occurs as runoff begins to form small concentrated channels. As rill erosion begins, erosion rates increase dramatically due to the resulting concentrated higher velocity flows. Rill can be repaired by tilling or normal cultivation operation and should be repaired as soon as possible in order to prevent gullies from forming.
River	A river is a natural watercourse, usually freshwater, flowing towards an ocean, a lake, a sea, or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water. Small rivers may also be called by several other names, including stream, creek, brook, rivulet, tributary and rill.

River Regime	River regime can described as one of two characteristics of a reach of an alluvial river: (1) The variability in its discharge throughout the course of a year in response to precipitation, temperature, evapotranspiration, and drainage basin characteristics and (2) a series of characteristic power-law relationships between discharge and width, depth, and slope.
Rooftop Rainwater Harvesting	Rooftop rainwater harvesting is the most common type of rainwater harvesting (RWH) for domestic use. It is a simple low-cost technique that requires a minimum of specific expertise and that offers many benefits. Rainwater is collected on the roof and transported to a storage reservoir via gutters, where it supplies water at the point of use. Rainwater harvesting can supplement other water sources when they become scarce or are of low quality like brackish groundwater or polluted surface water in the rainy season. However, rainwater quality may be affected by air pollution, animal or bird droppings, insects, dirt and organic matter. Therefore regular maintenance (cleaning, repairs, etc.) and treatment before water use is very important (e.g. filtration or/and disinfection).
Roughing Filters	Roughing filters are used to separate solid matter from water. Some solid particles suspended in water are so small and light that they do not settle in a normal sedimentation tank. The same sedimentation tank can be improved by filling it with rough filter material such as gravel. Roughing filters usually consist of sedimentation tanks filled with differently sized filter material decreasing successively in size in the direction of flow. The bulk of solid particles is separated by the coarse filter medium located next to the filter inlet. The subsequent medium and fine filter media further reduce the concentration of suspended solids. Roughing filters are operated with small hydraulic loads - filtration velocity is usually about 0.3-1.5 m/h.
Runoff	The portion of precipitation that does not infiltrate the ground and runs overland.
Runoff Coefficient	The assignment of the runoff coefficient (C) is somewhat subjective. At the time the runoff producing rainfall occurs, the coefficient varies with topography, land use, vegetal cover, soil type and moisture content of the soil. In selecting the runoff coefficient, consider the future characteristics of the watershed. If land use varies within a watershed, you must consider watershed segments individually, and you can calculate a weighted runoff coefficient value.
Safe Water	Water that is safe to drink, in general potable water, or water that is treated at the Point of Use (POU), is commonly referred to as safe water.
Sand Dam	A sand dam is a small dam built on and into the riverbed of a seasonal sand river. Its purpose is to capture and store water beneath sand: sand is transported during periods of high flow and accumulates upstream of a sand dam, resulting in additional groundwater storage capacity of riverbed and –banks. This reservoir fills during the wet season, providing water to cover dry periods.
Sand River	Dry and sandy riverbeds are seasonal watercourses that transport runoff-water from catchment areas to rivers or swamps once or several times a year. Dry riverbeds are also called ephemeral streambeds, seasonal watercourses or sand rivers. Most of the rainwater that is being transported downstream in riverbeds occurs as floods of several meters height. Sand rivers are only suitable as sand dams if coarse sand is available and the river is bedded on impervious bedrock (or clay like black cotton soil).
Sanitation	The means of safely collecting and hygienically disposing of excreta and liquid wastes for the protection of public health and the preservation of the quality of public water bodies and, more generally, of the environment. See also environmental sanitation.
Sanitation System	Sanitation is as a multi-step process in which human excreta and wastewater are managed from the point of generation to the point of use or ultimate disposal. A Sanitation System is a context-specific series of technologies and services for the management of these wastes (or resources), i.e., for their collection, containment, transport, transformation, utilisation or disposal. A sanitation system is comprised of Products (i.e. waste, organic wastewater, excreta, blackwater, greywater, etc.) that travel through functional groups, which contain Technologies that can be selected according to the context. By selecting a Technology for each Product from each applicable Functional Group, one can design a logical Sanitation System. A sanitation system also includes the management, operation and maintenance (O&M) required to ensure that the system functions safely and sustainably.
Sanitised	Hygienised describes any wastewater product (e.g. faeces, blackwater etc.) that has undergone a transformation which turns it into a hygienically safe product for handling, reuse or disposal.
Screening	Screening is a wastewater pre-treatment, which aims to prevent coarse solids, such as plastics, rags and other trash, from entering a sewage system or treatment plant. Solids get trapped by inclined screens or bar racks. The spacing between the bars usually is 15 to 40 mm, depending on cleaning patterns. Screens can be cleaned by hand or mechanically raked. The latter allows for a more frequent solids removal and, correspondingly, a smaller design.
Scum	Scum is the general name given to the floating layer of dirt or froth on the surface of a liquid. It is also used to describe the layer of solids formed by wastewater constituents that float to the surface of a tank or reactor (e.g., oil and grease).
Secondary Disinfection	The application of a disinfectant, either at the exit of the treatment plant or in the distribution system, with the objective of ensuring that a disinfectant residual is present throughout the distribution system, thus preventing recontamination of water.
Secondary Treatment	Follows primary treatment to achieve the removal of biodegradable organic matter and suspended solids from wastewater effluent. Nutrient removal (e.g., phosphorus) and disinfection can be included in the definition of secondary treatment or tertiary treatment, depending on the configuration.
Sedimentation	Gravity settling of particles in a liquid such that they accumulate. It is one of the most basic water treatments for both drinking water and wastewater.
Sedimentation / Thickening Ponds	Sedimentation or thickening ponds are settling ponds that allow sludge to thicken and dewater. The effluent is removed and treated, while the thickened sludge can be further treated in a subsequent technology.
Semipermeable	Allowing passage of certain, especially small, molecules or ions but acting as a barrier to others. Use of biological and synthetic membranes.
Separate Sewers	Separate sewerage consists in the separate collection of municipal wastewaters (blackwater from toilets, greywater and industrial wastewater) and surface run-off (rainwater and stormwater). The separate collection prevent the overflow of sewer systems and treatment stations during rainy periods and the mixing of the relatively little polluted surface run-off with chemical and microbial pollutants from the municipal wastewater. The design of the sewers and the (semi-) centralised treatment stations thus needs to consider the volume of the wastewater only and the surface run-off and rainwater can be reused (e.g. for landscaping or agriculture) after a simplified treatment.
Septic Tank	A septic tank is a watertight chamber made of concrete, fibreglass, PVC or plastic, through which blackwater and greywater flows for primary treatment. Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate.
Sewage	Waste matter that is transported through the sewer. It contains generally excreta (urine or faeces) and water (blackwater), grey water and may also contain other wastes (e.g. kitchen waste).
Sewer	An open channel or closed pipe used to convey sewage.

Shadouf	The simplest and cheapest method of lifting groundwater from an open dug well or surface water source is by means of a rope and a bucket. The job of drawing water from the well can be made easier by adding a "windlass" (a horizontal cylinder with a winch which can be turned to raise the bucket on a rope) or a "Shadouf" (an upright frame with a long pole suspended on top with the bucket hanging from one end and a weight which serves as the counterpoise of a lever at the other). The basic Shadouf consists of a rope, pole, bucket and counterweight and is capable of lifting water up to 4 metres. The counterweight can be just a heavy rock, however, in the more advanced picottah design, one person guides the bucket while the other acts as a moving counterweight. The Shadouf is generally used for lifting water from unlined wells, streams or ponds for irrigating small fields. Approximately 60 litres/min can be lifted from a depth of 2 to 3 metres. **Advantages** ● A relatively inexpensive traditional technology, which can be locally made and maintained. ● Easy to operate ● Relatively efficient (30-60%) **Disadvantages** ● Limited to lifts of less than 4 metres ● Limited water yield, 60 l/min suitable for small fields
Shallow Dug Well	Shallow dug wells usually are dug wells up to 5 metres in depth. Construction is fast and easy but the wells are likely to get contaminated.
Shallow Well	A shallow well is a hand-dug water well ranging up to 7m in depth and about 1.5m in diameter.
Simplified Sewer	A simplified sewer describes a sewerage network that is constructed using smaller diameter pipes laid at a shallower depth and at a flatter gradient than conventional sewers. The simplified sewer allows for a more flexible design at lower costs.
Single Pit	The single pit is one of the most widely used sanitation technologies. Excreta, along with anal cleansing materials (water or solids) are deposited into a pit. Lining the pit prevents it from collapsing and provides support to the superstructure. A single pit latrine consists of a toilet superstructures and a single pit to be filled up, emptied and filled up again. To improve pit latrines, aeration or an additional pit can be added (see single VIP, double VIP or double pit latrine).
Siphon	A siphon is instrument, usually in the form of a tube bent to form two legs of unequal length, for conveying liquid over the edge of a vessel and delivering it at a lower level. Siphons may be of any size; they are used in civil engineering to transfer water or other fluids over elevations. The action depends upon the influence of gravity (not, as sometimes thought, on the difference in atmospheric pressure—a siphon will work in a vacuum) and upon the cohesive forces that prevent the columns of liquid in the legs of the siphon from breaking under their own weight. Water has been lifted more than 35 feet (11 m) by a siphon.
Slow Sand Filter	Slow sand filtration is a biological, physical and chemical purification process. As the water flows through a porous filter-bed, its quality improves considerably by reduction of the number of micro-organisms, viruses, protozoa, turbidity, heavy metals, organic matter, iron and arsenic.
Sludge	Sludge is a mixture of solids and liquids, containing mostly excreta and water, in combination with sand, grit, metals, trash and/or various chemical compounds. A distinction can be made between faecal sludge and wastewater sludge. Faecal sludge comes from onsite sanitation technologies, i.e., it has not been transported through a sewer. It can be raw or partially digested, a slurry or semisolid, and results from the collection and storage/treatment of excreta or blackwater, with or without greywater. For a more detailed characterization of faecal sludge refer to Strande et al., 2014. Wastewater sludge (also referred to as sewage Sludge) is sludge that originates from sewer-based wastewater collection and (semi-) centralized treatment processes. The sludge composition will determine the type of treatment that is required and the end-use possibilities.
Sludge Thickening	Sludge thickening consists in the separation of solids and liquids in order to process each separately (e.g. composting for the solid and waste stabilisation ponds or infiltration for the liquid). It can be done in thickening ponds (settling tanks or sedimentation ponds) or planted and unplanted drying beds.
Sludge Treatment	Sludge treatment describes the processes used to manage and dispose of the sludges produced from human excreta or from the treatment of wastewater.
Sludge Treatment Facility	This is a drying bed system of the sludge from a septic tank. The sludge is allowed to dry after mixing with lime, fly fly ash/charcoal, sawdust, corncobs plus the indigenous microorganisms.
Sludge Volume Index	Sludge Volume Index (SVI) is a very important indicator that determines your control or rate of desludging on how much sludge is to be returned to the aeration basin and how much to take it out from the system. It actually serves as a very important empirical measurement that can be used as a guide to maintain sufficient concentration of activated sludge in the aeration basin whereby too much or too little can be considered detrimental to the system's overall health.
Soak Pit	A soak pit, also known as a soakaway or leach pit, is a covered, porous-walled chamber that allows water to slowly soak into the ground. Pre-settled effluent from a collection and storage/treatment or (Semi-) centralized treatment technology is discharged to the underground chamber from which it infiltrates into the surrounding soil.
Soil Aquifer Treatment	Soil Aquifer Treatment is an artificial groundwater recharge method. Water is introduced into the groundwater under controlled conditions via soil percolation. Soil aquifer treatment is either used to artificially augment the groundwater level in order to withdraw freshwater at a later stage or as a barrier to prevent saltwater or contaminants from entering the aquifer. During percolation, soil filtration occurs and the water remains some time in the aquifer where mixing and may some other physical and chemical reaction occur, so it can be used as reclaimed water (treated blackwater) or relatively little polluted water (e.g. pre-treated greywater or stormwater).
Soil Compaction	Compaction resulting from heavy vehicles putting strong pressure on the soil and reduceing pore volume. Consequently, oxygen and water are squeezed out and can hardly infiltrate again.
Soil Solarisation	Soil solarisation is a non-pesticidal method of controlling soilborne pests by placing plastic sheets on moist soil during periods of high ambient temperature. The plastic sheets allow the sun's radiant energy to be trapped in the soil, heating the upper levels. Solarisation during the hot summer months can increase soil temperature to levels that kill many disease-causing organisms (pathogens), nematodes, and weed seed and seedlings. It leaves no toxic residues and can be easily used on a small or large scale. Soil solarisation also improves soil structure and increases the availability of nitrogen (N) and other essential plant nutrients.
Solar Pasteurisation	Solar pasteurisation is the process of pasteurisation using solely solar thermal energy. It is mostly applied for water. It is applied by using a solar cooker that can absorb solar thermal energy and transmit it to a black container e.g. a black jar. Typically, the significant time of heating by solar heat and cooling down contributes to the pasteurisation process. Applied to water, the solar pasteurisation (heating to 60°C (140°F)) can inactivate both bacteria and rotaviruses, the main causes for severe diarrhea in children.
Solar Water Disinfection	Solar water disinfection - the SODIS method - is a simple procedure to disinfect drinking water. Contaminated water is filled in a transparent PET-bottle or glass bottle and exposed to the sun for 6 hours. During this time, the UV-radiation of the sun kills diarrhoea generating pathogens.
Solid Waste	Solid waste refers to the products that are thrown away by households, agriculture and industry because they do not assign any value to the material anymore. It is generally classified into organic waste, which can be used for the production of biogas or compost; or non-organic waste which either can be recycled as a material (e.g. PET) or, if there is no possibility for recycling anymore, needs to be incinerated and disposed off.

Spate Irrigation	Spate irrigation diverts seasonal flood water from valleys, rivers, riverbeds and gullies onto farm land situated at lower elevation than the origin of the flood water. In sandy riverbeds flood water seeps into the voids between sand particles pushing air to the surface where it forms thousands of air bubbles making the floodwater appear to be boiling.
Spring	When groundwater makes its way to the earth's surface and emerges as small water holes or wet spots, this feature is referred to as a spring.
Spring Catchment Area	The spring catchment area is divided into immediate catchment area and the enlarged catchment area. The immediate catchment area is where human activity is not allowed. It is defined by a watershed specialist and should be fenced off immediately. The enlarged catchment area extends further beyond the immediate catchment area. Here some form of human activity may be allowed with the advice of a watershed specialist.
Stored Urine	Stored Urine is Urine that has been hydrolysed naturally over time, i.e., the urea has been converted by enzymes into ammonia and bicarbonate. Stored Urine has a pH of approximately 9. Most pathogens cannot survive at this pH. After 6 months of storage, the risk of pathogen transmission is considerably reduced.
Stormwater	Stormwater is the general term for the rainfall runoff collected from roofs, roads and other surfaces before flowing towards low-lying land. It is the portion of rainfall that does not infiltrate into the soil.
Stream Erosion	Valley or stream erosion occurs with continued water flow along a linear feature. The erosion is both downward, deepening the valley, and head ward, extending the valley into the hillside. In the earliest stage of stream erosion, the erosive activity is dominantly vertical, the valleys have a typical V cross-section and the stream gradient is relatively steep. When some base level is reached, the erosive activity switches to lateral erosion, which widens the valley floor and creates a narrow floodplain. The stream gradient becomes nearly flat, and lateral deposition of sediments becomes important as the stream meanders across the valley floor. In all stages of stream erosion, by far the most erosion occurs during times of flood, when more and faster-moving water is available to carry a larger sediment load. In such processes, it is not the water alone that erodes: suspended abrasive particles, pebbles and boulders can also act erosively as they traverse a surface.
Subsurface Groundwater Recharge	Subsurface groundwater recharge conveys water directly into an aquifer without the filtration or oxidation that occurs when water percolates naturally through an unsaturated zone.
Subsurface Irrigation	Subsurface drip irrigation is a variation of the conventional surface drip irrigation. The laterals are buried in a depth below the soil surface depending mostly on the tillage practices and the crop to be irrigated. It is using water more efficiently than traditional irrigation techniques like surface irrigation by minimising evaporation.
Sullage	A historical term for greywater.
Supernatant	The liquid lying above a solid residue after settling, sedimentation, or other processes.
Surface Disposal and Storage	Surface disposal refers to the stockpiling of sludge, faeces or other materials that cannot be used elsewhere. Once the material has been taken to a surface disposal site, it is not used later. Storage refers to temporary stockpiling. It can be done when there is no immediate need for the material and a future use is anticipated, or when further hygienization and drying is desired before application.
Surface Groundwater Recharge	Artificial surface groundwater recharge refers to different groundwater recharge techniques that release effluent from above the ground into the groundwater aquifer via soil percolation.
Surface Irrigation	Surface irrigation is an umbrella term for irrigation methods (the three most common methods are: basin, border and furrow) in which water is distributed by gravity over the surface of a field.
Surface Water	A natural or man-made water body that appears on the surface, such as a stream, river, lake, pond, or reservoir. Surface water, unlike groundwater is generally of bad quality and need treatment before human consumption because it accumulates pathogens, metals, nutrients and chemicals as it flows across contaminated surfaces.
Surfactants	Organic compounds with a hydrophilic (attracted by water) head and a hydrophobic (repelled by water) end. Surfactants reduce the surface tension of water by adsorbing at the air-water interface. They also reduce the interfacial tension between oil and water by adsorbing at the liquid-liquid interface. Surfactants are the main components of cleaning products.
Tertiary Treatment	Follows secondary treatment to achieve enhanced removal of residual suspended solids and other pollutants from effluent. Nutrient removal (e.g., phosphorus) and disinfection can be included in the definition of secondary treatment or tertiary treatment, depending on the configuration.
Thermophilic Composting	Composting is possible at high temperatures (thermophilic composting) and at low temperatures (ambient or mesophilic composting). Thermophilic composting is faster and more efficient to inactivate pathogens, but it requires specific optimal conditions to take place (moisture content of 50 to 60 %, C/N ratio of 30 to 35) and can therefore be difficult to manage.
Toilet	Toilets are sanitation facilities at the user interface that allow the safe and convenient urination and defecation. Toilets can be combined with onsite storage and/or treatment and are then referred to as toilet systems such pit latrines, VIPs, UDDTs, composting toilet systems or terra preta toilet systems.
Total Dissolved Solid	The total dissolved solids is the content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular (colloidal) suspended form. Generally the operational definition is that the solids must be small enough to survive filtration through a sieve the size of two micrometers.
Total Solid	The residue that remains after filtering a water or sludge sample and drying it at 105°C (expressed in mg/L). It is the sum of Total Dissolved Solids (TDS) and Total Suspended Solids (TSS).
Total Suspended Solid	The total suspended solids correspond to the total solid particulate matter contained in water. They are generally removed by sedimentation and settling or floating. Suspended solids can lead to the development of sludge deposits and anaerobic conditions if untreated wastewater is discharged into the aquatic environment.
Total Volatile Solid	Total volatile solids are those solids that can volatise and be burned off when the total solids are ignited (500 +/- 50 °C).
Toxins	Toxins are substances that can harm aquatic and human life. They are created by a wide variety of human practices and products like heavy metals, pesticides and organic compounds like PCB's.
Transpiration	Water loss of the plant to the atmosphere through the plants stoma.
Treated Water	Water that has been chemically or biological polluted, but after having been treated is now safe to be reused or discharged to the environment.
Trench Latrine	Excreta disposal system especially suited for emergency situations. Shallow or deep trench latrines (from 15 to 200cm) are pit latrines with trenches instead of slabs and superstructure. They can be arranged as simple trench latrines or as multiple trench latrines. In the latter case they are an improvement of an open defecation field. They should be at a distance of 15-30m from any groundwater source and the bottom of any latrine at least 1.5m above the water table. Latrines should be backfilled when full to within 0.2m from the slab.

Trickling Filter	A trickling filter is a fixed-bed, biological reactor that operates under (mostly) aerobic conditions. Pre-settled wastewater is continuously 'trickled' or sprayed over the filter made out of rocks, gravel, plastic modules. As the water migrates through the pores of the filter, organics are degraded by the biofilm covering the filter material.
Trihalomethane (THM)	THMs are chemical compounds in which three of the four hydrogen atoms of methane (CH4) are replaced by halogen atoms. They are environmental pollutants and are known to be carcinogenic. Disinfection of drinking water with chlorine can cause the formation of THM if organic matter (THM precursors) is present. See also DBPs.
Turbidity	Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates.
Ultra Violet Radiation	Ultraviolet radiation spans wavelengths from about 10 nm to 400 nm and is an important component of sunlight although the ozone layer prevents much of it from reaching the earth's surface. It is seperated in UV-A, UV-B and UV-C light. UV-C and UV-B light have a damaging effect on DNA and can therefore act as a desinfectant (killing microbes) or cause skin cancer and genetic mutation.
Ultrafiltration	A kind of low-pressure membrane filtration process in which hydrostatic pressure forces a liquid against a semipermeable membrane. Suspended solids and solutes of high molecular weight are retained, while water and low molecular weight solutes pass through the membrane (typically with a pore size of l 0.1–to 0.01 micrometres).
Unplanted Drying Beds	An unplanted drying bed is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates. The sludge, however, is not effectively stabilized or sanitized. Unplanted drying beds need to be desludged regularly. The percolate or leachate needs to be collected and treated before reuse or disposal. See also planted drying beds.
Unsaturated Zone	The unsaturated zone is the portion of the subsurface above the groundwater table. The soil and rock in this zone contains air as well as water in its pores. In some places the unsaturated zone is absent, as is common where there are lakes and marshes, and in some places it is hundreds of meters thick, as is common in arid regions. Hydrologically, the unsaturated zone is often the main factor controlling water movement from the land surface to the aquifer. Flow rates and chemical reactions in the unsaturated zone control whether, where, and how fast contaminants enter groundwater supplies.
Urea	The organic molecule (NH2)2CO that is excreted in urine and that contains the nutrient nitrogen. Over time, urea breaks down into carbon dioxide and ammonium, which is readily used by organisms in soil.
Urinal	A urinal is used only for collecting urine. Urinals are generally for men, although models for women have also been developed. Most urinals use water for flushing, but waterless urinals are becoming increasingly popular.
Urine	Urine is the liquid produced by the body to rid itself of urea and other waste products. In this context, the urine product refers to pure urine that is not mixed with faeces or water. Depending on diet, human urine collected from one person during one year (approx. 300 to 550 L) contains 2 to 4 kg of nitrogen. With the exception of some rare cases, urine is sterile when it leaves the body.
Urine Diversion	Urine diversion devices collect urine separately from faeces and from water (or with minimal flush water). A urine diversion toilet has two outlets with two collection systems: one for urine and one for faeces in order to keep these two excreta or wastewater fractions separate.
Urine Storage	Urine storage is the simplest and cheapest way to hygienise separately collected urine in order to reuse it safely in agriculture. Urine is generally sterile but contains most of the plant nutrients excreted by humans. To hygienise urine, it is stored for one up to six or more month, depending on estimated risk of cross-contamination with faeces. The sanitising effect comes from a combination of the rise of pH (due to the transformation of urea to ammonium by the naturally present enzyme urease), the raise of temperature and time.
Urine Storage Tank	When urine cannot be used immediately or transported using a conveyance technology (e.g. jerrycans), it can be stored onsite in containers or tanks. The storage tank must then be moved or emptied into another container for transport.
UV-A Radiation	The longest ultraviolet radition, UV-A, lies within 315 and 400 nm. Most of it passes through the atmosphere and reaches the earth surface.
UV-B Radiation	Ultraviolet radiation within 280 and 315 nm. UV-B can be directly absorbed by DNA and is therefore carcinogenic and can kill microorganisms. Most of it in natural sunlight is filtred out by the ozone layer and only some few percent of the solar spectre contain UV-B.
UV-C Radiation	Ultraviolet radation within 100 and 280 nm. Almost all of UV-C light from the natural solar light is filtred out in the atmosphere.
Vault Composting Toilet	Composting toilet using an above vault as a composting chamber (e.g. continuous composting, concrete or brick double-vaults or movable containers).
Vector	An organism (most commonly an insect) that transmits a disease to a host. For example, flies are vectors as they can carry and transmit pathogens from faeces to humans.
Ventilated Improved Pit	The single VIP is a ventilated improved pit. It is an improvement over the single pit because continuous airflow through the ventilation pipe vents odours and acts as a trap for flies as they escape towards the light.
Vermicomposting	Vermicomposting is the process of using earthworms to break down organic waste in order to create a faster than normal composting. The worm population is self regulating and will increase to the point where available food and space constrain further expansion. The process must be monitored for such parameters as moisture content and temperature but is not labor-intensive. Compared to ordinary soils, the earthworm castings (the material produced from the digestive tracts of worms) contain much more nitrogen (N), phosphorus (P) and potassium (K). They are rich in humic acids and improve the structure of the soil if used as a soil conditioner. The worms are placed in bedding made of loose materials such as coconut husk or shredded paper in a shallow box or tub and fed with soft organic matter such as kitchen waste. After about two months the compost can be harvested by putting the compost in the shape of a cone and scrapping of the top layers. The worms go to the bottom of the cone as they run away from light. Vermicomposting is a popular sustainable low-cost treatment for organic solid wastes (kitchen wastes, plant wastes). It is also applied to treat fecal matter, such as human excreta in the form of sewage sludge, sieved blackwater or faeces. Vermicomposting is also used to produce Terra Preta.
Vertical Flow Constructed Wetland	A vertical flow constructed wetland is a planted filter bed that is drained at the bottom. Wastewater is poured or dosed onto the surface from above using a mechanical dosing system. The water flows vertically down through the filter matrix to the bottom of the basin where it is collected in a drainage pipe. The important difference between a vertical and horizontal flow constructed wetland is not simply the direction of the flow path, but rather the aerobic conditions.
Vertical Garden	The term vertical garden refers to any kind of construction and support structure for growing plants in an upwards-directed, vertical way and thereby efficiently and productively making use of the existing space for food or other kind of plant production. A huge variety of different designs and concepts are available including greywater towers, green walls or living walls. The reuse of different composts (e.g. compost, vermicompost or terra preta) from household wastes and reclaimed water (e.g. greywater) or urine can be considered in vertical gardening allowing to enhance food production and to close the nutrient and water cycle at a local level.

Viredox	The Vyredox method for water purification was developed in Finland and is now also used in Sweden and some other countries. It oxidises the ferrous ion, which is soluble in water, to the ferric ion, which is insoluble, before the water enters the well.
Wadi	A valley, gully, or streambed in northern Africa and southwest Asia that remains dry except during the rainy season. Wadis are often used for spate irrigation.
Waste Stabilisation Pond	Waste stabilisation ponds are large, manmade water bodies used for the treatment of wastewater by the means of naturally occurring processes, such as solar light, wind, and microbial activity. There are three types of ponds, anaerobic ponds, facultative ponds and aerobic or maturation ponds, each with different treatment and design characteristics. The ponds can be used individually, or linked in a series for improved wastewater treatment. Investment and operation costs are relatively low, but large surface areas far from housings are required.
Wastewater	Used water from any combination of domestic, industrial, commercial or agricultural activities, surface runoff/stormwater, and any sewer inflow/infiltration. Wastewater from sanitation contains one or more of the following products: excreta, faeces, urine, blackwater, brownwater, flushwater, dry cleansing material, cleansing water.
Wastewater Collection	In order to facilitate treatment and reuse of wastewater, it has to be collected. Wastewater can either be collected in a centralised sewer system, or, in the absence of this, with a system of human-powered or mechanised vehicles (cartage).
Wastewater Reuse at Home	This is the title of the factsheet that describes the various ways that wastewater reuse can be practiced at the household level. Water use optimisation means resistance to chronic and short-term water scarcity and cost and energy savings for water supply and wastewater treatment as less water is required and less polluted water produced. Besides installing water saving appliances, source separation and reuse of different types of wastewater is a way to optimise water use at home. Depending on the type, quality and quantity of water, wastewater can either be reused directly, or treated and reused (recycled).
Wastewater Treatment	Wastewater treatment means the treatment of wastewater and related products (e.g. blackwater, faecal sludge, greywater, non-biodegradable waters, etc.) for safe reuse or disposal in order to minimise health risks for people and protect the environment from pollution.
WATA technology	The WATA technology allows the local production of sodium hypochlorite (active chlorine) for water treatment and disinfection purposes. Antenna Foundation developed a range of devices, suitable for the production of various volumes to serve a variety of implementation needs.
Water Footprint	The water footprint expresses human appropriation of freshwater in volume terms. It counts the direct and indirect freshwater (blue water, grey water and green water) used to produce a product, but can also be applied to consumers, companies, nations, areas. It can be used as an indicator that provides information on the volume, location, time and source of water used and can be compared to water availability at the affected water bodies in order to assess risk of water scarcity and pollution.
Water Use	Quantitatively, this is 50 litres of water per day.
Water Pasteurisation Indicator	A Water Pasteurisation Indicator (WAPI) is a simple thermometer that indicates when water has reached pasteurisation temperature and is safe to drink. It consists of a small polycarbonate tube that contains a soybean wax that melts when water or milk is heated enough to be pasteurised (65˚C/149˚F). Since water pasteurises at temperatures well below its boiling point, WAPIs save time and fuel.
Water Purification	Water purification describes a process during which contaminants such as organic material, pathogens or chemical substances are removed from raw water. Water purification can either denominate the process of making water safe for human consumption, but the term is also used for other cleansing processes to make water suitable for e.g. industrial or agricultural uses. Water purification includes physical processes such as filtration or sedimentation, or chemical processes such as chlorination or use of sunlight which contains ultraviolet light.
Water Risk Map	A Water Risk Map gives an overview of the water risk in a geographic area with regard to for example baseline water stress, seasonal variability, drought severity, groundwater stress and flood occurrence. Various Water Risk Maps are open source available online.
Water Sources	This term denominates the different sources of water, including shallow or deep groundwater, precipitation, surface water, or desalinised seawater. Preserving existing water sources (e.g. through moisture control techniques or water-saving technologies in households, industry and agriculture), resulting in a decreased water use, can also be considered part of water sources, as water saved becomes available for other purposes.
Water Table	The level below the earth's surface, which is saturated with water. It corresponds to the level where water is found when a hole is dug or drilled. A groundwater table is not static and can vary by season, year or usage.
Water Use	This term denominates the consumption of water for different purposes, without which no life would be possible on earth. Water use is generally divided into household use, industrial and commercial use, and agricultural use.
Water Use Efficiency	Water use efficiency includes any measure that reduces the amount of water used per unit of any given activity, consistent with the maintenance or enhancement of water quality. Generally, efficient water use is defined as the ratio between the actual volume of water used for a specific purpose and the volume extracted or derived from a supply source for that same purpose.
Water-borne Diseases	Water-related diseases include: those due to micro-organisms and chemicals in water people drink; diseases like schistosomiasis which have part of their lifecycle in water; diseases like malaria with water-related vectors; drowning and some injuries; others such as legionellosis carried by aerosols containing certain micro-organisms.
Waterless Urinal	Waterless urinals function without water. They have two important advantages compared to flush urinals: They save water and they allow the collection of undiluted urine, which is a valuable resource as fertiliser in agriculture.
Well Casing	Casing used in boreholes is tubular material that provides support to the walls of the borehole and may be either temporary (used by the driller during drilling of the borehole and subsequently withdrawn) or permanent (forming part of the final construction of the completed borehole). Selection of casing material should be based upon water quality, borehole depth and diameter, drilling methods, local regulations and cost.
Well Development	All drilling methods alter the hydraulic characteristics of formation materials in the vicinity of the borehole. Development of a borehole after completion of drilling forms part of the normal drilling procedure. Development procedures are designed to restore or improve these characteristics to maximise the performance of the borehole by improving specific capacity and hydraulic efficiency. Well development methods include: overpumping, surging, jetting, hydro-fracturing, and other supplementary development methods.
Well Rehabilitation	Well rehabilitation of dug or drilled wells becomes necessary if operating wells lack in providing adequate water quality or quantity as the well becomes contaminated or clogged through natural processes or in consequence of emergencies (e.g. floods, seawater intrusion, etc.). It involves the cleaning and disinfection of the well and sometimes the application of well development procedures.
Well Remediation	The term well remediation is used in the oil industry. It refers to the cleaning of oil wells to improve performance and requires utterly different methods than the rehabilitation of water wells.

Well Screen	A well screen is a filtering device that allows groundwater to enter the well. It provides structural support but prevents sediment from entering, especially in unconsolidated strata. Proper screen design and selection is important for the hydraulic efficiency of the well, as well as for the longevity and long-term cost of the structure. Screens should have maximum open area to create minimum resistance to flow into the hole, but at the same time must minimise sediment ingress and provide adequate structural strength. Optimising each of these criteria for a particular well is the essence of screen design.
Wet Well	Sewage is fed into and stored in an underground pit, commonly known as a wet well. The well is equipped with electrical instrumentation to detect the level of sewage present. When the sewage level rises to a predetermined point, a pump will be started to lift the sewage upwards.
Yellow Water	Yellowwater refers to urine mixed with flushing water.

Weapons

Meteorology

NOAA	National Oceanic and Atmospheric Administration - A mobile weather data collection and forecasting facility including personnel, which can be utilized within the incident area.
NWS	National Weather Service

Maintenance

Document updates, user tips, credits and FAQs

"Learning is a lifetime process, but there comes a time when we must stop adding and start updating."
Robert Breault

Introduction

This section is for logging content between versions to keep track of what's been done and what's left to do. It also contains known problems that need fixing in the future. Any modifications to this document are logged below as individual entries per category that was modified. Updates are logged for ease of seeing what's new in the document and when a certain section was added. Small fixes such as spelling, grammar, capitalisation etc are not documented.

Purpose	The aim of MAINTENANCE is to keep track of the content added to The Preparedness Encyclopedia and to help show readers the enormous amount of work it's taken to produce such a document.
Lost?	• For reader tips and information on using this guide, see the PRELUDE section. • For a list of the categories in this document, see the CONTENTS section.

Contents

1 Additional Reader Tips

These are additional reader tips to help anyone get the most out of reading this document. It also includes settings and fixes that might be beneficial while reading TPE on different programs and devices.

Headings

Headings are found everywhere in the guide and span vertically and horizontally so it's easier to see when you change sections.

Category Heading	The first type of heading is for the category, spanning the row from the "A" column and includes a "jump to top" button, and a percentage that section is complete. It is hashed for easier recognition. Example: Column "A" and the heading entitled 'PRELUDE' above is an example of a category heading.
Subcategory Heading	The second is the subcategory heading spanning the row from the "B" column. It splits the category down into smaller sections to assist in finding what you want easier. Example: Column "B" and the heading entitled 'Reader Tips' above is an example of a Subheading.

MAINTENANCE | Additional Reader Tips | Headings | Subheadings

Sub-Subcategory Heading	The third is the sub-subcategory heading spanning the row from the "C" column and takes on the same colour as it. Example: Column "C" and the heading entitled 'Headings' above is an example of a Sub-Subheading. The green heading above is an example of the Sub-Subcategory.

Sub-Sub-Subcategory Headings

Sub-Sub-Subcategory Heading	The fourth is the sub-sub-subcategory heading spanning the row from the "D" column and takes on the same colour as it. Example: Column "D" and the white heading above is an example of a Sub-Sub-Subcategory.

Additional Heading

Additional Heading	An additional subcategory (if required) is shown with colours matching that categories theme. This is only used if a section requires even more division such as the "GARDENING" section. Example: The heading entitled 'Additional Heading' above is an example of one.

2 Developer Tips

MAINTENANCE | Developer Tips

These are tips for working on the spreadsheet to make editing easier. They should only be used if you're editing the sheet otherwise they will have no impact so continue on to the CONTENTS section. The spreadsheet was made in Microsoft Excel 2010 and any other spreadsheet application (not the same version) will most likely skew the sheet. Unfortunately due to its size this sheet occasionally becomes corrupt while I'm working on it, so now I back it up to 3 places every iteration.

There are a few sections that require updating from time to time due to the information being prone to changing frequently. This information can be found by searching the following 'Update Marker' without the brackets or spaces: " ⁿ ". Cells with Red text to the right side of the column means it's a comment about that row and should be removed when it's resolved. I have also tested splitting the sheet into multiple tabs but there was no performance gain so I will leave it as one long sheet. It will also be more difficult to change sections on mobile devices if it's split in ~70 parts.

These are the recommended programs to edit TPE. Ordered by speed of running and editing the sheet.	**Pc (Editing)** 1. Microsoft Excel 2010 (The one I use) 2. Microsoft Excel 2007 3. Microsoft Excel 2013 4. Microsoft Excel 2016 (Laggy) 5. Google Sheets (Not as fast as Excel)	**Mobile Editing** ● Can't edit on mobile device without it taking an extremely long time to load. It may also crash randomly.	

Picture Quality	Picture quality is based on how much information it gives, detailed pictures are a bigger filesize and may take up multiple cells whereas simple pictures are 1-2kb. The largest ones can be found in the GEOGRAPHY section under "World Map" and can be deleted to save about 3Mb. 'Almost' all pictures are all compressed to save space.
Laggy Characters	The accented character "é" when used in the vertical columns causes extreme lag. This likely applies to other accented characters as well.
Widths	Column widths are 25 units and default row widths are 16.5 units.
Searching for New Line Characters	Use Ctrl + J to add a new line in the Excel search box.
Fix Vertical Text	General + Distributed + No Wrap + 90° This re-aligns the columns vertical text so it's centred and in the middle of the cell.
(Excel) Disable Double Click Jump	File > Options > Advanced > Untick "Enable fill handle and cell drag and drop" Stops the teleporting that happens when you double click between cells.
Backups	Use the "Always Create Backup" Option when saving. This just creates a backup file in case it becomes corrupted.
Hiding Excess Cells	Select Cell/Column > HOLD Shift + Tap End + Tap Arrow > Right Click > "Hide" Hides columns and rows which aren't used.
RAM Overload Problem	At all costs when pasting data into row "R" make sure the entire hidden row isn't selected. **Symptom:** When creating new rows the sheet may crash or lag and the RAM jumps into the gigabytes instantly. **Fix:** Unhide all hidden columns and delete the infinite rows of text.
Jump To Top	When reading the Excel version: Use the up arrow to the left of each heading title to jump to the top of the sheet. To reach an arrow quickly, select the "A" vertical column and press the up or down arrow.
Jumping Categories	Jump up and down categories, subcategories and sub subcategories (in Excel) by selecting the merged cell to the far left and pressing the up or down arrow to jump to the next one (Pc only). The further the column to the left, the faster you jump sections.
Content Limits	No informational text will go beyond column "Q" giving 11 cells working space per row plus the header row "E".
Column Height Fixers	Column "R" contains numbers which maintain a minimum column height so all the text is readable if some cells in that row are merged.
Row Visibility	At 100% zoom all rows up to "M" should be visible on a 1080p screen for ease of reading. Up to row "Q" on 1440p." Up to row "Z" on 4K.
Cell Border Colour	The cell border colour in "Theme Colours" is the last grey color on the first row. Otherwise it is colour: R: 128, G:128, B:128.
Text Indents	● Rows that touch column "D" have 2 indents. ● Rows that are further inside the guide have 1 indent. ● Other rows may be determined on a case by case basis.

Developer Settings

Change Units to Cm	Start > Excel Options > Advanced > Display > Ruler Units
Cell Shading / Pattern	Ctrl + 1 to access cell shading options.

Cell Alignment	Quotes (") at the start of a cell aligns the text to the right side. Therefore use a ^ symbol before it to center it or a ' to align it left.
Excel Version Bolding	There's a problem when editing the document in different excel versions where the " symbols are exchanged for '. This causes cell font to be bolded when edited and the ' symbol has to be removed.
Add Developer Mode	"Start > Excel Options > Customize Ribbon > Developer" Unlocks a few extra features you can use.
Jumping to Top	"Start > Excel Options > Advanced > Lotus Compatibility > Tick Transition Navigation Keys" This puts the hyperlink at the top of the page when jumping sections.
Expand Button Location	"Data Tab > Outline Setting Corner Button > Untick "Summary rows below detail" This puts the groupings button at the top of the selection instead of the bottom.
Cell Widths	Col A-D/F/R Widths: 3 Col E/G-Q Widths: 25 1 Row Width: 16.5 2 Row Width: 27
Reading Font	Best read in the "Century Gothic Bold" font. Fonts in "Entertainment" may vary due to requirements. Typical font size is 10pt. The header font is: "Bookman Old Style".
Heading Sizes & (Row Height)	● Category Heading (A): (3+25+2) Heading: 120pt, Description: 30pt, Quote: 20pt ● Column B: 80pt (8) ● Column C: 60pt (6) ● Column D: 40pt (4) ● Column E: 30pt (3)

Cell Supporter Update Table
The supporter cell is the "Q" column and maintains the height of any merged cells. This table shows the difference between the font size 10 (Old Format) and the font size 20 (New Format). By updating the font size it will take fewer key presses to update the height, albeit with less control over the height of the row. To convert to the new system, open up replace (Ctrl + F), hit Options and tick the "Match entire cell contents" button then search for the numbers in the table below from biggest to smallest, replacing them with the "New Format" value. To Search multiple rows use the (Ctrl + J) shortcut to add a new line. Once they are all done you can resize the text in column "R" to 20 rather than 10. To add the ^ symbol as a prefix to rows, set the font format in the Find and Replace window to 'center'.

Text Lines	Old Format	New Format
	1	1
	2	1
	3	2
	4	2
1	5	3
	6	3
2	7	4
	8	4
3	9	5
	10	5
4	11	6
	12	6
5	13	7
	14	7
6	15	8
	16	8
7	17	9
	18	9
8	19	10
	20	10
9	21	11
	22	11
10	23	12
	24	12
11	25	13
	26	13
12	27	14
	28	14
13	29	15
14	30	16
15	30 (Max)	16 (Max)

Heading	Starting Marker	Height	Marker Meaning
Heading 1 Height	None"	2x30, 1x20	
Heading 2 Height	H21	10	H = Heading
Heading 3 Height	H31	7	H = Heading
Heading 4 Height	H41	5	H = Heading
Heading 5 Height	H51	4	H = Heading

Heading Tests

Below are some sample heading tests from the water category to get the sizing right.

EXAMPLE (13)

Heading 1 (80)

An example category to test for heading size (40)

"Few things are harder to put up with
than the annoyance of a good example."
Mark Twain (30)

Lv2 Heading B (100 fnt - 10h)

Example text.

Lv3 Heading C (70 fnt - 7h)

Example text.

Lv4 Heading D (50 fnt - 5h)

Example text.

Lv5 Heading E (40 fnt - 4h)

Example text.

Category Statistics

This section displays the statistics for the categories found in this guide. These statistics are used in formulas throughout this sheet, so don't delete them if you're using the Excel version. They are ordered by order of appearance within the document.

Category Name	Order	Row Start	Completion %	Rows			Approx Page Count	Sub-Headings		
Prelude	1	12	100	35			1	1		
Contents	2	47	100	109			5	2		
Introduction	3	156	80	193			8	9		
Preparedness	4	349	75	892			38	12		
Gear	5	1,241	92	1427			61	7		
Survival	6	2,668	62	1175			50	11		
Water	7	3,843	100	927			39	9		
Food	8	4,770	85	825			35	5		
Field Dressing	9	5,595	10	119			5	3		
Cooking	10	5,714	47	345			15	6		
Recipes	11	6,059	42	646			27	4		
Fire	12	6,705	88	385			16	8		
Shelter	13	7,090	80	572			24	11		
Electricity	14	7,662	88	751			32	13		
Fuel	15	8,413	76	449			19	4		
Light	16	8,862	94	320			14	9		
Health	17	9,182	80	569			24	6		
Medical	18	9,751	95	639			27	6		
Medication	19	10,390	95	4235			180	18		
Illness	20	14,625	100	1816			77	7		
Injury	21	16,441	97	1682			72	10		
Emotional	22	18,123	95	194			8	12		
Natural Remedies	23	18,317	94	1296			55	4		
Meteorology	24	19,613	78	383			16	7		
Skills	25	19,996	71	762			32	14		
Crafting	26	20,758	25	670			28	11		
Knots	27	21,428	97	301			13	10		
Animals	28	21,729	55	747			32	3		
Hunting	29	22,476	7	112			5	15		
Fishing	30	22,588	85	215			9	4		
Gardening	31	22,803	71	2012			86	11		
Plants	32	24,815	90	222			9	9		

Category Name	Order	Row Start	Completion %	Rows			Approx Page Count	Sub-Headings		
Animal Husbandry	33	25,037	15	488			21	4		
Homesteading	34	25,525	32	510			22	13		
Population	35	26,035	35	312			13	12		
Leadership	36	26,347	20	177			8	4		
Economy	37	26,524	25	368			16	9		
Offence	38	26,892	12	272			12	15		
Defence	39	27,164	33	905			38	12		
Weapons	40	28,069	50	474			20	15		
Warfare	41	28,543	70	780			33	9		
Security	42	29,323	48	866			37	12		
Materials	43	30,189	71	863			37	11		
Communication	44	31,052	87	1097			47	7		
Language	45	32,149	68	1906			81	13		
Religion	46	34,055	99	479			20	9		
Entertainment	47	34,534	99	3998			170	10		
Transport	48	38,532	70	458			19	7		
Navigation	49	38,990	91	417			18	11		
Geography	50	39,407	95	1600			68	7		
Locations	51	41,007	95	578			25	6		
Natural Disasters	52	41,585	97	991			42	20		
Man-Made Disasters	53	42,576	77	999			42	9		
Personal Disasters	54	43,575	36	249			11	9		
Disaster Triggers	55	43,824	93	266			11	5		
Mass Destruction	56	44,090	98	349			15	6		
Addendum	57	44,439	75	3742			159	3		
Maintenance	58	48,181	100	619			26	8		
Category Name	Order	Row Start	Completion %	Rows			Approx Page Count	Sub-Headings		

Summaries

	Total Categories	Row	Completion %	Rows	Total Rows		Pages	Sub-Headings		
Totals	**58**	**48,800**	**71.5**	**48800**			**2073**	**507**		
Maximum	58	48,181	100	4235			180	20		
Minimum	1	12	7	35			1	1		
Average	29.5	21,722	71.5	841.2			35.7	8.7		

Percentage Complete

This section displays the completion percentage of each category which is moved up or down accordingly as it's updated. Once the guide is complete this section will be removed. The "Potential Categories" row is for sections it may be of benefit to add in a future update.

80-100% Complete

80-100%	ILLNESS 100%	MASS DESTRUCTION 98%	DISASTER TRIGGERS 93%	EMOTIONAL 95%	ENTERTAINMENT 99%	80-100%
	WATER 100%	KNOTS 97%	CONTENTS 100%	PRELUDE 100%	NATURAL DISASTERS 97%	
	PLANTS 90%	NAVIGATION 91%	COMMUNICATION 87%	GEOGRAPHY 95%	ELECTRICITY 88%	
	FISHING 85%	MAINTENANCE 100%	NATURAL REMEDIES 94%	HEALTH 80%	FIRE 88%	
	INJURY 97%	RELIGION 99%	LIGHT 94%	MEDICAL 95%	LOCATIONS 95%	
	MEDICATION 95%					

60-80% Complete

60-80%	FOOD 85%	PREPAREDNESS 75%	INTRODUCTION 80%	GARDENING 71%	WARFARE 70%	60-80%
	FUEL 76%	MATERIALS 71%	TRANSPORT 70%	GEAR 92%	METEOROLOGY 78%	
	MAN-MADE DISASTERS 77%	SKILLS 71%	LANGUAGE 68%	SHELTER 80%	SURVIVAL 62%	
	ADDENDUM 75%					

40-60% Complete

40-60%	WEAPONS 50%	HOMESTEADING 32%	RECIPES 42%	ANIMALS 55%	SECURITY 48%	40-60%
	COOKING 47%					

20-40% Complete

20-40%	PERSONAL DISASTERS 36%	CRAFTING 25%	ECONOMY 25%	POPULATION 35%	DEFENCE 33%	20-40%

0-20% Complete

0-20%	FIELD DRESSING 10%	HUNTING 7%	OFFENCE 12%	LEADERSHIP 20%	ANIMAL HUSBANDRY 15%	0-20%
Potential Categories	WELDING					

Alphabetical Categories

This is a list of all the categories in the guide in alphabetical order, mostly to help me copy and paste them easily but could also be used to see what types of categories there are at a glance. This is where the total number of categories is calculated.

58

ADDENDUM	ANIMAL HUSBANDRY	ANIMALS	COMMUNICATION	CONTENTS	COOKING	CRAFTING	DEFENCE	DISASTER TRIGGERS	ECONOMY	ELECTRICITY	EMOTIONAL
ENTERTAINMENT	FIELD DRESSING	FIRE	FISHING	FOOD	FUEL	GARDENING	GEAR	GEOGRAPHY	HEALTH	HOMESTEADING	HUNTING
ILLNESS	INJURY	INTRODUCTION	KNOTS	LANGUAGE	LEADERSHIP	LIGHT	LOCATIONS	MAINTENANCE	MAN-MADE DISASTERS	MASS DESTRUCTION	MATERIALS
MEDICAL	MEDICATION	METEOROLOGY	NATURAL DISASTERS	NATURAL REMEDIES	NAVIGATION		OFFENCE	PERSONAL DISASTERS	PLANTS	POPULATION	PRELUDE
PREPAREDNESS	RECIPES	RELIGION	SHELTER	SKILLS	SECURITY	SURVIVAL	TRANSPORT	WARFARE	WATER	WEAPONS	

Rendering

PDF Rendering
These are the guidelines on rendering the guide as a PDF document to maximise the sheet and so the page numbers line up each version. These settings are accessed in the "Page Layout" menu and the "Margins > Custom Margins" menu.

Rendering - 'Page'
- Print Entire Workbook
- Orientation = Portrait
- Scaling = Fit All Columns to One Page Width
- Height = Automatic
- Size = A4 Page
- Print Quality = 1200 dpi

Rendering - 'Margin'
- Top Margin = 0.6
- Bottom Margin = 0.6
- Left Margin = 0.6
- Right Margin = 0.6
- Header = 0
- Footer = 0

Rendering - 'Footer'
- Left = "The Preparedness Encyclopedia - Version 0.0.0"
- Centre = "Page &[Page]"
- Right = "By Fluidic Ice - www.fluidicice.com/TPE"
- Untick - Align with Page Margins
- Gridlines - View
- Headings - View

Rendering - 'Sheet'
- Print Area = $A$1:$R$20431 (Change number to the max row count - if it isn't already)
- Gridlines - View
- Headings - View

Page Breaks
Page breaks have been added to the top of each category to start it on a new page. Some additional page breaks have been added to assist in the readibility of critical sections such as the eastern world map in the GEOGRAPHY section.

Page Breaks
- Category Start
- Eastern World Map

Other Page Breaks
-

If a page break hasn't been manually defined it will be automatically generated. Manual page breaks have longer dotted lines compared to the shorter dotted lines for automatic ones.

Unwanted Content - Search Values
The following items are used to find unwanted content in the spreadsheet.

- [1] to [500]
- [clarification needed]
-
- <nb>
- [citation needed]

- [vague]
- [specify]
- "Queensland"

Developer Excel Limitations
Excel Limitations to keep in mind.

Max Rows	Max Columns	Max Column Width	Max Row Height	Max Page Breaks	Max characters in a cell	Maximum number of line feeds per cell	Sheets in a workbook	Colors in a workbook	Undo Levels
1,048,576	16,384	255 characters	409 points	1,026	32,767	253	Limited by available memory (default is 3)	16 million colors	100

Render Tests

Font Size Test
This is a font size test to see the minimum font size that can be read when zoomed into as well as tests for heading font sizes.

Font size 100
Font size 90
Font size 80
Font size 70

This font size is 60
This font size is 50
This font size is 40
This font size is 30
This font size is 20
This font size is 15
This font size is 10
This font size is 9
This font size is 8
This font size is 7
This font size is 6
This font size is 5
This font size is 4
This font size is 3

Black Text on a White Background	This is a test of black text on a white background to see if it renders correctly in PDF readers.
White Text on a Black Background	This is a test of white text on a black background to see if it renders correctly in PDF readers.
Off-Black Text on a White Background	This is a test of off-black text on a white background to see if it renders correctly in PDF readers.
Off-White Text on a Black Background	This is a test of off-white text on a black background to see if it renders correctly in PDF readers.
White Text on a White Background	
Black Text on a Black Background	
Red Text on a White Background	This is a test of red text on a white background to see if it renders correctly in PDF readers.
Green Text on a White Background	This is a test of green text on a white background to see if it renders correctly in PDF readers.
Blue Text on a White Background	This is a test of blue text on a white background to see if it renders correctly in PDF readers.
Red Text on a Black Background	This is a test of red text on a black background to see if it renders correctly in PDF readers.
Green Text on a Black Background	This is a test of green text on a black background to see if it renders correctly in PDF readers.
Blue Text on a Black Background	This is a test of blue text on a black background to see if it renders correctly in PDF readers.

Spoiler Tests

Black Text on a 0% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.

Black Text on a 5% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 15% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 25% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 35% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 50% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 65% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 75% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 85% Black BG	This is a test of black text on a dark background to see if it can be used to reveal spoilers.
Black Text on a 95% Black BG	[redacted]
Black Text on a 100% Black BG	[redacted]

Pattern Fill Tests

Row 1 Solid Pattern		**Row 1 75% Gray**		**Row 1 50% Gray**	
Row 1 25% Gray		**Row 1 12.5% Gray**		**Row 1 6.25% Gray**	
Row 2 Horizontal Stripe		**Row 2 Vertical Stripe**		**Row 2 Reverse Diagonal Stripe**	
Row 2 Diagonal Stripe		**Row 2 Diagonal Crosshatch**		**Row 2 Thick Diagonal Crosshatch**	
Row 3 Thin Horizontal Stripe		**Row 3 Thin Vertical Stripe**		**Row 3 Thin Reverse Diagonal Stripe**	
Row 3 Thin Diagonal Stripe		**Row 3 Thin Diagonal Crosshatch**		**Row 3 Thin Diagonal Crosshatch**	

Exporting Checklist

The following tips should be followed in order when exporting TPE.

Pre-Export

Check and update the document prior to exporting:
1. Save the document as a new file of the version release number. E.g. 7.00 if the current version is 6.80.
2. Check the version number and date is current at the top of the document
3. Update the footer text to the current version
4. Update the % complete and the other statistics in MAINTENANCE > Updates > Version #
5. Update the condensed updates section directly under the 'Updates' section
6. Fix the header columns by re-aligning them, (General, Distributed, 90°)
7. Update the PRELUDE > Introduction > Statistics section
8. Update any Prep Drive references if required
9. Ensure the Updates category is up to date and the "This Version" marker is moved
10. Ensure row spacers in column "Q" are hidden.

Conversion

Convert the document to PDF:
1. Save and close TPE if it's open, to ensure all updates are saved.
2. Convert TPE to PDF using www.ilovepdf.com, then clear the browser cookies from the past hour.
3. Check that it exported correctly, didn't get cut off at the bottom and that row text isn't cut off.
4. If there were issues, fix them and re-export, then repeat #2.

Editing

Using Adobe DC, make the following changes to the document:
1. Add bookmarks to every primary category and Christianity.
2. Update the file size of the document in the MAINTENANCE section
3. Update the 'Number of Pages' in "CONTENTS > Categories"
4. Update the page counts for each category in the CONTENTS section
5. Add PDF bookmarks to the primary categories
6. Hyperlink every category in CONTENTS
7. Hyperlink every link in INTRODUCTION
8. Hyperlink the Rapture shortcuts

Releasing

Releasing TPE:
1. Upload TPE .PDF to fluidicice.com
2. Upload TPE .XLSX to fluidicice.com
3. Release to the TPE Mailing List for a week
4. Write a blog post on the new TPE version
5. Post the new version on Reddit.com
6. Post the new version on Facebook.com

Exporting Checklist Via Excel
The following checklist describes how to release a new version on PDF via Excel's built in features. To "print" to PDF Adobe Acrobat needs to be installed with the add on to allow exporting as PDF.

Formulas

These formulas are here so they don't lag the sheet and can be calculated prior to exporting.

Formula Name	Find the word count on a row	Count All Words (Change total row counts and use in cell E:4)	Days Since Creation		
Formula	="Approx Number of Words" & CHAR(10) & (ROUND(SUMPRODUCT((LEN(TRIM($G12:$Q12))-LEN(SUBSTITUTE($G12:$Q12," ",""))+1),--(TRIM($G12:$Q12)<>"")) / COUNTA($G12:$Q12), 0)) * COUNTA($G12:$Q12)	=SUMPRODUCT(LEN(TRIM(E5:Q19928))-LEN(SUBSTITUTE(E5:Q19928," ",""))+1)	="Sheet Creation Date" & CHAR(10) & "01 July 2017" & CHAR(10) & "(" & ROUND(TODAY() - DATE(2017,7,1),0) & " Days Ago)"		

Macros

The following are the macros in this sheet so if they become corrupt it's easy paste them again. This row is a fixed size because some macros are huge and thus can only be read with the excel file.

Macro Name	Macro
Page Number Generator Last Update: v8.43	See below

```
Sub PageNumberGenerator_Click()

    'Message to inform users to not click anything while it calculates the number of pages.
    MsgBox "The page numbers for each category are now going to be processed. Please click OK and then wait until it's been completed otherwise the program will crash if you click again."

    'Have to scroll to the bottom of the document and then back so this macro can recalculate the max number of pages - A message will let the user know if they missed this step.

    Dim categories As Variant 'Initializes the category defined names
    categories = Array("NEWS", "PRELUDE", "CONTENTS", "INTRODUCTION", "CONVERSIONS", "CREDITS", "DICTIONARY", "FAQ", "UPDATES", _
    "PREPAREDNESS", "BACKPACKS", "GEAR", "SURVIVAL", "WATER", "FIRE", "NAVIGATION", _
    "FOOD", "FIELD_DRESSING", "COOKING", "RECIPES", "FITNESS", "NUTRITION", "HYGIENE", _
    "MEDICAL", "MEDICATION", "ILLNESS", "NJURY", "EMOTIONAL", "NATURAL_REMEDIES", _
    "SHELTER", "HOMESTEADING", "CONSTRUCTION", "MINIMALISM", "BOATING", "ANIMAL_HUSBANDRY", "STORAGE", _
    "NATURAL_DISASTERS", "MAN_MADE_DISASTERS", "PERSONAL_DISASTERS", "DISASTER_TIMELINES", "DISASTER_TRIGGERS", "MASS_DESTRUCTION", "DISASTER_RECOVERY", _
    "ELECTRICITY", "LIGHT", "FUEL", "TRANSPORT", "GEOGRAPHY", "LOCATIONS", "COMMUNICATION", _
    "POPULATION", "BARTER", "ECONOMY", "PSYCHOLOGY", "RELIGION", "MEDIA", "LANGUAGE", "ENTERTAINMENT", _
    "SKILLS", "CRAFTING", "KNOTS", "TOOLS", "MATERIALS", "WOODWORKING", "BLACKSMITHING", "LEADERSHIP", _
    "GARDENING", "FORAGING", "HUNTING", "FISHING", "PLANTS", "ANIMALS", "METEOROLOGY", "PERMACULTURE", _
    "WEAPONS", "OFFENCE", "DEFENCE", "WARFARE", "TACTICS", "SAFETY_SECURITY", "CONSPIRACIES")

    Dim cellChange As Integer
    cellChange = Range("Page_Number_Marker").Row 'Initializes the starting row of cells if rows are added above the categories and below the category groups, to make it easier to change them all - 3 By Default"
    'The number should be the first row of the page count information

    Dim categoriesCell As Variant 'Initializes the categories destination page count information
    categoriesCell = Array("P" & cellChange, "P" & cellChange + 1, "P" & cellChange + 2, "P" & cellChange + 3, "P" & cellChange + 4, "P" & cellChange + 5, "P" & cellChange + 6, "P" & cellChange + 7, "P" & cellChange + 8, _
    "P" & cellChange + 10, "P" & cellChange + 11, "P" & cellChange + 12, "P" & cellChange + 13, "P" & cellChange + 14, "P" & cellChange + 15, "P" & cellChange + 16, _
    "P" & cellChange + 18, "P" & cellChange + 19, "P" & cellChange + 20, "P" & cellChange + 21, "P" & cellChange + 22, "P" & cellChange + 23, "P" & cellChange + 24, _
    "P" & cellChange + 26, "P" & cellChange + 27, "P" & cellChange + 28, "P" & cellChange + 29, "P" & cellChange + 30, "P" & cellChange + 31, _
    "P" & cellChange + 33, "P" & cellChange + 34, "P" & cellChange + 35, "P" & cellChange + 36, "P" & cellChange + 38, "P" & cellChange + 39, "P" & cellChange + 40, _
    "P" & cellChange + 42, "P" & cellChange + 43, "P" & cellChange + 44, "P" & cellChange + 45, "P" & cellChange + 46, "P" & cellChange + 47, "P" & cellChange + 48, _
    "P" & cellChange + 50, "P" & cellChange + 51, "P" & cellChange + 52, "P" & cellChange + 53, "P" & cellChange + 54, "P" & cellChange + 55, "P" & cellChange + 56, _
    "P" & cellChange + 58, "P" & cellChange + 59, "P" & cellChange + 60, "P" & cellChange + 61, "P" & cellChange + 62, "P" & cellChange + 63, "P" & cellChange + 64, "P" & cellChange + 65, _
    "P" & cellChange + 67, "P" & cellChange + 68, "P" & cellChange + 69, "P" & cellChange + 70, "P" & cellChange + 71, "P" & cellChange + 72, "P" & cellChange + 73, "P" & cellChange + 74, _
    "P" & cellChange + 76, "P" & cellChange + 77, "P" & cellChange + 78, "P" & cellChange + 79, "P" & cellChange + 80, "P" & cellChange + 81, "P" & cellChange + 82, "P" & cellChange + 83, _
```

Known Problems

These are known errors that I'm working on fixing.

Problems

1	In columns "A-D", If the merged cells are too tall for the looped text - it doesn't display for some parts of the column.
2	The .xlsx spreadsheet may not open in mobile Excel due to its size.

3	When using colored text, the color 'bleeds' over to nearby cells.
4	Text is hard to read on mobile devices when scrolled out to a full page.
5	Maximum row heights aren't tall enough to contain much text. (Limitation of Excel)

3 Content Credit

This section outlines and credits the people responsible for the resources used throughout this document such as the pictures and icons. The percentage denotes how much of that content type makes up TPE.

Content	The content throughout TPE is drawn from: ● Wikipedia (www.wikipedia.org) (65%) ● Fluidic Ice - Personal knowledge and experience (www.fluidicice.com) (15%) ● Other websites (7%) ○ Wikihow (www.wikihow.com) ● Artificial Intelligence Engines (5%) ● eBooks - With summarised content (5%) ○ Wikibooks (www.wikibooks.org) ● Physically Owned Books - With summarised content (2%) ● Content Creators - People who let me use their content in TPE (1%) ○ All quotes are by the original people who made them.
Icons	All icons are purchased on a subscription at: ● Iconfinder (www.iconfinder.com) (100%) The icon designers: ○ Dutchicon (www.iconfinder.com/dutchicon) (98%) ○ 13ree design (www.iconfinder.com/13ree.design) (1%) ○ Webalys (www.iconfinder.com/webalys) (1%)
Pictures	The pictures are supplied by either: ● Wikimedia Commons (www.commons.wikimedia.org) (85%) ● Shutterstock (www.shutterstock.com) (10%) ● Pixabay (pixabay.com) (5%) ● Artificial Intelligence (0%)
Conversion	TPE is converted to PDF using: ● ILovePDF - Free Resource (www.ilovepdf.com/excel_to_pdf) Highly recommended website - it's the only one that seems to render the PDF correctly.
Editing	TPE is edited using: ● Adobe Acrobat DC (www.ilovepdf.com/excel_to_pdf)

If you have any copyright issues please contact me via my website.

4 Contributions

Thank you tremendously to all the individuals in the supporters section below for their encouragement, support and input on TPE.

If you wish to contribute to the guide, please email me what topic you would like to assist on and the row/cell number (and the title of the row in case it's changed row count since then) you would like to add or amend and paste the new data.

Leaving Feedback
If you would like to leave feedback - please email it to me with your preferred alias and I'll add it below. Email is at the top. Feedback given on other platforms will be automatically added but will be taken off if requested.

Celebrity A celebrity is any individual with a website, channel, book, Tv series or podcast related to prepping, self-sufficiency or survival which is decently popular. Celebrities will have a starred name in the supporters section.	**Time is Money** If you contribute to the writing of this guide each cell you write/update (accurately) will be equivalent to 0.1 point.	**Download Latest** Ensure you download the latest version prior to adding content as it may have already been added.	**Star Contributors** People with over 1,500 points will be given their own cell at the top as gratitude to your contributions.	**Organisation** Supporter names are listed by date and will not be re-ordered by money, rank or celebrity status. There will be 10 names per cell.

Donations	Donations are highly appreciated as I've spent extensive hours compiling this guide to help any and all it falls into the possession of. Any donations will be converted to AUD and then to points at 3x the rate, so by donating $20 AUD you'll get 60 points added to the supporters section below. If it's $20 USD that's donated you'll get around 87 points. Your money will literally go into the writing of this guide. For every dollar that's donated I will sit down and spend 1 extra minute working on this spreadsheet. Even then 1/3 of all donations will be donated again to those in third world countries without access to clean water.

Donation amounts also stack with contribution, so if you donate $100 and you update 100 cells of the sheet, you'll have 310 points.
100 x 3 + (100 / 10)

Donations are preferred over contribution as I have a certain quality and accuracy level I want to meet for this sheet. Donation point counts aren't listed beside names, but the colours reflect how much someone has donated or worked on the sheet. I have a sheet tracking the points so I can add to the totals if more is donated.

If you'd like to donate, please see the TPE page on my website: **www.fluidicice.com/TPE**

MAINTENANCE Contributions

Donation Split This is like the fire triangle of donations, so try to donate in an amount divisible by 3! Donations will push me to keep working on the guide even more than I usually do. Here's how they will be used:	**Third 1** One third of all donations will be donated towards providing clean water for third world countries via missions trips. Using salt water electrolysis!	**Third 2** One third will go towards acquiring more information for the guide such as purchasing databases, website bills, books, server costs and content research etc.	**Third 3** One third will buy me a coffee occasionally or whatever I need at the time to keep me alive and working on the sheet.

Contribution	Edit the current version of the spreadsheet that you have and take note of where (which row number) you are adding new cells to. Extract the new data you added to a clean spreadsheet and email me your edits. You can have edits to multiple sections just ensure they are separated and are marked clearly which sections and subsections they are from. Detail in an email to me what category you're updating and what row you would like it added to as well as the heading and subcategories if any. I will add it to the next released version after vetting the information for accuracy. To edit single cells, do exactly the same but you don't need it in spreadsheet form, just email the data you would like changed. This is particularly useful if you want to update your own book / website or other content.

Contribution Guidelines Contribution is somewhat difficult due to the mix formatting in the guide. Recently I've been trying to upgrade sections to the new larger font "Word Format" for ease of reading. However currently most sections are the older and tinier "Excel Format" which is aimed at a higher density of information to keep the sheet small. Just use the smaller single cell or "Excel" format if you're adding content as it's easy to adapt to the larger style. Try to keep each cell to under 11 lines if using the excel format, moving it to an adjacent cell if required for ease of reading on mobile platforms. Link the source of the information if required. If you are the source, only link your website if the data pertains to the information given.	**Styling (Excel Fmt)** ● Font: Century Gothic ● Size: 10pt ● Colour: Black ● Alignment: Centre ● Single Cells ● Bold Headings	**Styling (Word Fmt)** ● Font: Century Gothic ● Size: 20pt ● Colour: Black ● Alignment: Left ● Merged Cells ● 30pt Bold Headings

Information Credits
The credits for information throughout the guide can be found via the link in column "F". Just copy and paste the cell into a web browser to find additional information and the origination of the information. I try not to copy the content directly but interpret it and then re-type it into the spreadsheet. Content without a link in column "F" is most likely my own authorship and researched by me. Unless I forgot to add it which is always a possibility.

MAINTENANCE Supporters

5 Supporters ★

Supporters are listed chronologically per colour with 5 names per cell. These people have either donated, assisted with information or given valuable feedback. If you donate enough to reach a new category you will be moved up in the next release. Please contact me if you wish for your name to be changed or removed. Note that the numbering system and colours may change over time if I alter the point number ranges. However your points respective to everyone else won't change.

To become a supporter you can either:
- Donate
- Add Information
- Blog Review TPE
- Video Review TPE
- Submit Detailed Feedback

Supporter Tiers

1. Blue Tier (1-49)

2. Green Tier (50-149)

3. Orange Tier (150-299)

4. Red Tier (300-499)

5. ☆ Star Contributors (500+) ☆

Supporter Effects

Bold (Donator)	*Italics* (Contributor)	Underlined (Multiple Donator)	*Star* (Celebrity)	#Hashtag# (Sharer)	@Amper@ (Vid Review)

MAINTENANCE Supporters Star Contributors

☆ Star Contributors ☆

Contributors with 500+ points are transferred to star contributors to highlight the amazing impact they are having. You can have a message with your name so type as much as you want, but the font size will be adjusted to fit. Choose your own background style, text, border and shading colours if you want or the default will be used.

-~-~-~-~-~-~-~-~-~-~-
☆ Fluidic Ice ☆
"Thank you for reading TPE!"
-~-~-~-~-~-~-~-~-~-~-

-~-~-~-~-~-~-~-~-~-~-
☆ **Ben McKeamish** ☆
Have I not commanded you? Be strong and of good courage; do not be afraid, nor be dismayed, for the Lord your God is with you wherever you go." Joshua 1:9
-~-~-~-~-~-~-~-~-~-~-

MAINTENANCE Supporters Red Tier

Red Tier

Those in the Red Tier have between 300 and 499 points. They can have a short message beside their name.

Example Name
This is an example message. The text is shrunk to fit in the square.

Orange Tier

Those in the Orange Tier have between 150 and 299 points. They get three choice words under their name to represent themselves.

Example Name
Coder, Prepper, Minimalist

Justin G				

Green Tier

Those in the Green Tier have between 50 and 149 points. Their name will just be shown.

Example Name

Mark G	**Roman P**	**Caleb A**	**Kirk B**	**Evan W**
David H				

Blue Tier

Those in the Blue Tier have between 1 and 49 points. Their name will just be shown.

Example Name

David H	**Sapper John**	**Nick A**	**Aunt Bea**	**Luis R**
Viviana P	**Dustin S**	**ByungJin Y**	**Jeff H**	**Kelsey K**
Jesus C	**James C**	**Brian R**		

6 Feedback

This sections contains any feedback both positive and negative I've received from various sources such as Email, Reddit, YouTube or Twitter. Feedback is automatically added here if I see it but can be removed if you wish by emailing me. I often come back here to read them to inspire me to keep working on it.

Positive

This is the positive feedback I've received on TPE via email, Reddit and other social media.

Name	Version	Comment
Ballisticklyterminal	v4	Damn, You seem to be really invested in this. This is really cool.
ker95	v4	Thank you for sharing! I've downloaded the pdf & will take a look at it
roolthemall	v4	This is awesome, great points from what I've gone over so far. Thanks!
subaruderek	v4	Appreciate the sharing of a large resource, just found this so haven't dug in really. From what I've seen so far I look forward to getting into it. Bravo
ker95	v4	Wow - this was a labor (probably of love, but labor none the less). Well done! This is going to take a while for me to go through. You have compiled an amazing amount of helpful information - excellent job!!
apestilence1	v4	Honestly, thank you for this. You're a saint.
areyouolsen	v4	This is awesome, dude. Thanks a lot!
ker95	v4	I, of course, went directly to the natural disaster we most likely face - hurricane. Ended up doing a 'find' and searching through the document (haven't made it all the way through). Pro - I don't know how you could have done it any other way because you have made your information as all-encompassing as possible, addressing multiple issues/scenarios/information/concerns.
StormCaller02	v4	Wow, thanks for the fantastic resource!
ZiggyIsMyName	v5	This is amazing!!!!
cysghost	v5	This is awesome! Similar to something I was trying to put together, but have been too busy for at the moment.
mikramero	v5	I want to thank you a lot. Great work.
LatinaViking	v5	I haven't even opened the file yet, but I'm amazed at your effort. I'm a physician and I plan on going through the medical part of it and see if I can contribute to it somehow. If you would like, of course. Thank you so much for sharing it with us. :)
-Noxxy-	v5	You absolute legend
vzei	v5	I've been wondering if anyone had put together some collection of resources that could help you survive and rebuild if s*** hit the fan. I never expected someone would curate all the information in one resource though. Thanks for all time and effort you took to put this together!
ufoO0Oo	v5	Great work, thank you for sharing. And nice website ツ
HomunculusEmeritus	v5	FluidicIce you magnificent bastard, I was all set to ask for a PDF but your link to it was the first thing I saw. Thank you.
c-two-the-d	v5	Holy wow!!! Thank you.
1qax2wsx	v5	Coming back to this later when I'm on my pc!
Cyliciana	v5	THANK YOU SO MUCH!! I can't donate at the moment, but will in the future. As someone who is just starting to get more serious about prepping, this a "god-send" for me!
Juggernaut78	v5	Holy f***! Thank you!!!
kingpoff	v5	Absolutely superb job....
lakecitybrass	v5	Great job.
apestilence1	v5	This man is the Messiah of prepping
shadley0000	v5	I haven't reviewed this whole 800 page document but it is clear a serious amount of time and effort went into it. Nice work and thanks for sharing it

MAINTENANCE Feedback Positive

Dogmeat_Jones	v5	Very nice.
newPrivacyPolicy	v5	I've only just begun to scratch the surface of this document, but I'm impressed with the amount of work this represents. Thank you.
DiarrheaVagina	v6	This is incredible! Thanks so much for sharing!
survivaljournal	v6	Excellent resource, thank you for all the hard work.
BrandoJC	v6	Amazing amount of work and detail! As someone who falls in the Level 1 "Wannabe" level of preparedness, this is exactly what I was hoping to find! Can't thank you enough!
OctaveTheory	v6	This is probably the most impressive thing i have seen in years. Thank you.
ImpossibleBridge	v6	thanks for your efforts brother. let us know if we can be of any help. Cheers
Alaric_Silvertongue	v6	Wanted to say that TPE is a fantastic document! Only had a brief few chances to look through it, but it's got a huge wealth of info.
dumblederp	v6	thanks dude.
hybridfrost	v6	This is very impressive work! Thanks for sharing!
prepperjo616	v6	Awesome! Ive been downloading wiki's to my phone as well.
rasputinspastry	v6	I think this guide is just so impressive in that it is all one source... I know many of us have seen the comments/posts about "what book or books would you recommend for a disaster/TEOTWAWKI situation" and while I think we would all agree there are single "right" answers, TPE's guide comes the closest.
CompleX999	v6	Do you have any idea what your 63 days of works have done? I love you man.
br0adband	v6	Thanks for your efforts, and I can't even begin to comprehend why anyone would downvote this, seriously. But then again, Humans are pretty stupid sometimes, who knows. :D
leeser11	v6	Holy s***! I'm amazed at people that put a ton of effort and skill into something like this just to give it away for the benefit of internet strangers! Thank you so much !
DKDCbye	v6	I'm so in love with this PDF! Thank you! I'll be giving private feedback via email later on today when I get home but again, thank you for taking the time to put this together
thegreatoutdoors44	v6	I love you, thank you so much Chris
[deleted user]	v6	Love the guide - and since it's a PDF I was able to upload to my personal library in Google Books so it's also available on my phone and tablet - given that in an extended emergency I would probably find it more likely I have those, and it would be easier to keep those charged up enough to use. Of course you then have to make sure you "Download to Device" as well - since 4G LTE might not be universally available during an apocalypse :-)
KipsterED	v6	Same here. I greatly appreciate you offering this for free but the amount of effort you put in to it is amazing. I would pay a little something for it.
paleochris	v6	What an amazing compendium of information! Thanks for you great work :)
whodunnit2019	v6	Wow thank you so much !!
zsepthenne	v6	Thank you!
tortugavelozzzz	v7	Absolutely amazing update!! I honestly had such a hard time zooming in and out on my 6 inch cell phone screen, this is 100 times better, thank you so very much for all the effort, I can't believe that a 1400+ page survival enciclopedia is being offered for free, thank you so much and I sincerely hope you get lots of donations.
Level_62	v7	I do think that the "conspiracy" section was quite good and highlighted what so many people refuse to admit.
TheDragonLake	v7	I started downloading and just browsing the table of contents on the main page. 1212 pages, lordy this is gonna be one heck of a read.
Dbajram	v7	Very interesting. Thank you for sharing!
GPGrieco	v8	This is such an amazing resource. Thank you so much for publishing this for everyone!
tooawkwrd	v8	I downloaded TPE expecting it to be a cut/paste cobbled together pile of information. You've sincerely blown me away with the organization and visual coding implemented. I obviously haven't read through it yet but can immediately see how useful this resource is. Sincerely, thank you not only for the incredibly hard work but also for the part of you that wants to share it rather than monetize it.
its_teotwawki	v8	Incredible work! I'll be poring over this for a good long while. Thank you so much!
Myghael	v8	I guess this is prime example of a content to have downloaded in every device, thank you very much!
economic-salami	v8	Amazing work, thank you so much for sharing.
Cybertron436	v8	Well done man. I'm sure this will benefit a lot of people. Thank you
Brend155	v8	OP how kind of you to share hard work, well done
lunagazer8	v8	You are amazing!
kaybek	v8	This is fantastic content! Thank you for all the work you've put into this. Do you mind if I share this elsewhere with links to your site and fully crediting you?
GroupSleep	v8	This is truly a work of art, seriously. Good job. I plan on downloading it and throwing it on devices and the cloud. Thanks.
ilovekitty1	v8	WOW! Very impressive!
Tonykbg	v8	Great work!
elfieray	v8	Blimey! Thank you for your this excellent resource!
mudpizza	v8	Looks impressive, but not gonna lie, having chapters about Rapture / Second Coming threw me off a bit
bobthecan	v8	Things like this are why this sub is so important for people right now. Knowledge sharing is power. Things look grim but people helping people help themselves will push us forward. Thank you for the effort.
FlyingJaffaCake	v8	Wow. This is immense.
ActivateNow	v8	THIS IS AMAZING! Thank you!
V1ND1C4T0R	v8	Damn this is fantastic. I will be deep diving I to this when I get home from work!!
rhoymand	v8	saved to my gDrive and will eventually print out. Thanks!

Critique/Negative

MAINTENANCE Feedback Negative

This is the critique and negative feedback section. This category may have duplicate information to the 'Fixes & Additions' section below - as that is where I work from to make changes to the document. You many not have meant your feedback to be 'negative' but it's listed here as potential changes I can make.

Name	Version	Comment
ker95	v4	Con - information is scattered. (When searching for a term like hurricane)

universalists_unite	**v5**	I have been trying to read this but I hate to say it really is unusable in its current pdf or spreadsheet form. If I export it as text and remove all the extra white spaces and all the duplicate words/headings it is a fraction of the size. It has grown tremendously, has good content, and deserves to be useable...Sorry for the criticism.
Avadon7	**v5**	Maybe did not get more upvotes since posting time not optimal? **Juggernaut78** I think he means that it didn't get as many upvotes as it obviously deserves because the time of day which it was uploaded people were either sleeping or out about their day. **Haunting_Guarantee** https://dashboard.laterforreddit.com/analysis/?subreddit=preppers&threshold=5
ElectricTaser	**v5**	Looks like a labor of love. Just glanced at a few sections so far. As a knife aficionado, under gear- tools- Knives; Best brands Ka Bar, Gerber, and Schrade? No, no no. So many better options. Fixed blades I recommend personally look at Mora, Esee, Bark River, (inexpensive like $10 to a $$$few hundred dollars) and so many others (dozens) before those three.
Pfoenix	**v6**	Amazing work. I'm not too happy about the explosives section though. The anarchist cookbook is outdated, misleading and sometimes dangerous (at least regarding this topic. Don't know enough about the other stuff). A fifty-cent sized pile of thermite won't burn through an engine block. If the hood is made of steel it probably won't even burn through that. Nitrogen triiodide (the touch explosive) is too sensitive. Things that will set it off: sunlight, loud noises, it's own weight if piled too high, carefully wrapping it in a piece of paper. Don't mix tetrachloroethylene with aluminum. Especially not finely divided aluminum. Carbon tetrachloride and aluminum might not kill you immediately but it's still a bad idea. Handling those two chemicals is a bad idea in general.I'm the last person to tell you to not include explodey things. But don't use instructions from a book written by a 19 yo in the 70s.
Cool_Bastard	**v6**	To be honest...I was interested. But, after clicking and then seeing that I had to a) download something, and b) I notice the Paypal button at the bottom, I quickly exited without reading anything else. I was also confused with the top links that said "games," not really knowing what to think or how games had anything to do with the survivor/prepper encyclopedia. Yes, I'm guilty of skimming and not reading indepth, but I don't think I'm alone here (on the web) when doing it. Some suggestions, for what they're worth: Change the font and look. It looked...sci-fi-gamey, I presume "Games" means prepper games? If so, maybe say that instead of just games. Then it's clearer to idiots such as myself. Have the encyclopedia all online and also as a download for an option. That way people can see what it is before downloading. Just like Wikipedia puts everything online but still offers printable versions of what you want, if you want. Change the Paypal button into a "Donate" link in the top nav bar. That way it won't scare people like me away who associate downloading with paying, like I did. Yes, I understand it's just a donation option, but it's still a visceral feeling I get when I see the damn Paypal button...I just don't like it; would rather see a "donate" or "contribute" link and click if I felt like it.

Fixes & Additions

This section is for the fixes, additions and changes people recommend I make to the document. I will strive to work on a few of them every update. Below is the example format of the fixes feedback.

Example	**v0**	Example text about the desired fix or addition.	**Fixed** / **Partially Fixed** / **Unfixed** / **In Progress** / **Irrelevant** (Additional Information)

Name	Version	Comment	Fixed
ker95	**v5**	You need to have a donate button somewhere obvious. If it's there, I couldn't find it :)	**Fixed** Added a more obvious donation button
cygshost	**v5**	Would love to see if I could adapt this to a mobi file for the kindle paper white (along with a whole bunch of other stuff).	**Unfixed**
SlowingDownAGif	**v5**	Conversions -> Shape formulas -> Surface Area Formulas (3D Shapes) -> Pyramid: the formula is incorrect.	**Fixed**
OlliesFreeOxen	**v5**	I'd love stuff for complete rebuilding of society. Like making antibiotics, plants for medicinal and scavenging purposes, how to gather seed for future crops, tanning hides, etc etc. pioneer level stuff. You need a go fund me for this work you put in at least.	**Unfixed**
SlowingDownAGif	**v5**	Conversions -> Other functions -> Trigonometry -> doesn't superscript the 2 on my computer, so "sin2 θ + cos2 θ = 1" is easily mistakable for "sin 2θ + cos 2θ = 1"	**Fixed**
SlowingDownAGif	**v5**	Preparedness -> Assessing Vulnerabilities -> Team Vulnerability -> Age: otehrs -> others.	**Fixed**
SlowingDownAGif	**v5**	Gear -> Gear descriptions -> Weapons -> Ammo -> Ammo (For Guns): I don't think you fletch bullets.	**Fixed**
SlowingDownAGif	**v5**	Gear -> Gear Lists INCH Gear (I'm Never Coming Home): definitely -> indefinitely, I'm guessing?	**Fixed**
SlowingDownAGif	**v5**	Preparedness -> SHTF Decisions -> Bug-Out Flowchart: Although I can follow the flowchart, I don't understand what the colon-separated numbers represent.	**Fixed**
SlowingDownAGif	**v5**	Gear -> Gear descriptions -> Food -> Spork / Other Utensils -> Materials: why do you call plastic utensils unbreakable?	**Irrelevant / Fixed**

MAINTENANCE	Feedback	Fixes & Additions	SlowingDownAGif	v5	By page 12 I was really wishing there was a glossary at the beginning (BOB, SCAR, SHTF, BOL, etc). These might be common knowledge on this sub, but as a new reader I didn't know what they meant.	**Fixed** Added the terms in the Introduction section
MAINTENANCE	Feedback	Fixes & Additions	SlowingDownAGif	v5	Gear -> Gear descriptions -> Medication, First Aid Kit, Trauma Kit, Dental Kit, Hygiene, and Misc: I think these five sections have a ways to go. I see the same "4/5 Size 5/5 Weight 3/5 Durability 4/5 Usefulness" on almost all of these, despite very wide ranges of importance. One of the things I've been really appreciating up until this point is help prioritizing where I should put my attention, and these sections don't do that for me.	**Partially Fixed** There was a big GEAR section change in version 7
MAINTENANCE	Feedback	Fixes & Additions	twistedfairyprepper	v5	In resource harvesting i'd also add to build a seed bank of heirloom seeds and non native varieties that thrive where you live and learn uses for them in preserving and medication. I'd also recommend building your seed bank to include cannabis as the uses for hemp fibre and the flowers healing power should put it top of the crop list.	**Partially Fixed** Added information on seeds
MAINTENANCE	Feedback	Fixes & Additions	TheGrapestShowman	v5	I read through much of the document. Lots of good info. I might suggest a format that is more standardized, such as a chapter book with an index, rather than a spread sheet. Other than that, great work. Kudos.	**Fixed** Version 7 converted everything to a 'word format'
MAINTENANCE	Feedback	Fixes & Additions	clamchowderz	v5	Recommend changing HTTP to HTTPS via SSL certificate. Safari is giving a "not secured" site warning. I'm sure everything is fine, but for those of us who look for this, it's good practice:) thanks for taking the time to create this document, awesome work!	**Fixed** My website is now secured
MAINTENANCE	Feedback	Fixes & Additions	mikramero	v5	I love your work. Have you ever thought about to put all in a smartphone app? For us, it's maybe better to handle than a 700 pages PDF, and you can monetize your hard work by selling your app.	**In Progress**
MAINTENANCE	Feedback	Fixes & Additions	makeworld	v6	I encourage you to release it under a Creative Commons license, and attribute any content that isn't yours. That'll help keep it free forever. And even if you do produce a book, releasing some sort of free PDF would still be great for the community.	**Partially Fixed** Added the creative commons licence
MAINTENANCE	Feedback	Fixes & Additions	Alaric_Silvertongue	v6	I would like to offer one suggestion specific to the idea of rebuilding society (as a total stranger on the internet). The addition of basic information to restart a chemical industry of sorts. The ability to make quicklime and slacked lime, potash and some other fairly basic chemicals allows for the creation of soap. There are other fairly basic processes for capturing wood gas, creating acids and bases and so on that all have uses in rebuilding society (eg chemical fertilizers and building materials). I'd include making glass and distillation here as well.	**In Progress** Adding "Rebuilding Society" to Mass Destruction
MAINTENANCE	Feedback	Fixes & Additions	Pfoenix	v6	Amazing work. I'm not too happy about the explosives section though. The anarchist cookbook is outdated, misleading and sometimes dangerous (at least regarding this topic. Don't know enough about the other stuff).	**Fixed** Removed the potentially dangerous explosives section
MAINTENANCE	Feedback	Fixes & Additions	bunningsnag69	v6	Please release as a hardcopy book once done. If you do release a hardcopy then include 10-20 pages of blank lined paper for note taking and if possible a plastic pocket for storing a local map Looks great though looking forward to reading it sometime	**Unfixed** Can't solve until TPE is complete
MAINTENANCE	Feedback	Fixes & Additions	bunningsnag69	v6	An area in defence for either creating your own weapons or things that can be bought legally in countries such as our Australia or other strict countries. A section for things like lock picking or siphoning fuel out of a car, or how to break a window safely and things like that.	**Fixed** Added all these sections.
MAINTENANCE	Feedback	Fixes & Additions	universalists_unite	v6	I have been trying to read this but I hate to say it really is unusable in its current pdf or spreadsheet form. If I export it as text and remove all the extra white spaces and all the duplicate words/headings it is a fraction of the size. It has grown tremendously, has good content, and deserves to be useable...Sorry for the criticism.	**Fixed** Conversion to the 'Word' format is complete
MAINTENANCE	Feedback	Fixes & Additions	NOFF44	v6	Hi, I've downloaded the pdf but don't get how to read through it. Could you give me some tips on how to get started? Oh I can open the pdf and I get the chapters. I just dont get how the rosters work. I cant seem to find in which direction to read the file :/	**Fixed** Conversion to the 'Word' format is complete
MAINTENANCE	Feedback	Fixes & Additions	tortugavelozzzz	v7	Quick suggestion if I may, on Page 16 BOB-Medical: 4 cheap, readily available and extremely important things to add: Imodium, Activated charcoal, A styptic hemostatic coagulation powder such as Celox (for deep cuts and any other hemorragic situation), & Oral rehydrating salts such as these: Oral Rehydration Salts ORS, New Formula for Electrolyte Replacement and Dehydration. One of the worse killers is dehydration due to diarrhea, however the oral rehydration salts are vital when you're simply doing any strenuous activities in hot weather, as you can easily pass out, or at best be severely weakened, from an electrolitic imbalance plus loss of fluid due to excessive sweating. Activated charcoal works great in case of poisoning. All of these things are light, cheap, and readily available. And in some regions I would also add antihelmitics (dewormers) as intestinal parasites are more common than malaria in many parts of the world.	**Unfixed**
MAINTENANCE	Feedback	Fixes & Additions	Dbajram	v7	You're using Excel to edit? Any thoughts on using LibreOffice calc? Foss, and therefore easy to install on any machine you'd have.	**Irrelevant** I haven't used it, but I may consider it in the future.
MAINTENANCE	Feedback	Fixes & Additions	Nick A	v9	I noticed one spelling error on page 3 of v9.01 (" which has happaned multiple times", the "happened" got a typo to it. . .).	**Fixed**

7 FAQs

This section answers the common questions people most commonly ask relating to TPE. It also includes statements that people often remark during use.

Common Questions

Question	**My website/channel or podcast isn't listed under ADDENDUM > Media, can I get it added?**	**I would like my website or channel to be listed as "Quality Content".**	**I would like my website or channel to be listed as "Quality Content".**	**Can I re-upload the spreadsheet elsewhere?**	**I've found spelling mistakes in the sheet.**
Answer	You can send an email to me with a link to your content requesting that you would like to be added. And if your content is preparedness based you will be added.	To be eligible for Quality Content you have to pass a visual inspection of your content. Details are listed in the ADDENDUM > Media section.	To be eligible for Quality Content you have to pass a visual inspection of your content. Details are listed in the ADDENDUM > Media section.	I'd prefer it if you didn't as (ordinary) people can't verify that the re-upload is safe as they don't understand checksums. Sites like oldversion are welcome to upload previous versions of TPE as I delete older versions when I bring out new ones.	If you find a spelling mistake, please let me know via email what word(s) and where they are found. However being Australian I spell some words differently such as "Defence" instead of "Defense".
Question	**How long did the guide take to make?**	**You used my content without permission.**	**How can I contribute to the guide?**	**I want to donate anonymously**	**I donated but my name isn't on the credits this version.**
Answer	Right at the top of the guide is a stat showing how many hours I've worked on the sheet based on number of cells with text and the average time spent on each one.	Most of the content is my own work, however let me know what you believe to be an infringement and I can reword it. Otherwise survival of the human race is more important than copyrights.	You help is greatly appreciated through donations, shares and letting me know what content you would like to see in the guide.	You can send money without any information exchange by donating with bitcoin as some preppers are highly secretive about their lifestyle.	I may have accidentally forgetten to add you to the list so please just send me an email with the date you donated and I'll add you to added to the next release.
Question	**Why did you start TPE?**	**How do you say TPE so it flows off the tongue?**	**The spreadsheet displays white areas with no information after scrolling fast.**	**The page numbers are off in the CONTENTS section.**	**I have more subs on my YouTube channel than is displayed, can you update it?**
Answer	That's answered in the PRELUDE section.	In casual conversation you can either say it like the letters T, P, E. Otherwise "Teepee" is one less syllable and contains all 3 letters in the right order. "Hey bro, have you read the teepee?"	This seems to be a problem with the later versions of excel (notably the 2016 version) and has nothing to do with pc power. I recommend using Excel 2010.	This is due to a new formula I'm working on to generate the correct page numbers. However due to differences in exporting software this can result in variations.	Unfortunately it's very difficult to keep those stats live for every channel. But I do update them all about twice a year. Request an update and I'll do my best to renew it.
Question					
Answer					

Mobile Questions

Question	**Links don't work on the mobile version when using Google Sheets.**	**The sheet crashes when trying to open it in Excel for mobile.**	**The excel sheet runs really slowly on mobile platforms.**	**The excel sheet takes ages to load on mobile.**	**Does the sheet work on E-reader devices?**
Answer	Unfortunately this is the case until I find a solution. However using the search function to find what you need may be much faster out in the field.	Try to use Google Sheets instead to open the spreadsheet or download the PDF version.	Unfortunately that's going to be a problem with so much information packed into a sheet. Splitting it into tabs doesn't speed it up either. Try using the PDF version instead.	Due to the size of the spreadsheet this is just a fact, however a faster device may help a little as it only takes 10s on the Samsung Galaxy S8+.	This is uncharted waters as I don't own an E-reader. Transfer the PDF to it and let me know how it looks, (patricularly the ENTERTAINMENT answers sections) or better yet, send pictures.

User Questions

Question	**EquestrianKnight via Reddit** "I have not looked at the link yet, but i have a question about your design philosophy. My biggest issue with similar things i can find elsewhere is how HUGE the library or reference becomes. How did you decide what to add, and what to leave out? How big is it (in mb/gb or pages) now? Do you feel like it includes a focused collection on the essentials, or more of a "everything you might need" sort of approach?
Answer	Understandably these kinds of things can grow to a monumental size over time, for TPE I'm trying to limit it to 100mb as a hard limit for the future, but also try to reduce the size wherever possible by limiting pictures. Most of the information is pure text to keep things simple but the larger and more complicated concepts have pictures of a few kilobytes. I've seen book collections over multiple gigabytes in size and my aim is to replace all the unnecessary content with a small and portable form factor. Accurate and useful content is what I've been working towards and if sections or content isn't read I can always remove it. Currently it's 38mb and about 600 pages (Version 5), but it's designed to be Ctrl+F'd to find what you need in your current situation. However pre-reading should be done to get to grips with preparedness basics. As for content it's more of an "everything you might need" approach including the essentials. Sure, there's sections that might not be needed for some people but others may find it vital.

Question	
Answer	

My Questions

This section is for questions that I have for all you readers out there. You can answer by emailing me which can be found on my website, or through my websites contact form.

Question	**Where do you mostly use TPE and how has it helped in the past?**	**How can I fix the text in column "A" and "B" so that it stretches down the whole merged cell?**	**Why can't I export TPE myself in Excel? Because it crashes every time no matter what version I use.**	**Why is my macro button moving randomly around and resizing when I run any macros?**	
Additional Details		In some large categories the REPT() text doesn't span the whole length of the cell.		It's easy to lose in the sheet due to it shrinking and changing cells.	

8 Updates

This is the update history grouped by version number to keep a track of what update was made and when. Updates are added left to right, top to bottom.

The Legend

Markers	**+** A plus above text means this is a new addition to the document.	**–** A minus above text means this content has been removed.	**~** A tilde symbol means this section has been modified or changed.		
Text	**+ / – / ~** A single marker means that a small amount has been altered. (Around 1 row)	**++ / – – / ~~** Two markers means that a fair amount of information has been altered. (Around a complete subsection)	**+++ / – – – / ~~~** Three markers means that a huge amount of content has been altered. (Multiple subsections to an entire category)	**+++++** Five plus' means that this is the first release version and contains everything previously added which was undocumented.	
Templates	**Template** Added (additions) to the (CATEGORY) section.				

A green cell signifies a category addition:	**+++** Added the ______ category	**A red cell signifies a category removal:**	**– – –** Removed the ______ category	**A purple cell signifies a change or fix:**	**~~~** Fixed the ______		

Version Summaries

Below is a quick summary of the different versions before getting into more detail further below.

Version 0 Never Released	The pre-release version, containing 80 categories and a completion percent of 40.5%
Version 1 January 2019	Version 1 is the first official release of TPE featuring 80 categories and the beginning of updates and fixes.
Version 2 February 2019	Version 2 saw the transferral of all content from columns "S" on, to the main document, the columns were then deleted to make printing easier. There was also huge updates to the GEAR and INTRODUCTION sections.
Version 3 April 2019	Version 3 added the WARFARE category and updated a lot of content in the ANIMAL IDENTIFICATION and NATURAL REMEDIES categories.
Version 4 May 2019	Version 4 updated the category headings including a related icon for each one. There were also large updates to the NATURAL DISASTERS and MEDICAL - GENERAL sections. It also saw the removal of blank rows from the bottom of the sheet. Page breaks were added to separate categories. This was the first version released on Reddit.
Version 5 June 2019	Version 5 had large updates to the FIRE, PREPAREDNESS and LANGUAGE sections. There was also updates to the headings for categories and subcategories to make them easier to distinguish. This was the second version released on Reddit.
Version 6 September 2019	Version 6 consists of a lot of fixes recommended by reddit users and a big update to the MEDICAL - GENERAL section. The GEAR section was recreated to make it easier to read and follow along with and the Earthquake section was updated a lot. This was the third version released on Reddit.
Version 7 January 2020	Version 7 features a HUGE visual update converting 60%+ of the existing guide to a "Word Format" with a larger font and merged cells making it easier to read on mobile devices. There are three new categories: INTRODUCTION, NEWS and CONSPIRACIES. The pre-existing INTRODUCTION category was renamed to PRELUDE to make room for the new and improved INTRODUCTION category. There are a lot of smaller visual updates throughout the guide besides the larger change but overall there's not a lot of new content in this release. This is the first version that contains PDF bookmarks to make navigating the document much easier.
Version 8 May 2020	Version 8 features the conversion of the rest of the 'excel' format categories to the new, larger and easier to read style. A title page was added to make it feel more like a book. There are also major updates to the INJURY, ELECTRICITY and LOCATIONS categories and a smaller update to the Pandemic section in MAN-MADE DISASTERS. The COMPACT LIVING section was removed.
Version 9 Sep 2020	Version 9 is another visual update to every category in TPE making better use of the whole width of the sheet and making it simpler, easier to navigate and easier to read. There have also been large updates to multiple categories such as ILLNESS, WEAPONS and ENTERTAINMENT. 16 categories have either been removed or been merged with similar categories to reduce the overall number and to assist in quicker information retrieval. There are also new "Purpose" and "Lost?" rows at the top of each category to assist in finding what you're looking for. A lot of content that would likely never be used has been removed from many categories.
Version 10 April 2021	Version 10 is another partial visual update featuring 20% larger text to all content, larger headings, subcategory icons and new category title pages. A lot of content throughout the guide has been updated and new information added. A few major sections have been added such as 'Search and Rescue' to SURVIVAL and infiltration type skills to SECURITY. 6 categories have been merged with others to help reduce clutter and some larger unnecessary sections have been removed. Multiple subheading contents sections were added to the larger headings to make it even easier to find what you're looking for. Overall version 10 should provide an easier reading experience with quicker searchability for needed information.
Version 11 June 2025	Version 11 has been very delayed, but features a lot of new content updates, filling in gaps and adding additional content to many different categories. The Prepping Goals has been added to help new preppers to find a path to starting out. LOCATIONS was also vastly filled in with a lot of content to help you find suitable shelter locations in a SHTF scenario. The shelf life of foods in FOOD was finally converted to a semi-word format. Finally, the MEDICATIONS section was completely re-written and filled out with new, more useful content with a survival focus. Overall version 11 provides a more complete document on the essential preparedness topics.

Version 0

These versions are pre-release and were never uploaded publically. They often went though large name and formatting changes. When I first started the sheet it was called "PQG" for Prepper Quick Guides. The sheet was in early infancy with most categories having very little information.

Release Date	Categories	Percent Complete	Total Hours Worked	Hours Since Last Version	File Size
None	80 (+80)	0-40.5%	N/A	N/A	N/A

Updates

+++++ The pre-release version, containing 80 categories and a completion percent of 40.5%											

Version 1

Version 1 is the first official release of TPE featuring 80 categories and the beginning of updates and fixes.

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
Jan 2019	80 (+0)	42.1% (+1.6%)	1,326.4 (55.2 Days)	N/A	30.5 Mb

Updates

~ Version type change for release. From now on released versions will be a whole number	**+** Added the UPDATES category and began logging updates	**~** Fixed the category hyperlinks and colours of categories	**+** Added camo types to the STEALTH & TACTICS section	**+** Added alcohol fuel to the FUEL section	**+** Updated the DICTIONARY section for STEALTH & TACTICS	**+** Added Topography Restrictions to STEALTH & TACTICS	**++** Added War Stories to ENTERTAINMENT	**++** Added Military Defence to DEFENCE	**+** Added Societal Breakdown to DISASTER TRIGGERS	**+** Updated DICTIONARY values under the ECONOMY subheading	**+** Added Verifying Gold to BARTER
+ Added Fire Resistance to FIRE	**+** Updated Fire Safety in FIRE	**~** Fixed the broken links above the CONTENTS section	**+** Added Banking to ECONOMY	**+** Added text below the banner to tell users to wait for the sheet to load	**+** Answered some mobile questions in FAQ	**~** Changed the name of the tab	**~** Modified the version types in UPDATES	**++** Added Valuables Storage to STORAGE	**++** Added Repellents to DEFENCE	**++** Added Insecticides to DEFENCE	**+** Added Insect Search to DEFENCE

+ Added Digital Files to BARTER	~ Updated the LIGHT section with more information	+ Added Integrated Batteries to ELECTRICITY	+ Expanded the Power Banks section in ELECTRICITY								

Version 2

Version 2 saw the transferral of all content from columns "S" on, to the main document, the columns were then deleted to make printing easier. There was also huge updates to the GEAR and INTRODUCTION sections.

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
Feb 2019 (+31 Days)	80 (+0)	43.7% (+1.6%)	1,344.2 (56.0 Days)	+17.8h (+0.7 Days Straight)	36.5 Mb (+6 Mb)

Updates

~~ Moved all information from the columns "S" onwards into the main article	– – – Removed all columns from "S" onwards.	+ Added Weird Facts to ENTERTAINMENT	+ Added PDF versions.	~ Updated the Equivalency Tables in CONVERSIONS	+ Added Constants to CONVERSIONS	~ Modified a few rows in the WATER category	+ Added Composites to MATERIALS	+ Added Multiple Bag Types to GEAR	+ Updated COMPACT LIVING with more headings and content	+ Added Best Brands to GEAR	~ Altered total hours worked formula so it may act slightly differently
~~ Modified most of the INTRODUCTION section	~~ Corrected all spelling mistakes	~ Modified the INTRODUCTION section headings	++ Added Multiple Sections to GEAR	~~ Modified the Water Purification Section	+ Added Short Questions to RELIGION	+ Added Water Items to DICTIONARY	+ Added Polar Vortex to NATURAL DISASTERS	+ Added Trapping / Killing Insects to DEFENCE	+++ Added and modified the Gear in the GEAR section	+ Added Gear Colour to LIGHT	~ Modified the Hot Weather Survival section in SURVIVAL
+ Added Digital Scales to NAVIGATION	+ Added Light Concealment to LIGHT	+ Added Light Beacon to LIGHT	+ Added Gear Grabbing to PREPAREDNESS	+ Added Eating Order to FOOD							

Version 3

Version 3 added the WARFARE category and updated a lot of content in the ANIMAL IDENTIFICATION and NATURAL REMEDIES categories.

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
Apr 2019 (+59 Days)	81 (+1)	44.2% (+0.5%)	1,372.9 (57.2 Days)	+28.7h (+1.1 Days Straight)	35.4 Mb (-1.1 Mb)

Updates

+ Added Operation to LIGHT	++ Added Natural Light to LIGHT	+ Added Alternative Uses to MATERIALS	+ Added Ground Signals to COMMUNICATION	+ Added Ground to Air Signals to COMMUNICATION	+++ Added the WARFARE category	~ Updated various content in MINIMALISM	++ Added Looting to LOCATIONS	~~ Modified formatting in LOCATIONS	+ Added PDF Page Numbers to CONTENTS	+ Added Assessing Vulnerabilities to PREPAREDNESS	+++ Added Herbs to NATURAL REMEDIES
+ Added Fuel Types to FUEL	++ Updated Christianity in RELIGION & QUOTES	+ Added various headings to MINIMALISM	+ Added various sections to HUNTING	+ Added Animal Tracks to ANIMAL IDENTIFICATION	– Removed multiple rows ANIMAL IDENTIFICATION	+ Added Identification to ANIMAL IDENTIFICATION	++ Added Animal Categories to ANIMAL IDENTIFICATION	++ Added Rapture to MASS DESTRUCTION	++ Filled in the Vegetable Information in GARDENING	++ Added Sea Materiel to WARFARE	~ Modified the total hours worked formula
+ Added more YouTube Channels to MEDIA											

Version 4

Version 4 updated the category headings including a related icon for each one. There were also large updates to the NATURAL DISASTERS and MEDICAL - GENERAL sections. It also saw the removal of blank rows from the bottom of the sheet. Page breaks were added to separate categories.

Version 4 was the first version released to the public via Reddit at:
https://www.reddit.com/r/preppers/comments/bumako/the_preparedness_encyclopedia_tpe/

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
May 2019 (+30 Days)	81 (+0)	50.4% (+6.2%)	1,361.9 (Recalculated Formula)	-11h (Recalculated Formula)	39.4 Mb (+4 Mb)

Updates

~ Modified the layout of Water Additives in WATER	+ Added Neutron Bomb to MASS DESTRUCTION	+ Added Water Resistance to WATER	+ Added EMP Generator to ELECTRICITY > Schematics	~ Reworded the INTRODUCTION content	~ Changed the layout of column "A".	+++ Added new headings to every category	+ Added icons to the CONTENTS page	+ Changed some Category Names	+ Added Prepping Basics to PREPAREDNESS	+ Added Tsunami to NATURAL DISASTERS	+ Added Meteotsunami to NATURAL DISASTERS
+ Added Flood to NATURAL DISASTERS	+ Added Storm Surge to NATURAL DISASTERS	+ Added Cloudburst to NATURAL DISASTERS	+ Added Quitting Drinking to MEDICAL - GENERAL	+ Added Quitting Drugs to MEDICAL - GENERAL	+ Added Quitting Caffeine to MEDICAL - GENERAL	+ Added Quitting Sugar to MEDICAL - GENERAL	+ Added Internet Repairs to ELECTRICITY	+ Added Hardware Repairs to ELECTRICITY	+ Added multiple sections to STEALTH & TACTICS	+ Fixed/Added various content in NATURAL DISASTERS	+ Added Drought to NATURAL DISASTERS
+ Modified Thunderstorms in NATURAL DISASTERS	+ Added Hailstorm to NATURAL DISASTERS	+ Updated Heatwave in NATURAL DISASTERS	+ Added Cold Wave to NATURAL DISASTERS	+ Added Civil Unrest to MAN-MADE DISASTERS	+ Added Weather Phenomenon to WEATHER	+ Set the maximum page printing limit	+ Created a macro to generate the page numbers	+ Added a footer to each page	+ Added a page break before each category		

Version 5

Version 5 had large updates to the FIRE, PREPAREDNESS and LANGUAGE sections. There was also updates to the headings for categories and subcategories to make them easier to distinguish.

Version 5 was the second version released to the public via Reddit at:
https://www.reddit.com/r/preppers/comments/c7cvdm/the_preparedness_encyclopedia_tpe_v5/?

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
June 2019 (+31 Days)	80 (-1)	51.8% (+1.4%)	1,425.1 (59.3 Days)	+63.2h (+2.6 Days Straight)	41.1 Mb (+1.7 Mb)

Updates

~ Modified various small things throughout the document	++ Added definitions to multiple categories in DICTIONARY	+ Added My Questions to FAQ	+ Updated The Rapture in Mass Destruction	+ Added Solar Fire Starters to FIRE	+ Added Spontaneous Combustion to FIRE	+ Updated Various Sections in FIRE	+ Updated Prepping Basics in PREPAREDNESS	~ Reworked the CREDITS section	+ Updated SHTF Planning in PREPAREDNESS	~~ Made the subcategory headings thicker	~ Fixed the row height issue crushing text in the PDF
+ Added Darkness to LIGHT	~ Modified column B-D's text size	~ Changed the subcategory heading text size and spacing	+ Added Line Strengtheners to Category Headings	~ Updated Complex Concepts in ENTERTAINMENT	+ Added Audio to Electronic Entertainment in ENTERTAINMENT	+ Added Audio to ENTERTAINMENT	~ Fixed the overflowing text in Robin Crusoe	~ Changed the sub-subcategory heading text size and spacing	~ Fixed minor things throughout the whole document	~ Updated the Plan Template in PREPAREDNESS	~ Updated various types of gear in GEAR

~ Enlarged the update cells markers in UPDATES	~ Enlarged Every Categories Initial Text Size to 13	++ Added the Chinese Character List to LANGUAGE	+ Added Language Introductions to LANGUAGE	++ Added more Language Translations to LANGUAGE	+ Added Active Denial System to WEAPONS	+ Added Panic Level to Local Disasters	~ Merged the LOCAL DISASTERS category with the GLOBAL DISASTERS category	– Removed the LOCAL DISASTERS category	~ Renamed the GLOBAL DISASTERS category to DISASTER TIMELINES	+ Added and updated skills in SKILLS	+ Added the Skills Analyser to SKILLS
+ Added the Skill Training Field to SKILLS	+ Added various sections to PREPAREDNESS	++ Added Pandemic to MAN-MADE DISASTERS	+ Added Protest to MAN-MADE DISASTERS	+ Added Riot to MAN-MADE DISASTERS	+ Added Civil War to MAN-MADE DISASTERS	+ Added Economic Collapse to MAN-MADE DISASTERS	+ Added Strike to MAN-MADE DISASTERS	+ Added Edibility Test to FORAGING			

Version 6

Version 6 consists of a lot of fixes recommended by reddit users and a big update to the MEDICAL - GENERAL section. The GEAR section was recreated to make it easier to read and follow along with and the Earthquake section was updated a lot.

Version 6 was the third version released to the public via Reddit at:
https://www.reddit.com/r/preppers/comments/d0xerm/the_preparedness_encyclopedia_tpe_v6/

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
September 2019 (+92 Days)	80 (+0)	54.2% (+2.4%)	1,514.7 (63.1 Days)	+89.6h (+3.7 Days Straight)	44.8 Mb (+3.7 Mb)

Updates

~ Fixed the broken text sizers for Robinson Crusoe in ENTERTAINMENT	~ Fixed multiple things picked up by reddit users	~ Changed the subcategory heading spacing	+ Added more Nonograms to ENTERTAINMENT	+ Added Journaling to ENTERTAINMENT	+ Added Seed Bank to GARDENING	~ Updated various sections in GARDENING	++ Updated Earthquakes in NATURAL DISASTERS	~ Altered the headings in NATURAL DISASTERS	+ Added Atmosphere to WEATHER	~ Altered multiple subcategories in NATURAL DISASTERS	+ Updated Wildfires in NATURAL DISASTERS
+ Updated Meteorite in NATURAL DISASTERS	+ Added Monsoons to Flood in NATURAL DISASTERS	+ Updated the layout in ANIMAL HUSBANDRY	+ Added Nutrients to NUTRITION	+ Added Malnutrition to NUTRITION	+ Added Eating Disorder to NUTRITION	+ Added Obesity to NUTRITION	+ Added Starvation to NUTRITION	+ Added Global Nutrition Challenges to NUTRITION	+ Added Intake to Vitamins in NUTRITION	+ Updated the Minerals section in NUTRITION	+ Added Famine to MAN-MADE DISASTERS
– Removed Global Warming from MAN-MADE DISASTERS	+ Added Discipline to LEADERSHIP	+ Added Crimes to LEADERSHIP	+ Added information to WOODWORKING	+ Added text messages to the page count generator.	++ Added Circulatory System to MEDICAL - GENERAL	++ Added Digestive System to MEDICAL - GENERAL	++ Added Excretory System to MEDICAL - GENERAL	++ Added Endocrine System to MEDICAL - GENERAL	++ Added Integumentary System to MEDICAL - GENERAL	++ Added Exocrine System to MEDICAL - GENERAL	++ Added Immune System to MEDICAL - GENERAL
++ Added Lymphatic System to MEDICAL - GENERAL	++ Added Muscular System to MEDICAL - GENERAL	++ Added Nervous System to MEDICAL - GENERAL	++ Added Urinary System to MEDICAL - GENERAL	++ Added Reproductive System to MEDICAL - GENERAL	++ Added Respiratory System to MEDICAL - GENERAL	++ Added Skeletal System to MEDICAL - GENERAL	++ Added Haematopoietic System to MEDICAL - GENERAL	+ Added a title to the top of the sheet	+ Added a lot of information in the GEAR section.	+++ Recreated the whole GEAR section for ease of reading.	+ Fixed the automated page count formula.
+ Changed the Update Marker text.	+ Added more recipes to RECIPES.										

Version 7

Version 7 features a HUGE visual update converting 60%+ of the existing guide to a "Word Format" with a larger font and merged cells making it easier to read on mobile devices. There are three new categories: INTRODUCTION, NEWS and CONSPIRACIES. The pre-existing INTRODUCTION category was renamed to PRELUDE to make room for the new and improved INTRODUCTION category. There are a lot of smaller visual updates throughout the guide besides the larger change but overall there's not a lot of new content in this release. This is the first version that contains PDF bookmarks to make navigating the document much easier.

Version 7 was the fourth version released to the public via Reddit at:
https://www.reddit.com/r/preppers/comments/eprdxe/the_preparedness_encyclopedia_tpe_v7/

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
January 2020 (+122 Days)	82 (+2)	56.6% (+2.4%)	1,953.9 (81.41 Days)	+439.2h (+18.3 Days Straight)	50.1 Mb (+5.3 Mb)

Updates

+ Made subcategory headings more visible	– Removed some explosives from the OFFENCE section	+ Added more board games to ENTERTAINMENT	~ Changed the WEATHER category to METEOROLOGY	+ Added colours to Equivalency Tables in CONVERSIONS	~~~ Changed the INTRODUCTION category to PRELUDE	+++ Added the INTRODUCTION category	~ Moved CONVERSIONS to the bottom of the sheet	~~ Converted INTRODUCTION to the "Word" format	~ Enlarged the category heading descriptions font sizes	~ Enlarged the column B heading sizes.	– Removed most of the Anarchist Cookbook content
~ Converted RELIGION & QUOTES to the "Word" format	~ Converted CREDITS to the "Word" format	~ Converted FAQ to the "Word" format	~ Modified the DISASTER RECOVERY section to a "Word" layout	+ Added large centred headings extending from the "B" rows.	+ Added large centred headings extending from the "C" rows.	~ Converted PRELUDE to the "Word" format	~ Converted INTRODUCTION to the "Word" format	~ Converted UPDATES to the "Word" format	~ Converted FAQ to the "Word" format	~ Converted DISASTER RECOVERY to the "Word" format	~ Converted PREPAREDNESS to the "Word" format
~ Converted BACKPACKS to the "Word" format	~ Converted CONTENTS to the "Word" format	+++ Added the NEWS category	– – – Removed the INDEX category	+++ Added the CONSPIRACIES category	+ Added page breaks to the new categories	~~ Fixed a nightmare problem which caused the sheet to use over 6 Gb Ram	~ Made the rows from 5 on visible again	~ Converted GEAR to the "Word" format	+~ Made the GEAR section easier to read and updated a lot of content	~ Converted ENTERTAINMENT to the "Word" format	~ Converted all category introductions to the "Word" format
+ Added more content to Christianity in RELIGION & QUOTES	+ Added more content to Islam in RELIGION & QUOTES	~ Converted WATER to the "Word" format	~ Converted FITNESS to the "Word" format	~ Converted ECONOMY to the "Word" format	~ Converted SURVIVAL to the "Word" format	~ Converted FIELD DRESSING to the "Word" format	~ Converted LIGHT to the "Word" format	~ Converted STORAGE to the "Word" format	~ Converted FUEL to the "Word" format	++ Added Evidence for God to RELIGION & QUOTES	~ Converted CONVERSIONS to the "Word" format
~ Updated the Equivalency Tables in CONVERSIONS	~ Converted NATURAL DISASTERS to the "Word" format	~ Converted PLANT IDENTIFICATION to the "Word" format	~ Converted BOATING to the "Word" format	~ Converted FIRE to the "Word" format	~ Converted PERMACULTURE to the "Word" format	~ Converted FORAGING to the "Word" format	~ Converted GEOGRAPHY to the "Word" format	~~~ Recreated the GEOGRAPHY category	~ Converted HYGIENE to the "Word" format	– Removed the freezes from the spreadsheet	~ Converted WEAPONS to the "Word" format
~ Converted MINIMALISM to the "Word" format	~ Converted PERSONAL DISASTERS to the "Word" format	++ Added a new contents section to each category	~ Converted COMMUNICATION to the "Word" format	~ Converted SAFETY & SECURITY to the "Word" format	+ Added more content to GEAR	~ Converted COOKING to the "Word" format	~ Converted NUTRITION to the "Word" format	+ Added large centred headings extending from the "D" rows.	+ Added content to the CONSPIRACIES section	~ Modified the Sudoku section in ENTERTAINMENT	~ Converted POPULATION to the "Word" format
++ Added a new categories section under CONTENTS	~ Updated the page count macro	– Removed the old categories section under CONTENTS	+ Added Types of Water to WATER	~ Made columns A, B, C, D and R thicker and increased the font size	+ Added rows to separate the end of categories	~ Modified some of the text colours in the guide which are rendered incorrectly.	+ Re-Added the broken page breaks	– Removed the underlines from the arrow links	~ Converted a few sections in ENTERTAINMENT to the "Word" format	~ Converted METEOROLOGY to the "Word" format	+ Added Survival Shelters in SHELTER
~ Fixed the clipping in the cells in UPDATES	~ Updated the category heading size to 100pts.	~ Changed the name of the ANIMAL_IDENTIFICATION category to ANIMALS	~ Changed the name of the PLANT_IDENTIFICATION category to PLANTS	~ Changed the name of the MEDICAL - GENERAL category to MEDICAL	~ Changed the name of the MEDICAL - MEDICATION category to MEDICATION	~ Changed the name of the MEDICAL - ILLNESS category to ILLNESS	~ Changed the name of the MEDICAL - INJURY category to INJURY	~ Changed the name of the MEDICAL - EMOTIONAL category to EMOTIONAL	~ Converted INJURY to the "Word" format	~ Converted SHELTER to the "Word" format	~ Cleaned up the SHELTER categories
++ Added a lot of new content to the SHELTER category	~ Converted LOCATIONS to the "Word" format	~ Converted ILLNESS to the "Word" format	+ Added the description for every illness in ILLNESS	~ Changed the name of the RELIGION & QUOTES category to RELIGION	+ Added Psalms 1-41 and Jude to RELIGION > Christianity	~ Updated the formatting in the CREDITS section.	~ Updated the text and formatting in the PRELUDE section.	~ Left aligned all contents text	~ Resized the category headings to be wider and better centered	~ Made the headings and subheadings font larger	~ Updated ENTERTAINMENT to make it easier to read
~ Converted GARDENING to the "Word" format	+ Added Real World Tips to PREPAREDNESS	~ Converted OFFENCE to the "Word" format	~ Converted DEFENCE to the "Word" format	~ Converted CRAFTING to the "Word" format							

Version 8

Version 8 features the conversion of the rest of the 'excel' format categories to the new, larger and easier to read style. A title page was added to make it feel more like a book. There are also major updates to the INJURY, ELECTRICITY and LOCATIONS categories and a smaller update to the Pandemic section in MAN-MADE DISASTERS. The COMPACT LIVING section was removed.

Version 8 was the fifth version released to the public via Reddit at:
https://www.reddit.com/r/preppers/comments/gflaly/the_preparedness_encyclopedia_tpe_v8/

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
May 2020 (+121 Days)	81 (-1)	58.5% (+1.9%)	2,257.6 (94.0 Days)	+303.7h (+12.6 Days Straight)	55.4 Mb (+5.3 Mb)

Updates

~ Fixed various small things throughout the document	~ Converted MEDICAL to the "Word" format	~ Converted KNOTS to the "Word" format	~ Converted NAVIGATION to the "Word" format	~ Converted MEDIA to the "Word" format	~ Converted TRANSPORT to the "Word" format	~ Converted TOOLS to the "Word" format	+ Added Monitoring Websites to PREPAREDNESS	~ Made minor aesthetic changes throughout the document.	~ Moved Developer Tips from PRELUDE to UPDATES	~ Converted LANGUAGE to the "Word" format	++ Updated Batteries in ELECTRICITY
~ Converted ELECTRICITY to the "Word" format	~ Improved the readability of the FIRE section.	~ Converted RECIPES to the "Word" format	~ Converted MATERIALS to the "Word" format	– Removed Enneagram from PSYCHOLOGY	~ Converted PSYCHOLOGY to the "Word" format	~ Converted STEALTH & TACTICS to the "Word" format	~ Converted WARFARE to the "Word" format	+ Added Combination Locks to STEALTH & TACTICS	~ Modified The Rapture in MASS DESTRUCTION	+ Added Monitoring Websites to PREPAREDNESS	+ Added Biblical Timeline to RELIGION
+ Updated Small Batteries in ELECTRICITY	+ Updated Developer Tips in UPDATES	+ Updated Pandemic in MAN-MADE DISASTERS	+ Added Colour & Heat Retention to LIGHT	~ Converted ANIMALS to the "Word" format	~ Fixed up multiple formatting things throughout the document	+ Added Boggle to ENTERTAINMENT	+ Updated Preparedness in INTRODUCTION	~ Spell checked the guide	+ Updated the Supporters section in CREDITS	+ Added The Fight for Freedom to CONSPIRACIES	+ Added lots of content in CONSPIRACIES
~ Fixed various small things throughout the document	~ Converted BLACKSMITHING to the "Word" format	~ Converted COMPACT LIVING to the "Word" format	~ Converted HOMESTEADING to the "Word" format	~ Converted NATURAL REMEDIES to the "Word" format	~ Converted ANIMAL HUSBANDRY to the "Word" format	~ Converted CONSTRUCTION to the "Word" format	~ Converted SKILLS to the "Word" format	~ Finished Converting ENTERTAINMENT to the "Word" format	~ Fixed various small things throughout the document	+ Added more information to LOCATIONS	~ Converted FOOD to the "Word" format
+ Added to Plant Pests & Diseases in GARDENING	– Removed the COMPACT LIVING category	~ Added the book of Romans to RELIGION	~ Modified the GEAR section.	~ Fixed the formatting of small things throughout the document	+ Expanded all heading widths	~ Updated the UPDATES section	+ Added War Crimes to RELIGION > Ethics	– Removed borders from category top and bottom	~ Modified the Hours Edited formula	+++ Added lots of information to INJURY	~ Made the "B" headings a larger font
+ Added New Pictures to GARDENING	++ Added a title page to the start of the document	~ Moved around some content in the NEWS section	– Removed the groupings	~ Updated the economy icon	~ Finished Converting 'SHTF Planning' in PREPAREDNESS to the new "Word" format.						

Version 9

Version 9 is another visual update to every category in TPE making better use of the whole width of the sheet and making it simpler, easier to navigate and easier to read. There have also been large updates to multiple categories such as ILLNESS, WEAPONS and ENTERTAINMENT. 16 categories have either been removed or been merged with similar categories to reduce the overall number and to assist in quicker information retrieval. There are also new "Purpose" and "Lost?" rows at the top of each category to assist in finding what you're looking for. A lot of content that would likely never be used has been removed from many categories.

Version 9 was not released to the public on Reddit, but instead was a 'silent' update via my website and the free TPE mailing list. Sign up to the mailing list so you don't miss any future updates.

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
Sep 2020 (+123 Days)	65 (-16)	66.7% (+8.2%)	2,537.8 (105.7 Days)	+280.2h (+11.6 Days Straight)	56.0 Mb (+0.6 Mb)

Updates

~ Reduced the margins to fit more on each page	~ Converted DICTIONARY to the "Word" format	– Removed the Macros	~ Updated the supporters section	~ Updated multiple things in the PREPAREDNESS section	+ Added Time Zones to GEOGRAPHY	~ Modified the layout of the KNOTS section	+ Added the Content Credit section to CREDITS	+ Added to the Rapture section in MASS DESTRUCTION	+ Added to the Christianity section in Religion	+ Added to the CONSPIRACIES section	~ Updated small things throughout the guide
– Removed the website column 'F' off the visible sheet	~~~ Re-flowed the text throughout the document to make better use of the "E" column	– Removed some of the more obscure componentry in ELECTRICITY > Componentry	~ Removed the smaller headings to the left of larger headings	~ Widened the headings bar for all headings	~~~ Added indents to all text for ease of reading	~ Made the UPDATES symbols slightly larger	– Removed Concrete from MATERIALS	~ Reworked the SURVIVAL > Landforms section	~ Reworked the WATER section	– Removed some of the more obscure foods in FOOD > Shelf Life	~ Made the update version stats bigger
~~ Added subheading numbers to the category headings	~~ Updated the Equivalency Tables in CONVERSIONS	~ Moved the trivia answers to its individual sections in ENTERTAINMENT	~ Increased the size of a lot of images throughout the guide	+ Added content to FOOD	~ Rearranged the headings in FOOD	~ Merged the CONSTRUCTION category with SHELTER	– Removed the CONSTRUCTION category	~ Merged the FAQ category with CREDITS	– Removed the FAQ category	~ Merged the TOOLS category with CRAFTING	– Removed the TOOLS category
++ Added icons to a quarter of the subheadings	– Restricted the colours to the first row when tables were fuly coloured	+ Added chapter numbers to all subheadings	+ Updated Worms in ILLNESS	+++ Added a huge amount of information to ILLNESS	~ Modified the subheadings in multiple categories	~ Moved the SHELTER category closer to the top	+ Updated the Radio section in COMMUNICATION	+ Added the division line back into the header page	+ Added Melting Silver to BLACKSMITHING	– Removed the cell 'flow' lines for the B and C headings	++ Completed most of the WEAPONS category
+ Added Mythbuster Results to ENTERTAINMENT	~~~ Made a ton of small changes throughout the guide	~ Merged the FORAGING section with the PLANTS section	– Removed the FORAGING category	~ Updated the GEAR section	~ Merged the BACKPACKS section with the GEAR section	– Removed the BACKPACKS category	+ Added Panic Level to PREPAREDNESS	– Removed the DISASTER TIMELINES category	~ Merged the BARTER section with the ECONOMY section	– Removed the BARTER category	~ Merged the PERMACULTURE section with the GARDENING section
– Removed the PERMACULTURE category	~ Merged the BOATING section with the SURVIVAL and WATER sections	– Removed the BOATING category	~ Updated the KNOTS pictures	– Removed the cell 'flow' lines for the D headings	+ Added Unusual Deaths to SURVIVAL	+++ Added the "Purpose" and "Lost?" sections to the start of the categories	+ Added a list of examples under some headings in CONTENTS	+ Added Space Warfare to WARFARE	~ Merged the PSYCHOLOGY section with the POPULATION section	– Removed the PSYCHOLOGY category	+ Added page breaks to most subcategory headings
~ Merged the STORAGE section with the ECONOMY and HOMESTEADING sections	– Removed the STORAGE category	~ Merged the DISASTER RECOVERY section with the PERSONAL DISASTERS section	– Removed the DISASTER RECOVERY category	+ Added Random Generators to ENTERTAINMENT	~ Merged the WOODWORKING section with the CRAFTING section	– Removed the WOODWORKING category	~ Merged the BLACKSMITHING section with the CRAFTING section	– Removed the BLACKSMITHING category	+ Added more Plant Pests & Diseases to GARDENING	~ Renamed NUTRITION to HEALTH	~ Merged the FITNESS section with the HEALTH section
– Removed the FITNESS category	~ Merged the HYGIENE section with the HEALTH section	– Removed the HYGIENE category	~ Updated the Magnetic Declination Map in NAVIGATION	+ Added Vaccine Development to MAN-MADE DISASTERS	+ Added Megaquake to MASS DESTRUCTION						

Version 10

Version 10 is another partial visual update featuring 20% larger text for (almost) all content, larger headings, subcategory icons and new category title pages. A lot of content throughout the guide has been updated and new information added. A few major sections have been added such as 'Search and Rescue' to SURVIVAL and infiltration type skills to SECURITY. 6 categories have been merged with others to help reduce clutter and some larger unnecessary sections have been removed. Multiple subheading contents sections were added to the larger headings to make it even easier to find what you're looking for. Overall version 10 should provide an easier reading experience with quicker searchability for needed information.

Version 10 was the sixth version released to the public via Reddit at:
https://www.reddit.com/r/preppers/comments/muc9ff/the_preparedness_encyclopedia_tpe_version_10/

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
Apr 2021 (+212 Days)	58 (-7)	68.1% (+1.4%)	2,540.7 (105.8 Days)	+2.9h (+0.1 Days Straight)	61.7 Mb (+5.7 Mb)

Updates

+ Added more information about each religion in RELIGION	+ Added Making Drugs to MEDICATION	+ Added Drug Alternatives to MEDICATION	+ Added Medication Storage to MEDICATION	+ Added Natural Medication to NATURAL REMEDIES	+ Added Derecho to NATURAL DISASTERS	+ Added an Overview to NATURAL DISASTERS	+ Added Quicksand to NATURAL DISASTERS	+ Added Water Cycle to METEOROLOGY	+ Added Changing Identity to STEALTH & TACTICS	+ Added Cyberattack to MAN-MADE DISASTERS	+ Added Siphoning Fuel to LOCATIONS
+ Added Jump Starting to TRANSPORT	+ Added Replace a Battery to TRANSPORT	+ Added Change a Tyre to TRANSPORT	+ Added Breaking Glass to STEALTH & TACTICS	++ Added Lockpicking to STEALTH & TACTICS	+ Added Yahtzee to ENTERTAINMENT	++ Added First Aid to MEDICAL	~ Updated Walking in TRANSPORT	+ Added Space to TRANSPORT	+ Added Simple Transport to TRANSPORT	+ Added Scooters to TRANSPORT	+ Added Quad Bikes to TRANSPORT
+++ Added Search & Rescue to SURVIVAL	+ Added content to SHELTER > Natural Shelters	+ Added Power Stations to ELECTRICITY	+ Added Battery Arrays to ELECTRICITY	+ Added Appliance Power Consumption to ELECTRICITY	~ Changed the Margin Size to 0.5 for the Top and Bottom	~ Changed the "Page Layout > Font" to "Metro" so images aren't stretched when exported	~~~ Corrected the images after swapping to the "Metro" theme	~~~ Increased the font size of all text to 25pts from 20pts	~~~ Formatted most of the paragraphs in the document to make reading easier.	– – Removed multiple sections from NATURAL REMEDIES	– Removed Intelligence Agencies from WARFARE
– Removed some Complex Concepts from ENTERTAINMENT	+ Added the number of pages for each category in the CONTENTS section	~ Made the quotes a little bigger	~~~ Created entirely new headings for each category	~~ Made the 2nd level headings bigger	~~ Changed the 2nd level heading hidden column text to make it easier to change later on	~~ Updated the Rapture section	+ Added Category Statistics to UPDATES	++ Added information to Bioterrorism in Man-Made Disasters	~~ Made the 3rd level headings bigger	~~ Changed the 3rd level heading hidden column text to make it easier to change later on	+ Added Life Expectancy to SURVIVAL
+ Increased the resolution of the images in Survival > Climate	+ Added Vegetation to SURVIVAL	++ Added subcategory pictures to most sections	~ Fixed the main category vertical text	~ Changed the "Page Layout > Font" to 'Angles' to further correct stretched images	+ Added Lifeform Events to MASS DESTRUCTION	++ Added Other Poisonings in ILLNESS	+ Added more content to Chemical in ILLNESS	+ Added Biological to ILLNESS	~~ Made adjustments to support the transition to the 'Angles' font.	~~ Made the 4th level headings bigger	~~ Changed the 4th level heading hidden column text to make it easier to change later on
~ Increased the font size of the 'Contents' of each category.	+ Added Bible Trivia to ENTERTAINMENT	~~ Made the 5th level headings bigger	~~ Changed the 5th level heading hidden column text to make it easier to change later on	~ Updated lots of little things throughout the document	~ Fixed the answer headings in the ENTERTAINMENT section	+ Added new subheadings in the ENTERTAINMENT section	+ Added Preparedness Trivia to ENTERTAINMENT	+ Added more puzzles to Logic Puzzles in ENTERTAINMENT	~ Merged the SAFETY & SECURITY section with various other sections	– Removed the SAFETY & SECURITY category	~ Renamed the STEALTH & TACTICS category to SECURITY
~ Changed the UPDATES category to MAINTENANCE	~ Merged the CREDITS section with the MAINTENANCE section	– Removed the CREDITS category	~ Merged the MINIMALISM section with the HOMESTEADING section	– Removed the MINIMALISM category	~ Updated rendering in MAINTENANCE	~ Made the gray line at the bottom of every category slightly larger	~ Renamed the DICTIONARY category to ADDENDUM	~ Merged the MEDIA section with the ADDENDUM section	– Removed the MEDIA category	~ Merged the CONVERSIONS section with the ADDENDUM section	– Removed the CONVERSIONS category
– Removed Format Conversion from MAINTENANCE	~ Reworded some of the INTRODUCTION section	+ Added Bugging In to PREPAREDNESS	+ Added Bugging Out to PREPAREDNESS	~ Modified the WATER headings	~ Fixed some of the constricted text which needed more spacing	++ Added Back to the Future I Script to ENTERTAINMENT	~ Merged the CONSPIRACIES section with the ENTERTAINMENT section	– Removed the CONSPIRACIES category	+ Added No Food to FOOD	~ Made the footer font a little bigger	~ Fixed many of the images after converting to 'Angles'
+ Added Natural Nightvision to LIGHT	+++ Added Subheadings to the largest topics throughout the guide	~ Fixed a lot of visual errors throughout the guide	~ Enlarged lots of rows which were overflowing	+ Added Tetanus to ILLNESS	+ Added Strep Throat to ILLNESS	– Removed the NEWS category	– – Removed content from RELIGION	– – Removed content from MASS DESTRUCTION	~ Updated the credits in MAINTENANCE	~ Fixed Micro Ratings sentences in WATER	

Version 11

CURRENT VERSION

Version 11 is a content update, filling in gaps and adding additional content to many different categories. The Prepping Goals has been added to help new preppers to find a path to starting out. LOCATIONS was also vastly filled in with a lot of content to help you find suitable shelter locations in a SHTF scenario. The shelf life of foods in FOOD was finally converted to a semi-word format. Finally, the MEDICATIONS section was completely re-written and filled out with new, more useful content with a survival focus.

Version 11 was the seventh version released to the public via:
- The TPE Mailing List (Request to join at: **https://fluidicice.com/tpe**)
- Reddit: (TBA)
- Facebook: (TBA)

Release Date	Categories	Percent Complete	Total Hours Worked	New Hours Worked	File Size
June 2025 (+1,525 Days)	58	71.5% (+3.4%)	2,710.78 (112.95 Days)	+170.08h (+7.08 Days Straight)	68.1 Mb (+6.4 Mb)

Updates

+ Added Blood Type Percentages to MEDICAL	– Removed content from MASS DESTRUCTION	~ Cleaned up a lot of minor things throughout the guide	++ Added Disaster Preparedness to PREPAREDNESS	+ Updated multiple sections under Knife in GEAR	+ Added heading descriptions to Gear Descriptions in GEAR	~ Moved Preparedness Kits to its own category in GEAR	~ Enlarged the Gear Lists font in GEAR	+ Filled in more information in the Gear Descriptions in GEAR	++ Added Household Gear to GEAR	~ Censored some course language throughout the guide	+ Added lots of missing content in WATER
+ Added Inorganic Contaminants to WATER	+ Filled in the Waves section in WATER	+ Filled in the Water Cycle in WATER	+ Added HEPA & MERV Air Filters to DEFENCE	+ Added Baby Safety to DEFENCE	+ Added Using an AED to MEDICAL	+ Added a lot of content to the COMMUNICATION > Technology > Mobile Phone section	+ Updated the Apps section in ADDENDUM > Media	~ Enlarged the pictures in LOCATIONS	+ Added Downloading YouTube Videos to ADDENDUM	+ Added Mapping to MEDIA	~ Modified the ELECTRICITY > Power Usage section
+ Added Wire to ELECTRICITY	+ Added an AWG Chart to ELECTRICITY	+ Added a Battery Voltage Chart to ELECTRICITY	+ Added Mylar Preservation to COOKING	+ Added Prep Drive to PRELUDE	+ Added Geomagnetic Storm Impacts to MASS DESTRUCTION	– Removed content from MASS DESTRUCTION	+ Added Car Kit to GEAR	+ Added Sandbagging to NATURAL DISASTERS	+++ Added Prepping Goals to PREPAREDNESS	+ Added colours to the MAINTENANCE updates	+++ Filled in most of the content in LOCATIONS
+ Updated various content all throughout the guide.	+ Added Swimming to SURVIVAL	+ Added Diving to SURVIVAL	++ Added River Crossing to SURVIVAL	+ Added to Urban Survival in SURVIVAL	+ Added Riding a Donkey to TRANSPORT > Animal	~ Made multiple fixes to the TRANSPORT section.	+ Added Prep Drive links throughout the document	~ Updated Eating Order in FOOD	~ Updated Long Life Foods in FOOD	~~~ Fixed all of the small text in the FOOD > Food Shelf Life section	+ Added the two letter country code abbreviations in GEOGRAPHY
+ Added country flags to GEOGRAPHY	+ Added continent summary maps to GEOGRAPHY	++ Updated country information for Carribbean in GEOGRAPHY	++ Updated country information for Central America in GEOGRAPHY	+ Added additional sections to multiple MAN-MADE DISASTERS categories.	+ Added the Vehicle Crash section to MAN-MADE DISASTERS.	++ Added Baby Gear to Nursery in GEAR	+ Added Sea Gear in GEAR	~ Updated Snow Gear in GEAR	~ Updated Mountain Gear in GEAR	~ Updated Cave Gear in GEAR	~ Updated Medical Specialist Gear in GEAR
~ Updated Pandemic Gear in GEAR	~ Updated Jungle Gear in GEAR	~ Updated Desert Gear in GEAR	+ Added more Real World Tips to PREPAREDNESS	+ Added Non-Lethal > Pepper Spray to DEFENCE	+ Added Non-Lethal > Explosives to DEFENCE	+ Added Non-Lethal > Ammunition to DEFENCE	++ Added Directed Energy Weapons to DEFENCE	++ Added Other Non Lethal Weapons to DEFENCE	+ Added content to Unarmed in DEFENCE	+ Added Insect Protection > Biting Midges to DEFENCE	+ Added Insect Protection > Ticks to DEFENCE
+ Added Insect Protection > Ants to DEFENCE	+ Added Insect Protection > Smoke to DEFENCE	~ Updated Bullet Defence in DEFENCE	+ Added Physical Security to SECURITY	~ Changed the headings of SECURITY	~ Moved around content in SECURITY	+ Added various updates to SECURITY	+ Added Stalking to SECURITY	~ Updated Medical Supplies in MEDICAL	+ Added Quitting Gambling to MEDICAL	~ Made lots of small changes throughout the document	++ Added Armour to DEFENCE
+ Added Total Weight > Weight to GEAR	~ Updated Tools > Knife in GEAR	+ Added Deterrence to SECURITY	+ Added Prevention to SECURITY	+ Added Response & Self-Defense to SECURITY	+ Added Grey Man to SECURITY	+ Added Toxic Solid Fuels to FUEL	+ Added Wood > Seasoning to FUEL	~ Updated Metaldehyde in FUEL	~ Updated Trioxane in FUEL	+ Added Wood > Wood Power to FUEL	~ Updated Hexamine in FUEL
+ Added Gas Fuel > Butane Gas to FUEL	+ Added Gas Fuel > Propane Gas to FUEL	+ Added Gas Fuel > Biogas to FUEL	~ Fixed a lot of things in FUEL	+ Added Gas Fuel > Natural Gas to FUEL	+ Added Creating Fuel > Wood Gasifier to FUEL	+ Added Alcohol Distillation > Purity of Alcohol Per Distillation Cycle to FUEL	~ Updated Darkness in LIGHT	+ Added Micronutrients to HEALTH	~ Updated Stressors in SURVIVAL	+ Added Documenting to SURVIVAL	~ Updated Earth's Climate in SURVIVAL
+ Added Team River Crossing to SURVIVAL	~ Rewrote the story in INTRODUCTION	+ Added salvageable materials for the story to INTRODUCTION	+ Added some Wreckage Loot to LOCATIONS	+ Added Threats to INTRODUCTION	+ Added Geomagnetic Reversal to NATURAL DISASTERS	+ Added Tornado Protection to NATURAL DISASTERS	~ Updated The Revelation Timeline Diagram	+ Added Cataclysmic Pole Shift to MASS DESTRUCTION	++ Added Sections 5-17 in MEDICATION	~ Modified Medication Info in MEDICATION	~ Fixed things throughout the whole document
– – – Removed most of the information from MEDICATIONS	+++ Added Medication List to MEDICATIONS	– Removed Treatments from ILLNESS	+ Added Medication Info > Antibiotics to MEDICATION	+ Added Storage to MEDICATION	+ Added Shelf Life to MEDICATION	+ Added Medication Info > Shelf Life Extension Program (SLEP) to MEDICATION	+ Added Medication Info > Dangerous Meds Post-Expiry to MEDICATION	+ Added Home Clinic > Medications to GEAR	++ Added info to Sections 5-17 in MEDICATION	++ Added lots of new information to SHELTER	+ Added Public Shelters to SHELTER
~ Fixed a lot of things in ENTERTAINMENT	+ Added various information to ENTERTAINMENT	– Removed some information from ENTERTAINMENT	+ Added Air Crash > Crash Preparation to MAN-MADE DISASTERS	+ Added Air Crash > After the Crash to MAN-MADE DISASTERS	+ Added Blackout > Blackout Preparation to MAN-MADE DISASTERS	+ Added Blackout > During a Blackout to MAN-MADE DISASTERS	+ Added Nuclear Accident to MAN-MADE DISASTERS	+ Added Medication Suffixes to MEDICATION	+++ Finished adding info to Sections 5-17 in MEDICATION	+ Added more categories to ANIMAL HUSBANDRY	+ Added Artichoke to GARDENING
+ Added Chili to GARDENING	+ Added information to the fruits in GARDENING	+ Added some content to DISASTER TRIGGERS	~ Updated the credits in MAINTENANCE	~ Updated other content in MAINTENANCE	+ Added more Prep Drive references	~ Fixed multiple things post-export	~ Fixed issues with the category icons post-export	~ Changed the Preparedness story in INTRODUCTION			

▲ Return To: PREPAREDNESS | SURVIVAL | NATURAL DISASTERS | MAN-MADE DISASTERS | MEDICAL | MASS DESTRUCTION | ENTERTAINMENT | SHELTER | GARDENING | RELIGION | UPDATES